Appendix 3.4 – Patterson Turf Removal Project Supporting Documentation

Sperry Avenue Landscape

LANDSCAPE IMPROVEMENT PLANS

Patterson, California

GENERAL NOTES:

1. LANDSCAPE IMPROVEMENTS TO BE CONSTRUCTED IN COMPLIANCE WITH CITY OF PATTERSON, CALIFORNIA STANDARDS AND SPECIFICATIONS. IN THE EVENT THERE IS A CONFLICT WITH THE PLANS AND REFERENCES STATED ABOVE, THE GOVERNING BODY STANDARDS AND SPECIFICATIONS SHALL PREVAIL. ALL WORK SHALL BE SUBJECT TO INSPECTION BY CITY OF PATTERSON, CALIFORNIA.

2. DESIGN: THE DRAWINGS HEREIN REPRESENT A GENERAL DESIGN TO BE IMPLEMENTED ON THE SITE DEPICTED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE LANDSCAPE ARCHITECT TO CLARIFY PLAN DETAILS RELATED TO SITE OR CONSTRUCTION DETAILS NECESSARY FOR PROJECT COMPLETION.

3. TRAFFIC CONTROL: CONTRACTOR TO SUPPLY CITY WITH TRAFFIC CONTROL PLAN PRIOR TO BEGINNING WORK ON SITE. PLAN TO BE APPROVED BY CITY AND IMPLEMENTED DURING ENTIRE CONSTRUCTION PERIOD.

4. COORDINATION: CONTRACTORS SHALL COORDINATE INSTALLATION AND SCHEDULING WITH THAT OF OWNER/OWNER REPRESENTATIVE AND OTHER CONTRACTORS EFFICIENTLY AND IN A TIMELY MANNER, ENSURING THE PROJECT COMPLETION IS UNIMPEDED AND INSTALLED CORRECTLY WITH MINIMAL MAINTENANCE. OWNER/OWNER REPRESENTATIVE TO BE CONTACTED DIRECTLY AT LEAST TWO WORKING DAYS PRIOR TO COVERING, COMPLETION, OR EXPOSING WORK THAT WILL BE INSTALLED.

5. SITE CONDITIONS: SEE GENERAL PROVISIONS, SPECIAL PROVISIONS, GENERAL REQUIREMENTS, AND TECHNICAL SPECIFICATIONS FOR CONTRACTOR RESPONSIBILITIES RELATED TO SITE CONDITIONS. CONTRACTOR TO EXAMINE EXISTING CONDITIONS OF SITE. IN THE EVENT THAT ON-SITE CONDITIONS DIFFER FROM CONDITIONS DEPICTED ON PLANS AND WILL IMPACT THE INSTALLATION PROCESS, THE CONTRACTOR WILL SUBMIT THESE FINDINGS TO THE LANDSCAPE ARCHITECT IN WRITING PRIOR TO BEGINNING WORK. COMMENCEMENT OF WORK IMPLIES ACCEPTANCE OF THE EXISTING SITE CONDITIONS.

6. BASE INFORMATION: THE PROPOSED LANDSCAPE IMPROVEMENTS SHOWN HEREIN ARE SUPERIMPOSED OVER DATA PROVIDED TO THE LANDSCAPE ARCHITECT BY OTHER SOURCES. THE LANDSCAPE ARCHITECT SHALL NOT BE HELD LIABLE FOR THE CHANGES, INACCURACIES, OMISSIONS, OR OTHER ERRORS RELATED TO THIS DATA. THE BASE INFORMATION IS PROVIDED AS AN AID ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REVIEWING ALL DOCUMENTS AND ACCOMMODATING ANY DISCREPANCIES.

6. BIDDING INFORMATION: SEE GENERAL PROVISIONS, SPECIAL PROVISIONS, GENERAL REQUIREMENTS, AND TECHNICAL SPECIFICATIONS FOR CONTRACTOR RESPONSIBILITIES RELATED TO BIDDING INFORMATION AND SITE VISITS PRIOR TO BID SUBMITTAL.

7. A PRE-CONSTRUCTION MEETING SHALL BE COORDINATED WITH THE PUBLIC WORKS DEPARTMENT PRIOR TO BEGINNING WORK.

UTILITY COMPANIES ARE MEMBERS OF THE UNDERGROUND SERVICE ALERT (U.S.A.) ONE-CALL PROGRAM. THE CONTRACTOR AND ANY SUBCONTRACTORS SHALL CONTACT U.S.A. AT LEAST TWO WORKING DAYS (48 HOURS) PRIOR TO BEGINNING WORK.

ONLY EXCAVATION WILL REVEAL ACTUAL TYPES, LOCATIONS, SIZES, AND DEPTHS OF UNDERGROUND UTILITIES. THE LANDSCAPE ARCHITECT ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF UNDERGROUND UTILITIES OR OF BURIED EXISTING OBJECTS AND UTILITIES NOT SHOWN ON THESE PLANS.

NOTICE TO PLAN CHECKER:

PROJECT TITLE:	SPERRY AVENUE LANDSCAPE
PROJECT ADDRESS:	SPERRY AVENUE PATTERSON, CA
OWNER:	CITY OF PATTERSON 1 PLAZA PATTERSON, CA, 95363 (209) 895-8023
PLANS PREPARED BY:	O'DELL ENGINEERING 1165 SCENIC DRIVE MODESTO, CA 95350 (209) 571-2466 FAX (209) 571-1765 OFFICE EMAIL: CKENNEDY@ODELLENGINEERING.COM
LICENSE NUMBER:	LA #5426
LANDSCAPE AREA:	36,678 S.F.
PROJECT TYPE:	EXISTING RETROFIT PUBLIC PROJECT
WATER SUPPLY TYPE & LOCAL PURVEYOR:	POTABLE / CITY OF PATTERSON

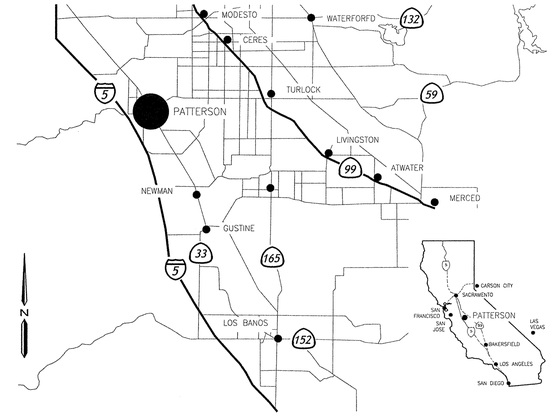
BID SET

APPROVED BY THE CITY OF PATTERSON, CALIFORNIA

BY: DATE:

LANDSCAPE IMPROVEMENT LIMITS

SCALE 1:600



VICINITY MAP

N.T.S.

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SYMBOLS

EXISTING PALM TREE

EXISTING STREET TREE

EXISTING ELECTRICAL OUTLET ON POST

PLAN ABBREVIATIONS

BC	BOTTOM OF CURB	HP	HIGH POINT
BW	BOTTOM OF WALL	INV	INVERT ELEVATION
BOW	BACK OF WALL	MAX	MAXIMUM
CL	CENTERLINE	ME	MECHANICAL ENGINEER
CLR	CLEAR	MIN	MINIMUM
CIP	CAST IN PLACE	(N)	NEW
CMU	CONCRETE MASONRY UNIT	OC	ON CENTER
CONC	CONCRETE	PA	PLANTING AREA
DG	DECOMPOSED GRANITE	PIP	POURED IN PLACE CONCRETE
DWGS	DRAWINGS	POB	POINT OF BEGINNING
EX	EXISTING	R	RADIUS
EJ	EXPANSION JOINT	RIM	RIM ELEVATION
EQ	EQUAL	RP	RADIUS POINT
FC	FACE OF CURB	SAD	SEE ARCH. DRAWINGS
FF/FFE	FINISH FLOOR ELEVATION	SCD	SEE CIVIL ENG. DRAWINGS
FG	FINISH GRADE	SED	SEE ELECTRICAL DRAWINGS
FL	FLOW LINE	SIM	SIMILAR
FOB	FACE OF BUILDING	SLD	SEE LANDSCAPE DRAWINGS
FOW	FACE OF WALL	SP	SPACE
FS	FINISH SURFACE	TC	TOP OF CURB
FV	FIELD VERIFY	TYP	TYPICAL

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LANDSCAPE IMPROVEMENT PLANS

SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

COVER SHEET

LICENSED LANDSCAPE ARCHITECT
CARL A. KENNEDY
Signature
1232111
Renewal Date
08-30-13
Date
STATE OF CALIFORNIA

Approved:

Designed:	CK
Drawn:	CK
Checked:	CK
Scale:	NTS
Date:	2013-08-13
Job No.:	20550
File No.:	20550ls.dwg

Sheet No.

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Of

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LOCATION MAP
1"=700'

N

0 15 30 60
SCALE: 1" = 30'

BID SET

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LANDSCAPE IMPROVEMENT PLANS

SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

DEMOLITION PLAN

LICENSED LANDSCAPE ARCHITECT
CHRIS J. KENNEDY
No. 4778
Signature
12/31/15
Renewal Date
08-26-15
Date
STATE OF CALIFORNIA

Approved:

Designed:	CK
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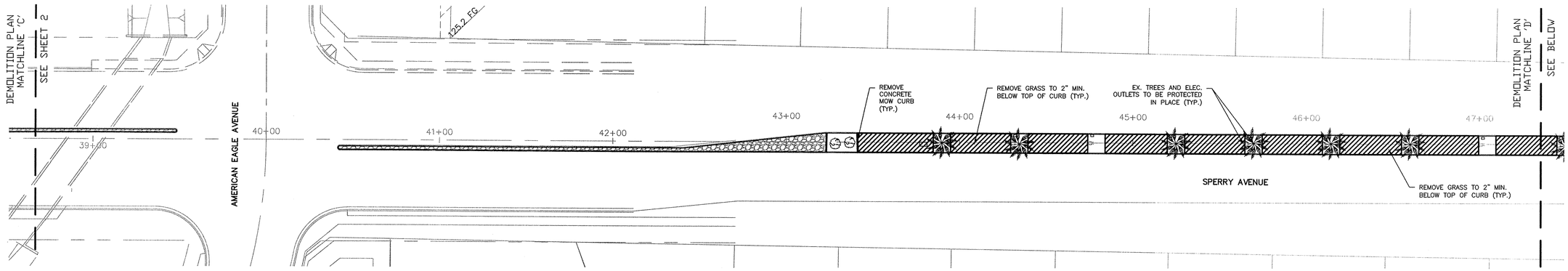
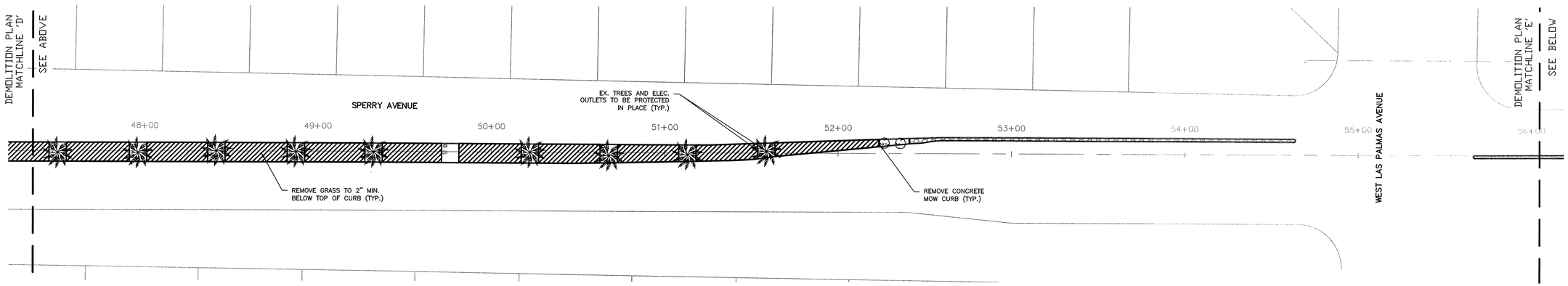
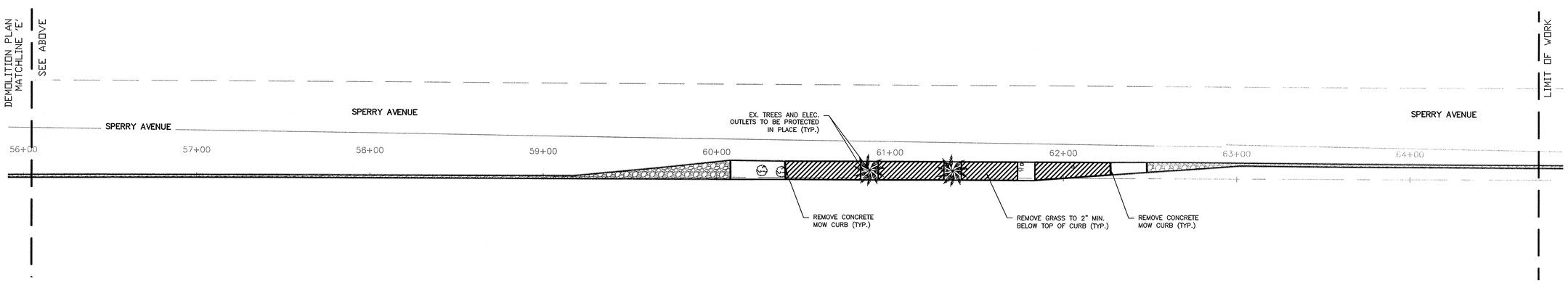


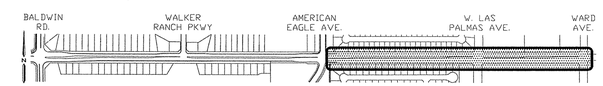




GENERAL DEMOLITION NOTES

1. EXISTING IRRIGATION LINES AND EQUIPMENT TO BE PROTECTED AND REMAIN IN WORKING CONDITION DURING AND AFTER CONSTRUCTION.
2. ALL EXISTING SITE FEATURES, SIGNS, AND TREES TO BE PROTECTED AND REMAIN UNDISTURBED UNLESS OTHERWISE NOTED. ANY SUCH FEATURES WHICH ARE DAMAGED SHALL BE REPLACED IN KIND AT THE CONTRACTOR'S EXPENSE.
3. ALL DEMOLITION WORK NOTED ON THESE PLANS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR UNLESS OTHERWISE NOTED.
4. EXISTING TREES TO BE WRAPPED IN 4' TALL SNOW FENCING TO PROTECT FROM MECHANICAL DAMAGE DURING THE CONSTRUCTION PROCESS.
5. REMOVE ALL TURF AS SHOWN ON PLANS. APPLY HERBICIDE TO TURF BY MEANS OTHER THAN SPRAY APPLICATION (WIPING, ROLLING, GRANULAR) AND CONFIRM COMPLETE TURF GRASS DEATH PRIOR TO REMOVAL. ALL APPLICATION RATES AND METHODS TO BE CONSISTENT WITH MANUFACTURER RECOMMENDATIONS.

DEMOLITION AREA



LOCATION MAP
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LANDSCAPE IMPROVEMENT PLANS

SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

DEMOLITION PLAN

LICENSED LANDSCAPE ARCHITECT
CHRIS A. KENNEDY
Signature
12/31/11
Renewal Date
08-20-13
Date
STATE OF CALIFORNIA

Approved:

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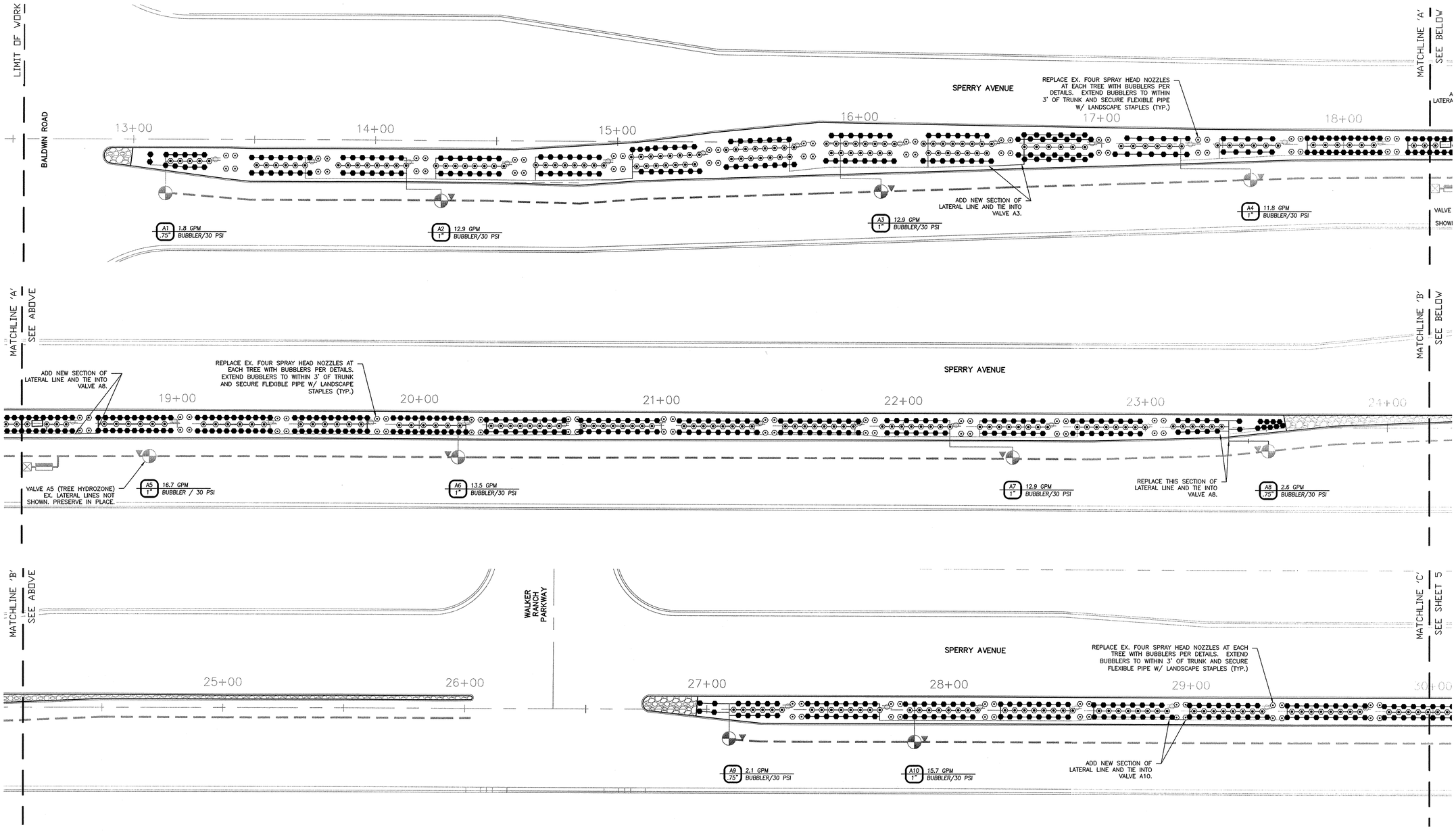


GENERAL IRRIGATION NOTES

1. ANY AND ALL PORTIONS OF THIS WORK ARE TO BE CONSTRUCTED IN COMPLIANCE WITH ALL APPLICABLE RULES AND REGULATIONS AS SET FORTH BY LOCAL MUNICIPALITIES, STATE AND NATIONAL AGENCIES. IN THE EVENT THERE IS A CONFLICT WITH THESE PLANS AND THE AGENCIES STATED ABOVE, THE GOVERNING BODY'S REGULATIONS SHALL PREVAIL.
2. THE IRRIGATION SYSTEM AS SHOWN WITHIN THESE PLANS HAS BEEN DESIGNED BASED ON OPERATING PRESSURES OF 30 PSI AND MAXIMUM FLOW DEMANDS OF 16.7 GPM. THE CITY OF PATTERSON REPORTS THAT STATIC WATER PRESSURES AT THE SITE WILL BE APPROXIMATELY 40–60 PSI.
3. PRIOR TO BIDDING AND COMMENCEMENT OF SITE WORK, THE CONTRACTOR SHALL BECOME FAMILIAR WITH AND EXAMINE CONDITIONS OF THE PROJECT SITE, VERIFYING LOCATIONS OF ALL EXISTING UTILITIES, STRUCTURES AND SERVICES. LOCATIONS OF ITEMS SHOWN ON THESE PLANS ARE ONLY APPROXIMATIONS. ANY DISCREPANCIES DISCOVERED SHALL BE REPORTED TO THE LANDSCAPE ARCHITECT. FAILURE TO REPORT DISCREPANCIES TO THE LANDSCAPE ARCHITECT BEFORE COMMENCEMENT OF SITE WORK IMPLIES ACCEPTANCE OF SITE CONDITIONS AND COSTS ASSOCIATED WITH CORRECTING IRRIGATION LAYOUTS.
4. ANY EXISTING SITE FEATURES, GRADE CHANGES, OR SITE PLAN DESIGN CHANGES NOT SPECIFICALLY ADDRESSED ON THESE PLANS, (OR UNKNOWN CONDITIONS THAT WERE NOT APPARENT DURING THE DESIGN PROCESS) THAT WILL IMPACT INSTALLATION OR OPERATING OF IRRIGATION SYSTEMS IN ANY WAY, SHALL BE REPORTED TO THE LANDSCAPE ARCHITECT PRIOR TO COMMENCEMENT OF SITE WORK.
5. INSTALL IRRIGATION EQUIPMENT PER DETAILS AND SPECIFICATIONS. ALL IRRIGATION EQUIPMENT REQUIRED FOR PROJECT COMPLETION BUT NOT DETAILED ON THESE PLANS SHALL BE INSTALLED PER LOCAL AND STATE CODES AND MANUFACTURER'S WRITTEN INSTALLATION RECOMMENDATIONS.
6. CONTRACTOR TO OBTAIN ALL REQUIRED PERMITS FOR SUCCESSFUL COMPLETION OF PROJECT PRIOR TO COMMENCEMENT OF WORK.
7. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN ANY AND ALL PROJECT RELATED ARCHITECTURAL OR ENGINEERING DRAWINGS PRIOR TO COMMENCEMENT OF WORK.
8. THE CONTRACTOR SHALL REPAIR, REPLACE, OR COMPENSATE OWNER FOR ALL ITEMS DAMAGED BY HIS / HER WORK.
9. THE CONTRACTOR SHALL COORDINATE AND SCHEDULE INSTALLATION EFFORTS WITH THOSE OF OTHER TRADES TO AVOID COSTLY DELAYS AND ERRORS.
10. CONTACT CITY OF PATTERSON @ (209)895–8089 TO SCHEDULE IRRIGATION INSPECTION BEFORE BACKFILLING TRENCHES.
11. CONTACT CITY OF PATTERSON @ (209)895–8089 TO SCHEDULE IRRIGATION INSPECTION AND TESTING OF BACKFLOW PREVENTION DEVICES.

PRESSURE NOTES

12. THE CONTRACTOR IS TO PERFORM PRESSURE TESTS AT THE POINT OF CONNECTION TO CONFIRM ACTUAL SITE PRESSURE LEVELS. ANY DISCREPANCIES BETWEEN INFORMATION ON THESE PLANS AND THAT OF EXISTING SITE CONDITIONS OR MANUFACTURER DATA ARE TO BE REPORTED TO THE LANDSCAPE ARCHITECT. FAILURE TO CONFIRM POC INFORMATION RESULTING IN REQUIRED CHANGES, DUE TO LOW PRESSURE OR VOLUME, WILL RESULT IN OWNER DIRECTED REVISIONS AT NO ADDITIONAL COST TO THE OWNER.

CONTROLLER ASSEMBLY NOTES

1. EXISTING CONTROLLER LOCATION SHOWN ON DRAWINGS IS AN APPROXIMATE LOCATION.
2. A LAMINATED, WATERPROOF, LEGIBLE, CHART OF THE IRRIGATION SYSTEM NOT EXCEEDING 11"X17" SHALL BE ADHERED TO THE INSIDE COVER OF THE CONTROLLER. ALL VALVES AND THEIR RESPECTIVE COVERAGE AREAS SHALL BE IDENTIFIED WITH SEPARATE AND DISTINCT COLORS.

IRRIGATION VALVE NOTES

1. VALVE AND QUICK COUPLER LOCATIONS SHOWN ON DRAWINGS ARE APPROXIMATE LOCATIONS. ALL EXISTING EQUIPMENT TO REMAIN IN PLACE.

PVC PIPING NOTES

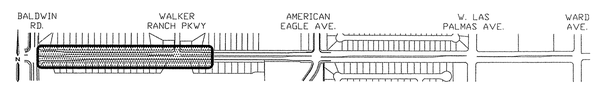
1. PIPING AND EQUIPMENT LAYOUT IS SHOWN SCHEMATICALLY FOR VISUAL CLARITY. PIPING AND EQUIPMENT SHOWN WITHIN PAVED AREAS ARE TO BE INSTALLED WITHIN AREAS DESIGNATED FOR LANDSCAPE. MAINLINES SHOULD BE LOCATED A MINIMUM OF 18" OFF ADJACENT PAVEMENT OR OTHER OBSTACLES.
2. NON–PRESSURIZED LINES ARE TO BE BURIED WITH A MINIMUM OF 18" COVER. PRESSURIZED MAINLINES ARE TO BE BURIED WITH A MINIMUM OF 24" COVER. UNDERGROUND WARNING TAPE READING "CAUTION, BURIED IRRIGATION LINE BELOW" SHALL BE INSTALLED 12" ABOVE PRESSURIZED LINES.
3. PIPE SIZES SHALL BE INSTALLED PER PLANS. SMALLER PIPE SIZE SUBSTITUTIONS ARE NOT ACCEPTABLE; LARGER PIPE SIZES MAY BE APPROVED.
4. SOLVENT WELD FITTINGS FOR MAINLINES 2" AND LARGER SHALL BE SCHEDULE 40 PVC. ALL THREADED FITTINGS SHALL BE SCHEDULE 80 PVC.

NON–POTABLE IRRIGATION WATER NOTES

1. IRRIGATION SYSTEM TO BE CONNECTED TO POTABLE SYSTEM UNTIL FUTURE CONNECTION TO RECYCLED WATER SERVICE.
2. SYSTEM TO BE DESIGNED FOR FUTURE NON–POTABLE WATER USE.
3. ALL RISERS TO BE TAGGED WITH PURPLE NON–POTABLE WATER LABELS NOTED IN ENGLISH AND SPANISH.
4. ALL NEW PIPE TO BE PURPLE PIPE AS SHOWN IN LEGEND.

WATER CONSERVATION STATEMENT

1. I HAVE COMPLIED WITH THE CRITERIA OF THE (STATE/CITY WATER CONSERVATION) ORDINANCE AND APPLIED THEM FOR THE EFFICIENT USE OF WATER IN THE IRRIGATION DESIGN PLAN.



LOCATION MAP
1"=700'

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SCALE: 1" = 20'

1-800-227-2600

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LANDSCAPE IMPROVEMENT PLANS

SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

IRRIGATION PLAN
12+50 – 30+00

LICENSED LANDSCAPE ARCHITECT
CHRISTOPHER KENNEDY
No. 5248
Signature
1201/11
Renewal Date
08-20-13
Date
STATE OF CALIFORNIA

Approved:

Designed:	CK
Drawn:	CK
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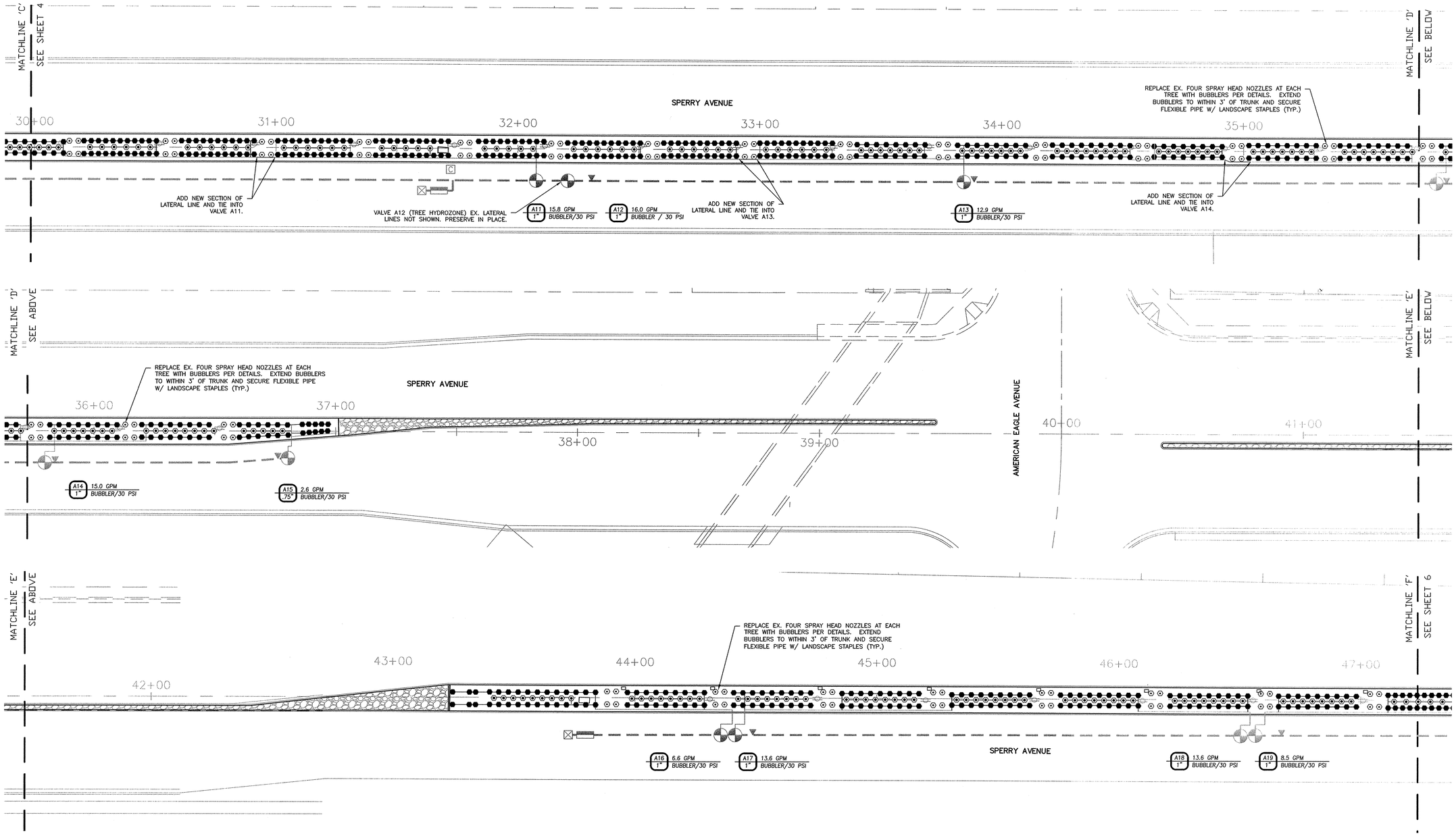

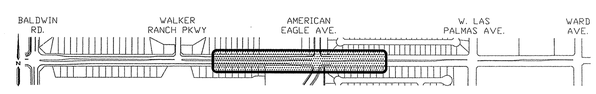

LOCATION MAP
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USA
1-800-227-2600

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LANDSCAPE IMPROVEMENT PLANS

SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

IRRIGATION PLAN
30+00 – 47+25

LICENSED LANDSCAPE ARCHITECT
CHRIS A. KENNEDY
No. 2522
12/31/11
Renewal Date
Signature
Date
STATE OF CALIFORNIA

Approved:

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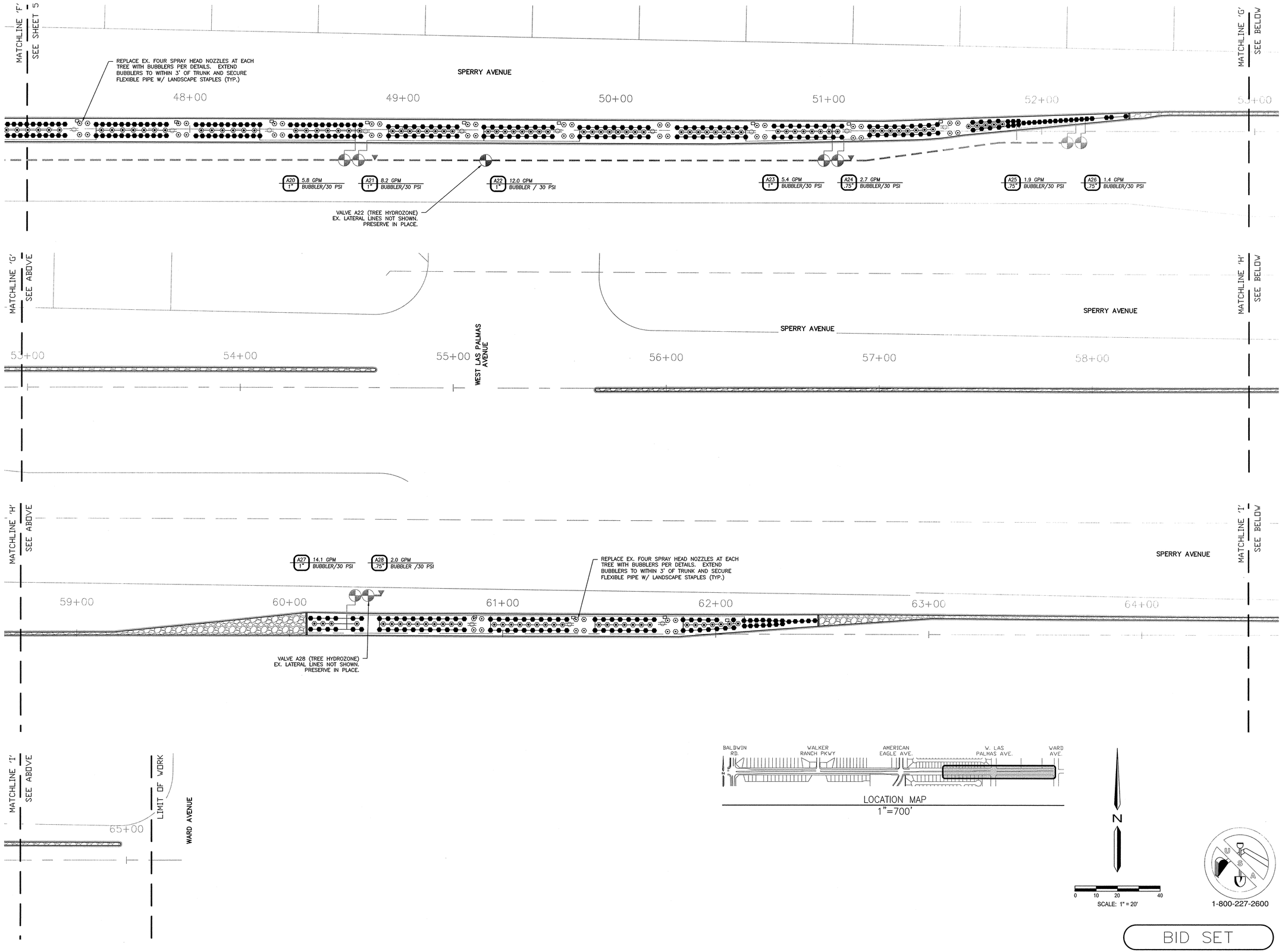

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LANDSCAPE IMPROVEMENT PLANS

SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

IRRIGATION PLAN
47+25 - 65+00

LICENSED LANDSCAPE ARCHITECT
CHRIS A. KENNEDY
Signature
1203111
Renewal Date
01-31-15
CALIFORNIA
STATE OF CALIFORNIA

Approved:

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IRRIGATION LEGEND

SYMBOL	MANUFACTURER	DESCRIPTION	GPM	PSI
BUBBLER				
	RAIN BIRD	PC-T-10 BUBBLER	.16	30
	RAIN BIRD	PC-T-05 BUBBLER	0.08	30
	RAIN BIRD	PC-T-10 BUBBLER	0.16	30
IRRIGATION EQUIPMENT				
	EXISTING TORO	P-220 SERIES EZ 100		
C	EXISTING	MC PLUS 36 STATION CONTROLLER WITH P-25 PEDESTAL. OPERATE ONLY BETWEEN DUSK AND DAWN.		
R	EXISTING	RAIN SENSOR		
	EXISTING	POINT OF CONNECTION		
	EXISTING	BACKFLOW PREVENTER		
	EXISTING	44LRC QUICK COUPLER VALVE. PLACE IN ROUND VALVE BOX WITH LID.		

VALVE CALLOUT

NO. / SIZE — STATION NUMBER; FLOW RATE (GPM) / APPLICATION RATE (IN/H) (TURF-SHRUB-DRIP-BUBBLER) / OP. PRESSURE (PSI); VALVE SIZE

PIPE SCHEDULE

EXISTING	EXISTING MAINLINE AND LATERALS	
¾"	PURPLE SCHEDULE 40 PVC PIPE	
1"	PURPLE SCHEDULE 40 PVC PIPE	
1¼"	PURPLE SCHEDULE 40 PVC PIPE	
1½"	PURPLE SCHEDULE 40 PVC PIPE	

IRRIGATED LANDSCAPE WATER EFFICIENCY TABLE

WATER BUDGET CALCULATIONS

MAXIMUM APPLIED WATER ALLOWANCE				
MAWA=(ETo)(0.62)((0.7xLA)+(0.3xLSA))	LA = 36,678	SLA = 0	LOCAL ETo = 57.3	**MAWA= 2,606,067 GAL**
ESTIMATED TOTAL WATER USE				
ETWU=(ETo)(0.62)(((PFxHA)/IE)+SLA)	PF= SEE BELOW	SLA = 0	LOCAL ETo = 57.3	**ETWU= 500,001 GAL**
	HA= SEE BELOW	IE= 0.86		

HYDROZONE INFORMATION TABLE

HYDROZONE TAG	WATER REQUIREMENT	PLANT FACTOR*	HYDROZONE AREA	ADJUSTED HYDROZONE AREA
SPRAY (A5,A12,A22,A28)	LOW	.243	8072	1,961 S.F.
BUBBLER (A3,A4,A6,A11,A13,A18,A19,A20,A21)	LOW	.243	13479	3,275 S.F.
BUBBLER (A1,A2,A7,A8,A9,A10,A14,A15,A16,A17, A23,A24,A25,A26,A27)	MODERATE	.5	15128	7,564 S.F.
				TOTAL AREA= 12,800.9 S.F.

* THIS INFORMATION DERIVED FROM PLANT FACTOR DESIGNATIONS IN THE WUCOLS DOCUMENT.

IRRIGATION SCHEDULE

SCHEDULING NOTES & RUN TIMES

WATERING CYCLES AND DURATION DURING PRE-ESTABLISHMENT PERIODS SHOULD BE ADJUSTED PER PLANT PROVIDER'S RECOMMENDATIONS AND CURRENT WEATHER CONDITIONS.

POST ESTABLISHMENT IRRIGATION SCHEDULE CALCULATED USING AVERAGE CLIMATE CONDITIONS AND AVERAGE PLANT REQUIREMENTS. THIS SCHEDULE SERVES AS A BASE FOR CONTROLLER PROGRAMMING. EXTREME AND SITE SPECIFIC CONDITIONS WILL RESULT IN ETo ADJUSTMENTS AND MAY REQUIRE ADJUSTMENTS TO SCHEDULE FREQUENCY/DURATION.

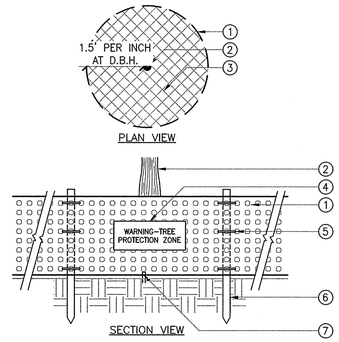
IRRIGATION CONTROLLER SHALL BE CONFIGURED TO RUN ALL ZONES ON SOAK CYCLES.

STATION RUN-TIMES ARE SHOWN IN MINUTES PER DAY (MIN) AND DAYS PER WEEK (DW)

	WINTER		SPRING		SUMMER		FALL	
	PRE-EST.	POST-EST.	PRE-EST.	POST-EST.	PRE-EST.	POST-EST.	PRE-EST.	POST-EST.
SPRAY (A5,A12,A22,A28)	8 MIN/4 DW	17 MIN/2 DW	31 MIN/4 DW	63 MIN/2 DW	33 MIN/4 DW	65 MIN/2 DW	16 MIN/4 DW	32 MIN/2 DW
BUBBLER (A3,A4,A6,A11,A13,A18,A19,A20,A21)	2 MIN/4 DW	2 MIN/2 DW	3 MIN/4 DW	6 MIN/2 DW	3 MIN/4 DW	7 MIN/2 DW	2 MIN/4 DW	3 MIN/2 DW
BUBBLER (A1,A2,A7,A8,A9,A10,A14,A15,A16,A17, A23,A24,A25,A26,A27)	2 MIN/4 DW	4 MIN/2 DW	7 MIN/4 DW	13 MIN/2 DW	7 MIN/4 DW	14 MIN/2 DW	3 MIN/4 DW	7 MIN/2 DW

1. PROTECTIVE BARRIER FENCING MATERIAL, DEFINING THE EDGE OF THE TREE PROTECTIVE ZONE, SHALL BE:
   - 4' HEIGHT
   - UV STABILIZED
   - 2600 PSI TENSILE STRENGTH
   - BRIGHT CONTRASTING COLOR

   PLACED AT A DISTANCE 1.5' PER INCH AT DIAMETER AT BREAST HEIGHT (D.B.H.) FROM THE TRUNK.
2. EXISTING TREE-TO BE PROTECTED
3. PROTECTION ZONE
4. WARNING SIGN ON EACH FENCE AS DEPICTED, WATERPROOF 18"x24".
5. UV STABILIZED 120LB BREAKING STRENGTH, NYLON TIE, MATCHING BARRIER COLOR (3 PER POST).
6. FENCE POST- METAL T-POSTS OR EQUAL @ 8' O.C.
7. 6" GROUND STAPLES

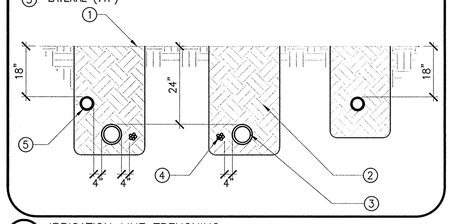


NOTE:
1. ALL EXISTING TREES ADJACENT TO CONSTRUCTION LIMITS SHALL BE FENCED OFF WITH ORANGE CONSTRUCTION FENCING.
2. WATERPROOF SIGNS (18"x24"), SHALL BE POSTED AT ENTRANCE POINTS TO SITE WITH INSTRUCTIONS TO PERSONNEL REGARDING RESTRICTIONS WITHIN THE FENCED AREAS. THE FOLLOWING ACTIVITIES MAY NOT OCCUR WITHIN THE FENCED AREAS.
   - A) DIGGING, TRENCHING, TILLING, GRADING, OR SOIL DISTURBANCE
   - B) ADDITION/REMOVAL/STORAGE OF SOIL.
   - C) PARKING OF VEHICLES, PLACEMENT OF EQUIPMENT, STORAGE OF MATERIALS
   - D) BURNING AND CEMENT WASH-OUT
   - E) CONSTRUCTION ACTIVITIES
3. A TREE WATERING SCHEDULE WILL BE REQUIRED WHEN CONSTRUCTION LASTS MORE THAN 2-WEEKS, CONSULT THE LANDSCAPE ARCHITECT.
4. MULCH 2-INCHES FROM THE TREE TRUNK TO THE EXTENTS OF THE TREE PROTECTION ZONE, DEFINED BY THE FENCE/BARRIER, AT A DEPTH OF 2-INCHES.
5. ADDITIONAL PROTECTION WILL BE REQUIRED WHEN: TREE'S CANOPY IS IN JEOPARDY, EXTREME SOIL COMPACTION OCCURS NEAR TREE, OR MAJOR GRADE CHANGE OCCURS NEAR TREE.
6. IN THE EVENT THAT ROOT DAMAGE TO FIBROUS/MINOR ROOTS OCCURS DURING PROJECT CONSTRUCTION THEY SHALL BE CLEANLY SEVERED AT A 90° ANGLE TO MINIMIZE DAMAGE. IF MAJOR ROOTS ARE DAMAGED AN INTERNATIONAL SOCIETY OF ARBORICULTURE (ISA) CERTIFIED ARBORIST SHALL BE CONSULTED (AT THE EXPENSE OF THE CONTRACTOR) FOR WORK TO REPAIR THE DAMAGE.
7. IN THE EVENT THAT DAMAGE OCCURS TO THE CROWN OR TRUNK OF THE TREE AN INTERNATIONAL SOCIETY OF ARBORICULTURE (ISA) CERTIFIED ARBORIST SHALL BE CONSULTED (AT THE EXPENSE OF THE CONTRACTOR) FOR WORK TO REPAIR THE DAMAGE.
8. IRRIGATION LINES ARE DESIGNED TO MINIMIZE IMPACT TO EXISTING TREES AND SHOULD NOT BE DEVIATED FROM WITHOUT PERMISSION FROM THE LANDSCAPE ARCHITECT OR OWNERS REPRESENTATIVE.
9. IN THE EVENT THAT THE ARBORIST RECOMMENDS REPLACEMENT OF AN EXISTING TREE DAMAGED BY THE CONTRACTOR, THE CONTRACTOR SHALL REPLACE THE TREE WITH STOCK NO SMALLER THAN A 36" BOX AND FAIRLY COMPENSATE THE OWNER FOR DAMAGES.

3 TREE PROTECTION FENCING

NOT TO SCALE

1. FINISH GRADE
2. SALVAGED EXCAVATED FILL COMPACTED TO ORIGINAL DENSITY (TYP)
3. SUPPLY LINE (TYP)
4. LV. WIRING (TYP)
5. LATERAL (TYP)

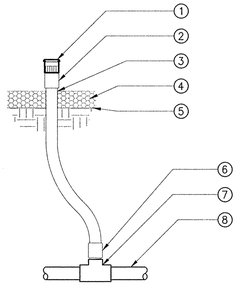


1 IRRIGATION LINE TRENCHING

NOT TO SCALE

1. BUBBLER PER PLANS
2. ½" SLIP X ½" MPT SCH 40 PVC MALE ADAPTER
3. PURPLE STRIPE BLACK ½" IPS FLEXIBLE PVC HOSE
4. TOP OF MULCH
5. FINISH GRADE
6. RAINBIRD MDCF75MPT ADAPTER
7. ½" SLIP X ½" MPT SCH 40 PVC MALE ADAPTER
8. PVC LATERAL PIPE

NOTE: USE 795 GLUE OR OTHER MAN. RECOMMENDED GLUE FOR PVC FITTINGS.



2 SHRUB BUBBLER

NOT TO SCALE

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LANDSCAPE IMPROVEMENT PLANS

SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

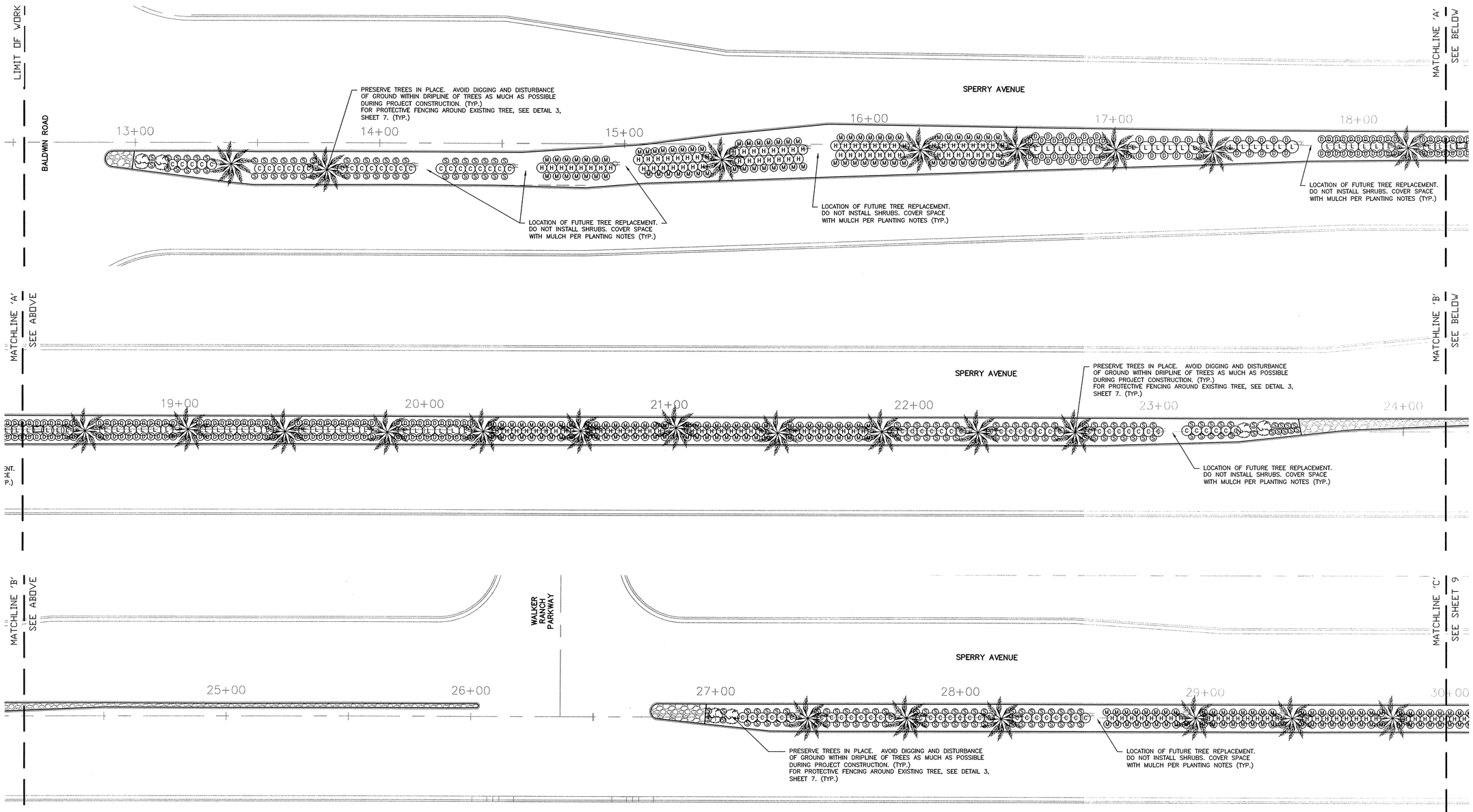
IRRIGATION PLAN NOTES & DETAILS

LICENSED LANDSCAPE ARCHITECT — DAVID A. KENNEDY — STATE OF CALIFORNIA — Signature — 12/31/11 Renewal Date — Date

Approved:

Designed:	CK
Drawn:	CK
Checked:	CK
Scale:	1"=20'
Date:	2013-08-13
Job No.:	20550
File No.:	20550ls.dwg

Sheet No. 7 Of 10



GENERAL PLANTING NOTES

1. ANY AND ALL PORTIONS OF THIS WORK ARE TO BE CONSTRUCTED IN COMPLIANCE WITH ALL APPLICABLE RULES AND REGULATIONS AS SET FORTH BY LOCAL MUNICIPALITIES, STATE AND NATIONAL AGENCIES. IN THE EVENT THERE IS A CONFLICT WITH THESE PLANS AND THE AGENCIES STATED ABOVE, THE GOVERNING BODY'S REGULATIONS SHALL PREVAIL.
2. PRIOR TO BIDDING AND COMMENCEMENT OF SITE WORK, THE CONTRACTOR SHALL BECOME FAMILIAR WITH AND EXAMINE CONDITIONS OF THE PROJECT SITE, VERIFYING LOCATIONS OF ALL EXISTING UTILITIES, STRUCTURES AND SERVICES. LOCATIONS OF ITEMS SHOWN ON THESE PLANS ARE ONLY APPROXIMATIONS. ANY DISCREPANCIES DISCOVERED SHALL BE REPORTED TO THE LANDSCAPE ARCHITECT. FAILURE TO REPORT DISCREPANCIES TO THE LANDSCAPE ARCHITECT BEFORE COMMENCEMENT OF SITE WORK IMPLIES ACCEPTANCE OF SITE CONDITIONS AND COSTS ASSOCIATED WITH CORRECTING PLANTING RELATED INSTALLATIONS.
3. CONTRACTOR TO PURCHASE AND PROVIDE ALL LABOR, MATERIALS, AND EQUIPMENT NECESSARY TO COMPLETE THE LANDSCAPE WORK AS SHOWN ON THE DRAWINGS AND AS SPECIFIED. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR PROTECTION OF THESE ITEMS UNTIL THE PROJECT IS COMPLETED.
4. ALL SCALED DIMENSIONS ARE APPROXIMATE. BEFORE PROCEEDING WITH ANY WORK, THE CONTRACTOR SHALL CAREFULLY CHECK AND VERIFY ALL DIMENSIONS AND QUANTITIES AND SHALL IMMEDIATELY INFORM THE OWNER'S REPRESENTATIVE OF ANY DISCREPANCY BETWEEN THE INFORMATION. NUMBERS PROVIDED ON THIS PLAN ARE FOR REFERENCE ONLY. THE NUMBER OF SYMBOLS SHOWN ON THE PLANS SHALL HAVE PRIORITY OVER THE NUMBERS GIVEN.

SOIL PREPARATION

1. THE LANDSCAPE CONTRACTOR SHALL INSPECT THE PLANTER AREAS FOR EXTREME COMPACTION PARTICULARLY AROUND CONSTRUCTION AREAS. PROVIDE MEANS FOR RIPPING TO A DEPTH OF TWELVE INCHES (12") ALL COMPACTED AREAS TO INSURE PROPER ROOT GROWTH OF NEW PLANTINGS.
2. CULTIVATE TOP SIX INCHES (6") OF SOIL IN ALL SHRUB AREAS.
3. NO SOIL SHALL BE HANDLED OR WORKED WHEN IN A MUDDY CONDITION.
4. FINISH GRADE SHALL BE APPROVED BY THE OWNERS REPRESENTATIVE BEFORE ANY PLANTING BEGINS.
5. AN EVEN FINISHED GRADE WITH NO RIDGES OR DEPRESSIONS SHALL BE CAREFULLY MAINTAINED DURING OPERATIONS TO ENSURE PROPER SURFACE DRAINAGE.
6. CONTRACTOR TO PERFORM SOILS ANALYSIS AND OBTAIN AMENDMENT RECOMMENDATIONS FROM SOIL LABORATORY PRIOR TO BEGINNING WORK AND AFTER BACKFILL SOIL HAS BEEN PLACED. CONTRACTOR SHALL AMEND SOILS PER MOST RECENT RECOMMENDATIONS. THE FOLLOWING MINIMUM AMENDMENTS SHALL BE INCORPORATED INTO ALL PLANTED AREAS AND TILLED INTO THE SOIL TO A DEPTH OF SIX TO TWELVE INCHES (6"–12"):
   –RECOMMENDED FERTILIZER AND ELEMENTAL AMENDMENTS.
   –ORGANIC AMENDMENT AT 3 CUBIC YARDS PER 1,000 SF.

PLANT MATERIAL

1. SUBSTITUTIONS WILL NOT BE PERMITTED UNLESS APPROVED BY THE OWNER.
2. PLANTS SHALL BE SOUND, HEALTHY, VIGOROUS, FREE FROM NOXIOUS WEEDS, PLANT DISEASE, INSECT PESTS, OR THEIR EGGS, AND SHALL HAVE HEALTHY, NORMAL ROOT SYSTEMS AND COMPLY WITH ALL STATE AND LOCAL REGULATIONS.
3. PLANTS SHALL NOT BE PRUNED PRIOR TO DELIVERY EXCEPT AS AUTHORIZED BY THE OWNER'S REPRESENTATIVE. DO NOT "TOP" TREES.
4. ALL PLANT MATERIAL IS SUBJECT TO REVIEW AND APPROVAL BY THE OWNER PRIOR TO INSTALLATION. THE CONTRACTOR WILL BE RESPONSIBLE FOR REPLACING ANY REJECTED MATERIAL.
5. CONTRACTOR TO PROVIDE PLANT MATERIAL DELIVERY TO JOB SITE. CONTRACTOR IS RESPONSIBLE FOR STORAGE, CARE, INSTALLATION, AND GUARANTEE FROM TIME OF DELIVERY. DO NOT STORE PLANT MATERIAL ON CONCRETE OR ASPHALT SURFACES.

WEED CONTROL

1. AFTER PLANTING SHRUB BEDS AND PRIOR TO TOPDRESSING, APPLY RONSTAR–G (OR EQUAL) PRE–EMERGENT WEED CONTROL IN THE AMOUNTS SPECIFIED BY THE MANUFACTURER. CONTRACTOR IS RESPONSIBLE FOR WATERING IN WEED CONTROL APPLICATION PER MANUFACTURER'S SPECIFICATIONS.

PLANTING OPERATIONS

1. ALL PLANTS SHALL BE PLANTED, STAKED, AND TIED ACCORDING TO THESE PLANS.
2. STAKE TREES AT THE LOWEST POINT WHERE THE TREE CAN SUPPORT ITSELF.
3. THOROUGHLY WATER TREES, SHRUBS, AND GROUNDCOVER IMMEDIATELY AFTER PLANTING.
4. RELOCATION OF TREES: IN THE EVENT THAT UNDERGROUND CONSTRUCTION WORK OR OBSTRUCTIONS ARE ENCOUNTERED IN EXCAVATION OF THE TREE HOLES, ALTERNATE LOCATIONS WILL BE SELECTED BY THE OWNER'S REPRESENTATIVE.
5. ALL TREES SHALL BE PRUNED TO REMOVE BROKEN AND DAMAGED LIMBS AND BRANCHES. NO OTHER PRUNING IS APPROVED.
6. ROOT BARRIERS ARE REQUIRED FOR ALL TREES PLANTED WITHIN 10' OF A PAVED SURFACE. SEE DETAILS FOR MORE INFORMATION.
7. 3" TOPDRESSING OF DECORATIVE MULCH (BLACK) BY GROVER ENVIRONMENTAL PRODUCTS (1–800–585–4401) (MAXIMUM 2 INCH LENGTHS) TO BE INSTALLED PER DETAILS. WASH EXCESS BARK OFF LEAVES AND DO NOT ENGULF STEMS OF PLANTS AND GROUNDCOVER.
8. FERTILIZER TABLETS SHALL BE BEST–PAKS (20–10–5) PLANTER PACKETS PLACED IN ALL PLANTING PITS PER DETAILS.

PLANT ESTABLISHMENT AND MAINTENANCE PERIODS

1. THE LANDSCAPE CONTRACTOR SHALL PROVIDE A PLANT ESTABLISHMENT PERIOD OF SIXTY (60) DAYS COMMENCING AT COMPLETION OF PLANT MATERIAL INSTALLATION.
2. APPROXIMATELY 30 DAYS AFTER INITIAL PLANTING, APPLY A BALANCED FERTILIZER TO SHRUB AREAS PER MANUFACTURER'S RECOMMENDED RATES.
3. FOLLOWING THE PLANT ESTABLISHMENT PERIOD, THE LANDSCAPE CONTRACTOR SHALL MAINTAIN THE INSTALLATION FOR SIXTY (60) DAYS INCLUDING MOWING AND MAINTENANCE OF TURF, SHRUBS, TREES, FERTILIZATION, REMOVING CLIPPINGS FROM SITE, EDGING, CONTROL OF WEEDS AND LITTER AND DEBRIS PICKUP. ADJUSTMENTS TO THE IRRIGATION SYSTEM FOR TIME AND DURATION OF FLOWS AND REPLACEMENT AND ADJUSTMENTS TO HEADS AND NOZZLES ARE ALSO REQUIRED.
4. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR DISEASE AND PEST CONTROL DURING THE ESTABLISHMENT AND MAINTENANCE PERIODS.
5. CONTRACTOR IS REQUIRED TO VISIT SITE ONCE PER WEEK TO PERFORM MAINTENANCE AND ESTABLISHMENT FUNCTIONS AS LISTED ABOVE.

ACCEPTANCE

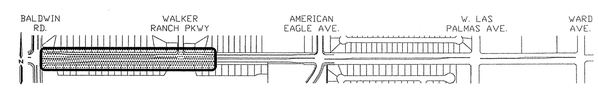
1. COMPLETED WORK WILL BE REVIEWED AND OBSERVED BY OWNER. ANY MODIFICATIONS REQUIRED TO MEET THE STANDARDS AS SET FORTH IN THESE LANDSCAPE DOCUMENTS WILL BE SUBMITTED TO THE LANDSCAPE CONTRACTOR AND CORRECTED AT THE LANDSCAPE CONTRACTOR'S EXPENSE. CORRECTED ITEMS MUST BE APPROVED BY OWNER.
2. UPON FINAL ACCEPTANCE, LANDSCAPE CONTRACTOR SHALL INSTRUCT MAINTENANCE PERSONNEL AS TO THE OPERATION AND MAINTENANCE OF ALL LANDSCAPING.

GUARANTEE

1. ALL SHRUBS SHALL BE GUARANTEED BY THE LANDSCAPE CONTRACTOR TO LIVE AND GROW IN A HEALTHY UPRIGHT POSITION DURING THE ESTABLISHMENT AND MAINTENANCE PERIODS. REPLACEMENT MATERIAL WILL BE AT THE LANDSCAPE CONTRACTOR'S EXPENSE EXCEPT IF VANDALIZED OR STOLEN.

WATER CONSERVATION STATEMENT

1. I HAVE COMPLIED WITH THE CRITERIA OF THE (STATE/CITY WATER CONSERVATION) ORDINANCE AND APPLIED THEM FOR THE EFFICIENT USE OF WATER IN THE LANDSCAPE DESIGN PLAN.



LOCATION MAP
1"=700'

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SCALE: 1" = 20'

U S A
1-800-227-2600

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LANDSCAPE IMPROVEMENT PLANS

SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

PLANTING PLAN
12+50 – 30+00

LICENSED LANDSCAPE ARCHITECT
GARY J. KENNEDY
Signature
12/01/11
Renewal Date
Date
STATE OF CALIFORNIA

Approved:

Designed:	CK
Drawn:	CK
Checked:	CK
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Date:	2013–08–13
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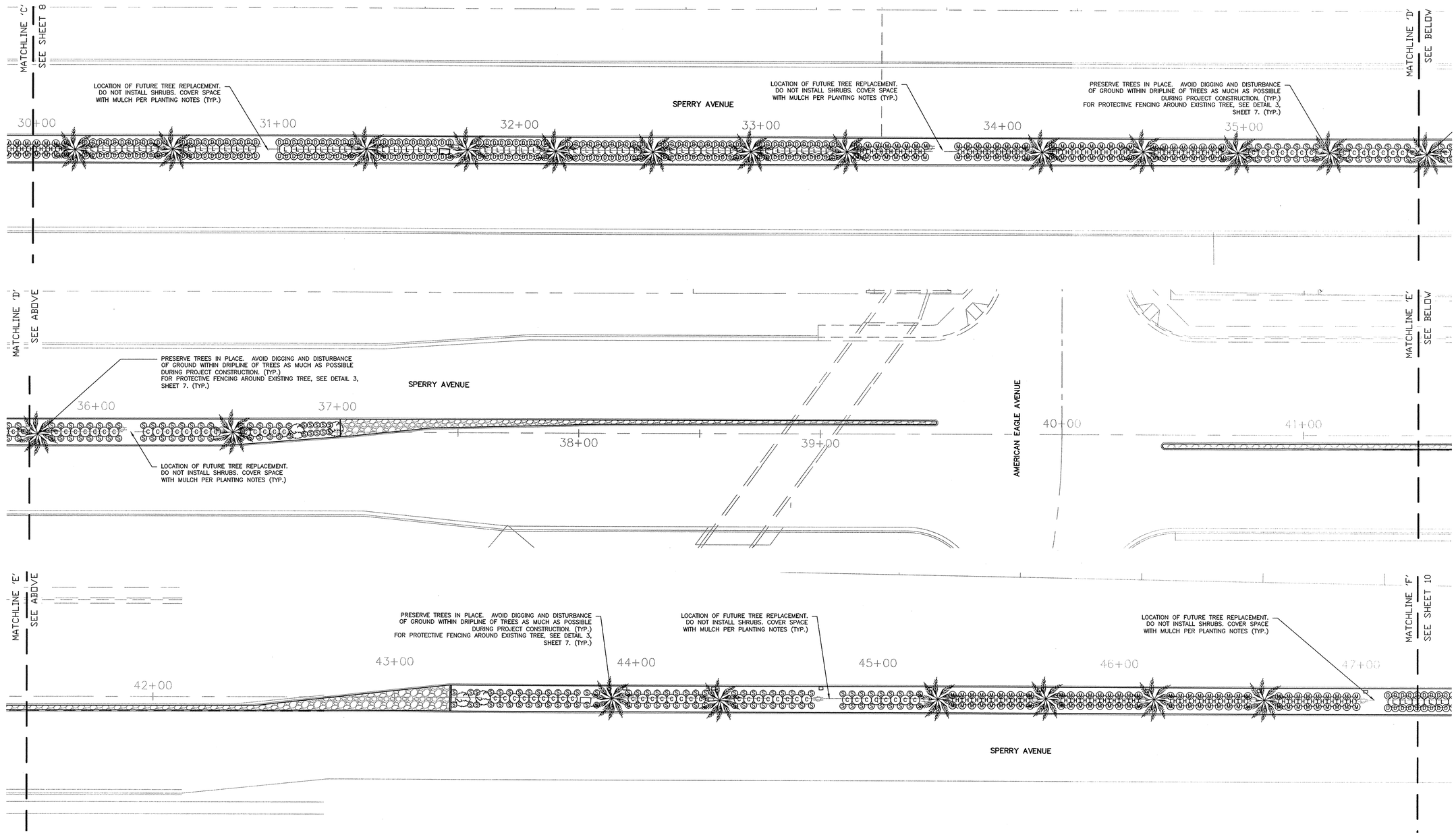

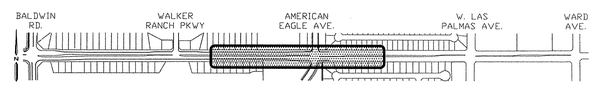

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LANDSCAPE IMPROVEMENT PLANS

SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

PLANTING PLAN
30+00 – 47+25

LICENSED LANDSCAPE ARCHITECT
CHRIS A. KENNEDY
Signature
12/31/11
Renewal Date
Date
STATE OF CALIFORNIA

Approved:

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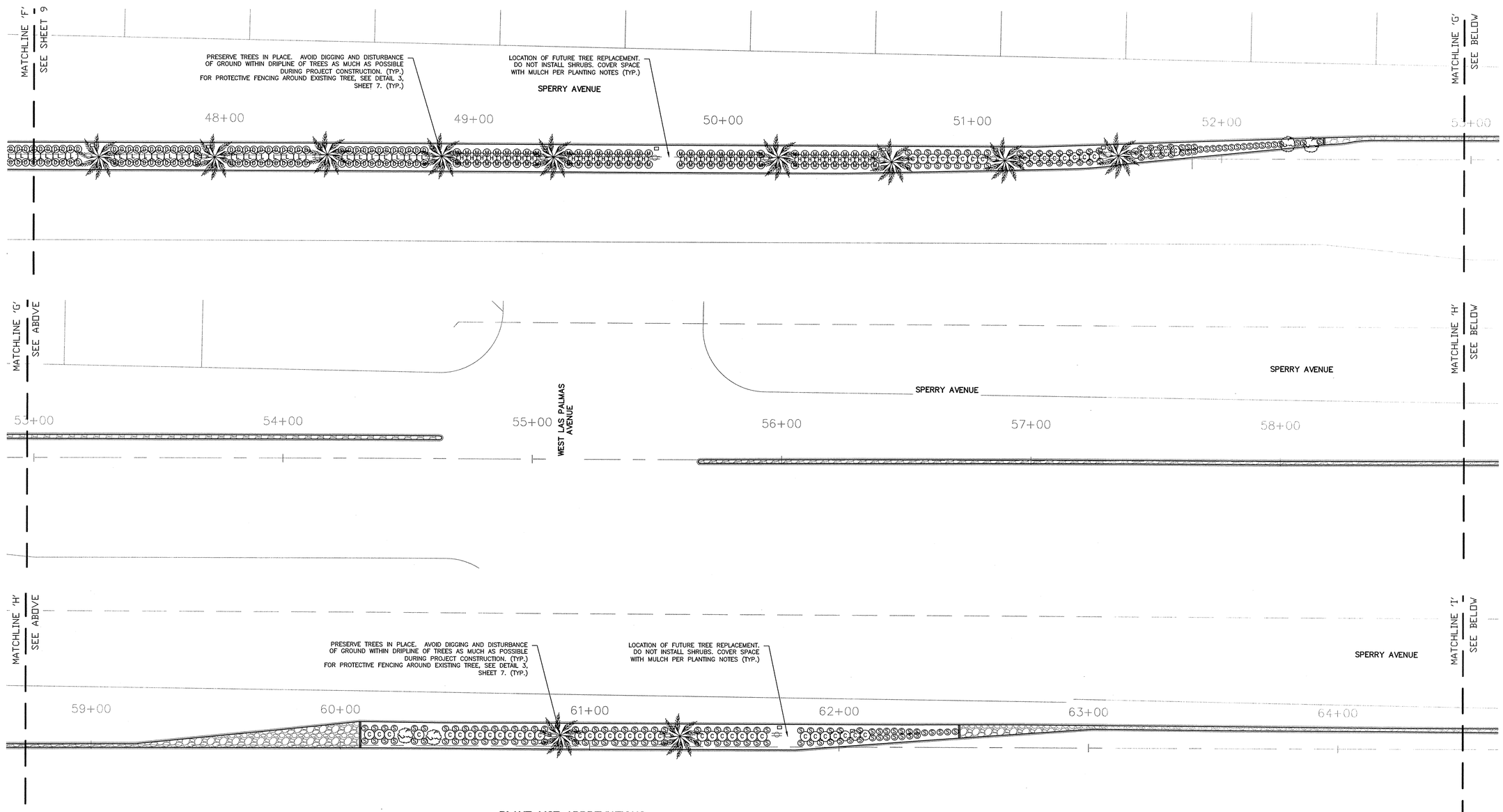
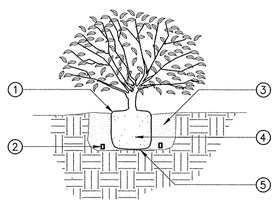


PLANT LIST ABBREVIATIONS

BR GR	BRANCHED TO GROUND	MATCH	MATCHED SIZE, FORM, CALIPER, BRANCHING AND CULTIVAR. SELECT FORM ONE LOT, ONE GROWER, FOR GUARANTEED CONSISTENCY THROUGH LIFE OF PLANTS. IN GENERAL PLANTS WITHIN A GROUP OR AREA ARE TO BE MATCHED, UNLESS NOTED OTHERWISE
DV	DWARF VARIETY		
F&B	FULL DENSE, BUSHY, VIGOROUS PLANTS, WITH YOUNG GROWTH CLOSELY SPACED ON BRANCHES		
FGR	FREE OF GIRDLING ROOTS	MULTI	MULTI STEMMED
FLW	FLOWER	SL	SINGLE, STRAIGHT, DOMINANT LEADER
GAL	GALLON CAN	TRI SP	TRIANGULARLY SPACED
HI BR	HIGH BRANCHED	TTW	TRAIN TO WALL
LO BR	LOW BRANCHED	VAR	VARIEGATED SPECIES

1. CROWN 2" ABOVE GROUND
2. FERTILIZER PLANT TABS: 1 PER 1 GAL, 3 PER 5 GAL
3. BACKFILL MIX (SEE PLANTING NOTES)
4. ROOTBALL
5. SCARIFY BOTTOM OF HOLE

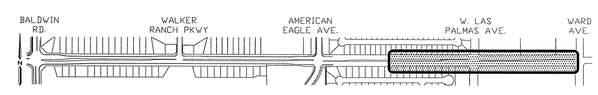


1 SHRUB PLANTING

NOT TO SCALE

PLANT LEGEND

SYMBOL	BOTANICAL NAME	COMMON NAME	SIZE	QUANTITY	WATER USE	APPROX. SPACING	COMMENTS/NOTES
SHRUBS							
C	Callistemon citrinus 'Jeffersii'	Lemon Bottlebrush 'Jeffersii'	5 GAL	213	MODERATE	5'	F&B, PINK FLW, MATCH
D	Dietes vegeta	Fortnight Lily	5 GAL	447	LOW	3'	F&B, WHITE FLW, MATCH
H	Hesperaloe parviflora 'Yellow'	Yellow Yucca	5 GAL	225	LOW	3'	F&B, YELLOW FLW, MATCH
L	Leucophyllum frutescens 'Compacta'	Texas Sage 'Compacta'	5 GAL	126	LOW	5'	F&B, DARK PINK FLW, MATCH
M	Myoporum parvifolium 'Putah Creek'	Putah Creek Myoporum	5 GAL	426	LOW	4'	F&B, WHITE FLW, MATCH
S	Salvia microphylla 'Hot Lips'	Hot Lips Sage	1 GAL	520	MODERATE	2'	F&B, RED FLW, MATCH



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SPERRY AVENUE LANDSCAPE

PATTERSON, CALIFORNIA

PLANTING PLAN
47+25 - 65+00

LICENSED LANDSCAPE ARCHITECT
CHRIS A. KENNEDY
Signature
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STATE OF CALIFORNIA

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City of Patterson Turf Removal Project - Energy Calculations

From Chris Linneman from Summers Engineering and confirmed by Richard Bichette (RMC)

$$\frac{GPM \times FT}{3960 \times e} = HP$$

ENTER NUMBERS IN BLUE

						AFY	GPM	
			Gallon per minute calculation			33.8	21	
			Gallon per minute calculation			5	3	
								30-year
Location	**GPM**	**Head (ft)**	**Efficiency**	**HP**	**kWh/y**	**MWh/y**	**30 Lyfecycle kWh**	**MWh**
Existing	21	498	80	3	21,526	21.53	650,000	650
Proposed	3	498	80	0	3,184	3.18	100,000	100
Difference						18.34	550,000	550

Greenhouse Gasses

Scenario	lbs of CO2	Metric Ton CO2	30 year
Without Project	15,585	7.1	212
With Project	2,305	1.0	31
Difference		6.0	181

Electricity	Months	Total Electricity (MWh/y)
Not Constructed	7	151
Constructed	5	16
Weighted Average =		14
	Benefit =	8

Greenhouse Gasses	Months	Total Electricity (MWh/y)
Not Constructed	7	49
Constructed	5	5
Weighted Average =		5
	Benefit =	3

California Climate Action Registry General Verification Protocol

Verifying Entity-Wide Greenhouse Gas Emissions

Version 3.0 | August 2008

Acknowledgements

The California Registry would like to thank and acknowledge the many experts who have helped make both the General Verification Protocol and the California Registry a reality. While it is impossible to properly acknowledge everyone who contributed to this document, the following organizations have provided valuable guidance and insightful feedback throughout the duration of this project:

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California Energy Commission

California Energy Commission Registry Workgroup

California EPA

CH2M Hill

California Council for Environmental & Economic Balance

Lawrence Berkeley National Laboratory

National Resources Defense Council – Convened State Registry Collaborative

Pew Center on Global Climate Change

Science Applications International Corporation (SAIC)

U.S. Department of Energy

U.S. Energy Information Administration (1605b Program)

U.S. Environmental Protection Agency

U.S. EPA Climate Leaders

World Business Council for Sustainable Development

World Resources Institute

The California Registry is also grateful to all of the individuals who participated in the California Registry's public workshops and meetings. Most notably, Rachel Tornek, Robyn Camp, Jill Gravender, Pierre duVair and Jeff Wilson should be singled out for their extensive contributions in the drafting and finalization of this report.

The California Energy Commission has been instrumental in providing technical policy guidance to the California Registry's staff and board of directors.

The California Registry wishes to extend a special thank you to SAIC for their help preparing the General Verification Protocol.

Finally, the California Registry wishes to thank the California Energy Commission and the Energy Foundation for their generous financial support of the California Registry.

Version 1 of the General Verification Protocol was released in October 2002. Version 2 was released in July 2003. Version 3 was released in August 2008.

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Abbreviations and Acronyms

CARB	California Air Resources Board
CARROT	Climate Action Registry Reporting Online Tool
CDF	California Department of Forestry and Fire Protection
CEMS	Continuous Emissions Monitoring Systems
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COI	Conflict of Interest
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
N_2O	nitrous oxide
PFC	perfluorocarbon
RFA	Request for Applications
SAR	IPCC Second Assessment Report (1996)
SF_6	sulfur hexafluoride
TA	Technical Assistance Provider
TAC	Technical Advisory Committee
TAR	IPCC Third Assessment Report (2002)

Part I Introduction

1.1 Overview

The California Climate Action Registry created this General Verification Protocol to provide California Registry-approved verifiers with clear instructions for executing a standardized approach to the independent verification of greenhouse gas (GHG) emissions baselines and annual emissions reported by California Registry participants. This standardized approach defines a verification process that promotes the relevance, completeness, consistency, accuracy and transparency of emissions data reported to the California Registry. While this Protocol is written for verifiers, California Registry participants who are interested in understanding and preparing for the verification process may also find it useful.

This Protocol is intended to be used in combination with the California Registry's General Reporting Protocol and web-based calculation and reporting tool (CARROT—Climate Action Registry Reporting Online Tool). **Approved verifiers will verify participants' GHG emissions reports to the standards of the California Registry's General Reporting Protocol, and sector-specific protocols using the process outlined in this General Verification Protocol**.

At a minimum, each emissions report must contain all of an entity's emissions of CO_2 in the state of California for a calendar year, reported in five categories: indirect emissions from purchased electricity, imports of steam, district heating/cooling, and direct emissions from mobile combustion, stationary combustion, manufacturing processes, and fugitive emissions. Where a participant is reporting their U.S. emissions, the report must contain all of their emissions nationally. Starting with the fourth year of reporting, each emissions report must contain all emissions of all six greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6).

Emissions reports may also contain other information about an organization and its emissions that does not require verification. For instance, this could include information about a company's environmental goals, programs, policies, etc. Participants may also choose to report other indirect emissions, like business travel or employee commuting. In the emissions reports, optional information will be clearly distinguished from information that is verified.

Activities for each specific verification will differ based on the length and complexity of a participant's emissions report, but the verification process will include at least the following steps:

- Case-by-case evaluation of Conflict of Interest
- Scoping and planning a participant's verification activities
- Conducting verification activities
    1. Identifying emissions sources
    2. Reviewing methodologies and management systems
    3. Verifying emission estimates
- Preparing a participant's Verification Report and Verification Opinion

- Submitting a participant-authorized electronic Verification Form and Verification Activity Log to the California Registry via CARROT

Upon completion of the above steps, the California Registry will review the emissions report before accepting a participant's verified emissions report into its emissions database. This process is repeated every year of an organization's participation in the California Registry.

To help decrease the potential for conflict of interest between a verifier and a participant, a verifier can verify the same participant for a maximum of six consecutive years. After six years, a participant must choose another verifier for at least three years. After that time, the original verifier would again be eligible to verify the participant's emissions for up to six consecutive years.

The California Registry assumes that the verifiers will use their best professional judgment when conducting verification activities.

1.2 Organization of this General Verification Protocol

This General Verification Protocol is divided into four parts which outline the necessary steps a verifier must follow to initiate and complete the verification of a participant's emissions report.

Part I, *Introduction* (this section), provides a brief overview of the purposes and requirements of the verification process, describes the principles of verification, highlights important definitions, and answers some key questions.

Part II, *Preparing for Verification*, focuses on activities that take place prior to beginning verification activities, including bidding for a contract with participants, determining conflict of interest, negotiating a contract with participants, providing required notifications, and designing appropriate verification activities for each participant.

Part III, *Core Verification Activities*, provides guidance on conducting the primary activities that the verifier will complete, including: identifying sources, reviewing management systems and methodologies, and verifying emission estimates.

Part IV, *Completing the Verification Process*, covers procedures for completing the verification process including: preparing a Verification Report and Verification Opinion, completing the Verification Form to submit a participant's verified data to the California Registry, and recording and retaining proper records.

1.3 Principles of Verification

The purpose of verification is to provide an independent review of data and information being submitted to the California Registry to ensure that they meet minimum quality criteria. To fulfill this purpose, the independent verification process maintains the criteria of completeness, consistency, accuracy, comparability and transparency as its underlying principles.

Relevance. Verification should ensure that GHG inventories submitted to the California Registry appropriately reflect the GHG emissions of the entity and include emissions information produced in accordance with the program rules on defining reporting boundaries and sources.

Completeness. Verification should ensure accounting of all material GHG emissions sources and activities within the specified scope of the participant's inventory (a minimum of 95%). Baseline and annual emissions results should include all sources for which the participant is responsible.

Consistency. An emissions report should allow for meaningful comparison of emissions performance over time and across similar organizations. Independent verification should ensure that consistent methodologies and measurements are used between the baseline results and annual emissions results. Additionally, changes to participant emission baselines are verified to ensure appropriate comparisons.

Accuracy. Entity-wide reported data should be within the materiality threshold of 5% of the verifier's estimate of total emissions. Calculations and estimates need to be as accurate as possible to prevent material errors.

Transparency. Verification should be a transparent exercise. The data used for verification and the verification activities should be clearly and thoroughly documented to allow for outside review by the California Registry or potential review by the State of California (the State) in the context of overseeing verification activities.

1.4 Verification Principles and Definitions

1.4.1 Verification Standard

Verifiers must verify participants' GHG emissions reports against the California Registry's General Reporting Protocol using the process outlined in this General Verification Protocol. If a participant is reporting process or fugitive emissions, a separate industry-specific protocol may also be used and cited, where available. Some participants may wish to use their GHG emissions report for additional purposes such as registering in another registry, participating in emissions trading schemes, crediting programs, etc., and thus may add additional standards for verification.

1.4.2 Minimum Quality Standard

A verified emissions report submitted to the California Registry must be free of material misstatements, achieving a level of at least 95% accuracy. It is possible that during the verification process, differences will arise between the emissions totals estimated by participants and those estimated by verifiers. Differences of this nature may be classified as either material (significant) or immaterial (insignificant). A discrepancy is considered to be material if the overall reported emissions differ from the overall emissions estimated by the verifier by 5% or more. A difference is immaterial if it is less than 5%.

1.4.3 Reporting Uncertainty vs. Inherent Uncertainty

When evaluating participants' emissions reports, verifiers are to determine if the reporting uncertainty (vs. the inherent uncertainty) is less than the minimum quality standard.

Reporting uncertainty entails the mistakes made in identifying emissions sources, managing data or information, and calculating GHG emissions. Inherent uncertainty refers to scientific uncertainty associated with measuring GHG emissions. The California Registry is aware that there is inherent uncertainty in emissions factors and measurement of activity data through metering and instrumentation (even after the calibration of meters and other data collection methods are verified as accurate), but determining scientific accuracy is not the focus of the California Registry or its General Reporting Protocol.

1.5 Professional Judgment

Approved verifiers must verify participants' GHG emissions reports against the California Registry's General Reporting Protocol using the process outlined in this General Verification Protocol. The California Registry asks verifiers to use their professional judgment when executing the verification activities described in this General Verification Protocol. The purpose of the verifier approval process is to find verification firms that demonstrate, through their staff's professional qualifications and relevant GHG experience, their ability to render sound professional judgments about GHG emissions reports.

Application of a verifier's professional judgment is expected in the following areas:

- Implementation of verification activities with appropriate rigor for the size and complexity of a participant's organization and with regard to the uncertainty of calculations associated with the participant's emissions sources;
- Review of the appropriateness of a participant's GHG emissions tracking, monitoring, and management systems for providing information to the California Climate Action Registry;
- Evaluation of participant compliance with the California Registry's General Reporting Protocol;
- Assessment of methods used for estimating emissions from sources for which the General Reporting Protocol does not provide specific guidance, such as process and fugitive emissions, and indirect emissions from sources other than electricity, imported steam, district heating/cooling; and
- Appraisal of assumptions, and estimation methods and emission factors that are selected as alternatives to those provided in the General Reporting Protocol.

The General Verification Protocol and training provided by the California Registry are intended to explain to the verifier the California Registry's guidelines and expectations and thus what types of professional judgments are appropriate for this program. In addition to these resources, verifiers may contact the California Registry at any time for clarification of California Registry guidelines, expectations and policies.

1.6 Conflict of Interest

In order to ensure the credibility of the emissions data reported to the California Registry and its potential utility under any future regulatory regime, it is critical that the verification process is completely independent from the influence of the participant submitting the emissions report. While conducting verification activities for California Registry participants, verifiers must work in a credible, independent, nondiscriminatory and transparent manner, complying with applicable state and federal law and the current version of the State of California's *Conflict of Interest Process and Requirements for State and California Registry-Approved Verifiers*. This document is posted on the California Registry's website**.**

Any pre-existing relationship between the verifier and participant must be acknowledged to the California Registry, which will evaluate the potential for a conflict of interest (COI) between the two organizations.

Verifiers must provide information to the California Registry about its organizational relationships and internal structures for identifying potential conflicts of interest

(organizational COI). Then, on an individual basis, the California Registry will review any pre-existing relationship between a verifier and participant and will assess the potential for conflict of interest (case-by-case COI). When the California Registry determines there is a low risk of COI, the participant and verifier can finalize negotiations of their contract. Following completion of a verification, the verifier must monitor for the next year if any new business relationship may create a COI (emerging COI).

As an added protection, a verifier may provide verification services to a California Registry participant for, at most, six consecutive years. After a six-year period, the California Registry participant must engage a different verifier. The original verifier may not provide verification services to that participant for three years. This three year hiatus begins with any lapse in providing annual verification services to a California Registry participant.

In the event that a verifier violates these conditions, the California Registry, in consultation with the State and at its discretion, may disqualify an approved verifier for a period of up to five years.

This conflict of interest clause does not preclude a verifier from engaging in consulting services for other clients that participate in the California Registry for whom the verifier does not provide any verification activities.

Part II Preparing for Verification

2.1 Verification Process Overview

Before any verification activities begin, a number of procedural steps must be taken to ensure that the obligations and responsibilities of both the verifier and participant are clear.

The following summary of the major steps of verification is provided as a reference.

1. **Verifier receives California Registry approval**: Verifier meets all accreditation requirements and completes a California Registry-sponsored verification training workshop.

2. **Participant selects verifier**: Participant contacts one or more State/California Registry-approved verifiers to discuss verification activities. Participant selects an organization to verify its GHG emissions results and begins to negotiate contract terms.

3. **Verifier submits case-specific Evaluation of Conflict of Interest (COI) and State Notification Form**: After a participant chooses a verifier, the verifier must submit a Conflict of Interest Evaluation and State Notification Form to the California Registry to establish that the likelihood of a COI between parties is low or that risk of any conflict can be sufficiently mitigated by the verifier. The form must be submitted at least 10 working days prior to the first scheduled verification meeting.

4. **California Registry sends COI determination to verifier**: The California Registry reviews the Evaluation of COI Form and supporting information to determine the level of risk associated with the proposed participant/verifier relationship, and notifies the verifier of its determination.

5. **Verifier & participant finalize contract**: When the California Registry provides a favorable COI determination between a participant and verifier, verifiers may finalize their contract with a participant.

6. **Verifier conducts verification activities**: Verifier follows the guidance in the General Verification Protocol to evaluate a participant's annual GHG emissions report.

7. **Verifier prepares Verification Report and Verification Opinion for participant**: Verifier prepares a detailed summary (Verification Report) of the verification activities for the participant. Verifier also prepares a Verification Opinion for participant's review, prior to sending opinion electronically to the California Registry via CARROT.

8. **Verifier & participant discuss Verification Report and Opinion**: Verifier meets with participant to discuss Verification Report and Opinion.

9. **Verifier completes Verification Form via CARROT**: Once authorized by a participant, a verifier completes the Verification Form via CARROT. Participant then submits the original Verification Opinion to the California Registry.

10. **California Registry Conducts Final Review**: California Registry reviews the Verification Opinion and Verification Activity Log and evaluates the participant's

emissions reports. Once accepted by the California Registry, a participant's aggregated entity-level emissions become available to the public via CARROT.

Even in multi-year verification contracts, verifiers must repeat steps 3-11 for each annual verification before submission to the California Registry.

2.2 Becoming an Approved Verifier

Only those firms approved by the California Registry, the State or those involved in the American National Standards Institute (ANSI) accreditation program may provide verification services to California Registry participants. In order to become approved, a verifier must complete a two-step process: 1) Obtain accreditation as a GHG verifier from either the California Air Resources Board or from the American National Standards Institute (or other approved accreditation body as specified on the California Registry website) and 2) achieve California Registry approval by attending a verification training workshop facilitated by the California Registry.

Information on ANSI GHG Verifier Accreditation is available at www.ansi.ghg.org.

Information on CARB GHG accreditation is available at arb.ca.gov.

The second step of the approval process requires that lead verifiers one of the California Registry's verification training workshops. A lead verifier is any verifier from the firm who will sign their firm's Verification Opinion. After completing the training workshop, the verification firm becomes an "approved verifier." Following the training session, the California Registry will provide verifiers with a notification of their full approval. Upon receiving this notice, a firm may approach current or prospective California Registry participants to market their services and capabilities, and advertise that they are "approved verifiers for the California Climate Action Registry". All approved verifiers are listed on the California Registry's website.

Approvals are valid for three years from the date of the California Registry approval. At the end of this period, the California Registry will send a notification to each firm's primary contact. If for any reason the State, ANSI or the California Registry finds that a verifier has failed to meet the standards of either the General Reporting Protocol or the General Verification Protocol, it may disqualify a verifier for a period of up to five years.

2.3 Updates to the General Verification Protocol

Periodically, the California Registry may update the General Verification Protocol. The California Registry will advise all verifiers of any changes, and any new requirements that may affect them. Where any changes are significant, the California Registry may require that lead verifiers attend the next verification training workshop.

2.4 Adding or Deleting Designated Staff

During the application process, verification firms will identify all staff members who will be designated verifiers for the California Registry. An applicant who is State-approved may add or delete staff to their roster. To add or delete designated staff after being approved, the verifier should submit the Designated Staff Form (available on the California Registry's Verifiers Only webpage), with the names and contact information for any personnel changing from the roster, and note if staff are to be deleted or added to the roster. When adding staff, the firm should describe each individual's job classifications, relevant experience, education, academic degrees, professional licenses for technical staff members and their respective roles.

2.5 Bidding on a Verification Contract

The California Registry recommends that those participants with complex GHG emissions reports solicit competitive bids for verification services from at least three approved verifiers. Those participants with simpler GHG emissions reports who do not seek, or are not eligible for, batch verification may wish to secure competitive bids or may wish to sole source the verification contract in order to reduce costs and expedite the verification process.

When preparing to send out a request for bids from verifiers, participants should first review the list of approved verifiers and select some (or all) as prospective bidders. Due to the possibility of access to proprietary information, participants may want to send each prospective bidder a non-disclosure agreement. The California Registry suggests that participants distribute requests for bids to prospective verifiers only after they have received a signed non-disclosure agreement from verifiers.

The California Registry recommends that participants include the following information in their requests for bids from verifiers:

1. The expected contract duration;
2. A general description of the participant's organization;
3. The geographic boundaries of the participant's emissions report;
4. The number and locations of facilities and operations;
5. The GHGs reported in the participant's emissions report;
6. The emission source categories (and possibly emission sources) in the participant's emissions report;
7. The password to a read-only (Reviewer) version of the participant's emissions report in CARROT; and
8. A list and description, by category, of how emissions data is organized and calculated (either using CARROT or another methodology).

The California Registry suggests that participants request that commercial proposals from potential verifiers include the following components:

1. History and description of verification company;
2. Explanation of core competencies;
3. Proposed price for verification services;
4. Proposed staff;
5. Statement of verifier liability;
6. Confidentiality policy; and
7. Duration of contract.

The California Registry expects only limited variation in the technical proposals since all of the approved verifiers are trained to implement the California Registry's standardized verification process.

2.6 Conflict of Interest (COI)

2.6.1 Objective of the Conflict of Interest Process

This COI process was developed by the State of California and adopted, with modifications, by the California Registry to assess the risk of potential COI between verifiers and California Registry participants. This process gives verifiers the ability to demonstrate that their organization is capable of identifying and mitigating situations that would impair their ability to render an impartial verification opinion.

Through this process, applicants and any partners must demonstrate:

1. Clearly-defined organizational boundaries, internal structures, and relationships with other companies that have management or financial control over the applicant.
2. The presence of internal mechanisms to identify and mitigate organizational and personal COIs with any potential clients.
3. The ability to be objective in providing verification activities.

To protect the credibility and rigor of the California Registry verification process, the relationship between verifiers and California Registry participants must not create or appear to create a COI. While conducting verification activities for California Registry participants, the verifier must work in a credible, independent, nondiscriminatory and transparent manner, complying with applicable state and federal law and the current version of the California Registry's conflict of interest process

2.6.2 Process and Requirements

In the verification process, all verifiers must demonstrate they do not have significant conflicts of interest with participants:

1. **Organizational COI** – in the application process, each verifying organization shows that they have internal mechanisms in place that help maintain their objectivity in verification activities.

2. **Case-by-Case COI** – in each case where verification services are requested, before a contract is signed with a participant, each verifier demonstrates that any pre-existing relationship between the verifier and participant will not impair impartiality in verifying a GHG emissions report.

3. **Emerging COI** – for a period of one year following a verification, verifiers will monitor their relationship with the participant to ensure impartiality has been protected in the verification process.

These are each discussed in greater detail below.

2.6.2.1 Organizational COI

As part of the application process, a verifier has already documented the ability of its organization to identify and react to COI due to organizational relationships. Verifiers have also submitted the form *Conflict of Interest Declaration of Ability and Intent to Comply*, declaring the applicant and each partner's ability to subsequently perform and submit a case-

by-case evaluation of COI to the California Registry. This form also conveys the applicant's intent to comply with the California Registry's COI process and requirements.

2.6.2.2 Case-by-Case COI

As an early step in the contract negotiation process between verifiers and participants, a verifier must demonstrate on a case-by-case basis that it, its partners, and the individuals performing verification activities do not have any actual or potential conflict of interest with the California Registry participants for which it has been selected to carry out verification functions.

A verifier will have a high risk of COI if the verifier and participant share any management, or if any of the California Registry participant's managers of GHG-related activities were previously employed with or by the verifier within the last three years, or vice versa. A verifier will have a high risk of COI if the verifier or its related companies (e.g., parent company, subsidiaries of a parent company, affiliates) has provided any GHG management or advocacy services (as identified on the list below) to the California Registry participant within the last three years. If a verifier has performed these services, they have a high potential COI, as they would be: 1) verifying their own work, 2) performing management functions for the client, or 3) acting as an advocate for the client. Where a high risk of COI is determined, the verifier is not approved to conduct the verification.

2.6.2.3 Incompatible Services

- Designing, developing, implementing, or maintaining a GHG emissions inventory
- Designing or developing GHG information systems
- Developing GHG emissions factors or other GHG-related engineering analysis
- Designing energy efficiency, renewable energy, or other projects which explicitly identify GHG reductions as a benefit
- Preparing or producing GHG-related manuals, handbooks, or procedures specifically for the California Registry participant
- Appraisal services of carbon or GHG liabilities or assets
- Brokering in, advising on, or assisting in carbon or GHG-related markets
- Management over health, environment and safety functions
- Legal and expert services unrelated to California Registry verification

If the verifier identifies a potential or actual COI, the verifier must also submit a plan to avoid, neutralize, or mitigate the COI situation. The California Registry will review the information submitted to determine if the verifier provided enough information to make a COI determination. If not, the California Registry may request additional information. Once the information is found to be complete, the California Registry will review and evaluate the case, and will issue a written determination within ten working days.

Once the case-by-case evaluation is complete, a verifier may provide verification services to a California Registry participant for, at most, six consecutive years. After a six-year period, the California Registry participant must engage a different verifier. The original verifier may not again provide verification services for at least three years. This three-year period is triggered following any lapse in providing annual verification services to a California Registry participant.

This cycling of verifiers will help to avoid potential COI situations due to lengthy and ongoing relationships. Also, this guarantees that another firm will review material previously reviewed by another verifier, thus providing another "check" on the consistency and appropriateness of professional judgments made.

2.6.2.4 Emerging COI

Verifiers agree to monitor their activities for one year after the verification, and seek the approval of the California Registry and the State before entering into arrangements or relationships during that time that may present COI. The verifier may not enter into any contract with a California Registry participant or related entity that the California Registry and/or the State determines would create an unacceptable level of risk of COI.

In order to obtain this determination, the verifier must submit *Form COI-AB: Notification of Verification Activities And Request for Evaluation of Potential for Conflict of Interest Between Verifier and California Registry Member* (available on the California Registry's Verifiers Only webpage) to the California Registry detailing the specifics of their situation and request a determination. The California Registry will use a similar procedure to determine the risk for COI during that period.

2.6.2.5 Confidentiality

The California Registry will enter into confidentiality agreements with verifiers and California Registry participants as necessary to evaluate potential COI. Any organization that must provide confidential information to support the evaluation should clearly indicate what information is confidential, and the California Registry will follow its standardized procedures to do its utmost to protect confidential business information.

2.7 Negotiating a Contract with the Participant

After a verifier has been selected by a California Registry participant, the two parties should negotiate and complete contract terms. This contract is exclusively between the participant and the verifier, and the particulars of any given contract are at the discretion of the two parties. However, contracts for verification services typically include the following components:

- **Scope of the Verification Process.** This component of the contract should outline the exact geographic and organizational boundaries of the participant's emissions inventory to be examined. This should, but may not necessarily, match the boundaries used in the GHG emissions report to the California Registry. This scope should indicate whether a participant's California-only emissions are included or if both California and U.S. emissions are included. It should also identify whether the participant has used the management control, equity share, or other methods based on contractual relationships to determine organizational boundaries.

- **Confirmation of Approved Verifier Status.** This is a simple statement that the verifier has been approved by the California Registry to verify emissions reports covering the scope listed above.

- **Verification Standard.** Verifiers must verify participants' GHG emissions reports against the California Registry's General Reporting Protocol using the process outlined in this General Verification Protocol. If a participant is reporting process or fugitive emissions, a separate industry-specific protocol may also be used and cited, where available. Some participants may wish to use their GHG emissions report for additional purposes such as, registering in another registry, participating in emissions trading schemes, crediting programs, etc., and thus may add additional requirements into their contract for verification.

- **Non-Disclosure Terms.** The verifier and the participant should agree in advance on methods for identifying and protecting proprietary and confidential business data that may be revealed during verification.

- **Site Access.** The verifier and the participant should agree in advance to the time, place, and conditions of a verifier's site visits, if any are required.

- **Documentation and Data Requirements.** The verifier and participant should agree on how and when the participant will provide activity and emissions data to the verifier. The range of required documentation will largely be determined by the size and complexity of participant operations, and whether the participant has used the online calculation tools available through CARROT.

- **Period of Performance.** The period of performance for verification services may be up to six years. Where a participant's operations do not significantly change from year to year, they may wish to work with a verifier on a three-year cycle. However, the participant has discretion as to whether to sign a one or multi-year contract.

- **Performance Schedule.** Participants and verifiers may wish to agree on a schedule to complete the verification process and for the verifier to deliver a Verification Report and Verification Opinion. Verification should be completed by October 31 of the same calendar year when the emissions report was submitted.

- **Payment Terms.** Typical payment terms include total value, schedule of payments, and method of payment (e.g., electronic funds transfer).

- **Re-Verification Terms.** If the verifier identifies material misstatements, the participant may choose to revise its GHG emissions report. At that time, the participant may ask the verifier to re-verify the portions of the report with material misstatements or seek verification from another provider. *A verifier may not provide guidance, technical assistance, or implementation work on the remediation of material misstatements, as this constitutes consulting services and results in a conflict of interest.* Contracts should also specify the length of time a participant will have to correct material misstatements.

- **Liability.** All verifiers are subject to minimum liability associated with completing the verification per the terms of the verification contract. The participant may require and the verifier may agree to additional liability under this contract.

- **Contacts.** Parties should identify technical leads for both the participant and verifier, as well as responsible corporate officials of each party.

- **Dispute Resolution.** Both parties must state their consent to submit irreconcilable differences for review to the California Registry-convened Dispute Resolution Committee.

- **Acknowledgement of State Site Visits.** Both parties must sign an acknowledgement that, on a random basis, the State may accompany a verifier for purposes of monitoring the verification process.

2.8 Batch Verification

In an effort to minimize the transaction costs of verification for small organizations with relatively simple emissions, the California Registry will contract with an approved verifier to

undertake the verification work for interested participants with limited GHG emissions. The California Registry calls this batch verification. Emissions reports verified under batch verification must meet the same standards as non-batch reports. Eligible participants include those with:

- Less than 500 metric tons of CO_2e emissions per year;
- No significant process or fugitive emissions (significance threshold is 5% of total CO_2e emissions) ;
- Indirect emissions from purchased electricity at four or fewer sites; and/or
- Direct emissions from five or fewer passenger vehicles only; and/or
- Direct emissions from stationary combustion at one site.

Upon the recommendation of the batch verifier, the California Registry reserves the right to deem a participant's GHG emissions inventory too complex for batch verification. The California Registry also reserves the right to grant batch verification eligibility on a case-by-case basis.

2.8.1 Procedures

Each year, the California Registry will solicit competitive bids for batch verification services from all eligible approved verifiers.

Participants interested in batch verification will contact the California Registry to express their interest. After confirming the participant's eligibility, the California Registry will keep track of interested participants.

Each participant will sign a standardized contract with the verifier that has been developed by the California Registry. If participants require non-standard contract language, they cannot participate in batch verification.

Once the contracts are signed, the California Registry will work with the verifier to identify all necessary documentation, as requested by the verifier and as required in the General Reporting and General Verification Protocols. The California Registry will collect the necessary supporting documentation from the participants and forward it to the verifier. It is expected that batch verification will not require a site visit, but will consist of document review and telephone interviews.

The verifier will contact each participant to understand their operations. Then, the batch verifier will review and assess the emissions reports and documentation and prepare the Verification Report and Opinion. The verifier will then discuss the findings with each participant and upon authorization, will submit the electronic Verification Form to the California Registry via CARROT.

To minimize any potential conflict of interest, the California Registry will contract with a batch verifier on an annual basis and the designated batch verifier will perform all eligible verifications for that calendar year of emissions. The batch verifier will be ineligible to bid on batch verification for the following three years. Because of this term limit, the limited nature of emissions and operations of the participant and the elevated level of oversight by the California Registry, the potential for COI is deemed low, and the requirement to request determination of COI is waived.

2.9 Notification of Planned Verification Activities

After verifiers and participants have completed contract terms, the verifier must notify both the California Registry and the State of California 10 business days prior to the beginning of verification activities, using Form D, *Notification of Verification Activities*. This form is available on the California Registry's Verifiers Only webpage. Notification should include:

- Verifying company information;
- Participant information;
- Year and types of greenhouse gas emissions data being verified;
- Schedule of verification activities; and
- Names of approved staff members conducting the verification activities

This notification period is necessary to allow the State the opportunity to accompany verifiers on visits to participants' sites. The State will observe, evaluate, and report on the quality and consistency of verification activities. A verifier that does not provide proper notification to the California Registry and the State may be disqualified as an approved verifier.

2.10 Kick-off Meeting with the Participant

After contract terms have been completed and the California Registry and State have been notified of planned verification activities, verifiers should conduct a kick-off meeting with participants. For some verifications, this may consist of a telephone call. The agenda for that meeting should include:

1. Introduction of the verification team;
2. Review of verification activities and scope;
3. Transfer of background information and underlying activity data (See Table 2); and
4. Review and confirmation of the verification process schedule.

Based on the information provided in agenda items 2 and 3, the verifier should determine the most effective, efficient, and credible detailed verification approach tailored to the particular characteristics of the participant.

2.11 Online Reporting

All participants must report their emissions using the California Registry's online calculation tool, CARROT. Participants may also opt to use CARROT to calculate their indirect emissions and direct emissions from stationary and mobile combustion. Where participants have used CARROT to calculate their emissions, the verifier needs to verify that data have been collected properly and entered accurately. The verifier should assume CARROT's calculations are correct and do not need to re-calculate the emissions. Due to the time savings, this should result in a less expensive and expedited verification process.

It is the participant's responsibility to provide the verifier with access to CARROT. A verifier will have read-only access to the participant's Total Emissions Summary, which provides a detailed summary of all the information that the participant has reported. Because the verifier needs to be able to evaluate any operational changes, access is also provided to the previous year's total emissions summary, as well as emissions reported in the baseline year if this has been specified and if it is different than the current emissions year. For example, for a participant who has set a baseline year of 2002, has reported data from 2002 – 2006, and is contracting with a verifier for evaluation of their 2007 emissions; the verifier will be able to access their 2007 report, their 2006 report, and their 2002 report. They would have public access to emissions reported in the intervening years.

Additional assistance with navigating and using CARROT is provided in the California Registry's Verification Training Workshops and by contacting the California Registry at 213-891-1444 or **help@climateregistry.org**. Verifiers may also request temporary access to CARROT for training purposes.

Part III Core Verification Activities

3.1 Overview

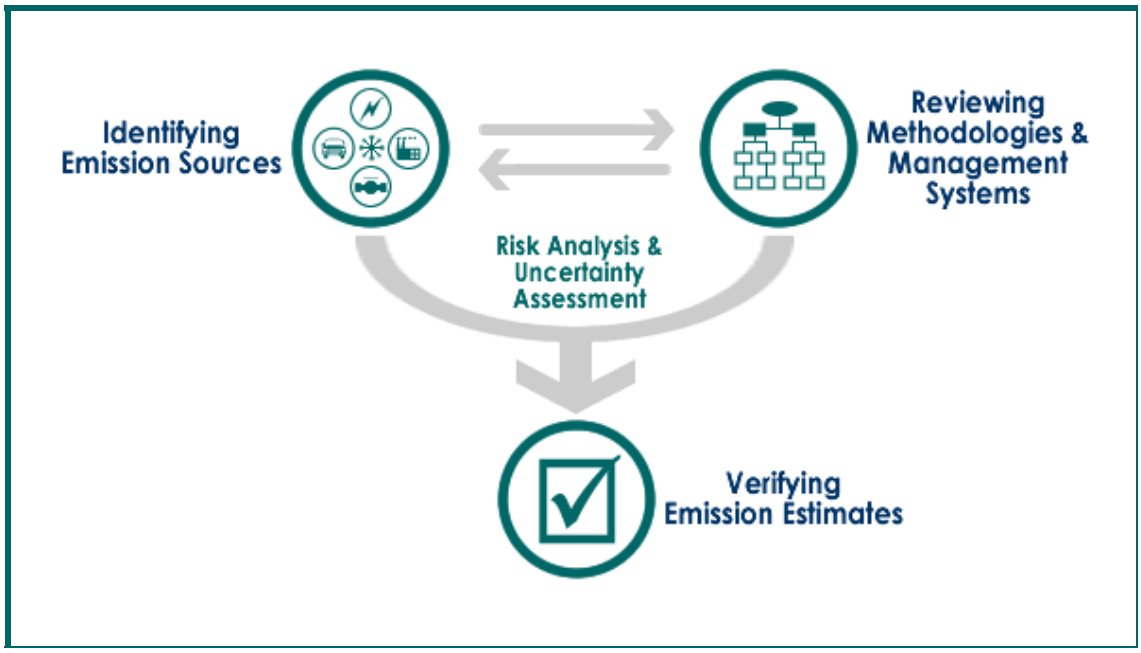
Once verifiers have completed the preparations for verification, they are ready to begin the core verification activities.

The core verification activities include three primary elements:

1. Identifying emissions sources in five emission source categories (indirect, mobile, stationary, process, and fugitive emissions);
2. Understanding management systems and estimation methods used; and
3. Verifying emission estimates.

The core verification activities are a risk assessment and data sampling effort aimed at ensuring that no material sources are excluded and that the risk of error is assessed and addressed through appropriate sampling and review. The complete core verification process is illustrated in Figure 1 below.

Figure 1. The Core Verification Process



3.2 Verification Activities Based on Participant Characteristics

Verifiers must apply the verification activities consistently for all participants. However, based on the size and complexity of participants' operations and management systems, verification activities and the duration of the process will vary. The documents that will need to be

reviewed during verification will also vary depending on the nature of the emission sources contained in the participant's emissions report.

3.2.1 Determining Appropriate Verification Activities

To guide verifiers in their determination of appropriate verification activities, the California Registry divides participants into three general groups, based on the level of effort necessary to verify their emissions. The characteristics of the verification approach for each of these groups are listed below. Of course, verifiers are expected to use their professional judgment to augment or narrow these approaches based on uncertainty in emissions estimates and other items affecting material accuracy.

Group 1: Small participants with simple operations. This group includes participants who have only the following material emissions sources:

- Indirect emissions from electricity consumption, steam imports, and district heating/cooling at four or fewer buildings; and/or
- Direct emissions from stationary combustion at one site; and/or
- Direct emissions from five or fewer passenger vehicles.

In an effort to minimize verification costs, small participants who also have total emissions that are less than 500 metric tons of CO_2e per year may elect to be batch verified with similar organizations. The California Registry will assist this batch of participants in bidding and negotiating contracts with the verifier. Standard terms and conditions will apply for all contract elements. Verification for these participants will usually not require a site visit, but rather, activities will be conducted via a telephone interview.

Alternatively, small participants may choose to contract out verification services through a sole source procurement or competitive bidding process.

Group 2: Larger participants with more complex operations. These include participants with only the following material emissions sources:

- Indirect emissions from electricity consumption, steam imports, and district heating/cooling at more than four sites;
- Direct emissions from stationary combustion at more than one site;
- Direct emissions from more than five vehicles; and/or
- No material process or fugitive emissions.

For these participants, most verifications will require at least one site visit. Additional visits may be required when characteristics of the participant changes between reporting periods (e.g., new sites, changed location, began new operations). Site visits are used to ensure that all material GHG emission sources have been included and appropriately accounted for in the greenhouse gas emissions report.

Group 3: Participants with process or fugitive emissions. For participants with material process or fugitive emissions or other emissions not covered above, verification activities must be more detailed. Because these emission calculations are not currently included in the General Reporting Protocol, the verifier is required to use their

professional judgment as to the appropriateness of the calculations used by the participant.

3.3 Verification Cycle

For participants whose operations do not change significantly, verification can be a three-year cycle. In Year 1, a verifier will need to form a detailed understanding of a participant's operations and resulting GHG emissions. If there have been no significant changes in a participant's boundaries, GHG emissions sources and/or management systems, a verifier may streamline and expedite the verification activities in Years 2 and 3 by focusing on verifying emissions estimates. To ensure data integrity, all of the core verification activities should be completed again in Year 4, followed by streamlined activities in Years 5 and 6.

The minimum core verification activities for each year are:

Year 1: Identify emission sources, review management systems, verify emissions estimates

Year 2: Verify emissions estimates

Year 3: Verify emissions estimates

Year 4: Same as Year 1

3.4 California Registry's Expectations for Verification Activities

Through these verification activities, verifiers are to verify that the annual emissions reports submitted to the California Registry via CARROT meet the standards of the General Reporting Protocol:

1. The participant has reported all material emissions, broken out into the following five categories:
    - Indirect emissions from purchased electricity, imported steam, district heating/ cooling;
    - Direct emissions from mobile combustion;
    - Direct emissions from stationary combustion;
    - Direct emissions from process activities; and
    - Direct fugitive emissions.
2. Total emissions reported as de minimis are less than 5% of the total emissions.
3. From the fourth year of reporting to the California Registry, all material emissions from all six greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6) are reported.
4. All California emissions are identified separately from the rest of a participant's U.S. emissions, where the participant has chosen to report their U.S. emissions.
5. All emissions were emitted during the calendar year specified.

6. Reported emissions meet the minimum quality standard of 95% accuracy.

Emissions reports may also contain other information about an organization and its emissions that does not require verification. This could include, for instance, information about a company's environmental policies and goals, and emission reduction projects. Participants may also choose to report other optional indirect emissions (e.g., business travel, employee commuting). In the report generated by CARROT, optional information will be clearly distinguished from verified information.

To verify information is accurately reported, the verifier will want to review, at a minimum, the documents listed in Table 1. To facilitate this review, once the participant reports their emissions using CARROT, the participant and the verifier can generate a Verification Checklist. Based on the types and categories of emissions they have reported, CARROT will provide participants and verifiers with a list of documents they will need for verification.

Table 1. Documents to be Reviewed during Verification

Activity or Emissions Source	Documents
Identifying Emission Sources	
Emission Source Inventory	Facility Inventory
	Emission Source Inventory Stationary Source Inventory Mobile Source Inventory Fuel Inventory
Understanding Management Systems and Methodologies	
Responsibilities for Implementing GHG Management Plan	Organization Chart, Greenhouse Gas Management Plan, Documentation and Retention Plan
Training	Training Manual, Procedures Manual, Consultant Quals Statement
Methodologies	Protocols Used (if in addition to the California Registry's General Reporting Protocol)
Verifying Emission Estimates	
Indirect Emissions from Electricity Use	Monthly Electric Utility Bills, Emission Factors (if not default)
Direct Emissions from Mobile Combustion	Fuel Purchase Records, Fuel in Stock, Vehicle Miles Traveled, Inventory of Vehicles, Emission Factors (if not default)
Direct Emissions from Stationary Combustion	Monthly Utility Bills, Fuel Purchase Records, CEMs Data, Inventory of Stationary Combustion Facilities, Emission Factors (if not default)
Indirect Emissions from Cogeneration	Monthly Utility Bills, Fuel and Efficiency Data from Supplier, Emission Factors (if not default)
Indirect Emissions from Imported Steam	Monthly Utility Bills, Fuel and Efficiency Data from Supplier, Emission Factors (if not default)
Indirect Emissions from District Heating	Monthly Utility Bills, Fuel and Efficiency Data from Supplier, Emission Factors (if not default)
Indirect Emissions from District Cooling	Monthly Utility Bills, Fuel and Efficiency Data from Supplier, Emission Factors (if not default)
Direct Emissions from Process Activities	Raw Material Inputs, Production Output, Calculation Methodology, Emission Factors
Direct Fugitive Emissions	
Refrigeration Systems	Refrigerant Purchase Records, Refrigerant Sales Records, Calculation Methodology, Emission Factors
Landfills	Waste-in-Place Data, Waste Landfilled, Calculation Methodology, Emission Factors
Coal Mines	Coal Production Data Submitted to EIA, Quarterly MSHA Reports, Calculation Methodology, Emission Factors
Natural Gas Pipelines	Gas Throughput Data, Calculation Methodology, Emission Factors
Electric Transmission and Distribution	Sulfur Hexafluoride Purchase Records, Calculation Methodology, Emission Factors

Step 1: Identifying Emission Sources

Verifiers should review a participant's reported emission source inventories (facility, source, and fuel) to ensure that all sources are identified. Verifiers should then determine the GHGs that will result from the identified sources and estimate their magnitude. GHGs that are not required to be reported can be disregarded. Finally, verifiers should rank the remaining reported emissions by CO_2e (using the Global Warming Potentials [GWPs] contained in the Intergovernmental Panel on Climate Change's (IPCC) Second Assessment Report (SAR) - see Table 2, below) to assess the environmental risk associated with the emissions.

Table 2. GWPs from IPCC's Second Assessment Report

Greenhouse Gas	GWP (SAR, 1996)
CO_2	1
CH_4	21
N_2O	310
HFC-23	11,700
HFC-32	650
HFC-125	2,800
HFC-134a	1,300
HFC-143a	3,800
HFC-152a	140
HFC-227ea	2,900
HFC-236fa	6,300
HFC-4310mee	1,300
CF_4	6,500
C_2F_6	9,200
C_4F_{10}	7,000
C_6F_{14}	7,400
SF_6	23,900

Source: U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2003 (April 2005).

When the emission source inventory is complete, verifiers should review participant's GHG emissions report and document answers to the following questions to assess if the GHG emissions report reflects the geographic, organizational, and operational scope of the participant:

1. Does the GHG emissions report include all processes and facilities under the management control of the participant? If not, why?

2. Does the report include all sources of GHG emissions within the geographic and organizational boundaries of the participant?

3. Does the report include all applicable types of GHGs from each emission source within the geographic and organizational boundaries of the participant?

4. Have any mergers, acquisitions, or divestitures occurred during the current reporting year? Have any activities been outsourced in the current year? If yes, has the participant specified a baseline? If so, has it been adjusted?

After these questions have been answered, verifiers will be able to determine if the GHG emissions report accurately reflects the geographic, organizational, and operational scope of the participant. Once all emission sources have been identified, verifiers may proceed to Step 2 to review the calculation methods used and the management systems employed.

Step 2: Reviewing Methodologies and Management Systems

After the scope and comprehensiveness of the participant's emission sources has been confirmed, verifiers should review the methodologies and management systems that the participant used to calculate their emissions. This is principally a risk assessment exercise, in which the verifier must weigh the relative complexity of the scope of the participant's emissions, the participant's methodologies and management systems used to prepare the GHG emissions report, and the risk of calculation error as a result of reporting uncertainty or misstatement. Through these steps, the verifier should determine the appropriateness of the management systems to provide required data to the California Registry. For example, the absence of a comprehensive GHG management system for a participant with a single retail

outlet and solely indirect emissions from electricity purchases may not add significant risk of material misstatement. In contrast, a large vertically-integrated manufacturing company with facilities in 31 states would require a much more robust management system for tracking and reporting its GHG emissions.

A verifier's general review of a participant's GHG management systems should document answers to the following questions:

1. Are calculation methodologies/procedures used to manage GHG emissions at the source level? Are they appropriate given the uncertainty/risk associated with the emissions? Are these methodologies/procedures standard within this industry?

2. Are appropriate methods used to manage and implement entity-wide GHG emissions reporting programs? If the participant has more than one facility, are the emissions data correctly aggregated and monitored?

3. Is someone responsible for managing and reporting GHG emissions? Is this individual qualified to perform this function?

4. Is appropriate training provided to personnel assigned to GHG emissions reporting duties? If the participant relies on external staff to perform required activities, are the contractors qualified to undertake such work? Is there internal oversight to assure quality of the contractor's work?

5. Are appropriate documents created to support and/or substantiate activities related to GHG emissions reporting activities, and is such documentation retained appropriately? For example, is such documentation maintained through reporting plans or procedures, utility bills, etc.?

6. Are the mechanisms used to measure and review the effectiveness of GHG emissions reporting programs appropriate for this purpose? For example, are policies, procedures, and practices evaluated and updated at appropriate intervals?

Verifiers should also consider how the participant's management systems are designed to support reporting five categories of emission sources (indirect, mobile, stationary, process and fugitive). Consequently, in reviewing a participant's Total Emissions Report, verifiers should document answers to the following questions:

1. Does the management system capture the diversity of the sources that comprise each emission category? For example, are there multiple types of vehicles and other transportation devices that require different emission estimation methodologies?

2. Does the system capture all the diversity of GHGs emitted from each emission source category?

3. Has the participant used the default emission factors and standardized estimation methods in the California Registry's General Reporting Protocol to calculate emissions in each source category? Has the participant or its technical assistance provider developed estimation methods independently? If the participant uses alternative emission factors, are they documented and explained appropriately?

4. Does the participant's GHG management systems appropriately track emissions in all of the emission source categories?

Once the verifier has assessed the overall risk associated with the management systems, the risks should be assessed in conjunction with the weighted CO_2e estimates determined in Step 1 (Identifying Emission Sources). Verifiers should then identify the areas with the greatest potential for material misstatements (either based on volume of emissions, lack of management systems, or both) to determine the best risk-based strategy to identify a representative sample of emissions to recalculate.

Step 3: Verifying Emission Estimates

Based on a participant's identified emission sources, management systems, and corresponding risk profile of GHG emissions, verifiers should select a representative sample of calculations to verify and sites to visit. Sampling procedures may entail conducting site visits, but should include reviewing documents such as utility bills or emissions monitor results, and recalculating emission estimates based on underlying activity data. In Table 3, below, the California Registry specifies the minimum number of sites that should be visited based on the size of the entity. The verifier should use professional judgment to assess if additional visits are needed.

Table 3. Minimum Site Visit Sample Size

Total Sites	Minimum Sample Size
2-10	30%
11-25	20%
26-50	15%
51-100	10%
101-250	5%
251-500	3%
501-1,000	2%
Over 1,000	1-2%

3.5 Potential Site Visits by the State of California

As part of the State of California's oversight of the verification process, the State will randomly accompany verifiers on site visits. The California Registry's enabling legislation directed the State to observe the verifier during verification visits, evaluate whether the participant has a GHG accounting program consistent with California Registry-approved procedures and protocols, and evaluate the reasonableness of the emissions information being reported. The State may send an employee or a contractor to accomplish this responsibility. The purpose of any site visit is to oversee the verifier's activities, and to evaluate the reasonableness of the participant's reported data. The State will report on its findings to the California Registry.

To accomplish this, during a site visit, the State will need to access the same information and sources as that of the verifier. The State will work with the verifier and participant to obtain this access. This may involve requesting access to on-site locations that may have GHG emission sources or related activities and participant information, data, records, or copies of records; observing verifiers during any exchange of participant data or data analyses; and/or asking the verifier to provide specific information related to their on-site and off-site data analyses. The State will also make every effort to not impede the normal activities of either the participant or the verifier. All costs for the State site visit are borne by the State.

Before the end of a site visit, the State will discuss its preliminary observations and evaluations with the verifier and participant. The State will also contact and discuss with the verifier and participant any findings that identify either party before reporting this to the California Registry.

As the Participant requests, a representative from the State, and/or the Verifier that will view confidential information should sign the Standard Nondisclosure Agreement (NDA). Rules covering State confidentiality can be found in the *California Code of Regulations, Title 20, Sect. 2501 et seq*.

3.6 Targeted Review & Recalculation of GHG Emissions

The California Registry does not expect nor require verifiers to review all of the participant's documents and recheck all their calculations. To ensure that data meet a minimum quality standard on an entity-wide basis, verifiers should concentrate their activities in the areas that have the greatest uncertainty and amount of emissions. Verifiers should calculate emissions for these sources and compare those calculations to emission levels reported by the participant. If they are free of material misstatement (have a difference of <5%), the verifier should declare that the participant's report conforms to the California Registry's Protocols.

If the reported data is not free of material misstatement, the verifier should include this information in its Verification Report and should complete its sampling effort of other sources. Once verifiers have confirmed that a sample of data is free of material misstatements, they should estimate total emissions and confirm that all material GHG emissions are reported.

3.7 De Minimis Emissions

De minimis emissions are a quantity of GHG emissions from one or more sources, for one or more gases, that when summed equal less than 5% of an organization's total CO_2e emissions. The percentage applies to California emissions for the purposes of California-only emissions reporting, and applies to U.S. emissions for national reporting. Participants have some discretion in choosing which sources and/or GHGs are de minimis, but are expected to disclose all de minimis emission sources in their emissions report. Verifiers should review participant's documentation and explanation of how de minimis emissions were calculated to confirm that not more than 5% of total CO_2e emissions are considered de minimis.

3.8 Identifying Material or Immaterial Misstatements

In order for verifiers to verify a GHG emissions report, a sample of data must be free of material misstatement. It is possible that during the verification process differences will arise between the emissions estimated by the participant and those estimated by the verifier. Differences of this nature may be classified as either material or immaterial. A discrepancy is considered to be material if the overall reported emissions differ from the overall emissions estimated by the verifier by 5% or more. A difference is immaterial if this difference is less than 5%.

A verifier's verification of emissions estimates should document the answers to the following questions:

1. Are the reported electricity, steam, and district heating and cooling use consistent with utility bills?

2. Is the reported total stationary fuel use by fuel type consistent with the fuel use records?

3. Is the reported total consumption of fuels in motor vehicles consistent with available documentation and by vehicle type? If the entity calculates transportation emissions based on vehicle mileage, is the reported vehicle mileage consistent with vehicle mileage records?

4. Are the reported process and fugitive emissions consistent with activity data or maintenance records?

5. Are the emission factors used by the participant appropriate? If California Registry default factors are not used, do the alternative emission factors provide increased accuracy? Is their derivation and explanation of increased accuracy properly documented and reasonable?

6. Does a sample of the participant's calculations agree with your re-calculated direct (mobile, stationary, process and fugitive) and indirect emissions estimates? Have you documented your process for determining the appropriate sampling plan?

7. Are all material GHG emissions included? Are all emissions that are considered de minimis emissions documented and reported as such?

8. Are the current year's reported emissions significantly different from the prior year's emission levels? If so, what has changed from prior years?

9. Has the accumulated change in reported emissions, since the last baseline update, changed by more than ten (10) percent? If so, has the baseline, if any, been recalculated?

10. Are there any discrepancies between your emissions estimates and the participant's material?

Once verifiers have reviewed these activities and answered these questions, they are ready to complete the verification process.

Part IV Completing the Verification Process

4.1 Overview

Once a verifier has completed reviewing a participant's annual GHG emissions report, they must do the following to complete the verification process:

1. Complete a detailed Verification Report, and deliver it to the participant;
2. Prepare a concise Verification Opinion, and deliver it to the participant;
3. Conduct an exit meeting with the participant to discuss the Verification Report and Verification Opinion and determine if material misstatements (if any) can be corrected. If so, the verifier and participant should schedule a second set of verification activities after the participant has revised the GHG emissions report.
4. Submit an electronic Verification Form and Verification Activity Log to the California Registry via CARROT;
5. Return important records and documents to the participant for retention.

4.2 Completing a Verification Report

4.2.1 Verification Report Content

The Verification Report is a confidential document that is shared between a verifier and a participant, and is only available to the California Registry or the public at the participant's request.

The Verification Report should include the following elements:

- The scope of the verification process undertaken;
- The standard used to verify emissions (this is the California Registry's General Reporting Protocol, but may also include other protocols or methodologies for those sources for which the California Registry has yet to provide detailed guidance);
- A description of the verification activities, based on the size and complexity of the participant's operations;
- A list of emission sources identified, including de minimis sources;
- A description of the sampling techniques and risk assessment methodologies employed for each source;
- An evaluation of whether the participant's annual GHG emissions report is in compliance with the California Registry's General Reporting Protocol;
- A comparison of the participant's overall emissions estimates with the verifier's overall emissions estimates;

- A list of material misstatements, if any;
- A list of immaterial misstatements, if any; and
- A general conclusion to be reflected in the Verification Opinion.

4.2.2 Quality Assurance Check

When the Verification Report is completed, it should be forwarded to an independent senior reviewer within the verifier's firm for a quality assurance check. No Verification Report should be forwarded to a participant until it has had an independent internal review.

4.2.3 Participant Review of Verification Report

Once a participant receives a Verification Report from their verifier, they should have at least 30 days to review and comment on the Verification Report. At the end of that review, the verifier and the appropriate official at the participant's organization should hold an exit meeting to discuss the nature of any material or immaterial misstatements.

4.3 Preparing a Verification Opinion

Verifiers should prepare a Verification Opinion using the template shown in Figure 2. The Verification Opinion is a simple confirmation of the verification activities and outcomes for all stakeholders (participants, verifiers, the California Registry, and the public). The Verification Opinion must also follow the same internal review process as the Verification Report and consequently must be reviewed by an independent senior reviewer within the verifier's firm, and signed by a designated lead verifier. An electronic version of this template is available on the California Registry's Verifiers Only webpage or may be obtained from the California Registry by emailing **help@climateregistry.org**.

4.4 Verification Activity Log

In order to assess the consistency of professional judgments that verifiers have been asked to make, verifiers should also complete a Verification Activity Log (Table 4 below) and submit a completed copy to the California Registry, along with the electronic Verification Form, in CARROT.

Table 4 includes a step-by-step outline of the standardized verification activities that all verifiers must consider. Not all activities are required of all participants or during each year, depending on a participant's specific circumstances, but verifiers should review this list and note "not applicable" (or "N/A") where appropriate. The table also includes a series of yes/no questions. Any "no" response should be explained, without revealing a participant's confidential information.

The California Registry will consider both the Verification Opinion and the answers in Table 4 in its final review of emissions data, before accepting a participant's report into the California Registry. An electronic version is available for download in CARROT, on the California Registry's Verifiers Only webpage, and from the California Registry by emailing **help@climateregistry.org**.

Table 4. Verification Activity Log

Verifier Company:		
California Registry Participant:		
Preparing for Verification	**Date Achieved**	
Bid on a Verification Contract		
Request determination of COI from California Registry		
Negotiate Contract with California Registry Participant		
Notify State of California and California Registry of Planned Verification Activities		
Conduct Kick-off Meeting With Participant		
Plan Verification Activities Based on Participant Characteristics		
Core Verification Activities **Identify Emission Sources**	**Date Achieved**	
Identify and list all facilities in the entity		
Identify and list all emission sources (indirect, mobile, stationary, process and fugitive)		
Identify and list all fuel types		
Rank all sources by magnitude on a carbon dioxide equivalent basis		
Assess any changes in geographic and organizational boundaries		
	Yes	**No**
1. Does the GHG emissions report include all processes and facilities under the management control of the participant?		
2. Does the report include all sources of GHG emissions within the geographic and organizational boundaries of the participant?		
3. Does the report include all applicable types of GHGs from each emission source within the geographic and organizational boundaries of the participant?		
4. Have any mergers, acquisitions, or divestitures occurred during the current reporting year?		
5. Have any activities been outsourced in the current year?		
6. If a baseline has been specified, has it been adjusted accordingly?		
7. Does the GHG emissions report include all processes and facilities under the management control of the participant?		
Review Methodologies and Management Systems	**Date Achieved**	
Evaluate procedures and systems for preparing emissions report		
Evaluate personnel and training for preparing emissions report		
Consider the uncertainty associated with methodologies and management systems		
	Yes	**No**
8. Are appropriate calculation methodologies/procedures used to manage GHG emissions at the source level? Are they appropriate given the uncertainty/risk associated with the emissions?		
9. Are appropriate methods used to manage and implement entity-wide GHG emissions reporting programs?		
10. If the participant has more than one facility, is the emissions data correctly aggregated and monitored?		
11. Is someone responsible for managing and reporting GHG emissions?		
12. Is that person qualified to do so?		
13. Is appropriate training provided to personnel assigned to GHG emissions reporting duties? If the participant relies on external staff to perform required activities, are the contractors' qualified to undertake such work?		
14. Are appropriate documents created to support and/or substantiate activities related to GHG emissions reporting activities, and is such documentation retained appropriately?		
15. Are appropriate mechanisms used to measure and review the effectiveness of GHG emissions reporting programs? For example, are policies, procedures, and practices evaluated and updated at appropriate intervals?		

16. Does the system account for the diversity of the sources that comprise each emission category? For example, are there multiple types of vehicles and other transportation devices that require different emission estimation methodologies?		
17. Do you know the diversity of GHGs emitted from each emission source category?		
18. Has the participant used the default emission factors and standardized estimation methods in the California Registry's General Reporting Protocol to calculate emissions in each source category?		
19. Has the participant or its technical assistance provider developed estimation methods independently?		
20. If participant uses alternative emission factors, are they documented and explained appropriately?		
21. Does the participant's GHG management system appropriately track emissions in all of the emission source categories?		
Assess Risk of Material Misstatement Associated with Management Systems/Procedures	**Date Achieved**	
Develop sampling procedures for sources based on risk of material misstatement		
Verify Emission Estimates		
Confirm total fuel consumption		
Confirm vehicle miles traveled		
Confirm that appropriate emission factors are used. If not default factors, ensure the derivation and explanation of increased accuracy is properly documented		
Calculate direct (mobile, stationary, process & fugitive) & indirect emissions based on sampling procedures		
Compare estimates from sample calculations to reported emissions		
Determine if there are any discrepancies between sample calculation and reported emissions		
Confirm that all material GHG emissions are included (that all emissions not included are either de minimis or not required)		
Determine if Discrepancies are Material or Immaterial	**Yes**	**No**
22. Based on the following table, have you visited an appropriate number of sites?		

Total Sites	Minimum Sample Size
2-10	30%
11-25	20%
26-50	15%
51-100	10%
101-250	5%
251-500	3%
501-1,000	2%
Over 1,000	1-2%

Total number of sites:_____
Total number visited:_____

23. Are the reported electricity, steam, and district heating and cooling use consistent with utility bills?		
24. Is the reported total stationary fuel use by fuel type consistent with the fuel use records?		
25. Is the reported total consumption of fuels in motor vehicles consistent with available documentation and by vehicle type? If the entity calculates transportation emissions based on vehicle mileage, is the reported vehicle mileage consistent with vehicle mileage records?		
26. Is the reported process and fugitive emissions consistent with activity data or maintenance records?		
27. Are the emission factors used by the participant appropriate? If California Registry default factors are not used, ensure that alternative emission factors provide increased accuracy and that the derivation and explanation of increased accuracy is properly documented and reasonable.		
28. Does a sample of the participant's calculations agree with your re-calculated direct (mobile, stationary, process & fugitive) & indirect emissions estimates? Have you documented your process for determining the appropriate sampling plan?		
29. Are all material GHG emissions included? Are all emissions that are considered de minimis emissions documented as such?		
30. Are the current year's reported emissions significantly different from the prior year?		
31. Has the accumulated change in reported emissions, since the last baseline update, changed by more than 10%? If so, has the baseline, if any, been recalculated?		
32. Are discrepancies between your emissions estimates and the participant's immaterial?		
Completing the Verification Process	**Date Achieved**	
Prepare a detailed Verification Report and submit to participant		
Prepare a Verification Opinion and submit to participant		
Conduct exit meeting with participant to discuss Verification Report & Opinion		
Provide records to participant for retention		

4.5 Completing the Verification Contract

4.5.1 Exit Meeting

Verifiers should prepare a brief summary presentation of their verification findings for the participant's key personnel. At the exit meeting, verifiers and participants might exchange lessons learned about the verification process and share thoughts for improving the verification process in the future. Verifiers and participants may wish to consider joint feedback to the California Registry.

The goals of this meeting should be:

- Acceptance of the Verification Report and Opinion (unless material misstatements exist and can be remediated, in which case the verification contract may need to be revised and a second verification process scheduled). If the participant does not wish to retain the verifier for the re-verification process, the verifier shall turn over the participant's relevant documentation to the participant within 30 days.

- Authorization for the verifier to complete the Verification Form in CARROT.

If the verifier is under contract for verification activities in future years, the verifier and participant may wish to establish a schedule for the next year's verification activities.

Figure 2. Sample Verification Opinion

[*Insert Verification Firm Logo*]

California Climate Action Registry Verification Opinion

Name of Verification Firm: _____

This is to verify that _____ [*Name of Member Organization*] has had its greenhouse gas emissions report covering the period January 1, _____ [*Insert Reporting Year*] to December 31,_____ [*Insert Reporting Year*] verified according to the California Climate Action Registry's General Verification Protocol against a standard of the California Registry's General Reporting Protocol.

Organizational Boundary of Verification

☐ Financial Management Control ☐ Operational Management Control ☐ Equity Share

GHGs Verified

☐ CO_2 ☐ CH_4 ☐ N_20 ☐ HFCs ☐ PFCs ☐ SF_6

Total Direct Emissions: _____

Total Indirect Emissions: _____

Geographic Scope of Verification

☐ California Emissions ☐ U.S. Emissions

Baseline Year (if specified)

_____ (Direct) _____ (Indirect) Year, if specified

Verification Opinion

☐ Verified without Qualification

☐ Unable to Verify

Attestation

_____ _____

[*Insert Name*], Lead Verifier Date

_____ _____

[*Insert Name*], Senior Internal Reviewer Date

Authorization

I _____ [*Name of Member Representative*] authorize the above named verifier to submit this Verification Opinion to the California Climate Action Registry for _____ [*Name of Member Organization*].

_____ _____

[Member Representative Signature] Date

4.5.2 Limits to Verifier Feedback

If a participant's emissions report is not verifiable due to material misstatements, a *verifier must not provide guidance on how to remediate the identified misstatements*. Such guidance would be considered a consulting activity and therefore, a conflict of interest. However, verifiers may provide any existing documentation that may be useful to participants in preparing remediation plans. A verifier should also enumerate any shortcomings in a participant's GHG tracking and management systems.

The California Registry will retain the participant's unverified emissions report in the California Registry database for up to two years pending verification. After two years, if the emissions report is still not verifiable, the California Registry will render the emissions report inactive.

4.6 Submitting the Verification Opinion to the California Registry

Once the Verification Opinion is complete and has been authorized by the participant, the verifier must complete the Verification Form and Verification Activity Log electronically in CARROT and the participant must email a Portable Document File (PDF) copy of the fully executed verification opinion to help@climateregistry.org. The participant may also elect to send a hard copy of the verification opinion with wet signatures to the address listed below:

Verification Opinion
California Climate Action Registry
523 W. Sixth Street, Suite 428
Los Angeles, CA 90014

Once the California Registry receives an electronic or hard copy of the Verification Opinion, the California Registry will perform a final review of the emissions report in CARROT. When successful, the participant's report will be formally accepted into the California Registry database and the annual verification process will be completed.

*Note: Participants are *not* required to submit their Verification Opinions to the California Registry for the first two years of their participation. However, it is important to note that a participant's emissions data will not be considered accepted by the California Registry unless the California Registry receives a Verification Opinion indicating a "verified without qualification" assessment.

4.7 Record Keeping and Retention

While the California Registry views the verification process essentially as a private exchange between the verifier and the participant, the verifier should remind the participant to retain sufficient records to enable an ex-post verification of the participant's emissions. The California Registry recommends that the following records be retained for a minimum of seven years as specified by contract with the participant.

Verifiers should retain hard and electronic copies, as applicable, of:

- The participant's GHG emissions report (printable from CARROT);
- The Verification Report; and
- The Verification Opinion.

The participant should maintain the following documentation for a minimum of seven years:

- Contact information for the lead verifier and a responsible corporate officer at the participant's organization;
- A general description of the participant's organization;
- The geographic boundaries;
- The number of facilities and operations assessed in the verification activities;
- The GHGs evaluated;
- The sources of emissions identified;
- Assessment of emission factors, demonstrating greater accuracy if not default emission factors;
- Copies of fuel use, mileage, or other activity data records used in sample recalculations;
- Verification methodology used based on the size and complexity of the participant;
- Sampling procedures for selecting site visits;
- Dates of site visits;
- The verifier's evaluation of the participant's management systems; and
- The verifier's estimates of the participant's emissions.

Copies of the original activity data records are necessary to perform an ex-post verification.

4.8 Timeline of Verification Process

Incorporating all of the steps and procedures involved in reporting, reviewing and verifying credible emissions data may be a lengthy process. The following table gives you an overview of the consecutive steps and necessary lapses of time between steps in the verification process.

Table 5. Verification Process Timeline

Activity	Elapsed Time
Preparing for Verification	
Contacted by participant to submit proposal for services	Where no consulting activities for 3 years prior to contract
Selected by participant	Varies
Submit request for case-by-case determination of COI to California Registry	Prior to contract negotiation
California Registry evaluates case and issues notification of low risk for COI	One month
Negotiate contract with participant	Varies
Notify State of California and California Registry of verification activities	One month
Core Verification Activities	
Begin verification activities	Maximum one year
Completing the Verification Process	
Submit Verification Report and Opinion to participant	Varies
Participant reviews Verification Report and Opinion and returns comments to verifier	One month
Verifier discusses findings with participant	Varies
Participant authorizes submission of electronic Verification Form to the California Registry	By October 31 of data year +1
Monitor emerging COI	One year
Verifier cannot provide consulting services to participant	One year
Participant chooses a new verifier	After a maximum of six years

Glossary

Applicant	A firm, or lead firm (if part of a team), responding to a State-issued RFA for Verifiers.
Baseline	Datum against which to measure greenhouse gas emissions performance over time, usually annual emissions in a selected base year.
Batch Verification	Verification process arranged by the California Registry for multiple participants with relatively simple GHG emissions (less than 500 tons of CO_2e emissions and typically only indirect emissions from electricity consumption and/or direct emissions from stationary or mobile combustion).
Verification	The process used to ensure that a given participant's greenhouse gas emissions inventory (either the baseline or annual result) has met a minimum quality standard and complied with the California Registry's procedures and protocols for calculating and reporting GHG emissions.
Verified Member	A California Registry participant that has submitted at least one verified annual emissions report to the California Registry.
Verifier	A firm or team of firms that has been State- and California Registry-approved to conduct verification activities under the California Registry program. A verifier may also refer to a single employee within a State- and California Registry-approved firm who conducts verification activities.
CO_2 equivalent*	(CO_2e) The quantity of a given GHG multiplied by its total global warming potential. This is the standard unit for comparing the degree of harm which can be caused by different GHGs.
Conflict of Interest	A situation in which, because of other activities or relationships with other persons or organizations, a person or firm is unable or potentially unable to render an impartial Verification Opinion of a potential client's greenhouse gas (GHG) emissions, or the person or firm's objectivity in performing verification activities is or might be otherwise compromised.
Datum	A reference or starting point.
De Minimis	A quantity of greenhouse gas emissions from one or more sources, for one or more gases, which, when summed equal less than 5% of an organization's total CO_2e emissions.
Direct Emissions	Emissions from sources that are owned or controlled by the reporting organization.
Emerging COI	A potential or actual COI situation that arises, or becomes known, during verification or for a period of one year after the completion of verification activities.

Emission Factor*	A factor relating activity data and absolute GHG emissions.
Equity Share	Fractional percentage or share of an interest in an entity based either on ownership interest, or on some other contractual basis negotiated among the entity's stakeholders.
Fugitive Emissions*	Unintended or incidental emissions of GHGs from the transmission, processing or transportation of fossil fuels or other materials, such as HFCs from refrigeration leaks, SF_6 from electric power distribution equipment, methane from mined coal, CO_2 emitted incidentally with geyser steam and/or fluid used in geothermal generating facilities.
Global Warming Potential*	(GWP) The ratio of radiative forcing (degree of harm to the atmosphere) that would result from the emission of one unit of a given GHG to one unit of CO_2.
Greenhouse Gases	(GHGs) For the purposes of the California Registry, GHGs are the six gases identified in the Kyoto Protocol: carbon dioxide (CO_2), nitrous oxide (N_20), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).
Indirect Emissions	Emissions that are a consequence of the actions of a reporting entity, but are produced by sources owned or controlled by another entity.
Inherent Uncertainty	The scientific uncertainty associated with measuring GHG emissions due to limitations on monitoring equipment, or measurement methodologies.
Lead Verifier	An individual who has completed a California Registry-sponsored verification training workshop and who has the authority to sign a verification firm's Verification Opinion.
Management Control	The ability of an entity to govern the operating policies of another entity or facility so as to obtain benefits from its activities.
Material misstatement	An error (for example from an oversight, omission or miscalculation) that results in the reported quantity being significantly different from the true value to an extent that will influence performance or decisions.
Member	A California Registry participant that is preparing its annual GHG emissions report, but has not yet submitted its verified report to the California Registry.
Minimum Quality Standard	Data that is free of material misstatements, and meets the California Registry's minimum level of accuracy of at least 95%.
Mobile Combustion*	Burning of fuels by transportation devices such as cars, trucks, airplanes, vessels, etc.
Organizational COI	Instances where the ability to render objective GHG verification services may be affected by the services provided by, shared management and/or financial resources with, or other situations created by a parent company or other related entities.

Outsourcing*	The contracting out of activities to other businesses.
Partner	An organization working through a lead firm (applicant) to respond to a State-issued RFA for Verifiers. A partner may or may not be a related entity. If the applicant submits an application wherein staff or financial capability is shared with either a parent firm or subsidiary of a parent firm, then that parent or subsidiary is considered a partner. If the applicant is part of a larger organization, but the application does not include any staff or financial capability from the larger organization, then the larger organization is not considered a partner.
Personal COI	A relationship of an employee or a partner employee that may impair the objectivity of the employee in performing a verification.
Process Emissions	Emissions from physical or chemical processing rather than from combustion, such as CO_2 emissions from cement manufacturing and PFC emissions from aluminum smelting.
Related Entity	An organization that is linked to the verifier by: common ownership or directors, contractual arrangement, a common name, informal understanding, or other means such that the related organization has a vested interest in the outcome of an assessment or has a potential ability to influence the outcome of an accredited management system assessment, greenhouse gas validation, or verification.
Reporting Uncertainty	The errors made in identifying emission sources and managing and calculating GHG emissions. This differs from inherent uncertainty due to incomplete understanding of climate science or a lack of ability to measure greenhouse gas emissions.
Stationary Combustion*	Burning of fuels to generate electricity, steam, or heat.

**Definitions of key terms obtained from "The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard," World Business Council for Sustainable Development and World Resources Institute, Switzerland, March 2004.*

Key Questions

Verifier Approval: *Who may qualify as a verifier?*

Only those firms accredited by the California Registry, the State of California, or The Climate Registry may provide verification services to California Registry participants

To become approved, a verifier must complete a two-step process: 1) Obtain accreditation as a GHG verifier from either the California Air Resources Board or from the American National Standards Institute (or other approved accreditation body as specified on the California Registry website) and 2) achieve California Registry approval by attending a verification training workshop facilitated by the California Registry.

Information on the ANSI GHG Verifier Accreditation is available at www.ansi.ghg.org. Information on CARB GHG accreditation is available at arb.ca.gov.

Applicants who wish to be qualified as approved verifiers need to demonstrate experience in GHG verification and verification of financial data, technical data, quality control, and/or environmental management systems. Verifiers must also demonstrate the means to accept financial liability for verification activities undertaken for a participant. *Firms providing verification services to a participant may not provide any non-verification services that create a high risk of COI to the same participant for three years prior to and one year after verification.*

Liability: *What liability will a verifier incur? What liability coverage must a verifier accept?*

At a minimum, a verifier is responsible for planning a participant's verification activities, conducting the verification activities, preparing a Verification Report and Opinion, and submitting authorized Verification Opinions to the California Registry via CARROT. If a California Registry-approved verifier fails to complete the contracted activities, they may be financially liable for the cost of hiring a different California Registry-approved verifier to complete a proper verification from start to finish (as defined in the contract between a verifier and a participant). The verifier may incur additional liability based on the negotiated terms of the contract. This liability may include the future value of GHG emissions or emission reductions, damages, or any other element agreed to by the verifier and the participant.

In their initial application, verifiers must demonstrate the means to accept financial liability for verification activities undertaken for a California Registry participant, specify such liability in any contract for verification activities, and make adequate arrangements (e.g., professional liability insurance coverage) to cover liabilities arising from its activities or operations. However, verifier liability may also be limited in the contract with the California Registry participant.

Resolution of Disputes: *What recourse is available if the participant does not accept the findings of the verification?*

There may be instances where a verifier and a participant cannot agree on identification of material misstatements and/or the findings of the Verification Opinion. In such instances, both parties can request the Dispute Resolution Committee, composed of qualified representatives from California state agencies, the California Registry, and one non-voting verifier, who serves pro bono on an annual, rotating basis. The participant and the verifier will

each pay a filing fee equal to 5% of the participant's annual membership fee to submit the matter to the Dispute Resolution Committee.

The Dispute Resolution Committee will interview the participant and the verifier, review the area of dispute and reach a unanimous, binding decision concerning verifiability. The California Registry will notify the verifier and the participant of the Committee's decision. Thus, as part of contract negotiations, each California Registry participant and verifier will need to sign a form agreeing to this Dispute Resolution policy.

"Batch Verification": *How does it work? How will it affect bidding, contracting, and the overall verification process?*

In an effort to minimize the transaction costs of verification, the California Registry will help eligible participants with simple GHG emissions contract for "batch verification". Eligible participants have relatively simple GHG emissions (indirect emissions from purchased electricity and/or emissions from limited stationary and mobile sources) and produce less than 500 metric tons of CO_2e per year.

In batch verification, the California Registry will work with one verifier each year to verify the emissions reports of multiple organizations at one time. Emissions must be verified to the standards of the General Reporting Protocol. Because of the nature of the emissions, batch verification activities will consist of document review and phone conversations, but will not require a site visit. The California Registry will assist in negotiating a standardized contract and a flat fee for each organization. Standardizing the contract language will help to minimize the transaction costs of verification for small, office-based organizations.

A new batch verifier will be chosen each year. This finite verifier term is to minimize the risk from COI and to eliminate the cost associated with a case by case COI.

Verification Deadlines: *What is the deadline for completing the verification process?*

Emissions should be reported to the Registry no later than June 30 following the emissions year. Verification should be completed by October 31 following the emissions year. For instance, 2008 emissions should be reported by June 30, 2009 and verified by October 31, 2009.

Verification Report and Verification Opinion: *What are the Verification Report and Verification Opinion and how are they different?*

The Verification Report is a detailed report that a verifier prepares for a participant. The Verification Report should describe the scope of the verification activities, standards used, emission sources identified, sampling techniques, evaluation of a participant's compliance with the General Reporting Protocol, assumptions, and a list of material and immaterial misstatements, if any. The Verification Report is a confidential document between the verifier and the participant, and is only shared with the California Registry or the public at the participant's request.

The Verification Opinion is a brief, one-page summary of the verifier's findings that simply states if the participant's emissions report is verifiable or not. The Verification Opinion is submitted in hard copy by the verifier to the participant for approval.

Verification and Remediation: *What if a participant's emissions report is not verified?*

After completing verification activities, the verifier will prepare a Verification Report and forward it to the responsible official representing the participant. The responsible official includes anyone authorized by the participant to approve the GHG emissions report for submission to the California Registry and will typically be a corporate official or the technical manager of the verification contract.

If the verifier identifies material misstatements that prevent a favorable Verification Opinion, those material misstatements should be listed and described in the Verification Report. If possible, the participant may correct those material misstatements and resubmit the emissions report for verification within a reasonable amount of time. The participant may seek technical assistance to correct material misstatements but the verifier may not provide such technical assistance as it would constitute non-verification services, and create a conflict of interest.

The California Registry will retain the participant's unverified data in the California Registry database for up to two years, pending correction. After that time, the participant will need to re-enter the data.

Confidentiality: *Are the results of the verification kept confidential? Will emissions data be kept confidential?*

All aggregated entity-level emissions data and metrics reported to the California Registry will be available to the public. However, the California Registry will keep confidential all reported emissions, activity data, methodologies, and emissions factors that are reported at facility, project, or source levels. Confidential information will only be accessible to the participant, the California Registry, and the verifier, unless the participant allows others access to such information or wishes to have it available to the public. In instances where the State of California accompanies verifiers on site visits, the State may have access to confidential information as needed to oversee verification activities and evaluate the reasonableness of the participant's data and systems to track emissions. Representatives from the State, the Verifier, and the Participant who will view confidential information will all be required to sign the Standard Nondisclosure Agreement (NDA). As noted in an earlier question, the Verification Report is a private document between a participant and verifier, while the Verification Opinion is shared with the California Registry. A majority of the contents of the Verification Opinion will also be shared with the public.

General Verification Protocol Revision Policy: *Will this General Verification Protocol change over time? How can verifiers provide feedback to the California Registry?*

The California Registry expects to regularly review, revise, update, and augment this General Verification Protocol. The California Registry invites all parties, verifiers, California Registry participants, California State agencies, and the public to provide insights and experiences that will help improve the General Verification Protocol. Anyone with suggestions or concerns is encouraged to contact the California Registry at any time at 213-891-1444 or by email at info@climateregistry.org**.**

Stakeholders will also be able to present suggestions directly to the California Registry's Board of Directors for consideration at their meetings. All suggestions and requests for modifications must be made by utilizing the "Protocol Comment Form" available on the California Registry's website at **www.climateregistry.org/protocols**.

California Registry-Approved Technical Assistance Providers: *What role do they play?*

Some participants may desire outside assistance, either in terms of expertise or human resources, to collect, document and report their emissions to the California Registry and/or otherwise manage their GHG emissions. To assist participants in identifying a firm qualified to help them, the State and the California Registry approve firms qualified to serve as technical assistance providers (TAs). Participants are not required to use only approved TAs. However, approved companies have been approved as firms experienced in providing GHG emissions services, and many of them have attended California Registry-sponsored training sessions. Where a participant has retained the services of a TA, the participant may ask the TA to play a role in the verification process. Neither the California Registry nor the State is responsible for any consulting services or recommendations they may provide, nor do they specify any role that TAs should or should not play.

All firms approved as verifiers also are automatically qualified to act as TAs. However, a firm cannot provide both technical assistance and verification services to the same client at the same time.

Role of California State Agencies: *What is the relationship between the California Registry and state agencies?*

The Registry was established by California statute as a non-profit voluntary registry for greenhouse gas emissions inventories, to help organizations establish GHG emissions baselines against which any future GHG emission reduction requirements may be applied. The State of California was directed to offer its best efforts to ensure that participants receive appropriate consideration for early actions in the event of any future state, federal or international GHG regulatory scheme.

The California Registry and state agencies work together and keep each other informed about current activities. The State of California continues to provide technical guidance to the California Registry and plays a direct oversight role in the verification process. The California Registry gives great weight to state agency guidance and relies in large part on these recommendations when developing California Registry policies, procedures and tools, including reporting and verification protocols and the online reporting tool. However, final policy and technical decisions are made independently by the California Registry's Board of Directors.

Updated Emissions Reports: *Once a report has been verified, will it ever change?*

Following verification of an annual GHG emissions report, there may be situations in which a verified report may change. A participant may wish to add information beyond the minimum reporting standards (add non-CO_2 gases during the first three years of reporting, report facilities outside of California, change the emission factor used, etc.). Participants can update their report at any time. However, any changes will need to be re-verified, and this information will need to be documented in CARROT. As understanding and sophistication of GHG accounting principles develops, the California Registry may elect to update accounting principles (e.g., alternate emission factors, Global Warming Potentials). Where participants have used CARROT to calculate their emissions, these changes do not need to be re-verified.

CARROT: *Am I required to use CARROT to communicate with the California Registry?*

Participants are required to report their emissions to the California Registry using CARROT. The participant-entered annual GHG emissions report generated by CARROT is the document on which the verifier provides its Verification Opinion to the California Registry. The Verification Opinion is submitted in separately by the participant. Verifiers are not restricted to only communicating with the California Registry via CARROT, but must use the online tool to submit an electronic Verification Form and Verification Activity Log. Questions about using CARROT may be directed to the California Registry at 213-891-1444 or **help@climateregistry.org**.

Additional Questions?

If you have any questions regarding GHG emissions reporting or verification under the California Registry Protocols, please contact the California Registry by phone (213-891-1444) or email (**help@climateregistry.org**).

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California Climate Action Registry
523 West Sixth Street, Suite 428
Los Angeles, California 90014
Tel: 213 891 1444
Email: info@climateregistry.org
www.climateregistry.org

Appendix 3.5 – Agricultural Drainage Recirculation and Intertie Expansion Project Supporting Documentation

00308SUMMERS ENGINEERING
887 N. Irwin St. – PO Box 1122
Hanford, CA 93232

MEMORANDUM

TO: Peter Rietkerk, Patterson Irrigation District
Doug Dalton, Twin Oaks Irrigation District

FROM: Chris Linneman

DATE: March 6, 2012

SUBJECT: Marshall - Ramona Recovery System DRAFT

At the request of Patterson Irrigation District (PID) and Twin Oaks Irrigation District (TOID), Summers Engineering has evaluated the potential to capture drain water from the Marshall Road Drain and Spanish Land Grant Drain and return it back into the irrigation systems of TOID and PID. Based on data collected by the Westside San Joaquin River Watershed Coalition (Westside Coalition), the combined irrigation season discharges from the two drains averages around 5,000[1] acre feet per year, with an average EC of around 1,000 µs/cm.

The attached map shows the Marshall Road Drain, Spanish Land Grant Drain (Spanish Drain) and other key features. The proposed project would divert water from the Marshall Road Drain and the Spanish Drain through separate diversion boxes. For the sake of this evaluation it was assumed that these diversions would be gravity, but pump stations may be required or preferred.

New concrete boxes would be installed in the existing Marshall Road and Spanish drain pipes, each with internal weirs to divert flows into a new gravity pipeline, transporting the water north to the existing Twin Oaks Drain. The Twin Oaks Drain will convey the water to Ramona Lake, where it will be pumped into the TOID irrigation system through an existing pump station and pipeline, or into the PID irrigation system through a new pump station and pipeline.

[1] This amount excludes the volume diverted from the Marshall Road Drain into the Southside Reservoir.

Project Area and Benefits.

The project will recover agricultural drain water from the Spanish Drain, the Marshall Road Drain, and Ramona Lake.

- The Spanish Drain watershed covers 1,620 acres of land mostly within Central California Irrigation District (CCID). The crops grown within this region are mostly field crops (alfalfa, wheat, beans) and orchard crops (apricots, walnuts, and almonds). The Spanish Drain discharged approximately 4,500 acre feet in 2009.
- The Marshall Road Drain watershed covers 1,100 acres of land within CCID, Del Puerto Water District, and PID. Crops grown in this region are similar to those grown within the Spanish Drain watershed. In 2003, PID constructed the South-Side Reservoir to divert flows from the Marshall Road Drain for irrigation. Since that time, about 1,000 acre feet a year has been discharged from the Marshall Road Drain.
- The Ramona Lake watershed covers 3,600 acres of land mostly within TOID. Crops grown within this watershed are mostly alfalfa and wheat. Drainage within this watershed is collected at Ramona Lake near the north edge of the watershed and either reused by TOID or discharged into the river.

Based on available flow data, the proposed project would recirculate approximately 5,000 acre feet per year of agricultural drain water back into the irrigation systems of TOID and PID. This would provide sufficient supplemental volume to irrigate approximately 1,600 acres as well as significantly reduce the volume of drainage discharged into the San Joaquin River. Since 2008, chlorpyrifos has been detected in Marshall Road Drain flows 10 times, and 2 times in Ramona Lake samples.

Project Components.

The project would include the following components:

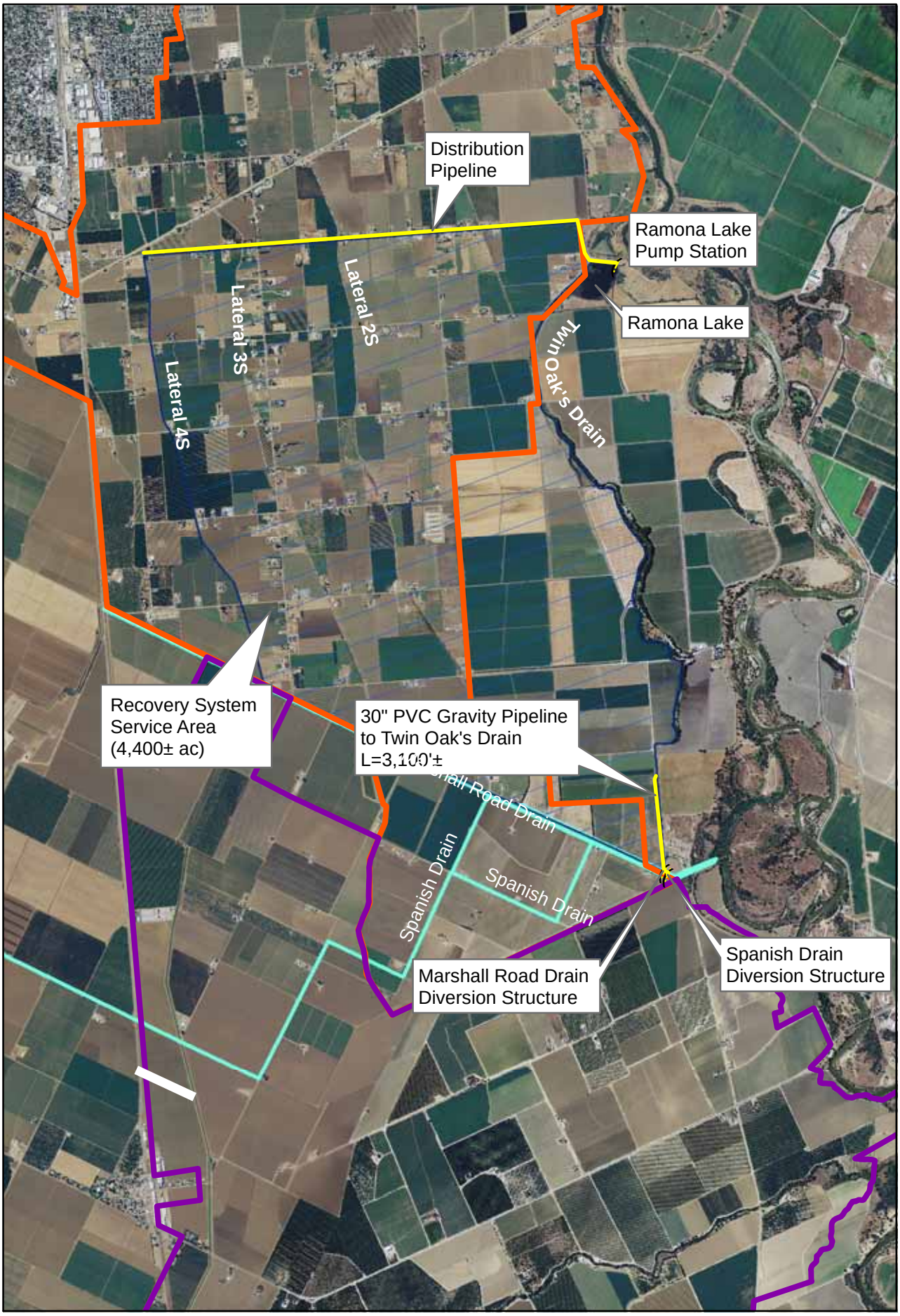
- Diversion structures. Two diversion structures would be needed, one each at the Spanish Drain diversion point, and one at the Marshall Road Drain diversion point. It is assumed that both of these would be concrete boxes with internal weirs that would backup the water in the drains and divert it north, into a new pipeline. Both the Spanish Drain and Marshall Road Drain are cast-in-place concrete pipe that is not designed to operate under pressure, and it is assumed that 1,000 feet of each drain would need to be replaced with rubber gasket reinforced concrete pipe to handle the additional pressure. The design phase would identify the actual length of pipe to be replaced.
- Diversion pipeline. Flows from the two diversion structures would combine into a single pipeline which would flow by gravity into the existing Twin Oaks Drain. This pipe is assumed to be reinforced concrete with sufficient capacity for 15 cfs.
- Twin Oaks Drain enlargement. Portions of the existing Twin Oaks Drain will need to be cleaned and enlarged in order to convey the additional flows.
- Ramona Lake Cleanout and Grading. The southerly portion of Ramona Lake would be regraded to increase storage volume. The additional volume would provide a longer detention time to allow for settling of solids.
- Recirculation Pump Station and pipeline. A new pump station would be installed on Ramona Lake. This station would have a capacity of 30 cfs to lift recirculated flows from the Spanish Drain, Marshall Road Drain, and Ramona Lake (as available) into a new pipeline that would deliver the water into the PID irrigation system. The pump station would include three pumps with variable frequency drives controlled by PID's SCADA system. The pipeline is estimated to be approximately three miles line, with connections to PID's four southerly laterals, serving approximately 4,400 acres within PID and TOID.

Estimated Cost.

An estimate of the project cost is attached. Project costs were based on a preliminary layout and design concepts. No survey or field measurements were made to verify distances or quantities.

Patterson Irrigation District
Marshall Road Drain Recovery Project
Project Estimate - 30 cfs Option

Item	Description	Quantity	Unit	Unit Cost	Amount
1	Furnish and Install (F&I) Diversion Structures at Marshall Road and Spanish Drains		lump sum		$40,000
2	F&I Pipeline Replacement	2,000	linear feet	$85	$170,000
3	F&I 30" PVC Pipeline to Twin Oaks Drain	3,100	linear feet	$65	$201,500
4	F&I Marshall Road Crossing	50	linear feet	$450	$22,500
5	F&I Twin Oaks Drain Cleanout		lump sum		$72,000
6	F&I Ramona Lake Regrading		lump sum		$88,000
7	F&I Ramona Lake Pump Station (30 cfs)		lump sum		$680,000
8	F&I 36" PVC Distribution Pipeline (to Lat. 2S)	9,500	linear feet	$90	$855,000
9	F&I 24" PVC Distribution Pipeline (to Lat. 3S)	2,800	linear feet	$40	$112,000
10	F&I 18" PVC Distribution Pipeline (to Lat. 4S)	3,000	linear feet	$25	$75,000
11	F&I Road Crossings	3	each	$22,500	$67,500
12	F&I Turnouts	3	each	$7,500	$22,500
			Subtotal:		**$2,406,000**
			Environmental, Engineering & Surveying		**$190,000**
			Contingencies & Incidentals (20%)		**$484,000**
			Total:		**$3,080,000**



Marshall - Ramona Recovery System

PID Drainige Reclamation/Recirculation and Intertie Pump Station Expansion - Energy Calculations

From Chris Linneman from Summers Engineering and confirmed by Richard Bichette (RMC)

$$\frac{GPM \times FT}{3960 \times e} = HP$$

ENTER NUMBERS IN BLUE

Location	GPM	Head (ft)	Efficiency	HP	kWh/y	MWh/y	30 Lyfecycle kWh	MWh
Delta Pumping	3098	186	65	224	1,462,948	1,463	43,890,000	43,890
Local	3098	72	80	70	460,121	460	13,800,000	13,800
Difference						1,003	30,090,000	30,090

Greenhouse Gasses

Scenario	lbs of CO2	Metric Ton CO2	30 year
Without Project	1,059,174	480	14,413
With Project	333,127	151	4,533
Difference		329	9,880

California Climate Action Registry General Verification Protocol

Verifying Entity-Wide Greenhouse Gas Emissions

Version 3.0 | August 2008

Acknowledgements

The California Registry would like to thank and acknowledge the many experts who have helped make both the General Verification Protocol and the California Registry a reality. While it is impossible to properly acknowledge everyone who contributed to this document, the following organizations have provided valuable guidance and insightful feedback throughout the duration of this project:

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California Energy Commission

California Energy Commission Registry Workgroup

California EPA

CH2M Hill

California Council for Environmental & Economic Balance

Lawrence Berkeley National Laboratory

National Resources Defense Council – Convened State Registry Collaborative

Pew Center on Global Climate Change

Science Applications International Corporation (SAIC)

U.S. Department of Energy

U.S. Energy Information Administration (1605b Program)

U.S. Environmental Protection Agency

U.S. EPA Climate Leaders

World Business Council for Sustainable Development

World Resources Institute

The California Registry is also grateful to all of the individuals who participated in the California Registry's public workshops and meetings. Most notably, Rachel Tornek, Robyn Camp, Jill Gravender, Pierre duVair and Jeff Wilson should be singled out for their extensive contributions in the drafting and finalization of this report.

The California Energy Commission has been instrumental in providing technical policy guidance to the California Registry's staff and board of directors.

The California Registry wishes to extend a special thank you to SAIC for their help preparing the General Verification Protocol.

Finally, the California Registry wishes to thank the California Energy Commission and the Energy Foundation for their generous financial support of the California Registry.

Version 1 of the General Verification Protocol was released in October 2002. Version 2 was released in July 2003. Version 3 was released in August 2008.

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Abbreviations and Acronyms

CARB	California Air Resources Board
CARROT	Climate Action Registry Reporting Online Tool
CDF	California Department of Forestry and Fire Protection
CEMS	Continuous Emissions Monitoring Systems
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COI	Conflict of Interest
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
N_2O	nitrous oxide
PFC	perfluorocarbon
RFA	Request for Applications
SAR	IPCC Second Assessment Report (1996)
SF_6	sulfur hexafluoride
TA	Technical Assistance Provider
TAC	Technical Advisory Committee
TAR	IPCC Third Assessment Report (2002)

Part I Introduction

1.1 Overview

The California Climate Action Registry created this General Verification Protocol to provide California Registry-approved verifiers with clear instructions for executing a standardized approach to the independent verification of greenhouse gas (GHG) emissions baselines and annual emissions reported by California Registry participants. This standardized approach defines a verification process that promotes the relevance, completeness, consistency, accuracy and transparency of emissions data reported to the California Registry. While this Protocol is written for verifiers, California Registry participants who are interested in understanding and preparing for the verification process may also find it useful.

This Protocol is intended to be used in combination with the California Registry's General Reporting Protocol and web-based calculation and reporting tool (CARROT—Climate Action Registry Reporting Online Tool). **Approved verifiers will verify participants' GHG emissions reports to the standards of the California Registry's General Reporting Protocol, and sector-specific protocols using the process outlined in this General Verification Protocol**.

At a minimum, each emissions report must contain all of an entity's emissions of CO_2 in the state of California for a calendar year, reported in five categories: indirect emissions from purchased electricity, imports of steam, district heating/cooling, and direct emissions from mobile combustion, stationary combustion, manufacturing processes, and fugitive emissions. Where a participant is reporting their U.S. emissions, the report must contain all of their emissions nationally. Starting with the fourth year of reporting, each emissions report must contain all emissions of all six greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6).

Emissions reports may also contain other information about an organization and its emissions that does not require verification. For instance, this could include information about a company's environmental goals, programs, policies, etc. Participants may also choose to report other indirect emissions, like business travel or employee commuting. In the emissions reports, optional information will be clearly distinguished from information that is verified.

Activities for each specific verification will differ based on the length and complexity of a participant's emissions report, but the verification process will include at least the following steps:

- Case-by-case evaluation of Conflict of Interest
- Scoping and planning a participant's verification activities
- Conducting verification activities
    1. Identifying emissions sources
    2. Reviewing methodologies and management systems
    3. Verifying emission estimates
- Preparing a participant's Verification Report and Verification Opinion

- Submitting a participant-authorized electronic Verification Form and Verification Activity Log to the California Registry via CARROT

Upon completion of the above steps, the California Registry will review the emissions report before accepting a participant's verified emissions report into its emissions database. This process is repeated every year of an organization's participation in the California Registry.

To help decrease the potential for conflict of interest between a verifier and a participant, a verifier can verify the same participant for a maximum of six consecutive years. After six years, a participant must choose another verifier for at least three years. After that time, the original verifier would again be eligible to verify the participant's emissions for up to six consecutive years.

The California Registry assumes that the verifiers will use their best professional judgment when conducting verification activities.

1.2 Organization of this General Verification Protocol

This General Verification Protocol is divided into four parts which outline the necessary steps a verifier must follow to initiate and complete the verification of a participant's emissions report.

Part I, *Introduction* (this section), provides a brief overview of the purposes and requirements of the verification process, describes the principles of verification, highlights important definitions, and answers some key questions.

Part II, *Preparing for Verification*, focuses on activities that take place prior to beginning verification activities, including bidding for a contract with participants, determining conflict of interest, negotiating a contract with participants, providing required notifications, and designing appropriate verification activities for each participant.

Part III, *Core Verification Activities*, provides guidance on conducting the primary activities that the verifier will complete, including: identifying sources, reviewing management systems and methodologies, and verifying emission estimates.

Part IV, *Completing the Verification Process*, covers procedures for completing the verification process including: preparing a Verification Report and Verification Opinion, completing the Verification Form to submit a participant's verified data to the California Registry, and recording and retaining proper records.

1.3 Principles of Verification

The purpose of verification is to provide an independent review of data and information being submitted to the California Registry to ensure that they meet minimum quality criteria. To fulfill this purpose, the independent verification process maintains the criteria of completeness, consistency, accuracy, comparability and transparency as its underlying principles.

Relevance. Verification should ensure that GHG inventories submitted to the California Registry appropriately reflect the GHG emissions of the entity and include emissions information produced in accordance with the program rules on defining reporting boundaries and sources.

Completeness. Verification should ensure accounting of all material GHG emissions sources and activities within the specified scope of the participant's inventory (a minimum of 95%). Baseline and annual emissions results should include all sources for which the participant is responsible.

Consistency. An emissions report should allow for meaningful comparison of emissions performance over time and across similar organizations. Independent verification should ensure that consistent methodologies and measurements are used between the baseline results and annual emissions results. Additionally, changes to participant emission baselines are verified to ensure appropriate comparisons.

Accuracy. Entity-wide reported data should be within the materiality threshold of 5% of the verifier's estimate of total emissions. Calculations and estimates need to be as accurate as possible to prevent material errors.

Transparency. Verification should be a transparent exercise. The data used for verification and the verification activities should be clearly and thoroughly documented to allow for outside review by the California Registry or potential review by the State of California (the State) in the context of overseeing verification activities.

1.4 Verification Principles and Definitions

1.4.1 Verification Standard

Verifiers must verify participants' GHG emissions reports against the California Registry's General Reporting Protocol using the process outlined in this General Verification Protocol. If a participant is reporting process or fugitive emissions, a separate industry-specific protocol may also be used and cited, where available. Some participants may wish to use their GHG emissions report for additional purposes such as registering in another registry, participating in emissions trading schemes, crediting programs, etc., and thus may add additional standards for verification.

1.4.2 Minimum Quality Standard

A verified emissions report submitted to the California Registry must be free of material misstatements, achieving a level of at least 95% accuracy. It is possible that during the verification process, differences will arise between the emissions totals estimated by participants and those estimated by verifiers. Differences of this nature may be classified as either material (significant) or immaterial (insignificant). A discrepancy is considered to be material if the overall reported emissions differ from the overall emissions estimated by the verifier by 5% or more. A difference is immaterial if it is less than 5%.

1.4.3 Reporting Uncertainty vs. Inherent Uncertainty

When evaluating participants' emissions reports, verifiers are to determine if the reporting uncertainty (vs. the inherent uncertainty) is less than the minimum quality standard.

Reporting uncertainty entails the mistakes made in identifying emissions sources, managing data or information, and calculating GHG emissions. Inherent uncertainty refers to scientific uncertainty associated with measuring GHG emissions. The California Registry is aware that there is inherent uncertainty in emissions factors and measurement of activity data through metering and instrumentation (even after the calibration of meters and other data collection methods are verified as accurate), but determining scientific accuracy is not the focus of the California Registry or its General Reporting Protocol.

1.5 Professional Judgment

Approved verifiers must verify participants' GHG emissions reports against the California Registry's General Reporting Protocol using the process outlined in this General Verification Protocol. The California Registry asks verifiers to use their professional judgment when executing the verification activities described in this General Verification Protocol. The purpose of the verifier approval process is to find verification firms that demonstrate, through their staff's professional qualifications and relevant GHG experience, their ability to render sound professional judgments about GHG emissions reports.

Application of a verifier's professional judgment is expected in the following areas:

- Implementation of verification activities with appropriate rigor for the size and complexity of a participant's organization and with regard to the uncertainty of calculations associated with the participant's emissions sources;
- Review of the appropriateness of a participant's GHG emissions tracking, monitoring, and management systems for providing information to the California Climate Action Registry;
- Evaluation of participant compliance with the California Registry's General Reporting Protocol;
- Assessment of methods used for estimating emissions from sources for which the General Reporting Protocol does not provide specific guidance, such as process and fugitive emissions, and indirect emissions from sources other than electricity, imported steam, district heating/cooling; and
- Appraisal of assumptions, and estimation methods and emission factors that are selected as alternatives to those provided in the General Reporting Protocol.

The General Verification Protocol and training provided by the California Registry are intended to explain to the verifier the California Registry's guidelines and expectations and thus what types of professional judgments are appropriate for this program. In addition to these resources, verifiers may contact the California Registry at any time for clarification of California Registry guidelines, expectations and policies.

1.6 Conflict of Interest

In order to ensure the credibility of the emissions data reported to the California Registry and its potential utility under any future regulatory regime, it is critical that the verification process is completely independent from the influence of the participant submitting the emissions report. While conducting verification activities for California Registry participants, verifiers must work in a credible, independent, nondiscriminatory and transparent manner, complying with applicable state and federal law and the current version of the State of California's *Conflict of Interest Process and Requirements for State and California Registry-Approved Verifiers*. This document is posted on the California Registry's website**.**

Any pre-existing relationship between the verifier and participant must be acknowledged to the California Registry, which will evaluate the potential for a conflict of interest (COI) between the two organizations.

Verifiers must provide information to the California Registry about its organizational relationships and internal structures for identifying potential conflicts of interest

(organizational COI). Then, on an individual basis, the California Registry will review any pre-existing relationship between a verifier and participant and will assess the potential for conflict of interest (case-by-case COI). When the California Registry determines there is a low risk of COI, the participant and verifier can finalize negotiations of their contract. Following completion of a verification, the verifier must monitor for the next year if any new business relationship may create a COI (emerging COI).

As an added protection, a verifier may provide verification services to a California Registry participant for, at most, six consecutive years. After a six-year period, the California Registry participant must engage a different verifier. The original verifier may not provide verification services to that participant for three years. This three year hiatus begins with any lapse in providing annual verification services to a California Registry participant.

In the event that a verifier violates these conditions, the California Registry, in consultation with the State and at its discretion, may disqualify an approved verifier for a period of up to five years.

This conflict of interest clause does not preclude a verifier from engaging in consulting services for other clients that participate in the California Registry for whom the verifier does not provide any verification activities.

Part II Preparing for Verification

2.1 Verification Process Overview

Before any verification activities begin, a number of procedural steps must be taken to ensure that the obligations and responsibilities of both the verifier and participant are clear.

The following summary of the major steps of verification is provided as a reference.

1. **Verifier receives California Registry approval**: Verifier meets all accreditation requirements and completes a California Registry-sponsored verification training workshop.

2. **Participant selects verifier**: Participant contacts one or more State/California Registry-approved verifiers to discuss verification activities. Participant selects an organization to verify its GHG emissions results and begins to negotiate contract terms.

3. **Verifier submits case-specific Evaluation of Conflict of Interest (COI) and State Notification Form**: After a participant chooses a verifier, the verifier must submit a Conflict of Interest Evaluation and State Notification Form to the California Registry to establish that the likelihood of a COI between parties is low or that risk of any conflict can be sufficiently mitigated by the verifier. The form must be submitted at least 10 working days prior to the first scheduled verification meeting.

4. **California Registry sends COI determination to verifier**: The California Registry reviews the Evaluation of COI Form and supporting information to determine the level of risk associated with the proposed participant/verifier relationship, and notifies the verifier of its determination.

5. **Verifier & participant finalize contract**: When the California Registry provides a favorable COI determination between a participant and verifier, verifiers may finalize their contract with a participant.

6. **Verifier conducts verification activities**: Verifier follows the guidance in the General Verification Protocol to evaluate a participant's annual GHG emissions report.

7. **Verifier prepares Verification Report and Verification Opinion for participant**: Verifier prepares a detailed summary (Verification Report) of the verification activities for the participant. Verifier also prepares a Verification Opinion for participant's review, prior to sending opinion electronically to the California Registry via CARROT.

8. **Verifier & participant discuss Verification Report and Opinion**: Verifier meets with participant to discuss Verification Report and Opinion.

9. **Verifier completes Verification Form via CARROT**: Once authorized by a participant, a verifier completes the Verification Form via CARROT. Participant then submits the original Verification Opinion to the California Registry.

10. **California Registry Conducts Final Review**: California Registry reviews the Verification Opinion and Verification Activity Log and evaluates the participant's

emissions reports. Once accepted by the California Registry, a participant's aggregated entity-level emissions become available to the public via CARROT.

Even in multi-year verification contracts, verifiers must repeat steps 3-11 for each annual verification before submission to the California Registry.

2.2 Becoming an Approved Verifier

Only those firms approved by the California Registry, the State or those involved in the American National Standards Institute (ANSI) accreditation program may provide verification services to California Registry participants. In order to become approved, a verifier must complete a two-step process: 1) Obtain accreditation as a GHG verifier from either the California Air Resources Board or from the American National Standards Institute (or other approved accreditation body as specified on the California Registry website) and 2) achieve California Registry approval by attending a verification training workshop facilitated by the California Registry.

Information on ANSI GHG Verifier Accreditation is available at www.ansi.ghg.org.

Information on CARB GHG accreditation is available at arb.ca.gov.

The second step of the approval process requires that lead verifiers one of the California Registry's verification training workshops. A lead verifier is any verifier from the firm who will sign their firm's Verification Opinion. After completing the training workshop, the verification firm becomes an "approved verifier." Following the training session, the California Registry will provide verifiers with a notification of their full approval. Upon receiving this notice, a firm may approach current or prospective California Registry participants to market their services and capabilities, and advertise that they are "approved verifiers for the California Climate Action Registry". All approved verifiers are listed on the California Registry's website.

Approvals are valid for three years from the date of the California Registry approval. At the end of this period, the California Registry will send a notification to each firm's primary contact. If for any reason the State, ANSI or the California Registry finds that a verifier has failed to meet the standards of either the General Reporting Protocol or the General Verification Protocol, it may disqualify a verifier for a period of up to five years.

2.3 Updates to the General Verification Protocol

Periodically, the California Registry may update the General Verification Protocol. The California Registry will advise all verifiers of any changes, and any new requirements that may affect them. Where any changes are significant, the California Registry may require that lead verifiers attend the next verification training workshop.

2.4 Adding or Deleting Designated Staff

During the application process, verification firms will identify all staff members who will be designated verifiers for the California Registry. An applicant who is State-approved may add or delete staff to their roster. To add or delete designated staff after being approved, the verifier should submit the Designated Staff Form (available on the California Registry's Verifiers Only webpage), with the names and contact information for any personnel changing from the roster, and note if staff are to be deleted or added to the roster. When adding staff, the firm should describe each individual's job classifications, relevant experience, education, academic degrees, professional licenses for technical staff members and their respective roles.

2.5 Bidding on a Verification Contract

The California Registry recommends that those participants with complex GHG emissions reports solicit competitive bids for verification services from at least three approved verifiers. Those participants with simpler GHG emissions reports who do not seek, or are not eligible for, batch verification may wish to secure competitive bids or may wish to sole source the verification contract in order to reduce costs and expedite the verification process.

When preparing to send out a request for bids from verifiers, participants should first review the list of approved verifiers and select some (or all) as prospective bidders. Due to the possibility of access to proprietary information, participants may want to send each prospective bidder a non-disclosure agreement. The California Registry suggests that participants distribute requests for bids to prospective verifiers only after they have received a signed non-disclosure agreement from verifiers.

The California Registry recommends that participants include the following information in their requests for bids from verifiers:

1. The expected contract duration;
2. A general description of the participant's organization;
3. The geographic boundaries of the participant's emissions report;
4. The number and locations of facilities and operations;
5. The GHGs reported in the participant's emissions report;
6. The emission source categories (and possibly emission sources) in the participant's emissions report;
7. The password to a read-only (Reviewer) version of the participant's emissions report in CARROT; and
8. A list and description, by category, of how emissions data is organized and calculated (either using CARROT or another methodology).

The California Registry suggests that participants request that commercial proposals from potential verifiers include the following components:

1. History and description of verification company;
2. Explanation of core competencies;
3. Proposed price for verification services;
4. Proposed staff;
5. Statement of verifier liability;
6. Confidentiality policy; and
7. Duration of contract.

The California Registry expects only limited variation in the technical proposals since all of the approved verifiers are trained to implement the California Registry's standardized verification process.

2.6 Conflict of Interest (COI)

2.6.1 Objective of the Conflict of Interest Process

This COI process was developed by the State of California and adopted, with modifications, by the California Registry to assess the risk of potential COI between verifiers and California Registry participants. This process gives verifiers the ability to demonstrate that their organization is capable of identifying and mitigating situations that would impair their ability to render an impartial verification opinion.

Through this process, applicants and any partners must demonstrate:

1. Clearly-defined organizational boundaries, internal structures, and relationships with other companies that have management or financial control over the applicant.
2. The presence of internal mechanisms to identify and mitigate organizational and personal COIs with any potential clients.
3. The ability to be objective in providing verification activities.

To protect the credibility and rigor of the California Registry verification process, the relationship between verifiers and California Registry participants must not create or appear to create a COI. While conducting verification activities for California Registry participants, the verifier must work in a credible, independent, nondiscriminatory and transparent manner, complying with applicable state and federal law and the current version of the California Registry's conflict of interest process

2.6.2 Process and Requirements

In the verification process, all verifiers must demonstrate they do not have significant conflicts of interest with participants:

1. **Organizational COI** – in the application process, each verifying organization shows that they have internal mechanisms in place that help maintain their objectivity in verification activities.

2. **Case-by-Case COI** – in each case where verification services are requested, before a contract is signed with a participant, each verifier demonstrates that any pre-existing relationship between the verifier and participant will not impair impartiality in verifying a GHG emissions report.

3. **Emerging COI** – for a period of one year following a verification, verifiers will monitor their relationship with the participant to ensure impartiality has been protected in the verification process.

These are each discussed in greater detail below.

2.6.2.1 Organizational COI

As part of the application process, a verifier has already documented the ability of its organization to identify and react to COI due to organizational relationships. Verifiers have also submitted the form *Conflict of Interest Declaration of Ability and Intent to Comply*, declaring the applicant and each partner's ability to subsequently perform and submit a case-

by-case evaluation of COI to the California Registry. This form also conveys the applicant's intent to comply with the California Registry's COI process and requirements.

2.6.2.2 Case-by-Case COI

As an early step in the contract negotiation process between verifiers and participants, a verifier must demonstrate on a case-by-case basis that it, its partners, and the individuals performing verification activities do not have any actual or potential conflict of interest with the California Registry participants for which it has been selected to carry out verification functions.

A verifier will have a high risk of COI if the verifier and participant share any management, or if any of the California Registry participant's managers of GHG-related activities were previously employed with or by the verifier within the last three years, or vice versa. A verifier will have a high risk of COI if the verifier or its related companies (e.g., parent company, subsidiaries of a parent company, affiliates) has provided any GHG management or advocacy services (as identified on the list below) to the California Registry participant within the last three years. If a verifier has performed these services, they have a high potential COI, as they would be: 1) verifying their own work, 2) performing management functions for the client, or 3) acting as an advocate for the client. Where a high risk of COI is determined, the verifier is not approved to conduct the verification.

2.6.2.3 Incompatible Services

- Designing, developing, implementing, or maintaining a GHG emissions inventory
- Designing or developing GHG information systems
- Developing GHG emissions factors or other GHG-related engineering analysis
- Designing energy efficiency, renewable energy, or other projects which explicitly identify GHG reductions as a benefit
- Preparing or producing GHG-related manuals, handbooks, or procedures specifically for the California Registry participant
- Appraisal services of carbon or GHG liabilities or assets
- Brokering in, advising on, or assisting in carbon or GHG-related markets
- Management over health, environment and safety functions
- Legal and expert services unrelated to California Registry verification

If the verifier identifies a potential or actual COI, the verifier must also submit a plan to avoid, neutralize, or mitigate the COI situation. The California Registry will review the information submitted to determine if the verifier provided enough information to make a COI determination. If not, the California Registry may request additional information. Once the information is found to be complete, the California Registry will review and evaluate the case, and will issue a written determination within ten working days.

Once the case-by-case evaluation is complete, a verifier may provide verification services to a California Registry participant for, at most, six consecutive years. After a six-year period, the California Registry participant must engage a different verifier. The original verifier may not again provide verification services for at least three years. This three-year period is triggered following any lapse in providing annual verification services to a California Registry participant.

This cycling of verifiers will help to avoid potential COI situations due to lengthy and ongoing relationships. Also, this guarantees that another firm will review material previously reviewed by another verifier, thus providing another "check" on the consistency and appropriateness of professional judgments made.

2.6.2.4 Emerging COI

Verifiers agree to monitor their activities for one year after the verification, and seek the approval of the California Registry and the State before entering into arrangements or relationships during that time that may present COI. The verifier may not enter into any contract with a California Registry participant or related entity that the California Registry and/or the State determines would create an unacceptable level of risk of COI.

In order to obtain this determination, the verifier must submit *Form COI-AB: Notification of Verification Activities And Request for Evaluation of Potential for Conflict of Interest Between Verifier and California Registry Member* (available on the California Registry's Verifiers Only webpage) to the California Registry detailing the specifics of their situation and request a determination. The California Registry will use a similar procedure to determine the risk for COI during that period.

2.6.2.5 Confidentiality

The California Registry will enter into confidentiality agreements with verifiers and California Registry participants as necessary to evaluate potential COI. Any organization that must provide confidential information to support the evaluation should clearly indicate what information is confidential, and the California Registry will follow its standardized procedures to do its utmost to protect confidential business information.

2.7 Negotiating a Contract with the Participant

After a verifier has been selected by a California Registry participant, the two parties should negotiate and complete contract terms. This contract is exclusively between the participant and the verifier, and the particulars of any given contract are at the discretion of the two parties. However, contracts for verification services typically include the following components:

- **Scope of the Verification Process.** This component of the contract should outline the exact geographic and organizational boundaries of the participant's emissions inventory to be examined. This should, but may not necessarily, match the boundaries used in the GHG emissions report to the California Registry. This scope should indicate whether a participant's California-only emissions are included or if both California and U.S. emissions are included. It should also identify whether the participant has used the management control, equity share, or other methods based on contractual relationships to determine organizational boundaries.

- **Confirmation of Approved Verifier Status.** This is a simple statement that the verifier has been approved by the California Registry to verify emissions reports covering the scope listed above.

- **Verification Standard.** Verifiers must verify participants' GHG emissions reports against the California Registry's General Reporting Protocol using the process outlined in this General Verification Protocol. If a participant is reporting process or fugitive emissions, a separate industry-specific protocol may also be used and cited, where available. Some participants may wish to use their GHG emissions report for additional purposes such as, registering in another registry, participating in emissions trading schemes, crediting programs, etc., and thus may add additional requirements into their contract for verification.

- **Non-Disclosure Terms.** The verifier and the participant should agree in advance on methods for identifying and protecting proprietary and confidential business data that may be revealed during verification.

- **Site Access.** The verifier and the participant should agree in advance to the time, place, and conditions of a verifier's site visits, if any are required.

- **Documentation and Data Requirements.** The verifier and participant should agree on how and when the participant will provide activity and emissions data to the verifier. The range of required documentation will largely be determined by the size and complexity of participant operations, and whether the participant has used the online calculation tools available through CARROT.

- **Period of Performance.** The period of performance for verification services may be up to six years. Where a participant's operations do not significantly change from year to year, they may wish to work with a verifier on a three-year cycle. However, the participant has discretion as to whether to sign a one or multi-year contract.

- **Performance Schedule.** Participants and verifiers may wish to agree on a schedule to complete the verification process and for the verifier to deliver a Verification Report and Verification Opinion. Verification should be completed by October 31 of the same calendar year when the emissions report was submitted.

- **Payment Terms.** Typical payment terms include total value, schedule of payments, and method of payment (e.g., electronic funds transfer).

- **Re-Verification Terms.** If the verifier identifies material misstatements, the participant may choose to revise its GHG emissions report. At that time, the participant may ask the verifier to re-verify the portions of the report with material misstatements or seek verification from another provider. *A verifier may not provide guidance, technical assistance, or implementation work on the remediation of material misstatements, as this constitutes consulting services and results in a conflict of interest.* Contracts should also specify the length of time a participant will have to correct material misstatements.

- **Liability.** All verifiers are subject to minimum liability associated with completing the verification per the terms of the verification contract. The participant may require and the verifier may agree to additional liability under this contract.

- **Contacts.** Parties should identify technical leads for both the participant and verifier, as well as responsible corporate officials of each party.

- **Dispute Resolution.** Both parties must state their consent to submit irreconcilable differences for review to the California Registry-convened Dispute Resolution Committee.

- **Acknowledgement of State Site Visits.** Both parties must sign an acknowledgement that, on a random basis, the State may accompany a verifier for purposes of monitoring the verification process.

2.8 Batch Verification

In an effort to minimize the transaction costs of verification for small organizations with relatively simple emissions, the California Registry will contract with an approved verifier to

undertake the verification work for interested participants with limited GHG emissions. The California Registry calls this batch verification. Emissions reports verified under batch verification must meet the same standards as non-batch reports. Eligible participants include those with:

- Less than 500 metric tons of CO_2e emissions per year;
- No significant process or fugitive emissions (significance threshold is 5% of total CO_2e emissions) ;
- Indirect emissions from purchased electricity at four or fewer sites; and/or
- Direct emissions from five or fewer passenger vehicles only; and/or
- Direct emissions from stationary combustion at one site.

Upon the recommendation of the batch verifier, the California Registry reserves the right to deem a participant's GHG emissions inventory too complex for batch verification. The California Registry also reserves the right to grant batch verification eligibility on a case-by-case basis.

2.8.1 Procedures

Each year, the California Registry will solicit competitive bids for batch verification services from all eligible approved verifiers.

Participants interested in batch verification will contact the California Registry to express their interest. After confirming the participant's eligibility, the California Registry will keep track of interested participants.

Each participant will sign a standardized contract with the verifier that has been developed by the California Registry. If participants require non-standard contract language, they cannot participate in batch verification.

Once the contracts are signed, the California Registry will work with the verifier to identify all necessary documentation, as requested by the verifier and as required in the General Reporting and General Verification Protocols. The California Registry will collect the necessary supporting documentation from the participants and forward it to the verifier. It is expected that batch verification will not require a site visit, but will consist of document review and telephone interviews.

The verifier will contact each participant to understand their operations. Then, the batch verifier will review and assess the emissions reports and documentation and prepare the Verification Report and Opinion. The verifier will then discuss the findings with each participant and upon authorization, will submit the electronic Verification Form to the California Registry via CARROT.

To minimize any potential conflict of interest, the California Registry will contract with a batch verifier on an annual basis and the designated batch verifier will perform all eligible verifications for that calendar year of emissions. The batch verifier will be ineligible to bid on batch verification for the following three years. Because of this term limit, the limited nature of emissions and operations of the participant and the elevated level of oversight by the California Registry, the potential for COI is deemed low, and the requirement to request determination of COI is waived.

2.9 Notification of Planned Verification Activities

After verifiers and participants have completed contract terms, the verifier must notify both the California Registry and the State of California 10 business days prior to the beginning of verification activities, using Form D, *Notification of Verification Activities*. This form is available on the California Registry's Verifiers Only webpage. Notification should include:

- Verifying company information;
- Participant information;
- Year and types of greenhouse gas emissions data being verified;
- Schedule of verification activities; and
- Names of approved staff members conducting the verification activities

This notification period is necessary to allow the State the opportunity to accompany verifiers on visits to participants' sites. The State will observe, evaluate, and report on the quality and consistency of verification activities. A verifier that does not provide proper notification to the California Registry and the State may be disqualified as an approved verifier.

2.10 Kick-off Meeting with the Participant

After contract terms have been completed and the California Registry and State have been notified of planned verification activities, verifiers should conduct a kick-off meeting with participants. For some verifications, this may consist of a telephone call. The agenda for that meeting should include:

1. Introduction of the verification team;
2. Review of verification activities and scope;
3. Transfer of background information and underlying activity data (See Table 2); and
4. Review and confirmation of the verification process schedule.

Based on the information provided in agenda items 2 and 3, the verifier should determine the most effective, efficient, and credible detailed verification approach tailored to the particular characteristics of the participant.

2.11 Online Reporting

All participants must report their emissions using the California Registry's online calculation tool, CARROT. Participants may also opt to use CARROT to calculate their indirect emissions and direct emissions from stationary and mobile combustion. Where participants have used CARROT to calculate their emissions, the verifier needs to verify that data have been collected properly and entered accurately. The verifier should assume CARROT's calculations are correct and do not need to re-calculate the emissions. Due to the time savings, this should result in a less expensive and expedited verification process.

It is the participant's responsibility to provide the verifier with access to CARROT. A verifier will have read-only access to the participant's Total Emissions Summary, which provides a detailed summary of all the information that the participant has reported. Because the verifier needs to be able to evaluate any operational changes, access is also provided to the previous year's total emissions summary, as well as emissions reported in the baseline year if this has been specified and if it is different than the current emissions year. For example, for a participant who has set a baseline year of 2002, has reported data from 2002 – 2006, and is contracting with a verifier for evaluation of their 2007 emissions; the verifier will be able to access their 2007 report, their 2006 report, and their 2002 report. They would have public access to emissions reported in the intervening years.

Additional assistance with navigating and using CARROT is provided in the California Registry's Verification Training Workshops and by contacting the California Registry at 213-891-1444 or **help@climateregistry.org**. Verifiers may also request temporary access to CARROT for training purposes.

Part III Core Verification Activities

3.1 Overview

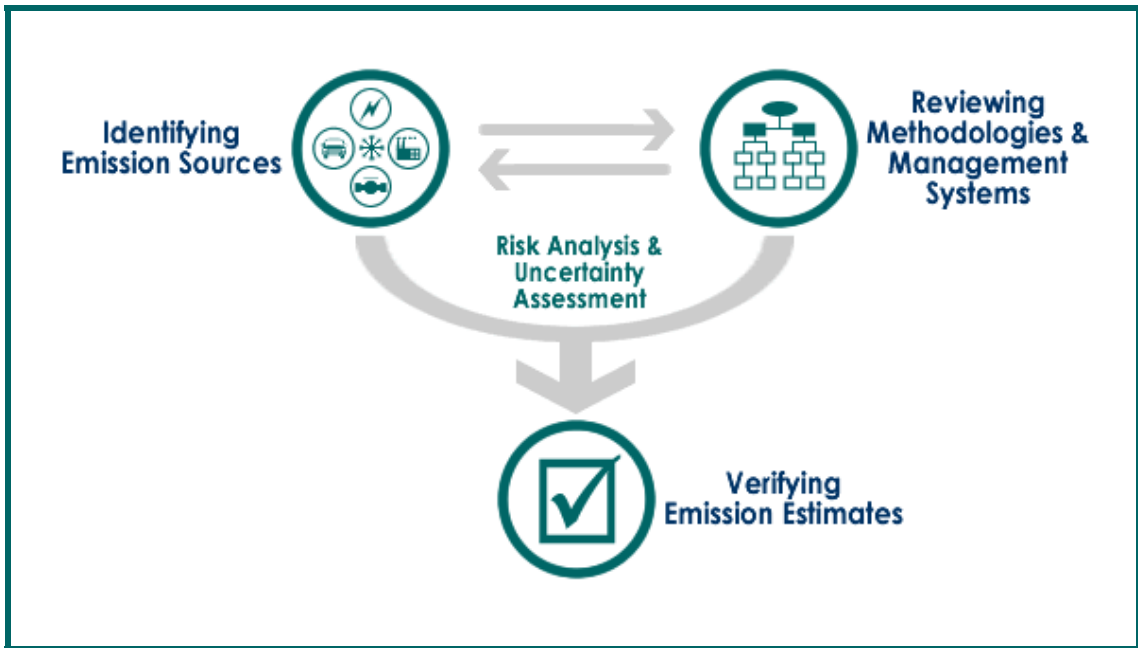
Once verifiers have completed the preparations for verification, they are ready to begin the core verification activities.

The core verification activities include three primary elements:

1. Identifying emissions sources in five emission source categories (indirect, mobile, stationary, process, and fugitive emissions);
2. Understanding management systems and estimation methods used; and
3. Verifying emission estimates.

The core verification activities are a risk assessment and data sampling effort aimed at ensuring that no material sources are excluded and that the risk of error is assessed and addressed through appropriate sampling and review. The complete core verification process is illustrated in Figure 1 below.

Figure 1. The Core Verification Process



3.2 Verification Activities Based on Participant Characteristics

Verifiers must apply the verification activities consistently for all participants. However, based on the size and complexity of participants' operations and management systems, verification activities and the duration of the process will vary. The documents that will need to be

reviewed during verification will also vary depending on the nature of the emission sources contained in the participant's emissions report.

3.2.1 Determining Appropriate Verification Activities

To guide verifiers in their determination of appropriate verification activities, the California Registry divides participants into three general groups, based on the level of effort necessary to verify their emissions. The characteristics of the verification approach for each of these groups are listed below. Of course, verifiers are expected to use their professional judgment to augment or narrow these approaches based on uncertainty in emissions estimates and other items affecting material accuracy.

Group 1: Small participants with simple operations. This group includes participants who have only the following material emissions sources:

- Indirect emissions from electricity consumption, steam imports, and district heating/cooling at four or fewer buildings; and/or
- Direct emissions from stationary combustion at one site; and/or
- Direct emissions from five or fewer passenger vehicles.

In an effort to minimize verification costs, small participants who also have total emissions that are less than 500 metric tons of CO_2e per year may elect to be batch verified with similar organizations. The California Registry will assist this batch of participants in bidding and negotiating contracts with the verifier. Standard terms and conditions will apply for all contract elements. Verification for these participants will usually not require a site visit, but rather, activities will be conducted via a telephone interview.

Alternatively, small participants may choose to contract out verification services through a sole source procurement or competitive bidding process.

Group 2: Larger participants with more complex operations. These include participants with only the following material emissions sources:

- Indirect emissions from electricity consumption, steam imports, and district heating/cooling at more than four sites;
- Direct emissions from stationary combustion at more than one site;
- Direct emissions from more than five vehicles; and/or
- No material process or fugitive emissions.

For these participants, most verifications will require at least one site visit. Additional visits may be required when characteristics of the participant changes between reporting periods (e.g., new sites, changed location, began new operations). Site visits are used to ensure that all material GHG emission sources have been included and appropriately accounted for in the greenhouse gas emissions report.

Group 3: Participants with process or fugitive emissions. For participants with material process or fugitive emissions or other emissions not covered above, verification activities must be more detailed. Because these emission calculations are not currently included in the General Reporting Protocol, the verifier is required to use their

professional judgment as to the appropriateness of the calculations used by the participant.

3.3 Verification Cycle

For participants whose operations do not change significantly, verification can be a three-year cycle. In Year 1, a verifier will need to form a detailed understanding of a participant's operations and resulting GHG emissions. If there have been no significant changes in a participant's boundaries, GHG emissions sources and/or management systems, a verifier may streamline and expedite the verification activities in Years 2 and 3 by focusing on verifying emissions estimates. To ensure data integrity, all of the core verification activities should be completed again in Year 4, followed by streamlined activities in Years 5 and 6.

The minimum core verification activities for each year are:

Year 1: Identify emission sources, review management systems, verify emissions estimates

Year 2: Verify emissions estimates

Year 3: Verify emissions estimates

Year 4: Same as Year 1

3.4 California Registry's Expectations for Verification Activities

Through these verification activities, verifiers are to verify that the annual emissions reports submitted to the California Registry via CARROT meet the standards of the General Reporting Protocol:

1. The participant has reported all material emissions, broken out into the following five categories:
    - Indirect emissions from purchased electricity, imported steam, district heating/ cooling;
    - Direct emissions from mobile combustion;
    - Direct emissions from stationary combustion;
    - Direct emissions from process activities; and
    - Direct fugitive emissions.
2. Total emissions reported as de minimis are less than 5% of the total emissions.
3. From the fourth year of reporting to the California Registry, all material emissions from all six greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6) are reported.
4. All California emissions are identified separately from the rest of a participant's U.S. emissions, where the participant has chosen to report their U.S. emissions.
5. All emissions were emitted during the calendar year specified.

6. Reported emissions meet the minimum quality standard of 95% accuracy.

Emissions reports may also contain other information about an organization and its emissions that does not require verification. This could include, for instance, information about a company's environmental policies and goals, and emission reduction projects. Participants may also choose to report other optional indirect emissions (e.g., business travel, employee commuting). In the report generated by CARROT, optional information will be clearly distinguished from verified information.

To verify information is accurately reported, the verifier will want to review, at a minimum, the documents listed in Table 1. To facilitate this review, once the participant reports their emissions using CARROT, the participant and the verifier can generate a Verification Checklist. Based on the types and categories of emissions they have reported, CARROT will provide participants and verifiers with a list of documents they will need for verification.

Table 1. Documents to be Reviewed during Verification

Activity or Emissions Source	Documents
Identifying Emission Sources	
Emission Source Inventory	Facility Inventory
	Emission Source Inventory Stationary Source Inventory Mobile Source Inventory Fuel Inventory
Understanding Management Systems and Methodologies	
Responsibilities for Implementing GHG Management Plan	Organization Chart, Greenhouse Gas Management Plan, Documentation and Retention Plan
Training	Training Manual, Procedures Manual, Consultant Quals Statement
Methodologies	Protocols Used (if in addition to the California Registry's General Reporting Protocol)
Verifying Emission Estimates	
Indirect Emissions from Electricity Use	Monthly Electric Utility Bills, Emission Factors (if not default)
Direct Emissions from Mobile Combustion	Fuel Purchase Records, Fuel in Stock, Vehicle Miles Traveled, Inventory of Vehicles, Emission Factors (if not default)
Direct Emissions from Stationary Combustion	Monthly Utility Bills, Fuel Purchase Records, CEMs Data, Inventory of Stationary Combustion Facilities, Emission Factors (if not default)
Indirect Emissions from Cogeneration	Monthly Utility Bills, Fuel and Efficiency Data from Supplier, Emission Factors (if not default)
Indirect Emissions from Imported Steam	Monthly Utility Bills, Fuel and Efficiency Data from Supplier, Emission Factors (if not default)
Indirect Emissions from District Heating	Monthly Utility Bills, Fuel and Efficiency Data from Supplier, Emission Factors (if not default)
Indirect Emissions from District Cooling	Monthly Utility Bills, Fuel and Efficiency Data from Supplier, Emission Factors (if not default)
Direct Emissions from Process Activities	Raw Material Inputs, Production Output, Calculation Methodology, Emission Factors
Direct Fugitive Emissions	
Refrigeration Systems	Refrigerant Purchase Records, Refrigerant Sales Records, Calculation Methodology, Emission Factors
Landfills	Waste-in-Place Data, Waste Landfilled, Calculation Methodology, Emission Factors
Coal Mines	Coal Production Data Submitted to EIA, Quarterly MSHA Reports, Calculation Methodology, Emission Factors
Natural Gas Pipelines	Gas Throughput Data, Calculation Methodology, Emission Factors
Electric Transmission and Distribution	Sulfur Hexafluoride Purchase Records, Calculation Methodology, Emission Factors

Step 1: Identifying Emission Sources

Verifiers should review a participant's reported emission source inventories (facility, source, and fuel) to ensure that all sources are identified. Verifiers should then determine the GHGs that will result from the identified sources and estimate their magnitude. GHGs that are not required to be reported can be disregarded. Finally, verifiers should rank the remaining reported emissions by CO_2e (using the Global Warming Potentials [GWPs] contained in the Intergovernmental Panel on Climate Change's (IPCC) Second Assessment Report (SAR) - see Table 2, below) to assess the environmental risk associated with the emissions.

Table 2. GWPs from IPCC's Second Assessment Report

Greenhouse Gas	GWP (SAR, 1996)
CO_2	1
CH_4	21
N_2O	310
HFC-23	11,700
HFC-32	650
HFC-125	2,800
HFC-134a	1,300
HFC-143a	3,800
HFC-152a	140
HFC-227ea	2,900
HFC-236fa	6,300
HFC-4310mee	1,300
CF_4	6,500
C_2F_6	9,200
C_4F_{10}	7,000
C_6F_{14}	7,400
SF_6	23,900

Source: U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2003 (April 2005).

When the emission source inventory is complete, verifiers should review participant's GHG emissions report and document answers to the following questions to assess if the GHG emissions report reflects the geographic, organizational, and operational scope of the participant:

1. Does the GHG emissions report include all processes and facilities under the management control of the participant? If not, why?

2. Does the report include all sources of GHG emissions within the geographic and organizational boundaries of the participant?

3. Does the report include all applicable types of GHGs from each emission source within the geographic and organizational boundaries of the participant?

4. Have any mergers, acquisitions, or divestitures occurred during the current reporting year? Have any activities been outsourced in the current year? If yes, has the participant specified a baseline? If so, has it been adjusted?

After these questions have been answered, verifiers will be able to determine if the GHG emissions report accurately reflects the geographic, organizational, and operational scope of the participant. Once all emission sources have been identified, verifiers may proceed to Step 2 to review the calculation methods used and the management systems employed.

Step 2: Reviewing Methodologies and Management Systems

After the scope and comprehensiveness of the participant's emission sources has been confirmed, verifiers should review the methodologies and management systems that the participant used to calculate their emissions. This is principally a risk assessment exercise, in which the verifier must weigh the relative complexity of the scope of the participant's emissions, the participant's methodologies and management systems used to prepare the GHG emissions report, and the risk of calculation error as a result of reporting uncertainty or misstatement. Through these steps, the verifier should determine the appropriateness of the management systems to provide required data to the California Registry. For example, the absence of a comprehensive GHG management system for a participant with a single retail

outlet and solely indirect emissions from electricity purchases may not add significant risk of material misstatement. In contrast, a large vertically-integrated manufacturing company with facilities in 31 states would require a much more robust management system for tracking and reporting its GHG emissions.

A verifier's general review of a participant's GHG management systems should document answers to the following questions:

1. Are calculation methodologies/procedures used to manage GHG emissions at the source level? Are they appropriate given the uncertainty/risk associated with the emissions? Are these methodologies/procedures standard within this industry?

2. Are appropriate methods used to manage and implement entity-wide GHG emissions reporting programs? If the participant has more than one facility, are the emissions data correctly aggregated and monitored?

3. Is someone responsible for managing and reporting GHG emissions? Is this individual qualified to perform this function?

4. Is appropriate training provided to personnel assigned to GHG emissions reporting duties? If the participant relies on external staff to perform required activities, are the contractors qualified to undertake such work? Is there internal oversight to assure quality of the contractor's work?

5. Are appropriate documents created to support and/or substantiate activities related to GHG emissions reporting activities, and is such documentation retained appropriately? For example, is such documentation maintained through reporting plans or procedures, utility bills, etc.?

6. Are the mechanisms used to measure and review the effectiveness of GHG emissions reporting programs appropriate for this purpose? For example, are policies, procedures, and practices evaluated and updated at appropriate intervals?

Verifiers should also consider how the participant's management systems are designed to support reporting five categories of emission sources (indirect, mobile, stationary, process and fugitive). Consequently, in reviewing a participant's Total Emissions Report, verifiers should document answers to the following questions:

1. Does the management system capture the diversity of the sources that comprise each emission category? For example, are there multiple types of vehicles and other transportation devices that require different emission estimation methodologies?

2. Does the system capture all the diversity of GHGs emitted from each emission source category?

3. Has the participant used the default emission factors and standardized estimation methods in the California Registry's General Reporting Protocol to calculate emissions in each source category? Has the participant or its technical assistance provider developed estimation methods independently? If the participant uses alternative emission factors, are they documented and explained appropriately?

4. Does the participant's GHG management systems appropriately track emissions in all of the emission source categories?

Once the verifier has assessed the overall risk associated with the management systems, the risks should be assessed in conjunction with the weighted CO_2e estimates determined in Step 1 (Identifying Emission Sources). Verifiers should then identify the areas with the greatest potential for material misstatements (either based on volume of emissions, lack of management systems, or both) to determine the best risk-based strategy to identify a representative sample of emissions to recalculate.

Step 3: Verifying Emission Estimates

Based on a participant's identified emission sources, management systems, and corresponding risk profile of GHG emissions, verifiers should select a representative sample of calculations to verify and sites to visit. Sampling procedures may entail conducting site visits, but should include reviewing documents such as utility bills or emissions monitor results, and recalculating emission estimates based on underlying activity data. In Table 3, below, the California Registry specifies the minimum number of sites that should be visited based on the size of the entity. The verifier should use professional judgment to assess if additional visits are needed.

Table 3. Minimum Site Visit Sample Size

Total Sites	Minimum Sample Size
2-10	30%
11-25	20%
26-50	15%
51-100	10%
101-250	5%
251-500	3%
501-1,000	2%
Over 1,000	1-2%

3.5 Potential Site Visits by the State of California

As part of the State of California's oversight of the verification process, the State will randomly accompany verifiers on site visits. The California Registry's enabling legislation directed the State to observe the verifier during verification visits, evaluate whether the participant has a GHG accounting program consistent with California Registry-approved procedures and protocols, and evaluate the reasonableness of the emissions information being reported. The State may send an employee or a contractor to accomplish this responsibility. The purpose of any site visit is to oversee the verifier's activities, and to evaluate the reasonableness of the participant's reported data. The State will report on its findings to the California Registry.

To accomplish this, during a site visit, the State will need to access the same information and sources as that of the verifier. The State will work with the verifier and participant to obtain this access. This may involve requesting access to on-site locations that may have GHG emission sources or related activities and participant information, data, records, or copies of records; observing verifiers during any exchange of participant data or data analyses; and/or asking the verifier to provide specific information related to their on-site and off-site data analyses. The State will also make every effort to not impede the normal activities of either the participant or the verifier. All costs for the State site visit are borne by the State.

Before the end of a site visit, the State will discuss its preliminary observations and evaluations with the verifier and participant. The State will also contact and discuss with the verifier and participant any findings that identify either party before reporting this to the California Registry.

As the Participant requests, a representative from the State, and/or the Verifier that will view confidential information should sign the Standard Nondisclosure Agreement (NDA). Rules covering State confidentiality can be found in the *California Code of Regulations, Title 20, Sect. 2501 et seq*.

3.6 Targeted Review & Recalculation of GHG Emissions

The California Registry does not expect nor require verifiers to review all of the participant's documents and recheck all their calculations. To ensure that data meet a minimum quality standard on an entity-wide basis, verifiers should concentrate their activities in the areas that have the greatest uncertainty and amount of emissions. Verifiers should calculate emissions for these sources and compare those calculations to emission levels reported by the participant. If they are free of material misstatement (have a difference of <5%), the verifier should declare that the participant's report conforms to the California Registry's Protocols.

