City of Hesperia Wastewater Reclamation Project, Final Preliminary Design Report, December 2009

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Final

Victor Valley Wastewater Reclamation Authority

PRELIMINARY DESIGN REPORT

City of Hesperia WRP

December 2009

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in association with HDR

Victor Valley Wastewater Reclamation Authority
SBCSA Apple Valley Hesperia Victorville

VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY

HESPERIA AND APPLE VALLEY WATER RECLAMATION PLANTS

CITY OF HESPERIA WRP

PRELIMINARY DESIGN REPORT

FINAL

December 2009

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pw://Carollo/Documents/Client/CA/VVWRA/8229A00/Deliverables/PDR_ESA.doc (Final)

Victor Valley Wastewater Reclamation Authority

CITY OF HESPERIA WRP

PRELIMINARY DESIGN REPORT

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PRELIMINARY DESIGN REPORT

1.0 INTRODUCTION

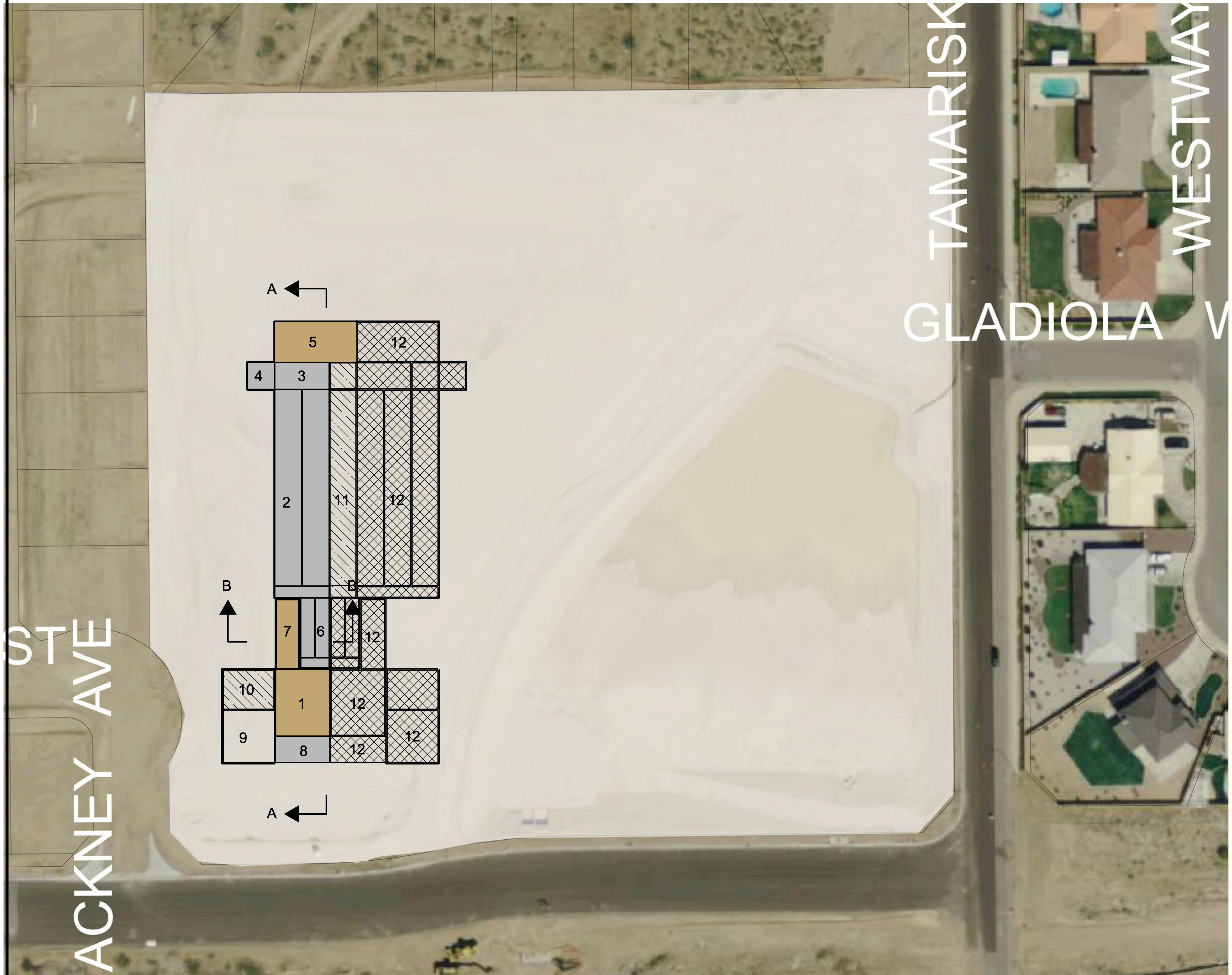
The Victor Valley Wastewater Reclamation Authority (VVWRA) in collaboration with its member agencies, City of Hesperia (Hesperia) and Town of Apple Valley (Apple Valley) has developed a strategic goal of locating subregional Water Reclamation Plants (WRPs) to augment reclaimed water capabilities. These subregional WRPs will be located in Hesperia and Apple Valley and these facilities are the focus of this preliminary design effort.

In order to report the results and conclusions of the preliminary design effort, a series of Design Information Memoranda (DIMs or individually as DIM) were developed. The DIMs, in their entirety, are included under separate tabs within this Preliminary Design Report (PDR). The DIMs discussed in this PDR are as follows.

- DIM No. 1A - Design Flows and Loadings
- DIM No. 2A - Plant Hydraulics
- DIM No. 3A - Process Modeling
- DIM No. 4A - Permitting and Effluent Disposal (forthcoming)
- DIM No. 5A - Preliminary Treatment
- DIM No. 6A - Secondary Treatment
- DIM No. 7A - Disinfection
- DIM No. 8A - Reclaimed Water Pump Station
- DIM No. 9A - Residuals Handling and Disposal
- DIM No. 10A - Site Aesthetics
- DIM No. 11A - Electrical Power and Distribution (forthcoming)
- DIM No. 12A - Instrumentation and Controls (forthcoming)
- DIM No. 13A - Site Layout and Constraints

2.0 BACKGROUND

VVWRA has decided to design and construct scalping plants within the overall wastewater collection system in order to reuse water closer to the end users. The first two scalping plants to be developed under this overall reuse goal are the Hesperia and Apple Valley Water Reclamation Plants (WRP or plural as WRPs). The WRPs will serve as scalping plants in order to deliver a fairly consistent reclaimed water production of 1.0 million gallons per day (mgd). Both WRPs will be designed for expansion to 2.0 mgd, while the Hesperia WRP may be expanded in the future up to 4.0 mgd. The Hesperia WRP will be located on the north side of Mojave Street, just west of Tamarisk Avenue, as shown in Figure ESA-1.



LEGEND

1. HEADWORKS/ MBR FACILITY BUILDING. FLOOR LEVEL: INFLUENT SCREENS, CITRIC ACID/ SODIUM HYPO STORAGE & FEED. LOWER LEVEL: UV SYSTEM & PERMEATE PUMPS
2. BIOLOGICAL BASIN
3. FEED FORWARD PUMP STATION
4. WAS PUMP STATION
5. PROCESS ELECTRICAL/ BLOWER BUILDING
6. SUBMERGED MEMBRANES
7. MBR ELECTRICAL/ BLOWER BUILDING FLOOR LEVEL: ELECTRICAL ROOM LOWER LEVEL: MEMBRANE AIR SCOUR BLOWERS
8. RECLAIMED WATER PUMP STATION
9. BIOFILTER (HEADWORKS ODOR CONTROL)
10. GRIT REMOVAL (FUTURE)
11. AERATION BASIN PHASE 2 EXPANSION (2 MGD)
12. PHASE 3 EXPANSION (4 MGD)

VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

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SITE LAYOUT

FIGURE ESA.1

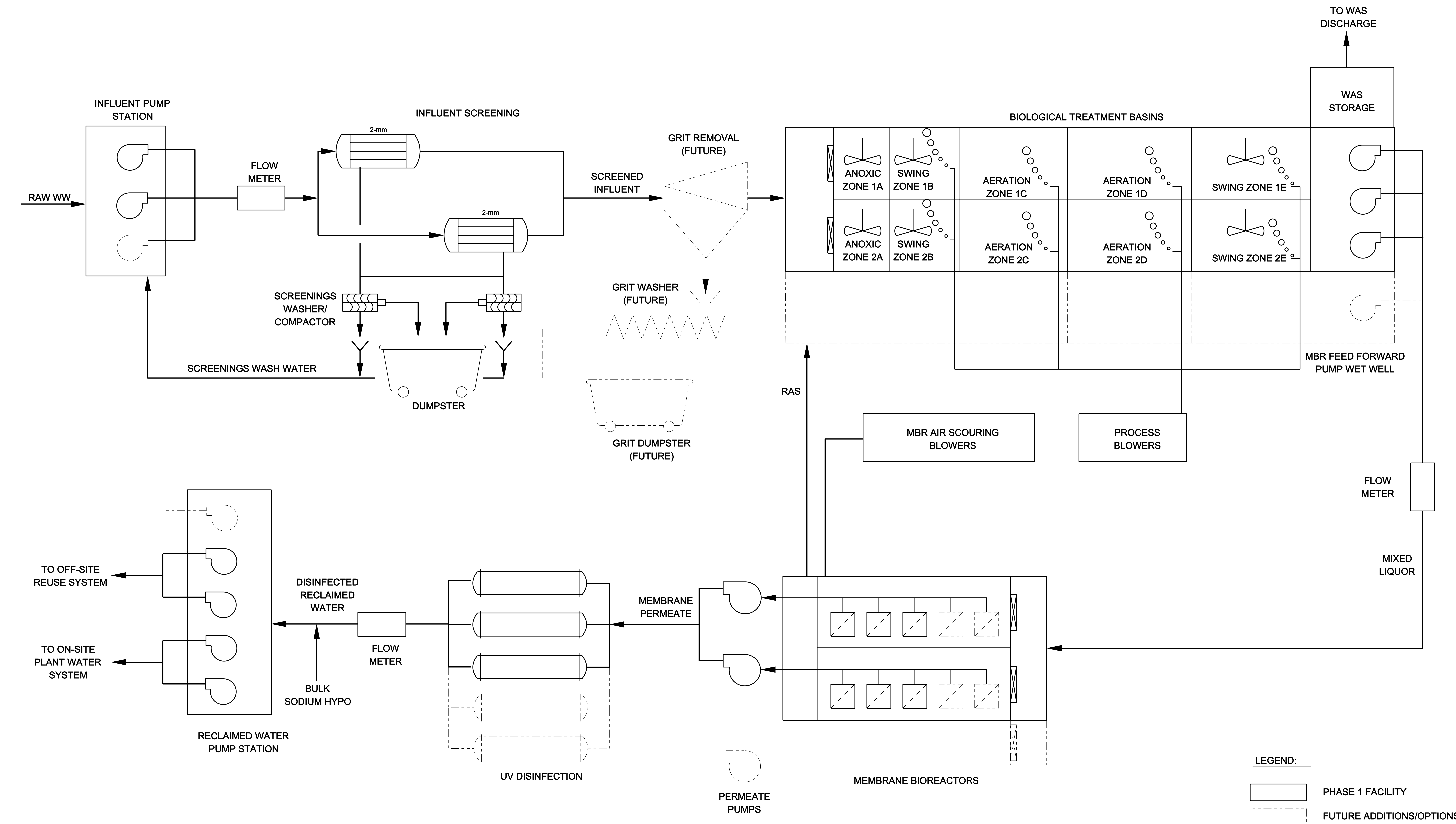
This PDR focuses on the Hesperia PDR with the Apple Valley PDR and the Hesperia Lift Station and Force Main under separate covers.

3.0 TREATMENT PROCESS

The overall process selected for this project is the Membrane Bioreactor approach to treating wastewater and the WRP will be configured as a scalping plant (producing the design flows at all times) designed to meet the Title 22 requirements for reclaimed water. The reclaimed water will be delivered to off-site percolation basins and used for on-site process and site irrigation. The Hesperia WRP will be comprised of the following:

- Influent lift station (discussed in a separate PDR).
- Influent force main (discussed in a separate PDR).
- Screening - 2 mm rotary drum screens.
- Activated sludge process - biological process with flexibility to meet future nitrogen regulations of less then 5 mg/L.
- Membrane filtration - submerged hollow fiber membrane filtration system.
- Ultraviolet disinfection - using low pressure high output closed vessel technology to reduce overall energy consumption.
- Reclaimed water pump station - Deliver water for off-site and on-site uses.
- Waste activated sludge - Pumped to downstream section of adjacent collection system.
- Headworks odor control - In ground non-proprietary biofilter for treating of foul air from the screening area.

A monolithic type of an arrangement was chosen for this project to encourage common wall construction and promote a low visual profile. Conceptual architectural elevations are provided in Figure ESA-3 and sections of the proposed WRP are provided as Figures ESA-4 and ESA-5. The details of the treatment process are provided in the DIMs within this PDR.



VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

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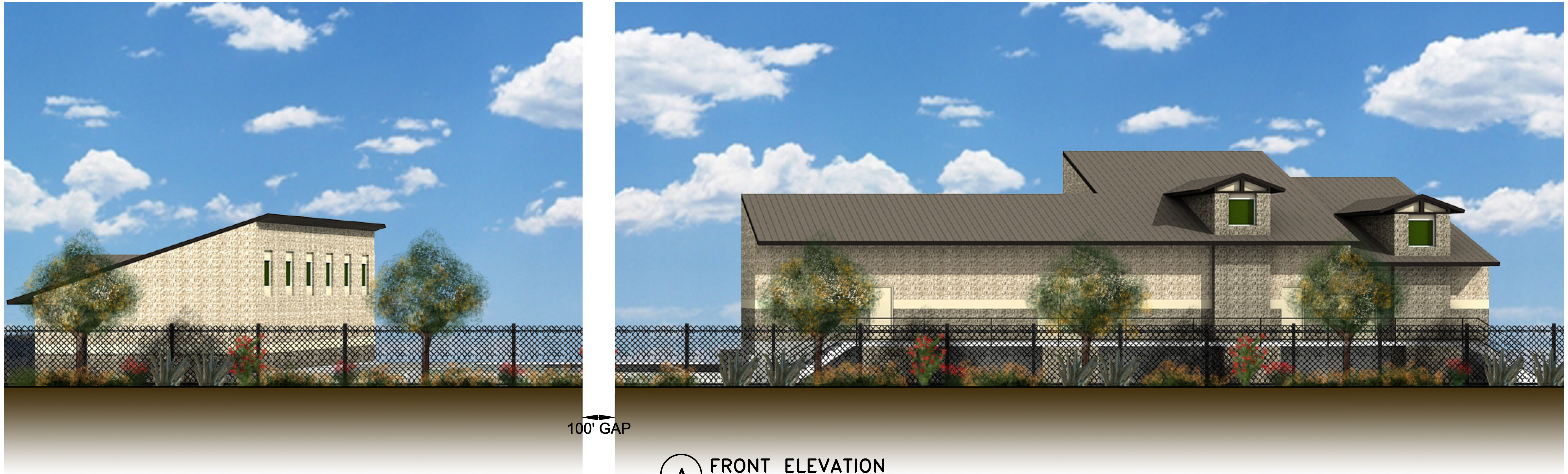
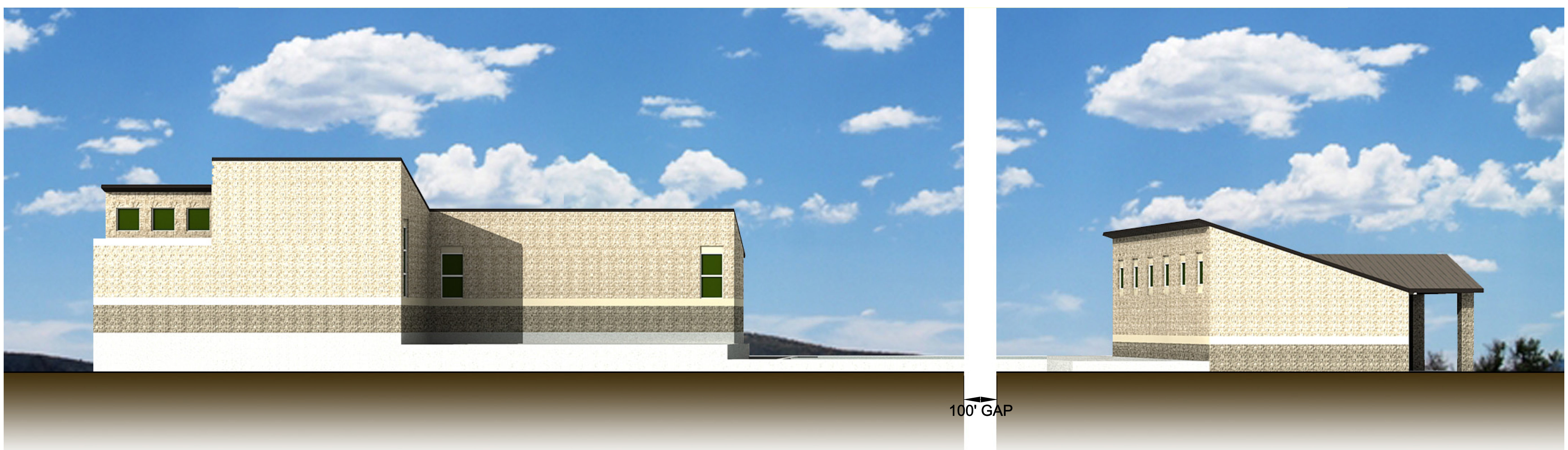
PROCESS FLOW DIAGRAM

FIG ESA-2

VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT



A FRONT ELEVATION
VIEW FROM THE WEST

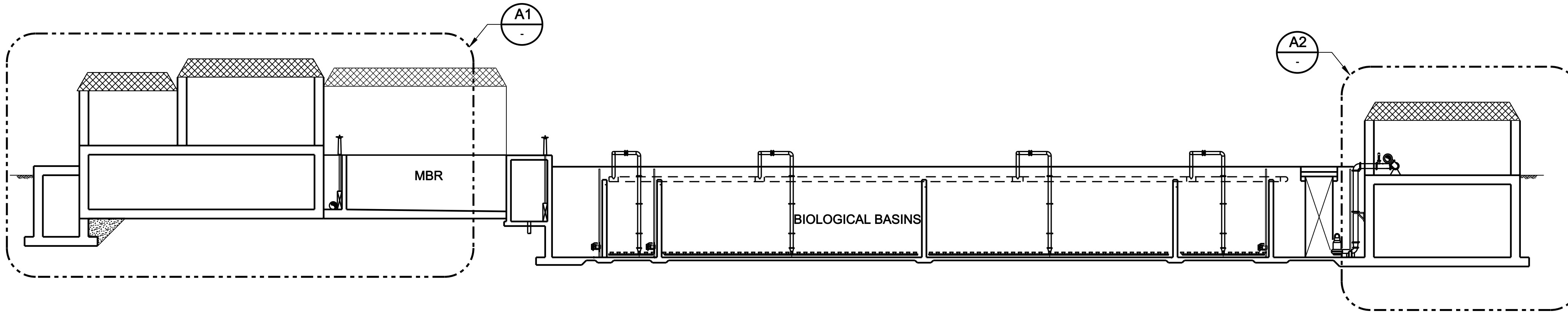


B REAR ELEVATION
VIEW FROM THE EAST

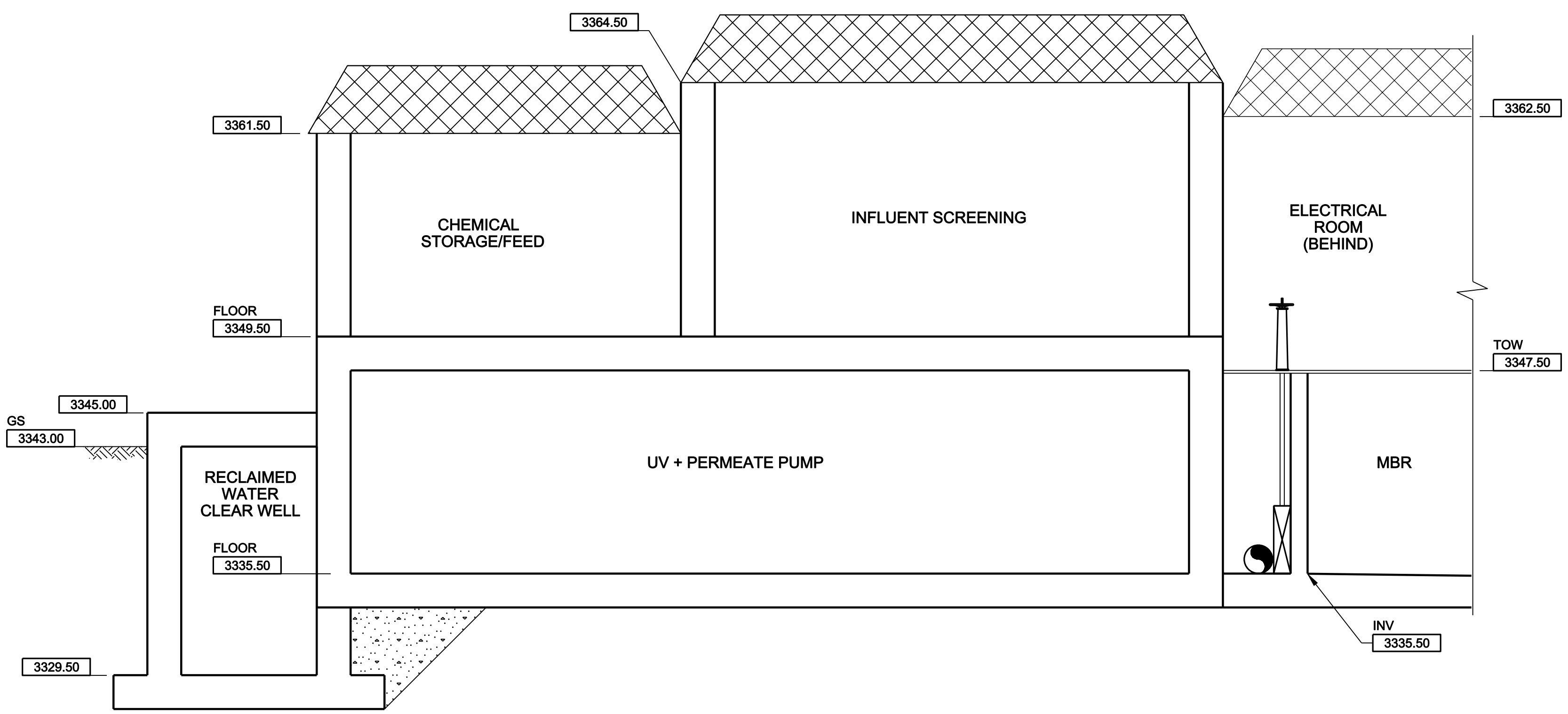
CONCEPTUAL ARCHITECTURAL ELEVATIONS

FIGURE ESA-3

VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT



A SECTION
SCALE: 1/16" = 1'-0"
FILE: 8229A00-SM-0100.dgn
0 2' 4' 6' 12'



A1 SECTION
SCALE: 3/16" = 1'-0"
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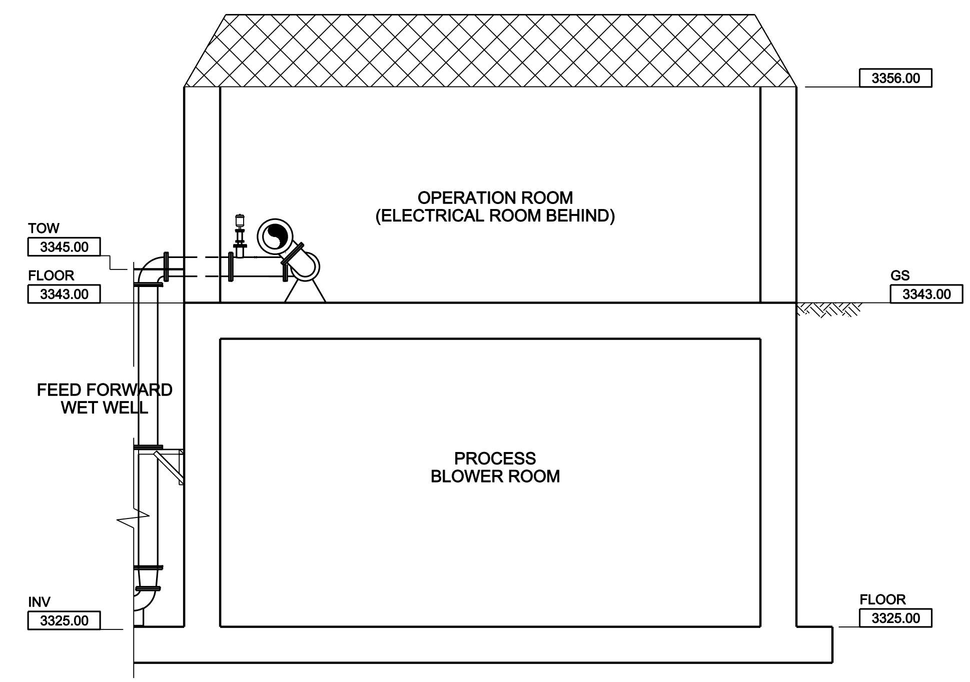
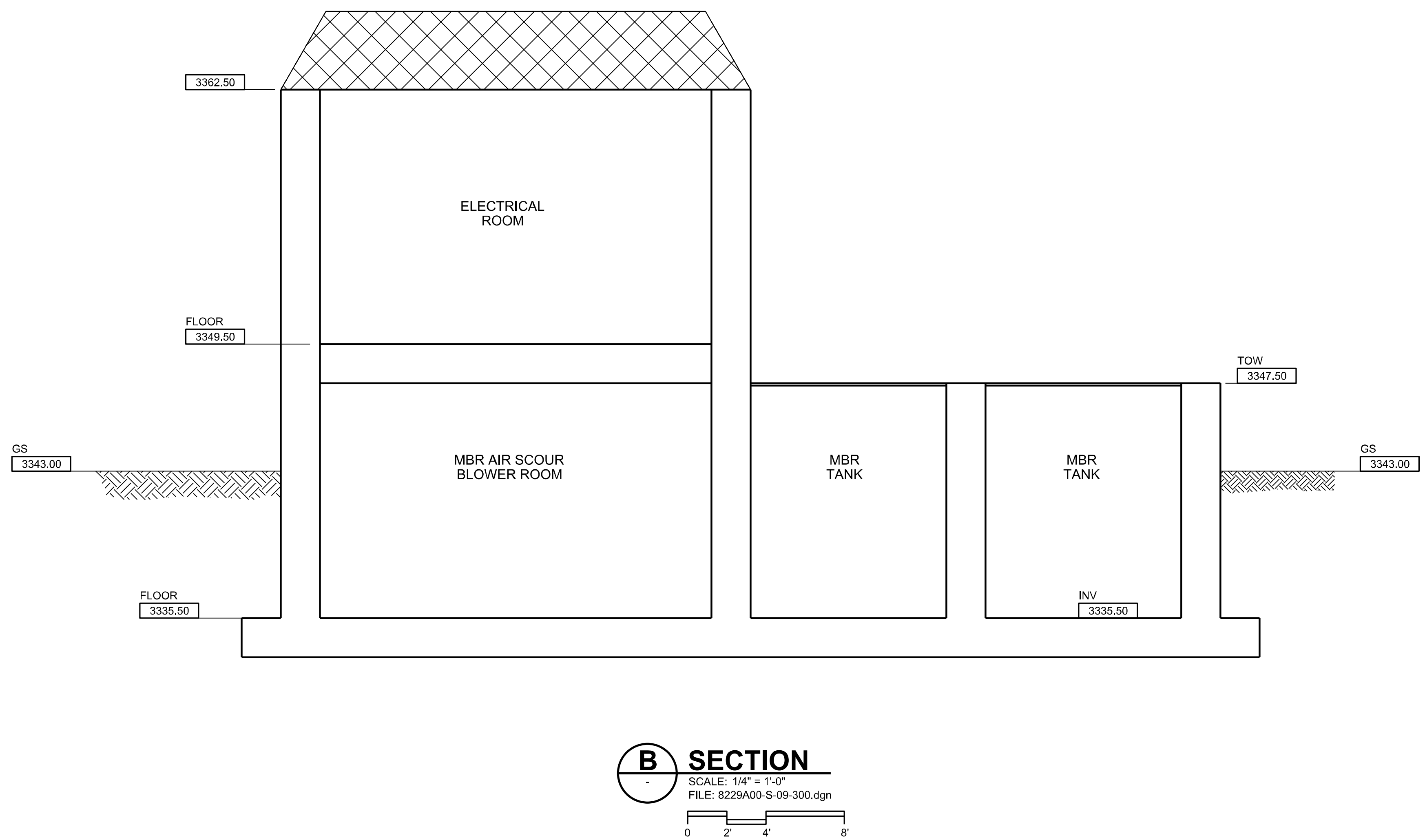


A2 SECTION
SCALE: 3/16" = 1'-0"
FILE: 8229A00-SM-0100.dgn
0 2' 4' 6' 12'

PLANT - SECTION A

FIG ESA-4



VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

PLANT - SECTION B

FIG ESA-5

4.0 BASIS OF DESIGN

The proposed Hesperia WRP basis of design is presented in Table ESA.1.

Table ESA.1 Design Criteria
Hesperia WRP
Victor Valley Wastewater Reclamation Authority, California

Design Parameters	Units	Phase 1	Phase 2
FLOW RATES (1)			
Design Flow	mgd	1.0	2.0
Minimum Flow	mgd	0.2	0.2
INFLUENT WASTEWATER QUALITY (2)			
Total BOD			
Annual Average	mg/L	305	305
Maximum Month	mg/L	468	468
Soluble BOD			
Annual Average	mg/L	130	130
Maximum Month	mg/L	200	200
TSS			
Annual Average	mg/L	355	355
Maximum Month	mg/L	577	577
NH_4-N			
Annual Average	mg/L	21	21
Maximum Month	mg/L	26	26
TKN			
Annual Average	mg/L	31	31
Maximum Month	mg/L	36	36
Alkalinity			
Annual Average	mg/L	200	200
Maximum Month	mg/L	200	200
Temperature (3)			
Annual Average	°C	15	15
Maximum Month	°C	15	15
pH (4)			
Annual Average	--	7.0	7.0
Maximum Month	--	7.0	7.0

Table ESA.1 Design Criteria Hesperia WRP Victor Valley Wastewater Reclamation Authority, California			
Design Parameters	**Units**	**Phase 1**	**Phase 2**
INFLUENT SCREENING			
Screens			
Type of Screen	--	Rotary drum, perforated plate	
Stage of Screening	--	1 stage	
Perforation Diameter	mm	2	
Screen Capacity, each	mgd	2.0	
Number of Screens (duty + standby)	--	1+1	1+1
Screenings Washer/Compactor			
Type of Washer/Compactor	--	Screw press	
Number of Washer/Compactor (duty+ standby)	--	1+1	1+1
Type of Headworks Odor Control System	--	In-ground biofilter	
BIOLOGICAL TREATMENT SYSTEM			
Biological Basins			
Type of Basins	--	Single Pass, multiple zones	
Number of Parallel Trains	--	2	3
Basin Volume, each Train	MG	0.331	0.331
Total Basin Volume	MG	0.662	0.993
Side Water Depth	ft	17 to 19 (5)	
Basin Width (6), each Train	ft	20	
Zone Lengths (6)			
Zone 1 - Anoxic	ft	20	
Zone 2 - Aerobic	ft	45	
Zone 3 - Aerobic	ft	45	
Zone 4 - Swing (Aerobic / Anoxic)	ft	20	
Total Basin Length, each Train	ft	130	
Aeration System			
Type of Diffusers	--	Fine bubble, membrane discs	
Blower Air Requirement	scfm	1,700	4,000
Number of Blowers (Duty + Standby)	--	2+1	4+1
Blower Capacity, each	scfm	1,000	1,000
Firm Blower Capacity, total	scfm	2,000	4,000
Estimated Discharge Pressure (7)	psig	9.4	9.4

Table ESA.1 Design Criteria Hesperia WRP Victor Valley Wastewater Reclamation Authority, California			
Design Parameters	**Units**	**Phase 1**	**Phase 2**
Feed Forward Pumping			
Feed Forward Wet Well Width (6)	ft	20	20
Feed Forward Wet Well Length (6)	ft	40	60
Solids Content	%	0.8 (range between 0.7 and 1.0)	
Pump Type	--	Submersible, Centrifugal, Wet Pit	
Pump Motor Control	--	VFD	
Design Flow	mgd	5.0	10.0
Number of Pumps (Duty + Standby)	--	2+1	3+1
Pump Capacity (Number of Pumps @ Capacity)	gpm	2 @ 2,350 gpm 1 @ 1,100 gpm	4 @ 2,350 gpm
Firm Capacity	mgd	5.0	10.2
Total Capacity	mgd	8.4	13.5
MEMBRANE FILTRATION SYSTEM			
Number of Membrane Trains	--	2	2
Number of Membrane Cassettes per Train	--	3	5
Number of Cassette Spaces per Train	--	5	5
Number of Membrane Modules per Cassette (8)	--	42	42
Total Membrane Area, “n” Condition	sq ft	85,680	142,800
Total Membrane Area, “n-1” Condition	sq ft	42,840	71,400
Design Membrane Flux, “n” Condition	gfd	11.7	14.0
Design Flow, “n” Condition	mgd	1.0	2.0
Design Flow, “n-1” Condition	mgd	0.5	1.0
DISINFECTION SYSTEM			
Maximum Total Suspended Solids	mg/L	5	
Type of UV Reactor	--	Closed-vessel	
Type of UV Lamp	--	LP/HO or MP	
Minimum UV Transmittance	%	65	
Design Dose	mJ/cm^2	88	
Number of UV Units (duty + standby) (9)	--		
LP/HO	--	2+1	3+1 or 4+1
MP	--	4+2	8+2
Type of Cleaning	--	Automatic chemical/mechanical	
End of Lamp Life (9)	--	0.80 – 0.90	

Table ESA.1 Design Criteria Hesperia WRP Victor Valley Wastewater Reclamation Authority, California			
Design Parameters	**Units**	**Phase 1**	**Phase 2**
Lamp Fouling Factor [9]	--	0.80 - 0.90	
RECLAIMED WATER PUMP STATION			
Type of Reclaimed Water Wet Well	--	Concrete clear well	
Type of Reclaimed Water Pump	--	Vertical turbine	
Pump Capacity, each	mgd	1.0	1.0
Number of Reuse Water Pumps (duty + standby)	--	1+1	2+1
Number of Plant Water Pumps (duty + standby)	--	1+1	1+1

Notes:

(1) The sub-regional scalping plant will be designed to produce the design flow at all times.
(2) Values are based on 2007 influent data at the Victor Valley Westside Water Reclamation Plant.
(3) Temperature based on the Westside Water Reclamation Plant Phase III Process Design Summary (HDR, March 1998).
(4) Assumed value.
(5) Normal side water depth is 17 ft, with the ability to operate up to 19 ft during periods of flow equalization.
(6) Inside dimensions
(7) Estimated discharge pressure includes the additional 2 ft of side water depth provided for potential equalization. At 17 ft of SDW, the estimated discharge pressure is 8.5 psig.
(8) Maximum number of modules per cassette is 48.
(9) Number of units, end of lamp life, and lamp fouling factor depend on type of UV lamp and UV manufacturers. See DIM-7A for detail.

5.0 PROJECT COSTS AND SCHEDULE

5.1 Project Costs

The level of accuracy for construction cost estimates varies depending on the level of detail to which the project has been defined. Feasibility studies and master plans represent the lowest level of accuracy, while pre-bid estimates (based on detailed plans and specifications) represent the highest level. The American Association of Cost Engineers International (AACEI) has developed the guidelines in Table 4 for the various types of estimates.

Table ESA.2 AACEI Cost Estimate Classification Matrix for Process Industries
Hesperia WRP
Victor Valley Wastewater Reclamation Authority, California

		Primary Characteristic	**Secondary Characteristic**			
		Level of Project Definition	**End Usage**	**Methodology**	**Expected Accuracy Range**	**Preparation Effort**
ANSI Standard Z94.0	AACE Estimate Class	Expressed as % of complete project definition (engineering)	Typical purpose of the estimate	Typical estimating method	Typical variation in low and high ranges (1)	Typical degree of effort relative to least cost index of 1(2)
Order-of-Magnitude Estimate – 30/+50	Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%	1
Budget Estimate – 15/+30	Class 4	1% to 15%	Study or feasibility	Equipment factored, or parametric models	L: -15% to -30% H: +20% to +50%	2 to 4
	Class 3	10% to 40%	Budget, authorization, or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%	3 to 10
Definitive Estimate – 5/+15	Class 2	30% to 70%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20T	4 to 20
	Class 1	50% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%	5 to 100

Notes:

(1) The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency.

(2) If the cost index value of "1" represents 0.005 percent, then an index value of 100 represents 0.5 percent. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

(3) Table reprinted with the permission of the American Association of Cost Engineers International (AACEI).

A preliminary design level (Class 3) opinion of probable construction costs is provided in this Design Report. The provided costs will be updated at each review submittal stage during detailed design (i.e., Agency Review, and Final Submittals) to reflect the detailed development at these design stages.

An adjustment of the total direct and indirect costs to the anticipated mid-point of construction is also included. The total estimate is based on the Engineering News Record (ENR) Construction Cost Index (CCI) for the 20-Cities Average, as noted in the estimate. The adjustment for mid-point of construction is based on an annual inflation rate of 5% percent compounded to March 2011.

The construction cost summary also includes an engineering contingency of 20 percent of the total direct cost, as indicated on the cost spreadsheets. Contingencies are specific provisions for unforeseeable elements of costs within the defined project scope, and are also included to cover known, but (at this time) undefined requirements for the facilities. Items such as variations in the project configuration developed during the detailed design phase, unforeseen site conditions encountered during construction, and reasonable project changes during construction are part of the contingency.

A summary of the Construction Costs are provided in Table ESA.3. The supporting cost estimate worksheets are provided at the end of the Executive Summary.

Table ESA.3 Opinion of Probable Construction Costs
Hesperia WRP
Victor Valley Wastewater Reclamation Authority, California

Project	Total Construction Cost [(1)] (Millions)
Hesperia WRP	$21.6
Hesperia Lift Station & Force Main	$3.6

Note:

(1) Total construction cost is escalated to the projected mid-point of construction of March 2011.

5.2 Project Schedule

The preliminary project schedule is based upon feedback from VVWRA on the timing of the project and the anticipated construction duration and is presented in Table ESA.4.

Table ESA.4 Project Schedule
Hesperia WRP
Victor Valley Wastewater Reclamation Authority, California

Activity	Duration
Detailed Design [(1)]	9 months
Bidding Phase [(2)]	3 months
Construction Phase [(3)]	18 months
Environmental Impact Report Schedule [(4)]	10 months (March 2010 completion)

Notes:

(1) Detail design starts upon Notice to Proceed.
(2) Bidding phase starts following detail design completion. The time of bidding phase is contingent upon funding.
(3) Construction starts following bidding phase.
(4) Environmental Impact Report starts in May 2009.

PRELIMINARY COST ESTIMATE WORKSHEETS

PROJECT SUMMARY

Project:	**VVWRA/Hesperia/Apple Valley - Preliminary Estimate**	**Estimate Class:**	**3**
Job #:	**8229A.00**	**PIC:**	**J Hagstrom**
Location:	**City of Hesperia, CA**	**PM:**	**A Gilmore**
Zip Code:	**92340**	**Date:**	**11/25/09**
		By:	**Z Liu**
		Reviewed:	**TD 20090728**

NO.	DESCRIPTION		TOTAL
01	GENERAL CONDITION		$2,590,000
02	INFLUENT LIFT STATION		$0
03	SCREENING		$4,554,385
04	AERATION BASIN		$2,651,450
05	MBR		$3,717,186
06	UV		$950,700
07	EFF PS		$283,268
08	SUPPLEMENTAL FACILITY		$54,648
			$0
			$0
			$0
			$0
			$0
			$0
			$0
	TOTAL DIRECT COST		**$14,801,637**
	Contingency	20.0%	$2,960,327
	Subtotal		**$17,761,965**
	General Contractor Overhead, Profit & Risk	10.0%	$1,776,196
	Subtotal		**$19,538,161**
	Escalation to Mid-Point	8.5%	$1,654,224
	Subtotal		**$21,192,385**
	Sales Tax (Based on Apple Valley tax)	8.8%	$927,167
	Subtotal		**$22,119,552**
	Bid Market Allowance	0.0%	$0
	TOTAL ESTIMATED CONSTRUCTION COST		**$22,119,552**
	Engineering, Legal & Administration Fees	10.0%	$2,211,955
	Owner's Reserve for Change Orders	5.0%	$1,105,978
	TOTAL ESTIMATED PROJECT COST		**$25,437,485**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

RECAP MATRIX

Project:VVWRA/Hesperia/Apple Valley - Preliminary Estimate
Job #:8229A.00
Location:City of Hesperia, CA

Estimate Class: 3

Capacity:

Connected HP:

Date : November 25, 2009

By: Z Liu

SPEC. DIVISION/ ELEMENT DESCRIPTION	DIV. 01 GEN REQTS	DIV. 02 SITE WORK	DIV. 03 CONC	DIV. 04 MSNRY	DIV. 05 METALS	DIV. 06 WOOD & Plastics	DIV. 07 MOIST PROTN	DIV. 08 DOORS & WDOS	DIV. 09 FINISHES	DIV. 10 SPECIAL-TIES	DIV. 11 EQUIP	DIV. 12 FURN	DIV. 13 SPECIAL CONST	DIV. 14 CONVEY	DIV. 15 PLUMBG & MECH	DIV. 16 ELECT/ I & C	Div 17 INST. & CONT.	ELEMENT TOTALS	ELEMENT % of Total
01 GENERAL CONDITION	$1,590,000	$1,000,000																$2,590,000	17.50%
02 INFLUENT LIFT STATION																		$0	0.00%
03 SCREENING			$30,353	$38,389	$112,144	$30,000		$20,000	$30,000		$770,000		$2,000,000		$554,000	$554,000	$415,500	$4,554,385	30.77%
04 AERATION BASIN			$829,383	$70,314	$112,144	$30,000		$20,000	$30,000		$752,390		$150,000		$219,073	$219,073	$219,073	$2,651,450	17.91%
05 MBR			$163,261	$115,898	$112,144	$30,000		$20,000	$30,000		$1,908,000		$59,202		$393,440	$491,801	$393,440	$3,717,186	25.11%
06 UV									$30,000		$594,000				$59,400	$148,500	$118,800	$950,700	6.42%
07 EFF PS			$66,484						$30,000		$120,506				$24,101	$24,101	$18,076	$283,268	1.91%
08 SUPPLEMENTAL FACILITY											$36,432				$5,465	$7,286	$5,465	$54,648	0.37%
Total Direct Cost	**1,590,000**	**1,000,000**	**1,089,480**	**224,600**	**336,432**	**90,000**	**0**	**60,000**	**150,000**	**0**	**4,181,328**	**0**	**2,209,202**	**0**	**1,255,480**	**1,444,761**	**1,170,354**	**$14,801,637**	
Percent of Total	**10.74%**	**6.76%**	**7.36%**	**1.52%**	**2.27%**	**0.61%**	**0.00%**	**0.41%**	**1.01%**	**0.00%**	**28.25%**	**0.00%**	**14.93%**	**0.00%**	**8.48%**	**9.76%**	**7.91%**	**100.00%**	

COMMENTS / NOTES

1. Note that the above costs DO NOT include all of the applicable mark-ups for the total construction or project cost. Refer to the SUMMARY for these values.

DETAILED COST ESTIMATE

Project: VVWRA/Hesperia/Apple Valley - Preliminary Estimate
Job #: 8229A.00
Location: City of Hesperia, CA
Element: 01 GENERAL CONDITION

Date : 11/25/09
By : Z Liu
Reviewed: TD 20090728

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 01 - General Conditions					
01000	General Conditions	1.00	LS	$1,590,000.00	$1,590,000.00	
	Total					**$1,590,000**
	Division 02 - Site Construction					
02000	Site Work	1.00	LS	$1,000,000.00	$1,000,000.00	
	Total					**$1,000,000**
	Grand Total					**$2,590,000**

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DETAILED COST ESTIMATE

Project: VVWRA/Hesperia/Apple Valley - Preliminary Estimate
Job #: 8229A.00
Location: City of Hesperia, CA
Element: 03 SCREENING

Date : 11/25/09
By : Z Liu
Reviewed: TD 20090728

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Elevated Slab To 20'	66.67	CY	$455.27	$30,353	
	Total					**$30,353**
	Division 04 - Masonry					
04220	Concrete Block, Split Face 12"	900.00	SF	$18.28	$16,452	
04220	Concrete Block, Split Face 12"	1,200.00	SF	$18.28	$21,936	
	Total					**$38,389**
	Division 05 - Metals					
05000	Metal	1.00	LS	$100,000.00	$100,000.00	
05000	Metal Roofing	1.00	LS	$12,144.00	$12,144.00	
	Total					**$112,144**
	Division 06 - Wood and Plastics					
06000	Wood and Plastics	1.00	LS	$30,000.00	$30,000.00	
	Total					**$30,000**
	Division 08 - Doors and Windows					
08000	Doors and Windows	1.00	LS	$20,000.00	$20,000.00	
	Total					**$20,000**
	Division 09 - Finishes					
09000	Finishes	1.00	LS	$30,000.00	$30,000.00	
	Total					**$30,000**
	Division 11 - Equipment					
11332	Fine Screens	2.00	EA	$256,200.00	$512,400.00	
11333	Screenings Washer/Compactor	2.00	EA	$128,800.00	$257,600.00	
	Total					**$770,000**
	Division 13 - Special Construction					
13329	Biofilter System	1.00	LS	$2,000,000.00	$2,000,000.00	
	Total					**$2,000,000**
	Division 15 - Mechanical					
15000	Plumbing and Mechanical - IFSN	0.20	Perct	$2,770,000.00	$554,000	
	Total					**$554,000**
	Division 16 - Electrical					
16000	Electrical	0.20	Perct	$2,770,000.00	$554,000.00	
	Total					**$554,000**
	Division 17 - Instrumentation and Controls					
17000	Instrumentation and Controls	0.15	Perct	$2,770,000.00	$415,500.00	
	Total					**$415,500**
	Grand Total					**$4,554,385**

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DETAILED COST ESTIMATE

Project: VVWRA/Hesperia/Apple Valley - Preliminary Estimate
Job #: 8229A.00
Location: City of Hesperia, CA
Element: 04 AERATION BASIN

Date : 11/25/09
By : Z Liu
Reviewed: TD 20090728

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Flat Non-Formed S.O.G.	316.67	CY	$274.38	$86,889	
03300	12" Edge Forms, Slab On Grade, Add	190.00	LF	$9.68	$1,839	
03300	18" Straight Wall >8' High	422.22	CY	$720.39	$304,163	
03300	18" Straight Wall >8' High	133.33	CY	$720.39	$96,050	
03300	18" Straight Wall >8' High	211.11	CY	$720.39	$152,081	
03300	18" Straight Wall >8' High	188.89	CY	$720.39	$136,074	
03300	18" Straight Wall >8' High	66.67	CY	$720.39	$48,028	
03300	12" Flat Non-Formed S.O.G.	14.81	CY	$274.38	$4,064	
03300	12" Edge Forms, Slab On Grade, Add	20.00	LF	$9.68	$194	
	Total					**$829,383**
	Division 04 - Masonry					
04220	Concrete Block, Split Face 12"	1,740.00	SF	$18.28	$31,808	
04220	Concrete Block, Split Face 12"	1,740.00	SF	$18.28	$31,808	
04220	Standard Concrete Block, 12"	390.00	SF	$17.17	$6,698	
	Total					**$70,314**
	Division 05 - Metals					
05000	Metal	1.00	LS	$100,000.00	$100,000.00	
05000	Metal Roofing	1.00	LS	$12,144.00	$12,144	
	Total					**$112,144**
	Division 06 - Wood and Plastics					
06000	Wood and Plastics	1.00	LS	$30,000.00	$30,000.00	
	Total					**$30,000**
	Division 08 - Doors and Windows					
08000	Doors and Windows	1.00	LS	$20,000.00	$20,000.00	
	Total					**$20,000**
	Division 09 - Finishes					
09000	Finishes	1.00	LS	$30,000.00	$30,000.00	
	Total					**$30,000**
	Division 11 - Equipment					
11293	Slide Gate, 36" X 36"	2.00	EA	$13,048.23	$26,096	
11293	Slide Gate, 48" X 48"	2.00	EA	$16,385.65	$32,771	
11312	10Hp Submersible Sump Pump	2.00	EA	$22,536.47	$45,073	
11312	15Hp Submersible Sump Pump	1.00	EA	$32,656.47	$32,656	
11312	30Hp Submersible Sump Pump	2.00	EA	$42,776.47	$85,553	
11317	Submersible Mixers - High Speed	6.00	EA	$16,698.00	$100,188.00	
11376	Rotary Positive Displacement Blower	4.00	EA	$51,600.00	$206,400.00	
11378	Membrane Disk Fine Bubble Diffused Aeration System	1.00	LS	$223,651.99	$223,651.99	
	Total					**$752,390**
	Division 13 - Special Construction					
13000	Aluminum Aeration Basin Cover	1.00	LS	$150,000.00	$150,000.00	
	Total					**$150,000**
	Division 15 - Mechanical					
15000	Plumbing and Mechanical - AB	0.25	Perct	$876,293.62	$219,073.40	
	Total					**$219,073**
	Division 16 - Electrical					
16000	Electrical	0.25	Perct	$876,293.62	$219,073.40	
	Total					**$219,073**
	Division 17 - Instrumentation and Controls					
17000	Instrumentation and Controls	0.25	Perct	$876,293.62	$219,073.40	
	Total					**$219,073**
	Grand Total					**$2,651,451**

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DETAILED COST ESTIMATE

Project: VVWRA/Hesperia/Apple Valley - Preliminary Estimate
Job #: 8229A.00 — **Date :** 11/25/09
Location: City of Hesperia, CA — **By :** Z Liu
Element: 05 MBR — **Reviewed:** TD 20090728

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	12" Flat Non-Formed S.O.G.	74.07	CY	$274.38	$20,324	
03300	12" Edge Forms, Slab On Grade, Add	50.00	LF	$9.68	$484	
03300	18" Straight Wall >8' High	53.33	CY	$720.39	$38,418	
03300	18" Straight Wall >8' High	23.33	CY	$720.39	$16,807	
03300	18" Straight Wall >8' High	26.67	CY	$720.39	$19,213	
03300	12" Sloped Slab On Grade (To 30%)	29.63	CY	$399.98	$11,851	
03300	12" Sloped S.O.G. Edge Forms (To 30%), Add	40.00	LF	$10.88	$435	
03300	12" Elevated Slab To 20'	74.07	CY	$455.27	$33,722	
03300	12" Flat Non-Formed S.O.G.	29.63	CY	$274.38	$8,130	
03300	12" Edge Forms, Slab On Grade, Add	40.00	LF	$9.68	$387	
03300	12" Elevated Slab To 20'	29.63	CY	$455.27	$13,490	
	Total					**$163,261**
	Division 04 - Masonry					
04220	Concrete Block, Split Face 12"	1,040.00	SF	$18.28	$19,012	
04220	Concrete Block, Split Face 12"	280.00	SF	$18.28	$5,119	
04220	Concrete Block, Split Face 12"	1,560.00	SF	$18.28	$28,517	
04220	Concrete Block, Split Face 12"	520.00	SF	$18.28	$9,506	
04220	Concrete Block, Split Face 12"	640.00	SF	$18.28	$11,699	
04220	Concrete Block, Split Face 12"	1,000.00	SF	$18.28	$18,280	
04220	Concrete Block, Split Face 12"	1,000.00	SF	$18.28	$18,280	
04220	Concrete Block, Split Face 12"	300.00	SF	$18.28	$5,484	
	Total					**$115,897**
	Division 05 - Metals					
05000	Metal	1.00	LS	$100,000.00	$100,000.00	
05000	Metal Roofing	1.00	LS	$12,144.00	$12,144	
	Total					**$112,144**
	Division 06 - Wood and Plastics					
06000	Wood and Plastics	1.00	LS	$30,000.00	$30,000.00	
	Total					**$30,000**
	Division 08 - Doors and Windows					
08000	Doors and Windows	1.00	LS	$20,000.00	$20,000.00	
	Total					**$20,000**
	Division 09 - Finishes					
09000	Finishes	1.00	LS	$30,000.00	$30,000.00	
	Total					**$30,000**
	Division 11 - Equipment					
11500	Membrane Equipment System (Loose Ship)	1.00	LS	$1,908,000.00	$1,908,000.00	
	Total					**$1,908,000**
	Division 13 - Special Construction					
13209	Back Pulse Tank	1.00	LS	$59,202.00	$59,202.00	
	Total					**$59,202**
	Division 15 - Mechanical					
15000	Plumbing and Mechanical - MBR	0.20	Perct	$1,967,202.00	$393,440.40	
	Total					**$393,440**
	Division 16 - Electrical					
16000	Electrical	0.25	Perct	$1,967,202.00	$491,800.50	
	Total					**$491,800**
	Division 17 - Instrumentation and Controls					
17000	Instrumentation and Controls	0.20	Perct	$1,967,202.00	$393,440.40	
	Total					**$393,440**
	Grand Total					**$3,717,186**

DETAILED COST ESTIMATE

Project: VVWRA/Hesperia/Apple Valley - Preliminary Estimate
Job #: 8229A.00
Location: City of Hesperia, CA
Element: 06 UV

Date : 11/25/09
By : Z Liu
Reviewed: TD 20090728

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 09 - Finishes					
09000	Finishes	1.00	LS	$30,000.00	$30,000.00	
	Total					**$30,000**
	Division 11 - Equipment					
11287	UV Disinfection System	1.00	LS	$594,000.00	$594,000.00	
	Total					**$594,000**
	Division 15 - Mechanical					
15000	Plumbing and Mechanical - UV	0.10	Perct	$594,000.00	$59,400.00	
	Total					**$59,400**
	Division 16 - Electrical					
16000	Electrical	0.25	Perct	$594,000.00	$148,500.00	
	Total					**$148,500**
	Division 17 - Instrumentation and Controls					
17000	Instrumentation and Controls	0.20	Perct	$594,000.00	$118,800.00	
	Total					**$118,800**
	Grand Total					**$950,700**

DETAILED COST ESTIMATE

Project: VVWRA/Hesperia/Apple Valley - Preliminary Estimate
Job #: 8229A.00
Location: City of Hesperia, CA
Element: 07 EFF PS

Date : 11/25/09
By : Z Liu
Reviewed: TD 20090728

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03300	18" Straight Wall >8' High	68.89	CY	$720.39	$49,628	
03300	12" Flat Non-Formed S.O.G.	14.81	CY	$274.38	$4,064	
03300	12" Edge Forms, Slab On Grade, Add	40.00	LF	$9.68	$387	
03300	18" Straight Wall >8' High	17.22	CY	$720.39	$12,405	
	Total					**$66,484**
	Division 09 - Finishes					
09000	Finishes	1.00	LS	$30,000.00	$30,000.00	
	Total					**$30,000**
	Division 11 - Equipment					
11312	20Hp Vertical Turbine Pump	2.00	EA	$32,656.47	$65,313	
11312	10Hp Vertical Turbine Pump	2.00	EA	$27,596.47	$55,193	
	Total					**$120,506**
	Division 15 - Mechanical					
15000	Plumbing and Mechanical - EPS	0.20	Perct	$120,505.87	$24,101.17	
	Total					**$24,101**
	Division 16 - Electrical					
16000	Electrical	0.20	Perct	$120,505.87	$24,101.17	
	Total					**$24,101**
	Division 17 - Instrumentation and Controls					
17000	Instrumentation and Controls	0.15	Perct	$120,505.87	$18,075.88	
	Total					**$18,076**
	Grand Total					**$283,268**

DETAILED COST ESTIMATE

Project: VVWRA/Hesperia/Apple Valley - Preliminary Estimate
Job #: 8229A.00
Location: City of Hesperia, CA
Element: 08 SUPPLEMENTAL FACILITY

Date : 11/25/09
By : Z Liu
Reviewed: TD 20090728

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 11 - Equipment					
11242	Bulk Sodium Hypochlorite Pumps	4.00	EA	$9,108.00	$36,432.00	
	Total					**$36,432**
	Division 15 - Mechanical					
15000	Plumbing and Mechanical - SF	0.15	Perct	$36,432.00	$5,464.80	
	Total					**$5,465**
	Division 16 - Electrical					
16000	Electrical	0.20	Perct	$36,432.00	$7,286.40	
	Total					**$7,286**
	Division 17 - Instrumentation and Controls					
17000	Instrumentation and Controls	0.15	Perct	$36,432.00	$5,464.80	
	Total					**$5,465**
	Grand Total					**$54,648**

DESIGN INFORMATION MEMORANDUM NO. 1A

DESIGN FLOWS AND LOADINGS

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

The purpose of this Design Information Memorandum (DIM) No. 1A is to define the design influent flows and loadings and effluent quality criteria for the Hesperia Water Reclamation Plant (WRP). The criteria presented in this DIM No. 1A serves as the basis for the design of the treatment process and facilities of the Hesperia WRP.

