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City of Oxnard

Public Works Integrated Master Plan

STORMWATER

PROJECT MEMORANDUM 5.4
TREATMENT ALTERNATIVES

FINAL DRAFT
December 2015

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City of Oxnard

Public Works Integrated Master Plan

STORMWATER

PROJECT MEMORANDUM 5.4
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ALTERNATIVES ANALYSIS

1.0 INTRODUCTION

The purpose of this Project Memo (PM) is to develop a list of stormwater projects to be included in the Capital Improvement Program (CIP) of the Public Works Integrated Master Plan (PWIMP) with associated project cost, timing, and drivers. The CIP is an estimate of the City's capital expenses over the next 25 years to address limitations, rehabilitation needs, and recommended improvements to the water and recycled water systems. The CIP is intended to assist the City in planning future budgets and making financial decisions.

1.1 PMs Used for Reference

The recommendations outlined in this PM may integrate with information from the following other PMs:

- PM 1.1 - Overall - Master Plan Process Overview.
- PM 1.4 - Overall - Basis of Costs.
- PM 5.1 - Stormwater System - Background Study.
- PM 5.2 -: Stormwater System - Infrastructure Modeling and Alternatives.
- PM 5.3 - Stormwater System - Condition Assessment.

1.2 Other Reports Used for Reference

In developing the stormwater options, recommendations from other reports were referenced to the existing stormwater system. The following reports are used in this PWIMP analysis:

- Indicator Bacteria Total Maximum Daily Load Draft Implementation Plan for the Lower Santa Clara River Watershed (County of Ventura, 2015).
- Revlon Slough and Beardsley Wash Trash TMDL (City of Oxnard, 2013).
- Feasibility of Using the Oxnard Advanced Water Purification Facility to Treat Storm Water from the J Street and Oxnard Industrial Drains (CH2M Hill, 2013).
- Surface Water and Groundwater Sampling and Analysis Results: Halaco Superfund Site Remedial Investigation (CH2M Hill, 2012).
- Master Plan of Drainage (Hawks and Associates, 2003).
- Green Alleys Plan Draft Report (SWA, 2015).

- Ormond Beach Wetland Restoration Feasibility Study (California State Coastal Conservancy, 2009).
- Stormwater Diversion White Paper (Carollo, 2010).

2.0 STORMWATER GOALS

In considering potential stormwater projects and the integration of these projects with the overall PWIMP, a number of goals were established to aid in alternatives development. The five main goals are as follows:

- Goal 1: Provide a compliant, reliable, resilient, and flexible system.
- Goal 2: Manage assets effectively (economic sustainability).
- Goal 3: Mitigate and adapt to potential impacts of climate change.
- Goal 4: Protect and enhance environmental and resource sustainability.
- Goal 5: Investigate green and grey infrastructure with an emphasis on energy efficiency.

These goals go further than simply maintaining the existing system. This PWIMP seeks to propose stormwater projects that could enhance the quality of stormwater entering the environment and potentially harvest some of that stormwater as an additional water supply. Through doing this, this PWIMP hopes to provide a more robust, adaptable, and cost efficient system overall.

3.0 FATAL FLAW ANALYSIS FOR STORMWATER OPTIONS

A number of potential stormwater projects were considered as part of the PWIMP planning process. The three main types of projects considered were: 1) projects that treated stormwater as an additional water source for harvest, 2) projects that enhanced stormwater quality to meet TMDL requirements, and 3) smaller scale projects that could be implemented at a local level in conjunction with the Green Alleys program. Once initial stormwater project options were identified, all options went through a fatal flaw screening to determine the most viable stormwater projects for further refinement. This section briefly describes the initial round of option development and screening.

3.1 Stormwater as a Water Source

3.1.1 <u>Diversion from Stormwater Channels</u>

Stormwater consists of both wet weather and dry weather flows. Wet weather flows from rainfall are what one normally associates with stormwater; however, dry weather flows from irrigation runoff, pool draining, washdown water, construction work, and other related activities also enter the stormwater collection system. In Oxnard, another component to dry weather flow is likely shallow groundwater infiltration.

There is the potential in Oxnard to divert a portion of this wet weather and/or dry weather flow from the stormwater collection system for treatment in the OWTP. This would not only create a water quality benefit to receiving waters, but would also create a supplementary water source, since OWTP effluent is sent to the AWPF for advanced treatment and reuse.

Water could be diverted from the stormwater collection system in a number of ways. Typically stormwater diversion structures in California are constructed by first screening water for trash and then pumping water from a stormwater pump station to a sanitary collection system. Alternatively, water can be diverted in an open channel by installing an inflatable dam or mechanical gate. Water that builds up behind the dam or gate is pumped into the sanitary collection system. The diverted stormwater is then treated downstream at a secondary and potentially tertiary waste water treatment plant.