If the reported data is not free of material misstatement, the verifier should include this information in its Verification Report and should complete its sampling effort of other sources. Once verifiers have confirmed that a sample of data is free of material misstatements, they should estimate total emissions and confirm that all material GHG emissions are reported.

3.7 De Minimis Emissions

De minimis emissions are a quantity of GHG emissions from one or more sources, for one or more gases, that when summed equal less than 5% of an organization's total CO_2e emissions. The percentage applies to California emissions for the purposes of California-only emissions reporting, and applies to U.S. emissions for national reporting. Participants have some discretion in choosing which sources and/or GHGs are de minimis, but are expected to disclose all de minimis emission sources in their emissions report. Verifiers should review participant's documentation and explanation of how de minimis emissions were calculated to confirm that not more than 5% of total CO_2e emissions are considered de minimis.

3.8 Identifying Material or Immaterial Misstatements

In order for verifiers to verify a GHG emissions report, a sample of data must be free of material misstatement. It is possible that during the verification process differences will arise between the emissions estimated by the participant and those estimated by the verifier. Differences of this nature may be classified as either material or immaterial. A discrepancy is considered to be material if the overall reported emissions differ from the overall emissions estimated by the verifier by 5% or more. A difference is immaterial if this difference is less than 5%.

A verifier's verification of emissions estimates should document the answers to the following questions:

1. Are the reported electricity, steam, and district heating and cooling use consistent with utility bills?

2. Is the reported total stationary fuel use by fuel type consistent with the fuel use records?

3. Is the reported total consumption of fuels in motor vehicles consistent with available documentation and by vehicle type? If the entity calculates transportation emissions based on vehicle mileage, is the reported vehicle mileage consistent with vehicle mileage records?

4. Are the reported process and fugitive emissions consistent with activity data or maintenance records?

5. Are the emission factors used by the participant appropriate? If California Registry default factors are not used, do the alternative emission factors provide increased accuracy? Is their derivation and explanation of increased accuracy properly documented and reasonable?

6. Does a sample of the participant's calculations agree with your re-calculated direct (mobile, stationary, process and fugitive) and indirect emissions estimates? Have you documented your process for determining the appropriate sampling plan?

7. Are all material GHG emissions included? Are all emissions that are considered de minimis emissions documented and reported as such?

8. Are the current year's reported emissions significantly different from the prior year's emission levels? If so, what has changed from prior years?

9. Has the accumulated change in reported emissions, since the last baseline update, changed by more than ten (10) percent? If so, has the baseline, if any, been recalculated?

10. Are there any discrepancies between your emissions estimates and the participant's material?

Once verifiers have reviewed these activities and answered these questions, they are ready to complete the verification process.

Part IV Completing the Verification Process

4.1 Overview

Once a verifier has completed reviewing a participant's annual GHG emissions report, they must do the following to complete the verification process:

1. Complete a detailed Verification Report, and deliver it to the participant;
2. Prepare a concise Verification Opinion, and deliver it to the participant;
3. Conduct an exit meeting with the participant to discuss the Verification Report and Verification Opinion and determine if material misstatements (if any) can be corrected. If so, the verifier and participant should schedule a second set of verification activities after the participant has revised the GHG emissions report.
4. Submit an electronic Verification Form and Verification Activity Log to the California Registry via CARROT;
5. Return important records and documents to the participant for retention.

4.2 Completing a Verification Report

4.2.1 Verification Report Content

The Verification Report is a confidential document that is shared between a verifier and a participant, and is only available to the California Registry or the public at the participant's request.

The Verification Report should include the following elements:

- The scope of the verification process undertaken;
- The standard used to verify emissions (this is the California Registry's General Reporting Protocol, but may also include other protocols or methodologies for those sources for which the California Registry has yet to provide detailed guidance);
- A description of the verification activities, based on the size and complexity of the participant's operations;
- A list of emission sources identified, including de minimis sources;
- A description of the sampling techniques and risk assessment methodologies employed for each source;
- An evaluation of whether the participant's annual GHG emissions report is in compliance with the California Registry's General Reporting Protocol;
- A comparison of the participant's overall emissions estimates with the verifier's overall emissions estimates;

- A list of material misstatements, if any;
- A list of immaterial misstatements, if any; and
- A general conclusion to be reflected in the Verification Opinion.

4.2.2 Quality Assurance Check

When the Verification Report is completed, it should be forwarded to an independent senior reviewer within the verifier's firm for a quality assurance check. No Verification Report should be forwarded to a participant until it has had an independent internal review.

4.2.3 Participant Review of Verification Report

Once a participant receives a Verification Report from their verifier, they should have at least 30 days to review and comment on the Verification Report. At the end of that review, the verifier and the appropriate official at the participant's organization should hold an exit meeting to discuss the nature of any material or immaterial misstatements.

4.3 Preparing a Verification Opinion

Verifiers should prepare a Verification Opinion using the template shown in Figure 2. The Verification Opinion is a simple confirmation of the verification activities and outcomes for all stakeholders (participants, verifiers, the California Registry, and the public). The Verification Opinion must also follow the same internal review process as the Verification Report and consequently must be reviewed by an independent senior reviewer within the verifier's firm, and signed by a designated lead verifier. An electronic version of this template is available on the California Registry's Verifiers Only webpage or may be obtained from the California Registry by emailing **help@climateregistry.org**.

4.4 Verification Activity Log

In order to assess the consistency of professional judgments that verifiers have been asked to make, verifiers should also complete a Verification Activity Log (Table 4 below) and submit a completed copy to the California Registry, along with the electronic Verification Form, in CARROT.

Table 4 includes a step-by-step outline of the standardized verification activities that all verifiers must consider. Not all activities are required of all participants or during each year, depending on a participant's specific circumstances, but verifiers should review this list and note "not applicable" (or "N/A") where appropriate. The table also includes a series of yes/no questions. Any "no" response should be explained, without revealing a participant's confidential information.

The California Registry will consider both the Verification Opinion and the answers in Table 4 in its final review of emissions data, before accepting a participant's report into the California Registry. An electronic version is available for download in CARROT, on the California Registry's Verifiers Only webpage, and from the California Registry by emailing **help@climateregistry.org**.

Table 4. Verification Activity Log

Verifier Company:		
California Registry Participant:		
Preparing for Verification	**Date Achieved**	
Bid on a Verification Contract		
Request determination of COI from California Registry		
Negotiate Contract with California Registry Participant		
Notify State of California and California Registry of Planned Verification Activities		
Conduct Kick-off Meeting With Participant		
Plan Verification Activities Based on Participant Characteristics		
Core Verification Activities **Identify Emission Sources**	**Date Achieved**	
Identify and list all facilities in the entity		
Identify and list all emission sources (indirect, mobile, stationary, process and fugitive)		
Identify and list all fuel types		
Rank all sources by magnitude on a carbon dioxide equivalent basis		
Assess any changes in geographic and organizational boundaries		
	Yes	**No**
1. Does the GHG emissions report include all processes and facilities under the management control of the participant?		
2. Does the report include all sources of GHG emissions within the geographic and organizational boundaries of the participant?		
3. Does the report include all applicable types of GHGs from each emission source within the geographic and organizational boundaries of the participant?		
4. Have any mergers, acquisitions, or divestitures occurred during the current reporting year?		
5. Have any activities been outsourced in the current year?		
6. If a baseline has been specified, has it been adjusted accordingly?		
7. Does the GHG emissions report include all processes and facilities under the management control of the participant?		
Review Methodologies and Management Systems	**Date Achieved**	
Evaluate procedures and systems for preparing emissions report		
Evaluate personnel and training for preparing emissions report		
Consider the uncertainty associated with methodologies and management systems		
	Yes	**No**
8. Are appropriate calculation methodologies/procedures used to manage GHG emissions at the source level? Are they appropriate given the uncertainty/risk associated with the emissions?		
9. Are appropriate methods used to manage and implement entity-wide GHG emissions reporting programs?		
10. If the participant has more than one facility, is the emissions data correctly aggregated and monitored?		
11. Is someone responsible for managing and reporting GHG emissions?		
12. Is that person qualified to do so?		
13. Is appropriate training provided to personnel assigned to GHG emissions reporting duties? If the participant relies on external staff to perform required activities, are the contractors' qualified to undertake such work?		
14. Are appropriate documents created to support and/or substantiate activities related to GHG emissions reporting activities, and is such documentation retained appropriately?		
15. Are appropriate mechanisms used to measure and review the effectiveness of GHG emissions reporting programs? For example, are policies, procedures, and practices evaluated and updated at appropriate intervals?		

16. Does the system account for the diversity of the sources that comprise each emission category? For example, are there multiple types of vehicles and other transportation devices that require different emission estimation methodologies?		
17. Do you know the diversity of GHGs emitted from each emission source category?		
18. Has the participant used the default emission factors and standardized estimation methods in the California Registry's General Reporting Protocol to calculate emissions in each source category?		
19. Has the participant or its technical assistance provider developed estimation methods independently?		
20. If participant uses alternative emission factors, are they documented and explained appropriately?		
21. Does the participant's GHG management system appropriately track emissions in all of the emission source categories?		
Assess Risk of Material Misstatement Associated with Management Systems/Procedures	**Date Achieved**	
Develop sampling procedures for sources based on risk of material misstatement		
Verify Emission Estimates		
Confirm total fuel consumption		
Confirm vehicle miles traveled		
Confirm that appropriate emission factors are used. If not default factors, ensure the derivation and explanation of increased accuracy is properly documented		
Calculate direct (mobile, stationary, process & fugitive) & indirect emissions based on sampling procedures		
Compare estimates from sample calculations to reported emissions		
Determine if there are any discrepancies between sample calculation and reported emissions		
Confirm that all material GHG emissions are included (that all emissions not included are either de minimis or not required)		
Determine if Discrepancies are Material or Immaterial	**Yes**	**No**
22. Based on the following table, have you visited an appropriate number of sites?		

Total Sites	Minimum Sample Size
2-10	30%
11-25	20%
26-50	15%
51-100	10%
101-250	5%
251-500	3%
501-1,000	2%
Over 1,000	1-2%

Total number of sites:_____
Total number visited:_____

23. Are the reported electricity, steam, and district heating and cooling use consistent with utility bills?		
24. Is the reported total stationary fuel use by fuel type consistent with the fuel use records?		
25. Is the reported total consumption of fuels in motor vehicles consistent with available documentation and by vehicle type? If the entity calculates transportation emissions based on vehicle mileage, is the reported vehicle mileage consistent with vehicle mileage records?		
26. Is the reported process and fugitive emissions consistent with activity data or maintenance records?		
27. Are the emission factors used by the participant appropriate? If California Registry default factors are not used, ensure that alternative emission factors provide increased accuracy and that the derivation and explanation of increased accuracy is properly documented and reasonable.		
28. Does a sample of the participant's calculations agree with your re-calculated direct (mobile, stationary, process & fugitive) & indirect emissions estimates? Have you documented your process for determining the appropriate sampling plan?		
29. Are all material GHG emissions included? Are all emissions that are considered de minimis emissions documented as such?		
30. Are the current year's reported emissions significantly different from the prior year?		
31. Has the accumulated change in reported emissions, since the last baseline update, changed by more than 10%? If so, has the baseline, if any, been recalculated?		
32. Are discrepancies between your emissions estimates and the participant's immaterial?		
Completing the Verification Process	**Date Achieved**	
Prepare a detailed Verification Report and submit to participant		
Prepare a Verification Opinion and submit to participant		
Conduct exit meeting with participant to discuss Verification Report & Opinion		
Provide records to participant for retention		

4.5 Completing the Verification Contract

4.5.1 Exit Meeting

Verifiers should prepare a brief summary presentation of their verification findings for the participant's key personnel. At the exit meeting, verifiers and participants might exchange lessons learned about the verification process and share thoughts for improving the verification process in the future. Verifiers and participants may wish to consider joint feedback to the California Registry.

The goals of this meeting should be:

- Acceptance of the Verification Report and Opinion (unless material misstatements exist and can be remediated, in which case the verification contract may need to be revised and a second verification process scheduled). If the participant does not wish to retain the verifier for the re-verification process, the verifier shall turn over the participant's relevant documentation to the participant within 30 days.

- Authorization for the verifier to complete the Verification Form in CARROT.

If the verifier is under contract for verification activities in future years, the verifier and participant may wish to establish a schedule for the next year's verification activities.

Figure 2. Sample Verification Opinion

[*Insert Verification Firm Logo*]

California Climate Action Registry Verification Opinion

Name of Verification Firm: _____

This is to verify that _____ [*Name of Member Organization*] has had its greenhouse gas emissions report covering the period January 1, _____ [*Insert Reporting Year*] to December 31,_____ [*Insert Reporting Year*] verified according to the California Climate Action Registry's General Verification Protocol against a standard of the California Registry's General Reporting Protocol.

Organizational Boundary of Verification

☐ Financial Management Control ☐ Operational Management Control ☐ Equity Share

GHGs Verified

☐ CO_2 ☐ CH_4 ☐ N_20 ☐ HFCs ☐ PFCs ☐ SF_6

Total Direct Emissions: _____

Total Indirect Emissions: _____

Geographic Scope of Verification

☐ California Emissions ☐ U.S. Emissions

Baseline Year (if specified)

_____ (Direct) _____ (Indirect) Year, if specified

Verification Opinion

☐ Verified without Qualification

☐ Unable to Verify

Attestation

_____ _____

[*Insert Name*], Lead Verifier Date

_____ _____

[*Insert Name*], Senior Internal Reviewer Date

Authorization

I _____ [*Name of Member Representative*] authorize the above named verifier to submit this Verification Opinion to the California Climate Action Registry for _____ [*Name of Member Organization*].

_____ _____

[Member Representative Signature] Date

4.5.2 Limits to Verifier Feedback

If a participant's emissions report is not verifiable due to material misstatements, a *verifier must not provide guidance on how to remediate the identified misstatements*. Such guidance would be considered a consulting activity and therefore, a conflict of interest. However, verifiers may provide any existing documentation that may be useful to participants in preparing remediation plans. A verifier should also enumerate any shortcomings in a participant's GHG tracking and management systems.

The California Registry will retain the participant's unverified emissions report in the California Registry database for up to two years pending verification. After two years, if the emissions report is still not verifiable, the California Registry will render the emissions report inactive.

4.6 Submitting the Verification Opinion to the California Registry

Once the Verification Opinion is complete and has been authorized by the participant, the verifier must complete the Verification Form and Verification Activity Log electronically in CARROT and the participant must email a Portable Document File (PDF) copy of the fully executed verification opinion to help@climateregistry.org. The participant may also elect to send a hard copy of the verification opinion with wet signatures to the address listed below:

Verification Opinion
California Climate Action Registry
523 W. Sixth Street, Suite 428
Los Angeles, CA 90014

Once the California Registry receives an electronic or hard copy of the Verification Opinion, the California Registry will perform a final review of the emissions report in CARROT. When successful, the participant's report will be formally accepted into the California Registry database and the annual verification process will be completed.

*Note: Participants are *not* required to submit their Verification Opinions to the California Registry for the first two years of their participation. However, it is important to note that a participant's emissions data will not be considered accepted by the California Registry unless the California Registry receives a Verification Opinion indicating a "verified without qualification" assessment.

4.7 Record Keeping and Retention

While the California Registry views the verification process essentially as a private exchange between the verifier and the participant, the verifier should remind the participant to retain sufficient records to enable an ex-post verification of the participant's emissions. The California Registry recommends that the following records be retained for a minimum of seven years as specified by contract with the participant.

Verifiers should retain hard and electronic copies, as applicable, of:

- The participant's GHG emissions report (printable from CARROT);
- The Verification Report; and
- The Verification Opinion.

The participant should maintain the following documentation for a minimum of seven years:

- Contact information for the lead verifier and a responsible corporate officer at the participant's organization;
- A general description of the participant's organization;
- The geographic boundaries;
- The number of facilities and operations assessed in the verification activities;
- The GHGs evaluated;
- The sources of emissions identified;
- Assessment of emission factors, demonstrating greater accuracy if not default emission factors;
- Copies of fuel use, mileage, or other activity data records used in sample recalculations;
- Verification methodology used based on the size and complexity of the participant;
- Sampling procedures for selecting site visits;
- Dates of site visits;
- The verifier's evaluation of the participant's management systems; and
- The verifier's estimates of the participant's emissions.

Copies of the original activity data records are necessary to perform an ex-post verification.

4.8 Timeline of Verification Process

Incorporating all of the steps and procedures involved in reporting, reviewing and verifying credible emissions data may be a lengthy process. The following table gives you an overview of the consecutive steps and necessary lapses of time between steps in the verification process.

Table 5. Verification Process Timeline

Activity	Elapsed Time
Preparing for Verification	
Contacted by participant to submit proposal for services	Where no consulting activities for 3 years prior to contract
Selected by participant	Varies
Submit request for case-by-case determination of COI to California Registry	Prior to contract negotiation
California Registry evaluates case and issues notification of low risk for COI	One month
Negotiate contract with participant	Varies
Notify State of California and California Registry of verification activities	One month
Core Verification Activities	
Begin verification activities	Maximum one year
Completing the Verification Process	
Submit Verification Report and Opinion to participant	Varies
Participant reviews Verification Report and Opinion and returns comments to verifier	One month
Verifier discusses findings with participant	Varies
Participant authorizes submission of electronic Verification Form to the California Registry	By October 31 of data year +1
Monitor emerging COI	One year
Verifier cannot provide consulting services to participant	One year
Participant chooses a new verifier	After a maximum of six years

Glossary

Applicant	A firm, or lead firm (if part of a team), responding to a State-issued RFA for Verifiers.
Baseline	Datum against which to measure greenhouse gas emissions performance over time, usually annual emissions in a selected base year.
Batch Verification	Verification process arranged by the California Registry for multiple participants with relatively simple GHG emissions (less than 500 tons of CO_2e emissions and typically only indirect emissions from electricity consumption and/or direct emissions from stationary or mobile combustion).
Verification	The process used to ensure that a given participant's greenhouse gas emissions inventory (either the baseline or annual result) has met a minimum quality standard and complied with the California Registry's procedures and protocols for calculating and reporting GHG emissions.
Verified Member	A California Registry participant that has submitted at least one verified annual emissions report to the California Registry.
Verifier	A firm or team of firms that has been State- and California Registry-approved to conduct verification activities under the California Registry program. A verifier may also refer to a single employee within a State- and California Registry-approved firm who conducts verification activities.
CO_2 equivalent*	(CO_2e) The quantity of a given GHG multiplied by its total global warming potential. This is the standard unit for comparing the degree of harm which can be caused by different GHGs.
Conflict of Interest	A situation in which, because of other activities or relationships with other persons or organizations, a person or firm is unable or potentially unable to render an impartial Verification Opinion of a potential client's greenhouse gas (GHG) emissions, or the person or firm's objectivity in performing verification activities is or might be otherwise compromised.
Datum	A reference or starting point.
De Minimis	A quantity of greenhouse gas emissions from one or more sources, for one or more gases, which, when summed equal less than 5% of an organization's total CO_2e emissions.
Direct Emissions	Emissions from sources that are owned or controlled by the reporting organization.
Emerging COI	A potential or actual COI situation that arises, or becomes known, during verification or for a period of one year after the completion of verification activities.

Emission Factor*	A factor relating activity data and absolute GHG emissions.
Equity Share	Fractional percentage or share of an interest in an entity based either on ownership interest, or on some other contractual basis negotiated among the entity's stakeholders.
Fugitive Emissions*	Unintended or incidental emissions of GHGs from the transmission, processing or transportation of fossil fuels or other materials, such as HFCs from refrigeration leaks, SF_6 from electric power distribution equipment, methane from mined coal, CO_2 emitted incidentally with geyser steam and/or fluid used in geothermal generating facilities.
Global Warming Potential*	(GWP) The ratio of radiative forcing (degree of harm to the atmosphere) that would result from the emission of one unit of a given GHG to one unit of CO_2.
Greenhouse Gases	(GHGs) For the purposes of the California Registry, GHGs are the six gases identified in the Kyoto Protocol: carbon dioxide (CO_2), nitrous oxide (N_20), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).
Indirect Emissions	Emissions that are a consequence of the actions of a reporting entity, but are produced by sources owned or controlled by another entity.
Inherent Uncertainty	The scientific uncertainty associated with measuring GHG emissions due to limitations on monitoring equipment, or measurement methodologies.
Lead Verifier	An individual who has completed a California Registry-sponsored verification training workshop and who has the authority to sign a verification firm's Verification Opinion.
Management Control	The ability of an entity to govern the operating policies of another entity or facility so as to obtain benefits from its activities.
Material misstatement	An error (for example from an oversight, omission or miscalculation) that results in the reported quantity being significantly different from the true value to an extent that will influence performance or decisions.
Member	A California Registry participant that is preparing its annual GHG emissions report, but has not yet submitted its verified report to the California Registry.
Minimum Quality Standard	Data that is free of material misstatements, and meets the California Registry's minimum level of accuracy of at least 95%.
Mobile Combustion*	Burning of fuels by transportation devices such as cars, trucks, airplanes, vessels, etc.
Organizational COI	Instances where the ability to render objective GHG verification services may be affected by the services provided by, shared management and/or financial resources with, or other situations created by a parent company or other related entities.

Outsourcing*	The contracting out of activities to other businesses.
Partner	An organization working through a lead firm (applicant) to respond to a State-issued RFA for Verifiers. A partner may or may not be a related entity. If the applicant submits an application wherein staff or financial capability is shared with either a parent firm or subsidiary of a parent firm, then that parent or subsidiary is considered a partner. If the applicant is part of a larger organization, but the application does not include any staff or financial capability from the larger organization, then the larger organization is not considered a partner.
Personal COI	A relationship of an employee or a partner employee that may impair the objectivity of the employee in performing a verification.
Process Emissions	Emissions from physical or chemical processing rather than from combustion, such as CO_2 emissions from cement manufacturing and PFC emissions from aluminum smelting.
Related Entity	An organization that is linked to the verifier by: common ownership or directors, contractual arrangement, a common name, informal understanding, or other means such that the related organization has a vested interest in the outcome of an assessment or has a potential ability to influence the outcome of an accredited management system assessment, greenhouse gas validation, or verification.
Reporting Uncertainty	The errors made in identifying emission sources and managing and calculating GHG emissions. This differs from inherent uncertainty due to incomplete understanding of climate science or a lack of ability to measure greenhouse gas emissions.
Stationary Combustion*	Burning of fuels to generate electricity, steam, or heat.

**Definitions of key terms obtained from "The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard," World Business Council for Sustainable Development and World Resources Institute, Switzerland, March 2004.*

Key Questions

Verifier Approval: *Who may qualify as a verifier?*

Only those firms accredited by the California Registry, the State of California, or The Climate Registry may provide verification services to California Registry participants

To become approved, a verifier must complete a two-step process: 1) Obtain accreditation as a GHG verifier from either the California Air Resources Board or from the American National Standards Institute (or other approved accreditation body as specified on the California Registry website) and 2) achieve California Registry approval by attending a verification training workshop facilitated by the California Registry.

Information on the ANSI GHG Verifier Accreditation is available at www.ansi.ghg.org. Information on CARB GHG accreditation is available at arb.ca.gov.

Applicants who wish to be qualified as approved verifiers need to demonstrate experience in GHG verification and verification of financial data, technical data, quality control, and/or environmental management systems. Verifiers must also demonstrate the means to accept financial liability for verification activities undertaken for a participant. *Firms providing verification services to a participant may not provide any non-verification services that create a high risk of COI to the same participant for three years prior to and one year after verification.*

Liability: *What liability will a verifier incur? What liability coverage must a verifier accept?*

At a minimum, a verifier is responsible for planning a participant's verification activities, conducting the verification activities, preparing a Verification Report and Opinion, and submitting authorized Verification Opinions to the California Registry via CARROT. If a California Registry-approved verifier fails to complete the contracted activities, they may be financially liable for the cost of hiring a different California Registry-approved verifier to complete a proper verification from start to finish (as defined in the contract between a verifier and a participant). The verifier may incur additional liability based on the negotiated terms of the contract. This liability may include the future value of GHG emissions or emission reductions, damages, or any other element agreed to by the verifier and the participant.

In their initial application, verifiers must demonstrate the means to accept financial liability for verification activities undertaken for a California Registry participant, specify such liability in any contract for verification activities, and make adequate arrangements (e.g., professional liability insurance coverage) to cover liabilities arising from its activities or operations. However, verifier liability may also be limited in the contract with the California Registry participant.

Resolution of Disputes: *What recourse is available if the participant does not accept the findings of the verification?*

There may be instances where a verifier and a participant cannot agree on identification of material misstatements and/or the findings of the Verification Opinion. In such instances, both parties can request the Dispute Resolution Committee, composed of qualified representatives from California state agencies, the California Registry, and one non-voting verifier, who serves pro bono on an annual, rotating basis. The participant and the verifier will

each pay a filing fee equal to 5% of the participant's annual membership fee to submit the matter to the Dispute Resolution Committee.

The Dispute Resolution Committee will interview the participant and the verifier, review the area of dispute and reach a unanimous, binding decision concerning verifiability. The California Registry will notify the verifier and the participant of the Committee's decision. Thus, as part of contract negotiations, each California Registry participant and verifier will need to sign a form agreeing to this Dispute Resolution policy.

"Batch Verification": *How does it work? How will it affect bidding, contracting, and the overall verification process?*

In an effort to minimize the transaction costs of verification, the California Registry will help eligible participants with simple GHG emissions contract for "batch verification". Eligible participants have relatively simple GHG emissions (indirect emissions from purchased electricity and/or emissions from limited stationary and mobile sources) and produce less than 500 metric tons of CO_2e per year.

In batch verification, the California Registry will work with one verifier each year to verify the emissions reports of multiple organizations at one time. Emissions must be verified to the standards of the General Reporting Protocol. Because of the nature of the emissions, batch verification activities will consist of document review and phone conversations, but will not require a site visit. The California Registry will assist in negotiating a standardized contract and a flat fee for each organization. Standardizing the contract language will help to minimize the transaction costs of verification for small, office-based organizations.

A new batch verifier will be chosen each year. This finite verifier term is to minimize the risk from COI and to eliminate the cost associated with a case by case COI.

Verification Deadlines: *What is the deadline for completing the verification process?*

Emissions should be reported to the Registry no later than June 30 following the emissions year. Verification should be completed by October 31 following the emissions year. For instance, 2008 emissions should be reported by June 30, 2009 and verified by October 31, 2009.

Verification Report and Verification Opinion: *What are the Verification Report and Verification Opinion and how are they different?*

The Verification Report is a detailed report that a verifier prepares for a participant. The Verification Report should describe the scope of the verification activities, standards used, emission sources identified, sampling techniques, evaluation of a participant's compliance with the General Reporting Protocol, assumptions, and a list of material and immaterial misstatements, if any. The Verification Report is a confidential document between the verifier and the participant, and is only shared with the California Registry or the public at the participant's request.

The Verification Opinion is a brief, one-page summary of the verifier's findings that simply states if the participant's emissions report is verifiable or not. The Verification Opinion is submitted in hard copy by the verifier to the participant for approval.

Verification and Remediation: *What if a participant's emissions report is not verified?*

After completing verification activities, the verifier will prepare a Verification Report and forward it to the responsible official representing the participant. The responsible official includes anyone authorized by the participant to approve the GHG emissions report for submission to the California Registry and will typically be a corporate official or the technical manager of the verification contract.

If the verifier identifies material misstatements that prevent a favorable Verification Opinion, those material misstatements should be listed and described in the Verification Report. If possible, the participant may correct those material misstatements and resubmit the emissions report for verification within a reasonable amount of time. The participant may seek technical assistance to correct material misstatements but the verifier may not provide such technical assistance as it would constitute non-verification services, and create a conflict of interest.

The California Registry will retain the participant's unverified data in the California Registry database for up to two years, pending correction. After that time, the participant will need to re-enter the data.

Confidentiality: *Are the results of the verification kept confidential? Will emissions data be kept confidential?*

All aggregated entity-level emissions data and metrics reported to the California Registry will be available to the public. However, the California Registry will keep confidential all reported emissions, activity data, methodologies, and emissions factors that are reported at facility, project, or source levels. Confidential information will only be accessible to the participant, the California Registry, and the verifier, unless the participant allows others access to such information or wishes to have it available to the public. In instances where the State of California accompanies verifiers on site visits, the State may have access to confidential information as needed to oversee verification activities and evaluate the reasonableness of the participant's data and systems to track emissions. Representatives from the State, the Verifier, and the Participant who will view confidential information will all be required to sign the Standard Nondisclosure Agreement (NDA). As noted in an earlier question, the Verification Report is a private document between a participant and verifier, while the Verification Opinion is shared with the California Registry. A majority of the contents of the Verification Opinion will also be shared with the public.

General Verification Protocol Revision Policy: *Will this General Verification Protocol change over time? How can verifiers provide feedback to the California Registry?*

The California Registry expects to regularly review, revise, update, and augment this General Verification Protocol. The California Registry invites all parties, verifiers, California Registry participants, California State agencies, and the public to provide insights and experiences that will help improve the General Verification Protocol. Anyone with suggestions or concerns is encouraged to contact the California Registry at any time at 213-891-1444 or by email at info@climateregistry.org**.**

Stakeholders will also be able to present suggestions directly to the California Registry's Board of Directors for consideration at their meetings. All suggestions and requests for modifications must be made by utilizing the "Protocol Comment Form" available on the California Registry's website at **www.climateregistry.org/protocols**.

California Registry-Approved Technical Assistance Providers: *What role do they play?*

Some participants may desire outside assistance, either in terms of expertise or human resources, to collect, document and report their emissions to the California Registry and/or otherwise manage their GHG emissions. To assist participants in identifying a firm qualified to help them, the State and the California Registry approve firms qualified to serve as technical assistance providers (TAs). Participants are not required to use only approved TAs. However, approved companies have been approved as firms experienced in providing GHG emissions services, and many of them have attended California Registry-sponsored training sessions. Where a participant has retained the services of a TA, the participant may ask the TA to play a role in the verification process. Neither the California Registry nor the State is responsible for any consulting services or recommendations they may provide, nor do they specify any role that TAs should or should not play.

All firms approved as verifiers also are automatically qualified to act as TAs. However, a firm cannot provide both technical assistance and verification services to the same client at the same time.

Role of California State Agencies: *What is the relationship between the California Registry and state agencies?*

The Registry was established by California statute as a non-profit voluntary registry for greenhouse gas emissions inventories, to help organizations establish GHG emissions baselines against which any future GHG emission reduction requirements may be applied. The State of California was directed to offer its best efforts to ensure that participants receive appropriate consideration for early actions in the event of any future state, federal or international GHG regulatory scheme.

The California Registry and state agencies work together and keep each other informed about current activities. The State of California continues to provide technical guidance to the California Registry and plays a direct oversight role in the verification process. The California Registry gives great weight to state agency guidance and relies in large part on these recommendations when developing California Registry policies, procedures and tools, including reporting and verification protocols and the online reporting tool. However, final policy and technical decisions are made independently by the California Registry's Board of Directors.

Updated Emissions Reports: *Once a report has been verified, will it ever change?*

Following verification of an annual GHG emissions report, there may be situations in which a verified report may change. A participant may wish to add information beyond the minimum reporting standards (add non-CO_2 gases during the first three years of reporting, report facilities outside of California, change the emission factor used, etc.). Participants can update their report at any time. However, any changes will need to be re-verified, and this information will need to be documented in CARROT. As understanding and sophistication of GHG accounting principles develops, the California Registry may elect to update accounting principles (e.g., alternate emission factors, Global Warming Potentials). Where participants have used CARROT to calculate their emissions, these changes do not need to be re-verified.

CARROT: *Am I required to use CARROT to communicate with the California Registry?*

Participants are required to report their emissions to the California Registry using CARROT. The participant-entered annual GHG emissions report generated by CARROT is the document on which the verifier provides its Verification Opinion to the California Registry. The Verification Opinion is submitted in separately by the participant. Verifiers are not restricted to only communicating with the California Registry via CARROT, but must use the online tool to submit an electronic Verification Form and Verification Activity Log. Questions about using CARROT may be directed to the California Registry at 213-891-1444 or **help@climateregistry.org**.

Additional Questions?

If you have any questions regarding GHG emissions reporting or verification under the California Registry Protocols, please contact the California Registry by phone (213-891-1444) or email (**help@climateregistry.org**).

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California Climate Action Registry
523 West Sixth Street, Suite 428
Los Angeles, California 90014
Tel: 213 891 1444
Email: info@climateregistry.org
www.climateregistry.org

SAN JOAQUIN VALLEY DRAINAGE AUTHORITY

P O Box 2157 Los Banos, CA 93635
209 826 9696 Phone 209 826 9698 Fax

November 30, 2012

Pamela Creedon, Executive Officer
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, CA. 95670-6114

Subject: Westside San Joaquin River Watershed Coalition
Submittal of November 30, 2012 semi-annual monitoring report

Dear Pamela,

Attached is the November 30, 2012 semi-annual monitoring report as required under our Monitoring and Reporting Program Order No. R5-2008-0831 (as revised by the letter dated 3/9/12). This report covers the irrigation season monitoring from March through August 2012.

Laboratory reports associated with this monitoring period are included electronically (on a CD) as Appendix C, along with associated electronic data deliverables (EDDs). Hard copies of the laboratory reports can be provided upon request.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment for violations.

If you should have any questions on the information submitted in this report, please give me a call directly at 559-582-9237.

Joseph C. McGahan
Watershed Coordinator
Westside San Joaquin River Watershed Coalition

San Joaquin Valley Drainage Authority

Westside San Joaquin River Watershed Coalition

Semi-Annual Monitoring Report

2012 Irrigation Season Report

Covering the period: March 2012 through August 2012
(Sampling Events 89 through 94)

November 30, 2012

Prepared by:
Summers Engineering, Inc.
Consulting Engineers
Hanford California

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SEMI-ANNUAL MONITORING REPORT REQUIRED COMPONENTS

Component No.	Description	Report Section
1	Signed Transmittal Letter	Attached
2	Title Page	Cover
3	Table of Contents	Table of Contents
4	Executive Summary	Section 1
5	Description of the Coalition Group Geographical Area	Section 2
6	Monitoring Objectives and Design	Section 2
7	Site Descriptions and Rainfall Records	Sections 3 & 4
8	Location Map	Section 4
9	Tabulation of Analytical Results	Appendix A
10	Discussion of Data	Sections 3, 4, 6, 8, & 9, Attachments 1, & 2
11	SWAMP Comparable EDD	Appendix C
12	Sampling and Analytical Methods	Sections 2, 5, & 7
13	Copies of Chain of Custody Sheets	Appendix A
14	Field Data sheets, Laboratory Reports, Laboratory Raw Data	Appendix C
15	Laboratory and Field Quality Control Results	Section 6, Attachment 3, Appendix D
16	Summary of Quality Assurance Evaluation Results	Section 6, Appendix D
17	Method Used to Obtain Flow	Section 6
18	Monitoring Site and Event Photos	Appendix D
19	Summary of Exceedances and Related Pesticide Use Information	Sections 4, 8, Attachments 2 & 5, & Appendix B
20	Actions Taken to Address Water Quality Exceedances	Section 9
21	Management Plan Status Update	Section 9, Attachment 6
22	Conclusions and Recommendations	Section 11

SECTION 1: EXECUTIVE SUMMARY

This report covers the 2012 irrigation season sampling events beginning March 2012 through August 2012 (Event 89 through Event 94). In accordance with Monitoring Order No. R5-2008-0831, assessment monitoring at all discharge sites was completed in February 2012. Data from the assessment monitoring period was reviewed and the Special Project Monitoring list was adjusted for the 2012 Irrigation Season (see **Attachment 7**), including the removal of the four monitoring sites in San Luis Water District. Nineteen of the 22 monitoring sites within the Westside San Joaquin River Watershed Coalition (Westside Coalition) are located on streams that are dominated by summer agricultural drainage runoff and are often dry or have little flow outside of the irrigation season. Four monitoring sites are located within San Luis Water District (SLWD). SLWD has implemented an aggressive tailwater prohibition policy and growers within the district do not discharge tailwater. Only one has discharged since their inclusion within the Westside Coalition and these sites have been removed from the Westside Coalition Monitoring Program.

The 2012 irrigation season was classified as a dry hydrologic year type for the westside of the San Joaquin Valley and Federal water districts were limited to 40% of federal water contact allocation. There were few significant storms during winter and spring and no rain event sample collections were triggered due to storm activity. See **Section 3** for a discussion of measured rainfall. Irrigation season monitoring samples were collected at all sites containing sufficient water in accordance with the Westside Coalition's Monitoring and Reporting Plan (MRP – see MRP Order No. R5-2008-0831). Sediment samples were collected in March 2012, as scheduled. Sediment toxicity was observed at Hospital Creek, Ingram Creek, Westley Wasteway and Orestimba Creek (at Highway 33). All four sediment samples were tested for selected pesticides. See **Sections 8** and **9.**

Attachment 1 details the samples collected at each site during each sampling event. A summary of the monitoring results is presented in **Appendix A**. Significant aquatic toxicity was measured ten times during four events: twice for *Ceriodaphnia dubia*, seven times for algae, and once for fathead minnow. These are summarized in **Table 1** below.

Table 1: Summary of Toxicity

Event	Site	Species/% Survival or % Control Growth
Event 89 (Mar.)	Ingram Creek at River Rd.	*Selenastum* – 20% of Control
Event 89 (Mar.)	Westley Wasteway near Cox Rd.	*Selenastum* – 8% of Control
Event 89 (Mar.)	Los Banos Cr. at China Camp Rd.	*Selenastum* – 80% of Control
Event 90 (Apr.)	Poso Slough at Indiana Ave.	*Ceriodaphnia dubia* – 0% survival
Event 90 (Apr.)	Turner Slough nr. Edminster Rd.	Fathead Minnow – 83% survival
Event 91 (May)	Poso Slough at Indiana Ave.	*Selenastum* – 52% of Control
Event 91 (May)	Del Puerto Cr. near Cox Rd.	*Ceriodaphnia dubia* – 5% survival
Event 91 (May)	Orestimba Creek (Hwy 33)	*Selenastum* – 55% of Control
Event 92 (Jun.)	Orestimba Creek (Hwy 33)	*Selenastum* – 48% of Control
Event 92 (Jun.)	Los Banos Cr. at China Camp Rd.	*Selenastum* - 78% of Control

These results, along with associated water quality and flow data, are summarized in **Attachment 2**. Details of the aquatic toxicity analyses are included in **Appendix C**.

Quality control samples were collected in addition to the event analysis sample. The quality control samples included field blanks, field duplicates, laboratory blanks and spike, and matrix spike/matrix spike duplicate samples (MS/MSD).

There were a handful of minor quality control issues, including exceedance of the field duplicate relative percent difference (RPD) value, and surrogate or laboratory spike recoveries outside of the expected range. None of these issues are expected to affect data usability. Results of the Field Quality Control samples are discussed in **Section 6** and **Attachment 3**. A review of laboratory quality assurance activities is included in **Appendix D**.

Table 2 lists the sites that were sampled during the 2012 Irrigation Season.

Table 2: Collected Samples March through August 2012.

Map Designation	Monitoring Site	Event 89		Event 90	Event 91	Event 92	Event 93	Event 94
	Discharge Sites	March		April	May	June	July	August
1	Hospital Cr at River Road	NF	SS	S	S	S	S	S
2	Ingram Cr at River Road	S	SS	S	S	S	S	S
3	Westley Wasteway near Cox Road	S	SS	S	S	S	S	S
4	Del Puerto Cr near Cox Road	S	SS	S	S	S	S	S
5	Del Puerto Cr at Hwy 33	S	SS	NF	NF	NF	NF	NF
7	Ramona Lake near Fig Avenue	S	SS	S	S	S	S	S
8	Marshall Road Drain near River Road	S	NP	S	S	S	S	S
9	Orestimba Cr at River Road	S	SS	S	NF	S	S	S
10	Orestimba Cr at Hwy 33	S	SS	S	S	S	S	S
11	Newman Wasteway near Hills Ferry Road	S	SS	S	S	S	S	S
13	San Joaquin River at Lander Avenue	S	NP	S	S	S	S	S
14	Mud Slough u/s San Luis Drain	S	NP	S	S	S	S	S
15	Salt Slough at Lander Avenue	S	NP	S	S	S	S	S
16	Salt Slough at Sand Dam	S	SS	S	S	S	S	S
17	Los Banos Creek at Highway 140	S	NP	S	S	S	S	S
18	Los Banos Creek at China Camp Road	S	SS	S	S	S	S	S
19	Turner Slough near Edminster Road	S	NP	S	S	S	S	S
20	Blewett Drain near Highway 132	S	SS	S	S	S	NF	S
21	Poso Slough at Indiana Avenue	S	SS	S	S	S	S	S
	Source Water Sites							
12	San Joaquin River at Sack Dam	S	NP	S	S	S	S	S
22	San Joaquin River at PID Pumps	S	NP	S	S	S	S	S
23	Delta Mendota Canal at Del Puerto WD	S	NP	S	S	S	S	S

Notes: S = Water sampled according to the MRP. NF = Not sampled due to lack of flow.
SS = Sediment sampled according to the MRP. NP = Not included in the sampling plan.
NA = Not sampled due to lack of safe access.

SECTION 2: COALITION AND MONITORING PROGRAM DESCRIPTION

In June, 2003, the San Joaquin Valley Drainage Authority (SJVDA) submitted a Conditional Waiver Report for the Westside San Joaquin River Watershed Coalition (Westside Coalition). The Westside Coalition watershed generally lies on the westside of the San Joaquin River from approximately the Stanislaus River on the north to 10 miles south of Mendota and encompasses an area of approximately 460,500 acres. There are approximately 4,000 landowners and 1,500 operators within the watershed. Most of the watershed receives water supplies from the Central Valley Project, while certain areas receive water from the State Water Project. In addition, some

areas receive supplies from the San Joaquin River and local water sources, one area receives a Kings River supply, and some areas receive water from groundwater wells. The Delta-Mendota Canal and San Luis Canal run through the watershed. Water deliveries are made to Federal Central Valley Project Contractors and to San Joaquin River Exchange Contractors from these facilities. State water deliveries are also made to one area.

The Grassland Drainage Area encompasses 97,400 acres that are geographically within the watershed. The Grassland Drainage Area is covered under waste discharge requirements (No. 5-01-234), which regulates the discharge of subsurface drainage water through the San Luis Drain to the San Joaquin River. Tailwater is aggressively controlled and not allowed to discharge from the region. The area coordinates a separate monitoring and reporting program under the above waste discharge requirements.

The Westside Coalition area also includes federal, state and private managed wetlands. These areas share water delivery and drainage conveyance systems with the surrounding agricultural areas. Due to the integrated nature of the water facilities the managed wetlands have joined the Westside Coalition as a wetland sub-watershed participant to comply with the Conditional Waiver to effectively and efficiently address water quality issues. The effects of discharges from the wetland areas are covered in this monitoring program.

The communities of Grayson, Westley, Vernalis, Crows Landing, Patterson, Newman, Gustine, Stevinson, Los Banos, Dos Palos, South Dos Palos, Firebaugh, Mendota and Tranquillity lie within the geographic area of the Westside Coalition. These communities do not have discharges from irrigated lands and are not included in the Westside Coalition, but contribute storm waters and municipal waste waters to the watershed and may impact discharges from irrigated lands.

Interstate Highway 5, State Highways 33, 140, 165 and 152 and many county roads run through the geographic area of the Westside Watershed. Storm water discharges from these roads and highways can contribute contaminants to the same water bodies that carry agricultural return water.

The San Joaquin Valley Drainage Authority, a joint powers agency, is the umbrella organization for the Westside Coalition for purposes of the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands within the Central Valley Region (Resolution No.R5-2003-0105). On July 30, 2004, the Westside Coalition received approval for its irrigated agricultural monitoring plan from the Central Valley Regional Water Quality Control Board. The first sampling event took place on July 6, 2004, with subsequent event samples collected monthly. In February, 2008, the Westside Coalition received approval for a revised Monitoring and Reporting Plan (Revised MRP). The Revised MRP was designed to focus monitoring efforts at sites with known water or sediment issues and to support the Management Plan issues. The Revised MRP was implemented in March of 2008. Monitoring and Reporting Program Order No. R5-2008-0831 (MRP Order or MRP) was issued by the Regional Board in September 2008. This order was largely reflective of the Revised MRP and took effect in March 2009, modified after the 2011/12 assessment period. See **Attachment 7**.

The MRP Order includes a targeted monthly sampling plan for 22 monitoring sites within the Coalition area as well as plans for sampling for two rain events during each year. The monitoring sites include three source water sites and 19 sites that discharge agricultural drain water. Four of the discharge sites are within San Luis Water District, which maintains a tailwater discharge prohibition. These sites generally only discharge during severe storm events.

During any given sampling event, each accessible site is visited, visually assessed, and samples are collected in accordance with the field sampling manual. See **Table 2.**

The objectives of the original monitoring program are:

- To assess the existing water quality characteristics of major agricultural drains within the watershed area.
- To determine the location and magnitude of water quality problems.
- To determine the cause of water quality problems and develop solutions.

Two sampling crews have been trained by the analytical laboratories to collect samples according to the Westside Coalition's QAPP and Field Sampling Manual. These crews are responsible for collecting samples at each of the 22 sites; the field coordinator for the northerly region is responsible for collecting samples north of Newman Wasteway. The field coordinator for the southerly region is responsible for collecting samples south of (and including) Newman Wasteway. The sampling responsibilities include completion of the field data sheets, collection of water and sediment samples, completion of labels and chain of custody sheets, and coordination with the labs for sample pickup. The parameters analyzed at each site are shown in **Table 3**. The laboratory, method, and constituent groups analyzed are shown in **Table 4** and a list of specific analytes is included in **Attachment 7**.

Table 3: Monitoring Stations and Samples

Monitoring Site	Site Code	2011-2012 Season		
		Irrigation (Mar-Aug)*	Non-Irrigation (Sep-Feb)*	Rain Event (2x per year)
Discharge Sites				
Blewett Drain at Highway 132	VH132	Special	Core	Rain**
Poso Slough at Indiana Avenue	PSAIA	Special	Core	Rain**
Hospital Cr at River Road	HCARR	Special	-	Rain**
Ingram Cr at River Road	ICARR	Core + Special	Core	Rain**
Westley Wasteway near Cox Road	WWNCR	Core + Special	Core	Rain**
Del Puerto Cr near Cox Road	DPCCR	Core + Special	Core	Rain**
Del Puerto Cr at Hwy 33	DPCHW	Special	-	Rain**
Ramona Lake near Fig Avenue	ROLFA	Core + Special	Core	Rain**
Marshall Road Drain near River Road	MRDRR	Core + Special	Core	Rain**
Orestimba Cr at River Road	OCARR	Core + Special	Core	Rain**
Orestimba Cr at Hwy 33	OCAHW	Special	-	Rain**
Newman Wasteway near Hills Ferry Road	NWHFR	Core + Special	Core	Rain**
San Joaquin River at Lander Avenue	SJRLA	Core + Special	Core + Special	Rain**
Mud Slough u/s San Luis Drain	MSUSL	Core + Special	Core + Special	Rain**
Salt Slough at Lander Avenue	SSALA	Core + Special	Core + Special	Rain**
Salt Slough at Sand Dam	SSASD	Special	-	Rain**
Los Banos Creek at Highway 140	LBCHW	Core + Special	Core + Special	Rain**
Los Banos Creek at China Camp Road	LBCCC	Core + Special	Core	Rain**
Turner Slough near Edminster Road	TSAER	Core + Special	Core	Rain**
~~Little Panoche Cr at Western Boundary~~	~~LPCWB~~	~~Assmt~~	~~Assmt~~	~~Rain**~~
~~Little Panoche Cr at San Luis Canal~~	~~LPCSL~~	~~Assmt~~	~~Assmt~~	~~Rain**~~
~~Russell Ave. Drain at San Luis Canal~~	~~RADSL~~	~~Assmt~~	~~Assmt~~	~~Rain**~~
~~Los Banos Creek at Sunset Ave~~	~~LBCSA~~	~~Assmt~~	~~Assmt~~	~~Rain**~~
Source Water Sites				
San Joaquin River at Sack Dam	SJRSD	Source	Source	Source
Delta Mendota Canal at Del Puerto WD	DMCDP	Source	Source	Source
San Joaquin River at PID Pumps	SJRPP	Source	Source	Source

Table 4: Analytes, Laboratories, and Methods

	Constituent	Laboratory	Method	Units	Laboratory SOP No.
Field Data	pH	Field Crew	YSI meter	-	Field Manual
	Temperature	Field Crew	YSI meter	ºC	Field Manual
	Conductivity	Field Crew	YSI meter	µmhos/cm	Field Manual
	Dissolved Oxygen	Field Crew	YSI meter	mg/L	Field Manual
	Flow	Field Crew	Estimate	cfs	Field Manual
	pH	Caltest	SM 4500-H+B	-	PH-rev4
	TDS	Caltest	SM 2540C	mg/L	TDS-rev4E
	TSS	Caltest	SM 2540D	mg/L	TSS-rev4
	Turbidity	Caltest	SM 2130B	NTU	TURB-rev4E
	Hardness	Caltest	EPA 130.2	mg/L	HARD-rev5E
	Metals	Caltest	EPA 200.7, 200.8	mg/L	M-ICP-rev10E & 2008rev5Ea
	Bromide/Nitrate	Caltest	EPA 300.0	mg/L	DIONEX-rev5E
	Nitrogen, Nitrite	Caltest	EPA 354.1	mg/L	NO2-rev6
	TKN	Caltest	EPA 351.3	mg/L	NH3-TKN-rev6E
	Phosphate	Caltest	EPA 365.2	mg/L	PHOS-rev4
	Ammonia (as N)	Caltest	EPA 350.2	mg/L	NH3-TKN-rev6E
	DOC	Caltest	SM 5310-B/C	mg/L	TOC-D0C-rev7E
	TOC	Caltest	SM 5310-B/C	mg/L	TOC-D0C-rev7E
	E. Coli	Caltest	SM 9221BF/9223-B	mpn/100ml	MMOMUG-rev8E
Pesticides	Organophosphates	APPL	EPA 8141A	µg/L	ANA8141A
	Organochlorines	APPL	8081A/8082	µg/L	ANA8081A
	Carbamates	APPL	EPA 8321A LL	µg/L	HPL8321A
	Herbicides	APPL	EPA 619	µg/L	ANA8151A
Sediment	Organochlorine	Caltest	SW846 8081	mg/kg (dry)	8081rev8
	Pyrethroid	Caltest	SW846 8270(SIM)	mg/kg (dry)	Pyrethroidsrev4a
	% Solids	Caltest	EPA 160.3	%	Residue-rev6
	TOC	Caltest	EPA 9060A	%	WalkleyBlack TOC
Toxicity	*Ceriodaphnia d.*	PER	EPA-821-R-02-012	% survival	Acute Cerio SOP
	Selenastrum c.	PER	EPA-821-R-02-013 & EPA-600-4-91-002	cell growth	Chronic Selenastrum SOP
	Pimephales p.	PER	EPA-821-R-02-012	% survival	Acute FHM SOP
	Hyalella a.	PER	EPA-600-R-99-064	% survival	10-D HyalellaAcuteSedTest

CalTest Labs in Napa, California
APPL Labs in Fresno, California
Pacific Ecorisk (PER) in Martinez, California

Aquatic toxicity samples were collected and analyzed by Pacific Ecorisk, Inc. using the methods described below:

- *Ceriodaphnia dubia*: "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (USEPA 2002a).
- *Pimephales promelas*: "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (USEPA 2002a).
- *Selenastrum capricornutum*: "Short-term Methods for Estimated the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms" (USEPA 2002b).
- *Hyalella azteca*: "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Organisms" (USEPA 2000).

SECTION 3: MONITORING EVENT SUMMARIES

Monitoring Event Summaries.
In accordance with the MRP order, irrigation season monitoring was implemented at all discharge sites beginning in March 2012. Each site was visited monthly during the reporting period and samples were collected from every site with sufficient water to submerge and fill a sample container.

Three CIMIS[1] stations were monitored by the Westside Coalition for rainfall: Patterson, Los Banos, and Firebaugh. **Table 5** summarizes the monthly rainfall measured at each station.

Table 5: Monthly Rainfall in Inches

Month	Patterson	Los Banos	Firebaugh
March	1.24	1.39	1.18
April	1.38	0.71	0.65
May	0.02	0.04	0.16
June	0.15	0.15	0.00
July	0.00	0.00	0.00
August	0.00	0.00	0.00
Report Period Total:	2.79	2.29	1.99

Rainfall during the 2012 irrigation season was typical of summers in the Central Valley, with moderate rainfall in the spring and dry summer months. None of the storms during the spring of 2012 produced sufficient runoff to collect storm event samples.

Event 89, March 12th and 13th, 2012.
Irrigation season water samples were collected at 18 sites and 3 source water sites on March 13th in accordance with the Westside Coalition MRP. There was insufficient flow for sample collection at Hospital Creek. Aquatic toxicity was tested for algae, invertebrates, and fish in accordance with the Monitoring Order (see **Attachment 7**). Aquatic toxicity to algae was observed at Ingram Creek (20% of control), Westley Wasteway (8% of control), and Los Banos Creek at China Camp Road (80% of control). A TIE was performed on the Ingram Creek and Westley Wasteway samples, and both indicated that a herbicide was the likely cause. Diuron was detected in both samples (21 µg/L at Ingram Creek and 19 µg/L at Westley Wasteway). No other aquatic toxicity was observed. Sediment samples were collected at 13 sites on March 12th. Significant toxicity was observed in the Westley Wasteway sample (15% survival), the Hospital Creek sample (81% survival), the Ingram Creek sample (60% survival), and the Orestimba Creek at Highway 33 sample (36%) survival. Sediment from the Westley Wasteway, Ingram Creek and Orestimba Creek samples was sent to CalTest Laboratories for pesticide analysis. In all three sediment samples, pesticides were present in sufficient concentration to have caused the observed toxicity. See **Section 8** and **Attachment 4**.

[1] California Irrigation Management Information System, http://wwwcimis.water.ca.gov/cimis/welcome.jsp

Event 90, April 10th, 2012.
Irrigation season water samples were collected at 18 monitoring sites and source water samples were collected at 3 sites on April 10th. There was insufficient flow to collect samples at Del Puerto Creek at Highway 33. Aquatic toxicity to water flea was observed at Poso Slough (0% survival) and chlorpyrifos (0.66 µg/L) was detected in the sample. A dilution series measured 2.9 toxic units and the TIE indicated that a pesticide was the likely cause. Aquatic toxicity to fathead minnow (82.5% survival) was observed at Turner Slough. Although this observation was statistically significant, it was small in magnitude and no cause is apparent.

Event 91, May 8th, 2012.
Irrigation season water samples were collected at 17 monitoring sites and 3 source water sites on May 8th. There was insufficient flow for sample collection at Del Puerto Creek at Highway 33 and Orestimba Creek at River Road. Aquatic toxicity to algae was observed at Orestimba Creek at Highway 33 (55% of control) and at Poso Slough (52% of control for the event sample and 72% for the field duplicate). Prowl was detected in the Orestimba Creek sample (2.1 µg/L) and diuron (3.1 µg/L) and Prowl (0.78 µg/L) were detected in the Poso Slough sample. Aquatic toxicity to water flea was observed at Del Puerto Creek near Cox Road (5% survival). A TIE was performed but the toxicity was not persistent and there were no insecticides detected in the sample.

Event 92, June 12th, 2012.
Irrigation season water samples were collected at 18 monitoring sites and 3 source water sites on June 12th in accordance with the Westside Coalition's MRP. There was insufficient flow at Del Puerto Creek at Highway 33 for sample collection. Aquatic toxicity to algae was observed at Orestimba Creek at Highway 33 (48% of control) and Los Banos Creek at China Camp Road (77% of control). A TIE was performed on the Orestimba Creek sample but toxicity was not persistent and the TIE was inconclusive. No herbicides were present in either sample and the cause of toxicity is not known.

Event 93, July 10th, 2012.
Irrigation season water samples were collected at 17 monitoring sites and 3 source water sites. There was insufficient flow at Blewett Drain and Del Puerto Creek at Highway 33 to collect samples. No aquatic toxicity was observed in any of the samples.

Event 94, August 14th, 2011.
Irrigation season water samples were collected at 18 monitoring sites and 3 source water sites. There was insufficient flow at Del Puerto Creek at Highway 33. No aquatic toxicity was observed in any of the samples.

SECTION 4: SAMPLING SITE AND WATERSHED DESCRIPTIONS

Figure 1 shows the Westside Coalition area and the location of the monitoring sites. Following is a description and rationale for the monitoring sites.

- Blewett Drain near Highway 132 (originally called Vernalis at Highway 132 [VH132]). This site is located at the northerly boundary of the Westside Coalition. The cropping pattern for discharges into this drain is similar to that of Hospital Creek. Flow at this site is calculated as an estimated velocity and measured flow area. The Westside Coalition began monitoring this site in 2008.
- Poso Slough at Indiana Avenue (PSAIA). This site is located on Poso Slough near the boundary between San Luis Canal Company and Central California Irrigation District in the Dos Palos Subarea of the Westside Coalition. Flow at this site is calculated as an estimated velocity and measured flow area. The Westside Coalition began monitoring this site in 2008. Poso Slough is a tributary to Salt Slough, discharging upstream of the Sand Dam monitoring site.
- Hospital Creek at River Road (HCARR). This site is a significant drainage for the Patterson Subarea of the Westside Coalition and has been monitored since July 2004 for a variety of constituents. Sediment discharge, sediment toxicity, aquatic toxicity (water flea), and pesticides have been measured at this site. It is on the 303(d) list for pesticides. Flow at this site is measured by a rectangular weir.
- Ingram Creek at River Road (ICARR). This site is a significant drainage for the Patterson Subarea of the Westside Coalition and has been monitored since July 2004 for a variety of constituents. Sediment discharge, sediment toxicity, aquatic toxicity (water flea), and pesticides have been measured at this site. It is on the 303(d) list for pesticides. Flow at this site is measured by a rectangular weir.
- Westley Wasteway near Cox Road (WWNCR). Westley Wasteway is a significant drainage for the Patterson Subarea for both tailwater and storm runoff. Land use upstream of this monitoring station is similar to that of Del Puerto Creek. This site has been monitored for a variety of constituents since 2004. Sediment discharge, sediment toxicity, aquatic toxicity (water flea), and pesticides have been measured at this site. Flow at this site is measured by a rectangular weir.
- Del Puerto Creek near Cox Road (DPCCR) and Del Puerto Creek near Highway 33 (DPCHW). Del Puerto Creek is on the 303(d) list for pesticides and is a major drainage for the Patterson Subarea and major storm runoff collector. Two stations are identified on this waterbody; one near the discharge to the San Joaquin River, and one at Highway 33, near the middle of the Patterson Subarea. Biological assessments are performed on Del Puerto Creek to assess its overall health, which will be useful in relating to collected water quality data. Both of these sites have been monitored for a variety of constituents since 2004. Sediment discharge, sediment toxicity, aquatic toxicity (water flea), and pesticides have been measured at both sites. At the Highway 33, flow is estimated using the float method. A beaver dam has been constructed (by a beaver) downstream of the Cox Road site, creating a backwater that prevents safe flow measurement at the site. The Coalition is considering options to address this issue.
- Ramona Lake near Fig Avenue (ROLFA). This site monitors discharge from a small lake as it flows into the San Joaquin River. Agricultural and storm runoff from the Patterson

Subarea can discharge into the lake. This site has been monitored for a variety of constituents since 2004. Some pesticides have been measured at this site.

- Marshall Road Drain near River Road (MRDRR). This site monitors a pipe drain that carries agricultural and storm runoff from the Patterson Subarea of the Westside Coalition. This site has been monitored for a variety of constituents since 2004. Some pesticides and aquatic toxicity have been measured at this site. Flow from this site is measured by a weir within the pipe. During periods of high flow, the weir can become submerged and incapable of measuring flow.
- Orestimba Creek at River Road (OCARR) and Highway 33 (OCAHW). There are two monitoring locations on Orestimba Creek; one near the discharge point to the San Joaquin River; and one upstream at Highway 33. Orestimba Creek is similar to that of Del Puerto in both the surrounding landscape and discharged water quality. It is on the 303(d) list for pesticides, is a major drainage for the Patterson Subarea, and is included in the biological assessment portion of the monitoring program. Pesticides, sediment discharge, sediment toxicity, and aquatic toxicity have been measured at these sites. USGS monitors and reports flow at Orestimba Creek at River Road. Flow at Orestimba Creek at Highway 33 is calculated through an estimated velocity and cross-sectional flow area.
- Newman Wasteway near Hills Ferry Road (NWHFR). The Newman Wasteway is a significant drainage for the Patterson Subarea and is on the 303(d) list for salt and pesticides. This site measures drainage that originates from the southerly region of the Patterson Subarea, and has been monitored for a variety of constituents since 2004. Pesticides, sediment discharge, sediment toxicity, and aquatic toxicity have been measured at this site. Flow at this site is calculated through an estimated velocity and cross-sectional flow area.
- The San Joaquin River at Lander Avenue (SJRLA). This site is both a receiving waterbody for agricultural and storm drainage and a source water for districts that pump from the San Joaquin River. It also receives drainage flows from irrigated wetlands in the fall and winter months. It has been monitored for a variety of constituents since 2004, and pesticides, sediment toxicity, and aquatic toxicity have been measured. Flow at this site is reported by a nearby CDEC station.
- Mud Slough upstream of the San Luis Drain (MSUSL). This site measures drainage originating from the Dos Palos and Los Banos Subareas that flow through the wetlands as well as the wetlands themselves. Mud Slough is on the 303(d) list for a variety of constituents. In addition to the Westside Coalition's monitoring program, the Central Valley Regional Water Quality Control Board, Surface Water Ambient Monitoring Program (SWAMP) collects and analyzes samples from this site throughout the year. These samples are analyzed for selenium, boron, and EC, along with other constituents. Flow at this site is calculated as the difference between the flow downstream of the San Luis Drain (reported by CDEC) and the measured San Luis Drain Discharge. The SWAMP Data is available via the internet at: http://www.waterboards.ca.gov/centralvalley/programs/agunit/swamp/index.html.
- Salt Slough at Lander Avenue (SSALA) Salt Slough at Lander Avenue measures agricultural, storm, and wetland runoff from the Dos Palos and Los Banos Subareas, and has been monitored (and 303(d) listed) for a variety of constituents since 2004. In addition to the Westside Coalition's monitoring program, the Central Valley Regional

Water Quality Control Board, SWAMP collects and analyzes samples from this site throughout the year. These samples are analyzed for selenium, boron, and EC, along with other constituents. Flow at this site is reported by CDEC. The SWAMP Data is available via the internet at: http://www.waterboards.ca.gov/centralvalley/programs/agunit/swamp/index.html.

- Salt Slough at Sand Dam (SSASD). This site is upstream of the Lander Avenue site and measures agricultural and storm drainage originating in portions of the Dos Palos Subarea. Pesticides and aquatic toxicity have been measured at this site, which has been monitored for a variety of constituents since 2004. Flow at this site is measured by a weir.
- Los Banos Creek at Highway 140 (LBCHW). This site carries agricultural, storm and irrigated wetland runoff from the Los Banos Subarea. Some pesticides have been measured at this site. Flow at this site is calculated through an estimated velocity and cross-sectional flow area.
- Los Banos Creek at China Camp Road (LBCCC). This site monitors agricultural and storm runoff from the Los Banos Subarea, upstream of the Highway 140 site. There is a farmer-maintained dam downstream of this site which is frequently used to stop flows so that it may be diverted for irrigation. Flow at this site is calculated through an estimated velocity and cross-sectional flow area.
- Turner Slough near Edminster Road (TSAER). This station is located on the eastside of the San Joaquin River and measures drainage from a portion of the Patterson Subarea. A very small number of pesticides have been detected at this site since 2004. In 2007, Stevinson Water District constructed a drain water return system upstream of the Turner Slough discharge (and monitoring) point. This system captures most of the drainage that flows through Turner Slough and returns it to the Stevinson Water District irrigation system. Since the construction of this system, discharges from Turner Slough into the San Joaquin River have become infrequent. Flow at this site is calculated through an estimated velocity and cross-sectional flow area.
- Little Panoche Creek at Western Boundary (LPCWB) and at San Luis Canal (LPCSL). These two sites were removed from the monitoring program in March 2012 and are no longer monitored.
- Russell Avenue Drain at San Luis Canal (RADSL). This is a small drain along Russell Avenue that discharges into the San Luis Canal. This site was removed from the monitoring program in March 2012 and is no longer monitored.
- Los Banos Creek at Sunset Avenue (LBCSA). This monitoring site was incorporated from the San Luis Water District Water Quality Coalition, and is located near the western boundary of the Westside Coalition, downstream of the Los Banos Reservoir. There is not a large amount of actively farmed land at or upstream of this site and it was removed from the monitoring program in March 2012.
- San Joaquin River at Sack Dam (SJRSD). This is a source water monitoring site located at the diversion point for San Luis Canal Company. This site is monitored for source water constituents. Flow at this site is measured across the dam.
- Delta Mendota Canal at Del Puerto Water District (DMCDP). This site monitors water quality in the Delta Mendota Canal at a Del Puerto Water District turnout. This site characterizes the source water quality typical of the Delta Mendota Canal, and is monitored for source water constituents. Flow is not measured at this site.

- San Joaquin River at Patterson Irrigation District Pumps (SJRPP). This monitoring site is located at the Patterson Irrigation District pump station on the San Joaquin River and characterizes the source water quality of the San Joaquin River in the Patterson Subarea. This site is monitored for source water constituents. Flow from this site is reported by CDEC. This site is the same as the San Joaquin River at Las Palmas site listed in the Chlorpyrifos and Diazinon TMDL program.

Table 6 lists the monitoring sites and coordinates in the WGS84 datum.

Table 6: Monitoring Site Coordinates

Site	Latitude (N)	Longitude (W)
Hospital Cr at River Road	37.61047	121.23078
Ingram Cr at River Road	37.60022	121.22506
Westley Wasteway near Cox Road	37.55822	121.16372
Del Puerto Cr near Cox Road	37.53936	121.12206
Del Puerto Cr at Hwy 33	37.51406	121.15956
Ramona Lake near Fig Avenue	37.47875	121.06839
Marshall Road Drain near River Road	37.43631	121.03617
Orestimba Cr at River Road	37.41386	121.01489
Orestimba Cr at Hwy 33	37.37717	121.05856
Newman Wasteway near Hills Ferry Road	37.32036	120.98336
San Joaquin River at Sack Dam	36.98353	120.50050
San Joaquin River at Lander Avenue	37.29506	120.85139
Mud Slough u/s San Luis Drain	37.26164	120.90614
Salt Slough at Lander Avenue	37.24797	120.85225
Salt Slough at Sand Dam	37.13664	120.76194
Los Banos Creek at Highway 140	37.27619	120.95547
Los Banos Creek at China Camp Road	37.11447	120.88953
Turner Slough near Edminster Road	37.30411	120.90083
Blewett Drain at Highway 132	37.64053	121.22942
Poso Slough at Indiana Ave	37.00622	120.59033
SJR at PID Pumps	37.49739	121.08267
DMC at Del Puerto WD	37.43678	121.13347
~~Los Banos Creek at Sunset Ave~~	~~37.02747~~	~~120.88983~~
~~Little Panoche Cr at Western Boundary~~	~~36.79100~~	~~120.76200~~
~~Little Panoche Cr at San Luis Canal~~	~~36.81728~~	~~120.72614~~
~~Russell Ave Drain at San Luis Canal~~	~~36.75142~~	~~120.65775~~

FIGURE 1: WATERSHED MAP W/ MONITORING SITES.

More than 59 different varieties of crops are grown within the Westside Coalition watershed area, ranging from fruit and nut trees to melons and cotton. **Table 7** shows the top ten crops within the Coalition area based on 2012 irrigation season Agricultural Commissioner pesticide use data.

Table 7: Top 10 Crops Grown by County

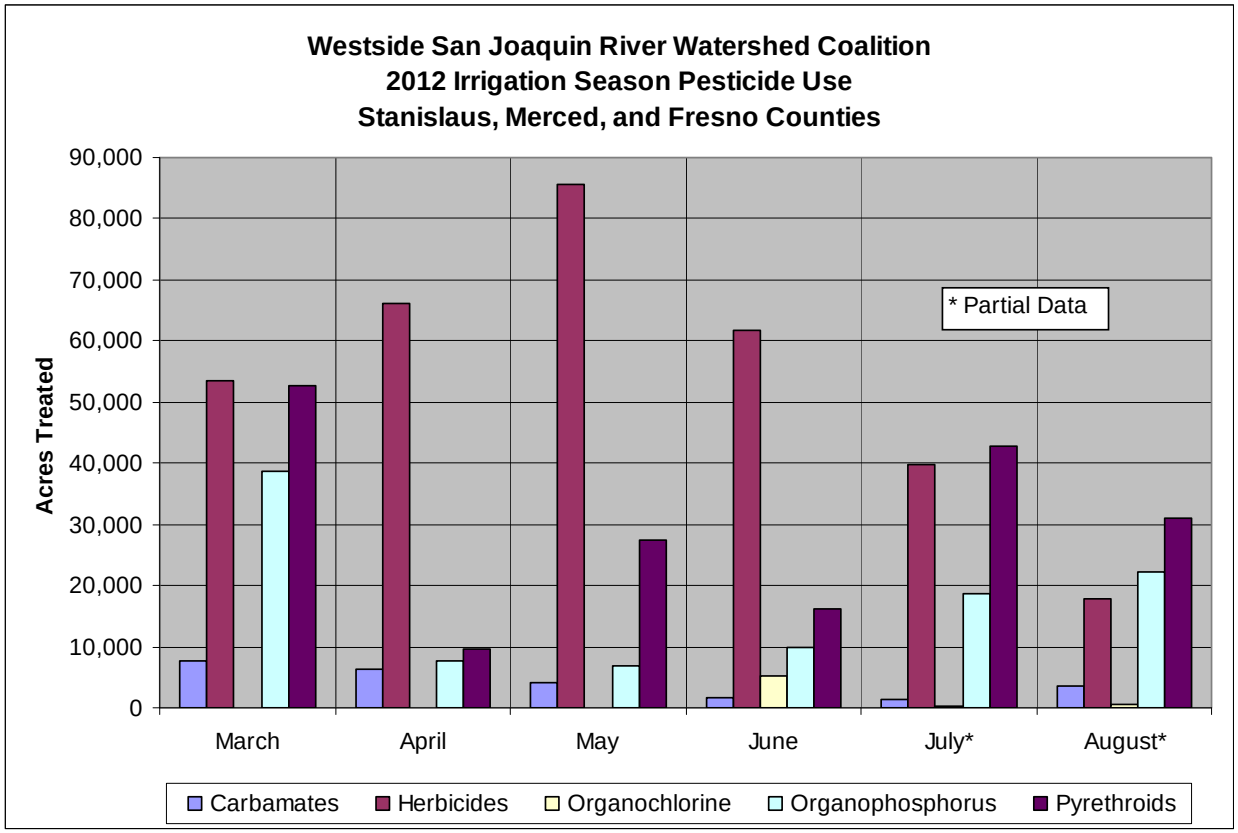
Fresno	Merced	Stanislaus
Almonds	Cotton	Lettuce
Tomatoes	Alfalfa	Almonds
Cotton	Tomatoes	Cabbage
Alfalfa	Almonds	Tomatoes
Grapes	Corn	Mixed Greens
Melons	Wheat	Beets
Pistachios	Pistachios	Apricots
Wheat	Oats	Walnuts
Rice	Walnuts	Corn
Pomegranate	Melons	Grapes

These crops are dispersed approximately evenly throughout the Coalition area, with the exceptions of cotton (mostly in the Los Banos, Dos Palos and Tranquillity Subareas), and fruit trees and beans (mostly in the Patterson Subarea). The planting practices are typical for conventional agriculture within the Central Valley. A complete crop list and detailed crop calendar was presented in the "Watershed Evaluation Report", submitted in April, 2004.

Annual field crops are typically planted as seed or transplants after the field has been pre-irrigated to provide salt leaching and soil moisture for germination. These crops can be furrow irrigated using either a plowed head ditch or gated pipe, sprinkler irrigated with hand-move sprinkler pipe, or sub-surface drip irrigated. Permanent field crops such as pasture or alfalfa are usually flood or sprinkler irrigated. The younger fruit and nut trees are almost universally irrigated with drip or micro-sprinkler systems, though some of the older orchards are still flood irrigated.

The irrigation season is typically the peak of agricultural activity, with most planting occurring between March and May, and irrigation and cultivation activities beginning just after planting and carrying on until harvest. Harvest timing is dependant or crop and weather conditions and may be as early as July or as late as October. Pesticide applications during the irrigation season include both insecticides and herbicides and will be applied according to the growth stage of the affected crop and the actual pest pressures. **Figure 2** shows the 2012 irrigation season monthly pesticide application within the Westside Coalition by pesticide group.

Figure 2: 2012 Irrigation Season Pesticide Use.



A more detailed review of pesticide use and detections is provided in **Section 8**. **Table 8** shows the 10 most commonly applied pesticides during the 2012 irrigation season (by acreage) within the three counties occupied by the Westside Coalition. A complete list of reported pesticide applications is included in **Attachment 6**.

Table 8: Most Commonly Applied Pesticides by County (2012 Irrigation Season)

Fresno County		Merced County		Stanislaus County	
Pesticide	**Class**	**Pesticide**	**Class**	**Pesticide**	**Class**
Lambda-Cyhalothrin	Pyrethroid	Lambda-Cyhalothrin	Pyrethroid	Glyphosate	Herbicide
Chlorpyrifos	Organophosphorus	Glyphosate	Herbicide	Lambda-Cyhalothrin	Pyrethroid
Pendimethalin	Herbicide	Trifluralin	Herbicide	Oxyflurofen	Herbicide
Befenthrin	Pyrethroid	Pendimethalin	Herbicide	Dimethoate	Organophosphorus
Glyphosate	Herbicide	Malathion	Organophosphorus	Esfenvalerate	Pyrethroid
Trifluralin	Herbicide	Oxyflurofen	Herbicide	Pendimethalin	Herbicide
Paraquat Dichloride	Herbicide	Paraquat Dichloride	Herbicide	Metolachlor	Herbicide
Oxyflurofen	Herbicide	Chlorpyrifos	Organophosphorus	Bifenthrin	Pyrethroid
Malathion	Organophosphorus	MCPA	Herbicide	Paraquat Dichloride	Herbicide
Cypermethrin	Pyrethroid	Beta-Cyfluthrin	Pyrethroid	Rimsulfuron	Herbicide

SECTION 5: FIELD SAMPLING PROCEDURE

Field water quality data and sample collections were collected as outlined in the Westside Coalition's Quality Assurance Project Plan (QAPP) and Field Sampling Manual. Three sampling crews have been trained by the analytical laboratories to collect samples according to the Westside Coalition's QAPP and Field Sampling Manual. These crews are responsible for collecting samples at each of the monitoring sites: The field coordinator for the northerly region is responsible for collecting samples from north of Newman Wasteway. The field coordinator for the southerly region is responsible for collecting samples south of (and including) Newman Wasteway. The sampling responsibilities include completion of the field data sheets, collection of water and sediment samples, completion of labels and chain of custody sheets, and coordination with the labs for sample pickup. Samples are collected either as a direct grab from the waterbody or as a bucket grab, where a large volume of water is collected in a stainless steel bucket and transferred to the sample bottles. Details of these collection methods are explained in the Field Sampling Manual. The list of tested constituents is discussed in the MRP Order.

In accordance with the MRP Order, the Westside Coalition collected irrigation season samples starting with the March 2012 sample event. Aquatic toxicity, pesticides and metals are analyzed at specific sites according to the monitoring plan.

SECTION 6: FIELD AND LABORATORY QUALITY CONTROL SAMPLES

Laboratory Quality Control Samples. The three laboratories that perform analyses for the Westside Coalition monitoring activities are certified through the National Environmental Laboratory Accreditation Program (NELAP) and perform all testing and analyses according to the most current NELAP standards, including the performance of several quality control tests to ensure all methods and equipment are operating correctly. A handful of quality control tests for APPL and Caltest failed to meet acceptability criteria. These failures represented less than 2% of the QA/QC analyses performed by each lab and do not affect data usability. Details of the laboratory quality control review are included in **Appendix D**. Although the Westside Coalition reviews each of the laboratories' QA/QC results, it considers each of the laboratories to be experts in their respective fields and defers to their judgment regarding data acceptability.

Field Quality Control Samples. Field quality control samples included the collection of field duplicate samples for sediment and aquatic toxicity analysis, and the collection of both field duplicate and field blank samples for pesticides, drinking water, and general physical constituent analysis. It should be noted that the field duplicate samples are typically collected as separate samples simultaneously with the event sample (as opposed to field split samples). The calculated RPD between the event sample and field duplicate sample should be considered a measurement of site water variability.

- **Water Chemistry Analyses.** Six sets of field duplicate and field blank samples were collected during the reporting period and analyzed for general chemistry and drinking water constituents. A comparison of the event samples, duplicate samples, and blank samples is tabulated in **Attachment 3**. A total of 156 duplicate analyses were completed

and compared to the event sample results. Six duplicate samples exceeded the 25% relative percent difference (RPD) established in the QAPP for:

Cadmium (total) Copper (total) E. Coli Turbidity
TKN

These exceedances of the field duplicate quality control criteria account for approximately 4% of the field duplicates analyzed and are reflective of the complicated nature of the site water and the naturally occurring variations of the stream water quality. Three of the results exceeding the RPD criteria were detected below the reporting limit (flagged "DNQ") where small variations between the duplicate and event sample can result in relatively large RPD values. The Westside Coalition does not expect these variations to impact data usability.

Six field blank sample sets were analyzed during the report period (155 results, total). Of these, five analyses resulted in values greater than 20% of the event sample result for:

Copper (dissolved) Copper (total) DOC
Zinc (dissolved)

- **Pesticide Analyses.** Six field duplicate and field blank samples sets were collected during the reporting period and analyzed for pesticides (336 results each). During Event 89, Chlorpyrifos was detected in the field blank sample at 50% of the event sample concentration. For that sample event, the chlorpyrifos results for the event sample, field blank and field duplicate were all marked "DNQ" indicating that the reported values were measured below the instruments reporting limit and are estimated. Calculated RPD for field duplicate results did exceeded the 25% threshold for Prowl during Event 89. The results of the field blank, field duplicate and event sample comparisons are tabulated in **Attachment 3**.

- **Aquatic Toxicity Analyses.** Field duplicate samples were collected and analyzed for toxicity to all species tested during the report period. The calculated RPD value exceeded the 25% threshold during the May sampling event (Event 91) for the algae test (calculated RPD = 32.2%). Toxicity was observed in both the event sample and the field duplicate and the resulting low cell counts likely contributed to the higher RPD value.

- **Sediment Toxicity Analyses.** A field duplicate sample was collected for sediment toxicity during the March sampling event (Event 89). The measured RPD was 3.9%.

Completeness for sampling collection and analysis was reviewed for samples collected during this monitoring program. Completeness was measured for sample collection and transit, sample analysis, and field quality control samples.

- Collection and Transit: For the July sample event, the DOC and dissolved metals for one site were not collected by mistake. Excess volume for a second sample was used for the DOC analysis however there was not sufficient excess volume for the dissolved metals.

These issues account for less than 1% of the samples collected and completeness for this reporting period for sample collection and transit is 100%.

- Sample Analysis: Completeness for sample analysis during this reporting period is 100%.
- Field Quality Control Samples: All field quality control samples were collected and analyzed. Completeness for toxicity duplicate samples is 100% for this reporting period. The completeness for field blank and duplicate samples is 100% for both pesticide analyses and water chemistry samples.

SECTION 7: ANALYTICAL METHODS

Table 4 indicates the laboratories responsible for the analytical results of this monitoring program, the analytical method used, and the standard operating procedure (SOP) document number. This table reflects the constituents analyzed as part of the Revised MRP.

Chain of Custody (COC) sheets were maintained from the time of sample collection to receipt at the laboratories. Copies of the COC sheets are included in **Appendix A**, along with a summary of the data results. The data summary includes all of the field readings, analytical chemistry results, pesticide scan results, and toxicity screening test results. The original laboratory reports are included in **Appendix C**. These reports also include all of the field and internal quality control results.

The laboratory original data sheets (raw data) for the toxicity results are included in **Appendix C**, as part of the laboratory reports. Raw data for general physical results, drinking water results, and pesticide results are kept by the laboratories for a minimum of five years and are available upon request.

SECTION 8: DATA INTERPRETATION

The primary objective of the monitoring program is to identify water bodies that are adversely affected by agricultural discharges and to help determine the impacts of management activities. The monitoring program has used a combination of toxicity tests and pesticide analyses, along with close coordination among districts and growers to not only identify problem areas but also to determine the magnitude and cause of the problems. During this report period, toxicity analyses for all three species along with pesticide analyses and metals analyses were performed according to the Special Monitoring schedule included in the MRP Order (as modified in the March 2012 letter. See **Attachment 7**).

The Westside Coalition's monitoring program includes 22 monitoring sites on the Westside of the San Joaquin Valley (see **Table 2** and **Figure 1**). These sites are representative of the various regions within the Coalition and include agricultural discharge sites, storm drainage sites, and irrigation source water sites. A summary of this data is presented in **Appendix A**, and the laboratory data reports are provided in **Appendix C**.

All of the analyzed parameters were reviewed regularly to evaluate the overall health of the water bodies within the Coalition area. This reporting period covered the 2012 irrigation season

months, during which there was significant agricultural activity. Statistically significant aquatic toxicity occurred ten times during four events: two to *Ceriodaphnia dubia* and seven to algae and once to fathead minnow. All observations of aquatic toxicity are detailed in **Attachment 2**.

Ceriodaphnia dubia. Toxicity to *Ceriodaphnia dubia* was measured once in April 2012, and once in May 2012.

- Poso Slough at Indiana Avenue – Event 90 (April 10th), 0% survival. Dilution series analyses calculated 2.9 toxic units and the TIE indicated that a pesticide(s) were the likely cause. Chlorpyrifos was detected in the sample (0.66 µg/L) at a level that would be expected to cause full mortality and is assumed to be the source of the toxicity. Two herbicides were detected but no other insecticides were detected.
- Del Puerto Creek near Cox Road – Event 91 (May 8th), 5% survival. A TIE was performed on the sample, however toxicity was not persistent and the TIE was inconclusive. Diuron was the only detected pesticide and is not expected to have caused the mortality. The cause of toxicity is not known.

Selenastrum capricornutum (algae). Toxicity to algae was observed seven times during the report period.

- Ingram Creek at River Road – Event 89 (March 13th), 20% of control growth. A TIE was performed and indicated that pesticides were the likely cause. Diuron was detected in the sample (21 µg/L) and is expected to be the cause of toxicity.
- Westley Wasteway near Cox Road – Event 89 (March 13th), 8% of control growth. A TIE was performed and indicated that pesticides were the likely cause. Diuron was detected in the sample (19 µg/L) and is expected to have caused the toxicity.
- Los Banos Creek at China Camp Road – Event 89 (March 13th), 80% of control growth. Although statistically significant, to toxicity in this sample was not large in magnitude and follow up testing was not required. No pesticides were detected in the sample and the cause of toxicity is not known.
- Poso Slough at Indiana Avenue – Event 91 (May 8th), 52% of control growth. Diuron (3.1µg/L), Prowl (0.78 µg/L), and trifluralin (0.96 µg/L) were detected in the sample and are expected to have contributed to the toxicity.
- Orestimba Creek at Highway 33 – Event 91 (May 8th), 55% of control growth. Prowl (2.1 µg/L) was detected in the sample and may have contributed to the toxicity. No other pesticides were detected.
- Orestimba Creek at Highway 33 – Event 92 (June 12th), 48% of control growth. A TIE was performed on the sample but toxicity was not persistent in the ambient water sample and the cause of toxicity could not be determined. DDE was detected in the sample but not expected to have contributed to the toxicity. No other pesticides were detected and the cause of toxicity is not known.
- Los Banos Creek at China Camp Road – Event 92 (June 12th), 77% of control growth. No pesticides were detected and the cause of toxicity is not known.

Pimephales promelas (fathead minnow).

- Turner Slough near Edmnster – Event 90 (April 10th), 82.5% survival. The toxicity was not sufficient to require follow up testing and no pesticides were detected in the sample. The cause of toxicity is not known.

Sediment Toxicity (*Hyalella azteca*). The Westside Coalition's MRP Order specifies that sediment sample collection should occur at the beginning of the irrigation season, between March 1st and April 30th [2]. Fourteen samples were collected (including one duplicate) and tested for toxicity to *Hyalella azteca* on March 12th. Statistically significant toxicity was measured at four sites, and follow up pesticide analysis were performed on all four samples. **Table 9** lists the results for the sites exhibiting sediment toxicity. **Table 10** summarizes the detected pesticide data at those four sites. See **Appendix C** for the full laboratory report. **Table 11** shows the sediment toxicity results since September 2006.

Table 9: Sites Exhibiting Statistically Significant Toxicity to *Hyalella azteca.*

Site	Percent Survival
Orestimba Creek at Highway 33*	36.2%
Hospital Creek at River Road*	81.3%
Ingram Creek at River Road*	60%
Westley Wasteway near Cox Road*	15%

* Sample analyzed for specific pesticides.

Table 10: Detected Pesticides in Sediment Samples (September 2011)

	Orestimba Creek at Hwy 33	Hospital Creek at River Rd.	Ingram Creek	Westley Wasteway
Sediment Toxicity (% survival)	36.2	81.3	60	15
Percent Solids (%)	94	98	96	97
Bifenthrin (µg/kg)	24.8	0.31	2	21.8
Chlorpyrifos (µg/kg)	0.79	ND	0.91	0.61
Cyfluthrin (µg/kg)	0.57	ND	ND	0.12J
Cypermethrin (µg/kg)	ND	ND	ND	ND
Es/Fenvalerate (µg/kg)	5.7	4.2	1.2	1.5
Fenpropathrin	ND	ND	0.15j	ND
Lambda-Cyhalothrin (µg/kg)	0.61	0.6	7.1	2.3
Permethrin (µg/kg)	0.35	ND	ND	ND
Total Organic Carbon (mg/kg)	10,000	5,000	9,200	17,000

Details of the sediment pesticide analyses are in **Attachment 4.**

[2] MRP Order No. R5-2008-0831, p. 16.

Table 11: Sediment Toxicity Results.

Site	March 12 % Survival	March 12 Toxicity (Y/N)	Sept 11 % Survival	Sept 11 Toxicity (Y/N)	May 11 % Survival	May 11 Toxicity (Y/N)	Sept 10 % Survival	Sept 10 Toxicity (Y/N)
Blewett Drain (Vernalis at hwy 132)	93.8	N	56.3	**Y**	86.3	N		
Hospital Creek	**81.3**	**Y**	20	**Y**	8.75	**Y**	0	**Y**
Ingram Creek	**60**	**Y**	0	**Y**	16.3	**Y**	0	**Y**
Westley Wasteway	**15**	**Y**	90	N	93.8	N	41.2	**Y**
Del Puerto Creek (Cox Rd)	97.5	N	88.8	N	81.3	N	0	**Y**
Del Puerto Creek (Hwy 33)	98.6	N			96.3	N	81.2	**Y**
Orestimba Creek at River Rd.	97.5	N	96.3	N	100	N	95	N
Orestimba Creek at Hwy 33	**36.2**	**Y**	0	**Y**	92.5	N	93.8	N
Ramona Lake at Fig Ave.	95	N	96.3	N	92.5	**Y**	92.5	N
Newman Wasteway	100	N	97.5	N			97.5	N
Poso Slough	96.2	N	98.8	N	87.5	**Y**		
Turner Slough			95	N	100	N		
SJR at Lander			98.8	N				
Salt Slough at Lander			97.5	N				
Salt Slough at Sand Dam	92.5	N	100	N	78.8	**Y**		
Los Banos Creek at Hwy 140			97.5	N	97.5	N		
Los Banos Creek at China Camp Rd.	100	N	97.5	N	98.15	N	98.8/96.2	N
Los Banos Creek at Sunset Ave.								
Mud Slough			98.8	N	96.3	N		

Site	March 10 % Survival	March 10 Toxicity (Y/N)	Sept 09 % Survival	Sept 09 Toxicity (Y/N)	Mar 09 % Survival	Mar 09 Toxicity (Y/N)	Sept 08 % Survival	Sept 08 Toxicity (Y/N)
Blewett Drain (Vernalis at hwy 132)					18.8	**Y**	16.2	**Y**
Hospital Creek	77.5	**Y**	10	**Y**	0	**Y**	25	**Y**
Ingram Creek	35	**Y**	0	**Y**	18.8	**Y**	0	**Y**
Westley Wasteway	N/A	N/A	92.5	N	82.5	**Y**	1.25	**Y**
Del Puerto Creek (Cox Rd)	77.5	**Y**	13.8	**Y**	97.5	N	62.5	**Y**
Del Puerto Creek (Hwy 33)	92.5	N	N/A	N/A	97.5	N	N/A	N/A
Orestimba Creek at River Rd.	96.2	N	87.5	N	91.2	**Y**	80	N
Orestimba Creek at Hwy 33	90	N	80	N	88.8	**Y**	92.5	N
Ramona Lake at Fig Ave.	93.8	N	92.5	N	97.5	N	98.8	N
Newman Wasteway	93.8	N	98.8	N	98.8	N	82.5	**Y**
Poso Slough					N/A	N/A	72.5	**Y**
Turner Slough								
SJR at Lander								
Salt Slough at Lander								
Salt Slough at Sand Dam								
Los Banos Creek at Hwy 140								
Los Banos Creek at China Camp Rd.	95	N	96.2	N	97.5	N	87.5	**Y**
Los Banos Creek at Sunset Ave.	96.2	N						
Mud Slough								

Pesticide Analyses.

A total of twelve different pesticides were detected in water samples during the 2012 irrigation season for a total of 119 detections. Thirty six of these detections (30%) were below the reporting limit (DNQ) and 25 (21%) were legacy pesticides that are no longer in use (DDT, DDE, DDD, and dieldrin). Each of the detected pesticides is discussed below.

- Carbaryl (1 detection): Carbaryl is a carbamate insecticide used to control insects on a variety of citrus and nut trees and fruit and fiber crops.

- Chlorpyrifos (8 detections): Chlorpyrifos is a common organophosphate pesticide used to control a wide range of insects in orchards, pasture, and field crops. It can be used as a dormant spray for fruit and nut trees. Chlorpyrifos use during this reporting season likely occurred on field and forage crops (corn, cotton, and alfalfa) in the fall and as dormant sprays on fruit and nut trees in the mid to late winter.
- DDT/DDE/DDD (4 DDT detection, 20 DDE detections): DDT is an organochlorine pesticide that was banned for agricultural use in 1972. It is a legacy pesticide that is still detected in the watershed at relatively low levels. DDE and DDD have no commercial use but are compounds normally associated with the degradation of DDT.
- Dieldrin (2 detections): Dieldrin is an orgaonchlorine insecticide that was used on a variety of field and orchard crops including cotton, corn, and citrus. Most uses of Dieldrin were banned in 1987.
- Dimethoate (10 detections): Dimethoate is an organophosphate pesticide used to control a wide range of insects. It is used on a variety of field crops including alfalfa, beans, tomatoes, and cotton.
- Diuron (53 detections): Diuron is a substitute urea herbicide used to control weeds in a variety of field crops including cotton, alfalfa, walnuts and wheat. It is also effective in controlling algae.
- Endrin (1 detection): Endrin is an organochlorine pesticides and was most commonly used on cotton and corn. Endrin has not been produced or available in the United States since 1986.
- Malathion (4 detections): Malathion is an organophosphate insecticide used on a variety of crops including alfalfa, walnuts, lettuce, grapes, and cotton.
- Prowl (12 detections): Prowl is a herbicide used to control broadleaf and grassy weeds and is approved for a variety of crops including cotton, field corn, beans, rice, and vineyards.
- Simazine (1 detection): Simazine is a triazine herbicide used to control broadleaf weeds and annual grasses in a variety of field crops.
- Trifluralin (3 detections): Trifluralin is a pre-emergent herbicide used to control broadleaf and grassy weeds and is approved for a variety of crops including fruit and nut trees, cotton, beans, and tomatoes.

Exceedances of Recommended Water Quality Values.
Water chemistry analyses were compared to recommended water quality values[3] (RWQV). **Attachment 5** tabulates all of the RWQV exceedances for the reporting period by site.

- **Field, General Physical and Drinking Water Quality Exceedances.** Comparisons were made to several RWQVs. **Attachment 5** tabulates the results for these constituents and the comparison to the RWQVs. The Westside Coalition performed analyses or observed almost 2,900 field and chemistry (non-pesticide) parameters during the reporting period, during which, 315 (11%) results were greater than the RWQVs. Electrical conductivity and total dissolved solids (TDS) accounted for 110 and 86, respectively, of these exceedances (approximately 62% of the exceedances, combined).

[3] Water Quality Limits were provided by the Central Valley Regional Water Quality Control Board as part of the MRP Order. Water quality limits for cadmium, copper, lead, nickel and zinc are calculated from equations provided by the Central Valley Regional Water Quality Control Board.

E. coli results accounted for 37 of these exceedances, 22 for boron and 13 for dissolved oxygen. The RWQV for cadmium, copper, lead, nickel, and zinc are dependant on site water hardness and is a calculated value. There were no exceedances of dissolved metals during this report period. Potential causes for EC/TDS, E. coli, DO, and boron exceedances are discussed below.

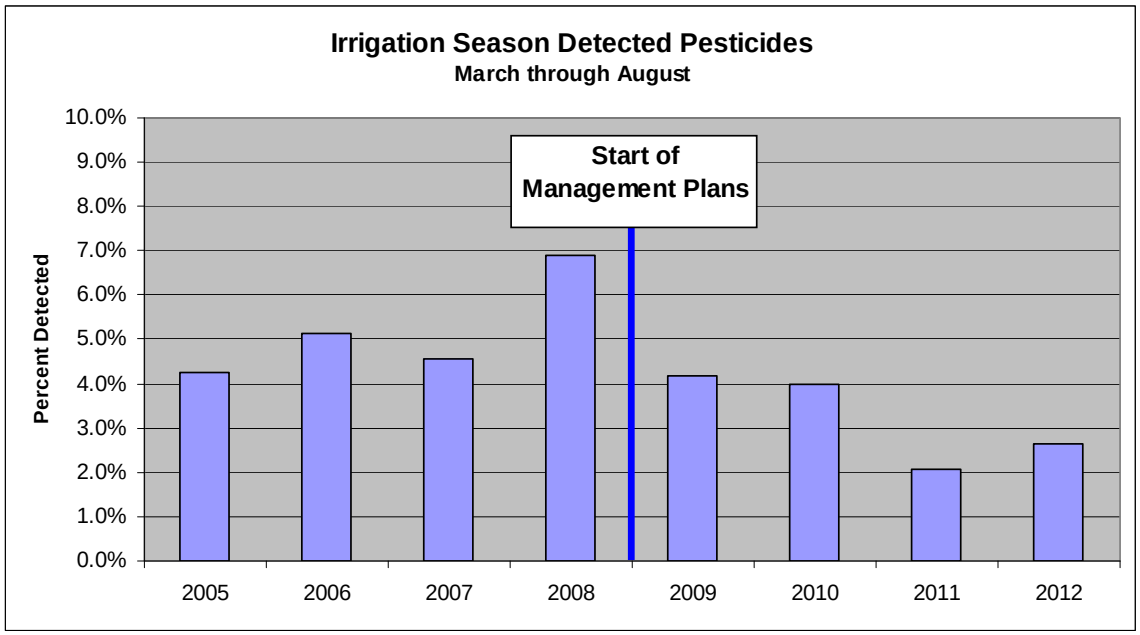
- **EC/TDS.** Electrical Conductivity and TDS are measures of the amount of salts dissolved in the water column. There are a variety of sources of salts that may be contributing to these results including natural marine sediments, accretion of shallow/perched ground water, and the irrigation source water. Additionally, the many growers to rely on wells to supplement surface water supplies. Most of the groundwater wells within the Westside Coalition are more saline than the surface water sources.
- **E. coli.** E. coli is a measurement of bacteria in the water column. The Westside Coalition has participated in a study to attempt to identify the source of these exceedances. The preliminary results were not conclusive, however human sources were identified as the possible cause for at least some of the exceedances. There is also some suspicion that E. coli colonies have become self-sustaining within some watersheds. The Westside Coalition's Management Plan, approved November 18, 2008, discusses future activities related to the E. coli exceedances. In a letter dated February 17, 2012, the Westside Coalition was requested to participate in a group discussion to develop a joint workplan. The Westside Coalition will participate in this workgroup.
- **Dissolved Oxygen.** DO is measured through a field probe at the time of sample collection. By it's nature, DO is a highly variable and influenced by a variety of conditions including sunlight exposure (related to time of day and time of year), turbidity, biological growth and decay, and channel turbulence. The cause of the DO exceedances measured during this report period is not immediately clear, in many cases, a low DO measurement is accompanied with no flow – indicating that the water is stagnant.
- **Boron.** Boron is a metal element commonly found in soils on the Westside of the San Joaquin Valley. It is not applied by growers for any agricultural purpose but may be dissolved in tail water, storm runoff, subsurface flows, or groundwater supplies.

The number and type of field and general chemistry exceedances was not dramatically different than those of prior years.

- **Pesticide exceedances.** Up to 48 different pesticides were tested at monitoring sites each month. Samples collected within the Westside Coalition during this report period provided almost 4500 pesticide results, 97% of which resulted in no detection. Of the detected pesticides (119), 44 were greater than established RWQVs. Of the 44 exceedances, 24 (54%) were caused by legacy pesticides (DDT, and DDE) which are not currently in use. Of the remaining 20, seven were caused by chlorpyrifos, one by dimethoate, five by diuron, and four by malathion.

As a fraction of the number of pesticide tests, there were slightly more pesticides detected during this reporting period when compared to the previous irrigation season (2.6% verses 2.1%). **Figure 3** shows the percent of total pesticides detected in each irrigation season since 2005 (number of detections / number of results).

Figure 3: Percent of Total Pesticides Detected.



Chlorpyrifos and Diazinon. In 2010, the Regional Board implemented a chlorpyrifos and diazinon TMDL on the San Joaquin River. In response to this TMDL, the Westside Coalition has increased its outreach efforts with additional grower workshops and individual grower meetings in regions with a history of chlorpyrifos or diazinon exceedances. These meetings emphasized the water quality issues related to these materials and management practices that could be implemented to reduce or eliminate discharge. During this reporting period there were no detections of diazinon and eight detections of chlorpyrifos (none of which occurred at any of the San Joaquin River monitoring sites). The Westside Coalition mailed 83 letters to growers (affecting about 185 parcels) and more than 180 field "tailgate" meetings were held to increase awareness of the chlorpyrifos and diazinon discharge issues. Pesticide use report (PUR) data became available too late to provide useful information for effective follow up. In accordance with the TMDL program requirements, an annual monitoring report for chlorpyrifos and diazinon monitoring results, covering the period of October 2010 through September 2011, was submitted in May 2011. Westside Coalition monitoring results from September 2011 through August 2012 have not detected either chlorpyrifos or diazinon in any of the samples from the three San Joaquin River monitoring sites.

SECTION 9: ACTIONS TAKEN TO ADDRESS WATER QUALITY IMPACTS – MANAGEMENT PLAN ACTIVITIES

In October 2008, the Westside Coalition submitted a Management Plan and Focused Watershed Plan (Focused Plan) which described the actions that would be taken to address the water quality issues identified by the monitoring program. The Management Plan described a general approach that covered all of the subwatersheds within the Westside Coalition. Focused Plans have been developed for specific issues within Hospital Creek, Ingram Creek, Del Puerto Creek, Westley Wasteway, Orestimba Creek, and Salt Slough (including both Salt Slough monitoring sites and Poso Slough). **Table 12** shows the implementation schedule listed in the Management Plan (see the Management Plan – General Approach, Table 4, October 23, 2008). In addition to these actions, the Westside Coalition reviews exceedances over the past three years to determine what modifications (if any) need to be made to the Management or Focused plans. A tally of exceedances from September 2009 through August 2012 is included in **Attachment 6**, along with a more detailed review of Management Plan activities.

Table 12: Management Plan Implementation Schedule

Item	Action	Affecting	Estimated Start	Estimated Completion
1	Continue monitoring program	All Categories	On-going	On-going
2	Develop and implement Focused Plan	Site-specific	July 2008	2013
3	Compile MP inventory	All Categories	Jan. 2009	Complete for FP1, FP2, and FP3
4	Develop subwatershed maps	All Categories	On-going	Jan. 2013
5	Determine regional pesticide application	Pesticides, aquatic toxicity	On-going	Annually updated
6	Continue participation in the Dissolved Oxygen Study	Dissolved Oxygen	On-going	On-going
7	Analyze results of E. coli study and map/inventory potential sources	E. coli	Sept. 2007	Jan. 2010
8	Continue outreach and education efforts	All Categories	On-going	On-going
9	Analyze for correlation between low DO and other parameters	Dissolved Oxygen	Sept. 2008	June 2009
10	Continue participation in the Salinity TMDL Program	EC/TDS	On-going	On-going
11	Track changes in water quality	All Categories	On-going	On-going

1. Continue Monitoring Program.

This semi-annual monitoring report represents the 16th monitoring report submitted by the Westside Coalition since its inception in 2004. The monitoring program (as revised by the MRP Order) is designed to be a dynamic program that aggressively tracks known water quality issues and conducts broad assessment monitoring to identify new issues (see the MRP Order). The monitoring program is also designed to support the activities of the Management Plan and the Focused Watershed plans. The results of the monitoring program are reported twice annually (June and November). Beginning in March of 2011 the Westside Coalition implemented assessment monitoring at all discharge sites which continued through February 2012. The results of the assessment monitoring period were reviewed and adjustments were made to the Special Project Monitoring table included in the MRP order (see **Attachment 7**).

2. Develop and Implement Focused Watershed Plan.
A Focused Plan for the Ingram and Hospital Creek watersheds was developed and submitted to the Regional Board on October 23, 2008 followed by a Focused Plan for the Westley Wasteway, Del Puerto Creek, and Orestimba Creek in February 2011. The Focused Plan for Salt Slough (including Poso Slough) was adopted in December 2011. Since that time, the Westside Coalition has implemented a number of activities. A detailed update of the focused plan activities is included in **Attachment 6.**

3. Compile Management Practice Inventory.
A management plan survey for the Ingram and Hospital Creek watersheds was completed in 2010 with a similar survey completed for Del Puerto Creek, Westley Wasteway, and Orestimba Creek completed in the Spring of 2011, the results of which were reported in the June 2011 SAMR. A management practice survey for Salt Slough was completed and submitted in August 2012. A summary of the survey results received to date are included in **Attachment 6**.

4. Develop Subwatershed Maps.
The Westside Coalition submitted subwatershed maps for the major watersheds within its boundaries in 2008. These maps were based on known drainage patterns and available mapping information. As part of the focused plans, the Westside Coalition collected highly detailed drainage information on the Ingram and Hospital Creek subwatersheds. Draft maps for the Westley Wasteway, Del Puerto Creek, Orestimba Creek, and Salt Slough subwatersheds have been developed and submitted in previous SAMRs.

5. Determine Regional Pesticide Use.
Pesticide use report data is collected from the agricultural commissioners in the various counties occupied by the Westside Coalition. In addition to general trends analysis, specific regional pesticide use data is periodically reviewed to attempt to compare with pesticide detections through the monitoring program. Limitations with pesticide use report data completeness and availability limit the usefulness of this data for that purpose. A summary of available pesticide use data is provided in **Attachment 6**.

6. Continue Participation in the Dissolved Oxygen Study.
On January 27, 2005 the Central Valley Regional Water Quality Control Board adopted Resolution R5-2005-0005 which included a TMDL directed to the point and non-point discharges that contribute to the dissolved oxygen impairment in the Stockton Deepwater Ship Channel (DO TMDL). As part of the DO TMDL certain studies were required. The San Joaquin Valley Drainage Authority received funds from the State Water Resources Control Board to undertake these studies (Recipient Agreement ERP-02D-P63). These studies were completed in June of 2008. The project established a series of monitoring stations, developed a DO model, characterized the fate of algae and nutrients, developed linkages between flow, algae, nutrients and dissolved oxygen. Additional studies were proposed to connect the results of this effort to downstream impacts. This work is ongoing. The Westside Coalition has maintained the monitoring sites within boundaries of the Westside Coalition to maintain the data availability. The Westside Coalition also is prepared to continue to participate in the DO TMDL as further actions are developed. The SJVDA is currently participating with other stakeholders to provide

funding for operation of the aerator installed by the Department of Water Resources. A funding agreement was completed in April 2012 between the parties and a mechanism in place to fund short term operation of the Stockton Deepwater Ship Channel aerator until May 31, 2014. There are provisions in the agreement for extensions of time.

7. Analyze results of E. coli study and map/inventory potential sources.
Since 2007, the Westside Coalition has participated in studies and other investigations to attempt to identify the source and cause of various E. coli exceedances (reported in previous SAMRs). A technical committee is currently developing an approach plan with which the Westside Coalition will participate.

8. Continue Reporting and Outreach.
Coalition outreach during this period consisted of two mailing campaigns regarding localized sediment discharges in the Blewett Drain and Orestimba Creek areas, general outreach to our entire coalition regarding chlorpyrifos exceedances and submittal of leter from the CVRWQCB, grower meetings, monthly updates to the Westside Coalition management committee and one on one meetings with coalition members. Outreach was conducted per the tabulation in **Table 13**.

Outreach this period included our normal group outreach meeting as well as focused individual meetings. A staff person from the Westside Coalition made frequent trips through the Coalition area to observe field conditions. Individual meeting affecting more than 11,000 acres were performed during this report period.

In both general grower workshops and individual member meetings, landowners and operators with irrigation drainage are encouraged to adopt practices to protect surface water that include a number of options based on their crop and farming conditions. Those practices include irrigation drainage return systems, sediment ponds for containing irrigation drainage, managed vegetation in drainage ditches, use of PAM in irrigation water, and upgrading irrigation systems.

As a reaction to pesticide exceedances, the Coalition has also scheduled individual meetings with growers who may have used pesticides associated with those exceedances in the waterways. In preparation for the meetings, pesticide use information from the Fresno, Merced and Stanislaus County Agricultural Commissioners office is compiled and examined to see if use reports could be correlated to exceedances in the waterways, however in all cases this data was insufficiently complete to provide any useful information at the time outreach activities were performed.

Table 13 lists the outreach activities performed during this reporting period coalition-wide.

Table 13: Outreach Meetings.

Date	Group	Location	Description	Attended	By
3/1/2012	Westside Stanislaus County Farm Bureau	Patterson	Annual Meeting	50	Joe Mc/Parry Klassen
3/13/2012	PCA's in Stanislaus County	Westley	Chlorpyrifos and sedmiment issues	8	Joe McGahan/ Parry Klassen
3/22/2012	San Luis Canal Co Annual Meeting	Dos Palos	Update of ILRP and issues in area	25	Joe McGahan
3/27/2012	CCID Landowners Meeting	Firebaugh	Dos Palos Area Update	50	Joe McGahan
3/28/2012	CCID Landowners Meeting	Los Banos	Los Banos Area Update	75	Joe McGahan
3/28/2012	Field tailgate meetings	Field	Survey follow up and BMPs	9	Rich Peltzer
3/29/2012	CCID Landowners Meeting	Gustine	Patterson Area Update	100	Joe McGahan
4/3/2012	Stanislaus County Ag Commissioner	Patterson	Ag Comm meeting to review new policies	25	Joe McGahan
4/5/2012	Field tailgate meetings	Field - Salt Sl.	Survey follow up and BMPs	18	Rich Peltzer
4/9/2012	Field tailgate meetings	Field - Salt Sl.	Survey follow up and BMPs	15	Rich Peltzer
4/16/2012	Field tailgate meetings	Field - Salt Sl.	Survey follow up and BMPs	14	Rich Peltzer
4/24/2012	Field tailgate meetings	Field - Salt Sl.	Survey follow up and BMPs	10	Rich Peltzer
4/25/2012	Grassland Habitat Management Coordination Committee Meeting	Los Banos	ILRP Status to wetland members	15	Joe McGahan
7/13/2012	ACWA Regions 6 & 7	Fresno	Presentation to Association of California Water Agencies region meetings on status of ILRP	40	Joe McGahan
7/25/2012	Tailgate Mtg.	Westley	BMP's Sediment	6	Rich Peltzer
8/1/2012	Tailgate Mtg.	Westley/Crows Landing	BMP's Sediment	15	Rich Peltzer
8/7/2012	Tailgate Mtg.	Westley/Crows Landing	BMP's Sediment	9	Rich Peltzer
8/15/2012	Tailgate Mtg.	Patterson/Crows Landing	BMP's Sediment	16	Rich Peltzer
8/21/2012	Tailgate Mtg.	Patterson/Crows Landing/Westley	BMP's Sediment	15	Rich Peltzer
8/30/2012	Tailgate Mtg.	Patterson/Crows Landing/Westley	BMP's Sediment	8	Rich Peltzer

Grant Funding

The Westside Coalition continued to offer private grant funding to its members totaling more $30,000 for construction of new tailwater silt ponds or to maintain existing ponds. The program funds 75% of the costs of any single project, up to a maximum of $6,000 per project. Thirty four projects were completed during the 2012 non-irrigation season, expending $27,200 of the grant funds (about 91% of the available funds). Most of these projects were in the northerly region of the Westside Coalition, affecting about 6,000 acres that drain into the Marshall Road Drain, Orestimba Creek, Spanish Land Grant Drain and Delta-Mendota Canal.

Proposition 84 has also been made available in 2012 through a program managed by CURES and funded by the State Water Resources Control Board. Information on the grant funding availability has been communicated during the previous reporting period to landowners and operators through direct mailings, grower group meetings and individual contacts with landowners.

The Proposition 84 program provides funding for projects in the Central Valley primarily for the purpose of improving irrigation systems. Outreach by CURES was focused on landowners with fields along waterways with management plans in place by the local watershed coalition and located in the northern San Joaquin Valley, San Joaquin County/Sacramento Rivers Delta and southern Sacramento Valley. To date, 35 projects have been funded, affecting a total of 3,620 acres within the Westside Coalition. A map showing the completed and in-progress projects funded through Proposition 84 is included in **Attachment 6**.

9. Analyze for Correlation Between Low DO and Other Parameters.

The Westside Coalition has performed a preliminary review of the low DO measurements and other data. A summary of this review was included in the November 2009 Semi-Annual Monitoring Report. No additional work has been performed on this issue.

10. Continue Participation in the Salinity TMDL Program.

The Westside Coalition is actively engaged in the Central Valley Salinity Alternatives for Long-term Sustainability (CVSALTS) process and is an active member of the Central Valley Salinity Coalition that has been organized to facilitate the funding of the CVSALT effort. The Coalition's participation includes both monetary contributions and a substantial commitment of staff time.

Specific actions by the Westside Coalition to support the CVSALT efforts include: (1) Coalition representative's consistent participation in the CVSALT committees and sub-committees including serving as chair of the Economic and Social Impact Committee. (2) Consistent participation and economic contributions to the Central Valley Salinity Coalition, including representative serving as president of the CV Salinity Coalition. In addition the San Joaquin Valley Drainage Authority is providing contracting and contract administration services for the CVSALT effort. The Westside Coalition has committed to substantial resources to help ensure that the CVSALT effort results in an effective and efficient salinity management program for the Central Valley.

11. Track Changes in Water Quality.
Water quality changes are tracked through the Westside Coalition's monitoring program (see the MRP Order). Water quality data is reported and summarized twice annually.

Other Activities:

- **Conversion to high efficiency irrigation systems:** Several of the districts within the Westside Coalition have implemented grant and loan programs to assist growers in upgrading their irrigation systems, and more 17,000 acres of high efficiency systems came on-line during the 2011/12 non-irrigation season within the Westside Coalition, including almost 3,700 acres funded through the Proposition 84 program. Several more projects are in the planning stages. Typically, irrigation improvements are installed during the non-irrigation season for use in the following irrigation season.
- **NRCS EQUIP Funding:** The Westside Coalition, in cooperation with Central California Irrigation District, submitted a proposal for funding assistance to NRCS to develop a targeted funding program. NRCS chose not to fund the proposal and the Westside Coalition continues to pursue additional funding assistance for growers.

Monitoring Results:
Data gathered since the inception of the monitoring program has allowed the Westside Coalition to identify problem areas and issues. Details of sites exhibiting significant toxicity during this monitoring period are included in **Attachment 2** and all results that exceeded RWQVs are included in **Attachment 5**. This information, along with results from previous years will be used as talking points during upcoming grower meetings to outline the problem issues and sites. The Management Plan and Focused Watershed Plan also outline approaches that will be implemented to address the highlighted issues. A number of preliminary conclusions can be made from the data collected so far:

- **Sediment Toxicity:** Sediment toxicity tests were performed on 14 samples (including one duplicate) collected in March (Event 89). Statistically significant toxicity was measured at four sites (See **Tables 10** and **11**), and follow up pesticide testing was performed on all four. These results were compared to literature values for the purpose of determining the probable cause of toxicity in each sample. In all cases pesticides were present in sufficient quantity to have caused the toxicity.

  - Orestimba Creek at Highway 33 (36.2% Survival): A total of 5.1 sediment toxic units (TUs) were calculated based on the detected pesticides. Bifentrhin accounted for 4.5 toxic units.
  - Hospital Creek (81.3% Survival): 0.91 TUs were calculated, with esfenvalerate accounting for 0.53 TUs. Although statistically significant toxicity was observed, the survival at this site was the highest observed since 2006.
  - Ingram Creek (60% Survival): 2.18 TUs were calculated, with lambda-cyhalothrin and bifenthrin accouting for 1.65 TUs and 0.4 TUs, respectively. Similar to Hospital Creek, the observed survival in the sample is the highest on record since the Westside Coalition began sediment toxicity monitoring.

- Westley Wasteway near Cox Road (15% Survival): A total of 2.77 TUs, were calculated with lambda-cyhalothrin and bifenthrin accounting for 0.29 TUs and 2.39 TUs respectively.

Bifenthrin, Lambda-cyhalothrin, and Es/fenvlaerate are all pyethroids use on a variety of field and tree crops including, tomatos, corn, beans, alfalfa, walnuts, and almonds, all of which are grown in the northerly part of the Westside Coalition. The majority of walnut and almond orchards within the Westside Coalition are irrigated with micro-sprinklers and drip systems which do not generate significant tailwater. It is likely that the discharge of these materials were from field crops using furrow or other surface irrigation methods.

Figure 4 shows the number statistically significant observations during the spring sediment sampling events. The spring 2012 sediment results showed smaller number of sites with observed toxicity than the previous year. The Westside Coalition believes the best way to reduce sediment toxicity will be through the management of sediment discharges at the farm level. Sedimentation ponds and tailwater return ponds, along with grower awareness of the issue will likely reduce the amount of sediment load leaving the farm and depositing in the waterways. The Coalition's Management Plan and Focused Watershed Plan include management approaches to address sediment toxicity. There appears to be an improving trend in sediment toxicity, possibly due to the Coalition's outreach efforts.

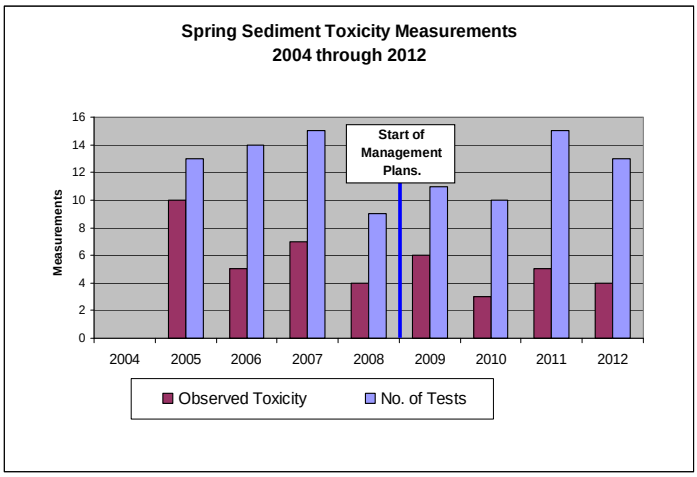


Figure 4: Spring Sediment Toxicity.

Figure 5 shows the trend of percent survival for sediment toxicity (average percent survival for all tested sites at each event), along with a linear trendline. Based on the trendline, there appears to be an improving trend in terms of the magnitude of survival. It is also apparent that the magnitude of Fall survival is generally worse than that of Spring survival.

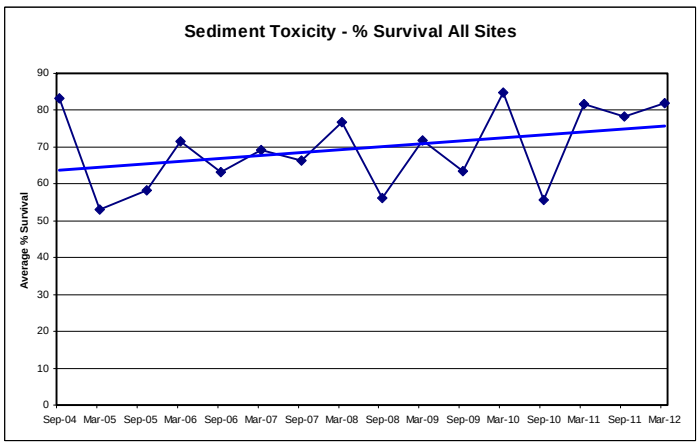


Figure 5: Average Sediment % Survival.

- **Aquatic Toxicity:** Aquatic toxicity to *Ceriodaphnia dubia*, fathead minnow, and algae were tested in accordance with the MRP Order (see **Attachment 7**). A total of 118 aquatic toxicity tests were performed, including 18 field duplicates. A total of 10 incidences of statistically significant toxicity (8.5%) were observed during the irrigation season – two for *Ceriodaphnia dubia*, seven for algae and one for fathead minnow. **Attachment 2** provides monitoring results for all of the sites that measured significant toxicity, including a discussion of the TIE and dilution series findings.

- **Pesticide Analyses:** During this reporting period, a total of twelve different pesticides were detected for a total of 119 detections. Forty four of these detections exceeded the established RWQV, however 54% of these exceedances were caused by legacy pesticides like DDT. During this report period, aquatic toxicity was observed twice to *Ceriodaphnia dubia*, of which one event could be tied to an insecticide (chlorpyrifos). There were seven observations of algae toxicity, of which five could be tied to herbicides (diuron or Prowl) as the likely cause. See **Attachment 2**.

- **Chlorpyrifos and Diazinon TMDL Program:** In addition to its monthly monitoring program, the Westside Coalition also participates in the San Joaquin River Chlorpyrifos and Diazinon TMDL program. The Westside Coalition collects water monthly samples for chlorpyrifos and diazinon analysis at the San Joaquin River at Sack Dam, Lander Avenue, and Las Palmas Avenue (near the PID pumps) and collaborates with the Eastside Coalition in the development of the TMDL monitoring report and outreach activities. During this reporting period, neither chlorpyrifos nor diazinon were detected at any of the San Joaquin River monitoring sites sampled by the Westside Coalition. An annual monitoring report for the San Joaquin River Chlorpyrifos and Diazinon TMDL program covering October 2010 through September 2011 was submitted to the Central Valley Regional Water Quality Control Board in May 2012.

- **General Chemistry and Field Observations:** The monitoring results for field and general chemistry tests were generally similar to previous irrigation seasons. EC/TDS measured the largest number of exceedances for this reporting period (110 and 86 exceedances, respectively). Bacteria continues to be a leading source of exceedances (37 for E. Coli during this period). There were also 22 boron exceedances. Boron is typically connected with shallow groundwater within the Westside San Joaquin Valley. Other constituent exceedances include dissolved oxygen (13 exceedances), pH (30 exceedances) and arsenic (9 exceedances). Dissolved cadmium, copper, lead, nickel, and zinc results were compared to the calculated RWQV (based on site water hardness) and no exceedances were measured during this reporting period. With many of these constituents, the source of the exceedance is neither clear nor easily traceable, and often can be found in the source water itself (such as the San Joaquin River at Sack Dam or the Delta-Mendota Canal).

SECTION 10: COMMUNICATION REPORTS

Exceedance reports were submitted to the Central Valley Regional Water Quality Control Board in response to monitoring results for the reporting period. These reports are included in **Appendix B.**

Follow-up included reporting statistically significant toxic events and exceedences of water quality values to the overlying districts, PCA's and to individual Coalition participants. The districts would then communicate with the affected growers to notify them that there is a problem. Meetings are then to be organized at the Coalition level as required to inform landowners, operators, PCA's, chemical applicators and others on monitoring results and likely best management measures that could be undertaken to minimize these problems (see **Table 13**).

SECTION 11: CONCLUSIONS AND RECOMMENDATIONS

The Westside Coalition's monitoring program has identified constituents of concern (see **Attachments 2** and **5**). The Westside Coalition has submitted a Management Plan and Focused Watershed Plan to address the water quality concerns discovered by previous monitoring. Implementation of these plans has begun.

The Westside Coalition monitoring program has accumulated data from 94 regular monitoring events and 12 rain events. Data from this reporting period has verified previously identified water quality issues but has also showed some indications of an improving trend in water quality (see **Section 9**). The Westside Coalition began implementation of management plans in 2008. For a basis of comparison, data from the most recent three year period (September 2009 to August 2012) was compared to the three year period prior to management plan implementation (September 2005 to August 2008) and there are some promising improvements:

- Algae toxicity: 18 exceedances out of 364 tests (5%) for the most current period, compared to 33 exceedances out of 345 tests (9.5%).
- Chlorpyrifos: 53 exceedances out of 614 tests (8.6%) for the most current period compared to 67 exceedances out of 390 tests (17%).
- Diazinon: 2 exceedances out of 615 tests (0.3%) for the most current period compared to 6 exceedances out of 391 tests (1.5%).
- Total pesticide detections: Approximately 2.7% of analyzed pesticides detected in the current period verses almost 5% of analyzed pesticides detected in the period prior to management plan implementation.
- Sediment toxicity: 24 toxicity observations out of 73 tests (33%) in the current period compared to 38 observations out of 85 tests (45%). Additionally, the average percent survival for the current period is 71% compared to the 65% for the period prior to implementation of the management plans.

A complete tally of exceedances by site and constituent is included in **Attachment 6**.

Attachment 1
Sampling Event Details

Event 89	Map	Caltest		APPL	PER				
March, 2012	Desig.	Gen Phy	metals	Pest	Sed Tox	CD Tox	PP Tox	SC Tox	Dup?
Hospital Cr at River Road	HCARR	**No Flow**							
Ingram Cr at River Road	ICARR	x	x	x		x	x	x	
Westley Wasteway near Cox Road	WWNCR	x	x	x		x	x	x	
Del Puerto Cr near Cox Road	DPCCR	x	x	x		x	x	x	
Del Puerto Cr at Hwy 33	DPCHW	x	x	x		x	x	x	
Ramona Lake near Fig Avenue	ROLFA	x	x	x		x	x	x	
Marshall Road Drain near River Road	MRDRR	x	x	x		x	x	x	
Orestimba Cr at River Road	OCARR	x	x	x		x	x	x	
Orestimba Cr at Hwy 33	OCAHW	x	x	x		x	x	x	
Newman Wasteway near Hills Ferry Road	NWHFR	x	x	x		x	x	x	
San Joaquin River at Lander Avenue	SJRLA	x	x	x		x	x	x	
Mud Slough u/s San Luis Drain	MSUSL	x	x	x		x	x	x	
Salt Slough at Lander Avenue	SSALA	x	x	x		x	x	x	
Salt Slough at Sand Dam	SSASD	x	x	x		x	x	x	
Los Banos Creek at Highway 140	LBCHW	x	x	x		x	x	x	
Los Banos Creek at China Camp Road	LBCCC	x	x	x		x	x	x	
Turner Slough near Edminster Road	TSAER	x	x	x		x	x	x	
Blewett Drain near Highway 132	VH132	x	x	x		x	x	x	
Poso Slough at Indiana Avenue	PSAIA	x	x	x		x	x	x	x
~~Los Banos Creek at Sunset Ave~~	~~LBCSA~~								
~~Little Panoche Cr at Western Boundary~~	~~LPCWB~~								
~~Little Panoche Cr at San Luis Canal~~	~~LPCSL~~								
~~Russell Ave. Drain at San Luis Canal~~	~~RADSL~~								
San Joaquin River at Sack Dam	SJRSD	x	x	x		x	x	x	
San Joaquin River at PID Pumps	SJRPP	x	x	x		x	x	x	
Delta Mendota Canal at Del Puerto WD	DMCDP	x	x	x		x	x	x	

Event 90	Map	Caltest		APPL	PER				
April, 2012	Desig.	Gen Phy	metals	Pest	Sed Tox	CD Tox	PP Tox	SC Tox	Dup?
Hospital Cr at River Road	HCARR	x	x	x		x	x	x	
Ingram Cr at River Road	ICARR	x	x	x		x	x	x	
Westley Wasteway near Cox Road	WWNCR	x	x	x		x	x	x	
Del Puerto Cr near Cox Road	DPCCR	x	x	x		x	x	x	
Del Puerto Cr at Hwy 33	DPCHW	**No Flow**							
Ramona Lake near Fig Avenue	ROLFA	x	x	x		x	x	x	
Marshall Road Drain near River Road	MRDRR	x	x	x		x	x	x	
Orestimba Cr at River Road	OCARR	x	x	x		x	x	x	
Orestimba Cr at Hwy 33	OCAHW	x	x	x		x	x	x	
Newman Wasteway near Hills Ferry Road	NWHFR	x	x	x		x	x	x	
San Joaquin River at Lander Avenue	SJRLA	x	x	x		x	x	x	
Mud Slough u/s San Luis Drain	MSUSL	x	x	x		x	x	x	
Salt Slough at Lander Avenue	SSALA	x	x	x		x	x	x	
Salt Slough at Sand Dam	SSASD	x	x	x		x	x	x	
Los Banos Creek at Highway 140	LBCHW	x	x	x		x	x	x	
Los Banos Creek at China Camp Road	LBCCC	x	x	x		x	x	x	
Turner Slough near Edminster Road	TSAER	x	x	x		x	x	x	
Blewett Drain near Highway 132	VH132	x	x	x		x	x	x	
Poso Slough at Indiana Avenue	PSAIA	x	x	x		x	x	x	x
~~Los Banos Creek at Sunset Ave~~	LBCSA								
~~Little Panoche Cr at Western Boundary~~	LPCWB								
~~Little Panoche Cr at San Luis Canal~~	LPCSL								
~~Russell Ave. Drain at San Luis Canal~~	RADSL								
San Joaquin River at Sack Dam	SJRSD	x	x	x		x	x	x	
San Joaquin River at PID Pumps	SJRPP	x	x	x		x	x	x	
Delta Mendota Canal at Del Puerto WD	DMCDP	x	x	x		x	x	x	

Event 91	Map	Caltest		APPL	PER				
May, 2012	Desig.	Gen Phy	metals	Pest	Sed Tox	CD Tox	PP Tox	SC Tox	Dup?
Hospital Cr at River Road	HCARR	x	x	x		x	x	x	
Ingram Cr at River Road	ICARR	x	x	x		x	x	x	
Westley Wasteway near Cox Road	WWNCR	x	x	x		x	x	x	
Del Puerto Cr near Cox Road	DPCCR	x	x	x		x	x	x	
Del Puerto Cr at Hwy 33	DPCHW	**No Flow**							
Ramona Lake near Fig Avenue	ROLFA	x	x	x		x	x	x	
Marshall Road Drain near River Road	MRDRR	x	x	x		x	x	x	
Orestimba Cr at River Road	OCARR	**No Flow**							
Orestimba Cr at Hwy 33	OCAHW	x	x	x		x	x	x	
Newman Wasteway near Hills Ferry Road	NWHFR	x	x	x		x	x	x	
San Joaquin River at Lander Avenue	SJRLA	x	x	x		x	x	x	
Mud Slough u/s San Luis Drain	MSUSL	x	x	x		x	x	x	
Salt Slough at Lander Avenue	SSALA	x	x	x		x	x	x	
Salt Slough at Sand Dam	SSASD	x	x	x		x	x	x	
Los Banos Creek at Highway 140	LBCHW	x	x	x		x	x	x	
Los Banos Creek at China Camp Road	LBCCC	x	x	x		x	x	x	
Turner Slough near Edminster Road	TSAER	x	x	x		x	x	x	
Blewett Drain near Highway 132	VH132	x	x	x		x	x	x	
Poso Slough at Indiana Avenue	PSAIA	x	x	x		x	x	x	x
~~Los Banos Creek at Sunset Ave~~	LBCSA								
~~Little Panoche Cr at Western Boundary~~	LPCWB								
~~Little Panoche Cr at San Luis Canal~~	LPCSL								
~~Russell Ave. Drain at San Luis Canal~~	RADSL								
San Joaquin River at Sack Dam	SJRSD	x	x	x		x	x	x	
San Joaquin River at PID Pumps	SJRPP	x	x	x		x	x	x	
Delta Mendota Canal at Del Puerto WD	DMCDP	x	x	x		x	x	x	

Event 92	Map	Caltest		APPL	PER				
June, 2012	Desig.	Gen Phy	metals	Pest	Sed Tox	CD Tox	PP Tox	SC Tox	Dup?
Hospital Cr at River Road	HCARR	x	x	x		x	x	x	
Ingram Cr at River Road	ICARR	x	x	x		x	x	x	
Westley Wasteway near Cox Road	WWNCR	x	x	x		x	x	x	
Del Puerto Cr near Cox Road	DPCCR	x	x	x		x	x	x	
Del Puerto Cr at Hwy 33	DPCHW	**No Flow**							
Ramona Lake near Fig Avenue	ROLFA	x	x	x		x	x	x	
Marshall Road Drain near River Road	MRDRR	x	x	x		x	x	x	
Orestimba Cr at River Road	OCARR	x	x	x		x	x	x	
Orestimba Cr at Hwy 33	OCAHW	x	x	x		x	x	x	
Newman Wasteway near Hills Ferry Road	NWHFR	x	x	x		x	x	x	
San Joaquin River at Lander Avenue	SJRLA	x	x	x		x	x	x	
Mud Slough u/s San Luis Drain	MSUSL	x	x	x		x	x	x	
Salt Slough at Lander Avenue	SSALA	x	x	x		x	x	x	
Salt Slough at Sand Dam	SSASD	x	x	x		x	x	x	
Los Banos Creek at Highway 140	LBCHW	x	x	x		x	x	x	
Los Banos Creek at China Camp Road	LBCCC	x	x	x		x	x	x	
Turner Slough near Edminster Road	TSAER	x	x	x		x	x	x	
Blewett Drain near Highway 132	VH132	x	x	x		x	x	x	
Poso Slough at Indiana Avenue	PSAIA	x	x	x		x	x	x	x
~~Los Banos Creek at Sunset Ave~~	LBCSA								
~~Little Panoche Cr at Western Boundary~~	LPCWB								
~~Little Panoche Cr at San Luis Canal~~	LPCSL								
~~Russell Ave. Drain at San Luis Canal~~	RADSL								
San Joaquin River at Sack Dam	SJRSD	x	x	x		x	x	x	
San Joaquin River at PID Pumps	SJRPP	x	x	x		x	x	x	
Delta Mendota Canal at Del Puerto WD	DMCDP	x	x	x		x	x	x	

Event 93 July, 2012	Map Desig.	Caltest Gen Phy	Caltest metals	APPL Pest	PER Sed Tox	PER CD Tox	PER PP Tox	PER SC Tox	Dup?
Hospital Cr at River Road	HCARR	x	x	x		x	x	x	
Ingram Cr at River Road	ICARR	x	x	x		x	x	x	
Westley Wasteway near Cox Road	WWNCR	x	x	x		x	x	x	
Del Puerto Cr near Cox Road	DPCCR	x	x	x		x	x	x	
Del Puerto Cr at Hwy 33	DPCHW	**No Flow**							
Ramona Lake near Fig Avenue	ROLFA	x	x	x		x	x	x	
Marshall Road Drain near River Road	MRDRR	x	x	x		x	x	x	
Orestimba Cr at River Road	OCARR	x	x	x		x	x	x	
Orestimba Cr at Hwy 33	OCAHW	x	x	x		x	x	x	
Newman Wasteway near Hills Ferry Road	NWHFR	x	x	x		x	x	x	
San Joaquin River at Lander Avenue	SJRLA	x	x	x		x	x	x	
Mud Slough u/s San Luis Drain	MSUSL	x	x	x		x	x	x	
Salt Slough at Lander Avenue	SSALA	x	x	x		x	x	x	
Salt Slough at Sand Dam	SSASD	x	x	x		x	x	x	
Los Banos Creek at Highway 140	LBCHW	x	x	x		x	x	x	
Los Banos Creek at China Camp Road	LBCCC	x	x	x		x	x	x	
Turner Slough near Edminster Road	TSAER	x	x	x		x	x	x	
Blewett Drain near Highway 132	VH132	**No Flow**							
Poso Slough at Indiana Avenue	PSAIA	x	x	x		x	x	x	x
~~Los Banos Creek at Sunset Ave~~	LBCSA								
~~Little Panoche Cr at Western Boundary~~	LPCWB								
~~Little Panoche Cr at San Luis Canal~~	LPCSL								
~~Russell Ave. Drain at San Luis Canal~~	RADSL								
San Joaquin River at Sack Dam	SJRSD	x	x	x		x	x	x	
San Joaquin River at PID Pumps	SJRPP	x	x	x		x	x	x	
Delta Mendota Canal at Del Puerto WD	DMCDP	x	x	x		x	x	x	

Event 94 August, 2012	Map Desig.	Caltest Gen Phy	Caltest metals	APPL Pest	PER Sed Tox	PER CD Tox	PER PP Tox	PER SC Tox	Dup?
Hospital Cr at River Road	HCARR	x	x	x		x	x	x	
Ingram Cr at River Road	ICARR	x	x	x		x	x	x	
Westley Wasteway near Cox Road	WWNCR	x	x	x		x	x	x	
Del Puerto Cr near Cox Road	DPCCR	x	x	x		x	x	x	
Del Puerto Cr at Hwy 33	DPCHW	**No Flow**							
Ramona Lake near Fig Avenue	ROLFA	x	x	x		x	x	x	
Marshall Road Drain near River Road	MRDRR	x	x	x		x	x	x	
Orestimba Cr at River Road	OCARR	x	x	x		x	x	x	
Orestimba Cr at Hwy 33	OCAHW	x	x	x		x	x	x	
Newman Wasteway near Hills Ferry Road	NWHFR	x	x	x		x	x	x	
San Joaquin River at Lander Avenue	SJRLA	x	x	x		x	x	x	
Mud Slough u/s San Luis Drain	MSUSL	x	x	x		x	x	x	
Salt Slough at Lander Avenue	SSALA	x	x	x		x	x	x	
Salt Slough at Sand Dam	SSASD	x	x	x		x	x	x	
Los Banos Creek at Highway 140	LBCHW	x	x	x		x	x	x	
Los Banos Creek at China Camp Road	LBCCC	x	x	x		x	x	x	
Turner Slough near Edminster Road	TSAER	x	x	x		x	x	x	
Blewett Drain near Highway 132	VH132	x	x	x		x	x	x	
Poso Slough at Indiana Avenue	PSAIA	x	x	x		x	x	x	x
~~Los Banos Creek at Sunset Ave~~	LBCSA								
~~Little Panoche Cr at Western Boundary~~	LPCWB								
~~Little Panoche Cr at San Luis Canal~~	LPCSL								
~~Russell Ave. Drain at San Luis Canal~~	RADSL								
San Joaquin River at Sack Dam	SJRSD	x	x	x		x	x	x	
San Joaquin River at PID Pumps	SJRPP	x	x	x		x	x	x	
Delta Mendota Canal at Del Puerto WD	DMCDP	x	x	x		x	x	x	

Attachment 2
Significant Aquatic Toxicity Results

Westside San Joaquin River Watershed Coalition
Significant Aquatic Toxicity Results

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Ingram Creek at River Road	3/13/2012	89	Selenastrum capricornutum	469,000	2,308,000	80%	cells/ml

Followup: A TIE indicated that herbicides were the likely cause of toxicity. Diuron was detected in the sample and is expected to have contributed to the toxicity.

Field Data

DO	7	mg/l
EC	1269	µmhos/cm
Est Depth	1	ft
Flow	8.2	cfs
pH	6.45	
Staff Gage	0.4	ft
Temp	8.31	c

Water Chemistry

Bromide	0.92	DNQ	mg/L
Dissolved Organic Carbon	7.3		mg/L
E. coli	120		MPN/100m
Total Organic Carbon	7.0		mg/L
Dissolved Solids	1000		mg/L
Hardness (as CACO3)	390		mg/L
Suspended Solids	548		mg/L
Turbidity	130		NTU
Arsenic	5.3		ug/L
Boron	951		ug/L
Cadmium	0.08	DNQ	ug/L
Cadmium (Dissolved)	-0.04	ND	ug/L
Copper	14		ug/L
Copper (Dissolved)	1.8		ug/L
Lead	4.4		ug/L
Lead (Dissolved)	-0.03	ND	ug/L
Nickel	24		ug/L
Nickel (Dissolved)	2.6		ug/L
Selenium	1.1		ug/L
Zinc	45		ug/L
Zinc (Dissolved)	3.7		ug/L
Ammonia as N	0.22		mg/L
Nitrate + Nitrite as N	2.6		mg/L
Nitrogen, Total Kjeldahl	2.4		mg/L
OrthoPhosphate as P	0.27		mg/L
Phosphate as P	0.66		mg/L

Detected Pesticides

DDE(p,p')	0.027	=
Diuron	21	=

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Los Banos Creek at China Camp Road	3/13/2012	89	Selenastrum capricornutum	1,760,000	2,185,000	19%	cells/ml

Followup: Toxicity was not sufficient to require follow up testing. No pesticides were detected in the sample and the cause of toxicity is not known.

Field Data

DO	10	mg/l
EC	2132	µmhos/cm
Est Depth	2.58	ft
Flow	0	cfs
pH	8.28	
Staff Gage		ft
Temp	13.52	c

Water Chemistry

Bromide	0.92	DNQ	mg/L
Dissolved Organic Carbon	3.6		mg/L
E. coli	150		MPN/100m
Total Organic Carbon	4.2		mg/L
Dissolved Solids	1400		mg/L
Hardness (as CACO3)	460		mg/L
Suspended Solids	295		mg/L
Turbidity	60		NTU
Arsenic	11		ug/L
Boron	1910		ug/L
Cadmium	-0.04	ND	ug/L
Cadmium (Dissolved)	-0.04	ND	ug/L
Copper	1.9		ug/L
Copper (Dissolved)	1.3		ug/L
Lead	0.22	DNQ	ug/L
Lead (Dissolved)	-0.03	ND	ug/L
Nickel	3.8		ug/L
Nickel (Dissolved)	2.1		ug/L
Selenium	3.4		ug/L
Zinc	1.8		ug/L
Zinc (Dissolved)	-0.7	ND	ug/L
Ammonia as N	0.18		mg/L
Nitrate + Nitrite as N	5.9		mg/L
Nitrogen, Total Kjeldahl	1.4		mg/L
OrthoPhosphate as P	0.0080	DNQ	mg/L
Phosphate as P	0.30		mg/L

Detected Pesticides

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Westley Wasteway near Cox Road	3/13/2012	89	Selenastrum capricornutum	191,000	2,308,000	92%	cells/ml

Followup: A TIE indicated that herbicides were the likely cause of toxicity. Diuron was detected in the sample and is expected to have contributed to the toxicity.

Field Data

DO	6	mg/l
EC	930	µmhos/cm
Est Depth	4	ft
Flow	5	cfs
pH	6.55	
Staff Gage		ft
Temp	8.1	c

Water Chemistry

Bromide	0.83	DNQ	mg/L
Dissolved Organic Carbon	7.3		mg/L
E. coli	250		MPN/100m
Total Organic Carbon	7.2		mg/L
Dissolved Solids	930		mg/L
Hardness (as CACO3)	330		mg/L
Suspended Solids	87		mg/L
Turbidity	24		NTU
Arsenic	3.7		ug/L
Boron	880		ug/L
Cadmium	-0.04	ND	ug/L
Cadmium (Dissolved)	-0.04	ND	ug/L
Copper	7.5		ug/L
Copper (Dissolved)	2.0		ug/L
Lead	2.2		ug/L
Lead (Dissolved)	-0.03	ND	ug/L
Nickel	12		ug/L
Nickel (Dissolved)	2.9		ug/L
Selenium	0.96	DNQ	ug/L
Zinc	23		ug/L
Zinc (Dissolved)	5.0		ug/L
Ammonia as N	0.20		mg/L
Nitrate + Nitrite as N	2.3		mg/L
Nitrogen, Total Kjeldahl	1.9		mg/L
OrthoPhosphate as P	0.058		mg/L
Phosphate as P	0.22		mg/L

Detected Pesticides

DDE(p,p')	0.0074	DNQ
Dimethoate	0.12	=
Diuron	19	=

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Poso Slough at Indiana Ave	4/10/2012	90	Ceriodaphnia dubia	0	100	100%	%

Followup: A dilution series measured 2.9 toxic units and a TIE indicated that the probable cause of toxicity was metabolically activated compounds. Chlorpyrifos was detected in the sample and suspected of contributing to the toxicity.

Field Data

DO	10	mg/l
EC	1282	µmhos/cm
Est Depth	1.31	ft
Flow	6.4	cfs
pH	7.9	
Staff Gage		ft
Temp	20	c

Water Chemistry

Bromide	0.51	DNQ	mg/L
Dissolved Organic Carbon	6.5		mg/L
E. coli	360		MPN/100m
Total Organic Carbon	7.8		mg/L
Dissolved Solids	790		mg/L
Hardness (as CACO3)	310		mg/L
Suspended Solids	158		mg/L
Turbidity	45		NTU
Arsenic	5.0		ug/L
Boron	562		ug/L
Cadmium	0.04	DNQ	ug/L
Cadmium (Dissolved)	-0.04	ND	ug/L
Copper	4.0		ug/L
Copper (Dissolved)	2.0		ug/L
Lead	0.87		ug/L
Lead (Dissolved)	-0.03	ND	ug/L
Nickel	6.0		ug/L
Nickel (Dissolved)	2.5		ug/L
Selenium	1.4		ug/L
Zinc	7.9		ug/L
Zinc (Dissolved)	1	DNQ	ug/L
Ammonia as N	1.2		mg/L
Nitrate + Nitrite as N	1.6		mg/L
Nitrogen, Total Kjeldahl	2.6		mg/L
OrthoPhosphate as P	0.26		mg/L
Phosphate as P	0.31		mg/L

Detected Pesticides

Chlorpyrifos	0.66	=
Diuron	0.29	DNQ
Prowl	1.0	=

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Turner Slough at Edminster Road	4/10/2012	90	Pimephales promelas	83	100	18%	%

Followup: The toxicity was not sufficient to require follow up testing. No pesticides were detected and the cause is not known.

Field Data

DO	6	mg/l
EC	312	µmhos/cm
Est Depth		ft
Flow	0	cfs
pH	8.38	
Staff Gage		ft
Temp	16.01	c

Water Chemistry

Bromide	0.026	DNQ	mg/L
Dissolved Organic Carbon	4.8		mg/L
E. coli	580		MPN/100m
Total Organic Carbon	6.2		mg/L
Dissolved Solids	200		mg/L
Hardness (as CACO3)	120		mg/L
Suspended Solids	33		mg/L
Turbidity	12		NTU
Ammonia as N	0.11		mg/L
Nitrate + Nitrite as N	2.3		mg/L
Nitrogen, Total Kjeldahl	1.2		mg/L
OrthoPhosphate as P	0.19		mg/L
Phosphate as P	0.20		mg/L

Detected Pesticides

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Del Puerto Creek near Cox Road	5/8/2012	91	Ceriodaphnia dubia	5	95	95%	%

Followup: A TIE was performed but toxicity was not persistent and the cause of toxicity could not be determined. No insecticides were detected in the sample.

Field Data

DO	5.79	mg/l
EC	833	µmhos/cm
Est Depth	1	ft
Flow	18	cfs
pH	7.08	
Staff Gage		ft
Temp	11.95	c

Water Chemistry

Bromide	0.44	DNQ	mg/L
Dissolved Organic Carbon	3.1		mg/L
E. coli	26		MPN/100m
Total Organic Carbon	3.3		mg/L
Dissolved Solids	660		mg/L
Hardness (as CACO3)	310		mg/L
Suspended Solids	104		mg/L
Turbidity	16		NTU
Ammonia as N	0.11		mg/L
Nitrate + Nitrite as N	6.1		mg/L
Nitrogen, Total Kjeldahl	0.75		mg/L
OrthoPhosphate as P	0.11		mg/L
Phosphate as P	0.19		mg/L

Detected Pesticides

Diuron	0.21	DNQ

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Orestimba Creek at Hwy 33	5/8/2012	91	Selenastrum capricornutum	1,278,000	2,320,000	45%	cells/ml

Followup: Toxicity was not sufficient to rquire follow up testing. Prowl was detected in the sample and may have contributed to the toxicity.

Field Data

DO	4.36	mg/l
EC	1187	µmhos/cm
Est Depth		ft
Flow	0	cfs
pH	6.99	
Staff Gage		ft
Temp	16.51	c

Water Chemistry

Hardness (as CACO3)	410		mg/L
Arsenic	2.2		ug/L
Boron	405		ug/L
Cadmium	-0.04	ND	ug/L
Cadmium (Dissolved)	-0.04	ND	ug/L
Copper	3.5		ug/L
Copper (Dissolved)	2.0		ug/L
Lead	0.36		ug/L
Lead (Dissolved)	-0.03	ND	ug/L
Nickel	4.3		ug/L
Nickel (Dissolved)	3.3		ug/L
Selenium	6.1		ug/L
Zinc	17		ug/L
Zinc (Dissolved)	6.1		ug/L

Detected Pesticides

Prowl	2.1	=

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Poso Slough at Indiana Ave	5/8/2012	91	Selenastrum capricornutum	1,198,000	2,318,000	48%	cells/ml

Followup: Toxicity was not sufficient to require follow up testing. Diuron was present in the sample and is expected to have contributed to the toxicity.

Field Data

DO	5.66	mg/l
EC	912	µmhos/cm
Est Depth	2.21	ft
Flow	31.74	cfs
pH	7.61	
Staff Gage		ft
Temp	22.82	c

Water Chemistry

Bromide	0.32	DNQ	mg/L
Dissolved Organic Carbon	8.1		mg/L
E. coli	2400	>	MPN/100m
Total Organic Carbon	10		mg/L
Dissolved Solids	550		mg/L
Hardness (as CACO3)	210		mg/L
Suspended Solids	308		mg/L
Turbidity	24		NTU
Arsenic	9.3		ug/L
Boron	375		ug/L
Cadmium	0.11		ug/L
Cadmium (Dissolved)	-0.04	ND	ug/L
Copper	9.4		ug/L
Copper (Dissolved)	2.1		ug/L
Lead	2.9		ug/L
Lead (Dissolved)	-0.03	ND	ug/L
Nickel	12		ug/L
Nickel (Dissolved)	2.9		ug/L
Selenium	0.46	DNQ	ug/L
Zinc	24		ug/L
Zinc (Dissolved)	-0.7	ND	ug/L
Ammonia as N	1.1		mg/L
Nitrate + Nitrite as N	0.70		mg/L
Nitrogen, Total Kjeldahl	3.4		mg/L
OrthoPhosphate as P	1.3		mg/L
Phosphate as P	1.6		mg/L

Detected Pesticides

Diuron	3.1	=
Prowl	0.78	=
Trifluralin	0.96	=

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Los Banos Creek at China Camp Road	6/12/2012	92	Selenastrum capricornutum	1,823,000	2,353,000	23%	cells/ml

Followup: Toxicity was not sufficient to require follow up testing and no pesticides were detected. Cause of toxicity is not known.

Field Data

DO	10.37	mg/l
EC	2299	µmhos/cm
Est Depth	2.5	ft
Flow	0	cfs
pH	8.19	
Staff Gage	1.59	ft
Temp	21.26	c

Water Chemistry

Bromide	0.71	DNQ	mg/L
Dissolved Organic Carbon	4.7		mg/L
E. coli	310		MPN/100m
Total Organic Carbon	43		mg/L
Dissolved Solids	1500		mg/L
Hardness (as CACO3)	770		mg/L
Suspended Solids	114		mg/L
Turbidity	50		NTU
Arsenic	22		ug/L
Boron	2440		ug/L
Cadmium	0.25		ug/L
Cadmium (Dissolved)	-0.04	ND	ug/L
Copper	24		ug/L
Copper (Dissolved)	1.5		ug/L
Lead	6.4		ug/L
Lead (Dissolved)	-0.03	ND	ug/L
Nickel	58		ug/L
Nickel (Dissolved)	2.2		ug/L
Selenium	5.1		ug/L
Zinc	53		ug/L
Zinc (Dissolved)	-0.7	ND	ug/L
Ammonia as N	0.82		mg/L
Nitrate + Nitrite as N	5.6		mg/L
Nitrogen, Total Kjeldahl	16		mg/L
OrthoPhosphate as P	0.015		mg/L
Phosphate as P	0.75		mg/L

Detected Pesticides

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Monitoring Site	Sample Date	Event	Reactive Species	Results	Control Results	Percent Difference	Units
Orestimba Creek at Hwy 33	6/12/2012	92	Selenastrum capricornutum	1,063,000	2,208,000	52%	cells/ml

Followup: A TIE was performed but toxicity was not persistent. No herbicides were present in the sample and the cause of toxicity is not known.

Field Data

DO	4.55	mg/l
EC	1178	µmhos/cm
Est Depth	2	ft
Flow	0	cfs
pH	7.99	
Staff Gage		ft
Temp	13.1	c

Water Chemistry

Hardness (as CACO3)	470		mg/L
Arsenic	3.1		ug/L
Boron	455		ug/L
Cadmium	-0.04	ND	ug/L
Cadmium (Dissolved)	-0.04	ND	ug/L
Copper	6.3		ug/L
Copper (Dissolved)	2		ug/L
Lead	1.3		ug/L
Lead (Dissolved)	-0.03	ND	ug/L
Nickel	8.4		ug/L
Nickel (Dissolved)	2.8		ug/L
Selenium	7.8		ug/L
Zinc	12		ug/L
Zinc (Dissolved)	6.6		ug/L

Detected Pesticides

DDE(p,p')	0.028	=

DNQ = Estimated value, below reporting limit.
Y = % Difference primary and confirmation column is >40%.
B = Constituent also detected in blank sample.

Attachment 3
Field Quality Control Sample Results

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD
Sample Date: 3/13/2012	**Site: Poso Slough at Indiana Ave**						
Ammonia as N	General Chemistry	8.7		8.9		mg/L	2%
Arsenic	General Chemistry	8.4		8.5		ug/L	1%
Boron	General Chemistry	433		432		ug/L	0%
Bromide	General Chemistry	0.80	DNQ	0.74	DNQ	mg/L	8%
Cadmium	General Chemistry	0.06	DNQ	0.07	DNQ	ug/L	15%
Cadmium (Dissolved)	General Chemistry	-0.04	ND	-0.04	ND	ug/L	NA
Copper	General Chemistry	6.5		6.4		ug/L	2%
Copper (Dissolved)	General Chemistry	2.5		2.4		ug/L	4%
Dissolved Organic Carbon	General Chemistry	5.6		5.4		mg/L	4%
E. coli	General Chemistry	190		150		MPN/100mL	24%
Hardness (as CACO3)	General Chemistry	270		240		mg/L	12%
Lead	General Chemistry	1.6		1.6		ug/L	0%
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA
Nickel	General Chemistry	8.0		7.9		ug/L	1%
Nickel (Dissolved)	General Chemistry	2.3		2.2		ug/L	4%
Nitrate + Nitrite as N	General Chemistry	2.4		2.4		mg/L	0%
Nitrogen, Total Kjeldahl	General Chemistry	9.5		9.8		mg/L	3%
OrthoPhosphate as P	General Chemistry	0.32		0.33		mg/L	3%
Phosphate as P	General Chemistry	0.48		0.49		mg/L	2%
Selenium	General Chemistry	1.1		1.1		ug/L	0%
Suspended Solids	General Chemistry	111		114		mg/L	3%
Total Organic Carbon	General Chemistry	5.5		5.8		mg/L	5%
Turbidity	General Chemistry	50		55		NTU	10%
Zinc	General Chemistry	15		15		ug/L	0%
Zinc (Dissolved)	General Chemistry	-0.7	ND	-0.7	ND	ug/L	NA
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlorpyrifos	Pesticide	0.0076	DNQ	0.0078	DNQ	ug/L	3%
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD	
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA	
Diuron	Pesticide	0.24	DNQ	0.23	DNQ	ug/L	4%	
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA	
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA	
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Malathion	Pesticide	0.25	=	0.25	=	ug/L	0%	
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA	
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA	
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA	
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA	
Prowl	Pesticide	1.2	=	1.2	=	ug/L	0%	
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA	
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA	
Trifluralin	Pesticide	0.049	DNQ	0.049	DNQ	ug/L	0%	
Sample Date: 4/10/2012	**Site: Poso Slough at Indiana Ave**							
Ammonia as N	General Chemistry	1.2		1.2		mg/L	0%	
Arsenic	General Chemistry	5.0		4.9		ug/L	2%	
Boron	General Chemistry	562		574		ug/L	2%	
Bromide	General Chemistry	0.51	DNQ	0.50	DNQ	mg/L	2%	
Cadmium	General Chemistry	0.04	DNQ	0.04	DNQ	ug/L	0%	
Cadmium (Dissolved)	General Chemistry	-0.04	ND	-0.04	ND	ug/L	NA	
Copper	General Chemistry	4.0		4.1		ug/L	2%	
Copper (Dissolved)	General Chemistry	2.0		2.0		ug/L	0%	
Dissolved Organic Carbon	General Chemistry	6.5		6.5		mg/L	0%	
E. coli	General Chemistry	360		520		MPN/100mL	36%	*
Hardness (as CACO3)	General Chemistry	310		320		mg/L	3%	
Lead	General Chemistry	0.87		0.84		ug/L	4%	

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD	
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA	
Nickel	General Chemistry	6.0		5.8		ug/L	3%	
Nickel (Dissolved)	General Chemistry	2.5		2.6		ug/L	4%	
Nitrate + Nitrite as N	General Chemistry	1.6		1.6		mg/L	0%	
Nitrogen, Total Kjeldahl	General Chemistry	2.6		2.7		mg/L	4%	
OrthoPhosphate as P	General Chemistry	0.26		0.28		mg/L	7%	
Phosphate as P	General Chemistry	0.31		0.33		mg/L	6%	
Selenium	General Chemistry	1.4		1.5		ug/L	7%	
Suspended Solids	General Chemistry	158		157		mg/L	1%	
Total Organic Carbon	General Chemistry	7.8		7.9		mg/L	1%	
Turbidity	General Chemistry	45		32		NTU	34%	*
Zinc	General Chemistry	7.9		8.0		ug/L	1%	
Zinc (Dissolved)	General Chemistry	1	DNQ	1.2		ug/L	18%	
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA	
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA	
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Chlorpyrifos	Pesticide	0.66	=	0.67	=	ug/L	2%	
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA	
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA	
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA	
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA	
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA	
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA	
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA	
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA	
Diuron	Pesticide	0.29	DNQ	0.28	DNQ	ug/L	4%	
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA	
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA	
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD	
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA	
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA	
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA	
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA	
Prowl	Pesticide	1.0	=	0.55	=	ug/L	58%	*
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA	
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA	
Trifluralin	Pesticide	-0.036	ND	-0.036	ND	ug/L	NA	

Sample Date: 5/8/2012 Site: Poso Slough at Indiana Ave

Ammonia as N	General Chemistry	1.1		1.1		mg/L	0%
Arsenic	General Chemistry	9.3		9.7		ug/L	4%
Boron	General Chemistry	375		364		ug/L	3%
Bromide	General Chemistry	0.32	DNQ	0.33	DNQ	mg/L	3%
Cadmium	General Chemistry	0.11		0.10		ug/L	10%
Cadmium (Dissolved)	General Chemistry	-0.04	ND	-0.04	ND	ug/L	NA
Copper	General Chemistry	9.4		10		ug/L	6%
Copper (Dissolved)	General Chemistry	2.1		2.0		ug/L	5%
Dissolved Organic Carbon	General Chemistry	8.1		8.2		mg/L	1%
E. coli	General Chemistry	2400	>	2400	>	MPN/100mL	0%
Hardness (as CACO3)	General Chemistry	210		230		mg/L	9%
Lead	General Chemistry	2.9		3.1		ug/L	7%
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA
Nickel	General Chemistry	12		12		ug/L	0%
Nickel (Dissolved)	General Chemistry	2.9		2.8		ug/L	4%
Nitrate + Nitrite as N	General Chemistry	0.70		0.75		mg/L	7%
Nitrogen, Total Kjeldahl	General Chemistry	3.4		3.9		mg/L	14%
OrthoPhosphate as P	General Chemistry	1.3		1.4		mg/L	7%
Phosphate as P	General Chemistry	1.6		1.6		mg/L	0%
Selenium	General Chemistry	0.46	DNQ	0.48	DNQ	ug/L	4%
Suspended Solids	General Chemistry	308		300		mg/L	3%
Total Organic Carbon	General Chemistry	10		8.7		mg/L	14%
Turbidity	General Chemistry	24		24		NTU	0%
Zinc	General Chemistry	24		26		ug/L	8%
Zinc (Dissolved)	General Chemistry	-0.7	ND	1	DNQ	ug/L	NA
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlorpyrifos	Pesticide	-0.0026	ND	-0.0026	ND	ug/L	NA
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA
Diuron	Pesticide	3.1	=	3.1	=	ug/L	0%
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA
Prowl	Pesticide	0.78	=	0.77	=	ug/L	1%
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD
Trifluralin	Pesticide	0.96	=	0.84	=	ug/L	13%

Sample Date: 6/12/2012 Site: Poso Slough at Indiana Ave

Ammonia as N	General Chemistry	1.8		1.9		mg/L	5%
Arsenic	General Chemistry	8.4		8.4		ug/L	0%
Boron	General Chemistry	331		332		ug/L	0%
Bromide	General Chemistry	0.28	DNQ	0.26	DNQ	mg/L	7%
Cadmium	General Chemistry	0.13		0.13		ug/L	0%
Cadmium (Dissolved)	General Chemistry	-0.04	ND	-0.04	ND	ug/L	NA
Copper	General Chemistry	13		13		ug/L	0%
Copper (Dissolved)	General Chemistry	2.5		2.3		ug/L	8%
Dissolved Organic Carbon	General Chemistry	6.7		6.9		mg/L	3%
E. coli	General Chemistry	310		370		MPN/100mL	18%
Hardness (as CACO3)	General Chemistry	220		190		mg/L	15%
Lead	General Chemistry	3.9		3.9		ug/L	0%
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA
Nickel	General Chemistry	17		16		ug/L	6%
Nickel (Dissolved)	General Chemistry	2.8		2.8		ug/L	0%
Nitrate + Nitrite as N	General Chemistry	4		3.9		mg/L	3%
Nitrogen, Total Kjeldahl	General Chemistry	4.4		4.4		mg/L	0%
OrthoPhosphate as P	General Chemistry	0.31		0.31		mg/L	0%
Phosphate as P	General Chemistry	0.5		0.53		mg/L	6%
Selenium	General Chemistry	0.76	DNQ	0.71	DNQ	ug/L	7%
Suspended Solids	General Chemistry	329		362		mg/L	10%
Total Organic Carbon	General Chemistry	7.6		8.4		mg/L	10%
Turbidity	General Chemistry	160		160		NTU	0%
Zinc	General Chemistry	34		34		ug/L	0%
Zinc (Dissolved)	General Chemistry	-0.7	ND	-0.7	ND	ug/L	NA
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlorpyrifos	Pesticide	-0.0026	ND	-0.0026	ND	ug/L	NA
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD	
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA	
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA	
Diuron	Pesticide	0.27	DNQ	0.27	DNQ	ug/L	0%	
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA	
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA	
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA	
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA	
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA	
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA	
Prowl	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA	
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA	
Trifluralin	Pesticide	-0.036	ND	-0.036	ND	ug/L	NA	
Sample Date: 7/10/2012	**Site: Poso Slough at Indiana Ave**							
Ammonia as N	General Chemistry	1.3		1.2		mg/L	8%	
Arsenic	General Chemistry	9.8		9.1		ug/L	7%	
Boron	General Chemistry	284		255		ug/L	11%	
Bromide	General Chemistry	0.25	DNQ	0.27	DNQ	mg/L	8%	
Cadmium	General Chemistry	0.16		0.14		ug/L	13%	
Cadmium (Dissolved)	General Chemistry	-0.05	ND	-0.05	ND	ug/L	NA	
Copper	General Chemistry	15		13		ug/L	14%	
Copper (Dissolved)	General Chemistry	2		2		ug/L	0%	
Dissolved Organic Carbon	General Chemistry	6		6		mg/L	0%	
E. coli	General Chemistry	81		210		MPN/100 mL	89%	*
Hardness as CaCO3	General Chemistry	170		170		mg/L	0%	

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD
Lead	General Chemistry	5.1		4.4		ug/L	15%
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA
Nickel	General Chemistry	18		17		ug/L	6%
Nickel (Dissolved)	General Chemistry	2.2		2.1		ug/L	5%
Nitrate + Nitrite as N	General Chemistry	1.8		1.8		mg/L	0%
Nitrogen, Total Kjeldahl	General Chemistry	3.6		3.7		mg/L	3%
OrthoPhosphate as P	General Chemistry	0.31		0.32		mg/L	3%
Phosphate as P	General Chemistry	0.59		0.57		mg/L	3%
Selenium	General Chemistry	0.41	DNQ	0.41	DNQ	ug/L	0%
Suspended Solids	General Chemistry	440		438		mg/L	0%
Total Organic Carbon	General Chemistry	6.9		6.7		mg/L	3%
Turbidity	General Chemistry	150		150		NTU	0%
Zinc	General Chemistry	42		37		ug/L	13%
Zinc (Dissolved)	General Chemistry	-0.5	ND	-0.5	ND	ug/L	NA
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlorpyrifos	Pesticide	-0.0026	ND	-0.0026	ND	ug/L	NA
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA
Diuron	Pesticide	0.28	DNQ	0.29	DNQ	ug/L	4%
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD	
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA	
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA	
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA	
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA	
Prowl	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA	
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA	
Trifluralin	Pesticide	-0.036	ND	-0.036	ND	ug/L	NA	
Sample Date: 8/14/2012	**Site: Poso Slough at Indiana Ave**							
Ammonia as N	General Chemistry	0.24		0.198	DNQ	mg/L	19%	
Arsenic	General Chemistry	8.2		8.3		ug/L	1%	
Boron	General Chemistry	297		290		ug/L	2%	
Bromide	General Chemistry	0.32	DNQ	0.33	DNQ	mg/L	3%	
Cadmium	General Chemistry	0.12		0.22		ug/L	59%	*
Cadmium (Dissolved)	General Chemistry	-0.05	ND	-0.05	ND	ug/L	NA	
Copper	General Chemistry	13		17		ug/L	27%	*
Copper (Dissolved)	General Chemistry	1.7		1.7		ug/L	0%	
Dissolved Organic Carbon	General Chemistry	4.8		4.8		mg/L	0%	
E. coli	General Chemistry	2400	>	2400	>	MPN/100 mL	0%	
Hardness as CaCO3	General Chemistry	180		180		mg/L	0%	
Lead	General Chemistry	4.7		5.2		ug/L	10%	
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA	
Nickel	General Chemistry	17		18		ug/L	6%	
Nickel (Dissolved)	General Chemistry	2		2		ug/L	0%	
Nitrate + Nitrite as N	General Chemistry	0.94		0.88		mg/L	7%	
Nitrogen, Total Kjeldahl	General Chemistry	1.7		2.5		mg/L	38%	*
OrthoPhosphate as P	General Chemistry	0.3		0.24		mg/L	22%	
Phosphate as P	General Chemistry	0.72		0.8		mg/L	11%	
Selenium	General Chemistry	0.52	DNQ	0.55	DNQ	ug/L	6%	
Suspended Solids	General Chemistry	378		380		mg/L	1%	
Total Organic Carbon	General Chemistry	4.7		4.4		mg/L	7%	
Turbidity	General Chemistry	150		150		NTU	0%	
Zinc	General Chemistry	39		37		ug/L	5%	
Zinc (Dissolved)	General Chemistry	-0.5	ND	-0.5	ND	ug/L	NA	

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlorpyrifos	Pesticide	-0.0026	ND	-0.0026	ND	ug/L	NA
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Dimethoate	Pesticide	0.14	=	-0.080	ND	ug/L	NA
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA
Diuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA
Prowl	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Duplicate and RPD Calculation

Analyte/Species	Type	Event	QC Code	FD	QC Code	Units	RPD
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA
Trifluralin	Pesticide	-0.036	ND	-0.036	ND	ug/L	NA

Event = Event Sample Results FD = Field Duplicate Sample Results RPD = Relative percent difference

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference	
Sample Date: 3/13/2012 Site: Poso Slough at Indiana Ave								
Ammonia as N	General Chemistry	8.7		-0.040	ND	mg/L	NA	
Arsenic	General Chemistry	8.4		-0.02	ND	ug/L	NA	
Boron	General Chemistry	433		-0.7	ND	ug/L	NA	
Bromide	General Chemistry	0.80	DNQ	-0.010	ND	mg/L	NA	
Cadmium	General Chemistry	0.06	DNQ	-0.04	ND	ug/L	NA	
Cadmium (Dissolved)	General Chemistry	-0.04	ND	-0.04	ND	ug/L	NA	
Copper	General Chemistry	6.5		3.2		ug/L	51%	*
Copper (Dissolved)	General Chemistry	2.5		3.0		ug/L	20%	*
Dissolved Organic Carbon	General Chemistry	5.6		-0.30	ND	mg/L	NA	
Dissolved Solids	General Chemistry	680		-4.0	ND	mg/L	NA	
E. coli	General Chemistry	190		-1.0	ND	MPN/100mL	NA	
Hardness (as CACO3)	General Chemistry	270		-1.7	ND	mg/L	NA	
Lead	General Chemistry	1.6		-0.03	ND	ug/L	NA	
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA	
Nickel	General Chemistry	8.0		0.09	DNQ	ug/L	99%	
Nickel (Dissolved)	General Chemistry	2.3		0.06	DNQ	ug/L	97%	
Nitrate + Nitrite as N	General Chemistry	2.4		-0.020	ND	mg/L	NA	
Nitrogen, Total Kjeldahl	General Chemistry	9.5		-0.070	ND	mg/L	NA	
OrthoPhosphate as P	General Chemistry	0.32		-0.0060	ND	mg/L	NA	
Phosphate as P	General Chemistry	0.48		-0.0070	ND	mg/L	NA	
Selenium	General Chemistry	1.1		-0.06	ND	ug/L	NA	
Suspended Solids	General Chemistry	111		-1	ND	mg/L	NA	
Total Organic Carbon	General Chemistry	5.5		-0.30	ND	mg/L	NA	
Turbidity	General Chemistry	50		-0.030	ND	NTU	NA	
Zinc	General Chemistry	15		1.8		ug/L	88%	
Zinc (Dissolved)	General Chemistry	-0.7	ND	1.5		ug/L	NA	*
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA	
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA	
Azinphos methyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Chlordane, Alpha-	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
Chlordane, gamma-	Pesticide	-0.006	ND	-0.006	ND	ug/L	NA	
Chlorpyrifos	Pesticide	0.0076	DNQ	0.0038	DNQ	ug/L	50%	*
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA	
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA	
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA	
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA	
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA	
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA	

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA
Diuron	Pesticide	0.24	DNQ	-0.20	ND	ug/L	NA
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Malathion	Pesticide	0.25	=	-0.050	ND	ug/L	NA
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA
Prowl	Pesticide	1.2	=	-0.04	ND	ug/L	NA
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA
Trifluralin	Pesticide	0.049	DNQ	-0.036	ND	ug/L	NA
Sample Date: 4/10/2012 Site: Poso Slough at Indiana Ave							
Ammonia as N	General Chemistry	1.2		-0.040	ND	mg/L	NA
Arsenic	General Chemistry	5.0		-0.02	ND	ug/L	NA
Boron	General Chemistry	562		-0.7	ND	ug/L	NA
Bromide	General Chemistry	0.51	DNQ	-0.010	ND	mg/L	NA
Cadmium	General Chemistry	0.04	DNQ	-0.04	ND	ug/L	NA
Cadmium (Dissolved)	General Chemistry	-0.04	ND	-0.04	ND	ug/L	NA
Copper	General Chemistry	4.0		-0.07	ND	ug/L	NA
Copper (Dissolved)	General Chemistry	2.0		-0.07	ND	ug/L	NA
Dissolved Organic Carbon	General Chemistry	6.5		-0.30	ND	mg/L	NA
Dissolved Solids	General Chemistry	790		-4.0	ND	mg/L	NA
E. coli	General Chemistry	360		-1.0	ND	MPN/100mL	NA
Hardness (as CACO3)	General Chemistry	310		-1.7	ND	mg/L	NA

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference
Lead	General Chemistry	0.87		-0.03	ND	ug/L	NA
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA
Nickel	General Chemistry	6.0		-0.04	ND	ug/L	NA
Nickel (Dissolved)	General Chemistry	2.5		-0.04	ND	ug/L	NA
Nitrate + Nitrite as N	General Chemistry	1.6		-0.020	ND	mg/L	NA
Nitrogen, Total Kjeldahl	General Chemistry	2.6		-0.070	ND	mg/L	NA
OrthoPhosphate as P	General Chemistry	0.26		-0.0060	ND	mg/L	NA
Phosphate as P	General Chemistry	0.31		-0.0070	ND	mg/L	NA
Selenium	General Chemistry	1.4		-0.06	ND	ug/L	NA
Suspended Solids	General Chemistry	158		-1	ND	mg/L	NA
Total Organic Carbon	General Chemistry	7.8		-0.30	ND	mg/L	NA
Turbidity	General Chemistry	45		-0.030	ND	NTU	NA
Zinc	General Chemistry	7.9		-0.7	ND	ug/L	NA
Zinc (Dissolved)	General Chemistry	1	DNQ	-0.7	ND	ug/L	NA
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Azinphos methyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlordane, Alpha-	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Chlordane, gamma-	Pesticide	-0.006	ND	-0.006	ND	ug/L	NA
Chlorpyrifos	Pesticide	0.66	=	-0.0026	ND	ug/L	NA
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA
Diuron	Pesticide	0.29	DNQ	-0.20	ND	ug/L	NA
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA
Prowl	Pesticide	1.0	=	-0.04	ND	ug/L	NA
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA
Trifluralin	Pesticide	-0.036	ND	-0.036	ND	ug/L	NA
Sample Date: 5/8/2012 Site: Poso Slough at Indiana Ave							
Ammonia as N	General Chemistry	1.1		-0.040	ND	mg/L	NA
Arsenic	General Chemistry	9.3		0.02	DNQ	ug/L	100%
Boron	General Chemistry	375		-0.7	ND	ug/L	NA
Bromide	General Chemistry	0.32	DNQ	-0.010	ND	mg/L	NA
Cadmium	General Chemistry	0.11		-0.04	ND	ug/L	NA
Cadmium (Dissolved)	General Chemistry	-0.04	ND	-0.04	ND	ug/L	NA
Copper (Dissolved)	General Chemistry	2.1		-0.07	ND	ug/L	NA
Dissolved Organic Carbon	General Chemistry	8.1		0.40	DNQ	mg/L	95%
Dissolved Solids	General Chemistry	550		-4.0	ND	mg/L	NA
E. coli	General Chemistry	2400	>	-1.0	ND	MPN/100mL	NA
Hardness (as CACO3)	General Chemistry	210		-1.7	ND	mg/L	NA
Lead	General Chemistry	2.9		0.03	DNQ	ug/L	99%
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA
Nickel	General Chemistry	12		-0.04	ND	ug/L	NA
Nickel (Dissolved)	General Chemistry	2.9		-0.04	ND	ug/L	NA
Nitrate + Nitrite as N	General Chemistry	0.70		0.042	DNQ	mg/L	94%
Nitrogen, Total Kjeldahl	General Chemistry	3.4		-0.070	ND	mg/L	NA
OrthoPhosphate as P	General Chemistry	1.3		-0.0060	ND	mg/L	NA
Phosphate as P	General Chemistry	1.6		-0.0070	ND	mg/L	NA
Selenium	General Chemistry	0.46	DNQ	-0.06	ND	ug/L	NA
Suspended Solids	General Chemistry	308		-1	ND	mg/L	NA
Total Organic Carbon	General Chemistry	10		-0.30	ND	mg/L	NA
Turbidity	General Chemistry	24		-0.030	ND	NTU	NA
Zinc	General Chemistry	24		-0.7	ND	ug/L	NA
Zinc (Dissolved)	General Chemistry	-0.7	ND	-0.7	ND	ug/L	NA
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Azinphos methyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlordane, Alpha-	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Chlordane, gamma-	Pesticide	-0.006	ND	-0.006	ND	ug/L	NA
Chlorpyrifos	Pesticide	-0.0026	ND	-0.0026	ND	ug/L	NA
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA
Diuron	Pesticide	3.1	=	-0.20	ND	ug/L	NA
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA
Prowl	Pesticide	0.78	=	-0.04	ND	ug/L	NA
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA
Trifluralin	Pesticide	0.96	=	-0.036	ND	ug/L	NA
Sample Date: 6/12/2012 Site: Poso Slough at Indiana Ave							
Ammonia as N	General Chemistry	1.8		-0.04	ND	mg/L	NA
Arsenic	General Chemistry	8.4		0.1	DNQ	ug/L	99%
Boron	General Chemistry	331		-0.7	ND	ug/L	NA
Bromide	General Chemistry	0.28	DNQ	-0.01	ND	mg/L	NA
Cadmium	General Chemistry	0.13		-0.04	ND	ug/L	NA
Cadmium (Dissolved)	General Chemistry	-0.04	ND	-0.04	ND	ug/L	NA
Copper	General Chemistry	13		-0.07	ND	ug/L	NA
Copper (Dissolved)	General Chemistry	2.5		-0.07	ND	ug/L	NA
Dissolved Organic Carbon	General Chemistry	6.7		0.6		mg/L	91%
Dissolved Solids	General Chemistry	490		-4	ND	mg/L	NA
E. coli	General Chemistry	310		-1	ND	MPN/100mL	NA
Hardness (as CACO3)	General Chemistry	220		-1.7	ND	mg/L	NA
Lead	General Chemistry	3.9		-0.03	ND	ug/L	NA
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA
Nickel	General Chemistry	17		-0.04	ND	ug/L	NA
Nickel (Dissolved)	General Chemistry	2.8		-0.04	ND	ug/L	NA
Nitrate + Nitrite as N	General Chemistry	4		-0.02	ND	mg/L	NA
Nitrogen, Total Kjeldahl	General Chemistry	4.4		-0.07	ND	mg/L	NA
OrthoPhosphate as P	General Chemistry	0.31		-0.006	ND	mg/L	NA
Phosphate as P	General Chemistry	0.5		-0.007	ND	mg/L	NA
Selenium	General Chemistry	0.76	DNQ	-0.06	ND	ug/L	NA
Suspended Solids	General Chemistry	329		-1	ND	mg/L	NA
Total Organic Carbon	General Chemistry	7.6		1		mg/L	87%
Turbidity	General Chemistry	160		-0.03	ND	NTU	NA
Zinc	General Chemistry	34		-0.7	ND	ug/L	NA
Zinc (Dissolved)	General Chemistry	-0.7	ND	-0.7	ND	ug/L	NA
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Azinphos methyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlordane, Alpha-	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Chlordane, gamma-	Pesticide	-0.006	ND	-0.006	ND	ug/L	NA
Chlorpyrifos	Pesticide	-0.0026	ND	-0.0026	ND	ug/L	NA
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference	
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA	
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA	
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA	
Diuron	Pesticide	0.27	DNQ	-0.20	ND	ug/L	NA	
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA	
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA	
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA	
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA	
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA	
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA	
Prowl	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA	
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA	
Trifluralin	Pesticide	-0.036	ND	-0.036	ND	ug/L	NA	
Sample Date: 7/10/2012 Site: Poso Slough at Indiana Ave								
Ammonia as N	General Chemistry	1.3		-0.04	ND	mg/L	NA	
Arsenic	General Chemistry	9.8		-0.06	ND	ug/L	NA	
Boron	General Chemistry	284		-2	ND	ug/L	NA	
Bromide	General Chemistry	0.25	DNQ	-0.01	ND	mg/L	NA	
Cadmium	General Chemistry	0.16		-0.05	ND	ug/L	NA	
Cadmium (Dissolved)	General Chemistry	-0.05	ND	-0.05	ND	ug/L	NA	
Copper	General Chemistry	15		-0.07	ND	ug/L	NA	
Copper (Dissolved)	General Chemistry	2		0.26	DNQ	ug/L	87%	
Dissolved Organic Carbon	General Chemistry	6		1.6		mg/L	73%	*
Dissolved Solids	General Chemistry	400		-4	ND	mg/L	NA	

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference
E. coli	General Chemistry	81		-1	ND	MPN/100 mL	NA
Hardness as CaCO3	General Chemistry	170		-1.7	ND	mg/L	NA
Lead	General Chemistry	5.1		-0.03	ND	ug/L	NA
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA
Nickel	General Chemistry	18		-0.06	ND	ug/L	NA
Nickel (Dissolved)	General Chemistry	2.2		-0.06	ND	ug/L	NA
Nitrate + Nitrite as N	General Chemistry	1.8		-0.02	ND	mg/L	NA
Nitrogen, Total Kjeldahl	General Chemistry	3.6		-0.07	ND	mg/L	NA
OrthoPhosphate as P	General Chemistry	0.31		-0.006	ND	mg/L	NA
Phosphate as P	General Chemistry	0.59		-0.007	ND	mg/L	NA
Selenium	General Chemistry	0.41	DNQ	-0.06	ND	ug/L	NA
Suspended Solids	General Chemistry	440		-2	ND	mg/L	NA
Total Organic Carbon	General Chemistry	6.9		0.37	DNQ	mg/L	95%
Turbidity	General Chemistry	150		-0.03	ND	NTU	NA
Zinc	General Chemistry	42		-0.5	ND	ug/L	NA
Zinc (Dissolved)	General Chemistry	-0.5	ND	-0.5	ND	ug/L	NA
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Azinphos methyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlordane, Alpha-	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Chlordane, gamma-	Pesticide	-0.006	ND	-0.006	ND	ug/L	NA
Chlorpyrifos	Pesticide	-0.0026	ND	-0.0026	ND	ug/L	NA
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Dimethoate	Pesticide	-0.080	ND	-0.080	ND	ug/L	NA
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA
Diuron	Pesticide	0.28	DNQ	-0.20	ND	ug/L	NA
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference	
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA	
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA	
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA	
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA	
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA	
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA	
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA	
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA	
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA	
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA	
Prowl	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA	
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA	
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA	
Trifluralin	Pesticide	-0.036	ND	-0.036	ND	ug/L	NA	
Sample Date: 8/14/2012 Site: Poso Slough at Indiana Ave								
Ammonia as N	General Chemistry	0.24		-0.08	ND	mg/L	NA	
Arsenic	General Chemistry	8.2		-0.06	ND	ug/L	NA	
Boron	General Chemistry	297		-2	ND	ug/L	NA	
Bromide	General Chemistry	0.32	DNQ	-0.01	ND	mg/L	NA	
Cadmium	General Chemistry	0.12		-0.05	ND	ug/L	NA	
Cadmium (Dissolved)	General Chemistry	-0.05	ND	-0.05	ND	ug/L	NA	
Copper	General Chemistry	13		0.08	DNQ	ug/L	99%	
Copper (Dissolved)	General Chemistry	1.7		-0.07	ND	ug/L	NA	
Dissolved Organic Carbon	General Chemistry	4.8		1		mg/L	79%	*
Dissolved Solids	General Chemistry	480		-4	ND	mg/L	NA	
E. coli	General Chemistry	2400	>	-1	ND	MPN/100 mL	NA	
Hardness as CaCO3	General Chemistry	180		-1.7	ND	mg/L	NA	
Lead	General Chemistry	4.7		-0.03	ND	ug/L	NA	
Lead (Dissolved)	General Chemistry	-0.03	ND	-0.03	ND	ug/L	NA	
Nickel	General Chemistry	17		-0.06	ND	ug/L	NA	
Nickel (Dissolved)	General Chemistry	2		-0.06	ND	ug/L	NA	
Nitrate + Nitrite as N	General Chemistry	0.94		-0.02	ND	mg/L	NA	
Nitrogen, Total Kjeldahl	General Chemistry	1.7		0.088	DNQ	mg/L	95%	
OrthoPhosphate as P	General Chemistry	0.3		-0.006	ND	mg/L	NA	
Phosphate as P	General Chemistry	0.72		-0.007	ND	mg/L	NA	
Selenium	General Chemistry	0.52	DNQ	-0.06	ND	ug/L	NA	
Suspended Solids	General Chemistry	378		-2	ND	mg/L	NA	
Total Organic Carbon	General Chemistry	4.7		-0.3	ND	mg/L	NA	
Turbidity	General Chemistry	150		-0.03	ND	NTU	NA	

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference
Zinc	General Chemistry	39		-0.5	ND	ug/L	NA
Zinc (Dissolved)	General Chemistry	-0.5	ND	-0.5	ND	ug/L	NA
Aldicarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Aldrin	Pesticide	-0.009	ND	-0.009	ND	ug/L	NA
Atrazine	Pesticide	-0.07	ND	-0.07	ND	ug/L	NA
Azinphos methyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Carbaryl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Carbofuran	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Chlordane, Alpha-	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Chlordane, gamma-	Pesticide	-0.006	ND	-0.006	ND	ug/L	NA
Chlorpyrifos	Pesticide	-0.0026	ND	-0.0026	ND	ug/L	NA
Cyanazine	Pesticide	-0.09	ND	-0.09	ND	ug/L	NA
DDD(p,p')	Pesticide	-0.003	ND	-0.003	ND	ug/L	NA
DDE(p,p')	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
DDT(p,p')	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Demeton-s	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Diazinon	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Dichlorvos	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Dicofol	Pesticide	-0.01	ND	-0.01	ND	ug/L	NA
Dieldrin	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Dimethoate	Pesticide	0.14	=	-0.080	ND	ug/L	NA
Disulfoton	Pesticide	-0.020	ND	-0.020	ND	ug/L	NA
Diuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Endosulfan I	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endosulfan II	Pesticide	-0.004	ND	-0.004	ND	ug/L	NA
Endosulfan Sulfate	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Endrin	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
EPTC	Pesticide	-0.03	ND	-0.03	ND	ug/L	NA
HCH, alpha	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, beta	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
HCH, delta	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
HCH, gamma	Pesticide	-0.005	ND	-0.005	ND	ug/L	NA
Heptachlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Heptachlor epoxide	Pesticide	-0.007	ND	-0.007	ND	ug/L	NA
Linuron	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Malathion	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methamidophos	Pesticide	-0.10	ND	-0.10	ND	ug/L	NA
Methidathion	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA
Methiocarb	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Methomyl	Pesticide	-0.050	ND	-0.050	ND	ug/L	NA
Methoxychlor	Pesticide	-0.008	ND	-0.008	ND	ug/L	NA
Oxamyl	Pesticide	-0.20	ND	-0.20	ND	ug/L	NA
Parathion, Ethyl	Pesticide	-0.02	ND	-0.02	ND	ug/L	NA
Parathion, Methyl	Pesticide	-0.075	ND	-0.075	ND	ug/L	NA
Phorate	Pesticide	-0.072	ND	-0.072	ND	ug/L	NA

Event = Event Sample Result FB = Field Blank Sample Result

Field Quality Control Samples

Field Blank

Analyte/Species	Type	Event	QC Code	FB	QC Code	Units	% Difference
Phosmet	Pesticide	-0.06	ND	-0.06	ND	ug/L	NA
Prowl	Pesticide	-0.04	ND	-0.04	ND	ug/L	NA
Simazine	Pesticide	-0.08	ND	-0.08	ND	ug/L	NA
Toxaphene	Pesticide	-0.380	ND	-0.380	ND	ug/L	NA
Trifluralin	Pesticide	-0.036	ND	-0.036	ND	ug/L	NA

Event = Event Sample Result FB = Field Blank Sample Result

Attachment 4
Sediment Toxicity Follow-up Analyses

Sediment Toxicity Follow-up Analysis

Hospital Creek at River Road

Toxicity Results Hyalella azteca 81.25 %

Sample Event: 89 3/12/2012

Pesticide	Results	Units
4,4'-DDD	0.003 DNQ	mg/kg
4,4'-DDE	0.094	mg/kg
4,4'-DDT	0.022	mg/kg
Bifenthrin	0.31	ug/kg
Chlorpyrifos	ND	ug/kg
Cyfluthrin	ND	ug/kg
Cypermethrin	ND	ug/kg
Esfenvalerate:Fenvalerate	4.2	ug/kg
Fenpropathrin	ND	ug/kg
Lambda-Cyhalothrin	0.6	ug/kg
Permethrin	ND	ug/kg
Total Organic Carbon	5000	mg/kg

DNQ: Result is below the report limit and is estimated

Sediment Toxicity Follow-up Analysis

Ingram Creek at River Road

Toxicity Results Hyalella azteca 60 %

Sample Event: 89 3/12/2012

Pesticide	Results	Units
4,4'-DDD	0.0073	mg/kg
4,4'-DDE	0.14	mg/kg
4,4'-DDT	0.037	mg/kg
Bifenthrin	2	ug/kg
Chlorpyrifos	0.91	ug/kg
Esfenvalerate:Fenvalerate	1.2	ug/kg
Fenpropathrin	0.15 DNQ	ug/kg
Lambda-Cyhalothrin	7.1	ug/kg
Total Organic Carbon	9200	mg/kg

DNQ: Result is below the report limit and is estimated

Sediment Toxicity Follow-up Analysis

Orestimba Creek at Hwy 33

Toxicity Results Hyalella azteca 36.25 %

Sample Event: 89 3/12/2012

Pesticide	Results	Units
4,4'-DDD	0.017	mg/kg
4,4'-DDE	0.33	mg/kg
4,4'-DDT	0.12	mg/kg
Bifenthrin	24.8	ug/kg
Chlorpyrifos	0.79	ug/kg
Cyfluthrin	0.57	ug/kg
Esfenvalerate:Fenvalerate	5.7	ug/kg
Lambda-Cyhalothrin	0.61	ug/kg
Permethrin	0.35	ug/kg
Total Organic Carbon	10000	mg/kg

DNQ: Result is below the report limit and is estimated

Sediment Toxicity Follow-up Analysis

Westley Wasteway near Cox Road

Toxicity Results Hyalella azteca 15 %

Sample Event: 89 3/12/2012

Pesticide	Results	Units
4,4'-DDD	0.0038 DN	mg/kg
4,4'-DDE	0.1	mg/kg
Bifenthrin	21.8	ug/kg
Chlorpyrifos	0.61	ug/kg
Cyfluthrin	0.12 DNQ	ug/kg
Esfenvalerate:Fenvalerate	1.5	ug/kg
Lambda-Cyhalothrin	2.3	ug/kg
Total Organic Carbon	17000	mg/kg

DNQ: Result is below the report limit and is estimated

Attachment 5
Exceedance of Recommended Water Quality Values

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	2	106
Aquatic Toxicity	Pimephales promelas	1	18
Aquatic Toxicity	Selenastrum capricornutum	7	46
Field Data	DO	13	133
Field Data	EC	110	133
Field Data	pH	30	154
General Chemistry	Ammonia as N	4	88
General Chemistry	Arsenic	9	46
General Chemistry	Boron	22	64
General Chemistry	E. Coli	37	106
General Chemistry	Selenium	4	46
General Chemistry	Total Dissolved Solids	86	106
Pesticide	Chlorpyrifos	7	129
Pesticide	DDE(p,p')	20	71
Pesticide	DDT(p,p')	4	71
Pesticide	Dimethoate	1	130
Pesticide	Diuron	5	106
Pesticide	Malathion	4	130
Sediment Toxicity	Hyalella azteca	3	13

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Blewett Drain at Highway 132

Type	Constituent	# of Exceedances	# of Tests
Field Data	DO	1	6
Field Data	EC	5	6
General Chemistry	Ammonia as N	1	5
General Chemistry	E. Coli	1	5
General Chemistry	Total Dissolved Solids	4	5
Pesticide	Chlorpyrifos	2	5
Pesticide	Diuron	2	5

Del Puerto Creek at Hwy 33

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	2	2
Field Data	pH	1	2

Del Puerto Creek near Cox Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	6
Field Data	EC	7	7
Field Data	pH	2	7
General Chemistry	Total Dissolved Solids	6	6
Pesticide	DDE(p,p')	2	6
Pesticide	DDT(p,p')	1	6

Delta Mendota Canal at DPWD

Type	Constituent	# of Exceedances	# of Tests
General Chemistry	Total Dissolved Solids	1	6

Hospital Creek at River Road

Type	Constituent	# of Exceedances	# of Tests
Field Data	DO	1	6
Field Data	EC	4	6
Field Data	pH	1	6
General Chemistry	Arsenic	2	5
General Chemistry	Boron	2	5
Pesticide	Chlorpyrifos	1	6

Ingram Creek at River Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Selenastrum capricornutum	1	6
Field Data	EC	7	7
Field Data	pH	2	7

General Chemistry	Arsenic	1	6
General Chemistry	Boron	4	6
General Chemistry	E. Coli	1	6
General Chemistry	Total Dissolved Solids	6	6
Pesticide	Chlorpyrifos	1	7
Pesticide	DDE(p,p')	6	6
Pesticide	DDT(p,p')	1	6
Pesticide	Diuron	1	6
Sediment Toxicity	Hyalella azteca	1	1

Los Banos Creek at China Camp Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Selenastrum capricornutum	2	6
Field Data	EC	7	7
Field Data	pH	2	9
General Chemistry	Arsenic	3	6
General Chemistry	Boron	6	6
General Chemistry	E. Coli	4	6
General Chemistry	Selenium	1	6
General Chemistry	Total Dissolved Solids	6	6

Los Banos Creek at Hwy 140

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	6	6
Field Data	pH	1	8
General Chemistry	Arsenic	3	6
General Chemistry	Boron	6	6
General Chemistry	E. Coli	6	6
General Chemistry	Total Dissolved Solids	6	6

Marshall Road Drain near River Road

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	6	6
Field Data	pH	1	6
General Chemistry	E. Coli	1	6
General Chemistry	Total Dissolved Solids	5	6
Pesticide	Chlorpyrifos	1	6

Mud Slough Upstream of San Luis Drain

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	6	6
Field Data	pH	3	8
General Chemistry	E. Coli	2	6
General Chemistry	Total Dissolved Solids	6	6

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Newman Wasteway near Hills Ferry Road

Type	Constituent	# of Exceedances	# of Tests
Field Data	DO	1	7
Field Data	EC	7	7
General Chemistry	E. Coli	4	6
General Chemistry	Total Dissolved Solids	6	6
Pesticide	Dimethoate	1	6

Orestimba Creek at Hwy 33

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Selenastrum capricornutum	2	6
Field Data	DO	4	7
Field Data	EC	6	7
Field Data	pH	1	7
General Chemistry	Selenium	3	6
Pesticide	DDE(p,p')	5	6
Pesticide	DDT(p,p')	2	6
Sediment Toxicity	Hyalella azteca	1	1

Orestimba Creek at River Road

Type	Constituent	# of Exceedances	# of Tests
Field Data	DO	1	6
Field Data	EC	5	6
Field Data	pH	3	6
General Chemistry	E. Coli	2	5
General Chemistry	Total Dissolved Solids	3	5
Pesticide	DDE(p,p')	4	5

Poso Slough at Indiana Ave

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	6
Aquatic Toxicity	Selenastrum capricornutum	1	6
Field Data	EC	5	6
Field Data	pH	2	8
General Chemistry	Ammonia as N	2	6
General Chemistry	E. Coli	4	6
General Chemistry	Total Dissolved Solids	5	6
Pesticide	Chlorpyrifos	1	6
Pesticide	Diuron	1	6
Pesticide	Malathion	1	6

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Ramona Lake near Fig Avenue

Type	Constituent	# of Exceedances	# of Tests
Field Data	DO	1	6
Field Data	EC	6	6
Field Data	pH	2	6
General Chemistry	Total Dissolved Solids	6	6
Pesticide	DDE(p,p')	1	6

Salt Slough at Lander Ave

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	6	6
General Chemistry	Total Dissolved Solids	6	6
Pesticide	Malathion	1	6

Salt Slough at Sand Dam

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	6	6
Field Data	pH	1	8
Pesticide	Chlorpyrifos	1	6
Pesticide	Malathion	1	6

San Joaquin River at Lander Ave

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	6	6
Field Data	pH	4	8
General Chemistry	E. Coli	3	6
General Chemistry	Total Dissolved Solids	6	6
Pesticide	Malathion	1	6

San Joaquin River at PID Pumps

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	6	6
Field Data	pH	1	6
General Chemistry	Boron	3	6
General Chemistry	E. Coli	2	6
General Chemistry	Total Dissolved Solids	6	6

San Joaquin River at Sack Dam

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	1	6
Field Data	pH	3	8
General Chemistry	Total Dissolved Solids	1	6

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Turner Slough at Edminster Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Pimephales promelas	1	6
Field Data	DO	4	6
Field Data	EC	2	5
General Chemistry	Ammonia as N	1	6
General Chemistry	E. Coli	2	6
General Chemistry	Total Dissolved Solids	2	6

Westley Wasteway near Cox Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Selenastrum capricornutum	1	6
Field Data	EC	4	7
General Chemistry	Boron	1	6
General Chemistry	E. Coli	5	6
General Chemistry	Total Dissolved Solids	5	6
Pesticide	DDE(p,p')	2	6
Pesticide	Diuron	1	6
Sediment Toxicity	Hyalella azteca	1	1

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Blewett Drain at Highway 132

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	835		µmhos/cm		700	
EC	89	3/13/2012	810		µmhos/cm		700	
Total Dissolved Solids	89	3/13/2012	700		mg/L		450	
Chlorpyrifos	90	4/10/2012	0.024	=	ug/L		0.015	
Diuron	90	4/10/2012	16	=	ug/L		2	
DO	90	4/10/2012	4		mg/l			5
EC	90	4/10/2012	845		µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	700		mg/L		450	
Ammonia as N	91	5/8/2012	2.6		mg/L		1.5	
Diuron	91	5/8/2012	8.7	=	ug/L		2	
E. Coli	91	5/8/2012	>2400		MPN/100mL		235	
EC	92	6/12/2012	820		µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	620		mg/L		450	
Chlorpyrifos	94	8/14/2012	0.14	=	ug/L		0.015	
EC	94	8/14/2012	867		µmhos/cm		700	
Total Dissolved Solids	94	8/14/2012	580		mg/L		450	

Del Puerto Creek at Hwy 33

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	1100		µmhos/cm		700	
EC	89	3/13/2012	1190		µmhos/cm		700	
pH	89	3/13/2012	6.39				8.5	6.5

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Del Puerto Creek near Cox Road

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	1211		µmhos/cm		700	
pH	89	3/12/2012	6.46				8.5	6.5
DDE(p,p')	89	3/13/2012	0.015	=	ug/L		0.00059	
DDT(p,p')	89	3/13/2012	0.007	DNQ	ug/L		0.00059	
EC	89	3/13/2012	1190		µmhos/cm		700	
pH	89	3/13/2012	6.46				8.5	6.5
Total Dissolved Solids	89	3/13/2012	1100		mg/L		450	
EC	90	4/10/2012	1313		µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	1100		mg/L		450	
Ceriodaphnia dubia	91	5/8/2012	5		%	yes		
EC	91	5/8/2012	833		µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	660		mg/L		450	
DDE(p,p')	92	6/12/2012	0.0059	DNQ	ug/L		0.00059	
EC	92	6/12/2012	1001		µmhos/cm		700	
Flow	92	6/12/2012	0		cfs			0.01
Total Dissolved Solids	92	6/12/2012	720		mg/L		450	
EC	93	7/10/2012	1195		µmhos/cm		700	
Total Dissolved Solids	93	7/10/2012	860		mg/L		450	
EC	94	8/14/2012	1055		µmhos/cm		700	
Total Dissolved Solids	94	8/14/2012	690		mg/L		450	

Delta Mendota Canal at DPWD

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
Total Dissolved Solids	90	4/10/2012	520		mg/L		450	

Hospital Creek at River Road

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	1165		µmhos/cm		700	
pH	89	3/12/2012	6.41				8.5	6.5
Flow	89	3/13/2012	0		cfs			0.01
Arsenic	90	4/10/2012	17		ug/L		10	
Chlorpyrifos	90	4/10/2012	0.071	=	ug/L		0.015	
EC	90	4/10/2012	885		µmhos/cm		700	
DO	91	5/8/2012	4.89		mg/l			5
Boron	92	6/12/2012	733		ug/L		700	
EC	92	6/12/2012	1029		µmhos/cm		700	
Arsenic	93	7/10/2012	16		ug/L		10	
Boron	93	7/10/2012	714		ug/L		700	
EC	93	7/10/2012	1048		µmhos/cm		700	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Ingram Creek at River Road

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	1269		µmhos/cm		700	
Hyalella azteca	89	3/12/2012	60		%	yes		
Boron	89	3/13/2012	951		ug/L		700	
DDE(p,p')	89	3/13/2012	0.027	=	ug/L		0.00059	
Diuron	89	3/13/2012	21	=	ug/L		2	
EC	89	3/13/2012	1269		µmhos/cm		700	
pH	89	3/13/2012	6.45				8.5	6.5
Selenastrum capricornutum	89	3/13/2012	469000		cells/ml	yes		
Total Dissolved Solids	89	3/13/2012	1000		mg/L		450	
Boron	90	4/10/2012	1030		ug/L		700	
DDE(p,p')	90	4/10/2012	0.017	=	ug/L		0.00059	
EC	90	4/10/2012	1307		µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	1000		mg/L		450	
DDE(p,p')	91	5/8/2012	0.0066	DNQ	ug/L		0.00059	
EC	91	5/8/2012	801		µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	590		mg/L		450	
Arsenic	92	6/12/2012	16		ug/L		10	
Boron	92	6/12/2012	1030		ug/L		700	
DDE(p,p')	92	6/12/2012	0.029	=	ug/L		0.00059	
E. Coli	92	6/12/2012	2000		MPN/100mL		235	
EC	92	6/12/2012	1075		µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	990		mg/L		450	
Boron	93	7/10/2012	835		ug/L		700	
Chlorpyrifos	93	7/10/2012	0.052	=	ug/L		0.015	
DDE(p,p')	93	7/10/2012	0.033	=	ug/L		0.00059	
DDT(p,p')	93	7/10/2012	0.012	=	ug/L		0.00059	
EC	93	7/10/2012	1134		µmhos/cm		700	
pH	93	7/10/2012	8.58				8.5	6.5
Total Dissolved Solids	93	7/10/2012	830		mg/L		450	
DDE(p,p')	94	8/14/2012	0.03	=	ug/L		0.00059	
EC	94	8/14/2012	1046		µmhos/cm		700	
Total Dissolved Solids	94	8/14/2012	720		mg/L		450	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Los Banos Creek at China Camp Road

Analyte/Species	Event	Sample Date	Result	Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	2101	µmhos/cm		700	
pH	89	3/12/2012	8.87			8.5	6.5
Arsenic	89	3/13/2012	11	ug/L		10	
Boron	89	3/13/2012	1910	ug/L		700	
EC	89	3/13/2012	2132	µmhos/cm		700	
Flow	89	3/13/2012	0	cfs			0.01
Selenastrum capricornutum	89	3/13/2012	1760000	cells/ml	yes		
Total Dissolved Solids	89	3/13/2012	1400	mg/L		450	
Boron	90	4/10/2012	1830	ug/L		700	
EC	90	4/10/2012	2016	µmhos/cm		700	
Flow	90	4/10/2012	0	cfs			0.01
pH	90	4/10/2012	8.56			8.5	6.5
Total Dissolved Solids	90	4/10/2012	1200	mg/L		450	
Boron	91	5/8/2012	889	ug/L		700	
E. Coli	91	5/8/2012	920	MPN/100mL		235	
EC	91	5/8/2012	1202	µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	720	mg/L		450	
Arsenic	92	6/12/2012	22	ug/L		10	
Boron	92	6/12/2012	2440	ug/L		700	
E. Coli	92	6/12/2012	310	MPN/100mL		235	
EC	92	6/12/2012	2299	µmhos/cm		700	
Flow	92	6/12/2012	0	cfs			0.01
Selenastrum capricornutum	92	6/12/2012	1823000	cells/ml	yes		
Selenium	92	6/12/2012	5.1	ug/L		5	
Total Dissolved Solids	92	6/12/2012	1500	mg/L		450	
Boron	93	7/10/2012	916	ug/L		700	
E. Coli	93	7/10/2012	2000	MPN/100 mL		235	
EC	93	7/10/2012	1460	µmhos/cm		700	
Flow	93	7/10/2012	0	cfs			0.01
Total Dissolved Solids	93	7/10/2012	640	mg/L		450	
Arsenic	94	8/14/2012	14	ug/L		10	
Boron	94	8/14/2012	2350	ug/L		700	
E. Coli	94	8/14/2012	290	MPN/100 mL		235	
EC	94	8/14/2012	2284	µmhos/cm		700	
Flow	94	8/14/2012	0	cfs			0.01
Total Dissolved Solids	94	8/14/2012	1400	mg/L		450	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Los Banos Creek at Hwy 140

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
Boron	89	3/13/2012	2180		ug/L		700	
E. Coli	89	3/13/2012	2000		MPN/100mL		235	
EC	89	3/13/2012	2652		µmhos/cm		700	
Total Dissolved Solids	89	3/13/2012	1600		mg/L		450	
Arsenic	90	4/10/2012	13		ug/L		10	
Boron	90	4/10/2012	2360		ug/L		700	
E. Coli	90	4/10/2012	240		MPN/100mL		235	
EC	90	4/10/2012	2641		µmhos/cm		700	
pH	90	4/10/2012	8.86				8.5	6.5
Total Dissolved Solids	90	4/10/2012	1600		mg/L		450	
Arsenic	91	5/8/2012	12		ug/L		10	
Boron	91	5/8/2012	1820		ug/L		700	
E. Coli	91	5/8/2012	2400		MPN/100mL		235	
EC	91	5/8/2012	2115		µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	1300		mg/L		450	
Boron	92	6/12/2012	1100		ug/L		700	
E. Coli	92	6/12/2012	360		MPN/100mL		235	
EC	92	6/12/2012	1514		µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	810		mg/L		450	
Arsenic	93	7/10/2012	17		ug/L		10	
Boron	93	7/10/2012	1260		ug/L		700	
E. Coli	93	7/10/2012	2400	>	MPN/100 mL		235	
EC	93	7/10/2012	1568		µmhos/cm		700	
Total Dissolved Solids	93	7/10/2012	930		mg/L		450	
Boron	94	8/14/2012	812		ug/L		700	
E. Coli	94	8/14/2012	2400	>	MPN/100 mL		235	
EC	94	8/14/2012	1114		µmhos/cm		700	
Total Dissolved Solids	94	8/14/2012	680		mg/L		450	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Marshall Road Drain near River Road

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/13/2012	990		µmhos/cm		700	
pH	89	3/13/2012	6.25				8.5	6.5
Total Dissolved Solids	89	3/13/2012	1100		mg/L		450	
EC	90	4/10/2012	1329		µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	1000		mg/L		450	
Chlorpyrifos	91	5/8/2012	0.17	=	ug/L		0.015	
E. Coli	91	5/8/2012	2400		MPN/100mL		235	
EC	91	5/8/2012	817		µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	540		mg/L		450	
EC	92	6/12/2012	968		µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	670		mg/L		450	
EC	93	7/10/2012	1119		µmhos/cm		700	
Total Dissolved Solids	93	7/10/2012	820		mg/L		450	
EC	94	8/14/2012	952		µmhos/cm		700	

Mud Slough Upstream of San Luis Drain

Analyte/Species	Event	Sample Date	Result	Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/13/2012	2464	µmhos/cm		700	
Total Dissolved Solids	89	3/13/2012	1600	mg/L		450	
EC	90	4/10/2012	2537	µmhos/cm		700	
pH	90	4/10/2012	8.53			8.5	6.5
Total Dissolved Solids	90	4/10/2012	1700	mg/L		450	
E. Coli	91	5/8/2012	250	MPN/100mL		235	
EC	91	5/8/2012	1166	µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	710	mg/L		450	
EC	92	6/12/2012	1403	µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	900	mg/L		450	
E. Coli	93	7/10/2012	2400	MPN/100 mL		235	
EC	93	7/10/2012	4410	µmhos/cm		700	
pH	93	7/10/2012	8.63			8.5	6.5
Total Dissolved Solids	93	7/10/2012	890	mg/L		450	
EC	94	8/14/2012	1235	µmhos/cm		700	
pH	94	8/14/2012	8.66			8.5	6.5
Total Dissolved Solids	94	8/14/2012	820	mg/L		450	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Newman Wasteway near Hills Ferry Road

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	903		µmhos/cm		700	
DO	89	3/13/2012	4.79		mg/l			5
EC	89	3/13/2012	1597		µmhos/cm		700	
Total Dissolved Solids	89	3/13/2012	970		mg/L		450	
Dimethoate	90	4/10/2012	3.3	=	ug/L		1	
EC	90	4/10/2012	1327		µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	800		mg/L		450	
E. Coli	91	5/8/2012	340		MPN/100mL		235	
EC	91	5/8/2012	1651		µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	1000		mg/L		450	
E. Coli	92	6/12/2012	410		MPN/100mL		235	
EC	92	6/12/2012	1330		µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	840		mg/L		450	
E. Coli	93	7/10/2012	770		MPN/100 mL		235	
EC	93	7/10/2012	1110		µmhos/cm		700	
Total Dissolved Solids	93	7/10/2012	730		mg/L		450	
E. Coli	94	8/14/2012	350		MPN/100 mL		235	
EC	94	8/14/2012	1029		µmhos/cm		700	
Total Dissolved Solids	94	8/14/2012	640		mg/L		450	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Orestimba Creek at Hwy 33

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	811		µmhos/cm		700	
Flow	89	3/12/2012	0		cfs			0.01
Hyalella azteca	89	3/12/2012	36.25		%	yes		
DDE(p,p')	89	3/13/2012	0.015	=	ug/L		0.00059	
EC	89	3/13/2012	809		µmhos/cm		700	
DDE(p,p')	90	4/10/2012	0.044	=	ug/L		0.00059	
DO	90	4/10/2012	4		mg/l			5
EC	90	4/10/2012	823		µmhos/cm		700	
Flow	90	4/10/2012	0		cfs			0.01
DO	91	5/8/2012	4.36		mg/l			5
EC	91	5/8/2012	1187		µmhos/cm		700	
Flow	91	5/8/2012	0		cfs			0.01
Selenastrum capricornutum	91	5/8/2012	1278000		cells/ml	yes		
Selenium	91	5/8/2012	6.1		ug/L		5	
DDE(p,p')	92	6/12/2012	0.028	=	ug/L		0.00059	
DO	92	6/12/2012	4.55		mg/l			5
EC	92	6/12/2012	1178		µmhos/cm		700	
Flow	92	6/12/2012	0		cfs			0.01
Selenastrum capricornutum	92	6/12/2012	1063000		cells/ml	yes		
Selenium	92	6/12/2012	7.8		ug/L		5	
DDE(p,p')	93	7/10/2012	0.09	=	ug/L		0.00059	
DDT(p,p')	93	7/10/2012	0.043	=	ug/L		0.00059	
DO	93	7/10/2012	4.81		mg/l			5
EC	93	7/10/2012	1241		µmhos/cm		700	
Flow	93	7/10/2012	0		cfs			0.01
pH	93	7/10/2012	8.55				8.5	6.5
Selenium	93	7/10/2012	7.7		ug/L		5	
DDE(p,p')	94	8/14/2012	0.27	=	ug/L		0.00059	
DDT(p,p')	94	8/14/2012	0.11	=	ug/L		0.00059	
Flow	94	8/14/2012	0		cfs			0.01

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Orestimba Creek at River Road

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	890		µmhos/cm		700	
Flow	89	3/12/2012	0		cfs			0.01
pH	89	3/12/2012	6.14				8.5	6.5
DDE(p,p')	89	3/13/2012	0.0056	DNQ	ug/L		0.00059	
DO	89	3/13/2012	4		mg/l			5
EC	89	3/13/2012	850		µmhos/cm		700	
Flow	89	3/13/2012	0		cfs			0.01
pH	89	3/13/2012	6.25				8.5	6.5
Total Dissolved Solids	89	3/13/2012	730		mg/L		450	
DDE(p,p')	90	4/10/2012	0.0074	DNQ	ug/L		0.00059	
EC	90	4/10/2012	795		µmhos/cm		700	
Flow	90	4/10/2012	0		cfs			0.01
Total Dissolved Solids	90	4/10/2012	620		mg/L		450	
DDE(p,p')	92	6/12/2012	0.058	=	ug/L		0.00059	
EC	92	6/12/2012	845		µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	500		mg/L		450	
E. Coli	93	7/10/2012	2400		MPN/100 mL		235	
pH	93	7/10/2012	8.69				8.5	6.5
DDE(p,p')	94	8/14/2012	0.031	=	ug/L		0.00059	
E. Coli	94	8/14/2012	730		MPN/100 mL		235	
EC	94	8/14/2012	743		µmhos/cm		700	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Poso Slough at Indiana Ave

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	1207		µmhos/cm		700	
pH	89	3/12/2012	8.92				8.5	6.5
Ammonia as N	89	3/13/2012	8.7		mg/L		1.5	
EC	89	3/13/2012	1182		µmhos/cm		700	
Malathion	89	3/13/2012	0.25	=	ug/L		5E-07	
pH	89	3/13/2012	8.75				8.5	6.5
Total Dissolved Solids	89	3/13/2012	680		mg/L		450	
Ceriodaphnia dubia	90	4/10/2012	0		%	yes		
Chlorpyrifos	90	4/10/2012	0.66	=	ug/L		0.015	
E. Coli	90	4/10/2012	360		MPN/100mL		235	
EC	90	4/10/2012	1282		µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	790		mg/L		450	
Diuron	91	5/8/2012	3.1	=	ug/L		2	
E. Coli	91	5/8/2012	2400	>	MPN/100mL		235	
EC	91	5/8/2012	912		µmhos/cm		700	
Selenastrum capricornutum	91	5/8/2012	1198000		cells/ml	yes		
Total Dissolved Solids	91	5/8/2012	550		mg/L		450	
Ammonia as N	92	6/12/2012	1.8		mg/L		1.5	
E. Coli	92	6/12/2012	310		MPN/100mL		235	
Total Dissolved Solids	92	6/12/2012	490		mg/L		450	
E. Coli	94	8/14/2012	2400	>	MPN/100 mL		235	
EC	94	8/14/2012	786		µmhos/cm		700	
Total Dissolved Solids	94	8/14/2012	480		mg/L		450	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Ramona Lake near Fig Avenue

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	1413		µmhos/cm		700	
Total Dissolved Solids	89	3/13/2012	1200		mg/L		450	
EC	90	4/10/2012	1455		µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	1200		mg/L		450	
DO	91	5/8/2012	3.18		mg/l			5
EC	91	5/8/2012	1484		µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	1100		mg/L		450	
EC	92	6/12/2012	1392		µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	980		mg/L		450	
DDE(p,p')	93	7/10/2012	0.01	=	ug/L		0.00059	
EC	93	7/10/2012	1668		µmhos/cm		700	
pH	93	7/10/2012	8.8				8.5	6.5
Total Dissolved Solids	93	7/10/2012	1200		mg/L		450	
EC	94	8/14/2012	1639		µmhos/cm		700	
pH	94	8/14/2012	8.58				8.5	6.5
Total Dissolved Solids	94	8/14/2012	1100		mg/L		450	

Salt Slough at Lander Ave

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/13/2012	1855		µmhos/cm		700	
Malathion	89	3/13/2012	0.25	=	ug/L		5E-07	
Total Dissolved Solids	89	3/13/2012	1100		mg/L		450	
EC	90	4/10/2012	2016		µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	1300		mg/L		450	
EC	91	5/8/2012	1382		µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	830		mg/L		450	
EC	92	6/12/2012	1064		µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	640		mg/L		450	
EC	93	7/10/2012	1016		µmhos/cm		700	
Total Dissolved Solids	93	7/10/2012	590		mg/L		450	
EC	94	8/14/2012	900		µmhos/cm		700	
Total Dissolved Solids	94	8/14/2012	540		mg/L		450	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Salt Slough at Sand Dam

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	1202		µmhos/cm		700	
Chlorpyrifos	89	3/13/2012	0.018	=	ug/L		0.015	
EC	89	3/13/2012	1226		µmhos/cm		700	
Malathion	89	3/13/2012	0.41	=	ug/L		5E-07	
EC	90	4/10/2012	1184		µmhos/cm		700	
pH	90	4/10/2012	8.51				8.5	6.5
EC	91	5/8/2012	998		µmhos/cm		700	
EC	93	7/10/2012	762		µmhos/cm		700	
EC	94	8/14/2012	750		µmhos/cm		700	

San Joaquin River at Lander Ave

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
E. Coli	89	3/13/2012	770		MPN/100mL		235	
EC	89	3/13/2012	1798		µmhos/cm		700	
Malathion	89	3/13/2012	0.25	=	ug/L		5E-07	
Total Dissolved Solids	89	3/13/2012	1100		mg/L		450	
EC	90	4/10/2012	1730		µmhos/cm		700	
pH	90	4/10/2012	8.77				8.5	6.5
Total Dissolved Solids	90	4/10/2012	1000		mg/L		450	
E. Coli	91	5/8/2012	1600		MPN/100mL		235	
EC	91	5/8/2012	1915		µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	1100		mg/L		450	
E. Coli	92	6/12/2012	1000		MPN/100mL		235	
EC	92	6/12/2012	1517		µmhos/cm		700	
pH	92	6/12/2012	8.92				8.5	6.5
Total Dissolved Solids	92	6/12/2012	880		mg/L		450	
EC	93	7/10/2012	1543		µmhos/cm		700	
pH	93	7/10/2012	8.6				8.5	6.5
Total Dissolved Solids	93	7/10/2012	880		mg/L		450	
EC	94	8/14/2012	1586		µmhos/cm		700	
pH	94	8/14/2012	8.59				8.5	6.5
Total Dissolved Solids	94	8/14/2012	920		mg/L		450	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

San Joaquin River at PID Pumps

Analyte/Species	Event	Sample Date	Result	Units	Significant Toxicity	WQV Max	WQV Min
Boron	89	3/13/2012	1020	ug/L		700	
E. Coli	89	3/13/2012	1100	MPN/100mL		235	
EC	89	3/13/2012	1259	µmhos/cm		700	
Total Dissolved Solids	89	3/13/2012	1000	mg/L		450	
Boron	90	4/10/2012	1030	ug/L		700	
EC	90	4/10/2012	1410	µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	1100	mg/L		450	
E. Coli	91	5/8/2012	1200	MPN/100mL		235	
EC	91	5/8/2012	715	µmhos/cm		700	
Total Dissolved Solids	91	5/8/2012	460	mg/L		450	
Boron	92	6/12/2012	722	ug/L		700	
EC	92	6/12/2012	1219	µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	800	mg/L		450	
EC	93	7/10/2012	1194	µmhos/cm		700	
pH	93	7/10/2012	9.45			8.5	6.5
Total Dissolved Solids	93	7/10/2012	780	mg/L		450	
EC	94	8/14/2012	1203	µmhos/cm		700	
Total Dissolved Solids	94	8/14/2012	730	mg/L		450	

San Joaquin River at Sack Dam

Analyte/Species	Event	Sample Date	Result	Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/13/2012	829	µmhos/cm		700	
pH	89	3/13/2012	8.62			8.5	6.5
Total Dissolved Solids	89	3/13/2012	480	mg/L		450	
pH	90	4/10/2012	8.85			8.5	6.5
pH	92	6/12/2012	8.57			8.5	6.5
Flow	93	7/10/2012	0	cfs			0.01

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Westside San Joaquin River Watershed Coalition

Water Quality Value Exceedances for the period of 3/1/2012 to 9/1/2012

Turner Slough at Edminster Road

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/13/2012	979		µmhos/cm		700	
Total Dissolved Solids	89	3/13/2012	560		mg/L		450	
E. Coli	90	4/10/2012	580		MPN/100mL		235	
Pimephales promelas	90	4/10/2012	82.5		%	yes		
Ammonia as N	91	5/8/2012	1.8		mg/L		1.5	
DO	91	5/8/2012	2.95		mg/l			5
E. Coli	91	5/8/2012	260		MPN/100mL		235	
DO	92	6/12/2012	3.58		mg/l			5
Flow	92	6/12/2012	0		cfs			0.01
DO	93	7/10/2012	2.9		mg/l			5
EC	93	7/10/2012	1262		µmhos/cm		700	
Flow	93	7/10/2012	0		cfs			0.01
Total Dissolved Solids	93	7/10/2012	720		mg/L		450	
DO	94	8/14/2012	3.25		mg/l			5

Westley Wasteway near Cox Road

Analyte/Species	Event	Sample Date	Result		Units	Significant Toxicity	WQV Max	WQV Min
EC	89	3/12/2012	968		µmhos/cm		700	
Hyalella azteca	89	3/12/2012	15		%	yes		
Boron	89	3/13/2012	880		ug/L		700	
DDE(p,p')	89	3/13/2012	0.0074	DNQ	ug/L		0.00059	
Diuron	89	3/13/2012	19	=	ug/L		2	
E. Coli	89	3/13/2012	250		MPN/100mL		235	
EC	89	3/13/2012	930		µmhos/cm		700	
Selenastrum capricornutum	89	3/13/2012	191000		cells/ml	yes		
Total Dissolved Solids	89	3/13/2012	930		mg/L		450	
EC	90	4/10/2012	739		µmhos/cm		700	
Total Dissolved Solids	90	4/10/2012	610		mg/L		450	
E. Coli	91	5/8/2012	250		MPN/100mL		235	
DDE(p,p')	92	6/12/2012	0.0052	DNQ	ug/L		0.00059	
E. Coli	92	6/12/2012	390		MPN/100mL		235	
EC	92	6/12/2012	979		µmhos/cm		700	
Total Dissolved Solids	92	6/12/2012	760		mg/L		450	
E. Coli	93	7/10/2012	440		MPN/100 mL		235	
Total Dissolved Solids	93	7/10/2012	520		mg/L		450	
E. Coli	94	8/14/2012	610		MPN/100 mL		235	
Total Dissolved Solids	94	8/14/2012	470		mg/L		450	

WQV = Water Quality Value as established by the Central Valley Regional Water Quality Control Board

DNQ = Detected, Not Quantifiable

Attachment 6
Management Plan Activities

San Joaquin Valley Drainage Authority

Westside San Joaquin River Watershed Coalition

Hospital and Ingram Creek Focused Watershed Plan
Westley Wasteway, Del Puerto Creek, and Orestimba Creek Focused Watershed Plan
Salt Slough Focused Watershed Plan

Status Report
November 30, 2012

Prepared by:
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Introduction and Background

In October, 2008, the San Joaquin Valley Drainage Authority (SJVDA) submitted a Focused Watershed Management Plan (Focused Plan I) for Ingram and Hospital Creeks for the Westside San Joaquin River Watershed Coalition (Westside Coalition). A Focused Watershed Plan (Focused Plan II) for Westley Wasteway, Del Puerto Creek, and Orestimba Creek was finalized in February 2011. Both of these plans outline management practice performance goals and schedules. A Focused Plan for the Salt Slough watershed (including discharges into Poso Slough) was adopted in December 2011 and performance goals were finalized in June of 2012.

