PREPARED FOR
CITY OF SANTA MONICA

Focused Study of the Pilot Distributed Recycled Water Treatment Facility

DRAFT

July 2015

STUDY

MWH®

City of Santa Monica

Distributed Recycled Water Treatment Facility Study

DRAFT

July 2015

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BUILDING A BETTER WORLD

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Section 1
Introduction

The Distributed Recycled Water Treatment Facility Study (Study) will be used to determine a advanced treatment facility location, appropriate treatment technology, and implementation requirements to support the submission of a grant application to help fund a local supplemental water supply project. This Study will assist the City of Santa Monica (City) in reducing reliance on imported water by using highly treated local wastewater to recharge the City's groundwater basin. The objectives of this study is to develop a project that efficiently meets these goals.

1.1 BACKGROUND

In April of 2015 the City elected to conduct an engineering study that focused on the advanced treatment of 0.5 to 1 million gallons per day (mgd) of municipal wastewater. The City's intended uses for the treated wastewater include landscape irrigation, toilets, sea water intrusion barriers, and indirect potable reuse via aquifer storage and recovery. Through the development of the scope of work for this Study, the City identified six (6) potential sites for evaluation and has since collected information on available flow and water quality in sewers in proximity to the sites. The City's existing recycled water system will provide conveyance to recharge wells connected to the City's groundwater basin.

1.2 OBJECTIVES

The City identified the objectives of the Study to be:

- Develop a recommended short list of the best treatment technologies available to achieve the City's stated finished water quality and reuse goals,
- Develop preliminary order of magnitude engineering costs for the construction and operation of the facility, including any avoided costs of treatment or purchase of water,
- Evaluate the six (6) sites identified by the City for constructability, compatibility with the surrounding area, and cost and schedule, and
- Develop a critical path schedule that identifies detailed design, construction, and recommended permitting timeline.

1.3 STUDY AREA

The City identified six (6) potential sites for the location of the advanced treatment facility. These six (6) sites are shown on **Figure 1-1**, described in detailed in subsequent sections of this report, and are listed below:

- **Site #1 – Sears Triangle**
- **Site #2 – Colorado Yard/Memorial Park**
- **Site #3 – Civic Center Parking**
- **Site #4 – Bus Maintenance Facility**
- **Site #5 – Stewart Park**
- **Site #6 – MAPS Facility**

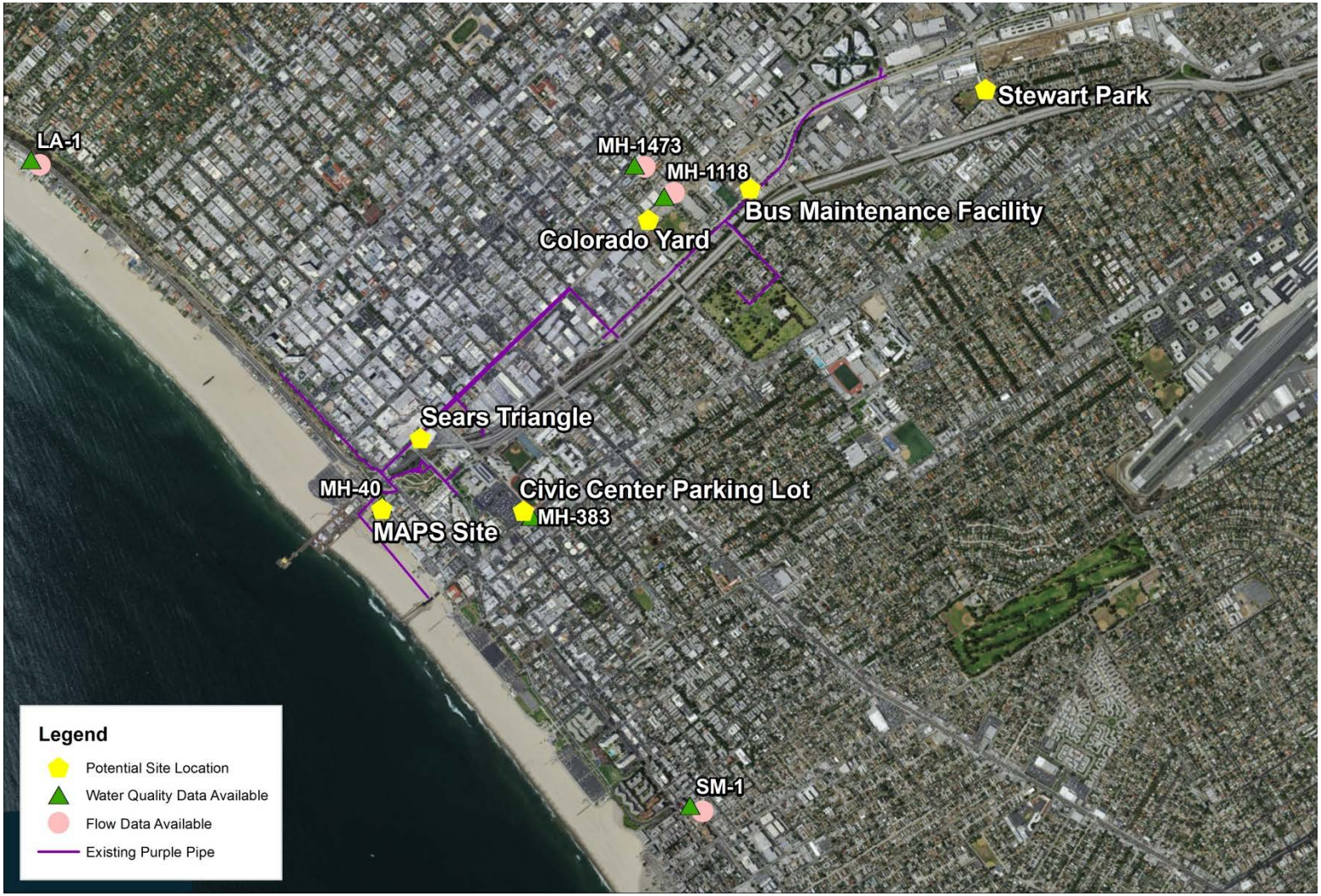


Figure 1-1
Potential Sites for Advanced Treatment

Section 2
Current Conditions

This section of the Study describes the potentials sites, available flow, and water quality information. The City has provided MWH with flow and wastewater quality information obtained from manholes located within the City. **Figure 2-1** depicts the locations of these flow monitoring locations, the six potential sites for the advanced treatment facility, and the water quality sampling sites.

Figure 2-1
City of Santa Monica

POTENTIAL SITE LOCATIONS

The six (6) potential sites that were evaluated as part of this study are:

- **Sears Triangle (Site #1).** This site is located at the intersection of Main Street and Colorado Avenue. The area that is available for construction on this site is approximately 9,250 square feet (ft^2). The City has stipulated that any facility constructed at this site be entirely underground. The property is currently unoccupied and has periodically contained decorative plants or construction equipment.

- **Colorado Yard/Memorial Park (Site #2).** This site is located adjacent to Colorado Avenue between 14th Street and 16th Street. The area that is available for construction on this site is approximately 87,150 ft^2. The property currently serves as a City maintenance yard and the maintenance facilities are scheduled for relocation in the near future. For this site, the location of the influent and recycled water pipelines will need to be carefully planned to take into account the location of the Expo Line.

- **Civic Center Parking Lot (Site #3).** This site is located near the intersection of 4th Street and Pico Boulevard. The area that is available for construction on this site is approximately 12,300 ft^2. This site currently contains parking for the Civic Center. This site is highly desired by several departments and groups within the City for development.

- **Bus Maintenance Facility (Site #4).** This site is located at the intersection of Olympic Boulevard and 19th Street. The area that is available for construction on this site is approximately 20,860 ft^2. This site currently contains a lot for storage and for the maintenance of buses owned by the Santa Monica-Malibu Unified School District. This site is currently owned by the school district and the City would be required to purchase the land.

- **Stewart Park (Site #5).** This site is located adjacent to the City Maintenance Yards at 2500 Michigan Avenue (these are different maintenance yards than those listed in the description of Colorado Yard). The area that is available for construction on this site is approximately 12,540 ft^2. The site is currently a City of Santa Monica Owned park and was previously a landfill for construction debris. The City is currently extracting methane from the site. Additional geotechnical work will be required prior to new construction taking place on this site.

- **MAPS Facility (Site #6).** This site is located near the intersection of Moss Avenue and Appian Way, near the SMURF facility and Moss Avenue Pump Station. The area that is available for construction on this site is approximately 17,400 ft^2. This site currently contains a parking lot. Construction at this site would need to maintain a small footprint to minimize the impact on parking in the area and take into consideration the upcoming construction near the Pier that will have a temporary ramp along Moss Avenue.

WATER QUALITY

The City sampled water quality at six locations, previously identified in **Figure 2-1**, and provided water quality information to MWH for analysis. The water quality constituent averages for each location are summarized in **Table 2-1** on the next page.

Table 2-1
City of Santa Monica Water Quality Summary

Parameter	Units	MH-1118	MH-40	MH-1473	MH-383	LA-1	SM-1
Chloride	mg/L	110	120	300	69		
Fluoride	mg/L	0.61	0.9	0.79	0.67		
Nitrate as NO_3	mg/L	ND	ND	12	ND		
Nitrite as N	mg/L	ND	ND	ND	ND		
Sulfate as SO_4	mg/L	109	130	680	100		
Oil & Grease	mg/L	11	7.8	12	10		
COD	mg/L	1160	770	640	680		
Alkalinity	mg/L	370	280	920	300		
Bicarbonate Alkalinity	mg/L	455	350	1100	370		
Carbonate Alkalinity	mg/L	ND	ND	ND	ND		
Hydroxide Alkalinity	mg/L	ND	ND	ND	ND		
Specific Conductance		1350	1300	3700	1100		
Salinity	mg/L	0.7	0.68	2	0.55		
TDS	mg/L	555	660	2200	470		
TSS	mg/L	440	280	300	400	178	177
pH		7.77	7.46	7.69	8.08	7	8
BOD	mg/L	205	260	280	270	157	195
MBAS	mg/L	4.3	3.9	4.1	5.5		
Total Anions	meq/L	13	12	41	10		
Total Cations	meq/L	8.95	11	38	7.8		
Total Hardness	mg/L	215	260	1400	210		
Antimony	mg/L	ND	ND	ND	ND	ND	ND
Arsenic	mg/L	ND	ND	ND	ND	ND	ND
Beryllium	mg/L	ND	ND	ND	ND	ND	ND
Cadmium	mg/L	ND	ND	ND	ND	ND	ND
Calcium	mg/L	53.5	61	330	49		
Chromium	mg/L	0.006	ND	0.0053	ND	0.0027	0.00465
Copper	mg/L	0.165	0.11	0.12	0.081	0.135	0.2
Iron	mg/L	2500	780	2300	1700		
Lead	mg/L	0.0054	ND	ND	ND	ND	ND
Magnesium	mg/L	20	28	130	22		
Mercury	ug/L	0.1	0	0.26	0	0.2	0.583857
Manganese	mg/L	53	45	29	36		
Nickel	mg/L	0.0075	0.018	ND	ND	0.0068	0.006375
Potassium	mg/L	19.5	14	17	15		
Selenium	mg/L	ND	ND	ND	ND	0.012	0.011
Silver	mg/L	0.0027	ND	ND	ND	ND	ND
Sodium	mg/L	94.5	130	250	72	ND	ND

Parameter	Units	MH-1118	MH-40	MH-1473	MH-383	LA-1	SM-1
Thallium	mg/L	ND	ND	ND	ND	ND	ND
Zinc	mg/L	0.265	0.2	0.25	0.27	0.168	0.253556

FLOW DATA

The City provided flow data for four sites within the City boundaries. The average flows, minimum flows, and maximum flows at each location are summarized in **Table 2-2** below. The flow monitoring locations are depicted in **Figure 2-1**.

Table 2-2
City of Santa Monica Flow Data Summary

Parameter	Unit	MH-1118	MH-1473	LA-1	SM-1
Average	mgd	0.54	2.29	2.96	13.8
Minimum	mgd	0.172	1.76	0	4.84
Maximum	mgd	0.96	3.80	5.72	22.3

LA-1 and SM-1 monitor the flow that comes into the City of Santa Monica from the City of Los Angeles and the flow that leaves the City of Santa Monica, respectively. These two monitoring locations were provided to determine how the flow within the City varies during dry and wet weather seasons. **Figure 2-2** shows the flow variation between dry and wet weather. The information in **Figure 2-2** indicates that the stormwater that falls on the City is well-separated and therefore has very little impact on the sewer flow rates.

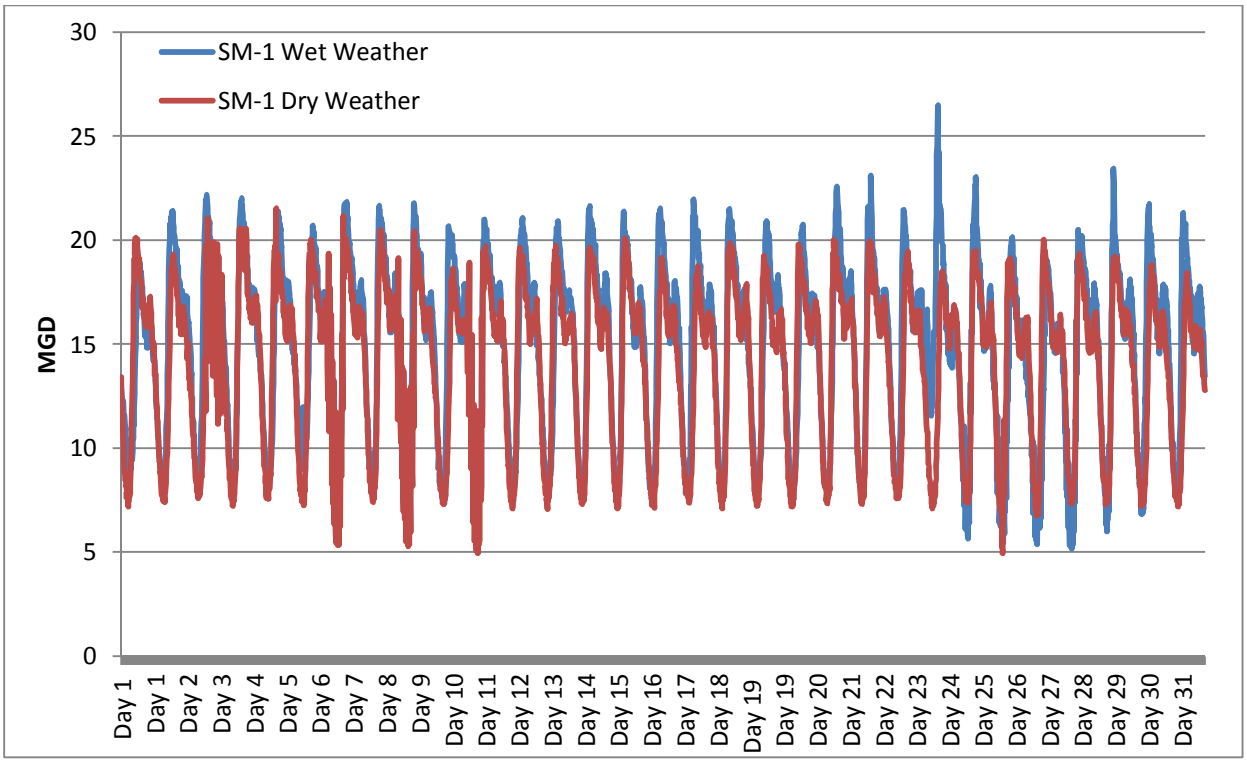


Figure 2-2
SM-1 Dry & Wet Weather

In order to capture and divert wastewater to a treatment facility, it will be necessary to construct a new manhole diversion structure in-line with the existing sewer pipe. This can be accomplished with the installation of a simple manhole with a weir. The weir will function to raise the hydraulic grade line of the pipeline to match the elevation of flow over the weir. This will allow for flow to be diverted into a new lift station to be pumped to the new advanced treatment facility. The proposed diversion structure is depicted in **Figure 2-3**.

The addition of this diversion structure will result in a minor negative consequence of a 1 to 1.5 foot surcharge in the sanitary sewer system upstream of this point. This surcharge is not anticipated to impact sewer operation, especially given the small variation between dry weather flow and wet weather flow. The major advantage of the weir manhole diversion structure is its simplicity, which will allow for a constant level to be maintained in the lift station wet well and reliability of supply. The weir manhole diversion structure is also extremely robust and unlikely to fail or clog.

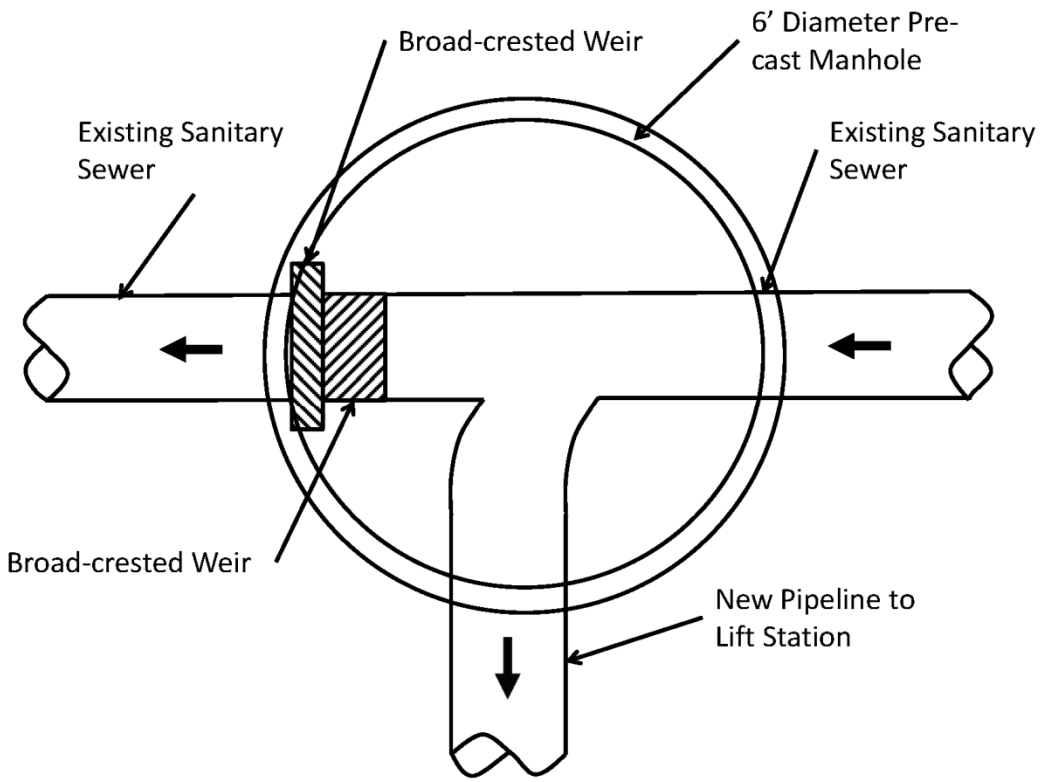


Figure 2-3
Diversion Structure

COMBINED FLOW AND WATER QUALITY DATA

Flow information for MH-1118 and MH-1473 were provided as a basis for potential source flows for the advanced treatment system. One of the objectives of the City was to generate 0.5 mgd to 1 mgd of advanced treated water. The advanced treatment processes will have roughly 20 percent of rejection, which indicates a need of 0.7 mgd of influent wastewater to generate 0.5 mgd of product water or 1.2 mgd of influent wastewater to generate 1 mgd of product water. Probability plots have shown that 90% of the time MH-1118 does not receive enough flow to supply a 0.5 mgd advanced treatment plant. Probability plots for all flow data can be found in **Appendix A**. The City has suggested that the flows from MH-1118 and MH-1473 can be combined to provide sufficient flow to the advanced water treatment system 90 percent of the time. **Table 2-3** below summarizes water quality with the combined flow from MH-1118 and MH-1473, in a 20% and 80% flow ratio, respectively.

Table 2-3
MH-1118 and MH-1473 Combine Water Quality

Parameter	Units	Value
Chloride	mg/L	264
Floride	mg/L	0.756

Parameter	Units	Value
Nitrate as NO3	mg/L	ND
Nitrite as N	mg/L	ND
Sulfate as SO4	mg/L	571
Oil & Grease	mg/L	11.8
COD	mg/L	739
Alkalinity	mg/L	815
Bicarbonate Alkalinity	mg/L	977
Carbonate Alkalinity	mg/L	ND
Hydroxide Alkalinity	mg/L	ND
Specific Conductance	mg/L	3252
Salinity	mg/L	1.75
TDS	mg/L	1886
TSS	mg/L	327
pH		7.70
BOD	mg/L	266
MBAS	mg/L	4.14
Total Anions	meq/L	35.7
Total Cations	meq/L	32.5
Total Hardness	mg/L	1174
Antimony	mg/L	ND
Arsenic	mg/L	ND
Beryllium	mg/L	ND
Cadmium	mg/L	ND
Calcium	mg/L	277
Chromium	mg/L	0.00543
Copper	mg/L	0.129
Iron	mg/L	2338
Lead	mg/L	ND
Magnesium	mg/L	109
Mercury	ug/L	0.229
Manganese	mg/L	33.6
Nickle	mg/L	ND
Potassium	mg/L	17.5
Selenium	mg/L	ND
Silver	mg/L	ND
Sodium	mg/L	220.3
Thallium	mg/L	ND
Zinc	mg/L	0.2528

Section 3
Options Development

The goal of this Study is to assist the City in the identification of a potential advanced treatment facility location and the appropriate treatment technology for the intended use of the recycled water. This section summarizes the regulations, the appropriate treatment train, and the design criteria for 0.5 mgd and 1.0 mgd of product water.

RECYCLED WATER REGULATIONS

Through the Regional Water Quality Control Board (RWQCB), the Division of Drinking Water (DDW) and the California State Water Resources Control Board (SWRCB) are the main regulatory bodies governing the use of reclaimed water under requirements set forth in the California Health and Safety Code, Water Code, and Titles 22 and 17 of the California Code of Regulations. The permitted uses for reclaimed water are water quality specific. With ever-advancing and sophisticated treatment technologies, the regulations are evolving from standards for separate non-potable reuse (NPR) distribution systems, and now include indirect potable reuse (IPR) standards for injection into groundwater aquifers.

The City has indicated that the advanced treated water will be discharged to the existing recycled water distribution system for groundwater injection. DDW requires that groundwater injected for IPR is treated by specific processes, including membrane filtration, reverse osmosis, and advanced oxidation processes. Treatment goals for pathogens, organic carbon, and synthetic contaminants are very stringent and 100% of the water must be treated, so no partial by-pass is allowed. Water quality monitoring and aquifer management are also very important components of the overall system.

TREATMENT PROCESS FLOW DIAGRAM

Major treatment processes selected for the advanced treatment facility are briefly described below. Each individual element's specifications can be found in the Design Criteria **Table 3-1**.

A Membrane Bioreactor (MBR) is a proven wastewater technology that combines the positive aspects of conventional wastewater treatment with the positive aspects of solids removal via membrane filtration. The process works by using a suspended growth biological rector to break down organic matter with microorganisms and then forcing the water through a membrane. The sequential use of a pre-anoxic, aeration, and post-anoxic zones allows effective removal of both organic matter and nutrients. The membranes used in an MBR have a high removal efficiency of particulates, including bacteria and total suspended solids, and provide a stable and uniform product water for subsequent treatment. MBRs have a small footprint and are ideally suited for use in dense urban areas. The MBR is shown as part of **Figure 3-1**, including the pre-anoxic, aeration, and post anoxic tanks. Solids generated by the MBR process will be returned to a downstream sewer.

Micro/Ultra Filtration (MF/UF) is also a proven process for the removal of particulates, and may or may not be required as a supplemental treatment step between MBR and reverse osmosis. MF/UF is shown in Figure 3-1 as a dashed box. The membranes used in the MBR process are

functionally equivalent to an MF/UF system (i.e. particulate removal), but the regulations do not yet recognize MBR membranes as providing the same level of pathogen control as the MF/UF membranes. This MBR pathogen control issue is a matter of extensive study in the water industry, and may be resolved prior to implementation of this project. For the purposes of this Study, it is assumed that the MF/UF process will not be needed, and that either MBR pathogen credit will be allowed, or any additional pathogen removal can be obtained with chlorine and aquifer management provisions included in the IPR regulations.

Reverse Osmosis (RO) is a proven process that uses pressure to push water through a semipermeable membrane to remove dissolved ions, such as calcium and chloride. The RO process is also highly effective at removing many other contaminants of concern from wastewater, including pharmaceuticals and personal care products. Only a portion of the water applied to the RO process can pass through the membrane, with the remainder rejected as a highly concentration brine. The RO rejection rate is anticipated to be approximately 20% of the full flow. The brine generated at the advanced treatment facility would be discharged to a downstream sewer. Energy recovery is possible from the high pressure discharge.

Ultraviolet Disinfection (UV) works by destroying a microorganisms' DNA and RNA thus rendering the cell unable to reproduce. The effectiveness of UV disinfection depends on the characteristics of the wastewater, amount of time the microorganisms are exposed, and the intensity of the UV light. When high doses of UV light are combined with an oxidant, such as hydrogen peroxide or chlorine, it creates an Advanced Oxidation Process (AOP) that provides both pathogen inactivation and destruction of trace synthetic contaminants. This process is highly effective and provides the final treatment and assurance that the water is fully treated and suitable for injection into a drinking water aquifer. For the purposes of this Study, it is assumed that chlorine will be used for the AOP process, as chlorine will provide additional disinfection as a residual during storage and conveyance to the injection point.

The final product water generated from the treatment process is very soft and corrosive, and has low alkalinity. To help stabilize the water, it is common to add lime to raise the pH and make the water less aggressive to mortar lined piping. However, in this instance, the City's recycled water system is constructed of plastic pipe, which does not need protection. Well casings may be vulnerable, but partial blending with other supplies would eliminate this concern. This issue should be investigated further to determine if lime addition is needed. For the purposes of this Study, the addition of lime is not included.

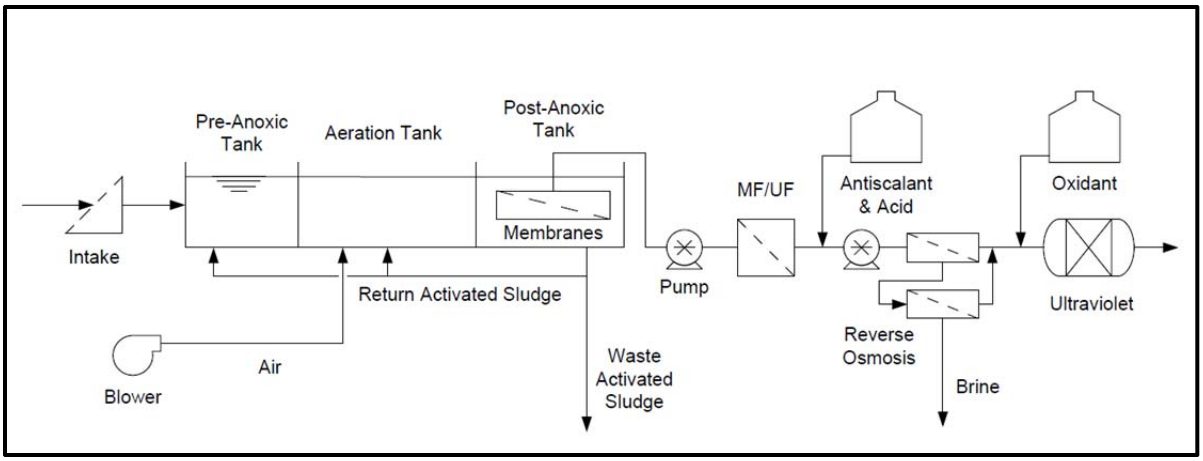


Figure 3-1
Process Flow Diagram

DESIGN CRITERIA

The design criteria required on all sites is summarized in **Table 3-1**. The design flows are 0.5 mgd and 1.0 mgd with plant capacities of 0.7 mgd and 1.2 mgd respectively.

Table 3-1
Design Criteria

Description	Units	Value	
Design Flow	mgd	0.5	1.0
Plant Design Capacity	mgd	0.7	1.2
	gpm	486	833
Influent Pump Station			
Screens		Self-Cleaning	
Influent Pumps			
Number of Pumps	--	2 (1+1)	2 (1+1)
Horsepower	hp	10	20
Fine Screen			
Size of Perforations	mm	2	2
Number of Screens	--	1	1
Basin Geometry			
Number		2	2
Volume	gallons	161,568	323,136
Length	ft	40	40
Width	ft	15	30
Depth	ft	18	18
Anoxic Zone			

Description	Units	Value	
Volume	gallons	48,470	96,941
Length	ft	11	11
Width	ft	15	30
Depth	ft	19	19
Aerobic Zone			
Volume	gallons	113,098	226,195
Length	ft	28	28
Width	ft	15	30
Depth	ft	18	18
Internal Recycle Ratio	% of Q	277.9	277.9
Process Air Blowers			
Type	--	Positive Displacement	
Number of Blowers	--	2 (1+1)	2 (1+1)
Membrane System Pumps			
Membrane Recycle Pumps	--	1 per skid	1 per skid
Membrane Filtrate Pumps	--	1 per skid	1 per skid
Membrane Flush Pumps	--	1 per skid	1 per skid
Membrane System			
Design Flux	gpd	15	15
Cassettes Required @ Ave Flow	--	2	4
Retention Time	hrs	7.8	7.8
Membrane Backwash Pumps		2 duty, 1 standby	
UV System			
Type	--	Low Pressure, High Intensity	
UV System Flow-rate	gpd	500,000	1,000,000
	gpm	347	694
Applied UV Dose	mJ/cm^2	40	40
Number of UV Reactors	--	1	1
Clearwell			
Number	--	1	1
Wet Volume	gallons	41,667	41,667
Diameter	ft	20	28
Side Water Depth	ft	18	18
IPR Pumps			
Type	--		
Number of Pumps	--	2 (1+1)	2 (1+1)
Design Flow-rate, Each	gpm	350	700
TDH	ft	100	100
Chemical Dosing Systems			
COD Pumps			

Description	Units	Value	
Sodium Hydroxide Pumps			
Residual Chlorine Pump			
Flow to be chlorinated	gpd	500,000	1,000,000
Target Chlorine Dose	mg/L	5	5
Odor Control and HVAC System			
Odor Control Exhaust Fans			
Type	--	Belt-driven FRP Centrifugal Fan	
Number of Fans	--	2 (1+1)	2 (1+1)
Carbon Vessels			
Type	--	Radial	
Number of Fans	--	2 (1+1)	2 (1+1)

The required footprint size of a 0.5 mgd and 1.0 mgd system are presented in **Table 3-2**. Based upon the required footprint size, the viability of sites #1 through #6 were evaluated.

Table 3-2
0.5 & 1 mgd Footprint

	0.5 mgd		**1.0 mgd**	
Facility	**Dimensions**	**SF**	**Dimensions**	**SF**
Intake & Screens	10’ x 10’	100	10’ x 10’	100
Pumps & Blowers	40’ x 20’	800	40’ x 20’	800
MBR	20’ x 30’	600	40’ x 30’	1,200
Chemical Storage & Feed	60’ x 20’	1,200	80’ x 20’	1,600
RO	(2) 30’ x 5’	300	(2) 30’ x 8’	480
Locker Room	10’ x 15’	150	10’ x 15’	150
Control Room	10’ x 15’	150	10’ x 15’	150
Electrical	12’ x 30’	360	12’x 30’	360
Clearwell and Pumps	25’ x 31’	775	25’ x 31’	775
Access Corridors	Varies	2,340	Varies	2,360
Total Building Area Requirement		6,775		7,975
Total Area Required*		**9,835**		**11,235**

*Total area required includes 10 foot buffer on both sides of building

INITIAL SCREENING OF OPTIONS

A detailed facility layout of both the 0.5 mgd and 1 mgd advanced treatment facility are shown in **Figure 3-2** and **Figure 3-3**. **Figure 3-4** shows the section view cut of the 1mgd layout and **Figure 3-5** displays the section view of the 1 mgd layout. Each individual site is summarized in **Section 2**, with specific area requirements summarized in **Table 3-2**. **Figures 3-6** through **3-17** display the proposed layout of each site for both 0.5 mgd and 1.0 mgd configurations.

