Sewer System Master Plan Update

City of Huntington Beach

July 05, 2024

→ The Power of Commitment



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ES-1. Executive Summary

This report summarizes the results and recommendations of the Sewer System Master Plan Update project for the City of Huntington Beach. The Sewer System Master Plan Update (SMP) was prepared by GHD in close coordination with the City of Huntington Beach (City) staff. The SMP report will be used to guide improvements to the City's sanitary sewer system to accommodate current and future development and to support the City in continuing to provide a high level of service to its customers. The City will use the results of this project, in conjunction with other planning and investigative efforts, to prioritize areas of the sanitary sewer system for replacement and rehabilitation work.

This Executive Summary is presented in three parts:

- Purpose of SMP and System Overview – describes the impetus for the sewer master plan and provides context and background on the City's sanitary sewer system.
- SMP Preparation - describes the scope and methodologies of the hydraulic modeling effort, including key planning and technical assumptions incorporated into the sewer system capacity analysis.
- Capital Improvement Program Recommendations – describes methodologies and strategies involved in assessing system risk, condition, design basis capacity and solutions, capacity improvement project priorities for both gravity sewers and lift station priorities, and estimated probable costs associated with all recommendations as part of a 10-year capital improvement program (CIP).

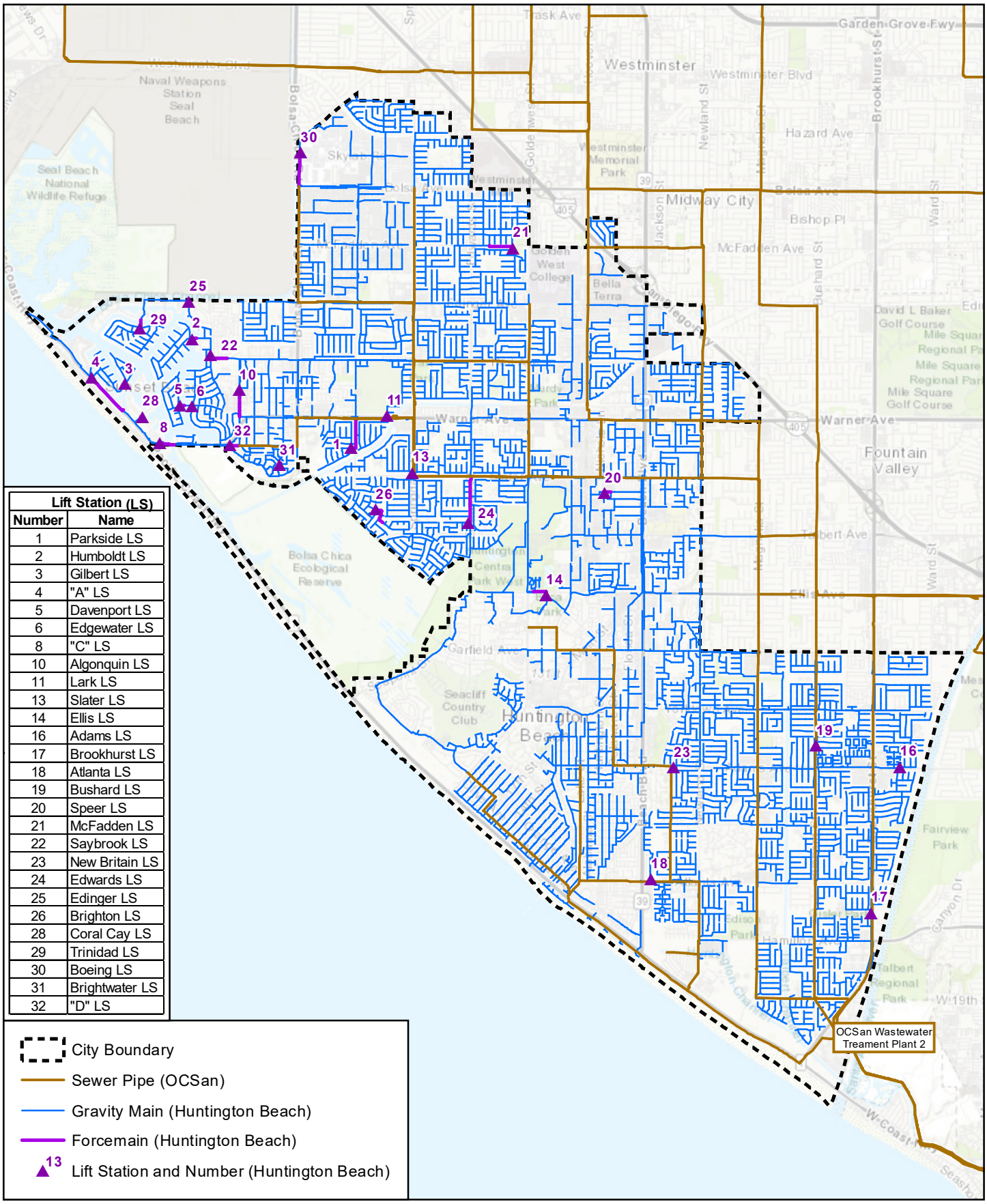
ES-2. Background and Purpose of SMP and System Overview

The City of Huntington Beach (City) was founded in the 1880's and incorporated in 1909. The study area for the SMP includes areas within the City boundary and small tributary portions of the Cities of Westminster, Seal Beach, Newport Beach, and Fountain Valley. The population has increased from 11,000 in 1960 to over 200,000 in 2023, due to its increase in commercial and industrial opportunities and development.

The SMP is a critical tool in aligning the existing condition of the system with ongoing operation, rehabilitation, and maintenance. Development of a SMP includes tasks that directly address compliance actions established as part of the recent Sewer System Management Plan (SSMP) update of 2022. In addition, the SMP will allow the City to maintain compliance with state laws that require development and implementation of a SMP under the State Water Resources Control Board (SWRCB) Waste Discharge Permit. The last SMP was completed in August 2003, which furthers the need for updating a comprehensive guiding document. The City is committed to maintaining a high level of service to its customers and this SMP will provide the City with a comprehensive decision making guide for planning and maintaining its sewer assets over the next 10 years.

To understand system needs and prioritize investments for the next 10 years, the City contracted with GHD to prepare and deliver the objectives of the SMP. An all-pipes dynamic hydraulic sewer model was built, calibrated, and used to develop a 10-year CIP plan for the City to address existing, near-term, and future development-based capacity deficiencies for both gravity sewers and lift stations and associated forcemains. The City performed lift station assessments to provide a basis for current condition and hydraulic modeling was performed for lift station capacity and operations. Together, the condition assessment findings and modeling results contributed to the lift station CIP recommendations. Then, the findings from both modelling and condition assessments are captured and presented as CIP improvements in this SMP report.

The modeled sewer system consists of approximately 360 miles, or 1,900,000 feet of sanitary sewer system, 27 lift stations, and 3 miles of forcemains. Wastewater treatment and disposal are provided through the Orange County Sanitation District (OCSan). **Figure ES.1** displays the existing sanitary sewer system showing City owned lift stations and City owned and managed sewers themed by diameter.



Lift Station (LS)	
Number	Name
1	Parkside LS
2	Humboldt LS
3	Gilbert LS
4	"A" LS
5	Davenport LS
6	Edgewater LS
8	"C" LS
10	Algonquin LS
11	Lark LS
13	Slater LS
14	Ellis LS
16	Adams LS
17	Brookhurst LS
18	Atlanta LS
19	Bushard LS
20	Speer LS
21	McFadden LS
22	Saybrook LS
23	New Britain LS
24	Edwards LS
25	Edinger LS
26	Brighton LS
28	Coral Cay LS
29	Trinidad LS
30	Boeing LS
31	Brightwater LS
32	"D" LS

Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Existing Sewer System and Service Area

Project No. 12585300
Revision No. 1
Date 4/2/2024

FIGURE ES.1

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Print date: 02 Apr 2024 - 14:29

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

ES-3. SMP Preparation

A dynamic hydraulic model of all public right-of-way sewer pipelines in the system was built using Innovyze's InfoWorks ICM v. 2023.2. The model was developed through a systematic process to accurately portray and predict existing and future system capacities.

ES-3.1 Hydraulic Evaluation Considers Existing and Future Planning Scenarios

An existing conditions scenario was developed to reflect current capacity of the collection system based on existing development and flow monitoring data. Existing base wastewater flow (dry weather residential and commercial usage-based sewer loads) was based on average winter water use records for both residential and commercial sources from 2018. The future development scenarios assumed near-term and future (2040) development conditions and involved updating existing base wastewater flow (BWF) to account for recent development projects, planned development projects, potential development projects, and development of select vacant parcels, in accordance with the designated land use classifications. In aggregate, these modified BWFs represent the future (2030) scenario. Timing for the cumulative development of land within the study area was considered in the hydraulic analysis with recently developed and planned projects assumed to happen for the near-term scenario, and all remaining potential development assumed to be completed for the future (2040) scenario.

ES-3.2 Calibrated Dynamic Model Informs Capacity and Planning

A dynamic hydraulic model of the City's sanitary sewer system was built to estimate flow inputs, route flows, and assess the system capacity. The model was based on data from the City's Geographic Information System (GIS) and additional information provided by the City staff. Flow monitoring data from 24 area-velocity flow meters from a carefully planned flow monitoring effort, conducted by the flow monitoring consultant, ADS Environmental Services as part of this project, were reviewed and used to calibrate the model during dry and wet weather conditions.

The model integrates various dry and wet weather flow parameters to determine system capacity under different flow and planning scenarios. Key flow components in the model include BWF, groundwater infiltration (GWI), and rainfall-dependent inflow and infiltration (RDI&I). Of these, RDI&I has the biggest impact on peak wet weather flows; therefore, the basis for CIP projects and recommendations is a future (2040 development) wet weather scenario. Furthermore, the model shows no overflows occurring under existing or future dry weather scenarios, whereas the model shows overflows occurring during wet weather scenarios.

ES-3.3 Design Basis Criteria

Calibrated dry weather flow (DWF) and wet weather flow (WWF) parameters were checked to determine their applicability for use in identifying capacity deficiencies under future conditions and for sizing future sewers. The term 'Design Basis' refers to the set of criteria and conditions used for formulating CIP actions and recommendations. For this SMP, it consists of a future 2040 development and WWF condition model scenario, with the following assumptions:

Future Water Use from Parcels Experiencing No Growth: it is assumed that there will be no significant increases (i.e. from higher water use) or decreases (i.e. from water conservation) in existing usage rates for parcels that show no appreciable changes in zoning, land use, dwelling type, or development status between existing and future scenarios.

Future RDI&I Contributions: No increases or decreases in I&I were applied to system sewers in the near-term and future scenarios, from existing or future development.

Wet Weather Flow: A real storm from March of 2023 (a 2-3 year 24-hour event) was scaled up to a 10-year 24-hour design storm rainfall event and applied and used in all model simulations evaluating capacity for the City. This design rainfall event was applied to the calibrated future wet weather model to determine peak design state. The storm produces 3.7 – 3-8 inches of rain in 24 hours and has a peak intensity of .49 inches/hour.

Boundary Conditions: This SMP benefited from utilizing the OCSan model as the foundation for integrating the City's geographic information system (GIS) into the SMP model. This allows the more accurate modelling of the dozen locations at the service area boundary where flows originating from outside the City's service area, carried by the OCSan trunks, would pass through and comingle with the 225 locations within the City's service area where City sewers enter the OCSan trunks, as they would do in reality. This also provides more realistic depictions of head-discharge and potential backwater relationships that are experienced in several areas of the service area under peak wet weather conditions. **Figure ES.2** is a simplified schematic of the system flow configuration, and shows the locations of the 24 flow meters, lift stations, and interconnectivity of the City and OCSan systems.

Peak-on-Peak Design Storm Timing: To elicit a worst-case scenario, the design storm was timed to cause its peak RDI&I to coincide with peak BWF, to produce a roughly peak-on-peak response in most areas of the service area.

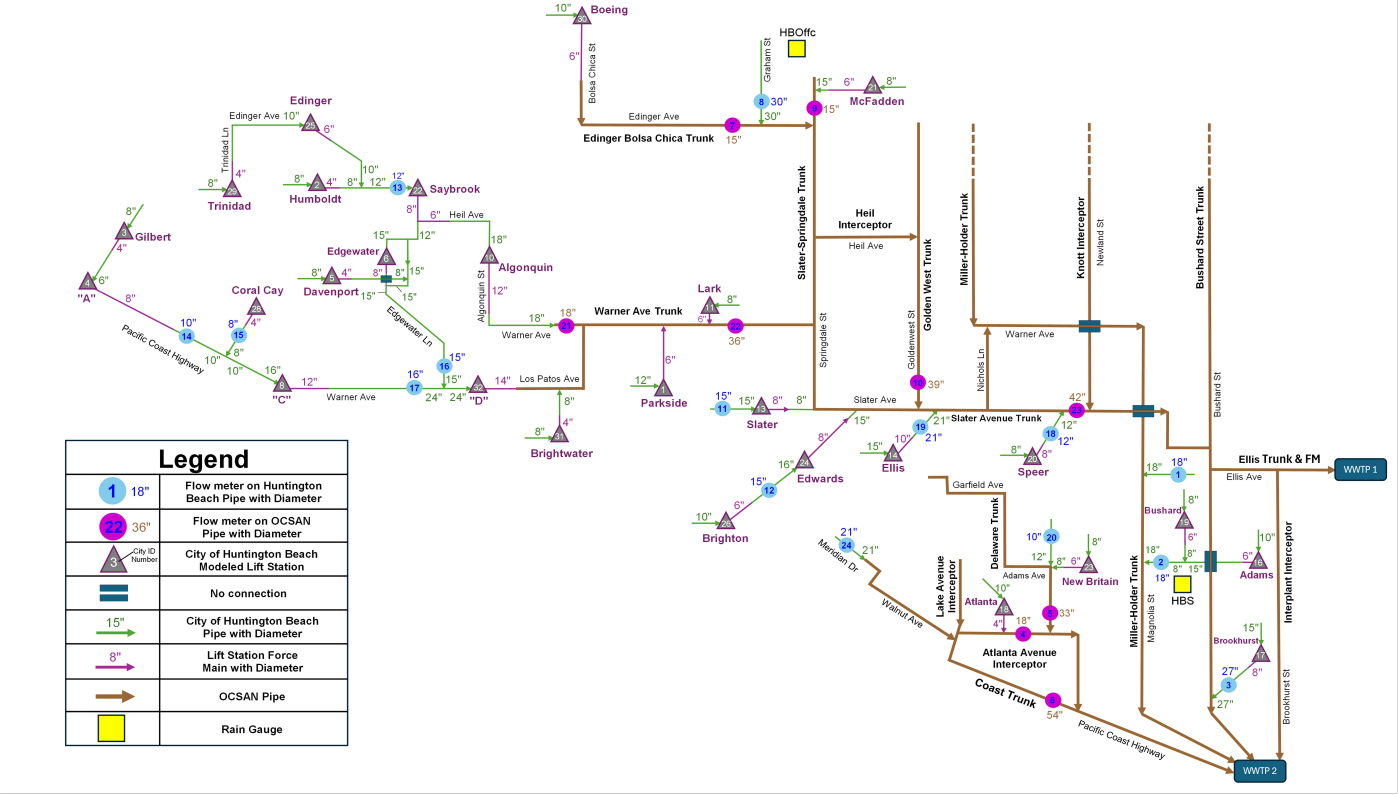


Figure ES.2 Schematic of Calibration Flow Meters, Basins, and Rain Gauges

ES-3.4 Hydraulic Capacity Results

ES-3.4.1 Gravity Sewers

City design standards define an addressable wet weather capacity deficiency as any gravity pipe or connected manhole that experiences a full flowing capacity or a ratio of depth of flow to pipe diameter (d/D) of 1.0 or greater, and the distance from highest flow level, or depth from flow level to ground surface being less than 5.0 feet.

No triggered deficiencies or sanitary sewer overflows (SSOs) were observed during any dry weather model scenarios within the system. The wet weather calibration storm of March 2023 was deemed to be a 2-3 year 24-hour storm, triggered 39 capacity deficiencies totalling 11,184 feet of pipe, and contributed to 2 small modeled SSOs totalling 9,100 gallons.

The Design Basis model scenario (based on the 10-year 24-hour design storm), triggered 69 addressable capacity deficiencies totalling 18,366 feet (ft) of pipe, and contributed to 6 modeled SSOs totalling 430,000 gallons.

ES-3.4.2 Lift Stations

A desktop evaluation of the hydraulic components was performed using key model output exported from existing and future model scenarios. The evaluated criteria include peak flows, velocities, forcemain headloss, pump cycle time, and pump/system curve operation. The hydraulic model was also used to determine pumping capacities, wet well capacities, and risk of overflow at and just upstream of each lift station as well as within each lift station's tributary area. Understanding the operation and capacity of the lift stations will enable the City to make operational decisions to plan and design future lift station improvement projects, as appropriate. Further, having a timeframe and approximate location of potential overflows will aid the City in making operational decisions during emergencies.

Results of the emergency storage analysis show that 21 of the 27 lift stations have an overflow potential within their tributary area after 24 hours from initial pump failure. Brookhurst and Slater show cumulative overflow volumes well over 500,000 gallons, while Ellis, "A" and Algonquin are the next highest three, totaling between 286,000 to 243,000 gallons. In total, 8 lift stations have cumulative SSOs over 100,000 gallons during the WWF design storm condition. The first SSO is modeled to occur between 4 and 5 hours after shutdown during dry weather, while the first SSO is modeled to occur between 3-4 hours after shutdown during wet weather.

ES-4. Capital Improvement Program Recommendations

ES-4.1 Gravity Sewer CIP Project Solution Model Scenarios

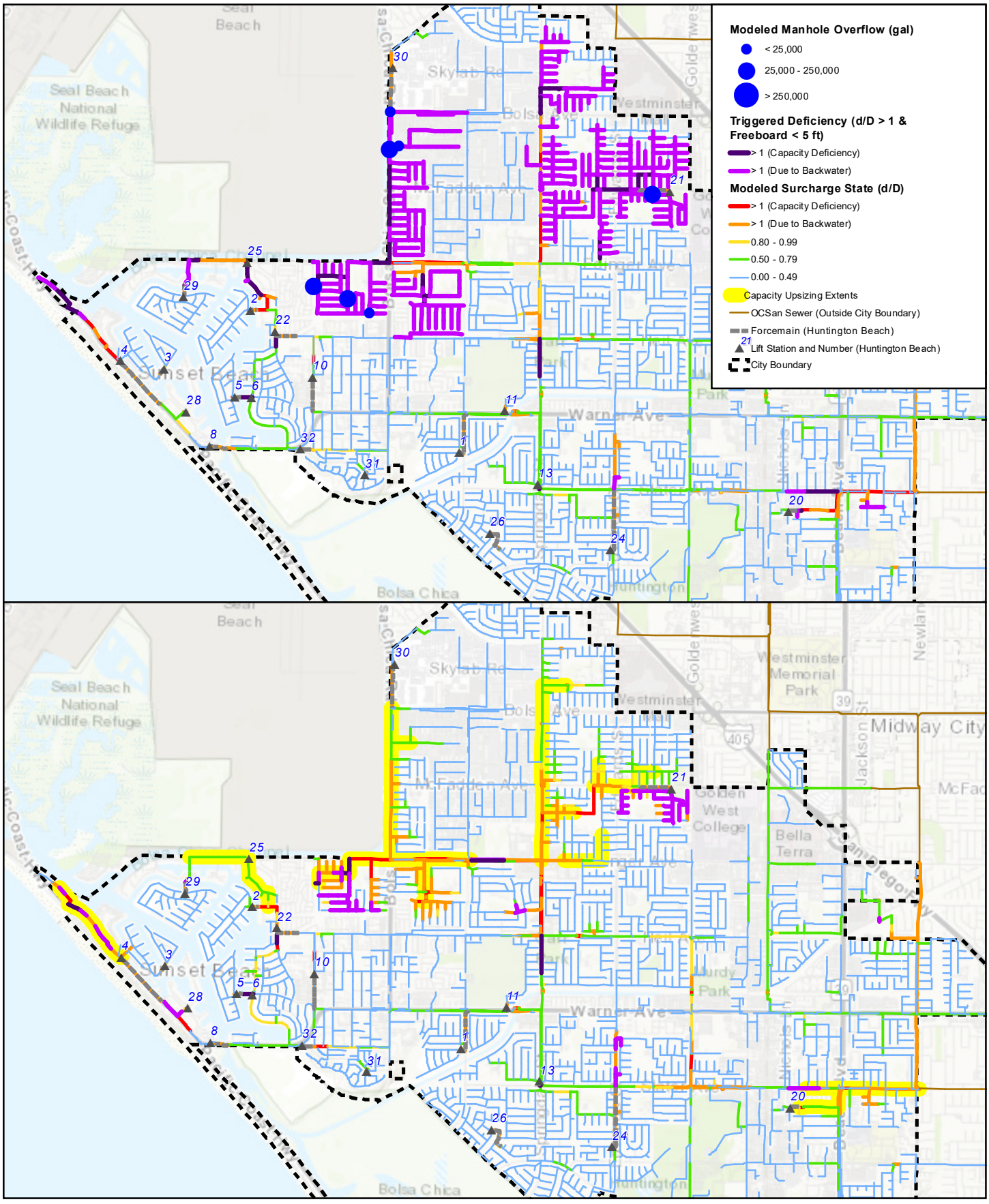
Capacity upsizing in the gravity sewer system was considered in various combinations to determine the most beneficial solutions for the City through the year 2034. This analysis considers hydrologic and hydraulic inputs and outputs. These model scenarios include combinations of pump setting adjustments and capacity upsizing that address eliminating triggered deficiencies, reduce hydraulic grade lines (HGLs), eliminate modelled overflows, and reduce peak wet weather flows to the OCSan system and it's wastewater treatment plants (WWTPs). **Table ES.1** displays the results from the CIP solution modelling organized by owning entity.

The overwhelming majority of the system's deficiencies reside in the north half of the system, therefore, the following **Figure ES.3** focuses on the situation in that part of the system, showing the design basis hydraulic results and then the state of the system after capacity upsizing solutions have been implemented in those same areas.

Table ES.1 Comparison of Future Design Basis vs CIP Basis Scenario Results under 10 yr 24 hour Design Storm

Metric	HB Sewers Only FUDB WWF (10 yr 24 hr DS)	HB Sewers Only CIP Basis*	OCSan Sewers Only FUDB WWF (10 yr 24 hr DS)	OCSan Sewers Only CIP Basis*	Entire Service Area FUDB WWF (10 yr 24 hr DS)	Entire Service Area CIP Basis*
Total Volume of Overflow (gal)	194,700	0	235,300	0	430,000	0
Number of SSOs	4	0	2	0	6	0
Number of Surcharged Pipes	877	456	109	120	986	576
Total Length Surcharged (ft)	205,935	93,373	34,493	42,666	240,428	136,039
# Surcharged due to Capacity Def	127	67	28	26	155	93
Total Length of Surcharged due to Cap Def (ft)	29,277	16,329	13,871	11,846	43,148	28,175
Number of Surcharged Pipes within 5 ft of Surface	629	117	20	8	649	125
Total Length Surcharged Pipes within 5 ft of Surface (ft)	153,350	24,521	9,084	4,642	162,434	29,163
# Surcharged and within 5 ft of Surface due to Capacity Def	61	10	8	3	69	13
Total Length of Surcharged within 5 feet of Surface due to Capacity Deficiency	12,916	2,079	5,450	2,437	18,366	4,516

*CIP Basis refers to the Design Basis model plus all Capacity Upsizing



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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Pre vs Post Capacity Upsizing (North)
Future 10 yr 24 hr Design Storm
Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **4/2/2024**

FIGURE ES.3

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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

ES-4.2 Gravity Sewer CIP Project Summary

Sixteen (16) distinct open-cut capacity upsize projects were developed that would provide immediate and long-term benefits to the City. Open-Cut (Dig and Replace) project costs were derived from the City's 2023 Edinger Avenue Sewer Improvement Project, which comprised 7 construction project bid tabulations from 7 area contractors. A project received an 'HB' prefix if the domain and/or ownership is clearly the City's. If the sewer(s) are owned by the OCSan district, then they show an 'OC' prefix before the project ID.

Then, logic and criteria were developed to score upsize projects relative to each other to determine which projects should be addressed firSt Specifically, the 16 gravity upsize projects were grouped into quartiles for the following categories:

- Length of sewer pipes upstream of CIP project (total length of all pipes in a given project's tributary area):
- Largest diameter within the CIP project's extent
- Peak wet weather flow (WWF) (from the Future Design Basis with 10 yr 24 hr storm simulation)
- SSOs upstream of CIP project pipe; (SSOs in tributary area)
- Reduces or even eliminates additional upstream deficiencies if constructed

Though most categories were simply given a score of 1 to 4 (1 being in the lowest quartile, 4 being in highest quartile), scores from categories that eliminated SSOs and upstream deficiencies were given more weight since they aligned with the City's SMP goals and levels of service.

Then, the implementation strategy attempted to find the best balance between maximizing reduction of risk, I&I, and working efficiently within manageable geographic areas. Though the quartile rankings provided a starting point, and the practical ordering and executing the gravity CIP projects considers engineering judgment as well as the following when breaking ties or projects very close in quartile rank:

1) Ability to solve largest and/or highest number of triggered hydraulic deficiencies.
2) Ability to eliminate largest overflows (by volume and number)
3) Addresses the greatest number of high-risk sewers/assets
4) Minimal public right of way disruption (including pavement removal on streets with recent pavement projects, easements, and general accessibility)

Table ES.2 displays the execution ranking and overarching phase recommended for constructing each gravity sewer CIP project. The executable rankings generally follow the quartile rankings but may not quite align completely. Further, the phases allow the City more flexibility, as in the end, there is less difference between projects within a phase than between phases. In other words, if the City deems that project HB_10 actually should go ahead and be constructed before any others in phase 3, it would be fine to do so, but all projects in phases 1 and 2 should be constructed before any in phases 3 and 4.

Further, OC_03, though scoring third in quartile rank for reasons of large tributary area, pipe diameter, and peak flows, is somewhat dependent on all of the CIP project success upstream of it. A hydraulic model run was done to see the impact of completing all of the upstream projects first, and though hydraulic grade lines (HGLs) and flows seen in project OC_03 sewers increase slightly, it is a very expensive project that could be in a 'wait to see what actually happens to the system in 10 years' approach, or near to the next master plan update. At that time, most if not all of the upstream CIP projects will have been built, and a model run could determine if it is still needed. The same logic applies to project HB_09. It may not be necessary and is dependent on the success of project OC_02 and further flow monitoring in the area. The 12-inch sewer that flows west along Edinger which sends all of the flow this project carries has not been flow monitored as part of this project and should be monitored as part of a post-construction monitoring phase, to determine flows in the OC_02 project area as well as this area.

Figure ES.4 shows the locations of the 16 projects, color coded to match **Table ES.2's** phase distinctions. Each project also shows its executable rank in parentheses. Certainly, the City should complete projects OC_01, and OC_02 as soon as possible, and would receive the highest return on investment from the construction of those two projects above all others.

Therefore, although the grand total for gravity portion of the CIP shows $66,354,000, the SMP recommends the implementation of 14 of the 16 projects, or all projects in phases 2-4. As mentioned, the phase 5 projects are conditional, making the ‘Recommended’ project probable cost total of $53,878,000.

Table ES.2 Gravity Sewer CIP Projects

	Within CIP Project			Within Tributary Area								
Gravity Project ID	Count of Pipes	Length (ft)	*Max Diameter in Project (in)	Count of Pipes	*Length (ft)	*Peak WWF (MGD)	*SSOs Upstream	*Eliminates SSOs	Total Cost	Quartile Score	Executable Rank	Implementation Phase
OC_01	21	8,232	24	333	89,645	7.20	Yes	Yes	$14,295,000	36	1	1
OC_02	13	5,212	21	425	107,382	1.36	Yes	Yes	$8,366,000	28	2	1
HB_04	13	3,383	15	73	19,099	0.79	Yes	Yes	$4,932,000	22	3	1
HB_13	4	1,139	18	240	61,144	1.26	Yes	Yes	$1,848,000	21	4	2
HB_06	11	2,623	15	198	50,579	1.08	Yes	Yes	$3,833,000	19	5	2
HB_05	11	1,941	15	114	30,101	0.81	No	No	$2,610,000	14	6	2
HB_03	10	1,966	12	99	19,250	0.80	No	No	$2,734,000	12	7	3
HB_08	8	1,706	15	103	25,924	0.92	No	No	$2,475,000	15	8	3
HB_11	5	1,069	15	101	26,543	1.02	No	No	$1,610,000	15	9	3
HB_10	8	2,062	15	112	24,524	1.44	No	No	$2,556,000	14	10	3
HB_01	20	3,509	10	66	13,960	0.75	No	No	$3,901,000	10	11	4
HB_02	9	2,092	12	83	13,481	0.70	No	No	$2,909,000	9	12	4
HB_07	4	773	10	47	11,554	0.32	No	No	$859,000	9	13	4
HB_12	3	683	12	17	4,771	0.57	No	No	$950,000	9	14	4
HB_09[1]	8	2,213	10	60	15,969	0.39	No	No	$2,418,000	11	15	5
OC_03[1]	8	3,974	48	4,201	1,007,685	21.50	Yes	Yes	$10,058,000	22	16	5
Grand Total	156	42,573	48	6,272	1,521,611	21.50	-	-	$66,354,000	-	-	-
Cond Total	16	6,187	48	4,261	1,023,654	21.50	-	-	$12,476,000	-	-	-
Recc Total	**140**	**36,386**	24	2,011	497,957	7.20	-	-	**$53,878,000**	-	-	-

*Indicates parameter considered in quartile scoring/ranking (yellow text)

[1] Conditional projects should be only implemented after implementation of all projects in earlier phases and further flow monitoring warrant their need

ES-4.2 Lift Station CIP Project Summary

Recommendations for the City's lift stations were developed based on the desktop condition assessment efforts as well as the pump hydraulic capacity and pump operation evaluations. Specifically, improvements were generated where maintaining if not enhancing usability and accessibility for the lift station was necessary, as well as optimizing pump operations. The hydraulic modelling of pumps evaluated peak flows, velocities, forcemain headloss, pump cycle time, and pump/system curve operation. For this SMP, recommendations were separated and organized by site, structural, mechanical, hydraulic (pumping), and electrical improvements.

Opinions of probable cost for the lift station recommendations are based on similar recently completed projects. If a City approved contract bid was unavailable for an item, commensurate regional bids were used to influence the cost basis.

Ranking and prioritizing the lift station improvements was not as straightforward as for the gravity sewer improvement projects. The City had already pre-determined a list of organized and prioritized improvements, with many lift stations slated for full replacement. A few condition based improvements were added, but the majority of the findings from the desktop condition assessment exercise matched what the City was already recommending in its own 2023 lift station CIP liSt

However, a significant hydraulic evaluation of each the lift station's pumping operation and capacity was undertaken, and these findings are listed here with an overarching hydraulic priority shown as well. Then, a final implementation phase is presented that while considers the City's final 2023 Lift Station CIP priority ranking, offers an updated ranking and phase that includes the hydraulic observation and recommendation portion from this SMP's efforts.

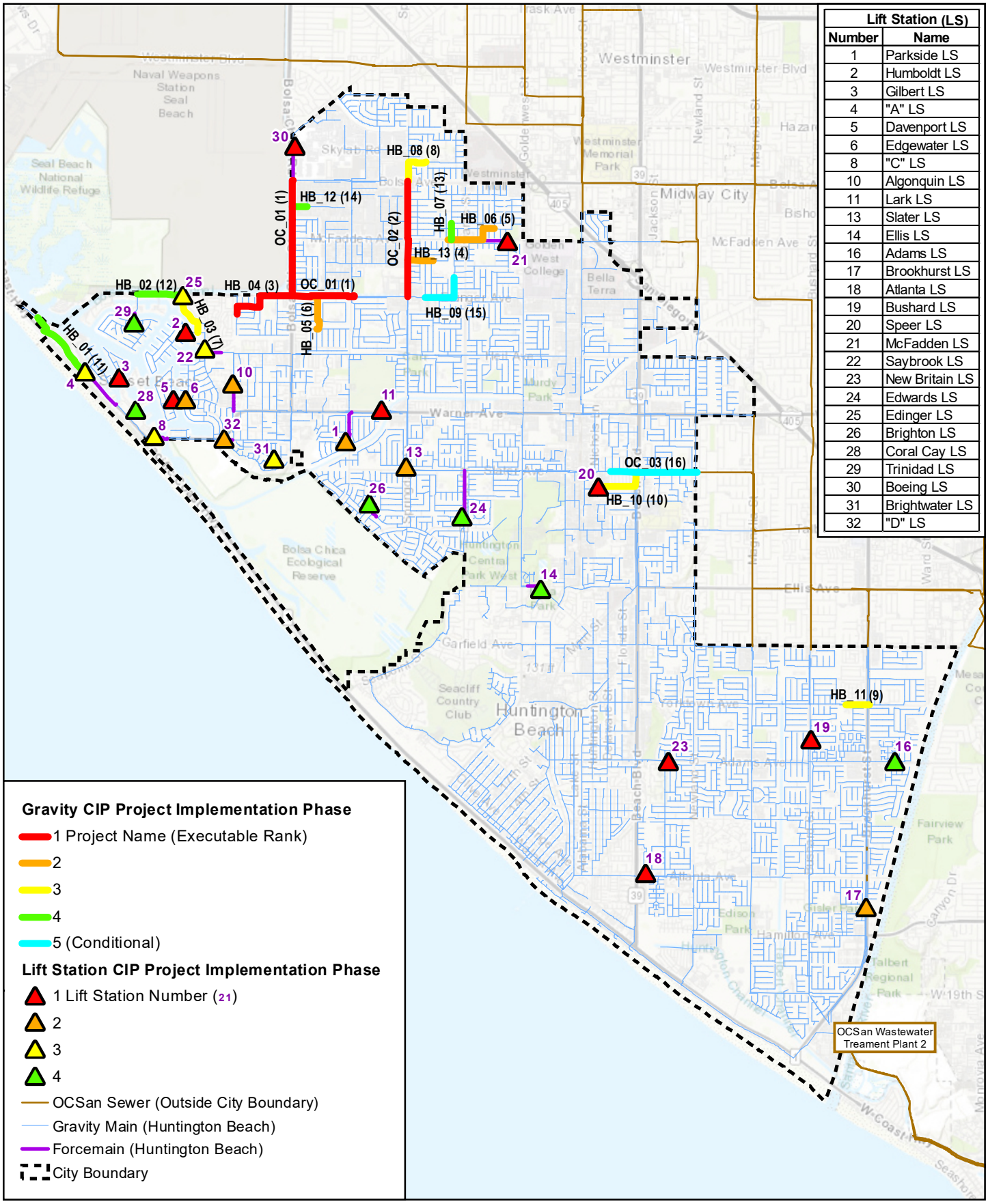
The City may continue as per their 2023 ranking, but this list offers a plan that could be utilized based on condition, level of service, and hydraulic/pumping/operational issues. **Table ES.3** presents the lift station CIP projects and **Figure ES.4** shows the gravity sewer projects as well as the lift station projects, color coded by the phase that is recommended for each, in a heat map fashion, with most urgent phase 1 projects in red, moving through to lowest priority projects in phase's 4 and 5 in green and blue.

Table ES.3 Lift Station CIP Project Implementation Plan

Station Number ID	Station Name	Original Const-ruction Year	Most Recent Update	Condition Recommendation Summary	Hydraulic Recommendation Summary	City Priority Rank	Hydraulic/ Pumping Priority (1 Highest, 6 Least)	Final Rank	Priority Phase	Total Estimated Probable Cost
21	McFadden	1972	In Constructi on	Complete Replacement.	Increase wet well size and pumping capacity as part of replacement redesign.	1	1	1	1	$2,732,000
30	Boeing	2006	NA	Mechanical piping and valve replacements.	Perform in-situ pump operations test; Modify pump size accordingly. Address foam issues.	14	1	2	1	$1,614,000
23	New Britain	1972	NA	Complete Replacement.	Perform in-situ pump operations test; Modify pump size accordingly (one pump should run during PDWF, and two during PWWF).	4	2	3	1	$5,350,000
2	Humboldt	1964	In Constructi on	Complete Replacement.	Increase wet well operational volume; Consider a new pump that runs at or beyond the Best Efficiency Point (BEP).	NA	3	4	1	$4,933,000
3	Gilbert	1967	NA	Complete Replacement.	Increase wet well operational volume.	2	3	5	1	$4,350,000
11	Lark	1969	NA	Complete Replacement.	Increase wet well operational volume; Perform in-situ pump operations test; Modify pump curve accordingly.	3	3	6	1	$5,050,000
18	Atlanta	1964	1969	Complete Replacement.	Increase wet well operational volume. Re-evaluate design of pump and forcemain. Consider enlarging the forcemain before replacing the pump.	6	3	7	1	$5,550,000
20	Speer	1968	NA	Complete Replacement.	Raise the lead pump on elevation by 0.3 - .5 ft.	7	4	8	1	$4,550,000
5	Davenport	1963	2020	Complete Replacement.	Increase wet well operational volume; Perform in-situ pump operations test; Modify pump curve accordingly.	NA	4	9	1	$4,500,000
19	Bushard	1976	NA	Complete Replacement.	No hydraulic issues	5	6	10	1	$4,550,000
1	(Old – Graham~1965; New - Parkside~2019)	1965	2019	Site is not secure. Install 150 kWH on-site backup generator with screening.	No hydraulic issues	8	6	11	2	$521,000
32	Station D	2005	2013	Replace onsite stationary generator and add backup pump system.	No hydraulic issues. Add backup pump system for pump station redundancy and reliability.	9	6	12	2	$228,000

Station Number ID	Station Name	Original Const-ruction Year	Most Recent Update	Condition Recommendation Summary	Hydraulic Recommendation Summary	City Priority Rank	Hydraulic/ Pumping Priority (1 Highest, 6 Least)	Final Rank	Priority Phase	Total Estimated Probable Cost
10	Algonquin	2014	2019	Remove and replace both submersible pumps within 3 years.	Increase wet well operational volume; Perform in-situ pump operations test; Modify pump curve accordingly.	12	5	13	2	$1,430,000
17	Brookhurst	2007	2017	Replace onsite stationary generator, spray epoxy coating on wet well; upgrade/modify pumps within next 10 years.	Perform in-situ pump operations test; Modify pump size accordingly.	19	2	14	2	$814,000
6	Edgewater	1964	2020	Install fall protection grating at valve vault.	Perform in-situ pump operations test; Modify pump size accordingly. Monitor forcemain condition.	23	3	16	2	$41,000
13	Slater	2021	NA	Already completed; in-situ pump operations testing required.	Perform in-situ pump operations test; Modify pump size accordingly. Monitor forcemain condition.	NA	2	15	2	$8,000
4	Station A	2007	2021	Mechanical piping and valve replacements.	Perform in-situ pump operation test to confirm the pump is not operating below the MCSF. If below, coordinate with manufacturer and monitor pump condition.	10	4	16	3	$211,000
8	Station C	2017	NA	Mechanical piping and valve replacements.	Perform in-situ pump operations test; Modify pump size accordingly.	17	4	17	3	$321,000
22	Saybrook	2022	NA	Already completed in 2021. Air scrubber for future odor issues.	Continue to ease pressure and velocity on forcemain during storms > 2 years, by opening outlet to east (to Algonquin)	24	4	18	3	$121,000
25	Edinger	2008	NA	Spray epoxy coating on wet well within next 3 to 5 years. Install fall protection. Replace centrifugal pumps within next 3 years.	Re-evaluate pump curve at next replacement.	15	5	19	3	$1,304,000
31	Brightwater	2013	NA	Install fall protection grating at valve vault.	Perform in-situ pump operations test; Verify flow is greater than MCSF. Consider a slightly lower capacity pump at next pump replacement	22	5	20	3	$41,000
16	Adams	2011	NA	Spray epoxy coating on wet well within next 3 to 5 years. Install fall protection.	No hydraulic issues	13	6	21	4	$921,000

Station Number ID	Station Name	Original Const-ruction Year	Most Recent Update	Condition Recommendation Summary	Hydraulic Recommendation Summary	City Priority Rank	Hydraulic/ Pumping Priority (1 Highest, 6 Least)	Final Rank	Priority Phase	Total Estimated Probable Cost
				Replace pumps within next 3 years.						
14	Ellis	1995	NA	Spray epoxy coating on wet well within next 3 to 5 years. Install fall protection. Replace mechanical pipeline and valves within 3 to 5 years.	No hydraulic issues	11	6	22	4	$301,000
28	Coral Cay	2007	NA	Spray epoxy coating on wet well within next 3 to 5 years.	No hydraulic issues	16	6	23	4	$58,000
24	Edwards	2010	NA	Replace pumps within next 5 years. Install fall proection. Other mechanical and valve replacements.	No hydraulic issues	18	6	24	4	$599,000
26	Brighton	2010	NA	Replace onsite stationary generator, spray epoxy coating on wet well.	No hydraulic issues	20	6	25	4	$481,000
29	Trinidad	2016	NA	Install fall protection grating at valve vault.	No hydraulic issues	21	6	26	4	$41,000
Totals										**$50,620,000**



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

Project No. 12585300
Revision No. 0
Date 4/2/2024

Prioritized and Phased CIP Implementation Plan

FIGURE ES.4

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Executive Summary\Figure ES.4_Phase and Prioritized Gravity CIP.mxd
Print date: 03 Apr 2024 - 09:41

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

ES-4.3 CIP Implementation Strategy

This section brings both gravity and lift station project recommendations into one comprehensive prioritized and phased implementation plan. It captures the gravity and lift station CIP improvement project costs, as well as line items for other key City programs like the Annual Sewer Lining Program, Organization Video Inspection Program, Residential Overlay Program, Edinger Sewer Murdy Channel Parkside Lane project, and the PCH Restroom Sewer Lift Station Project.

The structure of this detailed implementation plan accounts for lift station projects currently in design or construction phases or recently completed by laying out specific projects that fit this category, though it should be noted that total costs associated with them are not included in the total 'Recommended Plan' cost as part the 10-year CIP. **Table ES.4** shows all CIP projects (both gravity and lift station), as well as the other programs and projects introduced above, with cost and timing over the next 10 years. The 'Fiscal Years' columns show the year that the CIP project should commence and includes additional years if the project may take more than one year, as is the case for gravity sewer project OC_01.

Table ES.4 All-Asset Comprehensive CIP Project Implementation Plan

				Costs					Fiscal Years		
Phase	Gravity CIP Project	Lift Station (LS) CIP Project	Other	Gravity CIP	LS CIP	Other	Grand Total	Recc[2] Total	Gravity CIP	LS CIP	Other
1	OC_01[1]	McFadden		$14.30	$2.73		$17.03	$17.03	25, 26, 27	25	
	OC_02	Boeing		$8.37	$1.61		$9.98	$9.98	28	25	
	HB_04	New Britain		$4.93	$5.35		$10.28	$10.28	29	26	
		Humboldt			$4.93		$4.93			23	
		Gilbert			$4.35		$4.35	$4.35		26	
		Lark			$5.05		$5.05	$5.05		27	
		Atlanta			$5.55		$5.55	$5.55		27	
		Speer			$4.55		$4.55	$4.55		28	
		Davenport			$4.50		$4.50			24	
		Bushard			$4.55		$4.55	$4.55		29	
2	HB_13	Parkside		$1.85	$0.52		$2.37	$2.37	30	30	
	HB_06	Station D		$3.83	$0.03		$3.87	$3.87	30	30	
	HB_05	Algonquin		$2.61	$1.43		$4.04	$4.04	30	30	
		Brookhurst			$0.81		$0.81	$0.81		30	
		Edgewater			$0.04		$0.04	$0.04		30	
		Slater			$0.01		$0.01	$0.01		30	
3	HB_03	Station A		$2.73	$0.21		$2.95	$2.95	31	31	
	HB_08	Station C		$2.48	$0.32		$2.80	$2.80	31	31	
	HB_11	Saybrook		$1.61	$0.12		$1.73	$1.73	32	31	
	HB_10	Edinger		$2.56	$1.30		$3.86	$3.86	32	32	
		Brightwater			$0.04		$0.04	$0.04		32	
4	HB_01	Adams		$3.90	$0.92		$4.82	$4.82	33	33	
	HB_02	Ellis		$2.91	$0.30		$3.21	$3.21	34	33	
	HB_07	Coral Cay		$0.86	$0.06		$0.92	$0.92	34	33	
	HB_12	Edwards		$0.95	$0.60		$1.55	$1.55	34	34	
		Brighton			$0.48		$0.48	$0.48		34	
		Trinidad			$0.04		$0.04	$0.04		34	
5	HB_09 (Conditional)			$2.42			$2.42		35		
	OC_03 (Conditional)			$10.06			$10.06		35		
Annual or as per FY			Annual Sewer Lining Program			$15.13	$15.13	$13.75			25-34
			Video Inpsection Program			$0.55	$0.55	$0.50			25-34
			Residential Overlay Program			$1.65	$1.65	$1.50			25-34
			Edinger Sewer Murdy Channel Parkside Lane			$2.00	$2.00				23
			PCH Restroom Sewer Lift Station			$5.57	$5.57	$5.57			25
Grand Total				$66.35	$50.43	$24.89	**$141.67**				
Recommended Total				**$53.88**	**$40.99**	**$21.32**		**$116.19**			

[2] 'Recc Total' columns do not include costs for Humboldt or Davenport lift stations, both of which are already in construction. The 'Recc Total' includes 'other' City program projects only from FY 2025 through FY 2035 or matching the 10 year period the CIP comprises.

ES-4.4 Conclusions and Other Recommendations

The City is mostly built out in terms of future development. This fact was supported by the hydraulic modelling in that additional loads to the system due to future development neither increased any deficient area or stretch of sewer over the threshold from being acceptable to deficient, from a capacity standpoint. This assertion was true during dry and wet weather scenarios. In other words, the same capacity upsize projects are necessary under existing and future development wet weather conditions.

In conclusion, the City's sanitary sewer system has adequate dry weather capacity for existing and projected future development conditions but has capacity deficiencies in specific areas during peak wet weather events in all development scenarios. In addition to implementing and phasing the CIP plan as laid out above, the City should proceed with the following recommendations:

- Continue to prioritize I&I Reduction, with emphasis on the collection and evaluation of data that achieves goals for improving level of service, reducing risk, and achieving a positive return on investment. Although the City should continue to maximize rehabilitating available public domain sewers in this study's flow monitoring basins 7, 8, 9, 13, 14, 15, 16, 17, 21, and 22, it should identify illicit storm laterals into the sanitary system, re-connect them to the storm system. High rates of inflow in these areas may be because of these illicit storm drain connections, which more detailed investigations there may uncover. Flow meter basin 7 is the highest priority area for further I&I investigations.
- The phased approach presented in this SMP allows for better tracking of rehabilitation and replacement project success through organization of implementation group by hydraulic boundary. Setting up pre and post flow monitoring will be more easily performed due to this and should be done for each of the flow monitoring basins mentioned in the first bullet point above.
- The desktop condition assessment and hydraulic model analysis provide for a clear roadmap of proactive investment in addressing structural, electrical, and mechanical issues with each lift station. Further, the hydraulic analysis provides for recommendations on which lift stations could benefit from performing more extensive in-situ pump operations tests, which will inform the needs for properly sizing of completely new lift stations, but also for existing lift stations that are not performing optimally.
- The emergency storage analysis should provide the City with information necessary to further establish a detailed emergency action plan in the event of any one or systemwide pump failure.
- The hydraulic model (InfoWorks ICM) is an invaluable tool for evaluating existing and future conditions. It should be updated as new information is obtained, namely when CCTV inspection work is performed and when construction of new sewer mains and post construction sewer flow monitoring has been performed. In conclusion, the results from the detailed hydraulic modeling effort and 10-year CIP plan prepared for this SMP will allow the City to continue to mitigate sanitary sewer system risk and maximize its capital program budget return on investment while providing the most hydraulic benefit in terms of I&I and overflow reduction potential.

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Acronyms and Abbreviations

AC	Asbestos cement pipe
ADS	ADS Consulting Engineers
approx	approximately
Ave	Avenue
BWF	base wastewater flow
CDMP	Community Development Major Projects
CDR	Center of Demographic Research
CI	commercial/industrial
CIP	capital improvement program
City	City of Huntington Beach
DIP	ductile iron pipe
dr	drive
DU	dwelling unit
DWF	dry weather flow
FM	Forcemain
ft	foot/feet
GIS	geographic information system
gpd	gallons per day
GWI	groundwater infiltration
H	hotel
HDPE	high density polyethylene
hr	hour(s)
I&I	inflow and infiltration
ICM	Integrated Catchment Modeling
ID	identification number
in	inch(es)
ln	lane
LS	lift station
MFR	multi-family residential
MGD	million gallons per day
mi	miles
MSL	mean sea level
NOAA	National Oceanic Atmospheric Administration
NT	Near-Term
OCSan	Orange County Sanitation District
O&M	Operations and Maintenance
PDWF	Peak Dry Weather Flow
PLP	Pipeline projects
PVC	Polyvinyl chloride
PWWF	Peak Wet Weather Flow
RDI&I	rainfall-dependent inflow and infiltration
RHNA	Residential Housing Needs Analysis
RTK	Rate, time, ratio of time to recession
sf	square foot (feet)
SMP	Sewer System Master Plan Update
SFR	single-family residential
SS	Sanitary sewer
SSMP	Sewer System Management Plan
st	street
SWRCB	State Water Resources Control Board
TAZ	Traffic Analysis Zone
VCP	vitrified clay pipe
WWF	wet weather flow
yr	year(s)

1. Introduction

This chapter provides an overview of the Sewer System Master Plan Update (SMP) for the City of Huntington Beach, CA. A brief description of the SMP project background, the scope of work, and a description of the report comprise the following sections of **Chapter 1**. Further, since the number and complexity of abbreviated terms is high, and to aid the reader, terms found in the List of Acronyms and Abbreviations are spelled out the first instance they occur in every chapter, instead of just once at the beginning of the report.

1.1 Background and Purpose

The City of Huntington Beach (City) was founded in the 1880's and incorporated in 1909. The City is located on the shore of the Pacific Ocean in northwestern Orange County. It is surrounded by Westminster to the north, Fountain Valley to the northeast, Costa Mesa to the east, Newport Beach to the southeast, Seal Beach and the U.S. Naval Weapons Station to the northwest, and the Pacific Ocean to the weSt The City covers an area of approximately 27 square miles.

The study area includes areas within the City boundary and small tributary portions of the Cities of Westminster, Seal Beach, Newport Beach, and Fountain Valley. These small areas are served through direct connections to the wastewater collection system of the City and have been included for evaluation purposes. Due to local topography, some areas within the City are served through a connection to the wastewater system of the City of Fountain Valley and are not included in the evaluation. The City's population has increased from 11,000 in 1960 to over 200,000 in 2023, due to its increase in commercial, industrial, and industrial opportunities and development.

The sewer system consists of approximately 360 miles, or 1,900,000 feet of sanitary sewer system, 27 lift stations, and 3 miles of forcemains. Wastewater treatment and disposal are provided through the Orange County Sanitation District (OCSan).

1.2 Sewer System Master Plan Update Objectives and Approach

The Sewer System Master Plan Update, hereinafter referred as the SMP, is a critical tool in aligning the existing condition of the system with ongoing operation, rehabilitation, and maintenance. Development of a SMP includes tasks that directly address compliance actions established as part of the recent Sewer System Management Plan (SSMP) update of 2022. In addition, the SMP will meet regulatory mandates and maintain compliance with state laws that require development and implementation of a SMP under the State Water Resources Control Board (SWRCB) Waste Discharge Permit. The last SMP was completed in August 2003, which furthers the need for a comprehensive guiding document.

The focus of this SMP is to develop a 10-year Capital Improvement Program (CIP) for the City with a focus on improvements and rehabilitation of failed or failing gravity, forcemain, and lift station assets as identified as part of the desktop condition assessment (for lift stations only) and capacity assessment efforts (both lift stations, forcemains, and gravity sewers).

The key goals of the SMP are as follows:

- Perform as-built research and data collection of the City's sanitary sewer system.
- Perform a desktop high level condition assessment of lift stations and forcemains.
- Build and validate an all-pipes dynamic hydraulic model using the City's geographic information system (GIS) data.

- Target key areas of the system for flow monitoring and install and measure flows at 24 locations for 2+ months to obtain dry and wet condition flows.
- Calibrate the all-pipes dynamic hydraulic model using observed flow data.
- Determine design basis criteria and scenarios for identifying capacity-based deficiencies in the system.
- Develop a 10-year CIP plan for the City to address existing, near-term- and future capacity-based deficiencies in the system. Prepare a comprehensive report documenting the evaluation findings and recommended investment, management, and planning strategies for determining and validating key planning and design decisions for the City's major conveyance assets.

1.3 Sewer Master Plan Update Organization

This SMP is organized systematically, generally following the order of the scope of services listed in **Chapter 1.2**. The following describes the contents of each chapter and appendices of this report.

Executive Summary: Provides a brief stand-alone summary of the SMP, with emphasis on the significant findings and recommendations.

Chapter 1. Introduction and Background: Presents background information on the purpose, scope, and objectives of the planning effort, and the contents and organization of this SMP.

Chapter 2. Existing Sanitary Sewer System Summary: Describes the existing service area, which includes the regional (OCSan) and City's current sanitary sewer system.

Chapter 3. Hydraulic Model Development: Summarizes the methodology, data import, creation, and model data validation of the dynamic hydraulic model of the City's sanitary sewer system.

Chapter 4. Planning Conditions. Discusses modeling considerations in this SMP, including the planning conditions and scenarios, existing and future land uses, water consumption data, and development assumptions for future scenarios.

Chapter 5. Sanitary Sewer System Flows and Model Calibration. Describes the wastewater flow concepts and the strategy for estimated loads to the model system. It also discusses the use of flow data and incorporation of the regional system's (OCSan) model and flows, and the City's flow and level sensor monitoring programs for model calibration.

Chapter 6. Hydraulic Capacity Analysis. Conveys the capacity analysis and design basis condition criteria and presents the results from the hydraulic capacity analysis for the existing and future design flow conditions.

Chapter 7. Inflow and Infiltration: Presents an evaluation and characterization of Rain Dependent Inflow & Infiltration (RDI&I) from the 2022-2023 flow monitoring efforts.

Chapter 8. Assessment of Wastewater Lift Stations. Describes the approach used to assess sanitary sewer lift stations and the findings from the desktop condition assessment and hydraulic modeling analysis of them.

Chapter 9. Capital Improvement Program Development: Presents a summary of recommendations that form the basis for the CIP. The CIP includes project cost indices and considerations for pricing project solutions. Specific CIP projects and solutions to address capacity deficiencies identified in **Chapter 6**, and structural and operations and maintenance (O&M) deficiencies identified in **Chapter 8** are discussed and summarized in tables and figures.

Chapter 10. Capital Improvement Program Implementation and Recommendations: Presents potential prioritization and implementation strategies for the CIP projects and solutions identified in **Chapter 9**. It also contains conclusions and other recommendations the City may consider over the life of the 10-year CIP.

Appendix A. Future Planning Details: Presents details on data, methods, and results from the processing of planning information used to generate near-term and future development scenarios used in the hydraulic model.

Appendix B. Dry Weather Flow Calibration Plots

Appendix C. Wet Weather Flow Calibration Plots

Appendix D. Lift Station Hydraulic Analysis Details: Presents plan and profiles from the design basis condition for both dry and wet weather through the key stretches of each lift station. Also includes pump operation curves.

Appendix E. Lift Station Emergency Storage Analysis Details: Presents plan maps of hydraulic information (depth of highest flow level to surface~freeboard, SSOs) for all manholes within each lift station's tributary area from an emergency shutdown of power to that lift station. Results from the design basis condition for both dry and wet weather are presented.

Appendix F. Gravity Sewer CIP Project Details: Presents plan, profile, and detailed cost information for each gravity sewer upsize project. The profile shows the hydraulic grade line (HGL) for the pre and post upsizing model condition.

Appendix G. Lift Station Assessment Forms: Includes the raw Lift Station Assessment forms filled out by the City.

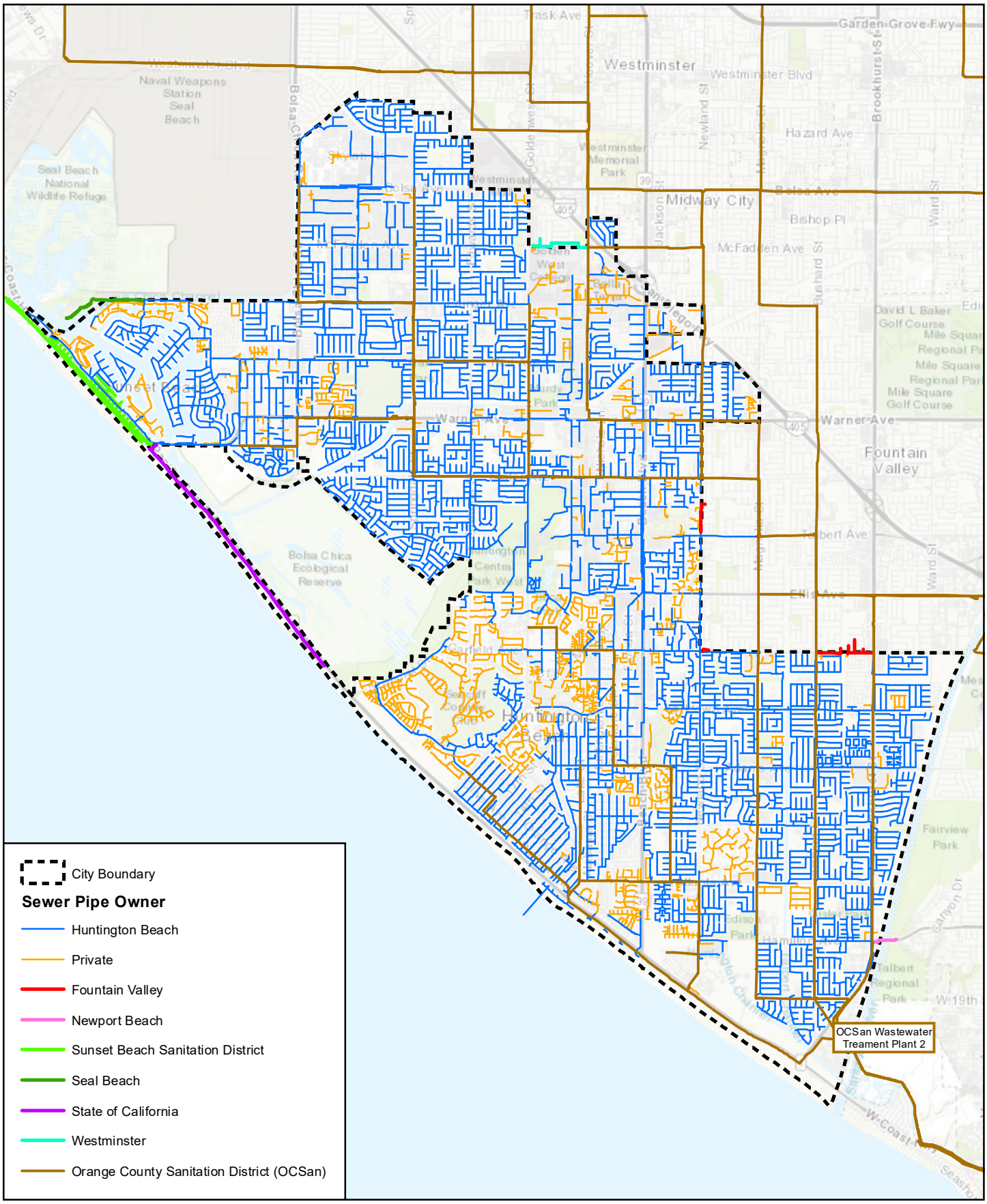
Appendix H. Lift Station CIP Project Details: Presents detailed cost information for each lift station CIP project.

2. Existing Sanitary Sewer System Summary

This chapter outlines the extent of the study area and summarizes the City's sanitary sewer system and service area.

2.1 Service Area

Located in Orange County, California, the City's service area is comprised of 28.33 square miles along the Pacific Ocean. The service area includes areas within the City boundary and small tributary portions of the Cities of Westminster, Seal Beach, Newport Beach, Sunset Beach, Fountain Valley, and the State of California. These small areas are served through direct connections to the wastewater collection system of the City and have been included for evaluation purposes. Due to local topography, some areas within the City are served through a connection to the wastewater system of the City of Fountain Valley and are not included in the evaluation. **Figure 2.1** displays the limits of the service area used in the sewer master plan update (SMP), which generally corresponds to the incorporated City boundary. It also shows the owner of sewer pipelines and shows the routing of flows east towards the OCSan Wastewater Treatment Plants.



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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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Sewer Master Plan Update

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Service Area

FIGURE 2.1

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 2.1 Service Area.mxd
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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

2.2 Existing Sewers, Lift Stations, and Basins

The City's existing sanitary sewer system currently consists of gravity sewers, lift stations, and forcemains, as presented in **Figure 2.2.** Each of these components are described in further detail below. Due to the City's generally flat conditions, the City also operates and maintains twenty-seven lift stations. The lift stations are assigned numerical values one through thirty-two and missing numbers are likely facilities that have previously been decommissioned in the paSt These facilities lift sewage from low points in the collection system to manholes at higher locations.

The Orange County Sanitation District (OCSan) is responsible for receiving, treating, and disposing of the wastewater generated in central and northwest Orange County, including the City's wastewater. In this regional management capacity, OCSan owns, operates and maintains the majority of the "backbone" wastewater collection trunk pipelines. As such, the City's local system generally discharges to larger OCSan facilities to convey wastewater to the regional treatment plant. The City connects to the OCSan system at 225 unique locations throughout the City. The collected wastewater is ultimately conveyed to OCSan's local wastewater treatment Plant No. 2, located at the south end of Brookhurst St within Huntington Beach. Flow travels through the system as follows:

- Flows originating east of Algonquin St flow to the Station "D" LS, located at the south end of Algonquin street. From there, flows are lifted to be transported with flows from the rest of the northern part of the City at the intersection of Slater Ave and Newland St
- Flows originating north of Slater Ave are combined with flows east of Algonquin Ave at the intersection of Slater Ave and Newland St Wastewater flows are then transported south by gravity on Newland St and east on Garfield Ave to meet with flows from the south part of the City.
- Flows from Ellis LS and south of Ellis Ave are transported south on Delaware St, Magnolia St, Bushard St, and Brookhurst St, connecting directly to Plant No. 2.

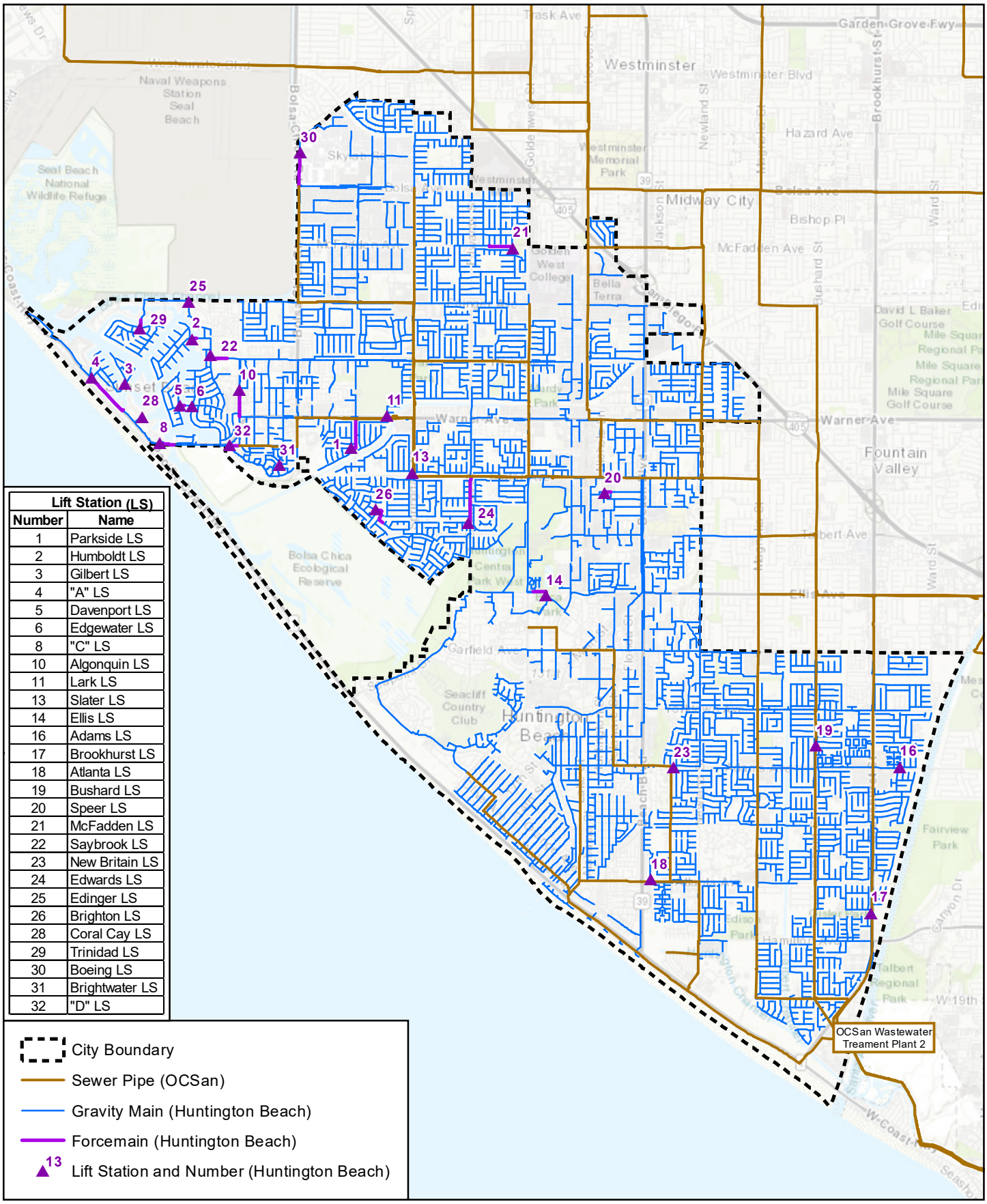
As previously stated, the City also owns and operates twenty-seven lift stations to hydraulically lift flow in low lying area into receiving sewers. **Figure 2.2** shows the location of each lift station and **Table 2.1** provides additional details. The depth of lift stations is based on topographic surface elevation to the invert of the lift station.

Figure 2.3 is a simplified schematic of the system presented and discussed above and provides an easier depiction of where lift stations are located, and how flows are generally routed throughout the City to arrive at the OCSan sewer system.

Table 2.1 Lift Station Additional Details

No.	Name	Address	Depth	No. Pumps	*Forcemain Info	On-Site Generator	SmartCover
1	Parkside LS	5475 Rivergate Dr	29’-0”	2	6" PVC - Approx. 0.31 mi	No	Yes
2	Humboldt LS	4076 Humboldt Dr	15’-8”	2	4" SS - Approx. 0.04 mi	No	Yes
3	Gilbert LS	3332 Gilbert Dr	14’-10”	2	4" CI - Approx. 0.05 mi	No	Yes
4	Station "A" LS	16702 PCH	31’-11”	2	8" HDPE - Approx. 0.41 mi	No	Yes
5	Davenport LS	4012 Davenport Dr	16’-8”	2	4" SST - Approx. 0.04 mi	No	Yes
6	Edgewater LS	16903 Edgewater Ln	22’-4”	2	8" PVC – Approx.0.01 mi	Yes	Yes
8	Station "C" LS	3819 Warner Ave	24’-5”	2	12" PVC - Approx. 0.12 mi	Yes	Yes
10	Algonquin LS	16729 Algonquin St	29’-7”	2	12" DI - Approx. 0.24 mi	No	Yes
11	Lark LS	16971 Lark Ln	15’-3”	2	6" AC - Approx. 0.03 mi	No	Yes
13	Slater LS	17482 Springdale St	27’-5”	3	4" PVC - Approx. 0.02 mi	Yes	Yes
14	Ellis LS	7165 Ellis Ave	33’-7”	3	10" PVC - Approx.0.14 mi	No	Yes
16	Adams LS	10221 Adams Ave	15’-3”	2	6" PVC - Approx. 0.01 mi	No	Yes
17	Brookhurst LS	21241 Brookhurst St	23’-2”	2	8" DI -Approx. 0.01 mi	No	Yes
18	Atlanta LS	8149 Atlanta Ave	20’-6”	2	6" AC - Approx. 0.02 mi	No	No
19	Bushard LS	19802 Bushard St	11’-8”	2	6" PVC - Approx. 0.02 mi	No	Yes
20	Speer LS	17632 Crabb Ln	15’-1”	2	8" PM/DI - Approx. 0.07 mi	No	Yes
21	McFadden LS	6832 McFadden Ave	17’-0”	2	6" PVC - Approx. 0.22 mi	No	Yes
22	Saybrook LS	16451 Saybrook Ln	21’-1”	2	8" PVC - Approx. 0.18 mi	Yes	Yes
23	New Britain LS	8262 Adams Ave	13’-7”	2	6" PVC - Approx. 0.02 mi	No	Yes
24	Edwards LS	6470 Balmoral Dr	19’-1”	2	8" PVC - Approx.0.42 mi	No	No
25	Edinger LS	4062 Edinger Ave	20’-9”	2	6" PVC - Approx. 0.01 mi	No	No
26	Brighton LS	5681 Brighton Dr	16’-7”	2	6" PVC - Approx. 0.18 mi	No	No
28	Coral Cay LS	17302 Coral Cay Ln	19’-0”	2	4" PVC - Approx.0.02 mi	No	Yes
29	Trinidad LS	16249 Trinidad Ln	20’-3”	2	4" SST - Approx. 0.08 mi	Yes	Yes
30	Boeing LS	14700 Bolsa Chica St	21’-8”	2	6" HDPE - Approx.0.30 mi	No	No
31	Brightwater LS	17413 Oakbluffs Ln	26’-9”	2	4" PVC - Approx. 0.02 mi	Yes	No
32	Station "D" LS	4410 Brightwater Dr	49’-0”	3	(2) 14" PVC - Approx. 0.08 mi	Yes	Yes

*PVC = Polyvinyl Chloride; HDPE = high density polypropylene; CI = Cast Iron; DI = Ductile Iron; AC = Asbestos Cement; SST= stainless steel



Lift Station (LS)	
Number	Name
1	Parkside LS
2	Humboldt LS
3	Gilbert LS
4	"A" LS
5	Davenport LS
6	Edgewater LS
8	"C" LS
10	Algonquin LS
11	Lark LS
13	Slater LS
14	Ellis LS
16	Adams LS
17	Brookhurst LS
18	Atlanta LS
19	Bushard LS
20	Speer LS
21	McFadden LS
22	Saybrook LS
23	New Britain LS
24	Edwards LS
25	Edinger LS
26	Brighton LS
28	Coral Cay LS
29	Trinidad LS
30	Boeing LS
31	Brightwater LS
32	"D" LS

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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Date **3/6/2024**

Existing Sewer System

FIGURE 2.2

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 2.2 Existing Sewer System.mxd
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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

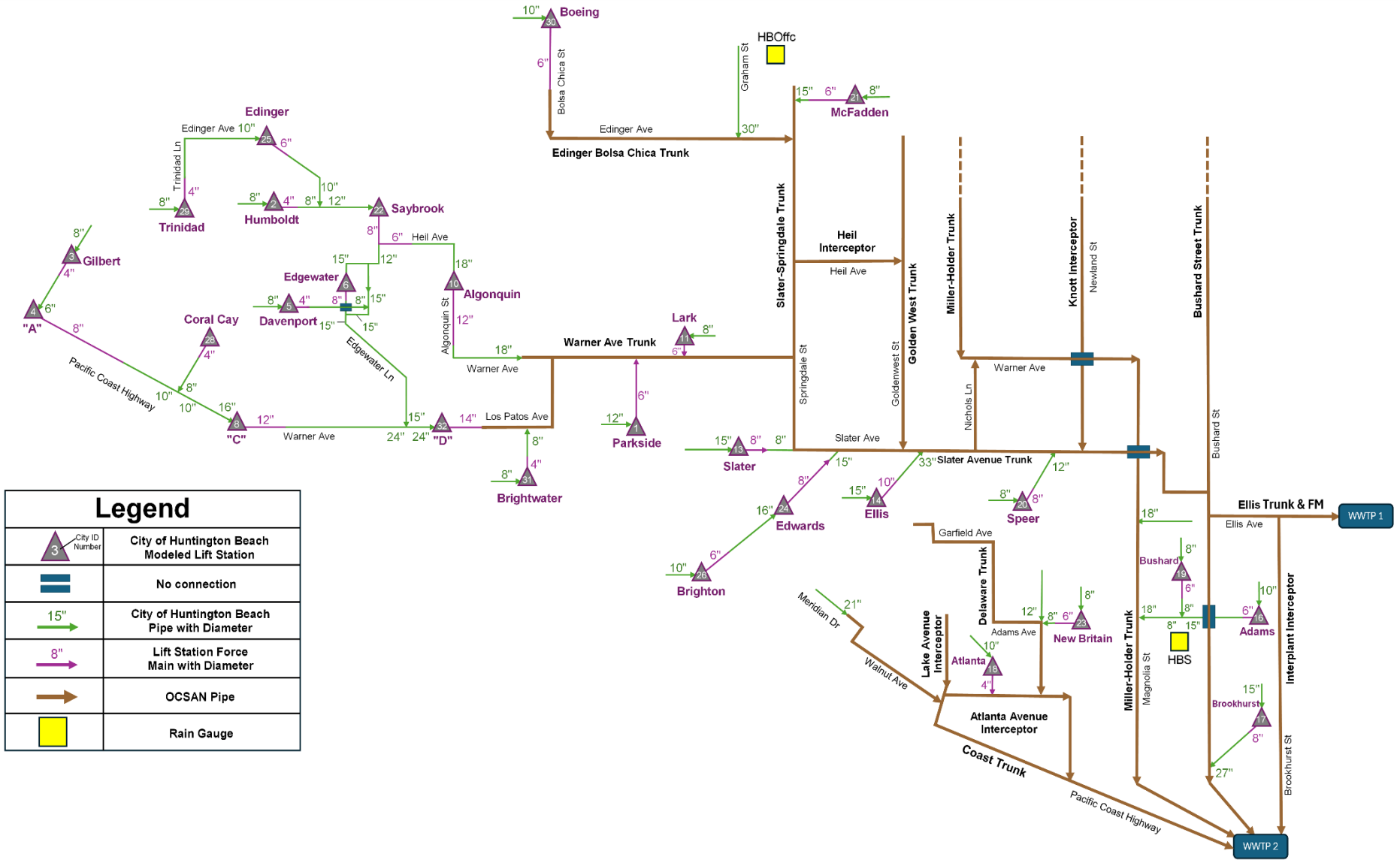


Figure 2.3 ***Existing Sewer System Schematic***

Construction of the City's sanitary sewer system began before 1900. However, the majority of the system appears to have been constructed to support the rapid growth that began in the 1960's. Although the City is substantially built out and only a minimal increase in future wastewater flows is projected, the City has recognized that the condition of the infrastructure needs to be further quantified and additional proactive provisions for long-term reliability implemented.

The sanitary sewer system is comprised of approximately 360 miles of wastewater pipelines ranging in size from 4 to 36 inches in diameter. Approximately 85 percent of the City's wastewater pipelines are 8 inches in diameter. The vast majority of the City's gravity sewers are constructed of vitrified clay pipe (VCP) . **Table 2.2** summarizes the approximate length of pipe for each diameter as a percentage within the City's system and **Figure 2.4** displays this same information.

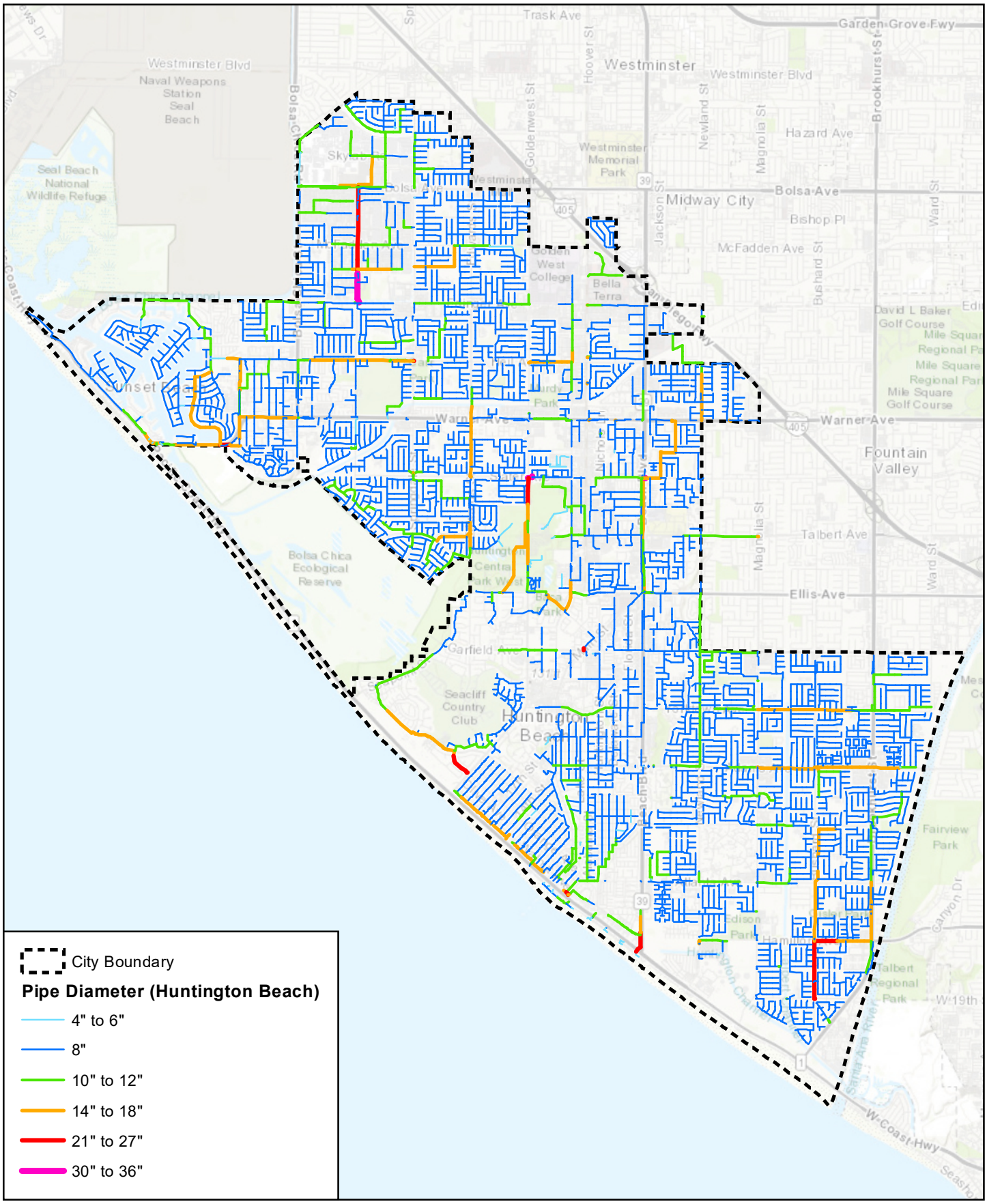
Table 2.2 Sewer System by Diameter and Length

Diameter (inches)	Length (ft)	Percentage of Entire System
4	3,085	0.2%
6	16,893	0.9%
8	1,599,237	83.3%
10	117,823	6.1%
12	83,464	4.3%
14	439	0.0%
15	62,438	3.3%
16	7,813	0.4%
18	15,126	0.8%
21	3,534	0.2%
24	2,851	0.1%
27	5,348	0.3%
30	1,314	0.1%
36	43	0.0%
Total	1,919,413	100%

Approximately 13% of the pipe in the system was rehabilitated utilizing trenchless rehabilitation since the completion of the 2003 master plan. **Table 2.3** summarizes the length of rehabilitated pipe by diameter.

Table 2.3 Summary of Pipeline Rehabilitation Activity (2003-2020)

Diameter (inches)	Length (ft)
8	238,232
10	6,990
12	1,032
15	2,669
24	495
Total	249,418



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Sewer Master Plan Update

Existing Sewer System by Diameter

Project No. **12585300**
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Date **3/1/2024**

FIGURE 2.4

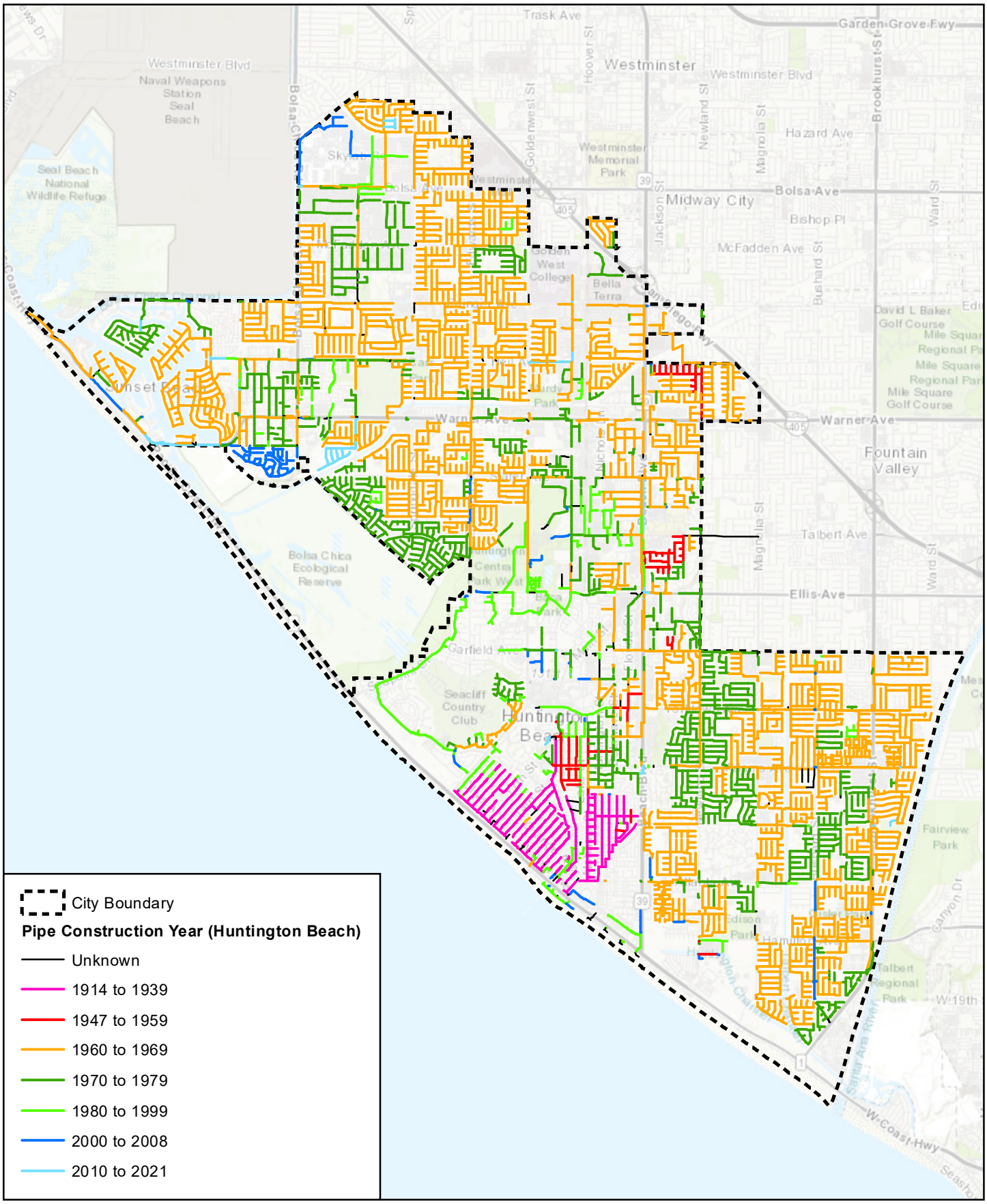
\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 2.4 Existing Sewer System by Diameter.mxd
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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

Overall, most of the sewer pipelines were installed between 1960 and 1969 with more expansions occurring in the 1970s and the 1980s to accommodate development in the City. **Table 2.4** presents the approximate length of pipe by installation age and **Figure 2.5** shows the age distribution in the sewer system.

Table 2.4 Sewer System by Age and Length

Year Constructed	Count	Length (ft)	Percentage of Entire System
Unknown	252	28,766	1.5%
1914 - 1939	319	78,893	4.1%
1947 -1959	142	37,827	2.0%
1960 - 1969	4,694	1,138,851	59.3%
1970 - 1979	2,057	459,982	24.0%
1980 - 1999	498	100,295	5.2%
2000 - 2008	249	47,225	2.5%
2010 - 2021	510	27,575	1.4%
Total	8,394	1,919,414	100%



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Map Projection: Lambert Conformal Conic
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Grid: Lambert Conformal Conic

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Sewer Master Plan Update

Existing Sewer System by Age

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Revision No. **1**
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FIGURE 2.5

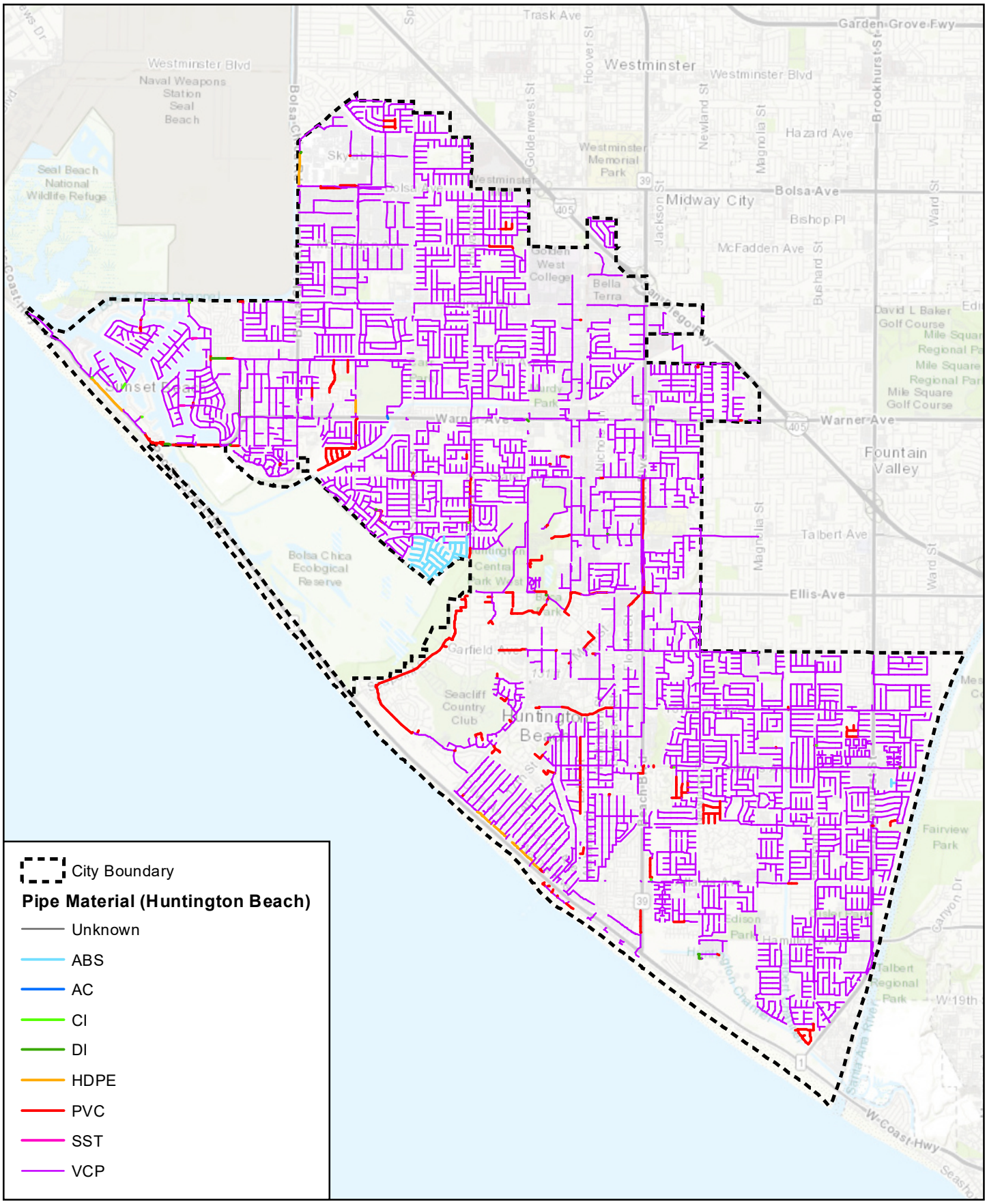
\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 2.5 Existing Sewer System by Age.mxd
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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

Pipe material can be a general indication of the age and condition of a pipe with the plastic materials being newer and typically in better condition that the older vitrified clay (VC) and asbestos cement (AC) materials. Approximately 94% of the installed pipe material consists of VC, AC, or “unknown” material (typically VC or AC for older pipe) (See **Table 2.5**). A small quantity of metal pipe, cast iron (CI), ductile iron (DI) and stainless steel (SST), exists and are primarily associated with the forcemain sewer lines. The remaining 6% of the pipes are plastic consisting of acrylonitrile butadiene styrene (ABS), polyvinyl chloride (PVC), or high-density polyethylene (HDPE) pipe. **Figure 2.6** shows the distribution of pipe materials throughout the sanitary sewer system.

Table 2.5 Sewer System by Material and Length

Diameter (inches)	Count	Length (ft)	Percentage of Entire System
Acrylonitrile Butadiene Styrene (ABS)	86	17,252	0.9%
Asbestos Cement (AC)	2	224	0.0%
Cast Iron (CI)	9	354	0.0%
Ductile Iron (DI)	31	3,168	0.2%
Polyvinyl Chloride (PVC)	449	82,827	4.3%
High Density Polyethylene (HDPE)	28	7,724	0.4%
Stainless Steel (SST)	4	769	0.0%
Vitrified Clay (VC)	7,784	1,807,091	94.1%
Unknown	1	5	0.0%
Total	8,394	1,919,413	100.0%



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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Existing Sewer System by Material

Project No. 12585300
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FIGURE 2.6

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 2.6 Existing Sewer System by Material.mxd
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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

3. Hydraulic Model Development

An all-pipes dynamic hydraulic model of the City's sanitary sewer system was built to estimate flow inputs, route flows, and assess the sanitary sewer system capacity under dry and wet weather conditions. This chapter discusses the modeling methodologies and software as well as the model network import, build, and validation processes. It also discusses the flow loading areas, including the delineation of subcatchments (areas tributary to the modeled system) used to define flow inputs into the model. The last section covers verification and validation of the physical model components.

3.1 Modeling Strategy

The City's 2022 geographic information system (GIS) database was the basis for an updated all-pipes dynamic hydraulic model used for this project. Innovyze's InfoWorks ICM (Integrated Catchment Modeling; v. 2023.2 Ultimate) was used as the modeling platform for hydraulic analyses on this project. InfoWorks ICM is a fully dynamic, hydraulic modeling package for the analysis of complex wastewater and drainage networks. Unlike static models, InfoWorks ICM realistically portrays the effects of surcharging, storage, and backwater of flows over time. InfoWorks ICM has a geo-centric interface with advanced tools for model construction, validation, calibration, and hydraulic analysis.

The hydraulic model network was developed though the following steps to ensure that the model accurately portrays and predicts existing and future system capacities. These steps and terms used in them are further described in the remainder of this and subsequent chapters.

- **Initial GIS Review:** The City's GIS data was imported into ESRI's ArcGIS environment, and the sanitary sewer system assets were reviewed for identification number (ID) correctness and topological integrity (the attributes match their related map features).
- **Import and Validation**: The sanitary sewer system network was imported into InfoWorks ICM for more advanced physical model build and validation including determining directional connectivity (all pipes are connected and flow in the correct direction) and data correctness using built-in inference and interpolation tools and queries. Details provided here in **Chapter 3**.
- **Water Billing and Land Use Analysis**: Water consumption, land use, and future development data were reviewed for use in estimating wastewater generation loads. Unit flow factors and diurnal flow curves were developed to estimate loads in the model. Details are provided in **Chapter 4**.
- **Delineate Subcatchments**: The service area was divided and delineated into manageable and logical subcatchments where flow inputs were applied to the physically modeled system.
- **Dry Weather Calibration**: Representative dry weather flow (DWF) days were selected from the flow monitoring period and the metered flows were compared to the model results. The model was calibrated by refining 24-hour diurnal profiles to match monitored flow volumes and peaks at each flow meter. Details are provided in **Chapter 5**.
- **Wet Weather Calibration**: Wet weather rainfall events were selected for use in wet weather flow (WWF) calibration. The wet weather parameters governing the volume and peak flow responses in terms of rain dependent inflow & infiltration (RDI&I), were developed and calibrated by comparing model results to monitored meter and observed overflow data for these periods. The model ran simulations over specific selected events in an iterative process to further refine and calibrate all short- and long-term wet weather parameters. Details are provided in **Chapter 5**.
- **Capacity Analysis and Design Basis Criteria**: The parameters used in the capacity analysis were defined and applied to the model. A design storm was developed using real storm data from the flow monitoring period and scaled up to match Orange County's accepted 10-year 24 hour storm profile (matches the Orange County Sanitation District's (OCSan) storm on intensity and shape, but with real City rainfall). The capacity analysis criteria include peak design storm flows, and depth-to-diameter (d/D) in surcharged pipes within five feet of the rim or surface. The term 'Design Basis' refers to all assumptions and conditions involved in creating a model scenario that when

simulated, provides a basis for determining deficiencies in the system worth addressing with capital improvement projects. Details are provided in **Chapters 5 and 6**.

- **Existing and Future Model Runs:** The calibrated model was run for existing, near-term, and future development load scenarios under design basis dry and wet (design storm) conditions. Details from these runs are shown in **Chapter 6**. The sewer reaches having capacity deficiencies were identified for further evaluation as part of the Capital Improvement Program (CIP) development and evaluation process, discussed in more detail in **Chapter 9**.
- **CIP Development**: As part of the detailed CIP evaluation, hydraulic improvement solutions were developed and tested using the calibrated model. Solutions and improvements included pipe upsizing/replacement and potential flow diversion, storage, and pumping optimizations. Details are provided in **Chapters 9 and 10**.

