May 2013

City of Salinas

Pollutant Load Reduction Plan
Salinas River Outfall

submitted to:

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

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Revised September 2013

Second Revision December 2013

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GLOSSARY OF ACRONYMS

BMP	Best Management Practice
CCAMP	Central Coast Ambient Monitoring Program
CCRWQCB	Central Coast Regional Water Quality Control Board
CWA	Clean Water Act
DNQ	Detected, but not quantified
FREP	Fertilizer Research and Education Program
LC50	Concentration that is lethal to 50% of test species
MCL	Maximum Contaminant Level
mg/L	Milligrams per liter (concentration)
mL	Milliliter (volume)
MPN	Most Probable Number
MRWPCA	Monterey Regional Water Pollution Control Agency
MS4	Municipal Separate Stormwater Sewer System
N	Nitrogen
ND	Non-Detect
ng/L	Nanograms per liter (concentration)
NPDES	National Pollutant Discharge Elimination System
P	Phosphorus
QAPP	Stormwater Program Quality Assurance Project Plan
SRO	Salinas River Outfall
SRSPS	Salinas River Stormwater Pump Station
TDS	Total Dissolved Solids
TMDL	Total maximum Daily Load
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
WDR	Waste Discharge Requirements
WLA	Wasteload Allocation
WQO	Water Quality Objectives
WWTP	Wastewater Treatment Plant

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1 Background and Introduction

The City of Salinas (City) is situated in northern Salinas Valley in Monterey County, approximately ten miles east of the Pacific Ocean and near the Salinas River. Stormwater runoff is generated from various land uses in the area and discharges into receiving waters, which in turn flow into Monterey Bay. Four major creeks and several minor tributaries pass through the Salinas area and receive stormwater discharges from the area northeast and adjacent to Highway 101. Stormwater from the southernmost portion of the City flows to a lift station which discharges to the Salinas River. The Salinas River discharges to the Old Salinas River during low-flow periods and directly to Monterey Bay during high flows. The Old Salinas River discharges into the Pacific Ocean at the downstream end of the Elkhorn Slough and Moro Cojo Slough estuary system near Moss Landing.

Stormwater discharges from urban and developing areas in the area are significant sources of certain pollutants that may contribute to water quality impairment in the Salinas River. Furthermore, as delineated in the 2010 Clean Water Act (CWA) section 303(d) list, **Table 1**, the Central Coast Water Quality Control Board (Regional Water Board) has found that there is a reasonable potential that municipal stormwater discharges cause or may cause or contribute to an excursion above water quality standards for the impairments identified in the table below. In accordance with section 303(d) of the CWA, the Regional Water Board is required to establish total maximum daily loads (TMDLs) for these pollutants to eliminate impairment and attain water quality standards. Therefore, certain early pollutant control actions and further pollutant impact assessments are required.

Table 1. 2010 Clean Water Act Section 303(d) List for the Salinas River

Receiving Water	CWA Section 303(d) Listed Impairments
Salinas River	Fecal coliform (source unknown); Nitrate (source unknown); Pesticides (from agricultural and nonpoint sources); Toxaphene (source unknown); Chlordane; Chloride; Chlorpyrifos; DDD; Diazinon; Dieldrin; Electrical Conductivity; Enterococcus; E. coli; PCBs; Sodium; Total dissolved solids; Turbidity; Unknown toxicity; pH
Old Salinas River	Nutrients and pesticides; chloryphyll-a, chlorpyrifos; diazinon, E. coli, fecal coliform, low dissolved oxygen, nitrate, sediment toxicity, turbidity, unknown toxicity, and pH.

Order R3-2012-0005 (NPDES Permit No. CA0049981 Waste Discharge Requirements for City of Salinas Municipal Storm Water Discharges, Monterey County, Central Coast Regional Water Quality Control Board) requires the City to develop a solution to improve water quality from the Salinas River stormwater outfall. The outfall, a 66-inch diameter pipe, conveys urban runoff from the Salinas River Stormwater Pump Station (SRSPS) into the Salinas River while traveling for approximately a mile under agricultural fields. The Fact Sheet for Order R3-2012-0005 states that Central Coast Ambient Monitoring Program (CCAMP) monitoring has documented high values of nutrients, salts, pathogen indicators, and pesticides for over a decade from this outfall.

Table 2 displays the *Water Quality Control Plan for the Central Coast Region* (Basin Plan) water quality objectives (WQOs) applicable to nutrients, salts, pathogen indicators, and pesticides. For constituents that do not have a Basin Plan WQO, **Table 2** lists criteria that

historically have been used to evaluate these constituents in this region. The City has been identified as a responsible party in TMDLs that have been adopted by the Regional Water Board to address nutrients and fecal coliform impairments in the Lower Salinas River; although, the TMDL meant to address nutrients has not yet been approved by the State Water Resources Control Board or the United States Environmental Protection Agency (USEPA).

Table 3 summarizes pertinent information for these TMDLs.

Table 2. Summary of WQOs or Other Relevant Criteria

Pollutant Category or Species	WQO or Historically Used Criteria	Units	Criteria Type
Nitrate	10	mg/L as N	Primary MCL
Unionized Ammonia	0.025	mg/L as N	Basin Plan Objective
Orthophosphate	0.12	mg/L as P	CCAMP Action Level
Fecal Coliform	200 for 5 samples in 30-d, 400 for 10% samples in 30-d	MPN/100 mL	TMDL WLA
E. coli	235	MPN/100 mL	USEPA Guidelines
Pesticides	concentrations shall not adversely affect beneficial uses	--	Basin Plan Objective
Salts	none applicable	--	--

Table 3. Pertinent Information Regarding Fecal Coliform, Nutrient, and Chlorpyrifos and Diazinon TMDLs

TMDL	Pollutant Category or Species	Interim WLA	Interim Compliance Date	Final WLA	Final Compliance Date
Lower Salinas River Watershed Nutrient TMDL	Nitrate as N	10 mg/L (Dry)	12 years after effective date	1.4 mg/L (Dry)	30 years after effective date
		10 mg/L (Wet)	12 years after effective date	8.0 mg/L (Wet)	20 years after effective date
	Orthophosphate as P	N/A	N/A	0.07 mg/L (Dry)	30 years after effective date
		N/A	N/A	0.3 mg/L (Wet)	20 years after effective date
	Unionized Ammonia as N	N/A	N/A	0.025 mg/L	12 years after effective date
Fecal Coliform in Lower Salinas River Watershed TMDL	Fecal Coliform	N/A	N/A	200 MPN/ 100mL for 5 samples in 30-d, 400 MPN/ 100mL for 10% samples in 30-d	12/20/2024

Order R3-2012-0005 requires that the City develop a plan to reduce pollutant loads for nutrients, salts, pathogen indicators, and pesticides. The following sections describe this Plan:

- Section 2. Pollutant Source Identification
- Section 3. Pollutant Source Prioritization
- Section 4. Pollutant Reduction Actions
- Section 5. Salinas River Outfall Monitoring Plan
- Section 6. Effectiveness Assessment
- Section 7. Implementation Schedule
- Section 8. Summary

2 Pollutant Source Identification

The Salinas River Outfall (SRO) discharges flow that is mainly generated within a 2.5 square mile area located within the southwestern portion of the City.[1] The City's SRSPS drainage area is labeled as the Salinas River watershed in **Figure 1**. Urban runoff generated within the SRO watershed drains by gravity to the SRSPS. The SRSPS receives flow from two sources: the urban runoff generated within the City and from a groundwater pump that is located underneath a nearby City-owned stormwater detention basin. This basin serves to detain overflow storm water during significant storm events that exceed the storm drainage system's ability to readily discharge the flows. Flow is detained and feeds water back into the system as stormwater flows subside. During dry weather the pumps are active to remove groundwater so it does not surface at the mouth of the basin to cause a vector, weed, and water nuisance near adjacent farm fields.[2] The sources that are most likely to influence the groundwater that is pumped to the SRSPS are urban runoff that is able to infiltrate into the subsurface prior to being discharged to the SRSPS via the City's Municipal Separate Stormwater Sewer System (MS4) and infiltration occurring on nearby agricultural land.

Groundwater infiltration from nearby agricultural land is also introduced into the pipeline between the SRSPS and the SRO. The SRSPS is separated from the SRO by approximately one mile of agricultural land (**Figure 2**). City staff conducted a video inspection of the discharge pipe from the SRSPS to the SRO to assess pipeline condition and other potential influences to water quality and found ground water intrusion at several locations. Given that the pipeline connecting the SRSPS to the SRO passes underneath agricultural land, it is possible that current or historical agricultural practices occurring on the land above the pipeline may be contributing or historically contributed pollutants to the groundwater that infiltrates the pipeline.

Potential sources for the pollutants of focus are discussed in subsection 2.1, urban runoff; and subsection 2.2, groundwater infiltration.

[1] CDM. 2004. *City of Salinas Storm Water Master Plan*.
[2] City of Salinas. 2009. *City of Salinas 2008-2009 Annual Report, Urban Watershed Management Program*.

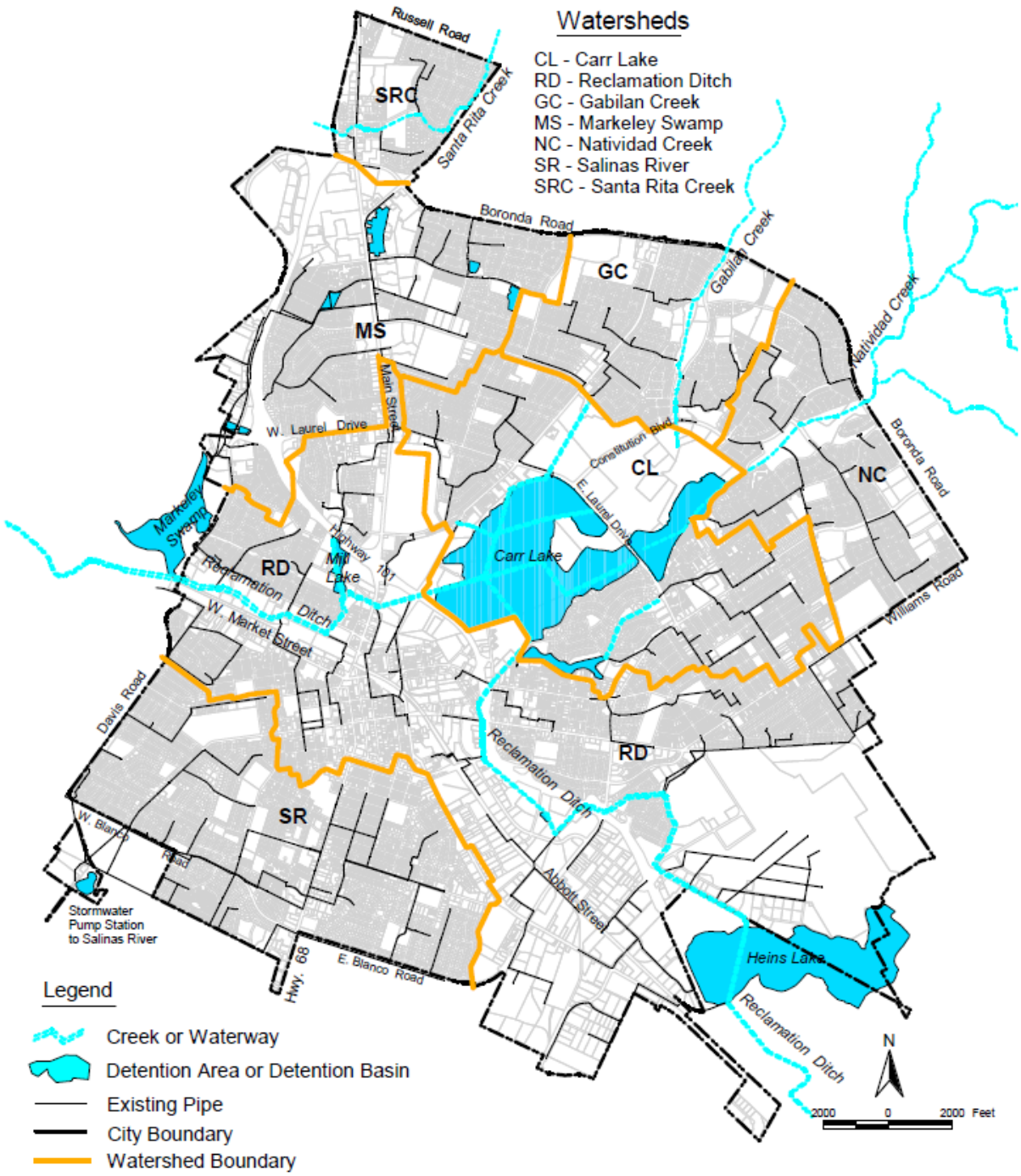

Figure 1. City of Salinas MS4 Watershed Boundaries[3]

[3] CDM. 2004. *City of Salinas Storm Water Master Plan*.