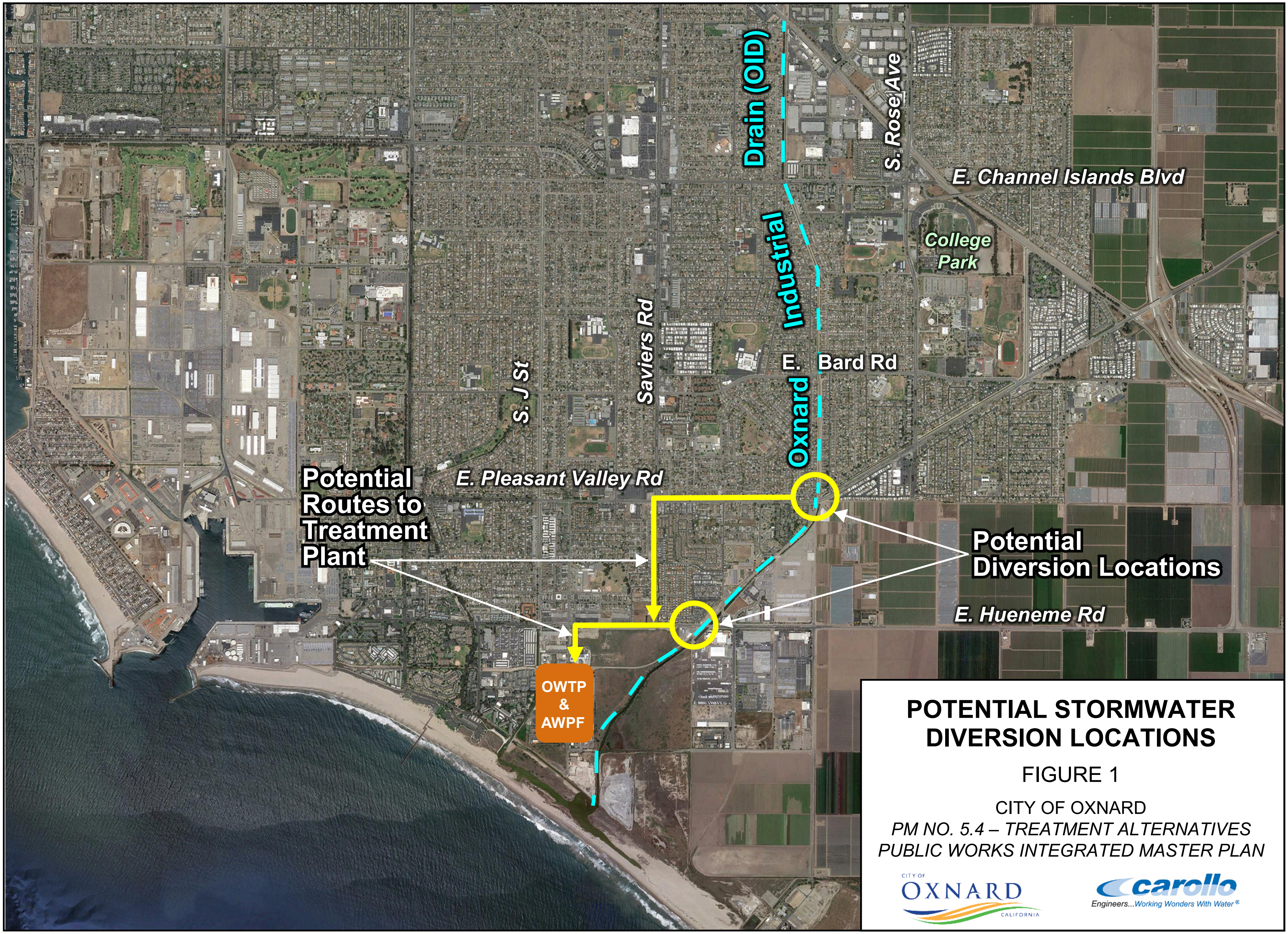
In Oxnard, because there are two major open stormwater channels that run near the OWTP, namely the J-Street Drain and the Oxnard Industrial Drain, installing a mechanical gate or inflatable dam in these channels was chosen for alternative development. Two potential locations for a diversion structure are shown in Figure 1. These locations were chosen for preliminary option development and cost estimating; however, if such a diversion structure was constructed, a more detailed technical analysis should be conducted to choose the optimal site. Diversion locations on the J Street Drain were not chosen based on CH2M Hill's 2013 report stating that only trace amounts of flow were observed in this drain during dry weather.

3.1.1.1 Wet-Weather Diversion

At either of the locations shown in Figure 1 it is possible to divert wet weather flows to the OWTP. However, it is rare for a wastewater treatment plant to accept wet weather stormwater flows. If such a diversion were constructed, a storage facility would be required to hold the wet weather stormwater flows until the OWTP had sufficient capacity to accept additional flow. Additionally, the diversion structures would need to be operated in such a way as to not capture the first flush of rainfall which is typically high in pollutant loading. Due to the expensive storage required and uncertainty in water quality and quantity, this option was not considered further at this time.

3.1.1.2 Dry-Weather Diversion

Diverting dry weather flow in the stormwater collection system is a much more common practice in California. Preliminary locations for a dry weather diversion are shown in Figure 1. Such a diversion could be used only when the OWTP has excess capacity and storage would not be required because dry weather flows in stormwater channels occur year-round. To prevent significant water quality degradation of OWTP influent, dry weather



POTENTIAL STORMWATER DIVERSION LOCATIONS

FIGURE 1

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diversions should be kept small in proportion to OWTP influent. This option is developed further in Section 4.1 below.