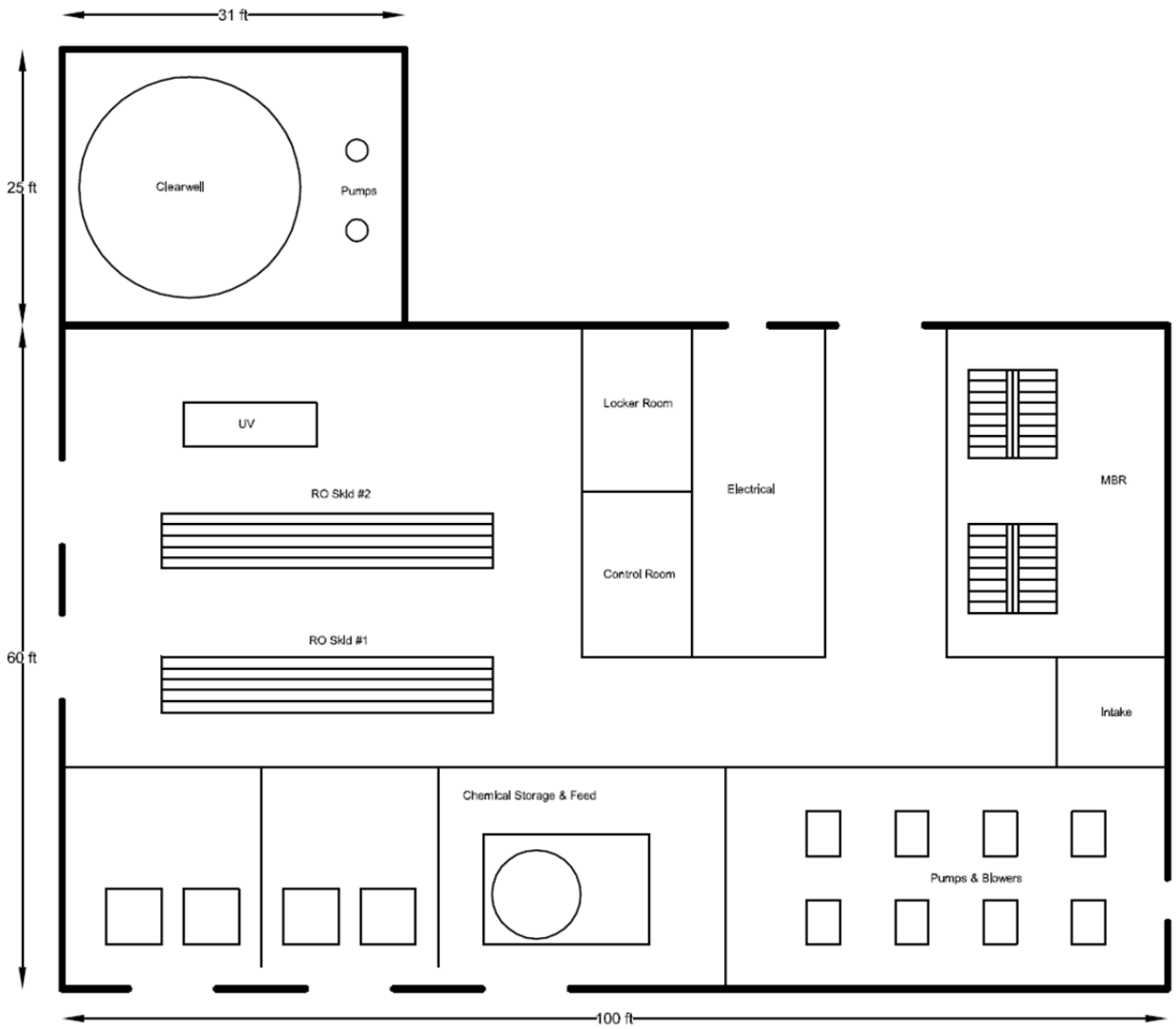


Figure 3-2
Detailed Facility Layout, 0.5 mgd

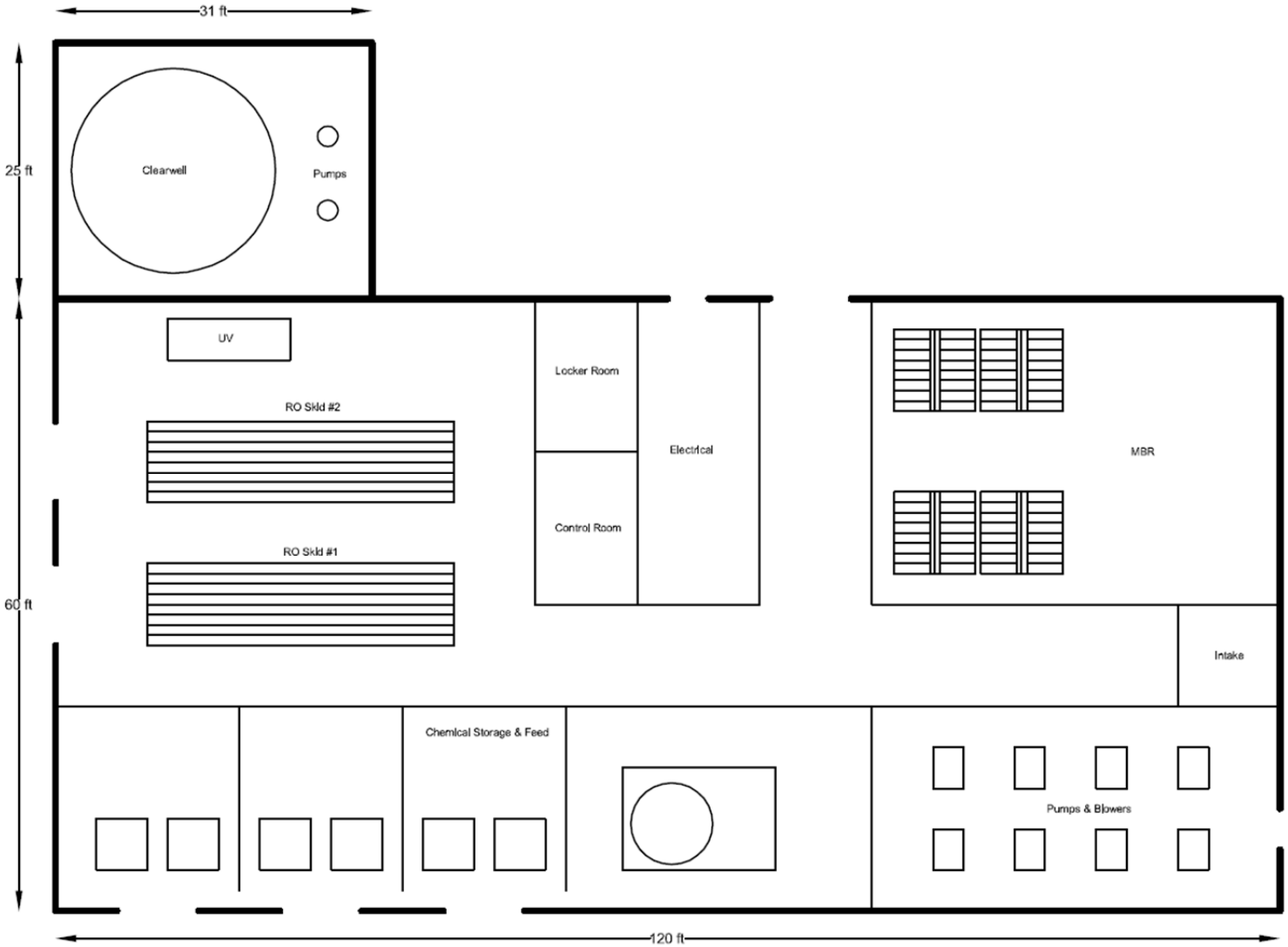


Figure 3-3
Detailed Facility Layout, 1 mgd

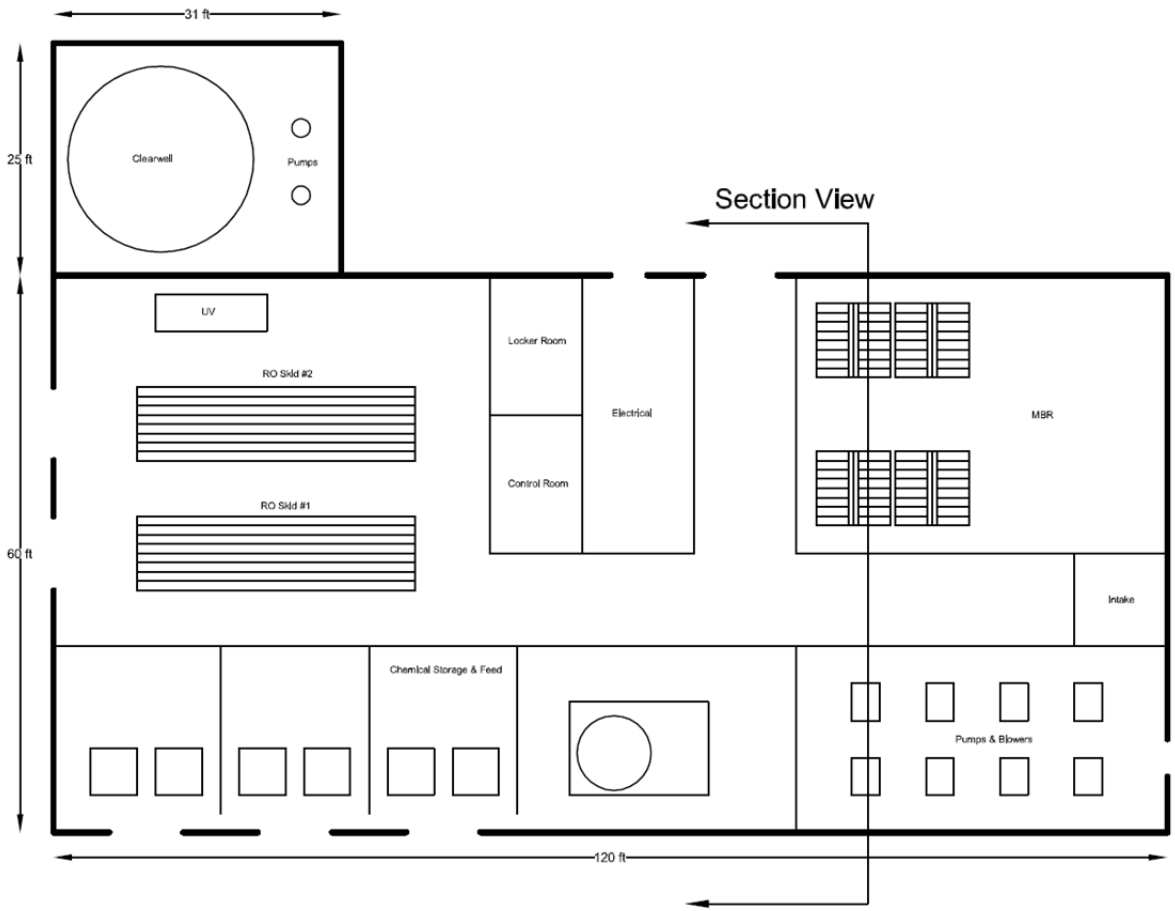


Figure 3-4
Section View Cut, 1 mgd

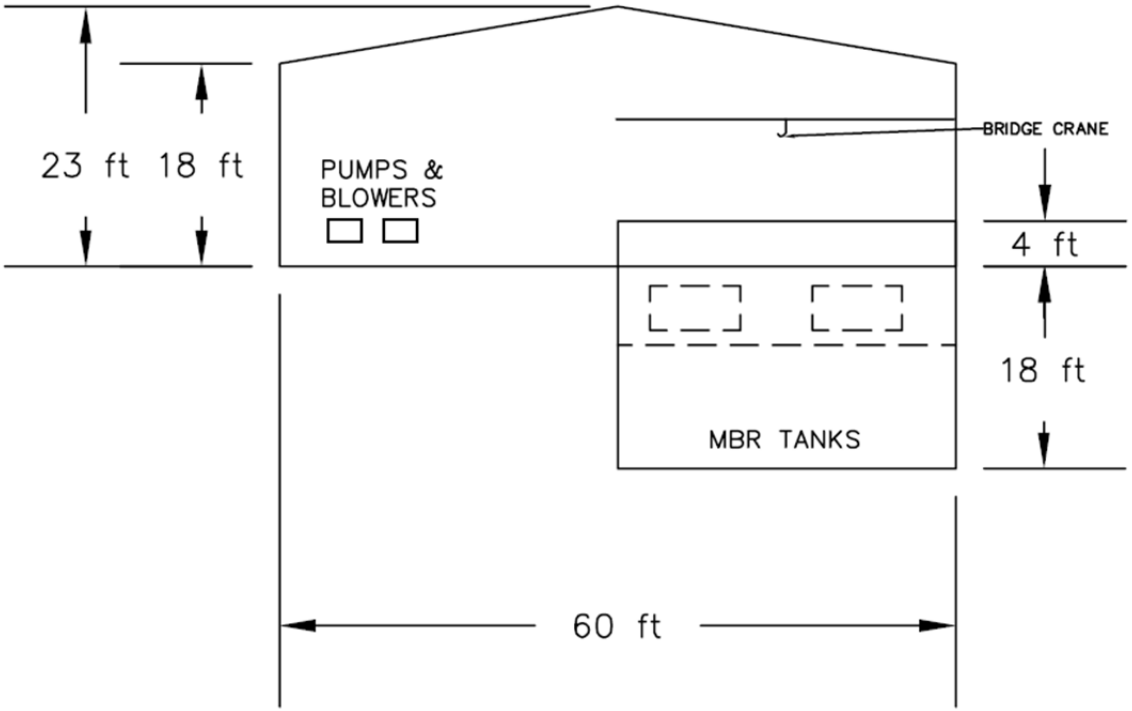


Figure 3-5
Section View, 1 mgd

Figure 3-6
Sears Triangle Layout, 0.5 mgd

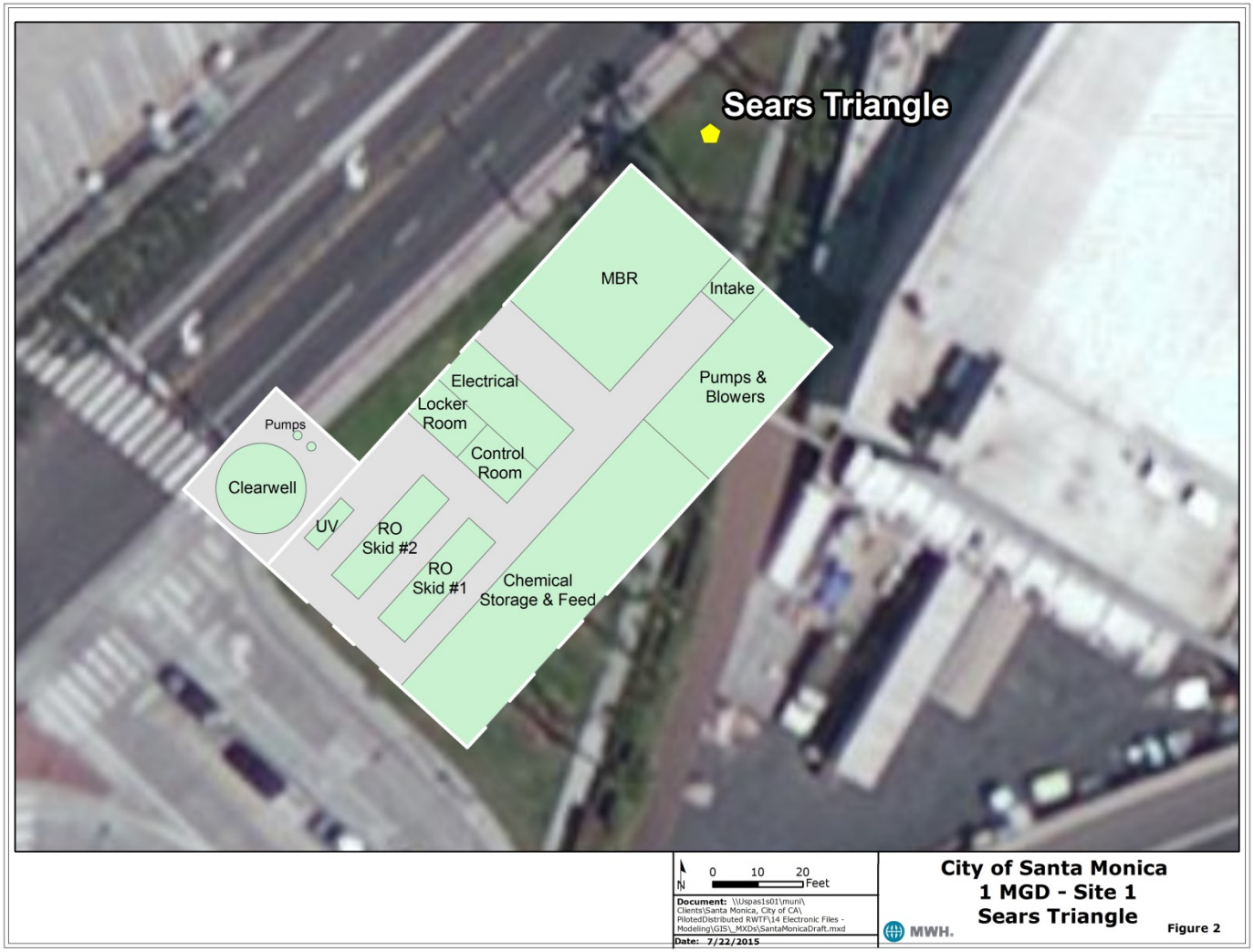


Figure 3-7
Sears Triangle Layout, 1.0 mgd

Figure 3-8
Colorado Yard Layout, 0.5 mgd

Figure 3-9
Colorado Yard Layout, 1.0 mgd

Figure 3-10
Civic Center Parking Lot, 0.5 mgd

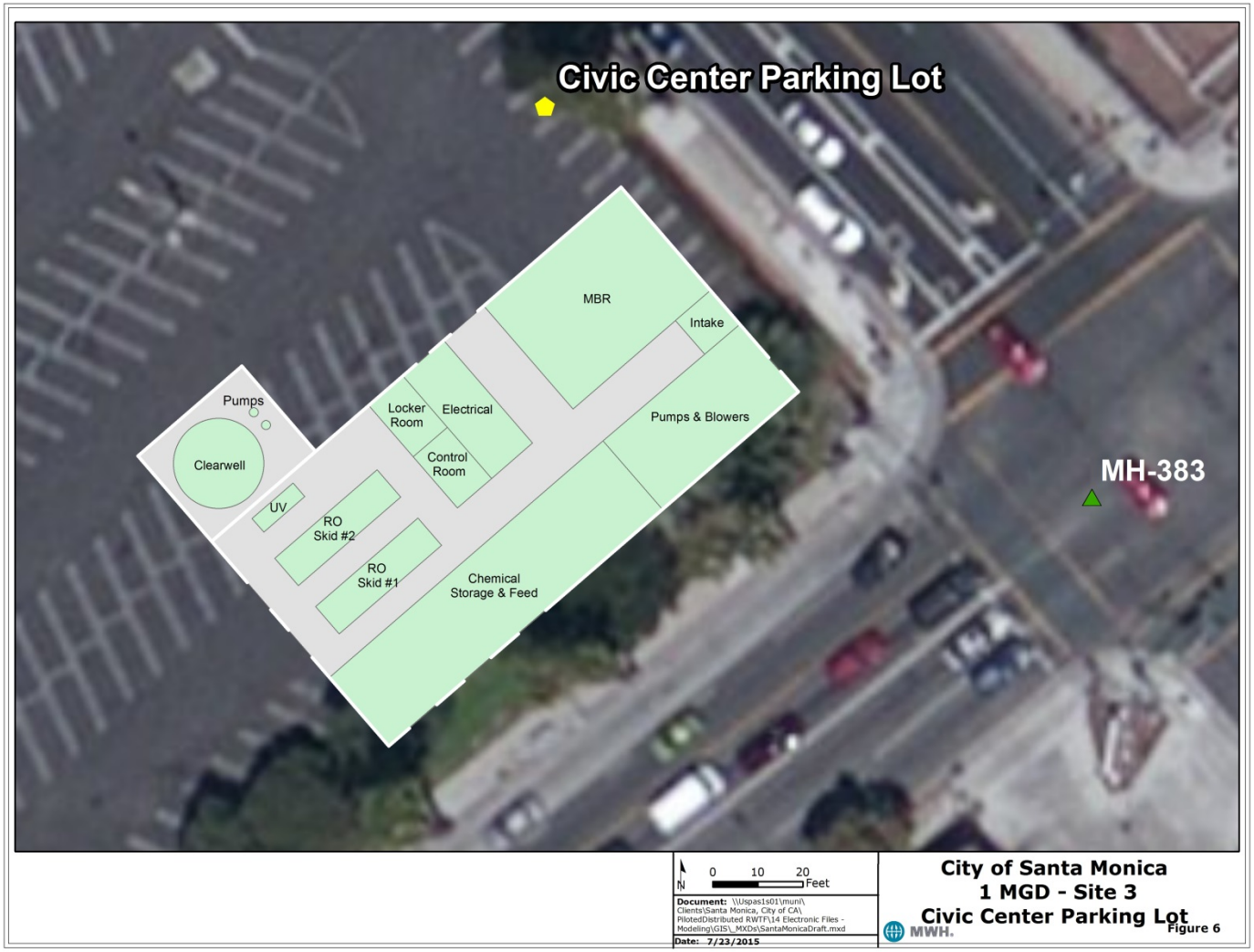


Figure 3-11
Civic Center Parking Lot, 1.0 mgd

Figure 3-12
Bus Maintenance Facility, 0.5 mgd

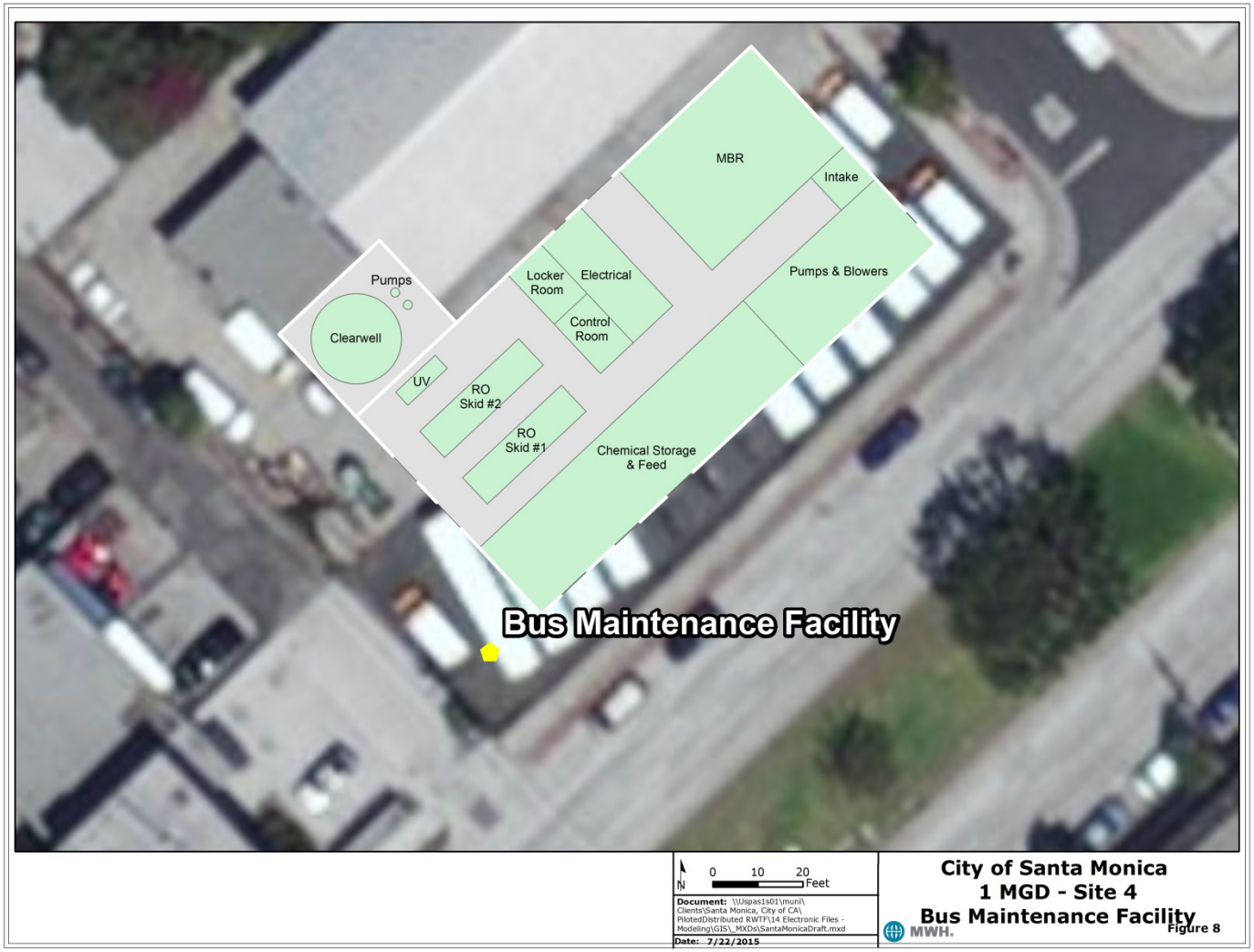


Figure 3-13
Bus Maintenance Facility, 1.0 mgd

Figure 3-14
Stewart Park, 0.5 mgd

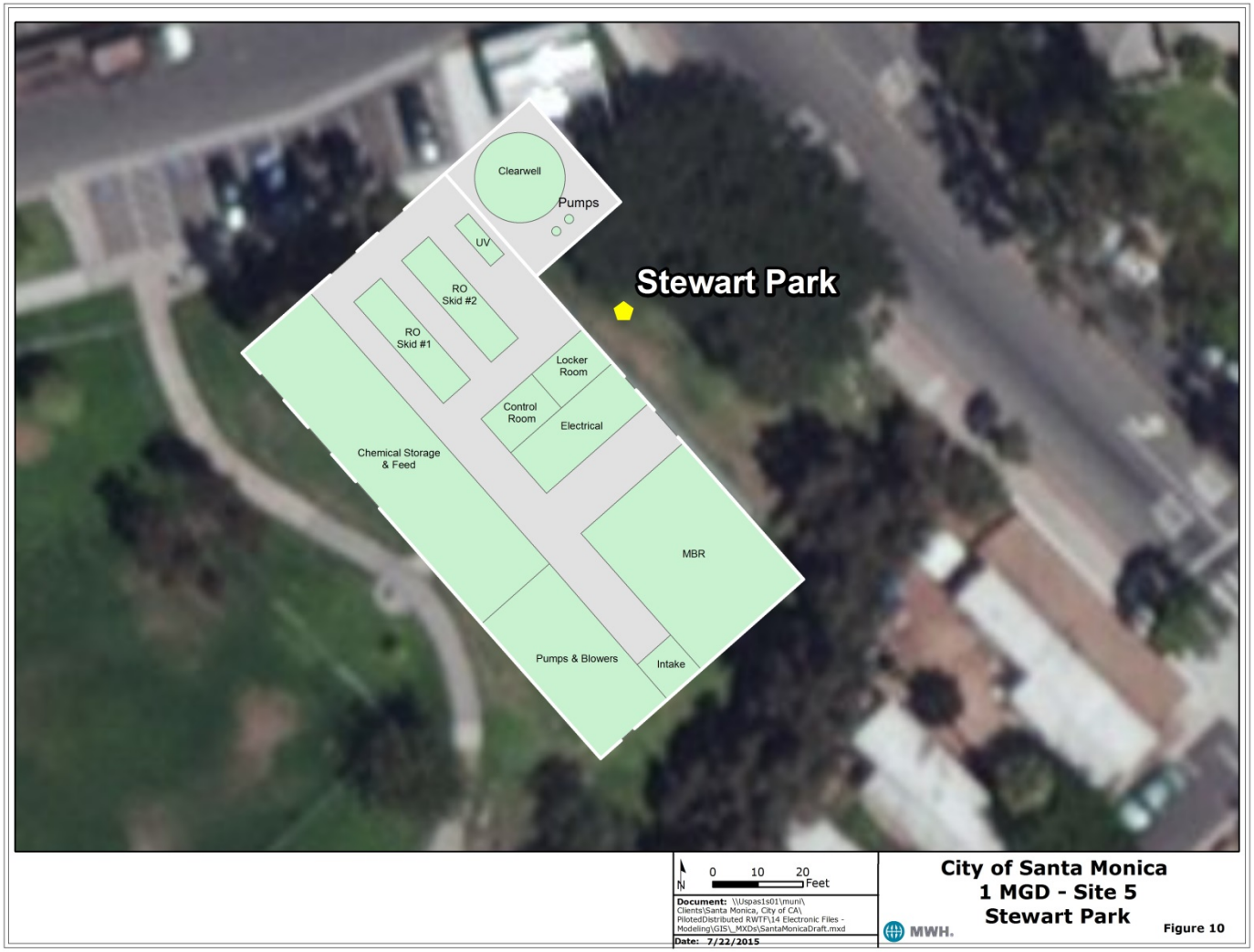


Figure 3-15
Stewart Park, 1.0 mgd

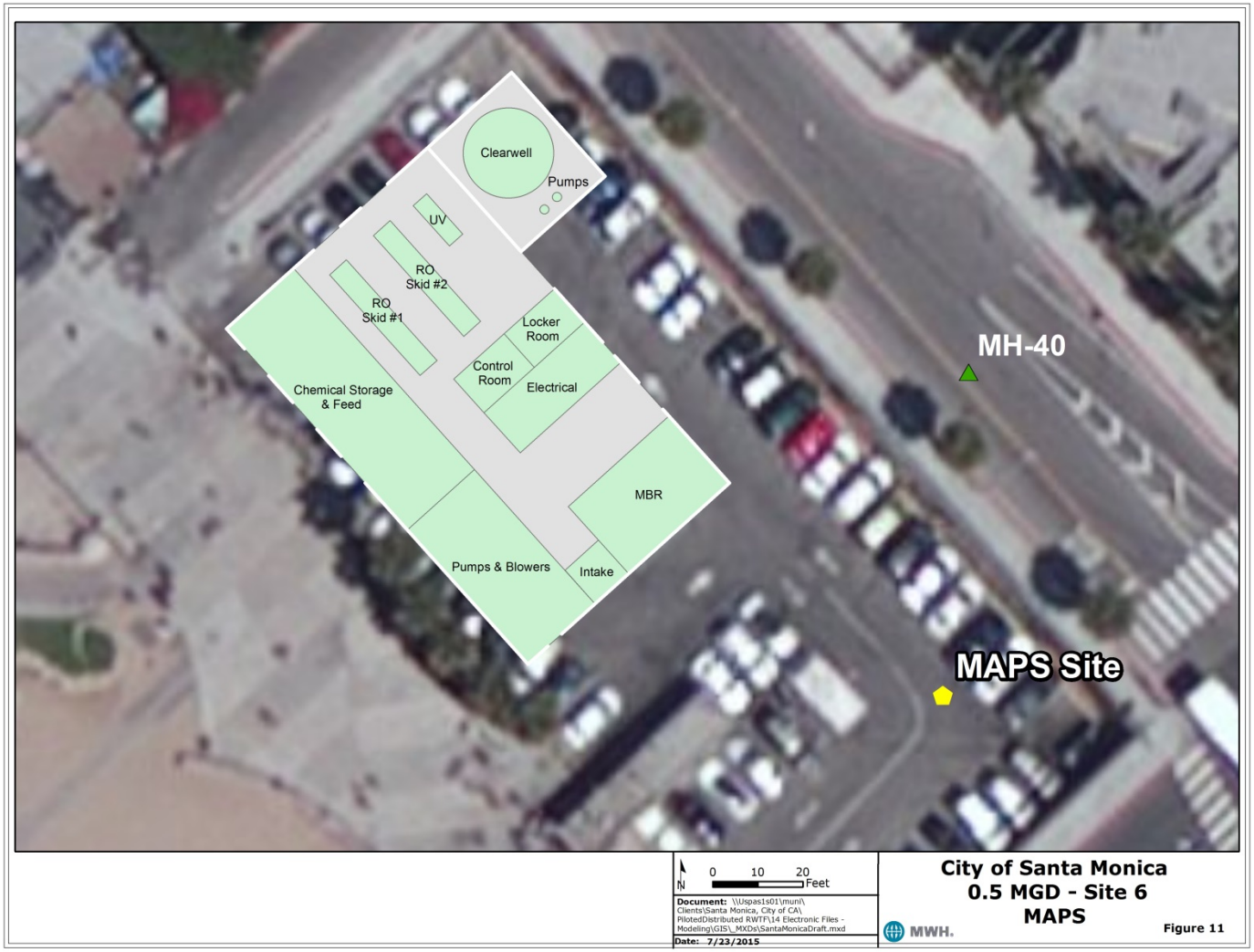


Figure 3-16
MAPS Facility, 0.5 mgd

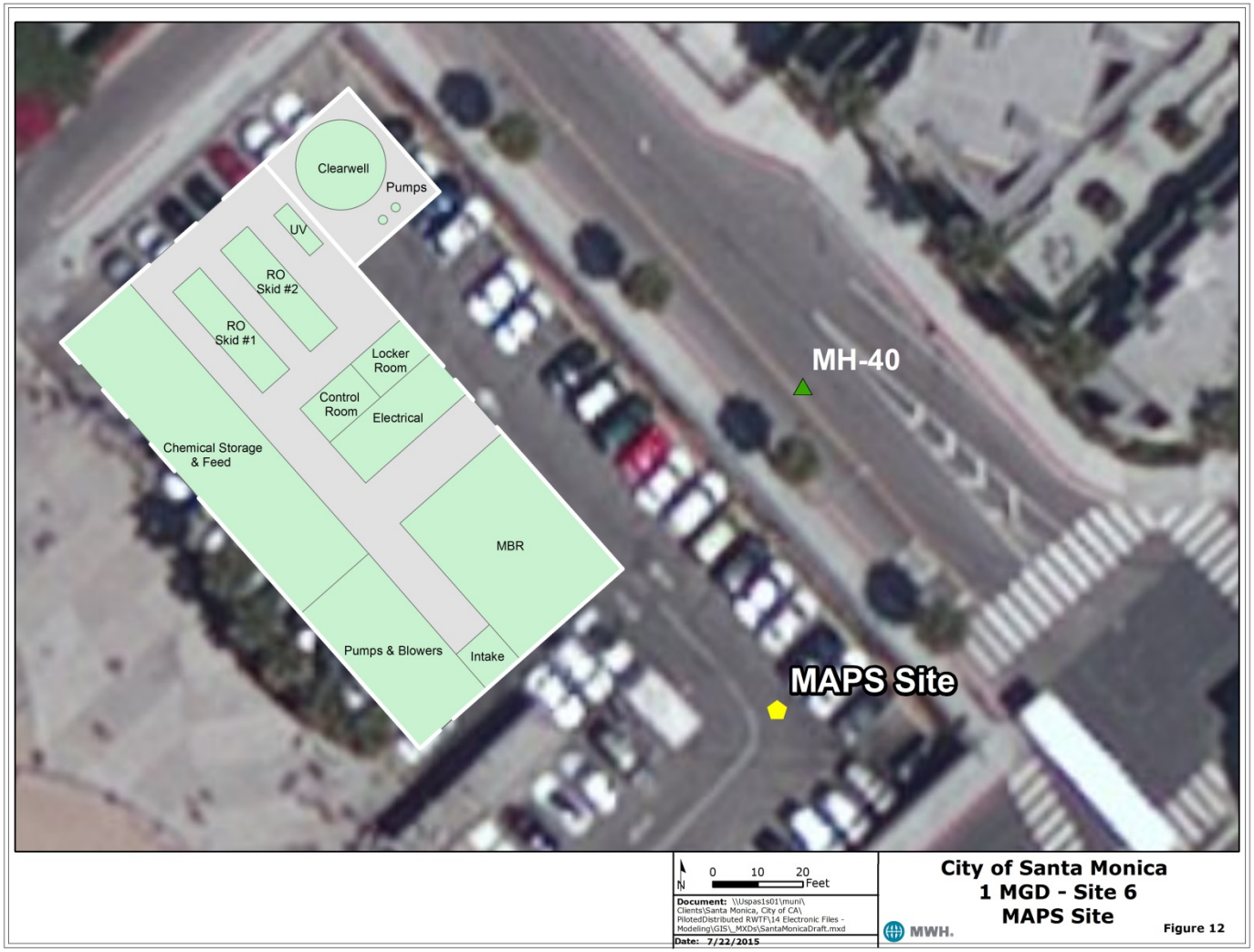


Figure 3-17
MAPS Facility, 1.0 mgd

Section 4
Cost Data Development

4.1 INTRODUCTION

Cost estimates for each of the six sites were developed considering the present worth summation of capital and annual operation and maintenance (O&M) costs. A discussion of the cost elements contained in both capital and annual O&M costs is summarized and presented in **Table 4-1** and **Table 4-2**. This section provides a detailed description of the line items associated with the capital costs as well as the annual O&M costs for each of the sites. The detailed costs for each site are located at the end of the section. The methodology for converting these cost estimates into present worth values is also presented in this section of the report.