The long term goals addressed in Section 5 of the Focused Plan I for Ingram and Hospital Creeks are as follows (in order of priority):

- Construct sediment basins to intercept direct tailwater discharges into Hospital and Ingram Creeks.
- Install high-efficiency irrigation systems such as sprinkler or drip irrigation, tailwater recirculation, gated pipes, shorter runs, etc., where warranted by the crops that are grown.
- Implement additional use of PAM to address sedimentation discharge.
- Reduce use of pesticides, or incorporate use of pesticides that are less likely to be transported to the waters of the State, or which breakdown quickly and are less likely to impact water quality.
- Calibrate ground spray rigs utilized on farmed acres to address possible overspray.
- Address potential aerial overspray by identifying the sensitive regions for all aerial applicators, or elimination of this as an acceptable application procedure for Ingram and Hospital Creeks.
- Increase size of vegetated buffer zones along the perimeters of Ingram and Hospital Creeks.

For the Focused Plan II for Westley Wasteway, and Del Puerto and Orestimba Creeks, the long term goals are listed as:

- Implement additional use of PAM to address sediment discharge
- Reduce use of pesticides, or incorporate use of pesticides that are less likely to be transported to the waters of the State, or which breakdown quickly and are less likely to impact water quality.
- Calibrate ground spray rigs utilized on farmed acres to address possible overspray.
- Address potential aerial overspray by identifying the sensitive regions for all aerial applicators, or elimination of this as an acceptable application procedure for these subwatersheds.
- Increase size of vegetated buffer zones along the perimeters of Westley Wasteway, Del Puerto Creek, and Orestimba Creek.
- Install high-efficiency irrigation systems such as sprinkler or drip irrigation, tailwater recirculation, gated pipes, shorter runs, etc., where warranted by the crops that are grown.

The long term goals for the Focused Plan III for the Salt Slough watershed are listed as:

- Reduce use of pesticides, or incorporate use of pesticides that are less likely to be transported to the waters of the State, or which breakdown quickly and are less likely to impact water quality.
- Calibrate spray rigs utilized on farmed acres to address possible overspray.
- Address potential aerial overspray by identifying the sensitive regions for all aerial applicators.
- Construct tailwater ponds to intercept and hold direct tailwater discharges.
- Install high-efficiency irrigation systems such as sprinkler or drip irrigation, tailwater recirculation, gated pipes, shorter runs, etc, where warranted by the crops that are grown.

This report summarizes the status of each of these goals for all of the focused plans.

Sediment Basins.
Sediment and tailwater basins collect and detain surface irrigation runoff prior to discharge into regional drains and creeks. Detention time provided by these ponds allows suspended sediment to settle out of the water column, reducing the sediment load discharged as well as a portion of the hydrophobic pesticides (such as pyrethroids). Since 2008, the Westside Coalition has provided funding assistance to growers who want to install new sedimentation ponds or clean out existing ponds. Typically, sediment ponds are cleaned and constructed during the non-irrigation season.

- New Activities - Funding Assistance. Approximately $27,200 in grant funding has been provided by the Westside Coalition for the cleanout of 34 sedimentation ponds in 26 parcels, affecting approximately 6,000 acres both within and outside of the focused plans' subwatersheds. Approximately 91% of the 2012 sediment pond grant program has been used.

High-efficiency Irrigation Systems.
High-efficiency irrigation systems have evolved significantly in recent years and now can replace conventional surface irrigation methods on practically every crop (with alfalfa and pasture as the largest exceptions). There are a several benefits to high-efficiency irrigation systems, however, in terms of drainage, the primary benefit is the virtual elimination of tailwater discharge. These advanced systems are designed to deliver water directly to each individual plant at a rate that is both uniform throughout the irrigated field and slow enough for soil to absorb, resulting in almost no surface runoff. Additionally, these systems allow for the direct application of fertilizer and other chemicals through the drip hoses (a process called fertigation). High-efficiency irrigation systems require a significant financial investment on the part of the grower (generally $1,000 to $2,000 per acre).

The acreage of high-efficiency irrigation systems continues to increase within the Westside Coalition. The Coalition is in the process of mapping the fields with these systems within the focused plans' subwatersheds.

Management Practice Surveys have provided some detail on the usage of high efficiency irrigation systems. **Table A6-1** shows the acreage (and percent of irrigated acreage) of these

irrigation systems by watershed, based on the initial management practice surveys within each watershed and the estimated 2012 acreage. The estimated increase was based on a sampling of irrigation and water districts within the subject subwatersheds. Based on information provided by individual districts, the acreage of high efficiency irrigation systems has increased by approximately 17,000 acres Coalition-wide, largely due to aggressive funding assistance programs through individual Districts and other funding programs such as AWEP or EQUIP. These increases in irrigation improvements are reported at the District level and the geographic distribution is generally not available.

Table A6-1: High Efficiency Irrigation Systems by Subwatershed - Baseline.

Subwatershed	Survey Year	Acreage	Percent of Irrigated Acreage	2012 Estimated Drip Acreage	2012 Estimated Percent Drip
Hospital Creek	2010	3515	68%	3600	70%
Ingram Creek	2010	927	17%	1800	33%
Westley Wasteway	2011	2891	63%	2950	64%
Del Puerto Creek	2011	3934	50%	5700	72%
Orestimba Creek	2011	5821	50%	6300	54%
Salt Slough (partial data)	2012	14,400	23%	14,400	23%

The estimates presented in **Table A6-1** are based on the geographic location of each district, an assumed distribution of the reported irrigation improvements, and mapping information provided by some districts. Irrigation system improvements are typically installed during the winter months for use in the following irrigation system. The acreages represented in **Table A6-1** reflect non-irrigation season irrigation system improvements. Much of the acreage that converted to high efficiency irrigation systems occurred outside of these six subwatersheds. The Westside Coalition is working with Districts to develop more complete GIS maps and other methods to geographically identify irrigation methods and this data will be updated as it becomes available.

PAM Usage.

PAM is a flocculating agent added to irrigation or drain water. When added to drain water with high suspended solids, PAM binds the suspended sediment materials together into larger particles which then settle out of the water column. When added to the irrigation water, PAM prevents the suspension of soil as the water travels down the furrow.

Tailwater with high suspended solids (no PAM usage)	Tailwater with PAM

In addition to the removal of suspended solids, PAM also helps to control the discharge of pyrethroids, which tend to adhere to the sediment particles which should result in a reduction of sediment toxicity within the subwatersheds.

PAM usage is difficult to track. Typically, PAM is added to irrigation or drain water on an "as needed" basis, which could be every third or fourth irrigation, depending on the soil, field slope, and crop. Additionally, PAM is not a material for which growers are required to report usage (as they must do for most pesticides), so there is no "clearinghouse" through which usage can be tracked. The only available mechanism for tracking PAM usage is through direct contact with the growers. **Table A6-2** shows the acreage that reported PAM usage through management practice surveys, and the associated percent of surface irrigation acreage reported in the baseline Management Practice surveys. To date, the Westside Coalition has not performed any follow-up surveys and no additional data on PAM usage trends is available.

Table A6-2: PAM by Subwatershed.

Subwatershed	Survey Year	Acreage	Percent of Irrigated Acreage
Hospital Creek	2010	488	29%
Ingram Creek	2010	4375	95%
Westley Wasteway	2011	3346	73%
Del Puerto Creek	2011	2955	37%
Orestimba Creek	2011	3408	29%
Salt Slough	2012	710	1.2%

Applications of PAM is only appropriate on fields that are surface irrigated (such as furrow or gated pipe) and produce tailwater. As a result, as more fields within the coalition are converted to drip irrigation systems, PAM usage will decrease.

Pesticide Use Activities.
Pesticide use activities vary depending on the crop planted, time of year, current and anticipated pest pressures, and available materials. Most growers utilize a pest control advisor (PCA) who is trained to identify insect, weed, and disease threats, and make recommendations on what material(s) should be applied and what cultural practices should be implemented. It should be noted that pesticides are applied in reaction to actual pest pressures and the material selected to target specific pests as well as rotate through a variety of materials to prevent pesticide resistance. Based on available Pesticide Use Report (PUR) data, most insecticide use (including pyrethroids and organophosphorus pesticides) occurred in March, July and August on a variety of field and tree crops. Herbicide use continued throughout the irrigation season. A summary of the 2012 irrigation PUR data by watershed is attached.

Chlorpyrifos exceedances were measured seven times during the 2012 irrigation season (see **Table A6-3**). As with past pesticide exceedances, the Westside Coalition is working aggressively to increase awareness and encourage growers to implement management practices to avoid future exceedances. These activities included a number of meetings and workshops (addressed both to growers and PCAs) and letters distributed to targeted areas within the coalition. In October 2011, the Westside Coalition began circulating management plan surveys in the Salt Slough subwatershed, which were completed in June 2012. These surveys included questions about pesticide use including chlorpyrifos, diazinon, malathion, and diuron. A summary of the survey data is included under the **Management Practice Survey** section below. In addition to these surveys, a staff person from the Westside Coalition performed more than 180 field visits to regions of the Coalition with known problems. These visits reviewed the status of irrigation activities, general watershed conditions, visually assessed drainage discharges, and provided a visible public presence.

Table A6-3: 2012 Irrigation Season Chlorpyrifos Exceedances

Site	FP #	Date	Constituent	Concentration
Salt Slough @ Sand Dam	3	3/13/12	Chlorpyrifos	0.018 µg/L
Blewett Drain	NA	4/10/12	Chlorpyrifos	0.024 µg/L
Poso Slough	3	4/10/12	Chlorpyrifos	0.66 µg/L
Hospital Creek	1	4/10/12	Chlorpyrifos	0.071 µg/L
Marshall Road Drain	NA	5/8/12	Chlorpyrifos	0.17 µg/L
Ingram Creek	1	7/10/12	Chlorpyrifos	0.052 µg/L
Blewett Drain	NA	8/14/12	Chlorpyrifos	0.14 µg/L

The Westside Coalition reviewed pesticide use data within the Salt Slough subwatershed and summarized pesticide use for the 2010, 2011 and 2012 irrigation seasons in **Table A6-4**. Based on this data, pesticide applications were reduced by approximately 47% between 2011 and 2012, and by 37% between 2010 and 2012. However PUR data for all of the 2012 irrigation season is not yet available and these conclusions should be considered preliminary.

Table A6-4: Salt Slough Pesticide Use Summary.

Subwatershed	Pesticide Group	2012* Acres Treated	2011 Acres Treated	2010 Acres Treated
Poso Slough	Carbamates	1,685	335	770
	Herbicide	18,113	32,335	20,950
	Organochlorine	190		
	Organophosphorus	8,222	4,783	5,282
	Pyrethroid	8,680	12,115	14,171
Salt Sl. @ Sand Dam	Carbamates	382	1,049	1,806
	Herbicide	17,084	45,978	36,941
	Organochlorine	1,435		175
	Organophosphorus	4,433	5,294	5,984
	Pyrethroid	7,443	14,851	14,044
Salt Sl. @ Lander Ave	Carbamates	382	1,451	2,444
	Herbicide	22,886	59,600	45,261
	Organochlorine	1,568		175
	Organophosphorus	6,209	5,747	6,604
	Pyrethroid	8,871	19,021	16,843

* Partial data.

Calibrate Ground Spray Rigs to Address Overspray.
In addition to stressing proper spray applications near waterways in group and individual grower meetings, the Westside Coalition has contracted with CURES to provide a trained sprayer calibration technician and a high-tech instrument for calibrating orchard sprayers for members operating near priority waterways. To date there has been little interest from growers to calibrate the spray rigs and no calibrations have been performed. The Westside Coalition still believes that this service is important for pesticide use management and will continue to encourage growers to utilize the program.

Address Potential Aerial Overspray and Identify Sensitive Regions.
In the last update, the Westside Coalition reported that aerial photo maps of Ingram, Hospital, Del Puerto, and Orestimba Creeks along with Westley Wasteway had been circulated to growers, PCAs and applicators. A draft irrigation method map for the Salt Slough subwatershed has been developed from the survey data and is included in this update.

Vegetated Buffer Zones along Creek Perimeters.
Vegetated buffer zones are intended to provide unfarmed space between the edge of a field and the creek. Conceptually, the buffer zone would reduce the amount of pesticides drifting into the creeks. The Westside Coalition is in the process of identifying buffer zones along the focused plans' targeted water ways. In the previous update, vegetated buffers for Ingram, Hospital, Del Puerto, and Orestimba Creeks, along with Westley Wasteway were described. Vegetated buffer regions along Salt Slough and Poso Slough are in the process of being identified and a map will be submitted once it is complete.

Management Practice Surveys.
Management practice surveys (surveys) were circulated throughout the Ingram and Hospital Creek subwatersheds (Focused Plan I Surveys) in 2009, and in the Focused Plan II subwatersheds during the summer of 2010. The Focused Plan III subwatershed management practice survey was completed and submitted to the Regional Board in June 2012 and a summary of this data is presented in **Table A6-5**. Summaries for the Focused Plan I and II survey results were presented in previous updates and new information regarding acreage irrigated with high efficiency systems is presented in the **High-efficiency Irrigation Systems** section above.

Table A6-5: Summary of Focused Plan 3 Management Practice Surveys.

	Salt Slough at Lander Avenue*		Salt Slough at Sand Dam*		Poso Slough at Indiana Avenue	
	Acres	%	Acres	%	Acres	%
Survey Area (APN Acreage)	10,250		43,313		11,142	
Area Returned	10,248	100%	35,972	100%	11,475	100%
Surveys Sent	99		622		153	
Surveys Returned	99	100%	622	100%	153	100%
Irrigated Acreage	10,122	87%	42,446	98%	11,410	99%
Furrow/Flood (% Irrigated Acreage)	8,315	94%	33,384	79%	7,876	69%
Drip/Micro/Sprinkler (% Irrigated Ac.)	1,807	20%	9,062	21%	3,543	31%
Fallow/Non-irrigated (% Irrigated Ac.)	296	3.3%	695	2%	65	0.6%
Tree Crops (% Irrigated Ac.)	476	5.4%	531	1%	196	2%
Field Crops (% Irrigated Ac.)	9,647	109%	42.034	99%	11,209	98%
Open/Other (% Irrigated Ac.)	296	3.3%	673	2%	70	0.6%
Sedimentation Ponds (% Irrigated Ac.)	86	1%	284	1%	-	0%
Tile System (% Irrigated Ac.)	216	2%	3,214	8%	-	0%
PAM usage (% Irrigated Ac.)	0	0%	671	2%	39	0.3%
Tailwater leaves field (% Irrigated Ac.)	9,603	95%	39,827	94%	9,274	81%
Stormwater leaves field (% Irrigated Ac.)	8,768	87%	38,727	91%	9,995	88%
Berm Spray Usage (% Irrigated Ac.)	1,301	13%	1,365	3%	670	6%
Manure Usage (% Irrigated Ac.)	4,026	40%	18,321	43%	3,563	31%

* Geographically, the Salt Slough at Lander Avenue subwatershed is inclusive of the Salt Slough at Sand Dam subwatershed, which is inclusive of the Poso Slough Subwatershed. For the sake of data clarity, the data presented in this table represents practices exclusive to each subwatershed without any data overlap. The Salt Slough at Sand Dam data does not include lands in the Poso Slough Subwatershed and the Salt Slough at Lander Avenue data does not include data for lands within the Salt Slough at Sand Dam subwatershed.

Outreach and Grower Education.
The Westside Coalition organizes outreach meetings throughout the year to inform growers and PCA about the materials that have been detected at the monitoring sites and to suggest possible practices that may prevent future detections. Additionally, the exceedance reports that are submitted to the Central Valley Regional Water Quality Control Board are also sent to the Westside Coalition member districts. A list of the meetings is included in **Table A6-6.**

Table A6-6: Outreach Meetings.

Date	Group	Location	Description	Attended	By
3/1/2012	Westside Stanislaus County Farm Bureau	Patterson	Annual Meeting	50	Joe Mc/Parry Klassen
3/13/2012	PCA's in Stanislaus County	Westley	Chlorpyrifos and sedmiment issues	8	Joe McGahan/ Parry Klassen
3/22/2012	San Luis Canal Co Annual Meeting	Dos Palos	Update of ILRP and issues in area	25	Joe McGahan
3/27/2012	CCID Landowners Meeting	Firebaugh	Dos Palos Area Update	50	Joe McGahan
3/28/2012	CCID Landowners Meeting	Los Banos	Los Banos Area Update	75	Joe McGahan
3/28/2012	Field tailgate meetings	Field	Survey follow up and BMPs	9	Rich Peltzer
3/29/2012	CCID Landowners Meeting	Gustine	Patterson Area Update	100	Joe McGahan
4/3/2012	Stanislaus County Ag Commissioner	Patterson	Ag Comm meeting to review new policies	25	Joe McGahan
4/5/2012	Field tailgate meetings	Field - Salt Sl.	Survey follow up and BMPs	18	Rich Peltzer
4/9/2012	Field tailgate meetings	Field - Salt Sl.	Survey follow up and BMPs	15	Rich Peltzer
4/16/2012	Field tailgate meetings	Field - Salt Sl.	Survey follow up and BMPs	14	Rich Peltzer
4/24/2012	Field tailgate meetings	Field - Salt Sl.	Survey follow up and BMPs	10	Rich Peltzer
4/25/2012	Grassland Habitat Management Coordination Committee Meeting	Los Banos	ILRP Status to wetland members	15	Joe McGahan
7/13/2012	ACWA Regions 6 & 7	Fresno	Presentation to Association of California Water Agencies region meetings on status of ILRP	40	Joe McGahan
7/25/2012	Tailgate Mtg.	Westley	BMP's Sediment	6	Rich Peltzer
8/1/2012	Tailgate Mtg.	Westley/Crows Landing	BMP's Sediment	15	Rich Peltzer
8/7/2012	Tailgate Mtg.	Westley/Crows Landing	BMP's Sediment	9	Rich Peltzer
8/15/2012	Tailgate Mtg.	Patterson/Crows Landing	BMP's Sediment	16	Rich Peltzer
8/21/2012	Tailgate Mtg.	Patterson/Crows Landing/Westley	BMP's Sediment	15	Rich Peltzer
8/30/2012	Tailgate Mtg.	Patterson/Crows Landing/Westley	BMP's Sediment	8	Rich Peltzer

The Coalition began conducting individual meetings with growers in March of 2010. These meetings target parcels adjacent to the creeks and major drains in the Focused Plan watersheds and resulting from observations during the Coalition's Field Visits. The intent of these meetings was to increase awareness of the water quality concerns related to agricultural practices. The individual contacts also help to gain parcel-specific information in regards to agricultural discharges and management practices currently implemented on the properties adjacent to the priority watersheds. In the individual grower visits the Coalition offer resources (i.e. management practice handbooks, information to obtain NRCS-EQIP funds) to aid them in implementing additional management practices if it is determined that additional practices are needed. This determination is made after the discussion and a review of the property by a Coalition representative.

Overview of Decision Tree for Adopting Management Practices

Management practices are adopted at the discretion of the landowner or operator. The Westside Coalition provides resources regarding applicable management practices given the specific water quality issue for a given subwatershed.

1. Management practice surveys mailed to landowners
2. Individual meeting held to discuss current/potential practices
3. Options reviewed with landowner
4. Landowner makes decision on implementing practice

Overview of Outreach Procedure resulting from Pesticide Exceedances.

Pesticide results are typically available to the Westside Coalition approximately 6 weeks after the sample collection. After receipt of this data, it is imported into the Coalition's database and reviewed for exceedances. When a pesticide detection is determined to have exceeded the recommended water quality value, the Westside Coalition begins a review procedure.

1. Determine the material, time of year, and subwatershed in which the material was applied.
2. Identify the crops that are registered for the subject material.
3. Review the subwatershed for the identified crops.

These steps can usually be performed within a week of the exceedance determination and will generally reduce the pool of growers who are likely to have contributed to the exceedance. With that information, the Coalition can target outreach efforts directly to those growers.

Grant Program Outreach.

Information on grant funding availability has been communicated to landowners and operators through direct mailings, grower group meetings and individual contacts with landowners. A letter was sent in April 2011 to landowners with property along the Westside Coalitions priority watersheds regarding availability of Proposition 84 grant funds for irrigation system improvements and other water conservation related projects. This letter and other efforts from the Coalition resulted in 12 completed projects (1,053 acres) for the 2012 irrigation season funded through Proposition 84, and more than 35 projects since this program started. A map showing the project locations is included with this update.

During the 2011/12 non-irrigation season, a new funding program through NRCS to help with management practice installation was pursued. NRCS chose not to fund the proposal and the Westside Coalition is actively pursuing other funding opportunities as they become available.

Other Activities.

In addition to grower-level management practices, Westside Coalition districts are in the process of planning a number of regional projects that will help with drainage management and grower management practice implementation.

- Poso Canal and East Ditch Reservoirs project. CCID is in the process of designing two reservoirs that will capture excess flows and recirculate drain water while improving delivery flexibility. The reservoirs are expected to recover 4,000 acre feet per year of drain water and the improved delivery operation will help encourage growers to convert to high efficiency irrigation systems that will reduce tailwater volumes. Both reservoirs are expected to come on-line by the 2014 irrigation season.
- Moran and Oil Station delivery system improvements. CCID is reviewing project alternatives to improve the delivery systems in two areas of the District. The existing systems are antiquated and are generally not compatible with high efficiency irrigaiton systems. Improvements would encourage growers to upgrade their irrigation systems and reduce tailwater discharges.
- Marshall Road and Spanish Land Grant Drain Return System. Patterson Irrigation District is reviewing alternatives to capture and recirculate drainage flows into the Marshall Road Drain and Spanish Land Grant Drain. Although only in the planning stages, this project could potentially reduce drainage discharges to the San Joaquin River by 5,000 acre feet annually.

Table A6-7: Focused Plan III Performance Goals

	Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Targets
1	Implement Focuses Plan III for eliminating toxicity and pesticide detections by increasing grower participation and implementing additional management practices.	Address potential overspray by identifying the sensitive regions for all applicators.	1. No. of applicators contacted. 5 2. No. of miles of sensitive regions. ~700	1. Provide a detailed watershed map of the subwatersheds. Included in Attachment 6.	1. Contact 5 applicators. Complete.
		Submit survey form to growers that inquires about management practices relevant to Tier 1 parameters	1. Develop survey document. complete 2. No. of growers to survey. 874 3. No. of growers surveyed. 874	1. Percent of surveys submitted to growers. 100% 2. Percent of survey responses back from growers. 100%	1. Submit survey form to Regional Board by 9/30/11. complete. 2. Submit surveys to 100% of growers within site subwatershed by 12/21/11. Complete. 3. Receive 100% of survey responses back from growers by 3/31/12. Complete 4. Finalize survey findings and report on management practice baseline and provide a summary of existing management activities by 6/15/12. See Attachment 6. 5. SAMR Report on management practice baseline and provide a summary of existing management practices by 11/30 and 6/15. Summary to include: historical & known MPs, changes from previous update, summary of affected acres, may include crop/irrigation type. See Attachment 6.
		Conduct grower outreach in the form of group meetings, tailgate meetings.	1. Growers to have broad understanding of better management practices and its effect on water quality.	1. No. of group meetings. 2. No. of individual meetings.	1. Report grower outreach in SAMR. 2. Conduct 5 outreach meetings annually.
		Determine effective management practices and develop next steps (Performance Goals)	1. Develop management practices that can be implemented. 2. Detailed plan for next steps and communicate to Regional Board.	1. Prepare Performance Goals with Regional Board staff. Complete.	1. Submit/finalize Performance Goals by 6/30/12. Complete.
2	Reduce use of pesticides, or incorporate use of pesticides that are less likely to be transported to the waters of the State, or which breakdown quickly and are less likely to impact water quality.	Collect pesticide use data	1. No. of pounds of pesticide used in each subwatershed. See Attachment 6. 2. No. of pesticide pounds reduced. See Attachment 6. 3. Name of alternative pesticides used. Unable to determine.	1. Percent of pesticide use reduction. See Attachment 6.	1. SAMR report twice annually - 6/15 and 11/30. Report submitted 11/30/12
		Secure funding sources to implement MPs	1. Distribute grant funds annually to implement management practices.	1. Percent of grant funds distributed	1. Attempt to distribute 50% of grant funds annually to growers. 91% of sediment pond funds distributed.
3	Evaluate management practices effectiveness	Calibrate spray rigs utilized on farmed acres to address possible overspray.	1. No. of spray rigs calibrated. 2. No. of acres affected	1. Percent of acres affected.	1. Calibrate 10 spray rigs. Calibration machine in for repairs. No calibrations performed.
		Construct tailwater ponds to intercept and hold direct tailwater discharges.	1. No. of tailwater ponds constructed.	1. Map tailwater ponds and irrigation methods. In progress.	1. Provide map for each subwatershed in SAMRs.
		Install high-efficiency irrigation systems such as sprinkler or drip irrigation, tailwater recirculation, gated pipes, shorter runs, etc., where warranted by the crops that are grown.	1. No. of growers that will install high-efficiency irrigation systems such as sprinkler or drip irrigation, tailwater recirculation, gated pipes, shorter runs, etc. 2. No. of acres affected.	1. Percent of growers installing new/additional management practices. 2. Percent of acres affected.	1. Affect 60% of acres for the long term. 24% of Salt Slough subwatershed w/ high efficiency systems. Districts have internal funding assistance programs for growers.
		Collect and report monitoring data results	1. No. of tests conducted. 2. No. of detections observed. 3. No. of exceedances observed.	1. Percent decrease in detections. 2. Percent decrease in exceedances.	1. SAMR report twice annually - 6/15 and 11/30 2. Show a decrease in detections. See SAMR sections 8, 9, and 11.

Exceedance Tally

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 9/1/2009 to 8/31/2012

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	24	506
Aquatic Toxicity	Pimephales promelas	2	301
Aquatic Toxicity	Selenastrum capricornutum	18	364
Field Data	DO	73	765
Field Data	EC	435	769
Field Data	pH	82	781
General Chemistry	Ammonia as N	8	557
General Chemistry	Arsenic	17	365
General Chemistry	Boron	113	478
General Chemistry	E. Coli	230	661
General Chemistry	Selenium	4	248
General Chemistry	Total Dissolved Solids	403	662
Pesticide	a-Chlordane	1	426
Pesticide	Aldrin	1	426
Pesticide	Chlorpyrifos	53	614
Pesticide	DDD(p,p')	3	426
Pesticide	DDE(p,p')	118	426
Pesticide	DDT(p,p')	22	426
Pesticide	Diazinon	2	615
Pesticide	Dimethoate	2	615
Pesticide	Diuron	33	503
Pesticide	Endrin	1	426
Pesticide	g-Chlordane	3	426
Pesticide	Malathion	17	615
Pesticide	Methamidophos	1	635
Pesticide	Toxaphene	2	426
Sediment Toxicity	Hyalella azteca	23	73

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 9/1/2009 to 8/31/2012

Blewett Drain at Highway 132

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	10
Field Data	DO	3	22
Field Data	EC	6	22
Field Data	pH	3	22
General Chemistry	Ammonia as N	1	20
General Chemistry	E. Coli	10	20
General Chemistry	Total Dissolved Solids	5	20
Pesticide	Chlorpyrifos	3	11
Pesticide	DDE(p,p')	2	11
Pesticide	Diuron	2	11
Sediment Toxicity	Hyalella azteca	1	3

Del Puerto Creek at Hwy 33

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	8
Field Data	DO	1	13
Field Data	EC	4	13
Field Data	pH	3	13
General Chemistry	Boron	1	7
General Chemistry	E. Coli	1	5
General Chemistry	Total Dissolved Solids	4	5
Pesticide	DDD(p,p')	1	8
Pesticide	DDE(p,p')	1	8
Pesticide	DDT(p,p')	1	8
Sediment Toxicity	Hyalella azteca	1	4

Del Puerto Creek near Cox Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	26
Field Data	EC	19	38
Field Data	pH	5	38
General Chemistry	Ammonia as N	1	33
General Chemistry	Boron	3	20
General Chemistry	E. Coli	13	33
General Chemistry	Total Dissolved Solids	25	33
Pesticide	Chlorpyrifos	5	26
Pesticide	DDE(p,p')	12	26
Pesticide	DDT(p,p')	1	26
Pesticide	Diuron	1	26
Pesticide	Endrin	1	26
Pesticide	Malathion	1	26
Sediment Toxicity	Hyalella azteca	3	6

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 9/1/2009 to 8/31/2012

Delta Mendota Canal at DPWD

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	3
Field Data	pH	6	38
General Chemistry	Total Dissolved Solids	3	38
Pesticide	Chlorpyrifos	1	39

Hospital Creek at River Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	3	19
Aquatic Toxicity	Selenastrum capricornutum	1	14
Field Data	DO	2	24
Field Data	EC	6	25
Field Data	pH	4	25
General Chemistry	Arsenic	3	19
General Chemistry	Boron	2	19
General Chemistry	E. Coli	9	9
General Chemistry	Total Dissolved Solids	3	9
Pesticide	Chlorpyrifos	6	20
Pesticide	DDE(p,p')	12	14
Pesticide	DDT(p,p')	2	14
Pesticide	Diuron	2	19
Pesticide	g-Chlordane	1	14
Pesticide	Malathion	1	20
Pesticide	Toxaphene	1	14
Sediment Toxicity	Hyalella azteca	5	6

Ingram Creek at River Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Selenastrum capricornutum	2	17
Field Data	DO	2	34
Field Data	EC	24	34
Field Data	pH	4	34
General Chemistry	Arsenic	2	23
General Chemistry	Boron	9	23
General Chemistry	E. Coli	11	29
General Chemistry	Total Dissolved Solids	24	29
Pesticide	Chlorpyrifos	6	24
Pesticide	DDE(p,p')	22	23
Pesticide	DDT(p,p')	5	23
Pesticide	Dimethoate	1	24
Pesticide	Diuron	4	23
Pesticide	g-Chlordane	1	23
Pesticide	Malathion	1	24

Sediment Toxicity	Hyalella azteca	6	6

Little Panoche Creek at W. Boundary

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	1
Aquatic Toxicity	Selenastrum capricornutum	1	1
Field Data	EC	1	1
Field Data	pH	1	1
General Chemistry	Boron	1	1
General Chemistry	E. Coli	1	1
General Chemistry	Total Dissolved Solids	1	1
Pesticide	DDE(p,p')	1	1

Los Banos Creek at China Camp Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Pimephales promelas	1	29
Aquatic Toxicity	Selenastrum capricornutum	2	28
Field Data	DO	8	46
Field Data	EC	36	46
Field Data	pH	9	47
General Chemistry	Arsenic	5	22
General Chemistry	Boron	16	22
General Chemistry	E. Coli	17	39
General Chemistry	Selenium	1	15
General Chemistry	Total Dissolved Solids	28	39
Pesticide	Aldrin	1	16
Pesticide	Chlorpyrifos	1	28

Los Banos Creek at Hwy 140

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	2	39
Field Data	DO	4	40
Field Data	EC	37	40
Field Data	pH	4	41
General Chemistry	Arsenic	4	22
General Chemistry	Boron	18	22
General Chemistry	E. Coli	26	39
General Chemistry	Total Dissolved Solids	36	39
Pesticide	Diuron	1	38

Los Banos Creek at Sunset Ave.

Type	Constituent	# of Exceedances	# of Tests
General Chemistry	Boron	1	2

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 9/1/2009 to 8/31/2012

Marshall Road Drain near River Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	19
Field Data	DO	1	22
Field Data	EC	12	22
Field Data	pH	3	22
General Chemistry	Ammonia as N	1	22
General Chemistry	E. Coli	9	22
General Chemistry	Total Dissolved Solids	16	22
Pesticide	Chlorpyrifos	7	19
Pesticide	DDE(p,p')	9	19
Pesticide	DDT(p,p')	4	19
Pesticide	Diuron	2	19
Pesticide	g-Chlordane	1	19
Pesticide	Malathion	3	20

Mud Slough Upstream of San Luis Drain

Type	Constituent	# of Exceedances	# of Tests
Field Data	DO	1	40
Field Data	EC	39	40
Field Data	pH	7	41
General Chemistry	Boron	14	16
General Chemistry	E. Coli	10	39
General Chemistry	Total Dissolved Solids	38	39
Pesticide	Malathion	1	39

Newman Wasteway near Hills Ferry Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	28
Field Data	DO	19	43
Field Data	EC	40	43
Field Data	pH	1	44
General Chemistry	Boron	10	22
General Chemistry	E. Coli	17	38
General Chemistry	Total Dissolved Solids	36	38
Pesticide	DDE(p,p')	2	28
Pesticide	Dimethoate	1	28

Orestimba Creek at Hwy 33

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	26
Aquatic Toxicity	Selenastrum capricornutum	2	26
Field Data	DO	8	32

Field Data	EC	6	32
Field Data	pH	3	32
General Chemistry	E. Coli	7	14
General Chemistry	Selenium	3	19
Pesticide	Chlorpyrifos	3	27
Pesticide	DDD(p,p')	2	26
Pesticide	DDE(p,p')	23	26
Pesticide	DDT(p,p')	6	26
Pesticide	Diazinon	1	27
Pesticide	Methamidophos	1	28
Pesticide	Toxaphene	1	26
Sediment Toxicity	Hyalella azteca	2	7

Orestimba Creek at River Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	23
Field Data	DO	3	33
Field Data	EC	13	33
Field Data	pH	3	33
General Chemistry	E. Coli	14	29
General Chemistry	Total Dissolved Solids	10	29
Pesticide	Chlorpyrifos	4	23
Pesticide	DDE(p,p')	18	23
Pesticide	DDT(p,p')	1	23
Pesticide	Malathion	1	23

Poso Slough at Indiana Ave

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	3	23
Aquatic Toxicity	Selenastrum capricornutum	4	23
Field Data	DO	1	41
Field Data	EC	29	41
Field Data	pH	4	42
General Chemistry	Ammonia as N	3	39
General Chemistry	Arsenic	2	22
General Chemistry	E. Coli	26	39
General Chemistry	Total Dissolved Solids	24	39
Pesticide	Chlorpyrifos	3	22
Pesticide	DDE(p,p')	1	22
Pesticide	Diazinon	1	22
Pesticide	Diuron	6	22
Pesticide	Malathion	1	22
Sediment Toxicity	Hyalella azteca	1	3

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 9/1/2009 to 8/31/2012

Ramona Lake near Fig Avenue

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	26
Field Data	DO	5	39
Field Data	EC	38	39
Field Data	pH	5	39
General Chemistry	Boron	13	20
General Chemistry	E. Coli	3	34
General Chemistry	Total Dissolved Solids	34	34
Pesticide	Chlorpyrifos	2	26
Pesticide	DDE(p,p')	2	26
Sediment Toxicity	Hyalella azteca	1	6

Salt Slough at Lander Ave

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	2	40
Aquatic Toxicity	Selenastrum capricornutum	1	33
Field Data	EC	39	40
General Chemistry	Boron	11	32
General Chemistry	E. Coli	6	39
General Chemistry	Total Dissolved Solids	39	39
Pesticide	Chlorpyrifos	1	41
Pesticide	Diuron	3	41
Pesticide	Malathion	3	41

Salt Slough at Sand Dam

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Selenastrum capricornutum	1	22
Field Data	DO	3	29
Field Data	EC	23	30
Field Data	pH	3	31
General Chemistry	Arsenic	1	16
General Chemistry	Total Dissolved Solids	12	16
Pesticide	Chlorpyrifos	4	28
Pesticide	Diuron	6	28
Pesticide	Malathion	2	28
Sediment Toxicity	Hyalella azteca	1	3

San Joaquin River at Fremont Ford

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Selenastrum capricornutum	1	4
Field Data	EC	4	4
General Chemistry	Boron	3	4

General Chemistry	Total Dissolved Solids	4	4
Pesticide	Diuron	1	4

San Joaquin River at Lander Ave

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	34
Field Data	EC	14	36
Field Data	pH	4	37
General Chemistry	E. Coli	7	34
General Chemistry	Total Dissolved Solids	13	34
Pesticide	Malathion	2	34

San Joaquin River at PID Pumps

Type	Constituent	# of Exceedances	# of Tests
Field Data	EC	25	38
Field Data	pH	3	38
General Chemistry	Boron	10	38
General Chemistry	E. Coli	6	38
General Chemistry	Total Dissolved Solids	27	38
Pesticide	Chlorpyrifos	4	39

San Joaquin River at Sack Dam

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	1	3
Field Data	EC	4	39
Field Data	pH	5	41
General Chemistry	E. Coli	1	37
General Chemistry	Total Dissolved Solids	3	38
Pesticide	Chlorpyrifos	1	37
Pesticide	Diuron	1	3
Pesticide	Malathion	1	37

Turner Slough at Edminster Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Ceriodaphnia dubia	2	27
Aquatic Toxicity	Pimephales promelas	1	27
Field Data	DO	12	39
Field Data	EC	10	38
General Chemistry	Ammonia as N	2	36
General Chemistry	E. Coli	16	36
General Chemistry	Total Dissolved Solids	9	36
Pesticide	DDE(p,p')	1	15
Pesticide	DDT(p,p')	1	15

Westside San Joaquin River Watershed Coalition

Number of Water Quality Value Exceedances for the period of 9/1/2009 to 8/31/2012

Westley Wasteway near Cox Road

Type	Constituent	# of Exceedances	# of Tests
Aquatic Toxicity	Selenastrum capricornutum	3	21
Field Data	EC	6	32
Field Data	pH	2	32
General Chemistry	Boron	1	21
General Chemistry	E. Coli	20	27
General Chemistry	Total Dissolved Solids	9	27
Pesticide	a-Chlordane	1	21
Pesticide	Chlorpyrifos	2	21
Pesticide	DDE(p,p')	12	21
Pesticide	DDT(p,p')	1	21
Pesticide	Diuron	4	20
Sediment Toxicity	Hyalella azteca	2	5

Pesticide Use Report Summary

(Includes partial data, duplicate records and incomplete records)

Pesticide Use Summary

3/1/12 through 8/31/12

County Fresno

Monitoring Site Poso Slough at Indiana Ave

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
(S)-CYPERMETHRIN	August	257.4	7		Cotton
BETA-CYFLUTHRIN	March	92	2		Alfalfa
BETA-CYFLUTHRIN	June	666	6		Cotton
BETA-CYFLUTHRIN	July	74	2		Cotton
BETA-CYFLUTHRIN	August	333	7		Cotton
BIFENTHRIN	July	774	6		Melons
BIFENTHRIN	August	774	6		Melons
CARBARYL	April	55.02	1		Tomatos
CHLORPYRIFOS	March	625.1	7		Alfalfa
CHLORPYRIFOS	April	3422	48		Alfalfa
CHLORPYRIFOS	June	280	4		Almonds
CHLORPYRIFOS	July	28.2	1		Alfalfa
CHLORPYRIFOS	August	328	14		Alfalfa
CLETHODIM	May	714	36		Cotton
CLETHODIM	June	20	2		Melons
CLETHODIM	August	36	2		Alfalfa
DIMETHOATE	July	166.5	2		Alfalfa
DIURON	April	312	4		Asparagus
DIURON	May	212	2		Asparagus
DIURON	August	247	13		Cotton
ESFENVALERATE	June	334	6		Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	March	1608	18		Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	April	262	2		Melons
GLYPHOSATE, ISOPROPYLAMINE SALT	April	40	8		Oats
GLYPHOSATE, ISOPROPYLAMINE SALT	April	2231	40		Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	May	12206	195		Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	May	150	10		Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	June	80	8		Oats
GLYPHOSATE, ISOPROPYLAMINE SALT	June	224	2		Melons
GLYPHOSATE, ISOPROPYLAMINE SALT	June	6075.1	193		Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1600	80		Alfalfa
IMAZAMOX, AMMONIUM SALT	May	162	1		Alfalfa
IMAZETHAPYR, AMMONIUM SALT	May	162	1		Alfalfa
LAMBDA-CYHALOTHRIN	March	8110.02	159		Alfalfa
LAMBDA-CYHALOTHRIN	April	665	25		Tomatos
LAMBDA-CYHALOTHRIN	April	1044	54		Pistachios
LAMBDA-CYHALOTHRIN	June	2472	108		Pistachios
LAMBDA-CYHALOTHRIN	August	100	2		Tomatos
MALATHION	March	5163.4	83		Alfalfa

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

MALATHION	March	561	15		Wheat
MALATHION	April	150	6		Alfalfa
MALATHION	April	249.6	16		Wheat
MALATHION	August	150	6		Alfalfa
PARAQUAT DICHLORIDE	March	251.56	8		Cotton
PARAQUAT DICHLORIDE	April	77	4		Corn
PARAQUAT DICHLORIDE	April	344	2		Cotton
PARAQUAT DICHLORIDE	July	81	3		Alfalfa
PARAQUAT DICHLORIDE	August	81	3		Alfalfa
PENDIMETHALIN	April	1232	29		Cotton
PENDIMETHALIN	April	660	9		Tomatos
PENDIMETHALIN	May	536	4		Tomatos
PENDIMETHALIN	May	1337	22		Alfalfa
PENDIMETHALIN	May	1440	20		Cotton
PENDIMETHALIN	June	422	4		Cotton
PENDIMETHALIN	July	260	4		Alfalfa
PENDIMETHALIN	August	296	4		Alfalfa
RIMSULFURON	April	150	5		Tomatos
THIDIAZURON	August	247	13		Cotton
TRIFLURALIN	March	430	4		Tomatos
TRIFLURALIN	April	60	1		Alfalfa
TRIFLURALIN	April	9192.64	115		Tomatos
TRIFLURALIN	April	100	5		Cotton
TRIFLURALIN	May	2139.1	52		Alfalfa
TRIFLURALIN	June	263.54	5		Cotton
TRIFLURALIN	June	250	5		Tomatos
TRIFLURALIN	July	192	3		Tomatos

Monitoring Site **San Joaquin River at Sack D**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
CHLORPYRIFOS	April	5080	80		Alfalfa
CHLORPYRIFOS	August	500	20		Alfalfa
CLETHODIM	July	852	8		Alfalfa
GLYPHOSATE	March	876	19		Grapes
GLYPHOSATE	April	1260	54		Almonds
GLYPHOSATE	June	1260	54		Almonds
GLYPHOSATE	June	876	19		Grapes
GLYPHOSATE	August	1275	55		Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	80	16		Oats
GLYPHOSATE, ISOPROPYLAMINE SALT	April	8680	80		Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	June	160	16		Oats
GLYPHOSATE, ISOPROPYLAMINE SALT	August	2180	20		Alfalfa
LAMBDA-CYHALOTHRIN	March	2888.8	60		Alfalfa
MALATHION	March	8213.6	84		Alfalfa

***Includes duplicate and incomplete data**
**** Not available in all counties.**

OXYFLUORFEN	April	1260	54		Almonds
OXYFLUORFEN	June	876	19		Grapes
OXYFLUORFEN	June	1260	54		Almonds
OXYFLUORFEN	August	1275	55		Almonds
PENDIMETHALIN	March	648	13		Grapes
TRIFLURALIN	April	3140	44		Tomatos
TRIFLURALIN	May	912.8	36		Alfalfa

County **Madera**

Monitoring Site **Poso Slough at Indiana Ave**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
GLYPHOSATE, ISOPROPYLAMINE SALT	March	66	1	91.0259	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	544	8	750.274	Almonds
OXYFLUORFEN	June	1182	20	111.003	Almonds
PENDIMETHALIN	May	242	1	171.874	Tomatos
PENDIMETHALIN	June	242	1	114.583	Tomatos
PERMETHRIN	June	150	2	44.85	Pistachios

Monitoring Site **San Joaquin River at Lander**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
GLYPHOSATE, ISOPROPYLAMINE SALT	March	165.2	4	168.201	Alfalfa

Monitoring Site **San Joaquin River at Sack D**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
ACEPHATE	June	1971	24	1919.75	Alfalfa
BETA-CYFLUTHRIN	June	91.6	2	2.16	Tomatos
CLETHODIM	April	336	4	89.5054	Alfalfa
CLETHODIM	June	286	4	76.1712	Alfalfa
DIMETHOATE	June	2226	27	1109.28	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	March	7928.12	76	19412.7	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	9648	144	13306.3	Almonds
LAMBDA-CYHALOTHRIN	March	266	6	8.1974	Alfalfa
MALATHION	March	566.8	4	686.215	Wheat
MALATHION	March	100	2	96.024	Alfalfa
NALED	June	180	2	271.997	Alfalfa
OXYFLUORFEN	March	800.04	12	50.0844	Almonds
OXYFLUORFEN	June	960	12	90.2952	Pistachios
OXYFLUORFEN	June	5940	94	557.705	Almonds
PARAQUAT DICHLORIDE	May	540	6	560.64	Alfalfa
PENDIMETHALIN	May	4725	59	15884.4	Alfalfa
PENDIMETHALIN	May	484	2	343.748	Tomatos

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

PENDIMETHALIN	June	484	2	229.165	Tomatos
PENDIMETHALIN	June	720	8	2727.26	Alfalfa
PERMETHRIN	June	556	8	166.258	Pistachios
TRIFLURALIN	April	100	2	200	Alfalfa

County **Merced**

Monitoring Site **Los Banos Creek at China C**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
BETA-CYFLUTHRIN	March	971.2	28	22.8328	Alfalfa
BETA-CYFLUTHRIN	May	108	6	4.6572	Cherrys
BETA-CYFLUTHRIN	August	964	20	2.9342	Cotton
CHLORPYRIFOS	March	3076	80	1287.42	Alfalfa
CHLORPYRIFOS	August	1300	28	654.902	Alfalfa
CLETHODIM	July	16	2	1.9374	Spice
CYFLUTHRIN	March	5810.6	106	253.52	Alfalfa
DICAMBA, DIMETHYLAMINE SALT	March	821.9	25	117.196	Wheat
DICAMBA, DIMETHYLAMINE SALT	March	200.5	8	28.658	Oats
DIMETHOATE	March	200	2	99.6476	Alfalfa
ESFENVALERATE	May	558	18	27.9954	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	April	511.9	10	575.109	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	176	8	174.888	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	May	2015	31	3023.63	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1007.5	31	2015.34	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1604	32	1605.92	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	June	176	8	230.783	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	July	680.46	14	5577.15	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	July	650	5	852.272	Almonds
LAMBDA-CYHALOTHRIN	March	1958	45	59.0591	Alfalfa
LAMBDA-CYHALOTHRIN	May	550	5	20.6567	Almonds
LAMBDA-CYHALOTHRIN	June	258	8	7.7216	Corn
MALATHION	March	8243.46	176	8273.68	Alfalfa
NICOSULFURON	June	300	15	12.2625	Corn
OXYFLUORFEN	April	204.76	4	200.072	Almonds
PARAQUAT DICHLORIDE	August	130	2	448.494	Almonds
PENDIMETHALIN	March	1404.4	38	2659.83	Alfalfa
PENDIMETHALIN	July	230.22	18	218.010	Tomatos
PERMETHRIN	June	1215.6	36	188.4	Corn
TRIFLURALIN	April	680	5	675.905	Tomatos
TRIFLURALIN	April	200	2	400	Alfalfa
TRIFLURALIN	May	1372	32	2744	Alfalfa

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

Monitoring Site **Los Banos Creek at Hwy 140**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
(S)-CYPERMETHRIN	March	244	6	12.1406	Alfalfa
2,4-D, DIMETHYLAMINE SALT	April	31.82	2	54.49	Almonds
2,4-D, DIMETHYLAMINE SALT	May	1039.31	27	1728.46	Almonds
BETA-CYFLUTHRIN	March	971.2	28	22.8328	Alfalfa
BETA-CYFLUTHRIN	May	108	6	4.6572	Cherrys
BETA-CYFLUTHRIN	August	964	20	2.9342	Cotton
CHLORPYRIFOS	March	3356	84	1428.82	Alfalfa
CHLORPYRIFOS	May	540	16	1039.69	Walnuts
CHLORPYRIFOS	June	360	4	676.08	Walnuts
CHLORPYRIFOS	June	740	16	529.257	Corn
CHLORPYRIFOS	August	1300	28	654.902	Alfalfa
CLETHODIM	July	16	2	1.9374	Spice
COPPER SULFATE (BASIC)	March	88	4	375.408	Walnuts
COPPER SULFATE (BASIC)	April	88	4	375.408	Walnuts
CYFLUTHRIN	March	6895.4	122	300.768	Alfalfa
DICAMBA, DIMETHYLAMINE SALT	March	821.9	25	117.196	Wheat
DICAMBA, DIMETHYLAMINE SALT	March	200.5	8	28.658	Oats
DIMETHOATE	March	3714	70	1843.47	Alfalfa
DIMETHOATE	April	476	14	118.017	Tomatos
DIMETHOATE	May	1442	14	356.821	Tomatos
DIMETHOATE	July	1566	24	780.6	Beans
DIMETHOATE	August	5140	108	2561.30	Beans
DIMETHOATE	August	400	8	197.483	Tomatos
DIURON	April	32.75	5	39.2725	Walnuts
ESFENVALERATE	April	90	2	4.3924	Almonds
ESFENVALERATE	May	514	19	14.1932	Walnuts
ESFENVALERATE	May	1238	35	61.1828	Apricots
ESFENVALERATE	June	260	4	12.7024	Tomatos
ESFENVALERATE	June	412	12	20.1076	Walnuts
ESFENVALERATE	July	172	2	8.3946	Almonds
ESFENVALERATE	August	300	6	12.1818	Tomatos
FENPROPATHRIN	August	412	8	6275.45	Tomatos
GLYPHOSATE	April	31.82	2	66.1432	Almonds
GLYPHOSATE	May	153.95	3	320.191	Almonds
GLYPHOSATE	July	80	2	183.038	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	March	6718	53	4442.31	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	March	144	4	199.778	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	March	15	1	15.0026	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	March	1000	25	818.265	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	April	120	6	240.287	Persimmon
GLYPHOSATE, ISOPROPYLAMINE SALT	April	866.9	87	1262.53	Walnuts

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

GLYPHOSATE, ISOPROPYLAMINE SALT	April	11049.3	248	11120	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	176	8	174.888	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	April	962	122	1924.57	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	April	290	58	580.099	Pluot
GLYPHOSATE, ISOPROPYLAMINE SALT	April	511	91	1022.17	Peaches
GLYPHOSATE, ISOPROPYLAMINE SALT	May	15309	300	23173.8	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	731.5	22	731.404	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1018	117	2036.35	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1032	20	1597.08	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	May	200	10	400.068	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	May	486.8	16	725.785	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	June	290	58	1160.2	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	June	5474	155	7214.87	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	June	176	8	230.783	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	June	25729.9	530	43127.9	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	480	60	960.162	Peaches
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1168	98	2336.4	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	June	265	11	530.090	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	July	145	58	580.099	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	July	1588.86	44	6863.54	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	July	19768	400	39742.7	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	3505	154	5710.97	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	August	100	5	300.051	Walnuts
LAMBDA-CYHALOTHRIN	March	9262.8	208	281.170	Alfalfa
LAMBDA-CYHALOTHRIN	April	3080	64	124.007	Cherrys
LAMBDA-CYHALOTHRIN	April	272	8	8.0912	Tomatos
LAMBDA-CYHALOTHRIN	May	2792	40	83.0560	Tomatos
LAMBDA-CYHALOTHRIN	May	618	46	24.747	Cherrys
LAMBDA-CYHALOTHRIN	May	448	22	17.3006	Walnuts
LAMBDA-CYHALOTHRIN	May	10032	141	333.402	Almonds
LAMBDA-CYHALOTHRIN	June	398	12	11.9116	Corn
LAMBDA-CYHALOTHRIN	June	5482	182	184.881	Walnuts
LAMBDA-CYHALOTHRIN	July	9798	246	321.062	Almonds
LAMBDA-CYHALOTHRIN	July	1428	26	42.7374	Beans
LAMBDA-CYHALOTHRIN	July	220	2	6.5842	Corn
LAMBDA-CYHALOTHRIN	August	5236	111	291.929	Beans
LAMBDA-CYHALOTHRIN	August	1648	16	48.7864	Tomatos
MALATHION	March	11574.26	246	11792.4	Alfalfa
MALATHION	May	185	20	330.19	Cherrys
MALATHION	June	120	6	214.675	Cherrys
MCPA, DIMETHYLAMINE SALT	March	1836	51	1016.58	Oats
MCPA, DIMETHYLAMINE SALT	April	180	12	99.93	Oats
METOLACHLOR	May	820	20	1633.18	Beans
METOLACHLOR	June	120	3	239.966	Beans
NICOSULFURON	June	300	15	12.2625	Corn

***Includes duplicate and incomplete data**

**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

OXYFLUORFEN	March	90	1	18.8116	Walnuts
OXYFLUORFEN	April	4889.76	100	794.770	Almonds
OXYFLUORFEN	May	4348	84	574.088	Almonds
OXYFLUORFEN	May	682	17	162.43	Walnuts
OXYFLUORFEN	June	16187	313	1861.46	Almonds
OXYFLUORFEN	June	342	62	39.5272	Peaches
OXYFLUORFEN	June	808	85	101.333	Cherrys
OXYFLUORFEN	June	201	14	20.5005	Walnuts
OXYFLUORFEN	July	3714	96	1176.54	Almonds
OXYFLUORFEN	July	60	4	20.0656	Walnuts
OXYFLUORFEN	August	80	4	20.0656	Walnuts
PARAQUAT DICHLORIDE	April	120	6	124.587	Cherrys
PARAQUAT DICHLORIDE	April	40	2	45.99	Walnuts
PARAQUAT DICHLORIDE	April	928	20	813.042	Almonds
PARAQUAT DICHLORIDE	June	180	8	113.263	Almonds
PARAQUAT DICHLORIDE	August	130	2	448.494	Almonds
PENDIMETHALIN	March	1614.4	50	3495.29	Alfalfa
PENDIMETHALIN	April	75	15	284.09	Pluot
PENDIMETHALIN	May	1364	29	3874.98	Alfalfa
PENDIMETHALIN	May	657	16	821.901	Beans
PENDIMETHALIN	June	120	3	150.092	Beans
PENDIMETHALIN	July	230.22	18	218.010	Tomatos
PERMETHRIN	June	1215.6	36	188.4	Corn
PERMETHRIN	August	94	4	18.7564	Almonds
SIMAZINE	April	32.75	5	99.823	Walnuts
TRIFLURALIN	April	200	2	400	Alfalfa
TRIFLURALIN	April	680	5	675.905	Tomatos
TRIFLURALIN	May	6062	92	12124	Alfalfa
TRIFLURALIN	May	1328	36	999.812	Beans

Monitoring Site **Newman Wasteway near Hill**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
CHLORPYRIFOS	March	500	20	146.484	Alfalfa
CHLORPYRIFOS	May	2300	20	4602.28	Walnuts
CHLORPYRIFOS	July	148	4	277.944	Almonds
CLETHODIM	June	64	2	9.074	Alfalfa
DIMETHOATE	March	368	4	91.0256	Alfalfa
ESFENVALERATE	May	280	7	17.0821	Almonds
ESFENVALERATE	July	920	8	56.1264	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	March	1274	52	1229.18	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	725	41	1081.05	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	May	2555	7	3829.23	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	96	6	144.025	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	2411	83	2909.3	Corn

***Includes duplicate and incomplete data**
**** Not available in all counties.**

GLYPHOSATE, ISOPROPYLAMINE SALT	July	539	7	520.039	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	July	630	12	472.640	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	July	2555	7	5105.64	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	August	1274	52	2551.04	Almonds
IMAZETHAPYR, AMMONIUM SALT	June	64	2	4.531	Alfalfa
LAMBDA-CYHALOTHRIN	March	4150	120	125.027	Alfalfa
LAMBDA-CYHALOTHRIN	June	1160	8	44.8996	Walnuts
LAMBDA-CYHALOTHRIN	June	784	32	23.3232	Almonds
LAMBDA-CYHALOTHRIN	June	462	6	11.5524	Corn
LAMBDA-CYHALOTHRIN	July	160	4	6.346	Almonds
ORYZALIN	March	392	16	815.402	Almonds
OXYFLUORFEN	April	120	8	30.5472	Walnuts
OXYFLUORFEN	June	128	8	32.1048	Almonds
OXYFLUORFEN	July	840	16	421.38	Walnuts
OXYFLUORFEN	August	392	16	196.644	Almonds
PENDIMETHALIN	April	110	2	437.498	Alfalfa
PENDIMETHALIN	April	30	2	56.8178	Walnuts

Monitoring Site **Poso Slough at Indiana Ave**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
BETA-CYFLUTHRIN	August	36	2	0.1096	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1800	60	1421.69	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	June	600	20	600.718	Cotton
RIMSULFURON	May	60	4	1.12	Tomatos
TRIFLURALIN	April	884	4	590.722	Tomatos

Monitoring Site **Salt Slough at Lander Ave**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
BETA-CYFLUTHRIN	March	1306.68	28	212.307	Alfalfa
BETA-CYFLUTHRIN	May	10	2	0.039	Tomatos
BETA-CYFLUTHRIN	July	767.6	32	2.3336	Cotton
BETA-CYFLUTHRIN	July	271.6	4	1.0324	Tomatos
BETA-CYFLUTHRIN	August	7912.2	172	24.1294	Cotton
BIFENTHRIN	June	176	8	14.1232	Cotton
BIFENTHRIN	August	244.88	8	18.3804	Tomatos
CHLORPYRIFOS	March	1708	37	737.804	Alfalfa
CLETHODIM	May	695.2	12	182.504	Cotton
CLETHODIM	July	531.28	26	140.096	Cotton
COPPER SULFATE (BASIC)	April	271.6	4	386.198	Tomatos
DIURON	March	96	8	57.5888	Alfalfa
GLYPHOSATE	April	300.8	6	312.828	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	March	5458.0000	60	6824.24	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	March	2054	52	3061.53	Corn

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

GLYPHOSATE, ISOPROPYLAMINE SALT	March	34210.200	418	34232.6	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	March	8461.8	144	8468.87	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	April	998.8	22	1499.85	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	April	7208.6	148	7193.95	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	April	675.4	22	676.647	Wheat
GLYPHOSATE, ISOPROPYLAMINE SALT	May	8618	195	9137.96	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	June	4680	40	4666.81	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	June	50473.7	593	50331.4	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	July	6579.6	196	5888.54	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	July	688	32	1030.85	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	July	128	4	191.787	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	August	4715.6	52	6196.51	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	August	6117.8	98	6105.34	Cotton
LAMBDA-CYHALOTHRIN	March	20398.6	344	629.919	Alfalfa
LAMBDA-CYHALOTHRIN	April	1722.4	14	51.2856	Wheat
LAMBDA-CYHALOTHRIN	August	1354.4	10	40.3184	Alfalfa
MALATHION	March	6702.48	123	7581.61	Alfalfa
MALATHION	April	2401	30	3524.11	Alfalfa
MALATHION	April	944	10	1111.81	Wheat
MCPA, DIMETHYLAMINE SALT	March	206.8	2	114.548	Wheat
METHOMYL	August	894.4	16	603.72	Alfalfa
OXYFLUORFEN	March	14736.1	186	2406.02	Cotton
OXYFLUORFEN	March	4527.2	99	709.663	Tomatos
OXYFLUORFEN	April	245.6	8	38.5264	Wheat
OXYFLUORFEN	April	616.1	19	96.4351	Tomatos
PARAQUAT DICHLORIDE	March	489.76	16	677.973	Tomatos
PARAQUAT DICHLORIDE	March	380	15	263.017	Alfalfa
PARAQUAT DICHLORIDE	May	289.2	4	664.972	Alfalfa
PARAQUAT DICHLORIDE	June	3207.84	36	7376.61	Alfalfa
PARAQUAT DICHLORIDE	August	8477.44	80	13632.4	Alfalfa
PENDIMETHALIN	March	756	28	1749.99	Alfalfa
PENDIMETHALIN	April	152	2	143.939	Alfalfa
PENDIMETHALIN	May	490.46	6	768.613	Alfalfa
PENDIMETHALIN	June	70	2	132.575	Alfalfa
PENDIMETHALIN	June	219.8	7	416.286	Cotton
PENDIMETHALIN	July	513.28	28	486.058	Tomatos
PERMETHRIN	June	176	2	26.4	Corn
PYRITHIOBAC-SODIUM	May	933.23	18	189.212	Cotton
TRIFLURALIN	April	3926.4	60	7852.8	Alfalfa
TRIFLURALIN	April	1596	22	725.464	Tomatos
TRIFLURALIN	May	2104.2	34	4208.4	Alfalfa
TRIFLURALIN	May	2647.73	43	1568.85	Tomatos
TRIFLURALIN	June	1089.8	17	2179.6	Alfalfa
TRIFLURALIN	June	344.8	8	58.06	Tomatos
TRIFLURALIN	June	8688.26	134	4761.08	Cotton

***Includes duplicate and incomplete data**

**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

TRIFLURALIN	July	2278.22	26	1248.41	Cotton

Monitoring Site **Salt Slough at Sand Dam**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
BETA-CYFLUTHRIN	March	1306.68	28	212.307	Alfalfa
BETA-CYFLUTHRIN	May	10	2	0.039	Tomatos
BETA-CYFLUTHRIN	July	767.6	32	2.3336	Cotton
BETA-CYFLUTHRIN	July	271.6	4	1.0324	Tomatos
BETA-CYFLUTHRIN	August	6682.8	118	20.3602	Cotton
BIFENTHRIN	June	176	8	14.1232	Cotton
BIFENTHRIN	August	244.88	8	18.3804	Tomatos
CHLORPYRIFOS	March	1646	35	706.737	Alfalfa
CLETHODIM	July	271.28	14	71.383	Cotton
COPPER SULFATE (BASIC)	April	271.6	4	386.198	Tomatos
DIURON	March	96	8	57.5888	Alfalfa
GLYPHOSATE	April	300.8	6	312.828	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	March	7164.4	118	7169.4	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	March	5458.0000	60	6824.24	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	March	20089.7	255	20142	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	April	998.8	22	1499.85	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	April	675.4	22	676.647	Wheat
GLYPHOSATE, ISOPROPYLAMINE SALT	April	5716.2000	96	5701.89	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	May	8618	195	9137.96	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	June	4680	40	4666.81	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	June	35185.4	394	35086.0	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	July	6579.6	196	5888.54	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	July	688	32	1030.85	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	July	128	4	191.787	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	August	4715.6	52	6196.51	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	August	6117.8	98	6105.34	Cotton
LAMBDA-CYHALOTHRIN	March	17362.4	304	536.856	Alfalfa
LAMBDA-CYHALOTHRIN	April	1722.4	14	51.2856	Wheat
MALATHION	March	5166.08	103	5396.38	Alfalfa
MALATHION	April	2401	30	3524.11	Alfalfa
MALATHION	April	944	10	1111.81	Wheat
MCPA, DIMETHYLAMINE SALT	March	206.8	2	114.548	Wheat
METHOMYL	August	894.4	16	603.72	Alfalfa
OXYFLUORFEN	March	3828.6	85	600.105	Tomatos
OXYFLUORFEN	March	8008.5	100	1351.32	Cotton
OXYFLUORFEN	April	245.6	8	38.5264	Wheat
OXYFLUORFEN	April	330.5	5	51.7695	Tomatos
PARAQUAT DICHLORIDE	March	489.76	16	677.973	Tomatos
PARAQUAT DICHLORIDE	March	380	15	263.017	Alfalfa
PARAQUAT DICHLORIDE	May	289.2	4	664.972	Alfalfa

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

PARAQUAT DICHLORIDE	June	273.44	4	628.809	Alfalfa
PARAQUAT DICHLORIDE	August	1687.92	24	2914.24	Alfalfa
PENDIMETHALIN	March	756	28	1749.99	Alfalfa
PENDIMETHALIN	June	219.8	7	416.286	Cotton
PENDIMETHALIN	June	70	2	132.575	Alfalfa
PENDIMETHALIN	July	513.28	28	486.058	Tomatos
TRIFLURALIN	April	1596	22	725.464	Tomatos
TRIFLURALIN	April	3926.4	60	7852.8	Alfalfa
TRIFLURALIN	May	708.2	18	1416.4	Alfalfa
TRIFLURALIN	May	2647.73	43	1568.85	Tomatos
TRIFLURALIN	June	344.8	8	58.06	Tomatos
TRIFLURALIN	June	8688.26	134	4761.08	Cotton
TRIFLURALIN	June	636.8	7	1273.6	Alfalfa
TRIFLURALIN	July	2278.22	26	1248.41	Cotton

Monitoring Site **San Joaquin River at Lander**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	May	1075	13	1572.79	Wheat
BETA-CYFLUTHRIN	July	575.6	8	2.1916	Tomatos
BETA-CYFLUTHRIN	July	999	12	3.0384	Cotton
BETA-CYFLUTHRIN	August	7054.0000	142	21.5166	Cotton
CHLORPYRIFOS	August	456	6	199.224	Alfalfa
CLETHODIM	March	140.98	1	37.5318	Alfalfa
CLETHODIM	August	468.6	6	77.9604	Alfalfa
COPPER SULFATE (BASIC)	March	232.8	6	496.562	Tomatos
COPPER SULFATE (BASIC)	April	718.8	20	1022.16	Tomatos
GLYPHOSATE	June	1209.8	23	1258.18	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	March	26834	307	27483.1	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	March	2866	47	3393.31	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	March	4715.6	52	5895.13	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	April	3917.6	65	5883.35	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	April	675.4	22	676.647	Wheat
GLYPHOSATE, ISOPROPYLAMINE SALT	June	27647.4	298	27569.6	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	July	776.6	22	968.084	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	August	2669.8	46	2662.38	Cotton
GLYPHOSATE, ISOPROPYLAMINE SALT	August	4715.6	52	6196.51	Alfalfa
LAMBDA-CYHALOTHRIN	March	11845.4	154	3579.74	Alfalfa
LAMBDA-CYHALOTHRIN	April	576	6	17.1348	Wheat
LAMBDA-CYHALOTHRIN	August	481.8	6	14.3584	Alfalfa
MALATHION	March	454.4	4	555.903	Wheat
MALATHION	March	6073.6	82	6035.83	Alfalfa
MALATHION	April	2349.6	20	2766.83	Wheat
MALATHION	April	4249.6	46	6238.8	Alfalfa
MCPA, DIMETHYLAMINE SALT	March	386.8	6	214.301	Wheat

***Includes duplicate and incomplete data**
**** Not available in all counties.**

MCPA, DIMETHYLAMINE SALT	March	247.2	4	136.961	Barley
METHOMYL	August	606.4	8	409.32	Alfalfa
METOLACHLOR	April	168.6	2	224.209	Beans
OXYFLUORFEN	March	10812.8	137	1739.85	Cotton
OXYFLUORFEN	March	648	8	101.613	Tomatos
OXYFLUORFEN	April	60	2	7.5046	Cotton
OXYFLUORFEN	April	245.6	8	38.5264	Wheat
OXYFLUORFEN	July	421.5	15	211.442	Cotton
PARAQUAT DICHLORIDE	May	289.2	4	664.972	Alfalfa
PARAQUAT DICHLORIDE	June	6226.88	88	14319	Alfalfa
PARAQUAT DICHLORIDE	August	4622.32	56	6976.42	Alfalfa
PENDIMETHALIN	May	351.6	6	166.469	Alfalfa
PENDIMETHALIN	June	351.6	6	665.878	Alfalfa
TRIFLURALIN	March	327.6	12	655.2	Alfalfa
TRIFLURALIN	April	168.6	2	92.3908	Beans
TRIFLURALIN	April	1212.8	16	2425.6	Alfalfa
TRIFLURALIN	April	3192.2	48	1696.01	Tomatos
TRIFLURALIN	May	4678.8	62	9357.6	Alfalfa
TRIFLURALIN	May	1935.8	26	722.601	Tomatos
TRIFLURALIN	June	1210.5	17	438.782	Tomatos
TRIFLURALIN	June	9252.3	129	5067.84	Cotton
TRIFLURALIN	July	316.8	8	57.8696	Tomatos
TRIFLURALIN	July	368	4	201.662	Cotton

County **San Joaquin**

Monitoring Site **Blewett Drain at Highway 13**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
GLYPHOSATE, ISOPROPYLAMINE SALT	May	420	7	1260.21	Apricots
PARAQUAT DICHLORIDE	April	616	8	1605.07	Apricots

Monitoring Site **Hospital Creek at River Roa**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
ESFENVALERATE	May	37	1	1.8806	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	2768	16	5545.45	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	May	840	14	2520.43	Apricots
LAMBDA-CYHALOTHRIN	May	1038	6	43.5366	Apricots
PARAQUAT DICHLORIDE	April	1232	16	3210.14	Apricots
TRIFLURALIN	March	346	2	173.290	Apricots

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

County Stanislaus

Monitoring Site Blewett Drain at Highway 13

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	May	52	2	85.0342	Walnuts
2,4-D, DIMETHYLAMINE SALT	May	50	2	81.8072	Almonds
BIFENTHRIN	July	284.4	6	42.7242	Almonds
CHLORPYRIFOS	July	74	2	138.972	Almonds
ESFENVALERATE	May	990	18	48.3174	Walnuts
ESFENVALERATE	May	1726	21	97.4419	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	3596.65	37	3242.89	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1230	25	2677.37	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	624	8	934.961	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	July	3195	21	7084.14	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	July	624	8	934.961	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	July	5741	55	12181.6	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	August	3255	30	4878.33	Almonds
LAMBDA-CYHALOTHRIN	May	1730	14	43.9574	Almonds
LAMBDA-CYHALOTHRIN	May	2160	20	83.592	Walnuts
LAMBDA-CYHALOTHRIN	July	170	2	6.9632	Almonds
LAMBDA-CYHALOTHRIN	August	36	2	1.071	Tomatos
ORYZALIN	April	140.73	3	292.733	Almonds
ORYZALIN	July	450	3	1404.07	Walnuts
OXYFLUORFEN	April	516.01	11	64.713	Almonds
OXYFLUORFEN	May	329	5	165.040	Almonds
OXYFLUORFEN	July	3656	36	1931.03	Almonds
OXYFLUORFEN	July	2130	14	856.604	Walnuts
PARAQUAT DICHLORIDE	July	1080	8	2768.06	Almonds

Monitoring Site Del Puerto Creek at Hwy 33

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	March	100	5	45.713	Apricots
2,4-D, DIMETHYLAMINE SALT	March	432	9	418.608	Grapes
2,4-D, DIMETHYLAMINE SALT	May	22.5	5	28.132	Turf grass
2,4-D, DIMETHYLAMINE SALT	July	120	2	139.882	Apricots
BIFENTHRIN	June	140	2	14.0212	Melons
BIFENTHRIN	July	568	14	60.0588	Almonds
DIMETHOATE	March	1836	20	898.967	Alfalfa
DIMETHOATE	May	1090.88	32	539.506	Tomatos
DIMETHOATE	July	2472	82	1226.17	Beans
DIMETHOATE	July	2400	32	1184.90	Tomatos
DIMETHOATE	August	3730	45	1841.53	Beans

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

ESFENVALERATE	March	296	4	12.0388	Apricots
ESFENVALERATE	May	120	4	4.8804	Cherrys
ESFENVALERATE	May	4540	117	193.785	Apricots
ESFENVALERATE	May	152	8	7.7048	Almonds
ESFENVALERATE	July	600	8	24.4156	Tomatos
ESFENVALERATE	July	32	4	0.1016	Apricots
ESFENVALERATE	July	300	2	19.5222	Almonds
ETHALFLURALIN	May	112	4	142.428	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	March	4494	49	5839	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	March	1344	28	2691.21	Grapes
GLYPHOSATE, ISOPROPYLAMINE SALT	March	189.99	3	380.105	Peaches
GLYPHOSATE, ISOPROPYLAMINE SALT	March	92	23	46.0552	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	March	2980	44	2378.76	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	April	7100	69	6870.43	Peaches
GLYPHOSATE, ISOPROPYLAMINE SALT	April	896	14	3588.28	Fallow
GLYPHOSATE, ISOPROPYLAMINE SALT	April	490	5	490.837	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1708.5	29	1166.23	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	3150	21	3150.54	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	896	14	3588.28	Fallow
GLYPHOSATE, ISOPROPYLAMINE SALT	June	266	14	266.045	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	230	23	331.596	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1287	47	1688.06	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	July	4238	66	5900.59	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	July	161	23	92.1104	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	July	1720	25	2525.43	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	July	15691.5	211	23911.7	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	August	1344	28	2016.34	Almonds
LAMBDA-CYHALOTHRIN	March	2424	53	70.4007	Alfalfa
LAMBDA-CYHALOTHRIN	March	14125	117	350.155	Peaches
LAMBDA-CYHALOTHRIN	March	150	3	3.7185	Apricots
LAMBDA-CYHALOTHRIN	April	372.5	10	14.4284	Cherrys
LAMBDA-CYHALOTHRIN	April	13000	108	771.582	Peaches
LAMBDA-CYHALOTHRIN	May	2683	32	98.7604	Apricots
LAMBDA-CYHALOTHRIN	May	630	9	6.8157	Tomatos
LAMBDA-CYHALOTHRIN	May	80	5	3.1425	Almonds
LAMBDA-CYHALOTHRIN	July	221	13	8.8192	Walnuts
LAMBDA-CYHALOTHRIN	July	1028	32	30.6338	Beans
LAMBDA-CYHALOTHRIN	August	1470	19	43.9939	Beans
MALATHION	July	55	1	78.2136	Beans
MALATHION	August	128	2	158.327	Beans
METOLACHLOR	April	900	18	1196.47	Tomatos
METOLACHLOR	May	100	2	122.653	Tomatos
METOLACHLOR	May	112	4	187.014	Beans
ORYZALIN	June	144	3	102.092	Almonds
OXYFLUORFEN	March	1950	13	76.4218	Almonds

***Includes duplicate and incomplete data**

**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

OXYFLUORFEN	April	96	8	24.0792	Almonds
OXYFLUORFEN	May	1950	13	195.641	Almonds
OXYFLUORFEN	July	56	8	8.0264	Walnuts
OXYFLUORFEN	July	20	5	0.8365	Cherrys
OXYFLUORFEN	July	5960	80	698.537	Almonds
OXYFLUORFEN	July	339	9	143.971	Apricots
PARAQUAT DICHLORIDE	March	118	2	42.4554	Apricots
PARAQUAT DICHLORIDE	March	150	2	53.9688	Almonds
PARAQUAT DICHLORIDE	July	16	2	20.7644	Walnuts
PARAQUAT DICHLORIDE	July	54	18	74.7522	Cherrys
PARAQUAT DICHLORIDE	July	23	2	31.8388	Apricots
PARAQUAT DICHLORIDE	August	882	9	3042.23	Olive
PENDIMETHALIN	March	316.65	5	599.808	Peaches
PENDIMETHALIN	March	66	6	46.875	Cherrys
PENDIMETHALIN	March	240	5	909.086	Grapes
PENDIMETHALIN	March	89	4	63.21	Apricots
PENDIMETHALIN	April	700	14	662.876	Tomatos
PENDIMETHALIN	May	250	5	201.23	Tomatos
RIMSULFURON	May	958.16	26	28.7418	Tomatos
SIMAZINE	March	288	6	1153.46	Grapes
ZIRAM	March	961	14	3287.76	Apricots

Monitoring Site **Del Puerto Creek near Cox**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	March	432	9	418.608	Grapes
2,4-D, DIMETHYLAMINE SALT	March	150	9	168.793	Turf grass
2,4-D, DIMETHYLAMINE SALT	March	100	5	45.713	Apricots
2,4-D, DIMETHYLAMINE SALT	May	229.5	20	261.066	Turf grass
2,4-D, DIMETHYLAMINE SALT	July	150	3	62.3298	Almonds
2,4-D, DIMETHYLAMINE SALT	July	120	2	139.882	Apricots
BIFENTHRIN	June	140	2	14.0212	Melons
BIFENTHRIN	July	820	22	85.2968	Almonds
BROMOXYNIL HEPTANOATE	April	40	2	7.0858	Alfalfa
BROMOXYNIL OCTANOATE	April	40	2	7.3482	Alfalfa
CHLORPYRIFOS	March	304.5	11	106.95	Alfalfa
CHLORPYRIFOS	August	88	4	44.0648	Alfalfa
CHLORPYRIFOS	August	226	6	228.267	Corn
DIMETHOATE	March	3876	44	1817.80	Alfalfa
DIMETHOATE	April	378.16	8	187.118	Tomatos
DIMETHOATE	April	402	18	198.752	Alfalfa
DIMETHOATE	May	666	12	329.592	Broccoli
DIMETHOATE	May	4498.64	150	2039.45	Tomatos
DIMETHOATE	June	2164	48	741.186	Tomatos
DIMETHOATE	July	11022	272	5378.57	Tomatos

***Includes duplicate and incomplete data**
**** Not available in all counties.**

DIMETHOATE	July	4392	170	2176.58	Beans
DIMETHOATE	August	3008	32	744.037	Tomatos
DIMETHOATE	August	6646	105	3283.11	Beans
ESFENVALERATE	March	296	4	12.0388	Apricots
ESFENVALERATE	May	3447	73	179.686	Almonds
ESFENVALERATE	May	120	4	4.8804	Cherrys
ESFENVALERATE	May	5643	181	244.712	Apricots
ESFENVALERATE	June	1056.25	36	42.9165	Tomatos
ESFENVALERATE	July	2744	28	143.787	Almonds
ESFENVALERATE	July	6218	171	260.587	Tomatos
ESFENVALERATE	July	32	4	0.1016	Apricots
ESFENVALERATE	July	485	30	28.5479	Walnuts
ESFENVALERATE	August	590	6	26.9796	Tomatos
ETHALFLURALIN	May	148	7	188.208	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	March	189.99	3	380.105	Peaches
GLYPHOSATE, ISOPROPYLAMINE SALT	March	92	23	46.0552	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	March	2980	44	2378.76	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	March	1344	28	2691.21	Grapes
GLYPHOSATE, ISOPROPYLAMINE SALT	March	368	48	360.432	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	March	4494	49	5839	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	7100	69	6870.43	Peaches
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1194	21	3201.55	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	April	260	13	390.467	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	April	896	14	3588.28	Fallow
GLYPHOSATE, ISOPROPYLAMINE SALT	April	234	18	432.517	Turf grass
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1390	20	1274.65	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	April	160	2	120.020	Alfalfa
GLYPHOSATE, ISOPROPYLAMINE SALT	April	100	16	65.0784	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	April	8788.5	86	21870.3	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1080	12	4325.16	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	May	2380	28	4765.69	Melons
GLYPHOSATE, ISOPROPYLAMINE SALT	May	4060	112	4434.33	Grapes
GLYPHOSATE, ISOPROPYLAMINE SALT	May	3150	21	3150.54	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	896	14	3588.28	Fallow
GLYPHOSATE, ISOPROPYLAMINE SALT	June	230	23	331.596	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	June	6986	53	20429.5	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	2022	79	2423.18	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	June	130	13	260.311	Turf grass
GLYPHOSATE, ISOPROPYLAMINE SALT	July	161	23	92.1104	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	July	1912	31	2717.46	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	July	4238	66	5900.59	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	July	16551.5	239	24818.3	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	234	18	468.56	Turf grass
GLYPHOSATE, ISOPROPYLAMINE SALT	August	4614	80	11171.4	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	August	342	18	684.817	Turf grass

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

GLYPHOSATE, ISOPROPYLAMINE SALT	August	182	26	208.035	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	August	840	28	1009.20	Grapes
GLYPHOSATE, ISOPROPYLAMINE SALT	August	1209	39	3623.06	Spice
LAMBDA-CYHALOTHRIN	March	14125	117	350.155	Peaches
LAMBDA-CYHALOTHRIN	March	8255	243	246.294	Alfalfa
LAMBDA-CYHALOTHRIN	March	1230	21	30.4917	Apricots
LAMBDA-CYHALOTHRIN	April	13000	108	771.582	Peaches
LAMBDA-CYHALOTHRIN	April	372.5	10	14.4284	Cherrys
LAMBDA-CYHALOTHRIN	April	856	32	25.464	Alfalfa
LAMBDA-CYHALOTHRIN	April	176	11	4.7718	Walnuts
LAMBDA-CYHALOTHRIN	May	680	7	18.8711	Almonds
LAMBDA-CYHALOTHRIN	May	1086.68	40	18.9773	Tomatos
LAMBDA-CYHALOTHRIN	May	3763	50	125.534	Apricots
LAMBDA-CYHALOTHRIN	May	30	3	1.1898	Cherrys
LAMBDA-CYHALOTHRIN	June	197.5	15	7.8122	Walnuts
LAMBDA-CYHALOTHRIN	July	100	2	3.9716	Almonds
LAMBDA-CYHALOTHRIN	July	910	26	26.9508	Tomatos
LAMBDA-CYHALOTHRIN	July	1928	80	57.4922	Beans
LAMBDA-CYHALOTHRIN	July	261	17	9.9096	Walnuts
LAMBDA-CYHALOTHRIN	August	330	11	5.4868	Walnuts
LAMBDA-CYHALOTHRIN	August	2460	37	75.3247	Beans
LAMBDA-CYHALOTHRIN	August	642	6	19.098	Tomatos
LINURON	March	208	13	208	Asparagus
MALATHION	May	22	4	21.4676	Cherrys
MALATHION	July	55	1	78.2136	Beans
MALATHION	August	128	2	158.327	Beans
MCPA, DIMETHYLAMINE SALT	April	116	8	44.8268	Oats
METOLACHLOR	April	900	18	1196.47	Tomatos
METOLACHLOR	May	100	2	122.653	Tomatos
METOLACHLOR	May	922	13	1539.70	Beans
METOLACHLOR	June	360	9	601.115	Beans
ORYZALIN	March	1200	4	3599.71	Almonds
ORYZALIN	June	144	3	102.092	Almonds
OXYFLUORFEN	March	20	4	1.8812	Cherrys
OXYFLUORFEN	March	1950	13	76.4218	Almonds
OXYFLUORFEN	April	4756	47	2204.12	Almonds
OXYFLUORFEN	May	4093	26	287.177	Almonds
OXYFLUORFEN	June	1390	14	588.928	Almonds
OXYFLUORFEN	July	8103	93	787.24	Almonds
OXYFLUORFEN	July	339	9	143.971	Apricots
OXYFLUORFEN	July	20	5	0.8365	Cherrys
OXYFLUORFEN	July	56	8	8.0264	Walnuts
OXYFLUORFEN	August	1142	20	166.514	Almonds
OXYFLUORFEN	August	480	16	144.474	Grapes
PARAQUAT DICHLORIDE	March	118	2	42.4554	Apricots

***Includes duplicate and incomplete data**

**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

PARAQUAT DICHLORIDE	March	536	24	1232.53	Alfalfa
PARAQUAT DICHLORIDE	March	1050	5	3158.29	Almonds
PARAQUAT DICHLORIDE	July	23	2	31.8388	Apricots
PARAQUAT DICHLORIDE	July	54	18	74.7522	Cherrys
PARAQUAT DICHLORIDE	July	132	6	82.7596	Walnuts
PARAQUAT DICHLORIDE	August	116	4	151.396	Walnuts
PARAQUAT DICHLORIDE	August	882	9	3042.23	Olive
PENDIMETHALIN	March	204	24	281.071	Cherrys
PENDIMETHALIN	March	329	8	381.39	Apricots
PENDIMETHALIN	March	316.65	5	599.808	Peaches
PENDIMETHALIN	March	240	5	909.086	Grapes
PENDIMETHALIN	April	638	8	604.163	Beans
PENDIMETHALIN	April	1757.32	30	1664.08	Tomatos
PENDIMETHALIN	April	37.5	6	14.382	Cherrys
PENDIMETHALIN	May	234	6	221.59	Beans
PENDIMETHALIN	May	2629	124	2454.06	Tomatos
PENDIMETHALIN	June	576	12	545.452	Beans
RIMSULFURON	April	567.24	12	17.73	Tomatos
RIMSULFURON	May	3956.54	152	127.179	Tomatos
RIMSULFURON	June	562.5	9	17.5725	Tomatos
SIMAZINE	March	288	6	1153.46	Grapes
SIMAZINE	April	40	2	19.8946	Almonds
TRIFLURALIN	April	68	4	27.2796	Beans
ZIRAM	March	961	14	3287.76	Apricots

Monitoring Site **Hospital Creek at River Roa**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	April	700	5	763.128	Almonds
BIFENTHRIN	July	706	10	92.3892	Almonds
BROMOXYNIL HEPTANOATE	March	130	2	22.3536	Alfalfa
BROMOXYNIL OCTANOATE	March	130	2	23.1814	Alfalfa
CARBARYL	May	420	3	357	Tomatos
CHLORPYRIFOS	June	210	5	394.38	Almonds
DIMETHOATE	March	130	2	40.2096	Alfalfa
DIMETHOATE	June	1872	24	926.088	Tomatos
DIMETHOATE	July	6076	96	3004.47	Beans
DIMETHOATE	July	11344	126	4898.3	Tomatos
DIMETHOATE	August	220	4	108.756	Beans
ESFENVALERATE	May	330	11	16.1062	Apricots
ESFENVALERATE	May	5687	56	298.86	Almonds
ESFENVALERATE	May	1980	36	96.6348	Walnuts
ESFENVALERATE	July	2255	22	114.674	Almonds
ESFENVALERATE	July	1080	12	43.9376	Tomatos
ETHALFLURALIN	May	5400	86	6867.07	Beans

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

GLYPHOSATE, ISOPROPYLAMINE SALT	March	1050	14	643.8	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	126	12	141.629	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	April	8719.65	73	8728.83	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	144	6	299.744	Right of Way
GLYPHOSATE, ISOPROPYLAMINE SALT	May	126	12	141.629	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	May	11097	119	18675.1	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1944	36	3888.66	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	255	24	464.389	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	July	5992	56	13120.9	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	3195	21	7084.14	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	August	1683.96	79	4261.12	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	August	2424	42	4608.05	Almonds
IMAZETHAPYR, AMMONIUM SALT	March	130	2	9.2314	Alfalfa
LAMBDA-CYHALOTHRIN	March	4780	62	142.194	Alfalfa
LAMBDA-CYHALOTHRIN	April	4185	54	124.494	Alfalfa
LAMBDA-CYHALOTHRIN	May	997	11	28.4424	Almonds
LAMBDA-CYHALOTHRIN	May	360	8	15.0992	Walnuts
LAMBDA-CYHALOTHRIN	May	3780	27	112.447	Tomatos
LAMBDA-CYHALOTHRIN	June	944	8	20.6024	Walnuts
LAMBDA-CYHALOTHRIN	June	1080	20	28.312	Almonds
LAMBDA-CYHALOTHRIN	June	6309.28	88	127.716	Tomatos
LAMBDA-CYHALOTHRIN	July	5646	90	168.187	Beans
LAMBDA-CYHALOTHRIN	July	12644	134	363.101	Tomatos
LAMBDA-CYHALOTHRIN	July	170	2	6.9632	Almonds
LAMBDA-CYHALOTHRIN	August	2160	40	70.778	Almonds
LAMBDA-CYHALOTHRIN	August	3780	27	112.447	Tomatos
LAMBDA-CYHALOTHRIN	August	960	8	41.9032	Walnuts
LAMBDA-CYHALOTHRIN	August	330	6	9.8169	Beans
METOLACHLOR	May	3614	52	5129.34	Tomatos
METOLACHLOR	May	8088	123	13505.3	Beans
METOLACHLOR	June	2730	26	3874.76	Tomatos
ORYZALIN	March	150	2	191.463	Almonds
ORYZALIN	April	140.73	3	292.733	Almonds
ORYZALIN	May	7542	30	23532.2	Almonds
ORYZALIN	July	450	3	1404.07	Walnuts
OXYFLUORFEN	April	3266.01	29	334.14	Almonds
OXYFLUORFEN	May	240	10	100.328	Right of Way
OXYFLUORFEN	May	8073	53	902.717	Almonds
OXYFLUORFEN	June	864	16	108.354	Almonds
OXYFLUORFEN	July	2130	14	856.604	Walnuts
OXYFLUORFEN	July	14432	74	2266.89	Almonds
OXYFLUORFEN	August	378	9	119.961	Walnuts
OXYFLUORFEN	August	1694	48	103.655	Almonds
OXYFLUORFEN	August	1049.4	6	526.484	Grapes
PARAQUAT DICHLORIDE	July	1080	8	2768.06	Almonds

***Includes duplicate and incomplete data**

**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

PENDIMETHALIN	April	360	3	340.907	Beans
PENDIMETHALIN	May	720	8	681.815	Beans
RIMSULFURON	May	3740	34	87.125	Tomatos
RIMSULFURON	June	339.96	12	10.605	Tomatos
RIMSULFURON	August	2380	17	74.375	Tomatos

Monitoring Site **Ingram Creek at River Road**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	April	700	5	763.128	Almonds
BIFENTHRIN	July	2354	32	269.115	Almonds
BROMOXYNIL HEPTANOATE	March	130	2	22.3536	Alfalfa
BROMOXYNIL OCTANOATE	March	130	2	23.1814	Alfalfa
CARBARYL	April	120	1	60	Tomatos
CARBARYL	May	590	5	501.5	Tomatos
CHLORPYRIFOS	May	340	4	319.26	Walnuts
DIMETHOATE	March	130	2	40.2096	Alfalfa
DIMETHOATE	May	120	6	59.3646	Tomatos
DIMETHOATE	June	2232	30	1015.14	Tomatos
DIMETHOATE	July	21979	251	9043.80	Tomatos
DIMETHOATE	July	16122	251	7983.78	Beans
DIMETHOATE	August	1550	32	769.827	Beans
ESFENVALERATE	May	902	12	46.9636	Almonds
ESFENVALERATE	May	240	6	11.7132	Walnuts
ESFENVALERATE	May	1320	84	85.8972	Cherrys
ESFENVALERATE	May	1684	31	80.4484	Apricots
ESFENVALERATE	July	150	6	7.3206	Almonds
ESFENVALERATE	July	1240	14	51.265	Tomatos
ETHALFLURALIN	May	15185	197	19146.4	Beans
ETHALFLURALIN	June	270	3	343.353	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	March	3724	133	3047.55	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	March	2040	24	2723.17	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	March	7460	142	5420.29	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	April	306	17	381.916	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	April	9568	428	11640	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	400	5	1601.91	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	April	360	6	1440.25	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	May	2166	36	2864.80	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	May	930	43	3724.45	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	May	390	6	425.969	Grapes
GLYPHOSATE, ISOPROPYLAMINE SALT	May	144	6	299.744	Right of Way
GLYPHOSATE, ISOPROPYLAMINE SALT	May	13307	208	11622.6	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	750	6	3003.59	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	June	9842	931	19687.4	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	June	3424	46	6111.32	Almonds

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

GLYPHOSATE, ISOPROPYLAMINE SALT	June	3578.67	423	7112.85	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	June	270	2	216.258	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	July	19046.880	733	35248.5	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	2661.3300	399	5323.58	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	July	390	6	732.124	Grapes
GLYPHOSATE, ISOPROPYLAMINE SALT	July	2926	133	1594.64	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	July	8778	798	17559	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	August	6724.58	200	8825.84	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	August	1683.96	79	4261.12	Walnuts
IMAZETHAPYR, AMMONIUM SALT	March	130	2	9.2314	Alfalfa
LAMBDA-CYHALOTHRIN	March	4780	62	142.194	Alfalfa
LAMBDA-CYHALOTHRIN	April	4185	54	124.494	Alfalfa
LAMBDA-CYHALOTHRIN	May	7785	80	188.373	Tomatos
LAMBDA-CYHALOTHRIN	May	360	8	15.0992	Walnuts
LAMBDA-CYHALOTHRIN	May	2674	81	78.76	Almonds
LAMBDA-CYHALOTHRIN	June	1080	20	28.312	Almonds
LAMBDA-CYHALOTHRIN	June	944	8	20.6024	Walnuts
LAMBDA-CYHALOTHRIN	June	6309.28	88	127.716	Tomatos
LAMBDA-CYHALOTHRIN	July	14346	217	427.078	Beans
LAMBDA-CYHALOTHRIN	July	24519	265	716.534	Tomatos
LAMBDA-CYHALOTHRIN	July	1680	60	62.916	Almonds
LAMBDA-CYHALOTHRIN	August	470	8	13.9633	Beans
LAMBDA-CYHALOTHRIN	August	3780	27	112.447	Tomatos
LAMBDA-CYHALOTHRIN	August	2160	40	70.778	Almonds
LAMBDA-CYHALOTHRIN	August	960	8	41.9032	Walnuts
MALATHION	May	6240	312	11163.1	Cherrys
METOLACHLOR	April	120	2	179.975	Tomatos
METOLACHLOR	May	28571	403	46182.5	Beans
METOLACHLOR	May	4585.65	62	6408.26	Tomatos
METOLACHLOR	June	810	9	1352.51	Beans
METOLACHLOR	June	3315	35	5240.94	Tomatos
ORYZALIN	March	9.48	3	29.5791	Cherrys
ORYZALIN	March	29.46	3	91.9197	Almonds
ORYZALIN	March	1490	25	1690.64	Apricots
ORYZALIN	April	684	57	1422.79	Almonds
ORYZALIN	June	836	76	1738.96	Cherrys
OXYFLUORFEN	April	5304	238	548.334	Almonds
OXYFLUORFEN	May	2936	20	123.397	Almonds
OXYFLUORFEN	May	240	10	100.328	Right of Way
OXYFLUORFEN	June	864	16	108.354	Almonds
OXYFLUORFEN	July	260	4	65.2136	Grapes
OXYFLUORFEN	July	8354.6400	384	1847.28	Almonds
OXYFLUORFEN	August	864	16	81.2656	Almonds
OXYFLUORFEN	August	1049.4	6	526.484	Grapes
OXYFLUORFEN	August	378	9	119.961	Walnuts

***Includes duplicate and incomplete data**

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Pesticide Use Summary

3/1/12 through 8/31/12

OXYFLUORFEN	August	685.24	74	171.872	Cherrys
PARAQUAT DICHLORIDE	June	55.6	8	76.9672	Cherrys
PARAQUAT DICHLORIDE	July	148.16	16	205.098	Cherrys
PARAQUAT DICHLORIDE	August	74.08	8	102.549	Cherrys
PENDIMETHALIN	April	360	3	340.907	Beans
PENDIMETHALIN	May	3730	64	3532.18	Beans
RIMSULFURON	May	9821	115	225.923	Tomatos
RIMSULFURON	June	339.96	12	10.605	Tomatos
RIMSULFURON	August	2380	17	74.375	Tomatos
TRIFLURALIN	May	250	2	68.441	Tomatos
TRIFLURALIN	June	260	4	136.882	Tomatos

Monitoring Site **Marshall Road Drain near R**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	June	48	2	26.1644	Almonds
BIFENTHRIN	June	54	6	6.7602	Almonds
BIFENTHRIN	July	140	4	10.9366	Melons
BIFENTHRIN	July	772	20	89.3142	Almonds
BIFENTHRIN	July	270	12	27.4014	Walnuts
BIFENTHRIN	August	170	2	17.0256	Corn
BIFENTHRIN	August	560	8	45.5616	Melons
CHLORPYRIFOS	March	216	6	76.0216	Alfalfa
CHLORPYRIFOS	May	54	6	54.5418	Walnuts
DIMETHOATE	March	440	4	218.165	Alfalfa
DIMETHOATE	May	1348	28	168.79	Tomatos
DIMETHOATE	June	600	14	262.478	Tomatos
DIMETHOATE	July	1620	20	788.620	Tomatos
DIMETHOATE	July	480	6	118.49	Beans
DIMETHOATE	August	500	10	246.854	Tomatos
DIMETHOATE	August	706	12	348.744	Beans
ESFENVALERATE	May	23	2	0.9354	Cherrys
ESFENVALERATE	May	108	6	5.271	Almonds
ESFENVALERATE	June	90	10	4.36	Walnuts
ESFENVALERATE	July	864	18	36.7898	Tomatos
ESFENVALERATE	August	240	6	9.7608	Tomatos
ESFENVALERATE	August	900	6	58.5666	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	March	42	14	83.9286	Pasture
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1575	21	2365.32	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	April	310	4	464.079	Fallow
GLYPHOSATE, ISOPROPYLAMINE SALT	April	44	2	66.0112	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	240	20	360.062	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	May	3360	42	13456.1	Melons
GLYPHOSATE, ISOPROPYLAMINE SALT	May	40	2	159.549	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	May	100	2	83.3542	Walnuts

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

GLYPHOSATE, ISOPROPYLAMINE SALT	May	2306	16	2606.45	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1540	22	1540.26	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1980	35	3721.37	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	190	2	760.13	Melons
GLYPHOSATE, ISOPROPYLAMINE SALT	June	100	2	125.213	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	June	440	11	440.075	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	July	4402.48	120	6385.92	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	706	24	706.12	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	August	42	14	83.9286	Pasture
GLYPHOSATE, ISOPROPYLAMINE SALT	August	2730	36	3992.16	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	August	935	11	935.16	Corn
LAMBDA-CYHALOTHRIN	March	2171	44	65.2807	Alfalfa
LAMBDA-CYHALOTHRIN	April	360	12	10.7088	Tomatos
LAMBDA-CYHALOTHRIN	May	180	12	7.0632	Walnuts
LAMBDA-CYHALOTHRIN	May	564	12	22.0272	Almonds
LAMBDA-CYHALOTHRIN	May	375	5	4.0565	Tomatos
LAMBDA-CYHALOTHRIN	June	28	4	1.1924	Walnuts
LAMBDA-CYHALOTHRIN	July	80	4	2.1692	Tomatos
LAMBDA-CYHALOTHRIN	August	452	12	13.4464	Beans
LAMBDA-CYHALOTHRIN	August	480	12	14.3652	Melons
LAMBDA-CYHALOTHRIN	August	720	12	21.5484	Tomatos
ORYZALIN	May	22.5	3	9.3606	Almonds
ORYZALIN	August	600	4	624.031	Almonds
OXYFLUORFEN	March	33	11	11.0363	Pasture
OXYFLUORFEN	May	2084	18	266.944	Almonds
OXYFLUORFEN	July	2845.94	61	424.148	Almonds
OXYFLUORFEN	August	33	11	11.0363	Pasture
OXYFLUORFEN	August	1698	13	177.582	Almonds
PARAQUAT DICHLORIDE	April	20	2	20.7644	Walnuts
PENDIMETHALIN	April	32	2	75.7572	Alfalfa
PENDIMETHALIN	April	980	9	1344.69	Tomatos
PENDIMETHALIN	May	273.34	6	258.862	Tomatos
PENDIMETHALIN	May	200	8	378.786	Alfalfa
PENDIMETHALIN	June	40	1	37.8786	Tomatos
PENDIMETHALIN	June	444	10	370.794	Beans
RIMSULFURON	April	180	6	5.625	Tomatos
RIMSULFURON	May	1395	18	31.7034	Tomatos
RIMSULFURON	July	140	2	2.625	Tomatos

Monitoring Site **Newman Wasteway near Hill**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
BIFENTHRIN	April	280	4	26.2796	Broccoli
BIFENTHRIN	May	480	8	37.4964	Corn
CHLORPYRIFOS	March	340	10	104.673	Alfalfa

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

DIAZINON	April	80	2	120	Cherrys
DIMETHOATE	March	360	6	178.094	Broccoli
DIMETHOATE	March	264	4	130.339	Alfalfa
DIMETHOATE	April	420	6	207.776	Broccoli
DIMETHOATE	April	48	4	23.698	Alfalfa
DIMETHOATE	May	960	12	118.729	Tomatos
DIMETHOATE	May	720	12	356.188	Corn
ESFENVALERATE	April	30	12	0.732	Cherrys
ESFENVALERATE	May	1636	10	53.2284	Almonds
ESFENVALERATE	June	1840	24	65.4128	Tomatos
ESFENVALERATE	July	560	8	36.4416	Almonds
ESFENVALERATE	August	920	12	37.4308	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	April	720	8	1440.25	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	979	15	1958.33	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	2126	28	4252.73	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	5260	34	6876.82	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	August	1800	18	3600.61	Almonds
LAMBDA-CYHALOTHRIN	March	1062	29	30.2309	Alfalfa
LAMBDA-CYHALOTHRIN	April	156	4	4.9074	Alfalfa
LAMBDA-CYHALOTHRIN	May	1300	14	30.1246	Tomatos
LAMBDA-CYHALOTHRIN	June	640	4	24.79	Almonds
LAMBDA-CYHALOTHRIN	July	824	14	28.5756	Almonds
OXYFLUORFEN	March	708.6	12	179.873	Almonds
OXYFLUORFEN	April	270	3	33.8607	Almonds
OXYFLUORFEN	June	1976	28	294.965	Almonds
PARAQUAT DICHLORIDE	March	436.2	8	1002.95	Almonds
PARAQUAT DICHLORIDE	April	400	4	1379.7	Almonds
PARAQUAT DICHLORIDE	May	200	4	689.849	Almonds
PARAQUAT DICHLORIDE	June	100	4	69.2148	Almonds
PENDIMETHALIN	March	277.15	5	524.96	Almonds
TRIFLURALIN	April	132	2	264	Alfalfa

Monitoring Site **Orestimba Creek at Hwy 33**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	June	340	17	555.994	Walnuts
CHLORPYRIFOS	May	210	8	211.947	Walnuts
CHLORPYRIFOS	May	1968	36	3042.17	Citrus
CHLORPYRIFOS	July	1140	12	4534.3	Citrus
CHLORPYRIFOS	July	352	24	840.597	Almonds
DIMETHOATE	March	650	26	324.373	Alfalfa
DIMETHOATE	May	1526	51	377.678	Tomatos
DIMETHOATE	June	136	2	67.28	Beans
DIMETHOATE	June	1962	40	485.044	Tomatos
DIMETHOATE	July	8130	45	2008.49	Beans

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

DIMETHOATE	July	800	8	394.967	Tomatos
DIMETHOATE	August	3570	17	1762.54	Beans
DIMETHOATE	August	360	3	89.0469	Tomatos
DIURON	April	15	1	11.9977	Walnuts
DIURON	July	320	2	234.546	Walnuts
ESFENVALERATE	May	8032	108	493.079	Almonds
ESFENVALERATE	May	294	6	19.1316	Walnuts
ESFENVALERATE	June	1230	18	49.9636	Tomatos
ESFENVALERATE	July	510	4	33.1876	Almonds
ESFENVALERATE	July	1030	14	43.3522	Tomatos
ESFENVALERATE	July	1482	34	89.1774	Walnuts
ESFENVALERATE	August	940	8	43.0008	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	March	1500	20	360.062	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	March	408	6	816.139	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	March	585	45	499.886	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	March	150	15	225.039	Right of Way
GLYPHOSATE, ISOPROPYLAMINE SALT	March	21105	268	27783.8	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1100	11	4030.78	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	April	4589	78	5048.76	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1620	40	1620.28	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1000	40	1120.19	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1283.38	80	2090.93	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	May	8559	138	10638.5	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1500	20	1120.19	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	May	6790	41	20529.3	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	May	6211.56	114	10034.1	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	June	290	2	1160.2	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	June	3120	39	3123.73	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	June	2262	78	3042.52	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	June	4195	39	8391.43	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1500	20	600.102	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	July	1500	20	360.062	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	July	45184.75	592	91860.8	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	5405.5	178	7690.19	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	July	816	4	1137.05	Citrus
GLYPHOSATE, ISOPROPYLAMINE SALT	August	1146.28	71	2355.96	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	August	6580	91	12282.1	Almonds
LAMBDA-CYHALOTHRIN	March	1980	48	89.406	Alfalfa
LAMBDA-CYHALOTHRIN	March	900	12	26.4936	Broccoli
LAMBDA-CYHALOTHRIN	April	240	20	7.14	Tomatos
LAMBDA-CYHALOTHRIN	April	2968	58	74.223	Walnuts
LAMBDA-CYHALOTHRIN	May	3880	50	151.897	Walnuts
LAMBDA-CYHALOTHRIN	May	25326	830	785.474	Almonds
LAMBDA-CYHALOTHRIN	June	1056	32	28.598	Walnuts
LAMBDA-CYHALOTHRIN	June	640	8	19.0384	Tomatos

***Includes duplicate and incomplete data**

**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

LAMBDA-CYHALOTHRIN	July	1410	22	44.3226	Almonds
LAMBDA-CYHALOTHRIN	July	500	10	14.874	Tomatos
METOLACHLOR	May	8967	189	15970.7	Beans
METOLACHLOR	June	1785	42	4535.36	Beans
NORFLURAZON	March	750	3	294.75	Almonds
NORFLURAZON	May	486	12	190.998	Almonds
OXYFLUORFEN	March	90	9	33.9507	Right of Way
OXYFLUORFEN	March	455	7	30.4801	Walnuts
OXYFLUORFEN	April	1458	36	146.165	Almonds
OXYFLUORFEN	April	186	2	11.6782	Fallow
OXYFLUORFEN	May	6111	78	874.094	Almonds
OXYFLUORFEN	May	3463	39	535.934	Walnuts
OXYFLUORFEN	June	798	21	100.659	Walnuts
OXYFLUORFEN	June	1955	23	263.763	Almonds
OXYFLUORFEN	July	4580	40	464.709	Almonds
OXYFLUORFEN	July	815	39	289.365	Walnuts
OXYFLUORFEN	August	414	18	41.4792	Almonds
PARAQUAT DICHLORIDE	April	520	8	1766.01	Tomatos
PARAQUAT DICHLORIDE	June	110	2	52.554	Almonds
PARAQUAT DICHLORIDE	August	304	2	315.62	Walnuts
PARAQUAT DICHLORIDE	August	1790	68	2572.56	Almonds
PENDIMETHALIN	March	32	4	121.211	Almonds
PENDIMETHALIN	April	420	2	397.725	Beans
PENDIMETHALIN	April	344.37	16	652.213	Walnuts
PENDIMETHALIN	May	520	16	984.844	Walnuts
PENDIMETHALIN	May	6158	128	6583.57	Beans
PENDIMETHALIN	May	220	2	416.665	Alfalfa
PENDIMETHALIN	May	1160	13	1098.48	Fallow
PENDIMETHALIN	May	850	10	804.92	Tomatos
PENDIMETHALIN	June	1190	28	1540.94	Beans
RIMSULFURON	April	36	3	1.125	Tomatos
RIMSULFURON	May	480	6	22.4925	Tomatos
RIMSULFURON	June	360	3	16.875	Tomatos

Monitoring Site **Orestimba Creek at River R**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	June	790	35	1291.87	Walnuts
BIFENTHRIN	May	336	2	26.2796	Corn
BIFENTHRIN	July	40	4	4.086	Almonds
BIFENTHRIN	July	632	12	64.0116	Walnuts
CHLORPYRIFOS	May	210	8	211.947	Walnuts
CHLORPYRIFOS	May	1968	36	3042.17	Citrus
CHLORPYRIFOS	July	352	24	840.597	Almonds
CHLORPYRIFOS	July	1140	12	4534.3	Citrus

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

DIMETHOATE	March	3321	77	1649.15	Alfalfa
DIMETHOATE	May	6334	143	1512.63	Tomatos
DIMETHOATE	May	840	5	415.553	Corn
DIMETHOATE	June	7360	183	1817.72	Tomatos
DIMETHOATE	June	511	11	159.624	Beans
DIMETHOATE	July	9405	62	2639.57	Beans
DIMETHOATE	July	3928	63	1938.89	Tomatos
DIMETHOATE	August	360	3	89.0469	Tomatos
DIMETHOATE	August	4845	34	2391.68	Beans
DIURON	April	15	1	11.9977	Walnuts
DIURON	July	320	2	234.546	Walnuts
ESFENVALERATE	May	10360	146	640.981	Almonds
ESFENVALERATE	May	294	6	19.1316	Walnuts
ESFENVALERATE	June	4670	62	189.69	Tomatos
ESFENVALERATE	July	1914	58	110.261	Walnuts
ESFENVALERATE	July	510	4	33.1876	Almonds
ESFENVALERATE	July	5144	78	232.861	Tomatos
ESFENVALERATE	August	940	8	43.0008	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	March	150	15	225.039	Right of Way
GLYPHOSATE, ISOPROPYLAMINE SALT	March	21105	268	27783.8	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	March	1500	20	360.062	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	March	2096	32	8385.43	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	March	585	45	499.886	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	March	408	6	816.139	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	April	4589	78	5048.76	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1435	31	5740.98	Fallow
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1000	40	1120.19	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1460	17	5472.50	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1283.38	80	2090.93	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	April	2660	53	2363.48	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	2266	31	3071.63	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	May	4200	60	7565.35	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	May	9730.56	218	15830.7	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	May	11535	101	36927.1	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	May	9144	151	11808.7	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1500	20	1120.19	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	June	9850	103	19703.4	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	June	3140	124	4798.82	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1500	20	600.102	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	June	4158	63	4158.63	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1310	17	5240.89	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	July	1500	20	360.062	Nursery
GLYPHOSATE, ISOPROPYLAMINE SALT	July	9879.5	232	14419.4	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	July	48649.75	631	93751.1	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	816	4	1137.05	Citrus

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

GLYPHOSATE, ISOPROPYLAMINE SALT	August	7620	104	14288.9	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	August	1210.28	87	2451.98	Walnuts
LAMBDA-CYHALOTHRIN	March	4995.2	97	179.516	Alfalfa
LAMBDA-CYHALOTHRIN	March	900	12	26.4936	Broccoli
LAMBDA-CYHALOTHRIN	April	336	29	9.996	Tomatos
LAMBDA-CYHALOTHRIN	April	3124	61	78.1137	Walnuts
LAMBDA-CYHALOTHRIN	May	25646	834	797.964	Almonds
LAMBDA-CYHALOTHRIN	May	480	12	14.9424	Corn
LAMBDA-CYHALOTHRIN	May	4036	53	158.093	Walnuts
LAMBDA-CYHALOTHRIN	June	1056	32	28.598	Walnuts
LAMBDA-CYHALOTHRIN	June	200	4	5.8704	Corn
LAMBDA-CYHALOTHRIN	June	640	8	19.0384	Tomatos
LAMBDA-CYHALOTHRIN	July	500	10	14.874	Tomatos
LAMBDA-CYHALOTHRIN	July	1410	22	44.3226	Almonds
METOLACHLOR	April	712	10	1160.1	Beans
METOLACHLOR	May	9722	198	17088.6	Beans
METOLACHLOR	May	1260	9	1675.61	Tomatos
METOLACHLOR	June	1785	42	4535.36	Beans
NORFLURAZON	March	750	3	294.75	Almonds
NORFLURAZON	May	486	12	190.998	Almonds
ORYZALIN	April	160	2	158.504	Almonds
OXYFLUORFEN	March	455	7	30.4801	Walnuts
OXYFLUORFEN	March	90	9	33.9507	Right of Way
OXYFLUORFEN	April	2578	50	521.14	Almonds
OXYFLUORFEN	April	186	2	11.6782	Fallow
OXYFLUORFEN	May	6111	78	874.094	Almonds
OXYFLUORFEN	May	4019	50	580.688	Walnuts
OXYFLUORFEN	June	1127	39	157.846	Walnuts
OXYFLUORFEN	June	1955	23	263.763	Almonds
OXYFLUORFEN	July	3932	71	1476.40	Walnuts
OXYFLUORFEN	July	4580	40	464.709	Almonds
OXYFLUORFEN	August	1534	32	322.399	Almonds
OXYFLUORFEN	August	420	5	15.0495	Walnuts
PARAQUAT DICHLORIDE	April	520	8	1766.01	Tomatos
PARAQUAT DICHLORIDE	June	110	2	52.554	Almonds
PARAQUAT DICHLORIDE	August	2150	74	3400.38	Almonds
PARAQUAT DICHLORIDE	August	304	2	315.62	Walnuts
PENDIMETHALIN	March	32	4	121.211	Almonds
PENDIMETHALIN	April	470	3	445.073	Beans
PENDIMETHALIN	April	344.37	16	652.213	Walnuts
PENDIMETHALIN	May	6533	133	6938.68	Beans
PENDIMETHALIN	May	520	16	984.844	Walnuts
PENDIMETHALIN	May	1930	19	1827.64	Tomatos
PENDIMETHALIN	May	1422	17	1346.58	Fallow
PENDIMETHALIN	May	220	2	416.665	Alfalfa

***Includes duplicate and incomplete data**

**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

PENDIMETHALIN	June	1190	28	1540.94	Beans
RIMSULFURON	April	228	11	7.125	Tomatos
RIMSULFURON	May	1207	21	56.565	Tomatos
RIMSULFURON	June	412	5	19.31	Tomatos
TRIFLURALIN	April	576	7	286.265	Beans
TRIFLURALIN	May	190	2	94.4676	Beans

Monitoring Site **Ramona Lake near Fig Aven**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
BIFENTHRIN	July	140	4	10.9366	Melons
BIFENTHRIN	August	170	2	17.0256	Corn
CHLORPYRIFOS	March	1963	87	689.827	Alfalfa
CHLORPYRIFOS	July	234	12	109.750	Corn
ESFENVALERATE	May	375	17	19.8348	Almonds
ESFENVALERATE	May	72	9	3.4362	Apricots
ESFENVALERATE	July	107	7	5.4534	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	March	240	30	248.901	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	420	30	630.108	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	April		0		Right of Way
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1540	22	1540.26	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	May	270	30	480.081	Walnuts
GLYPHOSATE, ISOPROPYLAMINE SALT	June	80	2	5.006	Fallow
GLYPHOSATE, ISOPROPYLAMINE SALT	June	5440	167	5440.93	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	June	250	10	397.568	Wheat
GLYPHOSATE, ISOPROPYLAMINE SALT	June	1500	15	3000.51	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	694	26	694.118	Corn
GLYPHOSATE, ISOPROPYLAMINE SALT	July	728	43	1283.76	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	August	935	11	935.16	Corn
LAMBDA-CYHALOTHRIN	March	8031.5	222	243.392	Alfalfa
LAMBDA-CYHALOTHRIN	May	51.5	5	1.573	Tomatos
LAMBDA-CYHALOTHRIN	June	160	4	3.9904	Fallow
LAMBDA-CYHALOTHRIN	July	28.5	3	0.8808	Sudan Grass
LAMBDA-CYHALOTHRIN	July	54	3	1.6248	Corn
LAMBDA-CYHALOTHRIN	August	66	2	1.9634	Beans
MCPA, DIMETHYLAMINE SALT	March	352	32	145.997	Oats
OXYFLUORFEN	May	54	6	12.0396	Walnuts
OXYFLUORFEN	July	72	4	36.1184	Almonds
PENDIMETHALIN	May	9	1	7.5757	Walnuts
PENDIMETHALIN	May	430	11	407.195	Tomatos
PENDIMETHALIN	May	200	8	378.786	Alfalfa
PENDIMETHALIN	June	33	1	20.3029	Beans
RIMSULFURON	May	20.6	2	0.645	Tomatos
RIMSULFURON	July	140	2	2.625	Tomatos

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Pesticide Use Summary

3/1/12 through 8/31/12

Monitoring Site **Westley Wasteway near Cox**

Pesticide AI	Month	Acres Treated*	No of Applications *	AI Use Qty** (lbs)	Commodity
2,4-D, DIMETHYLAMINE SALT	April	1262	13	1163.4	Almonds
2,4-D, DIMETHYLAMINE SALT	July	150	3	62.3298	Almonds
2,4-D, DIMETHYLAMINE SALT	July	120	2	139.882	Apricots
BIFENTHRIN	June	348	6	40.8426	Almonds
BIFENTHRIN	July	1618	22	181.024	Almonds
BIFENTHRIN	July	216	2	16.9054	Melons
BIFENTHRIN	August	260	4	20.7912	Melons
DIMETHOATE	March	2480	32	1138.22	Alfalfa
DIMETHOATE	April	378.16	8	187.118	Tomatos
DIMETHOATE	May	1396.96	48	608.21	Tomatos
DIMETHOATE	June	2072	29	718.351	Tomatos
DIMETHOATE	July	2304	18	1263.4	Beans
DIMETHOATE	July	2610	34	1288.62	Tomatos
DIMETHOATE	August	300	4	148.491	Beans
ESFENVALERATE	March	296	4	12.0388	Apricots
ESFENVALERATE	May	4133	103	176.093	Apricots
ESFENVALERATE	May	120	4	4.8804	Cherrys
ESFENVALERATE	May	1948	16	100.985	Almonds
ESFENVALERATE	June	624	6	25.3788	Tomatos
ESFENVALERATE	July	1600	12	85.6112	Almonds
ESFENVALERATE	July	1180	18	47.9464	Tomatos
ESFENVALERATE	July	90	2	3.6604	Apples
GLYPHOSATE, ISOPROPYLAMINE SALT	March	3450	27	3510.97	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	March	4620	51	3577.67	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	March	572	11	555.567	Grapes
GLYPHOSATE, ISOPROPYLAMINE SALT	April	1008	21	990.898	Peaches
GLYPHOSATE, ISOPROPYLAMINE SALT	April	5403.5	71	8119.59	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	April	2362	19	2057.07	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	May	480	4	1440.25	Melons
GLYPHOSATE, ISOPROPYLAMINE SALT	May	480	4	1920.33	Tomatos
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1779	15	7117.21	Beans
GLYPHOSATE, ISOPROPYLAMINE SALT	May	9178.5	85	10530.6	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	May	1000	20	522.54	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	May	400	20	436.922	Grapes
GLYPHOSATE, ISOPROPYLAMINE SALT	June	2530	22	6107.56	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	22346.5	283	37536.5	Almonds
GLYPHOSATE, ISOPROPYLAMINE SALT	July	176	8	117.5	Cherrys
GLYPHOSATE, ISOPROPYLAMINE SALT	July	4003	61	5195.47	Apricots
GLYPHOSATE, ISOPROPYLAMINE SALT	August	3710	32	11215.4	Almonds
LAMBDA-CYHALOTHRIN	March	2606	42	76.5098	Alfalfa
LAMBDA-CYHALOTHRIN	March	5040	58	124.950	Apricots

***Includes duplicate and incomplete data**
**** Not available in all counties.**

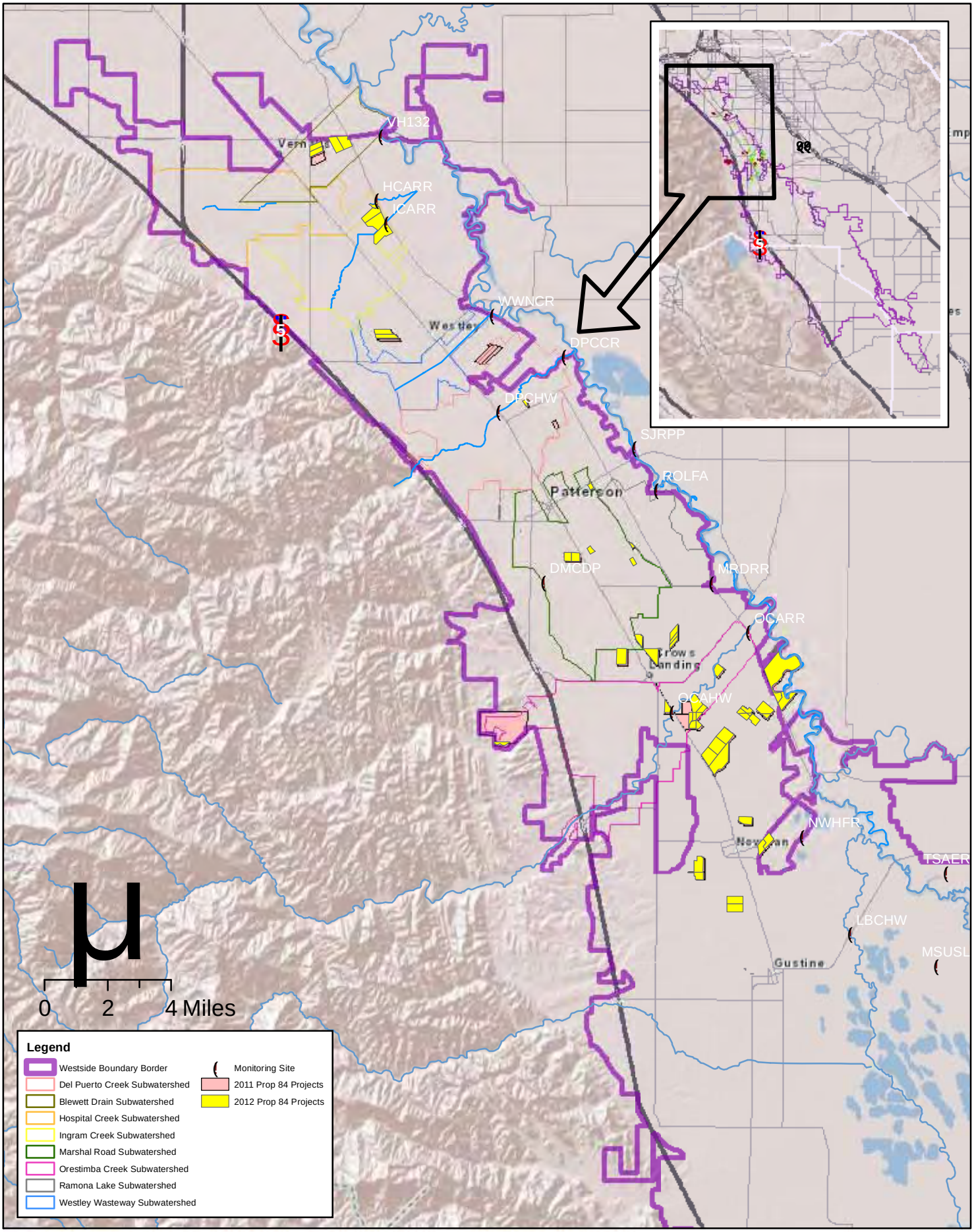
Pesticide Use Summary

3/1/12 through 8/31/12

LAMBDA-CYHALOTHRIN	March	1472	20	38.0768	Peaches
LAMBDA-CYHALOTHRIN	April	1268.5	58	49.462	Cherrys
LAMBDA-CYHALOTHRIN	April	220	4	2.38	Tomatos
LAMBDA-CYHALOTHRIN	April	1472	20	38.0768	Peaches
LAMBDA-CYHALOTHRIN	May	10931	113	290.257	Apricots
LAMBDA-CYHALOTHRIN	May	366.68	10	5.2286	Tomatos
LAMBDA-CYHALOTHRIN	May	2544	12	68.241	Almonds
LAMBDA-CYHALOTHRIN	July	2156	16	64.1364	Beans
LAMBDA-CYHALOTHRIN	July	460	12	15.8836	Almonds
LAMBDA-CYHALOTHRIN	July	40	4	1.0904	Walnuts
MALATHION	July	55	1	78.2136	Beans
METOLACHLOR	May	675	6	1025.23	Beans
METOLACHLOR	June	184	5	256.184	Beans
ORYZALIN	March	1514	6	4541.64	Almonds
OXYFLUORFEN	March	1950	13	76.4218	Almonds
OXYFLUORFEN	April	2816	24	677.946	Almonds
OXYFLUORFEN	May	8759	69	571.9	Almonds
OXYFLUORFEN	June	1390	14	588.928	Almonds
OXYFLUORFEN	July	104	4	26.0852	Apricots
OXYFLUORFEN	July	12726	123	1021.99	Almonds
OXYFLUORFEN	July	196	13	30.2525	Cherrys
OXYFLUORFEN	August	1582	18	187.972	Almonds
PARAQUAT DICHLORIDE	March	1986	11	6387.06	Almonds
PARAQUAT DICHLORIDE	March	118	2	42.4554	Apricots
PARAQUAT DICHLORIDE	June	168	3	215.875	Beans
PARAQUAT DICHLORIDE	July	23	2	31.8388	Apricots
PENDIMETHALIN	March	308	5	366.475	Apricots
PENDIMETHALIN	April	100	1	94.6965	Beans
PENDIMETHALIN	April	385.32	5	364.847	Tomatos
PENDIMETHALIN	May	979	7	927.079	Beans
PENDIMETHALIN	June	150	3	142.045	Beans
RIMSULFURON	April	567.24	12	17.73	Tomatos
RIMSULFURON	May	1520.22	45	48.3117	Tomatos
RIMSULFURON	June	712.5	15	22.2525	Tomatos
SIMAZINE	April	256	4	256.058	Almonds
ZIRAM	March	765	12	2394	Apricots

***Includes duplicate and incomplete data**
**** Not available in all counties.**

Management Practice Maps

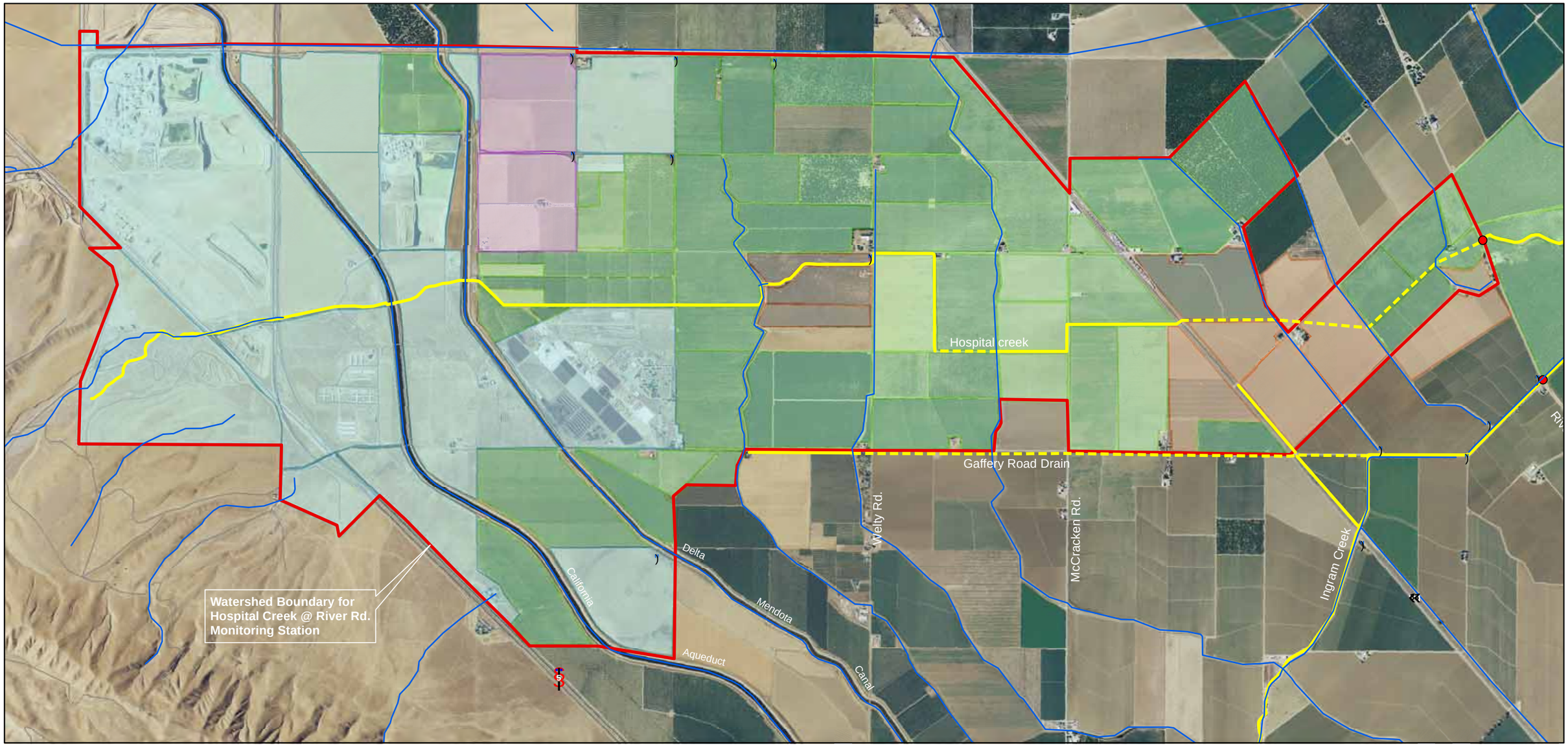


WESTSIDE SAN JOAQUIN RIVER WATERSHED COALITION

Proposition 84 Projects

Summers Engineering, Inc.
Consulting Engineers
Hanford California

Westside San Joaquin River Watershed Coalition



Legend

- Open
- Pipe
- Monitoring Site
- Tailwater Pond
- Drip/Microsprinklers
- Furrow
- Furrow w/ Return
- Not Irrigated

Hospital Creek Subwatershed
August 2010

Miles

0 0.25 0.5 1

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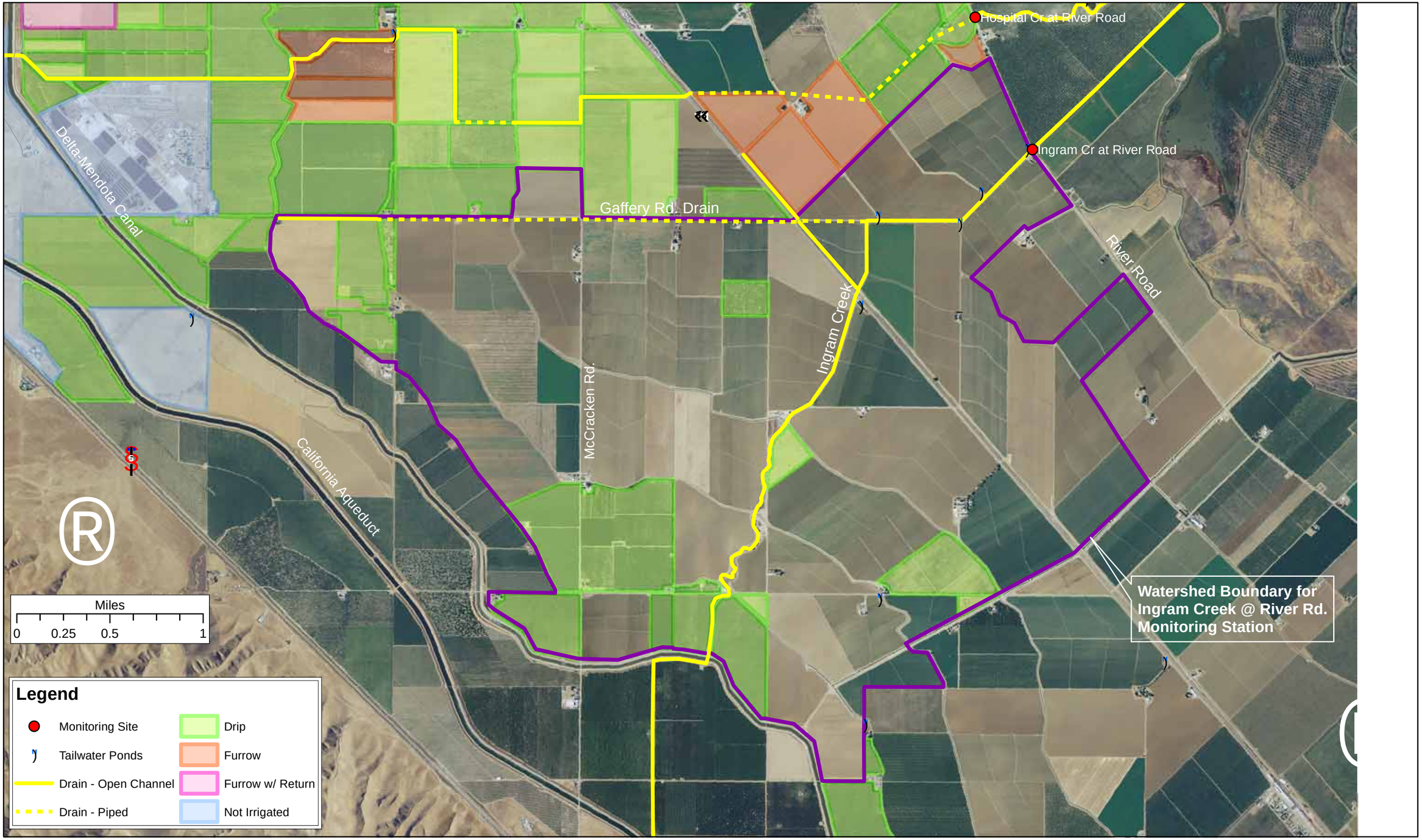
Consulting Engineers
Hanford California

Westside San Joaquin River Watershed Coalition



Ingram Creek Subwatershed Map
August 2010

Summers Engineering, Inc
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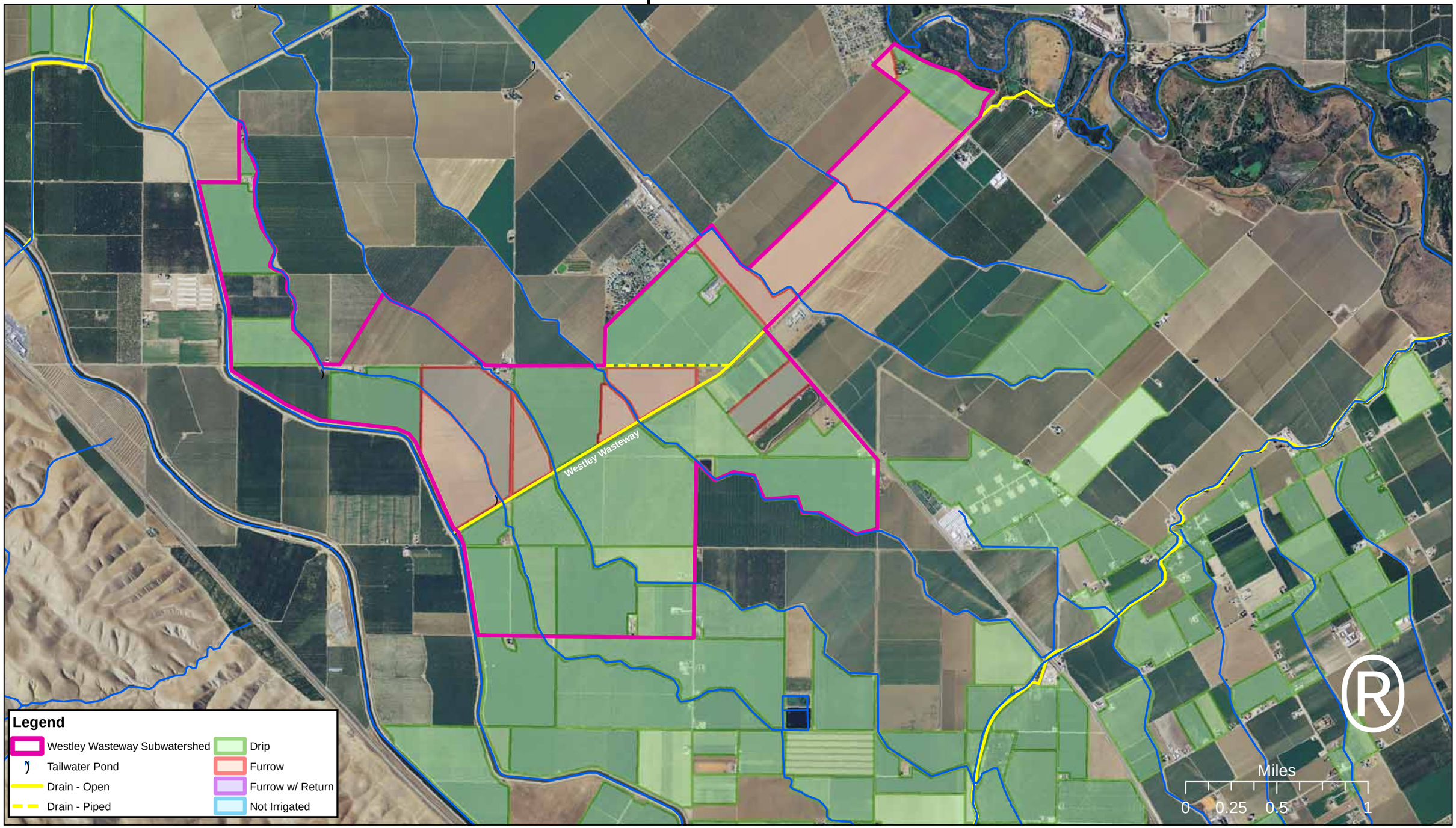
Hanford California

Westside San Joaquin River Watershed Coalition



Westley Wasteway Subwatershed
August 2010

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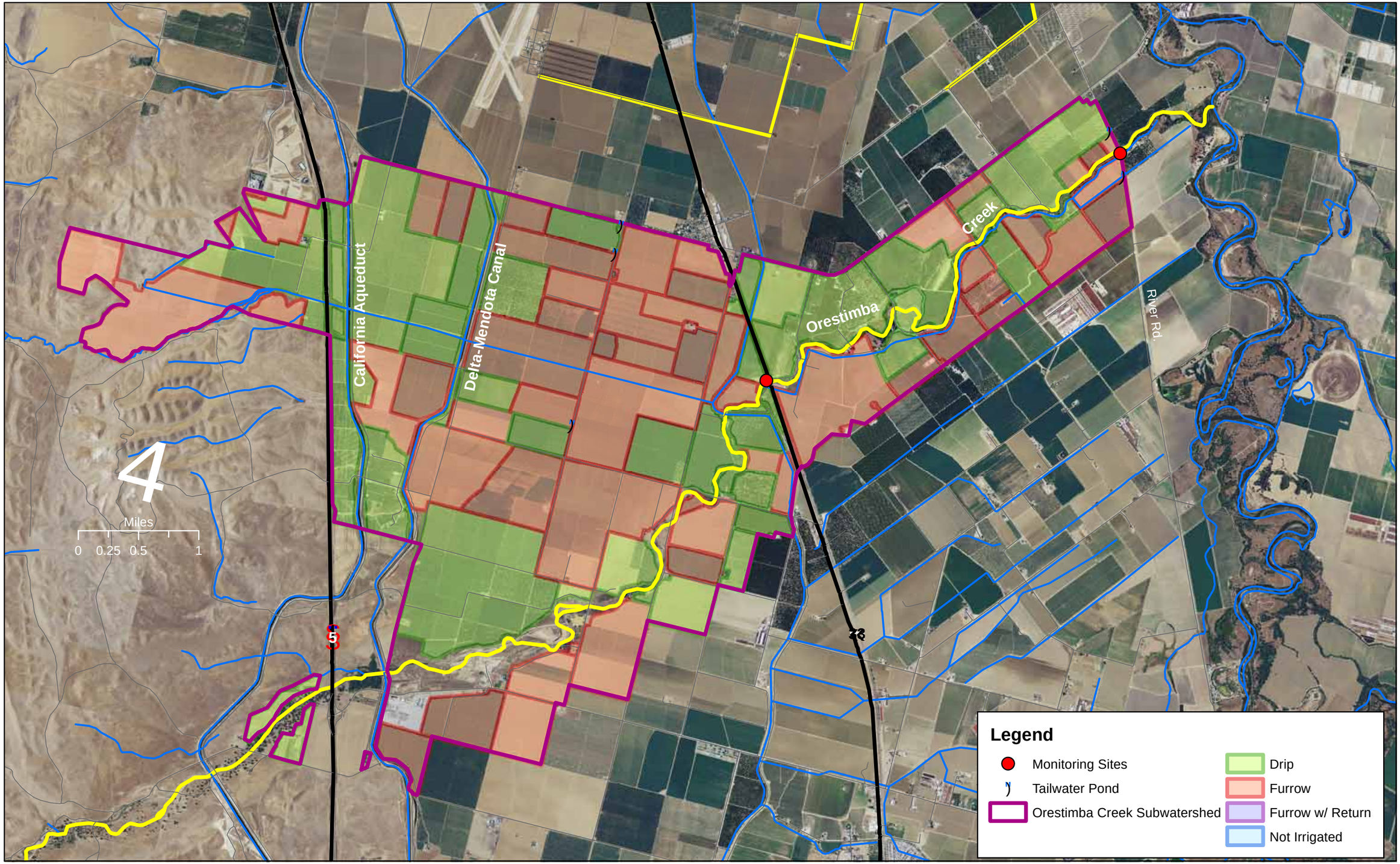
Westside San Joaquin River Watershed Coalition

Del Puerto Creek Subwatershed
August 2010

Summers Engineering, Inc.
Consulting Engineers
Hanford California



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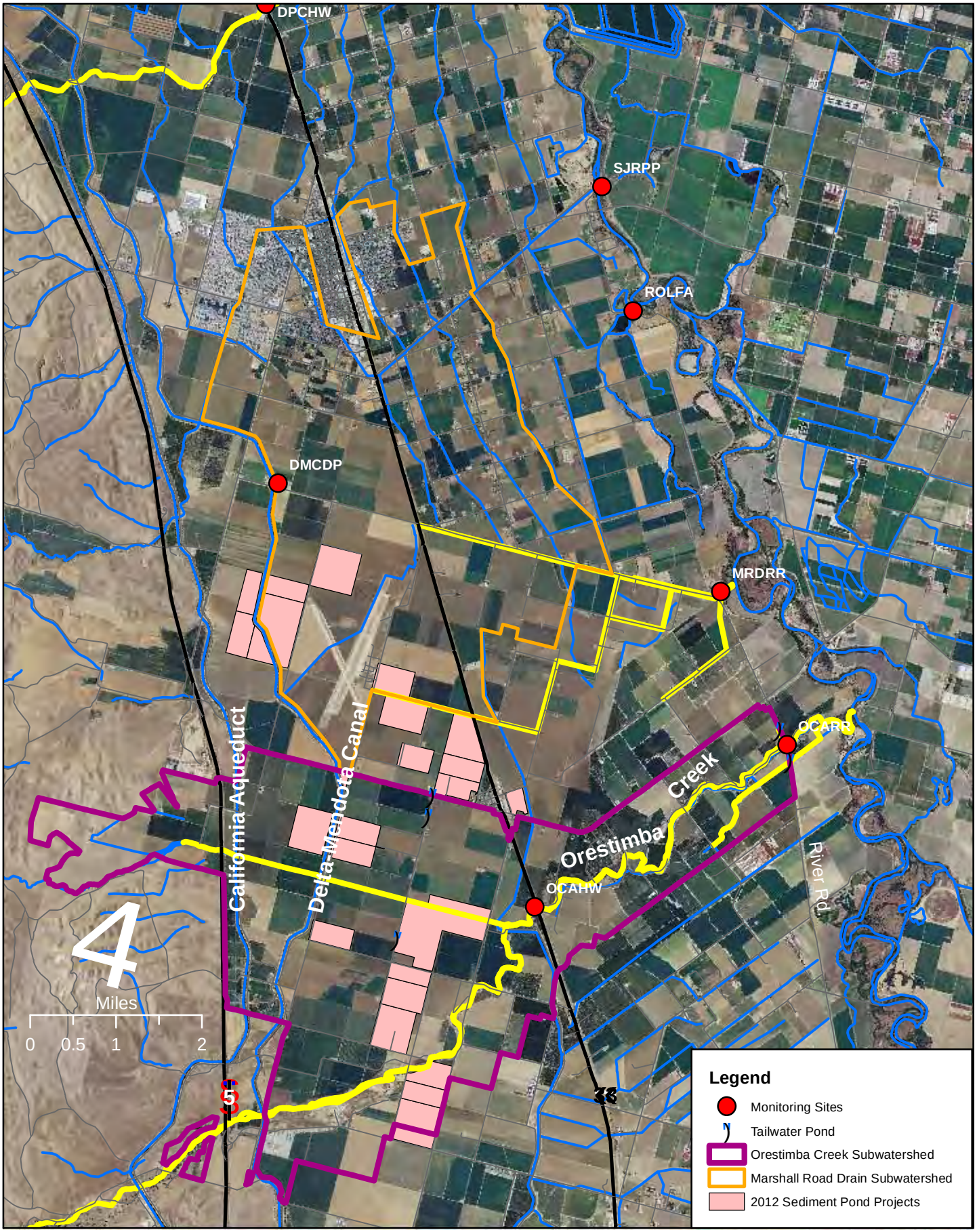
Hanford California

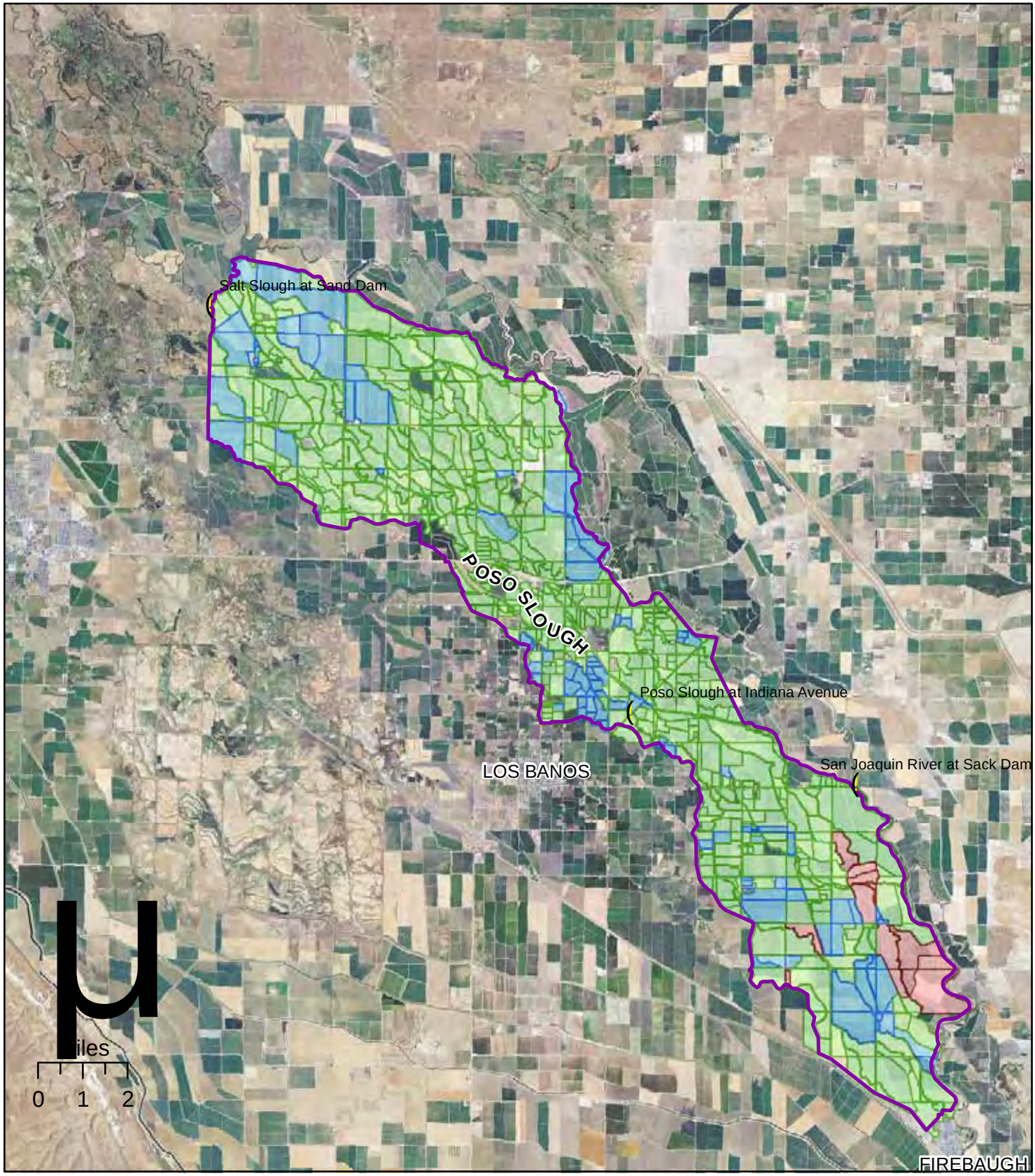
Orestimba Creek Subwhatershed
August 2010



2012 Sediment Pond Projects

Indicated projects may affect portions of the shaded parcel.

Prepared By:
Summers Engineering, Inc.
Consulting Engineers
Hanford California



Westside San Joaquin River Watershed Coalition

Legend

- Monitoring Sites
- Salt Slough Survey Area
- Drip
- Surface
- Drip & Surface

Salt Slough Subwatershed
Primary Agricultural Area
DRAFT

Attachment 7
Special Project Monitoring and Constituents

TABLE 4a: Monitoring Site Tests March 2012-February 2014

Monitoring Site	Site Code	Season: Irrigation (Mar-Aug)*	Season: Non-Irrigation (Sep-Feb)*	Season: Rain Event (2x per year)	Non-Irrig Season Core	Irrig Season Core	Special Study Analytes - March 2012 through February 2014: Metals**	Ceriodaphnia Toxicity	Fathead Toxicity	Algae Toxicity	Sediment Toxicity	Pesticides: OP	Pesticides: OC	Pesticides: Group A	Pesticides: Carb	Pesticides: Herb
Discharge Sites																
Vernalis at Highway 132	VH132	Special	Core	Rain**	x			x			x	x	x	x		x
Poso Slough at Indiana Avenue	PSAIA	Special	Core	Rain**	x		x	x		x	x	x	x	x	x	x
Hospital Cr at River Road	HCARR	Special	-	Rain**			x	x		x	x	x			x	x
Ingram Cr at River Road	ICARR	Core + Special	Core	Rain**	x	x	x	x		x	x	x	x	x	x	x
Westley Wasteway near Cox Road	WWNCR	Core + Special	Core	Rain**	x	x	x	x		x	x	x	x	x		x
Del Puerto Cr near Cox Road	DPCCR	Core + Special	Core	Rain**	x	x		x			x	x	x	x	x	x
Del Puerto Cr at Hwy 33	DPCHW	Special	-	Rain**				x			x	x	x	x	x	x
Ramonal Lake near Fig Avenue	ROLFA	Core + Special	Core	Rain**	x	x		x			x	x	x	x		x
Marshall Road Drain near River Road	MRDRR	Core + Special	Core	Rain**	x	x		x				x	x	x		x
Orestimba Cr at River Road	OCARR	Core + Special	Core	Rain**	x	x	x	x		x	x	x	x	x	x	x
Orestimba Cr at Hwy 33	OCAHW	Special	-	Rain**			x	x		x	x	x	x	x	x	x
Newman Wasteway near Hills Ferry Road	NWHFR	Core + Special	Core	Rain**	x	x		x			x	x	x	x		x
San Joaquin River at Lander Avenue	SJRLA	Core + Special	Core + Special	Rain**	x	x		x				x				x
Mud Slough u/s San Luis Drain	MSUSL	Core + Special	Core + Special	Rain**	x	x		x				x	x	x	x	x
Salt Slough at Lander Avenue	SSALA	Core + Special	Core + Special	Rain**	x	x		x				x	x	x	x	x
Salt Slough at Sand Dam	SSASD	Special	-	Rain**				x			x	x			x	x
Los Banos Creek at Highway 140	LBCHW	Core + Special	Core + Special	Rain**	x	x	x	x		x		x				x
Los Banos Creek at China Camp Road	LBCCC	Core + Special	Core	Rain**	x	x	x	x	x	x	x	x				x
Turner Slough near Edminster Road	TSAER	Core + Special	Core	Rain**	x	x		x	x			x				x
~~Little Panoche Cr at Western Boundary~~	~~LPCWB~~	~~Assmt~~	~~Assmt~~	~~Rain**~~												
~~Little Panoche Cr at San Luis Canal~~	~~LPCSL~~	~~Assmt~~	~~Assmt~~	~~Rain**~~												
~~Russell Ave. Drain at San Luis Canal~~	~~RADSL~~	~~Assmt~~	~~Assmt~~	~~Rain**~~												
~~Los Banos Creek at Sunset Ave~~	~~LBCSA~~	~~Assmt~~	~~Assmt~~	~~Rain**~~												
Source Water Sites																
San Joaquin River at Sack Dam	SJRSD	Source	Source	Source	x	x						x				
Delta Mendota Canal at Del Puerto WD	DMCDP	Source	Source	Source	x	x						x				
San Joaquin River at PID Pumps	SJRPP	Source	Source	Source	x	x						x				

* Irrigation season will run from March through August. Non-irrigation season will run from September through February. The Westside Coalition, in colaboration with the Regional Water Quality Control Board, may shift the seasons up or back 1 month to ac

* Rain events only

** Special Site list. See Table 5

** During rain event sample collection, Discharge sites will be sampled for the constituents listed

TABLE 5: Chemical Analyses

	Material	Matrix	Ass'ment	Core	Rain Event	Special Study	Source Water
Field Measurements	Flow (cfs)	Water	x	x	x	x	x
	Photo Documentation	Site	x	x	x	x	x
	Electrical Conductivity (µs/cm)	Water	x	x	x	x	x
	Temperature (ºc)	Water	x	x	x	x	x
	pH	Water	x	x	x	x	x
	Dissolved Oxygen (mg/L)	Water	x	x	x	x	x
Drinking Water	Bromide (Br)	Water	x	x	x	x	
	Dissolved Organic Carbon (DOC)	Water	x	x	x	x	
	E. Coli	Water	x	x	x	x	x
	Total Organic Carbon (TOC)	Water	x	x	x	x	
Gen Phys	Hardness (as CACO3)	Water	x	x	x	x	x
	Total Dissolved Solids (TDS)	Water	x	x	x	x	x
	Total Suspended (TSS)	Water	x	x	x	x	x
	Turbidity	Water	x	x	x	x	x
Metals	Arsenic	Water	x		x		
	Boron	Water	x		x	x	x
	Cadmium	Water	x		x		
	Copper	Water	x		x	x	x
	Lead	Water	x		x		
	Nickel	Water	x		x	x	x
	Selenium	Water	x		x		
	Zinc	Water	x		x	x	x
Nutrients	Ammonia (as N)	Water	x	x	x	x	
	Nitrogen, Nitrate-Nitrite	Water	x	x	x	x	
	Total Kjeldahl Nitrogen	Water	x	x	x	x	
	Total Phosphate as P	Water	x	x	x	x	
	Ortho Phosphate as P (Soluble)	Water	x	x	x	x	
Toxicity	Ceriodaphnia dubia	Water	x		x	See Attachment 1	
	Pimephales promelas	Water	x		x		
	Selenastrum capricornutum	Water	x		x		

TABLE 6: Pesticide Analyses

	Material	Matrix	Assessment	Core	Rain Event	Source
OP Pesticides	Azinphosmethyl	Water	x	(no pesticides)	x	x
	Chlorpyrifos	Water	x		x	x
	Demeton-S	Water	x		x	x
	Diazinon	Water	x		x	x
	Dichlorovos	Water	x		x	x
	Dimethoate	Water	x		x	x
	Disulfoton	Water	x		x	x
	Malathion	Water	x		x	x
	Methidathion	Water	x		x	x
	Methamidophos	Water	x		x	x
	Parathion, ethyl	Water	x		x	x
	Parathion, methyl	Water	x		x	x
	Phorate	Water	x		x	x
	Phosmet	Water	x		x	x
	EPTC	Water	x		x	x
Herbicides	Atrizine	Water	x		x	
	Cyanazine	Water	x		x	
	Diuron	Water	x		x	
	Linuron	Water	x		x	
	Prowl	Water	x		x	x
	Simazine	Water	x		x	
	Trifluralin	Water	x		x	x
Addnl Group A OC Pesticides	Aldrin	Water	x		x	
	a-BHC	Water	x		x	
	b-BHC	Water	x		x	
	d-BHC	Water	x		x	
	g-BHC (Lindane)	Water	x		x	
	a-Chlordane	Water	x		x	
	g-Chlordane	Water	x		x	
	Endosulfan I	Water	x		x	
	Endosulfan II	Water	x		x	
	Endosulfan Sulfate	Water	x		x	
	Heptachlor	Water	x		x	
	Heptachlor epoxide	Water	x		x	
	Toxaphene	Water	x		x	
OC Pest (Base)	Dicofol	Water	x		x	
	DDD(p,p')	Water	x		x	
	DDE(p,p')	Water	x		x	
	DDT(p,p')	Water	x		x	
	Dieldrin	Water	x		x	
	Endrin	Water	x		x	
	Methoxychlor	Water	x		x	
Carbamate Pest.	Aldicarb	Water	x		x	
	Carbaryl	Water	x		x	
	Carbofuran	Water	x		x	
	Methiocarb	Water	x		x	
	Methomyl	Water	x		x	
	Oxamyl	Water	x		x	

SUMMERS ENGINEERING
887 N. Irwin St. – PO Box 1122
Hanford, CA 93232

MEMORANDUM

TO: Peter Rietkerk, Patterson Irrigation District

FROM: Chris Linneman

DATE: March 3, 2014

SUBJECT: Pump Station 6 Capacity Increase Evaluation DRAFT

At the request of Patterson Irrigation District (PID or District), Summers Engineering, Inc. evaluated the requirements and associated costs to increase the flow capacity of Pump Station 6 to a maximum flow of 45 cfs, 50 cfs, and60 cfs. Increased pump flows were assumed for non-irrigation season deliveries, since the system would be at capacity during the irrigation system.

Capital Costs.

Capital costs were estimated to improve the electrical controls, replace the pumps and motors, and modify the existing sump structure to provide the necessary submergence for the new pumps. Initial estimates indicate the existing electrical control building would be adequate although new electrical equipment would be required. It was also assumed that the existing manifold and pipeline would remain, with only minor modifications to the manifold for the new pump connections. A contingency factor of 35% was applied to the capital costs to cover engineering and unknown costs. Capital costs were annualized assuming a 20 year term at a 6% interest rate.

Power Costs.

Power costs were calculated assuming a cost of $0.12 per kwh and an overall plant efficiency of 76%.

Delivered Water.

The volume of delivered water was estimated from District records. Irrigation season deliveries were estimated at 10,000 acre feet per year and left unchanged during all three flow regimes. The existing non-irrigation deliveries were estimated at 10,000 acre feet per year and increased by the ratio of the proposed flow rate to the existing flow rate (38 cfs).

Table 1 shows the breakdown of delivered water, capital costs, power costs and the overall cost per acre foot delivered.

Table 1

Option	Flow Option (cfs)	Volume delivered (af)	Capital Cost ($)	Annualized(1) ($/year)	Annualized/af ($/af)	Power Cost(2) ($/af)	Total/af ($/af)
1	45	21,842	$675,000	$58,850	$2.69	$21	$24
2	50	23,158	$712,000	$62,075	$2.68	$23	$25
3	60	25,789	$937,000	$81,692	$3.17	$27	$30

(1) Annualized at 6% over 20 years.
(2) Assumed at $0.12/kwh

SUMMERS ENGINEERING
887 N. Irwin St. – PO Box 1122
Hanford, CA 93232

MEMORANDUM

TO: Peter Rietkerk, Patterson Irrigation District
Paul Glenn, RMC

FROM: Chris Linneman

DATE: June 30, 2014

SUBJECT: Two-Drains Return System, Evolution of Alternatives

The purpose of this memo is to describe the alternatives reviewed during the evolution of what has become the Marshall Road Drain/Spanish Land Grant Drain Return System project (Two Drains Return System).

Patterson Irrigation District (PID or District) has long developed systems to integrate regional drain water into its irrigation supplies. In 2002, PID constructed the Marshall Road Reservoir, which captured drain water from a portion of the Marshall Road Drain and stored it in the reservoir for reuse in the southerly portion of the District. In 2006, the Northside System was constructed to capture and reuse local tailwater and operation spills.

In 2010, Patterson Irrigation District, in cooperation with Twin Oaks Irrigation District, began reviewing flow data in the Marshall Road Drain and Spanish Land Grant Drain. The data indicated that, on average, approximately 5,000 acre feet per year of drain water could be recaptured for irrigation use. In 2011, a brief study of alternatives to intercept and transport that water through the Twin Oaks Irrigation District system and into PID's irrigation system was completed (see Summers Engineering Memorandum April 20, 2011). Ultimately, Twin Oaks Irrigation District determined it could not participate in the project and PID sought additional alternatives.

In 2012, PID developed a concept to capture drain water from the two drains and pump it into the existing Marshall Road Reservoir, then construct additional pump stations and

pipelines to distribute that water to various irrigation facilities within the District. Existing PID right of way and other site-specific conditions (potential critical habitat, existing buildings, etc) were evaluated to identify the best possible alignments for the pipelines, ultimately resulting in the Two-Drains project submitted to the U.S. Bureau of Reclamation WaterSMART grant program (R13AP20042).

SUMMERS ENGINEERING
887 N. Irwin St. – PO Box 1122
Hanford, CA 93232

MEMORANDUM

TO: Peter Rietkerk, Patterson Irrigation District

FROM: Chris Linneman

DATE: April 20, 2011

SUBJECT: Marshall Road Drain/Spanish Land Grant Drain Return System – Preliminary Project Description.

At the request of Patterson Irrigation District (District or PID), Summers Engineering has evaluated the potential to capture drain water from the Marshall Road Drain and Spanish Land Grant Drain and return it back into the irrigation system. Based on data collected by the Westside San Joaquin River Watershed Coalition (Westside Coalition), the combined irrigation season discharges from the two drains averages around 5,000 acre feet per year, with an average EC of around 1,000 µs/cm.

The attached map shows the Marshall Road Drain, Spanish Land Grant Drain and other key features. There are a number of possible alternatives that would allow the capture and recirculation of drain water conveyed by these two drains not already captured by the South-Side Reservoir, three of which are outlined below.

Alternative 1: A diversion structure and pump station would be constructed where the two drains come together (near where Marshall Road merges with River Road). The water from the two drains would be pumped into a new pipeline running northwesterly to the existing drain within Twin Oaks Irrigation District. From there, water would flow by gravity into Ramona Lake. A new pump station within Ramona Lake would pump water into a new pipe that would deliver water to the PID Main Canal. The District would need to form an agreement with Twin Oaks Irrigation District. Additionally, water quality would be impacted by other drainage flows into the Twin Oaks drain and Ramona Lake. There are some subsurface (tile) discharges into Ramona Lake which increase the water's EC.

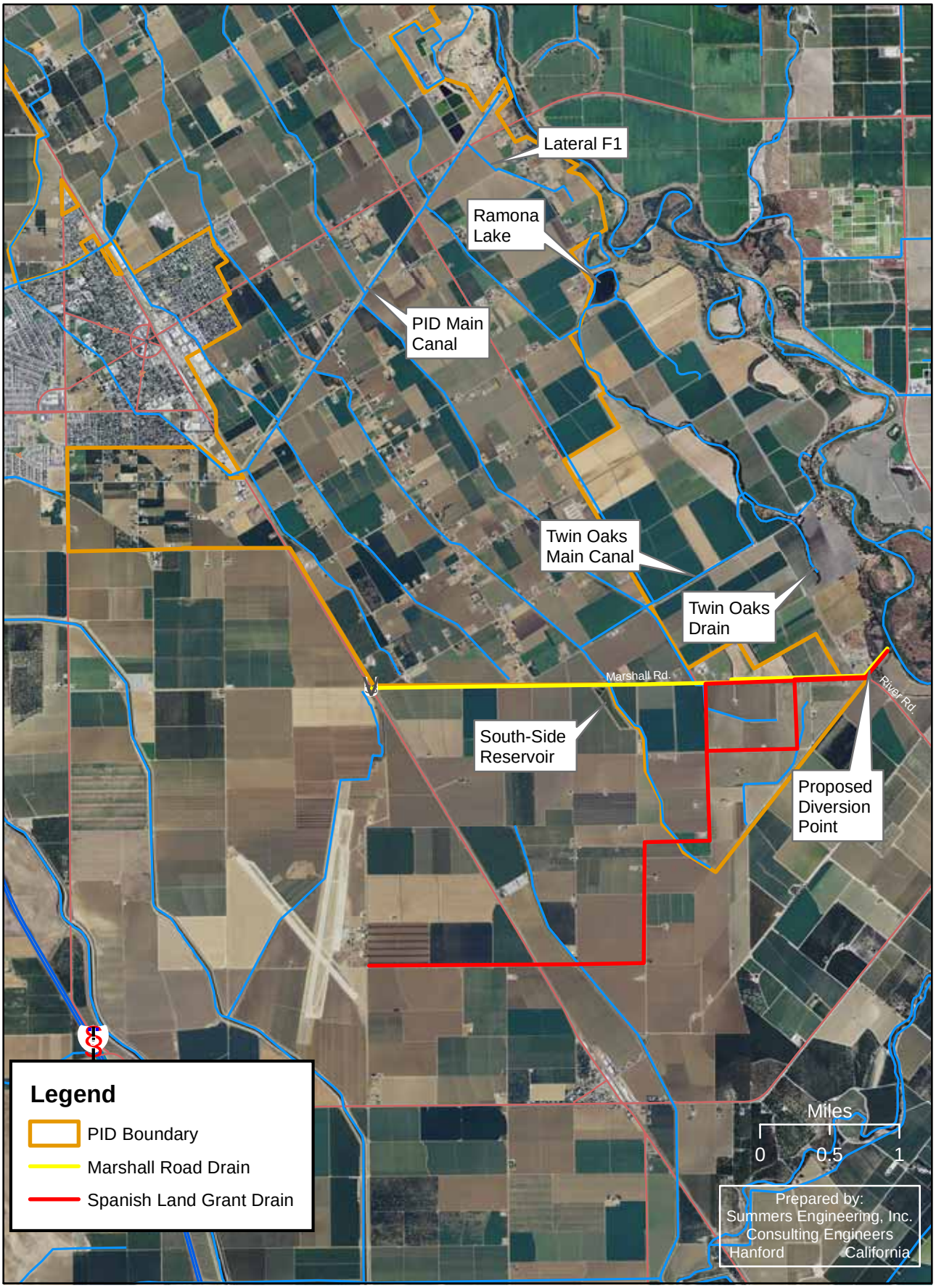
Alternative 2: Similar to Alternative 1, but the second pump station would be placed near the end of the Twin Oaks drain, near the terminus of the District Lateral 1S. A new pipeline would run parallel to Lateral 1S and discharge into the PID Main Canal. This alternative would not be impacted by tile flows into Ramona Lake and would require approximately the same length of pipe. A check structure (weir) would likely be required within the Twin Oaks drain to provide sufficient water depth for the pump structure. As with Alternative 1, the District would need an agreement with Twin Oaks I.D. to utilize their right of way and drain.

Alternative 3: Similar to Alternative 1. The second pipeline would run from the new pump station at Ramona Lake, along Ash Avenue to PID's Lateral F1. Lateral F1 would be replaced with a new pipeline from the intersection of Ash and Orange Avenues to the Main Canal. This new pipe would provide service to the water users along the alignment and deliver recirculated water from the two drains into the PID Main Canal. The total pipe length for this alternative is similar to the previous alternatives, however there is the potential to have adverse water quality impacts to landowners adjacent to Lateral F1 which may not be acceptable. The primary advantage of this alternative is that no new right of way would be required along the Lateral F1 alignment.

Next Step: The above alternatives are conceptual outlines only and have not been fully evaluated. No estimates of cost or potential benefits have been developed. Should the District wish to pursue this further, a more detailed evaluation of these alternatives (and any others that appear to be feasible) should be completed. This study would include:

- An estimate of the potential recovered water and impact to the District's water supply quality.
- Consultation with Twin Oaks I.D. to evaluate their level of interest in the project.
- An description of the project scope for each alternative, including required features, pipe sizes and lengths, and required right of way.
- An estimate of project costs for the alternatives.
- An evaluation of potential grant funding that may be available to the project.

Marshall Road Drain and Spanish Land Grant Drain



SUMMERS ENGINEERING
887 N. Irwin St. – PO Box 1122
Hanford, CA 93232

MEMORANDUM

TO: Peter Rietkirk, Patterson Irrigation District

FROM: Chris Linneman

DATE: December 10, 2012

SUBJECT: Marshall/Spanish Drainage Return System

This memo summarizes the scope and estimated costs of the proposed Marshall/Spanish Drain Return project. The proposed project will construct a new series of pump stations and pipelines to capture agricultural surface drain water from the Spanish Land Grant Drain and Marshall Road Drain and return that water for reintegration into the Patterson Irrigation District (District) distribution system. The project is expected to recover approximately 5,000 acre feet per year (afy) on average and reduce the load of pesticides, silt and other pollutants carried by the drainage flows.

The preliminary project estimated cost is approximately **$3.2 million**. The District is pursuing a grant from the U.S. Bureau of Reclamation that may provide up to $1.5 million in grant funding with a minimum cost share requirement of 50%.

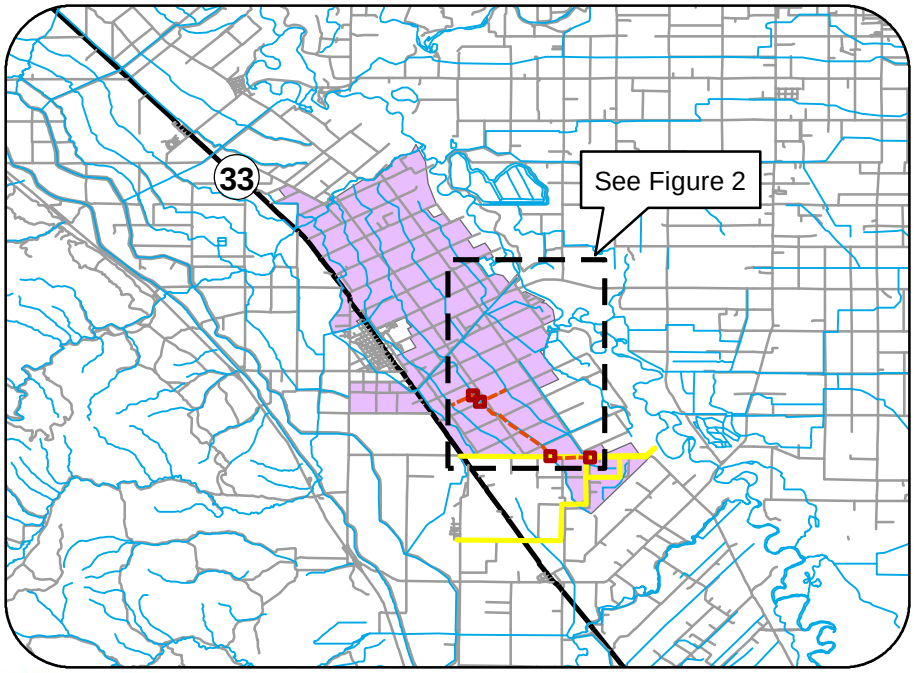
Technical Project Description.
The project will operate as a series of pump stations connecting to District water storage and conveyance facilities. Control of the project will be through the District's SCADA system, based on supply, demands, and water levels.

- Station 1 – Station 1 would be a 25 cfs pump station located on the south side of Marshall Road, east of Alfalfa Avenue. The new pump station would connect to both the Marshall Road Drain and Spanish Land Grant Drain pipelines and pump that water into a new pipeline running approximately 4,000 feet West to the District's South Side Reservoir, where the pumped water would be stored.
- Station 2 – Station 2 would be a 25 cfs pump station located at the District's South Side Reservoir and would pump water from the Reservoir into a new pipeline running approximately 10,200 feet along Lateral 3 South, discharging into that lateral upstream of Pomelo Avenue. A new long crested weir (or similar structure) would be required at the Pomelo Avenue check structure in order to properly control water .

- Station 3 – Station 3 would be a 10 cfs pump station located at Lateral 3 South, upstream of Pomelo Avenue and would pump water from Lateral 3 South into a 2,600 feet long pipeline connecting to Lateral 4 South. A new long crested weir (or similar structure) would be required downstream of the discharge.
- Station 4 – Station 4 would be a SCADA controlled gate structure that would regulate flow by gravity into a 2,900 foot long pipeline from Lateral 3 South to Lateral 2 South. A new long crested weir would be required downstream of the discharge. The capacity of the pipeline would be up to 10 cfs.
- SCADA Integration – All four stations will be integrated into the District's SCADA system to control pump flow rates and gate operation according to system demands and capacities.

The Attached Figures 1 and 2 show the proposed layout of the project. A preliminary cost estimate is also attached (please note that some cost details are still being developed).

Figure 1



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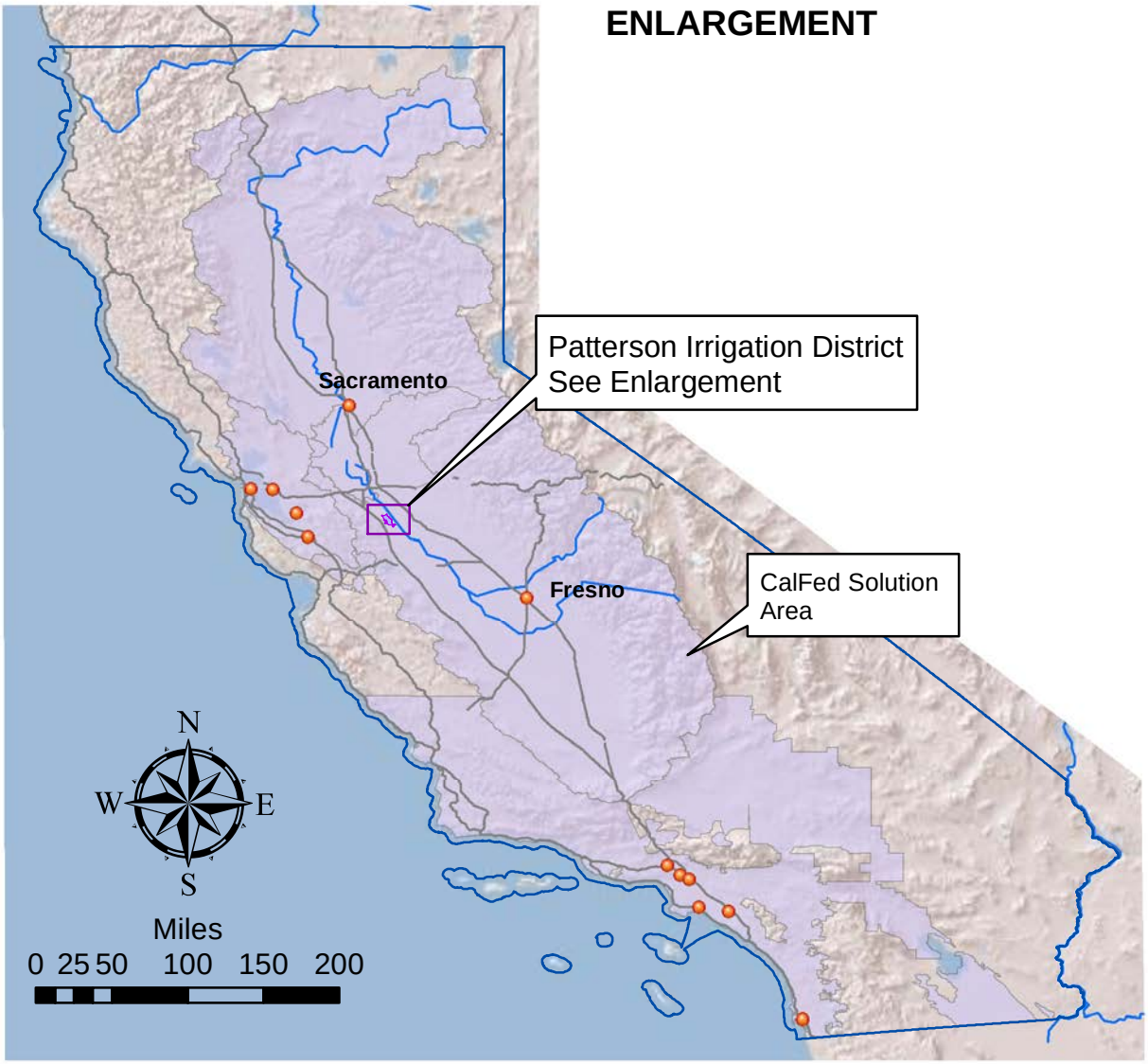

Patterson Irrigation District
Location Map - Marshal & Spanish Drain Return System

Summers Engineering, Inc.
Consulting Engineers
Hanford California

Marshal/Spanish Return System

Summers Engineering, Inc.
Consulting Engineers
Hanford California

Patterson Irrigation District
Marshall Road Drain and Spanish Land Grant Drain Return System
Preliminary Estimate of Cost - DRAFT

Item No.	Work or Material	Quantity	Unit	Unit Price	Amount
1	Furnish & Install (F&I) 36" PVC (Class 125psi)	14,200	L.F.	$90	$1,278,000.00
2	F&I 24" 100 psi PIP PVC Pipe	5,500	L.F.	$40	$220,000.00
3	F&I Reinforced Concrete Pump Stations 1 & 2	50	C.Y.	$1,200.00	$60,000.00
4	F&I Reinforced Concrete Pump Stations 3	10	C.Y.	$1,200.00	$12,000.00
5	F&I Pump Station 1 & 2 Pumping Units (25 cfs)	2	Each	$85,000.00	$170,000.00
6	F&I Pump Station 3 Pumping Unit (10 cfs)	1	Each	$50,000.00	$50,000.00
7	F&I Pump Station 1 & 2 Manifolds	2	Each	$150,000.00	$300,000.00
8	F&I Pump Station 3 Manifold	1	Each	$45,000.00	$45,000.00
9	F&I Electrical Equipment Pump Station 1			Lump Sum	$270,000.00
10	F&I Electrical Equipment Pump Station 2			Lump Sum	$270,000.00
11	F&I Electrical Equipment Pump Stations 3			Lump Sum	$80,000.00
12	F&I Long Crested Weirs	3	Each	$30,000.00	$90,000.00
13	F&I Outlet Structures	3	Each	$5,000.00	$15,000.00
14	Right of Way	6	Acres	$2,500.00	$15,000.00

Subtotal Construction Cost	$2,875,000.00
Environmental Compliance	$40,000.00
Engineering, Surveying, Etc.	$285,000.00
Estimated Total Budget Cost	**$3,200,000.00**

Appendix 3.6 – North Valley Regional Recycled Water Program Supporting Documentation

North Valley Regional Recycled Water Program Feasibility Study
Volume I:
Final Report

Prepared by:

RMC
Water and Environment

December 2013

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List of Abbreviations

AF	acre-feet
AFY	acre-feet per year
CCID	Central California Irrigation District
CDEC	California Data Exchange Network
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEDEN	California Environmental Data Exchange Network
CEC	Constituent of Emerging Concern
CEQA	California Environmental Quality Act
cfs	cubic-feet per second
CIWQS	California Integrated Water Quality System
CNFR	California Northern Railway
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DMC	Delta-Mendota Canal
DNQ	detected but not quantified
DPWD	Del Puerto Water District
DWR	California Department of Water Resources
FONSI	Finding of No Significant Impact
FT	Federally threatened
gpd	gallons per day
GPD/cap	gallons per day per capita
ID	Irrigation District
HP	Horsepower
kWh	kilowatt hour
LF	linear feet
MDL	minimum detection limit
MGD	million gallons per day
MPN	most probable number
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System

NVRRWP	North Valley Regional Recycled Water Program
PID	Patterson Irrigation District
QA/QC	Quality Assurance / Quality Control
Reclamation	United State Bureau of Reclamation
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
RWQCF	Regional Water Quality Control Facility
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TM	Technical Memorandum
TID	Turlock Irrigation District
USBR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
WQCF	Water Quality Control Facility
WWMP	Wastewater Master Plan

This study was prepared to meet the requirements of the United States Bureau of Reclamation (Reclamation) Directives and Standards for the Title XVI Reclamation and Reuse Program (USBR Document WTR 11-01). The Directives and Standards provide a minimum report contents. The following table summarizes the minimum report contents by USBR Document WTR 11-01Chapter and Subchapter; the third column of the table indicates where in this study the information can be found. If using the electronic version of this report, the text in the third column contains a hyperlink to the referenced section.

Reclamation Chapter	Reclamation Subchapter	Corresponding Section/Page No
Introductory Information	1a. Identification of the non-Federal project sponsor	• 1.1
	1b. A description of the study area and an area/project map	• 1.2
	1c. A definition of the study area in terms of both the site-specific project area where the reclaimed water supply will be needed and developed, and any reclaimed water distribution systems.	• 1.2
Statement of Problems and Needs	2a. Description of the problem and needs for a water reclamation and reuse project	• 2.1
	2b. Description of current and projected water supplies, include water rights, and potential sources of additional water, other than the proposed Title XVI project, and plans for new facilities.	• 2.2,3.4
	2c. Description of current and projected water demands	• 2.3,3.3
	2d. Description of any water quality concerns for the current and projected water supply.	• Chapter 4
	2e. Description of current and projected wastewaters and disposal options other than the proposed Title XVI project, and plans for new wastewater facilities, including projected costs.	• 3.4
Water Reclamation and Reuse Opportunities	3a. Description of all uses for reclaimed water, or categories of potential uses (included but not limited to, environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, and recreation). Identify any associated water quality, and associated treatment requirements.	• 3.2
	3b.Description of the water market available to utilize recycled water to be produced, including: 1. (i) Identification of: 1. Potential users,	• 3.2
	2. Expected use, peak use	• 3.4.1,3.4.2
	3. On-site conversion costs,	• 3.7
	4. Desire to use recycled water, including letters of intent if available.	• N/A
	2. (ii) Description of any consultation with potential recycled water customers.	• N/A
	3. (iii) Description of the market assessment procedures used.	• Appendix B
	3c. Discussion of considerations which may prevent implementing a water reuse project. Identify methods or community incentives to stimulate recycled water demand, and methods to eliminate obstacles which may inhibit the use of reclaimed water, including pricing.	• N/A

Reclamation Chapter	Reclamation Subchapter	Corresponding Section/Page No
	3d. Identification of all the water and wastewater agencies that have jurisdiction in the potential service area or over the sources of reclaimed water.	• 3.4
	3e. Description of potential sources of water to be reclaimed, including impaired surface and ground waters.	• 3.4
	3f. Description and location of the source water facilities, including: 1. Capacities, plans for future facilities	• 3.4.1,3.4.2
	2. Treatment processes	• 3.4.1,3.4.2
	3. Plans for future source water facilities	• 3.4.1,3.4.2
	4. Existing flows, quantities of impaired water available to meet new reclaimed and reused water demands	• Chapter 5,Chapter 6
	3g. Description of the current water reuse taking place, including a list of reclaimed water uses, type and amount of reuse, and a map of existing pipelines and use sites.	• 3.4.1,3.4.2
	3h. Summary of water reclamation and reuse technology currently in use, and opportunities for development of improved technologies.	• 4.1
Description of Alternatives	4a. Description of non-Federal funding condition. The reasonably foreseeable future actions that the non-Federal project sponsor would take if Federal funding were not provided for the proposed water reclamation and reuse project, including estimated costs.	• Chapter 11
	4b. Statement of the objectives all alternatives are designed to meet.	• Chapter 7
	4c. Description of the other water supply alternatives considered to accomplish the objectives to be addressed by the proposed Title XVI project, including benefits to be gained by each alternative, total project cost, life cycle cost, and corresponding cost of the project water produced expressed in dollars per million gallons (MG), and/or dollars per acre-foot. An appraisal level cost estimates, or better, is acceptable for these alternatives.	• N/A
	4d. Description of the proposed Title XVI project including detailed project cost estimate; annual operation, maintenance, and replacement cost estimate; and life cycle costs shall be provided with sufficient detail to permit a more in-depth evaluation of the project, including non-construction costs.	• Appendix M
	4e. Description of waste-stream discharge treatment and disposal water quality requirements for the proposed Title XVI project.	• Appendix E
	4f. Description of at least two alternative measures, or technologies available for water reclamation, distribution, and reuse for the project under consideration. These alternatives must be approvable by the state(s) or tribal authorities in which the project will be located.	• N/A
Economic Analysis	5a. The economic analysis included in the feasibility study report shall describe the conditions that exist in the area and provide projections of the future with, and without, the project. Emphasis in the analysis must be given to the contributions that the plan could make toward alleviation of economic problems and the meeting of future demand.	• Chapter 9

Reclamation Chapter	Reclamation Subchapter	Corresponding Section/Page No
	5b. The Title XVI feasibility study must include a cost comparison of alternatives that would satisfy the same demand as the proposed Title XVI project. Alternatives used for comparison must be likely and realistic, and developed with the same standards with respect to interest rates and period of analysis.	• 7.7
	5c. When a Title XVI project provides water supplies for municipal and industrial use, the benefits of the Title XVI project can be measured in terms of the cost of the alternatives most likely to be implemented in the absence of the project. This is assuming that the two alternatives would provide comparable levels of service.	• N/A
	5d. Some Title XVI project benefits may be difficult to quantify; for example, a drought tolerant water supply, reduced water importation, and other social or environmental benefits. These benefits shall be documented and described qualitatively as completely as possible. These qualitative benefits can be considered as part of the justification for a Title XVI project in conjunction with the comparison of project costs.	• 9.2.2
Selection of the Proposed Title XVI Project	6a. Provide an analysis of whether the proposed Title XVI project would address the following: 1. (i) Reduction, postponement, or elimination of development of new or expanded water supplies; 2. (ii) Reduction or elimination of the use of existing diversions from natural watercourses, or withdrawals from aquifers; 3. (iii) Reduction of demand on existing Federal water supply facilities; and 4. (iv) Reduction, postponement, or elimination of new or expanded wastewater facilities.	• 9.2.1

Reclamation Chapter	Reclamation Subchapter	Corresponding Section/Page No
Environmental Consideration and Potential Effects	7a. The Title XVI feasibility study report must include sufficient information on each alternative to allow Reclamation to assess the potential measures and costs that may be necessary to comply with NEPA, and any other applicable Federal law. Accordingly, the following information is required: 1. (i) Discussion whether, and to what extent, the proposed Title XVI project will have potentially significant impacts on endangered or threatened species, public health or safety, natural resources, regulated waters of the United States, or cultural resources. 2. (ii) Discuss whether, and to what extent, the project will have potentially significant environmental effects, or will involved unique or undefined environmental risks. 3. (iii) Description of the status of required Federal, state, tribal, and/or local environmental compliance measures for the proposed Title XVI project including copies of any documents that have been prepared, or results of any relevant studies. 4. (iv) Any other information available to the study lead that would assist with assessing the measures that may be necessary to comply with NEPA, and other applicable Federal, state or local environmental laws such as the Endangered Species Act or the Clean Water Act. 5. (v) Discussion of how the proposed Title XVI project will affect water supply and water quality from the perspective of a regional, watershed, aquifer or river basin condition. 6. (vi) Discussion of the extent to which the public was involved in the feasibility study, and a summary of comments received, if any. 7. (vii) Description of the potential effects the project may have on historic properties. Discussion must include potential mitigation measures, the potential for adaptive reuse of facilities, an analysis of historic preservation costs, and the potential for heritage education, if necessary.	• Chapter 6
Legal and Institutional Requirements	8a. Analysis of any water rights issues potentially resulting from implementation of the proposed water reclamation and reuse project. All proposed Title XVI projects must comply with state water law.	• 10.1
	8b. Discussion of legal and institutional requirements, state, and/or local requirements with the potential to affect implementation of the project. Title XVI projects using Reclamation project water must address contractual requirements.	• Chapter 10
	8c. Discussion of the need for multi-jurisdictional or interagency agreements, any coordination undertaken, and any planned coordination activities.	• Chapter 10
	8d. Discussion of permitting procedures required for the implementation of water reclamation projects in the study area, and any measures that the non-Federal project sponsor can implement that could speed the permitting process.	• 10.3

Reclamation Chapter	Reclamation Subchapter	Corresponding Section/Page No
	8e. Discussion of any unresolved issues associated with implementing the proposed water reclamation and reuse project, how and when such issues will be resolved, and how the project would be affected if such issues are not resolved.	• 10.4
	8f. Identification of current and projected wastewater discharge requirements resulting from the proposed Title XVI project.	• 10.3
	8g. Description of rights to wastewater discharges resulting from implementation of the proposed Title XVI project.	• 10.3
Financial Capability of Sponsor	9a. Proposed schedule for project implementation.	• 11.1
	9b. Discussion of the willingness of the non-Federal project sponsor to pay for its share of capital costs and the full operation, maintenance, and replacement costs.	• 11.2
	9c. A plan for funding the proposed water reclamation and reuse project's construction, operation, maintenance, and replacement costs, including an analysis of how the non-Federal project sponsor will pay construction and annual operation, maintenance, and replacement costs.	• 11.3
	9d. Description of all Federal and non-Federal sources of funding and any restrictions on such sources, for example, minimum or maximum cost-share limitations. Generally, for Title XVI authorized projects, the Federal cost share is limited to 25 percent, of $20,000,000, whichever is less.	• 11.4
Research Needs	At a minimum the report must include a statement on whether the proposed water reclamation and reuse project includes basic research needs, and the extent that the proposed Title XVI project will use proven technologies and conventional system components.	• Chapter 10

Executive Summary

ES-1 Introduction

Del Puerto Water District (DPWD or District) is located along the west side of the San Joaquin Valley and extends from Vernalis to Santa Nella. The District provides agricultural irrigation water to approximately 45,000 acres of productive farmland in Stanislaus, San Joaquin, and Merced Counties. Currently, DPWD's only source of water is through a contract with the United States Bureau of Reclamation (Reclamation or USBR) for the delivery of up to 140,210 acre-feet (AF) of Central Valley Project (CVP) water annually.

Since the early 1990's, DPWD's CVP water allocations have been significantly reduced due to drought conditions and Delta pumping restrictions resulting from the passage of the Central Valley Project Improvement Act (CVPIA), and the National Marine Fisheries Service (NMFS) salmon and United States Fish and Wildlife Service (USFWS) Delta smelt biological opinions. In 2009, DPWD received only 10 percent (i.e. 14,000 AFY) of its contract allocation. DPWD's contract supply for 2013 is 20 percent of their contracted allocation (28,000 AFY). While future contract water deliveries to DPWD are uncertain, it is anticipated that restrictions to CVP operations will result in the District receiving an average of 35 percent of its contract allocation (i.e., 49,000 AFY) on an annual basis under normal hydrologic conditions (i.e. non-drought conditions).

These shortfalls in water deliveries from Reclamation have required DPWD to find alternative water sources to supplement its CVP deliveries, which has recently been accomplished by temporary water transfers from other agencies or the use of groundwater from privately owned wells. While groundwater and water transfers have been effective temporary methods to meet the District's water demands, they do not provide a reliable, sustainable, or affordable long-term solution.

DPWD is located in close proximity to the City of Modesto's (Modesto) and the City of Turlock's (Turlock) wastewater treatment facilities. Both Modesto and Turlock have recycled water available that could be delivered to the District and its customers, as shown in Table ES- 1. This supply of recycled water from Modesto and Turlock could provide a long-term, reliable water supply for the District and its customers that would serve to augment DPWD's CVP supply.

This feasibility study reviews and evaluates the following five recycled water delivery alternatives for this supply:

- **Alternative 1**: Pipeline Conveyance of Recycled Water Directly to the Delta-Mendota Canal (DMC)[1] ,
- **Alternative 2**: Pipeline Conveyance of Recycled Water Directly to DPWD Lands,
- **Alternative 3**: San Joaquin River Conveyance of Recycled Water to Existing Diversion Facilities for Conveyance to the DMC,
- **Alternative 4**: Pipeline Conveyance of Recycled Water to Patterson ID Existing Facilities for Dilution and Conveyance to the DMC,
- **Alternative 5**: Pipeline Conveyance of Recycled Water to the DMC Utilizing Groundwater Storage and Operational Modifications.

[1] The DMC is a USBR-owned concrete lined, open channel canal that conveys Sacramento-San Joaquin River Delta water south along the west side of the San Joaquin Valley, primarily for agricultural use, and ends at the Mendota Pool along the San Joaquin River.

Table ES- 1: Summary of Recycled Water Available to DPWD

Recycled Water Source	2018 Available Recycled Water (AFY)	2045 Available Recycled Water (AFY)
Modesto	16,500	30,600
Turlock	14,100	28,400
Total	**30,600**	**59,000**

ES-2 Summary of Alternatives

As shown in Table ES- 1, both Modesto and Turlock anticipate expanding their recycled water production until reaching build-out conditions around 2045. The alternatives developed as part of this feasibility study were developed for the two recycled water production rates, i.e. 30,600 AFY available at the onset of the project (assumed to be 2018) and 59,000 AFY available at buildout in 2045. As shown in Table ES-2, some alternatives, which are further described below may require advanced levels of recycled water treatment (such as RO and advanced oxidation).

Alternative 1: Pipeline Conveyance of Recycled Water Directly to the DMC

Alternative 1 consists of constructing a pipeline or combination of pipelines to deliver recycled water from Modesto and Turlock directly to the DMC. Five sub-alternatives were developed taking into consideration various corridor alignments within Stanislaus County.

- Alternative 1A: DMC-1A- Separate Alignments along Patterson Irrigation District (PID) Right-of-Way
- Alternative 1B: DMC-1B- Separate Alignments (Most Direct)
- Alternative 1C: DMC-2- Combined East at Las Palmas
- Alternative 1D: DMC-3- Combined West at Pomelo Avenue
- Alternative 1E: DMC-4- Combined East at Harding Drain

The DMC would be used to convey the recycled water to DPWD customers or to the San Luis Reservoir for storage during low water demand periods. This alternative would require a Warren Act Contract or a long-term Exchange Agreement for conveyance and storage of recycled water within the CVP system. Recycled water would be discharged to the DMC year-round, and all recycled water could be delivered to DPWD.

The range of unit costs for Alternatives 1A through 1E is included in Table ES-2. It was assumed that advanced treatment would not be needed for these alternatives

Alternative 2: Pipeline Conveyance of Recycled Water Directly to DPWD Lands

Alternative 2 consists of constructing a pipeline from Modesto and Turlock to a selected service area within DPWD. Four sub-alternatives were developed taking into consideration delivery to different areas within DPWD and maximizing recycled water deliveries through the use of seasonal storage:

- Alternative 2A: Delivery to South and Central Areas, using seasonal storage at Modesto
- Alternative 2B: Delivery to South and Central Areas, with additional storage
- Alternative 2C: Delivery to the Central Area, using seasonal storage at Modesto
- Alternative 2D: Delivery to the North Area, using seasonal storage at Modesto

The range of unit costs for Alternatives 2A through 2D is included in Table ES-2. It was assumed that advanced treatment would not be needed for these alternatives

Alternative 3: San Joaquin River Conveyance of Recycled Water to Existing Diversion Facilities for Conveyance to the DMC

Under Alternative 3, Modesto and Turlock would continue to discharge treated water to the San Joaquin River. The recycled water could then be diverted from the river at one of three existing river diversion facilities, and conveyed to the DMC for reuse by DPWD. The three alternative river diversion facilities have various capacities that DPWD could utilize, and therefore the volume of recycled water delivered to DPWD is slightly different for each sub-alternative.

- Alternative 3A: Banta Carbona Irrigation District (BCID) Diversion
- Alternative 3B: West Stanislaus Irrigation (WSID) District Diversion
- Alternative 3C: Patterson Irrigation District (PID) / WSID Diversion

The unit costs for Alternatives 3A through 3C are included in Table ES-2. Because this alternative results in continued discharge to the San Joaquin River, Modesto and Turlock would have to meet any new river discharge regulations that may take effect. Because salinity limits on San Joaquin River discharges may take effect within a 10 to 15 year timeframe, Table ES-2 includes the cost associated with treatment upgrades that may be required for salinity reduction of recycled water (i.e. reverse osmosis [RO] treatment). This alternative would also require a Warren Act Contract or Exchange Agreement for conveyance and storage of recycled water within the CVP system.

Alternative 3 is currently being evaluated under a separate program for the short-term interim period before ultimate permanent project is designed and constructed. DPWD and Turlock are investigating the water rights and transfer implications of delivering water through PID's diversion facilities. If approved, this water could be available as early as the 2014 irrigation season.

Alternative 4: Pipeline Conveyance of Recycled Water to Existing Facilities for Dilution and Conveyance in the DMC

Alternative 4 consists of constructing a pipeline from Modesto and Turlock to PID conveyance facilities. The recycled water pipeline would cross the San Joaquin River, so that recycled water would either be discharged into PID's river sedimentation basins or into PID's Main Canal/pipeline. The recycled water would blend in their facilities with PID's appropriated San Joaquin River water (approximate dilution factor of 3:1 to 4:1 river water to treated water), and would then be conveyed to the DMC for delivery to DPWD and/or storage in San Luis Reservoir.

This alternative would maximize recycled water deliveries to DPWD because recycled water would be conveyed to PID as it is produced, and San Luis Reservoir would provide seasonal storage. This alternative would require a Warren Act Contract or Exchange Agreement for conveyance and storage of recycled water within the CVP system. Since recycled water would be mixed and diluted with diverted San Joaquin River water, PID's customers and Board of Directors may be required to approve use of recycled water in their service area. The unit costs for this alternative are included in Table ES-2. It was assumed that advanced treatment would not be needed for these alternatives. This alternative would also require a Warren Act Contract or Exchange Agreement for conveyance and storage of recycled water within the CVP system.

Alternative 5: Pipeline Conveyance to the DMC Utilizing Groundwater Storage and Operational Modifications

Alternative 5 consists of constructing a pipeline from Modesto to the DMC to deliver recycled water directly into the DMC during three months of the year (April through June). It was assumed that operational strategies could be developed with Reclamation to allow recycled water discharge into the DMC at times when the O'Neil Pumps are not delivering DMC water into the O'Neil Forebay and ultimately into San Luis Reservoir. Seasonal storage at Modesto would be used to maximize the recycled water deliveries to the DMC during the three month period. During the remainder of the year, recycled water would be diluted with river water and percolated into the groundwater. It was assumed that at least a 6-month residence time could be provided prior to extracting the groundwater and dilution water. This alternative would require a Warren Act Contract or an Exchange Agreement for conveyance and storage of recycled water within the CVP system. A total of 20,200 AFY of water could be provided to DPWD under this alternative. As indicated in Table ES-2, it is assumed that advanced treatment would not be necessary.

Table ES- 2: Summary of Alternatives

	Alternative 1: Pipeline to DMC	Alternative 2: Pipeline direct to DPWD	Alternative 3: San Joaquin River conveyance	Alternative 4: Pipeline to PID Facilities	Alternative 5: Groundwater Storage
Advanced Treatment Required?	No	No	Yes	No	No
Capital Costs (range) [1]	$96 M-$123 M	$168 -$175 M	$7.8M–$37.1 M	$41 M- $64 M	$128 M-$130 M
Operating Cost (range)	$1.5 M–$1.6 M	$2.1 –$2.6 M	$1.7 –$3.1 M	$1.7M –$3.4M	$2.7– $3.6 M
AFY Delivered [2]	30,600	25,700	30,600	30,600	20,200
Comparative Unit Cost (range) [3]	$180/AF - $240/AF	$470/AF - $660/AF	$1000/AF	$180/AF - $250/AF	$450/AF - $600

Notes:

1. Costs shown in 2013 dollars
2. Recycled Water Deliveries at Project Onset (year 2018)
3. Comparative unit costs assuming 25% capital cost grant, remaining capital financed at 5% over 30 years

ES-3 Refuge Water Supply

Reclamation has a need for Incremental Level 4 (IL4) water supply for the Refuges located south of the Delta. Although no commitments have been made, delivery of a portion of the available recycled water to the Refuges via the DMC is a viable option that needs to be further evaluated relative to cost and delivery requirements and potentially incorporated into the program.

ES-4 Conclusions and Recommendations

Each of the five alternatives was evaluated against the following criteria in order to determine the recommended alternative:

- Technical feasibility
- Potential treatment upgrades
- Recycled water delivery
- Ability to deliver water to the entire District
- Cost effectiveness
- Institutional issues and obstacles

Based on the evaluation of alternatives, Alternative 1, Pipeline Conveyance of Recycled Water Directly to the DMC, is the recommended option. Alternative 1 is technically feasible, avoids requirements for additional treatment upgrades, can convey all of the anticipated recycled water production at project buildout, uses the CVP facilities to provide seasonal storage, allows for delivery to all DPWD lands, is cost-effective compared to the other alternatives and currently has no identified fatal flaws from an institutional perspective.

Within Alternative 1 it is recommended that two scenarios, DMC 1-B and DMC-4, be carried forward to the next phase of project development. DMC-1B, which conveys project water separately from each City to the DMC, is recommended because it allows each City to implement its recycled water system independently and is the least costly of the separate pipeline scenarios. DMC-4, which conveys the combined flow from the two Cities to the DMC, is recommended because it is overall the lowest cost scenario in Alternative 1. The decision between these two scenarios will be based on more detailed evaluation of institutional agreements and project funding that will occur in the next project phase.

Figure ES 1: Recommended Alternative DMC-1B

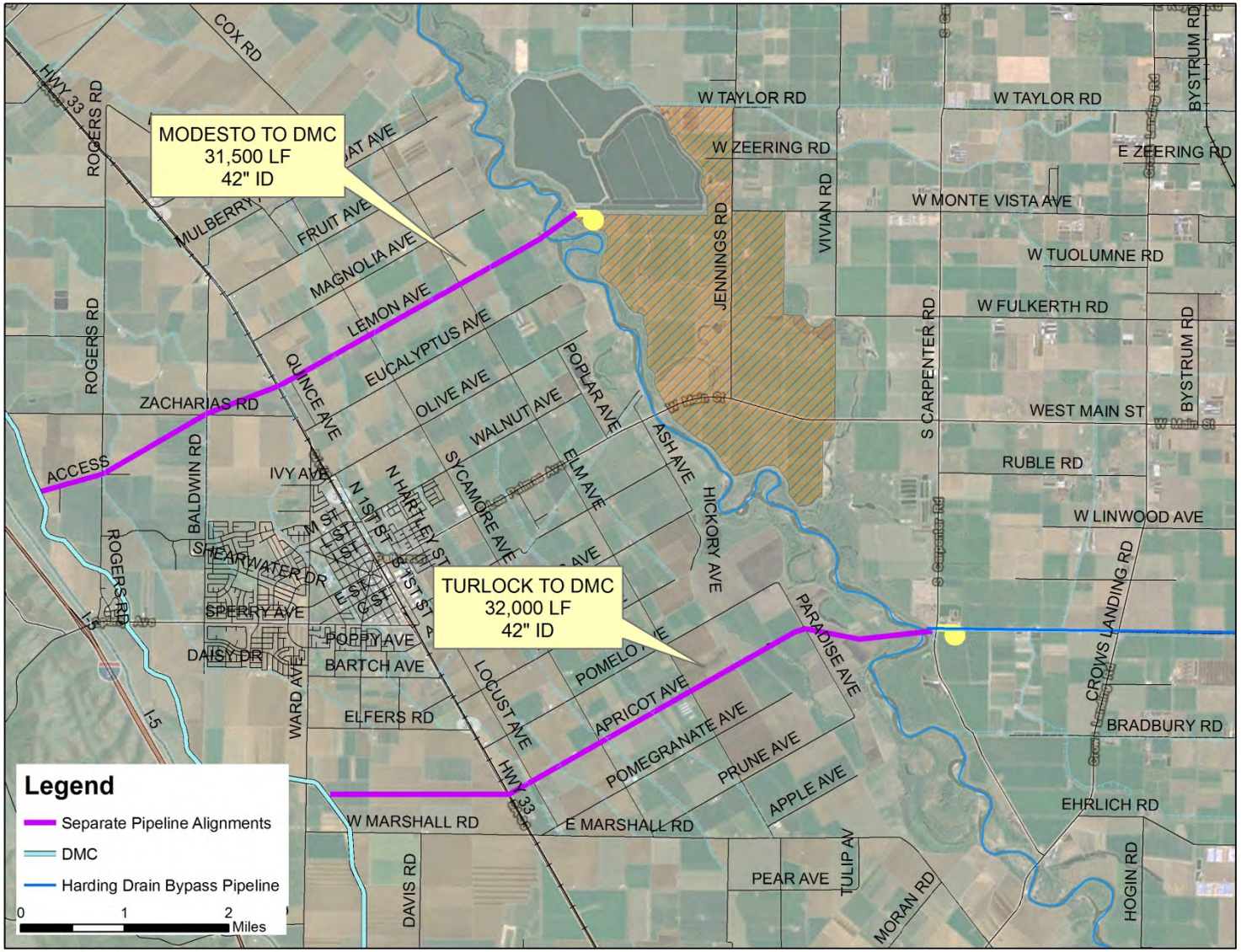
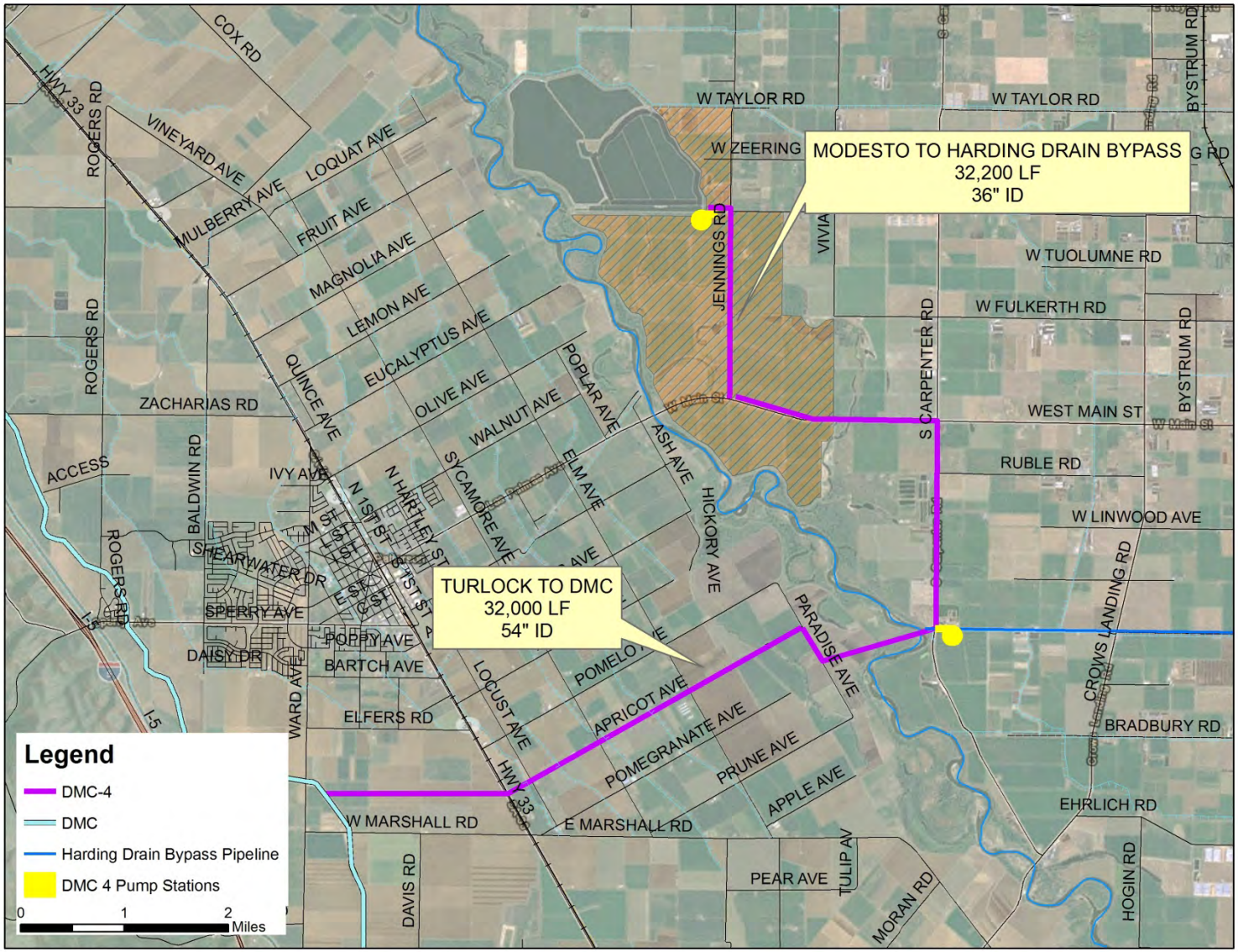


Figure ES 2: Recommended Alternative DMC-4



Chapter 1 Introduction

1.1 General Background

Del Puerto Water District (DPWD or District) is a California Special District of the State of California, formed under the provisions of Division 13 of the State of California Water Code . DPWD is located along the west side of the San Joaquin Valley and extends from Vernalis to Santa Nella. The District includes approximately 45,000 acres of productive farmland which generates $130 million of gross revenue annually in Stanislaus, San Joaquin, and Merced Counties (Figure 1-1).