3.2 Modeled Sewers and Flow Loading Areas

The modeled sanitary sewer system is made up of facility assets from the City's sanitary sewer system. The core model assets are links and nodes, which represent sewer system elements such as pipes, manholes, pumps, weirs, orifices, gates, and wet wells as exists in the sewer system including elements in the OCSan system. The City's sewer system does not contain weir, orifices or gates; however, more complex orifices and gates reside on the OCSan owned modeled trunks outside the City limit and sewered service area. The City's sewer system drains to the Orange County Sanitation District's Collection system, connecting at more than 225 distinct locations. The City's model was integrated with the existing OCSan's sanitary system hydraulic model to allow for a more accurate depiction of the dynamic nature of flow from the City system into OCSan's system. Model results from later in this report highlight the reason and benefit for building the model in this way. Refer to **Figure 2.3** for a simplified schematic showing the interdependencies of both systems.

InfoWorks ICM uses subcatchments to define the hydrologic area tributary to each modeled manhole. Parcels were used as the basis for defining subcatchments. The subcatchments are discussed further in **Chapter 3.2.3.** Break nodes define places in the model that allow hydraulic boundaries or changes to occur that in reality may not have a physical manhole. For example, many of the flow control structures (weirs) are line (link) features in the model and require an upstream node and downstream node. However, in reality, there is just a stop log, board or some more permanent blockade that acts as the weir element, and likely sits inside an existing diversion manhole. So as not to duplicate manholes that do not actually exist, the model uses a break node for the downstream portion of the weir link, and thus has no physical properties like shaft area or chamber area. Other instances of break nodes are where underground pipe slope or size changes occur without a physical manhole. Proper modeling of pressurized mains (forcemains) requires the use of break nodes as well to connect the pump and first pressurized main downstream of it.

3.2.1 Modeled Sewers

The City's portion of the modeled network totaled 8,241 nodes and 8,450 links. This node total is comprised of manholes, storages (all lift station wet wells), and outfalls. The link total includes gravity mains, pressure/forcemains, pumps, weirs, and gates. The majority of the sluice gate and weir diversion structures exist on the OCSan system outside the City's service area. There are two sluice gates that represent the control mechanisms that may split flow out of the Saybrook lift station's southbound forcmain. The modeled network is shown on **Figure 3.1** Modeled Network. Note, that nodes are not included in the figure as they would detract from visually seeing the catchments and pipes. A breakdown of model elements, including OCSan, both within and outside the City, is presented **Table 3.1**.

Table 3.1 Model Elements By Owning Entity

Model Element	City of Huntington Beach	OCSan within Huntington Beach	OCSan outside Huntington Beach	Total
Gravity Mains	8,320	485	4,320	13,125
Manhole Nodes	8,113	459	4,491	13,063
Break Nodes	101	26	168	295
Outfall Nodes	0	4	8	12
Storage Nodes (All Lift Station Wet Wells)	27	0	0	27
Pumps (Links)	54	7	52	113
Forcemains (Links)	74	17	265	356
Weirs (Links)	0	8	159	175
Gates (Links)	2	2	37	41
Total Length (ft)	1,919,418	232,643	1,832,717	3,984,778
Total Length (miles)	364	44	347	755

3.2.2 Lift Stations

The City's sanitary sewer system has twenty-seven wastewater lift stations. All the City's lift stations are modeled to represent the wet wells storage volume, pumping capacities (head-discharge curves), and pump on/off wet well elevation set points that mimic the actual operating state of each lift station. Each of the City's lift stations are modelled to evaluate their operation based on available wet well and pump data. Each pump uses a head discharge curve which is based on flow pumped on the x axis, and system head on the y-axis. These curves were provided by the City and modified by GHD during validation and calibration accordingly.

Table 3.2 lists each City lift station's wet well size, bottom and top elevation of wet well, incoming pipe's invert, outgoing forcemain size and length, and the change of elevation from the incoming pipe invert to the downstream forcemain connection to the gravity system. Note that OCSan lift stations are not documented in the following tables. The data compiled in **Table 3.2** and **Table 3.3** is taken from the City's as-built drawings. A rigorous process of populating, correcting, and validating the entire system's pipe invert, depth to rim, and rim elevations (as outlined in **Chapter 3.3.1**), may have changed some of the lift station's final values, but the relative differences between the incoming gravity pipe and outgoing forcemain's depths and the wet well's remain as shown in **Table 3.2** and **Table 3.3**.

Table 3.2 Modeled City Lift Stations

Lift Station ID	Name	Model Node and GIS ID	Wet Well Area (sq ft)	Wet Well Bottom (ft above MSL)	Wet Well Top (ft above MSL)	Incoming Pipe Invert (ft)	FM Diameter (in)	FM Length (ft)	Change in Elevation (ft)
1	Parkside	13105	64.0	-23.0	4.8	-17.2	6	1,631	22.6
2	Humboldt	2568	12.6	-6.2	7.0	-4.2	4	216	4.3
3	Gilbert	3382	12.6	-3.2	7.0	-2.4	4	241	7.4
4	Station "A"	10780	58.5	-27.5	4.2	-15.2	8	2,142	13.1
5	Davenport	3759	12.6	-4.9	11.9	0.0	4	227	10.0

Lift Station ID	Name	Model Node and GIS ID	Wet Well Area (sq ft)	Wet Well Bottom (ft above MSL)	Wet Well Top (ft above MSL)	Incoming Pipe Invert (ft)	FM Diameter (in)	FM Length (ft)	Change in Elevation (ft)
6	Edgewater	3737	142.5	-13.5	3.5	-9.0	8	55	12.5
8	Station "C"	12860	300.0	-15.0	6.5	-11.0	12	654	15.2
10	Algonquin	3474	60.0	-11.5	-1.5	-3.0	12	1,243	39.2
11	Lark	3915	12.6	-10.8	-3.2	-9.8	6	134	7.9
13	Slater	4732	91.0	-25.0	-2.0	-15.8	6	83	13.7
14	Ellis	12061	224.0	-3.8	11.0	6.5	10	765	43.1
16	Adams	12064	70.0	-4.4	7.0	-0.4	6	71	7.4
17	Brookhurst	12069	136.0	-18.7	1.5	-11.4	8	56	11.2
18	Atlanta	11134	50.3	-15.7	2.0	-13.7	4	95	9.3
19	Bushard	7926	50.3	-4.3	4.0	-2.6	6	94	6.5
20	Speer	5002	50.3	4.0	15.0	8.0	8	362	12.1
21	McFadden	1614	12.6	-0.3	9.0	3.8	4	1,145	7.1
22	Saybrook	2825	82.5	-12.0	5.0	-6.3	6	212	4.3
23	New Britain	8320	50.3	-6.6	4.1	-5.5	6	127	7.5
24	Edwards	12067	125.7	-18.9	-3.1	-14.8	8	2,199	9.8
25	Edinger	12068	28.3	-7.8	5.1	-5.4	6	61	9.0
26	Brighton	5168	69.9	-18.2	-5.0	-13.1	6	926	9.4
28	Coral Cay	3939	84.4	-7.1	2.1	-4.1	4	91	3.8
29	Trinidad	13050	47.8	-10.0	9.3	-5.2	4	407	12.8
30	Boeing	12063	96.0	-5.7	13.1	2.1	6	1,569	4.3
31	Brightwater	11310	28.3	25.4	51.0	30.9	4	109	15.7
32	Station "D"	12090	120.3	-24.0	23.0	-16.4	(2) 14	439	52.9

Table 3.3 lists each lift stations pumps, with station's firm capacity (capacity with one lead pump in operation), in millions of gallons per day (MGD) and on/off set points for all pumps. The on-set points define the level in feet above mean sea level (MSL) when each pump turns on (on set point), and the off-set point defines the level that each pump turns off (off set point). The set points were provided by the City. It should be noted that Humboldt, Slater, McFadden, and Saybrook are in design and/or construction as of the time the model was built and their final values for pump on/off and wet well depths may be different than what is shown in **Table 3.2 and Table 3.3.**

Table 3.3 Lift Station Pumps and Pump Settings

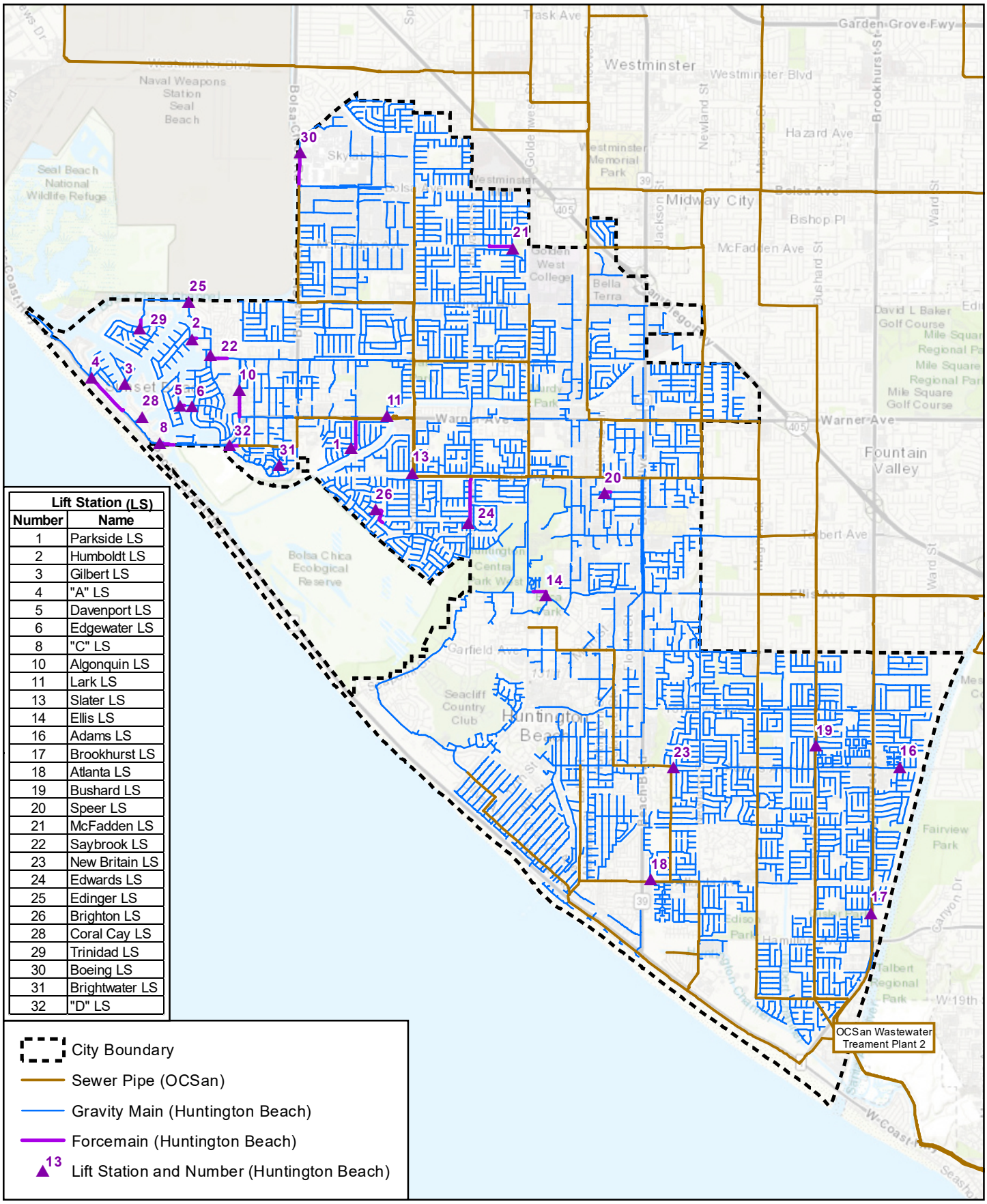
Lift Station ID	Name	Number of Pumps	Firm Capacity (mgd)	Pump(s)	Pump On Level (ft above MSL)	Pump Off Level (ft above MSL)	Depth from Top to Bottom of Wet Well (ft)
1	Parkside	2	0.69	Lead	-18.0	-20.5	27.8
				Lag	-17.5	-20.5	
2	Humboldt*	2	0.22	Lead	-4.4	-5.1	13.2
				Lag	-3.9	-5.1	
3	Gilbert	2	0.14	Lead	-1.9	-2.2	10.2
				Lag	-1.2	-2.2	
4	Station “A”	2	1.08	Lead	-24.5	-26.8	31.6
				Lag	-20.8	-26.8	
5	Davenport	2	0.29	Lead	-3.4	-3.8	16.8
				Lag	-2.7	-3.8	
6	Edgewater	2	1.44	Lead	-10.2	-11.8	21.9
				Lag	-9.2	-11.8	
8	Station “C”	2	1.73	Lead	-10.9	-12.0	21.5
				Lag	-10.2	-12.0	
10	Algonquin	2	1.37	Lead	-10.2	-11.0	9.8
				Lag	-7.0	-11.0	
11	Lark	2	0.18	Lead	-9.3	-10.1	7.6
				Lag	-8.8	-10.1	
13	Slater*	2	1.15	Lead	-18.3	-21.3	23.0
				Lag	-17.8	-21.3	
14	Ellis	3	0.96	Lead	-1.8	-3.3	14.8
				Lag	-1.2	-3.3	
				Standby	-0.4	-3.3	
16	Adams	2	0.47	Lead	-2.4	-3.9	11.4
				Lag	-1.9	-3.4	
17	Brookhurst	2	1.84	Lead	-16.9	-17.8	20.2
				Lag	-16.1	-17.5	
18	Atlanta	2	0.43	Lead	-14.0	-14.8	17.7
				Lag	-13.7	-14.8	
19	Bushard	2	0.49	Lead	-2.7	-3.5	8.3
				Lag	-1.0	-2.7	
20	Speer	2	0.72	Lead	5.7	4.6	11.5
				Lag	5.8	4.6	
21	McFadden*	2	0.17	Lead	1.2	0.6	9.3
				Lag	2.0	0.6	
22	Saybrook*	2	1.08	Lead	-6.2	-8.5	17.0
				Lag	-5.2	-8.5	
23	New Britain	2	0.26	Lead	-5.2	-5.5	10.7
				Lag	-4.7	-5.5	

Lift Station ID	Name	Number of Pumps	Firm Capacity (mgd)	Pump(s)	Pump On Level (ft above MSL)	Pump Off Level (ft above MSL)	Depth from Top to Bottom of Wet Well (ft)
24	Edwards	2	1.15	Lead	-15.7	-17.9	15.8
				Lag	-14.7	-17.9	
25	Edinger	2	0.32	Lead	-3.8	-6.8	13.0
				Lag	-2.8	-6.8	
26	Brighton	2	0.29	Lead	-16.1	-16.9	13.2
				Lag	-14.9	-16.9	
28	Coral Cay	2	0.08	Lead	-5.6	-6.2	9.2
				Lag	-5.1	-6.2	
29	Trinidad	2	0.36	Lead	-7.0	-8.5	19.3
				Lag	-6.4	-8.5	
30	Boeing	2	0.30	Lead	-2.7	-3.3	18.7
				Lag	-2.2	-3.3	
31	Brightwater	2	0.43	Lead	29.4	27.4	25.6
				Lag	29.7	27.4	
32	Station “D”	3	2.02	Lead	-17.0	-21.0	47.0
				Lag	-16.0	-21.0	
				Standby	-15.0	-21.0	

*Indicates lift station is being re-designed and/or in construction as of time of model build and final dimensions may differ than what is shown

3.2.3 Subcatchments

For InfoWorks ICM, the service area sewer basins were divided into subcatchments, a modeling term used for small drainage areas, each of which is used to define and load the DWF and WWF to manholes in the modeled system. The sewer basins, shown on **Figure 3.2**, may contain thousands of subcatchments. For the purposes of this sewer master plan update (SMP), subcatchments were delineated at the parcel level so that each parcel contributed a unique dry and wet loading to the model. This essentially means that the parcel shapefile received from the City was used to define each subcatchment, as they essentially were one in the same. Every parcel acted as a unique subcatchment, defining the unique loads into the model. The City’s portion of the model includes 51,764 parcels which equated to 51,764 subcatchments totaling 13,637 acres with an average size of 0.26 acres. The OCSan portion of the model includes 1,004 subcatchments totaling 238,263 acres with an average size of 237.55 acres. The hydraulic model’s ‘trace system upstream’ tool allowed for the determination of unique sewered mini-networks tributary to an OCSan trunk sewer. This effort resulted in 225 unique hydraulic sewer networks and basins. These are the unique or independent sewer basins that tie into the OCSan system. The 225 unique hydraulic sewer basins are shown in **Figure 3.2**.The 225 unique hydraulic sewer basins were then analysed and used to determine the flow monitoring program, as the 24 flow monitors were derived from these 225 hydraulic sewer basins.



Lift Station (LS)	
Number	Name
1	Parkside LS
2	Humboldt LS
3	Gilbert LS
4	"A" LS
5	Davenport LS
6	Edgewater LS
8	"C" LS
10	Algonquin LS
11	Lark LS
13	Slater LS
14	Ellis LS
16	Adams LS
17	Brookhurst LS
18	Atlanta LS
19	Bushard LS
20	Speer LS
21	McFadden LS
22	Saybrook LS
23	New Britain LS
24	Edwards LS
25	Edinger LS
26	Brighton LS
28	Coral Cay LS
29	Trinidad LS
30	Boeing LS
31	Brightwater LS
32	"D" LS

Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

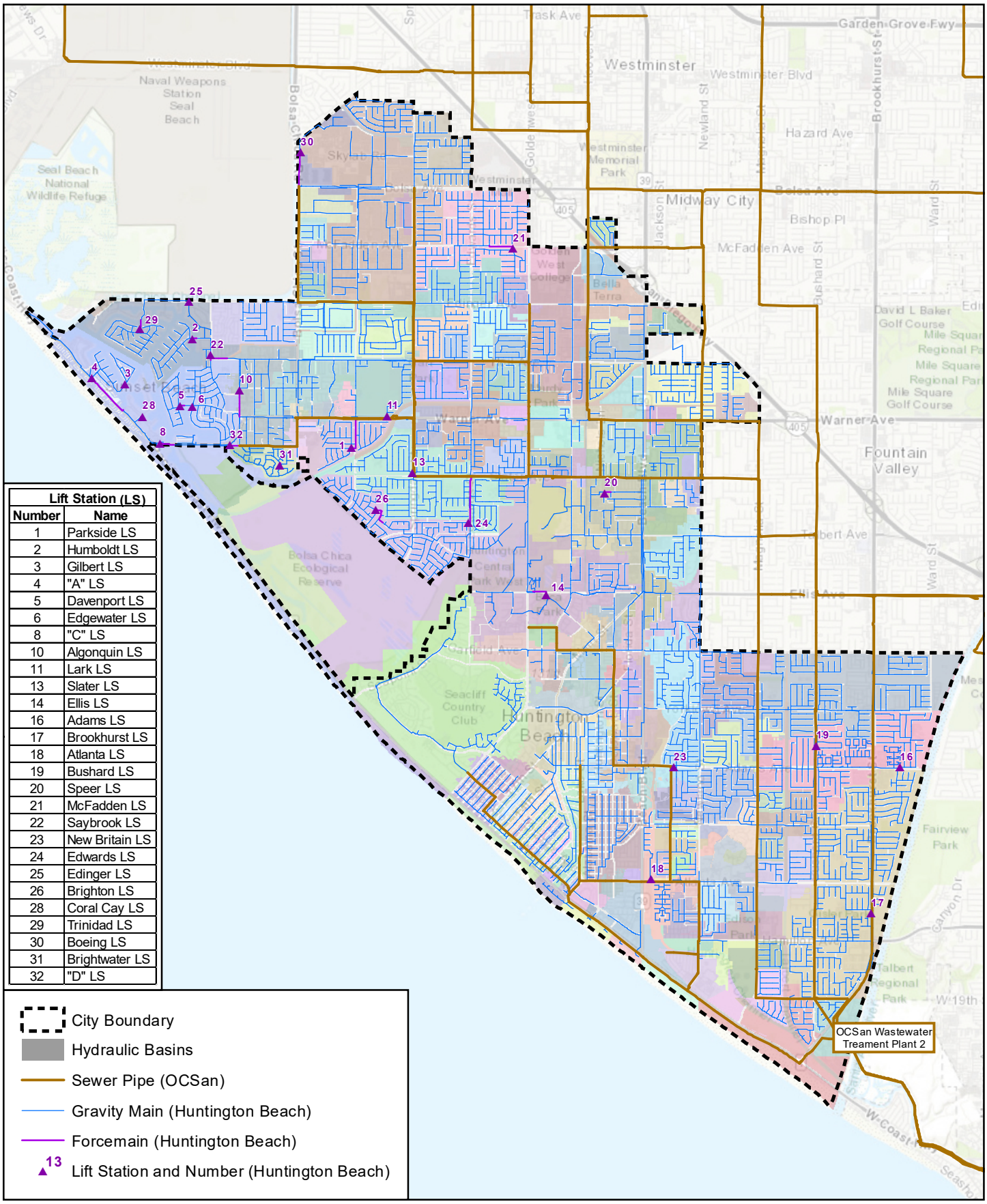
Project No. 12585300
Revision No. 1
Date 3/6/2024

Modeled Sewer Network

FIGURE 3.1

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Print date: 06 Mar 2024 - 12:48

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Lift Station (LS)	
Number	Name
1	Parkside LS
2	Humboldt LS
3	Gilbert LS
4	"A" LS
5	Davenport LS
6	Edgewater LS
8	"C" LS
10	Algonquin LS
11	Lark LS
13	Slater LS
14	Ellis LS
16	Adams LS
17	Brookhurst LS
18	Atlanta LS
19	Bushard LS
20	Speer LS
21	McFadden LS
22	Saybrook LS
23	New Britain LS
24	Edwards LS
25	Edinger LS
26	Brighton LS
28	Coral Cay LS
29	Trinidad LS
30	Boeing LS
31	Brightwater LS
32	"D" LS

City Boundary
Hydraulic Basins
Sewer Pipe (OCSan)
Gravity Main (Huntington Beach)
Forcemain (Huntington Beach)
13 Lift Station and Number (Huntington Beach)

Paper Size ANSI A
0 1,500 3,000 4,500 6,000
Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Existing Sewer System and Hydraulic Basins

Project No. 12585300
Revision No. 1
Date 3/6/2024

FIGURE 3.2

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 3.2 Hydraulic Sewer Basins.mxd
Print date: 06 Mar 2024 - 12:56

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

3.3 Network Build and Validation

Network information for the hydraulic model was provided by the City as an ESRI geodatabase that included all known gravity and pressurized sewer assets, including manholes and sewers pipelines. The City's data was processed and became the basis for the construction of the hydraulic model. Using topographic data and available GIS data, we are able to construct the pipe network in the model and identify locations that are subject to sewer surcharging and more importantly, areas that may result in surface flooding conditions.

3.3.1 GIS-Based Hydraulic Model Development

After a thorough review of the City's network GIS files, it was determined that the provided sewer system GIS data did not have pipe invert or manhole rim information, both necessary foundational data to properly populate and simulate a typical dynamic sewer model. However, the GIS data did have pipe slopes and manhole depths. A one-foot contour data file was provided and used to help estimate rim and invert elevations. The following is the general process that was used to estimate the inverts, with the primary goal to maintain pipe slopes, which are directly tied to pipe capacity.

The one-foot contours were used to estimate rim elevations, then pipe inverts were estimated by subtracting the manhole depth from the manhole rims (which were estimated from the contour file). This calculation estimated inverts, but with varying levels of confidence in accuracy. Sewer pipe slopes (estimated) were calculated based on the estimated inverts and pipe length. The estimated slopes were compared to the slopes in the GIS data, resulting in inconsistent matches. The conclusion was that estimated inverts were not accurate enough to establish pipe inverts for modeling purposes, as the correct slope is critical. However, they are generally correct to serve as a starting target point, so served as the 'Target Invert' in the calculations discussed below.

The **Target/Calculated Invert Rectification Process** was as follows:

- **Assumptions**
  - 0.1-ft drop in manholes
  - At a pipe size change, pipes match crowns
- **Process**
  - All pipe and manholes were brought into an excel spreadsheet
  - The most downstream inverts for all networks were manually entered to start the calculation
    - These locations are where the City's sanitary sewer system connects to the OCSan system
    - These downstream inverts were estimated from the Target Inverts (typically in a pipe or two upstream from the connection)
  - Queries were established for each pipe to calculate the pipe inverts
  - Downstream inverts were calculated by finding the upstream invert of the downstream pipe and adjusting for manhole drop and pipe size change
  - Upstream inverts were calculated from the downstream invert plus the slope multiplied by the pipes' length
  - Lift station and siphon record drawings were reviewed and their impacts on inverts were incorporated into the spreadsheet
  - The Calculated Inverts were then compared to the Target Inverts
  - The results were displayed visually in GIS to help identify correctly and incorrectly calculated data
  - Locations where the Calculated Invert was lower than Target Invert indicate a drop manhole
  - Drop manhole locations were identified and corrected
  - A visual review of each drop manhole location comparing the Target Inverts to the Calculated Inverts was used to correct the spreadsheet appropriately, thereby fixing all upstream inverts
  - Locations where the Calculated Invert was greater than the Target Invert indicated a mistake in the data or assumptions

- Each of these locations was reviewed and corrected individually
- Corrections included:
  - Fixing an error in the slope, often by a factor of 10
  - Removing the 0.1-ft fall in the manhole assumption for some stretches of pipes
  - As a last resort and very occasionally the pipe slope was reduced

This process resulted in an average difference in manhole depth (Calculated vs. Target) of 1.2-ft. This difference was taken into account when analyzing hydraulic results. The results of this analysis provide confidence that the slope data is acceptable and will provide an accurate model.

3.3.2 Topology Review and Gap Assessment

After the invert rectification process was complete, the updated GIS files were brought into InfoWorks ICM and mapped to the appropriate internal ICM tables. All assets were reviewed for ID accuracy, directional connectivity, and topological integrity. This review uncovered and rectified duplicates, disconnected (rogue) pipes and manholes, and ensured that each pipe's upstream and downstream manholes were correctly identified and accurately connected from the most downstream point, or the connection to OCSan, to the most upstream points of the network. The initial review of the GIS files yielded a handful of minor inconsistencies.

As mentioned in **Chapter 3.2.1,** portions of the OCSan system were included in the model to more accurately represent the dynamic interaction between the OCSan and the City networks.

3.3.3 Model Validation

After rectification of Asset IDs, initial topology, and the gap assessment-driven field investigations, a comprehensive engineering validation was performed to identify and resolve any remaining errors, issues, or inconsistencies, and to ensure that the digital model not only represented the physical system accurately, but that it met simulation criteria to allow detailed hydraulic engine calculations to converge correctly. In InfoWorks ICM, all physical parameters for each individual pipe were populated and validated including manhole rim elevations and diameters, length, and invert elevations; in addition, each pipe's slope and flow direction was verified. Due to the work detailed in **Chapter 3.2.1**, there were no model validation issues, which allows for basic model simulations to complete.

4. Planning Scenarios

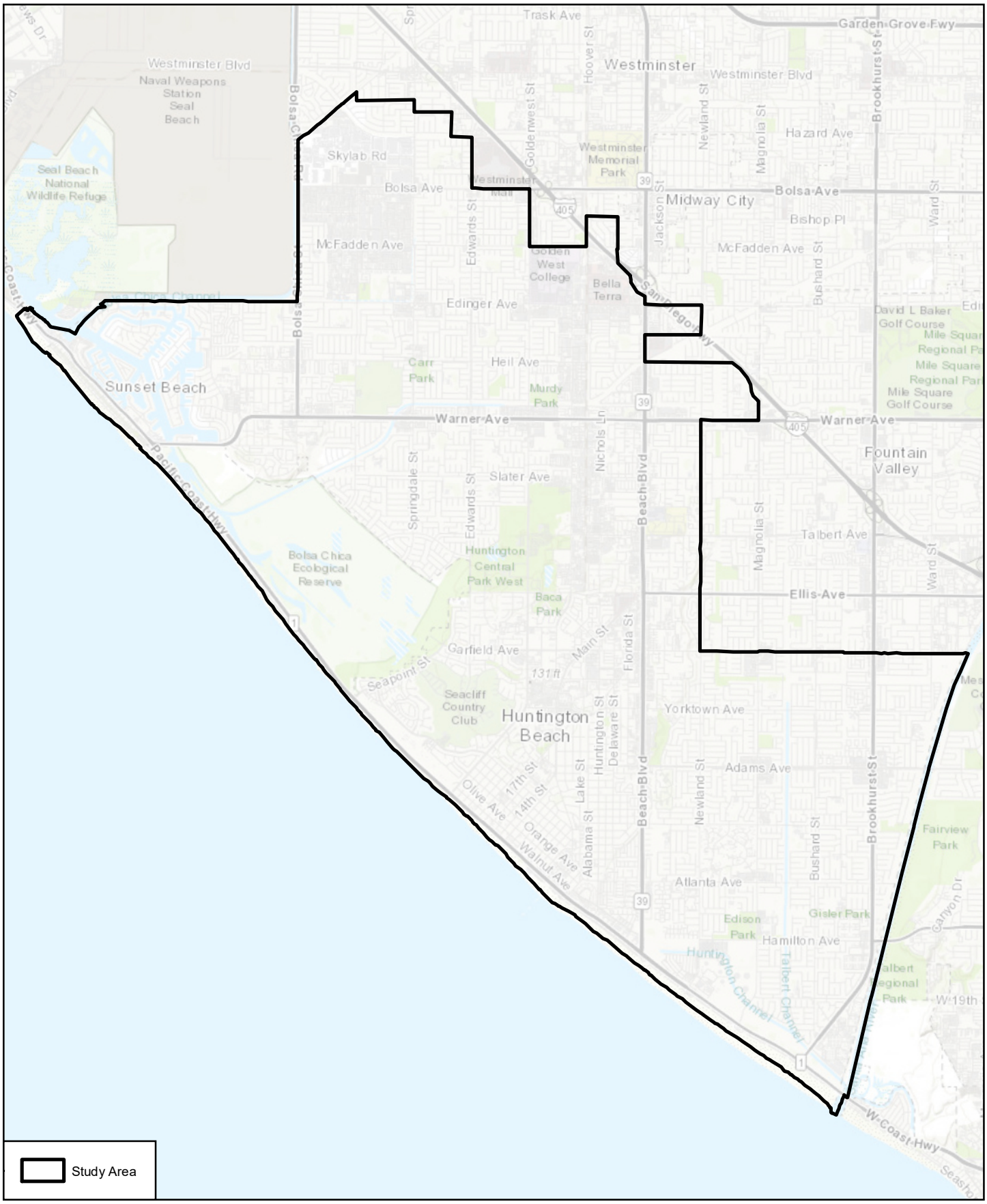
This chapter outlines the planning considerations that affect dry weather flow (DWF) for anticipated development within the planning area. The assessment of land use data helps determine existing and future loads and the diurnal patterns (daily usage over time) that dischargers (by land use type) use in the model. Existing land uses and designations are presented, and the assumptions for near-term and year 2040 future development are expressed.

Flow rates for existing conditions are based on flow monitoring data and water billing records, as described in **Chapter 5**. Development types and quantities (number of dwellings, square footage of commercial, etc.) were used to estimate sewer flow rates for the future conditions (near-term and 2040) based on the assumption that development is generally guided by the California State University at Fullerton, Center for Demographic Research (CDR) 2040 growth projections. The primary function of CDR is to produce estimates and projections for housing, population, and employment for a variety of geographic areas (i.e. census tract, census block, traffic analysis zone) in Orange County. In addition to CDR, other planning information was used. The City of Huntington Beach Department of Community Development identifies planned projects in various states of permitting, per the following link: (huntingtonbeachca.gov/government/departments/planning/major/).

The Huntington Beach General Plan Housing Element 2021-2029 (Housing Element) is an overarching planning document used in this SMP that includes a subsection called the Residential Housing Needs Assessment (RHNA). The RHNA identifies housing opportunity locations, densities, and housing growth targets and is used extensively in this SMP's planning process. Where specific project information was available for a new development or redevelopment of a property, that information was used.

4.1 Study Area

For the purposes of analyzing and aggregating planning data for generating sewer loads, the *Study Area* is the area in which existing customers actively tie-into the sanitary sewer system and is also the extent and coverage of all future customers. It is defined by the extents of the TAZ areas served by the Huntington Beach sewer system. It is essentially the same as the City limits with a few minor differences. It includes the Bolsa Chica Ecological Reserve and there are a few small slivers of areas where the sewer system does not provide service or where the TAZ boundaries are not quite contiguous with the city limits. The City also receives flow from outside the City limits that are not well defined and as a result not identified in the study area boundary as represented in **Figure 4.1** that represents the City limits and identified as the Study Area.



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Project No. **12585300**
Revision No. **1**
Date **3/6/2024**

Study Area

FIGURE 4.1

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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

4.2 Development Classifications

All projected developments were based on the number of units in the following categories:

- Single-Family Residential (SFR)
  - Dwelling Units (DUs)
  - Detached building with no shared land and one owner, built for one family, person, or household.
- Multi-Family Residential (MFR)
  - DUs
  - Building with more than one unit where people can live.
- Hotel (H)
  - Number of Rooms
  - Commercial hotels and motels and other similar uses such as a bed and breakfast
- Commercial/Industrial (CI)
  - 1,000 sf
  - All commercial and industrial uses, excluding hotels.

A dwelling unit is a house or apartment used to provide living accommodations in a building or structure. Other use types exist, such as schools and parks, but they are not part of future development, so they are not included here.

4.3 Existing Conditions

Existing flow conditions in the hydraulic model are based on water customer billing records and flow monitoring. Water billing records were obtained from the City for December 2022 through March 2023. Flow monitoring at 24 key locations within the service area was performed by ADS Consulting Engineers (ADS) for the same time period, and flow monitoring output from the meters as flow, depth, and velocity time series data sets were provided to GHD (ADS, 2023). Analysis of water billing and flow monitoring data is provided in **Chapter 5**.

4.4 Future Conditions

The following summarizes how 'Future' development conditions are generated to assess the impact of growth on the sanitary sewer system. Future conditions for this hydraulic modeling analysis are based on the following assumptions:

- Center for Demographic Research (CDR) projections provide target growth for 2040.
- Residential Housing Needs Assessment (RHNA) is a statutorily required zoning capacity assessment that specifies 13,368 residential units to be built from 2021-2029.
- The Housing Element also identifies Pipeline Projects (PLPs), which are projects that are in-progress (planning or construction) at the time the Housing Element was prepared and will be completed as part of a Near-Term (NT) development planning horizon.
- Community Development Major Projects (CDMP) in the planning and approval stages will be completed and are part of NT development.
- Where RHNA units and CDMP do not satisfy CDR 2040 targets, vacant parcels identify additional projects to be included.
- Where RHNA units, CDMP and vacant parcels do not satisfy CDR 2040 targets, growth is applied proportionally to existing flows and development types.

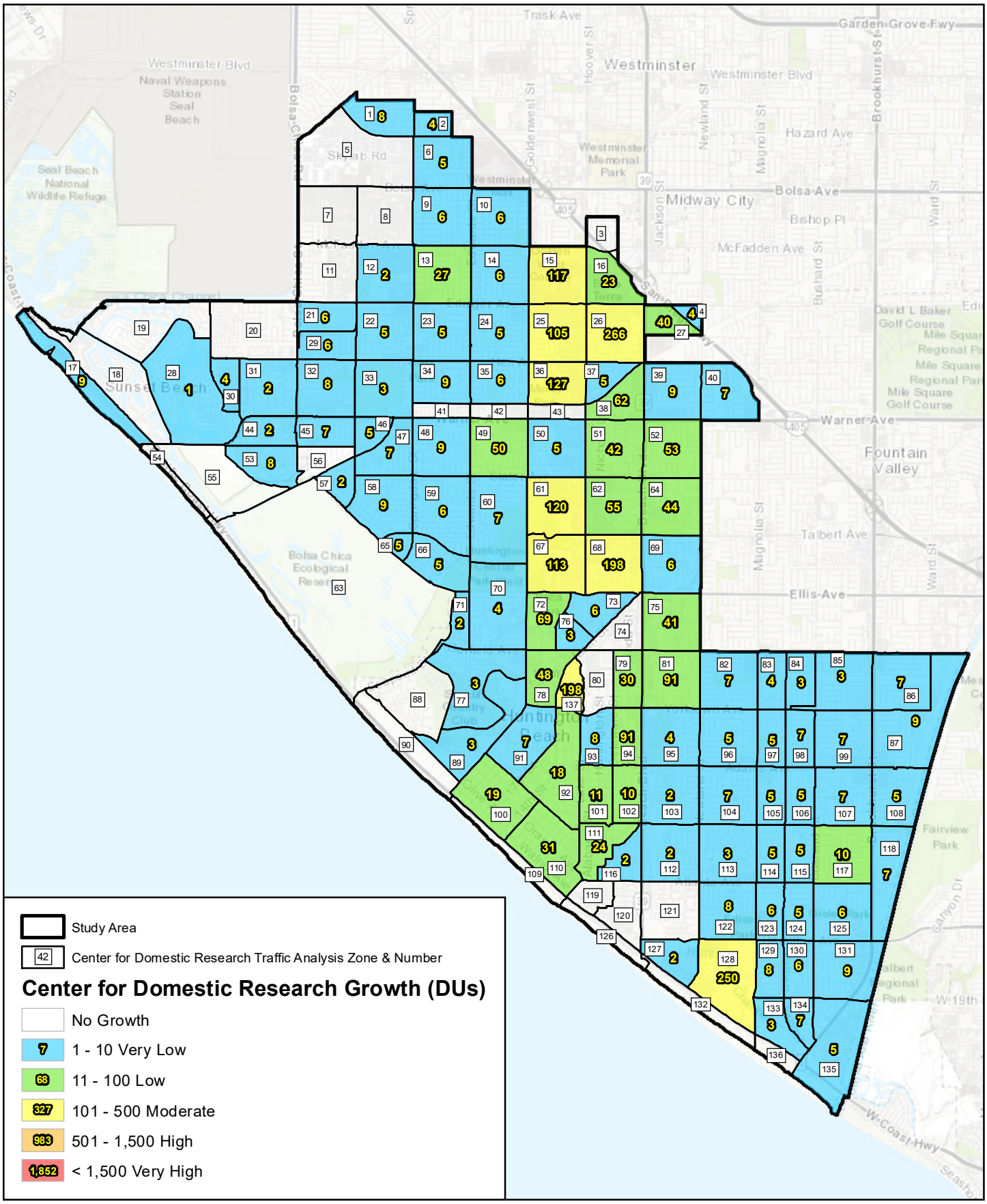
Chapter 5 provides analysis for calculation of flows, including a discussion of unit flows used for the calculations.

4.4.1 CDR 2040 Growth Projections

The Center for Demographic Research (CDR) is a non-profit research center focused on the development and support of demographic research. They provide information on population, housing, and employment. Their work mainly focuses on Orange County, California. The data that they provide is associated with geographic areas called Traffic Analysis Zones (TAZ). TAZ areas are part of census data and are often used for transportation planning. Each TAZ has associated growth projections for Single-Family Residential, Multi-Family Residential, Commercial, and Industrial land use types. To simplify the presentation of information and because SFR growth is very small, it is combined with MFR for presentation of growth in this document in Dwelling Units (DUs). Additionally, based on flow projections presented in **Table 5.12**, Commercial/Industrial growth is also small, at approximately 7% of the residential growth, so is not shown. **Appendix A** has detailed information on each TAZ.

Out of the large TAZ dataset of 11,276 TAZs, there are 137 that intersect with the study area. CDR projects a growth of 2,814 DUs from 2022 to 2040 in these TAZs. **Figure 4.2** shows the TAZ growth projections.

For each of the 137 TAZ areas in the study area, projected growth from CDMPs, PLPs, RHNA units, and vacant parcels were totalled and compared to the TAZ area target growth. Where target growth is not met, the growth is applied proportionally to existing parcels of the same use within each TAZ. There are 125 TAZ areas where other types of development do not meet the target growth. They total 867 DUs and approximately 2,000,000-sf of commercial and industrial space. See **Appendix A** for individual project details. **Table 4.1** details the development within each TAZ and **Figure 4.3** shows the locations.



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Center for Domestic Research 2022-2040 Traffic Analysis Zones Growth Projections

Project No. 12585300
Revision No. 1
Date 3/6/2024

FIGURE 4.2

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 4.2 CDR 2040 Growth Projections.mxd
Print date: 06 Mar 2024 - 10:57

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

4.4.2 Community Development Major Projects

The City of Huntington Beach Department of Community Development identifies planned projects in various states of permitting. These are considered near-term (NT) projects. In 2023, project details were provided by the City and parcels associated with the projects were identified. Since loadings are associated to subcatchments, which are essentially parcels, it is important to identify the parcels and loads to be adjusted on them. Where there was overlap with projects from other sources, the CDMP details were used. There are 35 Community Development Major Projects (CDMPs) that total 1,397 DUs, 530 hotel rooms, approximately 112,000-sf of commercial space, and approximately 1,371,000-sf of industrial space. See **Appendix A** for individual project details. **Table 4.1** details the CDMPs within each TAZ and **Figure 4.3** shows the locations.

4.4.3 General Plan Housing Element's 2021-2029 Residential Housing Needs Assessment (RHNA)

The General Plan Housing Element's Residential Housing Needs Assessment (RHNA) quantifies existing and projected housing needs for the 2021-2029 6th Cycle planning period. The City's 2021-2029 RHNA totals 13,368 residential dwelling units across all income levels. For this analysis, it is assumed that the zoning capacity to accommodate the 2021-2029 RHNA is provided. For purposes of analysis in the sewer master plan update (SMP), RHNA 2029 housing growth equals 11,924 DUs, this accounts for other housing development during the study period as follows:

- At the time of this study, 49 RHNA DUs have been constructed and are in use
- CDMPs total 1,397 DU
- PLPs total 310 DUs
- Vacant parcels total 32 DUs
- TAZ development totals 867 DUs

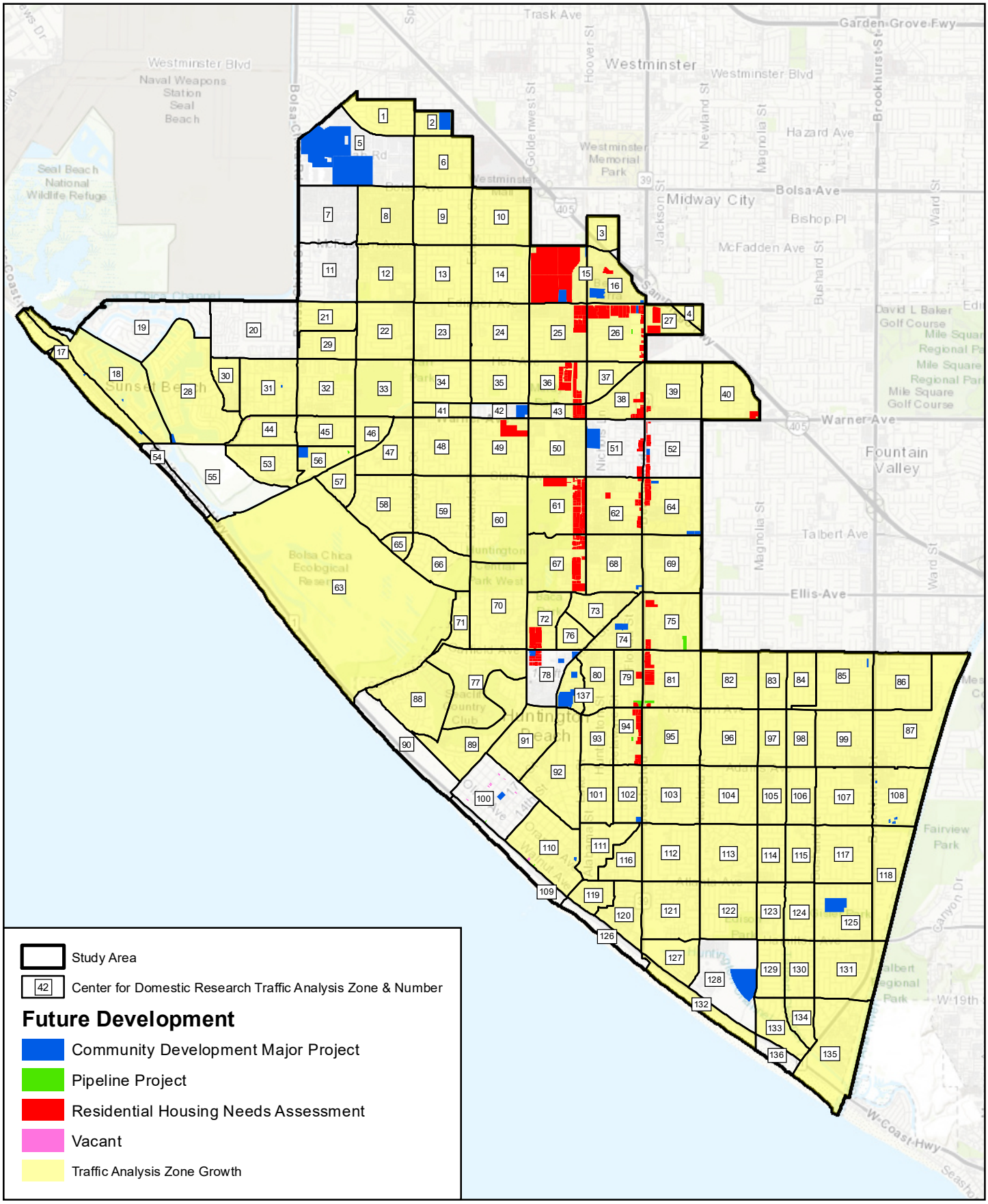
Therefore, the RHNA number presented here is less than the Housing Element.

The Housing Element also identifies Pipeline Projects (PLPs), which are projects that are in-progress (planning or construction) at the time the Housing Element was prepared. These are considered NT projects. Most of these projects overlap with CDMPs, only the projects that are different are presented here. There are 9 PLPs that total 310 DUs. See **Appendix A** for individual project details. **Table 4.1** details the PLPs within each TAZ and **Figure 4.3** shows the locations.

Additionally, the Housing Element identifies potential housing locations and units through an analysis of vacant and underdeveloped parcels along with the location of housing needs. To accommodate the 2021-2029 RHNA, it is assumed that all RHNA units are developed. They are scaled based on their potential to match the projected growth. There are 317 RHNA units that total 11,924 DUs. To be clear, these are hypothetical projects only, nothing is specifically planned at these locations. See **Appendix A** for assumptions and individual project details. **Figure 4.3** shows the locations of the RHNA units and **Table 4.1** provides details within each TAZ.

4.4.4 Vacant Parcels

Parcel data identifies vacant parcels. For each TAZ area, where CDMPs, PLPs, and RHNA units do not match target growth, vacant parcels are identified to potentially meet the development. There are very few vacant parcels within the City not already identified for development. There are 9 vacant parcels that total 32 DUs. See **Appendix A** for individual project details. **Table 4.1** details the PLPs within each TAZ and **Figure 4.3** shows the locations.



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Location and Category of Future Development

Project No. **12585300**
Revision No. **1**
Date **3/6/2024**

FIGURE 4.3

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Print date: 06 Mar 2024 - 11:15

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

4.4.5 Overall Planning Results

Table 4.1 below provides the number of DUs from each type of development within each TAZ. The TAZ number is a simple tag to match the table data to the figures. The TAZ ID is the unique ID associated with the TAZ area that ties it to the larger dataset. As discussed in **Chapter 4.4.1**, Commercial/Industrial growth is small, so is not shown. **Appendix A** has detailed information on each TAZ.

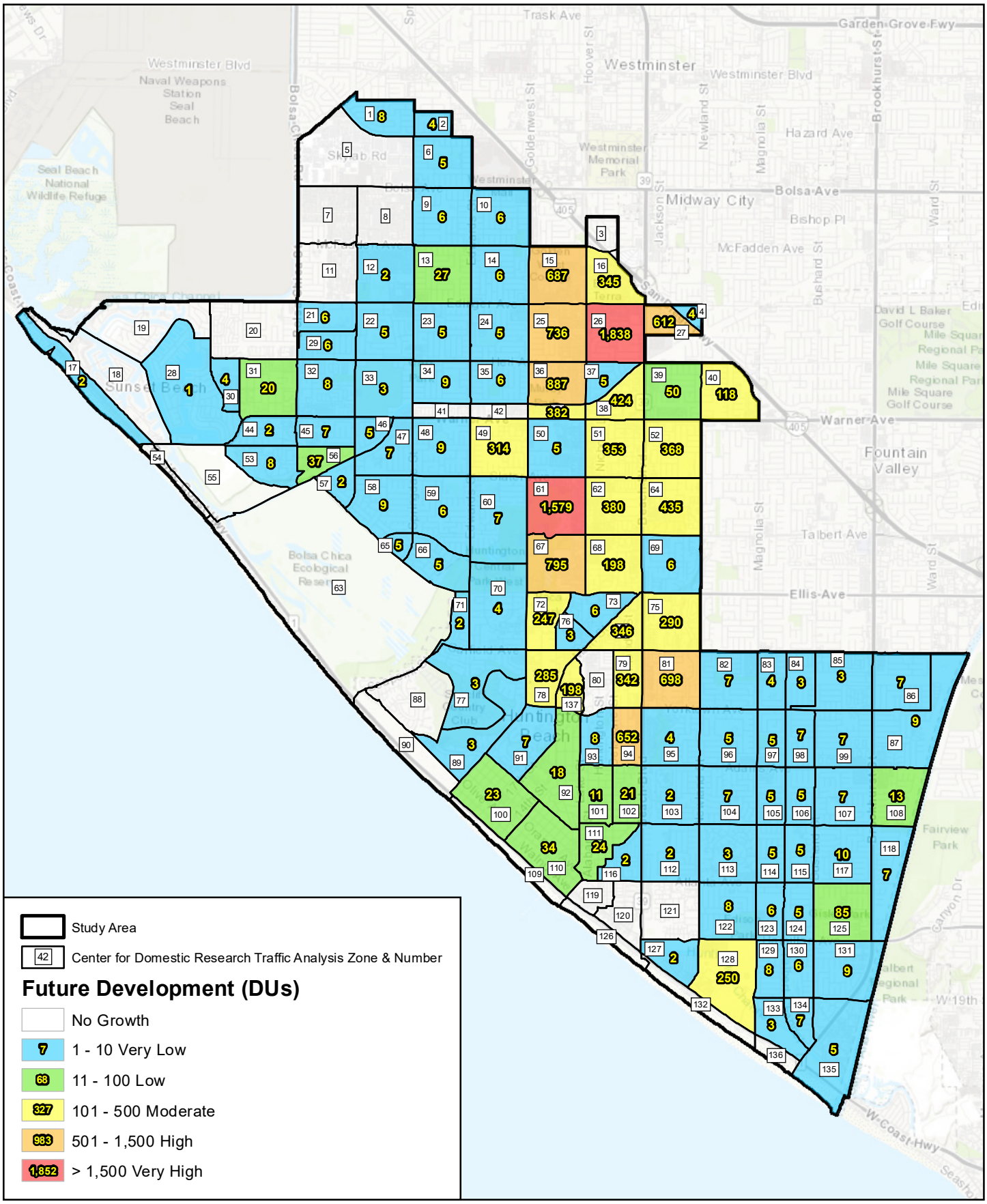
Table 4.1 TAZ Level Data for All Future Development

TAZ Number	TAZ ID	CDR Projection	Near Term		Future (2040)			Total
			CDMP	PLP	RHNA	Vac	TAZ	
		DUs	DUs	DUs	DUs	DUs	DUs	DUs
1	32651200	8	0	0	0	0	8	8
2	32658100	4	0	0	380	0	4	384
4	32689100	4	0	0	383	0	4	387
6	32658200	5	0	0	0	0	5	5
9	32656100	6	0	0	0	0	6	6
10	32664100	6	0	0	736	0	6	742
12	32652400	2	0	0	0	0	2	2
13	32656200	27	0	0	0	0	27	27
14	32664200	6	0	0	1,831	0	6	1,837
15	32664300	117	130	0	0	0	0	130
16	32682400	23	300	0	0	0	2	302
17	32641100	9	1	0	0	0	1	2
21	32648100	6	0	0	0	0	6	6
22	32654100	5	0	0	0	0	5	5
23	32661100	5	0	0	795	0	5	800
24	32661200	5	0	0	0	0	5	5
25	32672100	105	0	0	0	0	0	0
26	32672200	266	0	4	0	0	3	7
27	32689200	41	0	0	0	0	40	40
28	32644200	1	0	0	0	0	1	1
29	32648200	6	0	0	422	0	6	428
30	32645200	4	0	0	0	0	4	4
31	32647100	2	20	0	0	0	0	20
32	32648300	8	0	0	572	0	8	580
33	32654200	3	0	0	247	0	3	250
34	32660100	9	0	0	0	0	9	9
35	32660200	6	0	0	50	0	6	56
36	32673100	127	0	0	0	0	1	1
37	32673200	5	0	0	118	0	5	123
38	32673300	62	0	0	0	0	2	2
39	32690100	9	0	0	0	0	0	0
40	32690200	7	0	0	0	0	0	0
43	32673400	0	0	0	0	0	0	0
44	32646100	2	0	0	0	2	0	2

TAZ Number	TAZ ID	CDR Projection	Near Term		Future (2040)			Total
			CDMP	PLP	RHNA	Vac	TAZ	
		DUs	DUs	DUs	DUs	DUs	DUs	DUs
45	32646200	7	0	0	382	0	7	389
46	32646300	5	0	0	0	0	5	5
47	32649100	7	0	0	0	0	7	7
48	32657100	9	0	0	557	0	9	566
49	32665100	50	0	0	0	0	1	1
50	32674100	5	0	0	0	0	5	5
51	32674200	42	0	0	0	0	0	0
52	32685100	53	0	0	0	0	0	0
53	32646400	8	0	0	0	0	8	8
56	32646700	0	36	1	0	0	0	37
57	32649200	2	0	0	0	0	2	2
58	32649300	9	0	0	43	0	9	52
59	32657200	6	0	0	0	0	6	6
60	32665200	7	0	0	0	0	7	7
61	32674300	120	0	0	0	0	0	0
62	32674400	55	0	0	0	0	0	0
64	32685200	44	52	0	0	0	0	52
65	32649500	5	0	0	0	0	5	5
66	32649600	5	0	0	0	0	5	5
67	32666100	113	0	0	0	0	0	0
68	32675100	198	43	0	0	0	155	198
69	32684100	6	0	0	0	0	6	6
70	32666200	4	0	0	0	0	4	4
71	32649700	2	0	0	0	0	2	2
72	32666300	69	0	0	0	0	0	0
73	32675200	6	0	0	0	0	6	6
74	32675300	0	346	0	0	0	0	346
75	32684200	41	0	10	0	0	0	10
76	32675400	3	0	0	0	0	3	3
77	32659100	3	0	0	0	0	3	3
78	32669100	48	56	0	0	0	0	56
79	32678100	30	0	181	0	0	3	184
81	32686100	91	0	104	0	0	2	106
82	32694100	7	0	0	280	0	7	287
83	32702100	4	0	0	0	0	4	4
84	32702200	3	0	0	0	0	3	3
85	32702300	3	0	0	0	0	3	3
86	32715100	7	0	0	313	0	7	320
87	32715200	9	0	0	0	0	9	9
89	32659300	3	0	0	229	0	3	232
91	32669200	7	0	0	158	0	7	165

TAZ Number	TAZ ID	CDR Projection	Near Term		Future (2040)			Total
			CDMP	PLP	RHNA	Vac	TAZ	
		DUs	DUs	DUs	DUs	DUs	DUs	DUs
92	32669300	18	0	0	0	0	18	18
93	32678300	8	0	0	592	0	8	600
94	32678400	91	0	3	0	0	2	5
95	32686200	4	0	0	0	0	4	4
96	32694200	5	0	0	0	0	5	5
97	32703100	5	0	0	0	0	5	5
98	32703200	7	0	0	0	0	7	7
99	32703300	7	0	0	353	0	7	360
100	32662100	19	0	4	0	19	0	23
101	32677100	11	0	0	0	0	11	11
102	32677200	10	18	0	0	0	3	21
103	32687100	2	0	0	0	0	2	2
104	32693100	7	0	0	368	0	7	375
105	32700100	5	0	0	0	0	5	5
106	32700200	5	0	0	0	0	5	5
107	32709100	7	0	0	0	0	7	7
108	32711100	5	8	0	0	0	5	13
110	32670200	31	20	3	0	11	0	34
111	32677300	24	0	0	0	0	24	24
112	32687200	2	0	0	0	0	2	2
113	32693200	3	0	0	0	0	3	3
114	32700300	5	0	0	0	0	5	5
115	32700400	5	0	0	0	0	5	5
116	32676100	2	0	0	647	0	2	649
117	32709200	10	0	0	0	0	10	10
118	32711200	7	0	0	0	0	7	7
122	32691200	8	0	0	0	0	8	8
123	32701100	6	0	0	0	0	6	6
124	32701200	5	0	0	0	0	5	5
125	32705100	6	85	0	0	0	0	85
127	32691300	2	0	0	0	0	2	2
128	32691400	250	250	0	0	0	0	250
129	32701300	8	0	0	0	0	8	8
130	32701400	6	0	0	0	0	6	6
131	32705200	9	0	0	0	0	9	9
133	32701500	3	0	0	0	0	3	3
134	32701600	7	0	0	886	0	7	893
135	32705300	5	0	0	1,579	0	5	1,584
137	32669400	198	32	0	0	0	166	198
Total		**2,815**	**1,397**	**310**	**11,924**	**32**	**867**	**14,530**

As **Table 4.1** shows, future development is projected to exceed CDR growth by approximately 500%. This is due to the assumption that RHNA will be met. RHNA identified the housing deficit which is not accounted for in CDR planning. **Figure 4.4** shows the total future development projections within each TAZ.



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Future Development 2022-2040

Project No. **12585300**
Revision No. **1**
Date **3/6/2024**

FIGURE 4.4

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 4.4 Future Development by TAZ.mxd
Print date: 06 Mar 2024 - 11:43

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

5. System Flows and Model Calibration

This chapter outlines the fundamental components and concepts of wastewater flow used to develop system flow rates, as well as presents and discusses the calibration of the model that is used for evaluation of sanitary sewer system hydraulics. Sanitary sewer system flows for existing and future build-out conditions are also presented in this chapter. The development of wastewater flow rates reflecting current conditions are based on results from flow monitoring completed as part of this master plan and city-wide water billing records. The process to generate wastewater flow rates reflecting future development is described at the end of this chapter.

5.1 Flow Monitoring and Rainfall

As part of this master planning effort, ADS Environmental Services performed temporary flow monitoring in December 2022 through March 2023 at 24 sites throughout the City's service area. Data output from this effort included times series plots of flow, depth, and velocity data in 15-minute intervals that was used in model calibration. As introduced in **Chapter 3**, the 225 unique hydraulic sewer basins were analysed and used to determine the flow monitoring program, as the 24 flow monitors were derived from these 225 hydraulic sewer basins. A careful review of the City's system was done and the 24 flow meters were chosen considering the following criteria:

- Largest individual hydraulic basins were preferred (so from the 225 unique hydraulic sewer basins, those that could capture the largest areas were prioritized in the decision process);
- Type of contributor (isolating dry weather flow contributor, if possible, all residential, commercial, etc.);
- Areas of known high groundwater table/potential high infiltration
- Isolating or capturing high risk lift stations (those in high groundwater infiltration areas, capacity limitations, high DWF and/or WWF inputs
- Allowing manageable nesting of upstream meter basins (meter basins with around 50% of their tributary area captured by upstream meters provides a more confident subtraction of flow data for calibration).

Table 5.1 lists all the flow monitoring sites. Unless noted otherwise, all flow monitors were located at the downstream end of the pipe. This distinction is important in that the flow characteristics may be different coming into a manhole (from the downstream end of a pipe), versus coming out of a manhole (the upstream end of a pipe). This helps understanding hydraulics when evaluating flow meter data. Essentially, more turbulence or unsteady flow patterns may be introduced due to the varying shapes and dimensions that a manhole chamber imparts to the flow passing through the center of the manhole chamber, than from the straight-line portion of a sewer pipe at its downstream end. Because a more reliable flow pattern can be established in the pipe coming into a manhole for the reasons stated above, installing at these locations is preferred but is not always possible due to real world physical constraints. Further, the pipe ID in the model where the flow monitor is located is listed in this table because it provides a reference to **Appendices B and C** (DWF and WWF Calibration Plots/Graphs). Each DWF or WWF flow hydrograph's title contains this pipe ID in the dry weather flow (DWF) and wet weather flow (WWF) appendices.

Table 5.1 Flow Monitoring Locations

Flow Monitoring ID	Model Pipe ID	GIS ID	Diameter (in)	Address	Owner	Date Installed	Date Removed
1	7363.1 (Upstream)	6344	18	9347 Yorktown Ave	City	12/20/2022	3/28/2023
2	8347.1	7244	18	9116 Adams Ave	City	12/20/2022	3/28/2023
3	10499.1	11596	27	21934 Bushard St	City	12/20/2022	3/28/2023
4	CST0060-0500.1	n/a	18	8234 Atlanta Ave	OCSan	12/20/2022	3/28/2023
5	CST0060-0195.1	n/a	33	8234 Atlanta Ave	OCSan	12/20/2022	3/28/2023
6	CST0068-0000.1	n/a	54	21779-21899 PCH Parking/Inside Parking Stall	OCSan	12/30/2022	3/28/2023
7	KNT0080-0735.1	n/a	15	5452 Edinger Ave	OCSan	12/20/2022	3/28/2023
8	1868.1 (Upstream)	1860	30	15847 Graham St	City	12/20/2022	3/28/2023
9	KNT0080-0265.1	n/a	15	15942 Springdale St	OCSan	12/20/2022	3/28/2023
11	13310.1	13560	15	17498 Springdale St	City	12/28/2022	3/28/2023
12	5294.1	9266	15	6461 Balmoral Dr	City	12/20/2022	3/28/2023
13	2741.1 (Upstream)	2665	12	4232 Fisher Dr	City	12/20/2022	3/28/2023
14	3903.1	3713	10	6962 E Pacific Coast Hwy	City	12/20/2022	3/28/2023
15	4021.1 (Upstream)	9472	8	16957 Coral Cay Ln	City	12/20/2022	3/28/2023
16	4355.1	4019	15	17232 Courtney Ln	City	12/20/2022	3/28/2023
17	12870.1	13135	16	4324 Warner Ave	City	12/20/2022	3/28/2023
18	4988.1	4569	12	17541 Beach Blvd	City	12/28/2022	3/28/2023
19	11726.1	9276	21	7109 Slater Ave	City	12/20/2022	3/28/2023
20	7345.1	6523	10	19587 Newland St	City	12/29/2022	3/28/2023
21	KNT0080-0463.1	n/a	18	4972 Warner Ave	OCSan	12/20/2022	3/28/2023
22	KNT0080-0416.1	n/a	36	5700 Warner Ave	OCSan	12/20/2022	3/28/2023
23	KNT0080-0010.1	n/a	42	8500 Slater Ave	OCSan	12/20/2022	3/28/2023
24	8295.1	10705	21	NW of Meridian Dr & Goldenwest St on Meridian	City	12/29/2022	3/28/2023

In addition, ADS utilized two rain gauges throughout the system that provided key rainfall data for calibration and design storm development in the model. **Table 5.2** shows the rainfall totals and event classification at the two gauges for the key calibration storm from each monitoring year. Short term events are typically less than 2 days in duration. Long-term events can be between 30-120 days. **Figure 5.1** shows the flow monitoring locations and flow monitor basins used for the dry and wet weather flow calibration, as well as locations of the rain gauges.

Table 5.2 Calibration Rainfall Totals

Item	Rain Gauge 'HBOffc'	Rain Gauge 'HBS'
- Calibration Event (in): (March 14 – 15, 2023)	2.17	2.19
- Calibration Event: Short-Term Classification	2-Yr, 24-Hr	2-Yr, 24-Hr
- Preceding Rainfall (in): (Dec 15, 2022 – March 13, 2023)	12.73	9.96
- Preceding Rainfall: Long-Term Classification[a]	2-5-Yr, 90-Day	2-5-Yr, 90-Day

[a] The March 14, 2023 event took place near the tail end of 90 days of greater-than-average rainfall near the end of the wet weather season. The soils could be assumed to be nearly fully saturated or mostly saturated at the time of the calibration event.

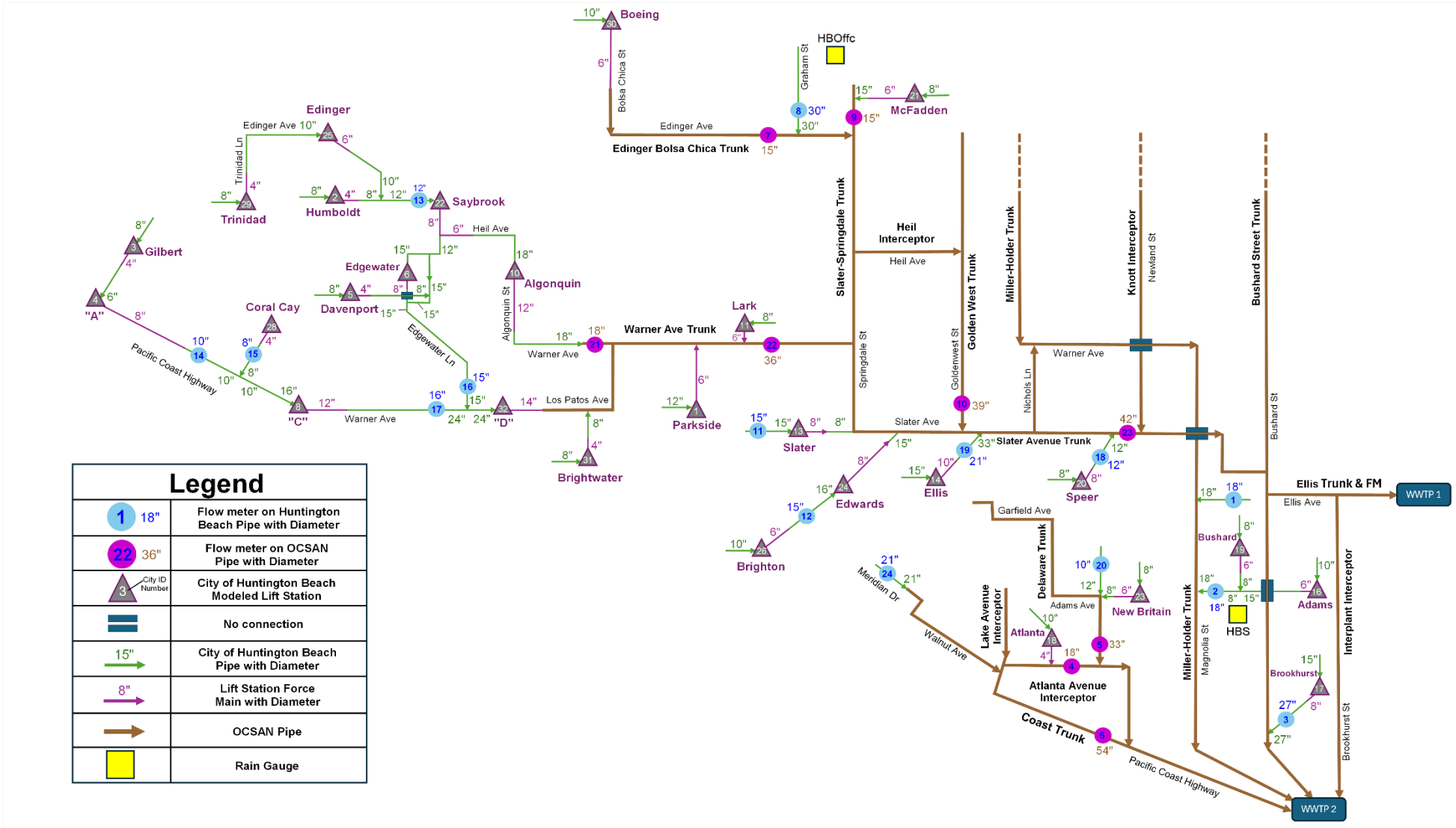


Figure 5.2 Schematic of Calibration Flow Meters, Basins, and Rain Gauges

5.2 Wastewater Flow Concepts

Wastewater flows generally includes three major components: base wastewater flow (BWF), groundwater infiltration (GWI), and rain dependent inflow and infiltration (RDI&I). BWF is comprised of sanitary and process flows from residential, commercial, institutional, and industrial users of the system. GWI is typically seasonal in nature (fluctuates with rise and fall of groundwater table) and is largely comprised of groundwater that infiltrates into the system through defects in manholes and pipes. The inflow portion of RDI&I is flow entering the system directly from rainfall and typically enters through holes or cracks in manhole covers or improper (illegal or illicit) roof or area drain connections. The infiltration portion of RDI&I is more indirect and is flow that enters the system much more slowly through cracks in manholes, sewers, and laterals. RDI&I typically results in spikes in peak flow that recede quickly after rainfall subsides. **Figure 5.3** shows these basic concepts through a typical sewer response hydrograph.

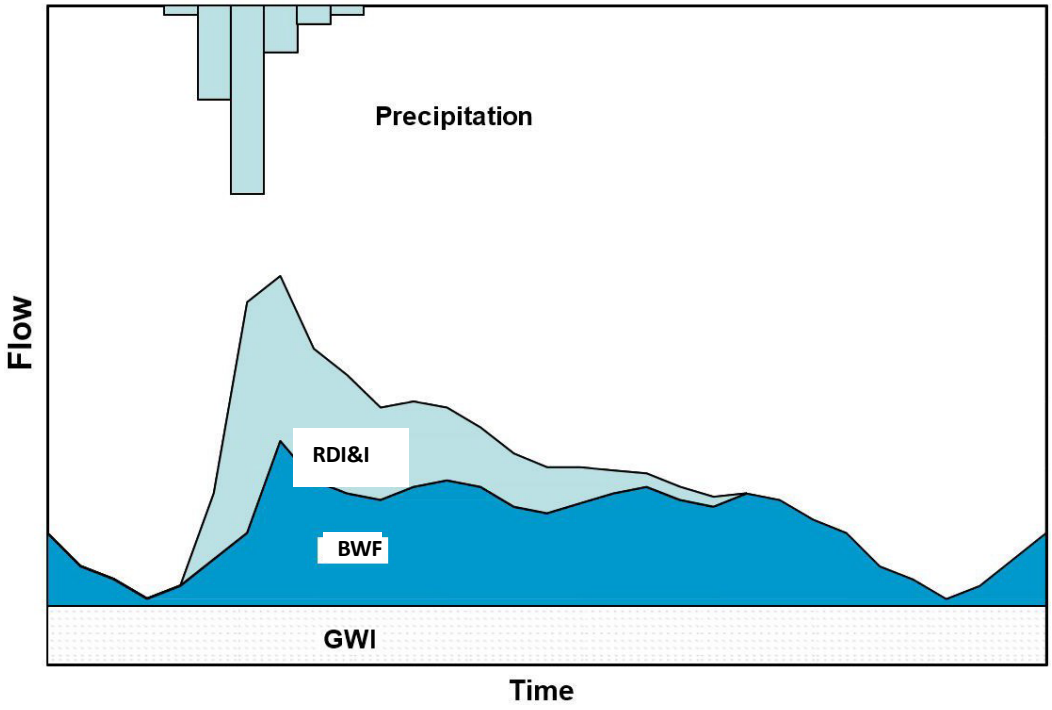


Figure 5.3 Components of Sanitary Sewer Flow[1]

5.3 Existing Condition Flow Estimates

As mentioned in **Chapter 3.2.3,** the service area was divided into subcatchments, each of which defines the DWF and WWF tributary areas to a manhole in the modeled system. Estimated BWF, GWI, and RDI&I flows were assigned to each subcatchment and input into the model. Actual flow monitoring data collected throughout the system were compared to model flows to refine the magnitude and timing of model flows. The following sub-chapters summarize the development and assumptions for each flow component.

[1] Rainfall Dependent Inflow and Infiltration from the EPA SWMM 5 Hydrology Manual" (4 September 2016), Figure 7-1 https://swmm5.org/2016/09/04/rainfall-dependent-inflow-and-infiltration-from-the-epa-swmm-5-hydrology-manual/

5.3.1 Diurnal Curves

BWF vary by time of day and type of contributor (i.e., residential vs. school) and must be defined for land use types in the model. These patterns are called diurnal curves and unique sets were developed for the hydraulic model for weekdays and weekends by parcel data land use type. Land use for each parcel was identified from parcel-level GIS data from the Southern California Association of Government's 2019 Annual Land Use, updated as of February 2021. The analysis of land use identified 64 unique land use classifications.

It would be too unwieldy and unnecessary to create 64 unique diurnal curves in the model. Therefore, a close review of DWF patterns revealed that these 64 use types could be grouped into seven distinct categories for hydraulic modeling purposes. **Table 5.3** shows these categories and their associated model diurnal curve.

Table 5.3 Diurnal Curve Categories

Aggregated Land Uses	Model Curve ID
Single-Family Residential	1
Multi-family Residential	2
Lodging Commercial, Mobile Home	3
Office Commercial, Public/Government, School	10
General Commercial, Automobile Commercial	11
Industrial, Light Industrial, Warehouse	20
Parks, Open Space	30

5.3.2 Existing Base Wastewater Flows

Existing BWF was estimated at the parcel level through the geo-processing of planning, land use, and water billing record data. This simply means that geographic information system (GIS) polygon layers containing planning and land use data were intersected and overlayed with the parcel and water billing record point layers so that pertinent data like land use type, densities, water usage etc. from them could be properly associated to the parcels (subcatchments) for use in loading flows to the sewer system. Specifically, the water billing record data was from December 2022 through March 2023 of winter season for both residential and commercial sources. Winter water use is considered a reasonable estimation of wastewater flow because outdoor water use during the winter is generally smallest, ensuring the wastewater return rate is likely the highest and most consistent (relative to the consumption rate) to any other times during the year.

A total of 50,750 water use records (from billing meters) were used to estimate BWF. The 50,750 billing meters were then distributed to the 46,832 parcels in the service area. This analysis found that 45,407 parcels had just one billing meter associated to each and 1,425 had more than one. The 1,425 parcels with more than one billing record contained 3,918 billing records in total. The 4-month averaged winter usage rates in gallons per day (gpd) and their associated diurnal curve category are shown in **Table 5.4** for each of the 64 land use types. This water use data was organized and aggregated by parcel and then coded to the GIS parcel files to determine their exact locations within the service area. All residential users were grouped into three overarching residential categories (diurnal profiles 1, 2, 3), and non-residential users were grouped into four non-residential categories (diurnals 10, 11, 20, and 30).

Table 5.4 Water Billing Business Class Land Use Categories

Land Use	Winter Water Usage Rate (gpd)	Model Diurnal Curve	Calibrated Return-to- Sewer Factor
Commercial General - Auto Related	29,558	11	0.78
Commercial General - Auto Sales	20,131	11	0.83
Commercial General - Commercial Parking Lots	23,165	11	0.81
Commercial General - Dining/Drinking Establishments	91,407	11	0.79
Commercial General - Financial	13,920	11	0.81
Commercial General - Gas Station	14,606	11	0.76
Commercial General - Grocery Store	18,493	11	0.80
Commercial General - Personal Services	97,080	11	0.75
Commercial General - Retail	269,412	11	0.76
Commercial Neighborhood - Auto Related	261	11	0.82
Commercial Neighborhood - Dining/Drinking Establishments	16,554	11	0.82
Commercial Neighborhood - Financial	1,826	11	0.82
Commercial Neighborhood - Grocery Store	7,441	11	0.83
Commercial Neighborhood - Personal Services	8,673	11	0.81
Commercial Neighborhood - Retail	28,700	11	0.78
Commercial Office - Medical Office	26,328	10	0.88
Commercial Office - Office	32,131	10	0.83
Commercial Office - Retail/Office	1,897	3	0.77
Commercial Regional - Retail Regional Center	26,755	3	0.87
Commercial Visitor - Coastal Recreation Related	4,529	3	0.84
Commercial Visitor - Entertainment	1,066	3	0.72
Commercial Visitor - Museums	525	3	0.87
Commercial Visitor - Overnight Accomodations	163,014	3	0.86
Conservation - Open Space/Cemetary	1,667	30	0.81
Industrial - Business Park	43,809	20	0.68
Industrial - Manufacturing	247,239	20	0.68
Industrial - Oil Production	8,844	20	0.70
Industrial - Warehousing	4,909	20	0.68
Mixed Use - Mixed Use	624	1	0.89
Mixed Use - MU Vertical	86,299	1	0.77
Mixed Use Horizontal - MU Horizontal	70	11	0.67
OS Commerical Recreation - Commerical Recreational	3,771	30	0.78
Park - City Park	4,186	30	0.78
Park - Other Park	7,351	30	0.72
Public Services - Fire Service Related	1,432	10	0.83
Public Services - Government Office	12,984	10	0.83
Public Services - Library	2,558	10	0.75
Public Services - Rail and Transportation	454	10	0.73
Public Services - Senior Center	11	10	0.90
Public Services - Utilities	6,555	10	0.84

Land Use	Winter Water Usage Rate (gpd)	Model Diurnal Curve	Calibrated Return-to- Sewer Factor
Residential High Density - Multi-Family Apartment	240,899	2	0.90
Residential High Density - Multi-Family Townhouse	116,093	2	0.88
Residential High Density - Res. Private Open Space	4,525	2	0.91
Residential High Density - Single Family	31,899	1	0.90
Residential Low Density - Res. Private Open Space	1,595	1	0.87
Residential Low Density - Single Family	5,802,924	1	0.84
Residential Med. High Density - Mobile Home	134,724	3	0.82
Residential Med. High Density - Multi-Family Apartment	2,386,309	2	0.84
Residential Med. High Density - Multi-Family Townhouse	196,507	2	0.89
Residential Med. High Density - Res. Private Open Space	658	2	0.91
Residential Med. High Density - Single Family	257,923	1	0.89
Residential Medium Density - Duplex	209,318	2	0.86
Residential Medium Density - Multi-Family Townhouse	42,090	2	0.91
Residential Medium Density - Res. Private Open Space	1,415	2	0.91
Residential Medium Density - Single Family	619,229	1	0.88
Right of Ways and Vacant - Streets/Alleys/Roadways	9,788	1	0.91
Right of Ways and Vacant - Vacant	10,589	1	0.86
Right of Ways and Vacant - Vacant Developed	9,068	1	0.90
School, Hospital, Religious - Hospital	30,172	11	0.80
School, Hospital, Religious - Private School	16,429	10	0.82
School, Hospital, Religious - Public School	19,005	10	0.79
School, Hospital, Religious - Religious	15,425	10	0.83
Shore - City Beach	912	10	0.90
Shore - State Beach	2,031	10	0.87
Total	11,489,764	n/a	0.83

For initial model simulation, GHD used systemwide wastewater-return-to-sewer factors based on other recent master planning work. When using water billing records as the starting point for wastewater generation into a model, not all of the water used by consumers is returned to the sewer system. Therefore, this fraction, or return-to-sewer factor, can be estimated or determined through sewer model calibration efforts, similar to what is done on this SMP. It can be generalized by land use and aggregated by land use as is shown in **Tables 5.5 and 5.6**. **Table 5.5** shows the initial return-to-sewer factors for each model diurnal curve, or the first guess at what these factors are, before they are refined and made more accurate through the calibration process.

Table 5.5 Initial Return-to-Sewer Factor by Land Use Categories

Aggregated Land Uses	Model Curve ID	Initial Return-to-sewer Factor
Single-family Residential	1	0.90
Multi-family Residential	2	0.91
Lodging Commercial, Mobile Home	3	0.87
Office Commercial, Public/Government, School	10	0.90
General Commercial, Automobile Commercial	11	0.83
Industrial, Light Industrial, Warehouse	20	0.78
Parks, Open Space	30	0.81

The calibrated overall systemwide average wastewater-return-to-sewer factor was 0.83 per **Table 5.4**, lower than the industry average of 0.88 (average from other master planning efforts completed by GHD and other consultants). The water usage was summed by diurnal pattern category and used to find the weighted average discharge factor per category. Then, all aggregated values were scaled down to account for the lower than 100% return-to-sewer factor. The aggregated return-to-sewer factors for each diurnal category are shown in **Table 5.6.**

Table 5.6 Aggregated Return-to-Sewer Factor by Land Use Categories

Aggregated Land Uses	Model Curve ID	Calibrated Return-to- sewer Factor
Single-family Residential	1	0.83
Multi-family Residential	2	0.83
Lodging Commercial, Mobile Home	3	0.84
Office Commercial, Public/Government, School	10	0.82
General Commercial, Automobile Commercial	11	0.76
Industrial, Light Industrial, Warehouse	20	0.67
Parks, Open Space	30	0.75

5.3.3 Groundwater Infiltration

Groundwater infiltration (GWI) is typically added to the hydraulic model as a constant flow added to the BWF. For this SMP model, dry season (yearly or perennial) and wet season contributions were estimated and added to the model at the subcatchment level, based on analysis of the flow meter data and model calibration.

The initial dry season estimates were based on the driest periods during flow monitoring, which were December 18-19, 2022. These days were a Sunday and Monday, chosen as they reflect a weekend and weekday diurnal flow pattern. For a few of the flow monitoring locations, there was no data for the specified days, so it was estimated from other days.

The GWI was then calculated and organized by the flow meter basins. Flow meter basins are presented in **Chapter 5.1** and refer to the sewers and drainage area tributary to a flow meter. Without any further knowledge on these specific sources of GWI within a flow meter basin, the total GWI is typically distributed equally throughout the flow meter basin, at the subcatchment level (which for this model, was the parcel level), by area-weighted allocation. This means that if a particular flow meter shows elevated minimum flows, then it's likely due to higher perennial groundwater. This initial calculation is based on difference between modeled minimum flow and observed minimum (where sufficient observed minimums exist). Further refinement is done on a case-by-case basis where the calibration process warrants more or less GWI. Calculated values for DWF GWI and WWF GWI for each meter basin are presented in **Tables 5.8 and 5.10**.

5.3.4 Rainfall Dependent Inflow and Infiltration

Rainfall-dependent inflow and infiltration (RDI&I) sewer flows are influenced by the magnitude, shape, and timing of the RDI&I response. The magnitude of the RDI&I response is often described by the percentage of rain volume entering the system ("R" value). The RDI&I hydrograph shape is defined by separating the total RDI&I hydrograph volume into components, mimicking the different responses to rainfall (fast, medium, and slow) associated with the typical Rate, Time, Ratio to Recession (RTK) method of synthesizing runoff.

This master plan's hydraulic model used the RTK method for runoff volume and routing generation within InfoWorks ICM, which defines the proportion of rainfall falling on the subcatchment that enters the system as RDI&I and the time at which this rainfall enters the system. Each set of RTK parameters defines a triangular graph against time, where:

- R is the area under the graph of the proportion of rainfall falling on the subcatchment that enters the sewer system
- T is the time from the onset of rainfall to the peak of the triangle
- K is the ratio of 'time to recession' to the ' time to peak' of the hydrograph

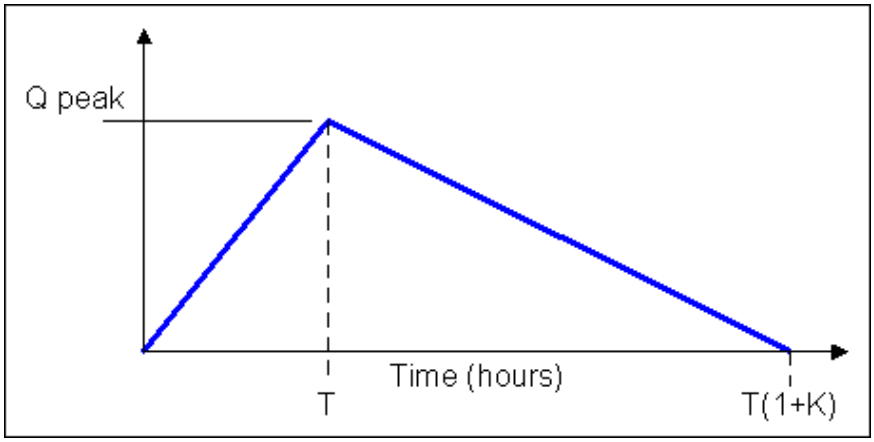


Figure 5.4 Basic Parameters of the Triangular RTK Hydrograph[2]

The RTK method is based on fitting up to three triangular unit hydrographs to an observed hydrograph to estimate the fast, medium, and slow rainfall-derived infiltration and inflow responses. Three sets of RTK parameters can be defined, representing short-term, medium-term, and long-term rainfall response. The three triangular graphs are combined to define the Unit Hydrograph as shown below in Figure 5.5.

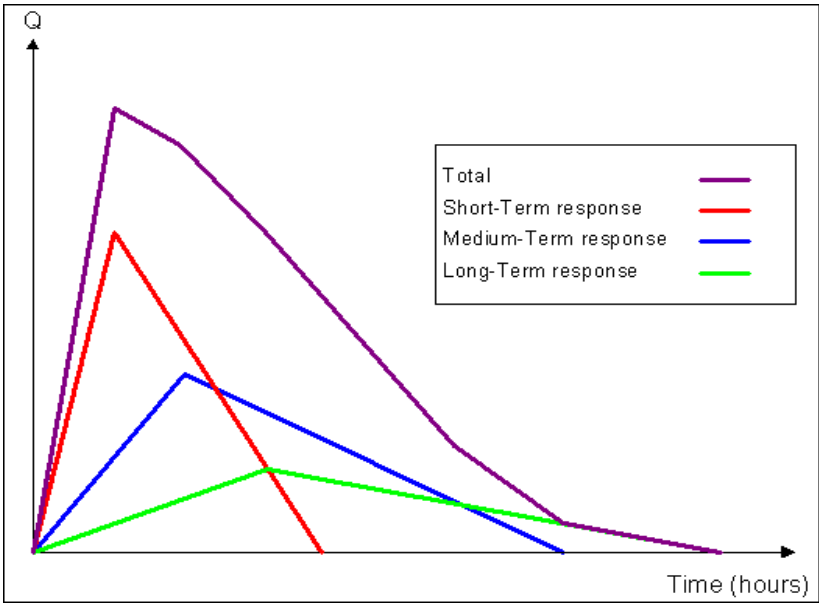


Figure 5.5 Fast, Medium, and Slow Components RTK Hydrograph[2]

For any simulation, the RTK hydrograph is applied to the rainfall profile associated with the subcatchment and multiplied by the subcatchment's contributing area to give the resulting RDI&I that loads to the subcatchment's node.

[2] Infoworks ICM Help Documentation (2021):

http://help2.innovyze.com/infoworksicm/Content/HTML/ICM_ILCM/RTK_Method.htm

5.4 Existing Model Calibration

Dry and wet weather model flows were calibrated by comparing model results to flow monitoring data for the flow monitoring periods. The calibration process and results are described below.

5.4.1 Dry Weather Flow Calibration

Dry weather flow calibration involves generating the average flow rates and 24-hour diurnal profiles in the model that provide an acceptable match of modeled flows to monitored flows for a typical dry period. This was done by adjusting BWF contributions and modifying diurnal curves where necessary. A two-day period from December 18th through December 19th (Sunday and Monday) was used to calibrate a dry weather condition. **Table 5.7** lists the observed and modeled flows for all meters. Overall, the dry weather calibration produced very close alignment between the observed and modeled flows. Typical goodness of fit for DWF calibration require modeled average flows to be within +/- 10% of observed flows. All but one flow meter site was within the +/-10 %. However, it did not impact the calibration accuracy and is explained as follows.

The initial calibration runs showed flow meter 16 overpredicting the observed flow meter data by 22%. Therefore, to bring the modeled flows closer to the observed values, the return-to-sewer factor was lowered to 73%, which is a low percentage, especially for a primarily residential basis as this one is. A thorough review of billing meter data and subcatchment loading confirm that flows estimated by the model are accurate and loaded correctly. While it is conservative to overestimate the flow at this meter location, it has negligible impact on the local and downstream system. **Figure 5.6** shows the flow meter 16 observed vs modeled hydrograph for dry weather, and **Figure 5.7** shows the flow meter 23 (this is the largest basin and is downstream of many other basins) hydrograph. **Appendix B** contains DWF hydrographs for all 24 flow meters used in DWF calibration. These hydrographs show how closely the model flows match to the observed flows.

Table 5.7 Dry Weather Flow Calibration Results

Calibration Graph and Flow Monitoring ID	Model Pipe ID	Modeled Total Flow (MGD)	Observed Total Flow (MGD)	% Difference
1	7363.1 (Upstream)	0.461	0.468	-1%
2	8347.1	0.414	0.405	2%
3	10499.1	0.908	0.905	0%
4	CST0060-0500.1	0.448	0.449	0%
5	CST0060-0195.1	1.550	1.582	-2%
6	CST0068-0000.1	1.684	1.637	3%
7	KNT0080-0735.1	0.608	0.549	11%
8	1868.1 (Upstream)	0.194	0.204	-5%
9	KNT0080-0265.1	0.425	0.449	-5%
11	13310.1	0.380	0.400	-5%
12	5294.1	0.270	0.283	-4%
13	2741.1 (Upstream)	0.394	0.407	-3%
14	3903.1	0.234	0.245	-4%
15	4021.1 (Upstream)	0.030	0.033	-8%
16	4355.1	0.613	0.504	22%
17	12870.1	0.338	0.369	-8%
18	4988.1	0.188	0.197	-5%
19	11726.1	0.361	0.371	-3%
20	7345.1	0.128	0.122	5%
21	KNT0080-0463.1	0.321	0.323	-1%
22	KNT0080-0416.1	1.579	1.547	2%
23	KNT0080-0010.1	5.657	5.187	9%
24	8295.1	0.512	0.504	2%

Final statistics for the net contributions for all of the City's sewer basins are shown below in **Table 5.8.**

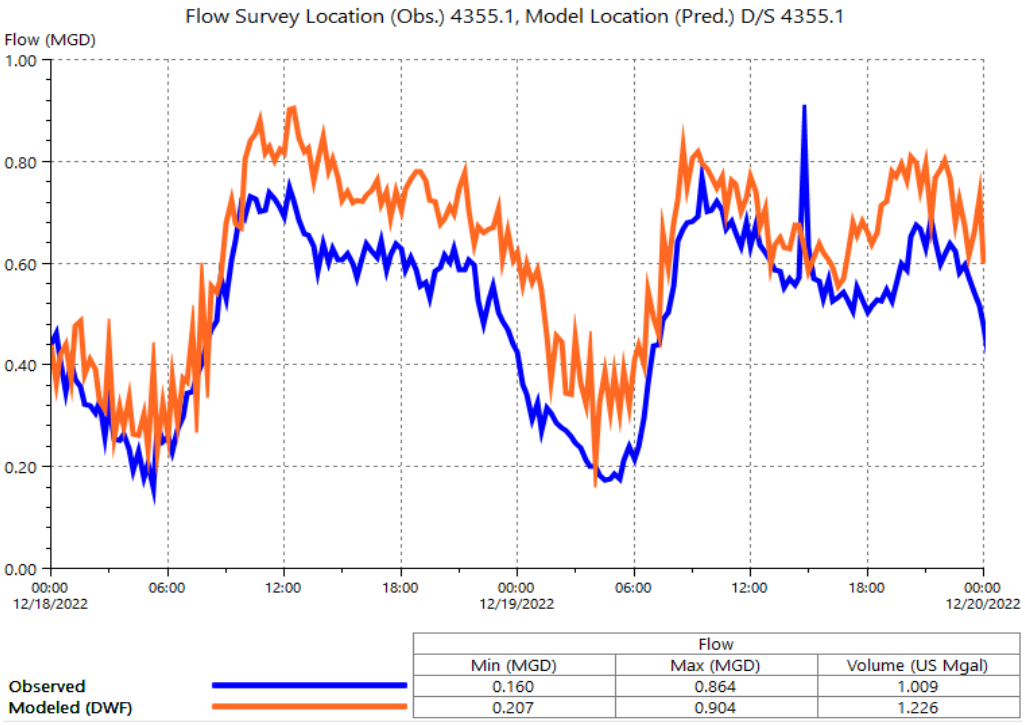


Figure 5.6 Example DWF Calibration Graph for Flow Meter 16

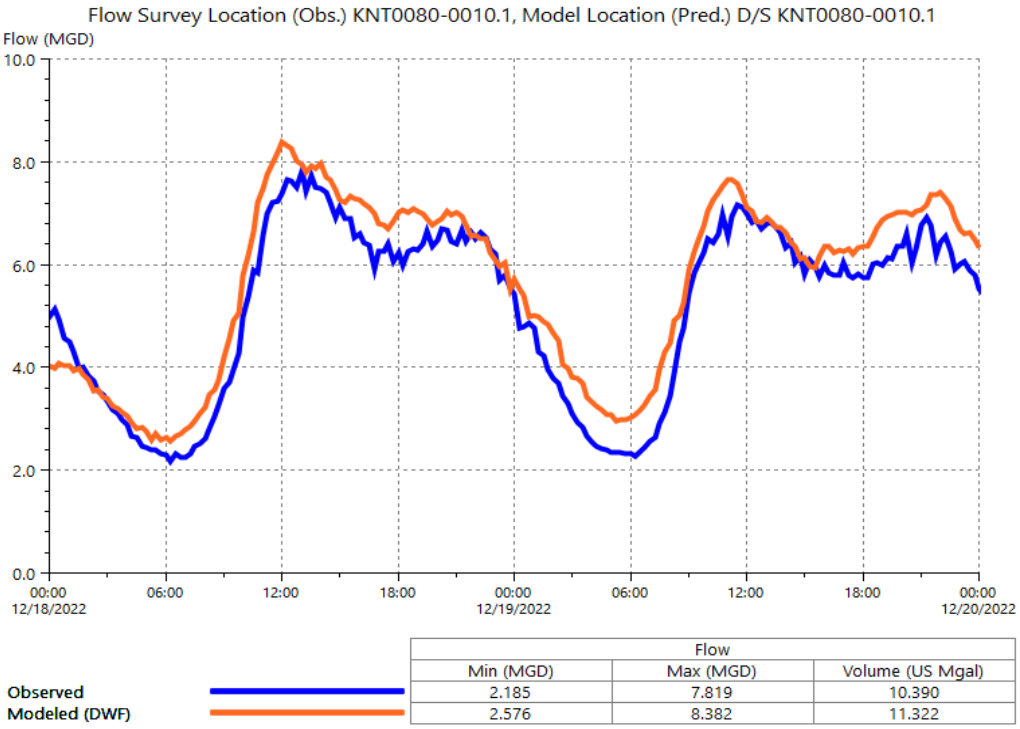


Figure 5.7 Example DWF Calibration Graph for Flow Meter 23

Table 5.8 DWF Calibration Sewer Basin Statistics

Sewer Basin ID	Model Pipe ID	Basin Contributing Area (acres)	Modeled BWF Load (gpd)	4 Month Winter BWF Average Usage (gpd)	Dry Season GWI (gpd)	Total DWF Model Input (gpd)	Dry Season GWI/area (gpd/acre)	Return-To-Sewer-Factor
1	7363.1 (Upstream)	386	327,795	366,299	134,961	462,756	350	0.89
2	8347.1	334	393,056	437,431	18,175	411,232	53	0.90
3	10499.1	626	739,684	823,322	159,091	898,774	254	0.90
4	CST0060-0500.1	471	571,018	666,809	87,025	658,042	185	0.86
5	CST0060-0195.1	875	1,003,597	1,121,428	436,932	1,440,529	499	0.89
6	CST0068-0000.1	493	791,938	887,215	192,052	983,989	389	0.89
7	KNT0080-0735.1	494	427,304	544,193	149,393	576,697	302	0.79
8	1868.1 (Upstream)	636	192,723	287,271	15,715	208,438	25	0.67
9	KNT0080-0265.1	482	347,428	430,057	76,963	424,391	160	0.81
11	13310.1	325	280,328	363,285	106,856	387,184	328	0.77
12	5294.1	245	212,851	252,988	55,996	268,847	229	0.84
13	2741.1 (Upstream)	225	229,644	254,523	46,131	275,775	205	0.90
14	3903.1	82	86,478	96,937	16,878	103,356	205	0.89
15	4021.1 (Upstream)	67	30,853	38,712	1,449[1]	32,302	221	0.80
16	4355.1	154	164,273	226,520	29,978	194,251	195	0.73
17	12870.1	87	17,897	25,281	19,994	37,891	229	0.71
18	4988.1	169	202,572	234,212	36,063	238,635	213	0.86
19	11726.1	462	287,886	354,470	77,004	364,891	167	0.81
20	7345.1	127	124,359	170,782	4,775	129,133	38	0.73
21	KNT0080-0463.1	177	308,087	420,761	20,355	328,442	113	0.73
22	KNT0080-0416.1	281	265,620	365,020	66,186	331,805	235	0.73
23	KNT0080-0010.1	1,828	1,475,461	2,041,672	120,269	1,595,730	66	0.72
24	8295.1	645	398,215	443,158	116,462	514,676	181	0.90
Not Metered	n/a	2,771	2,394,261	2,911,871	566,730	2,960,991	205	0.82
Totals		12,443	11,273,326	13,764,217	2,555,432	13,828,758	205	0.82

[1] The influence of Coral Cay lift stations on this flow monitoring location made it difficult to accurately estimate GWI

5.4.2 Wet Weather Flow Calibration

Wet weather flow calibration was a more complex process than the DWF calibration and involved varying multiple input parameters at the subcatchments (parcel) level to ultimately match modeled flows and volumes with those observed at the meter-basin level. As mentioned, the storm event from March 14th, 2023 was chosen as the wet weather calibration event for the SMP.