DESIGN FLOW QUANTITIES

The Hesperia WRP will be a sub-regional scalping facility to treat a portion of wastewater from its local collection system. The WRP will be designed to treat plant throughput capacities of 1.0 million gallons per day (mgd) in Phase 1, expandable to 2.0 mgd in Phase 2, and 4.0 mgd at buildout. No further expansions beyond 4.0 mgd are anticipated at the Hesperia WRP site.

The plant will be designed to produce the design flow at all times. If the flow in the interceptor is always greater than the design flow, the WRP will bypass flows above the design flows. However, flow equalization may be required in order to maintain reclaimed water production at the design flow at times when flows in the interceptor are smaller than the design flow of 1.0 mgd for Phase 1.

Diurnal Flow Analysis

An analysis of the diurnal flow profile for the Hesperia collection system was conducted in order to evaluate whether the raw wastewater flow in the interceptor would allow a consistent reclaimed water production flow of 1.0 mgd in Phase 1, and evaluate the need for flow equalization in the treatment process trains.

Two scenarios were considered in the analysis of the diurnal flows for the Hesperia WRP. The first scenario was based on an average day flow of 2.3 mgd, which is the predicted average day flow at plant startup in the year 2012 as reported in the City of Hesperia Wastewater Master Plan (Carollo Engineers, 2008). The second scenario was based on an average day flow of 1.0 mgd, based on historical and anecdotal information, and represents the minimum influent average day flow at which an average reclaimed water production of 1.0 mgd can be maintained.

The diurnal flow profile for this analysis was estimated by averaging normalized flow profiles at different points in the Hesperia collection system. The normalized flow profiles were based on a flow monitoring study performed as part of the City of Hesperia Wastewater Master Plan (Carollo Engineers, 2008). The average normalized diurnal profile was used to generate diurnal flow profiles for the two scenarios described above, at 1.0 mgd and at 2.3 mgd average day flows.

Diurnal profiles are presented in Figure 1A.1. For the two scenarios evaluated, there are periods of the day when the flow in the interceptor would be less than the design flow of 1.0 mgd in Phase 1. Equalization volume and pumping capacity need to be provided in order to consistently produce the required reclaimed water flow of 1.0 mgd under Phase 1. At an average day flow of 2.3 mgd, the estimated equalization volume required is 9,241 gallons. At an average day flow of 1.0 mgd, the estimated equalization volume required is 144,740 gallons. Equalization strategies are discussed further in DIM No. 6A, and the implications on influent pumping are discussed in DIM No. 1C.

INFLUENT FLOW CHARACTERISTICS

The influent wastewater quality characteristics define the constituent loadings to the Hesperia WRP. The influent wastewater design criteria characteristics include total biochemical oxygen demand (BOD), soluble BOD, total suspended solids (TSS), ammonium-nitrogen (NH_4-N), total kjeldahl nitrogen (TKN), alkalinity, and temperature.

Review of Existing Wastewater Quality Data

Wastewater quality data was received for review and analysis. Wastewater samples are regularly collected at the Hesperia Metering Station. The sampling point is located at the point of discharge to the VVWRA interceptor going to the Westside WRP. Therefore, the data is inclusive of all contributions (domestic, commercial, industrial) in each City.

Daily composite samples at the Metering Station are collected once every month, and analyzed for various constituents including Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), and ammonia (NH_3-N), among others. Data between July 2005 and August 2009 was made available for analysis.

Appendix 1A includes a detailed summary of the historical data reviewed for this analysis, including basic statistics and charts for the different constituents relevant for the design of the wastewater treatment process.

A summary of wastewater quality design criteria for the Westside WRP was also received for analysis. The design wastewater characteristics for the Westside WRP are based on 2007 plant data, and include annual average day and maximum month average day constituent concentrations.

Table 1A.1 shows a comparison between the average constituent concentrations for the Westside WRP and Hesperia Metering Station. COD, BOD, and TSS average concentrations for Hesperia are based on data between July 2005 and August 2009. Ammonia averages for Hesperia are based on data between September 2007 and August 2009. Ammonia values between July 2005 and September 2006 were not used in the calculation of the averages because the values are believed to be overestimated due to inaccuracies of the chemical analysis method used during that timeframe, based on discussions with VVWRA laboratory staff. After close review of the data, ammonia values between October 2006 and August 2007 were also excluded from the overall averages, due to the marked difference between values before and after August 2007.

Constituent concentrations at Hesperia are higher than the wastewater characteristics at the Westside WRP. Reasons for these differences are attributed to the relatively higher contributions of commercial and industrial discharges in Hesperia.

Based on the most recent wastewater master plan (Carollo Engineers, July 2008), Hesperia's commercial and industrial flows for 2005 were 34 percent of the total flow. However, the area tributary to the specific Hesperia WRP site includes a higher commercial/industrial contribution than the entire City. This is due to a commercial/industrial corridor located along the freeway (I-15). Based on information in the wastewater master plan, the commercial/industrial flow contribution for the proposed WRP's service area is approximately 50 percent.

BOD concentrations are trending down for Hesperia. However, it should be noted that the specific tributary area for the proposed WRP location includes a higher commercial/industrial contribution than what is reflected in the historical data reviewed herein. TSS and ammonia are also trending up over time.

**Table 1A.1 Comparison of Average Influent Wastewater Quality Characteristics
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California**

Constituent	Unit	Westside WRP (1)	Hesperia (2)
Total COD	mg/L	-	990
Total BOD	mg/L	305	461
Soluble BOD	mg/L	130	-
TSS	mg/L	355	439
NH_3-N (3)	mg/L	21	29.3
TKN	mg/L	31	-
Alkalinity	mg/L	200	-
Temperature (4)	°C	15 - 28	-

Notes:

(1) Values are based on 2007 influent data at the Victor Valley Westside WRP.

(2) Values based on 2005 – 2009 historical data at the Hesperia Metering Station. One sample per month is reported.

(3) Values based on historical data between September 2007 and August 2009.

(4) Temperature based on the Westside WRP Phase III Process Design Summary (HDR, March 2008).

Design Influent Wastewater Characteristics

Table 1A.2 summarizes the design wastewater characteristics for the Hesperia WRP. The proposed design influent wastewater characteristics are based on the historical wastewater quality information for Hesperia, discussed in the previous section.

The Hesperia WRP is designed as a scalping facility, and a maximum month flow (hydraulic) peaking factor has not been considered in the design. However, constituent loadings are expected to vary throughout the year. Increased constituent loadings result in maximum month loading conditions, which are further referred to as MMADF conditions throughout this report.

The maximum month load peaking factors for BOD, TSS, and TKN are 1.5, 1.5, and 1.3, respectively. The design maximum month peaking factors for constituent concentrations are based on the wastewater quality criteria used at the Westside WRP. Because only one sample per month is reported for the Hesperia Metering Station, a maximum month peaking factor could not be calculated from the historical data.

It is recommended that once the Hesperia WRP is constructed and operating, regular influent sampling be conducted to verify the design values, and to establish a long-term history of influent wastewater characteristics for future expansions.

Table 1A.2 Design Influent Wastewater Quality Characteristics
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Constituent	Unit	Annual Average	Maximum Month(1)
Total COD	mg/L	990	1,485
Total BOD	mg/L	461	691
Soluble BOD (2)	mg/L	198	297
TSS	mg/L	439	659
NH_3-N	mg/L	29.3	38.1
TKN (3)	mg/L	43.3	56.3
Alkalinity (4)	mg/L	200	200
Temperature (5)	°C	15	15
pH (5)	--	7.0	7.0

Notes:
(1) Maximum month peaking factors of 1.5 (BOD, COD, TSS) and 1.3 (TKN, NH_4-N) based on 2007 influent data at the Victor Valley Westside WRP.
(2) Soluble BOD fraction of 43% based on 2007 influent data at the Victor Valley Westside WRP.
(3) TKN based on ammonia to TKN ratio for the 2007 influent data at the Victor Valley Westside WRP.
(4) Based on 2007 influent data at the Victor Valley Westside WRP.
(5) Temperature based on the Westside WRP Phase III Process Design Summary (HDR, March 1998).

EFFLUENT QUALITY GOALS

Anticipated effluent quality are based on VVWRA Request for Proposal Attachment A - Effluent Limitations and Discharge Specifications, California Department of Public Health Title 22 Code of Regulations, Water Recycling Criteria, and August 5, 2008 Draft Regulation for Groundwater Recharge Reuse. Table 1A.3 lists effluent quality criteria based on different regulations, along with the recommended effluent quality design criteria.

Table 1A.3 Reclaimed Water Quality Standards and Recommended Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Parameter	VVWRA RFP Attachment A Effluent Limit	Title 22 Water Recycling Criteria	Draft Regulation for Groundwater Recharge Reuse	Recommended Effluent Design Criteria
pH	6.5 - 8.5	--	--	6.5 - 8.5
BOD_5 (mg/L)		--	--	
Avg. Monthly	10			10
Avg. Weekly	15			15
Max. Daily	30			30

Table 1A.3 Reclaimed Water Quality Standards and Recommended Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Parameter	VVWRA RFP Attachment A Effluent Limit	Title 22 Water Recycling Criteria	Draft Regulation for Groundwater Recharge Reuse	Recommended Effluent Design Criteria
TSS (mg/L)		--	--	
Avg. Monthly	10			10
Avg. Weekly	15			15
Max. Daily	30			30
Total N (mg/L)	--	--	5	8 / 4 (1)
Turbidity (NTU)	--		--	
24-hr 5% of time sample max.		0.2		0.2
Any time max.		0.5		0.5
Total Coliform (CFU/100 mL)	--		--	
7-day median max.		2.2		2.2
30-day one sample max.		23		23
Single sample max. any time		240		240

Note:
(1) Biological process will be designed to treat to a goal of 8 mg/L, with the flexibility to meet future end use limits at a goal of 4 mg/L (80 percent of maximum limits of 10 and 5 mg/L, respectively).

SUMMARY AND RECOMMENDATIONS

It is recommended that influent wastewater quality values based on historical data at the Hesperia Metering Station be used to design the facilities of the Hesperia WRP. Once the WRP is constructed and operating, it is recommended that regular influent sampling be conducted to verify the design values, and establish values for future expansions.

The recommended effluent quality goals comply with applicable regulations for water reuse in California. We recommend designing the biological treatment system to initially comply with a maximum Total Nitrogen (TN) limit of 10 mg/L, with provisions to meet a TN limit of 5 mg/L with minimal process modifications. Using a recommended 20 percent safety factor, the biological process will be designed to 80 percent of the maximum limits, resulting in a near-term effluent design criteria of 8 mg/L, with provisions to meet 4 mg/L in the future with minimal process modifications.

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ESTIMATED DIURNAL FLOW PROFILES

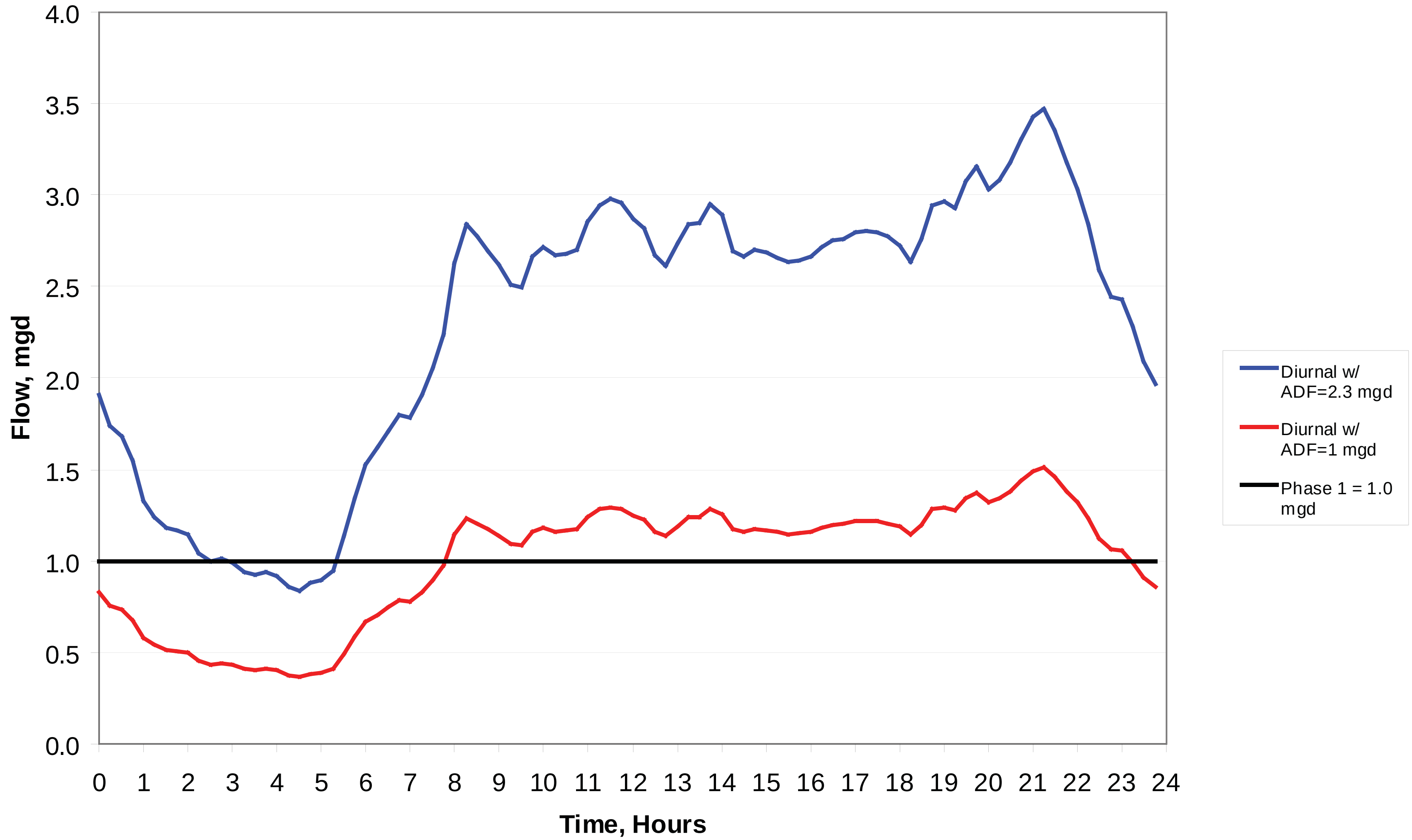


FIG 1A.1

carollo HDR

VICTOR VALLEY WATER RECLAMATION AUTHORITY - HESPERIA WRP - PRELIMINARY DESIGN REPORT

APPENDIX 1A

Wastewater Characteristics from VVWRA Metering Station

HESPERIA

Victor Valley Water Reclamation Authority
Hesperia and Apple Valley Scalping WRPs
Project No: 8229A.00

Hesperia

Wastewater Characteristics from VVWRA Metering Station
All samples are 24 hr. composite samples unless noted otherwise.

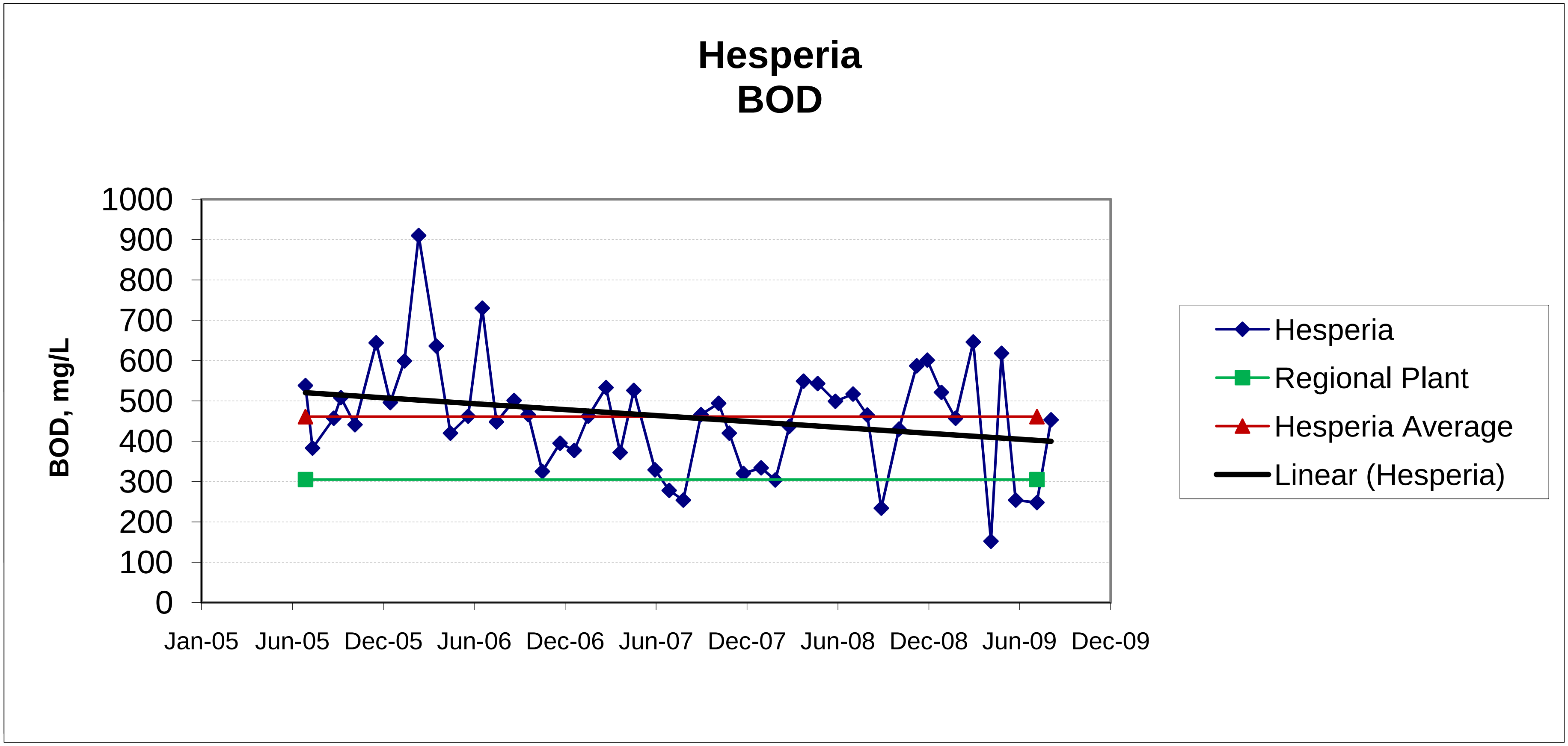
Parameter Date	pH	NH3-N mg/L	BOD mg/L	TSS mg/L	TDS mg/L	COD mg/L	Conductivity µS/cm	Zinc µg/L	COD/BOD
07/26/05	7.18	50	538	408	419	1223			2.27
08/09/05	7.37	45	383	353	278	855			2.23
09/20/05	7.28	51.9	457	440	332	1189			2.60
10/04/05	7.11	51.2	508	432	471	937			1.84
11/01/05	7.4	48.5	441	487	508	1137			2.58
12/13/05	7.41	53.3	644	476	314	1168			1.81
01/10/06	7.27	51	496	331	357	943			1.90
02/07/06	7.33	53.9	599	358	535	1071			1.79
03/07/06	7.24	55.8	910	506	346	1516			1.67
04/11/06	7.26	54.8	636	393	382	1129			1.78
05/09/06	7.06	52.1	420	283	455	790			1.88
06/13/06	7.15	42.9	462	278	547	907			1.96
07/11/06	7.04	45.6	730	337	234	1132			1.55
08/08/06	7.23	40.6	448	306	338	820			1.83
09/12/06	7.18	49	501	331	490	895			1.79
10/10/06	7.11	18.1	466	276	461	823			1.77
11/07/06	7.05	21	325	326	373	953			2.93
12/12/06	7.36	22.1	395	436	367	845			2.14
01/09/07	7.39	21.2	377	530	385	746			1.98
02/06/07	7.38	19.5	462	348	384	773			1.67
03/13/07	7.21	21	533	560	490	1053			1.98
04/10/07	7.29	24.4	372	412	420	789			2.12
05/07/07	7.27	23.7	526	348	424	1003			1.91
06/18/07	7.33	19.5	329	248	424	780			2.37
07/16/07	7.47	17	278	264	494	647			2.33
08/13/07	7.43	18.8	254	102	510	575			2.26
09/17/07	7.4	28.2	466	594	394	1221			2.62
10/22/07	7.45	29.7	494	530	542	1030			2.09
11/12/07	7.28	29.9	420	616	788	1138			2.71
12/10/07	7.39	28.2	320	320	430	786			2.46
01/14/08	7.43	26.5	334	618	524	949	732		2.84
02/11/08	7.38	28.7	304	332	546	806	734		2.65
03/10/08	7.26	30.9	437	532	500	1050	731		2.40
04/07/08	7.21	30.9	549	626	362	1162	728		2.12
05/05/08	7.29	28.4	543	806	404	1508	697		2.78
06/09/08	7.3	26.8	499	540	408	1097	690		2.20
07/14/08	7.38	28.1	517	712	318	1158	709		2.24
08/11/08	7.3	26.8	465	416	444	872	675		1.88
09/08/08	7.4	26.2	234	282	326	599	669		2.56
10/13/08	7.3	24	430	400	380	1075	655		2.50
11/17/08	7.26	29	587	746	400	1339	697		2.28
12/08/08	7.26	27.5	601	820	380	1299	695		2.16
01/05/09	7.21	30.3	521	650	368	1334	754		2.56
02/02/09	7.28	28	457	432	406	1008	753		2.21
03/09/09	7.1	29.4	646	646	360	1368	703		2.12
04/13/09	7.19	31.4	152	62	370	440	703		2.89
05/04/09	7.11	34.6	618	860	510	1480	739	290	2.39
06/01/09	7.28	30.3	254	254	332	589	710		2.32
07/13/09	7.3	27.9	248	192	400	544	692		2.19
08/10/09	7.24	42	453	418	698	940	813		2.08

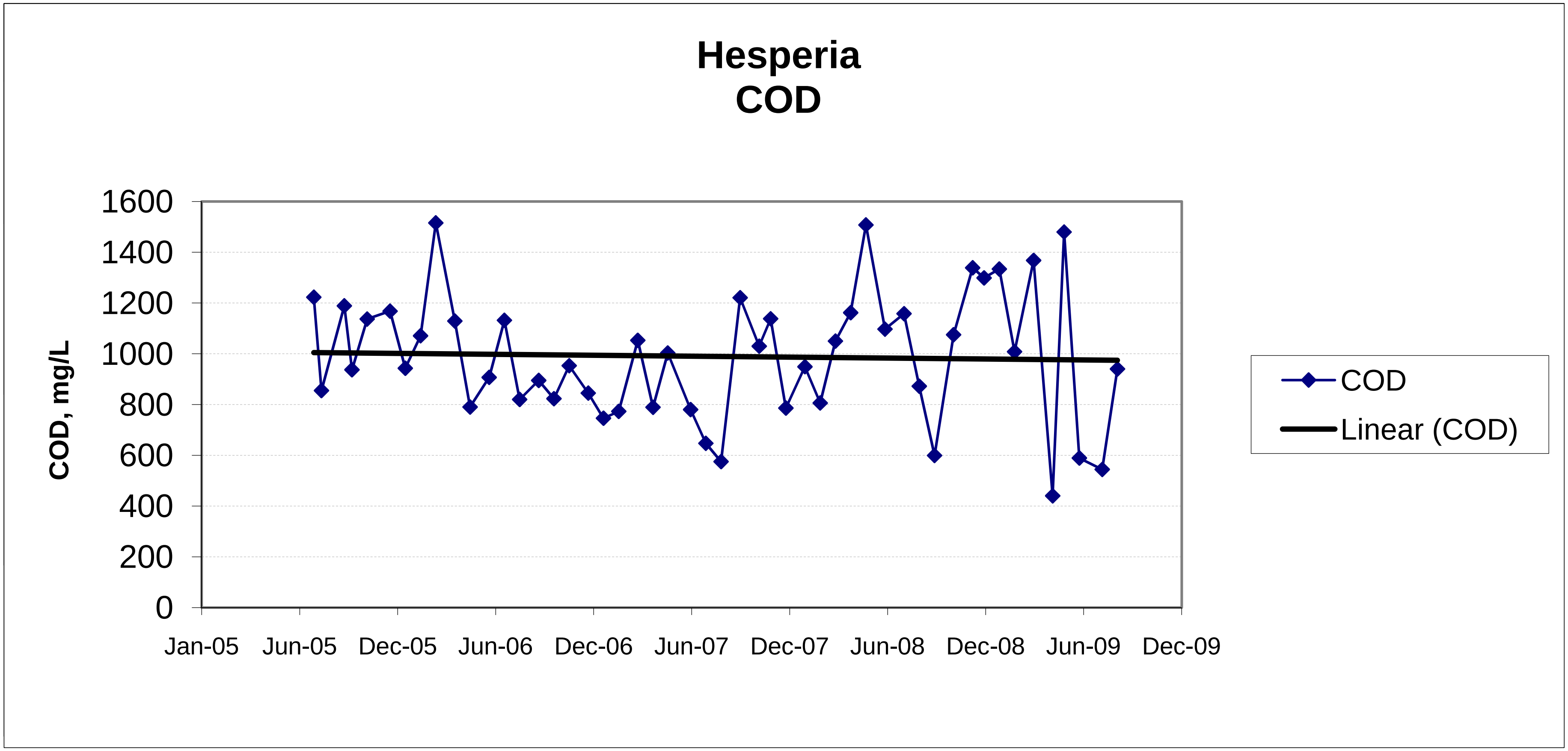
Victor Valley Water Reclamation Authority
Hesperia and Apple Valley Scalping WRPs
Project No: 8229A.00

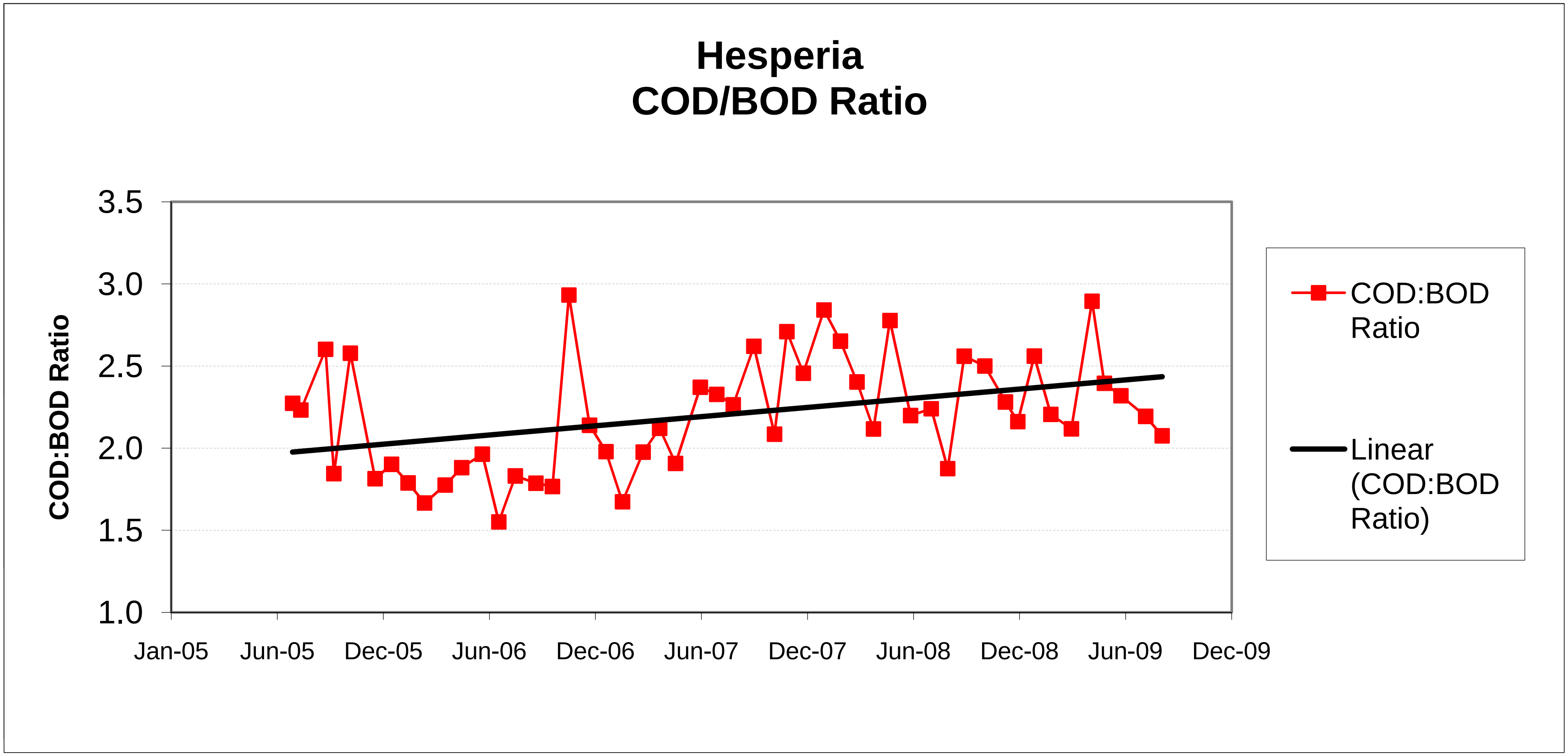
Hesperia

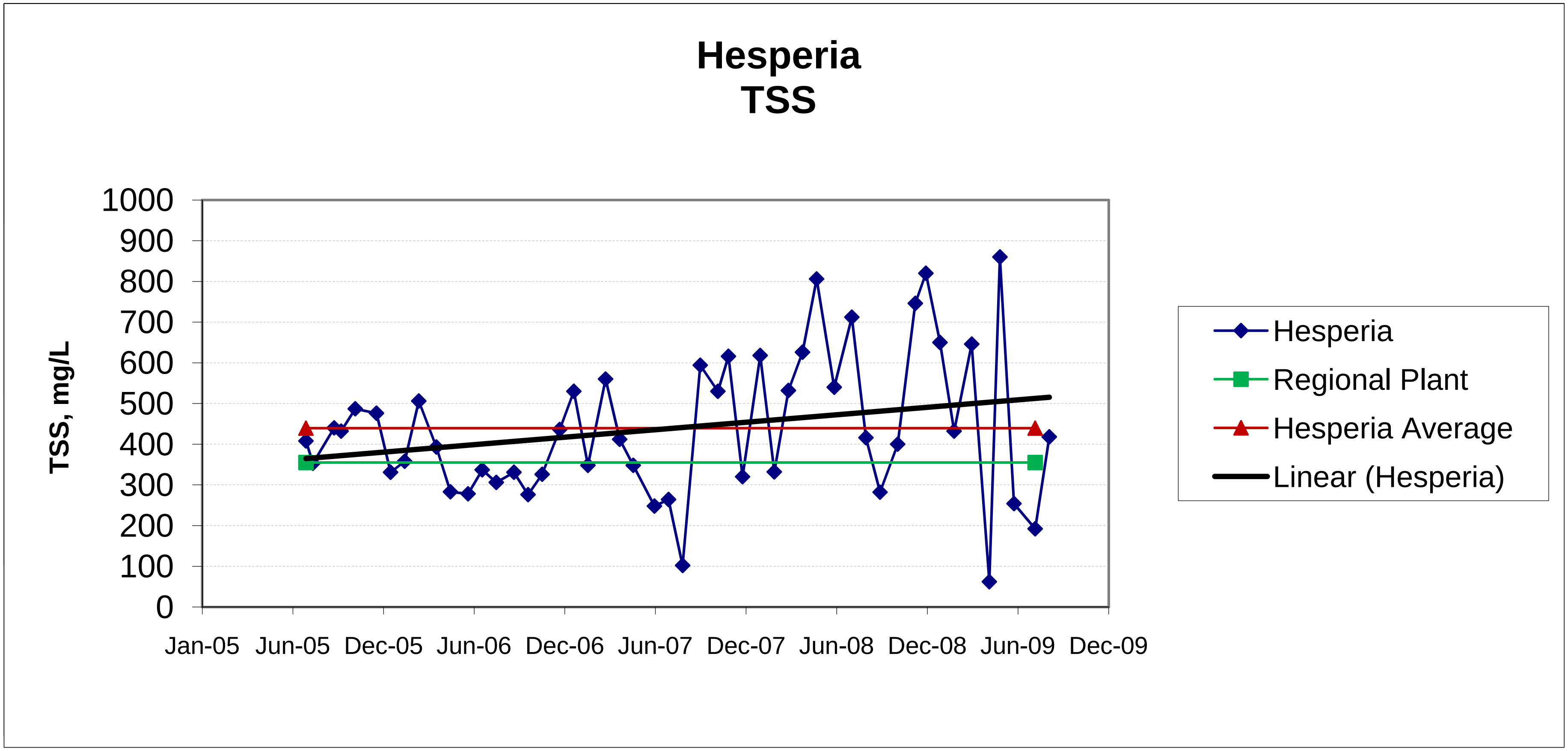
Wastewater Characteristics from VVWRA Metering Station
All samples are 24 hr. composite samples unless noted otherwise.

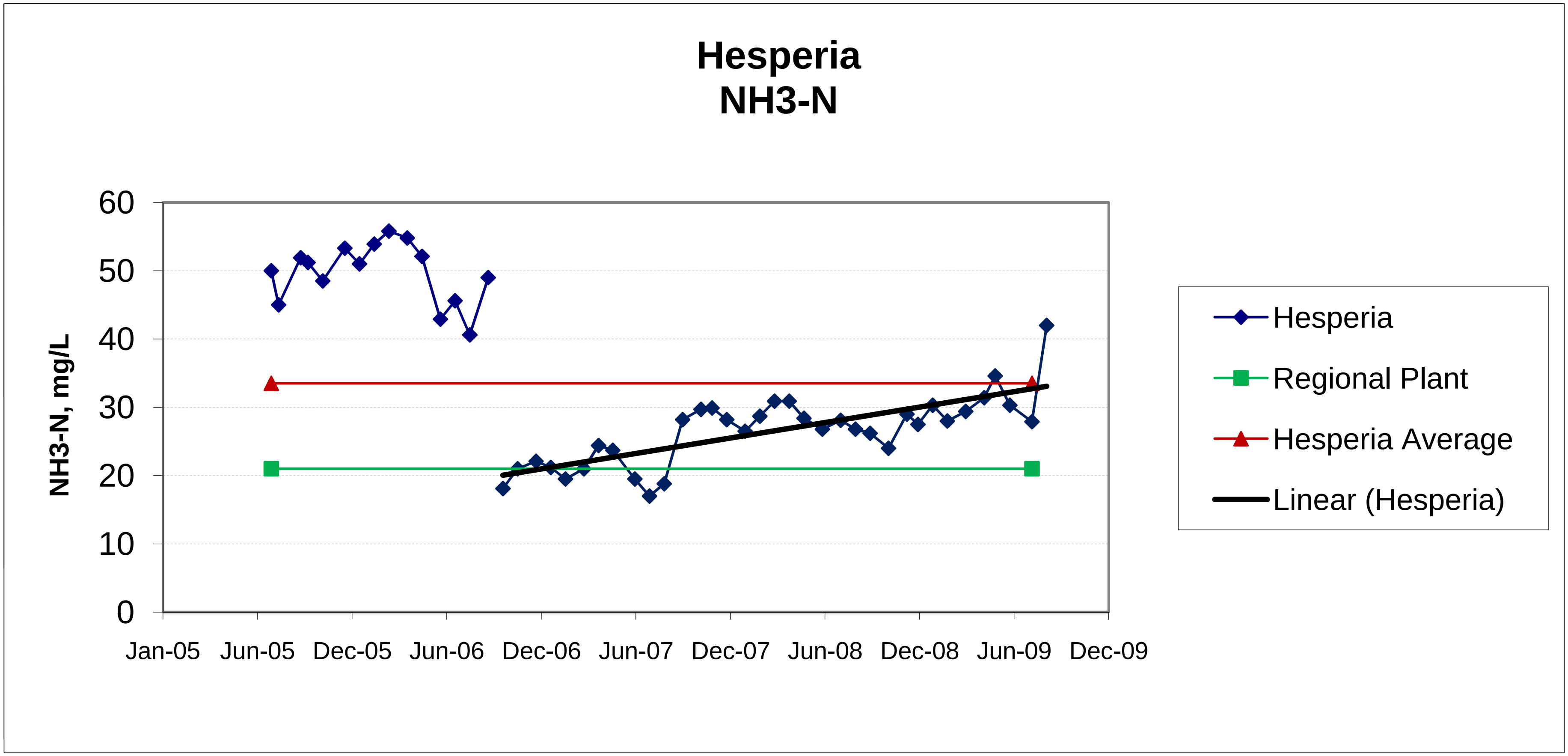
Parameter	pH	NH3-N	BOD	TSS	TDS	COD	Conductivity	Zinc	COD/BOD
Date		mg/L	mg/L	mg/L	mg/L	mg/L	µS/cm	µg/L	
2005-2009 Analysis									
Count	50	50	50	50	50	50	20	1	50
Average	7.28	**33.5**	**461**	**439**	427	**990**	714	290	2.20
Median	7.28	29.2	462	414	405	978	706	290	2.20
Std Dev	0.11	11.8	138	177	99	254	36		0.35
Percentile	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	7.40	50.7	595	623	510	1,222	741	290	2.59
PF (for reference)		1.73	1.29	1.51	1.26	1.25	1.05	1.00	
Yearly Averages									
2005	7.29	50.0	495	433	387	1085			2.22
2006	7.19	42.2	532	347	407	985			1.91
2007	7.36	23.4	403	406	474	878			2.21
2008	7.31	27.8	458	569	416	1076	701		2.38
2009	7.21	31.7	419	439	431	963	733	290	2.35
Sep-07toAug-09		**29.3**							


Hesperia
BOD
BOD, mg/L
1000
900
800
700
600
500
400
300
200
100
0
Jan-05
Jun-05
Dec-05
Jun-06
Dec-06
Jun-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Hesperia
Regional Plant
Hesperia Average
Linear (Hesperia)


Hesperia
COD
COD, mg/L
1600
1400
1200
1000
800
600
400
200
0
Jan-05
Jun-05
Dec-05
Jun-06
Dec-06
Jun-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
COD
Linear (COD)


Hesperia
COD/BOD Ratio
3.5
3.0
2.5
2.0
1.5
1.0
COD:BOD Ratio
Jan-05
Jun-05
Dec-05
Jun-06
Dec-06
Jun-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
COD:BOD Ratio
Linear (COD:BOD Ratio)


Hesperia
TSS
TSS, mg/L
1000
900
800
700
600
500
400
300
200
100
0
Jan-05
Jun-05
Dec-05
Jun-06
Dec-06
Jun-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Hesperia
Regional Plant
Hesperia Average
Linear (Hesperia)



Hesperia
NH3-N
NH3-N, mg/L
60
50
40
30
20
10
0
Jan-05
Jun-05
Dec-05
Jun-06
Dec-06
Jun-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Hesperia
Regional Plant
Hesperia Average
Linear (Hesperia)

HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 2A

PLANT HYDRAULICS

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

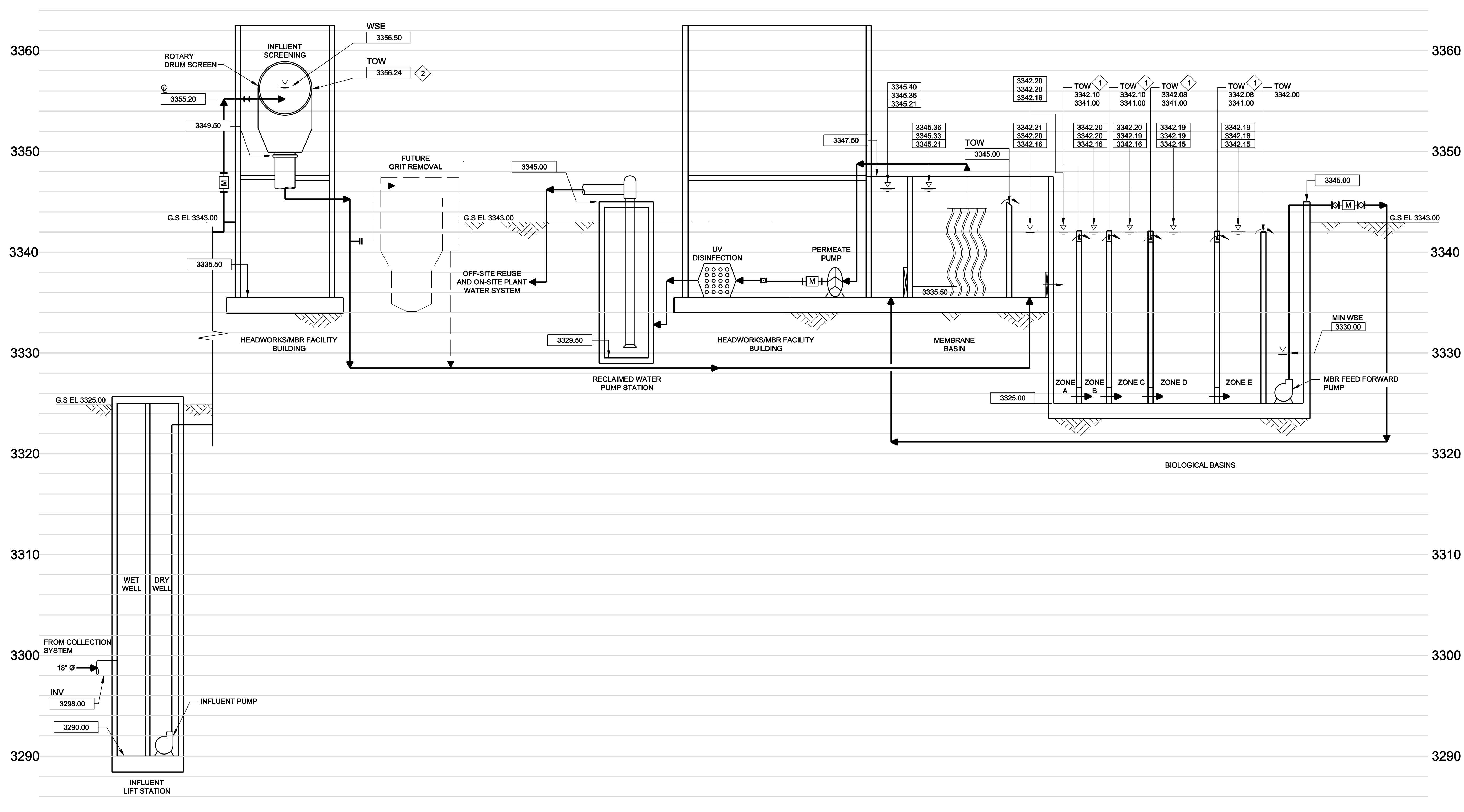
INTRODUCTION

The Design Information Memorandum (DIM) No. 2A defines the background information and assumptions made for the development of hydraulic profile of the Hesperia Water Reclamation Plant (WRP). The purpose of DIM-2A is to present the preliminary hydraulic profile developed for the Hesperia WRP.

HYDRAULIC PROFILE

A preliminary hydraulic profile was developed for the Hesperia WRP and is shown in Figure 2A.1. Since the WRP is designed as a scalping plant with design capacity of 1.0 mgd in Phase 1 expandable to 2.0 mgd in Phase 2 and 4.0 mgd in Phase 3, the hydraulic profile presents water surface elevations for all phases. The key components of the basis for developing the Hesperia WRP hydraulic profile include the following:

- The ground elevation at the Hesperia WRP site varies from approximately 3,335 feet to 3,343 feet above mean sea level. Assume the finished grade of the proposed plant is at 3,343 feet.
- The existing influent sewer will enter a proposed new lift station wet well (Hesperia Raw Sewage Lift Station). The influent pumps will lift the raw sewage to a water surface elevation of approximately 7 feet above finished grade of the proposed Headworks Building. Raw sewage will flow by gravity through the fine screening units.
- From headworks, the screened influent will flow by gravity through the biological treatment process to the membrane bioreactor (MBR) feed pumps wet well. The mixed liquor will be pumped via MBR feed-forward pumps to the membrane basins. From the MBR basins, permeate will be pumped through the closed-vessel UV disinfection system to the reclaimed water pump station. The return activated sludge (RAS) will flow by gravity back to the biological treatment basins.
- Disinfected reclaimed water will be pumped by the reclaimed water pumps to both an off-site reuse system and on-site plant water system.
- Hydraulic profile was developed for Phase 1 (1.0 mgd), Phase 2 (2.0 mgd) and Phase 3 (4.0 mgd), under the condition of all trains (biological and MBR basins) in service. To represent the possible maximum water surface elevation in the treatment basins under future operation condition, a hydraulic profile was developed for Phase 3 maximum flow capacity of 3.5 mgd (see DIM-6A for plant capacity design redundancy), under one train (biological and MBR basin) out-of-service condition.



GENERAL NOTES:

1. FINISHED GROUND SURFACE GRADE AT 3343.00 FEET AMSL.
2. RAS RECYCLE FLOW IS 4 TIMES INFLUENT Q

HYDRAULIC PROFILE

HORIZONTAL SCALE: NOT TO SCALE
VERTICAL SCALE: 1" = 5'

KEY NOTES:

1. ELEVATIONS FOR:
   TOP OF BAFFLE WALL AT HIGH SECTION
   TOP OF BAFFLE WALL AT LOW SECTION
2. TOP OF WEIR FOR DRUM SCREEN INFLUENT

LEGEND

W.S. ELEVATION

XX.XX — WATER SURFACE ELEVATION AT PHASE 3 FLOW OF 3.5MGD, ONE TRAIN OUT OF SERVICE
XX.XX — WATER SURFACE ELEVATION AT PHASE 2 FLOW OF 2MGD, ALL TRAINS IN SERVICE (SAME FOR PHASE 3 FLOW OF 4 MGD, ALL TRAINS IN SERVICE)
XX.XX — WATER SURFACE ELEVATION AT PHASE 1 FLOW OF 1MGD, ALL TRAINS IN SERVICE

VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

HDR
Carollo

HYDRAULIC PROFILE

FIG 2A.1

HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 3A

PROCESS MODELING

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

The Design Information Memorandum No. 1A (DIM No. 1A) defined the design influent flows and loadings and effluent quality criteria for the Hesperia Water Reclamation Plant (WRP), as well as the extent of future plant expansions at the Hesperia WRP site. The purpose of this DIM No. 3A is to present the results of the computerized process model simulations used to design the secondary treatment system for the Hesperia WRP.

PROCESS DESIGN

Figure 3A.1 presents the proposed process flow schematic for the Hesperia WRP. The liquid stream process consists of influent pumping, fine screening, potential future grit removal, activated sludge process, filtration via a membrane bioreactor (MBR) system, ultraviolet (UV) disinfection, and reclaimed water storage and pumping. Waste activated sludge will be pumped to the collection system for treatment at the Westside Water Reclamation Plant (WRP). Detailed descriptions and design criteria for each unit process are included in other DIMs as part of this project. The process design for the activated sludge and MBR system is presented herein.

The main objective of the biological treatment system is to reduce the concentrations of biochemical oxygen demand (BOD), total suspended solids (TSS), and total nitrogen (TN) in the raw wastewater. To achieve such reductions, the Hesperia WRP will utilize a suspended growth, activated sludge system followed by a membrane bioreactor (MBR) to achieve solids-liquid separation.

The activated sludge system is designed to perform nitrification and denitrification in order to achieve effluent TN concentrations below the target limits presented in DIM No. 1A. An initial TN target limit of 8 mg/L (maximum limit of 10 mg/L) was assumed for the design of the secondary treatment system. However, the activated sludge basins were designed with provisions to meet a future TN target limit of 4 mg/L (maximum limit of 5 mg/L) with relatively minor process adjustments.

Process Design for a TN Limit of 10 mg/L

The proposed process to meet a target TN limit of 8 mg/L is the Modified Ludzack-Ettinger (MLE) process coupled with MBR. The MLE process combines an anoxic zone with an aerobic zone in a common basin structure (biological treatment basins). Baffle walls are provided to help with zone separation, in order to minimize short-circuiting and back-mixing. The MLE process also includes a nitrate return, typically via internal mixed liquor recycle from the end of the aeration zone back to the start of the anoxic zone. In an MLE process coupled with MBR, the return activated sludge (RAS) from the MBR basins also functions as a nitrate return due to the high RAS flow rates required for the operation of the MBR system. Biological treatment in the proposed MLE process includes the following steps:

- Screened wastewater first enters the anoxic zone, where it is mixed with the RAS stream coming from the MBR basins. The combination of wastewater and RAS under anoxic conditions (nitrate, but no dissolved oxygen) promotes denitrification, where microorganisms in the mixed liquor will use nitrate (instead of oxygen) to metabolize the organic material in the wastewater, thereby converting nitrates to nitrogen gas, which is released to the atmosphere.
- In the aerobic zone, influent ammonia is converted to nitrate by nitrifying microorganisms. Carbon oxidation of the waste stream also occurs under aerobic conditions.
- Conversions under aerobic conditions continue in the MBR basins, as aeration is supplied in these basins to control membrane fouling. Membranes provide solids-liquid separation of the mixed liquor, combining clarification and filtration in one treatment step. The RAS return flow from the MBR basins back to the head of the biological treatment process controls the concentration of microorganisms in the activated sludge system, as well as the amount of nitrates returned for denitrification.