3.1.2 Ormond Beach Wetland Stormwater Capture

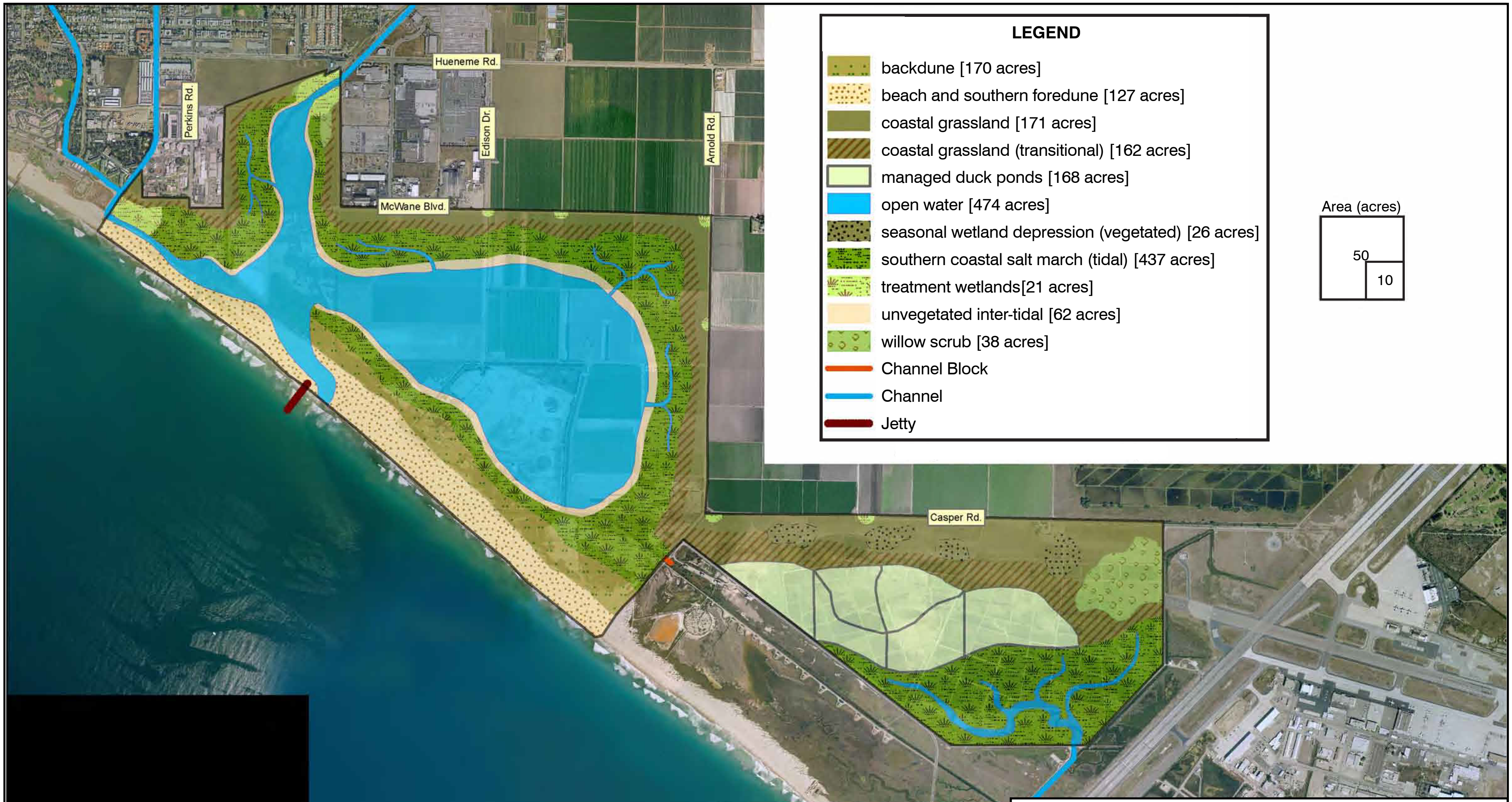
The Coastal Conservancy has identified Ormond Beach as the potential location for a major wetlands restoration project. Ormond Beach is at the mouth of the J-Street Stormwater Drain and the Oxnard Industrial Stormwater Drain. This location once had 1,100 acres of wetlands, but only 250 acres remain. The restoration of the Ormond Beach wetland is considered one of the most important wetland restoration efforts in Southern California by wetlands experts. Because of this, the Coastal Conservancy's goal is to restore at least 900 acres of wetlands and has already purchased 265 acres from Southern California Edison. Plans for this wetlands restoration project have been under consideration since the 1990s and a feasibility study was conducted in 2009.

Various wetland configurations were considered in this study, and one of the study's recommended configurations is shown in Figure 2. The timeframe for this restoration project is unknown at this time, but because one of the major water sources considered for this wetlands project is stormwater from the J-Street and Oxnard Industrial drains, this project is linked to any stormwater alternative considered in this PWIMP that affects water in these drainage systems.

One stormwater project considered in this PWIMP follows from the creation of wetlands at Ormond Beach. If these wetlands were constructed in a way that provides preliminary treatment and storage of stormwater, Oxnard could divert a portion of this stormwater flow downstream of the treatment wetlands through the OWTP and subsequently through the AWPF for reuse within the City. This could be an additional water source for the City of Oxnard. Because the wetlands could provide storage, and some initial treatment, the OWTP could divert stormwater flow after a storm has passed when wastewater flows have returned to normal levels, thus preventing overloading at the OWTP.

Additionally, excess dry weather flow from the stormwater channels, downstream of the treatment wetlands, could be diverted to the OWTP to potentially provide an additional water source for the City. However, since there is uncertainty surrounding the timing of these wetlands' construction and uncertainty surrounding regulatory feasibility, this option was not considered further at this time in the PWIMP. This option could be something to look at in the future; however, there will likely be regulation challenges associated with removing water from a wetland. Such challenges will need to be addressed if this option is to move forward.

As part of the original GREAT program, one thought was to discharge RO concentrate from the AWPF into the proposed wetlands. This option was not considered as part of this analysis, since this analysis focused on harvesting stormwater as an additional water source for the City.



N

0 1000 2000 4000

FEET

Source: "Ormond Beach Wetland Restoration Feasibility Study", Aspen Environmental Group 2009.

ONE POSSIBLE ORMOND BEACH WETLAND CONFIGURATION

FIGURE 2

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3.1.3 Percolation

As a preliminary option, stormwater diversion and percolation was also considered in Oxnard. The Woolsey Pits were chosen as one potential diversion and percolation location for this feasibility discussion. The location of the Woolsey Pits is shown in Figure 3. For this option stormwater would be diverted from local stormwater channels to the Woolsey Pits for preliminary treatment and subsequent percolation. While the stormwater channels nearby the Woolsey Pits collect a relatively large volume of stormwater, a diversion and pumping structure would likely be required for this option.

This option was not developed further as part of this PWIMP because the City of Oxnard sits on a perched, brackish aquifer that prevents recharge to the underlying deep aquifer used for Oxnard's water supply. Thus investing in percolation at the Woolsey Pits for stormwater would not help augment Oxnard's water supply. Additionally, extensive stormwater treatment would likely be required due to the uncertainty of stormwater quality.

3.1.4 Onsite Reuse and Deep Well Injection

Another option considered as part of this PWIMP is the use of stormwater for onsite reuse and as a water source for deep well injection. Onsite reuse was considered at two locations: 1) River Ridge Golf Course and 2) Seabee Golf Course. For both of these options, existing ponds would be used for stormwater storage prior to reuse. Additional ponds could be constructed as needed. Stormwater from nearby stormwater channels would be diverted to these existing ponds during wet weather flows. Pretreatment and pumping would likely be required for onsite reuse.

Deep well injection was also considered as a preliminary option for stormwater capture and reuse. For this option, stormwater would be diverted from a stormwater channel, treated, and injected into the local groundwater aquifer. Storage prior to injection would likely also be required.