The model calibration included distributing GWI and RDI&I throughout the model by adjusting inflow and infiltration (RTK) parameters to get the best match of observed flows to modeled flows at the majority of meters. **Table 5.9** compares the observed flows and modeled flows for all 24 meters. **Appendix C** contains WWF hydrographs for all 24

flow meters used in WWF calibration. These hydrographs show how closely the model flows match to the observed flows.

Table 5.9 Wet Weather Flow Calibration Results

Calibration Graph and Flow Monitoring ID	Model Pipe ID	Modeled Total Flow (MGD)	Observed Total Flow (MGD)	% Difference	Modeled Peak Flow (MGD)	Observed Peak Flow (MGD)	% Difference
1	7363.1 (Upstream)	1.83	1.81	1%	1.53	1.48	4%
2	8347.1	1.58	1.59	0%	1.15	1.18	-3%
3	10499.1	4.08	4.07	0%	3.28	3.13	5%
4	CST0060-0500.1	1.17	1.05	11%	0.99	0.99	0%
5	CST0060-0195.1	4.04	4.07	-1%	3.70	3.38	10%
6	CST0068-0000.1	4.31	4.52	-5%	3.90	3.78	3%
7	KNT0080-0735.1	4.42	4.14	7%	3.04	3.45	-12%
8	1868.1 (Upstream)	0.90	0.91	-1%	1.02	0.96	6%
9	KNT0080-0265.1	3.37	3.33	1%	2.49	2.53	-2%
11	13310.1	1.60	1.58	1%	1.36	1.29	5%
12	5294.1	0.33	0.40	-17%	0.65	0.79	-17%
13	2741.1 (Upstream)	1.08	1.09	-1%	0.99	1.07	-8%
14	3903.1	0.65	0.60	8%	0.64	0.77	-18%
15	4021.1 (Upstream)	0.10	0.10	2%	0.17	0.26	-34%
16	4355.1	1.71	1.25	36%	1.56	1.38	13%
17	12870.1	1.08	1.22	-11%	1.40	1.15	21%
18	4988.1	0.58	0.61	-5%	1.21	1.08	12%
19	11726.1	0.94	0.89	5%	1.24	0.94	32%
20	7345.1	0.28	0.27	3%	0.23	0.25	-8%
21*	KNT0080-0463.1	0.79	0.76*	3%	0.88	0.86*	2%
22	KNT0080-0416.1	4.85	5.02	-3%	4.16	3.93	6%
23	KNT0080-0010.1	23.04	22.15	4%	17.57	18.87	-7%
24	8295.1	1.25	1.22	2%	1.02	0.99	3%

*Observed flows adjusted down to what they should have been if the Saybrook forcemain east outlet was closed the entire 4-day calibration period

City operations and maintenance controls the distribution of flows out of Saybrook Lift Station during the wet season months. In 2023, it was confirmed that the City opened the east outlet forcemain from January 18th 2023 through March 14th, 2023. This had an effect on the calibration as the opening and closing of the gate was just after a key January storm and just before a key March storm (the chosen calibration storm for this SMP). **Figure 5.8 and Figure 5.9** depict this phenomenon.

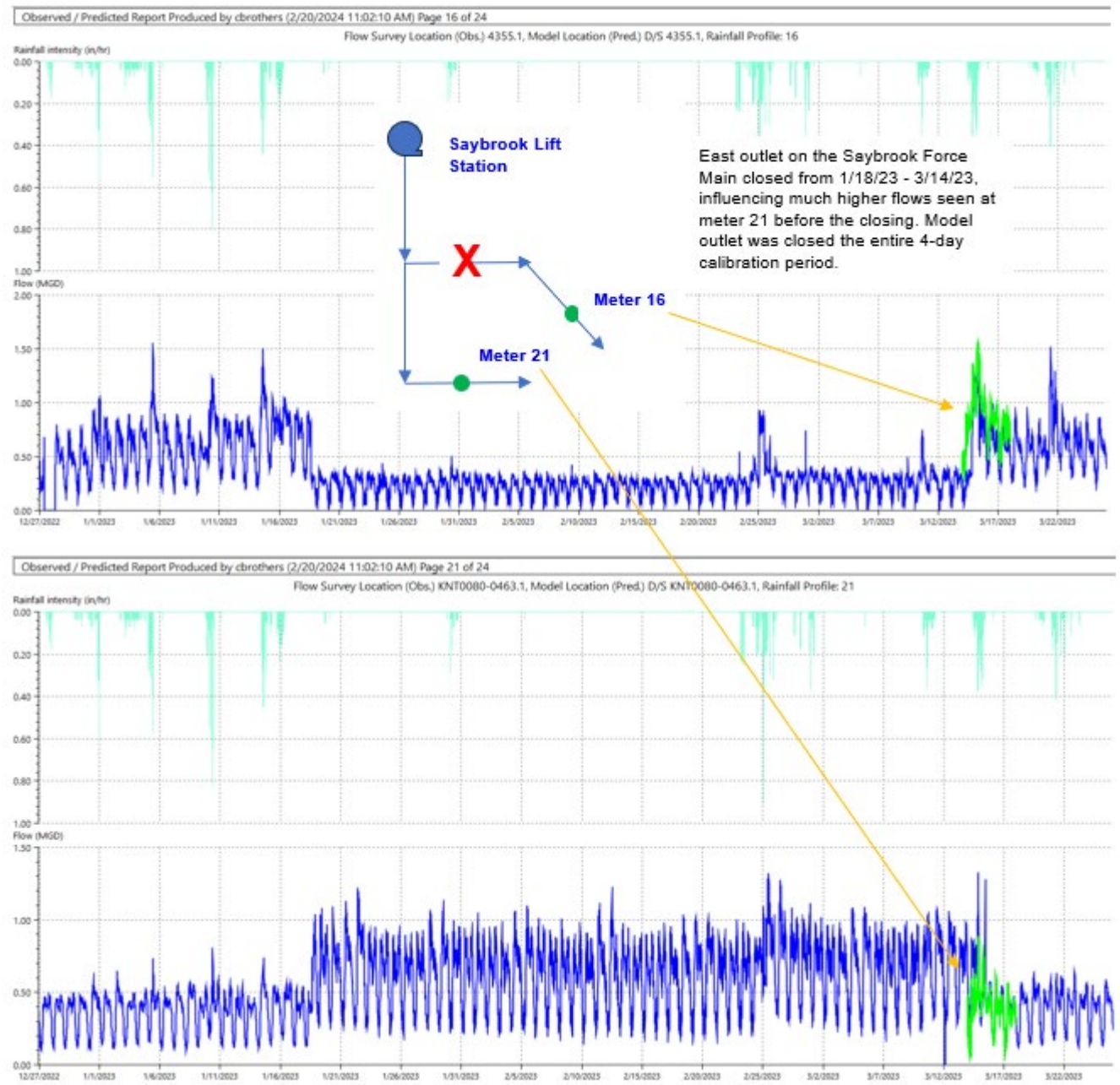
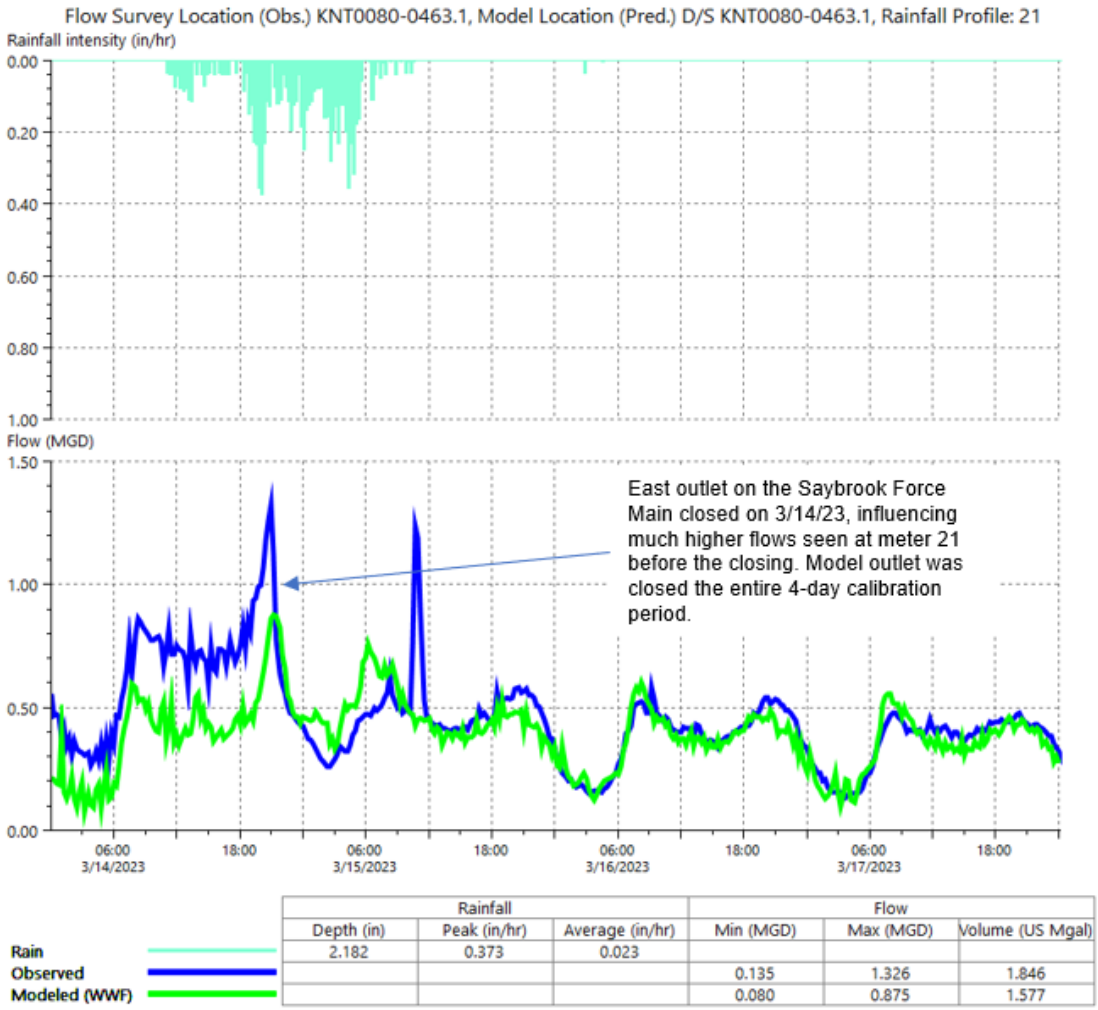


Figure 5.8 Impacts to Meters 16 & 21 from January 18 through March 14 Saybrook Forcemain Operations



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.182	0.373	0.023			
Observed				0.135	1.326	1.846
Modeled (WWF)				0.080	0.875	1.577

Figure 5.9 WWF Calibration Graph Meter 21

Table 5.10 shows each flow meter basins key statistics over the 4-day wet weather calibration period of March 14-17, 2023. This table displays wet weather and total GWI per meter basin, and normalized by area (acres). It also displays RDI&I as an average rate and peak rate, also normalized by area (acres). Finally, the total wet weather input to the model from each basin is presented, as well as the standard wet weather peaking factor, which divides the peak wet weather flow rate by the average dry weather flow rate.

Table 5.10 WWF Calibration Sewer Basin Statistics

Sewer Basin ID	Basin Contri-buting Area (acres)	Total DWF Model Input (gpd)	WWF GWI (gpd)	WWF GWI/area (gpd/acre)	Total GWI (gpd)	Total GWI/area (gpd/acre)	Average RDI&I (gpd)	Average RDI&I/area (gpd/acre)	Peak RDI&I (gpd)	Peak RDI&I/area (gpd/acre)	Total WWF Model Input (gpd)	Peak WWF Model Input (gpd)	WWF Peaking Factor (PkF)
1	386	463,000	140,000	363	275,000	712	311,000	805	1,040,000	2,704	910,000	1,590,000	3.4
2	334	411,000	162,000	476	180,000	529	217,000	636	460,000	1,361	780,000	1,240,000	3.0
3	626	899,000	440,000	703	599,000	957	702,000	1,121	1,760,000	2,804	2,040,000	3,370,000	3.7
4	471	658,000	10,000	21	97,000	206	204,000	432	630,000	1,344	860,000	1,560,000	2.4
5	875	1,441,000	87,000	99	524,000	598	381,000	435	1,980,000	2,265	1,890,000	3,820,000	2.7
6	493	984,000	31,000	62	223,000	451	261,000	529	1,570,000	3,186	1,260,000	2,760,000	2.8
7	494	577,000	271,000	549	420,000	851	1,404,000	2,840	5,310,000	10,737	2,260,000	6,120,000	10.6
8	636	208,000	65,000	102	81,000	127	154,000	242	960,000	1,513	450,000	1,230,000	5.9
9	482	424,000	465,000	965	542,000	1,125	838,000	1,740	2,190,000	4,541	1,730,000	3,200,000	7.5
11	325	387,000	248,000	759	355,000	1,087	182,000	557	750,000	2,284	820,000	1,410,000	3.6
12	245	269,000	69,000	280	125,000	509	71,000	291	320,000	1,302	410,000	670,000	2.5
13	225	276,000	31,000	138	77,000	343	87,000	386	400,000	1,798	390,000	790,000	2.9
14	82	103,000	12,000	146	29,000	351	32,000	384	160,000	1,943	150,000	290,000	2.8
15	67	32,000	3,000	45	4,000	66	15,000	219	90,000	1,298	50,000	130,000	4.1
16	154	194,000	4,000	28	34,000	223	92,000	597	360,000	2,360	290,000	570,000	2.9
17	87	38,000	60,000	688	80,000	917	61,000	703	200,000	2,323	160,000	310,000	8.2
18	169	239,000	17,000	101	53,000	314	95,000	559	850,000	5,040	350,000	1,130,000	4.7
19	462	365,000	29,000	62	106,000	228	76,000	165	670,000	1,457	470,000	1,120,000	3.1
20	127	129,000	3,000	23	8,000	61	8,000	63	70,000	568	140,000	240,000	1.9
21	177	328,000	12,000	68	32,000	182	71,000	394	530,000	2,928	400,000	940,000	2.9
22	281	332,000	250,000	889	316,000	1,124	53,000	190	250,000	881	630,000	990,000	3.0
23	1,828	1,596,000	737,000	403	857,000	469	225,000	123	970,000	529	2,540,000	3,980,000	2.5
24	645	515,000	31,000	48	147,000	228	80,000	125	430,000	667	630,000	1,120,000	2.2
Not Metered	2,771	2,961,000	649,000	235	1,216,000	441	1,824,000	661	6,580,000	2,385	5,390,000	10,630,000	3.6
Totals	12,443	13,829,000	3,826,000		6,380,000		7,444,000		28,530,000		25,000,000	49,210,000	

5.5 Future Condition Flow Estimates

The future conditions model assumed future conditions as discussed in **Chapter 4**. Existing BWFs were updated to account for Community Development Major Projects (CDMPs), Pipeline Projects (PLPs), Residential Housing Needs Assessment (RHNA) units, development of select vacant parcels, and the Center for Demographic Research (CDR) 2040 TAZ level development, in accordance with the land use classifications in **Chapter 4.2**. Flows were projected based on unit flows developed from the calibrated DWF model. In total, these modified BWFs (existing flows + future development flows) represent the future (2040) scenario. Timing for the cumulative development of land within the study area was considered in the hydraulic analysis with CDMP and PLP development assumed to happen for the near-term scenario, and all remaining anticipated development was assumed to be completed for the future (2040) scenario. Once BWF was estimated for each future development, the appropriate diurnal curve from **Table 5.3** was assigned.

5.5.1 Unit Flows for Development

Unit flows were used to estimate future flows for all future development. They are based on the assumption that a future development will have the same sewer contribution as an existing development for the same type of use. In other words, a future single-family residence will have the same contribution as an existing single-family residence. Unit flows are expressed as sewer contribution per dwelling unit, hotel room, and non-residential development (commercial or industrial) square-footage. Unit flows for future development were based on the calibrated DWF model, which includes water billing records, existing land use, return to sewer factors, and flow monitoring data. The unit flows in gallons per day (gpd) are provided in **Table 5.11**.

Table 5.11 Unit Flows for Future Development

Development Type	Units	Unit Flow
Single-Family Residential	gpd/DU	170
Multi-Family Residential	gpd/DU	135
Hotels	gpd/room	150
Commercial – Office	gpd/1,000-sf	100
Commercial - General	gpd/1,000-sf	200
Industrial	gpd/1,000-sf	100

5.5.2 Summary of Future Development Projects by TAZ and Type

Table 5.12 summarize the BWF for developments presented in **Chapter 4**, which are included in the future flows model. **Figure 5.10**, **Figure 5.11**, and **Figure 5.12** illustrate that the future sewer contribution (quantity of development BWF added to the future flow model scenarios) is occasionally projected to go down. In these rarer cases, there is a projected future reduction in commercial and industrial use. See **Appendix A** for specific development details and projected BWF.

Table 5.12 Summary of Future Development by TAZ and Development Type

TAZ Number	TAZ ID	Scenario	Single- Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
1	32651200	Near-Term	-	-	-	-	1,171
		2040	-	1,080	91	1,171	
2	32658100	Near-Term	-	-	1,235	1,235	1,775
		2040	-	540	-	540	
3	32681100	Near-Term	-	-	-	-	(7)
		2040	-	-	(7)	(7)	
4	32689100	Near-Term	-	-	-	-	547
		2040	-	540	7	547	
5	32651400	Near-Term	-	-	138,020	138,020	138,020
		2040	-	-	-	-	
6	32658200	Near-Term	-	-	-	-	892
		2040	170	540	182	892	
8	32652200	Near-Term	-	-	-	-	1,755
		2040	-	-	1,755	1,755	
9	32656100	Near-Term	-	-	-	-	1,168
		2040	-	810	358	1,168	
10	32664100	Near-Term	-	-	-	-	999
		2040	-	810	189	999	
12	32652400	Near-Term	-	-	-	-	1,226
		2040	-	270	956	1,226	
13	32656200	Near-Term	-	-	-	-	3,749
		2040	-	3,645	104	3,749	
14	32664200	Near-Term	-	-	-	-	953
		2040	-	810	143	953	
15	32664300	Near-Term	-	17,550	648	18,198	95,214
		2040	-	75,201	1,815	77,016	
16	32682400	Near-Term	-	45,500	1,957	47,457	54,257
		2040	340	5,765	695	6,800	
17	32641100	Near-Term	-	-	3,598	3,598	3,733
		2040	-	135	-	135	
18	32642100	Near-Term	270	-	-	270	264
		2040	-	-	(7)	(7)	
21	32648100	Near-Term	-	-	-	-	897
		2040	170	675	52	897	
22	32654100	Near-Term	-	-	-	-	827
		2040	170	540	117	827	
23	32661100	Near-Term	-	-	-	-	788
		2040	170	540	78	788	
24	32661200	Near-Term	-	-	-	-	437
		2040	170	540	(273)	437	
25	32672100	Near-Term	-	-	-	-	99,820
		2040	-	99,307	514	99,820	

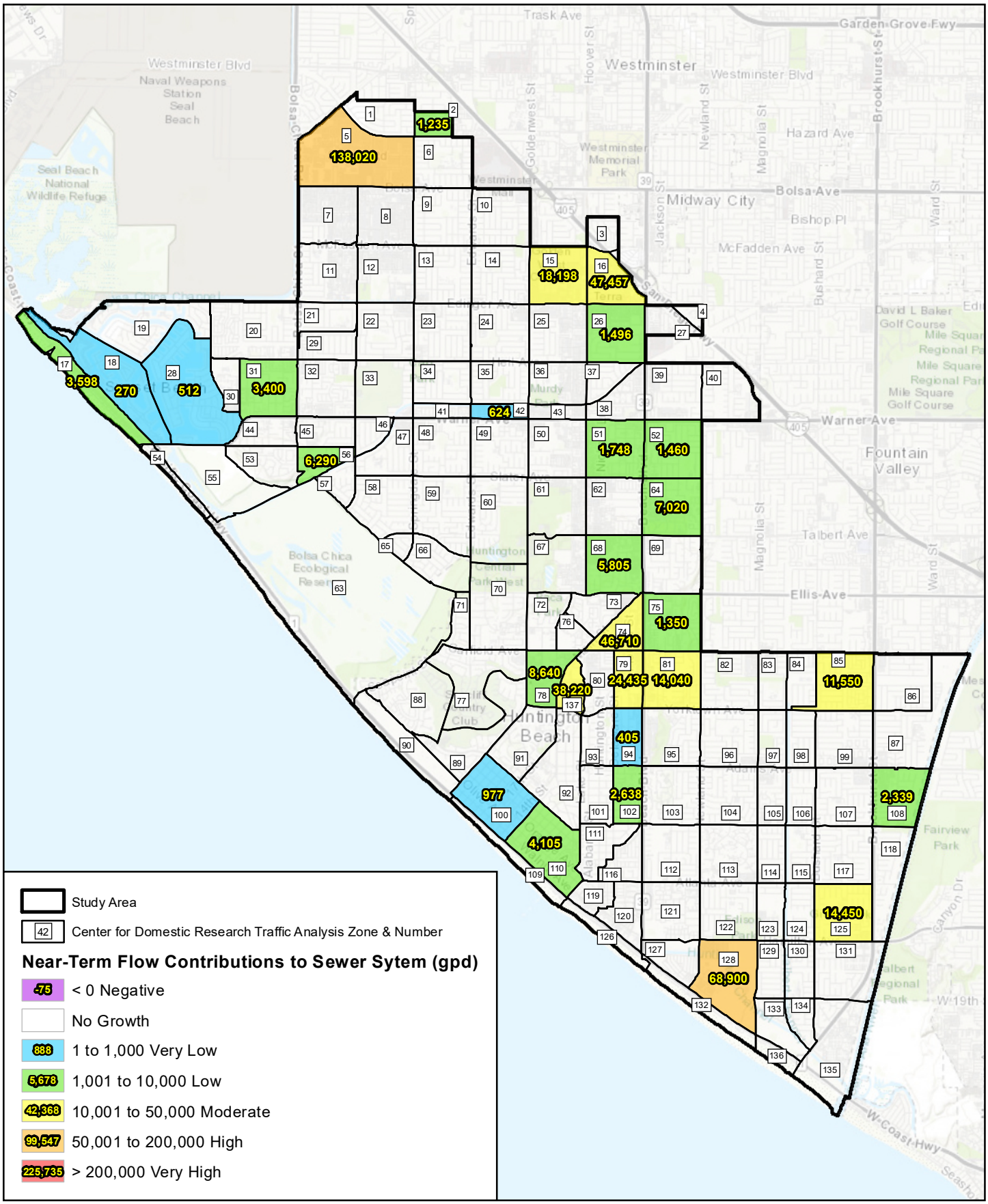
TAZ Number	TAZ ID	Scenario	Single- Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
26	32672200	Near-Term	680	-	816	1,496	249,225
		2040	510	247,219	-	247,729	
27	32689200	Near-Term	-	-	-	-	82,781
		2040	85	82,566	130	82,781	
28	32644200	Near-Term	-	-	512	512	682
		2040	170	-	-	170	
29	32648200	Near-Term	-	-	-	-	572
		2040	170	675	(273)	572	
30	32645200	Near-Term	-	-	-	-	998
		2040	170	405	423	998	
31	32647100	Near-Term	3,400	-	-	3,400	3,511
		2040	-	-	111	111	
32	32648300	Near-Term	-	-	-	-	1,378
		2040	340	810	228	1,378	
33	32654200	Near-Term	-	-	-	-	613
		2040	-	405	208	613	
34	32660100	Near-Term	-	-	-	-	1,363
		2040	340	945	78	1,363	
35	32660200	Near-Term	-	-	-	-	962
		2040	170	675	117	962	
36	32673100	Near-Term	-	-	-	-	120,837
		2040	170	119,614	1,053	120,837	
37	32673200	Near-Term	-	-	-	-	662
		2040	-	675	(13)	662	
38	32673300	Near-Term	-	-	-	-	57,610
		2040	340	56,990	280	57,610	
39	32690100	Near-Term	-	-	-	-	7,222
		2040	-	6,813	410	7,222	
40	32690200	Near-Term	-	-	-	-	16,133
		2040	-	15,983	150	16,133	
41	32660300	Near-Term	-	-	-	-	(65)
		2040	-	-	(65)	(65)	
42	32660400	Near-Term	-	-	624	624	624
		2040	-	-	-	-	
43	32673400	Near-Term	-	-	-	-	51,814
		2040	-	51,619	195	51,814	
44	32646100	Near-Term	-	-	-	-	335
		2040	-	270	65	335	
45	32646200	Near-Term	-	-	-	-	1,100
		2040	340	675	85	1,100	
46	32646300	Near-Term	-	-	-	-	662
		2040	-	675	(13)	662	
47	32649100	Near-Term	-	-	-	-	1,052

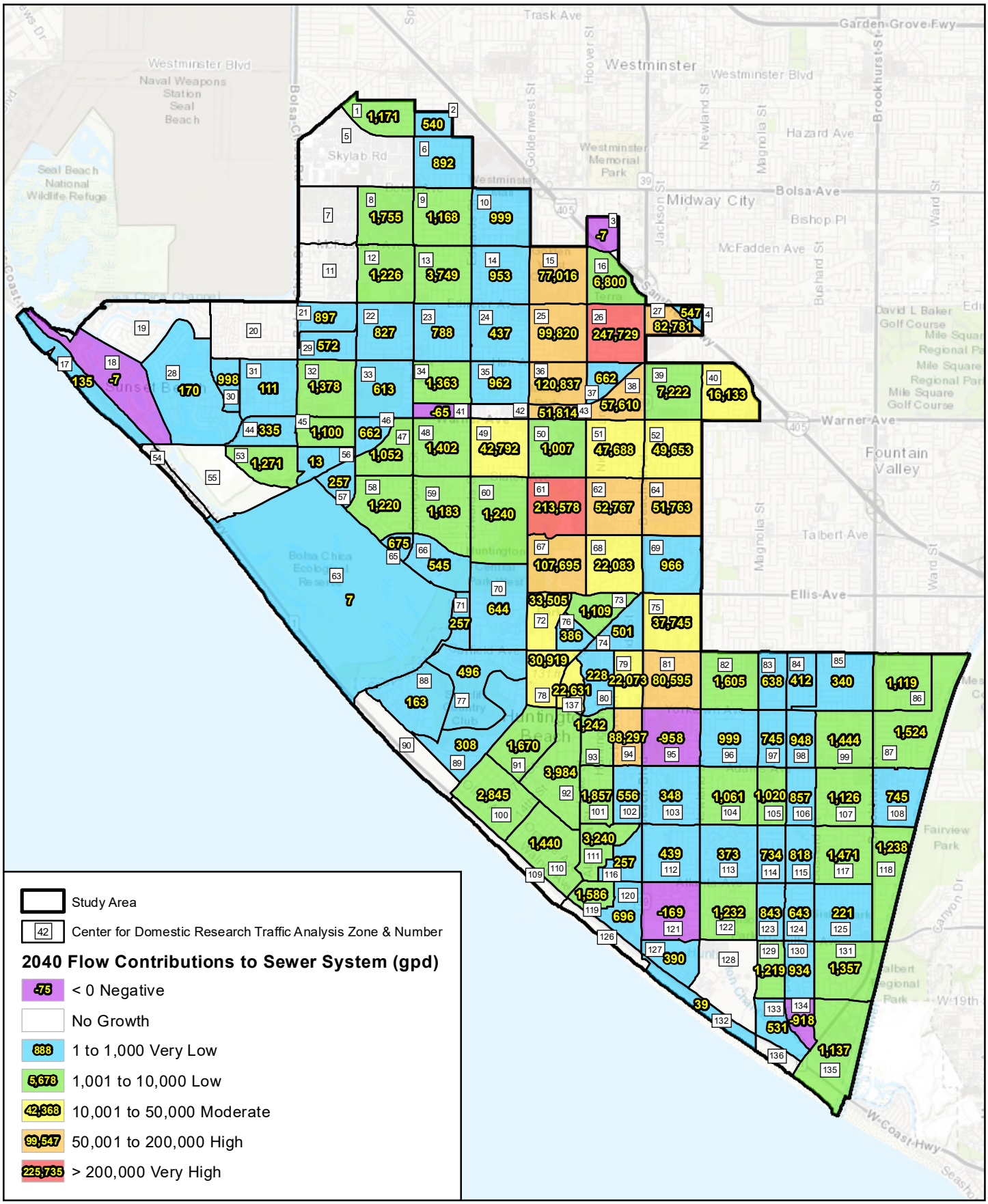
TAZ Number	TAZ ID	Scenario	Single- Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
		2040	170	810	72	1,052	
48	32657100	Near-Term	-	-	-	-	1,402
		2040	340	945	117	1,402	
49	32665100	Near-Term	-	-	-	-	42,792
		2040	170	42,317	306	42,792	
50	32674100	Near-Term	-	-	-	-	1,007
		2040	-	675	332	1,007	
51	32674200	Near-Term	-	-	1,748	1,748	49,436
		2040	-	47,688	-	47,688	
52	32685100	Near-Term	-	-	1,460	1,460	51,113
		2040	-	49,653	-	49,653	
53	32646400	Near-Term	-	-	-	-	1,271
		2040	1,020	270	(20)	1,271	
56	32646700	Near-Term	6,290	-	-	6,290	6,303
		2040	-	-	13	13	
57	32649200	Near-Term	-	-	-	-	257
		2040	-	270	(13)	257	
58	32649300	Near-Term	-	-	-	-	1,220
		2040	340	945	(65)	1,220	
59	32657200	Near-Term	-	-	-	-	1,183
		2040	170	675	338	1,183	
60	32665200	Near-Term	-	-	-	-	1,240
		2040	170	810	260	1,240	
61	32674300	Near-Term	-	-	-	-	213,578
		2040	-	213,156	423	213,578	
62	32674400	Near-Term	-	-	-	-	52,767
		2040	-	51,357	1,411	52,767	
63	32649400	Near-Term	-	-	-	-	7
		2040	-	-	7	7	
64	32685200	Near-Term	-	7,020	-	7,020	58,783
		2040	-	51,750	13	51,763	
65	32649500	Near-Term	-	-	-	-	675
		2040	-	675	-	675	
66	32649600	Near-Term	-	-	-	-	545
		2040	-	675	(130)	545	
67	32666100	Near-Term	-	-	-	-	107,695
		2040	-	107,299	397	107,695	
68	32675100	Near-Term	-	5,805	-	5,805	27,888
		2040	510	20,520	1,053	22,083	
69	32684100	Near-Term	-	-	-	-	966
		2040	-	810	156	966	
70	32666200	Near-Term	-	-	-	-	644
		2040	-	540	104	644	

TAZ Number	TAZ ID	Scenario	Single- Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
71	32649700	Near-Term	-	-	-	-	257
		2040	-	270	(13)	257	
72	32666300	Near-Term	-	-	-	-	33,505
		2040	-	33,408	98	33,505	
73	32675200	Near-Term	-	-	-	-	1,109
		2040	-	810	299	1,109	
74	32675300	Near-Term	-	46,710	-	46,710	47,211
		2040	-	-	501	501	
75	32684200	Near-Term	-	1,350	-	1,350	39,095
		2040	-	37,862	(117)	37,745	
76	32675400	Near-Term	-	-	-	-	386
		2040	-	405	(20)	386	
77	32659100	Near-Term	-	-	-	-	496
		2040	-	405	91	496	
78	32669100	Near-Term	-	7,560	1,080	8,640	39,559
		2040	-	30,919	-	30,919	
79	32678100	Near-Term	-	24,435	-	24,435	46,508
		2040	510	21,355	208	22,073	
80	32678200	Near-Term	-	-	-	-	228
		2040	-	-	228	228	
81	32686100	Near-Term	-	14,040	-	14,040	94,635
		2040	340	79,917	338	80,595	
82	32694100	Near-Term	-	-	-	-	1,605
		2040	680	405	520	1,605	
83	32702100	Near-Term	-	-	-	-	638
		2040	-	540	98	638	
84	32702200	Near-Term	-	-	-	-	412
		2040	-	405	7	412	
85	32702300	Near-Term	-	-	11,550	11,550	11,890
		2040	-	405	(65)	340	
86	32715100	Near-Term	-	-	-	-	1,119
		2040	340	675	104	1,119	
87	32715200	Near-Term	-	-	-	-	1,524
		2040	680	675	169	1,524	
88	32659200	Near-Term	-	-	-	-	163
		2040	-	-	163	163	
89	32659300	Near-Term	-	-	-	-	308
		2040	-	405	(98)	308	
91	32669200	Near-Term	-	-	-	-	1,670
		2040	680	405	585	1,670	
92	32669300	Near-Term	-	-	-	-	3,984
		2040	-	2,430	1,554	3,984	
93	32678300	Near-Term	-	-	-	-	1,242

TAZ Number	TAZ ID	Scenario	Single- Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
		2040	850	405	(13)	1,242	
94	32678400	Near-Term	-	405	-	405	88,702
		2040	340	87,385	572	88,297	
95	32686200	Near-Term	-	-	-	-	(958)
		2040	680	-	(1,638)	(958)	
96	32694200	Near-Term	-	-	-	-	999
		2040	340	405	254	999	
97	32703100	Near-Term	-	-	-	-	745
		2040	340	405	-	745	
98	32703200	Near-Term	-	-	-	-	948
		2040	170	810	(33)	948	
99	32703300	Near-Term	-	-	-	-	1,444
		2040	340	675	429	1,444	
100	32662100	Near-Term	-	540	437	977	3,822
		2040	1,360	1,485	-	2,845	
101	32677100	Near-Term	-	-	-	-	1,857
		2040	510	1,080	267	1,857	
102	32677200	Near-Term	-	2,638	-	2,638	3,194
		2040	510	-	46	556	
103	32687100	Near-Term	-	-	-	-	348
		2040	-	270	78	348	
104	32693100	Near-Term	-	-	-	-	1,061
		2040	340	675	46	1,061	
105	32700100	Near-Term	-	-	-	-	1,020
		2040	-	675	345	1,020	
106	32700200	Near-Term	-	-	-	-	857
		2040	-	675	182	857	
107	32709100	Near-Term	-	-	-	-	1,126
		2040	340	675	111	1,126	
108	32711100	Near-Term	1,360	-	979	2,339	3,084
		2040	340	405	-	745	
110	32670200	Near-Term	-	4,105	-	4,105	5,545
		2040	-	1,485	(46)	1,440	
111	32677300	Near-Term	-	-	-	-	3,240
		2040	-	3,240	-	3,240	
112	32687200	Near-Term	-	-	-	-	439
		2040	-	270	169	439	
113	32693200	Near-Term	-	-	-	-	373
		2040	-	405	(33)	373	
114	32700300	Near-Term	-	-	-	-	734
		2040	-	675	59	734	
115	32700400	Near-Term	-	-	-	-	818
		2040	-	675	143	818	

TAZ Number	TAZ ID	Scenario	Single- Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
116	32676100	Near-Term	-	-	-	-	257
		2040	-	270	(13)	257	
117	32709200	Near-Term	-	-	-	-	1,471
		2040	680	810	(20)	1,471	
118	32711200	Near-Term	-	-	-	-	1,238
		2040	-	945	293	1,238	
119	32676200	Near-Term	-	-	-	-	1,586
		2040	-	-	1,586	1,586	
120	32676300	Near-Term	-	-	-	-	696
		2040	-	-	696	696	
121	32691100	Near-Term	-	-	-	-	(169)
		2040	-	-	(169)	(169)	
122	32691200	Near-Term	-	-	-	-	1,232
		2040	170	945	117	1,232	
123	32701100	Near-Term	-	-	-	-	843
		2040	-	810	33	843	
124	32701200	Near-Term	-	-	-	-	643
		2040	-	675	(33)	643	
125	32705100	Near-Term	14,450	-	-	14,450	14,671
		2040	-	-	221	221	
127	32691300	Near-Term	170	135	85	390	69,290
		2040	-	1,055	67,845	68,900	
128	32691400	Near-Term	-	-	-	-	0
		2040	-	-	-	-	
129	32701300	Near-Term	170	945	104	1,219	1,219
		2040	-	-	-	-	
130	32701400	Near-Term	-	810	124	934	934
		2040	-	-	-	-	
131	32705200	Near-Term	340	945	72	1,357	1,357
		2040	-	-	-	-	
132	32691500	Near-Term	-	-	39	39	39
		2040	-	-	-	-	
133	32701500	Near-Term	170	270	91	531	531
		2040	-	-	-	-	
134	32701600	Near-Term	170	810	(1,898)	(918)	(918)
		2040	-	-	-	-	
135	32705300	Near-Term	-	675	462	1,137	1,137
		2040	-	-	-	-	
137	32669400	Near-Term	-	4,320	33,900	38,220	60,851
		2040	-	22,410	221	22,631	
Total		Near-Term	26,450	183,033	266,409	475,893	2,233,159
		2040	18,445	1,716,525	22,296	1,757,266	
		Total	44,895	1,899,558	288,706	2,233,159	


Study Area
Center for Domestic Research Traffic Analysis Zone & Number
Near-Term Flow Contributions to Sewer Sytem (gpd)
-75 < 0 Negative
No Growth
888 1 to 1,000 Very Low
5,678 1,001 to 10,000 Low
42,368 10,001 to 50,000 Moderate
99,547 50,001 to 200,000 High
225,735 > 200,000 Very High
1,235
138,020
18,198
47,457
1,496
3,598
270
512
3,400
624
6,290
1,748
1,460
7,020
5,805
1,350
46,710
8,640
38,220
24,435
14,040
11,550
405
977
2,638
2,339
4,105
14,450
68,900
Paper Size ANSI A
0 1,500 3,000 4,500 6,000
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic
N
GHD
City of Huntington Beach
Sewer Master Plan Update
Future Development
Near-Term
Flow Contributions to Sewer System
Project No. 12585300
Revision No. 1
Date 4/17/2024
FIGURE 5.10
\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 5.10 Future Development Near Term.mxd
Print date: 17 Apr 2024 - 10:36
Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

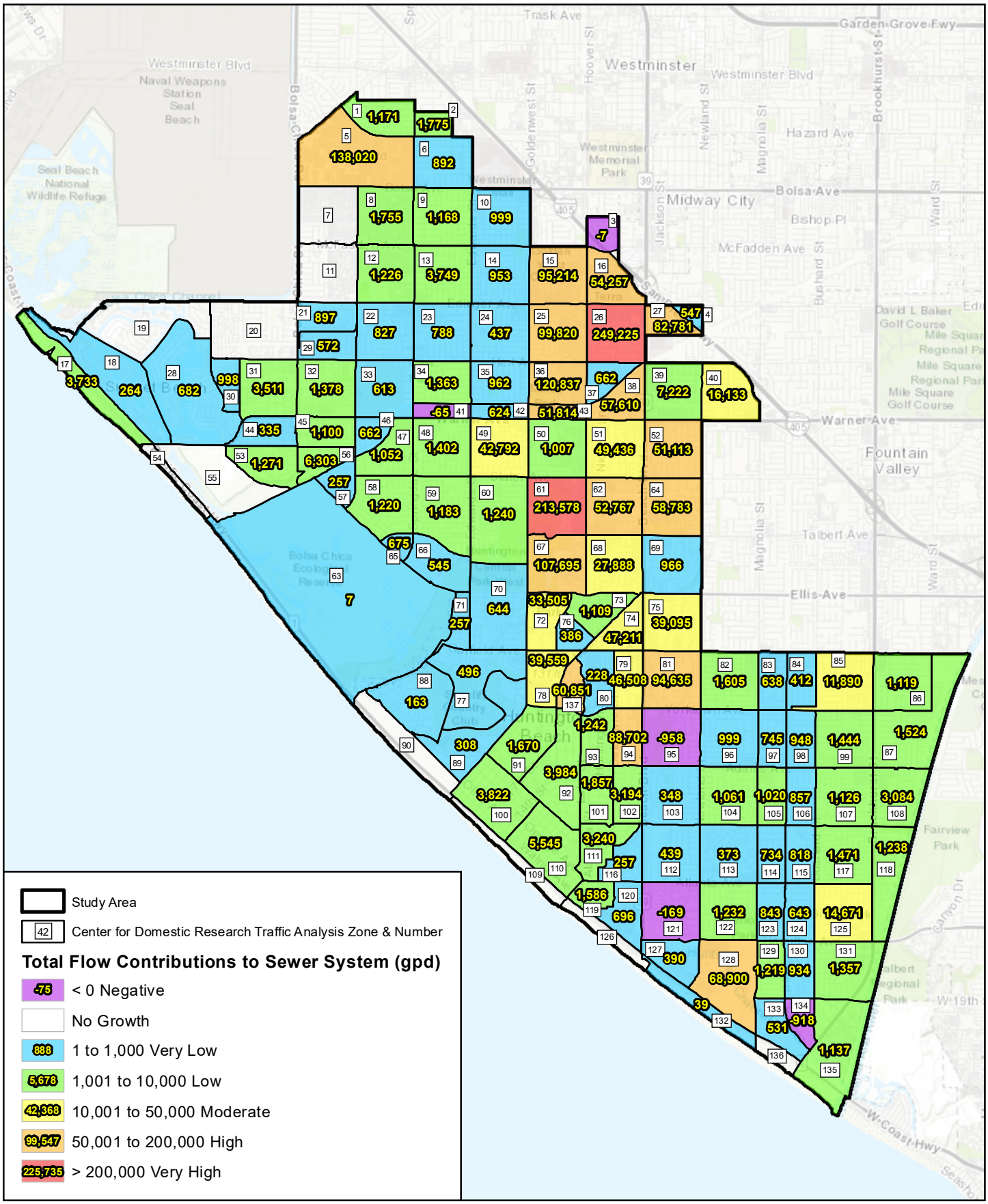
Future Development
2040
Flow Contributions to Sewer System

Project No. **12585300**
Revision No. **1**
Date **4/17/2024**

FIGURE 5.11

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 5.11 Future Development 2040.mxd
Print date: 17 Apr 2024 - 10:34

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Future Development Total Flow Contributions to Sewer System

Project No. 12585300
Revision No. 1
Date 4/17/2024

FIGURE 5.12

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Print date: 17 Apr 2024 - 10:33

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

6. Hydraulic Capacity Analysis

To achieve a desired level of service for sanitary sewer system performance, the hydraulic capacity of the City's sanitary sewer system as a whole must be large enough to convey peak wet weather flow (WWF) for the appropriate design storm event (i.e. 10-year 24-hour event). The hydraulic model calibration developed dry weather flow (DWF) and WWF parameters that approximate existing conditions. These parameters were checked to determine their applicability for use in identifying capacity deficiencies under existing and future conditions and for sizing future sewers. The calibrated hydraulic model predicts that peak wet weather flows most significantly influence surcharging, but no overflows occur under modeled dry weather conditions.

This chapter presents the results of the capacity analysis performed for both DWF and WWF under existing and future conditions. **Chapters 8 through 10** provide conclusions and recommendations to address hydraulic deficiencies noted in the model runs.

6.1 Gravity Sewer Design Basis Criteria

The following criteria are used to establish all existing and future 'Design Basis' capacity analysis conditions for the gravity sewers within the City. The term 'Design Basis' refers to all assumptions and conditions involved in creating a model scenario that when simulated, provides a basis for determining deficiencies in the system which will be addressed with capital improvement projects.

6.1.1 Future Development Loads

Flows from future development were integrated into the calibrated existing base wastewater flows discussed in **Chapter 5**. It is assumed that there will be no significant increase (i.e. from higher water use) or decrease (i.e. from water conservation) in existing usage rates in the future.

6.1.2 Design Storm Rainfall

The use of wet weather design events as the basis for capacity evaluations of sanitary sewer systems is generally accepted. The design event may be synthesized from rainfall statistics or may be an actual historical rainfall event of appropriate duration and intensity. Other considerations for the design storm event include spatial variation of the rainfall and the timing of the storm relative to the diurnal sanitary flow pattern. The City of Huntington Beach covers a medium sized area, so there is some variability in rainfall intensities across the City and service area, as evidenced by rainfall captured at the two rain gauges (shown in **Table 5.2**). Design rainfall is varied only in its mimicking of variation and intensity as per the rain gauges used for the calibration.

Selection of a design rainfall event is typically based on a tolerable level of risk, often expressed as the return period. This approach recognizes that while wet weather overflows are highly undesirable, it is not cost-effective to provide capacity for the largest possible event. Regulatory agencies have not adopted standard criteria for return periods, but the majority of sewer utilities throughout California that use a risk-based approach have designed their systems to accommodate events with return periods of 2, 5, or 10 years. A 2-year event has a 50 percent chance of occurring in any given year, while a 10-year event has a 10 percent chance of occurring. The desired target return period is a subjective choice that is made by each utility based on level of service, impacts of overflow events, and cost to achieve. The City of Huntington Beach has decided to establish a mid to high-level of service goal: a 10-year return period for wet weather capacity-related overflows. This was chosen in part to align with the receiving wastewater agency's (Orange County Sanitation District, OCSan) wet weather design standard, which used a 10-year 24-hour storm that was generated from an actual storm event from 2017. A realistic and acceptable design storm that was appropriate for a much smaller coverage area than the entire OCSan service area was then generated for the sewer master plan update (SMP) as follows:

- First, the March 2023 storm was reviewed and compared to the National Oceanic Atmospheric Administration (NOAA) precipitation frequency statistics to quantify its return period for various durations. **Figure 6.1** shows the comparison between NOAA 1, 2, 5, 10, and 25 year events with the average statistics from the March 14th, 2023 storm at the 1, 2, 3, 6, 12, and 24 hour durations. This comparison used rainfall amounts from both gauges, and then the average value at each duration. The graph of **Figure 6.1** shows that the March 14, 2023 event (in bold green) was around 1 year event for durations less than 6 hours, and approached a 2-year event for the 12- and 24-hour durations.
- Then, the rainfall depths at all durations were scaled up to approach NOAA's 10-year storm depth and intensity. Though the scaled storm's depth and intensity more closely matches a 5-year event for the durations less than 6 hours, it does approach a 10-year storm's total rainfall depth at the 12- and 24-hour durations. This scaled up 10-year 24-hour event is shown in bold magenta in **Figure 6.1.**
- The scaled-up storm was than modified to mimic the spatial variation determined during the calibration storm analysis, which area-weighted the rainfall across the model's 24 flow meter basins using the inverse triangulation method that considers distance-weighting rainfall amounts using the two rain gauges within the City limits. This resulted in 24 unique rainfall profiles (one for each flow meter basin).

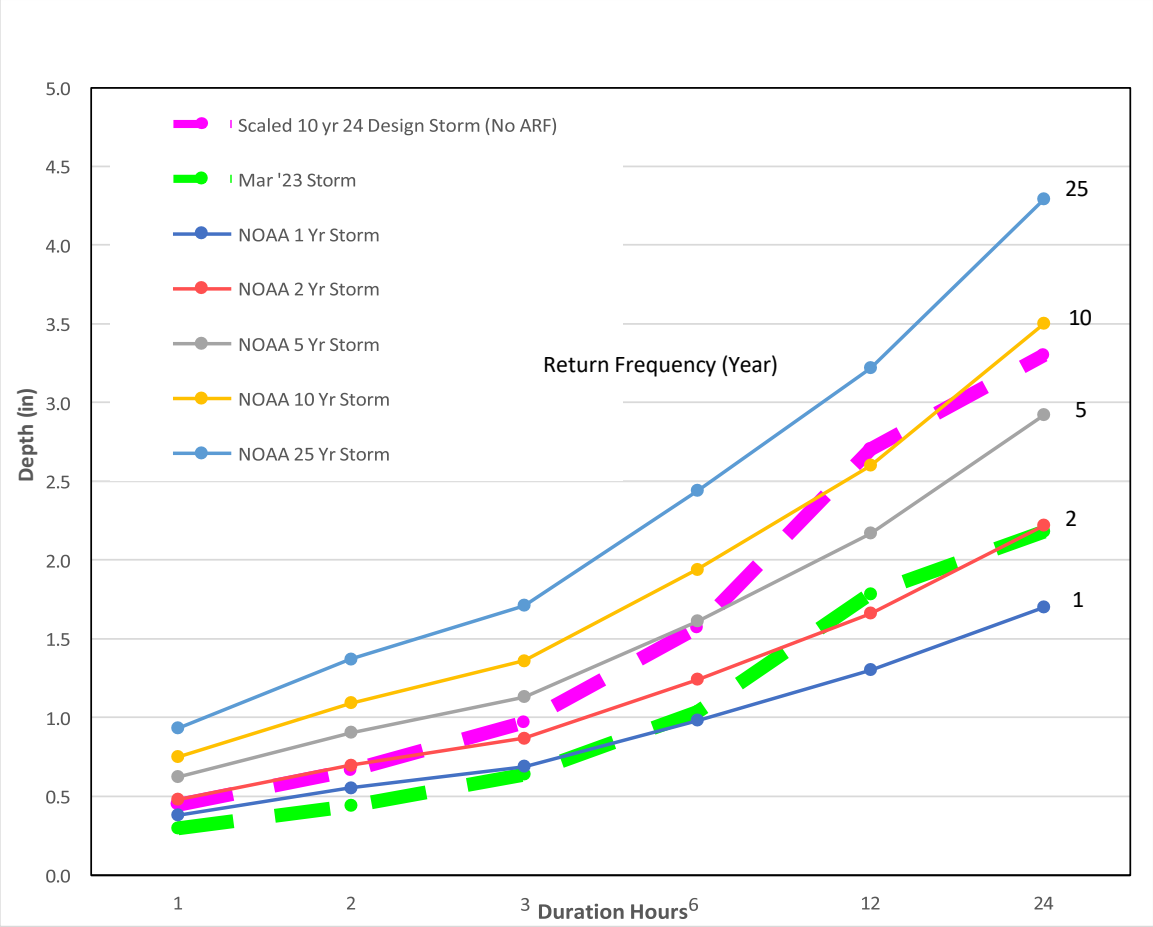
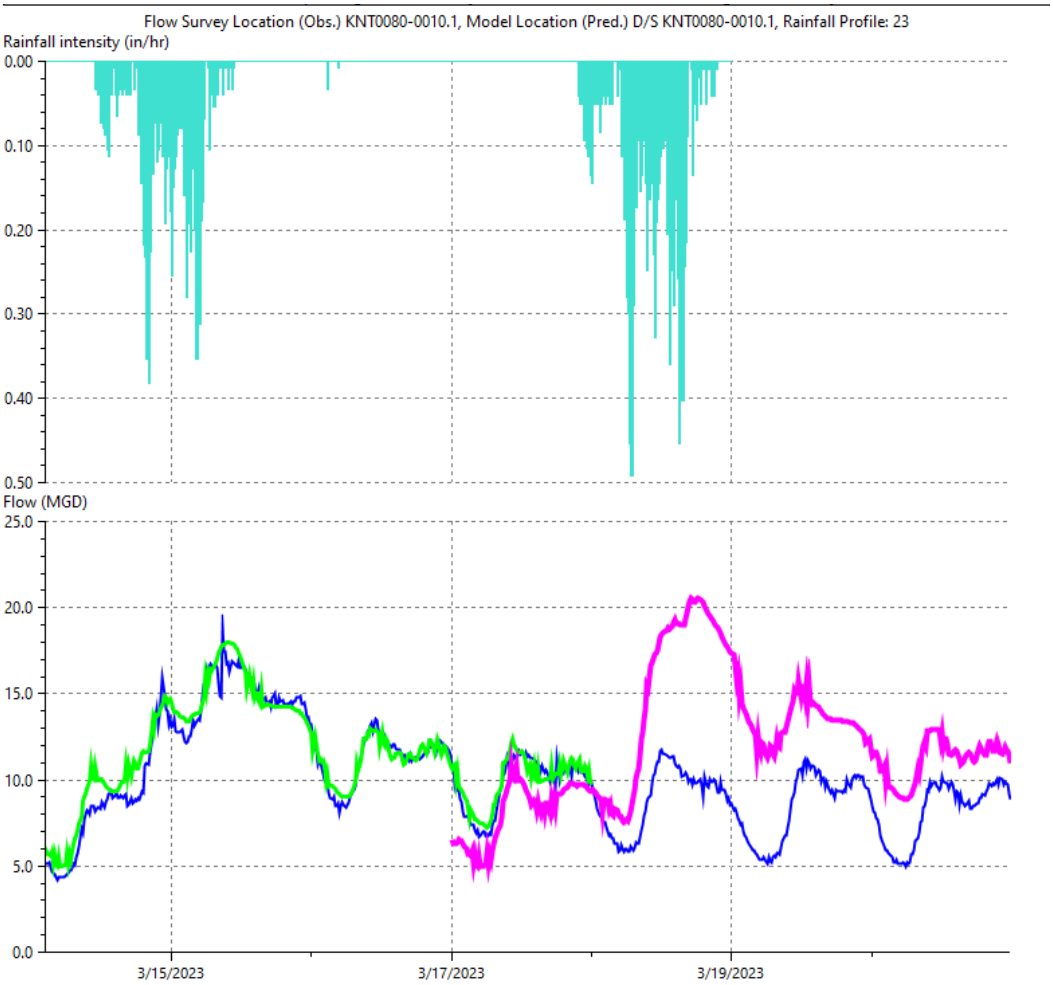


Figure 6.1 Rainfall Depth – Duration Comparisons between Calibration Event, Design Storm Event, and NOAA Data

The timing of the design storm was shifted such that the peak hour of rainfall occurs during the 6-7 am hour on a weekend, which is a few hours before a typical weekend diurnal peak. The remainder of the bulk of the rainfall occurs across the daylight hours of a Saturday, which in total allows for appropriately conservative timing.

The 10-year 24-hour design storm produces 3.7 – 3.8 inches of rain in 24 hours and has a peak intensity of 0.49 inches/hour. The hyteograph for both the March 14, 2023 calibration storm and the design storm are shown in **Figure 6.2.**



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.981	0.491	0.042			
Observed				4.240	18.872	68.963
...alibration Storm				4.958	17.988	44.939
...torm (ARF = .9)				4.958	20.548	47.754

Figure 6.2 Calibration and Design Storm Hyetographs

The scaled-up 10-year 24-hour event was applied to the calibrated future wet weather model to determine peak design state WWF. Because the difference in system performance is very minimal between existing dry to future dry as compared to existing wet to future wet, the baseline condition for evaluating system capacity and sizing improvements is the future development wet weather condition using the scaled 10-year 24-hour design storm.

6.1.3 Boundary Conditions

As mentioned in **Chapter 3**, this SMP benefited from utilizing the OCSan model as the foundation for integrating the City's geographic information system (GIS) into this SMP's model. This allows the more accurate modeling of the dozen locations at the service area boundary where flows originating from outside the City's service area, carried by the OCSan trunks, would pass through and comingle with the 225 locations where City sewers enter them, as they would do in reality. This allows for a more realistic depiction of head- discharge and potential backwater relationships that are experienced in several areas of the service area under peak wet weather conditions.

6.1.4 Future Conditions Inflow and Infiltration

It is standard industry practice to assume that no significant reductions or increases in inflows and infiltration (I&I) will occur in the future from currently developed and sewered areas. This is a valid assumption when evaluating system performance from the perspective used in this master plan. This assumes that increased I&I into the system due to natural pipe and manhole degradation is cancelled out by the reduction in I&I due to improvements to the system over the future time horizon.

6.2 Gravity Sewer Capacity Analysis Criteria

Hydraulic deficiencies were determined based on model-predicted surcharge and overflow conditions occurring in the 10-year, 24-hour design storm. Surcharging does not necessarily suggest that a capacity deficiency exists for a particular pipe or location; flows have been seen to rise due to downstream capacity issues that cause surcharging due to backwater.

City design standards define an addressable dry weather capacity deficiency as any pipe with a depth to diameter ratio (d/D) less than or equal to 0.5 for pipes 12-inch and diameter or less, and less than or equal to .75 for pipes larger than 12-inches in diameter.

City design standards define an addressable wet weather capacity deficiency as any pipe or connected manhole that experiences a full flowing capacity or a d/D of 1.0 or greater, and the distance from highest flow level, or depth from flow level to ground surface being less than 5.0 feet. Because the majority of pipes deemed deficient during dry weather are also deficient during wet weather, pipes triggered by the wet weather criteria are marked as deficient candidates, and the process to address these deficiencies is discussed in later chapters.

6.3 Calibration Scenario Gravity Sewer Hydraulic Results

Plan view figures of model results distinguish any pipe's source of deficiency by unique color-coding. For pipes, this is based on the modeled surcharge state, which is the ratio of depth of flow to pipe diameter (d/D) for pipes that haven't surcharged or reached a d/D of 1.0. For pipes with a d/D greater than 1.0, the model reports a value of '2' for pipes that are surcharged due to a capacity deficiency (red pipes in all hydraulic results figures), and '1' for pipes surcharged due to backwater from pipes downstream (orange pipes in all hydraulic results figures). Pipes that triggered the City's deficiency status for capacity were highlighted in thicker bold dark purple, and those due to backwater in thicker bold light purple in all hydraulic results figures.

6.3.1 Dry Weather Calibration Flow Results

As mentioned in the introduction to **Chapter 6**, no overflows and no surcharging occurred during the peak DWF calibration period conditions.

6.3.2 Wet Weather Calibration Flow Results

Figure 6.3 presents the model results for the calibration storm peak WWF condition. The figure shows portions of the system that were predicted to overflow, pipes that were predicted as surcharged due to a 'throttling" effect (i.e. insufficient capacity), and areas that were predicted as surcharged due to backwater.

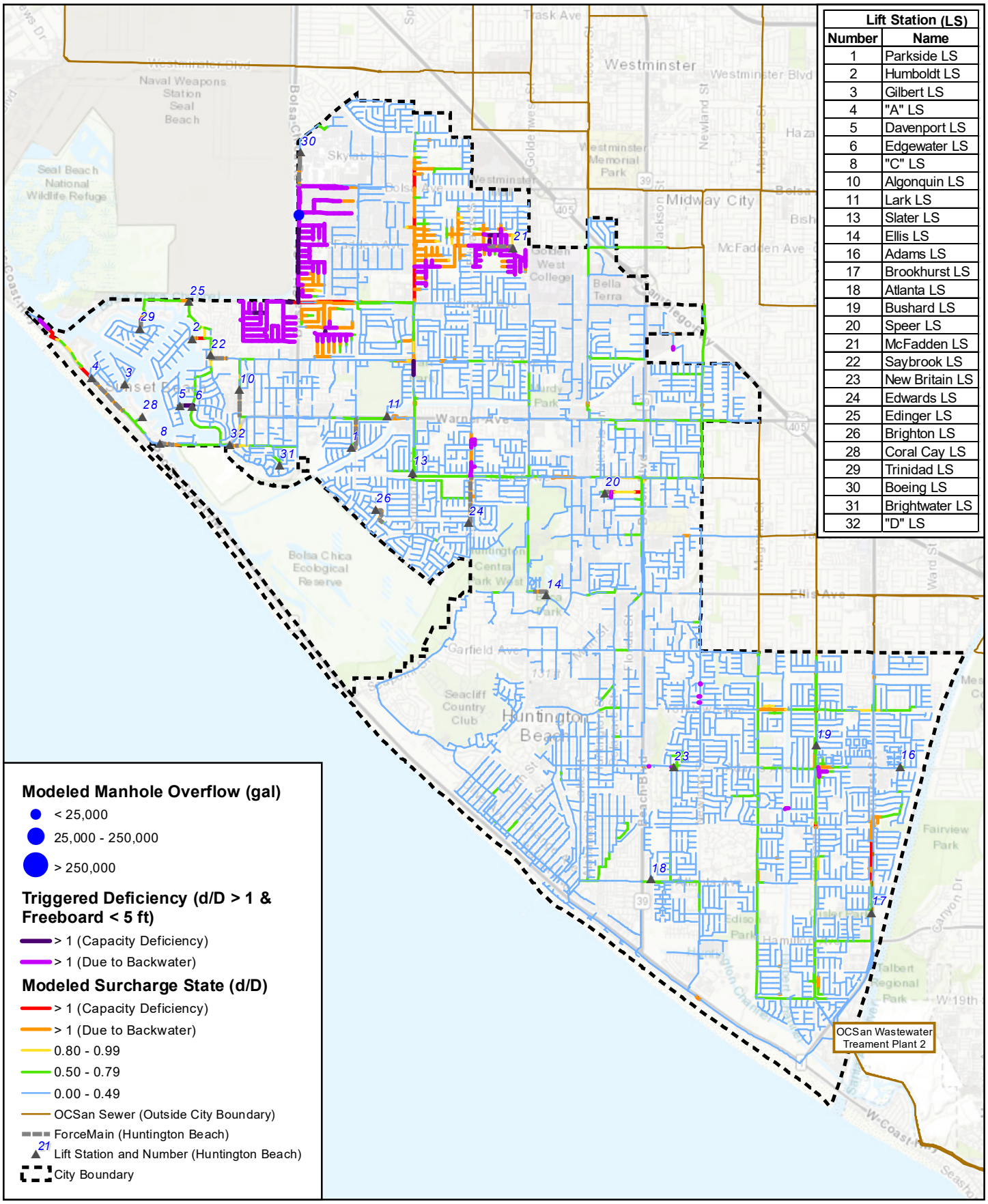
As previously noted, surcharging does not necessarily indicate a capacity deficiency at a specific stretch of pipe, as flows can back up from deficiencies downstream. Therefore, relief projects may not necessarily be chosen for pipes that are predicted to surcharge only due to backwater conditions. However, relieving capacity restrictions can increase peak flows translated downstream and offer additional capacity issues downstream of the relieved sewers. These effects were considered during capacity improvement project development.

Table 6.1 shows key metrics for the City's only sewers, OCSan's sewers, and the entire service area from the DWF and WWF calibration simulations. Although 222 sewers exceed DWF deficiency criteria during the DWF calibration

scenario, 168 of those 222 sewers surcharge above the crown of the pipe during wet weather conditions. Of the 118 sewers that reach 75% full in DWF, 110 of those same 118 surcharge above the crown of the pipe during wet weather. This essentially indicates that the majority of pipes with problems in dry weather are also problems in wet weather and would be dealt with accordingly as part of the Capital Improvement Program (CIP) development process discussed later.

Table 6.1 Calibration Condition Hydraulic Results

	HB Sewers Only						HB Sewers Only	OCSan Sewers Only	Entire Service Area
Metric	Existing DWF >.5 d/D	Existing DWF >.75 d/D	Existing DWF >1.0 d/D	In WWF Surch from DWF .5 List	In WWF Surch from DWF .75 List	In WWF Surch from DWF 1.0 List	WWF Cal Storm	WWF Cal Storm	WWF Cal Storm
Total Volume of Overflow (gal)							5,500	3,600	9,100
Number of SSOs							1	1	2
Number of Surcharged Pipes or Pipes exceeding criteria (in DWF, .5 d/D, .75d/D, etc.)	222	118	91	168	110	91	615	65	680
Total Length Surcharged (ft)	36,886	13,240	8,380	24,585	12,042	8,380	137,666	18,472	156,138
# Surcharged due to Capacity Def			10	62	21	15	65	17	82
Total Length of Surcharged due to Cap Def (ft)			992	13,907	4,031	2,478	13,900	9,117	23,017
Number of Surcharged Pipes within 5 ft of Surface							388	10	398
Total Length Surcharged Pipes within 5 ft of Surface (ft)							94,230	5,952	100,182
# Surcharged and within 5 ft of Surface due to Capacity Def							33	6	39
Total Length of Surcharged within 5 feet of Surface due to Cap Def							7,091	4,093	11,184



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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Calibration Period
Wet Weather Flow
Hydraulic Results

Project No. **12585300**
Revision No. **1**
Date **3/12/2024**

FIGURE 6.3

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 6.3_WWF_Cal_Results.mxd
Print date: 13 Mar 2024 - 09:58

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

6.4 Existing Condition Gravity Sewer Hydraulic Results

6.4.1 Existing Dry Weather Flow Results

No overflows and no surcharging occurred during the peak DWF design basis period conditions. **Figure 6.4** shows the model results during DWF period under existing development loadings.

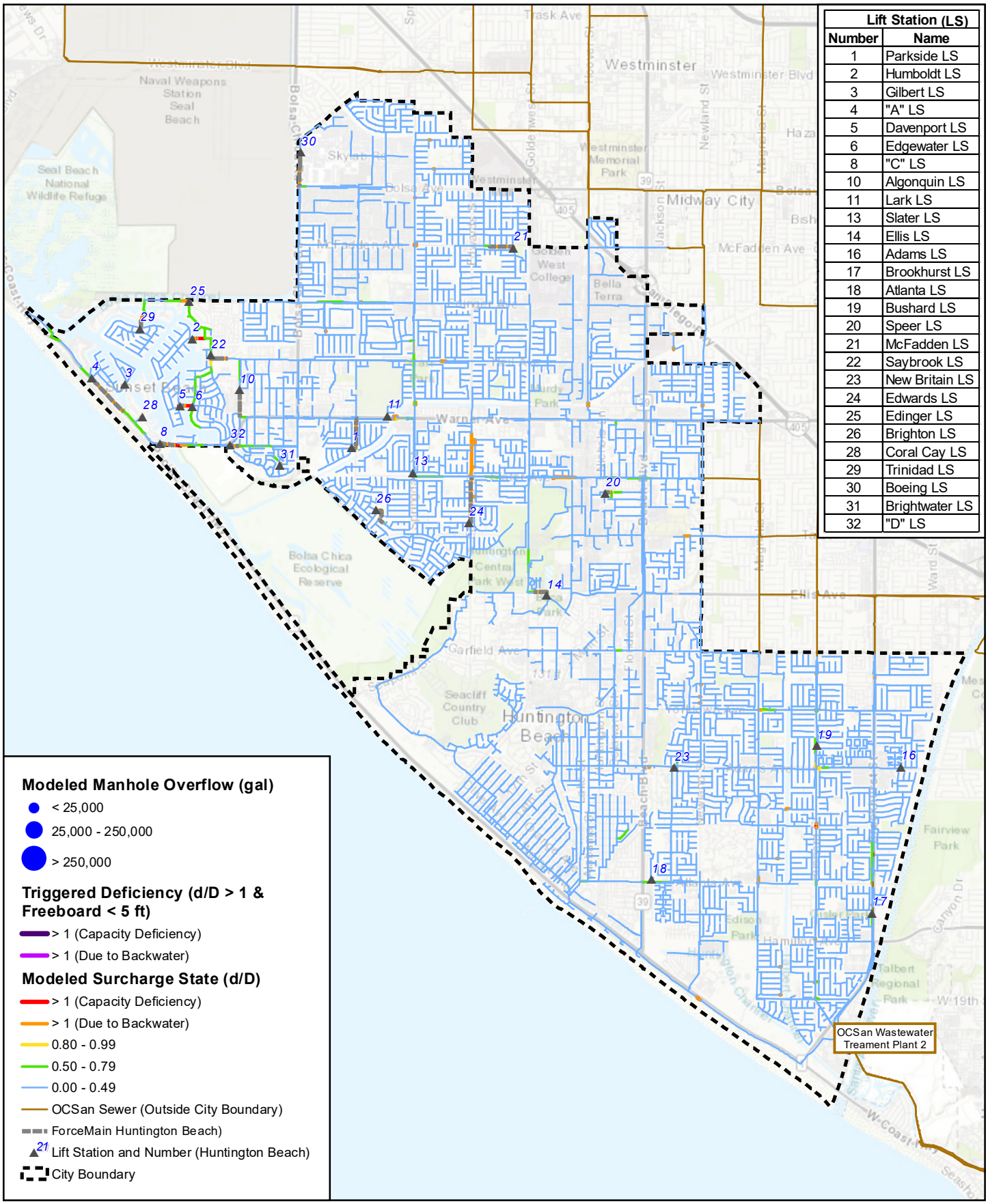
6.4.2 Existing Wet Weather Flow Results

Figure 6.5 presents the model results for the peak WWF condition (10-year, 24-hour design storm condition), considering existing condition loadings. The figure shows portions of the system that were predicted to overflow, pipes that were predicted surcharged due to a ‘throttling” effect (i.e. insufficient capacity), and areas that were predicted surcharged due to backwater. **Table 6.2** displays the hydraulic results from the existing condition design basis wet weather simulations in tabular form, organized by owning sewer entity (City, OCSan, Combined~entire service area).

As previously noted, surcharging does not necessarily indicate a capacity deficiency at a specific stretch of pipe, as flows can back up from deficiencies resulting in flow restrictions downstream. Therefore, relief projects may not necessarily be chosen for pipes that are predicted to surcharge only due to backwater conditions. However, relieving capacity restrictions can increase peak flows translated downstream and offer additional capacity issues downstream of the relieved sewers. These effects were considered during capacity improvement project development.

Table 6.2 Existing Condition Design Basis Results

Metric	HB Sewers Only	OCSan Sewers Only	Entire Service Area
	ECDB WWF (10 yr 24 hr DS)	ECDB WWF (10 yr 24 hr DS)	ECDB WWF (10 yr 24 hr DS)
Total Volume of Overflow (gal)	193,800	235,200	429,000
Number of SSOs	4	2	6
Number of Surcharged Pipes	880	94	974
Total Length Surcharged (ft)	203,474	33,579	237,053
# Surcharged due to Capacity Def	122	29	151
Total Length of Surcharged due to Cap Def (ft)	28,396	14,323	42,719
Number of Surcharged Pipes within 5 ft of Surface	622	20	642
Total Length Surcharged Pipes within 5 ft of Surface (ft)	151,988	9,084	161,072
# Surcharged and within 5 ft of Surface due to Capacity Def	61	8	69
Total Length of Surcharged within 5 feet of Surface due to Cap Def	13,405	5,450	18,855



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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

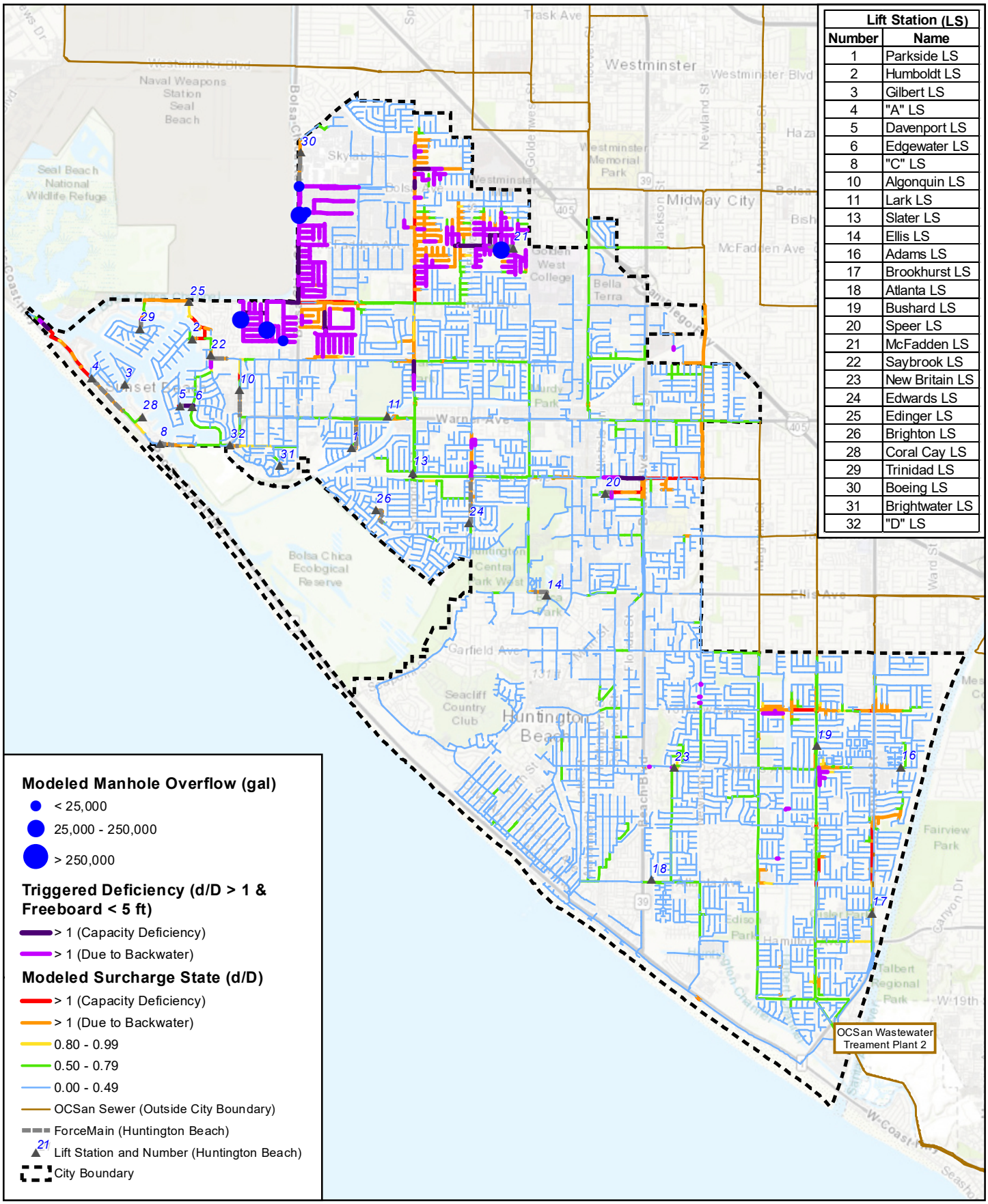
Existing Condition Dry Weather Flow Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **3/12/2024**

FIGURE 6.4

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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Existing Condition
10 yr 24 hr Design Storm
Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **3/12/2024**

FIGURE 6.5

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 6.5_ECDB_WWF.mxd
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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

6.5 Near-Term Condition Gravity Sewer Hydraulic Results

6.5.1 Near-Term Dry Weather Flow Results

No overflows and no surcharging occurred during the peak DWF period under near-term development conditions. **Figure 6.6** shows the model results during DWF period under near-term development loadings.

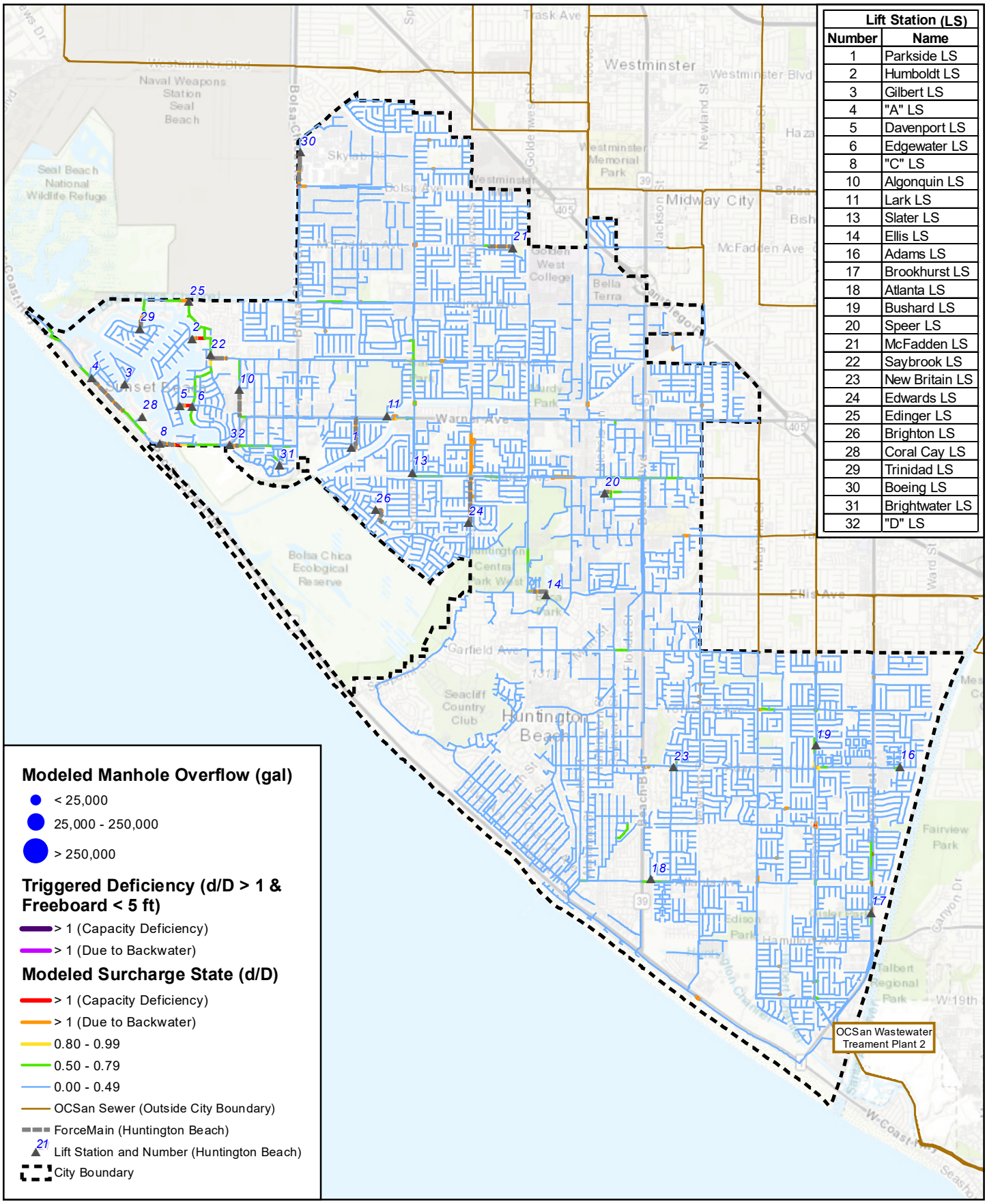
6.5.2 Near-Term Wet Weather Flow Results

Figure 6.7 presents the model results for the peak WWF condition (10-year, 24-hour design storm condition), considering near-term development. The figure shows portions of the system that were predicted to overflow, pipes that were predicted surcharged due to a 'throttling" effect (i.e. insufficient capacity), and areas that were predicted surcharged due to backwater. **Table 6.3** shows statistics for the state of the system under near-term development conditions and the 10-year 24-hour design storm.

Comparison between the existing and near-term development condition hydraulic scenarios shows a marginal change in number and length of surcharged and deficiency triggered pipes. This simply means that additional flow contributions in the near term do not impart any significant increase to system deficiencies under dry and wet weather (10 yr – 24 design storm) conditions.

Table 6.3 Near-Term Condition Design Basis Results

Metric	HB Sewers Only	OCSan Sewers Only	Entire Service Area
	NTDB WWF (10 yr 24 hr DS)	NTDB WWF (10 yr 24 hr DS)	NTDB WWF (10yr 24 hr DS)
Total Volume of Overflow (gal)	193,900	235,300	429,200
Number of SSOs	4	2	6
Number of Surcharged Pipes	881	93	974
Total Length Surcharged (ft)	203,492	34,229	237,721
# Surcharged due to Capacity Def	125	28	153
Total Length of Surcharged due to Cap Def (ft)	28,379	13,871	42,250
Number of Surcharged Pipes within 5 ft of Surface	625	20	645
Total Length Surcharged Pipes within 5 ft of Surface (ft)	152,559	9,084	161,643
# Surcharged and within 5 ft of Surface due to Capacity Def	62	8	70
Total Length of Surcharged within 5 feet of Surface due to Cap Def	13,409	5,450	18,859



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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

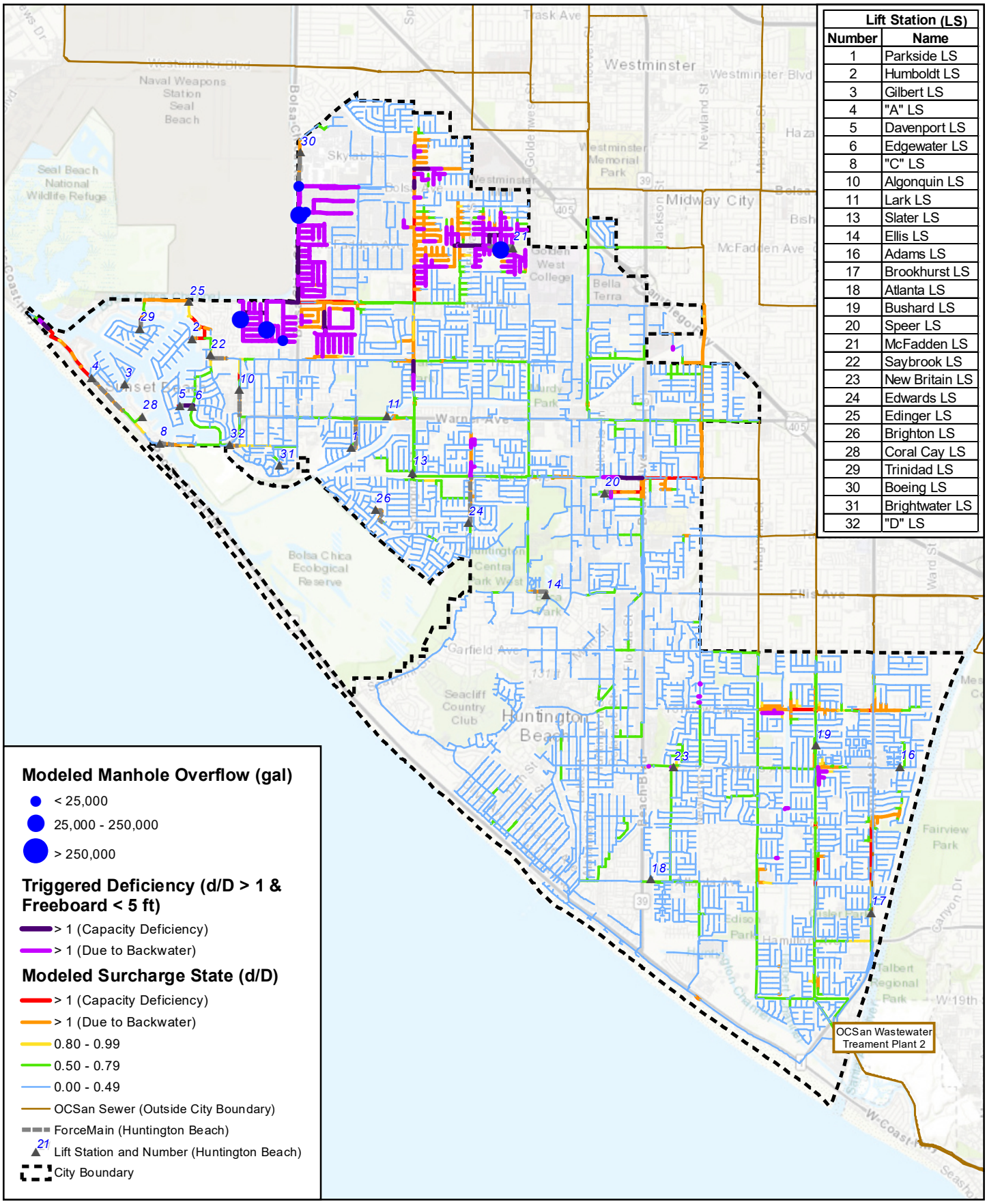
Near-Term Condition Dry Weather Flow Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **3/12/2024**

FIGURE 6.6

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Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Near-Term Condition
10 yr 24 hr Design Storm
Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **3/12/2024**

FIGURE 6.7

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 6.7_NTDB_WWF.mxd
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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

6.6 Future Condition Gravity Sewer Hydraulic Results

6.6.1 Future Dry Weather Flow Results

No overflows and no surcharging occurred during the peak DWF period under future development (2040) conditions. **Figure 6.8** shows the model results during DWF period under future development loadings.

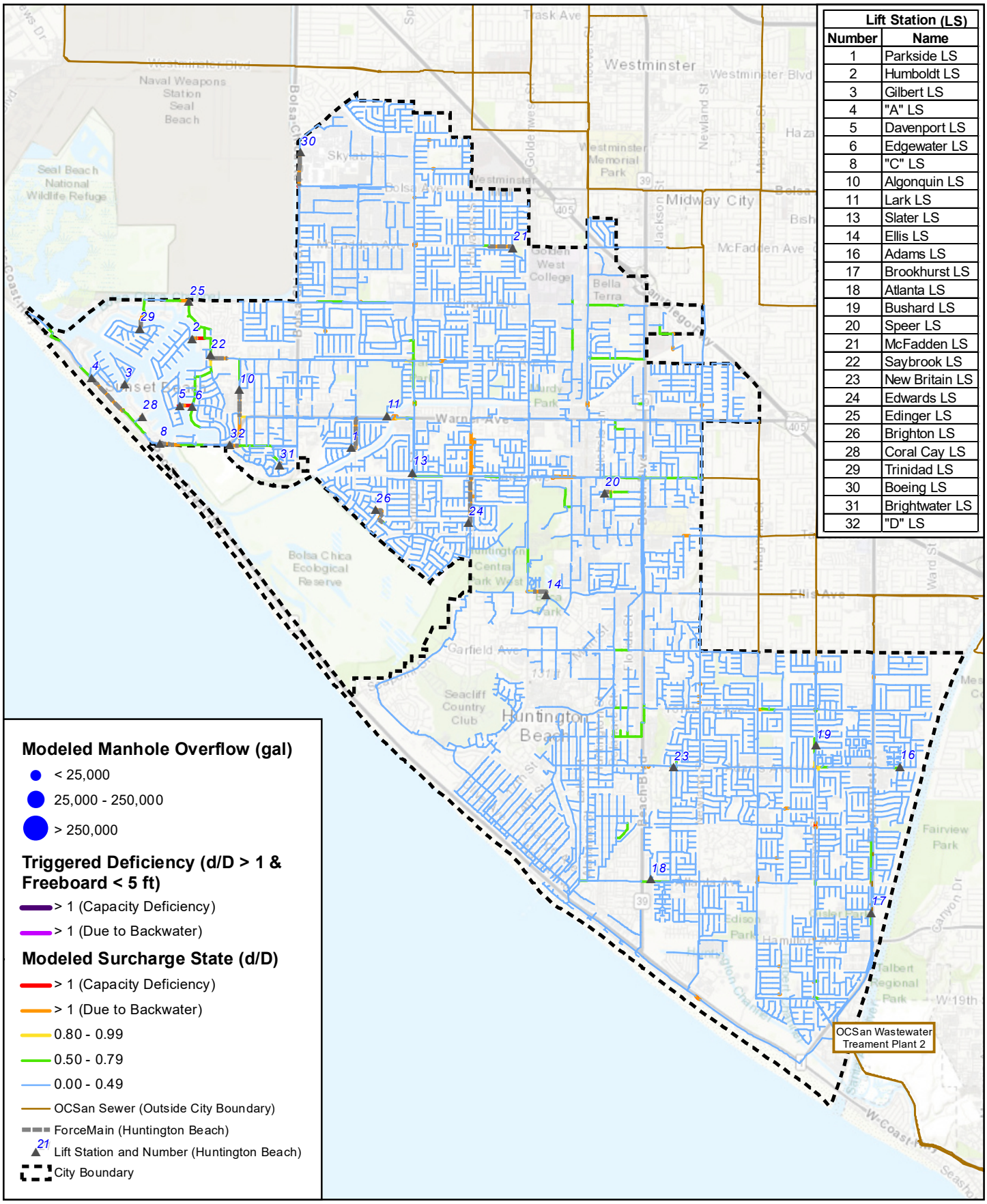
6.6.2 Future Wet Weather Flow Results

Figure 6.9 presents the model results for the peak WWF condition (10-year, 24-hour design storm condition), considering future development. The figure shows portions of the system that were predicted to overflow, pipes that were predicted to surcharge due to a ‘throttling” effect (i.e. insufficient capacity), and areas that were predicted to surcharge due to backwater. **Table 6.4** shows statistics for the state of the system under future development conditions and the 10-year 24-hour design storm.

Although comparison across the existing, near-term, and future development condition hydraulic scenarios show a marginal change in number and length of surcharged and deficiency triggered pipes between existing and near-term, there is a more pronounced increase in number and length of surcharged (pipes deficient due to backwater) in the future development condition scenarios. However, this development increase at the future condition time horizon does not push any pipes into the capacity deficient category under dry or wet weather conditions that were not already deficient under existing dry and wet weather conditions. The future development does however, increase the number of surcharged pipes due to backwater during the 10 yr – 24 hours design storm vs the existing condition scenario. This simply means that the same capacity deficient pipes may be slightly more capacity deficient during the future design storm, causing the system’s localized HGL to increase due to the higher backwater from these deficient areas.