The availability of adequate, readily biodegradable carbon is crucial to the denitrification process. Based on the influent wastewater characteristics identified in DIM No. 1A, the average and maximum month BOD:TKN ratios of 10.6:1 and 12.3:1 are considered within a “very good” range of BOD:TKN ratios suitable for a typical MLE process configuration without the need for supplemental carbon addition.

Process Design for a TN Limit of 5 mg/L

The proposed process to meet a target TN limit of 4 mg/L is a four-stage Bardenpho process. This configuration is achieved by modifying the proposed MLE process, retrofitting a post-anoxic zone and an internal mixed liquor recycle stream in the basins proposed to comply with a TN limit of 10 mg/L. The post-anoxic zone is achieved through the inclusion of an aerobic or anoxic “swing” zone located at the end of the biological process basins. The internal mixed liquor recycle is achieved by the addition of pumps to return mixed liquor from the end of the last aerated zone back to the start of the first anoxic zone. Biological treatment in a four-stage Bardenpho process includes the following steps:

- The first anoxic zone receives screened wastewater, RAS from the MBR basins, and nitrified mixed liquor recycled from the end of the aerated zones in the biological process treatment basins. The nitrates returned in the mixed liquor recycle and RAS are denitrified under anoxic conditions. Influent organic matter provides the carbon and energy source for denitrification (conversion of nitrate to nitrogen gas).
- The aerobic zones in the biological process treatment basins provide aerated treatment to achieve nitrification (conversion of ammonia to nitrate) and further reduction of BOD.
- The post-anoxic zone provides additional denitrification using endogenous carbon source (cell material) and nitrates generated in the preceding aerobic zones.
- The MBR basins provide the last aerobic stage of the Bardenpho process. Intermittent aeration is provided for air scouring the membranes, which creates an aerobic environment. Membranes provide solids-liquid separation of the mixed liquor, combining clarification and filtration in one treatment step. The RAS return flow from the MBR basins back to the head of the biological treatment process controls the concentration of

microorganisms in the activated sludge system, as well as a significant portion of the nitrates returned for denitrification in the first anoxic zone.

The integration of a post-anoxic zone between the primary aerobic zones and the aerated MBR basins, coupled with a mixed liquor recycle, is an effective yet cost-effective process strategy to reliably achieve low TN limits.

PROCESS MODELING

Sizing of the biological treatment basins was optimized through the use of process modeling tools including Biotran and BioWin. Biotran is a computer model developed by Carollo for wastewater treatment plant process evaluations. BioWin is a commercially available process modeling software program for the analysis and evaluation of wastewater treatment processes. These programs utilize mass balances, and biological and physical models, to simulate the interactions between the different processes in a wastewater treatment facility. The model is used in conjunction with the wastewater characteristics and design criteria to establish treatment capacities for the different processes, and predict the characteristics of the treated effluent. The models also generate projections for biosolids production, oxygen usage, etc., that can be used to size auxiliary facilities (i.e., blowers, pumps, etc.).

Modeling Scenarios

The biological treatment basins are sized for mass loadings of the different wastewater constituents (BOD, TSS, TKN, etc.) in the plant influent. While the capacity of biological treatment basins is commonly referred to in terms of hydraulic flow (million gallons per day), the capacity is really determined by the constituent loadings (pounds per day). Therefore, the two design conditions considered in sizing the biological treatment basins are the annual average day (AADF) loadings, and the maximum month average day (MMADF) loadings.

The biological process basins were sized to meet the following criteria, based on standard practice for biological treatment basins redundancy:

- Basins sized to treat the design flow at annual average day constituent loadings with one basin out-of-service.
- Basins sized to treat the design flow at maximum month average day constituent loadings with all basins in service.
- Basins sized to achieve an initial target TN concentration of 8 mg/L, and a future target TN concentration of 4 mg/L under both AADF and MMADF loadings. The initial TN permitted limit is anticipated to be 10 mg/L, with the possibility of a future TN limit of 5 mg/L.
- Basins sized for a modular expansion between Phase 1, Phase 2, and buildout.

Process Modeling Results

Sizing of the biological process basins is driven by the wastewater loadings at maximum month average day loading conditions. The basin design incorporates sufficient swing zones to provide flexibility to adapt to future changes in influent wastewater characteristics and future regulations requiring lower effluent TN concentrations.

In order to achieve the anticipated future TN limit of 5 mg/L, a second internal mixed liquor recycle (IMLR) loop is required. In order to provide adequate flexibility for the potential future lower TN limit without excessive capital expenditures under Phase 1, the basins will be designed such that the second set of IMLR pumps can be efficiently added in the future.

Figure 3A.2 presents the BioWin schematic of the process configuration to meet a TN limit of 10 mg/L. Table 3A.1 presents a summary of the process model simulation results for the secondary treatment process, operated to meet a TN limit of 10 mg/L. Two biological process basins are proposed for Phase 1, with a third basin added in Phase 2, each basin with a total volume of 0.381 million gallons (MG) without counting the volume in the MBR feed forward pump wet well. Two MBR basins are considered in Phase 1, with addition of membrane cassettes under Phase 2. A more detailed description of the basins is included in DIM No. 6A.

Figure 3A.2 BioWin Process Model Flow Schematic for TN Limit of 10 mg/L

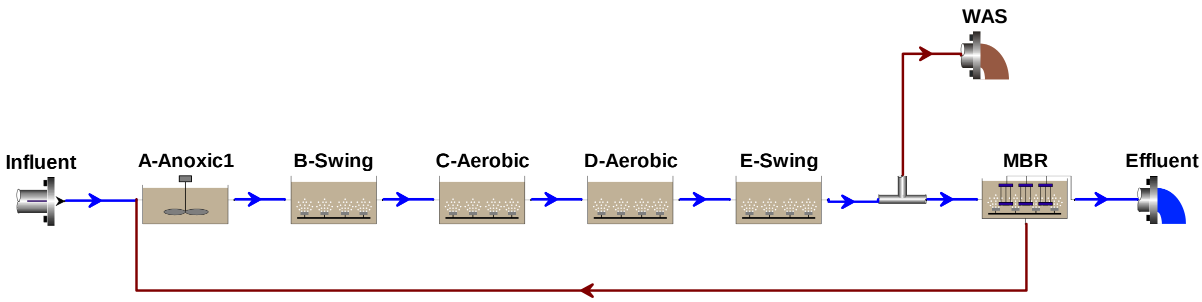


Table 3A.1	**Biological Treatment System Design Criteria for TN Limit of 10 mg/L Hesperia WRP Design Information Memoranda Victor Valley Wastewater Reclamation Authority, California**			
Parameter	**Unit**	**Phase 1 (1.0 mgd)**	**Phase 2 (2.0 mgd)**	**Buildout (4.0 mgd)**
AERATION BASINS				
Type of Basins	-	Single Pass, multiple zones		
Number of Parallel Trains	-	2	3	6
Basin Side Water Depth	ft	17		
Basin Width (1), each	ft	20		
Zone Lengths – (Operation) (1)				
Zone A – Anoxic	ft	10 (Anoxic)		
Zone B – Swing	ft	10 (Aerobic)		
Zone C – Aerobic	ft	55 (Aerobic)		
Zone D – Aerobic	ft	55 (Aerobic)		
Zone E – Swing	ft	20 (Aerobic)		
Total Basin Length	ft	150		

Table 3A.1 Biological Treatment System Design Criteria for TN Limit of 10 mg/L
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Parameter	**Unit**	**Phase 1 (1.0 mgd)**	**Phase 2 (2.0 mgd)**	**Buildout (4.0 mgd)**
Basin Volume, each	MG	0.381		
Total Basin Volume	MG	0.763	1.144	2.289
Anoxic Fraction of Total Volume	-	0.067		
Aerobic Fraction of Total Volume	-	0.933		
MLSS Concentration in Biological Basins	mg/L	8,000		
MLSS Concentration in MBR Basins	mg/L	10,000		
Feed Forward Flow	mgd	5.0	10.0	20.0
RAS Return Flow	mgd	4.0	8.0	16.0
Internal Mixed Liquor Return Flow	mgd	-	-	-
Total Solids Retention Time				
MMADF, all basins in service	days	11.6	7.9	7.9
AADF, all basins in service	days	19.4	13.1	13.1
AADF, one basin out-of-service	days	9.0	8.2	10.6
Aerobic Solids Retention Time				
MMADF, all basins in service	days	10.9	7.4	7.4
AADF, all basins in service	days	18.2	12.3	12.3
AADF, one basin out-of-service	days	8.4	7.6	9.9
EFFLUENT NITROGEN				
Effluent Nitrogen, MMADF all basins in service				
Ammonia Nitrogen (NH_4-N)	mg/L	0.25	0.27	0.27
Nitrate-Nitrogen (NO_3-N)	mg/L	3.88	3.10	3.10
Nitrite Nitrogen (NO_2-N)	mg/L	0.05	0.08	0.08
Organic Nitrogen	mg/L	2.61	2.58	2.57
Total Nitrogen (TN)	**mg/L**	**6.79**	**6.03**	**6.04**
Effluent Nitrogen, AADF all basins in service				
Ammonia Nitrogen (NH_4-N)	mg/L	0.18	0.18	0.18
Nitrate-Nitrogen (NO_3-N)	mg/L	4.16	3.74	3.74
Nitrite Nitrogen (NO_2-N)	mg/L	0.04	0.04	0.04
Organic Nitrogen	mg/L	2.21	2.21	2.21
Total Nitrogen (TN)	**mg/L**	**6.58**	**6.18**	**6.18**
Effluent Nitrogen, AADF one basin o.o.s.				
Ammonia Nitrogen (NH_4-N)	mg/L	0.18	0.21	0.19

Table 3A.1 Biological Treatment System Design Criteria for TN Limit of 10 mg/L
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Parameter	Unit	Phase 1 (1.0 mgd)	Phase 2 (2.0 mgd)	Buildout (4.0 mgd)
Nitrate-Nitrogen (NO_3-N)	mg/L	3.30	3.14	3.49
Nitrite Nitrogen (NO_2-N)	mg/L	0.04	0.06	0.04
Organic Nitrogen	mg/L	2.23	2.23	2.21
Total Nitrogen (TN)	**mg/L**	**5.76**	**5.64**	**5.93**
AERATION				
Oxygen Demand (2)	ppd	6,700	12,900	25,700
Estimated Blower Air Requirement (3)	scfm	3,200	7,200	14,400
WASTE ACTIVATED SLUDGE				
Daily Solids at Max. Month Loading	ppd	4,800	10,200	20,300
Daily Solids at Avg. Day Loading	ppd	2,800	6,100	12,100

Notes:
(1) Inside dimensions.
(2) At maximum month average day loadings.
(3) Includes peak day peaking factor of 1.3 over MMADF.

Figure 3A.3 presents the BioWin schematic of the process configuration to meet a TN limit of 5 mg/L. Table 3A.2 presents a summary of the process model simulation results for the secondary treatment process, operated to meet a TN limit of 5 mg/L. The differences with the process configuration for a TN limit of 10 mg/L are the operation of the second swing zone under anoxic conditions, and the addition of a second internal mixed liquor recycle loop.

Figure 3A.3 BioWin Process Model Flow Schematic for TN Limit of 5 mg/L

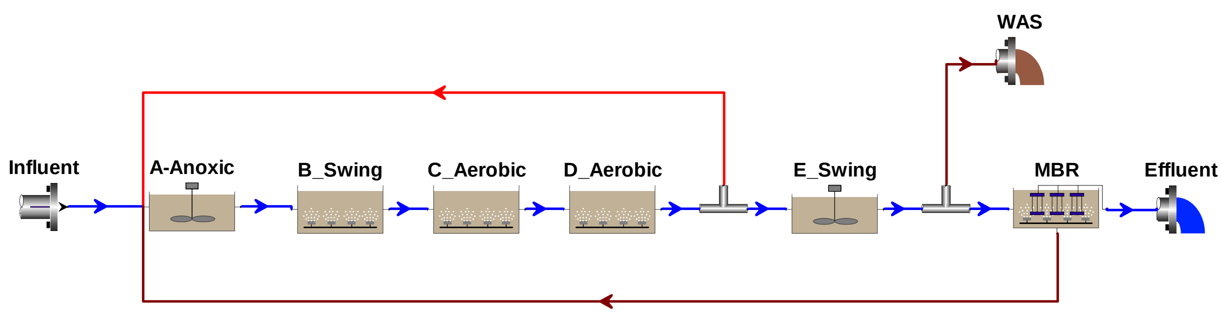


Table 3A.2 Biological Treatment System Design Criteria for TN Limit of 5 mg/L
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Parameter	Unit	Phase 1 (1.0 mgd)	Phase 2 (2.0 mgd)	Buildout (4.0 mgd)
AERATION BASINS				
Type of Basins	-	Single Pass, multiple zones		
Number of Parallel Trains	-	2	3	6
Basin Side Water Depth	ft	17		
Basin Width (1), each	ft	20		
Zone Lengths – (Operation) (1)				
Zone A – Anoxic	ft	10 (Anoxic)		
Zone B – Swing	ft	10 (Aerobic)		
Zone C – Aerobic	ft	55 (Aerobic)		
Zone D – Aerobic	ft	55 (Aerobic)		
Zone E – Swing	ft	20 (Anoxic)		
Total Basin Length	ft	150		
Basin Volume, each	MG	0.381		
Total Basin Volume	MG	0.763	1.144	2.289
Anoxic Fraction of Total Volume	-	0.20		
Aerobic Fraction of Total Volume	-	0.80		
MLSS Concentration in Biological Basins	mg/L	8,000	8,000 @ AADF 9,000 @ MMADF	
MLSS Concentration in MBR Basins	mg/L	10,000	10,000 @ AADF 11,000 @ MMADF	
Feed Forward Flow	mgd	5.0	10.0	20.0
RAS Return Flow	mgd	4.0	8.0	16.0
Internal Mixed Liquor Return Flow (Zone D to Zone A)	mgd	2.0	4.0	8.0
Total Solids Retention Time				
MMADF, all basins in service	days	11.5	8.8	8.8
AADF, all basins in service	days	18.8	12.8	12.8
AADF, one basin out-of-service	days	9.0	8.1	10.5
Aerobic Solids Retention Time				
MMADF, all basins in service	days	9.4	7.1	7.1
AADF, all basins in service	days	15.2	10.4	10.4
AADF, one basin out-of-service	days	7.4	6.5	8.5

**Table 3A.2 Biological Treatment System Design Criteria for TN Limit of 5 mg/L
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California**

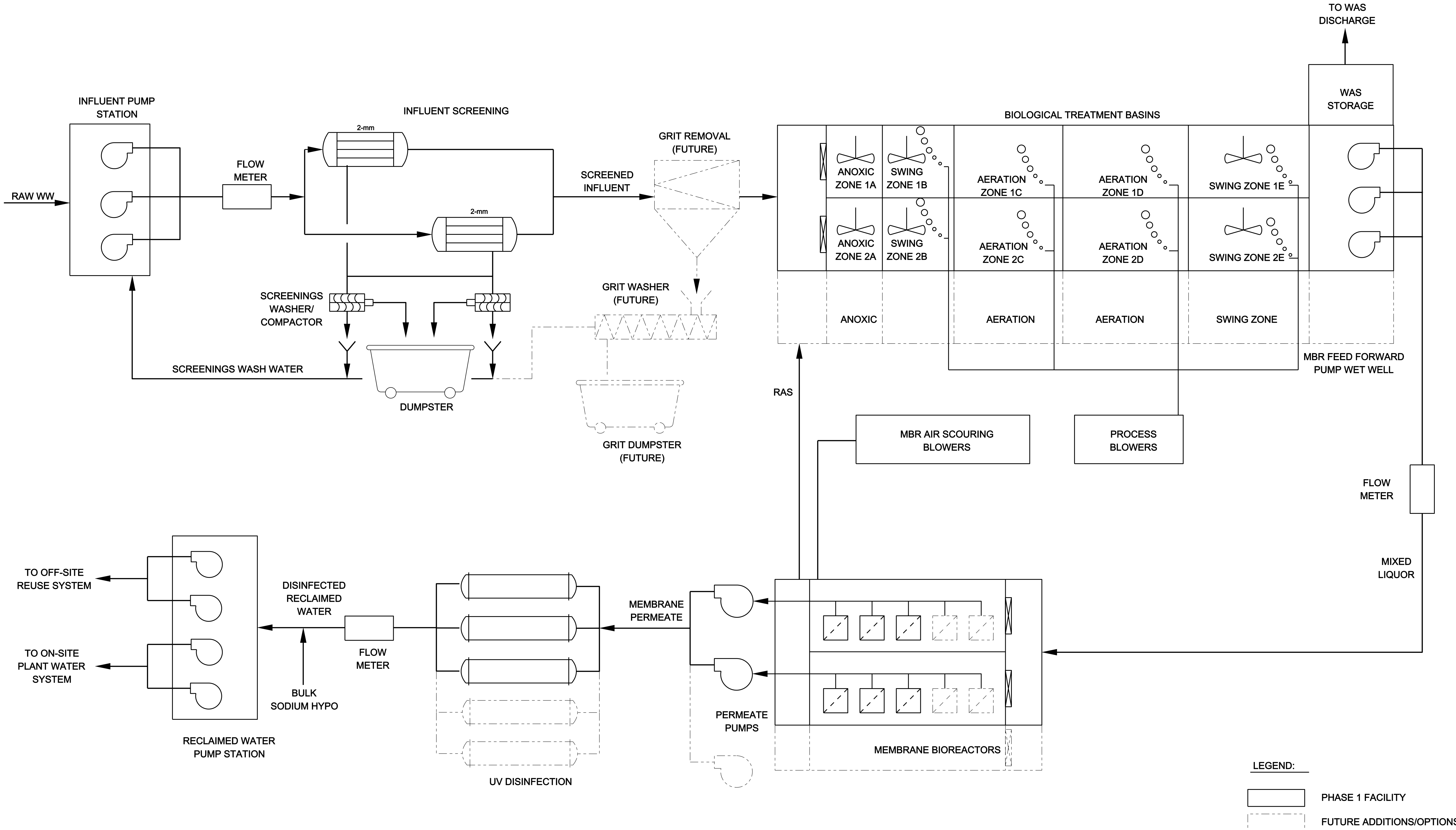
Parameter	Unit	Phase 1 (1.0 mgd)	Phase 2 (2.0 mgd)	Buildout (4.0 mgd)
EFFLUENT NITROGEN				
Effluent Nitrogen, MMADF all basins in service				
Ammonia Nitrogen (NH_4-N)	mg/L	0.56	0.86	0.85
Nitrate-Nitrogen (NO_3-N)	mg/L	0.36	0.14	0.15
Nitrite Nitrogen (NO_2-N)	mg/L	0.08	0.08	0.08
Organic Nitrogen	mg/L	2.50	2.39	2.40
Total Nitrogen (TN)	**mg/L**	**3.51**	**3.47**	**3.47**
Effluent Nitrogen, AADF all basins in service				
Ammonia Nitrogen (NH_4-N)	mg/L	0.40	0.57	0.57
Nitrate-Nitrogen (NO_3-N)	mg/L	0.99	0.64	0.64
Nitrite Nitrogen (NO_2-N)	mg/L	0.08	0.08	0.08
Organic Nitrogen	mg/L	2.05	1.98	1.98
Total Nitrogen (TN)	**mg/L**	**3.52**	**3.27**	**3.27**
Effluent Nitrogen, AADF one basin o.o.s.				
Ammonia Nitrogen (NH_4-N)	mg/L	0.40	0.66	0.58
Nitrate-Nitrogen (NO_3-N)	mg/L	0.62	0.32	0.51
Nitrite Nitrogen (NO_2-N)	mg/L	0.08	0.09	0.08
Organic Nitrogen	mg/L	2.18	2.01	1.99
Total Nitrogen (TN)	**mg/L**	**3.20**	**3.09**	**3.17**
AERATION				
Oxygen Demand (2)	ppd	6,200	12,200	24,300
Estimated Blower Air Requirement (3)	scfm	3,000	6,900	13,800
WASTE ACTIVATED SLUDGE				
Daily Solids at Max. Month Loading	ppd	4,800	10,100	20,000
Daily Solids at Avg. Day Loading	ppd	2,900	6,200	12,400

Notes:
(1) Inside dimensions.
(2) At maximum month average day loadings.
(3) Includes peak day peaking factor of 1.3 over MMADF.

SUMMARY AND RECOMMENDATIONS

The recommended redundancy for the aeration basins should allow the plant to reliably meet the effluent quality goals with one biological treatment basin out-of-service when treating annual average day loadings, and meet the same goals when treating maximum month average day loadings with all basins in service.

The recommended MLE process design for the biological treatment process can achieve compliance with a maximum TN limit of 10 mg/L. The recommended basin design allows the inclusion of the necessary provisions to readily accommodate a post-anoxic zone and internal mixed liquor return pumping, in order to achieve compliance with a potential future TN limit of 5 mg/L.



VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

HDR carollo

PROCESS FLOW DIAGRAM

FIG 3A.1

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HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 4A
PERMITTING AND EFFLUENT DISPOSAL

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Pump Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

This Design Information Memorandum (DIM) No. 4A describes the regulatory framework and permitting requirements for the proposed Hesperia Water Reclamation Plant (WRP) effluent disposal options. Disposal options include waste disposal with percolation ponds, indirect groundwater recharge, direct groundwater recharge, and incidental groundwater recharge.

DEFINITION OF TERMS

- **Reclaimed water** – water that, as a result of treatment of domestic wastewater, is suitable for direct beneficial use or a controlled use that would not otherwise occur (Title 22).
- **Recycled water** – "water that, as a result of treatment of waste, is suitable for direct beneficial use or a controlled use that would not otherwise occur." The act of reclaiming and using water, otherwise wasted, for beneficial purposes. Synonymous with "wastewater reclamation and reuse". Water recycling includes the process of treating wastewater, storing and distributing the recovered water, and the actual use of the reclaimed water.
- **Wastewater reclamation** – the treatment or processing of wastewater to make it reusable, normally in accordance with regulations established by the California Department of Public Health (CDPH) and the California Regional Water Quality Control Boards (RWQCB).
- **Water reuse** – the intentional or deliberate beneficial use of treated wastewater.
  - **Direct non-potable water reuse** – the use of recycled water where there is a direct link from the treatment system to the reuse application, such as landscape irrigation or other application via a dual distribution system or separate dedicated conveyance line.
  - **Direct beneficial use** (Title 22 term and definition) – use of recycled water that has been transported from the point of production to the point of use without an intervening discharge to waters of the State.
  - **Indirect reuse** – mixing, dilution and dispersion of recycled water by discharge to an impoundment, receiving water or groundwater aquifer prior to reuse, such as in groundwater recharge. Indirect reuse does not normally constitute planned (or deliberate) reuse.
  - **Unplanned (or incidental) reuse** – diversion/extraction from a surface water body or groundwater basin downstream of a treated wastewater discharge. An accepted practice throughout the world for centuries. Example: riverbed or percolation pond recharge of an underlying groundwater aquifer with a blend of runoff, natural flows

and treated wastewater, which in turn, is withdrawn by down-gradient users for domestic or industrial water supplies. In the Mojave Basin, nearly all wastewater effluent is incidentally recycled in this manner.

  - **Direct potable water reuse** – deliberate/planned/intentional use of highly treated recycled water to augment drinking water supplies, i.e. incorporation of recycled water into a potable water supply system, *without* relinquishing control over the resource (e.g., Occoquan Reservoir, Virginia).
  - **Indirect potable water reuse** – addition of an intermediate step in the hydrologic cycle whereby recycled water is mixed with surface or groundwater sources prior to drinking water treatment (e.g., Orange County Water District Project).
  - **Non-potable water reuse** – all water use applications other than drinking water supplies; the dominant mode of wastewater reuse throughout the world.

- **Intentional (artificial) groundwater recharge** – augmentation of the natural movement of surface water into underground formations either directly (e.g., injection well) or indirectly (e.g., percolation basin or infiltration gallery).
  - **Direct artificial groundwater recharge** – water introduced into an aquifer via injection wells.
  - **Indirect artificial groundwater recharge** – spreading surface water on land so that it infiltrates through vadose zone (the unsaturated layer above the water table) down to the aquifer; methods include over-irrigation, construction basins, or making artificial changes to natural conditions (e.g., modifying a stream channel such as the Santa Ana River).
- **Incidental (unintentional) groundwater recharge** – the unplanned or indirect infiltration of water to an aquifer from agricultural or landscape irrigation or discharge to a stream or river (e.g., Mojave River).

REGULATORY FRAMEWORK

The overall regulatory framework associated with wastewater reclamation and water reuse is described below. The framework is organized into three levels: federal, state, and local.

Federal

State of California recycled water regulations are influenced by federal regulatory policies and guidelines. The three federal agencies most involved in water management issues are the U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACOE) and U.S. Bureau of Reclamation (USBOR). The USEPA is responsible for administration of the Clean Water Act, provides National Pollutant Discharge Elimination System (NPDES) oversight, guidelines, and has advisory roles for reclamation and reuse issues. The USACOE is responsible for wetlands protection, enhancement and development using recycled water. The USBOR is responsible for water resource management improvement programs, which include identification and investigation of water reclamation and reuse opportunities in the western U.S. The USBOR also participates in the construction of identified regional water recycling projects and development of water conservation programs involving reuse.

State

The regulatory burden for wastewater reclamation and water reuse in the U.S. rests primarily with states. Regulation of water recycling in California is the responsibility of two agencies, the State Water Resources Control Board (SWRCB) and the California Department of Public Health (CDPH). Waste discharge requirements (WDR) are issued to treated wastewater dischargers by one of nine Regional Water Quality Control Boards (RWQCB). WDR can be used in conjunction with NPDES permits or water recycling requirements (WRR). WDR/WRR permits include water quality and public health protections that incorporate standards found in Title 22 (Water Recycling Criteria) of the California Code of Regulations. A single discharger may necessitate both NPDES and WRR permits to cover seasonal or continuous disposal of a portion of the effluent and water recycling of the other portion.

State recycled water use regulations can be adapted for specific applications and revised for new users. The CDPH has the authority and responsibility to establish health-related standards for production and use of recycled water. The California Water Code provides for the nine RWQCB to establish water quality control plans, which are developed to protect both surface water and groundwater, and to prescribe and enforce WRR (in conjunction with CDPH). The RWQCB has the regulatory responsibility for water recycling projects and programs in whose jurisdiction the wastewater reclamation plant and/or use sites are located.

The legal context of recycled water regulations in California involves overlapping public health, water quality, water conservation, and water rights issues. Water recycling in California is accomplished with the involvement of numerous entities at all levels of government and, in some cases, investor-owned utilities. Water supply and wastewater districts are primarily responsible for the planning, design, and implementation of local recycled water projects.

WDR/NPDES Permits

As previously stated, WDR can be used in conjunction with NPDES permits. The NPDES program developed by USEPA is a permitting program related to wastewater discharge under the Clean Water Act (CWA). Under this program, any facility discharging pollutants from any point source (including man-made conveyance structures such as a pipe or ditch) into waters of the U.S. must obtain a permit. The primary purpose of the program is to ensure that surface water discharge protects the water quality standards and anticipated and designated uses of those waters. The federal NPDES program has been delegated to California and is administered by the RWQCB; however, NPDES permits must receive federal review.

The NPDES permits are provided here for information only. NPDES permit will not be pursued for this project.

WDR/WRR Permits

The RWQCB may prescribe WDR and WRR where recycled water is used, or proposed to be used, if it determines it is necessary to protect public health, safety, or welfare (Water Code S.13523). WDR/WRR permits are not part of the NPDES program and do not receive federal review. Where recycled water criteria have been established by CDPH, no person or entity may either reclaim wastewater or use it until the RWQCB has either issued WRR or waived the necessity for such requirements (Water Code S.13524). This issuance of WRR is done in consultation with CDPH and with consideration of their recommendations.

Master Permits

The RWQCB historically issued permits with WDR for producers of recycled water (agencies) and permits with WRR for end-users. For reasons of efficiency, economy, and control, a “master permit” was developed to bring recycled water production, distribution and use under one regulatory document, typically issued to the agency that produces the recycled water. A single retail water purveying agency (with its own treatment plant) that produces and distributes recycled water to its own customers can be issued a master permit with resulting regulatory benefits.

Water Rights

Water rights are legally defined as the right to use water, which is different than ownership. A state typically retains ownership of water within its boundaries, and water rights laws govern the rights of government and private entities to use such water for recreation, irrigation and other activities. Water rights laws are of particular interest to recycled water projects because they can either promote or restrain water reuse depending on how the state views the use and return of recycled water. California law explicitly states that recycled water, where available and economically justified, must be used in lieu of potable water for meeting non-potable needs.

Most water rights issues are decided according to state law. However, in some cases, federal law may also impact planning of water reuse projects. This typically occurs when the project affects more than one state, region, or protected Native American tribe. The federal government may also claim jurisdiction in disputes between states regarding allocation of limited water supplies.

Local

Federal and state laws, regulations and policies do not prescribe requirements for implementation of water reuse programs and water recycling projects at the local level. Federal and state regulations generally acknowledge the importance of local program flexibility necessary to manage recycled water as a water resource. Local programs have the flexibility as well as broad authority needed to protect the health, welfare, and safety of their customers.

METHODS OF DISPOSAL

The primary reuse option is to supply recycled water to end-users for agriculture and landscape irrigation. This will require a recycled water program, which includes a Recycled Water Master Permit, establishment of an Ordinance, end-user letters of commitment, construction of a recycled water distribution system, and a site conversion program. The alternative disposal options described below provide for disposal of treated wastewater when distribution to end-users is not available. The selected disposal method will be relied upon during the interim period after the Hesperia WRP is constructed and when the recycled water program is established. Table 4A.1 summarizes the disposal methods described below and their respective permitting requirements.

An additional scenario becomes available after the recycled water program is established. Design of the recycled water distribution system should account for seasonal variations in recycled water demand and provide for storage to offset both diurnal and seasonal variations. A storage system that is sized to account for potential use scenarios could allow for no disposal of recycled water.

Table 4A.1 Agencies Involved in the Permitting of Recycled Water Reuse and Effluent Disposal
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Item	RWQCB	CDPH	DOFG	Federal [(1)]
Waste Disposal (Percolation Ponds)	X			
Indirect Groundwater Recharge (Percolation Ponds)	X	X		
Direct Groundwater Recharge (Injection Wells)	X	X		
Incidental Groundwater Recharge (Mojave River)	X		X	X

Note:

(1) Federal involvement will vary based on the disposal option, but may include federal review of NPDES and NEPA documentation (USEPA), U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers.

Waste Disposal (Percolation Ponds)

Disposal of treated wastewater to percolation ponds can be accomplished by identifying percolation as a treatment process for waste disposal. This characterization would require coordination with the RWQCB and a permit (WDR).

The RWQCB have recently become more concerned with the impacts of using percolation ponds for waste disposal on the groundwater table. They have begun imposing stricter discharge standards in WDR, including requirements for nutrient removal and restrictions on disinfection by-products. The requirements are likely to be similar to recent permit revisions issued to the VVWRA Westside WRP and other inland utilities. More stringent water quality requirements would entail more advanced treatment processes and more involved monitoring.

The conceptual sizing of percolation ponds for the Hesperia WRP is approximately 16 acres and provides approximately 12 acres of usable land for percolation. Based on percolation rates established for other sites of similar soil characteristics (sandy soil), it is estimated that approximately 1 acre of percolation area will be required for the proposed 1 mgd treatment plant. See Figure 4A.1 for the proposed conceptual location and an example pond layout to maximize land use. In addition, percolation could be achieved at the WRP work site as an option in short term.

Indirect Groundwater Recharge (Percolation Ponds)

Use of percolation ponds for indirect (artificial) groundwater recharge would require coordination with the RWQCB with consultation from CDPH. Approval from the RWQCB would entail water quality requirements based on spreading area operations, soil characteristics, hydrogeology, residence time, and distance from nearest withdrawal point. It would likely require advanced treatment of tertiary effluent (such as reverse osmosis, RO), potential supplementation of injected water with potable water, environmental permitting and monitoring, and an environmental impact report (CEQA documentation).

There may be water rights issues associated with groundwater recharge if it is determined that recharge of the aquifer will impact the quantity or quality of the established users of the aquifer. The potential impacts of mitigating water rights considerations would need to be evaluated further.

Direct Groundwater Recharge (Injection Wells)

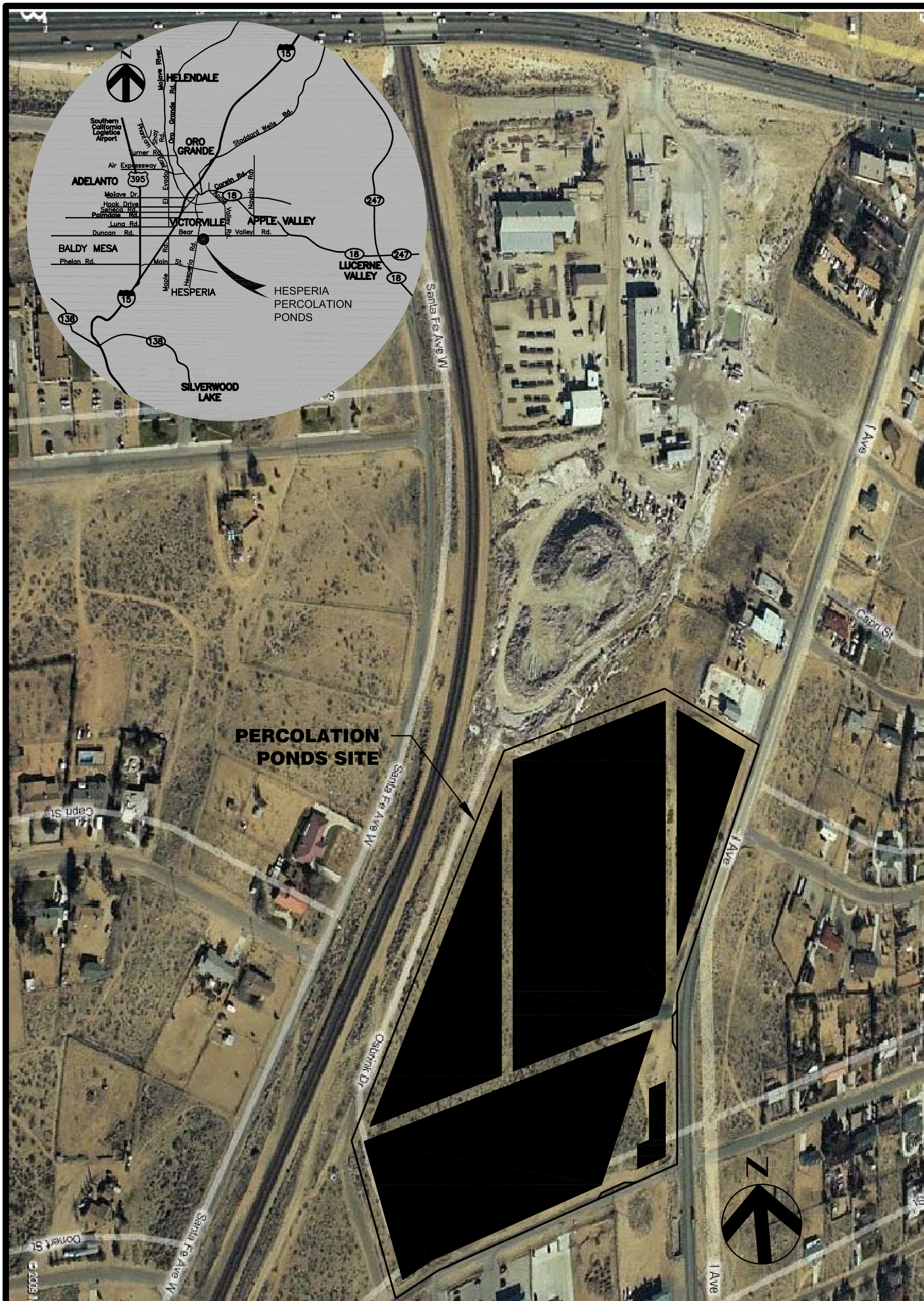
Direct groundwater recharge through the use of injection wells provide the advantage of reduced land area requirements, but impose more stringent water quality requirements. Approval and water quality requirements for indirect groundwater recharge typically assume a credit for the soil “barrier” between the percolation pond and the aquifer. Injections wells eliminate this credit, resulting in requirements for more advanced treatment and more stringent parameter compliance in addition to more complicated monitoring.

Incidental Groundwater Recharge (Mojave River)

The permitting requirements for direct discharge to the Mojave River would likely be similar to the requirements imposed on the Westside WRP. This option will require coordination with the RWQCB for an NPDES permit with review, consultation and input from USEPA and the Department of Fish and Game (DOFG). In addition, there may be water rights issues related to adding a new flow to the Mojave River, because it may impact the quantity or quality of established users.

CONCLUSIONS AND RECOMMENDATIONS

The permitting requirements for each alternative present unique challenges. Table 4A.1 provides a summary of the alternative disposal options when direct non-potable reuse is not available; they include disposal through percolation ponds, indirect groundwater recharge, direct groundwater recharge through injection wells, and incidental groundwater recharge (discharge to Mojave River). Given the permitting requirements for each option, waste disposal through percolation ponds appears to offer the greatest benefit. The increasing concern over the impact of waste disposal through percolation ponds will likely increase the water quality requirements and should be considered in the planning and design of the proposed treatment plant. The actual acreage required for the percolation ponds will be determined once the necessary geotechnical and hydrogeological investigation for the proposed disposal site is complete.



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HESPERIA WATER RECLAMATION PLANT
PERCOLATION PONDS SITE

FIGURE 4A.1

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HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 5A

PRELIMINARY TREATMENT

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

Raw wastewater from the influent pump station must be screened prior to entering the biological treatment process to remove items such as rags, fibers, and other large debris.

The Hesperia WRP will be equipped with membrane bioreactor (MBR) technology and therefore pre-membrane fine screening will be required to protect the membranes from damage by debris and to optimize membrane performance. The purpose of this DIM-5A is to summarize the proposed preliminary treatment requirements of the Hesperia WRP.

PROCESS EQUIPMENT

Influent Screening

A wide variety of coarse and fine screens is available for preliminary treatment depending on the degree of removal desired. Coarse screens generally have openings greater than 1/2 inch, and allow more rags and solids to pass through. Fine screens have openings less than 1/2 inch and generally remove a greater degree of smaller debris. Screening options typically used for wastewater pretreatment include in-channel screens, traveling band screens, and internally fed rotating drum screens.

Based on the recommendation of potential MBR manufacturer (GE/Zenon), the pre-membrane screening should be fine screen, typically internally fed rotating drum type. The fine screening should be equipped with perforated plate style drum screen (in lieu of a wedge wire and other configuration) to better screen the stringy or fibrous material that could collect in the MBR basins. These fibers could ultimately tangle around membrane fibers, affecting the operation of the system and the life span of membranes.

Based upon the information presented and decisions made at the June 11, 2009 Technical Workshop, a single stage 2-mm micro screen approach will be used. Two units (one operating, on standby) will be provided for Phase 1 (1.0 mgd) and Phase 2 (2.0 mgd).

Screenings Washer/Compactor

The screenings captured in the fine screens contain putrescible organic matters. Therefore, a screenings washer/compactor will be provided for each drum screen unit to break up and remove the organic matter in the screenings, and compress and dewater the washed screening prior to discharge to a dumpster. A screw type washer/compactor will be provided for washing and dewatering screen solids removed by the screens. Screenings wash water will be discharged to a drain for return back into the biological process.

Headworks Odor Control System

The influent screening equipment and screening dumpsters will be housed in a building. Foul air will be withdrawn and routed to an odor control facility. Typical odor control options include chemical scrubber, carbon absorber, and biofilter. Two technologies are proposed for the proposed Headworks Building odor control system:

- Low-profile wet chemical scrubber
- In-ground biofilter

Low-Profile Wet Chemical Scrubber

Wet chemical scrubbing relies on transferring vapor phase odorants from foul air to scrubbing solutions via absorption and chemical oxidation. Wet chemical scrubbers are capable of handling large air flow rates and high intensity odor, and are typically used at wastewater treatment plants. They can be single or multi-stage systems that use absorption and oxidation to remove air contaminants.

The advantages of wet chemical scrubber odor control include removal of high odor concentrations and air flows, as well as removal of a wide variety of odor-causing compounds. The disadvantages of this method include high chemical and power consumption, high maintenance costs, and potential for chlorinated compounds and bleach odor emission.

In-Ground Biofilter

Biofilter bed consists of natural media (soil, compost, peat, or mixture of variety materials) with indigenous microorganisms that can grow on the media surface and metabolize odorous compounds absorbed/adsorbed from the gas stream. Biofilter uses absorption/adsorption and biooxidation mechanisms to remove odorants from foul air. Biofilters can be modular or in-ground type, and are typically used for low to moderate odor air volumes.

The advantages of biofilter odor control include degradation of odor compounds, low energy requirements, and no chemical addition. The main disadvantage of using biofilters is the large land area for installation and the requirement of maintenance of media for moisture content.

Based on discussions with VVWRA representatives, an in-ground biofilter will be provided for the Headworks Building odor control at the Hesperia WRP. In-ground biofilters consist of a network of perforated lateral piping within a layer of drain rock, covered with a screening material and overlaid by a layer of porous filter media. The soil biofilter is usually equipped with an irrigation system to keep the bed moist, and a drainage system to remove any accumulated moisture. Foul air will pass through soil beds. Moistened soil provides contact surfaces for microbial reactions to oxidize odorants.

Based on the preliminary Headworks Building size, assuming loading rate of 2.7 cubic feet per minute per square foot (cfm/sf) of soil bed area, the preliminary in-ground biofilter size will require a land area of approximately 35 feet x 35 feet for Phase 1 (1.0 mgd) and Phase 2 (2.0 mgd).

PROCESS LAYOUT

The influent screens, screenings washer/compactors and dumpsters will be located in the upper level of the proposed Headworks Building. Preliminary headworks layout and sections are presented in Figures 5A.1 and 5A.2.

SUMMARY AND RECOMMENDATIONS

The preliminary treatment at the Hesperia WRP will consist of the following components:

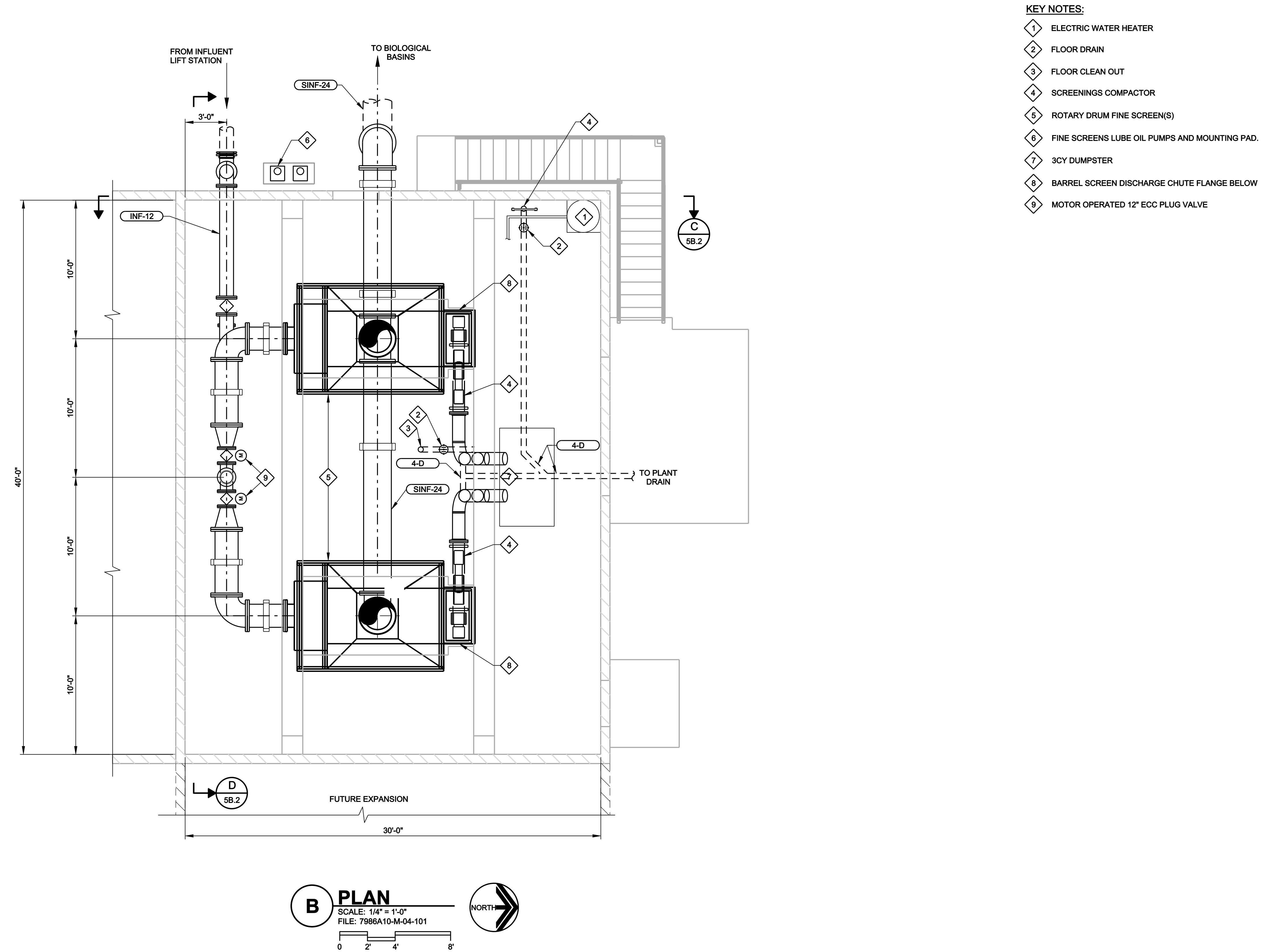
- Two 2-mm rotary drum screens. To reduce long-term capital costs of expanding the WRP from 1.0 mgd to 2.0 mgd, it is proposed to install 2.0 mgd screens, rather than 1.0 mgd screens.
- One screenings washer/compactor will be provided for each screen.
- In-ground biofilter for Headworks Building odor control.

The recommended influent screening design criteria for the Hesperia WRP is summarized in Table 5A.1.

**Table 5A.1 Influent Screening Recommended Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California**

Parameters	Phase 1 (1 mgd)	Phase 2 (2 mgd)	Buildout (4 mgd)
Screen Type	Rotary drum, perforated plate		
Stage of Screening	1 stage		
Perforation Diameter, mm	2		
Screen Capacity, mgd, each	2.0		
Number of Screens	2 (1 duty; 1 standby)		3 (2 duty; 1 standby)
Number of Washer/Compactors	2 (1 duty; 1 standby)		3 (2 duty; 1 standby)
Type of Washer/Compactors	Screw type		
Type of Odor Control	In-ground biofilter		

Grit removal is not provided in the preliminary design for Phase 1, other than what will be removed via the fine screening processes. Provisions for future grit removal (i.e. physical space on the plant as well as sufficient hydraulic head in the plant hydraulic profile) will be provided.



VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

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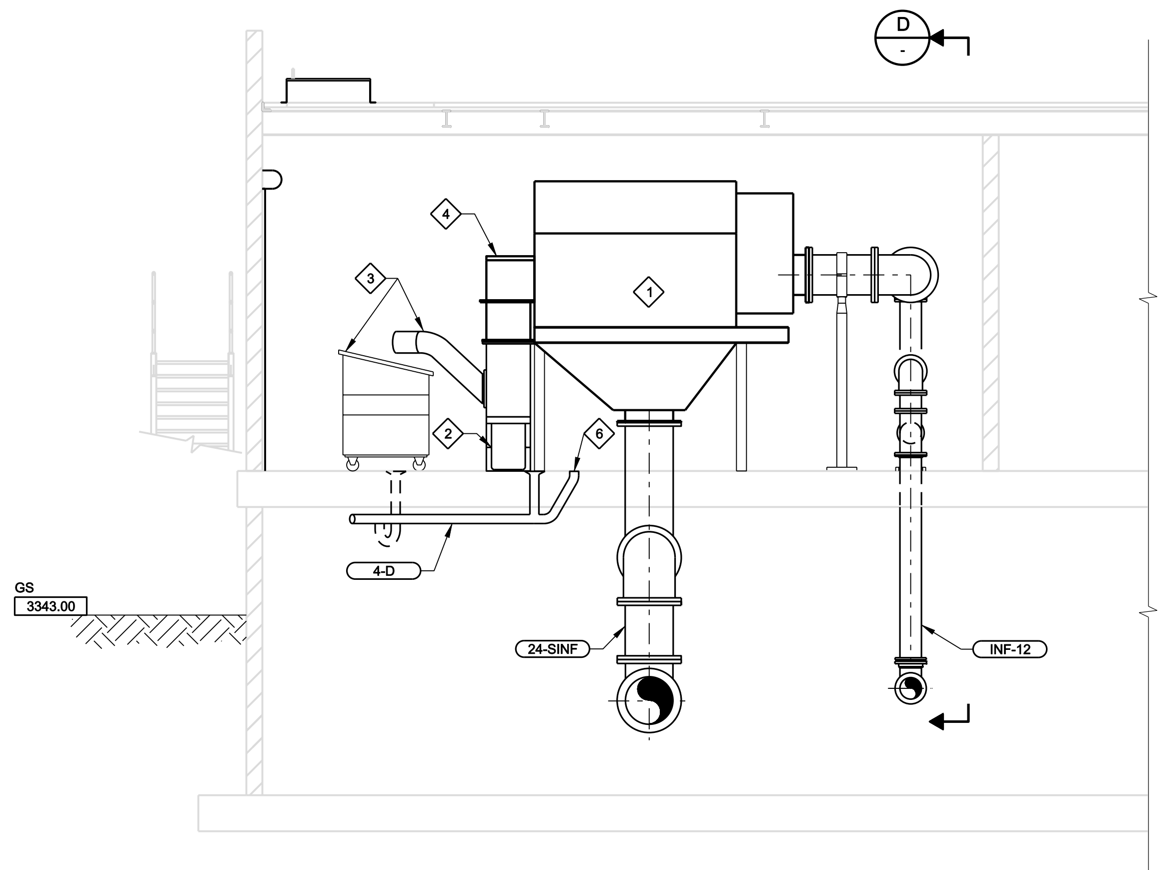
INFLUENT SCREENING PLAN

FIG 5A.1

KEY NOTES:

1. ROTARY DRUM FIRE SCREEN
2. SCREENINGS WASHER/COMPACTOR
3. COMPACTOR DISCHARGE PIPING AND COLLECTIONS DUMPSTER.
4. 316 STAINLESS STEEL SOLIDS DISCHARGE CHUTE
5. 8" MAGNETIC FLOWMETER
6. FLOOR CLEAN OUT (4"Ø)
7. 12" x 8" REDUCER



C SECTION
5B.1
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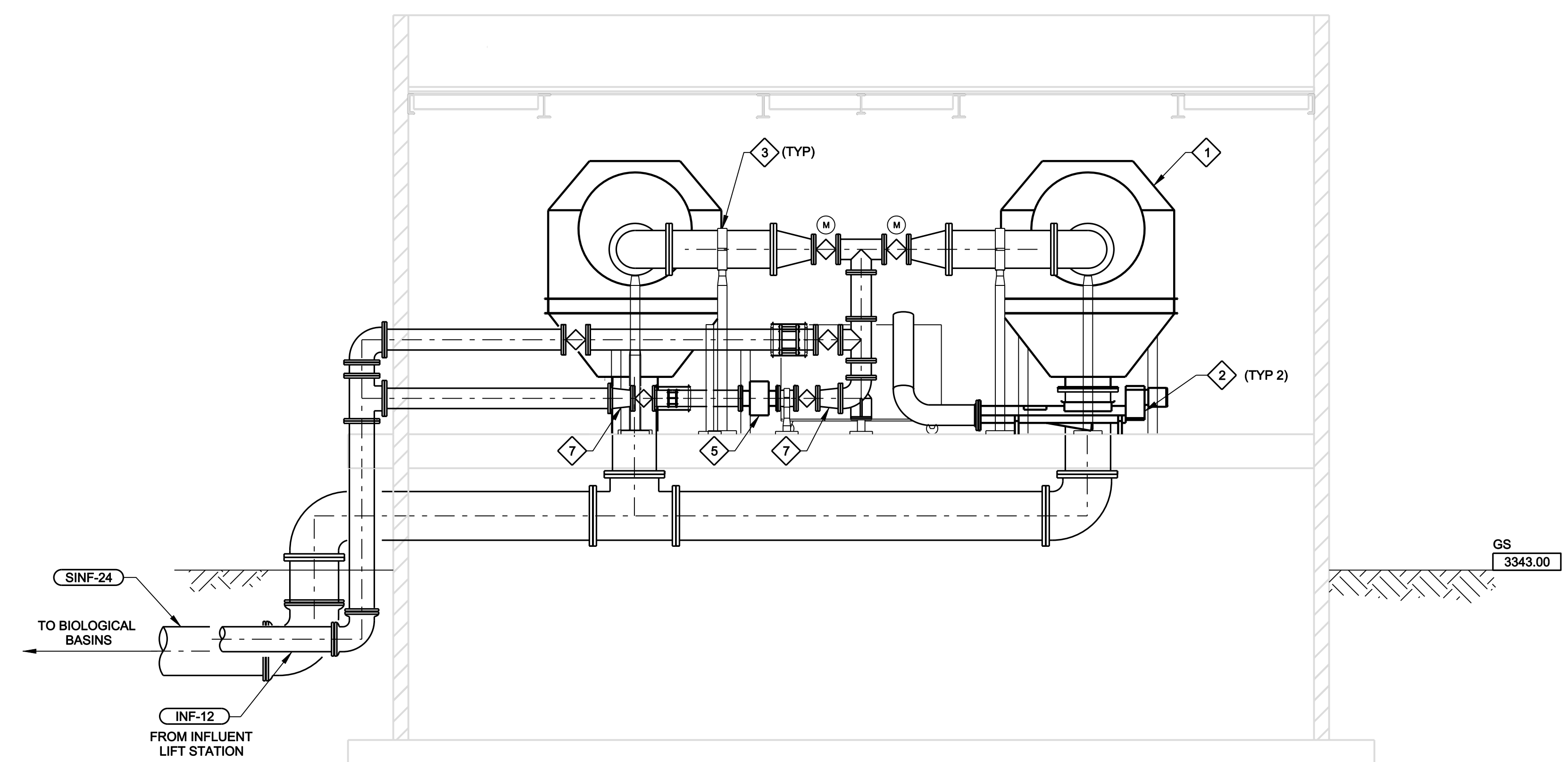

D SECTION
5B.1
SCALE: 1/4" = 1'-0"
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0 2' 4' 8'

VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

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INFLUENT SCREENING SECTIONS

FIG 5A.2

HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 6A

SECONDARY TREATMENT AND MEMBRANE FILTRATION

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

The biological treatment process is designed to remove biodegradable organic matter, suspended solids, and nutrients from the screened influent wastewater flow. Many different biological wastewater treatment technologies exist, and they represent a wide range of potential effluent quality, operational complexity, and capital cost.