Neither of these options was developed further at this time because they are not system-wide solutions and only address localized issues. Furthermore, extensive infrastructure would likely be required to treat the stormwater before reuse would be permitted. For deep well injection, regulations for a Class V well under the underground injection control (UIC) program apply. In California, the UIC program is administered jointly be the EPA Region 9 and the SWRCB. The injection of water must be protective of beneficial uses and anti-degradation policy applies. Since water would be injected into groundwater used as a municipal water supply the treatment requirements for injected stormwater would be extensive.

WOOLSEY PITS LOCATION

FIGURE 3

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3.1.5 City-Wide Incentive Program

A city-wide incentive program was also considered as a way to capture stormwater to offset potable water use. Such an incentive program would encourage new developers to invest in rainwater harvesting and onsite reuse. An incentive program would also allow interested residents the opportunity to retrofit their homes with rain barrels or rain cisterns. These measures would help decrease flooding overall and would encourage residents and developers to take a proactive stance on stormwater. This option is developed further in Section 4.2 below.

3.2 TMDL Compliance

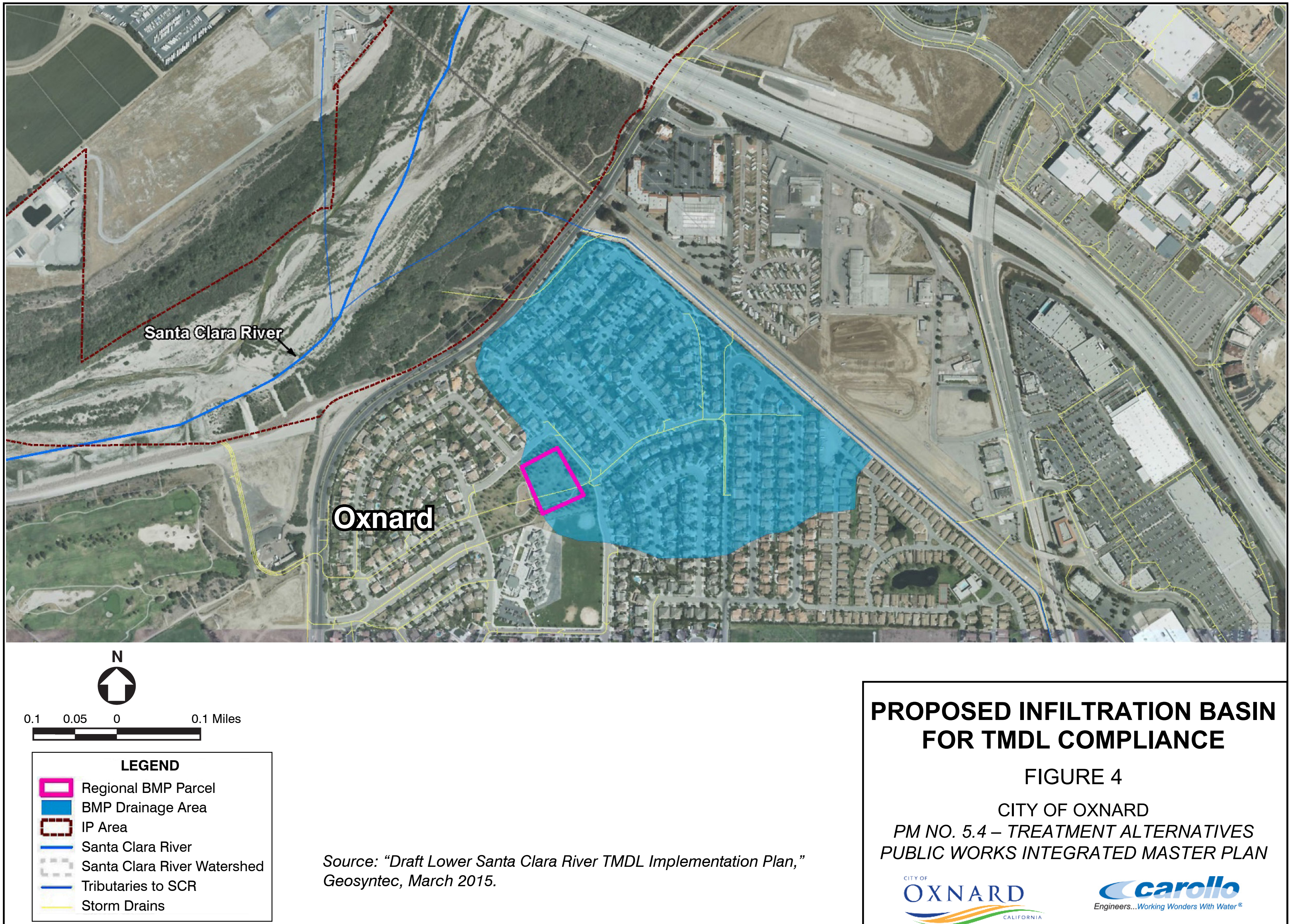
The Los Angeles Regional Water Quality Control Board (LARWQCB) adopted a Total Maximum Daily Load (TMDL) for Indicator Bacteria in the Santa Clara River Estuary which requires the participating agencies, of which Oxnard is one, to prepare an implementation plan that outlines proposed activities to achieve a reduction in bacteria load. A draft implementation plan was developed in March 2015. This plan identified locations for potential infiltration basins and subsurface infiltration basins for both dry and wet weather stormwater throughout the watershed. One of the locations identified was in the northern portion of Oxnard, just east of the River Ridge Golf Course. This location shown in Figure 4 is the proposed site for a subsurface infiltration basin. Details of the proposed basin can be found in the "Indicator Bacteria Total Maximum Daily Load Draft Implementation Plan for the Lower Santa Clara River Watershed" (County of Ventura, 2015). Implementation of this recommendation was considered as one of the options in the stormwater part of this PWIMP.