Table 6.4 Future Condition Design Basis Results

Metric	HB Sewers Only	OCSan Sewers Only	Entire Service Area
	FUDB WWF (10 yr 24 hr DS)	FUDB WWF (10 yr 24 hr DS)	FUDB WWF (10 yr 24 hr DS)
Total Volume of Overflow (gal)	194,700	235,300	430,000
Number of SSOs	4	2	6
Number of Surcharged Pipes	877	109	986
Total Length Surcharged (ft)	205,935	34,493	240,428
# Surcharged due to Capacity Def	127	28	155
Total Length of Surcharged due to Cap Def (ft)	29,277	13,871	43,148
Number of Surcharged Pipes within 5 ft of Surface	629	20	649
Total Length Surcharged Pipes within 5 ft of Surface (ft)	153,350	9,084	162,434
# Surcharged and within 5 ft of Surface due to Capacity Def	61	8	69
Total Length of Surcharged within 5 feet of Surface due to Cap Def	12,916	5,450	18,366



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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

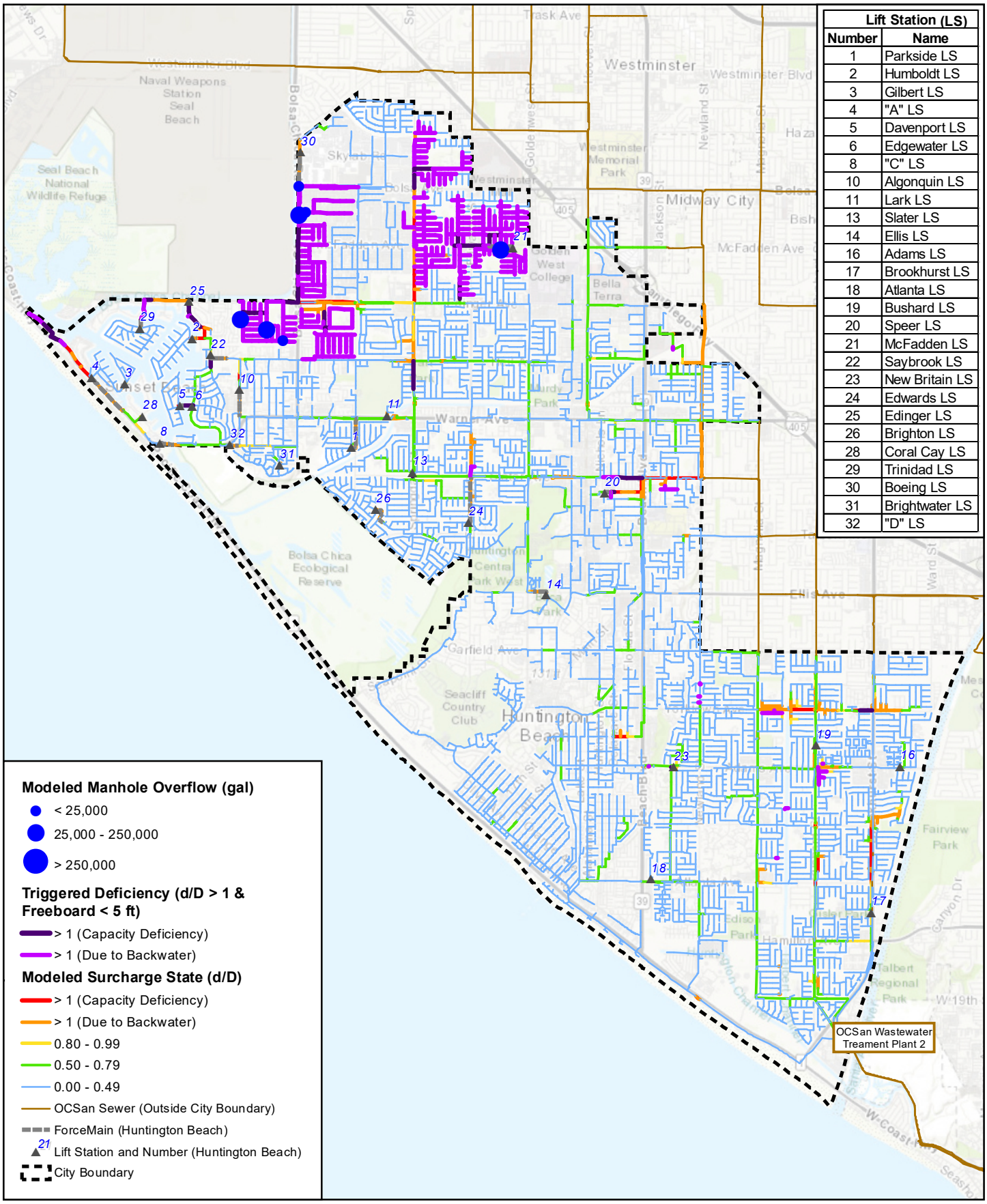
Future Condition
Dry Weather Flow
Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **3/12/2024**

FIGURE 6.8

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Print date: 18 Apr 2024 - 08:21

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Future Condition
10 yr 24 hr Design Storm
Hydraulic Results

Project No. **12585300**
Revision No. **1**
Date **3/12/2024**

FIGURE 6.9

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 6.9_FUDB_WWF.mxd
Print date: 21 Mar 2024 - 11:13

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

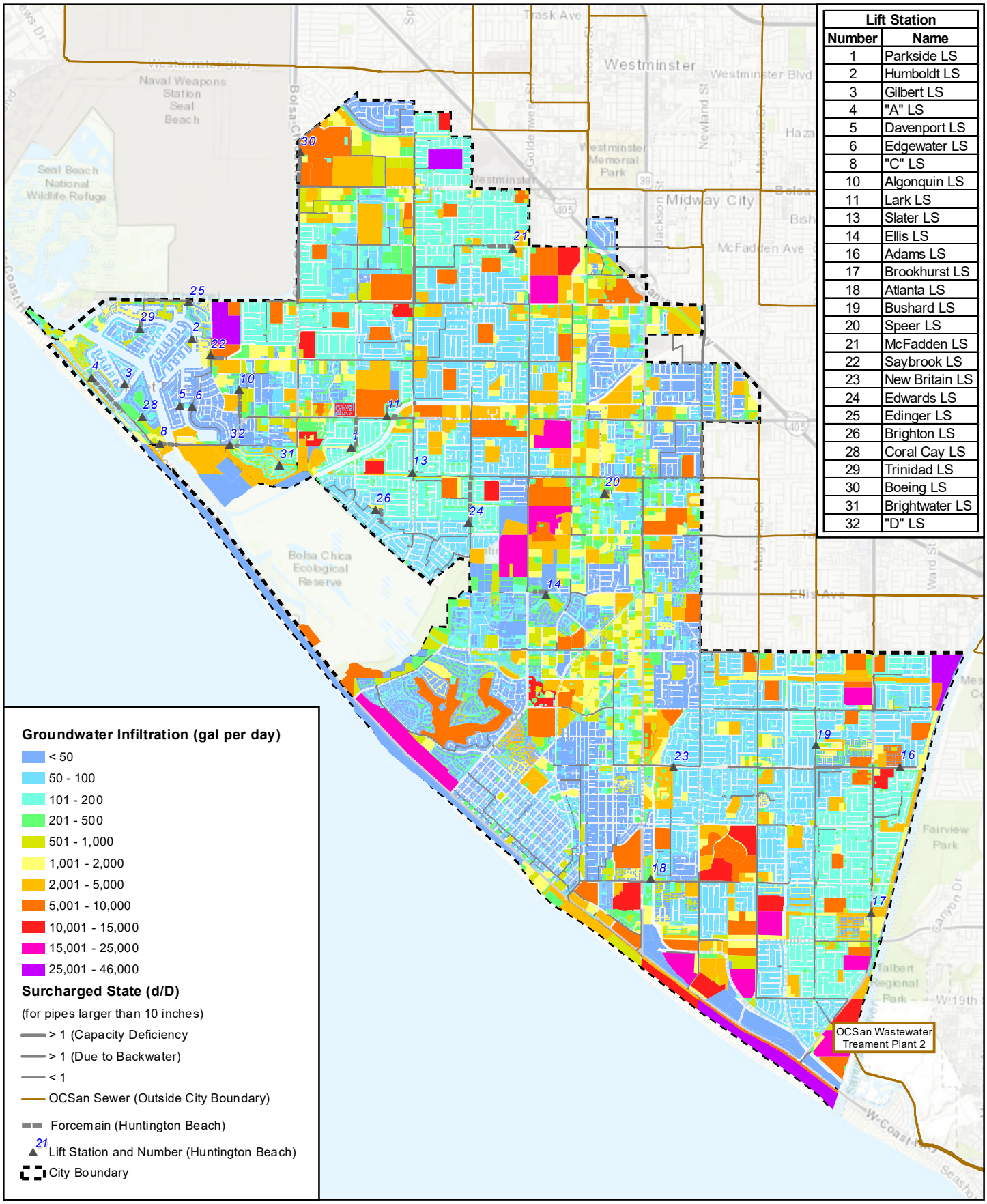
7. Inflow & Infiltration

A primary objective of this Sewer Master Plan Update (SMP) is to identify capacity and rehabilitation improvements that meet the City's service levels and comply with regulatory requirements. The characterization of groundwater infiltration (GWI) and rainfall dependent Inflow & Infiltration (RDI&I) identifies sources and contributors to peak hydraulic conditions that occur during or following large rainfall events that exacerbate sanitary sewer system conditions. This chapter discusses and displays the GWI and RDI&I contributions and impacts to the City's sanitary sewer system.

7.1 Groundwater Infiltration Characterization

As introduced in **Chapter 5**, groundwater infiltration (GWI) was added to the hydraulic model as a constant flow on top of the base wastewater flow (BWF). BWF is the domestic and or commercial load portion of the total dry weather flow input to the model. This process allocated GWI to each parcel with meter basins by area weighting as part of dry and wet season calibration.

There are several viable methods for characterizing GWI and the relative contributions of GWI from the differing parts of the sewer system. Because the primary issues with respect to GWI are the impact of the elevated base flows that are generated in the system, the focus is on determining overall average GWI influences. The distribution of this effort is shown in **Figure 7.1** by raw average daily rate of infiltration by individual parcel (equivalent to subcatchment) in gallons per day. Then, the same raw rate is normalized by subcatchment area and reported in gallons per acre per day and shown in **Figure 7.2**. Both figures show the slow infiltration responses within the system during elevated groundwater saturation periods of the wet weather season, independent of actual rain event contributions. The GWI analysis was based on results from the 10-year 24-hour design storm. The results show that the highest rates of non-rainfall induced infiltration occur in the Northwest portion of the system within flow monitoring basins 7 and 9, and from many of the basins near the marina and pacific coaSt



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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

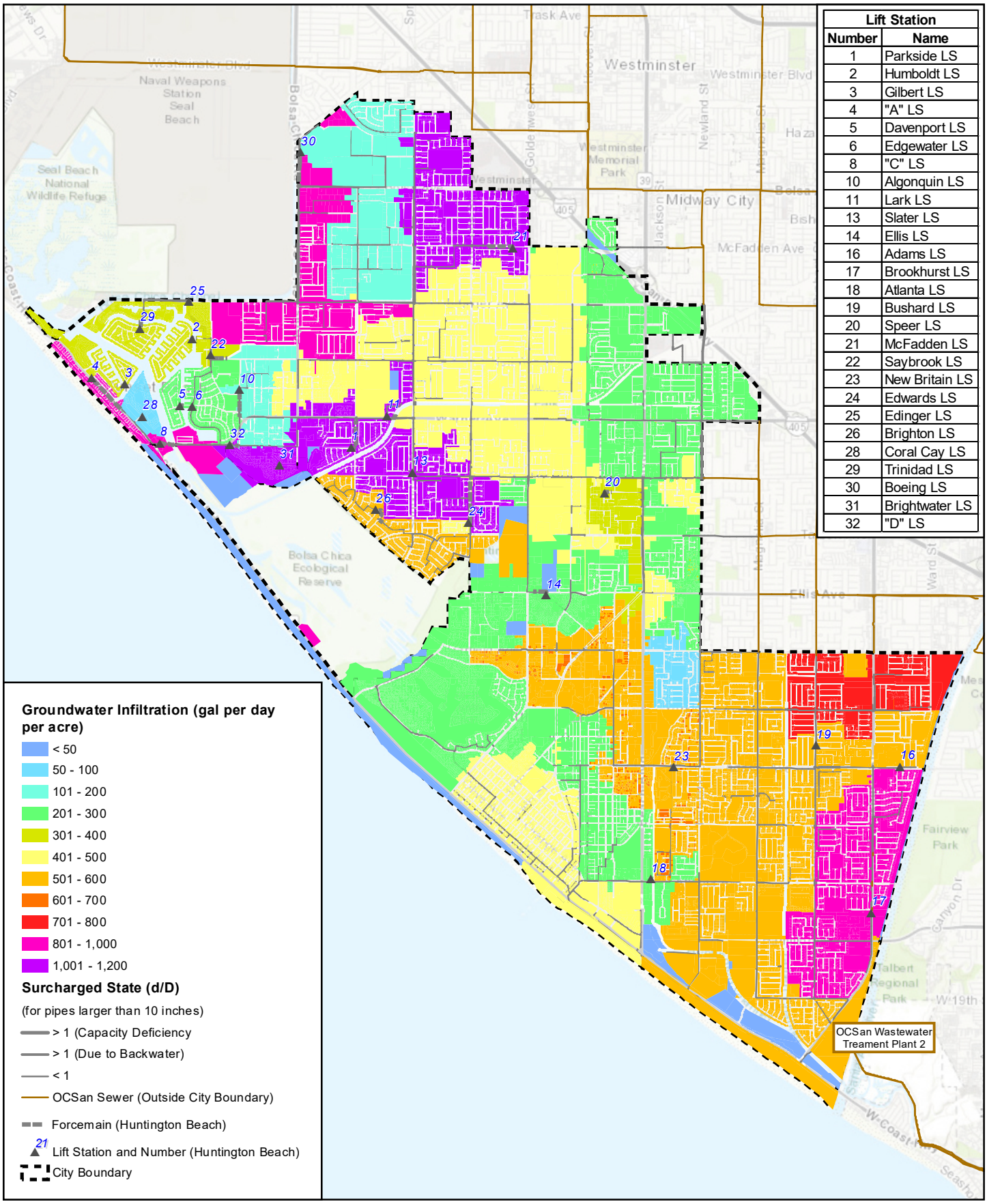
Existing Condition
10 yr 24 hr Design Storm
Groundwater Infiltration Rates

Project No. 12585300
Revision No. 0
Date 4/3/2024

FIGURE 7.1

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 7.1_ECDB_GWI.mxd
Print date: 03 Apr 2024 - 17:38

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Existing Condition
10 yr 24 hr Design Storm
Groundwater Infiltration Rates per Acre

Project No. 12585300
Revision No. 0
Date 4/3/2024

FIGURE 7.2

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 7.2_ECDB_GWI per acre.mxd
Print date: 03 Apr 2024 - 17:39

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

7.2 Rainfall Dependent Inflow and Infiltration Characterization

As mentioned in **Chapter 5**, the hydraulic model includes RDI&I inputs to characterize and assess the impacts that weather and RDI&I have on the sanitary sewer system. RDI&I was input into the hydraulic model through varying hydrologic and hydraulic parameters at the subcatchment level. The RDI&I analysis was based on results from the 10-year 24-hour design storm.

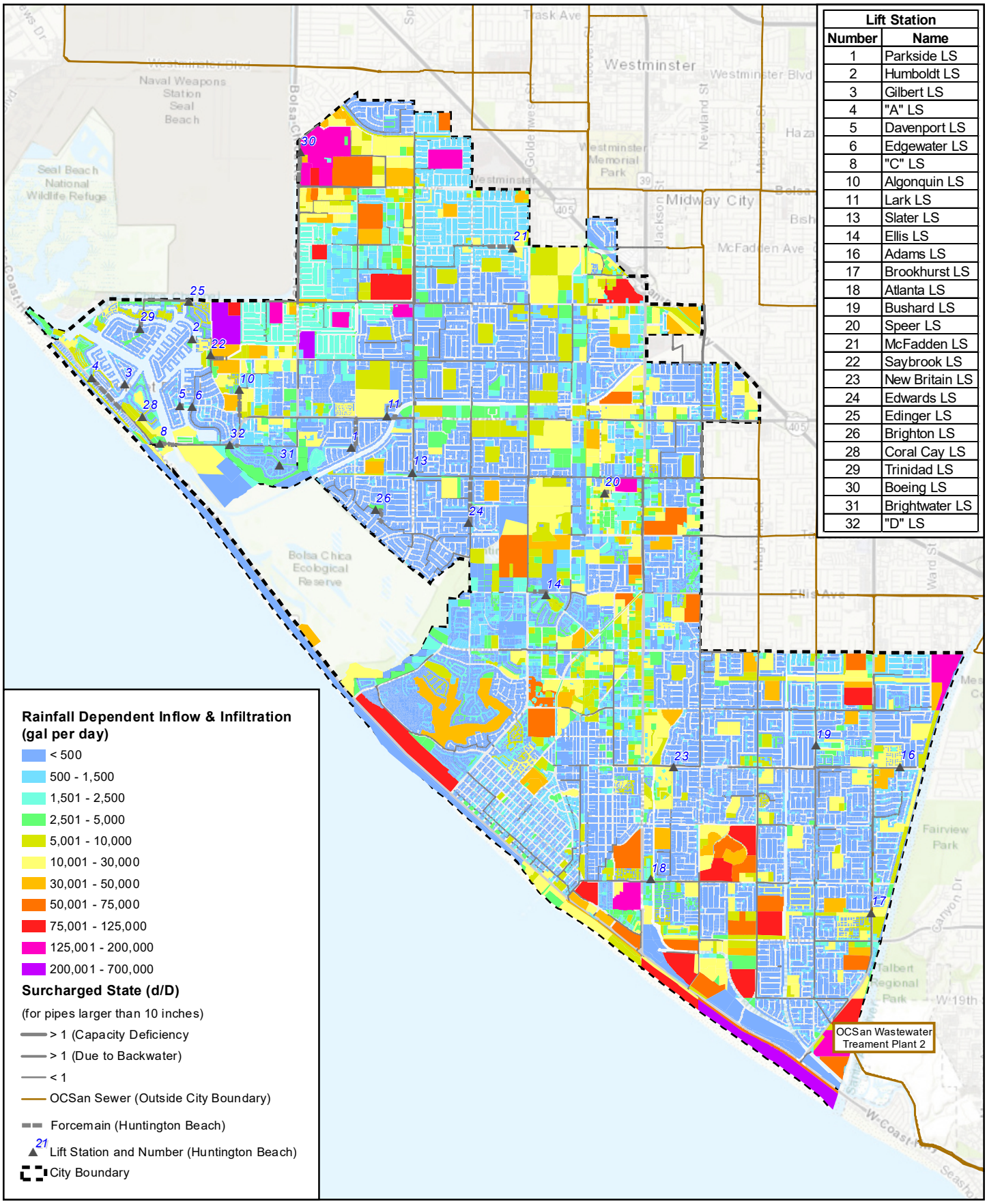
There are several viable methods for characterizing RDI&I and the relative contributions of RDI&I from the differing parts of the sewer system. Because the primary issues with respect to RDI&I are the impact of the peak flows that are generated in the system, the focus is on determining peak RDI&I influencers using two standard methods.

Because RDI&I flows are generally large in comparison to wastewater flows, it is possible to show the peak rate from the 24-hour design storm at which flow is generated by all 51,763 subcatchments. These peak flow rates are generated from the RDI&I only, and not from perennial or wet season groundwater influences (previous sub-chapter). Further, it is important to note that all values expressed here are inputs into the system and are not based on flows through the system itself, so the typical considerations of attenuation and routing are not necessary for this analysis.

Normalizing the peak RDI&I by unit length or area may give a better sense of how flows are distributed and get into the sanitary sewer system on a unit basis. Some subcatchments have many pipes in very small contributing areas, and others may have just a few pipes in large contributing areas. Normalizing by total contributing area helps understand if the same RDI&I could be attributed to many potential sources or from a larger area draining to one load source. Areas of the system with larger lots may have larger contributing areas, but not necessarily in proportion to the amount of RDI&I generated because the density of sewers may be lower. In this way, two subcatchments may contribute the same relative RDI&I, but one subcatchment may be much larger. Dividing by contributing area shows that the smaller area may be more critical because much more inflow is generated from it on a unit area basis.

Figure 7.3 shows the results for peak RD&I rate from each parcel (equivalent to subcatchment), and **Figure 7.4** shows peak RDI&I rate per acre of contributing subcatchment area. Low RDI&I quantity is represented by blue and green colors whereas high RDI&I quantity is represented by orange, red, and purple colors.

Overall, RDI&I, and I&I in general when combined with groundwater induced I&I (GWI), is prevalent in several areas of the sanitary sewer system. Specifically, evaluation of peak RDI&I rates indicates wet weather triggered deficient pipe status in much of the City's northwest area (flow meter basins 7 and 9). The City would benefit from prioritizing I&I investigations in flow meter basins 7 and 9 with further flow monitoring, smoke and dye testing, and flow isolating, and rehabilitation of older sewer pipe, since the majority of the I&I related problems occur there.



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Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

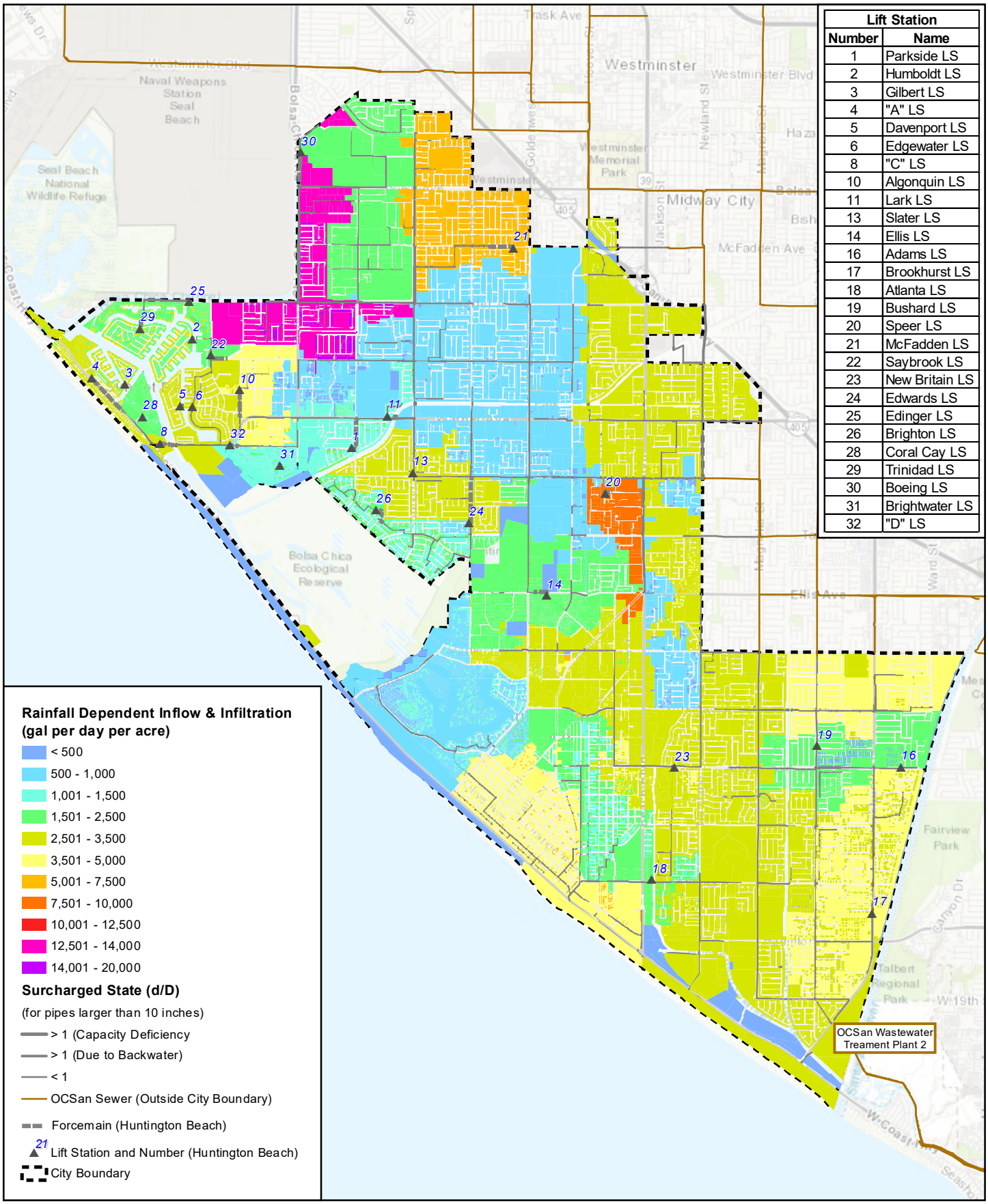
Existing Condition
10 yr 24 hr Design Storm
Peak Rainfall Dependent Inflow & Infiltration Rates

Project No. 12585300
Revision No. 0
Date 4/3/2024

FIGURE 7.3

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Print date: 03 Apr 2024 - 17:40

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Existing Condition
10 yr 24 hr Design Storm
Peak Rainfall Dependent
Inflow & Infiltration Rates per Acre

Project No. 12585300
Revision No. 0
Date 4/3/2024

FIGURE 7.4

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 7.4_ECDB_RDII per acre.mxd
Print date: 03 Apr 2024 - 17:33

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

8. Assessment of Wastewater Lift Stations

This chapter summarizes the desktop assessment of the City's lift stations. This includes determining lift station condition using assessment forms completed by City personnel. Then, lift station capacities under normal existing operating conditions and after emergency shutdowns are presented, as well as the regional impacts to each lift station's sewered tributary area due to hypothetical shutdowns. The recommended condition and capacity recommendations are listed in the subsequent chapters.

8.1 Lift Station Condition Assessment

Assessment forms for the City's twenty-seven (27) lift stations were provided as shown in **Figure 8.1** on the following page. An example of a typical lift station assessment sheet is shown below for Parkside LS in **Table 8.1** and **Table 8.2**. Full assessment sheets for the remaining 26 lift stations can be found in **Appendix G**.

Table 8.1 Condition Assessment Form for Parkside Lift Station (1/2)

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #1 Parkside
2. Address: 5475 Rivergate Drive (Graham St / Rivergate Dr)
3. Wet Well – Depth 25 Feet

Background Information:

4. Year Built: 2019
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:
   - ☒Submersible
   - ☒Concrete Wet Well/Dry Well (Both Concrete Structures)
   - ☐Steel Dry Well / Concrete Wet Well
   - ☒Self-Priming Pumps Above Concrete Wet Well
   - ☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐Other:	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/ Torque Flow	Wemco/ Torque Flow		
Pump Model	4x11 Model CLCESR	4x11 Model CLCESR		
Design Flow (nameplate)	480 gpm	480 gpm		
Design TDH (nameplate)	61 feet	61 feet		
VFD?	No (?)	No (?)		
Motor Horsepower	20 HP/480V	20 HP/480V		
Date Installed	2019	2019		

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	Needs Fencing or wall
3. Turnaround provided	☒ Y ☐ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 150KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch (1,616 feet)
34. Material PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☐ None ☒ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

Table 8.2 Condition Assessment Form for Parkside Lift Station (2/2)

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☒ Lining ☐ Coating

Criteria		Comments
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	N/A shallow
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	N/A

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   Station needs onsite stationary generator and security fencing.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   No access or parking issues

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   NO

4. **Dry Well Assessment. What condition is the Dry Well in?**

   New Condition

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   New Condition

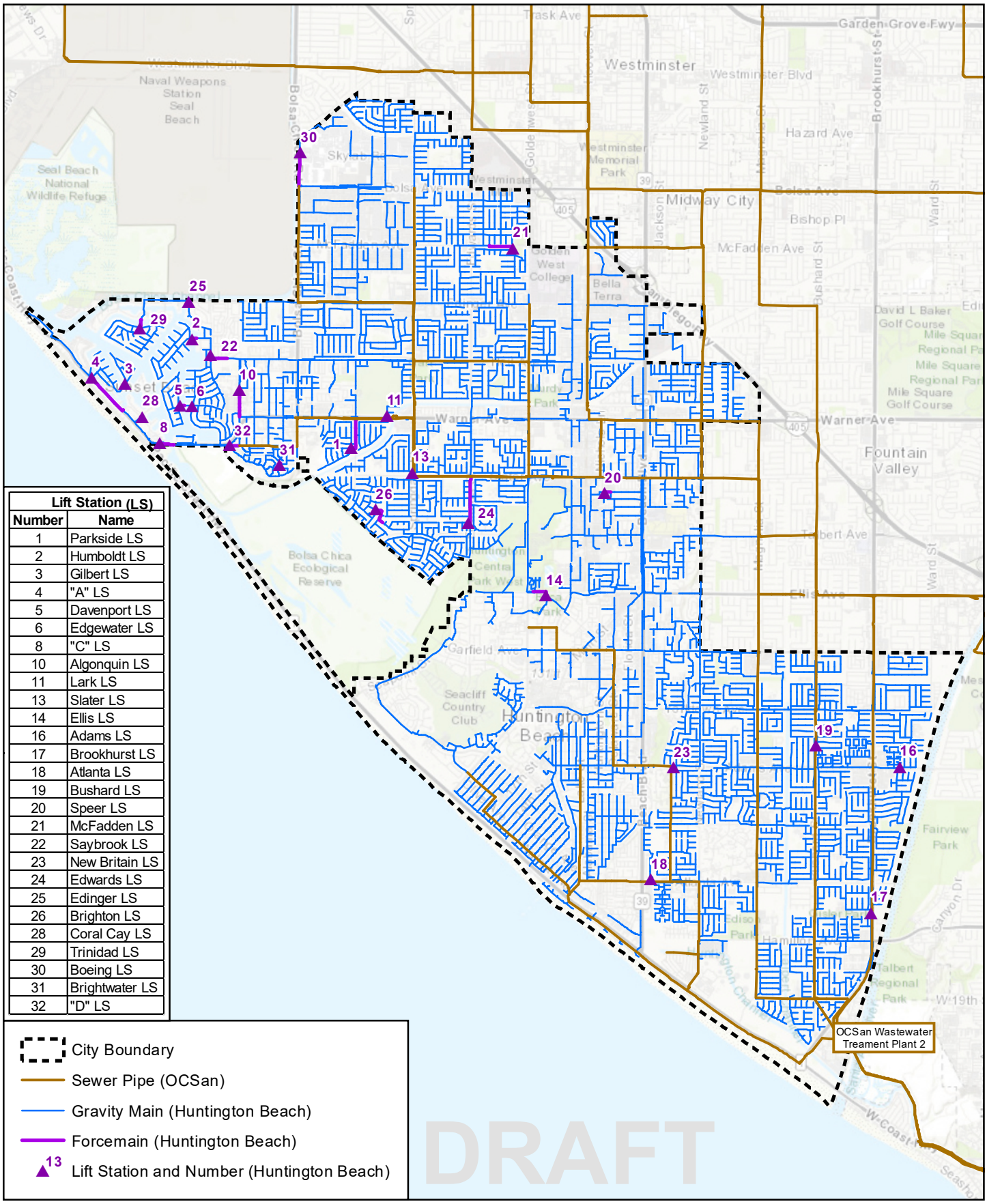
6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement**
   6" to 8" New piping no issues

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**
   Running well newer pumps

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   6" discharge to 6" forcemain 6" kennedy check valves 6" DEZURIK . (NEW) no issues



Lift Station (LS)	
Number	Name
1	Parkside LS
2	Humboldt LS
3	Gilbert LS
4	"A" LS
5	Davenport LS
6	Edgewater LS
8	"C" LS
10	Algonquin LS
11	Lark LS
13	Slater LS
14	Ellis LS
16	Adams LS
17	Brookhurst LS
18	Atlanta LS
19	Bushard LS
20	Speer LS
21	McFadden LS
22	Saybrook LS
23	New Britain LS
24	Edwards LS
25	Edinger LS
26	Brighton LS
28	Coral Cay LS
29	Trinidad LS
30	Boeing LS
31	Brightwater LS
32	"D" LS

City Boundary
Sewer Pipe (OCSan)
Gravity Main (Huntington Beach)
Forcemain (Huntington Beach)
13 Lift Station and Number (Huntington Beach)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Project No. 12585300
Revision No. 1
Date 3/8/2024

Lift Station Locations

FIGURE 8.1

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Print date: 08 Mar 2024 - 11:19

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

8.1.1 Lift Station Condition

The **Table 8.3** below shows the results from the City's desktop condition assessment task, summarizing the findings from the lift station assessment sheets provided by the City. Details on how these condition findings translate to recommendations is shown in **Chapter 9**.

Table 8.3 Condition Summary for Assessed Lift Stations

City ID	Lift Station	Original Construction Year	Most Recent Update	Condition Summary
1	Parkside	1965	2019	There are no significant issues with the lift station itself at this site.
2	Humboldt	1964	In Construction	The lift station shows significant signs of settling and cracking in the concrete structure. There is also evidence of creeping in the concrete at the dry well and aged polymer coating in the wet well.
3	Gilbert	1967	NA	The lift station is starting to show signs of corrosion due to its age. The concrete at the dry well is porous and the epoxy liner in the wet well is showing sign of wear.
4	"A"	2007	2021	This lift station has a wide range of notable issues. The check valve and gate valve on the inlet piping will need to be replaced within the next 3 years. The gate valve on the discharge piping should also be replaced at this time, as well as the bypass piping and valves. A fence or wall should be installed to limit public access to the station. As there is no emergency power at this site.
5	Davenport	1963	2020	The lift station has had past issues with the forcemain. As the station is aging, the City has requested to relocate the station to the Park area.
6	Edgewater	1964	2020	There are no significant issues with the lift station.
8	"C"	2017	NA	The epoxy in the wet well will need to be repaired. The lift station's valves and piping were noted as showing signs of wear due to aging.
10	Algonquin	2014	2019	The lift station has notable structural and mechanical deficiencies. The dry pit vault doors are very heavy, making maintenance difficult. These doors should be replaced with a lighter alternative. The wet well requires new epoxy liner to be sprayed as a preventative measure.
11	Lark	1969	NA	The lift station is beginning to settle under the structure due to its age. There is also notable corrosion on the forcemain, internal piping, and intake pipe.
13	Slater	2021	NA	There are no significant issues with the lift station.
14	Ellis	1995	NA	This lift station has multiple structural and mechanical deficiencies. Concrete above the wet well has begun to settle and crack. It also requires a new spray coating of epoxy. The lift station floor has become uneven and the floor of the dry well has begun to settle. The intake check valves, gate valves, and piping are past their useful life and require replacement.
16	Adams	2011	NA	The lift station requires new epoxy coating for preventative maintenance around the entire structure. The dry pumps are approaching their end of life.
17	Brookhurst	2007	2017	There are no significant issues with the lift station.
18	Atlanta	1964	1969	There are no significant issues with the lift station, though it's age may lend it to be replaced in near term.

City ID	Lift Station	Original Construction Year	Most Recent Update	Condition Summary
19	Bushard	1976	NA	This lift station has multiple required structural and mechanical improvements currently. However, there are no significant issues with the lift station, though it's age may lend it to be replaced in near term.
20	Speer	1968	NA	This lift station has multiple required structural and mechanical improvements currently and is slated for complete replacement by the City.
21	McFadden	1972	NA	This lift station has significant hydraulic/capacity issues, and is slated for complete replacement.
22	Saybrook	2022	NA	A relatively new station, in great condition with the exception of odor issues.
23	New Britain	1972	NA	The lift station is beginning to show signs of corrosion. The dry well has minor cracking in the porous concrete due to groundwater infiltration and the epoxy liner needs to be rehabilitated in the wet well. The piping in the lift station needs to be replaced due to its age.
24	Edwards	2010	NA	The pumps at the lift station will need to be replaced due to their age. Epoxy coating within the piping needs to be replaced within 2 years and the check valves and gate valves should be replaced within 3 years. For preventative maintenance, replace the epoxy within the wet well.
25	Edinger	2008	NA	This lift station's pumps have average ragging but will need to be replaced within 3 years due to their age. The epoxy liner within the wet well will need to be rehabilitated within 3-5 years for preventative maintenance purposes.
26	Brighton	2010	NA	There are no notable improvements to be made at this station. The epoxy coating in the wet well is in fair condition and may be replaced.
28	Coral Cay	2007	NA	There are no notable improvements to be made at this station. The epoxy coating in the wet well is in fair condition and may be replaced.
29	Trinidad	2016	NA	A relatively new station, in great condition with the exception of odor issues.
30	Boeing	2006	NA	This lift station has multiple structural and mechanical defects on top of requiring a new parking lot. The wet well epoxy liner needs to be refurbished within the next 3-5 years. Piping and valves should be replaced as preventative maintenance within 10 years. An emergency generator should be installed on site in case of a localized power outage. Evaluate and address foam issues.
31	Brightwater	2013	NA	There are no notable improvements to be made at this station.
32	"D"	2005	2013	There are no significant issues with the lift station; however, due to the critical nature of the pump station remaining in operation a backup pump system should be added to maintain operations in the event of a critical failure.

8.2 Lift Station Hydraulic Capacity Assessment

Understanding the operation and capacity of the lift stations will enable the City to make operational decisions to plan and design future lift station improvement projects, as appropriate. The hydraulic model was used to determine pumping capacities, wet well capacities, and risk of overflow, at, and just upstream, of each lift station, as well as within each lift station's tributary area. Having an understanding of the timeframe and approximate location of potential spills will aid the City in making operational decisions during emergencies. **Appendix E** shows the emergency storage situation within each lift station's tributary area at 24 hours after pump failure, providing a detailed look at where the City is most vulnerable and where an emergency preparedness action plan is most logical.

Further, A desktop evaluation of hydraulic components using key model output exported from existing and future model scenarios was performed. The evaluated criteria include peak flows, velocities, forcemain headloss, pump cycle time, and pump/system curve operation. The observations and findings from this detailed pumping analysis are intricately tied to the hydraulic recommendations, and for ease in translating this relationship, are presented as an introduction to the Lift Station CIP Projects section of **Chapter 9**.

8.2.1 Lift Station Hydraulic Capacities

The hydraulic model was leveraged to assess capacity considering existing loads and subsequent loads due to future development, under both dry and wet weather conditions. **Table 8.4** and **Table 8.5** summarize minimum and maximum flows coming into each station under gravity, as well as those same flows pumped through each station under the above-mentioned loadings for dry weather flow (DWF) and wet weather flow (WWF) conditions.

Table 8.4 Reported Lift Station Capacities and Modeled Lift Station Flows (Dry Weather)

	Reported	Modeled Gravity In			Modeled Pumped Out	
Lift Station	Firm Capacity (MGD)[1]	Existing Condition Low DWF (MGD)	Existing Condition PDWF (MGD)	Future Condition PDWF (MGD)	Existing Condition PDWF (MGD)	Future Condition PDWF (MGD)
Parkside	0.690	0.063	0.187	0.188	0.539	0.559
Humboldt	0.220	0.028	0.091	0.091	0.101	0.101
Gilbert	0.140	0.002	0.057	0.057	0.074	0.074
"A"	1.080	0.134	0.300	0.300	0.488	0.488
Davenport	0.290	0.000	0.049	0.061	0.049	0.063
Edgewater	1.440	0.143	0.709	0.726	1.479	1.479
"C"	1.730	0.182	0.373	0.375	1.822	1.822
Algonquin	1.370	0.019	1.035	1.035	1.405	1.405
Lark	0.180	0.000	0.046	0.050	0.102	0.272
Slater	1.150	0.197	0.501	0.504	1.472	1.482
Ellis	0.960	0.105	0.313	0.456	1.021	1.021
Adams	0.470	0.034	0.131	0.132	0.543	0.545
Brookhurst	1.840	0.182	0.533	0.559	1.983	1.984
Atlanta	0.430	0.058	0.181	0.182	0.436	0.438
Bushard	0.490	0.011	0.046	0.046	0.489	0.489
Speer	0.720	0.009	0.032	0.032	0.516	0.516
McFadden	0.170	0.021	0.067	0.067	0.111	0.112
Saybrook	1.080	0.075	0.684	0.684	1.177	1.177
New Britain	0.260	0.054	0.191	0.195	0.472	0.472
Edwards	1.150	0.137	0.387	0.387	0.971	0.971
Edinger	0.320	0.015	0.609	0.610	0.645	0.645
Brighton	0.290	0.041	0.123	0.123	0.350	0.350
Coral Cay	0.080	N/A	N/A	N/A	0.142	0.146
Trinidad	0.360	0.033	0.103	0.103	0.327	0.329
Boeing	0.300	0.015	0.095	0.095	0.244	0.244

Lift Station	Reported	Modeled Gravity In			Modeled Pumped Out	
	Firm Capacity (MGD)[1]	Existing Condition Low DWF (MGD)	Existing Condition PDWF (MGD)	Future Condition PDWF (MGD)	Existing Condition PDWF (MGD)	Future Condition PDWF (MGD)
Brightwater	0.430	0.017	0.049	0.049	0.244	0.244
"D"	2.020	0.346	1.381	1.449	2.271	2.271

[1]Firm capacities taken from table 3.2 2023 Sewer Master Plan Update (SMP) report

Table 8.5 Reported Lift Station Capacities and Modeled Lift Station Flows (Wet Weather)

Lift Station	Reported	Modeled Gravity In				Modeled Pumped Out	
	Firm Capacity (MGD)[1]	Existing Condition Low WWF (MGD)	Existing Condition Calibration Event PWWF (MGD)	Existing Condition 10 yr 24 hr DS PWWF (MGD)	Future Condition 10 yr 24 hr DS PWWF (MGD)	Existing Condition 10 yr 24 hr DS PWWF (MGD)	Future Condition 10 yr 24 hr DS PWWF (MGD)
Parkside	0.690	0.151	0.371	0.376	0.377	0.548	0.549
Humboldt	0.220	0.035	0.142	0.220	0.238	0.322	0.321
Gilbert	0.140	0.003	0.113	0.157	0.157	0.204	0.204
"A"	1.080	0.129	0.740	0.740	0.741	0.770	0.770
Davenport	0.290	0.001	0.069	0.221	0.221	0.388	0.382
Edgewater	1.440	0.140	1.330	1.439	1.447	2.432	2.423
"C"	1.730	0.150	1.096	1.155	1.160	1.835	1.835
Algonquin	1.370	0.023	1.117	1.128	1.236	1.426	1.429
Lark	0.180	0.000	0.100	0.193	0.193	0.321	0.321
Slater	1.150	0.440	1.343	1.653	1.656	2.233	2.268
Ellis	0.960	0.120	0.639	0.733	0.840	1.030	1.029
Adams	0.470	0.076	0.275	0.332	0.333	0.559	0.559
Brookhurst	1.840	0.388	1.494	1.687	1.709	2.012	2.010
Atlanta	0.430	0.060	0.289	0.336	0.477	0.438	0.438
Bushard	0.490	0.025	0.097	0.110	0.110	0.510	0.510
Speer	0.720	0.015	0.188	0.313	0.313	0.573	0.569
McFadden	0.170	0.061	0.156	0.166	0.166	0.156	0.156
Saybrook	1.080	0.091	0.986	1.104	1.104	1.608	1.585
New Britain	0.260	0.063	0.405	0.466	0.466	0.487	0.488
Edwards	1.150	0.207	0.687	0.808	0.809	0.973	0.974
Edinger	0.320	0.009	0.658	0.680	0.680	0.966	0.958
Brighton	0.290	0.061	0.208	0.243	0.243	0.353	0.354
Coral Cay	0.080	N/A	N/A	N/A	N/A	0.148	0.148
Trinidad	0.360	0.040	0.190	0.227	0.227	0.331	0.331
Boeing	0.300	0.043	0.247	0.286	0.286	0.273	0.273
Brightwater	0.430	0.045	0.106	0.110	0.110	0.254	0.254
"D"	2.020	0.486	2.791	3.341	3.341	4.430	4.422

[1]Firm capacities taken from table 3.2 2023 SMP report

8.2.2 Wet Well Emergency Storage

The hydraulic model was utilized to determine the impacts on wet well storage from a system-wide emergency shutdown (all pumps fail at the same time across the system). **Table 8.6** lists key measurements that aided in determining the volume of wastewater that each lift station's wet well could hold before backing up into the gravity system upstream of it. The storage basis depth is essentially the depth of each lift station's gravity inlet pipe from the

bottom of the wet well. Then, the emergency storage volume is calculated from this depth and the wet well's prominent cross-sectional area. The amount of time that it takes to exceed the emergency storage capacity is shown in the far right two columns, under DWF and WWF (10-year 24-hour design storm) conditions.

Table 8.6 Lift Station Emergency Storage Volumes and Times to reach Capacity

Lift Station	Wet Well Area (sq ft)	Wet Well Depth (ft)	Wet Well Volume (gal)	Storage Basis Depth (ft)	Emergency Storage Capacity (gal)	Emergency Storage Duration Dry Weather (hours)	Emergency Storage Duration 10 yr 24 hr Storm Event (hours)
Parkside	64.0	29'-0"	13,309	5.8	2,777	0.42	0.25
Humboldt	12.6	15'-8"	1,244	2.0	189	0.25	0.08
Gilbert	12.6	14'-10"	961	0.8	75	0.17	0.08
"A"	58.5	31'-11"	13,872	12.3	5,383	0.50	0.33
Davenport	12.6	16'-8"	1,583	6.0	564	0.17	0.08
Edgewater	142.5	22'-4"	19,539	10.4	11,086	1.58	1.42
"C"	300.0	24'-5"	48,249	4.0	8,977	6.25	4.92
Algonquin	60.0	29'-7"	4,331	8.9	3,995	0.67	0.50
Lark	12.6	15'-3"	716	1.0	94	0.17	0.08
Slater	91.0	27'-5"	15,657	10.1	6,875	0.42	0.25
Ellis	224.0	33'-7"	24,799	10.3	17,259	1.33	1.08
Adams	70.0	15'-3"	5,969	4.0	2,095	0.42	0.25
Brookhurst	136.0	23'-2"	20,550	7.3	7,427	0.42	0.25
Atlanta	50.3	20'-6"	6,660	2.0	753	0.17	0.08
Bushard	50.3	11'-8"	3,123	1.7	640	0.33	0.17
Speer	50.3	15'-1"	4,139	4.0	1,505	1.42	0.83
McFadden	12.6	17'-0"	877	4.1	386	0.25	0.08
Saybrook	82.5	21'-1"	10,491	5.7	3,518	1.00	0.83
New Britain	50.3	13'-7"	4,026	1.1	414	0.17	0.08
Edwards	125.7	19'-1"	14,857	4.1	3,855	0.42	0.25
Edinger	28.3	20'-9"	2,731	2.4	508	0.17	0.08
Brighton	69.9	16'-7"	6,902	5.1	2,667	0.58	0.42
Coral Cay	84.4	19'-0"	5,808	3.0	1,894	1.25	0.75
Trinidad	47.8	20'-3"	6,901	4.8	1,716	0.42	0.25
Boeing	96.0	21'-8"	13,501	7.8	5,601	1.58	1.25
Brightwater	28.3	26'-9"	5,419	5.5	1,164	0.67	0.50
"D"	120.3	49'-0"	42,296	7.6	6,839	1.83	1.58

[1]Firm capacities taken from table 3.2 2023 SMP report

8.2.3 Lift Station Tributary Basin Emergency Storage during DWF

This section builds on the analysis done in the previous one, as it identified the most vulnerable points in each lift station's tributary sewershed. For the purposes of analyzing the system during a widespread shutdown, each lift station becomes an isolated sewershed with no outlet. The following **Table 8.7** displays the minimum freeboard on any surcharged sewer tributary or upstream of each lift station, and only within that net basin. Then, **Table 8.8** shows the cumulative overflow volume from all manholes within each lift station tributary basin at each time threshold.

Table 8.7 Minimum Freeboard on Surcharged Sewers with Lift Station Tributary Basins (Dry Weather)

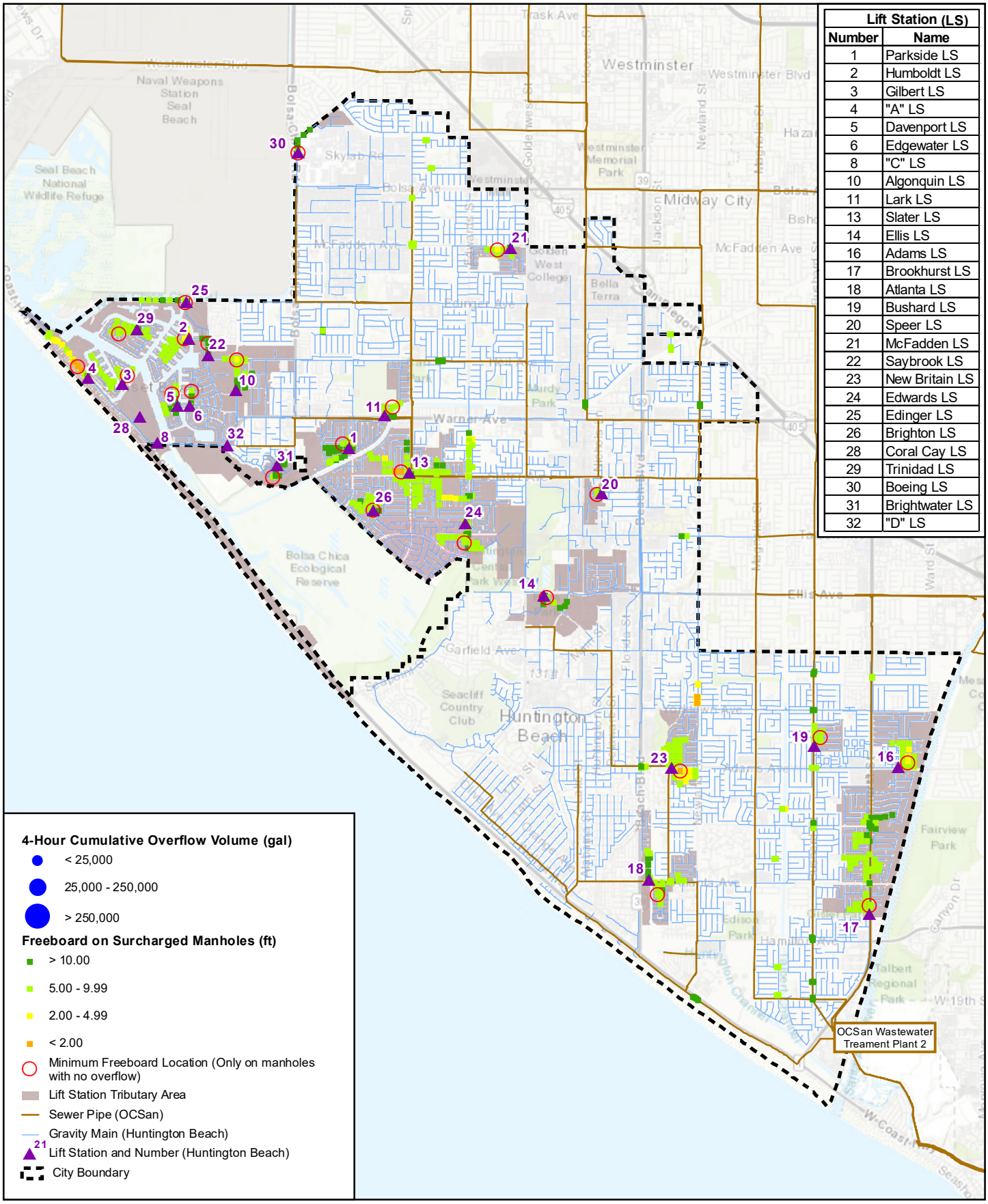
	Minimum Freeboard (ft)							
Lift Station	**1 Hour**	**2 Hours**	**3 Hours**	**4 Hours**	**5 Hours**	**6 Hours**	**12 Hours**	**24 Hours**
Parkside	15.6	10.1	9.9	7.1	6.2	5.5	2.4	0.0
Humboldt	5.2	3.5	2.7	2.1	1.6	1.2	0.0	0.0
Gilbert	9.7	9.4	8.4	8.3	7.9	7.4	4.8	0.7
"A"	8.6	5.3	2.9	1.1	0.0	0.0	0.0	0.0
Davenport	10.8	8.7	6.2	6.2	6.2	6.2	4.1	1.6
Edgewater	11.2	10.1	9.2	7.9	5.9	5.9	4.7	4.3
"C"	N/A	N/A	N/A	N/A	N/A	N/A	17.5	10.8
Algonquin	16.8	9.8	6.5	4.7	3.5	2.4	0.0	0.0
Lark	8.1	6.5	5.9	5.3	4.8	4.4	2.7	0.6
Slater	4.9	2.6	1.3	0.5	0.0	0.0	0.0	0.0
Ellis	N/A	11.9	11.9	5.9	2.8	0.3	0.0	0.0
Adams	9.1	5.5	4.4	3.6	2.9	2.6	0.4	0.0
Brookhurst	6.6	3.0	1.3	0.4	0.0	0.0	0.0	0.0
Atlanta	11.9	6.2	5.8	5.8	4.0	3.6	2.5	2.5
Bushard	7.2	5.9	5.7	5.5	5.2	4.9	3.6	1.9
Speer	N/A	11.7	8.1	8.0	6.0	5.0	2.6	0.0
McFadden	6.1	5.3	5.0	4.7	4.5	4.3	2.9	1.7
Saybrook	N/A	12.2	11.1	10.1	9.3	7.5	2.2	0.0
New Britain	4.5	3.0	2.4	1.9	1.4	0.9	0.0	0.0
Edwards	10.5	7.2	5.9	5.9	5.6	4.7	2.9	1.1
Edinger	8.2	8.1	8.0	7.9	7.8	7.7	7.2	6.4
Brighton	9.4	8.2	7.6	7.1	6.6	6.2	4.1	2.1
Coral Cay	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trinidad	10.7	8.9	8.2	7.8	6.7	6.3	4.4	1.5
Boeing	N/A	12.8	11.0	9.5	8.1	6.6	1.4	0.0
Brightwater	15.1	13.4	11.4	8.8	6.7	6.3	2.6	0.0
"D"	N/A	N/A	10.8	7.9	5.9	5.9	4.7	4.3

Table 8.8 Cumulative Overflow Volume within Lift Station Tributary Basins (Dry Weather)

Lift Station	Time after pump failure of first Overflow (hours)	Cumulative Overflow Volume (gal)							
		1 Hour	2 Hours	3 Hours	4 Hours	5 Hours	6 Hours	12 Hours	24 Hours
Parkside	21.33	0	0	0	0	0	0	0	13,400
Humboldt	9.83	0	0	0	0	0	0	7,100	34,800
Gilbert	N/A	0	0	0	0	0	0	0	0
"A"	5.08	0	0	0	0	100	7,200	62,900	158,200
Davenport	N/A	0	0	0	0	0	0	0	0
Edgewater	N/A	0	0	0	0	0	0	0	0
"C"	N/A	0	0	0	0	0	0	0	0
Algonquin	8.42	0	0	0	0	0	0	38,500	126,200
Lark	N/A	0	0	0	0	0	0	0	0
Slater	5.00	0	0	0	0	400	9,800	103,400	275,700
Ellis	6.25	0	0	0	0	0	0	63,100	157,100
Adams	13.42	0	0	0	0	0	0	0	29,100
Brookhurst	4.75	0	0	0	0	2,249	15,300	123,000	294,985
Atlanta	N/A	0	0	0	0	0	0	0	0
Bushard	N/A	0	0	0	0	0	0	0	0
Speer	22.08	0	0	0	0	0	0	0	1,800
McFadden	N/A	0	0	0	0	0	0	0	0
Saybrook	14.75	0	0	0	0	0	0	0	19,100
New Britain	8.25	0	0	0	0	0	0	16,700	63,700
Edwards	N/A	0	0	0	0	0	0	0	0
Edinger	N/A	0	0	0	0	0	0	0	0
Brighton	N/A	0	0	0	0	0	0	0	0
Coral Cay	N/A	0	0	0	0	0	0	0	0
Trinidad	N/A	0	0	0	0	0	0	0	0
Boeing	19.67	0	0	0	0	0	0	0	7,400
Brightwater	20.50	0	0	0	0	0	0	0	4,900
"D"	N/A	0	0	0	0	0	0	0	0
Totals		0	0	0	0	2,749	32,300	414,700	1,186,385

Table 8.8 shows that under normal DWF conditions, no manhole upstream of any lift station would overflow until sometime between the 4th and 5th hour after systemwide simultaneous pump failure. Further, only 13 of the 27 lift stations have an overflow potential within their tributary area after 24 hours from initial pump failure. Brookhurst, Slater, “A”, Ellis, and Algonquin are the most vulnerable with cumulative overflow volumes exceeding 100,000 gallons after 24 hours. **Figure 8.2** displays the state of the system at 4 hours, or the time horizon just before any modeled

overflows are projected to occur. **Figure 8.3** and **Figure 8.4** show the state of the system at the 12 and 24 hour time horizons. Details on freeboard and overflow potential are shown in individual Lift Station tributary plan maps for the 24 hour time horizon under DWF conditions in **Appendix E**.



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

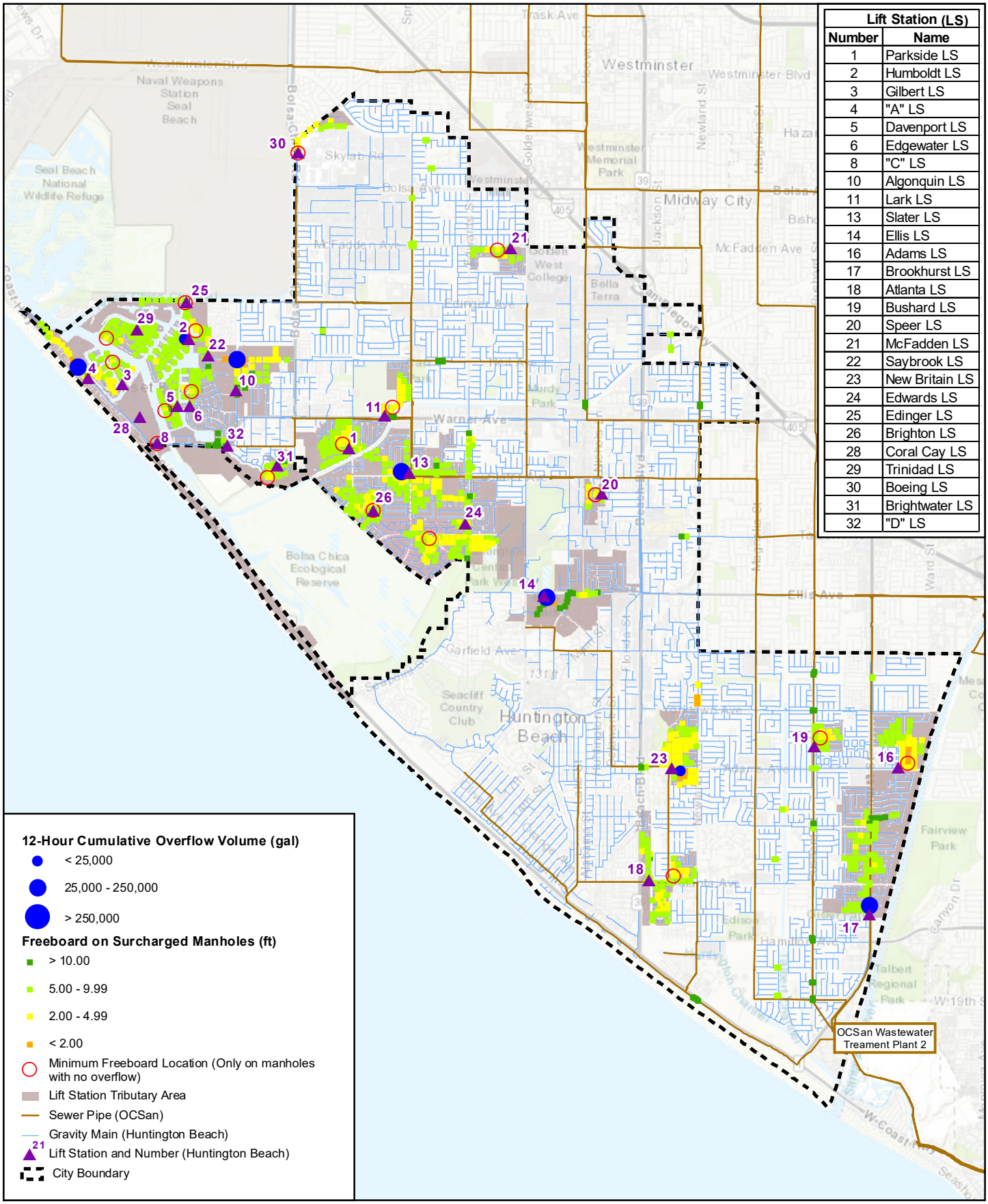
4-Hour Dry Weather Flow Emergency Storage after Systemwide Pump Failure

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE 8.2

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Print date: 15 Mar 2024 - 10:33

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

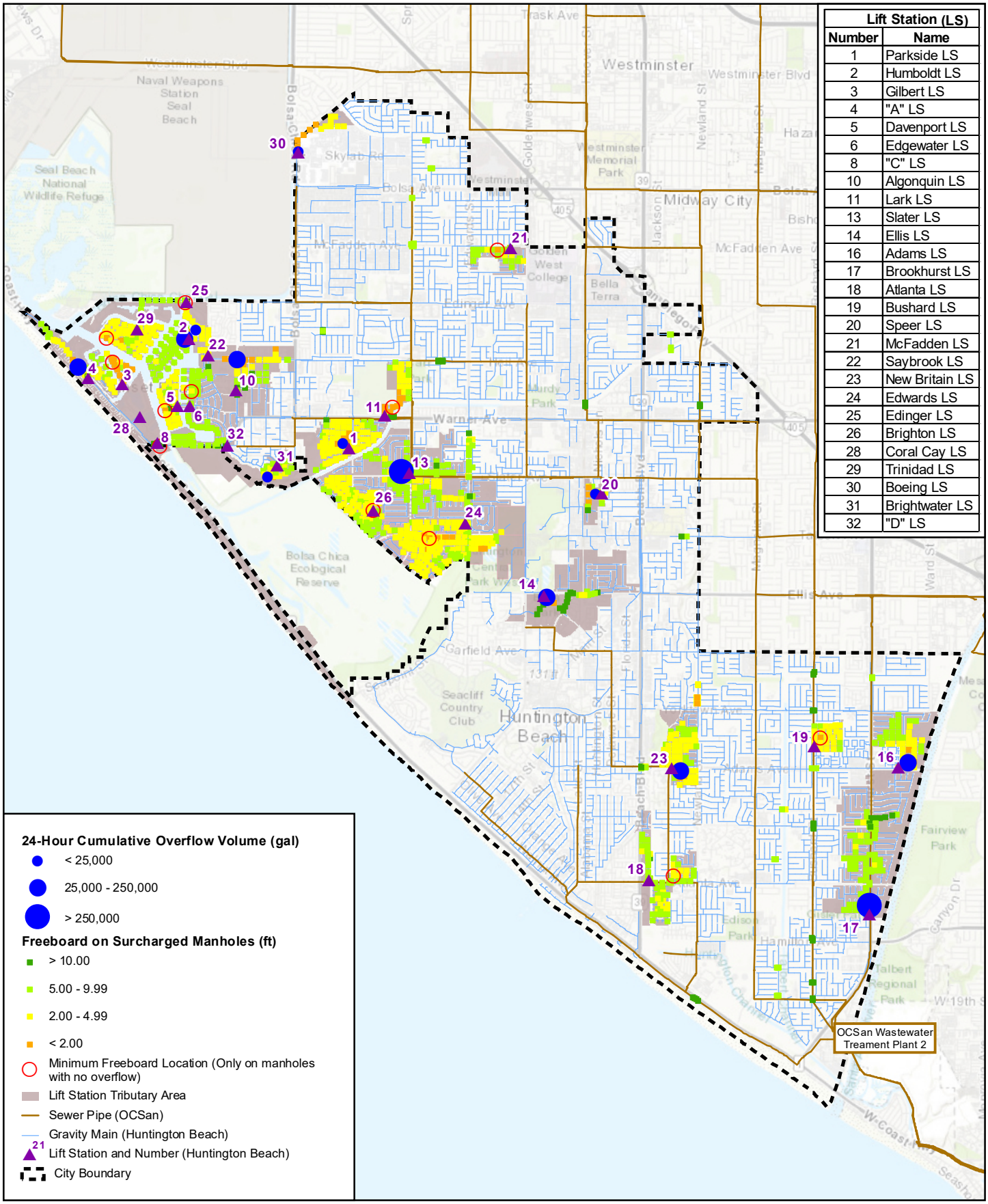
12-Hour Dry Weather Flow Emergency Storage after Systemwide Pump Failure

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE 8.3

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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

24-Hour Dry Weather Flow Emergency Storage after Systemwide Pump Failure

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE 8.4

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Print date: 15 Mar 2024 - 10:16

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

8.2.4 Lift Station Tributary Basin Emergency Storage during WWF

This section presents the same information as in **Chapter 8.2.3** but considering the 10-year 24 design storm condition. **Table 8.9** displays the minimum freeboard on any surcharged sewer tributary or upstream of each lift station, and only within that net basin. Then, **Table 8.10** shows the cumulative overflow volume from all manholes within each lift station tributary basin at each time threshold.

Table 8.9 Minimum Freeboard on Surcharged Sewers with Lift Station Tributary Basins (Wet Weather Design Storm)

	Minimum Freeboard (ft)							
Lift Station	1 Hour	2 Hours	3 Hours	4 Hours	5 Hours	6 Hours	12 Hours	24 Hours
Parkside	15.6	10.1	9.9	6.7	5.7	5.1	2.2	0.0
Humboldt	5.1	3.0	1.7	1.1	0.6	0.2	0.0	0.0
Gilbert	9.7	8.4	8.0	7.3	6.6	6.0	2.3	0.0
“A”	9.1	4.9	1.7	0.0	0.0	0.0	0.0	0.0
Davenport	10.8	6.2	6.2	6.1	5.5	5.0	2.0	0.0
Edgewater	11.2	9.9	7.8	5.9	5.9	5.3	4.6	0.0
“C”	N/A	N/A	N/A	17.6	17.2	16.0	9.0	9.0
Algonquin	18.8	7.8	3.3	1.6	0.1	0.0	0.0	0.0
Lark	8.1	6.5	5.7	4.9	4.4	4.1	2.4	0.0
Slater	4.7	1.6	0.2	0.0	0.0	0.0	0.0	0.0
Ellis	N/A	11.9	2.8	0.0	0.0	0.0	0.0	0.0
Adams	9.1	5.0	3.5	2.6	2.1	1.6	0.0	0.0
Brookhurst	6.5	2.5	0.5	0.0	0.0	0.0	0.0	0.0
Atlanta	11.9	6.2	5.8	4.1	3.5	3.1	2.5	2.4
Bushard	7.2	5.9	5.5	4.9	4.5	4.3	2.8	1.5
Speer	11.3	3.8	2.5	1.3	0.0	0.0	0.0	0.0
McFadden	6.1	5.1	4.5	3.9	3.4	2.9	0.8	0.0
Saybrook	N/A	11.3	9.1	5.2	4.4	3.5	0.0	0.0
New Britain	4.5	2.5	1.3	0.6	0.0	0.0	0.0	0.0
Edwards	10.5	5.9	5.9	5.4	4.4	3.9	2.2	0.0
Edinger	9.0	8.1	7.9	7.8	7.7	7.6	6.5	5.0
Brighton	9.4	8.0	7.1	6.5	5.9	5.4	3.5	0.0
Coral Cay	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trinidad	10.7	8.4	6.7	6.0	5.6	5.3	3.2	0.0
Boeing	N/A	N/A	12.5	10.5	8.6	6.5	0.0	0.0
Brightwater	15.1	13.4	11.2	8.4	6.3	5.7	2.0	0.0
“D”	N/A	N/A	7.8	5.9	5.9	5.3	4.6	0.0

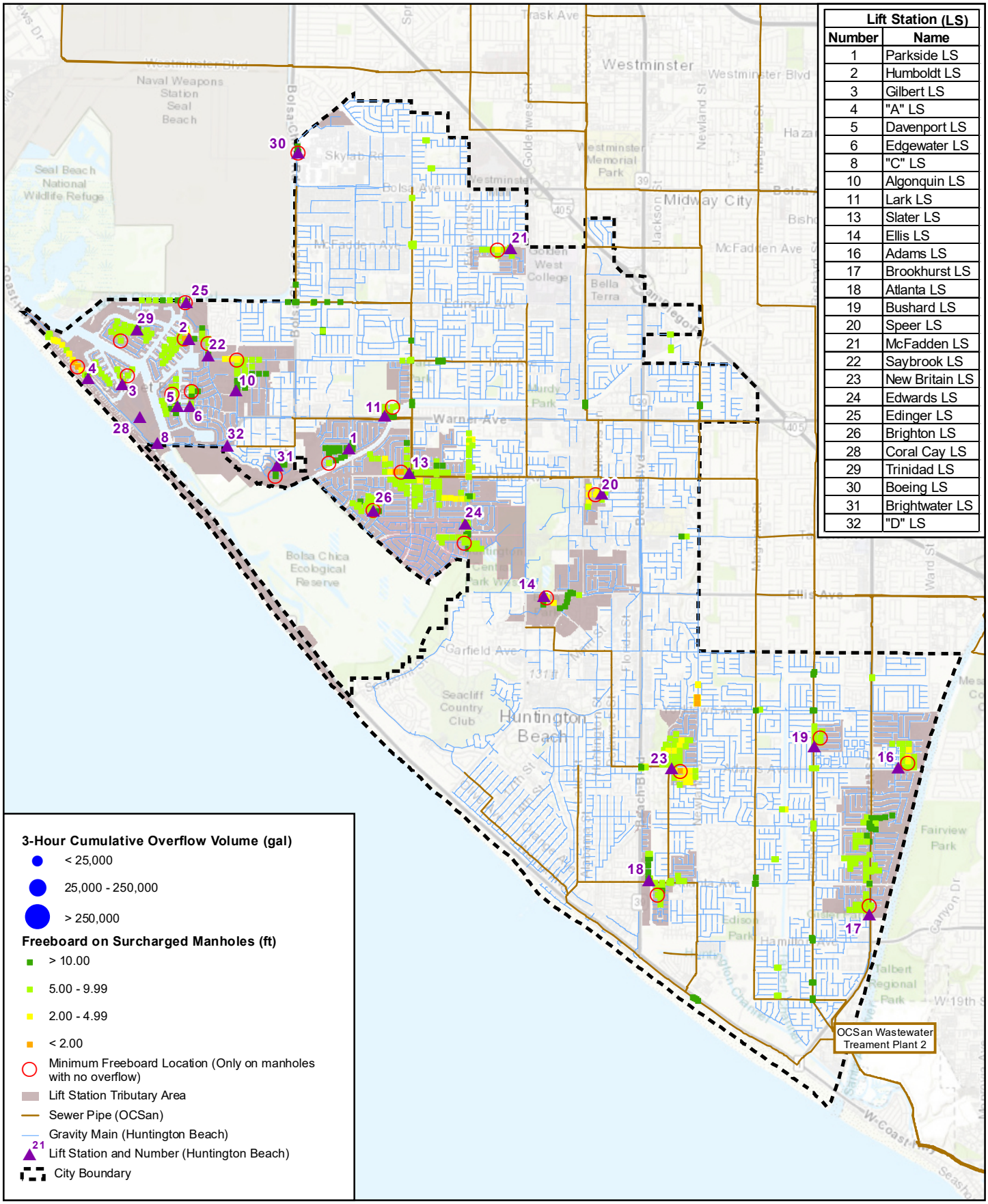
Table 8.10 Cumulative Overflow Volume within Lift Station Tributary Basins (Wet Weather Design Storm)

Lift Station	Time after pump failure of first Overflow (hours)	Cumulative Overflow Volume (gal)							
		1 Hour	2 Hours	3 Hours	4 Hours	5 Hours	6 Hours	12 Hours	24 Hours
Parkside	15.52	0	0	0	0	0	0	0	67,300
Humboldt	6.95	0	0	0	0	0	0	19,600	69,900
Gilbert	14.47	0	0	0	0	0	0	0	12,400
“A”	4.12	0	0	0	0	7,800	18,500	91,400	255,000
Davenport	14.68	0	0	0	0	0	0	0	29,500
Edgewater	18.85	0	0	0	0	0	0	0	66,500
“C”	N/A	0	0	0	0	0	0	0	0
Algonquin	5.20	0	0	0	0	0	8,500	91,500	243,900
Lark	18.12	0	0	0	0	0	0	0	12,100
Slater	3.33	0	0	0	9,000	27,500	49,000	208,800	599,122
Ellis	3.80	0	0	0	3,100	17,100	31,500	125,700	285,500
Adams	10.63	0	0	0	0	0	0	9,000	104,300
Brookhurst	3.53	0	0	0	7,555	28,674	52,583	227,417	716,569
Atlanta	N/A	0	0	0	0	0	0	0	0
Bushard	N/A	0	0	0	0	0	0	0	0
Speer	4.80	0	0	0	0	900	6,400	35,700	57,000
McFadden	15.02	0	0	0	0	0	0	0	56,000
Saybrook	9.95	0	0	0	0	0	0	13,000	66,700
New Britain	5.27	0	0	0	0	0	2,900	42,300	133,200
Edwards	18.58	0	0	0	0	0	0	0	68,600
Edinger	N/A	0	0	0	0	0	0	0	0
Brighton	22.25	0	0	0	0	0	0	0	9,900
Coral Cay	N/A	0	0	0	0	0	0	0	0
Trinidad	17.72	0	0	0	0	0	0	0	28,600
Boeing	10.03	0	0	0	0	0	0	13,300	106,600
Brightwater	14.67	0	0	0	0	0	0	0	22,100
“D”	N/A	0	0	0	0	0	0	0	0
Totals		0	0	0	19,655	81,974	169,383	877,717	3,010,791

As expected, the wet weather cumulative overflow volume was significantly higher during the simulated design storm vs during dry weather conditions, with the system experiencing over 3 Mgal of modeled overflow vs 1.2 Mgal of modeled overflow during dry weather emergency conditions.

Table 8.10 shows that under the WWF 10-year 24-hour design storm conditions, manholes upstream of any lift station would first overflow between the 3rd and 4th hour after systemwide simultaneous pump failure. Further, 21 of the 27 lift stations have an overflow potential within their tributary area after 24 hours from initial pump failure. Brookhurst and

Slater show cumulative overflow volumes well over 500,000 gallons, while Ellis, “A” and Algonquin are the next highest three, totalling between 286,000 to 243,000 gallons. In total, 8 lift stations have cumulative overflows over 100,000 gallons during the WWF design storm condition. **Figure 8.5** displays the state of the system at 3 hours, or the time horizon just before any modelled overflows are projected to occur. **Figure 8.6** and **Figure 8.7** show the state of the system at the 12 and 24 hour time horizons. The lift stations with the largest and soonest overflow potential after pump failure are Brookhurst, Slater, and Ellis. Details on freeboard and overflow potential are shown in individual lift station tributary plan maps for the 24-hour time horizon under WWF design storm conditions in **Appendix E**.



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

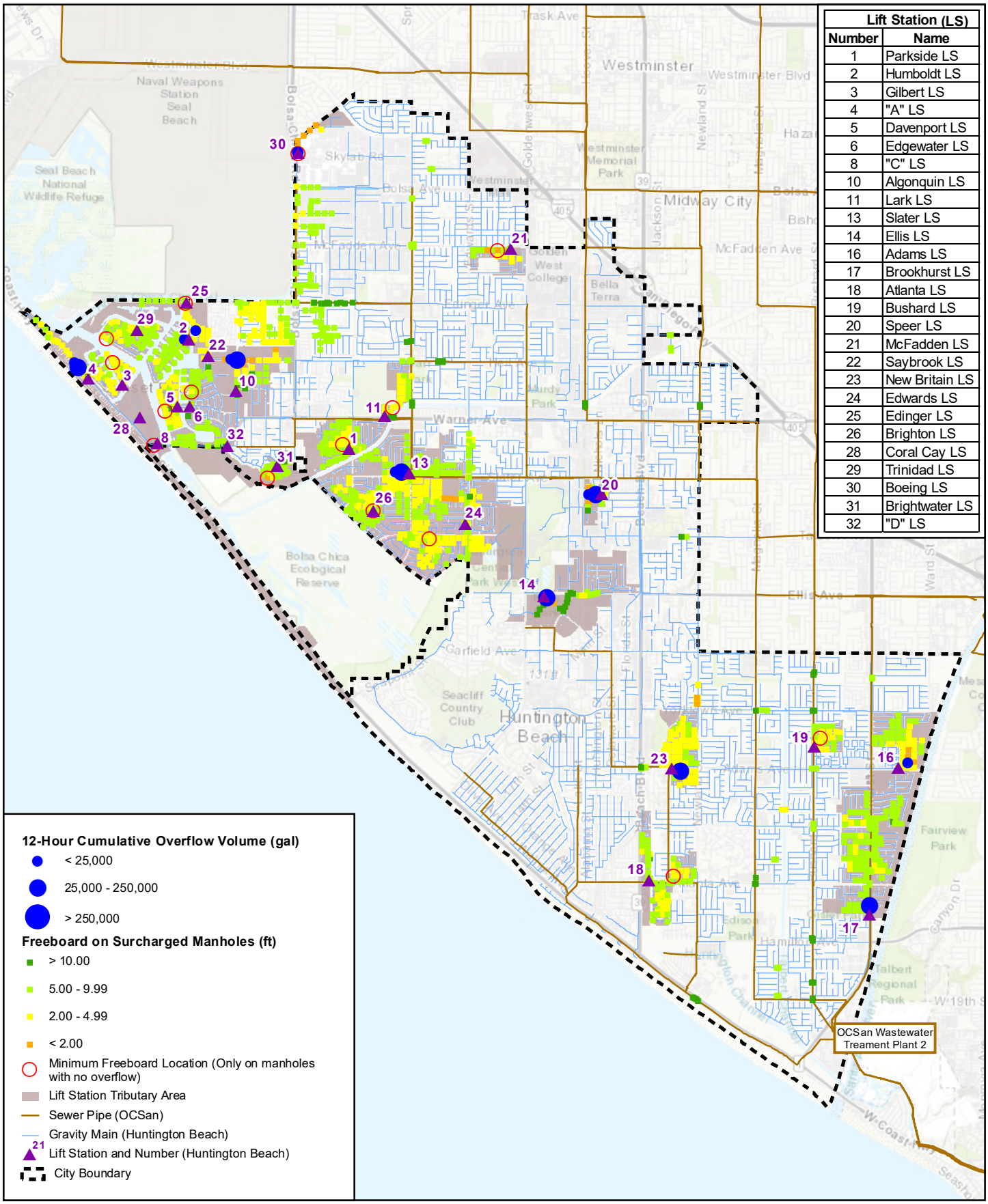
3-Hour Wet Weather Flow Emergency Storage after Systemwide Pump Failure

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE 8.5

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 8.5_3Hr WWF Emergency Storage.mxd
Print date: 15 Mar 2024 - 10:20

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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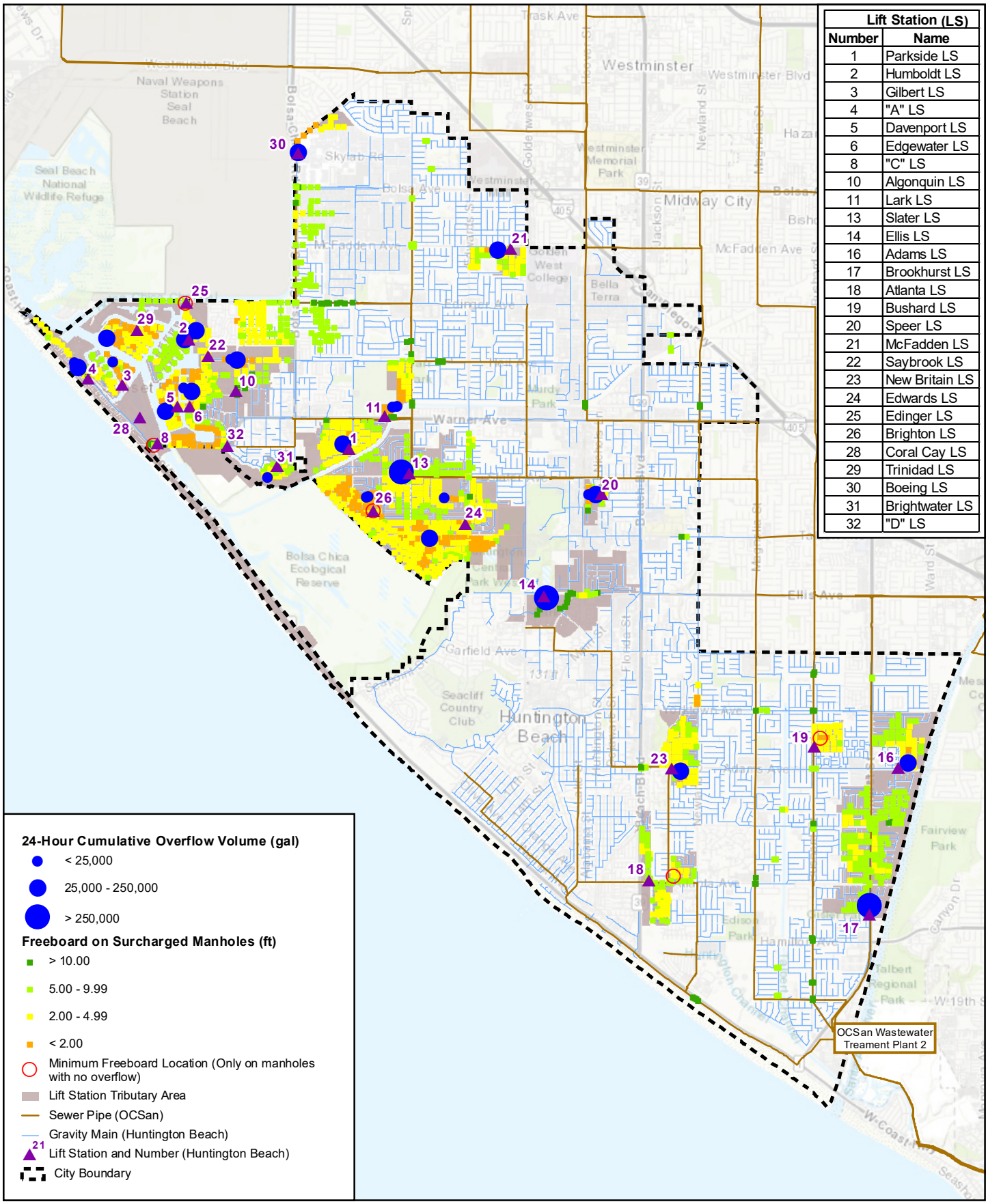
12-Hour Wet Weather Flow Emergency Storage after Systemwide Pump Failure

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE 8.6

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 8.6_12Hr WWF Emergency Storage.mxd
Print date: 15 Mar 2024 - 10:27

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
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24-Hour Wet Weather Flow Emergency Storage after Systemwide Pump Failure

Project No. 12585300
Revision No. 1
Date 3/12/2024

FIGURE 8.7

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 8.7_24Hr WWF Emergency Storage.mxd
Print date: 15 Mar 2024 - 10:31

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

9. Capital Improvement Program Development

This chapter presents a comprehensive capital improvement program (CIP) strategy that focuses on capacity upsizing for gravity sewers and condition and operational improvements for lift stations. Prior to discussing the specific projects, this chapter discusses the major hydraulic model considerations, strategy used to identify gravity sewer improvement projects, and CIP project organization and naming conventions. Hydraulic modelling results and decision logic used to categorize and prioritize projects triggered by the design basis (future development condition and the 10-year 24-hour design storm) are presented in summary tables and figures. Project cost indices and considerations for gravity main and lift station recommendations are also discussed.

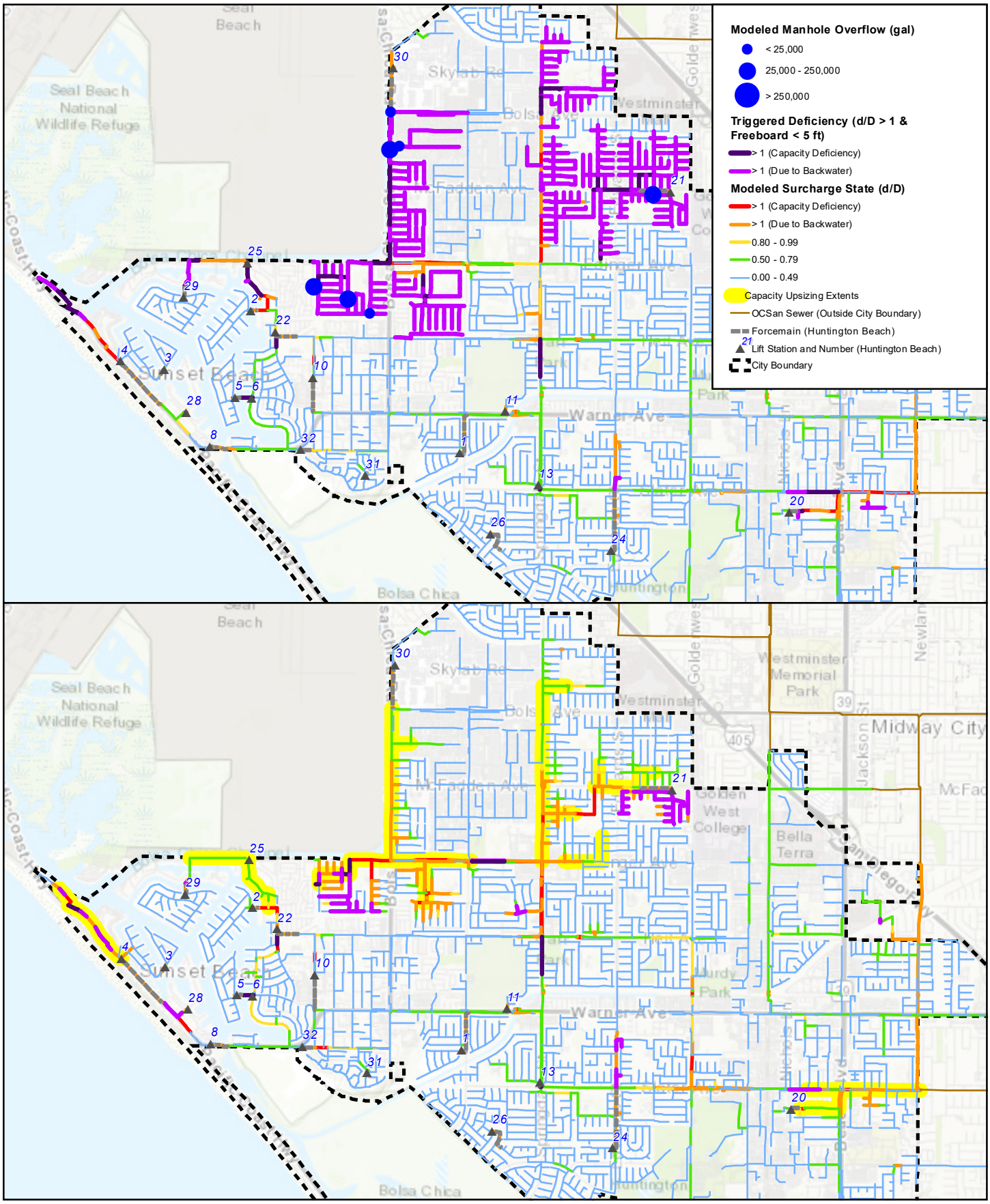
9.1 Model Results from Gravity CIP Solution Analysis

Capacity upsizing was considered in various scenarios to determine the most beneficial solutions for the City through the year 2030. These model scenarios include combinations of pump setting adjustments and capacity upsizing that address eliminating triggered deficiencies, reduce hydraulic grade lines (HGLs), eliminate modelled overflows, and reduce peak wet weather flows to the Orange County Sanitation District (OCSan) system and its' WWTP.

The most logical and cost-effective way to directly address hydraulically restricted / deficient areas in the system, is to run the model with an upsized pipe in those segments. **Figure 9.1** shows the state of the north half of the system for the future development design basis condition under the 10 year 24 hour design in the top viewframe, and shows the state of the system after capacity upsizing and highlighting the sections of sewer that have been upsized. Then, **Figure 9.2** shows the same map details as **Figure 9.1**, but for the south half of the system. The system still shows a few minor areas of surcharged pipe, but a significant decrease in backwater, especially in meter basins 7 and 9, and a complete elimination of modeled overflows under the 10-year 24 storm. **Table 9.1** shows the same statistics from **Chapter 6** but compares the future development wet weather design basis scenario to one that includes the 16 distinct capacity upsize projects implemented (CIP Basis columns).

Table 9.1 Comparison of Future Design Basis vs CIP Basis Scenario Results under 10 yr 24 hour Design Storm

Metric	HB Sewers Only	HB Sewers Only	OCSan Sewers Only	OCSan Sewers Only	Entire Service Area	Entire Service Area
	FUDB WWF (10 yr 24 hr DS)	CIP Basis	FUDB WWF (10 yr 24 hr DS)	CIP Basis	FUDB WWF (10 yr 24 hr DS)	CIP Basis
Total Volume of Overflow (gal)	194,700	0	235,300	0	430,000	0
Number of SSOs	4	0	2	0	6	0
Number of Surcharged Pipes	877	456	109	120	986	576
Total Length Surcharged (ft)	205,935	93,373	34,493	42,666	240,428	136,039
# Surcharged due to Capacity Def	127	67	28	26	155	93
Total Length of Surcharged due to Cap Def (ft)	29,277	16,329	13,871	11,846	43,148	28,175
Number of Surcharged Pipes within 5 ft of Surface	629	117	20	8	649	125
Total Length Surcharged Pipes within 5 ft of Surface (ft)	153,350	24,521	9,084	4,642	162,434	29,163
# Surcharged and within 5 ft of Surface due to Capacity Def	61	10	8	3	69	13
Total Length of Surcharged within 5 feet of Surface due to Capacity Deficiency	12,916	2,079	5,450	2,437	18,366	4,516



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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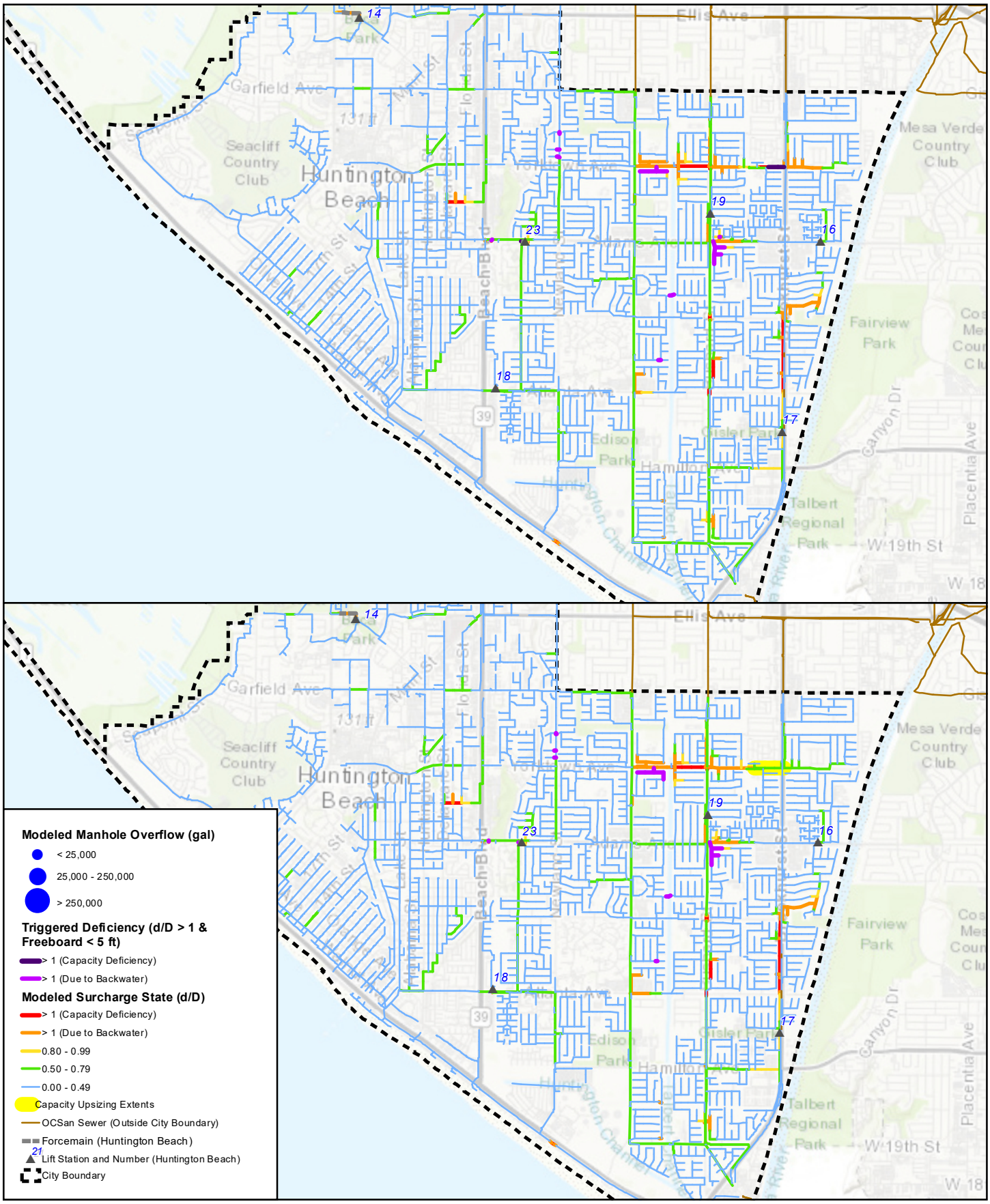
Pre vs Post Capacity Upsizing (North)
Future 10 yr 24 hr Design Storm
Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **3/18/2024**

FIGURE 9.1

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 9.1 Pre vs Post North.mxd
Print date: 21 Mar 2024 - 14:18

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 1,150 2,300 3,450 4,600

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Pre vs Post Capacity Upsizing (South) Future 10 yr 24 hr Design Storm Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE 9.2

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Figure 9.2_Pre vs Post South.mxd
Print date: 21 Mar 2024 - 14:22

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

9.2 Gravity Sewer CIP Project Development

The improvement actions, methods, costs, and designation logic for the purposes of prioritizing and generating pipe-by-pipe capital improvement program recommendations for gravity sewers were developed, along with asset and component specific improvement recommendations and costs for lift stations.

9.2.1 Gravity Sewer CIP Project Cost Basis

The term improvement action is an umbrella term used for this project that includes rehabilitation, replacement and/or upsize, CCTV inspection, smoke & dye testing, flow monitoring, and any other investigative or improvement measure that the City may choose to perform on any given gravity sewer asset. For this Sewer Master Plan Update (SMP), the focus was on capacity upsizing of key gravity sewer mains.

Appropriate improvement methods and costs were developed and associated to the gravity sewer improvement actions. Some had multiple methods for a single action. The City assisted to develop the logic to determine appropriateness of action and prioritization of timing.

Table 9.2 presents the possible improvement actions, methods, and a note column with commentary relevant to how each action was developed and used in the improvement action planning process. If an improvement action lists multiple methods, the order of operations moves from left to right, so that method 1 should be performed before method 2, and method 2 before method 3. For example, a standard trenchless rehabilitation pipe project would include five methods. First, the specific pipe(s) would be pre-CCTV inspected. Then specific rehabilitation to the attached manholes would be performed. Next, the sewer main cured-in-place-lining would be performed. Then, lower (public domain) lateral rehabilitation. And finally post-construction CCTV inspection of all assets involved. Condition based pipe rehabilitation was not performed as a part of this SMP.

Table 9.2 Improvement Actions and Methods

Improvement Action	Method 1	Method 2	Method 3	Method 4	Method 5	Note
Capacity Upsize	Not Applicable (Advance to Method 2)	Manhole Rehabilitation	Dig and Replace (Open-Cut) Construction	Public Domain Lateral Rehabilitation	Post-ConSt CCTV	Applies to all pipes earmarked/identified for capacity upsizing based on hydraulic modeling
Pipe Rehabilitation	Pre-ConSt CCTV and Clean	Manhole Rehabilitation	Dig and Replace (Open-Cut) Construction Or Cured-in-Place Construction	Public Domain Lateral Rehabilitation	Post-ConSt CCTV	Was not applied to this SMP since focus was on capacity upsizing
General CCTV Inspection	CCTV Inspection and cleaning (if necessary)					Inspections for sewers older than 30 years

Opinions of probable cost for the improvement actions and methods for this master plan were developed with the City. **Table 9.3** lists the major improvement methods and their cost basis.