Figure 2. Subsurface Pipeline from the SRSPS to the SRO

2.1 URBAN RUNOFF

Analytical results from mostly wet weather samples taken at the SRSPS were used to assess whether urban runoff generated within the SRSPS drainage area is a source of each pollutant of focus. For pesticides, due to the limited availability of analytical results, information from literature sources (such as typical application locations and recent regulations) was taken into consideration to supplement the assessment of whether urban runoff generated within the SRSPS drainage area is a source of each pollutant of focus.

2.1.1 Nutrients

Samples were analyzed for the following nutrient species at the SRSPS: nitrate as N, unionized ammonia as N, and orthophosphate as P. **Figure 3** shows that the concentrations of nitrate

observed at the SRSPS were all below the Primary Drinking Water Maximum Contaminant Level (MCL) of 10 mg/L as N. These results indicate that urban runoff generated within the SRSPS drainage area is not a significant source of nitrate. **Figure 4** shows that, with the exception of one result, the concentrations of ammonia observed at the SRSPS were all below the Basin Plan Objective of 0.025 mg/L as N.[4] These results indicate that urban runoff generated within the SRSPS drainage area is not a significant source of ammonia. In contrast, **Figure 5** shows that the concentrations of orthophosphate observed at the SRSPS were all equal to or greater than the CCAMP action level of 0.12 mg/L as P. These results indicate that urban runoff generated within the SRSPS drainage area is likely a significant source of orthophosphate.

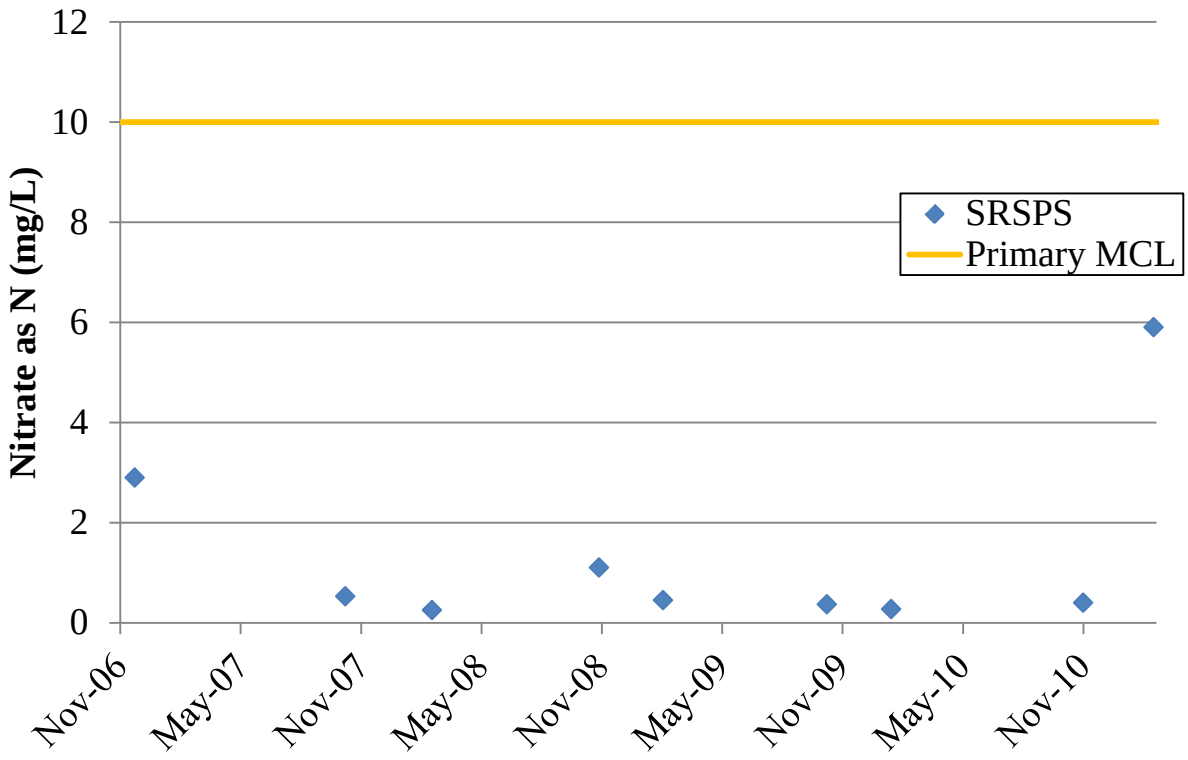

Figure 3. Nitrate Concentrations at SRSPS

[4] Central Coast Regional Water Quality Control Board. 2011. *Water Quality Control Plan for the Central Coast Basin*.

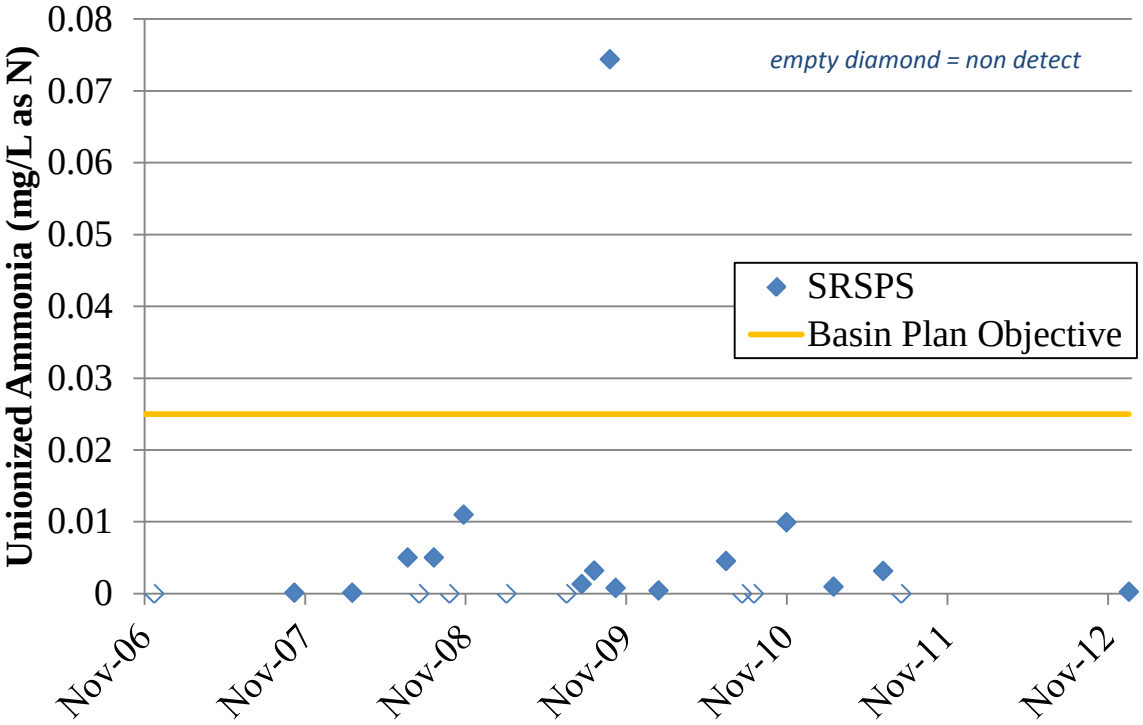

Figure 4. Unionized Ammonia Concentrations at SRSPS

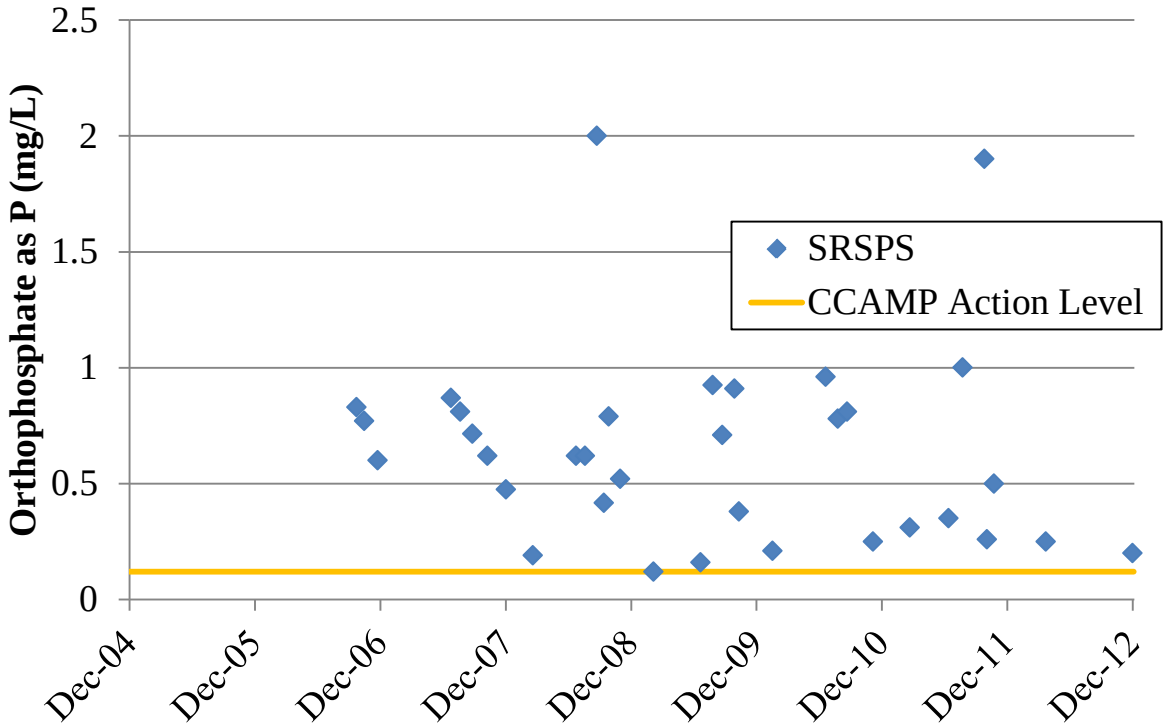

Figure 5. Orthophosphate Concentrations Measured at SRSPS

2.1.2 Salts

Results for total dissolved solids (TDS) provide the only measure of the salts content in the urban runoff generated within the SRSPS drainage area. The Basin Plan does not state an objective for TDS in the location where the SRO discharges to the Salinas River. Also, CCAMP has not specified an action level for TDS. **Figure 6** shows the concentrations of TDS observed at the SRSPS; with one exception the concentrations are consistently below 400 mg/L.

