CITY OF OXNARD CALIFORNIA

MARCH 2017

Advanced Water Purification Facility

Indirect Potable Reuse Engineering Report Appendices

VOLUME 2 OF 2

carollo

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CITY OF OXNARD

ADVANCED WATER PURIFICATION FACILITY

INDIRECT POTABLE REUSE
POTABLE REUSE ENGINEERING REPORT

FINAL
VOLUME 2 OF
2
March 2017

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CITY OF OXNARD
ADVANCED WATER PURIFICATION FACILITY

INDIRECT POTABLE REUSE
POTABLE REUSE ENGINEERING REPORT

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APPENDIX A – INDIRECT POTABLE REUSE ENHANCED SOURCE WATER CONTROL AND COLLECTION SYSTEM MONITORING PROGRAM

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CITY OF OXNARD

ADVANCED WATER PURIFICATION FACILITY

INDIRECT POTABLE REUSE
ENHANCED SOURCE CONTROL AND COLLECTION SYSTEM MONITORING PROGRAM

SUPPLEMENTAL REPORT

DRAFT

March 2017

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CITY OF OXNARD

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INDIRECT POTABLE REUSE
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INDIRECT POTABLE REUSE ENHANCED SOURCE WATER CONTROL AND COLLECTION SYSTEM MONITORING PROGRAM

Acknowledgements: At the onset of this effort, Carollo and Oxnard staff reached out to the Orange County Sanitation District and the Los Angeles County Sanitation Districts for initial guidance on source control for potable water reuse. Their assistance was substantial and is appreciated.

The production of purified water starts with an effective source control program. This supplement goes beyond the existing approved source control program for Oxnard, hence the use of "Enhanced" in the title of this document. This Enhanced Source Control Program (ESCP) details the planned program to effectively monitor the industrial and municipal contributions to the Oxnard Wastewater Treatment Plant (OWTP) as it pertains to the forthcoming potable water reuse project. This document is intended as guidance to the City with proposed methods to monitor in numerous locations and proposed methods to trace pollutants to their source. Some changes to the monitoring and response recommendations will occur as the City gains more experience and moves forward with their forthcoming project.

Much of this ESCP details sampling efforts currently employed as part of the existing source control program and sampling efforts that are already required by DDW for finished water quality monitoring. This document is not recommending duplication of those efforts, but instead presents the overall collection and use of data to optimize source control.

1.0 DDW REGULATIONS

The regulatory requirements for wastewater source control are defined in the California Code of Regulations Section 60320.206 of the regulations for groundwater recharge with recycled water (DDW2014). For this project, the City must administer an industrial pretreatment and pollutant source control program. The City must implement and maintain a program that includes, at a minimum:

A. An assessment of the fate of chemicals and contaminants that are specified by the Department of Drinking Water (Department) and Regional Water Quality Control Board, Los Angeles Region (RWQCB) through the wastewater and recycled municipal wastewater treatment systems (addressed in Section 7).

B. Chemical and contaminant source investigations and monitoring that focuses on Department-specified and RWQCB-specified chemicals and contaminants (addressed in Sections 3 and 4).

C. An outreach program to industrial, commercial, and residential communities within the portions of the sewage collection agency's service area that flows into the water reclamation plant subsequently supplying the groundwater replenishment reuse project (GRRP), for the purpose of managing and minimizing the discharge of chemicals and contaminants at the source (addressed in Sections 5 and 6).

D. A current inventory of chemicals and contaminants identified pursuant to this section, including new chemicals and contaminants resulting from new sources or changes to existing sources, that may be discharged into the wastewater collection system (addressed in Section 5).

E. Is compliant with the effluent limits established in the wastewater management agency's RWQCB permit (addressed in Section 4).

This document is intended to address each of these items to the satisfaction of the Division of Drinking Water (DDW).

2.0 COLLECTION SYSTEM AND SECONDARY EFFLUENT SOURCE MONITORING PROGRAMS

The main purpose of any source control monitoring program is to protect public health. With potable reuse systems, it is even more imperative that all steps used to protect public health are taken. Title 22 requires a source monitoring and control program be implemented upstream of potable reuse systems. The City's current source water control program has been recently upgraded to include more stringent discharge limits and monitoring in the collection system. Suggestions to enhance the current collection system monitoring plan are included in this document.

While collection system pre-treatment programs and monitoring are important, secondary effluent is the source water to be used for IPR. The proposed enhanced source control program includes a specific contaminant inventory to be monitored in the secondary effluent as well as in the purified water. An action plan detailing when and how to trace contaminants back through the wastewater treatment plant and potentially into the collection system can be found in Section 5.

A generic example of how to trace industrial discharges from their source to the AWPF, based upon different constituent groups, is shown in Figure 1. Monitoring parameters vary by location, with more constituents being tested in the secondary effluent and purified water.

An effective enhanced source control program will have a monitoring and data analysis plan that starts with the first discharge of wastewater into the collection system all the way through to the final purification step at the AWPF. Key to this success is having a dedicated staff member heading up the program as the Source Control Program Manager (SCPM). A further job description for the SCPM is provided later in this document.

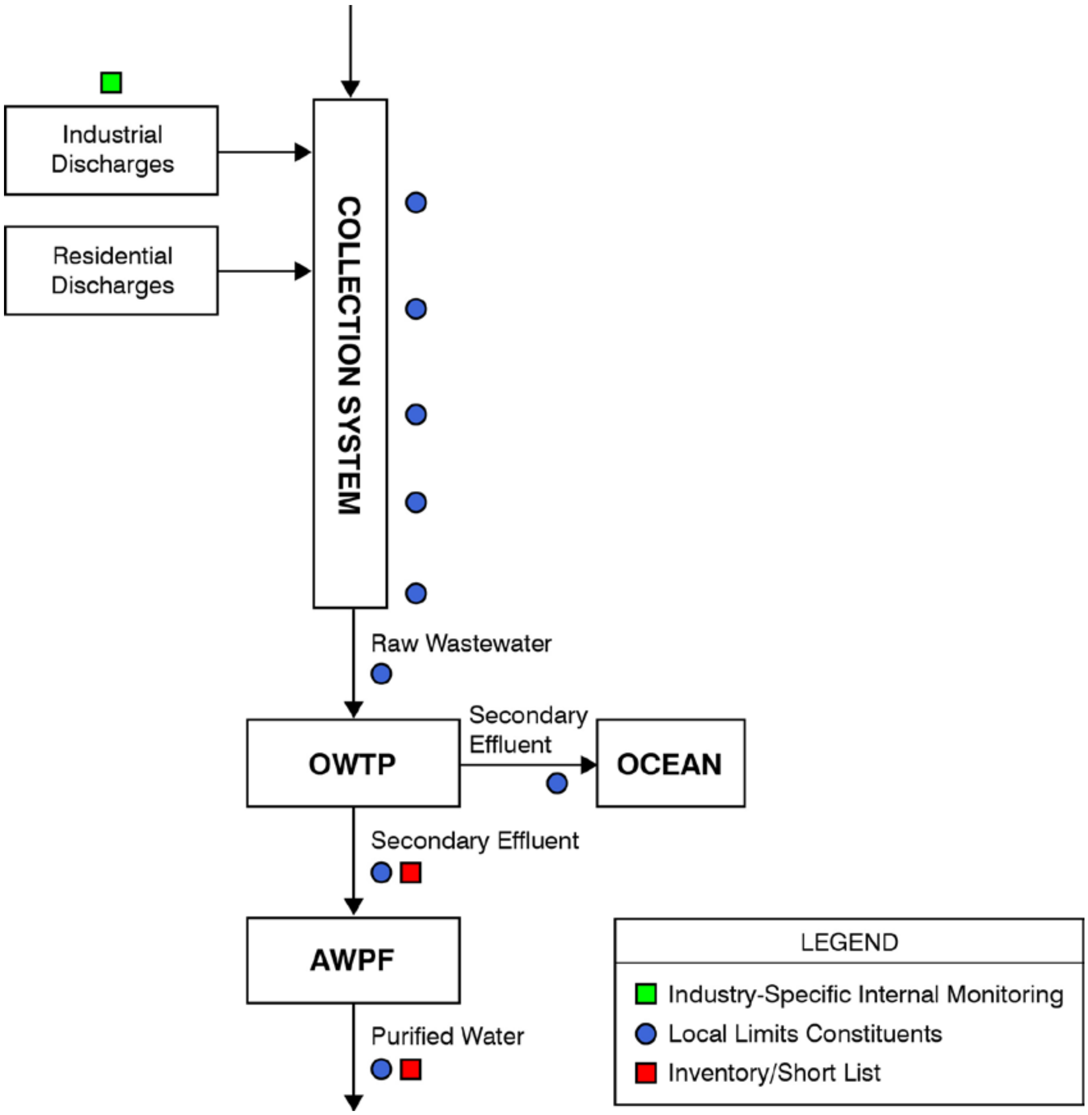

Figure 1 Dischargers, Sampling Locations and Monitoring Constituents Across the Collection and Treatment System.

3.0 EXISTING INDUSTRIAL PRETREATMENT AND COLLECTION SYSTEM SOURCE CONTROL PROGRAM OVERVIEW

The OWTP is permitted under Waste Discharge Requirements Order No. R4-2013-0094 (National Pollutant Discharge Elimination System [NPDES] No. CA0054097), issued to the City in June 2013, and operates an Environmental Protection Agency (EPA)-approved industrial pretreatment program. That program is operating based upon an approved Local Limits program (from 1999). Oxnard is now updating that Local Limits program. The City is undertaking such an effort in accordance with the permit, and will submit the proposed limits to the Los Angeles office of the RWQCB for approval. As part of this new Local Limits effort, the City and their contractors have performed detailed sampling efforts of the various industrial users and across the OWTP and the AWPF. The sampling plan included different sewer sampling sites for residential sampling as well as additional sites for industrial and commercial business sampling. A draft local limits report is now under evaluation by the City.

Elements of, and updates to, the City's current source control program are provided below.

3.1 Description of Industrial Users

The OWTP treats wastewater from the City and Port Hueneme as well as the Point Mugu Naval Base, Ventura County. Approximately 75 percent of this collected flow is residential. The remaining 25 percent is from industrial users.

Categorical Industrial Users (CIUs) are defined by the federal government and subject to categorical pretreatment standards established in the Code of Federal Regulations. Their discharge requirements are applicable nationwide and are based on best available technology. CIUs, by definition, are also defined as Significant Industrial Users (SIUs). There are typically other SIUs which may not be CIUs.

An industrial user is classified as a SIU if it meets any of the following:

- Is subject to categorical pretreatment standards under 40 CFR 403.6 and 40 CFR Section I, Subsection N.
- Discharges an average of 25,000 gpd or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blowdown wastewater).
- Contributes a process waste stream that makes up 5 percent or more of the average dry-weather hydraulic or organic capacity of the POTW treatment plant.
- Is designated as such by the POTW on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)].

There are thirty-five industries in the service area identified as SIUs discharging into the OWTP collection system, as shown in Table 1. Included in Table 2 are several dischargers not defined as SIUs, but are regulated under the Oxnard Local Limits program. For each discharger shown in the table below, pertinent details are included, such as Regulatory Classification, Wastewater Type, Type of Pretreatment, Potential Contaminants, Average Daily Flow (ADF), Location, and Oxnard permit number. Figure 2 shows the location of these customers within the Oxnard wastewater collection system.

Table 1 Industrial Dischargers to OWTP
Advanced Water Purification Facility
City of Oxnard

	Regulatory Classification	Categorical Standard[1]	Wastewater Type	Type of Pretreatment	Potential Contaminants[2]	ADF, kgal (Permit)	Address	Permit #
Aluminum Precision	SIU with Local Limits	Aluminum Forming	Aluminum Forming for Aerospace Automotive and Military Industries	Metals Precipitation, Filter Press, Ultra-Filtration and pH Adjustment	Cd, Cr, Cu, CN, Pb, Ni, O&G, pH, TTO, Zn, Flow	7	1001 McWayne Blvd.	74162
Arcturus	SIU with Local Limits	Aluminum Forming	Ferrous & Non-Ferrous Metals Forming	Settling Pond, Oil Skimming, pH Adjustment with H2SO4	Cd, Cr, Cu, CN, Pb, Ni, O&G, pH, TTO, Zn, Flow	25	6001 Arcturus Ave.	308
Boskovich Farms, Inc.	SIU with Local Limits	N/A	Food Processor; wash, cool, package	Screenings & Filtration	BOD, H2S, O&G, TSS, Flow	250	711 Diaz Ave.	23035
Cal Sun	SIU with Local Limits	N/A	Strawberry Food Processor	Activated Sludge	BOD, H2S, pH, TSS, Flow	32	511 Mountain View Ave.	87549
City of Oxnard Desalter	SIU with Local Limits	N/A	Water Treatment	None	TDS, pH, TSS, Flow	1,500	251 S. Hayes Ave.	23233
Coastal Green Vegetables	SIU with Local Limits	N/A	Food Processor; wash, cool, package, freeze	Activated Sludge	BOD, H2S, O&G, pH, TSS, Flow	220	605 Buena Vista Ave.	94108
Coastal Metal Finishing *(now owned by Limons Metal Finishing)*	Local Limits Only	Metal Finishing	Metal Finishing	Batch Treatment: pH Adjustment, Filtration, Ion Exchange, Evaporation, Solids Dewatering	Ag, CN, Cr, Cu, Pb, Ni, pH, TTO, Zn	4	1160 Mercantile St.	86037
Consolidated Precision Products	SIU with Local Limits	Metal Molding and Casting (Foundries)	Metal Molding & Casting	pH Adjustment	Cd, Cr, Cu, Pb, Ni, Ag, Zn, O&G, pH, TSS, TTO, Flow	30	705 Industrial Ave.	OC-25
Crestview Municipal Water Company	SIU with Local Limits	N/A	Filter Backwash	None	BOD, TSS, pH	Not Operating	602 Valley Vista	OC-5
Deardorf Farms	SIU with Local Limits	N/A	Food Processor; wash, cool, package	Clarifier	BOD, H2S, O&G, TSS, pH, Flow	10	400 N. Lombard	24330
Duda Farms	SIU with Local Limits	N/A	Food Processor	Screening	BOD, H2S, TSS, pH, Flow	37	860 Pacific Ave.	87287
EF Oxnard	SIU with Local Limits	Steam Electric Power Generating	Steam Electric Power Generation; cooling tower blowdown, reverse osmosis reject	None	Cd, Cr, Cu, Pb, Ni, O&G, pH, TTO, Zn, Flow	15	550 Diaz	85723
Elite	SIU with Local Limits	Metal Finishing	Metal Finishing	Batch Treatment: pH Adjustment, Filtration, Ion Exchange, Evaporation, Solids Dewatering	Ag, CN, Cr, Cd, Cu, Pb, Ni, pH, TTO, Zn	14	540 Spectrum Circle	69418
Frozsun Foods, Inc. *(Sunrise Growers 3rd St.)*	SIU with Local Limits	N/A	Food Processor	Rotating Hydrosieve, Biological	BOD, H2S, pH, TSS, O&G, Flow	350	808 E. Third St.	60905
Frozsun, Inc. *(Sunrise Growers Sturgis)*	SIU with Local Limits	N/A	Food Processor; wash, cook, pack	Bio Reactors, Clarification, pH Adjustment	BOD, H2S, TSS, pH, Flow	40	2640 Sturgis Rd.	103247
Gills Onions	SIU with Local Limits	N/A	Food Processor; onion washing, cutting and packaging	Screening, Biological Treatment, Settling/Clarification	BOD, H2S, O&G, TSS, pH, Flow	250	901 Pacific Ave.	57277
Harris Water Conditioning	SIU with Local Limits	N/A	Water Softener Regenerator	Gravity Separator, Settling Tanks	BOD, H2S, O&G, pH, TSS, TDS, Flow	138	1025 S. Rose	2072
Herzog	SIU with Local Limits	N/A	Winery	Gravity Separator, pH Adjustment	BOD, H2S, pH, TSS, Flow	11	3201 Camino Del Sol	84360
J.M. Smuckers Co.	SIU with Local Limits	N/A	Food Processor; wash, process, package	Activated Sludge	BOD, H2S, pH, TSS, Flow	148	800 Commercial Ave.	88262
Limons Metal Finishing, Inc.	SIU with Local Limits	Metal Finishing	Metal Finishing	Batch Treatment: pH Adjustment, Filtration, Ion Exchange, Evaporation, Solids Dewatering	Ag, CN, Cr, Cu, Pb, Ni, pH, TTO, Zn	4	1160 Mercantile St.	26531
Mission Linen	SIU with Local Limits	N/A	Commercial Laundry	pH Adjustment, Gravity Separation, DAF and Filtration	BOD, O&G, pH, TSS, Flow, H2S, Temperature	39	505 Maulhardt	533
Naval Base Ventura Cty - Point Mugu Facility	SIU with Local Limits	N/A	Domestic/Commercial	Settling	BOD, Cd, Cu, Pb, O&G, H2S, pH, TSS, TTO, Zn, Flow	382	Bldg. 64, Point Mugu	OC-2
Naval Base Ventura Cty - Port Hueneme Facility	SIU with Local Limits	N/A	Domestic/Commercial	None	BOD, Cd, Cr, Ag, Cu, Pb, Ni, O&G, H2S, pH, TSS, TTO Zn, Flow	650	Mills Road Bldg. 1430, Port Hueneme	OC-04
New Indy	SIU with Local Limits	Pulp, Paper and Paperboard	Pulp, Paper, and Paperboard Processing	Activated Sludge	BOD, H2S, O&G, pH, TSS, TTO, Flow, PCP, TCP	309	5936 Perkins Rd.	100024
Oxnard Lemon Co.	SIU with Local Limits	N/A	Food Processor; wash, process, package	Activated Sludge, Clarification	BOD, H2S, O&G, pH, TSS, Flow	35	2001 Sunkist Circle	13266
Pacific Ridge Farms *(now owned by Frozsun)*	Local Limits Only	N/A	Food Processor; wash, cool, pack	Bio Reactors, Clarification, pH Adjustment	BOD, H2S, TSS, pH, Flow	30	2640 Sturgis Rd.	96073
Parker Hannafin	SIU with Local Limits	N/A	Membrane and Filter Manufacturing	Reverse Osmosis, Vacuum Distillation and UV Advanced Oxidation	BOD, TTO, O&G, pH, TSS, Zn	26	2340 Eastman	88211

Table 1 Industrial Dischargers to OWTP
Advanced Water Purification Facility
City of Oxnard

	Regulatory Classification	Categorical Standard(1)	Wastewater Type	Type of Pretreatment	Potential Contaminants(2)	ADF, kgal (Permit)	Address	Permit #
Port Hueneme Water Agency	SIU with Local Limits	N/A	Water Treatment	None	TDS, pH, TSS, Flow	650	5751 Perkins Rd.	56788
Proctor and Gamble	SIU with Local Limits	Pulp, Paper and Paperboard	Pulp, Paper and Paperboard Processing	Gravity Separation, Filtration, Dewatering, Equalization, Neutralization	BOD, H2S, O&G, pH, TSS, TTO, Flow, PCP, TCP	1,376	800 N. Rice	4438
Puretec Industrial	SIU with Local Limits	N/A	Water Softener Regenerator	pH Adjustment	BOD, H2S, O&G, pH, TSS, Flow	100	3151 Sturgis Rd.	56690
Raypak	SIU with Local Limits	Metal Finishing	Metal Finishing	Chemical Precipitation, Neutralization, Settling/Clarification, Filter Press, Filtration	O&G, Cd, Cr, Cu, CN, Pb, pH, Ni, Ag, TTO, Zn	11	2151 Eastman	64517
Saticoy Lemon	SIU with Local Limits	N/A	Food Processor; wash lemons, box and package	Biological Control, Clarification, Aeration, Screening	BOD, H2S, O&G, TSS, pH, Flow	50	600 E. Third St.	1345
Scarborough Farms, Inc.	SIU with Local Limits	N/A	Food Processor; vegetable washing, packaging	None	BOD, H2S, pH, TSS, Flow	17	731 Pacific Ave.	57313
Seaboard Produce	SIU with Local Limits	N/A	Food Processor	Settling, Clarification	BOD, H2S, O&G, TSS, Flow	6	601 Mountain View	9866
Seminis	SIU with Local Limits	N/A	Seed Processing	Batch Treatment, Precipitation, Clarification, pH Adjustment, Solids Removal, Ozone	BOD, H2S, TSS, pH, Flow, Zn, TTO, COD, O&G	19	2700 Camino Del Sol	47449
Simba Cal	SIU with Local Limits	Metal Finishing	Metal Finishing	None	Cd, Cr, Cu, Pb, Ni, Ag, Zn, CN, TTO, pH	0.75	1680 Universe Circle	32321
Terminal Freezers (Del Mar, Sun Coast, Tree Top)	SIU with Local Limits	N/A	Food Processor	Activated Sludge, Hydrosieve	BOD, H2S, pH, TSS, O&G, Flow	730	1300 E. Third St.	98242
Ventura Pacific	SIU with Local Limits	N/A	Food Processor; (processing & packaging of lemons)	Activated Sludge, Screening and Clarification	BOD, H2S, O&G, TSS, pH, Flow	70	245 E. Colonia Rd.	26979

Notes:
(1) N/A indicates the industry is not federally regulated.
(2) All TTOs required for monitoring are included in Table 3, with corresponding federal categorical standards, where applicable. TTO requirements for non-federally regulated industries are determined by the POTW and will be updated with the Local Limits study.

Table 2 Industrial Discharge Customers and Corresponding Numbers to Figure 2
Advanced Water Purification Facility
City of Oxnard

INDUSTRIAL CUSTOMERS	
No.	Name
1	Aluminum Precision Products
2	Arcturus Manufacturing
3	Automobile Racing Products
4	Boskovich Farms
5	Cal Sun Produce
6	City of Oxnard Blending Station 3
7	City of Oxnard Desalter
8	Coastal Green Vegetable Company
9	Coastal Metal Finishing
10	Consolidated Precision Products
11	Crestview Municipal Water Company
12	Deardorf Farms
13	Duda Farm Fresh Foods
14	EF Oxnard
15	Elite Metal Finishing
16	Frozsun Foods
17	Frozsun Inc
18	Gill's Onions
19	Harris Water Conditioning
20	Herzog Wine Cellars
21	J.M. Smucker Co.
22	Limons Metal Finishing, Inc.
23	Mission Linen Supply
24	Naval Base Ventura County - Point Mugu Facility
25	Naval Base Ventura County - Port Hueneme Facility
26	New Indy
27	Oxnard Lemon Co.
28	Pacific Ridge Farms
29	Parker Hannifin
30	Port Hueneme Water Agency
31	Proctor and Gamble
32	Puretec Industrial Water
33	Raypak

Table 2 Industrial Discharge Customers and Corresponding Numbers to Figure 2
Advanced Water Purification Facility
City of Oxnard

INDUSTRIAL CUSTOMERS	
No.	Name
34	Santa Clara Waste Water Co.[(1)]
35	Saticoy Lemon #4
36	Scarborough Farms
37	Seaboard Produce Distributors
38	Seminis
39	Simba Cal
40	Terminal Freezer
41	Ventura Pacific Co.

Notes:
(1) Santa Clara Waste Water Co.'s permit is suspended.

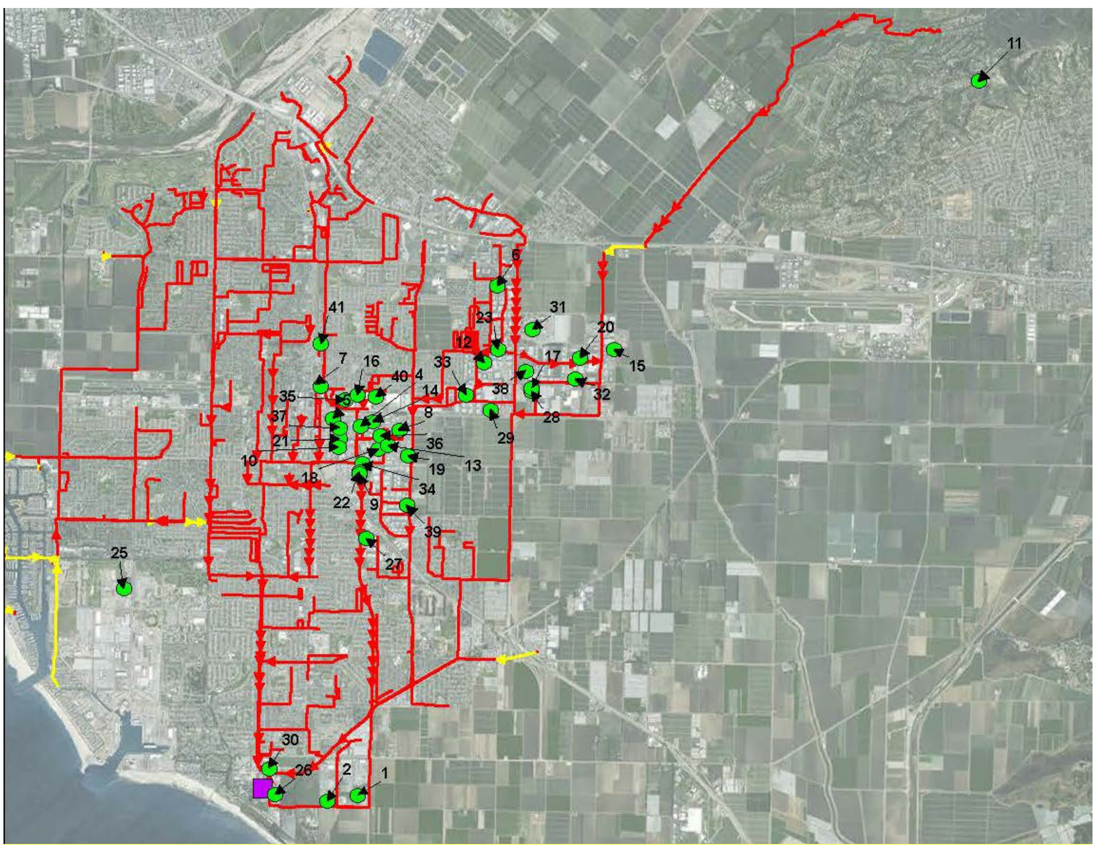

Figure 2 Oxnard Collection System with SIUs

3.2 Source Control Program Description

Oxnard's Source Control Program was established as part of the City's industrial pretreatment program, to prevent contaminants from entering the sewer system that could negatively impact the wastewater treatment process or reclaimed water quality. The source control program was also designed to protect the public and environment as well as OWTP personnel from harmful industrial waste. To achieve these goals, the City adopted a Sewer Ordinance within Section 19, Article 1 of the Oxnard Code of Ordinances. *Although not specifically designed to address potable water reuse, Oxnard's existing source control program is intended to protect OWTP effluent, which is the source to the AWPF.* The proposed source control program specifically tailored to potable water reuse is detailed further on in this document.

3.2.1 <u>Local Limits Evaluation</u>

A Local Limits Evaluation Report was created in 1999 to determine allowable contaminant concentrations in industrial wastewater. The Local Limits Evaluation Report is now being updated (September 2015 Draft).

3.2.2 <u>Permitting of Industrial Users</u>

All SIUs are required to obtain an Industrial Wastewater Discharge Permit from the Oxnard City Manager. Permits are issued for up to five-year periods and contain both effluent limits and sampling requirements. These limits can be both local and federal. SIUs are required to submit their permit application at least 90 days before any proposed discharge. Table 2, above, includes all industrial dischargers permitted by the City.

3.2.3 <u>Industrial Waste Monitoring</u>

Oxnard's monitoring program provides necessary information for evaluating industry compliance, assessing OWTP loading and operation, and determining illicit discharges. SIUs are monitored via three mechanisms: self-monitoring, monitoring by the City, and surveillance sampling.

Self-monitoring is required for each SIU. The Industrial Wastewater Discharge Permits mandate daily flow monitoring as well as bi-monthly contaminant sampling. Each month the SIU must submit a Surveillance Monitoring Report to the City. Typical parameters for which dischargers must sample include: Biological Oxygen Demand (BOD), TSS, Total Toxic Organics (TTO), Oil and Grease, and pH. Industry specific metal monitoring is often also mandated. Monthly TTO monitoring may not be required if TTO samples contain less than 1.0 mg/L, and in this case, only yearly samples are necessary. The following Table 3 contains a list of all TTOs and the corresponding industry category that requires monitoring.

Table 3 Industrial Discharge Monitoring Requirements for TTOs
Advanced Water Purification Facility
City of Oxnard

Total Toxic Organics (TTOs)	Aluminum Forming	Metal Finishing	Metal Molding and Casting (Foundries)	Steam Electric Power Generating	Pulp, Paper and Paperboard	Centralized Waste Treatment
1,1,1-trichloroethane		X	X	X		
1,1,2,2-Tetrachloroethane		X		X		
1,1,2-trichloroethane		X		X		
1,12-benzoperylene (benzo(ghi) perylene)		X		X		
1,1-dichloroethane		X		X		
1,1-dichloroethylene		X		X		
1,2,4-trichlorobenzene		X		X		
1,2,5,6-dibenzanthracene (dibenzo(a,h)anthracene)		X		X		
1,2-benzanthracene (benzo(a) anthracene)		X		X		
1,2-dichlorobenzene		X		X		
1,2-dichloroethane		X		X		
1,2-dichloropropane		X		X		
1,2-dichloropropylene (1,3-dichloropropene)				X		
1,2-diphenylhydrazine	X	X		X		
1,2-trans-dichloroethylene		X		X		
1,3-dichlorobenzene		X		X		
1,3-Dichloropropylene (1,3-dichloropropene)		X				
1,4-dichlorobenzene		X		X		
11,12-benzofluoranthene (benzo(b) fluoranthene)				X		
11,12-Benzofluoranthene (benzo(k)fluoranthene)		X				
2,3,4,6-tetrachlorophenol					X	
2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD)		X		X		
2,4,5-trichlorophenol					X	
2,4,6-trichlorophenol		X	X	X	X	X
2,4-dichlorophenol		X		X		
2,4-dimethylphenol		X	X	X		
2,4-dinitrophenol		X		X		
2,4-dinitrotoluene	X	X		X		
2,6-dinitrotoluene		X		X		
2-chloroethyl vinyl ether (mixed)		X		X		
2-chloronaphthalene		X		X		
2-chlorophenol	X	X		X		
2-nitrophenol		X		X		
3,3-dichlorobenzidine		X		X		
3,4,5-trichlorocatechol					X	
3,4,5-trichloroguaiacol					X	
3,4,6-trichlorocatechol					X	
3,4,6-trichloroguaiacol					X	
3,4-Benzofluoranthene (benzo(b) fluoranthene)	X	X		X		

Table 3 Industrial Discharge Monitoring Requirements for TTOs Advanced Water Purification Facility City of Oxnard

Total Toxic Organics (TTOs)	Aluminum Forming	Metal Finishing	Metal Molding and Casting (Foundries)	Steam Electric Power Generating	Pulp, Paper and Paperboard	Centralized Waste Treatment
4,4-DDD (p,p-TDE)		X		X		
4,4-DDE (p,p-DDX)		X		X		
4,4-DDT		X		X		
4,5,6-trichloroguaiacol					X	
4,6-dinitro-o-cresol		X		X		
4-bromophenyl phenyl ether		X		X		
4-chlorophenyl phenyl ether		X		X		
4-nitrophenol		X		X		
Acenaphthene	X	X	X	X		
Acenaphthylene	X	X		X		
Acrolein		X		X		
Acrylonitrile		X		X		
Aldrin		X		X		
Alpha-BHC		X		X		
Alpha-endosulfan		X		X		
Anthracene	X	X	X	X		
Antimony				X		
Arsenic				X		
Asbestos				X		
Benzene		X	X	X		
Benzidine		X		X		
benzo (a)anthracene (1,2-benzanthracene)			X			
Benzo(a)pyrene (3,4-benzo-pyrene)	X	X	X	X		
benzo(ghi)perylene	X					
Benzo(k)fluoranthene	X					
Beryllium				X		
Beta-BHC		X		X		
Beta-endosulfan		X		X		
Bis (2-chloroethoxy) methane		X		X		
Bis (2-chloroethyl) ether		X		X		
Bis (2-chloroisopropyl) ether		X		X		
Bis (2-ethylhexyl) phthalate	X	X	X	X		X
Bromoform (tribromomethane)		X		X		
Butyl benzyl phthalate		X	X	X		
Cadmium				X		
Carbazole						X
Carbon tetrachloride (tetrachloromethane)		X		X		
Chlordane (technical mixture and metabolites)		X		X		
Chlorobenzene		X	X	X		

Table 3 Industrial Discharge Monitoring Requirements for TTOs
Advanced Water Purification Facility
City of Oxnard

Total Toxic Organics (TTOs)	Aluminum Forming	Metal Finishing	Metal Molding and Casting (Foundries)	Steam Electric Power Generating	Pulp, Paper and Paperboard	Centralized Waste Treatment
Chlorodibromomethane		X		X		
Chloroethane		X		X		
Chloroform (trichloromethane)		X	X	X		
Chromium				X		
Chrysene	X	X	X	X		
Copper				X		
Cyanide, Total				X		
Delta-BHC (PCB-polychlorinated biphenyls)		X		X		
dibenzo(a,h)	X					
Dichlorobromomethane		X		X		
Dieldrin		X		X		
Diethyl Phthalate	X	X	X	X		
Dimethyl phthalate		X		X		
Di-N-Butyl Phthalate	X	X	X	X		
Di-n-octyl phthalate		X		X		
Endosulfan sulfate	X	X		X		
Endrin	X	X		X		
Endrin aldehyde	X	X		X		
Ethylbenzene	X	X		X		
Fluoranthene	X	X	X	X		X
Fluorene	X	X	X	X		
Gamma-BHC (lindane)		X		X		
Heptachlor		X		X		
Heptachlor epoxide (BHC-hexachlorocyclohexane)		X		X		
Hexachlorobenzene		X		X		
Hexachlorobutadiene		X		X		
Hexachlorocyclopentadiene		X				
Hexachloroethane		X		X		
Hexachloromyclopentadiene				X		
Indeno (,1,2,3-cd) pyrene (2,3-o-pheynylene pyrene)	X			X		
Indeno(1,2,3-cd) pyrene (2,3-o-phenlene pyrene)		X				
Isophorone	X	X		X		
Lead				X		
Mercury				X		
Methyl bromide (bromomethane)		X		X		
Methyl chloride (chloromethane)		X				
Methyl chloride (dichloromethane)				X		
Methylene chloride (dichloromethane)		X	X	X		
Naphthalene	X	X	X	X		

Table 3 Industrial Discharge Monitoring Requirements for TTOs
Advanced Water Purification Facility
City of Oxnard

Total Toxic Organics (TTOs)	Aluminum Forming	Metal Finishing	Metal Molding and Casting (Foundries)	Steam Electric Power Generating	Pulp, Paper and Paperboard	Centralized Waste Treatment
n-Decane						X
Nickel				X		
Nitrobenzene		X		X		
N-nitro sodi phenyl amine	X					
N-nitrosodimethylamine		X		X		
N-nitrosodi-n-propylamine		X		X		
N-nitrosodiphenylamine		X		X		
n-Octadecane						X
o-Cresol						X
Para-chloro meta-cresol (p-chloro-m-cresol)	X	X	X	X		
PCB-1016 (Arochlor 1016)	X	X		X		
PCB-1221 (Arochlor 1221)	X	X		X		
PCB-1232 (Arochlor 1232)	X	X		X		
PCB-1242 (Arochlor 1242)	X	X		X		
PCB-1248 (Arochlor 1248)	X	X		X		
PCB-1254 (Arochlor 1254)	X	X		X		
PCB-1260 (Arochlor 1260)	X	X		X		
p-Cresol						X
Pentachlorophenol		X		X	X	
Phenanthrene	X	X	X	X		
Phenol	X	X	X	X		
Pyrene	X	X	X	X		
Selenium				X		
Silver				X		
TCDD					X	
TCDF					X	
Tetrachlorocatechol					X	
Tetrachloroethylene	X	X	X	X		
Tetrachloroguaiacol					X	
Thallium				X		
Toluene	X	X	X	X		
Toxaphene		X		X		
Trichloroethylene	X	X	X	X		
Trichlorophenol					X	
Trichlorosyringol					X	
Vinyl chloride (chloroethylene)		X		X		
Zinc				X		

To help ensure the validity of self-monitoring results, sampling and analyses for required chemicals must be performed by a California state-certified laboratory, acceptable to the City's Technical Services Program – Source Control (TSP-SC), in accordance with 40 CFR, Part 136.

In addition to industry self-monitoring, the City conducts facility sampling twice per year. The sampling location is outlined in each SIU's permit.

To facilitate detection of illegal discharges of prohibited materials into the collection system, surveillance monitoring is also conducted. Such monitoring is performed if the City suspects illegal dumping or if there are complaints.

3.2.4 Slug Control

A slug load or slug discharge is defined as any discharge which would cause a violation of the industrial pretreatment program, either by a flow violation or an exceedance of contaminant concentration limit. Slug loads can be caused by accidental spills or batch discharges of irregular nature, causing a drastic increase in contaminant concentration (slug) to occur in the collection system. Slug loads by definition are not routine or predictable. If an event occurs that may cause a slug discharge, the industrial user must notify the city manager immediately. The City Manager is then responsible for assessing the severity of the load and once identified, taking appropriate measures to ensure public safety and optimal operations. This may involve diverting the wastewater treatment plant effluent flow or purified water flow until the slug load has been processed appropriately.