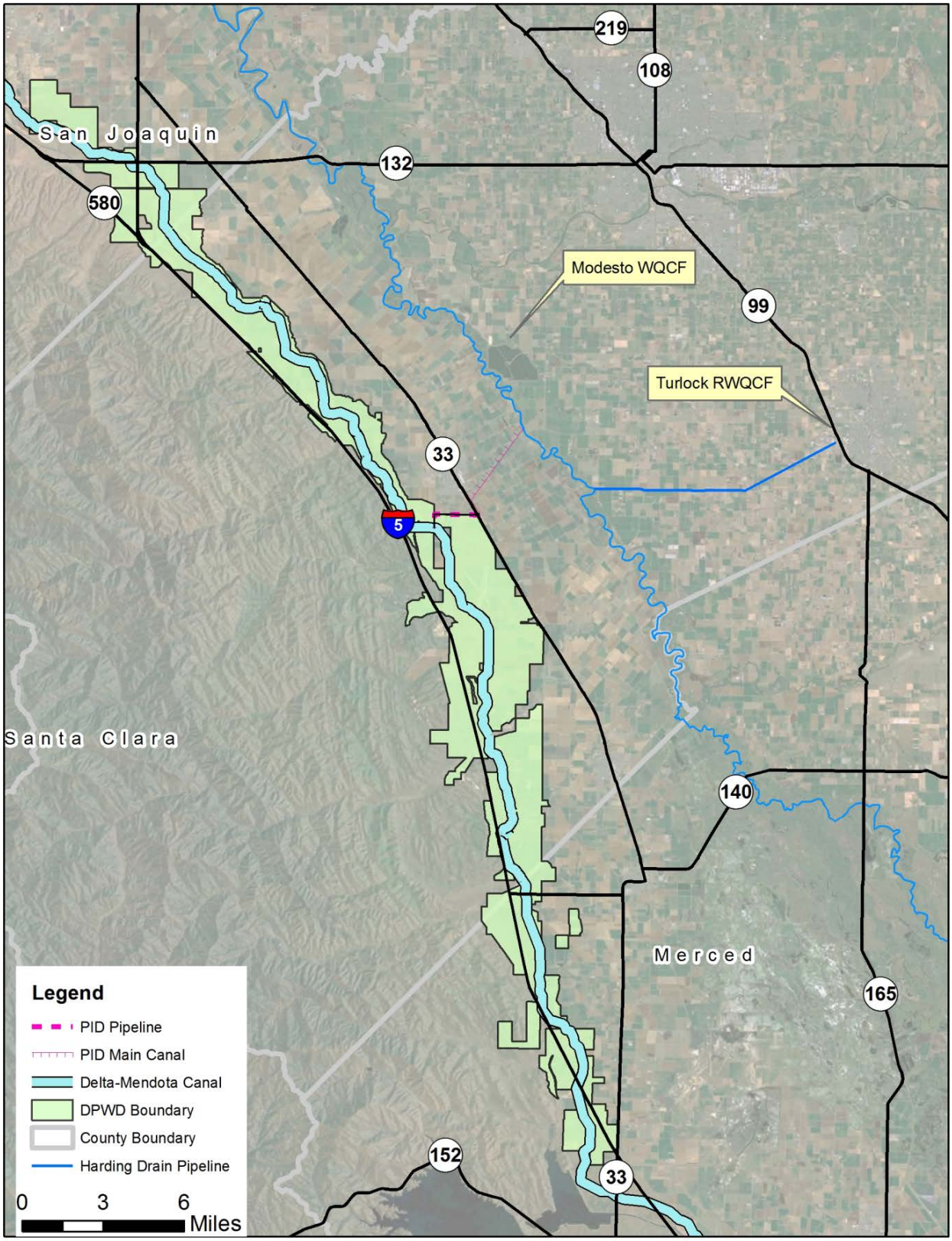
Currently, DPWD's only source of water is through its contract with the United States Bureau of Reclamation (Reclamation). The District's contract with Reclamation provides for an entitlement of up to 140,210 acre-feet (AF) of Central Valley Project (CVP) water annually, which correlates to an irrigation supply of approximately 3 AF per acre. Prior to the 1990's, DPWD received its full contractual water supply from Reclamation. Beginning in the early 1990's, DPWD's entitlements were significantly reduced due to drought conditions, impacts associated with implementation of the Central Valley Project Improvement Act (CVPIA), and regulatory restrictions imposed on Central Valley Project (CVP) operations. In 2009, due to hydrologic conditions as well as new Delta pumping restrictions resulting from the biological opinions of the NMFS and USFWS, DPWD only received 10 percent (≈14,000 AF) of its updated CVP allocation, which translated to an irrigation rate of approximately 4 inches per acre. In 2013, DPWD received only 20 percent of its CVP allocation. It is currently anticipated that future restrictions to the CVP operations will result in the District receiving an average of only 35 percent of its contract allocation (49,000 AFY) under normal hydrologic conditions (i.e., non-drought conditions).

1.2 Project Description

The water shortages and the lack of water supply reliability that DPWD has experienced have resulted in economic hardships on the District and its growers. In 2009, over 11,000 acres of lands were fallowed, representing approximately 25 percent of the District's productive farmland. To bridge the gap between Reclamation allocations and District demands, DPWD has relied on costly water transfers from other water agencies. However, Delta exports and surface water supplies in the future are expected to become scarcer due to the impacts of climate change and the need to maintain the Delta ecosystem (California Water Plan Update 2009, Bulletin 160-09, DWR), which will likely result in water transfers becoming more costly and less reliable. DPWD growers have also relied on groundwater from private wells to augment water supplies, but groundwater the DPWD service area ranges in quality and quantity across the District. The shortage of CVP water will continue to negatively impact the District, and may force the District's customers to rely more heavily on unreliable and sometimes poor quality groundwater supplies and/or to fallow more land.

One possible solution to DPWD's water supply shortage/reliability problem is to reuse or recycle treated wastewater from the Cities of Modesto (Modesto) and Turlock (Turlock) to supplement their CVP water supplies. Recycled water has been successfully used in California for a variety of agricultural uses, including the irrigation of raw fruit and vegetable crops. Modesto operates a water quality control facility (WQCF) located in Stanislaus County on the east side of the San Joaquin River (Figure 1-1.) A portion of Modesto's WQCF's effluent is treated to secondary standards and currently used for local pasture irrigation on City-owned property. The portion of the WQCF effluent that would be developed under the NVRRWP would receive tertiary treatment in full compliance with State of California Title 22 requirements for disinfected, tertiary recycled water.

Figure 1-1: Project Site Map



The City of Modesto had a population of 201,165 in 2011 and 202,290 in 2012. Domestic Flow into the City's Treatment Plants decreased between 2006 through 2012, from 27.2 MGD to 20.4 MGD. The decrease in flows may be attributed to water conservation (due to water metering), foreclosures, or reduction of year-round commercial industrial flows.

From that starting point, and using the same growth rates that were in the 2008 WWMP Supplement, it is assumed that there would be gradual growth of 0.6% in 2013-14, 1.6% from 2015-16, and 1.75% from then on, the City developed a reasonable projection of anticipated sewer connections in Modesto Municipal Sewer District #1, including Empire, North Ceres and County Islands. These assumptions include commercial and minor industrial growth, but exclude large scale industrial (canning) growth.

The 2007 WWMP used a per capita flow in 2005 of 117.3 GPD/cap, based on population and flow into the plant. Currently, flow per capita is estimated at 94.9 GPD/cap. A 5 year average (between 2008 to 2012) is 102.4 GPD/cap and 8 year average (between 2005-2012) is 109 GPD/cap. Based on these per capita flows, the estimated build-out date for the City of Modesto is between 2043 and 2046.

The City also estimated that expansion of the tertiary treatment facilities would occur in 5 phases, ultimately reaching a capacity of 27.5 mgd. Communication with the City indicates there will probably be some onsite uses of tertiary treated water, such as a demonstration irrigation project in the future. This memorandum estimates that 0.2 mgd will be used for in-facility recycled water use, leaving 27.3 mgd available at buildout for NVRRWP.

The Turlock RWQCF receives flow well in excess of what one would normally see for a City of 70,000 because they have a number of food processors, etc. The General Plan projects job growth commensurate with population growth, i.e. does not overestimate job growth. However, a significant portion of the job growth will occur in water intensive industries. The City has zoned a significant amount of land (1,700 acres) for new industrial development and has seen significant interest from food processors considering a move to Turlock. Therefore wastewater flows will increase significantly over time.

The City of Turlock has several long term commitments for recycled water use from the facility. The first commitment is for 2 mgd for 50 years for use at Turlock Irrigation District's (TID) Walnut Energy Center. Although the commitment is for up 2 mgd, the actual deliveries in 2012 have averaged 1.0 mgd. For the sake of assessing availability of recycled water, the contractual commitment of 2 mgd will be reserved for delivery to TID. The other current recycled water use in Turlock is for irrigation at Pedretti Park. The average irrigation use for the park is assumed to be 0.1 mgd, which was the average use in 2012. Therefore, in calculating the recycled water that would be available for NVRRWP, it is assumed that 2.1 mgd will be reserved for in-City use, leaving a flow rate of 25.4 mgd available at buildout for NVRRWP.

Based on the Cities' evaluation of buildout flows, it is estimated that approximately 52.7 mgd (59,000 AFY) of recycled water may be available by the year 2043 for the NVRRWP project.

The City of Ceres, located in between Modesto and Turlock, send a portion of their wastewater effluent to both Modesto and Turlock for further treatment. Currently, the rate of flow to either plant ranges from 0.5 to 2 mgd with a total planned export of 4.2 and 6.0 mgd to Modesto and Turlock, respectively. The timing of these increases is subject to when Ceres decides to discontinue their current practice of on-site disposal in the existing percolation ponds.

The geographic proximity of DPWD to Turlock's and Modesto's treatment facilities provides a unique opportunity for recycled water to be used to supplement DPWD's existing water supply and to improve water reliability for the District's customers. The respective wastewater outfalls of each City are located

approximately 4 river miles apart from each other. The recycled water delivery alternatives that were evaluated as part of this feasibility study include:

- **Alternative 1- Pipeline Conveyance of Recycled Water Directly to the Delta Mendota Canal (DMC)** for delivery to DPWD customers.
- **Alternative 2 - Pipeline Conveyance of Recycled Water Directly to DPWD Lands** from Modesto and Turlock Treatment Plants.
- **Alternative 3 – San Joaquin River Conveyance of Recycled Water to Existing Diversion Facilities for conveyance to the DMC.**
- **Alternative 4 – Pipeline Conveyance of Recycled Water to Patterson Irrigation District Existing Facilities for Conveyance to the DMC**. Recycled water would combine with river water diverted from Patterson Irrigation District's (PID) river diversion facility and the blended water would be used by PID customers and then pumped into the DMC for distribution to DPWD customers.
- **Alternative 5 - Pipeline Conveyance of Recycled to DMC Utilizing Groundwater Storage and Operational Modifications.** Recycled water would be pumped into the DMC when water is not being pumped from the DMC into O'Neil Forebay/San Luis Reservoir (assumed three-month period of April through June). Recycled water during the remainder of the year would be banked in the groundwater basin with dilution water, extracted six months later, and pumped into the DMC to DPWD customers.

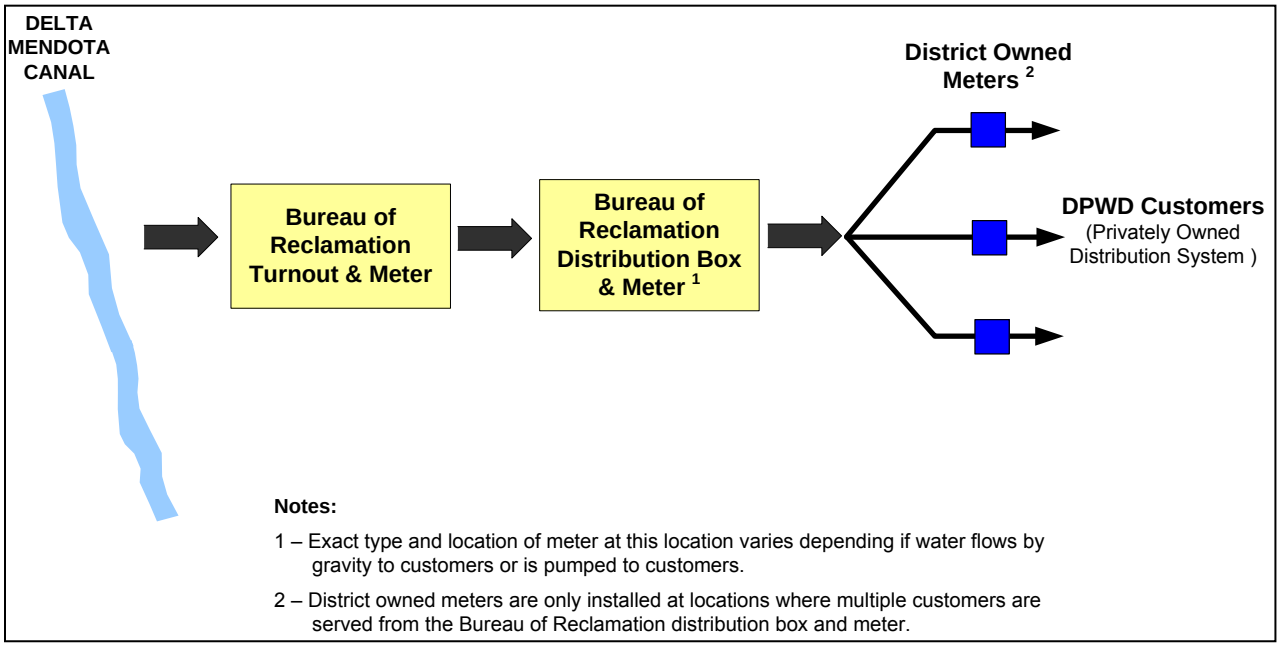
1.3 Existing Infrastructure

The Turlock RWQCF produces Title 22 tertiary treated recycled water and discharges it to the San Joaquin River via the Harding Drain Pipeline (currently under construction). The City of Turlock has several long-term commitments for recycled water use from the facility. The first commitment is for 2 mgd for 42 years for use at Turlock Irrigation District's (TID) Walnut Energy Center. Although the commitment is for up 2 mgd, the actual deliveries in 2012 averaged 1.0 mgd. For the sake of assessing availability of recycled water, the contractual commitment of 2 mgd will be reserved for delivery to TID. The other current recycled water use in Turlock is for irrigation at Pedretti Park. The average irrigation use for the park is assumed to be 0.1 mgd, which was the average use in 2012. Therefore, in calculating the recycled water that would be available for NVRRWP, it is assumed that 2.1 mgd will be reserved for in-City use, leaving a flow rate of 25.4 mgd (28,400 AFY) available at buildout for NVRRWP.

The Modesto WQCF is in the process of expanding their tertiary treatment facilities as flow has increased to the treatment plant. The City's total wastewater flow at build-out (in approximately 2040) is projected to be around 40.6 mgd. The expansion of the tertiary treatment facilities will occur in 5 phases, ultimately reaching a capacity of 27.5 mgd. Phase 1A is currently constructed and online, and the Phase 2 construction is currently in progress with an expected completion in 2016. There will likely be some onsite uses of tertiary treated water, such as a demonstration irrigation project in the future. It is estimated that 0.2 mgd will be used for in-facility recycled water use, leaving 27.3 mgd (30,600 AFY) available at buildout for NVRRWP. The remainder of the flow would be treated to secondary levels and would be used for local pasture irrigation at Modesto.

There are no recycled water treatment facilities within DPWD's service area, but there are three facilities in close proximity. DPWD does not currently own any water distribution facilities. CVP water is delivered to the District directly from the DMC through metered turnouts owned by the Bureau of Reclamation and licensed for DPWD's use. The water is then delivered to District customers either directly or through Bureau-owned distribution boxes via privately owned pumps, pipelines, and/or canals (see Figure 1-2). The San Luis and Delta Mendota Water Authority (SLDMWA) was established in 1992 to assume the operation and maintenance responsibilities of certain Reclamation CVP facilities, including those that deliver water to DPWD.

Figure 1-2: DPWD Distribution System



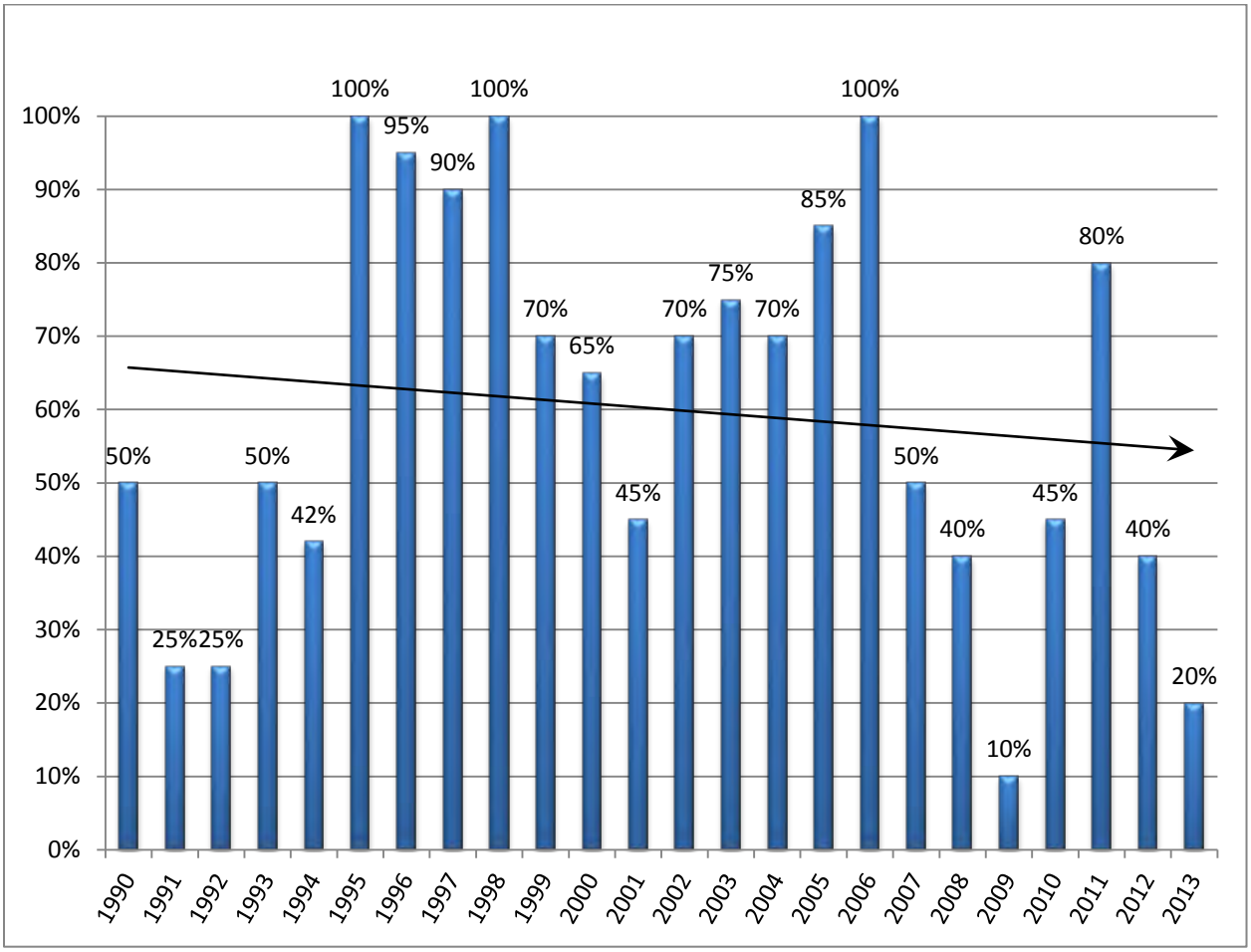
The three facilities that produce recycled water in proximity to DPWD are owned and operated by the Cities of Modesto, Turlock, and Patterson. The City of Patterson's (Patterson) Water Quality Control Facility (WQCF) is located approximately three miles northeast from central Patterson and has a design capacity of 2.75 mgd. The average daily flow treated at this facility is approximately 1.5 mgd (City of Patterson's WQCF monthly report, January 2010). Patterson's WQCF produces secondary effluent that is disposed of via percolation ponds located near the treatment facility. Patterson's 2010 General Plan indicates that they intend to recycle water within the city limits in the future to offset potable water demands and to recharge the groundwater basin. Because Patterson intends to use all treated water within its city limits, the Patterson's WQCF was not considered a potential source of recycled water for DPWD.

Chapter 2 Statement of Problems and Needs

2.1 Project Need

DPWD relies on a single source of water supply, a CVP water contract with the USBR for up to 140,210 AFY. DPWD's full entitlement provides for approximately 3 AFY to District lands. In the early 1990's, water deliveries to DPWD were significantly reduced by up to 75 percent due to drought conditions (Figure 2-1). The drought was followed by the passage of the Central Valley Project Improvement Act (CVPIA), which resulted in Delta pumping restrictions and continued water delivery shortages (A Summary of Activities and Accomplishments in the Implementation of the CVPIA, Bureau of Reclamation, February 2005).

Figure 2-1: Historic DPWD CVP Allocations[2]



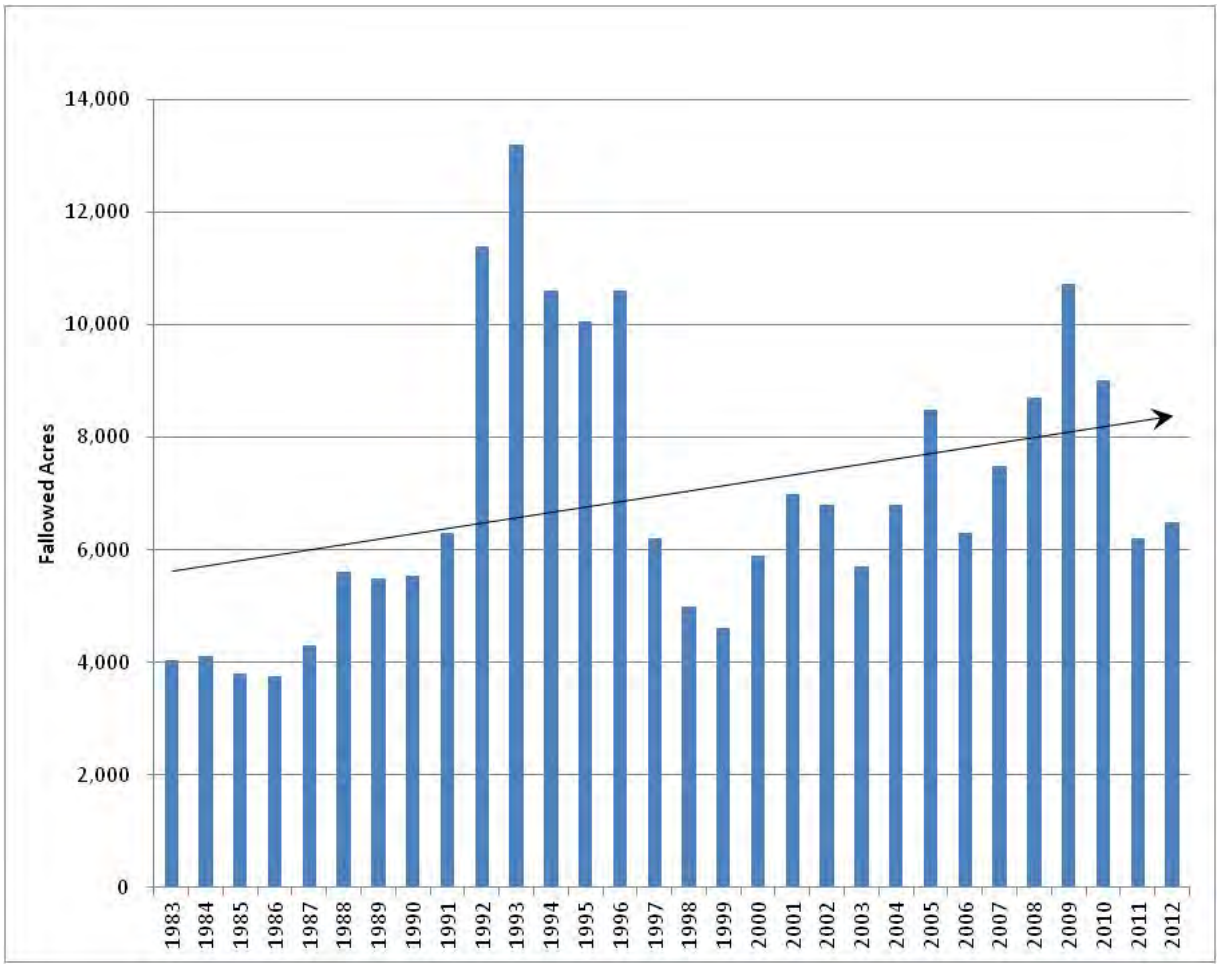
In 2009, when drought conditions and Delta pumping restrictions due to the National Marine Fisheries Service (NMFS) salmon and the USFWS Delta smelt biological opinions were imposed on CVP operations, DPWD received only 14,000 AFY of water from the CVP, which translates to an irrigation rate of approximately 4 inches per acre. In the past nineteen years, DPWD has been subject to water delivery reductions in all but three years. Under currently regulatory conditions, it is estimated that in the future DPWD may receive up to 35 percent of their contract entitlement (49,000 AFY) in an average

[2] Data from DPWD based on historic CVP allocations for a water year

hydrologic year, which would provide only 1 AF/acre. The future deliveries to DPWD were developed by applying historic South of Delta water allocation reductions from Delta pumping restrictions due to the CVPIA and biological opinions for Delta smelt and salmon, to the DPWD contract entitlement (see Appendix A).

Because DPWD does not have a secure alternate water supply, shortages in CVP deliveries result in economic hardships on the District as well as its growers, and results in fallowing practices within the District (Figure 2-2). In order to maintain the existing cropping patterns and economic conditions within the District, DPWD needs to secure an alternate water supply to supplement CVP deliveries.

Figure 2-2: Historic Fallowing Practices



2.2 Water Supplies

As discussed in Section 2.1, DPWD's primary source of water is its contract with Reclamation. When DPWD does not receive its full contract entitlement, it has historically relied on securing temporary water transfers each year from other water agencies to supplement its contract water deliveries. In addition, land owners increase their reliance on pumped groundwater in years when CVP water supplies are reduced. Table 2-1 provides a summary of recent water transfers and the cost incurred by DPWD for the water. The source and cost of the transferred water varies each year, but as indicated in Table 2-1, the water transfers can cost DPWD anywhere from two to six times as much as its CVP contract supply.

Water transfers have been an effective and temporary way to meet the District's water demands, but are not a reliable or sustainable long-term solution because of uncertainty in the availability of future surface

water supplies, the projected difficulties in the ability to wheel water through the Delta in future years, and the financial impact to customers associated with the constant increase in annual water costs. As the availability of source water decreases, the cost of water transfers will increase while the ability to secure water transfers will decrease. There are several factors that could impact future surface water supplies in California. Climate change is expected to affect the availability of Delta water exports because weather patterns are anticipated to become more severe (longer droughts and wetter non-drought years) and warmer temperatures are expected to reduce snowpack amounts. These two weather changes are expected to impact the amount of surface water runoff, the timing of runoff, and the ability to use runoff. In addition, changes in climate are expected to result in sea levels rising which will, in turn, increase the salinity of the Delta, requiring more fresh water to be kept in the Delta to maintain water quality conditions to support the Delta ecosystem and to maintain adequate flow and water quality in Old and Middle Rivers. Furthermore, a significant capital investment is needed in the future to maintain the infrastructure system that enables Delta conveyance. Without these improvements, Delta conveyance may be limited, which ultimately impacts the ability of South of the Delta water users to wheel water transfers through the Delta (California Water Plan Update 2009, Bulletin 160-09, DWR).

Table 2-1: Historic Temporary Water Transfer Data

Water Year	Bureau of Reclamation Contract Rate ($/AF)	Additional Water Supply Rate[2] ($/AF)
2006-2007	$40	$118
2007-2008	$43	$156
2008-2009	$45	$145-$220
2009-2010	$50	$245 - $320
2010-2011	$51	$162-$200

Notes:
1. Information provided by DPWD.
2. Additional water supplies were obtained through a combination of temporary water transfers from Exchange Contractors, Cross Valley Canal Contractors, PID, Tracy, In-District Emergency Groundwater, and WSID.

Groundwater is a major water supply source in the state of California for agricultural and municipal users. Shortages of surface water supplies have historically forced agricultural and municipal users to rely more heavily on limited groundwater supplies, which has led to overdraft and land subsidence conditions in some areas. The DWR California Water Plan Update estimated in 1995 that the majority of overdraft conditions that were occurring in California were in the Tulare Lake, San Joaquin River, and Central Coast regions. Furthermore, the area between Los Banos and Kettleman City has been identified as one of the most pronounced areas of historic and potential future subsidence problems (Poland and Lofgren, California Case History No. 9.13. San Joaquin Valley, California 1975). The risk at these locations is not merely the lowering of land elevation, but the destruction of recharge and storage capability within the aquifer (Galloway, Jones, and Ingebritsen, Land Subsidence in the United States, Part I, The San Joaquin Valley, Largest Human Alteration of the Earth's Surface, Circular 1182, 1999).

DPWD is located within the San Joaquin River groundwater basin and overlies the Delta Mendota groundwater subbasin. The Delta Mendota groundwater subbasin is not considered to be in a state of overdraft (DWR, California Groundwater Bulletin 118, January 2006). Groundwater has been used within the District to supplement CVP water deliveries but there are potential long-term challenges associated with continued reliance on groundwater pumping such as declining water table elevation, land subsidence, degradation of groundwater quality, and adverse impacts to crop yield from unsuitable groundwater quality. Further or increased reliance on groundwater pumping to meet crop water demand is not considered a viable or sustainable option for DPWD given the potential adverse impacts that would

likely occur. For example, the City of Modesto relied solely on groundwater to meet the demands in its service area until 1995. In 1995, Modesto entered into a contract to purchase surface water from MID, thereby reducing their dependence on groundwater. As Modesto has decreased their reliance on groundwater, they have seen an increase in groundwater levels and a reduction in overdraft conditions, which demonstrates the potential impacts decreasing the reliance of groundwater as a major component of water supply (City of Modesto Urban Water Management Plan, 2005). Similarly, the Turlock subbasin is experiencing overdraft conditions as the result of groundwater reliance; like the City of Modesto area, these conditions will be addressed by the use of surface water in lieu of groundwater supplies.

Existing groundwater wells within the District are privately owned and maintained, and DPWD does not track and/or monitor groundwater use within the District. The majority of groundwater wells are located in the northern part of the District because the groundwater quality is generally better in this area. In the southern area of the District, including lands in southern Stanislaus and northern Merced Counties, groundwater is both harder to locate and generally of poorer quality. This presents a particular challenge for the District in that almond trees are the major crop in this area. Almonds, which typically stay in production for 25 years or more, are a capital intensive crop that are sensitive to salts (chloride and sodium in particular) and require an adequate and reliable source of water supply to maintain economic production throughout their lifespan. Because groundwater availability and quality in the southern area is often inadequate for use as a supplemental water supply, DPWD customers in the area are forced to find and purchase an alternate supply of surface water to supplement CVP deliveries. The District's northern area, which includes lands in southern San Joaquin and northern Stanislaus Counties, has groundwater that is both more available and of higher quality and can be used to supplement curtailed CVP deliveries.

The State of California recognizes that the conditions described above will result in a shortage of water in future years (California Water Plan Update 2009, Bulletin 160-09, DWR). Recognizing that recycled water use within the State is a key water resource and component to meeting future water demands, the State Water Resources Control Board adopted the following Recycled Water Policy on January 22, 2013:

> *"We declare our independence from relying on the vagaries of annual precipitation and move towards sustainable management of surface waters and groundwater, together with enhanced water conservation, water reuse and the use of storm water. To this end, we adopt the following goals for California:*
>
> - *Increase the use of recycled water over 2002 levels by at least one million acre-feet per year (afy) by 2020 and by at least two million afy by 2030.*
> - *Increase the use of storm water over use in 2007 by at least 500,000 afy by 2020 and by at least one million afy by 2030.*
> - *Increase the amount of water conserved in urban and industrial uses by comparison to 2007 by at least 20 percent by 2020.*
> - *Included in these goals is the substitution of as much recycled water for potable water as possible by 2030."*

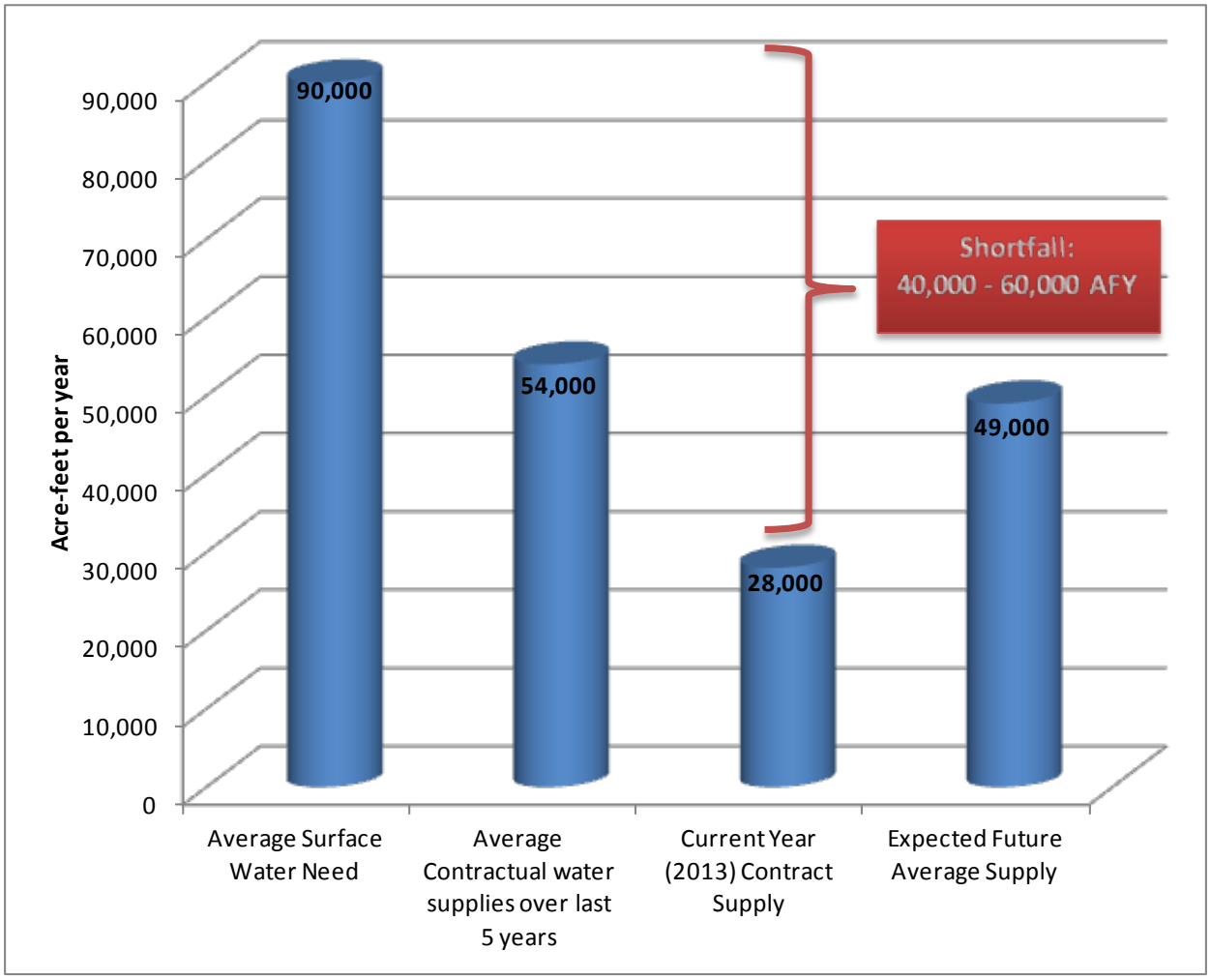
Modesto and Turlock treat their wastewater to specific water standards in order to meet the San Joaquin River discharge requirements in their NPDES permits. Use of this recycled water resource for agricultural irrigation aligns with the State Water Resources Control Board's overall objectives and goals and puts the recycled water to its highest and best use. It offers the additional benefit of helping to meet DPWD's water demand, while also offsetting future treatment upgrade costs for Modesto and Turlock that may be required for continued discharge to the San Joaquin River.

2.3 Water Gaps

It is predicted that future deliveries from the CVP to DPWD will average approximately 49,000 AFY of water, an allocation of only 1 AF/acre, which is inadequate to meet the District's water demand.

The 2013 water demand was estimated at approximately 90,000 AFY (Figure 2-3) and was assumed to represent the District's existing average annual water demand. The demand was estimated using the methodology described in Appendix B and the 2009 cropping pattern (Table 3-1). The existing water demand represents the demand in a dry hydrologic year, when fallowing patterns may be higher than average. It was recognized that if the District had an alternate, reliable source of water, cropping and fallowing patterns would resume historic patterns. Under this scenario, the projected water demand was estimated to be 90,000 AFY.

Figure 2-3: DPWD Water Supplies and Shortfalls



If DPWD is unable to deliver recycled water to its customers, the District will be forced to rely on reduced CVP deliveries supplemented with groundwater and/or water transfers, which are collectively unreliable and unsustainable sources of water for the future. This will result in economic hardships to the District, the Counties, and the agricultural community within DPWD. It is expected that future cropping patterns would be similar to 2009 (10,737 acres of land fallowed) if the District is unable to secure an alternate, reliable water source. Water transfers are not considered to be a long-term, reliable source of water due to uncertainties in the timing and quantities of Delta water that can be pumped in the future.

The cost of water transfers would likely increase as demand for water increases, which would result in economic hardship for the agricultural community in DPWD. Groundwater is also not considered to be an effective long-term solution due to the potential for overdraft conditions and water quality parameters.

2.4 Recycled Water Supply for South of Delta Refuges

A separate study prepared by Reclamation (Refuge Recycled Water Study, June, 2013) evaluated the feasibility of providing recycled water from the NVRRWP to the Sacramento-San Joaquin Delta (South of the Delta) refuges. The NVRRWP represents a potentially significant new water source which could help meet both agricultural irrigation demands in the Del Puerto Water District (DPWD) and Incremental Level 4 (IL4) water demands in the wildlife refuges south of the Delta. On an annual basis, the optimum IL4 water demand is 105,514 AFY. The total 2012-2013 IL4 water delivery to the San Joaquin Valley refuges was 36,600 AF, leaving an IL4 shortfall of approximately 70,000 AF. This shortfall is typical of the IL4 delivery to south of Delta refuges.

Chapter 3 Water Reclamation and Reuse Opportunities

This section discusses reclamation and reuse opportunities for the disinfected tertiary-treated recycled water produced at the Turlock and Modesto treatment facilities.

3.1 Potential Water Uses

In 2005, Modesto prepared the Northern San Joaquin Valley Water Reclamation Project, Feasibility Study Report (RMC, 2005) which identified potential uses for recycled water in Modesto as well as the surrounding area, including Stanislaus County and the City of Patterson Urban recycled water use from the Jennings Road WQCF was determined to be cost prohibitive, and satellite treatment located at Modesto's Primary Treatment Plant was determined to be more cost effective because the facility is located close to the center of Modesto, near urban demands. The study further determined that recycled water use for agricultural irrigation within Modesto's service area would be challenging because MID currently provides a low-cost, highly reliable agricultural water supply. The 2005 study also recommended investigation of conveyance and distribution of recycled water to surrounding irrigation districts west of the San Joaquin River, via the DMC. Recycled water distribution to irrigation districts west of the San Joaquin River was identified as the most cost effective project because the magnitude of deliveries was greater than their urban demands, which translated into lower recycled water unit costs (unit recycled water cost of $700/AF for agricultural irrigation versus $1,500 to $5,000/AF for urban use).

Turlock currently distributes up to 2 mgd of recycled water to the Walnut Energy Center. Purple pipe (recycled water pipe) is installed to serve future irrigation demands that are near the Turlock WQCF (City of Turlock Urban Water Management Plan, 2005). Land immediately adjacent to the Turlock WQCF is primarily agricultural land, and farmers in the area have had little incentive to use recycled water due to the availability of low cost surface water. Turlock's 2005 Urban Water Management Plan indicated that the most cost effective recycled water projects within the city limits would be to supply recycled water to future developments due to the cost of constructing a distribution system in a developed area. Section 3.4.2 provides an analysis of recycled water from Turlock that could be available to DPWD, and includes a reservation of recycled water for future city uses. The remainder of the recycled water produced at Turlock would likely be discharged to the San Joaquin River, if it were not distributed to DPWD.

Distribution of Turlock's and Modesto's recycled water to DPWD is consistent with the findings and recommendations of earlier studies. The predominant crop in the District is almonds, with trees located mainly in the southern portion of the District (see Table 3-1). Almonds are a high-value crop that requires a significant capital investment and a constant water source. In general, use of recycled water for agricultural irrigation is much more cost-effective than for urban irrigation, due primarily to the scale of the required deliveries (Northern San Joaquin Valley Water Reclamation Project, RMC 2005). As such, delivering the recycled water to DPWD would be more cost-effective than delivery to urban centers for similar uses.

Beyond DPWD, other entities, including the City of Patterson and Stanislaus County, have expressed interest with using urban recycled water. These discussions are in preliminary stages and the development of feasibility with these entities will continue in subsequent phases of the project.

3.2 Market Assessment

A market assessment was conducted as a part of this feasibility study to assess the level of interest in tertiary recycled water use, as well as to obtain water user input on potential water quality issues, acceptance issues, and other related issues (e.g., acceptability with product processors) that could be associated with tertiary treated recycled water irrigation uses. The market assessment process also

provided an opportunity to discuss existing irrigation practices, water demands, current groundwater use (e.g. availability and quality), and water supply cost sensitivity. This information was carefully considered during the development of the feasibility study. A total of twelve customers were interviewed in individual meetings between June 8 and June 16, 2010. Individual meetings were conducted to provide a setting where open feedback could be obtained. The major findings from the market assessment can be summarized as follows:

- The potential use of tertiary treated recycled water for irrigation was well received and interviewees did not raise issues of negative perception related to tertiary recycled water use, potential water quality impacts to soil or crop production, or awareness of acceptability issues with product processors.
- The potential recycled water cost was an issue with all the interviewees. There was a concern that DPWD would have a difficult time delivering the tertiary recycled water at a cost that would be affordable.
- Most interviewees pump groundwater to supplement DPWD surface water deliveries; however groundwater pumping does not provide adequate flow or volume necessary to meet water demand, especially during peak water demand months in the summertime.
- DPWD groundwater contains elevated concentrations of soluble salts and chlorides in some locales, which may affect the production of agricultural crops sensitive to those constituents, unless groundwater is blended with other source water.

3.3 Recycled Water Demand Analysis

Water demands were estimated for the entire District and used to develop the alternatives described in Chapter 4. Based on the feedback from the initial market assessment, it is assumed that all customers within the District would be amenable to recycled water use if the cost of the water is reasonable and there are no issues with product processors. Therefore delivery of recycled water to the entire District for agricultural irrigation was considered a feasible option.

Water demands within the District were estimated based on the specific water demand (e.g., evapotranspiration requirement) of each crop grown in the District. Appendix B provides a detailed description of the methodology used to estimate the water demands throughout the District. Each year DPWD conducts a survey of what crops were cultivated on each parcel number; this annual data is tracked in a database that is maintained by DPWD. DPWD's database was used to determine the acreages associated with each crop type. The cropping patterns in 2009 were used to estimate the existing water demand for the District. It was recognized that 2009 represented a dry hydrologic year, and that projected cropping and fallowing patterns could resume historic patterns with an alternate, reliable source of water. The projected water demand was developed by performing a comparative parcel analysis using cropping pattern data from 2004, 2007 and 2009; land fallowed in 2009 was spread to the crop type in 2004 and/or 2007, if fallowing was due solely to a lack of water. Table 3 1 provides a summary of the 2009 cropping patterns for the District and the projected cropping pattern for the District.

Table 3-1: Existing and Projected District Wide Cropping Patterns

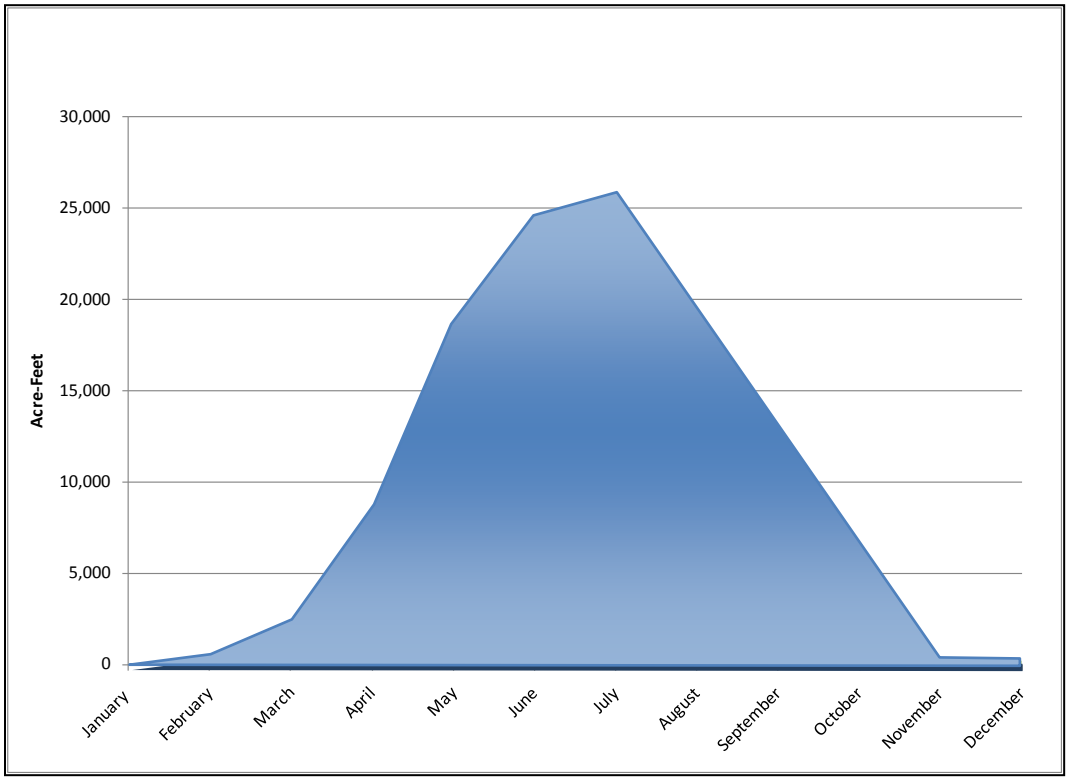
Crop Type	2009 acreage (acres)	Projected [1] (acres)
Alfalfa	1,660	1,920
Almonds	14,184	15,184
Apricots	2,519	2,519
Beans	2,221	2,756
Cantaloupes	398	398
Cherries	518	518
Citrus	340	340
Dry Farm (Barley/Oats)	2,472	2,472
Nursery	66	66
Other Deciduous Fruits & Nuts	1,185	1,185
Tomatoes	3,892	5,011
Vegetables	915	1,197
Vineyards	370	370
Walnuts	1,782	1,782
Subtotal Farmed Acres	32,522	35,718
Acres Fallowed	10,737	7,541
Total Acres	43,259	43,259

Notes:

1. Projected cropping pattern was estimated by comparing cropping patterns, by parcel number, in 2004, 2007 and 2009. Land fallowed in 2009 was spread to the crop type in 2004 and/or 2007, if fallowing was due solely to a lack of water.

Table 3-1 presents the calculated crop acreages for the entire District, using the methodology described in Appendix B and the 2009 cropping patterns. The estimated demands for projected conditions are provided as Figure 3-1.

Figure 3-1: Projected Future District Water Demands



3.4 Recycled Water Sources and Availability

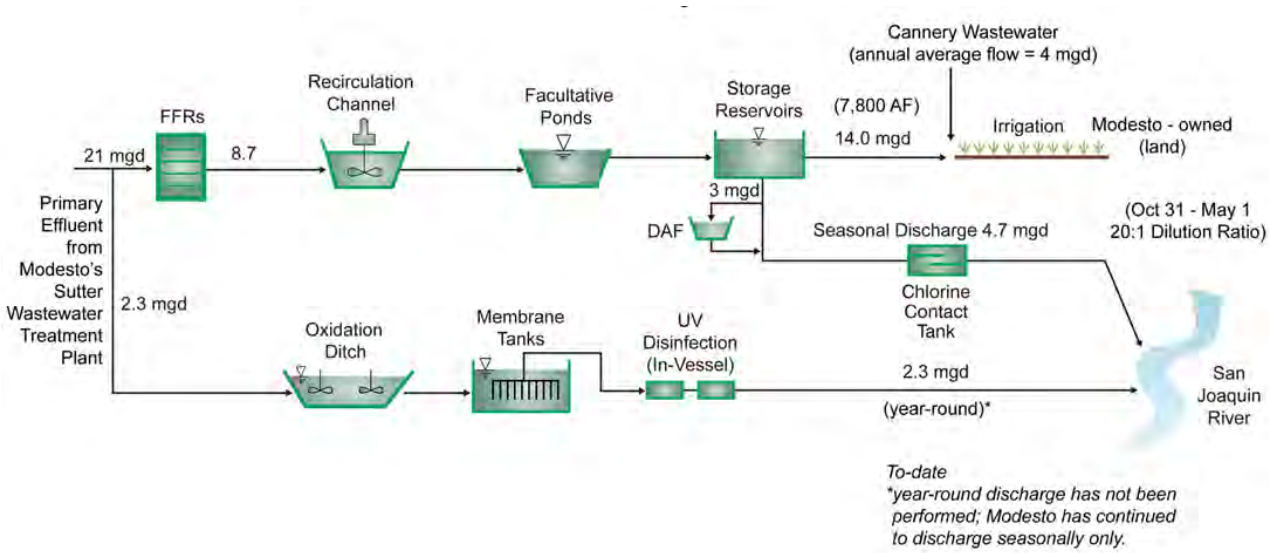
Modesto and Turlock will produce up to 59,000 AFY of recycled water that meets the Title 22 requirements for unrestricted reuse. Both treatment facilities are located in close proximity to DPWD and therefore are both considered as sources of recycled water. Sections 5.4.1 and 5.4.2 provide additional details on Turlock and Modesto's treatment facilities as well as the amount of recycled water that is available for reuse in 2018 and 2045.

3.4.1 City of Modesto

Treatment Facilities

In 2009, Modesto treated over 23 mgd (annual average daily flow) at the Jennings Road Secondary Treatment Facility (Jennings Plant). The secondary treatment facilities at the Jennings Plant consist of facultative ponds that produce secondary effluent that is applied on Modesto-owned ranch land (approximately 2,500 acres), or is discharged to the San Joaquin River between October 1 through May 31, when San Joaquin River flows provide a 20:1 dilution ratio (Figure 3-2). There are two storage ponds at the Jennings Plant that provide approximately 7,800 AF of seasonal secondary effluent storage when effluent cannot be discharged to the river or land-applied.

Figure 3-2: Existing Modesto Wastewater Treatment Facilities

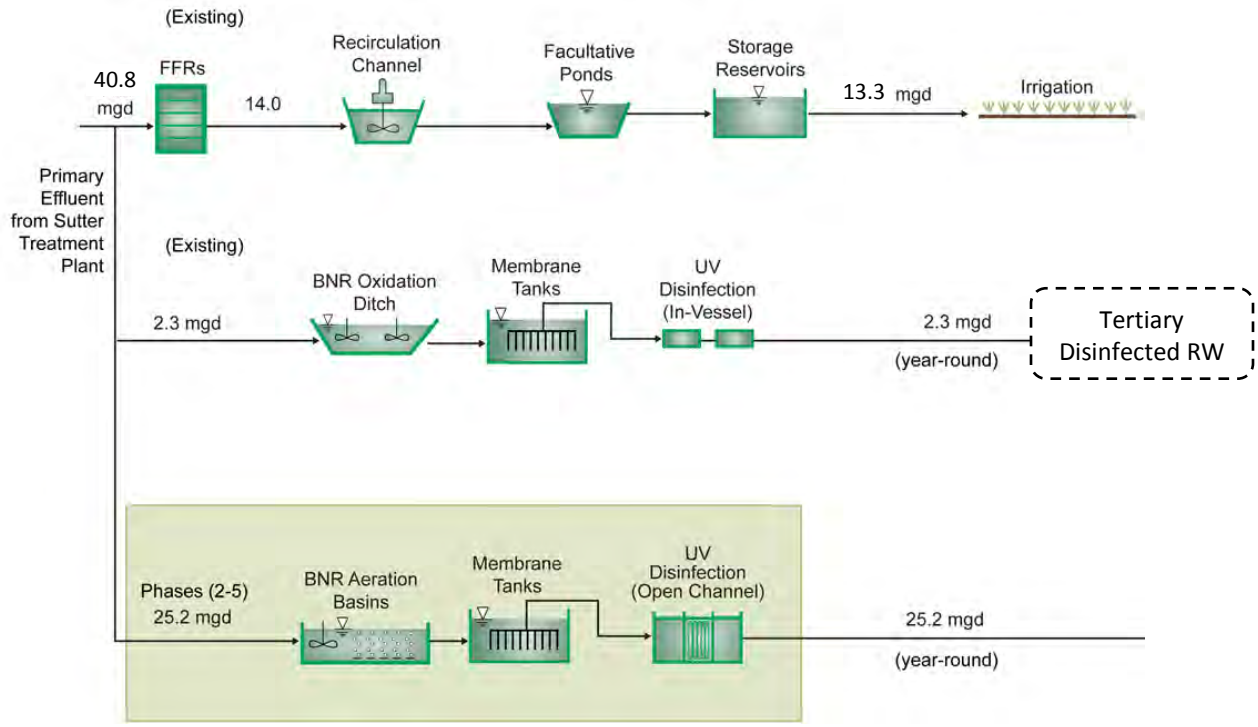


Note: Adapted from 2007 Modesto Wastewater Treatment Master Plan (Carollo, 2007)

In 2007, Modesto prepared a Wastewater Treatment Master Plan (Carollo, 2007) that addressed treatment upgrades that were needed to meet new discharge requirements and to increase Modesto's disposal capacity. The recommended approach to increase the City's disposal capacity was to obtain a permit from the Regional Water Quality Control Board (RWQCB) for year-round discharge to the San Joaquin River. The RWQCB granted a year-round discharge permit to Modesto in 2008. The new permit also increased the level of treatment required for discharge to the river. Based on the new permit requirements, Modesto is required to provide nutrient removal, tertiary filtration, and disinfection for discharge to the San Joaquin River. The recommended treatment processes from the Wastewater Treatment Master Plan include biological nitrogen removal, membrane filtration, and ultraviolet (UV) disinfection.

The master plan identified a phased approach to upgrading Modesto's treatment facilities (Figure 3-3). The phased approach enables Modesto to produce recycled water for reuse or river discharge, and to continue to treat a side-stream of wastewater in the facultative ponds (i.e., secondary effluent) for ranch-land irrigation. In 2010, the first phase of the treatment upgrades was completed (Phase 1A), which provides Modesto with 2.3 mgd of membrane-filtered tertiary effluent. The Phase 2 treatment facilities are scheduled to be online by February 2016, resulting in a total membrane-filtered tertiary effluent volume of 14.9 mgd. In total, the City plans to construct tertiary treatment in five phases reaching a total recycled water production capacity of 27.5 mgd by the year 2040.

Figure 3-3: Future Modesto Wastewater Treatment Facilities[3]



Note: Adapted from 2007 Modesto Wastewater Treatment Master Plan (Carollo, 2007)

Recycled Water Availability

The City of Modesto has estimated its build-out flow to be around 40.8 mgd. The City originally estimated that it would reach buildout flow in 2030; however, based on outside factors, such as the economic downturn, water metering, etc, the City has seen reductions in population and sewer flow, which would impact the project build-out year.

The City of Modesto had a population of 201,165 in 2011 and 202,290 in 2012. Domestic Flow into the City's Treatment Plants decreased between 2006 through 2012 from 27.2 mgd to 20.4 mgd. The decrease in flows may be attributed to water conservation (due to water metering), foreclosures, or reduction of year-round commercial industrial flows.

From that starting point, and using the same growth rates that were presented in the 2008 WWMP Supplement, it is assumed that there would be gradual growth of 0.6% in 2013-14, 1.6% from 2015-16, and 1.75% from then on. Using these assumptions, the City developed a reasonable projection of anticipated sewer connections in Modesto Municipal Sewer District #1, including Empire, North Ceres and County Islands. These assumptions include commercial and minor industrial growth, but exclude large scale industrial (canning) growth.

The 2007 WWMP used a per capita flow in 2005 of 117.3 GPD/capita, based on population and flow into the plant. Currently, flow per capita is estimated at 94.9 GPD/capita. A 5 year average (between 2008 and

[3] Phase 1 = 2.3 mgd
Phase 2 = 14.9 mgd
Phase 3 = 19.1 mgd
Phase 4 = 23.3 mgd
Phase 5 = 27.5 mgd

2012) is 102.4 GPD/capita and 8 year average (between 2005 and 2012) is 109 GPD/capita. Based on these per capita flows, the estimated build-out date for the City of Modesto is between 2043 and 2046.

As previously mentioned, the City estimates expansion of the tertiary treatment facilities to occur in 5 phases, ultimately reaching a capacity of 27.5 mgd. Communication with the City indicates there will probably be some limited onsite uses of tertiary treated water, such as a 0.2 mgd demonstration irrigation project in the future. Reserving capacity for the demonstration irrigation project leaves 27.5 mgd available at buildout for the NVRRWP.

Modesto has two storage ponds that have a total volume of 7,300 AF. In the future, when Phases 1A and 2 are online, Modesto would either reuse the recycled water or discharge it year-round to the San Joaquin River. The side-stream of secondary effluent would still be produced and would be applied to the City's ranch lands during summer months. Because Modesto will continue to produce secondary effluent that can only be land applied seasonally, storage of secondary effluent would still be needed. It was assumed that secondary effluent would be stored during winter months (assumed 105 days per year) when the ranch lands cannot be irrigated. Table 3-2 provides the assumed volume of storage that would be reserved for secondary effluent storage and the volume of storage available for recycled water storage.

Table 3-2: Modesto Recycled Water Storage

Parameter	
Total Storage Volume (AF)[1]	7,300
Volume Reserved for Secondary Effluent Storage (AF)	4,700
Volume Reserved for Recycled Water Storage (AF)	2,600

Notes:
1. Two storage ponds are available at Modesto.
2. Assumes that secondary effluent treated until Phase 3 facilities are online (assumed in 2024) is stored for 105 days per year.
3. Assumes that secondary effluent treated until Phase 4 facilities are online is stored for 105 days per year.

3.4.2 City of Turlock

Treatment Facilities

The City of Turlock's wastewater treatment facility has a design capacity of 20 mgd; currently the plant treats an annual average flow of approximately 10 mgd. Turlock's treatment facilities include secondary treatment, tertiary treatment (cloth media filtration), and chlorine disinfection (Figure 3-4). All recycled water produced at Turlock meets the Title 22 recycled water standards for unrestricted reuse. Currently, the majority of recycled water produced at Turlock is discharged year-round to the San Joaquin River via the Harding Drain. The Harding Drain is an open channel drain owned by Turlock Irrigation District (TID). Because Turlock is permitted to discharge year-round to the San Joaquin River, recycled water storage is not needed. Turlock is currently constructing a pipeline (Harding Drain Bypass Pipeline) that will convey recycled water directly to the San Joaquin River for discharge. The Harding Drain Bypass Pipeline was designed to convey recycled water to the San Joaquin River and also to enable recycled water deliveries to irrigation customers along the pipeline alignment. The Harding Drain Bypass Pipeline represents Turlock's first step towards implementing a recycled water delivery program that would minimize and eventually eliminate recycled water discharges to the San Joaquin River.

Recycled Water Availability

The City of Turlock General Plan Update (West Yost, 2012) estimated the City would reach an influent flow of 27.5 mgd at buildout in the year 2030. City staff has reviewed the projected buildout flows for the Turlock RWQCF and has researched the data provided to City planning staff and their consultants for the General Plan Update. Based on that review, the buildout flows and timing listed in the General Plan

are the best reasonable estimate at this time and are reflective of projected job growth, not just population growth.

The Turlock RWQCF receives flow well in excess of what one would normally see for a City of 70,000 because they have a number of food processors. The General Plan projects job growth commensurate with population growth to prevent overestimating job growth. However, a significant portion of the job growth will occur in water intensive industries. The City has zoned a significant amount of land (1,700 acres) for new industrial development and has seen significant interest from food processors considering a move to Turlock. Therefore wastewater flows will increase significantly over time.

The City of Turlock has several long-term commitments for recycled water use from the facility. The first commitment is for 2 mgd for 42 years for use at TID's Walnut Energy Center. Although the commitment is for up 2 mgd, the actual deliveries in 2012 have averaged 1.0 mgd. For the sake of assessing availability of recycled water, the contractual commitment of 2 mgd will be reserved for delivery to TID. The other current recycled water use in Turlock is for irrigation at Pedretti Park. The average irrigation use for the park is assumed to be 0.1 mgd, which was the average use in 2012. Therefore, in calculating the recycled water that would be available for NVRRWP, it is assumed that 2.1 mgd will be reserved for in-City use, leaving a flow rate of 25.4 mgd available at buildout for NVRRWP.

Figure 3-4: Turlock Wastewater Treatment Facilities

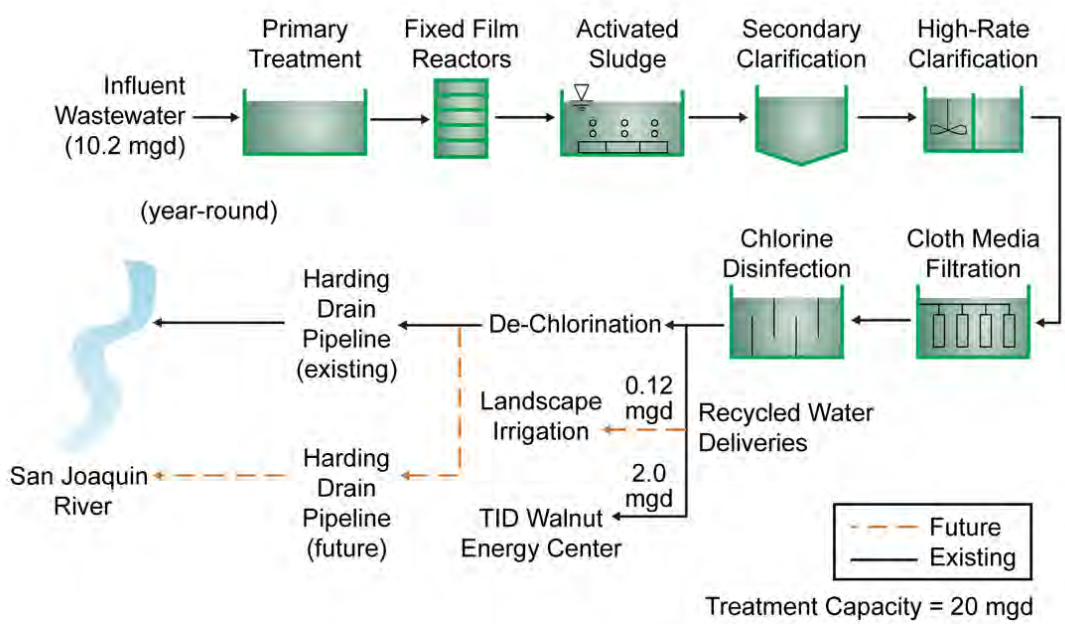


Table 3-3: Turlock Recycled Water Production

Parameter	2018	2045
Influent Wastewater Flow		
MGD	14.7	27.5
AFY	16,500	30,800
Total Recycled Water Produced		
MGD	14.7	27.5
AFY	16,500	30,800
Recycled Water Reserved For Turlock Reuse[1]		
MGD	2.1	2.1
AFY	2,400	2,400
Recycled Water Available to DPWD		
MGD	12.6	25.4
AFY	14,100	28,400

Notes:
1. Assumed volume of recycled water reserved for use within Turlock's service area. Includes Turlock's contracted supply of 2 mgd of recycled water to the Walnut Energy Center

3.4.3 Recycled Water Availability and Demands (Modesto and Turlock)

Based on the Cities' evaluation of the buildout flows, it is estimated that approximately 52.7 mgd (59,000 AFY) of recycled water may be available by the year 2045 for the NVRRWP.

Figure 3-5 and Figure 3-6 summarize the estimated recycled water flows annually from now until buildout. A detailed spreadsheet of the flow estimates is included in Appendix C.

Figure 3-5: NVRRWP Flow Rates at Buildout, mgd

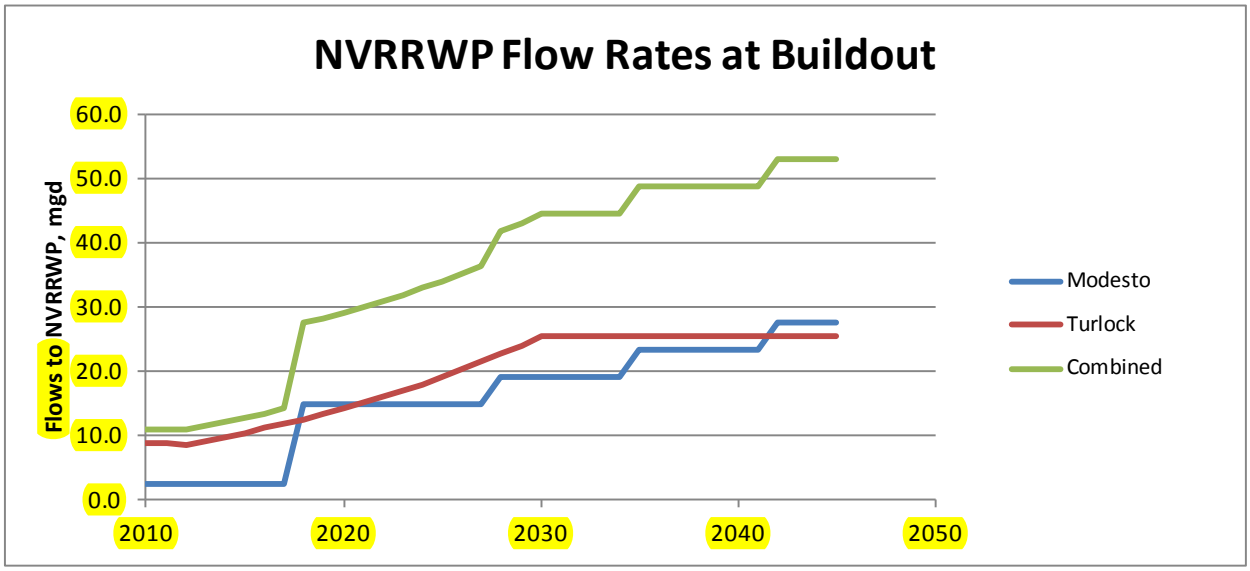
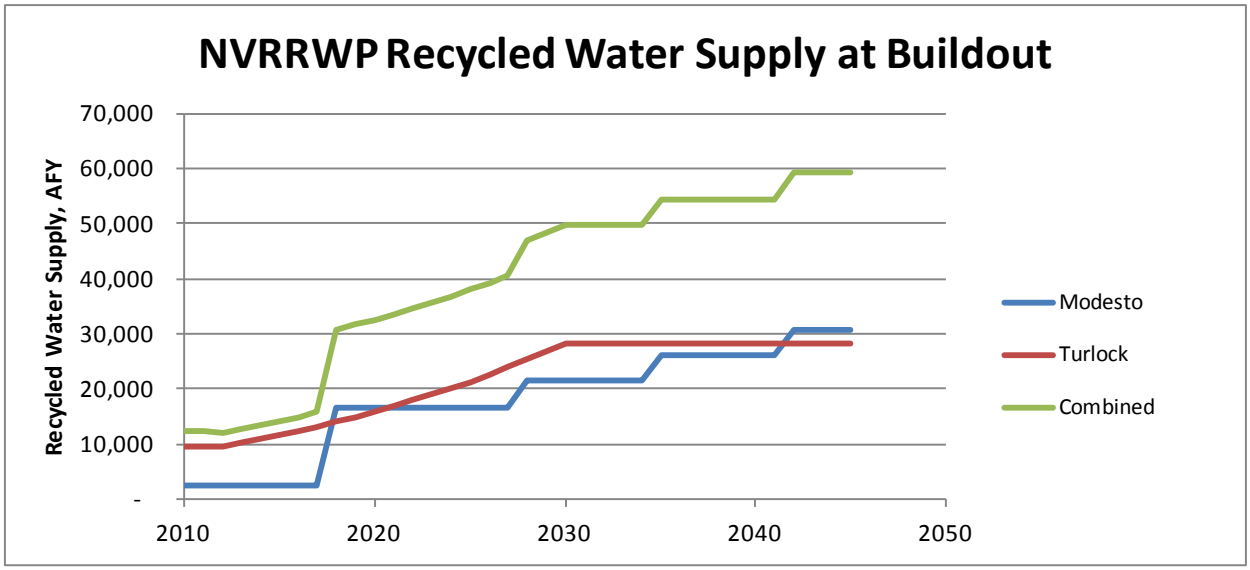


Figure 3-6: NVRRWP Flow Rates at Buildout, AFY



3.5 Water and Wastewater Agencies

DPWD supplies irrigation water to its customers. The Cities of Modesto and Turlock are the local water and wastewater service purveyors in their areas and are the producers of the recycled water that DPWD is proposing to use for supplemental agricultural irrigation supply. As DPWD would not be supplying recycled water for urban or commercial use, it will not directly affect potable water sales or use and therefore, there are no water and/or wastewater agencies that would have jurisdiction over DPWD's service area and/or the delivery of recycled water associated with this project. This feasibility study has been prepared on behalf of DPWD in cooperation with Modesto and Turlock; therefore the recycled water production rates and supply availability have been developed with input from Modesto and Turlock and do not conflict with their future or existing recycled water delivery commitments.

3.6 Renewable Energy and Energy Efficiency

Recycled water delivery to DPWD would not in itself generate electricity. However, the project consists of several components, described below, that would serve to: 1) minimize new energy demands, and 2) offset the energy demands of the project.

- **Minimize Energy Demands:**
  - The recycled water delivery projects described in Chapter 7 would include new pump stations and/or retrofits of existing pump station. In all project alternatives, it was assumed that new, energy efficient pumps would be utilized to minimize the energy demands of the project.
  - If the Cities continue to discharge to the San Joaquin River (i.e. if the NVRRWP is not constructed), they may be required to add energy-intensive reverse osmosis facilities in the future to meet river discharge requirements. For most of the NVRRWP alternatives, reverse osmosis treatment would not be required so the energy needed for future reverse osmosis treatment would be eliminated.
- **Offset Energy Demands:** Modesto's 2008 Wastewater Treatment Master Plan Supplement (Carollo, 2008) considered the construction of solar and wind power generation facilities for the purpose of offsetting the energy demands of the treatment plant upgrades, which consume more

energy than the older treatment facilities. Based on discussions with Modesto, Turlock and DPWD, solar power generation facilities (photovoltaic cells) could be installed to offset the energy requirements of the recycled water delivery project. If implemented, the photovoltaic cells would likely be installed at Modesto's WQCF.

3.7 Drought Protection and Climate Change

3.7.1 Drought Protection

California has a history of droughts that impact the delivery of water to DPWD. As a south of Delta CVP water contractor, the impacts of drought can be exacerbated by the impacts of Delta operations, resulting in potentially significant reductions in water supply reliability for DPWD. DPWD's CVP deliveries were reduced to 40% and 20% of its contract allocation in 2012 and 2013, respectively. Alternatively, recycled water has proven to be a highly drought resistant water supply.

For Modesto, the City's water supply is a combination of groundwater and surface water supply. The surface water supply is provided by the Modesto Irrigation District from its Tuolumne River supply. This combination of supplies provides a true conjunctive use water supply system that provides a high degree of drought tolerance to the City of Modesto.

For the City of Turlock, its present water supply is groundwater. However, the City of Turlock is in the process of evaluating a surface water supply that would augment its existing groundwater supplies. The City of Turlock's water supply provides a high level of drought tolerance, which will only increase if the City is able to implement a surface water supply and move to a conjunctive use water supply.

Recycled water is highly resistant to drought conditions. As urban supplies are reduced, the reduction in domestic water use is primarily focused on external uses, such as lawn and garden irrigation, with minimal reduction in internal uses, particularly as the Cities have invested in domestic water conservation programs. It is the internal water use that provides the wastewater flows that are treated and become the recycled water supply. As such, recycled water is highly drought resistant and provides a high degree of protection against drought conditions, and can be considered as firm water supply.

3.7.2 Response to Climate Change

Climate change is impacting the reliability of water supplies throughout California. Climate change does and will continue to impact the ability of water agencies to provide reliable water supplies through varying climatic conditions. Recycled water provides a reliable water supply that helps to reduce climate change impacts on water supplies.

For DPWD, introduction of recycled water as a source of supply will significantly improve its ability to meet the water supply needs of its landowners. When combined with DPWD's existing CVP supply and individual landowners' groundwater supplies, the mix of supply provides a high degree of reliance and protection against the impacts of climate change on DPWD's water supply portfolio.

3.8 Other Considerations

One of the considerations associated with the recycled water delivery options is the required level of treatment. As previously noted, the two Cities provide or are implementing facilities capable of providing tertiary treatment prior to discharge to the San Joaquin River. The existing and projected level of treatment for the two cities will result in a filtered, disinfected effluent that meets the requirements of Title 22 for unrestricted use.

Based on ongoing discussions with the RWQCB, it appears that conveyance of recycled water in the DMC will not require any levels of advanced treatment beyond the levels presently provided by the two cities, i.e. reverse osmosis for all or a portion of the flow. Table 3-4 provides a summary of the estimated

capital and operating costs for advanced treatment of all recycled water produced at the Modesto and Turlock treatment plants. As shown, reverse osmosis treatment would result in unit water costs that cannot be supported by DPWD customers. Any alternatives requiring advanced treatment would likely be financially infeasible.

Table 3-4: Advanced Treatment Costs for Alternative

Item	Cost
Modesto	
Recycled Water Treatment Size (AFY)	21,200
Capital Cost[2] ($M) (No Grants)	$165.6 – $516.5
Operating Cost ($M)	$8.9 -$9.0
Annualized Capital and Operating Cost – No Grants[3] ($M)	$19.8 - $42.4
Unit Cost – No Grants($/AF)	$934.4 – $2,005.2
Unit Cost – With Grants($/AF)	$808.4 - $1,606.3
Turlock	
Recycled Water Treatment Size (AFY)	9,000
Capital Cost[4] ($M) (No Grants)	$93.9 – $231.5
Operating Cost ($M)	$5.2 - $5.4
Annualized Capital and Operating Cost[3] ($M)	$11.4 - $20.4
Unit Cost – No Grants ($/AF)	$1,270.3 - $2,267.7
Unit Cost – With Grants ($/AF)	$1,112.8 - $1,858.2

Notes:

1. Appendix D provides a detailed cost estimate for advanced treatment costs of recycled water produced the Modesto and Turlock tertiary treatment plants.
2. Capital cost includes RO membranes for 24 mgd, and advanced oxidation for 19 mgd. An RO recovery rate of 80 percent was assumed. The range in capital costs is based on two methods for brine disposal (evaporation ponds or deep well injection). The capital costs are escalated to 2014 using a 4% escalation rate.
3. Capital costs were annualized based on a 5% over 30 years. No grants were assumed.
4. Capital cost includes MF for 10 mgd, RO membranes for 10 mgd, and advanced oxidation for 8 mgd. An RO recovery rate of 80 percent was assumed. The range in capital costs is based on two methods for brine disposal (evaporation ponds or deep well injection). The capital costs are escalated to 2014 using an escalation rate of 4%.
5. Unit costs for RO treatment are based on the capital costs provided in Modesto's Wastewater Treatment Facility Master Plan Supplement (Carollo, 2008), escalated to 2013 dollars

Chapter 4 Water Quality

Tertiary treated recycled water from the NVRRWP must meet the stringent requirements established in Title 22 of the California Code of Regulations, and is suitable for a wide variety of non-potable uses. The recycled water quality is typically better than San Joaquin River water quality. For example, NVRRWP water contains lower concentration of constituents such as boron, selenium, electrical conductivity, mercury, and pesticides than the river.

Recycled water from the NVRRWP, when blended with water from the DMC, will comply with Reclamation's Groundwater Pump-in Program water quality standards for the Upper DMC. No other water quality standards are presently in place for water introduced into the DMC. With one exception, the recycled water quality also complies with the USBR's current water quality standards for acceptance of water into the Upper DMC. Both sets of standards are in place to regulate the practice of pumping well water into the DMC under Warren Act Contracts, and are not necessarily applicable to recycled water. Of the 48 constituents covered by these standards, only the recycled water of the NVRRWP sodium content is expected to exceed Reclamation's standards for acceptance into the DMC.

Salts are the primary water quality constituent of concern for agricultural irrigation water. In agriculture, salinity is typically monitored as a measure of conductivity with a preferred conductance level of 1,000 µS/cm or less for zero impact to almond crop yields (UNFAO#29, Water Quality for Agriculture). DMC water on average has a conductivity of approximately 500 µS/cm according to the DWR Online Water Data Library. Based on information provided by DPWD customers during the market assessment, groundwater underlying DPWD can have conductivity as high as 2,000 to 2,400 µS/cm. As this quality water is unsuitable for almonds (the main District crop), groundwater is typically blended with CVP water to improve quality prior to irrigation. Therefore, the quality and quantity of groundwater available is adequate only as a supplemental source, and cannot be relied upon as a primary source of water.

4.1 NVRRWP Recycled Water

DPWD is an agricultural water purveyor only; it does not provide potable water or wastewater treatment to residential or commercial/industrial customers in its service area. These services are provided by the cities and community services districts that are adjacent to DPWD's jurisdictional boundaries.

The Cities of Modesto and Turlock conduct water quality sampling of their effluent both for process control and to meet the Monitoring and Reporting Program requirements of their respective NPDES permits. The data resulting from this sampling are submitted to the Regional Water Quality Control Board (RWQCB) and are available through the California Integrated Water Quality System (CIWQS), a computer system used by the State and RWQCBs to track information about places of environmental interest, manage permits and other orders, track inspections, and manage violations and enforcement activities.

For Turlock, effluent data from the period April 2010 – February 2013 reported to CIWQS were used as the basis for this study, with the exception of a few constituents with no monitoring requirement under Turlock's current NPDES permit. For barium, nitrite, molybdenum, and sulfate, Turlock provided effluent data from samples collected over the period July 2007 – December 2009. The Turlock water quality data set used for this study is included in Appendix F.

The Modesto tertiary treatment facilities currently treat only a small portion of their effluent, and tertiary effluent has not yet been discharged to the San Joaquin River; this means that the data collected to meet NPDES Permit requirements is representative of Modesto's secondary treated effluent rather than their tertiary effluent. Therefore, for this study, the water quality data set for Modesto relies on samples collected for process control and other internal use. Effluent water quality data included in this study represent samples collected over the period July 2011 - December 2012. The Modesto water quality data set used for this study is included in Appendix G.

Based on preliminary discussions with the Region 5 California RWQCB, river discharge requirements are expected to become more stringent in the future. In particular, dischargers to the San Joaquin River could be faced with salinity limits (based on the Vernalis water quality standards) in the next 10 to 15 years. Limits for endocrine disruptors/constituents of emerging concern are also expected in the future, although the exact timing is uncertain. If salinity limits are imposed on Modesto and Turlock, advanced treatment (such as RO) would likely be required and would result in treatment upgrades at both facilities. In order to meet the Vernalis water quality standards (conductivity of 700 µS/cm), approximately 50 percent of the recycled water would need to be treated with RO for river discharge; the RO permeate could be blended with the remaining 50 percent of recycled water prior to discharge. Removal of these contaminants would require advanced oxidation for the entire recycled water flow.

4.2 Recycled Water Standards

Title 22, Chapter 3 of the California Code of Regulations forms the backbone of recycled water regulations through water quality standards and treatment reliability criteria for water recycling. Title 22 sets bacteriological water quality standards based on types of contact expected between the public and the recycled water, outlining applications for which disinfected tertiary treatment is required and also application for which three levels of secondary treatment would also suffice.

Recycled water treatment criteria vary depending on the application of the recycled water and its contact potential with the public. NVRRWP tertiary recycled water is suitable for all currently allowed uses of recycled water including irrigation of public parks and all food crops, toilet flushing, and some industrial processes.

4.3 Water Quality Standards for Acceptance of Groundwater into Upper Delta-Mendota Canal

The Warren Act of 1911 authorizes Reclamation to execute temporary contracts to impound, store, and carry water in federal irrigation canals when excess capacity is available. Such contracts are negotiated by Reclamation to allow the introduction of “non-project water” into the DMC. This non-project water can include groundwater from wells near the DMC.

To maintain appropriate water quality in the DMC, Reclamation has developed a set of standards for the acceptance of non-project water in the DMC based on the requirements of downstream water users. These standards are summarized in the following tables of the *2012 Delta-Mendota Canal Pump-in Program Water Quality Monitoring Plan* (herein referred to as Pump-in Plan):

- Table 4a, Maximum Allowable Concentration of Seven Constituents in the Upper DMC (between Jones Pumping Plant and Check 13)
- Table 4b, Maximum Allowable Concentration of Three Constituents in the Lower DMC
- Table 5, Water Quality Standards for Acceptance of Groundwater into the Upper Delta-Mendota Canal Jones Pumping Plant to Check 13 (O'Neill Forebay).
- Table 6, Water Quality Standards for Acceptance of Groundwater into the lower Delta-Mendota Canal Check 13 (O'Neill Forebay) To Check 21 (Mendota Pool).

Reclamation has not established similar water quality standards for any other source of water being introduced into the DMC. Because the NVRRWP recycled water would be put into the DMC north (upstream) of the O’Neill Forebay, Table 4a and Table 5 of the Pump-in Plan contain the only potentially relevant water quality criteria for comparison to the water quality of the NVRRWP. Both Table 4a and Table 5 of the Pump-in Plan are reproduced in Appendix E. As noted in the table footnotes, many of the water quality criteria listed in Table 5 are drinking water criteria. This is because several CVP water

contractors, such as Santa Clara Valley Water District and San Benito County Water District, use water from the San Luis Reservoir or the O'Neill Forebay for potable water supplies.

Reclamation will allow groundwater to be pumped into the DMC only if such water does not cause the concentration of important constituents in the canal to exceed the thresholds listed in Table 4a, and if the groundwater concentrations do not exceed the thresholds listed in Table 5. With the exception of specific conductance and total dissolved solids, the values in Table 4a are identical to those in Table 5.

4.4 Water Quality Data

The sources for water quality data used in this study are discussed below.

4.4.1 Modesto and Turlock Recycled Water Quality Data and Reporting

The Cities of Modesto and Turlock conduct water quality sampling of their effluent both for process control and to meet the Monitoring and Reporting Program requirements of their respective NPDES permits. The data resulting from this sampling are submitted to the RWQCB and are available through the California Integrated Water Quality System (CIWQS), a computer system used by the State and RWQCBs to track information about places of environmental interest, manage permits and other orders, track inspections, and manage violations and enforcement activities.

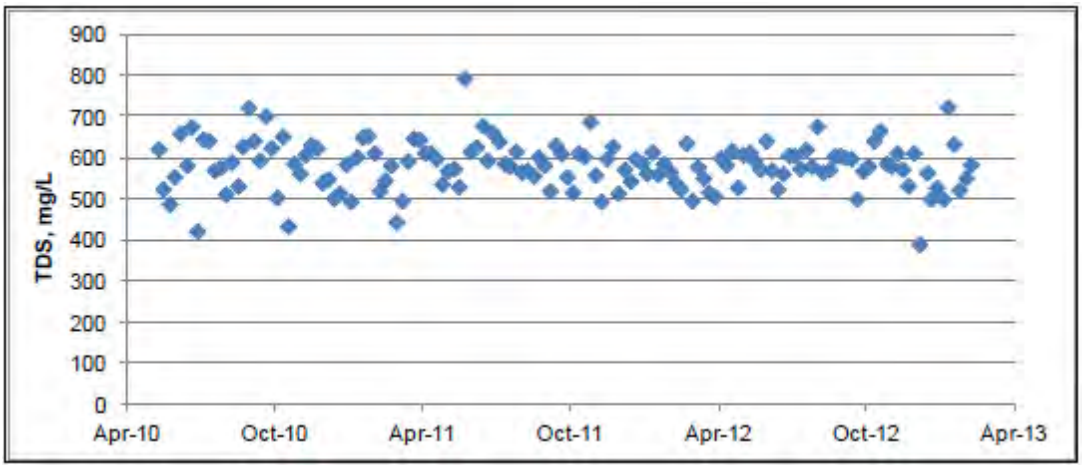
For Turlock, effluent data from the period April 2010 – February 2013 reported to CIWQS were used as the basis for this study, with the exception of a few constituents with no monitoring requirement under Turlock's current NPDES permit. For barium, nitrite, molybdenum, and sulfate, Turlock provided effluent data from samples collected over the period July 2007 – December 2009.

The Modesto tertiary treatment facilities currently treat only a small portion of their effluent, and tertiary effluent has not yet been discharged to the San Joaquin River; this means that the data collected to meet NPDES Permit requirements is representative of Modesto's secondary treated effluent rather than their tertiary effluent. Therefore, for this study, the water quality data set for Modesto relies on samples collected for process control and other internal use. Effluent water quality data included in this study represent samples collected over the period July 2011 - December 2012. The Turlock and Modesto water quality data sets used for this study is included in Appendix G.

For several organic constituents with no NPDES monitoring requirements (e.g., atrazine, bentazon, and others), no sample results are available from either Modesto or Turlock.

For some inorganic constituents, few sample results are available from Modesto or Turlock. However, wastewater effluent, particularly tertiary treated wastewater effluent, is generally very stable in its water quality profile and tends not to have significant seasonal variations or spikes in constituent concentrations. This trend is illustrated by the concentration of total dissolved solids in Turlock effluent shown below in Figure 4-1; unlike the DMC and San Joaquin River, there is no strong seasonal variability.

Figure 4-1: Total Dissolved Solids Concentration in Turlock Effluent, 2010-2013



Modesto and Turlock are both certified by the Environmental Laboratory Accreditation Program (ELAP) of the California Department of Public Health and maintain a high standard for laboratory procedures. The City of Modesto's Jennings Laboratory uses a Quality Assurance Manual which contains a Quality Assurance/Quality Control (QA/QC) plan, sample collection procedures and Standard Operating Procedures (SOPs) for all analytical methods. Likewise, the City of Turlock follows a Water Quality Control Laboratory Quality Assurance Manual, last updated in September 2012. Both labs use Standard Methods for the Examination of Water and Wastewater for test protocols.

The City of Modesto's Jennings Laboratory holds ELAP certificate #2674 with expiration in September 2013, and are in the process of renewing. The City of Turlock's ELAP certificate #2150 expires in September 2014. Both laboratories are certified to perform laboratory tests on microbiology and inorganic chemistry of wastewater; analyses for all other constituents, such as metals, volatile organics, semi-volatile organics, pesticides and chronic toxicity, are sent out to other certified facilities.

4.4.2 DMC Water Quality Data Collection and Reporting

DMC water quality data were obtained from the California Data Exchange Center (CDEC[28]) and the USBR Mid-Pacific Region's Environmental Monitoring Database. Water quality data for the DMC are from CDEC at the Tracy Pumping Plant (Station ID: TRP) and DMC Headworks (Station ID: DMC), covering the period 2003-2013. Data from the USBR Environmental Monitoring Database are from samples collected between 1991 and 2013 at three stations representing the Upper DMC: Milepost 9.87, the DMC at McCabe near Milepost 68, and the O'Neill Forebay Inlet Bridge.

Under the authority of California Water Code Sections 228 and 236, CDEC installs, maintains, and operates an extensive hydrologic data collection network, including automatic snow reporting gages for the California Cooperative Snow Surveys Program and precipitation and river stage sensors for the flood forecasting program. In addition, CDEC provides a centralized location to store and process real-time hydrologic information gathered by various cooperators throughout the State; and then disseminates this information to support forecasting and flood operations activities and to meet the data reporting needs of various cooperators, public and private agencies, the news media, and the public.

The USBR Mid-Pacific Region's Environmental Monitoring Database includes water quality monitoring data reported by the USBR Environmental Monitoring Branch, which was established in 1985 to design and implement environmental monitoring programs.

4.4.3 San Joaquin River Water Quality Data and Reporting

For most constituents, water quality data for the San Joaquin River was compiled from the California Environmental Data Exchange Network (CEDEN) stations "SJR @ Patterson" for the period covering

1995-2011, and from station "San Joaquin River @ PID Pumps" for the period covering 2008-2012. This data set is representative of the water quality in the PID canals as PID draws its water from the San Joaquin River near these locations. PID does not regularly monitor the water quality in their Main Canal.

CEDEN is a central location to find and share information about California's water bodies, including streams, lakes, rivers, and the coastal ocean. Many groups in California monitor water quality, aquatic habitat, and wildlife health to ensure good stewardship of our ecological resources. CEDEN aggregates this data and makes it accessible to environmental managers and the public.

For five constituents (antimony, beryllium, mercury, thallium, and silver) with no data available from CEDEN, water quality data are from CIWQS as reported by the City of Turlock at Receiving Water Station 003, which is located along the San Joaquin River 1,000 feet upstream of Harding Drain. These data cover the period April 2012 – March 2013, and consist entirely of non-detects.

Water quality and flow data for the San Joaquin River are also available from CDEC. The closest CDEC monitoring station to the area of interest is located near Vernalis, south of Tracy and nearly due west of Modesto. This data was not used in the analysis presented in this chapter because the CEDEN monitoring stations are closer to the intake of the PID canals.

4.4.4 Additional Sampling

As part of a separate USBR contract through RMC titled *Refuge Recycled Water Supply Study* (Task Order R13PD20071), a water quality sampling program was implemented in conjunction with the NVRRWP to assess the feasibility of providing program recycled water to Wildlife Areas and National Wildlife Refuges. These Wildlife Areas also receive DMC water and are a potential NVRRWP partner. On May 2, 2012 and May 9, 2013, samples were collected at four locations relevant to this Study: the Delta Mendota Canal (DMC) at the proposed point of addition of North Valley Regional Recycled Water Program (NVRRWP) water, the Patterson Irrigation District (PID) Main Canal, and Turlock tertiary effluent, and the Newman Canal at the water delivery point to the China Island Unit of the North Grasslands Wildlife Area. On May 9, 2013 a sample was also collected of Modesto secondary effluent (the Modesto tertiary facilities were offline during the duration of this sampling program). These samples were analyzed for "conventional constituents" (total dissolved solids, electrical conductivity, sodium, selenium, nitrate, nitrite, boron, mercury, and chloride) and Contaminants of Emerging Concern (CECs) Compete analysis of this complimentary water quality analysis is provided in Appendix I.

4.5 Comparison of Existing Water Quality Data to Relevant Water Quality Standards

The existing water quality data was compared to the water quality standards found in Tables 4a and 5 of the Pump-in Plan. Individual water quality parameters and chemical constituents are discussed and provided in Appendix I.

4.5.1 Summary of Findings

Recycled water from the NVRRWP, when blended with water from the DMC, will comply with the Reclamation's water quality standards for the Upper DMC. Those standards have been established by Reclamation for the Groundwater Pump-in Program. No other water quality standards are presently in place for water introduced into the DMC. With one exception, the recycled water quality also complies with the USBR's current water quality standards for acceptance of water into the Upper DMC as defined in Reclamation's Groundwater Pump-In Program. Both sets of standards are in place to regulate the practice of pumping well water into the DMC under Warren Act Contracts, and are not necessarily applicable to recycled water. Of the 48 constituents covered by these standards, only the recycled water sodium content is expected to exceed Reclamation's standards for acceptance into the DMC.

Selenium, a constituent of concern for recycled water use at wildlife refuges, is present in NVRRWP recycled water at a concentration comparable to the existing DMC water quality (0.8 µg/L). The same is true for boron and arsenic. Recycled water would be delivered to the refuges after mixing with the existing water in the DMC. Based on the results presented in this chapter, the recycled water generated from the NVRRWP is not expected to produce a significant change in water quality to downstream DMC users.

Table 4-1: NVRRWP Water Quality Comparison to Table 4a

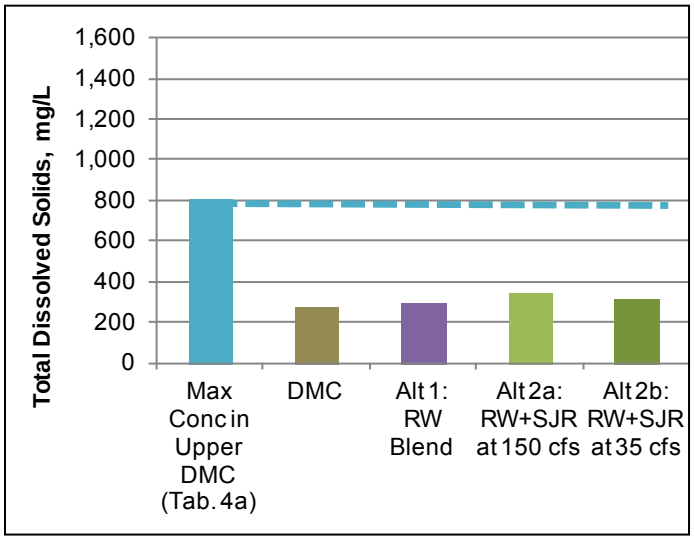
Constituent	Maximum Concentration in DMC	Modesto Concentration	Turlock Concentration	Combined Concentration[4]
Arsenic	0.01 mg/L	0.001	0.006	0.0006
Boron	0.7 mg/L	0.197	0.197	0.20
Nitrates as N	45 mg/L	6	16.8	8.4
Selenium	0.002 mg/L	0.0011	0.00026	0.001
Specific Conductance (EC)	1,200 µS/cm	973	915	946
Sulfates	250 mg/L	63	58	61
Total Dissolved Solids	800 mg/L	522	582	550

For the constituents listed in Tables 4a and 5 of the Pump-in Plan and for which data were available, sodium is expected to be present in any mixture of recycled water, San Joaquin River water, and DMC water at levels that are expected to exceed water quality standards. Nitrate and/or nitrate + nitrite would exceed standards for alternatives that mix NVRRWP water with San Joaquin River water and blend with the PID Main Canal water for DMC conveyance.

Of particular interest is Total Dissolved Solids (TDS) in the DMC. Presented in Figure 4-2 is the TDS values for a range of the alternatives evaluated in this feasibility study.

[4] Projected flows for Modesto and Turlock total 27.3 MGD in 2018 (14.9 MGD Modesto, 12.6 MGD Turlock)

Figure 4-2: Comparison Chart for Total Dissolved Solids



For the CEC analyses conducted in May 2013, 34 analytes were detected in the Turlock tertiary effluent and/or Modesto secondary effluent samples with most analytes being detected in the samples from both locations. In the samples from the China Island delivery point, the DMC, and the PID canal, nine analytes were detected using the analysis for CECs and included both herbicides/pesticides and constituents that are likely originate from wastewater effluent (such as caffeine and the artificial sweetener sucralose). The detection of these analytes is to be expected as wastewater treatment plants discharge to the source waters for the DMC and the PID Main Canal.

Chapter 5 Surface Water Modeling

5.1 Summary of Findings

Analysis of observed and modeled flows at two locations in the San Joaquin River indicate there are no significant impacts to San Joaquin River flows from removing wastewater discharges from the Cities of Modesto and Turlock. From a high-level analysis of electrical conductivity in the San Joaquin River, there is a small but positive impact on river water quality from removing wastewater discharges.

The complete technical memorandum, *NVRRWP San Joaquin River Flow Analysis*, is located in Appendix K.

5.2 Introduction and Background

The goal of this analysis was to determine if the impacts of ceasing City of Modesto and City of Turlock discharges to the San Joaquin River (SJR) are significant from an environmental point of view. The primary objective was to determine the impacts of flow changes. A secondary objective was to determine, if possible, the impacts to salinity in the San Joaquin River. The results of this analysis were also used as input for the aquatic species impact assessment for the San Joaquin River.

The San Joaquin River has a variety of inflows, outflows, and measuring points along its path to the California Delta. Figure 5-1 shows a schematic of the major components from Friant Dam to the Vernalis gauging station at river mile 0.

The Vernalis gauging station is an important monitoring point for the SJR. The Long-Term Central Valley Project Operational Criteria and Plan (OCAP) was developed in 2004 by the US Bureau of Reclamation (USBR) and summarized flow objectives at the Vernalis gage to both maintain minimum flows in the SJR and to maintain a specific salinity balance in the Delta. The flow objectives, shown in Table 5-1, include a higher and lower flow objective; the higher objective is used for more strict Delta salinity requirements.

Table 5-1: OCAP Requirements at Vernalis Gage (cfs)

Year Type	All Years	Wet Year		Above Normal Year		Below Normal Year		Dry Year		Critical Year	
Flow Standards for Feb – Apr 14 and May 16- Jun	N/A	Low 2,130	High 3,420	Low 2,130	High 3,420	Low 1,420	High 2,280	Low 1,420	High 2,280	Low 710	High 1,140

An analysis of the flow values at Vernalis was conducted based on the 2009 Delivery Reliability Report prepared by DWR. Figure 5-2 presents the exceedence values for flows at Vernalis based on an analysis of existing conditions (2009) and future conditions (2020) as presented in the 2009 Delivery Reliability Report. The analysis evaluated the impacts of removing the wastewater discharges from the San Joaquin River.

Figure 5-1: Schematic of San Joaquin River Inflows and Monitoring Points

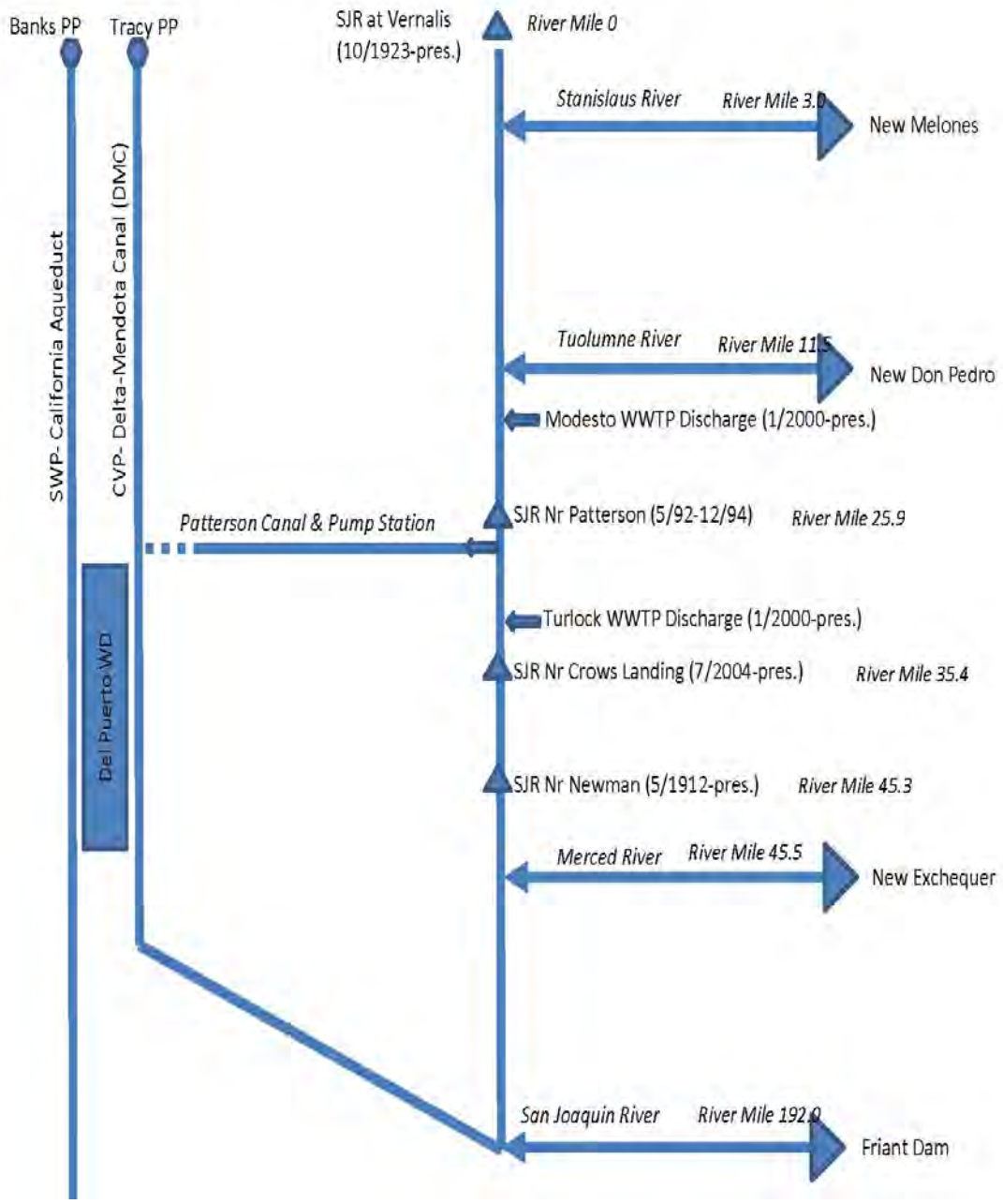
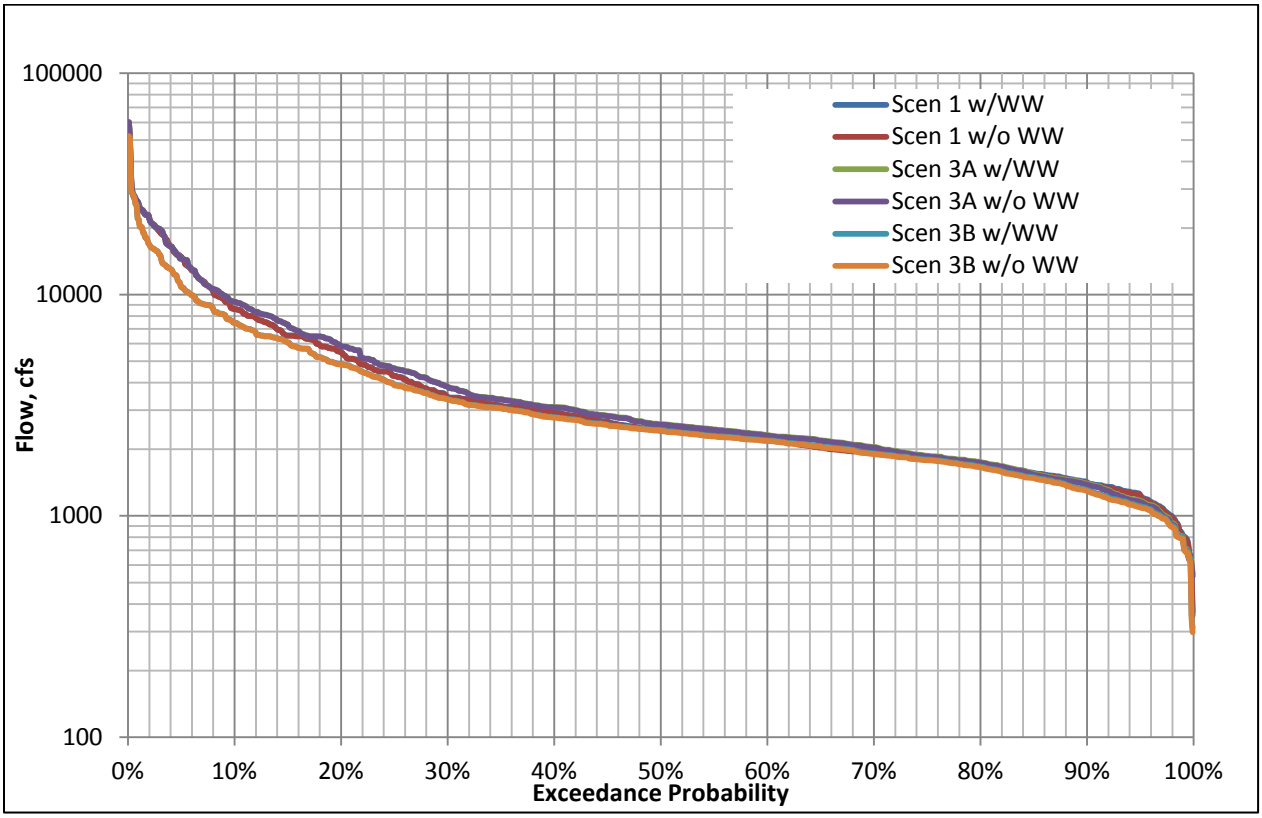


Figure 5-2: Impacts of Cessation of Wastewater Discharge to San Joaquin River at Vernalis



5.3 Conclusions

1- Observed data analysis:

- The Patterson Irrigation District ISMND study found that the 90% exceedance flow (160 cfs, 32.57 ft, mean sea level stage) is an acceptable flow criterion; the updated flow records find the 90% exceedance flow is approx 180 cfs (33.19 ft, mean sea level stage); discharge flows are approximately less than 8% of the 90% flow.
- Cessation of discharge flows does not have a significant impact on the SJR flows, based on the Newman and Vernalis gage records.

2- Modeled data analysis:

- The WWTP discharge flows are less than 1% of the 90% exceedance flows at Vernalis and thus not significant for any impacts.

3- Water quality analysis:

- Removing wastewater flows has a positive impact on water quality in the SJR since less dilution water would be needed to meet salinity goals at the Vernalis gage.

Chapter 6 Environmental Considerations

CEQA and NEPA studies have not yet been performed for this project, and will be performed as part of the next phase of project development. As described in Chapter 1, the purpose of this feasibility study is to identify and evaluate feasible conveyance alternatives that could be further developed for CEQA and NEPA evaluations.

The current phase of work did, however, conduct a study on the impacts of removing the Cities' effluent from the San Joaquin River. The following sections provide detail on the aquatic biota assessment.

6.1 Aquatic Biota Assessment

Hanson Environmental consulted with staff of the California Department of Fish and Wildlife (CDFW) and prepared an Aquatic Biology Assessment titled *Assessment of Potential Effects of the North Valley Regional Recycled Water Program (NVRRWP) Reductions in Freshwater Discharges into the San Joaquin River on Fishery Habitat and Juvenile Salmon Survival,* August 2013. This section provides a summary of results. The full memo is located in Appendix L.

6.1.1 Background

The San Joaquin River provides habitat for a diverse assemblage of fish and aquatic macroinvertebrates. The river also serves as a migration corridor and juvenile rearing habitat for Chinook salmon. Results of previous studies have shown positive relationships between the flow in the San Joaquin River during the spring (e.g., March-May) and the survival of juvenile salmon as well as adult salmon escapement 2.5 years later. Currently the Modesto and Turlock waste water treatment plants (WWTPs) discharge treated waste water into the San Joaquin River where it augments existing flows and therefore provides potential biological benefits to improved habitat conditions for salmon and other fishery resources. As shown in Table 6-1 the Modesto and Turlock WWTPs release an average of 25 cfs into the San Joaquin River with a range of average monthly flows of 12.9 – 51.4 cfs. The NVRRWP is proposing that rather than discharging the treated and processed wastewater into the San Joaquin River as is currently being done, the Modesto and Turlock treatment plants would recycle the wastewater for other inland uses such as irrigation of farmland. The curtailment in WWTP discharges from these two plants into the river would result in an incremental reduction in river flows as shown in Table 6-1. For comparison, the average flow in the San Joaquin River during the spring months (March –May) of dry water years typically ranges from approximately 1,500 to 2,000 cfs while average flows in a normal water year typically range from approximately 3,000 to 4,000 cfs. Spring flows in a wet year typically range from approximately 8,000 to 14,000 cfs. The actual flow in the San Joaquin River varies substantially within and among years.

Table 6-1: Ave. Monthly WQCF Discharges to San Joaquin River from 2000 to 2012 (mgd)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Modesto	31.4	38.2	35.2	10.1	7.0	0.0	0.0	0.0	0.0	0.1	5.1	17.7
Turlock	13.1	13.2	12.9	13.0	12.7	12.9	12.9	13.4	13.3	13.8	13.3	13.4
Total	**44.5**	**51.4**	**48.1**	**23.1**	**19.7**	**12.9**	**12.9**	**13.4**	**13.3**	**13.9**	**18.4**	**31.1**

Although the amount of spring discharges is relatively small compared to total river flows (e.g., for example the April average WWTP discharge is 23.2 cfs and the San Joaquin River mean April flow at Vernalis is 3,095 cfs), the removal of these discharges into the San Joaquin River would contribute to an incremental reduction in the water levels and flows in the river downstream of the discharge location. This reduction in river flow could potentially adversely affect habitat conditions in the river for fish and the survival of juvenile salmon during their spring migration from the river to coastal marine waters. The objective of this analysis is to evaluate the potential for adverse effects of a reduction in freshwater

discharges to the San Joaquin River as a result of the proposed NVRRWP water recycling project on instream flows, fishery habitat and juvenile Chinook salmon survival and abundance.

6.1.2 Discussion

To assess the potential effects of changes in river flow four independent analyses were considered including (1) the predicted change in juvenile salmon survival as a function of river flow, (2) the predicted change in adult salmon escapement as a function of river flow during the spring outmigration period 2.5 years earlier, (3) changes in river habitat based on stage-discharge relationships developed for the river by the U.S. Geological Survey (USGS) and the location of the estuarine low salinity zone during biologically sensitive spring months, and (4) predicted changes in salmon abundance based on use of the California Department of Fish and Wildlife (CDFW) San Joaquin River fall-run salmon lifecycle simulation model (SalSim). By comparing historic flows to those flows without the addition of WWTP discharges the study simulates the potential effect that the removal of WWTP discharges would have on salmon from a variety of metrics. Results are summarized below:

Predicted changes to San Joaquin River flow when the WWTP discharge is removed (Adjusted flow) are on average less than 1% (ranges from 0.16 – 2.46%) of the total San Joaquin River flow (base flow) between March and May.

Using the SalSim model, the decreases in predicted juvenile Chinook salmon survival with and without the WWTP discharges ranged from 0.000 to 0.005 for conditions with the Head of Old River Barrier (HORB) in place and were all 0.000 without the HORB.

Total predicted reduction in adult Chinook salmon escapement in the March-May juvenile migration period is 145 fish out of predicted escapement estimates ranging from approximately 14,000 to 31,000 adults (less than 1%). The predicted small change in escapement appears well within the observed variability in the escapement/flow relationship and would not be detectable in the river.

The reduction in river stage height (a reflection of water depth in the river) associated with curtailment of the WWTP discharges was estimated to range from 0.02 to 0.08 feet. The predicted change in X2 location, a reflection of the low salinity zone habitat for estuarine fish and other organisms, moved upstream on average 0.06 km in March, an average of 0.03 km in April, and an average of 0.02 km in May. The magnitude of these changes would not be detectable in the field given the natural variation in X2 location based on variation in tidal conditions.

The SalSim model simulating hypothetical flow conditions and response of the Chinook salmon population showed a small reduction in metrics of salmon abundance. However, dry year results of the SalSim model appear to be the result of model simulation errors. These apparent errors were discussed with CDFW staff, and it was determined that the SalSim model was not developed to address changes in San Joaquin River flows as small as those that would occur under the proposed project operations, and therefore, the model could not be used to reliably predict changes in San Joaquin River fall-run Chinook salmon abundance or population dynamics as an assessment tool for the proposed project evaluation. Based on these initial model results and consultation with CDFW the SalSim model was not used in these analyses.

6.1.3 Conclusions

The report evaluated effects of reductions in flows associated with discontinuing wastewater discharges from the Modesto and Turlock Wastewater Treatment Plants (WWTP). The analysis considered average monthly discharges from each WWTP to the San Joaquin River, and compared base flow (with discharge) to adjusted flow (without discharge). Chinook salmon were used as the indicator species.

The two primary conclusions from this assessment are:

- Curtailment of treated waste water discharges from the Modesto and Turlock WWTPs into the San Joaquin River will result in a small incremental reduction in river flow from the point of the existing discharge downstream. The reduction in San Joaquin River flow would contribute, based on the best scientific information available, to an incremental reduction in juvenile Chinook salmon survival during spring outmigration, a reduction in adult salmon escapement (0.00 to 0.05) to the San Joaquin River tributaries, and an incremental reduction in habitat quality and availability in the lower river and estuary.
- The magnitude of predicted changes in juvenile salmon survival, adult escapement, and habitat conditions in the lower river and estuary is small (typically less than 1% when compared to current baseline conditions) and is well within the natural observed variation in the regression relationships used in these analyses. The magnitude of predicted changes in juvenile salmon survival and adult escapement, habitat quality in the lower San Joaquin River, and the location of the estuarine low salinity zone (X2 location) would not be detectable in field studies and is considered to be less than significant.

Chapter 7 Description of Alternatives

7.1 Overview

Five project alternatives were developed for the conveyance of recycled water from the Modesto and Turlock tertiary treatment facilities to DPWD customers. The primary objectives of the alternatives were to maximize delivery of recycled water to DPWD customers while minimizing project costs, and to identify a project that is technically feasible and implementable.

The five alternatives evaluated include:

- **Alternative 1**: Pipeline Conveyance of Recycled Water Directly to the DMC,
- **Alternative 2**: Pipeline Conveyance of Recycled Water Directly to DPWD Lands,
- **Alternative 3**: San Joaquin River Conveyance of Recycled Water to Existing Diversion Facilities for Conveyance to the DMC,
- **Alternative 4**: Pipeline Conveyance of Recycled Water to Patterson ID Existing Facilities for Dilution and Conveyance to the DMC,
- **Alternative 5**: Pipeline Conveyance of Recycled Water to the DMC Utilizing Groundwater Storage and Operational Modifications.

This feasibility study focuses on recycled water delivery mechanisms, and does not include the costs of expanding the tertiary facilities at Modesto or Turlock as influent flows increase since those treatment plant expansions would be required with or without the NVRRWP project.

7.2 Alternative 1: Pipeline Conveyance of Recycled Water Directly to DMC

Alternative 1 consists of several sub alternatives for conveying recycled water in a pipeline from Modesto and Turlock tertiary treatment facilities directly to the DMC (Figure 7-1). A detailed description of these alternatives is included in the Pipeline Corridor Study in Appendix M.

- **DMC-1A**: Separate Pipeline Alignments Using PID Right-of-Way Country Roads; Directly Discharge into DMC
- **DMC-1B**: Separate Pipeline Alignments with Most Direct Routes; Directly Discharge into DMC
- **DMC-2**: Pipeline Alignments Combined East at Las Palmas; Directly Discharge into DMC
- **DMC-3**: Pipeline Alignments Combined West at Pomelo Avenue; Directly Discharge into DMC
- **DMC-4**: Pipeline Alignments Combined East at Harding Drain; Directly Discharge into DMC

Figure 7-1: Alternative 1 Pipeline Conveyance Alternatives

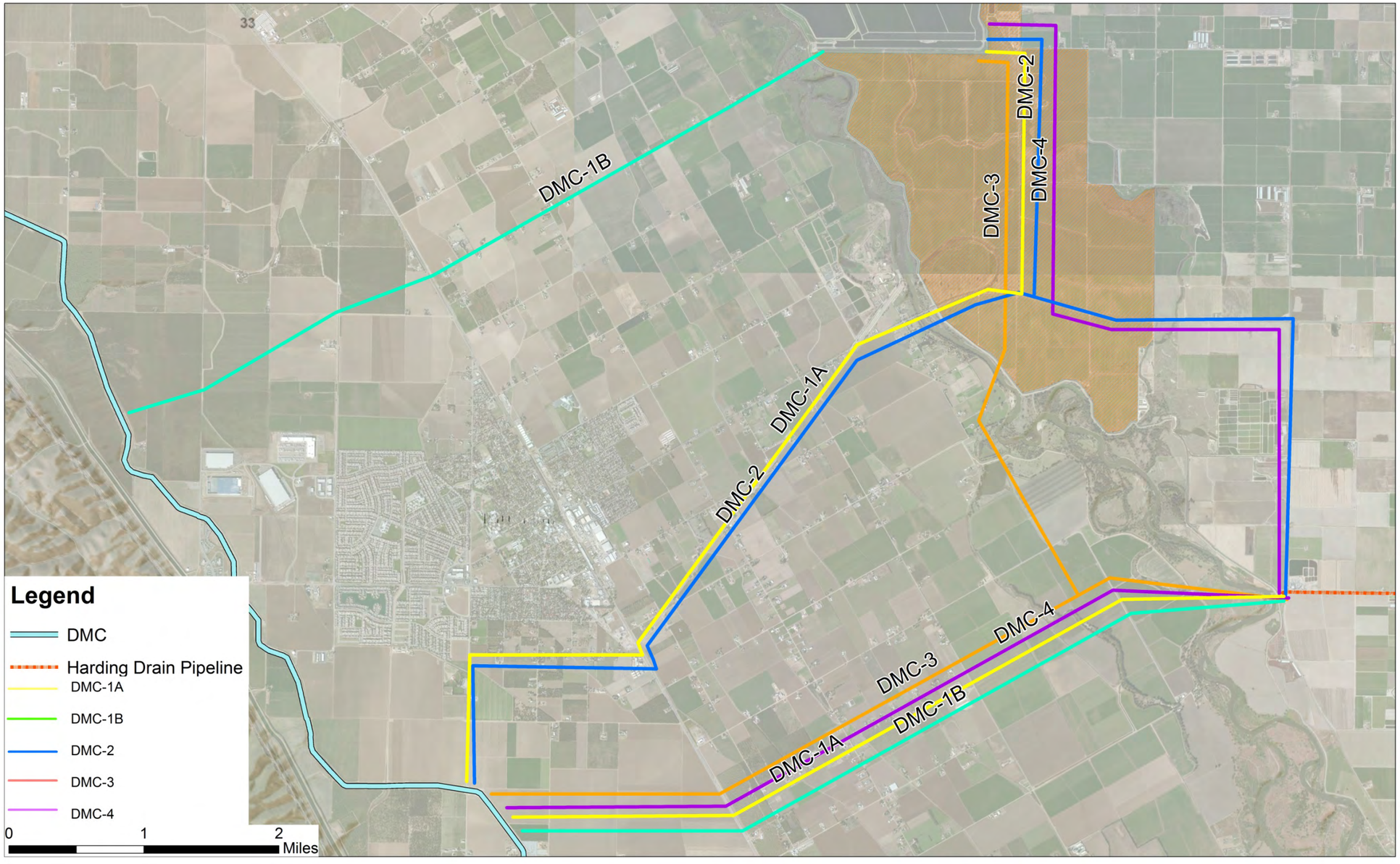


Table 7-1: Summary of Sub Alternatives in Alternative 1

Alt No.	Description	Estimate of Most Probable Capital Cost	Advantages/Disadvantages
DMC-1A	Separate pipelines from Modesto and Turlock to DMC via, respectively, PID canal right-of-way and Apricot Avenue. HDD river crossings at Las Palmas bridge for Modesto and Harding Drain for Turlock. Pump stations at Jennings plant, Harding Drain and Las Palmas Avenue.	$123 million	• Highest cost DMC option • Most difficult constructability due to multiple river, canal, highway crossings and two pipeline corridors • Separate pipelines allows Cities to proceed independently of each other • PID right-of-way alignment might conflict with PID capital improvements
DMC-1B	Separate pipelines from Modesto and Turlock to DMC via, respectively, Lemon Avenue and Apricot Avenue. HDD river crossings at Jennings Road WQCF San Joaquin River discharge for Modesto and Harding Drain Pipeline for Turlock. Pump stations at Jennings Road plant and at Harding Drain.	$102 million	• Separate pipelines allows Cities to proceed independently of each other • Least-cost separate alignment option • Modesto alignment does not follow PID right-of-way alignment
DMC-2	Pipes from Jennings plant and Harding Drain combine at Las Palmas then follow PID canal right-of-way to DMC. HDD River crossing at Las Palmas bridge. Combined pump station at Las Palmas.	$104 million	• PID right-of-way alignment might conflict with PID capital improvements
DMC-3	Separate HDD river crossings, combine east of Pomelo Ave and along Apricot Avenue. HDD river crossings south of Las Palmas for Modesto and at Harding Drain for Turlock. Pump stations at Jennings plant and at combined pump station.	$99 million	• Multiple river crossings increase permitting and constructability complexity. • Separate river crossings allow Cities to proceed somewhat independently of each other
DMC-4	Modesto pipeline to head south to Harding Drain Pipeline via Jennings Road, West Main Avenue, and South Carpenter Road. Combined pipe river crossing at Harding Drain Pipeline and follow Apricot Avenue. Combined pump station at Harding Drain.	$96 million	• Lowest cost DMC option.

7.2.1 Alternative1A: DMC-1A

DMC-1A uses separate alignments from each City to the DMC with the Modesto pipeline following the PID right-of-way.

Modesto Alignment:

The proposed separate alignment from Modesto begins at the Modesto Recycled Water Facility off of Jennings Road. Following Jennings Road south, the alignment will turn west on West Main Avenue, crossing the river adjacent to the Las Palmas Bridge. The alignment continues west until reaching the intersection of the PID Main Canal and Las Palmas Avenue and then follows the PID Main Canal right-of-way utilizing the access roads that flank the north and south sides of the canal. The PID canal turns south along the east side of HWY 33, and at this point, the proposed alignment would cross underneath HWY 33, the CFNR, and the PID Main Canal. After heading south along HWY 33 for approximately 1,000 feet, the alignment then turns west along Bartch Avenue. When Bartch Avenue intersects Ward Avenue, the alignment will then head south along Ward Avenue until the intersection of Ward Avenue and Elfers Avenue, which constitutes the terminus of the Modesto section of pipeline.

Turlock Alignment:

The proposed separate alignment from Turlock would tie into the Harding Drain Bypass Pipeline (estimate construction completion in 2014) and immediately cross under the San Joaquin River heading west towards Paradise Avenue. Once reaching Paradise Avenue, the alignment heads southwest along Apricot Avenue towards Highway 33. This alignment avoids the high-pressure natural gas transmission lines along Marshall Road where Pomegranate Avenue or Apricot Avenue would intersect, as well as constituting the most direct and shortest alignment. Once reaching HWY 33, the alignment would then cross underneath HWY 33 and the CFNR, and head directly west toward the DMC, approximately 1,000 feet north of Marshall Avenue as a cross country route before reaching the DMC.

7.2.2 Alternative 1B: DMC-1B

DMC-1B is similar to DMC-1A in that this alternative includes separate pipelines from each Cities respective tertiary effluent location; however the Modesto alignment heads directly west towards the DMC north of Patterson as opposed to following the PID Main Canal right-of-way.

Modesto Alignment:

The proposed separate alignment from Modesto begins at the Modesto Recycled Water Quality Control Facility off of Jennings Road. The alignment immediately crosses under the San Joaquin River. Once on the west side of the San Joaquin River, the pipeline alignment heads west along Lemon Avenue until reaching the intersection of Lemon Avenue and Highway 33. After crossing under the CNFR and HWY 33, the alignment continues west following a County road alignment toward Access Road.

Turlock Alignment:

The Turlock alignment for DMC-1B is identical to DMC-1A.

7.2.3 Alternative 1C: DMC-2

DMC- 2 combines the Turlock and Modesto flows at a point east of the San Joaquin River and crosses under the San Joaquin River adjacent to the Las Palmas Bridge. The combined alignment then parallels the PID Main Canal right-of-way.

Modesto Alignment:

The proposed alignment from Modesto begins at the Modesto Recycled Water Quality Control Facility off of Jennings Road. Following Jennings Road south, the alignment intersects with West Main Avenue where it will tie into the Turlock alignment.

Turlock Alignment:

The proposed alignment from Turlock begins at the Harding Drain Bypass Pipeline at the west end of Harding Road. After tying into the Harding Drain Bypass Pipeline (estimated construction completion in 2014), the alignment heads north on South Carpenter Road until reaching West Main Ave. At West Main Ave., the alignment turns west along West Main Ave until the intersection of Jennings Rd. and West Main Ave.

Combined Alignments:

At the intersection of Jennings Road and West Main Ave, the pipelines from Turlock and Modesto combine into one pipeline alignment that heads west along West Main Ave. The alignment continues west on West Main Avenue, crossing under the river near the Las Palmas Bridge. The road changes names from West Main Avenue to Las Palmas Avenue at the San Joaquin River. From the Las Palmas Bridge, the alignment continues west until reaching the intersection of the PID Main Canal and Las Palmas Avenue. The alignment then follows the PID Main Canal Right-of-Way utilizing the access roads that flank the north and south sides of the canal. The PID canal intersects with HWY 33, and at this point, the proposed alignment would cross underneath HWY 33 and the CFNR, head south along HWY 33 until Bartch Avenue, and then continue west along Bartch Avenue. When Bartch Avenue intersects Ward Avenue, the alignment will then head south along Ward Avenue until the intersection of Ward Avenue and the DMC, which constitutes the terminus of the combined section of pipeline.

7.2.4 Alternative 1D: DMC-3

DMC- 3 combines the Turlock and Modesto flows at a point west of the San Joaquin River, and south of the PID Main Canal right-of-way. The alignment then follows Apricot Avenue before reaching the DMC.

Modesto Alignment:

The proposed alignment from Modesto begins at the Modesto Recycled Water Quality Control Facility off of Jennings Road. Following Jennings Road south, the alignment intersects with West Main Avenue. The alignment would then cross underneath West Main Ave and continue heading south-southwest until reaching the San Joaquin River where it would cross under the river. The alignment would then connect with the Turlock pipeline near the intersection of Paradise Avenue and Apricot Avenue and combine before heading towards the DMC.

Note that this alignment is adjacent to Lake Ramona, a privately owned recreational lake, which was discussed earlier in this project as a potential location for recycled water storage. However, subsequent discussions with PID have determined that the Lake Ramona storage option is infeasible. Lake Ramona is private, recreational land owned by a local church and there is no connection from Lake Ramona to the PID main canal.

Turlock Alignment:

The proposed separate alignment from Turlock begins at the Harding Drain Bypass Pipeline at the west end of Haring Road. After tying into the Harding Drain Bypass Pipeline (estimated construction completion in 2014), the alignment immediately crosses under the San Joaquin River heading west towards the combined pump station at Paradise Avenue.

Combined Alignment:

The combined alignment heads southwest along Apricot Avenue towards Highway 33. This alignment avoids the high-pressure natural gas transmission lines along Marshall Road where Pomegranate Avenue or Apricot Avenue would intersect, as well as constituting the most direct and shortest alignment. Once reaching HWY 33, the alignment would then cross underneath HWY 33 and the CFNR, and head directly west toward the DMC, approximately 1,000 feet north of Marshall Avenue as a cross country route before reaching the DMC.

7.2.5 Alternative 1E: DMC-4

DMC- 4 combines the Turlock and Modesto flows at the Harding Drain Bypass Pipeline at the west end of Harding Road. The alignment then crosses the San Joaquin River and follows Apricot Avenue before reaching the DMC.

Modesto Alignment:

The proposed alignment from Modesto begins at the Modesto Recycled Water Facility off of Jennings Road. Following Jennings Road south, the alignment intersects with West Main Avenue. The alignment would then cross underneath West Main Ave and turn east along West Main Avenue before heading south on South Carpenter Road. Once reaching the Harding Drain Bypass Pipeline, the Modesto Alignment would tie into the Combined Alignment.

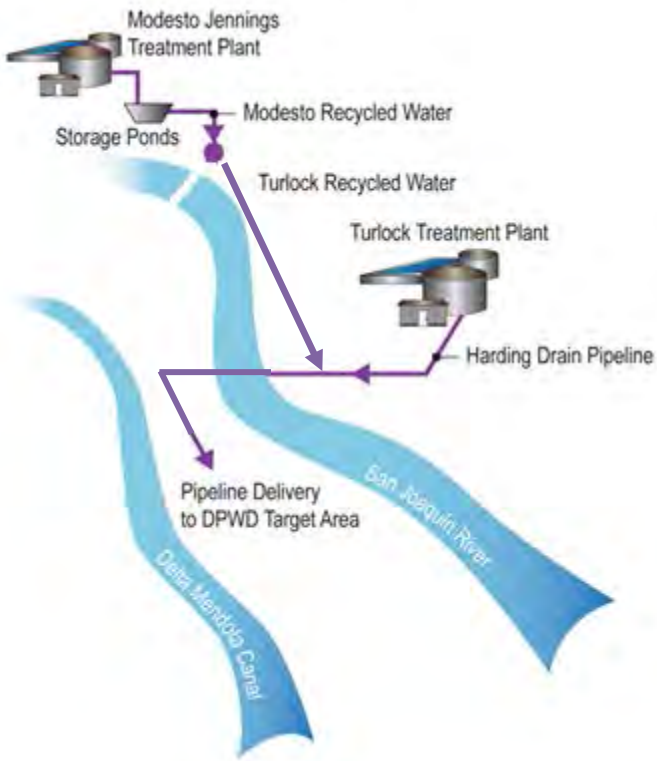
Combined Alignment:

The proposed separate alignment from Turlock begins with a combined pump station at the Harding Drain Bypass Pipeline terminus at the west end of Harding Road. After tying into the Harding Drain Bypass Pipeline (estimated construction completion in 2014), the alignment immediately crosses under the San Joaquin River heading west towards Paradise Avenue. The combined alignment then heads southwest along Apricot Avenue towards HWY 33. This alignment avoids the high-pressure natural gas transmission lines along Marshall Road where Pomegranate Avenue or Apricot Avenue would intersect, as well as constituting the most direct and shortest alignment. Once reaching HWY 33, the alignment would then cross underneath HWY 33 and the CFNR, and head directly west toward the DMC, approximately 1,000 feet north of Marshall Avenue as a cross country route before reaching the DMC

7.3 Alternative 2: Pipeline Conveyance of Recycled Water Directly to DPWD Lands

Alternative 2 consists of constructing a pipeline to deliver recycled water to target areas within DPWD (Figure 7-2). In this alternative it was assumed that a pipeline would approximately follow the alignment of the DMC and recycled water would be delivered either directly or by way of Reclamation-owned distribution boxes into privately owned irrigation systems. This delivery scenario enables customers to blend recycled water with canal water, when possible and if desired.

Figure 7-2: Alternative 2 Pipeline Schematic



Three delivery target areas shown in Figure 7-3 were developed for recycled water distribution: North, Central, and South Areas. The North Area is bounded by the San Joaquin/Stanislaus County border on the north, and the City of Patterson on the south, the Central Area is bounded by the City of Patterson on the north and Orestimba Creek on the south, and the South Area is bounded by Orestimba Creek on the north and the Merced/Stanislaus County border on the south. To avoid the capital costs associated with crossing the DMC multiple times, it was assumed that recycled water would be conveyed and distributed only to land on the east side of the DMC. Pipeline deliveries to the North, Central, and South Areas were reviewed; however the South Area was identified by DPWD to be the target delivery area due to the high percentage of permanent crops (almonds) and the relative lack of groundwater supplies in the South Area.

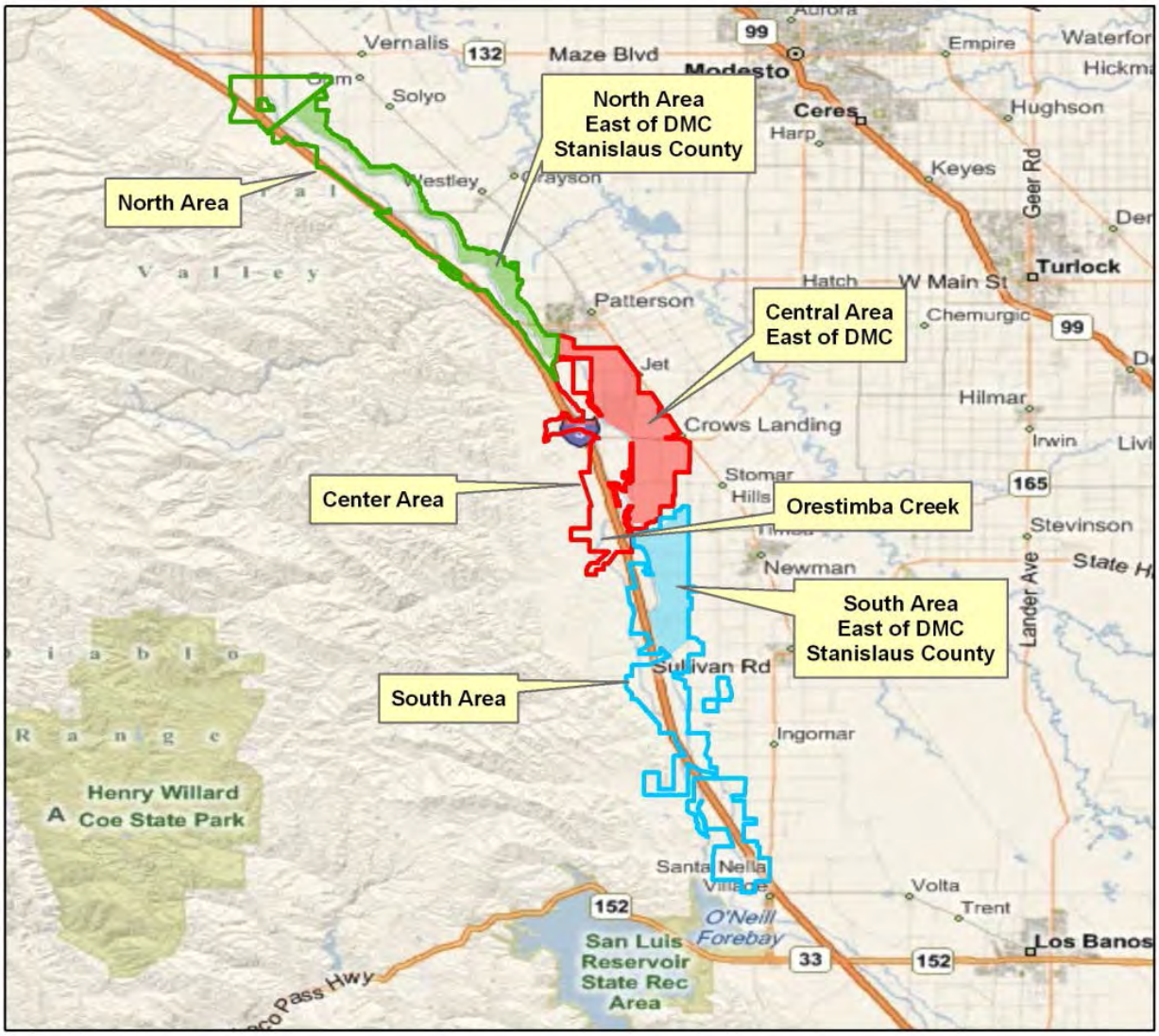
Since Alternative 2 does not have access to the seasonal storage facilities of the DMC and Central Valley Project, the Alternative 2 scenarios include seasonal storage at Modesto or elsewhere to increase the volume of recycled water that could be used by DPWD. Without seasonal storage, the recycled water production in the wet weather months would need to be discharged rather than used for irrigation.

The following pipeline conveyance scenarios were evaluated and are described in the following sections:

- Scenario 2A: Conveyance of recycled water to the Central and South Areas, using seasonal storage at Modesto only
- Scenario 2B: Conveyance of recycled water to the Central and South Areas with additional seasonal storage
- Scenario 2C: Conveyance of recycled water to the Central Area, using seasonal storage at Modesto only
- Scenario 2D: Conveyance of recycled water to the North Area, using seasonal storage at Modesto only

Costs were estimated for all four scenarios for both 2018 and 2045 recycled water production rates. Costs for use of Modesto's storage facilities are not included in the estimates.

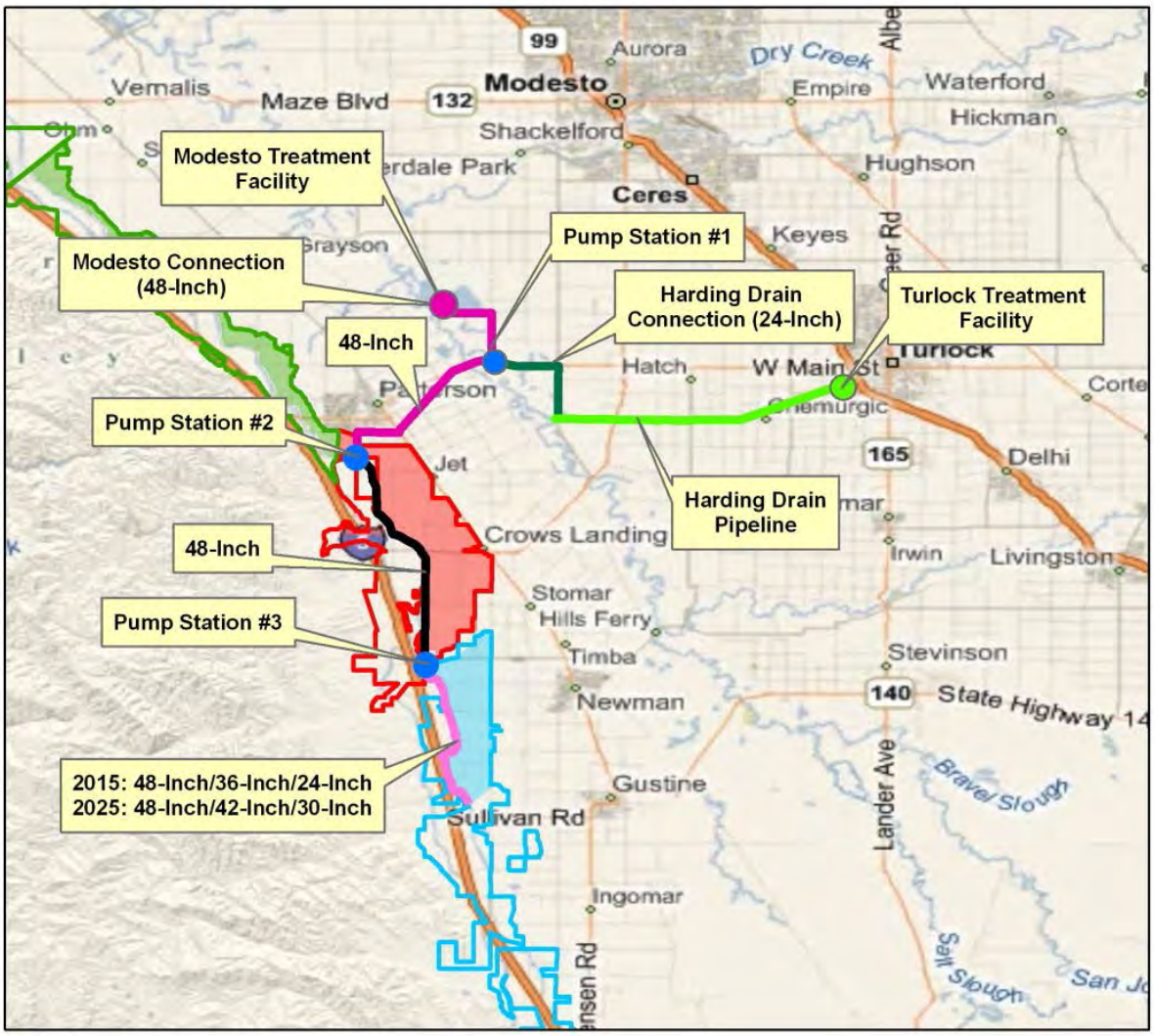
Figure 7-3: DPWD Delivery Areas



7.3.1 Scenario 2A: Pipeline to South and Central Areas, Seasonal Storage at Modesto Only

Under Scenario 2A, recycled water would be conveyed via a pipeline from the Modesto and Turlock tertiary treatment facilities to the Central and South Areas as shown in Figure 7-4. It is assumed that seasonal storage at Modesto would be used and additional storage would not be constructed, as the storage available at Modesto is adequate to serve the entire South Area and part of the Central Area water demands. Table 7-2 provides a summary of key design criteria assumed for this scenario.

Figure 7-4: Scenario 2A Distribution System



A 24-inch pipeline (Harding Drain Connection) would convey recycled water from Turlock's Harding Drain Pipeline at South Carpenter Road, north and west to the intersection of West Main Street and Jennings Road. At this location Turlock and Modesto recycled water would be combined and pumped into a 48-inch pipeline to the southern area. It was assumed that the pipeline would cross the San Joaquin River under the bridge at West Main Street, in lieu of tunneling under the San Joaquin River. After crossing the San Joaquin River, the 48-inch pipeline would follow PID's Main Canal, to Highway 33. It was assumed that the 48-inch pipeline would cross under Highway 33, and would be routed west and south along Bartch Avenue and Ward Avenue. The 48-inch pipeline would then follow the DMC through the Central and South areas. To provide operational flexibility for the distribution system, three pump stations were assumed at the locations shown in Figure 7-4. The costs for Scenario 2A are provided as Table 7-13.

Table 7-2: Pipeline Scenario 2A Design Criteria

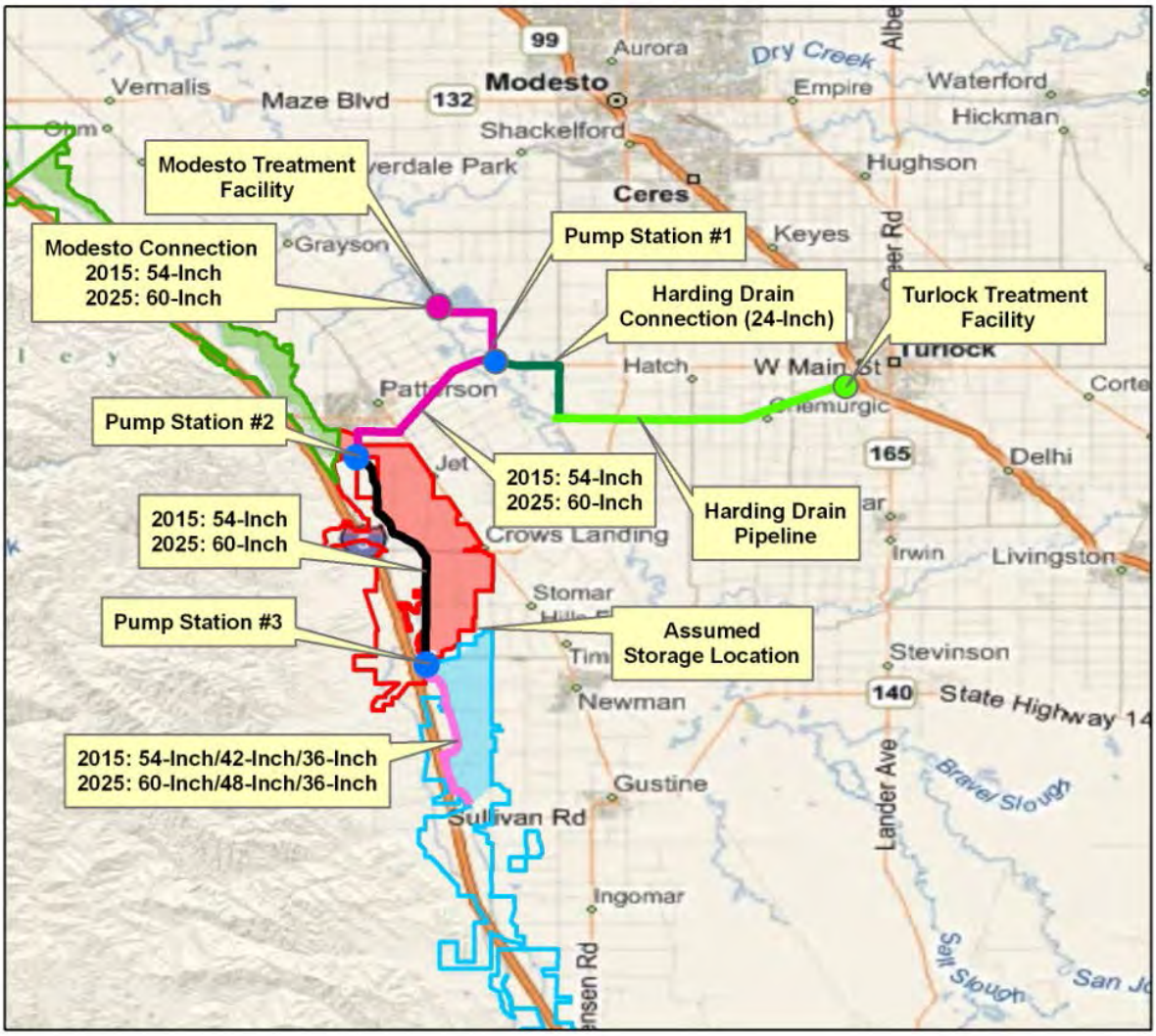
Criteria	2015 Recycled Water Delivery	2025 Recycled Water Delivery
DPWD Area Served[1]	South and Central	South and Central
Peak Monthly Demand Cap (AFM)[2]	2,400	3,500
Volume of Seasonal Storage (AF)	3,900	4,300
Peak Recycled Water Delivery Rate (gpm/acre)	5.4	5.5
Total Acres Irrigated with Recycled Water (acres)	4,900	4,900
Recycled Water Delivered to DPWD (AFY)	25,700	23,700
Recycled Water Not Delivered to DPWD (AFY)		9,200
Harding Drain Connection Pipeline		
Diameter	24-inch	24-inch
Distance	21,000 feet	21,000 feet
Modesto Connection Pipeline		
Diameter	48-inch	48-inch
Distance	17,400 feet	17,400 feet
Pipeline through Central Area		
Diameter	48-inch	48-inch
Distance	46,000 feet	46,000 feet
Pipeline through Southern Area		
Diameter[3]	48,36,24-inch	48,42,30-inch
Distance	33,300	33,300
Distribution Pump Stations[4]		
Pump Station 1 (HP)	2,250	3,000
Pump Station 2 (HP)	700	1,600
Pump Station 3 (HP)	1,200	1,800

Notes:
1. It is assumed that the southern area peak monthly demand is met, and remaining water is distributed to the central area.
2. Applies to Central Area because it is assumed the peak monthly demand of the southern area is met.
3. Pipeline diameter is reduced through the southern area as water demands are met along the alignment.
4. An allowance for a booster pump station is included in the cost estimate.

7.3.2 Scenario 2B: Pipeline to South and Central Areas, with Additional Seasonal Storage

Under Scenario 2B, recycled water would be conveyed via pipeline from the Modesto and Turlock tertiary treatment facilities to the Central and South Areas, as shown in Figure 7-5, and exactly as described in Scenario 2A. Additional storage would be constructed in addition to Modesto's storage ponds so that all recycled water produced by Modesto and Turlock is delivered to DPWD. Similar to Scenario 2A, it is assumed that after serving the South Area, recycled water would be distributed to the Central Area. Table 7-3 provides a summary of key design criteria assumed for this scenario. A summary of the costs of this scenario are provided in Table 7-14.

Figure 7-5: Scenario 2B Distribution Facilities



Seasonal Storage

For this scenario, it was assumed that additional recycled water storage was constructed to augment the storage volume available at Modesto. The cost estimate provided in Table 7-14 assumes that lined storage ponds were constructed. The exact location of the storage ponds would need to be further investigated in subsequent studies due to the significant area of land required (approximately 1,300 acres).

Groundwater banking was also reviewed as an alternative to constructing recycled water storage ponds. Groundwater banking would consist of using spreading basins for recycled water to percolate into the groundwater aquifer and the construction of extraction wells down gradient of the basins to recapture the stored water. Groundwater injection wells also can be used as an alternative to spreading basins, however direct injection of recycled water into a groundwater aquifer would likely require advanced treatment (RO) prior to injection. There are a number of unknowns associated with groundwater banking at this time, including the true storage capacity of the aquifer, the soil and hydrogeologic conditions of the area, the percolation rate, and the regulatory requirements (e.g., need for dilution water, advanced treatment) for storage of recycled water in the groundwater aquifer. Due to these unknowns, it is recommended that additional information be obtained to better understand the soil, groundwater and hydrogeologic conditions in the area should groundwater banking be pursued as an option.

Table 7-3: Pipeline Scenario 2B Design Criteria

Criteria	2015 Recycled Water Delivery	2025 Recycled Water Delivery
DPWD Area Served[1]	South and Central	South and Central
Peak Monthly Demand Cap (AFM)[2]	4,000	5,800
Total Volume of Seasonal Storage[4] (AF)	9,700	13,400
Seasonal Storage Constructed		
Type of Storage	Lined storage pond	Lined storage pond
Volume (AF)	5,800	9,100
Peak Recycled Water Delivery Rate (gpm/acre)	5.0	5.2
Total Acres Irrigated with Recycled Water (acres)	6,000	8,500
Recycled Water Delivered to DPWD (AFY)	25,700	32,900
Recycled Water Not Delivered to DPWD (AFY)	—	—
Harding Drain Connection Pipeline		
Diameter	24-inch	24-inch
Distance	21,000 feet	21,000 feet
Modesto Connection Pipeline		
Diameter	54-inch	60-inch
Distance	17,400 feet	17,400 feet
Pipeline through Central Area		
Diameter	54-inch	60-inch
Distance	46,000 feet	46,000 feet
Pipeline through Southern Area		
Diameter[3]	54,42,36-inch	60,48,36-inch
Distance	33,300	33,300
Distribution Pump Stations[5]		
Pump Station 1 (HP)	3,000	3,300
Pump Station 2 (HP)	1,200	1,350
Pump Station 3 (HP)	1,200	2,000

Notes:

1. It is assumed that the southern area peak monthly demand is met, and remaining water is distributed to the central area.
2. Applies to Central Area because it is assumed the peak monthly demand of the southern area is met.
3. Pipeline diameter is reduced through the southern area as water demands are met along the alignment.
4. Assumes that storage available at Modesto is used (3,900 in 2015 and 4,300 in 2025), and additional storage is constructed.
5. An allowance for a booster pump station is included in the cost estimate.

7.3.3 Scenario 2C: Pipeline to Central Area, with Seasonal Storage at Modesto Only

Scenario 2C consists of conveying recycled water in a pipeline from the Modesto and Turlock recycled water facilities to the entire Central Area, using only two pump stations, as shown in Figure 7-6, rather than 3 pump stations as described in Scenarios 2A and 2B. It was assumed that seasonal storage available at Modesto would be used. Table 7-4 provides a summary of key design criteria assumed for this scenario. A summary of the costs of this scenario are provided in Table 7-15.

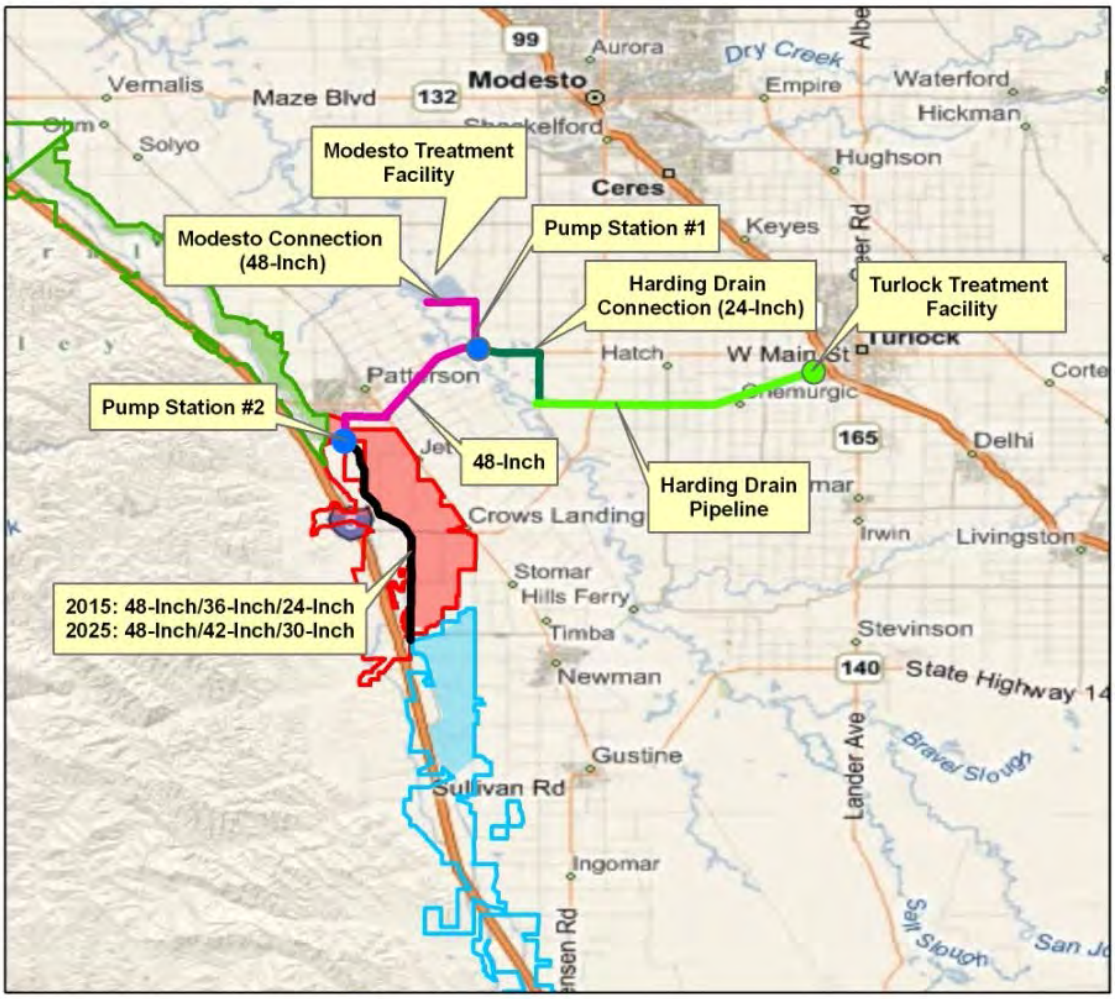
Table 7-4: Pipeline Scenario 2C Design Criteria

Criteria	2015 Recycled Water Delivery	2025 Recycled Water Delivery
DPWD Area Served	Central	Central
Peak Monthly Demand Cap (AFM)	3,100	4,100
Volume of Seasonal Storage (AF)	3,900	4,300
Peak Recycled Water Delivery Rate (gpm/acre)	2.4	3.2
Total Acres Irrigated with Recycled Water (acres)	9,792	9,792
Recycled Water Delivered to DPWD (AFY)	28,100	20,400
Recycled Water Not Delivered to DPWD (AFY)		12,500
Harding Drain Connection Pipeline		
Diameter	24-inch	24-inch
Distance	21,000 feet	21,000 feet
Modesto Connection Pipeline		
Diameter	48-inch	48-inch
Distance	17,400 feet	17,400 feet
Pipeline through Central Area		
Diameter[1]	48,36,24-inch	48,42,30-inch
Distance	33,300	33,300
Distribution Pump Stations		
Pump Station 1 (HP)	2,000	3,000
Pump Station 2 (HP)	1,400	1,500

Notes:

1. Pipeline diameter is reduced through the central area as water demands are met along the alignment.
2. An allowance for a booster pump station is included in the cost estimate.

Figure 7-6: Scenario 2C Distribution Facilities



7.3.4 Scenario 2D: Pipeline to North Area, Seasonal Storage at Modesto Only

Under Scenario 2D, recycled water is conveyed via a pipeline from Modesto to the North Area, as shown in Figure 7-7. A 48-inch pipeline from Modesto's tertiary treatment facility would be routed to the DMC using the same alignment. At Ward Avenue, the pipeline would follow the DMC through the North Area. The pipeline diameter would decrease as water is diverted from the distribution line. To provide operational flexibility for the distribution system, two pump stations were assumed at the locations shown in Figure 7-7. The existing storage ponds at Modesto would be used for seasonal storage. Table 7-5 provides a summary of key design criteria assumed for this scenario. There are several key differences with Scenario 2D. The demand in the North Area is such that recycled water from Modesto alone can meet the area's demands; therefore, this scenario does not include the costs of connecting Turlock recycled water with Modesto's. A summary of the costs of this scenario are provided as Table 7-16.

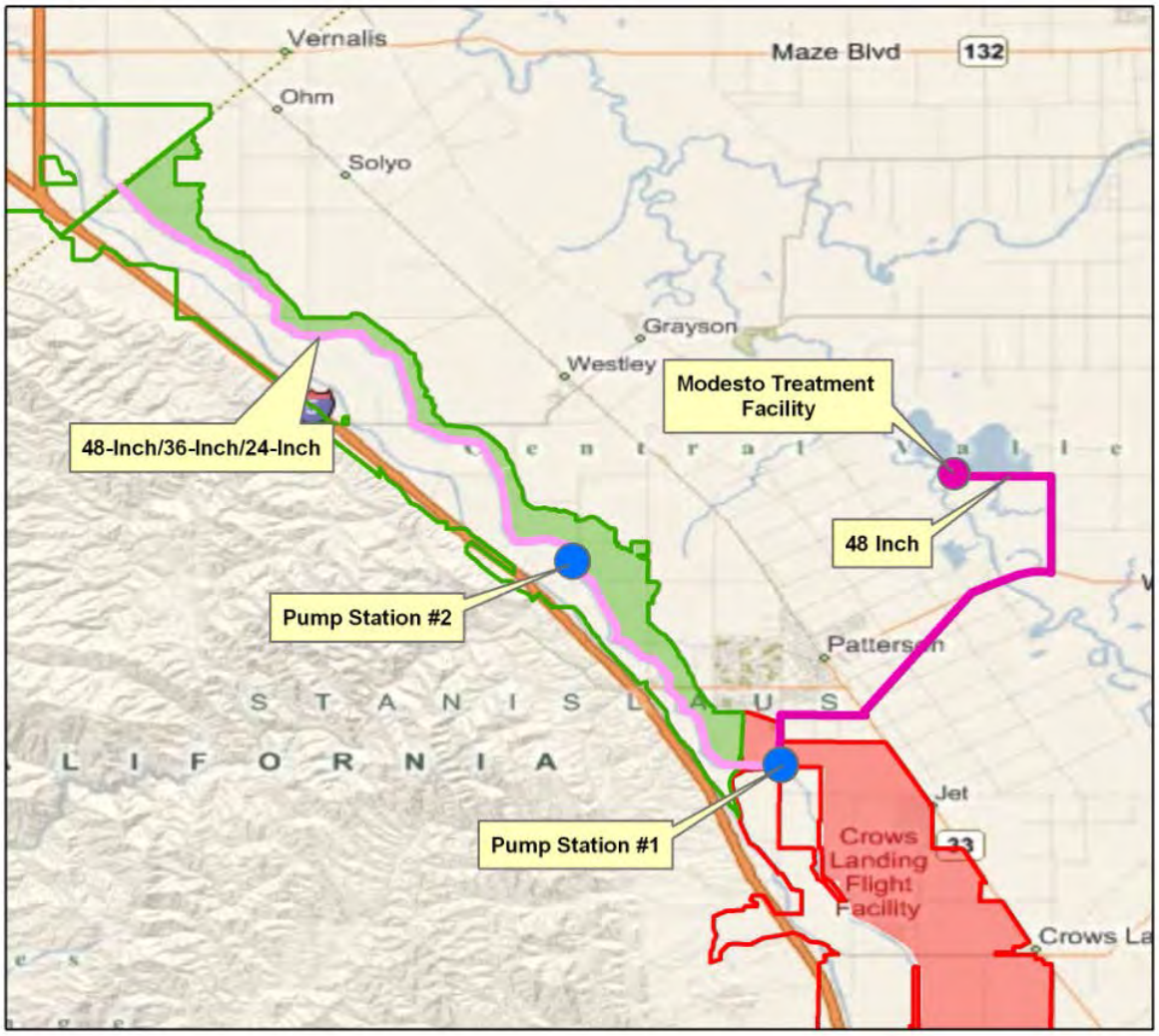
Table 7-5: Pipeline Scenario 2D Design Criteria

Criteria	2015 Recycled Water Delivery
DPWD Area Served	North
Peak Monthly Demand Cap[1] (AFM)	3,000
Volume of Seasonal Storage (AF)	3,900
Peak Recycled Water Delivery Rate (gpm/acre)	5.8
Total Acres Irrigated with Recycled Water (acres)	3,386
Recycled Water Delivered to DPWD (AFY) Recycled Water Not Delivered to DPWD (AFY)	28,100
Modesto Pipeline Diameter Distance	 48-inch 17,400 feet
Pipeline through North Area Diameter[2] Distance	 48,36,24-inch 89,200
Distribution Pump Stations Pump Station 1 (HP) Pump Station 2 (HP)	 1,800 900

Notes:
1. The peak monthly demand cap represents the peak month demand. Recycled water is adequate to meet the peak month demand.
2. Pipeline diameter is reduced through the north area as water demands are met along the alignment

Based on information from DPWD, recycled water delivery to the North Area could be institutionally more difficult to implement because the North Area customers have historically relied on groundwater to meet their water supplemental water demands. Finding incentives for North Area customers to use recycled water in lieu of groundwater may be difficult. For these reasons, delivery of recycled water to the North Area is not a preferred pipeline scenario under Alternative 2.

Figure 7-7: Scenario 2D Distribution Facilities

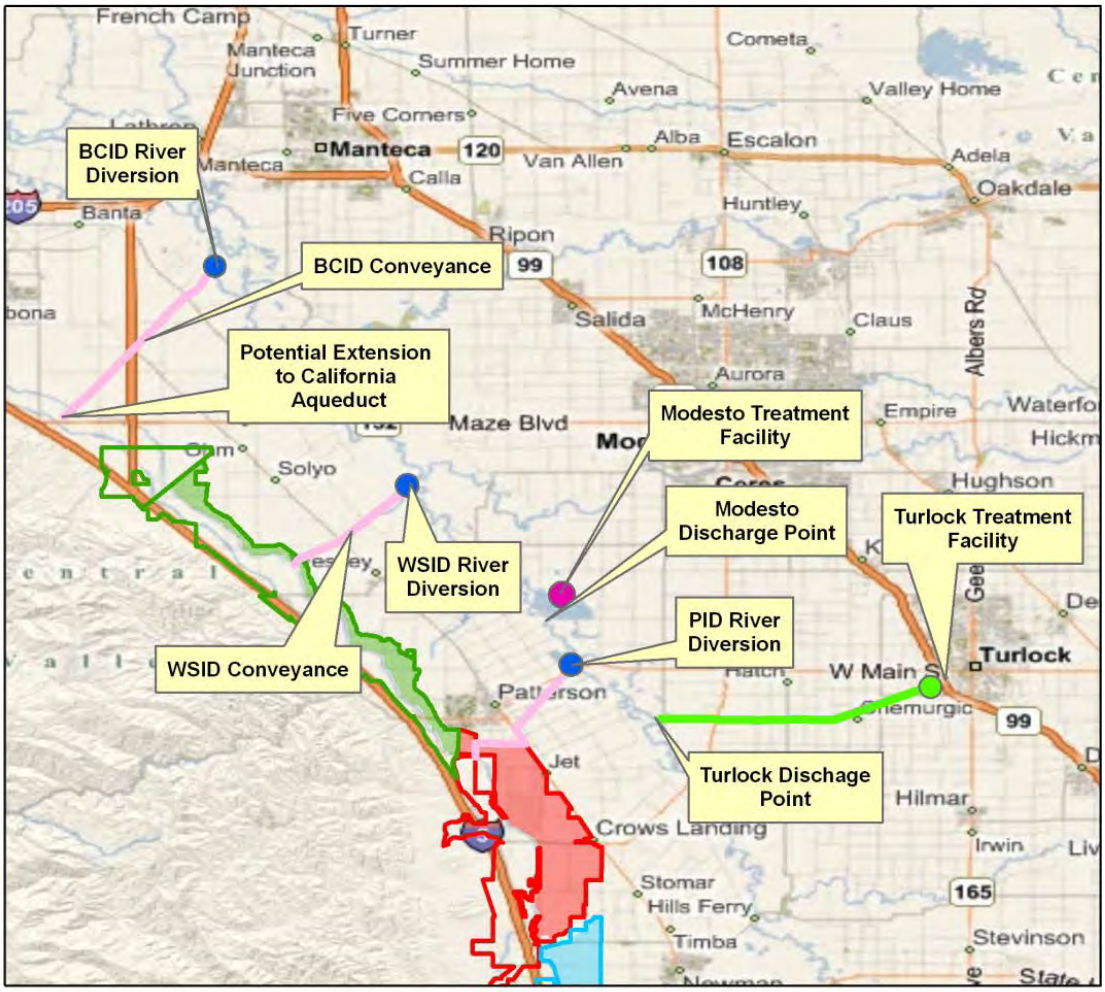


7.4 Alternative 3: San Joaquin River Conveyance of Recycled Water to Existing Diversion Facilities

Alternative 3 consists of conveying recycled water in the San Joaquin River, and diverting it at a downstream river diversion facility owned and operated by Banta Carbona Irrigation District (BCID), West Stanislaus Irrigation District (WSID), and/or at Patterson Irrigation District (PID). Figure 7-8 identifies the locations of three potential river diversion facilities relative to the location of Modesto and Turlock's permitted discharge locations. As can be seen in the figure, though downstream from Turlock's current discharge point, PID's river diversion facility is upstream of Modesto's permitted discharge location. Therefore, using PID's facility to convey Modesto's recycled water would require relocating the discharge point.. The following sections further describe how this alternative would operate at each of the potential diversion facilities.

It was assumed for all alternatives that recycled water would be conveyed in the San Joaquin River and diverted at the rate of production (i.e., seasonal storage would not be required) into existing diversion facilities. The dilution ratio provided by the discharge of recycled water to the San Joaquin River ranges from 0.5 to 3 percent (recycled water to river water flows).

Figure 7-8: River Diversion Facilities



7.4.1 Banta Carbona Irrigation District (BCID) Diversion Facility

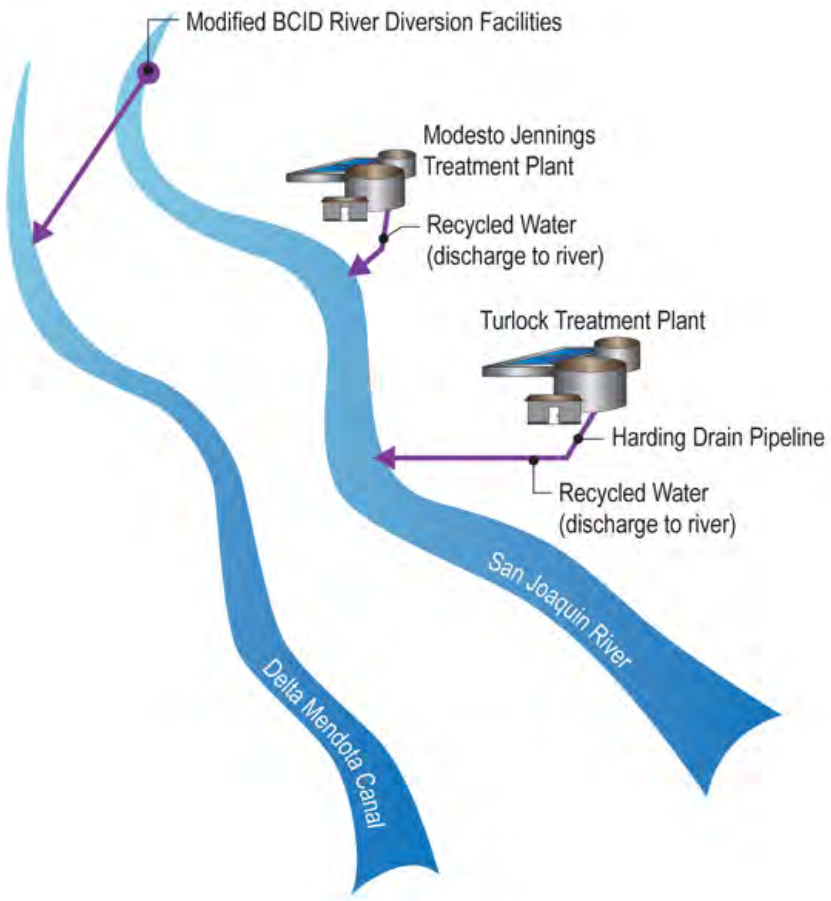
BCID's river diversion facility is located in Vernalis at Mile 63 of the San Joaquin River. The facility has the capacity to divert up to 250 cfs from the San Joaquin River. BCID is currently reviewing possible expansion of their river diversion facility to 400 cfs. River water that is currently diverted from the San Joaquin River is conveyed through a canal and a series of lift stations to BCID customers. The existing facilities are capable of delivering up to 60 cfs of river water to the DMC. The new facilities at BCID would include an additional 150 cfs of river diversion facilities, approximately 7.5 miles of new pipeline, and increased pumping capacity to deliver up to 150 cfs to the DMC or the California Aqueduct. BCID has estimated the capital cost of the new facilities is estimated to be $140 to $150 million.

BCID is currently looking for investors to buy capacity in the proposed new facilities. A preliminary method developed by BCID would involve investors purchasing ownership shares of the new facilities. One share would provide 1 AFY of diversion capacity, and would cost $1,000/share. Based on discussions with BCID, annual operating and maintenance costs would also be paid by the shareholders (estimated at $19/AF). All costs at this time are preliminary in nature and the institutional mechanism for BCID's concept is still under development, but a Joint Powers Authority established among shareholders is envisioned.

Based on the preliminary information provided by BCID, DPWD could purchase 33,000 shares in BCID's facility which would enable diversion of Turlock and Modesto 2025 recycled water flows from the San Joaquin River. The costs for this alternative are summarized in Table 7-17.

This alternative would require Modesto and Turlock to continue to discharge recycled water to the San Joaquin River and meet existing and future river discharge regulations. Advanced treatment prior to discharge could be required in the future. The cost for advanced treatment for river discharge (assuming evaporation ponds for RO concentrate disposal) was estimated to be $900/AF. Because the estimated recovery rate through the RO system is only 80 percent, this would reduce the amount of recycled water available to DPWD. The unit cost of the recycled water if advanced treatment is required is provided in Table 7-17.

Figure 7-9: BCID River Diversion Scenario

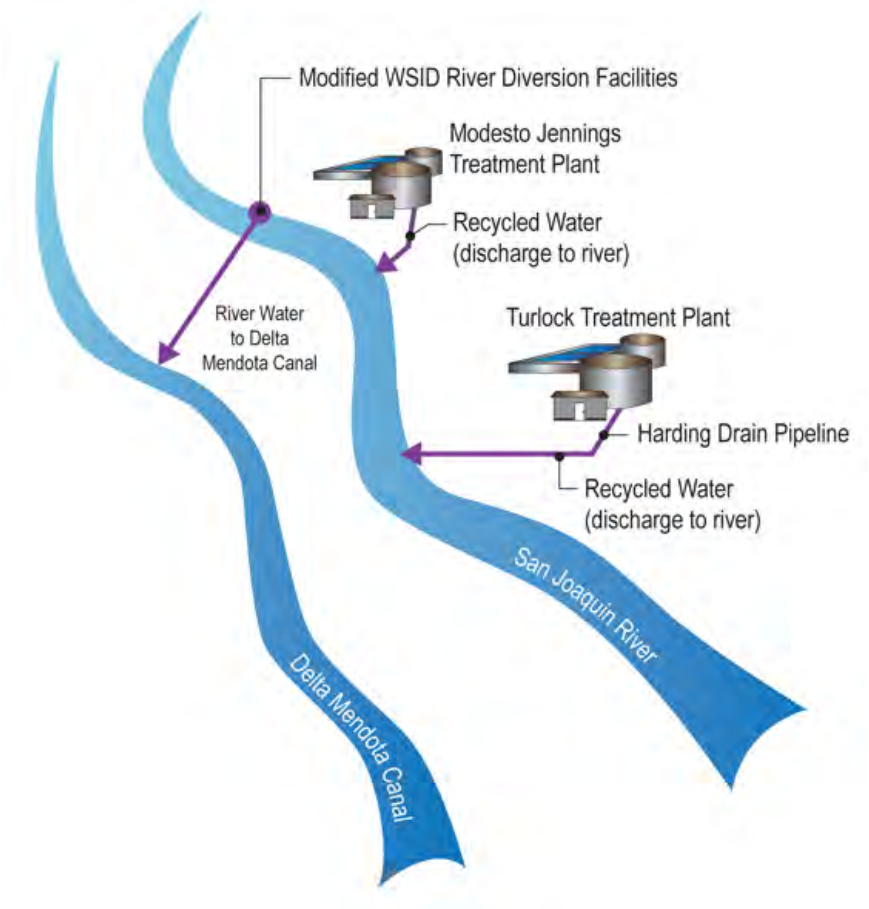


7.4.2 West Stanislaus Irrigation District (WSID) Diversion Facility

WSID diverts 262 cfs per their water right for irrigation from the San Joaquin River in accordance with their License Number 3957 (Permit 2758, Application 1987). The District is also obligated by a 1939 agreement to divert up to 45 cfs of riparian water for irrigation of the White Lake Water Company lands located north of the unincorporated community of Grayson at its diversion point on the San Joaquin River. WSID also provides river water to the USFWS to irrigate habitat maintained on the San Joaquin River National Wildlife Refuge. Including the USFWS diversions, WSID's existing river diversion capacity is approximately 350 cfs.

WSID's diversion from the San Joaquin River is by way of a two mile intake channel located just upstream of the confluence of the Tuolumne and San Joaquin Rivers and a pump station that lifts the water into WSID's Main Canal. The Main Canal consists of roughly 3 miles of concrete lined channel with six pump stations. In 2009, WSID installed a temporary pump station and 0.25 mile pipeline to convey up to 60 cfs of river water from the top of their Main Canal to the DMC. WSID is currently planning to design and construct a permanent pump station and pipeline capable of conveying up to 250 cfs of river water from the top of their Main Canal to the DMC. The estimated capital cost of the permanent conveyance facility is $5 million. WSID also intends to perform improvements to their river diversion facilities, which are estimated to have a capital cost of $7 million. At this time, WSID does not anticipate construction of fish screens in the near-term at their river intake facility; therefore, the capital costs associated with future fish screens are not considered in the alternative. WSID has indicated that the energy costs to pump river water to the DMC are approximately $44/AF. Maintenance and administrative costs are estimated to be an additional $23/AF.

Figure 7-10: WSID River Diversion Scenario



Initial discussions with WSID indicate that they could provide DPWD with 50 cfs of river diversion capacity for at least 10 months of the year. WSID may have the capacity to provide DPWD with river diversion capacity during the remaining two months of the year, however there is a level of uncertainty associated with this assumption due to limits in current installed capacity, water quality constraints, and institutional water rights agreements. Therefore, this alternative was developed assuming that DPWD could divert 50 cfs of recycled water at WSID's intake for 10 months of the year, which translates to approximately 30,500 AFY (or 42 cfs). An Exchange Agreement or Warren Act Contract would be needed with Reclamation to convey the water in the DMC and store the water in San Luis Reservoir.

Table 7-6 provides a summary of assumptions for this alternative and Table 7-18 provides the estimated capital and operating costs for this option. The cost estimate for this option was based on the assumption that DPWD would pay the capital costs of the diversion facility, pipeline and pump station improvements that are equivalent to the fraction of the facility capacity used by DPWD (e.g., 42 cfs of 350 cfs, or approximately 12 percent of the total capital costs). The current operating costs provided by WSID were used to develop the annual costs for this alternative. An additional $30/AF was included for the cost of a Warren Act Contract or Exchange Agreement with Reclamation. DPWD would be responsible to pay the O&M costs associated with diverting up to 50 cfs of water from the river and pumping it to the DMC.

As with the BCID alternative, continued discharge of Modesto and Turlock's recycled water to the San Joaquin River may require advanced treatment in the future. The cost for advanced treatment ($900/AF) was added to the capital and operating cost of recycled water for this project, and the total cost was divided by the expected amount of recycled water to be produced.

Table 7-6: WSID River Diversion Design Criteria

Item	Design Criteria
Total WSID Diversion Facility Capacity (cfs)	350
Assumed River Diversion by DPWD (cfs)1	42
WSID Conveyance Upgrades to DMC	
Pipeline length (ft)	5,100
Assumed diameter	96-inch
WSID O&M Costs	
Operating cost to pump river water to the DMC	$44/AF
Maintenance and Administrative Costs	$23/AF

Notes:
1. DPWD would have the ability to divert 50 cfs over 10 months of the year, which equates to an annual average of 42 cfs.

7.4.3 Patterson Irrigation District (PID) / WSID Dual River Diversion

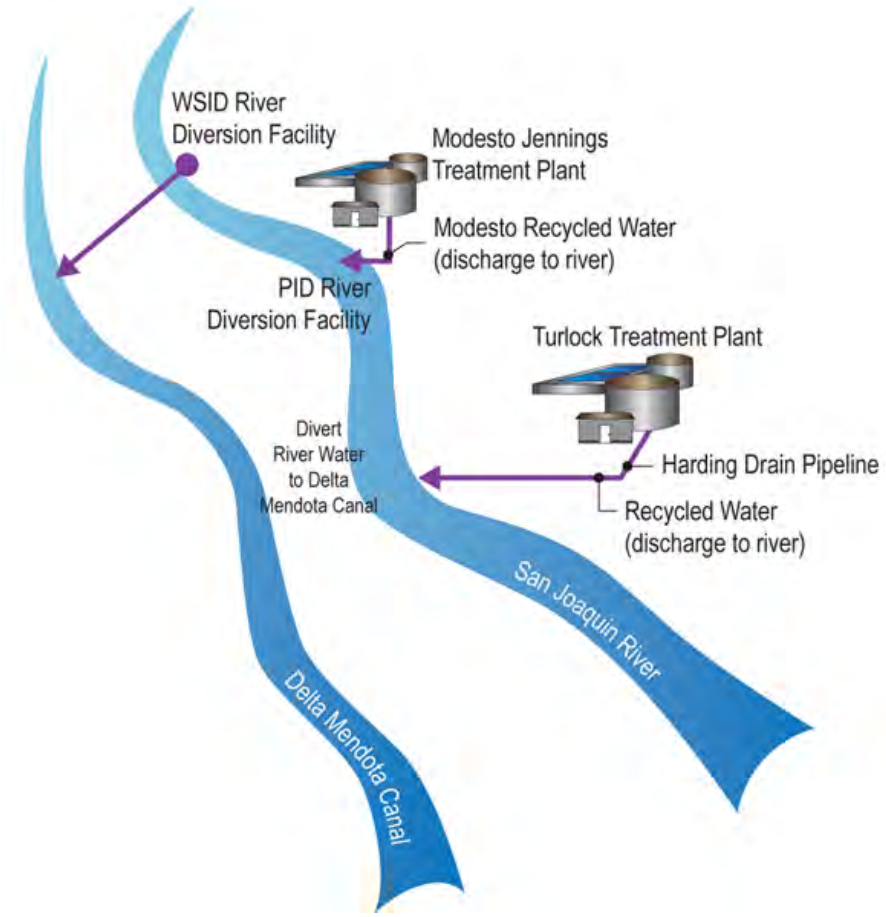
PID's river diversion facility is located on the San Joaquin River approximately 3.5 miles east of the City of Patterson at River Mile 98.5. PID's existing river diversion facility has a capacity of approximately 195 cfs. Diverted river water is conveyed in PID's main canal and through a series of lift stations to laterals that serve its customers. PID recently constructed a pump station and 2-mile pipeline to convey up to 35 cfs of river water to the DMC. PID is currently installing fish screens (195 cfs capacity) at their diversion facility for which funding has been received, and no further expansion of the diversion facility is planned. Within the next year, PID plans to design improvements to their canal system which may include construction of a pipeline to replace their main lift canal at an estimated capital cost of $23-$53 million. PID is also considering construction of sedimentation basins near their river diversion facility to settle out river sediment in the diverted water prior to its delivery. Based on conversations with PID, PID intends to make improvements to their diversion facilities that will enable delivery of up to 195 cfs of river water to the DMC, with a potential to expand to 300 cfs if the district is able to locate parties that are interested in utilizing a portion of the Main Canal capacity.

As shown in Figure 7-11, the PID river diversion facility is upstream of Modesto's permitted discharge point. Therefore, use of PID's diversion facility to move Modesto's recycled water would require Modesto to amend their NPDES permit and relocate their discharge point. Because relocation of

Modesto's discharge point would be time intensive and result in additional capital expenses, it was determined that this alternative would use multiple river diversion facilities as follows:

- Turlock would discharge recycled water to the San Joaquin River via the Harding Drain Pipeline, and recycled water would be diverted at PID's river diversion facility.
- Modesto would discharge recycled water to the San Joaquin River at their permitted location, and recycled water would be diverted at WSID's diversion facility.

Figure 7-11: PID and WSID Dual River Diversion Scenario



It is currently understood that recycled water could be diverted at WSID's river diversion facility 10 months of the year. Using the available seasonal storage at Modesto, recycled water could be stored for the 2 months of the year when diversion at WSID is not available. The stored recycled water could be discharged during the remaining 10 months of the year to enable DPWD to use all of Modesto's recycled water. Under this scenario, DPWD would utilize approximately 35 cfs of river diversion capacity at WSID for 10 months of year which translates into 21,200 AFY (or 29 cfs).

Turlock's recycled water would be diverted at PID's river diversion facility, which would require 16 cfs of capacity. PID has indicated that during peak irrigation demand months, there is uncertainty as to how much river diversion capacity could be made available to DPWD. Therefore, this alternative assumes that PID could provide 16 cfs of river diversion capacity to DPWD over 10 months of the year, which translates to approximately 9,700 AFY (or 13 cfs). The total recycled water that would be delivered to DPWD under this alternative would be approximately 31,000 AFY.

Table 7-7 provides a summary of design criteria for this alternative and Table 7-19 provides the estimated capital cost for DPWD to divert water at PID and WSID river diversion facilities.

Table 7-7: PID and WSID Dual River Diversion Design Criteria

Item	Design Criteria
Total WSID River Diversion Capacity (cfs)	350
Total PID River Diversion Capacity (cfs)	195
Assumed River Diversions by DPWD	
WSID River Diversion [1] (cfs)	29
PID River Diversion [2](cfs)	13
WSID Conveyance Upgrades to DMC	
Pipeline length (ft)	3,200
Assumed diameter	96-inch
PID Conveyance Upgrades to DMC	
Pipeline length (ft)	29,000
Assumed pipeline diameter	84-inch

Notes:

1. WSID would have the ability to divert 35 cfs over 10 months of the year for DPWD, which translates to an annual average value of 29 cfs and enables diversion of 21,200 AFY of recycled water from Modesto.
2. PID would have the ability to divert 16 cfs over 10 months of the year for DPWD, which translates to an annual average value of 13 cfs and enables diversion of 9,800 AFY per year of recycled water from Turlock.

For the purposes of developing preliminary budget numbers, the cost estimate for this option was based on the assumption that DPWD would pay the capital costs of diversion and conveyance facility upgrades at WSID and PID that are equivalent to the fraction of the facility capacity used. The operating costs provided by WSID ($44/AF for operating costs and $23/AF for labor and maintenance) and PID ($30/AF for operating and maintenance costs and an estimated $5/AF for labor costs) were used to estimate the annual costs for this alternative. O&M costs for this alternative would include the pumping, maintenance, and administrative costs for diverting recycled water from the San Joaquin River and conveying the water to the DMC at both facilities. An additional $30/AF was included for the costs associated with a Warren Act Contract or Exchange Agreement with Reclamation.

7.5 Alternative 4: Pipeline Conveyance of Recycled Water to Existing Facilities for Dilution and Conveyance in the DMC

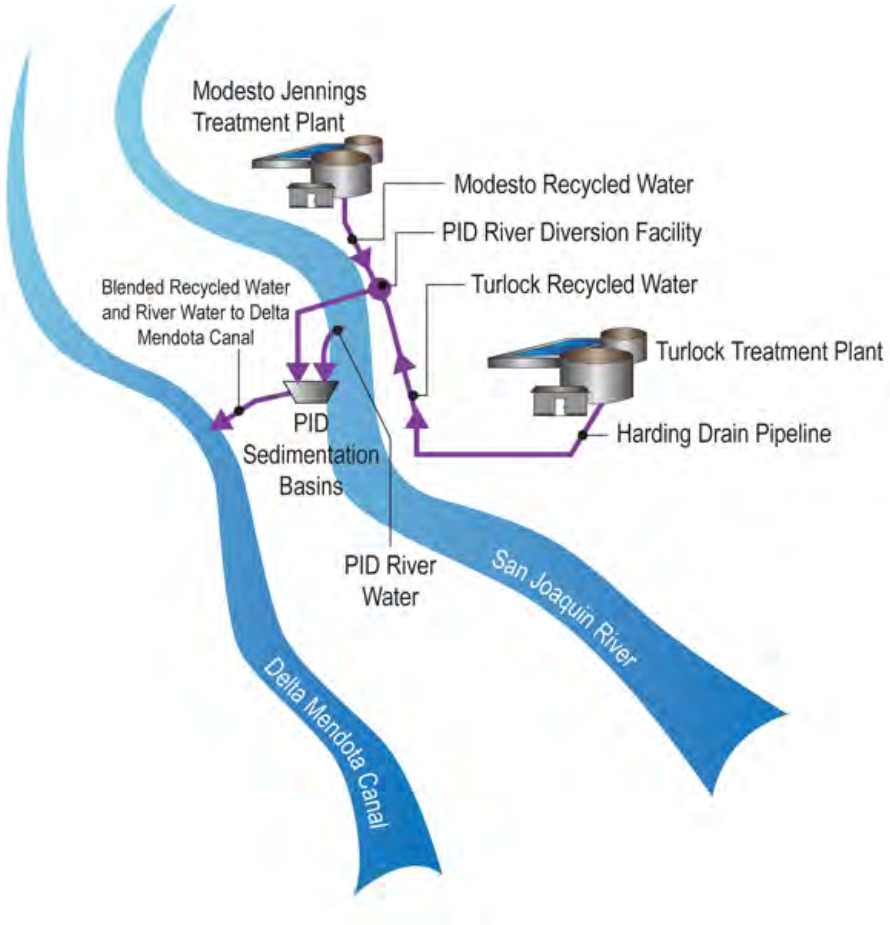
On August 30, 2013, PID issued a Proposal Solicitation to identify parties interested in participating in PID's East West Conveyance Project, which is designed to renovate, replace, modernize, and increase the capacity of PID facilities to more reliably meet the District's water demands, as well as increase the ability to wheel water supplies from the San Joaquin River or tributaries to the DMC.

The PID project is potentially considering several capacities beyond their current capacity of 195 cfs: 250, 350, and 500 cfs. These larger projects would require construction of a new fish screen and pumping facilities at the San Joaquin River.

Alternative 4 consists of directly conveying recycled water from the Modesto and Turlock tertiary treatment facilities via pipeline to the PID main lift canal or pipeline and participating in PID's East West Conveyance Project. Under this Alternative, the recycled water would be diluted with San Joaquin River water at either of these locations prior to being distributed to PID customers and/or to the DMC. The dilution ratio (river water: recycled water) would range from 2:1 to 4:1, based on a PID river diversion rate 195 cfs, and a recycled water rate of 81 cfs. The recycled water would then be further diluted in the

DMC. Figure 7-12 depicts dilution of the recycled water. Based on an average flow in the DMC of 4,000 cfs, the recycled water would represent less than 0.3% of flow in the DMC. Further dilution would occur in San Luis Reservoir, which has an approximate volume of 2 million AF.

Figure 7-12: Diluted Recycled Water Scenario



7.5.1 Alternative 4A: PID-1

PID-1 combines the Cities' project water east of the San Joaquin River along West Main Avenue. The alignment then crosses the San Joaquin River at Las Palmas Bridge and intersects with the PID Main Canal as shown in Figure 7-13. Table 7-8 shows the pump station information for the PID-1 alternative.

Table 7-8: PID-1 Pump Stations

Pump Stations	Brake Horsepower	Motor Size, hp	No. Duty Pumps	No. Standby Pumps
Modesto	56	100	1	1
Turlock	30	100	1	1
Combined	104	225	2	1

Modesto Alignment:

The proposed alignment from Modesto begins at the Modesto Recycled Water Facility off of Jennings Road. Following Jennings Road south, the alignment intersects with West Main Avenue.

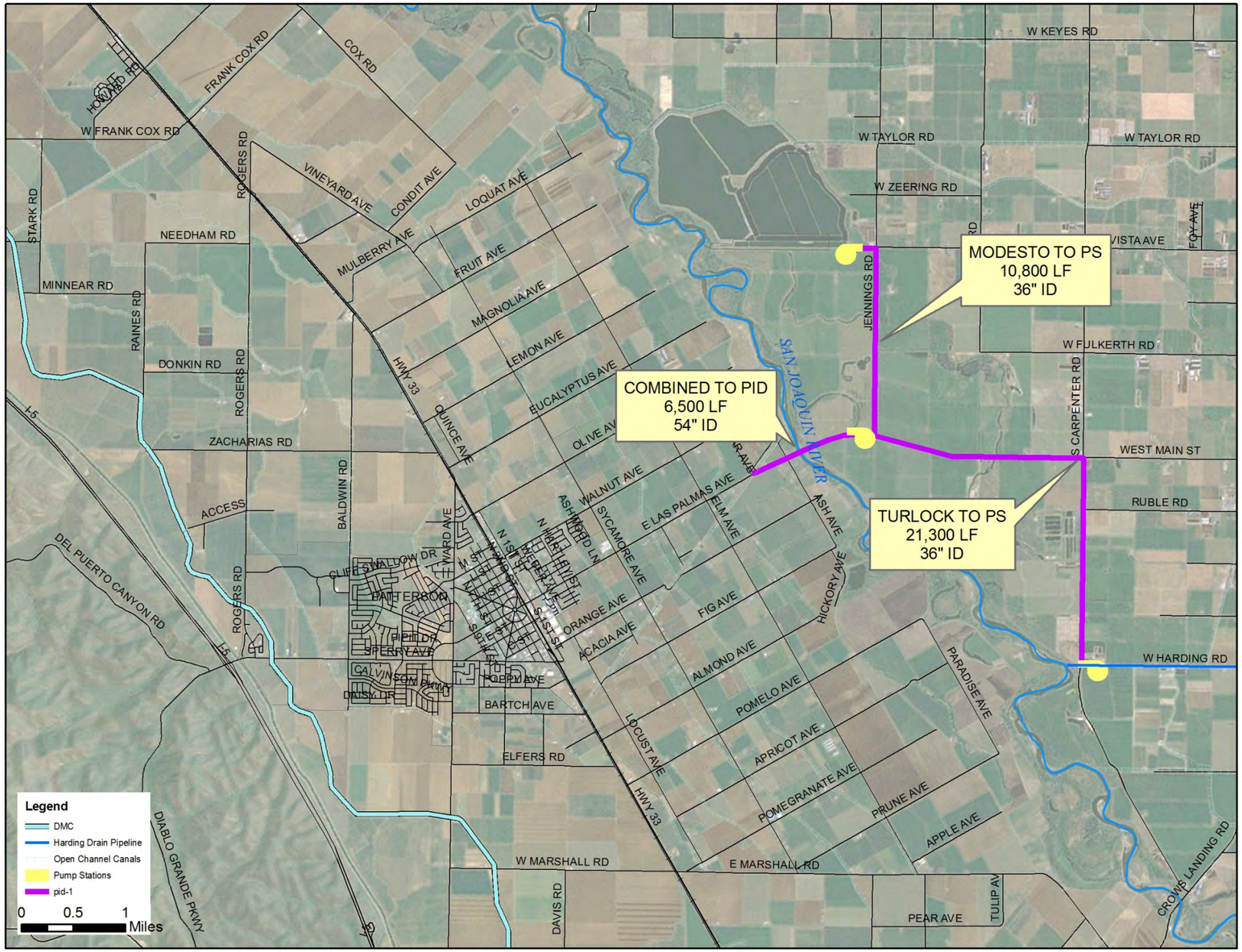
Turlock Alignment:

The proposed alignment from Turlock begins at the Harding Drain Pipeline terminus along the San Joaquin River. The alignment will head north along S. Carpenter Road until reaching West Main Ave. At West Main Ave, the alignment then heads west along West Main Ave to the intersection of Jennings Rd. and West Main Ave.

Combined Alignments:

At the intersection of Jennings Road and West Main Ave, the pipelines from Turlock and Modesto will be combined into one pipeline alignment and head west along West Main Ave. The alignment will continue west on West Main Avenue, crossing under the San Joaquin River near the Las Palmas Bridge. The road changes names from West Main Avenue to Las Palmas Avenue at the San Joaquin River. From the Las Palmas Bridge, the alignment continues west until reaching the intersection of the PID Main Canal and Las Palmas Avenue where it discharges into the PID Main Canal. This constitutes the terminus of the combined section of pipeline.

Figure 7-13: PID-1 Pipeline Conveyance Alternative



7.5.2 Alternative 4B: PID-2

PID-2 combines the Cities' recycled water west of the San Joaquin River at the PID Main Canal after both cities have crossed the San Joaquin River separately, as shown in Figure 7-14. Table 7-9 shows the pump station information for the PID-2 alternative.

Table 7-9: PID-2 Pump Stations

Pump Stations	Brake Horsepower	Motor Size, hp	No. Duty Pumps	No. Standby Pumps
Modesto	46	150	1	1
Turlock	95	225	2	1
Combined	-	-	-	-

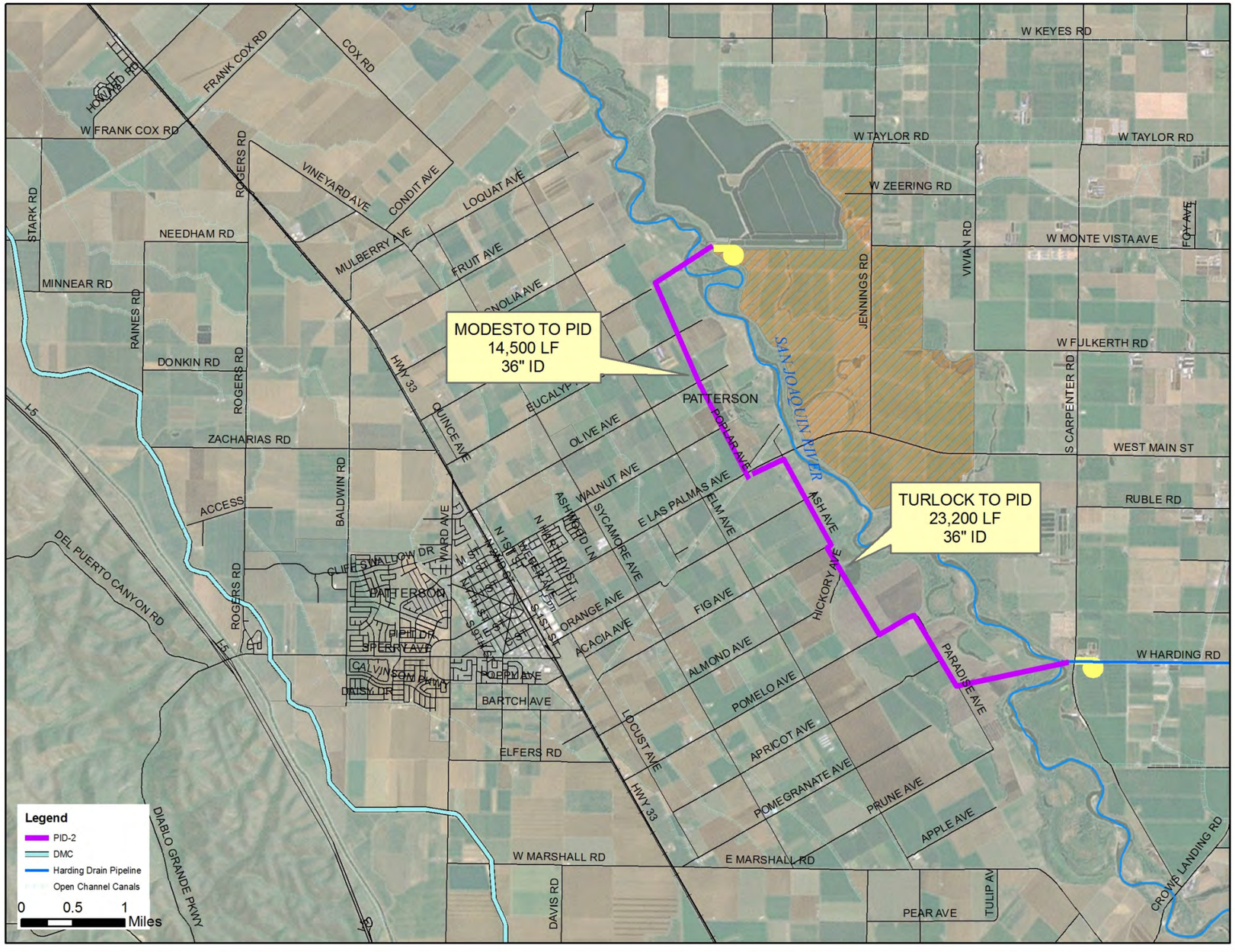
Modesto Alignment:

The proposed separate alignment from Modesto begins at the Modesto Recycled Water Facility at the discharge point along the San Joaquin River. The alignment immediately crosses under the San Joaquin River, heading west, until reaching Lemon Ave. From the end of Lemon Ave, the alignment would head southeast directly to the PID Main Canal, which constitutes the terminus of the Modesto Alignment.

Turlock Alignment:

The proposed separate alignment from Turlock begins at the Harding Drain outfall along the San Joaquin River. After tying into the Harding Drain (est. completion in 2014), the alignment immediately crosses under the San Joaquin River heading west towards Paradise Avenue. The alignment then heads northwest along Paradise Avenue until Paradise Avenue ends at Pomelo Avenue. The alignment would then head southwest along Pomelo Ave for approximately 1,500 ft. At this point, the alignment would head northwest directly to the PID Main Canal, which constitutes the terminus of the Turlock Alignment.

Figure 7-14: PID-2 Pipeline Conveyance Alternative



7.6 Alternative 5: Pipeline Conveyance of Recycled Water to the DMC Using Groundwater Storage and Operational Modifications

Alternative 5 consists of two components for delivering recycled water to DPWD, which are depicted in Figure 7-15. The first component requires determination of a schedule with Reclamation for delivery of recycled water to the DMC only when the O'Neil Pumping Plant is not operating to eliminate the potential delivery of recycled water into San Luis Reservoir. Currently, water from the DMC is pumped into O'Neil Forebay at times when downstream demands are lower than the amount of Delta water pumped at Jones Pumping Plant (see Figure 7-16). Conveyance of recycled water in the DMC when the O'Neil pumping plant is not operating would keep this water out of the Forebay and San Luis Reservoir which provides water to downstream potable water users. The second component requires storage of NVRRWP water in groundwater basins to provide seasonal storage during the periods when the O'Neil Pumping Plant is operational.

Figure 7-15: Groundwater Storage and Operational Modifications Scenario

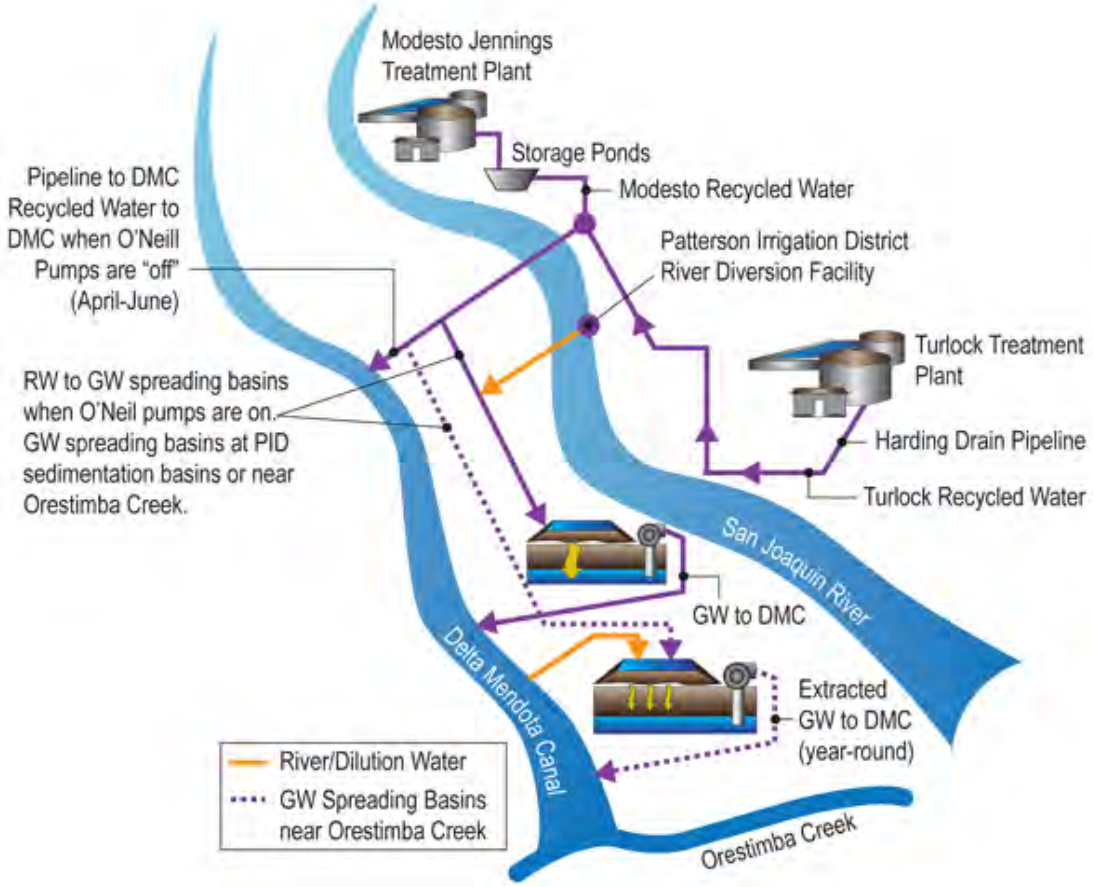
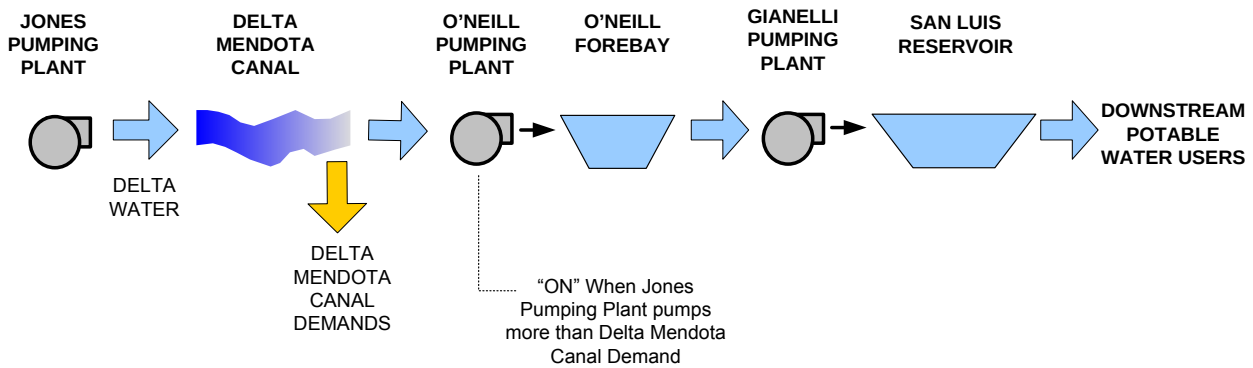


Figure 7-16: Existing Delta-Mendota Canal Operation



Based on the past 5 years of operating data from Reclamation, the O'Neil Pumps are typically off between April and June (approximately for 3 months) (Appendix N). It should be noted that the operation of the O'Neil Pumps varies from year to year and historically there has not been a set timeframe when the pumps are off; therefore, the key to this alternative is coordination with Reclamation and the SLDMWA to develop a standard schedule, taking into account operational changes that will occur when the intertie between the California Aqueduct and the DMC is operational. This alternative assumes that for three months per year, recycled water produced and stored in the Modesto ponds would be conveyed in the DMC for use by DPWD.

During the remainder of the year, recycled water would be diverted to spreading basins for soil aquifer treatment. Title 22 guidelines permit recycled water that is blended with an additional source of water (50- 75% blend) to be percolated into a groundwater basin. After a six-month residence time the water can be extracted from the ground and reused for potable and/or other purposes. Advanced treatment is not required for this scenario. Based on the preliminary review of groundwater conditions underlying DPWD, it was assumed that up to 15,000 AFY of diluted recycled water could be percolated into the groundwater basin using spreading basins. If a 50% dilution ratio is assumed, 7,500 AFY of recycled water could be stored in groundwater basin, extracted six-months later and conveyed in the DMC to DPWD customers.

For evaluation of this alternative, two potential spreading basin locations were identified. The gravel pit area near Orestimba Creek is believed to have good conditions for percolation and spreading basins. Dilution water for this alternative would come from the DMC through an exchange agreement with PID or WSID for 7,500 AFY of river water (during the off-peak demand season when diversion capacity exists). The water would be conveyed in the DMC, and put into the spreading basins. When the water is extracted from the ground, it would then be transferred back to WSID or PID. The second potential location for spreading basins is near PID's sedimentation basins/river diversion facility. This location would enable river water to be used for dilution water in the spreading basins. The range of capital costs for this alternative are based on spreading basins located in the Orestimba Creek area and those that could be located at PID's sedimentation/river diversion facility.

Figure 7-17 provides a water balance schematic of this alternative. Because recycled water must be blended with dilution water in the spreading basins, the amount of recycled water that can be diverted to the spreading basins is limited. Under this alternative, approximately 20,200 AFY of recycled water would be delivered to DPWD, which is less than the volume of recycled water that Modesto will produce in 2025. Therefore, this alternative assumes that only recycled water from Modesto would be used. There is potential that future regulations could reduce the blending requirements for the groundwater spreading basins, which would increase the amount of recycled water that could be delivered to DPWD. Therefore, if the regulations change, Turlock could be connected to the project.

A summary of design criteria and facilities required for the alternative is provided as

Table 7-10. The range of costs for this alternative is provided in Table 7-21.

As previously stated in reference to Alternative 2, there are a number of unknowns associated with groundwater banking at this time, including the true storage capacity of the aquifer, the soil and hydrogeologic conditions of the area, the percolation rate, and the regulatory requirements (e.g., need for dilution water, advanced treatment) for storage of recycled water in the groundwater aquifer. Due to these unknowns, it is recommended that additional information be obtained to better understand the soil, groundwater and hydrogeologic conditions in the area should groundwater banking be pursued as an option.

Figure 7-17: Alternative 5 Water Balance Schematic

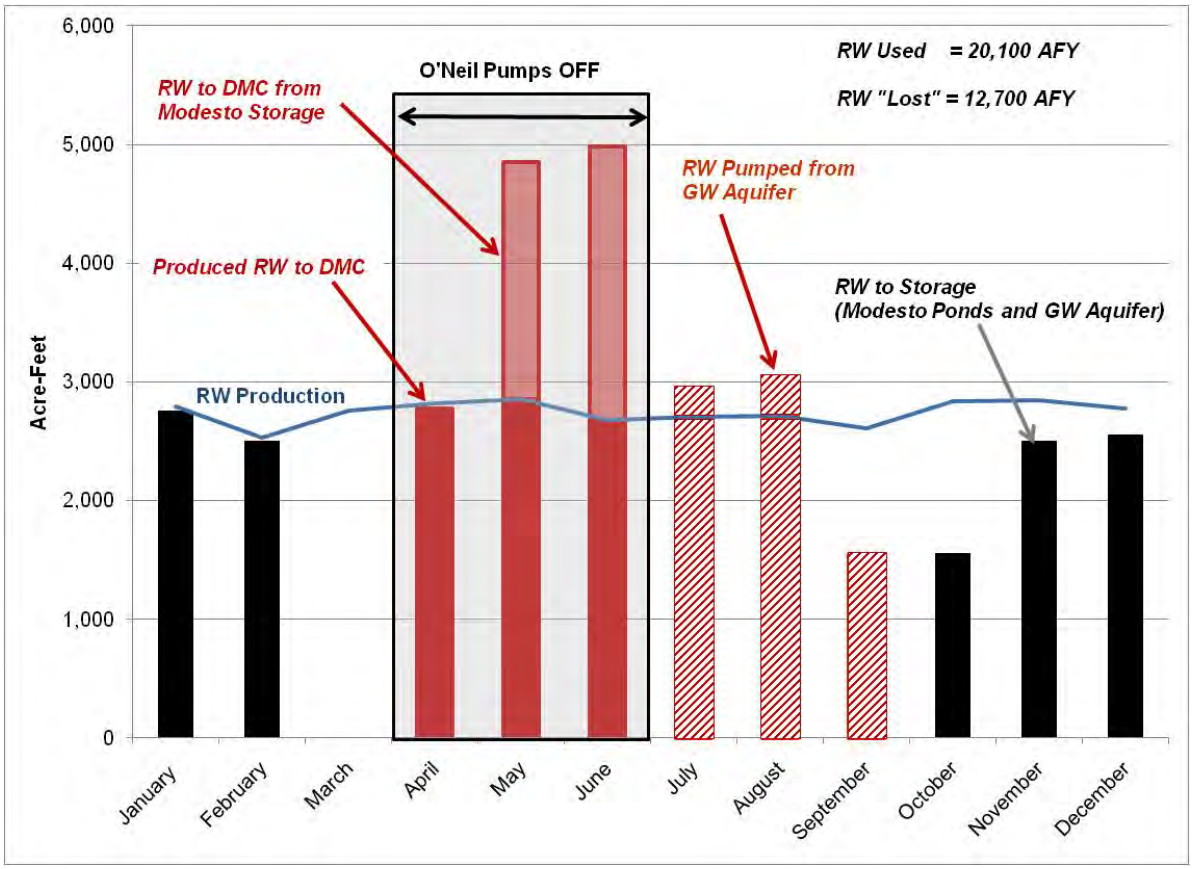


Table 7-10: Alternative 5 Design Criteria

Criteria	GW Spreading Basins At PID	GW Spreading Basins at Orestimba Creek
Modesto Pipeline		
Diameter	48-inch	48-inch
Distance	51,200 feet	51,200 feet
Pipeline to Orestimba Creek area		
Diameter (inch)		48
Distance (ft)	N/A	16,700
Distribution Pump Stations		
Pump Station 1 (HP)	3,500	3,500
Pump Station 2 (HP)	NA	500
Capacity of Upper Aquifer (AFY)	15,000	15,000
Spreading Basins		
Assumed Percolation Rate (ft/day)	1	1
Area Required for Spreading Basins	103	103
Dilution Percentage	50%	50%
Source of Dilution Water	River Water	DMC Water[1]
Timeline for RW Diversion to Basins	Oct - Feb	Oct - Feb
No. of Groundwater Extraction Wells	10	10
Pipeline from Groundwater Wells to DMC		
Diameter (inch)	42	--
Distance (ft)	20,000	--[2]
RW to the DMC		
Assumed Timeline (months)	Apr – June	Apr – June
RW Delivered to DMC (AF)	12,600	12,600
Seasonal Storage Volume (AF)	4,300	4,300

Notes:

1. Assumes an exchange agreement with WSID or PID could be reached for river water to be conveyed to Orestimba Creek area via the DMC.
2. This option assumes that the groundwater spreading area and associated groundwater extraction wells would be located in close proximity to the DMC to minimize pipeline costs. The cost associated with the construction of a pipeline from the extraction wells to the DMC is not considered to be significant and is not included at this time.