4.1.1 Capital and Annual O&M Expenditures

Capital improvement expenditures associated with each of the six sites are projected over the next 30 years and are converted to a present worth value. 30 years was used as an average value between the usable life of mechanical equipment and pipelines. The annual inflation rate is assumed to be two (2) percent. A detailed backup of the estimate for each capital and O&M cost line item is presented in **Appendix B**.

The capital costs for each site are generally similar, with the exception of the influent and effluent piping and land acquisition costs for the Bus Maintenance Facility. **Table 4-1** shows the Capital Cost and Annual O&M Cost for the treatment option at each site for 0.5 mgd facility and **Table 4-2** shows these costs for the 1 mgd facility. O&M costs vary between the sites due to variation in the TDS of the source water and the resulting pressure requirements for the RO process. 100% capacity utilization of the facility is assumed. Costs for the Sears Triangle were not developed as the site is not large enough to support a 0.5 mgd or 1 mgd facility.

Table 4-1 Capital Cost and O&M per Site for 0.5 mgd

	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS Facility
Capital Cost	$10,479,000	$13,155,000	$13,889,,000	$16,967,000	$10,042,000
Annual O&M Cost	$430,000	$380,000	$430,000	$430,000	$380,000

Table 4-2 Capital Cost and O&M per Site for 1 mgd

	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS Facility
Capital Cost	$16,132,000	$18,959,000	$19,690,000	$22,773,000	$15,846,000
Annual O&M Cost	$850,000	$760,000	$850,000	$860,000	$760,000

4.1.2 Avoided Costs

This section presents the costs that the City currently incurs for the treatment of wastewater and the purchase of imported water. These are costs that may be avoided through the implementation of an advanced treatment facility. The current cost of imported water is $2,832/MG ($923/AF) and the current cost for treating wastewater is $1,213/MG. For a 0.5 mgd advanced treatment plant, the avoided water cost and avoided wastewater treatment costs are $517,023 and $221,373 per year, respectively, at current rates. For a 1 mgd advanced treatment plant, the avoided water cost and avoided wastewater treatment costs are $1,034,045 and $442,745 per year, respectively. Details on the avoided costs can be found in **Appendix B**. For estimating purposes, it is assumed that imported water rates will escalate throughout the 30 year study period at a rate that is 5% higher than inflation. Wastewater service charges are assumed to escalate a rate that is 2% higher than inflation.

4.2 COST SUMMARY

This section presents the costs described above for each of the six sites. **Table 4-3** summarizes the capital cost, escalated O&M costs, avoided costs, and the present worth for 0.5 mgd, and **Table 4-4** summarizes these same costs for 1 mgd. The annual O&M cost was inflated at 2 percent per year. The avoided wastewater cost was escalated at 2 percent in addition to regular inflation for a total inflation value of 4 percent. The avoided water cost was escalated at 5 percent in addition to regular inflation for a total inflation value of 7 percent. All values were then discounted at a rate of 3 percent per year.

Table 4-3 Summary Cost Per Site for 0.5 mgd

	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS Facility
Capital Cost	$10,479,000	$13,155,000	$13,889,,000	$16,967,000	$10,042,000
Annual O&M Cost	$17,444,000	$15,416,000	$17,444,000	$17,444,000	$15,416,000
Avoided Imported Water Cost	($48,838,000)	($48,838,000)	($48,838,000)	($48,838,000)	($48,838,000)
Avoided WW Treatment Cost	($12,416,000)	($12,416,000)	($12,416,000)	($12,416,000)	($12,416,000)
Net Annual Cost	($43,810,000)	($45,838,000)	($43,810,000)	($43,810,000)	($45,838,000)
Present Worth of Annual Costs	($17,723,000)	($18,739,000)	($17,723,000)	($17,723,000)	($18,739,000)
Total Present Worth	($7,244,000)	($5,584,000)	($3,834,000)	($756,000)	($8,697,000)

Table 4-4 Summary Cost Per Site for 1 mgd

	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS Facility
Capital Cost	$16,610,000	$19,449,000	$20,180,000	$23,263,000	$16,336,000
Annual O&M Cost	$34,483,000	$30,832,000	$34,483,000	$34,889,000	$30,832,000
Avoided Imported Water Cost	($97,767,000)	($97,767,000)	($97,767,000)	($97,767,000)	($97,767,000)
Avoided WW Treatment Cost	($24,846,000)	($24,846,000)	($24,846,000)	($24,846,000)	($24,846,000)
Net Annual Cost	($88,130,000)	($91,781,000)	($88,130,000)	($87,724,000)	($91,781,000)
Present Worth of Annual Costs	($35,694,000)	($37,524,000)	($35,694,000)	($35,490,000)	($37,524,000)
Total Present Worth	($19,084,000)	($18,075,000)	($15,514,000)	($12,227,000)	($21,188,000)

Section 5
Schedule

5.1 PROPOSED SCHEDULE

The City wants to decrease their use of imported water by increasing their use of recycled water. Proper implementation of the options identified in this study will achieve these goals. This section will discuss the recommended schedule from the production of the conceptual report to the final delivery of recycled water. The schedule has been broken up into six sections: Grant Funding, Engineering RFP, Permitting, Engineering Design, Bid Phase, and Construction Phase. This schedule is shown on **Figure 5-1.**

5.2 GRANT FUNDING

This project may be eligible for local, state, or federal funding. This schedule accounts for the time that may be required to coordinate with the agencies providing funding. Each agency will have slightly different reporting requirements. The schedule currently estimates 6 months to secure grant funding.

5.3 SELECTION OF DESIGN TEAM

The City will develop a Request for Proposals for engineering firms to develop competitive bids to conduct preliminary design, design, construction support, and project management activities on behalf of the City. The City will accept and review proposals from engineering firms and select the firm that best meets its needs. It is anticipated that this task would require 4 months to complete.

5.4 PERMITTING

The City will draft an Environmental Impact Report for Mitigated Negative Declaration, a Coastal Commission application (if necessary), a Cultural Affairs Division Permit, and will coordinate with DDW. The Environmental Impact Report is scheduled for 80 working days with a delay of approximately 30 working days for community, stakeholder, and City review. The Coastal Commission application is scheduled for 10 working days. The Cultural Affairs permit is scheduled for 30 working days. The DDW coordination is anticipated to require approximately 160 calendar days. It is anticipated that the permitting task will take approximately 11 months to complete. Permitting work will be conducted in parallel with the Engineering Design task.

5.5 ENGINEERING DESIGN

Implementation of an IPR project requires extensive coordination with regulating agencies, which is reflected in an extended pre-design effort estimated at 9 months. The regulating agencies are heavily backlogged, and the potential for delays is high. Once preliminary approvals are received, detailed design can progress relatively quickly and can be completed in as little as 5 months. This duration can increase, depending on the number of submittals and review periods.

5.6 BIDDING

The contract for the construction phase of the contract will be put out to competitive bid, which typically requires a 6 week bid period for this size project. Including time to review the bids, recommend award, and approve the final contract, the overall bid period is estimated to be 3 months.

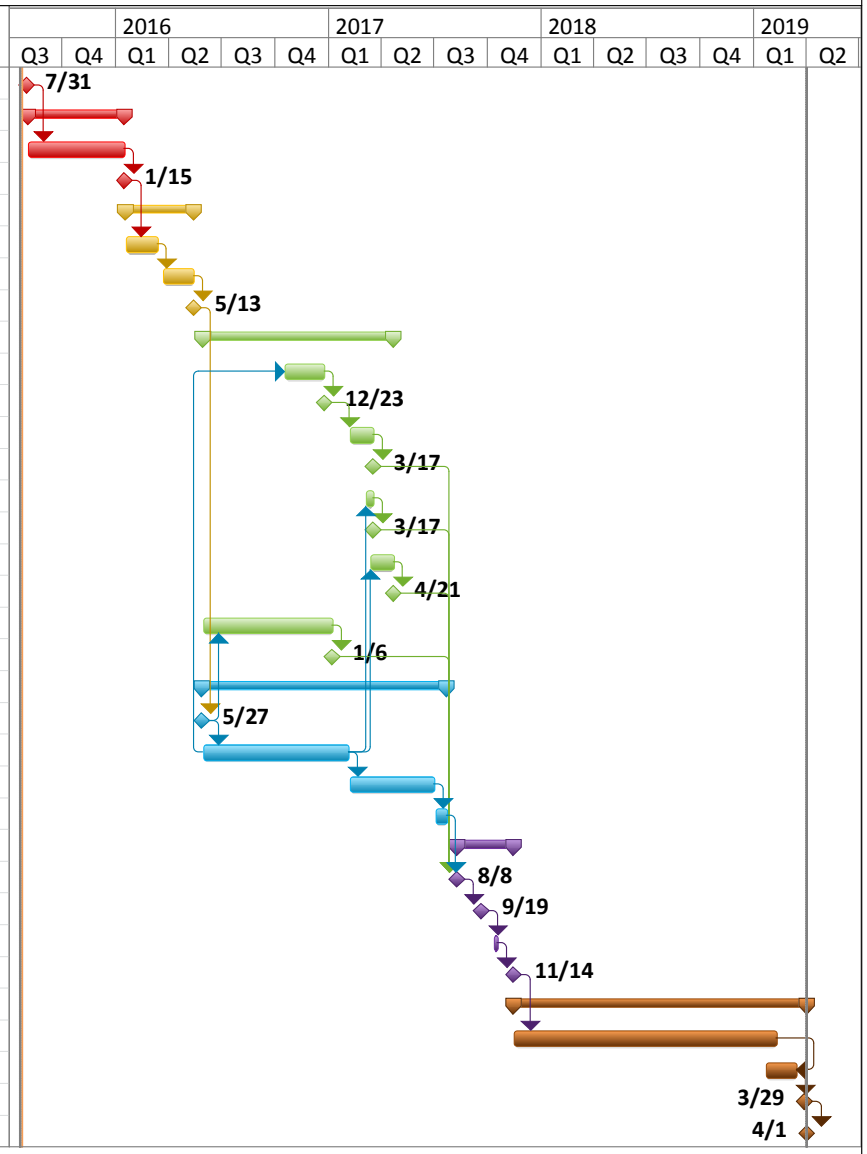
5.7 CONSTRUCTION

The construction of the facilities is estimated to require 15 to 16 months. This duration is largely dependent on the lead time required to approve, fabricate, deliver, and install the proprietary equipment systems and electrical gear required for this type of facility.

Plant commissioning, startup, and testing will take 40 working days to complete, due to the relative sophistication of the processes and control systems. Once DDW approves the plant, it will be authorized to deliver recycled water. Final completion is estimated to occur on April 1, 2019.

City of Santa Monica
Schedule for the Pilot Distributed Recycled Water Treatment Facility

ID	Task Name	Start	Finish	Duration
1	Conceptual Report	Fri 7/31/15	Fri 7/31/15	0 days
2	**Grant Funding**	**Mon 8/3/15**	**Fri 1/15/16**	**120 days**
3	Grant Funding	Mon 8/3/15	Fri 1/15/16	120 days
4	Grant Funding Procured	Fri 1/15/16	Fri 1/15/16	0 days
5	**Selection of Design Team**	**Mon 1/18/16**	**Fri 5/13/16**	**85 days**
6	Develop RFP for Engineering Services	Mon 1/18/16	Fri 3/11/16	40 days
7	Development of Proposals	Mon 3/21/16	Fri 5/13/16	40 days
8	Select Design Team	Fri 5/13/16	Fri 5/13/16	0 days
9	**Permitting**	**Mon 5/30/16**	**Fri 4/21/17**	**235 days**
10	Develop Draft EIR for Mitigated Negative Declaration	Mon 10/17/16	Fri 12/23/16	50 days
11	Submit Draft EIR for Mitigated Negative Declaration	Fri 12/23/16	Fri 12/23/16	0 days
12	Develop Final EIR for Mitigated Negative Declaration	Mon 2/6/17	Fri 3/17/17	30 days
13	Submit Final EIR for Mitigated Negative Declaration	Fri 3/17/17	Fri 3/17/17	0 days
14	Prepare Coastal Commission Permit Application (if needed)	Mon 3/6/17	Fri 3/17/17	10 days
15	Submit Coastal Commission Permit Application (if needed)	Fri 3/17/17	Fri 3/17/17	0 days
16	Prepare Documentation for Cultural Affairs Division	Mon 3/13/17	Fri 4/21/17	30 days
17	Submit Documentation to Cultural Affairs Division	Fri 4/21/17	Fri 4/21/17	0 days
18	DDW Coordination	Mon 5/30/16	Fri 1/6/17	160 days
19	DDW Approval of Concept	Fri 1/6/17	Fri 1/6/17	0 days
20	**Engineering Design**	**Fri 5/27/16**	**Fri 7/21/17**	**300 days**
21	Notice to Proceed	Fri 5/27/16	Fri 5/27/16	0 days
22	Preliminary Design	Mon 5/30/16	Fri 2/3/17	180 days
23	Design	Mon 2/6/17	Fri 6/30/17	105 days
24	Prepare Bidding Documents	Mon 7/3/17	Fri 7/21/17	15 days
25	**Bid Phase**	**Tue 8/8/17**	**Tue 11/14/17**	**70 days**
26	Release Project for Bidding	Tue 8/8/17	Tue 8/8/17	0 days
27	Accept Bids	Tue 9/19/17	Tue 9/19/17	0 days
28	Award Contract	Wed 10/11/17	Tue 10/17/17	5 days
29	Notice to Proceed	Tue 11/14/17	Tue 11/14/17	0 days
30	**Construction Phase**	**Wed 11/15/17**	**Mon 4/1/19**	**359 days**
31	Construction	Wed 11/15/17	Fri 2/8/19	323 days
32	Plant Startup and Testing	Mon 1/21/19	Fri 3/15/19	40 days
33	Permit to Operate	Fri 3/29/19	Fri 3/29/19	0 days
34	Deliver Recycled Water	Mon 4/1/19	Mon 4/1/19	0 days



Section 6
Options Evaluation and Selection

One of the objectives of this study is to identify the preferred sites for further consideration and evaluation. The selection of the preferred sites involves evaluating each site against a set of weighted evaluation criteria and then ranking the sites relative to one another. The criteria used to evaluate each site considered for this Study were developed, defined, weighted, and assigned an agreed quantitative measure. This section describes that process, presents a definition for each criterion, the weighting, and the point system used to apply each criterion to the various options considered. This section also presents the individual rating for each site and weighted scores. A sensitivity analysis was conducted to determine how the ratings of the most highly ranked sites change with a wide range of adjustment in the weighting factors. The criteria and weighting were developed by the City of Santa Monica. The ranking and sensitivity analysis were developed by MWH.

6.1 DEVELOPMENT OF CRITERIA

The criteria were reviewed at the project kickoff meeting and were revised following the Mid-course Briefing. The weighting for each criterion was also developed following the Mid-course Briefing. The evaluation criteria are described below and summarized in **Table 6-1**.

6.1.1 Description of Evaluation Criteria

The description of each evaluation criterion highlights the particular considerations in applying the criteria to each option. The application of the criteria and assignment of a numeric value is discussed later.

<u>Proximity to Source Water</u>

This criterion scores the relative distance from source water. A higher score denotes a facility that is adjacent to source water and a lower score denotes a facility that is farther away from source water. This criterion is important because locations that are farther away will require more pipe, larger horsepower pumps, and will cause greater community disruptions.

<u>Proximity to Reclaimed Water Distribution System</u>

This criterion scores the relative distance to Santa Monica's reclaimed water distribution system. A higher score denotes a facility that is adjacent to the reclaimed water distribution system and closer to the injection wells and a lower score denotes a facility that is either farther away from reclaimed water distribution system or farther from the injection wells. This criterion is important because locations that are farther away will require more pipe, larger horsepower pumps, and will cause greater community disruption.

<u>Adequate Raw Feed Water Flow Volume</u>

This criterion scores the adequacy of the volumetric flow rate of source water. A higher score denotes a source water location with excess source water and a lower score denotes a source

water location with insufficient source water. Membrane treatment systems operate best when the source water flow rate is consistent, and variability in flow has negative impacts on the proper operation of this type of facility. Similarly, it is MWH's understanding that the recycled water will be used primarily for groundwater injection, and injection wells respond best to a water source that is consistent and does not vary over time. Wastewater flow rates will vary over the course of the day, and a location that can supply the desired volumetric flow rate for 24 hours a day will benefit from full utilization of capacity, more stable plant operation, better recycled water system operation, and lower labor costs.

Acceptable Raw Feed Water Quality

This criterion addresses the water quality of the influent flow to the advanced treatment facility. This criterion largely reflects the discharge of the brine from the current water treatment facility and its impact on treatment processes at the advanced treatment facility. This criterion allows the City to account for increased operation and maintenance requirements that will result from water that is more complicated to treat.

Site Availability

This criterion takes into consideration sites that may need to be acquired or that may take longer to prepare due to geotechnical considerations or underground construction that may need to take place. This criterion is important as it will impact the schedule of the facility construction.

Construction Costs

This criterion includes capital costs which were compiled for each of the five sites. A cost estimate was not developed for the Sears Triangle because the site was determined to be too small to host either a 0.5 mgd or 1.0 mgd facility. Construction costs considered were the cost of the treatment facility building, influent and effluent piping and, where necessary, the purchase of Land. Details of the construction costs can be found in **Section 4**.

O&M Costs

This criterion includes annual O&M costs as well as the potential avoided costs. The annual O&M costs include the costs for labor, chemicals, energy, and replacement parts. The avoided costs include the cost for treatment at the Hyperion Water Reclamation Plant (HWRP) and the cost of imported water from the Metropolitan Water District of Southern California (MWD). Details of the O&M costs and avoided costs can be found in **Section 4**.

Potential for Future Expansion

The sites are evaluated under this criterion for the ability to expand beyond 1 mgd capacity of product water. This criterion is important because it allows the City to continue to reduce the reliance on imported water during in the future.

6.2 EVALUATION CRITERIA WEIGHTING

In applying the evaluation criteria, some criteria may weigh more heavily than others. Each of the evaluation criteria were assigned weights based on the judgment of the City participants. The final assessment was also accompanied by a sensitivity analysis on assigned scores by shifting the weighting to observe any changes in the ranking of options. Weights that were used for each criterion are shown in **Table 6-1**.

Table 6-1 Evaluation Criteria Description and Weighting

Criteria	Weight
Proximity to Source	10%
Proximity to Reclaimed Water Distribution System	10%
Adequate to Raw Feed Water Flow Volume	35%
Acceptable Raw Feed Water Quality	10%
Site Availability	5%
Construction Costs	10%
M&O Costs	15%
Potential for Future Expansion	5%

6.3 RATING METHODOLOGY

Each of the potential sites described in **Section 3** were scored based on the evaluation criteria using the point system of 1 to 5, with 1 being the least favorable and 5 being the most favorable. The score assigned to each site for construction and O&M costs is based on a linear interpolation between the lowest present worth cost alternative (assigned a score of 5) and the highest present worth cost alternative (assigned a score of 1). As scores were assigned to each site for the criteria, the scores were reviewed to see that there was rational relativity between sites. The question that was asked frequently was: "if one site scored this much, and a second site has a higher score, does the second site realistically meet the criteria in a stronger fashion?"

6.4 RATING OF OPTIONS

The rating of each of the sites was conducted by MWH. Each of the sites were scored for each of the criteria using the point system outlined above. The criteria scores were multiplied by the corresponding weights and those products were then added together to give a total weighted score for each site. The analysis was run both with and without cost. A detailed summary of each individual site score and ranking is presented in **Table 6-2**.

Table 6-2 Rating Matrix

Site	Estimated Construction Cost ($ Million)	Construction Cost	Proximity to Source Water	Proximity to Reclaimed Water Distribution System	Adequate Raw Feed Water Flow Volume	Acceptable Raw Feed Water Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank	Weighted Score Without Cost Factors	Rank without Cost Factors
Criteria Weighting (%)		**10**	**10**	**10**	**35**	**10**	**5**	**15**	**5**	**-**	**-**	**-**	**-**
1. Sears Triangle	NOT FEASIBLE												
2. Colorado Yard/Memorial Park	16.6	4	3	4	3	3	5	2	5	**315**	3	275	**3**
3. Civic Center Parking Lot	19.5	3	4	1	4	4	3	4	2	**325**	2	295	**2**
4. Bus Maintenance Facility	20.2	2	2	5	2	2	2	2	4	**230**	4	210	**4**
5. Stewart Park	23.2	1	1	2	1	1	1	1	1	**105**	5	95	**5**
6. MAPS Facility	16.3	5	5	3	5	5	4	4	3	**430**	1	380	**1**

6.5 SENSITIVITY ANALYSIS

A sensitivity analysis was conducted to determine how sensitive the individual rankings were to the evaluation criteria weighting. Adjustments were made to the weighting of each criterion to explore the effects of such variation on the rankings. The progression of weighting adjustments over the course of the analysis, starting with the original weights which are identified as the Selected scenario, is presented in **Table 6-3**. These criterion weighting adjustments were applied to the individual rankings, summarized in **Table 6-4**.

Table 6-3 Criteria Weight Adjustments

Revision	Construction Cost	Proximity to Source Water	Proximity to Reclaimed Water Distribution System	Adequate Raw Feed Water Flow Volume	Acceptable Raw Feed Water Quality	Site Availability	O&M Cost	Potential for Future Expansion
Selected	10	10	10	35	10	5	15	5
I	35	5	5	20	5	5	15	10
II	5	35	15	10	10	10	10	5
III	5	5	35	10	15	10	10	10
IV	5	5	5	35	15	10	10	15
V	5	5	5	5	35	15	15	15
VI	15	15	5	5	5	35	10	10

Table 6-4 Ranking Summary Changes

Revision	Site					
	Sears Triangle	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS Facility
Selected	Not Feasible	**3**	**2**	4	5	**1**
I		**2**	**3**	4	5	**1**
II		**2**	**3**	4	5	**1**
III		**2**	4	**3**	5	**1**
IV		**2**	**3**	4	5	**1**
V		**2**	**3**	4	5	**1**
VI		**2**	**3**	4	5	**1**

The number one and number two ranked sites for all scenarios remain as the MAPS Facility and the Colorado Yard/Memorial Park, respectively, with the changes in the criteria weighting.

Section 7
Summary and Conclusions

The City has identified six (6) potential sites within the City of Santa Monica boundaries that could be used to house an advanced treatment facility. This Study evaluated these six sites to identify the sites that were the most appropriate and warranted further investigation. This section summarizes the evaluation that was conducted and provides material that can be used for briefing interested parties.

7.1 SUMMARY OF OPTIONS

The six sites were evaluated against a set of criteria. The evaluation criteria and the sensitivity analysis were discussed in **Section 6**. In addition to the evaluation criteria these sites were evaluated against the available footprint, quality and quantity of flow, and the accessibility of the site. The evaluation has been summarized in the following **Table 7-1**. In **Table 7-1** the red means that there is a fatal flaw at this site, the yellow means the site may work, and the green means that there is a strong possibility the site will work.

Table 7-1 Summary of Options

	Sears Triangle	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS Facility
Site Area (ft^2)	9,250	87,150	12,300	20,860	12,540	17,400
*0.5 mgd Min. Space Required 9,835 ft^2						
*1 mgd Min. Space Required 11,235ft^2						
Space for Expansion						
Adequate Source Water						

*Footprint includes a 10 foot buffer around the site

7.2 CONCLUSION

Based on the evaluation of this Study, the Colorado Yard/Memorial Park and the MAPS facility appear to have the most potential in terms of available site area for a 1 mgd facility, the ability to expand in the future, flow of sufficient quality and quantity, and accessibility to source flow as well as accessibility to the recycled water distribution system for injection into the groundwater aquifer.

7.3 BRIEFING MATERIALS

As part of the scope of work, MWH developed a set of briefing "plates" for each site. These "plates" summarize key site attributes, construction and O&M costs, evaluation criteria, and key

notes that are applicable to the site. These summary plates are based on a 1 mgd plant capacity and are located on the following pages.

City of Santa Monica – Pilot Distributed Recycled Water Facility

Site #1: Sears Triangle Site

Site Attributes	
Available Area	9,250 ft^2
Footprint for 0.5 mgd	9,835 ft^2
Footprint for 1 mgd	11,235 ft^2

Design Criteria	OPCC
Design Criteria was not developed for this site as it was determined to be too small	Costs were not developed for the site as it was determined to be too small

Evaluation Criteria (1-5)	
Proximity to Source Water	NOT FEASIBLE
Proximity to Reclaimed Water Distribution System	
Adequate Raw Feed Water Flow Volume	
Acceptable Raw Feed Water Quality	
Site Availability	
Construction Costs	
O&M Costs	
Potential for Future Expansion	

Notes:

- Shape and size of site footprint will present significant challenges to construction and operation and maintenance
- Potential requirement of subgrade facility will significantly increase costs, and
- Potential for future expansion is nil

City of Santa Monica – Pilot Distributed Recycled Water Facility

Site #2: Colorado Yard/Memorial Park

Site Attributes	
Available Area	87,150 ft^2
Footprint for 0.5 mgd	9,835 ft^2
Footprint for 1 mgd	11,235 ft^2

Design Criteria	
Influent Flow	1.2 mgd
Membrane System Flux	15 gpd
UV	Low Press, High Intensity
RO	Double Pass RO
Product Water	1 mgd

OPCC	
Capital Cost	$16,610,000
Annual O&M Cost	$850,000
Avoided Cost	($1,476,790)

Evaluation Criteria (1-5)	
Proximity to Source Water	3
Proximity to Reclaimed Water Distribution System	4
Adequate Raw Feed Water Flow Volume	3
Acceptable Raw Feed Water Quality	3
Site Availability	5
Construction Costs	4
O&M Costs	2
Potential for Future Expansion	5

Notes:

- Site has adequate space and is currently utilized as commercial/industrial,
- As currently configured, there is potential for future expansion,
- Site is within close proximity of existing reclaimed water distribution system,
- A portion of the site is slated for redevelopment as a parking facility,
- To achieve adequate raw water flow volumes for desired eventual 1MGD production of new water it will be necessary to mine mains on Colorado and Broadway, and
- Access to the Broadway main will require boring beneath the Expo Line.

City of Santa Monica – Pilot Distributed Recycled Water Facility

Site #3: Civic Center Parking Site

Site Attributes	
Available Area	12,300 ft^2
Footprint for 0.5 mgd	9,835 ft^2
Footprint for 1 mgd	11,235 ft^2

Design Criteria	
Influent Flow	1.2 mgd
Membrane System Flux	15 gpd
UV	Low Press, High Intensity
RO	Double Pass RO
Product Water	1 mgd

OPCC	
Capital Cost	$19,449,000
Annual O&M Cost	$760,000
Avoided Cost	($1,476,790)

Evaluation Criteria (1-5)	
Proximity to Source Water	4
Proximity to Reclaimed Water Distribution System	1
Adequate Raw Feed Water Flow Volume	4
Acceptable Raw Feed Water Quality	4
Site Availability	3
Construction Costs	3
O&M Costs	4
Potential for Future Expansion	2

Notes:

- Site has adequate space for construction and potential future expansion,
- Site is mostly adjacent to other commercial activities,
- Site is more distant than others from the reclaimed water distribution system,
- Adequate raw feed water flow volumes may require mining of multiple mains,
- A location near SAMOH may pose community and/or regulatory acceptance challenges, and
- Portions of this site (parking lot) are currently slated for various redevelopment activities.

City of Santa Monica – Pilot Distributed Recycled Water Facility

Site #4: Bus Maintenance Yard

Site Attributes	
Available Area	20,860 ft^2
Footprint for 0.5 mgd	9,835 ft^2
Footprint for 1 mgd	11,235 ft^2

Design Criteria	
Influent Flow	1.2 mgd
Membrane System Flux	15 gpd
UV	Low Press, High Intensity
RO	Double Pass RO
Product Water	1 mgd

OPCC	
Capital Cost	$20,180,000
Annual O&M Cost	$850,000
Avoided Cost	($1,476,790)

Evaluation Criteria (1-5)	
Proximity to Source Water	2
Proximity to Reclaimed Water Distribution System	5
Adequate Raw Feed Water Flow Volume	2
Acceptable Raw Feed Water Quality	2
Site Availability	2
Construction Costs	2
O&M Costs	2
Potential for Future Expansion	4

Notes:

- Site has adequate space for construction and potential future expansion,
- Site is mostly adjacent to mixed industrial/commercial activities,
- Site is in close proximity to the reclaimed water distribution system,
- Adequate raw feed water flow volumes may require mining of multiple mains,
- Pump station to aid in treated water distribution will likely be necessary,
- Site acquisition process from the school district may be protracted, and
- Additional costs for property acquisition.

City of Santa Monica – Pilot Distributed Recycled Water Facility

Site #5: Stewart Park

Site Attributes	
Available Area	12,540 ft^2
Footprint for 0.5 mgd	9,835 ft^2
Footprint for 1 mgd	11,235 ft^2

Design Criteria	
Influent Flow	1.2 mgd
Membrane System Flux	15 gpd
UV	Low Press, High Intensity
RO	Double Pass RO
Product Water	1 mgd

OPCC	
Capital Cost	$23,263,000
Annual O&M Cost	$860,000
Avoided Cost	($1,476,790)

Evaluation Criteria (1-5)	
Proximity to Source Water	1
Proximity to Reclaimed Water Distribution System	2
Adequate Raw Feed Water Flow Volume	1
Acceptable Raw Feed Water Quality	1
Site Availability	1
Construction Costs	1
O&M Costs	1
Potential for Future Expansion	1

Notes:

- Site, as currently configured, has adequate space for construction and potential future expansion,
- Depending on exact location, the Site is adjacent to a mix of commercial/industrial and residential uses,
- Site is more distant than some other proposed sites to reclaimed water distribution system,
- Planned redevelopment at the City Yards may impinge on a portion of the proposed site,
- Possible presence of non-engineered fill soils will require a pre-construction geotechnical study,
- A portion of the Site is slated for redevelopment as the location of a new City drinking water treatment plant, and
- Adequate raw feed water flow volumes may require mining of multiple mains.