It is recommended that the City should require all SIUs to develop and submit a Slug Discharge Control (SDC) Plan. The slug control plan would be reviewed and updated by the source control program manager as needed.

3.2.5 Inspection of Industries

Annual SIU inspections are conducted by City staff. Such inspections allow for the investigation of SIU permit compliance. These inspections also help identify if a SIU is responsible for treatment plant upsets. Additionally, the inspections act as industrial outreach efforts and help disseminate information on technical issues such as permit requirements and pollution prevention opportunities.

3.2.6 Centralized Waste Treatment

Oxnard has one of the largest centralized waste treatment (CWT) facilities in California within their service area (Santa Clara Wastewater). CWTs treat hazardous and nonhazardous wastes (e.g. industrial tank residuals called "tank bottoms", oil field operations wastes, etc.). They are regulated under 40 CRF 437, and are managed by POTWs through their industrial pretreatment programs. The major issue surrounding the acceptance by POTWs of the discharge from CWT facilities, especially Subcategory D facilities that accept multiple wastestreams, is their potential impact on water reuse programs. An explosion occurred at the Santa Clara Wastewater facility, a CWT that receives hauled waste from many sources, treats those wastes, then discharges them into the Oxnard collection system. The cause of the accident has been attributed to the unsafe mixture of specific chemicals with domestic sewage.

In response to the explosion event, Carollo prepared Best Management Practices (BMP) policy for CWTs on behalf of the City, which, were then endorsed by the California Association of Sanitation Agencies (CASA). Carollo surveyed six POTWs regarding CWTs in their service areas. Carollo contacted and received help from POTWs that have CWTs; including OCSD, LACSD, City of LA, the City of San Jose, and Oxnard. The BMP for CWTs is attached as Appendix A to this document. Oxnard has implemented this BMP for any CWT within its collection system. Key elements of the BMP are:

- Waste Receiving Requirements - including manifests for haulers, testing of hauled waste before disposal, prohibition of specific activities, and allowance for random sampling.
- Treatment Requirements - treatment meeting EPA standards under 40 CFR 437, emergency shutoff, treatment reliability and redundancy, prohibition of holding tanks for dilution, and recording of treatment system operations details.
- Effluent Discharge and Sampling/Testing Requirements - continuous discharge prohibited, batch tanks continuously mixed, sampling and analysis before discharge required, reprocessing if necessary.
- Recommended Certification and Documentation Requirements - requirements for certifications, plans, procedures, O&M, treatment system details, documentation of all waste haulers, and testing and monitoring requirements.

3.2.7 Enforcement

The 2013 OWTP Annual Pretreatment Report identified 42 total industrial dischargers having 49 total violations (with zero penalties or legal action required), and 3 industrial dischargers with significant non-compliance necessitating public notification. If an SIU violated its permit, a written Notice of Violation (NOV) is sent to the SIU. The SIU then has 10 days to submit an explanation of violation and a plan for correction. For BOD and TSS limit violations, the SIU is surcharged based on a predetermined formula. For other exceedances, increasing enforcement action is taken as necessary. Such actions can include discontinuing sewer or water service, a cease and desist order, issuance of a fine, or termination of permission to discharge to the system. Sections 19, Article 1, Divisions 8 through 10 of Oxnard's Municipal Code outline all the allowable enforcement actions.

4.0 COLLECTION SYSTEM AND OWTP WATER QUALITY RESULTS

4.1 Industrial Sampling Program

As a requirement of their local limits update, the City conducted an extensive wastewater sampling program to characterize pollutant loadings and process removals to develop scientifically-based local limits in Fall 2015. In addition to this study, the City performed routine monitoring for NPDES permit requirements as well as industrial discharge constituents. OWTP's routine influent monitoring is conducted at the headworks of the plant, which is downstream of plant recycled flows.

4.1.1 Prior Incident of Pass-Through with Gross Beta Radioactivity

On September 4th, 2014 analytical results showed an exceedance of the OWTPs gross-beta NPDES defined permit limit. The gross-beta sample concentration was 94 pCi/L and the permit requirement was 50 pCi/L. The sample was taken one month prior on August 5th during a routine semiannual sampling event at the OWTP. Oxnard's Technical Services Program found hydraulic fracturing fluids to be a potential source of gross-beta contaminant. Wastewater staff then collected wastewater samples at City Water Yard and SCWW (both known to discharge this type of contaminants) on Wooley Road. Following analytical results reported on October 14, 2014, monitoring staff were informed that the Santa Clara Wastewater (SCWW) sample port had a gross-beta concentration of 4400 pCi/L. The next day on October 15, 2014, the staff convened a meeting to determine an action plan.

On October 16, 2014 additional samples were taken upstream of the SCWW site to track the source of the gross-beta discharge into the Santa Clara collection system. Green Compass, the parent company of SCWW, was identified as the responsible discharger, stating that Vintage Productions, an industrial customer of SCWW, was the point source into their facility. A Cease and Desist order was issued to Green Compass, who immediately complied with the order. Continuous gross-beta monitoring was conducted near the sampling site for the following months, and a NOV was issued to SCWW for violations on sample dates 9/24, 10/16, 10/22 and subsequently 10/28, 11/6, and 11/13.

Shortly thereafter (11/2014), the aforementioned accident at the SCWW occurred and the Oxnard City Manager issued a suspension of discharge permit and prohibited SCWW from discharging any wastewater into the Oxnard Collection System.

4.2 Industry Water Quality Results

Industrial pretreatment programs are in place and additional pretreatment and auditing programs are recommended as part of this enhanced source control program as detailed in Section 5. Table 4 contains a list of detected industrial discharge contaminants from 2013-2014. The permit limits for these industries are being updated (Local Limits Report),

Table 4 Industry Water Quality Data 2013-2014 for all Industrial Dischargers to the City of Oxnard WWTP
Advanced Water Purification Facility
City of Oxnard

Industry Name	2013 ADF	Avg BOD	Avg pH	Avg TSS	Avg H2S	Avg O&G	TDS	TTO	Cd	Cr	Cu	Pb	Zn	Ni	Ag	CN-	As	Sb	Ar	Co	Hg	Sn	Ti	V
	gpd	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Industries																								
Alliance Finishing & Manufacturing	--																							
Aluminum Precision Products	7,000	N/A	7.8	9	NA	4	2,063		0.0023	0.007	0.021	0.0075	0.21	0.0118		0.004								
Arcturus Manufacturing	25,000	N/A	8.3	NA	NA	14	N/A		0.004	0.01	0.04	0.009	0.008	0.065		0.004								
Automotive Racing Products*																								
Boskovich Farms	250,000	364	N/A	176	0.10	6	N/A																	
Cal Sun Produce	32,000	171	7.3	135	0.1	7	N/A																	
Coastal Green Vegetable Co.	220,000	219	7.2	300	0.02	5	N/A																	
Coastal Metal Finishing/Limons Metal Finishing	1,000	N/A	7.8	N/A			N/A	1	0.0200	0.2000	0.5000	0.0800	0.6000	1.3000	0.0200	0.0050	0.1000							
Consolidated Precision Products	11,907																							
Deardorff Family Farms	10,000	31	7.9	46	0.1	6	N/A	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Duda Farm Fresh Foods	37,000	507	7.3	156	0.02	9	N/A																	
EF Oxnard	15,000	N/A	7.7	N/A	0.20	4	2,842		0.0103	0.0403	0.0245	0.0528	0.1841	0.0263										
Elite Metal Finishing	14,000	N/A	8.1	N/A	NA	NA	N/A		0.01	0.06	0.1	0.03	0.14	0.15	0.01	0.03								
Frozsun Foods	350,000	371	7.2	119	0.10	N/A	N/A																	
Gill's Onions	250,000	185	7.5	53	0.38	5	N/A																	
Harris Water Conditioning	138,000	2	6.9-8.5	19	0.10	3	20,883	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Herzog Wine Cellars	10,000	2,187	7.2	190	0.5	6	N/A	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
J.M. Smucker Co.	148,000	139	7.7	224	0.12	4	N/A	na																
Mission Linen Supply	39,000	217	7.4	134	0.02	41	N/A	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
New Indy	300,000	28	7.4	26	0.04	5	3,390	0.67	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Oxnard Lemon Co.	35,000																							
Pacific Ridge Farms	30,000	559	6.9	322	0.25	6	N/A	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Parker Hannifin	26,000	995	6.8	8	NA	5	N/A	0.037					0.05											
Proctor and Gamble	1,400,000	112	6.2-9.3	214	0.02	23	N/A	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Puretec Industrial Water	100,000	14	6.3-9.3	43	0.02	5	N/A	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Raypak	11,000	N/A	6.8-9.9	N/A	NA	6	N/A	0.03	0.02	0.06	0.02	0.05	0.12	0.04		0.031								
Saticoy Lemon #4	50,000	131	8.3	214	0.1	15	N/A																	
Scarborough Farms	17,000	25	7.2	432	0.1	NA	N/A																	
Schlumberger Technology																								
Seaboard Produce Distributors	25000																							
Seminis	19,000	156	8.1	455	0.1	17	N/A	0.46					0.29											
Simba Cal	750	N/A	9.3	N/A	NA	NA	N/A	<1 mg/l	0.01	0.052	0.67	0.05	0.21	0.027	0.013	0.005								

Table 4 Industry Water Quality Data 2013-2014 for all Industrial Dischargers to the City of Oxnard WWTP
Advanced Water Purification Facility
City of Oxnard

Industry Name	2013 ADF	Avg BOD	Avg pH	Avg TSS	Avg H2S	Avg O&G	TDS	TTO	Cd	Cr	Cu	Pb	Zn	Ni	Ag	CN-	As	Sb	Ar	Co	Hg	Sn	Ti	V
	gpd	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Terminal Freezer (Del Mar, Suncoast, Tree Top)	730,000	84	8.0	102	N/A		N/A																	
Ventura Pacific Co.	70,000	408	7.6	88	0.12	13																		
Other Agencies																								
City of Oxnard Desalter	1,500,000	N/A	7.2	5	N/A	N/A	1,580																	
Crestview Municipal Water Co.	0																							
NBVC Point Mugu	223,722																							
NBVC Port Hueneme	452,807																							
Port Hueneme Water Agency	347,947																							
Santa Clara Waste Water Co.	150,000	185	7.7	26	0.02	5	N/A	0.34	<0.01	0.01	0.02	0.03	0.06	0.01	0.01			<0.05	<0.01	<0.005	<0.005	0.01	0.01	0.03

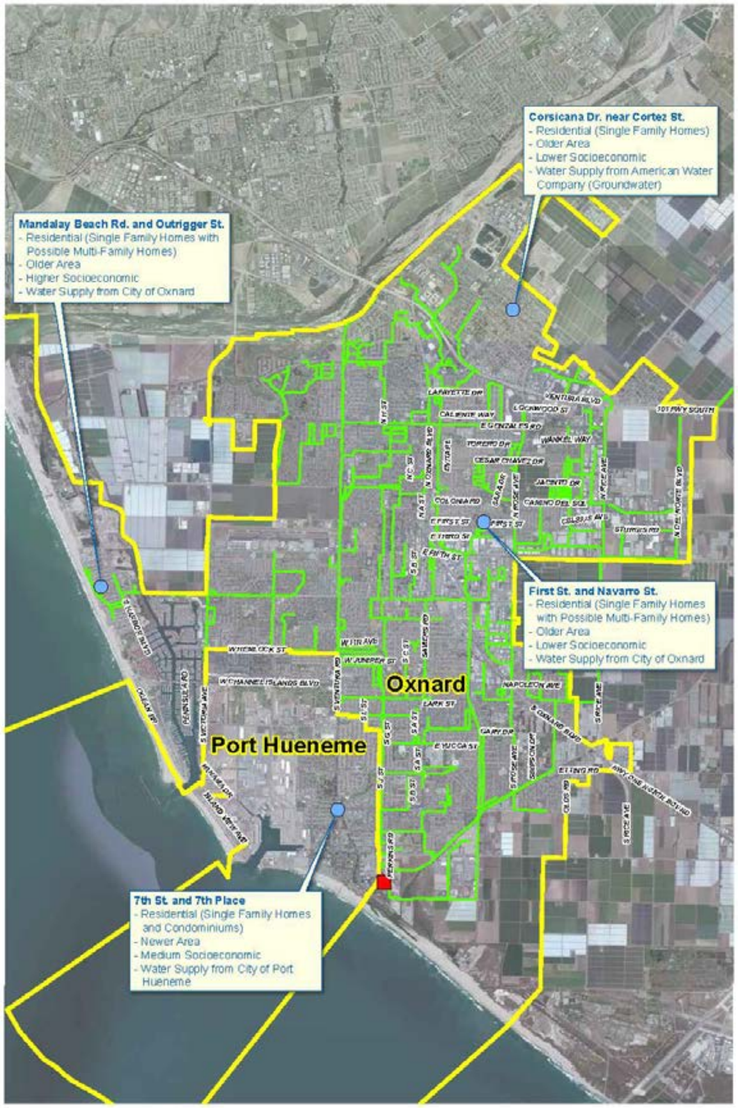

Figure 3 Four Residential Sampling Locations Included in the Local Limits Study

and for some more stringent limits are to follow. All collection system monitoring samples are tested for the constituents listed, however, many of the industries do not produce or use these contaminants in their processes as shown by the blank cells. Internal monitoring program data is also available in the Local Limits study and internal auditing can take place by the SCPM when collection system monitoring data does not align.

4.3 Residential (only) Water Quality Results

The domestic/residential sectors of the service area had not been sampled in over 15 years prior to the recent Local Limits study. Four sampling locations were chosen for the study, based on collection system discharges and trunk lines (Figure 3). Concentrations from residential dischargers for a limited set of constituents tested are shown in Table 5, below.

These results provide baseline concentrations for OWTP influent monitoring, allowing the isolation of industrial and domestic discharge inputs.

Table 5 Residential Wastewater Concentrations from 4 Sampling Locations Listed in Figure 3
Advanced Water Purification Facility
City of Oxnard

Constituent	Units	Average	Geometric Mean
Ammonia Nitrogen	mg/L	39	38
Antimony Total	ug/L	1.011	1.009
Arsenic Total	ug/L	2.31	2.09
Barium Total	ug/L	45.46	40.1
Beta, Gross	pCi/L	21.96	21.04
Biochemical Oxygen Demand	mg/L	258	248
Boron Total	mg/L	0.77	0.76
Cadmium Total	ug/L	0.505	0.504
Calcium Total	mg/L	98	88
Chloride	mg/L	123.1	116.8
Chromium Total	ug/L	1.39	1.24
Copper Total	ug/L	89.04	75.48
Fixed Dissolved Solids	mg/L	839	776
Fluoride	mg/L	0.54	0.53
Gross Alpha	pCi/L	3.55	3.44
Iron Total	mg/L	0.93	0.56
Lead Total	ug/L	1.81	1.54
Magnesium Total	mg/L	34.1	30.4
Manganese Total	mg/L	0.043	0.037
Mercury	ng/L	23.43	6.08
Molybdenum Total	ug/L	10.53	9.45
Nickel Total	ug/L	6.99	6.68
Potassium Total	mg/L	21.7	21.3
Selenium Total	ug/L	5.4	5.35
Silica	mg/L	27.8	26.5
Silver Total	ug/L	0.508	0.507
Sodium Total	mg/L	151.4	148.5
Specific Conductance	umho/cm	1689	1659
Strontium	mg/L	0.91	0.81
Sulfate	mg/L	325.4	284.7
Total Dissolved Solids	mg/L	1252	1187
Total Kjeldahl Nitrogen	mg/L	61	59
Total phosphorus as P	mg/L	7.3	7
Total Suspended Solids	mg/L	241	211
Uranium	ug/L	5.07	4.3
Zinc Total	ug/L	177.46	161.77

Notes: Concentrations were averaged for all 5 sampling locations for all dates tested.

4.4 Raw Wastewater Water Quality Results

As part of the Local Limits discharge update study, raw wastewater was tested for regulated, industrial and NPDES contaminants. Results are included in the Local Limits study. ***It is important to note that although many contaminants were tested for, few were found at detectable concentrations in the raw wastewater.*** This provides a further level of confidence for downstream treatment and secondary effluent source protection.

5.0 PROPOSED ENHANCED SOURCE CONTROL PROGRAM FOR POTABLE REUSE

Title 22 Regulations require a source control program to be in place prior to operating an IPR facility. As previously discussed, Oxnard's current source control program meets all of the requirements, however, an enhanced source control program (ESCP) is recommended as an additional barrier for producing purified water from IPR. An ESCP would build on an existing source control program in place, with increased monitoring frequency and an additional location, secondary effluent. The following section provides a framework for an ESCP, which could be implemented in Oxnard.

5.1 Source Control Program Manager

The current structure of the source control program at the City of Oxnard includes multiple points of contact covering the collection system, wastewater treatment plant, drinking water treatment plant and groundwater injection. In order to ensure all data is reported, logged and analyzed, a Source Control Program Manager (SCPM), acting as a single point of contact should be hired into a full-time position and charged with the following tasks:

- Collect and log all data from the collection system, OWTP, AWPF and groundwater monitoring program.
- Analyze online data for trends indicating potential upsets in the treatment process.
- Report any concerns, issues, and violations to City management. Any finished water violations would be reported by other City staff to the RWQCB.
- Plan and facilitate all industrial stakeholder workshops.
- Plan and oversee all residential outreach efforts.
- Ensure staffing needs are met for industrial audits, collection system sampling and outreach efforts.
- Update any new industrial dischargers or housing developments to source control program.
- Ensure all SIUs report monthly and annual TTO monitoring results.
- Annual review of slug discharge control plans from SIUs.

Data collected and provided to the SCPM will be analyzed under the supervision of this person to create baseline trends and identify when there are outliers, events, or a constituent is slowly increasing in the treatment process. All information from the pretreatment program, wastewater, AWPF, drinking water and compliance/permitting processes must go through the SCPM. The SCPM should have a second in command who is knowledgeable about the status of the source control program in the event the SCPM is not available. Having a single point of contact will contribute to risk mitigation by allowing for early detection of trends, monitoring efforts and process upsets.

5.2 Recommended Parameters, Detection Levels, and Methods

Monitoring wastewater influent, secondary treated wastewater, RO concentrate and AWPF water in one program can pose challenges due to analytical methods. The same contents could be monitored in each water type, but will likely require at least 2 different methods, if not 4. Methods for detecting all Title 22 monitored constituents in RO concentrate (very low water quality) and purified water (very high water quality) exist, but prove to be challenging due to their unique water qualities. Current analytical monitoring practices are described in detail below.

5.2.1 General Monitoring Provisions

General monitoring provisions proposed by the City include flow rate and water quality of the secondary effluent, AWPF finished water, receiving groundwater supply and production (ASR) wells. This enhanced source control document focuses on secondary effluent and AWPF finished water quality.

Compliance with RWQCB waste discharge requirements (WDRs) will be evaluated based on the analytical monitoring data. Monitoring reports produced by the SCPM will include at a minimum:

- Analytical results across the collection system through AWPF finished water (see Section 7.2).
- A clear map identifying the location of each sampling station, including groundwater monitoring and production wells (details following permit approval)
- Analytical test methods used and corresponding method report limits (MRLs).
- Name(s) and copies of laboratory certifications granted by the DDW's Environmental Laboratory Accreditation Program (ELAP).
- Quality assurance and control information.

Brief details about analytical testing methods and reporting are included in subsequent sections.

5.2.2 Sampling and Analytical Protocols

Though not required to be included in the monitoring reports unless specifically requested by DDW or the RWQCB, the City will have in place sampling protocols including procedures for handling, storing, testing, and disposing of purge and decontamination waters generated from sampling events. For groundwater monitoring, the sampling protocols will outline the methods and procedures for: measuring water levels; purging wells; collecting samples; decontaminating equipment; containing, preserving, and shipping samples; and maintaining appropriate documentation such as Chain of Custody (COC).

All wastewater samples and industrial wastewater samples will use the methods and QA/QC procedures contained in 40 CFR Part 136. All purified water samples will be analyzed and use the QA/QC procedures included in 40 CFR Part 141.

Where no methods are specified for a given pollutant, by methods approved by the DDW, RWQCB, and/or SWRCB. The City will select the analytical methods that provide MRLs lower than the limits prescribed in the WDR or as low as possible that will provide reliable data.

The City will instruct outside contract laboratories to establish calibration standards so that the MRLs (or its equivalent if there is a different treatment of samples relative to the calibration standards) are the lowest calibration standard. At no time will analytical data extrapolated from below the calibration curve be used.

5.2.3 QA/QC Procedures

The RWQCB, DDW and the SWRCB Quality Assurance Program may specify maximum MRLs in any of the following situations:

- When the pollutant has no established method under 40 CFR 141.
- When the method under 40 CFR 141 for the pollutant has a MRL higher than the limit specified in the WDR.
- When the City proposes to use a test method that is more sensitive than those specified in 40 CFR Part 141.

For regulated constituents, the laboratory conducting the analyses will be certified by ELAP or approved by the DDW, LARWQCB, and/or SWRCB for a particular pollutant or parameter.

Samples will be collected with method specific containers and preservatives and analyzed within defined holding time limits as specified in 40 CFR Part 141. All QA/QC analyses will be run simultaneously with collected samples. The City SCPM will retain the QA/QC documentation in its files and make those files available for inspection and/or submit them when requested by the RWQCB or the DDW. Proper chain of custody procedures will be followed and a copy of this documentation will be submitted with the quarterly report.

5.2.4 Unregulated Chemical Procedures

For unregulated chemical analyses, the City will select methods according to the following approach:

- Use drinking water methods, if available and matrix appropriate.
- Use DDW-recommended methods for unregulated chemicals, if available and matrix appropriate.
- If there is no DDW-recommended or approved drinking water method for a chemical, then City staff will use the method that results in the lowest MRL for that chemical in the applicable matrix.
- If there is more than a single USEPA-approved method available, the most sensitive of the USEPA-approved methods for the applicable matrix will be used.
- If there is no USEPA-approved method for a chemical in the applicable matrix, and more than one method is available from the scientific literature and commercial laboratory, after consultation with DDW, use the most sensitive method.
- If no approved method is available for a specific chemical, the City's laboratory (or contract laboratory) may develop methods or use its own methods and will provide the analytical methods to DDW for review. Those methods may be used until DDW-recommended or USEPA-approved methods are available. This option is likely to be used when an unregulated contaminant needs to be traced back through the collection system and no raw wastewater matrix method exists or when sampling RO concentrate for the unregulated contaminant.

5.2.5 Online and Benchtop Constituent Monitoring

Online monitoring data from the OWTP and the AWPF will be reported to the SCPM and analyzed to create a baseline for nominal concentrations and process performance. Total Organic Carbon (TOC), Electrical Conductivity (EC), BOD, Turbidity, and UV Transmittance (UVT) are all relevant monitoring parameters and will be continuously collected to award pathogen log removal (LRV) credits across the OWTP and AWPF. The online data trends used for LRV information will be directly applied to contaminant removal correlations. If a new contaminant or a slug load is detected, a process upset or unusual online data trend is observed, an intervention into the responsible process can be identified and responded to promptly to prevent further contaminant loading.

Accuracy and confidence in monitoring tools is important. Benchtop measurements are not necessarily more accurate that online monitors, however they provide an independent measure of the parameters being tracked. Therefore, benchtop measurements should be conducted frequently to compare online meter measurements and discrepancies should be evaluated, and calibrations on either benchtop or online meters should be performed immediately. Benchtop measurements as well as calibration dates and times should be well-documented and reported to the SCPM weekly. Online sampling parameters and benchtop verification frequencies are shown in Table 6.

Table 6 Online Sampling Parameters and Benchtop Verification Frequencies for the Potable Reuse Enhanced Source Control Program Advanced Water Purification Facility City of Oxnard

Online Monitoring Parameters	Location and Frequency of Sampling				
	OWTP	**Secondary Effluent**	**RO Influent**	**RO Permeate**	**Purified Water**
TOC			Online	Online	
Bench			Bi-weekly	Bi-weekly	Bi-weekly
EC	Online	Online	Online	Online	Online
Bench	2 X daily	2 X daily	2 X daily	2 X daily	2 X daily
BOD					
Bench	Daily	Daily			
Turbidity	Online	Online	Online		
Bench	Daily	Daily	Daily		
UVT		Online	Online	Online	Online
Bench	Daily	Daily	4 X Daily	4 X Daily	4 X Daily

5.2.6 Regulated and Unregulated Constituents

Tables 7 through 12 constitute the required water quality performance, consistent with CDPH (2014). The tables of constituents referenced in CDPH (2014) are found in CDPH (2014a). Within each table is a specific reference to the table within the regulation (e.g., Primary MCLs are listed in Table 7 below and also found in Table 64431-A).

SWRCB (2013) lists specific compounds for monitoring for groundwater injection projects (Table 13). The initial monitoring program is intended to be quarterly, followed by semi-annual monitoring for the duration of the project.

The RWQCB requires specific monitoring for CECs. This list, provided to our team by Elizabeth Erickson on 10/29/2014. This list is provided below as Table 14.

5.3 Monitoring and Enforcement Programs

As part of this enhanced source control monitoring plan for potable reuse, regulated and unregulated constituents will be monitored with the same frequency (for the first year of operation) and given equal scrutiny for detection and available health criteria in the source water (OWTP secondary effluent) and the purified effluent of the AWPF. All regulated MCLs and unregulated contaminants (Secondary MCLs, NLs and CECs) are provided in Tables 7 through 14.

Table 7	Inorganics with Primary MCLs[(1)] Advanced Water Purification Facility City of Oxnard		
Constituents	**Primary MCL (in mg/L)**	**Constituents**	**Primary MCL (in mg/L)**
Aluminum	1.0	Fluoride	2
Antimony	0.2	Lead	0.015[(4)]
Arsenic	0.006	Mercury	0.002
Asbestos	7 (MFL)[(2)]	Nickel	0.1
Barium	1	Nitrate (as NO_3)	45
Beryllium	0.004	Nitrite (as N)	1
Cadmium	0.005	Total Nitrate/Nitrite (as N)	10
Hexavalent Chromium	0.010	Perchlorate	0.006
Copper	1.3[(3)]	Selenium	0.05
Cyanide	0.15	Thallium	0.02

Notes:

(1) Based on **Table 64431-A.**
(2) MFL = Million fibers per liter, with fiber lengths > 10 microns.
(3) Regulatory Action Level; if system exceeds, it must take certain actions such as additional monitoring, corrosion control studies and treatment, and for lead, a public education program; replaces MCL.
(4) The MCL for lead was rescinded with the adoption of the regulatory action level described in footnote 'd'.

Table 8	Radioactivity[(1)] Advanced Water Purification Facility City of Oxnard		
Constituents	**MCL (in pCi/L)**	**Constituents**	**MCL (in pCi/L)**
Uranium	20	Gross Beta particle activity	50[(2)]
Combined radium-226 & 228	5	Strontium-90	8[(2)]
Gross alpha particle activity	15	Tritium	20,000[(2)]

Notes:

(1) Based on **Tables 64442 and 64443**.
(2) MCLs are intended to ensure that exposure above 4 millirem/yr does not occur.

Table 9	Regulated Organics[1] Advanced Water Purification Facility City of Oxnard		
Constituents	**MCL (in mg/L)**	**Constituents**	**MCL (in mg/L)**
Volatile Organic Compounds			
Benzene	0.001	Monochlorobenzene	0.07
Carbon Tetrachloride	0.0005	Styrene	0.1
1,2-Dichlorobenzene	0.6	1,1,2,2-Tetrachloroethane	0.001
1,4-Dichlorobenzene	0.005	Tetrachloroethylene	0.005
1,1-Dichloroethane	0.005	Toluene	0.15
1,2-Dichloroethane	0.0005	1,2,4 Trichlorobenzene	0.005
1,1-Dichloroethylene	0.006	1,1,1-Trichloroethane	0.2
cis-1,2-Dichloroethylene	0.006	1,1,2-Trichloroethane	0.005
trans-1,2-Dichloroethylene	0.01	Trichloroethylene	0.005
Dichloromethane	0.005	Trichlorofluoromethane	0.15
1,3-Dichloropropene	0.0005	1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2
1,2-Dichloropropane	0.005	Vinyl chloride	0.0005
Ethylbenzene	0.3	Xylenes	1.75
Methyl-tert-butyl ether (MTBE)	0.013		
SVOCs			
Alachlor	0.002	Hexachlorobenzene	0.001
Atrazine	0.001	Hexachlorocyclopentadiene	0.05
Bentazon	0.018	Lindane	0.0002
Benzo(a) Pyrene	0.0002	Methoxychlor	0.03
Carbofuran	0.018	Molinate	0.02
Chlordane	0.0001	Oxamyl	0.05
Dalapon	0.2	Pentachlorophenol	0.001
Dibromochloropropane	0.0002	Picloram	0.5
Di(2-ethylhexyl)adipate	0.4	Polychlorinated Biphenyls	0.0005
Di(2-ethylhexyl)phthalate	0.004	Pentachlorophenol	0.001
2,4-D	0.07	Picloram	0.5
Dinoseb	0.007	Polychlorinated Biphenyls	0.0005
Diquat	0.02	Simazine	0.004
Endothall	0.1	Thiobencarb	0.07/0.001[2]
Endrin	0.002	Toxaphene	0.003
Ethylene Dibromide	0.00005	2,3,7.8-TCDD (Dioxin)	$3x10^{-8}$
Glyphosate	0.7	2,4,5-TP (Silvex)	0.05
Heptachlor	0.00001		
Heptachlor Epoxide	0.00001		

Notes:

(1) Based on Table 64444-A.
(2) Second value is listed as a Secondary MCL.

Table 10 Disinfection By-Products[1]
Advanced Water Purification Facility
City of Oxnard

Constituents	MCL (in mg/L)	Constituents	MCL (in mg/L)
Total Trihalomethanes	0.080	Bromate	0.010
Total haloacetic acids	0.060	Chlorite	1.0

Notes:
(1) Based on **Table 64533-A.**

Table 11 Constituents/Parameters with Secondary MCLs
Advanced Water Purification Facility
City of Oxnard

Constituents[1]	MCL (in mg/L)	Constituents[2]	MCL (in mg/L)
Aluminum	0.2	TDS	500
Color	15 (units)	Specific Conductance	900 *u*S/cm
Copper	1	Chloride	250
Foaming Agents (MBAS)	0.5	Sulfate	250
Iron	0.3		
Manganese	0.05		
Methyl-tert-butyl-ether (MBTE)	0.005		
Odor Threshold	3 (units)		
Silver	0.1		
Thiobencarb	0.001		
Turbidity	5 (NTU)		
Zinc	5		

Notes:
(1) Based on **Table 64449-A.**
(2) Based on **Table 64449-B.**

Table 12 Constituents with Notification Levels[1,2]
Advanced Water Purification Facility
City of Oxnard

Constituents	NL (in μg/L)	Constituents	NL (in μg/L)
Boron	1000	Manganese	500[2]
n-Butylbenzene	260	Methyl isobutyl ketone (MIBK)	120
sec-Butylbenzene	260	Naphthalene	17
tert-Butylbenzene	260	N-Nitrosodiethylamine (NDEA)	0.01
Carbon disulfide	160	N-Nitrosodimethylamine (NDMA)	0.01
Chlorate	800	N-Nitrosodi-n-propylamine (NDPA)	0.01
2-Chlorotoluene	140	Propachlor**	90
4-Chlorotoluene	140	n-Propylbenzene	260
Diazinon	1.2	RDX	3
Dichlorodifluoromethane (Freon 12)	1000	Tertiary butyl alcohol (TBA)	12
1,4-Dioxane	1	1,2,3-Trichloropropane (1,2,3-TCP)	0.005
Ethylene glycol	14000	1,2,4-Trimethylbenzene	330
Formaldehyde	100	1,3,5-Trimethylbenzene	330
HMX	350	2,4,6-Trinitrotoluene (TNT)	1
Isopropylbenzene	770	Vanadium	50

Notes:

(1) Based on http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/notificationlevels/notificationlevels.pdf.

(2) The web link above also contains the levels of the pollutants in this table that must result in a removal of the water source from service.

Table 13	Monitoring Trigger Levels for Groundwater Recharge, as Listed in SWRCB (2013) Advanced Water Purification Facility City of Oxnard		
Constituents	**Relevance/ Indicator Type/ Surrogate**	**Monitoring Trigger Level (in μg/L)**	**Removal Percentages (%)**
17B-estradiol	Health	0.0009	--
Caffeine	Health & Performance	0.35	>90
NDMA	Health & Performance	0.01	25-50, >80(1)
Triclosan	Health	0.35	--
DEET	Performance	--	>90
Sucralose	Performance	--	>90
Electrical Conductivity	Surrogate	--	>90
TOC	Surrogate	--	>90

Notes:

(1) 25 to 50 % removal by RO, >80% removal by RO followed by UV, depending upon the UV dose.

Table 14	CECs Required for Monitoring by LARWQCB(1) Advanced Water Purification Facility City of Oxnard	
Constituents	**Sample Type**	**Reporting Level, ng/L**
17-alpha-estradiol	Composite	0.5
Caffeine	Composite	10
DEET	Composite	10
Iodinated Contrast Media (Iopromide)	Composite	10
Triclosan	Composite	10
NDMA	Composite	10
Sucralose	Composite	100

Notes:

(1) Information provided by Elizabeth Erickson to the project team on 10/29/2014.

Each class of constituent (regulated, CECs, etc.), monitoring location and proposed monitoring frequency are shown in Table 15. Following acceptable monitoring performance during the first year of operation, the sampling frequency in the secondary effluent will decrease for select classes of constituents.

Table 15	Class of Constituents, Location and Frequency Monitoring Plan Advanced Water Purification Facility City of Oxnard		
	Monitoring Plan(1)		
Class of Constituents	**Collection System**	**Secondary Effluent**	**Purified Water**
Industrial Discharge	Monthly and Internally (by permit requirement)	Monthly	Monthly
Local Limits	Monthly	Monthly (year 1) and Quarterly (starting year 2)	Monthly
NPDES Permit	Monthly	Monthly	Monthly
Regulated (MCLs)		Monthly (year 1) and Quarterly (starting year 2)	Monthly
Secondary Treatment Goals MCLs		Monthly (year 1) and Quarterly (starting year 2)	Monthly
Notification Levels		Monthly (year 1) and Quarterly (starting year 2)	Monthly
Contaminants of Emerging Concern (CECs)		Monthly (year 1) and Quarterly (starting year 2)	Monthly

Note:
(1) Monitoring frequency for industrial dischargers will be determined by flow, as outlined in each industry permit.

5.3.1 Finished Water Monitoring and Enforcement

At a minimum, pursuant to Section 60320.201 of Title 22 (CDPH 2014), the AWPF purified water effluent must be analyzed for all MCLs and NLs monthly for the first year. For subsequent years, a permit change can be granted with the monitoring frequency reduced to a minimum of quarterly. The monitoring and enforcement plans currently required by Title 22 for IPR finished water are shown as Figure 4 through 7. This sampling pertains to finished water quality for potable water reuse; and is not an added sampling effort for the ESCP. However, the data obtained as part of this required sampling is a useful component of the ESCP.

The proposed ESCP will be including secondary MCLs and a SRWQCB approved list of CECs to this monitoring plan for both monthly and quarterly sampling of the secondary effluent. The ESCP program calls for continuous monthly sampling of the purified water, with no decrease in frequency following the first year of operation, regardless of acceptable plant process performance.

An ESCP action and enforcement plan for purified water is provided in Figure 8. Mimicking Titile 22 requirements for potable reuse source control plans, the finished water plan is based on two response procedures, regulated and unregulated contaminants. An additional step in the ESCP requires a more rigorous response to regulated contaminant detection, where a detected regulated contaminant (above or below the action level) will require resampling and subsequent *tracking through both the wastewater treatment plant and collection system*. Where unregulated contaminants are detected and reported above the health action level, the same response plan as regulated contaminants reported below their corresponding action level will be enforced.