7.7 Evaluation of Alternatives

Alternatives 1 through 5 were evaluated to identify potential fatal flaws, identify key elements and features to be incorporated into the final alternative system design, and develop a preliminary construction cost estimate.

The following list summarizes the evaluation criteria:

- Technical feasibility
- Potential treatment upgrades
- Recycled water delivery
- Cost effectiveness
- Institutional issues and obstacles

For the alternatives evaluation, alternatives 2, 3 and 5 were evaluated during the first phase of this Feasibility Study, using 2015 and 2025 flow criteria and 2010 – 2012 dollars. As the Program transitioned to Phase 2, Alternatives 1 and 4 became the more viable alternatives and were thus looked into with greater scrutiny and evaluated using 2013 dollars.

7.7.1 Alternative 1 Evaluation

For the alternatives evaluation, alternatives 2, 3 and 5 were evaluated during the first phase of this Feasibility Study, using 2015 and 2025 flow criteria and 2010 – 2012 dollars. As the Program transitioned to Phase 2, Alternatives 1 and 4 became the more viable alternatives and were thus looked into with greater scrutiny and evaluated using 2013 dollars.

Cost

Table 7-11 provides the unit costs that are used in the evaluation of calculating Alternative 1 capital and operating costs.

Table 7-11: Alternative 1 Unit Costs

Item	Unit	Cost	Description / Example
Pipeline – Open Cut Field	$ / in dia/ LF	$12	Cross country and agricultural land alignments
Pipeline – Cut Road (non-residential)	$ / in dia/ LF	$14	Rural roads and parallel to roads with adequately sized shoulders
Pipeline – Cut Road (residential)	$ / in dia/ LF	$18	Heavy traffic roads, little to no shoulder PID Main Canal access road (narrow corridor)
Bore and Jack	$ / LF	$1,800	Crossing under lateral canals, major roads
River Crossing (HDD)[5]	$ / LF	$2,300	San Joaquin River, Las Palmas Bridge
Pump Station – Capital	$ / HP	HP x (15,570 x HP^-.442)[6]	Complete pump station
Pump Station – Energy	$ / kW-hr	$0.07	TID rate based on power usage between 500-2,999 kw demands
Easement Acquisition	$ / SF	$0.11	Assumes 25% of land value
Direct Pipeline Tie-ins to DPWD services	$ / EA	$10,000	Includes 40 LF of 10" piping, 10" tee, and 10" gate valve

In general, the total length of pipe is proportional to cost and complexity of the project, and should be minimized within other constraints. The acquisition of easements is also a potentially significant cost for the project. Where possible, pipelines should be aligned within public rights of ways or on lands owned by participating agencies. Operational costs include the cost of energy to operate new pumping stations, an allowance for equipment repair and replacement, and the costs to wheel the recycled water through the Bureau's DMC facilities, which are assumed to be $30/AF for this report.

The cost of water for the alternatives varies significantly depending on the type of financing that will be available for construction. Four financing scenarios have been evaluated:

- 100% of capital financed with a new Reclamation Low Interest Loan program. Terms assumed to be 1% interest rate over 30 years.
- 25% of capital financed with a Reclamation Grant. Remainder financed with Bond financing. Terms assumed to be 5% interest rate over 30 years.
- 100% of capital financed with an SRF Loan. Terms assumed to be 2.5% interest rate over 20 years.
- 25% of capital financed with a Reclamation Grant. Remainder financed with an SRF Loan. Terms assumed to be 2.5% interest rate over 20 years.

In all cases shown, a 100% low interest Reclamation loan results in the lowest cost of water.

Table 7-12 provides the associated capital and O&M costs associated with Alternative 1.

[5] HDD: Horizontal Directional Drill
[6] James M. Montgomery Consulting Engineers, INC. Cost Estimating Manual

Table 7-12: Alternative 1 Capital and O&M Costs

	DMC-1A (2018) Separate Pipelines to DMC (PID)	DMC-1B (2018) Separate Pipelines to DMC (Most Direct)	DMC-2 (2018) Combined Pipelines East	DMC-3 (2018) Combined Pipelines West	DMC-4 (2018) Combined @ Harding
Summary of Costs					
Capital Cost	$ 122,700,000	$102,400,000	$ 104,000,000	$ 99,000,000	$ 96,000,000
Annual O&M Costs	$ 1,500,000	$ 1,500,000	$ 1,600,000	$ 1,500,000	$ 1,500,000
Year	2018	2018	2018	2018	2018
Total Production, AFY	30,600	30,600	30,600	30,600	30,600
Cost of Water[7] under Various Financing Scenarios ($/AF)					
100% Reclamation Low Interest Loan, 1% over 30 years	$ 200	$ 180	$ 180	$ 180	$ 180
25% Reclamation Grant 75% Bond financing, 5% over 30 years	$ 240	$ 210	$ 210	$ 210	$ 200
SRF Loan, 2.5% over 20 year loan period	$ 310	$ 260	$ 270	$ 260	$ 230
25% Reclamation Grant 75% SRF Loan, 2.5% over 20 years	$ 240	$ 210	$ 210	$ 210	$ 200

[7] Unit cost of water calculated from NVRRWP facilities and O&M only and does not include costs associated with the treatment of water.

Constructability

Constructability of the pipeline must take into consideration the proposed construction methods and existing site conditions to assess the relative risk and cost of the project. A January 28, 2013 field visit of the proposed alignment forms the basis for this assessment of constructability. The following constructability issues have been identified for the NVRRWP Recycled Water Pipeline:

- San Joaquin River crossing (Las Palmas Bridge / Directional Drill)

  All alignment alternatives require one or two crossings of the San Joaquin River, depending on whether Modesto and Turlock cross separately or as a combined pipeline. All river crossings are assumed to be accomplished by horizontal directional drilling (HDD). This construction method avoids direct impact to the waterway, but requires launching and receiving pits on either side of the waterway and outside of the river levees. There is a possibility that those alternatives that cross the river at the Las Palmas Bridge could be constructed in coordination with the planned bridge replacement at this location. The bridge would be designed to support the weight of the pipeline. However, this memo assumes that all river crossings would be done by HDD.

- Existing utility interferences (natural gas transmission lines, petroleum gas lines, fiber optic, etc).

  Preliminary utility information was collected via an alignment field visit conducted on January 28, 2013. The proposed pipeline alignments run parallel and across a variety of underground and overhead utilities, including natural gas, fiber optic communication, cable, electricity, and water. Due to the rural location setting of the proposed project, most parcels are on septic systems, thus limiting the impacts of sewer mains on potential pipeline alignments, and no alignment conflicts with existing storm drain infrastructure.

  PG&E high-pressure natural gas transmission pipes are installed along Prune Avenue and Marshall Road. These pipes run parallel and occasionally cross underneath those roads. Due to the associated constructability issues associated with these high-pressure pipes, this corridor evaluation avoids alignments along Prune or Marshall.

  Recycled water pipelines must meet the State of California separation requirements. Preliminary and final design activities will confirm that separation meets the requirements. Title 22 separation standards for water, sewer, and recycled water pipelines call for 10 feet of horizontal clearance of recycled water lines to any parallel water or sewer pipeline. Vertical clearance requirements are one foot below any water line and one foot above any sewer line. Special construction details apply inside 10 feet and 4 feet from a parallel water line, and between one foot and 4 inches vertically for crossings. Special permission from the state and local health agencies may be required. Signs of underground utilities, as well as other constructability issues, were noted along the length of the proposed alignments.

  Most utilities in the project area can be avoided by selecting pipe corridors that slot between these utilities, or constructing the pipeline in the shoulder of the roadway; precise pipeline locations will be determined during final design. The alignments shown avoid known major utility conflicts.

- Irrigation canal crossings

  There are numerous irrigation canals throughout the project area; it will be necessary to cross these canals on most alignments. Crossing methods may vary. If a canal is in use when the crossing takes place, it may be necessary to tunnel beneath the crossing or to bypass pump canal water over the crossing area to allow open cut construction. If the canal is not in use, open cut construction followed by canal reconstruction may be possible without bypass. Cost estimates for this evaluation assume open-cut construction/restoration.

- State Highway 33 crossing

  All alignment alternatives with the DMC as the final destination require one or two crossings of Highway 33, depending on whether Modesto and Turlock cross separately or combined at this location. Similar to the San Joaquin River crossing, the highway crossing is anticipated to be accomplished by HDD.

- California Northern Railroad Company (CFNR) crossing

  Primarily a transporter of food and agricultural commodities, the CFNR parallels the east side of Highway 33 through much of the San Joaquin Valley, and spans the extent of the NVRRWP project bounds. Similar to the State Highway 33 crossing, the CNFR crossing is anticipated to be accomplished by HDD. The center line of Highway 33 is approximately 75 ft apart from the center line of the CFNR. Due to the proximity of the highway to the CNFR, it is assumed that a single HDD will be sized to span both crossings.

- Narrow construction corridor along Patterson Irrigation District Canal and various roads.

  While much of the PID canal is served by a wide, gravel access road suitable for open cut construction, the available area varies along the length of the canal. It is assumed that an open cut corridor can be located within the available space; however this must be confirmed during final design. Embankments on either side of the canal will require shoring and settlement monitoring to protect the integrity of the canal where the alignment cannot be sited a sufficient distance from the canal. Geotechnical investigations conducted prior to final design will aid in selecting appropriate clearances and shoring requirements.

  PID is also in progress to either upgrade their facilities which may include increased capacity. This could potentially further the complexity of including the NVRRWP pipeline through the PID right-of-way.

- Environmental and Permitting impacts/requirements

  No environmental review has been completed as part of this evaluation. However, it is generally expected that the most significant environmental concerns will center on impacts to the San Joaquin River and other waterways or wetlands. Crossing of the river is addressed through trenchless technologies. Proposed alignments avoid other waterways (creeks, etc.) and lie within county roads or cultivated farmland. A full environmental review will be required to identify wetlands or sensitive habitats/species.

  Additional permitting will be required for the crossing of Highway 33 and the CFNR, work encroaching into local roadways (City of Patterson/Stanislaus County), and work impacting facilities of operated by any local jurisdiction, including the PID irrigation canals.

- Traffic Impacts

  Most of the roads in the project area are rural in nature, which will permit lane closures or road closures with minimal impact (though these must still be coordinated with local businesses and agricultural operations). However, West Main Avenue / Las Palmas Avenue is a high traffic area, and construction on this two-lane road will require significant traffic control, including potential detours and/or temporary signals depending on the final pipeline location along the road. If possible, aligning the pipeline in the shoulder right of way area would be recommended, though this may not be possible when the roadway is raised on an embankment.

Schedule

A preliminary project schedule shows completion of construction in early 2018, if construction begins by 2015. This completion date coincides with completion of the expansion of the Modesto tertiary facilities. However, there may be opportunities to accelerate this schedule to convey the flows from Turlock since

the tertiary treatment facilities there are already in operation and the City is currently discharging tertiary treated flows to the San Joaquin River.

Alternatives

A site visit to the project area was performed on January 28, 2013 to evaluate a number of potential corridors within Stanislaus County and make note of constraints and utilities that may constrain pipeline alignments.

Using the information gained from the field visit, a total of eight alternative alignments/corridor options were developed. The proposed project will convey tertiary treated, recycled water from both the City of Turlock and City of Modesto recycled water production facilities to the DMC.

7.7.2 Alternative 2 Evaluation

Alternative 2 consists of four alternatives that convey NVRRWP water to DPWD directly via a pipeline. Table 7-13, Table 7-14, Table 7-15, and Table 7-16 provide the capital and operating costs associated with Alternative 2.

Table 7-13: Pipeline Scenario 2A Cost Estimate[1]

Item	2015 Recycled Water Delivery	2025 Recycled Water Delivery
Capital Cost [3]	$168,400,000	$175,400,000
Annual O&M[2,3]	$2,100,000	$2,600,000
Grants (25%)	$38,900,000	$40,600,000
Annualized Capital and O&M (without grants)[4]	$13,100,000	$14,000,000
Annualized Capital and O&M (with grants) [4]	$10,300,000	$11,200,000
Recycled Water Produced	19,800	23,700
Unit Cost (without grants)[5]	$660/AF	$590/AF
Unit Cost (with grants) [5]	$520/AF	$470/AF
Cost of Advanced Treatment with grants[6]	N/A	N/A
Total Unit Cost with advanced treatment (with grants)	N/A	N/A

Notes:
1. Detailed cost estimates are provided in Appendix M.
2. O&M costs include power costs ($0.12/kWh), labor, maintenance, and equipment replacement.
3. Costs were escalated to June 2012 (24 months) at an escalation rate of 4%.
4. Capital costs were annualized over 30 years at an interest rate of 5%.
5. Cost of recycled water includes annualized capital costs, and annualized O&M costs, divided by the recycled water produced per year.
6. Advanced treatment would not be necessary with this alternative.

Table 7-14: Pipeline Scenario 2B Cost Estimate

Item	2015 Recycled Water Delivery	2025 Recycled Water Delivery
Capital Cost [3]	$274,100,000	$349,100,000
Annual O&M[2,3]	$1,800,000	$3,600,000
Grants (25%)	$63,400,000	$80,700,000
Annualized Capital and O&M (without grants)[4]	$20,600,000	$26,300,000
Annualized Capital and O&M (with grants) [4]	$16,200,000	$20,600,000
Recycled Water Produced	25,700	32,900
Unit Cost (without grants)[5]	$800/AF	$800/AF
Unit Cost (with grants) [5]	$630/AF	$630/AF
Cost of Advanced Treatment (with grants)[6]	N/A	N/A
Total Unit Cost with Advanced Treatment (with grants)	N/A	N/A

Notes:

1. Detailed cost estimates are provided in Appendix M.
2. O&M costs include power costs ($0.12/kWh), labor, maintenance, and equipment replacement.
3. Costs were escalated to June 2012 (24 months) at an escalation rate of 4%.
4. Capital costs were annualized over 30 years at an interest rate of 5%.
5. Cost of recycled water includes annualized capital costs, and annualized O&M costs, divided by the recycled water produced per year.
6. Advanced treatment would not be necessary with this alternative.

Table 7-15: Pipeline Scenario 2C Cost Estimate

Item	2015 Recycled Water Delivery	2025 Recycled Water Delivery
Capital Cost [3]	$125,000,000	$131,000,000
Annual O&M[2,3]	$1,700,000	$2,100,000
Grants (25%)	28,900,000	$30,300,000
Annualized Capital and O&M (without grants)[4]	$9,800,000	$10,600,000
Annualized Capital and O&M (with grants) [4]	$7,800,000	$8,500,000
Recycled Water Produced	17,400	20,400
Unit Cost (without grants)[5]	$560/AF	$520/AF
Unit Cost (with grants) [5]	$450/AF	$420/AF
Cost of Advanced Treatment (with grants)[6]	N/A	N/A
Total Unit Cost with Advanced Treatment (with grants)	N/A	N/A

Notes:
1. Detailed cost estimates are provided in Appendix M.
2. O&M costs include power costs ($0.12/kWh), labor, maintenance, and equipment replacement.
3. Costs were escalated to June 2012 (24 months) at an escalation rate of 4%.
4. Capital costs were annualized over 30 years at an interest rate of 5%.
5. Cost of recycled water includes annualized capital costs, and annualized O&M costs, divided by the recycled water produced per year.
6. Advanced treatment would not be necessary with this alternative.

Table 7-16: Pipeline Scenario 2D Cost Estimate

Item	2015 Recycled Water Delivery
Capital Cost [3]	$143,400,000
Annual O&M[2,3]	$1,400,000
Grants (25%)	33,200,000
Annualized Capital and O&M (without grants)[4]	$10,700,000
Annualized Capital and O&M (with grants) [4]	$8,400,000
Recycled Water Produced	12,200
Unit Cost (without grants)[5]	$880/AF
Unit Cost (with grants) [5]	$690/AF
Unit Cost of Advanced Treatment (with grants)[6]	N/A
Total Unit Costs with Advanced Treatment (with grants)	N/A

Notes:
1. Detailed cost estimates are provided in Appendix M.
2. O&M costs include power costs ($0.12/kWh), labor, maintenance, and equipment replacement.

3. Costs were escalated to June 2012 (24 months) at an escalation rate of 4%.
4. Capital costs were annualized over 30 years at an interest rate of 5%.
5. Cost of recycled water includes annualized capital costs, and annualized O&M costs, divided by the recycled water produced per year.
6. Advanced treatment would not be necessary with this alternative

In general, the total length of pipe is proportional to cost and complexity of the project, and should be minimized within other constraints. The acquisition of easements is also a potentially significant cost for the project. Due to solely consisting of pipeline, Alternative 2 was deemed too complex and cost prohibitive in order to move forward.

7.7.3 Alternative 3 Evaluation

Alternative 3 consists of three alternatives that utilize existing operations and facilities in order to convey NVRRWP water to the DMC. Table 7-17, Table 7-18, and Table 7-19 break down the costs associated with Alternative 3.

Table 7-17: Alternative 3A - BCID River Diversion Cost Estimate

Item	Cost
Capital Cost [3] (Purchase 33,000 shares of Expanded BCID Facility)	$ 37,100,000
Total Annual O&M[2,3]	$ 1,700,000
Grants (25%)	$ 8,575,000
Annualized Capital Costs (without grants)[5]	$ 4,100,000
Annualized Capital Costs (with grants)[5]	$ 3,500,000
Recycled Water Produced (AFY)	32,900
Unit Cost (without grants)[6]	$120/AF
Unit Cost (with grants)[6]	$110/AF
Unit Cost of Advanced Treatment with Grants	$900/AF
Recycled Water Produced with Advanced Treatment (AFY)[6]	31,600
Unit Cost with Advanced Treatment (with grants)	$1010/AF

Notes:
1. Detailed cost estimates are provided in Appendix M.
2. O&M costs include $19/AF for operating costs (provided by BCID), a $10/AF allowance for labor and maintenance, and a $20/AF allowance for agreements with the Bureau of Reclamation.
3. Costs were escalated to June 2012 (24 months) at an escalation rate of 4%.
4. Capital costs were annualized over 30 years at an interest rate of 5%.
5. Cost of recycled water includes annualized capital costs, and annualized O&M costs, divided by the recycled water produced per year.
6. Advanced treatment for river discharge assumes 50% of recycled water is treated with RO. Reduction in recycled water production is due to assumed 80% recovery rate of water through RO. It was assumed that Modesto would increase recycled water treatment facilities to deliver 21,200 AFY, and Turlock would deliver 10,400 AFY of recycled water to DPWD.

Table 7-18: Alternative 3B – WSID River Diversion Cost Estimate

Item	Cost
Capital Cost [3]	$ 1,800,000
Annual O&M Costs[2,3]	$ 3,100,000
Grants (25%)	$ 425,000
Annualized Capital and O&M (without grants)[4]	$3,220,000
Annualized Capital and O&M (with grants)[4]	$ 3,200,000
Recycled Water Produced (AFY)[5]	30,500
Unit Cost (without grants)[6]	**$110/AF**
Unit Cost (with grants)[6]	**$100/AF**
Cost of Advanced Treatment with Grants	$900/AF
Recycled Water Produced with Advanced Treatment (AFY)[7]	29,600
Total Unit Cost with Advanced Treatment (with grants)	**$1,000/AF**

Notes:

1. Detailed cost estimates are provided in Appendix M.
2. O&M costs include $44/AF for operating costs (provided by WSID), a $23/AF allowance for labor and maintenance (provided by WSID), and a $20/AF allowance for agreements with the Bureau of Reclamation.
3. Costs were escalated to June 2012 (24 months) at an escalation rate of 4%.
4. Capital costs were annualized over 30 years at an interest rate of 5%.
5. It was assumed that Modesto would use seasonal storage to discharge 21,200 AFY over 10 months. Turlock would deliver 9,300 AFY over 10 months.
6. Cost of recycled water includes annualized capital costs, and annualized O&M costs, divided by the recycled water produced per year.
7. Advanced treatment for river discharge assumes 50% of recycled water is treated with RO. The cost of advanced treatment was added to the capital and operating costs of the alternative and divided by the reduced estimate of recycled water production. Recycled water produced with advanced treatment was assumed to be 29,500 AFY due to loss of recycled water through RO (80% recovery assumed). It is assumed that Modesto would increase recycled water treatment facilities to produce 21,200 AFY per year of advanced treated recycled water and Turlock would deliver approximately 8,400 AF of advanced treated recycled water.

Table 7-19: Alternative 3C - PID and WSID Dual River Diversion Cost Estimate

Item	Cost
Capital Costs[3]	$ 7,800,000
Annual O&M Costs [2,3]	$2,400,000
Grants (25%)	$ 1,950,000
Annualized Capital and O&M (without grants)[4]	$3,150,000
Annualized Capital and O&M (with grants)[4]	$ 3,000,000
Recycled Water Produced (AFY)	31,000
Unit Cost (without grants)[5]	$100/AF
Unit Cost (with grants)[5]	$100/AF
Unit Cost of Advanced Treatment (with grants)	$900/AF
Recycled Water Produced with Advanced Treatment (AFY)[6,7]	29,500
Total Unit Cost with Advanced Treatment (with grants)[7]	$1,000/AF

Notes:

1. Detailed cost estimates are provided in Appendix M.
2. O&M costs for diversion of water at WSID were assumed to be $44/AF for operating costs and $23/AF for labor and maintenance costs (provided by WSID). O&M costs for diversion at PID's facilities were assumed to be $30/AF for operating and maintenance costs (provided by PID), and an assumed $5/AF for labor costs. An additional $20/AF was included for agreements with the Bureau of Reclamation.
3. Costs were escalated to June 2012 (24 months) at an escalation rate of 4%.
4. Capital costs were annualized over 30 years at an interest rate of 5%.
5. Cost of recycled water includes annualized capital costs, and annualized O&M costs, divided by the recycled water produced per year.
6. Advanced treatment for river discharge assumes 50% of recycled water is treated with RO. The cost of advanced treatment was added to the capital and operating costs of the alternative and divided by the reduced estimate of recycled water production.

Reduction in recycled water production is due to assumed 80% recovery rate of water through RO. It was assumed that Modesto would increase recycled water treatment facilities to produce 21,200 AFY per year of advanced treated recycled water. Turlock would be unable to do this and would produce approximately 8,000 AFY of recycled water.

Due to the likely requirement of increasing water treatment for both Cities and associated capital improvements necessary, Alternative 3 is considered infeasible.

7.7.4 Alternative 4 Evaluation

Alternative 4 consists of two alternatives that convey NVRRWP water to the existing PID Main Canal in order to utilize their facilities for DMC conveyance. Table 7-20 provides the capital and operating costs associated with Alternative 4.

Table 7-20: Alternative 4 Cost Estimate

	PID-1 (2018) PID East	PID-2 (2018) PID West
Summary of Costs		
Capital Cost	$ 41,600,000	$ 64,000,000
Annual O&M Costs	$ 3,400,000	$ 3,300,000
Year	2018	2018
Total Production, AFY	30,600	30,600
Cost of Water under Various Financing Scenarios		
100% Reclamation Low Interest Loan, 1% over 30 years	$ 180	$ 170
25% Reclamation Grant 75% Bond financing, 5% over 30 years	$ 200	$ 200
SRF Loan, 2.5% over 20 year loan period	$ 230	$ 250
25% Reclamation Grant 75% SRF Loan, 2.5% over 20 years	$ 200	$ 200

[1]The costs associated with Alternative 4 do not include shared capital costs with PID improvements.

Alternative 4 would reduce the amount of required pipeline length required, thus reducing total capital costs for the Program. However, a number of potential fatal flaws have been identified.

- PID routinely ceases pumping and operation of their Main Canal for approximately 4-6 weeks each year for routine sedimentation basin clearing and maintenance. With the limited storage at Modesto comprising as the only storage within the NVRRWP, the operational constraints of PID would hinder the ability for the Cities to discharge their effluent.
- Recent discussions with the RWQCB have indicated that mixing rations of PID Main Canal Water with NVRRWP water would require PID to comply with Title 22 Recycled Water regulations. Subsequent discussions with PID have indicated that the land owners and growers of the district may not be in favor of such indications and regulations.

Due to the potential fatal flaws, Alternative 4 is considered infeasible.

7.7.5 Alternative 5 Evaluation

Alternative 5 consists of groundwater banking and storage of NVRRWP program water. Table 7-21 provides the capital and operating costs associated with Alternative 5.

Table 7-21: Alternative 5 Cost Estimate

Item	Cost with Spreading Basins at PID	Cost with Spreading Basins at Orestimba Creek
Capital Cost[3]	$ 128,400,000	$ 129,900,000
Annual O&M[2]	$ 2,700,000	$ 3,600,000
Grants (25%)	$29,700,000	$ 30,000,000
Annualized Capital + O&M (without grants)[4]	$11,100,000	$12,100,000
Annualized Capital + O&M Costs (with grants)[4]	$9,000,000	9,900,000
Recycled Water Production, AFY	20,200	20,200
Unit Cost (without grants) [5]	$550/AF	$600/AF
Unit Cost (with grants) [5]	$450/AF	$490/AF
Cost of Advanced Treatment (with grants)	N/A	N/A
Total Unit Cost (with grants)	N/A	N/A

Notes:

1. Detailed cost estimates are provided as Appendix M.
2. O&M costs include power costs ($0.12/kWh), labor, maintenance, equipment replacement, and agreements with the Bureau of Reclamation ($20/AF).
3. Costs were escalated to June 2012 (24 months) at an escalation rate of 4%.
4. Capital costs were annualized over 30 years at an interest rate of 5%.
5. Cost of recycled water includes annualized capital costs, and annualized O&M costs, divided by the recycled water produced per year.

Alternative 5 utilizes the local groundwater resources as well as positively impacts the groundwater levels in the surrounding area. However, potential fatal flaws have been identified with Alternative 5.

- Groundwater location: DPWD supplements their CVP allocations with groundwater from the northern area of the district. The feasibility of conveying program water to the spreading basins in the north as well as constructing the spreading basins would be cost prohibitive.
- Groundwater quality has been decreasing in recent years, and once mixed with NVRRWP project water, it is likely that the program will not meet the DMC Pump-in Program requirements.

Due to the potential fatal flaws of Alternative 5, this alternative is considered infeasible.

Table 7-22: Alternatives Analysis

Criteria	Alternative 1: Conveyance in the DMC	Alternative 2B: Pipeline Conveyance to DPWD[1]	Alternative 3: River Conveyance and Diversion	Alternative 4: Dilution and Conveyance via the PID to the DMC	Alternative 5: DMC Operational Changes with Groundwater Aquifer Treatment
Alternative Summary	Convey 2018, 2045 recycled water flows in a pipeline to the DMC	Convey 2018 recycled water flows in a pipeline to the southern and central area of DPWD, with additional storage	Divert recycled water from the San Joaquin River at a modified diversion facility at WSID, PID or BCID	Divert recycled water to PID's sedimentation basins or main canal for dilution with river water; convey diluted recycled water to the DMC	Divert recycled water into the DMC when the O'Neil Pumps are Off; infiltrate diluted recycled water to groundwater and extract 6 months later for conveyance in the DMC.
Recycled Water Delivered in 2018 (AFY)	30,600	25,700	30,600	30,600	20,200
Unit Cost without Advanced Treatment ($/AF)[2]	$180 - $240/AF	$630/AF	$100/AF Additional cost of Advanced Treatment could be required to meet future discharge regulations	$150/AF Not including cost of PID Upgrades	$450 – 490/AF
Unit Cost with Advanced Treatment ($/AF)	$1,800/AF	$630/AF	$1,000/AF	$1,750/AF	$450 – 490/AF
Technical Feasibility	+	+	+	+	- It may be difficult to coordinate and implement recycled water discharge to the DMC only when the O'Neil Pumping Plant is off.
Potential to Avoid Additional Treatment Costs	+	+	- Advanced treatment could be required to meet future discharge regulations	+	+
Maximizes Recycled Water Delivery	+	-	+	+	- Modification of DMC operations and/or reduction in the % dilution required for groundwater infiltration would increase the amount of recycled water that could be delivered
Ability to Deliver Water District-Wide	+	-	+	+	+
Cost Effectiveness	+	-	+	+	-

Criteria	Alternative 1: Conveyance in the DMC	Alternative 2B: Pipeline Conveyance to DPWD[1]	Alternative 3: River Conveyance and Diversion	Alternative 4: Dilution and Conveyance via the PID to the DMC	Alternative 5: DMC Operational Changes with Groundwater Aquifer Treatment
Institutional Issues/Obstacles	• - • • Requires coordination/permitting with Reclamation for use of DMC • Easements required for pipeline construction • Requires SWRCB permit for discharge into DMC • Some uncertainty whether additional treatment may be required for introduction of recycled water into San Luis Reservoir	• + • Easements required for pipeline construction • Requires modification of customer turnouts to accept irrigation water from pipeline rather than DMC. • Limits the availability of the Modesto storage facilities to serve as secondary effluent storage. If Modesto storage not available, requires construction of large seasonal storage reservoir. •	• + • Requires institutional agreements with BCID, WSID and/or PID • Requires SWRCB permit for DMC conveyance • Likely to require advanced treatment for continued river discharge. •	• - • This alternative increases the number of project stakeholders. • May trigger the need for PID to comply with Title 22 recycled water distribution requirements. • Requires coordination/permitting with Reclamation for use of DMC • Easements required for pipeline construction • Requires SWRCB permit for discharge into DMC • Some uncertainty whether additional treatment may be required for introduction of recycled water into San Luis Reservoir	• - • Requires coordination/permitting with Reclamation for use of DMC • Easements required for pipeline construction • Some uncertainty whether additional treatment may be required for introduction of recycled water into groundwater • Requires operational coordination with the San Luis Reservoir to deliver water only when the San Luis Reservoir pump station is not operational.

Notes:
+ Indicates the alternative meets the criteria /objective
- Indicates the alternative does not meet the criteria/objective
0 Neutral or indicates that sufficient information does not exist to determine

1. Alternative 2B is the pipeline alternative included in this summary table.

7.8 Recommended Alternative

Based on the evaluation of alternatives, Alternative 1 is the recommended option for the NVRRWP. Alternative 1 is technically feasible, avoids requirements for additional treatment upgrades, can convey all of the anticipated recycled water production at project buildout, uses the CVP facilities to provide seasonal storage, allows for delivery to all DPWD lands, is cost-effective compared to the other alternatives and currently has no identified fatal flaws from an institutional perspective.

Within Alternative 1 it is recommended that two scenarios, DMC 1-B and DMC-4, be carried forward to the next phase of project DMC-1B is recommended because it allows each City to implement its recycled water system independently and it is the lower cost of the separate pipeline scenarios. DMC-4 is recommended because it is overall the lowest cost scenario in Alternative 1. The decision between these two scenarios will be based on more detailed evaluation of institutional agreements and project funding that will occur in the next project phase.

Figure 7-18: Recommended Alternative: Alternative 1 – Subalternative DMC-1B

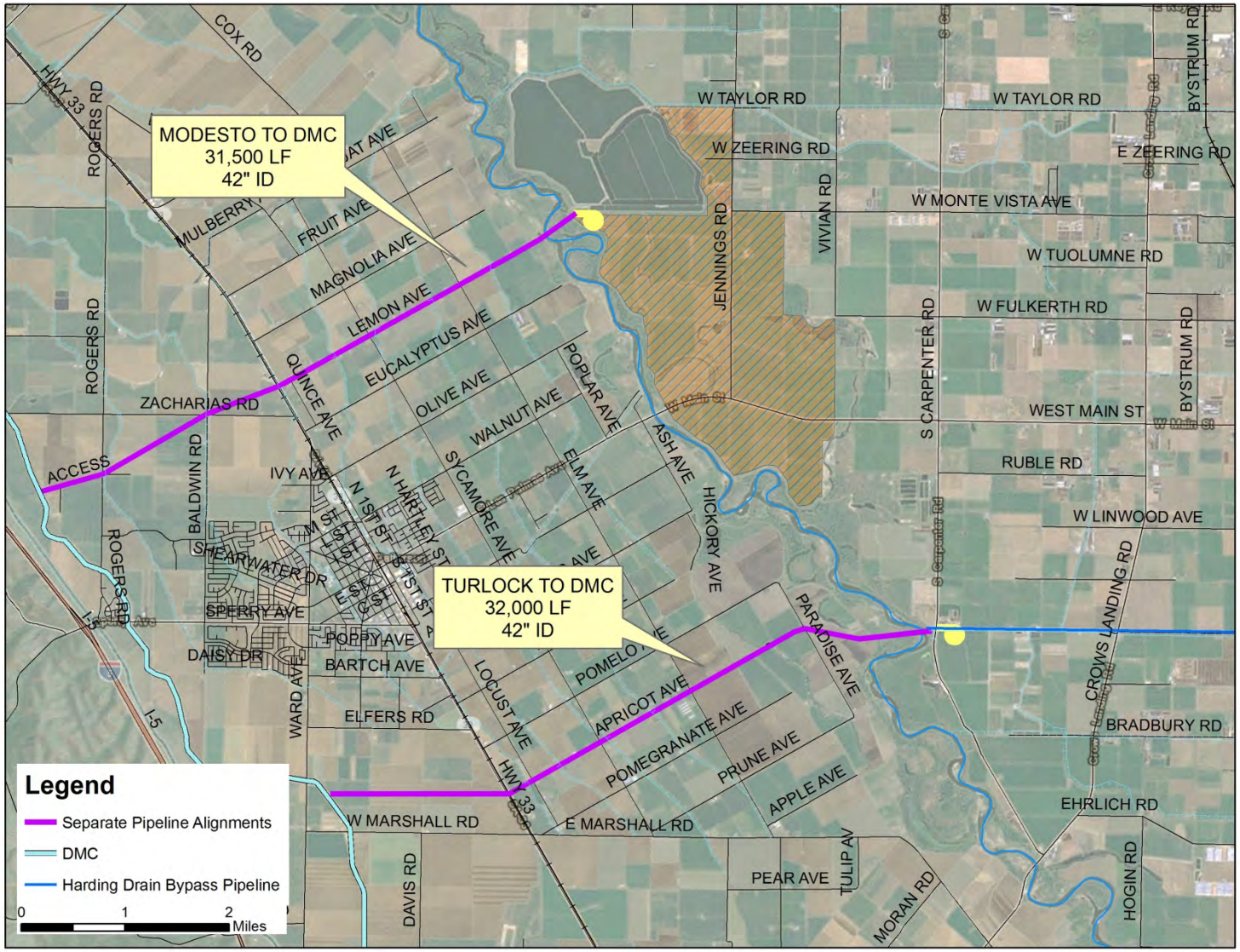
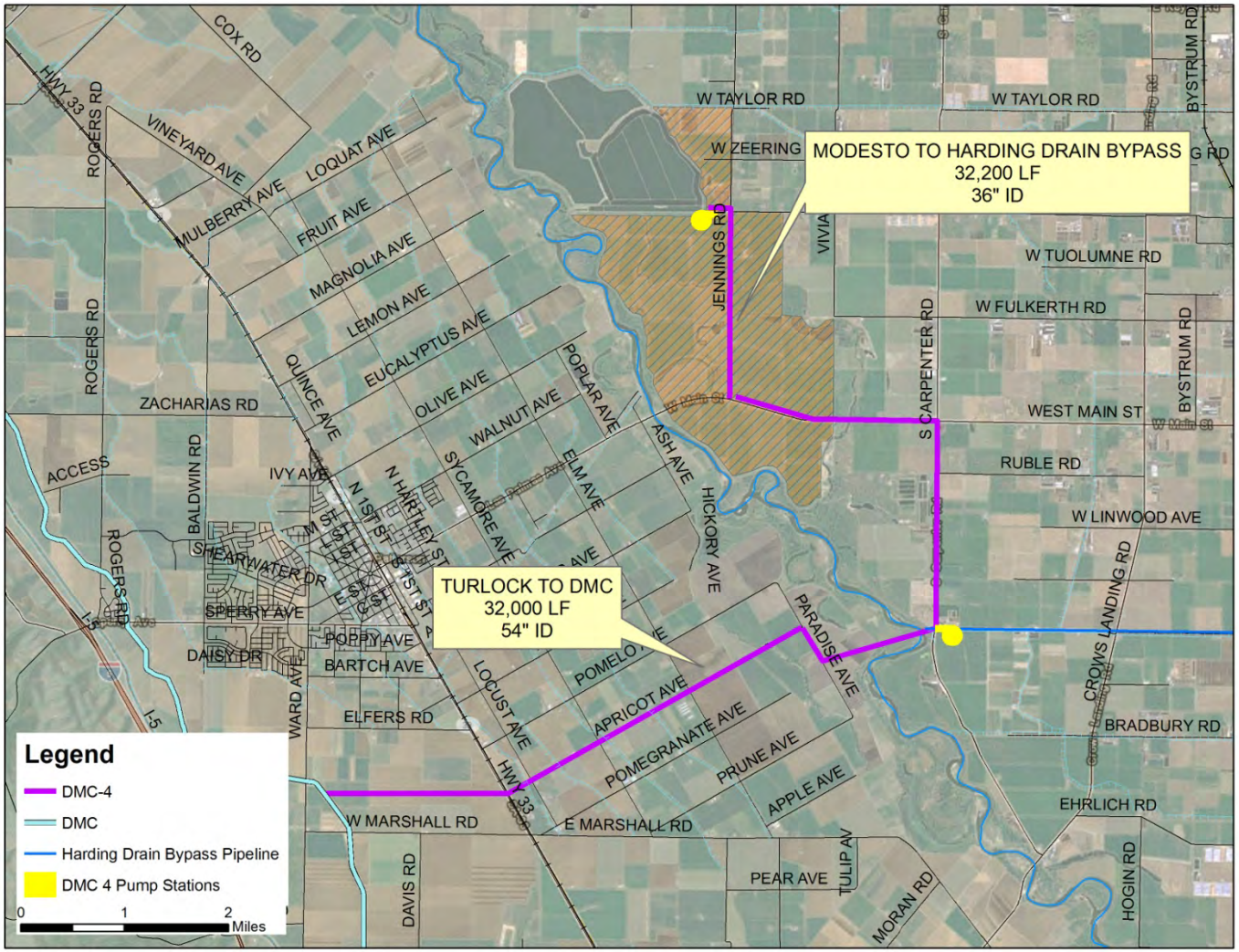


Figure 7-19: Recommended Alternative: Alternative 1 – Subalternative DMC-4



Chapter 8 Stakeholder Outreach

8.1 Outreach Conducted to Date

The program partners have initiated numerous outreach efforts, with the intent of providing program updates and informing local, regional, and state level stakeholders. Table 8-1 provides a summary of agencies and entities contacted and the status of those contacts.

Table 8-1: Entities and Agencies Contacted

Agency	Contact Notes
DPWD Land Owners / Growers	Joint Grower and Landowner meetings Board Meetings and Workshops
San Luis and Delta-Mendota Water Authority	Continuing communication
USBR	Continuing communication
Turlock and Modesto City Councils	Continuing Communication
RWQCB	Continuing Communication
SWRCB	Continuing Communication
CDPH	Contact initiated, confirming RWQCB permitting approach before next outreach
Nature Conservancy	Continuing Communication
Various local and regional elected representatives	Continuing communication

The project partners have met with and informed the State and federal elected officials whose jurisdictions coincide with the project area. To date, these meetings have resulted in expressions of support for the project.

8.2 Future Outreach Needed

Upon completion of this feasibility study, significant and continuing outreach will be required to keep stakeholders and interested entities fully informed regarding the project and its progress. It is anticipated that these meetings will include the entities shown in Table 8-2.

Table 8-2: Future and Continuing Outreach Needed

Agency	Contact Notes
DPWD Land Owners / Growers	Joint Grower and Landowner meetings Board Meetings and Workshops
San Luis Delta-Mendota Water Authority and member agencies	Continuing communication DMC Operations
USBR	Continuing communication Title XVI program Refuge Water Supply Program
Turlock and Modesto City Councils	Continuing Communication
RWQCB	Continuing Communication
SWRCB	Water Rights applications Continuing Communication
CDPH	Coordination thru RWQCB
Farm Bureau	Continuing Communication
Various local and regional elected representatives	Continuing communication

Chapter 9 Economic Analysis

9.1 Existing and Projected Conditions in Service Area

As described in Chapters 1 and 2, DPWD is under contract with Reclamation for the delivery of up to 140,210 AF of water annually to approximately 45,000 acres of highly productive farmland with a production value of over $130 million gross farm dollars annually. DPWD's contractual entitlement is its primary source of supply, though privately developed groundwater is used by growers in the District service area on a limited basis. Since the early 1990's, DPWD's CVP allocations have been subject to shortages due to the effects of drought conditions as well as new legislative and regulatory restrictions imposed on the CVP beginning in 1992. In 2009, a combination of these prior regulations, three years of below normal precipitation and more recent operating constraints imposed on the CVP under the Endangered Species Act resulted in a contractual allocation to DPWD of only 10 percent. Prior to the Federal biological opinions on Delta smelt and salmon, it was estimated that the District's future average allocation would be 65% (91,137 AFY). As a consequence of these most recent biological opinions, it is estimated that in normal years, DPWD will receive only about 35% (49,000 AFY) of its contract supply. These on-going shortages and lack of water supply reliability have created a severe hardship on the District and its growers. Over 10,000 acres were fallowed in 2009, resulting in a significant loss in both farm income and agricultural-related jobs. The effect of these shortages on the agriculturally-based economy of communities on the west side of the San Joaquin Valley has had severe economic repercussions and will exhibit continuing negative economic impacts as these losses ripple through the local and regional economies.

The shortage of surface water has, and will continue, to negatively impact local groundwater resources by forcing agricultural and municipal users to rely more heavily on limited groundwater supplies. Not only can this result in the depletion of this resource, it generates increasing concerns over possible land subsidence resulting from groundwater overdraft. With the introduction of Federal and State imported water supplies, groundwater increasingly was used as an "insurance hedge" during times of drought or imported water shortages. However, land subsidence has been a concern (Poland, U.S. Geological Survey, and Lofgren, California Case History No. 9.13. San Joaquin Valley, California, 1975). The risk is not merely the lowering of land elevation but the destruction of recharge and storage capability within the aquifer (Galloway, Jones, and Ingebritsen, Land Subsidence in the United States, Part I, The San Joaquin Valley, Largest Human Alteration of the Earth's Surface, Circular 1182, 1999). If this occurs, as the aquifer is allowed to recharge after a period of extensive groundwater pumping, less water is available for future needs when drought or imported water shortages occur. This diminishes the insurance value of the aquifer and makes cropping decisions more uncertain.

For this evaluation, the 2009 water supply conditions, characterized by a contract allocation of only 10% are projected as the "worst-case" scenario. The cropping patterns under the "worst-case" would look similar to those observed during 2009. According to the 2009 Crop Report, the District fallowed 10,737 acres of its 42,783 irrigable acres. In a recent examination of economic impacts in the San Joaquin Valley, Jeffery Michael and Richard Howitt, et al (Michael, Howitt, Medellín-Azuara, and MacEwan, "A Retrospective Estimate of the Economic Impacts of Reduced Water Supplies to the San Joaquin Valley in 2009" September 28, 2010), determined a San Joaquin Valley-wide fallowing estimate that distinguishes between "normal" annual fallowing practices and fallowing associated with the lack of imported water supplies due to Delta pumping restrictions. The estimate provides a basis for establishing acreage fallowed as a result of pumping restrictions (water shortages) at 36% of the total fallowed acreage. By this calculation, the DPWD cropping acreage impact attributable to shortages in 2009 was 3,865 acres. Thus, with reliable water supplies, we would expect to see 6,872 of "normally" fallowed acres (10,737-3,865 = 6,872). While this calculation provides a relatively robust "rule of thumb" for estimating fallowing from pumping restrictions, a specific estimate for DPWD was desired.

The portion of the DPWD service area specified as the targeted area for delivery of more reliable water from the project has experienced an increase in acreage planted to higher valued permanent crops. In the face of uncertain water deliveries, while growers may defer land conversion investments for a period of years and leave those lands fallow, this is not an option for already converted lands. For this reason and the lack of accessible groundwater for emergency uses in the target area, an area specific fallowing analysis was performed. Michael and Howitt, et al, determined that drought conditions and pumping restrictions had major economic impacts on San Joaquin Valley counties. Those impacts were mitigated somewhat by water transfers, cropping changes to less water intensive crops, and increased groundwater pumping. Additionally Michael and Howitt, et al, note that growers focused more on saving permanent crops like fruit and nut trees than on growing annual crops. The impacts were more pronounced on the west side of the San Joaquin Valley with Kern, Kings, and Fresno counties suffering the greatest losses. For the purposes of this analysis, the 2009 crop year was used for the baseline definition of the water-short future. While there is no specific method to distinguish "normal" fallowing from extraordinary fallowing due to drought or water shortage (other than the work of Michael, Howitt, et al.), an examination of historical fallowing practices can illuminate both trends and magnitudes of observations. For DPWD, historical cropping and fallowing practices were observed from 1982 to 1993. This period exhibited both full CVP deliveries and some dry years due to drought conditions in the early 1990s. This period also preceded the impacts associated with CVPIA, which was signed into law October 30, 1992.

Figure 9-1 illustrates both the initial and final CVP water allocations. Examining the periods of normal water delivery between 1982 and 1986, a period of low water rates and mild climate, out of total district acreage of 45,229 acres, average fallowing was 3,349 acres annually. From 1987 to 1989, when fisheries restoration discussions began as a prelude to the CVPIA, fallowing increased to an annual average of 5,272. Allocations to DPWD growers were cut to 50% of contractual commitment during the 1990-91 water year due primarily to drought.

Figure 9-1: Historic Annual Initial / Final CVP Allocations[1]

Notes:

1. Data provided by DPWD. Initial supply indicates the initial water supply allocation from the Bureau of Reclamation at the beginning of the water year (February). The final supply indicates the final allocation from the Bureau of Reclamation at the end of the water year.

Beginning with the implementation of CVPIA in 1993 and other legal and regulatory delivery constraints, there was a growing concern that the new "normal" allocation would not be a full allocation. As shown in Figure 9-1, only three water years since the 1990-91 water year provided full entitlement deliveries of CVP water: 1995-96, 1998-99, and 2006-07. As uncertainty entered growers' cropping decisions, they made risk calculations as best as possible given the growing number of unknowns surrounding water supply allocations. Thus, fallowing increased markedly from water year 1987 to 1992 when CVP water deliveries were anticipated to be and/or actually reduced but appeared somewhat more "measurable" and thus more amenable to risk assessment and better business decisions. Risk represents "measurable" assessments of potential future events. Uncertainty represents "immeasurable" assessments. Thus uncertain events cannot adequately be evaluated for business decision making. Uncertain situations produce more severe impacts on business decisions and result in extremely uninformed investment decisions.

For the purposes of this analysis, the "normal" agronomic fallowing decision is based on pre-CVPIA cropping decisions (3,349 acres annually on average, 1982-86) and compared to cropping and fallowing decisions during periods that include uncertainty (5,272 acres annually on average, 1987-1989) and increased risk leading up to promulgation of the CVPIA (7,913 acres on average, 1987-92). Thus, this analysis selects a period of normalcy, uncertainty, and risk for growers and their cropping and fallowing plans. By this statistic, 58 percent of the land that is fallowed in any year since CVPIA can be attributed

to the uncertainty and risk of water shortage and not to agronomic decisions alone. The base year for analysis is 2009 wherein growers in DPWD service area fallowed 10,737 acres. Of that acreage, by our calculation of fallowing causality, 58% of that acreage, or 6,227 acres, were fallowed due to uncertainty and risk associated with water shortages, legal and regulatory policies, and judicial decisions, and not strictly on agronomic decisions of growers. This recycled water delivery project provides a reliable water supply and as such removes uncertainty and risk associated with CVP deliveries and Delta diversions. The calculated cropping under a reliable water supply scenario would have increased crop acreage during the 2009 water year by 3,196 acres. Thus, the project resolves 51 percent (3,196/6,227) of the acreage in the District fallowed due to uncertainty and risk.

Figure 9-1 depicts the CVP deliveries to DPWD growers and graphically illustrates the basis for grower investment uncertainty and negative economic impacts. DPWD can expect avoidance of cropland investment from growers in the central and southern "target" region of the DPWD service area. Whether growers hold off investment in permanent plantings, grow lesser valued crops, or fallow more land, the economic costs, whether in terms of increased groundwater pumping and the attendant impacts or the continued loss of jobs and incomes in the surrounding communities, will be significant. The value of resolving such a high proportion of uncertainty and risk for growers in the DPWD and the surrounding community is explored in Section 5.3.1.

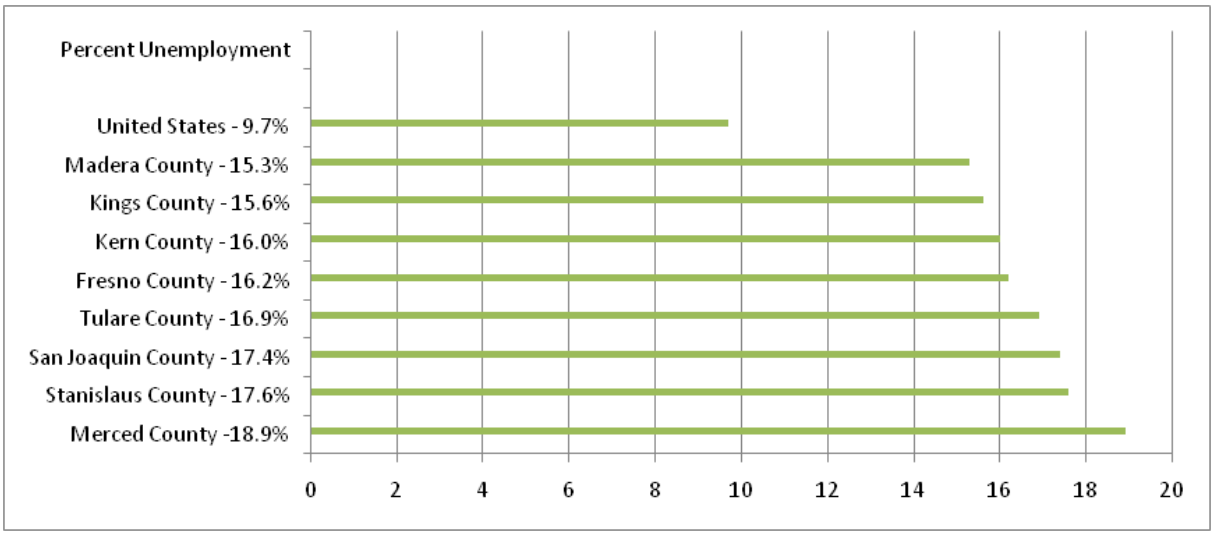
July unemployment rates in the eight counties in the San Joaquin Valley have been rising since July 2008. Two years ago, jobless rates ranged from 9.2 percent in Madera County to 12.1 percent in Merced County. By 2010, the lowest unemployment rate, 15.3 percent in Madera County, exceeded the highest rate recorded two years earlier. Merced County has had the area's highest jobless rate for the past three years.

Table 9-1: United States and San Joaquin Valley Unemployment Rates, July 2010

Location	Unemployment Rate			Net Change From	
	July 2008	July 2009	July 2010	July 2008 to July 2010	July 2009 to July 2010
United States	6.0	9.7	9.7	3.7	0.0
Fresno County	9.9	14.8	16.2	6.3	1.4
Kern County	9.6	14.4	16.0	6.4	1.6
Kings County	9.9	13.8	15.6	5.7	1.8
Madera County	9.2	13.9	15.3	6.1	1.4
San Joaquin County	10.4	15.7	17.4	7.0	1.7
Stanislaus County	10.9	16.0	17.6	6.7	1.6
Tulare County	10.4	15.1	16.9	6.5	1.8

Notes:
1. Unemployment rates were not seasonally adjusted.

Figure 9-2: United States and San Joaquin Valley Unemployment Rates, July 2010



Notes:
1. Unemployment rates were not seasonally adjusted.

Jobs will be created directly from the project. In December 2010, Jeffery Michael and Thomas Pogue analyzed and reported the site-specific income and employment benefits that a recycled water delivery project would bring to the DPWD region (North Valley Regional Recycled Water Project: Impact on Regional Income, Employment and Output, December 2010). The analysis was performed using an input-output (I/O) model that was calibrated to the existing local economic data, and focused on quantifying the income and employment benefits associated with the additional water supply only and did not taken into account the short-term and long-term employment benefits associated with the construction, operation, and maintenance of the recycled water conveyance facilities. The Michael-Pogue approach allowed detailed analysis of the agricultural cropping impacts from new recycled water supplies measured as direct, indirect, and induced income and employment. The Michael-Pogue site-specific employment benefit numbers associated with the 2015 and 2025 projects were quantified to be 314 and 572 jobs, respectively. In order to fully capture the site-specific employment benefits of the project, these results would need to be supplemented with site-specific employment benefits associated with the construction, operation and maintenance of capital facilities as well.

The results from the Michael-Pogue analysis can be compared to the non-site specific employment benefit numbers developed using the guidance developed by the Executive Office of The President Council of Economic Advisers (Executive Office of The President Council of Economic Advisers, May 2009). The non site-specific employment benefits of the "preferred" and "most likely" projects, further described in Section 5.2 can be quantified as follows:

- 2015 A Projects – Average capital cost of $15,800,000 results in the creation of 172 permanent jobs.
- 2015 B Projects – Capital cost of $70,200,000 results in the creation of 763 permanent jobs.
- 2025 Projects – Capital cost of $85,300,000 results in the creation of 927 permanent jobs.

The employment benefits quantified by Michael-Pogue have the same order of magnitude as the non-site-specific employment benefit numbers, and therefore support the use of the non site-specific numbers, which comprehensively quantify the employment benefits associated with increased water supply and construction, operation, and maintenance of new conveyance facilities. Updating the Michael-Pogue analysis to include the direct, indirect, and induced incomes and employment from the construction and

operation and maintenance of the project would not significantly alter the findings or the employment benefits portrayed by the non-site specific analysis used herein, and therefore additional site-specific analyses were not performed at this time.

9.2 Net Benefit Analysis

9.2.1 Net Project Benefits

1. The 2015 A scenario has a net benefit of $86/AFY. This is a positive net benefit and assumes that advanced treatment technologies will not be required. The benefit can also be explained as a ratio of benefit to cost. In this case, for every dollar of cost that the project incurs, it produces and additional $0.83 in benefits.
2. The 2015 B scenario has a net benefit of $530/AFY. When examined as a benefit/cost ratio, the project generates $1.96 for every $1.00 in project cost.
3. These alternatives both exhibit positive net benefit.
4. The most substantive benefit of Scenario 2015 B is that it evolves directly into the 2025 solution and minimizes additional capital investment necessary to deliver the recycled water yields expected in the future (2025 and beyond).
5. The 2025 solution has a net benefit of $560/AFY. The net benefit of this alternative improves as the longer term planning horizon is evaluated. Examined as a ratio, the 2025 solution, for each $1.00 of project cost incurred, produces $2.33 of benefits.

9.2.2 Less Easily Quantified Benefits

Some Title XVI project benefits such as a drought tolerant water supply, reduced reliance on transfers and water importation, and increased water supply reliability, all of which influence grower long-term decision making on cropping and capital investments, are difficult to quantify. While these data can be reported, the extent of influence on benefits is less easily quantified and evaluated. Thus, the farm labor and management employment and income impacts from grower long-term decision making and investment is also indentified but not rigorously estimated. The Title XVI Directives and Standards allow for these benefits to be documented and described qualitatively as completely as possible. Accordingly, these qualitative benefits can be considered as part of the justification for a Title XVI project in conjunction with the comparison of project costs described above. Less easily quantified benefits for replacing unreliable CVP water for DPWD fall in three key areas:

1. Increased investment certainty for growers,
2. Increased property values, and
3. Increased and more stable employment and income in the district, local community, and region.

Increased Investment Certainty for Growers

The lands in the southern portion of the District's service area are those that will receive the greatest benefits from the more reliable recycled water supply. Those lands have the least access to groundwater and are where more permanent crops have been planted. For these growers, more reliable water supplies provide a stable basis for investment decisions that they cannot achieve relying solely on the availability of CVP water. Grower investment certainty allows more stable agricultural economies to sustain themselves. More consistent economic benefits can be expected from this increased certainty. Those economic benefits are realized as increased incomes, jobs, municipal tax base, and quality of life benefits such as public safety, efficient roadways and transit, clean and safe parks and playgrounds, increased educational opportunities, enhanced property values, and pride of community, among many others.

Increased Property Values

When investment becomes stable, plant and operations (and agricultural lands) become more valuable. In the absence of reliable water supplies, investments fall off, land productivity declines, and land values also decline. Economic impacts are felt in declining tax receipts, which causes municipal and county budgets decline and municipal services to suffer.

Increased and More Stable Employment and Income in the District, Local Community, and Region

Reliable water supplies lead to stable agricultural investments and more stable and plentiful agricultural employment. Incomes earned on the farm are spread throughout the local community and the region as farm labor wages are expended for goods and services within the community. When linked to increased property tax receipts, community health and safety increase along with quality of life. While less easily measured for evaluations such as this one, these types of economic benefits can be reflected in many municipal data.

Chapter 10 Legal, Institutional, and Permitting Requirements

10.1 Legal Requirements

The primary legal issue facing the recommended project DMC-4 will be the need to establish the right to deliver recycled water to DPWD rather than discharge to the San Joaquin River and/or land disposal.

10.1.1 Water Rights

Modesto and Turlock have engaged legal counsel to review applicable water rights issues associated with securing the right to each City's recycled water. Securing the right to the recycled water is required prior to proceeding with implementation of recycled water delivery to DPWD. As the recycled water delivery options are narrowed and further refined as a result of this feasibility study, further analyses will be undertaken on behalf of both cities to confirm the water rights necessary to support the proposed delivery of recycled water to DPWD and to develop a specific path forward for obtaining regulatory approvals necessary for project implementation. A preliminary description of the legal considerations and possible regulatory approvals that were considered and that may be required for implementing any of the project alternatives is described below.

As a general matter, California Water Code Section 1210 provides in part: "The owner of a waste water treatment plant . . . shall hold the exclusive right to the treated waste water as against anyone who has supplied the water discharged . . .". That section and other provisions provide, however, that such rights do not affect a treatment plant's obligations to other legal users of treated waste water and provide for an approval processes through the State Water Resources Control Board (SWRCB) which may be applicable for certain alternatives herein described. Modesto currently has no discharge to the San Joaquin River, except during the winter when there are more significant flows, and therefore redirecting its recycled water would not appear to create any insurmountable legal issue. Modesto has an agreement with the surface water supplier of a portion of its supply, Modesto Irrigation District (MID), which recognizes that Modesto may increase its reclamation of wastewater and reuse that water. Turlock currently discharges most of its effluent to the San Joaquin River, but preliminary analysis shows that any potential impacts to downstream interests associated with the proposed recycled water projects would be minimal and temporary.

It is anticipated that a water rights approval for each City will required from the SWRCB. With respect to Alternative 3 (River Conveyance of Recycled Water), Water Code Section 1485 allows dischargers on the San Joaquin River to "wheel" recycled water. That is, they may appropriate, in an amount that is roughly equivalent to their discharge, downstream of the discharge point, water which can then be sold or used for any beneficial purpose.

Modesto and Turlock rely in whole or part on groundwater pumped from a groundwater basin that is not in overdraft. Except for a portion of the Modesto wastewater effluent, the recycled supply is not presently directly recharging the groundwater basin (i.e., it is being diverted to the San Joaquin River or lost through evaporation).

An analysis of the groundwater pumping by Turlock does not intercept flows that would otherwise reach the San Joaquin River. It is anticipated that a similar analysis for the City of Modesto groundwater pumping will result in a similar conclusion. The primary institutional issue facing the recommended project DMC-4 will be the contractual arrangements between Modesto, Turlock, DPWD and Reclamation.

10.2 Institutional Requirements

There are a number of agreements that would need to be in place for the project alternatives to be implemented. The key agreements or memoranda of understanding (MOU) that would need to be developed and entered into are as follows:

- Water Supply Agreement(s) to address the contractual delivery of up to 30,600 AFY of recycled water from Modesto and up to 28,400 AFY of recycled water from Turlock to DPWD, and the terms of any cost sharing for the conveyance and/or production of the recycled water.
- Exchange Agreement or Long-term Warren Act Contract with Reclamation for conveyance and storage of water in the DMC would be needed. The Exchange Agreement or Warren Act Contract would give DPWD the ability to convey water via the DMC throughout the year, and to store the water in San Luis Reservoir.
- Wheeling Agreement with Patterson Irrigation District if the PID Main Canal is utilized for conveyance. PID has entered into similar agreement with DPWD and other water entities, and is in the process of implementing improvements to its canal system and has solicited proposals from other water agencies for participation and utilization of the PID Main Canal for conveyance of water to the DMC.

10.3 Permitting Requirements

A variety of permits and regulatory actions are required to implement the recommended alternatives DMC-1B and DMC-4. Table 10-1 summarizes the permits and regulatory requirements, including the permitting agency names and the project implementation stage when each permit should be obtained.

10.4 Unresolved Issues

There are no known unresolved issues beyond the legal, institutional, and permitting issues described in this report.

Table 10-1: Summary of Permits and Regulatory Actions for the Recommended Project

Agency	Regulatory Requirement	Project Stage	Brief Description
CA Department of Conservation	Williamson Act Cancellation	Planning / Design	If any ag land that has a Williamson Act Contract with the state government is converted to non-ag land (e.g. pump station is put on a corner of an existing ag parcel), that portion of land will need to have the Williamson Act Contract cancelled on it.
CA Natural Resources Agency	CEQA Compliance (TBD as lead agency)	Planning	California Environmental Quality Act (CEQA), is a statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.
CA Office of Historic Preservation	Section 106 Consultation	Planning	Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to coordinate with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP) regarding the effects a project may have on properties listed, or eligible for listing, in the National Register of Historic Places (NRHP) (16 USC 470 et seq.).
CA State Lands Commission	State Lands Lease Agreement	Planning	Depending on the lands near the San Joaquin River, a lease agreement with the State Lands Commission may be required.
Federal Government	NEPA Compliance (USBR as lead agency)	Planning	National Environmental Policy Act (NEPA) is the Federal equivalent of CEQA; NEPA can be done in conjunction with CEQA, pending USBR preference.
Natural Resource Conservation Service	Farmland Conversion Assessment	Planning	As part of compliance with the Farmland Preservation and Farmland Protection Act (FPPA), federal agencies assisting in projects that may convert important farmland to non-farm use must contact a local office of the Natural Resources Conservation Service (NRCS). NRCS uses a land evaluation and site assessment system to establish a farmland conversion impact rating score on each alternative project site. This score is used as an indicator for the project sponsor to consider alternative sites if the potential adverse impacts on the farmland exceed the recommended allowable level.
RWQCB	401 Water Quality Certification	Planning	Section 401 of the CWA requires that the discharge of dredged or fill material into waters of the United States does not violate effluent limitations or water quality standards established by the state.
RWQCB	Regulatory pathway for Discharge to the DMC	Planning	Based on preliminary discussions with the RWQCB, this will be likely be an NPDES permit
SWRCB	Wastewater Change Petition (Petition for Change)	Planning	Because the program will result in the removal of wastewater discharges to the SJR, a petition for change is needed from the SWRCB. Downstream water users are notified as part of the petition process.
US Army Corps of Engineers	404 Permit for any fill of wetlands or waters of the US	Planning / Design	Activities that result in discharge of dredged or fill material into waters of the United States are regulated by the U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (CWA). Discharges of dredged or fill material, including placement of structures, into waters of the United States, including wetlands, generally require a permit from USACE.
USBR	Warren Act Contract or Exchange Agreement	Planning	Under provisions of the Warren Act, Reclamation facilities can be utilized to convey and/or store water that is not a part of the CVP water supply (i.e., non-project water). DPWD presently has a Warren Act Agreement with Reclamation. Each Warren Act Agreement is specific to the source of water being conveyed and/or stored, and a new Warren Act Agreement will be required. Alternatively, an Exchange Agreement may be an appropriate vehicle for use of the DMC facilities for delivery of recycled water.
US Fish and Wildlife & National Marine Fisheries Service	Section 7 Consultation/Biological Opinions	Planning	Section 7 of the Endangered Species Act (ESA) requires all federal agencies, in consultation with USFWS and NMFS, to ensure that their actions do not jeopardize the continued existence of species listed as endangered or threatened or result in the destruction or adverse modification of the critical habitat of these species. Section 7 prohibits federal agencies from implementing an action that would result in the take of a species listed as threatened or endangered unless a biological opinion issued by USFWS or NMFS authorizes the take. Take includes harassing, harming, pursuing, hunting, wounding, killing or capturing, or attempting such activity.

Agency	Regulatory Requirement	Project Stage	Brief Description
San Joaquin Valley Air Pollution Control District	Authority to Construct / Permit to Operate	Construction	Only needed if a generator greater than 50 hp is included at the pump station.
County of Stanislaus (and Merced, pending Project Alternatives)	Encroachment Permit	Construction	Standard permit needed for work in County right-of-way.
Caltrans	Encroachment Permit	Construction	Standard permit needed for work in Caltrans right of way.
RWQCB	NOI for Coverage under Statewide Construction Storm water Permit (Section 402 CWA)	Construction	
RWQCB	NOI under Low-Threat Discharge Order for Coverage of Pipeline discharges for testing and startup	Construction	
CA Dept. of Fish and Game	Streambed Alteration Agreement for pipeline crossings of creeks	Construction	
CA Dept. of Fish and Game	Incidental Take Permit	Construction	
CalOSHA	Construction Permit / Tunnel Classification	Construction	
County of Stanislaus (and Merced pending project alternatives)	Grading Permit	Construction	Standard permit needed for grading work.
County of Stanislaus (and Merced pending project alternatives)	Building Permit	Construction	Standard permit needed for building work.
County of Stanislaus (and Merced pending project alternatives)	Tree Removal Permit	Construction	
UPRR	Encroachment Permit	Construction	Need permit for crossing CNFR / Union Pacific Railroad Road (UPRR).
Central Valley Flood Protection Board (CVFPB)		Construction	Levee tunneling.

Chapter 11 Financial Capability Sponsor

11.1 Project Schedule

The proposed project schedule has recycled water deliveries beginning in the 2018 timeframe, as seen in Table 11-1. This means that the design and construction of the facilities would be completed in 2018. This project schedule is aggressive, but is an indication of the need for water in the DPWD service area.

Table 11-1: Program Schedule

Activity	Schedule
Confirm Feasibility of DMC Conveyance	Complete by November 2013
Begin Implementation Steps • Environmental Documentation • Secure Funding • Interagency Agreements • Predesign • Stakeholder Outreach • Permitting	Complete by December 2014
Final Design	Complete by March 2016
Construction	Complete by April 2018

11.2 Willingness to Pay for the Project

All project entities are currently in discussion in regards to which facilities will be owned by which entity as well as long term project commitments for purchasing water. Contractually, these arrangements have not been established or determined at this time.

DPWD is a California Special District, formed under the provisions of the Division 13 Water Code of the State of California. DPWD is governed by a 7 person Board of Directors elected from among landowners within DPWD's jurisdictional boundaries. Under California Water Code, DPWD has the authority to incur debt, borrow money and issue bonds. DPWD also has the authority to assess parcels within the District for the purpose of equitably sharing District costs.

DPWD is a public agency responsible to its agricultural customers and is, by its legal basis and enabling acts, charged with the development and management of reliable and affordable water supplies in the interest of its customers. DPWD is therefore willing to pay its share for a recycled water delivery project, and has demonstrated their willingness by providing funding for the next phase of work , together with the City of Modesto and Turlock.

11.3 Funding Plan for Construction, Operation, Maintenance, and Replacement of Facilities

There are a variety of financing methods available to special districts to finance capital improvements, replacements, and expansion of water systems. These include pay-as-you-go (cash reserves and operating revenues), state revolving fund loans, grants, and tax exempt borrowings, such as general obligation bonds, special tax bonds, assessment bonds, revenue bonds, bond pools, and certificates of participation.

11.4 Description of all Federal and Non-Federal Funding Sources and their Limitations

11.4.1 Potential Funding Sources

There are several funding sources that the Agencies may pursue:

- Grants of up to 25% of project costs or $20 million, whichever is less, are potentially available from Reclamation under its Title XVI program. There is also potential for the Title XVI program to be superseded by a new USBR low-interest loan program. This source assumes a potential 1% low interest rate for a 30-year amortization period.
- Grants are potentially available through the California DWR Integrated Regional Water Management Planning Implementation Program funded through Proposition 84 (Prop 84 grants). There is a total of $35 million available to the San Joaquin planning area; this project would be eligible for a portion of that available amount.
- State Revolving Fund (SRF) loans, a low interest loan program administered by the State Water Resources Control Board. SRF loans typically have a lower interest rate than bonds, but are paid back over a 20-year period. A 30-year period may be allowed, provided the project serves a disadvantaged community.
- Traditional bond financing for the project, which typically has a higher interest rate but may be paid back over a 30-year period so that annual payments might be lower than traditional SRF 20-year loan payments.

11.4.2 Modeling of Unit Cost of Water for Potential Funding Sources

An RMC developed tool, titled Integrated Finance Model (IFM), evaluates and compares the cost of a project based a variety of funding options. The IFM allows the user to apply multiple funding sources (including grants and SRF loans), variable interest rates, and payback periods to determine the financing cost of a project. The IFM provides a more complete project cost estimate because it factors in the cost of acquiring funds, the impacts associated with having multiple funding sources, and interest paid during construction.

The IFM was used to evaluate 7 different financing scenarios to determine their impact on the overall cost of water. Each of the seven scenarios used the following base assumption for project cost, schedule, and water available to the project.

- Total Project Cost: $96 million
- Environment/Permitting/Design Schedule: 2 years
- Construction Schedule: 2 years
- Assumed Inflation Rate: 1%

IFM Runs and Assumptions

The seven IFM runs use a combination of the funding sources described in Table 11-2. For the IFM runs that use SRF and USBR funding (runs #5, 6, & 7), it was assumed an interim funding of approximately

$10 million at 5% interest would be needed to fund the project through the design phase (e.g. a bridge loan). Once the SRF or USBR funding has been acquired, the IFM assumes the higher interest rate interim funding would be retired using the lower interest rate funds.

Table 11-2: IFM Funding Assumptions

IFM Run #	Funding Source	Interest Rate	Loan Duration (yrs.)
1	Bond	5%	30
2	SRF	2.5%	20
3	SRF	2.5%	30
4	USBR	1%	30
5	SRF with $10 million Prop 84 grant	2.5%	20
6	SRF with $10 million Prop 84 grant	2.5%	30
7	USBR with $10 million Prop 84 grant	1%	30

Based on the assumptions listed above, Table 11-3 below summarizes the cost of water from the IFM runs and also shows the estimated financed cost of water ($/acre-foot) over a 30 year period. As the amount of available program water increases over time, the unit cost of water decreases. The largest drop in water cost occurs in the year 2038 for the SRF- 20 yrs. funding alternatives and 2048 for the others due to the completion of payments on the source of capital leaving only the O&M cost. This is an illustrative assumption used to demonstrate impacts that this type of funding would have on the overall program costs of water.

Table 11-3: Unit Cost of Water

IFM Run #	Funding Source	2018	2028	2038	2048
1	Bond	$321	$234	$215	$249
2	SRF- 20 yrs.	$267	$199	$71	$79
3	SRF- 30 yrs.	$213	$164	$156	$79
4	USBR	$180	$143	$139	$79
5	SRF- 20 yrs. w/ $10M Prop 84 grant	$245	$185	$71	$79
6	SRF-30 yrs. w/ $10M Prop 84 grant	$196	$154	$147	$79
7	USBR w/$10M Prop 84 grant	$167	$135	$132	$79

Chapter 12 References

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Appendices

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Appendix A – DPWD Contract Entitlement

Impacts to South-of-Delta Ag Districts Since 1992 Estimated Allocation Reductions			
	AG Service Contract Supplies Acre-Feet	% Reduction	Estimated Contract Allocation %
Historical South-of-Delta Ag Supply	1,800,000		
Less: Estimated Water lost to CVPIA, Clean Water Act and ESA	630,000	35%	
2007 Subtotal	1,170,000		65%
Less: Estimated Water lost to FWS 2008 Delta Smelt Opinion	337,500	29%	
2008 Subtotal	832,500		46%
Less: Estimated Water lost ot NMFS 2009 Salmon Opinion*	202,500	24%	
2010 Remainder	630,000		35%

* Preliminary Analysis; does not include "upstream impacts".

Impacts to Del Puerto Water District Since 1992 Estimated Allocation Reductions			
	District Contract Supply Acre-Feet	% Reduction	Estimated Contract Allocation %
District's 100% Contract Supply	140,210		
Less: Estimated Water lost to CVPIA, Clean Water Act and ESA	49,000	35%	
2007 Subtotal	91,210		65%
Less: Estimated Water lost to FWS 2008 Delta Smelt Opinion	26,450	29%	
2008 Subtotal	64,760		46%
Less: Estimated Water lost ot NMFS 2009 Salmon Opinion*	15,540	24%	
2010 Remainder	49,220		35%

* Preliminary Analysis; does not include "upstream impacts".

Appendix B – Recycled Water Demand Estimate Methodology

WATER DEMAND METHODOLOGY

Irrigation water demand was estimated for the entire District and each target delivery area. The estimated water demand was considered as an element of the alternatives analysis described in Section 4. Based on the results of the market assessment, it was assumed that DPWD water users would take delivery of tertiary recycled water if the cost of the water was competitive with other available water supply alternatives, and provided an economic benefit to their operation. Therefore, delivery of tertiary recycled water to the entire District was considered an option in the feasibility analysis.

Evapotranspiration (ET) is defined as the loss of water to the atmosphere by the combined processes of evaporation (from soil and wet plant surfaces) and transpiration (from plant tissue). The ET value provides an estimate of the amount of water that crops require for healthy growth and production under the given growing environment. ET values are specific to crop type, and because ET is a function of evaporation it is also influenced by stage of crop growth, soil conditions, irrigation method and climate. Research centers typically develop ET values for various crops (ET crop or ETc) by applying crop coefficient factors to a reference crop ET value. The reference crop ET (referred to as ETo) is the ET from a grass surface. The California Irrigation Management Information system (CIMIS) has developed ETo values for various climatic zones in California. DPWD is in CIMIS Zone 14 and that data were used to determine ETo for purposes of this feasibility study. Crop coefficients (Kc) have been developed for climate zones and irrigation methods (e.g., drip, sprinkler, etc.), and crop coefficients developed by the Irrigation Training and Research Center (ITRC) at Cal Poly San Luis Obispo were used in the analysis.. Using the ETo and Kc values for a region, the ETc can be calculated as follows:

$$ETc = Kc * ETo$$

The irrigation water application requirement for a crop (or gross crop water requirement) can be calculated by accounting for effective precipitation (EP) and the irrigation system efficiency (IE). EP is the portion of the total rainfall amount that contributes to Etc. For purposes of this feasibility study EP was calculated assuming that 80 percent of the wintertime rainfall (November – March) would be effective. Irrigation systems are not 100 percent efficient The 30-year normal precipitation data for the NOAA weather station in Patterson was used in the analysis. The irrigation method, climatic conditions, stage of crop growth, irrigation management and related factors all influence IE. Generally, IE varies with individual irrigation events, and estimates of annual IE are usually used to estimate irrigation water application requirements. IE was estimated for each irrigation method based on published data assuming good to excellent management and with consideration for the data collected during the market assessment interviews. IE values used in the analysis are summarized in Table B-1. The calculation of the gross crop irrigation requirement is:

$$\text{Gross Crop Irrigation Requirement (GCIR)} = \frac{ETc - EP}{IE}$$

Table B-1: Irrigation Method Efficiency

Irrigation Method	Irrigation Efficiency
Sprinkler	80%
Surface	75%
Drip	85%

ETc values by irrigation method and crop type are included in this appendix. **Table B-1** summarizes the assumed IE for each of the three irrigation methods used in DPWD. The different irrigation methods assumed for each crop type were based on information from DPWD and field surveys conducted during the market assessment. **Table B-2** provides a summary of the breakdown of irrigation methods used by crop type. Summary tables of the GCIRs that were calculated and used to develop demand estimates are attached to this appendix. Additionally, the GCIRs were modified as appropriate to account for actual irrigation management practices within the DPWD.

Table B-2: Assumed Assignment of Irrigation Method By Crop Category

Crop Type	Surface Irrigation	Drip/Micro Irrigation	Sprinkler	Dry Land
Deciduous Fruits & Nuts	38%	43%	19%	-
Field Crops (Beans, Dry)	100%	-	-	-
Grains & Hay	16%	-	-	84%
Pasture	94%	-	6%	-
Trucks, Nursery & Berry Crops	87%	11%	2%	-
Idle	-	-	-	-

The monthly water demand by was calculated by applying the GCIR to the total number acres for of a given crop type. DPWD's database was used to determine the acreage for each crop type. DPWD conducts an annual crop survey to track the cropping pattern and the data are summarized by DPWD parcel number. The annual data is tracked in a database that is maintained by DPWD. The cropping pattern data from 2009 were used as the basis to estimate the existing DPWD water demand. It was recognized that 2009 represented a dry hydrologic year, and that future cropping and fallowing patterns could be different with an alternate, reliable source of water. Therefore to estimate future water demands, the fallowed acreage in 2009 was adjusted to productive crop land by spreading fallowed acreage to the historic crop type (based on 2004 and 2007 historic data). **Table B-3** provides a summary of the 2009 DPWD cropping pattern as well as the anticipated future cropping pattern.

Table B-3: Existing and Predicted DPWD Cropping Pattern

Crop Type	Existing (2009) (acres)	Future [1] (acres)
Alfalfa	1,660	1,920
Almonds	14,184	15,184
Apricots	2,519	2,519
Beans	2,221	2,756
Cantaloupes	398	398
Cherries	518	518
Citrus	340	340
Dry Farm (Barley/Oats)	2,472	2,472
Fallow	10,737	7,541
Nursery	66	66
Other Deciduous Fruits & Nuts	1,185	1,185
Tomatoes	3,892	5,011
Vegetables	915	1,197
Vineyards	370	370
Walnuts	1,782	1,782
Total	**43,259**	**43,259**

Notes:

1 – Future cropping pattern was estimated by comparing cropping patterns, by parcel number, in 2004, 2007 and 2009. Fallowed land in 2009 was spread to the crop type in 2003 and/or 2007.

Peak Demand Methodology

The methodology described above was used to develop average monthly and seasonal water demands and seasonal variation in water demands. Peak delivery demands were also estimated for the purpose of sizing recycled water conveyance systems. The irrigation system design flow is the volume of irrigation water that must be delivered by the water conveyance facilities during peak ET conditions to satisfy crop water demand. The crop ET data for July, the month of highest demand or peak month, were used as the basis for developing an estimate of peak ET requirements. July is the month of highest crop water demand and the average daily ET was calculated for each crop in the cropping pattern, as previously described. A weighted ET value was calculated based on the expected cropping pattern. This weighted crop ET value doesn't include consideration for especially hot, dry or windy periods that can cause an increase in ET. Peaking factors are applied to account for these climatic conditions. The UNFAO (reference 1) has developed a procedure for calculating the peaking factor. The peaking factor for the DPWD area is 1.09, which is based on an arid/semi-arid climate with predominately clear weather during the peak ET month. It's also assumed that the irrigation water applications would be approximately 3 net inches. The peak ET value provides an estimate of the net amount of irrigation water that must be applied to meet water demand during peak ET conditions. These values are adjusted to account for irrigation efficiency associated with the various types of irrigation systems predominately used to irrigate the crops, which then determines the gross amount of irrigation water that must be applied to provide for crop water demand. The results of the landowner/grower survey indicated that on-farm irrigation systems are normally operated 24-hours/day during peak ET conditions. The design flow is calculated on a gallon/minute/acre basis, and is adjusted to reflect the irrigation system daily operating hours.

The total net irrigated area in the proposed service area is based on the area demand, supply of water provided (gpm/acre) and total storage available. Assuming a 24-hour/day on-farm irrigation system operating duration the table below summarizes the total acres that can be irrigated to meet crop water demand under peak ET conditions for different water supplies and storage conditions.

Area	Assumed Supply (gpm/acre)	Total Irrigated Acres	Required Storage (Acre Feet)
North	5.8	3,386	1,100
Central	4.0	5,846	3,900
Central	6.5	3,597	3,900
Central	2.4	9,792	3,900
South	3.9	9,790	8,500
South/Central	5.5	5,000	3,900

References:

1. Food and Agriculture Organization of the United Nations, "Irrigation and Drainage Paper 24 – Guidelines for Predicting Crop Water requirements", Rome, 1975.

GCIR Tables

- North Area
- Central Area
- South Area
- District Wide – Existing
- District Wide – Future

NORTH AREA- GCIR

Assumed Irrigation Efficiency

Sprinkler Irrigation	80%
Surface Irrigation	75%
Drip Irrigation	85%
Effective Prec. Percentage	80%

Notes

0.0 Mean we have forced the deamand to 0 due to field visits that show no watering is done during these months

	January inches	February inches	March inches	April inches	May inches	June inches	July inches	August inches	September inches	October inches	November inches	December inches	Annual inches
CIMIS Precipitation (30 year Effective Precipitation, 80% of Ave)	2.04	1.74	1.60	0.50	0.00	0.00	0.00	0.00	0.00	0.49	0.98	1.21	8.57

	January	February	March	April	May	June	July	August	September	October	November	December	Annual (in.)	Annual (ft)
Citrus & Subtropical	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Grapefruit/Lemons/Oranges	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	2.06	2.98	3.86	5.00	5.80	5.93	5.71	4.21	3.61	1.76	1.75	44.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68		
Gross Crop Irrig. Req.	0.00	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68	45.2	3.8
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	2.06	2.95	3.66	4.79	5.46	5.80	5.34	3.91	3.32	1.73	1.75	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73		
Gross Crop Irrig. Req.	0.00	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73	45.7	3.8
Total Surface Irrigation AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	2.05	2.79	3.33	4.48	5.06	5.36	5.00	3.68	3.25	1.68	1.75	40.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64		
Gross Crop Irrig. Req.	0.00	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64	37.5	3.1
Total Drip Irrigation AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Deciduous Fruits & Nuts	0.0	20.5	95.5	614.2	1,697.0	2,069.7	2,238.6	2,033.6	1,425.3	680.2	0.0	0.0		**10,874.7**
Apricots	0.0	0.0	0.0	105.2	400.3	517.7	558.2	510.9	361.2	156.4	0.0	0.0		2609.9
Sprinkler Irrigation														
ET	1.68	0.81	1.03	1.91	5.16	6.82	7.45	6.79	4.84	2.59	0.94	1.32	41.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.72	1.76	6.44	8.52	9.32	8.49	6.05	2.63	-0.05	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.76	6.44	8.52	9.32	8.49	6.05	2.63	0.00	0.14	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**19.8**	**72.6**	**95.9**	**104.9**	**95.6**	**68.1**	**29.6**	**0.0**	**1.6**		**488.0**
Surface Irrigation														
ET	1.68	0.81	1.03	1.91	5.50	7.11	7.63	7.02	4.94	2.63	0.94	1.32	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.76	1.88	7.33	9.48	10.18	9.36	6.58	2.86	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.88	7.33	9.48	10.18	9.36	6.58	2.86	0.00	0.15	47.8	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**42.7**	**167.0**	**216.0**	**232.0**	**213.4**	**150.0**	**65.1**	**0.0**	**3.4**		**1,089.7**
Drip Irrigation														
ET	1.68	0.82	1.04	1.93	5.37	6.87	7.39	6.75	4.78	2.55	0.92	1.33	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.66	1.68	6.32	8.09	8.70	7.94	5.62	2.42	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.68	6.32	8.09	8.70	7.94	5.62	2.42	0.00	0.15	40.9	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**42.6**	**160.8**	**205.8**	**221.3**	**202.0**	**143.1**	**61.6**	**0.0**	**3.7**		**1,040.9**
Cherries	0.0	1.9	6.0	39.5	120.9	150.1	165.5	148.1	105.1	49.9	0.0	0.0		787.0
Sprinkler Irrigation														
ET	1.72	2.23	3.15	3.89	6.55	8.22	9.04	7.98	5.89	3.60	1.61	1.77	55.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70		
Gross Crop Irrig. Req.	0.00	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70	59.3	4.9
Total Sprinkler AF	**0.0**	**1.9**	**6.0**	**13.2**	**25.4**	**31.9**	**35.1**	**31.0**	**22.9**	**12.1**	**2.4**	**2.2**		**184.1**
Surface Irrigation														
ET	1.68	0.81	1.01	2.08	5.64	7.03	7.82	6.97	4.91	2.84	0.92	1.32	43.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.10	7.52	9.37	10.42	9.29	6.54	3.14	-0.08	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.10	7.52	9.37	10.42	9.29	6.54	3.14	0.00	0.15	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**13.2**	**47.3**	**59.0**	**65.6**	**58.4**	**41.1**	**19.7**	**0.0**	**0.9**		**305.2**
Drip Irrigation														
ET	1.68	0.82	1.02	2.09	5.83	7.17	7.85	7.11	4.98	2.68	0.92	1.33	43.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.87	6.85	8.43	9.23	8.36	5.85	2.58	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.87	6.85	8.43	9.23	8.36	5.85	2.58	0.00	0.15	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**13.1**	**48.1**	**59.2**	**64.8**	**58.7**	**41.1**	**18.1**	**0.0**	**1.0**		**304.2**
Almonds	0.0	18.7	89.5	373.8	849.7	1,000.6	1,072.8	972.9	674.8	349.4	0.0	0.0		5402.1
Sprinkler Irrigation														
ET	1.72	1.97	2.63	3.34	6.42	7.09	7.45	6.78	4.81	3.43	1.51	1.71	48.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63		
Gross Crop Irrig. Req.	0.00	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63	50.8	4.2
Total Sprinkler AF	**0.0**	**5.9**	**26.4**	**72.7**	**164.6**	**181.8**	**191.2**	**173.9**	**123.3**	**75.6**	**13.5**	**13.0**		**1,041.7**
Surface Irrigation														
ET	1.72	1.97	2.74	3.91	6.64	7.99	8.63	7.77	5.37	3.39	1.56	1.71	53.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67		
Gross Crop Irrig. Req.	0.00	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67	60.2	5.0
Total Sprinkler AF	**0.0**	**12.8**	**63.0**	**188.5**	**367.8**	**442.3**	**477.9**	**430.4**	**297.2**	**160.9**	**32.0**	**28.0**		**2,500.9**
Drip Irrigation														
ET	1.68	0.82	1.21	2.57	5.82	6.90	7.40	6.76	4.66	2.56	0.92	1.33	42.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.46	2.43	6.84	8.12	8.71	7.95	5.48	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.43	6.84	8.12	8.71	7.95	5.48	2.44	0.00	0.15	42.1	3.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**112.6**	**317.3**	**376.5**	**403.8**	**368.6**	**254.3**	**112.9**	**0.0**	**6.8**		**1,952.8**
Walnuts	0.0	0.0	0.0	1.1	4.5	6.4	7.0	6.3	4.3	2.0	0.0	0.0		31.5
Sprinkler Irrigation														
ET	1.68	0.81	1.31	1.96	5.76	8.19	9.00	8.02	5.37	3.00	1.01	1.32	47.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.37	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14	50.6	4.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.2**	**0.9**	**1.3**	**1.4**	**1.3**	**0.8**	**0.4**	**0.0**	**0.0**		**6.4**
Surface Irrigation														
ET	1.68	0.81	1.14	1.57	5.19	8.19	8.93	8.08	5.39	3.09	1.09	1.32	46.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.61	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15		

Gross Crop Irrig. Req.	0.00	0.00	0.00	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15	52.9	4.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.4**	**1.8**	**2.8**	**3.0**	**2.8**	**1.8**	**0.9**	**0.0**	**0.0**		**13.5**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.5**	**1.9**	**2.3**	**2.5**	**2.3**	**1.6**	**0.7**	**0.0**	**0.0**		**11.8**

Other	0.0	0.0	0.0	94.7	321.6	395.0	435.2	395.4	279.8	122.6	0.0	0.0		2044.3
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**22.4**	**60.1**	**70.7**	**80.4**	**72.5**	**49.4**	**23.6**	**0.0**	**1.2**		**380.3**
Surface Irrigation														
ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**36.2**	**129.8**	**161.9**	**178.6**	**163.4**	**115.9**	**49.9**	**0.0**	**2.7**		**838.3**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**36.1**	**131.7**	**162.4**	**176.2**	**159.6**	**114.6**	**49.1**	**0.0**	**3.0**		**832.6**

Field Crops	0.0	0.0	0.0	18.7	56.5	163.5	188.5	71.9	6.8	7.0	0.0	0.0		**513.0**
Beans (dry)	0.0	0.0	0.0	18.7	56.5	163.5	188.5	71.9	6.8	7.0	0.0	0.0		513.0
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**18.7**	**56.5**	**163.5**	**188.5**	**71.9**	**6.8**	**7.0**	**0.0**	**2.6**		**515.6**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Miscellaneous Field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Grain & Hay	0.0	0.2	0.7	1.6	1.2	0.1	0.0	0.1	0.1	0.1	0.0	0.0		**4.1**
Oats/Barley	0.0	0.2	0.7	1.6	1.2	0.1	0.0	0.1	0.1	0.1	0.0	0.0		4.1
Sprinkler Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	-0.01	0.27		
Gross Crop Irrig. Req.	0.00	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	0.00	0.27	15.3	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	-0.01	0.29		
Gross Crop Irrig. Req.	0.00	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	0.00	0.29	16.4	1.4
Total Sprinkler AF	**0.0**	**0.2**	**0.7**	**1.6**	**1.2**	**0.1**	**0.0**	**0.1**	**0.1**	**0.1**	**0.0**	**0.1**		**4.1**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Pasture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		**0.0**
Alfalfa/Mixed Pasture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60		
Gross Crop Irrig. Req.	0.00	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60	49.9	4.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64		

Gross Crop Irrig. Req.	0.00	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64	53.2	4.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56		
Gross Crop Irrig. Req.	0.00	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56	47.0	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.51	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14	51.5	4.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-0.54	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15	55.0	4.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.48	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13		
Gross Crop Irrig. Req.	0.00	0.00	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Truck, Nursery, & Berry Crops	0.0	0.0	0.0	6.8	61.4	143.8	127.8	15.3	5.2	5.4	0.0	0.0		**365.7**
Melons	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	0.81	0.63	0.25	0.92	1.64	5.48	5.92	1.85	0.78	0.97	1.32	22.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-1.21	-0.31	1.15	2.05	6.85	7.40	2.31	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.15	2.05	6.85	7.40	2.31	0.37	0.00	0.14	20.3	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	0.63	0.25	1.01	1.08	4.09	5.21	1.67	0.78	0.97	1.33	19.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-1.14	-0.29	1.19	1.27	4.81	6.13	1.97	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.19	1.27	4.81	6.13	1.97	0.35	0.00	0.15	15.9	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Tomatoes	0.0	0.0	0.0	6.8	61.4	143.8	127.8	15.3	5.2	5.4	0.0	0.0		365.7
Sprinkler Irrigation														
ET	1.70	0.81	1.17	0.70	3.38	7.74	7.36	1.01	0.28	0.78	0.97	1.32	27.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.54	0.25	4.23	9.68	9.20	1.27	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.25	4.23	9.68	9.20	1.27	0.36	0.37	0.00	0.14	25.5	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.1**	**1.2**	**2.7**	**2.6**	**0.4**	**0.1**	**0.1**	**0.0**	**0.0**		**7.1**
Surface Irrigation														
ET	1.70	0.81	1.24	0.89	3.34	7.83	6.91	0.81	0.28	0.78	0.97	1.32	26.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.48	0.52	4.45	10.44	9.22	1.08	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.52	4.45	10.44	9.22	1.08	0.38	0.39	0.00	0.15	26.6	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**6.3**	**54.2**	**127.1**	**112.3**	**13.1**	**4.6**	**4.8**	**0.0**	**1.8**		**324.3**
Drip Irrigation														
ET	1.70	0.82	1.25	0.71	3.32	7.68	7.15	1.00	0.27	0.78	0.97	1.33	27.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.41	0.24	3.91	9.04	8.42	1.18	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.24	3.91	9.04	8.42	1.18	0.32	0.35	0.00	0.15	23.6	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.4**	**6.0**	**13.9**	**13.0**	**1.8**	**0.5**	**0.5**	**0.0**	**0.2**		**36.3**
Flowers, Nursery	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Vegetables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	1.44	3.39	5.06	1.89	0.33	0.09	1.45	1.71	1.68	1.55	1.66	22.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.40	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60		
Gross Crop Irrig. Req.	0.00	0.00	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60	18.7	1.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		

Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		
Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Vineyard	0.0	0.1	1.4	12.5	62.8	112.1	123.6	101.8	56.6	9.2	0.7	0.0		480.8
Sprinkler Irrigation														
ET	1.72	1.78	2.31	2.45	4.97	6.41	6.93	5.83	3.87	2.40	1.34	1.66	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56		
Gross Crop Irrig. Req.	0.00	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56	41.8	3.5
Total Sprinkler AF	**0.0**	**0.1**	**1.4**	**3.8**	**9.8**	**12.6**	**13.6**	**11.5**	**7.6**	**3.8**	**0.7**	**0.9**		**65.8**
Surface Irrigation														
ET	1.72	1.78	2.42	2.58	4.85	6.72	7.20	6.29	3.65	2.31	1.24	1.66	42.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60		
Gross Crop Irrig. Req.	0.00	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60	45.6	3.8
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	0.79	1.03	3.18	5.97	6.59	5.42	2.94	0.81	0.92	1.33	31.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.95	0.61	3.74	7.02	7.76	6.37	3.46	0.38	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.61	3.74	7.02	7.76	6.37	3.46	0.38	0.00	0.15	29.5	2.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**8.7**	**53.0**	**99.5**	**109.9**	**90.3**	**49.0**	**5.4**	**0.0**	**2.1**		**418.0**
Total (Irrigated Acres)	0	21	96	641	1,816	2,377	2,555	2,121	1,437	693	0	0		11,757

CENTRAL AREA- GCIR

Assumed Irrigation Efficiency

Sprinkler Irrigation	80%
Surface Irrigation	75%
Drip Irrigation	85%
Effective Prec. Percentage	80%

Notes

0.0 Mean we have forced the deamand to 0 due to field visits that show no watering is done during these months

	January inches	February inches	March inches	April inches	May inches	June inches	July inches	August inches	September inches	October inches	November inches	December inches	Annual inches
CIMIS Precipitation (30 year Effective Precipitation, 80% of Ave)	2.04	1.74	1.60	0.50	0.00	0.00	0.00	0.00	0.00	0.49	0.98	1.21	8.57

	January	February	March	April	May	June	July	August	September	October	November	December	Annual (in.)	Annual (ft)
Citrus & Subtropical	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Grapefruit/Lemons/Oranges	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	2.06	2.98	3.86	5.00	5.80	5.93	5.71	4.21	3.61	1.76	1.75	44.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68		
Gross Crop Irrig. Req.	0.00	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68	45.2	3.8
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	2.06	2.95	3.66	4.79	5.46	5.80	5.34	3.91	3.32	1.73	1.75	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73		
Gross Crop Irrig. Req.	0.00	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73	45.7	3.8
Total Surface Irrigation AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	2.05	2.79	3.33	4.48	5.06	5.36	5.00	3.68	3.25	1.68	1.75	40.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64		
Gross Crop Irrig. Req.	0.00	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64	37.5	3.1
Total Drip Irrigation AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Deciduous Fruits & Nuts	0.0	15.0	72.0	409.9	1,129.2	1,425.0	1,538.4	1,392.9	962.8	472.8	0.0	0.0		**7,418.0**
Apricots	0.0	0.0	0.0	13.1	49.9	64.5	69.6	63.7	45.0	19.5	0.0	0.0		325.3
Sprinkler Irrigation														
ET	1.68	0.81	1.03	1.91	5.16	6.82	7.45	6.79	4.84	2.59	0.94	1.32	41.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.72	1.76	6.44	8.52	9.32	8.49	6.05	2.63	-0.05	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.76	6.44	8.52	9.32	8.49	6.05	2.63	0.00	0.14	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**2.5**	**9.0**	**12.0**	**13.1**	**11.9**	**8.5**	**3.7**	**0.0**	**0.2**		**60.8**
Surface Irrigation														
ET	1.68	0.81	1.03	1.91	5.50	7.11	7.63	7.02	4.94	2.63	0.94	1.32	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.76	1.88	7.33	9.48	10.18	9.36	6.58	2.86	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.88	7.33	9.48	10.18	9.36	6.58	2.86	0.00	0.15	47.8	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**5.3**	**20.8**	**26.9**	**28.9**	**26.6**	**18.7**	**8.1**	**0.0**	**0.4**		**135.8**
Drip Irrigation														
ET	1.68	0.82	1.04	1.93	5.37	6.87	7.39	6.75	4.78	2.55	0.92	1.33	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.66	1.68	6.32	8.09	8.70	7.94	5.62	2.42	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.68	6.32	8.09	8.70	7.94	5.62	2.42	0.00	0.15	40.9	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**5.3**	**20.0**	**25.6**	**27.6**	**25.2**	**17.8**	**7.7**	**0.0**	**0.5**		**129.7**
Cherries	0.0	0.1	0.3	2.2	6.7	8.4	9.2	8.3	5.9	2.8	0.0	0.0		43.9
Sprinkler Irrigation														
ET	1.72	2.23	3.15	3.89	6.55	8.22	9.04	7.98	5.89	3.60	1.61	1.77	55.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70		
Gross Crop Irrig. Req.	0.00	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70	59.3	4.9
Total Sprinkler AF	**0.0**	**0.1**	**0.3**	**0.7**	**1.4**	**1.8**	**2.0**	**1.7**	**1.3**	**0.7**	**0.1**	**0.1**		**10.3**
Surface Irrigation														
ET	1.68	0.81	1.01	2.08	5.64	7.03	7.82	6.97	4.91	2.84	0.92	1.32	43.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.10	7.52	9.37	10.42	9.29	6.54	3.14	-0.08	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.10	7.52	9.37	10.42	9.29	6.54	3.14	0.00	0.15	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.7**	**2.6**	**3.3**	**3.7**	**3.3**	**2.3**	**1.1**	**0.0**	**0.1**		**17.0**
Drip Irrigation														
ET	1.68	0.82	1.02	2.09	5.83	7.17	7.85	7.11	4.98	2.68	0.92	1.33	43.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.87	6.85	8.43	9.23	8.36	5.85	2.58	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.87	6.85	8.43	9.23	8.36	5.85	2.58	0.00	0.15	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.7**	**2.7**	**3.3**	**3.6**	**3.3**	**2.3**	**1.0**	**0.0**	**0.1**		**17.0**
Almonds	0.0	14.9	71.6	299.4	680.5	801.4	859.2	779.2	540.5	279.8	0.0	0.0		4326.7
Sprinkler Irrigation														
ET	1.72	1.97	2.63	3.34	6.42	7.09	7.45	6.78	4.81	3.43	1.51	1.71	48.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63		
Gross Crop Irrig. Req.	0.00	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63	50.8	4.2
Total Sprinkler AF	**0.0**	**4.7**	**21.2**	**58.2**	**131.8**	**145.6**	**153.1**	**139.2**	**98.8**	**60.5**	**10.8**	**10.4**		**834.4**
Surface Irrigation														
ET	1.72	1.97	2.74	3.91	6.64	7.99	8.63	7.77	5.37	3.39	1.56	1.71	53.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67		
Gross Crop Irrig. Req.	0.00	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67	60.2	5.0
Total Sprinkler AF	**0.0**	**10.2**	**50.5**	**151.0**	**294.6**	**354.2**	**382.7**	**344.7**	**238.1**	**128.9**	**25.7**	**22.4**		**2,003.0**
Drip Irrigation														
ET	1.68	0.82	1.21	2.57	5.82	6.90	7.40	6.76	4.66	2.56	0.92	1.33	42.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.46	2.43	6.84	8.12	8.71	7.95	5.48	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.43	6.84	8.12	8.71	7.95	5.48	2.44	0.00	0.15	42.1	3.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**90.1**	**254.1**	**301.6**	**323.4**	**295.2**	**203.7**	**90.4**	**0.0**	**5.4**		**1,564.0**
Walnuts	0.0	0.0	0.0	95.2	392.0	550.8	600.3	541.7	371.4	170.7	0.0	0.0		2722.1
Sprinkler Irrigation														
ET	1.68	0.81	1.31	1.96	5.76	8.19	9.00	8.02	5.37	3.00	1.01	1.32	47.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.37	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14	50.6	4.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**19.9**	**78.5**	**111.5**	**122.6**	**109.3**	**73.1**	**34.2**	**0.3**	**1.5**		**550.9**
Surface Irrigation														
ET	1.68	0.81	1.14	1.57	5.19	8.19	8.93	8.08	5.39	3.09	1.09	1.32	46.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.61	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15	52.9	4.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**31.3**	**152.7**	**240.9**	**262.7**	**237.6**	**158.5**	**76.6**	**3.2**	**3.3**		**1,166.6**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**44.0**	**160.8**	**198.3**	**215.1**	**194.8**	**139.9**	**60.0**	**0.0**	**3.6**		**1,016.5**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														

ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Field Crops	0.0	0.0	0.0	164.0	494.2	1,431.7	1,650.6	629.3	59.4	61.7	0.0	0.0		**4,490.9**
Beans (dry)	0.0	0.0	0.0	164.0	494.2	1,431.7	1,650.6	629.3	59.4	61.7	0.0	0.0		4490.9
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**164.0**	**494.2**	**1,431.7**	**1,650.6**	**629.3**	**59.4**	**61.7**	**0.0**	**23.2**		**4,514.1**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Miscellaneous Field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Grain & Hay	0.0	0.9	4.0	8.7	6.4	0.6	0.2	0.6	0.5	0.6	0.0	0.0		**22.5**
Oats/Barley	0.0	0.9	4.0	8.7	6.4	0.6	0.2	0.6	0.5	0.6	0.0	0.0		22.5
Sprinkler Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	-0.01	0.27		
Gross Crop Irrig. Req.	0.00	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	0.00	0.27	15.3	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	-0.01	0.29		
Gross Crop Irrig. Req.	0.00	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	0.00	0.29	16.4	1.4
Total Sprinkler AF	**0.0**	**0.9**	**4.0**	**8.7**	**6.4**	**0.6**	**0.2**	**0.6**	**0.5**	**0.6**	**0.0**	**0.4**		**22.9**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Pasture	0.0	45.0	199.8	381.3	589.9	691.6	735.4	646.9	495.9	190.8	67.9	49.0		**4,093.4**
Alfalfa/Mixed Pasture	0.0	45.0	199.8	381.3	589.9	691.6	735.4	646.9	495.9	190.8	67.9	49.0		4093.4
Sprinkler Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60		
Gross Crop Irrig. Req.	0.00	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60	49.9	4.2
Total Sprinkler AF	**0.0**	**2.5**	**11.3**	**21.5**	**33.3**	**39.0**	**41.5**	**36.5**	**28.0**	**10.8**	**3.8**	**2.8**		**231.1**
Surface Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64		
Gross Crop Irrig. Req.	0.00	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64	53.2	4.4
Total Sprinkler AF	**0.0**	**42.5**	**188.5**	**359.8**	**556.6**	**652.5**	**693.9**	**610.4**	**467.9**	**180.0**	**64.1**	**46.2**		**3,862.3**
Drip Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56		
Gross Crop Irrig. Req.	0.00	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56	47.0	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.51	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14	51.5	4.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-0.54	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15	55.0	4.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.48	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13		
Gross Crop Irrig. Req.	0.00	0.00	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Truck, Nursery, & Berry Crops	0.0	0.0	149.8	526.2	1,442.4	3,000.0	2,812.2	690.1	325.1	223.9	48.2	38.3		**9256.2**
Melons	0.0	0.0	0.0	0.0	44.0	63.0	217.8	257.9	75.4	12.9	0.0	0.0		671.1
Sprinkler Irrigation														
ET	1.70	0.81	0.63	0.25	0.92	1.64	5.48	5.92	1.85	0.78	0.97	1.32	22.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-1.21	-0.31	1.15	2.05	6.85	7.40	2.31	0.37	-0.01	0.14		

Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.15	2.05	6.85	7.40	2.31	0.37	0.00	0.14	20.3	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.8**	**1.4**	**4.5**	**4.9**	**1.5**	**0.2**	**0.0**	**0.1**		**13.4**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**38.9**	**57.0**	**195.7**	**230.7**	**66.7**	**11.4**	**0.0**	**4.3**		**604.6**
Drip Irrigation														
ET	1.70	0.82	0.63	0.25	1.01	1.08	4.09	5.21	1.67	0.78	0.97	1.33	19.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-1.14	-0.29	1.19	1.27	4.81	6.13	1.97	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.19	1.27	4.81	6.13	1.97	0.35	0.00	0.15	15.9	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**4.3**	**4.6**	**17.6**	**22.4**	**7.2**	**1.3**	**0.0**	**0.5**		**57.9**
Tomatoes	0.0	0.0	0.0	137.0	1,242.6	2,908.9	2,586.4	309.0	105.4	109.8	0.0	0.0		7399.1
Sprinkler Irrigation														
ET	1.70	0.81	1.17	0.70	3.38	7.74	7.36	1.01	0.28	0.78	0.97	1.32	27.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.54	0.25	4.23	9.68	9.20	1.27	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.25	4.23	9.68	9.20	1.27	0.36	0.37	0.00	0.14	25.5	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**1.4**	**24.0**	**54.8**	**52.1**	**7.2**	**2.0**	**2.1**	**0.0**	**0.8**		**144.4**
Surface Irrigation														
ET	1.70	0.81	1.24	0.89	3.34	7.83	6.91	0.81	0.28	0.78	0.97	1.32	26.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.48	0.52	4.45	10.44	9.22	1.08	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.52	4.45	10.44	9.22	1.08	0.38	0.39	0.00	0.15	26.6	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**128.1**	**1,096.9**	**2,572.5**	**2,272.0**	**265.0**	**93.3**	**96.9**	**0.0**	**36.4**		**6,561.2**
Drip Irrigation														
ET	1.70	0.82	1.25	0.71	3.32	7.68	7.15	1.00	0.27	0.78	0.97	1.33	27.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.41	0.24	3.91	9.04	8.42	1.18	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.24	3.91	9.04	8.42	1.18	0.32	0.35	0.00	0.15	23.6	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**7.5**	**121.7**	**281.6**	**262.2**	**36.8**	**10.1**	**10.8**	**0.0**	**4.6**		**735.3**
Flowers, Nursery	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Vegetables	0.0	0.0	149.8	389.2	155.8	28.1	7.9	123.2	144.3	101.2	48.2	38.3		1186.1
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**3.0**	**12.6**	**4.0**	**0.5**	**0.2**	**2.3**	**3.1**	**3.4**	**1.8**	**0.7**		**31.7**
Surface Irrigation														
ET	1.72	1.44	3.39	5.06	1.89	0.33	0.09	1.45	1.71	1.68	1.55	1.66	22.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.40	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60		
Gross Crop Irrig. Req.	0.00	0.00	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60	18.7	1.6
Total Sprinkler AF	**0.0**	**0.0**	**134.0**	**341.5**	**141.7**	**24.9**	**7.0**	**108.7**	**128.6**	**89.5**	**42.1**	**33.8**		**1,051.8**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		
Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**12.8**	**35.1**	**10.2**	**2.7**	**0.8**	**12.1**	**12.6**	**8.2**	**4.3**	**3.8**		**102.6**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		
Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Vineyard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	1.78	2.31	2.45	4.97	6.41	6.93	5.83	3.87	2.40	1.34	1.66	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56		
Gross Crop Irrig. Req.	0.00	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56	41.8	3.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	1.78	2.42	2.58	4.85	6.72	7.20	6.29	3.65	2.31	1.24	1.66	42.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60		
Gross Crop Irrig. Req.	0.00	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60	45.6	3.8
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	0.79	1.03	3.18	5.97	6.59	5.42	2.94	0.81	0.92	1.33	31.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.95	0.61	3.74	7.02	7.76	6.37	3.46	0.38	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.61	3.74	7.02	7.76	6.37	3.46	0.38	0.00	0.15	29.5	2.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Total (Irrigated Acres)	0	61	426	1,490	3,662	6,549	6,737	3,360	1,844	950	116	87		25,281

SOUTH AREA- GCIR

Assumed Irrigation Efficiency

Sprinkler Irrigation	80%
Surface Irrigation	75%
Drip Irrigation	85%
Effective Prec. Percentage	80%

Notes

0.0 Mean we have forced the deamand to 0 due to field visits that show no watering is done during these months

	January inches	February inches	March inches	April inches	May inches	June inches	July inches	August inches	September inches	October inches	November inches	December inches	Annual inches
CIMIS Precipitation (30 year Effective Precipitation, 80% of Ave)	2.04	1.74	1.60	0.50	0.00	0.00	0.00	0.00	0.00	0.49	0.98	1.21	8.57

	January	February	March	April	May	June	July	August	September	October	November	December	Annual (in.)	Annual (ft)
Citrus & Subtropical	0.0	2.6	10.8	25.7	39.6	45.2	47.3	44.5	32.7	24.3	6.2	4.6		283.3
Grapefruit/Lemons/Oranges	0.0	2.6	10.8	25.7	39.6	45.2	47.3	44.5	32.7	24.3	6.2	4.6		283.3
Sprinkler Irrigation														
ET	1.72	2.06	2.98	3.86	5.00	5.80	5.93	5.71	4.21	3.61	1.76	1.75	44.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68		
Gross Crop Irrig. Req.	0.00	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68	45.2	3.8
Total Sprinkler AF	**0.0**	**0.8**	**3.5**	**8.6**	**12.8**	**14.9**	**15.2**	**14.6**	**10.8**	**8.0**	**2.0**	**1.4**		**92.7**
Surface Irrigation														
ET	1.72	2.06	2.95	3.66	4.79	5.46	5.80	5.34	3.91	3.32	1.73	1.75	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73		
Gross Crop Irrig. Req.	0.00	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73	45.7	3.8
Total Surface Irrigation AF	**0.0**	**0.6**	**2.5**	**5.8**	**8.7**	**9.9**	**10.6**	**9.7**	**7.1**	**5.2**	**1.4**	**1.0**		**62.4**
Drip Irrigation														
ET	1.72	2.05	2.79	3.33	4.48	5.06	5.36	5.00	3.68	3.25	1.68	1.75	40.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64		
Gross Crop Irrig. Req.	0.00	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64	37.5	3.1
Total Drip Irrigation AF	**0.0**	**1.2**	**4.8**	**11.4**	**18.0**	**20.3**	**21.5**	**20.1**	**14.8**	**11.1**	**2.8**	**2.2**		**128.3**
Deciduous Fruits & Nuts	0.0	53.1	254.6	1,064.4	2,420.7	2,850.9	3,057.0	2,772.2	1,923.0	995.4	0.0	0.0		**15,391.2**
Apricots	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.68	0.81	1.03	1.91	5.16	6.82	7.45	6.79	4.84	2.59	0.94	1.32	41.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.72	1.76	6.44	8.52	9.32	8.49	6.05	2.63	-0.05	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.76	6.44	8.52	9.32	8.49	6.05	2.63	0.00	0.14	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.68	0.81	1.03	1.91	5.50	7.11	7.63	7.02	4.94	2.63	0.94	1.32	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.76	1.88	7.33	9.48	10.18	9.36	6.58	2.86	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.88	7.33	9.48	10.18	9.36	6.58	2.86	0.00	0.15	47.8	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.68	0.82	1.04	1.93	5.37	6.87	7.39	6.75	4.78	2.55	0.92	1.33	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.66	1.68	6.32	8.09	8.70	7.94	5.62	2.42	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.68	6.32	8.09	8.70	7.94	5.62	2.42	0.00	0.15	40.9	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Cherries	0.0	0.1	0.2	1.6	4.9	6.1	6.7	6.0	4.3	2.0	0.0	0.0		32.0
Sprinkler Irrigation														
ET	1.72	2.23	3.15	3.89	6.55	8.22	9.04	7.98	5.89	3.60	1.61	1.77	55.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70		
Gross Crop Irrig. Req.	0.00	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70	59.3	4.9
Total Sprinkler AF	**0.0**	**0.1**	**0.2**	**0.5**	**1.0**	**1.3**	**1.4**	**1.3**	**0.9**	**0.5**	**0.1**	**0.1**		**7.5**
Surface Irrigation														
ET	1.68	0.81	1.01	2.08	5.64	7.03	7.82	6.97	4.91	2.84	0.92	1.32	43.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.10	7.52	9.37	10.42	9.29	6.54	3.14	-0.08	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.10	7.52	9.37	10.42	9.29	6.54	3.14	0.00	0.15	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.5**	**1.9**	**2.4**	**2.7**	**2.4**	**1.7**	**0.8**	**0.0**	**0.0**		**12.4**
Drip Irrigation														
ET	1.68	0.82	1.02	2.09	5.83	7.17	7.85	7.11	4.98	2.68	0.92	1.33	43.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.87	6.85	8.43	9.23	8.36	5.85	2.58	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.87	6.85	8.43	9.23	8.36	5.85	2.58	0.00	0.15	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.5**	**2.0**	**2.4**	**2.6**	**2.4**	**1.7**	**0.7**	**0.0**	**0.0**		**12.4**
Almonds	0.0	53.0	254.3	1,062.8	2,415.8	2,844.8	3,050.3	2,766.2	1,918.7	993.3	0.0	0.0		15359.2
Sprinkler Irrigation														
ET	1.72	1.97	2.63	3.34	6.42	7.09	7.45	6.78	4.81	3.43	1.51	1.71	48.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63		
Gross Crop Irrig. Req.	0.00	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63	50.8	4.2
Total Sprinkler AF	**0.0**	**16.8**	**75.1**	**206.7**	**467.9**	**516.8**	**543.5**	**494.3**	**350.6**	**214.9**	**38.5**	**36.8**		**2,961.9**
Surface Irrigation														
ET	1.72	1.97	2.74	3.91	6.64	7.99	8.63	7.77	5.37	3.39	1.56	1.71	53.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67		
Gross Crop Irrig. Req.	0.00	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67	60.2	5.0
Total Sprinkler AF	**0.0**	**36.3**	**179.2**	**536.1**	**1,045.8**	**1,257.4**	**1,358.7**	**1,223.8**	**845.1**	**457.5**	**91.1**	**79.5**		**7,110.4**
Drip Irrigation														
ET	1.68	0.82	1.21	2.57	5.82	6.90	7.40	6.76	4.66	2.56	0.92	1.33	42.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.46	2.43	6.84	8.12	8.71	7.95	5.48	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.43	6.84	8.12	8.71	7.95	5.48	2.44	0.00	0.15	42.1	3.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**320.0**	**902.2**	**1,070.5**	**1,148.1**	**1,048.1**	**723.0**	**321.0**	**0.0**	**19.3**		**5,552.2**
Walnuts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.68	0.81	1.31	1.96	5.76	8.19	9.00	8.02	5.37	3.00	1.01	1.32	47.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.37	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14	50.6	4.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.68	0.81	1.14	1.57	5.19	8.19	8.93	8.08	5.39	3.09	1.09	1.32	46.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.61	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15	52.9	4.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														

ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Field Crops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		**0.0**
Beans (dry)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Miscellaneous Field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Grain & Hay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		**0.0**
Oats/Barley	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	-0.01	0.27		
Gross Crop Irrig. Req.	0.00	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	0.00	0.27	15.3	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	-0.01	0.29		
Gross Crop Irrig. Req.	0.00	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	0.00	0.29	16.4	1.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Pasture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		**0.0**
Alfalfa/Mixed Pasture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60		
Gross Crop Irrig. Req.	0.00	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60	49.9	4.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64		
Gross Crop Irrig. Req.	0.00	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64	53.2	4.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56		
Gross Crop Irrig. Req.	0.00	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56	47.0	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.51	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14	51.5	4.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-0.54	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15	55.0	4.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.48	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13		
Gross Crop Irrig. Req.	0.00	0.00	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Truck, Nursery, & Berry Crops	0.0	0.0	74.1	192.6	77.1	13.9	3.9	61.0	71.4	50.1	23.9	19.0		**586.9**
Melons	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	0.81	0.63	0.25	0.92	1.64	5.48	5.92	1.85	0.78	0.97	1.32	22.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-1.21	-0.31	1.15	2.05	6.85	7.40	2.31	0.37	-0.01	0.14		

Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.15	2.05	6.85	7.40	2.31	0.37	0.00	0.14	20.3	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	0.63	0.25	1.01	1.08	4.09	5.21	1.67	0.78	0.97	1.33	19.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-1.14	-0.29	1.19	1.27	4.81	6.13	1.97	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.19	1.27	4.81	6.13	1.97	0.35	0.00	0.15	15.9	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Tomatoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	0.81	1.17	0.70	3.38	7.74	7.36	1.01	0.28	0.78	0.97	1.32	27.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.54	0.25	4.23	9.68	9.20	1.27	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.25	4.23	9.68	9.20	1.27	0.36	0.37	0.00	0.14	25.5	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.24	0.89	3.34	7.83	6.91	0.81	0.28	0.78	0.97	1.32	26.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.48	0.52	4.45	10.44	9.22	1.08	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.52	4.45	10.44	9.22	1.08	0.38	0.39	0.00	0.15	26.6	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	1.25	0.71	3.32	7.68	7.15	1.00	0.27	0.78	0.97	1.33	27.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.41	0.24	3.91	9.04	8.42	1.18	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.24	3.91	9.04	8.42	1.18	0.32	0.35	0.00	0.15	23.6	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Flowers, Nursery	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Vegetables	0.0	0.0	74.1	192.6	77.1	13.9	3.9	61.0	71.4	50.1	23.9	19.0		586.9
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**1.5**	**6.2**	**2.0**	**0.3**	**0.1**	**1.2**	**1.6**	**1.7**	**0.9**	**0.4**		**15.7**
Surface Irrigation														
ET	1.72	1.44	3.39	5.06	1.89	0.33	0.09	1.45	1.71	1.68	1.55	1.66	22.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.40	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60		
Gross Crop Irrig. Req.	0.00	0.00	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60	18.7	1.6
Total Sprinkler AF	**0.0**	**0.0**	**66.3**	**169.0**	**70.1**	**12.3**	**3.5**	**53.8**	**63.6**	**44.3**	**20.8**	**16.7**		**520.5**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		
Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**6.3**	**17.4**	**5.0**	**1.3**	**0.4**	**6.0**	**6.2**	**4.1**	**2.1**	**1.9**		**50.7**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		
Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Vineyard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	1.78	2.31	2.45	4.97	6.41	6.93	5.83	3.87	2.40	1.34	1.66	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56		
Gross Crop Irrig. Req.	0.00	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56	41.8	3.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	1.78	2.42	2.58	4.85	6.72	7.20	6.29	3.65	2.31	1.24	1.66	42.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60		
Gross Crop Irrig. Req.	0.00	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60	45.6	3.8
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	0.79	1.03	3.18	5.97	6.59	5.42	2.94	0.81	0.92	1.33	31.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.95	0.61	3.74	7.02	7.76	6.37	3.46	0.38	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.61	3.74	7.02	7.76	6.37	3.46	0.38	0.00	0.15	29.5	2.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Total (Irrigated Acres)	0	56	339	1,283	2,537	2,910	3,108	2,878	2,027	1,070	30	24		16,261

EXISTING DISTRICT WIDE AREA- GCIR

Assumed Irrigation Efficiency

Sprinkler Irrigation	80%
Surface Irrigation	75%
Drip Irrigation	85%
Effective Prec. Percentage	80%

Notes

0.0 Mean we have forced the deamand to 0 due to field visits that show no watering is done during these months

	January inches	February inches	March inches	April inches	May inches	June inches	July inches	August inches	September inches	October inches	November inches	December inches	Annual inches
CIMIS Precipitation (30 year Effective Precipitation, 80% of Ave)	2.04	1.74	1.60	0.50	0.00	0.00	0.00	0.00	0.00	0.49	0.98	1.21	8.57

	January	February	March	April	May	June	July	August	September	October	November	December	Annual (in.)	Annual (ft)
Citrus & Subtropical	0.0	10.8	44.7	106.7	164.1	187.2	196.1	184.4	135.6	100.6	25.5	19.0		1,174.9
Grapefruit/Lemons/Oranges	0.0	10.8	44.7	106.7	164.1	187.2	196.1	184.4	135.6	100.6	25.5	19.0		1174.9
Sprinkler Irrigation														
ET	1.72	2.06	2.98	3.86	5.00	5.80	5.93	5.71	4.21	3.61	1.76	1.75	44.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68		
Gross Crop Irrig. Req.	0.00	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68	45.2	3.8
Total Sprinkler AF	**0.0**	**3.4**	**14.7**	**35.7**	**53.2**	**61.6**	**63.0**	**60.7**	**44.7**	**33.2**	**8.3**	**5.8**		**384.2**
Surface Irrigation														
ET	1.72	2.06	2.95	3.66	4.79	5.46	5.80	5.34	3.91	3.32	1.73	1.75	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73		
Gross Crop Irrig. Req.	0.00	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73	45.7	3.8
Total Surface Irrigation AF	**0.0**	**2.4**	**10.2**	**23.9**	**36.2**	**41.3**	**43.9**	**40.4**	**29.5**	**21.4**	**5.6**	**4.1**		**258.7**
Drip Irrigation														
ET	1.72	2.05	2.79	3.33	4.48	5.06	5.36	5.00	3.68	3.25	1.68	1.75	40.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64		
Gross Crop Irrig. Req.	0.00	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64	37.5	3.1
Total Drip Irrigation AF	**0.0**	**5.1**	**19.9**	**47.1**	**74.7**	**84.3**	**89.3**	**83.4**	**61.4**	**46.0**	**11.6**	**9.1**		**531.9**
Deciduous Fruits & Nuts	0.0	208.4	991.1	4,993.9	12,678.0	15,376.8	16,560.1	15,023.9	10,451.8	5,188.7	0.0	14.4		81,487.0
Apricots	0.0	0.0	0.0	371.0	1,412.4	1,826.5	1,969.2	1,802.5	1,274.3	551.6	0.0	0.0		9207.6
Sprinkler Irrigation														
ET	1.68	0.81	1.03	1.91	5.16	6.82	7.45	6.79	4.84	2.59	0.94	1.32	41.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.72	1.76	6.44	8.52	9.32	8.49	6.05	2.63	-0.05	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.76	6.44	8.52	9.32	8.49	6.05	2.63	0.00	0.14	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**69.8**	**256.0**	**338.4**	**370.1**	**337.2**	**240.2**	**104.3**	**0.0**	**5.5**		**1,721.5**
Surface Irrigation														
ET	1.68	0.81	1.03	1.91	5.50	7.11	7.63	7.02	4.94	2.63	0.94	1.32	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.76	1.88	7.33	9.48	10.18	9.36	6.58	2.86	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.88	7.33	9.48	10.18	9.36	6.58	2.86	0.00	0.15	47.8	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**150.8**	**589.3**	**762.2**	**818.4**	**752.8**	**529.3**	**229.8**	**0.0**	**11.9**		**3,844.4**
Drip Irrigation														
ET	1.68	0.82	1.04	1.93	5.37	6.87	7.39	6.75	4.78	2.55	0.92	1.33	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.66	1.68	6.32	8.09	8.70	7.94	5.62	2.42	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.68	6.32	8.09	8.70	7.94	5.62	2.42	0.00	0.15	40.9	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**150.4**	**567.1**	**725.9**	**780.7**	**712.6**	**504.8**	**217.5**	**0.0**	**13.1**		**3,672.2**
Cherries	0.0	5.0	15.9	103.8	317.8	394.6	435.2	389.4	276.3	131.3	0.0	0.0		2069.2
Sprinkler Irrigation														
ET	1.72	2.23	3.15	3.89	6.55	8.22	9.04	7.98	5.89	3.60	1.61	1.77	55.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70		
Gross Crop Irrig. Req.	0.00	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70	59.3	4.9
Total Sprinkler AF	**0.0**	**5.0**	**15.9**	**34.6**	**66.9**	**83.9**	**92.3**	**81.5**	**60.1**	**31.8**	**6.4**	**5.7**		**484.0**
Surface Irrigation														
ET	1.68	0.81	1.01	2.08	5.64	7.03	7.82	6.97	4.91	2.84	0.92	1.32	43.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.10	7.52	9.37	10.42	9.29	6.54	3.14	-0.08	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.10	7.52	9.37	10.42	9.29	6.54	3.14	0.00	0.15	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**34.7**	**124.3**	**155.0**	**172.4**	**153.6**	**108.2**	**51.9**	**0.0**	**2.4**		**802.5**
Drip Irrigation														
ET	1.68	0.82	1.02	2.09	5.83	7.17	7.85	7.11	4.98	2.68	0.92	1.33	43.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.87	6.85	8.43	9.23	8.36	5.85	2.58	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.87	6.85	8.43	9.23	8.36	5.85	2.58	0.00	0.15	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**34.5**	**126.5**	**155.6**	**170.5**	**154.3**	**108.1**	**47.7**	**0.0**	**2.7**		**799.9**
Almonds	0.0	203.4	975.3	4,075.2	9,263.7	10,908.4	11,696.3	10,607.1	7,357.4	3,809.0	0.0	0.0		58895.8
Sprinkler Irrigation														
ET	1.72	1.97	2.63	3.34	6.42	7.09	7.45	6.78	4.81	3.43	1.51	1.71	48.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63		
Gross Crop Irrig. Req.	0.00	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63	50.8	4.2
Total Sprinkler AF	**0.0**	**64.4**	**288.0**	**792.5**	**1,794.1**	**1,981.7**	**2,084.2**	**1,895.5**	**1,344.4**	**823.9**	**147.6**	**141.2**		**11,357.5**
Surface Irrigation														
ET	1.72	1.97	2.74	3.91	6.64	7.99	8.63	7.77	5.37	3.39	1.56	1.71	53.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67		
Gross Crop Irrig. Req.	0.00	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67	60.2	5.0
Total Sprinkler AF	**0.0**	**139.0**	**687.3**	**2,055.6**	**4,010.0**	**4,821.7**	**5,209.8**	**4,692.8**	**3,240.7**	**1,754.2**	**349.3**	**305.0**		**27,265.3**
Drip Irrigation														
ET	1.68	0.82	1.21	2.57	5.82	6.90	7.40	6.76	4.66	2.56	0.92	1.33	42.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.46	2.43	6.84	8.12	8.71	7.95	5.48	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.43	6.84	8.12	8.71	7.95	5.48	2.44	0.00	0.15	42.1	3.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**1,227.1**	**3,459.6**	**4,105.0**	**4,402.3**	**4,018.9**	**2,772.3**	**1,230.9**	**0.0**	**74.0**		**21,290.1**
Walnuts	0.0	0.0	0.0	245.6	1,010.8	1,420.3	1,548.2	1,397.0	957.9	440.2	0.0	0.0		7020.0
Sprinkler Irrigation														
ET	1.68	0.81	1.31	1.96	5.76	8.19	9.00	8.02	5.37	3.00	1.01	1.32	47.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.37	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14	50.6	4.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**51.2**	**202.5**	**287.7**	**316.2**	**281.8**	**188.5**	**88.1**	**0.8**	**3.9**		**1,420.7**
Surface Irrigation														
ET	1.68	0.81	1.14	1.57	5.19	8.19	8.93	8.08	5.39	3.09	1.09	1.32	46.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.61	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15	52.9	4.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**80.8**	**393.8**	**621.3**	**677.4**	**612.7**	**408.6**	**197.4**	**8.2**	**8.4**		**3,008.6**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**113.6**	**414.6**	**511.4**	**554.6**	**502.5**	**360.7**	**154.6**	**0.0**	**9.3**		**2,621.3**
Other	0.0	0.0	0.0	198.3	673.3	827.0	911.1	827.9	585.9	256.6	0.0	14.4		4294.4
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**47.0**	**125.8**	**148.0**	**168.3**	**151.7**	**103.4**	**49.3**	**0.0**	**2.6**		**796.2**
Surface Irrigation														

ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**75.8**	**271.8**	**338.9**	**374.0**	**342.0**	**242.6**	**104.4**	**0.0**	**5.6**		**1,755.1**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**75.5**	**275.7**	**340.0**	**368.8**	**334.1**	**239.9**	**102.8**	**0.0**	**6.2**		**1,743.1**

Field Crops	0.0	0.0	0.0	193.5	583.1	1,689.1	1,947.3	742.4	70.1	72.8	0.0	0.0		**5,298.3**
Beans (dry)	0.0	0.0	0.0	193.5	583.1	1,689.1	1,947.3	742.4	70.1	72.8	0.0	0.0		5298.3
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**193.5**	**583.1**	**1,689.1**	**1,947.3**	**742.4**	**70.1**	**72.8**	**0.0**	**27.4**		**5,325.6**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Miscellaneous Field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Grain & Hay	0.0	125.8	594.7	1,286.4	936.6	93.7	25.7	89.8	78.0	81.0	0.0	0.0		**3,311.8**
Oats/Barley	0.0	125.8	594.7	1,286.4	936.6	93.7	25.7	89.8	78.0	81.0	0.0	0.0		3311.8
Sprinkler Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	-0.01	0.27		
Gross Crop Irrig. Req.	0.00	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	0.00	0.27	15.3	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	-0.01	0.29		
Gross Crop Irrig. Req.	0.00	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	0.00	0.29	16.4	1.4
Total Sprinkler AF	**0.0**	**125.8**	**594.7**	**1,286.4**	**936.6**	**93.7**	**25.7**	**89.8**	**78.0**	**81.0**	**0.0**	**60.3**		**3,372.1**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Pasture	0.0	80.7	358.1	683.5	1,057.5	1,239.8	1,318.3	1,159.7	889.0	342.0	121.7	87.8		**7,338.1**
Alfalfa/Mixed Pasture	0.0	80.7	358.1	683.5	1,057.5	1,239.8	1,318.3	1,159.7	889.0	342.0	121.7	87.8		7338.1
Sprinkler Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60		
Gross Crop Irrig. Req.	0.00	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60	49.9	4.2
Total Sprinkler AF	**0.0**	**4.6**	**20.2**	**38.6**	**59.7**	**70.0**	**74.4**	**65.5**	**50.2**	**19.3**	**6.9**	**5.0**		**414.3**
Surface Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64		
Gross Crop Irrig. Req.	0.00	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64	53.2	4.4
Total Sprinkler AF	**0.0**	**76.1**	**337.9**	**644.9**	**997.8**	**1,169.8**	**1,243.9**	**1,094.2**	**838.8**	**322.7**	**114.8**	**82.9**		**6,923.8**
Drip Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56		
Gross Crop Irrig. Req.	0.00	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56	47.0	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.51	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14	51.5	4.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-0.54	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15	55.0	4.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.48	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13		
Gross Crop Irrig. Req.	0.00	0.00	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Truck, Nursery, & Berry Crops	0.0	0.0	176.6	626.7	1,689.6	3,475.6	3,242.3	805.9	401.0	272.9	56.9	45.2		**10792.7**
Melons	0.0	0.0	0.0	0.0	44.0	63.0	217.8	257.9	75.4	12.9	0.0	0.0		671.1
Sprinkler Irrigation														
ET	1.70	0.81	0.63	0.25	0.92	1.64	5.48	5.92	1.85	0.78	0.97	1.32	22.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-1.21	-0.31	1.15	2.05	6.85	7.40	2.31	0.37	-0.01	0.14		

Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.15	2.05	6.85	7.40	2.31	0.37	0.00	0.14	20.3	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.8**	**1.4**	**4.5**	**4.9**	**1.5**	**0.2**	**0.0**	**0.1**		**13.4**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**38.9**	**57.0**	**195.7**	**230.7**	**66.7**	**11.4**	**0.0**	**4.3**		**604.6**
Drip Irrigation														
ET	1.70	0.82	0.63	0.25	1.01	1.08	4.09	5.21	1.67	0.78	0.97	1.33	19.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-1.14	-0.29	1.19	1.27	4.81	6.13	1.97	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.19	1.27	4.81	6.13	1.97	0.35	0.00	0.15	15.9	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**4.3**	**4.6**	**17.6**	**22.4**	**7.2**	**1.3**	**0.0**	**0.5**		**57.9**
Tomatoes	0.0	0.0	0.0	156.9	1,422.8	3,330.8	2,961.5	353.8	120.7	125.8	0.0	0.0		8472.3
Sprinkler Irrigation														
ET	1.70	0.81	1.17	0.70	3.38	7.74	7.36	1.01	0.28	0.78	0.97	1.32	27.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.54	0.25	4.23	9.68	9.20	1.27	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.25	4.23	9.68	9.20	1.27	0.36	0.37	0.00	0.14	25.5	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**1.6**	**27.4**	**62.8**	**59.7**	**8.2**	**2.3**	**2.4**	**0.0**	**0.9**		**165.3**
Surface Irrigation														
ET	1.70	0.81	1.24	0.89	3.34	7.83	6.91	0.81	0.28	0.78	0.97	1.32	26.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.48	0.52	4.45	10.44	9.22	1.08	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.52	4.45	10.44	9.22	1.08	0.38	0.39	0.00	0.15	26.6	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**146.7**	**1,256.0**	**2,945.6**	**2,601.6**	**303.5**	**106.9**	**111.0**	**0.0**	**41.7**		**7,512.8**
Drip Irrigation														
ET	1.70	0.82	1.25	0.71	3.32	7.68	7.15	1.00	0.27	0.78	0.97	1.33	27.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.41	0.24	3.91	9.04	8.42	1.18	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.24	3.91	9.04	8.42	1.18	0.32	0.35	0.00	0.15	23.6	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**8.6**	**139.4**	**322.5**	**300.3**	**42.1**	**11.5**	**12.4**	**0.0**	**5.2**		**842.0**
Flowers, Nursery	0.0	0.0	0.0	10.9	39.1	48.6	53.6	48.9	34.7	15.0	0.0	0.0		250.8
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.3**	**0.7**	**0.9**	**1.0**	**0.9**	**0.6**	**0.3**	**0.0**	**0.0**		**4.7**
Surface Irrigation														
ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**9.6**	**34.4**	**42.9**	**47.3**	**43.3**	**30.7**	**13.2**	**0.0**	**0.7**		**222.0**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**1.1**	**3.9**	**4.9**	**5.3**	**4.8**	**3.4**	**1.5**	**0.0**	**0.1**		**25.0**
Vegetables	0.0	0.0	176.6	458.9	183.7	33.1	9.4	145.3	170.2	119.3	56.9	45.2		1398.5
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**3.5**	**14.9**	**4.7**	**0.6**	**0.2**	**2.8**	**3.7**	**4.1**	**2.2**	**0.9**		**37.4**
Surface Irrigation														
ET	1.72	1.44	3.39	5.06	1.89	0.33	0.09	1.45	1.71	1.68	1.55	1.66	22.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.40	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60		
Gross Crop Irrig. Req.	0.00	0.00	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60	18.7	1.6
Total Sprinkler AF	**0.0**	**0.0**	**158.0**	**402.6**	**167.0**	**29.3**	**8.3**	**128.2**	**151.6**	**105.5**	**49.7**	**39.9**		**1,240.2**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		
Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**15.1**	**41.4**	**12.0**	**3.2**	**0.9**	**14.3**	**14.9**	**9.7**	**5.0**	**4.4**		**120.9**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		
Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Vineyard	0.0	0.2	2.7	24.5	122.9	219.5	241.9	199.3	110.8	18.0	1.4	0.0		941.3
Sprinkler Irrigation														
ET	1.72	1.78	2.31	2.45	4.97	6.41	6.93	5.83	3.87	2.40	1.34	1.66	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56		
Gross Crop Irrig. Req.	0.00	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56	41.8	3.5
Total Sprinkler AF	**0.0**	**0.2**	**2.7**	**7.5**	**19.1**	**24.7**	**26.7**	**22.5**	**14.9**	**7.4**	**1.4**	**1.7**		**128.8**
Surface Irrigation														
ET	1.72	1.78	2.42	2.58	4.85	6.72	7.20	6.29	3.65	2.31	1.24	1.66	42.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60		
Gross Crop Irrig. Req.	0.00	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60	45.6	3.8
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	0.79	1.03	3.18	5.97	6.59	5.42	2.94	0.81	0.92	1.33	31.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.95	0.61	3.74	7.02	7.76	6.37	3.46	0.38	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.61	3.74	7.02	7.76	6.37	3.46	0.38	0.00	0.15	29.5	2.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**17.0**	**103.7**	**194.8**	**215.2**	**176.9**	**95.9**	**10.7**	**0.0**	**4.1**		**818.3**
Total (Irrigated Acres)	0	426	2,165	7,891	17,109	22,062	23,290	18,006	12,026	6,058	204	166		109,403

FUTURE DISTRICT-WIDE AREA- GCIR

Assumed Irrigation Efficiency

Sprinkler Irrigation	80%
Surface Irrigation	75%
Drip Irrigation	85%
Effective Prec. Percentage	80%

Notes

0.0 Mean we have forced the deamand to 0 due to field visits that show no watering is done during these months

	January inches	February inches	March inches	April inches	May inches	June inches	July inches	August inches	September inches	October inches	November inches	December inches	Annual inches
CIMIS Precipitation (30 year Effective Precipitation, 80% of Ave)	2.04	1.74	1.60	0.50	0.00	0.00	0.00	0.00	0.00	0.49	0.98	1.21	8.57

	January	February	March	April	May	June	July	August	September	October	November	December	Annual (in.)	Annual (ft)
Citrus & Subtropical	0.0	10.8	44.7	106.7	164.1	187.2	196.1	184.4	135.6	100.6	25.5	19.0		1,174.9
Grapefruit/Lemons/Oranges	0.0	10.8	44.7	106.7	164.1	187.2	196.1	184.4	135.6	100.6	25.5	19.0		1174.9
Sprinkler Irrigation														
ET	1.72	2.06	2.98	3.86	5.00	5.80	5.93	5.71	4.21	3.61	1.76	1.75	44.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68		
Gross Crop Irrig. Req.	0.00	0.39	1.73	4.20	6.25	7.25	7.41	7.14	5.26	3.91	0.98	0.68	45.2	3.8
Total Sprinkler AF	**0.0**	**3.4**	**14.7**	**35.7**	**53.2**	**61.6**	**63.0**	**60.7**	**44.7**	**33.2**	**8.3**	**5.8**		**384.2**
Surface Irrigation														
ET	1.72	2.06	2.95	3.66	4.79	5.46	5.80	5.34	3.91	3.32	1.73	1.75	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73		
Gross Crop Irrig. Req.	0.00	0.42	1.79	4.21	6.38	7.28	7.74	7.12	5.21	3.78	1.00	0.73	45.7	3.8
Total Surface Irrigation AF	**0.0**	**2.4**	**10.2**	**23.9**	**36.2**	**41.3**	**43.9**	**40.4**	**29.5**	**21.4**	**5.6**	**4.1**		**258.7**
Drip Irrigation														
ET	1.72	2.05	2.79	3.33	4.48	5.06	5.36	5.00	3.68	3.25	1.68	1.75	40.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64		
Gross Crop Irrig. Req.	0.00	0.36	1.40	3.32	5.28	5.95	6.30	5.89	4.33	3.25	0.82	0.64	37.5	3.1
Total Drip Irrigation AF	**0.0**	**5.1**	**19.9**	**47.1**	**74.7**	**84.3**	**89.3**	**83.4**	**61.4**	**46.0**	**11.6**	**9.1**		**531.9**
Deciduous Fruits & Nuts	0.0	222.7	1,059.9	5,281.2	13,331.1	16,145.9	17,384.7	15,771.7	10,970.5	5,457.2	0.0	14.4		85,639.3
Apricots	0.0	0.0	0.0	371.0	1,412.4	1,826.5	1,969.2	1,802.5	1,274.3	551.6	0.0	0.0		9207.6
Sprinkler Irrigation														
ET	1.68	0.81	1.03	1.91	5.16	6.82	7.45	6.79	4.84	2.59	0.94	1.32	41.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.72	1.76	6.44	8.52	9.32	8.49	6.05	2.63	-0.05	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.76	6.44	8.52	9.32	8.49	6.05	2.63	0.00	0.14	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**69.8**	**256.0**	**338.4**	**370.1**	**337.2**	**240.2**	**104.3**	**0.0**	**5.5**		**1,721.5**
Surface Irrigation														
ET	1.68	0.81	1.03	1.91	5.50	7.11	7.63	7.02	4.94	2.63	0.94	1.32	42.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.76	1.88	7.33	9.48	10.18	9.36	6.58	2.86	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.88	7.33	9.48	10.18	9.36	6.58	2.86	0.00	0.15	47.8	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**150.8**	**589.3**	**762.2**	**818.4**	**752.8**	**529.3**	**229.8**	**0.0**	**11.9**		**3,844.4**
Drip Irrigation														
ET	1.68	0.82	1.04	1.93	5.37	6.87	7.39	6.75	4.78	2.55	0.92	1.33	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.66	1.68	6.32	8.09	8.70	7.94	5.62	2.42	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.68	6.32	8.09	8.70	7.94	5.62	2.42	0.00	0.15	40.9	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**150.4**	**567.1**	**725.9**	**780.7**	**712.6**	**504.8**	**217.5**	**0.0**	**13.1**		**3,672.2**
Cherries	0.0	5.0	15.9	103.8	317.8	394.6	435.2	389.4	276.3	131.3	0.0	0.0		2069.2
Sprinkler Irrigation														
ET	1.72	2.23	3.15	3.89	6.55	8.22	9.04	7.98	5.89	3.60	1.61	1.77	55.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70		
Gross Crop Irrig. Req.	0.00	0.61	1.94	4.23	8.19	10.27	11.30	9.97	7.36	3.89	0.79	0.70	59.3	4.9
Total Sprinkler AF	**0.0**	**5.0**	**15.9**	**34.6**	**66.9**	**83.9**	**92.3**	**81.5**	**60.1**	**31.8**	**6.4**	**5.7**		**484.0**
Surface Irrigation														
ET	1.68	0.81	1.01	2.08	5.64	7.03	7.82	6.97	4.91	2.84	0.92	1.32	43.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.10	7.52	9.37	10.42	9.29	6.54	3.14	-0.08	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.10	7.52	9.37	10.42	9.29	6.54	3.14	0.00	0.15	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**34.7**	**124.3**	**155.0**	**172.4**	**153.6**	**108.2**	**51.9**	**0.0**	**2.4**		**802.5**
Drip Irrigation														
ET	1.68	0.82	1.02	2.09	5.83	7.17	7.85	7.11	4.98	2.68	0.92	1.33	43.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.87	6.85	8.43	9.23	8.36	5.85	2.58	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.87	6.85	8.43	9.23	8.36	5.85	2.58	0.00	0.15	43.3	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**34.5**	**126.5**	**155.6**	**170.5**	**154.3**	**108.1**	**47.7**	**0.0**	**2.7**		**799.9**
Almonds	0.0	217.7	1,044.0	4,362.5	9,916.8	11,677.5	12,521.0	11,355.0	7,876.1	4,077.5	0.0	0.0		63048.1
Sprinkler Irrigation														
ET	1.72	1.97	2.63	3.34	6.42	7.09	7.45	6.78	4.81	3.43	1.51	1.71	48.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63		
Gross Crop Irrig. Req.	0.00	0.29	1.29	3.54	8.02	8.86	9.32	8.47	6.01	3.68	0.66	0.63	50.8	4.2
Total Sprinkler AF	**0.0**	**68.9**	**308.3**	**848.4**	**1,920.6**	**2,121.4**	**2,231.1**	**2,029.1**	**1,439.2**	**882.0**	**158.0**	**151.2**		**12,158.2**
Surface Irrigation														
ET	1.72	1.97	2.74	3.91	6.64	7.99	8.63	7.77	5.37	3.39	1.56	1.71	53.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67		
Gross Crop Irrig. Req.	0.00	0.31	1.52	4.54	8.85	10.65	11.50	10.36	7.16	3.87	0.77	0.67	60.2	5.0
Total Sprinkler AF	**0.0**	**148.8**	**735.7**	**2,200.5**	**4,292.7**	**5,161.6**	**5,577.1**	**5,023.6**	**3,469.2**	**1,877.9**	**373.9**	**326.5**		**29,187.6**
Drip Irrigation														
ET	1.68	0.82	1.21	2.57	5.82	6.90	7.40	6.76	4.66	2.56	0.92	1.33	42.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.46	2.43	6.84	8.12	8.71	7.95	5.48	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.43	6.84	8.12	8.71	7.95	5.48	2.44	0.00	0.15	42.1	3.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**1,313.6**	**3,703.5**	**4,394.4**	**4,712.7**	**4,302.2**	**2,967.7**	**1,317.7**	**0.0**	**79.2**		**22,791.1**
Walnuts	0.0	0.0	0.0	245.6	1,010.8	1,420.3	1,548.2	1,397.0	957.9	440.2	0.0	0.0		7020.0
Sprinkler Irrigation														
ET	1.68	0.81	1.31	1.96	5.76	8.19	9.00	8.02	5.37	3.00	1.01	1.32	47.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.37	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.82	7.20	10.24	11.25	10.03	6.71	3.14	0.03	0.14	50.6	4.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**51.2**	**202.5**	**287.7**	**316.2**	**281.8**	**188.5**	**88.1**	**0.8**	**3.9**		**1,420.7**
Surface Irrigation														
ET	1.68	0.81	1.14	1.57	5.19	8.19	8.93	8.08	5.39	3.09	1.09	1.32	46.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.61	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.42	6.92	10.92	11.91	10.77	7.18	3.47	0.14	0.15	52.9	4.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**80.8**	**393.8**	**621.3**	**677.4**	**612.7**	**408.6**	**197.4**	**8.2**	**8.4**		**3,008.6**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**113.6**	**414.6**	**511.4**	**554.6**	**502.5**	**360.7**	**154.6**	**0.0**	**9.3**		**2,621.3**
Other	0.0	0.0	0.0	198.3	673.3	827.0	911.1	827.9	585.9	256.6	0.0	14.4		4294.4
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**47.0**	**125.8**	**148.0**	**168.3**	**151.7**	**103.4**	**49.3**	**0.0**	**2.6**		**796.2**
Surface Irrigation														

ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**75.8**	**271.8**	**338.9**	**374.0**	**342.0**	**242.6**	**104.4**	**0.0**	**5.6**		**1,755.1**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**75.5**	**275.7**	**340.0**	**368.8**	**334.1**	**239.9**	**102.8**	**0.0**	**6.2**		**1,743.1**

Field Crops	0.0	0.0	0.0	240.1	723.6	2,095.9	2,416.4	921.3	87.0	90.3	0.0	0.0		**6,574.6**
Beans (dry)	0.0	0.0	0.0	240.1	723.6	2,095.9	2,416.4	921.3	87.0	90.3	0.0	0.0		6574.6
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**240.1**	**723.6**	**2,095.9**	**2,416.4**	**921.3**	**87.0**	**90.3**	**0.0**	**33.9**		**6,608.5**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Miscellaneous Field	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	0.81	1.45	1.06	2.33	6.84	7.86	2.69	0.28	0.78	0.97	1.32	28.1	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.19	0.70	2.91	8.56	9.82	3.37	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.70	2.91	8.56	9.82	3.37	0.36	0.37	0.00	0.14	26.2	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	1.45	1.29	2.36	6.84	7.89	3.01	0.28	0.78	0.97	1.32	28.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.20	1.05	3.15	9.13	10.52	4.01	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.05	3.15	9.13	10.52	4.01	0.38	0.39	0.00	0.15	28.8	2.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Grain & Hay	0.0	125.8	594.7	1,286.4	936.6	93.7	25.7	89.8	78.0	81.0	0.0	0.0		**3,311.8**
Oats/Barley	0.0	125.8	594.7	1,286.4	936.6	93.7	25.7	89.8	78.0	81.0	0.0	0.0		3311.8
Sprinkler Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	-0.01	0.27		
Gross Crop Irrig. Req.	0.00	0.57	2.71	5.85	4.26	0.43	0.12	0.41	0.36	0.37	0.00	0.27	15.3	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.72	2.20	3.77	5.19	3.41	0.34	0.09	0.33	0.28	0.78	0.97	1.43	20.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	-0.01	0.29		
Gross Crop Irrig. Req.	0.00	0.61	2.89	6.24	4.55	0.46	0.12	0.44	0.38	0.39	0.00	0.29	16.4	1.4
Total Sprinkler AF	**0.0**	**125.8**	**594.7**	**1,286.4**	**936.6**	**93.7**	**25.7**	**89.8**	**78.0**	**81.0**	**0.0**	**60.3**		**3,372.1**
Drip Irrigation														
ET	1.70	0.82	1.47	1.20	2.39	6.90	7.78	2.90	0.27	0.78	0.97	1.33	28.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.16	0.82	2.81	8.12	9.15	3.41	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.82	2.81	8.12	9.15	3.41	0.32	0.35	0.00	0.15	25.1	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Pasture	0.0	93.3	414.2	790.6	1,223.1	1,434.0	1,524.8	1,341.3	1,028.3	395.5	140.8	101.6		**8,487.5**
Alfalfa/Mixed Pasture	0.0	93.3	414.2	790.6	1,223.1	1,434.0	1,524.8	1,341.3	1,028.3	395.5	140.8	101.6		8487.5
Sprinkler Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60		
Gross Crop Irrig. Req.	0.00	0.55	2.44	4.65	7.19	8.43	8.97	7.89	6.05	2.33	0.83	0.60	49.9	4.2
Total Sprinkler AF	**0.0**	**5.3**	**23.4**	**44.6**	**69.1**	**81.0**	**86.1**	**75.7**	**58.1**	**22.3**	**7.9**	**5.7**		**479.2**
Surface Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64		
Gross Crop Irrig. Req.	0.00	0.59	2.60	4.96	7.67	9.00	9.57	8.41	6.45	2.48	0.88	0.64	53.2	4.4
Total Sprinkler AF	**0.0**	**88.0**	**390.8**	**745.9**	**1,154.1**	**1,353.0**	**1,438.7**	**1,265.6**	**970.2**	**373.2**	**132.8**	**95.8**		**8,008.3**
Drip Irrigation														
ET	1.72	2.18	3.55	4.22	5.75	6.75	7.17	6.31	4.84	2.35	1.65	1.69	48.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56		
Gross Crop Irrig. Req.	0.00	0.52	2.29	4.38	6.77	7.94	8.44	7.42	5.69	2.19	0.78	0.56	47.0	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.51	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.78	4.30	7.82	9.07	9.98	9.09	6.48	3.32	0.56	0.14	51.5	4.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-0.54	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.83	4.59	8.34	9.67	10.65	9.69	6.91	3.54	0.59	0.15	55.0	4.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	1.34	2.22	3.94	6.26	7.25	7.98	7.27	5.18	3.14	1.43	1.32	49.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.48	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13		
Gross Crop Irrig. Req.	0.00	0.00	0.74	4.05	7.36	8.53	9.39	8.55	6.10	3.12	0.52	0.13	48.5	4.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**

Truck, Nursery, & Berry Crops	0.0	0.0	231.0	813.3	2,155.3	4,443.4	4,096.7	952.4	488.1	345.8	74.4	59.1		**13659.6**
Melons	0.0	0.0	0.0	0.0	44.0	63.0	217.8	257.9	75.4	12.9	0.0	0.0		671.1
Sprinkler Irrigation														
ET	1.70	0.81	0.63	0.25	0.92	1.64	5.48	5.92	1.85	0.78	0.97	1.32	22.3	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-1.21	-0.31	1.15	2.05	6.85	7.40	2.31	0.37	-0.01	0.14		

Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.15	2.05	6.85	7.40	2.31	0.37	0.00	0.14	20.3	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.8**	**1.4**	**4.5**	**4.9**	**1.5**	**0.2**	**0.0**	**0.1**		**13.4**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**38.9**	**57.0**	**195.7**	**230.7**	**66.7**	**11.4**	**0.0**	**4.3**		**604.6**
Drip Irrigation														
ET	1.70	0.82	0.63	0.25	1.01	1.08	4.09	5.21	1.67	0.78	0.97	1.33	19.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-1.14	-0.29	1.19	1.27	4.81	6.13	1.97	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.19	1.27	4.81	6.13	1.97	0.35	0.00	0.15	15.9	1.3
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**4.3**	**4.6**	**17.6**	**22.4**	**7.2**	**1.3**	**0.0**	**0.5**		**57.9**
Tomatoes	0.0	0.0	0.0	202.0	1,831.9	4,288.5	3,813.0	455.5	155.4	161.9	0.0	0.0		10908.1
Sprinkler Irrigation														
ET	1.70	0.81	1.17	0.70	3.38	7.74	7.36	1.01	0.28	0.78	0.97	1.32	27.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.17	-0.54	0.25	4.23	9.68	9.20	1.27	0.36	0.37	-0.01	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.25	4.23	9.68	9.20	1.27	0.36	0.37	0.00	0.14	25.5	2.1
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**2.1**	**35.3**	**80.8**	**76.8**	**10.6**	**3.0**	**3.1**	**0.0**	**1.2**		**212.8**
Surface Irrigation														
ET	1.70	0.81	1.24	0.89	3.34	7.83	6.91	0.81	0.28	0.78	0.97	1.32	26.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-0.48	0.52	4.45	10.44	9.22	1.08	0.38	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.52	4.45	10.44	9.22	1.08	0.38	0.39	0.00	0.15	26.6	2.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**188.8**	**1,617.1**	**3,792.5**	**3,349.6**	**390.7**	**137.6**	**142.9**	**0.0**	**53.7**		**9,672.9**
Drip Irrigation														
ET	1.70	0.82	1.25	0.71	3.32	7.68	7.15	1.00	0.27	0.78	0.97	1.33	27.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.41	0.24	3.91	9.04	8.42	1.18	0.32	0.35	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.24	3.91	9.04	8.42	1.18	0.32	0.35	0.00	0.15	23.6	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**11.1**	**179.4**	**415.2**	**386.6**	**54.2**	**14.8**	**15.9**	**0.0**	**6.7**		**1,084.0**
Flowers, Nursery	0.0	0.0	0.0	10.9	39.1	48.6	53.6	48.9	34.7	15.0	0.0	0.0		250.8
Sprinkler Irrigation														
ET	1.68	0.81	1.20	2.51	5.39	6.34	7.21	6.50	4.43	2.60	0.92	1.32	40.9	
[ET-Precip.] /(Irrigation Efficiency)	-0.45	-1.17	-0.50	2.51	6.73	7.92	9.01	8.12	5.53	2.64	-0.07	0.14		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.51	6.73	7.92	9.01	8.12	5.53	2.64	0.00	0.14	42.6	3.6
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.3**	**0.7**	**0.9**	**1.0**	**0.9**	**0.6**	**0.3**	**0.0**	**0.0**		**4.7**
Surface Irrigation														
ET	1.68	0.81	1.01	2.01	5.39	6.72	7.41	6.78	4.81	2.56	0.94	1.32	41.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.48	-1.25	-0.79	2.00	7.18	8.96	9.88	9.04	6.41	2.76	-0.06	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	2.00	7.18	8.96	9.88	9.04	6.41	2.76	0.00	0.15	46.4	3.9
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**9.6**	**34.4**	**42.9**	**47.3**	**43.3**	**30.7**	**13.2**	**0.0**	**0.7**		**222.0**
Drip Irrigation														
ET	1.68	0.82	1.02	2.02	5.55	6.84	7.42	6.73	4.83	2.56	0.92	1.33	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-1.09	-0.68	1.79	6.53	8.05	8.73	7.91	5.68	2.44	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	1.79	6.53	8.05	8.73	7.91	5.68	2.44	0.00	0.15	41.3	3.4
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**1.1**	**3.9**	**4.9**	**5.3**	**4.8**	**3.4**	**1.5**	**0.0**	**0.1**		**25.0**
Vegetables	0.0	0.0	231.0	600.3	240.3	43.3	12.3	190.1	222.6	156.1	74.4	59.1		1829.6
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**4.6**	**19.5**	**6.1**	**0.8**	**0.2**	**3.6**	**4.8**	**5.3**	**2.8**	**1.1**		**49.0**
Surface Irrigation														
ET	1.72	1.44	3.39	5.06	1.89	0.33	0.09	1.45	1.71	1.68	1.55	1.66	22.0	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	-0.40	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60		
Gross Crop Irrig. Req.	0.00	0.00	2.38	6.07	2.52	0.44	0.12	1.93	2.29	1.59	0.75	0.60	18.7	1.6
Total Sprinkler AF	**0.0**	**0.0**	**206.7**	**526.7**	**218.5**	**38.4**	**10.8**	**167.7**	**198.3**	**138.0**	**65.0**	**52.2**		**1,622.4**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		
Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**19.7**	**54.1**	**15.7**	**4.2**	**1.2**	**18.7**	**19.5**	**12.7**	**6.6**	**5.8**		**158.2**
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sprinkler Irrigation														
ET	1.72	1.45	3.45	8.31	2.45	0.33	0.09	1.45	1.94	2.62	2.12	1.66	27.6	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-0.36	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56		
Gross Crop Irrig. Req.	0.00	0.00	2.31	9.75	3.07	0.41	0.12	1.81	2.42	2.67	1.42	0.56	24.5	2.0
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Surface Irrigation														
ET	1.70	0.81	0.63	0.25	1.01	1.48	5.09	6.00	1.73	0.78	0.97	1.32	21.8	
[ET-Precip.] /(Irrigation Efficiency)	-0.46	-1.25	-1.29	-0.33	1.35	1.98	6.78	7.99	2.31	0.39	-0.01	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.00	1.35	1.98	6.78	7.99	2.31	0.39	0.00	0.15	21.0	1.7
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.72	1.42	3.13	4.70	1.22	0.32	0.09	1.45	1.51	1.47	1.50	1.66	20.2	
[ET-Precip.] /(Irrigation Efficiency)	-0.38	-0.38	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53		
Gross Crop Irrig. Req.	0.00	0.00	1.79	4.93	1.43	0.38	0.11	1.71	1.77	1.16	0.60	0.53	14.4	1.2
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Vineyard	0.0	0.2	2.7	24.5	122.9	219.5	241.9	199.3	110.8	18.0	1.4	0.0		941.3
Sprinkler Irrigation														
ET	1.72	1.78	2.31	2.45	4.97	6.41	6.93	5.83	3.87	2.40	1.34	1.66	41.7	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56		
Gross Crop Irrig. Req.	0.00	0.05	0.88	2.44	6.21	8.01	8.66	7.29	4.84	2.39	0.45	0.56	41.8	3.5
Total Sprinkler AF	**0.0**	**0.2**	**2.7**	**7.5**	**19.1**	**24.7**	**26.7**	**22.5**	**14.9**	**7.4**	**1.4**	**1.7**		**128.8**
Surface Irrigation														
ET	1.72	1.78	2.42	2.58	4.85	6.72	7.20	6.29	3.65	2.31	1.24	1.66	42.4	
[ET-Precip.] /(Irrigation Efficiency)	-0.43	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60		
Gross Crop Irrig. Req.	0.00	0.05	1.10	2.76	6.47	8.96	9.59	8.39	4.87	2.43	0.35	0.60	45.6	3.8
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**
Drip Irrigation														
ET	1.70	0.82	0.79	1.03	3.18	5.97	6.59	5.42	2.94	0.81	0.92	1.33	31.5	
[ET-Precip.] /(Irrigation Efficiency)	-0.40	-1.09	-0.95	0.61	3.74	7.02	7.76	6.37	3.46	0.38	-0.07	0.15		
Gross Crop Irrig. Req.	0.00	0.00	0.00	0.61	3.74	7.02	7.76	6.37	3.46	0.38	0.00	0.15	29.5	2.5
Total Sprinkler AF	**0.0**	**0.0**	**0.0**	**17.0**	**103.7**	**194.8**	**215.2**	**176.9**	**95.9**	**10.7**	**0.0**	**4.1**		**818.3**
Total (Irrigated Acres)	0	453	2,345	8,518	18,534	24,400	25,644	19,261	12,788	6,471	241	194		118,848

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	North Area (East of DMC)														
2			January	February	March	April	May	June	July	August	September	October	November	December	Total
3	**Classification**	**Total Acres**	Water Demand (AF/Month)												
4	**Citrus & Subtropical**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
10	**Deciduous Fruits & Nuts**	**2,786**	**0**	**21**	**95**	**614**	**1,697**	**2,070**	**2,239**	**2,034**	**1,425**	**680**	**0**	**0**	**10,875**
11	*Apricots*	*714*	*0*	*0*	*0*	*105*	*400*	*518*	*558*	*511*	*361*	*156*	*0*	*0*	*2,610*
12	*Cherries*	*197*	*0*	*2*	*6*	*39*	*121*	*150*	*166*	*148*	*105*	*50*	*0*	*0*	*787*
13	*Almonds*	*1,301*	*0*	*19*	*89*	*374*	*850*	*1,001*	*1,073*	*973*	*675*	*349*	*0*	*0*	*5,402*
14	*Walnuts*	*8*	*0*	*0*	*0*	*1*	*5*	*6*	*7*	*6*	*4*	*2*	*0*	*0*	*32*
15	*Other*	566	*0*	*0*	*0*	*95*	*322*	*395*	*435*	*395*	*280*	*123*	*0*	*0*	*2,044*
17	**Field Crops**	**215**	**0**	**0**	**0**	**19**	**56**	**164**	**189**	**72**	**7**	**7**	**0**	**0**	**513**
18	*Beans (dry)*	*215*	*0*	*0*	*0*	*19*	*56*	*164*	*189*	*72*	*7*	*7*	*0*	*0*	*513*
19	*Miscellaneous Field*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
23	**Grain & Hay**	**3**	**0**	**0**	**1**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**
24	**Pasture**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
25	**Truck, Nursery, & Berry Crops**	**168**	**0**	**0**	**0**	**7**	**61**	**144**	**128**	**15**	**5**	**5**	**0**	**0**	**366**
26	*Melons*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
27	*Tomatoes*	*168*	*0*	*0*	*0*	*7*	*61*	*144*	*128*	*15*	*5*	*5*	*0*	*0*	*366*
28	*Flowers, Nursery*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
29	*Vegetables*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
30	*Other*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
31	**Vineyard**	**189**	**0**	**0**	**1**	**13**	**63**	**112**	**124**	**102**	**57**	**9**	**1**	**0**	**481**
32	Total Irrigated Acres	3,361	0	21	98	654	1,879	2,489	2,679	2,223	1,494	702	1	0	12,238
33											Approximate Irrigation Requirement (AF/Acre)				3.6

NORTH AREA- DEMAND

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	North Area (East of DMC)														
2			January	February	March	April	May	June	July	August	September	October	November	December	Total
3	**Classification**	**Total Acres**	Water Demand (AF/Month)												
4	**Citrus & Subtropical**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
10	**Deciduous Fruits & Nuts**	**2,786**	**0**	**21**	**95**	**614**	**1,697**	**2,070**	**2,239**	**2,034**	**1,425**	**680**	**0**	**0**	**10,875**
11	*Apricots*	*714*	*0*	*0*	*0*	*105*	*400*	*518*	*558*	*511*	*361*	*156*	*0*	*0*	*2,610*
12	*Cherries*	*197*	*0*	*2*	*6*	*39*	*121*	*150*	*166*	*148*	*105*	*50*	*0*	*0*	*787*
13	*Almonds*	*1,301*	*0*	*19*	*89*	*374*	*850*	*1,001*	*1,073*	*973*	*675*	*349*	*0*	*0*	*5,402*
14	*Walnuts*	*8*	*0*	*0*	*0*	*1*	*5*	*6*	*7*	*6*	*4*	*2*	*0*	*0*	*32*
15	*Other*	566	*0*	*0*	*0*	*95*	*322*	*395*	*435*	*395*	*280*	*123*	*0*	*0*	*2,044*
17	**Field Crops**	**215**	**0**	**0**	**0**	**19**	**56**	**164**	**189**	**72**	**7**	**7**	**0**	**0**	**513**
18	*Beans (dry)*	*215*	*0*	*0*	*0*	*19*	*56*	*164*	*189*	*72*	*7*	*7*	*0*	*0*	*513*
19	*Miscellaneous Field*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
23	**Grain & Hay**	**3**	**0**	**0**	**1**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**
24	**Pasture**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
25	**Truck, Nursery, & Berry Crops**	**168**	**0**	**0**	**0**	**7**	**61**	**144**	**128**	**15**	**5**	**5**	**0**	**0**	**366**
26	*Melons*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
27	*Tomatoes*	*168*	*0*	*0*	*0*	*7*	*61*	*144*	*128*	*15*	*5*	*5*	*0*	*0*	*366*
28	*Flowers, Nursery*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
29	*Vegetables*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
30	*Other*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
31	**Vineyard**	**189**	**0**	**0**	**1**	**13**	**63**	**112**	**124**	**102**	**57**	**9**	**1**	**0**	**481**
32	Total Irrigated Acres	3,361	0	21	98	654	1,879	2,489	2,679	2,223	1,494	702	1	0	12,238
33											Approximate Irrigation Requirement (AF/Acre)				3.6

CENTRAL AREA- DEMAND

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
34	Central Area (East of DMC)														
35			January	February	March	April	May	June	July	August	September	October	November	December	Total
36	**Classification**	**Total Acres**	Water Demand (AF/Month)												
37	**Citrus & Subtropical**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
43	**Deciduous Fruits & Nuts**	**1,833**	**0**	**15**	**72**	**410**	**1,129**	**1,425**	**1,538**	**1,393**	**963**	**473**	**0**	**0**	**7,418**
44	*Apricots*	*89*	*0*	*0*	*0*	*13*	*50*	*65*	*70*	*64*	*45*	*19*	*0*	*0*	*325*
45	*Cherries*	*11*	*0*	*0*	*0*	*2*	*7*	*8*	*9*	*8*	*6*	*3*	*0*	*0*	*44*
46	*Almonds*	*1,042*	*0*	*15*	*72*	*299*	*681*	*801*	*859*	*779*	*540*	*280*	*0*	*0*	*4,327*
47	*Walnuts*	*691*	*0*	*0*	*0*	*95*	*392*	*551*	*600*	*542*	*371*	*171*	*0*	*0*	*2,722*
48	*Other*	0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
50	**Field Crops**	**1,883**	**0**	**0**	**0**	**164**	**494**	**1,432**	**1,651**	**629**	**59**	**62**	**0**	**0**	**4,491**
51	*Beans (dry)*	*1,883*	*0*	*0*	*0*	*164*	*494*	*1,432*	*1,651*	*629*	*59*	*62*	*0*	*0*	*4,491*
52	*Miscellaneous Field*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
56	**Grain & Hay**	**17**	**0**	**1**	**4**	**9**	**6**	**1**	**0**	**1**	**1**	**1**	**0**	**0**	**23**
57	**Pasture**	**926**	**0**	**45**	**200**	**381**	**590**	**692**	**735**	**647**	**496**	**191**	**68**	**49**	**4,093**
58	**Truck, Nursery, & Berry Crops**	**4,573**	**0**	**0**	**150**	**526**	**1,442**	**3,000**	**2,812**	**690**	**325**	**224**	**48**	**38**	**9,256**
59	*Melons*	*398*	*0*	*0*	*0*	*0*	*44*	*63*	*218*	*258*	*75*	*13*	*0*	*0*	*671*
60	*Tomatoes*	*3,399*	*0*	*0*	*0*	*137*	*1,243*	*2,909*	*2,586*	*309*	*105*	*110*	*0*	*0*	*7,399*
61	*Flowers, Nursery*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
62	*Vegetables*	*776*	*0*	*0*	*150*	*389*	*156*	*28*	*8*	*123*	*144*	*101*	*48*	*38*	*1,186*
63	*Other*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
64	**Vineyard**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
65	Total Irrigated Acres	9,231	0	61	426	1,490	3,662	6,549	6,737	3,360	1,844	950	116	87	25,281
66											Approximate Irrigation Requirement (AF/Acre)				2.7

SOUTH AREA- DEMAND

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
67	South Area (East of DMC)														
68			January	February	March	April	May	June	July	August	September	October	November	December	Total
69	**Classification**	**Total Acres**	Water Demand (AF/Month)												
70	**Citrus & Subtropical**	**82**	**0**	**3**	**11**	**26**	**40**	**45**	**47**	**44**	**33**	**24**	**6**	**5**	**283**
76	**Deciduous Fruits & Nuts**	**3,707**	**0**	**53**	**255**	**1,064**	**2,421**	**2,851**	**3,057**	**2,772**	**1,923**	**995**	**0**	**0**	**15,391**
77	*Apricots*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
78	*Cherries*	*8*	*0*	*0*	*0*	*2*	*5*	*6*	*7*	*6*	*4*	*2*	*0*	*0*	*32*
79	*Almonds*	*3,699*	*0*	*53*	*254*	*1,063*	*2,416*	*2,845*	*3,050*	*2,766*	*1,919*	*993*	*0*	*0*	*15,359*
80	*Walnuts*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
81	*Other*	0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
82															
83	**Field Crops**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
84	*Beans (dry)*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
85	*Miscellaneous Field*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
86															
87															
88															
89	**Grain & Hay**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
90	**Pasture**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
91	**Truck, Nursery, & Berry Crops**	**384**	**0**	**0**	**74**	**193**	**77**	**14**	**4**	**61**	**71**	**50**	**24**	**19**	**587**
92	*Melons*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
93	*Tomatoes*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
94	*Flowers, Nursery*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
95	*Vegetables*	*384*	*0*	*0*	*74*	*193*	*77*	*14*	*4*	*61*	*71*	*50*	*24*	*19*	*587*
96	*Other*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
97	**Vineyard**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
98	Total Irrigated Acres	4,173	0	56	339	1,283	2,537	2,910	3,108	2,878	2,027	1,070	30	24	16,261
99											Approximate Irrigation Requirement (AF/Acre)				3.9

EXISTING DISTRICT WIDE AREA- DEMAND

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Del Puerto Water District														
2			January	February	March	April	May	June	July	August	September	October	November	December	Total
3	**Classification**	**Total Irrigated Acres**	Water Demand (AF/Month)												
10	**Deciduous Fruits & Nuts**	**20,188**	**0**	**208**	**991**	**4,994**	**12,678**	**15,377**	**16,560**	**15,024**	**10,452**	**5,189**	**0**	**14**	**81,487**
11	*Apricots*	*2,519*	*0*	*0*	*0*	*371*	*1,412*	*1,827*	*1,969*	*1,803*	*1,274*	*552*	*0*	*0*	*9,208*
12	*Cherries*	*518*	*0*	*5*	*16*	*104*	*318*	*395*	*435*	*389*	*276*	*131*	*0*	*0*	*2,069*
13	*Almonds*	*14,184*	*0*	*203*	*975*	*4,075*	*9,264*	*10,908*	*11,696*	*10,607*	*7,357*	*3,809*	*0*	*0*	*58,896*
14	*Walnuts*	*1,782*	*0*	*0*	*0*	*246*	*1,011*	*1,420*	*1,548*	*1,397*	*958*	*440*	*0*	*0*	*7,020*
15	*Other*	1,185	*0*	*0*	*0*	*198*	*673*	*827*	*911*	*828*	*586*	*257*	*0*	*14*	*4,294*
17	**Field Crops**	**2,221**	**0**	**0**	**0**	**194**	**583**	**1,689**	**1,947**	**742**	**70**	**73**	**0**	**0**	**5,298**
18	*Beans (dry)*	*2,221*	*0*	*0*	*0*	*194*	*583*	*1,689*	*1,947*	*742*	*70*	*73*	*0*	*0*	*5,298*
23	**Grain & Hay**	**2,472**	**0**	**126**	**595**	**1,286**	**937**	**94**	**26**	**90**	**78**	**81**	**0**	**0**	**3,312**
24	**Pasture**	**1,660**	**0**	**81**	**358**	**684**	**1,057**	**1,240**	**1,318**	**1,160**	**889**	**342**	**122**	**88**	**7,338**
25	**Truck, Nursery, & Berry Crops**	**5,271**	**0**	**0**	**177**	**627**	**1,690**	**3,476**	**3,242**	**806**	**401**	**273**	**57**	**45**	**10,793**
26	*Melons*	*398*	*0*	*0*	*0*	*0*	*44*	*63*	*218*	*258*	*75*	*13*	*0*	*0*	*671*
27	*Tomatoes*	*3,892*	*0*	*0*	*0*	*157*	*1,423*	*3,331*	*2,962*	*354*	*121*	*126*	*0*	*0*	*8,472*
28	*Flowers, Nursery*	*66*	*0*	*0*	*0*	*11*	*39*	*49*	*54*	*49*	*35*	*15*	*0*	*0*	*251*
29	*Vegetables*	*915*	*0*	*0*	*177*	*459*	*184*	*33*	*9*	*145*	*170*	*119*	*57*	*45*	*1,399*
31	**Vineyard**	**370**	**0**	**0**	**3**	**25**	**123**	**219**	**242**	**199**	**111**	**18**	**1**	**0**	**941**
32	Total Irrigated Acres	32,522	0	426	2,168	7,915	17,232	22,282	23,532	18,206	12,136	6,076	206	166	110,344
33														Approximate Irrigation Requirement (AF/Acre)	3.4

FUTURE DISTRICT WIDE DEMAND

Del Puerto Water District

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2			January	February	March	April	May	June	July	August	September	October	November	December	Total
3	**Classification**	**Total Irrigated Acres**	Water Demand (AF/Month)												
10	**Deciduous Fruits & Nuts**	**21,188**	**0**	**223**	**1,060**	**5,281**	**13,331**	**16,146**	**17,385**	**15,772**	**10,971**	**5,457**	**0**	**14**	**85,639**
11	*Apricots*	*2,519*	*0*	*0*	*0*	*371*	*1,412*	*1,827*	*1,969*	*1,803*	*1,274*	*552*	*0*	*0*	*9,208*
12	*Cherries*	*518*	*0*	*5*	*16*	*104*	*318*	*395*	*435*	*389*	*276*	*131*	*0*	*0*	*2,069*
13	*Almonds*	*15,184*	*0*	*218*	*1,044*	*4,362*	*9,917*	*11,677*	*12,521*	*11,355*	*7,876*	*4,078*	*0*	*0*	*63,048*
14	*Walnuts*	*1,782*	*0*	*0*	*0*	*246*	*1,011*	*1,420*	*1,548*	*1,397*	*958*	*440*	*0*	*0*	*7,020*
15	*Other*	1,185	*0*	*0*	*0*	*198*	*673*	*827*	*911*	*828*	*586*	*257*	*0*	*14*	*4,294*
17	**Field Crops**	**2,756**	**0**	**0**	**0**	**240**	**724**	**2,096**	**2,416**	**921**	**87**	**90**	**0**	**0**	**6,575**
18	*Beans (dry)*	*2,756*	*0*	*0*	*0*	*240*	*724*	*2,096*	*2,416*	*921*	*87*	*90*	*0*	*0*	*6,575*
23	**Grain & Hay**	**2,472**	**0**	**126**	**595**	**1,286**	**937**	**94**	**26**	**90**	**78**	**81**	**0**	**0**	**3,312**
24	**Pasture**	**1,920**	**0**	**93**	**414**	**791**	**1,223**	**1,434**	**1,525**	**1,341**	**1,028**	**396**	**141**	**102**	**8,487**
25	**Truck, Nursery, & Berry Crops**	**6,672**	**0**	**0**	**231**	**813**	**2,155**	**4,443**	**4,097**	**952**	**488**	**346**	**74**	**59**	**13,660**
26	*Melons*	*398*	*0*	*0*	*0*	*0*	*44*	*63*	*218*	*258*	*75*	*13*	*0*	*0*	*671*
27	*Tomatoes*	*5,011*	*0*	*0*	*0*	*202*	*1,832*	*4,288*	*3,813*	*455*	*155*	*162*	*0*	*0*	*10,908*
28	*Flowers, Nursery*	*66*	*0*	*0*	*0*	*11*	*39*	*49*	*54*	*49*	*35*	*15*	*0*	*0*	*251*
29	*Vegetables*	*1,197*	*0*	*0*	*231*	*600*	*240*	*43*	*12*	*190*	*223*	*156*	*74*	*59*	*1,830*
31	**Vineyard**	**370**	**0**	**0**	**3**	**25**	**123**	**219**	**242**	**199**	**111**	**18**	**1**	**0**	**941**
32	Total Irrigated Acres	35,718	0	453	2,347	8,543	18,657	24,620	25,886	19,460	12,898	6,489	242	194	119,789
33														Approximate Irrigation Requirement (AF/Acre)	3.4

Appendix C – NVRRWP Flow Rates and Buildout Projections

DRAFT Memorandum

North Valley Regional Recycled Water Project

Subject:	**Calculation of NVRRWP Buildout Flows**
Prepared For:	North Valley Regional Recycled Water Program
Prepared by:	Marilyn Bailey
Reviewed by:	
Date:	May 3, 2013
Task	4.4

1 Purpose

This memorandum calculates the NVRRWP recycled water supply available at buildout conditions from the Cities of Turlock and Modesto based on input from the staff of both Cities. The flows included in this memorandum will be used for sizing project facilities and calculating unit costs of water. Note that the buildout flows in this memo supersede the flow rates calculated in the memorandum entitled "NVRRWP Design Criteria and Assumptions" (October 26 2012).

Based on the Cities' evaluation of buildout flows, it is now estimated that approximately 52.7 mgd (59,000 AFY) of recycled water may be available by the year 2043 for the NVRRWP project.

2 Recycled Water Availability

2.1 City of Modesto

The City of Modesto has reviewed the flow projections for the City based on the City's current land use, and using the flow coefficients found in the City's Wastewater Master Plan. The City's build-out flow is projected to be around 40.6 MGD. However, based on outside factors, such as the economic downturn, water metering, etc, the City has seen reductions in population and sewer flow, which would impact the project build-out year. In the 2007 WWMP, the City's sphere of influence was projected to reach build out in 2030. With the preliminary design of the City's Phase 2 BNR/Tertiary Treatment project, the build-out date was revised to 2038.

The City of Modesto had a population of 201,165 in 2011 and 202,290 in 2012. Domestic Flow into the City's Treatment Plants decreased between 2006 through 2012, from 27.2 MGD to 20.4 MGD. The decrease in flows may be attributed to water conservation (due to water metering), foreclosures, or reduction of year-round commercial industrial flows.

From that starting point, and using the same growth rates that were in the 2008 WWMP Supplement, it is assumed that there would be gradual growth of 0.6% in 2013-14, 1.6% from 2015-16, and 1.75% from then on, the City developed a reasonable projection of anticipated sewer connections in Modesto Municipal Sewer District #1, including Empire, North Ceres and County Islands. These assumptions include commercial and minor industrial growth, but exclude large scale industrial (canning) growth.

The 2007 WWMP used a per capita flow in 2005 of 117.3 GPD/cap, based on population and flow into the plant. Currently, flow per capita is estimated at 94.9 GPD/cap. A 5 year average (between 2008 to 2012) is 102.4 GPD/cap and 8 year average (between 2005-2012) is 109 GPD/cap. Based on these per capita flows, the estimated build-out date for the City of Modesto is between 2043 and 2046.

The City also estimated that expansion of the tertiary treatment facilities would occur in 5 phases, ultimately reaching a capacity of 27.5 mgd. Communication with the City indicates there will probably be some onsite uses of tertiary treated water, such as a demonstration irrigation project in the future. This memorandum estimates that 0.2 mgd will be used for in-facility recycled water use, leaving 27.3 mgd available at buildout for NVRRWP.

2.2 City of Turlock

The City of Turlock General Plan Update estimated the City would reach an influent flow of 27.5 mgd at buildout in the year 2030. City staff has reviewed the projected buildout flows for the Turlock Regional Water Quality Control Facility and has researched the data provided to City planning staff and their consultants for the General Plan Update. Based on that review, the buildout flows and timing listed in the General Plan are the best reasonable estimate at this time and are reflective of projected job growth, not just population growth.

The Turlock RWQCF receives flow well in excess of what one would normally see for a City of 70,000 because they have a number of food processors, etc. The General Plan projects job growth commensurate with population growth, i.e. does not overestimate job growth. However, a significant portion of the job growth will occur in water intensive industries. The City has zoned a significant amount of land (1,700 acres) for new industrial development and has seen significant interest from food processors considering a move to Turlock. Therefore wastewater flows will increase significantly over time.

The City of Turlock has several long term commitments for recycled water use from the facility. The first commitment is for 2 mgd for 50 years for use at Turlock Irrigation District's (TID) Walnut Energy Center. Although the commitment is for up 2 mgd, the actual deliveries in 2012 have averaged 1.0 mgd. For the sake of assessing availability of recycled water, the contractual commitment of 2 mgd will be reserved for delivery to TID. The other current recycled water use in Turlock is for irrigation at Pedretti Park. The average irrigation use for the park is assumed to be 0.1 mgd, which was the average use in 2012. Therefore, in calculating the recycled water that would be available for NVRRWP, it is assumed that 2.1 mgd will be reserved for in-City use, leaving a flow rate of 25.4 mgd available at buildout for NVRRWP.

2.3 NVRRWP Flows

Based on the Cities' evaluation of buildout flows, it is estimated that approximately 52.7 mgd (59,000 AFY) of recycled water may be available by the year 2043 for the NVRRWP project.

Figures 1 and 2 summarize the estimated recycled water flows annually from now until buildout. The detailed spreadsheet of the flow estimates is included as an attachment.

Figure 1 NVRRWP Flow Rates at Buildout, mgd

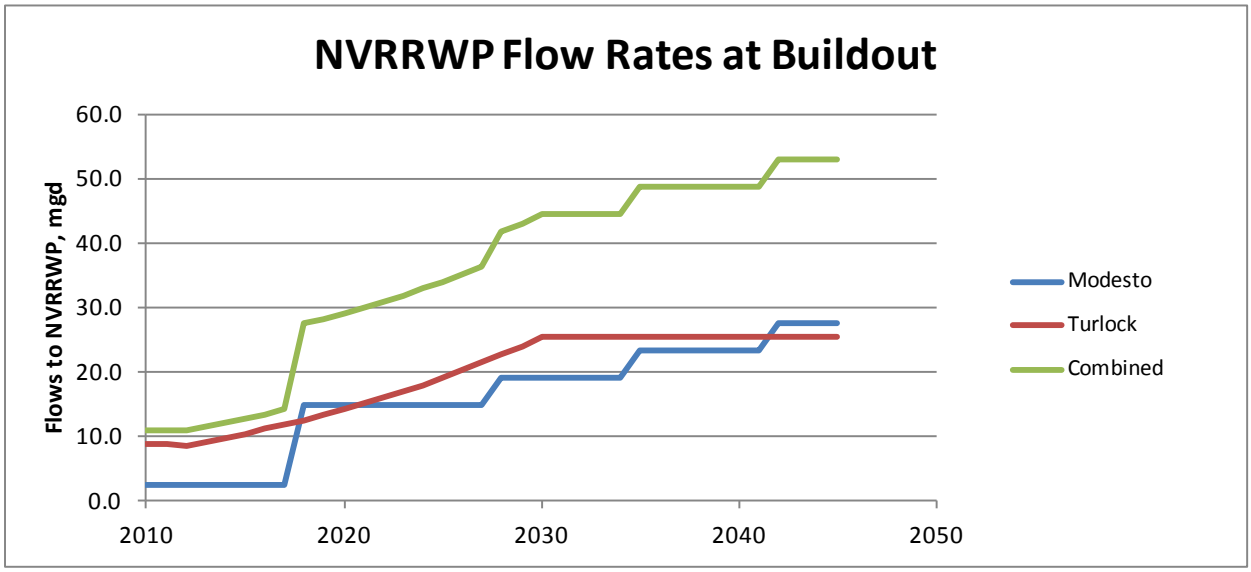
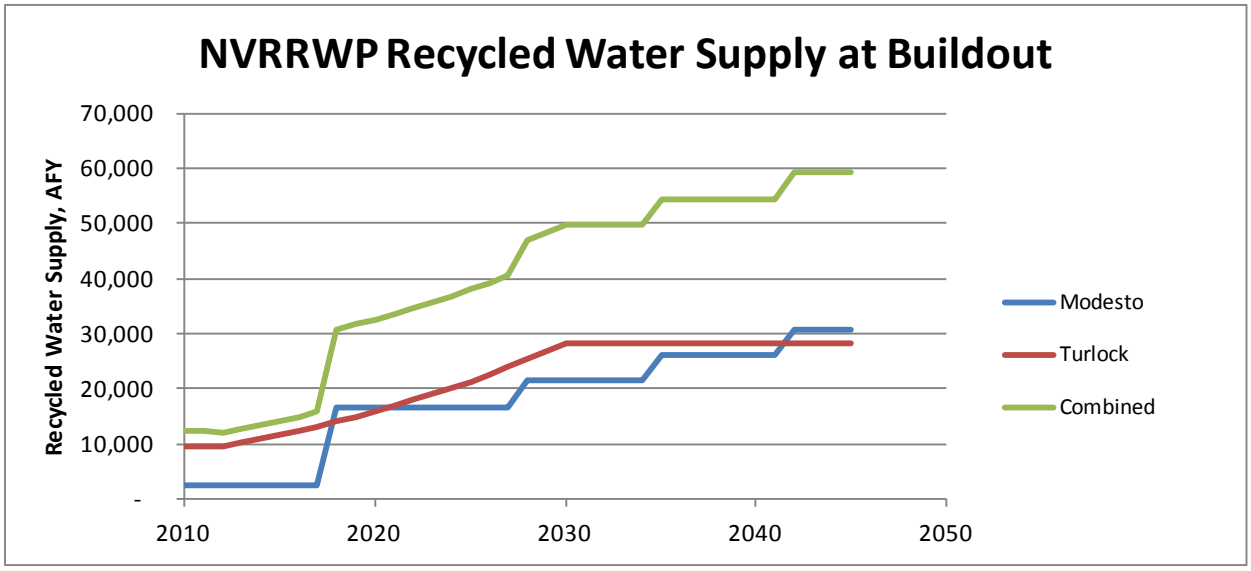


Figure 2 NVRRWP Recycled Water Supply at Buildout, AFY



Calculation of Buildout Flows

Note: This Calculation of Buildout Flows from each City incorporates analyses done by the Cities of Modesto and Turlock. The projected flows at buildout, and the timing of reaching buildout have been provided by the two Cities.

1. Modesto

Source: Wastewater Treatment Master Plan Supplement, September 2008

AAF in 2010	26.7	mgd																																			
AAF in 2038	40.5	mgd	Projected Flows at Buildout from Master Plan.																																		
Annual Growth Rate	Varies																																				
Projected Build-Out flows of SOI	40.5	mgd																																			
				9.22%	1.00%	1.84%	1.83%	1.96%	1.95%	1.94%	1.93%	1.92%	1.91%	1.90%	1.89%	1.89%	1.88%	1.87%	1.87%	1.86%	1.85%	1.85%	1.84%	1.83%	1.83%	1.82%	1.82%	1.81%	1.81%	1.80%	1.80%	1.79%	1.79%	1.78%	1.78%	1.78%	1.77%
Scenario 1 (based on 102.4 GPD/cap)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
ADWIF, mgd	20.9	20.4	20.4	22.3	22.5	22.9	23.3	23.8	24.3	24.7	25.2	25.7	26.2	26.7	27.2	27.7	28.2	28.7	29.3	29.8	30.4	30.9	31.5	32.1	32.7	33.3	33.9	34.5	35.1	35.7	36.4	37.0	37.7	38.4	39.0	39.7	40.4
Secondary Effluent to Land, mgd	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	9.4	9.8	10.3	10.8	11.3	11.8	12.3	12.8	13.3	13.8	10.2	10.7	11.3	11.8	12.4	13.0	13.6	10.0	10.6	11.2	11.8	12.4	13.1	13.7	10.2	10.9	11.5	12.2	12.9
Secondary Effluent to SJR, mgd	**4.6**	**4.1**	**4.1**	**6.0**	**6.2**	**6.6**	**7.0**	**7.5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Tertiary Treatment Capacity, mgd	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**14.9**	**14.9**	**14.9**	**14.9**	**14.9**	**14.9**	**14.9**	**14.9**	**14.9**	**14.9**	**19.1**	**19.1**	**19.1**	**19.1**	**19.1**	**19.1**	**19.1**	**23.3**	**23.3**	**23.3**	**23.3**	**23.3**	**23.3**	**23.3**	**27.5**	**27.5**	**27.5**	**27.5**	**27.5**
				Phase 1								**Phase 2**									**Phase 3**								**Phase 4**							**Phase 5**			
In-city RW Use, mgd	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
NVRRWP Flow from Modesto, mgd	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**14.7**	**14.7**	**14.7**	**14.7**	**14.7**	**14.7**	**14.7**	**14.7**	**14.7**	**14.7**	**18.9**	**18.9**	**18.9**	**18.9**	**18.9**	**18.9**	**18.9**	**23.1**	**23.1**	**23.1**	**23.1**	**23.1**	**23.1**	**23.1**	**27.3**	**27.3**	**27.3**	**27.3**	**27.3**
				16.20%	1.00%	1.84%	1.83%	1.96%	1.95%	1.94%	1.93%	1.92%	1.91%	1.90%	1.89%	1.89%	1.88%	1.87%	1.87%	1.86%	1.85%	1.85%	1.84%	1.83%	1.83%	1.82%	1.82%	1.81%	1.81%	1.80%	1.80%	1.79%	1.79%	1.78%			
Scenario 2 (based on 109 GPD/cap)	2010	2011.0	2,012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043			
ADWIF, mgd	20.9	20.4	20.4	23.7	23.9	24.4	24.8	25.3	25.8	26.3	26.8	27.3	27.8	28.4	28.9	29.5	30.0	30.6	31.1	31.7	32.3	32.9	33.5	34.1	34.8	35.4	36.0	36.7	37.3	38.0	38.7	39.4	40.1	40.8			
Secondary Effluent to Land, mgd	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	10.9	11.4	11.9	12.4	12.9	13.5	14.0	10.4	10.9	11.5	12.0	12.6	13.2	13.8	10.2	10.8	11.5	12.1	12.7	13.4	14.0	10.5	11.2	11.9	12.6	13.3			
Secondary Effluent to SJR, mgd	4.6	4.1	4.1	7.4	7.6	8.1	8.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Tertiary Treatment Capacity, mgd	2.3	2.3	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**14.9**	**14.9**	**14.9**	**14.9**	**14.9**	**14.9**	**14.9**	**19.1**	**19.1**	**19.1**	**19.1**	**19.1**	**19.1**	**19.1**	**23.3**	**23.3**	**23.3**	**23.3**	**23.3**	**23.3**	**23.3**	**27.5**	**27.5**	**27.5**	**27.5**	**27.5**			
				Phase 1								**Phase 2**									**Phase 3**								**Phase 4**							**Phase 5**			

2. Turlock

Source: General Plan Update, October 2011

ADWF in 2010	10.8	mgd
ADWF in 2030 (buildout)	27.5	mgd
Annual Growth Rate	5.38%	calculated from ADWF between 2010 and 2030

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
ADWIF, mgd	10.8	10.8	10.7	11.3	11.9	12.5	13.2	13.9	14.7	15.4	16.3	17.1	18.1	19.0	20.1	21.1	22.3	23.5	24.7	26.1	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5
In-city RW Use, mgd	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
NVRRWP Flow from Turlock, mgd	**8.7**	**8.7**	**8.6**	**9.2**	**9.8**	**10.4**	**11.1**	**11.8**	**12.6**	**13.3**	**14.2**	**15.0**	**16.0**	**16.9**	**18.0**	**19.0**	**20.2**	**21.4**	**22.6**	**24.0**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**	**25.4**

3. Flows to NVRRWP

RW Flows, mgd	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Modesto (Scenario 1)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	18.9	18.9	18.9	18.9	18.9	18.9	18.9	23.1	23.1	23.1	23.1	23.1	23.1	23.1	27.3	27.3	27.3	27.3
Turlock	8.7	8.7	8.6	9.2	9.8	10.4	11.1	11.8	12.6	13.3	14.2	15.0	16.0	16.9	18.0	19.0	20.2	21.4	22.6	24.0	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4
Combined	10.8	10.8	10.7	11.3	11.9	12.5	13.2	13.9	27.3	28.0	28.9	29.7	30.7	31.6	32.7	33.7	34.9	36.1	41.5	42.9	44.3	44.3	44.3	44.3	44.3	48.5	48.5	48.5	48.5	48.5	48.5	48.5	52.7	52.7	52.7	52.7

Annual RW Flows, AFY	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Modesto (Scenario 1)	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	21,200	21,200	21,200	21,200	21,200	21,200	21,200	25,900	25,900	25,900	25,900	25,900	25,900	25,900	30,600	30,600	30,600	30,600
Turlock	9,700	9,700	9,600	10,300	11,000	11,700	12,400	13,200	14,100	14,900	15,900	16,900	17,900	19,000	20,100	21,300	22,600	24,000	25,400	26,900	28,400	28,400	28,400	28,400	28,400	28,400	28,400	28,400	28,400	28,400	28,400	28,400	28,400	28,400	28,400	28,400
Combined	12,100	12,100	12,000	12,700	13,400	14,100	14,800	15,600	30,600	31,400	32,400	33,400	34,400	35,500	36,600	37,800	39,100	40,500	46,600	48,100	49,600	49,600	49,600	49,600	49,600	54,300	54,300	54,300	54,300	54,300	54,300	54,300	59,000	59,000	59,000	59,000

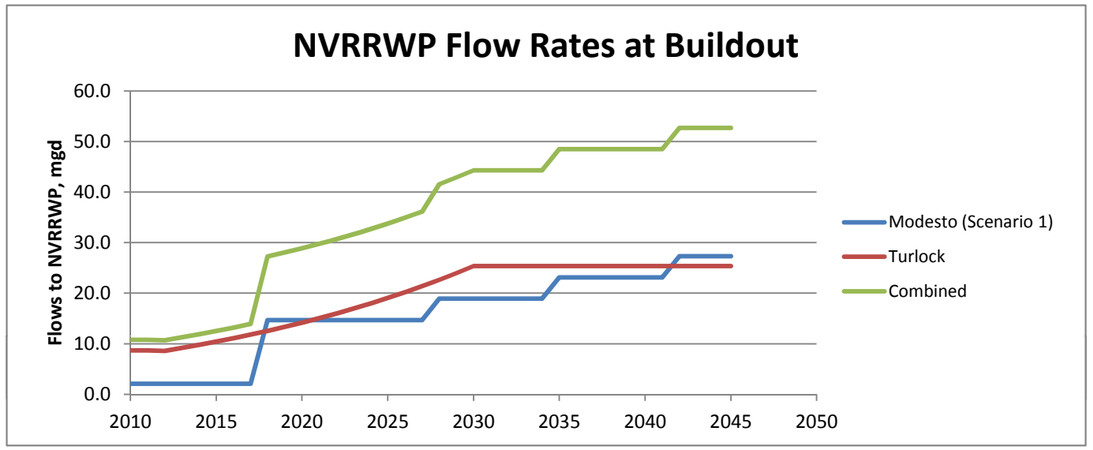
Annual RW Flows, cfs	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Modesto	3	3	3	3	3	3	3	3	23	23	23	23	23	23	23	23	23	23	29	29	29	29	29	29	29	36	36	36	36	36	36	36	42	42	42	42
Turlock	13	13	13	14	15	16	17	18	19	21	22	23	25	26	28	29	31	33	35	37	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
Combined	17	17	17	17	18	19	20	22	42	43	45	46	47	49	51	52	54	56	64	66	69	69	69	69	69	75	75	75	75	75	75	75	82	82	82	82

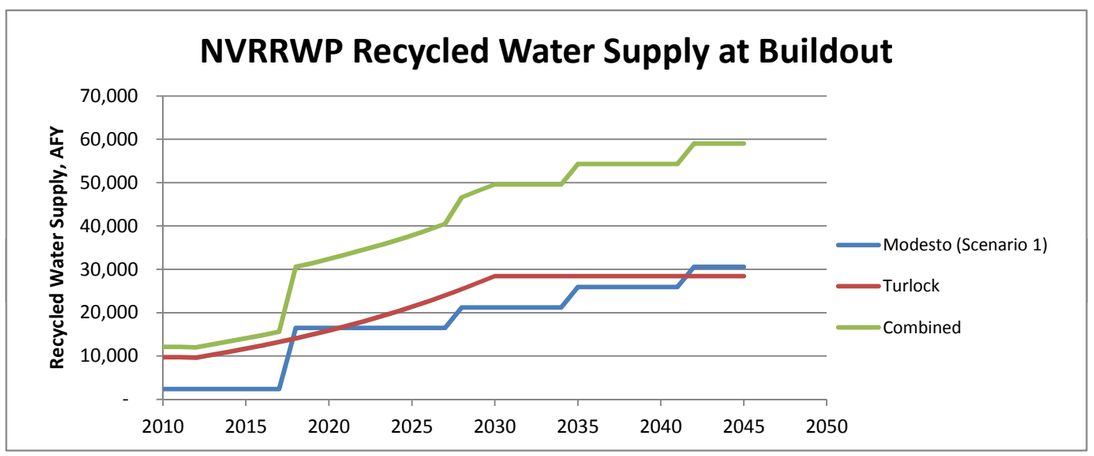
Assumed Project Start-up in 2018

4. Comparison to Flow Estimates in Design Criteria

RW Flows, mgd	Calculated Above		Used in Design Criteria	
	2018	2025	2018	2025
Modesto	14.7	14.7	14.8	18.9
Turlock	12.6	19.0	9.5	11.3
Combined	27.3	33.7	24.3	30.2

The Buildout Flow methodology produces 13% more Recycled Water as compared to flows in the Design Cri





Appendix D – Advanced Treatment Costs of Recycled Water

Project:	**Del Puerto Water District - Recycled Water Feasibility Study**	Date:	September 2, 2010
		Project Number:	
Component:	**Avoided Costs for River Discharge**	Prepared by:	RMC
Estimate Type:	Conceptual Design		

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
Facilities w/o markup	$ 42,000,000	
Facilities with markup	$ 301,061,989	
17- I&C	$ -	

RAW CONSTRUCTION COST w/o markup		**$**	**42,000,000**	
Mobilization/Demobilization	1%	*$*	*420,000*	only added to costs that are not already escalated
Contractors Overhead and Profit	20%	*$*	*8,400,000*	only added to costs that are not already escalated
Construction Contingency	30%	*$*	*12,600,000*	only added to costs that are not already escalated
Base Construction Cost		**$**	**63,420,000**	
Total Construction Cost		**$**	**364,481,989**	
Implementation (Program Management, Design, CEQA, Legal, CM)	20%	**$**	**12,680,000**	only added to costs that are not already escalated

Item	Size	Units	Quantity	Unit		Unit Cost		Total Cost	Notes
Facilities							**$**	**343,061,989**	
Modesto Advanced Treatment Facilities (2025 production)									
RO Treatment & Evaporation Ponds		mgd	12	$/mgd	$	17,203,542	$	206,442,507	includes markups
Advanced Oxidation		mgd	19	$/MGD	$	1,000,000	$	19,000,000	markups not included
Turlock Advanced Treatment Facilities									
MF Pretreatment		mgd	10	$/mgd	$	1,300,000	$	13,000,000	markups not included
RO Treatment & Evaporation Ponds		mgd	6	$/mgd	$	17,203,542	$	94,619,482	includes markups
Advanced Oxidation		mgd	10	$/mgd	$	1,000,000	$	10,000,000	markups not included
I&C							**$**	**-**	
I&C Allowance						0%	$	-	

O&M Costs	Amount	Unit		Value		Cost	
					$	**7,588,750**	
Modesto							
RO Facilities	mgd	8	$/MGD	$	337,500	$ 2,700,000	amount of RW produced
Advanced Oxidation	mgd	19	$/MGD	$	80,000	$ 1,520,000	combined MF + RO permeate
Turlock							
MF Facilities	mgd	10	$/MGD	$	113,000	$ 1,130,000	
RO Facilities	mgd	5	$/MGD	$	337,500	$ 1,518,750	amount of permeate produced
Advanced Oxidation	mgd	9	$/MGD	$	80,000	$ 720,000	combined permeate + MF

Project:	**Del Puerto Water District - Recycled Water Feasibility Study**	Date:	September 2, 2010
		Project Number:	
Component:	**Advanced Treatment Costs for Discharge to the DMC**	Prepared by:	RMC
	2025 Production Rate = 25,000 AFY (accounts for loss of water through MF + RO)		
Estimate Type:	Conceptual Design		

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
Facilities w/o markup		$ 39,800,000	
Facilities with markup		$ 576,318,665	
RAW CONSTRUCTION COST W/O MARKUP		**$ 39,800,000**	
Mobilization/Demobilization	1%	*$ 398,000*	only added to costs that are not already escalated
Contractors Overhead and Profit	20%	*$ 7,960,000*	only added to costs that are not already escalated
Construction Contingency	30%	*$ 11,940,000*	only added to costs that are not already escalated
Base Construction Cost		**$ 60,100,000**	
Total Construction Cost		**$ 636,418,665**	
Implementation (Program Management, Design, CEQA, Legal, CM)	20%	**$ 12,020,000**	only added to costs that are not already escalated

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 616,118,665**	
Modesto Advanced Treatment Facilities (2025 production)							
RO Treatment & Evaporation Ponds		mgd	24	$/mgd	$ 17,203,542	$ 412,885,014	includes markups
Advanced Oxidation		mgd	19	$/MGD	$ 1,000,000	$ 19,200,000	markups not included
Turlock Advanced Treatment Facilities							
MF Pretreatment		mgd	10	$/mgd	$ 1,300,000	$ 13,000,000	markups not included
RO Treatment & Evaporation Ponds		mgd	10	$/mgd	$ 17,203,542	$ 163,433,651	includes markups
Advanced Oxidation		mgd	8	$/mgd	$ 1,000,000	$ 7,600,000	markups not included

EASEMENT AND LAND ACQUISITION						Total Cost
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ -**

Repair and Replacement Costs			Cost
	Amount	**Unit**	**Value**	**$ -**

O&M Costs		Amount	Unit	Value	Cost
					$ 12,397,500
Modesto					
RO Facilities	mgd	19	$/MGD	$ 337,500	$ 6,412,500
Advanced Oxidation	mgd	19	$/MGD	$ 80,000	$ 1,520,000
Turlock					
MF Facilities	mgd	10	$/MGD	$ 112,500	$ 1,125,000
RO Facilities		8	$/MGD	$ 337,500	$ 2,700,000
Advanced Oxidation	mgd	8	$/MGD	$ 80,000	$ 640,000

Appendix E – Table 4a and Table 5 of the Pump-in Plan

Table 4a:Maximum Allowable Concentration of Seven Constituents in the Upper DMC (between Jones Pumping PLant and Check 13)

Constituent	Monitoring Location	Maximum Concentration in DMC
Arsenic	McCabe Road	10 µg/L
Boron	McCabe Road	0.7 mg/L
Nitrates as N	McCabe Road	45 mg/L
Selenium	Check 13	2 µg/L
Specific Conductance (EC)	Check 13	1,200 µS/cm
Sulfates	McCabe Road	250 mg/L
Total Dissolved Solids*	Check 13	800 mg/L

Table 5. Water Quality Standards for Acceptance of Groundwater into the Upper Delta-Mendota Canal Jones Pumping Plant to Check 13 (O'Neill Forebay)

Constituent	Units	Maximum Contaminant Level		Detection Limit for Reporting		CAS Registry Number	Recommended Analytical Method
Primary							
Aluminum	mg/L	1	(1)	0.05	(2)	7429-90-5	EPA 200.7
Antimony	mg/L	0.006	(1)	0.006	(2)	7440-36-0	EPA 200.8
Arsenic	mg/L	0.01	(1)	0.002	(2)	7440-38-2	EPA 200.8
Barium	mg/L	1	(1)	0.1	(2)	7440-39-3	EPA 200.7
Beryllium	mg/L	0.004	(1)	0.001	(2)	7440-41-7	EPA 200.7
Boron	mg/L	0.7	(13)			7440-42-8	EPA 200.7
Cadmium	mg/L	0.005	(1)	0.001	(2)	7440-43-9	EPA 200.7
Chromium, total	mg/L	0.05	(1)	0.01	(2)	7440-47-3	EPA 200.7
Lead	mg/L	0.015	(9)	0.005	(8)	7439-92-1	EPA 200.8
Mercury	mg/L	0.002	(1)	0.001	(2)	7439-97-6	EPA 245.1
Nickel	mg/L	0.1	(1)	0.01	(2)	7440-02-0	EPA 200.7
Nitrate (as NO3)	mg/L	45	(1)	2	(2)	7727-37-9	EPA 300.1
Nitrate + Nitrite (sum as nitrogen)	mg/L	10	(1)				EPA 353.2
Nitrite (as nitrogen)	mg/L	1	(1)	0.4	(2)	14797-65-0	EPA 300.1
Selenium	mg/L	0.002	(10)	0.0004		7782-49-2	EPA 200.8
Thallium	mg/L	0.002	(1)	0.001	(2)	7440-28-0	EPA 200.8
Secondary							
Chloride	mg/L	250	(7)			16887-00-6	EPA 300.1
Copper	mg/L	1	(10)	0.05	(8)	7440-50-8	EPA 200.7
Iron	mg/L	0.3	(6)			7439-89-6	EPA 200.7
Manganese	mg/L	0.05	(6)			7439-96-5	EPA 200.7
Molybdenum	mg/L	0.01	(11)			7439-98-7	EPA 200.7
Silver	mg/L	0.1	(6)			7440-22-4	EPA 200.7
Sodium	mg/L	69	(12)			7440-23-5	EPA 200.7
Specific Conductance	µS/cm	2,200	(7)				SM 2510 B
Sulfate	mg/L	250	(7)			14808-79-8	EPA 300.1
Total Dissolved Solids	mg/L	1,500	(7)				SM 2540 C
Zinc	mg/L	5	(6)			7440-66-6	EPA 200.7
Radioactivity							
Gross Alpha	pCi/L	15	(3)	3	(3)		SM 7110C
Organic Chemicals							
Dibromochloropane (DBCP)	µg/L	1	(4)	0.5	(5)	96-12-8	EPA 504.1
Ethylene Dibromide (EDB)	µg/L	18	(4)	2	(5)	206-93-4	EPA 504.1
Chlordane	µg/L	18	(4)	5	(5)	57-74-9	EPA 505
Endrin	µg/L	0.1	(4)	0.1	(5)	72-20-8	EPA 505
Heptachlor	µg/L	25	(4)	0	(5)	76-44-8	EPA 505
Heptachlor Epoxide	µg/L	70	(4)	10	(5)	1024-57-3	EPA 505
Lindane	µg/L	160	(4)	0	(5)	58-89-9	EPA 505
Methoxychlor	µg/L	0.2	(4)	0.01	(5)	72-43-5	EPA 505
Toxaphene	µg/L	2	(4)	0.1	(5)	8001-35-2	EPA 505
Diazinon	µg/L	0.16	(11)			333-41-5	EPA 507
Atrazine	µg/L	700	(4)	25	(5)	1912-24-9	EPA 508.1
Simazine	µg/L	0.01	(4)	0.01	(5)	122-34-9	EPA 508.1
Bentazon	µg/L	0.01	(4)	0.01	(5)	25057-89-0	EPA 515.1-4
2, 4, 5-TP (Silvex)	µg/L	30	(4)	10	(5)	93-72-1	EPA 515.1-4
2,4-D	µg/L	0.2	(4)	0.2	(5)	94-75-7	EPA 515.1-4
Molinate	µg/L	20	(4)	2	(5)	2212-67-1	EPA 525.2
Thiobencarb	µg/L	50	(4)	1	(5)	28249-77-6	EPA 525.2
Carbofuran	µg/L	4	(4)	1	(5)	1563-66-2	EPA 531.1-2
Glyphosate	µg/L	70	(4)	1	(5)	1071-83-6	EPA 547
Chlorpyrifos	µg/L	0.025	(11)			2921-88-2	EPA 8141

Table 5. Water Quality Standards for Acceptance of Groundwater into the Upper Delta-Mendota Canal Jones Pumping Plant to Check 13 (O'Neill Forebay)

Sources:

Sources:

Title 22. The Domestic Water Quality and Monitoring Regulations specified by the State of California Health and Safety Code (Sections 4010-4037), and Administrative Code (Sections 64401 et seq.), as amended

(1) Title 22. Table 64431-A Maximum Contaminant Levels, Inorganic Chemicals

(2) Title 22. Table 64432-A Detection Limits for Reporting (DLRs) for Regulated Inorganic Chemicals

(3) Title 22. Table 64442 Radionuclide Maximum Contaminant Levels (MCLs) and Detection Levels for Purposes of Reporting

(4) Title 22. Table 64444-A Maximum Contaminate Levels, Organic Chemicals

(5) Title 22. Table 64445.1-A Detection Limits for Purposes of reporting (DLRs) for Regulated Organic Chemicals

(6) Title 22. Table 64449-A Secondary Maximum Contaminant Levels "Consumer Acceptance Contaminant Levels"

(7) Title 22. Table 64449-B Secondary Maximum Contaminant Levels "Consumer Acceptance Contaminant Level Ranges"

(8) Title 22. Table 64678-A DLRs for Lead and Copper

(9) Title 22. Section 64678 (d) Lead Action level

California Drinking Water Regulations Sep 2011

http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Lawbook/dwregulations-2011-09-22.pdf

California Regional Water Quality Control Board, Central Valley Region, Fourth Edition of the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins.

(10) Basin Plan, Table III-1 (ug/L) (selenium in Grasslands water supply channels)

(11) Basin Plan, Table III-2A (ug/L) (chlorpyrifos & diazinon in San Joaquin River from Mendota to Vernalis)

Sacramento & San Joaquin River Basin Plan 2009

http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/sacsjr.pdf

Ayers, R. S. and D. W. Westcot,*Water Quality for Agriculture* , Food and Agriculture Organization of the United Nations - Irrigation and Drainage Paper No. 29, Rev. 1, Rome (1985).