3.3 Integration with the Green Alleys Program

The City of Oxnard is also pursuing a study to identify alleys throughout the City that could be revitalized. Standard revitalization includes elevated crosswalks, curb ramps and striped crossings, sustainable paving, alley naming, pedestrian lights, and safety signs. While this is not directly connected to stormwater, the Green Alley's Plan also outlines additional improvements that include permeable paving, bioswales, and rain barrels. Based on the community outreach that was done as a part of this plan, these environmental improvements were ranked near the top in importance to community members. Further discussion on how the Green Alleys Plan is incorporated into this PWIMP effort can be found in PM 5.2 - *Stormwater System - Infrastructure Modeling and Alternatives.*

4.0 DEVELOPMENT OF STORMWATER PROJECTS

Three of the options discussed in the fatal flaw analysis were chosen for further development as part of this PWIMP. These options are: 1) Dry weather stormwater diversion, 2) City-wide incentive program, and 3) TMDL study and demonstration project. These three projects are discussed in detail below.



Source: "Draft Lower Santa Clara River TMDL Implementation Plan," Geosyntec, March 2015.

PROPOSED INFILTRATION BASIN FOR TMDL COMPLIANCE

FIGURE 4

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4.1 Project 1: Dry Weather Diversion

As discussed in Section 3.1.1.2 above, one potential stormwater project is a dry weather diversion in the Oxnard Industrial Drain (OID) nearby the OWTP. This diversion would provide an additional water source for the AWPF when flows are low at the OWTP. According to the "Feasibility of Using the Oxnard Advanced Water Purification Facility to Treat Storm Water from the J Street and Oxnard Industrial Drains" by CH2M Hill from 2013, the OID typically discharges around 1,250 gpm of flow during dry weather conditions. This equates to around 1.8 mgd, or almost 10 percent of the OWTP's average annual flow. Almost all of this flow could be harvested for reuse.

The OID discharges into a naturally occurring coastal lagoon, which is separated from the ocean by a sand berm. The berm is seasonally breached during the winter months, dropping the water level in the OID during the winter.

It is likely that a large portion of OID dry weather flows is shallow groundwater infiltration into the stormwater channels, as Oxnard buried pipes are in a shallow perched aquifer. Like the sanitary sewers in Oxnard that can have infiltration issues, the storm drains, which are not constructed to be water tight, can drain significant amount of groundwater. This is promising for a dry weather diversion because groundwater is typically of better quality than agricultural or commercial runoff. Essentially, the Oxnard stormwater network of pipes already acts as a shallow water groundwater drainage system. Currently, this shallow groundwater simply drains to the ocean.

4.1.1 Regulatory Considerations

Before this project could be implemented, the City should consider the effects of removing this dry weather storm channel flow could have on downstream habitat. While the OID is a man-made stormwater channel, it is unclear whether the State Water Resources Control Board (SWRCB) would classify it as having beneficial uses downstream. Any agency that reduces flows to downstream habitat would need to consider if this action is detrimental to the current ecosystems and may need to obtain a permit from the SWRCB. Currently the OID discharges to a lagoon, which is protected and since 2012 the lagoon berm cannot be intentionally breached, instead it must occur naturally to protect the ecosystem in the lagoon.

However, based on other Southern California agencies that implemented similar projects, the SWRCB has not historically required such permits since the diverted water would not have been put to beneficial use downstream. Additionally, constructing a diversion in a storm channel may be subject to permitting programs administered by the Regional Water Quality Control Boards, the Department of Fish and Game, and the U.S. Army Corps of Engineers. Such a diversion project would also likely need to undergo environmental review under the California Environmental Quality Act (CEQA).

4.1.2 Water Quality Considerations

There is not a lot of recent data on the dry weather pollutant loading in the OID. The Ventura County Watershed Protection District (VCWPD) submits an annual Ventura Countywide Stormwater Quality Management Program Report which records both wet and dry weather flows and pollutant concentrations in two stormwater channels in the City of Oxnard. One of these channels (MO-HUE) is located in the nearby Hueneme Drain which has the same ocean discharge location as the OID. The other monitored channel is the El Rio Drain (MO-OXN) which discharges to the Santa Clara River on the other side of the city. The VCWPD records pollutant data for three wet weather events and one dry weather even each year. Additionally, dry weather stormwater quality in the OID was recorded daily for a short period in March 2013 and from the end of 2009 to the beginning of 2010 as part of a CH2M Hill feasibility study done in 2013. This limited data along with the limited VCWPD data is compiled in Table 1.

Table 1 also shows typical OWTP pollutant loading. Although there is not a lot of dry weather stormwater channel load data available for the OID, based on what is available, pollutant concentrations from the OWTP influent and from the OID do not appear to be substantially different. This is not surprising since both sets of pipes (sanitary and storm) are installed at similar depths in similar locations and thus both will drain shallow groundwater.

While the majority of pollutant concentrations are similar, there does appear to be more metal loading in the OID than in the OWTP influent. It is possible that these elevated metal loadings are seeping in from contaminated groundwater from the superfund site downstream (Halaco Site). As stated in a 2012 Remedial Investigation, "impacts on surface water are probably limited to major storm events when discharge velocities in the OID are high and stormwater runoff overwhelms erosion control measures. Discharge of contaminated groundwater to surface water is also possible, particularly when surface water level drops after the naturally occurring sand berm is breached" (CH2M Hill, 2012). However, the study also states that "The general chemistry, radionuclide, and metals testing results from 2009 and 2010 do not indicate impacts to surface water in the OID, lagoon, or NCL East from Halaco's operations" (CH2M Hill, 2012).

More dry weather stormwater channel water quality data is needed before this project could move forward. Water quality in the OID also appears to be quite variable depending on sampling location. Some of the locations that were previously monitored are influenced by tidal conditions and backflow, depending on the season. Thus more data is needed to determine the optimal diversion location.