City of Santa Monica – Pilot Distributed Recycled Water Facility

Site #6: MAPS Site

Site Attributes	
Available Area	17,400 ft^2
Footprint for 0.5 mgd	9,835 ft^2
Footprint for 1 mgd	11,235 ft^2

Design Criteria	
Influent Flow	1.2 mgd
Membrane System Flux	15 gpd
UV	Low Press, High Intensity
RO	Double Pass RO
Product Water	1 mgd

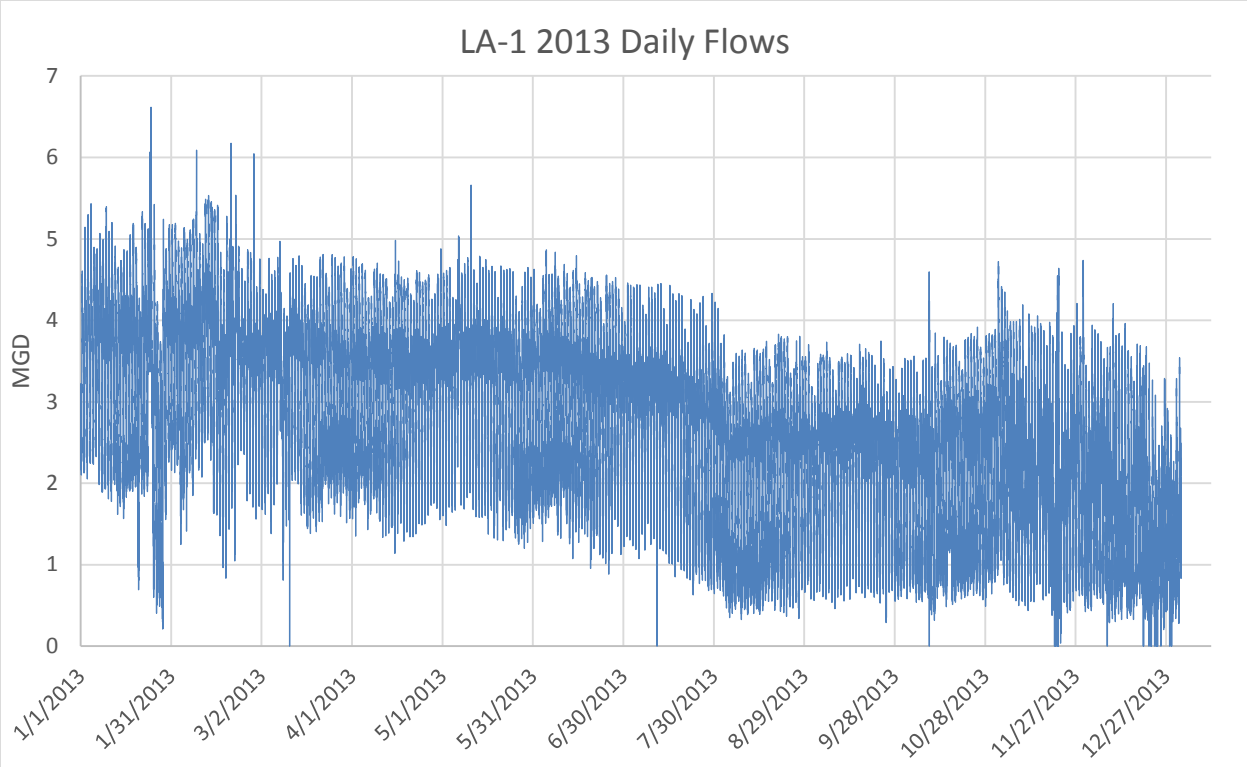
OPCC	
Capital Cost	$16,336,000
Annual O&M Cost	$760,000
Avoided Cost	($1,476,790)

Evaluation Criteria (1-5)	
Proximity to Source Water	5
Proximity to Reclaimed Water Distribution System	3
Adequate Raw Feed Water Flow Volume	5
Acceptable Raw Feed Water Quality	5
Site Availability	4
Construction Costs	5
O&M Costs	4
Potential for Future Expansion	3

Notes:

- Site, as currently configured, has adequate space for construction and potential future expansion,
- Flow volumes are adequate for 1MGD and beyond, up to 3MGD
- Facility construction and O&M could beneficially leverage the very close proximity to SMURRF, MAPS, and reclaimed water distribution system,
- Proposed facility could serve as a limited emergency by-pass in the event of a pump O&M or failure event at MAPS,
- Site is adjacent to mixed commercial and residential uses, including the busy Pier area,
- Unless offset elsewhere nearby, the Site would result in the loss of approximately 68 parking spaces near the Pier, and the associated parking revenue, and
- Site area is slated for various redevelopment including Pier related access bridge and parking projects which could limit access to the Site for a protracted period.

Appendix A
Flow and Water Quality Information


LA-1 2013 Daily Flows
MGD
0
1
2
3
4
5
6
7
1/1/2013
1/31/2013
3/2/2013
4/1/2013
5/1/2013
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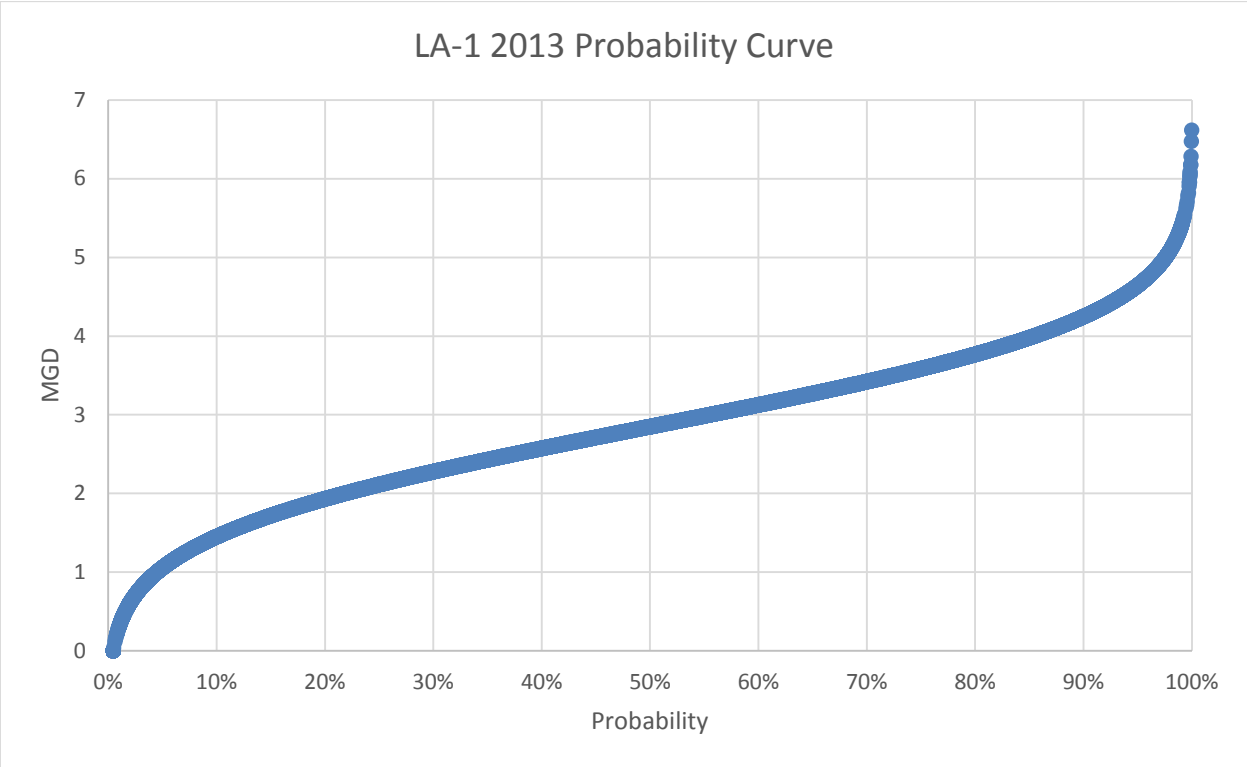
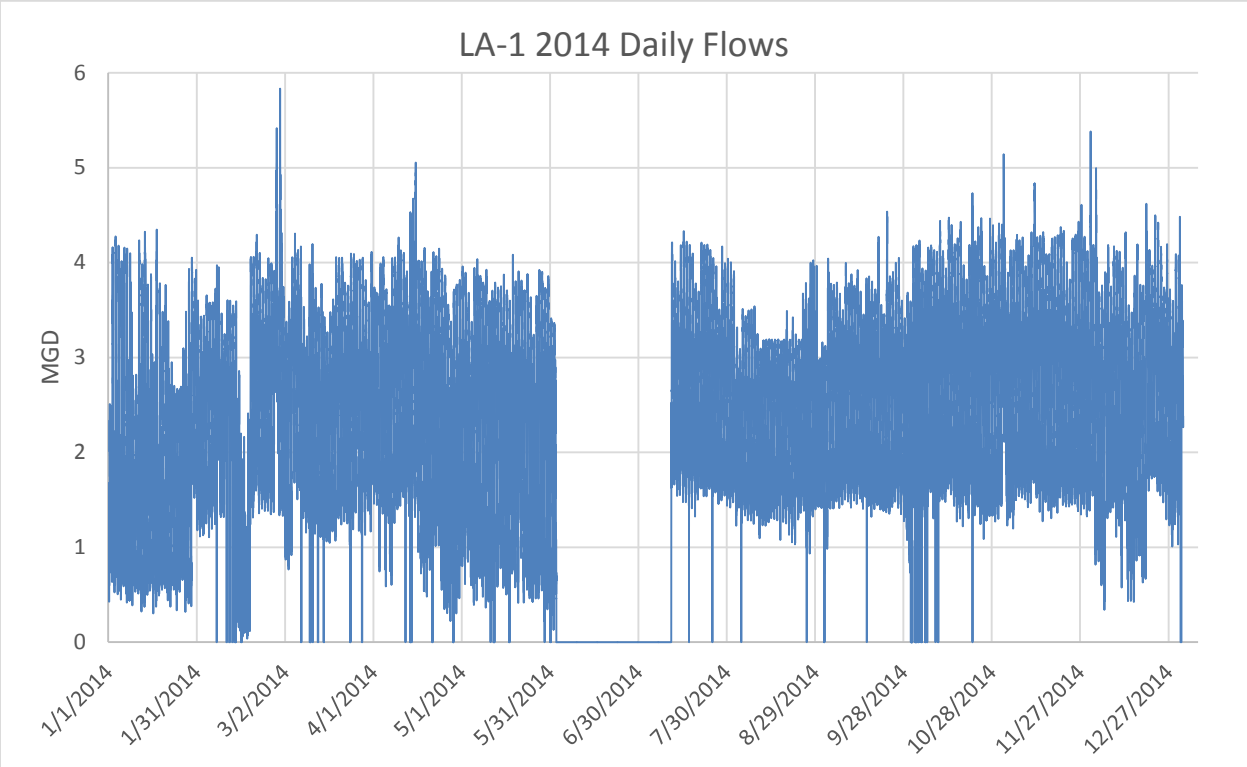
10/28/2013
11/27/2013
12/27/2013


LA-1 2013 Probability Curve
MGD
0
1
2
3
4
5
6
7
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability


LA-1 2014 Daily Flows
MGD
0
1
2
3
4
5
6
1/1/2014
1/31/2014
3/2/2014
4/1/2014
5/1/2014
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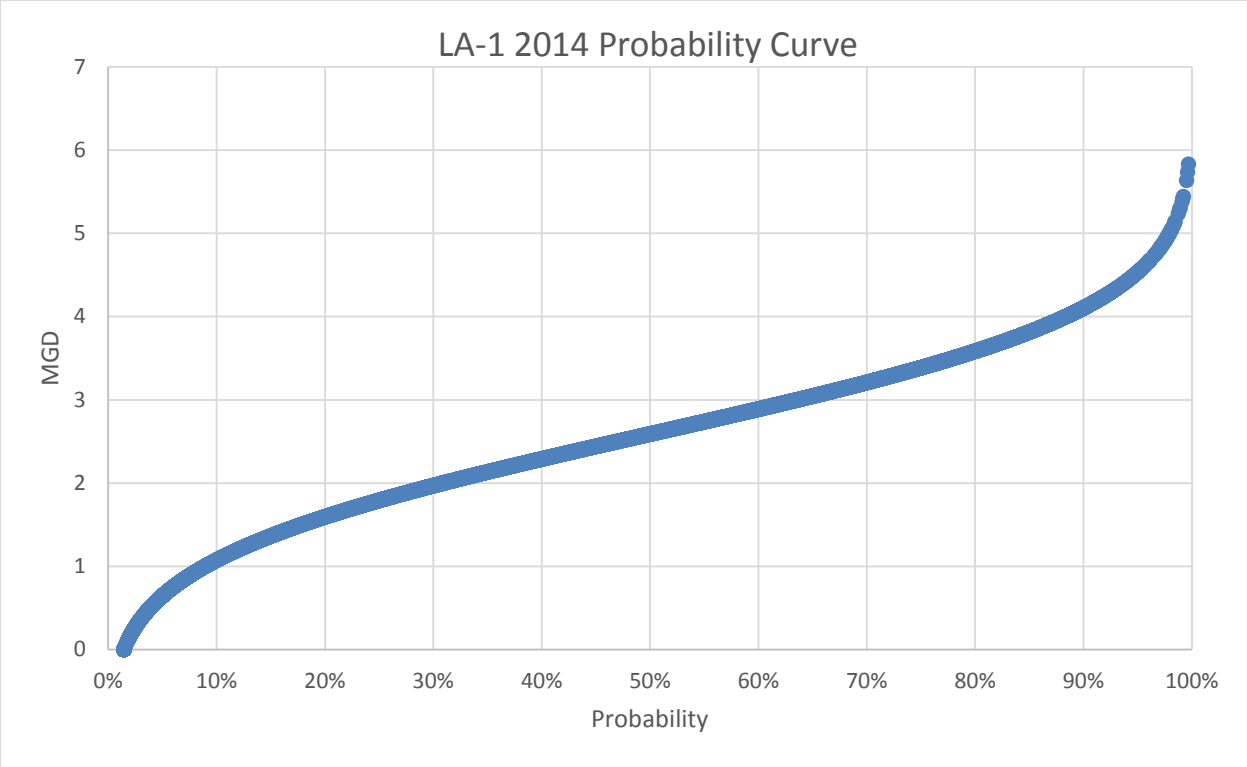
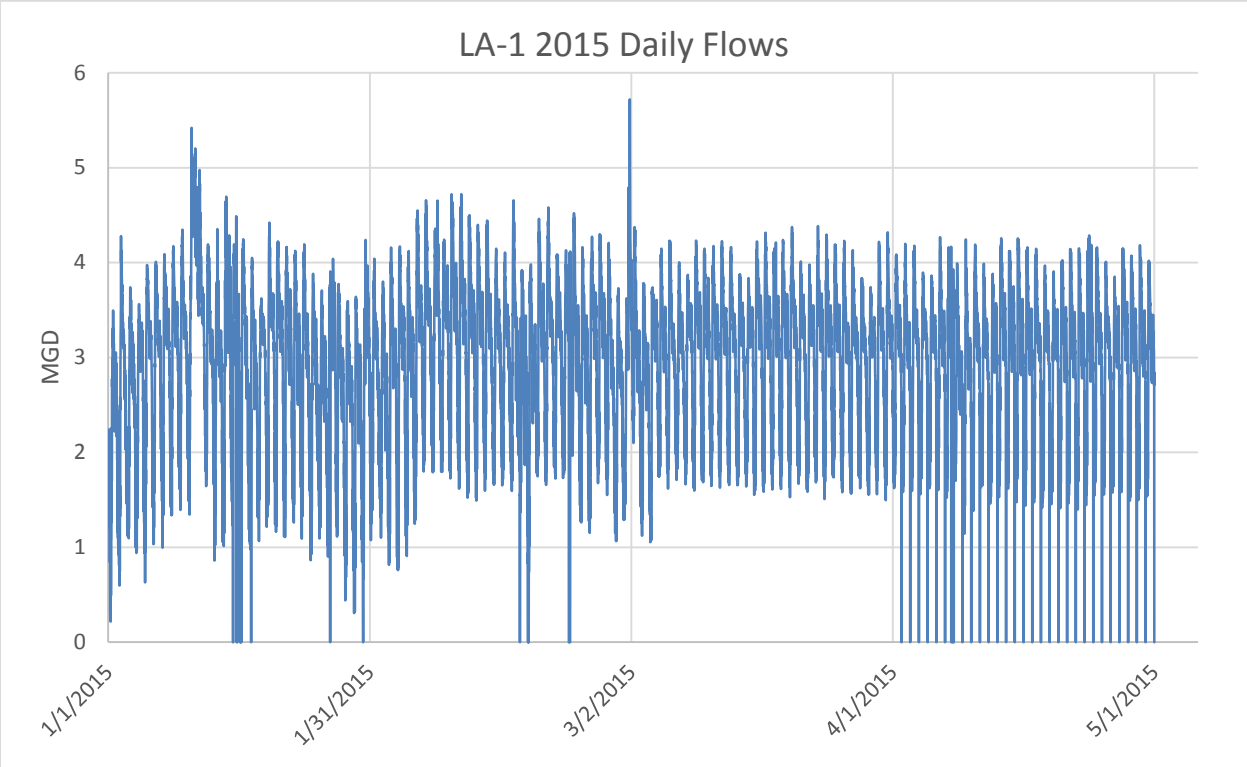
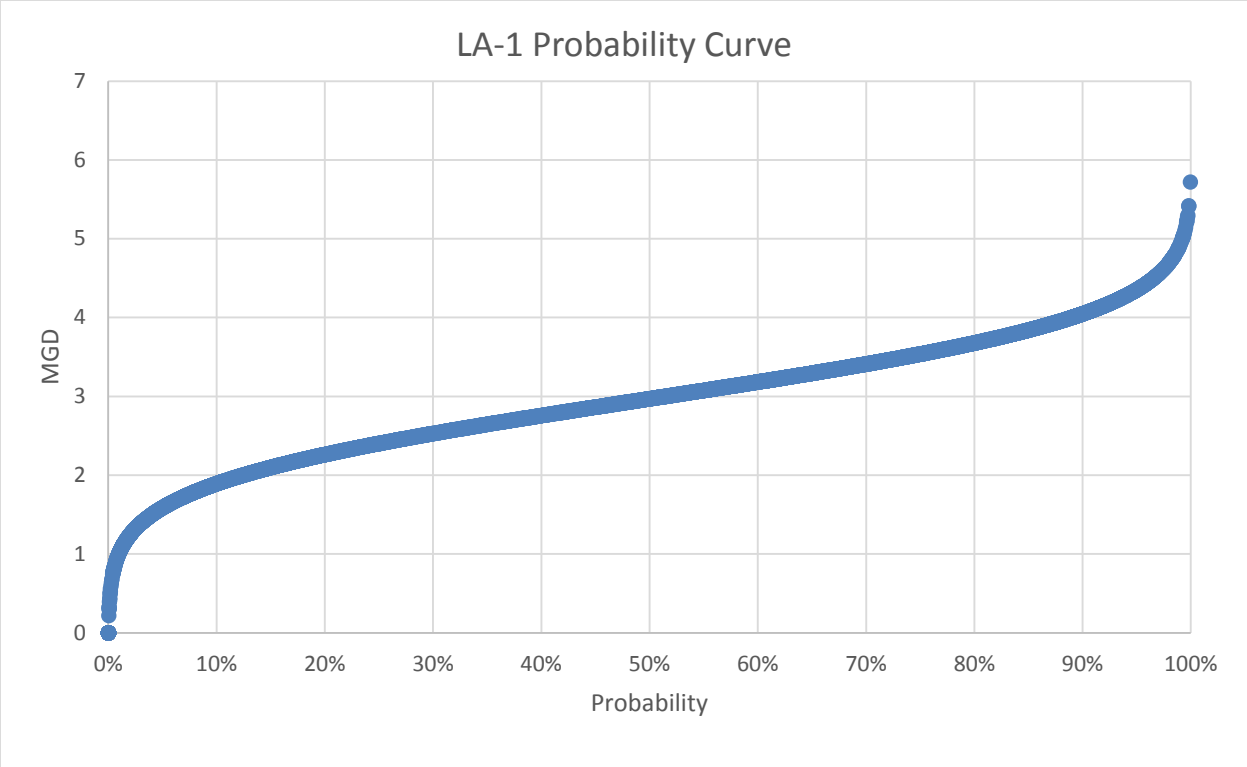
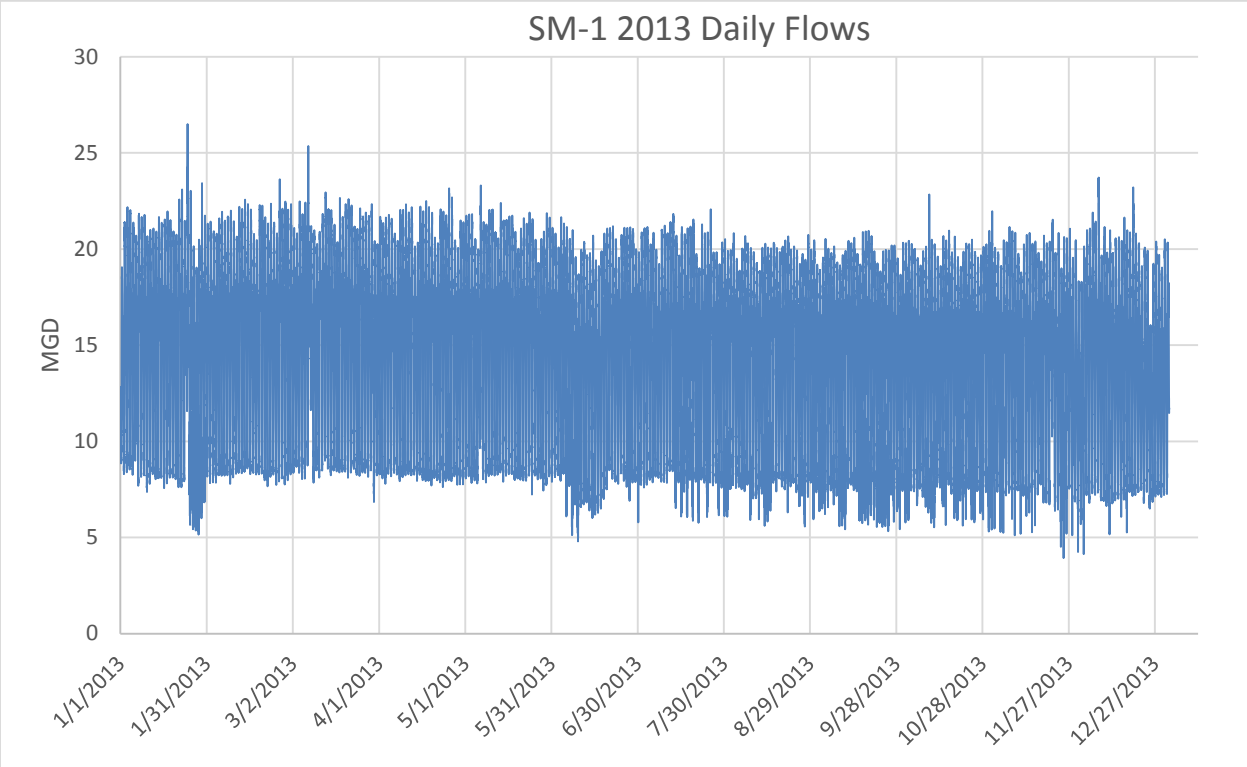
10/28/2014
11/27/2014
12/27/2014


LA-1 2014 Probability Curve
MGD
0
1
2
3
4
5
6
7
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability


LA-1 2015 Daily Flows
MGD
0
1
2
3
4
5
6
1/1/2015
1/31/2015
3/2/2015
4/1/2015
5/1/2015


LA-1 Probability Curve
MGD
0
1
2
3
4
5
6
7
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability


SM-1 2013 Daily Flows
MGD
30
25
20
15
10
5
0
1/1/2013
1/31/2013
3/2/2013
4/1/2013
5/1/2013
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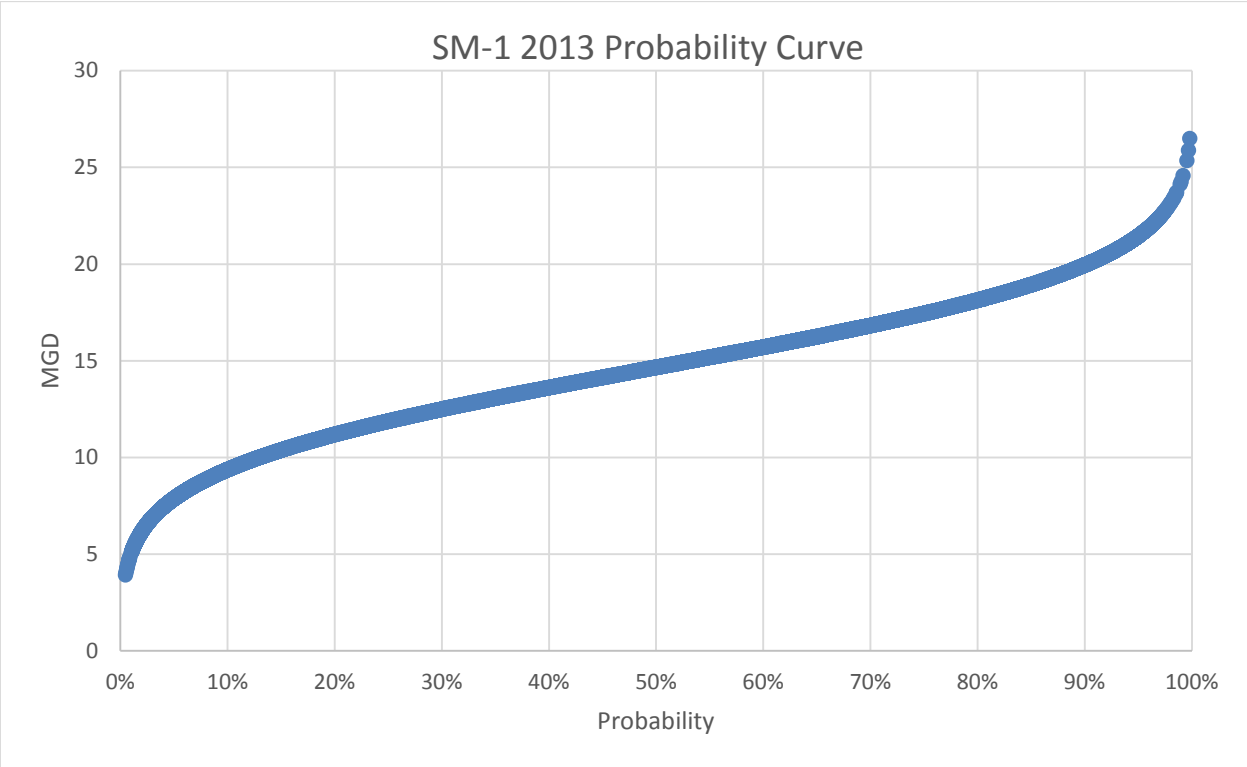
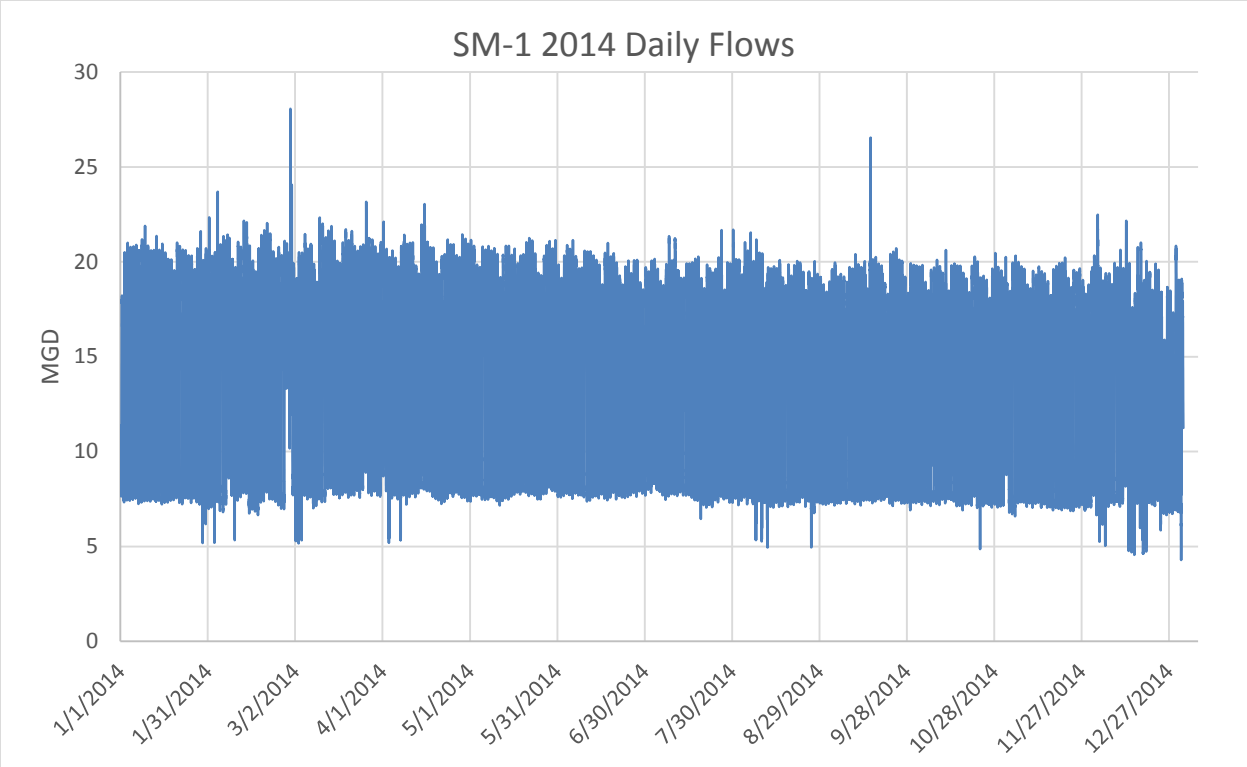
10/28/2013
11/27/2013
12/27/2013


SM-1 2013 Probability Curve
MGD
30
25
20
15
10
5
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability