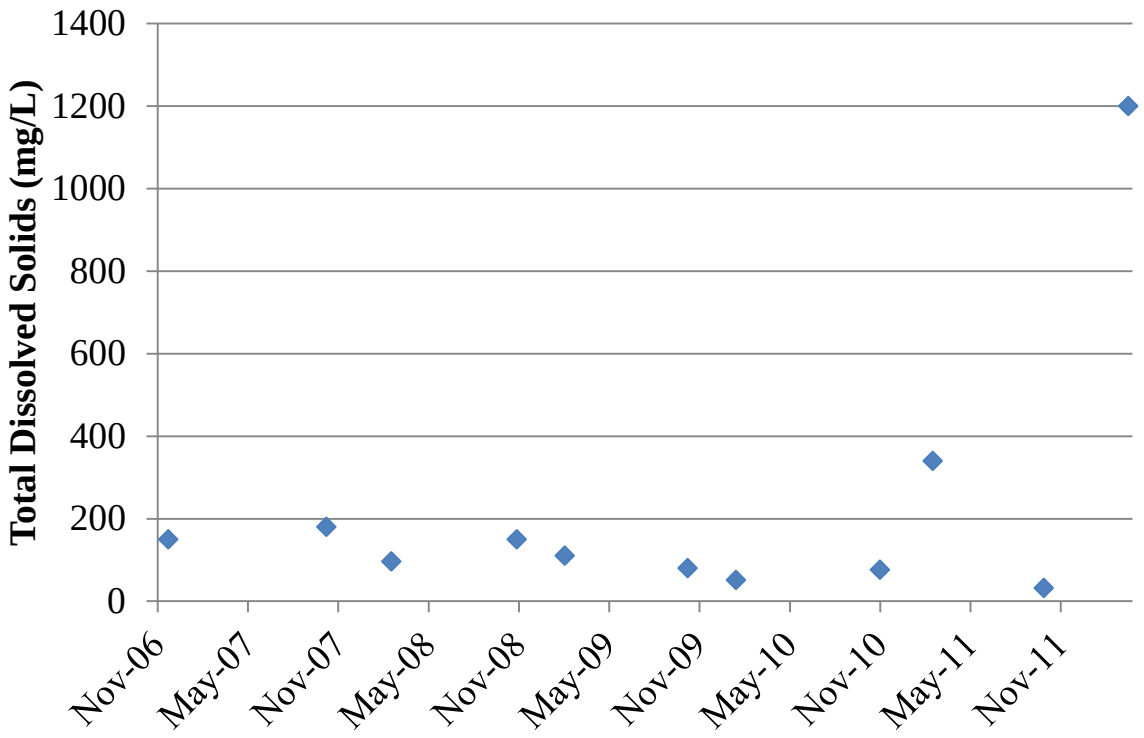

Figure 6. Total Dissolved Solids Concentrations Measured at SRSPS

2.1.3 Pathogen Indicators

Samples were analyzed for the following pathogen indicators at the SRSPS: fecal coliform and *E. coli*. The results for fecal coliform were all reported as greater than 1,600 MPN /100 mL, with one exception which was reported as 2,800 MPN/100 mL. These results indicate that urban runoff generated within the SRSPS drainage area is a significant source of fecal coliform. The Regional Water Board regulates *E. coli* at 235 MPN/100 mL based on USEPA guidelines for designated beach areas (as a binomial distribution for a minimum of 5 exceedances for up to 30 samples).[5] **Figure 7** shows that, with the exception of a few instances, the *E. coli* densities observed at the SRSPS were greater than the EPA guidelines. These results indicate that urban runoff generated within the SRSPS drainage area is a significant source of *E. coli*.

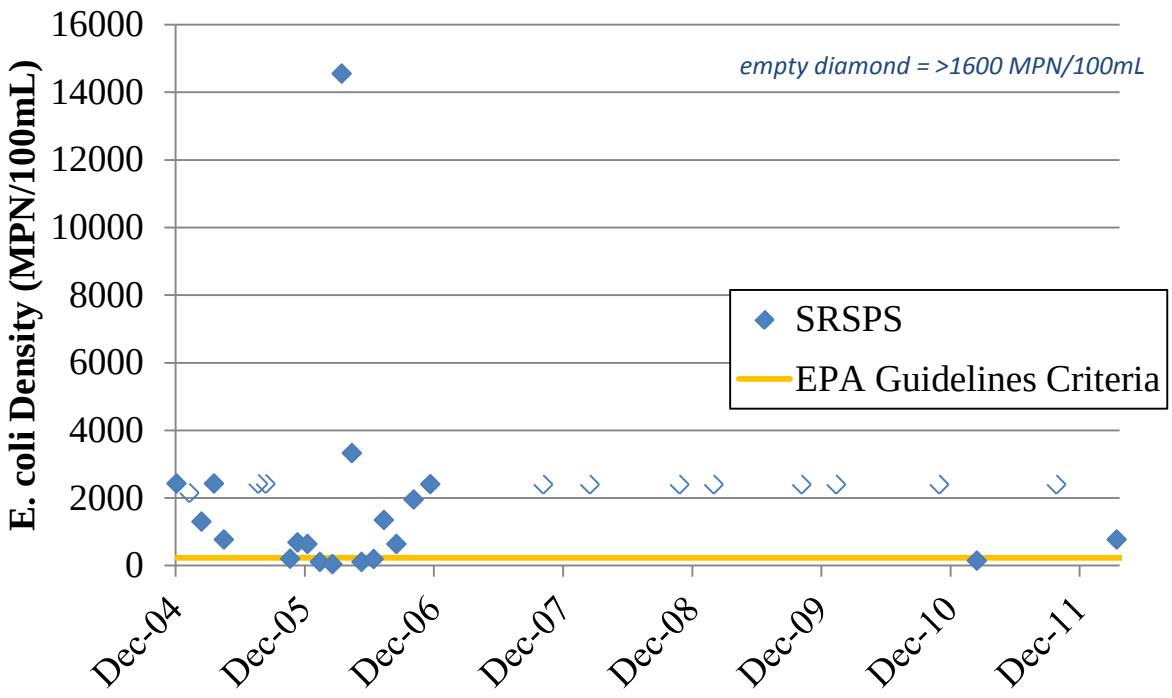

Figure 7. *E. coli* Densities Measured at SRSPS

[5] City of Salinas. 2009. *City of Salinas 2008-2009 Annual Report, Urban Watershed Management Program*.

2.1.4 Pesticides

Urban pesticide use includes structural pest control, landscape maintenance, rights-of-way pest control, public health protection, and residential applications.[6] The pesticide pollutant source category may be broken down into many subcategories (organophosphate pesticides, pyrethroids, etc.). In recent years, the urban use of many of these pesticides has been restricted by regulations. For example, urban uses of chlorpyrifos and diazinon have become more restricted as the USEPA has canceled or restricted uses due to concerns for human health.[7] Also, in July 2012, the California Department of Pesticide Regulation issued new restrictions to limit where structural pest control businesses can apply 17 pyrethroid insecticides in an effort to protect water quality in urban areas.[8] **Table 4** lists pyrethroid results measured at the SRSPS on December 2, 2012. These results indicate that urban runoff within the SRSPS drainage area may be a source of pyrethroid pesticides; however, only one data point exists for each pyrethroid and additional monitoring is needed before any conclusions can be drawn.

Table 4. Pesticide Concentrations Measured at SRSPS on December 2, 2012

Pesticide	SRSPS concentrations (ng/L)	USEPA LC_{50} for Freshwater Invertebrates[1] or CVRWQCB Recommended Acute Criteria[2] (ng/L)
Allethrin	<0.1	2,100
Bifenthrin	4.4	4
Cyfluthrin, total	0.9 (DNQ)	0.3
Cyhalothrin, lambda, total	0.7 (DNQ)	1
Cypermethrin, total	1.2 (DNQ)	1
Deltamethrin/Tralomethrin	<0.2	N/A
Esfenvalerate/Fenvalerate, total	0.4 (DNQ)	N/A
Fenpropathrin	0.8 (DNQ)	N/A
Permethrin, Total	24	10
T-Fluvalinate	<0.2	310
Tetramethrin	<0.2	45,000

1. http://www.epa.gov/opp00001/reregistration/status_page_t.htm
2. http://www.swrcb.ca.gov/rwqcb5/water_issues/tmdl/central_valley_projects/central_valley_pesticides/

Despite recent regulations restricting the use of certain pesticides, these pesticides may still be present in urban runoff and other pesticides still remain in use in urban settings. Given the absence of a robust dataset and restrictions on pesticide use set by recent regulations, the degree to which urban runoff within the SRSPS drainage area is a significant source of pesticides remains uncertain.

[6] He, L. 2008. *Study 249. Statewide Urban Pesticide Use and Water Quality Monitoring*.
[7] Central Coast Regional Water Quality Control Board. 2011. *Total Maximum Daily Loads for Chlorpyrifos and Diazinon in Lower Salinas River Watershed in Monterey County, California: Final Project Report for the May 4-5, 2011 Water Board Meeting*.
[8] http://www.cdpr.ca.gov/docs/pressrls/2012/120718.htm. Accessed April 5, 2013.

2.2 GROUNDWATER INFILTRATION AND POTENTIAL AGRICULTURAL IMPACTS

As stated previously, City staff conducted a video inspection of the discharge pipe from the SRSPS to the SRO and found ground water intrusion at several locations. Given that the pipeline connecting the SRSPS to the SRO passes underneath agricultural land, it is possible that current or historical agricultural practices occurring on the land above the pipeline may be contributing or historically contributed pollutants to the groundwater that infiltrates the pipeline. To assess whether groundwater infiltration is a source of each pollutant of focus, analytical results from samples taken at the SRO were compared to the analytical results from samples taken at the SRSPS. For pesticides, due to limited availability of analytical results, information from literature sources (such as the fate and transport properties of different classes of pesticides) was taken into consideration to supplement the assessment of whether groundwater infiltration to the pipeline is a source of each pollutant of focus.

2.2.1 Nutrients

Samples were analyzed for the following nutrient species at the SRO and the SRSPS: nitrate as N, unionized ammonia as N, and orthophosphate as P. **Figure 8** shows that the concentrations of nitrate observed at the SRO were generally well above the concentrations of nitrate observed at the SRSPS and above the WQO. These results indicate that groundwater infiltration may be a significant source of nitrate.

Figure 9 shows that the concentrations of ammonia observed at the SRO were generally equal to or below the concentrations of ammonia observed at the SRSPS. These results indicate that groundwater infiltration is not a significant source of ammonia. **Figure 10** shows that the concentrations of orthophosphate observed at the SRO were generally equal to or below the concentrations of orthophosphate observed at the SRSPS. These results indicate that groundwater infiltration is not a significant source of orthophosphate.

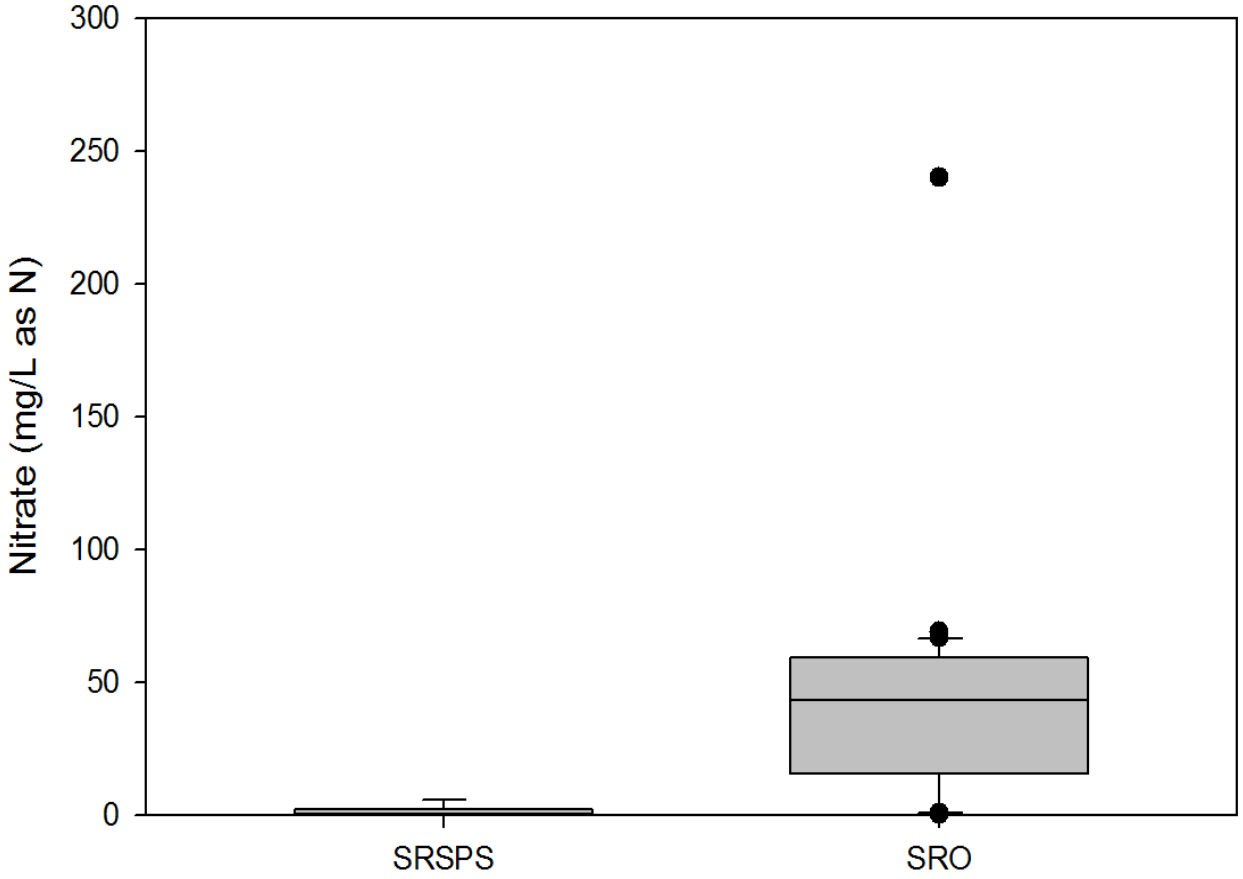

Figure 8. Comparison of Nitrate Concentrations at SRSPS and SRO

Note: The lower and upper boundaries of the box represent the 25th and 75th percentiles of the dataset, respectively. The horizontal line inside the box represents the median. The whiskers represent the minimum and maximum values unless there are outliers. Circular markers represent outliers.