As requested in the Request for Proposal (RFP) for this project, secondary/tertiary treatment at the Hesperia Water Reclamation Plant (WRP) will consist of an activated sludge process for biochemical oxygen demand (BOD) reduction and nutrient removal, coupled with membrane bioreactor (MBR) technology for solids-liquid separation. Design flows are 1.0 million gallons per day (mgd) for Phase 1, 2.0 mgd for Phase 2, and 4.0 mgd for buildout. Process modeling results for the proposed design are presented in DIM No. 3A, and include the basis of design for the secondary treatment process. This DIM No. 6A presents the process description and design criteria for the secondary treatment and membrane filtration facilities at the Hesperia WRP.

PROCESS DESCRIPTION

The MBR process was selected by VVWRA for the new Hesperia WRP. The MBR process combines the biological treatment process with membrane filtration to achieve secondary treatment and advanced filtration. This MBR configuration replaces the function of secondary clarifiers and granular media or cloth disk filtration in a conventional wastewater treatment process.

The biological nutrient removal (BNR) process is a critical component of the overall treatment system. As described in DIM No. 3A, a Modified Ludzack-Ettinger (MLE) process coupled with a MBR system is recommended to achieve a Total Nitrogen (TN) limit of 10 milligrams per liter (mg/L). The biological treatment process basins for the Hesperia WRP also are designed to accommodate a four-stage Bardenpho configuration with relatively minor modifications, in order to comply with a potential future TN limit of 5 mg/L.

The purpose of membrane filtration at the Hesperia WRP is to remove suspended solids in the mixed liquor from the biological treatment process and to provide a high-quality filtrate to optimize the efficiency of the UV disinfection process. Filtration is a vital component in producing reclaimed water to meet the effluent quality goals set for this project.

PROCESS DESIGN CRITERIA

Biological Treatment Basins

The biological treatment basins are configured as single pass basins, with internal baffles to separate the different anoxic (un-aerated) zones to achieve denitrification, and aerobic (aerated) zones to achieve nitrification, BOD and TSS removal. The baffles provide a physical separation between the different treatment zones within the basins, and are designed to promote serpentine flow and minimize potential short-circuiting and back-mixing between adjacent zones.

Screened wastewater and return activated sludge (RAS) from the MBR basins will be combined in a splitter structure (channel), and equally distributed between the biological treatment basins. Upward opening gates located at the bottom of the splitter channel will feed each biological treatment basin, and will also provide the ability to isolate basins for maintenance. Mixed liquor will flow through a first anoxic zone, a “swing zone”, two aerobic zones, and then a final “swing” zone. A “swing” zone is defined as a zone that can be operated either under aerated or un-aerated (mixed) conditions because it is equipped with both mixers and aeration diffusers. Provisions will be made to install an internal mixed liquor recycle pump in the second aerated zone, with a pipe running inside the basin and discharging into the first anoxic zone.

Mixed liquor will then flow over a weir and into the feed-forward pump wet well. Submersible pumps will transfer the mixed liquor from the wet well to the MBR basins. The feed-forward wet well can also provide equalization volume to compensate for differences between the plant influent flow and the effluent (permeate) flow from the membrane system. The biological process basins are designed with 2 feet of additional freeboard that can provide equalization volume to store peak flows. RAS flow will be returned by gravity from the MBR basins to the splitter channel at the head of the biological process basins.

Biological Treatment Basins Redundancy and Design Criteria

The redundancy of each unit process is defined herein as the treatment capacity as a percentage of the design flow, when operating with a basin out-of-service and while maintaining the effluent quality goals. For end-of-line plants, it is common practice to design fully redundant systems, i.e., provide standby basins for the different unit processes. However, for plants that have the ability to bypass influent flow (i.e., scalping plants) such as the Hesperia WRP, the level of redundancy required is less critical.

Table 6A.1 presents alternatives with different levels of redundancy for the biological treatment basins. The required biological treatment basins total volume is governed by the maximum month loadings presented in DIM No. 1A. Maximum month loading conditions result from increases in wastewater constituent concentrations, and not from an increase in hydraulic flow. The maximum month load peaking factors for BOD, TSS, and TKN are 1.5, 1.5, and 1.3, respectively.

Because the total required volume for biological treatment is determined by the maximum month loading conditions, the alternatives presented in Table 6A.1 require the same total basin volume at the end of Phase 2 (2.0 mgd), and at buildout (4.0 mgd). The number of basins for each alternative results in a different level of redundancy, expressed as a percentage of the design flow at annual average loadings when operating with one basin out-of-service.

Alternative C is recommended for the Hesperia WRP, Phase 1 and Phase 2. Alternative A does not provide any redundancy in Phase 1, and any maintenance performed in the biological treatment basins would result in a diversion of the entire plant flow to the interceptor system. Alternative B results in 4 basins for Phase 2 and a level of redundancy that exceeds standard practice of 100 percent redundancy at annual average day loadings. Alternative C is recommended because it provides 100 percent redundancy with one basin out-of-service under annual average day loading for both phases (1 and 2). The need for biological treatment basin volume and basin redundancy should be re-evaluated after Phase 2.

Table 6A.1 Biological Treatment Basins Redundancy Alternatives
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Phase	Alternative	Redundancy, % (1)	Number of Trains	Annual Average Day Flow Capacity, mgd			Maximum Month Average Day Flow Capacity, mgd
				Each Train	One Train Out of Service (n-1)	All Trains in Service (n)	All Trains in Service (n)
1 (1.0 mgd)	A	0	1	1.5	0.0	1.5	1.0
	B	75	2	0.75	0.75	1.5	1.0
	C	**100**	**2**	**1.0**	**1.0**	**2.0**	**1.3**
2 (2.0 mgd)	A	50	2	1.5	1.5	3.0	2.0
	B	125	4	0.75	2.25	3.0	2.0
	C	**100**	**3**	**1.0**	**2.0**	**3.0**	**2.0**
Buildout (4.0 mgd)	A	112	4	1.5	4.5	6.0	4.0
	B	131	8	0.75	5.25	6.0	4.0
	C	**125**	**6**	**1.0**	**5.0**	**6.0**	**4.0**

Notes:
(1) Expressed as a percentage ratio between the capacity with one basin out-of-service and the annual average design flow and load for each phase.

Table 6A.2 presents a summary of the design criteria for the biological treatment basins, which was established through a process modeling evaluation for the proposed design (DIM No. 3A).

**Table 6A.2 Biological Treatment Basins Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California**

Parameter	Unit	Phase 1 (1.0 mgd)	Phase 2 (2.0 mgd)
Type of Basins	-	Single Pass, multiple zones	
Number of Parallel Trains	-	2	3
Basin Volume, each	MG	0.381	
Total Basin Volume	MG	0.763	1.144
Side Water Depth	ft	17 to 19 (1)	
Basin Width (2)	ft	20	
Zone Lengths (2)			
Zone A – Anoxic	ft	10	
Zone B – Swing (Aerobic / Anoxic)	ft	10	
Zone C – Aerobic	ft	55	
Zone D – Aerobic	ft	55	
Zone E – Swing (Aerobic / Anoxic)	ft	20	
Total Basin Length	ft	150	
Feed-Forward Pump Wet Well Width (2)	mgd	20	
Feed-Forward Pump Wet Well Length (2)	mgd	40	60

Notes:

(1) Normal side water depth is 17 ft, with the ability to operate up to 19 ft during periods of flow equalization.

(2) Inside dimensions.

Anoxic Zone Mixing

Submersible propeller mixers are recommended to provide anoxic zone mixing. Submersible propeller mixers are a reliable mixing device and are commonly used in many wastewater treatment plants. To maximize mixing performance in the anoxic zone, it is beneficial to position the mixer to produce a well-defined circulation in the tank. This technique slows tank losses and evenly distributes shear forces and velocities throughout the tank. In general, the power input per unit volume of liquid is used as an indication of a mixer’s effectiveness. One mixer per zone is recommended for the biological treatment basins of the Hesperia WRP.

Several variations of submersible propeller mixers are available, including the number of impellers (single vs. dual) and type of mount (deck-mounted vs. rail-mounted). Some operators have identified problems with leaking oil gearboxes for deck- or bridge-mounted mixers. One alternative to this problem is the use of submersible, rail-mounted mixers, which are recommended for this project. While they need to be retrieved from the mixed liquor for maintenance (which typically includes semi-annual grease lubrication), rail-mounted mixers are high efficiency and typically have a lower capital cost than deck- or bridge-mounted units.

Aeration System

The overall aeration system will be designed to effectively control the amount of air delivered to the process. The design will also include sufficient monitoring and control points to allow for the proper control of the activated sludge process.

The aeration system includes the aeration blowers that provide the required process air, and the aeration diffusers that distribute the air and transfer the oxygen in the air into the mixed liquor. The oxygen transfer efficiency of the aeration diffusers has a significant impact not only on the required blower capacity (capital costs), but also on the power consumption of the aeration blowers (operational costs). More efficient oxygen transfer translates to reduced blower capacities required, and reduced operational costs due to the reduced power consumption.

Fine bubble diffusers are recommended for the Hesperia WRP aeration system due to their higher oxygen transfer efficiency, as compared to coarse bubble aeration. Membrane disc type fine bubble diffusers are used in many WRP facilities, including the Westside Water Reclamation Plant.

The recommended blower type is positive displacement. The standard GE/Zenon MBR process blowers are also positive displacement. Maintaining commonality between the biological treatment blowers and the MBR blowers facilitates maintenance and training for operations staff. Other types of blowers include high-speed turbo and centrifugal blowers. While high-speed turbo blowers can be more efficient, the capital cost can be considerably higher (approximately 20 percent more per preliminary estimates). Centrifugal blowers are not recommended for this application due to the variable discharge flows under the expected range of discharge pressures, and due to the higher capital cost for the size range required.

Table 6A.3 presents the basic preliminary design criteria for the aeration system.

**Table 6A.3 Aeration System Preliminary Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California**

Parameter	Unit	Phase 1 (1.0 mgd)	Phase 2 (2.0 mgd)
Type of Diffusers	-	Fine bubble, membrane discs	
Blower Air Requirement	scfm	3,200	7,200
Number of Blowers (Duty + Standby)	-	2 + 1	4 + 1
Blower Capacity, each	scfm	1,800	
Firm Blower Capacity, total	scfm	3,600	7,200
Estimated Discharge Pressure (1)	psig	9.4	

Notes:

(1) Estimated discharge pressure includes the additional 2 ft of side water depth provided for potential equalization. At 17 ft of SDW, the estimated discharge pressure is 8.5 psig.

Feed-Forward Pumping

The purpose of the feed-forward wet well pumps is to transfer the activated sludge from the biological process basins to the MBR basins for the final solids-liquid separation process via the membrane filtration system. The wet well can provide some equalization volume to handle variations in the influent flows that are beyond the production capacity of the membranes. In addition, the feed-forward pump station allows the accurate control of the flow from the aeration basins to the membrane zones. While other approaches use downward-opening weir gates to control flow into membrane zones, and equalize in the aeration zones, weirs are water level control devices which do not accurately control flow. The feed-forward pump station approach is superior in its ability to control both flow and level in an accurate fashion. The available flow equalization is discussed later in this memorandum. The feed-forward wet well will be located at the end of the biological process basins.

The proposed feed-forward pumps are non-clog, submersible, wet pit centrifugal pumps with variable speed control via variable frequency drives. The pumps will be provided with guide rails for easy retrieval from the wet well.

Table 6A.4 presents the design criteria for the feed-forward wet well. Three feed-forward pumps equipped with VFD drives will be provided at Phase 1 - two duty and one standby pump. At Phase 2, one of the pumps will require replacement with a larger capacity unit, and an additional pump will be required.

**Table 6A.4 Feed-Forward Wet Well Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California**

Parameter	Phase 1 (1.0 mgd)	Phase 2 (2.0 mgd)
Solids Content, %	0.8 (range between 0.7 and 1.0)	
Pump Type	Submersible, Centrifugal, Wet Pit	
Pump Motor Control	VFD	
Design Flow, mgd	5.0	10.0
Number of Pumps (Duty + Standby)	2 + 1	3 + 1
Pump Capacity	2 @ 2,350 gpm (3.4 mgd) 1 @ 1,100 gpm (1.6 mgd)	4 @ 2,350 gpm (3.4 mgd)
Firm Capacity, mgd	5.0	10.2
Total Capacity, mgd	8.4	13.5

Figure 6A.1 presents a preliminary plan and section of the biological treatment basins and feed-forward wet well.

Scum Control

Scum control can be a significant issue in MBR operation, and a positive means to waste scum from the surface of the liquid level in the mixed liquor should be provided in MBR plants. Therefore, the feed-forward wet well will be equipped with a downward-opening slide gate to remove floating scum and waste activated sludge (WAS) from the surface of the mixed liquor. In this manner, the scum and WAS can be simultaneously discharged to the WAS holding wet well, from where the submersible WAS pumps can send the wasted sludge and scum back to the interceptor. At buildout, each end of the feed-forward pump station will include downward-opening weir gates that allow the surface wasting of scum and WAS into each WAS pump station.

MBR System

MBRs consist of proprietary membrane filtration systems combined with a biological activated sludge treatment process. Because of the proprietary nature of the membrane system and its implications for design of the overall wastewater treatment process, the VVWRA selected a membrane system manufacturer at the beginning of the design process. The ZeeWeed® MBR system, manufactured by GE Water & Process Technologies, was selected as the membrane supplier for the new Hesperia WRP MBR system.

The ZeeWeed® MBR system consists of membranes that are immersed in open tanks of aerated mixed liquor. The membranes are hollow fibers with fixed pore sizes to prevent suspended solids from passing through. Permeate pumps create a vacuum in the membrane fibers, which drives flow from the outside of the membrane fiber to the inside of the fiber, filtering the flow through the membrane.

The basic component of the ZeeWeed® membranes is a bundle of hollow membrane fibers called a membrane module. Each module consists of approximately 340 square feet of membrane area. Modules are grouped together into membrane cassettes, and multiple cassettes are configured into a membrane train. Each membrane train is equipped with a dedicated permeate pump.

There are two important design criteria determine the membrane area required in the system. One of these criteria is redundancy. Based on standard practice, a fully redundant MBR train is recommended for the Hesperia WRP. Operating with one of the membrane trains out-of-service is known as the “n-1” condition. Designing the MBR system with the ability to reliably maintain water production at the design flow for the “n-1” condition provides a robust treatment process, capable of operating with an entire membrane train out-of-service. Several conditions result in the MBR system frequently operating with a membrane train out-of-service:

- Backpulsing or maintenance cleaning;
- Recovery cleaning; or
- Maintenance or repair.

Another key design criterion for the design of the MBR system is the flux through the membranes. Flux describes the rate of water filtered through the membrane measured in gallons per day per square foot of membrane area (gfd). Design fluxes need to be evaluated when the MBR system it is operating with all trains in service, and with one train out-of-service. A maximum design flux for these two operating conditions was established, so that the membranes are not subjected to excessive vacuum pressure from the permeate pumps. The maximum design fluxes for the Hesperia WRP were selected as 14 gfd when all membrane trains are in service, and 18 gfd when one membrane train is out-of-service.

MBR System Redundancy and Design Criteria

Table 6A.5 presents alternatives with different levels of redundancy for the membrane filtration trains. The capacity of a given configuration of membrane trains, cassettes, and modules is determined by the net permeate flux through the membranes. The alternatives presented are based on producing the Phase 1 and Phase 2 design flows with all MBR trains in service. The number of MBR trains for each alternative results in a different level of redundancy, expressed as a percentage of the design average day flow.

Alternative D is recommended for Phase 1 and Phase 2 of the Hesperia WRP. Alternative F does not provide any redundancy in Phase 1, and any maintenance performed in the MBR trains would result in a diversion of the entire plant flow to the interceptor system. Alternative E results in a level of redundancy that would exceed standard practice for a scalping plant. Alternative D is recommended because it provides 50 percent redundancy with one MBR train out-of-service under Phase 1 and Phase 2 flows, yet it provides the flexibility to re-evaluate redundancy needs after Phase 2, as expansions to either Alternative D or Alternative E are feasible for Phase 2. The recommended alternative requires that during periods when an MBR train is out-of-service, only 50 percent of the design influent flow can be pumped to the treatment system.

**Table 6A.5 MBR Basins Redundancy Alternatives
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California**

Phase	Alternative	Redundancy, % (1)	Number of Trains / Modules / Cassettes	Average Day Flow Capacity, mgd	
				One Train Out of Service (n-1)	All Trains in Service (n)
1 (1.0 mgd)	**D**	**50**	**2 / 3 / 42**	**0.5**	**1.0**
	E	100	3 / 2 / 42	1.0	1.0
	F	0	1 / 5 / 42	0.0	1.0
2 (2.0 mgd)	**D**	**50**	**2 / 5 / 42**	**1.0**	**2.0**
	E	100	3 / 4 / 42	2.0	2.0
	F	n/a	n/a	n/a	n/a
Buildout (4.0 mgd)	D	88	4 / 5 / 42	3.5	4.0
	E	100	5 / 4 / 42	4.0	4.0
	F	n/a	n/a	n/a	n/a

Notes:

(1) Expressed as a percentage ratio between the capacity with one basin out-of-service and the annual average design flow and load for each phase.

The recommended design criteria for the MBR system is presented in Table 6A.6. Membrane fluxes will be maintained below the established maximum design criteria for the “n” and “n-1” conditions by constructing two membrane trains. For the initial Phase 1 construction, each membrane train will be equipped with three membrane cassettes. To expand to the Phase 2 treatment capacity and maintain the same level of redundancy, two additional membrane cassettes will be added to each membrane train. Another alternative at Phase 2, if more redundancy is required, is to construct a third membrane train and install four cassettes per train. Both options are feasible by constructing the Phase 1 membrane trains with space for 5 cassettes per train. Alternatively, additional redundancy is provided for moving membranes from an out-of-service membrane train, by using the bridge crane, and installing into the operating train. Since the buildout operation is not known at this time, a recommendation on buildout redundancy is not provided.

Table 6A.6 Membrane Filtration Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Parameter	Phase 1	Phase 2
Number of membrane trains	2	2
Number of membrane cassettes per train	3	5
Number of cassette spaces per train	5	5
Number of membrane modules per cassette (1)	42	42
Total membrane area, “n” condition, ft^2	85,680	142,800
Total membrane area, “n-1” condition, ft^2	42,840	71,400
Design membrane flux, “n” condition, gfd	11.7	14.0
Design Flow, “n” condition, mgd	1.0	2.0
Design Flow, “n-1” condition, mgd	0.5	1.0

Notes:
(1) Maximum number of modules per cassette is 48.

The proposed membrane basins layout is illustrated in Figure 6A.2. In addition, ancillary equipment associated with the MBR process includes blowers, air compressors, and chemical feed systems. The MBR process blowers distribute air into the MBR basins to provide air scouring of the membrane fibers, and assist with the treatment process. Air compressors provide air to operate pneumatic valves associated with the MBR process. The chemical feed systems associated with the MBR process include bulk (12.5 percent) sodium hypochlorite and citric acid to assist with cleaning the membrane fibers. A back pulse tank is also provided to serve as the water source for membrane back pulsing and cleaning operations. The ancillary equipment associated with the MBR process is located in areas adjacent to the MBR basins.

Flow Equalization

Flow equalization is required when the influent flow to the WRP exceeds the membrane production capacity (plant effluent). Because the Hesperia WRP is being designed as a scalping plant, it is not expected that significant hydraulic peaks need to be dealt with at the plant. However, Carollo recommends adding flexibility to the design, in order to include some degree of flow equalization to equalize minor fluctuations in the flow, and also in case future design conditions change and the plant needs to operate as an “end-of-the-line” plant.

The proposed secondary system provides two locations for flow equalization. One of these locations is the feed-forward wet well, which can provide equalization volume that depends on the operating side water depth of the wet well. As a conservative approach, the side water depth of the feed-forward wet well is designed 2 feet below the side water depth in the biological treatment basins. Once this volume is used up, the water level rises, submerging the final weir of the biological treatment basins, making the water level in the feed-forward wet well and the water level in the biological treatment basins equal. Should equalization requirements increase in the future, the level in the wet well can be operated lower in order to increase the available equalization volume.

The biological process basins are designed with a total freeboard of 3 feet. Leaving a freeboard of approximately 1 feet at all times, the remaining 2 feet above the normal operating level can be used for equalization of peak flows.

To determine the system capability to equalize flows, a maximum water production from the MBR system needs to be determined. For the purposes of calculating equalization capabilities, the maximum allowable flux through the membranes was established at 20 gfd.

Table 6A.7 presents the design criteria as it relates to flow equalization within the proposed system. The most critical conditions for equalization occur when one biological process basin is out-of-service. The analysis presented herein does not consider MBR trains out-of-service (under such conditions, the plant flow is limited to 50 percent of the plant capacity). Under these conditions, the maximum peak flow (with a duration of 4 hours) that the system can equalize is 2.0 mgd (Phase 1) and 3.3 mgd (Phase 2) or a peaking factor of 2 and 1.65, respectively, with one aeration basin out-of-service.

Table 6A.7 Flow Equalization Analysis
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Parameter	Unit	Phase 1	Phase 2
Influent Average Flow	mgd	1.0	2.0
Maximum Influent Peak Flow (1)	mgd	2.0	3.3
Maximum Flux through MBR System	gfd	20.0	
Number of MBR Basins in Service	-	2	
MBR System Capacity (n-1)	mgd	1.71	2.86
Equalization Flow	mgd	0.29	0.44
Peak Flow Duration	hr	4.0	4.0
Equalization Volume (1)	gal	47,733	74,000
Number of Biological Treatment Basins in Service	-	1	2
Side Water Depth Used for Equalization (1)	ft	1.9	1.8
Total Available Freeboard	ft	3.0	3.0
Freeboard Below Top of Basin During Equalization	ft	1.1	1.2

Notes:

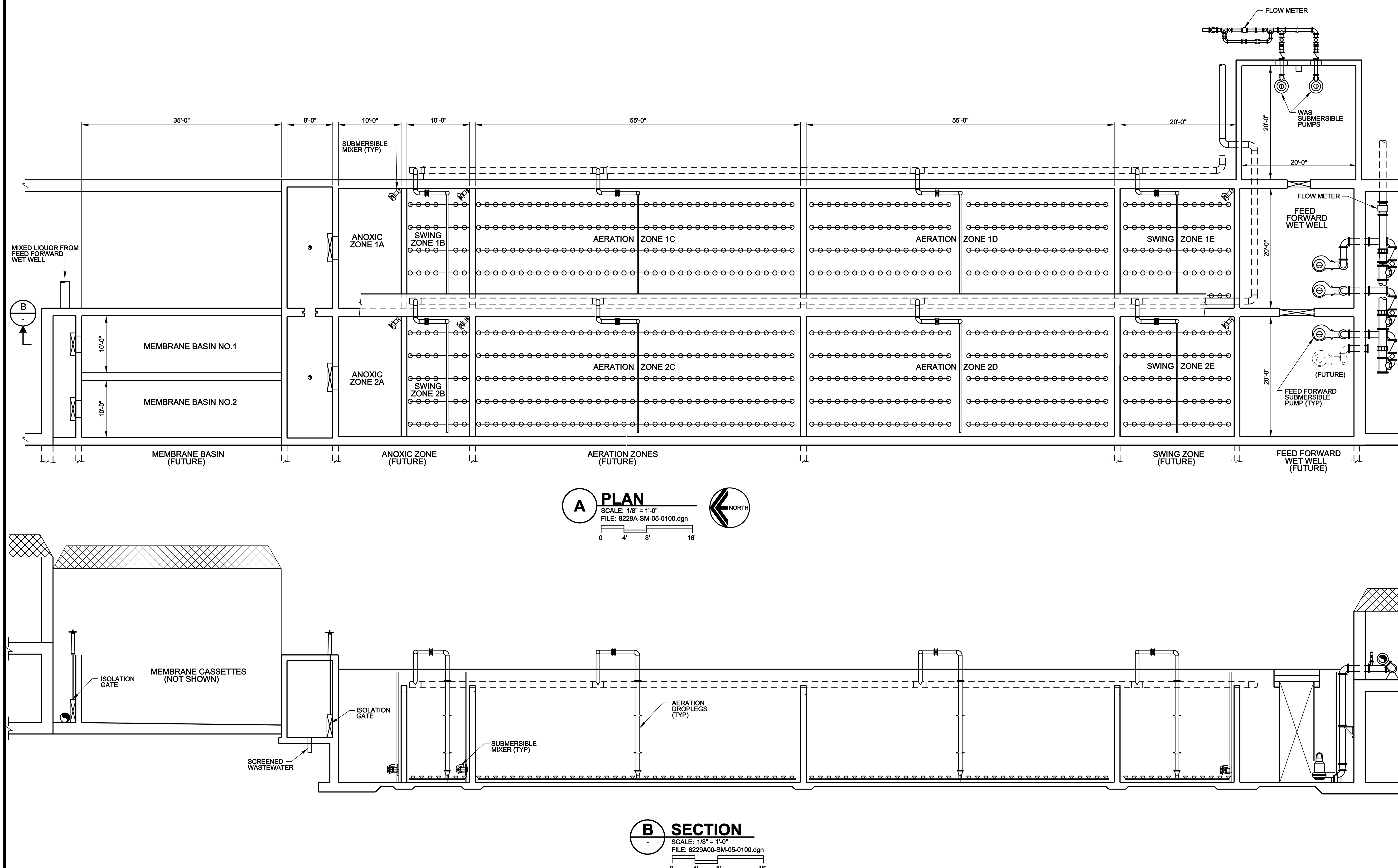
(1) Calculations assume that 2 feet of side water depth in the feed-forward wet well is available for flow equalization.

Equalization is required to compensate flows smaller than the target design capacity of 1.0 mgd. The proposed biological treatment basins and feed-forward pump station provide sufficient available volume to equalize influent flows and consistently produce 1.0 mgd of treated effluent Figure 6A.3 presents an analysis of the equalization volume used assuming an average day flow (ADF) of 2.3 mgd available in the interceptor. As presented in DIM No. 1A, the ADF of 2.3 mgd and the diurnal flow profile were obtained from the predicted flow according to the Wastewater Master Plan (Carollo Engineers, 2008). The required equalization volume can be obtained from the feed forward wet well, as shown in the level fluctuations presented in Figure 6A.4. The calculations assume that one aeration basin and one section of the feed-forward wet well are in service.

Because of the uncertainty of the actual ADF available in the interceptor at plant startup, an additional scenario with an ADF of 1.0 mgd was considered in the equalization volume analysis. This is the most critical scenario for the purposes of evaluating equalization volume requirements. Figure 6A.5 presents an analysis of the equalization volume used assuming an average day flow (ADF) of 1.0 mgd available in the interceptor. For this scenario, both biological treatment basins and both sections of the feed-forward wet well need to be in service in order to provide sufficient equalization volume to consistently produce 1.0 mgd of treated effluent. Figure 6A.6 presents the estimated level fluctuations in the biological treatment basins and the feed-forward wet well for this scenario.

SUMMARY AND RECOMMENDATIONS

- Two biological treatment basins are recommended for Phase 1. One additional basin is recommended for Phase 2. Basins are sized to reliably treat the design flow under average constituent loadings with one basin out-of-service, and to treat maximum month loadings with all units in service. The maximum month load peaking factors for BOD, TSS, and TKN are 1.5, 1.5, and 1.3, respectively.
- Each basin contains anoxic and aerobic zones separated by baffles that promote serpentine flow. The last zone of each basin is designed as a “swing” zone with the ability to operate under anoxic or aerobic conditions. We recommend making provisions to readily install an internal mixed liquor return pump in Zone D of each basin, which will discharge into Zone A.
- A feed-forward configuration is recommended for the biological process / MBR system to improve process control and equalization. Mixed liquor will be pumped from the feed-forward wet well to the MBR basins. RAS flow back to the biological treatment basins is achieved via gravity. The recommended feed-forward pumping system is based on wet pit submersible pumps with variable speed control.
- The recommended MBR system configuration is based on two trains for Phases 1. At Phase 2, the water production capacity of the MBR system is increased by adding either two more cassettes in each MBR train (2 trains, 5 cassettes per train), or by adding one more train with one more cassette per train (3 trains, 4 cassettes per train). Membrane trains will be designed to hold 5 cassettes to allow either expansion option at Phase 2.
- Propeller-type submersible mixers are recommended for anoxic mixing.
- Fine bubble membrane disc aeration diffusers are recommended due to the higher transfer efficiency compared to coarse bubble diffuser systems. Positive displacement blowers are recommended for the aeration system, based on commonality with MBR blowers and lower capital cost.
- A downward-opening gate is recommended as part of the sludge wasting system, in order to achieve a positive mean to eliminate scum from the surface.

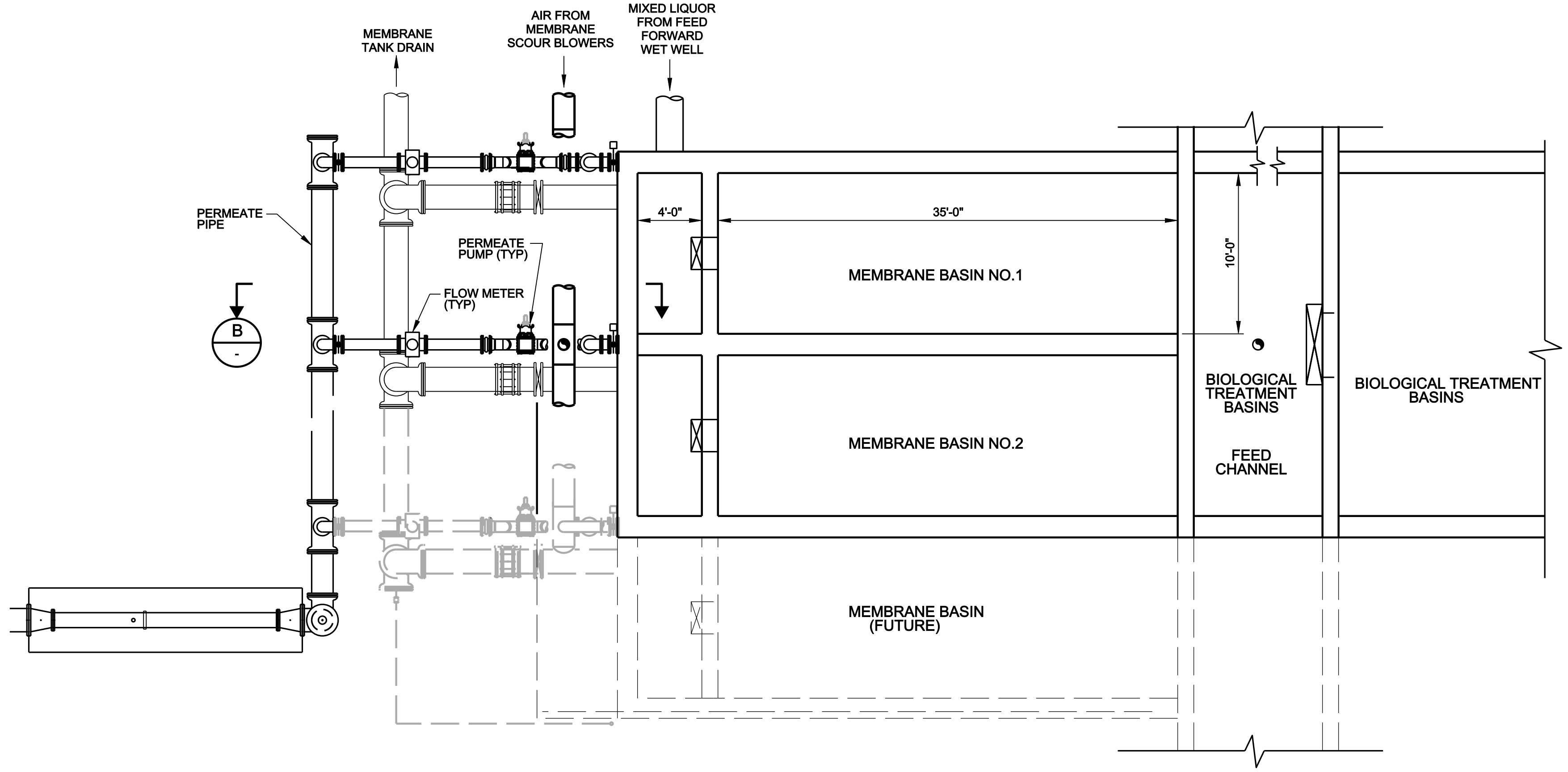


VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

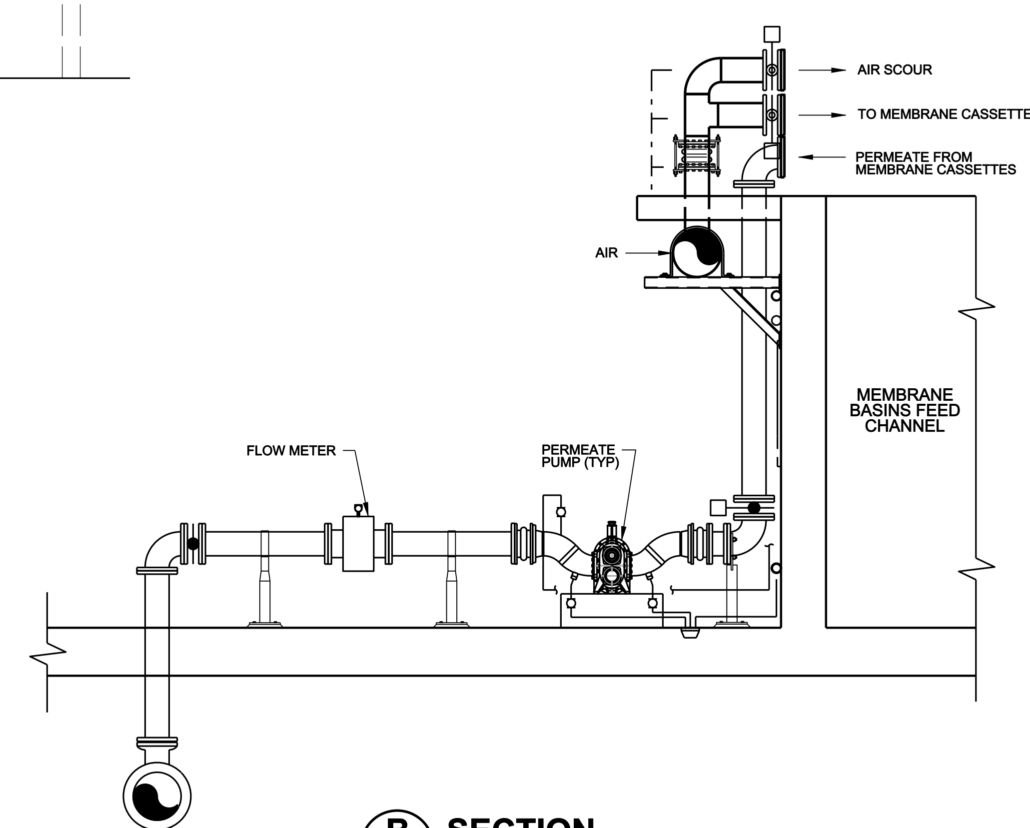
HDR | Carollo

AERATION/MEMBRANE FACILITIES - PLAN & SECTION

FIGURE 6A.1



A PLAN
SCALE: 3/16" = 1'-0"



B SECTION
SCALE: 3/8" = 1'-0"
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VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

HDR

Carollo

MBR FACILITIES - PLAN & SECTION

FIGURE 6A.2

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EQUALIZATION VOLUME ANALYSIS,
ADF = 2.3 MGD

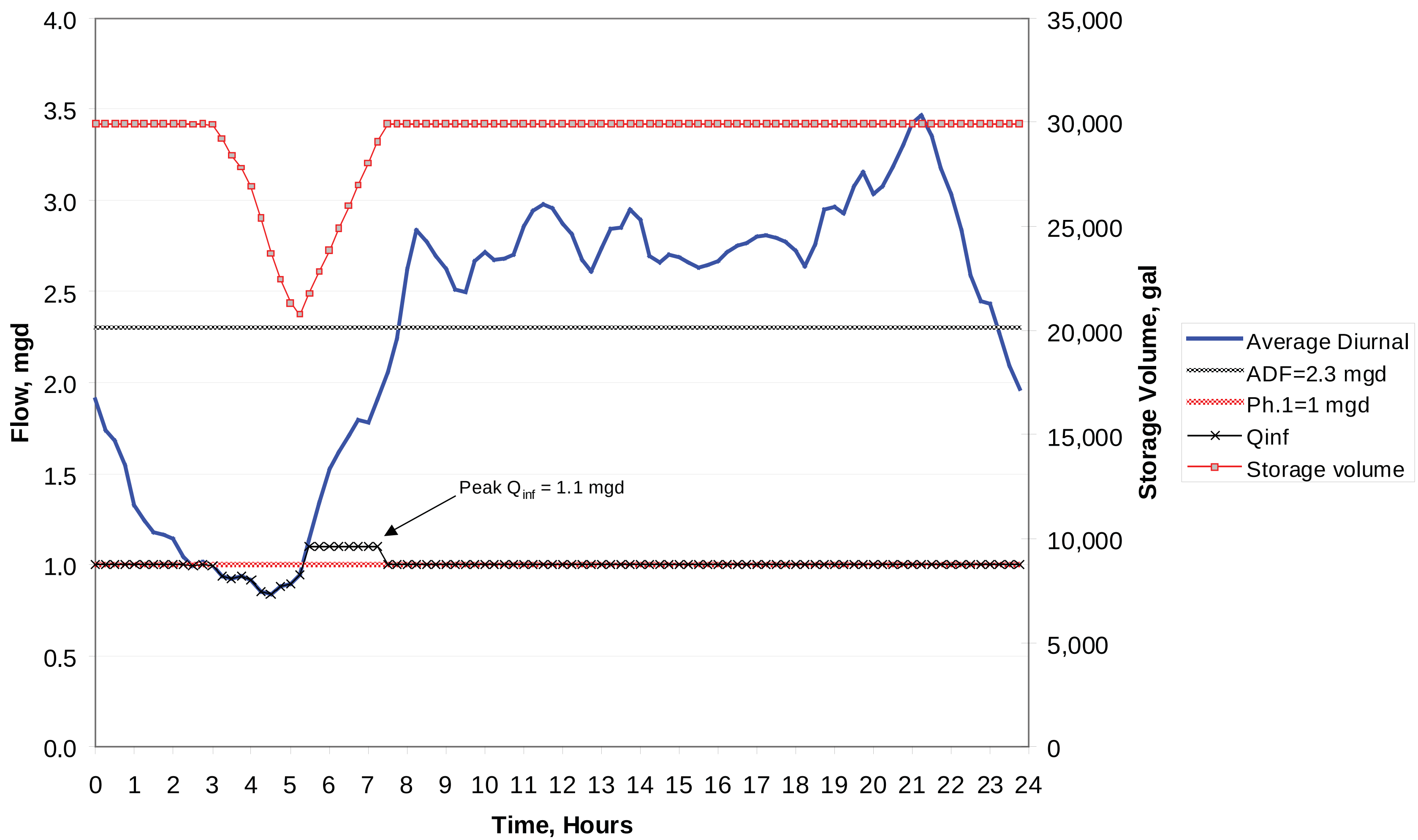

FIG 6A.3

VICTOR VALLEY WATER RECLAMATION AUTHORITY -
HESPERIA WRP - PRELIMINARY DESIGN REPORT

BASIN LEVEL FLUCTUATIONS, ADF = 2.3 MGD

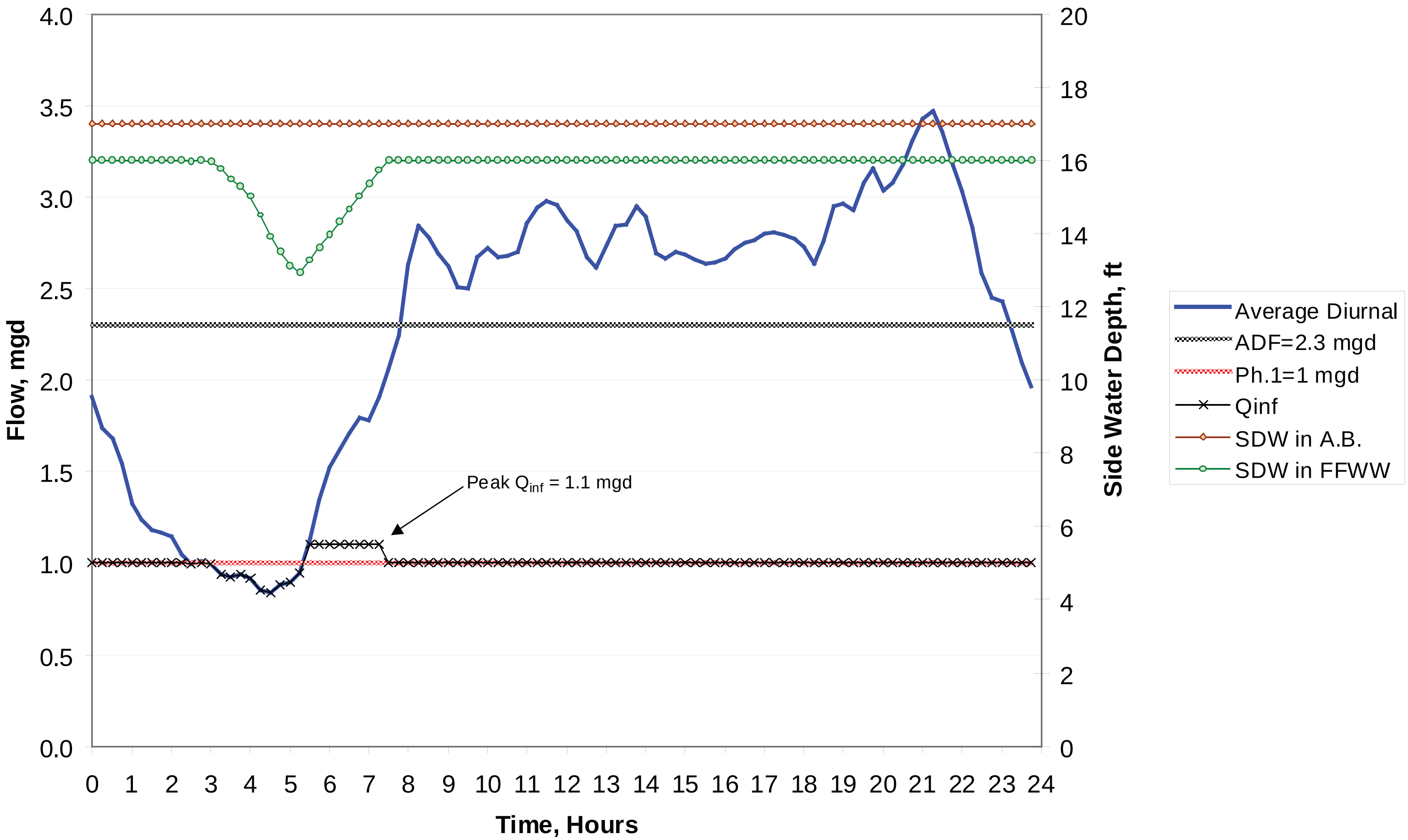

FIG 6A.4

VICTOR VALLEY WATER RECLAMATION AUTHORITY - HESPERIA WRP - PRELIMINARY DESIGN REPORT

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EQUALIZATION VOLUME ANALYSIS, ADF = 1.0 MGD

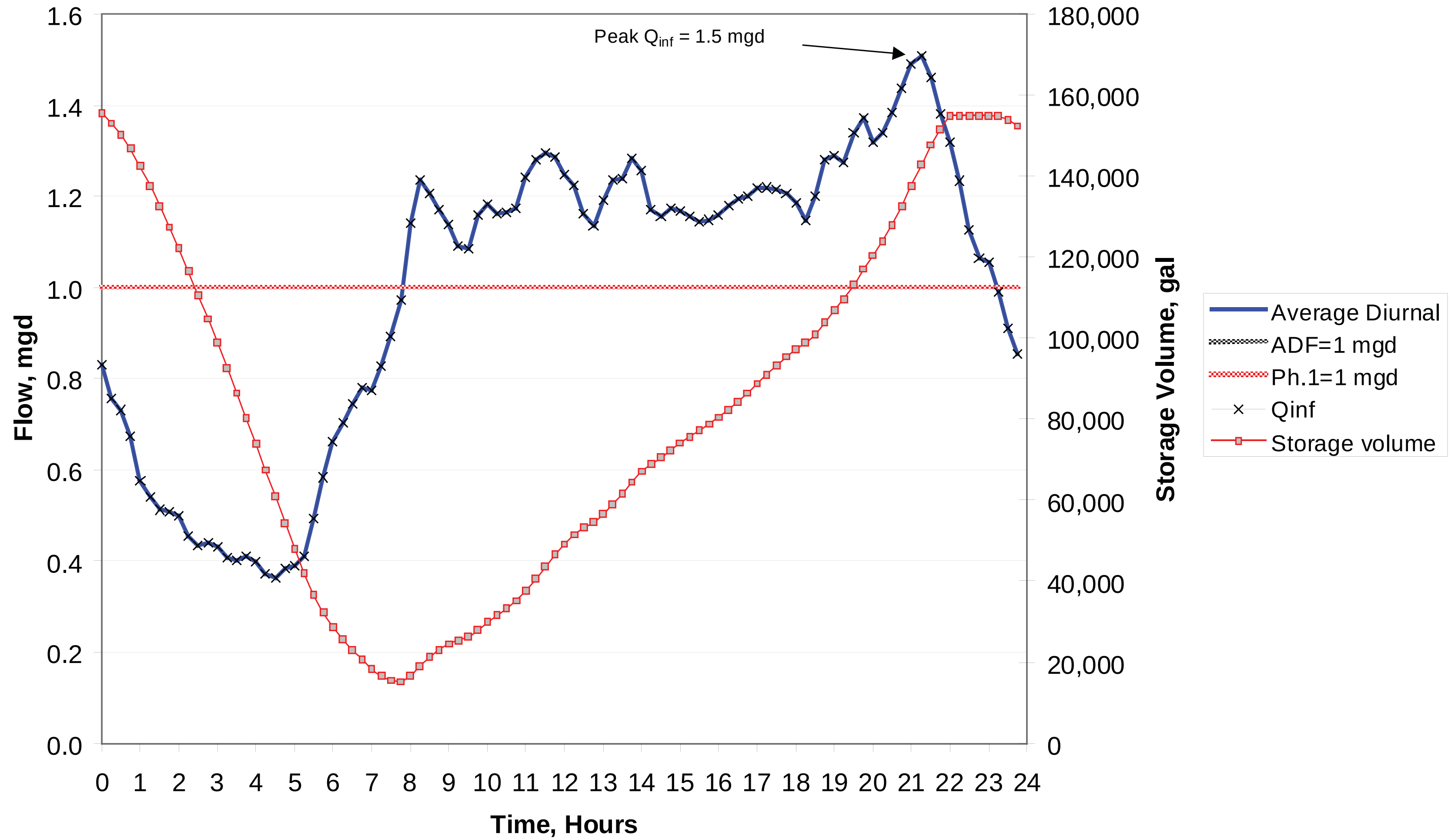

FIG 6A.5

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VICTOR VALLEY WATER RECLAMATION AUTHORITY -
HESPERIA WRP - PRELIMINARY DESIGN REPORT

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BASIN LEVEL FLUCTUATIONS, ADF = 1.0 MGD

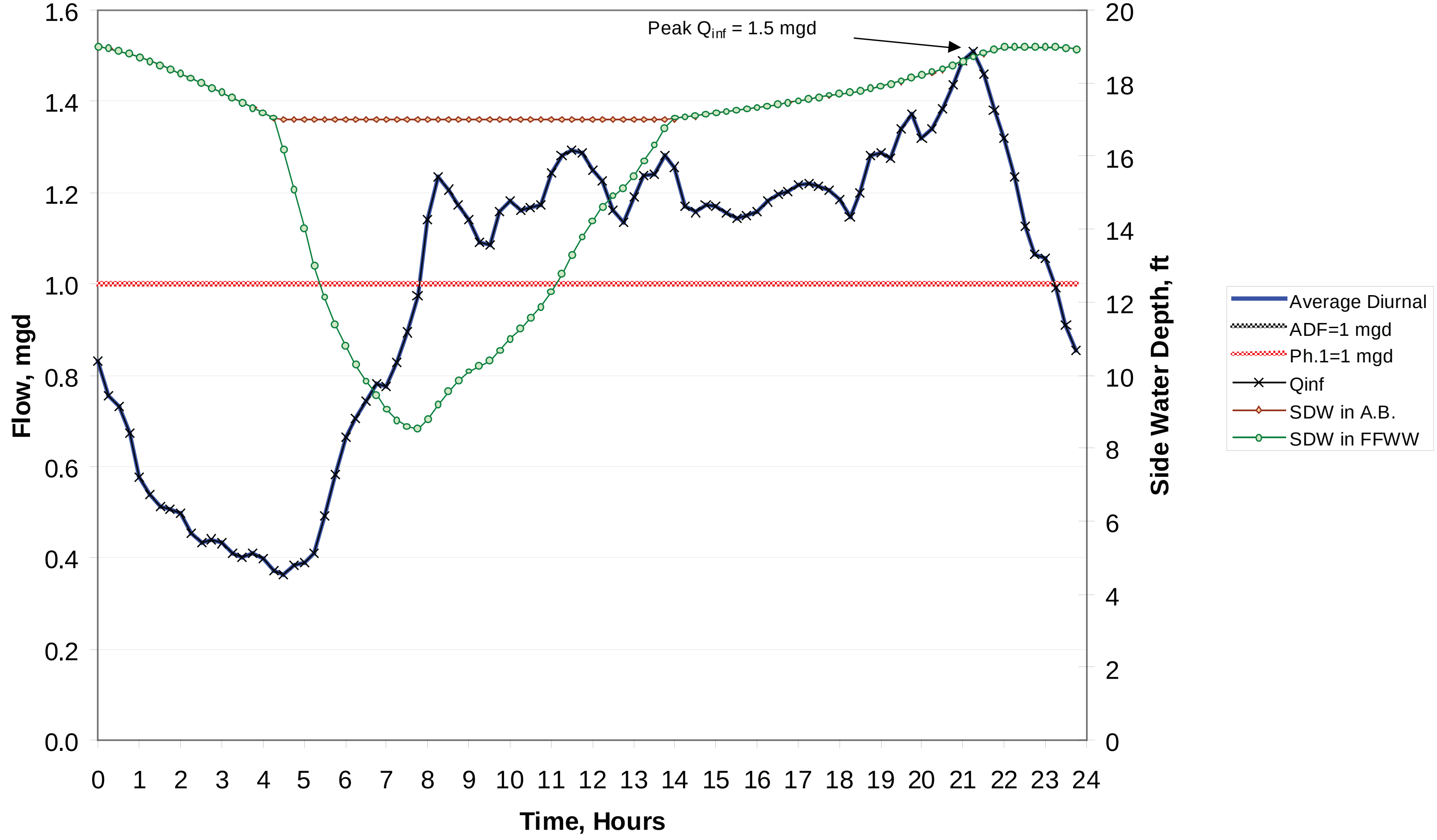


FIG 6A.6

VICTOR VALLEY WATER RECLAMATION AUTHORITY - HESPERIA WRP - PRELIMINARY DESIGN REPORT

HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 7A

DISINFECTION

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

The goal of the disinfection process is to significantly reduce or eliminate pathogenic microorganisms prior to discharging the treated effluent (reclaimed water). Multiple unit treatment processes may be used to achieve this requirement. As for the Hesperia WRP, ultraviolet light (UV) disinfection was pre-selected by VVWRA, to be consistent with the Westside Water Reclamation Plant (WRP) disinfection process.