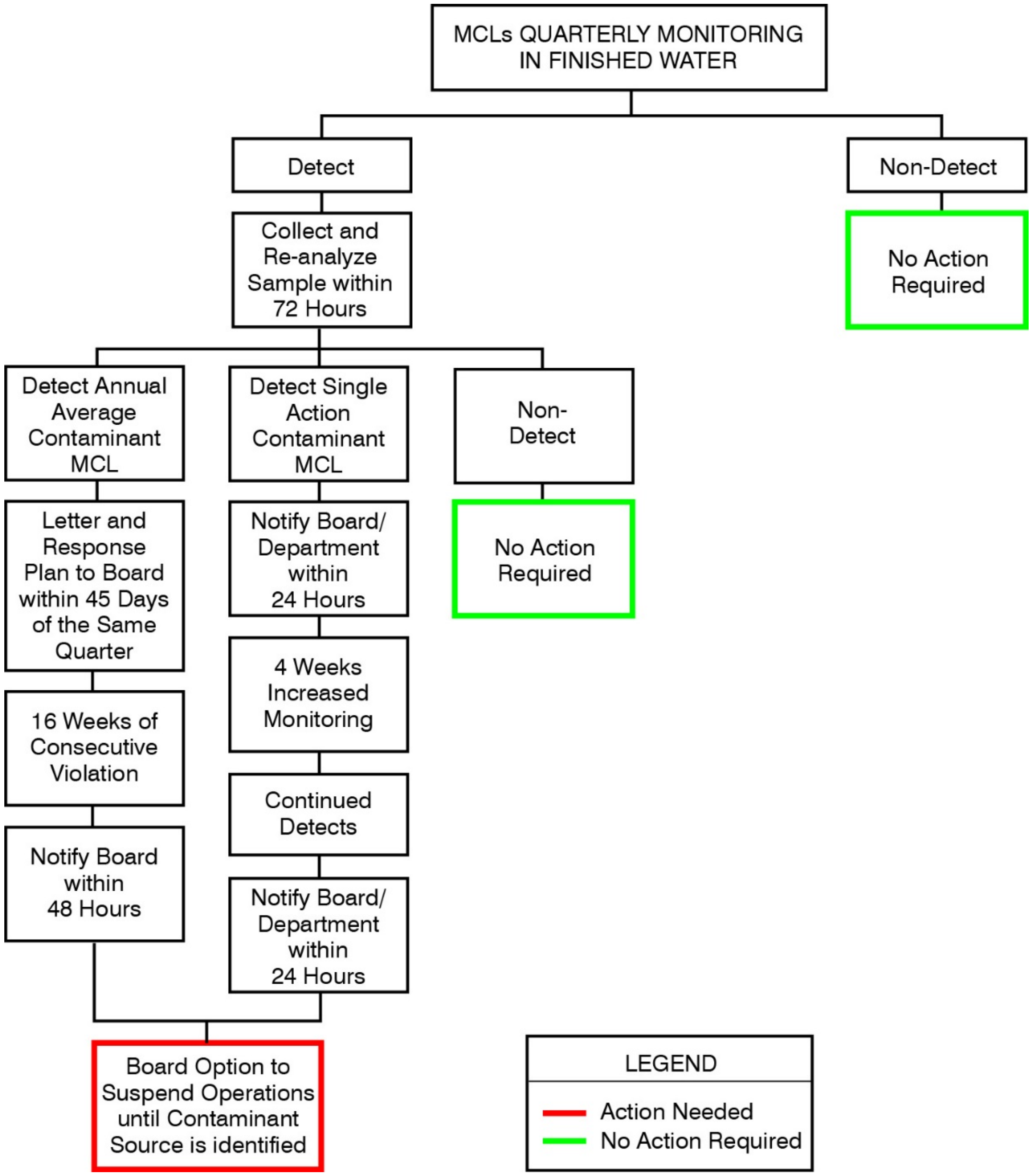

Figure 4 Title 22 MCL Monitoring Requirements and Action Plan for IPR Finished Water.

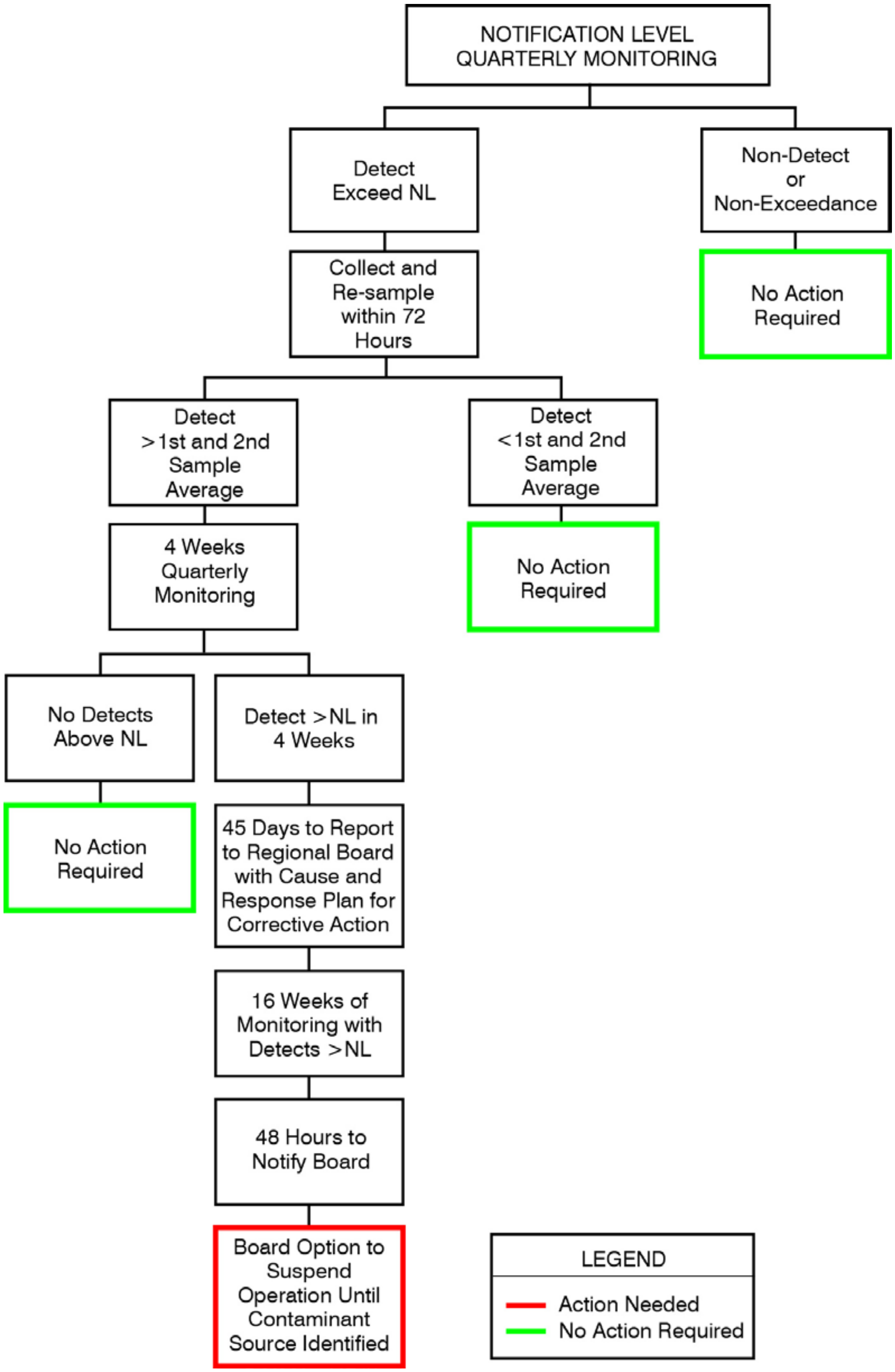

Figure 5 Title 22 Notification Levels Monitoring Requirements and Action Plan for IPR Finished Water.

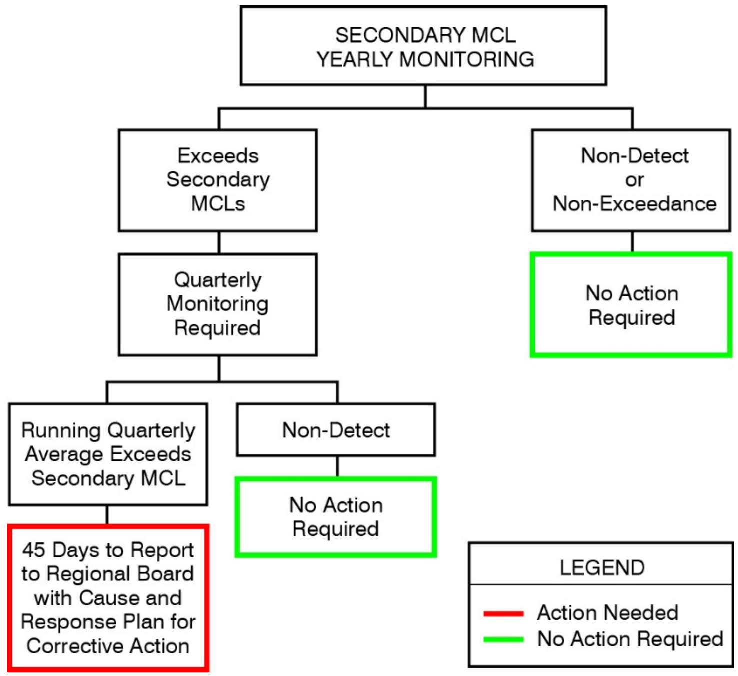

Figure 6 Title 22 Secondary MCL Monitoring Requirements and Action Plan for IPR Finished Water.

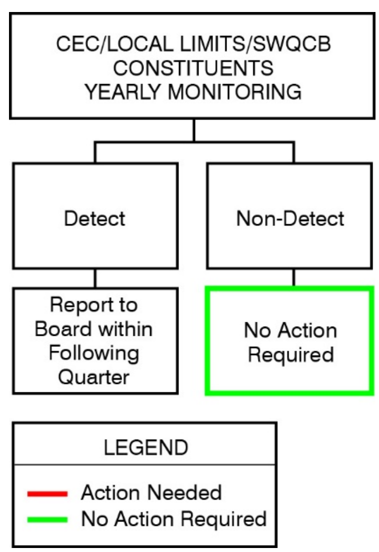

Figure 7 Title 22 CEC, Local Limits and Board RequiredContaminants Monitoring and Action Plan for IPR Finished Water.

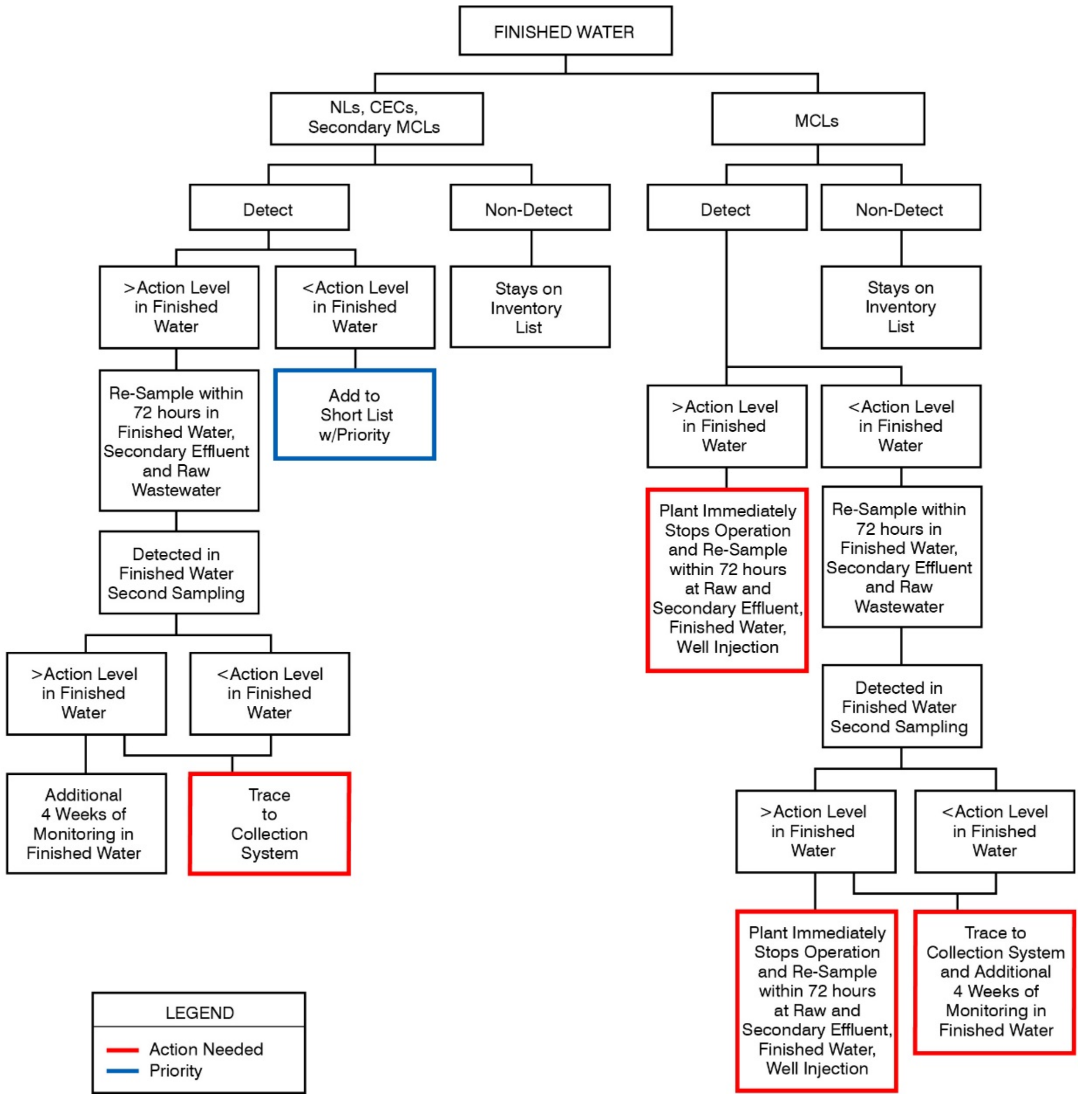

Figure 8 Finished Water Monitoring Response Plan for Proposed ESCP

5.3.2 Secondary Effluent Monitoring and Enforcement

This proposed enhanced source control program includes monitoring of the secondary effluent source water, matching the schedule of the purified water sampling frequency for the first year. Monitoring action plans tailored to secondary effluent sampling are included in Figures 9 and 10. *Secondary effluent sampling constituents are broken into two lists, Short List and Inventory List, which correspond to varying monitoring frequencies.*

A full list of all regulated and unregulated contaminants sampled for are included in the "Inventory List." All detected contaminants will be put into a more frequent monitoring registry called the "Short List." The "baseline" percent removal for wastewater treatment and contaminant removal corresponds to the contaminant removal percentage through secondary wastewater treatment measured during the Local Limits evaluation.

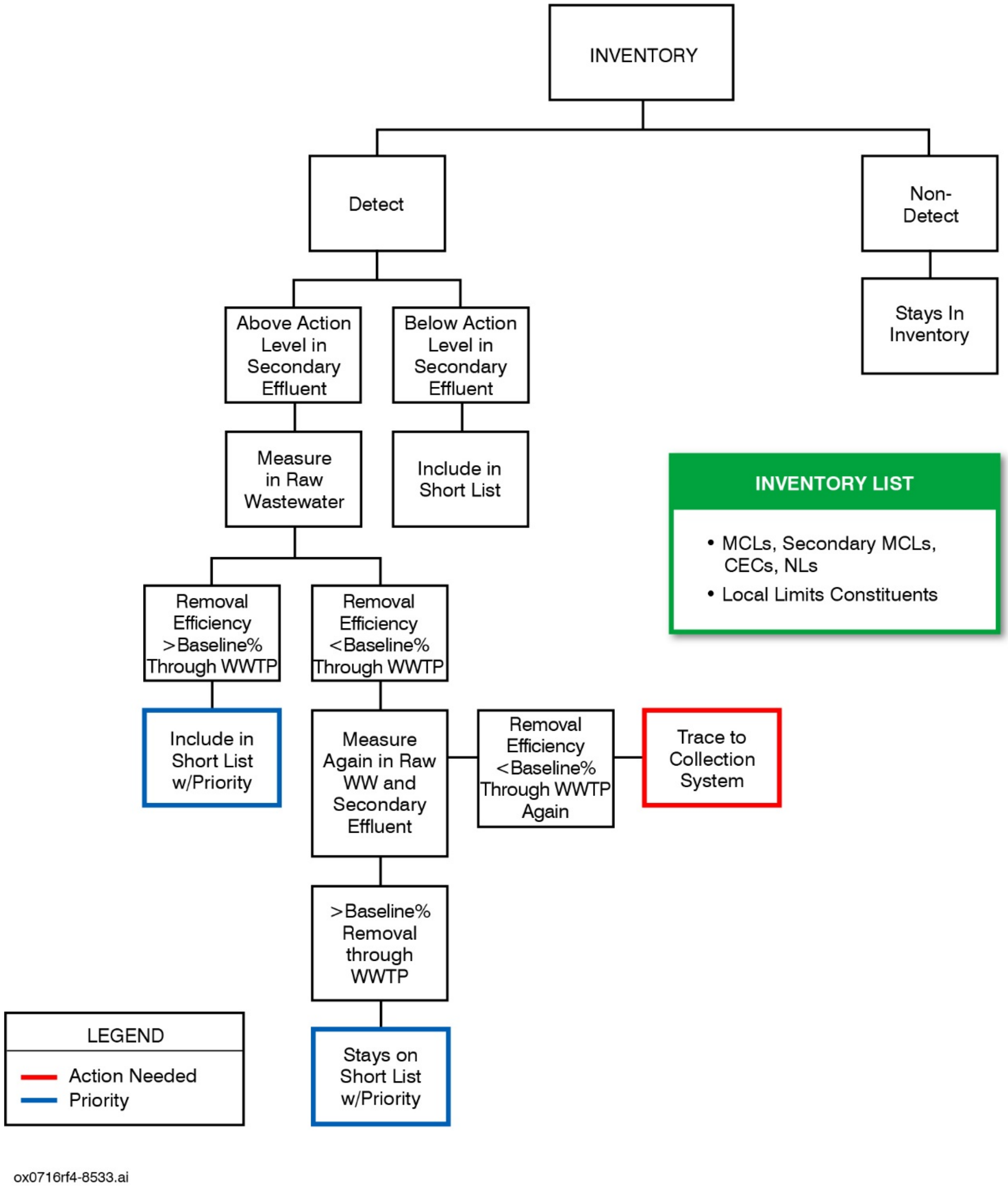

Figure 9 Secondary Effluent Source Inventory Monitoring Action Plan for Proposed ESCP

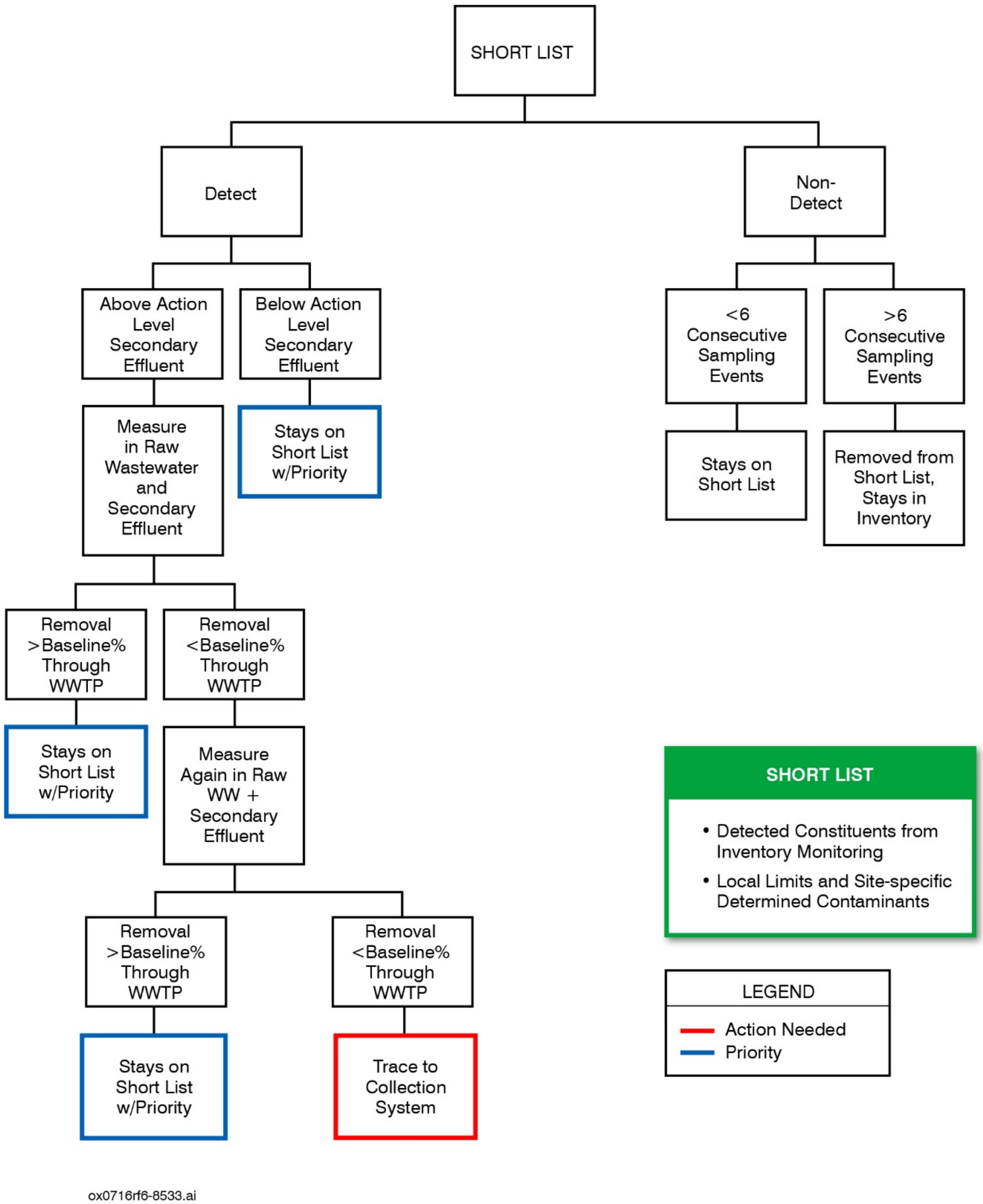

Figure 10 Secondary Effluent Source Short List Monitoring Action Plan

The Short List contains all detected contaminants from Inventory monitoring and any additional Local Limits constituents. Monitoring parameters on the Short List are revolving and contaminants can be added due to routine monitoring or a new discharge permit. If a contaminant is detected in the routine Inventory List, thereby going on the Short List, and no longer detected during monthly sampling of the Short List for 6 consecutive sampling events (6 months), the contaminant will then be removed from the frequently monitored list and monitored quarterly.

A contaminant added to the Short List with Priority, will be closely monitored for changes during the subsequent sampling periods and the detections will be noted during the Industrial Source Control Workshops held quarterly by the SCPM.

5.4 Source Mapping Strategy

The City currently has a collection system tracing strategy that has proven effective by the "gross-beta" incident. For enhanced source control monitoring, a defined area strategy is proposed. This strategy includes defining areas of the collection system from which all major trunks meet and allows for increased isolation between domestic and industrial dischargers. Example mapping areas are shown below in Figure 11 as (M1 - M6). Each area will be monitored at the major junctions on a monthly basis for the Local Limits contaminants, and as needed for priority events where mapping contaminants through the system is necessary.

The initial discharge area in M4 will be monitored as a "baseline" for collection system contaminant accumulation. This will provide information about loading rates through each sampling event. Industry measured contaminant discharge data and flow rates will be used to create a mass balance for industry-specific loading rates. If these loading rates remain within a +/- (TBD by City)% margin, the loading rates will be acceptable. If out of this range, all industrial dischargers known to discharge this specific contaminant will be contacted. Household dischargers could also be responsible for contributing to this difference in industrial contaminant discharge. This approach is not meant to replace downstream monitoring of industrial discharge by the City for confirmation of each industry, only to provide a larger data set for long-term monitoring and a first look at monthly data trending for increasing dischargers in the service area. This will also provide confirmation of residential input, not only industry input.

To reduce the likelihood that harmful pollutants enter the OWTP, a monitoring and enforcement response plan similar to the SCWW "gross-beta incident" must be implemented. Monitoring and sampling effluent wastewater on a semiannual basis (to analyze for radioactivity) allows for early detection of contaminants. If a contaminant is found, research should be conducted to locate the source. Once locations are identified, samples should be taken from several locations - upstream, downstream, onsite and adjacent to suspected violators. If unacceptable concentrations of contaminants are found, proper action by the City should be taken to control the problem. This can include an order to Cease-and-Desist discharge, a Notice of Violation, and/or suspension of Industrial Waste Discharge Permit that would prohibit the discharge of any wastewater by the violators to the Oxnard Collection System.

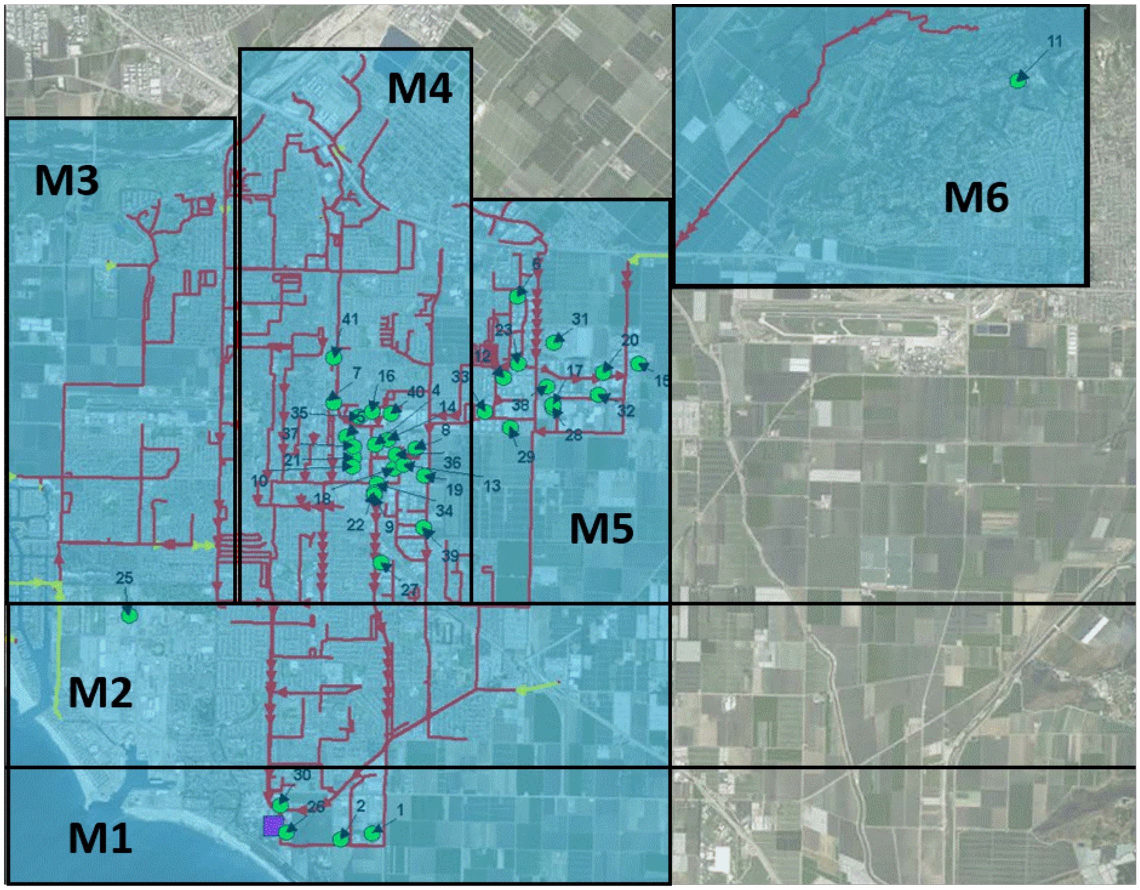

Figure 11 Proposed Collection System Strategic Monitoring Strategy for Both Routine Monitoring and Action Plan Response.

The City of Oxnard has a mostly residential section of town and another section that contains significant numbers of industrial dischargers. If a household is discharging a contaminant of concern, it will be difficult to pinpoint which house is causing the violations. In order to minimize painstaking contaminant tracking through the sewage discharge lines, a heavy emphasis will be put on household outreach and education. Additionally, the City will provide a hazardous waste disposal program where the public can bring medications, pesticides, and other hazardous waste items to the landfill for treatment, recovery, or burial. The plans for public outreach can be found in Section 6.3.

5.5 Hospital Discharge Program

Hospital waste discharge monitoring is not currently required in source control programs. The City of Oxnard has several hospitals, including animal hospitals, shown in Figure 12. There are many pharmaceuticals and personal care products monitored for in the Inventory List of contaminants and if an unexplained detection of these contaminants is found in the secondary effluent or purified water when tested, the compound will move to the Short List. If the action plan indicates the pharmaceutical contaminant should be traced back into the collection system (Figure 12), previously determined sampling locations downstream of the hospital dischargers will be utilized. Facilities with the highest discharge flow will be targeted first.

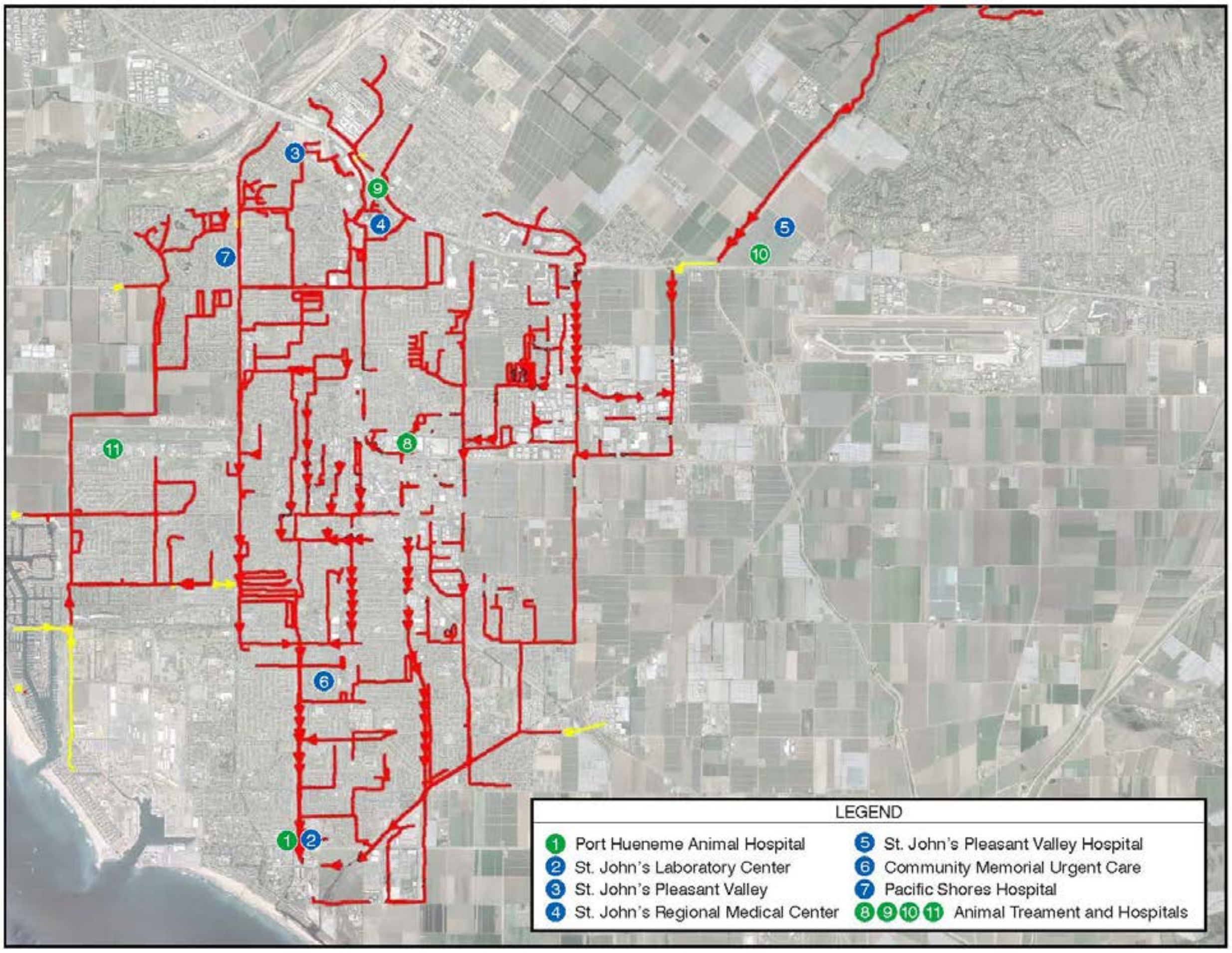

Figure 12 Short List of Human and Animal Hospitals Discharging to OWTP

5.5.1 <u>Iohexol Hospital Discharge Indicator</u>

Distinguishing hospital discharge versus residential discharge can prove challenging. Iohexol can be used as a potential indicator with which to identify hospital discharge locations and determine their contributions to the total flow. Iohexol is introduced into the wastewater collection system almost exclusively through the urine of patients in hospitals that have undergone medical imaging. Iohexol acts as a contrasting agent for medical imaging, and is designed to have no impact on human or animal health. Advanced oxidation processes efficiently remove Iohexol, and the compound is typically completely degraded in secondary treated wastewater. If incorporating a hospital discharge program into the ESCP becomes necessary, Iohexol should be used to help track medical dischargers.

6.0 OUTREACH PROGRAMS

6.1 Industrial Outreach

Meetings with all dischargers in groups will take place as described in the Local Limits Study. During these meetings, each discharger will be given their new discharge limits for all registered constituents. The rollout of the industrial discharge outreach program will be included in these meetings, where a clear plan will be made with each industrial discharger for what to do in the event of any constituent release changes. Changes could include a slug discharge event, a new contaminant introduced into production and needing to be added to the inventory list, removing a contaminant from a discharge list, and others.

Industrial dischargers will be reminded of the changes taking place downstream of them, and the effects discharging waste in violation of their permit could have on downstream potable reuse treatment and subsequent public consumption. The outreach plan will include 30 minutes to 1 hour monthly webinars to provide updates on their discharge statuses to each other and the City can provide the latest monitoring data and any updates or changes to the source control program. Monthly webinars will include information on any program updates, questions asked and answered by other dischargers during that time period and potable reuse monitoring information.

Quarterly 3-hour meetings will take place with all industries to send 1 representative to an update meeting in lieu of the monthly webinar. An example agenda for this meeting is shown as Figure 13. These meetings will be led by the SCPM with support from Oxnard staff. All industrial dischargers should participate with a short update on their recent monitoring and discharge information.

To encourage further engagement by industries, a yearly award will be given to those companies who have not had a discharge violation during audits or routine collection system monitoring. The "Enhanced Source Control Responsible Partner Award" is a yearly reminder to all industries that public health protection is a partnership with the community and water treatment system operations Figure 14.

6.2 Periodic Industry Reviews

In addition to educational outreach and coordinated industry discharger meetings, site audits currently run through the City's pre-treatment program will continue. The auditors will submit all data, reports, and meeting summaries directly to the SWPM immediately following site visits. The SWPM will then compile the data and files to ensure each industry is being properly monitored.

City of Oxnard Quarterly Source Control Dischargers Meeting

Meeting Month Day, Year

8:00 AM - 11:00 AM

Meeting Location

Welcome and Introductions (SCPM)	8:00 - 8:20
Source Control Program Updates (SCPM)	8:20 - 8:45
OWTP Monitoring Trends from Quarter (Oxnard Staff)	8:45 - 9:15
Individual Discharger Updates (Industry Representative)	9:15 - 10:30
Discussion and Q&A (Everyone)	10:30 - 10:50
Set Next Meeting Date and Agenda Items (SCPM)	10:50 - 11:00

SAMPLE

Figure 13 Example Quarterly Industrial Dischargers Source Control Meeting Agenda

Figure 14 ESCP Responsible Partner Award Certificate (Example)

If a violation is found during a site audit, the current enforcement plan for pre-treatment violations will apply, unless a more stringent enforcement plan is needed during audits in the future. Any violations reported or recorded will be discussed during the quarterly and monthly industry outreach meetings that include representatives from each industry.

In the event of a new discharge license being issued by the City, a source control review will be triggered. This review will be discussed and integrated into the industry discharger partnership attending monthly and quarterly meetings. All business licenses for dischargers will be reviewed annually by the industry's assigned auditor. The licenses are required to be within expiration date, show proper fees have been paid to the City for the annual time period, and no new constituents or major changes have been made to the discharge matrices.

6.3 Residential Outreach

Household outreach and education is the major residential source control strategy for most communities. Due to the increased risk involved in potable reuse, the residents should be strongly educated as to where their waste is going and the potential impacts to the communities drinking water supply. An outreach plan for public acceptance purposes is already planned for this project, and the discharge information could be rolled out along with this initiative upfront. Providing a proactive awareness program for household discharges prior to the operation of IPR in the community can provide increased confidence to the City in their residential source water control strategy.

Contaminant discharges causing unwanted impact to the water supply cannot be tracked easily in residual areas due to the quantity of individual dischargers with low-volume inputs. In order to prevent unwanted discharges from households in the sewer line, educational tools and disposal centers will be used for the public to have options for disposing of unwanted items.

Discharge information will address a list of household items that would potentially be detrimental to the wastewater and water purification process, and alternative disposal options for the residents provided by the City or otherwise available. Educational materials will include a website developed to address safe disposal practices. For example, the public would be educated that flushing leftover antibiotics or pharmaceuticals is unsafe, however, household cleaners are acceptable. A detailed list with brand examples will be made available to ensure public understanding of the issue. An example of a public outreach website for residential discharge was developed by the San Francisco Public Utilities Commission (SFPUC). The website offers top things not to flush, and a flyer you can print with the title "Think Before You Flush". The website can be accessed here: http://sfwater.org/index.aspx?page=151

The majority of households in Oxnard primarily speak Spanish, therefore it is imperative that bilingual educational materials are developed alongside of materials in English. The

SFPUC in the above example provides 4 language options (English, Spanish, Mandarin and Tagalog) to cater to that city's demographics. To direct residents to the informational website, a link and description will be highly visible on their monthly water bills mailed, or in their water bills provided online. Provided internet is not available in the household, annual residential source control program meetings will be organized by the SWPM to provide another educational option for City residents.

7.0 OWTP AND AWPF WATER QUALITY RESULTS

7.1 Secondary Effluent Water Quality Standards and Results

In order for AWPF effluent to be used for indirect potable reuse, the water must first meet the existing NPDES OWTP effluent regulations and Los Angeles Region Basin Plan (Basin Plan) objectives. Since secondary effluent is the influent source for AWPF treated water, the higher the secondary effluent water quality, the higher our source water quality is for IPR.