SM-1 2014 Daily Flows
MGD
30
25
20
15
10
5
0
1/1/2014
1/31/2014
3/2/2014
4/1/2014
5/1/2014
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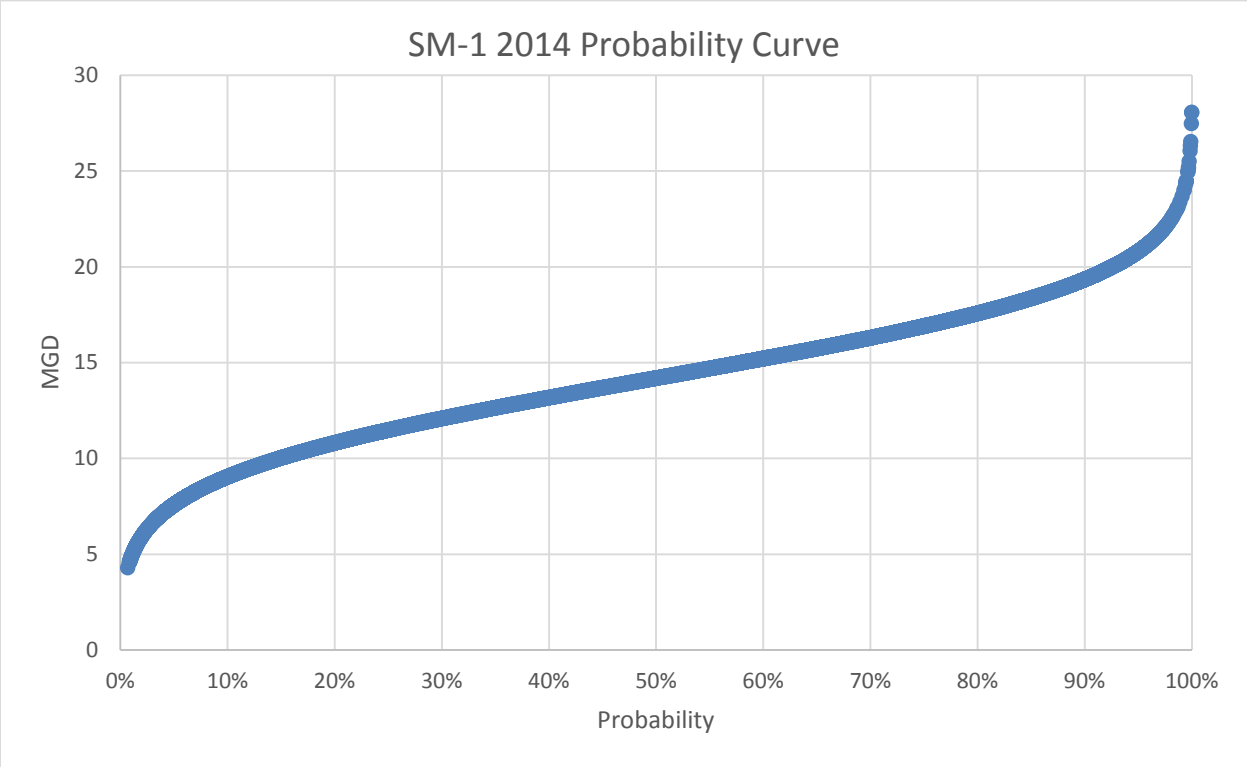
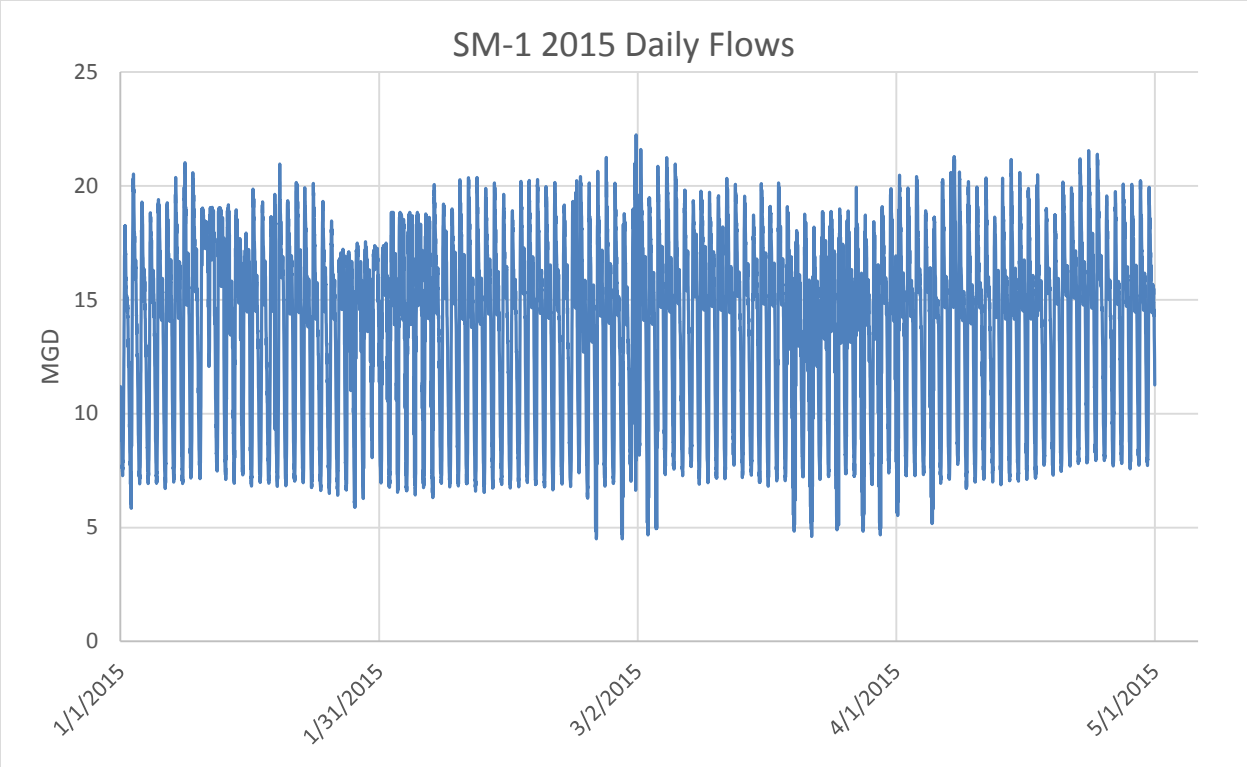
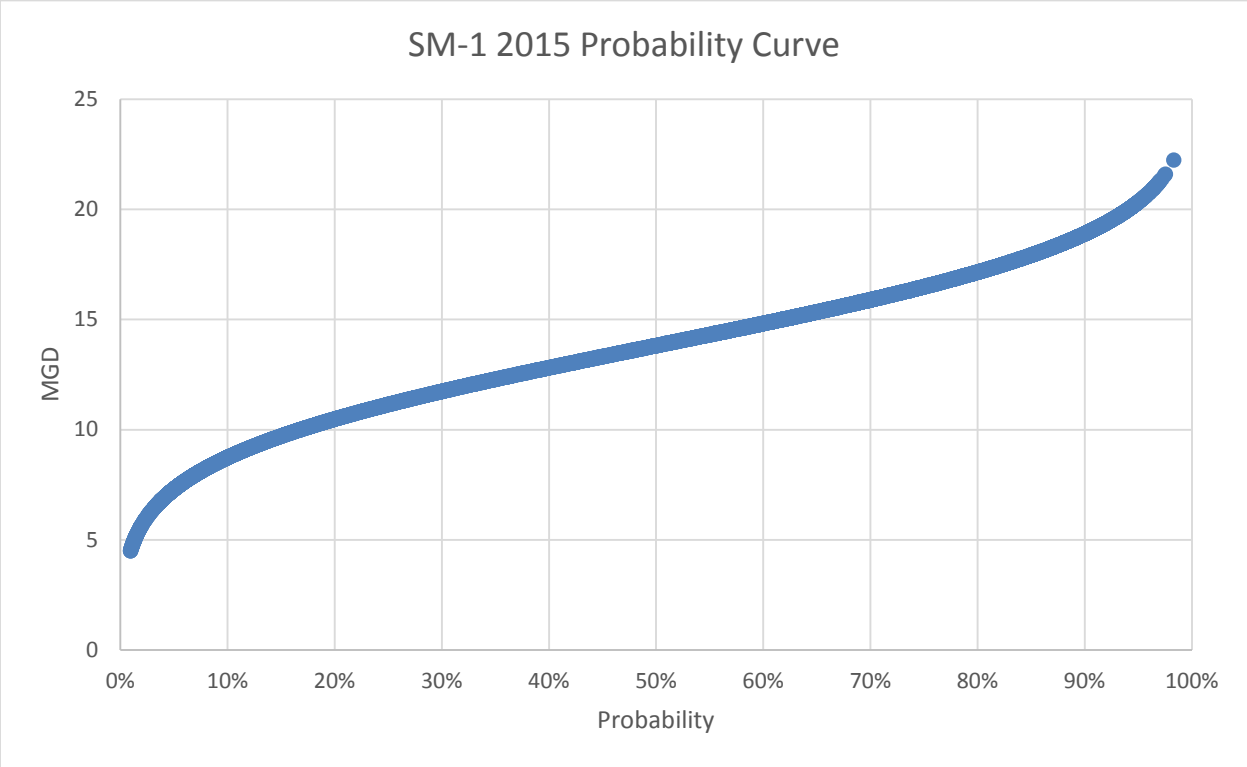
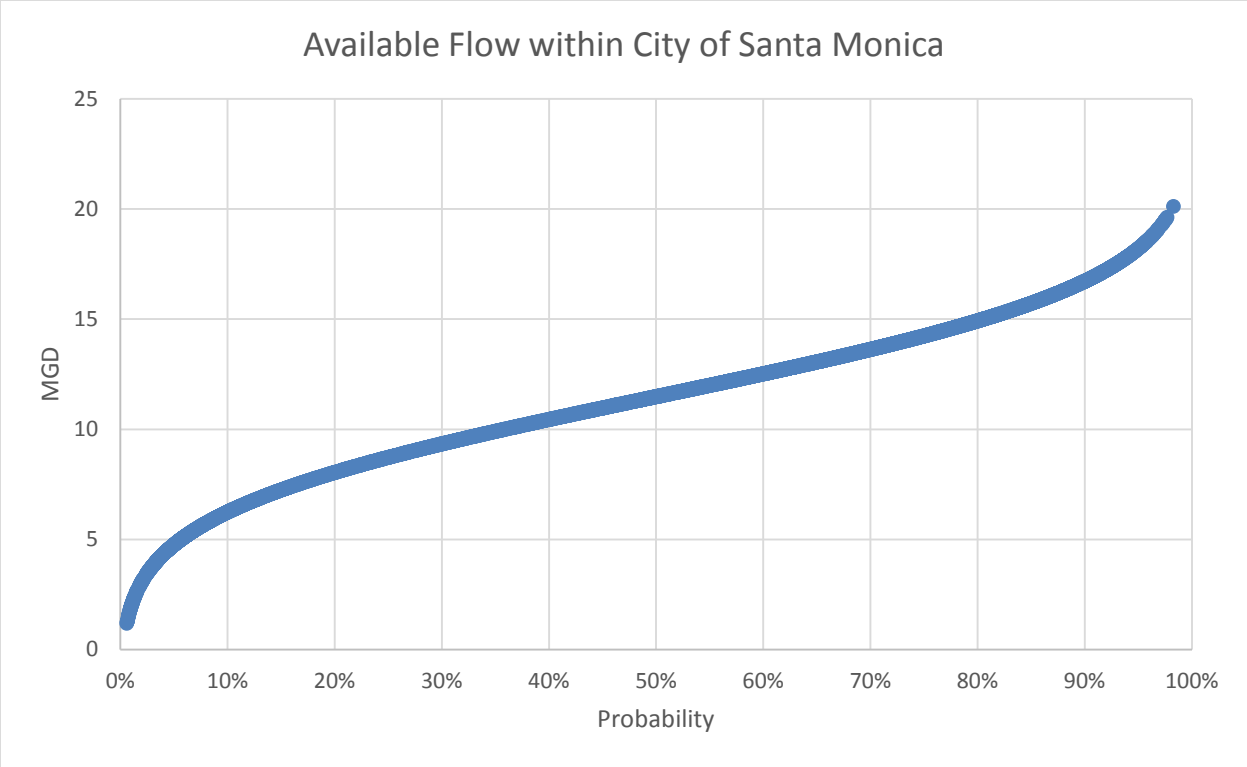
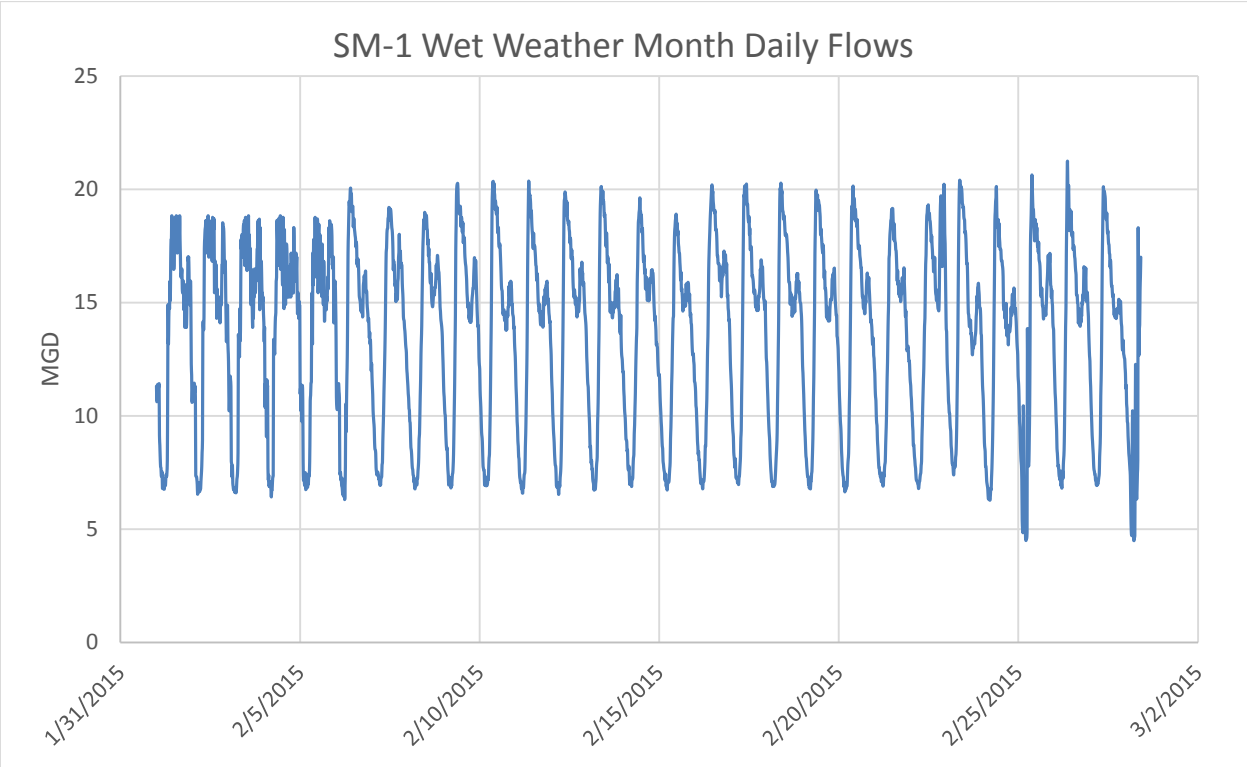
11/27/2014
12/27/2014

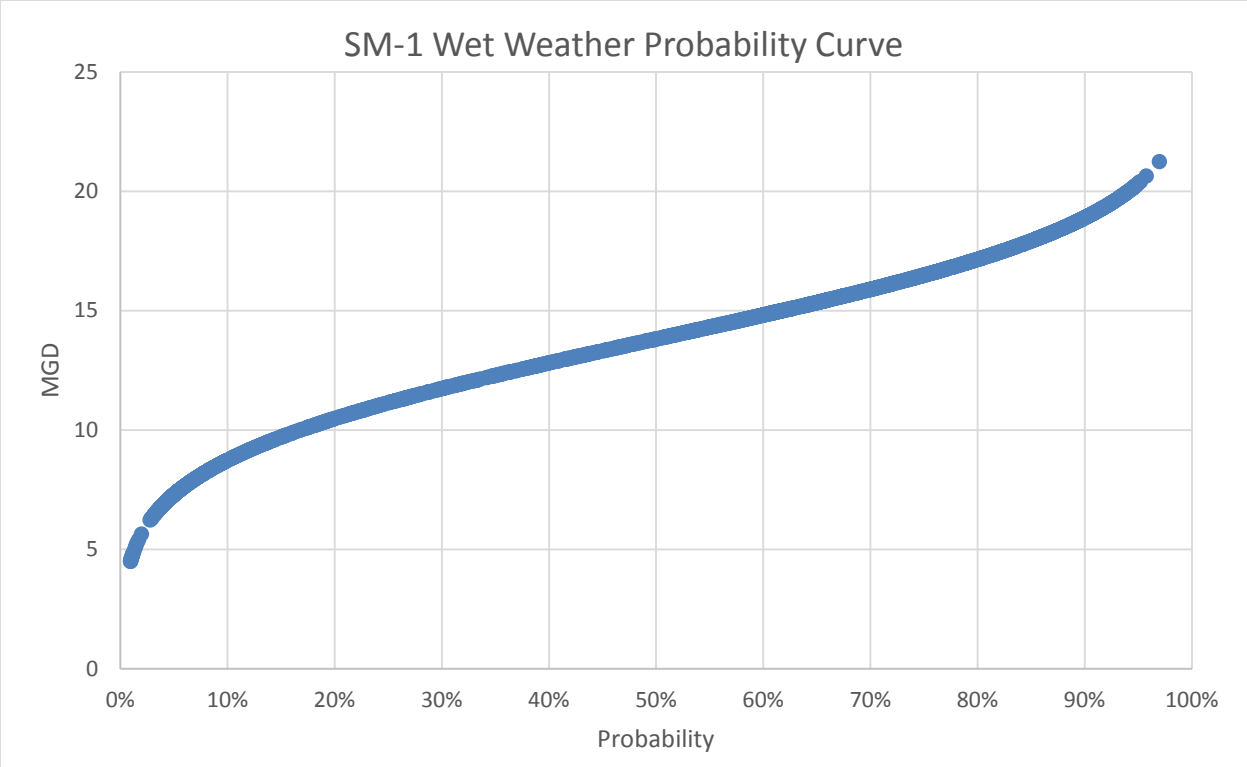

SM-1 2014 Probability Curve
MGD
30
25
20
15
10
5
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability

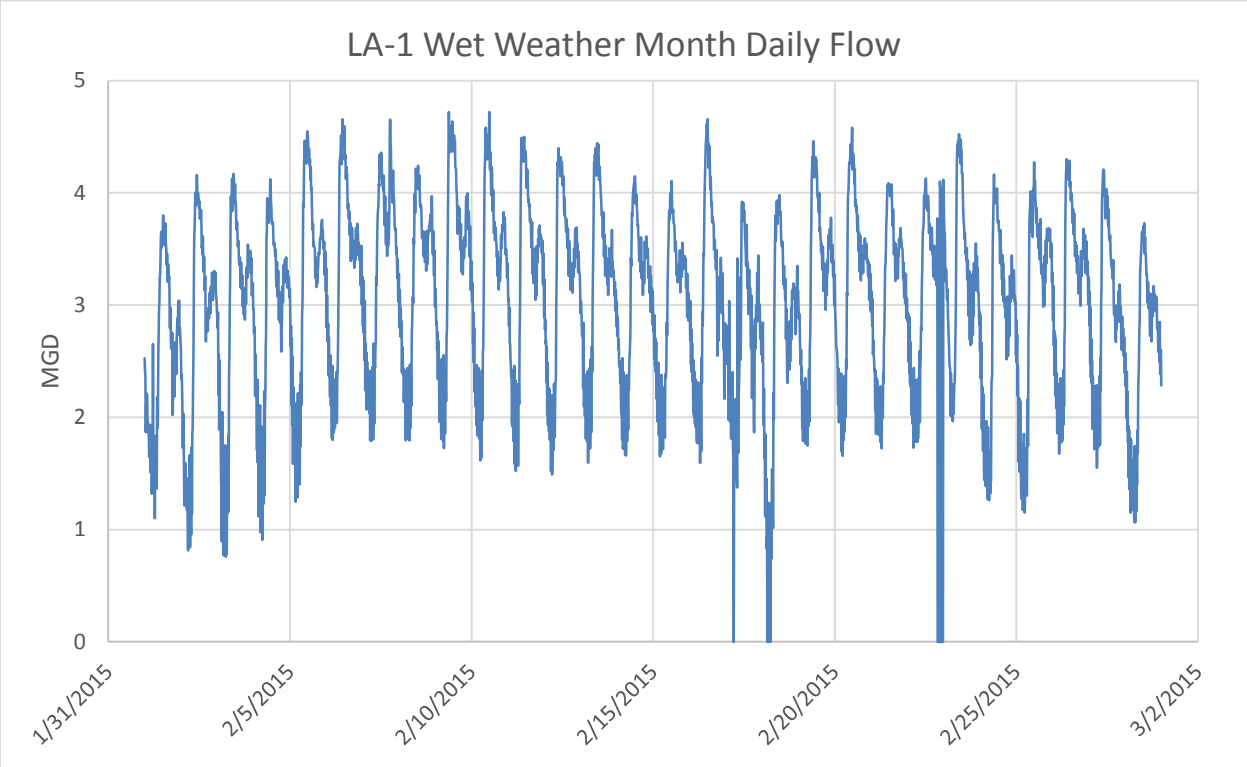

SM-1 2015 Daily Flows
MGD
25
20
15
10
5
0
1/1/2015
1/31/2015
3/2/2015
4/1/2015
5/1/2015

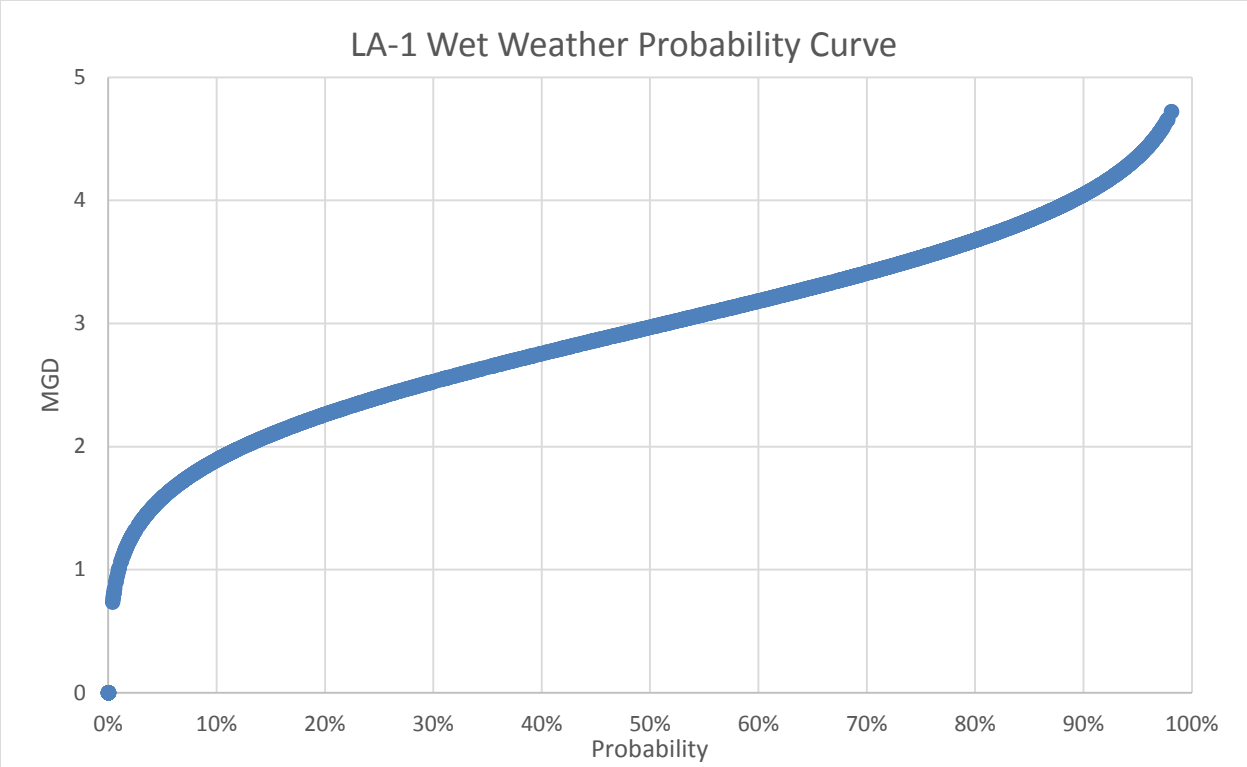

SM-1 2015 Probability Curve
MGD
25
20
15
10
5
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability

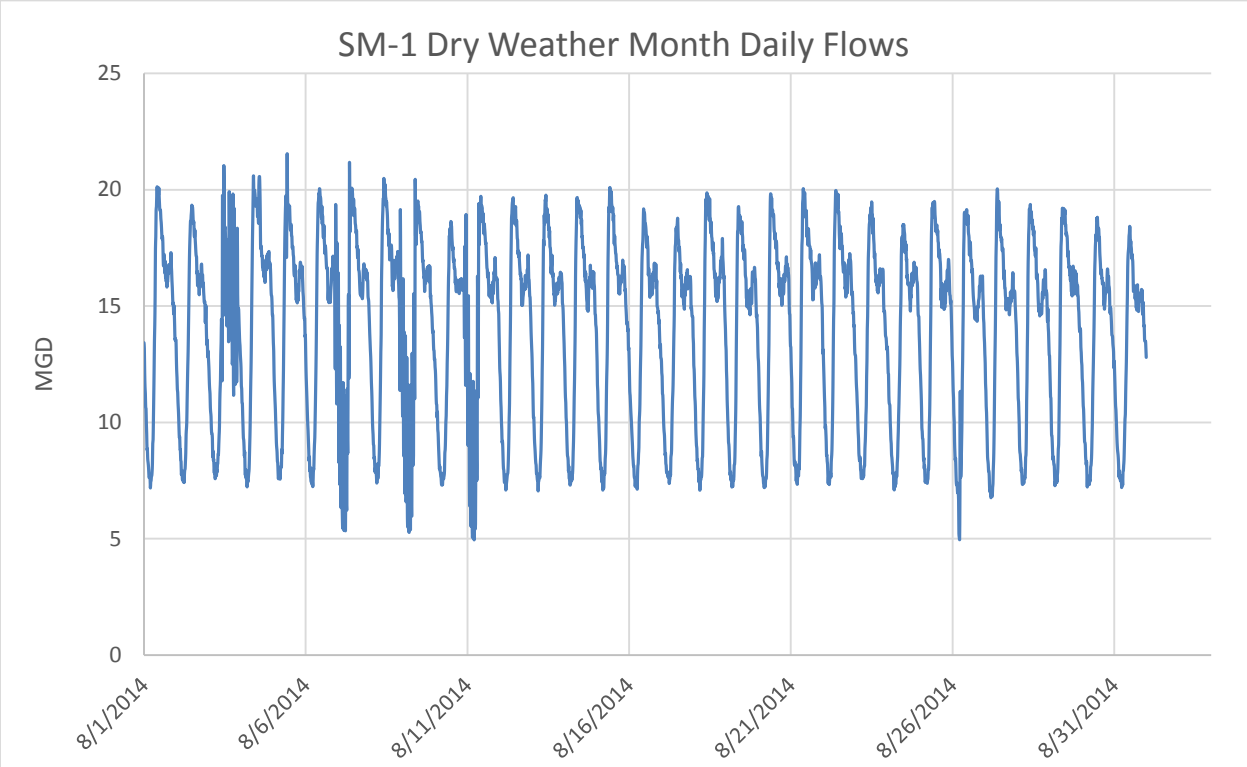

Available Flow within City of Santa Monica
MGD
25
20
15
10
5
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability

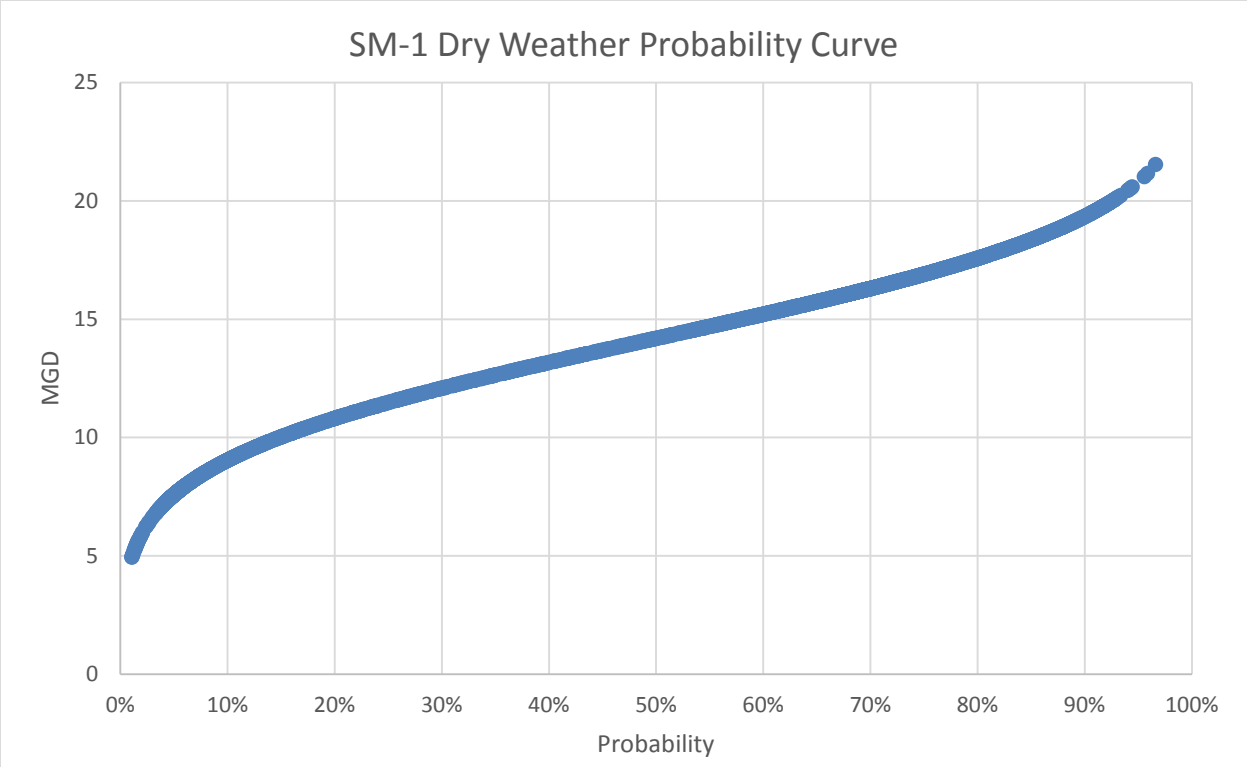

SM-1 Wet Weather Month Daily Flows
MGD
25
20
15
10
5
0
1/31/2015
2/5/2015
2/10/2015
2/15/2015
2/20/2015
2/25/2015
3/2/2015

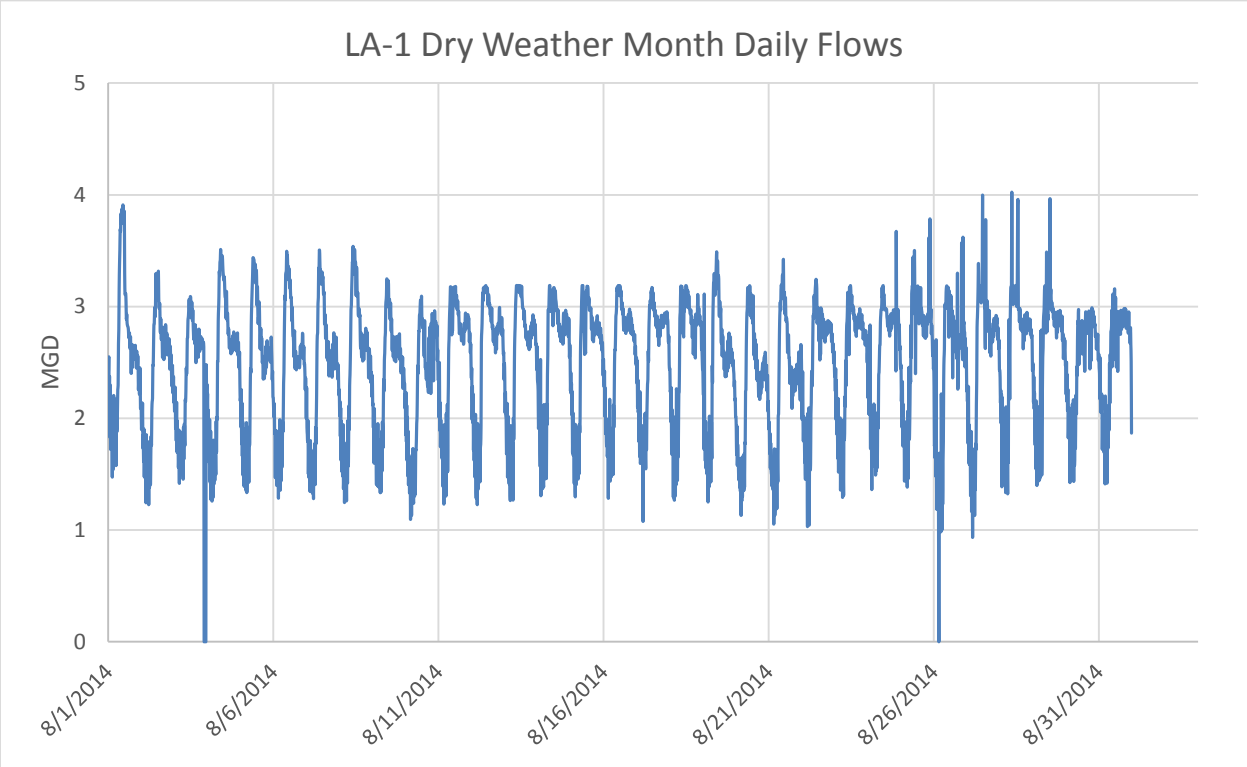

SM-1 Wet Weather Probability Curve
MGD
25
20
15
10
5
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability

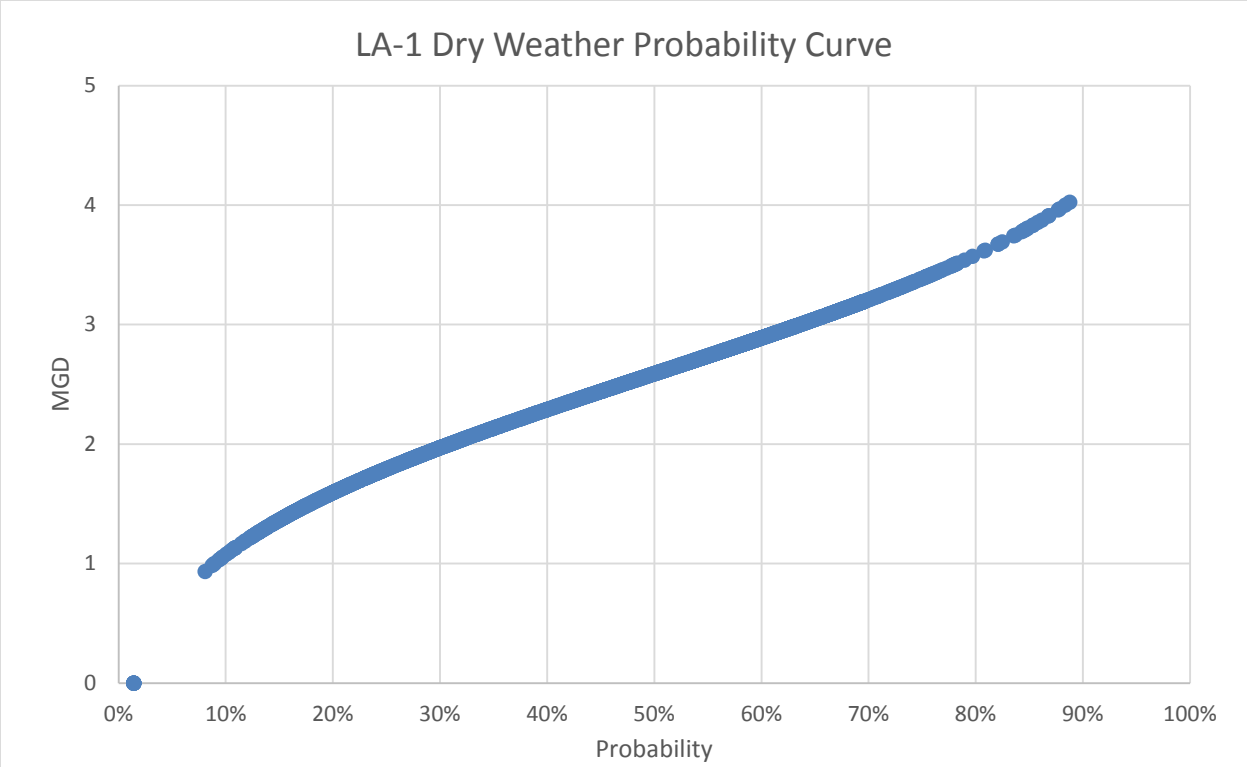

LA-1 Wet Weather Month Daily Flow
MGD
5
4
3
2
1
0
1/31/2015
2/5/2015
2/10/2015
2/15/2015
2/20/2015
2/25/2015
3/2/2015