The level of disinfection at Hesperia WRP is dictated by the desired end-use (reuse and recharge) of the reclaimed water. Effluent quality requirements and recommended effluent design criteria are discussed in detail in DIM-1A. The recommended reclaimed water disinfection design criteria is intended to meet the definition of “filtered wastewater” in California’s Water Recycling Criteria, Title 22, Division 4, Chapter 3.

PROCESS EQUIPMENT

UV disinfection uses UV light rays to inactivate pathogens in water. UV systems can be provided in open channel or closed-vessel configurations. Open channel UV systems flow by gravity through an open channel, which is often covered to discourage algal growth. Closed-vessel UV systems are pressurized vessels in which water must be pumped through the unit. At the Hesperia WRP, a closed-vessel UV system would take advantage of the permeate pumps associated with the MBR system (to pump the water through the UV vessels) and would provide a more compact system orientation.

UV light can be produced by UV lamps of low-pressure (LP), medium-pressure (MP) or low-pressure/high-output (LP/HO). Low-pressure UV systems require a large number of low-wattage lamps. Medium pressure UV systems use high-wattage lamps and therefore require fewer lamps than low-pressure systems to achieve similar disinfection. Low pressure/high output UV systems require an intermediate number of lamps (i.e. between their low and medium pressure counterparts) and also have an intermediate UV output. Based on considerations of competitive bid, both LP/HO and MP UV system are suitable for installation at the Hesperia WRP.

Based on preliminary discussions with Southern California Edison, they recommended using lower power equipment when practical; which will likely result in a final design recommendation to select LP/HO high output over MP UV reactors.

Using UV light for disinfection does not cause any disinfection byproduct (DBP) formation, requires no in-stream chemicals for primary disinfection, and eliminates on-site dechlorination requirements. UV disinfection also has the benefits of compact footprint, ease of upgradeability, future use in treating emerging contaminants, compatibility with MBR technology, and short treatment (i.e. exposure or contact time).

On the other hand, UV process has a relatively high electrical power consumption and can be used to achieve only primary disinfection. A secondary disinfection is typically required to maintain a disinfectant residual in reclaimed water storage and distribution systems.

PROCESS LAYOUT

Based on the recommended equipment, a preliminary closed-vessel UV disinfection configuration is presented in Figure 7A.1. The UV disinfection system at Hesperia WRP will be installed in the lower level of the facility building at the north end of MBR basins.

SUMMARY AND RECOMMENDATIONS

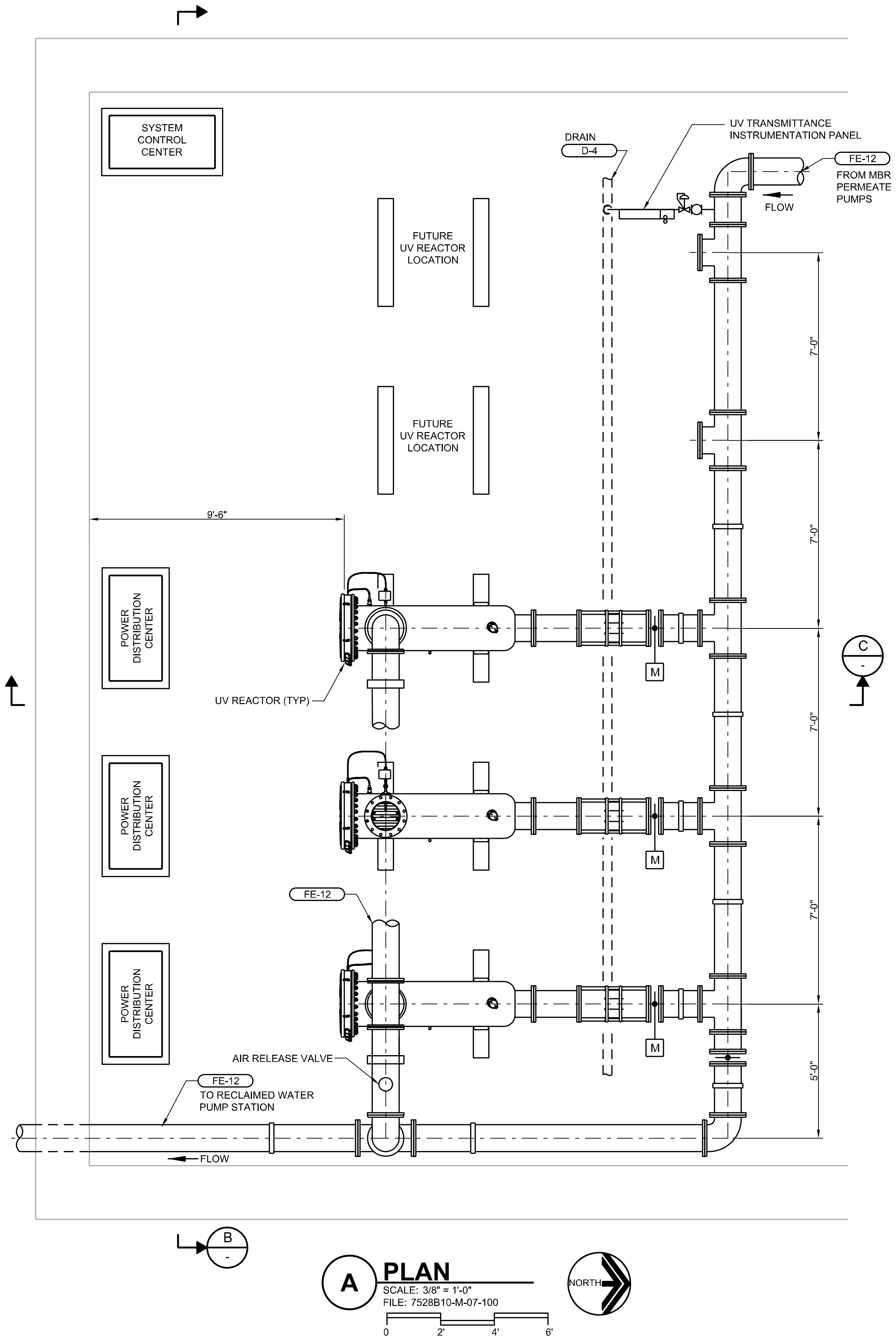
In summary, the recommended disinfection system for the Hesperia WRP include:

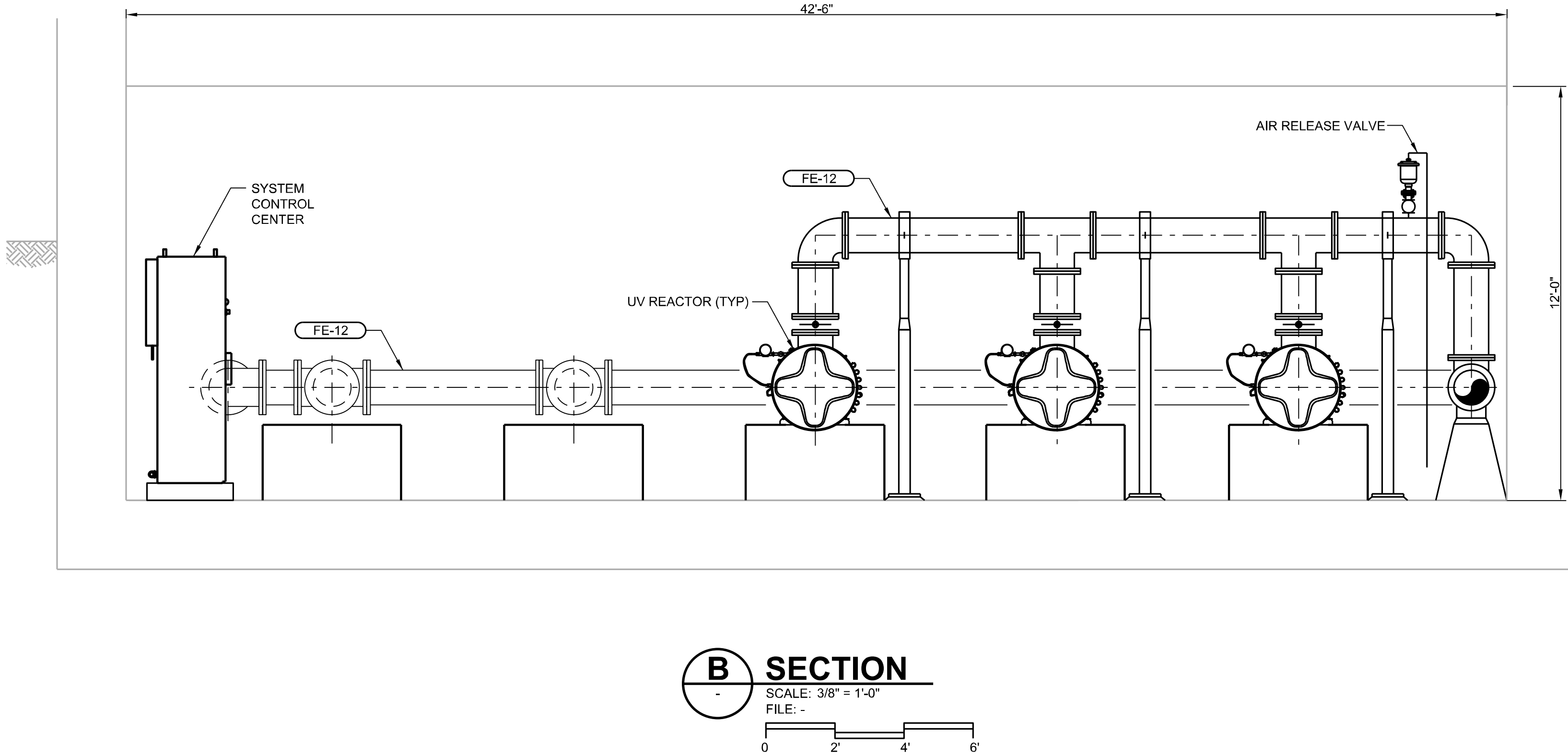
- The use of closed-vessel UV reactor.
- Low-pressure/high-output (LP/HO) or medium pressure (MP) UV lamps.
- NWRI (2003) requires designed UV dose of at least 80 mJ/cm^2 for water reuse disinfection downstream of membrane filtration. Based on Carollo's experience with UV validation testing, a UV design dose of 88 mJ/cm^2 is recommended to ensure the actual delivered UV dose in reclaimed water no lower than 80 mJ/cm^2.
- While UV light will be used to achieve primary disinfection of the WRP effluent, bulk sodium hypochlorite will be used for secondary disinfection to provide chlorine residual in the reclaimed water storage and distribution systems.

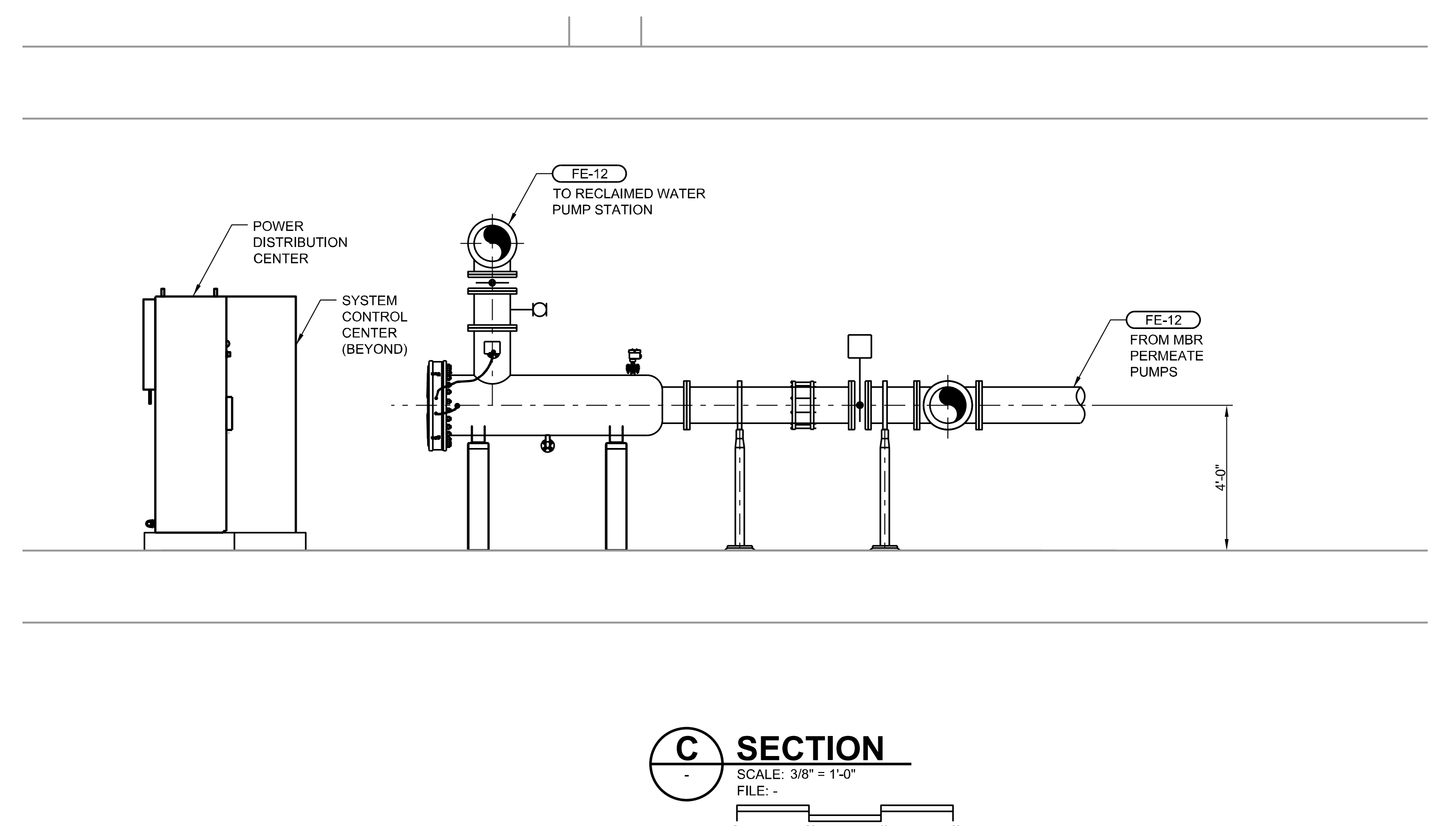
The recommended UV disinfection design criteria are listed in Table 7A.1 for the three UV manufacturers we evaluated.

**Table 7A.1 UV Disinfection System Recommended Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California**

Parameters	Phase 1 (1 mgd)	Phase 2 (2 mgd)
Design Maximum Flow, mgd	1.0	2.0
Maximum Total Suspended Solids, mg/L	5	
Type of UV Reactor	Closed-vessel	
Type of UV Lamp		
Wedeco LBX1000	Low-pressure/high-output	
Trojan UVFit - 32AL50	Low-pressure/high-output	
Aquionics Inline 4500+	Medium pressure	
Minimum UV Transmittance, %	65	
Design Dose, mJ/cm^2	88	
Number of UV Units		
Wedeco LBX1000	2 duty + 1 standby	3 duty + 1 standby
Trojan UVFit - 32AL50	2 duty + 1 standby	4 duty + 1 standby
Aquionics Inline 4500+	4 duty + 2 standby	8 duty + 2 standby
Type of Cleaning	Automatic chemical/mechanical	
End of Lamp Life		
Wedeco LBX1000	0.88	
Trojan UVFit - 32AL50	0.90	
Aquionics Inline 4500+	0.80	
Lamp Fouling Factor		
Wedeco LBX1000	0.90	
Trojan UVFit - 32AL50	0.80	
Aquionics Inline 4500+	0.90	







VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

HDR

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UV DISINFECTION SYSTEM - PLAN & SECTIONS

FIGURE 7A.1

HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 8A

RECLAIMED WATER PUMP STATION

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

A reclaimed water pump station will be provided to convey the reclaimed water for off-site uses and on-site reclaimed water uses. The pump station will be situated after the UV disinfection system. The purpose of this DIM-8A is to summarize the proposed reclaimed water pump station requirements for the Hesperia WRP.

PROCESS EQUIPMENT

The reclaimed water pump station will be comprised of a concrete clear well with vertical turbine pumps supplied with VFDs to provide pumping flexibility. Surge relief valves will be included on the reclaimed water force main that supplies off-site uses. The on-site plant water system will include a hydropneumatic tank to maintain pressure in the system. Chlorine feed will be provided to the clear well to provide for residual chlorination of the reclaimed water.

Phase 1 will include two vertical turbine pumps capable of pumping 1.0 mgd each, thereby providing a 1+1 configuration. Phase 2 will include a third 1.0 mgd pump to provide a 2+1 configuration. Phase 3 expansion will need to add two additional 1.0 mgd pumps to provide a 4+1 configuration. The plant water supply will be fed by two vertical turbine pumps in a 1+1 configuration.

The sizing of the effluent pumps, horsepower and total dynamic head requirements, are contingent upon the final selection of reuse sites by the City of Hesperia.

A back pulse tank will be provided as part of the membrane system requirements. This tank will hold reclaimed water for use in back pulsing the membranes.

The preliminary layout and sections of the reclaimed water pump station are shown in Figure 8A.1.

CONTROL DESCRIPTION

The pump station will be operated based upon the water level in the clear well. Since the WRP is typically run with a constant influent feed (Phase 1 at 1 mgd), the pump station will also typically pump a consistent flow of approximately 1 mgd (minus plant water uses, evaporative loses, WAS discharge, etc.).

Plant water uses will be augmented by potable water for periods when the WRP production is not sufficient to meet the in plant water uses.

An ultrasonic water level sensor, high water level float, reclaimed water flowmeter, and potable water flowmeter will be provided at the pump station.

The recommended reclaimed water pump station design criteria are listed in Table 8A.1.

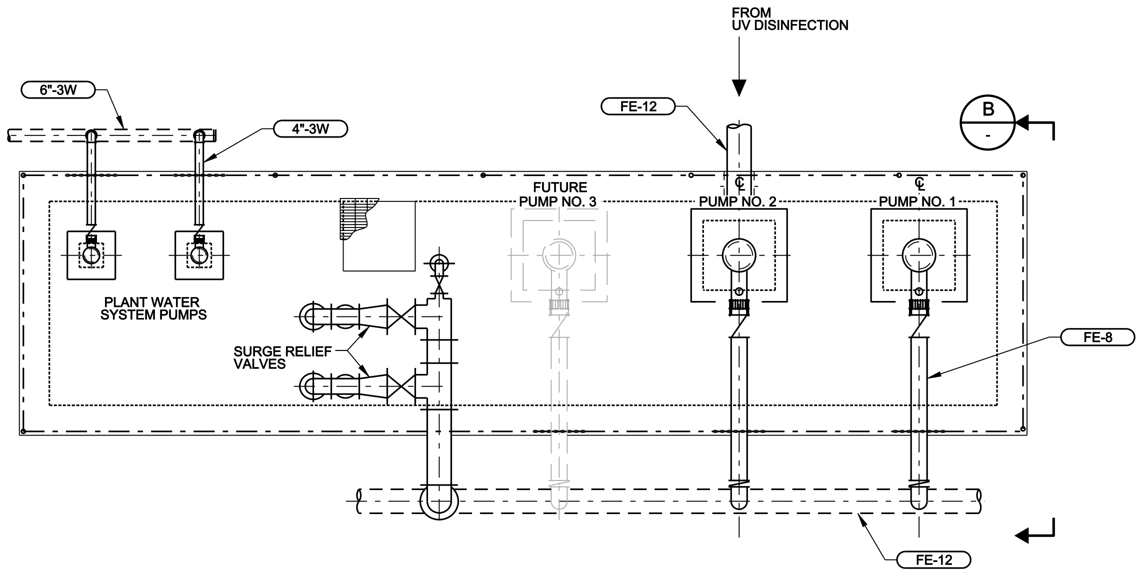
Table 8A.1 Reclaimed Water Pump Station Recommended Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Parameters	Phase 1 (1 mgd)	Phase 2 (2 mgd)	Phase 3 (4 mgd)
Type of Reclaimed Water Wet Well	Concrete clear well		
Type of Reclaimed Water Pump	Vertical turbine		
Pump Capacity, mgd, each	1.0		
Number of Reuse Water Pumps	1 duty + 1 standby	2 duty + 1 standby	4 duty + 1 standby
Number of Plant Water Pumps	1 duty + 1 standby		

SUMMARY AND RECOMMENDATIONS

In summary, the recommended reclaimed water pump station for the Hesperia WRP includes:

- Concrete clear well pump station.
- The use of vertical turbine pump for off-site reuse and on-site plant water system.
- Hydropneumatic tank to maintain plant water system pressure.
- Back pulse tank to store reclaimed water for membrane back pulsing.
- Chlorine feed to the clear well to provide residual chlorination of the reclaimed water.



A PLAN
SCALE: 1/4" = 1'-0"
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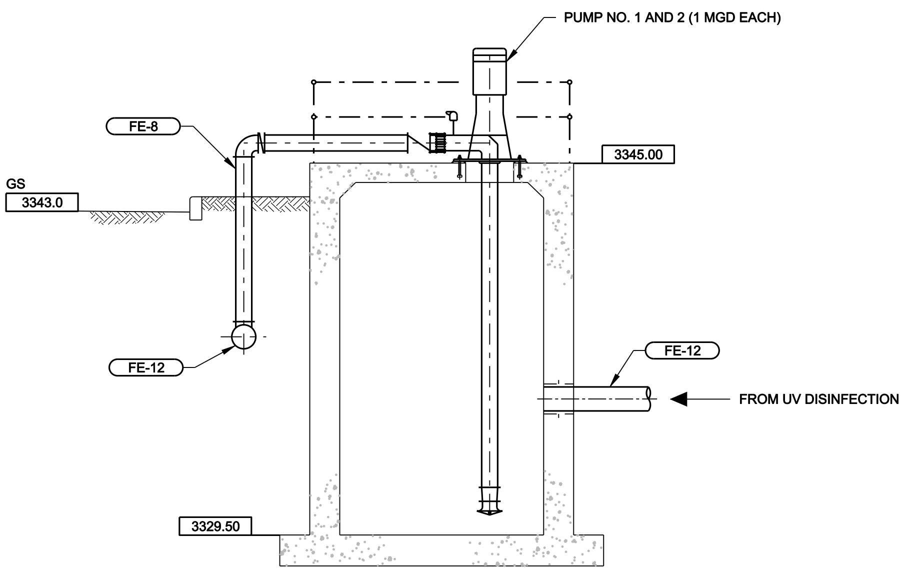
0 2' 4' 8'



B - SECTION
SCALE: 1/4" = 1'-0"
FILE: -
0 2' 4' 8'

VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

RECLAIMED WATER PUMP STATION - PLAN & SECTION

FIG 8A.1

HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 9A

RESIDUALS HANDLING AND DISPOSAL

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

The Hesperia WRP will be designed to treat incoming wastewater, but it will not include facilities for treatment of the residuals solids generated at the WRP. Waste activated sludge will be generated at the WRP as part of the biological wastewater treatment process. The solids stream generated at the Hesperia WRP will be sent to the Westside WRP for further treatment. The purpose of this DIM No. 9A is to summarize the residuals handling and disposal requirements for the Hesperia WRP.

PROCESS DESCRIPTION

Waste activated sludge (WAS) needs to be removed from the secondary process on a regular basis in order to maintain a target mixed liquor suspended solids (MLSS) concentration and a target solids retention time (SRT) in the biological treatment system. There are two optional locations from which WAS can be removed from the secondary treatment system. One option is to waste solids from the biological treatment basins, and a second option is to waste solids from the membrane basins.

The proposed location for solids wasting is at the feed-forward pump station located at the end of the biological treatment basins, upstream of the membrane basins. The main advantage of this location is that WAS and scum wasting can be achieved simultaneously. Removing scum that accumulates at the mixed liquor water surface is an important issue in the operation of MBR systems, where a surface wasting mechanism needs to be provided to selectively remove scum.

Wasted solids will be discharged to the interceptor for treatment at the Westside WRP. The WAS discharge point in the interceptor will be downstream of the intake to the influent pump station to avoid solids recycling and accumulation in the treatment process.

PROCESS EQUIPMENT

The feed-forward wet well will be equipped with a downward-opening slide gate to remove floating scum and waste activated sludge (WAS) from the surface of the mixed liquor. In this manner, the scum and WAS will be simultaneously discharged to a WAS holding wet well.

Non-clog submersible centrifugal pumps will send the wasted sludge and scum from the holding wet well to the interceptor. The WAS and scum flow will be metered using a magnetic flowmeter.

The WAS pump station will be operated based upon the water level in the wet well. The pumps will be constant speed pumps. Periodically, the pumps will be run down (operator local control) to clean out the wet well. A hose bib will be provided near the wet well to allow operators to wash down any scum accumulation in the wet well. An ultrasonic water level sensor, low and high water level floats, and a WAS/Scum flowmeter will be provided at the pump station.

Table 9A.1 summarizes the design criteria for the WAS and scum wasting system.

Table 9A.1 WAS and Scum Wasting Design Criteria
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Parameter	**Phase 1 (1.0 mgd)**	**Phase 2 (2.0 mgd)**	**Buildout (4.0 mgd)**
Daily Solids at Max. Month Loading, ppd	4,800	10,200	20,300
Daily Solids at Avg. Day Loading, ppd	2,800	6,100	12,100
Design WAS Solids Concentration, mg/L	8,000		
Daily Flow at Max. Month Loading, gpd	71,940	152,880	304,260
Daily Flow at Avg. Day Loading, gpd	41,970	91,430	181,350
WAS/Scum Pump Design Flow, gpm	450	450	450
Pump Operating Schedule			
Days per week	5	5	5
Hours per day at Max. Month Loading	3.7	7.9	7.9
Hours per day at Avg. Day Loading	2.2	4.7	4.7
Pump Type	Non-clog Centrifugal Submersible, Wet Pit		
Pump Motor Control	Constant Speed		
Number of Pumps (Duty + Standby)	1 + 1	1 + 1	2 + 1
Firm Capacity, gpm	450	450	900
Total Capacity, gpm	900	900	1,350
WAS Flowmeter Type	Magnetic		

SUMMARY AND RECOMMENDATIONS

WAS will be pumped from the Hesperia WRP into the collection system force main to allow conveyance to the downstream portion of the collection and ultimate treatment at the Westside WRP. The WAS holding wet well will be common-walled with the feed forward pump station to allow for surface wasting of WAS and scum. The wet well will consist of two submersible pumps in a 1+1 configuration for Phases 1 and 2. For buildout, one additional duty pump will be required.

HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 10A

SITE AESTHETICS

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

The Hesperia WRP will be located near existing residential homes and as such will be constructed to reduce aesthetics impacts. This DIM-10A focuses on the site aesthetics for the Hesperia WRP.

ARCHITECTURAL CONCEPT

The selected building façades provide an urban gesture that is respective and friendly to the community. The tones and movements are subtle as the California desert. The split face block incorporates accent block and two tones respective to a native palette. The buildings interact with the horizon with the use of sloped roofs and variation of building heights. The roof incorporates dormers to add natural light into the interior spaces and to break the large span of the roof. Natural and ambient day lighting will be incorporated where possible and practical. The architectural variations are integrated structurally into these facilities to maintain integrity. Preliminary elevations are provided in Figure 10A.1.

Summary of Architectural Concept

- Roof: Standing seam roof
- Façade: CMU split face
- Site fencing: Chain link fence (entrance feature at the plant site)
- Screening: Small berms and landscaping where appropriate
- Codes: Hesperia, California Municipal Code, Title 16 Development Code, Chapter 16.16, Article XII, Industrial Districts

NOISE ABATEMENT

The major equipment that produce noise are pumps and blowers. The process and membrane air scour blowers will be located inside a building with noise attenuation panels. The potential to enclose the blowers in a noise enclosure within the building will be explored to reduce the impact to operational personnel to the noise.

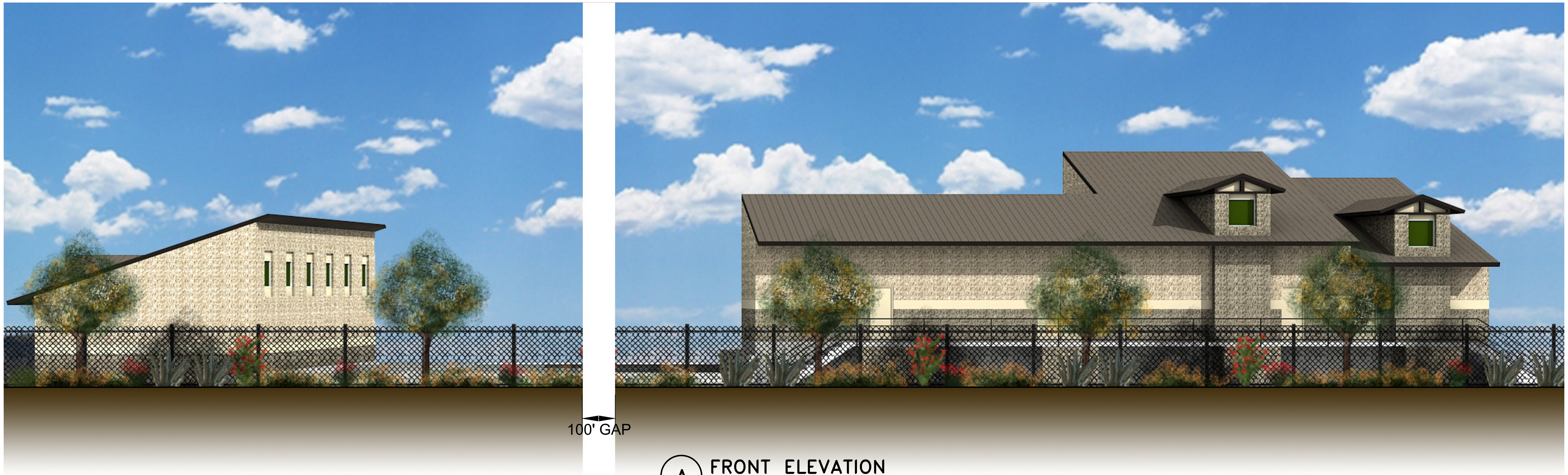
Motors not located within buildings will be further evaluated during the design phase to determine the appropriate speed to reduce noise potential.

LANDSCAPING AND SITE SCREENING

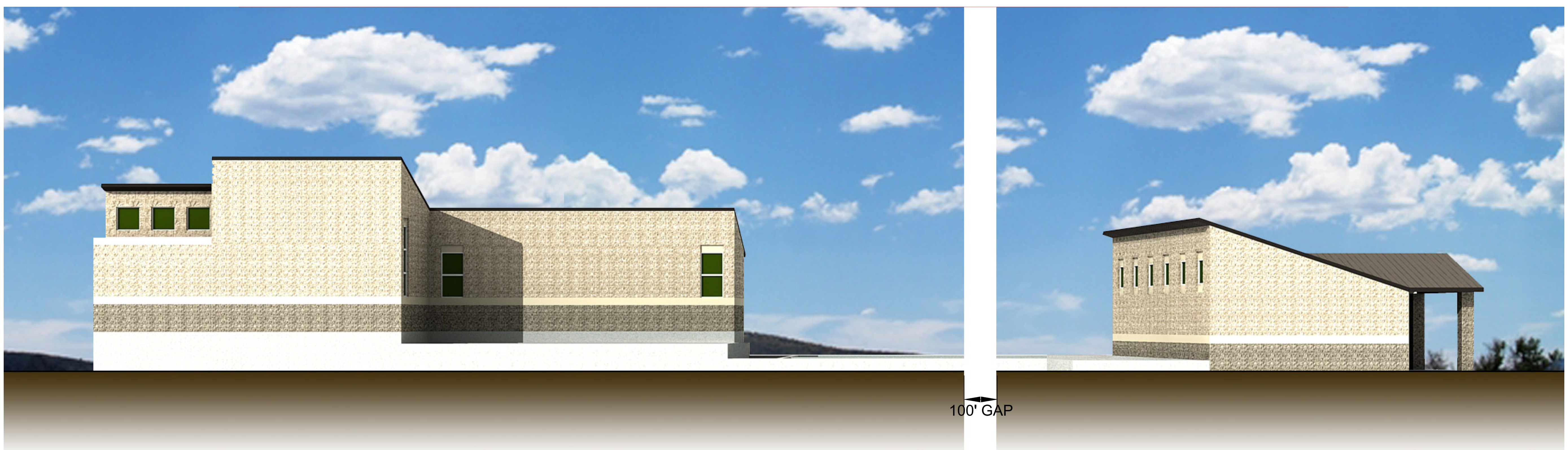
The site will be buffered with a native landscape incorporating the use of small berms and the site fence will be varied with pilasters where appropriate. This perimeter screening will reduce the line of site of the WRP and increase the overall aesthetic acceptability of the project.

SITE SECURITY

The perimeter fence will maintain security along the boundary of the facility. A gate with keycard and fire department access will be included. Other security features, such as cameras and alarms, are discussed in DIM 12A.



A FRONT ELEVATION
VIEW FROM THE WEST



B REAR ELEVATION
VIEW FROM THE EAST

CONCEPTUAL ARCHITECTURAL ELEVATIONS

FIGURE 10A.1

DESIGN INFORMATION MEMORANDUM NO. 11A
ELECTRICAL POWER AND DISTRIBUTION

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

The purpose of this Design Information Memorandum (DIM) No. 11A is to describe the preliminary basis of design for the electrical equipment for the Hesperia Water Reclamation Plant (WRP).

ELECTRICAL DESIGN LOADS

Table 11A.1 summarizes the anticipated new plant loads and the planned capacity at each electrical feed.

Table 11A.1 Electrical Loads
Hesperia WRP Design Information Memoranda
Victor Valley Wastewater Reclamation Authority, California

Item	Connected Load	Demand Load	MCC/MSB
Main Switchgear	1082A	1082A	MSB (1600A) bus
MCC	490	490	MCC (600A) bus

ELECTRICAL SYSTEM

Electrical Design Criteria

Site Power

480 VAC power to the site will be provided by an underground feed from Southern California Edison (SCE).

Main Switch Board (MSB) / Motor Control Center (MCC)

The MSB/MCC will be installed in an electrical room. The design will be based on 2008 National Electrical Code (NEC). The details are as follows:

- The MSB will be rated: 277/480 volt, 3-phase, 3-wire, 60K amps, interrupting and have a standby generator system dedicated to it. The generator will be switched to the system with an Automatic Transfer Switch (ATS). The switch will be interlocked with the Utility power feed so that the ATS will not switch back until Utility power is restored.
- The MCC will be rated: 277/480 volt, 3-phase, 3-wire, 60K amps.
- The MCC will be sub-fed from the MSB.

- MSB / MCC construction: NEMA 1 Gasketed, 21" Depth, Tin plated copper buses.
- Lighting panels will be served by dry transformers, will be wall-mounted and grounded per NEC 250 for separately derived system.

Motor Control

- Fixed speed motors up to 40 HP: Across the line starters.
- Fixed speed motors over 40 HP: Reduced voltage soft starter (RVSS).
- Variable frequency drives (VFDs) will be used where variable speed control is needed.
- VFD Criteria: for motors 75 HP and above, 18-pulse. For motors less than 75 HP, 6 pulse with input and output reactors.

Conduit

- Dry areas: Galvanized rigid steel.
- Outdoors, wet areas and corrosive areas: PVC-coated galvanized rigid steel.
- Underground ducts: PVC schedule 40 encased in red slurry.

Wire

- Power; Thermoplastic type THHN/THWN.
- Instrument; Twisted shielded pair, 600 volt, Type TC; 16 gauge minimum.
- Data Cables; as required.

Lighting

- Indoor Areas: Fluorescent, electronic ballast, T8 lamp. Lighting levels appropriate for each occupancy or process area.
- Outdoor lighting for safety and process access. High Intensity Discharge (HID) Metal Halide lamp.

Standby Generator

A standby generator and Automatic Transfer Switch (ATS) will be installed to provide automatic standby power for the Hesperia WRP.

Design Criteria

- Voltage: To match utility power, 277/480 volt, 3 phase, 3 wire, 60 Hz.
- Fuel: Diesel.
- Capacity: The standby generator will be capable of serving the Hesperia WRP maximum demand; 350 kW.
- Location: Hesperia WRP exterior.
- Day tank sized for 8-hour runtime.
- Sound attenuating outdoor enclosure.
- Critical exhaust silencer.

Equipment Description

The standby generator will be a diesel-fueled, concrete-pad mounted type with an external diesel fuel storage tank. Fuel capacity will be sized for 8 hours of operation at normal load. The generator will be connected to the Hesperia WRP MCC through an ATS. When in automatic mode, the ATS will sense a utility power failure, start the standby generator, transfer load to the generator, and then will return the load to the utility service when utility power has become available and is stable. The ATS also provides automatic exercise programming for the generator.

Construction Materials

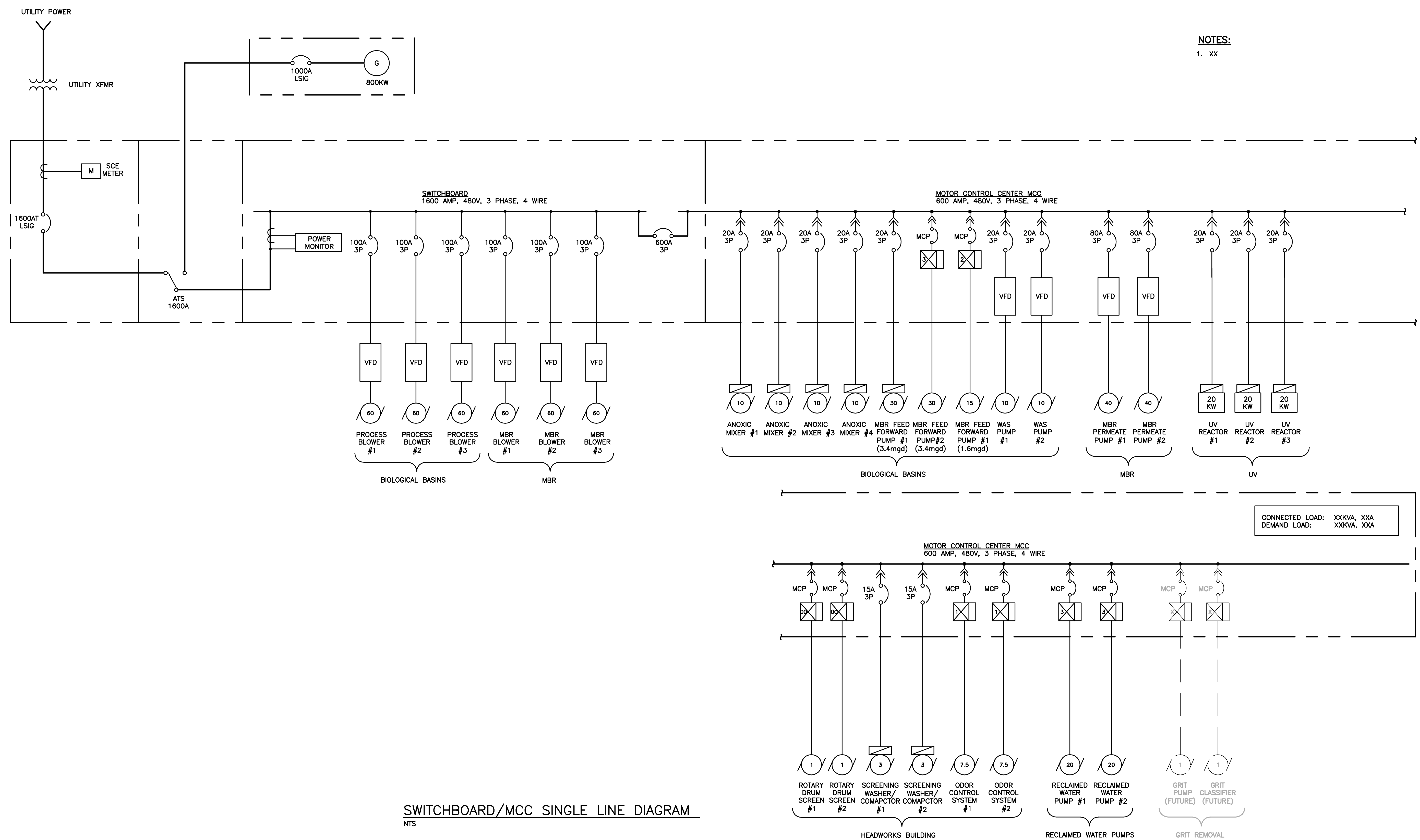
The standby generator will be specified with the necessary components needed for the application, such as an external fuel tank, a critical grade exhaust silencer, outdoor sound attenuated enclosure, and a block heater. Equipment will be standard manufacturer's models. The unit will meet all applicable local emissions requirements, including those for particulate emissions. The standby generator will be installed on a mass concrete pad outdoors.

Control Description

The standby generator will be controlled by a solid state configurable controller in the ATS. There will be a number of configurable points, but the major points are four time delays as follows:

- Time delay to start generator after loss of Utility power, typically 30 seconds.
- Time delay to transfer load to generator, typically 30 seconds.
- Time delay to transfer back to Utility, typically 15 minutes.
- Time delay to stop generator for cool down, typically five minutes.

In addition, it will be possible to configure various exercise and test options for the standby generator such as weekly, bi-weekly, or monthly start-and-run with or without load transfer.



NOTES:

1. XX

SWITCHBOARD/MCC SINGLE LINE DIAGRAM

NTS

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HESPERIA WRP - PRELIMINARY DESIGN REPORT

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HESPERIA WRP - SINGLE LINE

FIG.11A-E001

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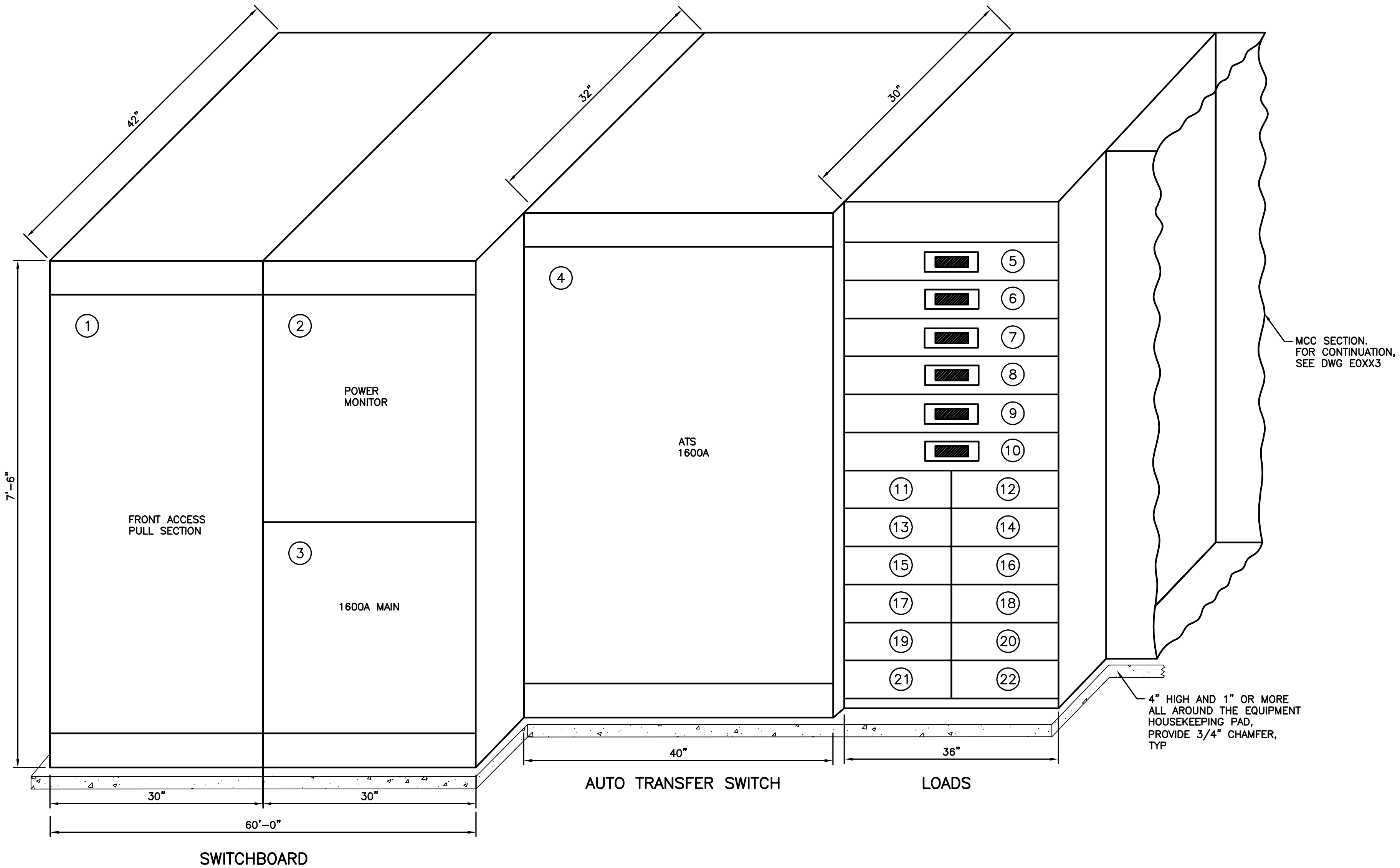

SWITCHBOARD ELEVATION
NTS

SWITCBOARD		
ITEM	DESCRIPTION	REMARK
1	PULL SECTION	
2	POWER MONITOR	50A, 3P BREAKER
3	MAIN BREAKER	1600A, 3P BREAKER
4	AUO TRANSFER SWITCH (ATS)	1600 AMP RATIMG
5	PROCESS BLOWER #1	VFD
6	PROCESS BLOWER #2	VFD
7	PROCESS BLOWER #3	VFD
8	MBR BLOWER #1	VFD
9	MBR BLOWER #2	VFD
10	MBR BLOWER #3	VFD
11	SPACE	
12	SPACE	
13	SPACE	
14	SPACE	
15	SPACE	
16	SPACE	
17	SPACE	
13	SPACE	
14	SPACE	
15	SPACE	
16	SPACE	
17	SPACE	

VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

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HESPERIA WRP - SWITCHGEAR ELEVATION

FIG.11A-E002

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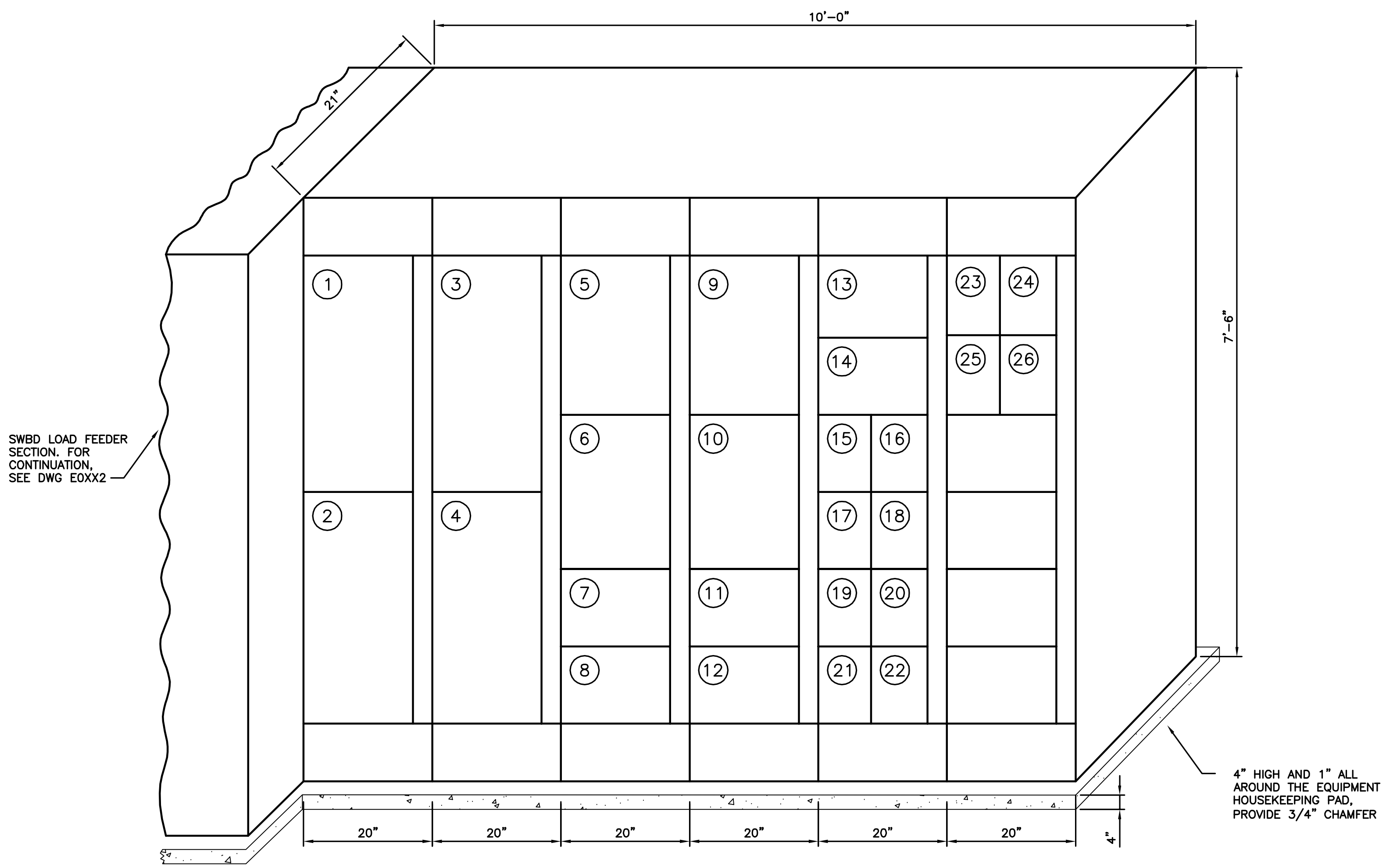
HESPERIA WRP - PRELIMINARY DESIGN REPORT

NOTES:
1. XX



MCC ELEVATION
NTS

MCC		
ITEM	DESCRIPTION	REMARK
1	WAS PUMP #1	VFD
2	WAS PUMP #2	VFD
3	MBR PERMEATE PUMP #1	VFD
4	MBR PERMEATE PUMP #2	VFD
5	MBR FEED FORWARD PUMP #1	SIZE 3 STARTER (3.4 mgd)
6	MBR FEED FORWARD PUMP #2	SIZE 3 STARTER (3.4 mgd)
7	MBR FEED FORWARD PUMP #1	SIZE 2 STARTER (1.6 mgd)
8	SPACE	
9	RECLAIMED WATER PUMP #1	SIZE 3 STARTER
10	RECLAIMED WATER PUMP #2	SIZE 3 STARTER
11	ODOR CONTROL SYSTEM #1	SIZE 1 STARTER
12	ODOR CONTROL SYSTEM #12	SIZE 1 STARTER
13	ROTARY DRUM SCREEN #1	SIZE 00 STARTER
14	ROTARY DRUM SCREEN #2	SIZE 00 STARTER
15	SCREENING WASHER/COMPACTOR #1	15A, 3P BREAKER
16	SCREENING WASHER/COMPACTOR #2	15A, 3P BREAKER
17	ANOXIC MIXER #1	20A, 3P BREAKER
18	ANOXIC MIXER #2	20A, 3P BREAKER
19	ANOXIC MIXER #3	20A, 3P BREAKER
20	ANOXIC MIXER #4	20A, 3P BREAKER
21	UV REACTOR #1	20A, 3P BREAKER
22	UV REACTOR #2	20A, 3P BREAKER
23	UV REACTOR #3	20A, 3P BREAKER
24	SPACE	
25	GRIT PUMP (FUTURE)	SIZE XX STARTER
26	GRIT CLASSIFIER (FUTURE)	SIZE XX STARTER

HESPERIA WRP - MCC ELEVATION

FIG.11A-E003

HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 12A

INSTRUMENTATION AND CONTROLS

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Pump Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

The purpose of this Design Information Memorandum (DIM) No. 12A is to describe the preliminary instrumentation and controls (I&C) basis of design for the Hesperia Water Reclamation Plant (WRP).

INSTRUMENTATION AND CONTROLS (I&C) BASIS OF DESIGN

System Overview

The VVWRA employs a combination of Allen Bradley PLC 5/20E and SLC500 series Programmable Logic Controllers (PLCs) to monitor and control their Westside WRP. The PLCs communicate using Ethernet over a fiber optic backbone. A similar strategy is proposed for the Hesperia WRP.

Within a proposed control room, the operators will interface with the system using the Wonderware Human Machine Interface (HMI). At key locations in the plant, an Industrial Personal Computer (IPC) will be loaded with the Wonderware screens, and would also serve as remote HMIs.

Instrumentation and Control

Purpose and Intent

The instrumentation and control (I&C) system will be designed to monitor and control the Hesperia WRP.