Table 9.3 Cost Basis for Improvement Methods

Improvement Method	Cost[1]	Cost Unit	Cost Basis
Dig and Replace (Open-Cut) Construction	Varies (see table 9.4)	$ / length of pipe (ft)	Varied by diameter, derived from City's 2023 Construction project bid results
Post-Construction CCTV	$8	$ / length of pipe (ft)	Derived from City's 2023 Construction Project Bid Tabulations

Improvement Method	Cost[1]	Cost Unit	Cost Basis
Manhole Rehabilitation	20% of Raw Dig & Replace Cost	Per Total Raw Construction Cost	Derived from City's 2023 Construction Project Bid Tabulations
Lateral Reconstruction	8% of Raw Dig & Replace Cost	Per Total Raw Construction Cost	Derived from City's 2023 Construction Project Bid Tabulations

Open-Cut Dig and Replace project costs were derived from the City's 2023 Edinger Avenue Sewer Improvement Project, which comprised 7 construction project bid tabulations from 7 area contractors. The 7 bids contained 30 items that were organized and grouped into nine distinct overarching categories, eight of which proved relevant for developing appropriate baseline construction costs for any Open-Cut CIP project for this SMP. The eight groupings and the line items they comprise are shown in **Table 9.4**. The analysis determined the high, low, and average bid cost for each grouping. Each grouping's average bid cost as percentage of the average raw Open-Cut construction cost was then applied to each of this SMP's designated gravity CIP projects, uniformly. Capacity upsize projects use an Open-Cut method of construction regardless of existing material or age.

Table 9.4 Cost Basis Development for Dig and Replace Method Gravity Sewer Capacity Upsize Projects

Item	Low	High	Average	% of Total Raw Open Cut / Baseline Construction Cost
Total Raw Open Cut Cost	***$1,477,250***	***$4,392,500***	***$2,522,782***	
[2]Total manhole and Sewer Remove/Replace Cost	$341,700	$1,115,000	$531,309	20%
[2]Total Lateral Cost	$110,000	$467,500	$251,429	8%
[2]Total Pre-Construction Survey/Stake/Safety/Env Plan Cost	$155,000	$490,000	$299,357	10%
[2]Bypass Pumping Cost	$15,000	$150,000	$52,857	2%
[2]Non-Sewer Remove & Replace Cost	$462,650	$676,500	$454,910	15%
[2]Traffic Control Cost	$75,000	$315,000	$175,059	6%
[1]Screening, Testing, Removal, Transporting, and Disposal of Contaminated Sediment & Groundwater Cost	$85,000	$1,600,000	$513,571	14%
Post Construction CCTV	$5 /lf	$12 / lf	$8 / lf	
Baseline Construction Cost Subtotal	***$2,636,600***	***$7,606,500***	***$4,287,702***	
[3]Mobilization/Demobilization $	$185,000	$320,000	$211,429	4%
[3]Engineering, Admin, Legal	NA	NA	NA	10%
[3]Construction Management	NA	NA	NA	7%
[3]Contingency	NA	NA	NA	25%

[1]Not used in the cost to develop a gravity CIP project as it was more extreme case cost for the Edinger Avenue Sewer Improvement Project.

[2]This % is based off the Raw Open Cut Cost

[3]This % is based off the Baseline Construction Subtotal, which is the sum of the first nine rows in the table (excluding Contaminated groundwater cost)

Table 9.5 shows the range of base costs by diameter for the dig-and-replace method of open- cut construction for VCP and capacity upsize projects.

Table 9.5 Total Raw Cost Range for Dig and Replace (Open-Cut) Method Projects

Diameter (inches)	Unit	Cost ($ / unit)
=<6	LF	409
6 < D =< 8	LF	448
8 < D =< 10	LF	468
10 < D =< 12	LF	587
12 < D =< 15	LF	636
15 < D =< 18	LF	685
18 < D =< 21	LF	735
21 < D =< 24	LF	784
24 < D =< 30	LF	856
30 < D =< 36	LF	928
36 < D =< 42	LF	1,000
42 < D =< 48	LF	1,072

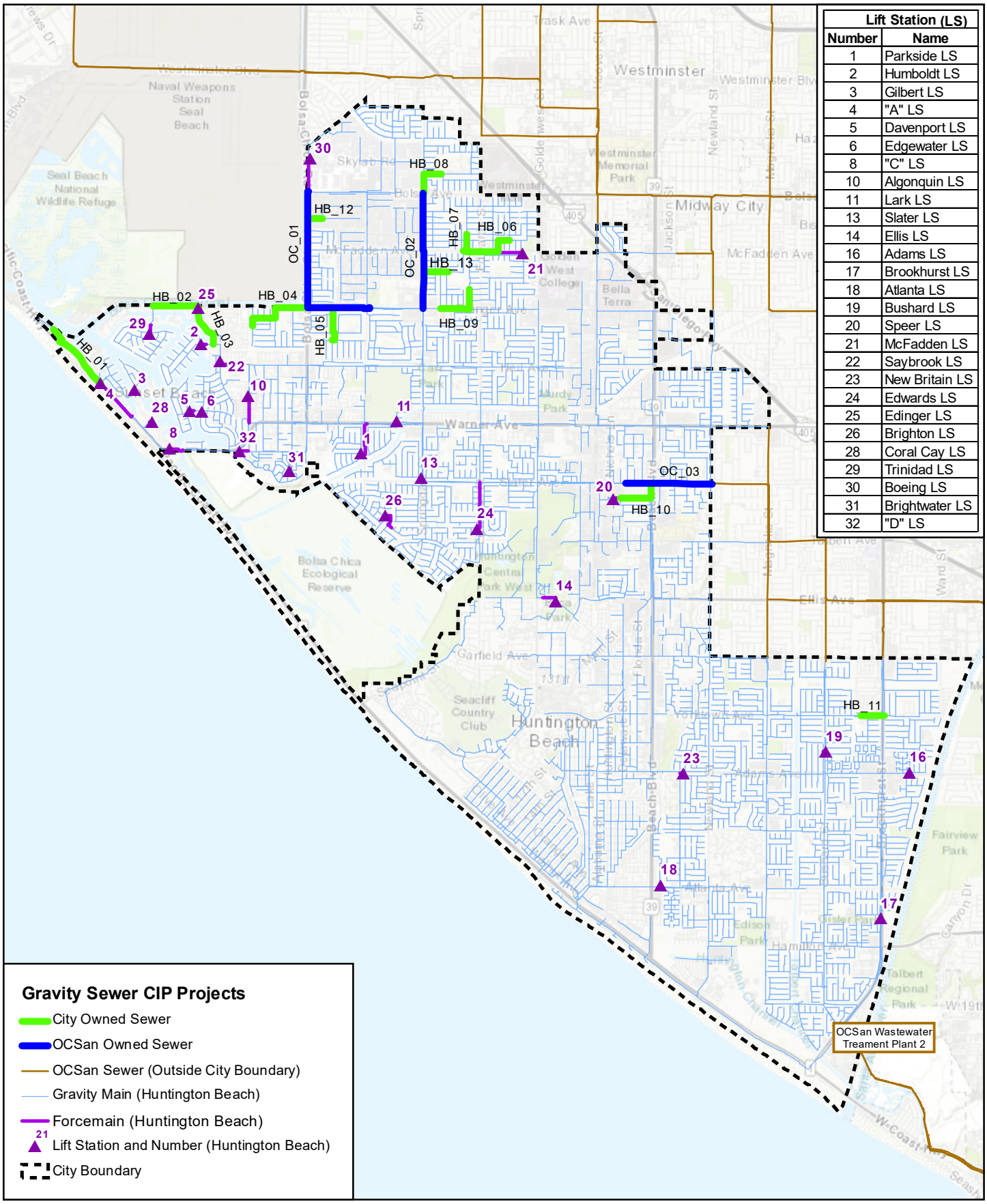
9.2.2 Gravity Sewer CIP Projects

16 distinct open-cut gravity capacity upsize projects that would provide immediate and long-term benefit to the City were identified. **Table 9.6** lists the 16 projects with key metrics of maximum diameter pipe within the project, number of manhole-to-manhole pipe segments, and total length of project. A project received an 'HB' prefix if the domain and/or ownership is clearly a City sewer. If the sewer(s) are owned by the OCSan district, then they show an 'OC' prefix before the project ID.

Then, as laid out in **Table 9.4**, total costs for the seven other major cost grouping are also listed. Then, as mentioned, a baseline project subtotal is shown, from which the mobilization/demobilization costs, engineering, administration, and legal costs, construction management costs, and contingency are calculated from. All projects' grouping costs are based on the percentage applied in **Table 9.4**. Then, these 16 projects are displayed geographically in **Figure 9.3.** The total cost for the 16 open-cut gravity upsize projects is $66.35M.

Table 9.6 Gravity Sewer CIP Projects' Cost Breakdown

Gravity Project ID	Max Diameter in Project (in)	Count of Pipe Segments	Length (ft)	*Total Raw Open Cut Cost*	Total MH and Sewer Remove/Replace Cost	Total Lateral Cost	Total Pre-Construction Survey/Stake/ Safety/Env Plan Cost	Bypass Pumping Cost	Non-Sewer Remove & Replace Cost	Traffic Control Cost	Post Construction CCTV	*Baseline Construction Subtotal Cost*	Mobilization/ Demobilization Cost	Engineering, Admin, Legal	Construction Management	Contingency	Total Cost
HB_01	10	20	3,509	***$1,643,000***	$329,000	$132,000	$165,000	$33,000	$247,000	$99,000	$29,000	***$2,672,000***	$107,000	$268,000	$188,000	$668,000	**$3,901,000**
HB_02	12	9	2,092	***$1,228,000***	$246,000	$99,000	$123,000	$25,000	$185,000	$74,000	$17,000	***$1,993,000***	$80,000	$200,000	$140,000	$499,000	**$2,909,000**
HB_03	12	10	1,966	***$1,154,000***	$231,000	$93,000	$116,000	$24,000	$173,000	$70,000	$16,000	***$1,873,000***	$75,000	$188,000	$132,000	$469,000	**$2,734,000**
HB_04	15	13	3,383	***$2,082,000***	$417,000	$167,000	$209,000	$42,000	$313,000	$125,000	$28,000	***$3,378,000***	$136,000	$338,000	$237,000	$845,000	**$4,932,000**
HB_05	15	11	1,941	***$1,101,000***	$221,000	$89,000	$111,000	$23,000	$166,000	$67,000	$16,000	***$1,788,000***	$72,000	$179,000	$126,000	$447,000	**$2,610,000**
HB_06	15	11	2,623	***$1,618,000***	$324,000	$130,000	$162,000	$33,000	$243,000	$98,000	$21,000	***$2,625,000***	$105,000	$263,000	$184,000	$657,000	**$3,833,000**
HB_07	10	4	773	***$362,000***	$73,000	$29,000	$37,000	$8,000	$55,000	$22,000	$7,000	***$589,000***	$24,000	$59,000	$42,000	$148,000	**$859,000**
HB_08	15	8	1,706	***$1,045,000***	$209,000	$84,000	$105,000	$21,000	$157,000	$63,000	$14,000	***$1,696,000***	$68,000	$170,000	$119,000	$424,000	**$2,475,000**
HB_09	10	8	2,213	***$1,018,000***	$204,000	$82,000	$102,000	$21,000	$153,000	$62,000	$18,000	***$1,656,000***	$67,000	$166,000	$116,000	$414,000	**$2,418,000**
HB_10	15	8	2,062	***$1,077,000***	$216,000	$87,000	$108,000	$22,000	$162,000	$65,000	$17,000	***$1,751,000***	$71,000	$176,000	$123,000	$438,000	**$2,556,000**
HB_11	15	5	1,069	***$680,000***	$136,000	$55,000	$68,000	$14,000	$102,000	$41,000	$9,000	***$1,103,000***	$45,000	$111,000	$78,000	$276,000	**$1,610,000**
HB_12	12	3	683	***$401,000***	$81,000	$33,000	$41,000	$9,000	$61,000	$25,000	$6,000	***$651,000***	$27,000	$66,000	$46,000	$163,000	**$950,000**
HB_13	18	4	1,139	***$781,000***	$157,000	$63,000	$79,000	$16,000	$118,000	$47,000	$10,000	***$1,266,000***	$51,000	$127,000	$89,000	$317,000	**$1,848,000**
OC_01	24	21	8,232	***$6,041,000***	$1,209,000	$484,000	$605,000	$121,000	$907,000	$363,000	$66,000	***$9,791,000***	$392,000	$980,000	$686,000	$2,448,000	**$14,295,000**
OC_02	21	13	5,212	***$3,533,000***	$707,000	$283,000	$354,000	$71,000	$530,000	$212,000	$42,000	***$5,730,000***	$230,000	$573,000	$402,000	$1,433,000	**$8,366,000**
OC_03	48	8	3,974	***$4,259,000***	$852,000	$341,000	$426,000	$86,000	$639,000	$256,000	$32,000	***$6,889,000***	$276,000	$689,000	$483,000	$1,723,000	**$10,058,000**
Totals	48	156	42,573	***$28,023,000***	$5,612,000	$2,251,000	$2,811,000	$569,000	$4,211,000	$1,689,000	$348,000	***$45,451,000***	$1,826,000	$4,553,000	$3,191,000	$11,369,000	**$66,354,000**



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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Gravity Sewer CIP Projects

Project No. **12585300**
Revision No. **0**
Date **3/18/2024**

FIGURE 9.3

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Print date: 21 Mar 2024 - 14:02

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

9.3 Lift Station CIP Project Development

9.3.1 Lift Station CIP Cost Basis

Improvement actions include any improvements required to maintain usability and accessibility for the lift station. For this SMP, the recommendations for site, structural, mechanical, and electrical improvements were separated.

Appropriate improvement methods and costs were developed and associated to the lift station improvement actions. The recommendations were compared with recent completed projects to determine severity and price points.

Opinions of probable cost for the improvement actions and methods for this SMP were developed with the City. **Table 9.7** lists the major improvement methods and associated cost basis. If a City approved contract bid was unavailable for an item, commensurate regional bids were used to influence the cost basis. Cost escalation factor was assigned based on ENR Construction Cost Index.

Table 9.7 Cost Basis for Improvements

Improvement	Cost[1]	Cost Unit	Cost Basis
Complete lift station replacement	Varies	Lump Sum $	Varied by size and capacity of the station, derived from City's 2021 McFadden and 2023 Humboldt Construction project bid results.
Backup Generator	$200,000 - $250,000	Lump Sum $	Derived from City's 2021 McFadden and 2023 Humboldt Construction project bid results, scaled for required capacity.
Security Fencing	$300	$ / LF	Derived from bids for other projects in the region.
Rehabilitate Concrete	$150	$ / SF	Derived from City's 2021 McFadden and 2023 Humboldt Construction project bid results.
Reapply Epoxy Coating	$30	$ / SF	Derived from bids for other projects in the region.
Install fall protection grating	$15,000	Lump Sum $	Derived from bids for other projects in the region.
Replace 8” pipe	$350	$ / LF	Derived from City's 2023 Humboldt Construction project bid results.
Replace 8” Gas Valve	$15,000	$ / EA	Derived from bids for other projects in the region.
Replace pumps	$250,000	$ / EA	Derived from City's 2023 Humboldt Construction project bid results.
Install Odor Scrubber	$70,000	$ / EA	Derived from bids for other projects in the region.
Install Backup Pump System	$120,000	Lump Sum $	Derived from complete system vendor quote provided to the City

9.3.2 Lift Station CIP Projects

A desktop evaluation of hydraulic components using key model output exported from existing and future model scenarios was performed. The evaluated criteria include peak flows, velocities, forcemain headloss, pump cycle time, and pump/system curve operation. The basis of observations are as follows:

- Maximum velocity through the forcemain should not exceed 6 feet per second (fps). Velocity greater than the maximum indicates the forcemain may be undersized.
    - Velocity near or less than 2 fps will likely incur settling issues and indicates the forcemain may be oversized.
- Maximum forcemain headloss in feet per foot should not exceed 0.02 ft/ft. Headloss greater than the maximum indicates the forcemain may be undersized.
- Pump station cycling, which is defined as the duration between pump starts, should not exceed 6 iterations per hour per pump (10 minutes per cycle). It is assumed that lead/lag pumps alternate (5-minute cycle when one pump is running).
    - Short pump cycles indicate that a wet well's operational volume may be too small and/or the pumps may be too large. If the pumps are discharging significantly greater flow than the inflow, the pumps are likely oversized.
    - Cycle times less than 2 minutes can be detrimental to the pump's electrical system.
- The relationship between the system curve and head curve based on an assumed best efficiency point (BEP) is at the center of the pump curve, and noting the following relations of the pump/system curve:
    - Far left intersection may mean the pump is running less than the minimum continuous stable flow (MCSF). MCSF is minimum recommended flow a pump can maintain prior to incurring potential damage. Running below this level for sustained periods of time can be detrimental to the life of the pump
    - Intersection left of the BEP indicates the pump does not ever hit the BEP and may be inefficient
    - Intersection at or slightly right of the BEP indicates the pump is running efficiently
    - Intersection far right of the BEP indicates the pump may be inefficient and may be in danger of running beyond the limits of the pump curve, which is detrimental to the life of the pump.

Table 9.8 summarizes key model outputs from **Chapter 8** as well as the hydraulic observations and recommendations per the evaluation basis described above. Terms specific to this table shown as acronyms are peak flow (PF), peak dry weather flow (PDWF), peak wet weather flow (PWWF), and forcemain (FM).

The City's proposed improvement plan for lift station assets was reviewed and integrated into the desktop review of lift stations performed for this SMP. The developed list of improvements, presented in **Table 9.9**, is organized by major type/category listed below:

- Dry/Wet Well
- Pumps
- Piping/Valves
- Other (walls, fence, etc)
- Hydraulic Recommendations.

Table 9.8 Summary of Hydraulic Observations and Recommendations for Lift Stations

Lift Station	Future WWF Design Basis Condition						Hydraulic Observations on Currently Modeled Lift Stations							Hydraulic Recommendations
	PWWF Gravity In (MGD)	PWWF Pumped (MGD)	Max velocity across FM (fps)	Max Headloss across FM (ft)	Max Headloss per foot of FM (ft/ft)	Lag Pump On in WWF?	Forcemain Observation	Cycle Duration (PDWF, PWWF) (min)	Pump Cycle	Pump Operation/ Curve Observation	Pump Size	Set Point Adj?	Notes	Recommendation
Parkside	0.38	0.55	4.32	40.01	0.030	No	Slightly high max headloss per ft of forcemain	14, 15	Good	Slightly left of Best Efficiency Point (BEP)	Good	-	None	None
Humboldt	0.24	0.32	5.70	14.71	0.070	No	Slightly high max headloss per ft of forcemain	11, 2	Short at PWWF	Slightly left of BEP	Good	-	Peak Wet Weather Flow (PWWF) pump cycle time is considerably short, but the pump itself is reasonably sized, though slightly inefficient. See note 1.	Increase wet well operational volume during lift station replacement; Consider a new pump that runs at or beyond the Best Efficiency Point (BEP).
Gilbert	0.16	0.20	3.61	6.60	0.027	No		3, 1	Short	Good	Good	-	Cycle time is too short, but the pump is suitably sized.	Increase wet well operational volume during lift station replacement.
"A"	0.74	0.77	3.41	22.2	0.010	Yes		13, 136	Good	Left of BEP at PWWF	Good	-	The pump likely approaches the minimum continuous stable flow (MCSF) during PWWF events. If so, this pump station is likely to have a shorter usable life and could experience dead heading if any clogging occurs. Dead heading is when the pump is rotating, but the pressure is too high to supply water.	Perform in situ Pump Opps Test to confirm the pump is not operating below the MCSF. If below, coordinate with manufacturer and monitor pump condition.
Davenport	0.22	0.38	6.78	21.93	0.097	No	Slightly high max velocity & max headloss per ft of forcemain	1, 1	Short	Good	Slightly Big	Lower both pumps 'On' and 'Off' by 0.8 ft	Cycle time is too short, and the forcemain velocity is too high. This could be improved by enlarging the wet well for the cycle time and slightly modifying the pump curve downward to reduce flow/pressure through the forcemain.	Increase wet well operational volume during lift station replacement. Perform in-situ Pump Opps Test; Modify pump size/curve accordingly
Edgewater	1.45	2.42	10.74	5.26	0.096	Yes	Very high max velocity & max headloss per ft of forcemain	9, 8	Short at PWWF	Good	Big	-	Velocity in the forcemain is much too high and cycle time is slightly short at PWWF. The system curve is practically flat, indicating little dynamic loss across the forcemain. As the pump produces 1 mgd more than required at PWWF, a reduced pump capacity or smaller impeller (if available) would improve the issue. See note 1.	Perform in-situ Pump Opps Test; Modify pump size/curve accordingly. Monitor forcemain condition.
"C"	1.16	1.84	3.65	5.77	0.009	No		12, 8	Good	Near max end of curve	Big (high pressure)	-	The system curve is flat and the forcemain velocity is average to low. As the pump produces approximately 0.5 mgd more than required at PWWF with one pump running, a reduced pump capacity or smaller impeller would improve the issue. However, a reduced capacity equal to the PWWF would reduce forcemain velocity to near 2 fps and settling may occur. Consider reducing the forcemain size.	Perform in-situ Pump Opps Test; Modify pump size/curve accordingly.
Algonquin	1.24	1.43	2.82	6.75	0.005	No		2, 3	Short	Good	Good	-	Pump cycle times are too short. Pump capacity is too close to PWWF to resolve with pump replacement. Greater wet well operational volume is required by a minimum of 1.5 ft depth.	Increase wet well operational volume. Perform in-situ Pump Opps Test; Modify pump size accordingly at next planned replacement.
Lark	0.19	0.32	2.53	1.05	0.008	No		3, 1	Short	Slightly left of BEP	Big	-	Pump cycle times are too short, FM velocity is low, and the system curve is flat. A pump capacity near the PWWF would not resolve the pump cycling issue and would reduce forcemain velocity further. Consider decreasing the forcemain diameter to increase forcemain velocity, noting this will change the system curve.	Increase wet well operational volume during lift station replacement. Perform in-situ Pump Opps Test; Modify pump curve accordingly.

Lift Station	Future WWF Design Basis Condition						Hydraulic Observations on Currently Modeled Lift Stations							Hydraulic Recommendations
	PWWF Gravity In (MGD)	PWWF Pumped (MGD)	Max velocity across FM (fps)	Max Headloss across FM (ft)	Max Headloss per foot of FM (ft/ft)	Lag Pump On in WWF?	Forcemain Observation	Cycle Duration (PDWF, PWWF) (min)	Pump Cycle	Pump Operation/ Curve Observation	Pump Size	Set Point Adj?	Notes	Recommendation
Slater	1.66	2.27	10.05	6.99	0.084	Yes	Very high max velocity & max headloss per ft of forcemain	9, 8	Short at PWWF	Near max end of curve	Big	-	The FM velocity is much too high, the pump runs near the end of its curve, and the cycle time is slightly short at PWWF. The system curve is flat with one pump running but reasonable with two pumps running during PWWF. Consider a smaller impeller (if available) for better system/pump curve relation during PDWF and reduced velocity. Consider enlarging the forcemain to further reduce velocity as pump capacity reduction equal to PWWF would still provide excessive velocity. See note 1.	Perform in-situ Pump Opps Test; Modify pump size/curve accordingly. Monitor forcemain condition.
Ellis	0.84	1.03	4.56	4.90	0.006	No		14, 24	Good	Slightly left of BEP	Good	-	None	None
Adams	0.33	0.56	4.40	2.89	0.041	No	Slightly high max headloss per ft of forcemain	11, 8	Good	Good	Good	-	None	None
Brookhurst	1.71	2.01	8.91	3.71	0.066	No	High max velocity & max headloss per ft of forcemain	3, 5	Short at PDWF	Runs at max end of curve	Big	-	The forcemain velocity is too high, pump cycles are too short, and the pump nearly runs off the curve as the system curve is flat. Reducing the size of the forcemain will further increase forcemain velocity. Consider a smaller impeller (if available).	Perform in-situ Pump Opps Test; Modify pump size/curve accordingly
Atlanta	0.34	0.49	7.77	13.86	0.146	No	Slightly high max velocity & max headloss per ft of forcemain	4, 4	Short	Slightly left of BEP	Big	-	A pump capacity near the PWWF would not resolve the pump cycling issue. Consider enlarging the FM to reduce velocity and headloss.	Increase wet well operational volume during lift station replacement Re-evaluate design of pump and forcemain. Consider enlarging the forcemain before replacing the pump.
Bushard	0.11	0.51	4.02	2.37	0.025	No		10, 5	Good	Slightly right of BEP	Good	-	None	None
Speer	0.31	0.57	2.52	1.92	0.005	No		20, 4	Short at PWWF	Slightly left of BEP	Slightly Big	-	Forcemain velocity is low, which should be taken into consideration during pump replacement. An increase in wet well depth of 0.3 ft would resolve the cycling issue.. See note 1.	Raise the lead pump on elevation by 0.3 ft.
McFadden	0.17	0.16	2.76	18.29	0.016	Yes	Low velocity, and high max headloss	3, -	-	Far left of BEP	Small	-	Two pumps are required during PDWF and cannot provide sufficient capacity during PWWF, the system curve is nearly vertical and approaches the MCSF, and cycle times are short.	Re-evaluate the design of the lift station, including wet well, force main, and pumps. Prioritize the replacement of this lift station.
Saybrook	1.10	1.59	7.02	10.71	0.050	Yes	Slightly high max velocity & max headloss per ft of forcemain	7, 9	Short at PWWF	Far right of BEP at PDWF; Near BEP at PWWF	Slightly Big	-	The system curve intersects right of the BEP during PDWF but near the BEP during PWWF, which appears appropriately sized. Velocity is a little fast, which may age the forcemain more quickly. See note 1.	Continue to ease pressure and velocity on forcemain during storms > 2 years, by opening outlet to east (to Algonquin)
New Britain	0.47	0.49	3.86	2.76	0.022	No		1, 8	Short	Runs at max end of curve	Big	-	Cycle time during PDWF is short, the system curve is flat, and the pump runs near its maximum. As dynamic headloss is low and PDWF is nearly half of PWWF, consider sizing new pumps with one pump running during PDWF and two pumps at PWWF.	Perform in-situ Pump Opps Test; Re-evaluate pump and wet well design.
Edwards	0.81	0.97	4.32	34.63	0.016	No		13, 22	Good	Slightly left of BEP	Good	-	None	None
Edinger	0.68	0.96	7.55	6.04	0.099	Yes	Slightly max velocity & max headloss per ft of forcemain	28, 6	Short at PWWF	Runs at max side of curve for DWF, right of BEP at PWWF;	Yes at PWWF	Lower both pumps	Consider a longer pump curve or lower pressure to maintain a PDWF system curve farther from the end of the pump curve. Note that revising the pump On	Re-evaluate pump curve at next replacement.

Lift Station	Future WWF Design Basis Condition						Hydraulic Observations on Currently Modeled Lift Stations							Hydraulic Recommendations
	PWWF Gravity In (MGD)	PWWF Pumped (MGD)	Max velocity across FM (fps)	Max Headloss across FM (ft)	Max Headloss per foot of FM (ft/ft)	Lag Pump On in WWF?	Forcemain Observation	Cycle Duration (PDWF, PWWF) (min)	Pump Cycle	Pump Operation/ Curve Observation	Pump Size	Set Point Adj?	Notes	Recommendation
												'On' by 1.5'	elevation without adjusting the Pump Off elevation will reducing the wet well operational volume. This is not anticipated to be of concern for PDWF. See note 1.	
Brighton	0.24	0.35	2.79	9.92	0.011	No		8, 8	Good	Slightly left of BEP	Good	-	Velocity is a little low but acceptable.	None
Coral Cay	0.11	0.15	2.63	1.53	0.017	No		18, 22	Good	Slightly left of BEP	Good	-	None	None
Trinidad	0.23	0.33	5.86	31.40	0.077	No	Slightly high max headloss per ft of forcemain	11, 11	Good	Flat pump curve. Slightly left of BEP.	Good	-	The pump curve is flat. This is acceptable for a steep system curve such as this. Forcemain velocity is a little high, which may age the forcemain more quickly.	None
Boeing	0.29	0.27	2.15	9.33	0.006	Yes	Low forcemain velocity	11, -	-	Far left of BEP	Small	-	Low forcemain velocity with one pump running indicates that there is likely insufficient velocity at PDWF. System curve is very steep, indicating an inability to decrease the forcemain diameter. The system curve may be near or below the MCSF. Insufficient flow at PWWF is a priority.	Perform in-situ Pump Opps Test; Modify pump size accordingly. Prioritize this lift station.
Brightwater	0.11	0.25	4.50	5.28	0.048	No	Slightly high max headloss per ft of forcemain	16, 10	Good	Far left of BEP	Big	-	The pump is likely running near the MCSF, which will age the pump more quickly.	Perform in-situ Pump Opps Test; Verify flow is greater than MCSF. Consider a slightly lower capacity pump at next pump replacement
"D"	3.34	4.42	6.40	3.33	0.008	Yes	Slightly high max velocity	10, 8	Good	Slightly right of BEP	Good	-	System curve is very flat, but the intersection with the pump curve is acceptable. PWWF cycle time assumes the third pump also alternates. See note 1.	Provide a pump bypass system for redundancy.

Note 1: Peak Wet Weather Flow (WWF) is indicative of a 10 year, 24-hour storm, which has a 10% chance of occurring in any given year. The modelled duration of peak flows are typically less than one hour, though high flows may occur for several hours. Although short cycle times are detrimental to the longevity of the pump, it is notable that short cycle times at PWWF may be considered low priority as they are considered rare, short occurrences.

Table 9.9 Lift Station Improvements and Associated Costs

		Improvements								Costs						
		Under design/construction/completed		Planned Full Lift Station Replacement	Planned Improvements					Planned Full Lift Station Replacement Cost	Planned Improvement Costs					
Lift Station ID	Lift Station (CIP Project)	Status	Description		Dry/Wet well	Pumps	Piping/valves	Other (walls, fences, etc)	Hydraulic Observation	Hydraulic Recommendations		Dry/Wet well	Pumps	Piping/ valves	Other (walls, fences, etc)	Contingency, Permits, and Mobilization/Demobilization	Total Recommended CIP Cost
1	Parkside							Install new security fencing and backup generator		None					$336,000	$185,000	$521,000
2	Humboldt	Construction	Design FY 22/23; Construction in FY 23/24; 4 years duration from Design to Construction.	X					Peak Wet Weather Flow (PWWF) pump cycle time is considerably short, but the pump itself is reasonably sized, though slightly inefficient. See note 1.	Increase wet well operational volume during lift station replacement; Consider a new pump that runs at or beyond the Best Efficiency Point (BEP).	$4,933,000						$4,933,000
3	Gilbert			X					Cycle time is too short, but the pump is suitably sized.	Increase wet well operational volume during lift station replacement.	$4,350,000						$4,350,000
4	"A"				Reapply epoxy wet well epoxy spray coating within 3 years (2026).		Replace mechanical, piping, bypass and valves, Replace Kennedy 8" valve and gate valve within 3 years (2026).	Install new security fencing. Add fall protection.	The pump likely approaches the minimum continuous stable flow (MCSF) during PWWF events. If so, this pump station is likely to have a shorter usable life and could experience dead heading if any clogging occurs.	Perform in situ Pump Opps Test to confirm the pump is not operating below the MCSF. If below, coordinate with manufacturer and monitor pump condition.		$27,000		$62,500	$15,000	$91,500	$211,000
5	Davenport	Redsign	Design FY 22/23; Construction in FY 23/24; 3.7 years duration from Design to Construction.	X					Cycle time is too short, and the forcemain velocity is too high. This could be improved by enlarging the wet well for the cycle time and slightly modifying the pump curve downward to reduce flow/pressure through the forcemain.	Increase wet well operational volume during lift station replacement. Perform in-situ Pump Opps Test; Modify pump size/curve accordingly	$4,500,000						$4,500,000
6	Edgewater							Install new fall protection	Velocity in the forcemain is much too high and cycle time is slightly short at PWWF. The system curve is practically flat, indicating little dynamic loss across the forcemain. As the pump produces 1 mgd more than required at PWWF, a reduced pump capacity or smaller impeller (if available) would improve the issue . See note 1.	Perform in-situ Pump Opps Test; Modify pump size/curve accordingly. Monitor forcemain condition.					$15,000	$26,000	$41,000
8	"C"				Reapply wet well epoxy spray coating due to H2S, within 5 years (2028).		Replace mechanical pipeline and valves within 3-5 years (2027 to 2029)	Install new fall protection	The system curve is flat and the forcemain velocity is average to low. As the pump produces approximately 0.5 mgd more than required at PWWF with one pump running, a reduced pump capacity or smaller impeller would improve the issue. However, a reduced capacity equal to the PWWF would reduce forcemain velocity to near 2 fps and settling may occur. Consider reducing the forcemain size.	Perform in-situ Pump Opps Test; Modify pump size/curve accordingly.		$25,000		$152,000	$30,000	$114,000	$321,000
10	Algonquin				Replace dry well doors lighter alternative. Reline wet	Remove and replace 2 ea submersible		Install new fall protection	Pump cycle times are too short. Pump capacity is too close to PWWF to resolve with pump replacement. Greater wet well	Increase wet well operational volume. Perform in-situ Pump Opps Test; Modify pump size accordingly		$98,400	$912,000		$15,000	$404,600	$1,430,000

					Improvements						Costs						
		Under design/construction/completed		Planned Full Lift Station Replacement		Planned Improvements					Planned Full Lift Station Replacement Cost	Planned Improvement Costs					
Lift Station ID	Lift Station (CIP Project)	Status	Description		Dry/Wet well	Pumps	Piping/valves	Other (walls, fences, etc)	Hydraulic Observation	Hydraulic Recommendations		Dry/Wet well	Pumps	Piping/ valves	Other (walls, fences, etc)	Contingency, Permits, and Mobilization/Demobilization	Total Recommended CIP Cost
					well with epoxy within 5 years.	pumps within 3 years (2026).			operational volume is required by a minimum of 1.5 ft depth .	at next planned replacement.							
11	Lark			X					Pump cycle times are too short, forcemain velocity is low, and the system curve is flat. A pump capacity near the PWWF would not resolve the pump cycling issue and would reduce forcemain velocity further. Consider decreasing the forcemain diameter to increase forcemain velocity, noting this will change the system curve.	Increase wet well operational volume during lift station replacement. Perform in-situ Pump Opps Test; Modify pump curve accordingly.	$5,050,000						$5,050,000
13	Slater	Completed	Installed air scrubber in Sept 2023 & budgeted in FY 23/24; 5.9 years duration from Design to Construction.						The FM velocity is much too high, the pump runs near the end of its curve, and the cycle time is slightly short at PWWF. The system curve is flat with one pump running but reasonable with two pumps running during PWWF. Consider a smaller impeller (if available) for better system/pump curve relation during PDWF and reduced velocity. Consider enlarging the forcemain to further reduce velocity as pump capacity reduction equal to PWWF would still provide excessive velocity. See note 1.	Perform in-situ Pump Opps Test; Modify pump size/curve accordingly. Monitor forcemain condition.					$4,000		$4,000
14	Ellis				Repair concrete settling and cracking above wet well, and wet well flow settlement within 3 years (2026), Reapply epoxy coating to wet well within 3 to 5 years (2026 to 2028).		Replace mechanical pipeline and valves within 3 to 5 years (2026 to 2028)	Install new fall protection.	None	None		$54,600		$105,000	$15,000	$126,400	$301,000
16	Adams	Need to readvertise	Project started construction in FY 22/23 & will be completed in FY 23/24; 3.4 years duration from Design to Construction.		Reapply epoxy wet well epoxy spray coating within 3 to 5 years (2026).	"Replace 2 ea dry pumps within the next 3 to 5 years			None	None		$36,000	$368,000		$215,000	$302,000	$921,000
17	Brookhurst				Reapply polyurethane base spray coat for wet well within 5 to 8 years (2028 to 2031).	Replace pumps within 10 years (2033).		Install new backup generator	The forcemain velocity is too high, pump cycles are too short, and the pump nearly runs off the curve as the system curve is flat. Reducing the size of the forcemain will further increase forcemain velocity. Consider a smaller impeller (if available).	Perform in-situ Pump Opps Test; Modify pump size/curve accordingly		$35,000	$205,000		$250,000	$324,000	$814,000
18	Atlanta			X					A pump capacity near the PWWF would not resolve the pump cycling issue. Consider enlarging the FM	Increase wet well operational volume during lift station	$5,550,000						$5,550,000

					Improvements						Costs						
		Under design/construction/completed		Planned Full Lift Station Replacement		Planned Improvements						Planned Improvement Costs					
Lift Station ID	Lift Station (CIP Project)	Status	Description		Dry/Wet well	Pumps	Piping/valves	Other (walls, fences, etc)	Hydraulic Observation	Hydraulic Recommendations	Planned Full Lift Station Replacement Cost	Dry/Wet well	Pumps	Piping/ valves	Other (walls, fences, etc)	Contingency, Permits, and Mobilization/Demobilization	Total Recommended CIP Cost
									to reduce velocity and headloss.	replacement Re-evaluate design of pump and forcemain. Consider enlarging the forcemain before replacing the pump.							
19	Bushard			X					None	None	$4,550,000						$4,550,000
20	Speer			X					Forcemain velocity is low, which should be taken into consideration during pump replacement. An increase in wet well depth of 0.3 ft would resolve the cycling issue.. See note 1.	Raise the lead pump on elevation by 0.3 ft.	$4,550,000						$4,550,000
21	McFadden			X					Two pumps are required during PDWF and cannot provide sufficient capacity during PWWF, the system curve is nearly vertical and approaches the MCSF, and cycle times are short.	Re-evaluate the design of the lift station, including wet well, force main, and pumps. Prioritize the replacement of this lift station.	$2,732,000						$2,732,000
22	Saybrook	Completed	Lift station constructed in FY 20/21; 3.7 years duration from design to construction					Install new odor scrubber (if required)	The system curve intersects right of the BEP during PDWF but near the BEP during PWWF, which appears appropriately sized. Velocity is a little fast, which may age the forcemain more quickly. See note 1.	Continue to ease pressure and velocity on forcemain during storms > 2 years, by opening outlet to east (to Algonquin)					$70,000	$51,000	$121,000
23	New Britain			X					Cycle time during PDWF is short, the system curve is flat, and the pump runs near its maximum. As dynamic headloss is low and PDWF is nearly half of PWWF, consider sizing new pumps with one pump running during PDWF and two pumps at PWWF.	Perform in-situ Pump Opps Test; Re-evaluate pump and wet well design.	$5,350,000						$5,350,000
24	Edwards				Reapply wet well epoxy spray coating within 2 to 3 years (2025 to 2026).	Replace pump within next 5 years (2028).	Reapply epoxy coating to piping and valves with next 2 years (2025), Replace 8-inch check valves and gate valves within next 3 years (2026),	Install new fall protection	None	None		$22,500	$250,000	$70,000		$326,500	$669,000
25	Edinger				Reapply wet well epoxy spray coating within 3 to 5 years (2026 to 2028).	Replace 2 ea vertical, dry, centrifugal pumps within the next 3 years (2026).		Install new fall protection.	Consider a longer pump curve or lower pressure to maintain a PDWF system curve farther from the end of the pump curve. Note that revising the pump On elevation without adjusting the Pump Off elevation will reducing the wet well operational volume. This is not anticipated to be of concern for PDWF. See note 1.	Re-evaluate pump curve at next replacement.		$24,000	$908,000		$15,000	$357,000	$1,304,000
26	Brighton				Reapply wet well epoxy spray coating within 3 to 5 years (2026 to 2028).			Install new backup generator and fall protection	Velocity is a little low but acceptable.	None		$25,500	$5,000		$215,000	$235,500	$481,000
28	Coral Cay				Reapply epoxy liner at wet well within 3 to 5 years				None	None		$21,000	$5,000			$32,000	$58,000

					Improvements						Costs						
		Under design/construction/completed		Planned Full Lift Station Replacement		Planned Improvements					Planned Full Lift Station Replacement Cost	Planned Improvement Costs					
Lift Station ID	Lift Station (CIP Project)	Status	Description		Dry/Wet well	Pumps	Piping/valves	Other (walls, fences, etc)	Hydraulic Observation	Hydraulic Recommendations		Dry/Wet well	Pumps	Piping/ valves	Other (walls, fences, etc)	Contingency, Permits, and Mobilization/Demobilization	Total Recommended CIP Cost
					(2026 to 2028).												
29	Trinidad							Install new fall protection	The pump curve is flat. This is acceptable for a steep system curve such as this. Forcemain velocity is a little high, which may age the forcemain more quickly.	None			$5,000		$15,000	$21,000	$41,000
30	Boeing				Reapply epoxy liner at wet well within 3 to 5 years (2026 to 2028).	Install dry pit submersible pumps style in future to address industrial discharge and upsize motors with 5 years (2028).	Replace mechanical piping and valves with the next 5 to 10 years (2028 to 2033).	New Parking lot area.	Low forcemain velocity with one pump running indicates that there is likely insufficient velocity at PDWF. System curve is very steep, indicating an inability to decrease the forcemain diameter. The system curve may be near or below the MCSF. Insufficient flow at PWWF is a priority.	Perform in-situ Pump Opps Test; Modify pump size accordingly. Prioritize this lift station.		$27,000	$911,000	$100,000	$85,000	$491,000	$1,614,000
31	Brightwater							Install new fall protection	The pump is likely running near the MCSF, which will age the pump more quickly.	Perform in-situ Pump Opps Test; Verify flow is greater than MCSF. Consider a slightly lower capacity pump at next pump replacement			$5,000		$15,000	$21,000	$41,000
32	"D"					Install backup pump system.		Install new fall protection.	System curve is very flat, but the intersection with the pump curve is acceptable. PWWF cycle time assumes the third pump also alternates. See note 1.	None			$120,000		$15,000	$93,000	$228,000
	Totals																**$50,620,000**

10. Capital Improvement Program Implementation and Recommendations

This chapter presents potential prioritization and packaging strategies for the capital improvement program (CIP) improvement actions identified in **Chapter 9.** A strategy to identify projects and solutions that focused on traditional public domain pipe replacements (upsized sewer mains) was developed with the City. Sixteen (16) unique gravity sewer CIP projects were developed and 14 of these 16 projects are recommended for implementation as part of this Sewer Master Plan Update (SMP); their cost and logistical details can be found in **Appendix F**. Twenty-seven lift station projects are recommended as part of this SMP, and their cost and logistical details can be found in **Appendix H**.

10.1 Gravity Sewer CIP Prioritization Strategy

Using the hydraulic model and design basis flow criteria described in **Chapter 6** and the inflow and infiltration (I&I) reduction and capacity upsize evaluation criteria and results from **Chapter 9**, a logic was developed that scored upsize projects relative to each other to determine which projects should be addressed first. In general, individual pipes are considered for improvement action (i.e. rehabilitation, upsize replacement, inspection, etc.), and prioritized by the following:

Specifically, the 16 gravity upsize projects were grouped into quartiles. A quartile is 25% of the data from any category, and a method of grouping data from lowest to highest, essentially into 4 groups for the following categories:

- Length of sewer pipes upstream of CIP project (total length of all pipes in a given project's tributary area):
- Largest diameter within the CIP project's extent;
- Peak wet weather flow (WWF) (from the Future Design Basis with 10 yr 24 hr storm simulation);
- SSOs upstream of CIP project pipe; (Overflows in tributary area);
- Reduces or even eliminates additional upstream deficiencies if constructed;

The following **Table 10.1** presents the raw results from the 5 categories for the 16 capacity upsize projects. The categories used in the quartile analysis are shown in yellow text in **Table 10.1**. Projects are sorted alphabetically by name in **Table 10.1.**

Then, **Table 10.2** displays the quartile scores from each category, and sorted by the total score for each project, from high (at the top of the table) to low. Though most categories were simply given a score of 1 to 4 (1 being in the lowest quartile, 4 being in highest quartile), scores from categories that eliminated SSOs and upstream deficiencies were given more weight since they aligned with the City's SMP goals and levels of service. Scores in the SSO categories thus show scores higher than 4 in **Table 10.2**.

Table 10.1 Gravity Sewer CIP Projects' Priority Ranking Metrics

	Within CIP Project			Within Tributary Area					
Gravity Project ID	Count of Pipe Segments	Length (ft)	Max Diameter in Project (in)	Count of Pipe Segments	Length (ft)	Peak WWF (MGD)	SSOs Upstream	Eliminates SSOs	Total Cost
HB_01	20	3,509	10	66	13,960	0.75	No	No	$3,901,000
HB_02	9	2,092	12	83	13,481	0.70	No	No	$2,909,000
HB_03	10	1,966	12	99	19,250	0.80	No	No	$2,734,000
HB_04	13	3,383	15	73	19,099	0.79	Yes	Yes	$4,932,000
HB_05	11	1,941	15	114	30,101	0.81	No	No	$2,610,000
HB_06	11	2,623	15	198	50,579	1.08	Yes	Yes	$3,833,000
HB_07	4	773	10	47	11,554	0.32	No	No	$859,000
HB_08	8	1,706	15	103	25,924	0.92	No	No	$2,475,000
HB_09	8	2,213	10	60	15,969	0.39	No	No	$2,418,000
HB_10	8	2,062	15	112	24,524	1.44	No	No	$2,556,000
HB_11	5	1,069	15	101	26,543	1.02	No	No	$1,610,000
HB_12	3	683	12	17	4,771	0.57	No	No	$950,000
HB_13	4	1,139	18	240	61,144	1.26	Yes	Yes	$1,848,000
OC_01	21	8,232	24	333	89,645	7.20	Yes	Yes	$14,295,000
OC_02	13	5,212	21	425	107,382	1.36	Yes	Yes	$8,366,000
OC_03	8	3,974	48	4201	1,007,685	2.64	Yes	Yes	$10,058,000
Totals	156	42,573	-	6,272	1,521,611	-	-	-	$66,354,000

Table 10.2 Gravity Sewer CIP Projects' Quartile Score Rankings

On CIP Project			Quartile Scores						
Gravity Project ID	Count of Pipe Segments	Length (ft)	Max Diameter in Project (in)	Length (ft)	Peak WWF (MGD)	SSOs Upstream	Eliminates SSOs	Total Score	Total Cost
OC_01	21	8,232	4	4	4	16	8	36	$14,295,000
OC_02	13	5,212	4	4	4	8	8	28	$8,366,000
OC_03	8	3,974	4	4	4	8	2	22	$10,058,000
HB_04	13	3,383	2	2	2	12	4	22	$4,932,000
HB_13	4	1,139	4	4	3	8	2	21	$1,848,000
HB_06	11	2,623	3	3	3	8	2	19	$3,833,000
HB_08	8	1,706	3	3	3	4	2	15	$2,475,000
HB_11	5	1,069	3	3	3	4	2	15	$1,610,000
HB_05	11	1,941	3	3	2	4	2	14	$2,610,000
HB_10	8	2,062	2	2	4	4	2	14	$2,556,000
HB_03	10	1,966	2	2	2	4	2	12	$2,734,000
HB_09	8	2,213	2	2	1	4	2	11	$2,418,000
HB_01	20	3,509	1	1	2	4	2	10	$3,901,000
HB_07	4	773	1	1	1	4	2	9	$859,000
HB_12	3	683	1	1	1	4	2	9	$950,000
HB_02	9	2,092	1	1	1	4	2	9	$2,909,000
Totals	156	42,573	-	1,521,611	-	-	-	-	$66,354,000

10.2 Capital Improvement Program Implementation Strategy

This sub-chapter focuses on practical execution strategies for implementing the gravity sewer and lift station CIP improvement projects presented in **Chapter 9** and prioritized in **Chapter 10**.

10.2.1 Gravity Sewer CIP Implementation Plan

The overarching prioritization strategy integrated findings from the detailed hydraulic modeling, prioritization schema described in **Chapter 10.1,** and conversations and meeting with City staff on practical execution of projects. The implementation strategy attempted to find the best balance between maximizing reduction of risk, I&I, and working efficiently within manageable geographic areas, and organizes up to groupings called phases. A phase attempts to organize projects similar in priority into a group that can be executed together before any projects in lower phases. Though the quartile rankings provided a starting point, this sub-chapter looks at practical ordering and executing the gravity CIP projects and considers engineering judgment as well as considering the following when breaking ties or projects very close in quartile rank:

1) Ability to solve largest and/or highest number of triggered hydraulic deficiencies.
2) Ability to eliminate largest overflows (by volume and number)
3) Addresses the greatest number of high-risk sewers/assets
4) Minimal public right of way disruption (including pavement removal on streets with recent pavement projects, easements, and general accessibility)

Table 10.3 displays the execution ranking and overarching phase recommended for constructing each gravity sewer CIP project. The executable rankings generally follow the quartile rankings but may not quite align completely. For example, though HB_03 had a lower quartile score than the other projects in phase 3, it was ranked ahead of HB_08, HB_11, and HB_10 because it is in a low lying area near the marina with a shallow groundwater table and susceptible to continued high I&I, and because it is located in close proximity between two lift stations where emergency shutdowns make the tributary areas more susceptible to overflows. In, short it is in a higher risk area for the reasons stated and should be prioritized above the other phase 3 projects. However, the phases allow the City a bit more flexibility, as in the end, there is less difference between projects within a phase than between phases. In other words, if the City deems that project HB_10 actually should go ahead and be constructed before any others in phase 3, it would be fine to do so, but all projects in phases 1 and 2 should be constructed before any in phases 3 and 4.

Further, OC_03, though scoring third in quartile rank for reasons of large tributary area, pipe diameter, and peak flows, it is somewhat dependent on all of the CIP project success upstream of it. A model run was done to see the impact of completing all of the upstream projects, and though HGLs and flows seen at OC_03 increase slightly, it is a very expensive project that could wait to see what actually happens to the system in 10 years, or near the next master plan update. At that time, most if not all of the upstream CIP projects will have been built, and a model run could determine if it is still needed. The same logic applies to project HB_09. It may not be necessary and is dependent on the success of project OC_02 and further flow monitoring in the area. The 12-inch sewer that flows west along Edinger which sends all of the flow this project carries has not been flow monitored as part of this project and should be monitored as part of a post-construction monitoring phase, to determine flows in the OC_02 project area as well as this area.

Figure 10.1 shows the locations of the 16 projects, color coded to match **Table 10.3's** phase distinctions. Each project also shows it's executable rank in parentheses. Certainly, the City should complete projects OC_01, and OC_02 as soon as possible, and would receive the highest return on investment from the construction of those two projects above all others.

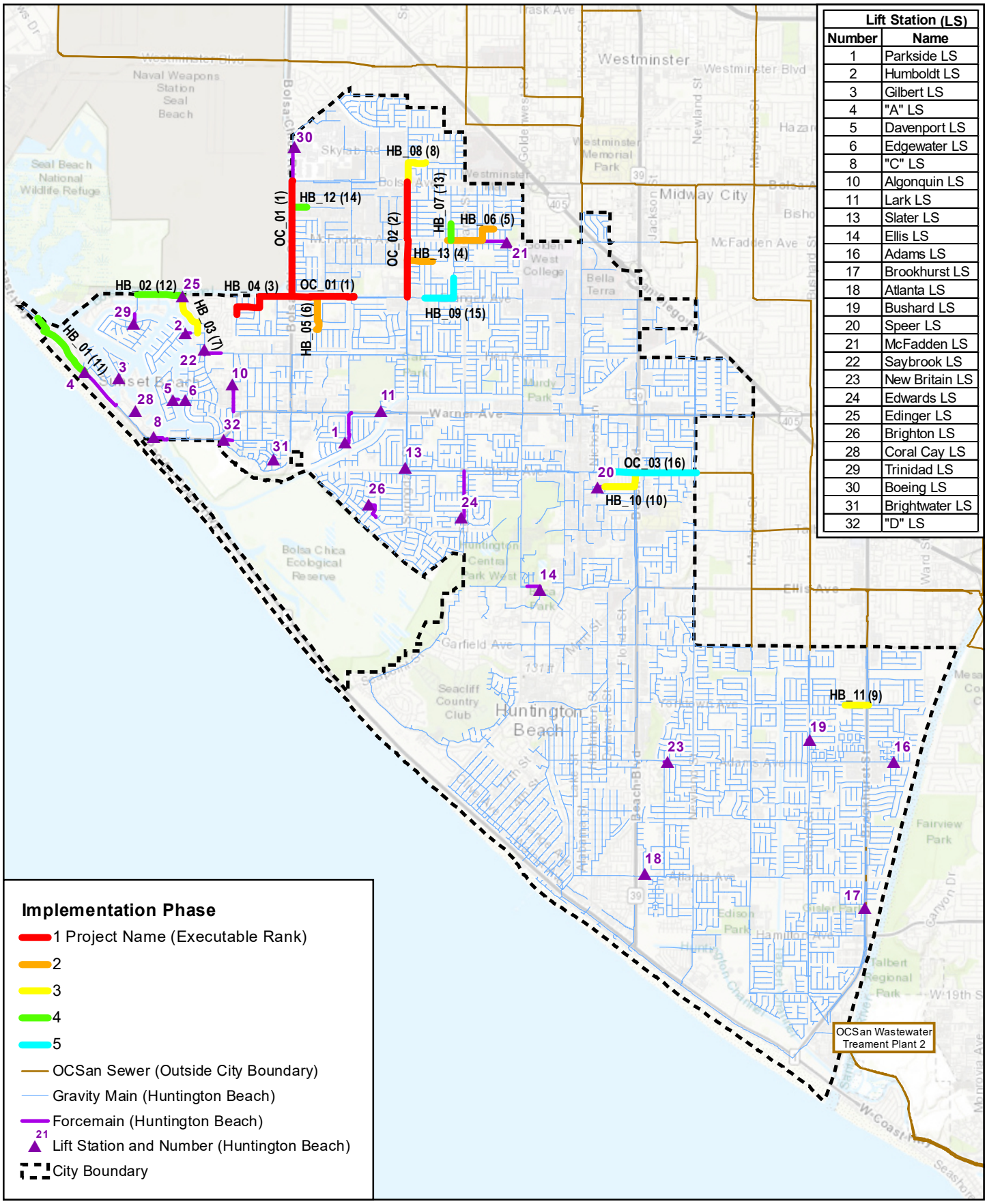
Therefore, although the grand total for gravity portion of the CIP shows $66,354,000, the SMP recommends the implementation of 14 of the 16 projects, or all projects in phases 1-4. As mentioned, the phase 5 projects are conditional, leaving the certain project probable cost total of $53,878,000.

Table 10.3 Gravity Sewer CIP Project Implementation Plan

	Within CIP Project			Within Tributary Area								
Gravity Project ID	Count of Pipes	Length (ft)	*Max Diameter in Project (in)	Count of Pipes	*Length (ft)	*Peak WWF (MGD)	*SSOs Upstream	*Eliminates SSOs	Total Cost	Quartile Score	Executable Rank	Implementation Phase
OC_01	21	8,232	24	333	89,645	7.20	Yes	Yes	$14,295,000	36	1	1
OC_02	13	5,212	21	425	107,382	1.36	Yes	Yes	$8,366,000	28	2	1
HB_04	13	3,383	15	73	19,099	0.79	Yes	Yes	$4,932,000	22	3	1
HB_13	4	1,139	18	240	61,144	1.26	Yes	Yes	$1,848,000	21	4	2
HB_06	11	2,623	15	198	50,579	1.08	Yes	Yes	$3,833,000	19	5	2
HB_05	11	1,941	15	114	30,101	0.81	No	No	$2,610,000	14	6	2
HB_03	10	1,966	12	99	19,250	0.80	No	No	$2,734,000	12	7	3
HB_08	8	1,706	15	103	25,924	0.92	No	No	$2,475,000	15	8	3
HB_11	5	1,069	15	101	26,543	1.02	No	No	$1,610,000	15	9	3
HB_10	8	2,062	15	112	24,524	1.44	No	No	$2,556,000	14	10	3
HB_01	20	3,509	10	66	13,960	0.75	No	No	$3,901,000	10	11	4
HB_02	9	2,092	12	83	13,481	0.70	No	No	$2,909,000	9	12	4
HB_07	4	773	10	47	11,554	0.32	No	No	$859,000	9	13	4
HB_12	3	683	12	17	4,771	0.57	No	No	$950,000	9	14	4
HB_09[1]	8	2,213	10	60	15,969	0.39	No	No	$2,418,000	11	15	5
OC_03[1]	8	3,974	48	4,201	1,007,685	21.50	Yes	Yes	$10,058,000	22	16	5
Grand Total	156	42,573	48	6,272	1,521,611	21.50	-	-	$66,354,000	-	-	-
Cond Total	16	6,187	48	4,261	1,023,654	21.50	-	-	$12,476,000	-	-	-
Recc Total	**140**	**36,386**	24	2,011	497,957	7.20	-	-	**$53,878,000**	-	-	-

*Indicates parameter considered in quartile scoring/ranking

[1] Conditional projects should be only implemented after implementation of all projects in earlier phases and further flow monitoring warrant their need



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

Gravity Sewer CIP Projects Prioritized and Phased Implementation Plan

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE 10.1

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 10.1_Phase and Prioritized Gravity CIP.mxd
Print date: 25 Mar 2024 - 08:02

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

10.2.2 Lift Station CIP Implementation Plan

Ranking and prioritizing the lift station improvements was not as straightforward as for the gravity sewer improvement projects. The City had already pre-determined a list of organized and prioritized improvements, with many lift stations slated for full replacement. A few condition based improvements have been added, but the majority of the findings from the desktop condition assessment exercise were already included in the City's released 2023 lift station CIP list

However, a significant hydraulic evaluation of each the lift station's pumping operation and capacity was performed, and these findings as mentioned in **Chapter 9.3.2**, **Table 9.8**, and **Table 9.9**, are listed in **Table 10.4** with a hydraulic priority ranking shown. Then, a final implementation phase is presented that considers the City's final 2023 Lift Station CIP priority ranking but offers an updated ranking and phase that includes the hydraulic observation and recommendation portion from this master plans' efforts. The City may continue as per their 2023 ranking, but this list offers a plan that could be utilized based on condition, level of service, and hydraulic/pumping/operational issues.

Table 10.4 Lift Station CIP Project Implementation Plan

Station Number ID	Station Name	Original Const-ruction Year	Most Recent Update	Condition Recommendation Summary	Hydraulic Recommendation Summary	City Priority Rank	Hydraulic/Pumping Priority (1 Highest, 6 Least)	Final Rank	Priority Phase	Total Estimated Probable Cost
21	McFadden	1972	NA	Complete Replacement.	Increase wet well size and pumping capacity as part of replacement redesign.	1	1	1	1	$2,732,000
30	Boeing	2006	NA	Mechanical piping and valve replacements.	Perform in-situ pump operations test; Modify pump size accordingly.	14	1	2	1	$1,614,000
23	New Britain	1972	NA	Complete Replacement.	Perform in-situ pump operations test; Modify pump size accordingly (one pump should run during PDWF, and two during PWWF).	4	2	3	1	$5,350,000
2	Humboldt	1964	In Construction	Complete Replacement.	Increase wet well operational volume; Consider a new pump that runs at or beyond the Best Efficiency Point (BEP).	NA	3	4	1	$4,933,000
3	Gilbert	1967	NA	Complete Replacement.	Increase wet well operational volume.	2	3	5	1	$4,350,000
11	Lark	1969	NA	Complete Replacement.	Increase wet well operational volume; Perform in-situ pump operations test; Modify pump curve accordingly.	3	3	6	1	$5,050,000
18	Atlanta	1964	1969	Complete Replacement.	Increase wet well operational volume. Re-evaluate design of pump and forcemain. Consider enlarging the forcemain before replacing the pump.	6	3	7	1	$5,550,000
20	Speer	1968	NA	Complete Replacement.	Raise the lead pump on elevation by 0.3 - .5 ft.	7	4	8	1	$4,550,000
5	Davenport	1963	2020	Complete Replacement.	Increase wet well operational volume; Perform in-situ pump operations test; Modify pump curve accordingly.	NA	4	9	1	$4,500,000
19	Bushard	1976	NA	Complete Replacement.	No hydraulic issues	5	6	10	1	$4,550,000
1	(Old – Graham~1965; New - Parkside~2019)	1965	2019	Site is not secure. Install 150 kWH onsite backup generator.	No hydraulic issues	8	6	11	2	$521,000
32	Station D	2005	2013	Replace onsite stationary generator and add backup pump system.	No hydraulic issues	9	6	12	2	$153,000

Station Number ID	Station Name	Original Const-ruction Year	Most Recent Update	Condition Recommendation Summary	Hydraulic Recommendation Summary	City Priority Rank	Hydraulic/Pumping Priority (1 Highest, 6 Least)	Final Rank	Priority Phase	Total Estimated Probable Cost
10	Algonquin	2014	2019	Remove and replace both submersible pumps within 3 years.	Increase wet well operational volume; Perform in-situ pump operations test; Modify pump curve accordingly.	12	5	13	2	$1,430,000
17	Brookhurst	2007	2017	Replace onsite stationary generator, spray epoxy coating on wet well; upgrade/modify pumps within next 10 years.	Perform in-situ pump operations test; Modify pump size accordingly.	19	2	14	2	$814,000
6	Edgewater	1964	2020	Install fall protection grating at valve vault.	Perform in-situ pump operations test; Modify pump size accordingly. Monitor forcemain condition.	23	3	16	2	$41,000
13	Slater	2021	NA	Already completed; in-situ pump operations testing required.	Perform in-situ pump operations test; Modify pump size accordingly. Monitor forcemain condition.	NA	2	15	2	$8,000
4	Station A	2007	2021	Mechanical piping and valve replacements.	Perform in-situ pump operation test to confirm the pump is not operating below the MCSF. If below, coordinate with manufacturer and monitor pump condition.	10	4	16	3	$211,000
8	Station C	2017	NA	Mechanical piping and valve replacements.	Perform in-situ pump operations test; Modify pump size accordingly.	17	4	17	3	$321,000
22	Saybrook	2022	NA	Already completed in 2021. Air scrubber for future odor issues.	Continue to ease pressure and velocity on forcemain during storms > 2 years, by opening outlet to east (to Algonquin)	24	4	18	3	$121,000
25	Edinger	2008	NA	Spray epoxy coating on wet well within next 3 to 5 years. Install fall protection. Replace centrifugal pumps within next 3 years.	Re-evaluate pump curve at next replacement.	15	5	19	3	$1,304,000
31	Brightwater	2013	NA	Install fall protection grating at valve vault.	Perform in-situ pump operations test; Verify flow is greater than MCSF. Consider a slightly lower capacity pump at next pump replacement	22	5	20	3	$41,000
16	Adams	2011	NA	Spray epoxy coating on wet well within next 3 to 5 years. Install fall protection.	No hydraulic issues	13	6	21	4	$921,000

Station Number ID	Station Name	Original Const-ruction Year	Most Recent Update	Condition Recommendation Summary	Hydraulic Recommendation Summary	City Priority Rank	Hydraulic/Pumping Priority (1 Highest, 6 Least)	Final Rank	Priority Phase	Total Estimated Probable Cost
				Replace pumps within next 3 years.						
14	Ellis	1995	NA	Spray epoxy coating on wet well within next 3 to 5 years. Install fall protection. Replace mechanical pipeline and valves within 3 to 5 years.	No hydraulic issues	11	6	22	4	$301,000
28	Coral Cay	2007	NA	Spray epoxy coating on wet well within next 3 to 5 years.	No hydraulic issues	16	6	23	4	$58,000
24	Edwards	2010	NA	Replace pumps within next 5 years. Install fall proection. Other mechanical and valve replacements.	No hydraulic issues	18	6	24	4	$599,000
26	Brighton	2010	NA	Replace onsite stationary generator, spray epoxy coating on wet well.	No hydraulic issues	20	6	25	4	$481,000
29	Trinidad	2016	NA	Install fall protection grating at valve vault.	No hydraulic issues	21	6	26	4	$41,000
TOTAL										**$50,545,000**

10.2.3 All-Asset CIP Implementation Plan

This sub-chapter attempts to capture the gravity and lift station CIP improvement project costs. Line items for other key City programs like the Annual Sewer Lining Program, Organization Video Inspection Program, Residential Overlay Program, Edinger Sewer Murdy Channel Parkside Lane project, and the PCH Restroom Sewer Lift Station Project are included.

The structure of this detailed implementation plan accounts for work in construction or recently completed by laying out specific projects that fit this category, though it should be noted that total costs associated with them are not included in the total cost recommended as part of the 10-year CIP. **Table 10.5** shows all CIP projects (both gravity and lift station), as well as the other programs and projects introduced above, with cost and timing over the next 10 years.

The City should begin implementation of the CIP plan corresponding to detailed plan recommended in this SMP, starting with the highest priority projects for both gravity main and lift station assets, as laid out in in the preceding sub-chapters of **Chapter 10**. It is recognized that executing projects according to the order by year as laid out in **Table 10.5** may not be feasible, it is recommended to provide the best return on investment.

Table 10.5 All-Asset Comprehensive CIP Project Implementation Plan (Costs in $Millions)

				FY 24/25 (or earlier)			FY 25/26			FY 26/27			FY 27/28			FY 28/29			FY 29/30			FY 30/31			FY 31/32			FY 32/33			FY 33/34			FY 34/35			FY 35/36				
Phase	Gravity CIP Project	Lift Station (LS) CIP Project	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Gravity CIP	LS CIP	Other	Grand Total	Recc[2] Total
1	OC_01[1]	McFadden					$4.77	$2.73		$4.77			$4.77																											$17.03	$17.03
	OC_02	Boeing						$1.61								$8.37																								$9.98	$9.98
	HB_04	New Britain									$5.35								$4.93																					$10.28	$10.28
		Humboldt			$4.93																																			$4.93	
		Gilbert									$4.35																														$4.35	$4.35
		Lark												$5.05																											$5.05	$5.05
		Atlanta												$5.55																											$5.55	$5.55
		Speer															$4.55																								$4.55	$4.55
		Davenport			$4.50																																				$4.50	
		Bushard																		$4.55																					$4.55	$4.55
2	HB_13	Parkside																					$1.85	$0.52																	$2.37	$2.37
	HB_06	Station D																					$3.83	$0.03																	$3.87	$3.87
	HB_05	Algonquin																					$2.61	$1.43																	$4.04	$4.04
		Brookhurst																						$0.81																	$0.81	$0.81
		Edgewater																						$0.04																	$0.04	$0.04
		Slater																						$0.01																	$0.01	$0.01
3	HB_03	Station A																								$2.73	$0.21														$2.95	$2.95
	HB_08	Station C																								$2.48	$0.32														$2.80	$2.80
	HB_11	Saybrook																									$0.12		$1.61												$1.73	$1.73
	HB_10	Edinger																											$2.56	$1.30											$3.86	$3.86
		Brightwater																												$0.04											$0.04	$0.04
4	HB_01	Adams																													$3.90	$0.92									$4.82	$4.82
	HB_02	Ellis																														$0.30		$2.91							$3.21	$3.21
	HB_07	Coral Cay																														$0.06		$0.86							$0.92	$0.92
	HB_12	Edwards																																$0.95	$0.60						$1.55	$1.55
		Brighton																																	$0.48						$0.48	$0.48
		Trinidad																																	$0.04						$0.04	$0.04
5	HB_09																																							$2.42			$2.42	
	OC_03																																							$10.06			$10.06	
			Annual Sewer Lining Program						$1.38			$1.38			$1.38			$1.38			$1.38			$1.38			$1.38			$1.38			$1.38			$1.38			$15.13	$13.75
			Video Inpsection Program						$0.05			$0.05			$0.05			$0.05			$0.05			$0.05			$0.05			$0.05			$0.05			$0.05			$0.55	$0.50
			Residential Overlay Program						$0.15			$0.15			$0.15			$0.15			$0.15			$0.15			$0.15			$0.15			$0.15			$0.15			$1.65	$1.50
			Edinger Sewer Murdy Channle Parkside Lane			$2.00																																			$2.00	
			PCH Restroom Sewer Lift Station						$5.57																																	$5.57	$5.57
Subtotals (per Category)					$9.43	$2.00	$4.77	$4.35	$7.14	$4.77	$9.70	$1.58	$4.77	$10.60	$1.58	$8.37	$4.55	$1.58	$4.93	$4.55	$1.58	$8.29	$2.85	$1.58	$5.21	$0.65	$1.58	$4.17	$1.35	$1.58	$3.90	$1.28	$1.58	$4.72	$1.12	$1.58	$12.48		$1.58		
Total (per FY)					**$11.43**			**$16.25**			**$16.04**			**$16.94**			**$14.49**			**$11.06**			**$12.71**			**$7.44**			**$7.09**			**$6.76**			**$7.41**			**$14.05**			**$141.67**	**$116.19**

*FY = Fiscal Year; Gravity CIP = Gravity sewer capital improvement program project; LS CIP = Lift Station capital improvement program project.

[1] Gravity sewer CIP project OC_01 has total cost of $14.295M. This project cost and effort is spread over the first three fiscal years.

[2] **Recc Total** includes only project costs from the first four phases. Work in construction or already completed (indicated by the FY 23/24 column) and work considered conditional (FY 35/36 column) is not included in the Recommended Total.

10.3 Future Studies and Final Recommendations

The City is mostly built out in terms of future development. This fact was supported by the hydraulic modelling in that additional loads to the system due to future development neither increased any deficient area or stretch of sewer over the threshold from being acceptable to deficient, from a capacity standpoint. This assertion was true during dry and wet weather scenarios. In other words, the same capacity upsize projects are necessary under existing and future development wet weather conditions.

In conclusion, the City's sanitary sewer system has adequate dry weather capacity for existing and projected future development conditions but has capacity deficiencies in specific areas during peak wet weather events in all development scenarios. In addition to implementing and phasing the CIP plan as laid out above, the City should proceed with the following recommendations:

- Continue to prioritize I&I Reduction, with an emphasis on the collection and evaluation of data that achieves goals for improving level of service, reducing risk, and achieving a positive return on investment. Although the City should continue to maximize rehabilitating available City sewers in this study's flow monitoring basins 7, 8, 9, 13, 14, 15, 16, 17, 21, and 22, it should identify illicit storm laterals into the sanitary system, and re-connect them to the storm system. High rates of inflow in these areas may be because of these illicit storm drain connections, which more detailed investigations may uncover. Flow meter basin 7 is the highest priority area for further I&I investigations.
- The phased approach presented in this SMP allows for better tracking of rehabilitation and replacement project success through organization of implementation group by hydraulic boundary. Setting up pre and post CIP project implementation flow monitoring will be more easily performed due to this and should be done for each of the flow monitoring basins mentioned in the first bullet point above.
- The desktop condition assessment and hydraulic model analysis provides for a clear roadmap of proactive investment in addressing structural, electrical, and mechanical issues with each lift station. Further, the hydraulic analysis provides recommendations on which lift stations could benefit from performing more extensive in-situ pump operation tests, which will inform the needs for properly sizing new lift stations, but also for existing lift stations that are not performing optimally.
- The emergency storage analysis provides the City with information necessary to further establish a detailed emergency action plan in the event of any one or systemwide pump failure. Likewise, it is recommended that the City address backup power supply needs as outlined in the lift station assessments.
- The hydraulic model (InfoWorks ICM) is an invaluable tool for evaluating existing and future conditions. It should be updated as new information is obtained, namely when CCTV inspection work is performed and when construction of new sewer mains and post construction sewer flow monitoring has been performed. In conclusion, the results from the detailed hydraulic modeling effort and 10-year CIP plan prepared for this SMP will allow the City to continue to mitigate sanitary sewer system risk and maximize its capital program budget return on investment while providing the most hydraulic benefit in terms of I&I and overflow reduction potential.

Appendices

Appendix A

Detailed Planning Scenarios

This Appendix presents future planning details for the City of Huntington Beach 2024 Sewer Master Plan Update (SMP).

Table A.1 provides parcel-level future development details for all the Community Development Major Projects (CDMP), Residential Housing Needs Assessment (RHNA) units, Pipeline Projects (PLP), and vacant parcels. CDMPs and PLPs are near-term scenario developments and RHNA and vacant parcels are future (2040) scenario developments. Details provided are assessor's parcel number (APN), acres, Traffic Analysis Zone (TAZ) ID, future scenario, development source, development name (where provided), type and quantity of development, and the estimated sewer contribution from the development.

Figures A.1 to A.20 shows the specific locations of each project detailed in **Table A.1**.

Table A.2 provides additional development beyond what is shown in **Table A.1**. This development is not tied to specific parcels, but rather general development within the TAZ area. All TAZ development is part of the future (2040) scenario. The sewer contribution is applied proportionally to all the parcels of the same use type (residential or non-residential) within the TAZ area.

Figure A.21 shows the TAZ area locations for the details presented in **Table A.2**.

Table A.1 Parcel Level Future Planning Details

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
1	153-201-27	0.69	32702300	Near-Term	CDMP	Autumn Care Assisted Living	77	0	0	0	0	0	0	0	11,550	1
2	142-075-01	6.87	32682400	Near-Term	CDMP	Bella Terra Residential	0	0	300	0	25,000	0	0	0	45,500	2
3	142-072-06	5.60	32664300	Near-Term	CDMP	Brandywine Townhomes	0	0	130	0	0	0	0	0	17,550	
4	159-121-37	0.21	32675300	Near-Term	CDMP	Delaware Housing Project	0	0	18	0	0	0	0	0	2,430	
5	159-121-38	1.86	32675300	Near-Term	CDMP	Delaware Housing Project	0	0	158	0	0	0	0	0	21,330	
6	159-121-25	1.00	32675300	Near-Term	CDMP	Delaware Housing Project	0	0	85	0	0	0	0	0	11,475	
7	159-121-26	1.00	32675300	Near-Term	CDMP	Delaware Housing Project	0	0	85	0	0	0	0	0	11,475	
8	142-073-21	0.44	32682400	Near-Term	CDMP	Fogo de Chao Brazilian Steakhouse	0	0	0	9,785	0	0	0	0	1,957	
9	149-302-17	14.06	32705100	Near-Term	CDMP	Gisler Residential	0	85	0	0	0	0	0	0	14,450	
10	178-301-01	1.91	32644200	Near-Term	CDMP	Harmony Cove Marina Development	0	0	0	2,559	0	0	0	0	512	
11	195-081-24	10.00	32658100	Near-Term	CDMP	Hebrew Academy Expansion	0	0	0	0	0	0	0	0	1,235	3
12	195-111-65	74.34	32651400	Near-Term	CDMP	Huntington Gateway Business Park, Phase	0	0	0	0	9,200	342,000	0	0	35,120	2
13	114-481-32	0.84	32691400	Near-Term	CDMP	Magnolia Tank Farm	0	0	7	0	552	0	6	0	1,055	2
14	114-152-09	28.14	32691400	Near-Term	CDMP	Magnolia Tank Farm	0	0	243	0	18,448	0	209	0	67,845	2
15	178-532-78	0.10	32642100	Near-Term	CDMP	Park Avenue Residential	0	0.5	0	0	0	0	0	0	85	
16	178-651-36	0.03	32642100	Near-Term	CDMP	Park Avenue Residential	0	0.5	0	0	0	0	0	0	85	
17	178-201-56	0.18	32647100	Near-Term	CDMP	Pearce Drive Condos	0	18	0	0	0	0	0	0	3,400	
18	111-360-17	12.55	32674200	Near-Term	CDMP	Rainbow Environmental Services Transfer	0	0	0	0	0	0	0	0	1,748	4
19	111-130-07	0.13	32669100	Near-Term	CDMP	Ralph’s Commercial Center	0	0	0	548	0	0	0	0	110	
20	111-130-08	0.13	32669100	Near-Term	CDMP	Ralph’s Commercial Center	0	0	0	548	0	0	0	0	110	
21	111-130-09	0.27	32669100	Near-Term	CDMP	Ralph’s Commercial Center	0	0	0	1,091	0	0	0	0	218	
22	111-130-14	0.55	32669100	Near-Term	CDMP	Ralph’s Commercial Center	0	0	0	2,223	0	0	0	0	445	
23	111-130-10	0.13	32669100	Near-Term	CDMP	Ralph’s Commercial Center	0	0	0	541	0	0	0	0	108	
24	111-130-39	0.11	32669100	Near-Term	CDMP	Ralph’s Commercial Center	0	0	0	450	0	0	0	0	90	
25	155-181-24	0.21	32711100	Near-Term	CDMP	Shake Shack	0	0	0	4,897	0	0	0	0	979	
26	142-073-39	0.96	32664300	Near-Term	CDMP	Wave Pool	0	0	0	3,033	208	0	0	0	648	2
27	163-361-10	4.88	32646700	Near-Term	CDMP	Windward Residential Development	0	36	0	0	0	0	0	0	6,120	
28	167-471-02	0.94	32685200	Near-Term	CDMP	Cameron Lane Townhomes	0	0	18	0	0	0	0	0	2,430	
29	167-311-02	1.04	32685100	Near-Term	CDMP	Hardin Hyundai	0	0	0	7,300	0	0	0	0	1,460	
30	159-281-01	0.22	32669100	Near-Term	CDMP	Holly Triangle Townhomes	0	0	4	0	0	0	0	0	675	
31	159-281-02	0.53	32669100	Near-Term	CDMP	Holly Triangle Townhomes	0	0	10	0	0	0	0	0	1,350	
32	159-281-03	0.13	32669100	Near-Term	CDMP	Holly Triangle Townhomes	0	0	3	0	0	0	0	0	405	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
33	159-281-04	0.08	32669100	Near-Term	CDMP	Holly Triangle Townhomes	0	0	2	0	0	0	0	0	135	
34	159-281-05	0.82	32669100	Near-Term	CDMP	Holly Triangle Townhomes	0	0	16	0	0	0	0	0	2,160	
35	195-111-66	56.00	32651400	Near-Term	CDMP	Huntington Gateway Business Park Project	0	0	0	0	0	1,029,000	0	0	102,900	
36	167-531-23	0.96	32685200	Near-Term	CDMP	Olson Residential	0	0	15	0	0	0	0	0	2,025	
37	167-531-24	1.16	32685200	Near-Term	CDMP	Olson Residential	0	0	19	0	0	0	0	0	2,565	
38	178-523-09	0.13	32641100	Near-Term	CDMP		0	0	1	6,513	0	0	0	0	1,438	
39	023-152-01	2.01	32662100	Near-Term	CDMP	Rodgers Senior Center Reuse Plan	0	0	0	0	0	0	0	4,375	437	
40	023-010-19	11.29	32669400	Near-Term	CDMP	Seacliff at HB Inspired Senior Living Facility	226	0	0	0	0	0	0	0	33,900	1
41	178-551-31	0.41	32641100	Near-Term	CDMP	Sunset Beach Hotel	0	0	0	1,800	0	0	12	0	2,160	
42	146-591-03	6.78	32660400	Near-Term	CDMP	Chick-Fil-A	0	0	0	3,121	0	0	0	0	624	
43	111-150-85	1.29	32669100	Near-Term	CDMP	Gothard Townhomes	0	0	21	0	0	0	0	0	2,835	
44	159-282-19	1.93	32669400	Near-Term	CDMP	Holly Townhomes	0	0	32	0	0	0	0	0	4,320	
45	142-081-27	1.29	32672200	Near-Term	CDMP	In-N-Out	0	0	0	4,080	0	0	0	0	816	
46	159-031-18	0.78	32675100	Near-Term	CDMP	Jamboree Senior Housing	0	0	43	0	0	0	0	0	5,805	
47	155-151-14	0.17	32711100	Near-Term	CDMP	LeBard Park and Residential Project	0	1	0	0	0	0	0	0	170	
48	155-151-13	0.18	32711100	Near-Term	CDMP	LeBard Park and Residential Project	0	1	0	0	0	0	0	0	170	
49	155-151-16	0.23	32711100	Near-Term	CDMP	LeBard Park and Residential Project	0	1	0	0	0	0	0	0	170	
50	155-151-10	0.14	32711100	Near-Term	CDMP	LeBard Park and Residential Project	0	1	0	0	0	0	0	0	170	
51	155-151-17	0.17	32711100	Near-Term	CDMP	LeBard Park and Residential Project	0	1	0	0	0	0	0	0	170	
52	155-151-09	0.24	32711100	Near-Term	CDMP	LeBard Park and Residential Project	0	1	0	0	0	0	0	0	170	
53	155-151-05	0.15	32711100	Near-Term	CDMP	LeBard Park and Residential Project	0	1	0	0	0	0	0	0	170	
54	155-151-04	0.22	32711100	Near-Term	CDMP	LeBard Park and Residential Project	0	1	0	0	0	0	0	0	170	
55	024-134-04	0.20	32670200	Near-Term	CDMP	Main Street Mixed-Use	0	0	9	2,236	0	0	0	0	1,662	
56	024-134-05	0.25	32670200	Near-Term	CDMP	Main Street Mixed-Use	0	0	11	2,764	0	0	0	0	2,038	
57	025-172-06	1.49	32677200	Near-Term	CDMP	Georgia Townhomes	0	0	18	1,040	0	0	0	0	2,638	
58	023-167-04	0.19	32662100	Near-Term	PLP	1620 PCH Apartments	0	0	0	0	0	0	0	0	540	
59	025-200-39	0.21	32678400	Near-Term	PLP	712 Utica	0	0	0	0	0	0	0	0	405	
60	024-124-18	0.13	32670200	Near-Term	PLP	712/714 PCH	0	0	0	0	0	0	0	0	405	
61	142-083-13	0.18	32672200	Near-Term	PLP	7851 Holt	0	0	0	0	0	0	0	0	680	
62	157-411-02	2.44	32684200	Near-Term	PLP	Garfield SFD	0	0	0	0	0	0	0	0	1,350	
63	153-051-11	1.01	32686100	Near-Term	PLP	NEC Beach and Yorktown	0	0	0	0	0	0	0	0	14,040	
64	025-180-21	0.46	32678100	Near-Term	PLP	NWC Beach and Yorktown	0	0	0	0	0	0	0	0	8,100	
65	025-180-23	0.93	32678100	Near-Term	PLP	NWC Beach and Yorktown	0	0	0	0	0	0	0	0	16,335	
66	163-363-39	0.19	32646700	Near-Term	PLP	Parkside Estates	0	0	0	0	0	0	0	0	170	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
67	142-072-11	35.40	32664300	2040	RHNA		0	0	150	0	0	0	0	0	13,363	
68	107-231-10	3.21	32690200	2040	RHNA		0	0	179	0	0	0	0	0	15,983	
69	107-782-08	5.01	32689200	2040	RHNA		0	0	400	0	0	0	0	0	35,766	
70	142-081-16	0.22	32672200	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
71	142-081-17	0.22	32672200	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
72	142-081-18	0.26	32672200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
73	142-081-25	0.26	32672200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
74	142-081-26	0.24	32672200	2040	RHNA		0	0	17	0	0	0	0	0	1,572	
75	142-082-02	0.06	32672200	2040	RHNA		0	0	1	0	0	0	0	0	131	
76	142-082-22	0.17	32672200	2040	RHNA		0	0	11	0	0	0	0	0	1,048	
77	142-082-26	0.34	32672200	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
78	142-082-27	0.72	32672200	2040	RHNA		0	0	56	0	0	0	0	0	4,978	
79	142-083-04	0.17	32672200	2040	RHNA		0	0	11	0	0	0	0	0	1,048	
80	142-091-09	0.15	32672200	2040	RHNA		0	0	10	0	0	0	0	0	917	
81	142-091-32	0.26	32672200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
82	142-101-14	0.70	32672200	2040	RHNA		0	0	54	0	0	0	0	0	4,847	
83	142-102-56	0.88	32672200	2040	RHNA		0	0	69	0	0	0	0	0	6,158	
84	142-103-17	0.23	32672200	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
85	142-111-27	1.68	32672200	2040	RHNA		0	0	133	0	0	0	0	0	11,922	
86	142-111-32	3.51	32672200	2040	RHNA		0	0	280	0	0	0	0	0	25,023	
87	142-111-39	0.78	32672200	2040	RHNA		0	0	61	0	0	0	0	0	5,502	
88	142-112-05	0.51	32672200	2040	RHNA		0	0	40	0	0	0	0	0	3,537	
89	142-112-08	2.50	32672200	2040	RHNA		0	0	197	0	0	0	0	0	17,687	
90	142-112-09	3.41	32672200	2040	RHNA		0	0	271	0	0	0	0	0	24,237	
91	142-112-10	7.55	32672200	2040	RHNA		0	0	601	0	0	0	0	0	53,715	
92	111-010-39	10.17	32674300	2040	RHNA		0	0	567	0	0	0	0	0	50,702	
93	142-072-02	25.57	32664300	2040	RHNA		0	0	150	0	0	0	0	0	13,363	
94	142-072-03	9.58	32664300	2040	RHNA		0	0	150	0	0	0	0	0	13,363	
95	142-072-05	37.35	32664300	2040	RHNA		0	0	150	0	0	0	0	0	13,363	
96	142-072-08	2.23	32664300	2040	RHNA		0	0	176	0	0	0	0	0	15,721	
97	142-072-09	0.86	32664300	2040	RHNA		0	0	67	0	0	0	0	0	6,027	
98	142-143-10	3.33	32673100	2040	RHNA		0	0	184	0	0	0	0	0	16,507	
99	142-481-11	1.84	32673300	2040	RHNA		0	0	146	0	0	0	0	0	13,101	
100	142-481-12	1.29	32673300	2040	RHNA		0	0	101	0	0	0	0	0	9,040	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
101	142-491-01	2.13	32673100	2040	RHNA		0	0	117	0	0	0	0	0	10,481	
102	142-491-02	0.54	32673100	2040	RHNA		0	0	29	0	0	0	0	0	2,620	
103	142-491-03	0.38	32673100	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
104	142-491-04	0.33	32673100	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
105	142-491-05	0.34	32673100	2040	RHNA		0	0	17	0	0	0	0	0	1,572	
106	142-491-06	0.49	32673100	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
107	142-492-06	0.50	32673100	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
108	142-492-07	0.41	32673100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
109	142-492-08	0.42	32673100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
110	142-492-09	0.49	32673100	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
111	142-492-10	2.57	32673100	2040	RHNA		0	0	143	0	0	0	0	0	12,839	
112	142-492-11	2.64	32673100	2040	RHNA		0	0	146	0	0	0	0	0	13,101	
113	142-501-09	0.77	32673100	2040	RHNA		0	0	41	0	0	0	0	0	3,668	
114	142-501-10	0.91	32673100	2040	RHNA		0	0	49	0	0	0	0	0	4,323	
115	142-501-11	3.11	32673100	2040	RHNA		0	0	173	0	0	0	0	0	15,459	
116	142-502-06	0.76	32673100	2040	RHNA		0	0	41	0	0	0	0	0	3,668	
117	142-502-07	0.96	32673100	2040	RHNA		0	0	51	0	0	0	0	0	4,585	
118	142-511-03	1.06	32672100	2040	RHNA		0	0	83	0	0	0	0	0	7,468	
119	142-511-04	0.82	32672100	2040	RHNA		0	0	63	0	0	0	0	0	5,634	
120	142-511-05	1.32	32672100	2040	RHNA		0	0	103	0	0	0	0	0	9,171	
121	142-511-06	0.79	32672100	2040	RHNA		0	0	41	0	0	0	0	0	3,668	
122	142-511-07	0.80	32672100	2040	RHNA		0	0	43	0	0	0	0	0	3,799	
123	142-511-08	0.93	32672100	2040	RHNA		0	0	50	0	0	0	0	0	4,454	
124	159-201-01	0.10	32666100	2040	RHNA		0	0	3	0	0	0	0	0	262	
125	159-201-22	0.68	32666100	2040	RHNA		0	0	36	0	0	0	0	0	3,275	
126	159-201-26	0.81	32666100	2040	RHNA		0	0	43	0	0	0	0	0	3,799	
127	159-201-27	0.46	32666100	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
128	159-201-28	0.44	32666100	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
129	159-201-29	0.94	32666100	2040	RHNA		0	0	50	0	0	0	0	0	4,454	
130	159-201-30	0.90	32666100	2040	RHNA		0	0	49	0	0	0	0	0	4,323	
131	159-201-31	0.40	32666100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
132	159-201-32	0.31	32666100	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
133	159-201-33	0.42	32666100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
134	159-201-36	0.23	32666100	2040	RHNA		0	0	10	0	0	0	0	0	917	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
135	159-201-37	0.63	32666100	2040	RHNA		0	0	34	0	0	0	0	0	3,013	
136	159-201-38	0.42	32666100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
137	159-202-03	0.57	32666100	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
138	159-202-04	0.57	32666100	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
139	159-202-05	1.14	32666100	2040	RHNA		0	0	63	0	0	0	0	0	5,634	
140	159-211-01	0.57	32666100	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
141	159-211-03	0.57	32666100	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
142	159-211-08	0.57	32666100	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
143	159-211-10	0.57	32666100	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
144	159-211-11	1.30	32666100	2040	RHNA		0	0	70	0	0	0	0	0	6,289	
145	159-211-12	0.98	32666100	2040	RHNA		0	0	54	0	0	0	0	0	4,847	
146	159-211-13	0.43	32666100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
147	159-211-14	0.43	32666100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
148	159-211-15	0.44	32666100	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
149	159-211-16	0.41	32666100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
150	159-212-07	0.61	32666100	2040	RHNA		0	0	33	0	0	0	0	0	3,013	
151	159-212-08	4.99	32666100	2040	RHNA		0	0	277	0	0	0	0	0	24,761	
152	159-212-09	0.31	32666100	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
153	159-212-10	0.30	32666100	2040	RHNA		0	0	14	0	0	0	0	0	1,310	
154	165-081-08	14.05	32665100	2040	RHNA		0	0	473	0	0	0	0	0	42,317	
155	165-181-37	0.60	32674400	2040	RHNA		0	0	47	0	0	0	0	0	4,192	
156	165-181-38	0.55	32674400	2040	RHNA		0	0	43	0	0	0	0	0	3,799	
157	165-181-39	0.30	32674400	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
158	165-181-40	0.25	32674400	2040	RHNA		0	0	17	0	0	0	0	0	1,572	
159	165-234-07	0.27	32674200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
160	165-234-08	0.26	32674200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
161	165-234-18	2.39	32674200	2040	RHNA		0	0	190	0	0	0	0	0	17,032	
162	165-283-04	0.31	32674200	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
163	165-283-05	0.48	32674200	2040	RHNA		0	0	36	0	0	0	0	0	3,275	
164	165-283-13	0.26	32674200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
165	165-283-14	0.26	32674200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
166	165-283-16	0.48	32674200	2040	RHNA		0	0	36	0	0	0	0	0	3,275	
167	165-283-17	0.48	32674200	2040	RHNA		0	0	36	0	0	0	0	0	3,275	
168	165-293-01	1.64	32674400	2040	RHNA		0	0	90	0	0	0	0	0	7,992	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
169	165-301-22	0.22	32674400	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
170	165-302-21	0.45	32674400	2040	RHNA		0	0	34	0	0	0	0	0	3,013	
171	165-302-22	0.40	32674400	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
172	167-311-03	1.18	32685100	2040	RHNA		0	0	93	0	0	0	0	0	8,385	
173	167-311-04	0.34	32685100	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
174	167-312-01	0.56	32685100	2040	RHNA		0	0	43	0	0	0	0	0	3,799	
175	167-312-02	0.71	32685100	2040	RHNA		0	0	56	0	0	0	0	0	4,978	
176	167-312-03	0.57	32685100	2040	RHNA		0	0	43	0	0	0	0	0	3,799	
177	167-312-04	0.18	32685100	2040	RHNA		0	0	13	0	0	0	0	0	1,179	
178	167-312-05	0.40	32685100	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
179	167-312-06	0.28	32685100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
180	167-324-14	0.25	32685100	2040	RHNA		0	0	17	0	0	0	0	0	1,572	
181	167-325-15	0.91	32685100	2040	RHNA		0	0	70	0	0	0	0	0	6,289	
182	167-325-16	0.45	32685100	2040	RHNA		0	0	34	0	0	0	0	0	3,013	
183	167-325-17	0.45	32685100	2040	RHNA		0	0	34	0	0	0	0	0	3,013	
184	167-325-18	0.45	32685100	2040	RHNA		0	0	34	0	0	0	0	0	3,013	
185	167-472-03	0.78	32685200	2040	RHNA		0	0	61	0	0	0	0	0	5,502	
186	167-472-04	0.15	32685200	2040	RHNA		0	0	10	0	0	0	0	0	917	
187	167-472-05	0.19	32685200	2040	RHNA		0	0	14	0	0	0	0	0	1,310	
188	167-472-06	0.43	32685200	2040	RHNA		0	0	33	0	0	0	0	0	3,013	
189	167-472-07	0.79	32685200	2040	RHNA		0	0	61	0	0	0	0	0	5,502	
190	167-472-08	0.79	32685200	2040	RHNA		0	0	63	0	0	0	0	0	5,634	
191	167-472-09	0.79	32685200	2040	RHNA		0	0	63	0	0	0	0	0	5,634	
192	167-472-10	0.46	32685200	2040	RHNA		0	0	36	0	0	0	0	0	3,275	
193	167-472-11	0.33	32685200	2040	RHNA		0	0	24	0	0	0	0	0	2,096	
194	167-472-12	0.38	32685200	2040	RHNA		0	0	29	0	0	0	0	0	2,620	
195	167-472-13	0.46	32685200	2040	RHNA		0	0	34	0	0	0	0	0	3,013	
196	167-472-14	0.32	32685200	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
197	167-472-15	0.31	32685200	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
198	153-041-18	0.78	32686100	2040	RHNA		0	0	41	0	0	0	0	0	3,668	
199	153-041-28	3.40	32686100	2040	RHNA		0	0	189	0	0	0	0	0	16,901	
200	157-452-03	0.51	32684200	2040	RHNA		0	0	27	0	0	0	0	0	2,358	
201	157-471-06	3.64	32684200	2040	RHNA		0	0	290	0	0	0	0	0	25,940	
202	025-180-22	1.12	32678100	2040	RHNA		0	0	87	0	0	0	0	0	7,730	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
203	025-191-03	2.12	32678400	2040	RHNA		0	0	167	0	0	0	0	0	14,935	
204	025-191-32	0.26	32678400	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
205	025-191-42	0.10	32678400	2040	RHNA		0	0	6	0	0	0	0	0	524	
206	025-191-43	0.53	32678400	2040	RHNA		0	0	41	0	0	0	0	0	3,668	
207	025-191-44	1.19	32678400	2040	RHNA		0	0	94	0	0	0	0	0	8,385	
208	025-191-51	2.12	32678400	2040	RHNA		0	0	167	0	0	0	0	0	14,935	
209	025-200-50	0.42	32678400	2040	RHNA		0	0	31	0	0	0	0	0	2,751	
210	025-200-51	0.42	32678400	2040	RHNA		0	0	31	0	0	0	0	0	2,751	
211	025-200-61	0.40	32678400	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
212	025-200-62	0.20	32678400	2040	RHNA		0	0	14	0	0	0	0	0	1,310	
213	025-200-64	0.96	32678400	2040	RHNA		0	0	76	0	0	0	0	0	6,813	
214	025-200-68	1.06	32678400	2040	RHNA		0	0	83	0	0	0	0	0	7,468	
215	025-200-69	1.10	32678400	2040	RHNA		0	0	86	0	0	0	0	0	7,730	
216	153-041-14	1.11	32686100	2040	RHNA		0	0	87	0	0	0	0	0	7,730	
217	153-041-15	0.83	32686100	2040	RHNA		0	0	64	0	0	0	0	0	5,765	
218	153-041-16	1.02	32686100	2040	RHNA		0	0	80	0	0	0	0	0	7,206	
219	153-041-17	2.32	32686100	2040	RHNA		0	0	183	0	0	0	0	0	16,376	
220	153-041-29	0.25	32686100	2040	RHNA		0	0	17	0	0	0	0	0	1,572	
221	153-051-14	0.81	32686100	2040	RHNA		0	0	63	0	0	0	0	0	5,634	
222	153-051-24	1.63	32686100	2040	RHNA		0	0	129	0	0	0	0	0	11,529	
223	159-161-04	1.93	32678100	2040	RHNA		0	0	153	0	0	0	0	0	13,625	
224	025-191-53	1.13	32678400	2040	RHNA		0	0	89	0	0	0	0	0	7,992	
225	025-191-54	0.53	32678400	2040	RHNA		0	0	41	0	0	0	0	0	3,668	
226	107-100-79	0.72	32690100	2040	RHNA		0	0	56	0	0	0	0	0	4,978	
227	107-100-80	0.28	32690100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
228	107-781-07	5.82	32689200	2040	RHNA		0	0	463	0	0	0	0	0	41,400	
229	111-120-12	0.13	32666300	2040	RHNA		0	0	4	0	0	0	0	0	393	
230	111-120-13	0.13	32666300	2040	RHNA		0	0	4	0	0	0	0	0	393	
231	111-120-14	0.13	32666300	2040	RHNA		0	0	4	0	0	0	0	0	393	
232	111-120-15	0.13	32666300	2040	RHNA		0	0	4	0	0	0	0	0	393	
233	111-120-16	0.33	32666300	2040	RHNA		0	0	10	0	0	0	0	0	917	
234	111-120-17	0.13	32666300	2040	RHNA		0	0	4	0	0	0	0	0	393	
235	111-120-18	0.13	32666300	2040	RHNA		0	0	4	0	0	0	0	0	393	
236	111-120-19	0.13	32666300	2040	RHNA		0	0	4	0	0	0	0	0	393	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
237	111-120-20	0.26	32666300	2040	RHNA		0	0	8	0	0	0	0	0	655	
238	111-130-02	0.20	32669100	2040	RHNA		0	0	10	0	0	0	0	0	917	
239	111-130-05	0.15	32669100	2040	RHNA		0	0	7	0	0	0	0	0	655	
240	111-130-06	0.13	32669100	2040	RHNA		0	0	6	0	0	0	0	0	524	
241	111-130-24	1.00	32669100	2040	RHNA		0	0	54	0	0	0	0	0	4,847	
242	111-130-25	0.61	32669100	2040	RHNA		0	0	31	0	0	0	0	0	2,751	
243	111-130-26	0.20	32669100	2040	RHNA		0	0	10	0	0	0	0	0	917	
244	142-081-01	0.50	32672200	2040	RHNA		0	0	40	0	0	0	0	0	3,537	
245	142-082-35	0.27	32672200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
246	142-102-19	0.12	32672200	2040	RHNA		0	0	7	0	0	0	0	0	655	
247	142-111-34	2.85	32672200	2040	RHNA		0	0	226	0	0	0	0	0	20,176	
248	142-111-42	1.37	32672200	2040	RHNA		0	0	107	0	0	0	0	0	9,564	
249	142-191-01	0.17	32673300	2040	RHNA		0	0	11	0	0	0	0	0	1,048	
250	142-191-12	0.06	32673300	2040	RHNA		0	0	3	0	0	0	0	0	262	
251	142-191-14	0.34	32673300	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
252	142-191-15	0.06	32673300	2040	RHNA		0	0	3	0	0	0	0	0	262	
253	142-191-23	0.56	32673300	2040	RHNA		0	0	43	0	0	0	0	0	3,799	
254	142-191-27	0.34	32673300	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
255	142-191-34	0.34	32673300	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
256	142-191-42	0.41	32673300	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
257	142-191-43	0.11	32673300	2040	RHNA		0	0	7	0	0	0	0	0	655	
258	142-191-47	1.68	32673300	2040	RHNA		0	0	133	0	0	0	0	0	11,922	
259	142-221-20	0.08	32673400	2040	RHNA		0	0	3	0	0	0	0	0	262	
260	142-342-18	2.20	32682400	2040	RHNA		0	0	64	0	0	0	0	0	5,765	
261	142-492-01	1.62	32673100	2040	RHNA		0	0	89	0	0	0	0	0	7,992	
262	142-492-02	0.23	32673100	2040	RHNA		0	0	11	0	0	0	0	0	1,048	
263	142-492-03	0.23	32673100	2040	RHNA		0	0	11	0	0	0	0	0	1,048	
264	142-492-05	1.35	32673100	2040	RHNA		0	0	74	0	0	0	0	0	6,682	
265	153-041-34	0.73	32686100	2040	RHNA		0	0	40	0	0	0	0	0	3,537	
266	159-201-04	0.10	32666100	2040	RHNA		0	0	3	0	0	0	0	0	262	
267	159-201-05	0.15	32666100	2040	RHNA		0	0	7	0	0	0	0	0	655	
268	159-201-12	0.06	32666100	2040	RHNA		0	0	1	0	0	0	0	0	131	
269	159-201-13	0.12	32666100	2040	RHNA		0	0	4	0	0	0	0	0	393	
270	159-201-34	0.40	32666100	2040	RHNA		0	0	21	0	0	0	0	0	1,834	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
271	159-201-39	0.23	32666100	2040	RHNA		0	0	10	0	0	0	0	0	917	
272	165-225-10	0.91	32674200	2040	RHNA		0	0	127	0	0	0	0	0	11,398	
273	165-301-23	0.14	32674400	2040	RHNA		0	0	10	0	0	0	0	0	917	
274	165-301-24	0.15	32674400	2040	RHNA		0	0	10	0	0	0	0	0	917	
275	165-311-16	0.52	32674400	2040	RHNA		0	0	40	0	0	0	0	0	3,537	
276	165-321-05	0.55	32674400	2040	RHNA		0	0	41	0	0	0	0	0	3,668	
277	165-391-23	0.55	32674300	2040	RHNA		0	0	29	0	0	0	0	0	2,620	
278	165-391-27	0.53	32674300	2040	RHNA		0	0	27	0	0	0	0	0	2,358	
279	165-391-38	0.55	32674300	2040	RHNA		0	0	29	0	0	0	0	0	2,620	
280	165-391-39	0.41	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
281	165-391-40	0.41	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
282	165-391-41	0.55	32674300	2040	RHNA		0	0	29	0	0	0	0	0	2,620	
283	165-391-43	0.31	32674300	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
284	165-391-44	0.41	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
285	165-391-45	0.43	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
286	165-391-46	0.53	32674300	2040	RHNA		0	0	27	0	0	0	0	0	2,358	
287	165-391-47	0.52	32674300	2040	RHNA		0	0	27	0	0	0	0	0	2,358	
288	165-401-01	2.44	32674300	2040	RHNA		0	0	134	0	0	0	0	0	12,053	
289	165-401-03	1.32	32674300	2040	RHNA		0	0	103	0	0	0	0	0	9,171	
290	165-401-04	2.64	32674300	2040	RHNA		0	0	210	0	0	0	0	0	18,735	
291	165-401-06	0.40	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
292	165-401-07	0.42	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
293	165-401-08	0.45	32674300	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
294	165-401-09	0.41	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
295	165-401-10	0.30	32674300	2040	RHNA		0	0	14	0	0	0	0	0	1,310	
296	165-401-11	0.34	32674300	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
297	165-401-12	0.28	32674300	2040	RHNA		0	0	14	0	0	0	0	0	1,310	
298	165-401-13	0.45	32674300	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
299	165-401-14	0.33	32674300	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
300	165-401-15	0.33	32674300	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
301	165-401-16	0.33	32674300	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
302	165-401-17	0.34	32674300	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
303	165-401-19	0.45	32674300	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
304	165-401-20	0.43	32674300	2040	RHNA		0	0	23	0	0	0	0	0	2,096	