Table 1 Comparing Oxnard Dry Weather Stormwater Channel Flows to OWTP Influent Flow
Public Works Integrated Master Plan
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		MO-HUE	MO-OXN	IOD-A	IOD-B	OID 6	OID 7	OWTP Influent
Constituent	**Units**	**2010-2013**	**2010-2013**	**March 2013**	**March 2013**	**End of 2009 - Beginning of 2010**	**End of 2009 - Beginning of 2010**	**Varies**
Alkalinity as CaCO3	mg/L	102	233	-	-	255	250	404[(1)]
Aluminum	ug/L	-	-	443	30	84	50	-
Ammonia as N	mg/L	0.2	0.4	-	-	0.1	0.1	37[(2)]
Antimony	ug/L	-	-	0.4	0.5	0.4	0.3	ND[(3)]
Arsenic	ug/L	-	-	1.9	1.6	6.7	5.6	1.3[(3)]
Barium	ug/L	-	-	42	45	39	34	65[(1)]
Beryllium	ug/L	-	-	0.1	0.1	0.7	0.7	ND[(3)]
BOD	mg/L	3.7	3.7	-	-	-	-	299[(1)]
Boron	mg/L	-	-	1.5	1.5	-	-	300[(4)]
Bromide	mg/L	-	-	-	-	6.9	6.3	-
Cadmium	ug/L	-	-	0.6	0.2	0.5	0.27	ND[(3)]
Calcium	mg/L	72	132	351	481	314,5	383	184[(1)]
Chloride	mg/L	117	1808	-	-	1,060	610	559[(1)]
Chromium	ug/L	-	-	2.3	2.0	10	10	7.3[(3)]
Cobalt	ug/L	-	-	1.0	0.8	1.0	1.0	-
COD	mg/L	58	52	-	-	-	-	-
Copper	ug/L	-	-	9.2	3.5	3.6	4.0	112[(3)]
Cyanide[(2)]	mg/L	0.0027	0.0027	-	-	-	-	ND[(3)]
Dissolved Iron	mg/L	-	-	-	-	0.1	0.1	-
DO	%	7.8	7.0	-	-	-	-	-
E. Coli	MPN/100mL	1,915	1,566	-	-	-	-	-
Fecal Coliform	MPN/100mL	156	953	-	-	-	-	-

Table 1 Comparing Oxnard Dry Weather Stormwater Channel Flows to OWTP Influent Flow
Public Works Integrated Master Plan
City of Oxnard

Constituent	Units	MO-HUE	MO-OXN	IOD-A	IOD-B	OID 6	OID 7	OWTP Influent
		2010-2013	2010-2013	March 2013	March 2013	End of 2009 - Beginning of 2010	End of 2009 - Beginning of 2010	Varies
Fluoride	mg/L	1.1	0.8	-	-	-	-	0.64(1)
Hardness as CaCO3	mg/L	316	769	-	-	-	-	757(1)
Iron	mg/L	-	-	1.3	0.1	0.3	0.3	7.8(1)
Lead	ug/L	-	-	2.7	0.3	0.3	0.3	ND(3)
Lithium	mg/L	-	-	0.1	0.1	-	-	-
Manganese	ug/L	-	-	469	54	263	213	148(1)
Magnesium	mg/L	32	107	116	101	169	146	72(1)
MBAS	mg/L	0.2	0.2	-	-	-	-	-
Mercury	mg/L	-	-	0.0001	0.0001	0.0001	0.0001	0.0002(3)
Molybdenum	ug/L	-	-	35	52	-	-	19(1)
Nickel	ug/L	-	-	6.5	13	9.9	10.4	7.4(3)
Nitrate as N	mg/L	-	0.5	-	-	5.0	5.0	ND(1)
Oil and Grease	mg/L	-	1.3	<5	<5	-	-	45(4)
pH	pH Units	8.9	8.5	-	-	8.1	8.2	7.6(2)
Phenolics	mg/L	0.1	0.05	-	-	-	-	-
Phosphorus as P	mg/L	0.1	0.2	-	-	-	-	7.0(1)
Potassium	mg/L	-	-	10	11	28	18	36(1)
Salinity	mg/L	350	2,050	-	-	-	-	-
Selenium	ug/L	-	-	5.8	4.0	19	18	5.7(3)
Silicon	mg/L	-	-	5.2	14	-	-	-
Silver	ug/L	-	-	0.1	0.1	0.4	0.4	2.4(3)
Sodium	mg/L	-	-	276	186	711	493	398(1)

Table 1 Comparing Oxnard Dry Weather Stormwater Channel Flows to OWTP Influent Flow
Public Works Integrated Master Plan
City of Oxnard

		MO-HUE	MO-OXN	IOD-A	IOD-B	OID 6	OID 7	OWTP Influent
Constituent	**Units**	**2010-2013**	**2010-2013**	**March 2013**	**March 2013**	**End of 2009 - Beginning of 2010**	**End of 2009 - Beginning of 2010**	**Varies**
Strontium	mg/L	-	-	2.9	4.1	-	-	1.7(1)
Sulfate	mg/L	-	-	-	-	1,225	1,300	571(1)
Thallium	ug/L	-	-	>0.2	>0.2	0.53	0.53	ND(3)
TKN	mg/L	1.5	1.3	-	-	-	-	54(1)
Total Coliform	MPN/100mL	55,235	60,863	-	-	-	-	-
Total Dissolved Solids	mg/L	680	3,865	-	2,740	3,750	3,150	1,901(1)
Total Organic Carbon	mg/L	14	11	-	-	5.4	6.4	98(1)
Total Suspended Solids	mg/L	61	38	-	-	-	-	279(4)
TPH	mg/L	1.9	1.9	-	-	-	-	-
Turbidity	NTU	10	11	5.8	0.7	-	-	-
Vanadium	ug/L	-	-	48	2.5	2.0	2.0	-
Volatile Suspended Solids	mg/L	32	19	-	-	-	-	243(2)
Zinc	ug/L	-	-	10,800	4.0	34	34	180(3)

Notes:
ND = Not Detected.
Indicates lower concentration than OWTP Influent.
Indicates higher concentration than OWTP Influent.
(1) Sampling for the 2015 Local Limits Study.
(2) Sampling from 2010 to 2013.
(3) Sampling from 2013 to 2014.
(4) Sampling from 2010 to 2014.

If this project is implemented, water quality would need to be monitored for diversion to the OWTP. Additionally, the volume of dry weather stormwater channel flow sent to the OWTP should be kept low in proportion to wastewater influent to ensure dilution at the OWTP. However, exact percentages would be dependent on the quality of both flow streams (influent flow to the OWTP from the sanitary sewers and from the storm drain diversion). Figure 5 illustrates the locations of these four stormwater sampling sites within the Oxnard drainage system.