7.1.1 NPDES Permit Regulations

The NPDES Permit for the OWTP includes regulations for major wastewater constituents such as 5-day biological oxygen demand (BOD_5) and total suspended solids (TSS), marine aquatic life contaminants, and contaminants relevant to human health (both carcinogens and non-carcinogens). A complete list of the NPDES permit water quality requirements is provided in Appendix B.

Per the NPDES permit, Oxnard already does periodic monitoring (quarterly) of the plant influent.

- Flow - continuous.
- pH, TSS, BOD - daily.
- Oil & Grease - weekly.
- Benzedrine, Heptachlor epoxide, PCBs, TCDD equivalents - quarterly.
- Everything else - semiannually.

7.1.2 Relevant Basin Plan Objectives

The Basin Plan was adopted in 1994 and outlines water quality requirements for waters in the Los Angeles region of which Oxnard is a part. All Basin Plan objectives pertaining to water designated for human consumption, are consistent with DDW requirements.

7.2 OWTP and AWPF Wastewater Quality

The OWTP has been in full compliance with its NPDES permit. Historical effluent data for BOD, TSS, turbidity, residual chlorine, pH, ammonia, oil and grease, and settleable solids are continuously measured in the OWTP effluent. Historical values for these parameters are provided in Tables 16 through 18. A summary of data for metals and trace pollutants in the OWTP effluent is shown in Table 17, including new data collected as part of the 2015 Local limits evaluation. The data provided in Tables 16 and 17 indicate that the OWTP provides high quality secondary-treated effluent suitable for advanced treatment and potable reuse. Further, the high beta radioactivity has been addressed through the source control program with the cease of all discharge from Santa Clara Wastewater, as demonstrated with the low beta radioactivity shown in Table 17.

The OWTP data collected to date was intended to demonstrate compliance with the existing NPDES permit and to address the local limits evaluation, and was not intended to address future potable reuse water quality standards. However, the OWTP secondary effluent data (Table 18) shows for any contaminant monitored under Title 22, the measured secondary effluent data meets or exceeds Title 22 maximum contaminant concentrations, with the exception of one event, where subsequent sampling consistently showed a much lower concentration. As discussed in the subsequent section, additional analytical testing of secondary effluent, ROP, and UV AOP effluent will be done during the startup of the AWPF and the production of non-potable recycled water, which will be done in the summer of 2016.

Table 16 Effluent Regulatory Limits and OWTP Data - Typical Wastewater Constituents
Advanced Water Purification Facility
City of Oxnard

Parameter	Units	NPDES Permit Limit: Discharge Limit	NPDES Permit Limit: Criteria	OWTP Data[1]
BOD_5	mg/L	30	Monthly Average	14 - 22
		45	Weekly Average	11 - 28
	lbs/day	7,900	Monthly Average	2,326 - 3,621
		12,000	Weekly Average	1,880 - 4,403
TSS	mg/L	30	Monthly Average	5.8 - 10.4
		45	Weekly Average	4.6 - 19.1
	lbs/day	7,900	Monthly Average	965 - 1,696
		12,000	Weekly Average	760 - 3,063
Turbidity	NTU	75	Monthly Average	2.9 - 6.8
		100	Weekly Average	2.7 - 12.9
		225	Daily Maximum	20.7
Total Residual Chlorine	mg/L	0.085	Monthly Performance Goal	0.01 - 0.04
	lbs/day	23		1.4 - 7.2
pH		6.0 - 9.0	Instantaneous Minimum to Maximum	7 - 7.9[2]
Ammonia Nitrogen	mg/L	25	Monthly Performance Goal	25 - 34
	lbs/day	6,600		4,259 - 5,781
Oil and Grease	mg/L	25	Monthly Average	4.9 - 4.9
		40	Weekly Average	4.9 - 5.1
	lbs/day	6,630	Monthly Average	782 - 827
		10,600	Weekly Average	769 - 850
Settleable Solids	ml/L	1	Monthly Average	0.01 - 0.016
		1.5	Weekly Average	0.01 - 0.036
		3	Daily Maximum	0.10

Notes:
(1) Based on 2013 Data.
(2) From daily grab samples.

Table 17 Effluent Regulatory Limits and OWTP Data – Other Pollutants Advanced Water Purification Facility City of Oxnard

Contaminant	Units	Effluent Limitations		Title 22 Contaminant Action Levels(1) and OWTP Discharge Goals	
		Average Monthly	Maximum Daily	Annual Average or Single Action	OWTP Data(2)
Marine Aquatic Life Toxicants					
Arsenic	ug/L	-	-	10	0.7
Cadmium	ug/L	-	-	5	<0.5
Chromium VI	ug/L	-	-	10	<0.3
Copper	ug/L	-	-	1300	28
Lead	ug/L	-	-	15	<5
Mercury	ug/L	-	-	2	<0.2
Nickel	ug/L	-	-	100	5
Selenium	ug/L	-	-	50	2.4
Silver	ug/L	-	-	100	1
Zinc	ug/L	-	-	5000	19
Cyanide	ug/L	-	-	0.15	-
Phenolic Compounds (non-chlorinated)(3)	ug/L	-	-	5(4)	<23
Phenolic Compounds (chlorinated) (3)	ug/L	-	-	0.42(4)	<5
Endosulfan(3)	ug/L	-	-	0.05(4)	<0.03
HCH(3)	ug/L	-	-	0.1(4)	-
Endrin	ug/L	-	-	2	<0.01
Chronic Toxicity(3)	Tuc	-	99	-	-
Radioactivity					
Alpha Radioactivity	Pci/L	-	15	15	1.67 ± 0.24
Beta Radioactivity	Pci/L	-	50	50	94 ± 3.939(5,6)
Combined Radium-226 & Radium-228	Pci/L	-	5	5	-
Tritium	Pci/L	-	20000	20000	-
Strontium-90	Pci/L	-	8	8	-
Uranium	Pci/L	-	20	20	-
Human Health Toxicants - Non Carcinogens					
Acrolein(3)	ug/L	-	-	10(4)	<5
Antimony	ug/L	-	-	6	<2
Bis (2-chloroethoxy) methane(3)	ug/L	-	-	25(4)	<1
bis (2-Chloroisopropyl) ether(3)	ug/L	-	-	10(4)	<1
Chlorobenzene(3)	ug/L	-	-	2.5(4)	<1

Table 17	**Effluent Regulatory Limits and OWTP Data – Other Pollutants Advanced Water Purification Facility City of Oxnard**				
		Effluent Limitations		**Title 22 Contaminant Action Levels[1] and OWTP Discharge Goals**	
Contaminant	**Units**	**Average Monthly**	**Maximum Daily**	**Annual Average or Single Action**	**OWTP Data[2]**
Chromium (III)	ug/L	-	-	50	<5
Di-N-Butyl phthalate[3]	ug/L	-	-	0.19[4]	<1
Dichlorobenzenes	ug/L	-	-	260	<3
Diethyl phthalate	ug/L	-	-	63	<1
Dimethyl phthalate[3]	ug/L	-	-	10[4]	<1
2-Methyl-4,6-dinitrophenol[3]	ug/L	-	-	25[4]	<5
2,4-Dinitrophenol[3]	ug/L	-	-	25[4]	<10
EthylBenzene	ug/L	-	-	600	<1
Fluoranthene[3]	ug/L	-	-	0.039[4]	<1
Hexachlorocyclopentadiene	ug/L	-	-	5	<1
Nitrobenzene[3]	ug/L	-	-	5[4]	<1
Thallium	ug/L	-	-	2	<2
Toluene	ug/L	-	-	150	<1
Tributyltin[3]	ug/L	-	-	0.0263[4]	<0.005
1,1,1-Trichloroethane	ug/L	-	-	200	<1
Human Health Toxicants - Carcinogens					
Acrylonitrile[3]	ug/L	-	-	10[4]	<2
Aldrin[3]	ug/L	-	-	0.025[4]	<0.005
Benzene	ug/L	-	-	1	<1
Benzedrine	ug/L	0.0068	-	-	<10
Beryllium	ug/L	-	-	4	<0.5
Bis (2-chloroethyl) ether[3]	ug/L	-	-	5[4]	<1
Bis (2-ethylhexyl) phthalate[3]	ug/L	-	-	50[4]	10
Carbon Tetrachloride	ug/L	-	-	0.5	<1
Chlordane	ug/L	-	-	2	<0.01
Chlorodibromomethane[3]	ug/L	-	-	0.61[4]	<.001
Chloroform[3]	ug/L	-	-	1.2[4]	<1
DDT[3]	ug/L	-	-	0.25[4]	<0.01
1,4-Dichlorobenzene[3]	ug/L	-	-	0.041[4]	<1
3,3-Dichlorobenzidine[3]	ug/L	-	-	25[4]	<5
1,2-Dichloroethane	ug/L	-	-	5	<1
1,1-Dichloroethylene	ug/L	-	-	6	<1
Bromodichloromethane[3]	ug/L	-	-	2.5[4]	<1

Table 17	Effluent Regulatory Limits and OWTP Data – Other Pollutants Advanced Water Purification Facility City of Oxnard				
		Effluent Limitations		**Title 22 Contaminant Action Levels(1) and OWTP Discharge Goals**	
Contaminant	**Units**	**Average Monthly**	**Maximum Daily**	**Annual Average or Single Action**	**OWTP Data(2)**
Dichloromethane	ug/L	-	-	5	<1
1,3-Dichloropropene	ug/L	-	-	0.5	<2
Dieldrin(3)	ug/L	-	-	0.05(4)	<0.01
2,4-Dinitrotoluene(3)	ug/L	-	-	25(4)	<1
Azobenzene (1,2-Diphenylhydrazine)(3)	ug/L	-	-	5(4)	<1
Halomethanes	ug/L	-	-	80	<4
Heptachlor	ug/L	-	-	0.04	<0.01
Heptachlor epoxide	ug/L	0.002	-	0.02	<0.01
Hexachlorobenzene	ug/L	-	-	1	<1
Hexachlorobutadiene(3)	ug/L	-	-	5(4)	<1
Hexachloroethane(3)	ug/L	-	-	5(4)	<1
Isophorone(3)	ug/L	-	-	5(4)	<1
N-Nitrosodimethylamine (NDMA)	ug/L	-	-	10	<1
N-Nitrosodi-N-propylamine (NDPA)	ug/L	-	-	10	<1
N-Nitrosodiphenylamine	ug/L	-	-	10	<1
PAHs(3)	ug/L	-	-	0.097(4)	<19
PCBs	ug/L	0.0019	-	0.5	<17.5
Total 2,3,7,8-TCDD Equivalence(3)	ug/L	0.00000039	-	-	<0.00001
1,1,2,2-Tetrachloroethane	ug/L	-	-	1200	<1
Tetrachloroethylene	ug/L	-	-	5	<1
Toxaphene	ug/L	-	-	3	<2.5
Trichloroethylene	ug/L	-	-	5	<1
1,1,2-Trichloroethane	ug/L	-	-	5	<1
2,4,6-Trichlorophenol(3)	ug/L	-	-	0.35(4)	<1
Vinyl chloride	ug/L	-	-	0.5	<1

Notes:
(1) OWTP not regulated according to Title 22 MCL, NL, Secondary MCL or action levels.
(2) Based on August 2014 Data. “<” values are below the reporting limit.
(3) No Title 22 sampling or enforcement requirement.
(4) When not listed under Title 22, OWTP discharge goals are used.
(5) Recent sampling for this pollutant showed RO permeate levels <2 Pci/L.
(6) The source of the gross-beta was found to be Santa Clara Wastewater, and they are no longer allowed to discharge to the City collection system or OWTP. Subsequent testing has demonstrated very low gross-beta results and compliance with the NPDES permit.

Table 18 AWPF Removal Efficiencies (Local Limits Constituents)
Advanced Water Purification Facility
City of Oxnard

Constituent	Units	Secondary Effluent	Finished Water	Removal Efficiency[(1)]
Ammonia	mg/L	33.9	1.67	95.1%
Antimony	ug/L	0.84[(2)]	<1	40.5%
Arsenic	ug/L	2.09[(2)]	<1	76.0%
Barium Tot	ug/L	23.0	<2	95.7%
Beta, Gross	pCi/L	5.96[(2)]	<3	74.8%
Biochemical Oxygen Demand, total	mg/L	6.91[(3)]	2.31[(3)]	66.6%
Boron	mg/L	1.09	0.74	31.9%
Cadmium	ug/L	<0.5	<0.5	--
Calcium	mg/L	164	7.52	95.4%
Chloride	mg/L	548	18.7	96.6%
Chromium	ug/L	0.52[(4)]	<1	4.2%
Copper	ug/L	7.16	<2	86.0%
Fixed Dissolved Solids	mg/L	1,603	1.14[(4)]	99.9%
Fluoride	mg/L	0.70	0.02	96.4%
Gross Alpha	pCi/L	26.5	<3	94.3%
Iron Total	mg/L	0.30	0.01[(4)]	96.2%
Lead Total	ug/L	<0.5	<0.5	--
Magnesium	mg/L	67.8	0.23	99.7%
Manganese	mg/L	0.11	<0.002	99.1%
Mercury	ng/L	6.01[(2)]	1.52	74.7%
Molybdenum	ug/L	16.4	<2	93.9%
Nickel	ug/L	6.57[(2)]	<5	62.0%
Potassium	mg/L	35.1	1.43	95.9%
Selenium	ug/L	8.05[(2)]	<5	69.0%
Silica	mg/L	30.8	1.01	96.7%
Silver Total	ug/L	<0.5	<0.5	--
Sodium	mg/L	397	17.4	95.6%
Specific Conductance	umho/cm	3,346	141	95.8%
Strontium	mg/L	1.55	0.01[(4)]	99.6%
Sulfate	mg/L	543	1.27	99.8%
Total Dissolved Solids	mg/L	1,869	69.9	96.3%
Total Kjeldahl Nitrogen	mg/L	34.3	1.70	95.0%
Total phosphorus as P	mg/L	1.45	0.03	97.8%
Total Suspended Solids	mg/L	5.32[(2)]	<10	6.1%
Uranium	ug/L	8.49	<1	94.1%
Zinc Total	ug/L	17.3[(2)]	<20	42.2%

Table 18	AWPF Removal Efficiencies (Local Limits Constituents) Advanced Water Purification Facility City of Oxnard

Notes:

(1) Where the reported value is < reporting limit, the removal efficiency was calculated assuming the reported value equaled one half of the reporting limit.

(2) Some data points in this dataset were extrapolated below reporting limit based on other reported data at the sampling location. These datasets had three or more data points above the reporting limit to allow regression analysis for extrapolating concentrations below the level of detection.

(3) BOD data were collected on 9 days from 6/11/15 through 8/30/15.

(4) These datasets had less than three data points above the reporting limit which makes a regression analysis inaccurate. Thus, a geometric mean of all data points was used. Data reported below the reporting limit were assumed to be one half the reporting limit for calculating the geometric mean.

8.0 SUMMARY

An ESCM Program framework has been proposed in this document, building on the existing source control program already in place at the City of Oxnard. The proposed ESCM for the City of Oxnard will include:

- A source control program manager overseeing all data collection and regulatory issues relating to discharge from the first user to groundwater wells.
- More frequent sampling than currently required of the secondary effluent and AWPF finished water, including for regulated, unregulated and industry-specific constituents.
- Use of historical and online monitoring data currently required for operation to create baselines and predict trends in process performance.
- Substantial industrial and residential outreach programs for potable reuse education and discharge initiatives.
- Mapping strategies for fast-acting collection system tracing of detected contaminants of health concern.
- Optional additions to discharge mapping, including hospitals.

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ACRONYMS

-A-	
ASR	Aquifer Storage and Recovery
AWPF	Advanced Water Purification Facility
-B-	
bgs	below ground surface
BOD	Biological Oxygen Demand
-C-	
CEC	Constituents of Emerging Concern
CEQA	California Environmental Quality Act
City	The City of Oxnard
CIUs	Categorical Industrial Users
CMWD	Calleguas Municipal Water District
CWC	California Water Code
-D-	
DDW	Division of Drinking Water
DIT	Direct Integrity Test
-E-	
EC	Electrical Conductivity
EDCs	Endocrine Disrupting Compounds
ELAP	Environmental Laboratory Accreditation Program
-F-	
FCGMA	Fox Canyon Groundwater Management Authority
-G-	
GRPs	Groundwater Recharge Projects
GRRP	Groundwater Replenishment Reuse Project
GWRS	Groundwater Replenishment System
-H-	
H_2O_2	Hydrogen Peroxide
-I-	
IPR	Indirect Potable Reuse
-L-	
LARWQCB	Los Angeles RWQCB
LAS	Lower Aquifer System
LASAN	LA Sanitation
LPHO	Low-Pressure High-Output
LRV	Log-Removal Value
-M-	
MCLs	Maximum Contaminant Levels
MDL	Method Detection Limit
MF	Microfiltration
MRP	Monitoring and Reporting Program
MWDSC	Metropolitan Water District of Southern California
-N-	
ND	Non-Detected
NLs	Notification Levels
NOV	Notice of Violation

NWRI	National Water Research Institute
-O-	
OMMP	Operations, Maintenance, and Monitoring Plan
ORP	Oxidation Reduction Potential
OVMWD	Ocean View Municipal Water District
OWTP	Oxnard Wastewater Treatment Plant
-P-	
PDT	Pressure Decay Test
PEIR	Program Environmental Impact Report
PHWA	Port Hueneme Water Authority
POTW	Publicly-Owned Treatment Works
PPCP(s)	Pharmaceuticals and Personal Care Products
-Q-	
QAPP	Quality Assurance Project Plan
-R-	
RO	Reverse Osmosis
ROP	RO Permeate
ROSA	Reverse Osmosis System Analysis
ROWD	Report of Waste Discharge
RRT	Response Retention Time
RWC	Recycled Water Contribution
RWQCB	Regional Water Quality Control Board
-S-	
SCVWD	Santa Clara Valley Water District
SIU(s)	Significant Industrial User(s)
SNMP(s)	Salt Nutrient Management Plan(s)
SWP	State Water Project
SWRCB	State Water Resources Control Board
-T-	
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TSP-SC	Technical Services Program – Source Control
TTO	Total Toxic Organics
-U-	
UAS	Upper Aquifer System
UV AOP	Ultraviolet Light and Hydrogen Peroxide
UVT	UV Transmittance
UWCD	United Water Conservation District's
-W-	
WDR(s)	Waste Discharge Requirement(s)
WRD	Water Replenishment District
WRR	Water Recycling Requirement

APPENDIX A – BEST MANAGEMENT PRACTICES (BMPS) FOR CENTRALIZED WASTE TREATMENT (CWT)

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CALIFORNIA ASSOCIATION OF SANITATION AGENCIES (CASA)

BEST MANAGEMENT PRACTICES
FOR
CENTRALIZED WASTE TREATMENT (CWT) FACILITIES
(SUBCATEGORY D MULTIPLE WASTESTREAM)
October 12, 2015

Purpose

These Best Management Practices (BMPs) have been endorsed by several major POTW's in California that currently accept CWT waste discharges. These major California POTWs have developed and adopted these BMPs to serve as guidance, and to help assure uniform compliance among POTWs in California with their mandates under the U.S. EPA pretreatment program requirements.

These requirements are designed to protect POTW wastewater treatment processes and conveyance systems; to assure compliance with the regulations governing discharge of treated effluent, water reuse, biosolids disposal/reuse, and air emissions; and to protect worker and public safety and the environment.

Acknowledgement

The following agencies participated in the development and review of this BMP.

- City of Oxnard
- County Sanitation District of Los Angeles
- City of San Jose (SJ/SC Water Pollution Control Plant)
- City of Los Angeles
- Orange County Sanitation District

Background

Centralized Waste Treatment (CWT) facilities are defined in Rule 40 CFR 437 as those that accept hazardous or non-hazardous industrial metal-bearing wastes, oily wastes and organic-bearing wastes received from off-site for pretreatment processing before discharge to a water of the U.S., or to a Publically Owned Wastewater Treatment (POTW) facility. Specifically, CWT Subcategory D dischargers are those that receive for treatment a combination of two of more any of the following three major categorical waste streams: metal-bearing wastes, oily wastes, and organic-bearing wastes.

CWTs are required to be permitted and to comply with all federal and local rules and regulations set by Rule 40 CFR 437. They are also required to meet those rules and regulations set by the local agency that owns and operates the POTW facility and administers the POTWs pretreatment program, if the CWT discharges to a POTW.

The EPA's guidance document labeled "Small Entity Compliance Guide, Centralized Waste Treatment (CWT) Effluent Limitations and Guidelines and Pretreatment Standards (40 CFR 437) (EPA 821-B-01-003; June 2001; Version 3.0) "sets guidance for businesses that are subject to the Rule in complying with the national regulations and limitations set forth in the Rule." A Subcategory D discharger must establish that its facility provides "equivalent treatment" in terms of comparable pollutant removals to the applicable treatment technologies used as the basis for the federal limitations and pretreatment standards (40 CFR 437.2).

Best Management Practices

The following summarizes the recommended Best Management Practices (BMPs) for CWT facilities discharging to California POTWs. These recommended BMPs are organized based on the following topical headings:

- Waste Receiving Requirements
- Treatment Requirements
- Effluent Discharge and Sampling/Testing Requirements
- Recommended Certification and Documentation Requirements.

1. Waste Receiving Requirements

a. The waste hauler bringing waste to a CWT shall submit a Waste Manifest to the CWT upon arrival at the CWT processing facility. The Waste Manifest shall include the following minimum information:

    i. Information as defined in Chapter 5 of Small Entity Compliance Guide, Centralized Waste Treatment (CWT) Effluent Limitations and Guidelines and Pretreatment Standards (40 CFR 437) (EPA 821-B-01-003; June 2001; Version 3.0). This shall include a date and time stamp.

b. The following mandatory tests shall be performed for confirmation of the Waste Manifest in accordance with 40 CFR 403 General Pretreatment Regulations and the analytical methods and sampling techniques stipulated in 40 CFR 136:

    i. Heavy Metals
    ii. Cyanides
    iii. Total Phenol
    iv. Sulfides
    v. Volatile Organic Compounds
    vi. Oil and Grease
    vii. Total Toxic Organics (TTOs)
    viii. BOD and TSS

c. Combining waste from multiple location into one tank truck (i.e. "Milk Runs") is prohibited.
d. Additional random sampling of waste haulers by the CWT may be requested by the POTW to confirm the waste characteristics are as described in the Waste Manifest.

2. Treatment Requirements

a. The minimum required treatment shall be as specified in 40 CFR 437, and as described in the Small Entity Compliance Guide, Centralized Waste Treatment (CWT) Effluent Limitations and Guidelines and Pretreatment Standards (40 CFR 437) (EPA 821-B-01-003; June 2001; Version 3.0).
b. Emergency shutoff and re-routing procedures must be in place.
c. Treatment reliability and redundancy requirements must meet. As a minimum, those that are established by the most recent version of the '*Ten-State Standards' (Board of State and Provincial Public Health and Environmental Managers, Health Research, Inc., Health Education Services Division).*
d. Holding tanks for the purpose of dilution will not be allowed.
e. A logbook shall be maintained of the operating parameters of the treatment process.

3. Effluent discharge and sampling/testing requirements.

a. Batch discharge will be required. Continuous discharge is not permitted.
b. The batch tanks will be continuously mixed.
c. A representative sample will be taken and analyzed by a POTW approved, State certified laboratory, before a decision is made to discharge to the POTW sewer system. Testing shall, as a minimum, be for the following:
    i. Local Limits as established by the POTW.
    ii. Applicable 40 CFR 437 Categorical Limits, adjusted by the combined waste stream formula if non-regulated waste streams are discharged at the compliance point.
    iii. Toxicity as determined by Specific Oxygen Uptake Rate (SOUR), Method 1683, EPA-821-R-01-014.
    iv. Any other limits imposed by the POTW.
d. The batch discharge will only be allowed if the above test results meet the applicable discharge limits.
e. Adequate emergency shut-off/rerouting procedures must be established. Incoming wastes must be halted or diverted to storage if an emergency shutdown of the treatment system is required.
f. If the federal or local discharge limitations are not met for a parameter other than pH, then the tank contents shall to be returned to the beginning of the treatment process train for reprocessing. If the federal or local pH limits are not met based on pH only, then the CWT Facility can add an acid or base to bring the pH into the allowable range before discharge. The POTW may have restrictions on the acid or base chemical that can be used for pH adjustment.
g. Installation of flow metering of the discharge to the POTW is required and must be maintained and calibrated routinely by a qualified professional.

4. Recommended General Certification and Documentation Requirements

Documents must be developed and submitted to the POTW, and be available for the POTW to review at the CWT site all times.

Note that all documents, forms, and other submittals must be certified and stamped by a registered professional engineer in California with expertise in industrial treatment. This list includes, but is not limited to the following.

1. Initial Certification Statement.

a. Submit initial Certification Statement to the POTW in accordance with 40 CFR 437.41.

b. The initial Certification Statement must be reviewed and approved by the POTW before a Permit to Discharge is granted to the CWT by the POTW.

2. Plans/Procedures

a. Monitoring, Sampling and Testing Plan (MSTP). The MSTP shall specify: location, frequency, and methodology for all monitoring/sampling of waste received, treatment processes and performance, and treated effluent discharged to the POTW.

b. Monitoring Plan Reporting: Monthly and annual reports shall be submitted summarizing all mandatory and self-monitoring data results.

c. Slug Discharge Control Plan.

d. Spill Containment plan.

e. Flow Metering Plan.

f. Rainwater and Stormwater Management Plan (Note: stormwater cannot be commingled with received and/or treated CWT wastes).

g. Solvent Management Plan.

h. Waste Minimization Plan.

5. Treatment Process/Facility Information.

a. O&M Manual
   - i. Routine O&M Procedures
   - ii. Emergency Response, Bypass, and Storage O&M Procedures
   - iii. O&M Logbook

b. Unit process sizing and design criteria. Information shall be sufficient for independently assessing the rated treatment capacity of all unit operations, including physical dimensions, and process design criteria (e.g. hydraulic detention times, overflow rates, pollutant removals, etc.).

c. Engineering Design Drawings (100% Design Drawings/As-built).

d. Process and Instrumentation diagram. This shall show the following information:
   - i. Process flows for all major unit operations (routine and emergency conditions). This shall include identification of all flow and recycle streams for each treatment process
   - ii. Process monitoring parameters (location and metrics). As a minimum these shall include:
     - a. Flow rates
     - b. pH
     - c. Temperature
     - d. Others as recommended by the POTW.

e. Wastewater Treatment Operator Requirements.
f. Water Usage. Copies of historical water bills and/or local well records showing water usage for a five-year (5) period.
g. Operating Records. All plant operating and performance records relating to wastewater discharge and waste manifests for up to five (5) years, including all monitoring, testing, and analytical results (See Testing and Monitoring *Information*, below).

6. Received Waste Documentation

a. Comprehensive list of all generators accepted by the CWT.
b. Waste Hauler Reports.
c. Logbook of all prequalification for each of the CWTs clients, this includes;
    i.. Generator information
    ii. Initial Sample information
    iii. Requalification tests
d. Customer Laboratory Treatability Information.

7. Testing and Monitoring Information

a. All sampling, testing and laboratory analyses must be performed by an independent testing laboratory that is licensed and certified in California.
b. All laboratory analytical results, including QA/QC information, shall be submitted monthly, and records maintained for a five-year period.
c. Effluent pH recordings from the previous 180 days
d. Flow Meter Calibration and Maintenance Reports (Note: must be signed and stamped by a registered professional engineer in California).
    i. Flow meter locations
    ii. Flow meter descriptions
    iii. Flow meter system details
    iv. Calibration methods/results
    v. Corrective measures
    vi. Discharge log (with signature(s) from responsible party at time of release from CWT facility to the POTW system.)
    vii.. Time, date, and volume of when the contents from the tank are discharged to the sewer
    viii. Signature from responsible operator
    ix Other observations
e. Chain of custody forms for monitoring samples with signatures.
f. All other sampling reports.

8. Compliance Paperwork

a. On-site Compliance Paperwork, as required by 40 CFR Part 437.47(a)(4)
b. Periodic Certification of equivalent treatment statement in the Self-Monitoring Report 40 CFR Part 437.41(b)
c. Facility shall continue to submit application information on a five-year cycle, with all applicable documentation and any information pertaining to changes planned for the future years. The information provided must include changes in the nature or volume of the discharge, or anticipated customers.

APPENDIX B – OXNARD WASTEWATER TREATMENT PLANT NPDES PERMIT REGULATIONS PER CURRENT ORDER R4-2013-0094

APPENDIX B – OXNARD WASTEWATER TREATMENT PLANT NPDES PERMIT REGULATIONS PER CURRENT ORDER R4-2013-0094

Table B.1 - Oxnard WWTP Permit Regulations		
Constituent	**Units**	**Average Monthly Limitation**
BOD	mg/L	30
TSS	mg/L	30
pH	Standard	6.0-9.0
Oil & Grease	mg/L	25
Setteable Solids	ml/L	1.0
Turbidity	NTU	75
Marine Aquatic life Toxicants(1)		
Arsenic	µg/L	2.0
Cadmium	µg/L	1.0
Chromium (VI)	µg/L	8.0
Copper	µg/L	30
Lead	µg/L	23
Mercury	µg/L	0.3
Nickel	µg/L	8.0
Selenium	µg/L	4.7
Silver	µg/L	1.9
Zinc	µg/L	36
Cyanide	µg/L	25
Chlorine Residual	mg/L	0.13
Ammonia as N	mg/L	32
Phenolic compounds (non-chlorinated)	µg/L	5.0
Phenolic compounds (chlorinated)	µg/L	0.42
Endosulfan	µg/L	0.05
HCH	µg/L	0.1
Endrin	µg/L	0.05
Chronic toxicity	TUc	99(2)
Radioactivity(2)		
Gross alpha	PCi/L	15
Gross beta	PCi/L	50
Combined Radium-226 & Radium-228	PCi/L	5.0

Table B.1 - Oxnard WWTP Permit Regulations		
Constituent	**Units**	**Average Monthly Limitation**
Tritium	PCi/L	20,000
Strontium-90	PCi/L	8.0
Uranium	PCi/L	20
Human Health Toxicants – Non Carcinogens(1)		
Acrolein	µg/L	10
Antimony	µg/L	2.5
Bis(2-chloroethoxy) methane	µg/L	25
Bis(2-chloroisopropyl) ether	µg/L	10
Chlorobenzene	µg/L	2.5
Chromium (III)	µg/L	8.0
Di-n-butyl-phthalate	µg/L	0.19
Dichlorobenzenes	µg/L	2.5
Diethyl phthalate	µg/L	10
Dimethyl phthalate	µg/L	10
2-Methyl-4,6-dinitrophenol	µg/L	25
2,4-Dinitophenol	µg/L	25
Ethyl benzene	µg/L	2.5
Fluoranthene	µg/L	
Hexachlorocyclopentadiene	µg/L	25
Nitrobenzene	µg/L	5
Thallium	µg/L	5
Toluene	µg/L	2.5
Tributylin	µg/L	0.0263
1,1,1-Trichloroethane	µg/L	2.5
Human Health Toxicants - Carcinogens		
Acrylonitrile	µg/L	10
Aldrin	µg/L	0.025
Benzene	µg/L	2.5
Benzidine	µg/L	0.0068
Beryllium	µg/L	2.5
Bis(2-chloroethyl) ether	µg/L	5.0
Bis(2-ethylhexyl)phthalate	µg/L	50
Carbon tetrachloride	µg/L	2.5
Chlordane	µg/L	0.5
Chlorodibromomethane	µg/L	0.61

Table B.1 - Oxnard WWTP Permit Regulations		
Constituent	**Units**	**Average Monthly Limitation**
Chloroform	µg/L	1.2
DDT	µg/L	0.25
1,4-Dichlorobenzene	µg/L	0.041
3,3'-Dichlorobenzidine	µg/L	25
1,2-Dichloroethane	µg/L	2.5
1,1-Dichloroethylene	µg/L	2.5
Bromodichloromethane	µg/L	2.5
Dichloromethane	µg/L	2.5
1,3-Dichloropropene	µg/L	2.5
Dieldrin	µg/L	0.05
2,4-Dinitrotoluene	µg/L	25
1,2-Diphenylhydrazine	µg/L	5
Halomethanes	µg/L	4.4
Heptachlor	µg/L	0.05
Heptachlor epoxide	µg/L	0.002
Hexachlorobenzene	µg/L	5
Hexachlorobutadiene	µg/L	5
Hexachloroethane	µg/L	5
Isophorone	µg/L	5
N-Nitrosodimethylamine	µg/L	5
N-Nitrosodi-N-propylamine	µg/L	25
N-Nitrosodiphenylamine	µg/L	5
PAHs	µg/L	0.097
PCBs	µg/L	0.0019
TCDD equivalents	µg/L	3.9×10^{-7}
1,1,2,2-Tetrachloroethane	µg/L	2.5
Tetrachloroethylene	µg/L	2.5
Toxaphene	µg/L	2.5
Trichloroethylene	µg/L	2.5
1,1,2-Trichloroethane	µg/L	2.5
2,4,6-Trichlorophenol	µg/L	0.35
Vinyl chloride	µg/L	2.5

Notes:
(1) Values reflect monthly performance goals.
(2) Maximum daily limitation.

APPENDIX B – PRELIMINARY HYDROGEOLOGICAL STUDY REPORT, CITY OF OXNARD GREAT PROGRAM, CAMPUS PARK GROUNDWATER REPLENISHMENT AND REUSE PROJECT

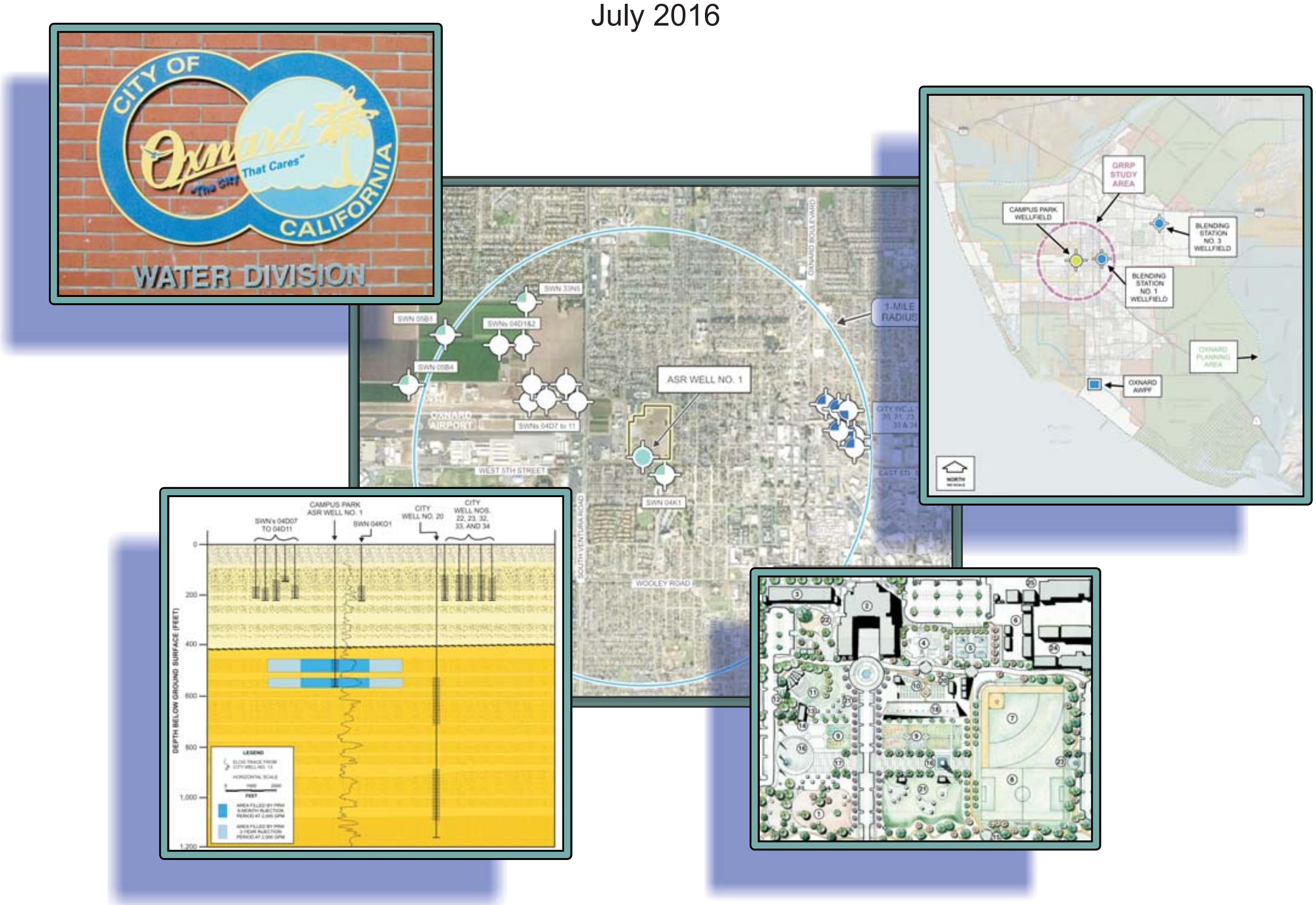
HOPKINS GROUNDWATER CONSULTANTS, INC.