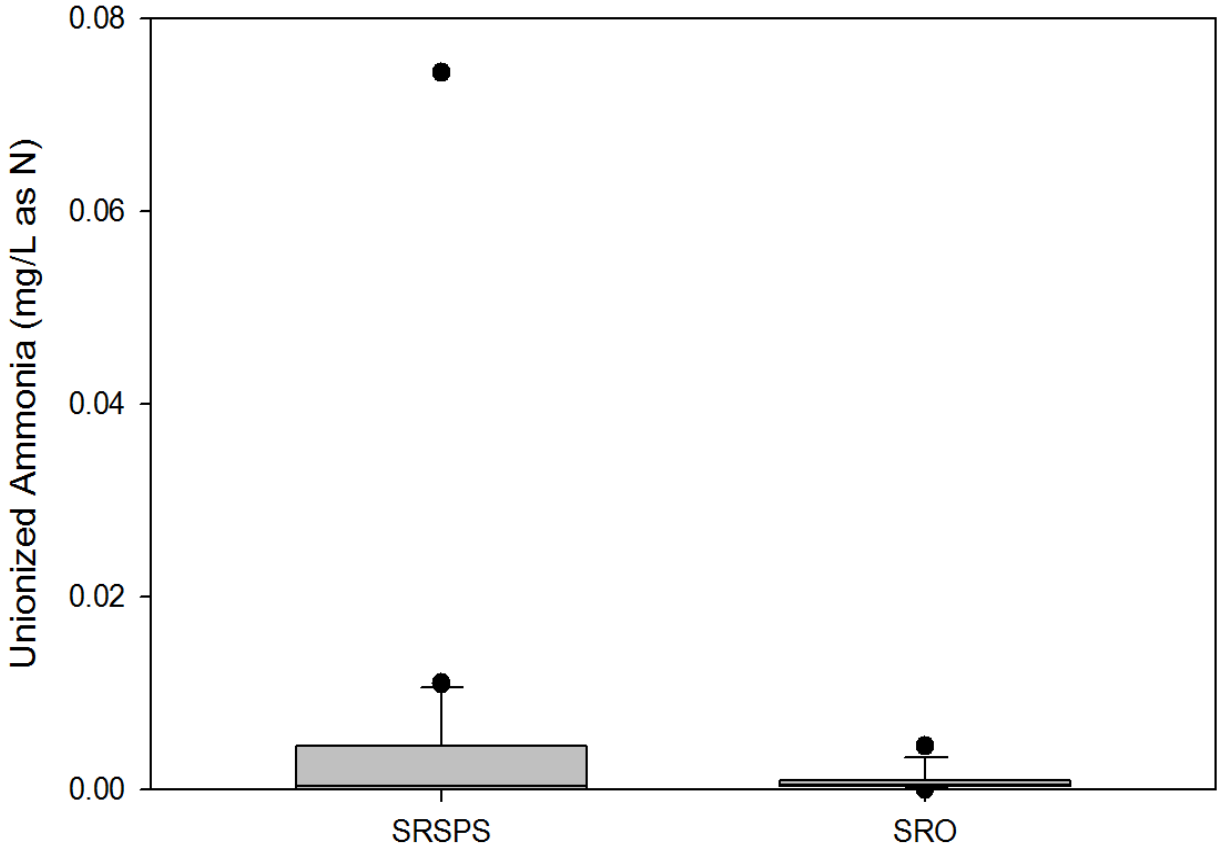

Figure 9. Comparison of Unionized Ammonia Concentrations at SRSPS and SRO

Note: The lower and upper boundaries of the box represent the 25th and 75th percentiles of the dataset, respectively. The horizontal line inside the box represents the median. The whiskers represent the minimum and maximum values unless there are outliers. Circular markers represent outliers.

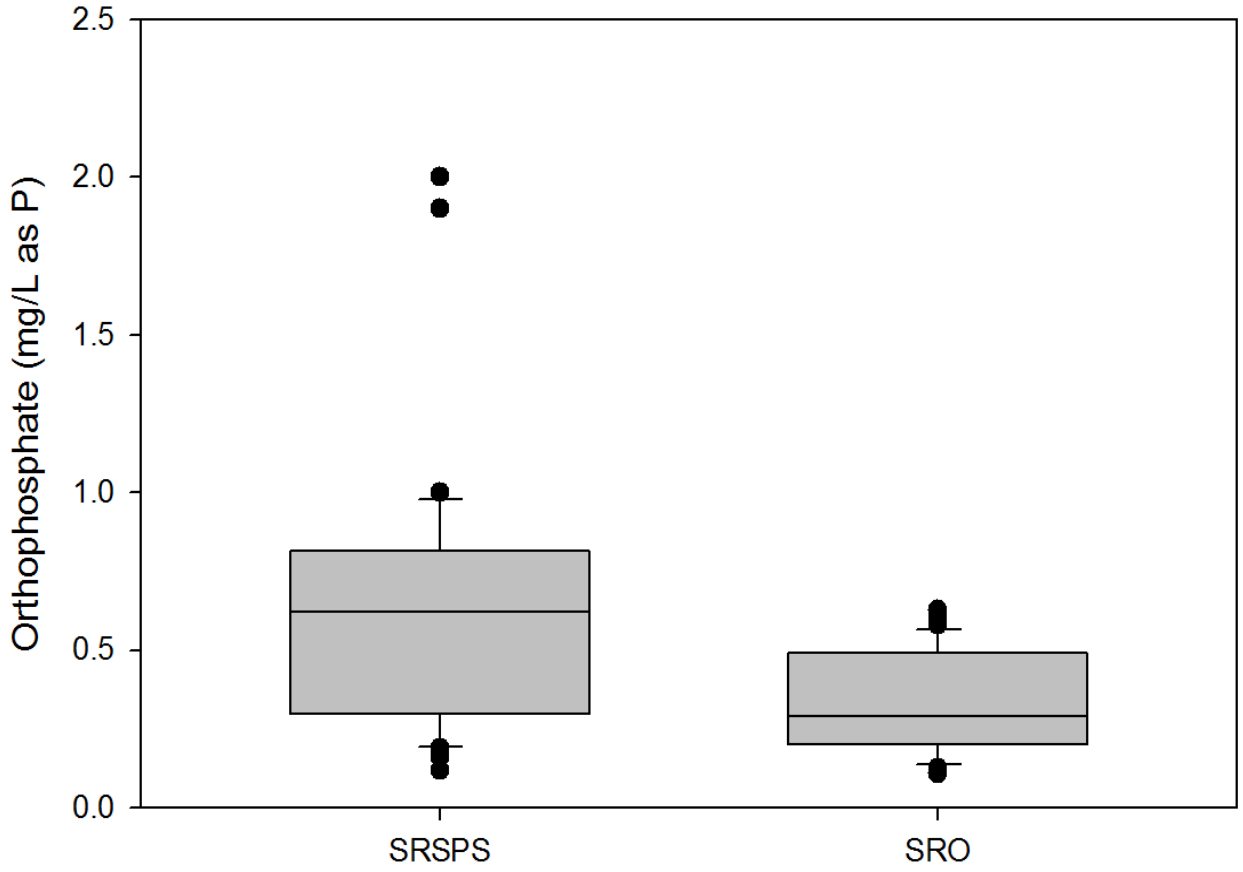

Figure 10. Comparison of Orthophosphate Concentrations Measured at SRSPS and SRO

Note: The lower and upper boundaries of each box represents the 25th and 75th percentiles of the dataset, respectively. The horizontal line inside the box represents the median. The whiskers represent the minimum and maximum values unless there are outliers. Circular markers represent outliers.

2.2.2 Salts

Results for TDS provide the only measure of the salts content that was measured at both the SRO and the SRSPS. **Figure 11** shows that the concentrations of TDS observed at the SRO were generally well above the concentrations of TDS observed at the SRSPS. These results indicate that groundwater infiltration is a significant source of salts.

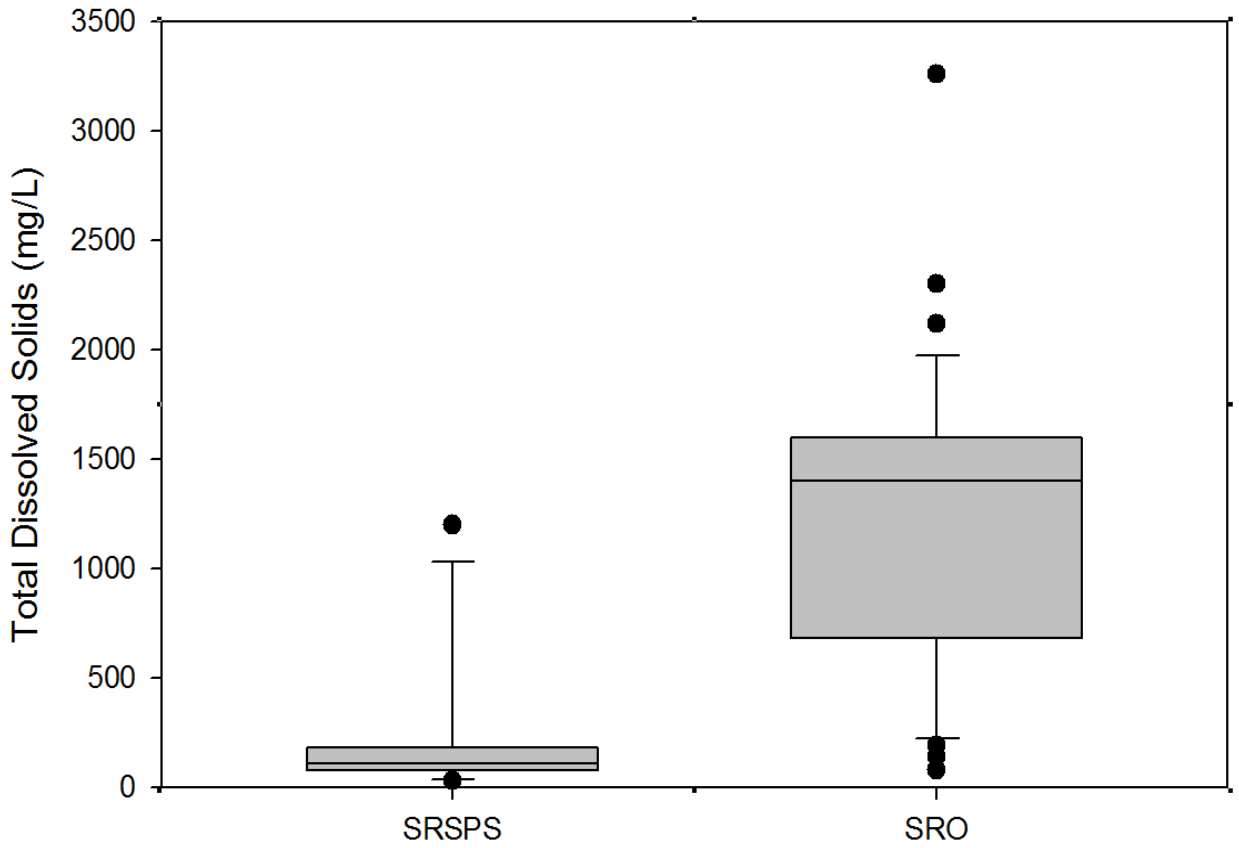

Figure 11. Comparison of Total Dissolved Solids Concentrations Measured at SRSPS and SRO

Note: The lower and upper boundaries of the box represent the 25th and 75th percentiles of the dataset, respectively. The horizontal line inside the box represents the median. The whiskers represent the minimum and maximum values unless there are outliers. Circular markers represent outliers.