Design Criteria

- The PLC that will be used to monitor and control the Hesperia WRP various systems will be the Allen Bradley (AB) PLC Model 5/20 E. VVWRA has standardized around this model PLC for all remote stations and in-plant controls. In addition, the existing Westside WRP operators and Information Technology (IT) staff have been trained in the maintenance, operation, and programming of the AB PLC 5/20E. Finally, the VVWRA keeps PLC 5/20 E spare Central Processing Units (CPUs) and input and output modules, both analog and digital. The software that will be used to program the AB PLC 5/20 E will be the RS LOGIX 5.
  – Allen Bradley 1771-A4B, 16-slot chassis

- Allen Bradley 1785-L20B, PLC 5/20E controller, 16k RAM, supporting TCP/IP Ethernet communications
- Allen Bradley 1771-IL, Analog Input Module, 8 Isolated Inputs, 4-20 mA
- Allen Bradley 177-OFE2, Analog Output Module, 4 / 4-20 mA Outputs
- Allen Bradley 1771-IA16, 16 channel AC Input Module
- Allen Bradley 1771-OAD, 16 channel AC Output Module
- Allen Bradley 1771-P7, Power Supply, Rack Mount, 2.88 A @ 24 VDC

- The HMI will provide the operator with the ability to monitor and control local processes at the field PLCs using the Allen Bradley Panelview Plus 1000s. Similar to the AB PLC 5/20 E, the VVWRA has standardized around this model of local HMI and use them in conjunction with the AB PLC 5/20 E at the field PLC cabinets. The operations and IT staff own a copy of RS View, the Panelview software tool, and can program and configure the Panelview.
  - Allen Bradley 2711-K10C4B2 Panel View 1000+, Ethernet and RS 232(DH-485), Communication & RS-232 port
- The HMI providing supervisory control and data acquisition (SCADA) of the entire treatment plant processes will be Wonderware. VVWRA staff is already trained in the programming and configuration of the Wonderware System. VVWRA need only to purchase additional client licenses to expand their system for the Hesperia WRP.
- The PLCs will communicate with the central control room using Ethernet protocol over fiber. Typically, the PLC and local HMI will connect to an Ethernet switch. A 10/100 MBPS Ethernet to fiber optic converter will also connect to the switch and allows the PLC to be placed on the network.
  - Ethernet to Fiber Optic Converter: (N-TRON 509FX)
  - Ethernet Switch: HP Procurve 1700-8
- The design will include the following instruments (and proposed manufacturer):
  - Electromagnetic flowmeters: Sparling, Siemens.
  - Thermal mass flowmeters: FCI with Vortab
  - Pressure indicating transmitters: Rosemount, Siemens
  - Gauges, and non-mercury filled switches: Dwyer
  - Ultrasonic level indicating transmitters: Siemens (Milltronics Hydroranger)
  - Hydrostatic level indicating transmitters: KPSI, Rosemount, Siemens
  - Non-Mercury filled level switches
  - Water quality analyzers including pH, turbidity, conductivity, chlorine residual, and dissolved oxygen: HACH
  - Samplers: HACH

Preliminary Control Strategies

Influent Pump Station

The proposed off-site Hesperia lift station will pump raw wastewater to the screening facility. Pump operation will be automatic based on level sensors and level switches provided in the pump station wet well. A flowmeter will measure the pump station discharge to the screening facility.

Screening

Operation of fine screens will be automatic, based on the water level differential across the screen. The water level upstream and downstream of the screens will be determined by two ultrasonic level sensors. When head loss across the screen reaches an operator-selected level, the screen will start a cleaning cycle, and the cleaning will continue until the levels equalize. Alternatively, the screens may be activated with operator-defined timers.

Screenings from the fine screens will be discharged to the screenings washer/compactor. Operation of each washer/compactor is tied to operation of the corresponding screens. The screenings washer/compactor and wash water valve will start/open on a signal from the screen. The washer/compactor will continue to operate for an adjustable period of time after the screen cleaning cycle is complete.

Aeration Basins

Centrifugal blowers will supply process air to the aeration basins. The blower operation will be automatically controlled based on operator selection of either DO control or air rate flow to the aeration tanks.

The Membrane Bioreactor (MBR) Feed Pump Station will pump mixed liquor to the MBR basins. Operation of the pumps will be automatic based on level sensors and level switches provided in the pump station wet well provided a permissive system ready signal is received from MBR system control. A flowmeter on common pump discharge header pipe will monitor flow rate and the signal will be used to control operation of the MBR system.

Membrane Bioreactor (MBR)

All valves and control devices of the MBR system will be interlocked through the MBR system PLC to allow smooth and continuous automatic operation. Valves will open, close and/or modulate, depending on signals from the PLC. These signals will be predetermined through PLC programming and allow the system to operate at optimal conditions. Variable speed pumps will also be controlled by the PLC and vary their vacuum/flow output based on signals from the PLC.

All operating parameters will be continuously monitored by the PLC. If an alarm or emergency condition occurs, the PLC signal will instruct the various components to change operation conditions and/or shut down the system and alert the operator for attention of the problem. In the event of an alarm condition that is detrimental to the equipment, PLC will have ability to shut down either one train or the whole system.

The modes of operation for the MBR system are as follows: off, production, relax, backpulse, standby, sludge wasting, maintenance clean, recovery clean, and manual. Other than the off and the manual mode, all modes of operation will be automatically controlled based on the PLC programming and operator input. Operation of the various automatic modes of the MBR system is described below.

- *Production*
  The MBR system will treat mixed liquor based on a dynamic hydraulic reference level in the system. As the MBR tank level increases indicating increase in plant flow, the permeate pump speeds up automatically and vice versa. Trans-membrane pressure (TMP) across the membrane will be monitored and initiate membrane cleaning cycle when the TMP value exceeds a preset value. Air scouring through coarse bubble

diffusers will keep the membrane clean and its operation will be controlled by the PLC.

- *Relax*

  In relax mode, the PLC will stop permeating and the membrane will be relaxed for predetermined time set by the operator. Operator will select relax frequency and duration.

- *Backpulse*

  If required, treated water can be periodically reversed back through the membranes using the permeate pumps to keep the membranes clean. The PLC will control all stages of this operation automatically based on PLC program and operator input. Operator will select backpulse frequency, duration, set flow rate, and TMP.

- *Standby*

  Several triggers such as low MBR tank level, low permeate demand, etc. may cause a train to go to standby mode rather than shutting it down. PLC program automatically switch between production mode and standby mode.

- *Sludge Wasting*

  To achieve desired solids retention time (SRT), sludge from the MBR tanks will be wasted periodically. Operator will set duration, frequency and flow of sludge.

- *Maintenance and Recovery Cleaning*

  Membrane cleaning will be fully automated and controlled by the PLC program. In addition to maintenance cleaning and recovery cleaning when the membrane stops production and uses chemicals for cleaning, continuous air scouring during production and relaxation will also keep the membranes clean.

UV Disinfection System

Permeate from membrane bioreactor (MBR effluent) will enter three UV disinfection reactors designed to work in parallel. A flow control valve and a flowmeter on each UV reactor inlet pipe will control permeate flow to the reactor. Depending on the permeate flow rate at any time, UV system PLC will allow permeate to enter one or more UV reactors.

The UV disinfection system operation will be automatically controlled by the UV system PLC to achieve a specific level of disinfection in the MBR effluent. In addition, based on operator selection, the system can be operated in manual or off mode. The three modes of operation are described below.

- *Automatic Mode*

  The UV system PLC will control the operation of all UV reactors by ensuring that the expected disinfection level is met. To achieve the expected disinfection level, the following parameters will be taken into account:

  – Actual flow to each UV reactor will come from the flowmeter installed on MBR permeate influent pipe to the UV reactor.
  – Target UV dose will be defined during the design stage as a preset value which is field adjustable, typically 15 percent above the required or minimum dose.
  – The UV PLC calculates the current UV dose and adjusts the number of UV reactors in operation as well as varying the lamp power to keep the current UV dose higher than or equal to the target UV dose. The average UV intensity will be measured by a UV intensity sensor. This signal will be used by the UV system control to “dose pace” in order to optimize energy consumption and achieve a specific level of disinfection.

- *Manual Mode*
  - The UV system reactors can be turned ON and OFF independent of the PLC. Each reactor will have a manual override to allow the operator to individually turn each reactor ON or OFF. When the reactor is on via manual mode, the lamp power will always be 100 percent.
- *Off Mode*
  - In the off mode, the UV reactor lamps are off. However, the lamp cleaning wiper sequence continues to operate in order to keep the quartz sleeves clean. In the off mode, MBR effluent will not be permitted to flow through the UV reactors as the effluent will exit the reactor without disinfection.

Reclaimed Water Pump Station

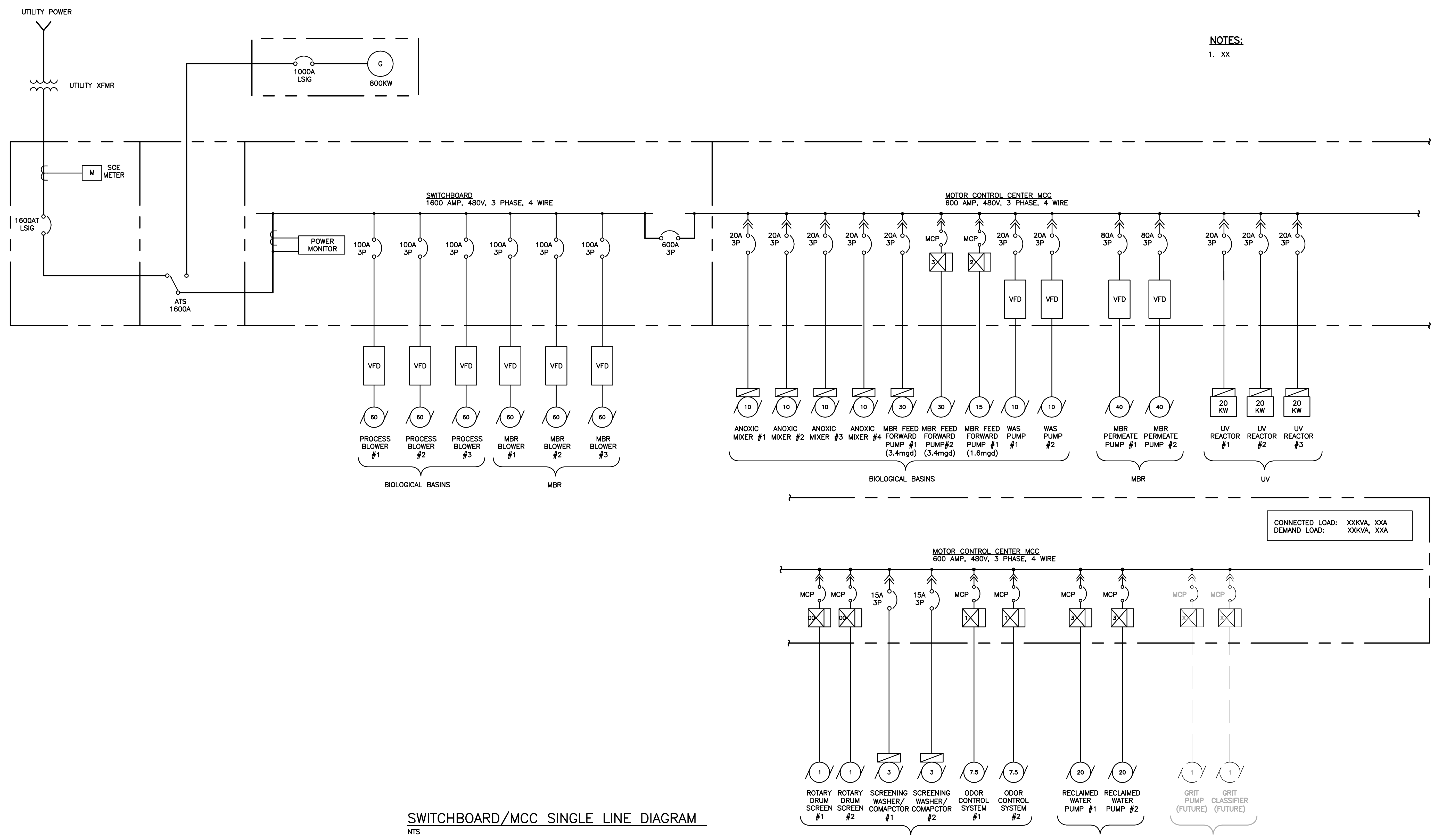
Reclaimed water pump station will pump reclaimed water to the proposed reclaimed (recycled) water distribution system and/or effluent disposal sites. Variable speed pumps will operate automatically based on level sensors and level switches provided in the pump station wet well. A flowmeter on the common pump discharge header will measure the pump station discharge to the reclaimed water system.

Other Miscellaneous Treatment Processes

The final design will likely include provisions for sodium hypochlorite addition to maintain chlorine residual in the recycled water distribution system.

Instrumentation and process Diagrams

The preliminary process and instrumentation diagrams are included at the end of this DIM No. 12A.



SWITCHBOARD/MCC SINGLE LINE DIAGRAM

NTS

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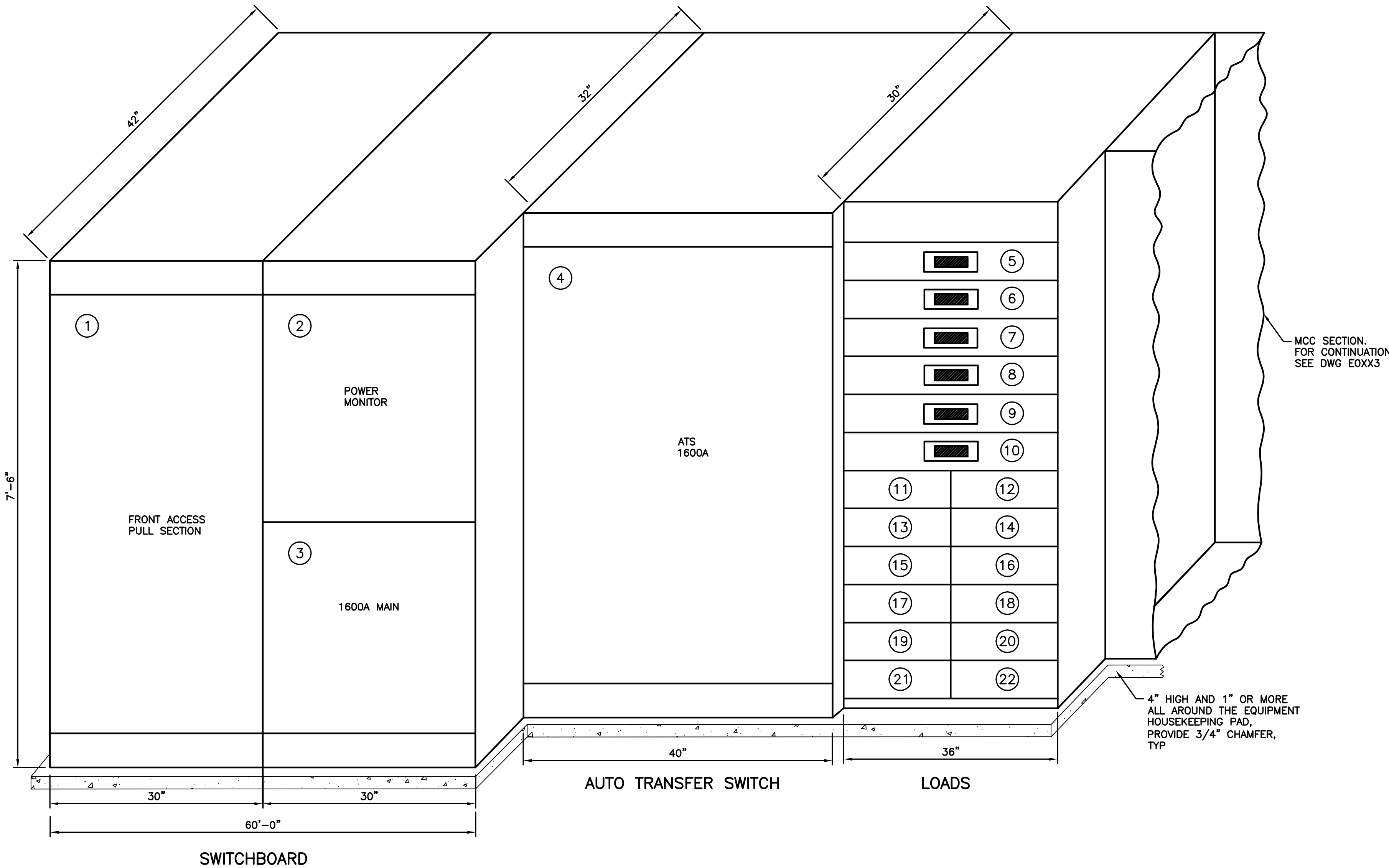
HESPERIA WRP - PRELIMINARY DESIGN REPORT

NOTES:
1. XX



SWITCHBOARD ELEVATION
NTS

SWITCHBOARD		
ITEM	DESCRIPTION	REMARK
1	PULL SECTION	
2	POWER MONITOR	50A, 3P BREAKER
3	MAIN BREAKER	1600A, 3P BREAKER
4	AUO TRANSFER SWITCH (ATS)	1600 AMP RATIMG
5	PROCESS BLOWER #1	VFD
6	PROCESS BLOWER #2	VFD
7	PROCESS BLOWER #3	VFD
8	MBR BLOWER #1	VFD
9	MBR BLOWER #2	VFD
10	MBR BLOWER #3	VFD
11	SPACE	
12	SPACE	
13	SPACE	
14	SPACE	
15	SPACE	
16	SPACE	
17	SPACE	
13	SPACE	
14	SPACE	
15	SPACE	
16	SPACE	
17	SPACE	

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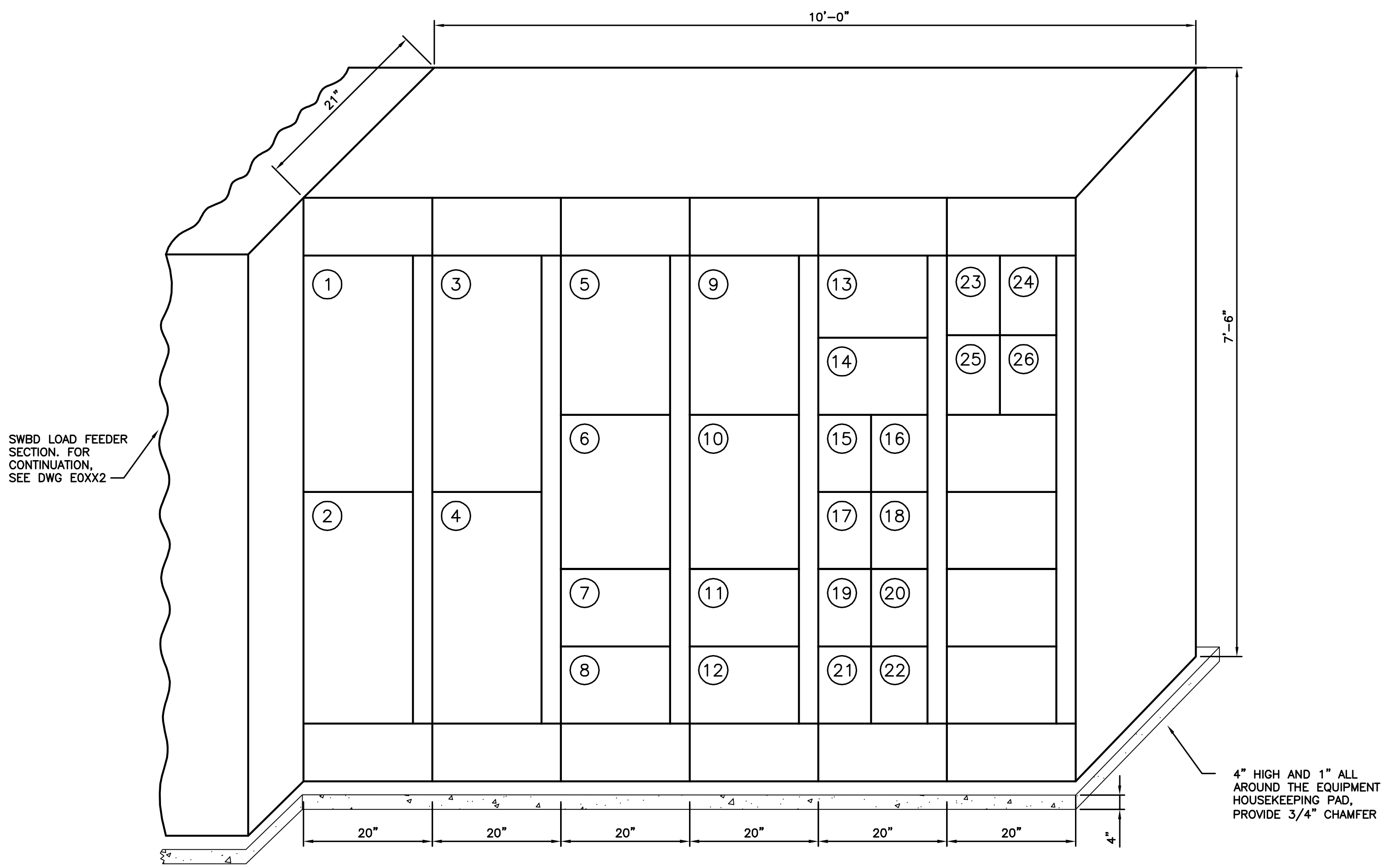
E002

NOTES:

1. XX



MCC ELEVATION
NTS

MCC		
ITEM	DESCRIPTION	REMARK
1	WAS PUMP #1	VFD
2	WAS PUMP #2	VFD
3	MBR PERMEATE PUMP #1	VFD
4	MBR PERMEATE PUMP #2	VFD
5	MBR FEED FORWARD PUMP #1	SIZE 3 STARTER (3.4 mgd)
6	MBR FEED FORWARD PUMP #2	SIZE 3 STARTER (3.4 mgd)
7	MBR FEED FORWARD PUMP #1	SIZE 2 STARTER (1.6 mgd)
8	SPACE	
9	RECLAIMED WATER PUMP #1	SIZE 3 STARTER
10	RECLAIMED WATER PUMP #2	SIZE 3 STARTER
11	ODOR CONTROL SYSTEM #1	SIZE 1 STARTER
12	ODOR CONTROL SYSTEM #12	SIZE 1 STARTER
13	ROTARY DRUM SCREEN #1	SIZE 00 STARTER
14	ROTARY DRUM SCREEN #2	SIZE 00 STARTER
15	SCREENING WASHER/COMPACTOR #1	15A, 3P BREAKER
16	SCREENING WASHER/COMPACTOR #2	15A, 3P BREAKER
17	ANOXIC MIXER #1	20A, 3P BREAKER
18	ANOXIC MIXER #2	20A, 3P BREAKER
19	ANOXIC MIXER #3	20A, 3P BREAKER
20	ANOXIC MIXER #4	20A, 3P BREAKER
21	UV REACTOR #1	20A, 3P BREAKER
22	UV REACTOR #2	20A, 3P BREAKER
23	UV REACTOR #3	20A, 3P BREAKER
24	SPACE	
25	GRIT PUMP (FUTURE)	SIZE XX STARTER
26	GRIT CLASSIFIER (FUTURE)	SIZE XX STARTER

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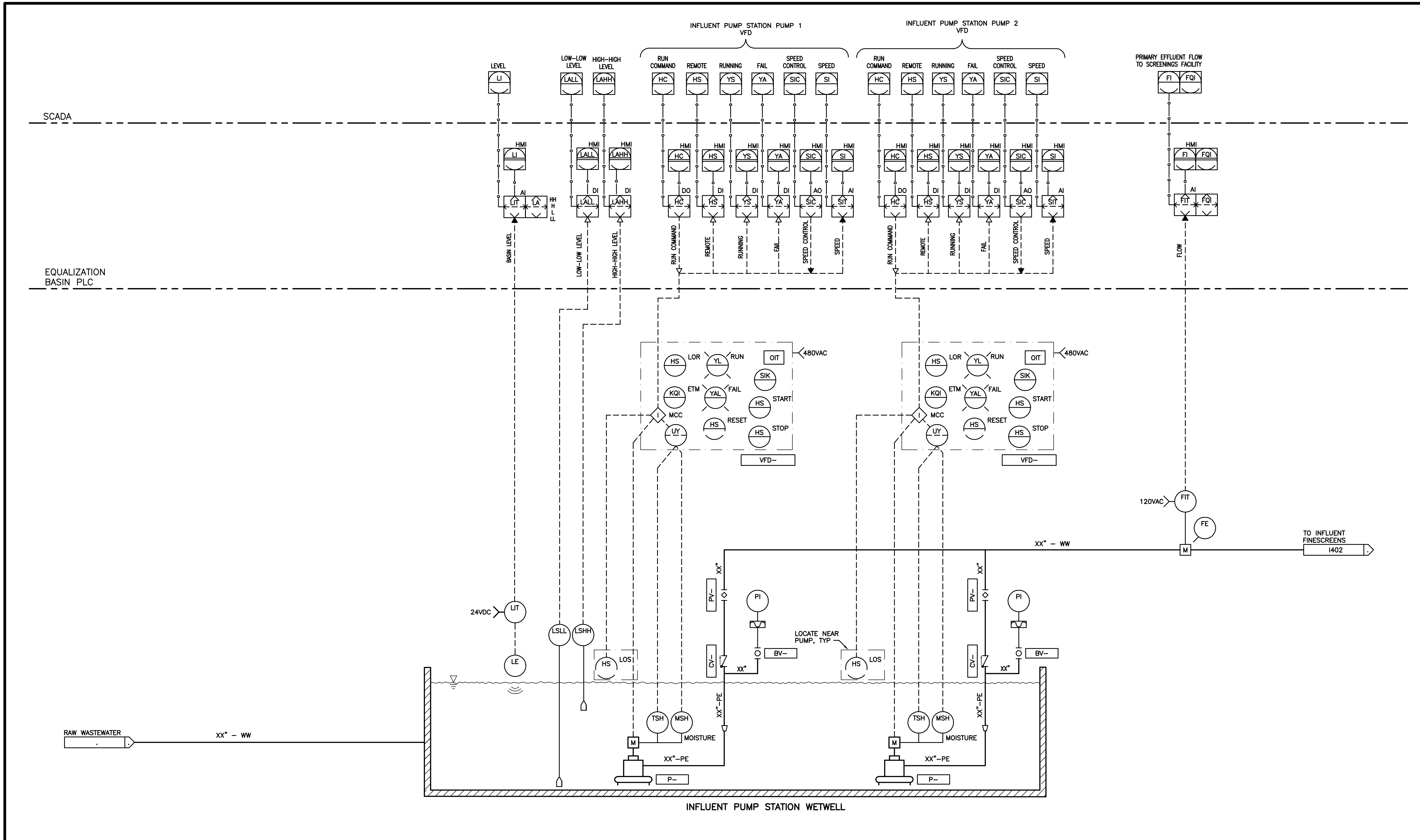
E003



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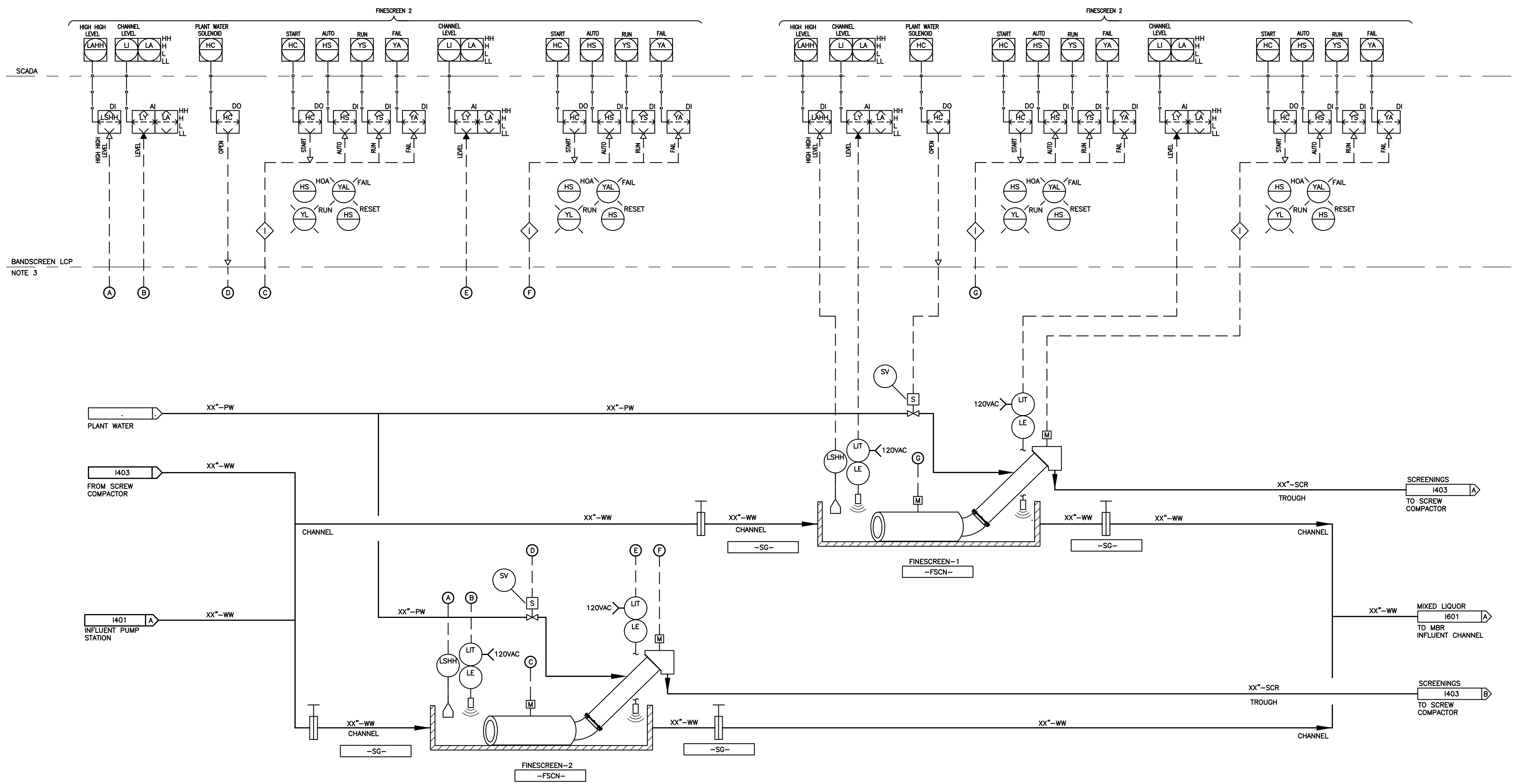
I401



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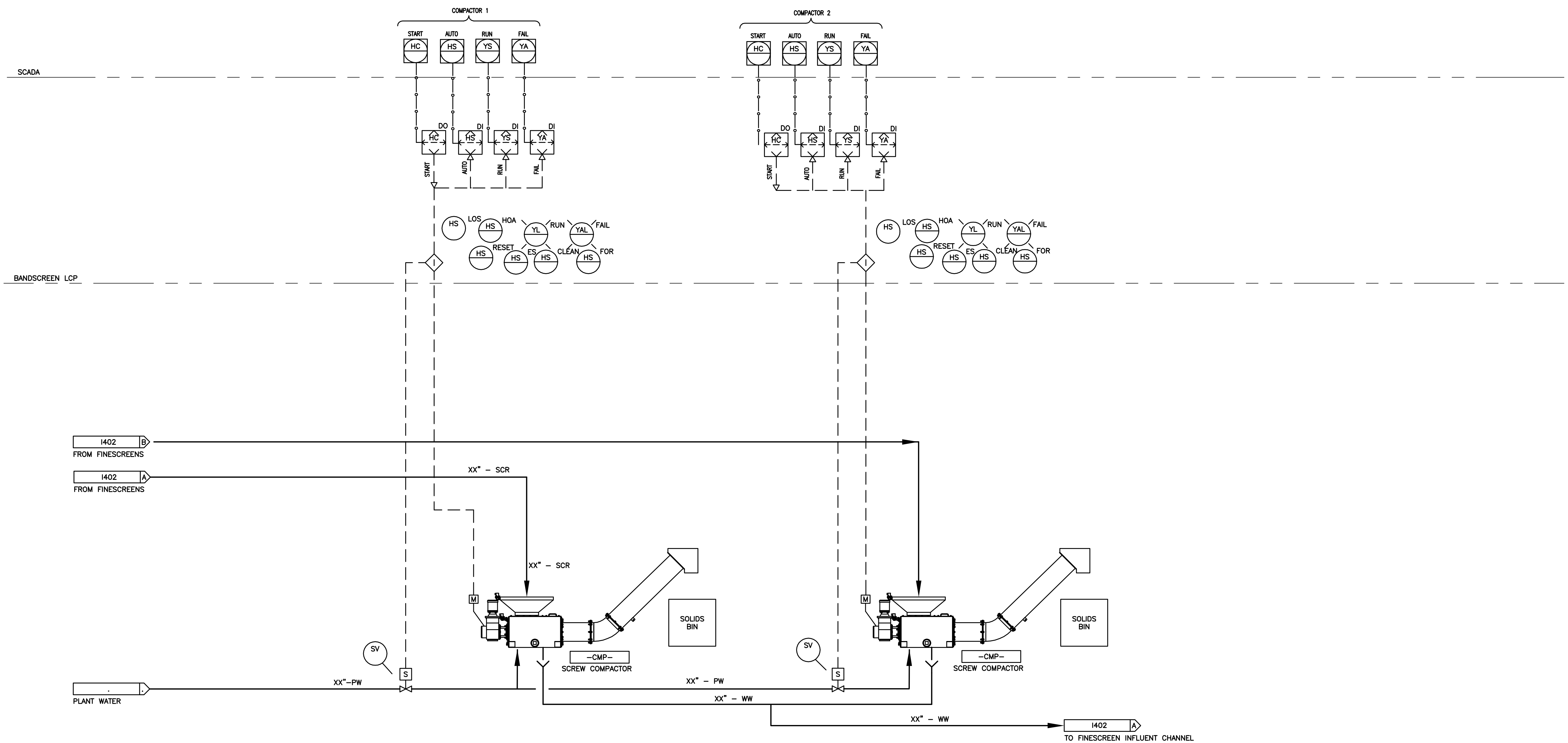
I402



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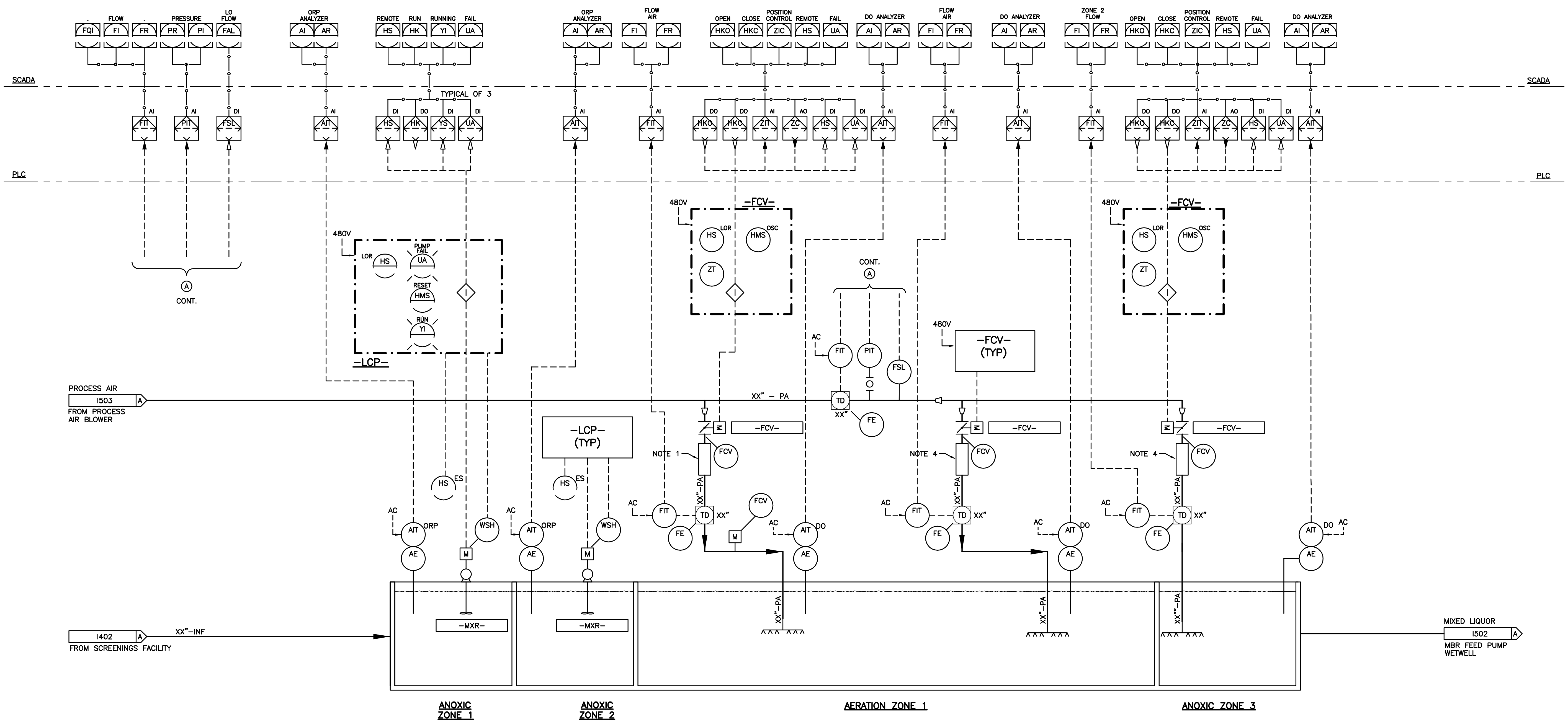
I403



NOTES:

1. VORTAB AIRFLOW CONDITIONER.

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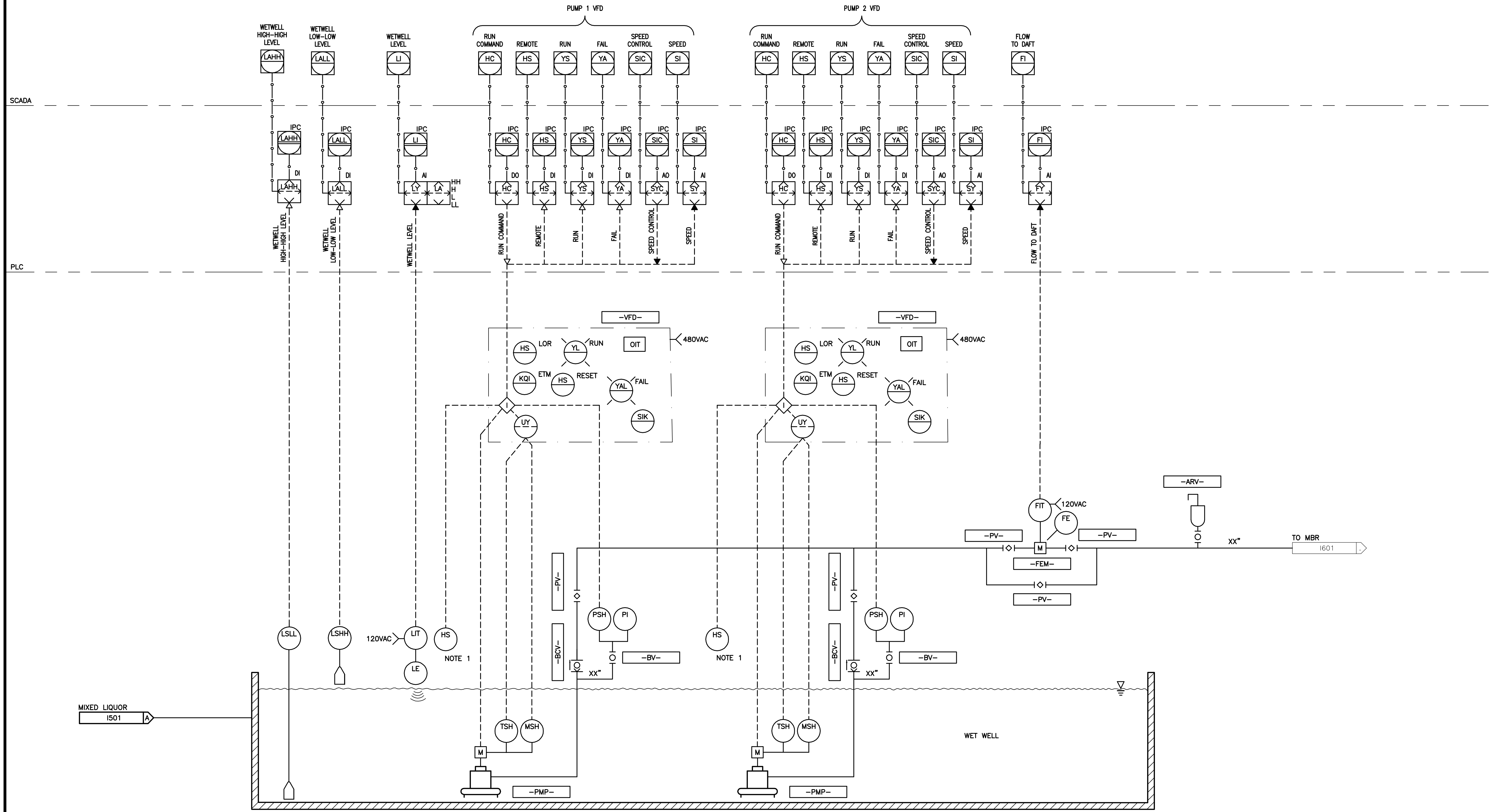

MBR FEED PUMP WET WELL

NOTES:

1. LOCATE NEAR PUMP.

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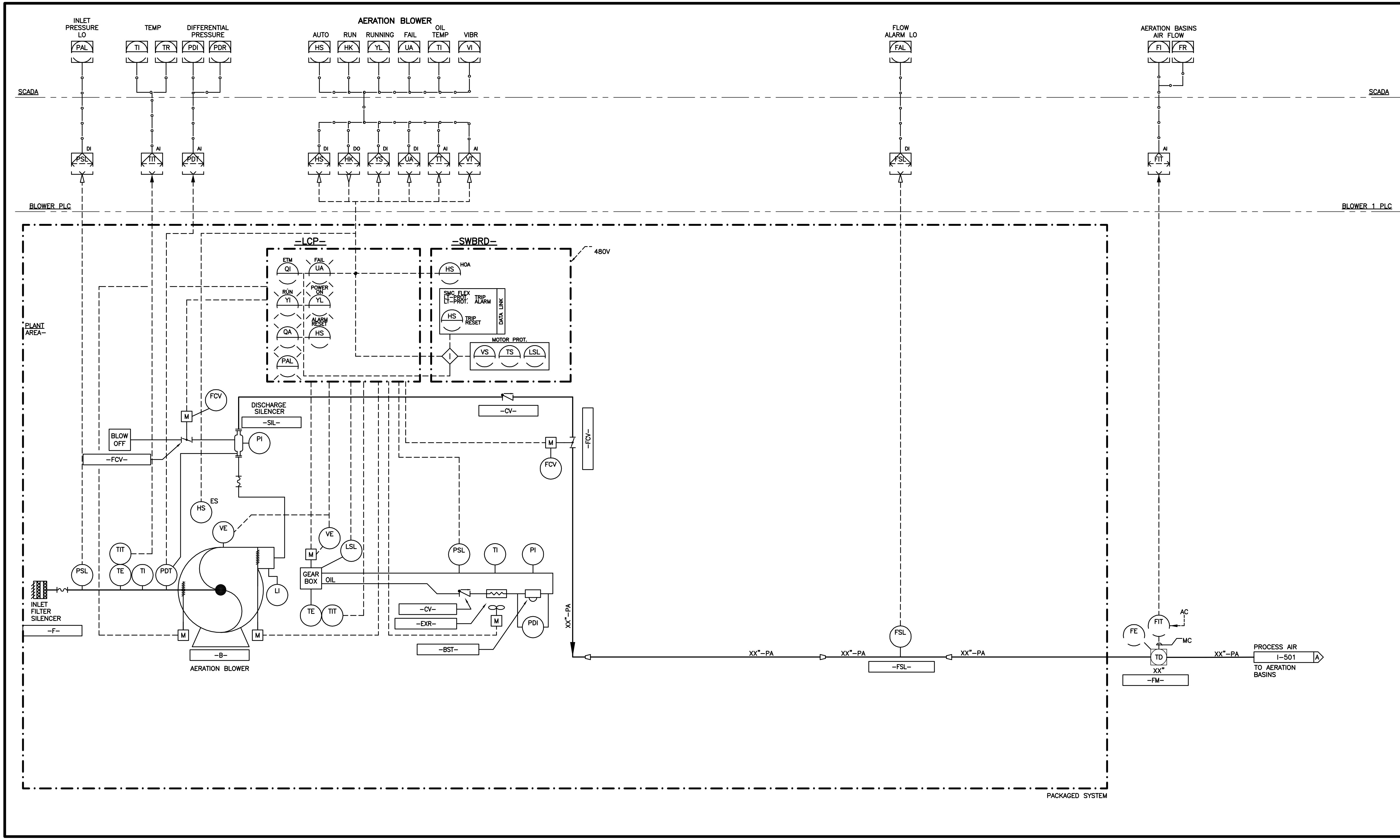

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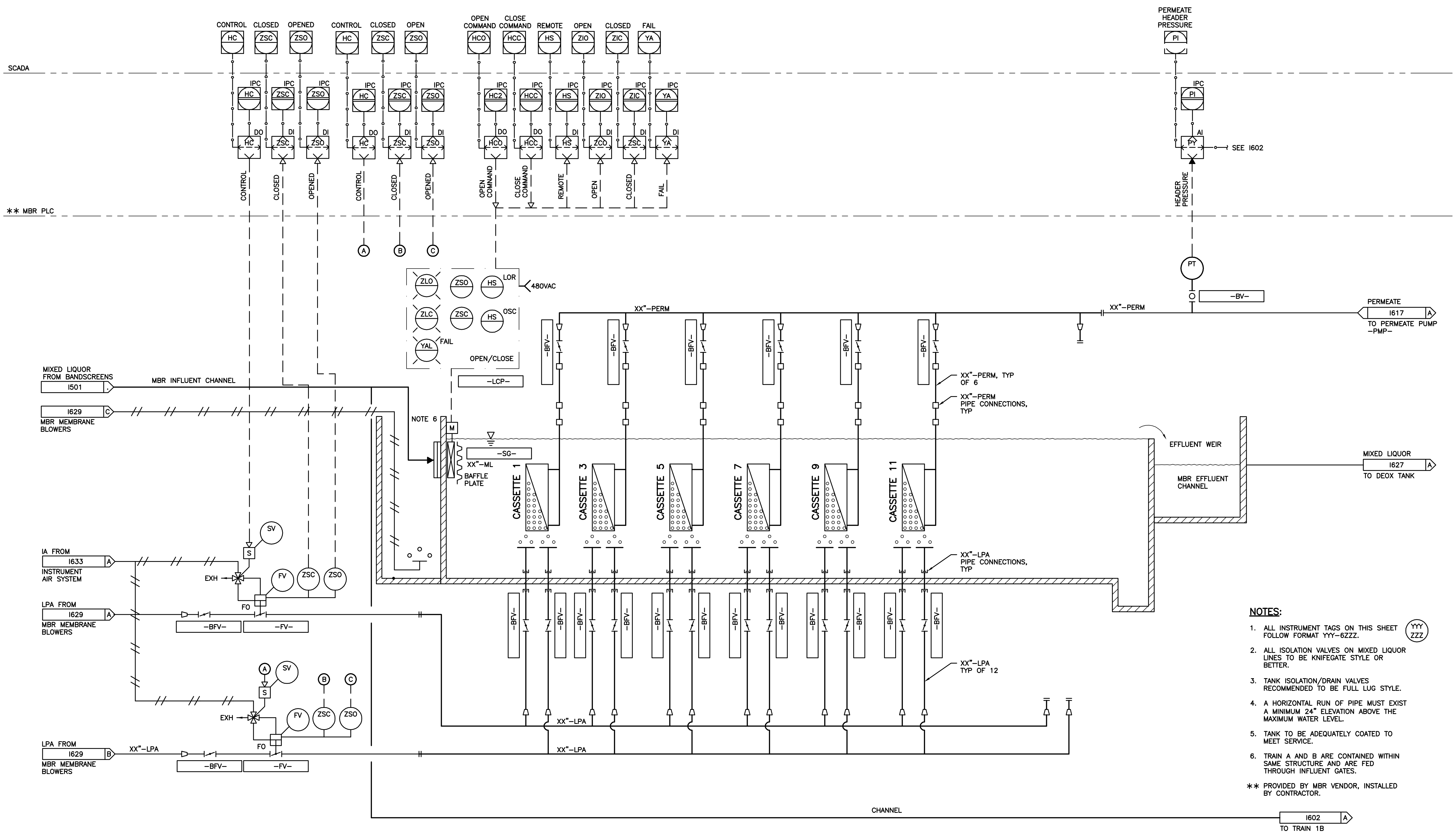
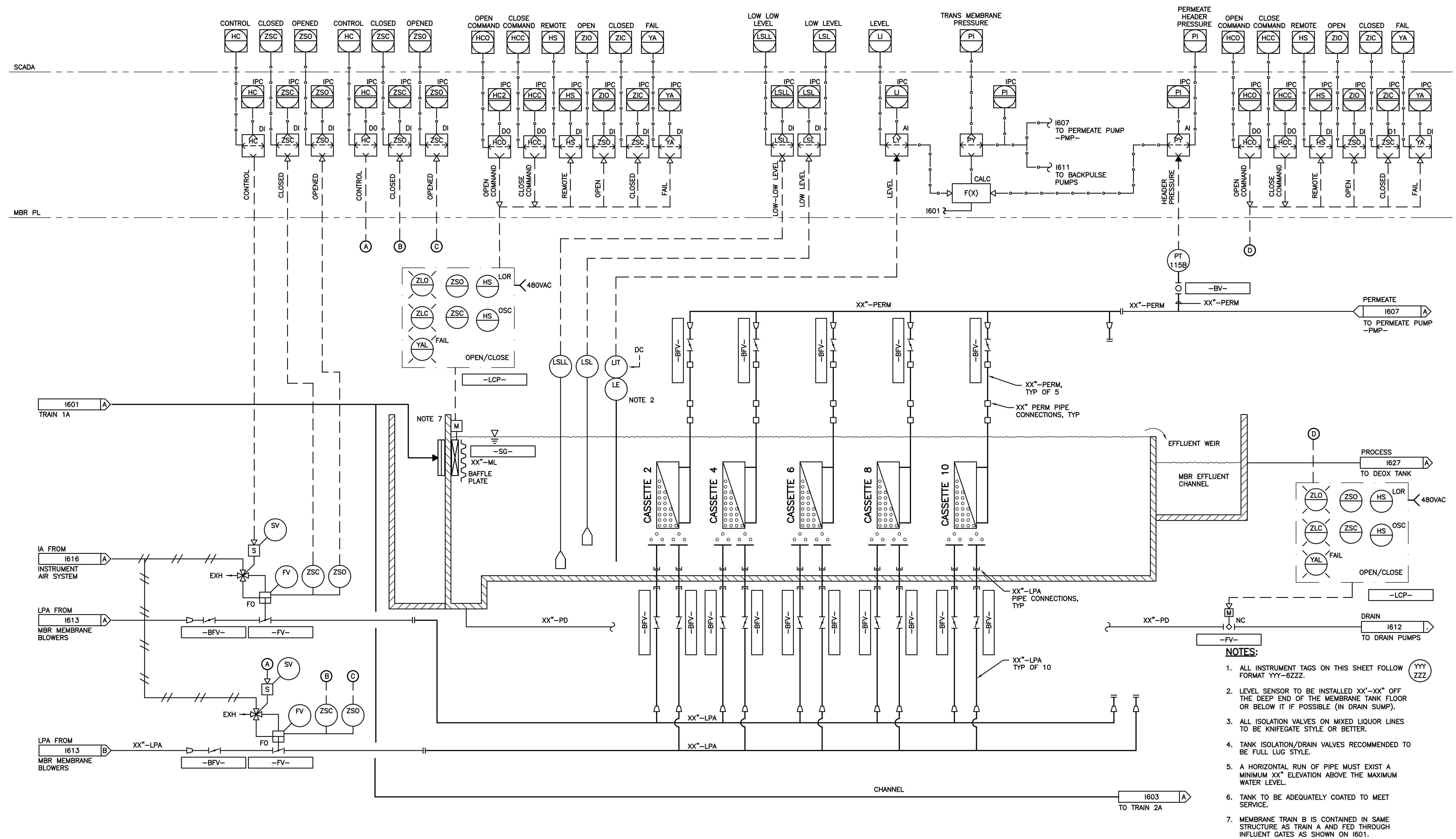


NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ.
2. ALL ISOLATION VALVES ON MIXED LIQUOR LINES TO BE KNIFEGATE STYLE OR BETTER.
3. TANK ISOLATION/DRAIN VALVES RECOMMENDED TO BE FULL LUG STYLE.
4. A HORIZONTAL RUN OF PIPE MUST EXIST A MINIMUM 24" ELEVATION ABOVE THE MAXIMUM WATER LEVEL.
5. TANK TO BE ADEQUATELY COATED TO MEET SERVICE.
6. TRAIN A AND B ARE CONTAINED WITHIN SAME STRUCTURE AND ARE FED THROUGH INFLUENT GATES.