(12) Ayers, Table 1 (mg/L) (sodium)

(13) Ayers, Table 21 (mg/L) (boron)

Water Quality Standards for Agriculture 1985

http://www.fao.org/DOCREP/003/T0234E/T0234E00.HTM

revised: 10 Jan 2012 SCC-107

Appendix F – City of Turlock Water Quality Data and Laboratory Information

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	120	ug/L				6/1/2010	06/03/2010
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	54	ug/L				7/6/2010	07/12/2010
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	45	ug/L	20		50	8/3/2010	08/05/2010
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	230	ug/L				9/7/2010	09/16/2010
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	55	ug/L				9/20/2010	09/28/2010
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	117	ug/L				10/3/2010	10/12/2010
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	110	ug/L				11/1/2010	11/04/2010
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	127	ug/L				12/5/2010	12/07/2010
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	315	ug/L				1/17/2011	01/18/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	330	ug/L				2/6/2011	02/10/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma-Mass Spectrometry	=	40	ug/L				2/17/2011	03/01/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma-Mass Spectrometry	=	83	ug/L				2/22/2011	03/01/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	29	ug/L	20		50	3/6/2011	03/08/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	205	ug/L				4/3/2011	04/07/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	60	ug/L				4/25/2011	05/02/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	88	ug/L				5/8/2011	05/10/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	70	ug/L				6/12/2011	06/14/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	41	ug/L	20		50	7/10/2011	07/18/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	154	ug/L				8/7/2011	08/09/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	31	ug/L	20		50	9/5/2011	09/12/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	142	ug/L				10/9/2011	10/12/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	373	ug/L				11/6/2011	11/14/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	70	ug/L				12/4/2011	12/07/2011
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	96	ug/L				1/8/2012	01/17/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	76	ug/L				2/5/2012	02/13/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	92	ug/L				3/11/2012	03/15/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	47	ug/L				4/15/2012	04/19/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	77	ug/L				5/13/2012	05/17/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	140	ug/L				6/10/2012	06/13/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	144	ug/L				7/8/2012	07/10/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	246	ug/L				8/12/2012	08/14/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	80	ug/L				9/9/2012	09/12/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	50	ug/L				10/7/2012	10/16/2012

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	129	ug/L				11/4/2012	11/07/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	120	ug/L				12/2/2012	12/20/2012
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	252	ug/L				1/13/2013	01/17/2013
1	EFF-001	Aluminum, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	439	ug/L				2/3/2013	02/06/2013
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5		1	4/15/2012	04/19/2012
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	2.1	ug/L				5/13/2012	05/17/2012
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5		1	6/10/2012	06/13/2012
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5		1	7/8/2012	07/10/2012
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			8/12/2012	08/14/2012
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			9/9/2012	09/12/2012
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	1.5	ug/L				10/7/2012	10/16/2012
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	1	ug/L				11/4/2012	11/07/2012
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			12/2/2012	12/20/2012
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			1/13/2013	01/17/2013
2	EFF-001	Antimony, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	1	ug/L				2/3/2013	02/06/2013
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	6.1	ug/L				4/15/2012	04/19/2012
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	7	ug/L				5/13/2012	05/17/2012
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	9.7	ug/L				6/10/2012	06/13/2012
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5.5	ug/L				7/8/2012	07/10/2012
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	6.3	ug/L				8/12/2012	08/14/2012
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5.9	ug/L				9/9/2012	09/12/2012
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	6.8	ug/L				10/7/2012	10/16/2012
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	6.08	ug/L				11/4/2012	11/07/2012
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	6.6	ug/L				12/2/2012	12/20/2012
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5	ug/L				1/13/2013	01/17/2013
3	EFF-001	Arsenic, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5.4	ug/L				2/3/2013	02/06/2013
4	EFF-001	Barium	U.S. EPA Method 200.8		47	ug/L				1/17/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		58	ug/L				2/5/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		58	ug/L				3/4/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		57.0	ug/L				4/2/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		59.0	ug/L				5/6/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		59.0	ug/L				6/6/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		62	ug/L				7/9/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		67	ug/L				8/5/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		56.0	ug/L				9/4/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		58	ug/L				10/2/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		60	ug/L				11/5/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		55	ug/L				12/4/2007	
4	EFF-001	Barium	U.S. EPA Method 200.8		52.0	ug/L				1/8/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		47.0	ug/L				2/3/2008	

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
4	EFF-001	Barium	U.S. EPA Method 200.8		51	ug/L				3/5/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		56.0	ug/L				4/1/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		53	ug/L				4/8/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		59.8	ug/L				5/6/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		62.0	ug/L				6/3/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		61.0	ug/L				7/13/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		60.0	ug/L				8/5/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		61	ug/L				9/3/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		77.0	ug/L				10/6/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		59.0	ug/L				11/5/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		59	ug/L				12/8/2008	
4	EFF-001	Barium	U.S. EPA Method 200.8		58	ug/L				1/6/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		60.0	ug/L				2/1/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		62	ug/L				3/3/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		65.0	ug/L				4/5/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		58.0	ug/L				5/5/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		56	ug/L				5/12/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		63.0	ug/L				6/2/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		59	ug/L				7/8/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		63	ug/L				8/4/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		65.0	ug/L				9/2/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		63.0	ug/L				10/6/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		59.1	ug/L				11/3/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		59.6	ug/L				11/8/2009	
4	EFF-001	Barium	U.S. EPA Method 200.8		59.0	ug/L				12/1/2009	
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	4/15/2012	04/19/2012
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	5/13/2012	05/17/2012
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	6/10/2012	06/13/2012
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	7/8/2012	07/10/2012
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			8/12/2012	08/14/2012
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			9/9/2012	09/12/2012
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			10/7/2012	10/16/2012
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			11/4/2012	11/07/2012
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			12/2/2012	12/20/2012
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			1/13/2013	01/17/2013
5	EFF-001	Beryllium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			2/3/2013	02/06/2013
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	208	ug/L				6/1/2010	06/03/2010
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	269	ug/L				7/6/2010	07/12/2010
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	279	ug/L				8/3/2010	08/05/2010
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	193	ug/L				9/7/2010	09/16/2010
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	226	ug/L				10/3/2010	10/12/2010
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	220	ug/L				11/1/2010	11/04/2010
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	231	ug/L				12/5/2010	12/07/2010
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	194	ug/L				1/17/2011	01/18/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	255	ug/L				2/6/2011	02/10/2011

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	170	ug/L				3/6/2011	03/08/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	169	ug/L				4/3/2011	04/07/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	210	ug/L				5/8/2011	05/10/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	203	ug/L				6/12/2011	06/14/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	197	ug/L				7/10/2011	07/18/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	232	ug/L				8/7/2011	08/09/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	175	ug/L				9/5/2011	09/12/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	212	ug/L				10/9/2011	10/12/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	152	ug/L				11/6/2011	11/14/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	173	ug/L				12/4/2011	12/07/2011
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	165	ug/L				1/8/2012	01/17/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	190	ug/L				2/5/2012	02/13/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	158	ug/L				3/11/2012	03/15/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	157	ug/L				4/15/2012	04/19/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	223	ug/L				5/13/2012	05/17/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	173	ug/L				6/10/2012	06/13/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	204	ug/L				7/8/2012	07/10/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	224	ug/L				8/12/2012	08/14/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	200	ug/L				9/9/2012	09/12/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	164	ug/L				10/7/2012	10/16/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	175	ug/L				11/4/2012	11/07/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	155	ug/L				12/2/2012	12/20/2012
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	155	ug/L				1/13/2013	01/17/2013
6	EFF-001	Boron, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	180	ug/L				2/3/2013	02/06/2013
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04		0.1	4/15/2012	04/19/2012
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04		0.1	5/13/2012	05/17/2012
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04		0.1	6/10/2012	06/13/2012
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04		0.1	7/8/2012	07/10/2012
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04			8/12/2012	08/14/2012
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04			9/9/2012	09/12/2012
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04			10/7/2012	10/16/2012
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04			11/4/2012	11/07/2012
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04			12/2/2012	12/20/2012

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04			1/13/2013	01/17/2013
7	EFF-001	Cadmium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.04	ug/L	0.04			2/3/2013	02/06/2013
8	EFF-001	Chromium (III)	Inductively Coupled Plasma/Mass Spectroscopy	=	2.3	ug/L				4/15/2012	04/19/2012
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.31	ug/L	0.08		0.5	4/15/2012	04/16/2012
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	3.2	ug/L				5/13/2012	05/17/2012
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	=	0.52	ug/L				5/13/2012	05/14/2012
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	2.7	ug/L				6/10/2012	06/13/2012
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.34	ug/L	0.08		0.5	6/10/2012	06/13/2012
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	1.5	ug/L				7/8/2012	07/10/2012
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.41	ug/L	0.08		0.5	7/8/2012	07/09/2012
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	1.8	ug/L				8/12/2012	08/14/2012
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.47	ug/L	0.08		0.5	8/12/2012	08/14/2012
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	1.26	ug/L				9/9/2012	09/12/2012
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.34	ug/L	0.08		0.5	9/9/2012	09/10/2012
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	2.43	ug/L				10/7/2012	10/16/2012
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	=	0.57	ug/L				10/7/2012	10/09/2012
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	2.13	ug/L				11/4/2012	11/07/2012
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	=	0.52	ug/L				11/4/2012	11/05/2012
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	3.17	ug/L				12/2/2012	12/20/2012
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.33	ug/L	0.08		0.5	12/2/2012	12/20/2012
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	2.7	ug/L				1/13/2013	01/17/2013
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.3	ug/L	0.08		0.5	1/13/2013	01/14/2013
8	EFF-001	Chromium (III)	Calculation for Trivalent Chromium: Total Cr - Hexavalent Cr	=	2.95	ug/L				2/3/2013	02/06/2013
8	EFF-001	Chromium (VI)	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.35	ug/L	0.08		0.5	2/3/2013	02/04/2013
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17		0.5	4/15/2012	04/19/2012
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17		0.5	5/13/2012	05/17/2012
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17		0.5	6/10/2012	06/13/2012
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17		0.5	7/8/2012	07/10/2012

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17			8/12/2012	08/14/2012
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17			9/9/2012	09/12/2012
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17			10/7/2012	10/16/2012
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17			11/4/2012	11/07/2012
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17			12/2/2012	12/20/2012
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17			1/13/2013	01/17/2013
9	EFF-001	Lead, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.17	ug/L	0.17			2/3/2013	02/06/2013
10	EFF-001	Mercury, Total Recoverable	Data Unavailable	=	2.3	ng/L				6/2/2010	06/10/2010
10	EFF-001	Mercury, Total Recoverable	Data Unavailable	=	4.3	ng/L				7/7/2010	07/15/2010
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	3	ng/L				8/2/2010	08/09/2010
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.5	ng/L				9/8/2010	09/10/2010
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	3.5	ng/L				10/4/2010	10/07/2010
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.5	ng/L				11/2/2010	09/10/2010
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	ND	0.2	ng/L	0.2		0.5	12/6/2010	12/10/2010
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	3.2	ng/L				1/18/2011	01/26/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.5	ng/L				2/7/2011	02/15/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	3	ng/L				3/7/2011	03/09/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	1.7	ng/L				4/4/2011	04/08/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2	ng/L				5/9/2011	05/13/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.9	ng/L				6/13/2011	06/22/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	3.9	ng/L				7/11/2011	07/19/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.6	ng/L				8/8/2011	08/17/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.1	ng/L				9/6/2011	09/16/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	3.4	ng/L				10/10/2011	10/18/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.9	ng/L				11/7/2011	11/10/2011

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.4	ng/L				12/5/2011	12/08/2011
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.4	ng/L				1/9/2012	01/17/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.4	ng/L				2/6/2012	02/10/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	4.2	ng/L				3/12/2012	03/19/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.5	ng/L				4/16/2012	04/24/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.8	ng/L				5/14/2012	05/18/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	4.5	ng/L				6/11/2012	06/18/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.9	ng/L				7/9/2012	07/18/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	4.1	ng/L				8/13/2012	08/16/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	4	ng/L				9/10/2012	09/14/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	3.3	ng/L				10/8/2012	10/16/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	3	ng/L				11/5/2012	11/09/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.8	ng/L				12/3/2012	12/14/2012
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	1.5	ng/L				1/14/2013	01/23/2013
10	EFF-001	Mercury, Total Recoverable	Mercury in Water by Oxidation, P&T, and Cold Vapor	=	2.9	ng/L				2/4/2013	02/08/2013
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	1.4	ug/L				4/15/2012	04/19/2012
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5	ug/L				5/13/2012	05/17/2012
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.2	ug/L				6/10/2012	06/13/2012
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.2	ug/L				7/8/2012	07/10/2012
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.8	ug/L				8/12/2012	08/14/2012
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	2.3	ug/L				9/9/2012	09/12/2012
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	1.5	ug/L				10/7/2012	10/16/2012
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	1.8	ug/L				11/4/2012	11/07/2012
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	2	ug/L				12/2/2012	12/20/2012
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	2	ug/L				1/13/2013	01/17/2013
11	EFF-001	Nickel, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	2.1	ug/L				2/3/2013	02/06/2013

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	13.7	mg/L				6/1/2010	06/02/2010
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	12.9	mg/L				7/6/2010	07/08/2010
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	11.7	mg/L				8/3/2010	08/04/2010
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	14.8	mg/L				9/7/2010	09/08/2010
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	15	mg/L				10/3/2010	10/04/2010
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	17.7	mg/L				11/1/2010	11/02/2010
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	18.4	mg/L				12/5/2010	12/07/2010
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	17.8	mg/L				1/17/2011	01/18/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	17.1	mg/L				2/6/2011	02/08/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	19.5	mg/L				3/6/2011	03/07/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	20.8	mg/L				4/3/2011	04/04/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	19	mg/L				5/8/2011	05/09/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	18.8	mg/L				6/12/2011	06/13/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	16.2	mg/L				7/10/2011	07/11/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	16.5	mg/L				8/7/2011	08/08/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	15.4	mg/L				9/5/2011	09/06/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	17.1	mg/L				10/9/2011	10/10/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	17.5	mg/L				11/6/2011	11/07/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	18.4	mg/L				12/4/2011	12/05/2011
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	19.4	mg/L				1/8/2012	01/09/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	18.6	mg/L				2/5/2012	02/06/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	17.4	mg/L				3/11/2012	03/12/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	18.4	mg/L				4/15/2012	04/16/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	18.7	mg/L				5/13/2012	05/14/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	16.3	mg/L				6/10/2012	06/11/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	14.1	mg/L				7/8/2012	07/09/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	16.9	mg/L				8/12/2012	08/14/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	15.8	mg/L				9/9/2012	09/10/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	13.3	mg/L				10/7/2012	10/08/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	15.7	mg/L				11/4/2012	11/05/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	14.2	mg/L				12/2/2012	12/03/2012
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	18	mg/L				1/13/2013	01/14/2013
12	EFF-001	Nitrate, Total (as N)	Inorganic Anions by Ion Chromatography	=	19.1	mg/L				2/3/2013	02/04/2013

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				1/17/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				1/17/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				2/5/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				2/5/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				3/4/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				3/5/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				4/2/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				4/3/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				5/6/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				5/7/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				6/6/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				6/6/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				7/9/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				7/10/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				8/1/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				8/1/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				9/4/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				9/6/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				10/2/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				10/3/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				11/1/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				11/5/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				12/4/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				12/4/2007	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				1/8/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				1/9/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				2/3/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				2/4/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				3/4/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				3/5/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				4/1/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				4/2/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				5/1/2008	

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				5/6/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				6/3/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				6/4/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				7/2/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				7/13/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				8/5/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				8/6/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				10/6/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				11/4/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				11/5/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				12/2/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				12/8/2008	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				1/6/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				2/1/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				3/3/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				3/4/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				4/5/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				4/6/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				5/5/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				5/5/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				6/2/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				6/2/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				7/8/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				8/4/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				9/1/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				9/2/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				10/6/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				11/3/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				11/4/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		100	ug/L				12/1/2009	
14	EFF-001	Nitrite (as NO2-N)	U.S. EPA Method 300		400	ug/L				9/3-4/08	
15	EFF-001	Selenium, Total Recoverable	Data Unavailable	DNQ	0.22	ug/L	0.06		0.5	6/1/2010	06/10/2010
15	EFF-001	Selenium, Total Recoverable	Data Unavailable	DNQ	0.25	ug/L	0.06		0.5	7/6/2010	07/14/2010

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.24	ug/L	0.06		1	8/3/2010	08/10/2010
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.27	ug/L	0.06		1	9/7/2010	09/14/2010
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.28	ug/L	0.06		1	10/3/2010	10/11/2010
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.25	ug/L	0.06		1	11/1/2010	11/09/2010
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.25	ug/L	0.06		1	12/5/2010	12/14/2010
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.31	ug/L	0.06		1	1/17/2011	01/21/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.32	ug/L	0.06		1	2/6/2011	02/16/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.29	ug/L	0.06		1	3/6/2011	03/11/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.29	ug/L	0.06		1	4/3/2011	04/11/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.27	ug/L	0.06		1	5/8/2011	05/20/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.23	ug/L	0.06		1	6/12/2011	06/17/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.28	ug/L	0.06		1	7/10/2011	07/18/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.28	ug/L	0.06		1	8/7/2011	08/12/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.25	ug/L	0.06		1	9/5/2011	09/09/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.22	ug/L	0.06		1	10/9/2011	10/20/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.27	ug/L	0.06		1	11/6/2011	11/11/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.23	ug/L	0.06		1	12/4/2011	12/07/2011
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.24	ug/L	0.06		1	1/8/2012	01/13/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.24	ug/L	0.06		1	2/5/2012	02/13/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.24	ug/L	0.06		1	3/11/2012	03/20/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.24	ug/L	0.06		1	4/15/2012	04/26/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.27	ug/L	0.06		1	5/13/2012	05/21/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.2	ug/L	0.06		1	6/10/2012	06/20/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.24	ug/L	0.06		1	7/8/2012	07/17/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.3	ug/L	0.06		0.5	8/12/2012	08/20/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.26	ug/L	0.06		0.5	9/9/2012	09/18/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.22	ug/L	0.06		0.5	10/7/2012	10/12/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.24	ug/L	0.06		0.5	11/4/2012	11/13/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.25	ug/L	0.06		0.5	12/2/2012	12/18/2012
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.3	ug/L	0.06		1	1/13/2013	01/23/2013
15	EFF-001	Selenium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.24	ug/L	0.06		0.5	2/3/2013	02/06/2013
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			4/15/2012	04/19/2012
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			5/13/2012	05/17/2012

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			6/10/2012	06/13/2012
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			7/8/2012	07/10/2012
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			8/12/2012	08/14/2012
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			9/9/2012	09/12/2012
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			10/7/2012	10/16/2012
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			11/4/2012	11/07/2012
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			12/2/2012	12/20/2012
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			1/13/2013	01/17/2013
16	EFF-001	Thallium, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.5	ug/L	0.5			2/3/2013	02/06/2013
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	120	mg/L				6/2/2010	06/02/2010
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	109	mg/L				7/7/2010	07/08/2010
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	110	mg/L				8/2/2010	08/03/2010
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	121	mg/L				9/8/2010	09/08/2010
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	109	mg/L				10/4/2010	10/04/2010
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	129	mg/L				11/2/2010	11/02/2010
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	111	mg/L				12/6/2010	12/07/2010
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	128	mg/L				1/18/2011	01/18/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	126	mg/L				2/7/2011	02/08/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	108	mg/L				3/7/2011	03/07/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	114	mg/L				4/4/2011	04/04/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	119	mg/L				5/9/2011	05/09/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	107	mg/L				6/13/2011	06/13/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	125	mg/L				7/11/2011	07/11/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	120	mg/L				8/8/2011	08/08/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	107	mg/L				9/6/2011	09/06/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	123	mg/L				10/10/2011	10/10/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	143	mg/L				11/7/2011	11/07/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	127	mg/L				12/5/2011	12/05/2011
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	145	mg/L				1/9/2012	01/09/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	125	mg/L				2/6/2012	02/06/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	115	mg/L				3/12/2012	03/12/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	111	mg/L				4/16/2012	04/16/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	121	mg/L				5/14/2012	05/14/2012

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	124	mg/L				6/11/2012	06/11/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	121	mg/L				7/9/2012	07/09/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	127	mg/L				8/13/2012	08/14/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	118	mg/L				9/10/2012	09/10/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	183	mg/L				10/8/2012	10/08/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	124	mg/L				11/5/2012	11/05/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	85.6	mg/L				12/3/2012	12/03/2012
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	126	mg/L				1/14/2013	01/14/2013
17	EFF-001	Chloride	Inorganic Anions by Ion Chromatography	=	110	mg/L				2/4/2013	02/04/2013
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.7	ug/L				6/1/2010	06/03/2010
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.1	ug/L				7/6/2010	07/12/2010
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	7.2	ug/L				8/3/2010	08/05/2010
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3	ug/L				9/7/2010	09/16/2010
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	2.8	ug/L				10/3/2010	10/12/2010
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4	ug/L				11/1/2010	11/08/2010
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.2	ug/L				12/5/2010	12/07/2010
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	6.5	ug/L				1/17/2011	01/18/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5.9	ug/L				2/6/2011	02/10/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4.3	ug/L				3/6/2011	03/08/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5.3	ug/L				4/3/2011	04/07/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.29	ug/L	0.29		0.5	5/8/2011	05/10/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.5	ug/L				6/12/2011	06/14/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4.5	ug/L				7/10/2011	07/18/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5.44	ug/L				8/7/2011	08/09/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5.4	ug/L				9/5/2011	09/12/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4	ug/L				10/9/2011	10/12/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5	ug/L				11/6/2011	11/14/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.91	ug/L				12/4/2011	12/07/2011
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4.6	ug/L				1/8/2012	01/17/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	7	ug/L				2/5/2012	02/13/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	8.5	ug/L				3/11/2012	03/15/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4	ug/L				4/15/2012	04/19/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4.5	ug/L				5/13/2012	05/17/2012

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4.7	ug/L				6/10/2012	06/13/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.7	ug/L				7/8/2012	07/10/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	5	ug/L				8/12/2012	08/14/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4.2	ug/L				9/9/2012	09/12/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	3.7	ug/L				10/7/2012	10/16/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	6.04	ug/L				11/4/2012	11/07/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4.5	ug/L				12/2/2012	12/20/2012
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	4.8	ug/L				1/13/2013	01/17/2013
18	EFF-001	Copper, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	6	ug/L				2/3/2013	02/06/2013
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	156	ug/L				4/6/2010	04/13/2010
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	266	ug/L				7/6/2010	07/12/2010
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	220	ug/L				10/3/2010	10/12/2010
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	250	ug/L				1/17/2011	01/18/2011
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	147	ug/L				4/3/2011	04/07/2011
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	140	ug/L				7/10/2011	07/18/2011
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	184	ug/L				10/9/2011	10/12/2011
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	167	ug/L				1/8/2012	01/17/2012
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	119	ug/L				4/15/2012	04/19/2012
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	182	ug/L				7/8/2012	07/10/2012
19	EFF-001	Iron, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	112	ug/L				10/7/2012	10/16/2012
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	8.8	ug/L	1		10	4/6/2010	04/13/2010
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	7.3	ug/L	1		10	7/6/2010	07/12/2010
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	11	ug/L				10/3/2010	10/12/2010
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	19	ug/L				1/17/2011	01/18/2011
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	47	ug/L				4/3/2011	04/07/2011
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	19	ug/L				7/10/2011	07/18/2011
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	=	11	ug/L				10/9/2011	10/12/2011
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	ND	1	ug/L	1		10	1/8/2012	01/17/2012
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	4.6	ug/L	1		10	4/15/2012	04/19/2012
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	9	ug/L	1		10	7/8/2012	07/10/2012
20	EFF-001	Manganese, Total	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	6	ug/L	1		10	10/7/2012	10/16/2012
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		7	ug/L				1/17/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		10	ug/L				2/5/2007	

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		5	ug/L				3/4/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		8	ug/L				4/2/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		5.0	ug/L				5/6/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		8	ug/L				6/6/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		8	ug/L				7/9/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		7	ug/L				8/5/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		8	ug/L				9/4/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		7	ug/L				10/2/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		10	ug/L				11/5/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		10	ug/L				12/4/2007	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		10	ug/L				1/8/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		3	ug/L				2/3/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4.5	ug/L				3/5/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4	ug/L				4/1/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		6.6	ug/L				5/6/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		5	ug/L				6/3/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		9.0	ug/L				7/13/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		5.2	ug/L				8/5/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4.8	ug/L				10/6/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4.2	ug/L				11/5/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		3.7	ug/L				12/8/2008	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		6	ug/L				1/6/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4.8	ug/L				2/1/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4	ug/L				3/3/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		3.7	ug/L				4/5/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		3.7	ug/L				5/5/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		5.3	ug/L				6/2/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		6	ug/L				7/8/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4.9	ug/L				8/4/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4.8	ug/L				9/2/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		5	ug/L				10/6/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4.1	ug/L				11/3/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		4.4	ug/L				11/8/2009	

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		3	ug/L				12/1/2009	
21	EFF-001	Molybdenum, Total	U.S. EPA Method 200.8		7	ug/L				9/3-4/08	
22	EFF-001	Silver, Total Recoverable	Data Unavailable	ND	0.063	ug/L	0.063		0.5	6/1/2010	06/10/2010
22	EFF-001	Silver, Total Recoverable	Data Unavailable	ND	0.063	ug/L	0.063		0.5	7/6/2010	07/14/2010
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.063	ug/L	0.063			8/3/2010	08/10/2010
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.03	ug/L	0.009		0.1	9/7/2010	09/20/2010
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.063	ug/L	0.063			10/3/2010	10/11/2010
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.02	ug/L	0.009		0.1	11/1/2010	11/09/2010
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.063	ug/L	0.063			12/5/2010	12/14/2010
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.063	ug/L	0.063		0.1	1/17/2011	01/21/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.063	ug/L	0.063			2/6/2011	02/16/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.063	ug/L	0.063			3/6/2011	03/11/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.02	ug/L	0.02		0.1	4/3/2011	04/11/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	5/8/2011	05/20/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			6/12/2011	06/17/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	7/10/2011	07/18/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	8/7/2011	08/12/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	9/5/2011	09/09/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	DNQ	0.03	ug/L	0.02		0.1	10/9/2011	10/20/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	11/6/2011	11/11/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			12/4/2011	12/07/2011
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	1/8/2012	01/13/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.5	2/5/2012	02/13/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	3/11/2012	03/20/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	4/15/2012	04/26/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	5/13/2012	05/21/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02			6/10/2012	06/20/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	7/8/2012	07/17/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.5	8/12/2012	08/20/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.5	9/9/2012	09/18/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.5	10/7/2012	10/12/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.5	11/4/2012	11/13/2012
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.5	12/2/2012	12/18/2012

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.1	1/13/2013	01/23/2013
22	EFF-001	Silver, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	ND	0.02	ug/L	0.02		0.5	2/3/2013	02/06/2013
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	852	umhos/cm				6/1/2010	06/01/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	893	umhos/cm				6/7/2010	06/07/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	922	umhos/cm				6/15/2010	06/15/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1004	umhos/cm				6/21/2010	06/21/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1047	umhos/cm				6/28/2010	06/28/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	960	umhos/cm				7/1/2010	07/01/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	958	umhos/cm				7/8/2010	07/08/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1028	umhos/cm				7/15/2010	07/15/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1031	umhos/cm				7/22/2010	07/22/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	898	umhos/cm				7/29/2010	07/29/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	917	umhos/cm				8/2/2010	08/02/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	985	umhos/cm				8/9/2010	08/09/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	897	umhos/cm				8/16/2010	08/16/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1001	umhos/cm				8/23/2010	08/23/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1018	umhos/cm				8/30/2010	08/30/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	920	umhos/cm				9/7/2010	09/07/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	944	umhos/cm				9/13/2010	09/13/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1042	umhos/cm				9/20/2010	09/20/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	907	umhos/cm				9/27/2010	09/27/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	880	umhos/cm				10/4/2010	10/04/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	989	umhos/cm				10/11/2010	10/11/2010

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	878	umhos/cm				10/18/2010	10/18/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	811	umhos/cm				10/25/2010	10/25/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	945	umhos/cm				11/1/2010	11/01/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	952	umhos/cm				11/8/2010	11/08/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	874	umhos/cm				11/15/2010	11/15/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	803	umhos/cm				11/22/2010	11/22/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	941	umhos/cm				11/29/2010	11/29/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	950	umhos/cm				12/6/2010	12/06/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	981	umhos/cm				12/13/2010	12/13/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	770	umhos/cm				12/20/2010	12/20/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	901	umhos/cm				12/27/2010	12/27/2010
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	774	umhos/cm				1/3/2011	01/03/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	833	umhos/cm				1/10/2011	01/10/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	918	umhos/cm				1/18/2011	01/18/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	915	umhos/cm				1/24/2011	01/24/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	934	umhos/cm				1/31/2011	01/24/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	903	umhos/cm				2/7/2011	02/07/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	867	umhos/cm				2/14/2011	02/14/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	774	umhos/cm				2/22/2011	02/22/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	799	umhos/cm				2/28/2011	02/28/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	858	umhos/cm				3/7/2011	03/07/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	905	umhos/cm				3/14/2011	03/14/2011

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	705	umhos/cm				3/21/2011	03/21/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	681	umhos/cm				3/28/2011	03/28/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	835	umhos/cm				4/4/2011	04/04/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	916	umhos/cm				4/11/2011	04/11/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	944	umhos/cm				4/18/2011	04/18/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	902	umhos/cm				4/25/2011	04/25/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	946	umhos/cm				5/2/2011	05/02/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	962	umhos/cm				5/9/2011	05/09/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	856	umhos/cm				5/16/2011	05/16/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	949	umhos/cm				5/23/2011	05/23/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	863	umhos/cm				5/31/2011	05/31/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	846	umhos/cm				6/6/2011	06/06/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	899	umhos/cm				6/13/2011	06/13/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	883	umhos/cm				6/20/2011	06/20/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	940	umhos/cm				6/27/2011	06/27/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	950	umhos/cm				7/5/2011	07/05/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	942	umhos/cm				7/11/2011	07/11/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1028	umhos/cm				7/18/2011	07/18/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1021	umhos/cm				7/25/2011	07/25/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	906	umhos/cm				8/1/2011	08/01/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	932	umhos/cm				8/8/2011	08/08/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	727	umhos/cm				8/15/2011	08/15/2011

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	920	umhos/cm				8/22/2011	08/22/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	907	umhos/cm				8/29/2011	08/29/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	817	umhos/cm				9/6/2011	09/06/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	874	umhos/cm				9/12/2011	09/12/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	880	umhos/cm				9/19/2011	09/19/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	978	umhos/cm				9/26/2011	09/26/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	975	umhos/cm				10/3/2011	10/03/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	971	umhos/cm				10/10/2011	10/10/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	938	umhos/cm				10/17/2011	10/17/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1012	umhos/cm				10/24/2011	10/24/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	857	umhos/cm				10/31/2011	10/31/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	941	umhos/cm				11/7/2011	11/07/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	962	umhos/cm				11/14/2011	11/14/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	891	umhos/cm				11/21/2011	11/21/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	813	umhos/cm				11/28/2011	11/28/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	911	umhos/cm				12/5/2011	12/05/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	933	umhos/cm				12/12/2011	12/12/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	893	umhos/cm				12/19/2011	12/19/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	823	umhos/cm				12/27/2011	12/27/2011
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	876	umhos/cm				1/3/2012	01/03/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	964	umhos/cm				1/9/2012	01/09/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	924	umhos/cm				1/17/2012	01/17/2012

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	859	umhos/cm				1/23/2012	01/23/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	879	umhos/cm				1/30/2012	01/30/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	953	umhos/cm				2/6/2012	02/06/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	867	umhos/cm				2/13/2012	02/13/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	877	umhos/cm				2/21/2012	02/21/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	853	umhos/cm				2/27/2012	02/27/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	876	umhos/cm				3/5/2012	03/05/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	924	umhos/cm				3/12/2012	03/12/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	796	umhos/cm				3/19/2012	03/19/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	891	umhos/cm				3/26/2012	03/26/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	890	umhos/cm				4/2/2012	04/02/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	910	umhos/cm				4/9/2012	04/09/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	930	umhos/cm				4/16/2012	04/16/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	920	umhos/cm				4/23/2012	04/23/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	835	umhos/cm				4/30/2012	04/30/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	901	umhos/cm				5/7/2012	05/07/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	877	umhos/cm				5/14/2012	05/14/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	957	umhos/cm				5/21/2012	05/21/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	912	umhos/cm				5/29/2012	05/29/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	948	umhos/cm				6/4/2012	06/04/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	946	umhos/cm				6/11/2012	06/11/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	935	umhos/cm				6/18/2012	06/18/2012

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	960	umhos/cm				6/25/2012	06/25/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	908	umhos/cm				7/2/2012	07/02/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	920	umhos/cm				7/9/2012	07/09/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	956	umhos/cm				7/16/2012	07/16/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	929	umhos/cm				7/23/2012	07/23/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	963	umhos/cm				7/30/2012	07/30/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	870	umhos/cm				8/6/2012	08/06/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	934	umhos/cm				8/13/2012	08/13/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	941	umhos/cm				8/20/2012	08/20/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	911	umhos/cm				8/27/2012	08/27/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	962	umhos/cm				9/4/2012	09/04/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	932	umhos/cm				9/10/2012	09/10/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1017	umhos/cm				9/17/2012	09/17/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1050	umhos/cm				9/24/2012	09/24/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	987	umhos/cm				10/1/2012	10/01/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	899	umhos/cm				10/8/2012	10/08/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	951	umhos/cm				10/15/2012	10/15/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	947	umhos/cm				10/22/2012	10/22/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1012	umhos/cm				10/29/2012	10/29/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	960	umhos/cm				11/5/2012	11/05/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	991	umhos/cm				11/13/2012	11/13/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	892	umhos/cm				11/19/2012	11/19/2012

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	928	umhos/cm				11/26/2012	11/26/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	982	umhos/cm				12/3/2012	12/03/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	929	umhos/cm				12/10/2012	12/10/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	926	umhos/cm				12/17/2012	12/17/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	987	umhos/cm				12/24/2012	12/24/2012
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	1008	umhos/cm				1/2/2013	01/02/2013
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	852	umhos/cm				1/7/2013	01/07/2013
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	925	umhos/cm				1/14/2013	01/14/2013
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	888	umhos/cm				1/22/2013	01/22/2013
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	890	umhos/cm				1/28/2013	01/28/2013
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	904	umhos/cm				2/4/2013	02/04/2013
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	912	umhos/cm				2/11/2013	02/11/2013
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	882	umhos/cm				2/19/2013	02/19/2013
24	EFF-001	Electrical Conductivity @ 25 Deg. C	Standard Method (19th) 2510 B: Specific Conductance	=	891	umhos/cm				2/25/2013	02/25/2013
25	EFF-001	Sulfate (as SO4)	U.S. EPA Method 300		44.4	mg/L				2/6/2007	
25	EFF-001	Sulfate (as SO4)	U.S. EPA Method 300		68.7	mg/L				2/3/2008	
25	EFF-001	Sulfate (as SO4)	U.S. EPA Method 300		77.1	mg/L				2/19/2008	
25	EFF-001	Sulfate (as SO4)	U.S. EPA Method 300		38.6	mg/L				2/20/2008	
25	EFF-001	Sulfate (as SO4)	U.S. EPA Method 300		60.1	mg/L				4/8/2008	
25	EFF-001	Sulfate (as SO4)	U.S. EPA Method 300		61.1	mg/L				5/12/2009	
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	622	mg/L				6/1/2010	06/01/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	524	mg/L				6/7/2010	06/07/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	488	mg/L				6/15/2010	06/15/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	554	mg/L				6/21/2010	06/21/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	660	mg/L				6/28/2010	06/28/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	582	mg/L				7/6/2010	07/06/2010

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	676	mg/L				7/12/2010	07/12/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	422	mg/L				7/19/2010	07/19/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	646	mg/L				7/26/2010	07/26/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	642	mg/L				8/2/2010	08/02/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	570	mg/L				8/9/2010	08/09/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	576	mg/L				8/16/2010	08/16/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	512	mg/L				8/23/2010	08/23/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	590	mg/L				8/30/2010	08/30/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	532	mg/L				9/7/2010	09/07/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	628	mg/L				9/13/2010	09/13/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	722	mg/L				9/20/2010	09/20/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	642	mg/L				9/27/2010	09/27/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	594	mg/L				10/4/2010	10/04/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	702	mg/L				10/11/2010	10/11/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	624	mg/L				10/18/2010	10/18/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	504	mg/L				10/25/2010	10/25/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	652	mg/L				11/1/2010	11/01/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	434	mg/L				11/8/2010	11/08/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	586	mg/L				11/15/2010	11/15/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	562	mg/L				11/22/2010	11/22/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	608	mg/L				11/29/2010	11/29/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	632	mg/L				12/6/2010	12/06/2010

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	624	mg/L				12/13/2010	12/13/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	540	mg/L				12/20/2010	12/20/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	549	mg/L				12/27/2010	12/27/2010
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	502	mg/L				1/3/2011	01/03/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	514	mg/L				1/10/2011	01/10/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	584	mg/L				1/18/2011	01/18/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	494	mg/L				1/24/2011	01/24/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	602	mg/L				1/31/2011	01/31/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	650	mg/L				2/7/2011	02/07/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	654	mg/L				2/14/2011	02/14/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	612	mg/L				2/22/2011	02/22/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	520	mg/L				2/28/2011	02/28/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	546	mg/L				3/7/2011	03/07/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	582	mg/L				3/14/2011	03/14/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	444	mg/L				3/21/2011	03/21/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	496	mg/L				3/28/2011	03/28/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	592	mg/L				4/4/2011	04/04/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	648	mg/L				4/11/2011	04/11/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	644	mg/L				4/18/2011	04/18/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	612	mg/L				4/25/2011	04/25/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	612	mg/L				5/2/2011	05/02/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	598	mg/L				5/9/2011	05/09/2011

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	536	mg/L				5/16/2011	05/16/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	568	mg/L				5/23/2011	05/23/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	574	mg/L				5/31/2011	05/31/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	530	mg/L				6/6/2011	06/06/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	794	mg/L				6/13/2011	06/13/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	616	mg/L				6/20/2011	06/20/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	626	mg/L				6/27/2011	06/27/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	678	mg/L				7/5/2011	07/05/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	594	mg/L				7/11/2011	07/11/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	660	mg/L				7/18/2011	07/18/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	640	mg/L				7/25/2011	07/25/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	586	mg/L				8/1/2011	08/01/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	580	mg/L				8/8/2011	08/08/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	616	mg/L				8/15/2011	08/15/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	566	mg/L				8/22/2011	08/22/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	570	mg/L				8/29/2011	08/29/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	556	mg/L				9/6/2011	09/06/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	602	mg/L				9/12/2011	09/12/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	582	mg/L				9/19/2011	09/19/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	520	mg/L				9/26/2011	09/26/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	631	mg/L				10/3/2011	10/03/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	610	mg/L				10/10/2011	10/10/2011

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	554	mg/L				10/17/2011	10/17/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	516	mg/L				10/24/2011	10/24/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	612	mg/L				10/31/2011	10/31/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	604	mg/L				11/7/2011	11/07/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	688	mg/L				11/14/2011	11/14/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	558	mg/L				11/21/2011	11/21/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	494	mg/L				11/28/2011	11/28/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	598	mg/L				12/5/2011	12/05/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	628	mg/L				12/12/2011	12/12/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	514	mg/L				12/19/2011	12/19/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	572	mg/L				12/27/2011	12/27/2011
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	544	mg/L				1/3/2012	01/03/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	598	mg/L				1/9/2012	01/09/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	588	mg/L				1/17/2012	01/17/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	562	mg/L				1/23/2012	01/23/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	614	mg/L				1/30/2012	01/30/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	560	mg/L				2/6/2012	02/06/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	586	mg/L				2/13/2012	02/13/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	566	mg/L				2/21/2012	02/21/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	540	mg/L				2/27/2012	02/27/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	524	mg/L				3/5/2012	03/05/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	636	mg/L				3/12/2012	03/12/2012

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	496	mg/L				3/19/2012	03/19/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	578	mg/L				3/26/2012	03/26/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	550	mg/L				4/2/2012	04/02/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	516	mg/L				4/9/2012	04/09/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	506	mg/L				4/16/2012	04/16/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	600	mg/L				4/23/2012	04/23/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	584	mg/L				4/30/2012	04/30/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	618	mg/L				5/7/2012	05/07/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	528	mg/L				5/14/2012	05/14/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	608	mg/L				5/21/2012	05/21/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	613	mg/L				5/29/2012	05/29/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	593	mg/L				6/4/2012	06/04/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	572	mg/L				6/11/2012	06/11/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	642	mg/L				6/18/2012	06/18/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	570	mg/L				6/25/2012	06/25/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	524	mg/L				7/2/2012	07/02/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	562	mg/L				7/9/2012	07/09/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	606	mg/L				7/16/2012	07/16/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	606	mg/L				7/23/2012	07/23/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	574	mg/L				7/30/2012	07/30/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	620	mg/L				8/6/2012	08/06/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	580	mg/L				8/13/2012	08/13/2012

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	676	mg/L				8/20/2012	08/20/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	566	mg/L				8/27/2012	08/27/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	572	mg/L				9/4/2012	09/04/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	604	mg/L				9/10/2012	09/10/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	606	mg/L				9/17/2012	09/17/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	600	mg/L				9/24/2012	09/24/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	598	mg/L				10/1/2012	10/01/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	500	mg/L				10/8/2012	10/08/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	568	mg/L				10/15/2012	10/15/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	580	mg/L				10/22/2012	10/22/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	642	mg/L				10/29/2012	10/29/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	666	mg/L				11/5/2012	11/05/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	586	mg/L				11/13/2012	11/13/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	580	mg/L				11/19/2012	11/19/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	612	mg/L				11/26/2012	11/26/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	572	mg/L				12/3/2012	12/03/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	532	mg/L				12/10/2012	12/10/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	612	mg/L				12/17/2012	12/17/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	390	mg/L				12/24/2012	12/24/2012
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	564	mg/L				1/2/2013	01/02/2013
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	500	mg/L				1/7/2013	01/07/2013
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	528	mg/L				1/14/2013	01/14/2013

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	500	mg/L				1/22/2013	01/22/2013
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	724	mg/L				1/28/2013	01/28/2013
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	634	mg/L				2/4/2013	02/04/2013
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	522	mg/L				2/11/2013	02/11/2013
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	552	mg/L				2/19/2013	02/19/2013
26	EFF-001	Total Dissolved Solids (TDS)	Standard Method (19th) 2540 C: Total Diss. Solids at 180 deg.	=	584	mg/L				2/25/2013	02/25/2013
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	43	ug/L				4/15/2012	04/19/2012
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	42	ug/L				5/13/2012	05/17/2012
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	30	ug/L				6/10/2012	06/13/2012
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	28	ug/L				7/8/2012	07/10/2012
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	31	ug/L				8/12/2012	08/14/2012
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	35	ug/L				9/9/2012	09/12/2012
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	37	ug/L				10/7/2012	10/16/2012
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	49.2	ug/L				11/4/2012	11/07/2012
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	111	ug/L				12/2/2012	12/20/2012
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	42	ug/L				1/13/2013	01/17/2013
27	EFF-001	Zinc, Total Recoverable	Inductively Coupled Plasma/Mass Spectroscopy	=	41	ug/L				2/3/2013	02/06/2013
31	EFF-001	Chlordane	Organochlorine Pesticides and PCBs	ND	0.1	ug/L	0.1			4/15/2012	04/19/2012
31	EFF-001	Chlordane	Organochlorine Pesticides and PCBs	ND	0.1	ug/L	0.1			5/13/2012	05/16/2012
31	EFF-001	Chlordane	Organochlorine Pesticides and PCBs	ND	0.1	ug/L	0.1			6/10/2012	06/13/2012
31	EFF-001	Chlordane	Organochlorine Pesticides and PCBs	ND	0.1	ug/L	0.1			7/8/2012	07/16/2012
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01		0.5	4/6/2010	04/13/2010
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01			7/6/2010	07/13/2010
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01		0.5	10/3/2010	10/06/2010
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01		0.5	1/17/2011	01/24/2011
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01		0.5	4/3/2011	04/07/2011
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	7/10/2011	07/14/2011

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01		0.5	10/9/2011	10/13/2011
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01		0.5	1/8/2012	01/12/2012
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01		0.5	4/4/2012	04/09/2012
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01		0.5	7/8/2012	07/12/2012
32	EFF-001	Chlorpyrifos	HISTORICAL: Organophosphorus Compounds by GC	ND	0.01	ug/L	0.01			10/7/2012	10/11/2012
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	4/6/2010	04/13/2010
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02			7/6/2010	07/13/2010
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	10/3/2010	10/06/2010
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	1/17/2011	01/24/2011
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	4/3/2011	04/07/2011
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	7/10/2011	07/14/2011
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	10/9/2011	10/13/2011
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	1/8/2012	01/12/2012
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	4/4/2012	04/09/2012
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02		0.5	7/8/2012	07/12/2012
34	EFF-001	Diazinon	HISTORICAL: Organophosphorus Compounds by GC	ND	0.02	ug/L	0.02			10/7/2012	10/11/2012
36	EFF-001	Endrin	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			4/15/2012	04/19/2012
36	EFF-001	Endrin	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			6/10/2012	06/13/2012
36	EFF-001	Endrin	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			7/8/2012	07/16/2012
39	EFF-001	Heptachlor	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			4/15/2012	04/19/2012
39	EFF-001	Heptachlor	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			5/13/2012	05/16/2012
39	EFF-001	Heptachlor	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			6/10/2012	06/13/2012
39	EFF-001	Heptachlor	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			7/8/2012	07/16/2012
40	EFF-001	Heptachlor Epoxide	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			4/15/2012	04/19/2012
40	EFF-001	Heptachlor Epoxide	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			6/10/2012	06/13/2012

Tertiary Effluent Water Quality - Turlock

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
40	EFF-001	Heptachlor Epoxide	Organochlorine Pesticides and PCBs	ND	0.01	ug/L	0.01			7/8/2012	07/16/2012
41	EFF-001	gamma-BHC	Organochlorine Pesticides and PCBs	ND	0.02	ug/L	0.02			4/15/2012	04/19/2012
41	EFF-001	gamma-BHC	Organochlorine Pesticides and PCBs	ND	0.02	ug/L	0.02			5/13/2012	05/16/2012
41	EFF-001	gamma-BHC	Organochlorine Pesticides and PCBs	ND	0.02	ug/L	0.02			6/10/2012	06/13/2012
41	EFF-001	gamma-BHC	Organochlorine Pesticides and PCBs	ND	0.02	ug/L	0.02			7/8/2012	07/16/2012
47	EFF-001	Toxaphene	Organochlorine Pesticides and PCBs	ND	0.5	ug/L	0.5			4/15/2012	04/19/2012
47	EFF-001	Toxaphene	Organochlorine Pesticides and PCBs	ND	0.5	ug/L	0.5			5/13/2012	05/16/2012
47	EFF-001	Toxaphene	Organochlorine Pesticides and PCBs	ND	0.5	ug/L	0.5			6/10/2012	06/13/2012
47	EFF-001	Toxaphene	Organochlorine Pesticides and PCBs	ND	0.5	ug/L	0.5			7/8/2012	07/16/2012

ANALYTICAL RESULTS

Lab Order: M070563
Project ID CITY OF TURLOCK - Y2G0908

Lab ID: **M070563001** Date Collected: 7/9/2012 11:00 Matrix: Water
Sample ID: **PLANT EFFLUENT GRAB** Date Received: 7/12/2012 09:26

Parameters	Result	Units	R. L.	MDL	DF	Prepared	Batch	Analyzed	Batch	Qual
Mercury Analysis, Trace Level		**Prep Method:**	EPA 1631E			**Prep by:** UK				
		Analytical Method:	EPA 1631E					**Analyzed by:** LM		
Mercury	0.0029	ug/L	0.0005	0.00020	1	07/17/12 00:00	MPR 11064	07/18/12 09:04	MHG 3956	
Methyl Mercury Analysis		**Prep Method:**	Draft EPA 1630			**Prep by:** SEF				
		Analytical Method:	Draft EPA 1630					**Analyzed by:** SEF		
Methyl Mercury	0.06	ng/L	0.05	0.020	1	07/20/12 00:00	MPR 11078	07/21/12 15:28	MHG 3962	

Lab ID: **M070563002** Date Collected: 7/8/2012 00:00 Matrix: Water
Sample ID: **PLANT EFFLUENT COMP** Date Received: 7/12/2012 09:26

Parameters	Result	Units	R. L.	MDL	DF	Prepared	Batch	Analyzed	Batch	Qual
Metals by ICPMS Collision Mode, Total		**Prep Method:**	EPA 200.8			**Prep by:** SMD				
		Analytical Method:	EPA 200.8					**Analyzed by:** SMD		
Selenium (reaction cell)	J0.24	ug/L	1.0	0.060	1	07/16/12 00:00	MPR 11056	07/17/12 18:14	MMS 6450	
Silver	ND	ug/L	0.10	0.020	1	07/16/12 00:00	MPR 11056	07/17/12 18:14	MMS 6450	1

Lab ID: **M070563003** Date Collected: 7/9/2012 00:00 Matrix: Water
Sample ID: **TRAVEL BLANK** Date Received: 7/12/2012 09:26

Parameters	Result	Units	R. L.	MDL	DF	Prepared	Batch	Analyzed	Batch	Qual
Mercury Analysis, Trace Level		**Prep Method:**	EPA 1631E			**Prep by:** UK				
		Analytical Method:	EPA 1631E					**Analyzed by:** LM		
Mercury	ND	ug/L	0.0005	0.00020	1	07/17/12 00:00	MPR 11064	07/18/12 09:04	MHG 3956	1

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Tuesday, July 24, 2012

Ms. Donna Keller
GeoAnalytical Laboratories, Inc.
2300 Maryann Dr.
Turlock, CA 95380

RE:	Lab Order:	M070563	Collected By:	KENNITH W.
	Project ID:	CITY OF TURLOCK - Y2G0908	PO/Contract #:	

Dear Ms. Keller:

Enclosed are the analytical results for sample(s) received by the laboratory on Thursday, July 12, 2012. Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Enclosures

Project Manager: Patrick J Barnard

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SAMPLE SUMMARY

Lab Order: M070563

Project ID: CITY OF TURLOCK - Y2G0908

Lab ID	Sample ID	Matrix	Date Collected	Date Received
M070563001	**PLANT EFFLUENT GRAB**	Water	7/9/2012 11:00	7/12/2012 09:26
M070563002	**PLANT EFFLUENT COMP**	Water	7/8/2012 00:00	7/12/2012 09:26
M070563003	**TRAVEL BLANK**	Water	7/9/2012 00:00	7/12/2012 09:26

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NARRATIVE

Lab Order: M070563

Project ID: CITY OF TURLOCK - Y2G0908

General Qualifiers and Notes

Caltest authorizes this report to be reproduced only in its entirety. Results are specific to the sample(s) as submitted and only to the parameter(s) reported.

Caltest certifies that all test results for wastewater and hazardous waste analyses meet all applicable NELAC requirements; all microbiology and drinking water testing meet applicable ELAP requirements, unless stated otherwise.

All analyses performed by EPA Methods or Standard Methods (SM) 20th Edition except where noted (SMOL=online edition).

Caltest collects samples in compliance with 40 CFR, EPA Methods, Cal. Title 22, and Standard Methods.

Dilution Factors (DF) reported greater than '1' have been used to adjust the result, Reporting Limit (RL), and Method Detection Limit (MDL).

All Solid, sludge, and/or biosolids data is reported in Wet Weight, unless otherwise specified.

Filtrations performed at Caltest for dissolved metals (excluding mercury) and/or pH analysis were not performed within the 15 minute holding time as specified by 40CFR 136.3 table II.

Results Qualifiers: Report fields may contain codes and non-numeric data correlating to one or more of the following definitions:

ND - Non Detect - indicates analytical result has not been detected.

RL - Reporting Limit is the quantitation limit at which the laboratory is able to detect an analyte. An analyte not detected at or above the RL is reported as ND unless otherwise noted or qualified. For analyses pertaining to the State Implementation Plan of the California Toxics Rule, the Caltest Reporting Limit (RL) is equivalent to the Minimum Level (ML). A standard is always run at or below the ML. Where Reporting Limits are elevated due to dilution, the ML calibration criteria has been met.

J - reflects estimated analytical result value detected below the Reporting Limit (RL) and above the Method Detection Limit (MDL). The 'J' flag is equivalent to the DNQ Estimated Concentration flag.

E - indicates an estimated analytical result value.

B - indicates the analyte has been detected in the blank associated with the sample.

NC - means not able to be calculated for RPD or Spike Recoveries.

SS - compound is a Surrogate Spike used per laboratory quality assurance manual.

NOTE: This document represents a complete Analytical Report for the samples referenced herein and should be retained as a permanent record thereof.

Qualifiers and Compound Notes

1 Analyte(s) reported as 'ND' means not detected at or above the listed Method Detection Limits (MDL).

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QUALITY CONTROL DATA

Lab Order: M070563

Project ID: CITY OF TURLOCK - Y2G0908

Analysis Description:	Metals by ICPMS Collision Mode, Total	**QC Batch:**	MPR/11056
Analysis Method:	EPA 200.8	**QC Batch Method:**	EPA 200.8

METHOD BLANK: 462158

Parameter	Blank Result	Reporting Limit	MDL	Units	Qualifiers
Selenium (reaction cell)	ND	1.0	0.06	ug/L	
Silver	ND	0.10	0.02	ug/L	

LABORATORY CONTROL SAMPLE: 462159

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Selenium (reaction cell)	ug/L	20	20	100	85-115	
Silver	ug/L	20	19	95	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 462161 462162

Parameter	Units	M070511002 Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Selenium (reaction cell)	ug/L	0.23	20	20	20	97	97	70-130	0.4	20	
Silver	ug/L	0.05	20	18	18	87	87	70-130	0	20	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 462163 462164

Parameter	Units	M070562001 Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Selenium (reaction cell)	ug/L	0.1	20	20	20	98	101	70-130	2.9	20	
Silver	ug/L	0	20	18	18	88	90	70-130	2	20	

Analysis Description:	Mercury Analysis, Trace Level	**QC Batch:**	MPR/11064
Analysis Method:	EPA 1631E	**QC Batch Method:**	EPA 1631E

METHOD BLANK: 462474

Parameter	Blank Result	Reporting Limit	MDL	Units	Qualifiers
Mercury	ND	0.0005	0.0002	ug/L	

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QUALITY CONTROL DATA

Lab Order: M070563

Project ID: CITY OF TURLOCK - Y2G0908

Analysis Description:	Mercury Analysis, Trace Level	**QC Batch:**	MPR/11064
Analysis Method:	EPA 1631E	**QC Batch Method:**	EPA 1631E

LABORATORY CONTROL SAMPLE: 462475

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	0.02	0.019	96	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 462479 462480

Parameter	Units	M070563001 Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Mercury	ug/L	0.0029	0.02	0.023	0.023	100	99	80-120	0.7	24	

Analysis Description:	Methyl Mercury Analysis	**QC Batch:**	MPR/11078
Analysis Method:	Draft EPA 1630	**QC Batch Method:**	Draft EPA 1630

METHOD BLANK: 463173

Parameter	Blank Result	Reporting Limit	MDL	Units	Qualifiers
Methyl Mercury	ND	0.05	0.02	ng/L	

LABORATORY CONTROL SAMPLE & LCSD: 463174 463175

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Methyl Mercury	ng/L	1.1	1	1.1	93	97	67-133	4.2	35	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 463176 463177

Parameter	Units	M070550003 Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qualifiers
Methyl Mercury	ng/L	0.04	1.1	1.1	1.1	98	100	65-135	1.4	35	

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QUALITY CONTROL DATA QUALIFIERS

Lab Order: M070563

Project ID: CITY OF TURLOCK - Y2G0908

QUALITY CONTROL PARAMETER QUALIFIERS

Results Qualifiers: Report fields may contain codes and non-numeric data correlating to one or more of the following definitions:

NS - means not spiked and will not have recoveries reported for Analyte Spike Amounts

QC Codes Keys: These descriptors are used to help identify the specific QC samples and clarify the report.

MB - Method Blank

Method Blanks are reported to the same Method Detection Limits (MDLs) or Reporting Limits (RLs) as the analytical samples in the corresponding QC batch.

LCS/LCSD - Laboratory Control Spike / Laboratory Control Spike Duplicate

DUP - Duplicate of Original Sample Matrix

MS/MSD - Matrix Spike / Matrix Spike Duplicate

RPD - Relative Percent Difference

%Recovery - Spike Recovery stated as a percentage

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Lab Order: M070563

Project ID: CITY OF TURLOCK - Y2G0908

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
M070563001	**PLANT EFFLUENT GRAB**	EPA 1631E	MPR/11064	EPA 1631E	MHG/3956
M070563003	**TRAVEL BLANK**	EPA 1631E	MPR/11064	EPA 1631E	MHG/3956
M070563001	**PLANT EFFLUENT GRAB**	Draft EPA 1630	MPR/11078	Draft EPA 1630	MHG/3962
M070563002	**PLANT EFFLUENT COMP**	EPA 200.8	MPR/11056	EPA 200.8	MMS/6450

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GeoAnalytical Laboratories, Inc.

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Report # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/16/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

CERTIFICATE OF ANALYSIS

Sampler: Jeanette White

Sample ID: Plant Effluent - Composite

Lab ID	Sample Date / Time	MDL	RL	Method	Analyte	Result	Units	Flags	Started
Y2G0913-01	7/08/2012 00:00	0.0700	2.50	200.7	Hardness as CaCO3	**110**	mg/L		7/10/12 07:50
		0.2000	1.00	200.7	Magnesium	**7.80**	mg/L		
		20.0000	50	200.8	Aluminum	**144**	ug/L		7/10/12 08:08
		0.5000	1.0	200.8	Antimony	ND	ug/L		
		0.5000	2.00	200.8	Arsenic	**5.50**	ug/L		
		0.0200	0.1	200.8	Beryllium	ND	ug/L		
		20.0000	100	200.8	Boron	**204**	ug/L		
		0.0400	0.1	200.8	Cadmium	ND	ug/L		
		0.5000	1.00	200.8	Chromium	**1.90**	ug/L		
		0.3200	1.00	200.8	Copper	**3.70**	ug/L		
		25.0000	50.0	200.8	Iron	**182**	ug/L		
		0.5000	1.00	200.8	Lead	ND	ug/L		
		1.0000	10.0	200.8	Manganese	**9.0**	ug/L	J	
		2.0000	10.0	200.8	Molybdenum	**5.3**	ug/L	J	
		0.5000	1.0	200.8	Nickel	**3.2**	ug/L		
		0.5000	1.0	200.8	Zinc	**28.0**	ug/L		
		0.0800	0.50	218.6	Chromium (VI)	**0.41**	ug/L	J	7/ 9/12 14:37
		2.3000	2.50	300.0	Nitrate as N	**14.1**	mg/L		7/ 9/12 14:39
		0.0800	0.50	Calc	Chrome III	**1.5**	ug/L		7/10/12 08:08
		0.0100	0.01	SM4500-CN E	Cyanide (total)	ND	mg/L		7/12/12 07:26

Sample ID: Plant Influent - Composite

Lab ID	Sample Date / Time	MDL	RL	Method	Analyte	Result	Units	Flags	Started
Y2G0913-02	7/08/2012 00:00	0.2000	1.00	200.7	Magnesium	**7.08**	mg/L		7/10/12 07:50
		25.0000	50.0	200.8	Iron	**612**	ug/L		7/10/12 08:08
		1.0000	10.0	200.8	Manganese	**31.0**	ug/L		
		0.3000	1.00	200.8	Mercury	ND	ug/L		
		2.0000	10.0	200.8	Molybdenum	**7.0**	ug/L	J	
		0.5000	1.0	200.8	Selenium	ND	ug/L		
		0.6000	2.0	200.8	Silver	ND	ug/L		

Cedric Gregory
Chemist

Donna Keller
Laboratory Director

Certification # 2585

GeoAnalytical Laboratories, Inc.

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port # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/24/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

CERTIFICATE OF ANALYSIS

Sampler: Jeanette White

Sample ID: Plant Effluent - Composite

Lab ID	Sample Date / Time	MDL	RL	Method	Analyte	Result	Units	Flags	Started
Y2G0913-01	7/08/2012 00:00	0.0900	0.1	608	Aldrin	ND	ug/L		7/16/12 07:59
		0.0900	0.1	608	alpha-BHC	ND	ug/L		
		0.0800	0.1	608	beta-BHC	ND	ug/L		
		0.5000	1.0	608	Chlordane	ND	ug/L		
		0.1300	0.5	608	DDD	ND	ug/L		
		0.0800	0.1	608	DDE	ND	ug/L		
		0.0800	0.5	608	DDT	ND	ug/L		
		0.1000	0.1	608	delta-BHC	ND	ug/L		
		0.0500	0.1	608	Dieldrin	ND	ug/L		
		0.0900	0.5	608	Endosulfan I	ND	ug/L		
		0.0500	0.5	608	Endosulfan II	ND	ug/L		
		0.2200	1.0	608	Endosulfan sulfate	ND	ug/L		
		0.0900	0.1	608	Endrin	ND	ug/L		
		0.0700	0.5	608	Endrin aldehyde	ND	ug/L		
		0.1000	0.1	608	gamma-BHC (Lindane)	ND	ug/L		
		0.1000	0.1	608	Heptachlor	ND	ug/L		
		0.1000	0.1	608	Heptachlor epoxide	ND	ug/L		
		0.3100	1.0	608	Methoxychlor	ND	ug/L		
		0.0500	1.0	608	PCB-1016	ND	ug/L		
		0.1400	1.0	608	PCB-1221	ND	ug/L		
		0.0900	1.0	608	PCB-1232	ND	ug/L		
		0.0600	1.0	608	PCB-1242	ND	ug/L		
		0.1500	1.0	608	PCB-1248	ND	ug/L		
		0.0600	1.0	608	PCB-1254	ND	ug/L		
		0.2200	1.0	608	PCB-1260	ND	ug/L		
		0.5000	1.0	608	Toxaphene	ND	ug/L		

Surrogate	Amnt Spiked	Amnt Recovered	% Recovery	QC Limit %	Surrogate Notes
TCMX	0.2500	0.350	*140 %*	*70-130*	

Matt Page
Chemist

Donna Keller
Laboratory Director

Certification # 2585

GeoAnalytical Laboratories, Inc.

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Report # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/16/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001506 - NO PREP			**Prepared: 07/09/12 Analyzed: 07/11/12**							
Blank (Y001506-BLK1)										
Chromium (VI)	ND	0.50	ug/L							
LCS (Y001506-BS1)										
Chromium (VI)	99	0.50	ug/L	100.0		99	80-120			
LCS Dup (Y001506-BSD1)										
Chromium (VI)	98	0.50	ug/L	100.0		98	80-120	0.7	20	
Matrix Spike (Y001506-MS1)		**Source: Y2G0911-01**								
Chromium (VI)	100	0.50	ug/L	100.0	0.13	101	80-120			
Matrix Spike Dup (Y001506-MSD1)		**Source: Y2G0911-01**								
Chromium (VI)	100	0.50	ug/L	100.0	0.13	101	80-120	0.6	20	
Batch Y001508 - NO PREP			**Prepared & Analyzed: 07/09/12**							
Blank (Y001508-BLK1)										
Nitrate as N	ND	0.25	mg/L							
LCS (Y001508-BS1)										
Nitrate as N	2.21	0.25	mg/L	2.258		98	85-115			
LCS Dup (Y001508-BSD1)										
Nitrate as N	2.23	0.25	mg/L	2.258		99	85-115	0.9	20	
Matrix Spike (Y001508-MS1)		**Source: Y2G0913-01**								
Nitrate as N	17.8	0.25	mg/L	2.258	14.1	165	85-115			QM-02

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Report # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/16/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

Inorganic Chemistry - Quality Control
GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001508 - NO PREP				**Prepared & Analyzed: 07/09/12**						
Matrix Spike Dup (Y001508-MSD1)		**Source: Y2G0913-01**								
Nitrate as N	18.0	0.25	mg/L	2.258	14.1	172	85-115	0.9	20	QM-02
Batch Y001512 - 3010A				**Prepared & Analyzed: 07/10/12**						
Blank (Y001512-BLK1)										
Aluminum	ND	50	ug/L							
Antimony	ND	1.0	"							
Arsenic	ND	2.00	"							
Beryllium	ND	0.1	"							
Boron	ND	100	"							
Cadmium	ND	0.1	"							
Chromium	ND	1.00	"							
Copper	ND	1.00	"							
Iron	ND	50.0	"							
Lead	ND	1.00	"							
Manganese	ND	10.0	"							
Mercury	ND	1.00	"							
Molybdenum	ND	10.0	"							
Nickel	ND	1.0	"							
Selenium	ND	1.0	"							
Silver	ND	2.0	"							
Zinc	ND	1.0	"							
LCS (Y001512-BS1)										
Aluminum	149	50	ug/L	125.0		119	80-120			
Antimony	29.0	1.0	"	25.00		116	80-120			
Arsenic	22.0	2.00	"	25.00		88	80-120			
Beryllium	21.0	0.1	"	25.00		84	80-120			
Boron	592	100	"	625.0		95	80-120			
Cadmium	24.0	0.1	"	25.00		96	80-120			
Chromium	27.0	1.00	"	25.00		108	80-120			
Copper	28.0	1.00	"	25.00		112	80-120			
Iron	282	50.0	"	250.0		113	80-120			
Lead	27.0	1.00	"	25.00		108	80-120			
Manganese	28.0	10.0	"	25.00		112	80-120			
Mercury	5.20	1.00	"	6.250		83	80-120			
Molybdenum	27.0	10.0	"	25.00		108	80-120			
Nickel	27.0	1.0	"	25.00		108	80-120			

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Report # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/16/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001512 - 3010A				**Prepared & Analyzed: 07/10/12**						
LCS (Y001512-BS1)										
Selenium	21.0	1.0	ug/L	25.00		84	80-120			
Silver	30.0	2.0	"	25.00		120	80-120			
Zinc	23.0	1.0	"	25.00		92	80-120			
LCS Dup (Y001512-BSD1)										
Aluminum	150	50	ug/L	125.0		120	80-120	0.7	20	
Antimony	30.0	1.0	"	25.00		120	80-120	3	20	
Arsenic	23.0	2.00	"	25.00		92	80-120	4	20	
Beryllium	22.0	0.1	"	25.00		88	80-120	5	20	
Boron	638	100	"	625.0		102	80-120	7	20	
Cadmium	24.0	0.1	"	25.00		96	80-120	0	20	
Chromium	27.0	1.00	"	25.00		108	80-120	0	20	
Copper	27.0	1.00	"	25.00		108	80-120	4	20	
Iron	272	50.0	"	250.0		109	80-120	4	20	
Lead	27.0	1.00	"	25.00		108	80-120	0	20	
Manganese	28.0	10.0	"	25.00		112	80-120	0	20	
Mercury	5.20	1.00	"	6.250		83	80-120	0	20	
Molybdenum	27.0	10.0	"	25.00		108	80-120	0	20	
Nickel	27.0	1.0	"	25.00		108	80-120	0	20	
Selenium	20.0	1.0	"	25.00		80	80-120	5	20	
Silver	30.0	2.0	"	25.00		120	80-120	0	20	
Zinc	23.0	1.0	"	25.00		92	80-120	0	20	
Matrix Spike (Y001512-MS1)		**Source: Y2G0911-01**								
Aluminum	955	50	ug/L	125.0	808	118	80-120			
Antimony	26.0	1.0	"	25.00	ND	104	80-120			
Arsenic	24.0	2.00	"	25.00	ND	96	80-120			
Beryllium	22.0	0.1	"	25.00	ND	88	80-120			
Boron	622	100	"	625.0	49	92	80-120			
Cadmium	23.0	0.1	"	25.00	ND	92	80-120			
Chromium	28.0	1.00	"	25.00	28.0	108	80-120			
Copper	28.0	1.00	"	25.00	2.00	104	80-120			
Iron	957	50.0	"	250.0	687	108	80-120			
Lead	28.0	1.00	"	25.00	ND	112	80-120			
Manganese	53.0	10.0	"	25.00	26.0	108	80-120			
Mercury	5.30	1.00	"	6.250	ND	85	80-120			
Molybdenum	27.0	10.0	"	25.00	ND	108	80-120			
Nickel	28.0	1.0	"	25.00	2.0	104	80-120			

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City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001512 - 3010A				**Prepared & Analyzed: 07/10/12**						
Matrix Spike (Y001512-MS1)		**Source: Y2G0911-01**								
Selenium	20.0	1.0	ug/L	25.00	ND	80	80-120			
Silver	30.0	2.0	"	25.00	ND	120	80-120			
Zinc	26.0	1.0	"	25.00	4.0	88	80-120			
Matrix Spike Dup (Y001512-MSD1)		**Source: Y2G0911-01**								
Aluminum	900	50	ug/L	125.0	808	74	80-120	6	20	QM-01
Antimony	26.0	1.0	"	25.00	ND	104	80-120	0	20	
Arsenic	23.0	2.00	"	25.00	ND	92	80-120	4	20	
Beryllium	22.0	0.1	"	25.00	ND	88	80-120	0	20	
Boron	647	100	"	625.0	49	96	80-120	4	20	
Cadmium	23.0	0.1	"	25.00	ND	92	80-120	0	20	
Chromium	27.0	1.00	"	25.00	27.0	104	80-120	4	20	
Copper	27.0	1.00	"	25.00	2.00	100	80-120	4	20	
Iron	907	50.0	"	250.0	687	88	80-120	5	20	
Lead	28.0	1.00	"	25.00	ND	112	80-120	0	20	
Manganese	52.0	10.0	"	25.00	26.0	104	80-120	2	20	
Mercury	5.40	1.00	"	6.250	ND	86	80-120	2	20	
Molybdenum	27.0	10.0	"	25.00	ND	108	80-120	0	20	
Nickel	27.0	1.0	"	25.00	2.0	100	80-120	4	20	
Selenium	20.0	1.0	"	25.00	ND	80	80-120	0	20	
Silver	30.0	2.0	"	25.00	ND	120	80-120	0	20	
Zinc	26.0	1.0	"	25.00	4.0	88	80-120	0	20	
Batch Y001513 - 3010A				**Prepared & Analyzed: 07/10/12**						
Blank (Y001513-BLK1)										
Magnesium	ND	1.00	mg/L							

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Report # Y2G0913 **Project:** Monthly/ Priority Pollutants **Date:** 07/16/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

Inorganic Chemistry - Quality Control
GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001513 - 3010A				**Prepared & Analyzed: 07/10/12**						
LCS (Y001513-BS1)										
Calcium	25.3	1.00	mg/L	25.00		101	80-120			
Magnesium	25.1	1.00	"	25.00		100	80-120			
Magnesium	25.1	1.00	"	25.00		100	80-120			
LCS Dup (Y001513-BSD1)										
Calcium	25.2	1.00	mg/L	25.00		101	80-120	0.3	20	
Magnesium	25.0	1.00	"	25.00		100	80-120	0.2	20	
Magnesium	25.0	1.00	"	25.00		100	80-120	0.2	20	
Matrix Spike (Y001513-MS1)		**Source: Y2G0913-01**								
Calcium	54.9	1.00	mg/L	25.00	31.1	95	80-120			
Magnesium	29.8	1.00	"	25.00	7.80	88	80-120			
Magnesium	29.8	1.00	"	25.00	7.80	88	80-120			
Matrix Spike Dup (Y001513-MSD1)		**Source: Y2G0913-01**								
Calcium	54.7	1.00	mg/L	25.00	31.1	95	80-120	0.2	20	
Magnesium	29.7	1.00	"	25.00	7.80	88	80-120	0.2	20	
Magnesium	29.7	1.00	"	25.00	7.80	88	80-120	0.2	20	
Batch Y001544 - NO PREP				**Prepared & Analyzed: 07/12/12**						
Blank (Y001544-BLK1)										
Cyanide (total)	ND	0.01	mg/L							
LCS (Y001544-BS1)										
Cyanide (total)	0.19	0.01	mg/L	0.2000		97	80-120			

GeoAnalytical Laboratories, Inc.

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Report # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/16/12

City of Turlock **Date Rec'd:** 07/09/12
156 South Broadway, Suite 270
Turlock, CA 95380

Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001544 - NO PREP				**Prepared & Analyzed: 07/12/12**						
LCS Dup (Y001544-BSD1)										
Cyanide (total)	0.20	0.01	mg/L	0.2000		98	80-120	0.9	20	
Matrix Spike (Y001544-MS1)		**Source: Y2G0913-01**								
Cyanide (total)	0.20	0.01	mg/L	0.2000	ND	98	68-132			
Matrix Spike Dup (Y001544-MSD1)		**Source: Y2G0913-01**								
Cyanide (total)	0.20	0.01	mg/L	0.2000	ND	98	68-132	0.2	5	

GeoAnalytical Laboratories, Inc.

2300 Maryann Dr. Turlock, CA 95380 Phone (209) 669-0100 Fax (209) 593-2212

email: lab.geo@att.net

Report # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/16/12

Date Rec'd: 07/09/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Notes and Definitions

QM-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
QM-01	The spike recovery for this QC sample is outside of established control limits due to sample matrix interference.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag). The J flag is equivalent to the DNQ Estimated Concentration flag.
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

GeoAnalytical Laboratories, Inc.

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Report # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/24/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

Volatile Organic Chemistry of Wastewater - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001569 - 3510B (Shake Out)			**Prepared: 07/16/12 Analyzed: 07/19/12**							
Blank (Y001569-BLK1)										
Aldrin	ND	0.1	ug/L							
alpha-BHC	ND	0.1	"							
beta-BHC	ND	0.1	"							
Chlordane	ND	1.0	"							
DDD	ND	0.5	"							
DDE	ND	0.1	"							
DDT	ND	0.5	"							
delta-BHC	ND	0.1	"							
Dieldrin	ND	0.1	"							
Endosulfan I	ND	0.5	"							
Endosulfan II	ND	0.5	"							
Endosulfan sulfate	ND	1.0	"							
Endrin	ND	0.1	"							
Endrin aldehyde	ND	0.5	"							
gamma-BHC (Lindane)	ND	0.1	"							
Heptachlor	ND	0.1	"							
Heptachlor epoxide	ND	0.1	"							
Methoxychlor	ND	1.0	"							
PCB-1016	ND	1.0	"							
PCB-1221	ND	1.0	"							
PCB-1232	ND	1.0	"							
PCB-1242	ND	1.0	"							
PCB-1248	ND	1.0	"							
PCB-1254	ND	1.0	"							
PCB-1260	ND	1.0	"							
Toxaphene	ND	1.0	"							
Surrogate: TCMX	*0.181*		*"*	*0.2500*		*72*	*70-130*			

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Report # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/24/12

City of Turlock **Date Rec'd:** 07/09/12
156 South Broadway, Suite 270
Turlock, CA 95380

Volatile Organic Chemistry of Wastewater - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001569 - 3510B (Shake Out)				**Prepared: 07/16/12 Analyzed: 07/19/12**						
LCS (Y001569-BS1)										
Aldrin	0.339	0.1	ug/L	0.5000		68	70-130			
DDT	0.880	0.5	"	1.000		88	70-130			
Dieldrin	0.513	0.1	"	0.5000		103	70-130			
Endrin	0.528	0.1	"	0.5000		106	70-130			
gamma-BHC (Lindane)	0.222	0.1	"	0.2500		89	70-130			
Heptachlor	0.411	0.1	"	0.5000		82	70-130			
Surrogate: TCMX	*0.252*		*"*	*0.2500*		*101*	*70-130*			
LCS Dup (Y001569-BSD1)										
Aldrin	0.353	0.1	ug/L	0.5000		71	70-130	4	20	
DDT	0.900	0.5	"	1.000		90	70-130	2	20	
Dieldrin	0.537	0.1	"	0.5000		107	70-130	4	20	
Endrin	0.572	0.1	"	0.5000		114	70-130	8	20	
gamma-BHC (Lindane)	0.244	0.1	"	0.2500		98	70-130	9	20	
Heptachlor	0.426	0.1	"	0.5000		85	70-130	4	20	
Surrogate: TCMX	*0.214*		*"*	*0.2500*		*85*	*70-130*			

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Report # Y2G0913 **Project: Monthly/ Priority Pollutants** **Date:** 07/24/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

Notes and Definitions

ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

GeoAnalytical Laboratories, Inc.

2300 Maryann Dr. Turlock, CA 95380 Phone (209) 669-0100 Fax (209) 668-8516
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port # Y2B0611 | Project: Monthly Wastewater | Date: 02/21/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 02/06/12

CERTIFICATE OF ANALYSIS

Sampler: Michelle Ford

Sample ID: Plant Effluent

Lab ID	Sample Date / Time	MDL	RL	Method	Analyte	Result	Units	Flags	Started
Y2B0611-01	2/05/2012 00:00	1.0000	1.0	120.1	Specific Conductance (EC)	**1200**	umhos/cm		2/ 6/12 16:00
		1.0000	1	140.1	Odor	4	T.O.N.		2/ 6/12 15:58
		0.1000	0.1	180.1	Turbidity	**1.3**	NTU		2/ 6/12 15:59
		0.0300	1.00	200.7	Calcium	**26.3**	mg/L		2/ 8/12 07:52
		0.9000	6.62	200.7	Hardness (as CaCO3)	**92.9**	mg/L		
		0.2000	1.00	200.7	Magnesium	**6.61**	mg/L		
		0.5000	1.00	200.7	Potassium	**18.3**	mg/L		
		0.6000	2.00	200.7	Sodium	**134**	mg/L		
		20.0000	50	200.8	Aluminum	**76**	ug/L		2/13/12 07:34
		0.5000	2.00	200.8	Arsenic	**5.50**	ug/L		
		0.2000	20.0	200.8	Barium	**54.0**	ug/L		
		0.0200	0.1	200.8	Beryllium	ND	ug/L		
		20.0000	100	200.8	Boron	**190**	ug/L		
		0.0400	0.1	200.8	Cadmium	ND	ug/L		
		0.5000	1.00	200.8	Chromium	**2.40**	ug/L		
		0.3200	1.00	200.8	Copper	**7.00**	ug/L		
		25.0000	50.0	200.8	Iron	**213**	ug/L		
		0.5000	1.00	200.8	Lead	**1.80**	ug/L		
		1.0000	10.0	200.8	Manganese	**11.0**	ug/L		
		0.3000	1.00	200.8	Mercury	ND	ug/L		
		0.5000	1.0	200.8	Selenium	ND	ug/L		
		0.6000	2.0	200.8	Silver	ND	ug/L		
		0.5000	1.0	200.8	Thallium	ND	ug/L		
		0.5000	1.0	200.8	Zinc	**92.0**	ug/L		
		2.0000	10.0	300.0	Chloride	**142**	mg/L		2/ 6/12 15:30
		2.3000	2.50	300.0	Nitrate as N	**18.6**	mg/L		
		4.0000	10.0	300.0	Nitrate as NO3	**82.5**	mg/L		
		2.6000	10.0	300.0	Sulfate as SO4	**83.8**	mg/L		
		5.0000	10.0	SM 2540 C	Total Dissolved Solids (TDS)	**645**	mg/L		2/ 7/12 15:30
		0.1000	0.1	SM 4500-H+ B	pH	**7.9**	Std. Units		2/ 6/12 16:38
		5.0000	5	SM2120B	Color	**5**	Color Units		2/ 6/12 15:56
		1.0000	20.0	SM2320B	Bicarbonate Alkalinity as CaCO3	**110**	mg/L		2/ 8/12 13:53
		1.0000	20.0	SM2320B	Carbonate Alkalinity as CaCO3	ND	mg/L		
		1.0000	20.0	SM2320B	Hydroxide Alkalinity as CaCO3	ND	mg/L		
		1.0000	20.0	SM2320B	Total Alkalinity as CaCO3	**110**	mg/L		
		100.0000	100	SM4500-CN E	Cyanide (total)	ND	ug/L		2/ 9/12 07:13
		0.0300	0.10	SM4500-F C	Fluoride	**0.13**	mg/L		2/ 9/12 07:15
		0.0200	0.05	SM5540C	Methylene Blue Active Substances (MBAS)	**0.02**	mg/L	J	2/ 7/12 07:00

Cedric Gregory
Chemist

Donna Keller
Laboratory Director

Certification # 2585

GeoAnalytical Laboratories, Inc.

2300 Maryann Dr. Turlock, CA 95380 Phone (209) 669-0100 Fax (209) 668-8516

email: lab.geo@att.net

Report # Y2B0611 **Project: Monthly Wastewater** **Date:** 02/21/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 02/06/12

Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y000283 - NO PREP			**Prepared & Analyzed: 02/06/12**							
Blank (Y000283-BLK1)										
Chloride	ND	1.00	mg/L							
Nitrate as N	ND	0.25	"							
Nitrate as NO3	ND	1.00	"							
Sulfate as SO4	ND	1.00	"							
LCS (Y000283-BS1)										
Chloride	9.2	1.00	mg/L	10.00		92	80-120			
Nitrate as N	2.23	0.25	"	2.258		99	85-115			
Nitrate as NO3	9.9	1.00	"	10.00		99	80-120			
Sulfate as SO4	9.9	1.00	"	10.00		99	80-120			
LCS Dup (Y000283-BSD1)										
Chloride	9.2	1.00	mg/L	10.00		92	80-120	0.02	20	
Nitrate as N	2.22	0.25	"	2.258		98	85-115	0.5	20	
Nitrate as NO3	9.8	1.00	"	10.00		98	80-120	0.5	20	
Sulfate as SO4	9.8	1.00	"	10.00		98	80-120	1	20	
Matrix Spike (Y000283-MS1)		**Source: Y2B0607-01**								
Chloride	39.5	1.00	mg/L	10.00	23.9	156	80-120			QM-02
Nitrate as N	32.0	0.25	"	2.258	24.7	323	85-115			QM-02
Nitrate as NO3	142	1.00	"	10.00	109	323	80-120			QM-02
Sulfate as SO4	59.8	1.00	"	10.00	50.2	96	80-120			
Matrix Spike Dup (Y000283-MSD1)		**Source: Y2B0607-01**								
Chloride	39.0	1.00	mg/L	10.00	23.9	152	80-120	1	20	QM-02
Nitrate as N	32.1	0.25	"	2.258	24.7	327	85-115	0.2	20	QM-02
Nitrate as NO3	142	1.00	"	10.00	109	327	80-120	0.2	20	QM-02
Sulfate as SO4	59.6	1.00	"	10.00	50.2	94	80-120	0.4	20	

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Date Rec'd: 02/06/12

Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y000286 - NO PREP				**Prepared & Analyzed: 02/06/12**						
Duplicate (Y000286-DUP1)		**Source: Y2B0607-01**								
Specific Conductance (EC)	640	1.0	umhos/cm		640			0	5	
Batch Y000289 - NO PREP				**Prepared & Analyzed: 02/06/12**						
Duplicate (Y000289-DUP1)		**Source: Y2B0612-01**								
pH	8.8	0.1	Std. Units		8.6			2	20	
Batch Y000290 - NO PREP				**Prepared & Analyzed: 02/06/12**						
Blank (Y000290-BLK1)										
Color	ND	5	Color Units							
Duplicate (Y000290-DUP1)		**Source: Y2B0611-01**								
Color	5	5	Color Units		5			0	20	
Batch Y000291 - NO PREP				**Prepared & Analyzed: 02/06/12**						
Blank (Y000291-BLK1)										
Odor	ND	1	T.O.N.							
Duplicate (Y000291-DUP1)		**Source: Y2B0611-01**								
Odor	4	1	T.O.N.		4			0.00	20	
Batch Y000292 - NO PREP				**Prepared & Analyzed: 02/06/12**						
Blank (Y000292-BLK1)										
Turbidity	ND	0.1	NTU							

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Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y000292 - NO PREP				**Prepared & Analyzed: 02/06/12**						
Duplicate (Y000292-DUP1)		**Source: Y2B0611-01**								
Turbidity	1.3	0.1	NTU		1.3			3	20	
Batch Y000293 - NO PREP				**Prepared & Analyzed: 02/07/12**						
Blank (Y000293-BLK1)										
Methylene Blue Active Substances (MBAS)	ND	0.05	mg/L							
LCS (Y000293-BS1)										
Methylene Blue Active Substances (MBAS)	0.06	0.05	mg/L	0.06250		96	73-125			
LCS Dup (Y000293-BSD1)										
Methylene Blue Active Substances (MBAS)	0.06	0.05	mg/L	0.06250		100	73-125	3	14	
Batch Y000309 - NO PREP				**Prepared: 02/07/12 Analyzed: 02/08/12**						
Blank (Y000309-BLK1)										
Total Dissolved Solids (TDS)	ND	10.0	mg/L							
Duplicate (Y000309-DUP1)		**Source: Y2B0710-01**								
Total Dissolved Solids (TDS)	1120	10.0	mg/L		1090			3	10	
Batch Y000320 - 3010A				**Prepared & Analyzed: 02/08/12**						
Blank (Y000320-BLK1)										
Calcium	ND	1.00	mg/L							
Magnesium	ND	1.00	"							
Potassium	ND	1.00	"							
Sodium	ND	1.00	"							

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City of Turlock
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Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y000320 - 3010A				**Prepared & Analyzed: 02/08/12**						
LCS (Y000320-BS1)										
Calcium	23.0	1.00	mg/L	25.00		92	80-120			
Magnesium	24.3	1.00	"	25.00		97	80-120			
Potassium	23.4	1.00	"	25.00		94	80-120			
Sodium	23.7	1.00	"	25.00		95	80-120			
LCS Dup (Y000320-BSD1)										
Calcium	23.0	1.00	mg/L	25.00		92	80-120	0.2	20	
Magnesium	24.2	1.00	"	25.00		97	80-120	0.3	20	
Potassium	23.4	1.00	"	25.00		94	80-120	0.01	20	
Sodium	22.8	1.00	"	25.00		91	80-120	4	20	
Duplicate (Y000320-DUP1)	**Source: Y2B0611-01**									
Calcium	26.4	1.00	mg/L		26.3			0.4	20	
Magnesium	6.61	1.00	"		6.61			0.02	20	
Potassium	18.8	1.00	"		18.3			3	200	
Sodium	134	2.00	"		134			0	20	
Batch Y000327 - NO PREP				**Prepared & Analyzed: 02/08/12**						
Blank (Y000327-BLK1)										
Bicarbonate Alkalinity as CaCO3	2.5	20.0	mg/L							J
Carbonate Alkalinity as CaCO3	ND	20.0	"							
Hydroxide Alkalinity as CaCO3	ND	20.0	"							
Total Alkalinity as CaCO3	2.5	20.0	"							J
LCS (Y000327-BS1)										
Total Alkalinity as CaCO3	40.8	20.0	mg/L	40.00		102	97-116			

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Inorganic Chemistry - Quality Control

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y000327 - NO PREP				**Prepared & Analyzed: 02/08/12**						
LCS Dup (Y000327-BSD1)										
Total Alkalinity as CaCO3	41.0	20.0	mg/L	40.00		102	97-116	0.5	5	
Batch Y000335 - NO PREP				**Prepared & Analyzed: 02/09/12**						
Blank (Y000335-BLK1)										
Cyanide (total)	ND	100	ug/L							
LCS (Y000335-BS1)										
Cyanide (total)	190	100	ug/L	200.0		97	80-120			
LCS Dup (Y000335-BSD1)										
Cyanide (total)	200	100	ug/L	200.0		98	80-120	0.6	20	
Matrix Spike (Y000335-MS1)		**Source: Y2B0707-02**								
Cyanide (total)	190	100	ug/L	200.0	ND	97	68-132			
Matrix Spike Dup (Y000335-MSD1)		**Source: Y2B0707-02**								
Cyanide (total)	190	100	ug/L	200.0	ND	97	68-132	0	5	
Batch Y000336 - NO PREP				**Prepared & Analyzed: 02/09/12**						
Blank (Y000336-BLK1)										
Fluoride	ND	0.10	mg/L							
LCS (Y000336-BS1)										
Fluoride	0.38	0.10	mg/L	0.4000		96	85-115			

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Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y000336 - NO PREP				**Prepared & Analyzed: 02/09/12**						
LCS Dup (Y000336-BSD1)										
Fluoride	0.38	0.10	mg/L	0.4000		96	85-115	0.5	20	
Matrix Spike (Y000336-MS1)		**Source: Y2B0611-01**								
Fluoride	0.53	0.10	mg/L	0.4000	0.13	100	70-118			
Matrix Spike Dup (Y000336-MSD1)		**Source: Y2B0611-01**								
Fluoride	0.53	0.10	mg/L	0.4000	0.13	101	70-118	0.8	4	
Batch Y000352 - 3010A				**Prepared & Analyzed: 02/13/12**						
Blank (Y000352-BLK1)										
Aluminum	ND	50	ug/L							
Arsenic	ND	2.00	"							
Barium	ND	20.0	"							
Beryllium	ND	0.1	"							
Boron	ND	100	"							
Cadmium	ND	0.1	"							
Chromium	ND	1.00	"							
Copper	ND	1.00	"							
Iron	ND	50.0	"							
Lead	ND	1.00	"							
Manganese	ND	10.0	"							
Mercury	ND	1.00	"							
Selenium	ND	1.0	"							
Silver	ND	2.0	"							
Thallium	ND	1.0	"							
Zinc	ND	1.0	"							

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Report # Y2B0611 **Project: Monthly Wastewater** **Date:** 02/21/12

City of Turlock **Date Rec'd:** 02/06/12
156 South Broadway, Suite 270
Turlock, CA 95380

Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y000352 - 3010A				**Prepared & Analyzed: 02/13/12**						
LCS (Y000352-BS1)										
Aluminum	148	50	ug/L	125.0		118	80-120			
Arsenic	25.0	2.00	"	25.00		100	80-120			
Barium	64.0	20.0	"	62.50		102	80-120			
Beryllium	21.0	0.1	"	25.00		84	80-120			
Boron	589	100	"	625.0		94	80-120			
Cadmium	22.0	0.1	"	25.00		88	80-120			
Chromium	27.0	1.00	"	25.00		108	80-120			
Copper	29.0	1.00	"	25.00		116	80-120			
Iron	284	50.0	"	250.0		114	80-120			
Lead	27.0	1.00	"	25.00		108	80-120			
Manganese	29.0	10.0	"	25.00		116	80-120			
Mercury	5.20	1.00	"	6.250		83	80-120			
Selenium	26.0	1.0	"	25.00		104	80-120			
Silver	23.0	2.0	"	25.00		92	80-120			
Thallium	25.0	1.0	"	25.00		100	80-120			
Zinc	24.0	1.0	"	25.00		96	80-120			
LCS Dup (Y000352-BSD1)										
Aluminum	146	50	ug/L	125.0		117	80-120	1	20	
Arsenic	25.0	2.00	"	25.00		100	80-120	0	20	
Barium	63.0	20.0	"	62.50		101	80-120	2	20	
Beryllium	21.0	0.1	"	25.00		84	80-120	0	20	
Boron	608	100	"	625.0		97	80-120	3	20	
Cadmium	22.0	0.1	"	25.00		88	80-120	0	20	
Chromium	27.0	1.00	"	25.00		108	80-120	0	20	
Copper	29.0	1.00	"	25.00		116	80-120	0	20	
Iron	274	50.0	"	250.0		110	80-120	4	20	
Lead	26.0	1.00	"	25.00		104	80-120	4	20	
Manganese	28.0	10.0	"	25.00		112	80-120	4	20	
Mercury	5.10	1.00	"	6.250		82	80-120	2	20	
Selenium	26.0	1.0	"	25.00		104	80-120	0	20	
Silver	23.0	2.0	"	25.00		92	80-120	0	20	
Thallium	24.0	1.0	"	25.00		96	80-120	4	20	
Zinc	24.0	1.0	"	25.00		96	80-120	0	20	

GeoAnalytical Laboratories, Inc.

2300 Maryann Dr. Turlock, CA 95380 Phone (209) 669-0100 Fax (209) 668-8516
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Report # Y2B0611 **Project: Monthly Wastewater** **Date:** 02/21/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 02/06/12

Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y000352 - 3010A				**Prepared & Analyzed: 02/13/12**						
Matrix Spike (Y000352-MS1)		**Source: Y2B0611-01**								
Aluminum	201	50	ug/L	125.0	76	100	80-120			
Arsenic	27.0	2.00	"	25.00	5.50	86	80-120			
Barium	120	20.0	"	62.50	54.0	106	80-120			
Beryllium	20.0	0.1	"	25.00	ND	80	80-120			
Boron	738	100	"	625.0	190	88	80-120			
Cadmium	21.0	0.1	"	25.00	ND	84	80-120			
Chromium	26.0	1.00	"	25.00	2.40	94	80-120			
Copper	30.0	1.00	"	25.00	7.00	92	80-120			
Iron	457	50.0	"	250.0	213	98	80-120			
Lead	29.0	1.00	"	25.00	1.80	109	80-120			
Manganese	35.0	10.0	"	25.00	11.0	96	80-120			
Mercury	5.70	1.00	"	6.250	ND	91	80-120			
Selenium	18.0	1.0	"	25.00	ND	72	80-120			QM-01
Silver	27.0	2.0	"	25.00	ND	108	80-120			
Thallium	27.0	1.0	"	25.00	ND	108	80-120			
Zinc	102	1.0	"	25.00	92.0	40	80-120			QM-01
Matrix Spike Dup (Y000352-MSD1)		**Source: Y2B0611-01**								
Aluminum	200	50	ug/L	125.0	76	99	80-120	0.5	20	
Arsenic	27.0	2.00	"	25.00	5.50	86	80-120	0	20	
Barium	120	20.0	"	62.50	54.0	106	80-120	0	20	
Beryllium	20.0	0.1	"	25.00	ND	80	80-120	0	20	
Boron	817	100	"	625.0	190	100	80-120	10	20	
Cadmium	21.0	0.1	"	25.00	ND	84	80-120	0	20	
Chromium	25.0	1.00	"	25.00	2.40	90	80-120	4	20	
Copper	30.0	1.00	"	25.00	7.00	92	80-120	0	20	
Iron	440	50.0	"	250.0	213	91	80-120	4	20	
Lead	28.0	1.00	"	25.00	1.80	105	80-120	4	20	
Manganese	34.0	10.0	"	25.00	11.0	92	80-120	3	20	
Mercury	6.00	1.00	"	6.250	ND	96	80-120	5	20	
Selenium	18.0	1.0	"	25.00	ND	72	80-120	0	20	QM-01
Silver	26.0	2.0	"	25.00	ND	104	80-120	4	20	
Thallium	27.0	1.0	"	25.00	ND	108	80-120	0	20	
Zinc	102	1.0	"	25.00	92.0	40	80-120	0	20	QM-01

GeoAnalytical Laboratories, Inc.

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Report # Y2B0611 **Project: Monthly Wastewater** **Date:** 02/21/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 02/06/12

Notes and Definitions

QM-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
QM-01	The spike recovery for this QC sample is outside of established control limits due to sample matrix interference.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag). The J flag is equivalent to the DNQ Estimated Concentration flag.
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

GeoAnalytical Laboratories, Inc.

2300 Maryann Dr. Turlock, CA 95380 Phone (209) 669-0100 Fax (209) 593-2212
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Report # Y2G0912 | Project: Quarterly Samples | Date: 07/24/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

CERTIFICATE OF ANALYSIS

Sampler: Kenneth Wooster

Sample ID: RSW-001

Lab ID	Sample Date / Time	MDL	RL	Method	Analyte	Result	Units	Flags	Started
Y2G0912-01	7/09/2012 09:05	0.0100	0.50	8141	Chlorpyrifos	ND	ug/L		7/12/12 10:11
		0.0200	0.50	8141	Diazinon	ND	ug/L		

Surrogate	Amnt Spiked	Amnt Recovered	% Recovery	QC Limit %	Surrogate Notes
Tributyl Phosphate	5.200	4.02	*77 %*	*70-130*	

Sample ID: RSW-2

Lab ID	Sample Date / Time	MDL	RL	Method	Analyte	Result	Units	Flags	Started
Y2G0912-02	7/09/2012 09:15	0.0100	0.50	8141	Chlorpyrifos	ND	ug/L		7/12/12 10:11
		0.0200	0.50	8141	Diazinon	ND	ug/L		

Surrogate	Amnt Spiked	Amnt Recovered	% Recovery	QC Limit %	Surrogate Notes
Tributyl Phosphate	5.200	4.30	*83 %*	*70-130*	

Sample ID: RSW-3

Lab ID	Sample Date / Time	MDL	RL	Method	Analyte	Result	Units	Flags	Started
012-03	7/09/2012 09:35	0.0100	0.50	8141	Chlorpyrifos	ND	ug/L		7/12/12 10:11
		0.0200	0.50	8141	Diazinon	ND	ug/L		

Surrogate	Amnt Spiked	Amnt Recovered	% Recovery	QC Limit %	Surrogate Notes
Tributyl Phosphate	5.200	3.93	*75 %*	*70-130*	

Sample ID: RSW-4

Lab ID	Sample Date / Time	MDL	RL	Method	Analyte	Result	Units	Flags	Started
Y2G0912-04	7/09/2012 09:45	0.0100	0.50	8141	Chlorpyrifos	ND	ug/L		7/12/12 10:11
		0.0200	0.50	8141	Diazinon	ND	ug/L		

Surrogate	Amnt Spiked	Amnt Recovered	% Recovery	QC Limit %	Surrogate Notes
Tributyl Phosphate	5.200	4.13	*79 %*	*70-130*	

Sample ID: Plant Effluent

Lab ID	Sample Date / Time	MDL	RL	Method	Analyte	Result	Units	Flags	Started
Y2G0912-05	7/08/2012 00:00	0.0100	0.50	8141	Chlorpyrifos	ND	ug/L		7/12/12 10:11
		0.0200	0.50	8141	Diazinon	ND	ug/L		

Surrogate	Amnt Spiked	Amnt Recovered	% Recovery	QC Limit %	Surrogate Notes
Tributyl Phosphate	5.200	4.37	*84 %*	*70-130*	

Matt Page
Matt Page
Chemist

Donna Keller
Donna Keller
Laboratory Director

Certification # 2585

GeoAnalytical Laboratories, Inc.

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Report # Y2G0912 **Project: Quarterly Samples** **Date:** 07/24/12

City of Turlock **Date Rec'd:** 07/09/12
156 South Broadway, Suite 270
Turlock, CA 95380

Semi-Volatile Organic Chemistry of Wastewater - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001552 - 3510B (Shake Out)				**Prepared: 07/12/12 Analyzed: 07/24/12**						
Blank (Y001552-BLK1)										
Chlorpyrifos	ND	0.50	ug/L							
Diazinon	ND	0.50	"							
Surrogate: Tributyl Phosphate	*3.83*		*"*	*5.200*		*74*	*70-130*			
LCS (Y001552-BS1)										
Diazinon	3.69	0.50	ug/L	5.000		74	70-130			
Surrogate: Tributyl Phosphate	*4.56*		*"*	*5.200*		*88*	*70-130*			
LCS Dup (Y001552-BSD1)										
Diazinon	3.66	0.50	ug/L	5.000		73	70-130	0.9	20	
Surrogate: Tributyl Phosphate	*4.94*		*"*	*5.200*		*95*	*70-130*			

GeoAnalytical Laboratories, Inc.

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Report # Y2G0912 **Project: Quarterly Samples** **Date:** 07/24/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

Notes and Definitions

ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

GeoAnalytical Laboratories, Inc.

2300 Maryann Dr. Turlock, CA 95380 Phone (209) 669-0100 Fax (209) 593-2212

email: lab.geo@att.net

Report # Y2G0912 **Project: Quarterly Samples** **Date:** 07/11/12

City of Turlock **Date Rec'd:** 07/09/12
156 South Broadway, Suite 270
Turlock, CA 95380

Inorganic Chemistry - Quality Control

GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch Y001513 - 3010A				**Prepared & Analyzed: 07/10/12**						
LCS (Y001513-BS1)										
Calcium	25.3	1.00	mg/L	25.00		101	80-120			
Magnesium	25.1	1.00	"	25.00		100	80-120			
LCS Dup (Y001513-BSD1)										
Calcium	25.2	1.00	mg/L	25.00		101	80-120	0.3	20	
Magnesium	25.0	1.00	"	25.00		100	80-120	0.2	20	
Matrix Spike (Y001513-MS1)		**Source: Y2G0913-01**								
Calcium	54.9	1.00	mg/L	25.00	31.1	95	80-120			
Magnesium	29.8	1.00	"	25.00	7.80	88	80-120			
Matrix Spike Dup (Y001513-MSD1)		**Source: Y2G0913-01**								
Calcium	54.7	1.00	mg/L	25.00	31.1	95	80-120	0.2	20	
Magnesium	29.7	1.00	"	25.00	7.80	88	80-120	0.2	20	

GeoAnalytical Laboratories, Inc.

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Report # Y2G0912 **Project: Quarterly Samples** **Date:** 07/11/12

City of Turlock
156 South Broadway, Suite 270
Turlock, CA 95380

Date Rec'd: 07/09/12

Notes and Definitions

ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

Appendix G – City of Modesto Water Quality Data and Laboratory Information

Tertiary Effluent Water Quality - Modesto

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
1	Jennings Tertiary Effluent	Aluminum	U.S. EPA Method 200.8		48	ug/L	2.0		10	7/13/2011	
1	Jennings Tertiary Effluent	Aluminum	U.S. EPA Method 200.8		44	ug/L	2.0		10	7/27/2011	
1	Jennings Tertiary Effluent	Aluminum	U.S. EPA Method 200.8		33	ug/L	2.0		10	8/9/2011	
2	Jennings Tertiary Effluent	Antimony	U.S. EPA Method 200.8		0.41	ug/L	0.02		0.25	8/9/2011	
3	Jennings Tertiary Effluent	Arsenic	U.S. EPA Method 200.8		0.69	ug/L	0.07		0.50	8/9/2011	
4	Jennings Tertiary Effluent	Barium	U.S. EPA Method 200.8		98	ug/L	0.03		0.50	8/9/2011	
5	Jennings Tertiary Effluent	Beryllium	U.S. EPA Method 200.8	ND		ug/L	0.02		0.10	8/9/2011	
7	Jennings Tertiary Effluent	Cadmium	U.S. EPA Method 200.8	ND		ug/L	0.020		0.10	8/9/2011	
8	Jennings Tertiary Effluent	Chromium	U.S. EPA Method 200.8		0.46	ug/L	0.080		0.50	8/9/2011	
9	Jennings Tertiary Effluent	Lead	U.S. EPA Method 200.8		0.16	ug/L	0.020		0.25	8/9/2011	
10	Jennings Tertiary Effluent	Mercury, Total	U.S. EPA Method 1631, Revision E		3	ng/L	0.2		0.5	7/13/2011	
10	Jennings Tertiary Effluent	Mercury, Total	U.S. EPA Method 1631, Revision E		0.752	ng/L	0.2		0.5	8/9/2011	
11	Jennings Tertiary Effluent	Nickel	U.S. EPA Method 200.8		0.92	ug/L	0.060		0.50	8/9/2011	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.38	mg/L	0.09		0.25	5/1/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		1.03	mg/L	0.09		0.25	5/8/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		1.38	mg/L	0.09		0.25	5/15/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		1.08	mg/L	0.09		0.25	5/22/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		1.52	mg/L	0.09		0.25	5/29/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		1.34	mg/L	0.09		0.25	6/5/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.4	mg/L	0.09		0.25	6/12/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.2	mg/L	0.09		0.25	6/19/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.2	mg/L	0.09		0.25	6/26/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.07	mg/L	0.09		0.25	7/3/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		1	mg/L	0.09		0.25	7/10/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.04		0.25	7/17/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.42	mg/L	0.09		0.25	7/24/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		1.55	mg/L	0.09		0.25	7/31/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.57	mg/L	0.09		0.25	8/7/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.23	mg/L	0.09		0.25	8/14/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.34	mg/L	0.09		0.25	8/21/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.54	mg/L	0.09		0.25	8/30/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.35	mg/L	0.09		0.25	9/4/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.81	mg/L	0.09		0.25	9/11/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.59	mg/L	0.09		0.25	9/18/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.24	mg/L	0.09		0.25	9/25/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.31	mg/L	0.09		0.25	10/2/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.63	mg/L	0.09		0.25	10/9/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.46	mg/L	0.09		0.25	10/16/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.16	mg/L	0.09		0.25	10/23/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.15	mg/L	0.09		0.25	10/30/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.93	mg/L	0.09		0.25	11/6/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.98	mg/L	0.09		0.25	11/13/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.34	mg/L	0.09		0.25	11/20/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.16	mg/L	0.09		0.25	11/27/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.33	mg/L	0.09		0.25	12/4/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		0.28	mg/L	0.09		0.25	12/11/2012	
12	EFF-001B	Nitrate (as N)	Standard Method 4500-NO3- F		1.38	mg/L	0.09		0.25	12/18/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	5/1/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	5/8/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	5/15/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	5/22/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	5/29/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F		0.01	mg/L	0.01		0.03	6/5/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	6/12/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	6/19/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	6/26/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	7/3/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	7/10/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	7/17/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	7/24/2012	

Tertiary Effluent Water Quality - Modesto

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F		0.01	mg/L	0.01		0.03	7/31/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	8/7/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	8/14/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	8/21/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	8/30/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	9/4/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F		0.01	mg/L	0.01		0.03	9/11/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	9/18/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	9/25/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F		0.01	mg/L	0.01		0.03	10/2/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	10/9/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	10/16/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	10/23/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	10/30/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	11/6/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	11/13/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	11/20/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	11/27/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	12/4/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	12/11/2012	
14	EFF-001B	Nitrite (as N)	Standard Method 4500-NO3- F	ND		mg/L	0.01		0.03	12/18/2012	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8	ND		ug/L	0.070		1.0	5/26/2011	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8	ND		ug/L	0.070		1.0	6/1/2011	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8	ND		ug/L	0.070		1.0	6/7/2011	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8	ND		ug/L	0.070		1.0	6/14/2011	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8	ND		ug/L	0.070		1.0	6/21/2011	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8		1.8	ug/L	0.070		1.0	6/28/2011	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8		1.9	ug/L	0.070		1.0	7/13/2011	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8		1.1	ug/L	0.070		1.0	7/27/2011	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8		0.5	ug/L	0.070		1.0	8/9/2011	
15	Jennings Tertiary Effluent	Selenium	U.S. EPA Method 200.8		1.4	ug/L	0.070		1.0	8/30/2011	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		0.87	ug/L	0.070		1.0	9/14/2011	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		0.78	ug/L	0.070		1.0	9/28/2011	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		0.96	ug/L	0.070		1.0	11/16/2011	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		0.89	ug/L	0.070		1.0	11/29/2011	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		0.66	ug/L	0.070		1.0	12/7/2011	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		0.095	ug/L	0.070		1.0	12/21/2011	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		1.1	ug/L	0.070		1.0	1/11/2012	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		1	ug/L	0.070		1.0	1/26/2012	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		2.1	ug/L	0.070		1.0	2/8/2012	
15	EFF-001B	Selenium	U.S. EPA Method 200.8		1	ug/L	0.070		1.0	2/22/2012	
16	Jennings Tertiary Effluent	Thallium	U.S. EPA Method 200.8	ND		ug/L	0.020		0.10	8/9/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		192	mg/L	0.55		1.5	5/26/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		140	mg/L	0.55		1.5	6/1/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		238	mg/L	0.55		1.5	6/7/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		188	mg/L	0.55		1.5	6/14/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		284	mg/L	0.55		1.5	6/21/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		222	mg/L	0.55		1.5	6/28/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		170	mg/L	0.55		1.5	7/13/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		154	mg/L	0.55		1.5	7/27/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		135	mg/L	0.55		1.5	8/9/2011	
17	Jennings Tertiary Effluent	Chloride	Standard Method 4500-Cl- E		138	mg/L	0.55		1.5	8/30/2011	

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		192	mg/L	0.55		1.5	9/14/2011	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		150	mg/L	0.55		1.5	9/28/2011	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		185	mg/L	0.55		1.5	11/16/2011	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		192	mg/L	0.55		1.5	11/29/2011	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		177	mg/L	0.55		1.5	12/7/2011	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		164	mg/L	0.55		1.5	12/21/2011	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		188	mg/L	0.55		1.5	1/11/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		189	mg/L	0.55		1.5	1/26/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		178	mg/L	0.55		1.5	2/8/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		152	mg/L	0.55		1.5	2/22/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		182	mg/L	0.55		1.5	3/6/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		171	mg/L	0.55		1.5	5/7/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		184	mg/L	0.55		1.5	5/19/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		191	mg/L	0.55		1.5	6/5/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		187	mg/L	0.55		1.5	7/10/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		150	mg/L	0.55		1.5	8/7/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		153	mg/L	0.55		1.5	9/11/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		178	mg/L	0.55		1.5	10/9/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		175	mg/L	0.55		1.5	11/13/2012	
17	EFF-001B	Chloride	Standard Method 4500-Cl- E		209	mg/L	0.55		1.5	12/11/2012	
18	Jennings Tertiary Effluent	Copper	U.S. EPA Method 200.8		0.74	ug/L	0.04		0.50	7/13/2011	
18	Jennings Tertiary Effluent	Copper	U.S. EPA Method 200.8		1.6	ug/L	0.04		0.50	7/27/2011	
18	Jennings Tertiary Effluent	Copper	U.S. EPA Method 200.8		0.84	ug/L	0.04		0.50	8/9/2011	
19	Jennings Tertiary Effluent	Iron	U.S. EPA Method 200.8		49	ug/L	1.8		50	7/13/2011	
19	Jennings Tertiary Effluent	Iron	U.S. EPA Method 200.8		68	ug/L	1.8		50	7/27/2011	
19	Jennings Tertiary Effluent	Iron	U.S. EPA Method 200.8		54	ug/L	1.8		50	8/9/2011	
20	Jennings Tertiary Effluent	Maganese	U.S. EPA Method 200.8		22	ug/L	0.030		5.0	7/13/2011	
20	Jennings Tertiary Effluent	Maganese	U.S. EPA Method 200.8		19	ug/L	0.030		5.0	7/27/2011	
20	Jennings Tertiary Effluent	Maganese	U.S. EPA Method 200.8		21	ug/L	0.030		5.0	8/9/2011	
21	Jennings Tertiary Effluent	Molybdenum	U.S. EPA Method 200.8		14	ug/L	0.020		0.25	7/13/2011	
21	Jennings Tertiary Effluent	Molybdenum	U.S. EPA Method 200.8		4.8	ug/L	0.020		0.25	7/27/2011	
21	Jennings Tertiary Effluent	Molybdenum	U.S. EPA Method 200.8		3.3	ug/L	0.020		0.25	8/9/2011	
22	Jennings Tertiary Effluent	Silver	U.S. EPA Method 200.8	ND		ug/L	0.020		0.10	8/9/2011	
23	Jennings Tertiary Effluent	Sodium	U.S. EPA Method 200.8		98	mg/L	20		1000	8/9/2011	
23	EFF-001B	Sodium	U.S. EPA Method 200.8		150	mg/L	20		1000	1/11/2012	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1090	umhos/cm				5/26/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		923	umhos/cm				6/1/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1180	umhos/cm				6/7/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1010	umhos/cm				6/14/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1390	umhos/cm				6/21/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1210	umhos/cm				6/28/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1010	umhos/cm				7/13/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1010	umhos/cm				7/27/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		851	umhos/cm				8/1/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		919	umhos/cm				8/2/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1060	umhos/cm				8/3/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1070	umhos/cm				8/4/2011	

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1160	umhos/cm				8/5/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		943	umhos/cm				8/6/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1030	umhos/cm				8/7/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		747	umhos/cm				8/8/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		812	umhos/cm				8/9/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		913	umhos/cm				8/10/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		958	umhos/cm				8/11/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		970	umhos/cm				8/12/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		916	umhos/cm				8/13/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		896	umhos/cm				8/14/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		760	umhos/cm				8/15/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		861	umhos/cm				8/16/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1030	umhos/cm				8/17/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		943	umhos/cm				8/18/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		914	umhos/cm				8/19/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		990	umhos/cm				8/20/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		882	umhos/cm				8/21/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		748	umhos/cm				8/22/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		922	umhos/cm				8/23/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		1010	umhos/cm				8/24/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		915	umhos/cm				8/25/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		930	umhos/cm				8/26/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		937	umhos/cm				8/27/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		912	umhos/cm				8/28/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		752	umhos/cm				8/29/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		901	umhos/cm				8/30/2011	
24	Jennings Tertiary Effluent	Conductivity	Standard Method 2510 B		904	umhos/cm				8/31/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		956	umhos/cm				9/1/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1040	umhos/cm				9/2/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1130	umhos/cm				9/3/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		940	umhos/cm				9/4/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		871	umhos/cm				9/5/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		835	umhos/cm				9/6/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		848	umhos/cm				9/7/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		890	umhos/cm				9/8/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		940	umhos/cm				9/9/2011	

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001B	Conductivity	Standard Method 2510 B		970	umhos/cm				9/10/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		744	umhos/cm				9/11/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		750	umhos/cm				9/12/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1040	umhos/cm				9/13/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1010	umhos/cm				9/14/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		981	umhos/cm				9/15/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		958	umhos/cm				9/16/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1000	umhos/cm				9/17/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		877	umhos/cm				9/18/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		745	umhos/cm				9/19/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		873	umhos/cm				9/20/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		903	umhos/cm				9/21/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		965	umhos/cm				9/22/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1000	umhos/cm				9/23/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				9/24/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		888	umhos/cm				9/25/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		816	umhos/cm				9/26/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		840	umhos/cm				9/27/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		901	umhos/cm				9/28/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		940	umhos/cm				9/29/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		921	umhos/cm				9/30/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1120	umhos/cm				10/1/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		768	umhos/cm				10/2/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		740	umhos/cm				10/3/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		820	umhos/cm				10/4/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		898	umhos/cm				10/5/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		918	umhos/cm				10/6/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		874	umhos/cm				10/7/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		890	umhos/cm				10/8/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		838	umhos/cm				10/9/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		734	umhos/cm				10/10/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		866	umhos/cm				10/11/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1010	umhos/cm				10/13/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1060	umhos/cm				10/14/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1080	umhos/cm				10/15/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1190	umhos/cm				10/16/2011	

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001B	Conductivity	Standard Method 2510 B		1090	umhos/cm				10/17/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1120	umhos/cm				10/18/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1290	umhos/cm				10/23/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1190	umhos/cm				10/24/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1070	umhos/cm				10/25/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				10/26/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1120	umhos/cm				10/27/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1160	umhos/cm				10/28/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1210	umhos/cm				10/29/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1240	umhos/cm				10/30/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1060	umhos/cm				10/31/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		992	umhos/cm				11/1/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1060	umhos/cm				11/2/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1120	umhos/cm				11/3/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1180	umhos/cm				11/4/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1240	umhos/cm				11/5/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1090	umhos/cm				11/6/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1050	umhos/cm				11/7/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		990	umhos/cm				11/8/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		993	umhos/cm				11/9/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1100	umhos/cm				11/10/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1200	umhos/cm				11/11/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1220	umhos/cm				11/12/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1130	umhos/cm				11/13/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1080	umhos/cm				11/14/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1060	umhos/cm				11/15/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				11/16/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1140	umhos/cm				11/17/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		967	umhos/cm				11/18/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		960	umhos/cm				11/19/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		847	umhos/cm				11/20/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		780	umhos/cm				11/21/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		862	umhos/cm				11/22/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		943	umhos/cm				11/23/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		975	umhos/cm				11/24/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		810	umhos/cm				11/25/2011	

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Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001B	Conductivity	Standard Method 2510 B		766	umhos/cm				11/26/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		777	umhos/cm				11/27/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		780	umhos/cm				11/28/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1050	umhos/cm				11/29/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		987	umhos/cm				11/30/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				12/1/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		950	umhos/cm				12/2/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1060	umhos/cm				12/3/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		890	umhos/cm				12/4/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		850	umhos/cm				12/5/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		970	umhos/cm				12/6/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1000	umhos/cm				12/7/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1040	umhos/cm				12/8/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1050	umhos/cm				12/9/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1040	umhos/cm				12/10/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				12/11/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		950	umhos/cm				12/12/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		970	umhos/cm				12/13/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		970	umhos/cm				12/14/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1010	umhos/cm				12/15/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				12/16/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1020	umhos/cm				12/17/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		995	umhos/cm				12/18/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		922	umhos/cm				12/19/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		993	umhos/cm				12/20/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		963	umhos/cm				12/21/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		984	umhos/cm				12/22/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1020	umhos/cm				12/23/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				12/24/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		1090	umhos/cm				12/25/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		970	umhos/cm				12/26/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		940	umhos/cm				12/27/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		940	umhos/cm				12/28/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		982	umhos/cm				12/29/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		996	umhos/cm				12/30/2011	
24	EFF-001B	Conductivity	Standard Method 2510 B		998	umhos/cm				12/31/2011	

Tertiary Effluent Water Quality - Modesto

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001B	Conductivity	Standard Method 2510 B		1000	umhos/cm				1/1/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		910	umhos/cm				1/2/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		950	umhos/cm				1/3/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		921	umhos/cm				1/4/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1000	umhos/cm				1/5/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1020	umhos/cm				1/6/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1150	umhos/cm				1/7/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1150	umhos/cm				1/8/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		864	umhos/cm				1/9/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1060	umhos/cm				1/10/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1140	umhos/cm				1/11/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1150	umhos/cm				1/12/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1130	umhos/cm				1/13/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1420	umhos/cm				1/14/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1090	umhos/cm				1/15/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		960	umhos/cm				1/16/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		992	umhos/cm				1/17/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1040	umhos/cm				1/18/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				1/19/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1050	umhos/cm				1/20/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1180	umhos/cm				1/21/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		840	umhos/cm				1/22/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		844	umhos/cm				1/23/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				1/26/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1050	umhos/cm				1/27/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1090	umhos/cm				1/28/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				1/29/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		961	umhos/cm				1/30/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1020	umhos/cm				1/31/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1090	umhos/cm				2/1/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1190	umhos/cm				2/2/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1210	umhos/cm				2/3/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1460	umhos/cm				2/4/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				2/5/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		840	umhos/cm				2/6/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1010	umhos/cm				2/7/2012	

Tertiary Effluent Water Quality - Modesto

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001B	Conductivity	Standard Method 2510 B		1040	umhos/cm				2/8/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		945	umhos/cm				2/9/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1070	umhos/cm				2/10/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1060	umhos/cm				2/11/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		960	umhos/cm				2/12/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		930	umhos/cm				2/13/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1070	umhos/cm				2/14/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1110	umhos/cm				2/15/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1100	umhos/cm				2/16/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1110	umhos/cm				2/17/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1250	umhos/cm				2/18/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1020	umhos/cm				2/19/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		937	umhos/cm				2/20/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		900	umhos/cm				2/21/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		900	umhos/cm				2/22/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		970	umhos/cm				2/23/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1050	umhos/cm				2/24/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1050	umhos/cm				2/25/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		946	umhos/cm				2/26/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		890	umhos/cm				2/27/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1070	umhos/cm				2/28/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1050	umhos/cm				2/29/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		977	umhos/cm				3/1/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1010	umhos/cm				3/2/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1020	umhos/cm				3/3/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		904	umhos/cm				3/4/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		910	umhos/cm				3/5/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1010	umhos/cm				3/6/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		950	umhos/cm				3/6/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				3/7/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1120	umhos/cm				3/8/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1040	umhos/cm				3/9/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1020	umhos/cm				3/10/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				3/11/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		936	umhos/cm				3/12/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		969	umhos/cm				3/13/2012	

Tertiary Effluent Water Quality - Modesto

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001B	Conductivity	Standard Method 2510 B		1000	umhos/cm				3/14/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		903	umhos/cm				3/15/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		973	umhos/cm				3/16/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		969	umhos/cm				3/17/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		770	umhos/cm				3/18/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		840	umhos/cm				3/19/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		930	umhos/cm				3/20/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		950	umhos/cm				3/21/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		927	umhos/cm				3/25/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1030	umhos/cm				5/8/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1040	umhos/cm				5/22/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1010	umhos/cm				6/5/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1200	umhos/cm				6/19/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1070	umhos/cm				7/10/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		897	umhos/cm				7/24/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		960	umhos/cm				8/7/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		840	umhos/cm				8/21/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		864	umhos/cm				8/29/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		892	umhos/cm				8/30/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		986	umhos/cm				8/31/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		913	umhos/cm				9/1/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		816	umhos/cm				9/2/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		760	umhos/cm				9/3/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		700	umhos/cm				9/4/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		756	umhos/cm				9/5/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		885	umhos/cm				9/6/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		926	umhos/cm				9/7/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		848	umhos/cm				9/9/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		764	umhos/cm				9/10/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		874	umhos/cm				9/11/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		847	umhos/cm				9/11/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		894	umhos/cm				9/12/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		897	umhos/cm				9/13/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		925	umhos/cm				9/14/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		926	umhos/cm				9/15/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		805	umhos/cm				9/16/2012	

Tertiary Effluent Water Quality - Modesto

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
24	EFF-001B	Conductivity	Standard Method 2510 B		707	umhos/cm				9/17/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		825	umhos/cm				9/18/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		850	umhos/cm				9/19/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		840	umhos/cm				9/20/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		872	umhos/cm				9/21/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		900	umhos/cm				9/22/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		780	umhos/cm				9/23/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		715	umhos/cm				9/24/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		824	umhos/cm				9/25/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		771	umhos/cm				9/25/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		807	umhos/cm				9/26/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		927	umhos/cm				9/27/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		948	umhos/cm				9/28/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		910	umhos/cm				9/29/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		790	umhos/cm				9/30/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		686	umhos/cm				10/1/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		803	umhos/cm				10/2/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		992	umhos/cm				10/9/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1060	umhos/cm				10/24/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1060	umhos/cm				11/13/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1040	umhos/cm				11/27/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		1260	umhos/cm				12/11/2012	
24	EFF-001B	Conductivity	Standard Method 2510 B		951	umhos/cm				12/17/2012	
26	Jennings Tertiary Effluent	Total Dissolved Solids	Standard Method 2540 C		552	mg/L	25		25	5/26/2011	
26	Jennings Tertiary Effluent	Total Dissolved Solids	Standard Method 2540 C		525	mg/L	25		25	6/1/2011	
26	Jennings Tertiary Effluent	Total Dissolved Solids	Standard Method 2540 C		654	mg/L	25		25	6/7/2011	
26	Jennings Tertiary Effluent	Total Dissolved Solids	Standard Method 2540 C		565	mg/L	25		25	6/14/2011	
26	Jennings Tertiary Effluent	Total Dissolved Solids	Standard Method 2540 C		746	mg/L	25		25	6/21/2011	
26	Jennings Tertiary Effluent	Total Dissolved Solids	Standard Method 2540 C		670	mg/L	25		25	6/28/2011	
26	Jennings Tertiary Effluent	Total Dissolved Solids	Standard Method 2540 C		456	mg/L	25		25	7/13/2011	
26	Jennings Tertiary Effluent	Total Dissolved Solids	Standard Method 2540 C		476	mg/L	25		25	8/9/2011	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		568	mg/L	25		25	9/14/2011	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		552	mg/L	25		25	11/16/2011	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		544	mg/L	25		25	12/7/2011	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		644	mg/L	25		25	1/11/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		1150	mg/L	25		25	2/8/2012	

Tertiary Effluent Water Quality - Modesto

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		537	mg/L	25		25	3/6/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		549	mg/L	25		25	5/7/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		565	mg/L	25		25	6/5/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		613	mg/L	25		25	7/10/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		559	mg/L	25		25	8/7/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		485	mg/L	25		25	8/29/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		502	mg/L	25		25	8/30/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		543	mg/L	25		25	8/31/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		521	mg/L	25		25	9/1/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		474	mg/L	25		25	9/2/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		392	mg/L	25		25	9/3/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		407	mg/L	25		25	9/4/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		443	mg/L	25		25	9/5/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		495	mg/L	25		25	9/6/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		516	mg/L	25		25	9/7/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		476	mg/L	25		25	9/9/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		437	mg/L	25		25	9/10/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		530	mg/L	25		25	9/11/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		474	mg/L	25		25	9/11/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		454	mg/L	25		25	9/12/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		501	mg/L	25		25	9/13/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		496	mg/L	25		25	9/14/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		553	mg/L	25		25	9/15/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		440	mg/L	25		25	9/16/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		410	mg/L	25		25	9/17/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		461	mg/L	25		25	9/18/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		477	mg/L	25		25	9/19/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		455	mg/L	25		25	9/20/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		492	mg/L	25		25	9/21/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		492	mg/L	25		25	9/22/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		440	mg/L	25		25	9/23/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		412	mg/L	25		25	9/24/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		407	mg/L	25		25	9/25/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		428	mg/L	25		25	9/26/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		524	mg/L	25		25	9/27/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		516	mg/L	25		25	9/28/2012	

Tertiary Effluent Water Quality - Modesto

Number	Location	Parameter	Analytical Method / Calculation Type	Qualifier	Results	Units	MDL	ML	RL	Sample Date	Analysis Date
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		462	mg/L	25		25	9/29/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		470	mg/L	25		25	9/30/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		407	mg/L	25		25	10/1/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		437	mg/L	25		25	10/2/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		554	mg/L	25		25	10/9/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		595	mg/L	25		25	11/13/2012	
26	EFF-001B	Total Dissolved Solids	Standard Method 2540 C		709	mg/L	25		25	12/11/2012	
27	Jennings Tertiary Effluent	Zinc	U.S. EPA Method 200.8		50	ug/L	5.0		5.00	8/9/2011	
32	Jennings Tertiary Effluent	Chlorpyrifos	U.S. EPA Method 8270C	ND		ug/L	0.0029		0.01	8/9/2011	
32	Jennings Tertiary Effluent	Chlorpyrifos	U.S. EPA Method 8270C	ND		ug/L	0.0029		0.01	8/11/2011	
32	EFF-001B	Chlorpyrifos (Dursban)	U.S. EPA Method 8270C	ND		ug/L	0.0029		0.01	9/14/2011	
32	EFF-001B	Chlorpyrifos (Dursban)	U.S. EPA Method 8270C	ND		ug/L	0.0029		0.01	1/11/2012	
34	Jennings Tertiary Effluent	Diazinon	U.S. EPA Method 8270C	ND		ug/L	0.0036		0.05	8/9/2011	
34	Jennings Tertiary Effluent	Diazinon	U.S. EPA Method 8270C	ND		ug/L	0.0036		0.05	8/11/2011	
34	EFF-001B	Diazinon	U.S. EPA Method 8270C	ND		ug/L	0.0036		0.05	9/14/2011	
34	EFF-001B	Diazinon	U.S. EPA Method 8270C	ND		ug/L	0.0036		0.05	1/11/2012	

Amended

BSK Associates
Engineers & Laboratories

A3A1010

02/01/2013

Invoice
A302350

Robbie Phillips
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

Dear Robbie Phillips,

Thank you for selecting BSK Associates for your analytical testing needs. We have prepared this report in response to your request for analytical services. Enclosed are the results of analyses for samples received by the laboratory on 01/11/2013 10:15.

If additional clarification of any information is required, please contact your Client Services Representative, Kasanna Coulter at (800) 877-8310 or (559) 497-2888.

BSK ASSOCIATES

Kasanna Coulter
Quality Assurance Manager

1414 Stanislaus Street Fresno, CA 93706 (559) 497-2888 FAX (559) 485-6935 www.bsklabs.com

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Environmental Engineering | Geotechnical Engineering | Materials Testing

Amended

BSK Associates Engineers & Laboratories

02/01/2013

Case Narrative

Work Order Information

Client Name:	Alpha Analytical Laboratories Inc	**Submitted by:**	Client
Client Code:	Alpha0401	**Shipped by:**	UPS
Work Order:	A3A1010	**COC Number:**	
Project:	General-Robbie Phillips-TRACE	**TAT:**	10
Client Project:	13A0490	**PO #:**	

Report Amendments

Date: 1-31-13

Initials: MSN

This amended report supersedes any previous reports issued by the laboratory. Amendments to this report are as follows:
Per Sheri Speaks, report Chlopyrifos and Diazinon results to their MDLs.

Sample Receipt Conditions

Cooler: **Default Cooler** **Temp. ºC:** 0.3

Containers Intact
COC/Labels Agree
Received On Blue Ice
Packing Material - Bubble Wrap
Sample(s) were received in temperature range.
Initial receipt at BSK-FAL

Report Manager	Report Format
All Lab Results	Final.rpt

1414 Stanislaus Street Fresno, CA 93706 (559) 497-2888 FAX (559) 485-6935 www.bsklabs.com

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Environmental Engineering | Geotechnical Engineering | Materials Testing

Amended

BSK Associates Engineers & Laboratories

Certificate of Analysis

Robbie Phillips
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

Report Issue Date: 2/1/2013 10:03
Received Date: 01/11/2013
Received Time: 10:15

Lab Sample ID: A3A1010-01
Sample Date: 01/09/2013 08:20
Sample Type: Grab

Client Project: 13A0490
Sampled by: Client
Matrix: Water

Sample Description: 13A0490-02 EFF-001A Grab

Organics

Analyte	Method	Result	MDL	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Organophosphates (EPA 8141 List) by GC-MS										
*Bolstar	EPA 8270C	ND	0.0035	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Chlorpyrifos	EPA 8270C	ND	0.0029	0.010	ug/L	1	A300610	01/16/13	01/20/13	
*Demeton O & S	EPA 8270C	ND	0.025	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Diazinon	EPA 8270C	ND	0.0036	0.050	ug/L	1	A300610	01/16/13	01/20/13	
*Dichlorvos	EPA 8270C	ND	0.0048	0.15	ug/L	1	A300610	01/16/13	01/20/13	
*Dimethoate	EPA 8270C	ND	0.0075	0.25	ug/L	1	A300610	01/16/13	01/20/13	
*Disulfoton	EPA 8270C	ND	0.024	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Ethion	EPA 8270C	ND	0.0040	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Ethoprop	EPA 8270C	ND	0.0042	0.15	ug/L	1	A300610	01/16/13	01/20/13	
*Fensulfothion	EPA 8270C	ND	0.0082	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Fenthion	EPA 8270C	ND	0.0029	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Guthion	EPA 8270C	ND	0.032	0.15	ug/L	1	A300610	01/16/13	01/20/13	
*Malathion	EPA 8270C	ND	0.0046	0.25	ug/L	1	A300610	01/16/13	01/20/13	
*Mevinphos	EPA 8270C	ND	0.0052	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Naled	EPA 8270C	ND	0.025	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Parathion Ethyl	EPA 8270C	ND	0.0029	0.25	ug/L	1	A300610	01/16/13	01/20/13	
*Parathion Methyl	EPA 8270C	ND	0.0030	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Phorate	EPA 8270C	ND	0.0033	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Phosmet	EPA 8270C	ND	0.029	1.0	ug/L	1	A300610	01/16/13	01/20/13	
*Ronnel	EPA 8270C	ND	0.0028	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Stirophos	EPA 8270C	ND	0.014	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Tokuthion	EPA 8270C	ND	0.0033	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Trichloronate	EPA 8270C	ND	0.0041	0.10	ug/L	1	A300610	01/16/13	01/20/13	
Surrogate: 2-Fluorobiphenyl	EPA 8270C	89 %			*Acceptable range: 50-120 %*					
Surrogate: Nitrobenzene-d5	EPA 8270C	71 %			*Acceptable range: 35-180 %*					
Surrogate: p-Terphenyl-d14	EPA 8270C	84 %			*Acceptable range: 24-149 %*					

A3A1010 FINAL 02012013 1003

Amended

BSK Associates Engineers & Laboratories

Organics Quality Control Report

Analyte	Result	MDL	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Batch: A300610					Analyst: KHH		Prepared: 1/16/2013					
Blank (A300610-BLK1) EPA 8270C - Quality Control												
Bolstar	ND	0.0035	0.10	ug/L							01/20/13	
Chlorpyrifos	ND	0.0029	0.010	ug/L							01/20/13	
Demeton O & S	ND	0.025	0.10	ug/L							01/20/13	
Diazinon	ND	0.0036	0.050	ug/L							01/20/13	
Dichlorvos	ND	0.0048	0.15	ug/L							01/20/13	
Dimethoate	ND	0.0075	0.25	ug/L							01/20/13	
Disulfoton	ND	0.024	0.10	ug/L							01/20/13	
Ethion	ND	0.0040	0.10	ug/L							01/20/13	
Ethoprop	ND	0.0042	0.15	ug/L							01/20/13	
Fensulfothion	ND	0.0082	0.10	ug/L							01/20/13	
Fenthion	ND	0.0029	0.10	ug/L							01/20/13	
Guthion	ND	0.032	0.15	ug/L							01/20/13	
Malathion	ND	0.0046	0.25	ug/L							01/20/13	
Mevinphos	ND	0.0052	0.10	ug/L							01/20/13	
Naled	ND	0.025	0.10	ug/L							01/20/13	
Parathion Ethyl	ND	0.0029	0.25	ug/L							01/20/13	
Parathion Methyl	ND	0.0030	0.10	ug/L							01/20/13	
Phorate	ND	0.0033	0.10	ug/L							01/20/13	
Phosmet	ND	0.029	1.0	ug/L							01/20/13	
Ronnel	ND	0.0028	0.10	ug/L							01/20/13	
Stirophos	ND	0.014	0.10	ug/L							01/20/13	
Tokuthion	ND	0.0033	0.10	ug/L							01/20/13	
Trichloronate	ND	0.0041	0.10	ug/L							01/20/13	
Surrogate: 2-Fluorobiphenyl	*4.6*				*5.0*		*93*	*50-120*			01/20/13	
Surrogate: Nitrobenzene-d5	*4.2*				*5.0*		*85*	*35-180*			01/20/13	
Surrogate: p-Terphenyl-d14	*4.8*				*5.0*		*97*	*24-149*			01/20/13	
Blank Spike (A300610-BS1) EPA 8270C - Quality Control												
Bolstar	0.23	0.0035	0.010	ug/L	0.25		93	60-140			01/20/13	
Chlorpyrifos	0.23	0.0029	0.010	ug/L	0.25		93	60-140			01/20/13	
Demeton O & S	0.19	0.025	0.050	ug/L	0.24		80	21-138			01/20/13	
Diazinon	0.22	0.0036	0.010	ug/L	0.25		89	57-151			01/20/13	
Dichlorvos	0.25	0.0048	0.010	ug/L	0.25		100	10-189			01/20/13	
Dimethoate	0.40	0.0075	0.010	ug/L	0.25		161	15-181			01/20/13	
Disulfoton	0.17	0.024	0.050	ug/L	0.25		68	14-165			01/20/13	
Ethion	0.25	0.0040	0.010	ug/L	0.25		99	65-151			01/20/13	
Ethoprop	0.25	0.0042	0.010	ug/L	0.25		98	58-156			01/20/13	
Fensulfothion	0.32	0.0082	0.010	ug/L	0.25		128	33-208			01/20/13	
Fenthion	0.24	0.0029	0.010	ug/L	0.25		98	63-138			01/20/13	
Guthion	0.35	0.032	0.050	ug/L	0.25		140	10-203			01/20/13	
Malathion	0.25	0.0046	0.010	ug/L	0.25		99	10-185			01/20/13	
Mevinphos	0.27	0.0052	0.010	ug/L	0.25		108	14-175			01/20/13	
Naled	0.37	0.025	0.050	ug/L	0.25		149	10-271			01/20/13	
Parathion Ethyl	0.29	0.0029	0.010	ug/L	0.25		117	58-161			01/20/13	

A3A1010 FINAL 02012013 1003

Amended

BSK Associates Engineers & Laboratories

Organics Quality Control Report

Analyte	Result	MDL	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Batch: A300610					Analyst: KHH		Prepared: 1/16/2013					
Blank Spike (A300610-BS1)	**EPA 8270C - Quality Control**											
Parathion Methyl	0.30	0.0030	0.010	ug/L	0.25		122	47-174			01/20/13	
Phorate	0.22	0.0033	0.010	ug/L	0.25		89	54-138			01/20/13	
Phosmet	0.34	0.029	0.10	ug/L	0.25		137	10-206			01/20/13	
Ronnel	0.23	0.0028	0.010	ug/L	0.25		91	67-139			01/20/13	
Stirophos	0.28	0.014	0.050	ug/L	0.25		111	47-157			01/20/13	
Tokuthion	0.26	0.0033	0.010	ug/L	0.25		104	71-141			01/20/13	
Trichloronate	0.22	0.0041	0.010	ug/L	0.25		88	61-141			01/20/13	
Surrogate: 2-Fluorobiphenyl	*4.7*				*5.0*		*95*	*50-120*			01/20/13	
Surrogate: Nitrobenzene-d5	*4.0*				*5.0*		*80*	*35-180*			01/20/13	
Surrogate: p-Terphenyl-d14	*4.7*				*5.0*		*94*	*24-149*			01/20/13	
Blank Spike Dup (A300610-BSD1)	**EPA 8270C - Quality Control**											
Bolstar	0.25	0.0035	0.010	ug/L	0.25		101	60-140	8	30	01/20/13	
Chlorpyrifos	0.23	0.0029	0.010	ug/L	0.25		94	60-140	1	30	01/20/13	
Demeton O & S	0.19	0.025	0.050	ug/L	0.24		79	21-138	1	30	01/20/13	
Diazinon	0.23	0.0036	0.010	ug/L	0.25		90	57-151	2	30	01/20/13	
Dichlorvos	0.24	0.0048	0.010	ug/L	0.25		95	10-189	5	30	01/20/13	
Dimethoate	0.38	0.0075	0.010	ug/L	0.25		151	15-181	7	30	01/20/13	
Disulfoton	0.18	0.024	0.050	ug/L	0.25		72	14-165	6	30	01/20/13	
Ethion	0.25	0.0040	0.010	ug/L	0.25		101	65-151	2	30	01/20/13	
Ethoprop	0.22	0.0042	0.010	ug/L	0.25		90	58-156	9	30	01/20/13	
Fensulfothion	0.33	0.0082	0.010	ug/L	0.25		134	33-208	4	30	01/20/13	
Fenthion	0.25	0.0029	0.010	ug/L	0.25		101	63-138	4	30	01/20/13	
Guthion	0.33	0.032	0.050	ug/L	0.25		130	10-203	7	30	01/20/13	
Malathion	0.23	0.0046	0.010	ug/L	0.25		92	10-185	8	30	01/20/13	
Mevinphos	0.24	0.0052	0.010	ug/L	0.25		97	14-175	11	30	01/20/13	
Naled	0.32	0.025	0.050	ug/L	0.25		130	10-271	14	30	01/20/13	
Parathion Ethyl	0.27	0.0029	0.010	ug/L	0.25		106	58-161	10	30	01/20/13	
Parathion Methyl	0.27	0.0030	0.010	ug/L	0.25		109	47-174	11	30	01/20/13	
Phorate	0.22	0.0033	0.010	ug/L	0.25		87	54-138	3	30	01/20/13	
Phosmet	0.30	0.029	0.10	ug/L	0.25		121	10-206	12	30	01/20/13	
Ronnel	0.23	0.0028	0.010	ug/L	0.25		90	67-139	1	30	01/20/13	
Stirophos	0.25	0.014	0.050	ug/L	0.25		100	47-157	11	30	01/20/13	
Tokuthion	0.24	0.0033	0.010	ug/L	0.25		98	71-141	6	30	01/20/13	
Trichloronate	0.21	0.0041	0.010	ug/L	0.25		86	61-141	3	30	01/20/13	
Surrogate: 2-Fluorobiphenyl	*4.6*				*5.0*		*92*	*50-120*			01/20/13	
Surrogate: Nitrobenzene-d5	*4.0*				*5.0*		*81*	*35-180*			01/20/13	
Surrogate: p-Terphenyl-d14	*4.9*				*5.0*		*98*	*24-149*			01/20/13	

A3A1010 FINAL 02012013 1003

Amended

BSK Associates Engineers & Laboratories

Certificate of Analysis

02/01/2013

Notes:

- The Chain of Custody document and Sample Integrity Sheet are part of the analytical report.
- Any remaining sample(s) for testing will be disposed of one month from the final report date unless other arrangements are made in advance.
- Sample(s) received, prepared, and analyzed within the method specified criteria unless otherwise noted within this report.
- The results relate only to the samples analyzed in accordance with test(s) requested by the client on the Chain of Custody document. Any analytical quality control exceptions to method criteria that are to be considered when evaluating these results have been flagged and are defined in the data qualifiers section.
- All results are expressed on wet weight basis unless otherwise specified.
- All positive results for EPA Methods 504.1, 502.2, and 524.2 require the analysis of a Field Reagent Blank (FRB) to confirm that the results are not a contamination error from field sampling steps. If Field Reagent Blanks were not submitted with the samples, this method requirement has not been performed.
- Results contained in this analytical report must be reproduced in its entirety.
- Samples collected by BSK Analytical Laboratories were collected in accordance with the BSK Sampling and Collection Standard Operating Procedures.
- BSK Analytical Laboratories certifies that the test results contained in this report meet all requirements of the NELAC Standards for applicable certified drinking water chemistry analyses unless qualified or noted in the Case Narrative.
- Analytical data contained in this report may be used for regulatory purposes to meet the requirements of the Federal or State drinking water, wastewater, and hazardous waste programs.
- J-value is equivalent to DNQ (Detected, not quantified) which is a trace value. A trace value is an analyte detected between the MDL and the laboratory reporting limit. This result is of an unknown data quality and is only qualitative (estimated). Baseline noise, calibration curve extrapolation below the lowest calibrator, method blank detections, and integration artifacts can all produce apparent DNQ values, which contribute to the un-reliability of these values.
- (1) - Residual chlorine and pH analysis have a 15 minute holding time for both drinking and waste water samples as defined by the EPA and 40 CFR 136. Waste water and ground water (monitoring well) samples must be field filtered to meet the 15 minute holding time for dissolved metals.
- * - This is not a NELAP accredited analyte.
- Summations of analytes (i.e. Total Trihalomethanes) may appear to add individual amounts incorrectly, due to rounding of analyte values occurring before or after the total value is calculated, as well as rounding of the total value.
- (2) The digestion used to produce this result deviated from EPA 200.2 by excluding hydrochloric acid in order to produce acceptable recoveries for affected metals.
- (2C) Result reported from secondary analytical column.
- RL Multiplier is the factor used to adjust the reporting limit (RL) due to variations in sample preparation procedures and dilutions required for matrix interferences.

Certifications:

State of California - CDPH - ELAP	1180
State of California - CDPH - SAC ELAP	2435
State of California - CDPH - NELAP	04227CA
State of Nevada - NDEP	CA000792009A
State of Hawaii - DOH	04227CA

Please refer to our website for a copy of our Accredited Fields of Testing for each certificattion.

Definitions and Flags for Data Qualifiers

mg/L:	Milligrams/Liter (ppm)	M:	Method Detection Limit	MDA95:	Min. Detected Activity
mg/Kg:	Milligrams/Kilogram (ppm)	RL:	Reporting Limit	MPN:	Most Probable Number
µg/L:	Micrograms/Liter (ppb)		:DL x Dilution	CFU:	Colony Forming Unit
µg/Kg:	Micrograms/Kilogram (ppb)	ND:	None Detected at RL	Absent:	Less than 1 CFU/100mLs
%:	Percent Recovered (surrogates)	pCi/L:	Picocuries per Liter	Present:	1 or more CFU/100mLs
		NR:	Non-Reportable	RL Mult:	RL Multiplier

A3A1010

Alpha Analytical Laboratories Inc

Alpha0401

01112013

Turnaround: Standard

Due Date: 1/25/2013

A3A1010 01/11/2013
Alpha0401 10

0.3

SUBCONTRACT ORDER

Alpha Analytical Laboratories, Inc.

13A0490

SENDING LABORATORY:	**RECEIVING LABORATORY:**
Alpha Analytical Laboratories, Inc.	BSK
208 Mason St.	1414 Stanislaus
Ukiah, CA 95482	Fresno, CA 93706
Phone: (707)468-0401	Phone :559-497-2888
Fax: (707)468-5267	Fax: (559) 485-6935
Project Manager: Robbie C. Phillips	**Terms: Net 30**

Analysis	Due	Expires	Comments
13A0490-02 EFF-001A Grab [Water] Sampled 01/09/13 08:20 Pacific			
8270C-OP SUB	01/25/13 12:00	01/23/13 08:20	Low Level SIM
Containers Supplied:			
1L Amber- Unpres. (G)	1L Amber- Unpres. (H)		

☐ *Report to State*

System Name: _____ **Employed by:** _____

User ID: _____ **Sampler:** _____

System Number: _____

Released By	Date	Received By	Date
	1-10-13		
Released By	Date	Received By	Date
		Sleep	1/11/13 1015
		UPS / Blue	

Sample Integrity

BSK Bottles: Yes (No) Page 1 of 1

COC Info				
Was temperature within range? Chemistry ≤ 6°C Micro < 10°C	(Yes) No NA	Were correct containers and preservatives received for the tests requested?	(Yes) No NA
If samples were taken today, is there evidence that chilling has begun?	Yes No (NA)	Were there bubbles in the VOA vials? (Volatiles Only)	Yes No (NA)
Did all bottles arrive unbroken and intact?	(Yes) No	Was a sufficient amount of sample received?	(Yes) No
Did all bottle labels agree with COC?	(Yes) No	Do samples have a hold time <72 hours?	Yes (No)
Was sodium thiosulfate added to CN sample(s) until chlorine was no longer present?	Yes No (NA)	Was PM notified of discrepancies? PM: By/Time:	Yes No (NA)

Bottles Received — "—" means preservation/chlorine checks are either N/A or are performed in the lab

250ml(A) 500ml(B) 1Liter(C) 40ml VOA(V)	Checks	Passed?	1					
Bacti $Na_2S_2O_3$	—	—						
None (P) White Cap	—	—						
Cr6 Buffer (P) Blue Cap	pH 9-9.5	Y N						
HNO_3 (P) Red Cap	—	—						
H_2SO_4 (P) Yellow Cap	pH ≤ 2	Y N						
NaOH (P) Green Cap	Cl, pH ≥12	Y N						
NaOH + ZnAc (P)	pH ≥ 9	Y N						
Dissolved Oxygen 300ml (g)	—	—						
None (AG) 608/8081/8082, 625, 632/8321, 8151, 8270	—	—	2					
H_2SO_4 (AG) Yellow Label O&G, Diesel	—	—						
$Na_2S_2O_3$ 1 Liter (Brown P) 549	—	—						
$Na_2S_2O_3$ (AG) Blue Label 547, 515, 525, 548	—	—						
$Na_2S_2O_3$ (AG) Blue Label THMs 524.2 or 524.3	—	—						
$Na_2S_2O_3$ (CG) Blue Label 504, 505	—	—					1/11/13	
$Na_2S_2O_3$ + MCAA (CG) Orange Label 531	pH = 3	Y N					8	
NH_4Cl (AG) Purple Label 552	—	—						
EDA (AG) Brown Label DBPs	—	—						
Ascorbic + Maleic (AG) Lt Green Label 524.3	—	—						
HCL (CG) 524.2,BTEX,Gas, MTBE, 8260/624	—	—						
Buffer pH 4 (CG)	—	—						
None (CG)	—	—						
H_3PO_4 (CG) Salmon Label	—	—						
Other:								
Asbestos 1Liter Plastic w/ Foil	—	—						
Low Level Hg / Metals Double Baggie	—	—						
Bottled Water	—	—						
Clear Glass Jar: 250 / 500 / 1 Liter	—	—						
Soil Tube Brass / Steel / Plastic	—	—						
Tedlar Bag / Plastic Bag	—	—						

Split

	Container	Preservative	Date/Time/Initials		Container	Preservative	Date/Time/Initials
S P				S P			
S P				S P			

Comments

Labeled by: MSA @ 1300 Labels checked by: MM @ 1535 RUSH Paged by: ____ @

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ELAP Certificate Numbers 1551 and 2728

23 January 2013

Modesto, City of - Wastewater
Attn: Regina Scoma
1221 Sutter Avenue
Modesto, CA 95351
RE: Jennings River Discharge
Work Order: 13A0490

Enclosed are the results of analyses for samples received by the laboratory on 01/10/13 21:20. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

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Modesto CA, 95351	Project Manager:	Regina Scoma	
Modesto, City of - Wastewater	Project:	Jennings River Discharge	Reported:
1221 Sutter Avenue	Project Number:	A08503A/155352-354	01/23/13 11:23

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
EFF-001A Comp	13A0490-01	Water	01/09/13 08:15	01/10/13 21:20
EFF-001A Grab	13A0490-02	Water	01/09/13 08:20	01/10/13 21:20

Alpha Analytical Laboratories, Inc.

Bruce L. Gove
Laboratory Director

1/23/2013

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Modesto CA, 95351	Project Manager: Regina Scoma	
Modesto, City of - Wastewater	Project: Jennings River Discharge	Reported:
1221 Sutter Avenue	Project Number: A08503A/155352-354	01/23/13 11:23

Metals by EPA Method 200.8 ICP/MS
Alpha Analytical Laboratories, Inc.

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
EFF-001A Comp (13A0490-01) Water Sampled: 01/09/13 08:15 Received: 01/10/13 21:20										
Aluminum	**35**	2.0	10	ug/l	1	AA31429	01/14/13 10:17	01/21/13 18:20	EPA 200.8	
Boron	**250**	6.0	50	"	"	"	"	"	"	
Copper	**3.2**	0.040	0.50	"	"	"	"	"	"	
Iron	**74**	1.8	50	"	"	"	"	"	"	
Manganese	**14**	0.030	5.0	"	"	"	"	"	"	
Molybdenum	**6.2**	0.020	0.25	"	"	"	"	"	"	

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Modesto CA, 95351	Project Manager: Regina Scoma	
Modesto, City of - Wastewater	Project: Jennings River Discharge	Reported:
1221 Sutter Avenue	Project Number: A08503A/155352-354	01/23/13 11:23

Metals by APHA/EPA Methods
Alpha Analytical Laboratories, Inc.

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
EFF-001A Grab (13A0490-02) Water Sampled: 01/09/13 08:20 Received: 01/10/13 21:20										
Methyl mercury	**0.0000424**	0.0000200	0.0000500	ug/l	1	AA31543	01/14/13 14:00	01/15/13 21:56	EPA 1630	J
Mercury	**0.00103**	0.000200	0.000500	"	"	AA31744	01/16/13 14:00	01/17/13 17:18	EPA 1631E	

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1221 Sutter Avenue	Project Number: A08503A/155352-354	01/23/13 11:23

Trihalomethanes by EPA Method 624
Alpha Analytical Laboratories, Inc.

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
EFF-001A Grab (13A0490-02) Water	**Sampled: 01/09/13 08:20**		**Received: 01/10/13 21:20**							**R-04**
Carbon tetrachloride	ND	0.55	2.50	ug/l	5	AA31133	01/11/13 09:00	01/11/13 22:41	EPA 624	U
Bromodichloromethane	**2.40**	0.48	2.50	"	"	"	"	"	"	J
Dibromochloromethane	**1.50**	0.38	2.50	"	"	"	"	"	"	J
Surrogate: Bromofluorobenzene		*84.5 %*	*81-135*			"	"	"	"	
Surrogate: Dibromofluoromethane		*84.4 %*	*46-130*			"	"	"	"	
Surrogate: Toluene-d8		*86.4 %*	*59-132*			"	"	"	"	

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Modesto, City of - Wastewater	Project: Jennings River Discharge	Reported:
1221 Sutter Avenue	Project Number: A08503A/155352-354	01/23/13 11:23

Metals by EPA Method 200.8 ICP/MS - Quality Control

Alpha Analytical Laboratories, Inc.

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AA31429 - EPA 200.8											
Blank (AA31429-BLK1)					Prepared: 01/14/13 Analyzed: 01/16/13						
Aluminum	ND	2.0	10	ug/l							U
Boron	11.5	6.0	50	"							J
Copper	ND	0.040	0.50	"							U
Iron	ND	1.8	50	"							U
Manganese	ND	0.030	5.0	"							U
Molybdenum	ND	0.020	0.25	"							U
LCS (AA31429-BS1)					Prepared: 01/14/13 Analyzed: 01/17/13						
Aluminum	442	2.0	10	ug/l	520		85.1	85-115		20	
Boron	109	6.0	50	"	100		109	85-115		20	
Copper	19.8	0.040	0.50	"	20.0		99.1	85-115		20	
Iron	521	1.8	50	"	520		100	85-115		20	
Manganese	20.0	0.030	5.0	"	20.0		100	85-115		20	
Molybdenum	20.2	0.020	0.25	"	20.0		101	85-115		20	
Duplicate (AA31429-DUP1)		**Source: 13A0473-01**			Prepared: 01/14/13 Analyzed: 01/16/13						
Aluminum	92.5	2.0	10	ug/l		86.8			6.39	20	
Boron	102	6.0	50	"		97.8			4.26	20	
Copper	25.1	0.040	0.50	"		28.9			14.0	20	
Iron	550	1.8	50	"		524			4.98	20	
Manganese	34.5	0.030	5.0	"		33.3			3.52	20	
Molybdenum	0.403	0.020	0.25	"		0.397			1.46	20	
Matrix Spike (AA31429-MS1)		**Source: 13A0473-01**			Prepared: 01/14/13 Analyzed: 01/16/13						
Aluminum	496	2.0	10	ug/l	520	86.8	78.8	70-130		20	
Boron	189	6.0	50	"	100	97.8	91.0	70-130		20	
Copper	43.4	0.040	0.50	"	20.0	28.9	72.5	70-130		20	
Iron	966	1.8	50	"	520	524	85.1	70-130		20	
Manganese	52.4	0.030	5.0	"	20.0	33.3	95.3	70-130		20	
Molybdenum	21.1	0.020	0.25	"	20.0	0.397	104	70-130		20	

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Modesto, City of - Wastewater	Project: Jennings River Discharge	Reported:
1221 Sutter Avenue	Project Number: A08503A/155352-354	01/23/13 11:23

Metals by EPA Method 200.8 ICP/MS - Quality Control

Alpha Analytical Laboratories, Inc.

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AA31429 - EPA 200.8											
Matrix Spike (AA31429-MS2)		**Source: 13A0593-04**			Prepared: 01/14/13 Analyzed: 01/21/13						
Copper	29.0	0.040	0.50	ug/l	20.0	8.66	102	70-130		20	
Iron	930	1.8	50	"	520	499	82.8	70-130		20	
Manganese	26.5	0.030	5.0	"	20.0	7.33	95.9	70-130		20	
Molybdenum	26.6	0.020	0.25	"	20.0	6.61	99.8	70-130		20	
Matrix Spike Dup (AA31429-MSD1)		**Source: 13A0473-01**			Prepared: 01/14/13 Analyzed: 01/16/13						
Aluminum	487	2.0	10	ug/l	520	86.8	76.9	70-130	1.99	20	
Boron	194	6.0	50	"	100	97.8	96.0	70-130	2.61	20	
Copper	47.9	0.040	0.50	"	20.0	28.9	95.0	70-130	9.88	20	
Iron	970	1.8	50	"	520	524	85.8	70-130	0.387	20	
Manganese	52.6	0.030	5.0	"	20.0	33.3	96.4	70-130	0.424	20	
Molybdenum	20.8	0.020	0.25	"	20.0	0.397	102	70-130	1.35	20	

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Modesto, City of - Wastewater	Project: Jennings River Discharge	Reported:
1221 Sutter Avenue	Project Number: A08503A/155352-354	01/23/13 11:23

Metals by APHA/EPA Methods - Quality Control

Alpha Analytical Laboratories, Inc.

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AA31543 - EPA 1630											
Blank (AA31543-BLK1)					Prepared: 01/14/13 Analyzed: 01/15/13						
Methyl mercury	ND	0.0000200	0.0000500	ug/l							U
LCS (AA31543-BS1)					Prepared: 01/14/13 Analyzed: 01/15/13						
Methyl mercury	0.000452	0.0000200	0.0000500	ug/l	0.000500		90.4	67-133		35	
Matrix Spike (AA31543-MS1)		**Source: 13A0490-02**			Prepared: 01/14/13 Analyzed: 01/15/13						
Methyl mercury	0.000490	0.0000200	0.0000500	ug/l	0.000500	0.0000424	89.5	65-135		35	
Matrix Spike Dup (AA31543-MSD1)		**Source: 13A0490-02**			Prepared: 01/14/13 Analyzed: 01/15/13						
Methyl mercury	0.000446	0.0000200	0.0000500	ug/l	0.000500	0.0000424	80.7	65-135	9.41	35	
Batch AA31744 - EPA 1631											
Blank (AA31744-BLK1)					Prepared: 01/16/13 Analyzed: 01/17/13						
Mercury	ND	0.000200	0.000500	ug/l							U
LCS (AA31744-BS1)					Prepared: 01/16/13 Analyzed: 01/17/13						
Mercury	0.00581	0.000200	0.000500	ug/l	0.00500		116	77-123		20	
Matrix Spike (AA31744-MS1)		**Source: 13A0490-02**			Prepared: 01/16/13 Analyzed: 01/17/13						
Mercury	0.0280	0.000200	0.000500	ug/l	0.0250	0.00103	108	71-125		24	
Matrix Spike (AA31744-MS2)		**Source: 13A0521-02**			Prepared: 01/16/13 Analyzed: 01/17/13						
Mercury	0.0276	0.000200	0.000500	ug/l	0.0250	0.000606	108	71-125		24	
Matrix Spike Dup (AA31744-MSD1)		**Source: 13A0490-02**			Prepared: 01/16/13 Analyzed: 01/17/13						
Mercury	0.0276	0.000200	0.000500	ug/l	0.0250	0.00103	106	71-125	1.44	24	

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Modesto CA, 95351	Project Manager: Regina Scoma	
Modesto, City of - Wastewater	Project: Jennings River Discharge	Reported:
1221 Sutter Avenue	Project Number: A08503A/155352-354	01/23/13 11:23

Metals by APHA/EPA Methods - Quality Control

Alpha Analytical Laboratories, Inc.

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AA31744 - EPA 1631											
Matrix Spike Dup (AA31744-MSD2)		**Source: 13A0521-02**			Prepared: 01/16/13 Analyzed: 01/17/13						
Mercury	0.0281	0.000200	0.000500	ug/l	0.0250	0.000606	110	71-125	1.80	24	

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1221 Sutter Avenue	Project Number: A08503A/155352-354	01/23/13 11:23

Trihalomethanes by EPA Method 624 - Quality Control

Alpha Analytical Laboratories, Inc.

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AA31133 - VOAs in Water GCMS											
Blank (AA31133-BLK1)					Prepared & Analyzed: 01/11/13						
Carbon tetrachloride	ND	0.11	0.50	ug/l							U
Bromodichloromethane	ND	0.10	0.50	"							U
Dibromochloromethane	ND	0.08	0.50	"							U
Surrogate: Bromofluorobenzene	*20.9*			*"*	*25.0*		*83.7*	*81-135*			
Surrogate: Dibromofluoromethane	*21.9*			*"*	*25.0*		*87.8*	*46-130*			
Surrogate: Toluene-d8	*21.0*			*"*	*25.0*		*84.1*	*59-132*			
LCS (AA31133-BS1)					Prepared & Analyzed: 01/11/13						
Carbon tetrachloride	24.7	0.11	0.50	ug/l	20.0		124	77-134		25	
Bromodichloromethane	22.9	0.10	0.50	"	20.0		115	87-118		25	
Dibromochloromethane	23.7	0.08	0.50	"	20.0		118	83-135		25	
Surrogate: Bromofluorobenzene	*22.0*			*"*	*25.0*		*88.0*	*81-135*			
Surrogate: Dibromofluoromethane	*20.8*			*"*	*25.0*		*83.0*	*46-130*			
Surrogate: Toluene-d8	*20.8*			*"*	*25.0*		*83.0*	*59-132*			
LCS Dup (AA31133-BSD1)					Prepared & Analyzed: 01/11/13						
Carbon tetrachloride	23.8	0.11	0.50	ug/l	20.0		119	77-134	3.71	25	
Bromodichloromethane	22.6	0.10	0.50	"	20.0		113	87-118	1.67	25	
Dibromochloromethane	23.6	0.08	0.50	"	20.0		118	83-135	0.465	25	
Surrogate: Bromofluorobenzene	*22.0*			*"*	*25.0*		*87.8*	*81-135*			
Surrogate: Dibromofluoromethane	*20.4*			*"*	*25.0*		*81.6*	*46-130*			
Surrogate: Toluene-d8	*20.8*			*"*	*25.0*		*83.4*	*59-132*			
Matrix Spike (AA31133-MS1)		**Source: 13A0500-01**			Prepared & Analyzed: 01/11/13						
Carbon tetrachloride	25.8	0.11	0.50	ug/l	20.0	ND	129	35-159		25	
Bromodichloromethane	23.3	0.10	0.50	"	20.0	ND	117	62-140		25	
Dibromochloromethane	22.3	0.08	0.50	"	20.0	ND	112	54-157		25	
Surrogate: Bromofluorobenzene	*21.8*			*"*	*25.0*		*87.0*	*81-135*			
Surrogate: Dibromofluoromethane	*20.6*			*"*	*25.0*		*82.3*	*46-130*			

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Modesto, City of - Wastewater	Project: Jennings River Discharge	Reported:
1221 Sutter Avenue	Project Number: A08503A/155352-354	01/23/13 11:23

Trihalomethanes by EPA Method 624 - Quality Control

Alpha Analytical Laboratories, Inc.

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch AA31133 - VOAs in Water GCMS											
Matrix Spike (AA31133-MS1)		**Source: 13A0500-01**			Prepared & Analyzed: 01/11/13						
Surrogate: Toluene-d8	*20.8*			*ug/l*	*25.0*		*83.3*	*59-132*			
Matrix Spike Dup (AA31133-MSD1)		**Source: 13A0500-01**			Prepared & Analyzed: 01/11/13						
Carbon tetrachloride	25.5	0.11	0.50	ug/l	20.0	ND	128	35-159	1.13	25	
Bromodichloromethane	22.8	0.10	0.50	"	20.0	ND	114	62-140	2.17	25	
Dibromochloromethane	23.2	0.08	0.50	"	20.0	ND	116	54-157	3.83	25	
Surrogate: Bromofluorobenzene	*21.8*			*"*	*25.0*		*87.2*	*81-135*			
Surrogate: Dibromofluoromethane	*20.0*			*"*	*25.0*		*80.2*	*46-130*			
Surrogate: Toluene-d8	*20.8*			*"*	*25.0*		*83.1*	*59-132*			

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Modesto CA, 95351	Project Manager:	Regina Scoma	
Modesto, City of - Wastewater	Project:	Jennings River Discharge	Reported:
1221 Sutter Avenue	Project Number:	A08503A/155352-354	01/23/13 11:23

Notes and Definitions

J	Detected but below the Reporting Limit; therefore, result is an estimated concentration, detected but not quantified (DNQ).
R-04	The Reporting Limits for this analysis are elevated due to sample foaming.
U	Analyte included in analysis, but not detected at or above MDL.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Alpha Analytical Laboratories, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Bruce L. Gove 1/23/2013
Laboratory Director

BSK Associates
Engineers & Laboratories

A3A1010

01/25/2013

Invoice
A302350

Robbie Phillips
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

Dear Robbie Phillips,

Thank you for selecting BSK Associates for your analytical testing needs. We have prepared this report in response to your request for analytical services. Enclosed are the results of analyses for samples received by the laboratory on 01/11/2013 10:15.

If additional clarification of any information is required, please contact your Client Services Representative, Michael Ng at (800) 877-8310 or (559) 497-2888.

BSK ASSOCIATES

Michael Ng
Project Manager

1414 Stanislaus Street Fresno, CA 93706 (559) 497-2888 FAX (559) 485-6935 www.bsklabs.com

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Environmental Engineering | Geotechnical Engineering | Materials Testing

01/25/2013

Case Narrative

Work Order Information

Client Name:	Alpha Analytical Laboratories Inc	**Submitted by:**	Client
Client Code:	Alpha0401	**Shipped by:**	UPS
Work Order:	A3A1010	**COC Number:**	
Project:	General-Robbie Phillips	**TAT:**	10
Client Project:	13A0490	**PO #:**	

Sample Receipt Conditions

Cooler: **Default Cooler** **Temp. ºC:** 0.3

Containers Intact
COC/Labels Agree
Received On Blue Ice
Packing Material - Bubble Wrap
Sample(s) were received in temperature range.
Initial receipt at BSK-FAL

Report Manager	Report Format
All Lab Results	Final.rpt

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BSK Associates Engineers & Laboratories

Certificate of Analysis

Robbie Phillips
Alpha Analytical Laboratories Inc
208 Mason Street
Ukiah, CA 95482

Report Issue Date: 1/25/2013 16:09
Received Date: 01/11/2013
Received Time: 10:15

Lab Sample ID: A3A1010-01
Sample Date: 01/09/2013 08:20
Sample Type: Grab

Client Project: 13A0490
Sampled by: Client
Matrix: Water

Sample Description: 13A0490-02 EFF-001A Grab

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Organophosphates (EPA 8141 List) by GC-MS									
*Bolstar	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Chlorpyrifos	EPA 8270C	ND	0.010	ug/L	1	A300610	01/16/13	01/20/13	
*Demeton O & S	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Diazinon	EPA 8270C	ND	0.050	ug/L	1	A300610	01/16/13	01/20/13	
*Dichlorvos	EPA 8270C	ND	0.15	ug/L	1	A300610	01/16/13	01/20/13	
*Dimethoate	EPA 8270C	ND	0.25	ug/L	1	A300610	01/16/13	01/20/13	
*Disulfoton	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Ethion	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Ethoprop	EPA 8270C	ND	0.15	ug/L	1	A300610	01/16/13	01/20/13	
*Fensulfothion	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Fenthion	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Guthion	EPA 8270C	ND	0.15	ug/L	1	A300610	01/16/13	01/20/13	
*Malathion	EPA 8270C	ND	0.25	ug/L	1	A300610	01/16/13	01/20/13	
*Mevinphos	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Naled	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Parathion Ethyl	EPA 8270C	ND	0.25	ug/L	1	A300610	01/16/13	01/20/13	
*Parathion Methyl	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Phorate	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Phosmet	EPA 8270C	ND	1.0	ug/L	1	A300610	01/16/13	01/20/13	
*Ronnel	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Stirophos	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Tokuthion	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
*Trichloronate	EPA 8270C	ND	0.10	ug/L	1	A300610	01/16/13	01/20/13	
Surrogate: 2-Fluorobiphenyl	EPA 8270C	89 %		*Acceptable range: 50-120 %*					
Surrogate: Nitrobenzene-d5	EPA 8270C	71 %		*Acceptable range: 35-180 %*					
Surrogate: p-Terphenyl-d14	EPA 8270C	84 %		*Acceptable range: 24-149 %*					

A3A1010 FINAL 01252013 1609

BSK Associates Engineers & Laboratories

Organics Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Batch: A300610				Analyst: KHH		Prepared: 1/16/2013					
Blank (A300610-BLK1) EPA 8270C - Quality Control											
Bolstar	ND	0.010	ug/L							01/20/13	
Chlorpyrifos	ND	0.010	ug/L							01/20/13	
Demeton O & S	ND	0.050	ug/L							01/20/13	
Diazinon	ND	0.010	ug/L							01/20/13	
Dichlorvos	ND	0.010	ug/L							01/20/13	
Dimethoate	ND	0.010	ug/L							01/20/13	
Disulfoton	ND	0.050	ug/L							01/20/13	
Ethion	ND	0.010	ug/L							01/20/13	
Ethoprop	ND	0.010	ug/L							01/20/13	
Fensulfothion	ND	0.010	ug/L							01/20/13	
Fenthion	ND	0.010	ug/L							01/20/13	
Guthion	ND	0.050	ug/L							01/20/13	
Malathion	ND	0.010	ug/L							01/20/13	
Mevinphos	ND	0.010	ug/L							01/20/13	
Naled	ND	0.050	ug/L							01/20/13	
Parathion Ethyl	ND	0.010	ug/L							01/20/13	
Parathion Methyl	ND	0.010	ug/L							01/20/13	
Phorate	ND	0.010	ug/L							01/20/13	
Phosmet	ND	0.10	ug/L							01/20/13	
Ronnel	ND	0.010	ug/L							01/20/13	
Stirophos	ND	0.050	ug/L							01/20/13	
Tokuthion	ND	0.010	ug/L							01/20/13	
Trichloronate	ND	0.010	ug/L							01/20/13	
Surrogate: 2-Fluorobiphenyl	*4.6*			*5.0*		*93*	*50-120*			01/20/13	
Surrogate: Nitrobenzene-d5	*4.2*			*5.0*		*85*	*35-180*			01/20/13	
Surrogate: p-Terphenyl-d14	*4.8*			*5.0*		*97*	*24-149*			01/20/13	
Blank Spike (A300610-BS1) EPA 8270C - Quality Control											
Bolstar	0.23	0.010	ug/L	0.25		93	60-140			01/20/13	
Chlorpyrifos	0.23	0.010	ug/L	0.25		93	60-140			01/20/13	
Demeton O & S	0.19	0.050	ug/L	0.24		80	21-138			01/20/13	
Diazinon	0.22	0.010	ug/L	0.25		89	57-151			01/20/13	
Dichlorvos	0.25	0.010	ug/L	0.25		100	10-189			01/20/13	
Dimethoate	0.40	0.010	ug/L	0.25		161	15-181			01/20/13	
Disulfoton	0.17	0.050	ug/L	0.25		68	14-165			01/20/13	
Ethion	0.25	0.010	ug/L	0.25		99	65-151			01/20/13	
Ethoprop	0.25	0.010	ug/L	0.25		98	58-156			01/20/13	
Fensulfothion	0.32	0.010	ug/L	0.25		128	33-208			01/20/13	
Fenthion	0.24	0.010	ug/L	0.25		98	63-138			01/20/13	
Guthion	0.35	0.050	ug/L	0.25		140	10-203			01/20/13	
Malathion	0.25	0.010	ug/L	0.25		99	10-185			01/20/13	
Mevinphos	0.27	0.010	ug/L	0.25		108	14-175			01/20/13	
Naled	0.37	0.050	ug/L	0.25		149	10-271			01/20/13	
Parathion Ethyl	0.29	0.010	ug/L	0.25		117	58-161			01/20/13	
Parathion Methyl	0.30	0.010	ug/L	0.25		122	47-174			01/20/13	
Phorate	0.22	0.010	ug/L	0.25		89	54-138			01/20/13	
Phosmet	0.34	0.10	ug/L	0.25		137	10-206			01/20/13	

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BSK Associates Engineers & Laboratories

Organics Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Batch: A300610				Analyst: KHH		Prepared: 1/16/2013					
Blank Spike (A300610-BS1) EPA 8270C - Quality Control											
Ronnel	0.23	0.010	ug/L	0.25		91	67-139			01/20/13	
Stirophos	0.28	0.050	ug/L	0.25		111	47-157			01/20/13	
Tokuthion	0.26	0.010	ug/L	0.25		104	71-141			01/20/13	
Trichloronate	0.22	0.010	ug/L	0.25		88	61-141			01/20/13	
Surrogate: 2-Fluorobiphenyl	*4.7*			*5.0*		*95*	*50-120*			01/20/13	
Surrogate: Nitrobenzene-d5	*4.0*			*5.0*		*80*	*35-180*			01/20/13	
Surrogate: p-Terphenyl-d14	*4.7*			*5.0*		*94*	*24-149*			01/20/13	
Blank Spike Dup (A300610-BSD1) EPA 8270C - Quality Control											
Bolstar	0.25	0.010	ug/L	0.25		101	60-140	8	30	01/20/13	
Chlorpyrifos	0.23	0.010	ug/L	0.25		94	60-140	1	30	01/20/13	
Demeton O & S	0.19	0.050	ug/L	0.24		79	21-138	1	30	01/20/13	
Diazinon	0.23	0.010	ug/L	0.25		90	57-151	2	30	01/20/13	
Dichlorvos	0.24	0.010	ug/L	0.25		95	10-189	5	30	01/20/13	
Dimethoate	0.38	0.010	ug/L	0.25		151	15-181	7	30	01/20/13	
Disulfoton	0.18	0.050	ug/L	0.25		72	14-165	6	30	01/20/13	
Ethion	0.25	0.010	ug/L	0.25		101	65-151	2	30	01/20/13	
Ethoprop	0.22	0.010	ug/L	0.25		90	58-156	9	30	01/20/13	
Fensulfothion	0.33	0.010	ug/L	0.25		134	33-208	4	30	01/20/13	
Fenthion	0.25	0.010	ug/L	0.25		101	63-138	4	30	01/20/13	
Guthion	0.33	0.050	ug/L	0.25		130	10-203	7	30	01/20/13	
Malathion	0.23	0.010	ug/L	0.25		92	10-185	8	30	01/20/13	
Mevinphos	0.24	0.010	ug/L	0.25		97	14-175	11	30	01/20/13	
Naled	0.32	0.050	ug/L	0.25		130	10-271	14	30	01/20/13	
Parathion Ethyl	0.27	0.010	ug/L	0.25		106	58-161	10	30	01/20/13	
Parathion Methyl	0.27	0.010	ug/L	0.25		109	47-174	11	30	01/20/13	
Phorate	0.22	0.010	ug/L	0.25		87	54-138	3	30	01/20/13	
Phosmet	0.30	0.10	ug/L	0.25		121	10-206	12	30	01/20/13	
Ronnel	0.23	0.010	ug/L	0.25		90	67-139	1	30	01/20/13	
Stirophos	0.25	0.050	ug/L	0.25		100	47-157	11	30	01/20/13	
Tokuthion	0.24	0.010	ug/L	0.25		98	71-141	6	30	01/20/13	
Trichloronate	0.21	0.010	ug/L	0.25		86	61-141	3	30	01/20/13	
Surrogate: 2-Fluorobiphenyl	*4.6*			*5.0*		*92*	*50-120*			01/20/13	
Surrogate: Nitrobenzene-d5	*4.0*			*5.0*		*81*	*35-180*			01/20/13	
Surrogate: p-Terphenyl-d14	*4.9*			*5.0*		*98*	*24-149*			01/20/13	

1414 Stanislaus Street **Fresno, CA 93706** **(559) 497-2888** **FAX (559) 485-6935** **www.bsklabs.com**

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BSK Associates Engineers & Laboratories

Certificate of Analysis

01/25/2013

Notes:

- The Chain of Custody document and Sample Integrity Sheet are part of the analytical report.
- Any remaining sample(s) for testing will be disposed of one month from the final report date unless other arrangements are made in advance.
- Sample(s) received, prepared, and analyzed within the method specified criteria unless otherwise noted within this report.
- The results relate only to the samples analyzed in accordance with test(s) requested by the client on the Chain of Custody document. Any analytical quality control exceptions to method criteria that are to be considered when evaluating these results have been flagged and are defined in the data qualifiers section.
- All results are expressed on wet weight basis unless otherwise specified.
- All positive results for EPA Methods 504.1, 502.2, and 524.2 require the analysis of a Field Reagent Blank (FRB) to confirm that the results are not a contamination error from field sampling steps. If Field Reagent Blanks were not submitted with the samples, this method requirement has not been performed.
- Results contained in this analytical report must be reproduced in its entirety.
- Samples collected by BSK Analytical Laboratories were collected in accordance with the BSK Sampling and Collection Standard Operating Procedures.
- BSK Analytical Laboratories certifies that the test results contained in this report meet all requirements of the NELAC Standards for applicable certified drinking water chemistry analyses unless qualified or noted in the Case Narrative.
- Analytical data contained in this report may be used for regulatory purposes to meet the requirements of the Federal or State drinking water, wastewater, and hazardous waste programs.
- J-value is equivalent to DNQ (Detected, not quantified) which is a trace value. A trace value is an analyte detected between the MDL and the laboratory reporting limit. This result is of an unknown data quality and is only qualitative (estimated). Baseline noise, calibration curve extrapolation below the lowest calibrator, method blank detections, and integration artifacts can all produce apparent DNQ values, which contribute to the un-reliability of these values.
- (1) - Residual chlorine and pH analysis have a 15 minute holding time for both drinking and waste water samples as defined by the EPA and 40 CFR 136. Waste water and ground water (monitoring well) samples must be field filtered to meet the 15 minute holding time for dissolved metals.
- * - This is not a NELAP accredited analyte.
- Summations of analytes (i.e. Total Trihalomethanes) may appear to add individual amounts incorrectly, due to rounding of analyte values occurring before or after the total value is calculated, as well as rounding of the total value.
- (2) The digestion used to produce this result deviated from EPA 200.2 by excluding hydrochloric acid in order to produce acceptable recoveries for affected metals.
- (2C) Result reported from secondary analytical column.
- RL Multiplier is the factor used to adjust the reporting limit (RL) due to variations in sample preparation procedures and dilutions required for matrix interferences.

Certifications:

State of California - CDPH - ELAP	1180
State of California - CDPH - SAC ELAP	2435
State of California - CDPH - NELAP	04227CA
State of Nevada - NDEP	CA000792009A
State of Hawaii - DOH	04227CA

Please refer to our website for a copy of our Accredited Fields of Testing for each certificattion.

Definitions and Flags for Data Qualifiers

mg/L:	Milligrams/Liter (ppm)	M:	Method Detection Limit	MDA95:	Min. Detected Activity
mg/Kg:	Milligrams/Kilogram (ppm)	RL:	Reporting Limit	MPN:	Most Probable Number
µg/L:	Micrograms/Liter (ppb)		:DL x Dilution	CFU:	Colony Forming Unit
µg/Kg:	Micrograms/Kilogram (ppb)	ND:	None Detected at RL	Absent:	Less than 1 CFU/100mLs
%:	Percent Recovered (surrogates)	pCi/L:	Picocuries per Liter	Present:	1 or more CFU/100mLs
		NR:	Non-Reportable	RL Mult:	RL Multiplier

Alpha
Alpha Analytical Laboratories Inc.
www.alpha-labs.com
Serving the California Environmental Sector

Laboratory: 208 Mason Street, Ukiah, CA 95482
707-468-0401 Fax) 707-468-5267
Service Center: 6398 Dougherty Road, Suite 3, Dublin, CA 94586
925-828-6226 Fax) 925-828-6309
clientservices@alpha-labs.com

Work Order

Chain of Custody Record

Lab No: 13A0490 Page 1 of 2

Signature below authorizes work under terms stated on reverse side.

Name: City of Modesto, Water Quality Control Laboratory
Mailing Address: 1221 Sutter Avenue, Modesto, CA 95351
Project Contact (Hardcopy or PDF to): Regina Scoma, rscoma@modestogov.com
Phone/Fax: Office (209) 577-6275, Fax (209) 525-9311
Samplers Signature:

Project Name: Jennings River Dicharge Monthly-Annual
Project Number: Lab ID#155352 Comp, Lab ID#155354 Grab
Project Address: NPDES Sampling, River Discharge (3-650)
P.O. #
Quote #
Bill to: .pdf invoice with report only

TAT: 24 hr / 48 hr / Lab Approval Required / 1 wk / 2 wk (standard) — Lab Approval Required For Rush

Sample Identification	Sampling Date	Sampling Time	Container: 40ml VOA	Poly	Amber	Sleeve	Glass	Preservative: HCL	HNO3	NH4SO4	NaOH	None	Matrix: River Water	Soil	Wastewater	Total Metals - *(see below) by 200 Series	EPA 624 - Vol Organics (**THM & CCL4)	EPA 1631 - Total Mercury	EPA 1630 - Methyl Mercury	EPA 625M - Chlorpyrifos	EPA 8270 SIM - Diazinon	Sample Notes
EFF-001A Comp	1/9/2013	08:15		X					X						X	X						**4 VOAs in HCl, 4 VOAs in Na2S2O3
EFF-001A Grab	1/9/2013	08:20	X					X							X		X					
EFF-001A Grab	1/9/2013	08:20					X	X							X			X				
EFF-001A Grab	1/9/2013	08:20					X	X							X				X			
EFF-001A Grab	1/9/2013	08:20			X							X			X					X		Lab ID#155353
EFF-001A Grab	1/9/2013	08:20			X							X			X						X	Lab ID#155356

Done Sample

Relinquished by	Received by	Date	Time
Shelly Ayala	Michael Franzwa	1/10/13	1230
Michael Franzwa	[illegible]	1-10	14 [illegible]
[illegible]	[illegible]	1-10-13	1801
[illegible]	[illegible]	1-10-13	2120

Sample Condition:
Travel and Site Time:
Storage:
Misc. Supplies:

*Metals = Al, B, Cu, Fe, Mn, Mo
**THM=DBCM & DCBM
EPA 8270 SIM - MDL
Chlorpyrifos <=0.015 ug/L
Diazinon <=0.1 ug/L

California EDF Report? ◯ ◯ No
Sampling Company Log Code:
Global ID:
EDF to (Email Address):
Drinking Water State System/Source Number:

CITY OF MODESTO - JENNINGS

7007 JENNINGS ROAD

MODESTO, CALIFORNIA 95358

PHONE: (209) 538 - 3256 FAX: (209) 538 - 4220

CITY OF MODESTO
WATER QUALITY CONTROL

JAN 09 2013

RECEIVING TEMPERATURE 30C

LAB: City of Modesto W.Q.C. Lab **DATE:** 1/9/2013

SAMPLER: **AREA:** Jennings

System #	SITE ID	ANALYSIS	SC	RN	TIME	AM / PM	COMMENT
FFR Influent	3-001 Comp	Turn on Composite sampler	W			AM /PM	CompTemp ___
FFR Effluent	3-010 Comp	Turn on Composite sampler	W			AM /PM	CompTemp ___
Recirculation Effluent	3-019.9 Comp	Turn on Composite sampler	W			AM /PM	CompTemp ___
Facultative Pond 1	3-510 Grab	Conductivity	W	RT		AM /PM	
Facultative Pond 2	3-520 Grab	Conductivity	W	RT		AM /PM	
Facultative Pond 3	3-530 Grab	Conductivity	W	RT		AM /PM	
Storage Pond 1	3-560 Grab	Conductivity	W	RT		AM /PM	
Irrigation Forebay	3-570 Grab	Conductivity	W	RT		AM /PM	
Storage Pond 2	3-665 Grab	Conductivity	W	RT		AM /PM	
Irrigation	3-750 Grab	BOD, Cond	W	RT		AM /PM	To be taken to Lab ONLY if Irrigating this day
Jennings River Discharge	EFF-001A Comp	Turn on Composite sampler	W		ON	AM /PM	CompTemp 3.1
Jennings River Discharge	EFF-001A Comp	Chloride	W	RT	0815 ~~0820~~	AM /PM	CompTemp ___
Jennings River Discharge	EFF-001A Comp	Monthly Total Metals	W	RT	~~0820~~	AM /PM	CompTemp ___

Weather:

Notes: Ponds are being collected by Ops

Sampled by: CR + MB **Date:** 1-9-13 **Time:** 0815 **AM / PM**

Relinquished by: M. L. B. **Date:** 1-9-13 **Time:** 09:50 **AM / PM**

Received by: R. Stoma **Date:** 1-9-13 **Time:** 09:50 **AM / PM**

NOTE: ALL COMPOSITE SAMPLES ARE FOR THE PREVIOUS 24 HOURS

ALL required samples have been collected and VISUALLY verified _____
Grade III Operator

* **Source** W = Wastewater

* **Reason** RT = Routine RP = Repeat IV = Investigative

CITY OF MODESTO - JENNINGS

7007 JENNINGS ROAD

MODESTO, CALIFORNIA 95358

PHONE: (209) 538 - 3256 FAX: (209) 538 - 4220

LAB: City of Modesto W.Q.C. Lab **DATE:** 1/9/2013

SAMPLER: **AREA:** Jennings

System #	SITE ID	ANALYSIS	SC	RN	TIME	AM / PM	COMMENT
Jennings River Discharge	EFF-001A Comp	Monthly Total Metals	W	RT			CompTemp ___
Jennings River Discharge	EFF-001A Comp	Hardness (as CaCO3)	W	RT	0815 0820	AM /PM	CompTemp ___
Jennings River Discharge	EFF-001A Comp	Total Organic Carbon	W	RT	0820	AM /PM	CompTemp ___
Jennings River Discharge	EFF-001A Comp	BOD, TSS	W	RT	0820	AM /PM	CompTemp ___
Jennings River Discharge	EFF-001A Comp	Phosphorus-T as P	W	RT	0820	AM /PM	CompTemp ___
Jennings River Discharge	EFF-001A Comp	Total Dissolved Solids	W	RT	0820	AM /PM	CompTemp ___
Jennings River Discharge	EFF-001A Comp	Conductivity	W	RT	0820	AM /PM	CompTemp ___
Jennings River Discharge	EFF-001A Grab	Bromodichloromethane	W	RT	0820	AM /PM	155354
Jennings River Discharge	EFF-001A Grab	Carbon Tetrachloride	W	RT		AM /PM	155354
Jennings River Discharge	EFF-001A Grab	Dibromochloromethane	W	RT		AM /PM	155354

Weather:

CITY OF MODESTO
WATER QUALITY CONTROL
JAN 09 2013
RECEIVING TEMPERATURE
5°C

Notes:

Sampled by: CR + UB **Date:** 1-9-13 **Time:** 0815 **AM / PM**

Relinquished by: [illegible] **Date:** 1-9-13 **Time:** 09:50 **AM / PM**

Received by: R. Ferro **Date:** 1-9-13 **Time:** 09:50 **AM / PM**

NOTE: ALL COMPOSITE SAMPLES ARE FOR THE PREVIOUS 24 HOURS

ALL required samples have been collected and VISUALLY verified _____
Grade III Operator

*** Source** W = Wastewater

*** Reason** RT = Routine RP = Repeat IV = Investigative

CITY OF MODESTO - JENNINGS

7007 JENNINGS ROAD

MODESTO, CALIFORNIA 95358

PHONE: (209) 538 - 3256 FAX: (209) 538 - 4220

LAB: City of Modesto W.Q.C. Lab **DATE:** 1/9/2013

SAMPLER: **AREA:** Jennings

System #	SITE ID	ANALYSIS	SC	RN	TIME	AM / PM	COMMENT	LH
Jennings River Discharge	EFF-001A Grab	MPN Total Coliform	W	RT	0817	AM /PM		
Jennings River Discharge	EFF-001A Grab	Mercury, Total	W	RT	0820	AM /PM		155354
Jennings River Discharge	EFF-001A Grab	Diazinon	W	RT		AM /PM		155356
Jennings River Discharge	EFF-001A Grab	Nitrate/Nitrite_Wastewater	W	RT		AM /PM		
Jennings River Discharge	EFF-001A Grab	Mercury, Methyl	W	RT		AM /PM		155354
Jennings River Discharge	EFF-001A Grab	Chlorpyrifos (Dursban)	W	RT		AM /PM		155356

CITY OF MODESTO
WATER QUALITY CONTROL

JAN 09 2013

RECEIVING TEMPERATURE
3°C

Weather:

Notes:

Sampled by: CR + MB **Date:** 1-9-13 **Time:** 0815 **AM / PM**

Relinquished by: [illegible] **Date:** 1-9-13 **Time:** 09:58 **AM / PM**

Received by: R. Romo **Date:** 1-9-13 **Time:** 09:50 **AM / PM**

NOTE: ALL COMPOSITE SAMPLES ARE FOR THE PREVIOUS 24 HOURS

ALL required samples have been collected and VISUALLY verified _____
Grade III Operator

* **Source** W = Wastewater

* **Reason** RT = Routine RP = Repeat IV = Investigative

Appendix H – Summary of Water Quality Analyses

Chapter 1 Existing Water Quality Analysis

The proposal to add NVRRWP recycled water to the DMC involves first combining the treated tertiary effluent from Modesto and Turlock and then adding the recycled water to either the PID Main Canal or directly to the DMC. Flow-weighted average concentrations of constituents of interest were calculated from the available water quality data from Modesto and Turlock. When the data set indicated that laboratory analysis for a particular constituent resulted in a non-detect, the concentration of that constituent was conservatively assumed to be equal to the reported method detection limit. The base assumptions regarding recycled water flows and three alternatives warranting water quality analyses are presented below. Alternatives 2a and 2b are similar with respect to institutional arrangements but different in the ratio of fresh versus recycled water, to account for the different geographic input of NVRRWP recycled water in the system.

- Recycled Water Quality: The average water quality of the NVRRWP flows was calculated using the available water quality information and the estimated future total flows in 2045 (build-out) (52.7 MGD total – 27.3 MGD from Modesto, 25.4 MGD from Turlock). The flow rate of 52.7 MGD in 2045 corresponds to 59,000 acre-feet/year (AFY) or 82 cubic feet per second (cfs).
- Alternative 1: Discharge recycled water directly to the DMC: Under this alternative, the NVRRWP recycled water would be piped directly to the DMC and thus comparison of recycled water quality is to the Table 5 standards and the blend of the recycled water and the DMC water to Table 4a standards. For the purposes of this comparison, it was assumed that the recycled water flow is 52.7 MGD and that flow in the DMC is 582 MGD (900 cfs). This DMC flow roughly corresponds to the 10th percentile flow rate for the Tracy Pumping Plant, as reported to CDEC, and as such represents a conservatively large amount of recycled water (9%) as a percentage of the total DMC flow.
- Alternative 2a: Blend recycled water with San Joaquin River water in PID Main Canal and discharge blended water to the DMC: This blend represents the scenario in which the NVRRWP recycled water is conveyed through the PID Main canal to the DMC. It was assumed that flow in the DMC is 582 MGD (900 cfs - see discussion above), flow in the PID Main Canal from the San Joaquin River is 96.0 MGD (150 cfs), and total recycled water flow is 52.7 MGD (82 cfs). This flow weighting contains a conservatively large amount of San Joaquin River water in the blend with recycled water compared to Alternative 2b, described below, and represents NVRRWP flow entering the PID Main Canal at the upstream end near the San Joaquin River. It also represents a conservatively large amount of San Joaquin River water entering the DMC (150 cfs River water + 82 cfs NVRRWP recycled water).
- Alternative 2b: Blend recycled water with San Joaquin River water in PID Main Canal and discharge blended water to the DMC: This blend is the same as Alternative 2a, described above, except that the flow in the PID Main Canal from the San Joaquin River is much lower at 22.6 MGD (35 cfs). This flow weighting contains a conservatively large amount of recycled water, representing NVRRWP flow entering the PID canal downstream of most irrigation withdrawals.

In all cases, complete blending/mixing was assumed. The nomenclature of “Alternative 1” and “Alternative 2” is used for ease of discussion and is not intended to convey that these are the only alternatives worthy of consideration at this junction. Currently, there is a third alternative of using a pipeline to convey recycled water to the Del Puerto Water District. In that case, the water quality

delivered would be the same as the water quality delivered under Alternative 1, and thus no further analysis is provided here.

1.1 Discussion of Individual Constituents

For the constituents listed in Tables 4a and 5 of the Pump-in Plan and for which data were available, sodium is expected to be present in any mixture of recycled water, San Joaquin River water, and DMC water at levels that are expected to exceed water quality standards. Nitrate and/or nitrate + nitrite would exceed standards for Alternatives 2a and 2b.

This section provides detailed information regarding water quality constituents that are listed in Table 4a of the Pump-in Plan (arsenic, boron, nitrates, selenium, conductance, sulfates, and TDS), as well as additional parameters of interest (sodium, bacteria, and chronic toxicity). This section also provides water quality analyses of the constituents for the individual alternatives.

1.1.1 Total Dissolved Solids (TDS) / Electrical Conductivity

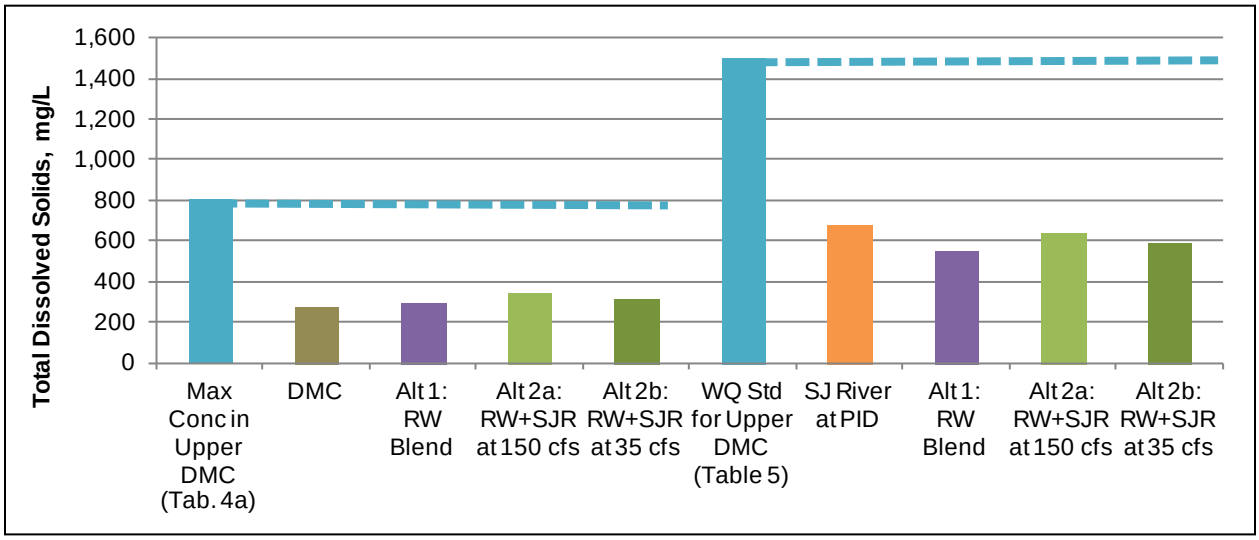
Total Dissolved Solids (TDS) is a measure of the combined content of all inorganic and organic substances contained in a liquid in: molecular, ionized or micro-granular (<2 micrometers) suspended form. In surface water and groundwater, the most common constituents of TDS are calcium, phosphates, nitrates, sodium, potassium and chloride. TDS can be taken as a field measurement by using an electrical conductivity meter and applying an appropriate conversion factor. Where necessary, the conversion factor listed on page 12 of the Pump-in Plan was used for the conductivity data from DMC:

$$TDS\ (mg/L) = Electrical\ Conductivity\ (\mu S/cm) \times 0.618\ 16$$

Alternative 1: Discharge recycled water directly to the DMC: As shown in Figure 4-2 below, adding the recycled water to the DMC (average TDS of 275 mg/L) has the potential to raise the TDS in the DMC slightly, but to a level (298) mg/L) that is significantly below the 800 mg/L threshold established in Table 4a of the Pump-in Plan. The average TDS in the recycled water (551 mg/L) is significantly lower than the TDS standards in Table 5 of the Pump-in Plan (1,500 mg/L).

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: Adding a blend of recycled water and river water to the DMC has the potential to slightly raise TDS in the DMC, but to a level (634-589 mg/L) significantly below the Table 4a threshold of800 mg/L. At an average of 679 mg/L, TDS in the San Joaquin River near Patterson is similar to but slightly higher than the TDS of the recycled water and still lower than the Table 5 threshold of 1,500 mg/L.

Figure 1-1: Comparison Chart for Total Dissolved Solids



1.1.2 Sodium

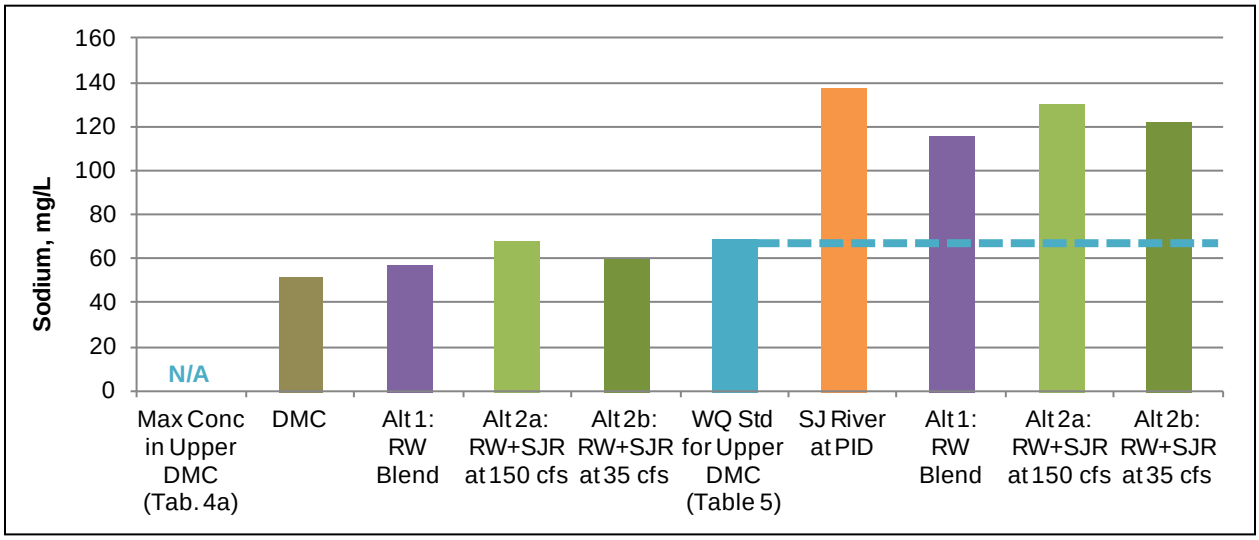
Sodium is of particular interest to agricultural users of DMC water due to the importance of managing and minimizing salt loads and salt accumulation in soils respectively to the health of plants and biota. The acceptance criteria of 69 mg/L listed in Table 5 of the Pump-in Plan is based on a water quality standard for agricultural irrigation. Figure XX shows the results of the water quality analysis for sodium for each of the three alternatives.

> Alternative 1: Discharge recycled water directly to the DMC: As shown in Figure XX below, calculated average sodium concentration (116 mg/L) in the recycled water is higher than the standard for sodium (69 mg/L) in Table 5 of the Pump-in Plan.
>
> Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: The calculated average sodium concentrantion in the San Joaquin River near Patters (taken to represent water quality in the PID canals) is, at 138 mg/L, even higher thant he calculated average sodium concentration (116 mg/L) in the recycled water.

Table 4a of the Pump-in Plan does not include a water quality standard for maximum sodium levels in the DMC, but the average sodium concentration in the DMC is 51 mg/L. After blending the recycled water of the recycled water plus the San Joaquin / PID canal water into the DMC, the sodium level is expected to be slightly lower than the standard of 69 mg/L in Table 5 of the Pump-in Plan.

Reducing the sodium concentration in the recycled water would involve significant and costly changes to the treatment facilities at the Modesto WQCF and Turlock RWQCF.

Figure 1-2: Comparison Chart for Sodium



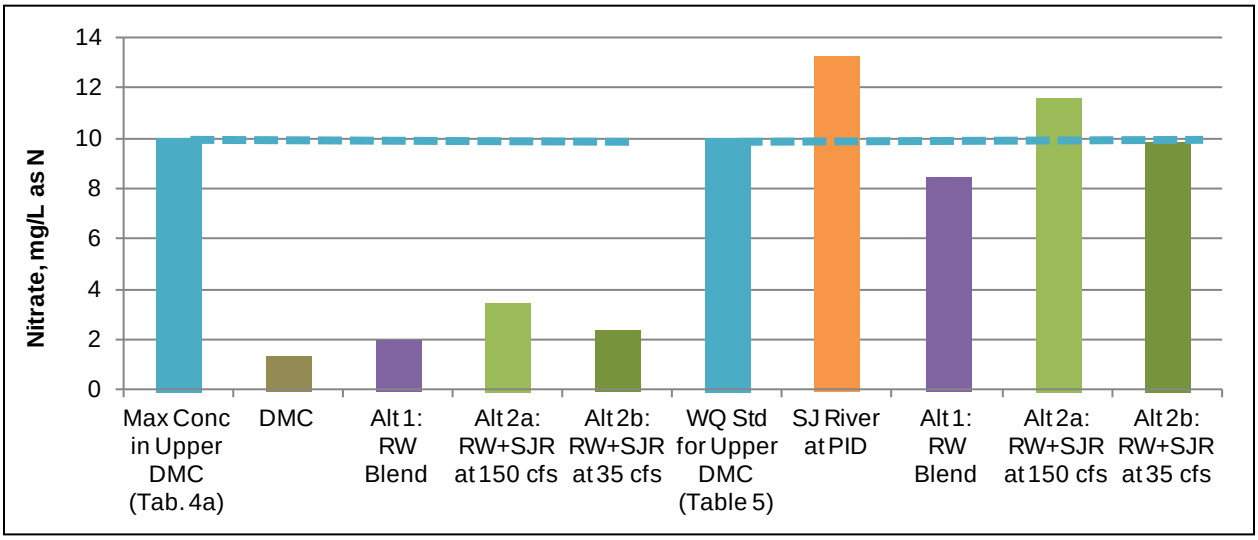
1.1.3 Nitrate and Nitrite

Relative to surface water, the influent to wastewater treatment plants contains highs levels of ammonia. Wastewater treatment plants nitrify (convert ammonia to nitrite and then to nitrate) and denitrify (reduce nitrate to nitrogen gas) to varying degrees based on treatment processes employed. Modesto's tertiary train includes full nitrification and denitrification, while Turlock's does not. Turlock's process includes nearly complete nitrification, resulting in low levels of ammonia and nitrite.

Figure XX shows the results of the water quality analysis for nitrate for each of the tree alternatives.

> Alternative 1: Discharge recycled water directly to the DMC: Based on the available water quality data and the expected 2045 ration of Modesto to Turlock tertiary effluent, the recycled water has an expected average nitrate concentration of 8.4 mg/L nitrate as N. Blending the recycled water with the DMC water results in a nitrate concentration of 2.0 mg/L. As the Table 4a standard and the Table 5 standard in the Pump-in Plan for nitrate are both 10 mg/L, "Alternative 1" (directly piping recycled water to the DMC), is consistent with the water quality standards of the Pump-in Plan.
>
> With an average concentration of just 0.1 mg/L nitrite, the recycled water is also below the Table 4a and Table 5 criteria for nitrite + nitrate (sum as N). See Appendix XX for the water quality standards and Appendix XX for the calculated nitrite + nitrate concentrations.
>
> Alternative 2: Blend recycled water with SJR water in PID canal and discharge blended water to the DMC: The average nitrate concentration is the San Joaquin River at Patterson is 13.3 mg/L. However, blending with DMC water reduces the nitrate concentration to levels (2.3 – 3.5 mg/L) well below the Table 4a and Table 5 standard of 10 mg/L. When the recyeld water and the San Joaquin River water are blended using the flow assumptions described above for alternative 2a (150 cfs in the PID canal), the resulting conrentration of 11.6 mg/L is above the standards of 10 mg/L due to the large concentration of San Joaquin River water. For Alternative 2b (35 cfs in the PID Main Canal), the resulting concentration of 9.9 mg/L is close to the standards in Table 4a and Table 5 of the Pump-in Plan.

Figure 1-3: Comparison Chart of Nitrate



1.1.4 Selenium

The acceptance criteria in Table 4a and 5 of the Pump-in Plan list a threshold of 2µg/L selenium based on the standard for Grasslands water supply channels. Selenium is often present at concentrations close the method detection limit and / or reporting limit. Making the average values in Turlock and Modesto effluent, the San Joaquin River, and the DMC potentially dependent on the method used. Therefore, this section contains additional information about the detection limits and reporting limits about each data set, where this information is known.

Turlock's NPDES permit contains an average monthly effluent limitation for selenium of 3.7 µg/L and requires monthly monitoring. Samples are analyzed using EPA methods 200.8 (ICP-MS). The selenium concentrations in Turlock's effluent data set (N=33), which has an MDL of 0.06 µg/L, were all lower than the reporting limit (i.e., detected but not quantified, or DNQ). The reporting limit ranged from 0.5 – 1 µg/L, and the average concentration was 0.26 µg/L.

By contrast, Modesto has no NPDES permit limit for selenium and has not discharges tertiary effluent to the receiving water, so the data set is more limited. For Modesto, three samples of tertiary effluent were available selenium detected in all samples, at an average concentration of 1.2 µg/L, with only 11 of 916 samples below the reporting limit.

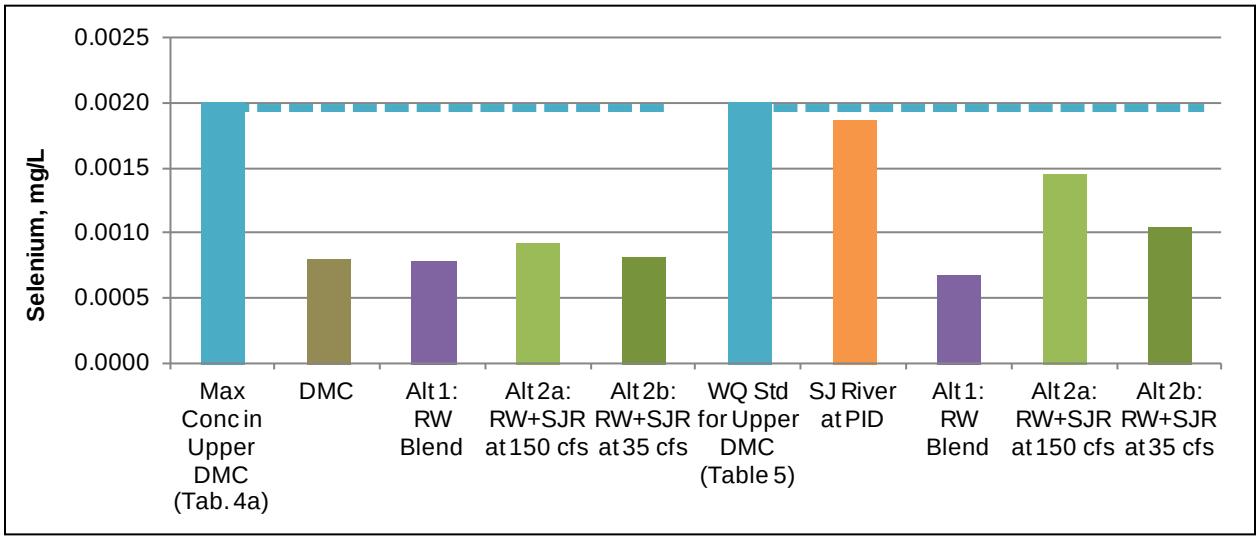
The DMC data set from the USBR Environmental Monitoring Database contains sample results with a reporting limit of 0.4 µg/L, 1.0 µg/L, and 2.0 µg/L. The database does not include information about a separate MDL, but most results (188 of 268) were below the respective reporting limit. In these cases, the average value is based on the reporting limit (not ½ the reporting limit); therefore, the calculated average value of 0.8 µg/L used for calculating blended concentration is conservatively high.

Figure XX shows the results of the water quality analysis for selenium for each of the three alternatives.

> Alternative 1: Discharge recycled water directly to the DMC: As shown in Figure 4-6 below, average selenium in the recycled water (0.0007 mg/L) is significantly lower than the selenium standard in Table 4a (0.002 mg/L). The DMC has a comparable concentration of selenium (0.0008 mg/L) to the recycled water, so adding recycled water results in no significant change; the DMC will remain well below the 0.002 mg/L threshold established in Table 4a and Table 5 of the Pump-in Plan.

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: At an average of 0.0019 mg/L, selenium in the San Joaquin River near Patterson is higher than either the recycled water or the DMC. However, blending with DMC water reduces the selenium concentration to well below the standard of 0.002 mg/L in Table 4a of the Pump-in Plan. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulting selenium concentrations of 0.0015 mg/L for Alternative 2a and 0.0010 mg/L for Alternative 2b are below the criteria in Table 5 of the Pump-in Plan.

Figure 1-4: Comparison Chart of Selenium



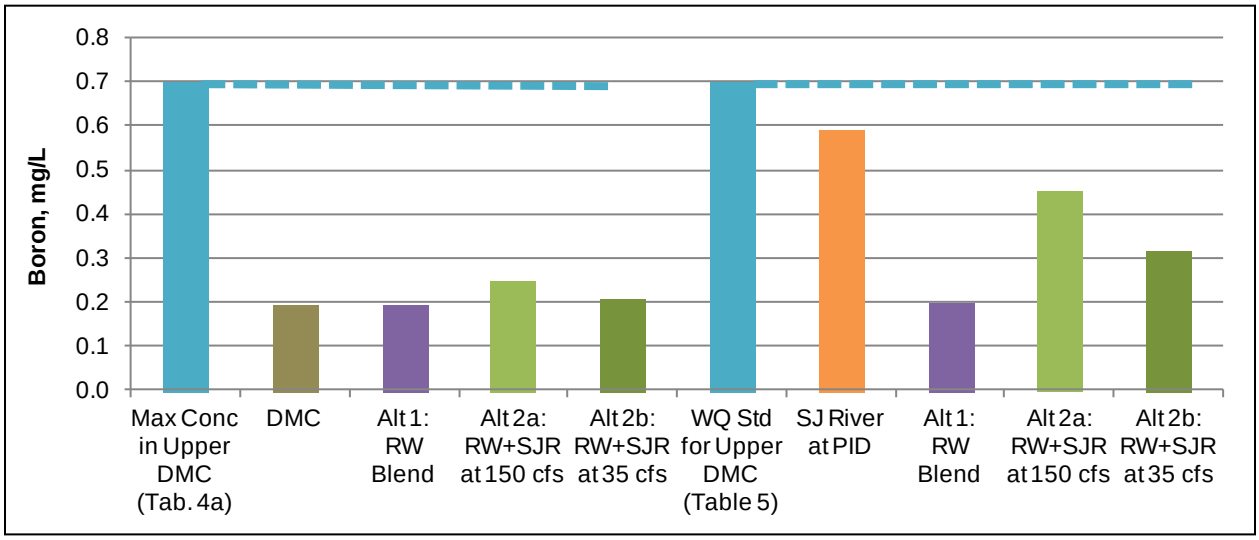
1.1.5 Boron

The acceptance criteria of 0.7 mg/L listed in Table 4a and 5 of the Pump-in Plan is based on a water quality standard for agricultural irrigation. Figure XX shows the results of the water quality analysis for boron for each of the three alternatives.

Alternative 1: Discharge recycled water directly to the DMC: As shows in the graph below, average boron in the recycled water (0.20 mg/L) is significantly lower that the boron standard in Table 4a of the Pump-in Plan (0.7 mg/L). The DMC has a comparable concentration of boron (0.19 mg/L) to the recycled water, so adding recycled water result in no significant change; the DMC will remain well below the 0.7 mg/L threshold established in Table 4a and 5 of the Pump-in Plan.

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: At an average of 0.59 mg/L, boron in the San Joaquin River near Patterson is higher than either the recycled water or the DMC, and close to the Table 5 limit of 0.7 mg/L. However, blending with DMC water reduces the boron concentration to well below the standard of 0.002 mg/L in Table 4a of the Pump-in Plan. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulting boron concentrations of 0.45 mg/L for Alternative 2a and 0.32 mg/L for Alternative 2b are blow the criteria of Table 4a and 5 of the Pump-in Plan.

Figure 1-5: Comparison Chart for Boron



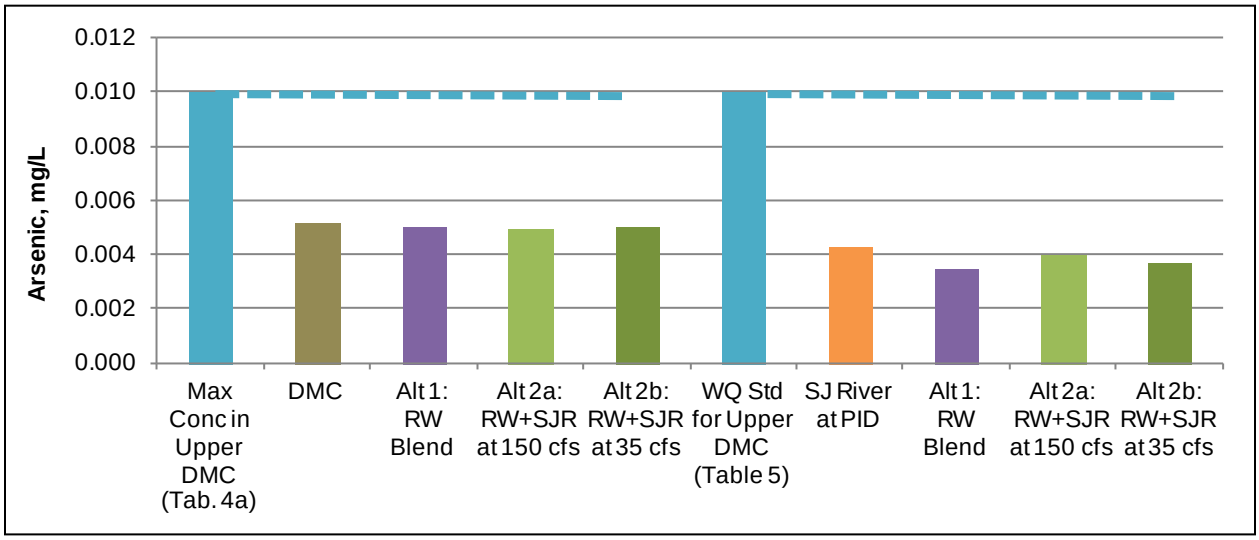
1.1.6 Metals, Arsenic, and Mercury

The acceptance criteria for arsenic and mercury listed in the Pump-in Plan are based on drinking water regulations. Figures 4-8 and 4-9 show the results of the water quality analyses for arsenic and mercury for each of the three alternatives.

Alternative 1: Discharge recycled water directly to the DMC: As shown in the graph below, average arsenic in the recycled water (0.003 mg/L) is significantly lower that the arsenic standard in Table 4a (0.01 mg/L). The DMC has a higher concentration of arsenic (0.005 mg/L) than the recycled water, so adding recycled water does not result in any degradation, and the DMC will remain well below the 0.01 mg/L threshold established in Table 4a of the Pump-in Plan.

Alternative 2: Blend recycled water with San Joaquin River water in PID canal and discharge blended water to the DMC: At an average of 0.004 mg/L, arsenic in the San Joaquin River near Patter is higher than the recycled water concentration but lower than the DMC concentrations, but below the Table 4a limit of 0.01 mg/L. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulted arsenic concentration of 0.004 mg/L is also below the Table 4a and Table 5 criteria. Blending with DMC water increases the arsenic concentration to 0.005 mg/L but the mixture remains well below the standard of 0.010 mg/L in Table 4a and Table 5 of the Pump-in Plan.

Figure 1-6: Comparison Chart for Arsenic

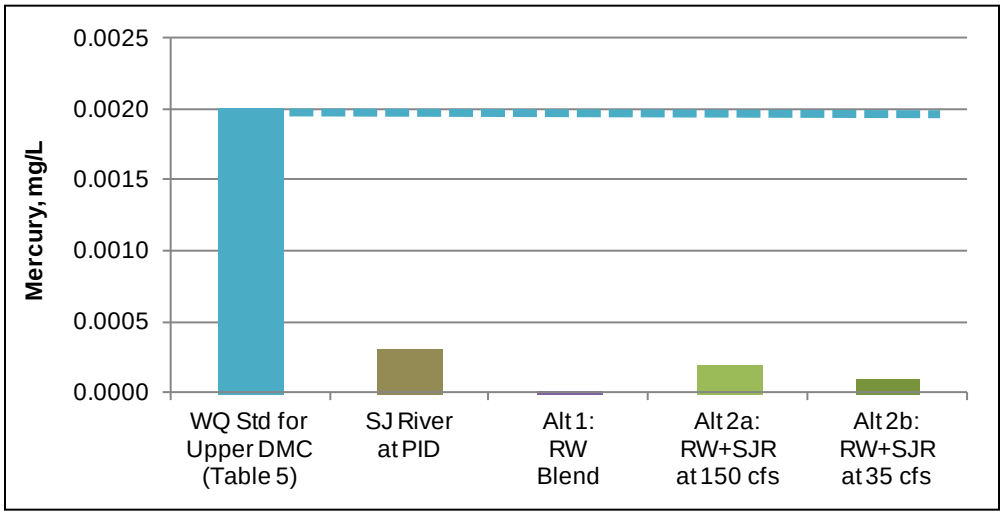


Unlike the constituents discussed above, mercury appears only in Table 5, and not Table 4a, of the Pump-in Plan. Therefore, the existing concentration in the DMC is not addressed in this study; only the mixture of recycled water and San Joaquin River water is relevant for comparison with Table 5 of the Pump-in Plan.