2.2.3 Pathogen Indicators

Samples were analyzed for the following pathogen indicators at the SRO and SRSPS: fecal coliform and *E. coli*. As mentioned in above, the results for fecal coliform at the SRSPS were all reported as greater than 1,600 MPN /100 mL, with one exception which was reported as 2,800 MPN/100 mL. Given the manner in which the SRSPS results were reported, a graphical comparison of the fecal coliform densities observed at the SRSPS and SRO is not warranted; however, a comparison can still be made. Of the 36 fecal coliform samples taken at the SRO, 25 (over 69%) were reported as less than 1,600 MPN/100 mL. This apparent decrease in fecal coliform densities between the SRSPS and SRO indicates that groundwater infiltration is not a significant source of fecal coliform. A comparison of the *E. coli* densities reported at the SRSPS and SRO cannot be made because the *E. coli* densities reported at the SRSPS and the SRO were reported as a mixture of greater than 2,400 MPN /100 mL and specific numeric results were not available. Given that the sources, fate, and transport of fecal coliform and *E. coli* are similar, the trend that is observed for fecal coliform can also be expected to be observed for *E. coli*. These results indicate that groundwater infiltration is not a significant source of *E. coli*.

2.2.4 Pesticides

The use of pesticides on agricultural lands is widespread. As a result, despite the fact that the samples collected at the SRO were not analyzed for pesticides, the effect of the application of pesticides on the agricultural lands overlying the pipeline leading from the SRSPS to the SRO warrants evaluation. As previously stated in **Section 2.1.4**, the pesticide pollutant source category may be broken down into many subcategories (e.g., organophosphate pesticides, pyrethroids). A study conducted by Bachman et al. observed that,

> "Liquid phase detections were more common for chlorinated pesticides than for organophosphate pesticides and triazine herbicides...Organophosphate pesticides and triazine herbicides were not commonly detected in soil water. The pesticides and herbicides detected at field sites were found in much greater concentrations in the solid phase than in the liquid phase, as many of the organic compounds evaluated bond strongly to soil particles."[9]

As a result, depending on the type of pesticide applied to the lands overlying the pipeline leading from the SRSPS to the SRO, one may or may not expect to observe pesticides in detectable concentrations in the groundwater that infiltrates the pipeline. Water samples taken at the SRO were analyzed for pesticides during one dry weather event and one wet weather event in 2012. With one exception, all results for both events were reported as non-detect (ND). The only pesticide that was detected was total disulfoton; it was detected, but not quantified (DNQ) for the wet weather event. The results indicate that agricultural infiltration may not be a source of pesticides; however, with only one data point for dry weather and wet weather, respectively, additional monitoring is necessary before any conclusions can be drawn. Due to the widespread use of pesticides on agricultural lands, the fate and transport properties of different classes of pesticides, and the absence of a robust dataset for pesticides at the SRO, the degree to which agricultural infiltration to groundwater is a significant source of pesticides remains uncertain.

2.3 SUMMARY

Table 5 summarizes the sources that have been identified for each pollutant of focus. The results for nutrients are broken out by species because they have different sources.

Table 5. Summary of Identified Pollutant Sources

	Significant Source?	
Pollutant Category or Species	**Urban Runoff**	**Groundwater Infiltration**
Nitrate	No	Yes
Ammonia	No	No
Orthophosphate	Yes	No
Salts	No	Yes
Pathogen Indicators	Yes	No
Pesticides	Unknown	Unknown

[9] Bachman, S., Detmer, D., Purpus, L. 2007. *Modifying Agricultural Practices, Nutrients, and Pesticides, Calleguas Creek and Santa Clara River*.

3 Pollutant Source Prioritization

Based upon the sources identified in Section 2, it is necessary to prioritize these sources to ensure the largest, or most controllable, sources are addressed first. When conducting this prioritization, the fundamental goal was to address the largest beneficial use impairments in the portion of the Salinas River that receives the SRO discharge. The beneficial uses of this portion of the Salinas River (designated as downstream of Spreckles) are:

- Municipal and domestic supply (MUN),
- Agricultural supply (AGR),
- Non-contact water recreation (REC-2),
- Wildlife habitat (WILD),
- Cold freshwater habitat (COLD),
- Warm freshwater habitat (WARM),
- Migration of aquatic organisms (MIGR),
- Freshwater replenishment (FRESH), and
- Commercial and sport fishing (COMM).[10]

Given this list of beneficial uses and the magnitude of concentrations observed at the outfall and in the receiving water, the identified sources are prioritized as follows:

1. Pathogen Indicators in Urban Runoff
2. Nitrate in Groundwater Infiltration
3. Orthophosphate in Urban Runoff
4. Salts in Groundwater Infiltration
5. Pesticides in Urban Runoff and/or Groundwater Infiltration

The following sections provide justification for each prioritization.

3.1 PATHOGEN INDICATORS IN URBAN RUNOFF

The highest priority pollutant-source category is considered to be pathogen indicators in urban runoff for three reasons. First, pathogen indicators in urban runoff constitute a potentially controllable pollutant source (pet waste, sewer overflows, etc.). Second, the exact magnitude of pathogen indicators in urban runoff is not known because the majority of results for pathogen indicators measured in samples taken at the SRSPS were reported as greater than a certain bacterial density. It is not known whether these bacterial densities were only slightly greater than the reported density or several orders of magnitude greater than the reported density. Given the potential magnitude of pathogen indicators in urban runoff, actions that decrease the presence of pathogen indicators, should be prioritized. Third, and most importantly, pathogen indicators in urban runoff pose the greatest threat to human health. Although not all pathogen indicators are themselves pathogens, their presence indicates the strong possibility that pathogens are present. The general population is at risk if it comes in contact with pathogen infested waters. The presence of *E. coli* in water is an indication of recent sewage or animal waste contamination.

[10] Central Coast Regional Water Quality Control Board. 2011. *Water Quality Control Plan for the Central Coast Basin*.

3.2 NITRATE IN GROUNDWATER INFILTRATION

The second highest priority pollutant–source category is considered to be nitrate present in groundwater. Given that the City does not have direct control over the agricultural practices that may contribute (or that may have contributed historically) to this source; this pollutant–source category is not as controllable as the pathogen indicators in urban runoff pollutant–source category. However, the nitrate in groundwater infiltration source category does pose a threat to human health. It is of greatest concern in infants, whose immature stomach environment enables conversion of nitrate to nitrite, which is then absorbed into the blood stream. Nitrite can interfere with the ability of red blood cells to carry oxygen to the tissues of the body, producing a condition called methemoglobinemia. The effects of nitrite are often referred to as the "blue baby syndrome." High nitrate levels may also affect the oxygen-carrying ability of the blood of pregnant women.[11]

The nitrate in groundwater infiltration source category is a large source with respect to the magnitude of nitrate concentrations observed at the SRO. The median nitrate concentrations observed at the SRO was 43 mg/L as N, which is more than four times greater than the Primary MCL of 10 mg/L as N, and a nitrate concentration as high as 240 mg/L as N was also observed. In addition, with regard to pollutant prioritization, regional studies and estuarine researchers suggest that currently, control of nitrogen in the portion of the Salinas River which receives the discharge from the SRO may be considerably more important than control of phosphorus.[12] Central Coast researchers and resource professionals have noted that nitrogen control is considered a higher priority than phosphorus control in coastal watersheds of the region.[13]

3.3 ORTHOPHOSPHATE IN URBAN RUNOFF

The third highest priority pollutant-source category is considered to be orthophosphate in urban runoff. As detailed in **Section 3.2**, nitrogen control is considered to be a higher priority than phosphorus control in the region. Accordingly, as a practical matter Regional Water Board staff maintains that at this time the focus of resources and implementation should be directed with respect to nitrogen.[14] However, as reported by the USEPA, while controlling one nutrient may potentially prevent the production of algal biomass, control of both nutrients (nitrogen and phosphorus) in upstream waters can also provide additional assurance that downstream algal biomass production will remain in control.[15] Also, given that the orthophosphate in the urban runoff pollutant–source category originates within City limits, it is considered to be moderately controllable.

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[11] http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Nitrate.aspx. Accessed April 7, 2013.

[12] Central Coast Regional Water Quality Control Board. 2013. *Total Maximum Daily Loads for Nitrogen Compounds and Orthophosphate for the Lower Salinas River and Reclamation Canal Basin, and the Moro Cojo Slough Subwatershed, Monterey County, California: Final Project Report*.

[13] Largay, G. et al. 2008. *Reduction of Nutrient and Sediment Loads using Vegetated Treatment Systems, Monterey County, California. Final Report, for Proposition 319(h) Grant Agreement No. 05-122-553-1*.

[14] Central Coast Regional Water Quality Control Board. 2013. *Total Maximum Daily Loads for Nitrogen Compounds and Orthophosphate for the Lower Salinas River and Reclamation Canal Basin, and the Moro Cojo Slough Subwatershed, Monterey County, California: Final Project Report*.

[15] United States Environmental Protection Agency. 2007. *Total Maximum Daily Load (TMDL) for Nutrients, Dissolved Oxygen and Biochemical Oxygen Demand in Springs Coast Basin*.

3.4 PESTICIDES IN URBAN RUNOFF AND/OR GROUNDWATER INFILTRATION

The fourth highest priority pollutant-source category is considered to be pesticides in urban runoff and/or groundwater infiltration. Pesticides are a relatively low priority at this point because the degree to which urban runoff and groundwater infiltration are significant sources of pesticides remains uncertain. Once additional evidence is gained through monitoring at the SRSPS and SRO, a reassessment of the priority of these pollutant–source categories will be warranted.

3.5 SALTS IN GROUNDWATER INFILTRATION

The lowest priority pollutant-source category is considered to be salts in groundwater. There are several reasons for this pollutant–source category being prioritized as such. First, the City has no control over the existing salt concentrations in groundwater; this pollutant source category is largely uncontrollable and likely caused by sea water intrusion. Second, this pollutant–source category does not pose the human health risks that are posed by the nitrate in groundwater infiltration pollutant–source category. Also important is the fact that there are no Basin Plan objectives for the Salinas River at the location of the SRO discharge. The City is better off employing source-reduction efforts on other high-priority pollutants with a goal or reaching or maintaining protection for beneficial water uses.

4 Pollutant Reduction Actions

Given the list of sources that have been identified and prioritized, it is necessary to identify actions that will provide measurable pollutant load reduction outcomes. As part of this process, the City's current and planned actions were considered. A list of the most reasonable reduction actions for each source is included. A ranking system was used to assess the expected effectiveness of each action and is shown in **Table 6**.

Table 6. Effectiveness Ranking System

Effectiveness Ranking	Description
5	Complete elimination of pollutant source
4	Significant reduction of pollutant source
3	Moderate reduction of pollutant source
2	Minor reduction of pollutant source
1	Little to no effect

Anthropogenic sources of pollutants likely need be reduced through employment of best management practices (BMPs). BMPs can encompass any program, technology, operational methods, or engineered systems which, when implemented, prevent, control, remove or reduce pollution. In the following sections, the potential BMPs have been organized into the following four broad categories:

- *Treatment Control BMPs*: Any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media absorption or any other physical, biological, or chemical process;
- *Site-Design BMPs*: Low technology practices designed to minimize the impact of impervious cover through the reduction of stormwater runoff volume and associated pollutants;
- *Source Control BMPs*: Activities, prohibitions of practices, maintenance procedures, managerial practices or operational practices that aim to prevent storm water pollution by reducing the potential for contamination at the source of pollution; and
- *Non-Stormwater BMPs*: Practices, operations or activities aimed at reducing the volume and/or pollutants associated with dry-weather flows.

In the following sections, pollutant reduction actions that address urban runoff are divided into four reduction categories: wet weather, dry weather, new (or re-) development, and existing development.