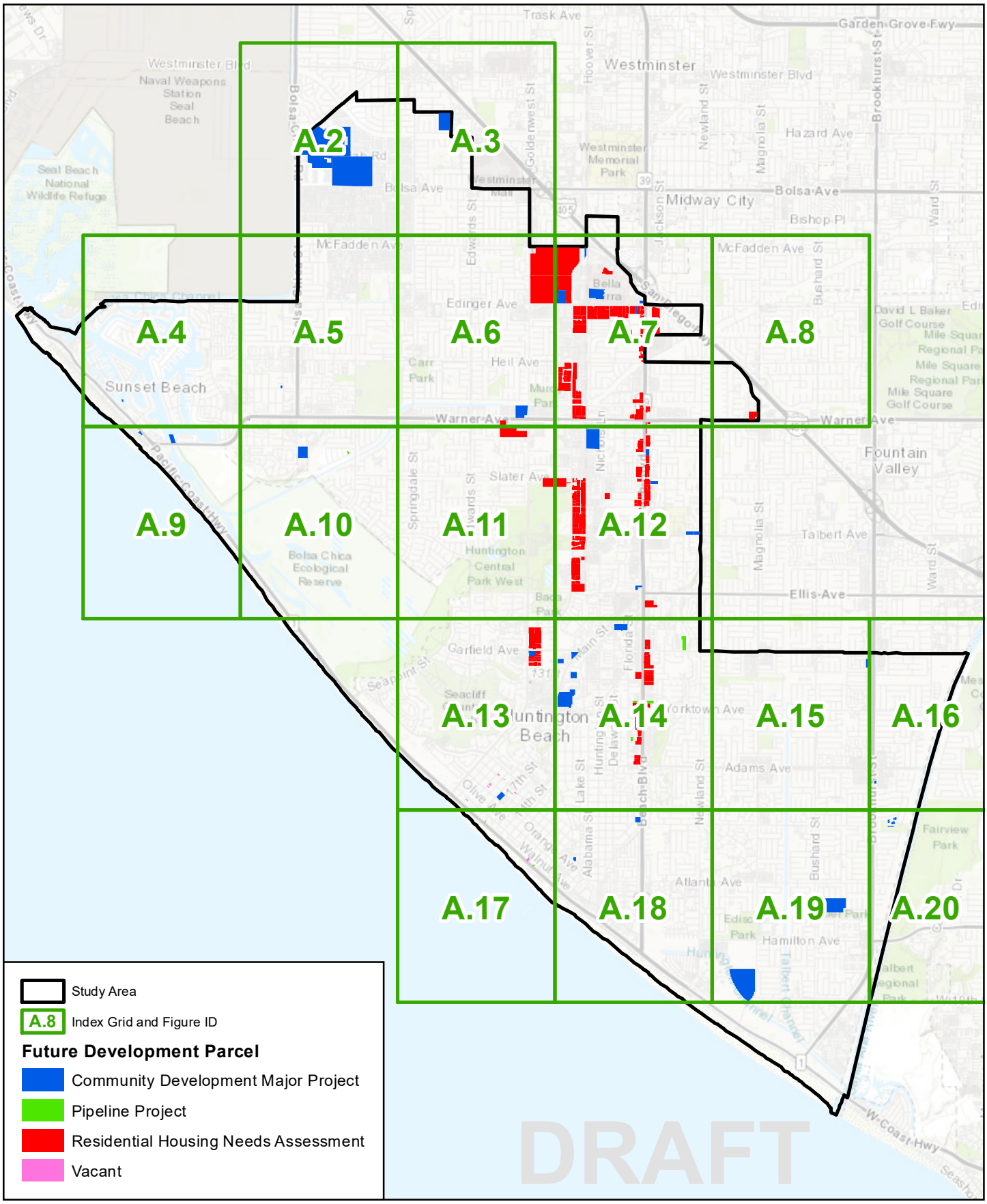
Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
305	165-401-21	0.51	32674300	2040	RHNA		0	0	40	0	0	0	0	0	3,537	
306	165-401-22	0.67	32674300	2040	RHNA		0	0	51	0	0	0	0	0	4,585	
307	165-401-23	0.47	32674300	2040	RHNA		0	0	24	0	0	0	0	0	2,096	
308	165-401-24	0.87	32674300	2040	RHNA		0	0	47	0	0	0	0	0	4,192	
309	165-401-25	0.59	32674300	2040	RHNA		0	0	31	0	0	0	0	0	2,751	
310	165-401-26	0.73	32674300	2040	RHNA		0	0	40	0	0	0	0	0	3,537	
311	165-401-27	0.75	32674300	2040	RHNA		0	0	40	0	0	0	0	0	3,537	
312	165-401-28	0.61	32674300	2040	RHNA		0	0	47	0	0	0	0	0	4,192	
313	167-324-11	0.57	32685100	2040	RHNA		0	0	43	0	0	0	0	0	3,799	
314	167-472-17	1.29	32685200	2040	RHNA		0	0	101	0	0	0	0	0	9,040	
315	165-392-25	1.14	32674300	2040	RHNA		0	0	61	0	0	0	0	0	5,502	
316	165-392-52	0.31	32674300	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
317	165-392-62	0.47	32674300	2040	RHNA		0	0	24	0	0	0	0	0	2,096	
318	165-392-63	0.38	32674300	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
319	165-392-64	0.35	32674300	2040	RHNA		0	0	17	0	0	0	0	0	1,572	
320	165-392-71	0.41	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
321	165-392-72	0.44	32674300	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
322	111-130-31	0.47	32669100	2040	RHNA		0	0	24	0	0	0	0	0	2,096	
323	111-130-32	0.48	32669100	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
324	111-130-33	0.44	32669100	2040	RHNA		0	0	23	0	0	0	0	0	2,096	
325	111-130-34	0.59	32669100	2040	RHNA		0	0	31	0	0	0	0	0	2,751	
326	111-130-35	0.38	32669100	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
327	111-130-36	0.38	32669100	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
328	111-130-37	0.51	32669100	2040	RHNA		0	0	28	0	0	0	0	0	2,489	
329	159-201-40	0.28	32666100	2040	RHNA		0	0	14	0	0	0	0	0	1,310	
330	165-392-73	1.03	32674300	2040	RHNA		0	0	56	0	0	0	0	0	4,978	
331	142-511-17	2.92	32672100	2040	RHNA		0	0	231	0	0	0	0	0	20,700	
332	165-311-17	0.50	32674400	2040	RHNA		0	0	37	0	0	0	0	0	3,275	
333	111-130-41	0.90	32669100	2040	RHNA		0	0	49	0	0	0	0	0	4,323	
334	111-120-29	0.87	32666300	2040	RHNA		0	0	25	0	0	0	0	0	2,227	
335	111-120-09	0.73	32666300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
336	111-120-22	1.00	32666300	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
337	111-120-08	0.90	32666300	2040	RHNA		0	0	27	0	0	0	0	0	2,358	
338	111-120-23	1.00	32666300	2040	RHNA		0	0	30	0	0	0	0	0	2,620	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
339	111-120-07	0.90	32666300	2040	RHNA		0	0	27	0	0	0	0	0	2,358	
340	111-120-24	1.00	32666300	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
341	111-120-06	0.90	32666300	2040	RHNA		0	0	27	0	0	0	0	0	2,358	
342	111-120-25	1.00	32666300	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
343	111-120-26	1.00	32666300	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
344	111-120-27	1.79	32666300	2040	RHNA		0	0	54	0	0	0	0	0	4,847	
345	111-130-01	0.13	32669100	2040	RHNA		0	0	6	0	0	0	0	0	524	
346	142-111-18	0.27	32672200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
347	142-191-48	1.03	32673300	2040	RHNA		0	0	81	0	0	0	0	0	7,206	
348	142-221-19	0.48	32673400	2040	RHNA		0	0	24	0	0	0	0	0	2,096	
349	142-221-17	0.61	32673400	2040	RHNA		0	0	33	0	0	0	0	0	3,013	
350	142-221-21	0.40	32673400	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
351	142-221-24	2.18	32673400	2040	RHNA		0	0	173	0	0	0	0	0	15,459	
352	142-221-22	2.06	32673400	2040	RHNA		0	0	163	0	0	0	0	0	14,542	
353	142-221-23	2.03	32673400	2040	RHNA		0	0	161	0	0	0	0	0	14,411	
354	142-511-11	0.80	32672100	2040	RHNA		0	0	61	0	0	0	0	0	5,502	
355	142-511-12	0.78	32672100	2040	RHNA		0	0	41	0	0	0	0	0	3,668	
356	142-511-10	0.96	32672100	2040	RHNA		0	0	74	0	0	0	0	0	6,682	
357	142-511-13	2.93	32672100	2040	RHNA		0	0	163	0	0	0	0	0	14,542	
358	142-511-16	2.85	32672100	2040	RHNA		0	0	157	0	0	0	0	0	14,018	
359	157-452-42	0.68	32684200	2040	RHNA		0	0	36	0	0	0	0	0	3,275	
360	157-452-41	1.27	32684200	2040	RHNA		0	0	70	0	0	0	0	0	6,289	
361	165-312-19	0.52	32674400	2040	RHNA		0	0	40	0	0	0	0	0	3,537	
362	165-312-20	0.42	32674400	2040	RHNA		0	0	31	0	0	0	0	0	2,751	
363	165-312-18	0.17	32674400	2040	RHNA		0	0	11	0	0	0	0	0	1,048	
364	165-312-16	0.41	32674400	2040	RHNA		0	0	30	0	0	0	0	0	2,620	
365	165-312-17	0.34	32674400	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
366	165-392-60	0.20	32674300	2040	RHNA		0	0	10	0	0	0	0	0	917	
367	165-392-38	0.54	32674300	2040	RHNA		0	0	41	0	0	0	0	0	3,668	
368	165-392-39	0.54	32674300	2040	RHNA		0	0	29	0	0	0	0	0	2,620	
369	165-392-40	0.66	32674300	2040	RHNA		0	0	50	0	0	0	0	0	4,454	
370	165-392-43	0.49	32674300	2040	RHNA		0	0	26	0	0	0	0	0	2,358	
371	165-392-44	0.47	32674300	2040	RHNA		0	0	24	0	0	0	0	0	2,096	
372	165-392-15	0.53	32674300	2040	RHNA		0	0	41	0	0	0	0	0	3,668	

Parcel ID	APN	Acres	TAZ ID	Future Scenario	Source	Development Name	Assisted Living (beds)	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Commercial (sf)	Retail (sf)	Industrial (sf)	Hotel (rooms)	Public (sf)	Estimated Sewer Contribution (gpd)	Note
373	165-392-70	0.43	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
374	165-392-69	0.43	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
375	165-392-26	0.43	32674300	2040	RHNA		0	0	21	0	0	0	0	0	1,834	
376	142-083-25	0.67	32672200	2040	RHNA		0	0	51	0	0	0	0	0	4,585	
377	142-092-15	0.67	32672200	2040	RHNA		0	0	51	0	0	0	0	0	4,585	
378	142-091-18	0.24	32672200	2040	RHNA		0	0	16	0	0	0	0	0	1,441	
379	142-091-33	0.26	32672200	2040	RHNA		0	0	20	0	0	0	0	0	1,834	
380	142-081-02	0.20	32672200	2040	RHNA		0	0	14	0	0	0	0	0	1,310	
381	142-081-29	1.85	32672200	2040	RHNA		0	0	224	0	0	0	0	0	20,045	
382	142-081-03	0.20	32672200	2040	RHNA		0	0	14	0	0	0	0	0	1,310	
383	023-114-14	0.13	32662100	2040	Vacant		0	1	0	0	0	0	0	0	170	
384	023-124-04	0.13	32662100	2040	Vacant		0	1	0	0	0	0	0	0	170	
385	023-137-02	0.10	32662100	2040	Vacant		0	0	11	0	0	0	0	0	1,485	
386	023-141-17	0.13	32662100	2040	Vacant		0	1	0	0	0	0	0	0	170	
387	023-147-24	0.07	32662100	2040	Vacant		0	1	0	0	0	0	0	0	170	
388	110-021-23	0.14	32646100	2040	Vacant		0	0	2	0	0	0	0	0	270	
389	023-147-25	0.07	32662100	2040	Vacant		0	1	0	0	0	0	0	0	170	
390	024-123-09	0.18	32670200	2040	Vacant		0	0	4	0	0	0	0	0	540	
391	024-123-08	0.27	32670200	2040	Vacant		0	0	7	0	0	0	0	0	945	
392	023-124-28	0.07	32662100	2040	Vacant		0	1	0	0	0	0	0	0	170	
393	023-124-30	0.07	32662100	2040	Vacant		0	1	0	0	0	0	0	0	170	
394	023-124-31	0.07	32662100	2040	Vacant		0	1	0	0	0	0	0	0	170	

Notes:

1. Assume contribution is the same as hotel.
2. Retail unit flow = 200 gpd / 1,000-sf.
3. Add 9 classrooms + 1,550-sf to an existing multi-purpose room @ 100 gpd / 1,000-sf. 9 classroom x 8 students per room = 72 students @ 15 gpd/student.
4. Capacity is proposed to increase from the current 2,800 tons per day (TPD) to 4,000 TPD. Scale existing contribution to estimate future.



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Feet

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Sewer Master Plan Update

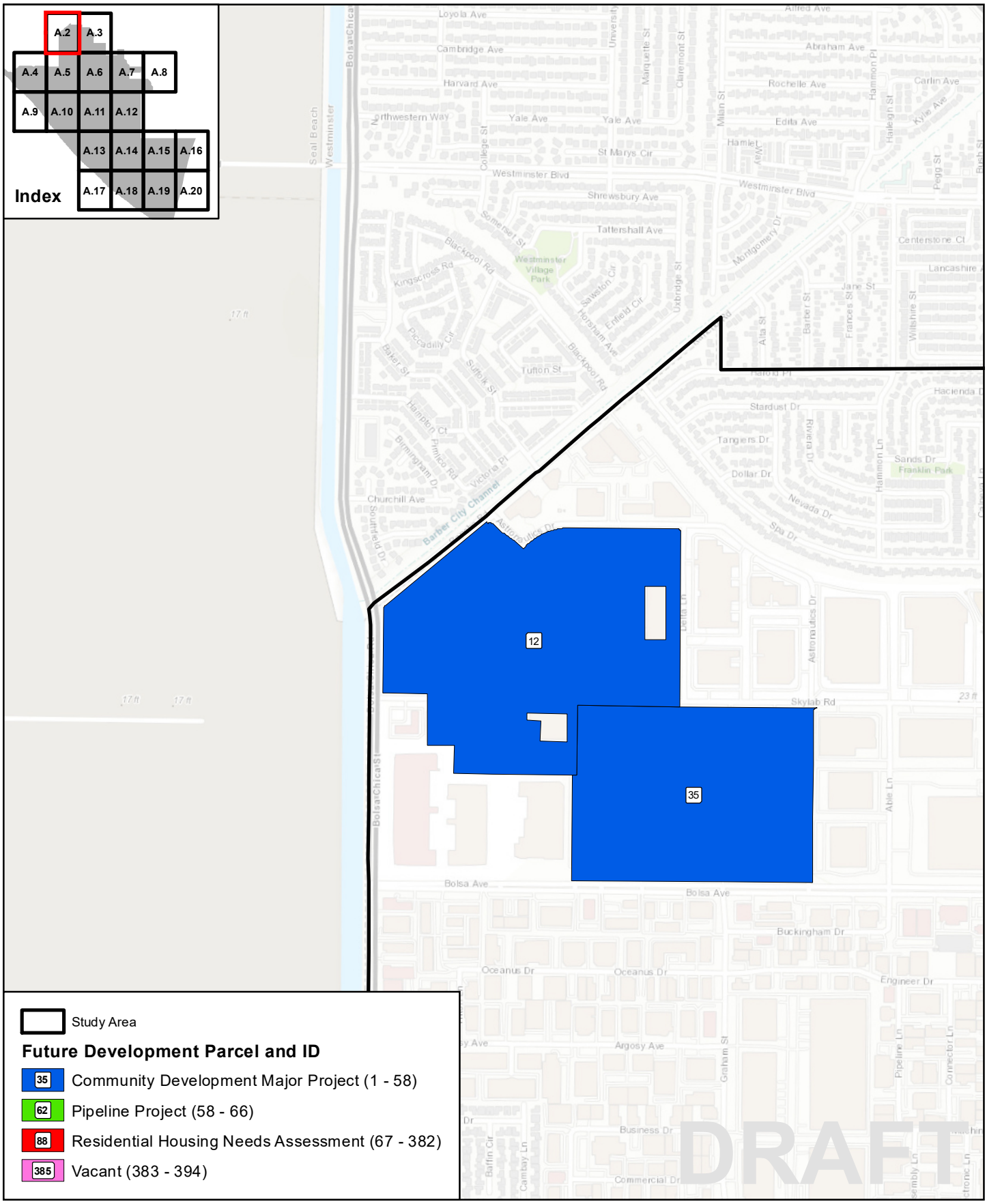
Location and Category of Future Development Parcels Overview

Project No. 12585300
Revision No. 0
Date 3/22/2024

FIGURE A.1

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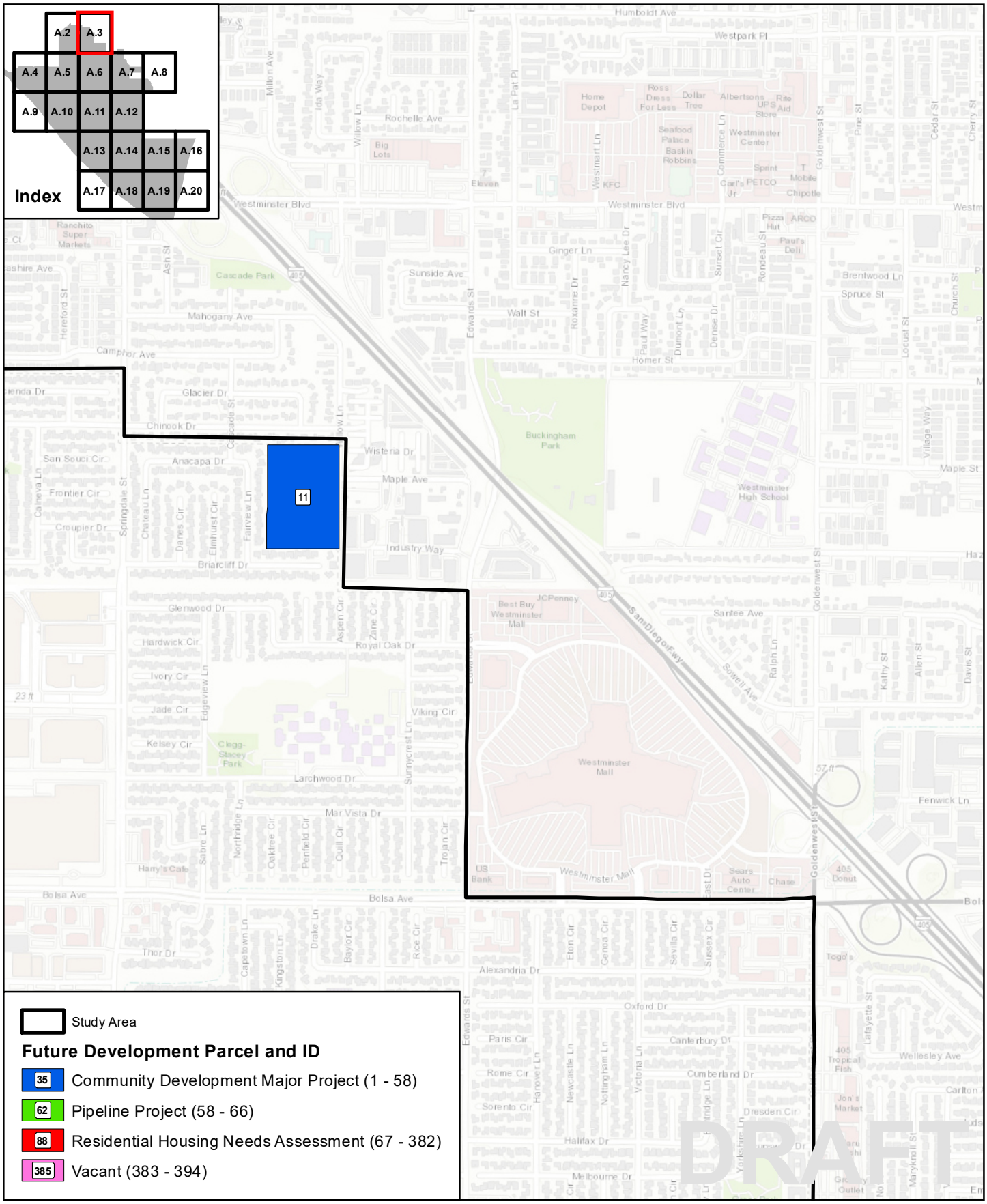
Project No. 12585300
Revision No. 0
Date 3/22/2024

Map 1 - Location and Category of Future Development Parcels

FIGURE A.2

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.2_3_6_9_10_11_15_17_18 Future Development Parcels.mxd
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Map Projection: Lambert Conformal Conic
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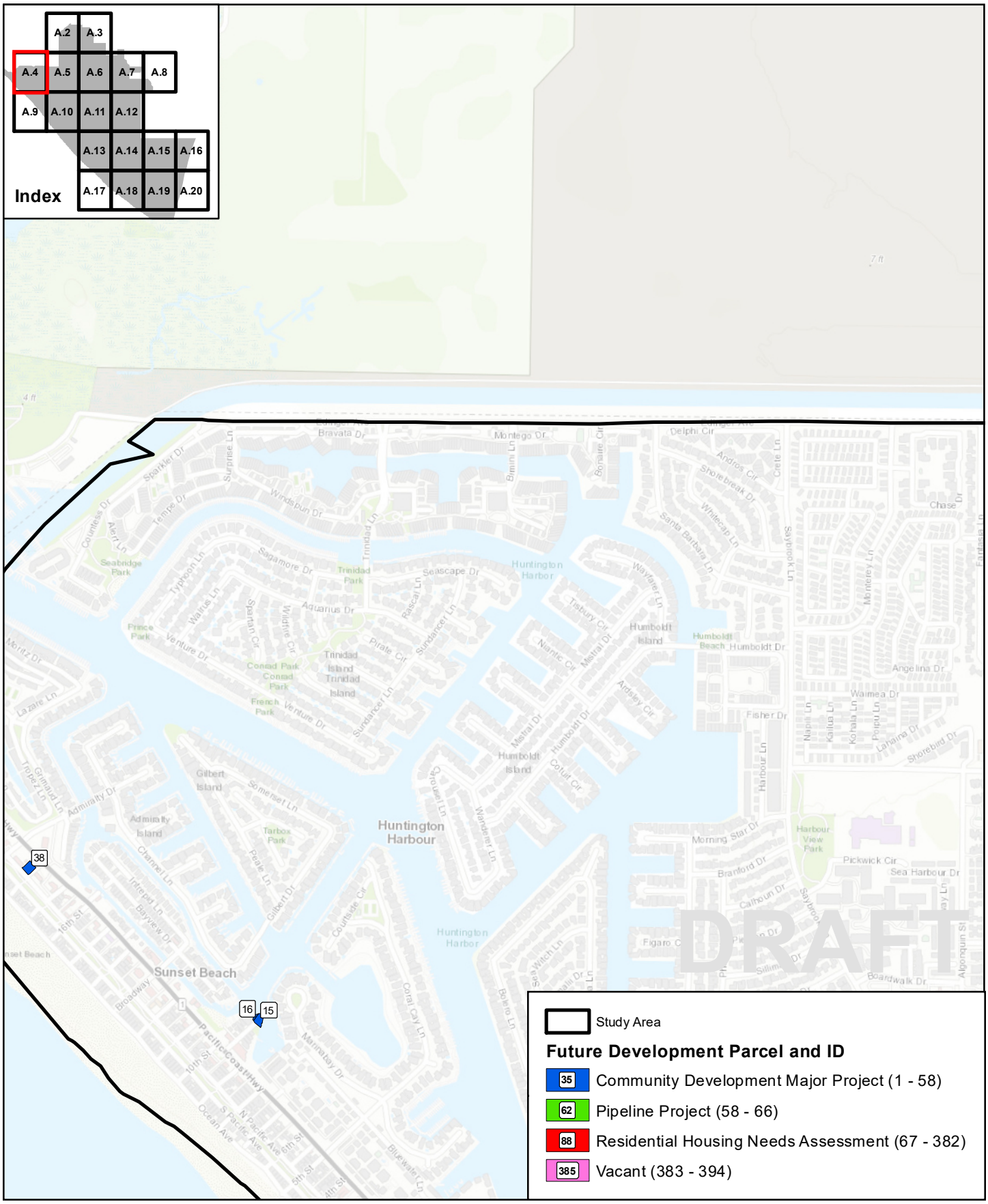
Project No. **12585300**
Revision No. **0**
Date **3/22/2024**

Map 2 - Location and Category of Future Development Parcels

FIGURE A.3

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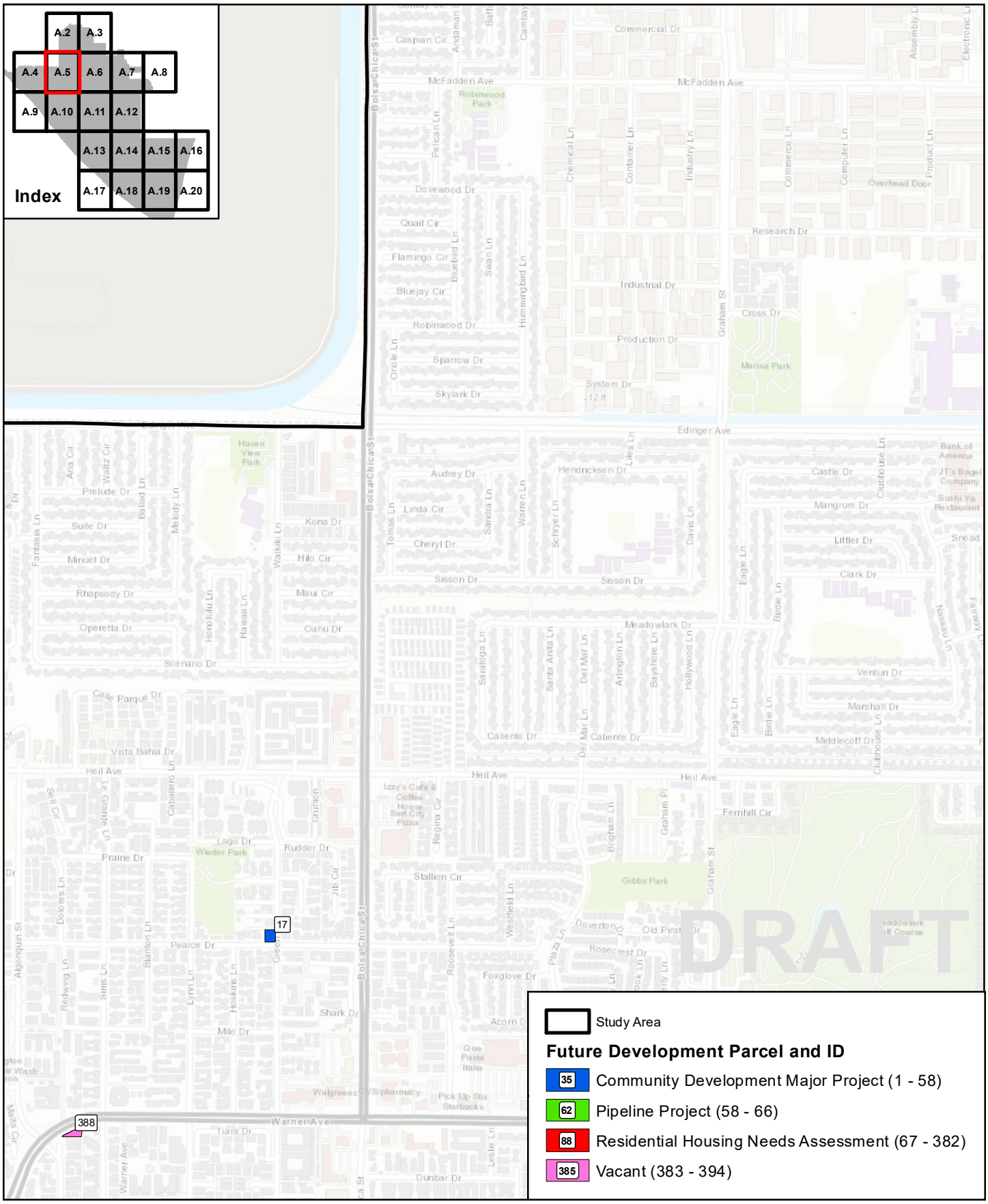
Project No. 12585300
Revision No. 0
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Map 3 - Location and Category of Future Development Parcels

FIGURE A.4

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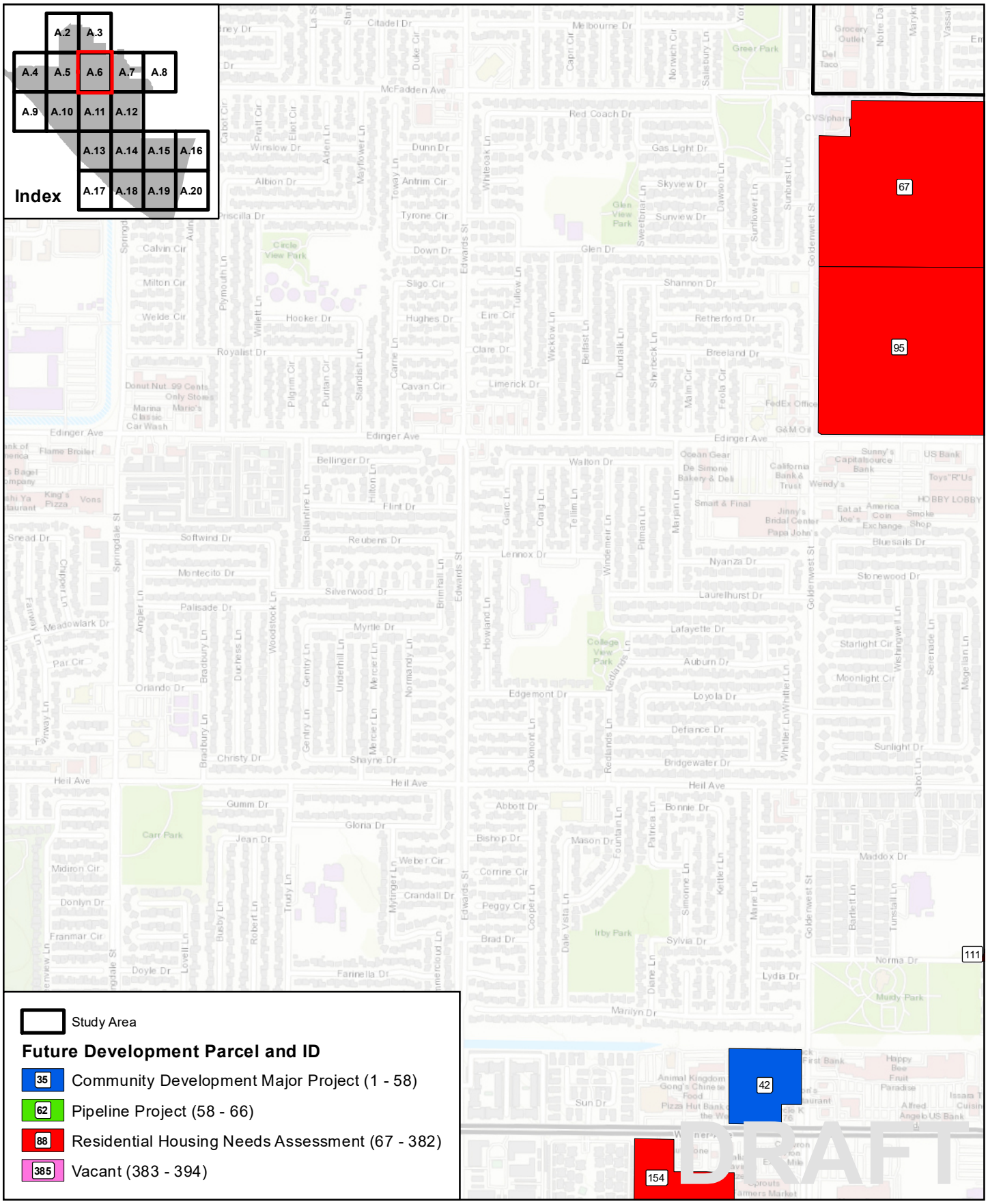
Project No. **12585300**
Revision No. **0**
Date **3/22/2024**

Map 4 - Location and Category of Future Development Parcels

FIGURE A.5

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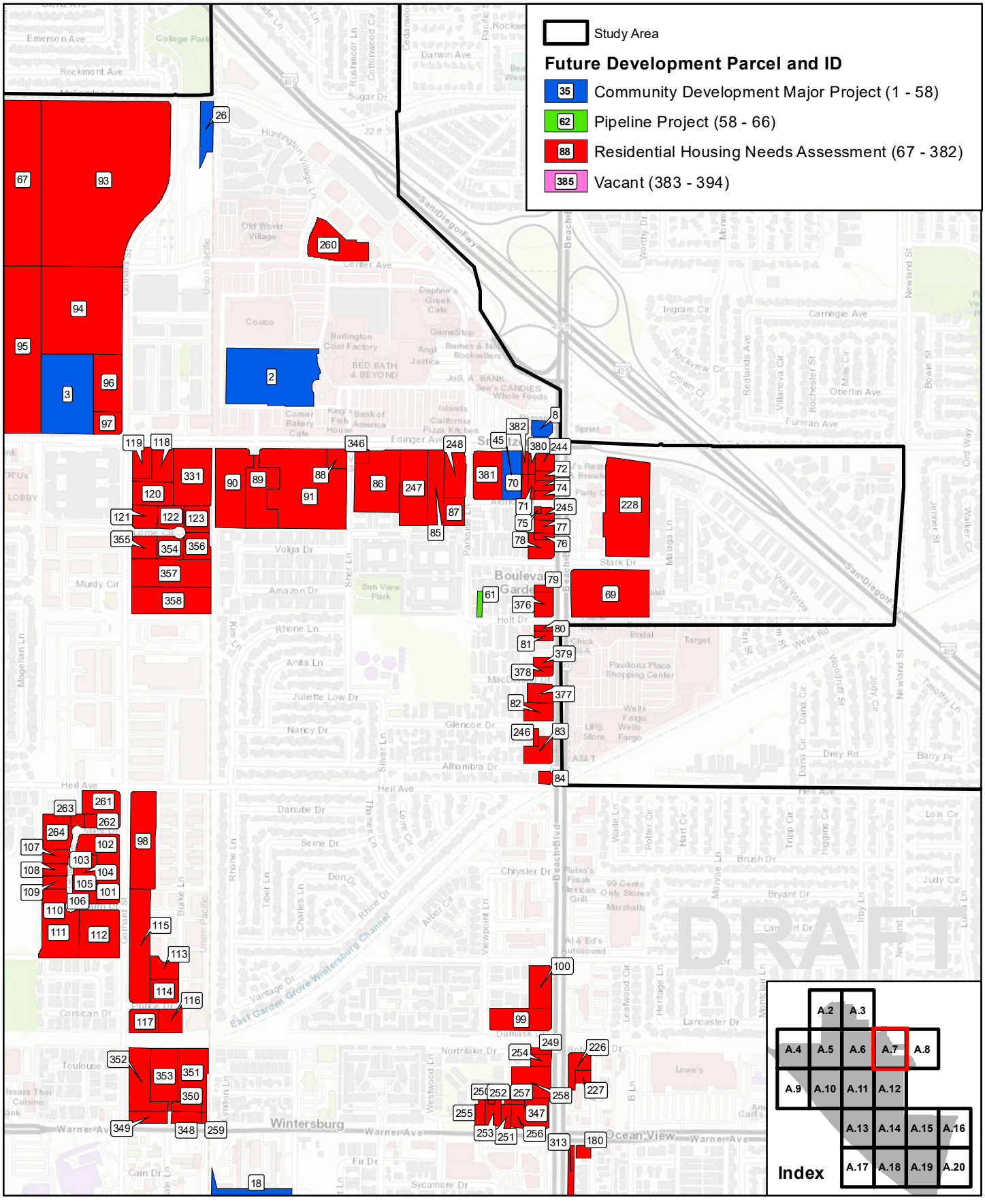
Project No. **12585300**
Revision No. **0**
Date **3/22/2024**

Map 5 - Location and Category of Future Development Parcels

FIGURE A.6

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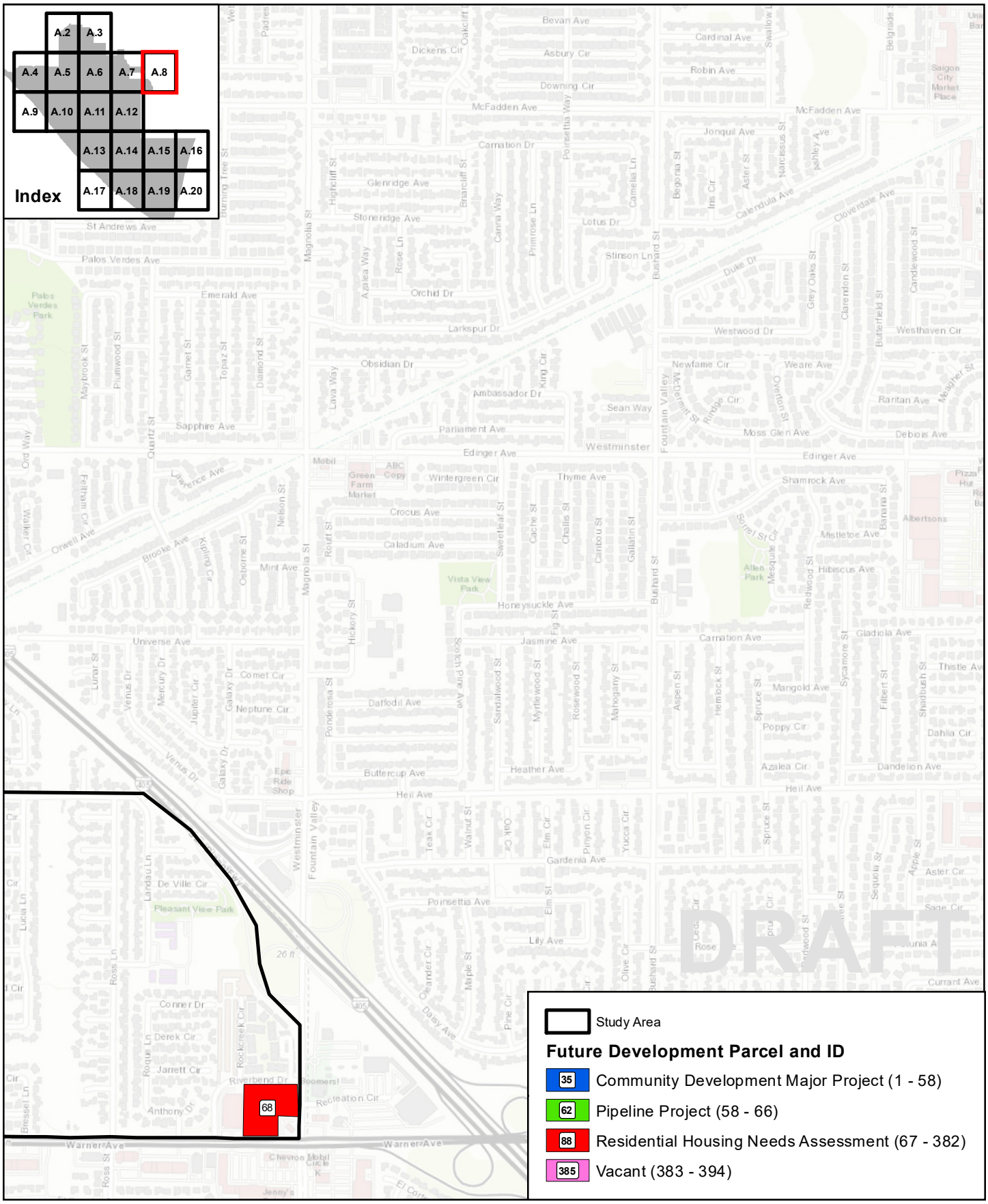
Project No. 12585300
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Date 3/22/2024

Map 6 - Location and Category of Future Development Parcels

FIGURE A.7

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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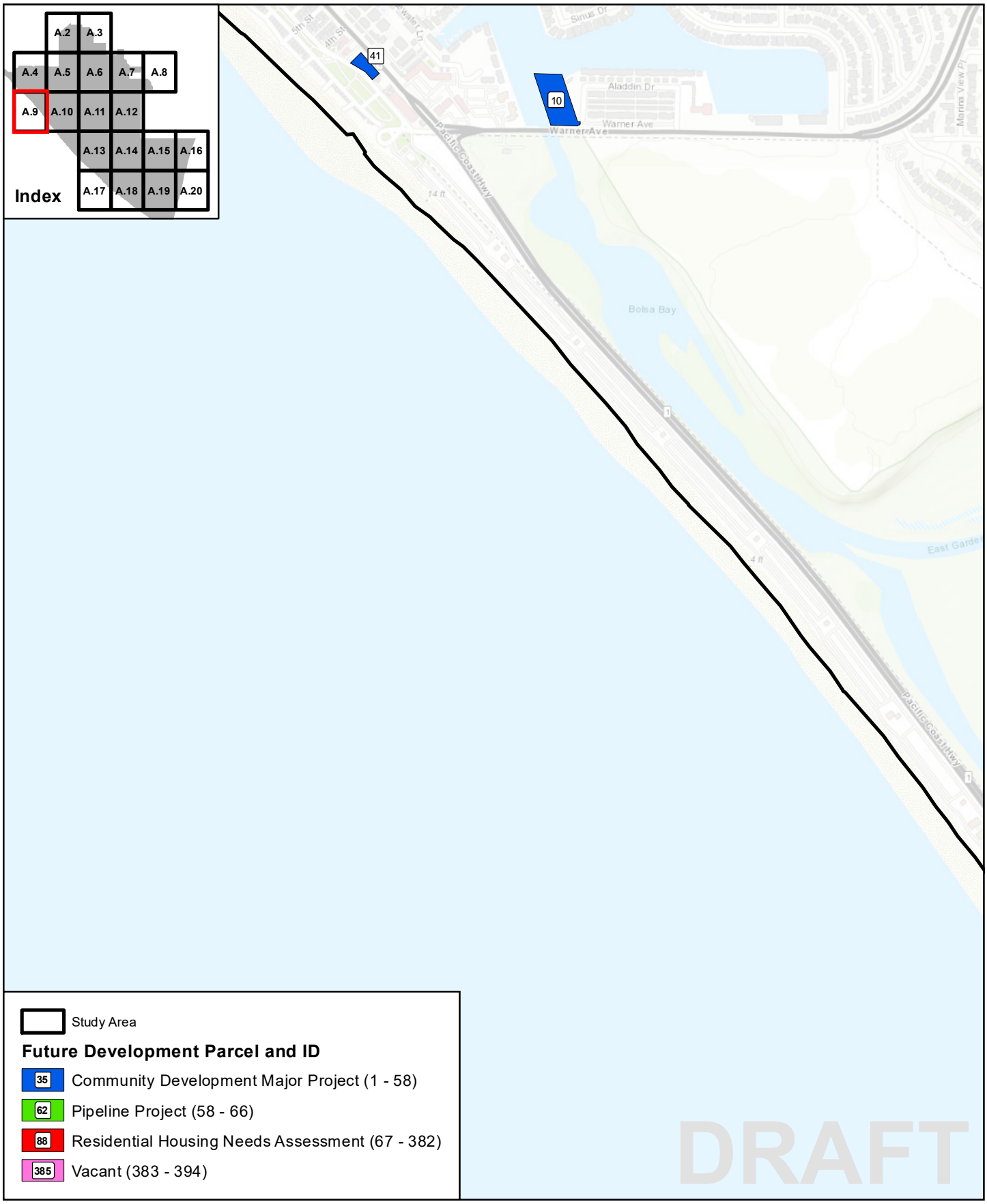
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Revision No. **0**
Date **3/22/2024**

Map 7 - Location and Category of Future Development Parcels

FIGURE A.8

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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



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Feet

Map Projection: Lambert Conformal Conic
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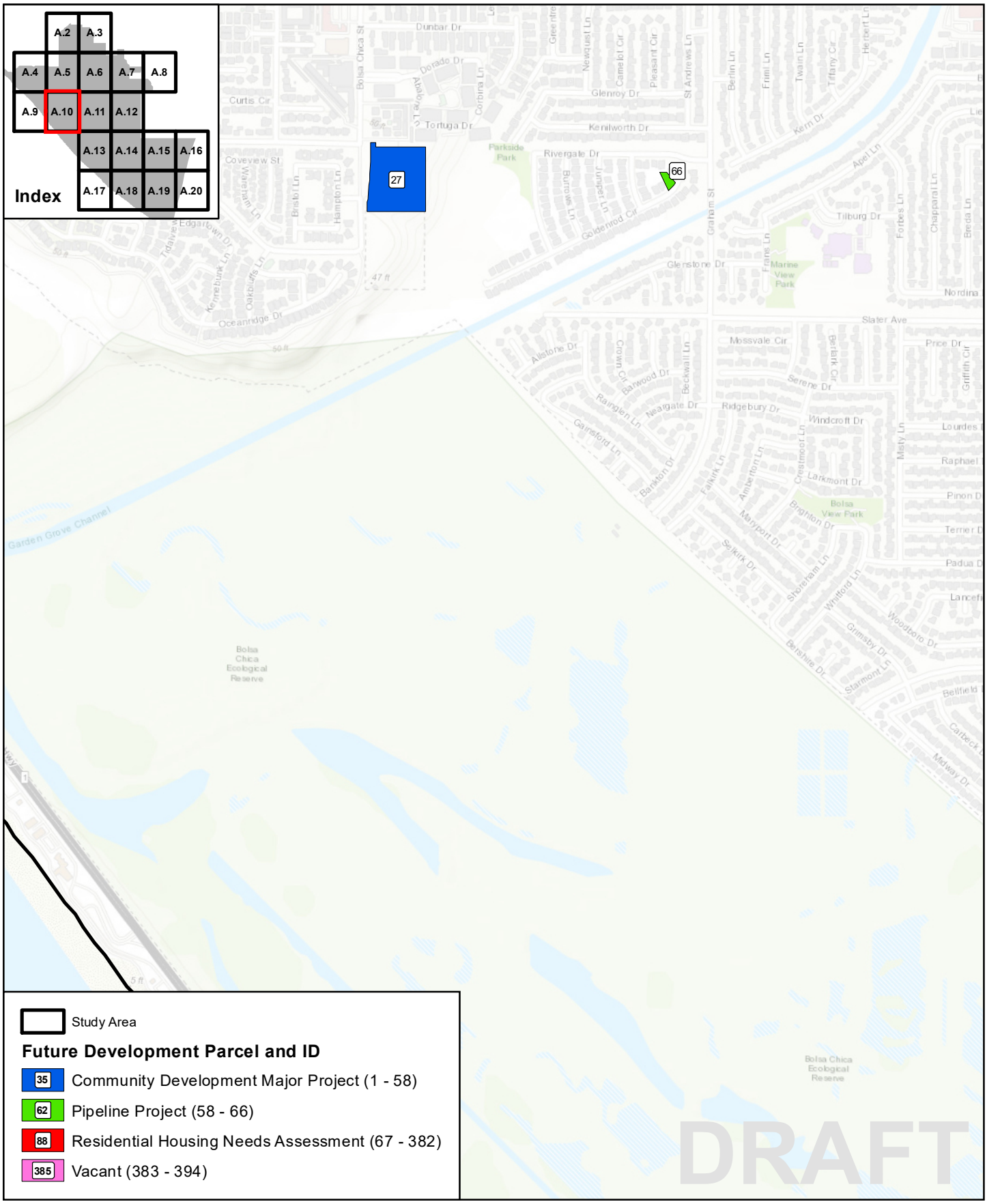
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Map 8 - Location and Category of Future Development Parcels

FIGURE A.9

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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

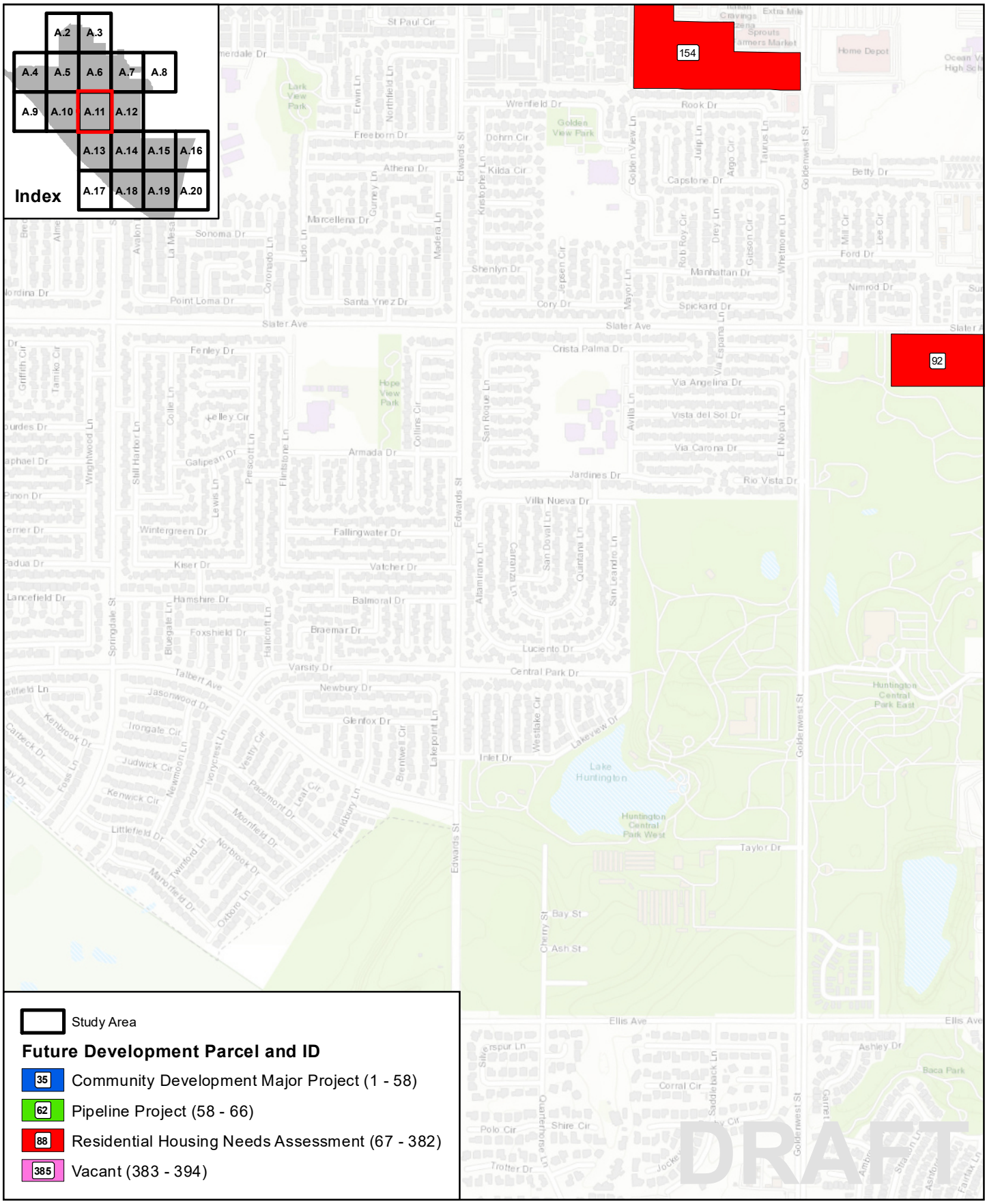
Project No. 12585300
Revision No. 0
Date 3/22/2024

Map 9 - Location and Category of Future Development Parcels

FIGURE A.10

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.2_3_6_9_10_11_15_17_18 Future Development Parcels.mxd
Print date: 22 Mar 2024 - 19:47

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

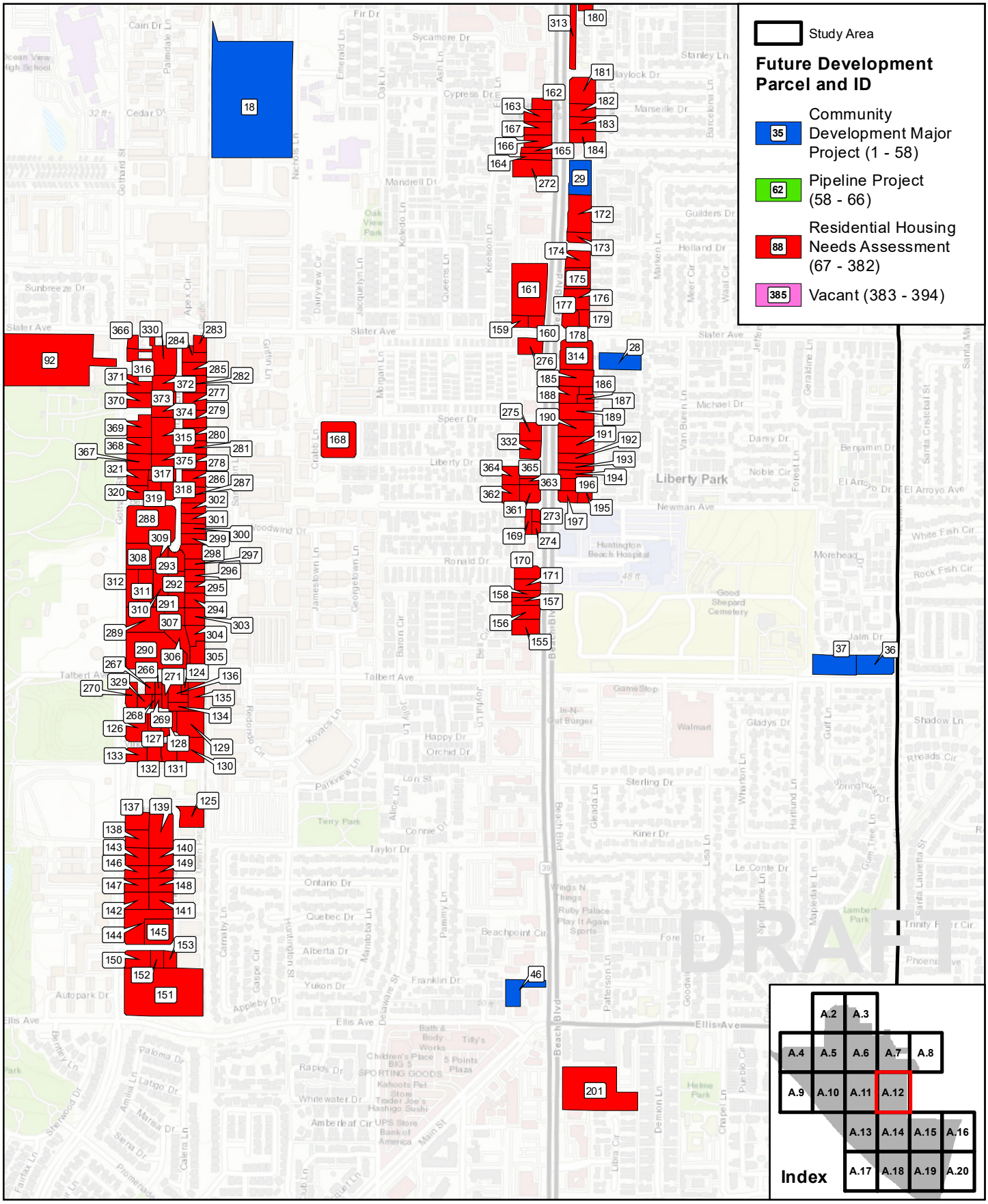
Project No. **12585300**
Revision No. **0**
Date **3/22/2024**

Map 10 - Location and Category of Future Development Parcels

FIGURE A.11

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.2_3_6_9_10_11_15_17_18 Future Development Parcels.mxd
Print date: 22 Mar 2024 - 19:47

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

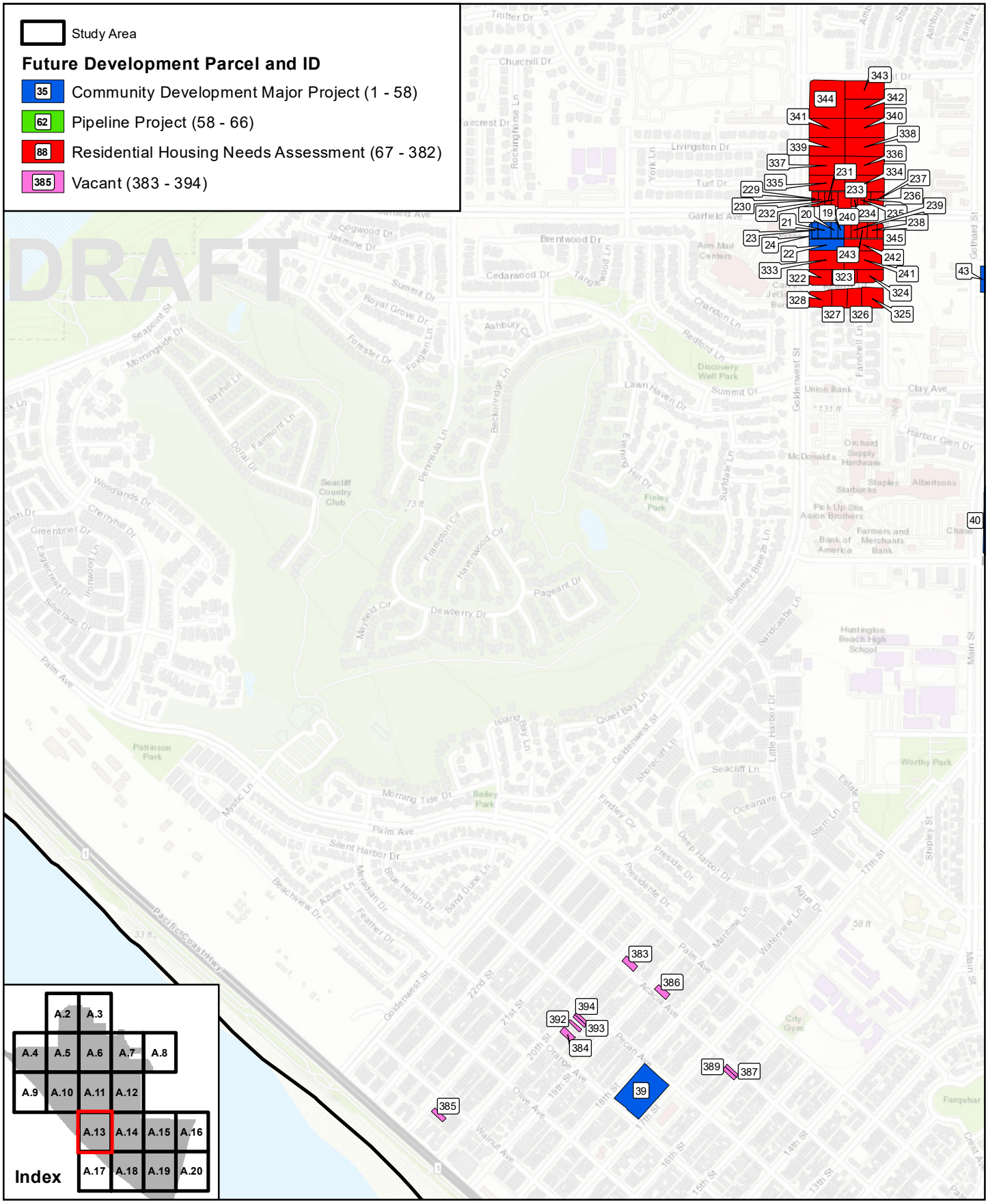
Project No. 12585300
Revision No. 0
Date 3/22/2024

Map 11 - Location and Category of Future Development Parcels

FIGURE A.12

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft90%\Appendix A\Figure A.12 Future Development Parcels.mxd
Print date: 22 Mar 2024 - 19:43

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

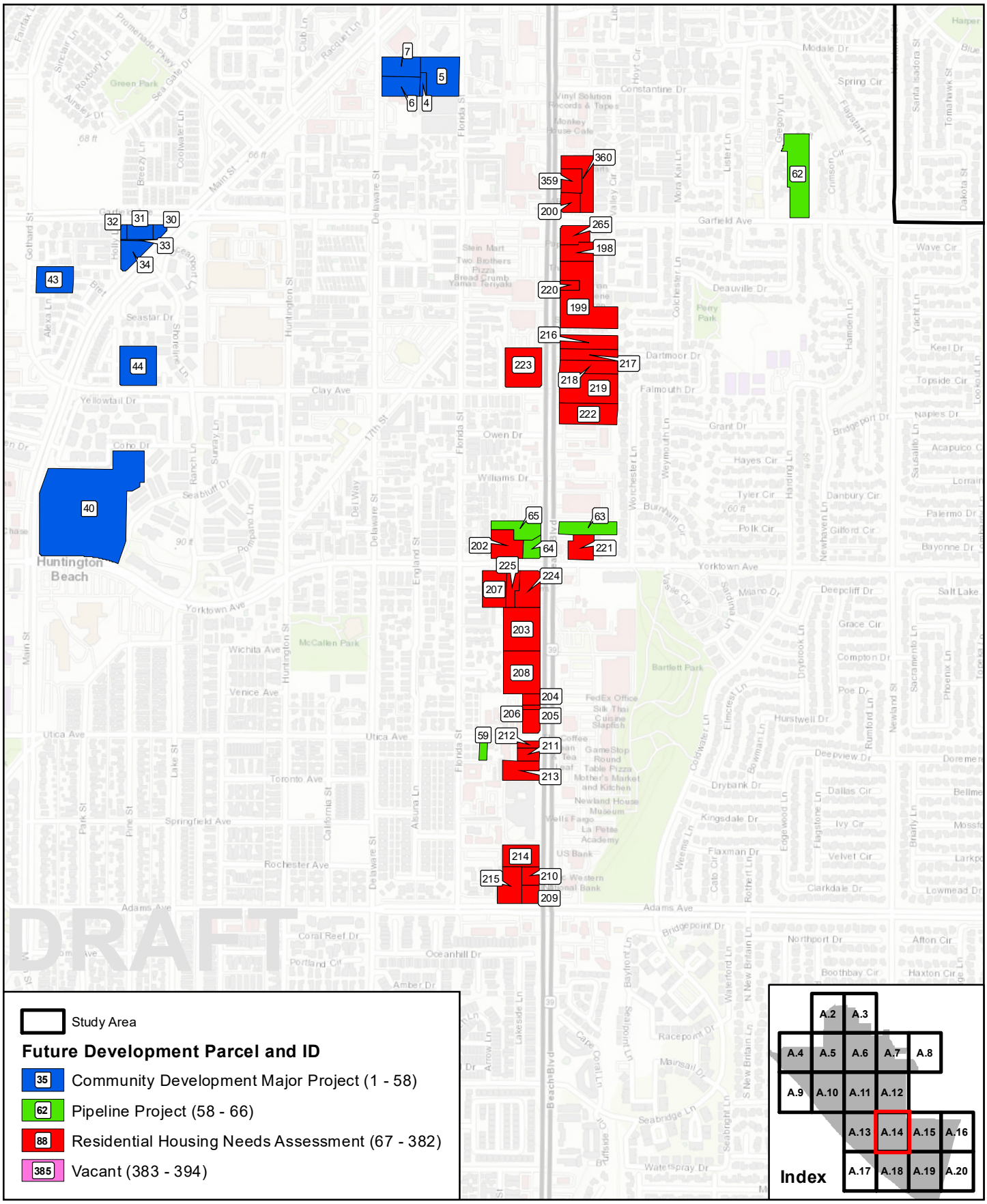
Project No. **12585300**
Revision No. **0**
Date **3/22/2024**

Map 12 - Location and Category of Future Development Parcels

FIGURE A.13

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.13 Future Development Parcels.mxd
Print date: 22 Mar 2024 - 18:30

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

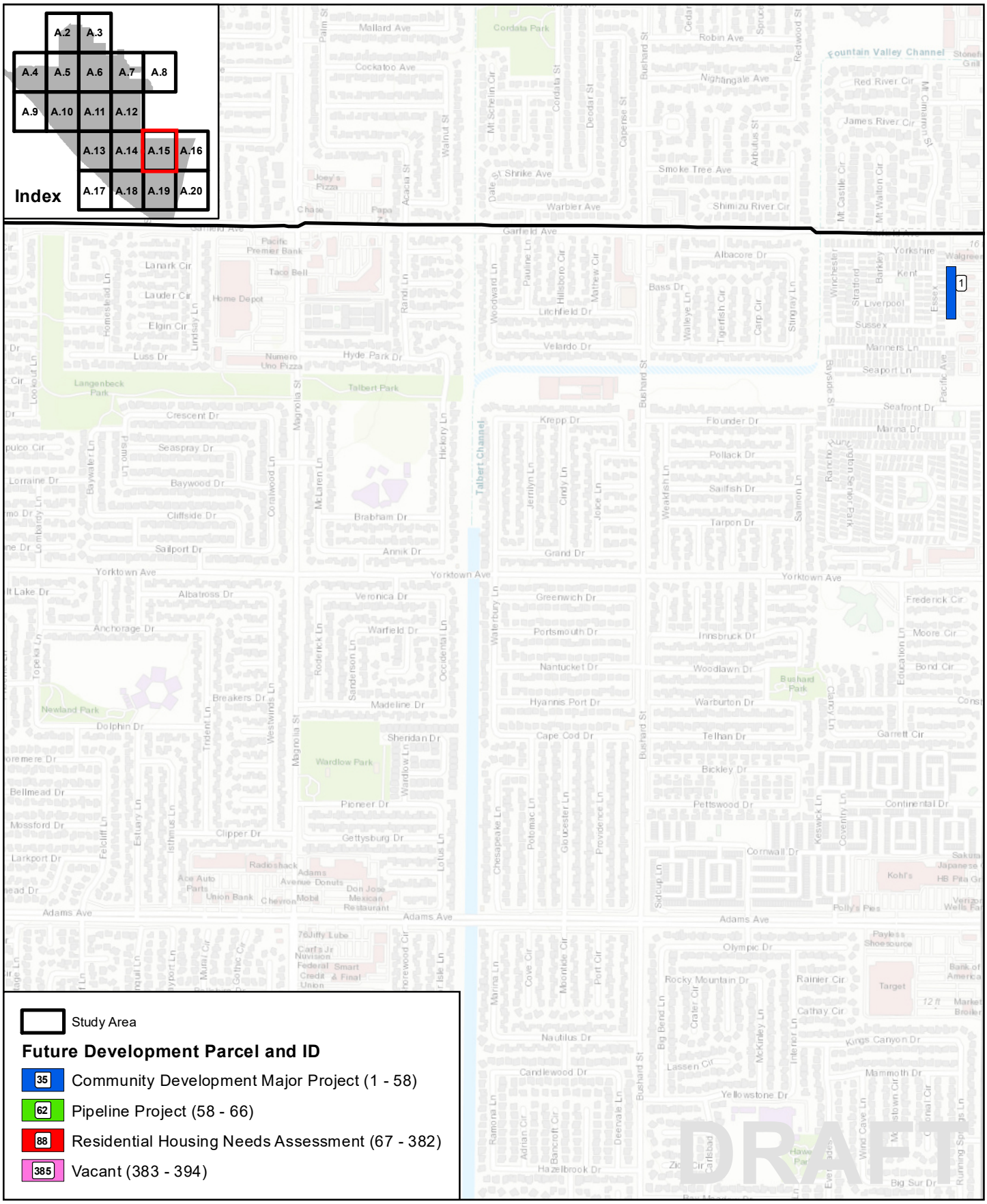
Project No. 12585300
Revision No. 0
Date 3/25/2024

Map 13 - Location and Category of Future Development Parcels

FIGURE A.14

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.14_20 Future Development Parcels.mxd
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Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

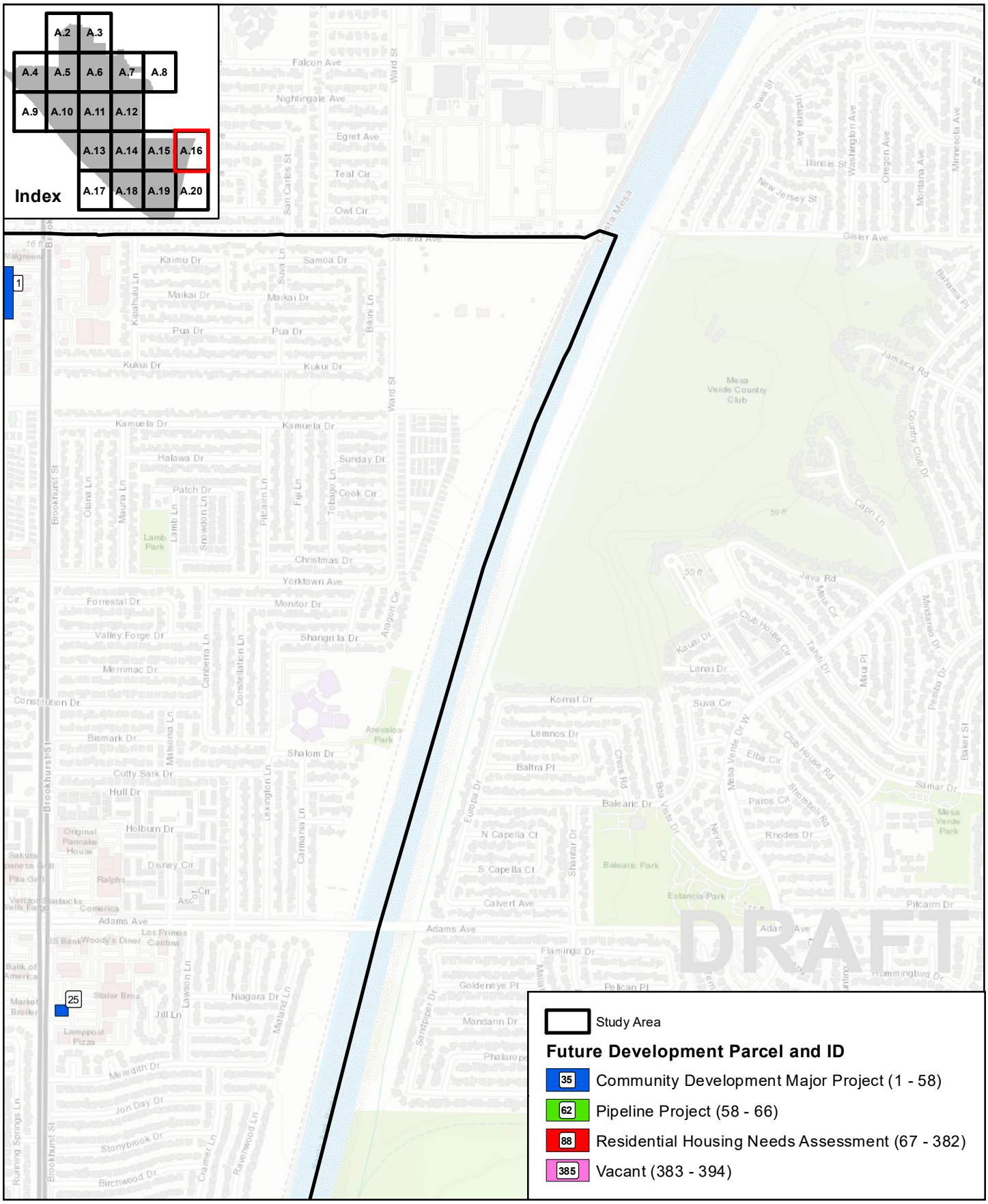
Project No. **12585300**
Revision No. **0**
Date **3/22/2024**

Map 14 - Location and Category of Future Development Parcels

FIGURE A.15

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.2_3_6_9_10_11_15_17_18 Future Development Parcels.mxd
Print date: 22 Mar 2024 - 19:47

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

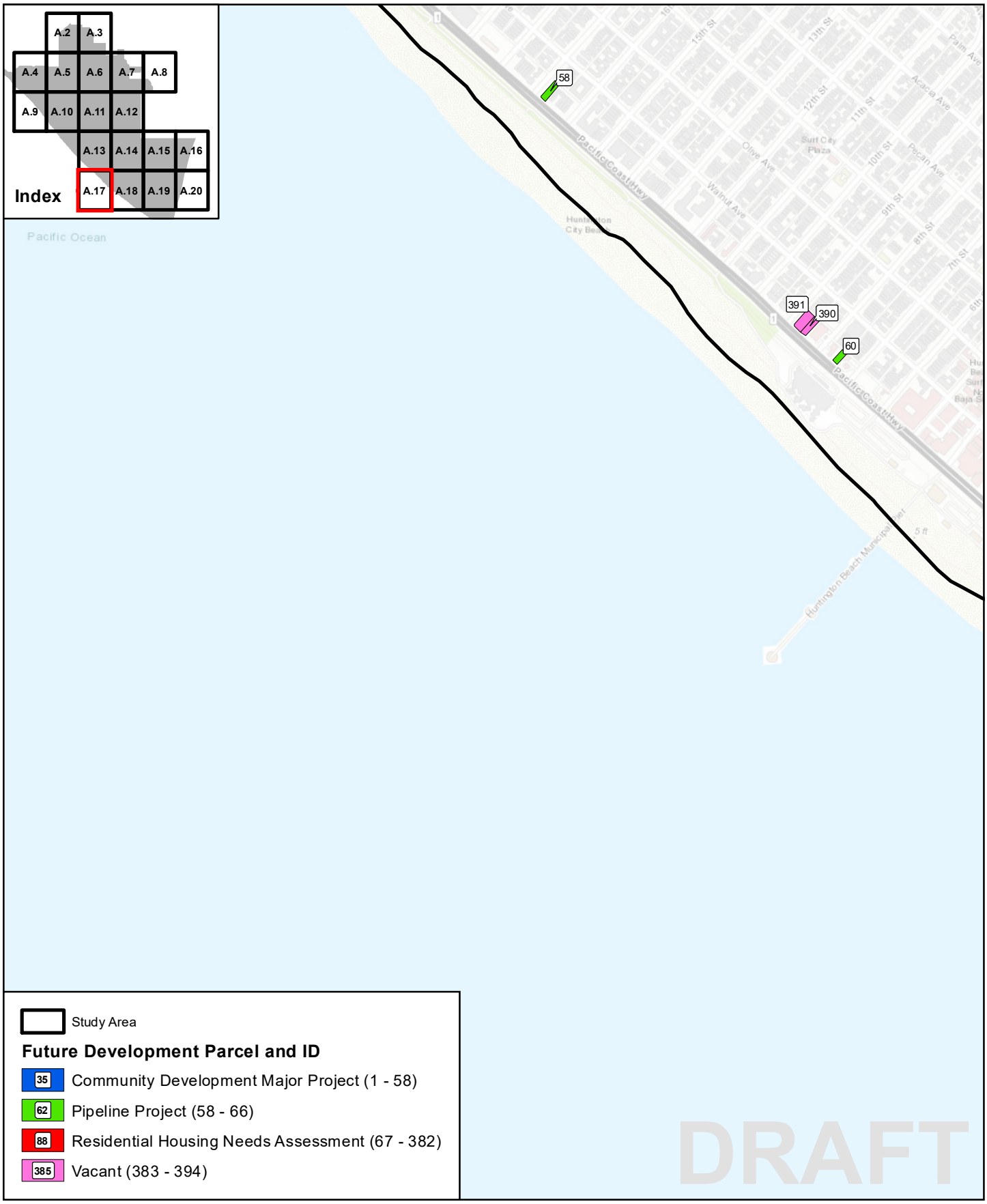
Project No. **12585300**
Revision No. **0**
Date **3/22/2024**

Map 15 - Location and Category of Future Development Parcels

FIGURE A.16

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.4_5_8_16_19 Future Development Parcels.mxd
Print date: 22 Mar 2024 - 19:48

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

0 250 500 750 1,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

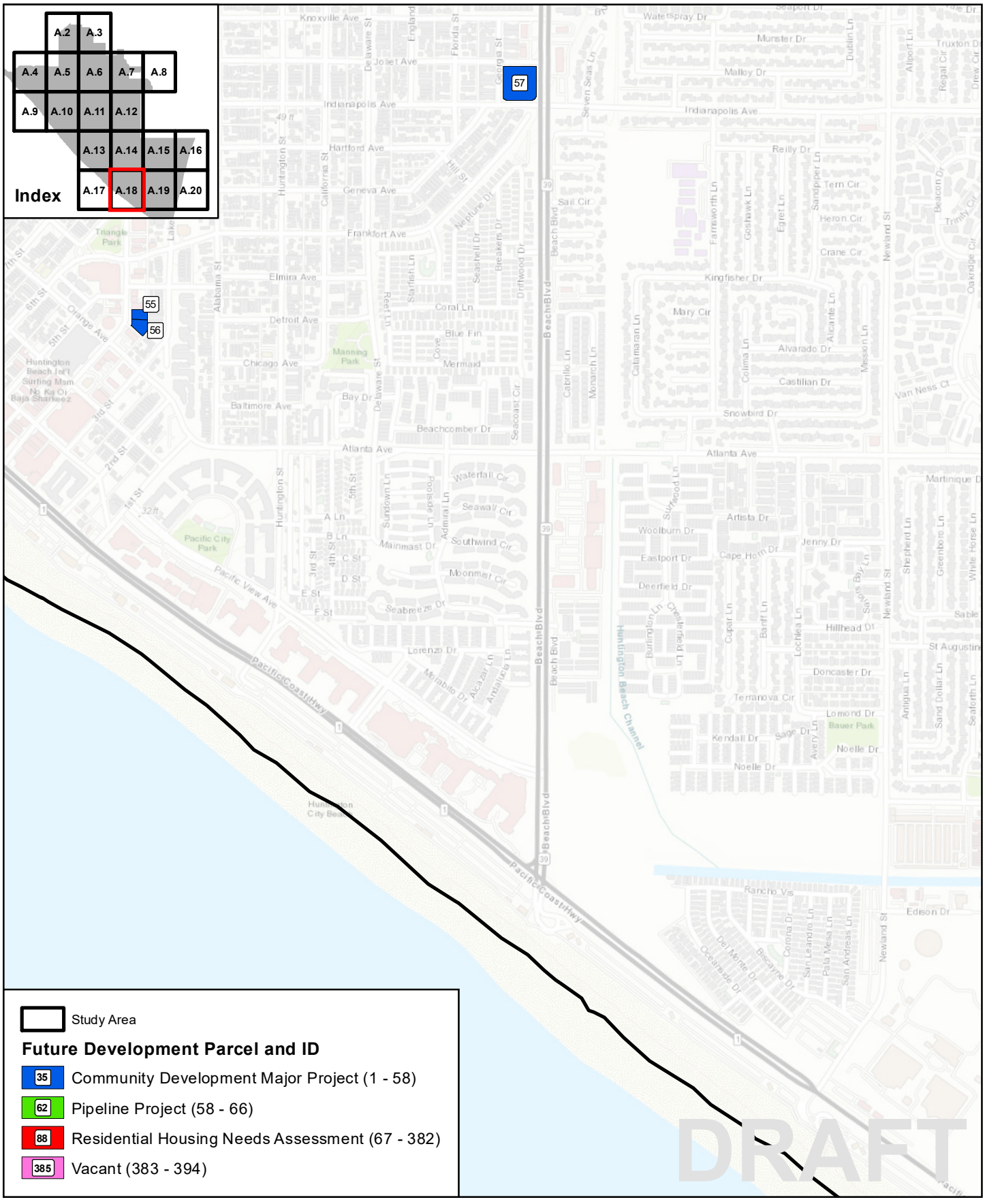
Project No. 12585300
Revision No. 0
Date 3/22/2024

Map 16 - Location and Category of Future Development Parcels

FIGURE A.17

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.2_3_6_9_10_11_15_17_18 Future Development Parcels.mxd
Print date: 22 Mar 2024 - 19:48

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

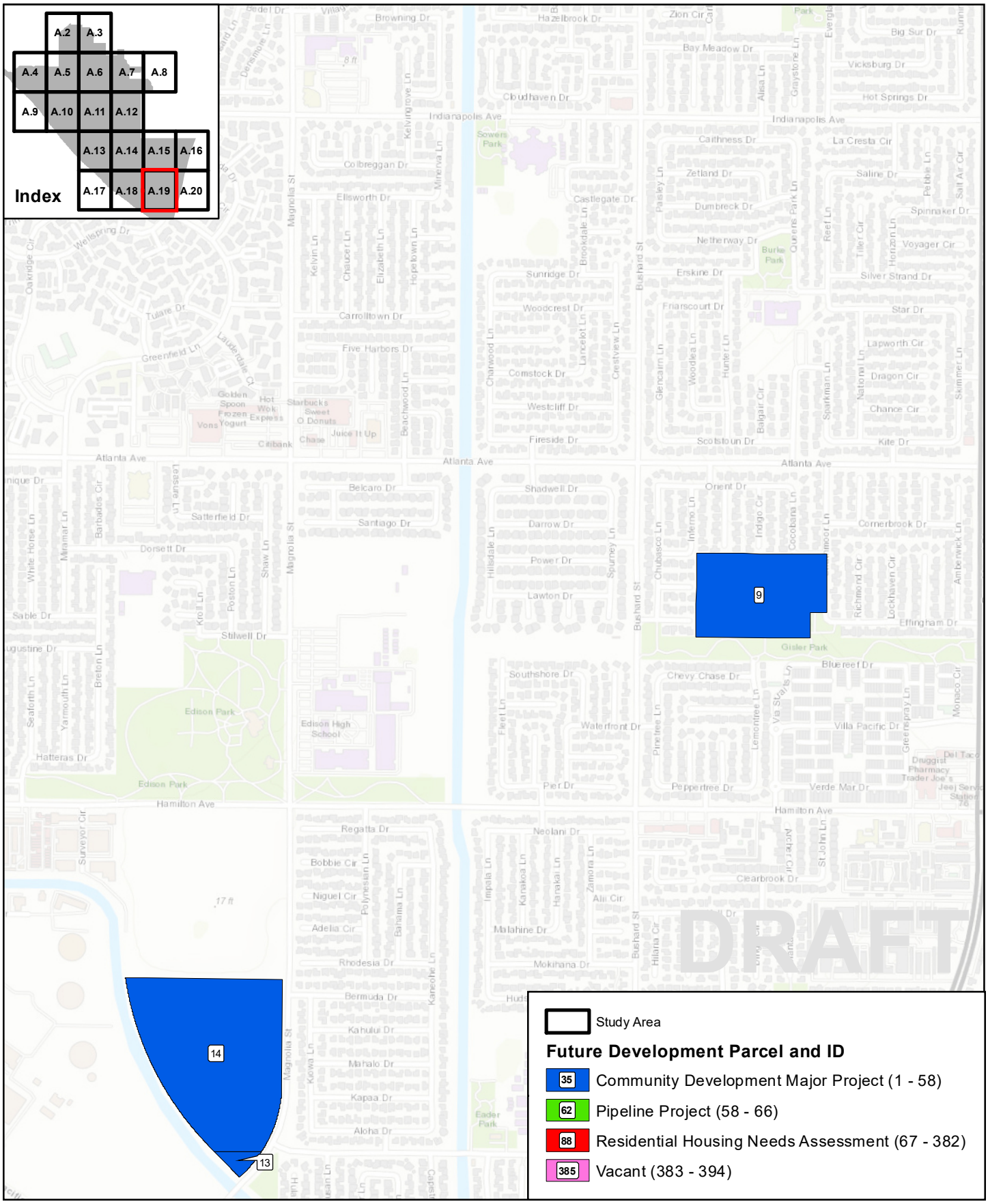
Project No. 12585300
Revision No. 0
Date 3/22/2024

Map 17 - Location and Category of Future Development Parcels

FIGURE A.18

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft90%\Appendix A\Figure A.2_3_6_9_10_11_15_17_18 Future Development Parcels.mxd
Print date: 22 Mar 2024 - 19:48