** PROVIDED BY MBR VENDOR, INSTALLED BY CONTRACTOR.



NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ.
2. LEVEL SENSOR TO BE INSTALLED XX'-XX" OFF THE DEEP END OF THE MEMBRANE TANK FLOOR OR BELOW IT IF POSSIBLE (IN DRAIN SUMP).
3. ALL ISOLATION VALVES ON MIXED LIQUOR LINES TO BE KNIFEGATE STYLE OR BETTER.
4. TANK ISOLATION/DRAIN VALVES RECOMMENDED TO BE FULL LUG STYLE.
5. A HORIZONTAL RUN OF PIPE MUST EXIST A MINIMUM XX" ELEVATION ABOVE THE MAXIMUM WATER LEVEL.
6. TANK TO BE ADEQUATELY COATED TO MEET SERVICE.
7. MEMBRANE TRAIN B IS CONTAINED IN SAME STRUCTURE AS TRAIN A AND FED THROUGH INFLUENT GATES AS SHOWN ON I601.

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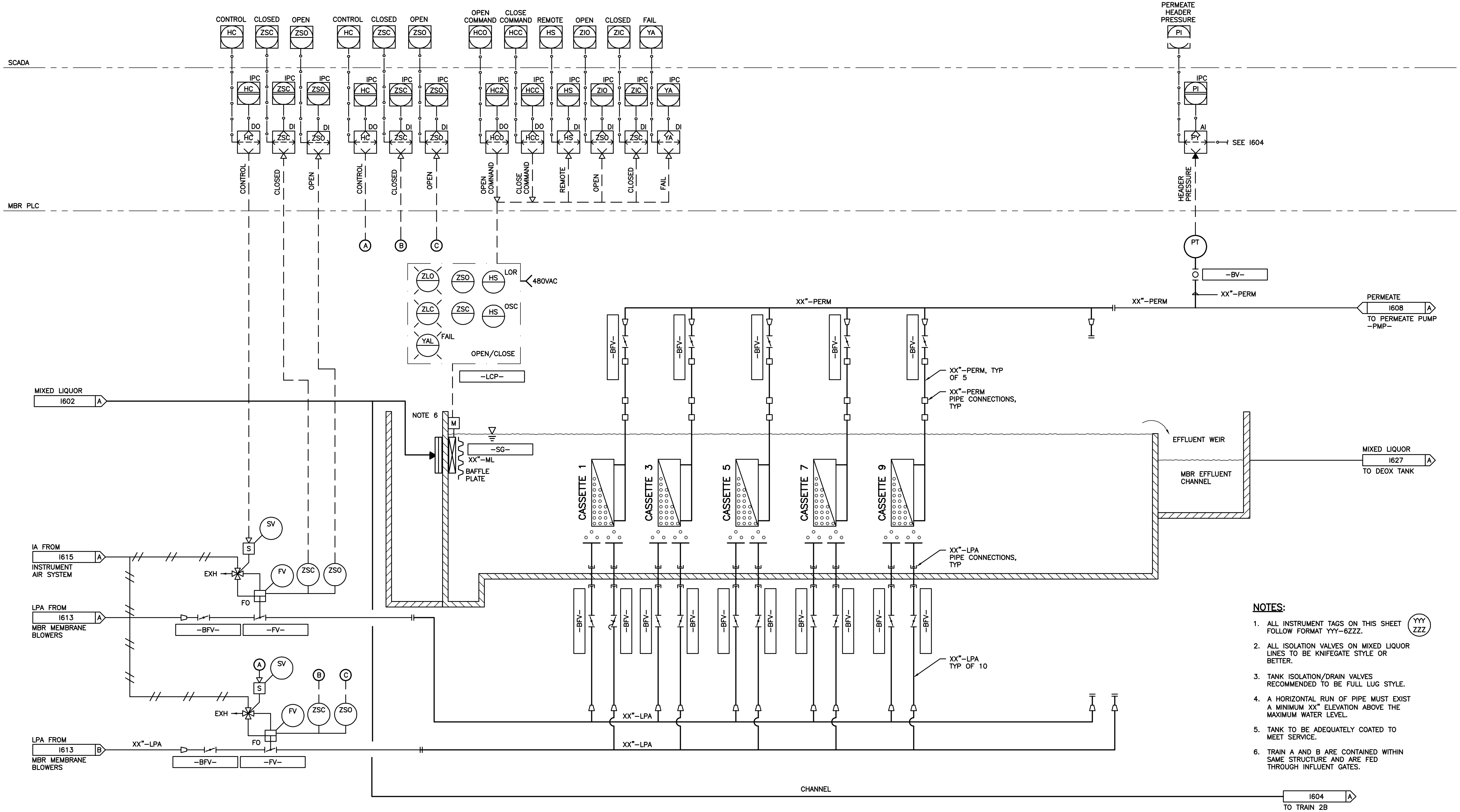
HESPERIA WRP - PRELIMINARY DESIGN REPORT



NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ. (YYY / ZZZ)
2. ALL ISOLATION VALVES ON MIXED LIQUOR LINES TO BE KNIFEGATE STYLE OR BETTER.
3. TANK ISOLATION/DRAIN VALVES RECOMMENDED TO BE FULL LUG STYLE.
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VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT

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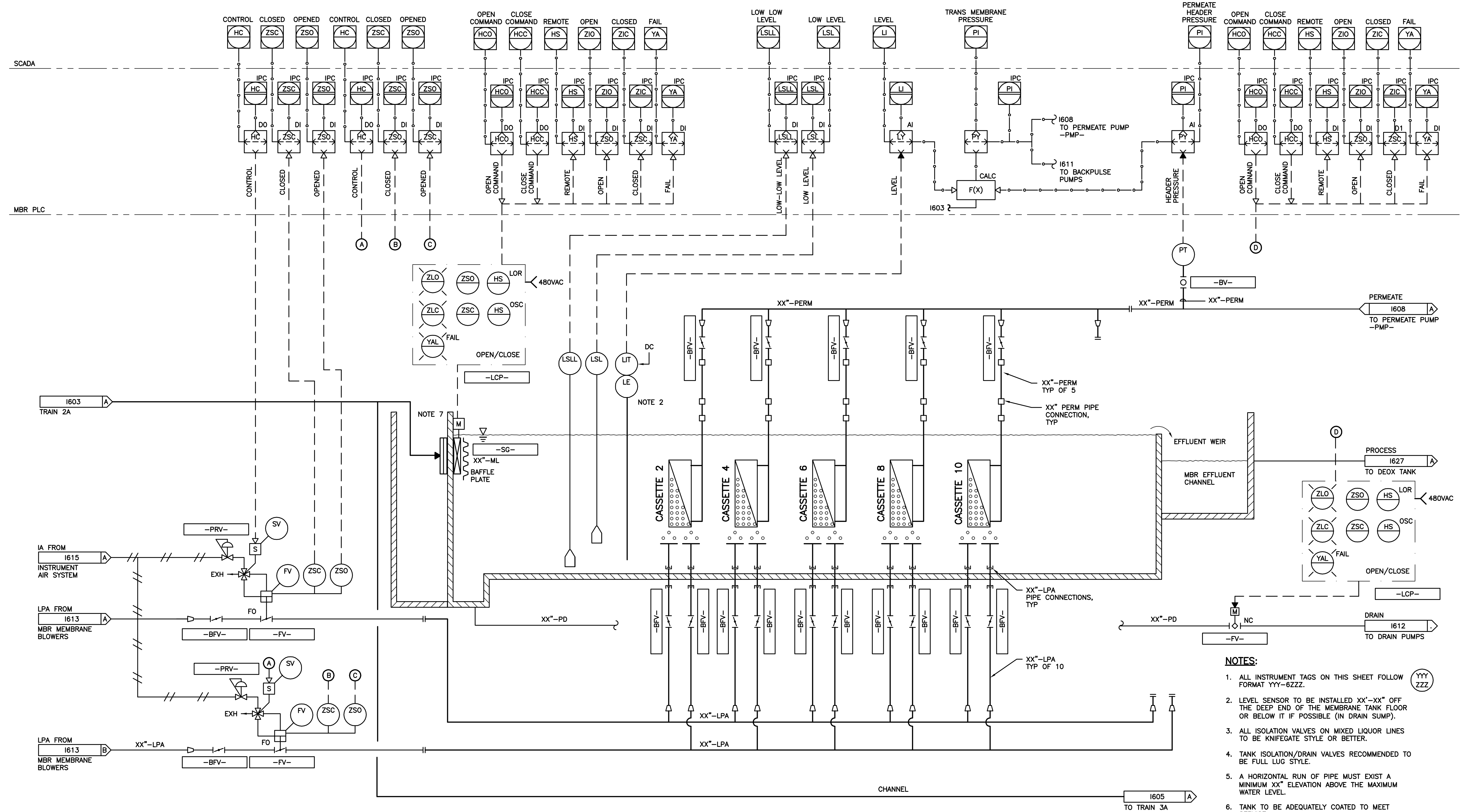

NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ. (YYY / ZZZ)
2. LEVEL SENSOR TO BE INSTALLED XX'-XX" OFF THE DEEP END OF THE MEMBRANE TANK FLOOR OR BELOW IT IF POSSIBLE (IN DRAIN SUMP).
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5. A HORIZONTAL RUN OF PIPE MUST EXIST A MINIMUM XX" ELEVATION ABOVE THE MAXIMUM WATER LEVEL.
6. TANK TO BE ADEQUATELY COATED TO MEET SERVICE.
7. MEMBRANE TRAIN B IS CONTAINED IN SAME STRUCTURE AS TRAIN A AND FED THROUGH INFLUENT GATES AS SHOWN ON I601.

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HESPERIA WRP - PRELIMINARY DESIGN REPORT

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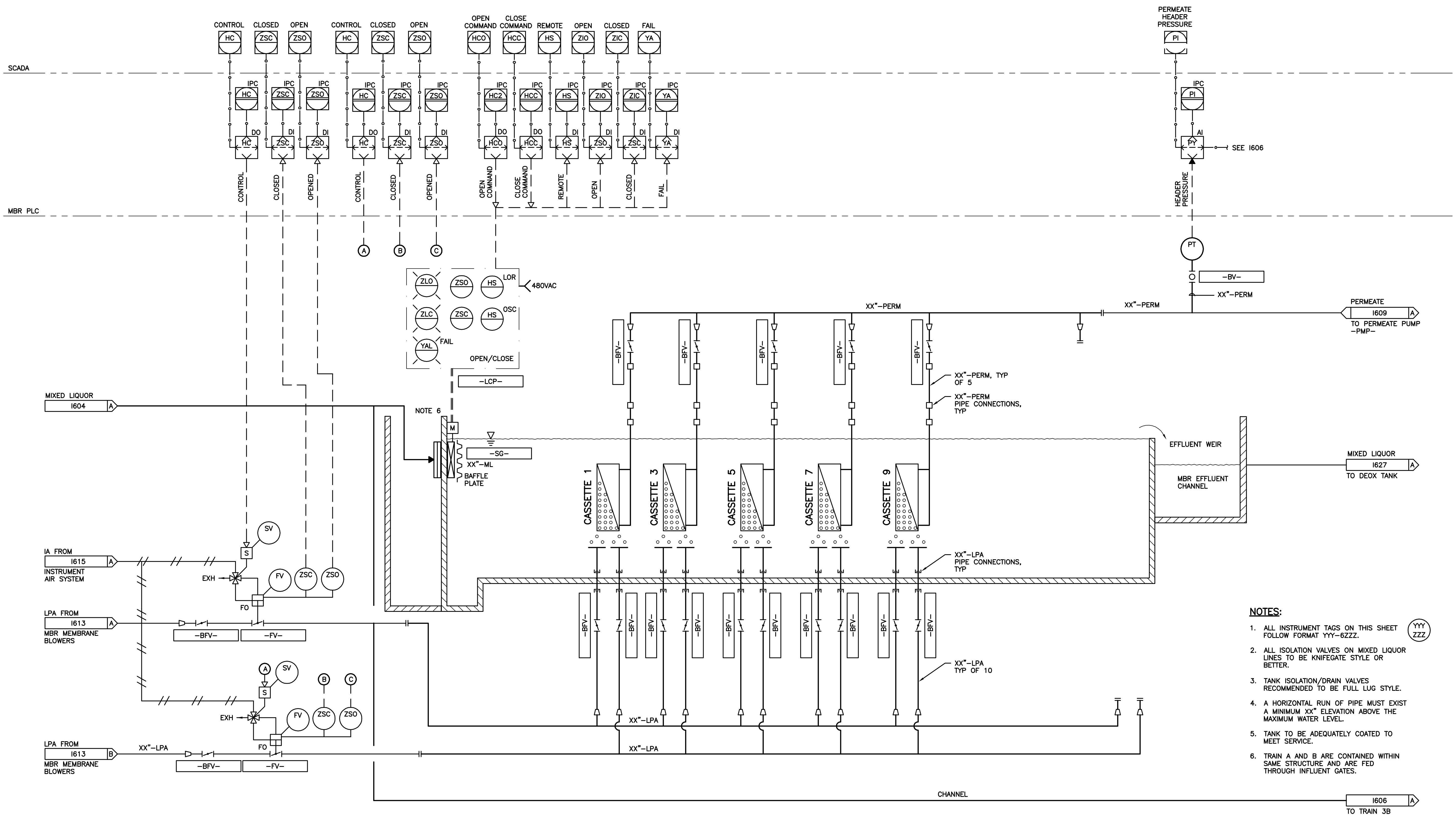

NOTES:

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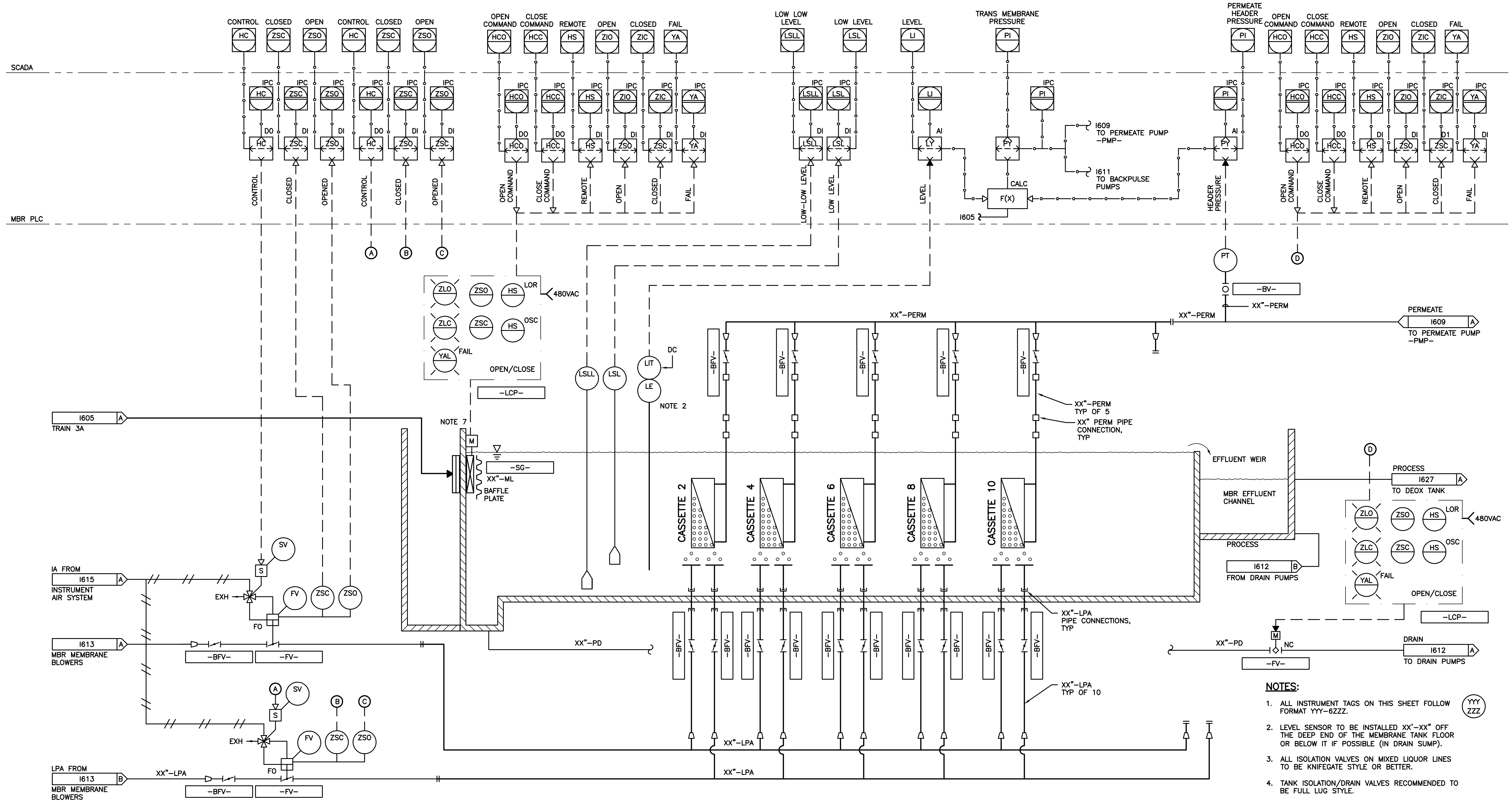
2. ALL ISOLATION VALVES ON MIXED LIQUOR LINES TO BE KNIFEGATE STYLE OR BETTER.
3. TANK ISOLATION/DRAIN VALVES RECOMMENDED TO BE FULL LUG STYLE.
4. A HORIZONTAL RUN OF PIPE MUST EXIST A MINIMUM XX" ELEVATION ABOVE THE MAXIMUM WATER LEVEL.
5. TANK TO BE ADEQUATELY COATED TO MEET SERVICE.
6. TRAIN A AND B ARE CONTAINED WITHIN SAME STRUCTURE AND ARE FED THROUGH INFLUENT GATES.

VICTOR VALLEY WASTEWATER RECLAMATION AUTHORITY
HESPERIA WRP - PRELIMINARY DESIGN REPORT



NOTES:

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2. LEVEL SENSOR TO BE INSTALLED XX'-XX" OFF THE DEEP END OF THE MEMBRANE TANK FLOOR OR BELOW IT IF POSSIBLE (IN DRAIN SUMP).
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6. TANK TO BE ADEQUATELY COATED TO MEET SERVICE.
7. MEMBRANE TRAIN B IS CONTAINED IN SAME STRUCTURE AS TRAIN A AND FED THROUGH INFLUENT GATES AS SHOWN ON I601.

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HESPERIA WRP - PRELIMINARY DESIGN REPORT

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I606

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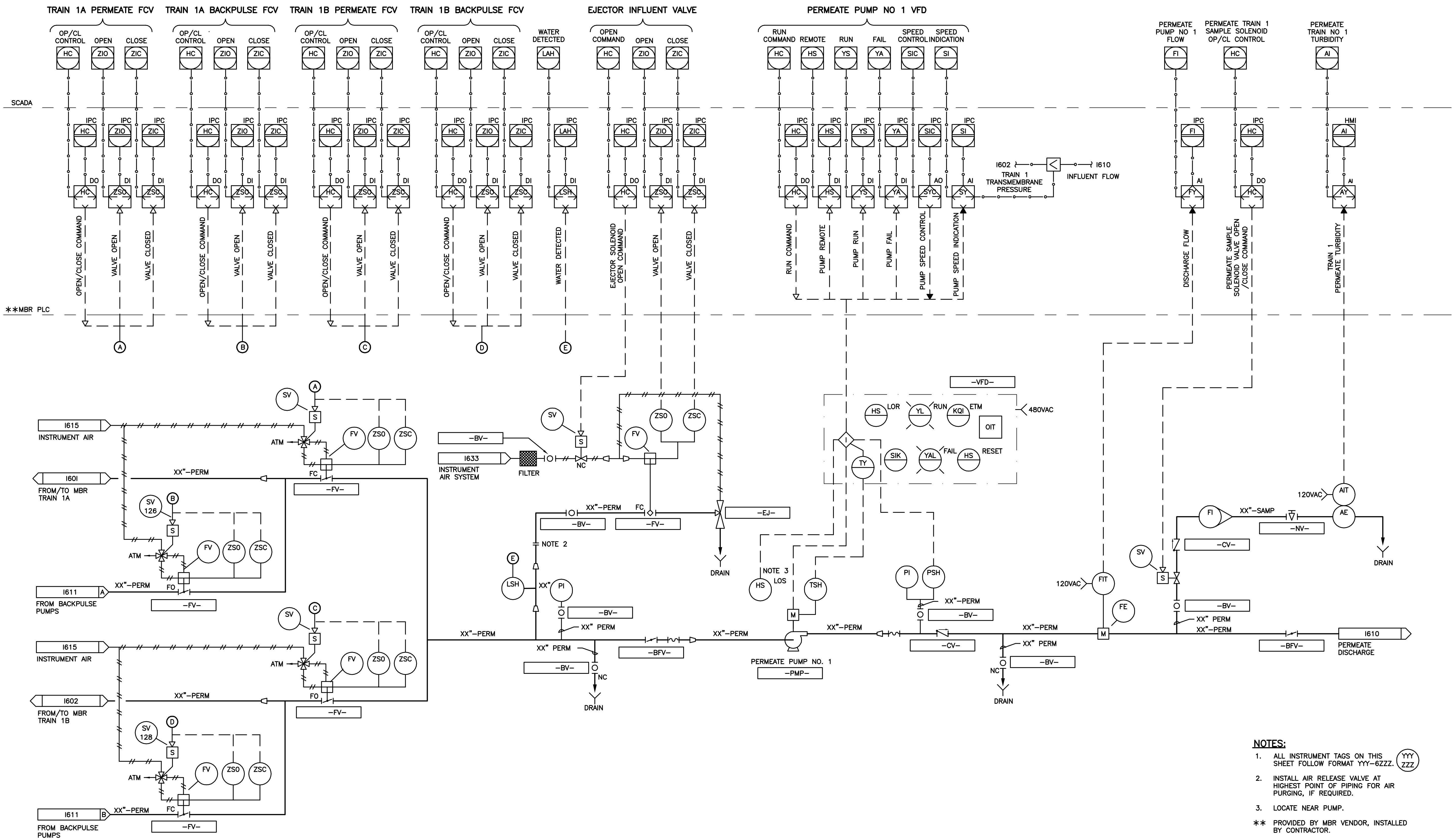
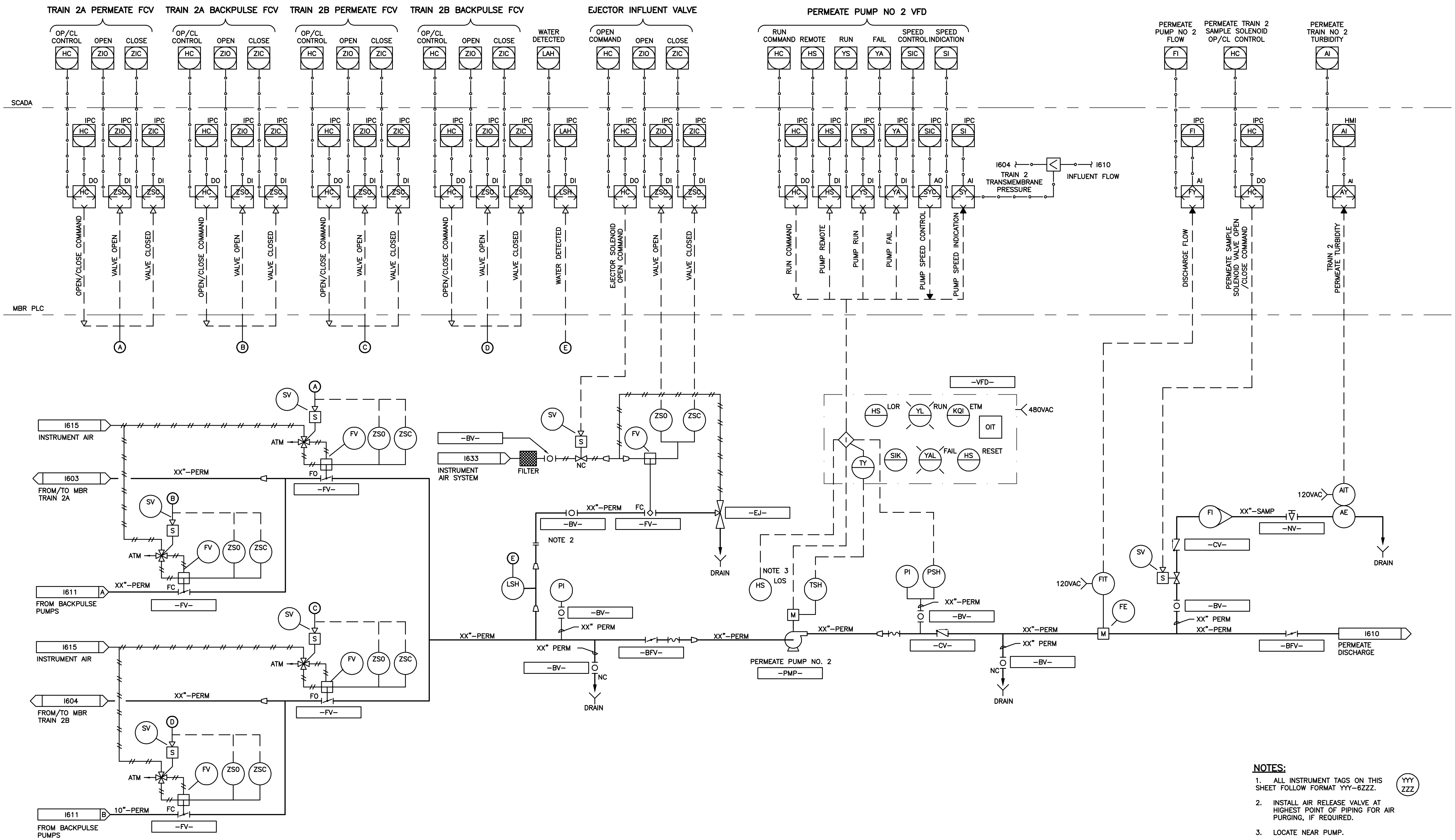


NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ. (YYY / ZZZ)
2. INSTALL AIR RELEASE VALVE AT HIGHEST POINT OF PIPING FOR AIR PURGING, IF REQUIRED.
3. LOCATE NEAR PUMP.

** PROVIDED BY MBR VENDOR, INSTALLED BY CONTRACTOR.

HDR carollo



NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ. (YYY / ZZZ)
2. INSTALL AIR RELEASE VALVE AT HIGHEST POINT OF PIPING FOR AIR PURGING, IF REQUIRED.
3. LOCATE NEAR PUMP.

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HESPERIA WRP - PRELIMINARY DESIGN REPORT

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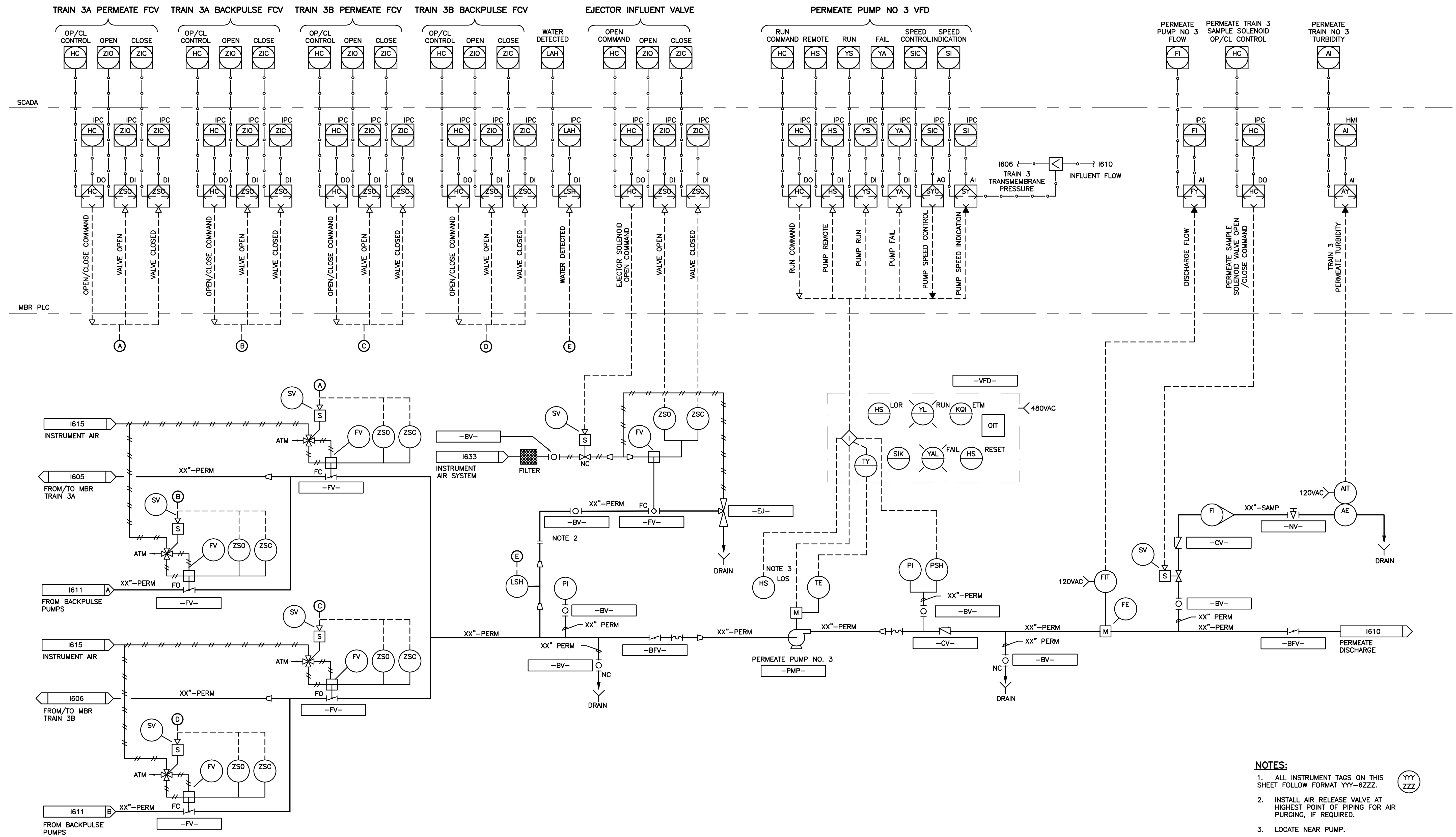

NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ. (YYY ZZZ)
2. INSTALL AIR RELEASE VALVE AT HIGHEST POINT OF PIPING FOR AIR PURGING, IF REQUIRED.
3. LOCATE NEAR PUMP.

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HESPERIA WRP - PRELIMINARY DESIGN REPORT

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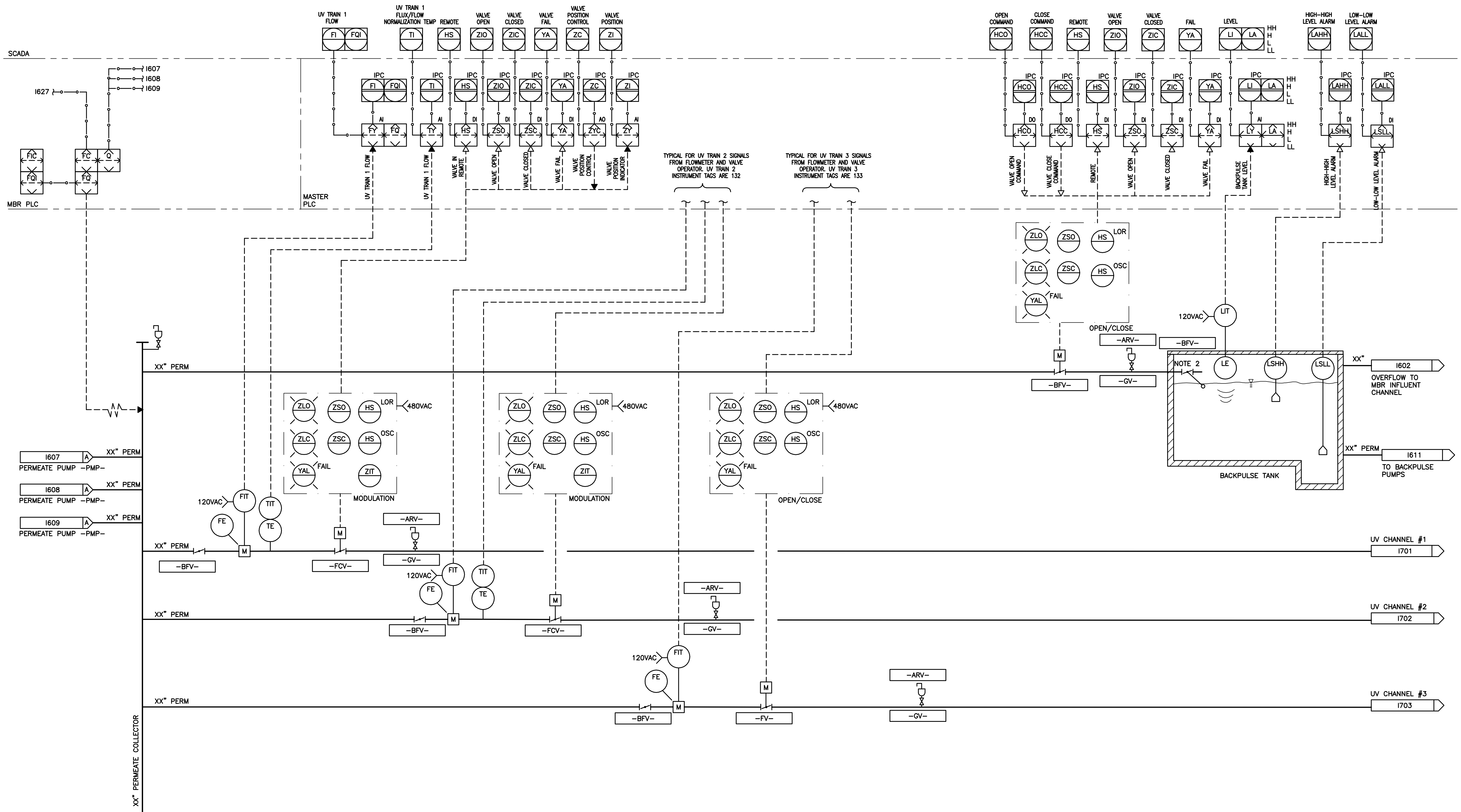

NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ. (YYY ZZZ)
2. BFV WITH MECHANICAL FLOAT SWITCH.

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HESPERIA WRP - PRELIMINARY DESIGN REPORT

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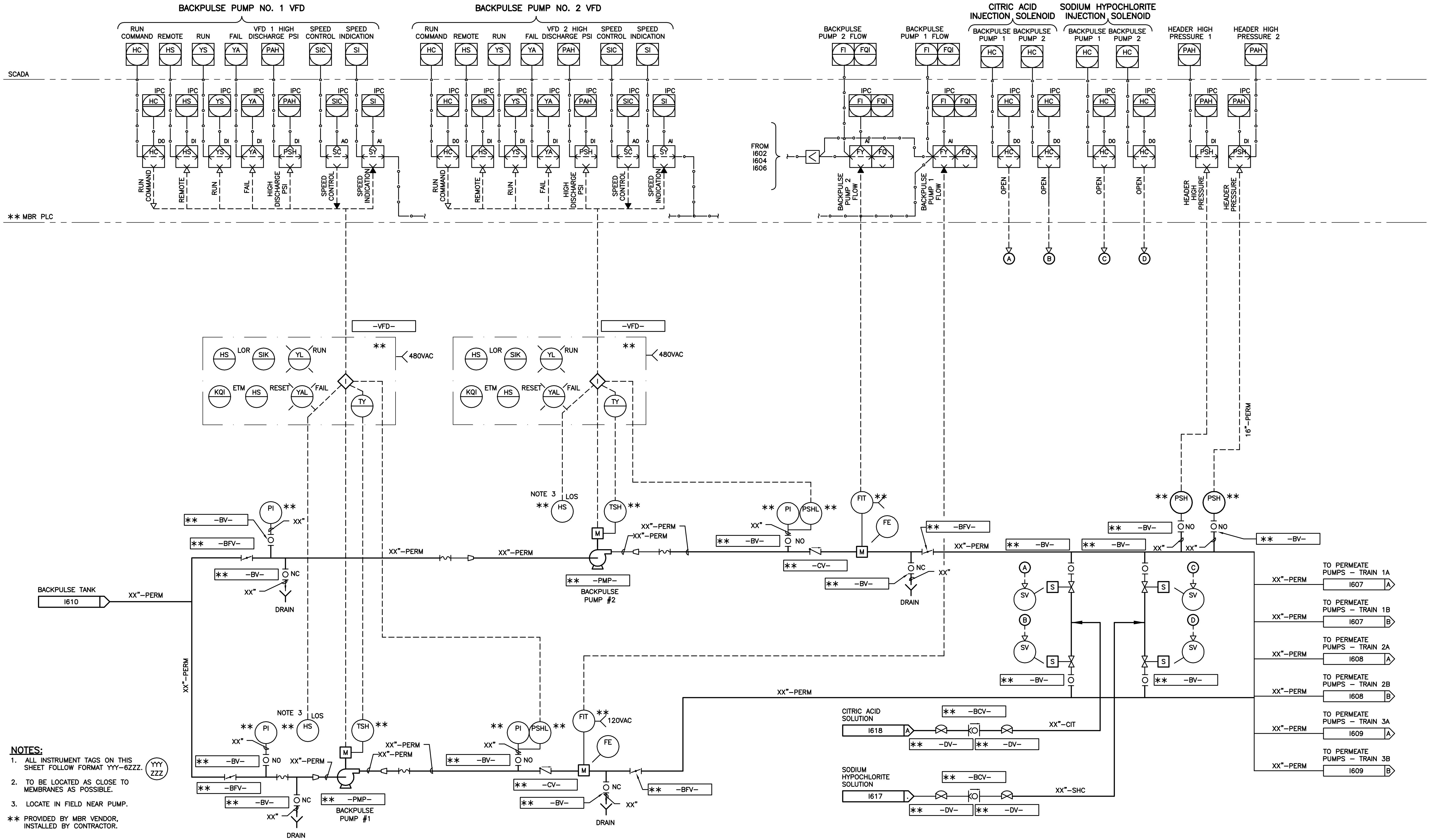
I610



NOTES:
1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ. (YYY ZZZ)
2. TO BE LOCATED AS CLOSE TO MEMBRANES AS POSSIBLE.
3. LOCATE IN FIELD NEAR PUMP.
** PROVIDED BY MBR VENDOR, INSTALLED BY CONTRACTOR.

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HESPERIA WRP - PRELIMINARY DESIGN REPORT

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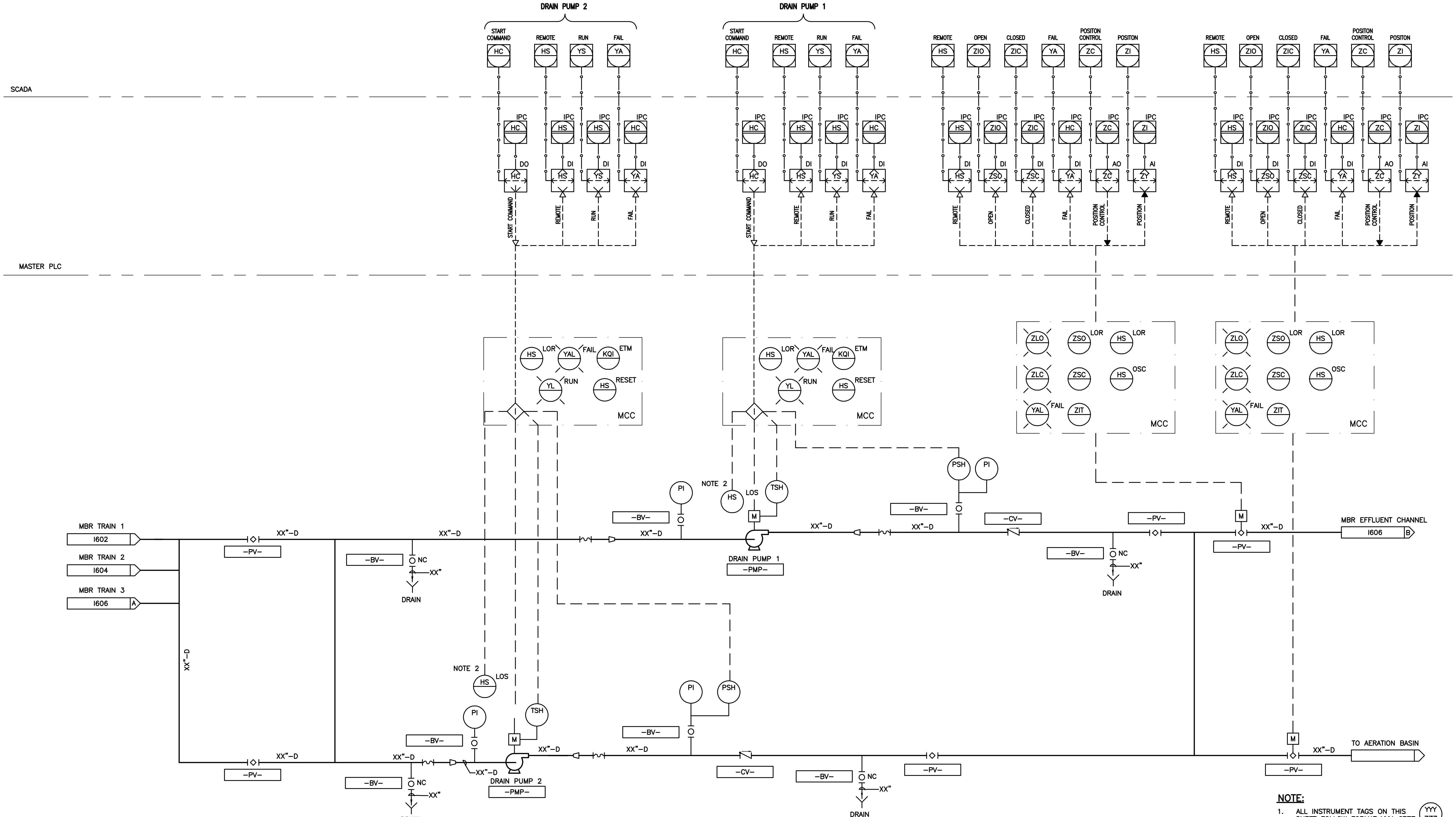
I611



NOTE:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ. (YYY / ZZZ)
2. LOCATE LOS NEAR PUMP.

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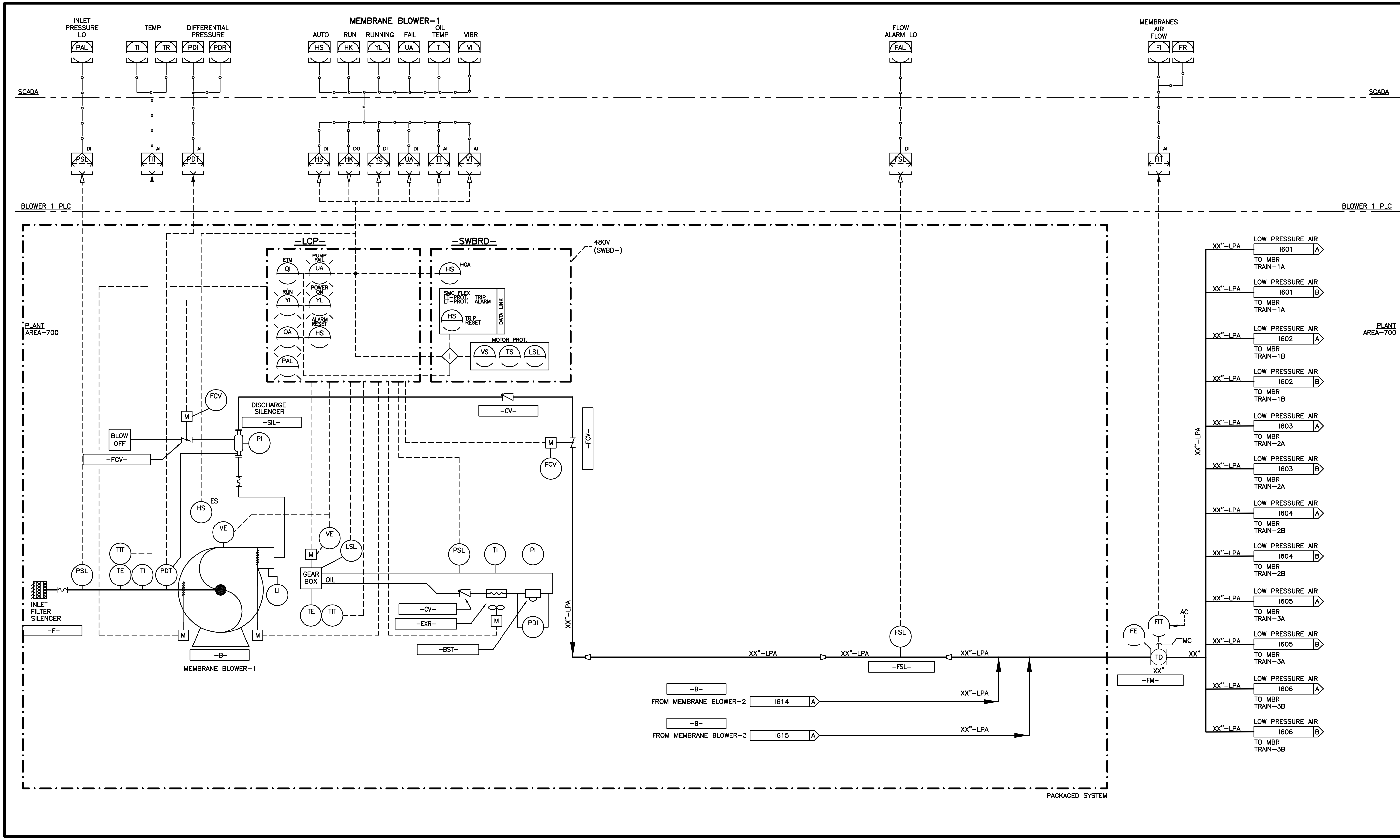

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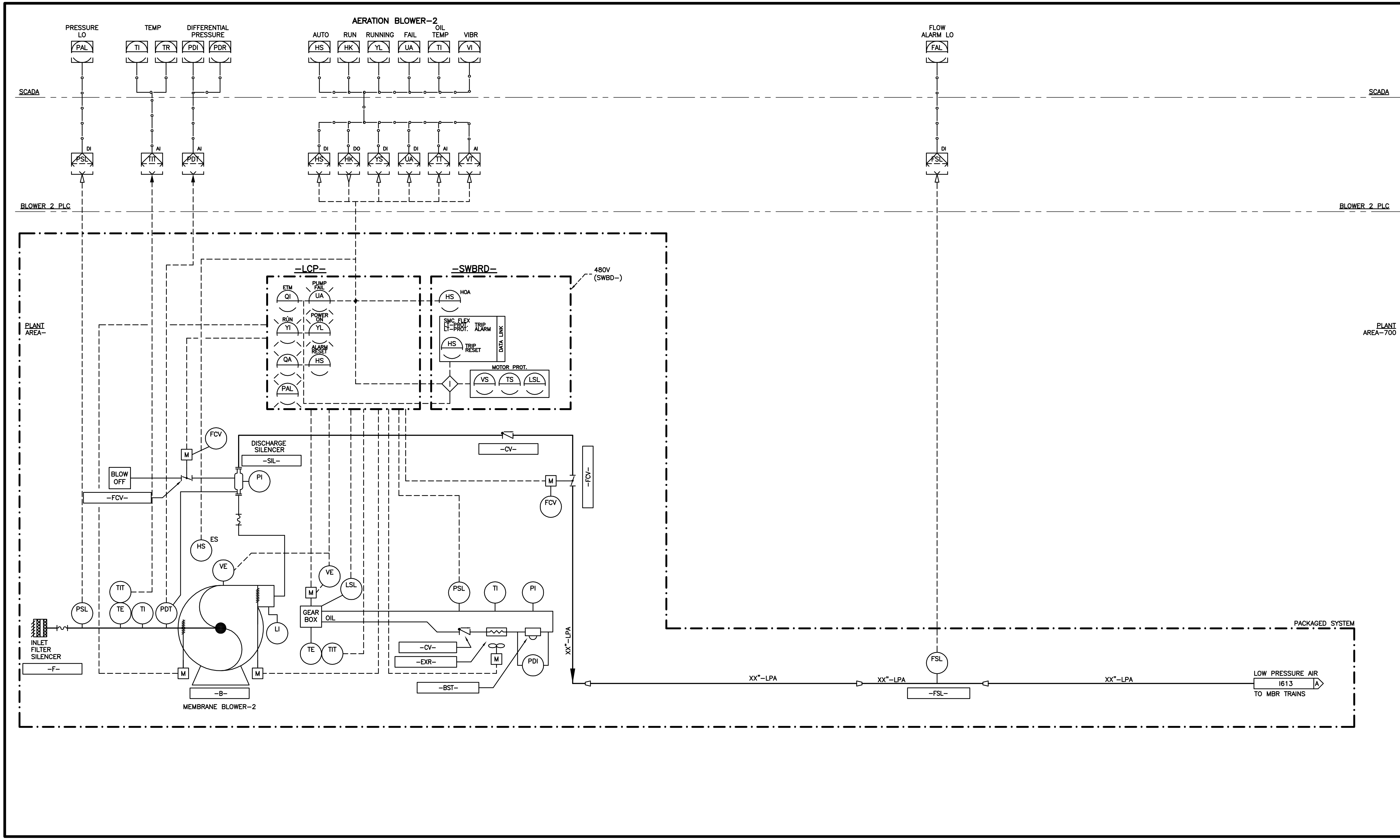
I613



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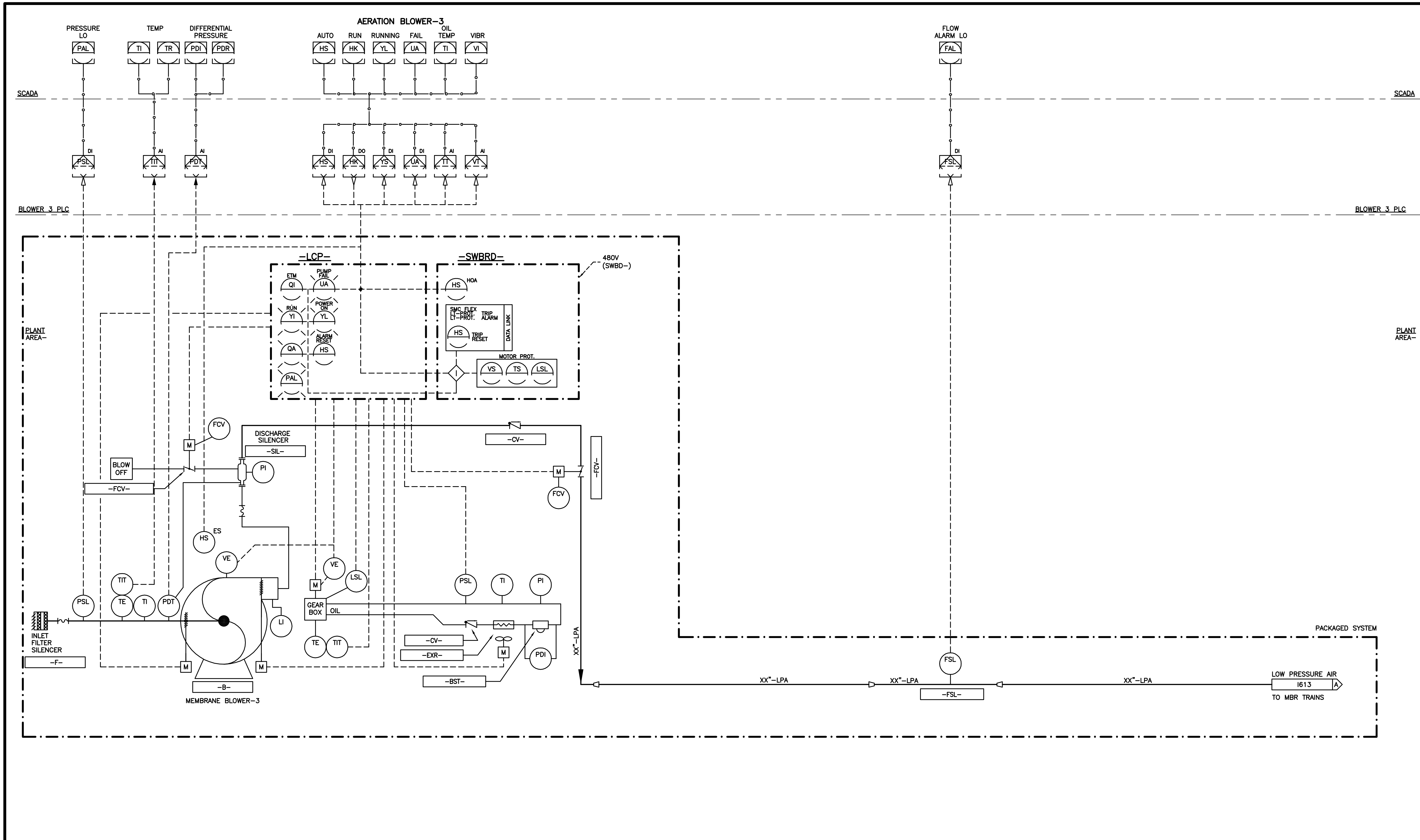

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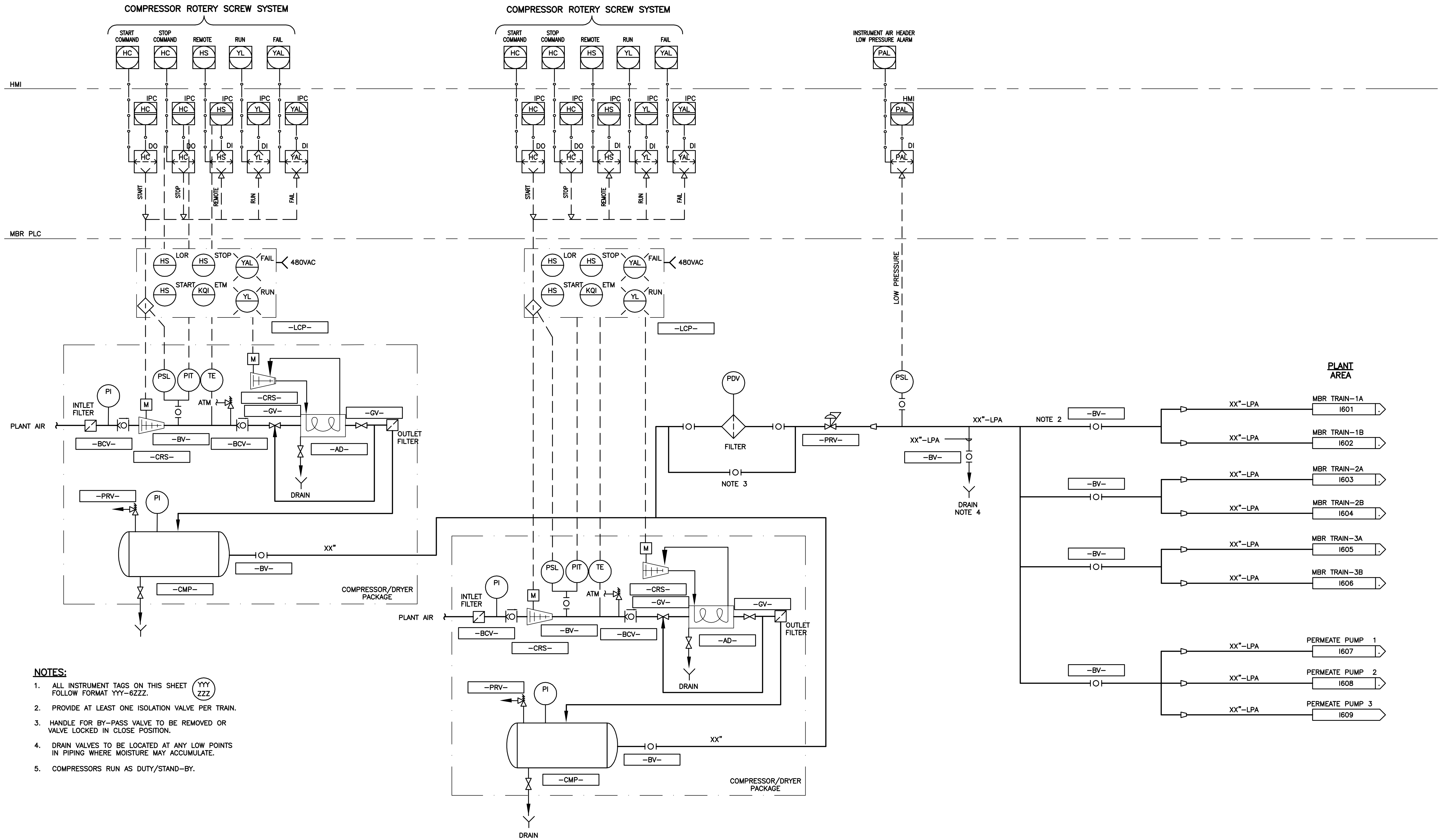

NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ. (YYY / ZZZ)
2. PROVIDE AT LEAST ONE ISOLATION VALVE PER TRAIN.
3. HANDLE FOR BY-PASS VALVE TO BE REMOVED OR VALVE LOCKED IN CLOSE POSITION.
4. DRAIN VALVES TO BE LOCATED AT ANY LOW POINTS IN PIPING WHERE MOISTURE MAY ACCUMULATE.
5. COMPRESSORS RUN AS DUTY/STAND-BY.