It is important to highlight one particular, highly-effective action, which the City plans to implement by the end of 2013 dependent on the award of grant funding. The City is the process of securing funding for Phase 1 of a proposed project that would divert dry weather flows and possibly first flush storm-generated flows and flows from infrequent smaller storms from the SRSPS into the force main that flows to the Monterey Regional Water Pollution Control Agency (MRWPCA) wastewater treatment plant (WWTP) in Marina. Dry weather flows would combine

with raw sewage from the City. MRWPCA would treat the combined flow to tertiary standards and pump it through the existing recycled water system in northern Monterey County during dry weather periods. The recycled water irrigates crop lands, virtually eliminating the need to pump groundwater for irrigation. In the future, as Phase 2 of the project, the City plans to study the potential diversion of flows from North Salinas which are currently discharged to the Reclamation Ditch. The cost for Phase 1 is $590,000; and costs would be covered by a Proposition 84 Grant and contributions from the City and the MRWPCA.

4.1 PATHOGEN INDICATORS IN URBAN RUNOFF

Potential BMPs which could be used to address the pathogen indicators in urban runoff pollutant-source category are shown in **Table 7,** along with their potential applicability to wet weather, dry weather, new (or re-) development, and existing development.

Table 7. Potential Pathogen Indicator BMPs organized by category

BMP Type	Wet Weather	Dry Weather flows	New Development/Re-development	Existing Development	Description
Treatment Control					
Dry-weather and First Flush Flow Diversion to WWTP	X	X	X	X	Diverts dry weather, non-stormwater flows as well as a portion of first-flush stormwater to the Monterey Regional Water Pollution Control Agency regional wastewater treatment plant (WWTP) for treatment.
Infiltration Basins and Trenches	X	X	X	X	Constructed control measures located in permeable soils that capture, store and infiltrate stormwater runoff over a prescribed period. Includes infiltration basins, infiltration trenches and porous pavement. Satisfactory removal is not expected in soils that are excessively well drained.
Porous Pavement Detention	X	X	X	X	This measure consists of impermeable blocks separated by spaces and joints filled with soil and/or gravel. The pore spaces between the pavers allow infiltration into a designed storage facility below the surface.
Wet Detention Basin (Wet Pond)	X	X	X	X	Constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season). The primary removal mechanism is settling while stormwater runoff resides in the pool. Nutrient uptake also occurs through biological activity in the pond.
Bioretention (Porous landscape detention)	X	X	X	X	Landscaped features designed to capture, treat and temporarily store stormwater runoff on the project site. Bioretention is commonly implemented as parking lot islands or as planters in residential and urban settings.
Sand Filters	X	X	X	X	Usually two-chambered stormwater treatment devices; the first chamber is for settling large particles, and the second is a filter bed filled with sand or another filtering media to remove finer particles and other pollutants Variations include public domain and proprietary media filters.

Table 7. Potential Pathogen Indicator BMPs organized by category (continued)

BMP Type	Wet Weather	Dry Weather flows	New Development/Re-development	Existing Development	Description
Treatment Control (continued)					
Constructed Wetland	X	X	X	X	Constructed basins similar to wet ponds that incorporate wetland plants in a shallow pool. As runoff flows through the wetland, pollutant removal is achieved by settling and biological uptake within the practice.
Site-Design					
Green Roof	X		X	X	Consists of a thin layer of vegetation and soil installed on top of a conventional flat or sloped roof. This layer creates an environment suitable for plant growth without damaging the underlying roof system. Green roofs create green space for public benefit, energy efficiency and stormwater retention/ detention and evapotranspiration.
Permeable Pavers	X	X	X	X	Impermeable blocks separated by spaces and joints filled with soil and/or gravel. The pore spaces between the pavers allow infiltration of stormwater into a designed storage facility below the surface.
Rain Barrel/Cistern	X		X	X	Collects stormwater from rooftops and stores it for future use such as lawn and garden watering.
Source Control					
Riparian Stream Buffer	X	X	X	X	A designated area along a shoreline, wetland, or stream where development or other activities are restricted or prohibited. The primary function of a riparian stream buffer is to physically protect and separate a stream from future disturbance or encroachment. If properly designed, buffers can remove pollutants from stormwater runoff.
Pet Waste Management	X	X	X	X	Combines educational outreach and enforcement to encourage residents to clean up after their pets.
Street Sweeping	X	X	X	X	Uses mechanical pavement cleaning practices to minimize pollutant transport to receiving water bodies. Sediment, debris, and gross particulate matter are the targeted pollutants, but removal of other pollutants can be accomplished as well.
Waterfowl Management	X	X			Reduces the number of geese and gulls roosting and defecating in or near the surface water. May employ the use of dogs, egg addling, and turf management. Includes ‘do not feed the waterfowl’ ordinances and signage. Applicable to open space and lakes/ponds with waterfowl populations.
Channel Maintenance	X	X			Maintenance activities that reduce the presence of biofilms or other substances that provide growth media for bacteria.

Table 7. Potential Pathogen Indicator BMPs organized by category (continued)

BMP Type	Wet Weather	Dry Weather flows	New Development/Re-development	Existing Development	Description
Non-Stormwater					
Dry-weather and First Flush Flow Diversion to WWTP	X	X	X	X	Diverts dry weather, non-stormwater flows as well as a portion of first-flush stormwater to the Monterey Regional Water Pollution Control Agency regional wastewater treatment plant (WWTP) for treatment.
Dry-weather UV Disinfection w/ Filtration		X	X	X	Exposes dry weather runoff to ultraviolet (UV) light. UV light alters the bacteria's DNA, which prevents it from reproducing and developing within the system. UV treatment does not alter water chemically; nothing is being added except energy.
Illicit Connection Removal		X		X	Works to find, fix, and prevent water quality degradation caused by illicit connections. Actions usually involve some form of infrastructure modification or repair that targets sewage cross-connections, industrial cross-connections and commercial cross connections.
Sanitary Sewer Overflow Repair	X	X		X	Works to eliminate overflows, spills, or discharges of untreated wastewater from the sanitary sewer system. Practices include sewer line maintenance, repairs, and upgrades and constructing wet weather storage and treatment facilities to treat excess flows.

The *Total Maximum Daily Loads for Fecal Coliform for the Lower Salinas River Watershed, Monterey County, California* (Fecal Coliform TMDL) noted that urban and residential bacteria loads were most often associated with impervious surface flow. Impervious surfaces include roads, parking lots, sidewalks, driveways, and any other surface that prohibits infiltration of water into the soil. Fecal waste that is deposited on impervious surfaces can enter the storm drain system and be discharged to surface waterbodies. For example, pet waste could enter storm drains during either wet or dry weather if deposited on impervious surfaces and transported by car wash water, irrigation, or stormwater. Impervious cover in the Fecal Coliform TMDL Project Area is concentrated most densely in the City of Salinas. Thus, it is expected that BMPs which mitigate runoff from impervious surfaces would decrease fecal coliform loading from urban areas. BMPs will be prioritized for further consideration based on their ability to reduce runoff from stormwater flows and from dry weather flows.

In addition, since human sources are potentially significant and problematic due to their pathogenic risk, BMPs that reduce human sources will be prioritized. BMPs which will be considered for evaluation are summarized in **Table 8**. A subset of potential BMPs summarized in **Table 8** will be evaluated based on available information on pollutant removal potential from the EPA Menu of BMPs[16] and the International Stormwater BMP Database[17]. These efforts will be

[16]http://cfpub1.epa.gov/npdes/stormwater/menuofbmps/index.cfm

coordinated with the Waste Load Allocation Attainment Plan for Fecal Coliform that the City is currently developing as required by Order R3-2012-0005.

Table 8. Evaluation Summary of Potential Pathogen Indicator BMPs

BMP Type	Effectiveness Evaluation Summary	Preliminary Effectiveness Ranking
Treatment Control		
Dry-weather and First Flush Flow Diversion to WWTP	Potential large reductions in bacteria due to removal of bacteria by treatment	5
Infiltration Basins and Trenches	Limited data available, but expected reduction in bacteria from runoff volume reduction	4
Porous Pavement Detention	Inadequate data available for evaluation, but expected reduction in bacteria from runoff volume reduction	4
Bioretention	Expected to have moderate potential bacteria removal from sorption and filtration, as well as volume reduction	3
Sand Filters	Potential moderate bacteria removal, but studies have shown inconsistent removal among sand filters	3
Wet Detention Basin (wet pond)	Potential moderate bacteria removal with slow infiltration. Long holding times enable sedimentation, solar irradiation, and natural predation	3
Constructed Wetland	Limited data available, but potential moderate bacteria removal, similar to wet pond	3
Site-Design		
Green Roof	Limited data available	3
Permeable Pavers	Limited data available, but potential high bacteria removal (analogous to porous pavement detention) due to decrease in runoff volume	4
Rain Barrel/Cistern	Potential low bacteria removal with slight decrease in runoff volume	2
Source Control		
Riparian Stream Buffer	Potentially effective for multiple constituents of concern	3
Street Sweeping	Potentially effective when timed before storm events	3
Pet Waste Management	Small reduction in bacteria from brochures/TV or radio ads, but intensive efforts might be more effective	2/3
Waterfowl Management	Potentially effective if applied in targeted areas where waterfowl are a major contributor	1/4
Channel / Storm Drain Maintenance	Effective in areas where biofilms or other substances that provide growth media for bacteria are present.	3
Non-stormwater		
Sanitary Sewer Overflow Repair	Potential large benefit in reducing bacteria if SSOs are present	4
Illicit Connection Removal	Potential across-the-board reduction in pollutants associated with an illicit connection	4
Dry-Weather Flow Diversion	Potential large reductions in bacteria due to removal of bacteria by treatment	5

[17] http://www.bmpdatabase.org/BMPPerformance.htm

4.2 NITRATE IN GROUNDWATER INFILTRATION

Potential BMPs which could be used to address the nitrate in groundwater infiltration pollutant-source category are shown in **Table 9**. Given that groundwater intrusion into the pipeline that leads from the SRSPS to the SRO takes place regardless of weather conditions, the BMPs are not subdivided by weather condition or development stage.

Table 9. Potential Nitrate BMPs organized by category

BMP Type	Description
Source Control	
Agricultural Outreach and Education	Coordinate with local Irrigated Lands Regulatory Program agricultural coalitions to determine if BMPs that may allow for reduction of nitrate loads to groundwater are being implemented by growers on lands overlying the pipeline. This may also involve coordination with the coalitions to determine if outreach regarding such BMPs is being provided to the growers. Depending on the coalitions' resources, this outreach may take the form of flyers, newsletters, or conducting training sessions on proper fertilizer application methods and rates with the local growers. If needed, training materials could be obtained from the California Department of Food and Agricultural Fertilizer Research and Education Program (FREP). FREP funds and coordinates research to advance the environmentally safe and agronomically sound use and handling of fertilizer materials. FREP provides technical education and outreach materials on its website which can be found at: http://www.cdfa.ca.gov/is/ffldrs/frep.html. While implementation of BMPs for proper handling and application of fertilizers may reduce growers' direct contribution of nitrates to groundwater, it may take many years for any benefit to be observed. It is possible that the current concentrations of nitrates in groundwater are due to historical agricultural practices and are not resolvable in the short term.
Non-Stormwater	
Pipeline Rehabilitation and Relining	Rehabilitates and relines the pipeline that leads from the SRSPS to the SRO to greatly reduce groundwater intrusion. The City has investigated the possibility of rehabilitating and relining this pipeline in the past. A preliminary cost estimate for rehabilitating and relining the pipeline was approximately $5 million and the rehabilitation and relining of the pipeline was scheduled to be completed by the end of June 2014.[18] Due to budgetary issues caused by the economic downturn, the City did not move forward with this project.
Pipeline Relocation	Relocates the pipeline that leads from the SRSPS to the SRO to another location so that it is no longer impacted by agriculturally impacted groundwater intrusion. Although this reduction action is likely to be substantially more costly than rehabilitating and relining the pipeline. The incremental benefit associated with relocating the pipeline as opposed to rehabilitating and relining the pipeline may be minimal and may not justify the additional cost.

BMPs will be prioritized for further consideration based on their ability to reduce the loading of nitrate from groundwater that has been impacted by the overlying agricultural operations to the SRO. In addition, BMPs that have the potential to be effective and minimize the commitment of scarce resources will be prioritized. If monitoring suggests that these BMPs are not effective, then higher resource intensive BMPs will be pursued. BMPs which will be considered for evaluation are summarized in **Table 10**.