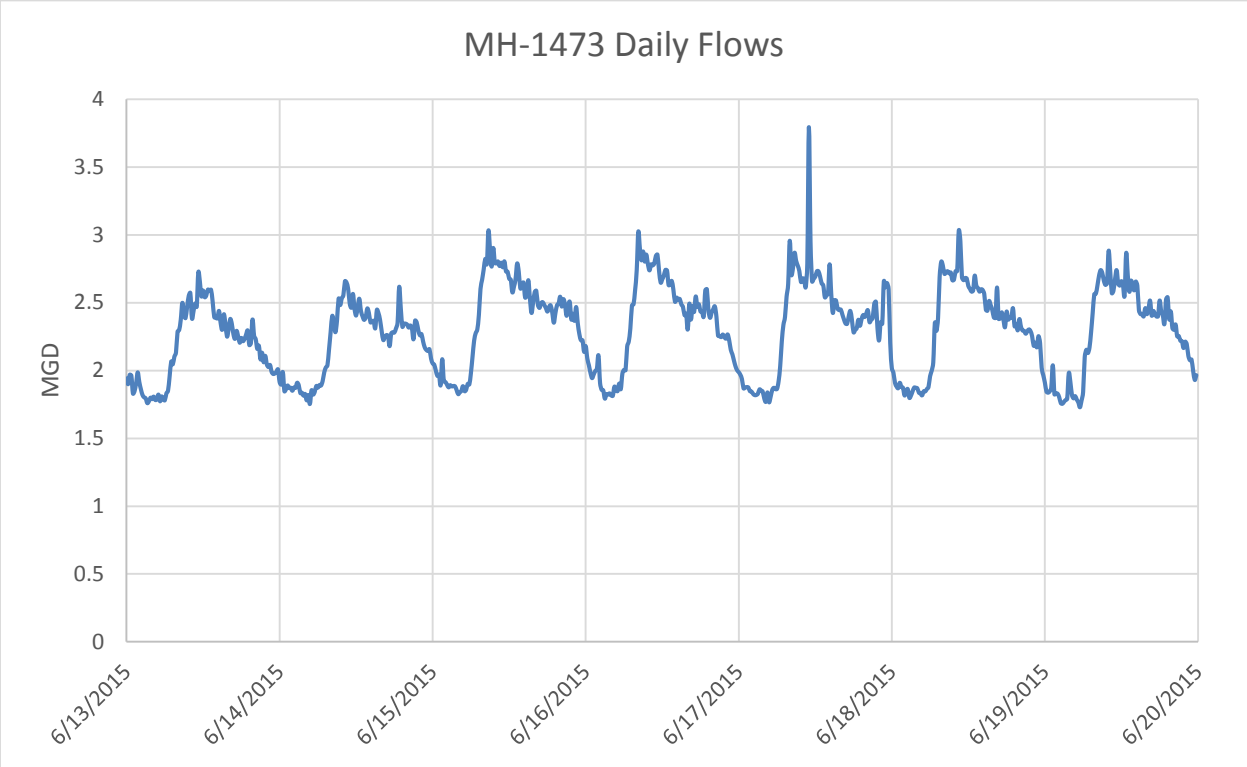

LA-1 Wet Weather Probability Curve
MGD
5
4
3
2
1
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability

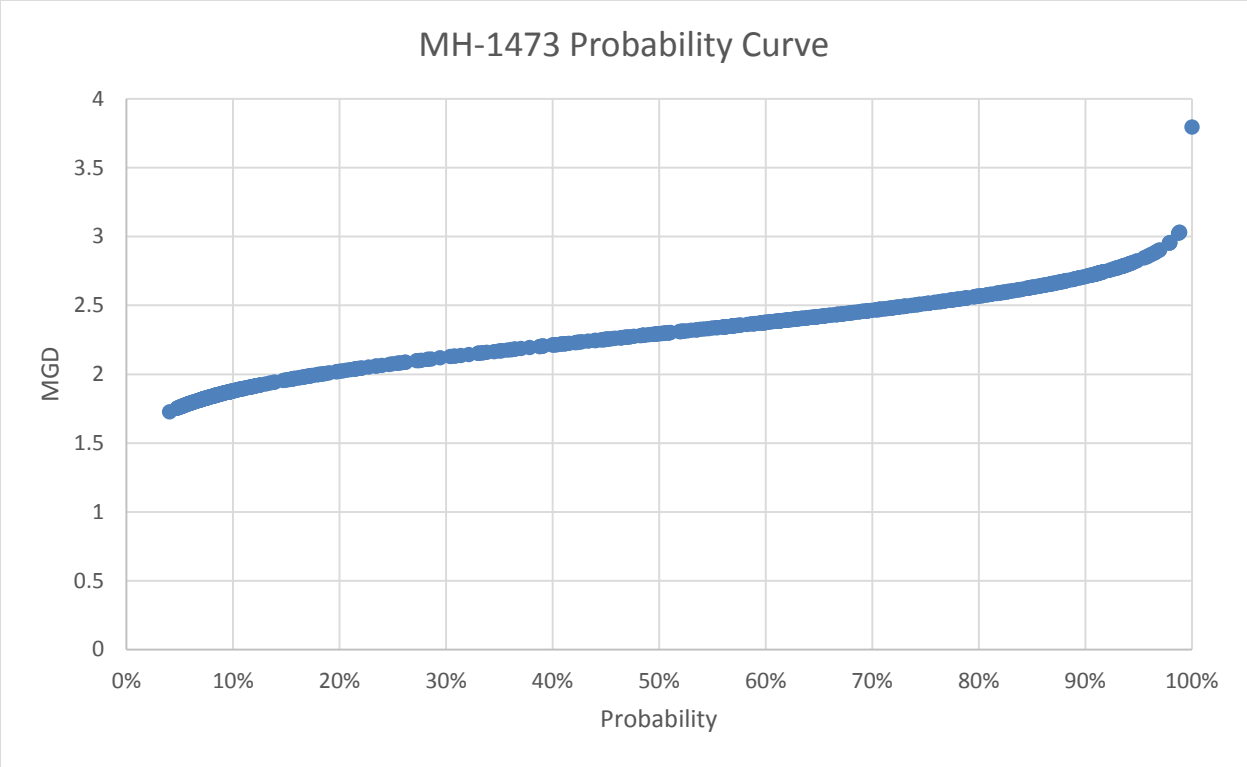

SM-1 Dry Weather Month Daily Flows
MGD
25
20
15
10
5
0
8/1/2014
8/6/2014
8/11/2014
8/16/2014
8/21/2014
8/26/2014
8/31/2014

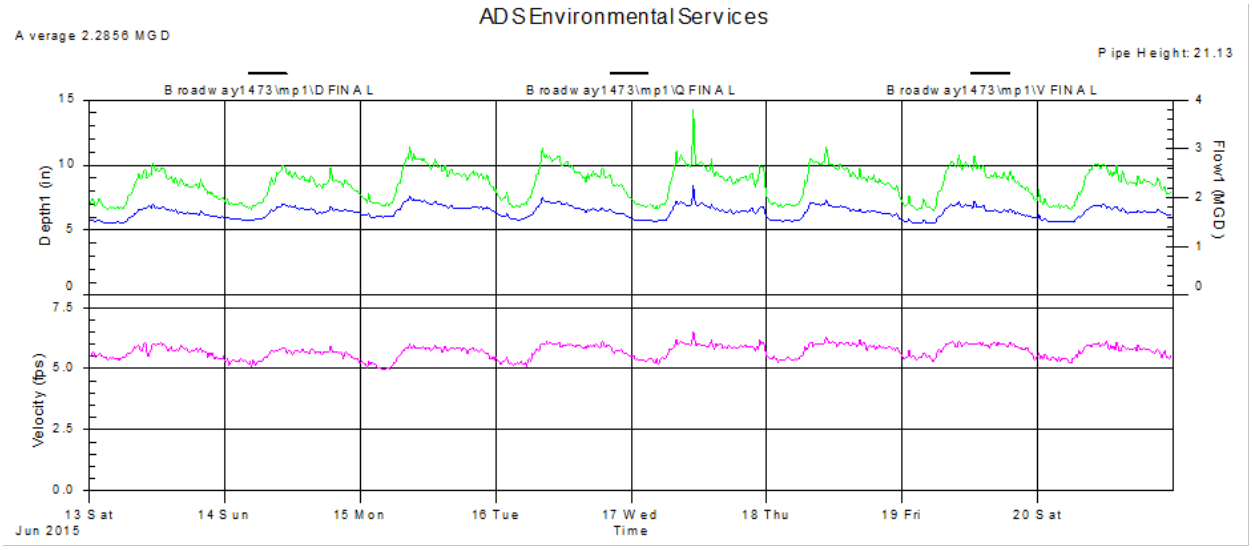

SM-1 Dry Weather Probability Curve
MGD
25
20
15
10
5
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability

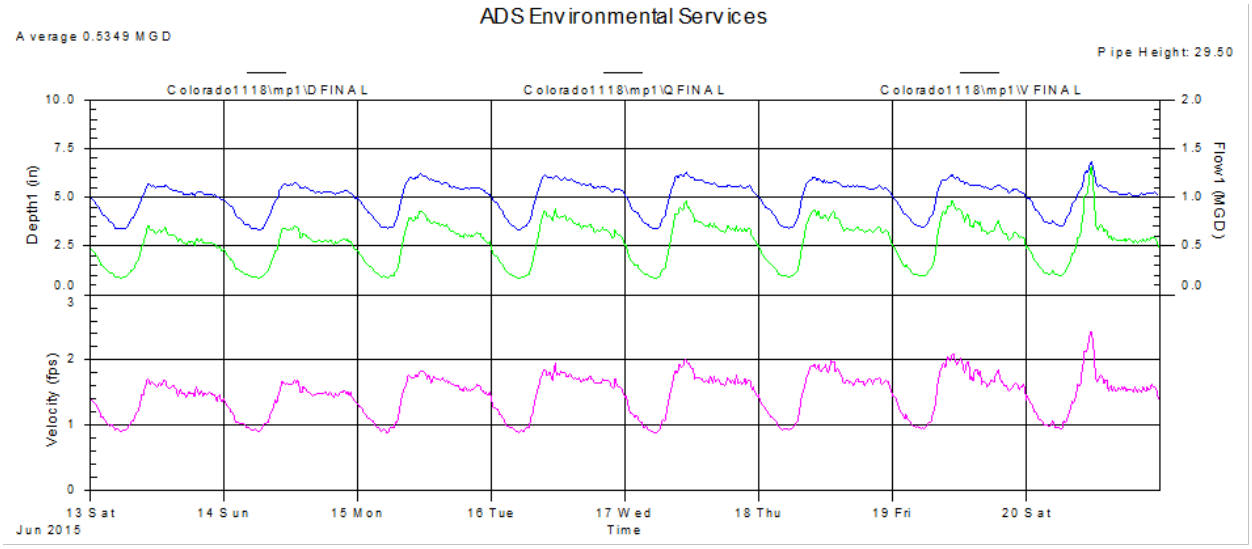

LA-1 Dry Weather Month Daily Flows
MGD
5
4
3
2
1
0
8/1/2014
8/6/2014
8/11/2014
8/16/2014
8/21/2014
8/26/2014
8/31/2014

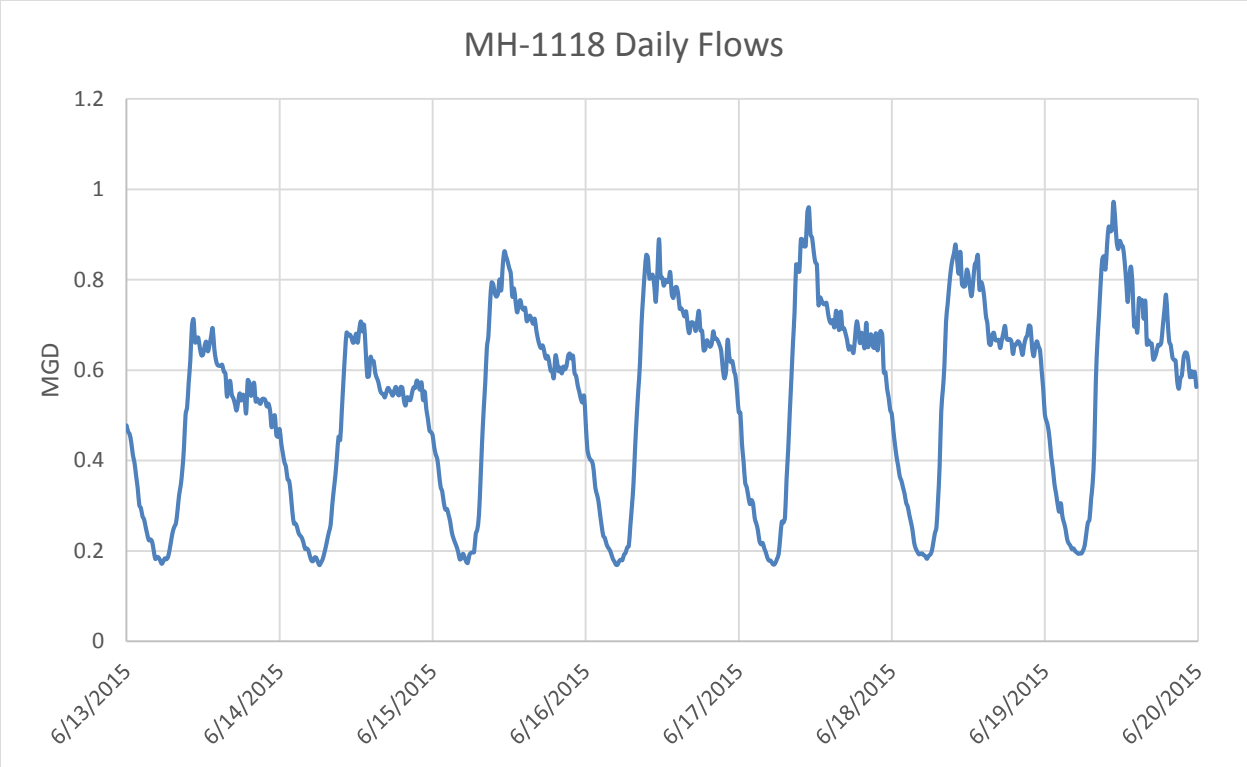

LA-1 Dry Weather Probability Curve
MGD
Probability
0
1
2
3
4
5
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%


MH-1473 Daily Flows
MGD
0
0.5
1
1.5
2
2.5
3
3.5
4
6/13/2015
6/14/2015
6/15/2015
6/16/2015
6/17/2015
6/18/2015
6/19/2015
6/20/2015


MH-1473 Probability Curve
MGD
4
3.5
3
2.5
2
1.5
1
0.5
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability


ADS Environmental Services
Average 2.2856 MGD
Pipe Height: 21.13
Broadway1473\mp1\D FINAL
Broadway1473\mp1\Q FINAL
Broadway1473\mp1\V FINAL
Depth1 (in)
Flow1 (MGD)
Velocity (fps)
13 Sat
14 Sun
15 Mon
16 Tue
17 Wed
18 Thu
19 Fri
20 Sat
Jun 2015
Time


ADS Environmental Services
Average 0.5349 MGD
Pipe Height: 29.50
Colorado1118\mp1\D FINAL
Colorado1118\mp1\Q FINAL
Colorado1118\mp1\V FINAL
Depth1 (in)
Flow1 (MGD)
Velocity (fps)
13 Sat
14 Sun
15 Mon
16 Tue
17 Wed
18 Thu
19 Fri
20 Sat
Jun 2015
Time


MH-1118 Daily Flows
MGD
1.2
1
0.8
0.6
0.4
0.2
0
6/13/2015
6/14/2015
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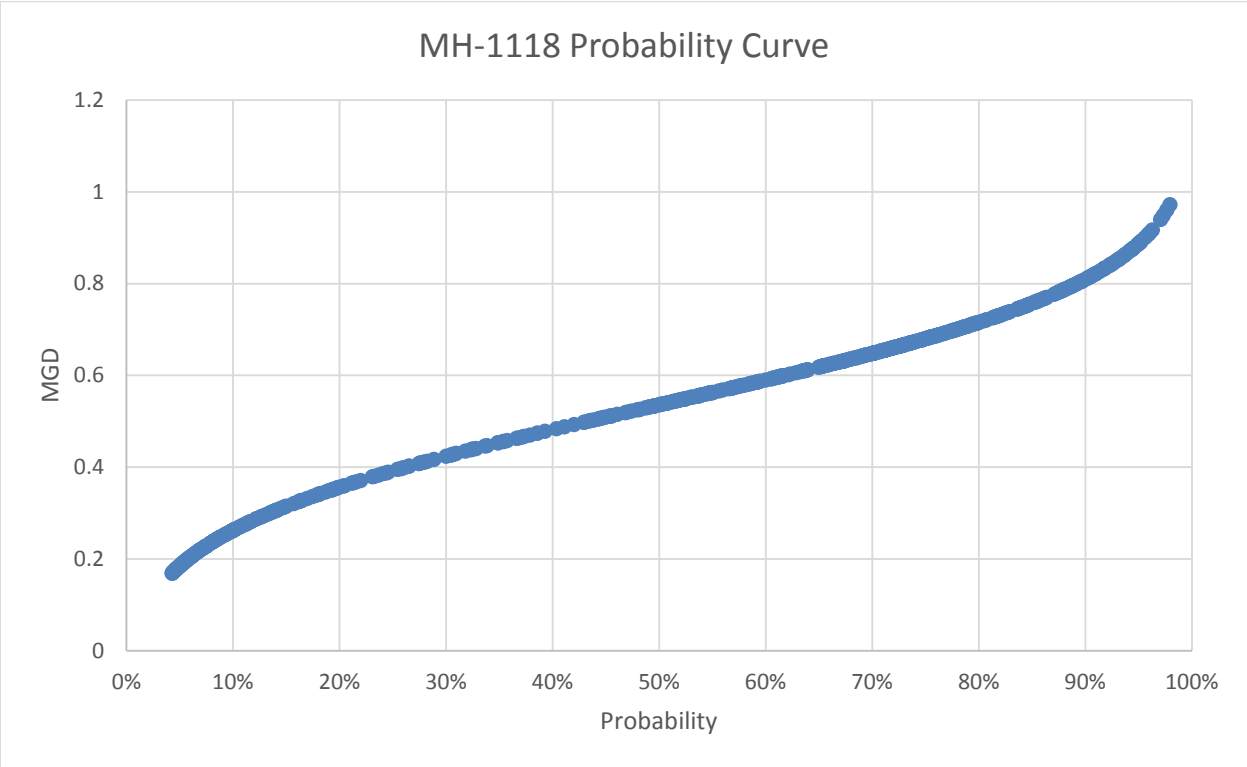
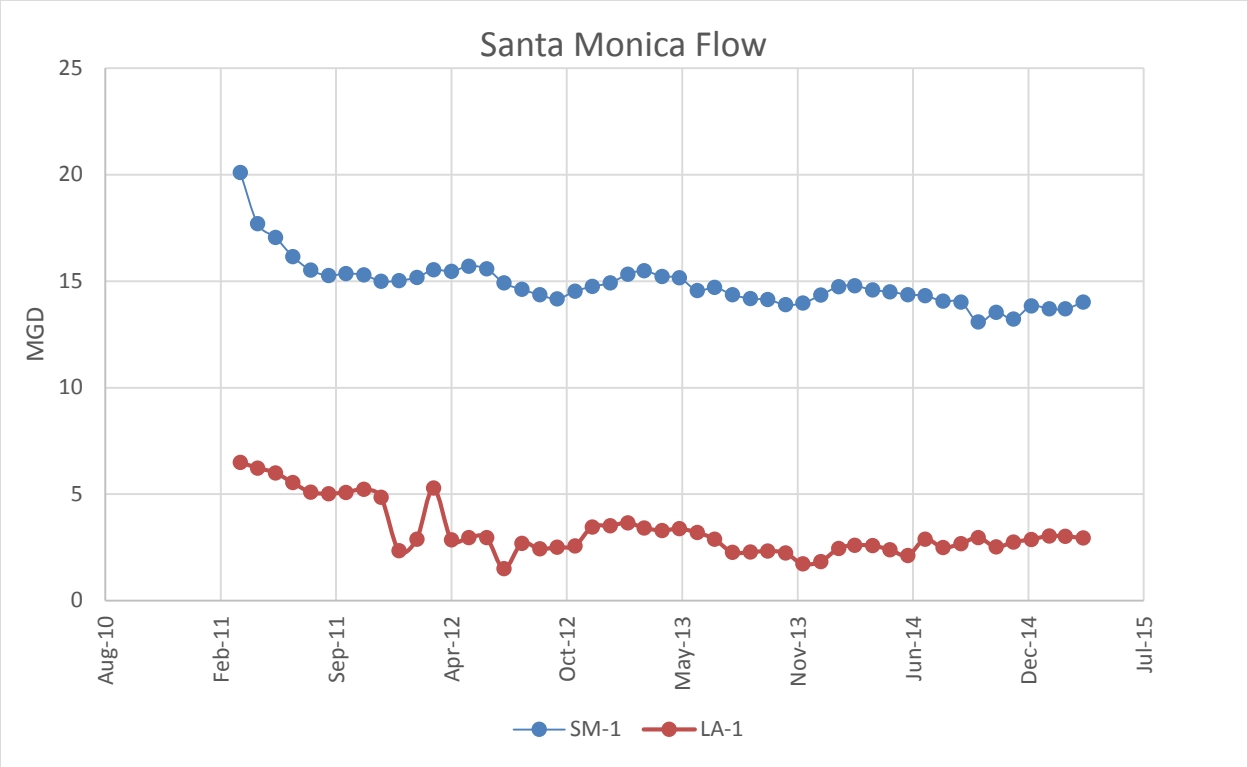
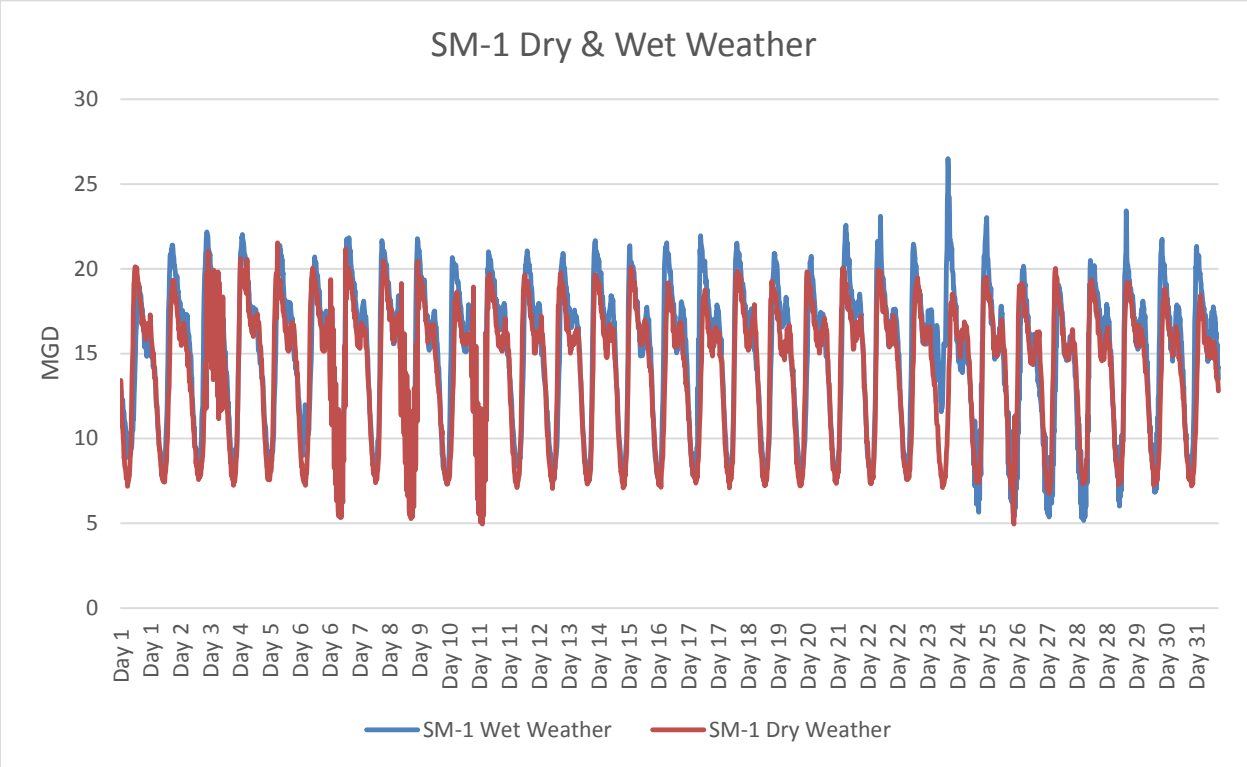
6/18/2015
6/19/2015
6/20/2015


MH-1118 Probability Curve
MGD
1.2
1
0.8
0.6
0.4
0.2
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability


Santa Monica Flow
MGD
25
20
15
10
5
0
Aug-10
Feb-11
Sep-11
Apr-12
Oct-12
May-13
Nov-13
Jun-14
Dec-14
Jul-15
SM-1
LA-1


SM-1 Dry & Wet Weather
MGD
30
25
20
15
10
5
0
Day 1
Day 1
Day 2
Day 3
Day 4
Day 5
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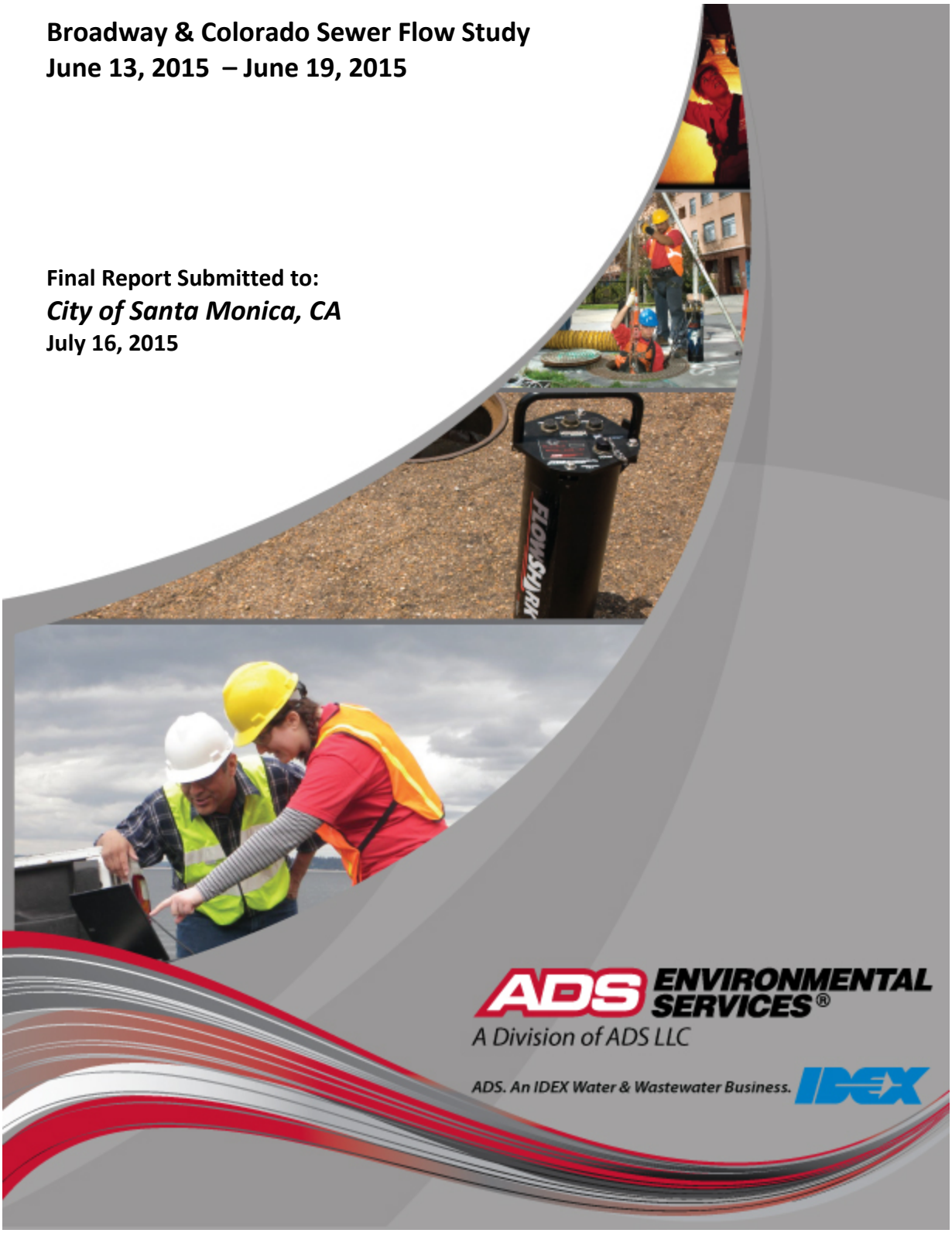
Day 27
Day 28
Day 28
Day 29
Day 30
Day 31
SM-1 Wet Weather
SM-1 Dry Weather

Broadway & Colorado Sewer Flow Study
June 13, 2015 – June 19, 2015

Final Report Submitted to:
City of Santa Monica, CA
July 16, 2015



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A Division of ADS LLC

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Broadway and Colorado Sewer Flow Study
Santa Monica, CA 2015

June 13, 2015 - June 19, 2015

Prepared for:

Chris Aguillon
City of Santa Monica
Water Resources Protection Programs
1212 5th Street, 3rd Floor
Santa Monica, CA 90401-4012
Office: 310.458.8235
Fax: 310.393.6697

Prepared by:

ADS, LLC
15201 Springdale Street
Huntington Beach, CA 92649

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Letter of Transmittal

ADS LLC

July 16, 2015

Chris Aguillon
City of Santa Monica
Water Resources Protection Programs
1212 5th Street, 3rd Floor
Santa Monica, CA 90401-4012

SUBJECT: Broadway and Colorado Sewer Flow Monitoring, Santa Monica, CA - Final Report

Dear Chris,

ADS is pleased to submit the Final Report for the Broadway and Colorado Sewer Flow Monitoring Study conducted on behalf of *The City of Santa Monica*. The metering was contracted for seven (7) days at two (2) locations. The study period is June 13, 2015 - June 19, 2015. The report contains hourly averaged depth, velocity, and quantity hydrographs as well as daily long tables for the metering period in pdf format. An Excel file containing depth, quantity, and velocity entities for each monitoring location in 15-minute format was provided previously.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Paul Mitchell at (714) 379-9778 ext 223.

Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,
ADS ENVIRONMENTAL SERVICES

Jackie Crutcher
Data Manager, West Region

15201 Springdale Street Â· Huntington Beach, CA 92649 Â· Phone: 714-379-9778

Scope and Methodology

Introduction

The City of Santa Monica entered into an agreement with ADS Environmental Services to conduct flow monitoring at (2) two metering points located in the Santa Monica, CA Sanitary Collection System. The study was contracted for a 7-day period. The objective of this study was to measure depth, velocity, and quantify flows. The data obtained will be used to verifiy current flows in order to better understand available capacity in the selected pipes.

Project Scope

The scope of this study involved using flow monitors to quantify wastewater flows at the designated locations for the 7-day time period. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring sites for adequate hydraulic conditions.
- Flow monitor installations.
- Flow monitor confirmations and data collections.
- Flow data analysis.

Equipment installation was accomplished on June 12, 2015. The monitoring period began on June 13, 2015 and was completed on June 19, 2015 .

Flow Monitoring Equipment

The ***ADS FlowShark Triton*** monitor was selected for this project. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS FlowShark Triton monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

The FS Triton monitor features cross-checking using multiple technologies in each sensor for continuous running of comparisons and tolerances. The FS Triton monitor can support two (2) sets of sensors. The sensor option used for this project was:

<u>The Peak Combo Sensor</u> installed at the bottom of the pipe includes three types of data acquisition technologies.
The ***up looking ultrasonic depth*** uses sound waves from two independent transceivers to measure the distance from the sensor upward toward the flow surface; applying the speed of sound in the water and the temperature measured by sensor to calculate depth.