PRELIMINARY HYDROGEOLOGICAL STUDY

CITY OF OXNARD GREAT PROGRAM
CAMPUS PARK GROUNDWATER REPLENISHMENT AND REUSE PROJECT
OXNARD, CALIFORNIA

Prepared for:
City of Oxnard

July 2016



HOPKINS
GROUNDWATER
CONSULTANTS, INC.
THE WATER RESOURCE SPECIALISTS

July 26, 2016
Project No. 01-011-09E

City of Oxnard
305 West Third Street, Second Floor, East Wing
Oxnard, California 93030

Attention: Mr. Daniel Rydberg
Public Works Director

Subject: Preliminary Hydrogeological Study, City of Oxnard Great Program, Campus Park Groundwater Replenishment Reuse Project, Oxnard, California.

Dear Mr. Rydberg:

Hopkins Groundwater Consultants, Inc. (Hopkins) is pleased to submit this final report summarizing the findings, conclusions, and recommendations developed from a preliminary study evaluating the feasibility of a Groundwater Replenishment Reuse Project (GRRP) that is proposed as part of the City of Oxnard Groundwater Recovery Enhancement and Treatment (GREAT) Program. The study findings indicate that the Campus Park GRRP site proposed for Indirect Potable Reuse is a feasible location and that the replenishment and recovery of groundwater with an improved quality could be achieved by the project for Indirect Potable Reuse. The study provides detailed hydrogeological findings in compliance with Groundwater Replenishment Using Recycled Water regulations designated DPH-14-003E, dated June 18, 2014, to augment the Indirect Potable Reuse engineering report required for the project, and to facilitate discussion with State regulatory agencies, local groundwater management agencies, and stakeholder groups that may have a direct interest in the project.

As always, Hopkins is pleased to be of service. If you have questions or need additional information, please give us a call.

Sincerely,

HOPKINS GROUNDWATER CONSULTANTS, INC.

REGISTERED GEOLOGIST
CURTIS J. HOPKINS
EG NO. 1800
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Curtis J. Hopkins
Principal Hydrogeologist
Professional Geologist PG 5695
Certified Hydrogeologist HG 114
Certified Engineering Geologist EG 1800

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ACRONYM LIST

AFY – Acre-Feet Per Year

ASR – Aquifer Storage and Recovery

AWPF – Advanced Water Purification Facility

BGS – Below Ground Surface

BS-1 – Blending Station No. 1

BS-3 – Blending Station No. 3

CDPH – California Department of Public Health

CRWQCB – California Regional Water Quality Control Board

DDW – California Department of Drinking Water

FCGMA – Fox Canyon Groundwater Management Agency

GPM – Gallons Per Minute

GREAT – Groundwater Recovery Enhancement and Treatment

GRRP – Groundwater Replenishment Reuse Project

GRURW – Groundwater Replenishment Using Recycled Water

IPR – Indirect Potable Reuse

LAS – Lower Aquifer System

MSL – Mean Sea Level

MG/L – Milligrams Per Liter

PRW – Purified Recycled Water

PSI – Pounds Per Square Inch

TDS – Total Dissolved Solids

UAS – Upper Aquifer System

UWCD – United Water Conservation District

VCWPD – Ventura County Watershed Protection District

CITY OF OXNARD GREAT PROGRAM
CAMPUS PARK GROUNDWATER
REPLENISHMENT AND REUSE PROJECT

INTRODUCTION

GENERAL STATEMENT

Presented in this report are the findings, conclusions, and recommendations developed from a preliminary hydrogeological study conducted by Hopkins Groundwater Consultants, Inc. (Hopkins) to assist the City of Oxnard (City) in evaluating the feasibility of a Groundwater Replenishment Reuse Project (GRRP) using purified recycled water (PRW). This hydrogeological study was conducted to support the City's Groundwater Recovery Enhancement and Treatment (GREAT) Program by developing an aquifer storage and recovery (ASR) project that will provide Indirect Potable Reuse (IPR) of the PRW produced at the City's Advanced Water Purification Facility (AWPF).

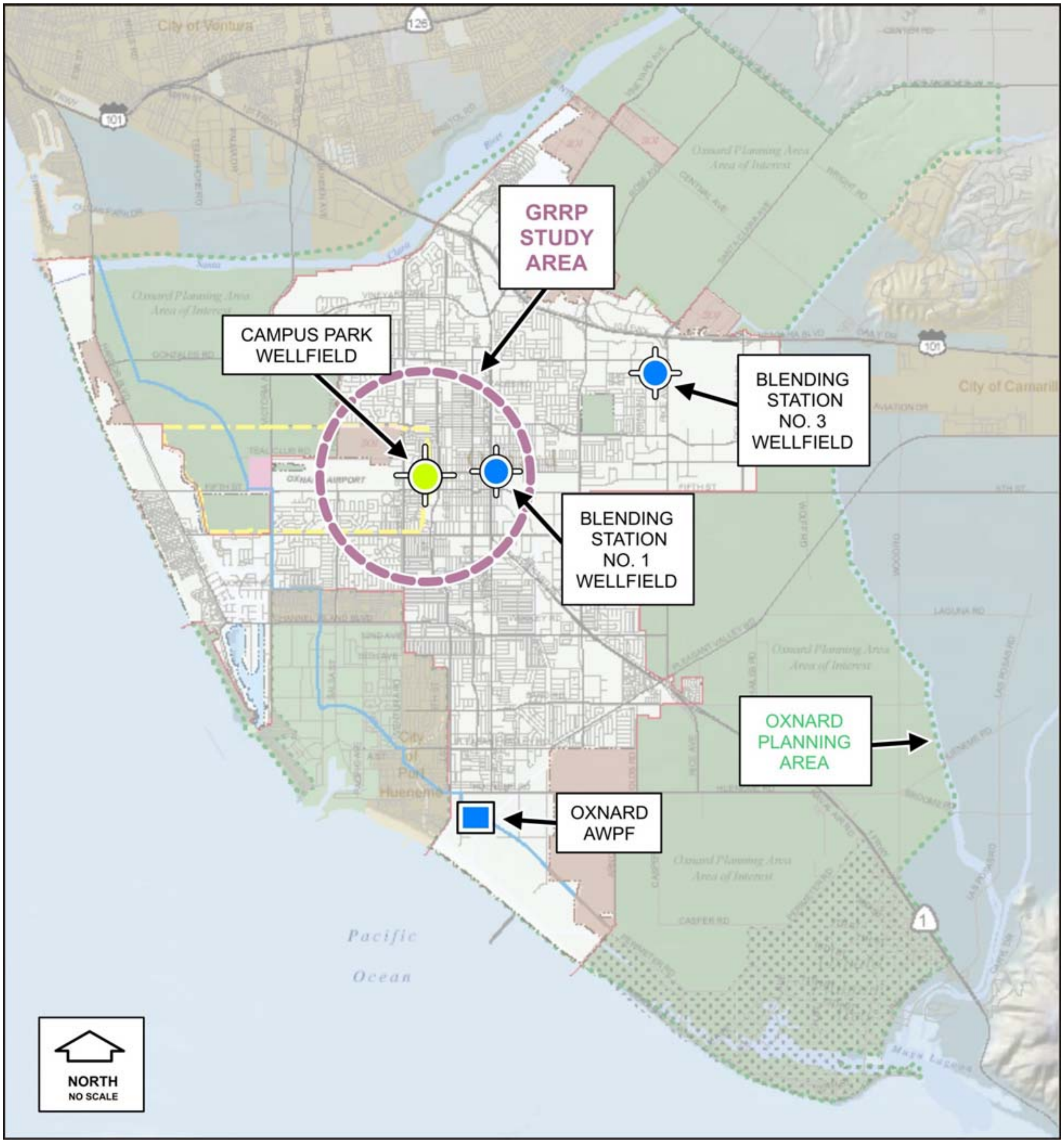
The proposed City GRRP includes developing a sustainable program for groundwater replenishment and IPR of PRW using aquifer units located in the Oxnard Plain Groundwater Basin. The proposed GRRP is intended to augment the City's potable water system by; 1) improving the delivered water quality, 2) increasing the available supply, and 3) providing greater reliability through source redundancy. The GRRP study area is indicated on Figure 1 – Study Area Location Map.

BACKGROUND

The present City water supply is a combination of sources including; a) imported water from the State Water Project, b) groundwater produced by the United Water Conservation District (UWCD), and c) groundwater produced by the City wellfields at Blending Station Nos. 1 and 3 (BS-1 and BS-3). Historically, the City has improved the quality of its municipal supply by blending the higher quality imported water with its local groundwater supplies. The recent construction of the brackish groundwater desalter facilities located at BS-1 has provided the City with the means to further improve its water quality through the desalination of poor quality groundwater. During the desalination process, approximately 20 percent of the produced groundwater feeding the desalter is lost as brine reject that is discharged to the sewer ocean outfall.

The present operation of the City's groundwater desalter has allowed the City to shift groundwater production from the higher quality aquifer zones in the Lower Aquifer System (LAS) to the poorer quality aquifer zones in the Upper Aquifer System (UAS). This shift of pumping was designed to comply with the most recent groundwater management strategies of the Fox Canyon Groundwater Management Agency (FCGMA).

Figure 1 – Study Area Location Map



The GREAT Program was originally developed at a time when recycled water regulations treated all recycled water in the same manner. State regulations required onerous project development studies, monitoring and reporting programs, and dilution requirements utilizing another potable supply. Soil and aquifer treatment criteria could require extended retention times and travel distances through an aquifer to provide additional treatment prior to beneficial potable reuse. With these regulations, the City believed the best approach was to inject the PRW into the local aquifer system at a location that optimized basin management strategies, and extract a like amount of native groundwater from another area of the basin for municipal use. Consistent with this approach, the City proposed the direct use of the PRW for permissible agricultural purposes. Subsequently, a transfer of the unused groundwater would be provided to the City for municipal uses. Both of these strategies would provide the City with a source of potable groundwater in exchange for its recycled water.

This original approach required that the City purify a greater portion of the groundwater with a desalter and resulted in additional treatment costs and a loss of approximately 20 percent of the produced groundwater supply. The present approach for IPR would eliminate the additional step of desalting groundwater by allowing the indirect reuse of the high quality PRW. This will conserve energy and prevent wasting 20 percent of the supply as part of the redundant treatment process. The stored and recovered PRW by the GRRP can be blended with lower quality groundwater to achieve the City's water quality objectives.

Since construction of the GREAT Program AWPF, Federal and State recycled water regulations have been updated to the present Groundwater Replenishment Using Recycled Water (GRURW) regulations designated DPH-14-003E, dated June 18, 2014. These regulations accommodate the use of highly treated effluent produced by the PRW process by reducing or eliminating the requirement for soil/aquifer treatment. The State has recognized that the threat to public health is significantly lower after municipal wastewater receives advanced purification and disinfection using reverse osmosis, advanced oxidation, and ultraviolet radiation treatment processes. Because of the PRW extreme high quality, the new GRURW regulations significantly reduce the requirements for IPR compared to wastewater treated to secondary or tertiary standards.

PURPOSE

The purpose of this hydrogeological assessment of the proposed GRRP is to provide specific information to comply with the GRURW regulations pursuant to section 60320.200(h) and permit the preliminary investigation to develop site specific information that is required for the GRRP Title 22 engineering report. The findings of this study are also intended to further define the conceptual components of the ASR program that will be necessary to implement the IPR of PRW as a municipal supply in accordance with regulation provisions.

As part of the GRRP, the City proposes a project that:

1) utilizes (to the extent practicable) existing pipelines and facilities to control potential costs,

2) recharges aquifer zones that preserve the water quality during underground storage,

3) minimizes the risk to other potable well facilities,

4) is consistent with the FCGMA and UWCD groundwater management strategies,

5) has operational flexibility to adapt to changing system demands and aquifer conditions,

6) demonstrates the ASR capacity of the Oxnard Plain LAS,

7) can be increased to facilitate future AWPF expansion, and

8) can simplify monitoring and reporting to UWCD, the FCGMA, the California State Water Resources Control Board Division of Drinking Water (DDW), and the California Regional Water Quality Control Board (CRWQCB).

This hydrogeological study utilizes the City GREAT Program Update, dated June 25, 2012, as the guide for the anticipated capacity of the AWPF and the initial availability of PRW. This study is intended to provide the mandatory hydrogeological assessment to accompany the engineering report required pursuant to section 60323 of the Title 22, California Code of Regulations, GRURW regulations for a new GRRP.

Additionally, this hydrogeological assessment is intended to provide operational criteria based on aquifer parameters estimated from historical well data, which will define the range of ASR capacity that can be reasonably anticipated from the underlying aquifer system. Subsequently, a conceptual GRRP operational schedule can be developed for the ASR operations to comply with the response retention time requirements of the GRURW regulations for IPR that is based on reasonable expectations of the natural aquifer system constraints.

Sources of available data and published information that were used for the study include; a) City data and reports, b) UWCD data and reports, c) United States Geological Survey, and d) Ventura County Watershed Protection District (VCWPD) databases.

HYDROGEOLOGICAL CONDITIONS

The City recognizes that the threat of seawater intrusion is a regional issue. The City has historically complied with FCGMA regulations and participated in UWCD groundwater supply management programs. Implementation of the GREAT Program is intended to continue this cooperative management effort and the beneficial use of the local groundwater resources in the vicinity of the City. The proposed GRRP using PRW includes ASR wells constructed in aquifer zones that comprise the LAS. Recharge into the LAS will store water in aquifer zones that receive significantly less groundwater recharge than the UAS because of the regional confined aquifer conditions. The UAS readily receives groundwater recharge derived from natural percolation of rainwater and Santa Clara River flows in the Oxnard Forebay Basin, as well as from river flow diversions into the engineered recharge facilities operated by UWCD.

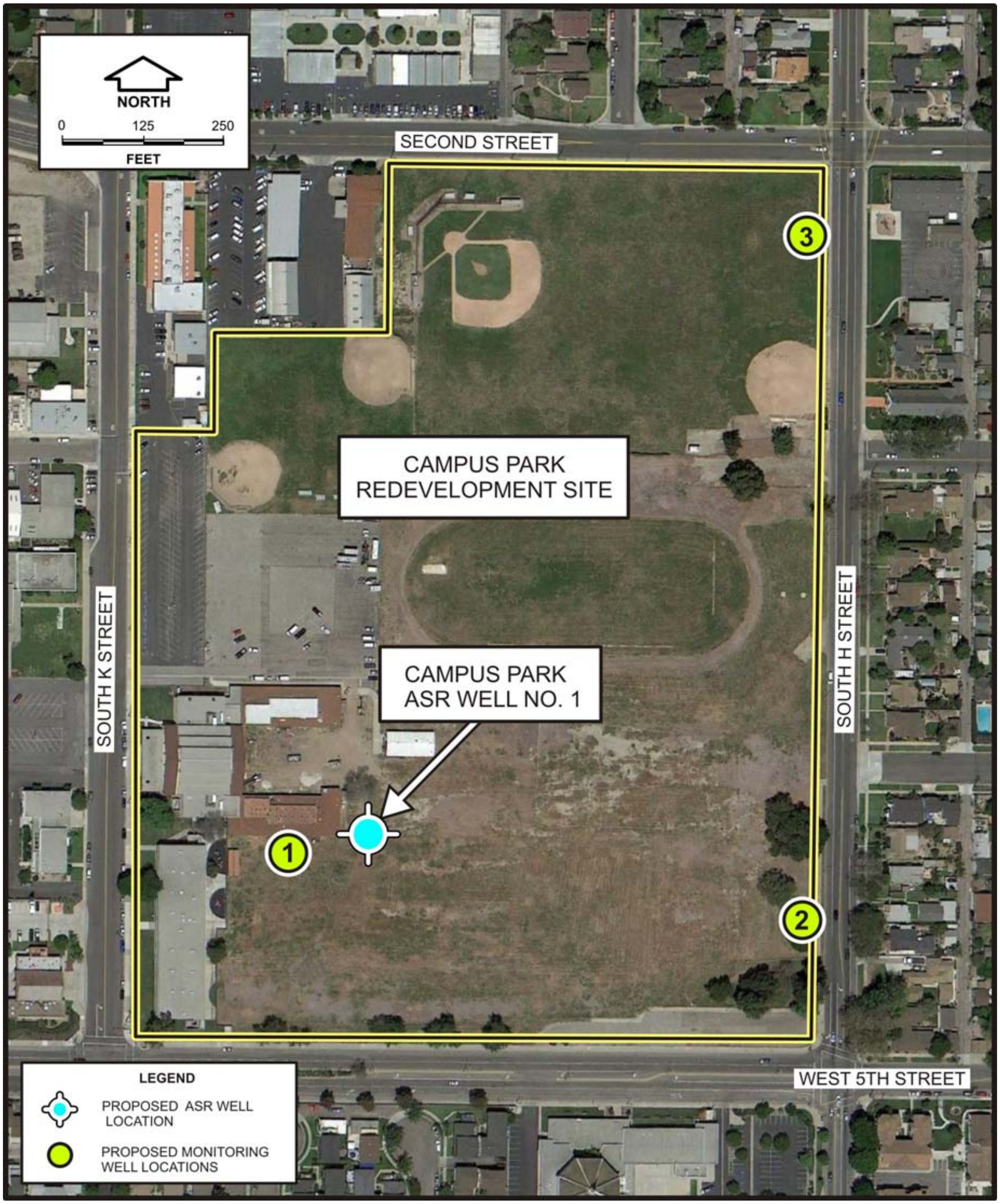
The GRRP ASR Well will be designed to inject PRW into discrete aquifer zones in the LAS and subsequently facilitate groundwater extraction after the response retention time is achieved and regulatory approval is granted. The proposed ASR Well No. 1 is anticipated to be constructed with a completion depth of about 580 feet below ground surface (bgs) and with a screened interval limited to a discrete aquifer zone(s) in the LAS. The well will be designed for an injection capacity of up to 2,000 gallons per minute (gpm). Plate 1 – Preliminary ASR Well No. 1 Design Drawing provides preliminary design details that reflect the anticipated hydrogeology and comply with the VCWPD sealing zone requirements.

Water to be injected during initial testing is proposed to be 100 percent PRW. Initially, the water may be conveyed to the ASR well from the City recycled water system using temporary piping. The initial phase of aquifer testing will determine the percentage of recovery that occurs prior to evidence of native groundwater mixing with the PRW along with any change in the PRW chemistry that could occur as it travels through the aquifer matrix. During the test period, PRW that is extracted from the ASR well will be discharged back into the recycled water transmission main and subsequently used for irrigation.

The ASR demonstration program, as developed, will comply with GRURW regulations and last for an anticipated period of between 2 and 4 months. During the initial demonstration period, monitoring well data and water quality samples will be collected and analyzed to verify the preliminary estimations of aquifer parameters, groundwater storage volumes, and groundwater travel times effectuated by PRW recharge. These data will be utilized to finalize the permit application required for full-scale project operation using the PRW generated by the AWPF.

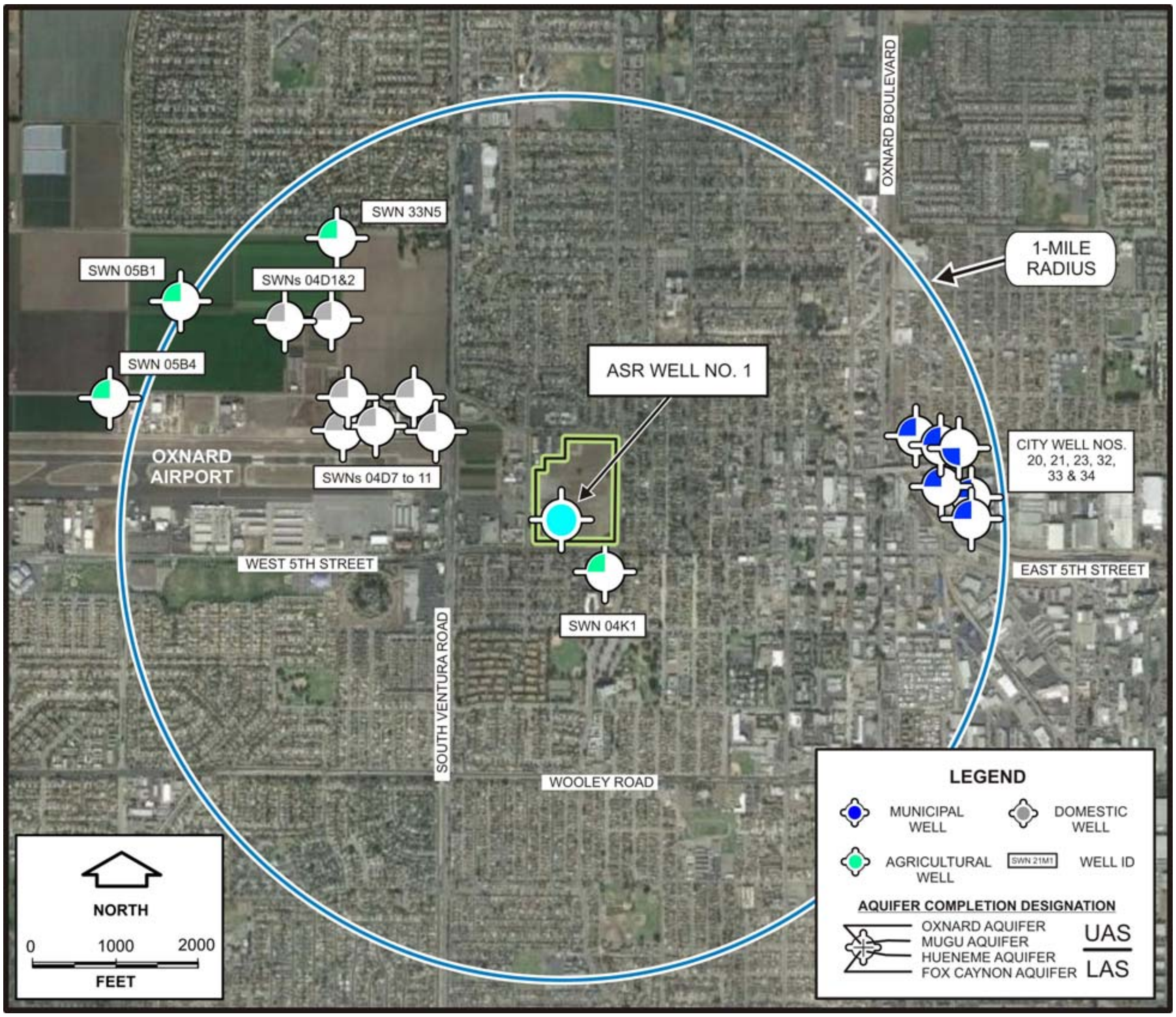
The proposed GRRP would ultimately be sized to accommodate the first phase of the AWPF, providing the ability to store and reuse up to 1,500 acre-feet per year (AFY). The GRRP location identified for groundwater recharge wells is indicated in Figure 2 – Proposed GRRP ASR Well Site Location Map. This location serves to isolate City groundwater facilities within the City boundaries where it has control of surrounding land uses and future groundwater development.

Figure 2 – Proposed GRRP ASR Well Site Location Map



The property selected for installation and operation of the GRRP ASR Well is owned by the City and had an existing City well proximately located and constructed in the LAS (City Well No. 13). While the old City well has since been destroyed, several smaller wells are presently active in the unincorporated area north of the Oxnard Airport along the western City limit. Figure 3 – Existing Well Location Map shows all the active wells within a 1-mile-radius of the GRRP ASR well location.

Figure 3 – Existing Well Location Map



As shown, many proximate wells are constructed in the UAS and as such will not be hydraulically connected with the LAS aquifer zones proposed for use by the GRRP. Review of available data indicates that the nearest well constructed in the LAS is almost 1 mile away and is a municipal supply well owned by the City. The closest existing LAS well is City Well No. 20 located at BS-1. As such, the City ASR well location appears to provide more than a sufficient distance from existing LAS wells to allow GRRP operations without interference.

HYDROGEOLOGY AND AQUIFER DELINEATION

Geology

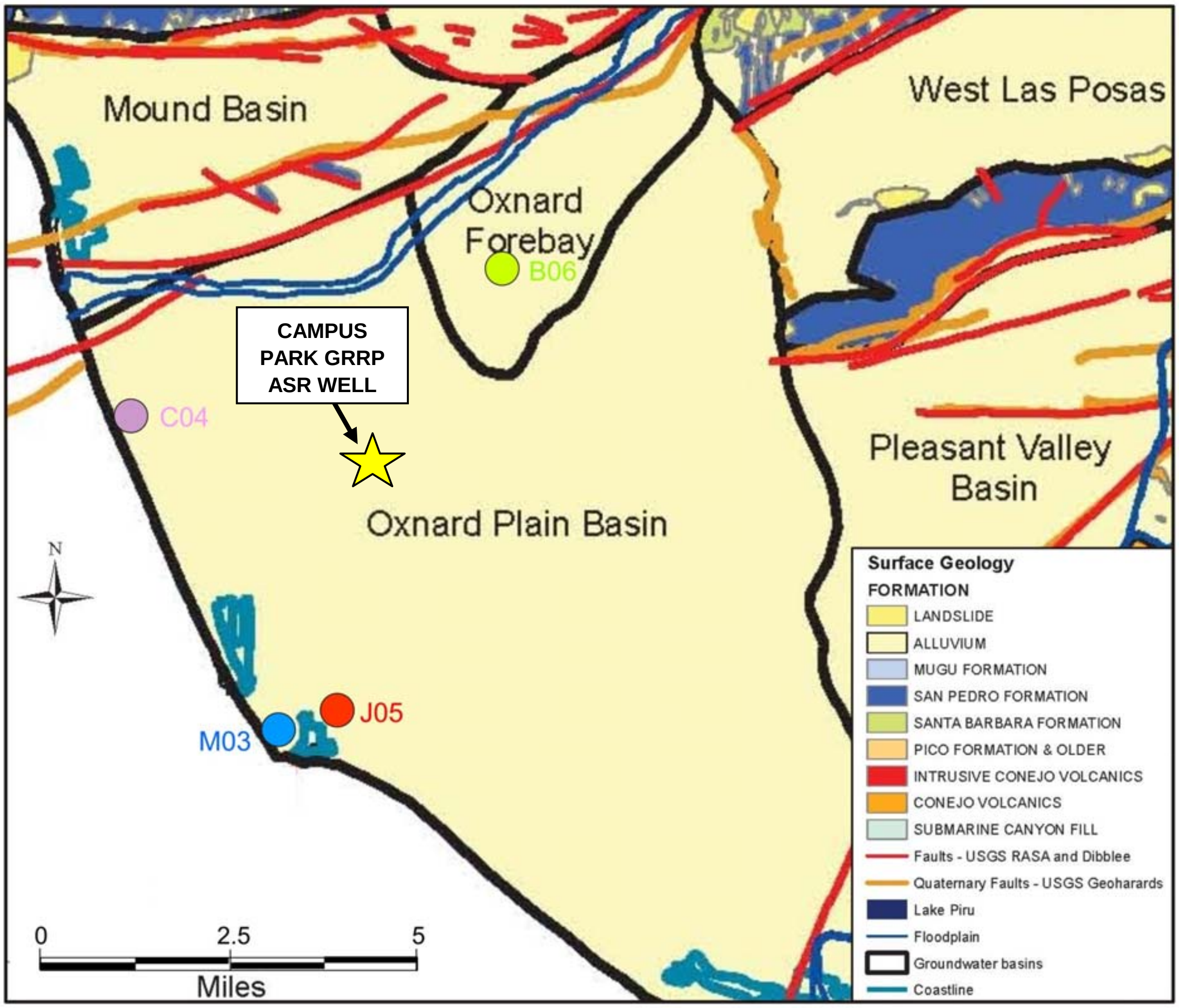
The proposed City project is located in the Oxnard Plain Groundwater Basin, which is part of the Transverse Ranges geologic/geomorphic province and defined by a number of geologic structures and features that separate it from the adjacent groundwater basins. The geology of the Oxnard Plain Basin has been described in detail by several authors including the California State Water Resources Board (SWRB, 1953), Turner (1975), and UWCD (2012). Figure 4 – Generalized Geologic Map and Oxnard Plain Basin Boundaries shows the project location in relation to the adjacent boundaries of the Oxnard Plain Basin with the Mound, Oxnard Forebay, West Las Posas, and Pleasant Valley Basins.

Plate 2 – Hydrogeological Cross-Section Location Map shows the location of cross-sections constructed from available well data to illustrate the subsurface profiles of the geological formations that comprise the underlying aquifer systems. Plate 2 also shows the location of wells that provided geophysical data near the Campus Park GRRP site. Plates 3 and 4 – Hydrogeological Cross-Section A-A’ and B-B’, respectively, provide an interpretation of the hydrostratigraphy in the study area. This conceptual understanding of the confined Oxnard Plain Basin aquifer system is key to the understanding of how the GRRP potential impacts are limited by natural conditions. It also illustrates how the GRRP was developed to utilize discrete aquifer zones that will allow rotation of the three phases of project operations; 1) injection/recharge of the PRW produced from the AWPF, 2) storage/response retention time, and 3) recovery and reuse/IPR.

Aquifer Zone Designation

The subsurface geology that controls groundwater flow in the study area is differentiated into two primary geologic units that include; the Holocene and late Pleistocene alluvium, and the San Pedro Formation. The first unit is comprised largely of unconsolidated sedimentary deposits and includes all older and Recent alluvial deposits. These shallower units are coarse-grained sand and gravel layers that form the Oxnard and Mugu Aquifers and comprise the UAS in the Oxnard Plain Basin (see Plates 3 and 4). The San Pedro Formation consists of consolidated marine and nonmarine clay, silt, sand, and gravel deposits that comprise the Hueneme and Fox Canyon Aquifers that are designated as the LAS. The low permeability geologic formations underlying the San Pedro Formation are generally considered to be non-water-bearing and effectively define the base of fresh water.

Figure 4 – Generalized Geologic Map and Oxnard Plain Basin Boundaries

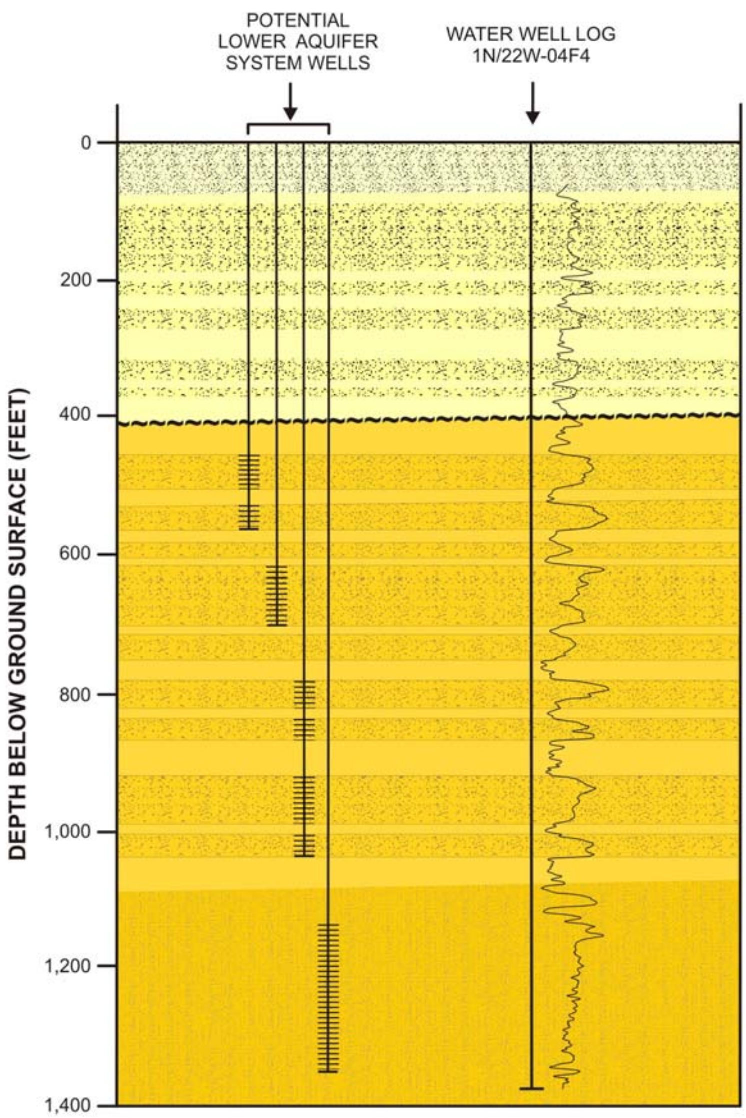


FROM UWCD, 2012

The groundwater in the Oxnard Plain Basin LAS is isolated from overlying land uses by the laterally extensive aquitard (silt and clay) layers that separate and confine the Hueneme and Fox Canyon Aquifer zones. The conceptual subsurface profile shown in Figure 5 – Discrete Aquifer Zone Delineation uses the geophysical survey (electric log) from the proximate City Well No. 13 to show the anticipated geology and aquifer zones beneath the Campus Park GRRP site. The aquifer zones shown in Figure 5 are discretely separated by clay layers that are laterally continuous and appear as marker beds in other well logs shown in Plates 3 and 4. The significance of the highly confined condition that results from the discretely layered aquifer system is that wells located in close proximity (50 feet apart) but producing from different aquifer layers, do not have hydraulic connectivity with each other.

Figure 5 shows a series of proposed wells that could be designed to utilize the storage capacity of discrete aquifer units while being effectively isolated from each other by the natural confining clay layers. This concept can allow the design and use of discrete aquifer zones as individual storage units, as demonstrated by Well Nos. 28, 29, 30, and 31 located at City BS-3. One aquifer zone can be filled without affecting wells that are competently constructed in other aquifer zones. The benefit of this natural condition to the GRRP is that multiple wells can be operated on the same site with a rotating schedule which allows discrete recharge, storage (response retention time), and recovery from separate aquifer zones.

Figure 5 – Discrete Aquifer Zone Delineation

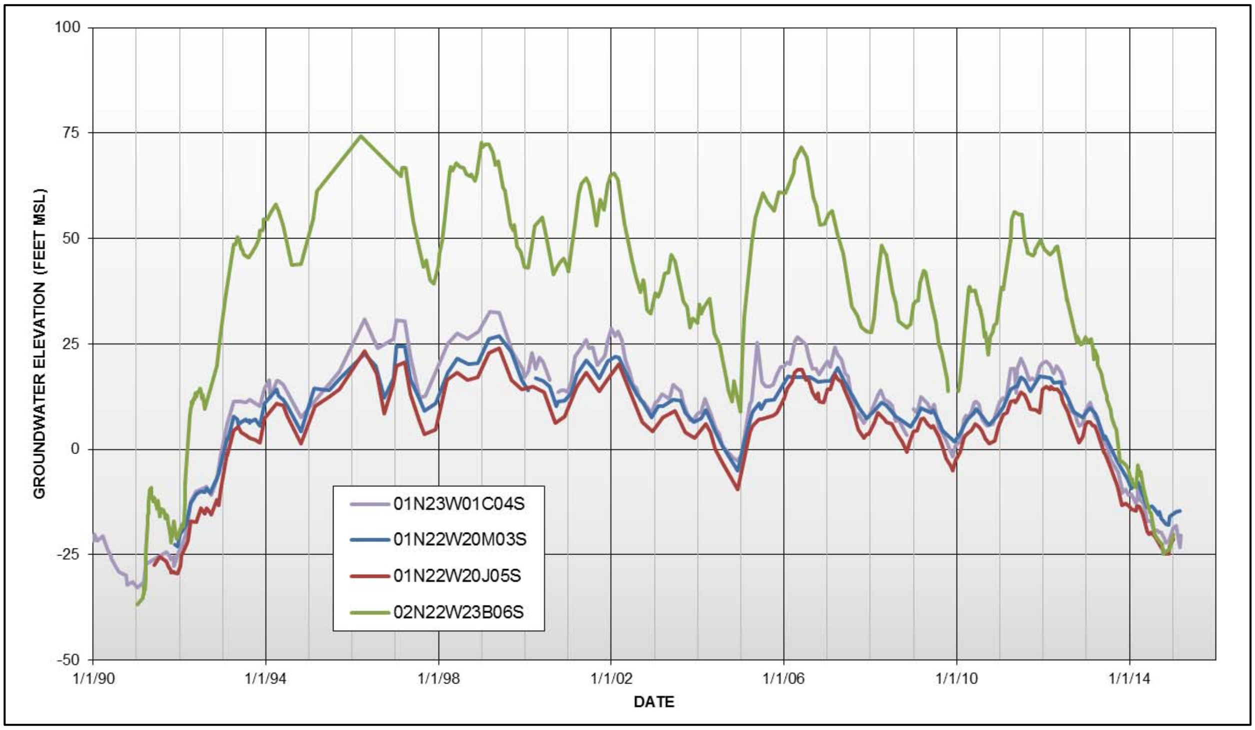


The proposed GRRP utilizes this natural confined aquifer condition to develop an operational scenario that is unique in its application. It can satisfy the GRURW regulations that require a minimum 2-month retention response time, while optimizing the proposed ASR well facilities at a single site. It can operate independent of groundwater flow direction and serve to minimizing the potential risk and consequence of PRW treatment violations (to be explained in following sections).

Groundwater Levels

Groundwater elevations in the Oxnard Plain Basin vary over time. Figure 6 – Groundwater Elevation Hydrograph shows the fluctuation of water levels in the upper Hueneme Aquifer zones in LAS. These data are from discretely screened monitoring wells in aquifer zones that correlate to the aquifer zones proposed for use by ASR Well No. 1. The location of the wells is shown on Figure 4 using the same color for the well symbols as is used for the water levels in the Figure 6 graph. Three of the wells are coastal monitoring wells, and one is located in the Oxnard Forebay where the upper Hueneme Aquifer zones lie unconformably beneath the overlying alluvium of the UAS. The Oxnard Forebay Basin is the primary source of recharge to the LAS.