Alternative 1: Discharge recycled water directly to the DMC: As shown in the graph below, average mercury in the recycled water (2 × 10-6 mg/L) is extremely low compared to the mercury standard in Table 5 of the Pump-in Plan (0.002 mg/L).

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: At an average of 0.0003 mg/L, mercury in the San Joaquin River near Patterson is higher than the recycled water concentration, but still well below the Table 5 limit of 0.002 mg/L. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulting mercury concentrations of 0.0002 mg/L for Alternative 2a and 0.00009 mg/L for Alternative 2b are also well below the criteria in Table 5 of the Pump-in Plan.

Figure 1-7: Comparison Chart for Mercury



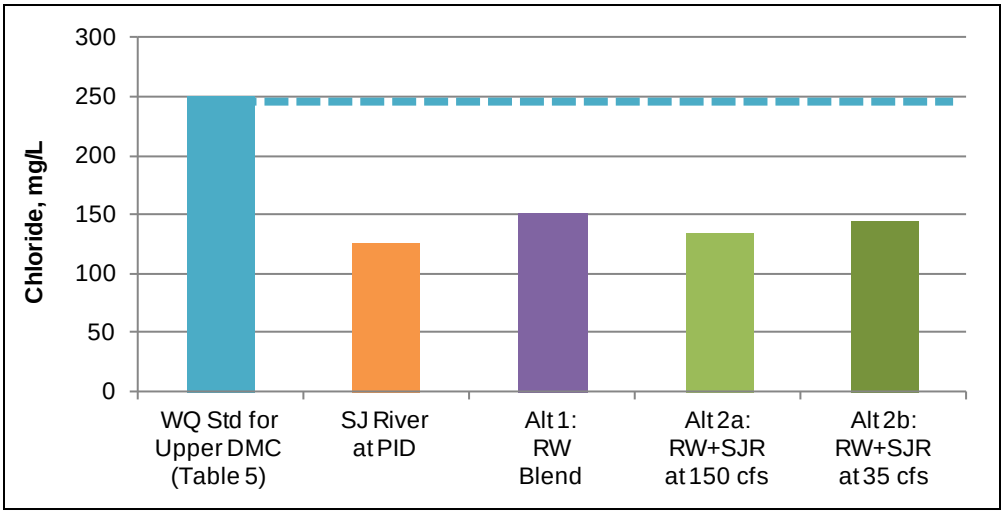
1.1.7 Chloride

Like mercury, chloride appears only in Table 5, and not Table 4a, of the Pump-in Plan. Therefore, the existing concentration in the DMC is not addressed in this study; only the mixture of recycled water and San Joaquin River water is relevant for comparison with Table 5 of the Pump-in Plan. Figure 4-XX shows the results of the water quality analysis for chlorides for each of the three alternatives.

Alternative 1: Discharge recycled water directly to the DMC: As shown in the graph below, average chloride in the recycled water (152 ^{mg}/L) is well below the chloride standard in Table 5 (250 mg/L).

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: At an average of 126 mg/L, chloride in the San Joaquin River near Patterson is comparable to the concentration in recycled water. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulting chloride concentrations of 135 mg/L for Alternative 2a and 144 mg/L for Alternative 2b are still well below the Table 5 criteria of 250 mg/L.

Figure 1-8: Comparison Chart for Chloride



1.1.8 Organic Chemicals Including Pesticides

The acceptance criteria listed in Table 5 of the Pump-in Plan are based on drinking water quality standards, with the exception of chlorpyrifos and diazinon. The for these two constituents, TMDLs and Basin Plan amendments have been developed for the San Joaquin River, which form the basis for the water quality standards in Table 5 of the Pump-in Plan. Both Modesto and Turlock have specific effluent monitoring requirements for chlorpyrifos and diazinon in their NPDES permits.

Of the 20 organic chemicals listed in Table 5, effluent data were only available for eight; all of these sample results were "non-detects." For six of these eight organic chemicals (all except chlorpyrifos and diazinon), effluent data were available from Turlock only, and were assumed to be representative of NVRRWP recycled water. For the constituents with data available from Turlock's effluent, all of the method detection limits were equal to or less than the detection limit for reporting required by Table 5 of the Pump-in Plan. Modesto's data for chlorpyrifos and diazinon did not list an MDL.

A few of the organic chemicals listed in Table 5 of the Pump-in Plan were detected in the San Joaquin River near Patterson. Of the 20 organic chemicals listed in Table 5, San Joaquin River water quality data were available for twelve. Most of these sample results were "non-detects," with the exception of chlorpyrifos, diazinon, methoxychlor, and simazine. All were reported at levels below the relevant standards in Table 5. For the constituents with data available, the method detection limits were equal to or less than the detection limit for reporting required by Table 5, where listed.

1.1.9 Bacteria

The Pump-in Plan does not address bacteria or include a bacteria limit. However, as stated above, California Title 22 regulations for tertiary recycled water require that the 7-day median concentration of total coliform bacteria measured in the disinfected effluent does not exceed 2.2 most probable number (MPN) per 100 mL, 23 MPN/100 mL more than once in any 30-day period, and 240 MPN/100 mL in any single sample. These same requirements are also specifically listed in the NPDES permits for both Modesto and Turlock, and are applicable for discharges of tertiary effluent. The limited data available for the San Joaquin River and DMC indicate that they do not comply with the Title 22 standards listed above. Therefore, the addition of recycled water is not expected to result in any bacterial degradation of water quality.

1.1.10 Chronic Toxicity

Both Modesto and Turlock conduct whole effluent chronic toxicity monitoring as a requirement of their NPDES permits. Compliance with the narrative prohibition against chronic toxicity in the effluent discharge is achieved by conducting the required monitoring; if chronic toxicity is observed, the discharger must conduct accelerated monitoring and identify corrective actions to reduce or eliminate effluent toxicity. Both NPDES Permits identify a trigger of 1 chronic toxicity unit (1 TUc) as the threshold for triggering accelerated monitoring. Modesto and Turlock will continue to comply with the narrative toxicity objective, as required.

1.1.11 Conclusions

Tertiary treated recycled water from both Turlock and Modesto meets the stringent requirements established in Title 22 of the California Code of Regulations, and is suitable for a wide variety of non-potables uses including all types of irrigation, toilet flushing, and industrial processes.

The recycled water quality is typically better than San Joaquin River water quality, since the river carries a high salt load at certain times of year and is listed as an impaired water body for boron, selenium, electrical conductivity, mercury, and several pesticides. On average, the recycled water contains lower concentrations of these chemicals than those currently found in the river. Compared to the river, the recycled water also contains lower concentrations of metals such as cadmium, chromium, and nickel, and lower concentrations of nitrates. In fact, if NVRRWP water is blended with San Joaquin River water in

the PID Main Canal prior to entering the DMC, described as Alternative 2a or 2b in this chapter, the blended water is expected to exceed the DMC water quality standard for acceptance of 10 mg/L. This is because the San Joaquin River already exceeds the standard.

Recycled water, when blended with water from the DMC, is expected to comply with the water quality standards for the Upper DMC. With a few exceptions, the recycled water quality also complies with the Reclamation's current water quality standards for acceptance into the DMC. Both sets of standards are in place to regulate the practice of pumping well water into the DMC under Warren Act Contracts. Of the 48 constituents covered by these standards, only the recycled water sodium content is expected to exceed the standards for acceptance into the DMC. The San Joaquin River also exceeds the 69 mg/L standard for sodium, so any blend of NVRRWP and San Joaquin River water would also exceed the standard.

Selenium, a constituent of concern for recycled water use at wildlife refuges, is present in NVRRWP recycled water at a concentration comparable to the existing DMC water quality (0.8 µg/L). The same is true for boron and arsenic. Recycled water would be delivered to the refuges after mixing with the existing water in the DMC. Based on the results presented in this chapter, the project is not expected to produce a significant change in water quality to downstream DMC users.

Appendix I – Summary of Existing Data from NVRRWP, San Joaquin River, and DMC

Summary of Effluent Water Quality Data from the North Valley Regional Recycled Water Program, San Joaquin River (SJR), and Delta Mendota Canal (DMC) and Comparison to USBR Water Quality Standards forthe Upper Delta-Mendota Canal

		Water Quality Data			Relevant Standards		Alternative 1: Discharge Recycled Water directly to the DMC			Alternative 2a: Blend recycled water with 150 cfs SJR water in PID Canal and discharge blended water to the DMC				Alternative 2b: Blend recycled water with 35 cfs SJR water in PID Canal and discharge blended water to the DMC			
Constituent	**Units**	**Recycled Water Quality[a]**	**San Joaquin River Quality Near Patterson[b]**	**DMC Water Quality[c]**	**Table 4a: Maximum Allowable Concentration in the Upper DMC[d]**	**Table 5: Water Quality Standard for Acceptance of Groundwater into Upper DMC[e]**	**Blended water quality in DMC after recycled water is blended with DMC[f]**	**Does blended water comply with Table 4a?**	**Does recycled water comply with Table 5?**	**Blended water quality in DMC after the recycled water/SJR mixture is blended with DMC[f]**	**Does blended water comply with Table 4a?**	**Blended water quality in PID after recycled water is blended with San Joaquin river water in PID Canal[g]**	**Does recycled water/SJR blend comply with Table 5?**	**Blended water quality in DMC after the recycled water/SJR mixture is blended with DMC[f]**	**Does blended water comply with Table 4a?**	**Blended water quality in PID after recycled water is blended with San Joaquin river water in PID Canal[g]**	**Does recycled water/SJR blend comply with Table 5?**
Primary																	
Aluminum	mg/L	0.09	-			1			Yes			-	Unknown			-	Unknown
Antimony	mg/L	0.0006	0.0005			0.006			Yes			0.0005	Yes			0.0006	Yes
Arsenic	mg/L	0.003	0.004	0.005	0.01	0.01	0.005	Yes	Yes	0.005	Yes	0.004	Yes	0.005	Yes	0.004	Yes
Barium	mg/L	0.08	-			1			Yes			-	Unknown			-	Unknown
Beryllium	mg/L	0.00002	0.00002			0.004			Yes			0.00002	Yes			0.00002	Yes
Boron	mg/L	0.20	0.59	0.19	0.70	0.70	0.19	Yes	Yes	0.25	Yes	0.45	Yes	0.21	Yes	0.32	Yes
Cadmium	mg/L	0.00004	0.00003			0.005			Yes			0.00004	Yes			0.00004	Yes
Chromium	mg/L	0.001	0.003			0.05			Yes			0.002	Yes			0.001	Yes
Lead	mg/L	0.0002	0.001			0.02			Yes			0.0008	Yes			0.0004	Yes
Mercury	mg/L	2E-06	0.0003			0.002			Yes			0.00020	Yes			0.00009	Yes
Nickel	mg/L	0.002	0.006			0.1			Yes			0.004	Yes			0.003	Yes
Nitrate (as N)[i]	mg/L	8.4	13.3	1.4	10	10	2.0	Yes	Yes	3.5	Yes	11.6	No	2.3	Yes	9.9	Yes
Nitrate + Nitrite (sum as N)	mg/L	8.6	13.5			10			Yes			11.8	No			10.1	No
Nitrite (as N)	mg/L	0.2	-			1			Yes			-	Unknown			-	Unknown
Selenium	mg/L	0.0007	0.0019	0.0008	0.002	0.002	0.0008	Yes	Yes	0.0009	Yes	0.0015	Yes	0.0008	Yes	0.0010	Yes
Thallium	mg/L	0.0005	0.0005			0.002			Yes			0.0005	Yes			0.0005	Yes
Secondary																	
Chloride	mg/L	152	126			250			Yes			135	Yes			144	Yes
Copper	mg/L	0.003	0.003			1			Yes			0.0029	Yes			0.0029	Yes
Iron	mg/L	0.1	-			0.3			Yes			-	Unknown			-	Unknown
Manganese	mg/L	0.02	-			0.05			Yes			-	Unknown			-	Unknown
Molybdenum	mg/L	0.01	0.004			0.01			Yes			0.0051	Yes			0.0059	Yes
Silver	mg/L	0.001	0.0006			0.1			Yes			0.001	Yes			0.001	Yes
Sodium	mg/L	116	138	51		69	57		No	68	- N/A -	130	No	60	- N/A -	122	No
Specific Conductance	K¹/Ôm	945	1,035	419	1,200	2,200	463	Yes	Yes	538	Yes	1,003	Yes	482	Yes	972	Yes
Sulfate	mg/L	61	162	40	250	250	42	Yes	Yes	57	Yes	126	Yes	46	Yes	91	Yes
Total Dissolved Solids	mg/L	551	679	275	800	1,500	298	Yes	Yes	348	Yes	634	Yes	311	Yes	589	Yes
Zinc	mg/L	0.05	0.005			5			Yes			0.020	Yes			0.035	Yes
Radioactivity		0.0															
Gross Alpha	pCi/L	-	-			15			Unknown			-	Unknown			-	Unknown

Constituent	Units	Water Quality Data			Relevant Standards		Alternative 1: Discharge Recycled Water directly to the DMC			Alternative 2a: Blend recycled water with 150 cfs SJR water in PID Canal and discharge blended water to the DMC				Alternative 2b: Blend recycled water with 35 cfs SJR water in PID Canal and discharge blended water to the DMC			
		Recycled Water Quality[a]	San Joaquin River Quality Near Patterson[b]	DMC Water Quality[c]	Table 4a: Maximum Allowable Concentration in the Upper DMC[d]	Table 5: Water Quality Standard for Acceptance of Groundwater into Upper DMC[e]	Blended water quality in DMC after recycled water is blended with DMC[f]	Does blended water comply with Table 4a?	Does recycled water comply with Table 5?	Blended water quality in DMC after the recycled water/SJR mixture is blended with DMC[f]	Does blended water comply with Table 4a?	Blended water quality in PID after recycled water is blended with San Joaquin river water in PID Canal[g]	Does recycled water/SJR blend comply with Table 5?	Blended water quality in DMC after the recycled water/SJR mixture is blended with DMC[f]	Does blended water comply with Table 4a?	Blended water quality in PID after recycled water is blended with San Joaquin river water in PID Canal[g]	Does recycled water/SJR blend comply with Table 5?
Organic Chemicals		0.0															
Atrazine	Kr/L	-	0.070			1			Unknown			-	Unknown			-	Unknown
Bentazon	Kr/L	-	-			18			Unknown			-	Unknown			-	Unknown
Carbofuran	Kr/L	-	0.050			18			Unknown			-	Unknown			-	Unknown
Chlordane	Kr/L	0.10	0.013			0.1			Yes			0.04	Yes			0.07	Yes
Chlorpyrifos	Kr/L	0.02	0.006			0.025			Yes			0.01	Yes			0.02	Yes
2,4-D	Kr/L	-	-			70			Unknown			-	Unknown			-	Unknown
Diazinon	Kr/L	0.02	0.004			0.16			Yes			0.01	Yes			0.02	Yes
Dibromochloropane (DBCP)	Kr/L	-	-			0.2			Unknown			-	Unknown			-	Unknown
Endrin	Kr/L	0.01	0.007			2			Yes			0.008	Yes			0.009	Yes
Ethylene Dibromide (EDB)	Kg/L	-	-			0.05			Unknown			-	Unknown			-	Unknown
Glyphosate	Kg/L	-	-			700			Unknown			-	Unknown			-	Unknown
Heptachlor	Kr/L	0.01	0.008			0.01			Yes			0.01	Yes			0.01	Yes
Heptachlor Epoxide	Kr/L	0.01	0.007			0.01			Yes			0.008	Yes			0.009	Yes
Lindane	Kr/L	0.02	0.005			0.2			Yes			0.010	Yes			0.015	Yes
Methoxychlor	Kr/L	-	0.008			30			Unknown			-	Unknown			-	Unknown
Molinate	Kg/L	-	-			20			Unknown			-	Unknown			-	Unknown
2, 4, 5-TP (Silvex)	Kr/L	-	-			50			Unknown			-	Unknown			-	Unknown
Simazine	Kr/L	-	0.1			4			Unknown			-	Unknown			-	Unknown
Thiobencarb	Kg/L	-	-			70			Unknown			-	Unknown			-	Unknown
Toxaphene	Kr/L	0.5	0.4			3			Yes			0.4	Yes			0.5	Yes

Notes

(a) Projected flows for Modesto and Turlock total 52.7 MGD in 2045 (27.3 MGD Modesto, 25.4 MGD Turlock). For **Modesto,** Tertiary effluent data from July 2011 - Dec 2012 provided by City of Modesto via email to RMC, April 2013, as files *Tertiary Update 9_9_11 update.xls* and *Tertiary Update 4_1_13.xls.* Nitrogen species are included from "Production" samples only. For all other constituents, both "Production" and" Surveillance" sampling results are included. For **Turlock**, Effluent data over the period Apr. 2010 - Feb. 2013 are from CIWQS, http://ciwqs.waterboards.ca.gov/ciwqs/readOnly/PublicReportEsmrAtGlanceServlet?inCommand=reset. A few constituents (e.g., Barium, Nitrite, Molybdenum, Sulfate) were not available; these are based on data provided by City of Turlock via email to RMC, July 2012, as file *Inf, Eff, R1,R2,R3,R4 NPDES data.xls*

(b) Water quality data for the San Joaquin River from CEDEN (Ceden.org) for the stations "SJR @ Patterson," covering 1995-2011, "San Joaquin River @ PID Pumps," covering 2008-2012, and CIWQS as reported by the City of Turlock at RSW-003, covering 2012-2013.

(c) Water quality data from the Delta-Mendota Canal is from CDEC at the Tracy Pumping Plant (Station ID: TRP) and DMC Headworks (Station ID: DMC), covering the period 2003-13, and from *3 stations on the Upper DMC in the* USBR Environmental Monitoring Database, covering the period 1991-2013.

(d) Source: Table 4a, "Maximum Allowable Concentration of Seven Constituents in the Upper DMC (between Jones Pumping Plant and Check 13), *2012 Delta-Mendota Canal Pump-in Program Water Quality Monitoring Plan*, USBR Mid-Pacific Region, February 6, 2012. The maximum concentration of "Nitrates

(e) Source: Table 5, "Water Quality Standards for Acceptance of Groundwater Into the Upper Delta-Mendota Canal, Jones Pumping Plant to Check 13 (O'Neill Forebay), *2012 Delta-Mendota Canal Pump-in Program Water Quality Monitoring Plan*, USBR Mid-Pacific Region, February 6, 2012. Values shown are the Maximum Contaminant Level (MCL).

(f) Blend assumes flow in the DMC is 582 MGD (900 cfs), corresponding to the 10th percentile, to show a blend that contains a conservatively large amount of effluent and SJR water.

(g) Blend assumes flow from the San Joaquin River in the Patterson Irrigation District Canal is 96.9 MGD (150 cfs), and total flow from Modesto and Turlock is 52.7 MGD (2045 condition)

(h) Blend assumes flow from the San Joaquin River in the Patterson Irrigation District Canal is 22.6 MGD (35 cfs), and total flow from Modesto and Turlock is 52.7 MGD (2045 condition)

(i) The water quality standard in (a) is given as 45 mg/L as NO_3, which is equivalent to 10 mg/L as N.

"-" Indicates that the information was not available. Blank cells are intentionally omitted.

Appendix J – Summary of Water Quality Sampling Event Results

In this Appendix, the analytical results for the samples collected on May 2, 2013 and May 9, 2013 are compared to existing water quality data. The organization of this section (by analyte) parallels the organization of Chapter 4 for ease of comparison.

Total Dissolved Solids (TDS)

Total Dissolved Solids (TDS) analytical results from CLS are similar to existing water quality data at all sampling locations.

As shown in the table below, the field duplicate Relative Percent Difference (RPD) was less than 10% on both sample dates and TDS was not detected in either equipment blank. These results of field QA/QC sampling indicate that field equipment and sampling procedures are unlikely to have significantly affected TDS results.

Table 1 TDS – Comparison of Sampling Results to Existing Water Quality Data

Sampling Location	Sample Name	Total Dissolved Solids (mg/L)			
		California Laboratory Services (CLS)		Previously Compiled Data	
		5/2/2013 [a]	5/9/2013 [a,b]	Average Concentration [c]	2045 Recycled Water [d]
China Island	RRW-1	400	350	--	--
DMC	RRW-2	240	220	275	--
PID Main Canal	RRW-3	750	700	679	--
Modesto Effluent [e]	RRW-4	--	700	522	551
Turlock Effluent	RRW-5	630	670	582	
Field Duplicate (duplicate of RRW-5)	RRW-6	630	720	--	--
Field duplicate RPD		*0%*	*7%*	--	--
Equipment Blank	RRW-7	< 10	< 10	--	--

(a) SM2540C. Method Detection Limit (MDL) = 10 mg/L; Reporting Limit = 10 mg/L.

(b) On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in this data table.

(c) Previously compiled average concentrations are discussed in Chapter 4. .

(d) Projected flow-weighted average of Turlock (48%) and Modesto (52%) effluent based on build-out conditions expected in 2045.

(e) Modesto's secondary effluent was sampled on 5/9/13. Previously compiled data is for tertiary effluent.

Specific Conductance (EC)

Specific Conductance (or electrical conductivity (EC)) analytical results from CLS are similar to existing water quality data at all sampling locations.

As shown in the table below, the field duplicate RPD was less than 10% on both sample dates and EC was very low in both equipment blank samples. These results of field QA/QC sampling indicate that field equipment and sampling procedures are unlikely to have significantly affected EC results.

Table 2 EC– Comparison of Sampling Results to Existing Water Quality Data

Sampling Location		Sample Name	Specific Conductance (µmhos/cm)			
			California Laboratory Services (CLS)		Previously Compiled Data	
			5/2/2013 [a]	5/9/2013 [a,b]	Average Concentration [c]	2045 Recycled Water [d]
	China Island	RRW-1	690	690	--	--
	DMC	RRW-2	420	410	419	--
	PID Main Canal	RRW-3	1300	1300	1035	--
	Modesto Effluent [e]	RRW-4	--	1300	973	945
	Turlock Effluent	RRW-5	1000	1200	915	
	Field Duplicate (duplicate of RRW-5)	RRW-6	980	1200	--	--
	Field duplicate RPD		*2%*	*0%*	--	--
	Equipment Blank	RRW-7	1.8	3.0	--	--

(a) EPA 120.1. Method Detection Limit (MDL) = 0.090 µmhos/cm; Reporting Limit = 1.0 µmhos/cm.

(b) On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in this data table.

(c) Previously compiled average concentrations are from the May 17, 2013 Draft Technical Memorandum, *Summary of Existing Water Quality Information.*

(d) Projected flow-weighted average of Turlock (48%) and Modesto (52%) effluent based on build-out conditions expected in 2045.

(e) Modesto's secondary effluent was sampled on 5/9/13. Previously compiled data is for tertiary effluent.

Sodium

Sodium analytical results from CLS are similar to existing water quality data at all sampling locations.

As shown in the table below, the field duplicate RPD was 0% on both sample dates and sodium concentrations were below the reporting limit for both equipment blank samples. These results of field QA/QC sampling indicate that field equipment and sampling procedures are unlikely to have significantly affected EC results.

Table 3 Sodium – Comparison of Sampling Results to Existing Water Quality Data

Sampling Location		Sample Name	Sodium (mg/L)			
			California Laboratory Services (CLS)		Previously Compiled Data	
			5/2/2013 [a]	5/9/2013 [a,b]	Average Concentration [c]	2045 Recycled Water [d]
	China Island	RRW-1	86	84	--	--
	DMC	RRW-2	49	45	51	--
	PID Main Canal	RRW-3	170	160	138	--
	Modesto Effluent [e]	RRW-4	--	190	124	116
	Turlock Effluent	RRW-5	150	180	107	
	Field Duplicate (duplicate of RRW-5)	RRW-6	150	180	--	--
	Field duplicate RPD		*0%*	*0%*	--	--
	Equipment Blank	RRW-7	J 0.42	J 0.24	--	--

J = Detected but below the Reporting Limit; therefore, result is an estimated concentration.

(a) EPA 200.7. Method Detection Limit (MDL) = 0.029 mg/L; Reporting Limit = 1.0 mg/L.

(b) On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in this data table.

(c) Previously compiled average concentrations are from the May 17, 2013 Draft Technical Memorandum, *Summary of Existing Water Quality Information.*

(d) Projected flow-weighted average of Turlock (48%) and Modesto (52%) effluent based on build-out conditions expected in 2045.

(e) Modesto's secondary effluent was sampled on 5/9/13. Previously compiled data is for tertiary effluent.

Nitrate (as NO_3)

Nitrate (as NO_3) analytical results from CLS are similar to existing water quality data at all sampling locations.

As shown in the table below, the field duplicate RPD was 0% on both sample dates and nitrate concentrations were below the reporting limit for both equipment blank samples. These results of field QA/QC sampling indicate that field equipment and sampling procedures are unlikely to have significantly affected nitrate results.

Table 4 Nitrate as NO_3– Comparison of Sampling Results to Existing Water Quality Data

Sampling Location		Sample Name	Nitrate as NO3 (mg/L)			
			California Laboratory Services (CLS)		Previously Compiled Data	
			5/2/2013 [a]	5/9/2013 [a,b]	Average Concentration [c]	2045 Recycled Water [d]
	China Island	RRW-1	6.0	5.6	--	--
	DMC	RRW-2	3.5	3.6	6.2	--
	PID Main Canal	RRW-3	14	19	59	--
	Modesto Effluent [e]	RRW-4	--	3.5	2.7	37
	Turlock Effluent	RRW-5	69	75	74	
	Field Duplicate (duplicate of RRW-5)	RRW-6	69	76	--	--
	Field duplicate RPD		*0%*	*1%*	--	--
	Equipment Blank	RRW-7	J 0.22	J 0.18	--	--

J = Detected but below the Reporting Limit; therefore, result is an estimated concentration.

(a) EPA 300.0. Method Detection Limit (MDL) = 0.053 mg/L and Reporting Limit (RL) = 0.5 mg/L except RRW-5 and RRW-6. For RRW-5 and RRW-6, MDL = 0.53 mg/L and MDL = 5 mg/L.

(b) On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in this data table.

(c) Previously compiled average concentrations are from the May 17, 2013 Draft Technical Memorandum, *Summary of Existing Water Quality Information.*

(d) Projected flow-weighted average of Turlock (48%) and Modesto (52%) effluent based on build-out conditions expected in 2045.

(e) Modesto's secondary effluent was sampled on 5/9/13. Previously compiled data is for tertiary effluent.

Nitrite (as N)

Nitrite analytical results from CLS are similar to existing water quality data at all sampling locations.

As shown in the table below, nitrate was not detected the Turlock effluent samples (RRW-5), the field blank samples (RRW-6), or the equipment blank samples (RRW-7). These results of field QA/QC sampling indicate that field equipment and sampling procedures are unlikely to have significantly affected nitrite results.

Table 5 Nitrate (as N) – Comparison of Sampling Results to Existing Water Quality Data

Sampling Location		Sample Name	Nitrite as N (mg/L)			
			California Laboratory Services (CLS)		Previously Compiled Data	
			5/2/2013 [a]	5/9/2013 [a,b]	Average Concentration [c]	2045 Recycled Water [d]
	China Island	RRW-1	J 0.020	J 0.043	--	--
	DMC	RRW-2	J 0.018	< 0.0022	--	--
	PID Main Canal	RRW-3	J 0.025	J 0.048	--	--
	Modesto Effluent [e]	RRW-4	--	J 0.240	< 0.01	0.2
	Turlock Effluent	RRW-5	< 0.0022	< 0.0022	0.4	
	Field Duplicate (duplicate of RRW-5)	RRW-6	< 0.0022	< 0.0022	--	--
	Field duplicate RPD		--	--	--	--
	Equipment Blank	RRW-7	< 0.0022	< 0.0022	--	--

(a) EPA 300.0. Method Detection Limit (MDL) = 0.0022 mg/L; Reporting Limit = 0.1 mg/L.

(b) On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in this data table.

(c) Previously compiled average concentrations are from the May 17, 2013 Draft Technical Memorandum, *Summary of Existing Water Quality Information.*

(d) Projected flow-weighted average of Turlock (48%) and Modesto (52%) effluent based on build-out conditions expected in 2045.

(e) Modesto's secondary effluent was sampled on 5/9/13. Previously compiled data is for tertiary effluent.

Selenium

Selenium analytical results from South Dakota Agricultural Laboratories are similar to existing water quality data at all sampling locations.

In the May 9, 2013 samples, selenium was not detected in the field sample (RRW-5) above the laboratory reporting limit of 0.4 µg/L while selenium was detected at a concentration of 0.521 µg/L in the field duplicate (RRW-6) and as such the RPD in this instance is greater than 26%. Because of the relatively low selenium detection limit of 0.4 µg/L and the low RPDs for other conventional constituents, this field duplicate RPD is unlikely to represent any wider data quality issues.

Selenium was not detected in the equipment blank.

Table 6 Selenium – Comparison of Sampling Results to Existing Water Quality Data

Sampling Location		Sample Name	Selenium (µg/L)			
			South Dakota Agricultural Laboratories		Previously Compiled Data	
			5/2/2013 [(a)]	5/9/2013 [(a,b)]	Average Concentration [(c)]	2045 Recycled Water [(d)]
	China Island	RRW-1	1.05	1.11		
	DMC	RRW-2	< 0.4	0.480	0.8	
	PID Main Canal	RRW-3	0.823	1.48	1.9	
	Modesto Effluent [(e)]	RRW-4	--	< 0.4	1.1	0.8
	Turlock Effluent	RRW-5	< 0.4	< 0.4	J 0.3	
	Field Duplicate (duplicate of RRW-5)	RRW-6	< 0.4	0.521		
	Field duplicate RPD		--	>26%		
	Equipment Blank	RRW-7	< 0.4	<0.1		

(a) SM3500-SE-C (fluorometric). Method Detection Limit (MDL) = 0.1 µg/L; Reporting Limit = 0.4 µg/L.

(b) On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in this data table.

(c) Previously compiled average concentrations are from the May 17, 2013 Draft Technical Memorandum, *Summary of Existing Water Quality Information.*

(d) Projected flow-weighted average of Turlock (48%) and Modesto (52%) effluent based on build-out conditions expected in 2045.

(e) Modesto's secondary effluent was sampled on 5/9/13. Previously compiled data is for tertiary effluent.

Boron

Boron analytical results from CLS are similar to existing water quality data at all sampling locations.

As shown in the table below, the field duplicate RPD was less than 10% on both sample dates and boron concentrations were below the reporting limit for both equipment blank samples. These results of field QA/QC sampling indicate that field equipment and sampling procedures are unlikely to have significantly affected nitrate results.

Boron concentrations in the equipment blank were below the method reporting limit.

Table 7 Boron – Comparison of Sampling Results to Existing Water Quality Data

Sampling Location		Sample Name	Boron (µg/L)			
			California Laboratory Services (CLS)		Previously Compiled Data	
			5/2/2013 [a]	5/9/2013 [a,b]	Average Concentration [c]	2045 Recycled Water [d]
	China Island	RRW-1	460	360	--	--
	DMC	RRW-2	260	190	190	--
	PID Main Canal	RRW-3	700	700	590	--
	Modesto Effluent [e]	RRW-4	--	230	200	116
	Turlock Effluent	RRW-5	170	130	200	
	Field Duplicate (duplicate of RRW-5)	RRW-6	170	140	--	--
	Field duplicate RPD		*0%*	*7%*	--	--
	Equipment Blank	RRW-7	J 8.6	< 4.9	--	--

J = Detected but below the Reporting Limit; therefore, result is an estimated concentration.

(a) EPA 200.7. Method Detection Limit (MDL) = 4.9 µg/L; Reporting Limit = 20 µg/L.

(b) On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in this data table.

(c) Previously compiled average concentrations are from the May 17, 2013 Draft Technical Memorandum, *Summary of Existing Water Quality Information.*

(d) Projected flow-weighted average of Turlock (48%) and Modesto (52%) effluent based on build-out conditions expected in 2045.

(e) Modesto's secondary effluent was sampled on 5/9/13. Previously compiled data is for tertiary effluent.

Mercury

Mercury was not detected above the method reporting limit in any of the samples collected as part of this sampling program. These results are consistent with the previously compiled water quality data.

The results of field QA/QC sampling indicate that field equipment and sampling procedures are unlikely to have significantly affected nitrite results.

Table 8 Mercury – Comparison of Sampling Results to Existing Water Quality Data

Sampling Location		Sample Name	Mercury (µg/L)			
			California Laboratory Services (CLS)		Previously Compiled Data	
			5/2/2013 [a]	5/9/2013 [a,b]	Average Concentration [c]	2045 Recycled Water [d]
	China Island	RRW-1	< 0.15	J 0.15	--	--
	DMC	RRW-2	< 0.15	< 0.15	--	--
	PID Main Canal	RRW-3	< 0.15	< 0.15	< 0.3	--
	Modesto Effluent [e]	RRW-4	--	< 0.15	0.002	0.002
	Turlock Effluent	RRW-5	< 0.15	< 0.15	0.003	
	Field Duplicate (duplicate of RRW-5)	RRW-6	< 0.15	< 0.15	--	--
	Field duplicate RPD		--	--	--	--
	Equipment Blank	RRW-7	< 0.15	< 0.15	--	--

(a) EPA 245.1. Method Detection Limit (MDL) = 0.15 µg/L; Reporting Limit = 0.20 µg/L.

(b) On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in this data table.

(c) Previously compiled average concentrations are from the May 17, 2013 Draft Technical Memorandum, *Summary of Existing Water Quality Information.*

(d) Projected flow-weighted average of Turlock (48%) and Modesto (52%) effluent based on build-out conditions expected in 2045.

(e) Modesto's secondary effluent was sampled on 5/9/13. Previously compiled data is for tertiary effluent.

Chloride

Chloride analytical results from CLS are similar to existing water quality data at all sampling locations.

As shown in the table below, the field duplicate RPD was 0% on both sample dates and chloride concentrations were below or near the reporting limit in the equipment blank samples. These results of field QA/QC sampling indicate that field equipment and sampling procedures are unlikely to have significantly affected nitrate results.

Table 9 Mercury – Comparison of Sampling Results to Existing Water Quality Data

Sampling Location		Sample Name	Chloride (mg/L)			
			California Laboratory Services (CLS)		Previously Compiled Data	
			5/2/2013 [a]	5/9/2013 [a,b]	Average Concentration [c]	2045 Recycled Water [d]
	China Island	RRW-1	90	82		
	DMC	RRW-2	54	48	--	
	PID Main Canal	RRW-3	190	180	126	
	Modesto Effluent [e]	RRW-4	--	240	180	152
	Turlock Effluent	RRW-5	130	160	121	
	Field Duplicate (duplicate of RRW-5)	RRW-6	130	160		
	Field duplicate RPD		*0%*	*0%*		
	Equipment Blank	RRW-7	J 0.31	0.56		

J = Detected but below the Reporting Limit; therefore, result is an estimated concentration.

(a) EPA 300.0. For RRW-1 and RRW-2, Method Detection Limit (MDL) = 0.13 mg/L and Reporting Limit (RL) = 2.5 mg/L. For RRW-3 through RRW-6, MDL = 0.26 mg/L and RL = 5 mg/L. For RRW-7, MDL = 0.026 mg/L and RL = 0.5 mg/L.

(b) On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in this data table.

(c) Previously compiled average concentrations are from the May 17, 2013 Draft Technical Memorandum, *Summary of Existing Water Quality Information.*

(d) Projected flow-weighted average of Turlock (48%) and Modesto (52%) effluent based on build-out conditions expected in 2045.

(e) Modesto's secondary effluent was sampled on 5/9/13. Previously compiled data is for tertiary effluent.

Appendix 5-D – California Laboratory Services (CLS) Lab Report

CALIFORNIA LABORATORY SERVICES

3249 Fitzgerald Road Rancho Cordova, CA 95742

16 May 2013

CLS Work Order #: CWE0110
COC #: 143143-143145

Phoebe Grow, P.E.
RMC Water and Environment

2001 North Main; Suite 400
Walnut Creek, CA 94596

Project Name: USBR Refuge Water Quality Analysis

Enclosed are the results of analyses for samples received by the laboratory on 05/02/13 17:00. Samples were analyzed pursuant to client request utilizing EPA or other ELAP approved methodologies. I certify that the results are in compliance both technically and for completeness. Any comments and exceptions are addressed below as well as under the Notes and Definitions section.

Analytical results are attached to this letter. Please call if we can provide additional assistance.

Sincerely,

James Liang, Ph.D.
Laboratory Director

CA DOHS ELAP Accreditation/Registration number 1233

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0110**
2001 North Main; Suite 400	Project Number: [none]	COC #: 143143-143145
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RRW-1 (CWE0110-01) Water	**Sampled: 05/02/13 09:55**		**Received: 05/02/13 17:00**							
Chloride	**90**	0.13	2.5	mg/L	5	CW02820	05/03/13	05/03/13	EPA 300.0	
Specific Conductance (EC)	**690**	0.090	1.0	µmhos/cm	1	CW02825	05/03/13	05/03/13	EPA 120.1	
Nitrate as NO3	**6.0**	0.053	0.50	mg/L	1	CW02820	05/03/13	05/03/13	EPA 300.0	
Nitrite as N	**0.020**	0.0022	0.10	"	1	"	"	"	"	J
Total Dissolved Solids	**400**	10	10	"	1	CW02848	05/06/13	05/07/13	SM2540C	
RRW-2 (CWE0110-02) Water	**Sampled: 05/02/13 11:00**		**Received: 05/02/13 17:00**							
Chloride	**54**	0.13	2.5	mg/L	5	CW02820	05/03/13	05/03/13	EPA 300.0	
Specific Conductance (EC)	**420**	0.090	1.0	µmhos/cm	1	CW02825	05/03/13	05/03/13	EPA 120.1	
Nitrate as NO3	**3.5**	0.053	0.50	mg/L	1	CW02820	05/03/13	05/03/13	EPA 300.0	
Nitrite as N	**0.018**	0.0022	0.10	"	1	"	"	"	"	J
Total Dissolved Solids	**240**	10	10	"	1	CW02848	05/06/13	05/07/13	SM2540C	
RRW-3 (CWE0110-03) Water	**Sampled: 05/02/13 11:30**		**Received: 05/02/13 17:00**							
Chloride	**190**	0.26	5.0	mg/L	10	CW02820	05/03/13	05/03/13	EPA 300.0	
Specific Conductance (EC)	**1300**	0.090	1.0	µmhos/cm	1	CW02825	05/03/13	05/03/13	EPA 120.1	
Nitrate as NO3	**14**	0.053	0.50	mg/L	1	CW02820	05/03/13	05/03/13	EPA 300.0	
Nitrite as N	**0.025**	0.0022	0.10	"	1	"	"	"	"	J
Total Dissolved Solids	**750**	10	10	"	1	CW02848	05/06/13	05/07/13	SM2540C	
RRW-5 (CWE0110-04) Water	**Sampled: 05/02/13 12:45**		**Received: 05/02/13 17:00**							
Chloride	**130**	0.26	5.0	mg/L	10	CW02820	05/03/13	05/03/13	EPA 300.0	
Specific Conductance (EC)	**1000**	0.090	1.0	µmhos/cm	1	CW02825	05/03/13	05/03/13	EPA 120.1	
Nitrate as NO3	**69**	0.53	5.0	mg/L	10	CW02820	05/03/13	05/03/13	EPA 300.0	
Nitrite as N	ND	0.0022	0.10	"	1	"	"	"	"	
Total Dissolved Solids	**630**	10	10	"	1	CW02848	05/06/13	05/07/13	SM2540C	

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0110**
2001 North Main; Suite 400	Project Number: [none]	COC #: 143143-143145
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RRW-6 (CWE0110-05) Water	**Sampled: 05/02/13 13:00**		**Received: 05/02/13 17:00**							
Chloride	**130**	0.26	5.0	mg/L	10	CW02820	05/03/13	05/03/13	EPA 300.0	
Specific Conductance (EC)	**980**	0.090	1.0	µmhos/cm	1	CW02825	05/03/13	05/03/13	EPA 120.1	
Nitrate as NO3	**69**	0.53	5.0	mg/L	10	CW02820	05/03/13	05/03/13	EPA 300.0	
Nitrite as N	ND	0.0022	0.10	"	1	"	"	"	"	
Total Dissolved Solids	**630**	10	10	"	1	CW02848	05/06/13	05/07/13	SM2540C	
RRW-7 (CWE0110-06) Water	**Sampled: 05/02/13 11:30**		**Received: 05/02/13 17:00**							
Chloride	**0.31**	0.026	0.50	mg/L	1	CW02820	05/03/13	05/03/13	EPA 300.0	J
Specific Conductance (EC)	**1.8**	0.090	1.0	µmhos/cm	1	CW02825	05/03/13	05/03/13	EPA 120.1	
Nitrate as NO3	**0.22**	0.053	0.50	mg/L	1	CW02820	05/03/13	05/03/13	EPA 300.0	J
Nitrite as N	ND	0.0022	0.10	"	1	"	"	"	"	
Total Dissolved Solids	ND	10	10	"	1	CW02848	05/06/13	05/07/13	SM2540C	

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0110**
2001 North Main; Suite 400	Project Number: [none]	COC #: 143143-143145
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Metals by EPA 200 Series Methods

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RRW-1 (CWE0110-01) Water	**Sampled: 05/02/13 09:55**		**Received: 05/02/13 17:00**							
Boron	**460**	4.9	20	µg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW02857	05/06/13	05/06/13	EPA 245.1	
Sodium	**86**	0.029	1.0	mg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
RRW-2 (CWE0110-02) Water	**Sampled: 05/02/13 11:00**		**Received: 05/02/13 17:00**							
Boron	**260**	4.9	20	µg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW02857	05/06/13	05/06/13	EPA 245.1	
Sodium	**49**	0.029	1.0	mg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
RRW-3 (CWE0110-03) Water	**Sampled: 05/02/13 11:30**		**Received: 05/02/13 17:00**							
Boron	**700**	4.9	20	µg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW02857	05/06/13	05/06/13	EPA 245.1	
Sodium	**170**	0.029	1.0	mg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
RRW-5 (CWE0110-04) Water	**Sampled: 05/02/13 12:45**		**Received: 05/02/13 17:00**							
Boron	**170**	4.9	20	µg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW02857	05/06/13	05/06/13	EPA 245.1	
Sodium	**150**	0.029	1.0	mg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
RRW-6 (CWE0110-05) Water	**Sampled: 05/02/13 13:00**		**Received: 05/02/13 17:00**							
Boron	**170**	4.9	20	µg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW02857	05/06/13	05/06/13	EPA 245.1	
Sodium	**150**	0.029	1.0	mg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	
RRW-7 (CWE0110-06) Water	**Sampled: 05/02/13 11:30**		**Received: 05/02/13 17:00**							
Boron	**8.6**	4.9	20	µg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	J
Mercury	ND	0.15	0.20	"	1	CW02857	05/06/13	05/06/13	EPA 245.1	
Sodium	**0.42**	0.029	1.0	mg/L	1	CW02854	05/06/13	05/06/13	EPA 200.7	J

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0110**
2001 North Main; Suite 400	Project Number: [none]	COC #: 143143-143145
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control
CLS Labs

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CW02820 - General Preparation											
Blank (CW02820-BLK1)					Prepared & Analyzed: 05/03/13						
Chloride	ND	0.026	0.50	mg/L							
Nitrate as NO3	ND	0.053	0.50	"							
Nitrite as N	ND	0.0022	0.10	"							
LCS (CW02820-BS1)					Prepared & Analyzed: 05/03/13						
Chloride	5.32	0.026	0.50	mg/L	5.00		106	80-120			
Nitrate as NO3	2.21	0.053	0.50	"	2.00		110	80-120			
Nitrite as N	0.667	0.0022	0.10	"	0.610		109	80-120			
LCS Dup (CW02820-BSD1)					Prepared & Analyzed: 05/03/13						
Chloride	5.02	0.026	0.50	mg/L	5.00		100	80-120	6	20	
Nitrate as NO3	2.05	0.053	0.50	"	2.00		102	80-120	7	20	
Nitrite as N	0.608	0.0022	0.10	"	0.610		100	80-120	9	20	
Matrix Spike (CW02820-MS1)		**Source: CWE0093-01**			Prepared & Analyzed: 05/03/13						
Nitrate as NO3	3.07	0.053	0.50	mg/L	2.00	0.210	143	80-120			QM-5
Chloride	16.4	0.026	0.50	"	5.00	10.8	112	75-125			
Nitrite as N	0.402	0.0022	0.10	"	0.610	ND	66	75-125			QM-5
Matrix Spike Dup (CW02820-MSD1)		**Source: CWE0093-01**			Prepared & Analyzed: 05/03/13						
Chloride	16.3	0.026	0.50	mg/L	5.00	10.8	110	75-125	0.6	25	
Nitrate as NO3	3.07	0.053	0.50	"	2.00	0.210	143	80-120	0.03	20	QM-5
Nitrite as N	0.391	0.0022	0.10	"	0.610	ND	64	75-125	3	25	QM-5
Batch CW02825 - General Preparation											
Blank (CW02825-BLK1)					Prepared & Analyzed: 05/03/13						
Specific Conductance (EC)	ND	0.090	1.0	µmhos/cm							

CALIFORNIA LABORATORY SERVICES

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RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0110**
2001 North Main; Suite 400	Project Number: [none]	COC #: 143143-143145
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control
CLS Labs

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CW02848 - General Preparation											
Blank (CW02848-BLK1)					Prepared: 05/06/13	Analyzed: 05/07/13					
Total Dissolved Solids	ND	10	10	mg/L							
Duplicate (CW02848-DUP1)		**Source: CWE0110-01**			Prepared: 05/06/13	Analyzed: 05/07/13					
Total Dissolved Solids	394	10	10	mg/L		403			2	20	

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0110**
2001 North Main; Suite 400	Project Number: [none]	COC #: 143143-143145
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Metals by EPA 200 Series Methods - Quality Control

CLS Labs

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CW02854 - EPA 3010A											
Blank (CW02854-BLK1)					Prepared & Analyzed: 05/06/13						
Boron	ND	4.9	20	µg/L							
Sodium	ND	0.029	1.0	mg/L							
LCS (CW02854-BS1)					Prepared & Analyzed: 05/06/13						
Sodium	14.5	0.029	1.0	mg/L	12.5		116	85-115			QM-1
Boron	1330	4.9	20	µg/L	1250		106	85-115			
Matrix Spike (CW02854-MS1)		**Source: CWE0110-01**			Prepared & Analyzed: 05/06/13						
Boron	1850	4.9	20	µg/L	1250	460	111	70-130			
Sodium	101	0.029	1.0	mg/L	12.5	86.1	121	70-130			
Matrix Spike (CW02854-MS2)		**Source: CWE0114-01**			Prepared & Analyzed: 05/06/13						
Boron	1490	4.9	20	µg/L	1250	107	111	70-130			
Sodium	101	0.029	1.0	mg/L	12.5	85.9	118	70-130			
Batch CW02857 - EPA 7470A											
Blank (CW02857-BLK1)					Prepared & Analyzed: 05/06/13						
Mercury	ND	0.15	0.20	µg/L							
LCS (CW02857-BS1)					Prepared & Analyzed: 05/06/13						
Mercury	4.51	0.15	0.20	µg/L	5.00		90	85-115			
Matrix Spike (CW02857-MS1)		**Source: CWE0100-06**			Prepared & Analyzed: 05/06/13						
Mercury	4.24	0.15	0.20	µg/L	5.00	ND	85	70-130			
Matrix Spike (CW02857-MS2)		**Source: CWE0140-08**			Prepared & Analyzed: 05/06/13						
Mercury	4.44	0.15	0.20	µg/L	5.00	ND	89	70-130			

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0110**
2001 North Main; Suite 400	Project Number: [none]	COC #: 143143-143145
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Metals by EPA 200 Series Methods - Quality Control

CLS Labs

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CW02857 - EPA 7470A											
Matrix Spike Dup (CW02857-MSD1)		**Source: CWE0100-06**			Prepared & Analyzed: 05/06/13						
Mercury	4.34	0.15	0.20	µg/L	5.00	ND	87	70-130	2	25	

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0110**
2001 North Main; Suite 400	Project Number: [none]	COC #: 143143-143145
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Notes and Definitions

QM-5	The spike recovery was outside acceptance limits for the MS and/or MSD due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.
QM-1	The spike recovery was outside acceptance limits for the LCS or LCSD. The batch was accepted based on acceptable MS/MSD recoveries & RPD's.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit (or method detection limit when specified)
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment 2001 North Main; Suite 400 Walnut Creek CA, 94596	Project: USBR Refuge Water Quality Analysis Project Number: [none] Project Manager: Phoebe Grow, P.E.	**CLS Work Order #: CWE0110** COC #: 143143-143145

CLS - Labs CHAIN OF CUSTODY CLS ID No.: CWE0110 LOG NO. 143144

REPORT TO:
NAME AND ADDRESS: RMC Water & Environment, 2001 N. Main. Suite 400, Walnut Creek, CA 94596
PROJECT MANAGER: Phoebe Grow PHONE #: 415.321.3432
PROJECT NAME:
SAMPLED BY: Ryan Doyle/Blaine Tech
JOB DESCRIPTION: USBR Refuge Water Quality Analysis
SITE LOCATION:

CLIENT JOB NUMBER:
DESTINATION LABORATORY: [X] CLS (916) 638-7301, 3249 FITZGERALD RD. RANCHO CORDOVA, CA. 95742 [ ] OTHER

GEOTRACKER: EDF REPORT [ ] YES [ ] NO
GLOBAL ID:
COMPOSITE:
FIELD CONDITIONS:

DATE	TIME	SAMPLE IDENTIFICATION	MATRIX	CONTAINER NO.	CONTAINER TYPE	Sodium	Boron	Chloride	TDS	EC	Mercury (total)
5/2/13	0955	RRW-1	Water	2	500/500 HNO3	X	X	X	X	X	X
5/2/13	1100	RRW-2	Water	2	500/500 HNO3	X	X	X	X	X	X
5/2/13	1130	RRW-3	Water	2	500/500 HNO3	X	X	X	X	X	X
5/2/13	1245	RRW-5	Water	2	500/500 HNO3	X	X	X	X	X	X
5/2/13	1300	RRW-6	Water	2	500/500 HNO3	X	X	X	X	X	X
5/2/13	1130	RRW-7	Water	2	500/500 HNO3	X	X	X	X	X	X

TURN AROUND TIME: 1 DAY / 2 DAY / 3 DAY / 5 DAY
SPECIAL INSTRUCTIONS OR ALT. ID:
INVOICE TO:
P.O. #:
QUOTE #:
PRESERVATIVES: (1) HCL (2) HNO3 (3) = COLD (4) = NaOH (5) = H2SO4 (6) = Na2S2O3 (7) =
SUSPECTED CONSTITUENTS:

RELINQUISHED BY (SIGN)	PRINT NAME / COMPANY	DATE / TIME	RECEIVED BY (SIGN)	PRINT NAME / COMPANY
	Corey Kilpatrick/BTS	5/2/13 1450		Chris Falling/BTS
	Chris Falling/BTS	5/2/13 1700		

REC'D AT LAB BY: DATE/TIME: 5/2/13 1700
CONDITIONS / COMMENTS: OC
SHIPPED BY: [ ] FED X [ ] UPS [ ] OTHER
AIR BILL #

CA DOHS ELAP Accreditation/Registration Number 1233

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment 2001 North Main; Suite 400 Walnut Creek CA, 94596	Project: USBR Refuge Water Quality Analysis Project Number: [none] Project Manager: Phoebe Grow, P.E.	**CLS Work Order #: CWE0110** COC #: 143143-143145

CLS - Labs CHAIN OF CUSTODY CLS ID No.: CWE0110 2 OF 3 LOG NO. 143143

REPORT TO:
NAME AND ADDRESS: RMC WATER & ENVIRONMENT, 2001 N. MAIN ST. SUITE 400, WALNUT CREEK, CA 94596
PROJECT MANAGER: Phoebe Grow PHONE#: 415.321.8132
PROJECT NAME:
SAMPLED BY: RYAN DOYLE / Blaine
JOB DESCRIPTION: USBR Refuge Water Quality Analysis
SITE LOCATION:

CLIENT JOB NUMBER:
DESTINATION LABORATORY:
☐ CLS (916) 638-7301, 3249 FITZGERALD RD, RANCHO CORDOVA, CA 95742
☒ OTHER South Dakota Aglab

GEOTRACKER: EDF REPORT ☐ YES ☐ NO
GLOBAL ID:
COMPOSITE:
FIELD CONDITIONS:

TURN AROUND TIME: 1 DAY, 2 DAY, 3 DAY, 5 DAY
SPECIAL INSTRUCTIONS OR ALT. ID:

DATE	TIME	SAMPLE IDENTIFICATION	MATRIX	CONTAINER NO.	CONTAINER TYPE	PRESERVATIVES	ANALYSIS REQUESTED: Selenium
5/2/13	0955	RRW-1	Water	1	250mL	HNO_3	X
5/2/13	1100	RRW-2	Water	1	250mL	HNO_3	X
5/2/13	1130	RRW-3	Water	1	250mL	HNO_3	X
5/2/13	1245	RRW-5	Water	1	250mL	HNO_3	X
5/2/13	1300	RRW-6	Water	1	250mL	HNO_3	X
5/2/13	1130	RRW-7	Water	1	250mL	HNO_3	X

INVOICE TO:
PO. #
QUOTE #
SUSPECTED CONSTITUENTS

PRESERVATIVES: (1) HCL (2) HNO_3 (3) = COLD (4) = NaOH (5) = H_2SO_4 (6) = $Na_2S_2O_3$ (7) =

RELINQUISHED BY (SIGN)	PRINT NAME / COMPANY	DATE / TIME	RECEIVED BY (SIGN)	PRINT NAME / COMPANY
	Corey Kilgore / BTS	5/2/13 1450		Chris Felling / BTS
	Chris Felling / BTS	5/2/13 1700		

RECD AT LAB BY: DATE / TIME: 5/2/13 1700 CONDITIONS / COMMENTS: 6°C

SHIPPED BY: ☐ FED X ☐ UPS ☐ OTHER AIR BILL #

LAB

CA DOHS ELAP Accreditation/Registration Number 1233

CALIFORNIA LABORATORY SERVICES

05/16/13 13:30

RMC Water and Environment 2001 North Main; Suite 400 Walnut Creek CA, 94596	Project: USBR Refuge Water Quality Analysis Project Number: [none] Project Manager: Phoebe Grow, P.E.	**CLS Work Order #: CWE0110** COC #: 143143-143145

3 OF 3

CLS - Labs CHAIN OF CUSTODY CLS ID No.: CWE0110 LOG NO. 143145

REPORT TO:
NAME AND ADDRESS: RMC Water & Environment, 2001 N. Main, Suite 400, Walnut Creek, CA 94596
PROJECT MANAGER: Phoebe Grow PHONE#: 415 321 8432
PROJECT NAME:
SAMPLED BY: Ryan Dowe / Blaine Tech
JOB DESCRIPTION: USBR Refuge Water Quality Analysis
SITE LOCATION:

CLIENT JOB NUMBER:

DESTINATION LABORATORY:
☐ CLS (916) 638-7301, 3249 FITZGERALD RD. RANCHO CORDOVA, CA. 95742
☒ OTHER Eurofins, 750 Royal Oaks Dr., Monrovia, CA 91016

GEOTRACKER:
EDF REPORT ☐ YES ☐ NO
GLOBAL ID:
COMPOSITE:
FIELD CONDITIONS:

DATE	TIME	SAMPLE IDENTIFICATION	MATRIX	CONTAINER NO.	CONTAINER TYPE	PRESERVATIVES	17β-estradiol	Caffeine	NDMA	Triclosan	Gemfibrozil	Iopromide	DEET / Sucralose	TURN AROUND TIME 1 DAY	2 DAY	3 DAY	5 DAY	SPECIAL INSTRUCTIONS OR ALT. ID:
5/2/13	0955	RRW-1	Water	7	Amber		X	X	X	X	X	X	X					
5/2/13	1100	RRW-2	Water	7	Amber		X	X	X	X	X	X	X					
5/2/13	1130	RRW-3	Water	7	Amber		X	X	X	X	X	X	X					
5/2/13	1245	RRW-5	Water	7	Amber		X	X	X	X	X	X	X					
5/2/13	1300	RRW-6	Water	5	Amber		X	X	X	X	X	X	X					
5/2/13	1130	RRW-7	Water	5	Amber		X	X	X	X	X	X	X					

INVOICE TO:
P.O. #
QUOTE #

SUSPECTED CONSTITUENTS

PRESERVATIVES: (1) HCL (2) HNO_3 (3) = COLD (4) = NaOH (5) = H_2SO_4 (6) = $Na_2S_2O_3$ (7) =

RELINQUISHED BY (SIGN)	PRINT NAME / COMPANY	DATE / TIME	RECEIVED BY (SIGN)	PRINT NAME / COMPANY
	Corey Kilpatrick / BTS	5/2/13 1450	/ BTS	Chris Kelling / BTS
	Chris Kelling / BTS	5/2/13 1700		

REC'D AT LAB: DATE/TIME: 5/2/13 1700 CONDITIONS / COMMENTS: 6°C

SHIPPED BY: ☐ FED X ☐ UPS ☐ OTHER AIR BILL #

LAB

CA DOHS ELAP Accreditation/Registration Number 1233

CALIFORNIA LABORATORY SERVICES

3249 Fitzgerald Road Rancho Cordova, CA 95742

16 May 2013

CLS Work Order #: CWE0363
COC #: 3 COCs

Phoebe Grow, P.E.
RMC Water and Environment

2001 North Main; Suite 400
Walnut Creek, CA 94596

Project Name: USBR Refuge Water Quality Analysis

Enclosed are the results of analyses for samples received by the laboratory on 05/09/13 17:00. Samples were analyzed pursuant to client request utilizing EPA or other ELAP approved methodologies. I certify that the results are in compliance both technically and for completeness. Any comments and exceptions are addressed below as well as under the Notes and Definitions section.

Analytical results are attached to this letter. Please call if we can provide additional assistance.

Sincerely,

James Liang, Ph.D.
Laboratory Director

CA DOHS ELAP Accreditation/Registration number 1233

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RRW-1 (CWE0363-01) Water	**Sampled: 05/09/13 09:40**		**Received: 05/09/13 17:00**							
Chloride	**82**	0.13	2.5	mg/L	5	CW02997	05/10/13	05/10/13	EPA 300.0	
Specific Conductance (EC)	**690**	0.090	1.0	µmhos/cm	1	CW02998	05/10/13	05/10/13	EPA 120.1	
Nitrate as NO3	**5.6**	0.053	0.50	mg/L	1	CW02997	05/10/13	05/10/13	EPA 300.0	
Nitrite as N	**0.043**	0.0022	0.10	"	1	"	"	"	"	J
Total Dissolved Solids	**350**	10	10	"	1	CW03002	05/10/13	05/10/13	SM2540C	
RRW-2 (CWE0363-02) Water	**Sampled: 05/09/13 10:30**		**Received: 05/09/13 17:00**							
Chloride	**48**	0.13	2.5	mg/L	5	CW02997	05/10/13	05/13/13	EPA 300.0	
Specific Conductance (EC)	**410**	0.090	1.0	µmhos/cm	1	CW02998	05/10/13	05/10/13	EPA 120.1	
Nitrate as NO3	**3.6**	0.053	0.50	mg/L	1	CW02997	05/10/13	05/10/13	EPA 300.0	
Nitrite as N	ND	0.0022	0.10	"	1	"	"	"	"	
Total Dissolved Solids	**220**	10	10	"	1	CW03002	05/10/13	05/10/13	SM2540C	
RRW-3 (CWE0363-03) Water	**Sampled: 05/09/13 11:00**		**Received: 05/09/13 17:00**							
Chloride	**180**	0.26	5.0	mg/L	10	CW02997	05/10/13	05/10/13	EPA 300.0	
Specific Conductance (EC)	**1300**	0.090	1.0	µmhos/cm	1	CW02998	05/10/13	05/10/13	EPA 120.1	
Nitrate as NO3	**19**	0.053	0.50	mg/L	1	CW02997	05/10/13	05/10/13	EPA 300.0	
Nitrite as N	**0.048**	0.0022	0.10	"	1	"	"	"	"	J
Total Dissolved Solids	**700**	10	10	"	1	CW03002	05/10/13	05/10/13	SM2540C	
RRW-4 (CWE0363-04) Water	**Sampled: 05/09/13 12:30**		**Received: 05/09/13 17:00**							
Chloride	**240**	0.26	5.0	mg/L	10	CW02997	05/10/13	05/10/13	EPA 300.0	
Specific Conductance (EC)	**1300**	0.090	1.0	µmhos/cm	1	CW02998	05/10/13	05/10/13	EPA 120.1	
Nitrate as NO3	**3.5**	0.053	0.50	mg/L	1	CW02997	05/10/13	05/10/13	EPA 300.0	
Nitrite as N	**0.24**	0.0022	0.10	"	1	"	"	"	"	
Total Dissolved Solids	**700**	10	10	"	1	CW03002	05/10/13	05/10/13	SM2540C	

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Conventional Chemistry Parameters by APHA/EPA Methods

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RRW-5 (CWE0363-05) Water	**Sampled: 05/09/13 13:35**		**Received: 05/09/13 17:00**							
Chloride	**160**	0.26	5.0	mg/L	10	CW02997	05/10/13	05/10/13	EPA 300.0	
Specific Conductance (EC)	**1200**	0.090	1.0	µmhos/cm	1	CW02998	05/10/13	05/10/13	EPA 120.1	
Nitrate as NO3	**75**	0.53	5.0	mg/L	10	CW02997	05/10/13	05/10/13	EPA 300.0	
Nitrite as N	ND	0.0022	0.10	"	1	"	"	05/10/13	"	
Total Dissolved Solids	**670**	10	10	"	1	CW03002	05/10/13	05/10/13	SM2540C	
RRW-6 (CWE0363-06) Water	**Sampled: 05/09/13 10:55**		**Received: 05/09/13 17:00**							
Chloride	**0.56**	0.026	0.50	mg/L	1	CW02997	05/10/13	05/10/13	EPA 300.0	
Specific Conductance (EC)	**3.0**	0.090	1.0	µmhos/cm	1	CW02998	05/10/13	05/10/13	EPA 120.1	
Nitrate as NO3	**0.18**	0.053	0.50	mg/L	1	CW02997	05/10/13	05/10/13	EPA 300.0	J
Nitrite as N	ND	0.0022	0.10	"	1	"	"	"	"	
Total Dissolved Solids	ND	10	10	"	1	CW03002	05/10/13	05/10/13	SM2540C	
RRW-7 (CWE0363-07) Water	**Sampled: 05/09/13 13:45**		**Received: 05/09/13 17:00**							
Chloride	**160**	0.26	5.0	mg/L	10	CW02997	05/10/13	05/10/13	EPA 300.0	
Specific Conductance (EC)	**1200**	0.090	1.0	µmhos/cm	1	CW02998	05/10/13	05/10/13	EPA 120.1	
Nitrate as NO3	**76**	0.53	5.0	mg/L	10	CW02997	05/10/13	05/10/13	EPA 300.0	
Nitrite as N	ND	0.0022	0.10	"	1	"	"	05/10/13	"	
Total Dissolved Solids	**720**	10	10	"	1	CW03002	05/10/13	05/10/13	SM2540C	

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Metals by EPA 200 Series Methods

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RRW-1 (CWE0363-01) Water	**Sampled: 05/09/13 09:40**		**Received: 05/09/13 17:00**							
Boron	**360**	4.9	20	µg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
Mercury	**0.15**	0.15	0.20	"	1	CW03023	05/13/13	05/13/13	EPA 245.1	J
Sodium	**84**	0.029	1.0	mg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
RRW-2 (CWE0363-02) Water	**Sampled: 05/09/13 10:30**		**Received: 05/09/13 17:00**							
Boron	**190**	4.9	20	µg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW03023	05/13/13	05/13/13	EPA 245.1	
Sodium	**45**	0.029	1.0	mg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
RRW-3 (CWE0363-03) Water	**Sampled: 05/09/13 11:00**		**Received: 05/09/13 17:00**							
Boron	**700**	4.9	20	µg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW03023	05/13/13	05/13/13	EPA 245.1	
Sodium	**160**	0.029	1.0	mg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
RRW-4 (CWE0363-04) Water	**Sampled: 05/09/13 12:30**		**Received: 05/09/13 17:00**							
Boron	**230**	4.9	20	µg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW03023	05/13/13	05/13/13	EPA 245.1	
Sodium	**190**	0.029	1.0	mg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
RRW-5 (CWE0363-05) Water	**Sampled: 05/09/13 13:35**		**Received: 05/09/13 17:00**							
Boron	**130**	4.9	20	µg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW03023	05/13/13	05/13/13	EPA 245.1	
Sodium	**180**	0.029	1.0	mg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
RRW-6 (CWE0363-06) Water	**Sampled: 05/09/13 10:55**		**Received: 05/09/13 17:00**							
Boron	ND	4.9	20	µg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW03023	05/13/13	05/13/13	EPA 245.1	
Sodium	**0.24**	0.029	1.0	mg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	J

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Metals by EPA 200 Series Methods

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
RRW-7 (CWE0363-07) Water Sampled: 05/09/13 13:45 Received: 05/09/13 17:00										
Boron	**140**	4.9	20	µg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	
Mercury	ND	0.15	0.20	"	1	CW03023	05/13/13	05/13/13	EPA 245.1	
Sodium	**180**	0.029	1.0	mg/L	1	CW03000	05/10/13	05/10/13	EPA 200.7	

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control
CLS Labs

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CW02997 - General Prep											
Blank (CW02997-BLK1)					Prepared & Analyzed: 05/10/13						
Chloride	ND	0.026	0.50	mg/L							
Nitrate as NO3	ND	0.053	0.50	"							
Nitrite as N	ND	0.0022	0.10	"							
LCS (CW02997-BS1)					Prepared & Analyzed: 05/10/13						
Chloride	5.20	0.026	0.50	mg/L	5.00		104	80-120			
Nitrate as NO3	2.10	0.053	0.50	"	2.00		105	80-120			
Nitrite as N	0.659	0.0022	0.10	"	0.610		108	80-120			
LCS Dup (CW02997-BSD1)					Prepared & Analyzed: 05/10/13						
Chloride	5.36	0.026	0.50	mg/L	5.00		107	80-120	3	20	
Nitrate as NO3	2.09	0.053	0.50	"	2.00		104	80-120	0.8	20	
Nitrite as N	0.629	0.0022	0.10	"	0.610		103	80-120	5	20	
Matrix Spike (CW02997-MS1)		**Source: CWE0336-06**			Prepared & Analyzed: 05/10/13						
Nitrate as NO3	2.73	0.053	0.50	mg/L	2.00	0.182	128	80-120			QM-5
Chloride	10.1	0.026	0.50	"	5.00	3.74	127	75-125			QM-5
Nitrite as N	0.582	0.0022	0.10	"	0.610	ND	95	75-125			
Matrix Spike Dup (CW02997-MSD1)		**Source: CWE0336-06**			Prepared & Analyzed: 05/10/13						
Chloride	9.80	0.026	0.50	mg/L	5.00	3.74	121	75-125	3	25	
Nitrate as NO3	2.66	0.053	0.50	"	2.00	0.182	124	80-120	3	20	QM-5
Nitrite as N	0.555	0.0022	0.10	"	0.610	ND	91	75-125	5	25	
Batch CW02998 - General Preparation											
Blank (CW02998-BLK1)					Prepared & Analyzed: 05/10/13						
Specific Conductance (EC)	ND	0.090	1.0	µmhos/cm							

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control
CLS Labs

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CW03002 - General Preparation											
Blank (CW03002-BLK1)					Prepared & Analyzed: 05/10/13						
Total Dissolved Solids	ND	10	10	mg/L							
Duplicate (CW03002-DUP1)		**Source: CWE0363-01**			Prepared & Analyzed: 05/10/13						
Total Dissolved Solids	366	10	10	mg/L		354			3	20	

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Metals by EPA 200 Series Methods - Quality Control

CLS Labs

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CW03000 - EPA 3010A											
Blank (CW03000-BLK1)					Prepared & Analyzed: 05/10/13						
Sodium	ND	0.029	1.0	mg/L							
Boron	ND	4.9	20	µg/L							
LCS (CW03000-BS1)					Prepared & Analyzed: 05/10/13						
Sodium	13.9	0.029	1.0	mg/L	12.5		111	85-115			
Boron	1270	4.9	20	µg/L	1250		102	85-115			
Matrix Spike (CW03000-MS1)		**Source: CWE0339-01**			Prepared & Analyzed: 05/10/13						
Boron	1610	4.9	20	µg/L	1250	150	117	70-130			
Sodium	93.4	0.029	1.0	mg/L	12.5	37.8	444	70-130			QM-7
Matrix Spike (CW03000-MS2)		**Source: CWE0363-05**			Prepared & Analyzed: 05/10/13						
Sodium	205	0.029	1.0	mg/L	12.5	183	178	70-130			QM-4X
Boron	1360	4.9	20	µg/L	1250	134	98	70-130			
Batch CW03023 - EPA 7470A											
Blank (CW03023-BLK1)					Prepared & Analyzed: 05/13/13						
Mercury	ND	0.15	0.20	µg/L							
LCS (CW03023-BS1)					Prepared & Analyzed: 05/13/13						
Mercury	5.49	0.15	0.20	µg/L	5.00		110	85-115			
Matrix Spike (CW03023-MS1)		**Source: CWE0399-01**			Prepared & Analyzed: 05/13/13						
Mercury	6.99	0.15	0.20	µg/L	5.00	1.36	113	70-130			
Matrix Spike (CW03023-MS2)		**Source: CWE0326-01**			Prepared & Analyzed: 05/13/13						
Mercury	5.58	0.15	0.20	µg/L	5.00	ND	112	70-130			

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Metals by EPA 200 Series Methods - Quality Control

CLS Labs

Analyte	Result	MDL	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch CW03023 - EPA 7470A											
Matrix Spike Dup (CW03023-MSD1)		**Source: CWE0399-01**			Prepared & Analyzed: 05/13/13						
Mercury	6.30	0.15	0.20	µg/L	5.00	1.36	99	70-130	10	25	

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

Notes and Definitions

QM-7	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS/LCSD recovery.
QM-5	The spike recovery was outside acceptance limits for the MS and/or MSD due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.
QM-4X	The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to analyte concentration at 4 times or greater the spike concentration. The QC batch was accepted based on LCS and/or LCSD recoveries within the acceptance limits.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit (or method detection limit when specified)
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment 2001 North Main; Suite 400 Walnut Creek CA, 94596	Project: USBR Refuge Water Quality Analysis Project Number: [none] Project Manager: Phoebe Grow, P.E.	**CLS Work Order #: CWE0363** COC #: 3 COCs

CLS - Labs CHAIN OF CUSTODY CLS ID No.: CWE0363-1 LOG NO. 143147

REPORT TO:

NAME AND ADDRESS: RMC WATER & ENVIRONMENT, 2001 N. MAIN ST. SUITE 400, WALNUT CREEK, CA 94596

PROJECT MANAGER: PHOEBE GROW PHONE# 415.321.3432

PROJECT NAME:

SAMPLED BY: BLAINE TECH - COREY

JOB DESCRIPTION: USBR REFUGE WATER QUALITY ANALYSIS

SITE LOCATION:

CLIENT JOB NUMBER:

DESTINATION LABORATORY: [X] CLS (916) 638-7301, 3249 FITZGERALD RD. RANCHO CORDOVA, CA. 95742 [ ] OTHER

GEOTRACKER: EDF REPORT [ ] YES [ ] NO GLOBAL ID:

COMPOSITE:

FIELD CONDITIONS:

TURN AROUND TIME: 1 DAY / 2 DAY / 3 DAY / 5 DAY

SPECIAL INSTRUCTIONS OR ALT. ID:

DATE	TIME	SAMPLE IDENTIFICATION	MATRIX	CONTAINER NO.	CONTAINER TYPE	PRESERVATIVES	Sodium	Boron	Chloride	TDS	EC	Mercury (Total)
5/9/13	0940	RRW-1	Water	2	500mL/500mL	2 -	X	X	X	X	X	X
5/9/13	1030	RRW-2	water	2	500mL/500mL	2 -	X	X	X	X	X	X
5/9/13	1100	RRW-3	water	2	500mL/500mL	2 -	X	X	X	X	X	X
5/9/13	1230	RRW-4	water	2	500mL/500mL	2 -	X	X	X	X	X	X
5/9/13	1335	RRW-5	water	2	500mL/500mL	2 -	X	X	X	X	X	X
5/9/13	1055	RRW-6	water	2	500mL/500mL	2 -	X	X	X	X	X	X
5/9/13	1345	RRW-7	water	2	500mL/500mL	2 -	X	X	X	X	X	X
~~5/9/13~~	~~1430~~	~~TB/FX~~										

INVOICE TO:

P.O. #:

QUOTE #:

SUSPECTED CONSTITUENTS:

PRESERVATIVES: (1) HCL (2) HNO_3 (3) = COLD (4) = NaOH (5) = H_2SO_4 (6) = $Na_2S_2O_3$ (7) =

RELINQUISHED BY (SIGN)	PRINT NAME / COMPANY	DATE / TIME	RECEIVED BY (SIGN)	PRINT NAME / COMPANY
RYAN DOME	RMC WATER	5/9/13 1415	/BTS	COREY KLAPPENICH / BTS
	COREY KLAPPENICH / BTS	5/9/13 1500	/BTS	MATT EITLE / BTS
	MATT EITLE / BTS	5-9-13 1655		

RECD AT LAB BY: DATE/TIME 5/9/13 1700 CONDITIONS / COMMENTS 2.0°C

SHIPPED BY: [ ] FED X [ ] UPS [ ] OTHER AIR BILL #

LAB

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment	Project: USBR Refuge Water Quality Analysis	**CLS Work Order #: CWE0363**
2001 North Main; Suite 400	Project Number: [none]	COC #: 3 COCs
Walnut Creek CA, 94596	Project Manager: Phoebe Grow, P.E.	

CLS - Labs CHAIN OF CUSTODY CLS ID No.: CWE 0363-2 LOG NO. 143146

REPORT TO:
NAME AND ADDRESS: RMC WATER & ENVIRONMENT, 2001 N. Main St. Suite 400, Walnut Creek, CA 94596
PROJECT MANAGER: Phoebe Grow PHONE#: 415.321.3432
PROJECT NAME:
SAMPLED BY: Blaine Tech - Corey
JOB DESCRIPTION: USBR Refuge Water Quality Analysis
SITE LOCATION:

CLIENT JOB NUMBER:
DESTINATION LABORATORY:
☐ CLS (916) 638-7301, 3249 FITZGERALD RD. RANCHO CORDOVA, CA. 95742
☒ OTHER: South Dakota Ag Lab, 1006 32nd Avenue, Brookings, SD 57006

GEOTRACKER: EDF REPORT ☐ YES ☐ NO
GLOBAL ID:
COMPOSITE:
FIELD CONDITIONS:

TURN AROUND TIME: 1 DAY / 2 DAY / 3 DAY / 5 DAY
SPECIAL INSTRUCTIONS OR ALT. ID:

DATE	TIME	SAMPLE IDENTIFICATION	MATRIX	CONTAINER NO.	CONTAINER TYPE	PRESERVATIVES	ANALYSIS REQUESTED: SELENIUM
5/9/13	0940	RRW-1	Water	1	250 ml poly	2	X
5/9/13	1030	RRW-2	Water	1	250 ml poly	2	X
5/9/13	1100	RRW-3	Water	1	250 ml poly	2	X
5/9/13	1230	RRW-4	Water	1	250 ml poly	2	X
5/9/13	1335	RRW-5	Water	1	250 ml poly	2	X
5/9/13	1055	RRW-6	Water	1	250 ml poly	2	X
5/9/13	1345	RRW-7	Water	1	250 ml poly	2	X
~~5/9/13~~	~~0920~~	~~TB-1~~	~~Water~~	~~1~~			

INVOICE TO:
P.O. #:
QUOTE #:
SUSPECTED CONSTITUENTS:
PRESERVATIVES: (1) HCL (2) HNO_3 (3) = COLD (4) = NaOH (5) = H_2SO_4 (6) = $Na_2S_2O_3$ (7) =

RELINQUISHED BY (SIGN)	PRINT NAME / COMPANY	DATE / TIME	RECEIVED BY (SIGN)	PRINT NAME / COMPANY
	RYAN DOYLE / RMC	5/9/13 1415		Corey Kilpatrick / BTS
	Corey Kilpatrick / BTS	5/9/13 1500		Matt Eitele BTS
	Matt Eitele / BTS	5-9-13 1655		

REC'D AT LAB BY: DATE / TIME: 5/9/13 1700 CONDITIONS / COMMENTS: 2°C
SHIPPED BY: ☐ FED X ☐ UPS ☐ OTHER AIR BILL #

LAB

CALIFORNIA LABORATORY SERVICES

05/16/13 13:31

RMC Water and Environment 2001 North Main; Suite 400 Walnut Creek CA, 94596	Project: USBR Refuge Water Quality Analysis Project Number: [none] Project Manager: Phoebe Grow, P.E.	**CLS Work Order #: CWE0363** COC #: 3 COCs

CWE0363-3

eurofins | Eaton Analytical

CHAIN OF CUSTODY RECORD

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629
Phone: 626 386 1100
Fax: 626 386 1101
800 566 LABS (800 566 5227)
Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY:

LOGIN COMMENTS: _____ **SAMPLES CHECKED AGAINST COC BY:** _____
SAMPLES LOGGED IN BY: _____
SAMPLE TEMP RECEIVED AT: **SAMPLES REC'D DAY OF COLLECTION?** ☐ (check for yes)
☐ Colton / No. California / Arizona _____ °C (Compliance: 4 ± 2 °C)
☐ Monrovia _____ °C (Compliance: 4 ± 2 °C)
CONDITION OF BLUE ICE: Frozen _____ Partially Frozen _____ Thawed _____ Wet Ice _____ No Ice _____
METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: _____

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME: RMC WATER & ENVIRONMENT
PROJECT CODE:
COMPLIANCE SAMPLES ☐ (check for yes) - Requires state forms ☐
NON-COMPLIANCE SAMPLES ☐ (check for yes)
REGULATION INVOLVED: _____
Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION (eg. SDWA, Phase V, NPDES, FDA, ...)
EEA CLIENT CODE:
COC ID:
SAMPLE GROUP:
SEE ATTACHED BOTTLE ORDER FOR ANALYSES ☐ (check for yes), *OR*
list ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)
TAT requested: rush by adv notice only STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA	17β-estradiol	Caffeine	N-Dma	Triclosan	Gemfibrozil	Iopromide	DEET	Sucralose								SAMPLER COMMENTS
5/9/13	0940	RRW-1		H_2O			X	X	X	X	X	X	X	X								
5/9/13	1030	RRW-2		H_2O			X	X	X	X	X	X	X	X								
5/9/13	1100	RRW-3		H_2O			X	X	X	X	X	X	X	X								
5/9/13	1230	RRW-4		H_2O			X	X	X	X	X	X	X	X								
5/9/13	1335	RRW-5		H_2O			X	X	X	X	X	X	X	X								
5/9/13	[redacted]	RRW-6 (1055)		H_2O			X	X	X	X	X	X	X	X								
5/9/13	1345	RRW-7		H_2O			X	X	X	X	X	X	X	X								
5/9/13	0920	TB-1																				

* **MATRIX TYPES:** **RSW** = Raw Surface Water **CFW** = Chlor(am)inated Finished Water **SEAW** = Sea Water **BW** = Bottled Water **SO** = Soil **O** = Other - Please Identify
RGW = Raw Ground Water **FW** = Other Finished Water **WW** = Waste Water **SW** = Storm Water **SL** = Sludge

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:					
RELINQUISHED BY:		RYAN DOYLE	RMC WATER	5/9/13	1415
RECEIVED BY:		COREY KIRKPATRICK	PLAINTECH	5/9/13	1415
RELINQUISHED BY:		COREY KIRKPATRICK	PLAINTECH	5/9/13	1500
RECEIVED BY:		MIL OREMANA	CLS 20°C	5/9/13	1700

PAGE ____ OF ____

Appendix 5-E – South Dakota Agricultural Laboratories Lab Report

Performed By:

South Dakota Agricultural Laboratories
Agricultural and Analytical Testing

1006 32nd Avenue
Brookings Biospace 105
Brookings, SD 57006-4728
Telephone (605)692-7325
Fax (605)692-7326
Web http://www.sdaglabs.com

Report Date: 5/16/2013 | **Final Report** | **Report ID: 20130507-005(8882)-1**

Report Of Analysis

Phoebe Grow

3249 Fitzgerald Rd.
Rancho Cordova, CA 95742

Received: May 07, 2013
Reported: May 16, 2013
Package #: 20130507-005

13S04479 RRW-1 Lab ID CWE0110-01 Water RRW-1 5/2/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	1.05	0.1	0.4	SM3500-Se-C(fluorometric)

13S04480 RRW-2 Lab ID CWE0110-02 Water RRW-2 5/2/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	< 0.4	0.1	0.4	SM3500-Se-C(fluorometric)

13S04481 RRW-3 Lab ID CWE0110-03 Water RRW-3 5/2/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	0.823	0.1	0.4	SM3500-Se-C(fluorometric)

13S04482 RRW-5 Lab ID CWE0110-04 Water RRW-5 5/2/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	< 0.4	0.1	0.4	SM3500-Se-C(fluorometric)

Comments: A selenium recovery of 96% was obtained on an 8 ng selenate addition.

13S04483 RRW-6 Lab ID CWE0110-05 Water RRW-6 5/2/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	< 0.4	0.1	0.4	SM3500-Se-C(fluorometric)

13S04484 RRW-7 Lab ID CWE0110-06 Water RRW-7 5/2/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	< 0.4	0.1	0.4	SM3500-Se-C(fluorometric)

Comments: An average value of 399 ng/mL Se was obtained on an in-house selenate Standard (value = 400 ng/mL).

Reviewed By: Regina Wixon Ph.D.

The analytical results on this report reflect what was found in the laboratory sample as it was received at the laboratory. Guidelines on taking a representative sample are available at <http://www.sdaglabs.com/index.php/guides>.

End of Report

Performed By:

1006 32nd Avenue
Brookings Biospace 105
Brookings, SD 57006-4728
Telephone (605)692-7325
Fax (605)692-7326
Web http://www.sdaglabs.com

Report Date: 5/24/2013 | **Final Report** | **Report ID: 20130516-001(8882)-1**

Report Of Analysis

Phoebe Grow

3249 Fitzgerald Rd.
Rancho Cordova, CA 95742

Received: May 16, 2013
Reported: May 24, 2013
Package #: 20130516-001

13S04848 RRW-1 Water RRW-1 5/9/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	1.11	0.1	0.4	SM3500-Se-C(fluorometric)

13S04849 RRW-2 Water RRW-2 5/9/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	0.480	0.1	0.4	SM3500-Se-C(fluorometric)

Comments: A selenium recovery of 96% was obtained on an 8 ng selenate addition.

13S04850 RRW-3 Water RRW-3 5/9/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	1.48	0.1	0.4	SM3500-Se-C(fluorometric)

13S04851 RRW-4 Water RRW-4 5/9/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	< 0.4	0.1	0.4	SM3500-Se-C(fluorometric)

13S04852 RRW-5 Water RRW-5 5/9/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	< 0.4	0.1	0.4	SM3500-Se-C(fluorometric)

Comments: A selenium recovery of 100% was obtained on an 8 ng selenate addition.

13S04853 RRW-6 Water RRW-6 5/9/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	ND	0.1	0.4	SM3500-Se-C(fluorometric)

13S04854 RRW-7 Water RRW-7 5/9/2013

		Result	LOD	LOQ	Method
Selenium	ug/L (ppb)	0.521	0.1	0.4	SM3500-Se-C(fluorometric)

Comments: An average value of 396 ng/mL Se was obtained on an in-house selenate Standard (value = 400 ng/mL).

Reviewed By: Regina Wixon Ph.D.

The analytical results on this report reflect what was found in the laboratory sample as it was received at the laboratory. Guidelines on taking a representative sample are available at <http://www.sdaglabs.com/index.php/guides>.

End of Report

Appendix K – San Joaquin River Surface Water Modeling Methodology and Assumptions

DRAFT Technical Memorandum

North Valley Regional Recycled Water Program

Subject:	**San Joaquin River Flow Analysis**
Prepared For:	Bill Harrison, Anthea Hansen (Del Puerto Water District); Rich Ulm, Jack Bond, Will Wong (City of Modesto); Dan Madden, Michael Cooke (City of Turlock); Michael Brinton (City of Ceres)
Prepared by:	Carrie Del Boccio, P.E., RMC Water and Environment
Reviewed by:	Ali Taghavi, P.E., PhD, RMC Water and Environment Marilyn Bailey, P.E., RMC Water and Environment Lyndel Melton, P.E., RMC Water and Environment
Date:	May 31, 2013
Reference:	0453-002 Task 5.1

This Technical Memorandum (TM) presents the methodology and findings of the North Valley Regional Recycled Water Program (NVRRWP) San Joaquin River Flow Analysis. The TM is organized as follows:

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1 Summary of Findings

By evaluating observed and modeled flows at two locations in the San Joaquin River, there are no significant impacts to San Joaquin River flows from removing wastewater discharges from the Cities of Modesto and Turlock. From a high-level analysis of electrical conductivity in the San Joaquin River, there is a small but positive impact on river water quality from removing wastewater discharges.

2 Introduction and Background

2.1 Introduction

The goal of this analysis was to determine if the impacts of ceasing City of Modesto and City of Turlock Wastewater Treatment Plants (WWTP) discharges to the San Joaquin River (SJR) are significant from an environmental point of view. The primary objective was to determine the impacts of flow changes. A secondary objective was to determine, if possible, the impacts to salinity in the San Joaquin River. The results of this analysis will be used as input for the aquatic species impact assessment for the San Joaquin River.

2.2 Background

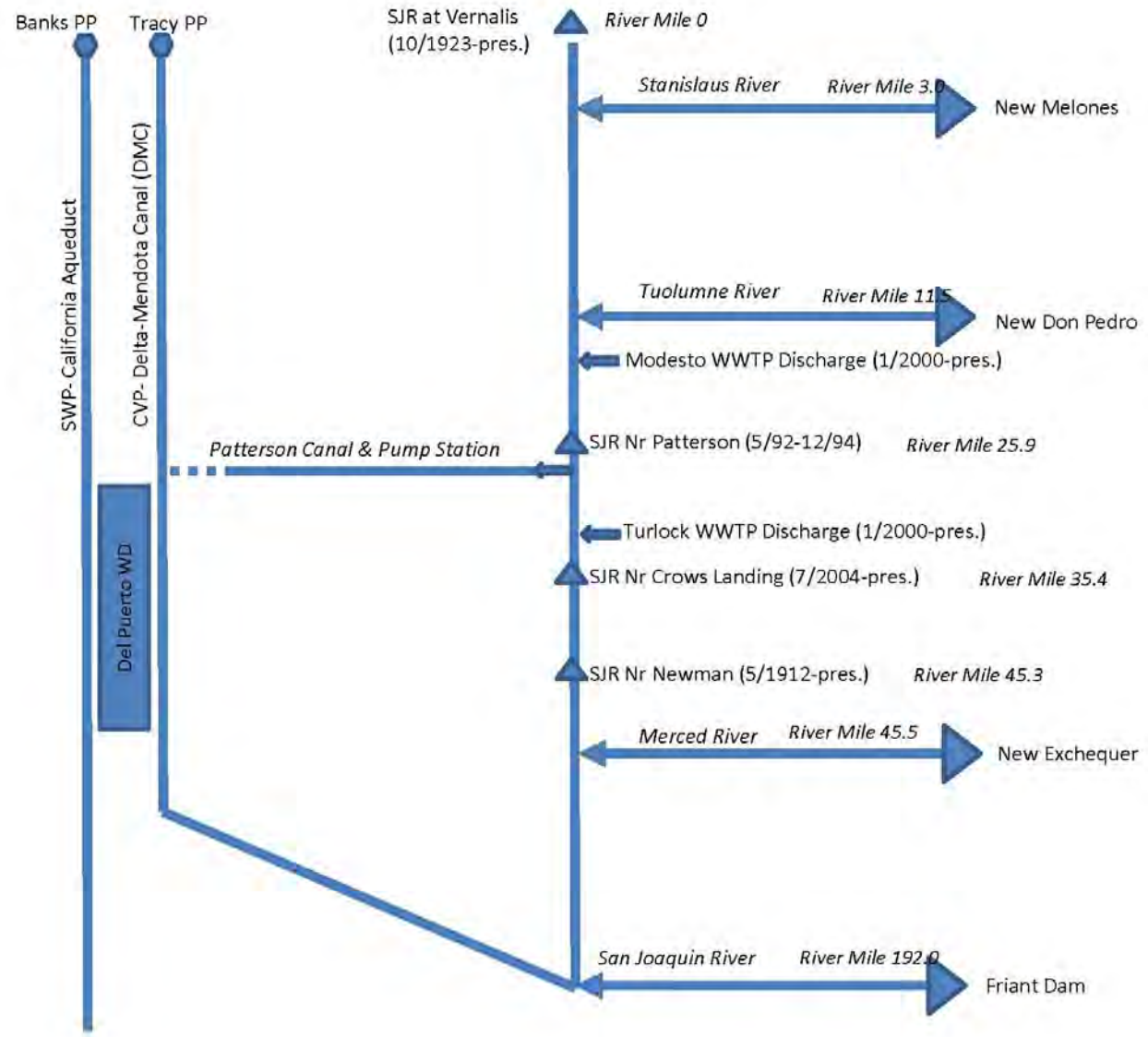
The San Joaquin River has a variety of inflows, outflows, and measuring points along its path to the California Delta. Figure 2-1 shows a schematic of the major components from Friant Dam to the Vernalis gaging station at river mile 0.

The Vernalis gaging station is an important monitoring point for the SJR. The Long-Term Central Valley Project Operational Criteria and Plan (OCAP) was developed in 2004 by the US Bureau of Reclamation (USBR) and summarized flow objectives at the Vernalis gage to both maintain minimum flows in the SJR and to maintain a specific salinity balance in the Delta. The flow objectives, shown in Table 1, include a higher and lower flow objective; the higher objective is used for more strict Delta salinity requirements.

Table 1: OCAP Requirements at Vernalis Gage

Year Type	All Years	Wet Year	Above Normal Year	Below Normal Year	Dry Year	Critical Year
Flow Standards for Feb – Apr 14 and May 16- Jun	N/A	2,130 or 3,420 cfs	2,130 or 3,420 cfs	1,420 or 2,280 cfs	1,420 or 2,280 cfs	710 or 1,140 cfs

Figure 2-1: Schematic of San Joaquin River Inflows and Monitoring Points



Note: Dates in parentheses indicate period of record for flow data at each monitoring location.

3 Methodology

The methodology was to evaluate available information from both a flow impacts and water quality perspective.

3.1 Flow Impacts Methodology

Both observed data and modeled data were evaluated to determine the impacts on flows in the San Joaquin River.

3.1.1 Observed Data Methodology

The first methodology was to analyze observed flow data records for patterns and compare to an established flow level at the Newman gage. This methodology follows the methodology used by the Patterson Irrigation District (PID) in the Initial Study/Mitigate Negative Declaration (ISMND) for the Fish Screen Project. The ISMND was completed in 2006. The ISMND included a flow analysis using Newman gage data. The methodology established a low flow month of October with an average monthly 90% exceedance flow of 160 cubic feet per second (cfs) that was deemed acceptable for use as a design flow for PID's Fish Screen Project.

3.1.2 Modeled Data Methodology

The second method was to analyze modeled flow data records and compare between modeled scenarios with and without the wastewater discharges. CalSim II is the Statewide operations model used by the Department of Water Resources and the Bureau of Reclamation to simulate the operations of the SWP and CVP systems. CalSim II data for several scenarios was developed as part of the Department of Water Resources 2009 Delivery Reliability Report[1] (DRR). The output from those modeled runs were processed to determine the modeled impacts of removing the wastewater flows from the San Joaquin River.

3.2 Water Quality Methodology

The methodology to determine the impacts on salinity in the San Joaquin River provides a high-level assessment of the impacts of removing the wastewater discharges on the salinity as measured at Vernalis. This method uses a simplified mass balance on the SJR using available flow and electrical conductivity (EC) data over the same period of record (June 2010-May 2012).

4 Assumptions

4.1 Wastewater Flows

The Cities of Modesto and Turlock provided wastewater flow discharge data from 2000 to 2012. The monthly averages of these discharges are summarized in Table 2. The analysis in this TM compares SJR flows to this historical record of wastewater discharges.

Table 2: Wastewater Discharges to the San Joaquin River (2000-2012)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Modesto	31.4	38..2	35.2	10.1	7.0	0.0	0.0	0.0	0.0	0.1	5.1	17.7
Turlock	13.1	13.2	12.9	13.0	12.7	12.9	12.9	13.4	13.3	13.8	13.3	13.4
Total	**44.6**	**51.4**	**48.2**	**23.2**	**19.8**	**12.9**	**12.9**	**13.4**	**13.3**	**13.9**	**18.5**	**31.1**

Flows are shown in cubic feet per second (cfs)

[1] Department of Water Resources (2010)

4.2 Observed Data

Both the Newman and Vernalis stream gages have long-term flow data records extending back to the early part of the 20th century. The last major operational component of the State and Federal management systems, the Lower San Joaquin River Flood Control Project, came online in 1965, resulting in a significant change in river operations pre and post-1965[2]. To represent results related to the managed SJR in this analysis, only flow records after 1965 were used.

4.3 Modeled Data

Modeled data was taken from the Department of Water Resources 2009 DRR. The DRR contained several CalSimII modeling scenarios; three of these modeling scenarios were used in this TM as summarized in Table 3. The complete original assumptions associated with the modeled data are included in Appendix A.

The Freeport Regional Water Project is a cooperative effort of the Sacramento County Water Agency and East Bay Municipal Utility District to supply surface water from the Sacramento River to customers in central Sacramento County and the East Bay area of California. The Freeport Project did not become operational until 2011 but was included in the modeled scenarios in the 2009 DRR.

The climate change scenario used by the Department of Water Resources in the DRR is described in detail in the Appendix, but generally is from MPI-ECHAM5 using the A2 emissions scenario with a 2050 level of emissions. MPI-ECHAM5 is a global climate change model that was used by United Nations (UN) Intergovernmental Panel on Climate Change (IPCC) in the Fourth Assessment Report: Climate Change 2007, which is the most current climate change report published by the UN[3].

Table 3: Modeled Scenarios Summary

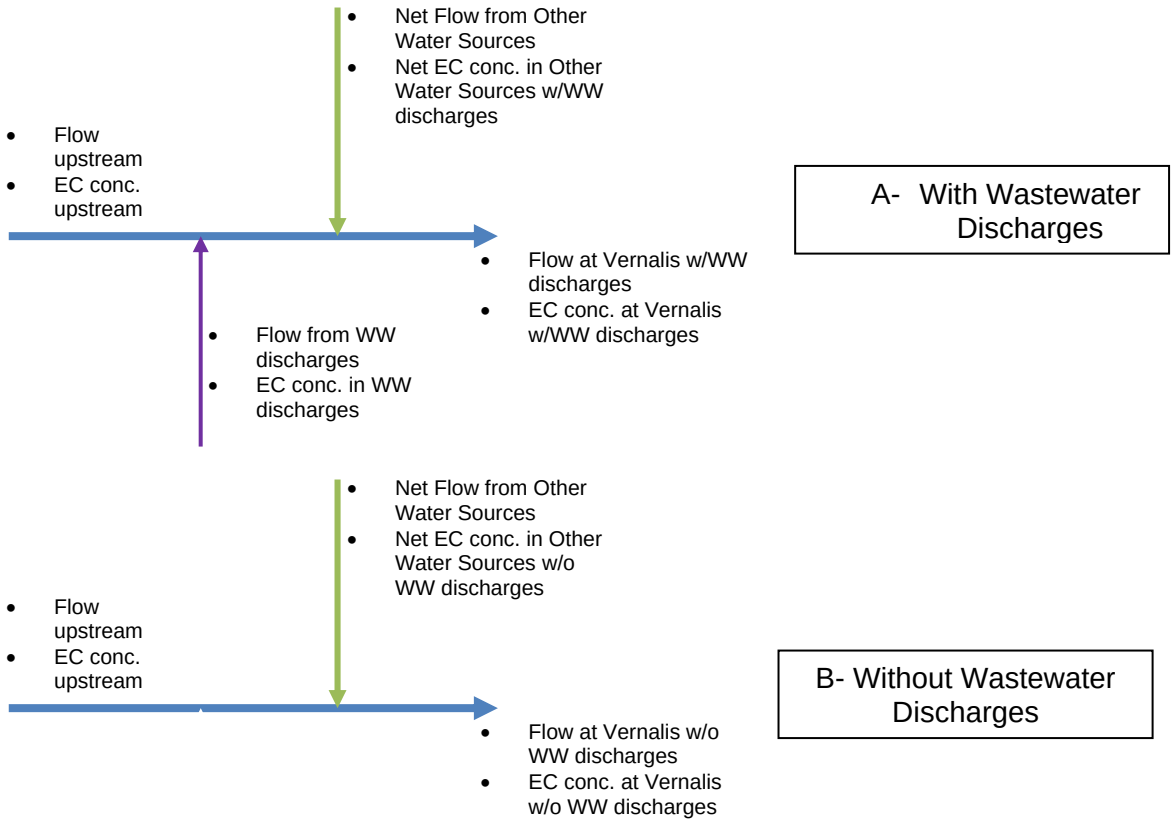
CalsimII Scenario	Description of Scenario	Level of Development Assumed	Freeport Included	Climate Change Included
1	2009 DRR Existing Conditions	2009	X	
3A	2009 DRR Future Conditions without Climate Change	2020	X	
3B	2009 DRR Future Conditions with Climate Change	2020	X	X

4.4 Water Quality Data

The simplified mass balance assumes that the net difference of inflows and outflows to the SJR (including losses due to seepage into the groundwater system) can be represented by a "net other water sources" value, which possesses two primary parameters: a combined flow amount and combined electrical conductivity value. A portion of the net other water sources comes from reservoir releases with the specific purpose of meeting flow and salinity targets at Vernalis. Net other water sources flows are modeled with an electrical conductivity value of 60 umhos/com[4]. Figure 3-1 shows schematics of the simplified salinity balances with and without wastewater discharges.

[2] Hill (Unknown)
[3] IPCC (2007)
[4] USBR (2011)

Figure 4-1: Simplified Salinity Mass Balance with and without Wastewater Discharges



5 Results

5.1 Observed Data Analysis

5.1.1 Newman Gage Data

The Newman gage is located upstream of the Cities of Modesto and Turlock's wastewater discharges. Therefore comparing the Newman gage data to the wastewater discharges is a 'worst case' condition and the flow analysis results are relatively more conservative and reasonable for this study.

On a monthly average basis over the available flow records, the wastewater discharges are small in comparison to the average monthly flows observed at the Newman gage (see Figure 5-1).

In evaluating the flow exceedance chart for the Newman gage over the period of record, the annual 90% exceedance flow is 286 cfs (see Figure 5-2). However, in assessing the flow exceedance by month, the low flow month for the period of record is September with an average monthly 90% exceedance flow of 186 cfs. This is 16 cfs higher than the low flow 90% exceedance flow identified in the Patterson Fish Screen ISMND indicating that minimum flows at Newman are being met even more frequently than at the time of preparation of the PID ISMND.

In evaluating the range of flows by month over the near-term period of record (2000-2012) at the Newman gage (see Figure 5-3), there is consistently a ten-fold difference between the lowest observed SJR flows and the wastewater discharges.

Figure 5-1: Comparison of Monthly Average Flows at Newman Gage and Wastewater Discharges

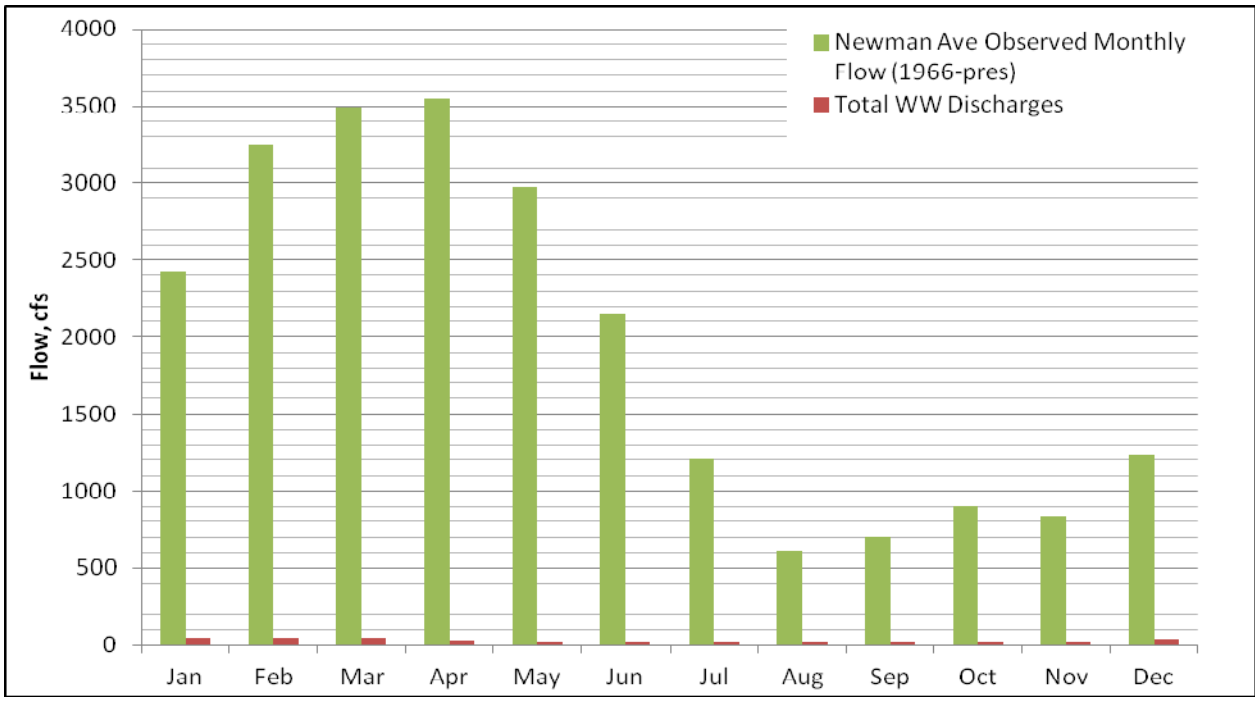


Figure 5-2: Exceedance Plot Newman Gage 1966-Present

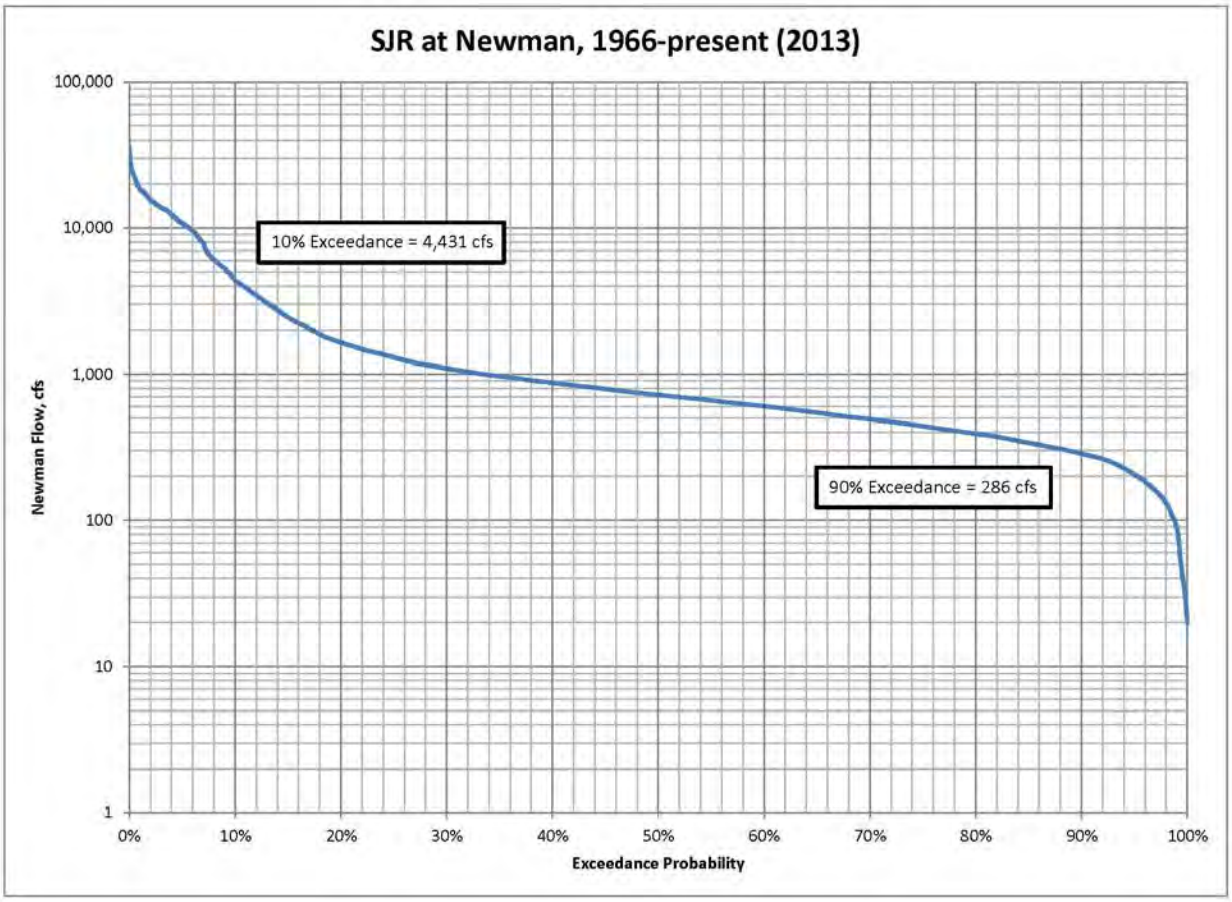
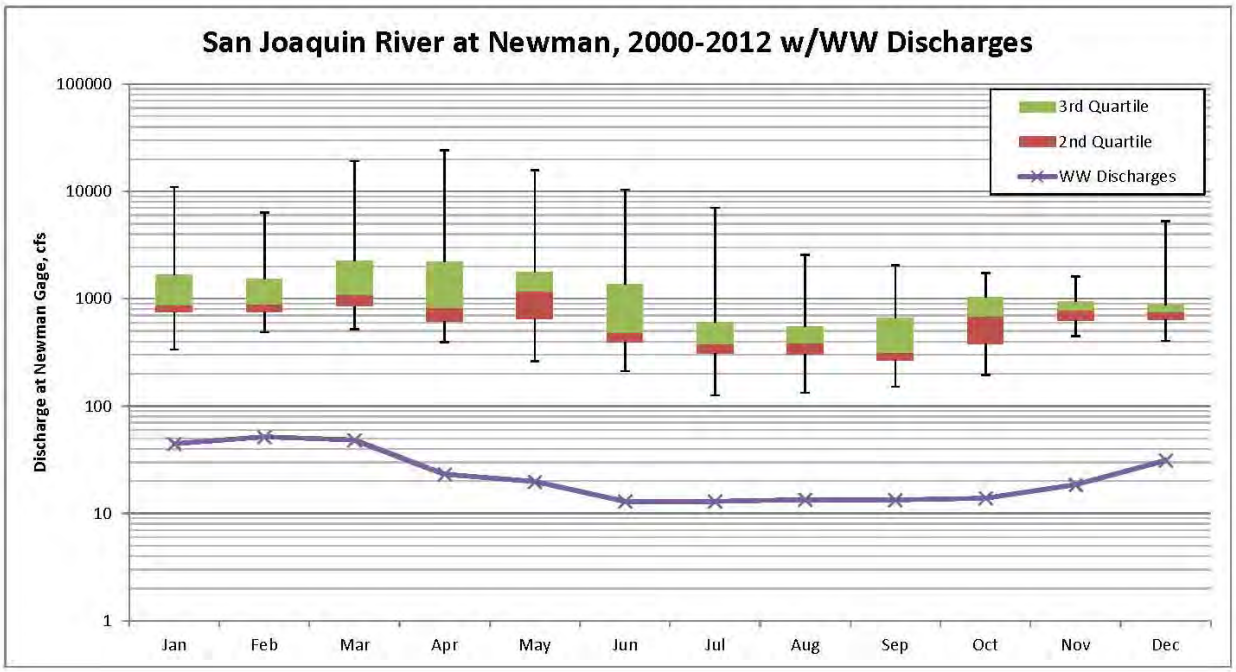


Figure 5-3: Box-Whisker Plot Newman Gage 2000-2012



5.1.2 Vernalis Gage Data

The Vernalis gage is the next available data source downstream from the Turlock and Modesto discharges, with long-term flow records. There are several inflows and outflows in the San Joaquin River between the Cities' discharges and the Vernalis gage (see Figure 2-1) but this is the only major downstream location where the impacts of removing the Turlock and Modesto discharges can be observed, which also helps evaluate the impacts as a point of inflow to the Delta.

Flows at Vernalis are higher than at Newman with the 90% exceedance flow at Vernalis equaling 932 cfs (see Figure 5-4).

In assessing the range of flows by month over the near-term period of record (2000-2012) (see Figure 5-5), there is more than a ten-fold difference between the wastewater discharges and the SJR flow at Vernalis. This difference in flow indicates that removing the wastewater discharges would have no significant impacts on the flows at Vernalis.

Figure 5-4: Exceedance Plot Vernalis Gage 1966-Present

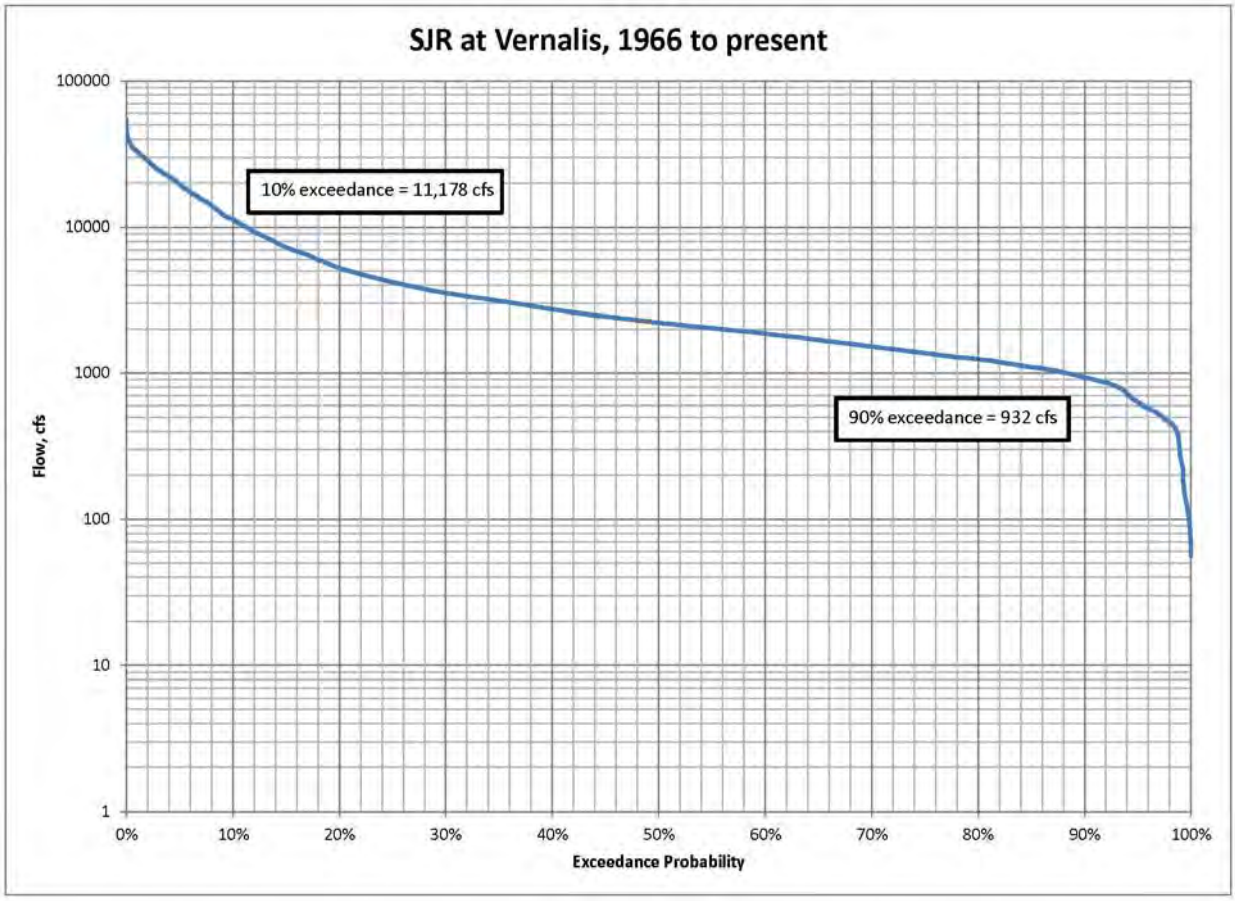
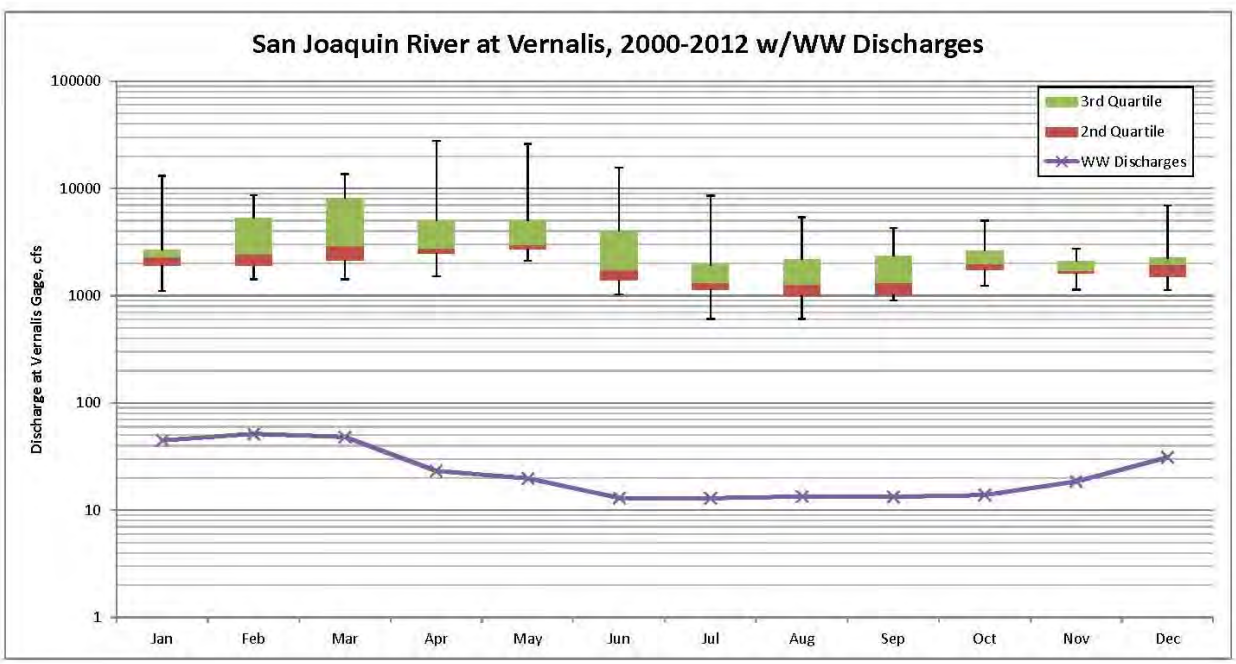


Figure 5-5: Box-Whisker Plot Vernalis 2000-2012



5.2 Modeled Data Analysis

As observed on the exceedance plots of modeled flows at Newman and Vernalis locations (see Figure 5-6 and Figure 5-7), there is little to no discernible difference within each scenario when considering with and without wastewater (WW) discharges. Changes are primarily due to assumptions in the base scenarios and not from changes due to wastewater discharges. It is important to note that the modeled data for the Newman gage includes several time periods where the flow at the Newman gage is anticipated to be zero. These years of zero flow are anticipated to occur, based on the simulated data, with or without the wastewater discharges.

The minor impact of wastewater discharge during the low flow regime can be observed in the flow exceedance charts. Table 4 and Table 5 show the difference in 90% exceedance flows for the baseline scenario and no wastewater discharge scenario at Newman and Vernalis. Note that the flow difference is consistently 13.9 cfs which is approximately 7-9% of the baseline flows at Newman and 1% of the baseline flows at Vernalis. For Newman, this range is within the margin of accuracy of the modeling results, specifically at the low flow range which the model is not calibrated for, and no significant impacts are expected. For Vernalis, 1% is within the margin of accuracy of the modeling results, and is considered to be no significant impact.

Table 4: Newman Flow Changes for the 90% Exceedance With and Without Wastewater Discharges

	With WW Discharges (Baseline) (cfs)	Without WW Discharges (cfs)	Flow Difference (cfs)	Percent Flow Difference
Scenario 1	204	190	13.9	7%
Scenario 3A	171	157	13.9	8%
Scenario 3B	148	134	13.9	9%

Table 5: Vernalis Flow Changes for the 90% Exceedance With and Without Wastewater Discharges

	With WW Discharges (Baseline) (cfs)	Without WW Discharges (cfs)	Flow Difference (cfs)	Percent Flow Difference
Scenario 1	1,413	1,400	13.9	1%
Scenario 3A	1,395	1,381	13.9	1%
Scenario 3B	1,307	1,293	13.9	1%

Figure 5-6: Exceedance Plot for Modeled Newman Location Flows

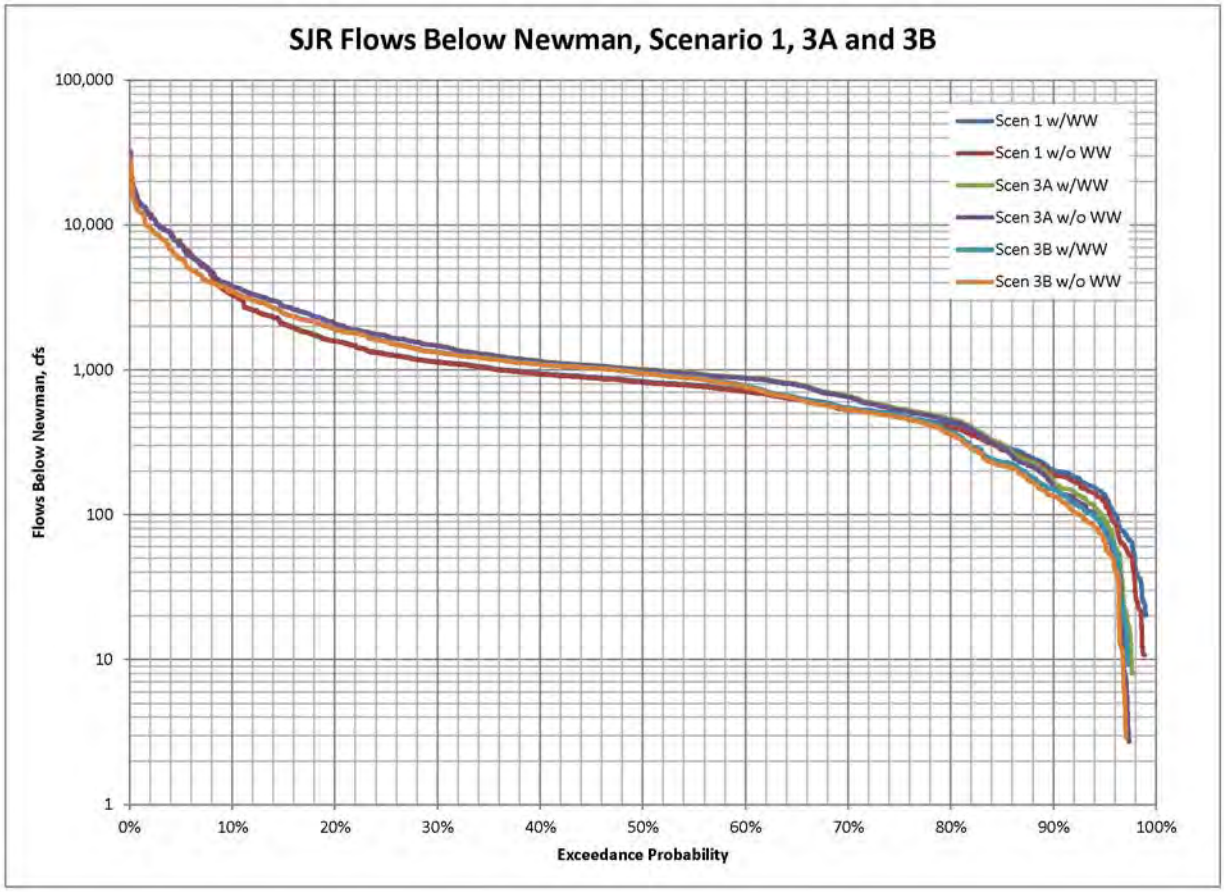
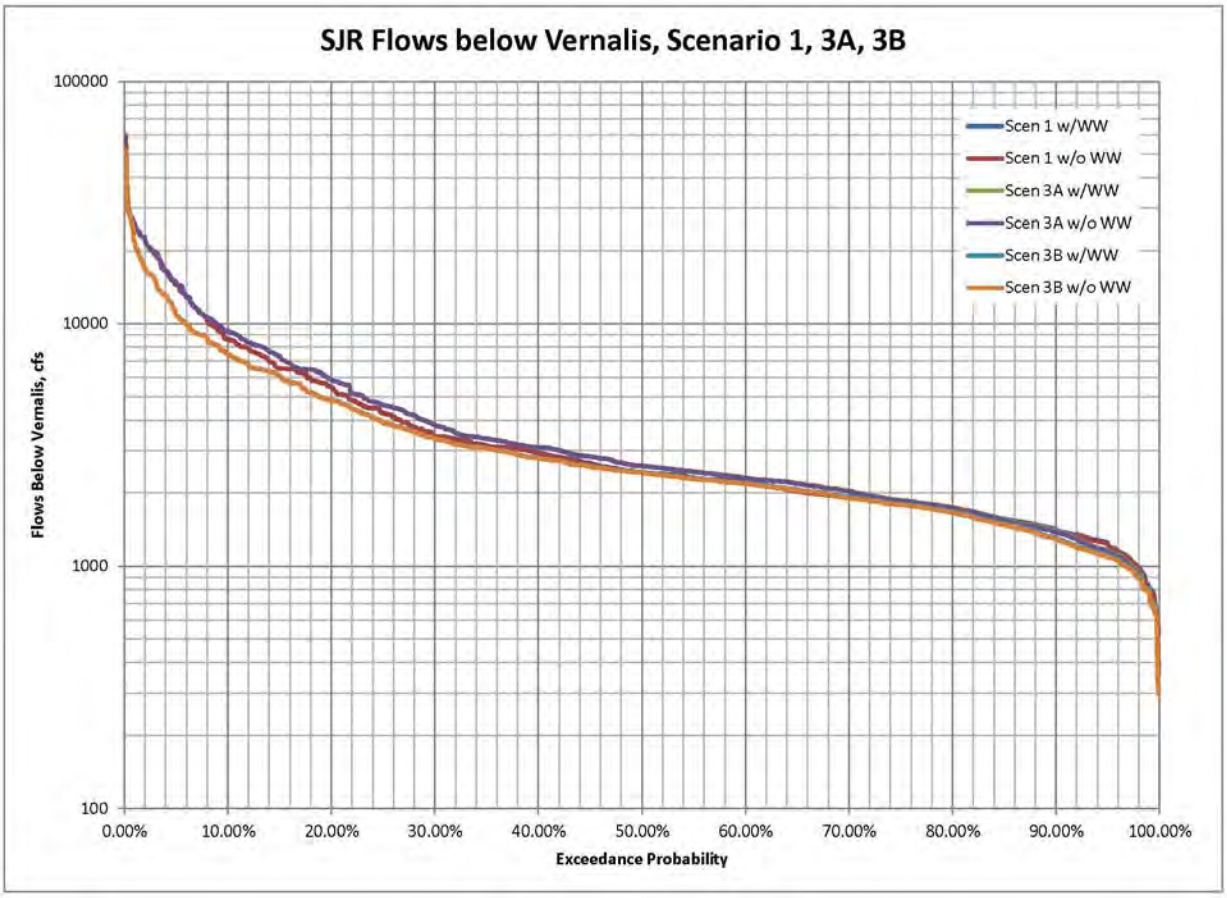


Figure 5-7: Exceedance Plot for Modeled Vernalis Location Flows



5.3 Water Quality Analysis

Using the available data for the wastewater flows, the Vernalis gage, and the SJR near Patterson, the salinity (as EC) was calculated to balance flow and then subsequently to balance salinity. The salinity difference between the with and without wastewater discharges scenarios is calculated as the change in EC of "net other water sources". In other words, to maintain the same EC levels at Vernalis as the observed record, what concentration of salinity would be needed from the net other water sources under the with and without wastewater discharges scenarios? As seen in Table 6, every month of the without wastewater discharges scenario results in a higher calculated salinity level in the net other water sources. A higher salinity level in the net other water sources infers that less dilution water would be required if the wastewater was not discharged to the SJR. Using less dilution water is a positive impact to water quality of removing the wastewater discharges from the SJR. The percentage differences shown in Table 6 are small indicating a neutral or positive impact of removing the wastewater discharges from the SJR.

Table 6: Electrical Conductivity in Net Other Water Sources With and Without Wastewater Discharges

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EC w/WW	379	306	280	79	108	149	263	343	385	247	449	493
EC w/o WW	384	314	285	82	111	152	266	347	390	251	454	499
Difference	5	7	5	3	3	2	4	4	5	5	5	5
%	1%	2%	2%	3%	3%	2%	1%	1%	1%	2%	1%	1%

All electrical conductivity (EC) values are shown in umhos/com.

6 Conclusions

1- Observed data analysis:

- The Newman Gage observed flow is upstream of the discharge points, and the flow analysis results are relatively more conservative and reasonable for this study
- The Patterson Irrigation District ISMND study found that the 90% exceedance flow (160 cfs, 32.57 ft, mean sea level stage) is an acceptable flow criterion; the updated flow records find the 90% exceedance flow is approx 180 cfs (33.19 ft, mean sea level stage); discharge flows are approximately less than 8% of the 90% flow
- Cessation of discharge flows does not have a significant impact on the SJR flows, based on the Newman and Vernalis gage records

2- Modeled data analysis:

- 90% exceedance probability simulated flow at Newman is approximately 200 cfs under existing conditions (Scenario 1) and 170 cfs under future conditions (Scenario 3A)
- Same flows at Newman with no wastewater discharge drops down by 7-8%. This is within the range of accuracy of gage and/or simulation and is not considered to be a significant impact
- The WWTP discharge flows are less than 1% of the 90% exceedance flows at Vernalis and thus not significant for any impacts

3- Water quality analysis:

- Removing wastewater flows has a positive impact on water quality in the SJR since less dilution water would be needed to meet salinity goals at the Vernalis gage.

7 Data Sources and References

Data

Newman Daily Flow Data – USGS Gage #11274000, taken from California Data Exchange Center cdec.water.ca.gov

Vernalis Daily Flow Data – USGS Gage #11303500, taken from California Data Exchange Center cdec.water.ca.gov

City of Modesto Monthly Average Wastewater Discharges to San Joaquin River, provided by City of Modesto

City of Turlock Monthly Average Wastewater Discharges to San Joaquin River, provided by City of Turlock

City of Modesto Electrical Conductivity in Wastewater Discharges, provided by City of Modesto

City of Turlock Electrical Conductivity in Wastewater Discharges, taken from City of Turlock reports to California Integrated Water Quality System Project (CIWQS) for monitoring point EFF-001 http://ciwqs.waterboards.ca.gov

San Joaquin River Monthly Flow Data, taken from City of Turlock reports to California Integrated Water Quality System Project (CIWQS) for monitoring point RSW-003 http://ciwqs.waterboards.ca.gov

San Joaquin River Electrical Conductivity, taken from City of Turlock reports to California Integrated Water Quality System Project (CIWQS) for monitoring point RSW-003 http://ciwqs.waterboards.ca.gov

Vernalis Electrical Conductivity, taken from California Data Exchange Center cdec.water.ca.gov

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Department of Water Resources (2010). The State Water Project Delivery Reliability Report 2009. Sacramento, CA.

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IPCC (2007). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland.

US Bureau of Reclamation. (2004). Long-Term Central Valley Project Operations Criteria and Plan. Sacramento, CA.

US Bureau of Reclamation. (2011). Special Study: Evaluation of Dilution Flows to Meet Interior South Delta Water Quality Objectives. Sacramento, CA.

Appendix A – Summary of Modeling Assumptions by Scenario

CalSIM Calculated Flows		
No.	CalSIM parameters	Description
1	C18F	Millerton Releases
2	D18A_16B	Millerton Diversions - FK Canal
3	D18A_215	Millerton Diversions - FK Canal
4	D18B_16B	Millerton Diversions - Madera Canal
5	D18B_215	Millerton Diversions - Madera Canal
6	D18F	Millerton Diversions
7	C620	SJR flows below Newman
8	C630	SJR flows below Tuolumne
9	C636	SJR flows below Maze
10	C639	SJR flows below Vernalis

CalSIM Scenarios				Assumptions							
No.	CalSIM Scenarios/Studies	Description	Level of Develop-ment	SJRR Flow-Interim- WY 2010	SJRR Flow-Full	NMFS BO (Articles III.1.2 & III.1.3)	Vernalis Min Flow	Goodwin Dam	Freeport	Fremont and Sacramento Weir	Climate Change
1	Scen 1	2009 DRR Existing Conditions	2009				60-Day min flow btwn Apr-May for BO Art IV.2.1 & New Melones Stg is obligated as a supply source	Flows bl Goodwin Dam is simulated to meet min flow per BO Article III.1.2 and III.1.3	X	Spills calculated on monthly Basis	
2	Scen 2	2011 DRR Existing Conditions	2011	X		X+ Revised Ops Plan	New Melones is obligated to commit a volume per Plan of Operations.	Goodwin Dam is simulated to meet Rev Ops Plan in addition to the BO		Spills calculated on daily Basis	
3	Scen 3A	2009 DRR Future Conditions w/o CC	2020		X	X	New Melones is obligated to commit a volume per Plan of Operations.	Goodwin Dam is simulated to meet Rev Ops Plan in addition to the BO	X	Spills calculated on monthly Basis	
4	Scen 3B	2009 DRR Future Conditions w CC	2020		X	X	New Melones is obligated to commit a volume per Plan of Operations.	Goodwin Dam is simulated to meet Rev Ops Plan in addition to the BO	X	Spills calculated on monthly Basis	X
5	Scen 4A	2011 DRR Future Conditions w/o CC	2020	X		X+ Revised Ops Plan	New Melones is obligated to commit a volume per Plan of Operations.	Goodwin Dam is simulated to meet Rev Ops Plan in addition to the BO		Spills calculated on daily Basis	
6	Scen 4B	2011 DRR Future Conditions w CC	2020	X		X+ Revised Ops Plan	New Melones is obligated to commit a volume per Plan of Operations.	Goodwin Dam is simulated to meet Rev Ops Plan in addition to the BO		Spills calculated on daily Basis	X

Notes:
DRR: Delivery Reliability Report
CC: Climate Change

Appendix L – Aquatic Biota Assessment

Assessment of Potential Effects of the North Valley Regional Recycled Water Program (NVRRWP) Reductions in Freshwater Discharges into the San Joaquin River on Fishery Habitat and Juvenile Salmon Survival

HANSON ENVIRONMENTAL, INC.
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AUGUST 2013

1. INTRODUCTION

The San Joaquin River provides habitat for a diverse assemblage of fish and aquatic macroinvertebrates. The river also serves as a migration corridor and juvenile rearing habitat for Chinook salmon. Results of previous studies have shown positive relationships between the flow in the San Joaquin River during the spring (e.g., March-May) and the survival of juvenile salmon as well as adult salmon escapement 2.5 years later. Currently the Modesto and Turlock waste water treatment plants (WWTP) discharge treated waste water into the San Joaquin River where it augments existing flows and therefore provides potential biological benefits to improved habitat conditions for salmon and other fishery resources. As shown in Table 1, the Modesto and Turlock WWTPs release an average of 25 cfs into the San Joaquin River with a range of average monthly flows of 12.9 – 51.4 cfs. The North Valley Regional Recycled Water Program (NVRRWP) is proposing that rather than discharging the treated and processed waste water into the San Joaquin River as is currently being done, the Modesto and Turlock treatment plants would recycle the waste water for other inland uses such as irrigation of farmland. The curtailment in WWTP discharges from these two plants into the river would result in an incremental reduction in river flows as shown in Table 1. For comparison, the average flow in the San Joaquin River during the spring months (March –May) of dry water years typically ranges from approximately 1,500 to 2,000 cfs while average flows in a normal water year typically range from approximately 3,000 to 4,000 cfs. Spring flows in a wet year typically range from approximately 8,000 to 14,000 cfs. The actual flow in the San Joaquin River varies substantially within and among years.

Table 1: Average monthly WWTP discharges to San Joaquin River in cfs from 2000-2012

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Modesto	31.4	38.2	35.2	10.1	7.0	0.0	0.0	0.0	0.0	0.1	5.1	17.7
Turlock	13.1	13.2	12.9	13.0	12.7	12.9	12.9	13.4	13.3	13.8	13.3	13.4
Total	**44.5**	**51.4**	**48.1**	**23.1**	**19.7**	**12.9**	**12.9**	**13.4**	**13.3**	**13.9**	**18.4**	**31.1**

Although the amount of spring discharges is relatively small compared to total river flows (e.g., for example the April average WWTP discharge is 23.2 cfs and the San Joaquin River mean April flow at Vernalis is 3,095 cfs), the removal of these discharges into the San Joaquin River would contribute to an incremental reduction in the water levels and flows in the river downstream of the discharge location. This reduction in river flow could potentially adversely affect habitat conditions in the river for fish and the survival of juvenile salmon during their spring migration from the river to coastal marine waters. The objective of this analysis is to evaluate the potential for adverse effects of a reduction in freshwater discharges to the San Joaquin River as a result of the proposed NVRRWP water recycling project on instream flows, fishery habitat and juvenile Chinook salmon survival and abundance.

2. APPROACH/METHODS

To assess the potential effects of reducing San Joaquin River flows as a result of implementing the water recycle program and curtailing the discharge of treated waste water to the river, Chinook salmon were selected as the indicator species for use in these analyses. Quantitative data on the relationships between San Joaquin River flows and habitat quality and availability, survival, and abundance are not available for other fish species inhabiting the river and therefore the potential effects of the proposed recycle project could not be quantified for these other fish species. Fall-run Chinook salmon are a species sensitive to changes in instream flows and other environmental factors such as exposure to seasonally elevated water temperature when compared to the greater tolerance of many of the resident and other migratory fish and therefore are considered to be a good indicator species for use in this assessment.

Fall-run Chinook salmon use the San Joaquin River tributaries for spawning and juvenile rearing. The juvenile salmon then migrate downstream through the lower river during the late winter and spring months. The greatest migration by juvenile salmon smolts occurs during March-May. The survival of juvenile salmon has also been shown to vary in response to changes in river flow during the spring migration period (SJRGA 2007). To assess the potential effects of changes in river flow four independent analyses were considered including (1) the predicted change in juvenile salmon survival as a function of river flow, (2) the predicted change in adult salmon escapement as a function of river flow during the spring outmigration period 2.5 years earlier, (3) changes in river habitat based on stage-discharge relationships developed for the river by the U.S. Geological Survey (USGS) and the location of the estuarine low salinity zone during biologically sensitive spring months, and (4) predicted changes in salmon abundance based on use of the California Department of Fish and Wildlife (CDFW) San Joaquin River fall-run salmon lifecycle simulation model (SalSim). By comparing historic flows to those flows without the addition of WWTP discharges we are able to simulate the potential effect that the removal of WWTP discharges will have on salmon from a variety of metrics.

2.1 Base Vs Adjusted Flow Conditions

To simulate the potential effects that the removal of WWTP discharge from the San Joaquin river system would have on potential salmon survival and abundance, it was first necessary to establish baseflow conditions in the river with the existing WWTP discharges and simulated river flow conditions without the contribution of the WWTP discharges. For purposes of these biological analyses, river flow at the USGS Vernalis gage was selected to represent baseflow conditions. Although the WWTP discharge occurs further upstream on the San Joaquin River, the flows at Vernalis were selected since the existing biological relationships between river flow and juvenile salmon survival, river flow and subsequent adult escapement, and Vernalis flows are a key driver in the SalSim lifecycle model. Average daily flows were compiled for the Vernalis gage from the USGS website for March, April and May, 1923-2012. In order to account for yearly variation, 5, 25, 50(mean) and 75 percentile flow data was used to represent "critical", "dry", "normal" and "wet" flow conditions. The daily average flow was used to create a monthly average. These average months are used to represent the "base" flow conditions in the lower San Joaquin River under existing conditions with the WWTP discharges in operation.

WWTP discharge levels were calculated using the average monthly discharge from the Modesto and Turlock plants for March, April and May for 2000-2012 (Table 1). These average monthly discharge rates were then subtracted from the corresponding average monthly river flow at the Vernalis gage to create the "adjusted" flow. The values for the base and adjusted flows were then entered into various survival models described below in order to predict how these changes in flow conditions may effect salmon survival and abundance.

Percent differences were calculated as:

$$\% = (1 - (\text{Adjusted flow}/\text{Base flow}))*100$$

2.2 Juvenile salmon survival-flow relationships

The San Joaquin River Agreement (SJRA) and Vernalis Adaptive Management Plan (VAMP) conducted a long-term scientific experiment to determine how juvenile salmon survival rates change in response to alterations in San Joaquin River flows and State Water Project (SWP)/Central Valley Project (CVP) exports with the installation of the Head of Old River Barrier (HORB). The survival studies were based on a mark-recapture experimental design in which juvenile fall-run Chinook salmon produced in the Merced River fish hatchery were coded wire tagged (CWT) and released into the San Joaquin River at Mossdale and Durham Ferry and subsequently recaptured downstream at Antioch and Chipps Island (SJRGA 2007). Additional CWT salmon were released at Jersey Point to act as a control. The ratio of CWT salmon recaptured from the upstream and downstream release sites was then used to calculate an estimate of juvenile salmon survival. The resulting survival estimates were then correlated with river flows measured at the Vernalis gage during the period of juvenile migration when the HORB was installed and when it was not installed. The relationship between survival estimates for juvenile salmon

based on recaptures at Antioch and Chipps Island were significantly related to corresponding estimates of survival based on adult salmon from the ocean fishery (SJRGA 2007), which improves the confidence in the use of the juvenile survival-flow relationship as the basis for this analysis. Regression analysis from these data was used as a predictive model to assess the potential change in juvenile salmon survival as a function of reducing river flow in response to the curtailment of the WWTP discharges. The flow-survival relationships with and without the HORB are shown in Figure 1. The regression equations used to predict the change in juvenile survival as a function of river flow during the spring migration period are:

With HORB

$$\text{Survival estimate} = 0.0001(\text{cfs})-0.2851$$
$$R^2 = 0.73$$

Without HORB

$$\text{Survival estimate} = 5e\text{-}6(\text{cfs}) + 0.1403$$
$$R^2 = 0.04$$

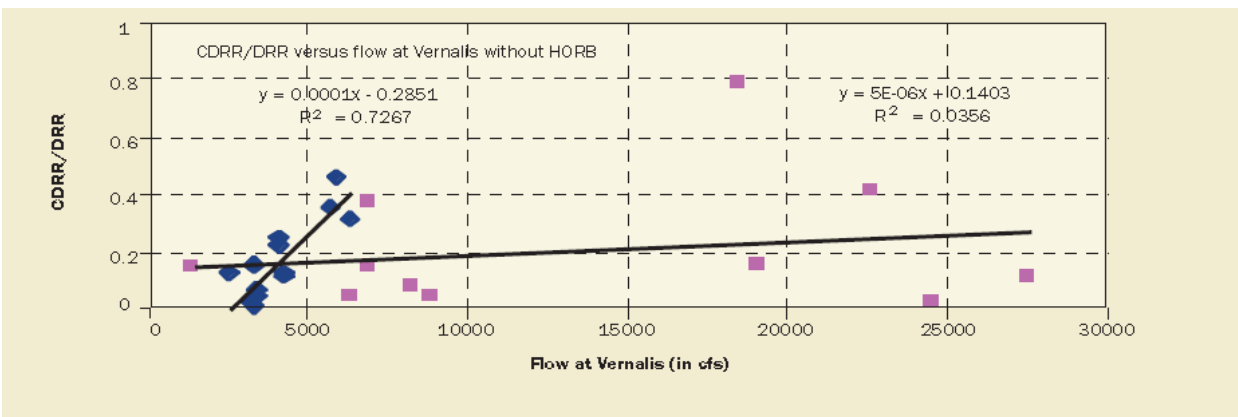


Figure 1: Relationships between juvenile salmon survival and flow in the San Joaquin River at Vernalis with and without the Head of Old River Barrier (HORB). The blue dots reflect flow-survival estimates when the HORB was installed and the red dots reflect flow-survival estimates when the HORB was not installed based on juvenile fall-run Chinook salmon mark-recapture experiments with tagged salmon released at Mossdale and Durham Ferry and recaptured at Chipps Island. Source: SJRGA 2007.

2.2.2 Escapement

Adult fall-run Chinook salmon return (escape) from the ocean and migrate through the San Joaquin River to spawn in upstream tributaries. Surveys have routinely been conducted by CDFW within the tributaries during the fall spawning period to quantify the number of spawning adults each year. Salmon escapement estimates are available for the period from 1952 through 2010 from the CDFW GranTab Chinook salmon escapement summaries. For these analyses, annual adult escapement to the Stanislaus, Tuolumne, and Merced rivers were combined to generate an annual estimate of fall-run Chinook salmon escapement to the San Joaquin River basin. No salmon currently spawn in the San Joaquin River between the confluence with the Merced River and Friant Dam, although restoration of

salmon populations in this reach of the river is underway. Although there are many factors effecting adult escapement and survival rates, studies have correlated San Joaquin River flows when juvenile salmon are migrating downstream in the spring with subsequent adult escapement in the fall 2.5 years later. For the analysis of changes in river flow presented in this assessment the average March-May flow in the San Joaquin River at the Vernalis gage from the USGS and DWR DAYFLOW data summaries were compiled each year. Regression analyses were used to establish a relationship between average spring river flow and subsequent adult salmon escapement 2.5 years later.

Regression analysis was used to predict escapement under the baseflow and adjusted flow conditions based on the following equation:

$$\text{Escapement} = 1.5879\ (\text{cfs}) + 11{,}458$$
$$R^2 = 0.32$$

2.2.3 River and Delta habitat

As flow through a channel increases the channel depth and/or wetted width increases, which may affect the area of usable habitat for juvenile salmon and other migrant and resident fish. As part of maintaining streamflow gages USGS periodically measures the stage-discharge relationship for each monitoring location. The shape of the stage-discharge curve is determined by the shape of the channel at the gage location. As the geomorphology of riverbeds change over time, regular stage-discharge surveys are necessary to insure accurate flow measurements at each gage. The most current stage-discharge relationship from the USGS gage at Vernalis (Figure 2) was used to simulate channel depths as an indicator of habitat conditions within the river with and without the WWTP discharges. Percent changes in the base versus adjusted flow conditions indicate predicted percent changes in salmon habitat with the removal of the WWTP discharge.

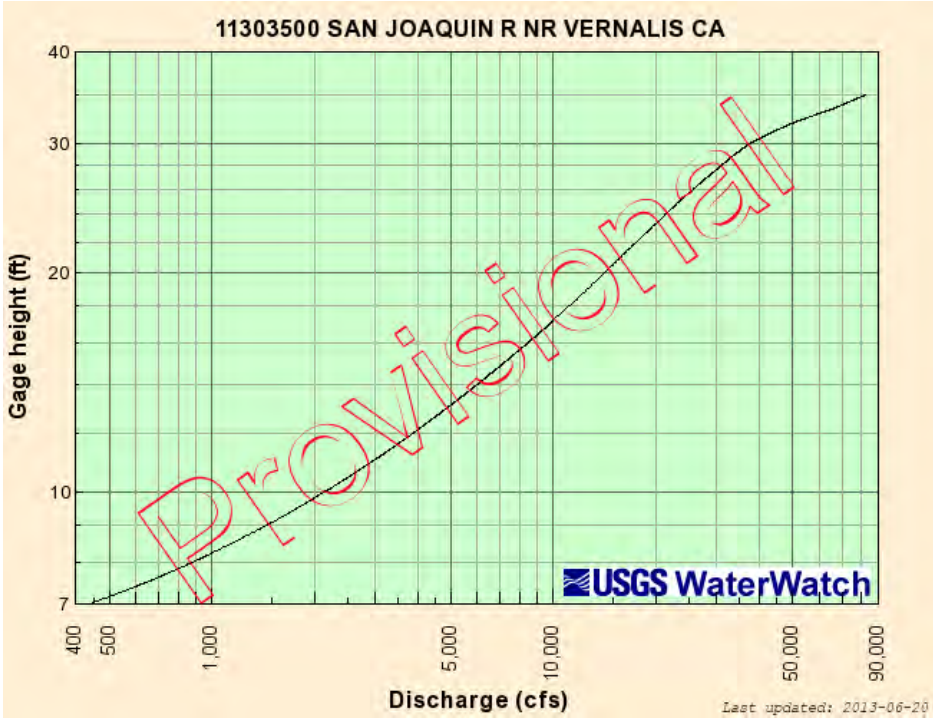


Figure 2: USGS stage-discharge relationship for the San Joaquin gage at Vernalis.

Habitat conditions for fish and other aquatic resources inhabiting the Delta and estuarine regions of the system have frequently been linked to the location of the low salinity zone. One indicator of the low salinity zone is the location, in kilometers upstream from the Golden Gate Bridge, where bottom salinity is 2 psu (referred to as X2 location). The location of the low salinity zone in the estuary is a function of the tides moving saltwater upstream from the ocean and bays and the magnitude of freshwater moving downstream from the Sacramento, San Joaquin, and other Central Valley rivers (referred to as Delta outflow). The relationship between Delta outflow and X2 location was used to assess the potential magnitude in changes of X2 location with and without the WWTP discharges. The analysis focused on X2 location during the biologically sensitive spring months of March-May. The change in X2 location was based on the following equation:

$$X2(t) = 10.16+0.945*X2(t-1)-1.487\log(Qout)(t)$$

where t=current day Delta outflow and t-1 is the X2 location on the previous day.

The analysis was run over Delta outflows ranging from approximately 3,500 to 23,000 cfs and assuming the total monthly WWTP discharge during March-May shown in Table 1.

2.2.4 SalSim

The CDFW has developed a lifecycle simulation model for fall-run Chinook salmon produced in San Joaquin River tributaries. The SalSim model (http://www.salsim.com/) is based on a series of

relationships between river flows, reservoir storage, water temperature, and a combination of other factors affecting survival and abundance in the upstream tributaries, within the lower San Joaquin River and Delta, and within the ocean. The SalSim model uses a variety of historic hydrological and biological data to simulate hypothetical flow conditions and the response of the Chinook salmon population. Although SalSim was not designed to be used as a "forecast model", altering the historic flows by known amounts generates alternative scenarios in which "what if" models can be used to simulate alternative salmon production through changes in historic water operations.

For this study, we simulated eight different flow conditions: critical, dry, normal and wet hydrologic conditions assuming baseline flows and adjusted flows at Vernalis without the WWTP discharges. The baseline conditions were generated by running the simulation without any changes to the flow conditions. The WWTP discharge reduction scenario (Adjusted) was simulated in the SalSim model by reflecting the percent change in river flow based on the WWTP discharge rates presented in Table 1. Because the simulation was run year round, rather than just during the spring, the WWTP discharge reduction calculations were calculated for an entire year. Total monthly WWTP discharges (Table 1) were subtracted from the monthly river flow at the USGS Vernalis gage under "Critical" (5 percentile), "Dry" (25 percentile), "Normal" (50 percentile or mean) and "Wet" (75 percentile) hydrologic conditions in the model. From these values, a percent change from the baseline flow was calculated.

SalSim was then used to simulate the changes in hydrologic conditions that would occur in the river with and without the WWTP discharges. SalSim produces a number of salmon population metrics for use in the analysis including ocean escapement, total spawners for all tributary spawning destinations, total spawning and egg production within the tributaries, total egg mortality, total juvenile salmon mortality and an estimate of the total number of juvenile salmon produced in the San Joaquin River tributaries entering the ocean assuming river flows with and without the WWTP discharges. The potential effect of changes in river flow on fall-run Chinook salmon population dynamics was assessed based on consideration of both the change in the abundance of various lifestages as well as the percentage change to account for variation in salmon abundance among years.

Results of the SalSim modeling produced a number of biological metrics for various lifestages of fall-run Chinook salmon under the baseline and proposed project hydrologic conditions. The model, however, does not allow changes to be made to instream flows in the San Joaquin River, but rather only allows flow changes in the model to occur in the upstream tributaries. By reducing flow in one of the tributaries to try to simulate the predicted flow reduction associated with the proposed project the model also changed upstream reservoir storage and associated seasonal water temperature conditions within the tributary that also affected the survival estimates for Chinook salmon (e.g., incubating eggs and juvenile rearing) within the tributary. Under these simulated conditions, results of the model became unstable and in some cases inconsistent with the general population dynamics of fall-run Chinook salmon. The initial results of the simulation model comparisons were not realistic or reliable. To help try to resolve these initial simulation model inconsistencies we met with Dale Stanton, an engineer with CDFW who is actively involved in development and evaluation of the SalSim model, to discuss how the model could be configured to simulate changes in San Joaquin River flows associated

with the proposed project, while not altering upstream reservoir operations and other aspects of the model. Mr. Stanton reported that the SalSim model was not developed to address changes in San Joaquin River flows such as those that would occur under the proposed project operations, and therefore, the model could not be used to reliably predict changes in San Joaquin River fall-run Chinook salmon abundance or population dynamics as an assessment tool for the proposed project evaluation. Based on these initial model results and consultation with CDFW the SalSim model was not subsequently used in these analyses.

3. RESULTS

3.1 Flow differences with and without WWTP discharges

Predicted changes to San Joaquin River flow when the WWTP discharge is removed (Adjusted flow) is on average less than 1% (ranges from 0.16 – 2.46%) of the total San Joaquin River flow (base flow) between March and May. Throughout the spring juvenile salmon migration season, the rate of WWTP discharges is reduced from an average 48.2 cfs in March to an average 19.8 cfs in May (Table 1). Dry, normal and wet years, as modeled by analyzing the 25th, 50th (mean) and 75th flow percentages from the Vernalis gage, showed that in dry and normal years, the net flow did not widely vary. Wet years, however show a steep increase in river flow during the March-May period. As a result, the net change in river flow at Vernalis is reduced in proportion to the change in baseflows within the river (Table 2). Results of these flow analyses were used in the comparative assessment of predicted changes to salmon survival and abundance with and without the WWTP discharges.

Table 2: Spring flow rates (cfs) for dry, normal and wet years, the average WWTP discharge rate (cfs) for their associated months and the percentage difference with and without the WWTP discharges.

	March			April			May		
	25th %	**Mean**	**75th %**	**25th %**	**Mean**	**75th %**	**25th %**	**Mean**	**75th %**
Base Flow (cfs)	1,957	3,481	9,178	1,600	3,095	10,392	1,739	3,470	12,126
WWTP Discharges (cfs)	48.2	48.2	48.2	23.2	23.2	23.2	19.8	19.8	19.8
Adjusted Flow (cfs)	1,909	3,433	9,130	1,577	3,072	10,369	1,719	3,450	12,106
% Change	**2.46%**	**1.38%**	**0.53%**	**1.45%**	**0.75%**	**0.22%**	**1.14%**	**0.57%**	**0.16%**

3.2 Juvenile Chinook salmon survival

Previous studies of juvenile salmon survival in the San Joaquin River clearly show that the presence of the HORB, used to keep juvenile salmon from migrating into Old River, greatly increases the likelihood of survival (Figure 1). As expected based on the regressions shown in Figure 1, the survival of juvenile salmon was extremely sensitive to increasing or decreasing river flows when the HORB was installed and

survival rates were not sensitive to river flow when the HORB was not installed. When the base and adjusted flow conditions were compared based on the juvenile salmon survival-flow regression models (Figure 1), the decrease in predicted survival with and without the WWTP discharges ranged from 0.000 to 0.005 for conditions with the HORB in place and were all 0.000 without the HORB (Table 3). Although changes in survival between the baseflow and adjusted flow conditions can be calculated using the regression models, the magnitude of these differences is so small that it could not be measured in field studies. The model predicts a moderately strong correlation between increased flow and increased survival (R^2 = 0.73) when the HORB is in place. Although there is still a positive relationship between survival and flow for conditions without the HORB, the statistical correlation is weak (R^2 = 0.04) and not statistically significant. The relatively high variability in the relationship between salmon survival and river flow, especially when the HORB is not installed, suggests that the predicted small change in survival shown in Table 3 is well within the observed variability in survival rates and would not be detectable in the river.

Table 3: Estimated change in juvenile Chinook salmon survival as a function of San Joaquin River flow with and without the Head of River Barrier (HORB).

	March			April			May		
	25th %	Mean	75th %	25th %	Mean	75th %	25th %	Mean	75th %
With HORB									
Baseflow survival	0.000	0.063	0.633	0.000	0.024	0.754	0.000	0.062	0.928
Adjusted flow survival	0.000	0.0.58	0.628	0.000	0.022	0.752	0.000	0.060	0.926
Net change	0.000	0.005	0.005	0.000	0.002	0.002	0.000	0.002	0.002
Without HORB									
Baseflow survival	0.150	0.158	0.186	0.148	0.156	0.192	0.149	0.158	0.201
Adjusted flow survival	0.150	0.157	0.186	0.148	0.156	0.192	0.149	0.158	0.201
Net change	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3 Adult Chinook salmon escapement

The correlation between the springtime flow measured at the USGS Vernalis gage and returning adult Chinook escapement 2.5 years later show a positive trend and predict that a reduction in river flow will contribute to a reduction in the number of adult salmon returning into the San Joaquin River tributaries to spawn. The predicted change in adult salmon escapement, as calculated by the regression for river flow conditions during the March-May juvenile outmigration period, was a reduction in average escapement of 0.52% assuming the WWTP discharge to the river is no longer occurring (Table 4). The regression model predicts a reduction in salmon returns of 77, 37 and 31 individuals for March, April and May respectively, assuming no WWTP discharges. The total predicted reduction in escapement from a reduction in river flow over the March-May juvenile migration period is 145 fish out of predicted escapement estimates ranging from approximately 14,000 to 31,000 adults (less than 1%). The actual adult salmon escapement to the San Joaquin River basin varies substantially among years. The high variation in the escapement-flow relationship (R^2 = 0.32) suggests that the predicted small change in escapement is well within the observed variability in the relationship and would not be detectable in the river.

Table 4: Predicted change in adult salmon escapement with and without the WWTP discharges.

	March			April			May		
	25th %	**Mean**	**75th %**	**25th %**	**Mean**	**75th %**	**25th %**	**Mean**	**75th %**
Base Flow Escapement	14,566	16,986	26,032	13,999	16,373	27,959	14,219	16,968	30,713
Adjusted Escapement	14,489	16,909	25,955	13,962	16,336	27,923	14,188	16,936	30,681
Difference	77	77	77	37	37	37	31	31	31
% Change	**0.53%**	**0.45%**	**0.29%**	**0.26%**	**0.22%**	**0.13%**	**0.22%**	**0.19%**	**0.10%**

3.4 Habitat in the river and Delta

Changes in water depth as a function of river flow were used as an indicator of potential changes in habitat conditions and availability for juvenile salmon and other resident and migratory fish species. As flow increased through the San Joaquin River the stage height, and associated useable habitat, increased as well. The ranges of changes in stage height for base and adjusted flow remained fairly consistent for each seasonal condition. The reduction in river stage height (a reflection of water depth in the river) associated with curtailment of the WWTP discharges was estimated to range from 0.02 to 0.08 feet (Table 5). Differences between base and adjusted flow river stages varied consistently by less than 0.8% (Table 5) which is consistent with results of previous analyses. Much of the San Joaquin River channel has been incised or contained by levees. Under these conditions the predicted change in river stage would not be expected to result in biologically meaningful reductions in the quantity or quality (e.g., wetted channel width) of habitat for fish within the river.

Table 5: Changes in stage height (feet) as a function of river flow.

	March			April			May		
	25th %	**Mean**	**75th %**	**25th %**	**Mean**	**75th %**	**25th %**	**Mean**	**75th %**
Base Stage Height (ft)	9.75	11.60	16.56	9.23	11.17	17.44	9.44	11.59	18.59
Adjusted Stage Height (ft)	9.67	11.55	16.53	9.20	11.14	17.40	9.41	11.57	18.57
Change in Stage (ft)	0.08	0.05	0.02	0.03	0.03	0.04	0.03	0.02	0.02
% Change	**0.82%**	**0.43%**	**0.18%**	**0.33%**	**0.27%**	**0.23%**	**0.32%**	**0.17%**	**0.11%**

The predicted change in X2 location, a reflection of the low salinity zone habitat for estuarine fish and other organisms, moved upstream on average 0.06 km in March, an average of 0.03 km in April, and an average of 0.02 km in May. The magnitude of these changes would not be detectable in the field given the natural variation in X2 location based on variation in tidal conditions. In other environmental analyses an upstream movement of X2 location by less than 0.25 km (and in some cases less than 0.5 km) has been found to be less than significant. The magnitude of upstream movement of X2 in this

assessment is expected to have no effect on habitat quality or availability in the estuarine low salinity zone or on the aquatic species that inhabit the low salinity zone.

4. SUMMARY AND CONCLUSIONS

The two primary conclusions from this assessment are:

- Curtailment of treated waste water discharges from the Modesto and Turlock WWTPs into the San Joaquin River will result in an incremental reduction in river flow from the point of the existing discharge downstream. The reduction in San Joaquin River flow would contribute, based on the best scientific information available, to an incremental reduction in juvenile Chinook salmon survival during spring outmigration, a reduction in adult salmon escapement to the San Joaquin River tributaries, and an incremental reduction in habitat quality and availability in the lower river and estuary.

- The magnitude of predicted changes in juvenile salmon survival, adult escapement, and habitat conditions in the lower river and estuary was small (typically less than 1% when compared to current baseline conditions) and is well within the natural observed variation in the regression relationships used in these analyses. The magnitude of predicted changes in juvenile salmon survival and adult escapement, habitat quality and availability in the lower San Joaquin River, and the location of the estuarine low salinity zone (X2 location) would not be detectable in field studies and is considered to be less than significant.

Based on results of this study, curtailment of the discharge of treated waste water from the WWTPs at Modesto and Turlock into the San Joaquin River would not be expected to result in a measureable effect on the population dynamics of Chinook salmon. Since Chinook salmon are among the most sensitive fish species to changes in instream flows and other associated environmental factors (e.g., exposure to seasonally elevated water temperatures) the potential effects of the proposed curtailment of WWTP discharges to the river would be expected to be less for other resident and migratory fish inhabiting the San Joaquin River.

Literature Cited

San Joaquin River Group Authority (SJRGA) 2007. San Joaquin River Agreement 2006 annual technical report. Prepared by San Joaquin River Group Authority. Prepared for State Water Resources Control Board. January 2007.

Appendix M – Detailed Alternative Cost Estimates

NVRRWP Conceptual Pipeline Cost Estimate

Alternatives Cost Comparison (2018, 33,600 AFY)

	2018	2045
	30600	59900

September 17, 2013

Cost Basis May 2013 SF CCI: 10383.09

Summary of Alternatives including all Facilities

	DMC-1A (2018) Separate Pipelines (PID)	DMC-1B (2018) Separate Pipelines (Most Direct)	DMC-2 (2018) Combined Pipelines East	DMC-3 (2018) Combined Pipelines West	DMC-4 (2018) Combined @ Harding	PID-1 (2018) PID East (See Note 3)	PID-2 (2018) PID West (See Note 3)	Direct Pipeline to DPWD (2018)	Notes
Capital Costs									
Base Construction Cost	**$ 93,310,000**	**$ 77,920,000**	**$ 79,180,000**	**$ 75,610,000**	**$ 73,230,000**	**$ 39,470,000**	**$ 44,550,000**	**$ 176,960,000**	
Implementation Costs	$ 27,990,000	$ 23,380,000	$ 23,750,000	$ 22,680,000	$ 21,970,000	$ 11,840,000	$ 13,370,000	$ 53,090,000	Implementation Cost derived as percentages of base construction estimate
ROW Easements and Land Acquisition	$ 169,600	$ 124,000	$ 152,400	$ 142,600	$ 146,100	$ 88,700	$ 111,700	$ 387,400	
Environmental Mitigation Measures Costs	$ 1,210,000	$ 1,010,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 500,000	$ 600,000	$ 2,300,000	Assumes 1% of Capital Costs
Most Probable Capital Cost	**$ 122,700,000**	**$ 102,400,000**	**$ 104,100,000**	**$ 99,400,000**	**$ 96,300,000**	**$ 51,900,000**	**$ 58,600,000**	**$ 232,700,000**	
High End of Accuracy Range	$ 153,400,000	$ 128,000,000	$ 130,100,000	$ 124,300,000	$ 120,400,000	$ 64,900,000	$ 73,300,000	$ 290,900,000	+25%
Low End of Accuracy Range	$ 104,300,000	$ 87,000,000	$ 88,500,000	$ 84,500,000	$ 81,900,000	$ 44,100,000	$ 49,800,000	$ 197,800,000	-15%
Annual Costs									
Equipment Repair and Replacement	$ 132,000	$ 124,000	$ 120,000	$ 132,000	$ 110,000	$ 66,000	$ 52,000	$ 180,000	
Wheeling Costs - USBR, $30/AF	$ 920,000	$ 920,000	$ 920,000	$ 920,000	$ 920,000	$ 920,000	$ 920,000	$ -	$30/AF for DMC-1 - DMC-4, $105/AF for PID-1 - PID-2
Wheeling Costs - PID, $75/AF		$ -	$ -	$ -	$ -	$ 2,300,000	$ 2,300,000	$ -	
Power	$ 460,000	$ 450,000	$ 500,000	$ 530,000	$ 510,000	$ 90,000	$ 60,000	$ 590,000	Using TID power rate @ $0.07 / kw-hr
Total Annual O&M	**$ 1,500,000**	**$ 1,500,000**	**$ 1,500,000**	**$ 1,600,000**	**$ 1,500,000**	**$ 3,400,000**	**$ 3,300,000**	**$ 800,000**	

	DMC-1A (2018) Separate Pipelines (PID)	DMC-1B (2018) Separate Pipelines (Most Direct)	DMC-2 (2018) Combined Pipelines East	DMC-3 (2018) Combined Pipelines West	DMC-4 (2018) Combined @ Harding	PID-1 (2018) PID East (See Note 3)	PID-2 (2018) PID West (See Note 3)	Direct Pipeline to DPWD (2018)	Notes
Cost of Water under Various Financing Scenarios									
Capital Cost	$ 122,700,000	$ 102,400,000 0	$ 104,100,000	$ 99,400,000	$ 96,300,000	$ 51,900,000	$ 58,600,000	$ 232,700,000	
Annual O&M Costs	$ 1,500,000	$ 1,500,000 0	$ 1,500,000	$ 1,600,000	$ 1,500,000	$ 3,400,000	$ 3,300,000	$ 800,000	
Total Production, AFY	$ 30,600	$ 30,600	$ 30,600	$ 30,600	$ 30,600	$ 30,600	$ 30,600	$ 30,600	

Cost of Water under Various Financing Scenarios									
100% Reclamation Low Interest Loan, 1% over 30 years	**$ 200**	**$ 180**	**$ 180**	**$ 180**	**$ 170**	**$ 180**	**$ 180**	**$ 320**	Terms of potential Reclamation loans haven't been established. This estimate assumes 1% over 30 years
25% Reclamation Grant 75% Bond financing, 5% over 30 years	**$ 240**	**$ 210**	**$ 210**	**$ 210**	**$ 200**	**$ 190**	**$ 200**	**$ 400**	
SRF Loan, 2.5% over 20 year loan period	**$ 310**	**$ 260**	**$ 270**	**$ 260**	**$ 250**	**$ 220**	**$ 230**	**$ 510**	
25% Reclamation Grant 75% SRF Loan, 2.5% over 20 years	**$ 240**	**$ 210**	**$ 210**	**$ 210**	**$ 200**	**$ 190**	**$ 200**	**$ 390**	

Notes:

1. Cost estimates are in February 2013 dollars using SF CCI = 10369.09
2. A/P Factor is a standard Cash flow factor that is use to calculate an annual cost based on a present value for a given time frame and interest rate.
3. Costs for PID-1 and PID-2 include only the costs to convey water to the PID canal facilities. It does not include any proportional costs for upgrades to the PID Canal System or wheeling charges for using the Canal facilities.

Financing Assumptions

100% Reclamation Low Interest Loan, 1% over 30 years								
Interest Rate	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
Time (Years)	30	30	30	30	30	30	30	30
A/P Factor	0.038748	0.038748	0.038748	0.038748	0.038748	0.038748	0.038748	0.038748
25% Reclamation Grant 75% Bond financing, 5% over 30 years								
Interest Rate	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Time (Years)	30	30	30	30	30	30	30	30
A/P Factor	0.065051	0.065051	0.065051	0.065051	0.065051	0.065051	0.065051	0.065051
SRF Loan, 2.5% over 20 year loan period								
Interest Rate	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
Time (Years)	20	20	20	20	20	20	20	20
A/P Factor	0.064147	0.064147	0.064147	0.064147	0.064147	0.064147	0.064147	0.064147
25% Reclamation Grant 75% SRF Loan, 2.5% over 20 years								
Interest Rate	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
Time (Years)	20	20	20	20	20	20	20	20
A/P Factor	0.064147	0.064147	0.064147	0.064147	0.064147	0.064147	0.064147	0.064147

Project: NVRRWP

Component: 2018 RW DMC-1 - Separate Pipelines (PID)

Date: September 17, 2013
Project Number: 0453-04.04

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary

Spec. Division		Subtotal	Notes
Facilities		$ 60,320,000	
RAW CONSTRUCTION COST		**$ 60,320,000**	
Mobilization/Demobilization	1%	*$ 600,000*	
Contractors Overhead and Profit	18%	*$ 10,860,000*	
Construction Contingency	30%	*$ 21,530,000*	
Base Construction Cost		**$ 93,310,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 27,990,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 60,320,600**	
Turlock Facilities							
Harding Drain to across SJR			4000	LF	$ 2,300.00	$ 9,200,000	HDD
SJR Xing to HWY 33	42	inch	18,500	LF	$ 12.00	$ 9,324,000	XC route in between Apricot Ave and Pomegranite Ave
Bore&Jack under Canals	100	LF	5	ea	$ 1,800.00	$ 900,000	
Bore&Jack under HWY 33, R&R	150	LF	1	ea	$ 1,800.00	$ 270,000	
HWY 33 to DMC	42	inch	8,850	LF	$ 14.00	$ 5,203,800	XC route approx. 1,000 N of Marshall Ave
Booster Pump Station	750	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 1,430,000	(2) 250 hp Duty, (1) 250 hp standby
Modesto Facilities							
RW Facility to W. Main	42	inch	10,800	feet	$ 12.00	$ 5,443,200	Parallel Jennings Rd.
W. Main to Las Palmas Bridge	42	inch	2,500	feet	$ 14.00	$ 1,470,000	
River Crossing at Las Palmas Bridge			2000	feet	$ 2,300.00	$ 4,600,000	HDD
West end of Las Palmas Bridhe to PID	42	inch	2,000	feet	$ 14.00	$ 1,176,000	
PID Canal Alignment	42	inch	14,900	feet	$ 18.00	$ 11,264,400	
Bore&Jack under Canals	100	feet	4	ea	$ 1,800.00	$ 720,000	
Bore&Jack Under HWY 33	100	feet	1	ea	$ 1,800.00	$ 180,000	
HWY 33 to DMC via Bartch and Ward Ave	42	inch	12,400	feet	$ 14.00	$ 7,291,200	
Booster Pump Station	1,000	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 1,848,000	(3) 250 hp Duty, (1) 250 hp standby

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Width**	**Units**	**Length**	**Unit**	**Unit Cost**	**$ 169,600**	
Pipelines - Turlock	25	LF	26800	LF	$ 0.11	$ 76,900	Modesto Ranch - no easement requirements (5,200 ft)
Pipelines - Modesto	25	LF	29,100	LF	$ 0.11	$ 83,500	Modesto Ranch - no easement requirements (14,000 ft)
Joint Pump Station	15,000	SF	0	EA	$ 0.46	$ -	
Booster Pump Station	10,000	SF	2	EA	$ 0.46	$ 9,200	

Repair and Replacement Costs			Cost
	Amount	**Unit**	**Value**	**$ 132,000**
Equipment Consumables	$ 3,278,000		2%	$ 66,000
Mechanical Consumables	$ 3,278,000		2%	$ 66,000

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ 1,380,000
Power	6,551,000	Kw-hr	$ 0.07	$ 460,000
Agreements with the Bureau	30,600	$/AF	$ 30	$ 920,000

Project: NVRRWP

Component: 2018 RW DMC-1 - Separate Pipelines (Most Direct)

Date: September 17, 2013
Project Number: 0453-04.04

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary

Spec. Division		Subtotal	Notes
Facilities		$ 50,370,000	
RAW CONSTRUCTION COST		**$ 50,370,000**	
Mobilization/Demobilization	1%	*$ 500,000*	
Contractors Overhead and Profit	18%	*$ 9,070,000*	
Construction Contingency	30%	*$ 17,980,000*	
Base Construction Cost		**$ 77,920,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 23,380,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 50,373,400**	
Turlock Facilities							
Harding Drain to across SJR			4000	LF	$ 2,300.00	$ 9,200,000	HDD
SJR Xing to HWY 33	42	inch	18,500	LF	$ 12.00	$ 9,324,000	XC route in between Apricot Ave and Pomegranite Ave
Bore&Jack under Canals	100	LF	5	ea	$ 1,800.00	$ 900,000	
Bore&Jack under HWY 33, R&R	150	LF	1	ea	$ 1,800.00	$ 270,000	
HWY 33 to DMC	42	inch	8,850	LF	$ 14.00	$ 5,203,800	XC route approx. 1,000 N of Marshall Ave
Booster Pump Station	750	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 1,430,000	(2) 250 hp Duty, (1) 250 hp standby
Modesto Facilities							
River Crossing at Modesto WQCF d/c PS			3,000	LF	$ 2,300.00	$ 6,900,000	
SJR to DMC	42	inch	27,650	LF	$ 12.00	$ 13,935,600	XC route
Bore&Jack under Canals	100	LF	7	ea	$ 1,800.00	$ 1,260,000	
Bore&Jack Under HWY 33, R&R	150	LF	1	ea	$ 1,800.00	$ 270,000	
Booster Pump Station	1,000	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 1,680,000	(3) 250 hp Duty, (1) 250 hp standby

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Width**	**Units**	**Length**	**Unit**	**Unit Cost**	**$ 136,300**	
Pipelines - Turlock	25	LF	26800	LF	$ 0.11	$ 76,900	Modesto Ranch - no easement requirements (5,200 ft)
Pipelines - Modesto	25	LF	17,500	LF	$ 0.11	$ 50,200	Modesto Ranch - no easement requirements (14,000 ft)
Joint Pump Station	15,000	SF	0	EA	$ 0.46	$ -	
Booster Pump Station	10,000	SF	2	EA	$ 0.46	$ 9,200	

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 124,000**
Equipment Consumables	$ 3,110,000		2%	$ 62,000
Mechanical Consumables	$ 3,110,000		2%	$ 62,000

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ 1,370,000
Power	6,432,000	Kw-hr	$ 0.07	$ 450,000
Agreements with the Bureau	30,600	$/AF	$ 30	$ 920,000

Project: NVRRWP

Component: 2018 RW DMC-2 - Pipeline Combined East / PID

Date: September 17, 2013
Project Number: 0453-04.04

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary

Spec. Division		Subtotal	Notes
Facilities		$ 51,190,000	
RAW CONSTRUCTION COST		**$ 51,190,000**	
Mobilization/Demobilization	1%	*$ 510,000*	
Contractors Overhead and Profit	18%	*$ 9,210,000*	
Construction Contingency	30%	*$ 18,270,000*	
Base Construction Cost		**$ 79,180,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 23,750,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 51,194,400**	
Turlock Facilities							
Pipeline to Joint PS / W. Main	36	inch	21,200	LF	$ 12.00	$ 9,158,400	
Bore&Jack - West Main Ave.	100	ft	1	ea	$ 1,800.00	$ 180,000	
Booster Pump Station	100	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 460,000	(1) 100 hp Duty, (1) 100 hp standby
Modesto Facilities							
Pipeline to Joint PS / W Main	36	inch	10,800	LF	$ 12.00	$ 4,665,600	
Booster Pump Station	100	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 460,000	(1) 100 hp Duty, (1) 100 hp standby
Joint Facilities to DMC							
Cnxn to Las Palmas Bridge	54	inch	2,500	LF	$ 18.00	$ 2,430,000	
River Crossing (SJR) at Las Palmas Bridge			2,000	LF	$ 2,300.00	$ 4,600,000	
Las Palmas Bridge to PID	54	inch	2,000	LF	$ 18.00	$ 1,944,000	
Alignment along PID Canal to HWY 33	54	inch	14,900	LF	$ 18.00	$ 14,482,800	
Bore&Jack Under PID Canals	100	LF	5	ea	$ 1,800.00	$ 900,000	
Bore&Jack Under Hwy 33	100	LF	1	ea	$ 1,800.00	$ 180,000	
PID Canal to Bartch Ave along HWY 33	54	inch	500	LF	$ 18.00	$ 486,000	
HWY 33 to DMC along Bartch Ave and Ward Ave	54	inch	12,100	LF	$ 14.00	$ 9,147,600	
Joint Pump Station	1,500	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 2,100,000	(4) 300 hp Duty, (1) 300 standby

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Width**	**Units**	**Length**	**Unit**	**Unit Cost**	**$ 152,400**	
Pipelines - Turlock	25	LF	16,100	LF	$ 0.11	$ 46,200	Modesto Ranch - no easement requirements (5,200 ft)
Pipelines - Modesto	25	LF	0	LF	$ 0.11	$ -	Modesto Ranch - no easement requirements (10,800 ft)
Pipelines - Combined	25	LF	31,400	LF	$ 0.11	$ 90,100	Modesto Ranch - no easement requirements (3,200 ft)
Joint Pump Station	15,000	SF	1	EA	$ 0.46	$ 6,900	
Booster Pump Station	10,000	SF	2	EA	$ 0.46	$ 9,200	

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 120,000**
Equipment Consumables	$ 3,020,000		2%	$ 60,000
Mechanical Consumables	$ 3,020,000		2%	$ 60,000

O&M Costs				Cost
	Amount	**Unit**	**Value**	**$ 1,420,000**
Power	7,125,000	kW-hr	$ 0.07	$ 500,000
Agreements with the Bureau	30,600	$/AF	$ 30	$ 920,000

Project: NVRRWP

Component: 2018, 2045 RW DMC-3 - Pipeline Combined West

Date: September 17, 2013
Project Number: 0453-04.04

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary

Spec. Division		Subtotal	Notes
Facilities		$ 48,870,000	
RAW CONSTRUCTION COST		**$ 48,870,000**	
Mobilization/Demobilization	1%	*$ 490,000*	
Contractors Overhead and Profit	18%	*$ 8,800,000*	
Construction Contingency	30%	*$ 17,450,000*	
Base Construction Cost		**$ 75,610,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 22,680,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 48,873,600**	
Turlock Facilities							
SJR River Xing	36	inch	4,000	LF	$ 2,300.00	$ 9,200,000	
Pipeline to Joint PS	36	inch	2,300	LF	$ 14.00	$ 1,159,200	
Booster Pump Station	100	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 460,000	(1) 50 hp Duty, (1) 50 hp stand-by
Modesto Facilities							
Pipeline to W Main	36	inch	10,800	LF	$ 14.00	$ 5,443,200	
Bore&Jack W Main			100	LF	$ 1,800.00	$ 180,000	
Pipeline to SJR Xing	36	inch	2,000	LF	$ 14.00	$ 1,008,000	
River Crossing (SJR)			1,300	LF	$ 2,300.00	$ 2,990,000	
Pipeline to Joint PS	36	inch	11,600		$ 14.00	$ 5,846,400	
Booster Pump Station	225	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 730,000	(2) 75 hp Duty, (1) 75 hp stand-by
Joint Facilities to DMC							
Pipeline to HWY 33	54	inch	17,000	LF	$ 14.00	$ 12,852,000	XC route in between Apricot Ave and Pomegranite Ave
Bore&Jack under Canals	100	LF	5	EA	$ 1,800.00	$ 900,000	
Bore&Jack Under Hwy 33, R&R	150	LF	1	EA	$ 1,800.00	$ 270,000	
HWY 33 to DMC Alignment	54	inch	8,850	LF	$ 12.00	$ 5,734,800	XC from HWY 33 straight to DMC
Joint Pump Station	1,500	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 2,100,000	(4) 300 hp Duty, (1) 300 hp stand-by

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Width**	**Units**	**Length**	**Unit**	**Unit Cost**	**$ 142,600**	
Pipelines - Turlock	25	LF	6,300	LF	$ 0.11	$ 18,100	
Pipelines - Modesto	25	LF	11,300	LF	$ 0.11	$ 32,400	Modesto Ranch - no easement requirements (14,500 ft)
Pipelines - Combined	25	LF	26,500	LF	$ 0.11	$ 76,000	
Joint Pump Station	15,000	SF	1	EA	$ 0.46	$ 6,900	
Booster Pump Station	10,000	SF	2	EA	$ 0.46	$ 9,200	

Repair and Replacement Costs				Cost	
	Amount	**Unit**	**Value**	**$ 132,000**	
Equipment Consumables	$ 3,290,000		2%	$ 66,000	
Mechanical Consumables	$ 3,290,000		2%	$ 66,000	

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**	
				$ 1,450,000	
Power	7,523,000	Kw-hr	$ 0.07	$ 530,000	
Agreements with the Bureau	30,600	$/AF	$ 30	$ 920,000	

Project: NVRRWP

Component: 2018, 2045 DMC-4 - Pipeline Combined East @ Harding

Date: September 17, 2013
Project Number: 0453-04.04

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary

Spec. Division		Subtotal	Notes
Facilities		$ 47,340,000	
RAW CONSTRUCTION COST		**$ 47,340,000**	
Mobilization/Demobilization	1%	*$ 470,000*	
Contractors Overhead and Profit	18%	*$ 8,520,000*	
Construction Contingency	30%	*$ 16,900,000*	
Base Construction Cost		**$ 73,230,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 21,970,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 47,340,800**	
Modesto Facilities							
Pipeline to W Main	36	inch	10,800	LF	$ 14.00	$ 5,443,200	
Bore&Jack			100	LF	$ 1,800.00	$ 180,000	
Pipeline to Harding Drain	36	inch	21200	LF	$ 14.00	$ 10,684,800	East on West Main, South on S. Carpenter
Canal Crossings - bore & jack	100	ft	1	ea	$ 1,800.00	$ 180,000	
Booster Pump Station	300	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 860,000	(3) 75 hp Duty, (1) 75 hp standby
Joint Facilities to DMC							
Harding Drain to across SJR			4000	LF	$ 2,300.00	$ 9,200,000	HDD
SJR Xing to HWY 33	54	inch	18,500	LF	$ 12.00	11988000	XC route in between Apricot Ave and Pomegranite Ave
Bore&Jack under Canals	100	LF	5	ea	$ 1,800.00	$ 900,000	
Bore&Jack under HWY 33, R&R	150	LF	1	ea	$ 1,800.00	$ 270,000	
HWY 33 to DMC	54	inch	8,850	LF	$ 12.00	$ 5,734,800	XC route approx. 1,000 N of Marshall Ave
Booster Pump Station	1,250	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 1,900,000	(4) 250 hp Duty, (1) 250 hp standby

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Width**	**Units**	**Length**	**Unit**	**Unit Cost**	**$ 146,100**	
Pipelines - Modesto	25	LF	14,900	LF	$ 0.11	$ 42,800	Modesto Ranch - no easement requirements (17,300 ft)
Pipelines - Combined	25	LF	32,000	LF	$ 0.11	$ 91,800	
Joint Pump Station	15,000	SF	1	EA	$ 0.46	$ 6,900	
Booster Pump Station	10,000	SF	1	EA	$ 0.46	$ 4,600	

Repair and Replacement Costs				Cost	
	Amount	**Unit**	**Value**	**$ 110,000**	
Equipment Consumables	$ 2,760,000		2%	$ 55,000	
Mechanical Consumables	$ 2,760,000		2%	$ 55,000	

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**	
				$ 1,430,000	
Power	7,272,000	Kw-hr	$ 0.07	$ 510,000	
Agreements with the Bureau	30,600	$/AF	$ 30	$ 920,000	

Project: NVRRWP

Component: 2018, 2045 RW PID-1 - PID Destination, East

Date: September 17, 2013
Project Number: 0453-04.04

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary

Spec. Division		Subtotal	Notes
Facilities		$ 25,510,000	
RAW CONSTRUCTION COST		**$ 25,510,000**	
Mobilization/Demobilization	1%	*$ 260,000*	
Contractors Overhead and Profit	18%	*$ 4,590,000*	
Construction Contingency	30%	*$ 9,110,000*	
Base Construction Cost		**$ 39,470,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 11,840,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 25,506,400**	
Turlock Facilities							
Pipeline to Joint PS / W. Main	36	inch	21,200	LF	$ 14.00	$ 10,684,800	
Canal Crossings - bore & jack	100	ft	1	ea	$ 1,800.00	$ 180,000	
Booster Pump Station	100	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 460,000	(1) 50 hp Duty, (1) 50 hp standby
Modesto Facilities							
Pipeline to Joint PS / W Main	36	inch	10,800	LF	$ 12.00	$ 4,665,600	
Booster Pump Station	100	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 460,000	(1) 100 hp Duty, (1) 100 hp standby
Joint Facilities to PID							
Cnxn to Las Palmas Bridge	54	inch	2,500	LF	$ 18.00	$ 2,430,000	
River Crossing (SJR) at Las Palmas Bridge			2000	LF	$ 2,300.00	$ 4,600,000	HDD
Las Palmas Bridge to PID	54	inch	2,000	LF	$ 12.00	$ 1,296,000	Cross country alignment on west side of SJR
Booster Pump Station	225	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 730,000	(2) 75 hp Duty, (1) 75 hp standby

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Width**	**Units**	**Length**	**Unit**	**Unit Cost**	**$ 88,700**	
Pipelines - Turlock	25	LF	21300	LF	$ 0.11	$ 61,100	
Pipelines - Modesto	25	LF	0	LF	$ 0.11	$ -	Modesto Ranch - no easement requirements (10,800 ft)
Pipelines - Combined	25	LF	4,000	LF	$ 0.11	$ 11,500	Modesto Ranch - no easement requirements (2,500 ft)
Joint Pump Station	15,000	SF	1	EA	$ 0.46	$ 6,900	
Booster Pump Station	10,000	SF	2	EA	$ 0.46	$ 9,200	

Repair and Replacement Costs	Amount	Unit	Value	Cost
				$ 66,000
Equipment Consumables	$ 1,650,000		2%	$ 33,000
Mechanical Consumables	$ 1,650,000		2%	$ 33,000

O&M Costs	Amount	Unit	Value	Cost
				$ 3,310,000
Power	1,242,000	Kw-hr	$ 0.07	$ 90,000
Agreements with PID	30,600	$/AF	$ 75	$ 2,300,000
Agreements with Reclamation	30,600	$/AF	$ 30	$ 920,000

Project: NVRRWP

Component: 2018, 2045 RW PID-2- PID Destination, West

Date: September 17, 2013
Project Number: 0453-04.04

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary

Spec. Division		Subtotal	Notes
Facilities		$ 28,800,000	
RAW CONSTRUCTION COST		**$ 28,800,000**	
Mobilization/Demobilization	1%	*$ 290,000*	
Contractors Overhead and Profit	18%	*$ 5,180,000*	
Construction Contingency	30%	*$ 10,280,000*	
Base Construction Cost		**$ 44,550,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 13,370,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 28,804,400**	
Turlock Facilities							
Reach							
Pipeline to PID Main Canal	36	inch	19,200	LF	$ 12.00	$ 8,294,400	
River Crossing (SJR)	4000	ft	1	EA	$ 2,300.00	$ 9,200,000	
Booster Pump Station	150	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 580,000	(1) 75 hp Duty, (1) 75 hp standby
Modesto Facilities							
River Crossing (SJR)			2,000	LF	$ 2,300.00	$ 4,600,000	
Pipeline to PID Main Canal	36	inch	12,500	LF	$ 12.00	$ 5,400,000	
Booster Pump Station	225	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 730,000	(2) 150 hp Duty, (1) 75 hp standby

EASEMENT AND LAND ACQUISITION						Total Cost
Item	**Width**	**Units**	**Length**	**Unit**	**Unit Cost**	**$ 111,700**
Pipelines - Turlock	25	LF	23,200	LF	$ 0.11	$ 66,600
Pipelines - Modesto	25	LF	12,500	LF	$ 0.11	$ 35,900
Pipelines - Combined	25	LF	0	LF	$ 0.11	$ -
Joint Pump Station	15,000	SF	0	EA	$ 0.46	$ -
Booster Pump Station	10,000	SF	2	EA	$ 0.46	$ 9,200

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 52,000**
Equipment Consumables	$ 1,310,000		2%	$ 26,000
Mechanical Consumables	$ 1,310,000		2%	$ 26,000

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ 3,280,000
Power	922,000	Kw-hr	$ 0.07	$ 60,000
Agreements with PID	30,600	$/AF	$ 75	$ 2,300,000
Agreements with Reclamation	30,600	$/AF	$ 30	$ 920,000

Project: **USBR - Recycled Water Feasibility Study**

Component: **2018 Direct Pipeline DPWD and Refuges**

Date: September 17, 2013
Project Number: 0453-04.04

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary

Spec. Division	Subtotal	Notes
Facilities	$ 114,390,000	

RAW CONSTRUCTION COST		**$**	**114,390,000**
Mobilization/Demobilization	1%	*$*	*1,140,000*
Contractors Overhead and Profit	18%	*$*	*20,590,000*
Construction Contingency	30%	*$*	*40,840,000*
Base Construction Cost		**$**	**176,960,000**
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$**	**53,090,000**

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 114,386,200**	
Turlock Facilities							
Pipeline to Joint PS / W. Main	36	inch	21,200	LF	$ 14.00	$ 10,684,800	S. Carpenter and West Main
Bore&Jack - West Main Ave.	100	ft	1	ea	$ 1,800.00	$ 180,000	
Booster Pump Station	150	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 580,000	@ Jennings Ponds
Modesto Facilities							
Pipeline to Joint PS / W Main	36	inch	10,800	LF	$ 12.00	$ 4,665,600	Modesto Ranch alignment
Booster Pump Station	200	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 680,000	@ Harding Drain
Combined Facilities - PS 1 to DMC							
Alignment towards Las Palmas Bridge	54	inch	2,500	LF	$ 18.00	$ 2,430,000	
River Crossing (SJR) near Las Palmas Bridge			2,000	LF	$ 2,300.00	$ 4,600,000	HDD
West side of Las Palmas Bridge to PID	54	inch	2,000	LF	$ 14.00	$ 1,512,000	Cross country alignment on west side of SJR
Alignment along PID Canal to HWY 33	54	inch	14,900	LF	$ 18.00	$ 14,482,800	
Bore&Jack Under PID Canals	100	LF	4	ea	$ 1,800.00	$ 720,000	Lateral canals on south side of Main Canal
Bore&Jack Under Hwy 33, R&R, PID Main Canal	250	LF	1	ea	$ 1,800.00	$ 450,000	
PID Canal to Bartch Ave along HWY 33	54	inch	350	LF	$ 18.00	$ 340,200	
HWY 33 to DMC along Bartch Ave and Ward Ave	54	inch	11,900	LF	$ 14.00	$ 8,996,400	
Booster Pump Station 1	1500		1		HP x (15,570 HP^-.442) x 2.28	$ 2,100,000	(4) 300 hp duty, (1) 300 hp stand-by
Combined Facilities - DMC to South							
Southern Alignment following DMC to Diehl Rd.	54	inch	79,900	LF	$ 14.00	$ 60,404,400	End at Stanislaus - Merced County Line
Turnout Boxes for DPWD Deliveries			42	ea	$ 10,000.00	$ 420,000	
Booster Pump Station 2	500	hp	1	ea	HP x (15,570 HP^-.442) x 2.28	$ 1,140,000	(2) 125 hp duty, (1) 250 hp stand-by

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Width**	**Units**	**Length**	**Unit**	**Unit Cost**	**$ 387,400**	
Pipelines - Turlock	25	LF	16,000	LF	$ 0.11	$ 45,900	Modesto Ranch - no easement requirements (5,200 ft)
Pipelines - Modesto	25	LF	0	LF	$ 0.11	$ -	Modesto Ranch - no easement requirements (10,800 ft)
Pipelines - Combined	25	LF	111,000	LF	$ 0.11	$ 318,500	Modesto Ranch - no easement requirements (3,200 ft)
Joint Pump Station	15,000	SF	2	EA	$ 0.46	$ 13,800	
Booster Pump Station	10,000	SF	2	EA	$ 0.46	$ 9,200	

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 180,000**
Equipment Consumables	$ 4,500,000		2%	$ 90,000
Mechanical Consumables	$ 4,500,000		2%	$ 90,000

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ 590,000
Power	8,445,000	Kw-hr	$ 0.07	$ 590,000
Agreements with the Bureau	0	$/AF	$ 30	$ -

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Component: **Alternative 2A- South Area North of County Line (2015 RW Supply)**

Date: September 2, 2010
Project Number:
Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
Facilities		$ 78,930,000	
17- I&C		$ 570,000	
RAW CONSTRUCTION COST		**$ 79,500,000**	
Mobilization/Demobilization	1%	*$ 800,000*	
Contractors Overhead and Profit	18%	*$ 14,310,000*	
Construction Contingency	30%	*$ 23,850,000*	
Base Construction Cost		**$ 118,460,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 35,540,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 78,928,380**	
Main Pipeline							
Segment 1 (TP to West Main Ave)	48	inch	17,400	feet	$ 12.00	$ 10,022,400	
West Main/Junniper Rd to Hwy 33	48	inch	21,600	feet	$ 12.00	$ 12,441,600	
Segment 3- Hwy 33 to DMC	48	inch	12,200	feet	$ 10.25	$ 6,002,400	
River Crossing (SJR)			1,000	feet	$ 2,300.00	$ 2,300,000	
River/DMC crossing			550	feet	$ 2,300.00	$ 1,265,000	
Bore&Jack Under Hwy 33			150	feet	$ 1,800.00	$ 270,000	
Harding Drain Connection	24		21,100	feet	$ 12.00	$ 6,076,800	
Central Area Pipeline							
Pipeline Through Central Area	48	inch	45,940	feet	$ 10.25	$ 22,602,480	
South Area Pipeline							
Section 1	48	inch	11,100	feet	$ 10.25	$ 5,461,200	
Section 2	36	inch	11,100	feet	$ 10.25	$ 4,095,900	
Section 3	24	inch	11,100	feet	$ 10.25	$ 2,730,600	
Pumpstation							
Distribution Pumpstation #1	2250	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 2,260,000	
Distribution Pumpstation #2	700	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 1,180,000	
Distribution Pumpstation #3	1200	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 1,590,000	
Harding Drain Bypass Pumpstation	225	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 630,000	
I&C						**$ 566,000**	
I&C Allowance					10%	$ 566,000	

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 232,000**	
Main Pipeline	25	feet	52,300	EA	$ 0.11	$ 150,000	easement
Harding Drain Pipeline	25	feet	21,100	EA	$ 0.11	$ 60,000	easement
Central Area Pipeline	25	feet	45,940	EA	$ -	$ -	easement
South Area Pipeline	25	feet	33,300	EA	$ -	$ -	easement
Distribution Pumpstation #1	15,000	SF	1	EA	$ 0.46	$ 7,000	
Distribution Pumpstation #2	10,000	SF	1	EA	$ 0.46	$ 5,000	
Distribution Pumpstation #3	10,000	SF	1	EA	$ 0.46	$ 5,000	
Harding Drain Bypass Pumpstation	10,000	SF	1	EA	$ 0.46	$ 5,000	

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 237,000**
Equipment Consumables	$ 5,660,000		2%	$ 113,000
Mechanical Consumables	$ 5,660,000		2%	$ 113,000
Instrumentation Consumables	$ 566,000		2%	$ 11,000

O&M Costs				Cost
	Amount	**Unit**	**Value**	**$ 1,703,000**
Agreements with the Bureau	0	$/AF	$ 20	$ -
Power	13,518,214	Kw-hr	$ 0.12	$ 1,623,000
Treatment				
Labor	1,000	hrs	$ 75.00	$ 80,000
Cost of Purchasing RW	$ -	AFY	$ -	$ -

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Component: **Alternative 2A- South Area North of County Line (2025 RW Supply)- irrigating some of the central area**

Date: September 2, 2010
Project Number:
Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
Facilities	$ 82,020,000	
17- I&C	$ 740,000	

RAW CONSTRUCTION COST		**$**	**82,760,000**
Mobilization/Demobilization	1%	*$*	*830,000*
Contractors Overhead and Profit	18%	*$*	*14,900,000*
Construction Contingency	30%	*$*	*24,830,000*
Base Construction Cost		**$**	**123,320,000**
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$**	**37,000,000**

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 82,023,680**	
Main Pipeline							
Segment 1 (TP to West Main Ave)	48	inch	17,400	feet	$ 12.00	$ 10,022,400	
West Main/Junniper Rd to Hwy 33	48	inch	21,600	feet	$ 12.00	$ 12,441,600	
Segment 3- Hwy 33 to DMC	48	inch	12,200	feet	$ 10.25	$ 6,002,400	
River Crossing (SJR)			1,000	feet	$ 2,300.00	$ 2,300,000	
River/DMC crossing			550	feet	$ 2,300.00	$ 1,265,000	
Bore&Jack Under Hwy 33			150	feet	$ 1,800.00	$ 270,000	
Harding Drain Connection	24		21,100	feet	$ 12.00	$ 6,076,800	
Central Area Pipeline							
Pipeline Through Central Area	48	inch	45,940	feet	$ 10.25	$ 22,602,480	
South Area Pipeline							
Section 1	48	inch	11,100	feet	$ 10.25	$ 5,461,200	
Section 2	42	inch	11,100	feet	$ 10.25	$ 4,778,550	
Section 3	30	inch	11,100	feet	$ 10.25	$ 3,413,250	
Pumpstation							
Distribution Pumpstation #1	3000	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 2,660,000	
Distribution Pumpstation #2	1600	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 1,870,000	
Distribution Pumpstation #3	1800	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 2,000,000	
Harding Drain Bypass Pumpstation	400	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 860,000	
I&C						**$ 739,000**	
I&C Allowance					10%	$ 739,000	

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 231,300**	
Main Pipeline	25	feet	52,300	EA	$ 0.11	$ 150,100	easement
Harding Drain Pipeline	25	feet	21,100	EA	$ 0.11	$ 60,500	easement
Central Area Pipeline	25	feet	45,940	EA	$ -	$ -	easement
South Area Pipeline	25	feet	33,300	EA	$ -	$ -	easement
Distribution Pumpstation #1	15,000	SF	1	EA	$ 0.46	$ 6,900	
Distribution Pumpstation #2	10,000	SF	1	EA	$ 0.46	$ 4,600	
Distribution Pumpstation #3	10,000	SF	1	EA	$ 0.46	$ 4,600	
Harding Drain Bypass Pumpstation	10,000	SF	1	EA	$ 0.46	$ 4,600	

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 311,000**
Equipment Consumables	$ 7,390,000		2%	$ 148,000
Mechanical Consumables	$ 7,390,000		2%	$ 148,000
Instrumentation Consumables	$ 739,000		2%	$ 15,000

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ 2,087,000
Power	16,719,321	Kw-hr	$ 0.12	$ 2,007,000
Treatment				
Labor	1,000	hrs	$ 75.00	$ 80,000
Cost of Purchasing RW	$ -	AFY	$ -	$ -

Project:	**Del Puerto Water District - Recycled Water Feasibility Study**	Date:	September 2, 2010
		Project Number:	
Component:	**Alternative 2B- Entire Southern and Central Area with Additional Storage (2015 RW Supply)**	Prepared by:	RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
Facilities	$ 128,900,000	
17- I&C	$ 490,000	

RAW CONSTRUCTION COST		**$**	**129,390,000**
Mobilization/Demobilization	1%	*$*	*1,290,000*
Contractors Overhead and Profit	18%	*$*	*23,290,000*
Construction Contingency	30%	*$*	*38,820,000*
Base Construction Cost		**$**	**192,790,000**
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$**	**57,840,000**

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 128,904,940**	
Additonal Storage	6000	Acre Feet	1	EA	$ 7,000	$ 42,000,000	Pond Storage
Main Pipeline							
Segment 1 (TP to West Main Ave)	54	inch	17,400	feet	$ 12.00	$ 11,275,200	
West Main/Junniper Rd to Hwy 33	54	inch	21,600	feet	$ 12.00	$ 13,996,800	
Segment 3- Hwy 33 to DMC	54	inch	12,200	feet	$ 10.25	$ 6,752,700	
River Crossing (SJR)			1,000	feet	$ 2,300.00	$ 2,300,000	
Bore&Jack Under Hwy 33			150	feet	$ 1,800.00	$ 270,000	
Harding Drain Connection	24		21,100	feet	$ 12.00	$ 6,076,800	
Central Area Pipeline							
Pipeline Through Central Area	54	inch	45,940	feet	$ 10.25	$ 25,427,790	
South Area Pipeline							
Section 1	48	inch	11,100	feet	$ 10.25	$ 5,461,200	
Section 2	42	inch	11,100	feet	$ 10.25	$ 4,778,550	
Section 3	36	inch	11,100	feet	$ 10.25	$ 4,095,900	
Pumpstation							
Distribution Pumpstation #1	3000	hp	1	ea	HP x (15,570 HP^-.442)	$ 2,660,000	
Distribution Pumpstation #2	1200	hp	1	ea	HP x (15,570 HP^-.442)	$ 1,590,000	
Distribution Pumpstation #2	1200	hp	1	ea	HP x (15,570 HP^-.442)	$ 1,590,000	
Harding Drain Bypass Pumpstation	225	hp	1	ea	HP x (15,570 HP^-.442)	$ 630,000	
I&C						**$ 488,000**	
I&C Allowance					10%	$ 488,000	

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 232,000**	
Main Pipeline	25	feet	52,300	EA	$ 0.11	$ 150,000	easement
Harding Drain Pipeline	25	feet	21,100	EA	$ 0.11	$ 60,000	easement
Central Area Pipeline	25	feet	45,940	EA		$ -	easement
South Area Pipeline	25	feet	22,200	EA	$ -	$ -	easement
Distribution Pumpstation #1	15,000	SF	1	EA	$ 0.46	$ 7,000	
Distribution Pumpstation #2	10,000	SF	1	EA	$ 0.46	$ 5,000	
Distribution Pumpstation #3	10,000	SF	1	EA	$ 0.46	$ 5,000	
Harding Drain Bypass Pumpstation	10,000	SF	1	EA	$ 0.46	$ 5,000	

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 206,000**
Equipment Consumables	$ 4,880,000		2%	$ 98,000
Mechanical Consumables	$ 4,880,000		2%	$ 98,000
Instrumentation Consumables	$ 488,000		2%	$ 10,000

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ 2,390,000
Agreements with the Bureau	0	$/AF	$ 20	$ -
Power	19,247,866	Kw-hr	$ 0.12	$ 2,310,000
Treatment				
Labor	1,000	hrs	$ 75.00	$ 80,000
Cost of Purchasing RW	$ -	AFY	$ -	$ -

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Component: **Alternative 2B- South Area North of County Line and Most of Central Area (2025 RW Supply)- Assuming storage of all RW available**

Date: September 2, 2010
Project Number:
Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
Facilities	$ 164,110,000	
17- I&C	$ 750,000	

RAW CONSTRUCTION COST		**$**	**164,860,000**
Mobilization/Demobilization	1%	*$*	*1,650,000*
Contractors Overhead and Profit	18%	*$*	*29,670,000*
Construction Contingency	30%	*$*	*49,460,000*
Base Construction Cost		**$**	**245,640,000**
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$**	**73,690,000**

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 164,111,500**	
Additional Storage			9500	AF	$ 7,000	$ 66,500,000	**storage pond**
Main Pipeline							
Segment 1 (TP to West Main Ave)	60	inch	17,400	feet	$ 12.00	$ 12,528,000	
West Main/Junniper Rd to Hwy 33	60	inch	21,600	feet	$ 12.00	$ 15,552,000	
Segment 3- Hwy 33 to DMC	60	inch	12,200	feet	$ 10.25	$ 7,503,000	
River Crossing (SJR)			1,000	feet	$ 2,300.00	$ 2,300,000	
River/DMC crossing			550	feet	$ 2,300.00	$ 1,265,000	
Bore&Jack Under Hwy 33			150	feet	$ 1,800.00	$ 270,000	
Harding Drain Connection	24		21,100	feet	$ 12.00	$ 6,076,800	
Central Area Pipeline							
Pipeline Through Central Area	60	inch	45,940	feet	$ 10.25	$ 28,253,100	
South Area Pipeline							
Section 1	60	inch	11,100	feet	$ 10.25	$ 6,826,500	
Section 2	48	inch	11,100	feet	$ 10.25	$ 5,461,200	
Section 3	36	inch	11,100	feet	$ 10.25	$ 4,095,900	
Pumpstation							
Distribution Pumpstation #1	3300	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 2,800,000	
Distribution Pumpstation #2	1350	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 1,700,000	
Distribution Pumpstation #3	2000	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 2,120,000	
Harding Drain Bypass Pumpstation	400	hp	1	ea	HP x (15,570 HP^-.442) x 1.	$ 860,000	
I&C						**$ 748,000**	
I&C Allowance					10%	$ 748,000	

EASEMENT AND LAND ACQUISITION

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	
						$ 231,300	
Main Pipeline	25	feet	52,300	EA	$ 0.11	$ 150,100	easement
Harding Drain Pipeline	25	feet	21,100	EA	$ 0.11	$ 60,500	easement
Central Area Pipeline	25	feet	45,940	EA	$ -	$ -	easement
South Area Pipeline	25	feet	33,300	EA	$ -	$ -	easement
Distribution Pumpstation #1	15,000	SF	1	EA	$ 0.46	$ 6,900	easement
Distribution Pumpstation #2	10,000	SF	1	EA	$ 0.46	$ 4,600	easement
Distribution Pumpstation #3	10,000	SF	1	EA	$ 0.46	$ 4,600	easement
Harding Drain Bypass Pumpstation	10,000	SF	1	EA	$ 0.46	$ 4,600	easement

Repair and Replacement Costs

	Amount	Unit	Value	Cost
				$ 315,000
Equipment Consumables	$ 7,480,000		2%	$ 150,000
Mechanical Consumables	$ 7,480,000		2%	$ 150,000
Instrumentation Consumables	$ 748,000		2%	$ 15,000

O&M Costs

	Amount	Unit	Value	Cost
				$ 3,013,000
Power	16,719,321	Kw-hr	$ 0.12	$ 2,333,000
Treatment				$ 600,000
Labor	1,000	hrs	$ 75.00	$ 80,000
Cost of Purchasing RW	$ -	AFY	$ -	$ -

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Component: **2015 Alternative 2C- Entire Central Area (2015 RW Supply)**

Date: September 2, 2010
Project Number:
Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
Facilities		$ 58,550,000	
17- I&C		$ 450,000	
RAW CONSTRUCTION COST		**$ 59,000,000**	
Mobilization/Demobilization	1%	*$ 590,000*	
Contractors Overhead and Profit	18%	*$ 10,620,000*	
Construction Contingency	30%	*$ 17,700,000*	
Base Construction Cost		**$ 87,910,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 26,370,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 58,550,140**	
Main Pipeline							
Segment 1 (TP to West Main Ave)	48	inch	17,400	feet	$ 12.00	$ 10,022,400	
West Main/Junniper Rd to Hwy 33	48	inch	21,600	feet	$ 12.00	$ 12,441,600	
Segment 3- Hwy 33 to DMC	48	inch	12,200	feet	$ 10.25	$ 6,002,400	
River Crossing (SJR)			1,000	feet	$ 2,300.00	$ 2,300,000	
Bore&Jack Under Hwy 33			150	feet	$ 1,800.00	$ 270,000	
Harding Drain Connection	24		21,100	feet	$ 12.00	$ 6,076,800	
Central Area Pipeline							
Section 1	48	inch	15,300	feet	$ 10.25	$ 7,527,600	
Section 2	36	inch	15,300	feet	$ 10.25	$ 5,645,700	
Section 3	24	inch	15,340	feet	$ 10.25	$ 3,773,640	
Pumpstation							
Distribution Pumpstation #1	2000	hp	1	ea	HP x (15,570 HP^-.442	$ 2,120,000	
Distribution Pumpstation #2	1400	hp	1	ea	HP x (15,570 HP^-.442	$ 1,740,000	
Harding Drain Bypass Pumpstation	225	hp	1	ea	HP x (15,570 HP^-.442	$ 630,000	
I&C						**$ 449,000**	
I&C Allowance					10%	$ 449,000	

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 227,000**	
Main Pipeline	25	feet	52,300	EA	$ 0.11	$ 150,000	easement
Harding Drain Pipeline	25	feet	21,100	EA	$ 0.11	$ 60,000	easement
Central Area Pipeline	25	feet	45,940	EA		$ -	easement
Distribution Pumpstation #1	15,000	SF	1	EA	$ 0.46	$ 7,000	
Distribution Pumpstation #2	10,000	SF	1	EA	$ 0.46	$ 5,000	
Harding Drain Bypass Pumpstation	10,000	SF	1	EA	$ 0.46	$ 5,000	

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 189,000**
Equipment Consumables	$ 4,490,000		2%	$ 90,000
Mechanical Consumables	$ 4,490,000		2%	$ 90,000
Instrumentation Consumables	$ 449,000		2%	$ 9,000

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ 1,387,000
Agreements with the Bureau	0	$/AF	$ 20	$ -
Power	10,883,563	Kw-hr	$ 0.12	$ 1,307,000
Treatment				
Labor	1,000	hrs	$ 75.00	$ 80,000
Cost of Purchasing RW	$ -	AFY	$ -	$ -

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Component: **Alternative 2C- Entire Central Area (2025 RW Supply)**

Date: September 2, 2010
Project Number:
Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
Facilities		$ 61,270,000	
17- I&C		$ 530,000	
RAW CONSTRUCTION COST		**$ 61,800,000**	
Mobilization/Demobilization	1%	*$ 620,000*	
Contractors Overhead and Profit	18%	*$ 11,120,000*	
Construction Contingency	30%	*$ 18,540,000*	
Base Construction Cost		**$ 92,080,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 27,620,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 61,274,500**	
Main Pipeline							
Segment 1 (TP to West Main Ave)	48	inch	17,400	feet	$ 12.00	$ 10,022,400	
West Main/Junniper Rd to Hwy 33	48	inch	21,600	feet	$ 12.00	$ 12,441,600	
Segment 3- Hwy 33 to DMC	48	inch	12,200	feet	$ 10.25	$ 6,002,400	
River Crossing (SJR)			1,000	feet	$ 2,300.00	$ 2,300,000	
Bore&Jack Under Hwy 33			150	feet	$ 1,800.00	$ 270,000	
Harding Drain Connection	24		21,100	feet	$ 12.00	$ 6,076,800	
Central Area Pipeline							
Section 1	48	inch	15,300	feet	$ 10.25	$ 7,527,600	
Section 2	42	inch	15,300	feet	$ 10.25	$ 6,586,650	
Section 3	30	inch	15,340	feet	$ 10.25	$ 4,717,050	
Pumpstation							
Distribution Pumpstation #1	3000	hp	1	ea	HP x (15,570 HP^-.442	$ 2,660,000	
Distribution Pumpstation #2	1500	hp	1	ea	HP x (15,570 HP^-.442	$ 1,810,000	
Harding Drain Bypass Pumpstation	400	hp	1	ea	HP x (15,570 HP^-.442	$ 860,000	
I&C						**$ 533,000**	
I&C Allowance					10%	$ 533,000	

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 226,700**	
Main Pipeline	25	feet	52,300	EA	$ 0.11	$ 150,100	easement
Harding Drain Pipeline	25	feet	21,100	EA	$ 0.11	$ 60,500	easement
Central Area Pipeline	25	feet	45,940	EA		$ -	easement
Distribution Pumpstation #1	15,000	SF	1	EA	$ 0.46	$ 6,900	
Distribution Pumpstation #2	10,000	SF	1	EA	$ 0.46	$ 4,600	
Harding Drain Bypass Pumpstation	10,000	SF	1	EA	$ 0.46	$ 4,600	

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 225,000**
Equipment Consumables	$ 5,330,000		2%	$ 107,000
Mechanical Consumables	$ 5,330,000		2%	$ 107,000
Instrumentation Consumables	$ 533,000		2%	$ 11,000

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ 1,660,000
Power	13,159,646	Kw-hr	$ 0.12	$ 1,580,000
Treatment				
Labor	1,000	hrs	$ 75.00	$ 80,000
Cost of Purchasing RW	$ -	AFY	$ -	$ -

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Component: **Alternative 2D North Area (2015 RW Supply - Modesto Only)**

Date: September 2, 2010
Project Number:

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
Facilities		$ 67,320,000	
17- I&C		$ 340,000	
RAW CONSTRUCTION COST		**$ 67,660,000**	
Mobilization/Demobilization	1%	*$ 680,000*	
Contractors Overhead and Profit	18%	*$ 12,180,000*	
Construction Contingency	30%	*$ 20,300,000*	
Base Construction Cost		**$ 100,820,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 30,250,000**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 67,318,580**	
Main Pipeline							
Segment 1 (TP to West Main Ave)	48	inch	17,400	feet	$ 12.00	$ 10,022,400	
West Main/Junniper Rd to Hwy 33	48	inch	21,600	feet	$ 12.00	$ 12,441,600	
Segment 3- Hwy 33 to DMC	48	inch	12,200	feet	$ 10.25	$ 6,002,400	
River Crossing (SJR)			1,000	feet	$ 2,300.00	$ 2,300,000	
Bore&Jack Under Hwy 33			150	feet	$ 1,800.00	$ 270,000	
North Area Pipeline							
Section 1	48	inch	29,740	feet	$ 10.25	$ 14,632,080	
Section 2	36	inch	29,740	feet	$ 10.25	$ 10,974,060	
Section 3	24	inch	29,740	feet	$ 10.25	$ 7,316,040	
Pumpstation							
Distribution Pumpstation #1	1800	hp	1	ea	HP x (15,570 HP^-.442	$ 2,000,000	
Distribution Pumpstation #2	900	hp	1	ea	HP x (15,570 HP^-.442	$ 1,360,000	
I&C						**$ 336,000**	
I&C Allowance					10%	$ 336,000	

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 222,000**	
Main Pipeline	25	feet	52,300	EA	$ 0.11	$ 150,000	easement
Harding Drain Pipeline	25	feet	21,100	EA	$ 0.11	$ 60,000	easement
North Area Pipeline	25	feet	89,220	EA		$ -	easement
Distribution Pumpstation #1	15,000	SF	1	EA	$ 0.46	$ 7,000	
Distribution Pumpstation #2	10,000	SF	1	EA	$ 0.46	$ 5,000	

Repair and Replacement Costs				Cost
	Amount	**Unit**	**Value**	**$ 141,000**
Equipment Consumables	$ 3,360,000		2%	$ 67,000
Mechanical Consumables	$ 3,360,000		2%	$ 67,000
Instrumentation Consumables	$ 336,000		2%	$ 7,000

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ 1,185,000
Agreements with the Bureau	0	$/AF	$ 20	$ -
Power	9,199,935	Kw-hr	$ 0.12	$ 1,105,000
Treatment				
Labor	1,000	hrs	$ 75.00	$ 80,000
Cost of Purchasing RW	$ -	AFY	$ -	$ -

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Component: **Alternative 3A - River Diversion At Banta Carbona**

Date: September 2, 2010
Project Number:

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
Facilities	$ 34,000,000	
17- I&C	$ -	
RAW CONSTRUCTION COST	**$ 34,000,000**	
Mobilization/Demobilization 0%	$ -	
Contractors Overhead and Profit 0%	$ -	
Construction Contingency 0%	$ -	
Base Construction Cost	**$ 34,000,000**	
Implementation (Program Management, Design, CEQA, Legal, CM) 0%	**$ -**	

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 34,000,000**	
Fish Screen							
Screen and Conveyance to CA Aqueduct		af	33000	$/af	$ 1,027	$ 34,000,000	
I&C						**$ -**	
I&C Allowance						$ -	

EASEMENT AND LAND ACQUISITION

Item	Width	Units	Length	Unit	Unit Cost	Total Cost
						$ -

Repair and Replacement Costs

Amount	Unit	Value	Cost
			$ -

O&M Costs

	Amount	Unit	Value	Cost	
				$ 1,600,000	
Power	33,000	$/AF	$ 24	$ 792,000	
Agreements with the Bureau	33,000	$/AF	$ 20	$ 660,000	
Cost to Pump River Water to DMC	33,000	$/AF	$ -	$ -	included in power cost
GW Well Operation	15,000	$/AF	$ -	$ -	
Spreading Basin and Well Maint.	0	$/year	$ -	$ -	
Treatment			$ -	$ -	
Labor	33,000	$/AF	$ 5	$ 165,000	
Cost of Purchasing RW	$ -	AFY	$ -	$ -	

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Component: **Alternative 4A- River Diversion at Patterson Irrigation District**

Date: September 2, 2010
Project Number:
Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
Facilities W/O Markup			$ 24,090,000	
Facilities W/Markup (PID Facilities)			$ 7,500,000	
17- I&C			$ 250,000	
RAW CONSTRUCTION COST			**$ 31,840,000**	
Mobilization/Demobilization	1%		*$ 240,000*	Modified markup b/c some unit costs are marked up
Contractors Overhead and Profit	18%		*$ 4,380,000*	
Construction Contingency	30%		*$ 7,300,000*	
Base Construction Cost			**$ 43,760,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%		**$ 14,120,000**	add in engineering costs for all facilities

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 31,590,000**	
Relocate Modesto Discharge Point							
Harding Connection	42	inch	21100	feet	$ 12	$ 10,600,000	
Modesto Pipeline to Harding Connection	42	inch	17400	feet	$ 12	$ 8,800,000	
Fish Screen							
New Fish Screen Structure			50	cfs	$ 65,000	$ 3,300,000	Increase capacity by 50 cfs
New Intake Pumps Allowance			1	LS	$ 1,000,000	$ 1,000,000	
Pipeline to Connect with Ex. Pipeline to DMC							
Incremental Cost to Replace Main Canal to Elfers Rd	108	inch	20,064	feet	$ 13	$ 3,200,000	incremental cost to increase diameter
Additional Capacity to DMC	24	inch	11,088	feet	$ 12	$ 3,200,000	convey additional 15 cfs to DMC
Pump Station							
Pump Station at Modesto	250	hp	1	ea	HP x (15,570 HP^-.442) x 1.96	$ 660,000	
Upgrade Pump Station @ Elfers Road Allowance	375	hp	1	ea	HP x (15,570 HP^-.442) x 1.96	$ 830,000	upgrade existing pump stations
I&C						**$ 249,000**	
I&C Allowance					10%	$ 249,000	

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 121,900**	
Harding Connection	25	feet	21,100	feet	$ 0.11	$ 60,500	
Modesto Pipeline to Harding Connection	25	feet	17,400	feet	$ 0.11	$ 49,900	
Incremental Cost to Replace Main Canal to Elfers Rd	25	feet	20,064	feet	$ -	$ -	assume no cost for easement
Additional Capacity to DMC	25	feet	11,088	feet	$ -	$ -	assume no cost for easement
Harding Drain Bypass Pumpstation	15,000	SF	1	EA	$ 0.46	$ 6,900	
Distribution Pump Station	10,000	SF	1	EA	$ 0.46	$ 4,600	

Repair and Replacement Costs	Amount	Unit	Value	Cost
				$ 65,000
Equipment Consumables	$ 1,490,000		2%	$ 30,000
Mechanical Consumables	$ 1,490,000		2%	$ 30,000
Instrumentation Consumables	$ 249,000		2%	$ 5,000

O&M Costs	Amount	Unit	Value	Cost	
				$ 2,092,000	
Power	33,000	$/AF	$ -	$ 277,000	pumping of modesto water to Turlock
Agreements with the Bureau	33,000	$/AF	$ 20	$ 660,000	
Cost to Pump River Water to DMC	33,000	$/AF	$ 30	$ 990,000	
GW Well Operation		$/AF	$ -	$ -	
Spreading Basin and Well Maint.	0	$/year	$ -	$ -	
Treatment	0		$ -	$ -	
Labor	33,000	$/AF	$ 5	$ 165,000	

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Component: **Alternative 3B: River Diversion at West Stanislaus Irrigation District Expand Diversion Facility**

Date: September 2, 2010
Project Number:
Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
Facilities	$ 18,200,000	
17- I&C	$ 810,000	
RAW CONSTRUCTION COST	**$ 19,010,000**	
Mobilization/Demobilization 0%	$ -	
Contractors Overhead and Profit 0%	$ -	
Construction Contingency 0%	$ -	
Base Construction Cost	**$ 19,010,000**	
Implementation (Program Management, Design, CEQA, Legal, CM) 15%	**$ 2,850,000**	assume some investment in engineering costs

Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 18,200,000**	
Fish Screens and Intake							
Expand Fish Screen Capacity		cfs	50	$/cfs	$ 113,043	$ 5,650,000	
Conveyance							
Increase Pump Station		cfs	50	$/cfs	$ 14,545	$ 1,000,000	
Pipeline from Intake	144	inch	5,280	ft	$ 16	$ 2,000,000	incremental cost for increasing diameter
Delivery to DMC							
Permanent Pipeline to DMC	42	inch	12,144	ft	$ 16	$ 8,050,000	
Pump Station Upgrade Allowance			1	LS	$ 1,500,000	$ 1,500,000	upgrade to provide redundancy
I&C						**$ 805,000**	
I&C Allowance					10%	$ 805,000	additional controls to pump station

EASEMENT AND LAND ACQUISITION						**Total Cost**
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ -**

Repair and Replacement Costs	**Amount**	**Unit**	**Value**	**Cost**
				$ -

O&M Costs	**Amount**	**Unit**	**Value**	**Cost**	
				$ 2,211,000	
Power	33,000	$/AF	$ 42	$ 1,386,000	
Agreements with the Bureau	33,000	$/AF	$ 20	$ 660,000	
Cost to Pump River Water to DMC	33,000	$/AF	$ -	$ -	included in power cost
GW Well Operation		$/AF	$ -	$ -	
Spreading Basin and Well Maint.	0	$/year	$ -	$ -	
Treatment	0		$ -	$ -	
Labor	33,000	$/AF	$ 5	$ 165,000	
Cost of Purchasing RW	$ -	AFY	$ -	$ -	

Project: **Del Puerto Water District - Recycled Water Feasibility Study**

Date: September 2, 2010
Project Number:

Component: **Alternative 5- GW Augmentation at Patterson Diversion Facilities (Modesto Flow**

Prepared by: RMC

Estimate Type: Conceptual Design

Process Cost Summary by Division

Spec. Division		Subtotal	Notes
Facilities		$ 59,240,000	
17- I&C		$ 290,000	
RAW CONSTRUCTION COST		**$ 59,530,000**	
Mobilization/Demobilization	1%	*$ 600,000*	
Contractors Overhead and Profit	18%	*$ 10,720,000*	
Construction Contingency	30%	*$ 17,860,000*	
Base Construction Cost		**$ 88,710,000**	
Implementation (Program Management, Design, CEQA, Legal, CM)	30%	**$ 26,610,000**	

Item	Size	Units	Quantity	Unit		Unit Cost		Total Cost	Notes
Facilities							**$**	**59,236,400**	
Segment 1 (TP to West Main Ave)	48	inch	17,400	feet	$	12.00	$	10,022,400	
West Main/Junniper Rd to Hwy 33	48	inch	21,600	feet	$	12.00	$	12,441,600	
Segment 3- Hwy 33 to DMC	48	inch	12,200	feet	$	10.25	$	6,002,400	
River Crossing (SJR)	48	inch	1,000	feet	$	1,800.00	$	1,800,000	
Pumpstation									
Distribution Pumpstation	3500	hp	1	ea		HP x (15,570 HP^-.442) x 1.96	$	2,900,000	DMC Pumping controls
Groundwater Recharge									
Spreading Basin Costs		acres	103	acre	$	23,900	$	2,460,000	
Well Installation		wells	10	well	$	1,500,000	$	15,000,000	
Allowance for GW Pipeline to DMC	42	inch	20,000	feet	$	10.25	$	8,610,000	
I&C							**$**	**290,000**	
I&C Allowance						10%	$	290,000	

EASEMENT AND LAND ACQUISITION								Total Cost	
Item	Size	Units	Quantity	Unit		Unit Cost	**$**	**2,213,800**	
Pipelines	25	feet	17,400	feet	$	0.11	$	49,900	
	25	feet	21,600	feet	$	0.11	$	62,000	
	25	feet	12,200	feet	$	0.11	$	35,000	
Distribution Pumpstation	15,000	SF	1	EA	$	0.46	$	6,900	
GW Pipeline to DMC	25	feet	20,000	feet	$	-	$	-	
Land Acquisition for Spreading Basins		acres	103	acres	$	20,000	$	2,060,000	

Repair and Replacement Costs	Amount	Unit		Value	Cost	
					$	**122,000**
Equipment Consumables	$ 2,900,000			2%	$	58,000
Mechanical Consumables	$ 2,900,000			2%	$	58,000
Instrumentation Consumables	$ 290,000			2%	$	6,000

O&M Costs	Amount	Unit		Value	Cost	
					$	**2,416,806**
Power	9,081,716	Kw-hr	$	0.12	$	1,089,806
Agreements with the Bureau	20,200	$/AF	$	20	$	400,000
Cost to Pump River Water to DMC	7,500	$/AF	$	-	$	-
GW Well Operation	15,000	$/AF	$	50	$	750,000
Spreading Basin and Well Maint.		$/year	$	102,000	$	102,000
Treatment						
Labor	1,000	hrs	$	75.00	$	75,000
Cost of Purchasing RW	$ -	AFY	$	-	$	-

Project:	**Del Puerto Water District - Recycled Water Feasibility Study**	Date:	September 2, 2010
		Project Number:	
Component:	**Alternative 5B- GW Augmentation at Orestimba Creek (Modesto Only)**	Prepared by:	RMC
Estimate Type:	Conceptual Design		

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
Facilities	$ 59,860,000	
17- I&C	$ 390,000	
RAW CONSTRUCTION COST	**$ 60,250,000**	
Mobilization/Demobilization 1%	*$ 600,000*	
Contractors Overhead and Profit 18%	*$ 10,850,000*	
Construction Contingency 30%	*$ 18,080,000*	
Base Construction Cost	**$ 89,780,000**	
Implementation (Program Management, Design, CEQA, Legal, CM) 30%	**$ 26,930,000**	

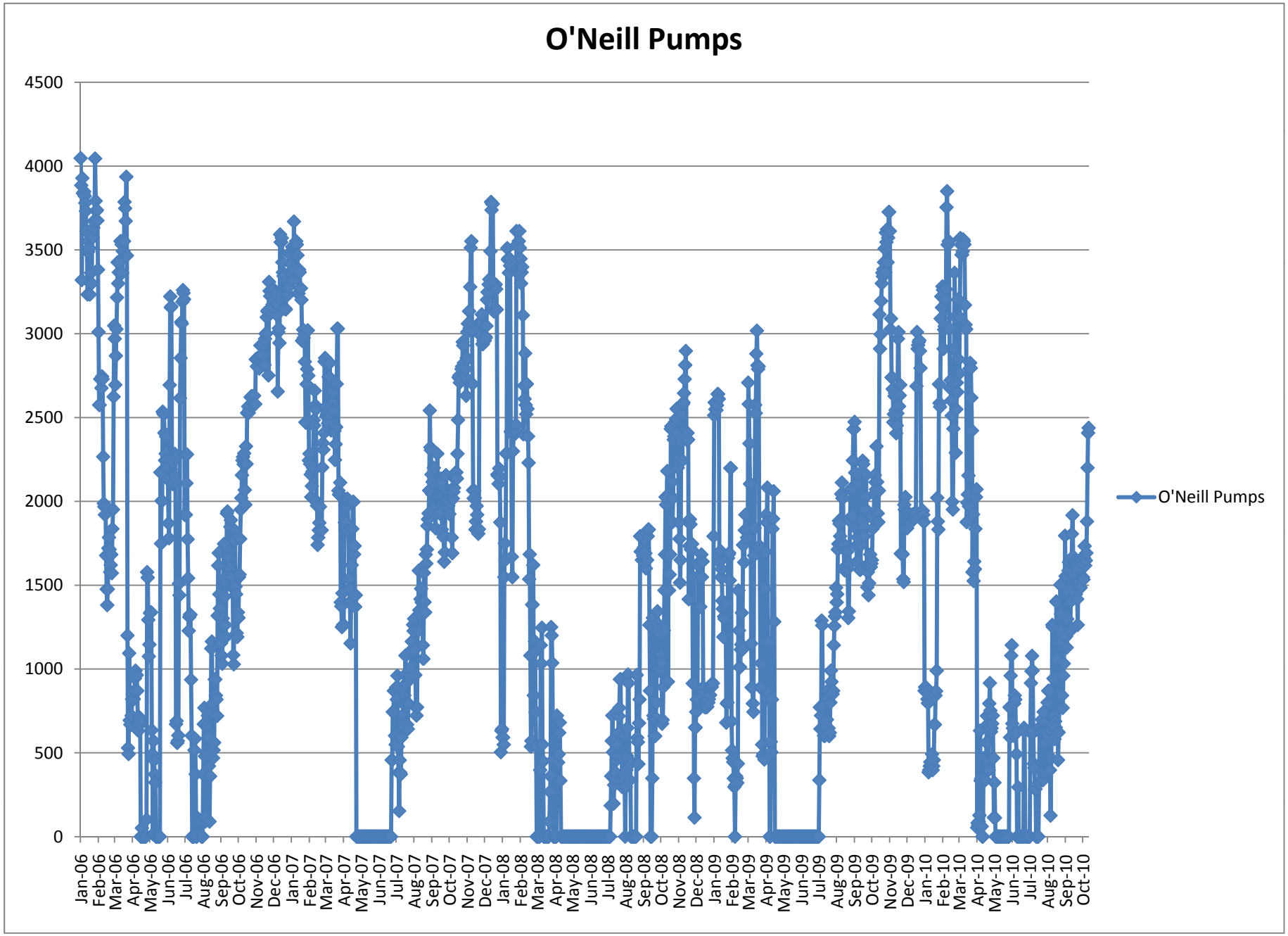
Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
Facilities						**$ 59,859,940**	
Segment 1 (TP to West Main Ave)	48	inch	17,400	feet	$ 12.00	$ 10,022,400	
West Main/Junniper Rd to Hwy 33	48	inch	21,600	feet	$ 12.00	$ 12,441,600	
Segment 3- Hwy 33 to DMC	48	inch	12,200	feet	$ 10.25	$ 6,002,400	
River Crossing (SJR)	48	inch	1,000	feet	$ 1,800.00	$ 1,800,000	
Bore&Jack Under Hwy 33			150	feet	$ 18.00	$ 2,700	
Central Area Pipeline							
Section 1	48	inch	5,590	feet	$ 10.25	$ 2,750,280	
Section 2	48	inch	5,590	feet	$ 10.25	$ 2,750,280	
Section 3	48	inch	5,590	feet	$ 10.25	$ 2,750,280	
Pumpstation							
Distribution Pumpstation #1	3500	hp	1	ea	HP x (15,570 HP^-.442) x 1.96	$ 2,900,000	DMC controls size due to higher flow
Distribution Pumpstation #2	500	hp	1	ea	HP x (15,570 HP^-.442) x 1.96	$ 980,000	
Groundwater Recharge							
Spreading Basin Costs		acres	103	acre	$ 23,900	$ 2,460,000	
Well Installation		wells	10	well	$ 1,500,000	$ 15,000,000	
I&C						**$ 388,000**	
I&C Allowance					10%	$ 388,000	

EASEMENT AND LAND ACQUISITION						Total Cost	
Item	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**$ 2,218,400**	
Pipelines	25	feet	17,400	feet	$ 0.11	$ 49,900	
	25	feet	21,600	feet	$ 0.11	$ 62,000	
	25	feet	12,200	feet	$ 0.11	$ 35,000	
Central Area Section 1	25	feet	5,590	feet	$ -	$ -	
Central Area Section 2	25	feet	5,590	feet	$ -	$ -	
Central Area Section 3	25	feet	5,590	feet	$ -	$ -	
Distribution Pumpstation #1	15,000	SF	1	EA	$ 0.46	$ 6,900	
Distribution Pumpstation #2	10,000	SF	1	EA	$ 0.46	$ 4,600	
Land Acquisition for Spreading Basins		acres	103	acres	$ 20,000	$ 2,060,000	

Repair and Replacement Costs	Amount	Unit	Value	Cost
				$ 164,000
Equipment Consumables	$ 3,880,000		2%	$ 78,000
Mechanical Consumables	$ 3,880,000		2%	$ 78,000
Instrumentation Consumables	$ 388,000		2%	$ 8,000

O&M Costs	Amount	Unit	Value	Cost
				$ 3,082,900
Power	14,632,502	Kw-hr	$ 0.12	$ 1,755,900
Agreements with the Bureau	20,200	$/AF	$ 20	$ 400,000
Cost to Pump River Water to DMC		$/AF	$ -	$ -
GW Well Operation	15,000	$/AF	$ 50	$ 750,000
Spreading Basin and Well Maint.		$/year	$ 102,000	$ 102,000
Treatment				
Labor	1,000	hrs	$ 75.00	$ 75,000
Cost of Purchasing RW	$ -	AFY	$ -	$ -

Appendix N – O'Neil Pumping Plant Historical Operations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O'Neill Pumps

RECLAMATION

Managing Water in the West

Volume I - Project Report

Refuge Recycled Water Supply Study

Task Order R13PD20071

U.S. Department of the Interior
Bureau of Reclamation
Sacramento, California

June 2013

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Refuge Recycled Water Supply Study

Prepared by

RMC Water and Environment

In association with
United States Department of the Interior
Bureau of Reclamation
Mid Pacific Region
Sacramento Office

U.S. Department of the Interior
Bureau of Reclamation
Sacramento, California

June 2013

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Executive Summary

This study evaluates the feasibility of providing recycled water from the North Valley Regional Recycled Water Program (NVRRWP) to the Sacramento-San Joaquin Delta (South of the Delta) refuges. The NVRRWP represents a significant new water source which could help meet both agricultural irrigation demands in the Del Puerto Water District (DPWD) and incremental Level 4 (IL4) water demands in the wildlife refuges south of the Delta. On an annual basis, the total 2012-2013 IL4 water delivery to the San Joaquin Valley refuges was 36,600 AFY while the optimum IL4 water demand is 105,514 AFY, leaving an IL4 shortfall of approximately 70,000 AFY. At the program's final build-out flows in 2045, and depending on the amount of recycled water delivered to DPWD, the NVRRWP could potentially supply approximately 29,000 AFY to the refuges, which would be approximately 40 percent of the 2012-2013 IL4 shortage.