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

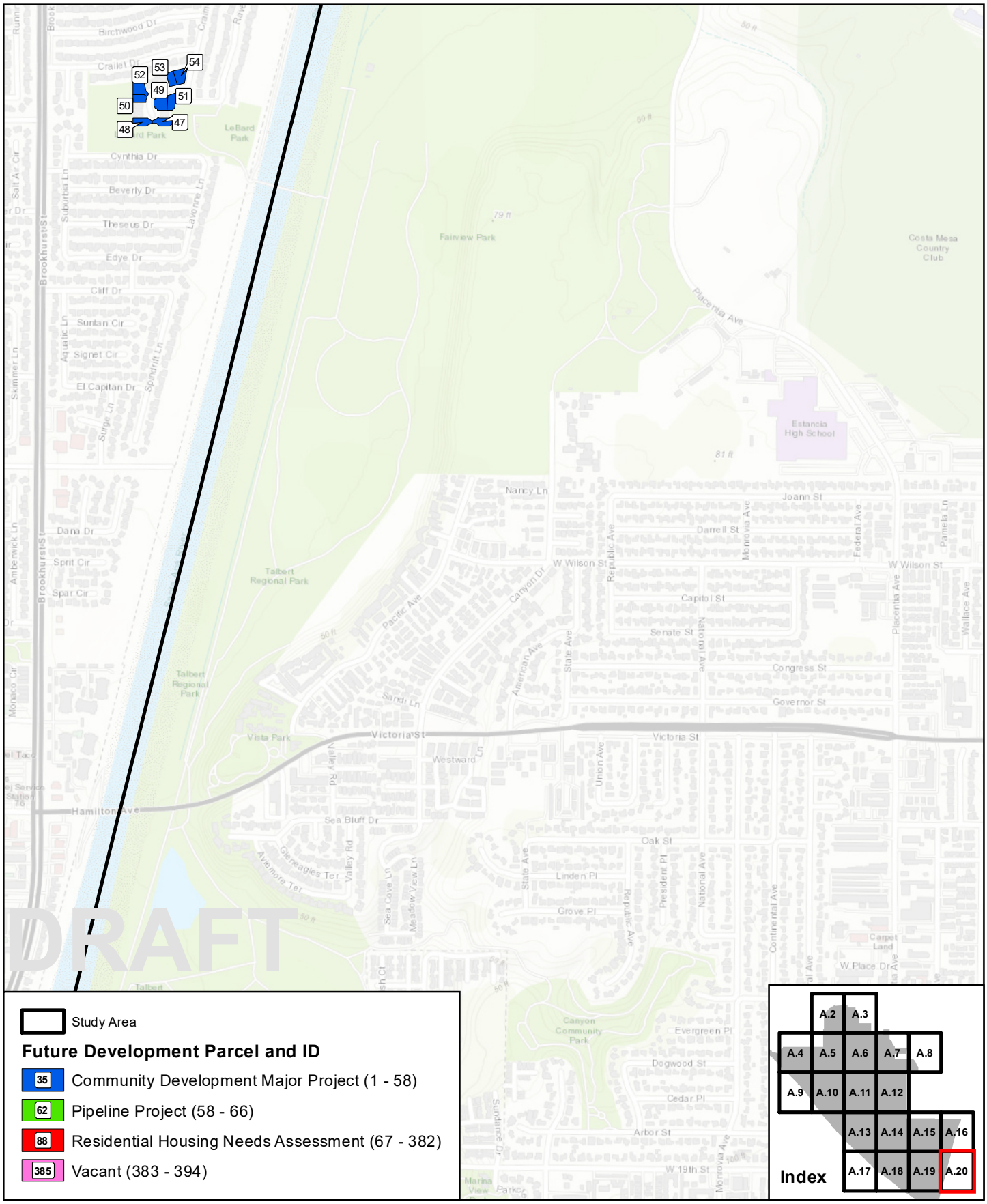
Project No. **12585300**
Revision No. **0**
Date **3/22/2024**

Map 18 - Location and Category of Future Development Parcels

FIGURE A.19

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.4_5_8_16_19 Future Development Parcels.mxd
Print date: 22 Mar 2024 - 19:48

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



Paper Size ANSI A

0 250 500 750 1,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Project No. 12585300
Revision No. 0
Date 3/25/2024

Map 19 - Location and Category of Future Development Parcels

FIGURE A.20

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.14_20 Future Development Parcels.mxd
Print date: 25 Mar 2024 - 08:50

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

Table A.2 TAZ Future Planning Details

TAZ Number	TAZ ID	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Non-Residential (Commercial and Industrial) Employees	Estimated Single-Family Residential Sewer Contribtuion (gpd)	Estimated Multi-Family Residential Sewer Contribtuion (gpd)	Estimated Non-Residential Sewer Contribtuion (gpd)	Estimated Total Sewer Contribtuion (gpd)	Note
1	32651200	0	8	7.0	0.0	1,080.0	91.0	1,171.0	1
2	32658100	0	4	0.0	0.0	540.0	0.0	540.0	0
3	32681100	0	0	-0.5	0.0	0.0	-6.5	-6.5	1
4	32689100	0	4	0.5	0.0	540.0	6.5	546.5	1
6	32658200	1	4	14.0	170.0	540.0	182.0	892.0	1
8	32652200	0	0	135.0	0.0	0.0	1,755.0	1,755.0	1
9	32656100	0	6	27.5	0.0	810.0	357.5	1,167.5	1
10	32664100	0	6	14.5	0.0	810.0	188.5	998.5	1
12	32652400	0	2	73.5	0.0	270.0	955.5	1,225.5	1
13	32656200	0	27	8.0	0.0	3,645.0	104.0	3,749.0	1
14	32664200	0	6	11.0	0.0	810.0	143.0	953.0	1
15	32664300	0	0	139.6	0.0	0.0	1,815.3	1,815.3	1
16	32682400	2	0	53.5	340.0	0.0	695.0	1,035.0	1
17	32641100	0	1	0.0	0.0	135.0	0.0	135.0	0
18	32642100	0	0	-0.5	0.0	0.0	-6.5	-6.5	1
21	32648100	1	5	4.0	170.0	675.0	52.0	897.0	1
22	32654100	1	4	9.0	170.0	540.0	117.0	827.0	1
23	32661100	1	4	6.0	170.0	540.0	78.0	788.0	1
24	32661200	1	4	-21.0	170.0	540.0	-273.0	437.0	1
25	32672100	0	0	39.5	0.0	0.0	513.5	513.5	1
26	32672200	3	0	0.0	510.0	0.0	0.0	510.0	0
27	32689200	1	40	10.0	85.0	5,400.0	130.0	5,615.0	1
28	32644200	1	0	0.0	170.0	0.0	0.0	170.0	0
29	32648200	1	5	-21.0	170.0	675.0	-273.0	572.0	1
30	32645200	1	3	32.5	170.0	405.0	422.5	997.5	1
31	32647100	0	0	8.5	0.0	0.0	110.5	110.5	1
32	32648300	2	6	17.5	340.0	810.0	227.5	1,377.5	1
33	32654200	0	3	16.0	0.0	405.0	208.0	613.0	1
34	32660100	2	7	6.0	340.0	945.0	78.0	1,363.0	1
35	32660200	1	5	9.0	170.0	675.0	117.0	962.0	1
36	32673100	1	0	81.0	170.0	0.0	1,053.0	1,223.0	1
37	32673200	0	5	-1.0	0.0	675.0	-13.0	662.0	1

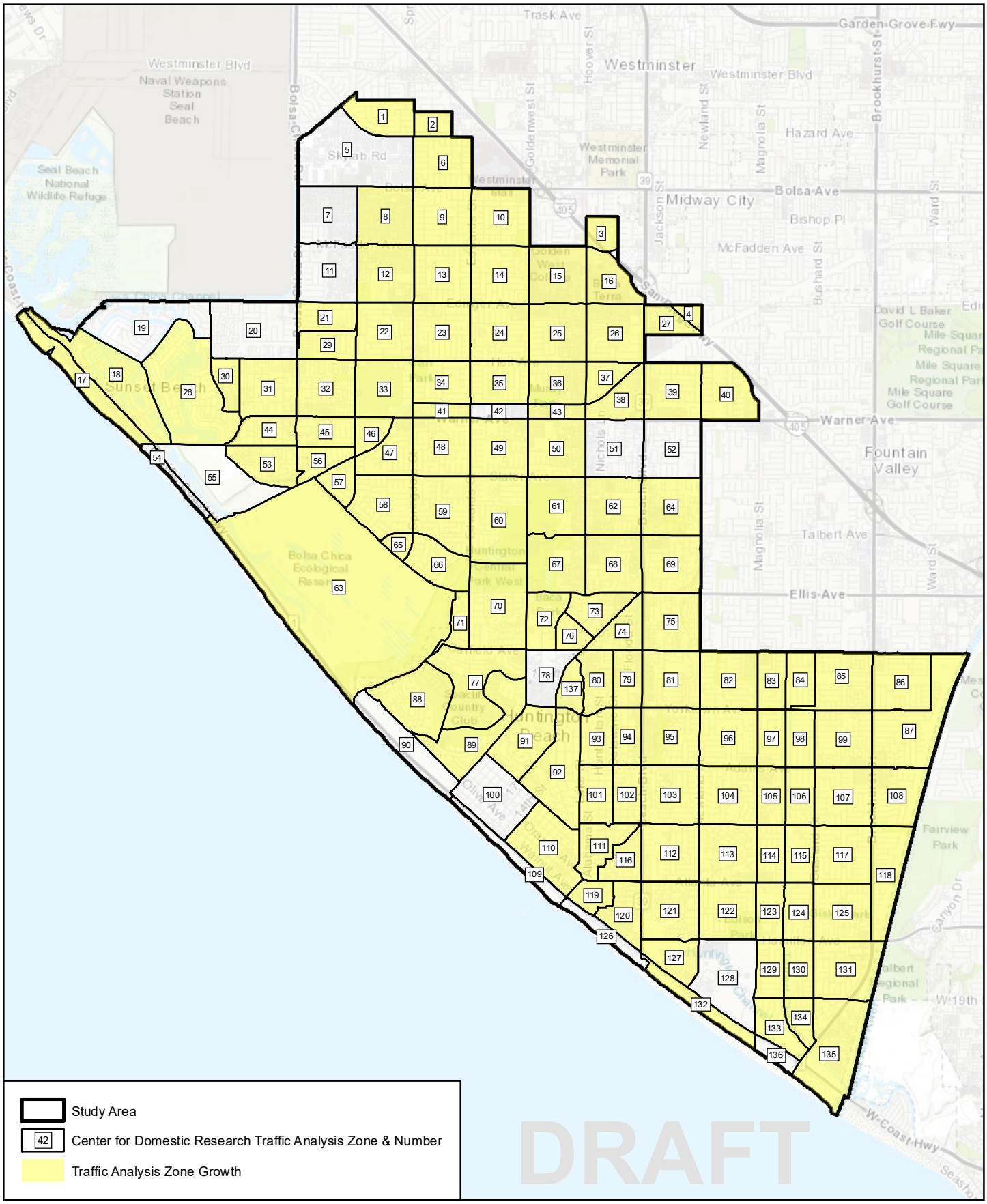
TAZ Number	TAZ ID	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Non-Residential (Commercial and Industrial) Employees	Estimated Single-Family Residential Sewer Contribtuion (gpd)	Estimated Multi-Family Residential Sewer Contribtuion (gpd)	Estimated Non-Residential Sewer Contribtuion (gpd)	Estimated Total Sewer Contribtuion (gpd)	Note
38	32673300	2	0	21.5	340.0	0.0	279.5	619.5	1
39	32690100	0	0	31.5	0.0	0.0	409.5	409.5	1
40	32690200	0	0	11.5	0.0	0.0	149.5	149.5	1
41	32660300	0	0	-5.0	0.0	0.0	-65.0	-65.0	1
43	32673400	0	0	15.0	0.0	0.0	195.0	195.0	1
44	32646100	0	0	5.0	0.0	0.0	65.0	65.0	1
45	32646200	2	5	6.5	340.0	675.0	84.5	1,099.5	1
46	32646300	0	5	-1.0	0.0	675.0	-13.0	662.0	1
47	32649100	1	6	5.5	170.0	810.0	71.5	1,051.5	1
48	32657100	2	7	9.0	340.0	945.0	117.0	1,402.0	1
49	32665100	1	0	23.5	170.0	0.0	305.5	475.5	1
50	32674100	0	5	25.5	0.0	675.0	331.5	1,006.5	1
53	32646400	6	2	-1.5	1,020.0	270.0	-19.5	1,270.5	1
56	32646700	0	0	1.0	0.0	0.0	13.0	13.0	1
57	32649200	0	2	-1.0	0.0	270.0	-13.0	257.0	1
58	32649300	2	7	-5.0	340.0	945.0	-65.0	1,220.0	1
59	32657200	1	5	26.0	170.0	675.0	338.0	1,183.0	1
60	32665200	1	6	20.0	170.0	810.0	260.0	1,240.0	1
61	32674300	0	0	32.5	0.0	0.0	422.5	422.5	1
62	32674400	0	0	108.5	0.0	0.0	1,410.5	1,410.5	1
63	32649400	0	0	0.5	0.0	0.0	6.5	6.5	1
64	32685200	0	0	1.0	0.0	0.0	13.0	13.0	1
65	32649500	0	5	0.0	0.0	675.0	0.0	675.0	0
66	32649600	0	5	-10.0	0.0	675.0	-130.0	545.0	1
67	32666100	0	0	30.5	0.0	0.0	396.5	396.5	1
68	32675100	3	152	81.0	510.0	20,520.0	1,053.0	22,083.0	1
69	32684100	0	6	12.0	0.0	810.0	156.0	966.0	1
70	32666200	0	4	8.0	0.0	540.0	104.0	644.0	1
71	32649700	0	2	-1.0	0.0	270.0	-13.0	257.0	1
72	32666300	0	0	7.5	0.0	0.0	97.5	97.5	1
73	32675200	0	6	23.0	0.0	810.0	299.0	1,109.0	1
74	32675300	0	0	38.5	0.0	0.0	500.5	500.5	1
75	32684200	0	0	-9.0	0.0	0.0	-117.0	-117.0	1

TAZ Number	TAZ ID	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Non-Residential (Commercial and Industrial) Employees	Estimated Single-Family Residential Sewer Contribtuion (gpd)	Estimated Multi-Family Residential Sewer Contribtuion (gpd)	Estimated Non-Residential Sewer Contribtuion (gpd)	Estimated Total Sewer Contribtuion (gpd)	Note
76	32675400	0	3	-1.5	0.0	405.0	-19.5	385.5	1
77	32659100	0	3	7.0	0.0	405.0	91.0	496.0	1
79	32678100	3	0	16.0	510.0	0.0	208.0	718.0	1
80	32678200	0	0	17.5	0.0	0.0	227.5	227.5	1
81	32686100	2	0	26.0	340.0	0.0	338.0	678.0	1
82	32694100	4	3	40.0	680.0	405.0	520.0	1,605.0	1
83	32702100	0	4	7.5	0.0	540.0	97.5	637.5	1
84	32702200	0	3	0.5	0.0	405.0	6.5	411.5	1
85	32702300	0	3	-5.0	0.0	405.0	-65.0	340.0	1
86	32715100	2	5	8.0	340.0	675.0	104.0	1,119.0	1
87	32715200	4	5	13.0	680.0	675.0	169.0	1,524.0	1
88	32659200	0	0	12.5	0.0	0.0	162.5	162.5	1
89	32659300	0	3	-7.5	0.0	405.0	-97.5	307.5	1
91	32669200	4	3	45.0	680.0	405.0	585.0	1,670.0	1
92	32669300	0	18	119.5	0.0	2,430.0	1,553.5	3,983.5	1
93	32678300	5	3	-1.0	850.0	405.0	-13.0	1,242.0	1
94	32678400	2	0	44.0	340.0	0.0	572.0	912.0	1
95	32686200	4	0	-126.0	680.0	0.0	-1,638.0	-958.0	1
96	32694200	2	3	19.5	340.0	405.0	253.5	998.5	1
97	32703100	2	3	0.0	340.0	405.0	0.0	745.0	0
98	32703200	1	6	-2.5	170.0	810.0	-32.5	947.5	1
99	32703300	2	5	33.0	340.0	675.0	429.0	1,444.0	1
101	32677100	3	8	20.5	510.0	1,080.0	266.5	1,856.5	1
102	32677200	3	0	3.5	510.0	0.0	45.5	555.5	1
103	32687100	0	2	6.0	0.0	270.0	78.0	348.0	1
104	32693100	2	5	3.5	340.0	675.0	45.5	1,060.5	1
105	32700100	0	5	26.5	0.0	675.0	344.5	1,019.5	1
106	32700200	0	5	14.0	0.0	675.0	182.0	857.0	1
107	32709100	2	5	8.5	340.0	675.0	110.5	1,125.5	1
108	32711100	2	3	0.0	340.0	405.0	0.0	745.0	0
110	32670200	0	0	-3.5	0.0	0.0	-45.5	-45.5	1
111	32677300	0	24	0.0	0.0	3,240.0	0.0	3,240.0	0
112	32687200	0	2	13.0	0.0	270.0	169.0	439.0	1

TAZ Number	TAZ ID	Single-Family Residential (DUs)	Multi-Family Residential (DUs)	Non-Residential (Commercial and Industrial) Employees	Estimated Single-Family Residential Sewer Contribtuion (gpd)	Estimated Multi-Family Residential Sewer Contribtuion (gpd)	Estimated Non-Residential Sewer Contribtuion (gpd)	Estimated Total Sewer Contribtuion (gpd)	Note
113	32693200	0	3	-2.5	0.0	405.0	-32.5	372.5	1
114	32700300	0	5	4.5	0.0	675.0	58.5	733.5	1
115	32700400	0	5	11.0	0.0	675.0	143.0	818.0	1
116	32676100	0	2	-1.0	0.0	270.0	-13.0	257.0	1
117	32709200	4	6	-1.5	680.0	810.0	-19.5	1,470.5	1
118	32711200	0	7	22.5	0.0	945.0	292.5	1,237.5	1
119	32676200	0	0	122.0	0.0	0.0	1,586.0	1,586.0	1
120	32676300	0	0	53.5	0.0	0.0	695.5	695.5	1
121	32691100	0	0	-13.0	0.0	0.0	-169.0	-169.0	1
122	32691200	1	7	9.0	170.0	945.0	117.0	1,232.0	1
123	32701100	0	6	2.5	0.0	810.0	32.5	842.5	1
124	32701200	0	5	-2.5	0.0	675.0	-32.5	642.5	1
125	32705100	0	0	17.0	0.0	0.0	221.0	221.0	1
127	32691300	1	1	6.5	170.0	135.0	84.5	389.5	1
129	32701300	1	7	8.0	170.0	945.0	104.0	1,219.0	1
130	32701400	0	6	9.5	0.0	810.0	123.5	933.5	1
131	32705200	2	7	5.5	340.0	945.0	71.5	1,356.5	1
132	32691500	0	0	3.0	0.0	0.0	39.0	39.0	1
133	32701500	1	2	7.0	170.0	270.0	91.0	531.0	1
134	32701600	1	6	-146.0	170.0	810.0	-1,898.0	-918.0	1
135	32705300	0	5	35.5	0.0	675.0	461.5	1,136.5	1
137	32669400	0	166	17.0	0.0	22,410.0	221.0	22,631.0	1

Notes:

1. Non-residential unit flow = 13 gpd / employee (developed as part of Unit Flow Analysis, Section 5.5.1).



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

Traffic Analysis Zone
Future Development

Project No. **12585300**
Revision No. **0**
Date **3/25/2024**

FIGURE A.21

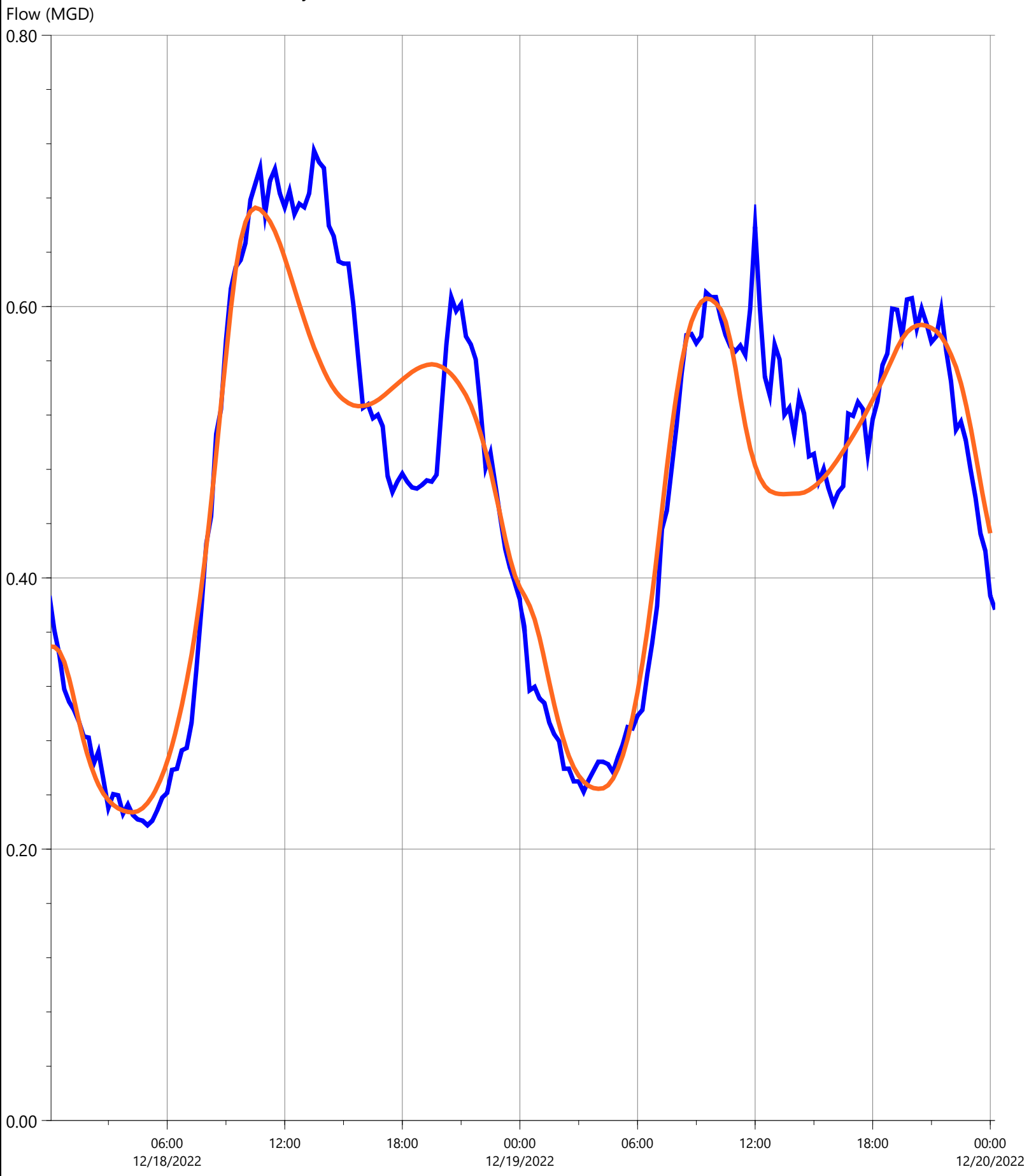
\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix A\Figure A.21 Future TAZ Development.mxd
Print date: 25 Mar 2024 - 18:28

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

Appendix B

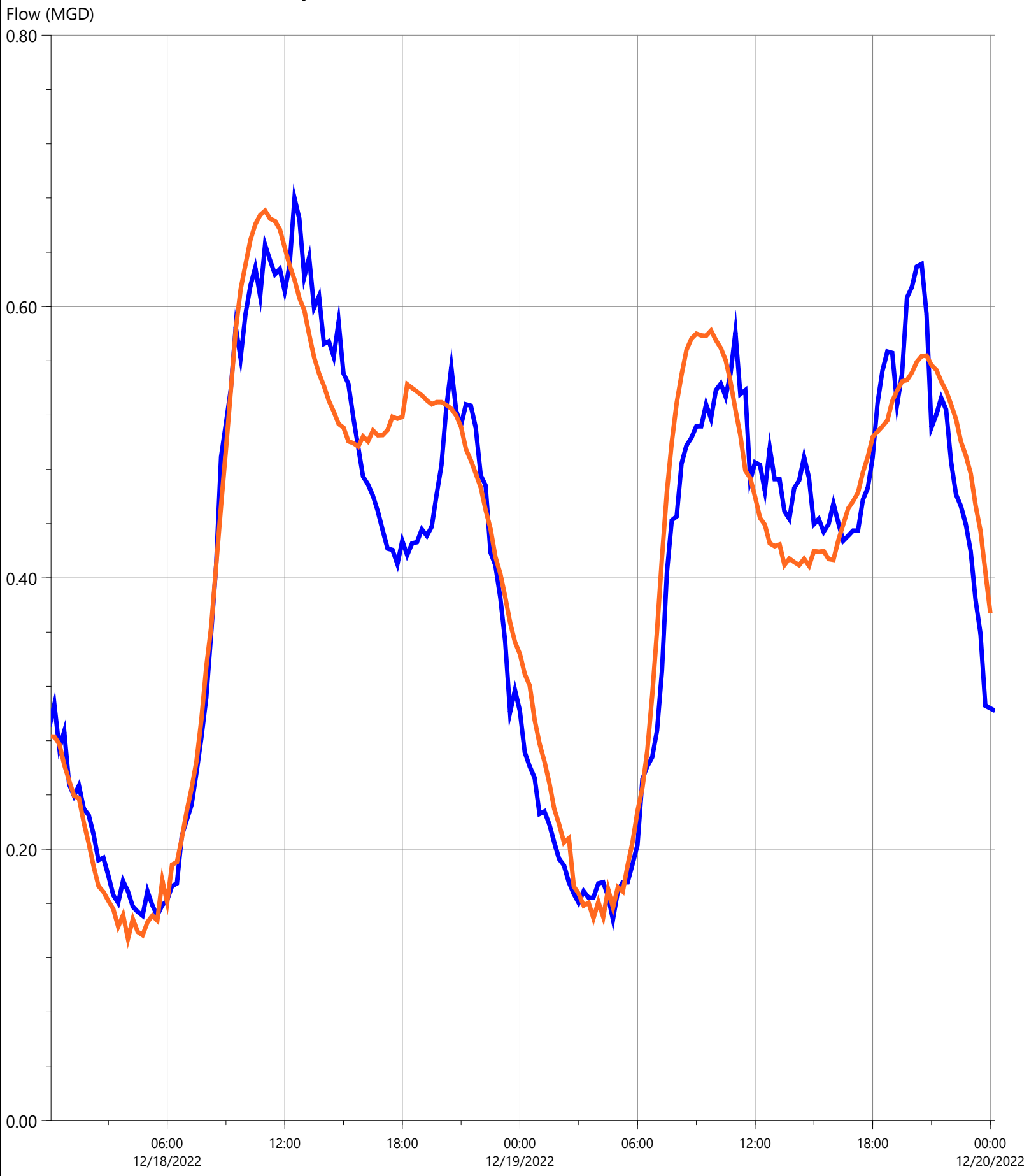
Dry Weather Flow Calibration Plots

Flow Survey Location (Obs.) 7363.1, Model Location (Pred.) U/S 7363.1



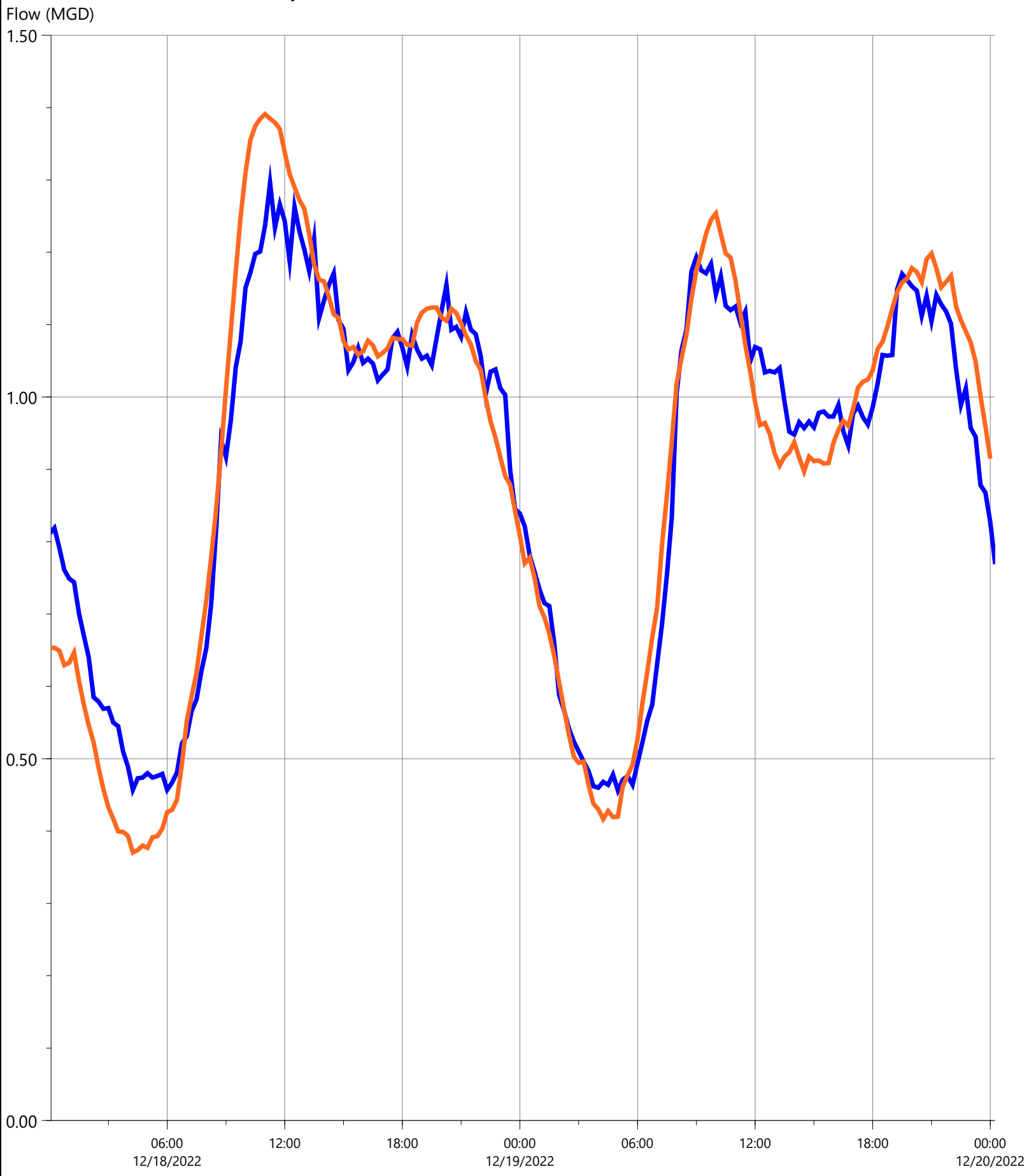
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.218	0.715	0.937
Modeled (DWF)	0.227	0.673	0.921

Flow Survey Location (Obs.) 8347.1, Model Location (Pred.) D/S 8347.1



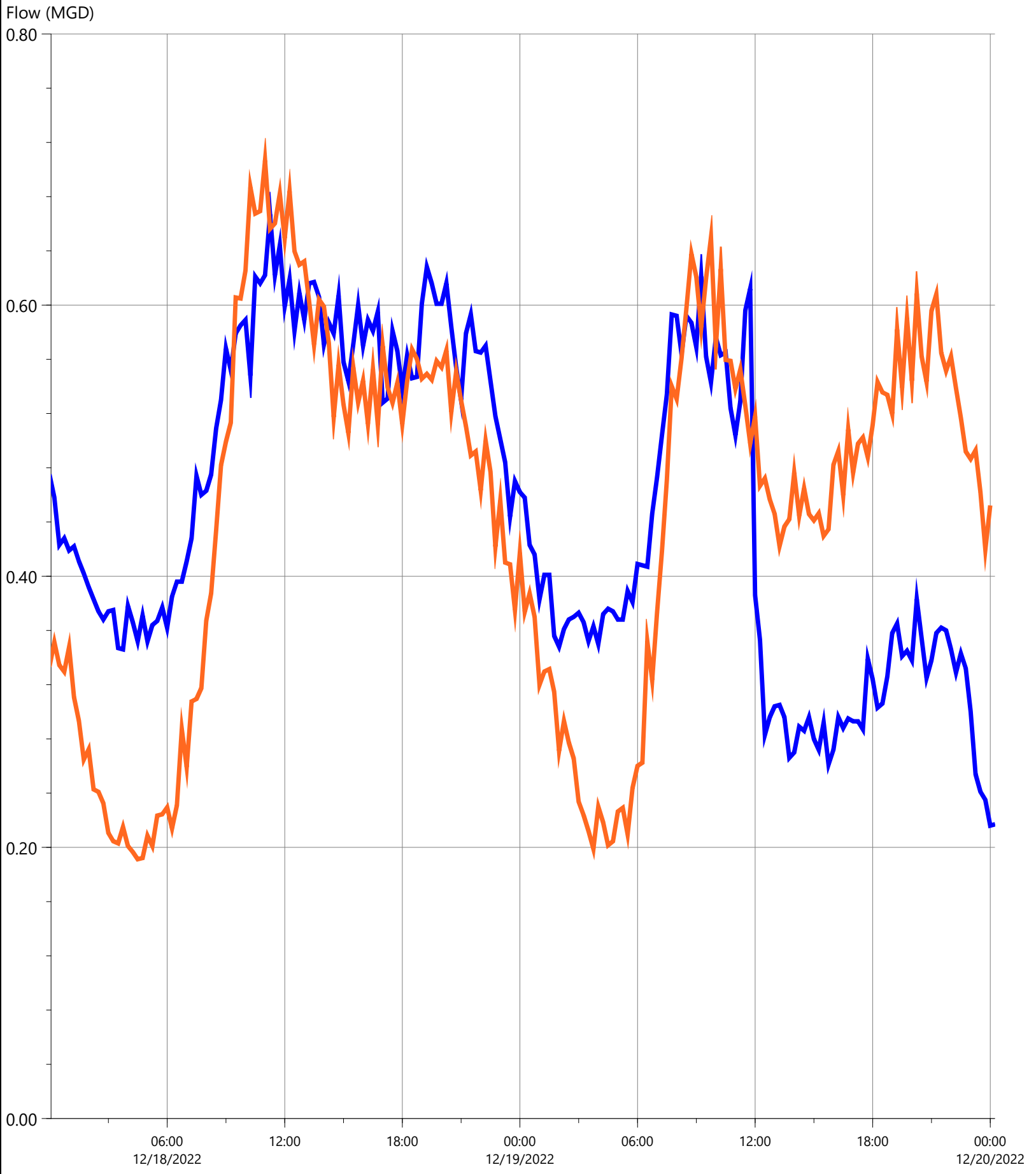
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.148	0.680	0.812
Modeled (DWF)	0.134	0.671	0.828

Flow Survey Location (Obs.) 10499.1, Model Location (Pred.) D/S 10499.1



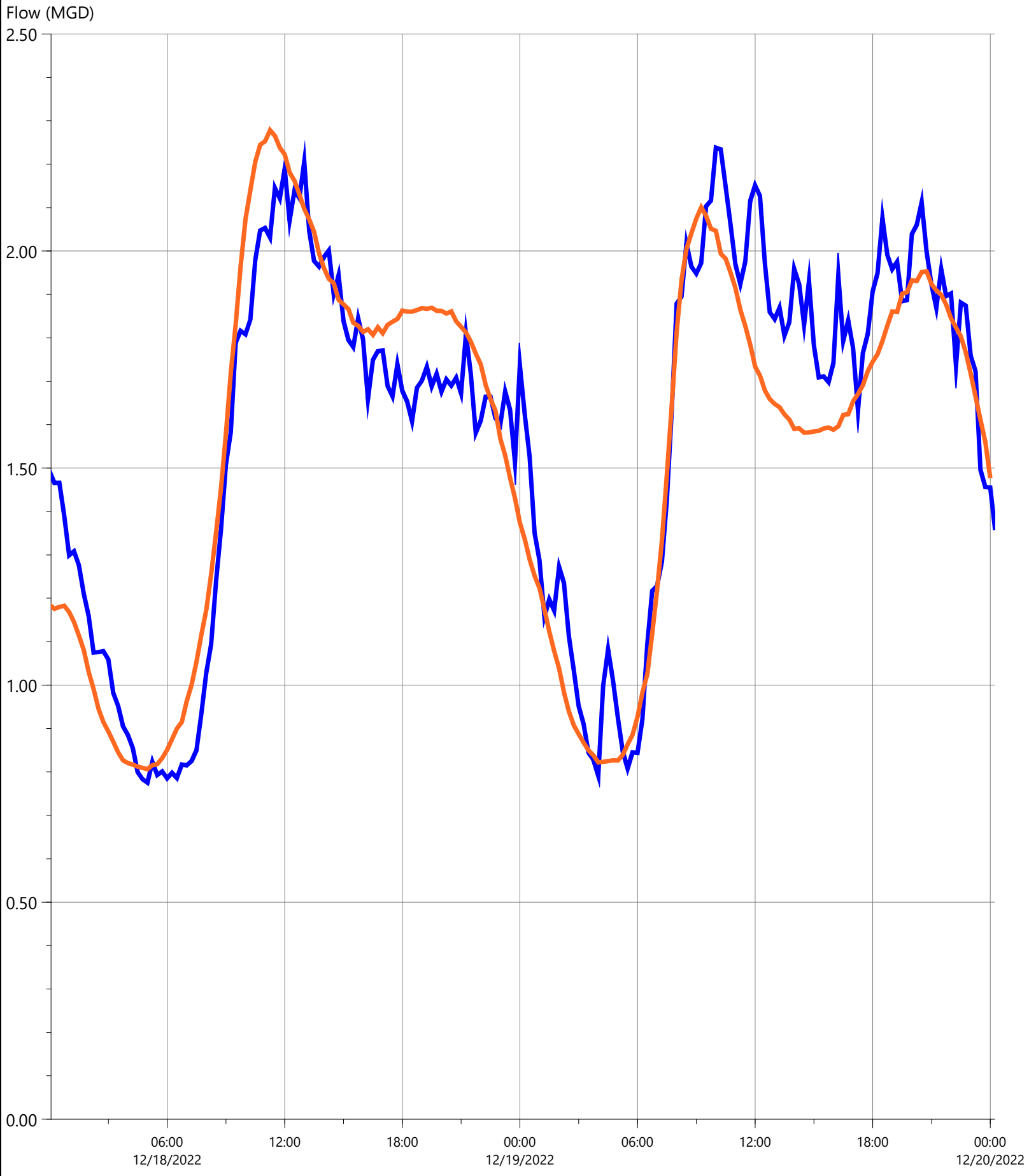
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.456	1.296	1.815
Modeled (DWF)	0.370	1.391	1.815

Flow Survey Location (Obs.) CST0060-0500.1, Model Location (Pred.) D/S CST0060-0500.1



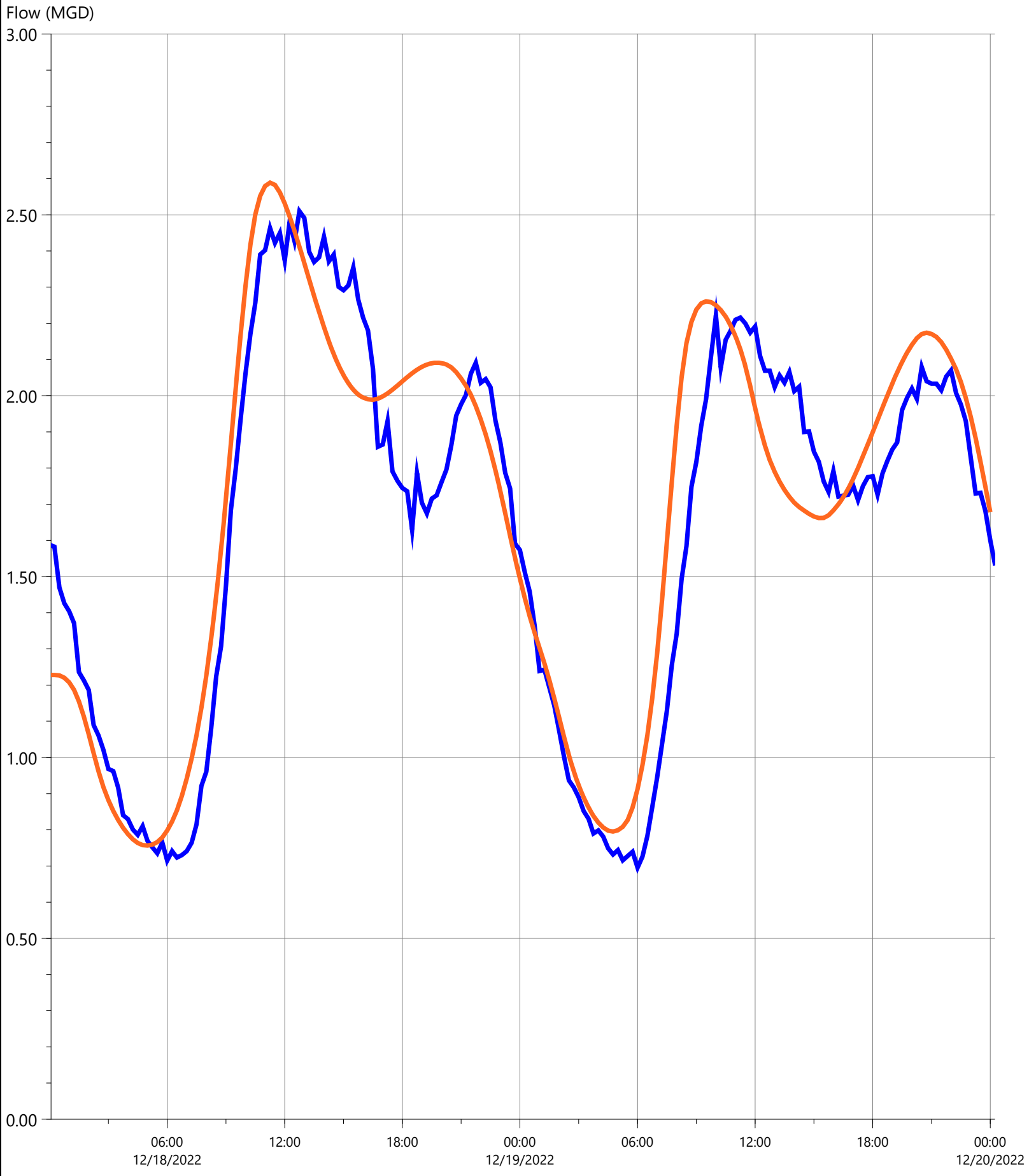
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.216	0.667	0.897
Modeled (DWF)	0.191	0.707	0.896

Flow Survey Location (Obs.) CST0060-0195.1, Model Location (Pred.) D/S CST0060-0195.1



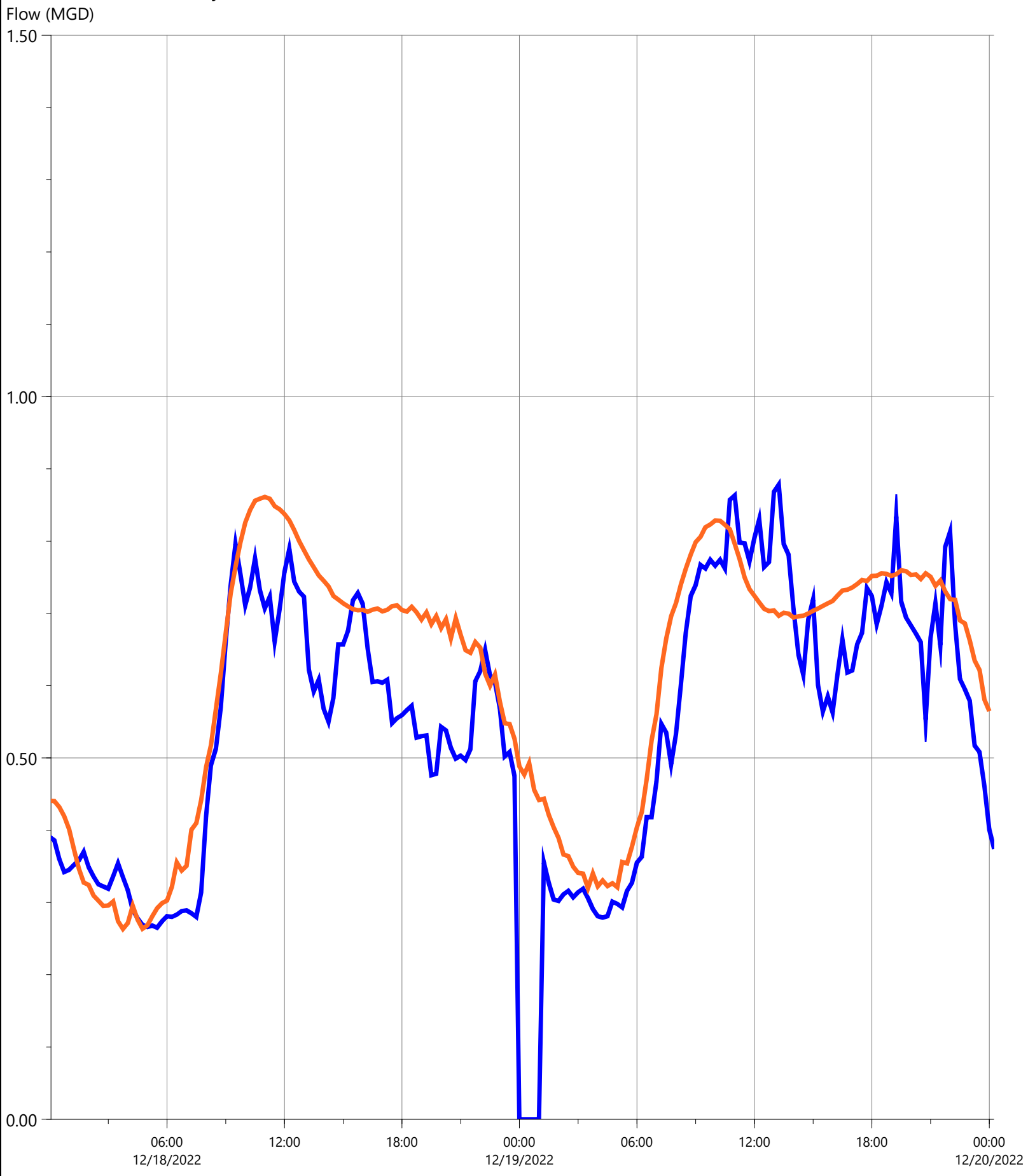
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.775	2.238	3.173
Modeled (DWF)	0.806	2.278	3.099

Flow Survey Location (Obs.) CST0068-0000.1, Model Location (Pred.) D/S CST0068-0000.1



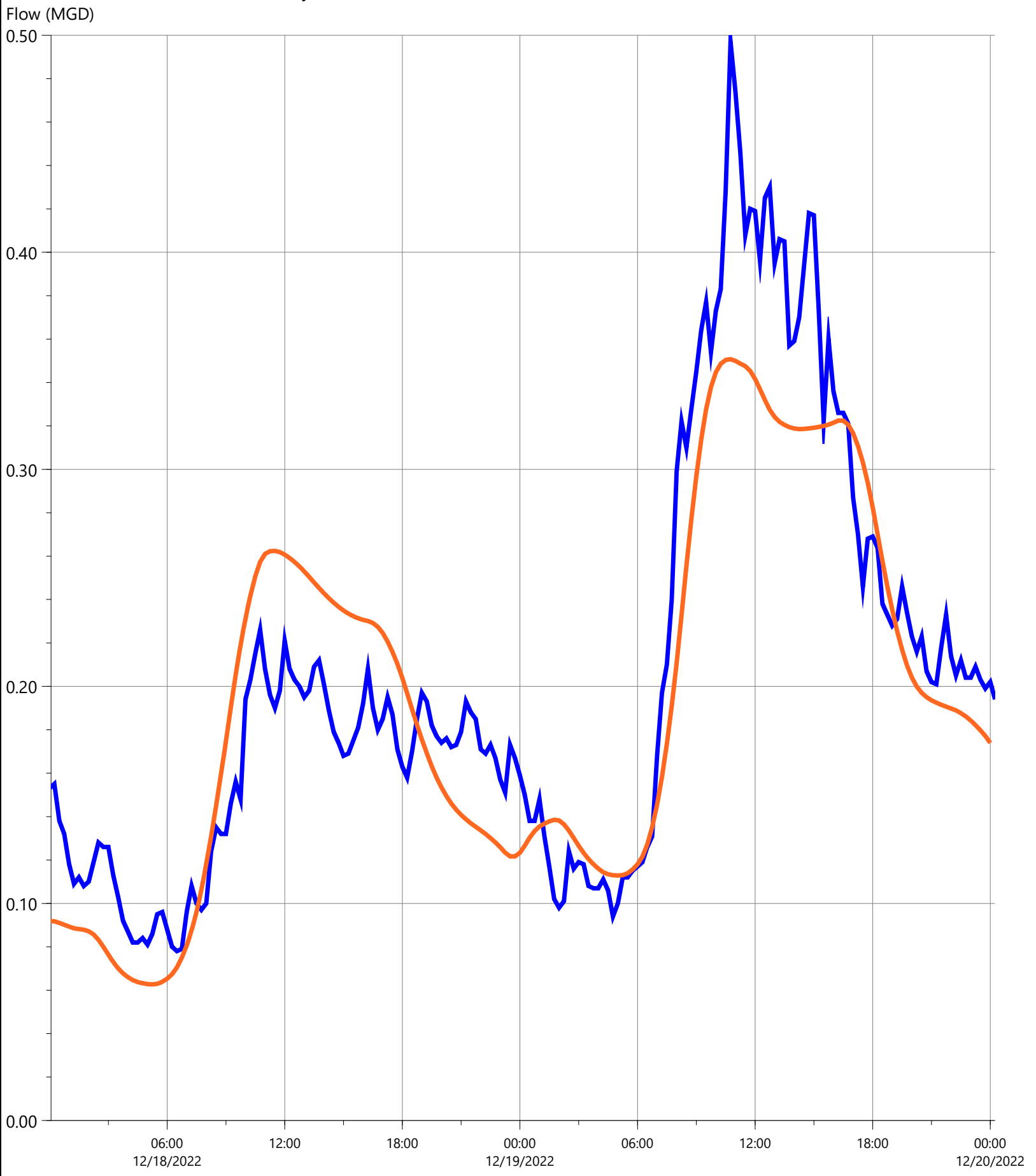
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.695	2.510	3.284
Modeled (DWF)	0.757	2.589	3.367

Flow Survey Location (Obs.) KNT0080-0735.1, Model Location (Pred.) D/S KNT0080-0735.1



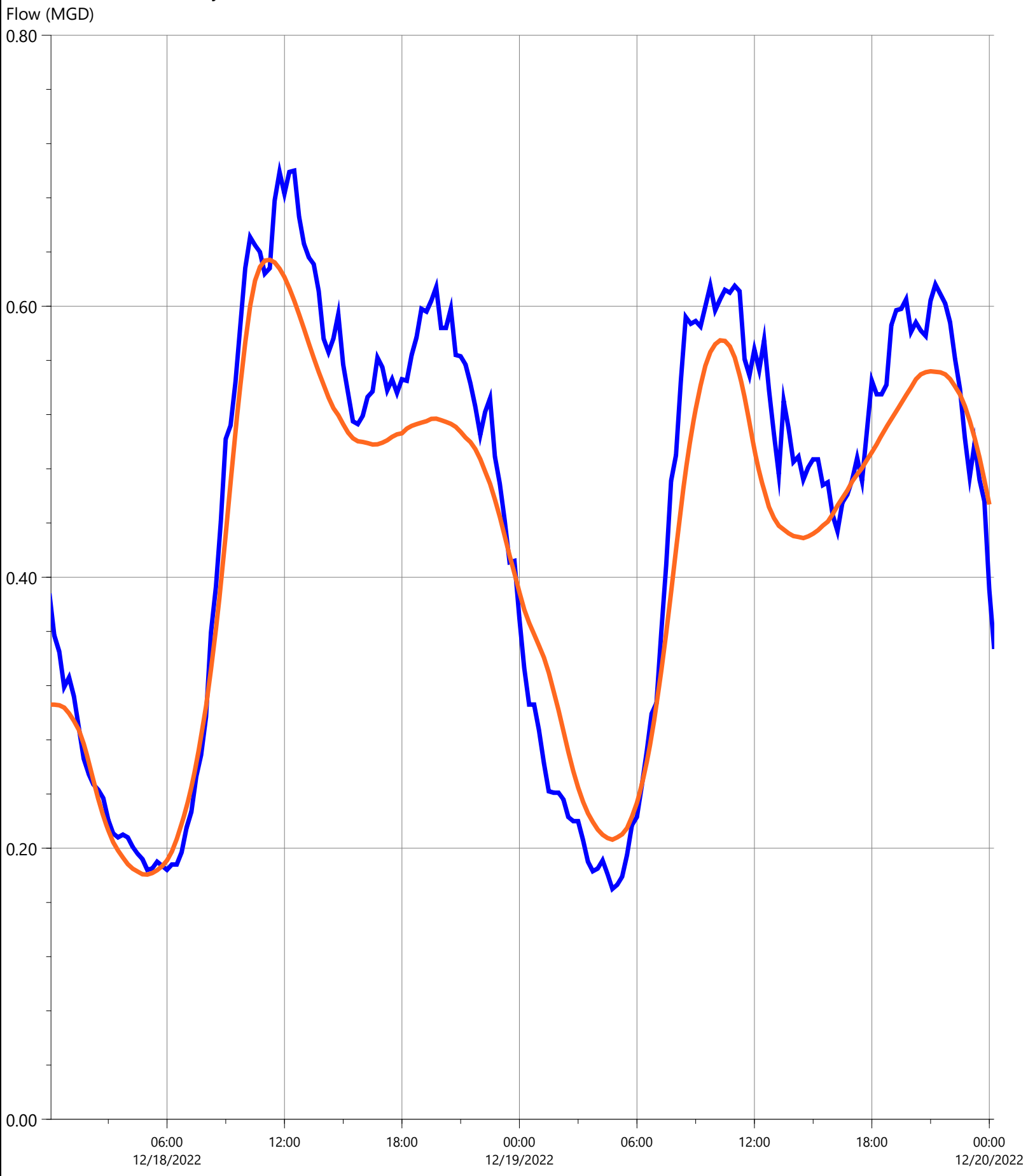
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.000	0.878	1.081
Modeled (DWF)	0.263	0.861	1.214

Flow Survey Location (Obs.) 1868.1, Model Location (Pred.) U/S 1868.1



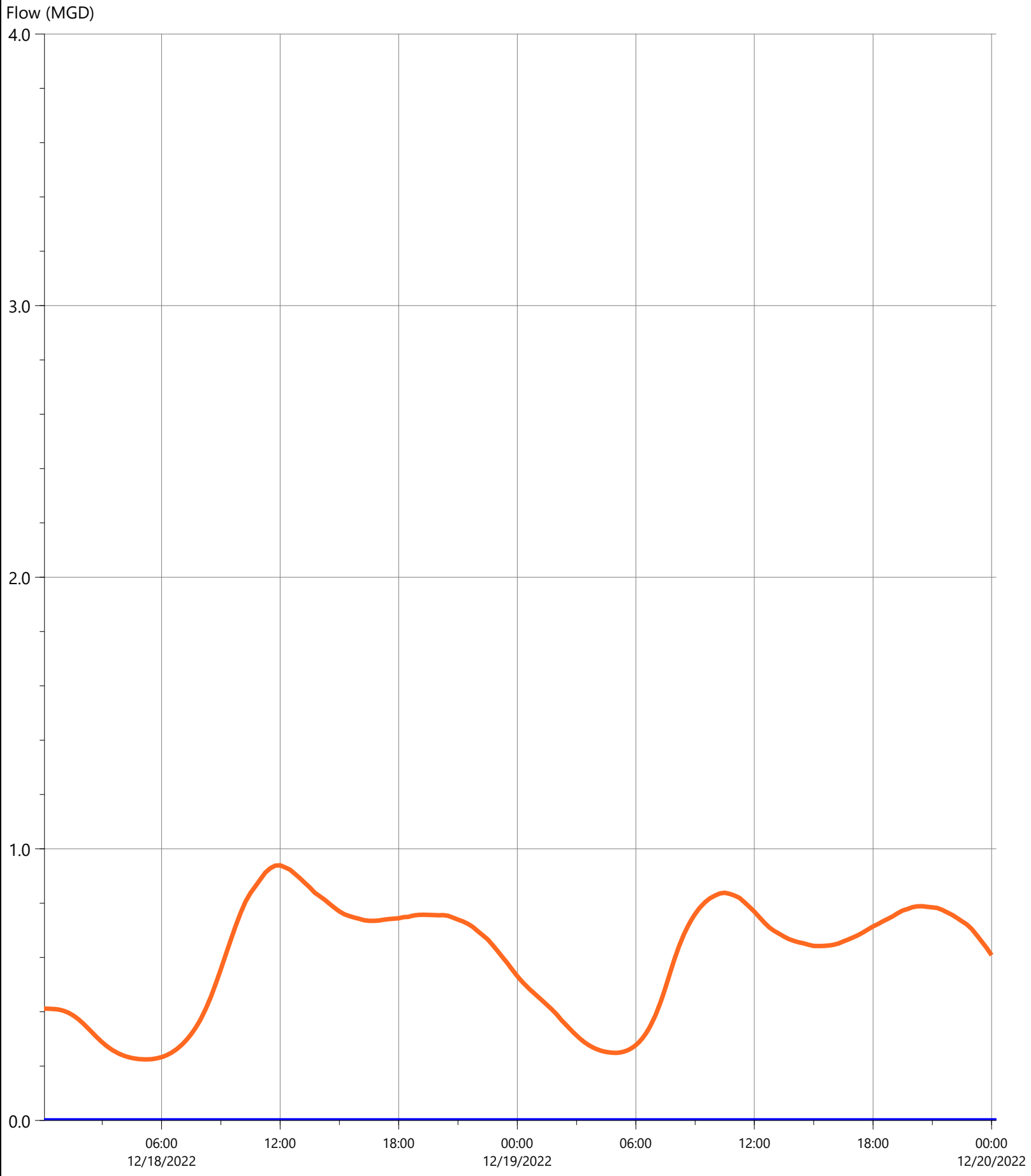
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.078	0.497	0.408
Modeled (DWF)	0.063	0.351	0.386

Flow Survey Location (Obs.) KNT0080-0265.1, Model Location (Pred.) D/S KNT0080-0265.1



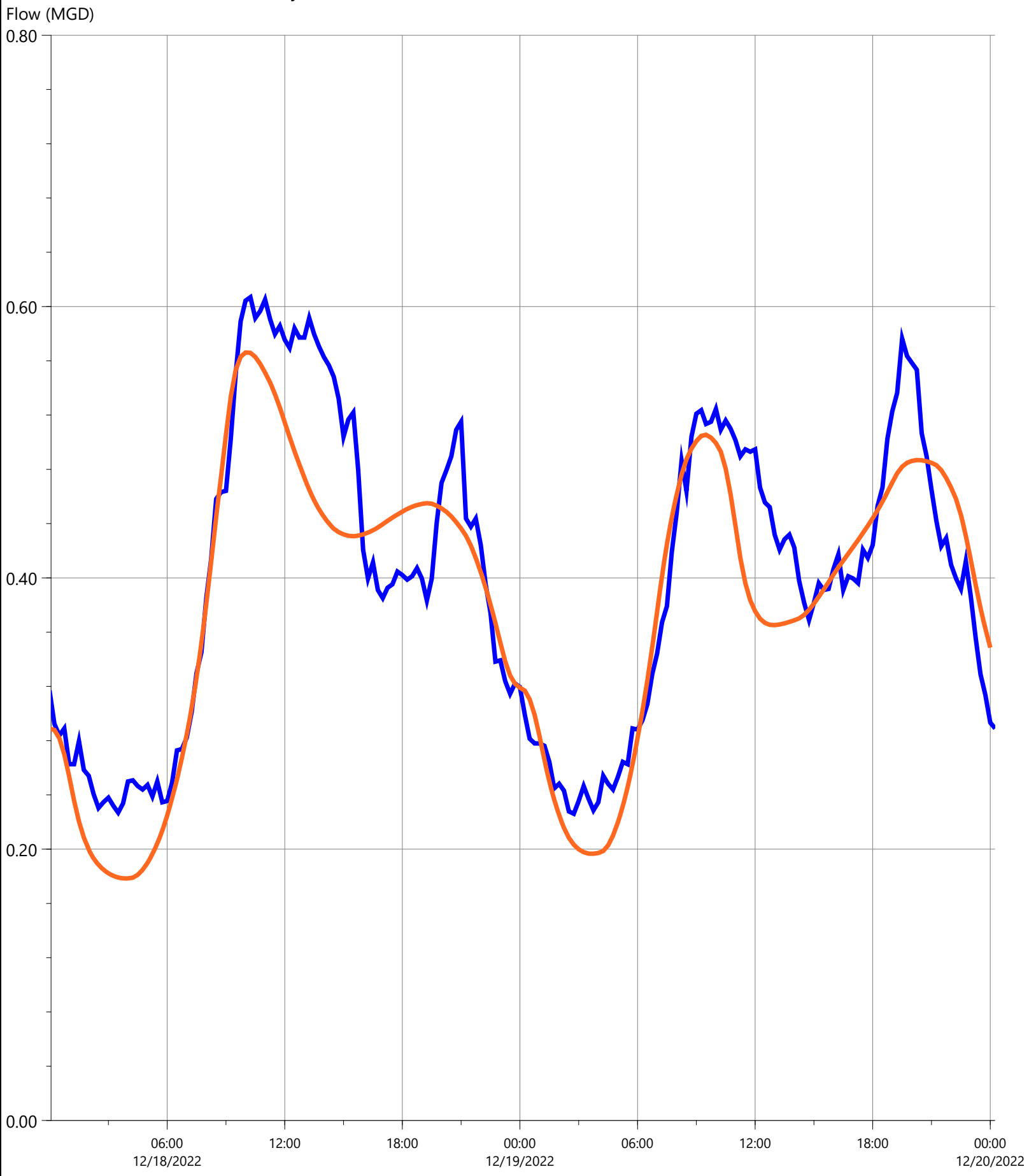
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.170	0.700	0.901
Modeled (DWF)	0.181	0.634	0.846

Flow Survey Location (Obs.) KNT0080-0535.1, Model Location (Pred.) D/S KNT0080-0535.1



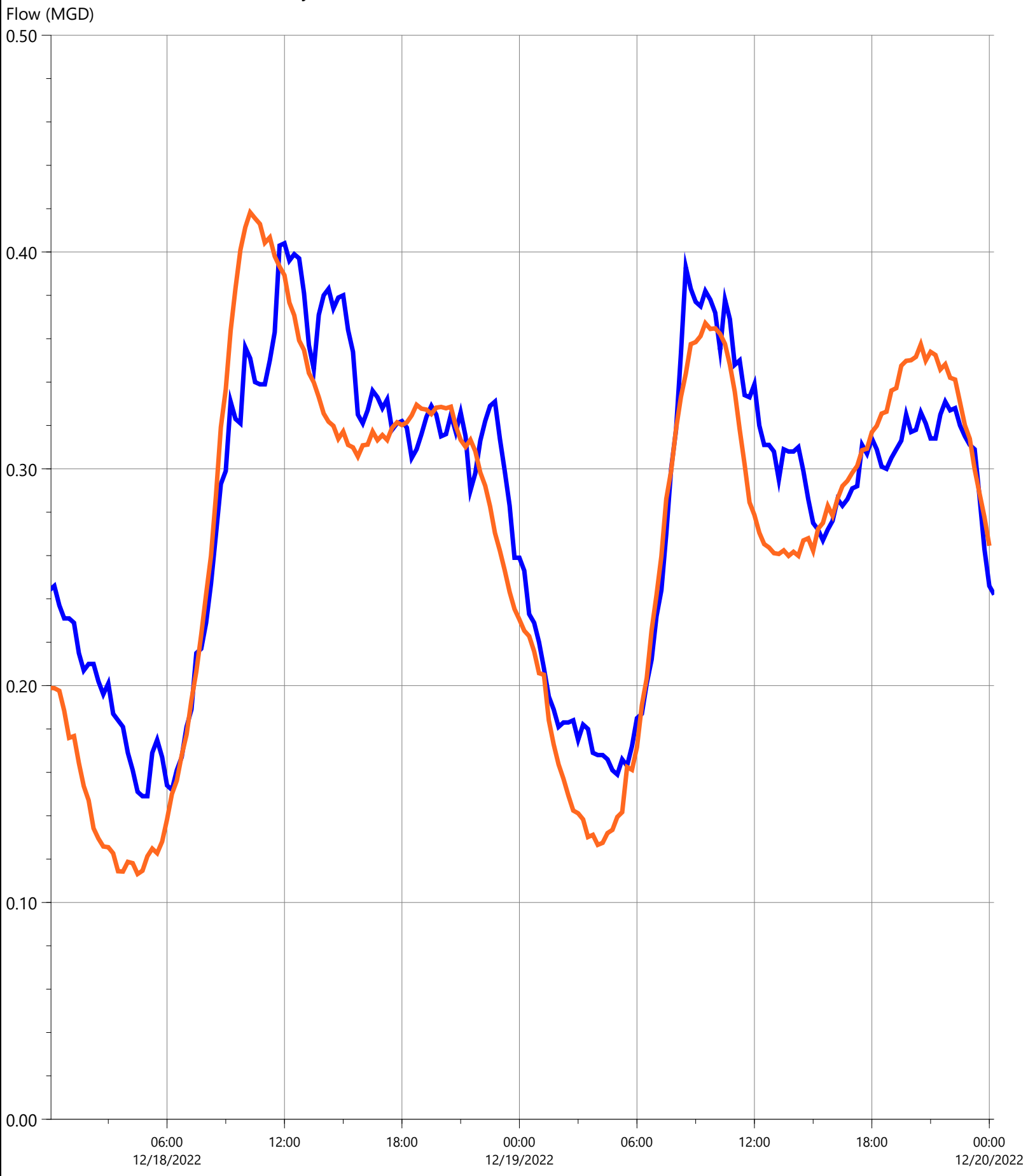
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.000	0.000	0.000
Modeled (DWF)	0.225	0.939	1.200

Flow Survey Location (Obs.) 13310.1, Model Location (Pred.) D/S 13310.1



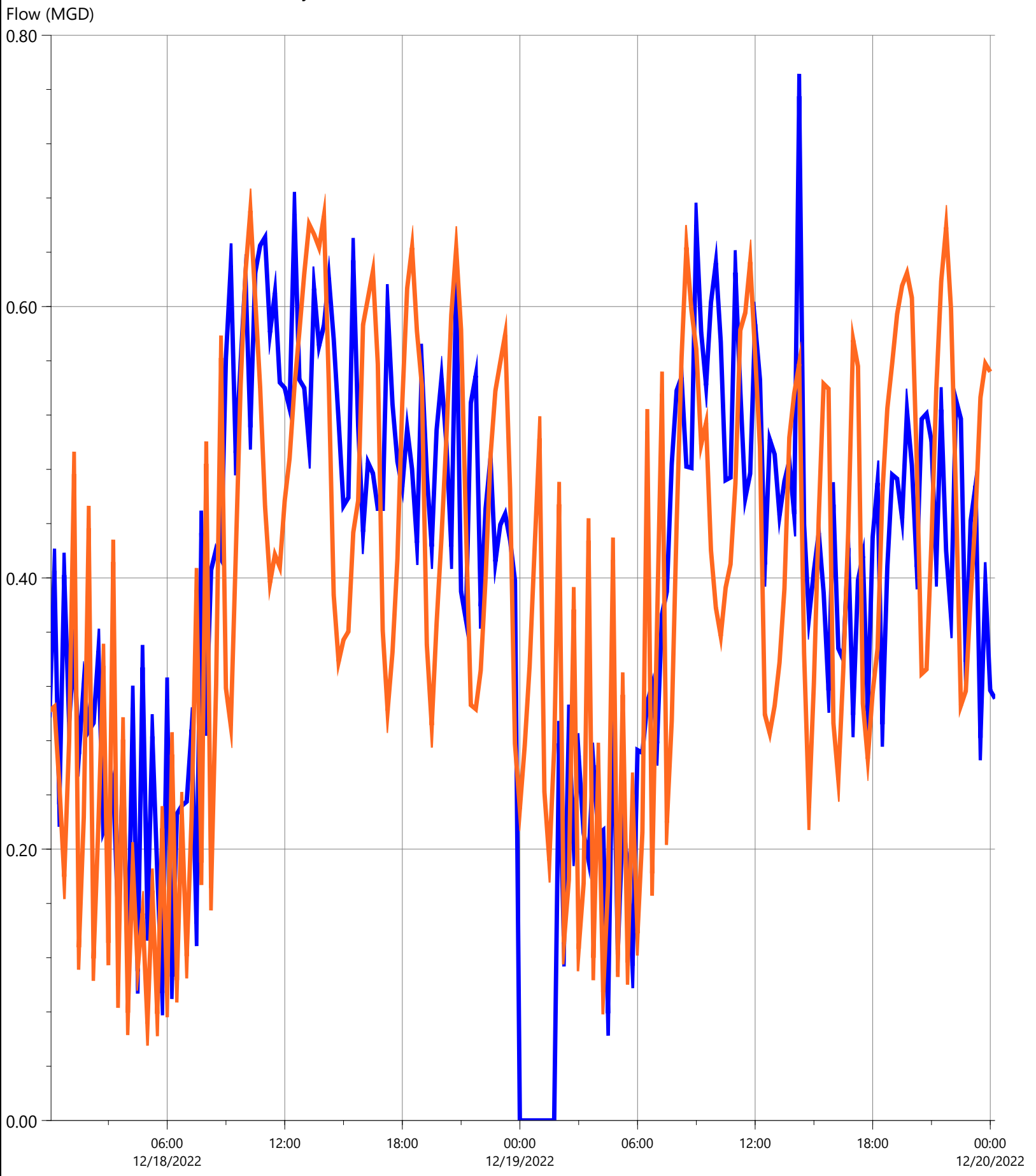
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.226	0.607	0.800
Modeled (DWF)	0.178	0.566	0.758

Flow Survey Location (Obs.) 5294.1, Model Location (Pred.) D/S 5294.1



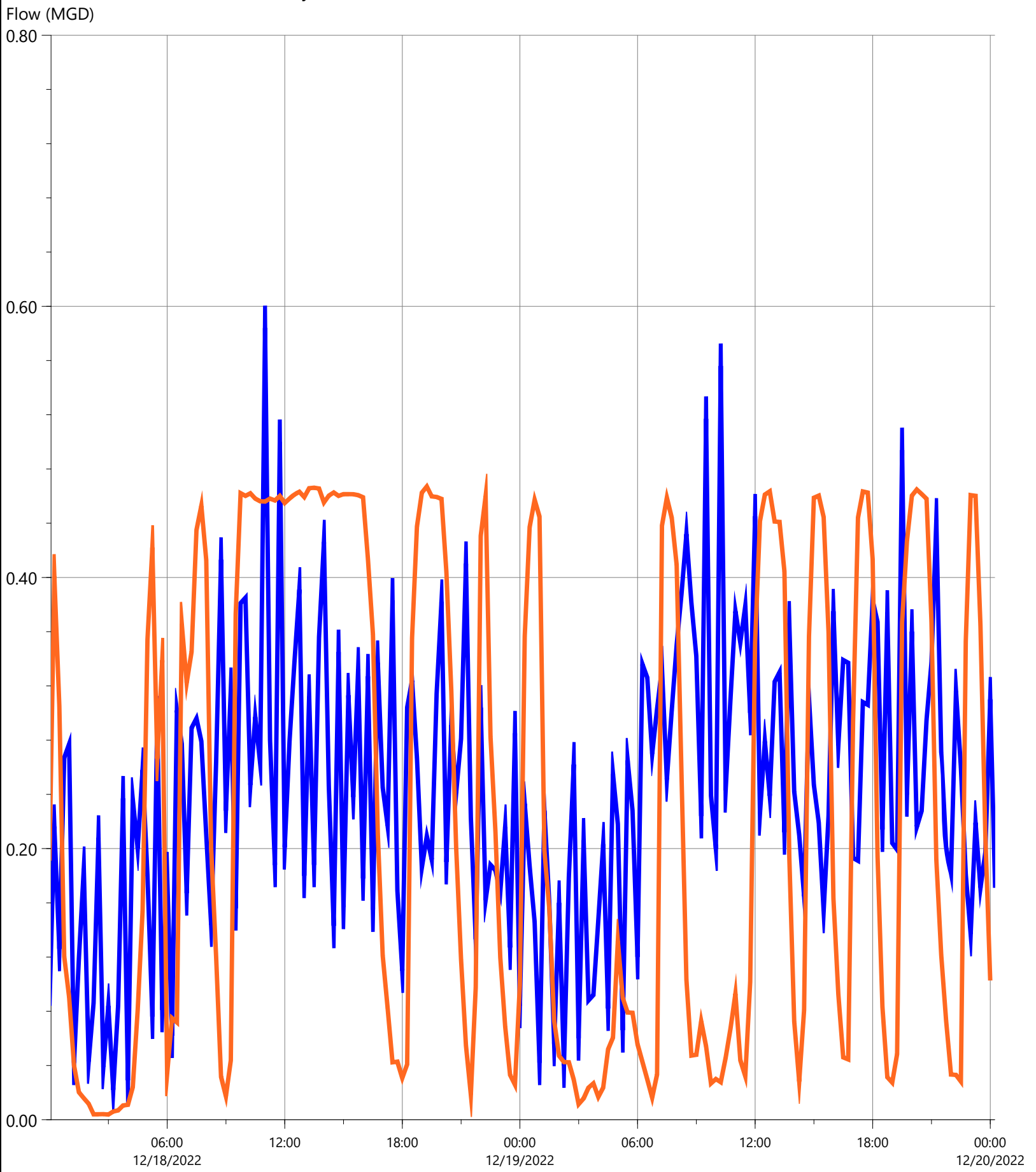
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.149	0.404	0.566
Modeled (DWF)	0.113	0.418	0.539

Flow Survey Location (Obs.) 2741.1, Model Location (Pred.) U/S 2741.1



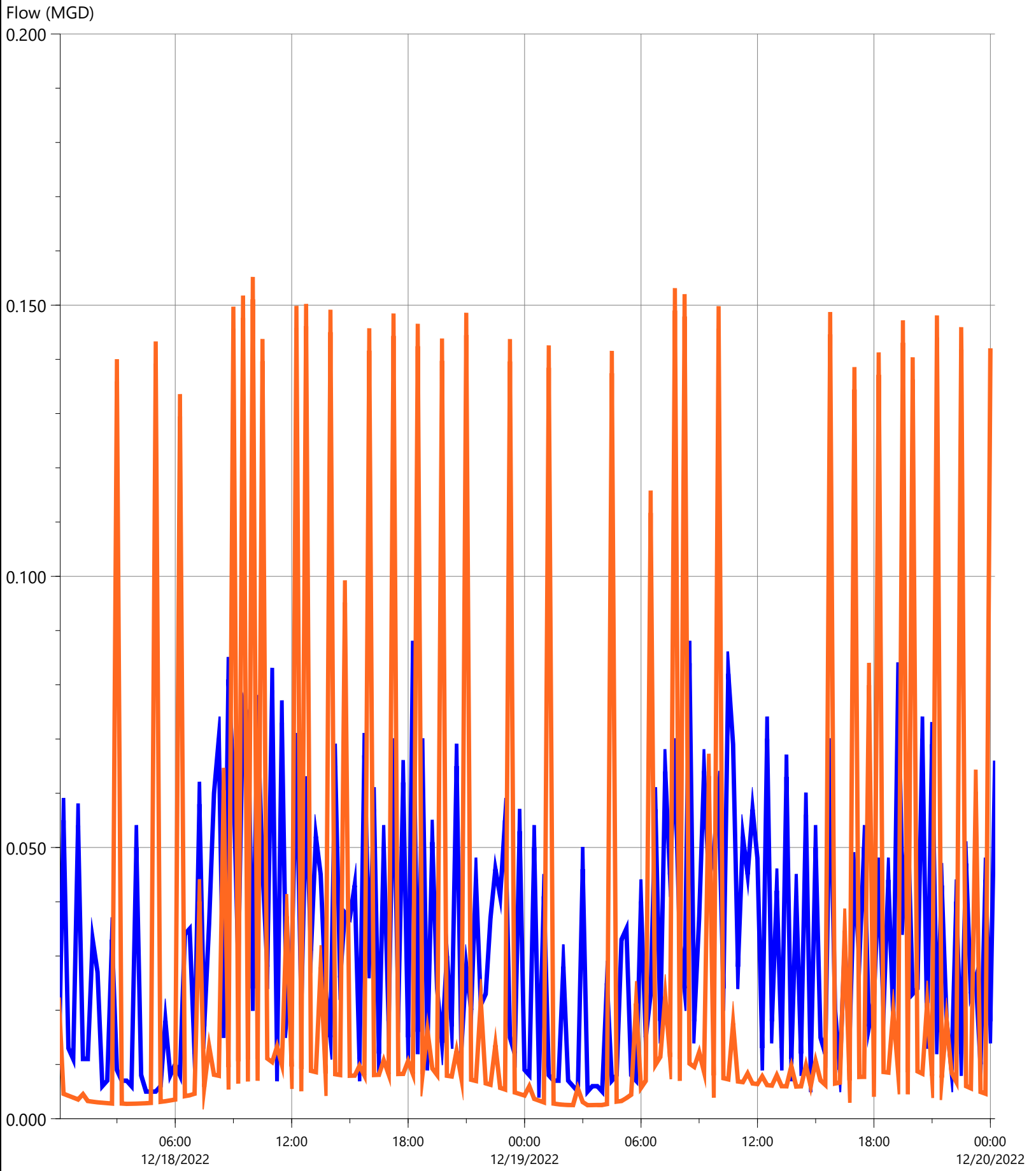
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.000	0.755	0.799
Modeled (DWF)	0.072	0.670	0.787

Flow Survey Location (Obs.) 3903.1, Model Location (Pred.) D/S 3903.1



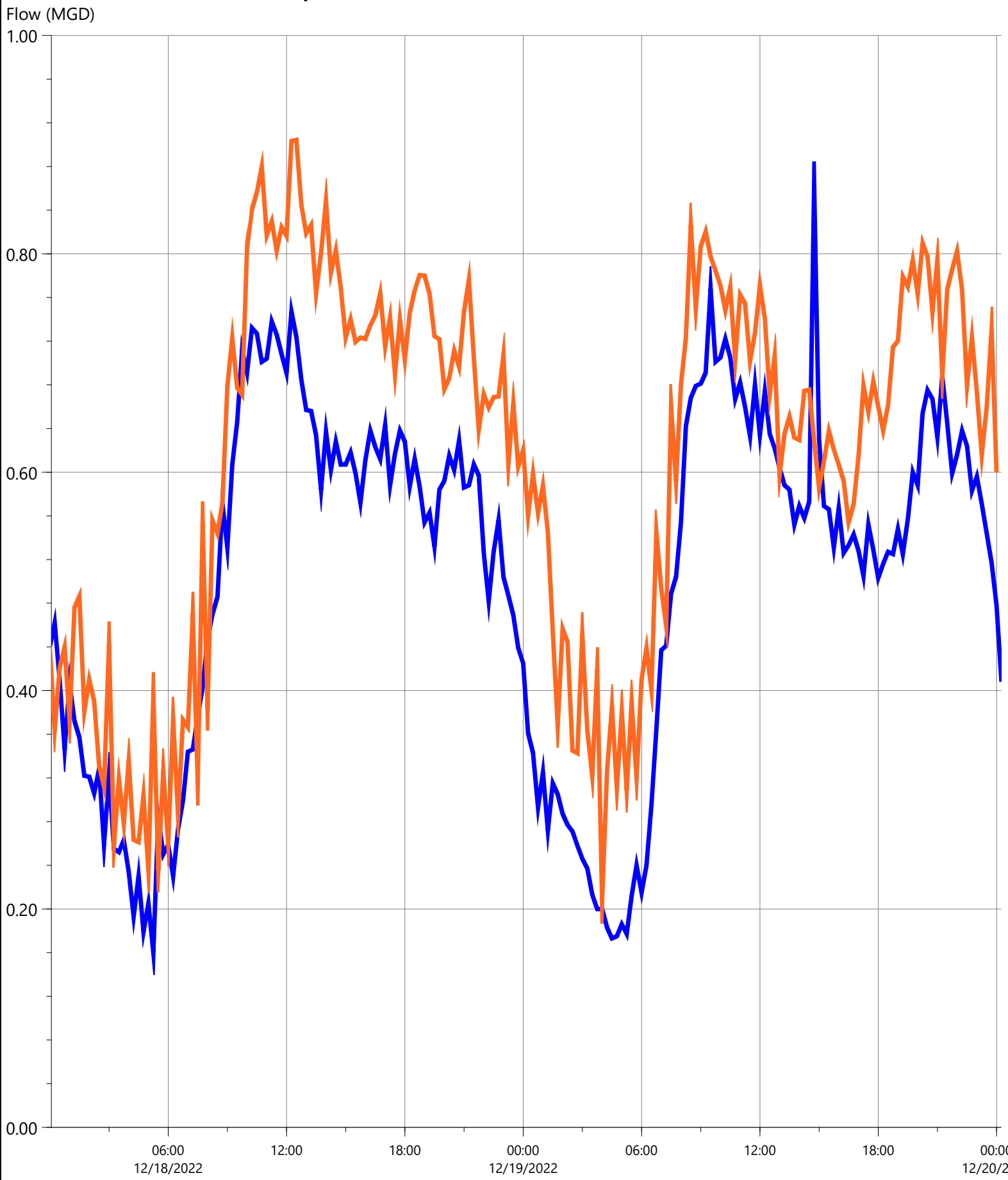
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.022	0.584	0.491
Modeled (DWF)	0.004	0.467	0.468

Flow Survey Location (Obs.) 4021.1, Model Location (Pred.) U/S 4021.1



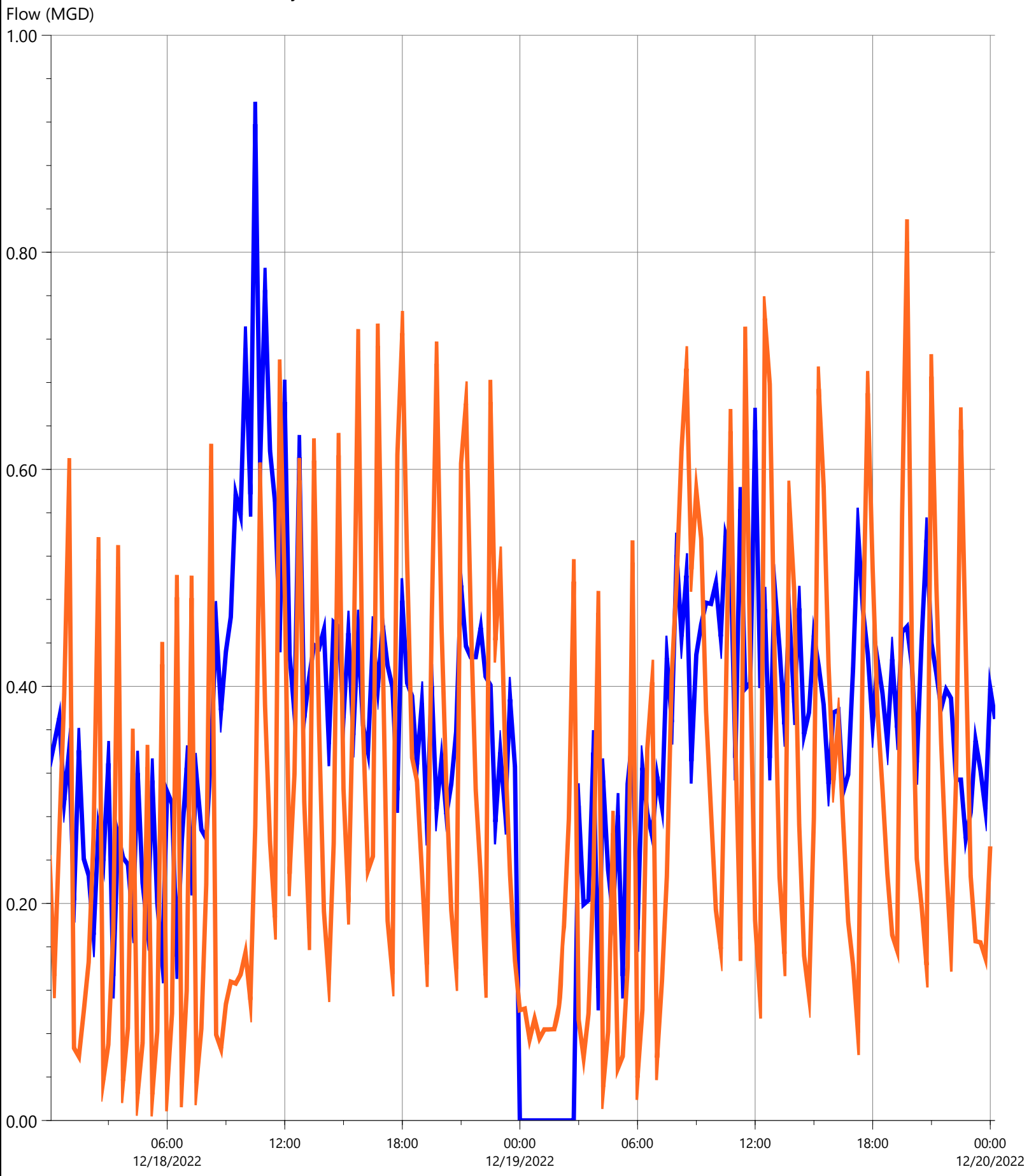
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.005	0.084	0.065
Modeled (DWF)	0.002	0.151	0.060

Flow Survey Location (Obs.) 4355.1, Model Location (Pred.) D/S 4355.1



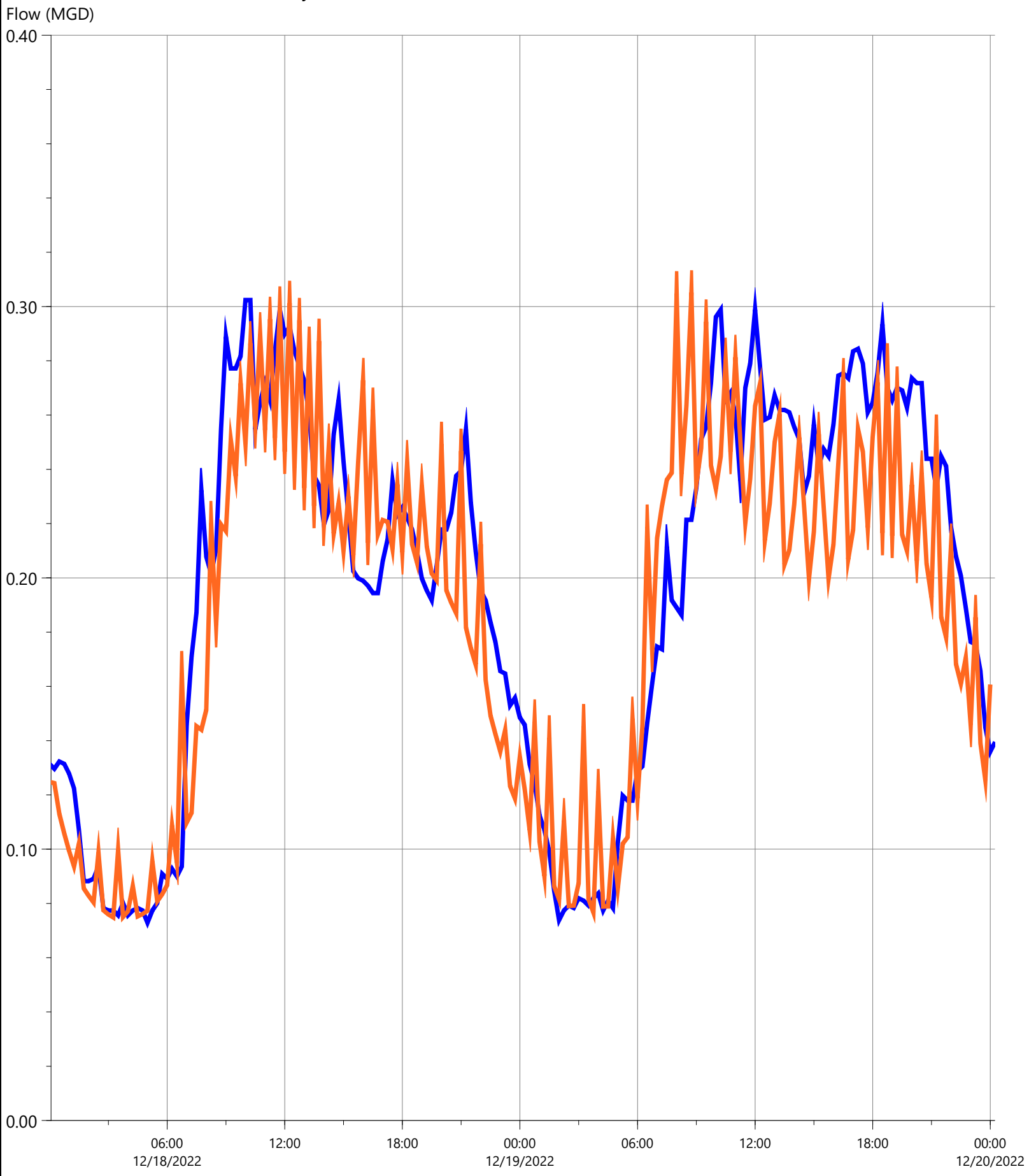
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.160	0.864	1.011
Modeled (DWF)	0.207	0.904	1.225

Flow Survey Location (Obs.) 12870.1, Model Location (Pred.) D/S 12870.1



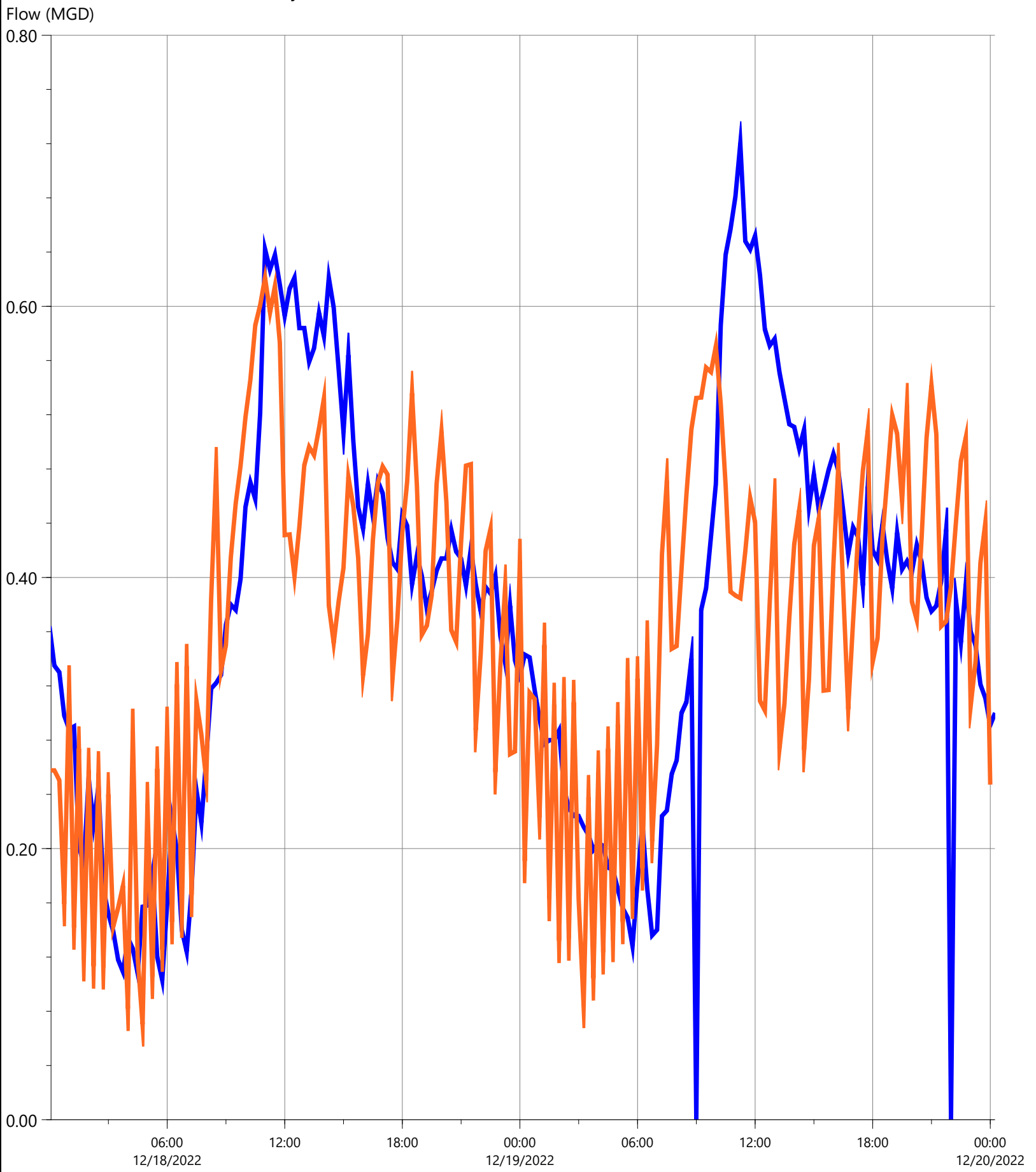
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.000	0.918	0.710
Modeled (DWF)	0.024	0.810	0.601