[18] City of Salinas. 2008. *Capital Improvement Program FY 2008-2014*.

Table 10. Evaluation Summary of Potential Nitrate BMPs

BMP Type	Effectiveness Evaluation Summary	Effectiveness Ranking
Source Control		
Agricultural Outreach and Education	Potential large benefit to reducing nitrate concentrations in groundwater if the agricultural community is cooperative	1
Non-Stormwater		
Pipeline Rehabilitation and Relining	By greatly reducing the amount of groundwater intrusion into the pipeline, the concentrations observed at the SRO will more closely resemble the concentrations observed at the SRSPS, which have been consistently below the Primary MCL of 10 mg/L as N.	4
Pipeline Relocation	Potential elimination of nitrate loadings to the SRO from groundwater infiltration	5

4.3 ORTHOPHOSPHATE IN URBAN RUNOFF

Potential BMPs which could be used to address the orthophosphate in urban runoff pollutant-source category are shown in **Table 11,** along with their potential applicability to wet weather, dry weather, new (or re-) development, and existing development.

Table 11. Potential Orthophosphate BMPs organized by category

BMP Type	Wet Weather	Dry Weather flows	New Development/Re-development	Existing Development	Description
Treatment Control					
Dry-weather and First Flush Flow Diversion to WWTP	X	X	X	X	Diverts dry weather, non-stormwater flows as well as a portion of first-flush stormwater to the Monterey Regional Water Pollution Control Agency regional wastewater treatment plant (WWTP) for treatment.
Infiltration Basins and Trenches	X	X	X	X	Constructed control measures located in permeable soils that capture, store and infiltrate stormwater runoff over a prescribed period. Includes infiltration basins, infiltration trenches and porous pavement. Satisfactory removal is not expected in soils that are excessively well drained.
Porous Pavement Detention	X	X	X	X	This measure consists of impermeable blocks separated by spaces and joints filled with soil and/or gravel. The pore spaces between the pavers allow infiltration of stormwater into a designed storage facility below the surface.
Wet Detention Basin (Wet Pond)	X	X	X	X	Constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season). The primary removal mechanism is settling while stormwater runoff resides in the pool. Nutrient uptake also occurs through biological activity in the pond.

Table 11. Potential Orthophosphate BMPs organized by category (continued)

BMP Type	Wet Weather	Dry Weather flows	New Development/Re-development	Existing Development	Description
Treatment Control (continued)					
Bioretention (Porous landscape detention)	X	X	X	X	Landscaped features designed to capture, treat and temporarily store stormwater runoff on the project site. Bioretention is commonly implemented as parking lot islands or as planters in residential and urban settings.
Sand Filters	X	X	X	X	Usually two-chambered stormwater treatment devices; the first chamber is for settling large particles, and the second is a filter bed filled with sand or another filtering media to remove finer particles and other pollutants Variations include public domain and proprietary media filters.
Constructed Wetland	X	X	X	X	Constructed basins similar to wet ponds that incorporate wetland plants in a shallow pool. As stormwater runoff flows through the wetland, pollutant removal is achieved by settling and biological uptake within the practice.
Site-Design					
Green Roof	X		X	X	Consists of a thin layer of vegetation and soil installed on top of a conventional flat or sloped roof. This layer creates an environment suitable for plant growth without damaging the underlying roof system. Green roofs create green space for public benefit, energy efficiency and stormwater retention/ detention and evapotranspiration.
Permeable Pavers	X	X	X	X	Impermeable blocks separated by spaces and joints filled with soil and/or gravel. The pore spaces between the pavers allow infiltration of stormwater into a designed storage facility below the surface.
Rain Barrel/Cistern	X		X	X	Collects stormwater from rooftops and stores it for future use such as lawn and garden watering.
Source Control					
Street Sweeping	X	X	X	X	Uses mechanical pavement cleaning practices to minimize pollutant transport to receiving water bodies. Sediment, debris, and gross particulate matter are the targeted pollutants, but removal of other pollutants can be accomplished as well.
Riparian Stream Buffer	X	X	X	X	A designated area along a shoreline, wetland, or stream where development or other activities are restricted or prohibited. The primary function of a riparian stream buffer is to physically protect and separate a stream from future disturbance or encroachment. If properly designed, buffers can remove pollutants from stormwater runoff.
Pet Waste Management	X	X	X	X	Combines educational outreach and enforcement to encourage residents to clean up after their pets.

Table 11. Potential Orthophosphate BMPs organized by category (continued)

BMP Type	Wet Weather	Dry Weather flows	New Development/Re-development	Existing Development	Description
Source Control (continued)					
Landscaping/ Fertilizer Education for Homeowners	X	X	X	X	Combines educational outreach and enforcement to encourage residents to use proper lawn care practices. Uses low water by choosing flowers, trees, shrubs, and groundcover. Considers alternative landscaping techniques: naturescaping and xeriscaping. Conducts appropriate maintenance (i.e. properly timed fertilizing, weeding, and pruning) to help preserve the landscape's water efficiency. Considers grass cycling (the natural recycling of grass by leaving the clippings on the lawn when mowing. The clippings decompose quickly and release valuable nutrients back into the lawn). Applies fertilizers on an as needed basis solely to ensure plant health. Immediately waters-in to prevent downstream pollution or plant burn. Covers storm drains during fertilizer application to prevent materials from entering storm drains/receiving waters
Wash Water Management	X	X	X	X	Uses properly maintained off-site commercial washing and steam cleaning businesses whenever possible. Minimizes the risk of contamination from wash water discharges. Uses biodegradable, phosphate-free detergents for washing vehicles.
Catch Basin/Sump Clean Out	X	X	X	X	Most stormwater conveyance systems have a catch basin or sump pit in the storm drain inlet to trap sediment and organic matter. Regular maintenance improves water quality and prevents clogging and flooding.
Non-Stormwater					
Dry-weather Flow Diversion to WWTP		X	X	X	Diverts dry weather, non-stormwater flows to the Monterey Regional Water Pollution Control Agency regional wastewater treatment plant (WWTP) for treatment.
Illicit Connection Removal		X		X	Works to find, fix, and prevent water quality degradation caused by illicit connections. Actions usually involve some form of infrastructure modification or repair that targets sewage cross-connections, industrial cross-connections and commercial cross connections.
Sanitary Sewer Overflow Repair	X	X		X	Works to eliminate overflow, spill, or discharge of untreated wastewater from the sanitary sewer system. Practices include cleaning maintenance of sewer line, repairing broken service lines, upgrading sewer, and constructing wet weather storage and treatment facilities.

Phosphorus is relatively insoluble and has a tendency to bind to the organic matter found in sediment. This property of phosphorus is demonstrated by monitoring data collected in the region that often show a positive correlation between orthophosphate concentrations and total

suspended solids (TSS) concentrations. [19] As a result, one would expect the same positive correlation between orthophosphate and TSS (i.e., sediment) to be observed in the SRSPS drainage area. BMPs will be prioritized for further consideration based on their ability to reduce solids in urban runoff.

In addition, BMPs that reduce runoff from stormwater flows and from dry weather flows will be prioritized. BMPs which will be considered for evaluation are summarized in **Table 12**.

Table 12. Evaluation Summary of Potential Orthophosphate BMPs

BMP Type	Effectiveness Evaluation Summary	Effectiveness Ranking
Structural and Treatment Control		
Dry-weather and First Flush Flow Diversion to WWTP	Potential large reductions orthophosphate due to removal by treatment	5
Infiltration Basins and Trenches	Potential moderate orthophosphate removal due to removal of fine sediment. Removal dependent on soil properties	3
Porous Pavement Detention	Potential moderate orthophosphate removal, with similar performance to infiltration basins and trenches	3
Bioretention	Potential moderate orthophosphate removal	3
Sand Filters	Potential high orthophosphate removal due to sediment removal	4
Wet Detention Basin (wet pond)	Potential moderate orthophosphate removal	3
Constructed Wetland	Potential high orthophosphate removal due to removal of particulate and dissolved orthophosphate	4
Site Design		
Green Roof	Potential high orthophosphate removal	4
Permeable Pavers	Potential high orthophosphate removal with substantial decrease in runoff volume	4
Source Control		
Riparian Stream Buffer	Effective for multiple constituents of concern, and may also provide bank stabilization	3
Street Sweeping	Effective when timed appropriately before storm events	3
Pet Waste Management	Small reduction in orthophosphate from brochures/TV or radio ads, but intensive efforts might be more effective	2/3
Landscaping/Fertilizer Education for Homeowners	Effective with intensive efforts	3/4
Wash Water Management	Effective if implemented on a wide scale and phosphate-free detergents are not already in use	3/4
Catch Basin/Sump Clean Out	Very effective when maintenance is conducted regularly	4
Non-Stormwater		
Sanitary Sewer Overflow Repair	Small benefit in reducing orthophosphate if SSOs are present	2
Illicit Connection Removal	Reduction in pollutants associated with an illicit connection	4
Dry-Weather Flow Diversion	Potential large reductions in orthophosphate	5

[19] Central Coast Regional Water Quality Control Board. 2013. *Total Maximum Daily Loads for Nitrogen Compounds and Orthophosphate for the Lower Salinas River and Reclamation Canal Basin, and the Moro Cojo Slough Subwatershed, Monterey County, California: Final Project Report*.

4.4 PESTICIDES IN URBAN RUNOFF AND/OR GROUNDWATER INFILTRATION

Given that the degree to which urban runoff and groundwater infiltration are significant sources of pesticides remains uncertain due to the absence of a robust dataset and restrictions on urban pesticide use set by recent regulations, identifying pollutant reduction actions to address the source(s) of pesticides to the SRO cannot be done at this time. Once additional evidence is gained through monitoring at the SRSPS and SRO and the source(s) of pesticides are identified and prioritized, potential BMPs which could be used to address these pollutant-source categories will be identified; however, the City will continue to address pesticides in urban runoff during the interim time period. **Table 13** lists a number of currently-employed BMPs and their applicability to wet weather, dry weather, new (or re-) development, and existing development.

Table 13. Current Pesticide BMPs organized by category

BMP Type	Wet Weather	Dry Weather flows	New Development/Re-development	Existing Development	Description
Source Control					
Pesticide Application	X	X	X	X	Reduces pesticide application to existing trees. Monitors weather conditions before pesticide application and applies them during optimal conditions. Applies chemicals in safe manner—all pesticide applications are made in accordance with federal, state and local regulations. Empties pesticide tanks of all pesticides as part of the application process. Prevents chemicals and irrigation overspray from ending-up in downstream receiving waters. Ensures safe application of chemicals.
Pesticide Storage	X	X	X	X	Stores pesticides covered and away from exposure to weather.
Pesticide Handling	X	X	X	X	Reduces or eliminates unsafe practices regarding the handling of pesticides. Through departmental training and tailgate sessions, informs staff regarding proper use and handling of chemicals consistent with Monterey County Environmental Health Department and County Agricultural Commissioner's Office. Documents training into Maintenance manuals.
Proper Pesticide Container Disposal	X	X			Recycles all municipal recyclable pesticide containers at the Monterey County Agricultural Commissioner's events.
Street Sweeping	X	X	X	X	Uses mechanical pavement cleaning practices to minimize pollutant transport to receiving water bodies. Sediment, debris, and gross particulate matter are the targeted pollutants, but removal of other pollutants can be accomplished as well.

Table 13. Current Pesticide BMPs organized by category (continued)

BMP Type	Wet Weather	Dry Weather flows	New Development/Re-development	Existing Development	Description
Source Control (continued)					
Tree List	X	X	X		Updates tree planting list and implements list to exclude tree species that rely on regular use of pesticides for good health. Prepares list of species that are compatible with low impact designs in Salinas. Reduces dependence upon potentially hazardous chemicals through increased application of Integrated Pesticide Management.
Toxic Pesticide Elimination	X	X	X	X	Eliminates the use of the more toxic pesticides for street and park weed control as practicable. Utilizes less toxic herbicides for weed control, which degrade quickly. Eliminates all use of chemicals included on State 303(d) listed water bodies.
Public Outreach and Education	X	X	X	X	Promote behavioral changes through increased knowledge that leads to greater responsibility and protection of water resources. Specific actions will be identified and may include past activities (store displays, Earth Day outreach, etc.), dependent on funding and personnel resources.