Figure 6 – Groundwater Elevation Hydrograph



The groundwater elevation in the LAS proximate to the GRRP study area has dropped to approximately 25 feet below mean sea level (msl) during the 1986 to 1990 drought and has risen as high as 20 to 25 feet above msl in wet years. These available data indicate that seasonal fluctuations in the Oxnard Plain Basin groundwater levels are typically around 5 to 10 feet. Dry climatic conditions result in consecutive annual declines in the coastal water levels of up to 45 feet (see Figure 6). These same dry climatic conditions result in water level declines in the Oxnard Forebay Basin on the order of 100 feet. These groundwater level conditions indicate that ASR well operation may require the ability to operate/inject under pressure during high water level conditions while gravity-flow injection operations may be sustained during dry climatic periods.

Combining these water level conditions with the depth to the top of the proposed aquifer units, an injection pressure of 20 pounds per square inch (psi) should be allowable without adverse consequences. The deeper the aquifer zone(s), the greater the operational pressure that is allowable for recharge without creating the potential for adverse effects.

Groundwater Gradient and Flow Velocity

Utilizing data provided by the UWCD, the groundwater elevations in the vicinity of the GRRP were contoured quarterly for 2011 and 2013. These years are believed representative of normal to wet groundwater conditions (2011) and dry year groundwater conditions (2013). Water level data from August 2014 were also contoured and represent groundwater flow conditions after multiple dry years. A series of quarterly groundwater elevation contour maps for the years selected are provided in Appendix A – Groundwater Elevation Contour Maps. Table 1 – Groundwater Gradient and Flow Direction summarizes the results of groundwater gradient estimations using the maps in Appendix A.

For the purpose of the Campus Park GRRP study, the use of the groundwater gradients provided by these data are believed sufficient for understanding the seasonal and climatic changes that occur to the groundwater gradient and the approximate prevailing flow directions in the upper Hueneme Aquifer zones of the LAS.

Table 1 – Groundwater Gradient and Flow Direction

OBSERVATION PERIOD	ASR WELL NO. 1	
	FLOW DIRECTION	GRADIENT
JANUARY 2011	S 43º W	0.0008
APRIL 2011	S 41º W	0.0011
JULY 2011	S 44º W	0.0011
OCTOBER 2011	S 43º W	0.0009
JANUARY 2013	S 44º W	0.0004
APRIL 2013	S 47º W	0.0004
JULY 2013	S 67º W	0.0003
OCTOBER 2013	N 74º W	0.0002
AUGUST 2014	N 04º E	0.0002

TABLE DATA DISPLAYED GRAPHICALLY ON PLATES IN APPENDIX A

As shown, during normal and wet years, recharge in the Oxnard Forebay Basin is significant and establishes a predominant southwesterly groundwater flow direction in the Oxnard Plain Basin (see Appendix A). During the Spring of 2011, the upper Hueneme Aquifer groundwater gradient was generally 0.0011 (dimensionless) and the flow direction was S 41º W as shown on Figure 7 - LAS Groundwater Elevation Contour Map April 2011. The fall gradient in October 2011 was observed to flatten out to a value of 0.0009 (see Table 1).

During dry years like 2013, the groundwater flow direction was observed to be roughly the same as 2011 but the gradient continued to flatten out and the groundwater elevations were closer to sea level. This prevailing flow pattern continues until inland pumping causes water levels to fall below sea level. The lack of recharge during repeated dry years can result in inland groundwater elevations that are substantially below sea level. Figure 8 – LAS Groundwater Elevation Contour Map August 2014 shows the groundwater elevations and flow direction that developed under a 3-year-drought condition.

Figure 7 – LAS Groundwater Elevation Contour Map April 2011

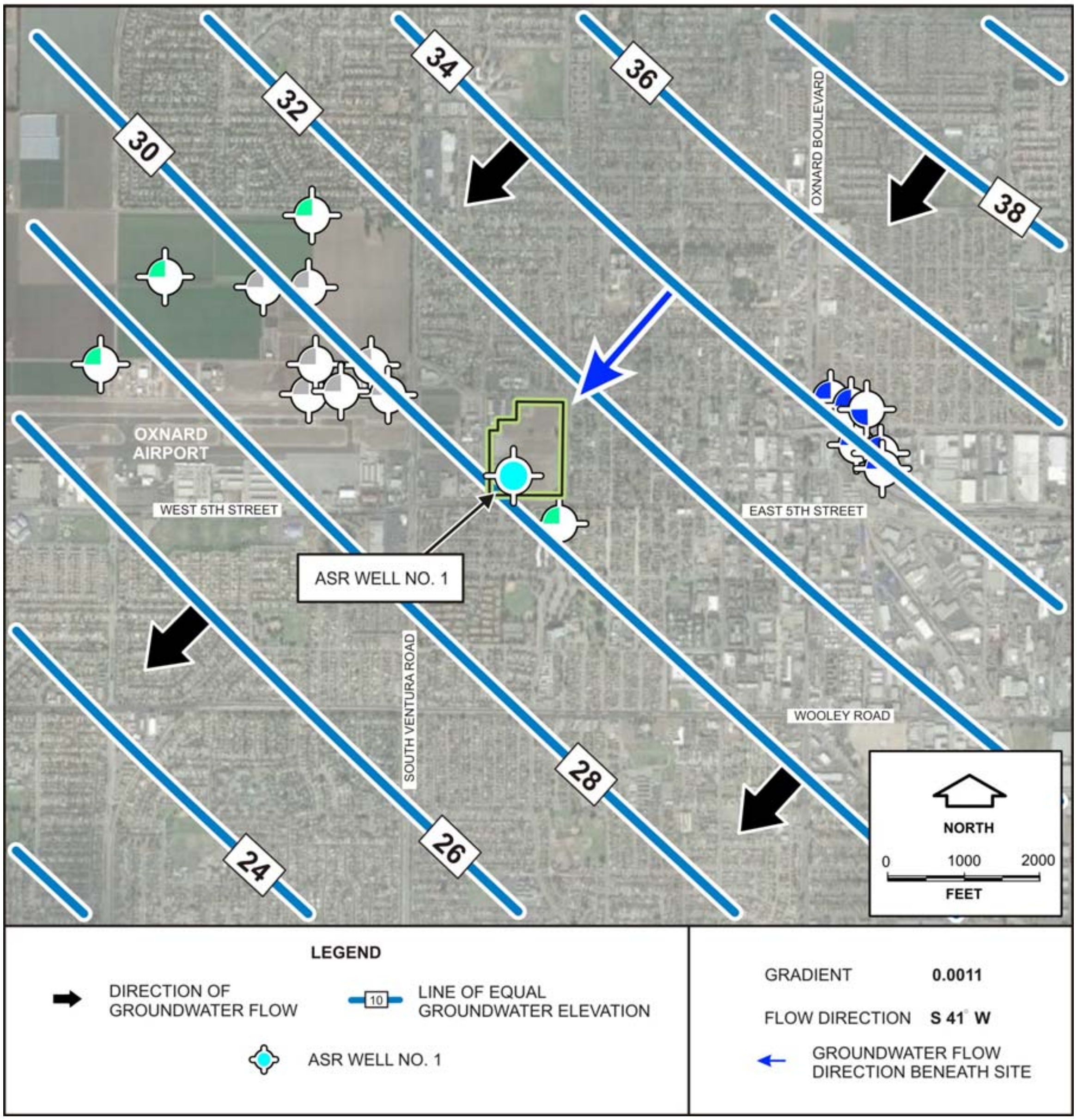
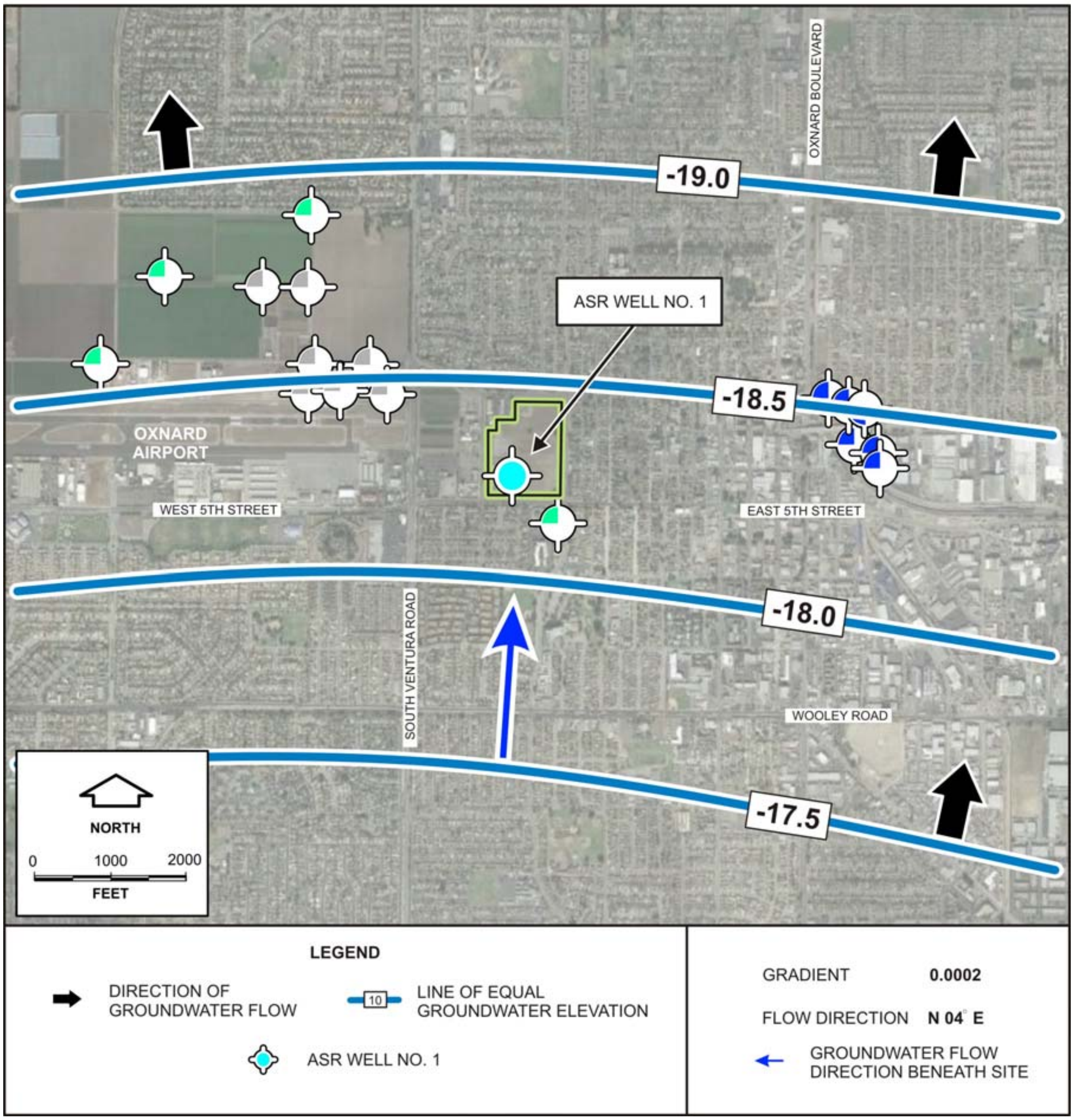


**Figure 8 – LAS Groundwater Elevation
Contour Map August 2014**



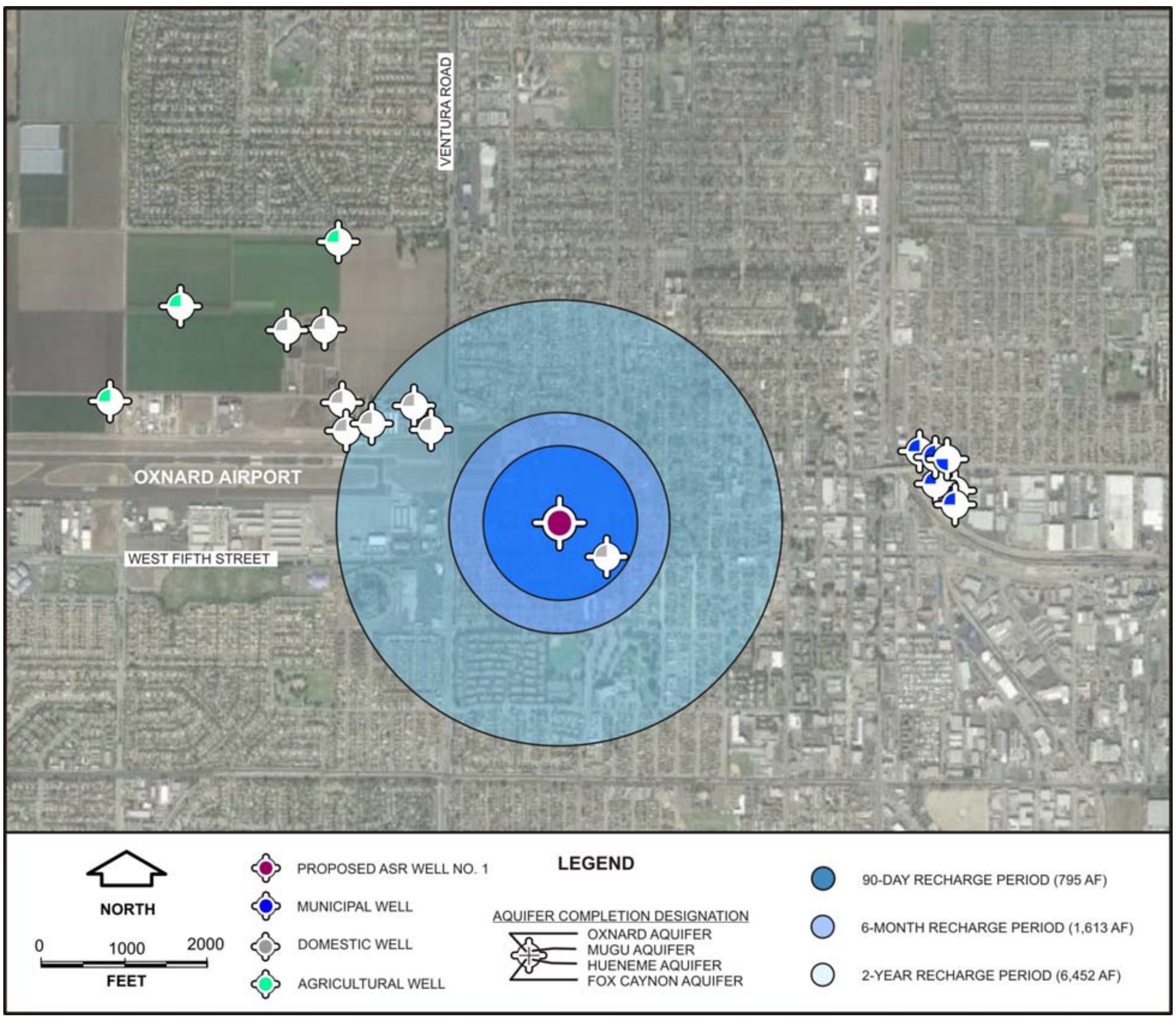
Aquifer Recharge and Retention

The area potentially influenced by recycled water recharge in the vicinity of the ASR well is determined by the aquifer area filled with the PRW during injection and the rate and direction of groundwater flow while it is in storage. The aquifer area filled by PRW replenishment was estimated by using;

- a discrete aquifer thickness of 85 feet,
- radial flow in the aquifer away from the center of recharge, and
- an average aquifer porosity of 15 percent (to be conservative).

The resulting aquifer area filled after injection of PRW at a rate of 2,000 gpm for a period of; 90 days (795 AF), 6 months (1,613 AF) and a period of 2 years (6,452 AF) is shown in Figure 9 – Aquifer Area Filled With Purified Recycled Water.

Figure 9 – Aquifer Area Filled With Purified Recycled Water



The aquifer area filled by these injection volumes would be proportionally less than those shown in Figure 9 as the porosity of the aquifer increases. Table 2 – Radial Distance Calculations shows the magnitude of change in the size of the recharge bubble within a range of typical aquifer porosity values.

Table 2 – Radial Distance Calculations

POROSITY	30-DAY RADIAL DISTANCE (FEET)	60-DAY RADIAL DISTANCE (FEET)	90-DAY RADIAL DISTANCE (FEET)	6-MONTH RADIAL DISTANCE (FEET)	2-YEAR RADIAL DISTANCE (FEET)
15 %	537	759	930	1,324	2,649
20%	465	658	806	1,147	2,294
25%	416	588	720	1,026	2,052
30%	380	537	658	937	1,873

AQUIFER THICKNESS IS 85 FEET AND THE INJECTION RATE IS 2,000 GPM

While the proposed City ASR operation will recharge the aquifer for a period of up to 3-months, a 6-month and 2-year-period of recharge were provided for comparison of potential project impacts. The estimated aquifer area filled with PRW in Figure 9 is believed conservative because a larger porosity value is highly likely. As shown, the nearest drinking water supply well (municipal well) constructed in the LAS is the City's and is beyond the 2-year aquifer replenishment area.

To approximate the area potentially influenced by PRW as it flows away from the point of recharge under the local groundwater gradient, the linear groundwater flow velocity was estimated by using;

- an average hydraulic conductivity value estimated from City Well No. 13 production test data (125 feet/day),
- the groundwater gradient at representative points in time (see Table 1),
- an average aquifer porosity of 15 percent (to be conservative), and
- the average linear flow velocity equation:

$$V = K\ I/\eta$$

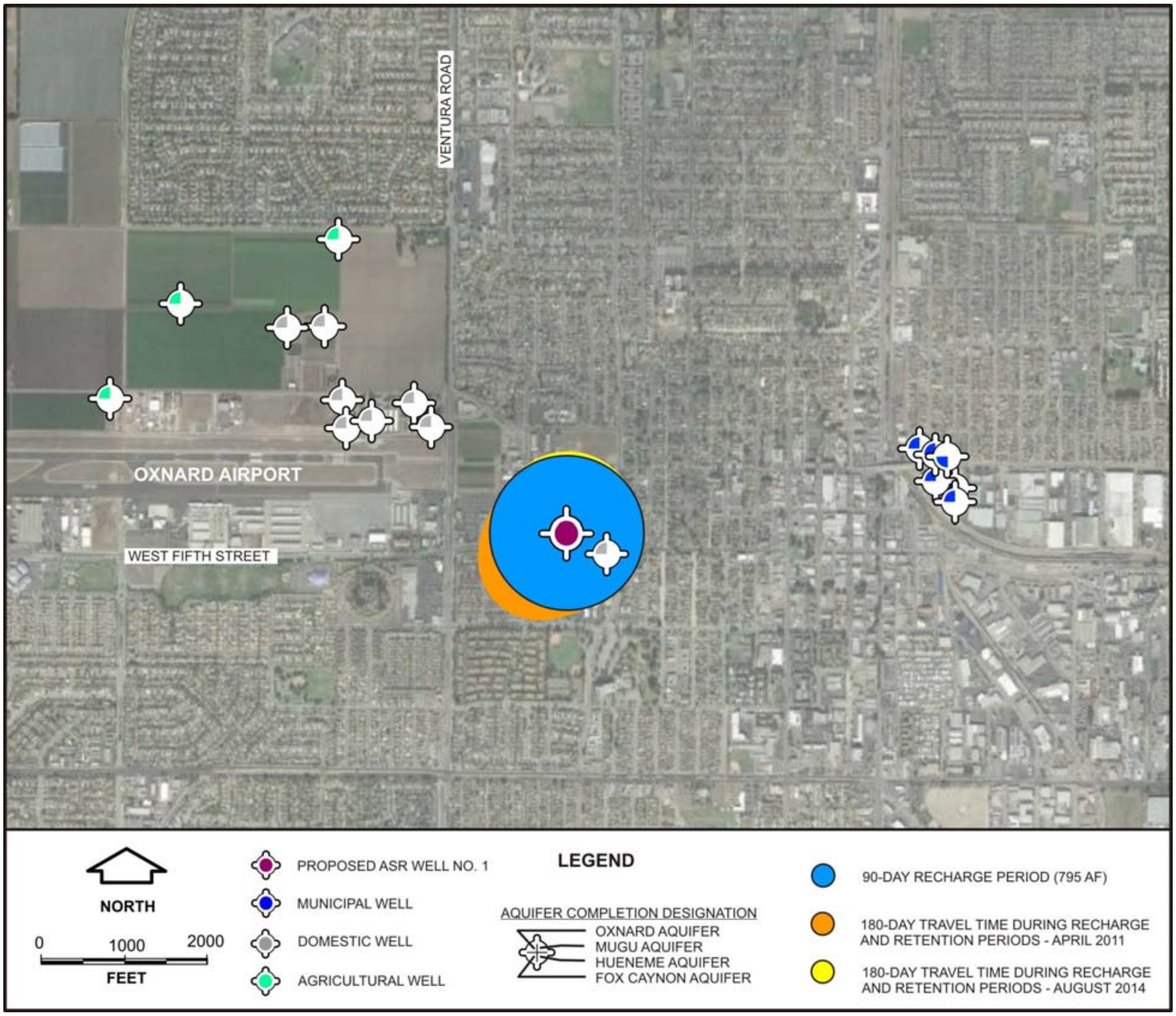
V	=	GROUNDWATER FLOW VELOCITY
K	=	AQUIFER HYDRAULIC CONDUCTIVITY
I	=	GROUNDWATER GRADIENT
η	=	AQUIFER POROSITY

The hydraulic conductivity of the upper Hueneme Aquifer zones was estimated from well production test data provided from City Well No. 13 combined with our experience and knowledge of wells in the Oxnard Plain Basin. The hydraulic conductivity of the aquifer zones that are proposed for ASR Well No. 1 was estimated to be 125 feet per day (ft/d). Using this hydraulic conductivity value and the range of groundwater gradients that are shown in Table 1, results in groundwater flow velocity estimates that range between 0.17 ft/d and 0.92 ft/d. Applying these two linear groundwater flow velocities over a 6-month period that includes the 3-month recharge period and the 3-month retention time, results in groundwater movement of a total distance between 30 feet and 165 feet.

The relative movement of the PRW from the ASR well during these 2 extreme conditions (April 2011 and August 2014) is shown in Figure 10 – Range of Purified Recycled Water Movement From ASR Well Location. These extremes are believed to bracket the actual anticipated movement of the recharge bubble in these aquifer zones. Because the quarterly groundwater measurements indicate a gradient of less than approximately 0.0011 exists a majority of the time (see Table 1), the transient groundwater gradient and flow direction will likely result in a cumulative movement that is between the two extremes indicated in Figure 10.

The result of this analysis indicates that the volume of water proposed for cyclical storage in the upper Hueneme Aquifer zone(s) of the LAS at the Campus Park GRRP well site will not have an adverse effect on any existing wells. Because of the assumptions stated above, these estimates are believed to be conservative and the area filled by PRW would likely be smaller. Based on the proposed cyclical recovery of the PRW for IPR, the distance of movement from the ASR well location could be significantly shorter. These factors indicate that the potential area of impact from the proposed GRRP presents little risk to existing well facilities.

**Figure 10 – Range of Purified Recycled Water Movement
From ASR Well Location**



Water Quality

Review of historical water quality data indicate that groundwater in the LAS is generally a calcium sulfate chemical character of fair to poor quality with total dissolved solids (TDS) concentrations in the range of 900 to 1,300 milligrams per liter (mg/l) and sulfate concentrations that range from 400 to 650 mg/l. These historical data indicate that the storage of the proposed recycled water will improve the general mineral quality of groundwater in the LAS (a beneficial impact) and that injection water chemistry can likely be controlled (buffered) to be compatible with native groundwater and avoid degradation.

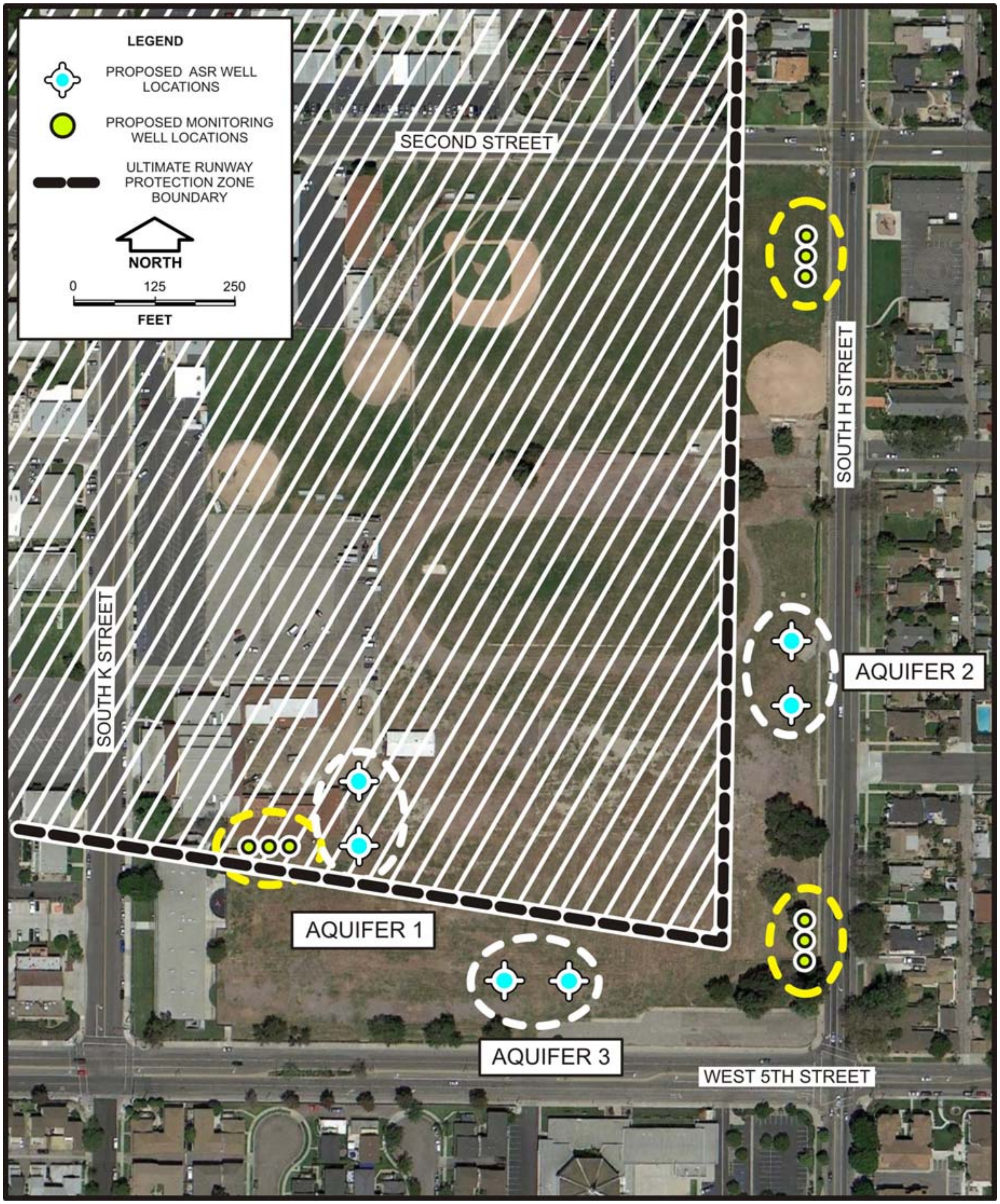
SITE LAYOUT AND FACILITIES DESIGN

To fully develop the Campus Park GRRP location, the City will utilize ASR well facilities that are constructed in discrete aquifer zones. These facilities will be used to conduct the demonstration testing required for final permitting of the IPR GRRP. The site specific groundwater data generated will further define the groundwater gradient, the aquifer materials, the site specific hydrogeology available for GRRP operations, local water quality, and ultimately the aquifer replenishment potential at the ASR well location. Initially, the proposed upper Hueneme Aquifer zone ASR well will be constructed along with 3 monitoring wells to develop information that establishes site specific data. Figure 11 – Proposed Campus Park ASR Wellfield Location Map shows the approximate location of the proposed ASR Wells and Monitoring Wells as they are positioned in the proposed City park development plan.

The proposed well locations were selected to construct facilities that will accomplish wellfield construction and data collection that complies with GRURW regulations and still be within the City property on the Campus Park site. As shown on Figure 11, the well locations are designed to be outside the ultimate runway protection zone boundary proposed by the County of Ventura Department of Airports for Federal Aviation Administration approval. This wellfield layout is designed to accommodate present and future conditions that may restrict the use of the Campus Park Property where drilling equipment of up to 60 feet high may be allowed to operate.

As shown, it is ultimately anticipated that a minimum of two wells will be required in each discrete aquifer zone(s) to achieve the full recharge and extraction capacities desired by the City. ASR Well No. 1 is located in the group labeled Aquifer 1 (see Figure 11). Aquifer 2 is the designated site for the wells that will utilize an aquifer(s) immediately below the Aquifer 1 wells. Accordingly, Aquifer 3 will utilize a deeper aquifer(s) to provide the final ASR capacity required for the recharge, retention, and recovery cycle to support continuous utilization of PRW produced from the AWPF. The initial demonstration ASR well location (see Figure 2) is within the Aquifer 1 area and the 3 monitoring wells are located within each of the monitoring well locations at variable distances from the ASR well.

Figure 11 – Proposed Campus Park ASR Wellfield Location Map



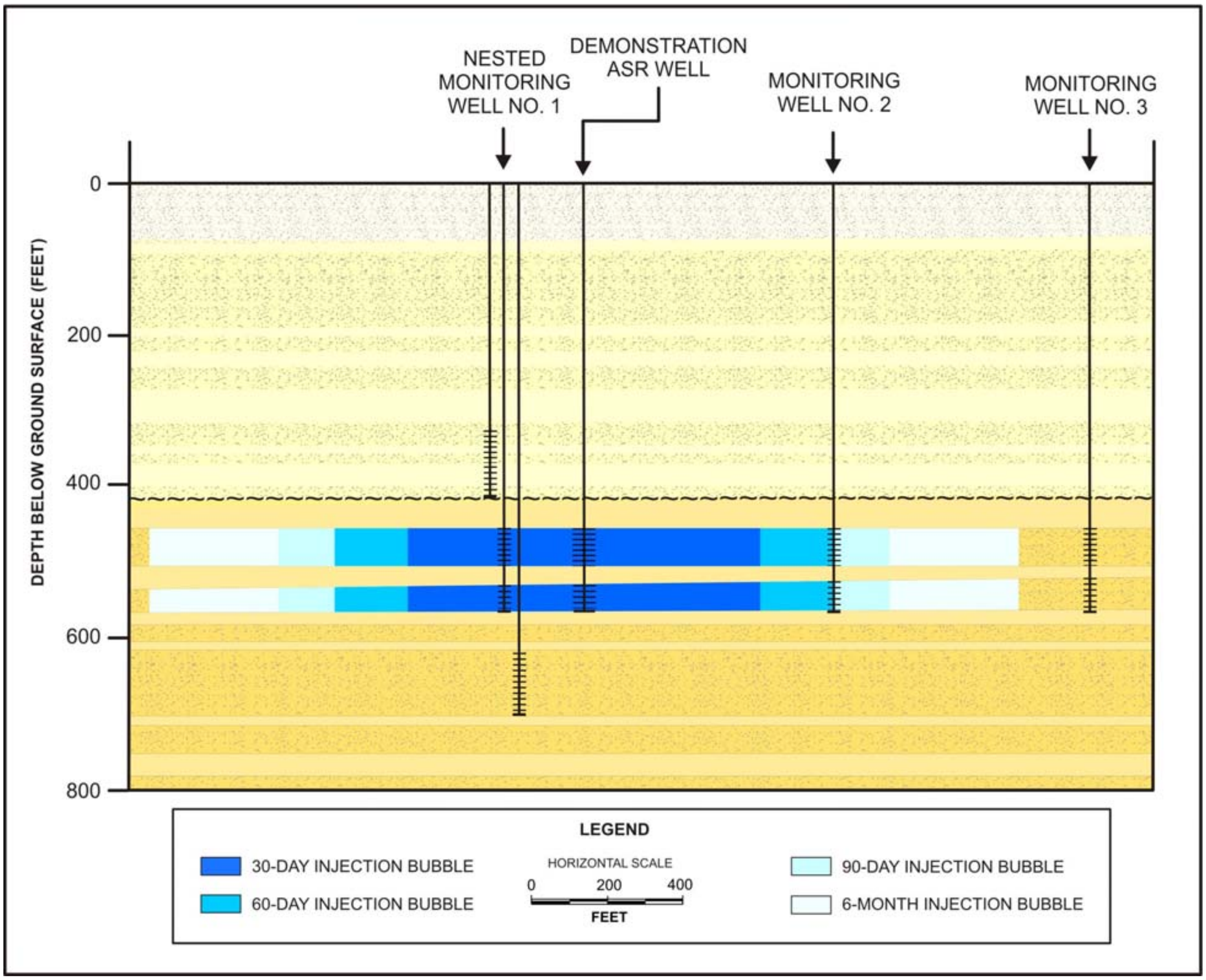
Well construction will be conducted by drilling and logging a pilot hole to select the aquifer(s) to be utilized by the ASR well(s). Based on these data, the final design of the demonstration ASR well and monitoring wells will be provided in the uppermost aquifer unit. The monitoring well locations selected are designed to test the aquifer properties and confirm groundwater travel time estimates at the Campus Park site in compliance with the GRURW regulations. Upon completion of well construction, groundwater tracer testing using an intrinsic tracer will be conducted to satisfy regulation provisions and obtain a CRWQCB permit for operation of the GRRP. Additional analyses to be conducted during the site investigation will include evaluating the geochemical compatibility of the PRW with the native groundwater and with the lithology of aquifer materials through direct sample analysis of the PRW during the recovery phase of the initial recharge cycle.

The locations of the monitoring wells are designed to; a) be far enough apart to collect water levels that will define the site specific groundwater gradient, b) be close enough to comply with GRURW regulation monitoring well requirements for GRRP permitting including a travel time of greater than 2 weeks and less than 6 months, and c) utilize the City owned parcel and minimize impacts to airport operations and future park development to be planned. The location of the demonstration ASR well is presently on the periphery of the future park property and positioned to allow the additional ASR wells to be constructed on the site.

Figure 12 – Subsurface Profile of PRW Travel Time Estimates shows the radial distances estimated that will be filled with PRW during replenishment in the discrete aquifer zones identified for storage using Campus Park ASR Well No. 1. These estimations were calculated using an aquifer porosity of 20 percent (which is believed a reasonable value for this purpose) and a test injection rate of 2,000 gpm. Variations in aquifer porosities will either decrease or increase the estimated travel time proportionally as shown in Table 2. As shown, the displacement volume from ASR Well No. 1 replenishment is anticipated to fill the aquifer at radial distances that will reach Monitoring Well No. 1 within approximately 2 weeks and Monitoring Well No. 2 in approximately 60 days. The estimated displacement volume from the proposed injection rate is not anticipated to reach Monitoring Well No. 3 for over 6 months and would likely be on the order of 9 months.

Based on the regional groundwater gradient, the travel time of PRW will be primarily dominated by the rate of injection and the displacement of native groundwater in the aquifer and not by the background flow of groundwater through Aquifer No. 1. Because the GRRP Wellfield is located within an area of the City where it has control over water well permitting, a prohibition of private wells constructed in the LAS can be implemented and prevent potential impacts to private well owners during the lifetime of the project. This condition effectively establishes the required isolation zone for future well construction.