The recommended conveyance alternative is to pipe tertiary treated recycled water from the Cities of Modesto and Turlock to the Delta Mendota Canal (DMC) and then use the DMC to convey the recycled water south to the refuges. A diversion near Newman would be used to divert water to the Newman Canal for delivery of the project water to the refuges. The estimated capital cost of the project is $89 million.

Tertiary treated recycled water from the NVRRWP meets the stringent requirements established in Title 22 of the California Code of Regulations, and is suitable for a wide variety of non-potables uses. The recycled water quality is typically better than San Joaquin River water quality; for example, NVRRWP water contains lower concentrations of constituents such as boron, selenium, electrical conductivity, mercury, and pesticides than the river.

Recycled water from the NVRRWP, when blended with water from the Delta Mendota Canal (DMC), will comply with the United States Bureau of Reclamation's water quality standards for the Upper DMC.

As part of this study, a sampling program was conducted to confirm the usefulness of the existing data and to provide information about analytes, particularly Constituents of Emerging Concern (CECs) that are not included in the existing data sets. Analytical results for conventional constituents were comparable to the existing water quality data. For the CEC analyses, 34 analytes were detected in the Turlock tertiary effluent and/or Modesto secondary effluent samples with most analytes being detected in the samples from both locations. In the samples from the China Island delivery point, the DMC, the PID canal, nine analytes were detected using the analysis for CECs and included both herbicides/pesticides and constituents that likely originate from wastewater effluent (such as caffeine and the artificial sweetener sucralose). The detection of these analytes is to be expected as wastewater treatment plants discharge to the source waters for the DMC and the PID Main Canal.

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Abbreviations and Acronyms

AFM	Acre-feet per month
AFY	Acre-feet per year
CCID	Central California Irrigation District
CDEC	California Data Exchange Center
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEDEN	California Environmental Data Exchange Network
cfs	cubic-feet per second
CIWQS	California Integrated Water Quality System
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DMC	Delta-Mendota Canal
DNQ	Detected but not quantified
DPWD	Del Puerto Water District
GPD	Gallons per day
GPD/cap	Gallons per day per capita
GRCD	Grasslands Resource Conservation District
IL4	Incremental Level 4
L2	Lever 2
MDL	Minimum detection limit
MGD	Million gallons per day
MPN	Most probable number
NPDES	National Pollutant Discharge Elimination System
NVRRWP	North Valley Regional Recycled Water Program
NWR	National Wildlife Refuge
PID	Patterson Irrigation District
QA/QC	Quality Assurance / Quality Control
Reclamation	United States Department of the Interior, Bureau of Reclamation
RWQCB	Regional Water Quality Control Board
RWQCF	Regional Water Quality Control Facility
SWA	State Wildlife Area
TDS	Total Dissolved Solids
TM	Technical Memorandum
USBR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
WA	Wildlife Area
WQCF	Water Quality Control Facility
WWMP	Wastewater Management Plan

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Chapter 1 Summary

Introduction

The purpose of this study is to evaluate the feasibility of providing recycled water from the North Valley Regional Recycled Water Program (NVRRWP) to the Sacramento-San Joaquin Delta (South of the Delta) refuges. This study contains five chapters that collectively evaluate refuge water demand and availability of NVRRWP recycled water flows, water conveyance alternatives, and water quality of the recycled water for use in the refuges.

The Refuge Water Demand Analysis chapter presents the water supply needs for the refuges to fulfill contractual obligation under CVPIA, the shortfall in incremental Level 4 water (IL4) based on actual water delivered in 2012-2013, and the availability of recycled water from the NVRRWP to meet refuge needs. Based on the analysis, NVRRWP flows have the potential to meet up to 17 percent and 42 percent of the 2012-2013 IL4 shortage in 2018 and 2045, respectively.

The Refuge Conveyance Facilities chapter provides an evaluation of alternatives for new infrastructure (pipelines and pump stations) required to convey recycled water via either the existing Delta Mendota Canal (DMC) to South of Delta refuges or a dedicated pipeline directly to one refuge. The alternatives were evaluated to identify potential fatal flaws, identify key elements and features, and develop a preliminary construction cost estimate. Based on the analysis, the recommended alternative for conveyance of NVRRWP flows to refuges is the DMC alternative, as it is the least cost alternative and therefore more cost-effective, provides seasonal storage through the Central Valley Project (CVP) facilities, makes the recycled water available for all of the refuges south of the Delta, and has less impact on existing Del Puerto Water District (DPWD) users.

The Water Quality Analysis chapter presents the water quality of the recycled water and compares it to relevant water quality criteria for the DMC. The chapter found that tertiary treated recycled water from both Turlock and Modesto (source of NVRRWP flows) meets the stringent requirements established in Title 22 of the California Code of Regulations, and is suitable for a wide variety of non-potables uses. Recycled water from the NVRRWP, when blended with water from the DMC, will comply with Reclamation water quality standards for the Upper DMC. Those standards have been established by Reclamation for the Groundwater Pump-in Program. No other water quality standards are presently in place for water introduced into the DMC. With one exception, the recycled water quality also complies with the USBR's current Groundwater Pump-In water quality standards for acceptance into the Upper DMC.

As part of this study, a sampling program was conducted to confirm the usefulness of the existing data and to provide information about analytes, particularly Constituents of Emerging Concern (CECs) that are not included in the existing data sets. Analytical results for conventional constituents were comparable to the existing water quality data. For the CEC analyses, 34 analytes were detected in the Turlock tertiary effluent and/or Modesto secondary effluent samples with most analytes being detected in the samples from both locations. In the samples from the China Island delivery point, the DMC, the PID canal, nine analytes were detected using the analysis for CECs and included both herbicides/pesticides and constituents that are likely originate from wastewater effluent (such as caffeine and the artificial sweetener sucralose). The detection of these analytes is to be expected as wastewater treatment plants discharge to the source waters for the DMC and the PID Main Canal.

Based on the analyses conducted for this project, recycled water is a viable water supply option for the refuges to meet contractual obligations under CVPIA, and the existing DMC, along with new pump stations and pipelines necessary to convey recycled water to the DMC, would be the preferred delivery mechanism for water to the refuges. Thus, it is recommended that USBR further considers this option. The next steps to move forward with this project include:

- Establish relationships with NVRRWP partners to discuss participation in the NVRRWP and confirm availability/quantity of recycled water flows
- Confirm permitting viability of discharging Title 22 recycle water to the DMC with the Regional Water Quality Control Board (RWQCB) and California Department of Public Health (CDPH)
- Obtain USFWS concurrence on use of recycled water in refuges
- Participate in implementation planning being proposed by the NVRRWP partners, including:
  - Engineering/alignment studies for the proposed, new conveyance infrastructure
  - Environmental documentation (in compliance with the National Environmental Policy Act [NEPA] and California Environmental Quality Act [CEQA])
  - Funding availability determination
- Confirm viability of facilities associated with delivery to the DMC
- Confirm cities can secure water right for diversion of recycled water out of San Joaquin River

There are more than 40 National Wildlife Refuges (NWR) and Wildlife Areas (WA) in California. A subset of these units within the Central Valley is

considered Central Valley Project Improvement Act (CVPIA)[1] units or "refuges[2]" (see Figure 1-1). Within the Central Valley, there are 12 Federal NWR/units, six state wildlife areas/units, and one privately-managed complex within the Grassland Resource Conservation District. The units south of the Delta are summarized in Table 1-1 below.

[1] The CVPIA is a multipurpose water legislation which was signed into law on October 30, 1992. It contains 40 separate titles providing for water resource project throughout the West. Title 34, the Central Valley Project Improvement Act, mandates changes in management of the Central Valley Project, particularly for the protection, restoration, and enhancement of fish and wildlife. Provisions of the CVPIA authorized water supplies for those wetland areas covered by the *USBR Report on Refuge Water Supply Investigations – Central Valley Hydrologic Basin, California* (USBR, 1989) and the San Joaquin Basin Action Plan, and required the investigation of water and conveyance needs for private wetlands. Specifically, the CVPIA required Reclamation to supply more than 133,000 AF of Level 2 water annually to 19 Central Valley wildlife refuges and wildlife areas and fix plumbing problems that affect water delivers to refuges by 2020.

[2] The term "refuges" is used generally to refer to the 19 CVPIA identified wetland habitat areas, including NWRs, State Wildlife Areas (WA), and the private wetland area within the Grasslands Resources Conservation District.

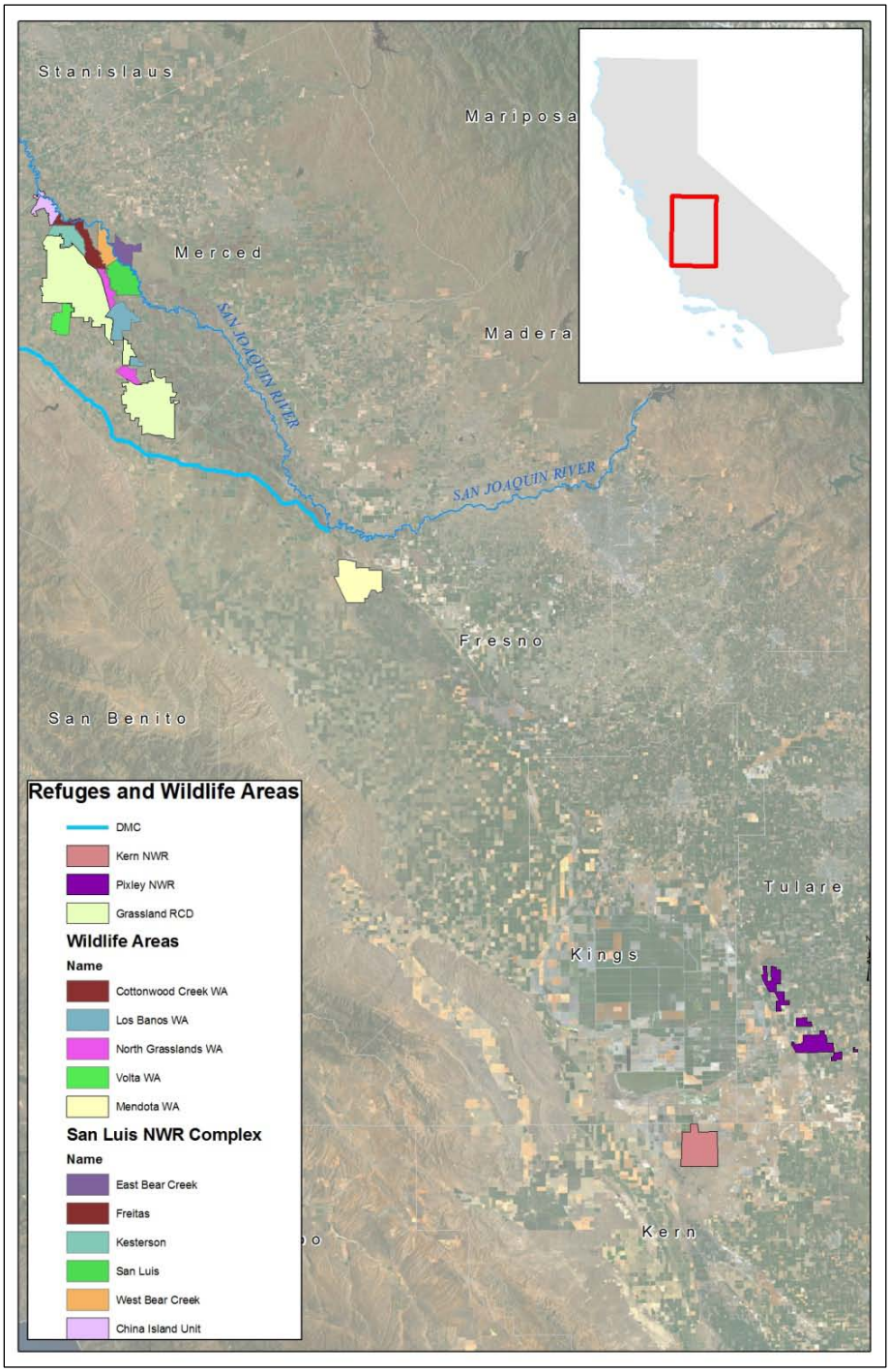

Figure 1-1 Existing CVPIA Units / Refuges within the Central Valley

Table 1-1 South of the Delta CVPIA Units / Refuges

National Wildlife Complex and Refuges	Wildlife Areas	Other
San Luis National Wildlife Complex • San Luis NWR o East Bear Creek Unit o Freitas Unit o Kesterson Unit o San Luis Unit o West Bear Creek Unit • Merced NWR Pixley NWR Kern NWR	Volta WA Mendota WA Los Banos WA North Grasslands WA • Salt Slough Unit • China Island Unit	Grassland Resources Conservation District

Source: Reclamation and USFWS 2012. (The Refuge Water Supply Program – 2013 Annual Work Plan CVPIA 3406 (b)(3) & (d)(1)(2)(5) presentation); USFWS and CDFW.
Notes: NWR = National Wildlife Refuge; WA = Wilderness Area

The United States Bureau of Reclamation (Reclamation or USBR) has a contractual obligation under the CVPIA, and in cooperation with the U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Wildlife (CDFW, formerly California Department of Fish and Game - CDFG), to provide firm, average annual historical water deliveries (Level 2, or L2) of suitable quality to maintain and improve habitat areas on certain Federal and State wildlife refuges in the Central Valley. In addition to L2 deliveries, an additional increment of water supply is needed for optimal wildlife management (incremental Level 4, or IL4). There are various sources of IL4 water supply. Reclamation has entered into five long-term water supply contracts with Grassland Water District (GWD), USFWS and CDFW which established Reclamation's commitment to the CVPIA delivery mandates[3]. Currently, nine long-term conveyance agreements (15-50 years) are utilized to convey CVPIA surface water supplies to the refuges. Reclamation administers eight of these agreements, and USFWS administers one of these agreements. The Program utilizes cooperative agreements to reimburse delivering entities for costs of conveying L2 and IL4 water supplies through Federal, State, and private water distribution systems to the refuges.

Figure 2 shows the breakdown of Level 2 and Level 4 water demands for the CVPIA units according to Reclamation's Report on Refuge Water Supply Investigations (1989). Based on information provided by Reclamation for the period of March 2012 thru February 2013, the CVPIA units in San Joaquin Valley would need a combined Level 2 supply of 271,001 acre-feet (AF) and an incremental Level 4 supply of 105,514 AF[4]. The actual deliveries of IL4 water during the 2012-2013 water year were only 42,700 AF, falling short of the optimum deliveries.

[3] USBR. 2012. Draft CVPIA Fiscal Year 2013 Annual Work Plan. August 22.
[4] USBR. 2013. Monthly Water Use & Scheduled Water (100% Level 2) – As delivered through March 31, 2013. 2012-2013.

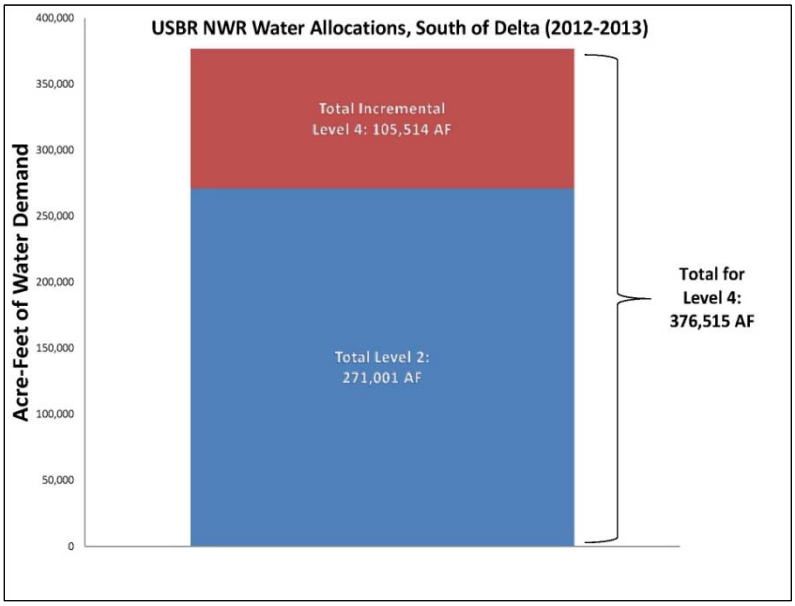

Figure 1-2 Refuges Water Demand

The NVRRWP could be an opportunity for the units south of the Delta to receive additional water toward meeting their full water allocations. Delivery of recycled water to Grassland Resource Conservation District (GRCD) wetlands, and therefore to a number of the South of Delta refuges, could be provided through, connection to the NVRRWP recycled water project via a new pipeline, or by using the Delta-Mendota Canal (DMC) for conveyance.

CVPIA Units / Refuges

San Luis NWR Complex[5]

The San Luis NWR Complex, managed by USFWS, includes the San Luis NWR, Merced NWR, San Joaquin River NWR, and Grasslands Wildlife Management Area. San Luis NWR and Merced NWR are described further below. San Luis Refuge is approximately 10 miles north of Los Banos, California. It encompasses over 26,800 acres of wetlands, riparian forests, native grasslands, and vernal pools[6]. The NWR supports populations of endemic tule elk and is host to assemblages of birds, mammals, reptiles, amphibians, fish, insects, and plants; some of which are endangered species. The NWR is a major wintering ground and migratory stopover point for large concentrations of waterfowl, shorebirds, and other water birds. The San Luis NWR includes the East Bear Creek Unit, Freitas Unit, Kesterson Unit, San Luis

[5] A National Wildlife Refuge Complex is an administrative grouping of two or more refuges, wildlife management areas or other refuge conservation areas that are primarily managed from a central location because they occur in a similar ecological region, such as a watershed or specific habitat type, and have a related purpose and management needs.

[6] USFWS. 2012. San Luis National Wildlife Refuge. Last updated December 18. Available at: http://www.fws.gov/Refuge/San_Luis/about.html

Unit, and West Bear Creek Unit. San Luis Refuge is intensively managed to produce optimum wetland conditions for a diversity of migratory birds.

Merced Refuge is approximately eight miles south of Merced on State Highway 59 and eight miles west on Sandy Mush Road. The Merced National Wildlife Refuge encompasses 10,258 acres of wetlands, native grasslands, vernal pools, and riparian areas[7]. The Refuge hosts to the largest wintering populations of lesser Sandhill cranes and Ross' geese along the Pacific Flyway. The Refuge also provides important breeding habitat for other birds.

Pixley NWR

Pixley National Wildlife Refuge, managed by USFWS, is located 35 miles south of Tulare, and 45 miles north of Bakersfield in the San Joaquin Valley, California[8]. The 6,389-acre refuge represents one of the few remaining examples of the grasslands, vernal pools, and playas that once bordered historic Tulare Lake. Over 100 bird and six reptile species use the refuge. Approximately 300 acres of managed wetlands provide habitat for migratory waterfowl and shorebirds. The primary management focus of the refuge is to maintain and restore native habitats including wetlands and upland habitat.

Kern NWR

Kern National Wildlife Refuge, managed by USFWS, is located approximately 20 miles west of the City of Delano[9]. The Refuge consists of 11,249-acres of natural desert uplands, a relict riparian corridor, and developed marsh[10]; it is situated on what was once the largest freshwater wetland complex in the western United States, Kern Refuge provides optimum wintering habitat for migratory birds with an emphasis on waterfowl and water birds. Through restoration and maintenance of native habitat diversity, the refuge also provides suitable habitat for several endangered species as well as preserving a remnant example of the historic valley uplands in the San Joaquin Desert.

Wildlife Areas

Volta

Volta WA, managed by CDFW, is located approximately 0.75 mile north of Volta[11]. Volta WA consists of 2,891 acres of managed marsh and valley alkali shrub, which support 150 species of birds including large numbers of waterfowl and shorebirds.

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[7] USFWS. No Date. Merced National Wildlife Refuge. Available at: http://www.fws.gov/refuges/profiles/index.cfm?id=81652
[8] USFWS. No date. Pixley National Wildlife Refuge. Available at: http://www.fws.gov/refuges/profiles/index.cfm?id=81612
[9] USFWS. No Date. Kern National Wildlife Refuge. Available at: http://www.fws.gov/refuges/profiles/index.cfm?id=81610
[10] USFWS. 2011. Kern National Wildlife Refuge. Last updated January 3. Available at: http://www.fws.gov/kern/refuges/kern/
[11] CDFW. No Date. Volta Wildlife Area – Merced County. Available at: http://www.dfg.ca.gov/lands/wa/region4/volta.html

Mendota WA

Mendota WA, managed by CDFW, is located approximately three miles south of Mendota near Whites Bridge. It consists of 11,802 acres with flatlands and floodplain.

Los Banos WA

Los Banos WA, managed by CDFW, is located approximately four miles northeast of Los Banos[12]. Los Banos WA was the first of a series of waterfowl refuges established throughout the state to manage habitat for wintering waterfowl and consists of more than 6,217 acres of wetland habitat which includes lakes, sloughs and managed marsh. The Refuge supports over 200 species of birds.

North Grasslands Wildlife Area

The North Grasslands WA, managed by CDFW, is located approximately six miles north of Los Banos[13]. It consists of 7,069 acres of wetlands, riparian habitat and uplands, which support Swainson's hawk and sandhill crane. The North Grasslands WA includes China Island Unit and Salt Slough Unit.

Other Units

GRCD

The GRCD comprises approximately 60,000 acres of habitat land[14] and is composed of privately-owned hunting clubs and other privately-owned wetland areas, as well as all or portions of several state wildlife areas (such as Volta Wildlife Area [WA], Los Baños WA, Mud Slough Unit, Gadwall Unit, and Salt Slough Unit) and federal wildlife refuges (such as San Luis NWR)[15]. The area is the largest contiguous block of wetlands remaining in California's Central Valley and is a major wintering ground for migratory waterfowl and shorebirds of the Pacific Flyway. Up to 30 percent of the Central Valley's wintering population of ducks use this area. USFWS ranks the habitat provided by the GRCD as the most important complex of wetlands in the San Joaquin Valley.

Lands within the GRCD are primarily managed for waterfowl habitat. The GWD has a Water Management Plan, but no overall habitat management plan exists for the GRCD because of the large number of individual property owners. The management objectives of the GRCD include an active program to encourage natural food plant and habitat protection. Land uses include seasonally flooded wetlands, moist soil impoundments, permanent wetland, irrigated pasture, and croplands.

[12] CDFW. Not Date. Los Banos Wildlife Area – Merced County. Available at: http://www.dfg.ca.gov/lands/wa/region4/losbanos.html
[13] CDFW. No Date. North Grasslands Wildlife Area – Merced and Stanislaus County. Available at: http://www.dfg.ca.gov/lands/wa/region4/northgrasslands.html
[14] Habitat types within the complex include seasonal wetlands, permanent wetland, semi-permanent wetland, reverse cycle wetlands, riparian, irrigated pasture, and upland.
[15] Grassland Water District. 2013. About Grassland. Available at: http://gwdwater.org/about/grcd.php5

The GRCD contains most of the 51,530 acre Grasslands Water District. The GWD is a legal entity that was established under section 34000 of the California Water Code to receive and distribute CVP water. The GWD delivers CVP water to the wetland areas within its boundaries. The GWD contains approximately 165 separate ownerships, most of which are duck clubs. Perpetual easements have been purchased by the USFWS to help preserve wetland-dependant migratory bird habitat on approximately 31,000 acres serviced by the GWD. These easements authorize the USFWS to restrict land uses that would diminish wetland habitat values.

Need for Additional Water Supply

Reclamation is striving to secure firm, reliable water supplies for the refuges to meet the CVPIA mandated water levels, which have not been achieved "due in large part to state and federal budget shortages, inconsistency in the timing of water deliveries, and increases in the costs of blocks of water made available annual from willing sellers on the open market[16]." For the refuges south of the Delta, a total allocation of 271,001 AF of Level 2 and 105,514 AFY of Level 4 water supplies were identified[17]. For the March 2012 to February 2013 period, the region received a total of 312,990 AF of water, which exceeded Level 2 water requirements for all of refuges except Pixley NWR (no Level 2 water was delivered to Pixley NWR during this period[18]). However, the lack of full acquisition of Level 4 water supplies by Reclamation affects the refuges' ability to provide optimum habitat management.

Potential Sources of Water Supply

A potential source of supply for the refuges south of the Delta is recycled water obtained through the NVRRWP. The NVRRWP is being developed as a regional solution to address south of the Delta water supply shortages and reliability concerns by utilizing recycled water for beneficial uses. The proposed NVRRWP would deliver recycled water produced by the Cities of Modesto and Turlock to the DPWD, a CVP agricultural water service contractor.

Located in western San Joaquin, Stanislaus, and Merced Counties, DPWD delivers water directly from the DMC to 45,000 acres of farmland between Vernalis on the north and Santa Nella to the south. As a CVP water contractor

[16] Central Valley Joint Venture. 2006. 2006 Implementation Plan. Available at: http://www.centralvalleyjointventure.org/assets/pdf/CVJV_fnl.pdf

[17] USBR. 2013. Monthly Water Use & Scheduled Water (100% Level 2) – As delivered through March 31, 2013. (Provided by USBR)

[18] Since passage of the CVPIA, Pixley NWR has been completely dependent upon a single groundwater well on the refuge, providing its only reliable water supplies, averaging 12 percent of Pixley NWR's CVPIA allocation since 2002. Production from new groundwater starting in 2013 will provide the full L2 supplies on an annual basis for this refuge although there is concern that using groundwater for the full L4 allocation may result in potential overdraft of the regional aquifer (USBR. 2012. Draft CVPIA Fiscal Year 2013 Annual Work Plan. August 22).

located south of the Delta, DPWD has experienced significant shortages and decreased reliability in the quantity of water it receives annually under the terms of its federal water service contract.

Because DPWD does not have an alternate water supply, shortages in CVP deliveries have resulted in serious economic hardship not only on DPWD growers but on the region in general, including several Disadvantaged Communities. To address this situation, the NVRRWP is considering using recycled water to augment and provide a more reliable supply of irrigation water to DPWD.

Recycled water may also be available for the refuges south of the Delta. On an annual basis, the total 2012-2013 IL4 water delivery to the San Joaquin Valley refuges was 36,600 AFY while the optimum IL4 water demand is 105,514 AFY, leaving an IL4 shortfall of approximately 70,000 AFY. Assuming the NVRRWP comes on line in 2018 there would be an estimated 12,100 AFY of potentially available NVRRWP flow during the non-irrigation season. If this water is available to Reclamation and was delivered to the refuges, it would meet 17 percent of the 2012-2013 IL4 shortage. As the project flows increase to build-out in 2045, the potentially available NVRRWP flows would increase to approximately 29,400 AFY, which is 42 percent of the 2012-2013 IL4 shortage (as shown in the chart below). The NVRRWP recycled water is produced year round. However, because the agricultural irrigators have their greatest need during the dry season (March to November), the potentially available NVRRWP flows would be available during the wet season (November to February) only. One of the advantages of using the DMC for conveyance is that the DMC facilities could be used as storage for the NVRRWP flows, making them available year-round for use. See Chapter 2 for details.

Participants in the NVRRWP currently include the Cities of Modesto, Turlock, Ceres, Stanislaus County, and Del Puerto Water District (DPWD) on the west side of the San Joaquin Valley within Stanislaus County; Figure 3 shows the location of the cities relative to the GRCD complex. The cities of Modesto and Turlock provide wastewater treatment for their own metropolitan areas as well as smaller communities in Stanislaus County. Title 22 treated recycled water from Turlock and Modesto is currently discharged to the San Joaquin River or via land application to agricultural crops.

City of Modesto

The City of Modesto provides sewerage service for the City of Modesto, the community of Empire, and a portion of the City of Ceres, serving a population of approximately 225,000[19]. The City owns and operates its secondary and tertiary treatment plants at the Jennings Road facility.

At present, the Modesto WQCF can produce 2,600 acre-feet/year (2.3 MGD) tertiary-treated effluent that meets Title 22 standards for unrestricted non-

[19] RWQCB. 2012. City of Modesto Water Quality Control Facility. ORDER R5-2012-0031, NPDES NO. CA0079103. Available at: http://www.swrcb.ca.gov/rwqcb5/board_decisions/adopted_orders/stanislaus/r5-2012-0031.pdf

potable reuse. By 2018 and 2045 (build-out), the City will have available 16,500 AFY and 30,600 AFY of NVRRWP flows.

City of Turlock

The City of Turlock provides wastewater treatment for the City of Turlock and the community service districts of Keyes and Denair and a portion of the City of Ceres, with a total population of approximately 78,000 people[20]. By 2018, the City of Turlock will have available 14,100 AFY of NVRRWP flows. By build-out, the City will have 28,400 AFY of NVRRWP flows. This increase in flows includes a projected transfer of 4,500 AFY of flow to the Turlock treatment plant when the City of Ceres ceases operation of its existing pond treatment and disposal system. The December 2012 Ceres Sewer Master Plan envisions a purchase of a further 4 MGD of flow from Turlock. This would increase Ceres' wastewater flow to Turlock to 6 MGD, the maximum capacity of the pipeline in place. The Ceres' plan notes that this is a longer-term project, occurring after the year 2022.

[20] RWQCB. 2010. City of Turlock Water Quality Control Facility. ORDER R5-2012-0079, NPDES NO. CA0078948. Available at: http://www.swrcb.ca.gov/rwqcb5/board_decisions/adopted_orders/stanislaus/r5-2012-0031.pdf

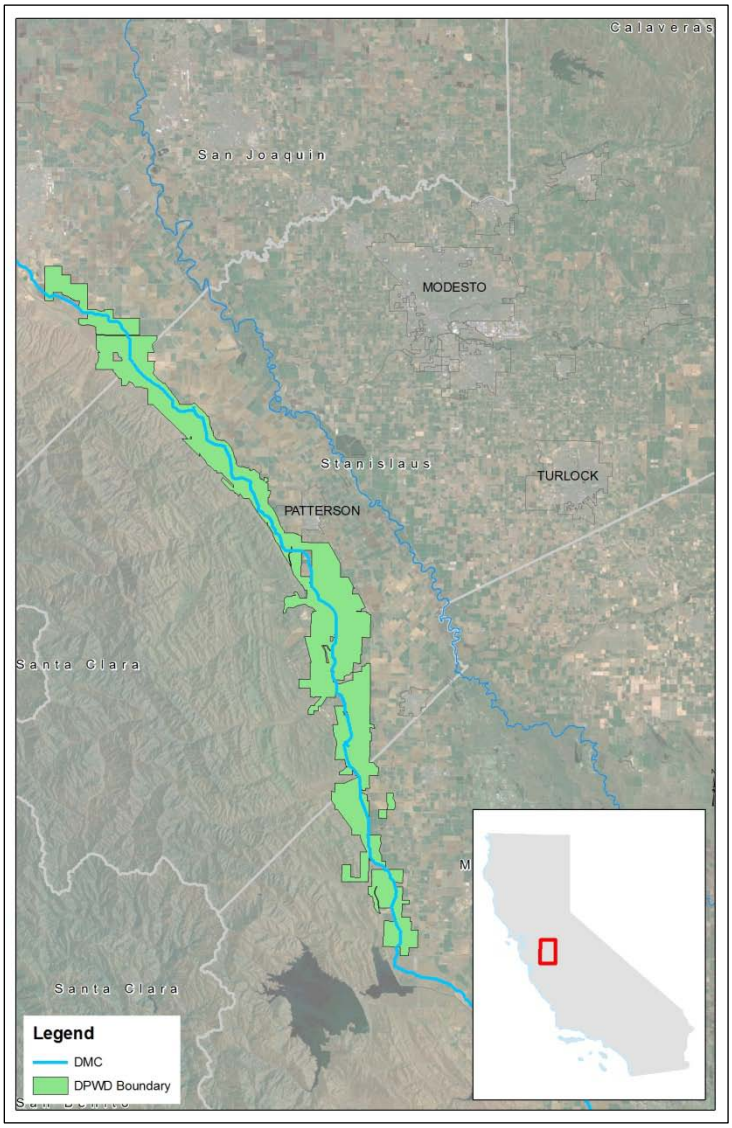

Figure 1-3 NVRRWP Recycled Water Providers and Participants

Water Conveyance

The following sections provide a description of existing facilities that may be used in part to convey/store NVRRWP water to Reclamation and the refuges and results of the conveyance alternatives analysis. A map of the existing facilities and their proximity to the refuges and DPWD is presented in Figure 4.

Two main alternatives have been evaluated for conveyance of NVRRWP water to the refuges; a direct pipeline that would serve both DPWD and the refuges, or conveyance of the NVRRWP through the DMC. These alternatives are

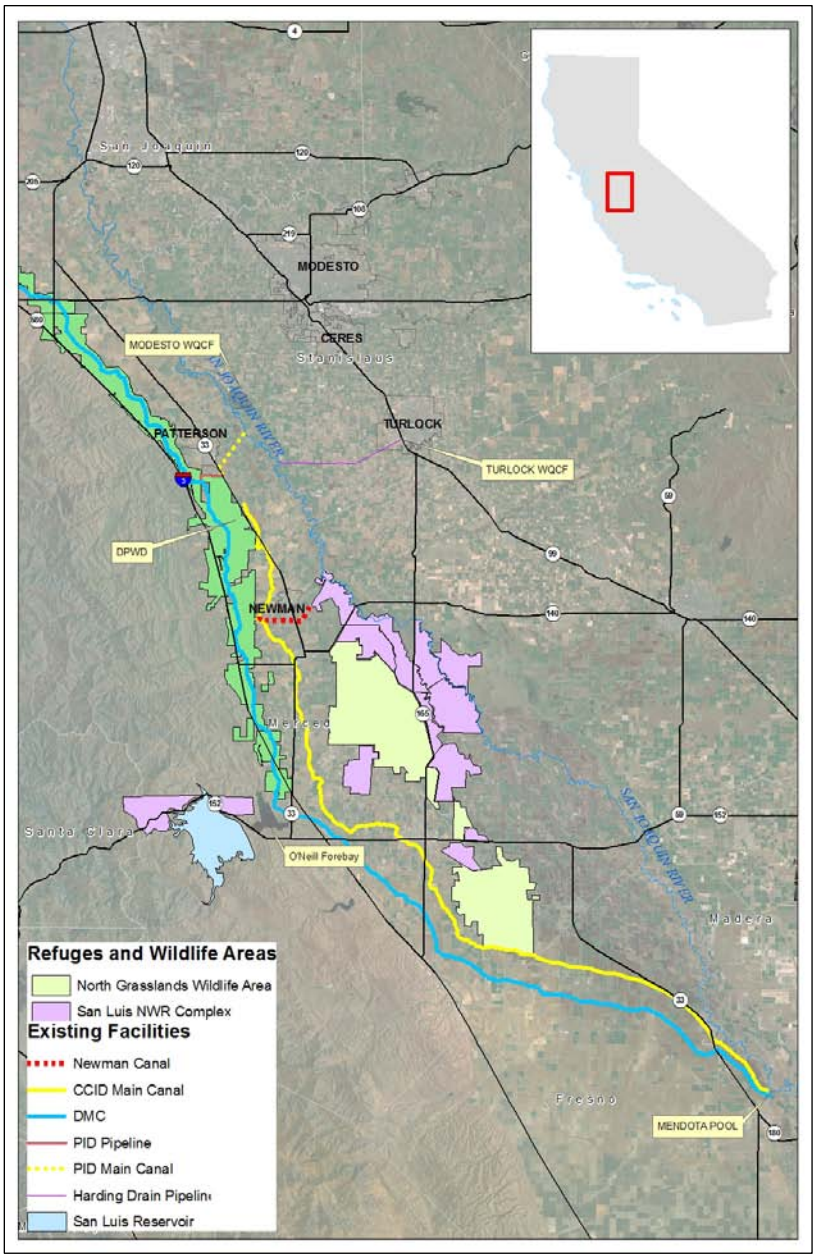

Figure 1-4 Map of Existing Facilities

described in detail in Chapter 3, Refuge Conveyance Facilities. Of those alternatives, using the DMC for conveyance is by far the more cost-effective option. The alternative would utilize the following existing facilities.

- Delta-Mendota Canal (DMC) and Mendota Pool
- San Luis Reservoir
- CCID and the Newman Canal

Delta-Mendota Canal and Mendota Pool

The DMC is being considered as the most cost-effective facility for conveyance of water for the NVRRWP to DPWD and refuges. Currently, the DMC is the primary source of water for both DPWD and the refuges.

The DMC, a CVP facility operated and maintained by the San Luis and Delta-Mendota Water Authority under contract with Reclamation, is a 117 mile-aqueduct in central California that has a maximum capacity of 4,600 cubic feet per second (cfs) and gradually decreases to 3,211 cfs at its terminus[21] (see Figure 2).

The canal begins at the C.W. Bill Jones Pumping Plant (formerly the Tracy Pumping Plant), which pumps water from the Sacramento-San Joaquin Delta. The canal runs south along the western edge of the San Joaquin Valley, parallel to the California Aqueduct for much of its length, but diverges to the east after passing San Luis Reservoir, which receives some a portion of its water from the DMC (the remaining portion of water flowing into San Luis Reservoir comes from the California Aqueduct). The water is pumped from the canal into O'Neill Forebay, and then is pumped into San Luis Reservoir by the Gianelli Pumping-Generating Plant. Occasionally, water from O'Neill Forebay is released into the canal. The Delta–Mendota Canal ends at the Mendota Pool, a small reservoir created by Mendota Dam on the San Joaquin River near the town of Mendota, approximately 30 miles west of Fresno.

The DMC is also hydraulically connected with the SWP California Aqueduct via an intertie with a pumping station and two 108-inch diameter pipes west of the City of Tracy.

San Luis Reservoir

The DMC is connected to the San Luis Reservoir midway along the length of the canal. The 2 million acre feet San Luis Reservoir is an artificial lake on San Luis Creek in the eastern slopes of the Diablo Range of Merced County that is jointly owned and operated by Reclamation and DWR and is one of California's largest reservoirs[22]. During the summer or dry season, water in the San Luis Reservoir is used by CVP contractors (as well as State Water Project contractors). Occasionally, water from O'Neill Forebay is released into the canal. South of the O'Neill Forebay, the DMC diverges from the path of the California Aqueduct and heads east towards its end point at the Mendota Pool.

CCID and the Newman Canal

The Central California Irrigation District (CCID)-owned Main Canal begins at the Mendota Pool. This unlined canal conveys water north for roughly 80 miles, providing irrigation water along its route.

[21] Wikipedia. 2013. Delta-Mendota Canal. Last updated April 20. Available at: http://en.wikipedia.org/wiki/Delta%E2%80%93Mendota_Canal

[22] Santa Clara Valley Water District. 2013, Available at: http://www.valleywater.org/Services/SanLuisReservoirLowPointImprovement.aspx

The Newman Canal is a concrete lined, open channel canal that receives its source water from the DMC through a wheeling agreement with Central California Irrigation District (CCID) and the use of their Main Canal[23]. The wheeling point along CCID's Main Canal is located approximately 2.5 miles southwest of Newman, CA. This canal travels east from the Main Canal, adjacent to the Newman Wasteway, with the eventual delivery point in the China Island Unit of the North Grasslands Wildlife Area.

The Newman Canal, shown in Figure 1-5, was reconstructed in 2001 to address issues with soil compaction. The resulting canal has a design capacity of 40 cfs. However, with the accumulation of silt and other sediment, the actual maximum operational flow is estimated to be approximately 35 cfs.

Figure 1-5 Newman Canal at China Island Unit

Patterson Irrigation District

The Patterson Irrigation District (PID) is located near the City of Patterson, CA and is bounded by the San Joaquin River to the east and the DMC on the west. PID owns and operates their Main Canal and laterals to serve agricultural users.

PID pumps water from the San Joaquin River into their Main Canal through a series of pump and lift stations. The Main Canal currently has a peak capacity of 200 cfs. The canal begins at the San Joaquin River, just north of the Las Palmas Bridge. The canal alignment heads southwest towards the City of Patterson for approximately 3.3 miles, before heading south along Highway 33. There are

[23] Miyamoto, Steve. 2013. Wildlife Habitat Supervisor of the USFWS China Island Unit. Conversation with Ryan Doyle (RMC Water and Environment)

five lift stations along the main canal. The Main Canal supplies 13 lateral canals that distribute water north and south from the main canal. At the west end of the PID Main Canal up to 35 cfs can be conveyed to the DMC via a 30" pipeline allowing for inter-agency transfers through a Warren Act Agreement. Figure 1-6 shows the PID pipeline diverting water into the DMC.

The PID Main Canal was originally constructed in the 1920s. PID has a pre-1914 water right to draw surface water from the San Joaquin River. PID recently completed construction of a new fish screen and main pump station, located on the San Joaquin River and discharging to the PID Main Canal. PID is projected to begin an overhaul of the rest of its system to increase conveyance capacity as well as increase conveyance reliability within the coming years. Efforts are underway to coordinate with PID to obtain a more precise schedule for this upgrade to evaluate whether the NVRRWP water may be conveyed in the PID Main Canal for delivery to the DMC.

Figure 1-6 PID Main Canal Diversion into DMC

Conveyance Options

The Refuge Conveyance Facilities chapter evaluated two options for conveying NVRRWP flows to the refuges. The alternatives and a brief description are provided below:

- **DMC to the Mendota Pool:** recycled water from the Turlock and Modesto WQCF would be conveyed through 26,800 ft of 36-inch pipelines to a combined pump station located near West Main Avenue east of the San Joaquin River. The combined flows would be pumped through a 34,300 ft long, 48-inch pipeline which crosses the San Joaquin River at Las Palmas Bridge. The pipeline would then parallel the PID Main Canal, cross Highway 33, and end at the DMC where the recycled water would discharge into the DMC.
- **Direct pipeline to the refuges via the CCID Newman Canal:** this alternative would follow the DMC alignment described previously up to the DMC right-of-way. Once the alignment reaches the DMC right of

way, the 48" pipeline would turn south and follow the east bank of the DMC for an additional 10,500 feet to the southern Stanislaus County border to serve the majority of south DPWD demands. To reach the refuge (China Island Unit) facilities, there would be a 48 inch tee near the City of Newman, CA that would extend east for approximately 6,400 ft. This tee would eventually end at the CCID Main Canal where the Newman Canal would be used to convey the project water to the refuges.

The alternatives were evaluated to identify potential fatal flaws, identify key elements and features, and develop a preliminary construction cost estimate. Potential pipeline routes were evaluated relative to the following criteria:

- Cost
- Constructability
- Schedule

The analysis determined the DMC conveyance is the preferable option because it provides the following advantages:

- Since NVRRWP water availability in the winter months exceeds the refuges' IL4 demands, the CVP/DMC facilities provide seasonal storage so that the NVRRWP water can be used by the refuges and DPWD when needed to help meet their peak demand periods;
- It allows all refuges south of the Delta to receive NVRRWP water; and
- The DMC alternative is more cost-effective than the Direct Pipeline to the Refuges alternative. The DMC alternative would have a capital cost of $89M compared to $207M for the Direct Pipeline alternative.

Water Quality

Tertiary treated recycled water from the NVRRWP must meet the requirements established in Title 22 of the California Code of Regulations. The recycled water quality is typically better than San Joaquin River water quality. Reclamation has established water quality standards for the Groundwater Pump-In Program, but does not have any existing standards for other sources of water that are or may be introduced into the DMC. In the absence of any other water quality standards, the water quality standards established in the Groundwater Pump-In Program have been utilized as a basis for evaluating introduction of recycled water into the DMC Recycled water from the NVRRWP, when blended with water from the DMC, will comply with Reclamation's Groundwater Pump-In water quality standards for the Upper DMC. With one exception, the recycled water quality also complies with the USBR's current water quality standards for acceptance into the Upper DMC. Both sets of standards are in place to regulate the practice of pumping well water into the DMC under Warren Act Contracts, and are not necessarily applicable to

recycled water. Of the 48 constituents covered by these standards, only the sodium content is expected to exceed Reclamation's standards for acceptance into the DMC. Selenium, a constituent of concern for recycled water use at wildlife refuges, is present in NVRRWP recycled water at a concentration comparable to the existing DMC water quality (0.8 µg/L). The same is true for boron and arsenic. Recycled water would be delivered to the refuges after mixing with the existing water in the DMC. The recycled water generated from the NVRRWP is not expected to produce a significant change in water quality to downstream DMC users. See the chapter on Water Quality Analysis for details.

Recommendation

Based on the analyses conducted for this project, recycled water is a viable water supply option for the refuges. Specifically, recycled water developed as part of the NVRRWP could provide a reliable refuge water supply. Direct delivery via the DMC would require additional infrastructure, but would be more cost-effective than other conveyance alternatives. Thus, it is recommended that USBR further considers this option and the next steps to move forward with this project:

- Establish relationships with NVRRWP partners to discuss participation in the NVRRWP and confirm availability/quantity of recycled water flows
- Confirm permitting viability of discharging Title 22 recycle water to the DMC with the Regional Water Quality Control Board (RWQCB) and California Department of Public Health (CDPH)
- Obtain USFWS concurrence on use of recycled water in refuges
- Participate in implementation planning being proposed by the NVRRWP partners, including:
  - Engineering/alignment studies for the proposed, new conveyance infrastructure
  - Environmental documentation (in compliance with the National Environmental Policy Act [NEPA] and California Environmental Quality Act [CEQA])
  - Funding availability determination
- Confirm viability of facilities associated with delivery to the DMC
- Confirm cities can secure water right for diversion of recycled water out of San Joaquin River

Chapter 2
Water Demand Analysis

Summary of Findings

The North Valley Regional Recycled Water Program (NVRRWP) represents a significant new water source which could help meet both agricultural irrigation demands in the Del Puerto Water District (DPWD) and incremental Level 4 (IL4) water demands in the wildlife refuges south of the Delta. Using the Central Valley Project (CVP) Delta-Mendota Canal (DMC) as the conveyance method for recycled water allows the NVRRWP water that may be in excess of monthly DPWD demands to be stored within the CVP system where it can be used on a schedule that best fits DPWD or other users needs.

On an annual basis, the total 2012-2013 IL4 water delivery to the San Joaquin Valley refuges was 36,600 AFY while the optimum IL4 water demand is 105,514 AFY, leaving an IL4 shortfall of approximately 70,000 AFY. Assuming the NVRRWP comes on line in 2018, and depending on the amount of recycled water delivered to DPWD, there could be an estimated 12,100 AFY of potentially available NVRRWP flow available for the refuges, which would meet 17 percent of the 2012-2013 IL4 shortage. As the program flows increase to build-out in 2045, the potentially available NVRRWP flows would increase to approximately 29,400 AFY, which is 42 percent of the 2012-2013 IL4 shortage.

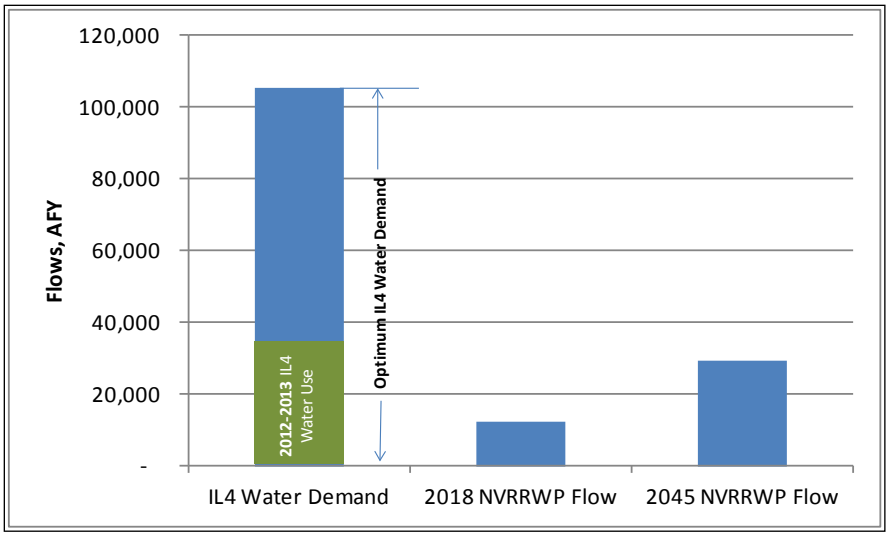

Figure 2-1 NVRRWP Flows and IL4 Water Demands

Introduction

This chapter summarizes and compares the current National Wildlife Refuge (NWR) water demands to the DPWD demands and to the recycled water supply available from the NVRRWP.

Refuge Water Use

Information on the timing and quantity of current refuge supplies has been provided by Reclamation and is shown on Table 2-1 for water year 2012-2013. Since the preferred conveyance option for NVRRWP water is via the DMC, the recycled water could be used for all of the refuges south of the Sacramento-San Joaquin Delta (south of the Delta). Therefore the total water use for the refuges[24] potentially served by this program is assumed to be the sum of the San Joaquin Valley as presented in Table 1.

Table 2-1 shows both the Level 2 (L2) and IL4 water deliveries for water year 2012-2013 as well as the full L2 and IL4 demands as established in the Report on Refuge Water Supply Investigations (USBR, 1989) L2 is defined as the amount of water required for minimum wetlands and wildlife habitat management based on historic average annual deliveries before 1989 while full Level 4 is the total annual amount of water identified for optimum wetland and wildlife habitat development and management[25]. IL4 water is the difference between L2 and Full Level 4 water uses. The IL4 water is acquired through voluntary measures such as conservation, conjunctive use, purchase, lease, donation, or similar activities. This study assumes that the NVRRWP recycled water would be one of the sources for the IL4 water use in the refuges. Therefore, subsequent comparisons of water supplies in this chapter focus on the IL4 water demands.

For water year 2012-2013 the total IL4 water delivery was 36,600 acre feet per year (AFY) which was distributed over the monthly basis shown on Figure 2-1 and Table 2-2. However, the optimum IL4 demand that was established in the Report on Refuge Water Supply Investigations (USBR, 1989) is 105,514 AFY, nearly 70,000 AFY more than the IL4 deliveries in water year 2012-2013.

[24] "refuges" is used generally to refer to the 19CVPIA identified wetland habitat areas, including NWRs, State Wildlife Areas (SWA), and the private wetland area within the Grasslands Resources Conservation District.
[25] USBR and USFWS. 2012. Draft CVPIA Fiscal Year 2013 Annual Work Plan. August 22.

Table 2-1 Monthly Refuge Water Deliveries (AFM) In Water Year 2012-2013

	Monthly Water Use for Water Year 2012 - 2013																								Total IL4 Demand per 1989 Report, AFY
	Mar-12		Apr-12		May-12		Jun-12		Jul-12		Aug-12		Sep-12		Oct-12		Nov-12		Dec-12		Jan-13		Feb-13		
Refuge	L2	IL4	L2	IL4	L2	IL4	L2	IL4	L2	IL4	L2	IL4	L2	IL4	L2	IL4	L2	IL4	L2	IL4	L2	IL4	L2	IL4	
San Luis NWR Complex																									
- San Luis Unit	1,854		800		1,300		1,000		800		300		1,800		3,500		2,500		1,946		1,800		1,400		0
- West Bear Creek Unit	300		600		550		800		500		500		300		1,000		1,100		800		400		357		3,603
- East Bear Creek Unit	0		500		800		600		200		400		900		1,100		1,100		1,450		1,000		813		4,432
- Kesterson Unit	1,014		600		1,043		700		500		500		1,450		2,000		1,300		1,050		511		408		0
- Freitas Unit	400		200		400		500		200		200		200		450		550		800		840		550		0
Merced NWR	1,752		0	1,000	100	1,500	1,600	0	1,400		1,600		1,900		2,400		900		900		500		448		2,500
Kern NWR	0		0		0	183	0	100	0	100	3,000	143	1,000	1,600	1,155	1,600	1,395	1,549	1,000		1,800		600		15,050
Pixley NWR	0		0		0		0		0		0		0		0		0		0		0		0		4,720
Volta WA	112		200		0		250		1,127		1,700		2,700		3,000		1,600		800		800		800		3,000
Los Banos WA	664	45	500	200	300	555	600	0	800	0	1,800	500	3,000	400	4,200	130	2,100	0	1,500	0	1,500	0	370	255	8,330
Subtotal San Luis NWR	6,096	45	3,400	1,200	4,493	2,238	6,050	100	5,527	100	10,000	643	13,250	2,000	18,805	1,730	12,545	1,549	10,246	0	9,151	0	5,746	255	41,635
N. Grasslands WA																									
- China Island Unit	243	441	0	479	0	300	0	355	182	300	1,500	0	1,000	0	830	0	855	0	950	0	1,100	0	550	0	3,483
-Salt Slough Unit	216	550	650	200	500	350	0	0	0	0	914	400	750	350	1,100	0	800	0	700	0	650	0	400	300	3,340
Mendota Wildlife Area	622	0	704	0	1,500	0	2,200	0	2,500	0	2,950	0	5,100	0	5,680	0	2,960	0	1,050	0	1,200	0	1,154	0	2,056
Grassland RCD	399	0	0	1,225	13,000	4,141	1,200	2,160	800	775	4,500	2,512	53,000	3,130	41,000	3,549	9,000	1,506	4,000	1,351	2,644	1,234	0	1,160	55,000
Subtotal N. Grasslands WA	1,480	991	1,354	1,904	15,000	4,791	3,400	2,515	3,482	1,075	9,864	2,912	59,850	3,480	48,610	3,549	13,615	1,506	6,700	1,351	5,594	1,234	2,104	1,460	63,879
TOTAL	**7,576**	**1,036**	**4,754**	**3,104**	**19,493**	**7,029**	**9,450**	**2,615**	**9,009**	**1,175**	**19,864**	**3,555**	**73,100**	**5,480**	**67,415**	**5,279**	**26,160**	**3,055**	**16,946**	**1,351**	**14,745**	**1,234**	**7,850**	**1,715**	**105,514**
TOTAL ANNUAL L2 WATER DELIVERY, AFY	**276,362**																								
TOTAL ANNUAL IL4 WATER DELIVERY, AFY	**36,628**																								

Notes:
As Delivered through March 31, 2013. At the Refuge boundary without conveyance losses - Water Year 2013-2014
Source: USBR. 2013. Monthly Water Use & Scheduled Water (100% Level 2) – As delivered through March 31, 2013.

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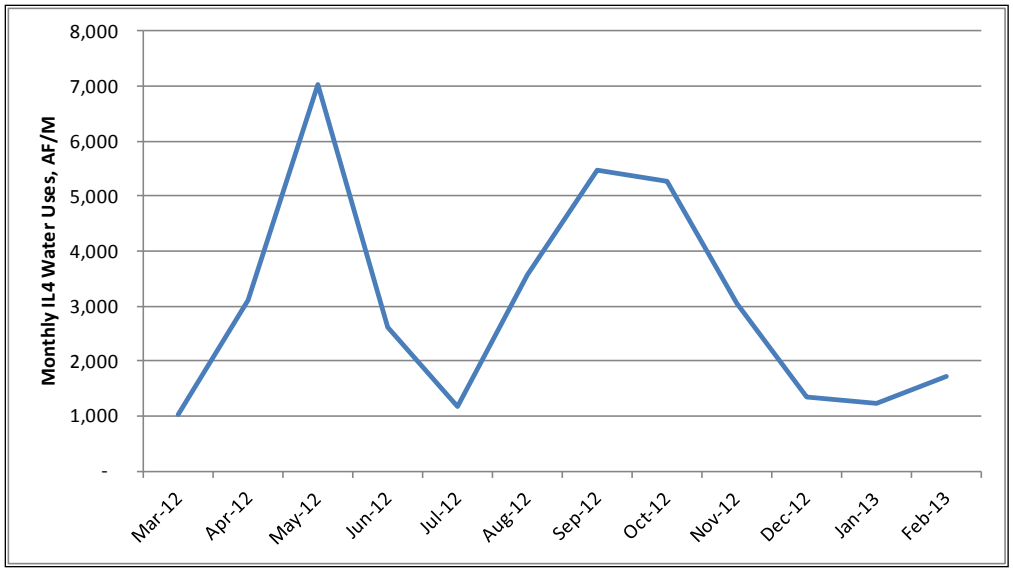

Figure 2-2 Monthly IL4 Water Deliveries to San Joaquin Valley Refuges in Water Year 2012-2013

Table 2-2 Monthly IL4 Water Deliveries to San Joaquin Valley Refuges in Water Year 2012-2013

	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
IL4 Water Delivery, AF/M	1,036	3,104	7,029	2,615	1,175	3,555	5,480	5,279	3,055	1,351	1,234	1,715

DPWD Demands

DPWD, located in western San Joaquin, Stanislaus, and Merced Counties, delivers water directly from the DMC to 45,000 acres of productive farmland between Vernalis on the north and Santa Nella to the south. As a CVP water contractor located south of the Sacramento-San Joaquin Delta, DPWD has experienced significant shortages and decreased reliability in the quantity of water it receives annually under the terms of its federal water service contract. Over the past five years DPWD has received an average of just over 40 percent of its full contract supply; in 2013 will receive only 20 percent of its full contract supply.

Shortages in CVP deliveries have resulted in serious economic hardship not only for DPWD growers but for the region in general. The NVRRWP was conceived as a method to utilize available recycled water to augment and provide a more reliable supply of agricultural irrigation water to the region.

DPWD consists of three areas, the North, Central, and South areas. The NVRRWP will serve only the Central and South areas since those areas are

downstream of the proposed point of recycled water delivery to the DMC. The total combined annual water demand of the Central and South areas is 41,500 AFY, distributed across the year as shown in Table 2-3 and graphically in Figure 2.

Table 2-3 Monthly DPWD Water Demands

	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
DPWD Demand, AF/M	765	2,773	6,199	9,459	9,845	6,237	3,871	2,019	146	111	0	117

Source: DPWD 2013

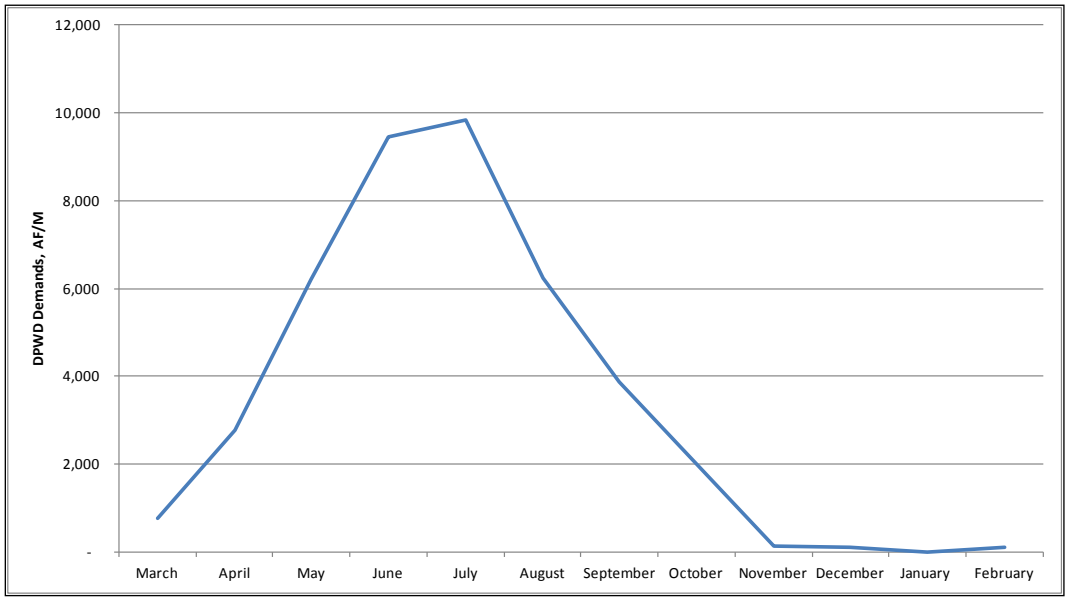

Figure 2-3 DPWD Demand in Central and South Area, AFM

NVRRWP Supply

The Cities of Modesto and Turlock provide wastewater treatment for their own metropolitan areas as well as for smaller communities in Stanislaus County. The recycled water produced for the NVRRWP would be tertiary filtered, disinfected water in compliance with the State of California Title 22 standards for unrestricted bodily contact. Treated recycled water from Turlock and Modesto is currently discharged to the San Joaquin River or disposed of via land application. With the NVRRWP, this recycled water could instead be utilized for agricultural irrigation and refuge water supply.

Tables 2-4 and 2-5 below show the expected amounts of recycled water that will be available from the NVRRWP. The first value shown represents flows available when the program initially comes on line (estimated in 2018). Both Cities are anticipating increased growth within their service areas and have estimated their tertiary flows at build-out conditions (2030 for Turlock and 2045

for Modesto). The second value shown represents the flows available at full build-out conditions in 2045.

A detailed explanation of the build-out flow calculations is included as Appendix 2A. Table 2-4 below summarizes the anticipated NVRRWP flows when the program comes on-line in 2018 and when both cities reach build-out in 2045.

Table 2-4 Projected NVRRWP Flows

Recycled Water Source	2018 Available Recycled Water (acre-feet/year)	2045 Available Recycled Water (acre-feet/year)
Modesto	16,500	30,600
Turlock	14,100	28,400
Total	**30,600**	**59,900**

Source: City of Modesto 2013; City of Turlock 2013.

The monthly distribution of recycled water flows is based on the historic monthly distribution of effluent flows for each City and is shown in Table 5 and Figure 3.

Table 2-5 Monthly Distribution of NVRRWP Supplies, AF/M

Year	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
2018	2,500	2,500	2,600	2,500	2,700	2,600	2,400	2,600	2,600	2,600	2,600	2,400
2045	4,800	4,900	5,000	4,800	4,900	5,000	4,800	5,200	4,900	5,000	5,200	4,500

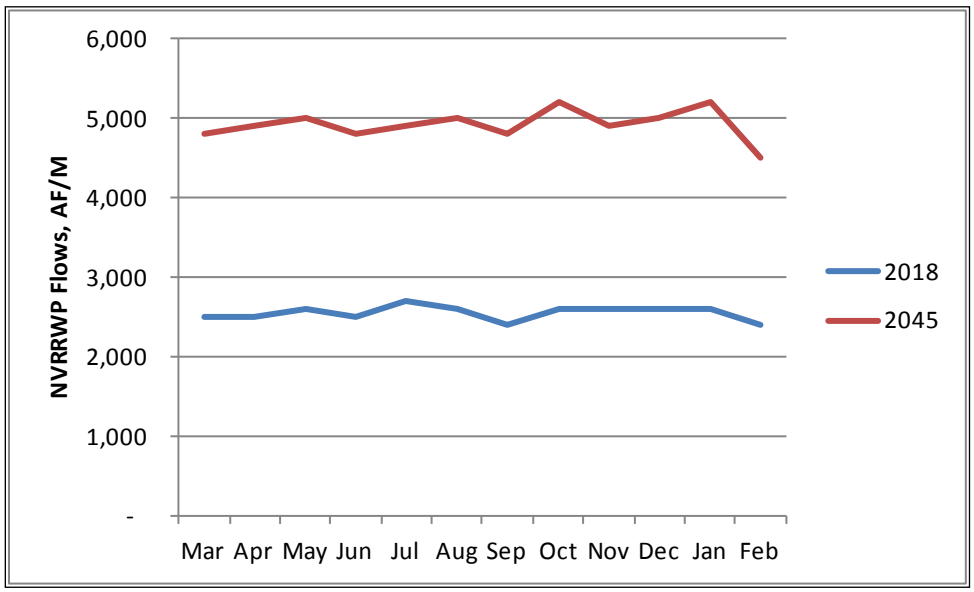

Figure 2-4 Monthly Distribution of NVRRWP Supplies, AF/M

Comparison of Flows

Comparison of DPWD Demands and NVRRWP Flows

NVRRWP flows in excess of DPWD demands could be available to help meet the IL4 water demands in the refuge. For the sake of this memo, NVRRWP flows in excess of the monthly DPWD demands are termed "Potentially Available NVRRWP Flows". Looking at the difference in DPWD demands versus NVRRWP excess flows on a monthly basis, there are NVRRWP flows potentially available in the months of October to March (September to April for build-out flows) Table 2-6 and Figure 2-5 show the calculation of NVRRWP flows potentially available on a monthly basis.

Table 2-6 Comparison of DPWD Demands and NVRRWP Flows

	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
DPWD Demand, AF/M	765	2,773	6,199	9,459	9,845	6,237	3,871	2,019	146	111	0	117
At Program Inception (2018)												
NVRRWP Flows Available, AF/M	2,500	2,500	2,600	2,500	2,700	2,600	2,400	2,600	2,600	2,600	2,600	2,400
Excess NVRRWP Flows, AF/M	1,735	-	-	-	-	-	-	581	2,454	2,489	2,600	2,283
At Program Build-out (2045)												
NVRRWP Flows Available, AF/M	4,800	4,900	5,000	4,800	4,900	5,000	4,800	5,200	4,900	5,000	5,200	4,500
Potentially Available NVRRWP Flows, AF/M	4,038	2,127	-	-	-	-	929	3,181	4,754	4,889	5,200	4,383

Note that the DPWD monthly demands during the irrigation season are greater than shown in Table 2-6. The monthly demands in Table 2-6 are limited to the amount of NVRRWP water availability for each month.

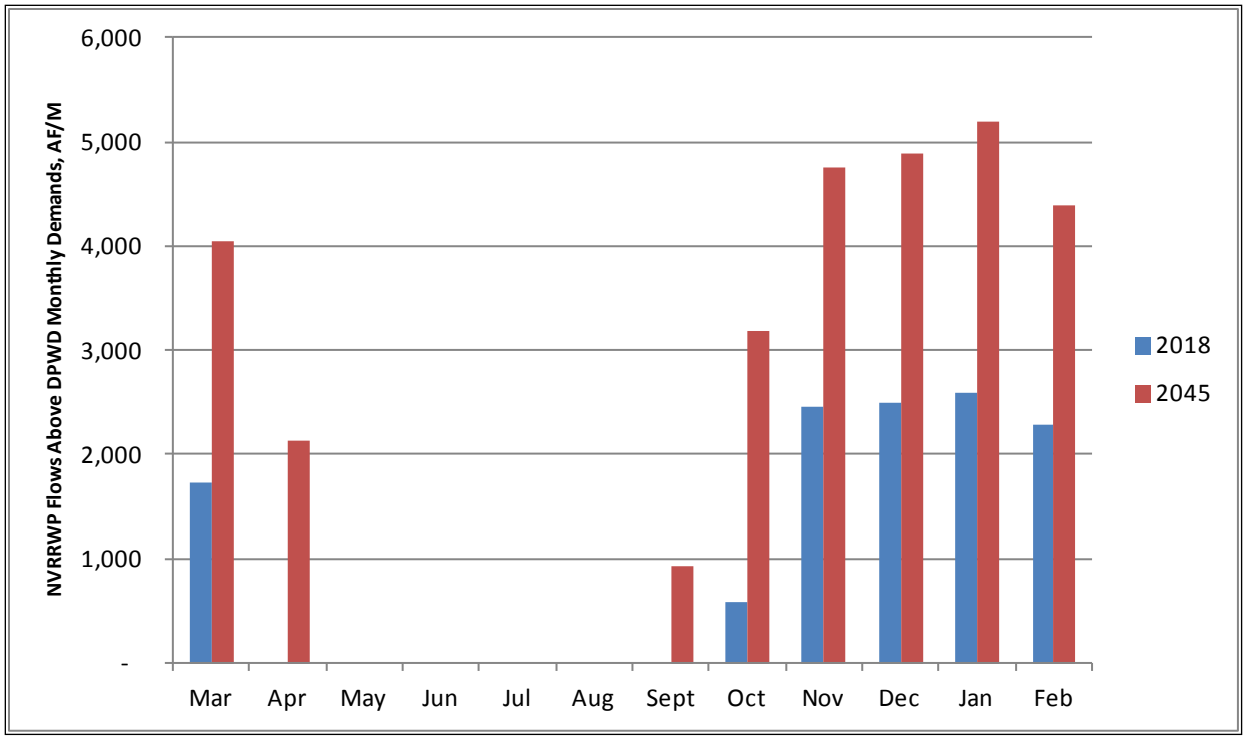

Figure 2-5 NVRRWP Flows above DPWD Monthly Demands, AF/M

Comparison of IL4 Water Demands to NVRRWP Potentially Available Flows

The water demand for the refuges is highest in the summer and lowest in the winter. As shown in Figure 4, the availability of NVRRWP flows is opposite, i.e. highest in the winter and lowest in the summer. If the NVRRWP water was delivered to the refuges via a direct pipeline, construction of seasonal storage would be required to make full use of the NVRRWP flows. However, since the DMC is the preferred option for NVRRWP conveyance, NVRRWP flows could be stored within the CVP system and used when it best fits the user's needs.

Considering the water comparison on an annual basis, the total 2012-2013 IL4 water delivery was 36,600 AFY while the optimum IL4 water demand is 105,514 AFY, leaving an IL4 shortfall of approximately 70,000 AFY. Assuming the NVRRWP comes on line in 2018 there would be an estimated 12,100 AFY of potentially available NVRRWP flow, which would meet 17 percent of the 2012-2013 IL4 shortage. As the program flows increase to build-out in 2045, the potentially available NVRRWP flows would increase to approximately 29,400 AFY, which is 42 percent of the 2012-2013 IL4 shortage.

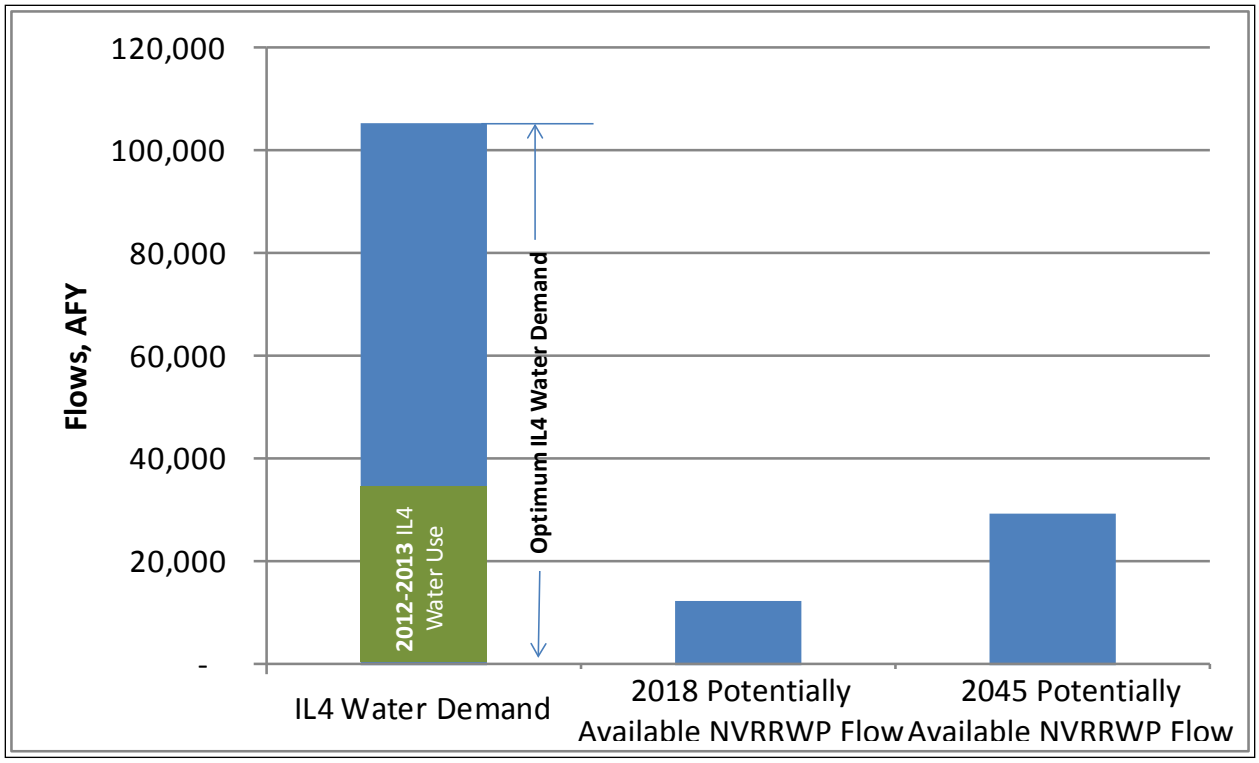

Figure 2-6 Comparison of IL4 Water Use to Potentially Available NVRRWP Flow

Conclusion

The NVRRWP could provide a significant new water source which could help meet both agricultural irrigation demands in the DPWD and meet IL4 water use in the wildlife refuges south of the Delta. Looking at the monthly distribution of DPWD demands versus NVRRWP availability, there are NVRRWP flows potentially available during the cooler, wetter months when irrigation uses decline. Using the DMC as the conveyance vehicle for the recycled water allows the NVRRWP flows to be stored within the DMC system to be used on a schedule that best serves the user's needs. With that storage system in place, the potentially available NVRRWP flows could meet 33 percent of the 2012-2013 IL4 water use (or 11 percent of the optimum IL4 demand) when the NVRRWP comes on line in 2018. As the NVRRWP flows increase to build-out conditions, the program could provide 80 percent of the 2012-2013 IL4 water use (or 28 percent of the optimum IL4 demand) by 2045.

Chapter 3
Refuge Water Conveyance

Summary of Findings

Two options were evaluated for conveying North Valley Regional Recycled Water Project (NVRRWP) flows to the refuges:

Delta-Mendota Canal (DMC) to the Mendota Pool

Direct Pipeline to the refuges via the Central California Irrigation District (CCID) Newman Canal

New facilities required to reach the DMC and Newman Canal include pipelines and pump stations, and are evaluated in further detail within this chapter.

The recommended alternative is DMC conveyance. Using the DMC as part of the conveyance system offers several advantages:

- The CVP/DMC facilities provide seasonal storage so that the NVRRWP water can be used by the refuges and Del Puerto Water District when needed to help meet their peak demand periods.
- It allows all refuges south of the Sacramento-San Joaquin Delta to receive NVRRWP project water, as opposed to the Direct Pipeline to Refuges, which would only serve the Grasslands Wildlife Area.

The DMC alternative is much more cost-effective than the Direct Pipeline to the Refuges alternative as shown below.

Table 3-1 Comparison of Capital Costs

	Estimated Capital Cost[26]
DMC Alternative	$ 89,000,000
Direct to Refuges Alternative	$207,000,000

[26] Most Probable Costs will be shared amongst project partners proportional to the amount NVRRWP project water allocated.

Introduction

This chapter evaluates options for conveying recycled water from the NVRRWP to the south of Delta refuges and wildlife areas. Existing and proposed water conveyance facilities are evaluated with respect to their ability to provide conveyance of NVRRWP water to DPWD's agricultural fields as well as wildlife refuges south of the Delta.

Existing Water Conveyance Facilities

California relies on an elaborate network of water storage and delivery systems to supply cities, farms, businesses, and the environment with adequate water year-round. Given the State's highly seasonable precipitation and the fact that annual runoff can vary widely from year to year, water supply infrastructure has given California improved ability to store and move water to where it's needed, when it's needed.

The proposed conveyance alternatives for the Refuge Recycled Water project potentially make use of a number of existing facilities, including the Patterson Irrigation District (PID) canal system, the CVP facilities, and the CCID Newman Canal. Figure 3-1 shows those facilities in relation to the refuges and wildlife areas.

Proposed Facilities

Conveyance of recycled water to serve refuge and wildlife areas will require a combination of existing and new infrastructure. The alternatives were evaluated to identify potential fatal flaws, identify key elements and features, and develop a preliminary construction cost estimate.

Potential pipeline routes were evaluated relative to the following criteria:

- Cost
- Constructability
- Schedule

Appendix 3A describes the methodology used for evaluation of project costs.

In general, the capital cost of the project is proportional to the total length of pipe. The acquisition of easements is also a potentially significant cost for the project. Where possible, pipelines should be aligned within public rights of ways or on lands owned by participating agencies. Operational costs include the costs of energy to operate the new pumping stations, allowances for equipment repair and replacement, and, for the DMC alternatives, the cost to wheel the recycled water through existing facilities (assumed to be $75/AF for options

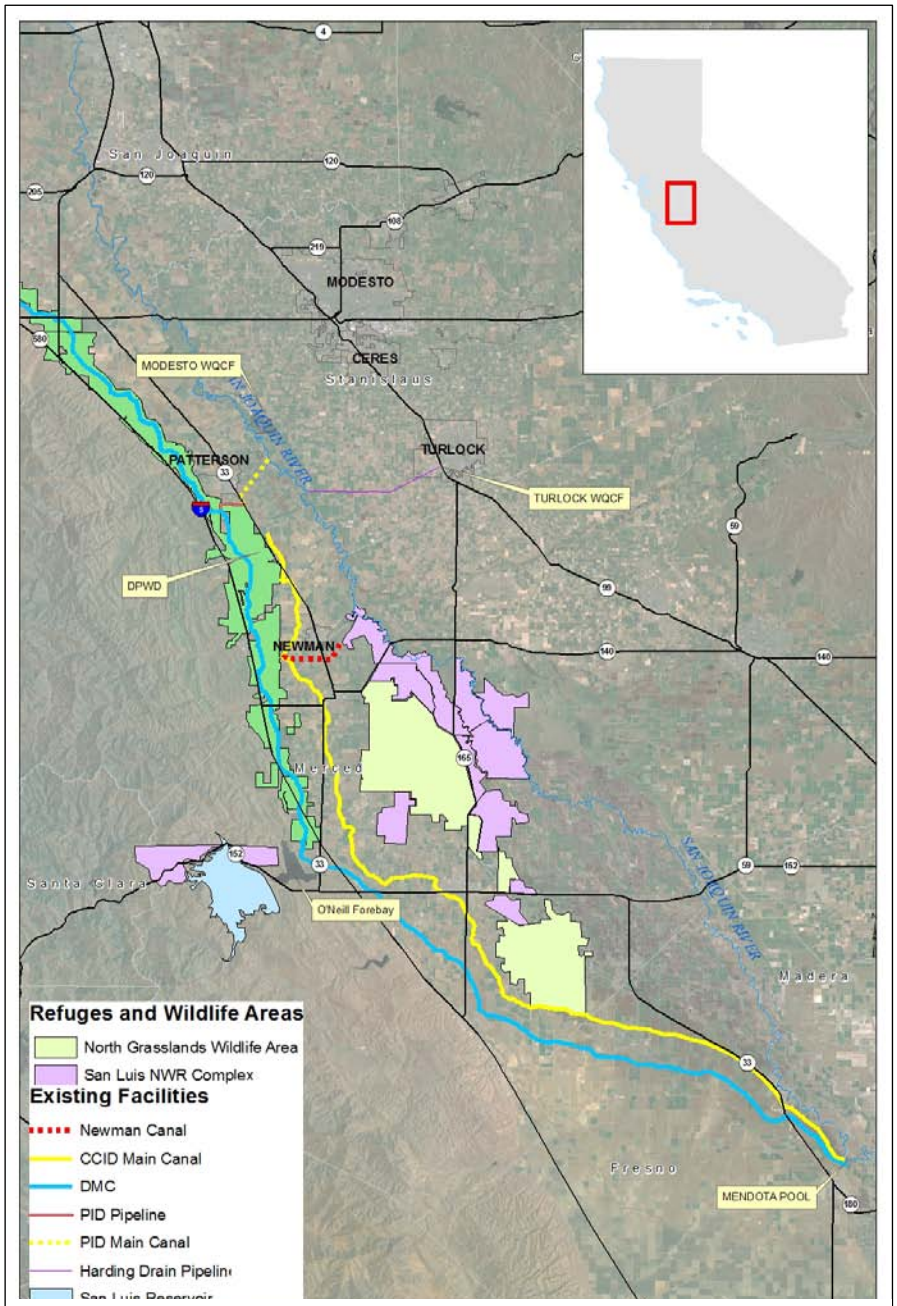

Figure 3-1: Map of Existing Facilities

including the PID system and $30/AF for DMC conveyance and storage for any water delivered to users other than Reclamation).

DMC Alternative

Alternatives for delivering recycled water to the DMC either via the PID Main Canal or via a pipeline directly to the DMC were evaluated in a Draft Corridor Study memorandum prepared by RMC Water and Environment for the NVRRWP in March 2013. The Modesto and Turlock water quality control facilities (WQCFs) are located on the east side of the San Joaquin River. All other facilities and locations of project water deliveries and use are located on the west side of the San Joaquin River.

The purpose of the Corridor Study was to evaluate conceptual pipeline alignments and develop capital and operating cost estimates. Two scenarios were evaluated:

- Direct Pipeline to DMC – convey recycled water via a pipeline or combination of pipelines directly to the DMC.
- PID Main Canal – convey recycled water to the PID Main Canal and then use the PID canal facilities to convey the rest of the way to the DMC.

Six alternatives were developed to consider alternate pipe corridors, river crossings, pumping systems, and whether the recycled water from each City would be conveyed separately or together.

Table 3-1 summarizes the alternatives considered in that study. The alternatives were evaluated based on cost and on other factors such as land acquisition, utility conflicts, traffic and community disruption, potential environmental impacts, construction schedule and permitting. For the purpose of the analysis of conveyance alternatives for this study, it was determined that the preferred alternative for conveying water to the DMC was DMC-2, and that alternative is used in this report as the DMC alternative. The actual preferred alternative for conveyance of recycled water for the NVRRWP is subject to further consideration.

Summary of Facilities for Recommended DMC Alternative

As shown on Figure 2, tertiary treated recycled water from the Turlock and Modesto WQCF would be conveyed through 26,800 ft of 36-inch pipelines to a combined pump station located near West Main Avenue east of the San Joaquin River. The combined flows would be pumped through a 34,300 ft long, 48-inch pipeline which crosses the San Joaquin River at Las Palmas Bridge. The pipeline would then parallel the PID Main Canal, cross Highway 33, and end at the DMC where the recycled water would discharge into the DMC.

Pump Stations

The horsepower required for each City to reach the combined point on West Main Avenue and for the combined pipeline to reach the DMC is as follows:

- Modesto's required Duty Horsepower: 90 hp
- Turlock's required Duty Horsepower: 20 hp
- Combined required Duty Horsepower: 1,200 hp

Cost

- Capital Cost: $ 89,000,000
- Annual Operating Cost $ 2,200,000

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Table 3-2: Summary of DMC Alternatives

Alt No.	Description	Estimate of Most Probable Capital Cost	Advantages/Disadvantages
DMC-1	Separate pipelines from Modesto and Turlock to DMC via, respectively, PID canal right-of-way and Pomelo Ave. River crossings at Las Palmas bridge for Modesto and Harding Drain for Turlock. Pump stations at Jennings plant and at Harding Drain.	$118 million	• Highest cost DMC option • Most difficult constructability due to multiple river, canal, highway crossings and two pipeline corridors • Separate pipelines allows Cities to proceed independently of each other
DMC-2	Pipes from Jennings plant and Harding Drain combine at Las Palmas then follow PID canal right-of-way to DMC. River crossing at Las Palmas bridge. Joint pump station at Las Palmas.	$89 million	• Lowest cost DMC option • River crossing contingent on Las Palmas bridge construction so less ability to accelerate schedule
DMC-3	Separate pipes across river, then combine east of Pomelo Ave and follow Pomelo Ave to DMC. River crossings south of Las Palmas for Modesto and at Harding Drain for Turlock. New pump stations at Jennings plant and at joint pump station.	$102 million	• Multiple river crossings increase permitting and constructability complexity. • Separate river crossings allow Cities to proceed somewhat independently of each other
DMC-4	Pipe Modesto south to Harding Drain then combined pipe across river and follow Pomelo Ave to DMC. River crossing at Harding Drain. Combined pump station at Harding Drain.	$105 million	• Potential ability to accelerate project and convey Turlock flows while waiting for Modesto tertiary facilities to be constructed.
PID-1	Pipes from Jennings plant and Harding Drain combine at Las Palmas then follow Las Palmas to PID canal. River crossing and combined pump station at Las Palmas.	$42 million (does not include cost of PID connection)	• Total capital cost is contingent on the cost of the PID connection • River crossing contingent on Las Palmas bridge construction so less ability to accelerate schedule • PID wheeling cost is high
PID-2	Separate pipelines from Modesto and Turlock to PID canal via, respectively Poplar and Ashe. River crossings at Modesto outfall and Harding Drain. New pump stations at Jennings Plant and Harding Drain. A connection to Lake Ramona could be added to this alternative.	$64 million (does not include cost of PID connection)	• Total capital cost is contingent on the cost of the PID connection • Separate pipelines from each plant could allow Cities to proceed independently; potential schedule acceleration • PID wheeling cost is high

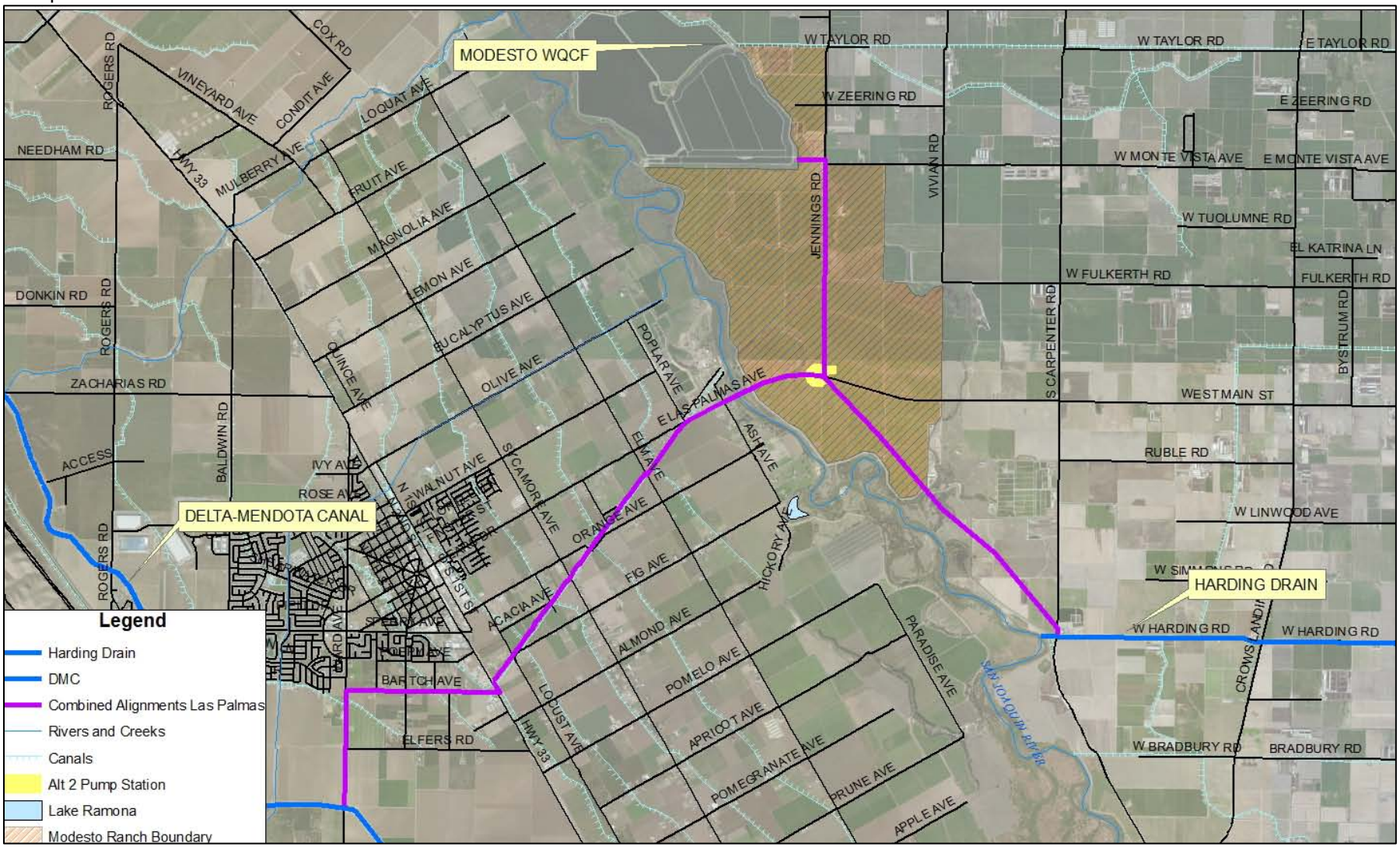

Figure 3-2 DMC Conveyance Alternative

Direct Pipeline to Refuge Conveyance Facilities

The Direct Pipeline to Refuge alternative would convey recycled water directly to DPWD irrigated lands and then to the China Island Unit. One disadvantage of this alternative is that other refuges and wildlife areas would not have direct access to the NVRRWP water.

As shown on Figure 3, the direct pipeline alternative would follow the DMC alignment described previously up to the DMC right-of-way. Once the alignment reaches the DMC right of way, the 48" pipeline would turn south and follow the east bank of the DMC for an additional 10.500 feet to the southern Stanislaus County border to serve the majority of south DPWD demands. DPWD demands in Merced County are lower than those in Stanislaus County; extension of the pipe into Merced County would require crossing the DMC which would be prohibitively expensive given the volume of demands.

To reach the refuge facilities, there would be a 48 inch tee near Newman, CA, and the pipeline would extend east for approximately 6,400 ft. This pipeline would eventually end at the CCID Main Canal where the Newman Canal would be used to convey the project water to the refuges.

Pump Stations

The horsepower required for each City to reach the combined point on West Main Avenue and for the combined pipeline to reach the refuges is as follows:

- Modesto's required Duty Horsepower: 105 hp
- Turlock's required Duty Horsepower: 20 hp
- Combined required Duty Horsepower: 1,700 hp

Cost

- Capital Cost: $ 207,000,000
- Annual O&M Cost $ 1,400,000

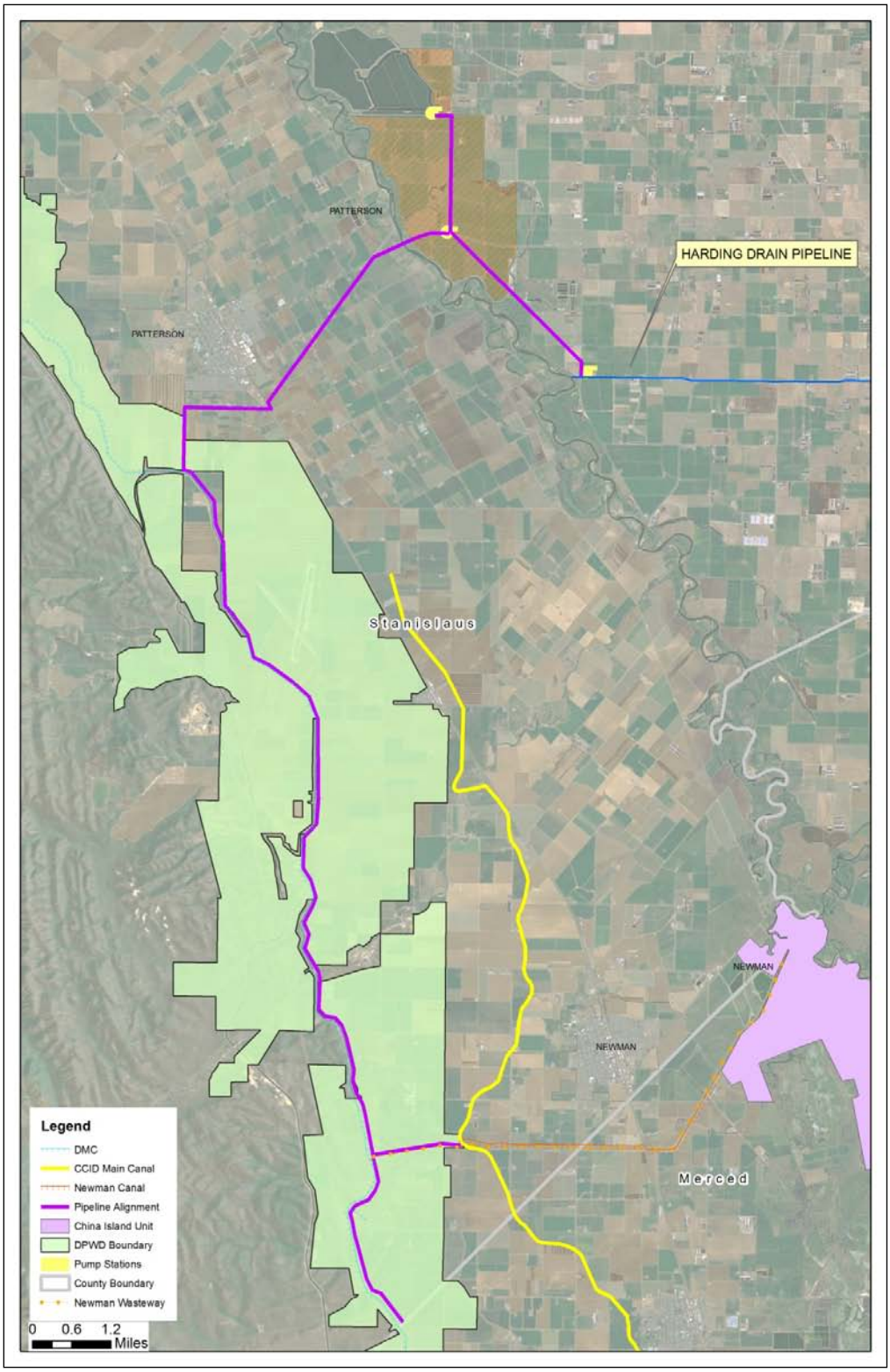

Figure 3-3 Direct Pipeline to Refuges

Comparison of Alternatives

Table 3-3 summarizes the costs for the DMC and Direct Pipeline to Refuges alternatives. The cost of water in terms of $/AF will be dependent on the financing available for the project; for example, unit costs for the direct pipeline alternative differ by up to $160/AF among various financing scenarios. For both alternatives, the lowest cost of water would be from a scenario in which the existing Title XVI grant program was converted to a low interest loan program. In all cases the DMC alternative is the lower cost alternative.

Table 3-3 Cost Comparison of Alternatives

	DMC	Direct Pipeline to Refuges
Annual Yield, AFY	33,810	33,810
Estimated Capital Costs	$ 89,000,000	$207,000,000
Annual Costs	$ 1,200,000	$ 1,400,000
Cost of Water under Various Financing Scenarios, $/AF [1]		
100% Reclamation Low Interest Loan at 1% over 30 years [2]	$140	$280
25% Title XVI Grant, 75% Bond financing, 5% over 30 years	$160	$340
State Revolving Fund Loan at 2.5% over 20 year loan period	$200	$440
25% Title XVI Grant, 75% SRF Loan at 2.5% over 20 years	$160	$340

(1) Cost of water for DPWD in DMC alternative would be approximately $30/AF higher than values shown to account for Warren Act wheeling charges through DMC.

(2) Low interest loan terms are speculative at this time since loan program does not currently exist.

Table 3-4 shows the breakdown of capital costs by project component

Table 3-4 Capital Costs by Project Component

Project Component	Estimated Capital Cost DMC	Estimated Capital Cost Direct Pipeline
Combined Facilities	$ 89,000,000	$177,000,000
Reclamation extension to Newman Canal	N/A	$ 21,000,000
DPWD Extension to County line	N/A	$ 9,000,000
Total Project Capital Cost	$ 89,000,000	$207,000,000

Conclusion

Table 3-5 compares the facilities, estimated costs, and advantages/ disadvantages of the two alternatives.

The recommended alternative for conveyance of NVRRWP flows is the DMC alternative. It is more cost-effective, provides seasonal storage through the CVP facilities, makes the recycled water available for all of the refuges south of the Delta, and has less impact on existing DPWD users since existing turnouts form the DMC could be used to access the water.

Table 3-5: Comparison of Alternatives

Alt	Description	Capital Cost	Annual Operating Costs	Unit Cost, $/AF	Constructability Issues	Advantages/Disadvantages
DMC	Pipes from Jennings plant and Harding Drain combine at Las Palmas, cross the San Joaquin River, and then follow PID canal right-of-way to DMC. Includes 61,100 feet of pipe, 3 pump stations	$89 million	$1.2 million	$140 - $160 [(1)]	• One San Joaquin River crossing • Significant utility interference • Nine irrigation canal crossings • One HWY 33 crossing • One railroad crossing • Potential interferences along the PID canal right-of-way • Moderate environmental permitting requirements • Potential traffic impacts due to alignment crossing at West Main, Avenue, HWY 33 and railroad crossings	• Lowest cost alternative • Seasonal storage could be provided by the CVP facilities which would provide more flexibility as to when the recycled water could be used. • Permitting for introduction of recycled water into the DMC potentially more difficult than the direct pipeline alternative. • No modifications needed to existing turnouts
Direct Pipeline to Refuges	Same as DMC alternative except at the DMC pipe turns south and follows the east bank of the DMC for an additional 10,500 feet to the southern border of Stanislaus County. Refuges would be served by a tee near the City of Newman that would extend east to the CCID Newman Canal. Includes 119,000 feet of pipe, 3 pump stations	$207 million	$1.4 million	$280 - $440	• Same as DMC alternative, plus the following: • Potential interferences along the DMC canal right-of-way • Modifications needed to all DPWD turnouts between Patterson and the Newman Wasteway.	• Highest cost alternative • Alternative does not include seasonal storage so timing of recycled water availability (winter) versus refuge demands may not coincide • Recycled water only available to N. Grasslands and China Island Unit

[(3)] Cost of water for DPWD in DMC alternative would be approximately $30/AF higher than values shown to account for Warren Act wheeling charges through DMC.

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Chapter 4
Summary of Existing Water Quality Information

Summary of Findings

Tertiary treated recycled water from the North Valley Regional Recycled Water Program (NVRRWP) must meet the stringent requirements established in Title 22 of the California Code of Regulations, and is suitable for a wide variety of non-potables uses. The recycled water quality is typically better than San Joaquin River water quality; for example, NVRRWP water contains lower concentrations of constituents such as boron, selenium, electrical conductivity, mercury, and pesticides than the river.

Recycled water from the NVRRWP, when blended with water from the Delta Mendota Canal (DMC), will comply with the Reclamation's water quality standards for the Upper DMC. Those standards have been established by Reclamation for the Groundwater Pump-in Program. No other water quality standards are presently in place for water introduced into the DMC. With one exception, the recycled water quality also complies with the USBR's current water quality standards for acceptance of water into the Upper DMC as defined in Reclamation's Groundwater Pump-In Program. Both sets of standards are in place to regulate the practice of pumping well water into the DMC under Warren Act Contracts, and are not necessarily applicable to recycled water. Of the 48 constituents covered by these standards, only the recycled water sodium content is expected to exceed Reclamation's standards for acceptance into the DMC.

Selenium, a constituent of concern for recycled water use at wildlife refuges, is present in NVRRWP recycled water at a concentration comparable to the existing DMC water quality (0.8 µg/L). The same is true for boron and arsenic. Recycled water would be delivered to the refuges after mixing with the existing water in the DMC. Based on the results presented in this chapter, the recycled water generated from the NVRRWP is not expected to produce a significant change in water quality to downstream DMC users.

Introduction

As part of an effort to evaluate the feasibility of providing recycled water from the NVRRWP to wildlife refuges in the San Joaquin Valley, this chapter

characterizes the water quality of the recycled water and compares it to relevant water quality criteria for the DMC. The DMC is the preferred conveyance alternative for delivering the recycled water to the refuges, which are located south of the Sacramento-San Joaquin Delta (south of the Delta), and is also one of the existing sources of water for the refuges. Additionally, Appendix 4E discusses other projects where recycled water is being used for wetlands or wildlife refuges.

The analysis in the chapter is based on available water quality data from the two recycled water suppliers to the NVRRWP (the City of Modesto and City and Turlock), the San Joaquin River, and the DMC.

Water Quality Standards

Relevant water quality criteria that are useful for interpreting the available water quality data are described below.

Title 22 Recycled Water Standards

Title 22, Chapter 3 of the California Code of Regulations forms the backbone of recycled water regulations through water quality standards and treatment reliability criteria for water recycling. Title 22 sets bacteriological water quality standards based on types of contact expected between the public and the recycled water, outlining applications for which disinfected tertiary treatment is required and also applications for which three levels of secondary treatment would also suffice.

In addition to establishing recycled water quality standards, Title 22 specifies the reliability and redundancy for each recycled water treatment and use operation. Title 22 (Articles 9 and 10) specify that the facilities must be designed to provide operational flexibility. Multiple treatment units capable of producing the required quality must be provided in the event that one unit is not in operation. In lieu of multiple units, alternative treatment processes, storage or disposal provisions may be provided for redundancy.

Recycled water treatment criteria vary depending on the application of the recycled water and its contact potential with the public. Disinfected tertiary recycled water, such as that to be produced at the NVRRWP, is suitable for almost all currently allowed uses for recycled water including irrigation of public parks and all food crops, toilet flushing, and some industrial processes.

California Title 22 regulations for tertiary recycled water require that the 7-day median concentration of total coliform bacteria measured in the disinfected effluent does not exceed 2.2 most probable number (MPN) per 100 mL, 23 MPN/100 mL more than once in any 30-day period, and 240 MPN/100 mL in any single sample.

Water Quality Standards for Acceptance of Groundwater into the Upper Delta-Mendota Canal

The Warren Act of 1911 authorizes Reclamation to execute temporary contracts to impound, store, and carry water in federal irrigation canals when excess capacity is available. Such contracts are negotiated by Reclamation to allow the introduction of "non-project water" into the DMC. This non-project water can include groundwater from wells nearby the DMC.

To maintain appropriate water quality in the DMC, Reclamation has developed a set of standards for the acceptance of non-project water in the DMC based on the requirements of downstream water users. These standards are summarized in the following tables of the *2012 Delta-Mendota Canal Pump-in Program Water Quality Monitoring Plan* (herein referred to as Pump-in Plan):

- Table 4a, Maximum Allowable Concentration of Seven Constituents in the Upper DMC (between Jones Pumping Plant and Check 13)
- Table 4b, Maximum Allowable Concentration of Three Constituents in the Lower DMC
- Table 5, Water Quality Standards for Acceptance of Groundwater into the Upper Delta-Mendota Canal Jones Pumping Plant to Check 13 (O'Neill Forebay).
- Table 6, Water Quality Standards for Acceptance of Groundwater into the lower Delta-Mendota Canal Check 13 (O'Neill Forebay) To Check 21 (Mendota Pool).

Reclamation has not established similar water quality standards for any other source of water being introduced into the DMC. Because the NVRRWP recycled water would be put into the DMC north (upstream) of the O'Neill Forebay, Table 4a and Table 5 contain the only potentially relevant water quality criteria for comparison to the water quality of the NVRRWP. Both Table 4a and Table 5 of the Pump-in Plan are reproduced in Appendix 4A. As noted in the table footnotes, many of the water quality criteria list in Table 5 are drinking water criteria. This is because several CVP water contractors, such as Santa Clara Valley Water District and San Benito County Water District, use water from the San Luis Reservoir or the O'Neill Forebay for potable water supplies.

Reclamation will allow groundwater to be pumped into the DMC only if such water does not cause the concentration of important constituents in the canal to exceed the thresholds listed in Table 4a, and if the groundwater concentrations do not exceed the thresholds listed in Table 5. With the exception of specific conductance and total dissolved solids, the values in Table 4a are identical to those in Table 5.

Other than those for the groundwater pump-in program, no other formal water quality standards exist for the DMC. The DMC is *not* subject to the water

quality criteria typically applied to point-source discharges to surface waters, which are regulated through the federal National Pollutant Discharge Elimination System (NPDES) program.

Available Water Quality Data

The existing sources of water quality data used in this study are discussed below.

Modesto and Turlock Recycled Water Quality Data and Reporting

The Cities of Modesto and Turlock conduct water quality sampling of their effluent both for process control and to meet the Monitoring and Reporting Program requirements of their respective NPDES permits. The data resulting from this sampling are submitted to the Regional Water Quality Control Board (RWQCB) and are available through the California Integrated Water Quality System (CIWQS[27]), a computer system used by the State and RWQCBs to track information about places of environmental interest, manage permits and other orders, track inspections, and manage violations and enforcement activities.

For Turlock, effluent data from the period April 2010 – February 2013 reported to CIWQS were used as the basis for this study, with the exception of a few constituents with no monitoring requirement under Turlock's current NPDES permit. For barium, nitrite, molybdenum, and sulfate, Turlock provided effluent data from samples collected over the period July 2007 – December 2009. The Turlock water quality data set used for this study is included in Appendix 4B.

The Modesto tertiary treatment facilities currently treat only a small portion of their effluent, and tertiary effluent has not yet been discharged to the San Joaquin River; this means that the data collected to meet NPDES Permit requirements is representative of Modesto's secondary treated effluent rather than their tertiary effluent. Therefore, for this study, the water quality data set for Modesto relies on samples collected for process control and other internal use. Effluent water quality data included in this study represent samples collected over the period July 2011 - December 2012. The Modesto water quality data set used for this study is included in Appendix 4C.

For several organic constituents with no NPDES monitoring requirements (e.g., atrazine, bentazon, and others), no sample results are available from either Modesto or Turlock.

For some inorganic constituents, few sample results are available from Modesto or Turlock. However, wastewater effluent, particularly tertiary treated wastewater effluent, is generally very stable in its water quality profile and tends not to have significant seasonal variations or spikes in constituents concentrations. This trend is illustrated by the concentration of total dissolved

[27] http://ciwqs.waterboards.ca.gov/ciwqs/readOnly/PublicReportEsmrAtGlanceServlet?inCommand=reset

solids in City of Turlock effluent shown below in Figure 4-1; unlike the DMC and San Joaquin River, there is no strong seasonal variability.

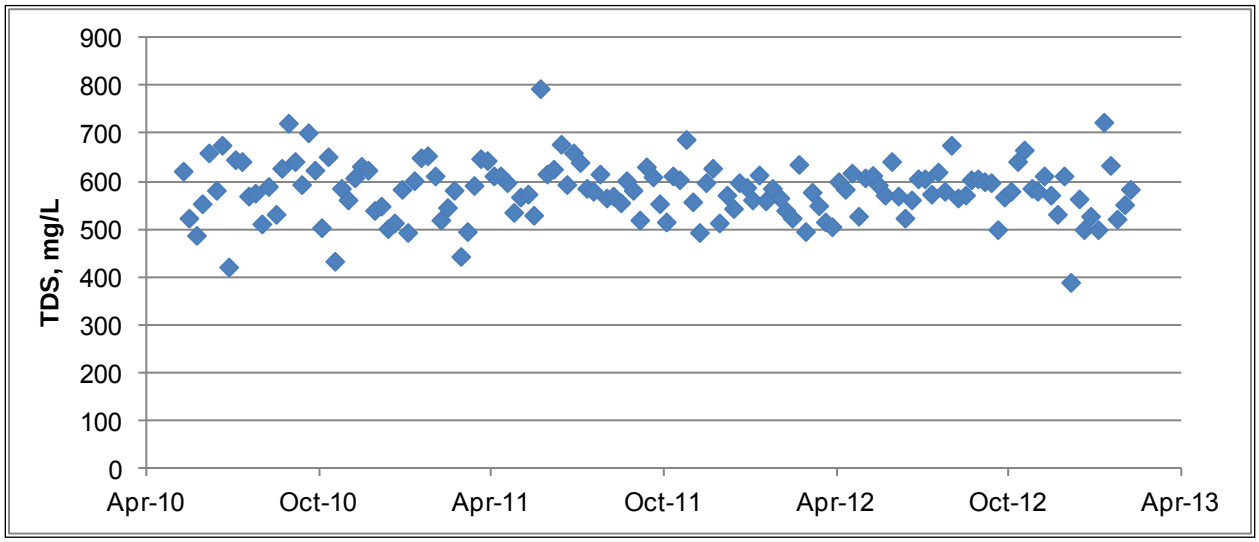

Figure 4-1: Total Dissolved Solids Concentration in Turlock Effluent, 2010-2013

Modesto and Turlock are both certified by the Environmental Laboratory Accreditation Program (ELAP) of the California Department of Public Health and maintain a high standard for laboratory procedures. The City of Modesto's Jennings Laboratory uses a Quality Assurance Manual which contains a Quality Assurance/Quality Control (QA/QC) plan, sample collection procedures and Standard Operating Procedures (SOPs) for all analytical methods. Likewise, the City of Turlock follows a Water Quality Control Laboratory Quality Assurance Manual, last updated in September 2012. Both labs use *Standard Methods for the Examination of Water and Wastewater* for test protocols.

The City of Modesto's Jennings Laboratory holds ELAP certificate #2674 with expiration in September 2013. The City of Turlock's ELAP certificate #2150 expires in September 2014. Both laboratories are certified to perform laboratory tests on microbiology and inorganic chemistry of wastewater; analyses for all other constituents, such as metals, volatile organics, semi-volatile organics, pesticides and chronic toxicity, are sent out to other certified facilities.

Appendix 4B contains example laboratory reports from the City of Turlock's two contract laboratory services providers, GeoAnalytical Laboratories and Caltest Analytical Laboratory, while Appendix 4C contains example laboratory reports from the City of Modesto's two contract laboratory services providers, BSK Associates and Alpha Analytical Laboratories.

DMC Water Quality Data Collection and Reporting

For this study, DMC water quality data were obtained from the California Data Exchange Center (CDEC[28]) and the USBR Mid-Pacific Region's Environmental Monitoring Database[29].

Water quality data from the DMC are from CDEC at the Tracy Pumping Plant (Station ID: TRP) and DMC Headworks (Station ID: DMC), covering the period 2003-13. Data from the USBR Environmental Monitoring Database are from samples collected between 1991 and 2013 at three stations representing the Upper DMC: Milepost 9.87, the DMC at McCabe near Milepost 68, and the O'Neill Forebay Inlet Bridge.

Under the authority of California Water Code Sections 228 and 236, CDEC installs, maintains, and operates an extensive hydrologic data collection network, including automatic snow reporting gages for the California Cooperative Snow Surveys Program and precipitation and river stage sensors for the flood forecasting program. In addition, CDEC provides a centralized location to store and process real-time hydrologic information gathered by various cooperators throughout the State; and then disseminates this information to support forecasting and flood operations activities and to meet the data reporting needs of various cooperators, public and private agencies, the news media, and the public.

The USBR Mid-Pacific Region's Environmental Monitoring Database includes water quality monitoring data reported by the USBR Environmental Monitoring Branch, which was established in 1985 to design and implement environmental monitoring programs.

San Joaquin River Water Quality Data and Reporting

For most constituents, water quality data for the San Joaquin River was compiled from the California Environmental Data Exchange Network (CEDEN[30]) stations "SJR @ Patterson" for the period covering 1995-2011, and from station "San Joaquin River @ PID Pumps" for the period covering 2008-2012. This data set is representative of the water quality in the PID canals as PID draws its water from the San Joaquin River near these locations. PID does not regularly monitor the water quality in their Main Canal.

CEDEN is a central location to find and share information about California's water bodies, including streams, lakes, rivers, and the coastal ocean. Many groups in California monitor water quality, aquatic habitat, and wildlife health to ensure good stewardship of our ecological resources. CEDEN aggregates this data and makes it accessible to environmental managers and the public.

For five constituents (antimony, beryllium, mercury, thallium, and silver) with no data available from CEDEN, water quality data are from CIWQS as reported by the City of Turlock at Receiving Water Station 003, which is located along

[28] http://cdec.water.ca.gov
[29] http://www.usbr.gov/mp/mp150/mp157/env_home.cfm
[30] http://ceden.org

the San Joaquin River 1,000 feet upstream of Harding Drain. These data cover the period April 2012 – March 2013, and consist entirely of non-detects.

Water quality and flow data for the San Joaquin River are also available from CDEC. The closest CDEC monitoring station to the area of interest is located near Vernalis, south of Tracy and nearly due west of Modesto. This data was not used in the analysis presented in this chapter because the CEDEN monitoring stations are closer to the intake of the PID canals.

Comparison of Existing Water Quality Data to Relevant Water Quality Standards

In this section, the existing water quality data is compared to the water quality standards found in Tables 4a and 5 of the Pump-in Plan. Individual water quality parameters and chemical constituents are discussed below. Additionally, a summary table is provided in Appendix 4D.

Analysis Methodology and Assumptions

The proposal to add NVRRWP recycled water to the DMC involves first combining the treated tertiary effluent from Modesto and Turlock and then adding the recycled water to either the PID Main Canal or directly to the DMC. Flow-weighted average concentrations of constituents of interest were calculated from the available water quality data from Modesto and Turlock discussed in Section 0. When the data set indicated that laboratory analysis for a particular constituent resulted in a non-detect, the concentration of that constituent was conservatively assumed to be equal to the reported method detection limit. The base assumptions regarding recycled water flows and three alternatives warranting water quality analyses are presented below. Alternatives 2a and 2b are similar with respect to institutional arrangements but different in the ratio of fresh versus recycled water, to account for the different geographic input of NVRRWP recycled water in the system.

- Recycled Water Quality: The average water quality of the NVRRWP flows was calculated using the available water quality information and the estimated future total flows in 2045 (build-out) (52.7 MGD total – 27.3 MGD from Modesto, 25.4 MGD from Turlock). The flow rate of 52.7 MGD in 2045 corresponds to 59,000 acre-feet/year (AFY) or 82 cubic feet per second (cfs).
- Alternative 1: Discharge recycled water directly to the DMC: Under this alternative, the NVRRWP recycled water would be piped directly to the DMC and thus comparison of recycled water quality is to the Table 5 standards and the blend of the recycled water and the DMC water to Table 4a standards. For the purposes of this comparison, it was assumed that the recycled water flow is 52.7 MGD and that flow in the DMC is 582 MGD (900 cfs). This

DMC flow roughly corresponds to the 10th percentile flow rate for the Tracy Pumping Plant, as reported to CDEC, and as such represent a conservatively large amount of recycled water (9%) as a percentage of the total DMC flow.

- Alternative 2a: Blend recycled water with San Joaquin River water in PID Main Canal and discharge blended water to the DMC: This blend represents the scenario in which the NVRRWP recycled water is conveyed through the PID Main canal to the DMC. It was assumed that flow in the DMC is 582 MGD (900 cfs - see discussion above), flow in the PID Main Canal from the San Joaquin River is 96.0 MGD (150 cfs), and total recycled water flow is 52.7 MGD (82 cfs). This flow weighting contains a conservatively large amount of San Joaquin River water in the blend with recycled water compared to Alternative 2b, described below, and represents NVRRWP flow entering the PID Main Canal at the upstream end near the San Joaquin River. It also represents a conservatively large amount of San Joaquin River water entering the DMC (150 cfs River water + 82 cfs NVRRWP recycled water).
- Alternative 2b: Blend recycled water with San Joaquin River water in PID Main Canal and discharge blended water to the DMC: This blend is the same as Alternative 2a, described above, except that the flow in the PID Main Canal from the San Joaquin River is much lower at 22.6 MGD (35 cfs). This flow weighting contains a conservatively large amount of recycled water, representing NVRRWP flow entering the PID canal downstream of most irrigation withdrawals.

In all cases, complete blending/mixing was assumed. The nomenclature of "Alternative 1" and "Alternative 2" is used for ease of discussion and is not intended to convey that these are the only alternatives worthy of consideration at this junction. Currently, there is a third alternative of using a pipeline to convey recycled water to the Del Puerto Water District and the refuges. In that case, the water quality delivered to the refuges would be the same as the water quality delivered under Alternative 1, and thus no further analysis is provided here.

Discussion of Individual Constituents

For the constituents listed in Tables 4a and 5 of the Pump-in Plan and for which data were available, sodium is expected to be present in any mixture of recycled water, San Joaquin River water, and DMC water at levels that are expected to exceed the applicable water quality standards. Thus, under all alternatives, sodium levels exceed water quality standards. Nitrate and/or nitrate + nitrate would exceed standards for Alternatives 2a and 2b.

This section provides detailed information regarding water quality constituents that are listed in Table 4a of the Pump-in Plan (arsenic, boron, nitrates,

selenium, conductance, sulfates, and TDS), as well as additional parameters of interest (sodium, bacteria, and chronic toxicity). This section also provides water quality analyses of the constituents for the individual alternatives.

Total Dissolved Solids (TDS)/Electrical Conductivity

Total Dissolved Solids (TDS) is a measure of the combined content of all inorganic and organic substances contained in a liquid in: molecular, ionized or micro-granular (<2 micrometers) suspended form. In surface water and groundwater, the most common constituents of TDS are calcium, phosphates, nitrates, sodium, potassium and chloride. TDS can be taken as a field measurement by using an electrical conductivity meter and applying an appropriate conversion factor. Where necessary, the conversion factor listed on page 12 of the Pump-in Plan was used for the conductivity data from DMC:

$$\text{TDS (mg/L)} = \text{Electrical Conductivity } (\mu\text{S/cm}) \times 0.618 + 16.$$

Figures 4-2 and **4-3** show the results of the water quality analysis for TDS/Electrical for each of the three alternatives.

Alternative 1: Discharge recycled water directly to the DMC: As shown in **Figure 4-2** below, adding the recycled water to the DMC (average TDS of 275 mg/L) has the potential to raise the TDS in the DMC slightly, but to a level (298 mg/L) that is significantly below the 800 mg/L threshold established in Table 4a of the Pump-in Plan. The average TDS in the recycled water (551 mg/L) is significantly lower than the TDS standard in Table 5 of the Pump-in Plan (1,500 mg/L).

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: Adding a blend of recycled water and river water to the DMC has the potential to slightly raise TDS in the DMC, but to a level (634-589 mg/L) significantly below the Table 4a threshold of800 mg/L. At an average of 679 mg/L, TDS in the San Joaquin River near Patterson is similar to but slightly higher than the TDS of the recycled water and still lower than the Table 5 threshold of 1,500 mg/L.

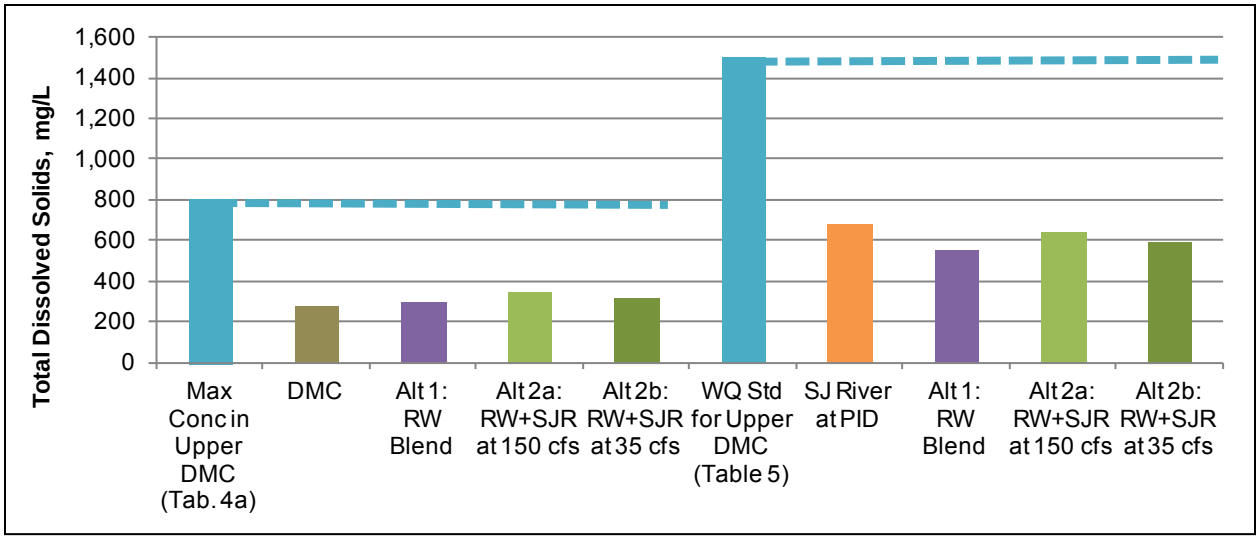

Figure 4-2 Comparison Chart for Total Dissolved Solids

The trends for electrical conductivity (expressed as specific conductance) closely mirror those for TDS.

<u>Alternative 1: Discharge recycled water directly to the DMC</u>: As shown in the graph below, adding the recycled water to the DMC (average specific conductance of 419 µS/cm) has the potential to raise the specific conductance in the DMC slightly, but to a level (463 µS/cm) that is significantly below the 1,200 µS/cm threshold established in Table 4a of the Pump-in Plan. Average specific conductance in the recycled water (945 µS/cm) is significantly lower than the standard in Table 5 of the Pump-in Plan (2,200 µS/cm).

<u>Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC</u>: Adding a blend of recycled water and river water to the DMC has the potential to slightly raise the specific conductance in the DMC, but to a level (972-1,003 µS/cm) significantly below the Table 4a threshold of 1,200 µS/cm. At an average of 1,035 µS/cm, TDS in the San Joaquin River near Patterson is similar but slightly higher than the TDS of the recycled water and still lower than the threshold of 2,200 µS/cm in Table 5 of the Pump-in Plan.

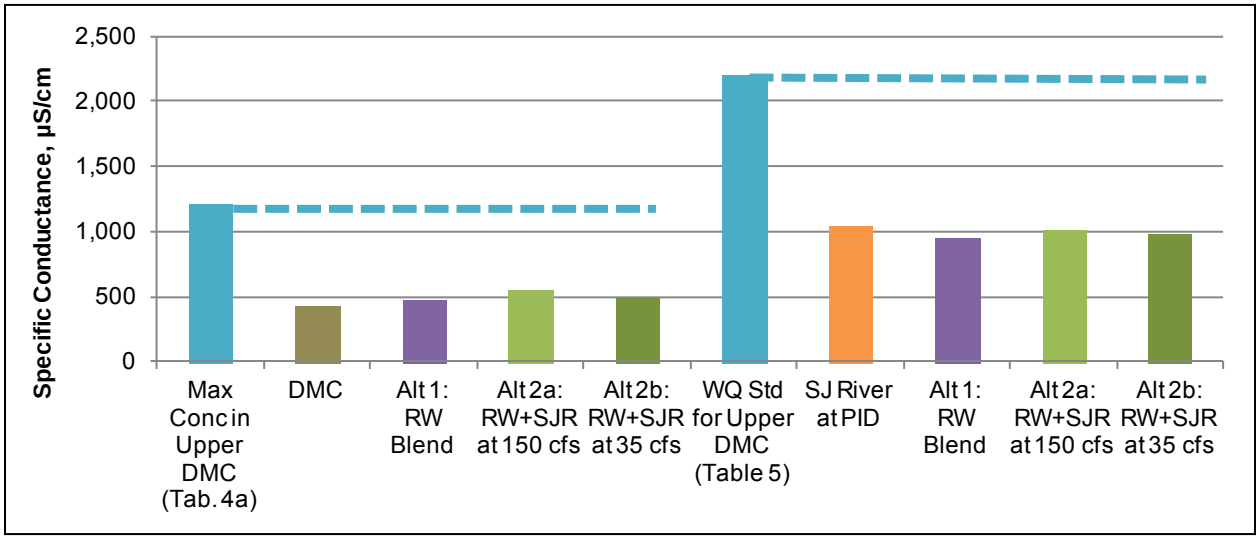

Figure 4-3 Comparison Chart for Specific Conductance

There is significant seasonality to the TDS and specific conductance of the San Joaquin River and DMC, while the recycled water is relatively consistent throughout the year. However, even the maximum observed conductivity in the San Joaquin River at Patterson (1,920 µS/cm) and the maximum observed conductivity in the DMC (1,046 µS/cm) would, when combined with recycled water, produce a blend that is below the thresholds established in Table 4a and Table 5.

Sodium

Sodium is of particular interest to both agricultural users of DMC water and to the refuges because managing and minimizing salt loads and salt accumulation in soils is important to the health of plants and other biota. The acceptance criteria of 69 mg/L listed in Table 5 of the Pump-in Plan is based on a water quality standard for agricultural irrigation. **Figure 4-4** shows the results of the water quality analysis for sodium for each of the three alternatives.

Alternative 1: Discharge recycled water directly to the DMC: As shown in Figure 4-4 below and in Appendix 4D, the calculated average sodium concentration (116 mg/L) in the recycled water is higher than the standard for sodium (69 mg/L) in Table 5 of the Pump-in Plan.

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: The calculated average sodium concentration in the San Joaquin River near Patterson (taken to represent water quality in the PID canals) is, at 138 mg/L, even higher than the calculated average sodium concentration (116 mg/L) in the recycled water.

Table 4a of the Pump-in Plan does not include a water quality standard for maximum sodium levels in the DMC, but the average sodium concentration in the DMC is 51 mg/L. After blending the recycled water or the recycled water plus the San Joaquin/PID canal water into the DMC, the sodium level is

expected to be slightly lower than the standard of 69 mg/L in Table 5 of the Pump-in Plan.

Reducing sodium concentrations in the recycled water would involve significant and costly changes to the treatment facilities at the Modesto WQCF and Turlock WQCF.

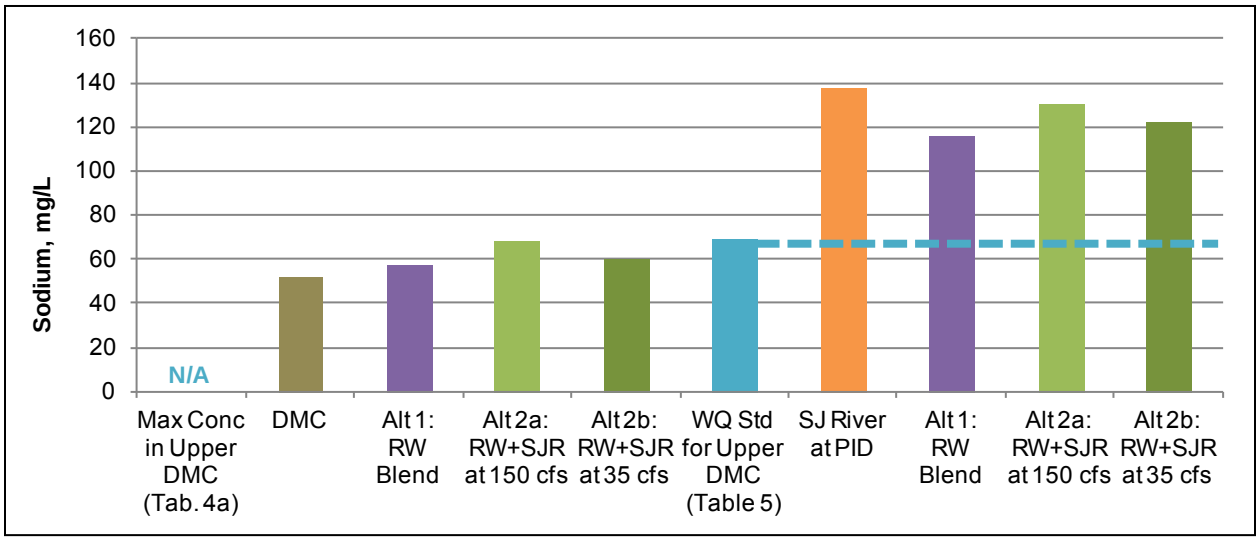

Figure 4-4 Comparison Chart for Sodium

Nitrate and Nitrite

Relative to surface waters, the influent to wastewater treatment plants contains high levels of ammonia. Wastewater treatment plants nitrify (convert ammonia to nitrite and then to nitrate) and denitrify (reduce nitrate to nitrogen gas) to varying degrees based on treatment processes employed. Modesto's tertiary treatment train includes full nitrification and denitrification, while Turlock's does not. Turlock's process includes nearly complete nitrification, resulting in low levels of ammonia and nitrite.

Figure 4-5 shows the results of the water quality analysis for nitrate for each of the three alternatives.

Alternative 1: Discharge recycled water directly to the DMC: Based on the available water quality data and the expected 2045 ratio of Modesto to Turlock tertiary effluent, the recycled water has an expected average nitrate concentration of 8.4 mg/L nitrate as N. Blending the recycled water with the DMC water results in a nitrate concentration of 2.0 mg/L. As the Table 4a standard and the Table 5 standard in the Pump-in Plan for nitrate are both 10 mg/L, "Alternative 1" (directly piping recycled water to the DMC), is consistent with the water quality standards in the Pump-in Plan.

With an average concentration of just 0.l mg/L nitrite, the recycled water is also below the Table 4a and Table 5 (of the Pump-in Plan) criteria for nitrite + nitrate (sum as N). See Appendix 4A for the water quality standards and Appendix 4D for calculated nitrite + nitrate concentrations.

Alternative 2: Blend recycled water with SJR water in PID Canal and discharge blended water to the DMC: The average nitrate concentration in the San Joaquin River at Patterson is 13.3 mg/L. However, blending with DMC water reduces the nitrate concentration to levels (2.3-3.5 mg/L) well below the Table 4a and Table 5 standard of 10 mg/L. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above for Alternative 2a (150 cfs in the PID canal), the resulting concentration of 11.6 mg/L is above the standards of 10 mg/L due to the large contribution of San Joaquin River water. For Alternative 2b (35 cfs in the PID Main Canal), the resulting concentration of 9.9 mg/L is close to the standards in Table 4a and Table 5 of the Pump-in Plan.

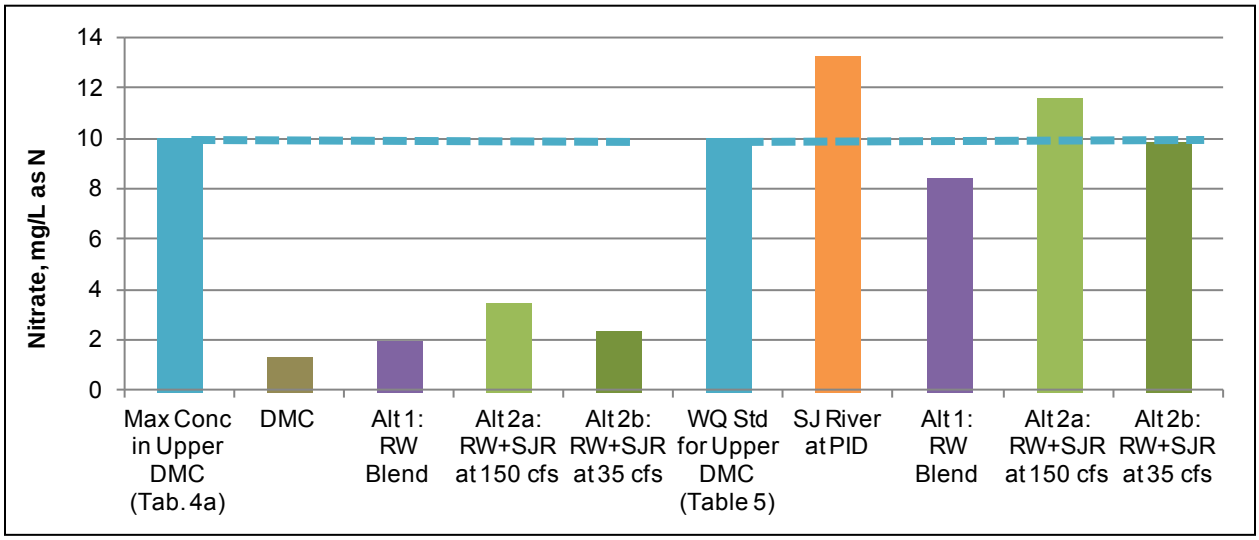

Figure 4-5 Comparison Chart for Nitrate

Selenium

The acceptance criteria in Tables 4a and 5 of the Pump-in Plan list a threshold of 2 µg/L selenium based on the standard for Grasslands water supply channels. Selenium is often present at concentrations close to the method detection limit and/or reporting limit, making the average values in Turlock and Modesto effluent, the San Joaquin River, and the DMC potentially dependent on the method used. Therefore, this section contains additional information about the detection limits and reporting limits about each data set, where this information is known.

Turlock's NPDES permit contains an average monthly effluent limitation for selenium of 3.7 µg/L and requires monthly monitoring. Samples are analyzed using EPA method 200.8 (ICP-MS). The selenium concentrations in Turlock's effluent data set (N=33), which has an MDL of 0.06 µg/L, were all lower than the reporting limit (i.e., detected but not quantified, or DNQ). The reporting limit ranged from 0.5 - 1 µg/L, and the average concentration was 0.26 µg/L.

By contrast, Modesto has no NPDES permit limit and has not discharged tertiary effluent to the receiving water, so the data set is more limited. For

Modesto, just three samples of tertiary effluent were available; selenium was detected in all the samples, at an average concentration of 1.2 µg/L. No reporting limit or MDL was available.

For the San Joaquin River, the selenium data set is drawn from CEDEN station 'SJR @ Patterson' as reported by the Grasslands Bypass Project, with an MDL of 0.1 µg/L and a reporting limit of 0.4 µg/L. The average value was 1.9 µg/L, with only 11 of 916 samples below the reporting limit.

The DMC data set from the USBR Environmental Monitoring Database contains sample results with a reporting limit of 0.4 µg/L, 1.0 µg/L, and 2.0 µg/L. The database does not include information about a separate MDL, but most results (188 of 268) were below the respective reporting limit. In these cases, the average value is based on the reporting limit (not ½ the reporting limit); therefore, the calculated average value of 0.8 µg/L used for calculating blended concentrations is conservatively high.

Figure 4-6 shows the results of the water quality analysis for selenium for each of the three alternatives.

<u>Alternative 1: Discharge recycled water directly to the DMC</u>: As shown in **Figure 4-6** below, average selenium in the recycled water (0.0007 mg/L) is significantly lower than the selenium standard in Table 4a (0.002 mg/L). The DMC has a comparable concentration of selenium (0.0008 mg/L) to the recycled water, so adding recycled water results in no significant change; the DMC will remain well below the 0.002 mg/L threshold established in Table 4a and Table 5 of the Pump-in Plan.

<u>Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC</u>: At an average of 0.0019 mg/L, selenium in the San Joaquin River near Patterson is higher than either the recycled water or the DMC. However, blending with DMC water reduces the selenium concentration to well below the standard of 0.002 mg/L in Table 4a of the Pump-in Plan. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulting selenium concentrations of 0.0015 mg/L for Alternative 2a and 0.0010 mg/L for Alternative 2b are below the criteria in Table 5 of the Pump-in Plan.

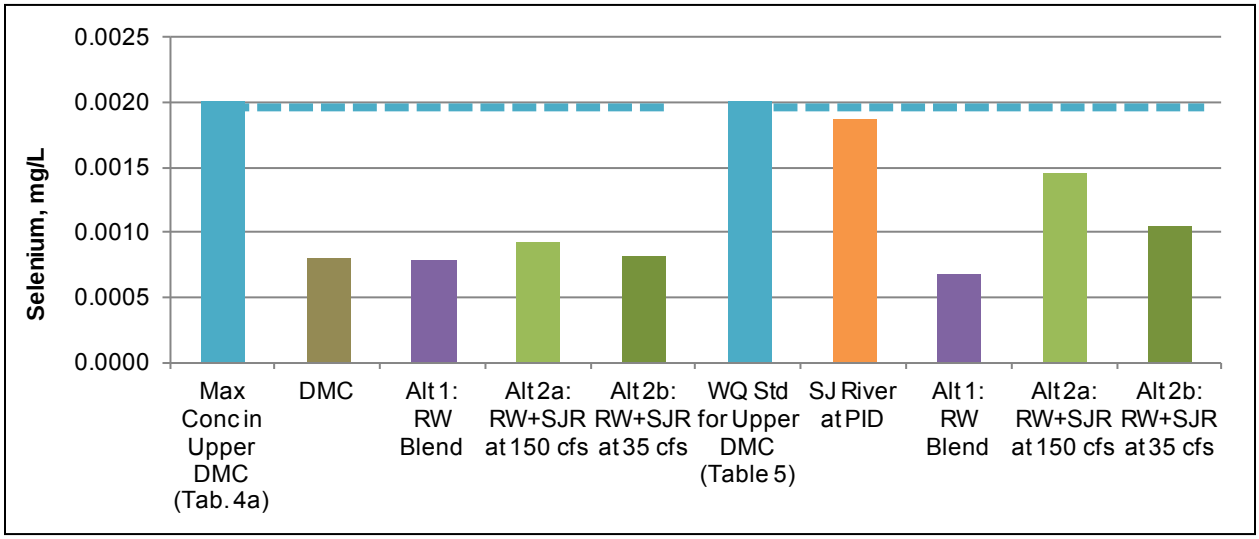

Figure 4-6 Comparison Chart for Selenium

Boron

The acceptance criteria of 0.7 mg/L listed in Tables 4a and 5 of the Pump-in Plan is based on a water quality standard for agricultural irrigation. **Figure 4-7** shows the results of the water quality analysis for boron for each of the three alternatives.

Alternative 1: Discharge recycled water directly to the DMC: As shown in the graph below, average boron in the recycled water (0.20 mg/L) is significantly lower than the boron standard in Table 4a of the Pump-in Plan (0.7 mg/L). The DMC has a comparable concentration of boron (0.19 mg/L) to the recycled water, so adding recycled water results in no significant change; the DMC will remain well below the 0.7 mg/L threshold established in Table 4a and Table 5 of the Pump-in Plan.

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: At an average of 0.59 mg/L, boron in the San Joaquin River near Patterson is higher than either the recycled water or the DMC, and close to the Table 5 limit of 0.7 mg/L. However, blending with DMC water reduces the boron concentration to well below the standard of 0.002 mg/L in Table 4a of the Pump-in Plan. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulting boron concentrations of 0.45 mg/L for Alternative 2a and 0.32 mg/L for Alternative 2b are below the criteria of Table 4a and Table 5 of the Pump-in Plan.

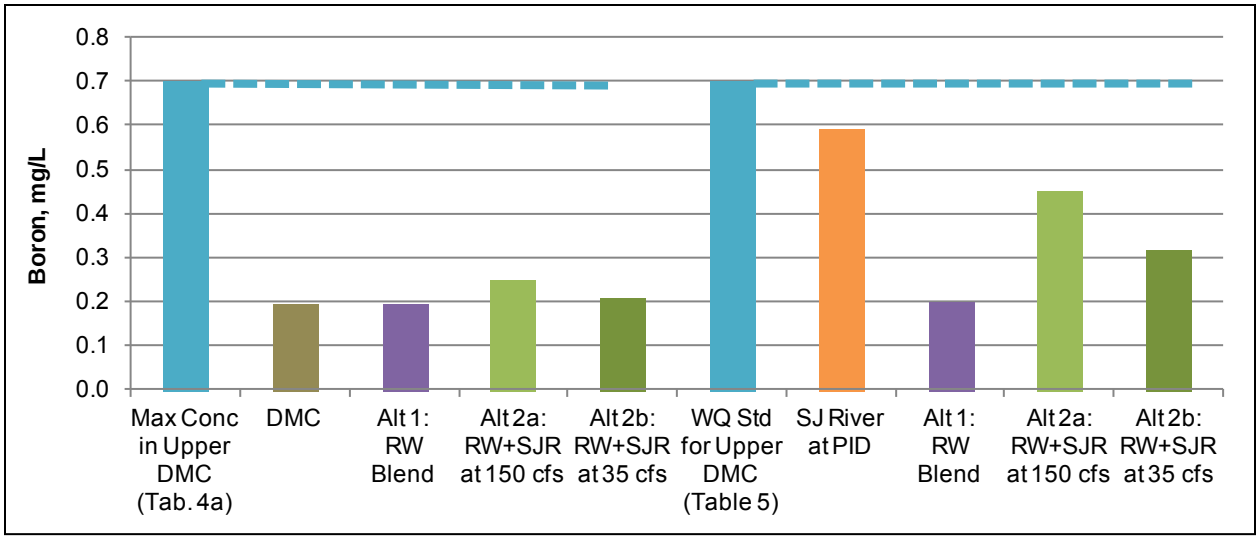

Figure 4-7 Comparison Chart for Boron

Metals, Arsenic and Mercury

The acceptance criteria for arsenic and mercury listed in the Pump-in Plan are based on drinking water regulations. **Figures 4-8** and **4-9** show the results of the water quality analyses for arsenic and mercury for each of the three alternatives.

Alternative 1: Discharge recycled water directly to the DMC: As shown in the graph below, average arsenic in the recycled water (0.003 mg/L) is significantly lower than the arsenic standard in Table 4a (0.01 mg/L). The DMC has a higher concentration of arsenic (0.005 mg/L) than the recycled water, so adding recycled water does not result in any degradation, and the DMC will remain well below the 0.01 mg/L threshold established in Table 4a of the Pump-in Plan.

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: At an average of 0.004 mg/L, arsenic in the San Joaquin River near Patterson is higher than the recycled water concentration but lower than the DMC concentrations, but below the Table 4a limit of 0.01 mg/L. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulting arsenic concentration of 0.004 mg/L is also below the Table 4a and Table 5 criteria. Blending with DMC water increases the arsenic concentration to 0.005 mg/L, but the mixture remains well below the standard of 0.01 mg/L in Table 4a and Table 5 of the Pump-in Plan.

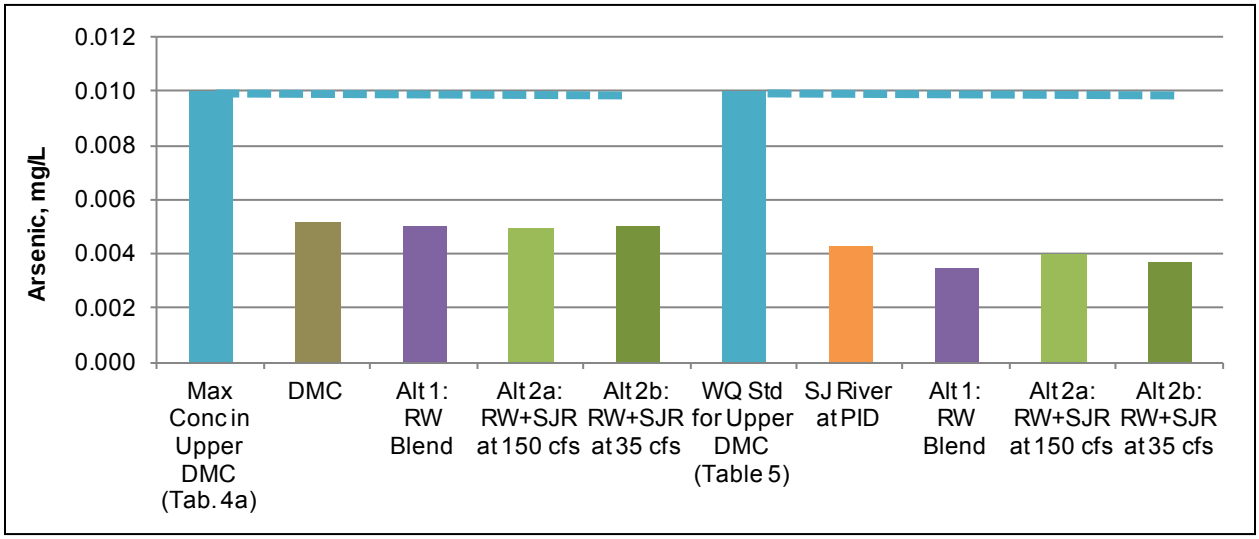

Figure 4-8 Comparison Chart for Arsenic

Unlike the constituents discussed above, mercury appears only in Table 5, and not Table 4a, of the Pump-in Plan. Therefore, the existing concentration in the DMC is not addressed in this study; only the mixture of recycled water and San Joaquin River water is relevant for comparison with Table 5 of the Pump-in Plan.

Alternative 1: Discharge recycled water directly to the DMC: As shown in the graph below, average mercury in the recycled water (2×10^{-6} mg/L) is extremely low compared to the mercury standard in Table 5 of the Pump-in Plan (0.002 mg/L).

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: At an average of 0.0003 mg/L, mercury in the San Joaquin River near Patterson is higher than the recycled water concentration, but still well below the Table 5 limit of 0.002 mg/L. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulting mercury concentrations of 0.0002 mg/L for Alternative 2a and 0.00009 mg/L for Alternative 2b are also well below the criteria in Table 5 of the Pump-in Plan .

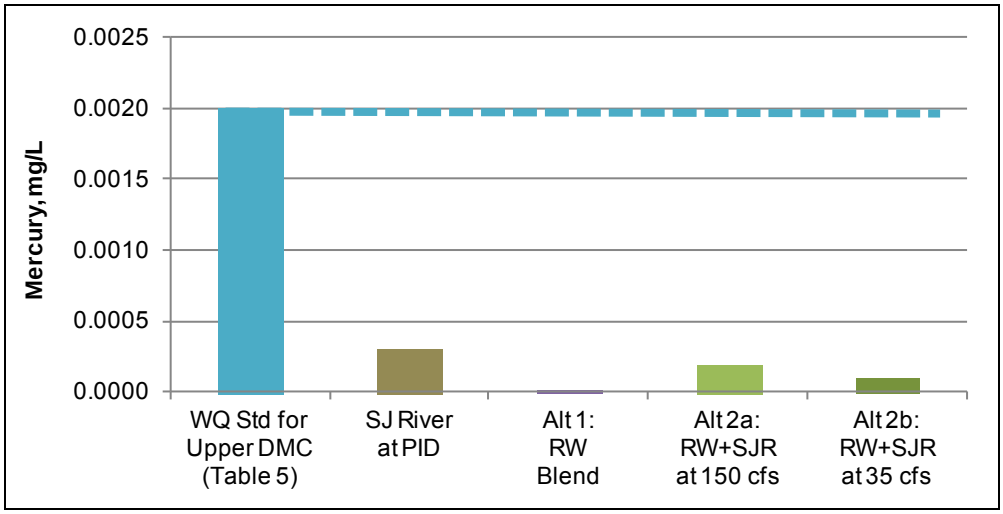

Figure 4-9 Comparison Chart for Mercury

Chloride

Like mercury, chloride appears only in Table 5, and not Table 4a, of the Pump-in Plan. Therefore, the existing concentration in the DMC is not addressed in this study; only the mixture of recycled water and San Joaquin River water is relevant for comparison with Table 5 of the Pump-in Plan. **Figure 4-10** shows the results of the water quality analysis for chlorides for each of the three alternatives.

Alternative 1: Discharge recycled water directly to the DMC: As shown in the graph below, average chloride in the recycled water (152 ^{mg}/L) is well below the chloride standard in Table 5 (250 mg/L).

Alternative 2: Blend recycled water with San Joaquin River water in PID Canal and discharge blended water to the DMC: At an average of 126 mg/L, chloride in the San Joaquin River near Patterson is comparable to the concentration in recycled water. When the recycled water and the San Joaquin River water are blended using the flow assumptions described above, the resulting chloride concentrations of 135 mg/L for Alternative 2a and 144 mg/L for Alternative 2b are still well below the Table 5 criteria of 250 mg/L.

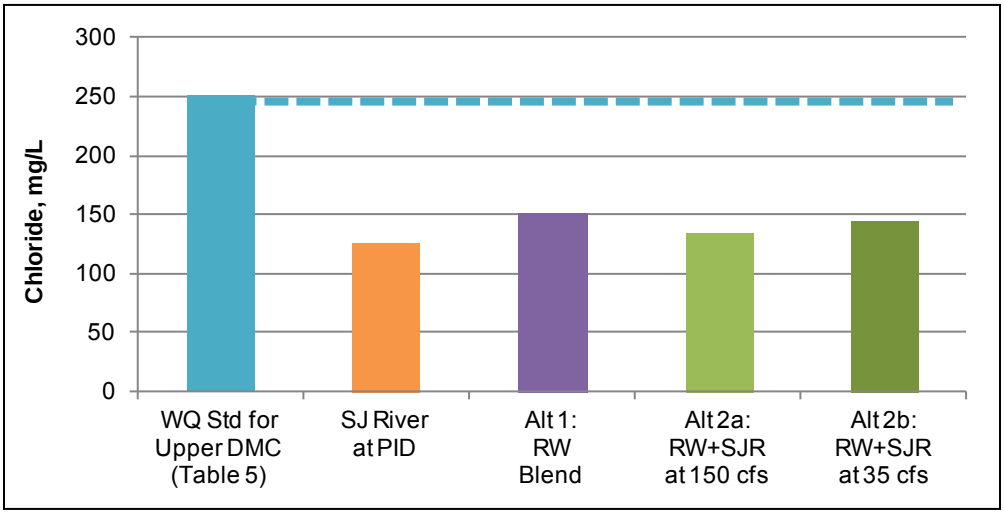

Figure 4-10 Comparison Chart for Chloride

Organic Chemicals including Pesticides

The acceptance criteria listed in Table 5 of the Pump-in Plan are based on a drinking water quality standards, with the exception of chlorpyrifos and diazinon. The for these two constituents, TMDLs and Basin Plan amendments have been developed for the San Joaquin River, which form the basis for the water quality standards in Table 5 of the Pump-in Plan. Both Modesto and Turlock have specific effluent monitoring requirements for chlorpyrifos and diazinon in their NPDES permits.

Of the 20 organic chemicals listed in Table 5, effluent data were only available for eight; all of these sample results were "non-detects." For six of these eight organic chemicals (all except chlorpyrifos and diazinon), effluent data were available from Turlock only, and were assumed to be representative of NVRRWP recycled water. For the constituents with data available from Turlock's effluent, all of the method detection limits were equal to or less than the detection limit for reporting required by Table 5 of the Pump-in Plan. Modesto's data for chlorpyrifos and diazinon did not list an MDL.

A few of the organic chemicals listed in Table 5 of the Pump-in Plan were detected in the San Joaquin River near Patterson. Of the 20 organic chemicals listed in Table 5, San Joaquin River water quality data were available for twelve. Most of these sample results were "non-detects," with the exception of chlorpyrifos, diazinon, methoxychlor, and simazine. All were reported at levels below the relevant standards in Table 5. For the constituents with data available, the method detection limits were equal to or less than the detection limit for reporting required by Table 5, where listed.

Bacteria

The Pump-in Plan does not address bacteria or include a bacteria limit. However, as stated above, California Title 22 regulations for tertiary recycled water require that the 7-day median concentration of total coliform bacteria

measured in the disinfected effluent does not exceed 2.2 most probable number (MPN) per 100 mL, 23 MPN/100 mL more than once in any 30-day period, and 240 MPN/100 mL in any single sample. These same requirements are also specifically listed in the NPDES permits for both Modesto and Turlock, and are applicable for discharges of tertiary effluent. The limited data available for the San Joaquin River and DMC indicate that they do not comply with the Title 22 standards listed above. Therefore, the addition of recycled water is not expected to result in any bacterial degradation of water quality.

Chronic Toxicity

Both Modesto and Turlock conduct whole effluent chronic toxicity monitoring as a requirement of their NPDES permits. Compliance with the narrative prohibition against chronic toxicity in the effluent discharge is achieved by conducting the required monitoring; if chronic toxicity is observed, the discharger must conduct accelerated monitoring and identify corrective actions to reduce or eliminate effluent toxicity. Both NPDES Permits identify a trigger of 1 chronic toxicity unit (1 TU_c) as the threshold for triggering accelerated monitoring. Modesto and Turlock will continue to comply with the narrative toxicity objective, as required.

Conclusions

Tertiary treated recycled water from both Turlock and Modesto meets the stringent requirements established in Title 22 of the California Code of Regulations, and is suitable for a wide variety of non-potables uses including all types of irrigation, toilet flushing, and industrial processes.

The recycled water quality is typically better than San Joaquin River water quality, since the river carries a high salt load at certain times of year and is listed as an impaired water body for boron, selenium, electrical conductivity, mercury, and several pesticides. On average, the recycled water contains lower concentrations of these chemicals than those currently found in the river. Compared to the river, the recycled water also contains lower concentrations of metals such as cadmium, chromium, and nickel, and lower concentrations of nitrates. In fact, if NVRRWP water is blended with San Joaquin River water in the PID Main Canal prior to entering the DMC, described as Alternative 2a or 2b in this chapter, the blended water is expected to exceed the DMC water quality standard for acceptance of 10 mg/L. This is because the San Joaquin River already exceeds the standard.

Recycled water, when blended with water from the DMC, is expected to comply with the water quality standards for the Upper DMC. With a few exceptions, the recycled water quality also complies with the Reclamation's current water quality standards for acceptance into the DMC. Both sets of standards are in place to regulate the practice of pumping well water into the DMC under Warren Act Contracts. Of the 48 constituents covered by these standards, only the recycled water sodium content is expected to exceed the standards for

acceptance into the DMC. The San Joaquin River also exceeds the 69 mg/L standard for sodium, so any blend of NVRRWP and San Joaquin River water would also exceed the standard.

Selenium, a constituent of concern for recycled water use at wildlife refuges, is present in NVRRWP recycled water at a concentration comparable to the existing DMC water quality (0.8 µg/L). The same is true for boron and arsenic. Recycled water would be delivered to the refuges after mixing with the existing water in the DMC. Based on the results presented in this chapter, the project is not expected to produce a significant change in water quality to downstream DMC users.

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Chapter 5 Water Quality Sampling and Analysis

Summary of Findings

On May 2, 2012 and May 9, 2013, samples were collected at four locations relevant to this Study: Newman Canal at the water delivery point to the China Island Unit of the North Grasslands Wildlife Area, the Delta Mendota Canal (DMC) at the proposed point of addition of North Valley Regional Recycled Water Program (NVRRWP) water, the Patterson Irrigation District (PID) Main Canal, and Turlock tertiary effluent. On May 9, 2013 a sample was also collected of Modesto secondary effluent (the Modesto tertiary facilities were offline during the duration of this sampling program).

These samples were analyzed for "conventional constituents" (total dissolved solids, electrical conductivity, sodium, selenium, nitrate, nitrite, boron, mercury, and chloride) and Contaminant of Emerging Concern (CECs). Analytical results for conventional constituents were comparable to the existing water quality data. For the CEC analyses, 34 analytes were detected in the Turlock tertiary effluent and/or Modesto secondary effluent samples with most analytes being detected in the samples from both locations. In the samples from the China Island delivery point, the DMC, the PID canal, nine analytes were detected using the analysis for CECs and included both herbicides/pesticides and constituents that are likely originate from wastewater effluent (such as caffeine and the artificial sweetener sucralose). The detection of these analytes is to be expected as wastewater treatment plants discharge to the source waters for the DMC and the PID Main Canal.

Introduction

This chapter summarizes the sampling program conducted under Task 4 of the Refuge Recycled Water Supply Study and compares the laboratory analytical results to existing water quality data as presented in Chapter 4.

The purpose of the sampling program was to confirm the usefulness of the existing data and to provide information about analytes, particularly Constituents of Emerging Concern (CECs) that are not included in the existing data sets.

Sampling Program

The sampling program, including the sample locations, requested analyses, and quality control/quality assurance (QA/QC) samples, is described below.

Sample Locations and Sampling Events

The proposal to add North Valley Regional Recycled Water Program (NVRRWP) recycled water to the Delta Mendota Canal (DMC) involves first combining the treated tertiary effluent from Modesto and Turlock and then adding the recycled water to either the Patterson Irrigation District (PID) Main Canal or directly to the DMC. As such, existing conditions water quality data from each of these four points – Modesto effluent, Turlock effluent, the DMC, and the PID Main Canal – is crucial to understanding the potential impacts of adding NVRRWP recycled water to the DMC (and potentially the PID Main Canal). Additionally, understanding the water quality profile of the water currently provided to the refuges is necessary to understand how this proposal would affect the refuges and whether the NVRRWP recycled water after mixing in the DMC is appropriate for use in the refuge areas. Under this sampling program, water samples were collected from these five locations as shown below in Table 5-1.

Table 5-1. Sample Locations and Sample Names

Sampling Location	Sample Name
China Island	RRW-1
DMC	RRW-2
PID Main Canal	RRW-3
Modesto Effluent	RRW-4
Turlock Effluent	RRW-5

The samples were given generic sample names to prevent any bias in the laboratory analysis. The sample locations are shown on Figure 5-1 and are further described below.

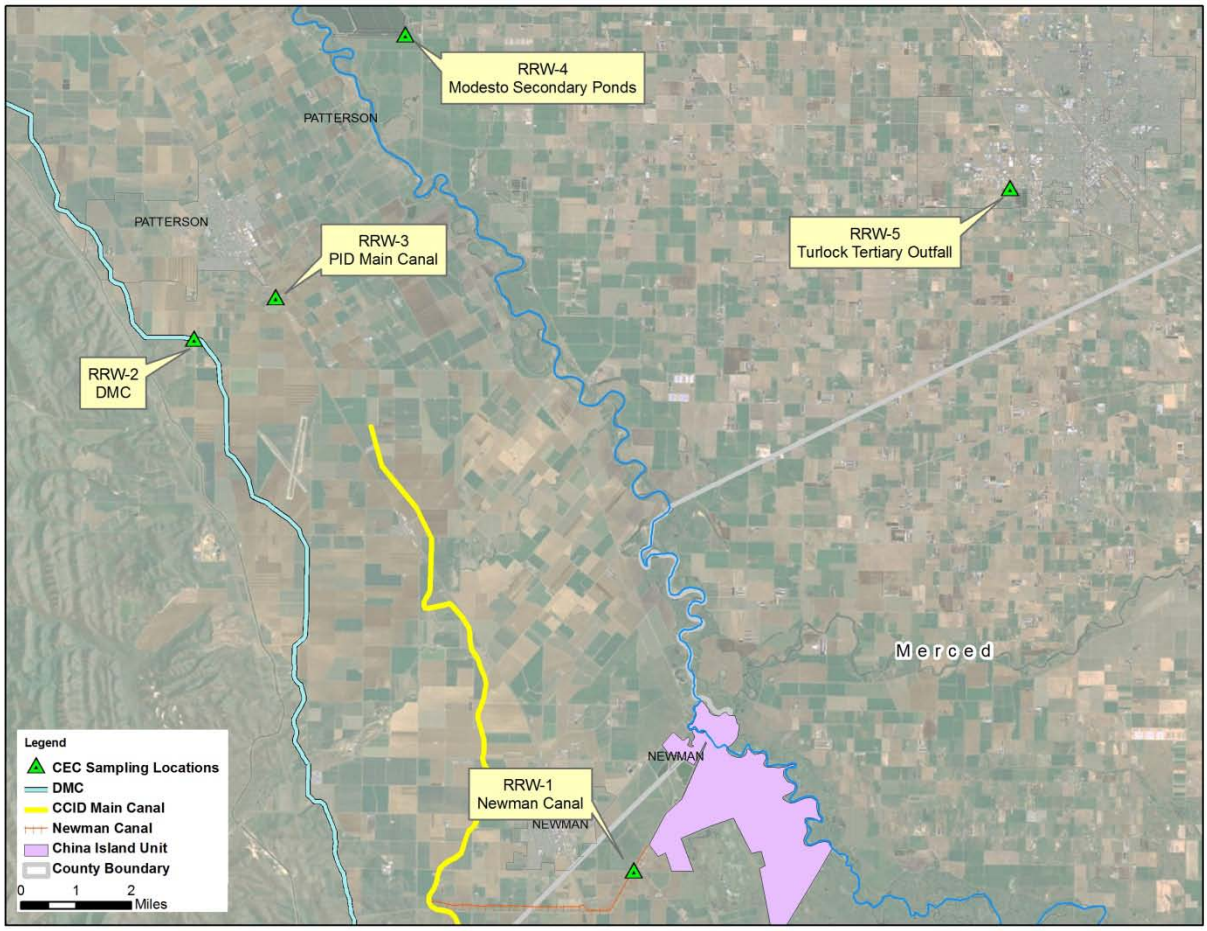

Figure 5-1: Sample Locations

China Island (RRW-1)

The China Island (RRW-1) samples were collected from Newman Canal at the water delivery point to the China Island Unit of the North Grasslands Wildlife Area.

The Newman Canal is a 4.75 mile long, concrete lined, open channel canal that receives its source water from the U.S. Bureau of Reclamation via the Delta-Mendota Canal (DMC) through a wheeling contract with Central California Irrigation District's (CCID) Main Canal. The Newman Canal begins approximately 2.5 miles southwest of Newman, CA and travels east towards the China Island Unit.

The samples for RRW-1 were collected at the intersection of the Newman Canal and Braza Road, in an unincorporated section of Stanislaus County. Using a disposable Teflon bailer, water was collected from the northeast and downstream side of the siphon that runs under Braza Road, seen in Figure 5-2.

Figure 5-2: RRW-1 Sampling Location, as seen on May 2nd, 2013

Follow up discussions with the U.S. Fish and Wildlife Service determined that the Newman Canal flow rates during the two sampling dates of May 2nd and May 9th were approximately 8 cubic-feet per second (cfs) and 2 cfs, respectively[31].

Delta Mendota Canal (RRW-2)

The DMC (RRW-2) samples were collected using a disposable Teflon bailer from the northern (upstream) side of the Ward Avenue bridge where it crosses over the DMC, as seen in Figure 5-3. RRW-2 is located
just south of the City of Patterson, CA city limits along Ward Avenue. The California Data Exchange Center's (CDEC) Tracy Pumping Plant monitoring station recorded flow rates for May 2nd and May 9th of 3,155 cfs and 978 cfs, respectively.

[31] Miyamoto, Steve. 2013. Wildlife Habitat Supervisor of the USFWS China Island Unit. Conversation with Ryan
Doyle (RMC Water and Environment)

Figure 5-3: RRW-2 Sampling Location, as seen on May 9th, 2013

PID Main Canal (RRW-3)

The PID Main Canal (RRW-3) samples were collected from the PID owned and operated Main Canal. At the intersection of the Main Canal and Almond Avenue, a disposable Teflon bailer was used to collect the water samples at the edge of the canal at the location shown in Figure 5-4.

Figure 5-4: RRW-3 Sampling Location, as seen on May 9th, 2013

Modesto Effluent (RRW-4)

A Modesto effluent sample was not collected on May 2, 2013 because the tertiary treatment facilities at the Modesto WQCF were not operational at that time and the original intention of this sampling program was to collect and analyze samples of the Modesto WQCF tertiary effluent. There are no current uses of Modesto WQCF effluent that require tertiary treatment so the tertiary facilities can be shut down for extended periods if needed. On May 9th, 2013 the tertiary facilities remained offline and a Modesto effluent (RRW-4) sample was collected from secondary effluent ponds located within the Jennings Facility, as seen in Figure 5-5.

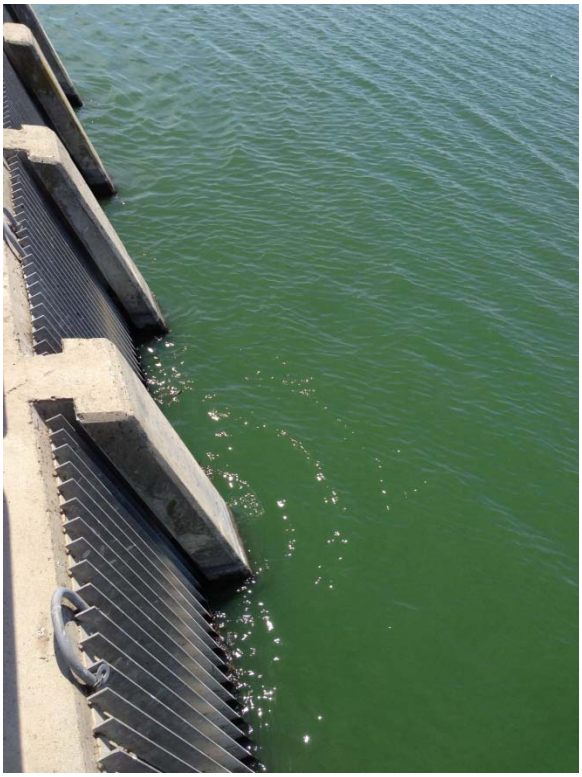

Figure 5-5: RRW-4 Sampling Location, as seen on May 9th, 2013

Although samples of the tertiary effluent would be more representative of the water that is proposed to be conveyed through the DMC, the secondary effluent should not differ substantially from the secondary effluent with respect to the chemical constituents and water quality parameters analyzed as part of this sampling program. The Modesto WQCF tertiary treatment process is a two-step membrane bioreactor (MBR) process that includes nitrification/denitrification and microfiltration. The filtration process removes particulates, i.e. suspended particles but does not remove dissolved constituents. The tertiary effluent water quality will be better than that of the secondary effluent sampled in this study so the results sampled are conservative with respect to the actual water quality of the Modesto flows sent to NVRRWP.

Turlock Effluent (RRW-5)

On May 2, 2013 and May 9, 2013 the Turlock effluent samples (RRW-5) were collected from the sampling tap for the tertiary effluent of the Turlock WQCF. The Turlock tertiary facilities were operating normally at the time.

Analytical Laboratories and Requested Analyses

The analytical laboratories, all of which are on the USBR list of approved laboratories, were as follows:

- California Laboratory Services (CLS) – USBR approved for inorganic, organic, and microbiological parameters. CLS analyzed the samples for

boron, mercury, sodium, chloride, nitrate, specific conductance (electrical conductivity – EC), and TDS.

- South Dakota Agricultural Laboratories – USBR approved for selenium. South Dakota Analytical Laboratories analyzed the samples for selenium.
- Eurofins Eaton Analytical (Eurofins) – USBR approved for all inorganic, organic, and radiochemistry parameters in water. Eurofins analyzed the samples for CECs.

Within this memorandum, the chemical constituents analyzed by CLS and South Dakota Agricultural Laboratories are referred to as "conventional constituents" and the Eurofins analytes are referred to as CECs.

Sampling Procedures and Protocols

On both May 2, 2013 and May 9, 2013, the sampling team consisted of Ryan Doyle of RMC Water and Environment and Corey Kilpatrick of Blaine Tech Services. The weather on both May 2, 2013 and May 9, 2013 was sunny and dry. Field notes including field measurements of water quality parameters (pH, conductivity, turbidity, dissolved oxygen, oxidation reduction potential, and total dissolved solids) are provided in Appendix 5-A.

Sample bottles for conventional constituents (including selenium) were provided by CLS and sample bottles for CECs were provided by Eurofins. All sample bottles came with the appropriate preservatives for the analyses being requested.

In addition to standard sampling procedures (changing gloves for every sample, keeping samples on ice, etc.), the sampling team followed the sampling protocols provided by Eurofins for collection of samples to be analyzed for CECs. A copy of these sampling protocols is provided in Appendix 5-B. The disposable Teflon bailers used for sample collection are consistent with these protocols.

QA/QC Samples

The following field QA/QC samples were collected and analyzed:

- Field duplicate (RRW-6). The field duplicate of the Turlock effluent samples (RRW-5) was collected on both May 2, 2013 and May 9, 2013 and analyzed for all analytes. The RRW-6 samples were collected in an identical manner as the RRW-5 samples (from the Turlock tertiary effluent sampling tap).
- Equipment blank (RRW-7): An equipment blank was collected on both May 2, 2013 and May 9, 2013, and analyzed for all analytes. The equipment blank was collected by pouring deionized water provided by the laboratories into a new disposable Teflon bailer and then pouring the water in the bailer into the sample bottles.

Conventional Constituents Analytical Results

As discussed above, the conventional constituents analyzed for were TDS, EC, sodium, selenium, nitrate, nitrite, boron, mercury, and chloride. The analytical results are compiled in Appendix 5-C. Copies of the laboratory reports are provided in Appendix 5-D (CLS) and Appendix 5-E (South Dakota Agricultural Laboratories).

Comparison to Existing Water Quality Data for Conventional Constituents

As shown in Appendix 5-C, the analytical results for the samples collected on May 2, 2013 and May 9, 2013 were compared to the existing water quality data presented in Chapter 4. For all analytes, the concentrations found in the May 2, 2013 and May 9, 2013 samples were within the range of concentrations seen in the existing data set.

Conventional Constituent QA/QC Results

This section discusses the results of field collected QA/QC samples as well as internal laboratory QA/QC procedures. In summary, neither the field collected QA/QC samples nor the internal laboratory QA/QC revealed any data quality issues for conventional constituents.

Field Duplicates (RRW-6)

On May 2, 2013 and May 9, 2013 a field duplicate (RRW-6) was collected at the Turlock tertiary effluent sampling location (the field sample of Turlock tertiary effluent is designated RRW-5). These field duplicates were analyzed for all conventional constituents to assess variability introduced by field sampling procedures

The precision of field duplicates was evaluated by calculating the relative percent difference (RPD) between the involved samples. Generally, an RPD of less than 25% is considered acceptable.

$$\text{RPD} = \left| \frac{\left(\text{field sample concentration} - \text{field duplicate concentration}\right)}{\text{mean}} \right| \times 100$$

Where:

$$\text{mean} = \frac{(\text{field sample concentration} + \text{field duplicate concentration})}{2}$$

As shown in Appendix 5-C, the field duplicate RPD was below 10% for all conventional constituents with the exception of selenium in the May 9, 2013 samples. In the May 9, 2013 samples, selenium was not detected in the field sample (RRW-5) above the laboratory reporting limit of 0.4 µg/L while selenium was detected at a concentration of 0.521 µg/L in the field duplicate

(RRW-6) and as such the RPD in this instance is greater than 26%. Because of the relatively low selenium detection limit of 0.4 µg/L and the low RPDs for other conventional constituents, this higher field duplicate RPD is unlikely to represent any wider data quality issues.

On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in the data tables in Appendix 5-C. A note has also been inserted in the laboratory reports (Appendix 5-D and Appendix 5-E) to avoid confusion.

Equipment Blanks (RRW-7)

On May 2, 2013 and May 9, 2012, equipment blank samples (RRW-7) were collected by pouring deionized water provided by CLS into a new Teflon bailer and then pouring the water in the bailer into the sample bottles.

As shown in Appendix 5-C, concentrations of conventional constituent in the RRW-7 samples were either not detected, below method reporting limits, or very low compared to the results for the field samples. As such, it is unlikely that the equipment or the sampling procedures affected analytical results for conventional constituents in any significant way.

Internal Laboratory QA/QC for Conventional Constituents

Per notes on the laboratory reports (see Appendix 5-D and Appendix 5-E), no unresolvable data quality issues were encountered by either CLS or the South Dakota Agricultural Laboratory.

Chemicals of Emerging Concern (CEC)

This section presents the results of CEC analysis. CECs include new classes of chemicals, such as pharmaceuticals, current use pesticides, and industrial chemicals.

Regulatory Framework for CEC Monitoring

Many CECs are potentially present in recycled water, surface waters, and groundwater, but the ability to detect many of these chemicals at low concentrations is so recent that a robust framework for interpreting their potential human or ecosystem health effects is unavailable.

In California, the most well-established regulations and policies related to CECs in recycled water are associated with the State Water Resources Control Board (SWRCB) Recycled Water Policy. The SWRCB adopted the Recycled Water Policy in May 2009 and in April 2013 adopted an amendment to the Recycled Water Policy that provided CEC monitoring requirements for groundwater recharge projects using recycled water.

Table 5-2 shows the human health-relevant and performance indicator CECs to be monitored at least in the initial assessment phase of projects that include surface application of recycled water for groundwater recharge of a groundwater basin designated for municipal use.

Table 5-2. CECs to be Monitored per the Recycled Water Policy

Constituent	Constituent Group	Relevance/Indicator Type[1]	Monitoring Trigger Level (µg/L)
17β-estradiol	Steroid hormones	Health	0.009
Caffeine	Stimulant	Health & Performance	0.35
N-Nitrosodimethylamine (NDMA)	Disinfection byproduct	Health	0.01
Triclosan	Antimicrobial	Health	0.35
Gemfibrozil	Pharmaceutical	Performance	--
Iopromide	Pharmaceutical	Performance	--
N,N-Diethyl-meta-toluamide (DEET)	Personal care product	Performance	--
Sucralose	Food additive	Performance	--

Within the Recycled Water Policy, CECs of toxicological relevance to human health are referred to as "health-based CECs." CECs determined not to have human health relevance, but useful for monitoring treatment process effectiveness, are referred to as "performance indicator CECs." A performance indicator CEC is an individual CEC used for evaluating a family of CECs with similar physicochemical or biodegradable characteristics. The removal of a performance indicator CEC through a treatment process provides an indication of removal of CECs with similar properties. A health-based CEC may also serve as a performance indicator CEC.

For the health-based CECs, monitoring trigger levels have been established. If initial monitoring shows the concentration of a CEC as equal to or greater than the monitoring trigger level, then the CEC should be considered for inclusion in a longer-term monitoring program.

The monitoring requirements and criteria for evaluating monitoring results in the Policy are based on recommendations the Science Advisory Panel that was convened in accordance with provisions of the Policy. The panel's recommendations were presented in the report; *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel*, dated June 25, 2010.

Requested CEC Analytes and Laboratory Test Methods

Because the Recycled Water Policy is the most well-established regulatory framework in California that addresses CECs in recycled water and because no regulatory framework exists for assessing CEC impacts in wetland areas such as the refuges, the constituents listed above in Table 2 were the requested analytes for the samples collected on May 2, 2013 and May 9, 2013.

In order in analyze for the eight constituents shown in Table 5-2, Eurofins runs four different laboratory test methods as shown in Table 5-3.

Table 5-3. Laboratory Test Methods for CECs

Constituent	Test Method Names	Comments
17β-estradiol	EPA 539	EPA approved method
N-Nitrosodimethylamine (NDMA)	EPA 521 – Nitrosamines by GCMS	EPA approved method
Caffeine	LC-MS-MS - Endocrine Disruptors Positive Mode - SPE	This is a research test method developed by Eurofins
N,N-Diethyl-meta-toluamide (DEET)		
Triclosan	LC-MS-MS - Endocrine Disruptors Negative Mode - SPE	This is a research test method developed by Eurofins
Gemfibrozil		
Iopromide		
Sucralose		

GCMS = Gas chromatography–mass spectrometry
LC-MS-MS = Liquid chromatography-tandem mass spectrometry

These test methods detect a variety of constituents beyond those listed in Table 5-2. The full list of analytes is shown in the laboratory reports (Appendix 5-F).

Analytical Results of CEC Sampling

The analytical results of CEC sampling are summarized in the table provided in Appendix 5-G. 34 different analytes were detected amongst the seven samples (RRW-1 through RRW-7). In Appendix 5-G and the tables below, concentrations are reported using the same units as in the Eurofins laboratory reports – ng/L (nanograms per liter) except for the analyte 4-androstene-3,17-dione which is reported in µg/L (micrograms per liter).

Table 5-4. Units of Concentration Conversions

mg/L	µg/L	ng/L
milligrams per liter	micrograms per liter	nanograms per liter
parts per million (ppm)	parts per billion (ppb)	parts per trillion (ppt)
1 mg/L =	1,000 µg/L =	1,000,000 ng/L
equivalent to one drop of water diluted into 50 liters (13 gallons)	equivalent to one drop of water diluted into 50 cubic meters (~13,000 gallons)	Equivalent to a drop of water diluted into 20 Olympic-size swimming pools.
Coffee has a concentration caffeine of approximately 500 mg/L	Coffee has a concentrations caffeine of approximately 500,000 µg/L	Coffee has a concentration caffeine of approximately 500,000,000 ng/L

RRW-1, RRW-2 and RRW-3 Analytical Results (Canal Samples)

As shown below in Table 5-5, the detected analytes were similar amongst the three canal samples: RRW-1 (China Island), RRW-2 (DMC) and RRW-3 (PID Main Canal). When an analyte was detected in two or more of these samples, the analytical results between the samples were similar (at least within an order of magnitude).

Table 5-5. Canal Sample Analytical Results from CEC Sampling

Analyte	Analyte Description	Units	Method Reporting Limit*	RRW-1		RRW-2		RRW-3	
				China Island		DMC		PID Main Canal	
				May 2	May 9	May 2	May 9	May 2	May 9
2,4-D	herbicide	ng/L	5	27	22	16	89	18	56
Acesulfame-K	artificial sweetener	ng/L	20	340	260	290	200	960	730
Caffeine	stimulant (as in coffee, tea, etc.)	ng/L	5	7.8	5.2	8.9	6.7	22	21
Diuron	herbicide	ng/L	5	700	360	160	170	600	230
Fluoxetine	pharmacetical (Prozac)	ng/L	10	**	**	**	13	**	**
Iohexal	contrast agent used in clinical radiology	ng/L	10	48	**	54	**	39	**
Metolachlor	herbicide	ng/L	5	17	18	21	20	38	140
Simazine	herbicide	ng/L	5	6.2	**	**	**	**	**
Sucralose	artificial sweetener	ng/L	100	690	440	410	300	650	580

* When the concentration of a chemical is high relative to the method reporting limit, dilution of the sample per standard laboratory protocols may be needed and will result in higher reporting limits. See laboratory reports (Appendix 5-F) for reporting limits for individual analysis.
** Analyte was not detected above the method reporting limit.

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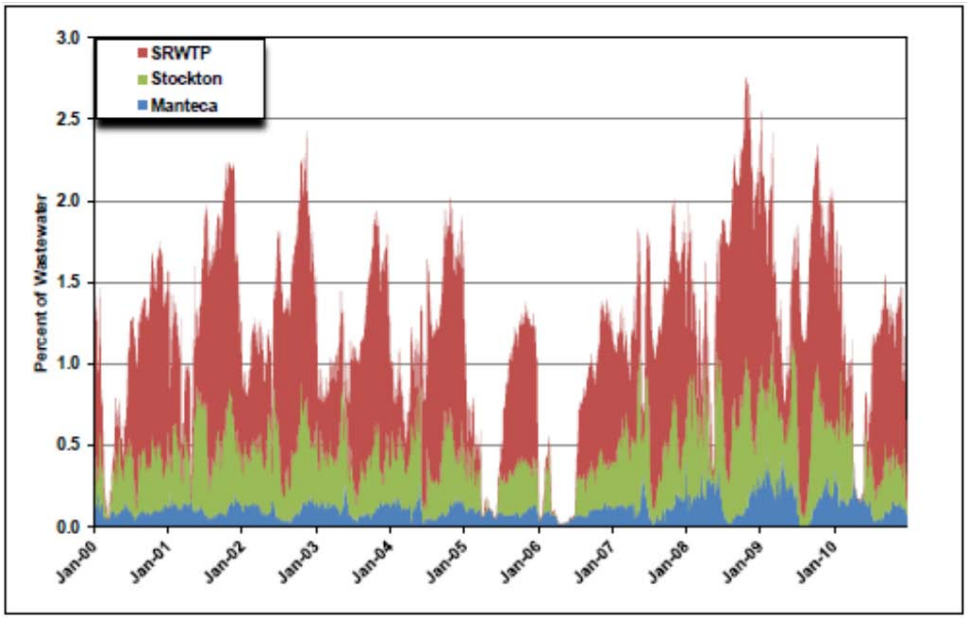
The presence of the non-herbicide analytes in the RRW-1 through RRW-3 samples likely indicates that these waters have at some point mixed with wastewater treatment plant effluent. This is to be expected as the water in the DMC is drawn from the Delta and multiple wastewater treatment plants discharge treated effluent to the Delta or to waterways that flow to the Delta. *The California State Water Project Watershed Sanitary Survey 2011 Update*[32] estimated that the discharge from three of the largest wastewater dischargers to Delta tributaries can comprise up to approximately 3% of the flow at the DMC intake at C.W. "Bill" Jones Pumping Plant (Delta intake for DMC).



Source: California State Water Project Watershed Sanitary Survey, 2011 Update.

Figure 5-6 Estimated Percent of Wastewater at C.W. "Bill" Jones Pumping Plant (Delta intake for DMC)

Similarly, the water pumped into the PID Main Canal is sourced from the San Joaquin River which contains a number of upstream wastewater treatment plant dischargers that pump effluent into the San Joaquin River, including the City of Turlock.

RRW-4 and RRW-5 Analytical Results (Treatment Plant Samples)

As shown below in Table 5-6, the detected analytes were similar amongst the three treatment plant samples: the one RRW-4 sample (Modesto secondary effluent), and the two RRW-5 samples (Turlock tertiary effluent) When an analyte was detected in two or more of these samples, the analytical results between the samples were similar (at least within an order of magnitude). Table 5-7 gives a short description of each of the chemicals detected in the RRW-4 and RRW-5 samples.

[32] *The California State Water Project Watershed Sanitary Survey 2011 Update*, Archibald Consulting, Palencia Consulting Engineers, Starr Consulting. June 2012.

Table 5-6. Treatment Plant Sample Analytical Results from CEC Sampling

Analyte	Units	Method Reporting Limit*	RRW-4	RRW-5	
			Modesto	Turlock	
			May 9	May 2	May 9
2,4-D	ng/L	5	18	64	92
4-androstene-3,17-dione	µg/L	0.0003		0.0029	0.00098
Acesulfame-K	ng/L	20	36,000	28,000	21,000
Atrazine	ng/L	5		12	12
BPA (Bisphenol A)	ng/L	10		100	**
Caffeine	ng/L	5	73	920	700
Carbamazepine	ng/L	5	120	84	140
Carisoprodol	ng/L	5	270	82	100
Cotinine	ng/L	10	12	99	87
DACT	ng/L	5	49	26	51
DEA	ng/L	5	15	9.8	10
DEET	ng/L	10	44	340	180
Dehydronifedipine	ng/L	5		99	110
DIA	ng/L	5		9.6	7.9
Dilantin	ng/L	20	150	110	110
Diuron	ng/L	5	35	32	35
Estrone	ng/L	0.002	27	**	**
Fluoxetine	ng/L	10		93	**
Gemfibrozil	ng/L	5	170	19	19
Ibuprofen	ng/L	10		42	61
Iohexal	ng/L	10	7,000	3,400	2,200
Lidocaine	ng/L	5	33	**	**
Lincomycin	ng/L	10	25	**	**
Meprobamate	ng/L	5	230	380	310
Metolachlor	ng/L	5		**	**
NDMA	ng/L	2		2.4	2.5
Pentoxifylline	ng/L	5		14	13
Primidone	ng/L	5	63	50	53
Simazine	ng/L	5		**	6
Sucralose	ng/L	100	24,000	38,000	11,000
Sulfamethoxazole	ng/L	5	1,700	**	**
TCPP	ng/L	100	360	200	200
TDCPP	ng/L	100	140	250	270

* When the concentration of a chemical is high relative to the method reporting limit, dilution of the sample per standard laboratory protocols may be needed and will result in higher reporting limits. See laboratory reports (Appendix 5-F) for reporting limits for individual analysis.
**Analyte was not detected above the method reporting limit.

Table 5-7. Descriptions of Analytes Detected in Treatment Plant Samples

Analyte	Description
2,4-D	Common pesticide/herbicide
4-androstene-3,17-dione	Steroid hormone produced in the adrenal glands and the gonads
Acesulfame-K	Artificial sweetener (marketed under the trade names Sunett and Sweet One).
Atrazine	Common herbicide
BPA (Bisphenol A)	Man-made compound used in plastics and epoxy resins
Caffeine	Natural compound that acts as a stimulant drug. Caffeine is found in varying quantities in the seeds, leaves, and fruit of some plants .
Carbamazepine	Prescription drug used to treat seizures, nerve pain and bipolar disorder.
Carisoprodol	Prescription drug used to treat pain and muscle spasms..
Cotinine	Alkaloid found in tobacco and is also a metabolite of nicotine
DACT	Herbicide
DEA	Chemical used as a wetting agent in shampoos, lotions, creams and other cosmetics.
DEET	Most common active ingredient in insect repellents.
Dehydronifedipine	Main metabolite of the pharmaceutical Nifedipine, a pharmaceutical taken to treat high blood pressure and angina (chest pain)
DIA (Desisopropyl atrazine)	Herbicide
Dilantin	Prescription drug used to treat seizures..
Diuron	Herbicide.
Estrone	Estrogenic hormone secreted by the ovary as well as adipose tissue
Fluoxetine	Prescription drug (Prozac) used to treat depression, obsessive compulsive disorder, eating disorders, and panic disorders.
Gemfibrozil	Prescription drug used to lower triglyceride and cholesterol levels.
Ibuprofen	Over-the-counter drug used to treat fever and pain.
Iohexal	Contrast agent used during coronary angiography.
Lidocaine	Prescription drug (local anesthetic)
Lincomycin	Prescription antibiotic
Meprobamate	Prescription drug used to treats tension, anxiety, and nervousness.
Metolachlor	Widely used herbicide.
NDMA	By-product of water disinfection by chlorination or chloramination.
Pentoxifylline	Prescription drug used to treat poor blood circulation.
Primidone	Prescription drug used to treat seizure disorders.
Simazine	Herbicide.
Sucralose	Artificial sweetener (marketed under the trade name Splenda).
Sulfamethoxazole	Prescription antibiotic.
TCPP	Flame retardant chemical.
TDCPP	Flame retardant chemical.

Comparison of CEC Analytical Results for RRW-4 and RRW-5 to Recycled Water Policy Monitoring Trigger Levels

Table 5-8 shows concentrations of CECs detected in the Modesto (RRW-4) and Turlock (RRW-5) as compared to the monitoring trigger levels established in the Recycled Water Policy. Only caffeine in the Turlock effluent samples exceeds these monitoring trigger levels. As discussed earlier in this chapter, these motoring trigger levels are based on human health risks associated with the use of recycled water in the surface application groundwater recharge projects.

Table 5-8. Comparison of CEC Analytical Results to Recycled Water Policy Monitoring Trigger Levels

Constituent	Monitoring Trigger Level (µg/L)	RRW-4	RRW-5	
		Modesto	Turlock	
		May 9	May 2	May 9
17β-estradiol	0.009	<0.004	<0.004	<0.004
Caffeine	0.35	0.073	0.920	0.700
N-Nitrosodimethylamine (NDMA)	0.01	<0.002	0.0024	0.0025
Triclosan	0.35	<0.01	<0.01	<0.01

Estimation of Concentrations of Detected CECs After Addition of NVRRWP Recycled Water in the DMC

The CEC data collected as part of this sampling program was used to estimate the concentrations of CEC in the DMC if the NVRRWP recycled water were added to the DMC via a direct pipeline (Alternative 1 as described in Chapter 4). Assumptions about flow of recycled water from Modesto and Turlock and flow in the DMC and PID Main Canal were identical to those used in the analysis of conventional constituent concentrations presented in Chapter 4. When a particular was not detected above the method reporting limit, the concentration of that constituent was estimated as half the method reporting limit. The results of this analysis are presented in Appendix 5-H. With exception of the herbicides 2,4-D, diruron, and metachlor that were detected as higher concentrations in the DMC samples (RRW-2) than in either the Modesto (RRW-4) or Turlock (RRW-6) samples, the calculated concentration in the DMC as a percentage of the calculated concentrations in the 2045 blend of NVRRWP recycled water range between 8% and 62% representing dilutions of between 92% and 48%.

CEC QA/QC Results

This section discusses the results of field collected QA/QC samples analyzed for CEC as well as Eurofins internal laboratory QA/QC procedures..

Field Duplicates (RRW-6)

On May 2, 2013 and May 9, 2013 a field duplicate (RRW-6) was collected at the Turlock tertiary effluent sampling location (the primary field sample of Turlock tertiary effluent is designated RRW-5). These field duplicates were analyzed for all CEC analytes to assess variability introduced by field sampling procedures

On May 9, 2013, RRW-6 was mislabeled as RRW-7 and RRW-7 was mislabeled as RRW-6. The error has been corrected in the data tables below. A note has also been inserted in the laboratory reports (Appendix 5-F) to avoid confusion.

The precision of field duplicates was evaluated by calculating the relative percent difference (RPD) between the analytical results for the primary (RRW-5) and duplicate (RRW-6) samples. As shown in Table 5-9 and Table 5-10, the field duplicate RPDs for several analytes were greater than 25%. All of these analytes are tested for using one of the two research methods (LC-MS-MS - Endocrine Disruptors Negative Mode or LC-MS-MS - Endocrine Disruptors Negative Mode) rather than the EPA approved methods (EPA 539 and EPA 521). Generally, an RPD of less than 25% is considered acceptable, however, with the very low detection limits (ng/L level) associated with these analyses RPDs of greater than 25% are not unusual.

Table 5-9. Comparison of Field Duplicate and Primary Samples for CEC Analytes – May 2, 2013

Analyte	Units	Method Reporting Limit*	RRW-5 Turlock May 2	RRW-6 Turlock May 2	RDP
2,4-D	ng/L	5	64	64	0%
4-androstene-3,17-dione	µg/L	0.0003	0.0029	0.0033	13%
Acesulfame-K	ng/L	20	28,000	28,000	0%
Atrazine	ng/L	5	12	11	9%
BPA	ng/L	10	100	71	34%
Caffeine	ng/L	5	920	820	11%
Carbamazepine	ng/L	5	84	80	5%
Carisoprodol	ng/L	5	82	86	5%
Cotinine	ng/L	10	99	89	11%
DACT	ng/L	5	26	21	21%
DEA	ng/L	5	9.8	9	9%
DEET	ng/L	10	340	330	3%
Dehydronifedipine	ng/L	5	99	91	8%
DIA	ng/L	5	9.6	5.9	48%
Dilantin	ng/L	20	110	90	20%
Diuron	ng/L	5	32	31	3%
Estrone	ng/L	0.002	**	**	--
Fluoxetine	ng/L	10	93	61	42%
Gemfibrozil	ng/L	5	19	27	35%
Ibuprofen	ng/L	10	42	41	2%
Iohexal	ng/L	10	3,400	7,000	69%
Lidocaine	ng/L	5	**	**	--
Lincomycin	ng/L	10	**	**	--
Meprobamate	ng/L	5	380	310	20%
Metolachlor	ng/L	5	**	**	--
NDMA	ng/L	2	2.4	2.9	19%
Pentoxifylline	ng/L	5	14	14	0%
Primidone	ng/L	5	50	48	4%
Simazine	ng/L	5	**	**	--
Sucralose	ng/L	100	27,000	20,000	30%
Sulfamethoxazole	ng/L	5	**	**	--
TCPP	ng/L	100	200	180	11%
TDCPP	ng/L	100	250	260	4%

* When the concentration of a chemical is high relative to the method reporting limit, dilution of the sample per standard laboratory protocols may be needed and will result in higher reporting limits. See laboratory reports (Appendix 5-F) for reporting limits for individual analysis.
**Analyte was not detected above the method reporting limit.

Table 5-10. Comparison of Field Duplicate and Primary Samples for CEC Analytes – May 9, 2013

Analyte	Units	Method Reporting Limit*	RRW-5 Turlock May 9	RRW-6 Turlock May 9	RDP
2,4-D	ng/L	5	92	95	3%
4-androstene-3,17-dione	µg/L	0.0003	0.00098	0.0016	**48%**
Acesulfame-K	ng/L	20	21,000	22,000	5%
Atrazine	ng/L	5	12	11	9%
BPA	ng/L	10	**	**	--
Caffeine	ng/L	5	700	660	6%
Carbamazepine	ng/L	5	140	120	15%
Carisoprodol	ng/L	5	100	110	10%
Cotinine	ng/L	10	87	85	2%
DACT	ng/L	5	51	28	**58%**
DEA	ng/L	5	10	11	10%
DEET	ng/L	10	180	160	12%
Dehydronifedipine	ng/L	5	110	110	0%
DIA	ng/L	5	7.9	8.6	8%
Dilantin	ng/L	20	110	110	0%
Diuron	ng/L	5	35	40	13%
Estrone	ng/L	0.002	**	**	--
Fluoxetine	ng/L	10	**	10	(b)
Gemfibrozil	ng/L	5	19	18	5%
Ibuprofen	ng/L	10	61	110	**57%**
Iohexal	ng/L	10	2,200	2,800	24%
Lidocaine	ng/L	5	**	**	--
Lincomycin	ng/L	10	**	**	--
Meprobamate	ng/L	5	310	330	6%
Metolachlor	ng/L	5	**	**	--
NDMA	ng/L	2	2.5	2.3	8%
Pentoxifylline	ng/L	5	13	12	8%
Primidone	ng/L	5	53	56	6%
Simazine	ng/L	5	6	6.8	13%
Sucralose	ng/L	100	11,000	19,000	**53%**
Sulfamethoxazole	ng/L	5	**	**	--
TCPP	ng/L	100	200	230	14%
TDCPP	ng/L	100	270	280	4%

* When the concentration of a chemical is high relative to the method reporting limit, dilution of the sample per standard laboratory protocols may be needed and will result in higher reporting limits. See laboratory reports (Appendix 5-F) for reporting limits for individual analysis.
**Analyte was not detected above the method reporting limit.

Equipment Blanks (RRW-7)

On May 2, 2013 and May 9, 2013, equipment blank samples (RRW-7) were collected by pouring deionized water provided by Eurofins into a new Teflon bailer and then pouring the water in the bailer into the sample bottles.

Concentrations of CECs in the May 9, RRW-7 samples were not detected above the method reporting limits. As shown in the table below, three analytes were detected in the May 2, RRW-7 sample

Table 5-11. CEC Analytes Detected in Field Blanks (RRW-7)

Analyte	Units	Method Reporting Limit*	RRW-7	
			Field Blank	
			May 2	May 9
Caffeine	ng/L	5	8.4	**
Erythromycin	ng/L	10	73	**
Fluoxetine	ng/L	10	48	**

* When the concentration of a chemical is high relative to the method reporting limit, dilution of the sample per standard laboratory protocols may be needed and will result in higher reporting limits. See laboratory reports (Appendix 5-F) for reporting limits for individual analysis.
**Analyte was not detected above the method reporting limit.

At 8.4 ng/L, the detected concentration of caffeine in the May 2, 2013 RRW-7 is similar to the detected concentrations of caffeine in the China Island (RRW-1) and DMC (RRW-2) samples. At 48 ng/L, the detected concentration of fluoxetine in the May 2, 2013 RRW-7 sample is similar to the detected concentrations of fluoxetine in the Modesto (RRW-4) and Turlock samples (RRW-4). Erythromycin, an antibiotic, was not detected in any other sample. Because only three analytes were detected in the May 2, 2013 sample and because these detections do not seem to follow any particular pattern, they are unlikely to represent any wider data quality issues.

Internal Laboratory QA/QC for CECs

Eurofins internal QA/QC results are noted in their laboratory reports (Appendix 5-F).

Conclusions

Analytical results for conventional constituents were comparable to the existing water quality data. For the CEC analyses, 34 analytes were detected in the Turlock tertiary effluent and/or Modesto secondary effluent samples with most analytes being detected in the samples from both locations. In the samples from the China Island delivery point, the DMC, the PID canal, nine analytes were detected using the analysis for CECs and included both herbicides/pesticides and constituents that likely originate from wastewater effluent (such as caffeine and the artificial sweetener sucralose). The detection of these analytes is to be expected as wastewater treatment plants discharge to the source waters for the DMC and the PID Main Canal.

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