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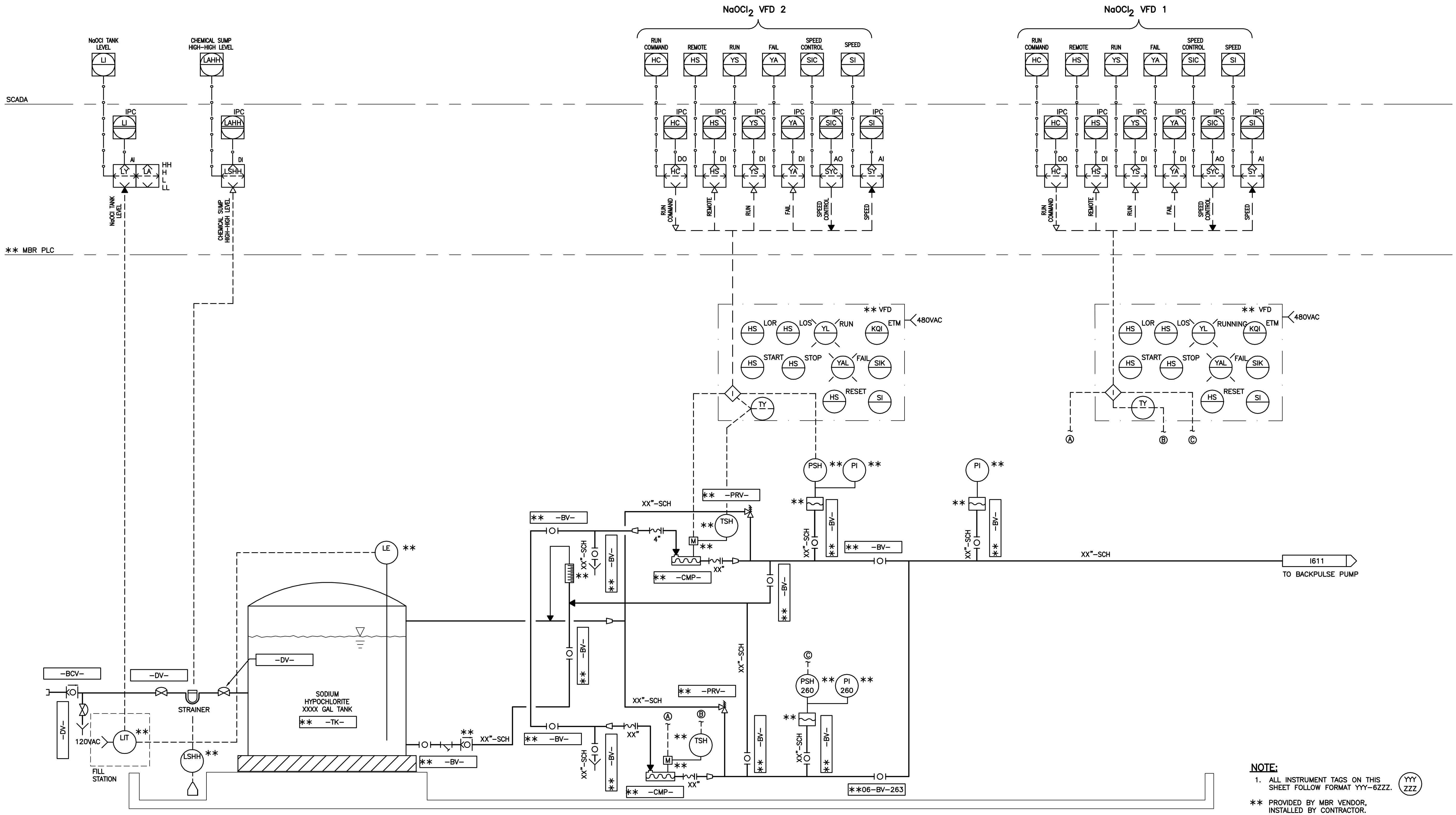

NOTE:

1. ALL INSTRUMENT TAGS ON THIS SHEET FOLLOW FORMAT YYY-6ZZZ.

** PROVIDED BY MBR VENDOR, INSTALLED BY CONTRACTOR.

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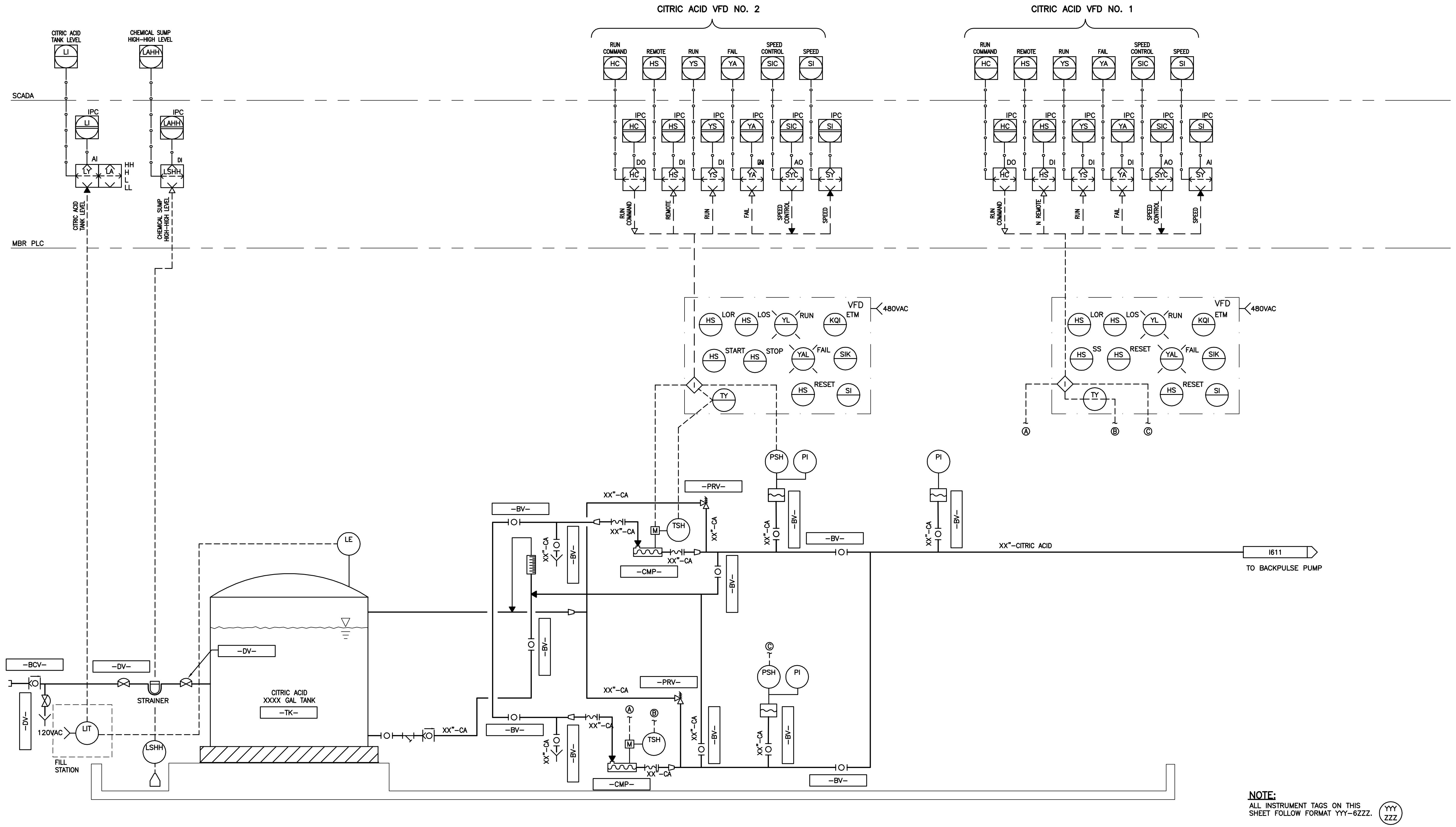

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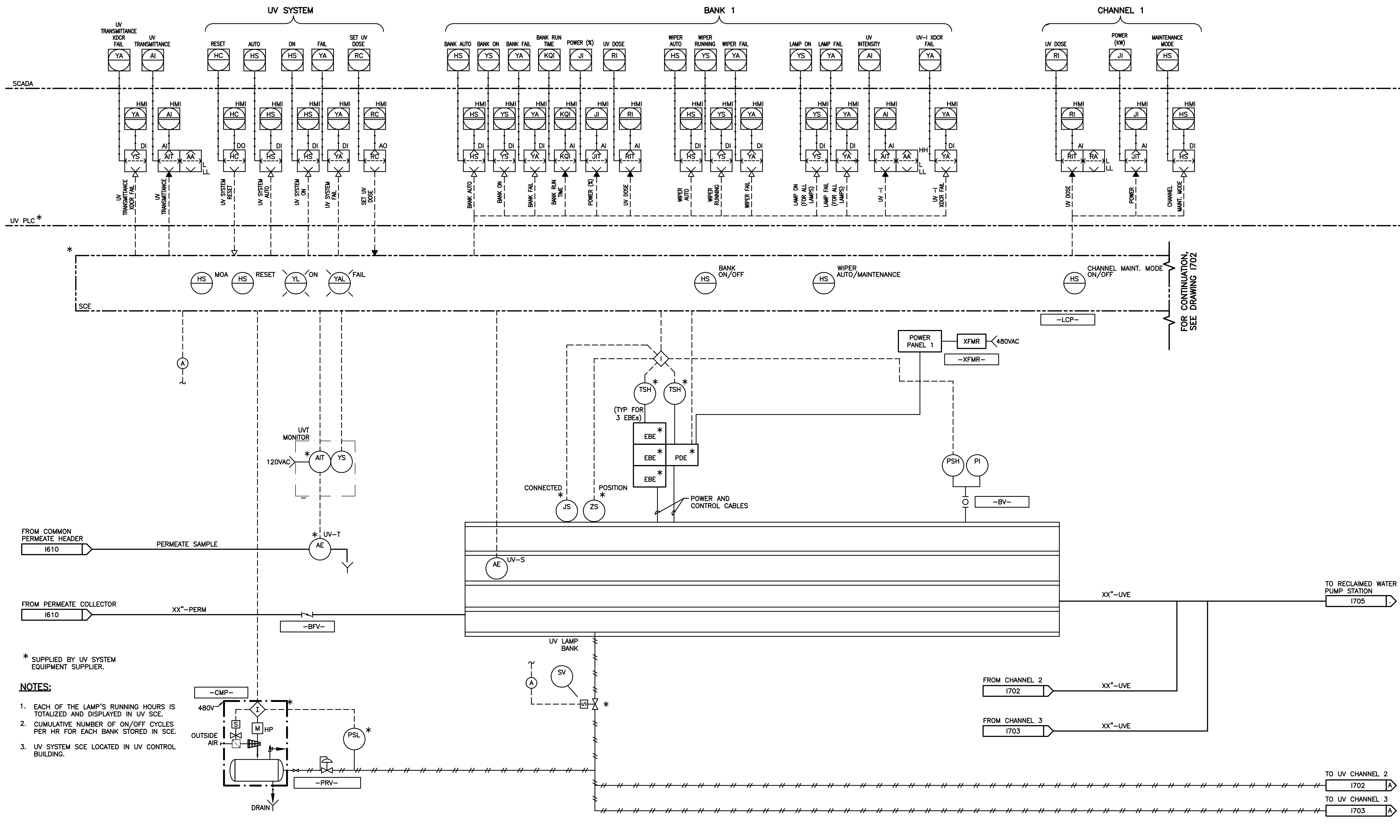

* SUPPLIED BY UV SYSTEM EQUIPMENT SUPPLIER.

NOTES:

1. EACH OF THE LAMP'S RUNNING HOURS IS TOTALIZED AND DISPLAYED IN UV SCE.
2. CUMULATIVE NUMBER OF ON/OFF CYCLES PER HR FOR EACH BANK STORED IN SCE.
3. UV SYSTEM SCE LOCATED IN UV CONTROL BUILDING.

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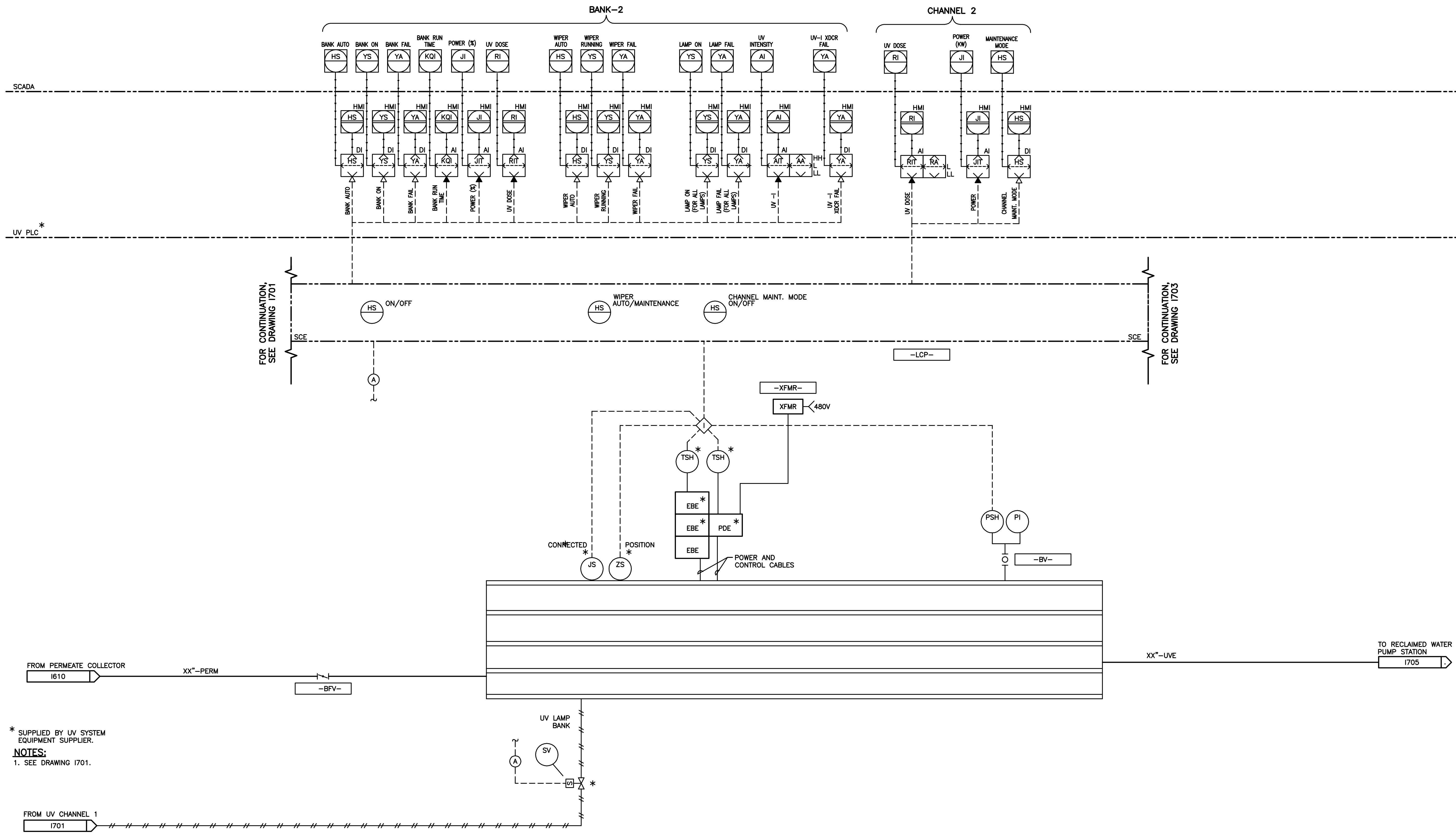
I701



* SUPPLIED BY UV SYSTEM EQUIPMENT SUPPLIER.

NOTES:

1. SEE DRAWING I701.

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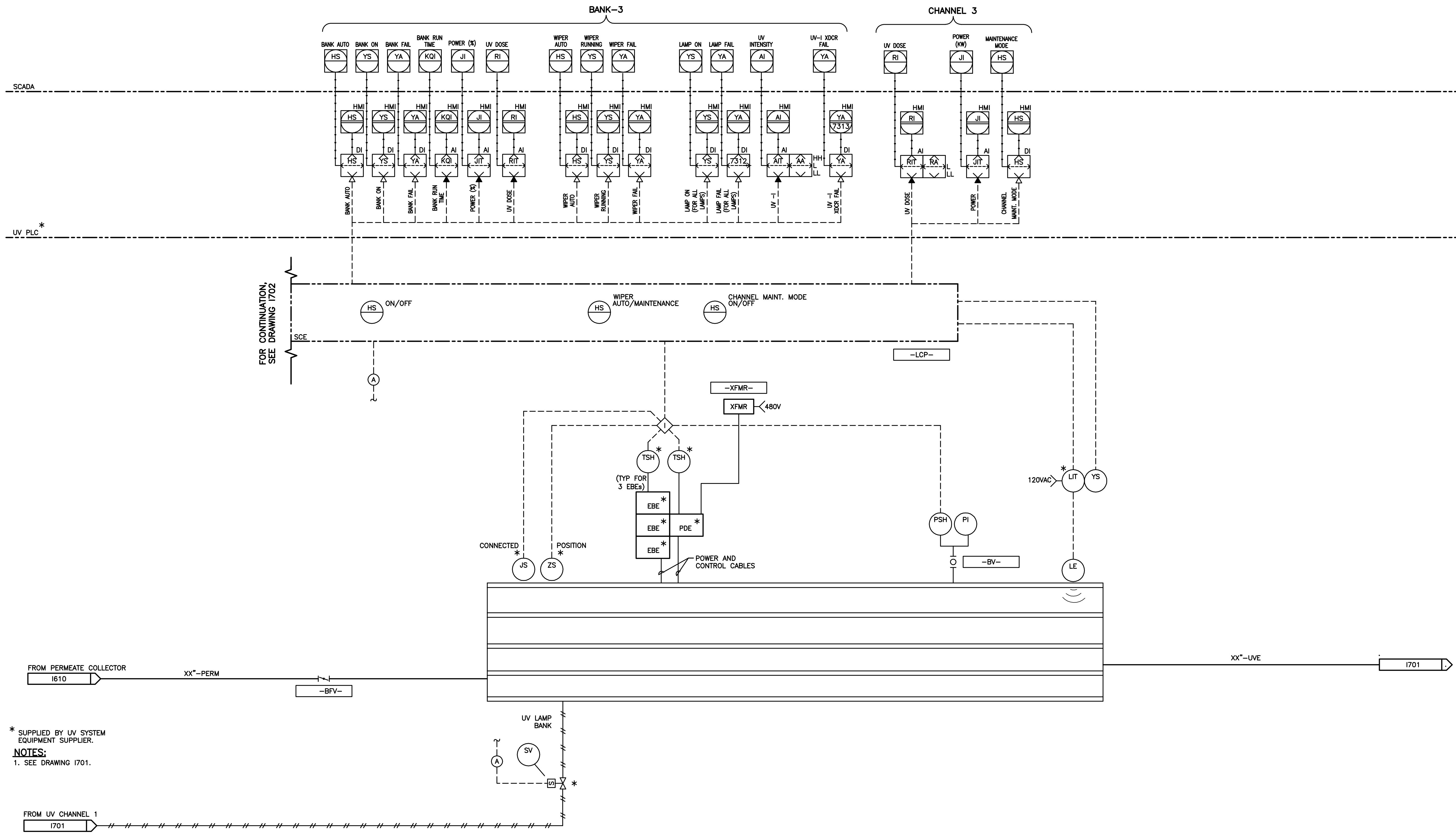

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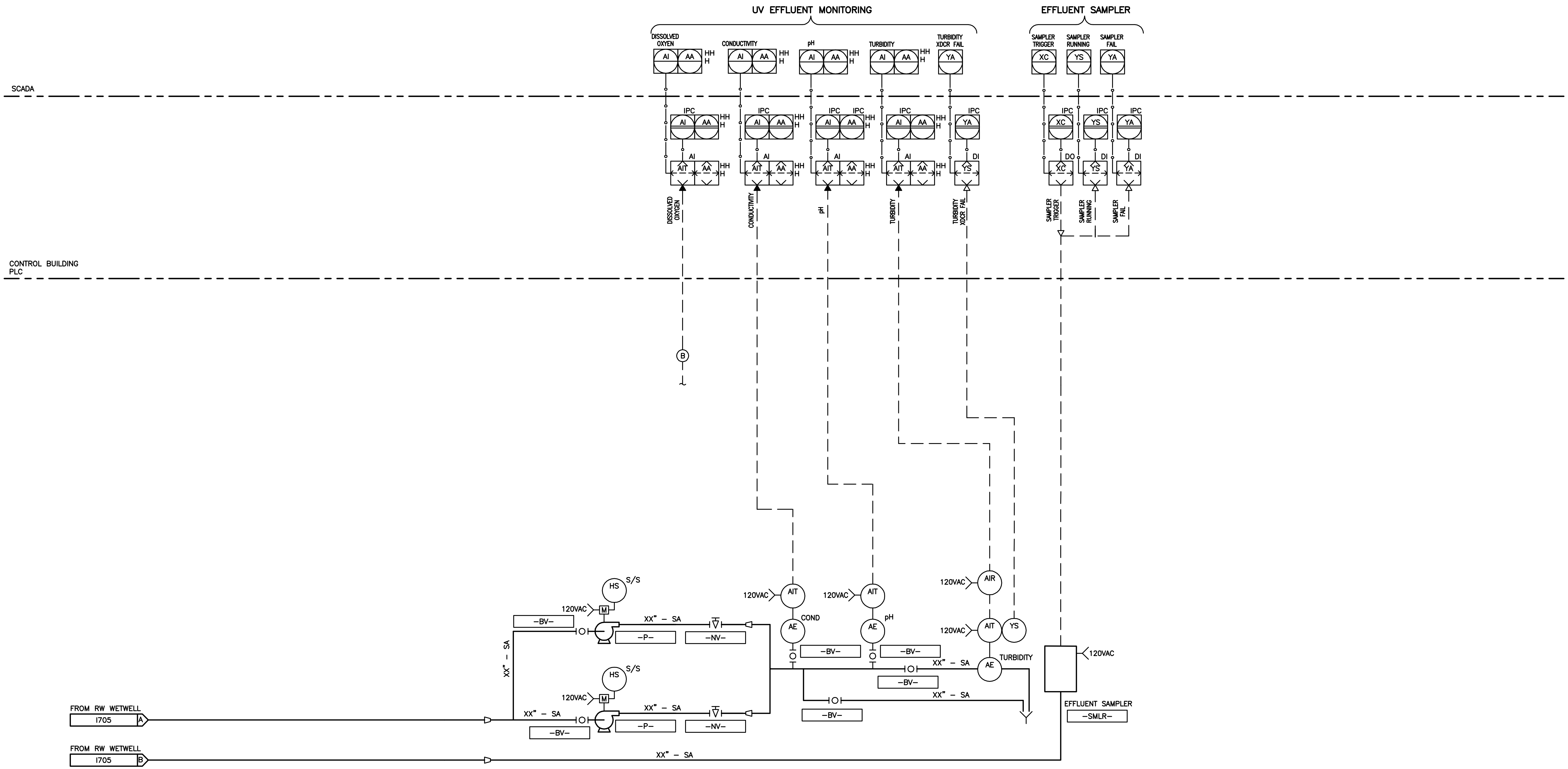

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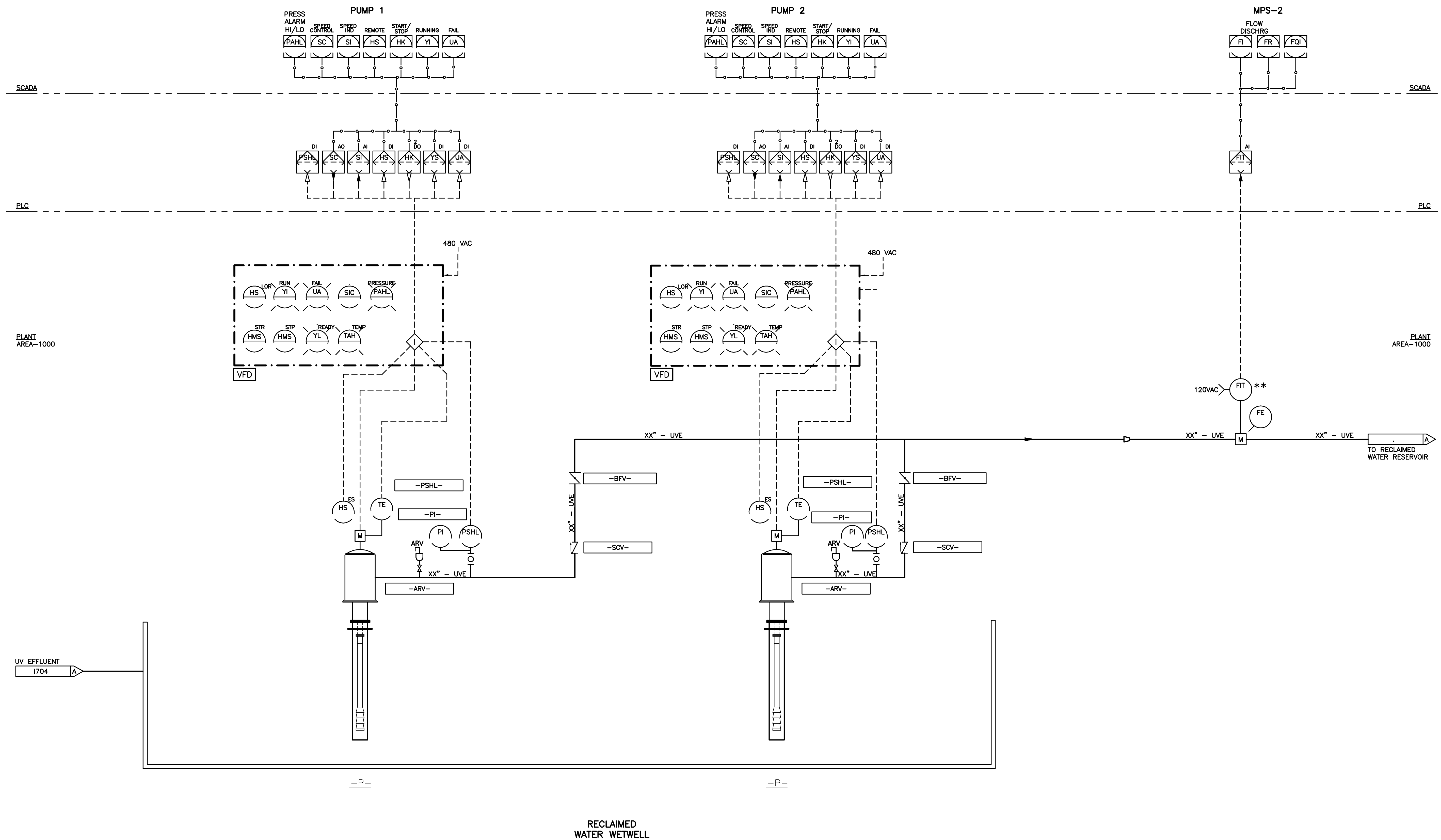

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HESPERIA WATER RECLAMATION PLANT

DESIGN INFORMATION MEMORANDUM NO. 13A

SITE LAYOUT AND CONSTRAINTS

Project Name:	Hesperia and Apple Valley Scalping WRPs, Raw Sewage Lift Station and Force Mains		
Client:	Victor Valley Wastewater Reclamation Authority	**Date:**	December 2009

INTRODUCTION

This DIM-13A discussed the selected Hesperia WRP site location and physical constraints at this location such as geotechnical and seismic constraints.

Site Layout

The Hesperia WRP will be located on the north side of Mojave Street, just west of Tamarisk Avenue, as shown in Figure 13A.1.

The WRP site layout has been developed with the following goals:

- Low profile;
- A monolithic or uniform structure concept to reduce footprint; and
- Common wall construction to reduce costs.

The proposed site layout is presented in Figure 13A.1. Sections of the proposed WRP are presented in Figure 13A.2 and Figure 13A.3.

Site Constraints

Seismicity and Geologic Hazards

An initial review of readily available geological maps suggests that there are no known active faults underlying the project sites. The San Andreas Fault is approximately 12 miles southeast of Hesperia. Other faults such as the Helendale, North Frontal, and Mirage Valley are significantly closer; but may be dormant and pose a smaller risk. Whatever distant fault sources are identified in the final geotechnical report, it is clear that the subject sites for this project are in seismically active areas for which strong ground motions must be considered. Based on available geotechnical borings that were placed for a prior project near the Apple Valley WRP site (Apple Valley was referenced due to the fact that at the time of developing the PDR, no Hesperia geotechnical report is available), the final geotechnical report for Hesperia WRP site will likely confirm that soils in that area are in Seismic Class C or D, and design ground accelerations will be on the order of 0.30 g. Soils in this category should allow the use of conventional concrete wall, column, and mat foundations. Since the soils are predominantly sands, gravel, and weak caliche, it is also suspected that seismic liquefaction, expansive soils, and soil corrosivity will not be major design considerations; but all such factors must be detailed for both sites by the geotechnical consultant.

Design Codes

Seismic and other design loads for the Project will be as specified in the 2007 California Building Code (CBC), which is based on the 2006 International Building Code (IBC). These industry standards also rely extensively on "Minimum Design Loads for Buildings and Other Structures" in American Society of Civil Engineers (ASCE) 7-05. Exceptions (to IBC & ASCE) outlined in the CBC, and in specifications by local municipalities or other jurisdictions, will also be researched and implemented.

Structural Systems

Available model extractions suggest that concrete foundation walls for basins will extend approximately 20 feet deep and will be 16 to 20 inches thick. The foundation mat beneath the walls will be approximately 18 to 22 inches thick. Walkway slabs will be 12 inches thick and span over the basins near ground level. Foundation walls for enclosed pump buildings will extend approximately 20 feet below ground and will be 12 to 16 inches thick. The first floor slab (near ground level) will be 12 inches thick, ribbed with concrete beams, which in turn are supported by the perimeter foundation walls.

Perimeter bearing walls above the first floor will be 12 inches thick, reinforced masonry. At least one interior CMU wall on the first floor would be required to transmit roof lateral loads (wind and seismic) to the first floor slab diaphragm.

The roofs for enclosed buildings will be supported by steel beams approximately 10 feet apart, sloping between the masonry bearing walls. The roof deck will be 3-inch deep corrugated steel spanning 10 feet between support beams. The exposed roof surface will be standing seam metal deck, supported by the 3-inch deck underlayment. Rigid insulation will be sandwiched between both decks.

Topography

The selected WRP site is adjacent to a wash and will require additional research into the floodway and floodplain elevations to determine top of concrete required for the water-bearing structures and other site facilities. The local flood control agency will be contacted and FEMA maps will be obtained. The site is generally sloped from the south/southwest to the north/northeast along the wash. The south portion of the site is at an elevation of approximately 3,340 feet above mean sea level (amsl) with the north end of the proposed WRP footprint at approximately 3,335 feet amsl. The change in grade across the site is not anticipated to create any additional site and or excavation requirements. A detailed topographic survey will be conducted upon final approval of the WRP site location from VVWRA and the City of Hesperia.

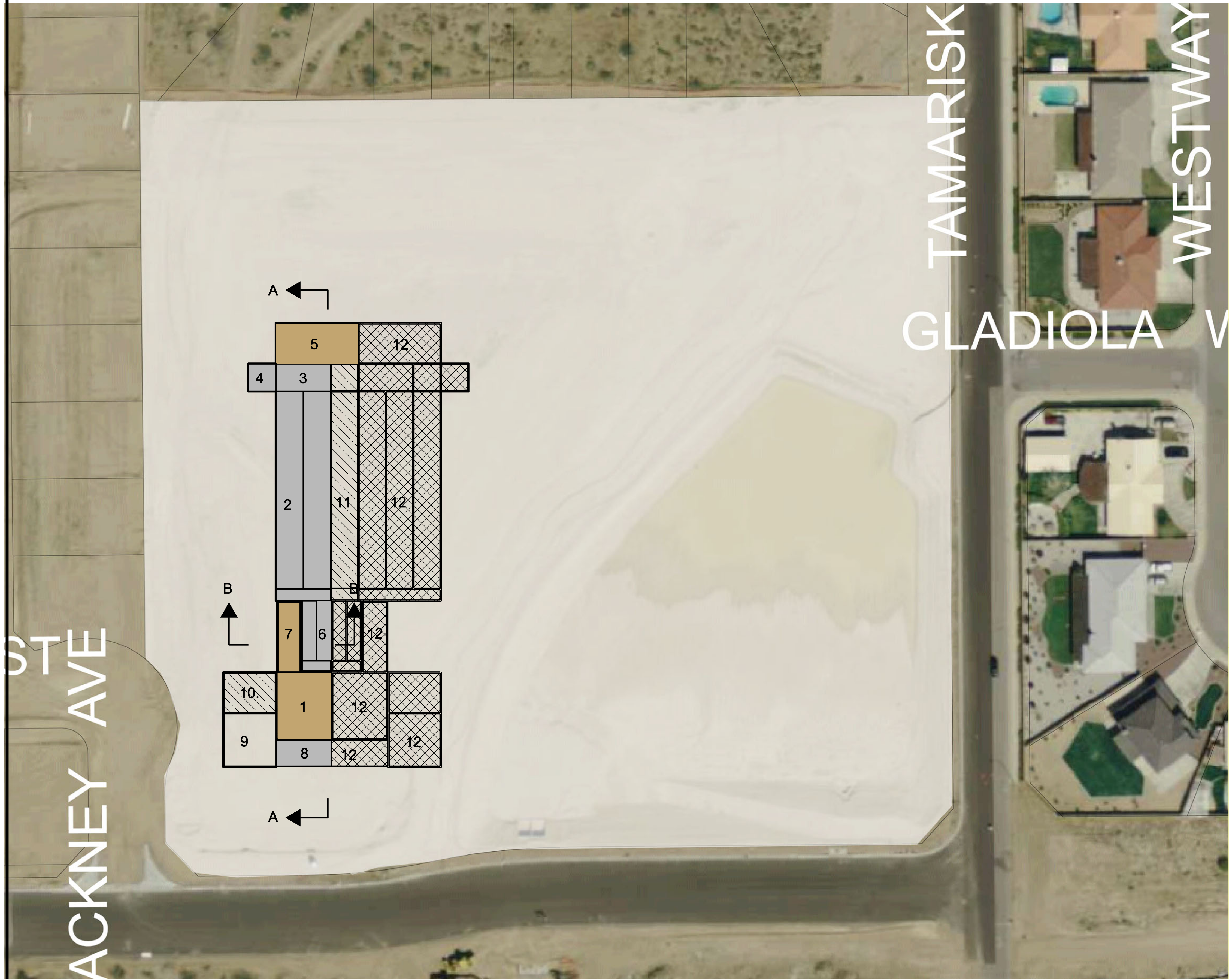
Noise Control

Noise attenuation needs to consider the three elements of noise: source, transmission path, and noise receiver. The impact of background noise, including existing environmental, transportation, and community noise sources in the absence of any audible construction activities must also be considered. For the Hesperia WRP, noise reduction will be accomplished by reduction at the source to practical limits.

Noise reduction at the source is dependent on the type of unit process or equipment in question. For typical equipment at wastewater treatment facilities, several options are available. The most effective solution is to enclose the equipment in some type of building or other enclosure. Sound attenuation panels can be provided on walls and/or ceilings of buildings or structures. For extremely high noise generating equipment or equipment located outside buildings or enclosures, manufactured noise suppression appurtenances can also be provided.

Considering public acceptance, a number of measures will be taken to provide noise attenuation for the Hesperia WRP. The proposed noise control features for the major process equipment are listed below:

- Pumps: Pumps at the Hesperia WRP include submersible pumps and motors (i.e., MBR feed forward pumps, WAS pumps) located in below-grade wet-well, dry-pit pumps (i.e., membrane permeate pumps) housed in building basement, and exposed pumps (effluent vertical turbine pumps) with motors at grade level. Noise attenuation will be accomplished by providing motor shrouds and/or increased level of motor insulation. For exposed pumps, some type of sound attenuation wall may be constructed if necessary.
- Mixers and Drives: Mixers and drives (i.e., on top of aeration basins, etc.) can also be provided with motor shrouds and/or increased level of motor insulation.
- Blowers: Blowers at the Hesperia WRP will be enclosed in building basement, with interior acoustical treatment on walls and ceiling. If necessary, each blower can be provided with individual enclosure to reduce noise level within the building.



LEGEND

1. HEADWORKS/ MBR FACILITY BUILDING. FLOOR LEVEL: INFLUENT SCREENS, CITRIC ACID/ SODIUM HYPO STORAGE & FEED. LOWER LEVEL: UV SYSTEM & PERMEATE PUMPS
2. BIOLOGICAL BASIN
3. FEED FORWARD PUMP STATION
4. WAS PUMP STATION
5. PROCESS ELECTRICAL/ BLOWER BUILDING
6. SUBMERGED MEMBRANES
7. MBR ELECTRICAL/ BLOWER BUILDING FLOOR LEVEL: ELECTRICAL ROOM LOWER LEVEL: MEMBRANE AIR SCOUR BLOWERS
8. RECLAIMED WATER PUMP STATION
9. BIOFILTER (HEADWORKS ODOR CONTROL)
10. GRIT REMOVAL (FUTURE)
11. AERATION BASIN PHASE 2 EXPANSION (2 MGD)
12. PHASE 3 EXPANSION (4 MGD)

NORTH

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SITE LAYOUT

FIGURE 13A.1

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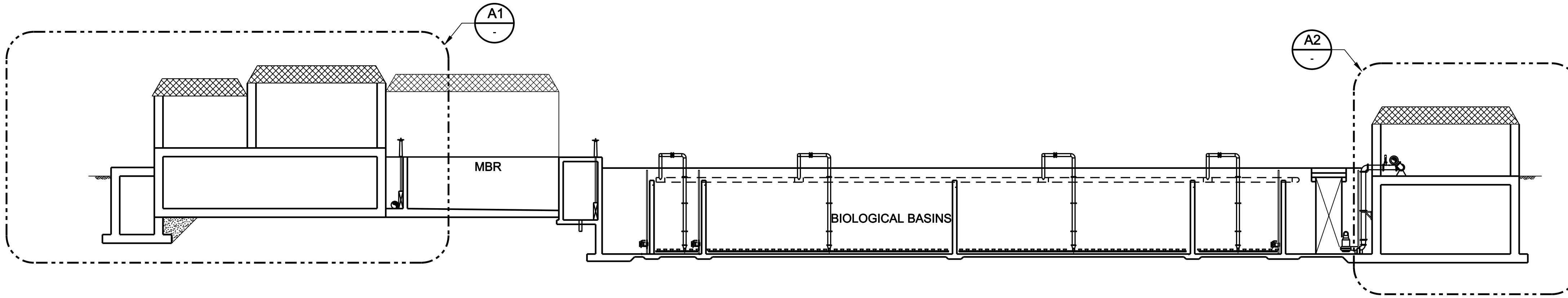
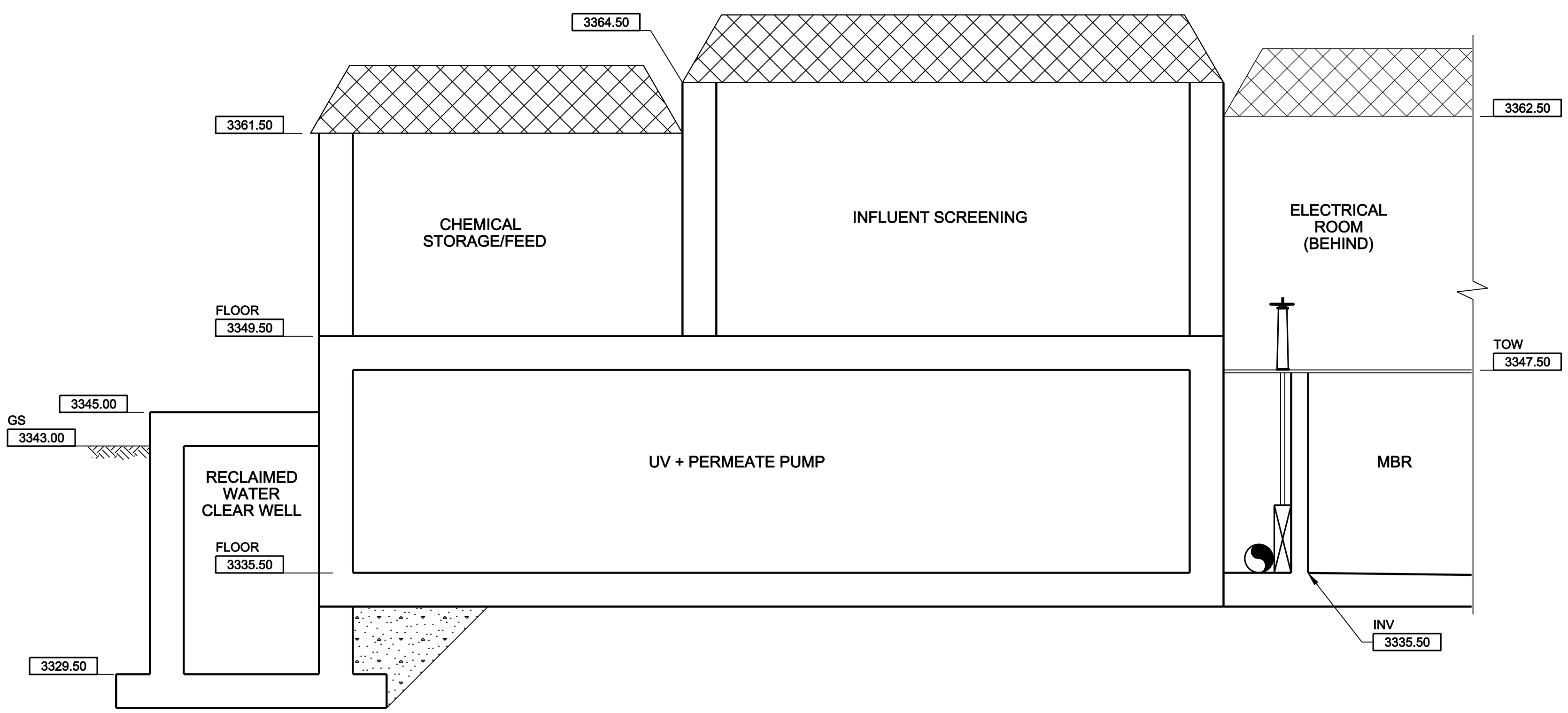


A SECTION
SCALE: 1/16" = 1'-0"
FILE: 8229A00-SM-0100.dgn
0 2' 4' 6' 12'



A1 SECTION
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FILE: 8229A00-SM-0100.dgn
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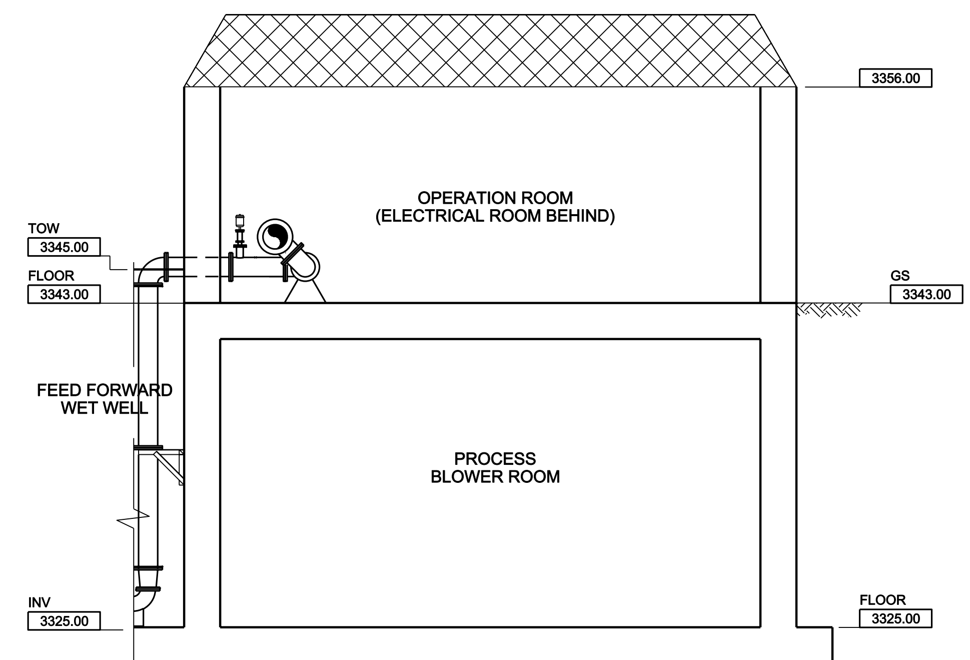
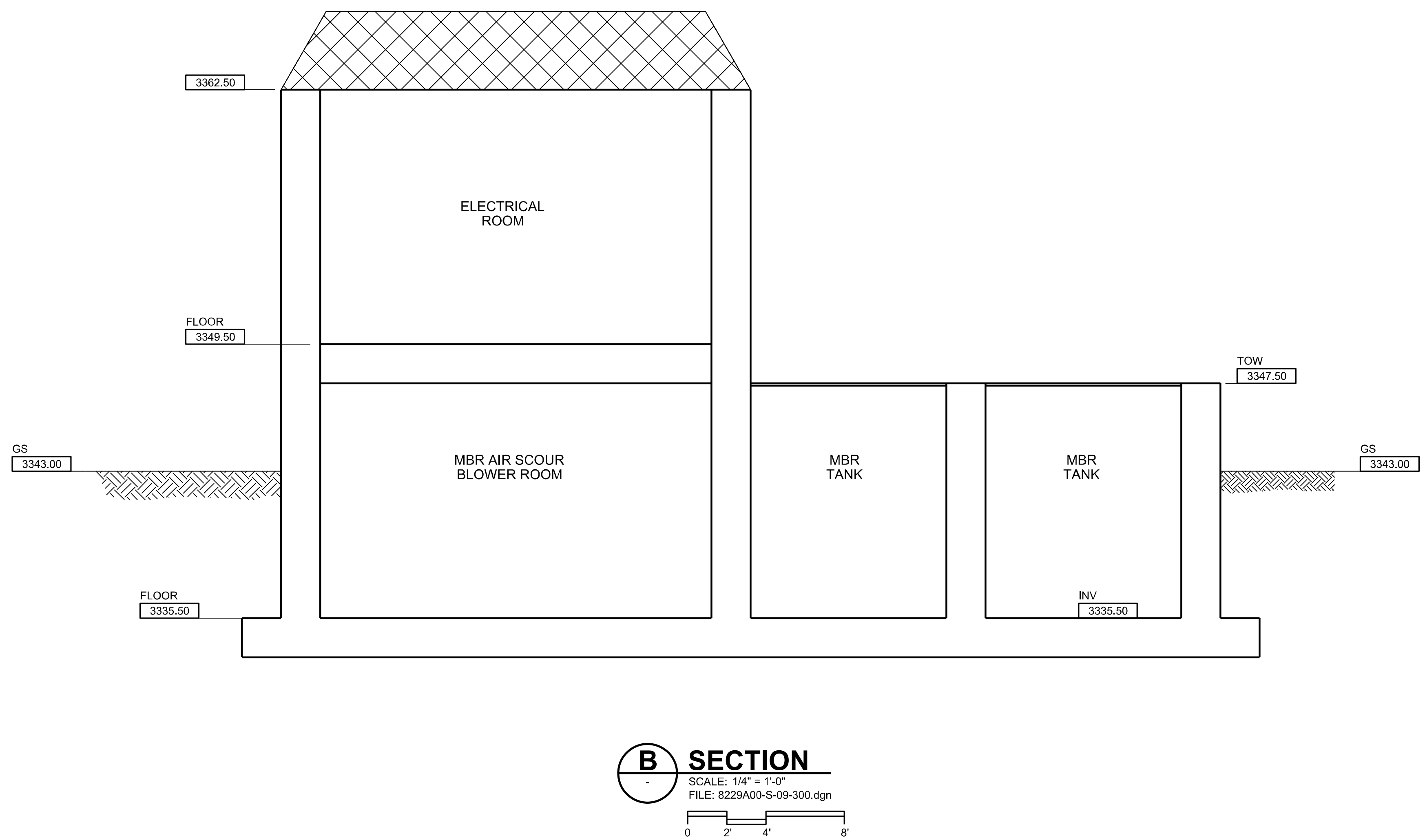


A2 SECTION
SCALE: 3/16" = 1'-0"
FILE: 8229A00-SM-0100.dgn
0 2' 4' 6' 12'

PLANT - SECTION A

FIG 13A.2



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HESPERIA WRP - PRELIMINARY DESIGN REPORT

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PLANT - SECTION B

FIG 13A.3