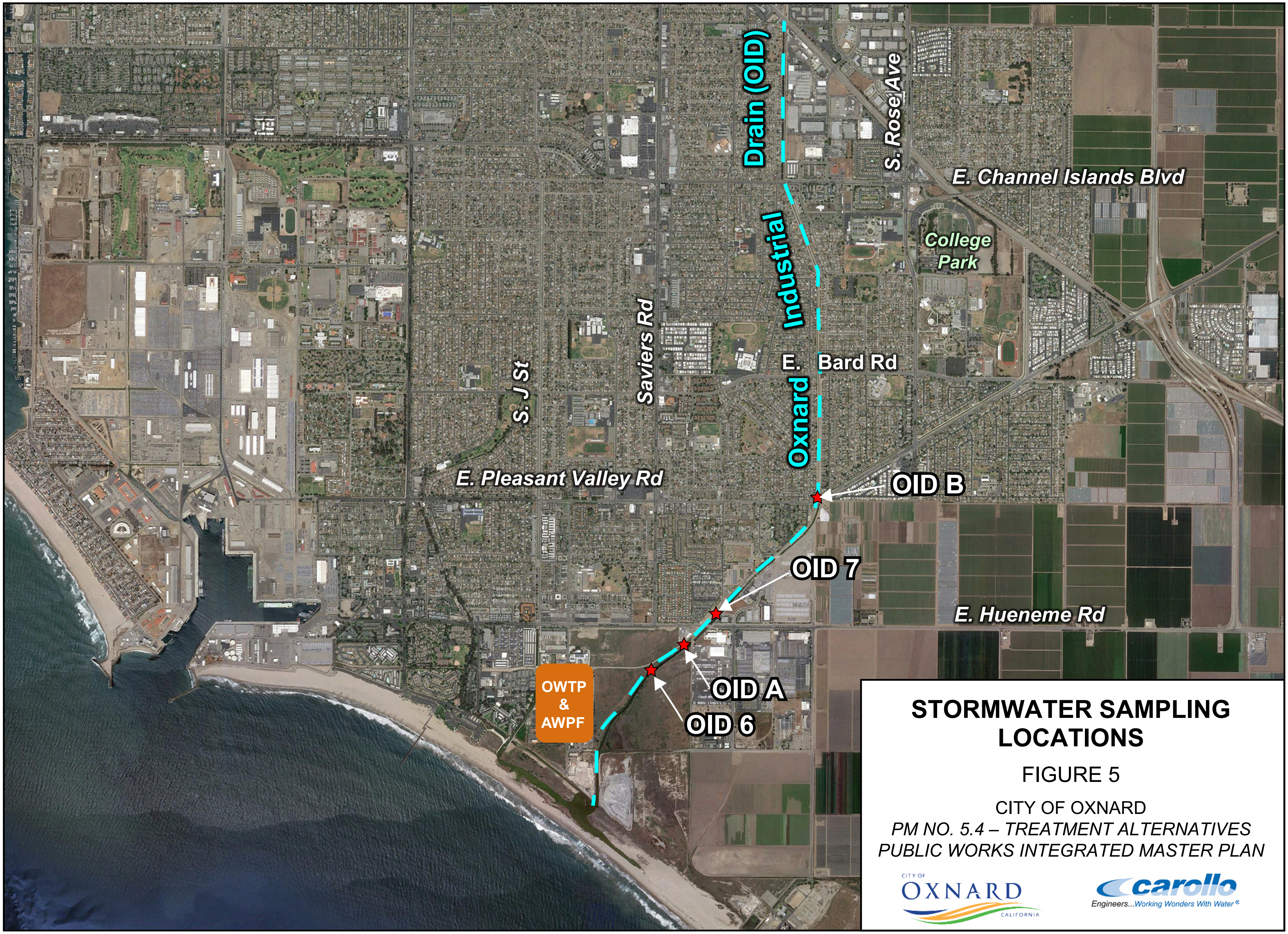
Since sampling location OID A or OID B represent feasible sites for a diversion location, the comparison of the water quality parameters at these locations to the OWTP influent is most appropriate at this time. Based on this preliminary data, roughly half of the measured constituents at these two sites have concentrations less than those observed in OWTP influent. Generally, even the constituents with higher concentrations in the stormwater channel have concentrations that are only moderately higher than those observed in the OWTP influent. Only Calcium, Lead, Molybdenum, and Zinc have substantially higher stormwater concentrations for this preliminary dataset. Total dissolved solids (TDS) concentration was also higher in stormwater channel flows, but at OID B it was only 40 percent higher.

4.2 Project 2: City-Wide Incentive Program

Another project the City of Oxnard could consider is the implementation of a city-wide incentive program to encourage citizens and developers to invest in onsite rainwater capture and use. There are many ways a City could encourage such rainwater collection. Discounted rain barrels and cisterns could be provided for purchase or a discount on water utilities bills could be offered. Such incentives could be provided for both existing land owners as well as developers.

The cost for such an incentive program depends entirely on the size of the program and how much the City is willing to offset. For the purpose of this master plan, it was assumed that approximately 20 percent of Oxnard households would take advantage of an incentive program and that they would purchase rain barrels or cisterns to capture approximately 20 percent of a 1-year 6-hour storm. Furthermore, it was assumed that the City would offset approximately 20 percent of the total cost for these rain barrels or cisterns.

Since the City of Oxnard is located on a shallow perched aquifer, this PWIMP recommends focusing any incentive program on onsite capture and use instead of infiltration. This focus will go the farthest in decreasing citizens' potable water use for landscape irrigation.



STORMWATER SAMPLING LOCATIONS

FIGURE 5

CITY OF OXNARD

PM NO. 5.4 – TREATMENT ALTERNATIVES

PUBLIC WORKS INTEGRATED MASTER PLAN

4.3 Project 3: TMDL Project

As proposed in the March draft of the Lower Santa Clara River TMDL Implementation Plan, one recommended project is an infiltration basin at South Bank Park in Oxnard. This infiltration basin would be sized to treat the 85th percentile volume from the local drainage area and would require approximately 85,000 square feet. This infiltration basin would be approximately 2 feet deep and infiltrate at a rate of 0.5 inches per hour. Currently the Lower Santa Clara River TMDL Implementation Plan recommends implementing this project by 2028.