4.5 SALTS IN GROUNDWATER INFILTRATION

Potential BMPs which could be used to address the salts in the groundwater infiltration pollutant-source category are shown in **Table 14**. Given that groundwater intrusion into the pipeline that leads from the SRSPS to the SRO takes place regardless of weather conditions, the BMPs are not subdivided by weather condition or development stage.

Table 14. Potential Salts BMPs organized by category

BMP Type	Description
Non-Stormwater	
Pipeline Rehabilitation and Relining	Rehabilitates and relines the pipeline that leads from the SRSPS to the SRO to greatly reduce groundwater intrusion. The City has investigated the possibility of rehabilitating and relining this pipeline in the past. A preliminary cost estimate for rehabilitating and relining the pipeline was approximately $5 million and the rehabilitation and relining of the pipeline was scheduled to be completed by the end of June 2014.[20] Due to budgetary issues caused by the economic downturn which resulted in 66 City employees being laid off, the City did not move forward with this project.
Pipeline Relocation	Relocates the pipeline that leads from the SRSPS to the SRO to another location so that it is no longer impacted by agriculturally impacted groundwater intrusion. Although this reduction action is likely to be substantially more costly than rehabilitating and relining the pipeline. The incremental benefit associated with relocating the pipeline as opposed to rehabilitating and relining the pipeline may be minimal and may not justify the additional cost.

[20] City of Salinas. 2008. *Capital Improvement Program FY 2008-2014*.

BMPs will be prioritized for further consideration based on their ability to reduce the loading of salts from groundwater that has been impacted by the overlying agricultural operations to the SRO. In addition, BMPs that have the potential to be effective and minimize the commitment of scarce resources will be prioritized. If monitoring suggests that these BMPs are not effective, then higher resource intensive BMPs will be pursued. BMPs which will be considered for evaluation are summarized in **Table 15**.

Table 15. Evaluation Summary of Potential Salts BMPs

BMP Type	Effectiveness Evaluation Summary	Effectiveness Ranking
Non-Stormwater		
Pipeline Rehabilitation and Relining	By greatly reducing the amount of groundwater intrusion into the pipeline, the concentrations observed at the SRO will more closely resemble the concentrations observed at the SRSPS, which have been consistently below 400 mg/L.	4
Pipeline Relocation	Potential elimination of salt loadings to the SRO from groundwater infiltration	5

4.6 SUMMARY

The potential BMPs summarized in the previous sections can be prioritized based on their feasibility of implementation, cost, and whether they address a potential major pollutant source. **Table 16** summarizes the most reasonable reduction actions ("1" being most reasonable) for each pollutant-source category with the highest priority pollutant-source categories listed first.

Table 16. Summary of Identified Pollutant Sources and Reduction Actions

Pollutant-Source Category	Reduction Action Ranking	BMP Type
Pathogen Indicators in Urban Runoff	1	Dry-Weather Flow Diversion
	2	Illicit Connection Removal
	3	Sanitary Sewer Overflow Repair
	4	Street Sweeping
	5	Permeable Pavers
	6	Green Roof
	7	Porous Pavement Detention
	8	Infiltration Basins and Trenches
Nitrate in Groundwater infiltration	1	Pipeline Rehabilitation and Relining
	2	Agricultural Outreach and Education

Table 16. Summary of Identified Pollutant Sources and Reduction Actions (continued)

Pollutant-Source Category	Reduction Action Ranking	BMP Type
Orthophosphate in Urban Runoff	1	Dry-Weather Flow Diversion
	2	Illicit Connection Removal
	3	Catch Basin/Sump Clean Out
	4	Street Sweeping
	5	Landscaping/Fertilizer Education for Homeowners
	6	Wash Water Management
	7	Permeable Pavers
	8	Green Roof
	9	Constructed Wetland
	10	Sand Filters
Pesticides in Urban Runoff/Groundwater Infiltration	-[1]	Pesticide Application
		Pesticide Storage
		Pesticide Handling
		Proper Pesticide Container Disposal
		Street Sweeping
		Toxic Pesticide Elimination
		Tree List
		Public Outreach and Education
Salts in Groundwater infiltration	1	Pipeline Rehabilitation and Relining
	2	Pipeline Relocation

1. BMPS are not ranked since there is insufficient data to determine the level of pesticide contamination and sources at the SRO. Rankings will be revised following more monitoring and completion of source analysis.

The selection of BMPs will be developed in consideration of other TMDL and MS4 permit requirements. This list provides a starting point for evaluation of BMPs that may provide higher pollutant removals and, therefore, could be considered further. Additional evaluation of the SRO subwatershed needs for compliance, ability of the BMPs to meet other TMDL requirements, and the feasibility of implementing the BMPs will be needed for final BMP selection. Emphasis will be placed on enhancing BMP efforts that are already in place within the City. A discussion of these efforts can be found in the Effectiveness Assessment section.

5 Salinas River Outfall Monitoring Plan

The outfall is a 66-inch diameter pipeline with a flap gate on the end of the pipe that discharges into a ditch about 100 meters east of the Salinas River. The discharge point is approximately 400 meters upstream of the Davis Road crossing. The City proposes to collect samples from the flow out of the drain pipe. Samples would be collected according to the schedule in **Table 17.** The selection of constituents is consistent with monitoring requirements for stormwater discharges, as noted in Order R3-2012-0005 (Table D-3, Attachment D), and the City's Stormwater Program Quality Assurance Project Plan (QAPP).[21] Although Order R3-2012-0005 does not require dry-weather monitoring for stormwater discharges, such monitoring is proposed here to allow for accurate calculation of pollutant loads *and* their reduction from the anticipated diversion of the dry-weather non-stormwater urban runoff.

Wet weather sampling shall occur during at least three significant rain events each rainy season, including the first significant storm event of the season. For the purposes of the monitoring schedule in **Table 17**, a significant rain event shall be defined as an event predicted to exceed ½ inch of rainfall within a 24 hour period, or resulting in significant runoff to the pump station. For the basis of collecting comparative data, wet weather sampling at the Salinas River Stormwater Pump Station and at the Salinas River Outfall Pipe should be taken concurrently during the same storm events.

Table 17. Constituents and Monitoring Frequency for the Salinas River Outfall

Constituent	Annual Monitoring Frequency
General Parameters	
Discharge Flow	
Temperature	
pH	
Electrical Conductivity	*Grab Sample
Turbidity	From Salinas River Outfall Pipe
Hardness	
Total Dissolved Solids	**2 dry-weather events**
Nutrients	**(July and September)**[1]
Nitrate + Nitrite (as N)	
Ammonia, total	
Ammonia, unionized	
Soluble orthophosphate	*Concurrent Grab Samples
Bacteria	1 Sample at SRSPS
Fecal coliform	(Salinas River Storm Pump Station)
Total coliform	
Metals	1 Sample From Salinas River Outfall Pipe
Copper, total	
Zinc, total	**3 wet-weather events**

[21] Pacific EcoRisk. October 2012. *Quality Assurance Project Plan for the City of Salinas Stormwater Monitoring Program.*

Table 17. Constituents and Monitoring Frequency Cont.

Pesticides
Gamma-cyhalothrin
Lambda-cyhalothrin
Esfenvalarate
Bifenthrin
Beta-cyfluthrin

Dry-weather sampling will commence in July 2014.

[21] Pacific EcoRisk. October 2012. *Quality Assurance Project Plan for the City of Salinas Stormwater Monitoring Program.* *The QAPP will be amended to include the site information in Table 17.

As previously discussed, the City is in the process of securing funding for Phase 1 of a proposed project that would divert dry weather flows and possibly first flush storm-generated flows and flows from infrequent smaller storms for treatment at the Monterey Regional WWTP. Outfall monitoring will continue following this diversion, to characterize possible groundwater infiltration flows into the City's infrastructure. In order to characterize the load reductions from the diversions, the City will also monitor the diverted flows for one year after project implementation. The diverted flow will be monitored prior to pretreatment at the detention ponds for the constituents and frequency listed in **Table 17**. Frequency of wet weather sampling of the diverted flows may be modified concurrent with the frequency of the Monterey Regional WWTP's ability to accept wet weather flows.

All collection and analytical procedures will follow the guidelines noted in the City's QAPP incorporated by reference here in.

6 Effectiveness Assessment

As outlined in Order R3-2012-0005, the City is required to implement an information management system to track and record information on maintenance and BMP implementation at catch basins and other surface drainage structures, structural BMPs, and municipal facilities. Additionally, the City will track the reduction actions identified in **Section** 4 as they are being implemented. Ultimately, the effectiveness of permit-mandated actions and additional ones proposed in this plan will be assessed based on pollutant load reductions at the Salinas River Outfall. The City will track the trends in stormwater and non-stormwater flow concentrations to assess whether there is a reduction in pollutant loads. If satisfactory reductions are not measured, additional BMPs may be implemented as needed.

Upon completion of the first year of paired monitoring at the SRO and SRSPS, the City will establish preliminary pollutant reduction goals to assist in evaluating the effectiveness of the implemented control measures. Preliminary pollutant reduction goals will be presented in the next Annual Report to be completed July 2015.

7 Implementation Schedule

The City proposes to follow the schedule outlined below. The schedule may be adjusted based on the timeline for the diversion project.

Table 18. Schedule of Actions for Pollutant Load Reductions at the Salinas River Outfall

Actions	Implementation Schedule
Outfall Monitoring	
Dry-weather monitoring	Beginning July 2014, July and September of each year, on-going throughout the permit term (5/2/17)
Wet-weather monitoring	3 stormwater events per year, on-going throughout the permit term (5/2/17)
Identify Actions Aimed at Pesticide Reductions	
Identify and prioritize actions aimed at pesticide load reductions	Following three-years of data collection at the outfall, by September 2016
Implement Actions Aimed at Pollutant Reductions in Urban Runoff	
Dry-Weather Flow Diversion	Planned for January 2014, pending securing Proposition 84 funds
Illicit Connection Removal	On-going, per Order R3-2012-0005 requirements
Sanitary Sewer Overflow Repair	On-going, per Order R3-2012-0005 and SSO WDR requirements
Catch Basin/Sump Clean Out	On-going, per Order R3-2012-0005 requirements
Landscaping/Fertilizer Education for Homeowners	On-going, per Order R3-2012-0005 requirements
Wash Water Management	On-going, per Order R3-2012-0005 requirements
Permeable Pavers Green Roof Porous Pavement Detention Infiltration Basins and Trenches Landscaping/Fertilizer Education for Homeowners Constructed Wetland Sand Filters	Schedule of implementation to be determined based on effectiveness of the flow diversion and on-going requirements. Program effectiveness will be assessed on an on-going basis and findings will be reported yearly in the Annual Reports.
Implement Actions Aimed at Pollutant Reductions from Agricultural Runoff	
Agricultural Outreach and Education Pipeline Rehabilitation and Relining	Schedule of implementation to be determined based on effectiveness of the flow diversion and on-going requirements. Program effectiveness will be assessed on an on-going basis and findings will be reported yearly in the Annual Reports.

8 Salinas River Outfall - Plan Update

By January 15, 2017, the City of Salinas will submit an updated Plan for Central Coast Water Board Executive Officer approval that incorporates and addresses the results of three years of Salinas River outfall water quality monitoring data collection, and complies with the requirements of Order No. R3-2012-0005 Section E.12. The City will begin implementation of the updated Plan, according to the implementation schedule identified in the updated Plan, following Central Coast Water Board Executive Officer approval.

9 Summary

More data is needed to fully assess sources of the pollutants of focus, but monitoring results to date indicate that urban runoff is a source of pathogen indicators and orthophosphate and that groundwater infiltration is a source of nitrate and salts. At this time, monitoring results are insufficient to determine whether urban runoff and/or groundwater infiltration are significant sources of pesticides. Pollutant-source combinations were prioritized based upon beneficial use impairments and the magnitude of concentrations observed at the outfall and in the receiving water. Reduction actions have been identified and ranked to address each significant pollutant-source category but the results of future monitoring efforts (including an assessment of the effectiveness of the flow diversion and on-going requirements) will guide the selection of the BMPs that will ultimately be implemented to attain pollutant reduction.