Figure 12 – Subsurface Profile of PRW Travel Time Estimates

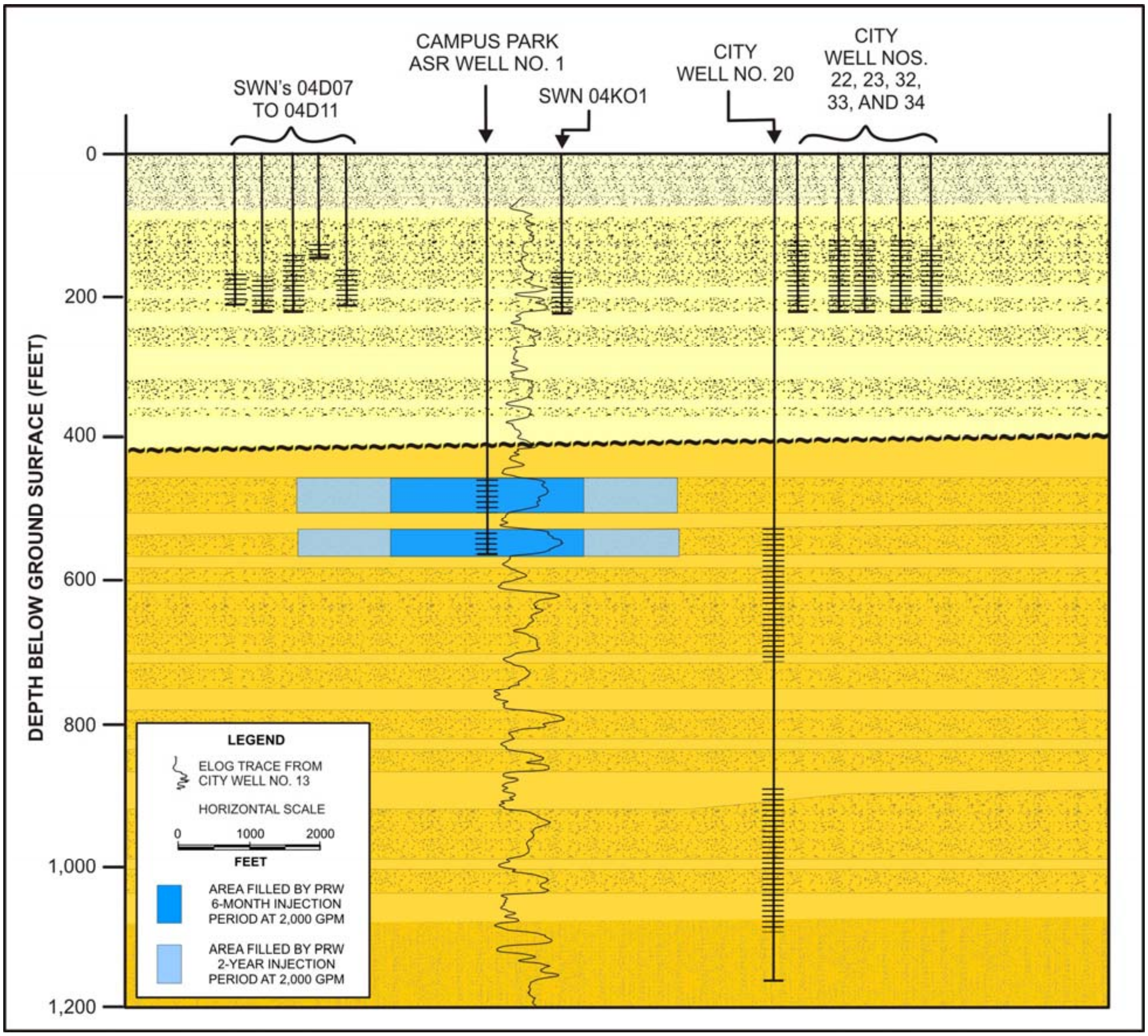


GRRP OPERATION AND VIOLATION MITIGATION

GRRP OPERATIONS

The conceptual design of the GRRP includes the cyclical recharge and storage of PRW in the discrete aquifer zones utilized by each ASR well. While it is anticipated that the majority of the recycled water produced by the AWPF during the first phase of production will be sold for in-City uses or for agricultural purposes, winter season demand will likely require injection and storage of the PRW to prevent plant shutdown or discharge to the ocean. The proposed use of the well is cyclical in nature, however, the actual amount that will be required for storage under full plant capacity is unknown and operational flexibility is always desirable. This study evaluated the merit of a 6-month and 2-year recharge/storage cycle (see Figure 9). The results indicated that these volumes can be accommodated if required, without adverse impacts to proximal well facilities. Figure 13 – Profile of Existing Wells shows the closest wells to the Campus Park site along with their approximate distance and completed depth. As indicated, City Well No. 20 is the only well within a mile of the site that is constructed in the LAS.

Figure 13 – Profile of Existing Wells



The injection volumes shown on the scaled drawing represent the radii of a 6-month and 2-year recharge period. This clearly indicates the low risk of the 3-month ASR cycle proposed. In addition, it illustrates the multiple confining layers and aquifer zones between the proposed ASR well constructed in the upper Hueneme Aquifer and the existing shallow 200- to 230-foot-deep wells constructed in the Oxnard Aquifer.

Preliminary analysis of the GRURW regulation requirements for treatment credits was performed by the City to understand the ability of the designed AWPF treatment process to satisfy the minimum 12-log reduction of enteric virus, 10-log reduction of Giardia cyst, and 10-log reduction of Cryptosporidium oocyst. The findings of that review indicated that the treatment process is capable of achieving the credits required for an IPR project for Giardia and Cryptosporidium, but is approximately 3-log reduction short of the requirement for enteric virus. Because of this finding, the aquifer used for storage may also be used for soil aquifer treatment to obtain the additional credit required for virus removal to achieve the IPR requirement (if no other treatment process is added to obtain additional credit). Based on the information in Table 60320.208 in the GRURW regulations, the necessary retention time will be approximately 3 months. The primary assessment of this hydrogeological study was to accommodate planned ASR operations on a 3-month cycle until treatment process improvements are implemented.

For initial GRRP operations, the City proposes to recharge the well for approximately 3 months with PRW. Upon completion of the recharge cycle, the City will allow a 3-month retention time (or less if additional treatment is provided) where the PRW will continue to move through the aquifer under the influence of the regional groundwater gradient (whichever direction that may be) and receive soil aquifer treatment throughout the retention time. Upon completion of the retention time necessary to achieve the required 3-log reduction credit, the stored water will be produced over an approximate 2- to 3-month recovery period. During recovery of the PRW, the well will discharge into the recycled water system and the recovered groundwater will be utilized for irrigation. Upon approval of use for IPR purposes, the groundwater will be recovered and conveyed to BS-1 for blending and use in the City municipal system.

Additional wells can be added to accommodate greater recharge and storage volumes or achieve higher retention time, as desired.

WATER QUALITY VIOLATION MITIGATION

The proposed GRRP is designed to allow rapid response and mitigation in the event of a AWPF treatment failure resulting in a water quality violation. Because the GRRP is designed to recapture the stored PRW at the point of replenishment, the ability for recapture of all of the water has a high level of certainty regardless of changes in the groundwater gradient direction. The steps toward mitigation at the time of violation detection would include the following components:

1. Stop aquifer recharge into the specific well(s) receiving the unsuitable water upon immediate discovery of a violation.

2. Address the treatment plant problem and supplement the recycled system, if necessary, with a potable supply.

3. Immediately begin removal/recapture of the tainted groundwater (if necessary) and discharge to a location other than the municipal water supply system until all the water has been removed from the aquifer system. The recovered water would be discharged either back into the recycled water system and used for irrigation (if suitable) or discharged to the sewer for disposal.

4. Initiate injection into another ASR well after the AWPF treatment problem has been solved and until the tainted groundwater in the previously active well has been remediated.

5. Allow the stored volume of water to remain in the aquifer for a greater response/retention time to receive additional soil aquifer treatment for the required time necessary based on the specific violation prior to subsequent removal and reuse.

Well discharge can be conducted until the affected aquifer zone is completely purged. Discharge from the affected well(s) can be directed to the most beneficial use allowable for its determined quality. City facilities provide multiple locations for discharge of the inadequately treated water, which include the City:

- sanitary sewer
- recycled water system for permitted irrigation reuse
- IPR after additional response retention time or aquifer travel time (soil aquifer treatment) has been achieved to mitigate the violation.

CONCLUSIONS AND RECOMMENDATIONS

In June 2014, the DDW released the final GRURW regulations that reflect its current thinking on the regulation for replenishing groundwater with PRW and the subsequent reuse as a potable supply. Based on the findings of this study, we conclude that available data indicate the proposed GRRP is feasible and that replenishment and recovery of groundwater with an improved quality could be accomplished in this portion of the Oxnard Plain Basin that would be consistent with the current GRURW regulations.

It is anticipated that properly designed and constructed ASR wells located at the proposed Campus Park GRRP site will provide operational well capacities beneficial for the proposed IPR program. Injection into the LAS in the Oxnard Plain Basin will require multiple wells that will likely be capable of sustained injection rates between 1,500 to 2,000 gpm. While the initial proposed demonstration project includes a single ASR well to achieve permitting, and a total of 3 ASR wells to achieve cycling for continual operation, additional wells can be added to facilitate a higher capacity GRRP operation in each of the aquifer storage units.

The City's review of the DDW regulations indicates that IPR operations may require a response retention time that achieves a 3-log removal credit for enteric virus and that the retention time of the PRW in the aquifer will likely be 3 months prior to reuse until additional treatment at the AWPF is provided. We conclude that it is feasible to inject PRW over a 3 to 6-month period into any discrete aquifer zone(s) and expect a high percentage of recovery after a 3-month retention period that allows full compliance with permit conditions. The proposed GRRP has direct control over the response retention time in that the ASR well facility that replenishes the aquifer(s) will remain off until the specified retention time has been achieved. Recovery of the final portion of the PRW will likely produce a component of groundwater with a reduced quality as a result of mixing with the native groundwater. Recovery percentages can be improved with the establishment of a buffer zone around the recharge bubble by originally using a greater quantity of the PRW than planned for recovery.

We conclude that while zone specific water level data from the Campus Park site are not available, the prevailing groundwater conditions indicated by available data in the Oxnard Plain Basin support the ability for effective capture and reuse of the higher quality recharge water from the Campus Park ASR Wellfield. As designed, the project does not rely on horizontal movement through an aquifer in any specific direction to allow capture at some distance away from the point of recharge. The point of capture is anticipated to be near the center of the PRW recharge bubble. We also conclude that in the event of a water quality violation where non-compliant water is injected in the aquifer system, the GRRP design will allow immediate mitigation and, as necessary, recapture of the non-compliant volume of PRW. There are no drinking water wells constructed in the LAS within ¾ of a mile of the proposed GRRP location. The only potable well in the LAS within a mile of the Campus Park is City Well No. 20.

Anticipated travel time to the nearest potable water supply well is greater than 2 years, if the PRW is not recovered for IPR. Because the City is the permitting agency and can control well construction within its limits, the proposed IPR operation has an effectively established isolation zone from future well construction.

We recommend the City drill a pilot borehole to a depth of 580 feet to define the site specific aquifer zone depths for use in final design of the GRRP ASR Well No. 1 in the upper Hueneme Aquifer zones (see Plate 1). We also recommend the City construct 3 monitoring wells at the designated locations which are preliminarily identified on Figures 2 and 11 to allow collection of groundwater data in compliance with the GRURW regulation pursuant to section 60320.200(h)(4). We recommend Monitoring Well No. 1 be constructed as a nested monitoring well to allow monitoring of the aquifer zones above and below the depths of Aquifer Storage Unit No. 1 during the operation of ASR Well No. 1.

PERSONNEL QUALIFICATIONS

The assessment of hydrogeological conditions for the proposed GRRP was conducted by and under the direction of Mr. Curtis J. Hopkins, Principal Hydrogeologist with Hopkins Groundwater Consultants, Inc. Mr. Hopkins is the company's president and is certified as a Professional Geologist (PG 5695), Certified Engineering Geologist (EG 1800) and Certified Hydrogeologist (HG 114) in the State of California. Mr. Hopkins has over 27 years of work experience on groundwater development projects performed throughout the Southern and Central California area and specifically, the Oxnard Plain Basin. Mr. Hopkins has extensive experience with water supply studies to establish municipal wellfields and with design and management of well construction projects.

CLOSURE

This report has been prepared for the exclusive use of the City of Oxnard and its agents for specific application to the City of Oxnard GREAT Program utilization of PRW treated at the AWPF and properly applied at the proposed Campus Park GRRP site for IPR. The findings, conclusions, and recommendations presented herein were prepared in accordance with generally accepted hydrogeological planning and engineering practices. No other warranty, express or implied is made.

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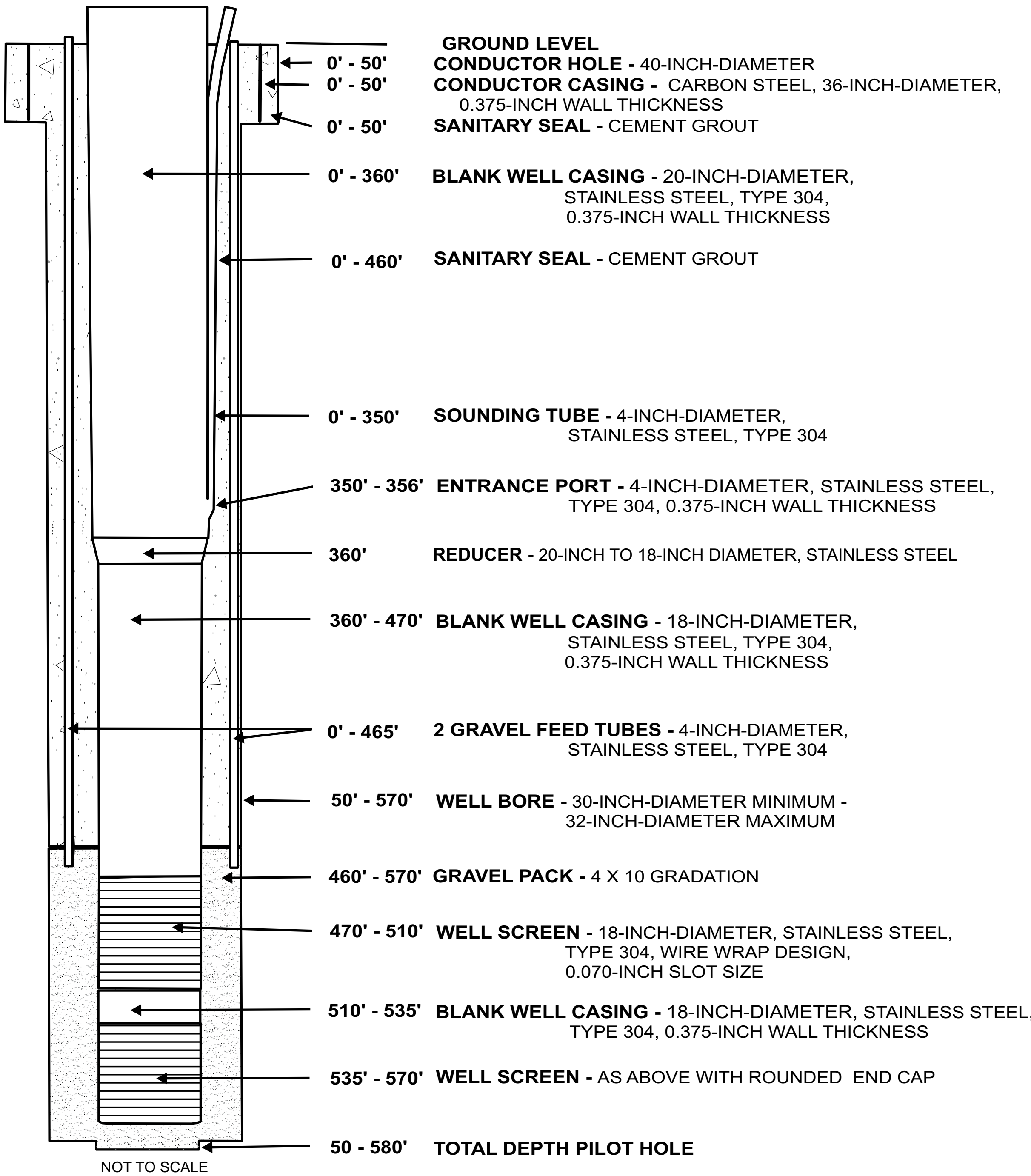
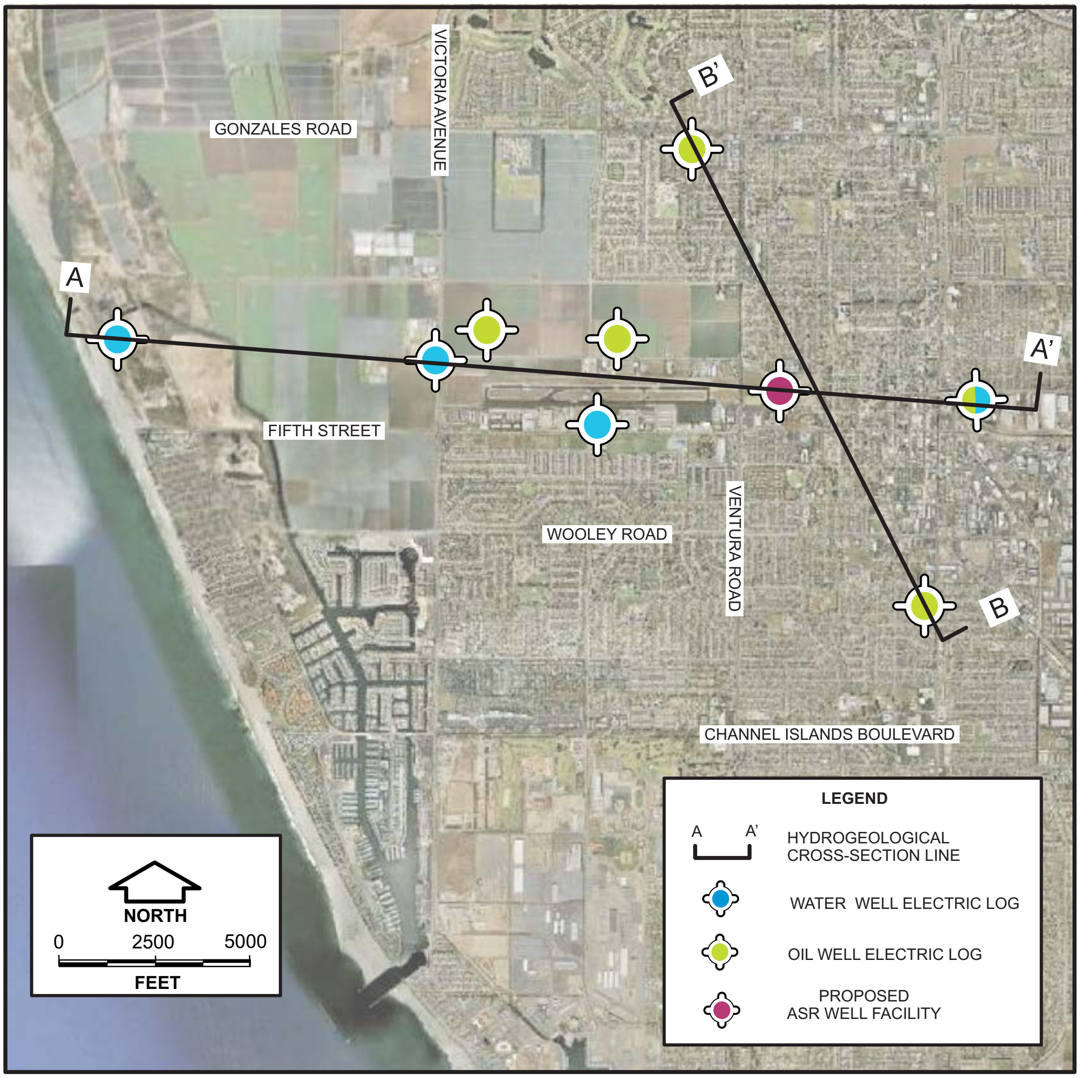
PLATES

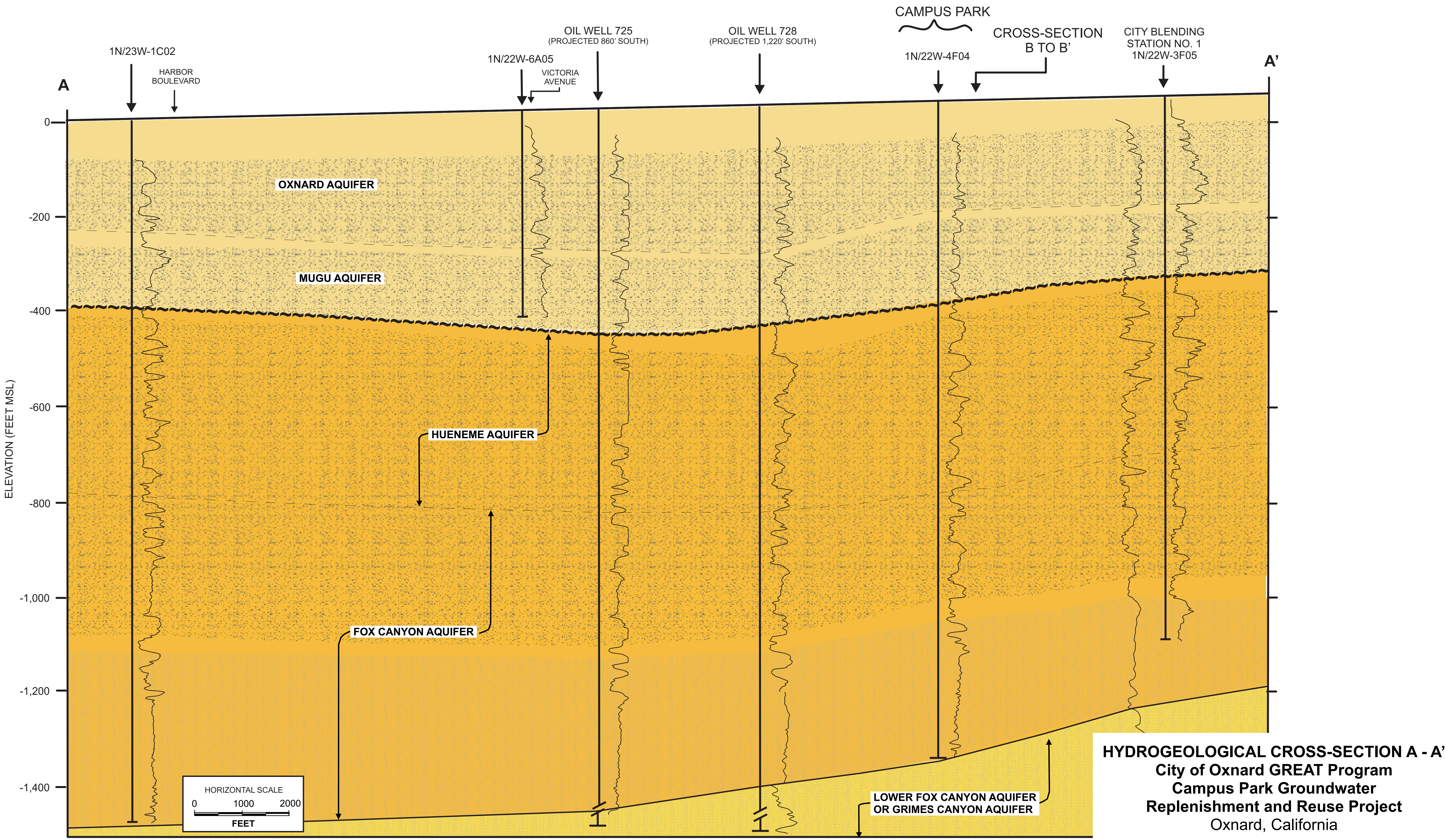


PRELIMINARY ASR WELL NO. 1 DESIGN DRAWING
City of Oxnard GREAT Program
Campus Park Groundwater
Replenishment and Reuse Project
Oxnard, California

PLATE 1

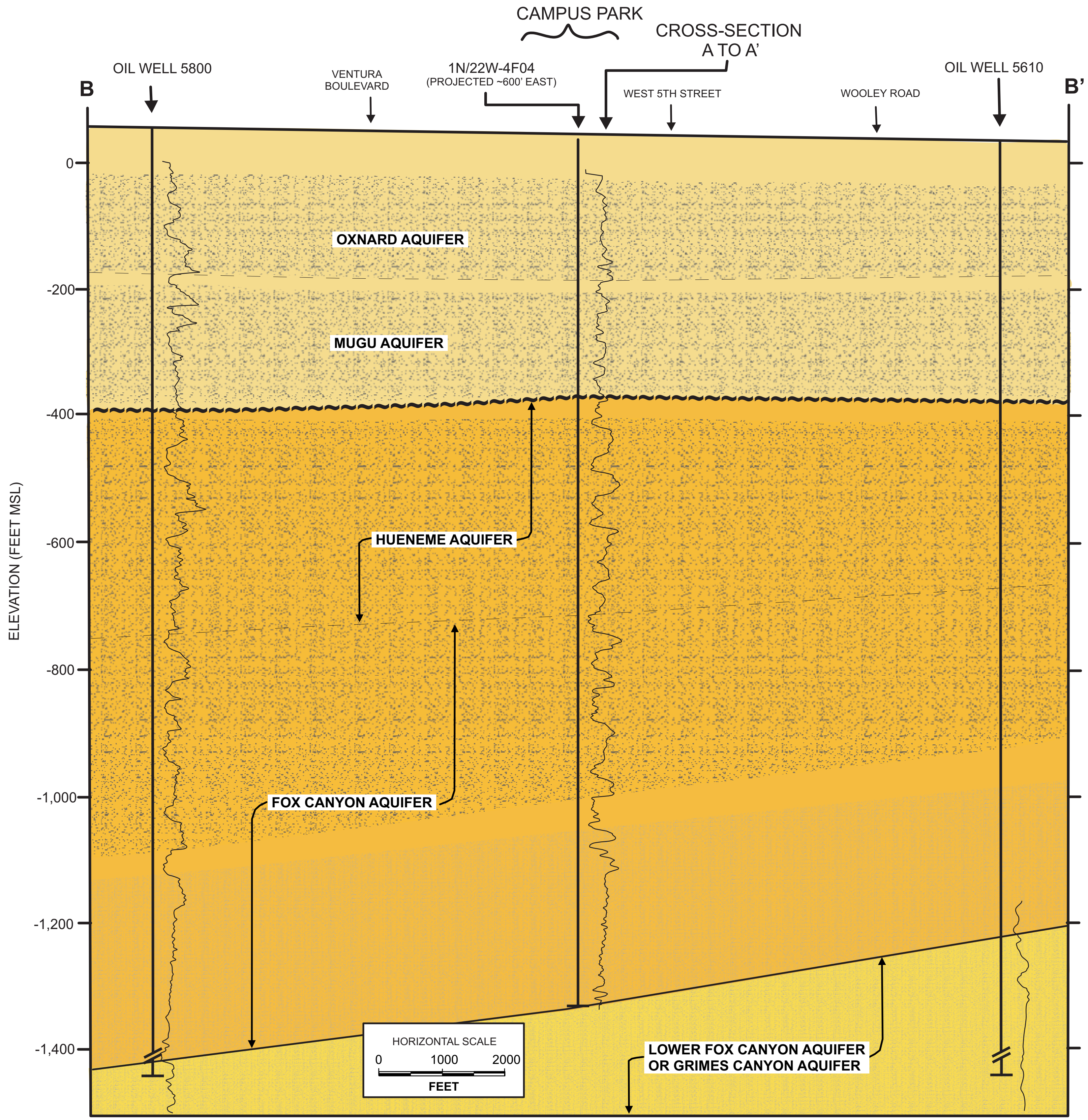


HYDROGEOLOGICAL CROSS-SECTION LOCATION MAP
City of Oxnard GREAT Program
Campus Park Groundwater
Replenishment and Reuse Project
Oxnard, California



HYDROGEOLOGICAL CROSS-SECTION A - A'
City of Oxnard GREAT Program
Campus Park Groundwater
Replenishment and Reuse Project
Oxnard, California

PLATE 3



LEGEND

QUATERNARY — HOLOCENE / PLEISTOCENE

- **Qoa** — **UN-DIFFERENTIATED OLDER AND YOUNGER ALLUVIUM -** older alluvial gravel, and silt/clay
- **QTs** — **SAUGUS FORMATION -** weakly consolidated alluvial deposits, light gray to light brown gravel composed of pebbles and small cobbles mostly of white to light gray granitic rocks, in coarse sandy matrix; weakly indurated sand, and fossiliferous sand, silt, and clay
- **Qtlp / Qsb** — **LAS POSAS SAND OR SANTA BARBARA FORMATION -** weakly indurated, fine to medium grained sand, in Las Posas Hills contains thin lenses of calcareous fossiliferous pebbly sandstone; unconformity at base

SYMBOLS

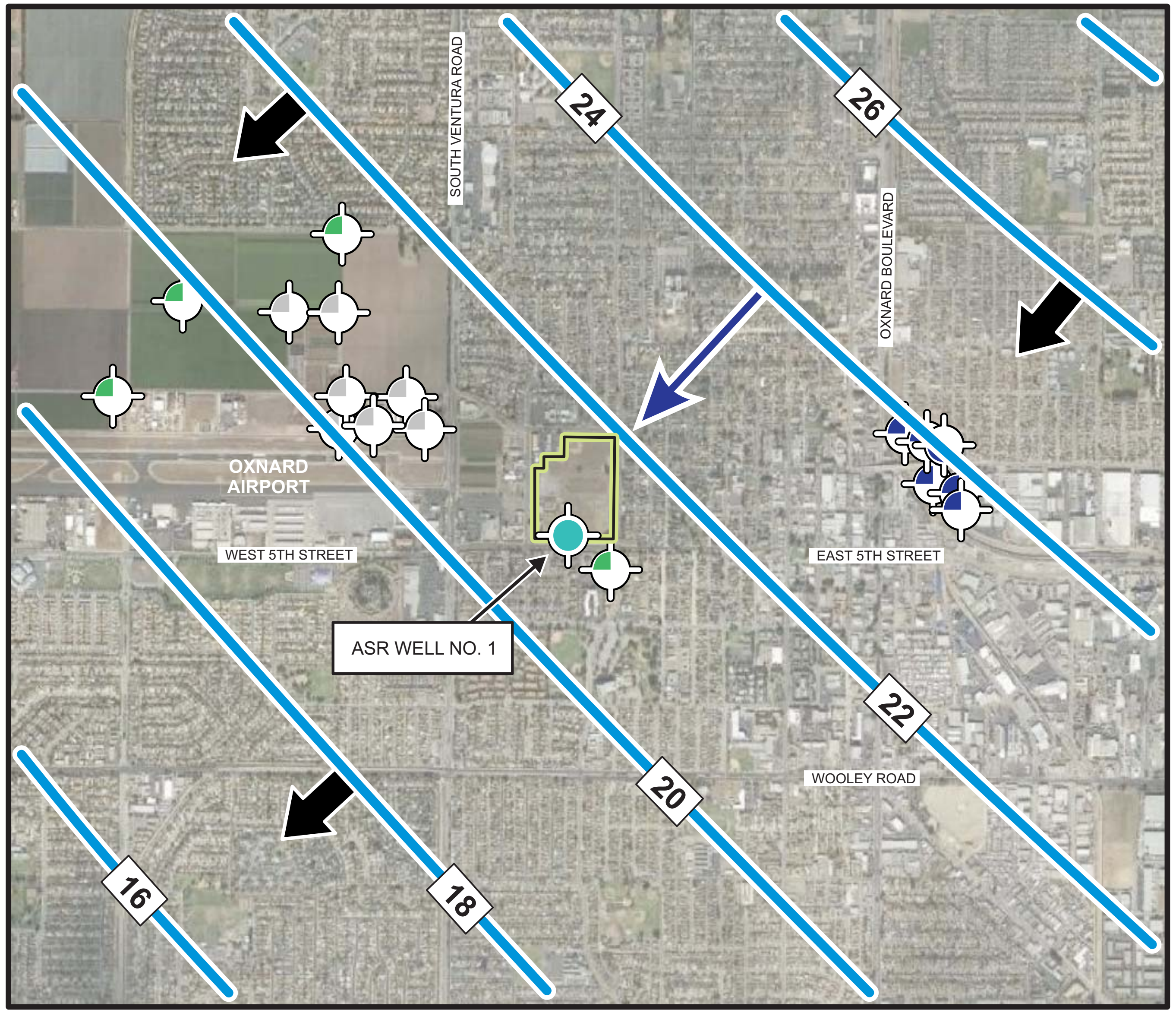
- Formation contact - dashed where inferred or indefinite
- Unconformable formation contact
- Electric Log Trace of Resistivity Curve
- Location of Historical Water or Oil Well

Geology from: THOMAS W. DIBBLEE

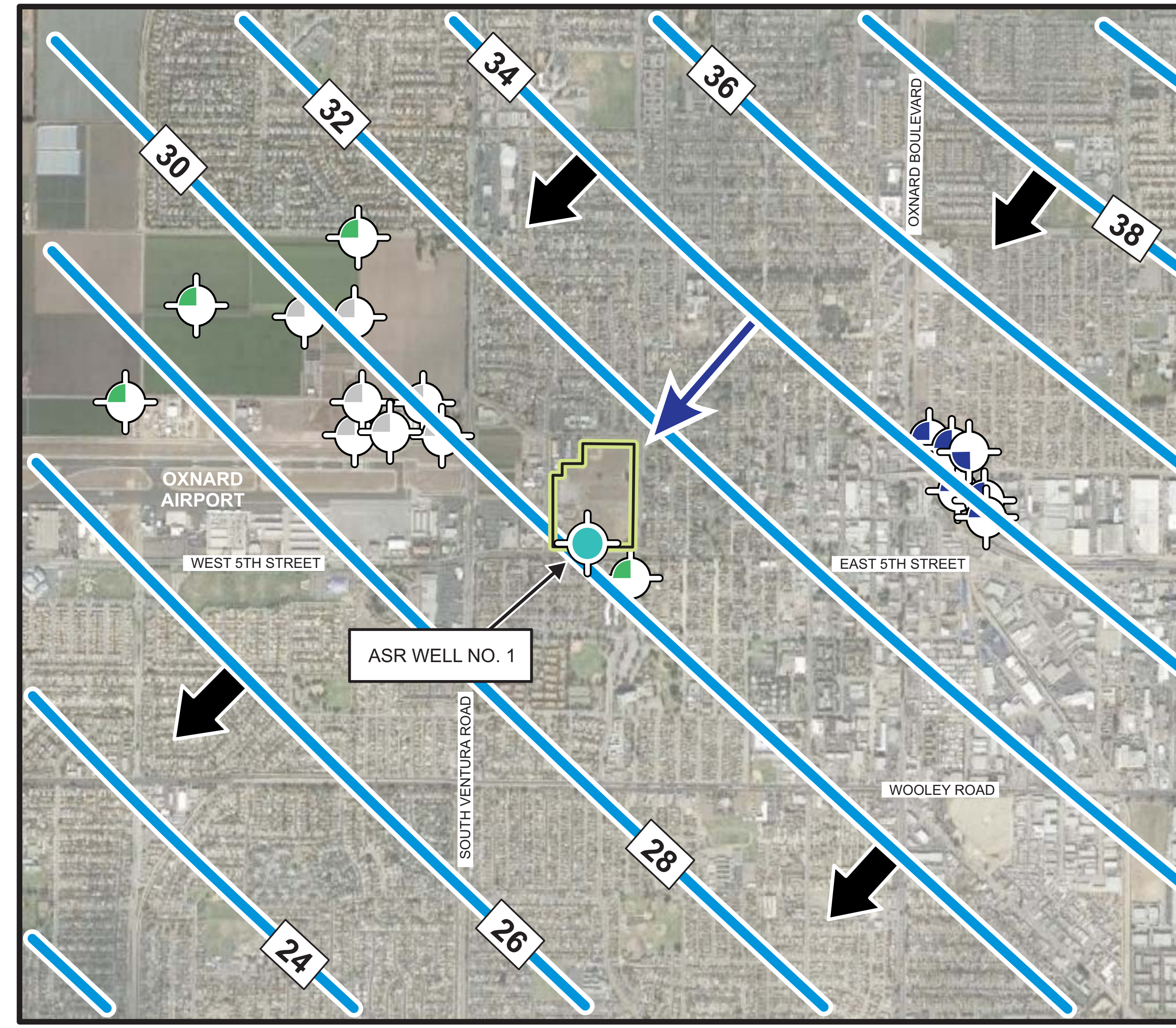
HYDROGEOLOGICAL CROSS-SECTION B - B'
City of Oxnard GREAT Program
Campus Park Groundwater
Replenishment and Reuse Project
Oxnard, California

PLATE 4

APPENDIX A
GROUNDWATER ELEVATION
CONTOUR MAPS



JANUARY 2011



APRIL 2011

GROUNDWATER LEGEND

- LINE OF EQUAL GROUNDWATER ELEVATION (10)
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER FLOW DIRECTION BENEATH SITE