5.0 PROJECT EVALUATION

5.1 Economic Analysis

A cost estimate of the three proposed projects was developed as part of the PWIMP. The costs were developed using factors outlined in PM 1.4, Basis of Cost, as well as cost information from past projects and the Lower Santa Clara River TMDL Implementation Plan. The costs for the three projects are shown in Table 2.

Table 2 Recommended Project Costs(1)
Public Works Integrated Master Plan
City of Oxnard

Projects	**Cost ($ M)**
Dry Weather Diversion Structure	$0.37
City-Wide Incentive Program	$2.42
TMDL Infiltration Basin	$1.85
Total Construction Cost	$4.65
Total Project Cost(2)	$5.76
Total O&M(3)	$0.08

Notes:
(1) Costs derived using the methodology outlined in PM 1.4, Overall - Basis of Cost.
(2) Project costs include project cost factor (as outlined in PM 1.4, Overall - Basis of Cost).
(3) O&M costs include only additional O&M costs from new capital improvement projects. See PM 8.0 for a detailed discussion of the overall O&M costs.

5.2 Non-Economic Considerations

In addition to the economic analysis, non-economic considerations were summarized that relate to the goals and objectives for the PWIMP, as noted in Section 2.0. That summary is included in Table 3. Using these non-economic considerations, along with the economic implications, a combined comparison was done to determine the full considerations for each project.

Table 3 **Non-Economic Considerations of Stormwater Projects**
Public Works Integrated Master Plan
City of Oxnard

	Dry Weather Diversion Structure	**City-Wide Incentive Program**	**TMDL Infiltration Basin**
Goal 1: Compliant, reliable, and flexible system	Moderate	Moderate	High
Goal 2: Economic sustainability	Moderate	Moderate	Low
Goal 3: Mitigate/adapt to climate change	Moderate	Moderate	Moderate
Goal 4: Resource sustainability	High	High	High
Goal 5: Energy efficiency	Moderate	High	High
Benefits	• Provides an additional water source for the AWPF • Relatively low cost compared to other recommended projects	• Encourages public participation • Reduces stormwater locally • Provides an additional water source for those who buy into the program	• Helps to achieve bacteria TMDL in the Santa Clara River
Drawbacks	• Are potentially diverting water from a downstream habitat • Water quality needs to be explored further	• Unclear how many citizens will participate • Hard to provide incentive for infiltration due to perched brackish aquifer	• Expensive

6.0 RECOMMENDED PROJECTS AND SCHEDULE

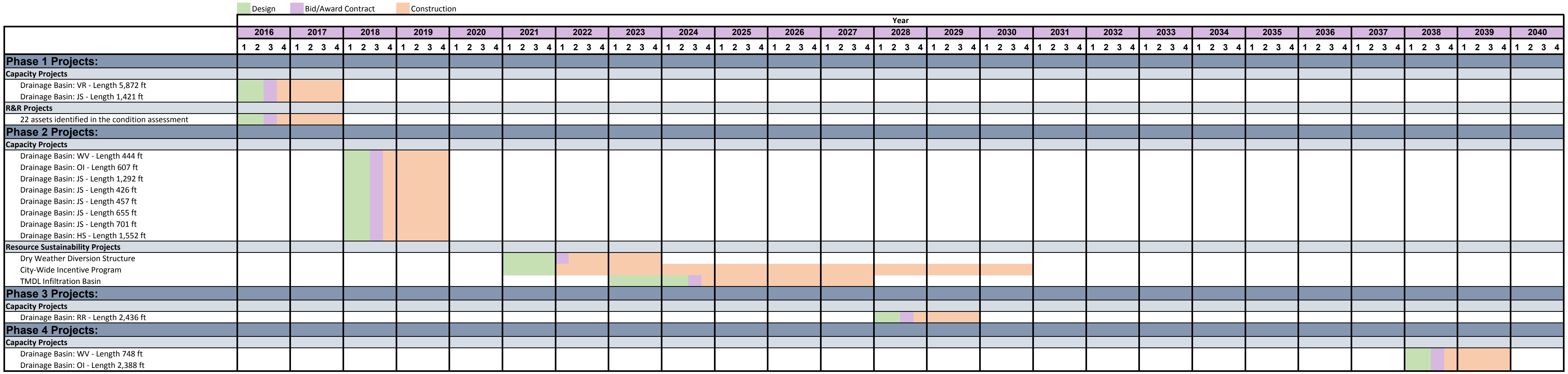
It is recommended that all three projects discussed here be further explored and potentially implemented in the future. If the City decides to move forward with these projects, Table 4 shows the recommended implementation year. Figure 6 shows a schedule for these projects as well as the capacity and R&R projects outlined in PM 5.2. The costs and timing presented in this PM represent Carollo's best professional judgment of the capital expenditure needs of the City and of the timing needed to maintain a reliable and compliant system that can meet current and future stormwater needs. Timing was set to align with the seven master plan drivers, namely: R&R, regulatory requirements, economic benefit, performance benefit, growth, resource sustainability, and policy decisions. Timing is also based on input from City staff and the condition assessments performed.

While the costs developed in this PM match the costs analyzed as part of the Cost of Service Study, the timing presented may differ. The Cost of Service Study will balance not only the CIP projects identified but also the rates and rate payer affordability based on a yearly balance and also the integrated costs for the different City funds and enterprises.

**Table 4 Recommended Project Start Year and Duration
Public Works Integrated Master Plan
City of Oxnard**

Projects	Start Year	Duration
Dry Weather Diversion Structure	2021	3
City-Wide Incentive Program	2021	10
TMDL Infiltration Basin	2023	5

Oxnard - Stormwater CIP Schedule



RECOMMENDED STORMWATER CIP SCHEDULE

FIGURE 6

CITY OF OXNARD
PM NO. 5.4 WASTEWATER
PUBLIC WORKS INTEGRATED MASTER PLAN

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