The ***pressure depth*** is calculated by using a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube.

To obtain ***peak velocity*****,** the sensor sends an ultrasonic signal at an angle upward through the widest cross-section of the oncoming flow. The signal is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity.

Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed.

In pipes up to 42 inches in diameter, the sensors were mounted on expandable stainless steel rings, inserted at least a foot upstream into influent pipes and tightened against the inside walls of the pipes. Influent pipe installations reduce the influences of turbulence and backwater often caused by changes in channel geometry in manholes.

Data Collection, Confirmation, and Quality Assurance

Data collects were done remotely via wireless connect on a weekly basis via ADS Field Representatives. Weekly, during the monitoring period, field crews visit each monitoring location to verify proper monitor operation and document field conditions. The following quality assurance steps are taken to assure the integrity of the collected data:

Measure power supplies: monitors were powered by dry cell battery packs. Voltages were recorded and battery packs replaced, as necessary. Separate batteries provided back-up power to memory allowing primary batteries to be replaced without loss of data.

Clock synchronization: Field crews synchronized monitor clocks to master clocks.

Confirm depth and velocity readings: Field crews descended into meter manholes to manually measure depths and velocities and compare them meter readings to confirm that they agreed. They also measured silt levels, if any, in the inverts of the pipes. Silt areas were subtracted from flow areas to compute true areas of flow.

Confirm average velocities through cross-sectional velocity profiles: Since ADS velocity sensors measure peak velocity, field crews collected cross-sectional velocity profiles in order to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

Upload and Review Data: Data collected from the monitors were uploaded and reviewed by a Data Analyst for completeness, outliers and deviations in the flow patterns, which indicate system anomalies or equipment failure.

Flow Quantification Methods

There are two main equations used to measure open channel flow: the ***Continuity Equation*** and the ***Manning Equation.*** The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on

certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

$$Q = A * V$$

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at either 15-minute or 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the ultrasonic depth, (2) the peak velocity and (3) the pressure depth. The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

Occasionally the velocity sensor's performance may be compromised resulting in invalid readings sporadically during the monitoring period. This is generally caused by excessive debris (silt) blocking the sensor's crystals, shallow flows (~< 2") that may drop below the top of the sensor or very clear flows lacking the particles needed to measure rate. In order to use the Continuity equation to quantify the flow during these periods, a Data Analyst and/or Engineer will use the site's historical pipe curve (depth vs. velocity) data along with valid field confirmations to reconstitute and replace the false velocity recordings with expected velocity readings for a given historical depth along the curve.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs. Hydrographs are based on hourly averaging. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the tables and hydrographs.

DEPTH - Final calculated depth measurement (in inches)

QUANTITY - Final calculated flow rate (in MGD)

VELOCITY - Final calculated flow velocity (in feet per second)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)

Site Commentary

Site Information

Broadway1473	
Pipe Dimensions	21.13 "
Silt Level	0.00"

Overview

Site Broadway1473 functioned under normal conditions during the period Saturday, June 13, 2015 to Friday, June 19, 2015 . The meter was installed at Broadway and 16th Ct (See Site Report For More Details). No surcharge conditions were experienced at this location (See Observation Table For More Details). Review of the scattergraph shows that free flow conditions were maintained throughout the study period.

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Saturday, June 13, 2015 to Friday, June 19, 2015 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate recorded in the table herein may vary from those recorded in the Excel data files previously provided. The values presented in the table are based on 5-minute data whereas the data provided in the Excel files are 15-minute averaged data. In regards to depth, this site flows at approximately 35% full at its recorded hourly peak depth of 7.38 inches and approximately 30% full during the typical average depth of 6.40 inches.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	6.40	5.71	2.294
Minimum	5.50	4.89	1.711
Maximum	8.50	6.55	3.851
Time of Minimum	6/19/2015 3:05 AM	6/15/2015 4:00 AM	6/19/2015 5:35 AM
Time of Maximum	6/17/2015 11:00 AM	6/17/2015 11:05 AM	6/17/2015 11:00 AM

Data Quality

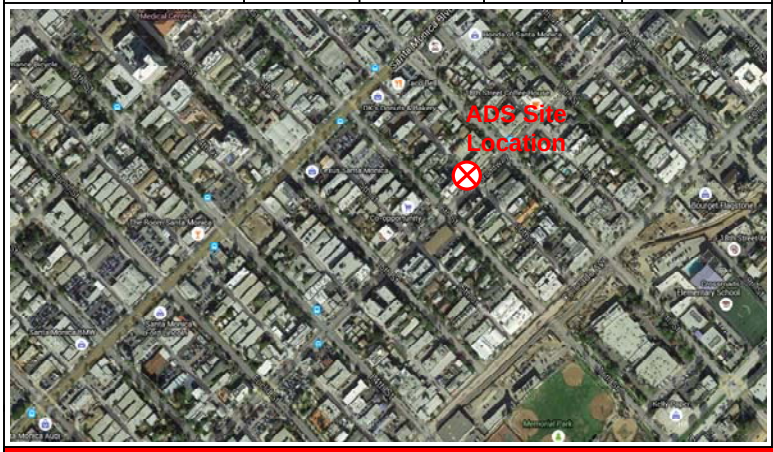
Data uptime observed during the Saturday, June 13, 2015 to the Friday, June 19, 2015 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

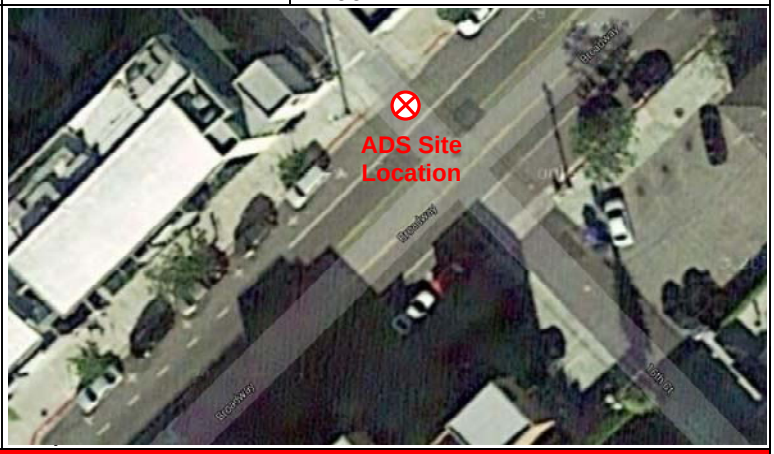
Percent Uptime	
Depth (in)	100
Velocity (ft/s)	100
Quantity (MGD)	100

ADS Site Report

Quality Form

Project Name: Santa Monica Broadway & Colorado TFM 2015	**City:** Santa Monica	**Agency:** Santa Monica	**FM Initials:** SK
Site Name: Broadway1473	**Install Date:** 6/12/15	**Monitor Type**	Peak Doppler
Address/Location:	Broadway & 16th ct	**Monitor Model**	Triton
		Data Acquisition	Manual Collect
		Manhole ID	1473
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	21.13 "
		Pipe Width:	21.00 "





Investigation Information:

Date/Time of Investigation:	6/12/15 @ 0900
Site Hydraulics:	Fast straight through flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not investigated
Downstream Manhole:	Not investigated
Depth of Flow:	7.50 " +/- 0.13"
Range (Air DOF):	+/-
Peak Velocity:	6.68 fps
Silt:	0.00 Inches

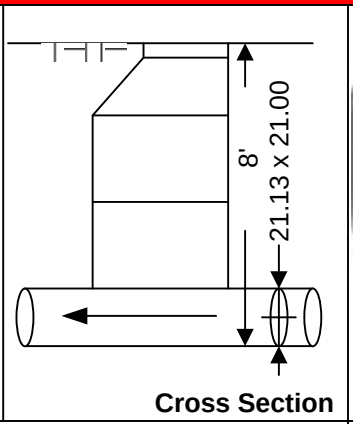
Manhole Information:

Manhole Depth:	8'			
Manhole Material / Condition	Precast/OK			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Trunk [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

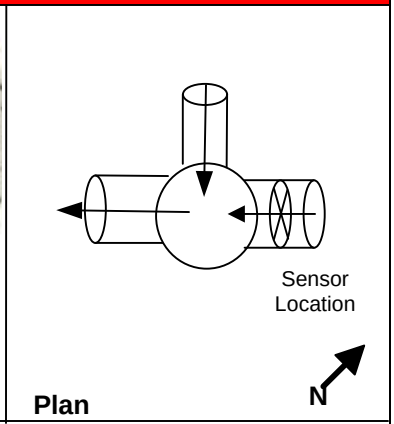
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic / Pressure/Velocity
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

Standard Traffic Control with No Safety Concerns

SCATTERGRAPH REPORT

Broadway1473

Flow Monitor

Broadway1473

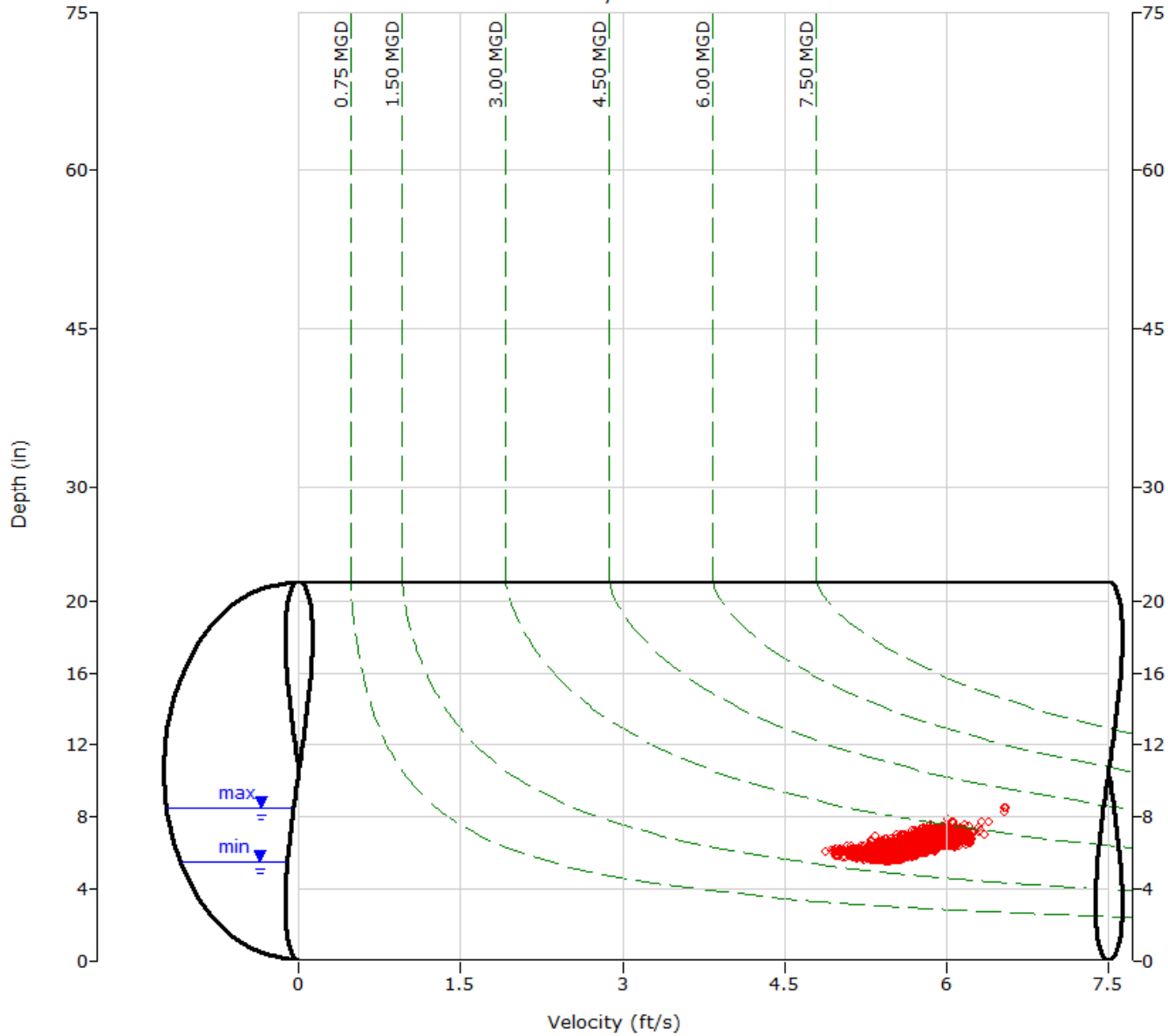
Pipe Height
21.13 in

Report Period

6/13/2015
To
6/19/2015

Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth



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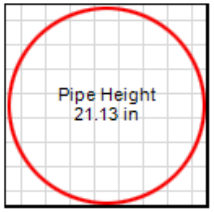
HYDROGRAPH REPORT

Broadway1473

Flow Monitor

Broadway1473

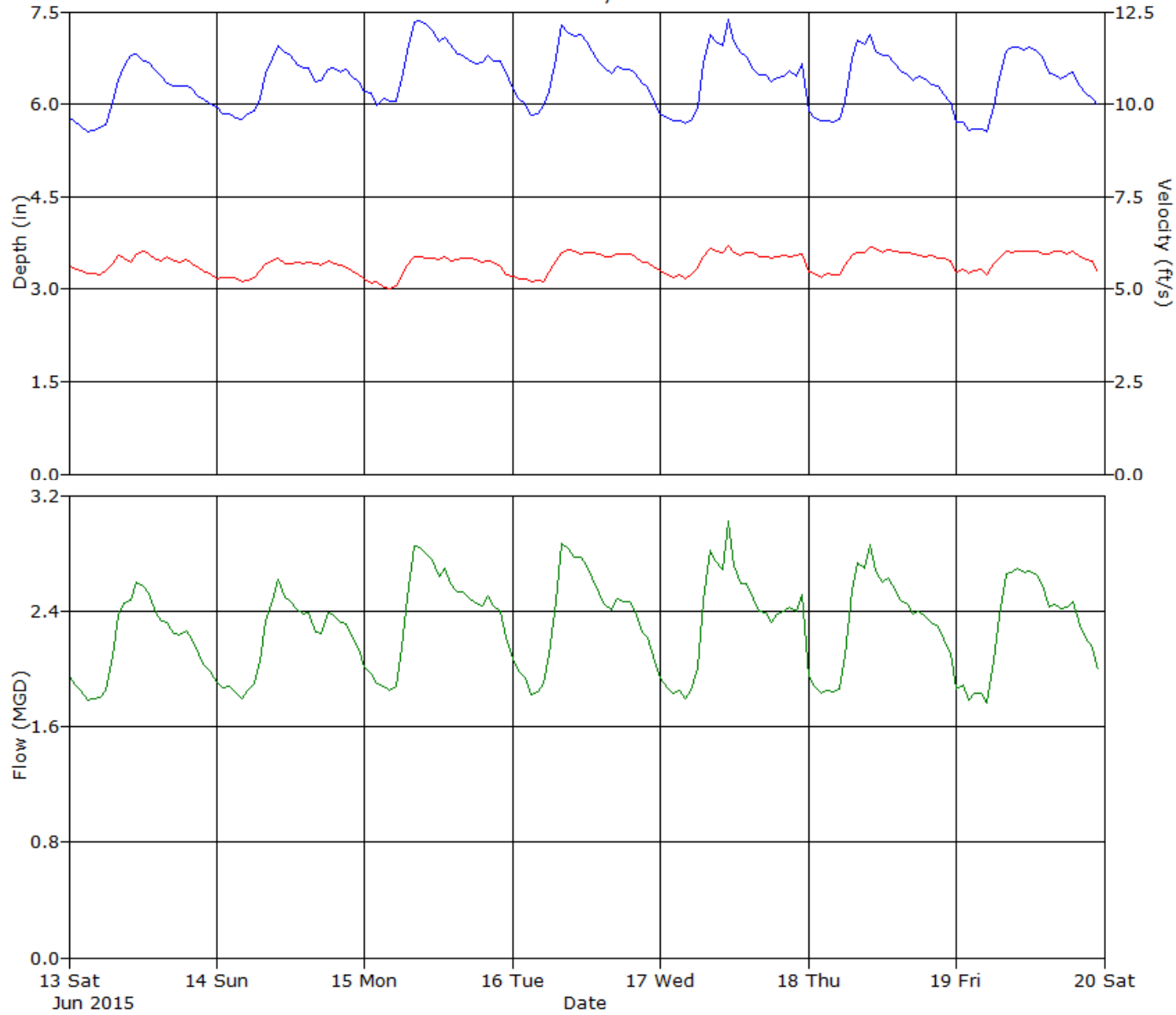


Report Period

6/13/2015
To
6/19/2015

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

Daily Tabular Report For The Period 6/13/2015 - 6/19/2015

Broadway1473, Pipe Height: 21.13 in

Daily Tabular Report

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total MG)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
6/13/2015	05:55	5.53	11:20	7.31	6.18	22:10	5.20	11:20	6.13	5.68	05:20	1.740	11:20	2.943	2.170	2.170	
6/14/2015	03:35	5.72	10:25	7.12	6.35	05:25	4.98	18:55	5.93	5.55	05:25	1.731	10:25	2.737	2.204	2.204	
6/15/2015	02:15	5.91	08:50	7.67	6.68	04:00	4.89	09:35	6.13	5.59	04:00	1.784	08:50	3.109	2.386	2.386	
6/16/2015	03:10	5.78	08:15	7.81	6.50	05:35	5.05	19:05	6.24	5.72	04:30	1.776	08:15	3.159	2.350	2.350	
6/17/2015	04:20	5.67	11:00	8.50	6.44	04:45	5.07	11:05	6.55	5.79	04:45	1.734	11:00	3.851	2.353	2.353	
6/18/2015	02:45	5.65	10:30	7.69	6.36	02:10	5.11	10:30	6.33	5.81	04:45	1.753	10:30	3.254	2.315	2.315	
6/19/2015	03:05	5.50	12:50	7.59	6.30	05:35	5.23	19:10	6.35	5.81	05:35	1.711	12:50	3.064	2.283	2.282	

Report Summary For The Period 6/13/2015 - 6/19/2015

	Depth (in)	Velocity (ft/s)	Quantity (MGD - Total MG)
Total			16.059
Avg	6.40	5.71	2.294

Site Commentary

Site Information

Colorado1118	
Pipe Dimensions	29.5 "
Silt Level	0.00"

Overview

Site Colorado1118 functioned under normal conditions during the period Saturday, June 13, 2015 to Friday, June 19, 2015 . The meter was installed at Colorado and 14th St. (See Site Report For More Details). No surcharge conditions were experienced at this location (See Observation Table For More Details). Review of the scattergraph shows that free flow conditions were maintained throughout the study period.

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Saturday, June 13, 2015 to Friday, June 19, 2015 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate recorded in the table herein may vary from those recorded in the Excel data files previously provided. The values presented in the table are based on 5-minute data whereas the data provided in the Excel files are 15-minute averaged data. In regards to depth, this site flows at approximately 21% full at its recorded hourly peak depth of 6.16 inches and approximately 17% full during the typical average depth of 5.02 inches.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	5.02	1.46	0.536
Minimum	3.31	0.81	0.163
Maximum	6.33	2.14	1.011
Time of Minimum	6/14/2015 6:25 AM	6/17/2015 6:00 AM	6/17/2015 6:00 AM
Time of Maximum	6/17/2015 11:10 AM	6/19/2015 10:35 AM	6/17/2015 10:50 AM

Data Quality

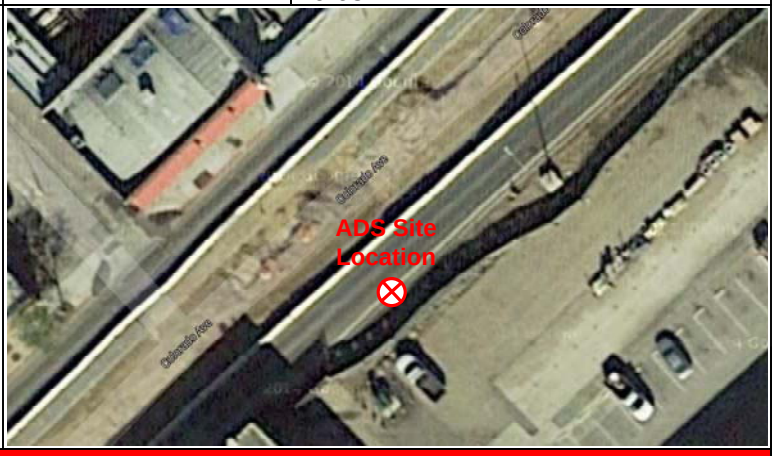
Data uptime observed during the Saturday, June 13, 2015 to the Friday, June 19, 2015 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Percent Uptime	
Depth (in)	100
Velocity (ft/s)	100
Quantity (MGD)	100

ADS Site Report

Quality Form

Project Name: Santa Monica Broadway & Colorado TFM 2015	**City:** Santa Monica	**Agency:** Santa Monica	**FM Initials:** SK
Site Name: Colorado1118	**Install Date:** 6/12/15	**Monitor Type**	Peak Doppler
Address/Location:	Colorado & 14th St.	**Monitor Model**	Triton
		Data Acquisition	Manual Collect
		Manhole ID	1118
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	29.50 "
		Pipe Width:	29.63 "



Investigation Information:

Date/Time of Investigation:	6/12/15 @ 1000
Site Hydraulics:	Good straight through flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not investigated
Downstream Manhole:	Not investigated
Depth of Flow:	6.75 " +/- 0.13"
Range (Air DOF):	+/-
Peak Velocity:	1.90 fps
Silt:	0.00 Inches

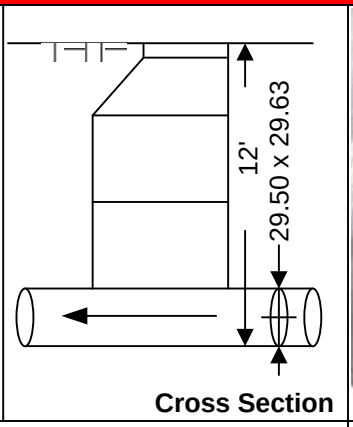
Manhole Information:

Manhole Depth:	12'			
Manhole Material / Condition	Precast/OK			
Pipe Material / Condition:	VCP/Good			
Land Use:	Residential [X]	Commercial [ ]	Industrial [ ]	Trunk [ ]
Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0	

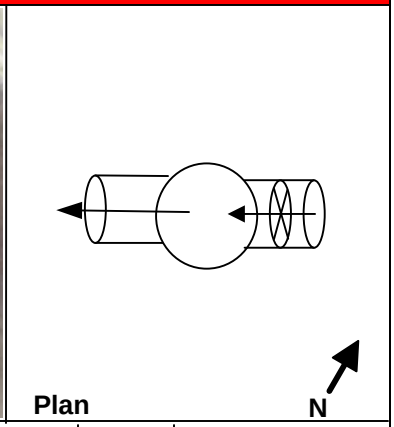
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic / Pressure/Velocity
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

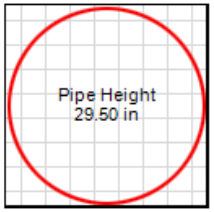
Standard Traffic Control with No Safety Concerns

SCATTERGRAPH REPORT

Colorado1118

Flow Monitor

Colorado1118

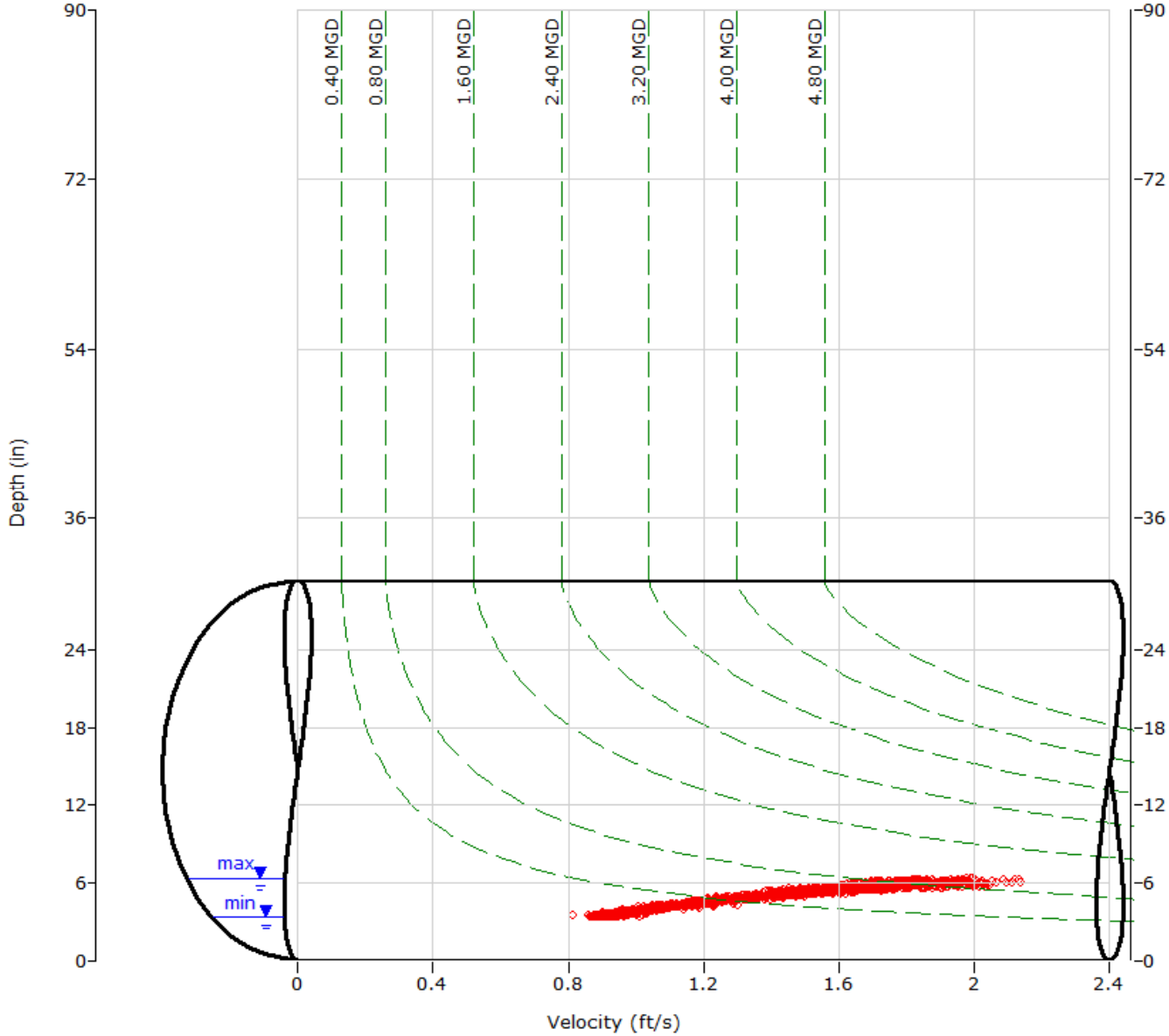


Report Period

6/13/2015
To
6/19/2015

Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth



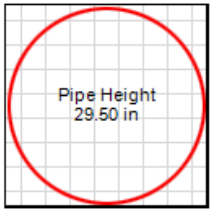
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

Colorado1118

Flow Monitor

Colorado1118

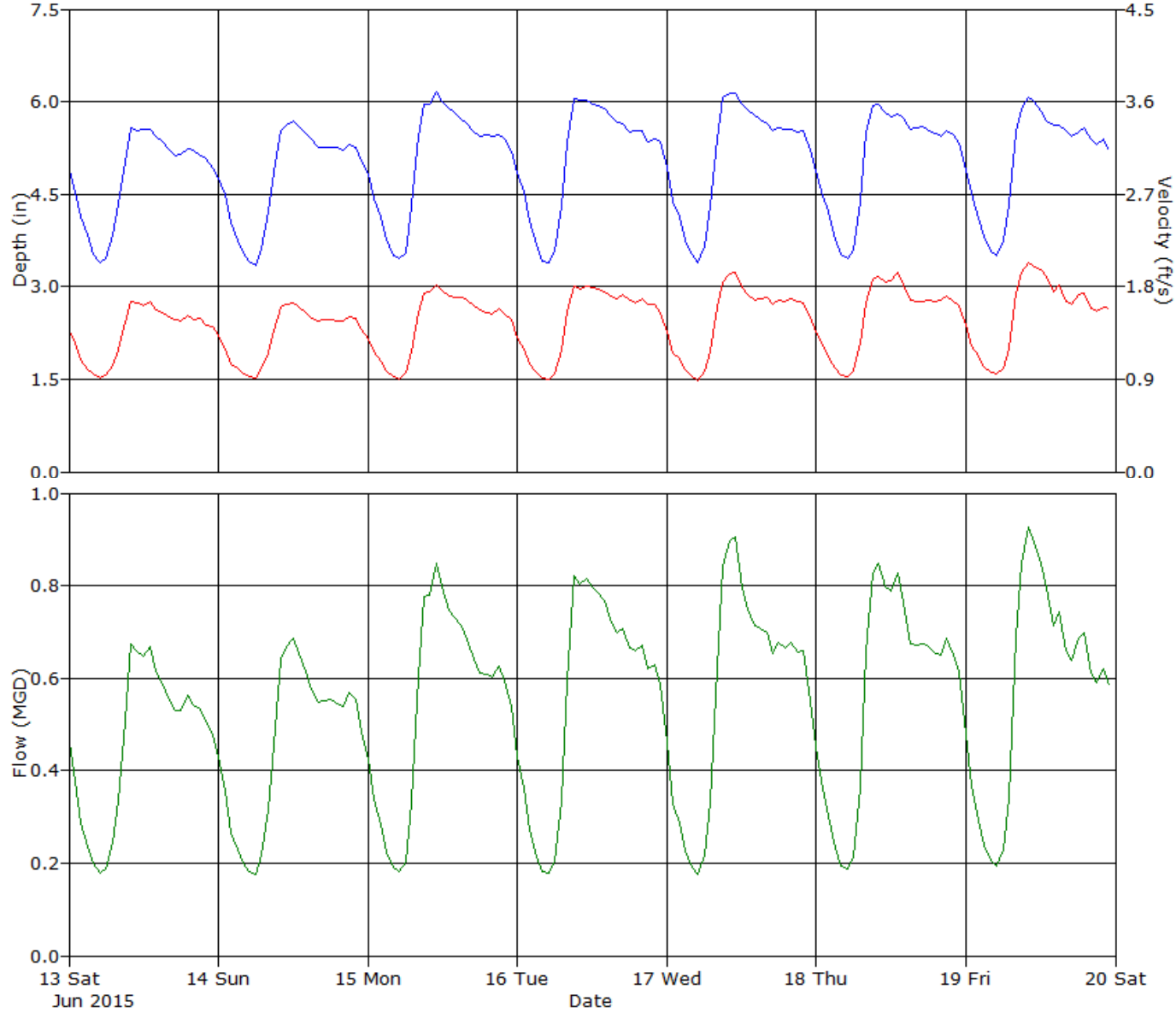


Report Period

6/13/2015
To
6/19/2015

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

Daily Tabular Report

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total MG)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
6/13/2015	05:45	3.35	10:30	5.77	4.79	05:30	0.87	13:35	1.72	1.36	05:30	0.171	10:30	0.719	0.462	0.462	
6/14/2015	06:25	3.31	12:55	5.76	4.80	06:15	0.87	12:50	1.71	1.34	06:15	0.166	12:50	0.722	0.459	0.459	
6/15/2015	05:40	3.40	11:25	6.22	5.10	05:25	0.86	11:50	1.87	1.45	05:25	0.172	11:20	0.865	0.545	0.545	
6/16/2015	04:50	3.31	09:45	6.16	5.11	05:50	0.88	11:30	1.99	1.49	04:50	0.168	11:30	0.906	0.563	0.563	
6/17/2015	05:25	3.37	11:10	6.33	5.14	06:00	0.81	10:50	2.12	1.49	06:00	0.163	10:50	1.011	0.570	0.570	
6/18/2015	05:30	3.41	10:00	6.07	5.10	04:15	0.90	12:05	2.03	1.53	05:30	0.183	10:00	0.890	0.573	0.573	
6/19/2015	05:35	3.47	10:45	6.18	5.09	05:10	0.91	10:35	2.14	1.55	05:10	0.188	10:50	0.997	0.579	0.579	

Report Summary For The Period 6/13/2015 - 6/19/2015

	Depth (in)	Velocity (ft/s)	Quantity (MGD - Total MG)
Total			3.751
Avg	5.02	1.46	0.536

Appendix B
Cost Information

Summary 0.5 mgd

Projects Options Evaluation

Revision	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	M&O Cost	Potential for Future Expansion
Selected	10	10	10	35	10	5	10	5
I	35	5	5	20	5	5	15	10
II	5	35	15	10	10	10	10	5
III	5	5	35	10	15	10	10	10
IV	5	5	5	35	15	10	10	15
V	5	5	5	5	35	15	15	15
VI	15	15	5	5	5	35	10	10

Site	**Sears Triangle**	**Colorado Yard/ Memorial Park**	**Civic Center Parking**	**Bus Maintenance Facility**	**Stewart Park**	**MAPS Facility**
Selected	6	**3**	**2**	4	5	1
I	6	**2**	**3**	4	5	1
II	6	**2**	**2**	4	5	1
III	6	**2**	4	**3**	5	1
IV	6	**2**	**2**	**4**	**5**	**1**
V	6	**2**	**3**	4	5	1
VI	6	**2**	**3**	4	5	1