GRADIENT **0.0008**

FLOW DIRECTION **S 43° W**

NORTH

0 1000 2000

FEET

WELL LEGEND

MUNICIPAL WELL
DOMESTIC WELL
AGRICULTURAL WELL
SWN 21M1 WELL ID

AQUIFER COMPLETION DESIGNATION

OXNARD AQUIFER
MUGU AQUIFER
HUENEME AQUIFER
FOX CANYON AQUIFER

UAS
LAS

GROUNDWATER LEGEND

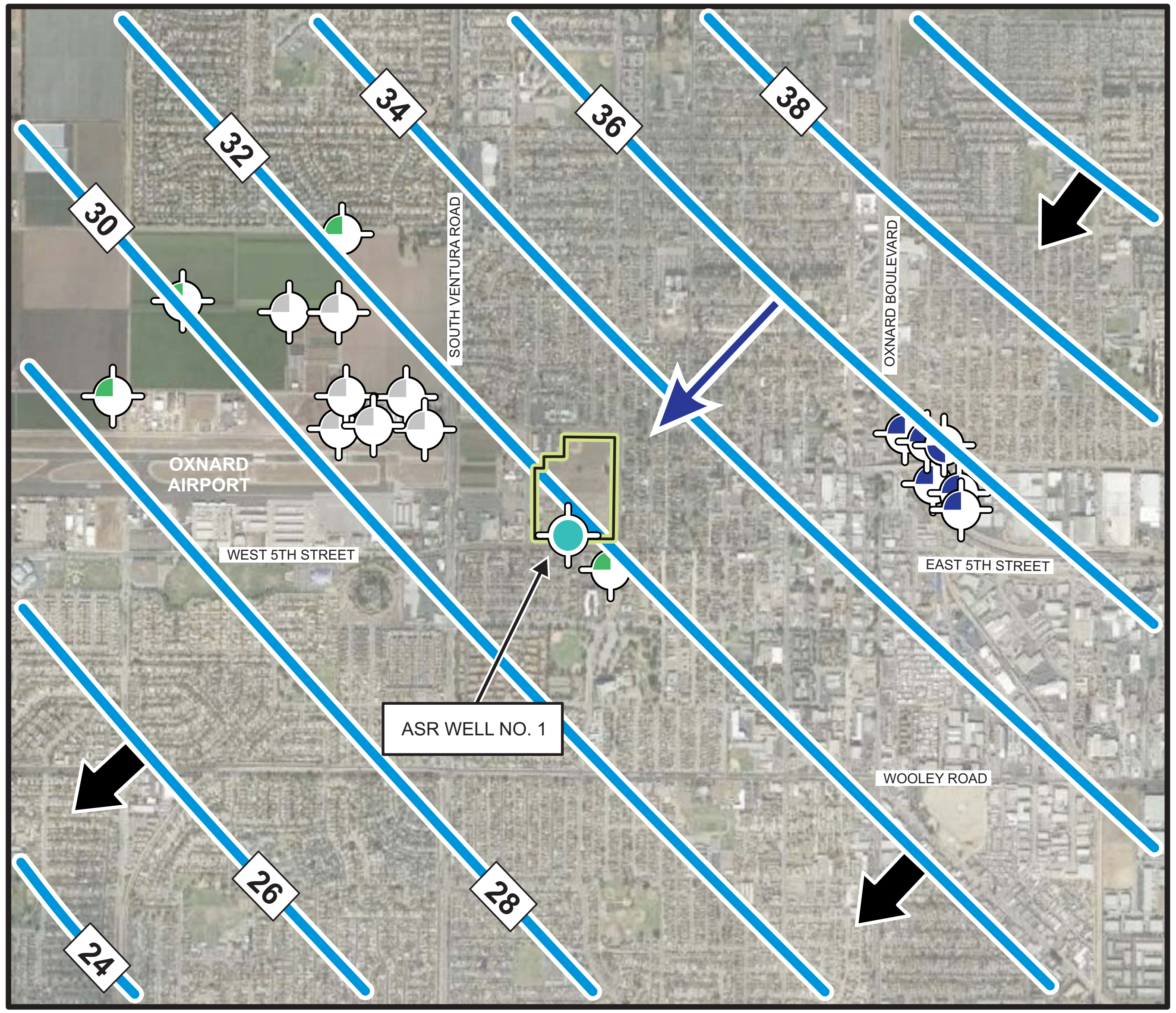
- LINE OF EQUAL GROUNDWATER ELEVATION (10)
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER FLOW DIRECTION BENEATH SITE

GRADIENT **0.0011**

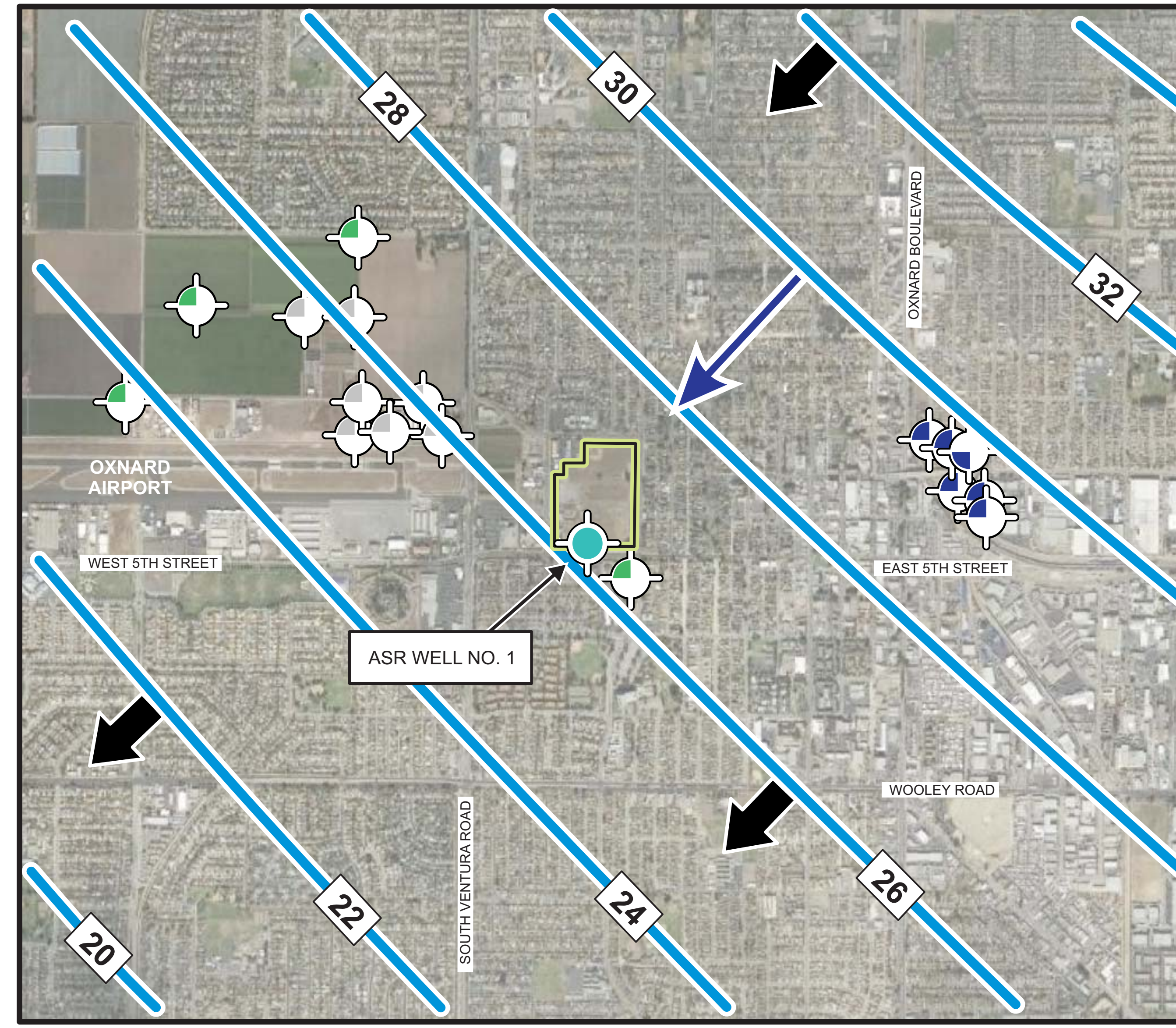
FLOW DIRECTION **S 41° W**

GROUNDWATER ELEVATION
CONTOUR MAPS
JANUARY AND APRIL 2011
City of Oxnard GREAT Program
Campus Park Groundwater
Replenishment and Reuse Project
Oxnard, California

PLATE A1



JULY 2011



OCTOBER 2011

GROUNDWATER LEGEND

- 10 LINE OF EQUAL GROUNDWATER ELEVATION
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER FLOW DIRECTION BENEATH SITE

GRADIENT **0.0011**

FLOW DIRECTION **S 44° W**

NORTH

0 1000 2000

FEET

WELL LEGEND

- MUNICIPAL WELL
- DOMESTIC WELL
- AGRICULTURAL WELL
- SWN 21M1 WELL ID

AQUIFER COMPLETION DESIGNATION

OXNARD AQUIFER
MUGU AQUIFER
HUENEME AQUIFER
FOX CAYNON AQUIFER

UAS
LAS

GROUNDWATER LEGEND

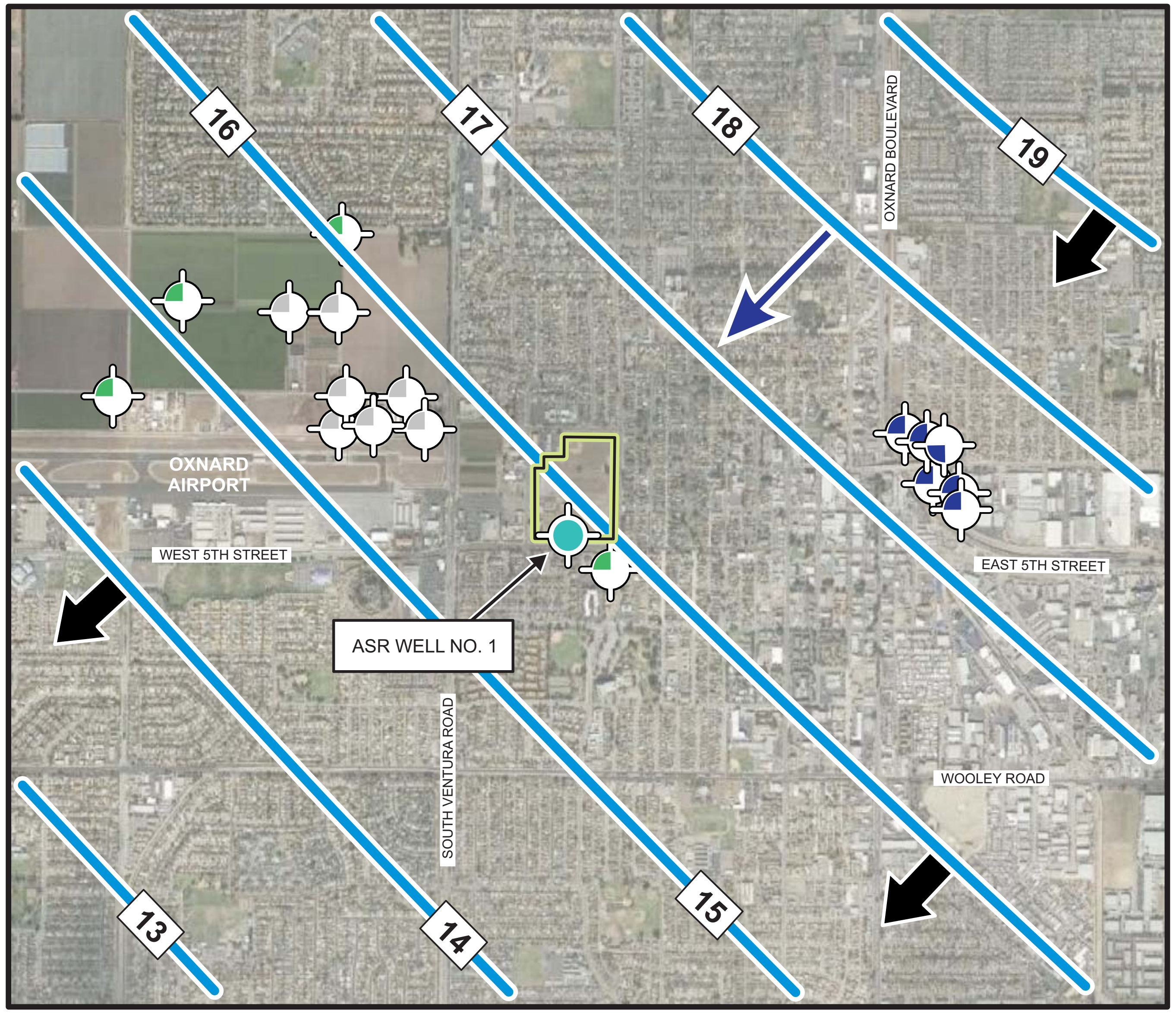
- 10 LINE OF EQUAL GROUNDWATER ELEVATION
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER FLOW DIRECTION BENEATH SITE

GRADIENT **0.0009**

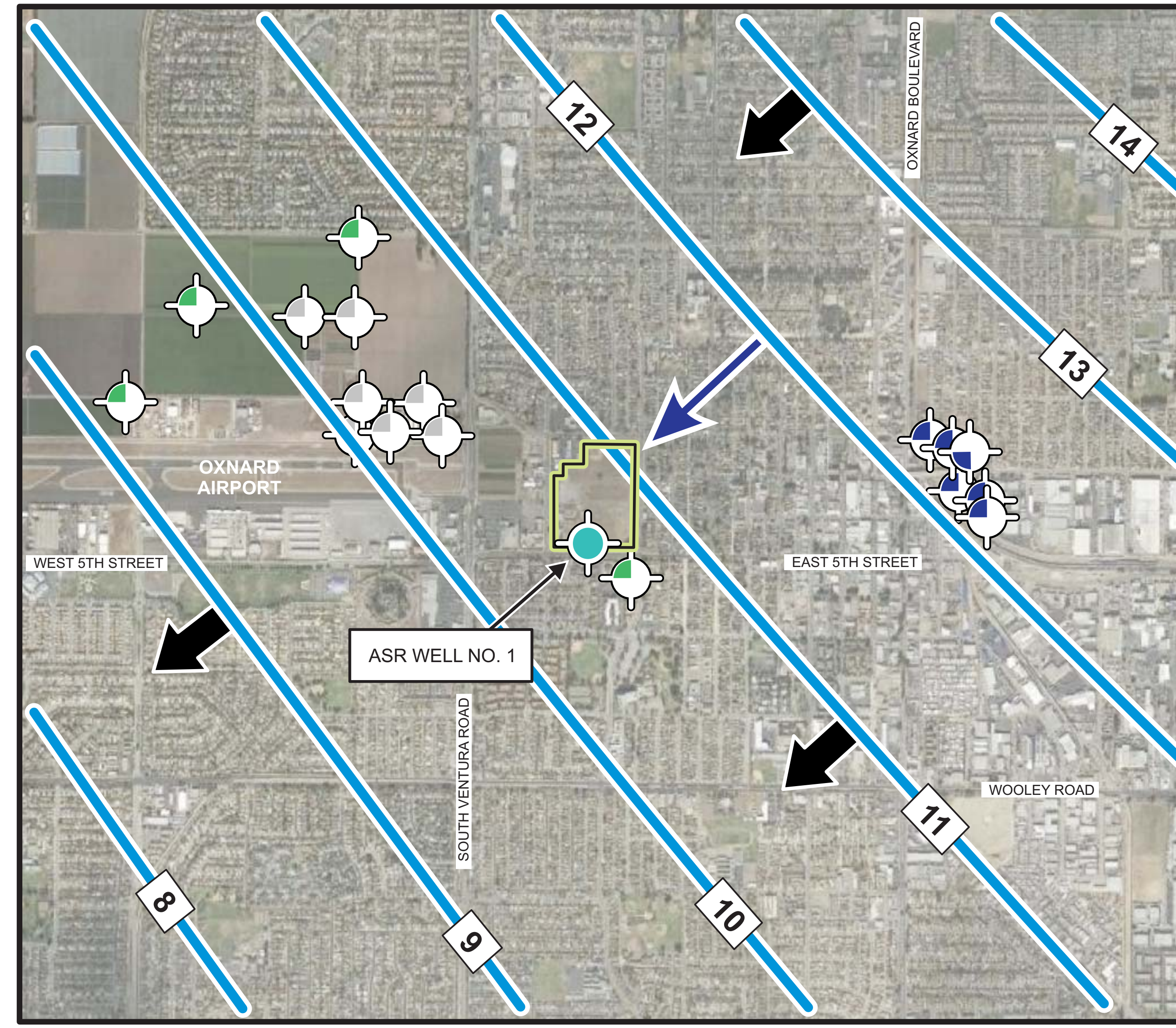
FLOW DIRECTION **S 43° W**

GROUNDWATER ELEVATION CONTOUR MAPS
JULY AND OCTOBER 2011
City of Oxnard GREAT Program
Campus Park Groundwater Replenishment and Reuse Project
Oxnard, California

PLATE A2



JANUARY 2013



APRIL 2013

GROUNDWATER LEGEND

- 10 LINE OF EQUAL GROUNDWATER ELEVATION
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER FLOW DIRECTION BENEATH SITE

GRADIENT **0.0004**

FLOW DIRECTION **S 44° W**

NORTH

0 1000 2000

FEET

WELL LEGEND

- MUNICIPAL WELL
- DOMESTIC WELL
- AGRICULTURAL WELL
- SWN 21M1 WELL ID

AQUIFER COMPLETION DESIGNATION

OXNARD AQUIFER
MUGU AQUIFER
UAS
HUENEME AQUIFER
FOX CAYNON AQUIFER
LAS

GROUNDWATER LEGEND

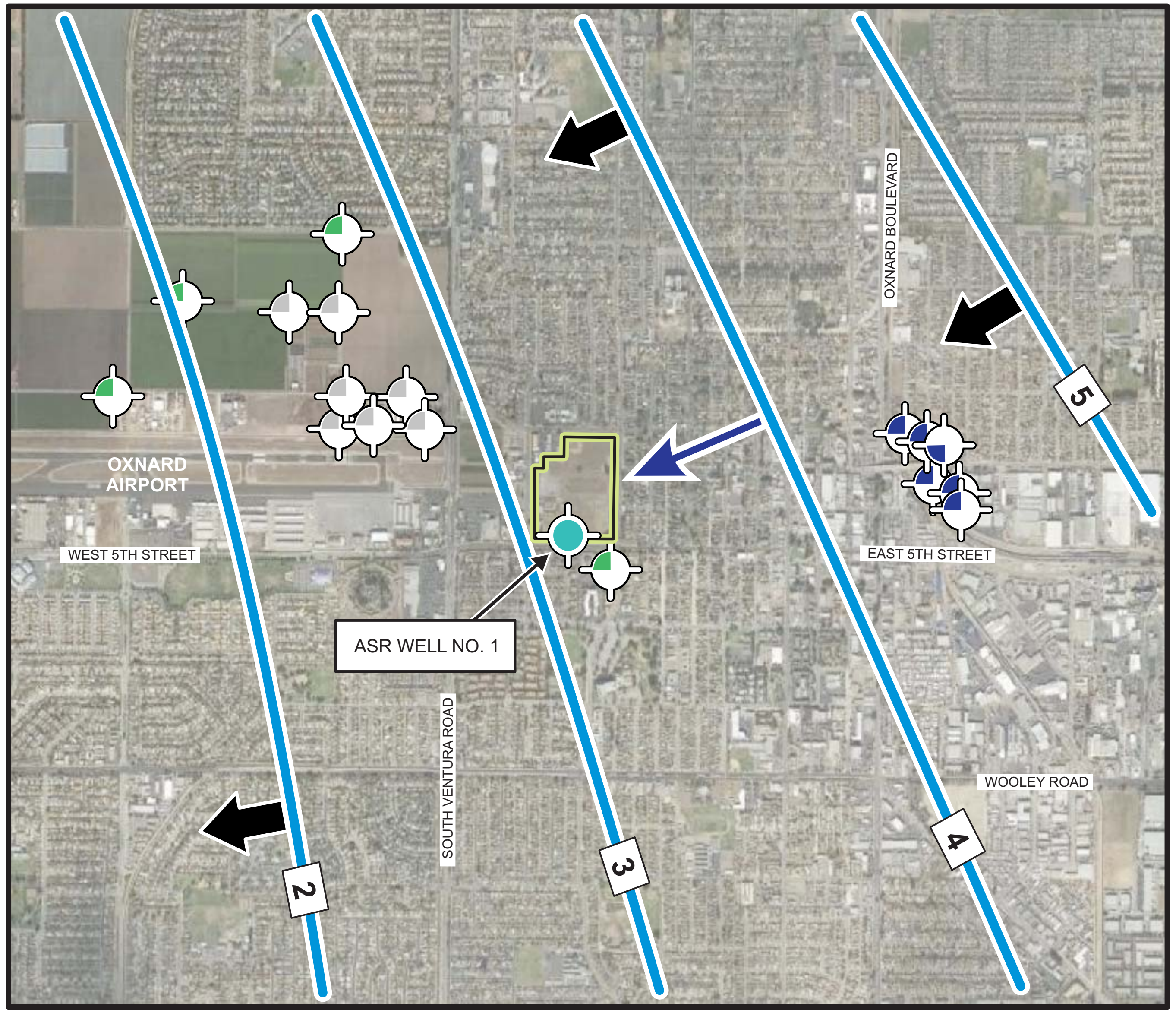
- 10 LINE OF EQUAL GROUNDWATER ELEVATION
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER FLOW DIRECTION BENEATH SITE

GRADIENT **0.0004**

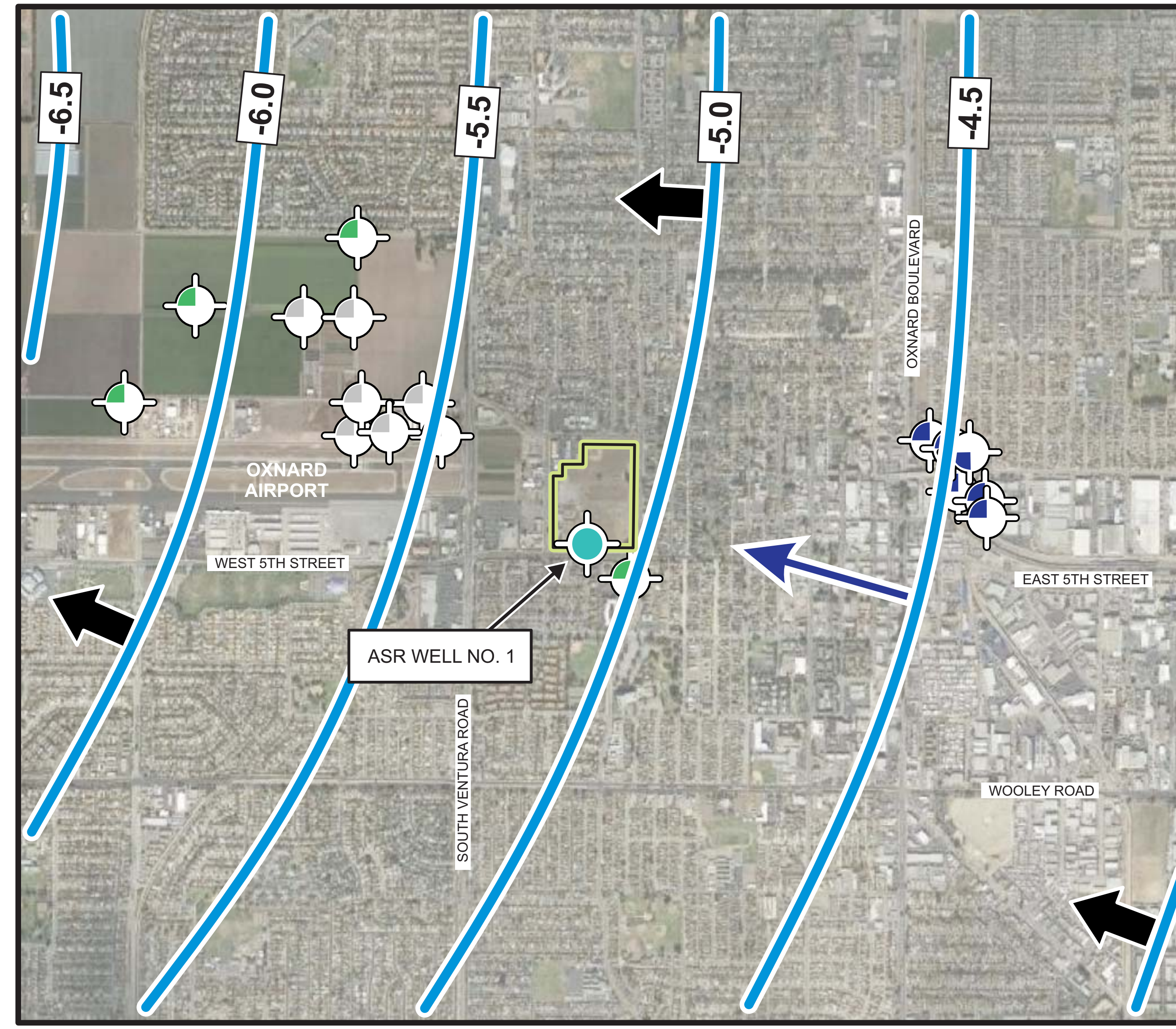
FLOW DIRECTION **S 47° W**

GROUNDWATER ELEVATION CONTOUR MAPS
JANUARY AND APRIL 2013
City of Oxnard GREAT Program
Campus Park Groundwater Replenishment and Reuse Project
Oxnard, California

PLATE A3



JULY 2013



OCTOBER 2013

GROUNDWATER LEGEND

- 10 — LINE OF EQUAL GROUNDWATER ELEVATION
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER FLOW DIRECTION BENEATH SITE

GRADIENT **0.0003**

FLOW DIRECTION **S 67° W**

NORTH

0 1000 2000

FEET

WELL LEGEND

- MUNICIPAL WELL
- DOMESTIC WELL
- AGRICULTURAL WELL
- SWN 21M1 WELL ID

AQUIFER COMPLETION DESIGNATION

OXNARD AQUIFER
MUGU AQUIFER
HUENEME AQUIFER
FOX CAYNON AQUIFER

UAS
LAS

GROUNDWATER LEGEND

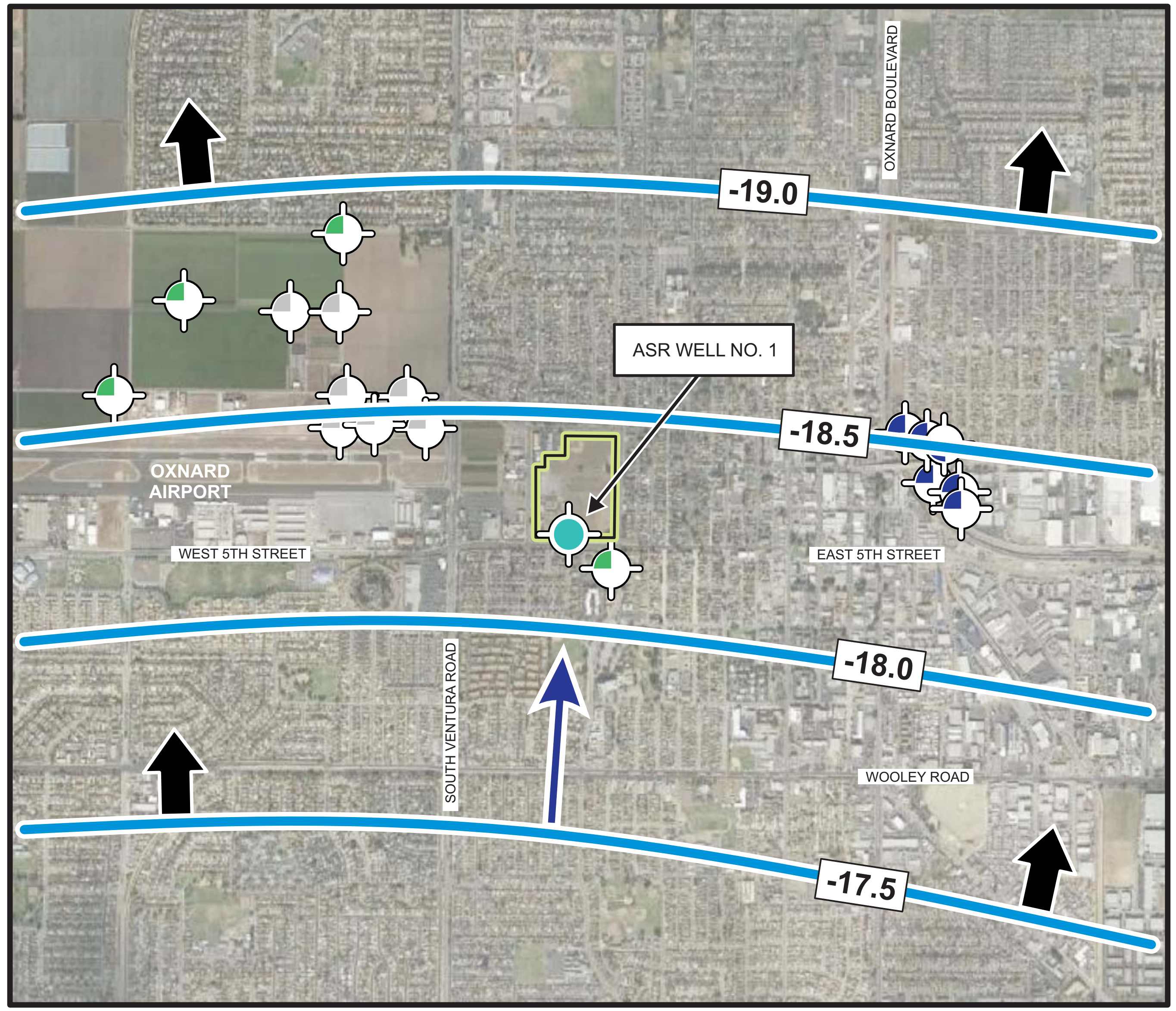
- 10 — LINE OF EQUAL GROUNDWATER ELEVATION
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER FLOW DIRECTION BENEATH SITE

GRADIENT **0.0002**

FLOW DIRECTION **N 74° W**

GROUNDWATER ELEVATION CONTOUR MAPS
JULY AND OCTOBER 2013
City of Oxnard GREAT Program
Campus Park Groundwater Replenishment and Reuse Project
Oxnard, California

PLATE A4



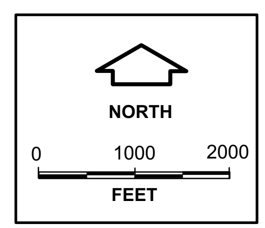
AUGUST 2014

GROUNDWATER LEGEND

- LINE OF EQUAL GROUNDWATER ELEVATION
- DIRECTION OF GROUNDWATER FLOW
- GROUNDWATER FLOW DIRECTION BENEATH SITE

GRADIENT **0.0002**

FLOW DIRECTION **N 04° E**



WELL LEGEND

- MUNICIPAL WELL
- DOMESTIC WELL
- AGRICULTURAL WELL
- SWN 21M1 WELL ID

AQUIFER COMPLETION DESIGNATION

OXNARD AQUIFER
MUGU AQUIFER
HUENEME AQUIFER
FOX CAYNON AQUIFER

UAS
LAS

GROUNDWATER ELEVATION CONTOUR MAPS
AUGUST 2014
City of Oxnard GREAT Program
Campus Park Groundwater Replenishment and Reuse Project
Oxnard, California

APPENDIX C – PALL MF PDT/LRV ANALYSIS

Resolution and LRV Calculations for Direct Integrity Testing Using the MFGM Method for Water Treatment Plant at 01.00106 Oxnard, CA

Objectives

The objective is to determine (1) the testing pressure required to meet the resolution criterion of 3 μm or less as specified in the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), (2) the pressure decay value (PDR) corresponding to required Log Reduction Value (LRV) for particles with the size of 3 μm at plant design conditions.

Calculation for Resolution and Sensitivity of the Membrane System

1. Determining Testing Pressure for Required Resolution (≤3 μm)

   The testing pressure can be calculated per Equation (4.1)

$$P_{test} = (0.193 * \kappa * \sigma * \cos\theta) + BP_{\max} \qquad \text{Equation (4.1)}$$

Table 1. Calculation Variables (P_{test})

Item	Description	Unit	Value
P_{test}	Test pressure for required resolution	psi	17.47
k	Shape correction factor	dimensionless	1
σ	Surface tension of water @ 5 °C	dynes/cm	74.97
θ	Water contact angle of membrane medium	degree	0.00
BP_{max}	Sum of backpressure and static head	psid	3

Since the testing pressure to be used is 25 psi or above and the pressure decay is anticipated lower than 1 psi during the duration of the test for Pall MF system, the resolution criterion is satisfied.

2. Calculating Sensitivity (LRV_{DIT})

The LRV calculation is performed by using Equation (4.9) in USEPA’s Membrane Filtration Guidance Manual (USEPA, 2005):

$$LRV_{DIT} = \log\left(\frac{Q_p * ALCR * P_{atm}}{\Delta P_{test} * V_{sys} * VCF}\right) \qquad \text{Equation (4.9)}$$

The air-liquid conversion ration (ALCR) is calculated using Darcy Equation by assuming that the hollow fiber breaks completely at the interface of potting layer, which results in a shortest flow path for bypass flow. The calculation also uses the highest trans-membrane pressure (TMP) during a filtration cycle. This results in a conservative result that has a low LRV.

Air-to-liquid-conversion ratio (ALCR):

$$ALCR = 170 * Y * \sqrt{\frac{(P_{test} - BP)(P_{test} + P_{atm})}{(460 + T) * TMP}} \qquad \text{Equation (C.4)}$$

$$Y \propto \left[\frac{1}{\frac{(P_{test} - BP)}{(P_{test} + P_{atm})}}, K \right] \qquad \text{Equation (C.5)}$$

K: resistant coefficient

$$K = f * \frac{L}{d_{fiber}} \qquad \text{Equation (C.6)}$$

The parameters used in the LRV calculation are presented in Table 2.

Table 2. Parameters Used for LRV Calculation

Item	Description	Unit	Value
Q_p	design (instantaneous) flow per rack	gpm	1,554
VCF [a]	volumetric concentration factor	dimensionless	1.00
ΔP_{test}	The smallest pressure decay rate associated w/ a breach	psi/min.	0.06
V_{sys} [b]	system hold-up volume	ft^3	44.17
P_{atm}	Atmospheric pressure	psi	14.7
BP [b,c]	back-pressure during pressure decay test	psi	0
T [b]	Temperature	^oF	80.6
TMP [b]	terminal trans-membrane pressure during filtration	psi	40
f	friction factor	dimensionless	0.025
L [c]	the length of flow path for breach	M	0.06
D	diameter of hollow fiber lumen	M	0.00064
P_{test} [b]	testing pressure for pressure decay test	psi	25.0

Note: a - *Dead-end filtration*

b - *Based on the design data*

c - *Assume worst-case fiber breakage (at the top potting layer)*

Find K:

$$K = f * \frac{L}{d_{fiber}} \qquad \text{Equation (C.6)}$$

f: friction factor

L: the length of flow path of the breach (equal to the potting thickness)

d_{fiber} lumen diameter of the fiber.

$$K = 0.025 * \frac{0.06}{0.00064}$$

Find Y value using the chart on page A-22 from Crane:

$$Y \propto \left[\frac{1}{\frac{(P_{test} - BP)}{(P_{test} + P_{atm})}}, K \right]$$

Substitute Y into Equation (C.4):

Substitute ALCR into Equation (4.9):

Table 3. Additional Parameters Used for LRV Calculation

Item	Description	Unit	Value
K	Resistant coefficient	dimensionless	2.34
Y	Net expansion factor	dimensionless	0.63
$ALCR$	Air to liquid conversion ratio	dimensionless	22.84
LRV_{dit}	Sensitivity of direct integrity test	log	4.4

Therefore, the sensitivity of direct integrity testing is = LRV_{dit} in Table 3.

1. Calculate Upper Control Limit (UCL) and Alert Level (AL) for Direct Integrity Testing. The UCL for direct integrity testing, the pressure decay rate corresponding to the required LRV, is determined by rearranging Equation (4.9):

$$UCL = \frac{Q_p \bullet ALCR \bullet P_{atm}}{10^{LRC*} \bullet V_{sys} \bullet VCF} \qquad \text{Equation (4.17)}$$

Where: UCL - upper control limit for pressure decay rate, psi/min.

$LRC*$ - required LRV for the membrane system

If the required LRV for the membrane system is 4-logs, substitute $LRC*$ = 4 and the same parameters in Table 2:

The plot of LRV as a function of pressure decay rate is presented in Figure 1 in which the UCL is marked with red dotted line.

Table 4. Results of UCL Calculation

Item	Description	Unit	Value
UCL	Upper control limit	dimensionless	0.16

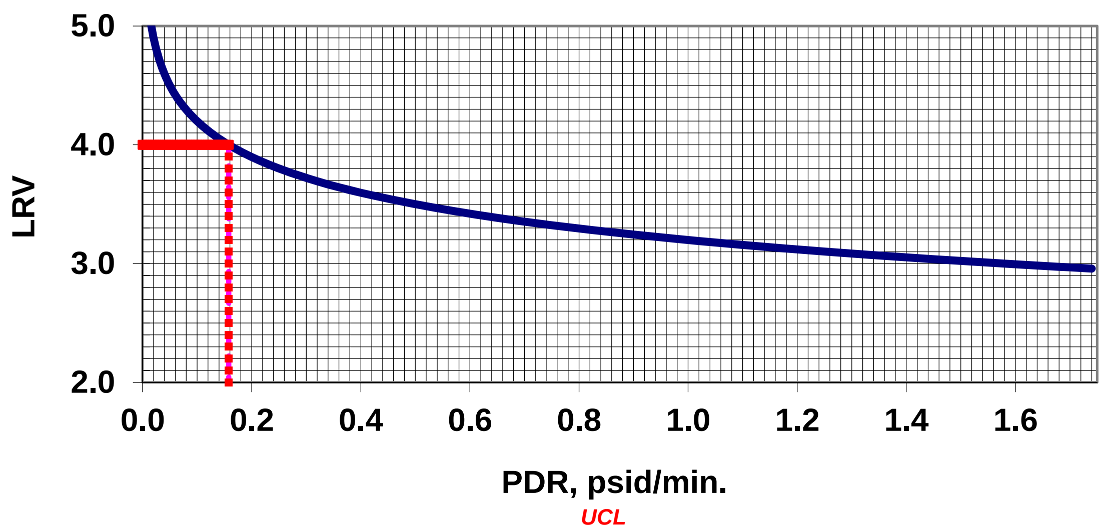


Figure 1: LRV as a function of pressure-decay rate (PDR)

UCL is indicated on the graph corresponding to LRV of 4-logs.

References

Sethi, S., G. Crozes, D. Hugaboom, B., Mi, J. M. Curl, and B. J. Mariñas (2004): *Assessment and Development of Low-Pressure Membrane Integrity Monitoring Tools* , AwwaRF Report No. 91032, Denvor, CO.

USEPA: *National Primary Drinking Water regulations: Long Term 2 Enhanced Surface Water Treatment Rule; Final Rule* , Federal Register, January 5, 2006

USEPA: *Membrane Filtration Guidance Manual* , EPA-815-R-06-009, November, 2005

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