Projects Options Evaluation

Base Case

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost		Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**10**	**10**	**10**	**35**	**10**	**5**	**10**	**5**					
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6		0	6
2	Colorado Yard/Maintenance Facility	10.479	4.0	3	4	3	3	5	1	5	305	3		265	3
3	Civic Center Parking	13.155	3.0	4	1	4	4	3	4	2	325	2		295	2
4	Bus Maintenance Facility	13.889	2.0	2	5	2	2	2	1	4	220	4		200	4
5	Stewart Park	16.967	1.0	1	2	1	1	1	1	1	105	5		95	5
6	MAPS Facility	10.042	5.0	5	3	5	5	4	4	3	430	1		380	1

Option 1

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**35**	**5**	**5**	**20**	**5**	**5**	**15**	**10**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	10.479	4.0	3	4	3	3	5	1	5	340	2	200	3
3	Civic Center Parking	13.155	3.0	4	1	4	4	3	4	2	325	3	220	2
4	Bus Maintenance Facility	13.889	2.0	2	5	2	2	2	1	4	220	4	150	4
5	Stewart Park	16.967	1.0	1	2	1	1	1	1	1	105	5	70	5
6	MAPS Facility	10.042	5.0	5	3	5	5	4	4	3	450	1	275	1

Option 2

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**5**	**35**	**15**	**10**	**10**	**10**	**10**	**5**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	10.479	4.0	3	4	3	3	5	1	5	330	2	310	3
3	Civic Center Parking	13.155	3.0	4	1	4	4	3	4	2	330	2	315	2
4	Bus Maintenance Facility	13.889	2.0	2	5	2	2	2	1	4	245	4	235	4
5	Stewart Park	16.967	1.0	1	2	1	1	1	1	1	115	5	110	5
6	MAPS Facility	10.042	5.0	5	3	5	5	4	4	3	440	1	415	1

Option 3

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**5**	**5**	**35**	**10**	**15**	**10**	**10**	**10**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	10.479	4.0	3	4	3	3	5	1	5	360	2	340	2
3	Civic Center Parking	13.155	3.0	4	1	4	4	3	4	2	260	4	245	4
4	Bus Maintenance Facility	13.889	2.0	2	5	2	2	2	1	4	315	3	305	3
5	Stewart Park	16.967	1.0	1	2	1	1	1	1	1	135	5	130	5
6	MAPS Facility	10.042	5.0	5	3	5	5	4	4	3	390	1	365	1

Option 4

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**5**	**5**	**5**	**35**	**15**	**10**	**10**	**15**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	10.479	4.0	3	4	3	3	5	1	5	340	2	320	3
3	Civic Center Parking	13.155	3.0	4	1	4	4	3	4	2	340	2	325	2
4	Bus Maintenance Facility	13.889	2.0	2	5	2	2	2	1	4	235	4	225	4
5	Stewart Park	16.967	1.0	1	2	1	1	1	1	1	105	5	100	5
6	MAPS Facility	10.042	5.0	5	3	5	5	4	4	3	440	1	415	1

Option 5

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**5**	**5**	**5**	**5**	**35**	**15**	**15**	**15**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	10.479	4.0	3	4	3	3	5	1	5	340	2	320	2
3	Civic Center Parking	13.155	3.0	4	1	4	4	3	4	2	335	3	320	2
4	Bus Maintenance Facility	13.889	2.0	2	5	2	2	2	1	4	230	4	220	4
5	Stewart Park	16.967	1.0	1	2	1	1	1	1	1	105	5	100	5
6	MAPS Facility	10.042	5.0	5	3	5	5	4	4	3	430	1	405	1

Option 6

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**15**	**15**	**5**	**5**	**5**	**35**	**10**	**10**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	10.479	4.0	3	4	3	3	5	1	5	390	2	330	2
3	Civic Center Parking	13.155	3.0	4	1	4	4	3	4	2	315	3	270	3
4	Bus Maintenance Facility	13.889	2.0	2	5	2	2	2	1	4	225	4	195	4
5	Stewart Park	16.967	1.0	1	2	1	1	1	1	1	105	5	90	5
6	MAPS Facility	10.042	5.0	5	3	5	5	4	4	3	425	1	350	1

Cost Summary

	1	2	3	4	5	6
	Sears Triangle	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS
Capital Cost		$10,479,000	$13,155,000	$13,889,000	$16,967,000	$10,042,000
Annual O&M Cost		$430,000	$380,000	$430,000	$430,000	$380,000
Avoided Imported Water Cost		$(517,023)	$(517,023)	$(517,023)	$(517,023)	$(517,023)
Avoided WW Treatment Cost		$(221,373)	$(221,373)	$(221,373)	$(221,373)	$(221,373)
Net Annual Costs		$(308,395)	$(358,395)	$(308,395)	$(308,395)	$(358,395)
Present Worth of Net Annual Costs		$(6,906,969)	$(8,026,794)	$(6,906,969)	$(6,906,969)	$(8,026,794)
Total Present Worth		$3,572,031	$5,128,206	$6,982,031	$10,060,031	$2,015,206
Construction Cost Rating		4	3	2	1	5
Annual O&M Rating		1	4	1	1	4

	1	2	3	4	5	6
	Sears Triangle	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS
Capital Cost		$10,479,000	$13,155,000	$13,889,000	$16,967,000	$10,042,000
Annual O&M Cost - Escalated at 2% for 30 yrs		$17,444,000	$15,416,000	$17,444,000	$17,444,000	$15,416,000
Avoided Imported Water Cost - Escalated at 2% for 30 yrs		$(48,838,000)	$(48,838,000)	$(48,838,000)	$(48,838,000)	$(48,838,000)
Avoided WW Treatment Cost - Escalated at 2% for 30 yrs		$(12,416,000)	$(12,416,000)	$(12,416,000)	$(12,416,000)	$(12,416,000)
Net Annual Costs		$(43,810,000)	$(45,838,000)	$(43,810,000)	$(43,810,000)	$(45,838,000)
Present Worth of Net Annual Costs - Discounted at 5% for 30 yrs		$(17,723,000)	$(18,739,000)	$(17,723,000)	$(17,723,000)	$(18,739,000)
Total Present Worth		$(7,244,000)	$(5,584,000)	$(3,834,000)	$(756,000)	$(8,697,000)

HWRP Wastewater Treatment Charge
Project Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: HWRP Wastewater Treatment Charge

Description	Unit	Quantity	Unit Price	Item Total
HWRP Treatment Charge	MG	183	$1,213	$221,373
Subtotal (1)				***$221,373***
Total Estimated Cost				**$221,373**

Assumptions:

1) Assumes operation 365 days per year of 0.5 mgd of product water, 0.2 mgd of reject is going back into the sewer
2) $1,213/MG is based on costs for fiscal year 2014-15

Prepared By: Sarah Munger

Checked By: Areeba Syed

Approved By:

MWH Imported Water Charge
Project Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: MWD Imported Water Charge

Description	Unit	Quantity	Unit Price	Item Total
Imported Water Charge	MG	183	$2,833	$517,023
Subtotal (1)				***$517,023***
Total Estimated Cost				**$517,023**

Assumptions:

1) Assumes operation 365 days per year of 0.5 mgd of product water, 0.2 mgd of reject is going back into the sewer
2) Value is based on imported water value of $923/AF

Prepared By: Sarah Munger

Checked By: Areeba Syed

Approved By:

Colorado Yard/Memorial Park
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #2 - Colorado Yard/Memorial Park

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 0.5 mgd AWT	SF	6,775	$200	$1,355,000
Diversion Structure	LS	2	$14,000	$28,000
Influent Pump Station	hp	10	$540	$5,400
Influent Piping	LF	739	$300	$221,760
Install 0.5 mgd of MBR System	mgd	0.5	$2,334,000	$1,167,000
Install 0.5 mgd RO System	mgd	0.5	$750,000	$375,000
Install 0.5 mgd UV System	mgd	0.5	$370,000	$185,000
Effluent Pump Station	hp	33	$540	$17,820
Effluent Piping	LF	1,690	$28	$47,320
Subtotal (1)				***$3,402,300***
Electrical Work - 15% of Subtotal (1)			15%	$510,345
I&C Work - 15% of Subtotal (1)			15%	$510,345
Civil Work - 10% of Subtotal (1)			10%	$340,230
Architectural Allowance - 10% of Subtotal (1)			10%	$340,230
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			5%	$170,115
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$510,345
Subtotal (2)				***$5,273,565***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$867,587
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$1,735,173
Construction Contingency - 25% of Subtotal (2)			25%	$2,168,966
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$433,793
Subtotal (3)				***$5,205,519***
Total Estimated Construction Cost				**$10,479,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Civic Center Parking Lot
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #3 - Civic Center Parking

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 0.5 mgd AWT	SF	6,775	$200	$1,355,000
Diversion Structure	LS	1	$14,000	$14,000
Influent Pump Station	hp	10	$540	$5,400
Influent Piping	LF	3,168	$300	$950,400
Install 0.5 mgd of MBR System	mgd	0.5	$2,334,000	$1,167,000
Install 0.5 mgd RO System	mgd	0.5	$750,000	$375,000
Install 0.5mgd UV System	mgd	0.5	$370,000	$185,000
Effluent Pump Station	hp	36	$540	$19,440
Effluent Piping	LF	3,274	$28	$91,672
Subtotal (1)				***$4,162,912***
Electrical Work - 15% of Subtotal (1)			15%	$624,437
I&C Work - 15% of Subtotal (1)			15%	$624,437
Civil Work - 10% of Subtotal (1)			10%	$416,291.20
Architectural Allowance - 10% of Subtotal (1)			10%	$416,291
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			10%	$416,291
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$624,437
Subtotal (2)				***$6,660,659***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$1,082,357
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$2,164,714
Construction Contingency - 25% of Subtotal (2)			25%	$2,705,893
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$541,179
Subtotal (3)				***$6,494,143***
Total Estimated Construction Cost				**$13,155,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Bus Maintenance Facility
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #4 - Bus Maintenance Facility

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 0.5 mgd AWT	SF	6,775	$200	$1,355,000
Diversion Structure	LS	1	$14,000	$14,000
Influent Pump Station	hp	10	$540	$5,400
Influent Piping	LF	2,482	$300	$744,480
Install 0.5 mgd of MBR System	mgd	0.5	$2,334,000	$1,167,000
Install 0.5 mgd RO System	mgd	0.5	$750,000	$375,000
Install 0.5 mgd UV System	mgd	0.5	$370,000	$185,000
Effluent Pump Station	hp	34	$540	$18,360
Effluent Piping	LF	1,109	$28	$31,052
Land Acquisition	LS	1	$500,000	$500,000
Subtotal (1)				***$4,395,292***
Electrical Work - 15% of Subtotal (1)			15%	$659,294
I&C Work - 15% of Subtotal (1)			15%	$659,294
Civil Work - 10% of Subtotal (1)			10%	$439,529.20
Architectural Allowance - 10% of Subtotal (1)			10%	$439,529
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			10%	$439,529
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$659,294
Subtotal (2)				***$7,032,467***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$1,142,776
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$2,285,552
Construction Contingency - 25% of Subtotal (2)			25%	$2,856,940
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$571,388
Subtotal (3)				***$6,856,656***
Total Estimated Construction Cost				**$13,889,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Stewart Park
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #5 - Stewart Park

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 0.5 mgd AWT	SF	6,775	$200	$1,355,000
Diversion Structure	LS	1	$14,000	$14,000
Influent Pump Station	hp	10	$540	$5,400
Influent Piping	LF	7,286	$300	$2,185,920
Install 0.5 mgd of MBR System	mgd	0.5	$2,334,000	$1,167,000
Install 0.5 mgd RO System	mgd	0.5	$750,000	$375,000
Install 0.5 mgd UV System	mgd	0.5	$370,000	$185,000
Effluent Pump Station	hp	37	$540	$19,980
Effluent Piping	LF	2,218	$28	$62,104
Subtotal (1)				***$5,369,404***
Electrical Work - 15% of Subtotal (1)			15%	$805,411
I&C Work - 15% of Subtotal (1)			15%	$805,411
Civil Work - 10% of Subtotal (1)			10%	$536,940.40
Architectural Allowance - 10% of Subtotal (1)			10%	$536,940
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			10%	$536,940
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$805,411
Subtotal (2)				***$8,591,046***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$1,396,045
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$2,792,090
Construction Contingency - 25% of Subtotal (2)			25%	$3,490,113
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$698,023
Subtotal (3)				***$8,376,270***
Total Estimated Construction Cost				**$16,967,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

MAPS Facility
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #6 - MAPS Facility

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 0.5 mgd AWT	SF	6,775	$200	$1,355,000
Diversion Structure	LS	1	$14,000	$14,000
Influent Pump Station	hp	10	$540	$5,400
Influent Piping	LF	42	$300	$12,672
Install 0.5 mgd of MBR System	mgd	0.5	$2,334,000	$1,167,000
Install 0.5 mgd RO System	mgd	0.5	$750,000	$375,000
Install 0.5 mgd UV System	mgd	0.5	$370,000	$185,000
Effluent Pump Station	hp	36	$540	$19,440
Effluent Piping	LF	1,584	$28	$44,352
Subtotal (1)				***$3,177,864***
Electrical Work - 15% of Subtotal (1)			15%	$476,680
I&C Work - 15% of Subtotal (1)			15%	$476,680
Civil Work - 10% of Subtotal (1)			10%	$317,786.40
Architectural Allowance - 10% of Subtotal (1)			10%	$317,786
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			10%	$317,786
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$476,680
Subtotal (2)				***$5,084,582***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$826,245
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$1,652,489
Construction Contingency - 25% of Subtotal (2)			25%	$2,065,612
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$413,122
Subtotal (3)				***$4,957,468***
Total Estimated Construction Cost				**$10,042,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Colorado Yard/Memorial Park
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #2 - Colorado Yard/Memorial Park

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	10	$0.12	$14,091
Operate 0.5 mgd of MBR System	mgd	0.5	$100,000	$50,000
Operate 0.5 mgd RO System	mgd	0.5	$600,000	$300,000
Operate 0.5 mgd UV System	mgd	0.5	$30,000	$15,000
Effluent Pump Station	hp	33	$0.12	$46,501
Total				***$430,000***

Assumptions:

MBR, RO, and UV system costs include annualized membrane and/or lamp replacement costs

Total costs have bee

Prepared By: Sarah Munger

Checked By:

Approved By:

Civic Center Parking
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #3 - Civic Center Parking

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	10	$0.12	$14,091
Operate 0.5 mgd of MBR System	mgd	0.5	$100,000	$50,000
Operate 0.5 mgd RO System	mgd	0.5	$500,000	$250,000
Operate 0.5 mgd UV System	mgd	0.5	$30,000	$15,000
Effluent Pump Station	hp	36	$0.12	$50,728
Total				***$380,000***

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Bus Maintenance Facility
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #4 - Bus Maintenance Facility

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	10	$0.12	$14,091
Operate 0.5 mgd of MBR System	mgd	0.5	$100,000	$50,000
Operate 0.5 mgd RO System	mgd	0.5	$600,000	$300,000
Operate 0.5 mgd UV System	mgd	0.5	$30,000	$15,000
Effluent Pump Station	hp	34	$0.12	$47,910
Total				***$430,000***

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Stewart Park
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #5 - Steward Park

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	10	$0.12	$14,091
Operate 0.5 mgd of MBR System	mgd	0.5	$100,000	$50,000
Operate 0.5 mgd RO System	mgd	0.5	$600,000	$300,000
Operate 0.5 mgd UV System	mgd	0.5	$30,000	$15,000
Effluent Pump Station	hp	37	$0.12	$52,137
Total				***$430,000***

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

MAPS Facility
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #6 - MAPS Facility

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	10	$0.12	$14,091
Operate 0.5 mgd of MBR System	mgd	0.5	$100,000	$50,000
Operate 0.5 mgd RO System	mgd	0.5	$500,000	$250,000
Operate 0.5 mgd UV System	mgd	0.5	$30,000	$15,000
Effluent Pump Station	hp	36	$0.12	$50,728
Total				***$380,000***

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Summary 1.0 mgd

Projects Options Evaluation

Base Case

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost		Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**10**	**10**	**10**	**35**	**10**	**5**	**10**	**5**					
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6		0	6
2	Colorado Yard/Maintenance Facility	16.610	4.0	3	4	3	3	5	2	5	315	3		275	3
3	Civic Center Parking	19.449	3.0	4	1	4	4	3	4	2	325	2		295	2
4	Bus Maintenance Facility	20.180	2.0	2	5	2	2	2	2	4	230	4		210	4
5	Stewart Park	23.263	1.0	1	2	1	1	1	1	1	105	5		95	5
6	MAPS Facility	16.336	5.0	5	3	5	5	4	4	3	430	1		380	1

Option 1

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**35**	**5**	**5**	**20**	**5**	**5**	**15**	**10**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	16.610	4.0	3	4	3	3	5	2	5	355	2	215	3
3	Civic Center Parking	19.449	3.0	4	1	4	4	3	4	2	325	3	220	2
4	Bus Maintenance Facility	20.180	2.0	2	5	2	2	2	2	4	235	4	165	4
5	Stewart Park	23.263	1.0	1	2	1	1	1	1	1	105	5	70	5
6	MAPS Facility	16.336	5.0	5	3	5	5	4	4	3	450	1	275	1

Option 2

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**5**	**35**	**15**	**10**	**10**	**10**	**10**	**5**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	16.610	4.0	3	4	3	3	5	2	5	340	2	320	2
3	Civic Center Parking	19.449	3.0	4	1	4	4	3	4	2	330	3	315	3
4	Bus Maintenance Facility	20.180	2.0	2	5	2	2	2	2	4	255	4	245	4
5	Stewart Park	23.263	1.0	1	2	1	1	1	1	1	115	5	110	5
6	MAPS Facility	16.336	5.0	5	3	5	5	4	4	3	440	1	415	1

Option 3

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**5**	**5**	**35**	**10**	**15**	**10**	**10**	**10**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	16.610	4.0	3	4	3	3	5	2	5	370	2	350	2
3	Civic Center Parking	19.449	3.0	4	1	4	4	3	4	2	260	4	245	4
4	Bus Maintenance Facility	20.180	2.0	2	5	2	2	2	2	4	325	3	315	3
5	Stewart Park	23.263	1.0	1	2	1	1	1	1	1	135	5	130	5
6	MAPS Facility	16.336	5.0	5	3	5	5	4	4	3	390	1	365	1

Option 4

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**5**	**5**	**5**	**35**	**15**	**10**	**10**	**15**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	16.610	4.0	3	4	3	3	5	2	5	350	2	330	2
3	Civic Center Parking	19.449	3.0	4	1	4	4	3	4	2	340	3	325	3
4	Bus Maintenance Facility	20.180	2.0	2	5	2	2	2	2	4	245	4	235	4
5	Stewart Park	23.263	1.0	1	2	1	1	1	1	1	105	5	100	5
6	MAPS Facility	16.336	5.0	5	3	5	5	4	4	3	440	1	415	1

Option 5

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**5**	**5**	**5**	**5**	**35**	**15**	**15**	**15**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	16.610	4.0	3	4	3	3	5	2	5	355	2	335	2
3	Civic Center Parking	19.449	3.0	4	1	4	4	3	4	2	335	3	320	3
4	Bus Maintenance Facility	20.180	2.0	2	5	2	2	2	2	4	245	4	235	4
5	Stewart Park	23.263	1.0	1	2	1	1	1	1	1	105	5	100	5
6	MAPS Facility	16.336	5.0	5	3	5	5	4	4	3	430	1	405	1

Option 6

Site Number	Site	Estimated Present Worth Cost ($ Million)	Construction Cost	Proximity to Source	Proximity to Recycled Water Distribution System	Adequate Raw Water Feed Flow Volume	Acceptable Raw Water Feed Quality	Site Availability	O&M Cost	Potential for Future Expansion	Weighted Score	Rank with Cost	Weighted Score without Cost Factors	Rank without Cost
	Criteria Weighting, percent		**15**	**15**	**5**	**5**	**5**	**35**	**10**	**10**				
1	Sears Triangle	-	0.0	0	0	0	0	0	0	0	0	6	0	6
2	Colorado Yard/Maintenance Facility	16.610	4.0	3	4	3	3	5	2	5	400	2	340	2
3	Civic Center Parking	19.449	3.0	4	1	4	4	3	4	2	315	3	270	3
4	Bus Maintenance Facility	20.180	2.0	2	5	2	2	2	2	4	235	4	205	4
5	Stewart Park	23.263	1.0	1	2	1	1	1	1	1	105	5	90	5
6	MAPS Facility	16.336	5.0	5	3	5	5	4	4	3	425	1	350	1

Cost Summary

	1	2	3	4	5	6
	Sears Triangle	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS
Capital Cost		$16,610,000	$19,449,000	$20,180,000	$23,263,000	$16,336,000
Annual O&M Cost		$850,000	$760,000	$850,000	$860,000	$760,000
Avoided Imported Water Cost		$(1,034,045)	$(1,034,045)	$(1,034,045)	$(1,034,045)	$(1,034,045)
Avoided WW Treatment Cost		$(442,745)	$(442,745)	$(442,745)	$(442,745)	$(442,745)
Net Annual Costs		$(626,790)	$(716,790)	$(626,790)	$(616,790)	$(716,790)
Present Worth of Net Annual Costs		$(14,037,902)	$(16,053,587)	$(14,037,902)	$(13,813,937)	$(16,053,587)
Total Present Worth		$2,572,098	$3,395,413	$6,142,098	$9,449,063	$282,413
Construction Cost Rating		4	3	2	1	5
Annual O&M Rating		2	4	2	1	4

	1	2	3	4	5	6
	Sears Triangle	Colorado Yard/ Memorial Park	Civic Center Parking	Bus Maintenance Facility	Stewart Park	MAPS
Capital Cost		$16,610,000	$19,449,000	$20,180,000	$23,263,000	$16,336,000
Annual O&M Cost - Escalated at 2% for 30 yrs		$34,483,000	$30,832,000	$34,483,000	$34,889,000	$30,832,000
Avoided Imported Water Cost - Escalated at 2% for 30 yrs		$(97,767,000)	$(97,767,000)	$(97,767,000)	$(97,767,000)	$(97,767,000)
Avoided WW Treatment Cost - Escalated at 2% for 30 yrs		$(24,846,000)	$(24,846,000)	$(24,846,000)	$(24,846,000)	$(24,846,000)
Net Annual Costs		$(88,130,000)	$(91,781,000)	$(88,130,000)	$(87,724,000)	$(91,781,000)
Present Worth of Net Annual Costs - Discounted at 5% for 30 yrs		$(35,694,000)	$(37,524,000)	$(35,694,000)	$(35,490,000)	$(37,524,000)
Total Present Worth		$(19,084,000)	$(18,075,000)	$(15,514,000)	$(12,227,000)	$(21,188,000)

HWRP Wastewater Treatment Charge
Project Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: HWRP Wastewater Treatment Charge

Description	Unit	Quantity	Unit Price	Item Total
HWRP Treatment Charge	MG	365	$1,213	$442,745
Subtotal (1)				***$442,745***
Total Estimated Cost				**$442,745**

Assumptions:

1) Assumes operation 365 days per year of 1 mgd of product water, 0.2 mgd of reject is going back into the sewer
2) $1,213/MG is based on costs for fiscal year 2014-15

Prepared By: Sarah Munger

Checked By: Areeba Syed

Approved By:

MWH Imported Water Charge
Project Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: MWD Imported Water Charge

Description	Unit	Quantity	Unit Price	Item Total
Imported Water Charge	MG	365	$2,833	$1,034,045
Subtotal (1)				***$1,034,045***
Total Estimated Cost				**$1,034,045**

Assumptions:

1) Assumes operation 365 days per year of 1 mgd of product water, 0.2 mgd of reject is going back into the sewer

2) Value is based on imported water value of $923/AF

Prepared By: Sarah Munger

Checked By: Areeba Syed

Approved By:

Colorado Yard/Memorial Park
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #2 - Colorado Yard/Memorial Park

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 1 mgd AWT	SF	7,975	$200	$1,595,000
Diversion Structure	LS	2	$14,000	$28,000
Influent Pump Station	hp	20	$540	$10,800
Influent Piping	LF	739	$300	$221,760
Install 1 mgd of MBR System	mgd	1	$2,334,000	$2,334,000
Install 1 mgd RO System	mgd	1	$750,000	$750,000
Install 1 mgd UV System	mgd	1	$370,000	$370,000
Effluent Pump Station	hp	66	$540	$35,865
Effluent Piping	LF	1,690	$28	$47,320
Subtotal (1)				***$5,392,745***
Electrical Work - 15% of Subtotal (1)			15%	$808,912
I&C Work - 15% of Subtotal (1)			15%	$808,912
Civil Work - 10% of Subtotal (1)			10%	$539,275
Architectural Allowance - 10% of Subtotal (1)			10%	$539,275
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			5%	$269,637
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$808,912
Subtotal (2)				***$8,358,755***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$1,375,150
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$2,750,300
Construction Contingency - 25% of Subtotal (2)			25%	$3,437,875
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$687,575
Subtotal (3)				***$8,250,900***
Total Estimated Construction Cost				**$16,610,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Civic Center Parking Lot
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #3 - Civic Center Parking

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 1 mgd AWT	SF	7,975	$200	$1,595,000
Diversion Structure	LS	1	$14,000	$14,000
Influent Pump Station	hp	20	$540	$10,800
Influent Piping	LF	3,168	$300	$950,400
Install 1 mgd of MBR System	mgd	1	$2,334,000	$2,334,000
Install 1 mgd RO System	mgd	1	$750,000	$750,000
Install 1 mgd UV System	mgd	1	$370,000	$370,000
Effluent Pump Station	hp	72	$540	$38,829
Effluent Piping	LF	3,274	$28	$91,672
Subtotal (1)				***$6,154,701***
Electrical Work - 15% of Subtotal (1)			15%	$923,205
I&C Work - 15% of Subtotal (1)			15%	$923,205
Civil Work - 10% of Subtotal (1)			10%	$615,470.14
Architectural Allowance - 10% of Subtotal (1)			10%	$615,470
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			10%	$615,470
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$923,205
Subtotal (2)				***$9,847,522***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$1,600,222
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$3,200,445
Construction Contingency - 25% of Subtotal (2)			25%	$4,000,556
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$800,111
Subtotal (3)				***$9,601,334***
Total Estimated Construction Cost				**$19,449,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Bus Maintenance Facility
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #4 - Bus Maintenance Facility

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 1 mgd AWT	SF	7,975	$200	$1,595,000
Diversion Structure	LS	1	$14,000	$14,000
Influent Pump Station	hp	20	$540	$10,800
Influent Piping	LF	2,482	$300	$744,480
Install 1 mgd of MBR System	mgd	1	$2,334,000	$2,334,000
Install 1 mgd RO System	mgd	1	$750,000	$750,000
Install 1 mgd UV System	mgd	1	$370,000	$370,000
Effluent Pump Station	hp	68	$540	$36,829
Effluent Piping	LF	1,109	$28	$31,052
Land Acquisition	LS	1	$500,000	$500,000
Subtotal (1)				***$6,386,161***
Electrical Work - 15% of Subtotal (1)			15%	$957,924
I&C Work - 15% of Subtotal (1)			15%	$957,924
Civil Work - 10% of Subtotal (1)			10%	$638,616.14
Architectural Allowance - 10% of Subtotal (1)			10%	$638,616
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			10%	$638,616
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$957,924
Subtotal (2)				***$10,217,858***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$1,660,402
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$3,320,804
Construction Contingency - 25% of Subtotal (2)			25%	$4,151,005
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$830,201
Subtotal (3)				***$9,962,412***
Total Estimated Construction Cost				**$20,180,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Stewart Park
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #5 - Stewart Park

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 1 mgd AWT	SF	7,975	$200	$1,595,000
Diversion Structure	LS	1	$14,000	$14,000
Influent Pump Station	hp	20	$540	$10,800
Influent Piping	LF	7,286	$300	$2,185,920
Install 1 mgd of MBR System	mgd	1	$2,334,000	$2,334,000
Install 1 mgd RO System	mgd	1	$750,000	$750,000
Install 1 mgd UV System	mgd	1	$370,000	$370,000
Effluent Pump Station	hp	74	$540	$39,901
Effluent Piping	LF	2,218	$28	$62,104
Subtotal (1)				***$7,361,725***
Electrical Work - 15% of Subtotal (1)			15%	$1,104,259
I&C Work - 15% of Subtotal (1)			15%	$1,104,259
Civil Work - 10% of Subtotal (1)			10%	$736,172.48
Architectural Allowance - 10% of Subtotal (1)			10%	$736,172
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			10%	$736,172
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$1,104,259
Subtotal (2)				***$11,778,760***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$1,914,048
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$3,828,097
Construction Contingency - 25% of Subtotal (2)			25%	$4,785,121
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$957,024
Subtotal (3)				***$11,484,291***
Total Estimated Construction Cost				**$23,263,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

MAPS Facility
Project Construction Cost Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #6 - MAPS Facility

Description	Unit	Quantity	Unit Price	Item Total
Installation of Building for 1 mgd AWT	SF	7,975	$200	$1,595,000
Diversion Structure	LS	1	$14,000	$14,000
Influent Pump Station	hp	20	$540	$10,800
Influent Piping	LF	42	$300	$12,672
Install 1 mgd of MBR System	mgd	1	$2,334,000	$2,334,000
Install 1 mgd RO System	mgd	1	$750,000	$750,000
Install 1 mgd UV System	mgd	1	$370,000	$370,000
Effluent Pump Station	hp	72	$540	$38,758
Effluent Piping	LF	1,584	$28	$44,352
Subtotal (1)				***$5,169,582***
Electrical Work - 15% of Subtotal (1)			15%	$775,437
I&C Work - 15% of Subtotal (1)			15%	$775,437
Civil Work - 10% of Subtotal (1)			10%	$516,958.19
Architectural Allowance - 10% of Subtotal (1)			10%	$516,958
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (1)			10%	$516,958
Miscellaneous Equipment Costs - 15% of Subtotal (1)			15%	$775,437
Subtotal (2)				***$8,271,331***
Direct Project Administration Cost - 10% of Subtotal (2)			10%	$1,344,091
Planning/Design/Engineering Cost- 20% of Subtotal (2)			20%	$2,688,183
Construction Contingency - 25% of Subtotal (2)			25%	$3,360,228
Regulatory Permitting/Monitoring Costs - 5% of Subtotal (2)			5%	$672,046
Subtotal (3)				***$8,064,548***
Total Estimated Construction Cost				**$16,336,000**

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Colorado Yard/Memorial Park
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #2 - Colorado Yard/Memorial Park

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	20	$0.12	$28,182
Operate 1 mgd of MBR System	mgd	1	$100,000	$100,000
Operate 1 mgd RO System	mgd	1	$600,000	$600,000
Operate 1 mgd UV System	mgd	1	$30,000	$30,000
Effluent Pump Station	hp	66	$0.12	$93,589
Total				***$850,000***
Escalated Cost				$19,037,025

Assumptions:

MBR, RO, and UV system costs include annualized membrane and/or lamp replacement costs

Total costs have bee

Prepared By: Sarah Munger

Checked By:

Approved By:

Civic Center Parking
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #3 - Civic Center Parking

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	20	$0.12	$28,182
Operate 1 mgd of MBR System	mgd	1	$100,000	$100,000
Operate 1 mgd RO System	mgd	1	$500,000	$500,000
Operate 1 mgd UV System	mgd	1	$30,000	$30,000
Effluent Pump Station	hp	72	$0.12	$101,456
Total				***$760,000***
Escalated Cost				$17,021,340

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Bus Maintenance Facility
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #4 - Bus Maintenance Facility

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	20	$0.12	$28,182
Operate 1 mgd of MBR System	mgd	1	$100,000	$100,000
Operate 1 mgd RO System	mgd	1	$600,000	$600,000
Operate 1 mgd UV System	mgd	1	$30,000	$30,000
Effluent Pump Station	hp	68	$0.12	$95,820
Total				***$850,000***
Escalated Cost				$19,037,025

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

Stewart Park
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #5 - Steward Park

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	20	$0.12	$28,182
Operate 1 mgd of MBR System	mgd	1	$100,000	$100,000
Operate 1 mgd RO System	mgd	1	$600,000	$600,000
Operate 1 mgd UV System	mgd	1	$30,000	$30,000
Effluent Pump Station	hp	74	$0.12	$104,275
Total				***$860,000***
Escalated Cost				$19,260,990

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

MAPS Facility
Project O&M Estimate

Project Title: City of Santa Monica Distributed Recycled Water Treatment Facility

Item: Site #6 - MAPS Facility

Description	Unit	Quantity	Unit Price	Item Total
Influent Pump Station	hp	20	$0.12	$28,182
Operate 1 mgd of MBR System	mgd	1	$100,000	$100,000
Operate 1 mgd RO System	mgd	1	$500,000	$500,000
Operate 1 mgd UV System	mgd	1	$30,000	$30,000
Effluent Pump Station	hp	72	$0.12	$101,456
Total				***$760,000***
Escalated Cost				$17,021,340

Assumptions:

Prepared By: Sarah Munger

Checked By:

Approved By:

MWH®

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