Flow Survey Location (Obs.) 4988.1, Model Location (Pred.) D/S 4988.1



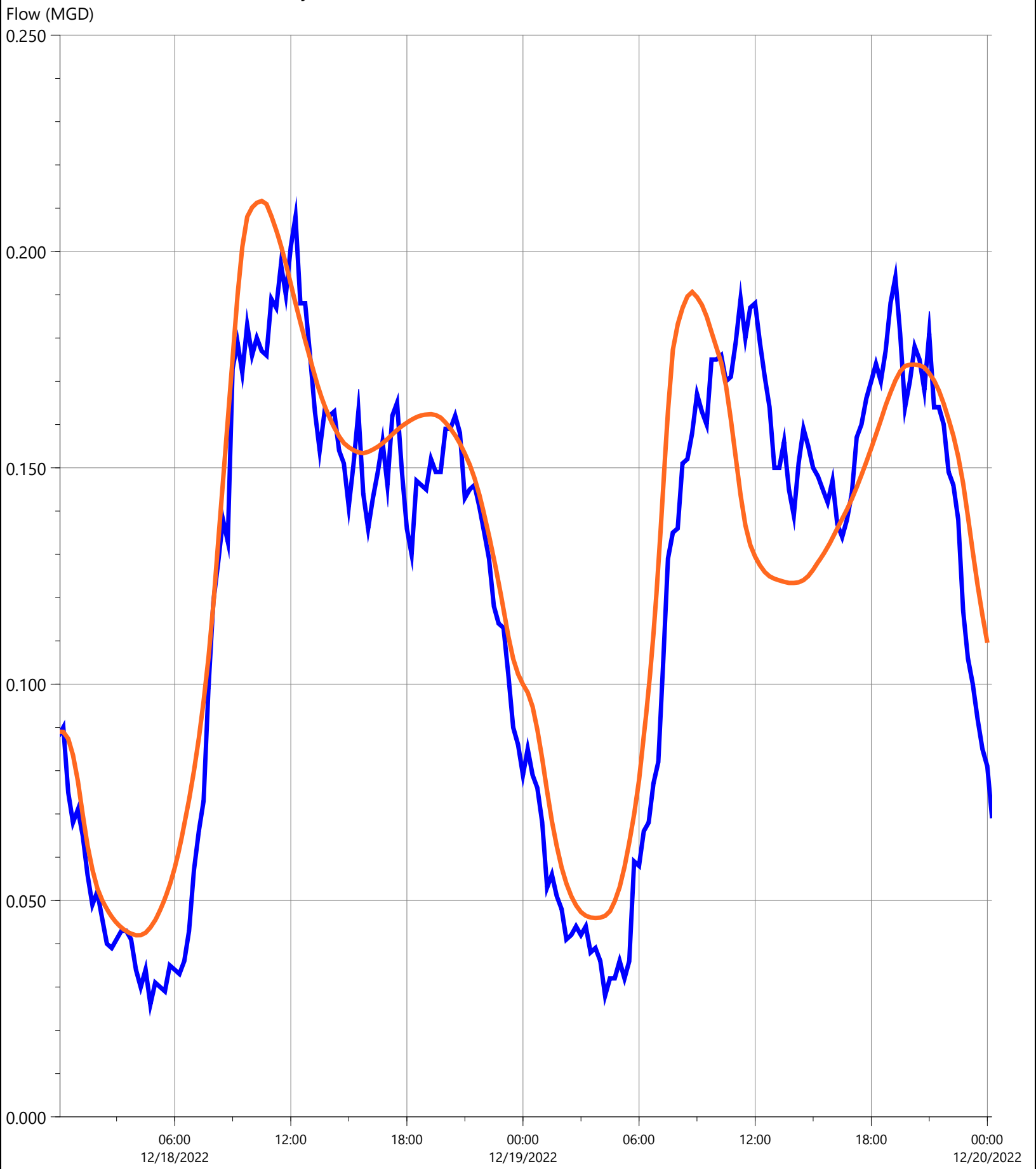
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.073	0.302	0.395
Modeled (DWF)	0.075	0.305	0.375

Flow Survey Location (Obs.) 11726.1, Model Location (Pred.) D/S 11726.1



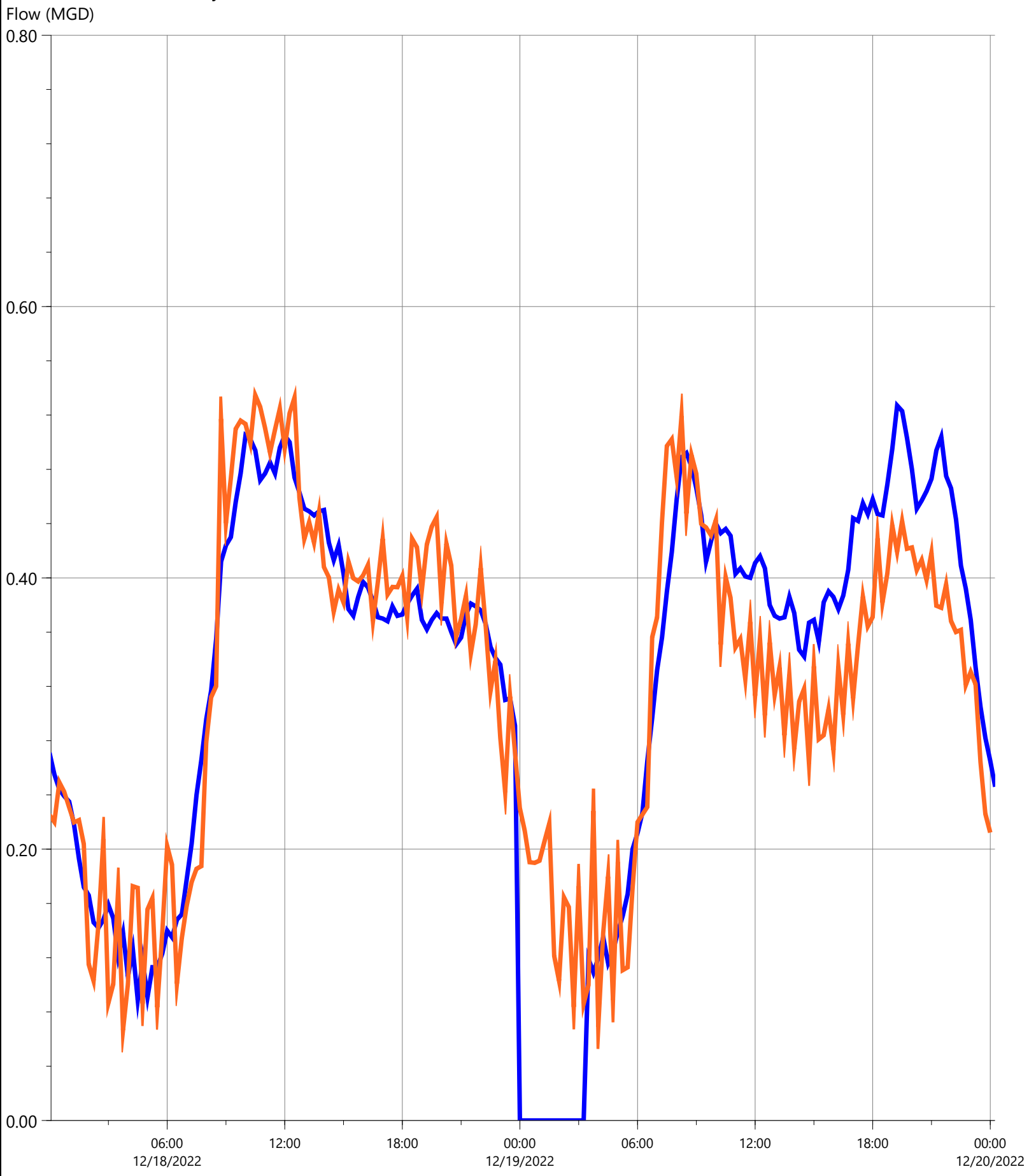
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.000	0.720	0.744
Modeled (DWF)	0.070	0.621	0.721

Flow Survey Location (Obs.) 7345.1, Model Location (Pred.) D/S 7345.1



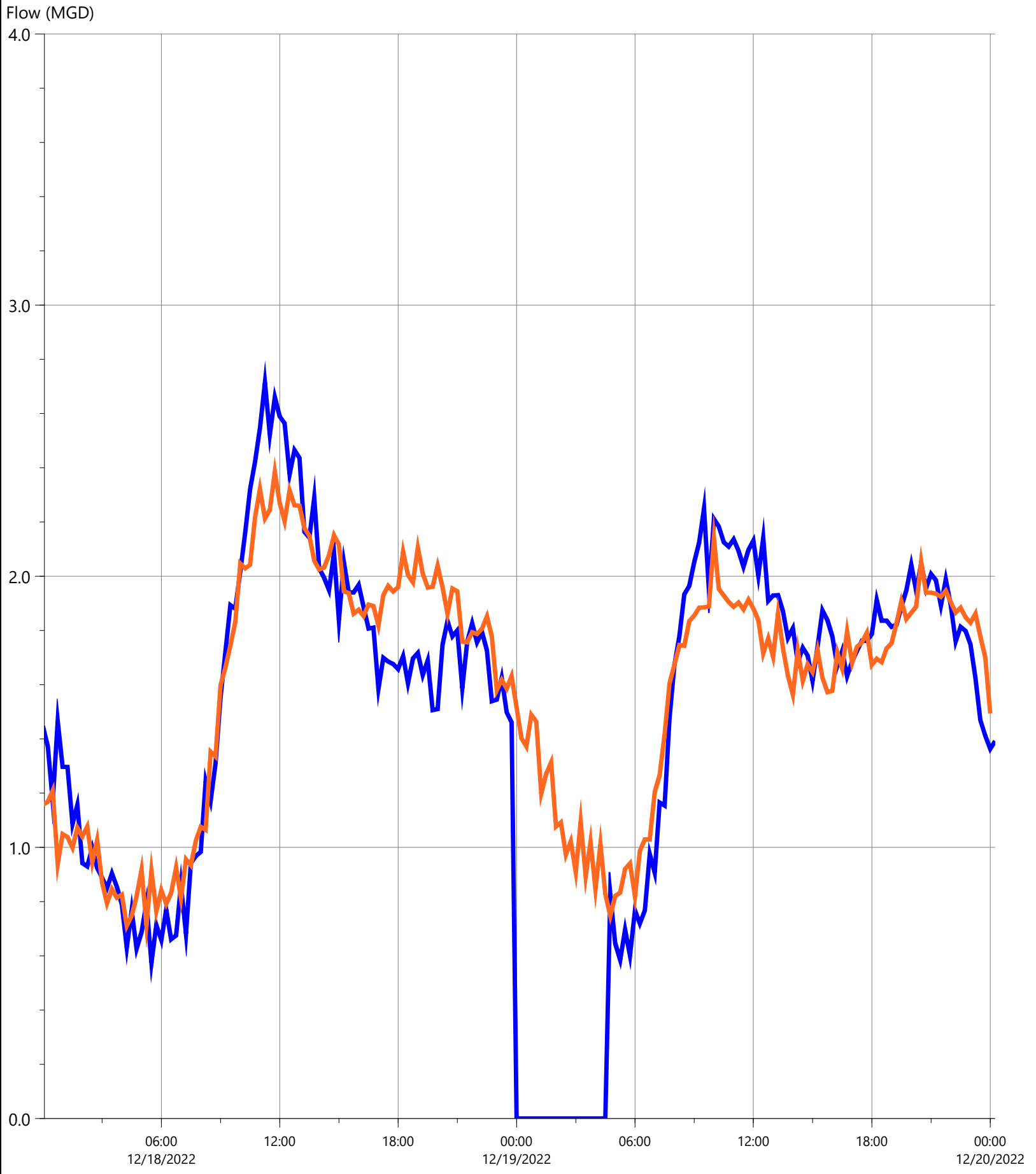
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.026	0.208	0.244
Modeled (DWF)	0.042	0.212	0.256

Flow Survey Location (Obs.) KNT0080-0463.1, Model Location (Pred.) D/S KNT0080-0463.1



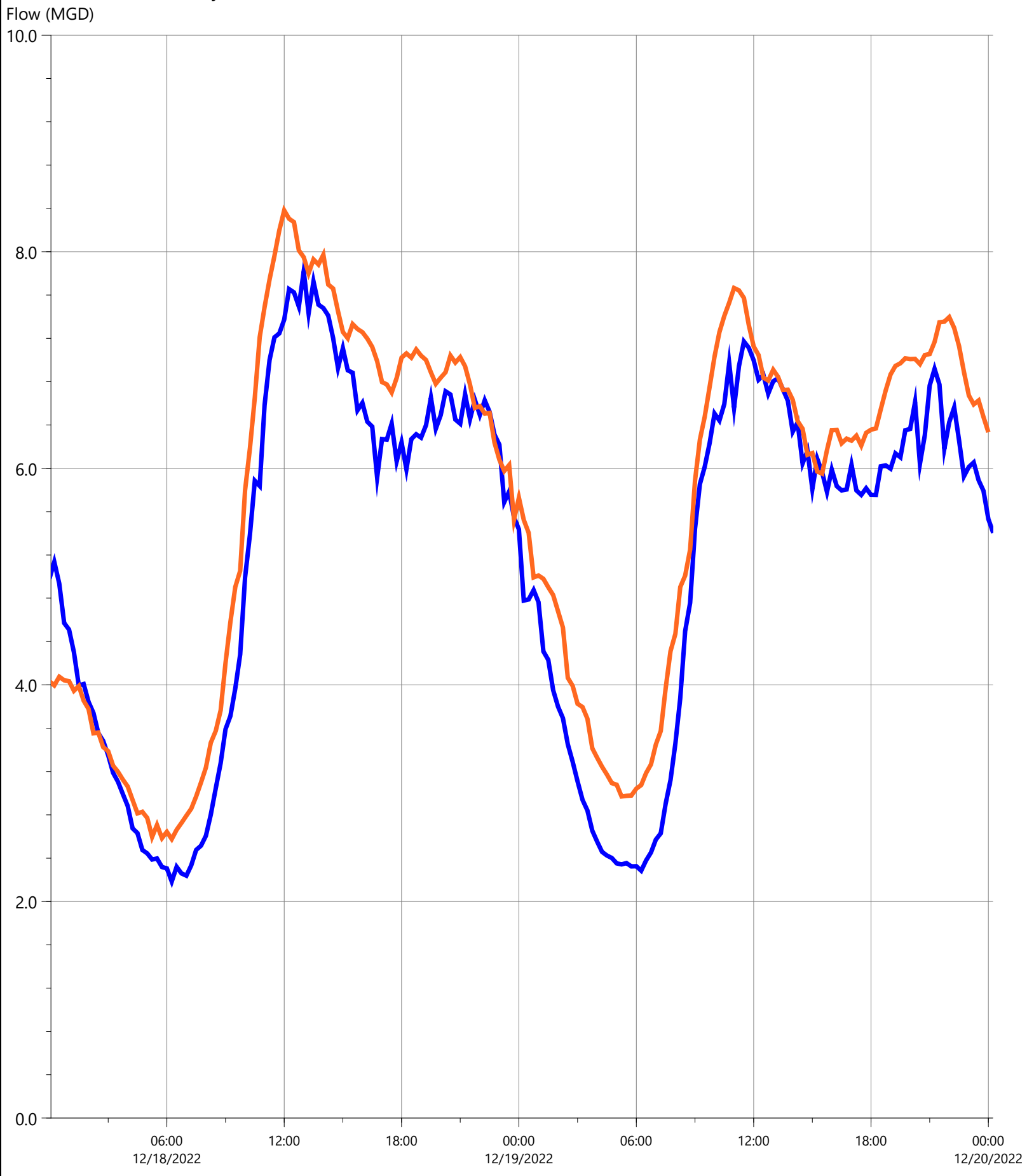
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.000	0.527	0.647
Modeled (DWF)	0.067	0.535	0.641

Flow Survey Location (Obs.) KNT0080-0416.1, Model Location (Pred.) D/S KNT0080-0416.1



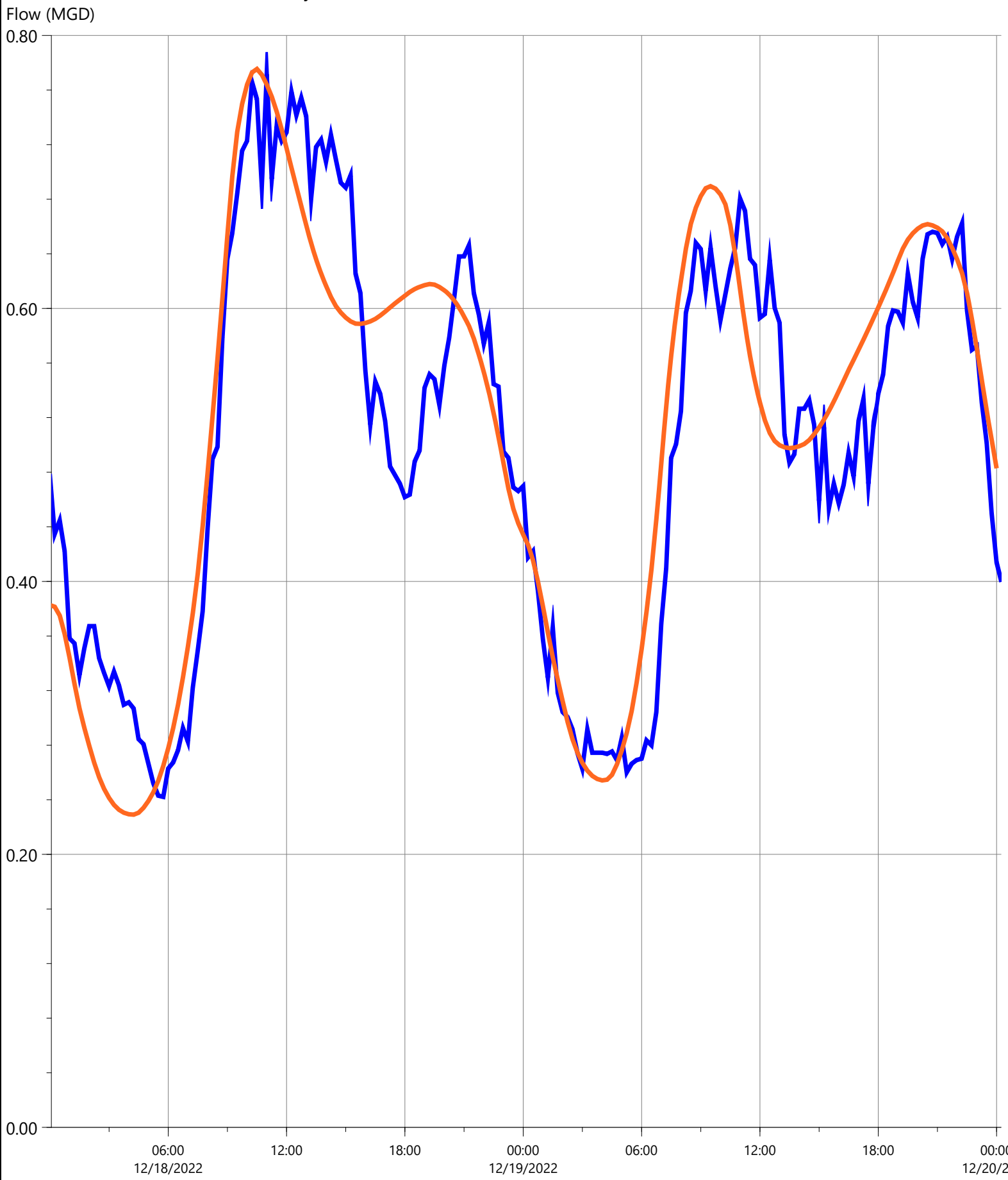
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.000	2.714	2.936
Modeled (DWF)	0.710	2.385	3.156

Flow Survey Location (Obs.) KNT0080-0010.1, Model Location (Pred.) D/S KNT0080-0010.1



	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	2.185	7.819	10.410
Modeled (DWF)	2.576	8.382	11.310

Flow Survey Location (Obs.) 8295.1, Model Location (Pred.) D/S 8295.1

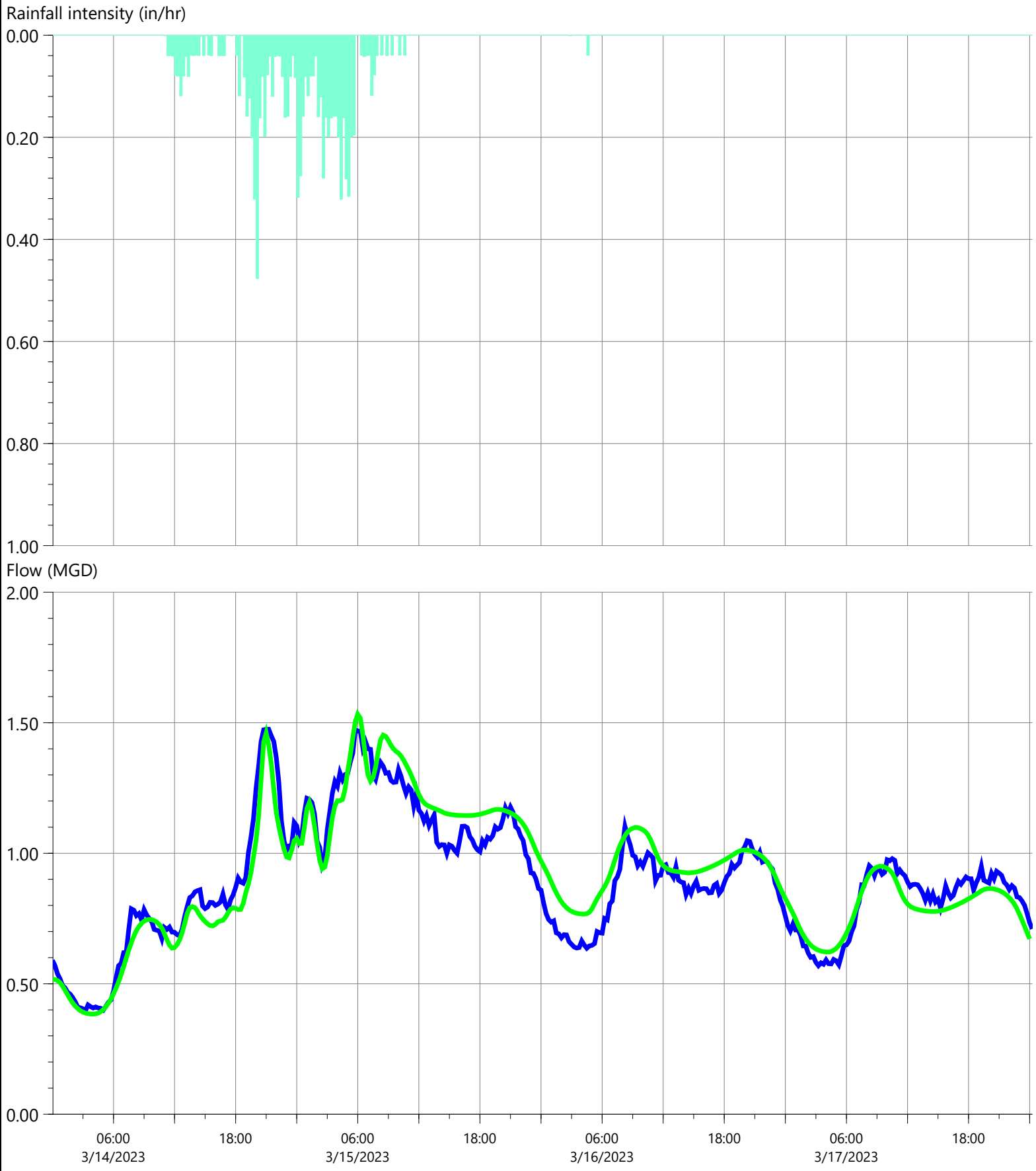


	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.242	0.771	1.010
Modeled (DWF)	0.229	0.775	1.023

Appendix C

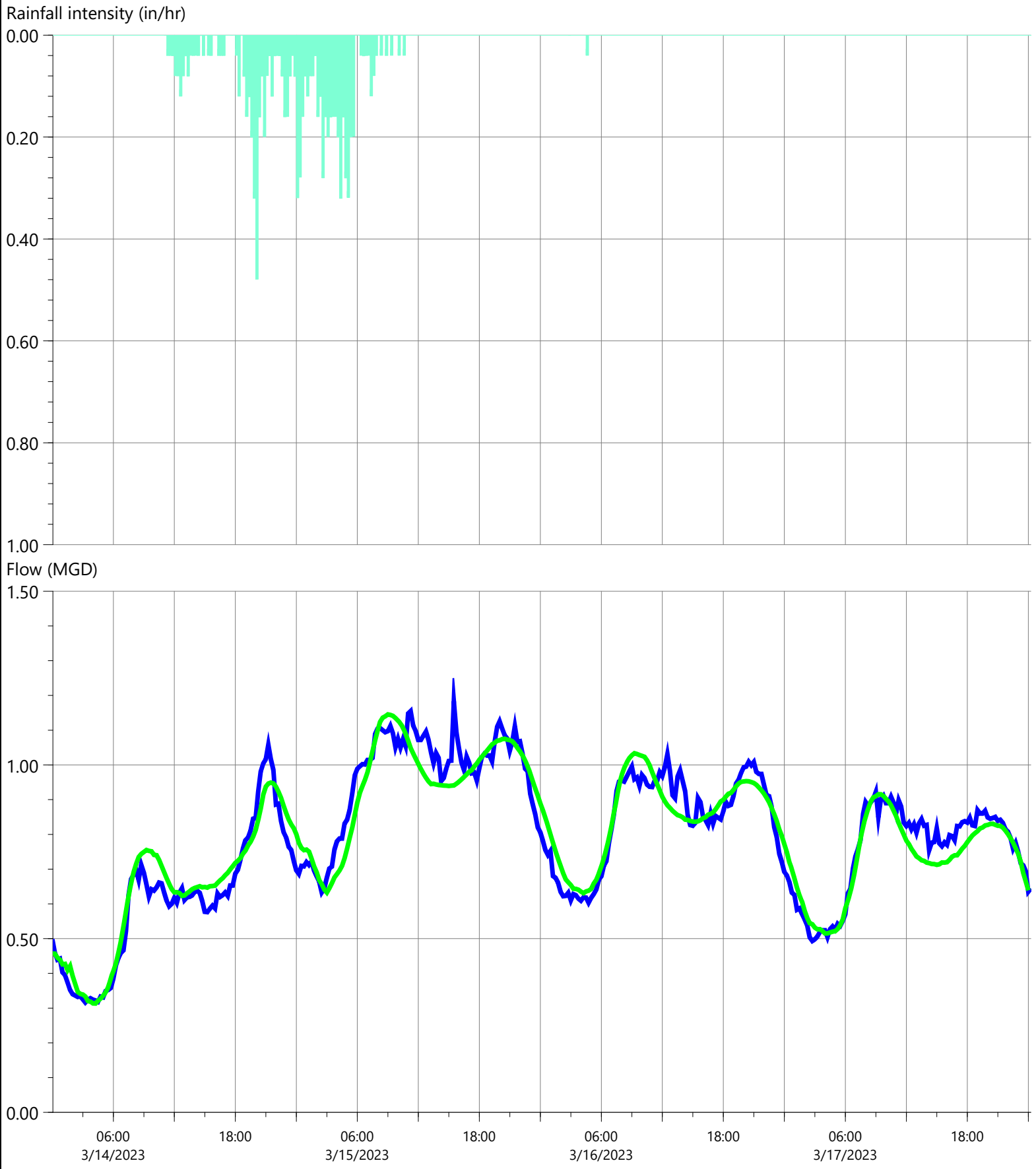
Wet Weather Flow Calibration Plots

Flow Survey Location (Obs.) 7363.1, Model Location (Pred.) U/S 7363.1, Rainfall Profile: 1



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.199	0.477	0.023			
Observed				0.397	1.475	3.615
Modeled (WWF)				0.384	1.533	3.656

Flow Survey Location (Obs.) 8347.1, Model Location (Pred.) D/S 8347.1, Rainfall Profile: 2



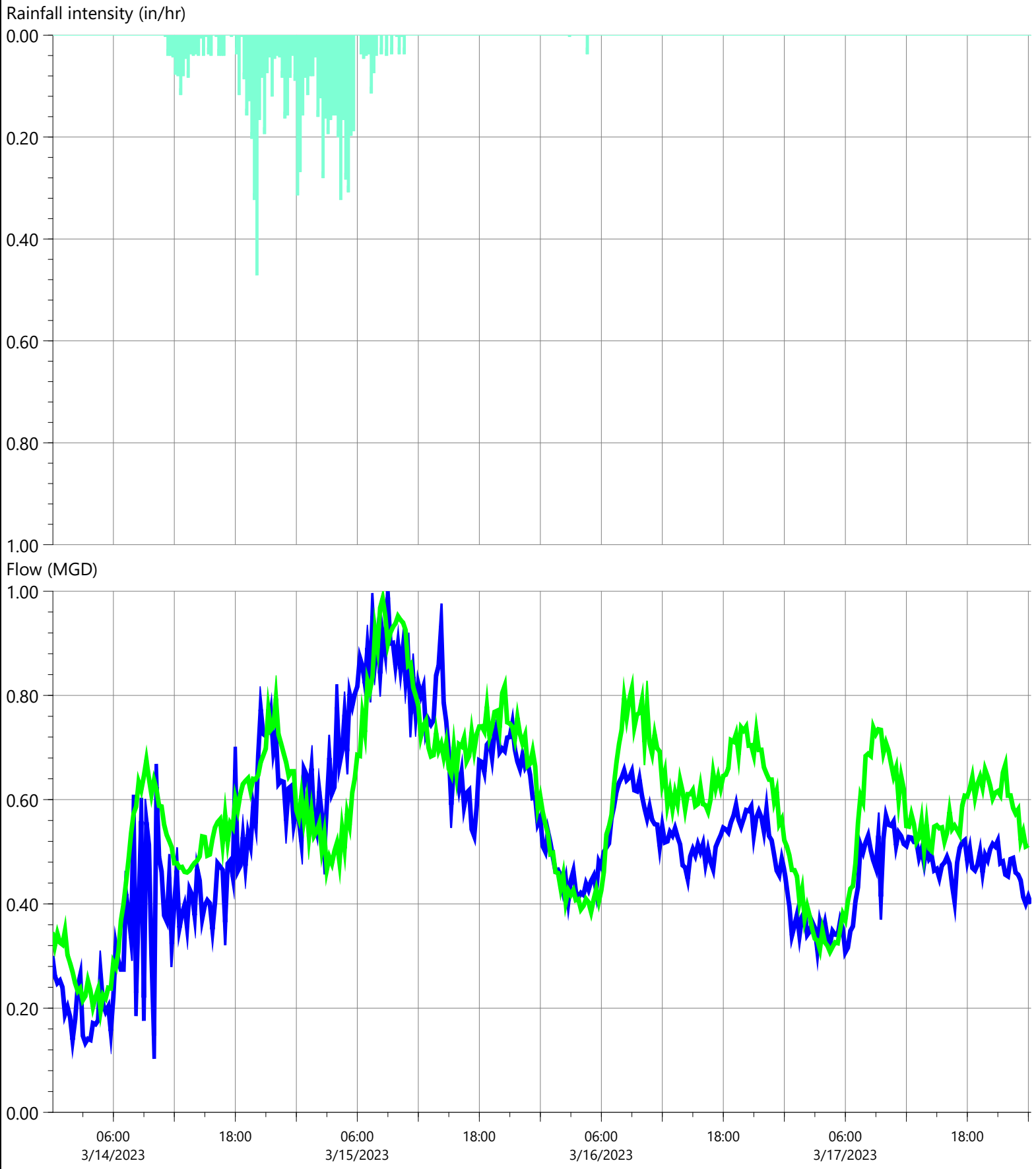
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.200	0.479	0.023			
Observed				0.316	1.183	3.176
Modeled (WWF)				0.313	1.145	3.161

Flow Survey Location (Obs.) 10499.1, Model Location (Pred.) D/S 10499.1, Rainfall Profile: 3



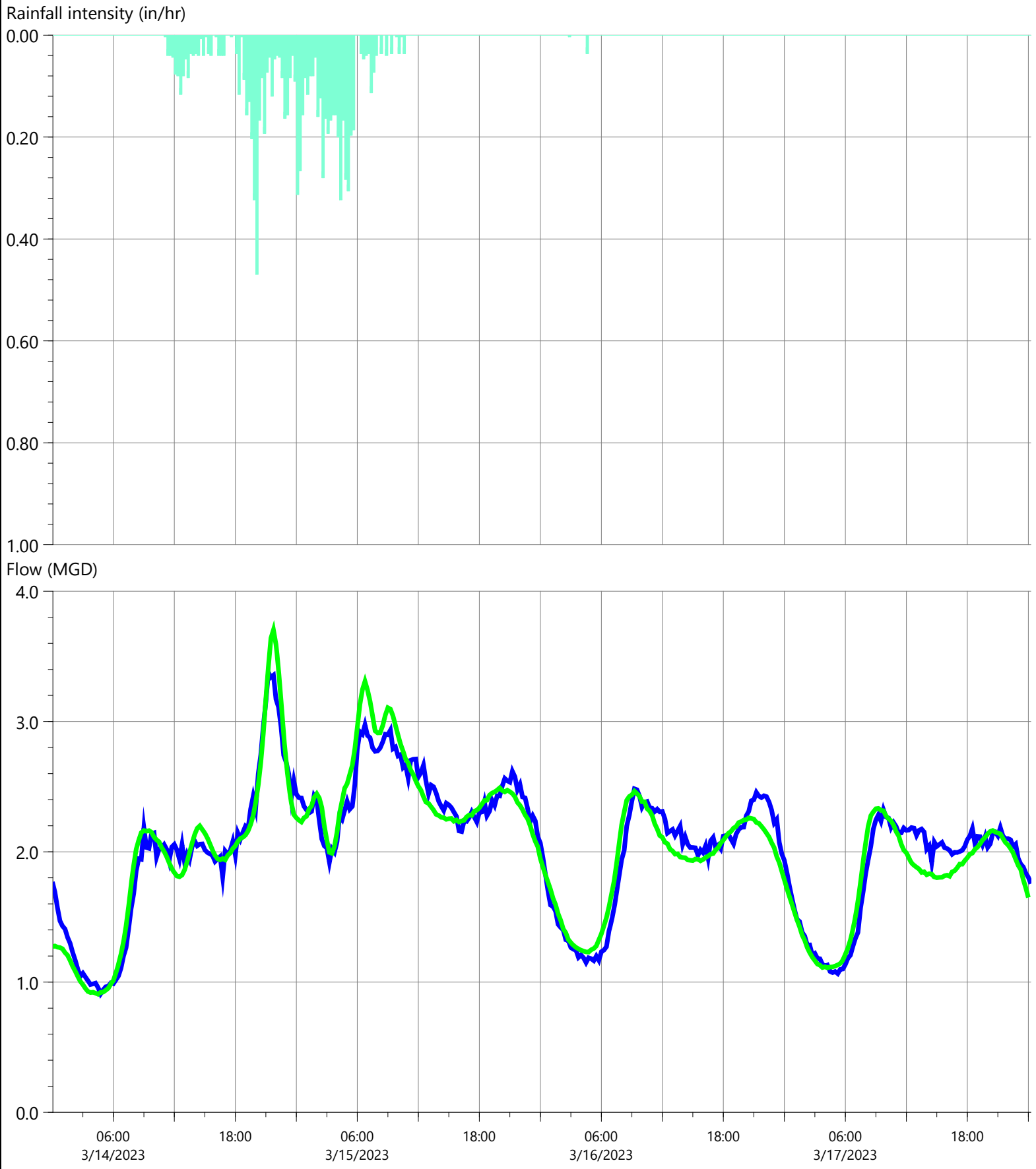
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.199	0.477	0.023			
Observed				0.871	3.129	8.133
Modeled (WWF)				0.865	3.280	8.160

Flow Survey Location (Obs.) CST0060-0500.1, Model Location (Pred.) D/S CST0060-0500.1, Rainfall Profile: 4



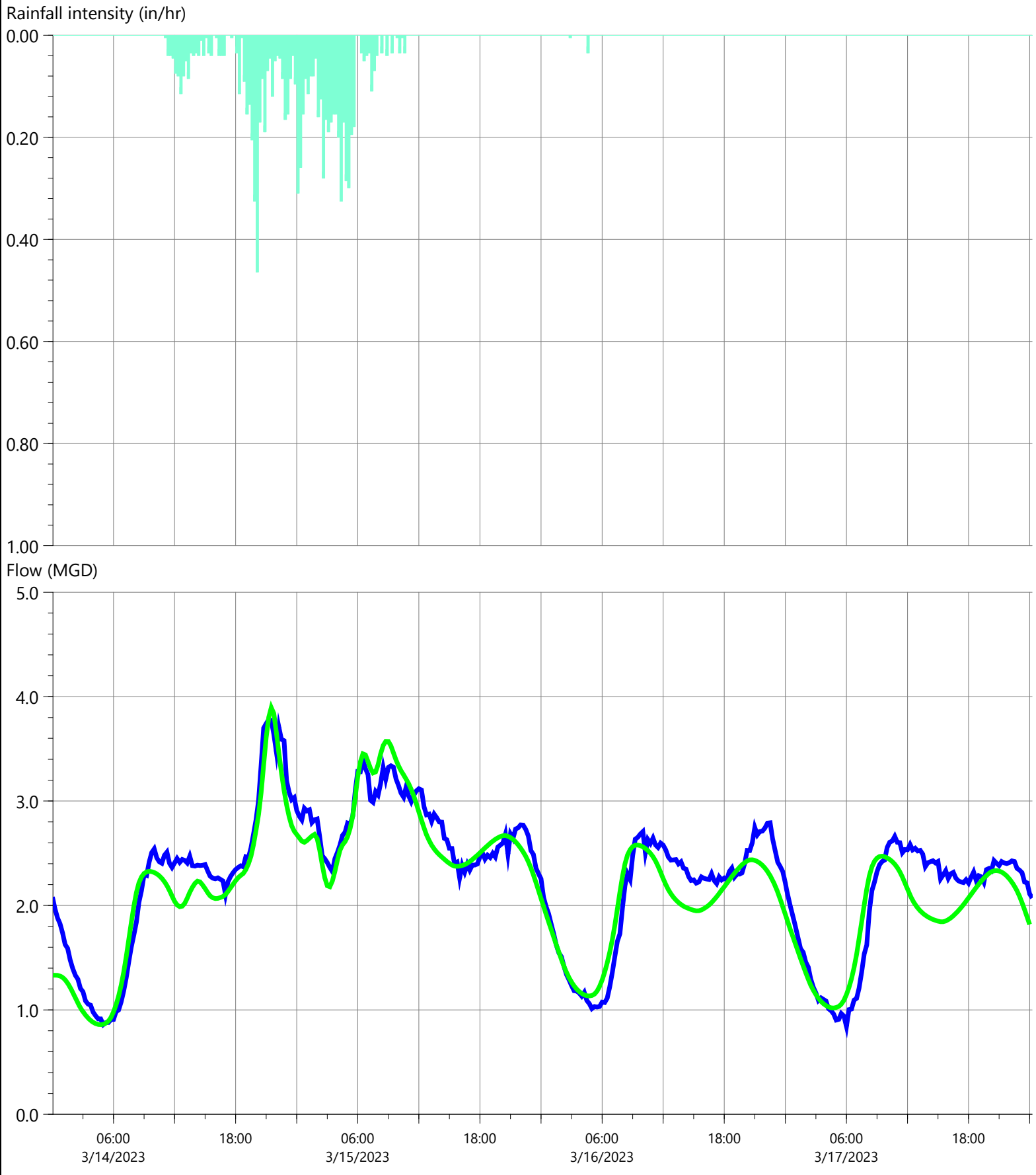
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.198	0.471	0.023			
Observed				0.133	0.988	2.107
Modeled (WWF)				0.195	0.986	2.345

Flow Survey Location (Obs.) CST0060-0195.1, Model Location (Pred.) D/S CST0060-0195.1, Rainfall Profile: 5



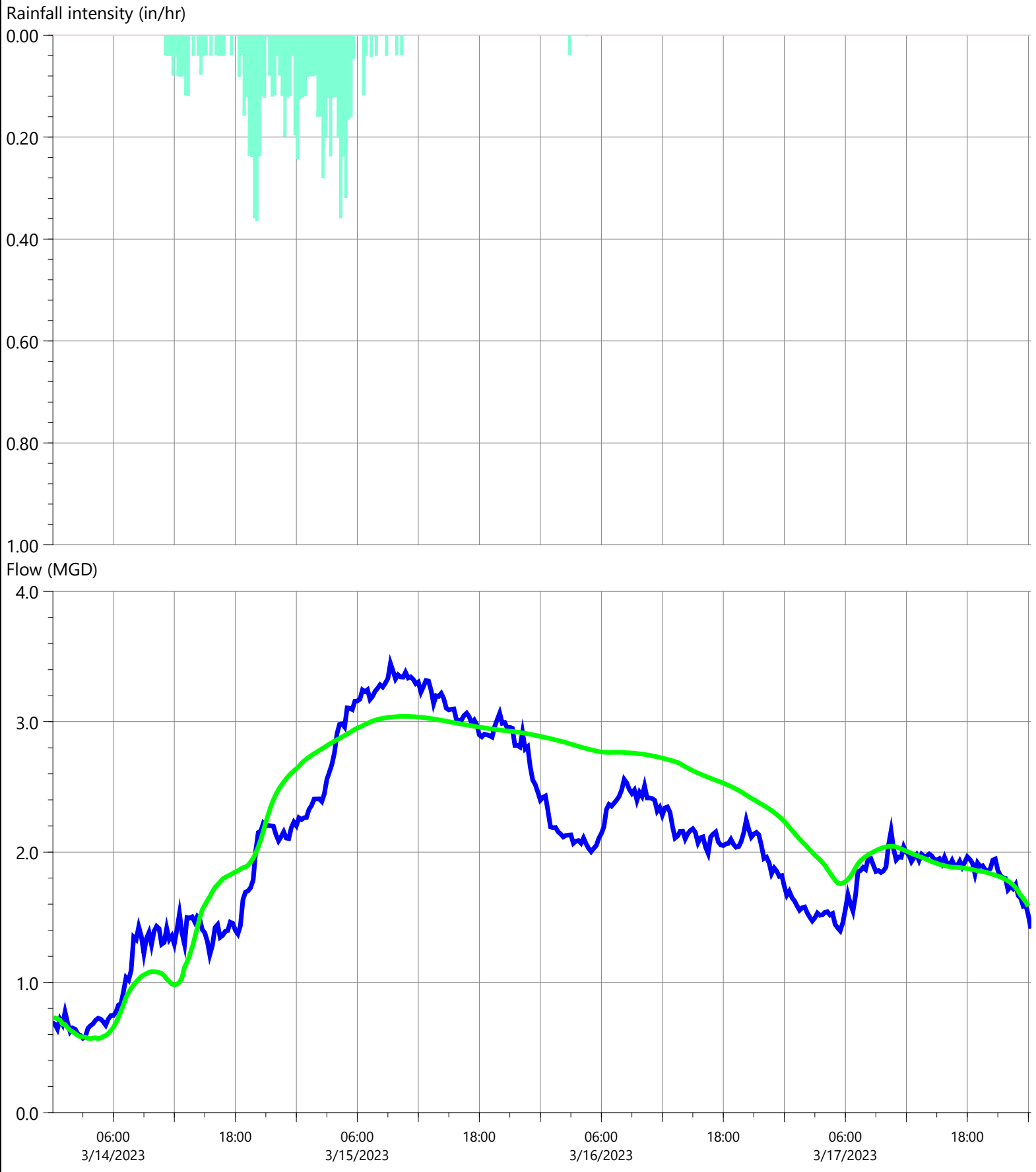
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.198	0.470	0.023			
Observed				0.910	3.376	8.138
Modeled (WWF)				0.907	3.702	8.080

Flow Survey Location (Obs.) CST0068-0000.1, Model Location (Pred.) D/S CST0068-0000.1, Rainfall Profile: 6



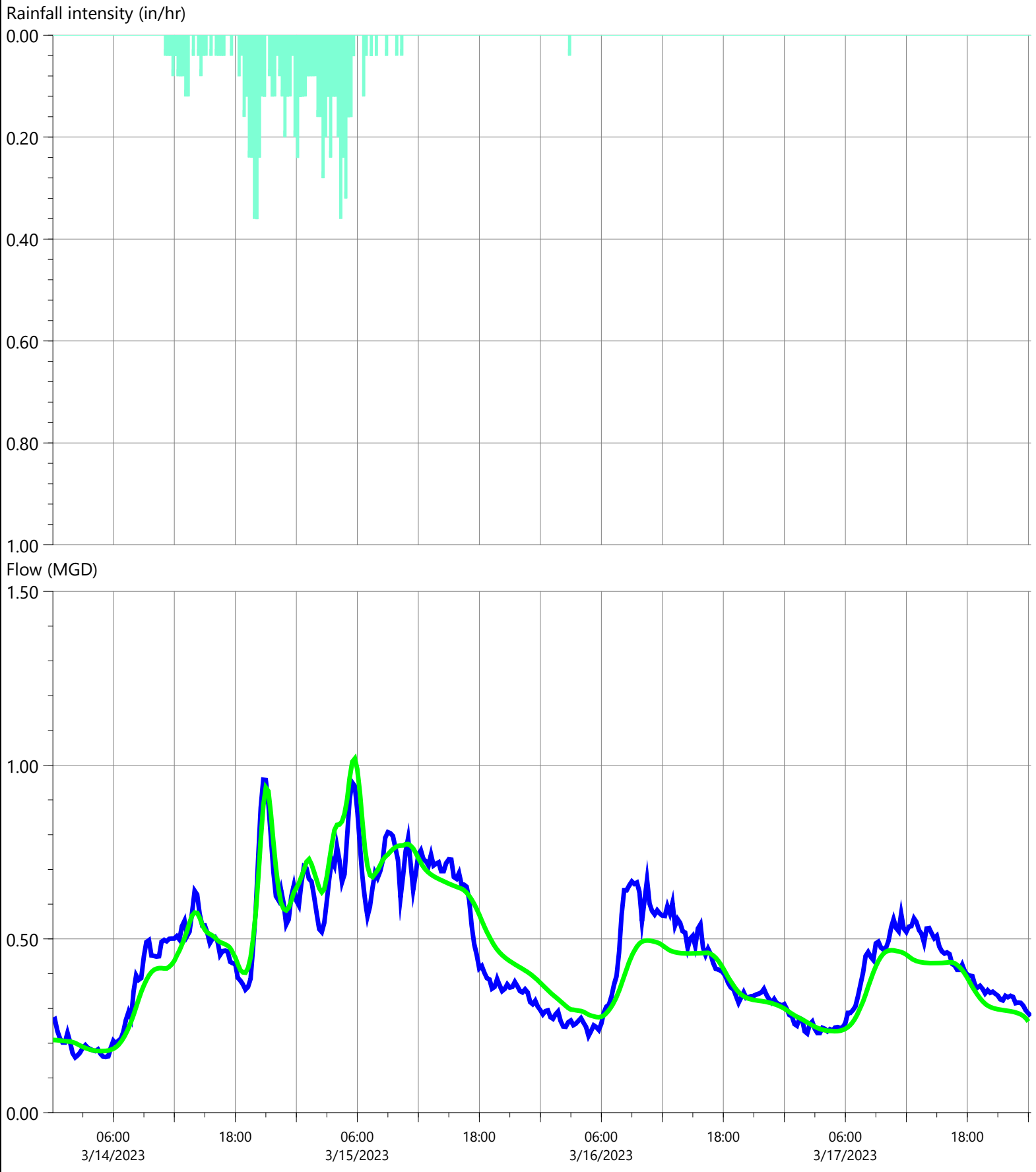
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.197	0.464	0.023			
Observed				0.841	3.781	9.045
Modeled (WWF)				0.858	3.895	8.620

Flow Survey Location (Obs.) KNT0080-0735.1, Model Location (Pred.) D/S KNT0080-0735.1, Rainfall Profile: 7



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.181	0.364	0.023			
Observed				0.571	3.448	8.276
Modeled (WWF)				0.568	3.041	8.832

Flow Survey Location (Obs.) 1868.1, Model Location (Pred.) U/S 1868.1, Rainfall Profile: 8



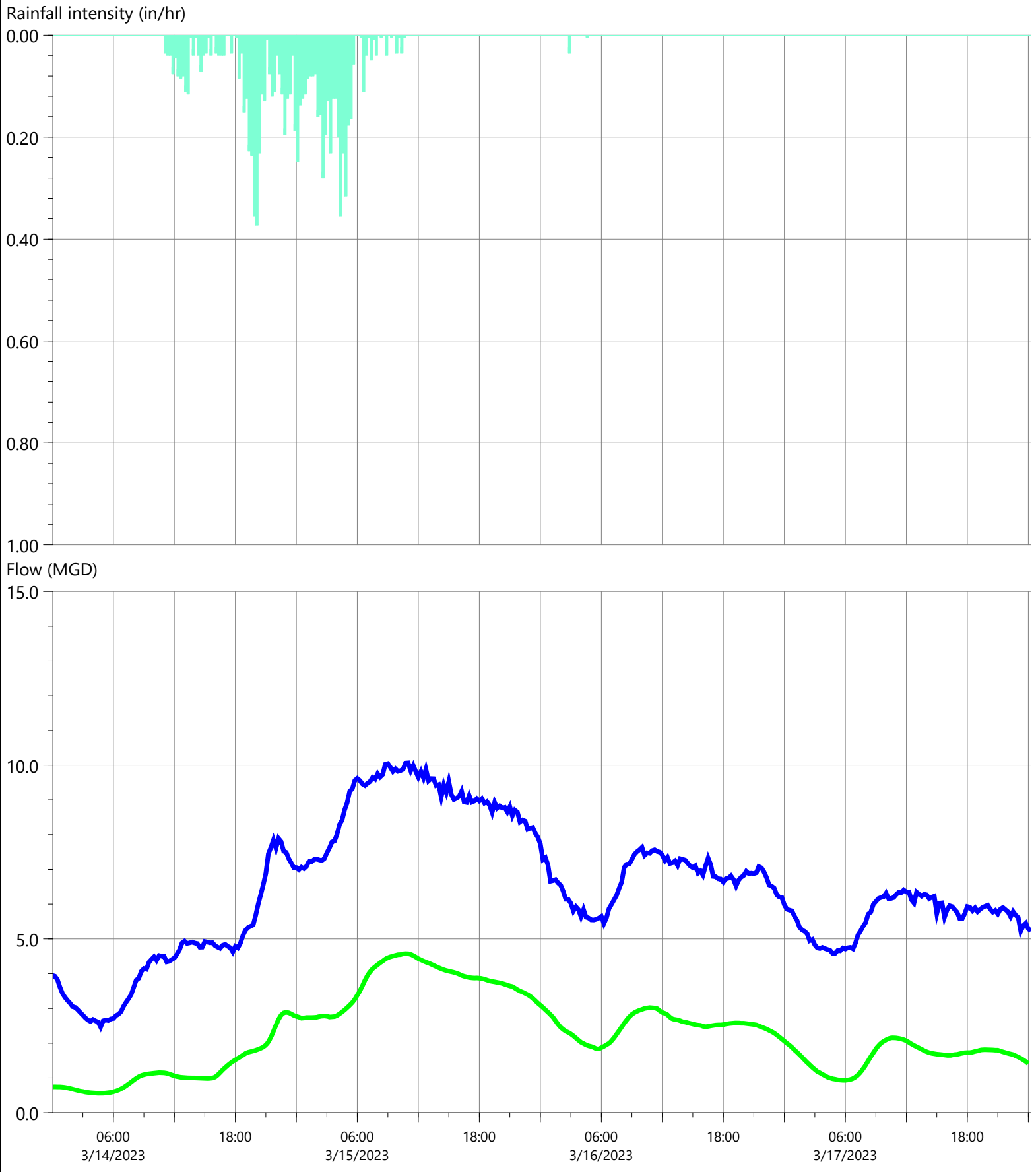
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.180	0.360	0.023			
Observed				0.159	0.958	1.822
Modeled (WWF)				0.177	1.019	1.796

Flow Survey Location (Obs.) KNT0080-0265.1, Model Location (Pred.) D/S KNT0080-0265.1, Rainfall Profile: 9



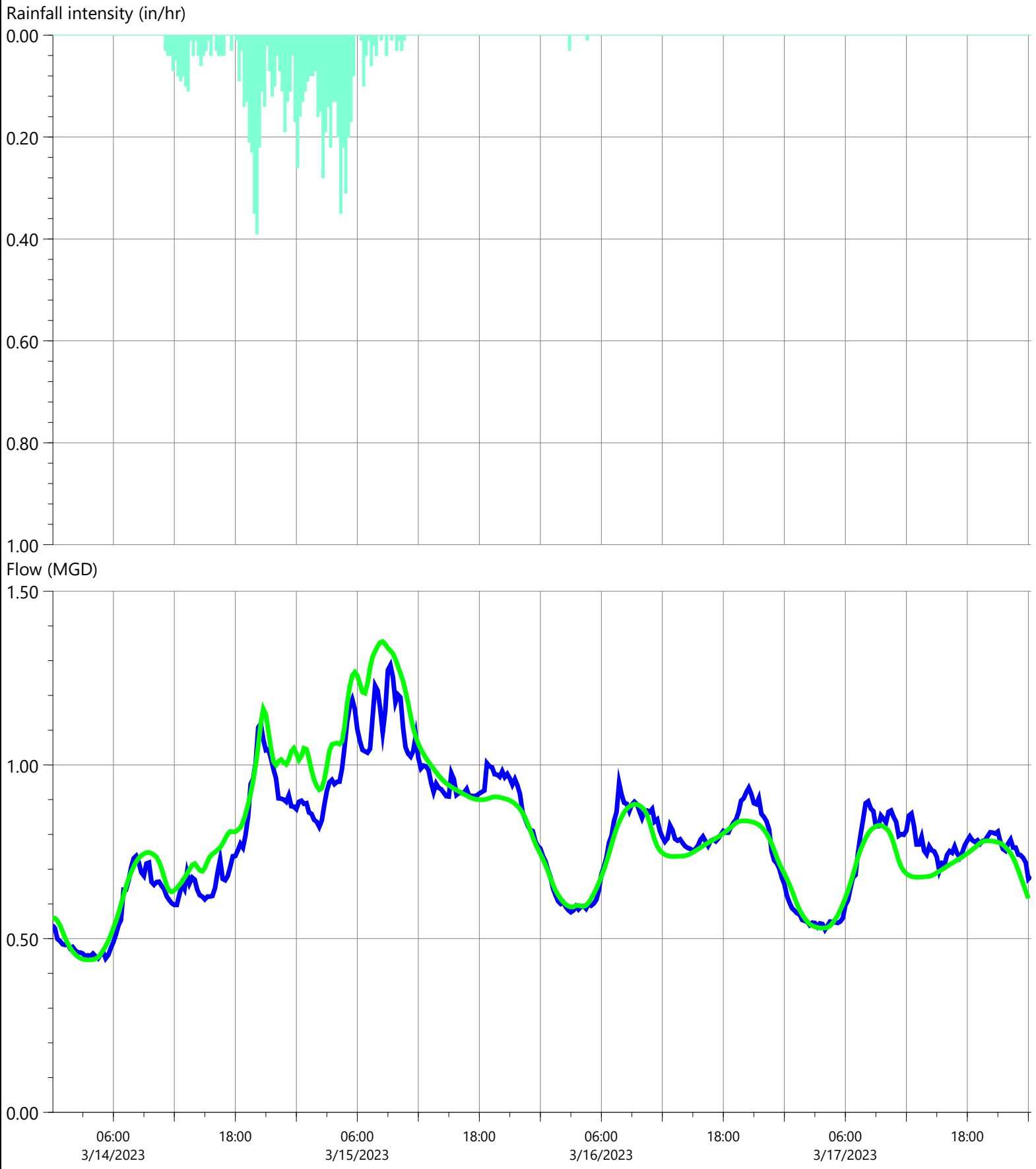
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.180	0.361	0.023			
Observed				0.656	2.531	6.664
Modeled (WWF)				0.663	2.493	6.746

Flow Survey Location (Obs.) KNT0080-0535.1, Model Location (Pred.) D/S KNT0080-0535.1, Rainfall Profile: 10



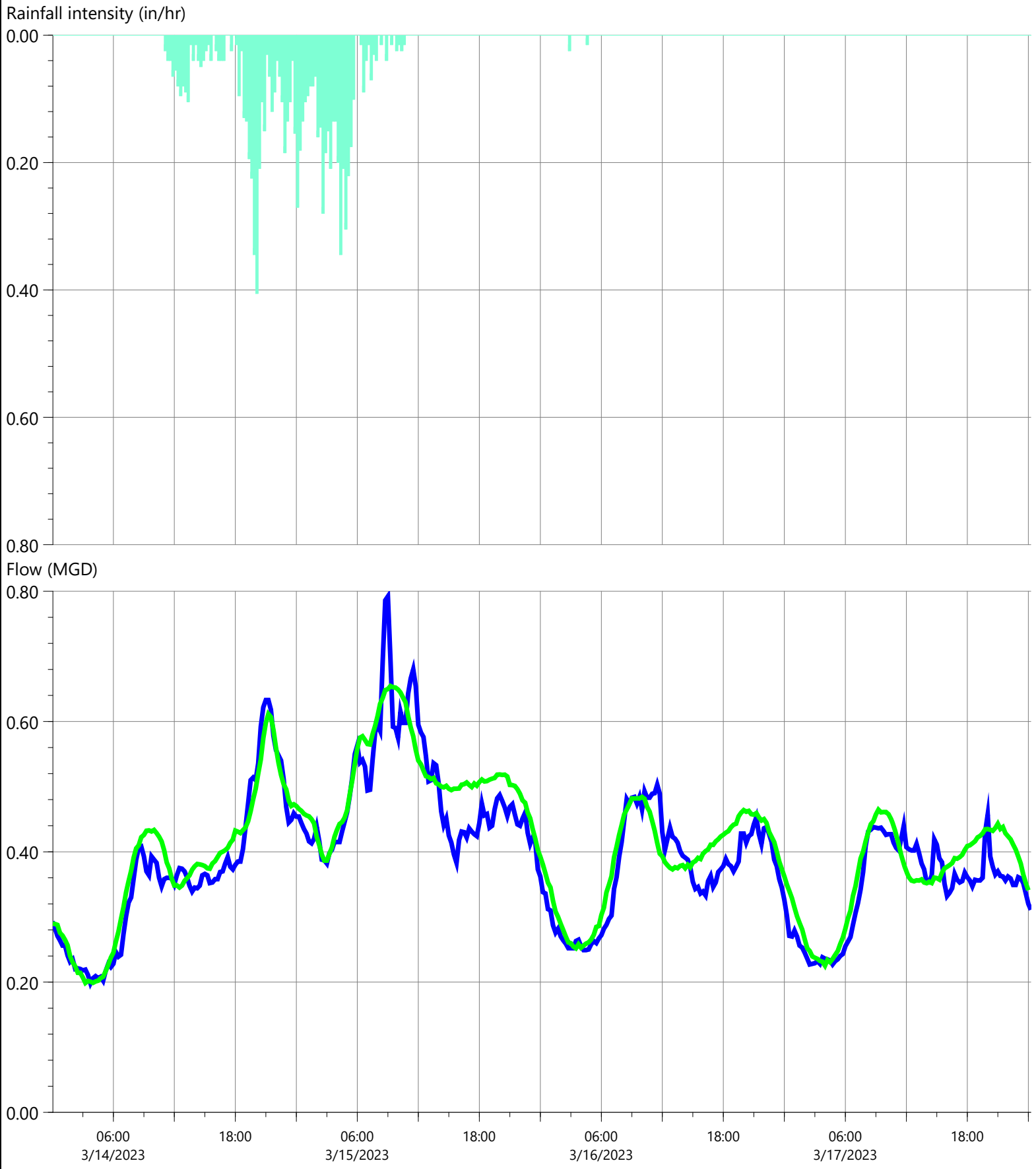
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.182	0.373	0.023			
Observed				2.465	10.066	25.831
Modeled (WWF)				0.556	4.577	9.044

Flow Survey Location (Obs.) 13310.1, Model Location (Pred.) D/S 13310.1, Rainfall Profile: 11



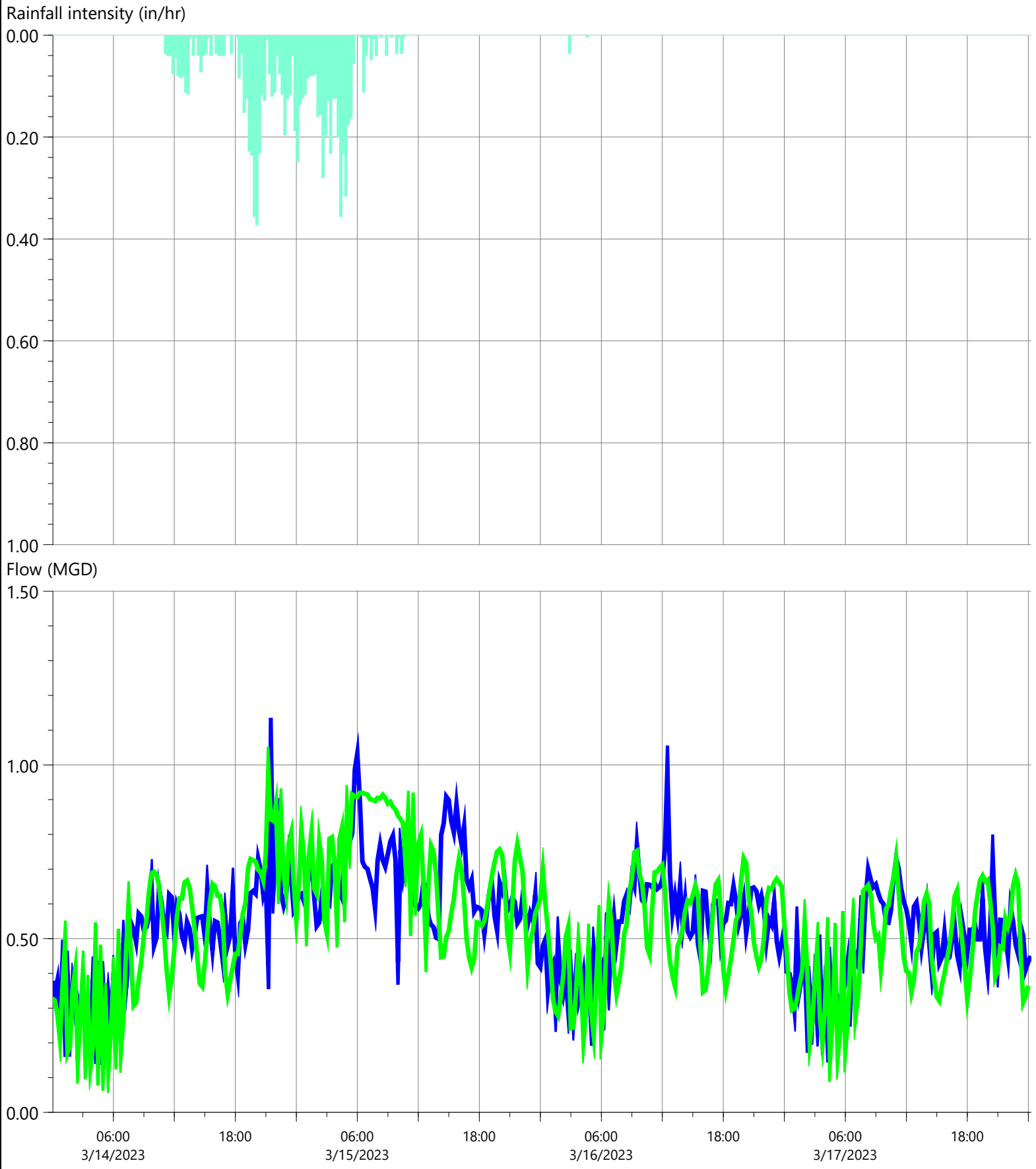
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.185	0.390	0.023			
Observed				0.443	1.287	3.159
Modeled (WWF)				0.439	1.355	3.199

Flow Survey Location (Obs.) 5294.1, Model Location (Pred.) D/S 5294.1, Rainfall Profile: 12



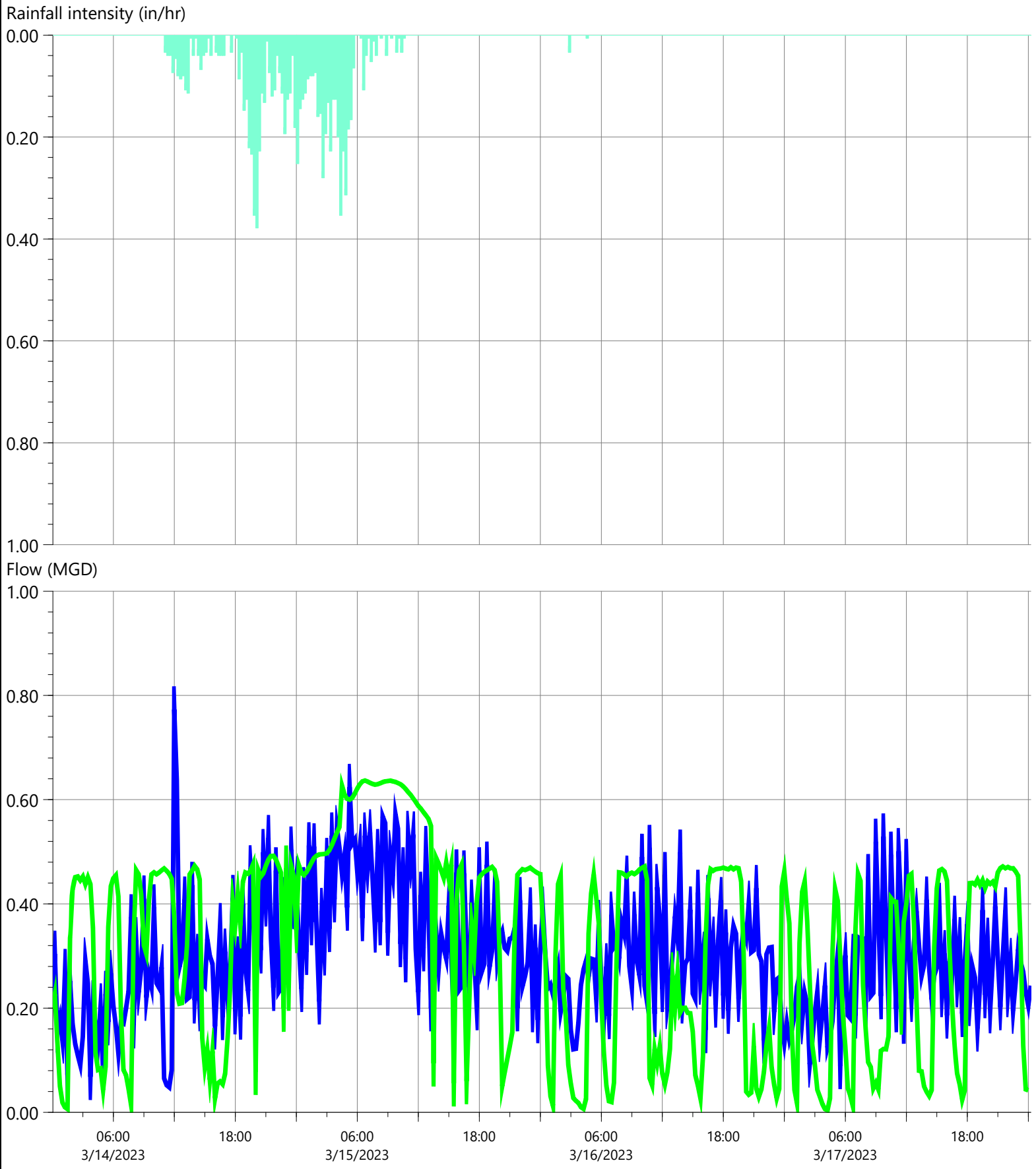
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.188	0.406	0.023			
Observed				0.198	0.792	1.569
Modeled (WWF)				0.199	0.654	1.637

Flow Survey Location (Obs.) 2741.1, Model Location (Pred.) U/S 2741.1, Rainfall Profile: 13



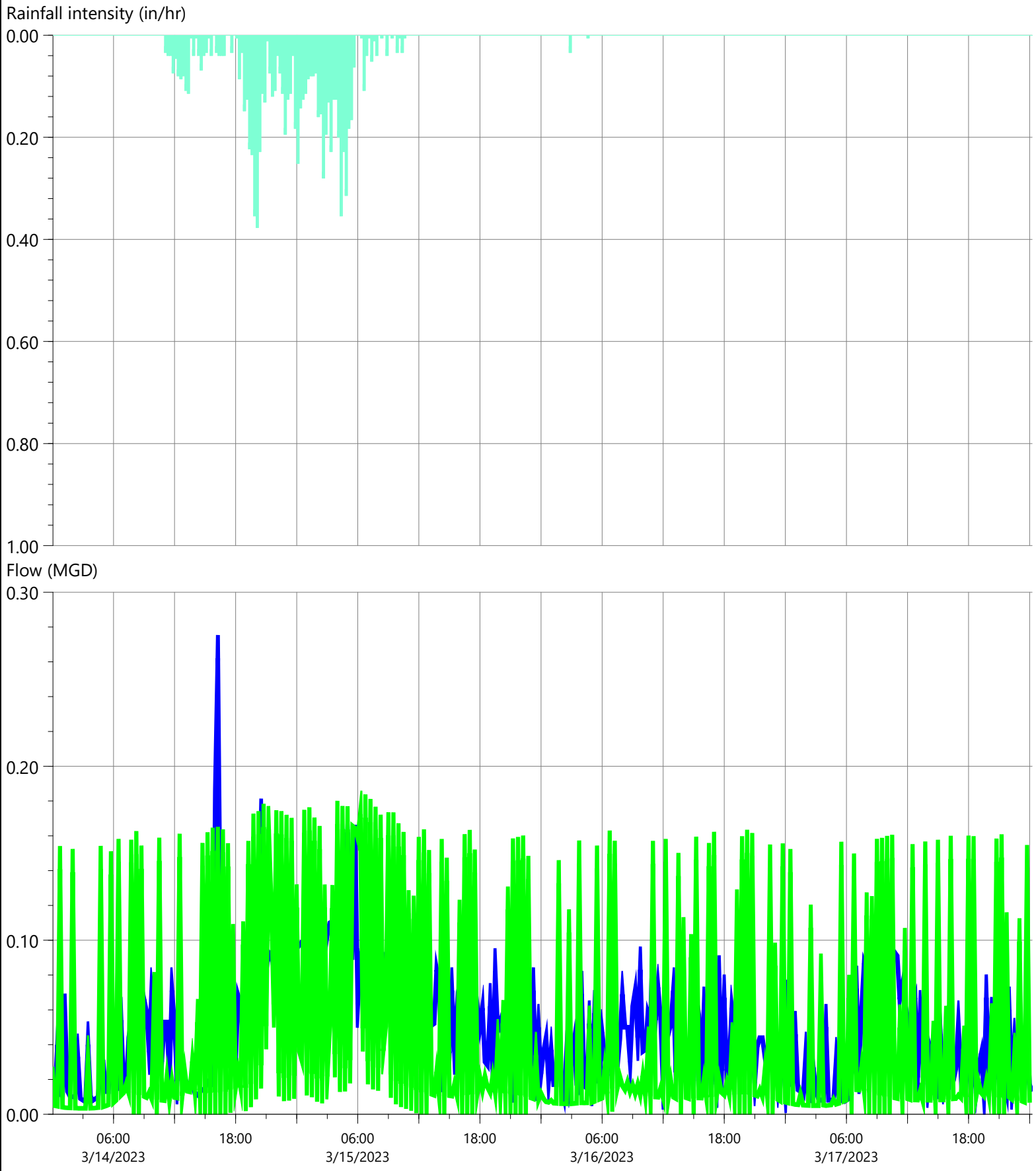
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.182	0.372	0.023			
Observed				0.200	1.069	2.184
Modeled (WWF)				0.122	0.985	2.165

Flow Survey Location (Obs.) 3903.1, Model Location (Pred.) D/S 3903.1, Rainfall Profile: 14



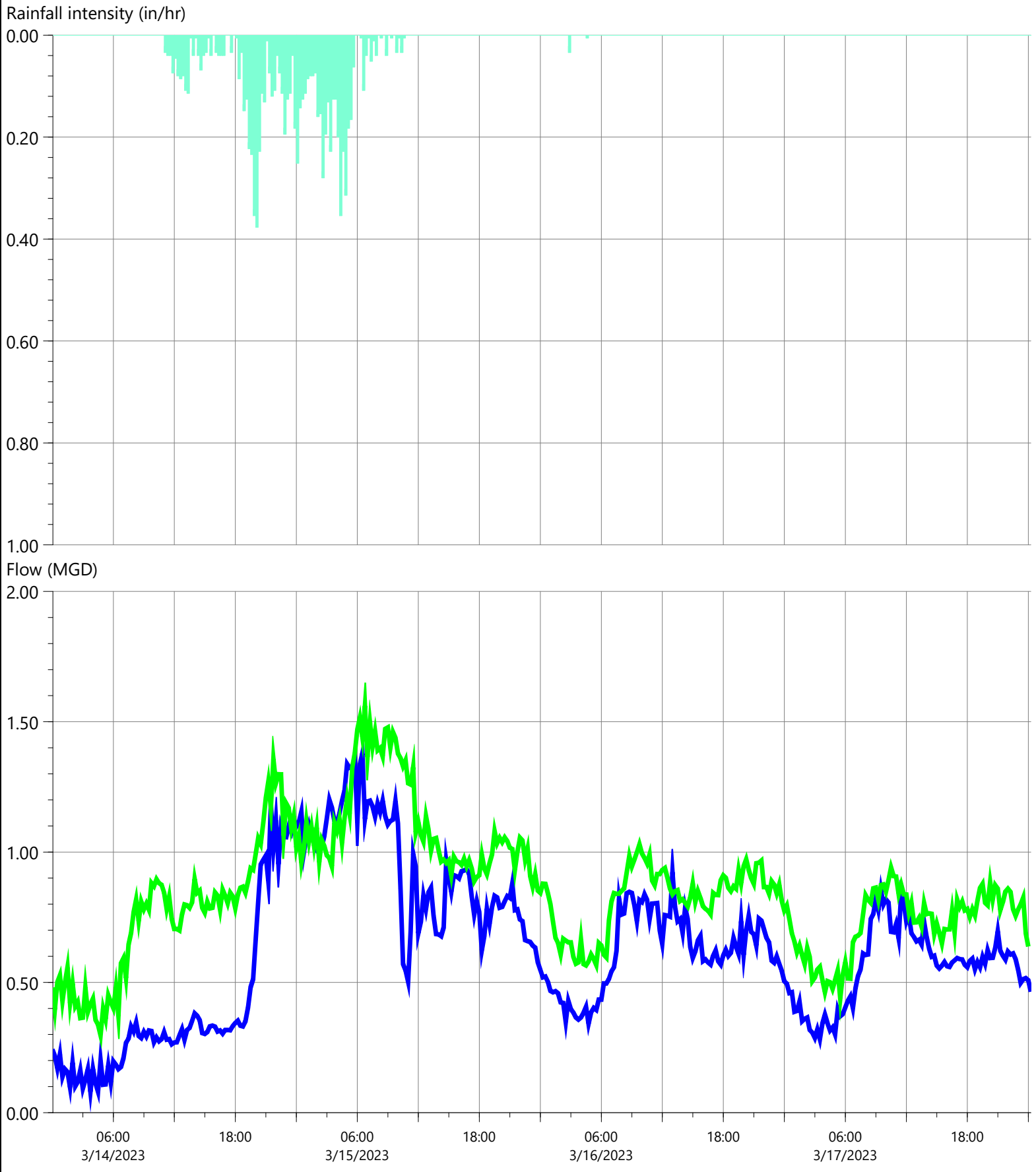
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.183	0.378	0.023			
Observed				0.048	0.773	1.204
Modeled (WWF)				0.004	0.637	1.299

Flow Survey Location (Obs.) 4021.1, Model Location (Pred.) U/S 4021.1, Rainfall Profile: 15



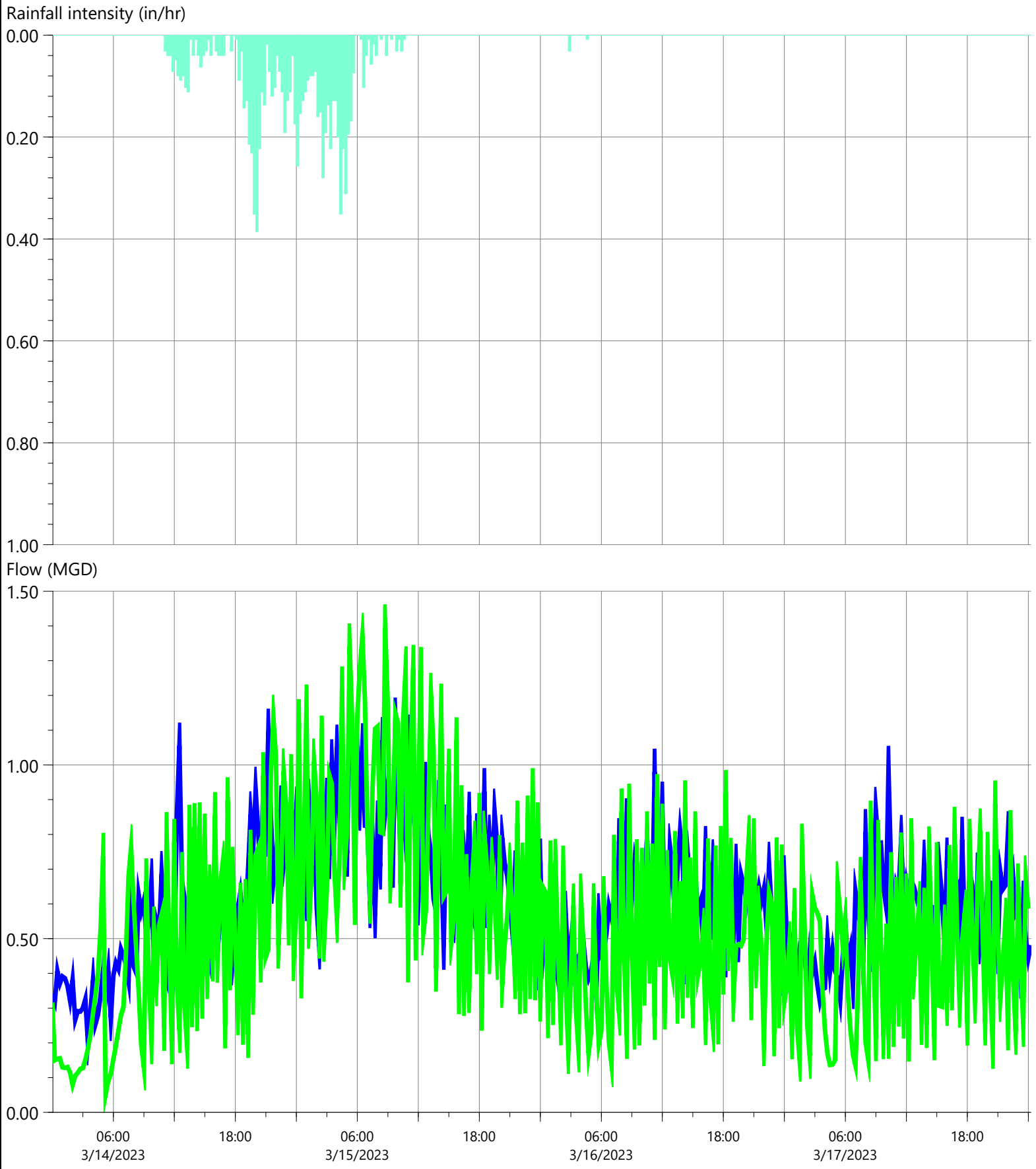
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.183	0.377	0.023			
Observed				0.007	0.262	0.199
Modeled (WWF)				0.003	0.173	0.203

Flow Survey Location (Obs.) 4355.1, Model Location (Pred.) D/S 4355.1, Rainfall Profile: 16



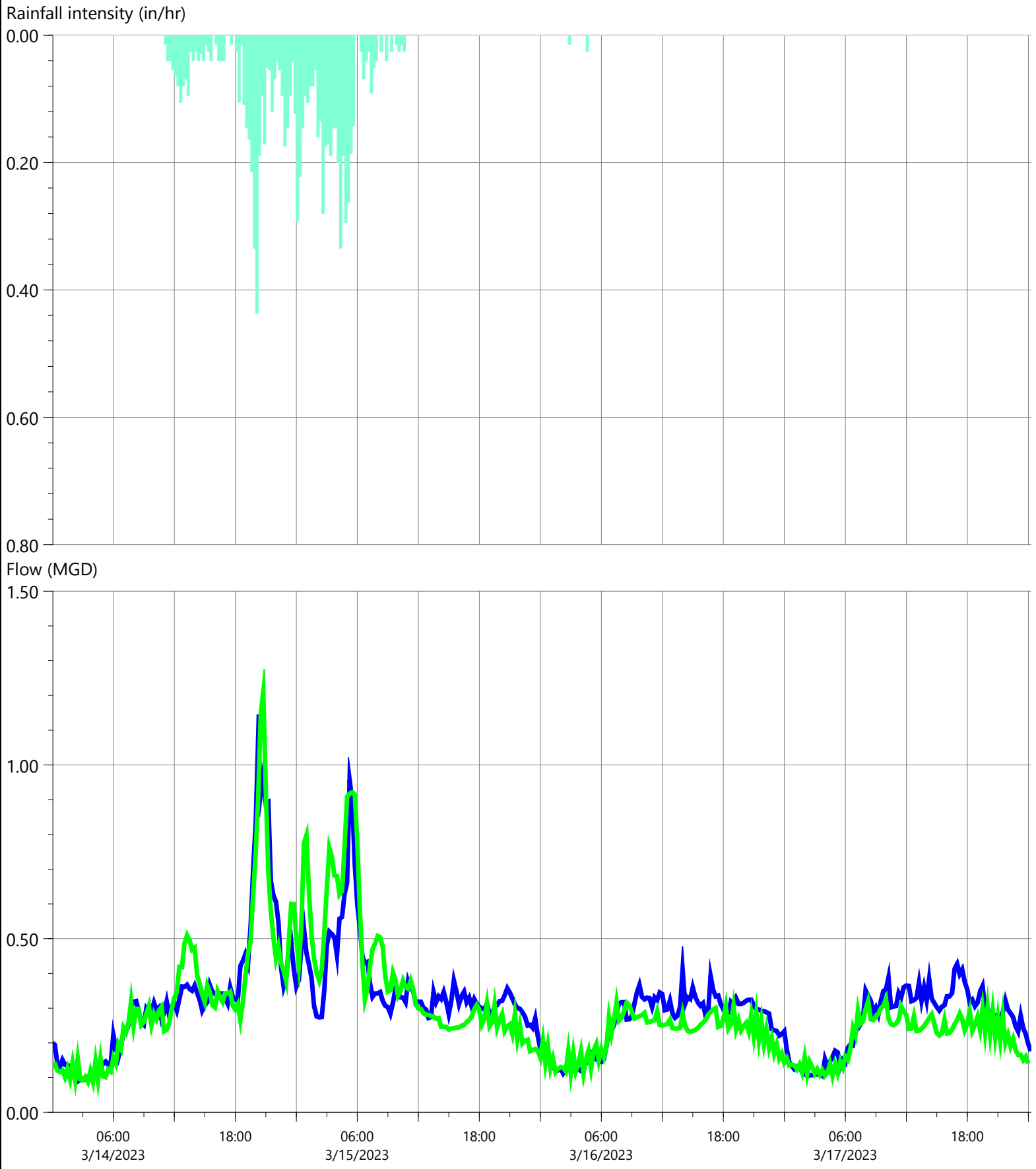
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.183	0.377	0.023			
Observed				0.080	1.379	2.503
Modeled (WWF)				0.297	1.561	3.415

Flow Survey Location (Obs.) 12870.1, Model Location (Pred.) D/S 12870.1, Rainfall Profile: 17



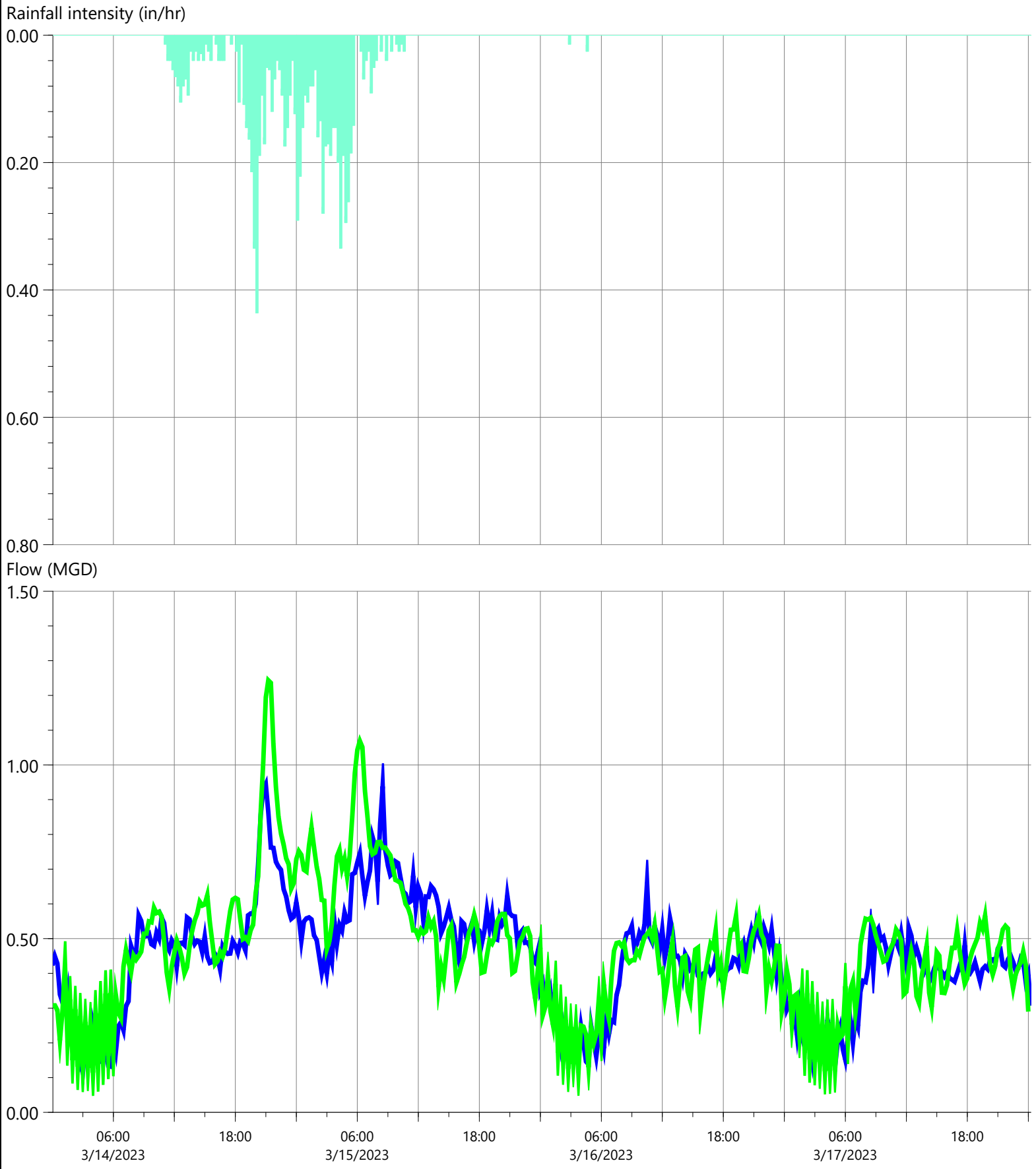
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.184	0.386	0.023			
Observed				0.202	1.149	2.438
Modeled (WWF)				0.052	1.396	2.169

Flow Survey Location (Obs.) 4988.1, Model Location (Pred.) D/S 4988.1, Rainfall Profile: 18



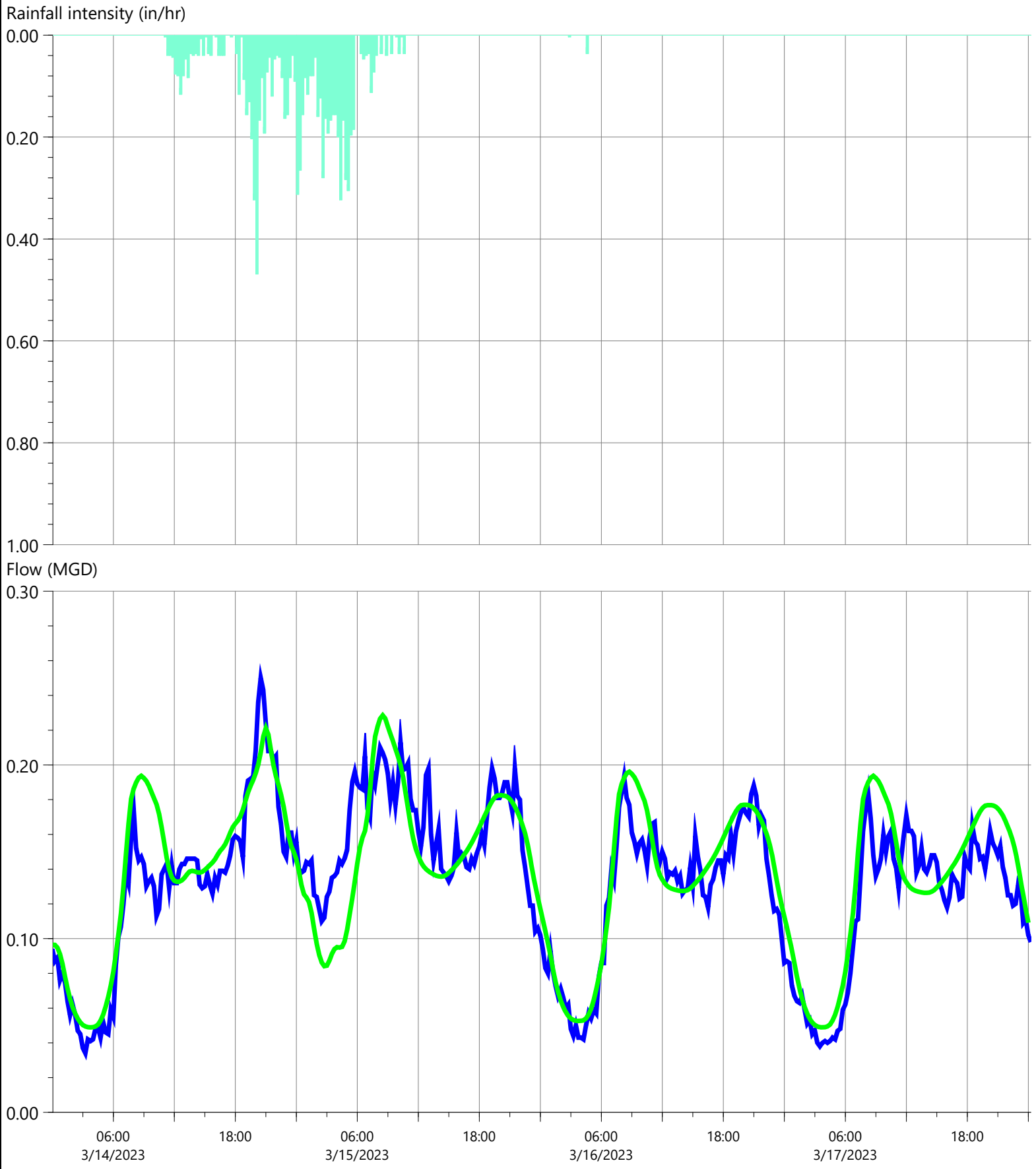
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.193	0.437	0.023			
Observed				0.089	1.079	1.228
Modeled (WWF)				0.088	1.209	1.165

Flow Survey Location (Obs.) 11726.1, Model Location (Pred.) D/S 11726.1, Rainfall Profile: 19



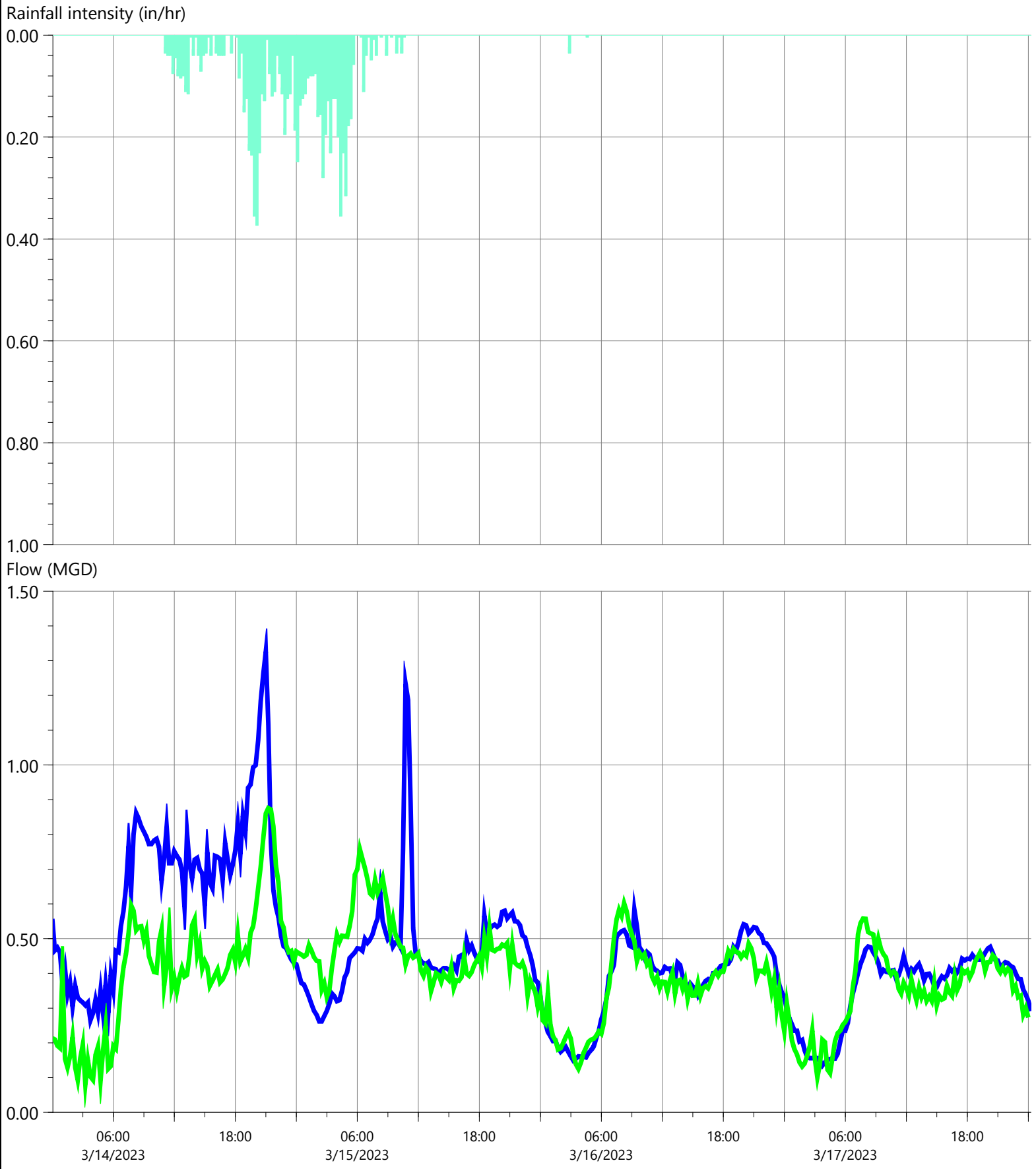
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.193	0.436	0.023			
Observed				0.114	0.944	1.787
Modeled (WWF)				0.114	1.243	1.873

Flow Survey Location (Obs.) 7345.1, Model Location (Pred.) D/S 7345.1, Rainfall Profile: 20



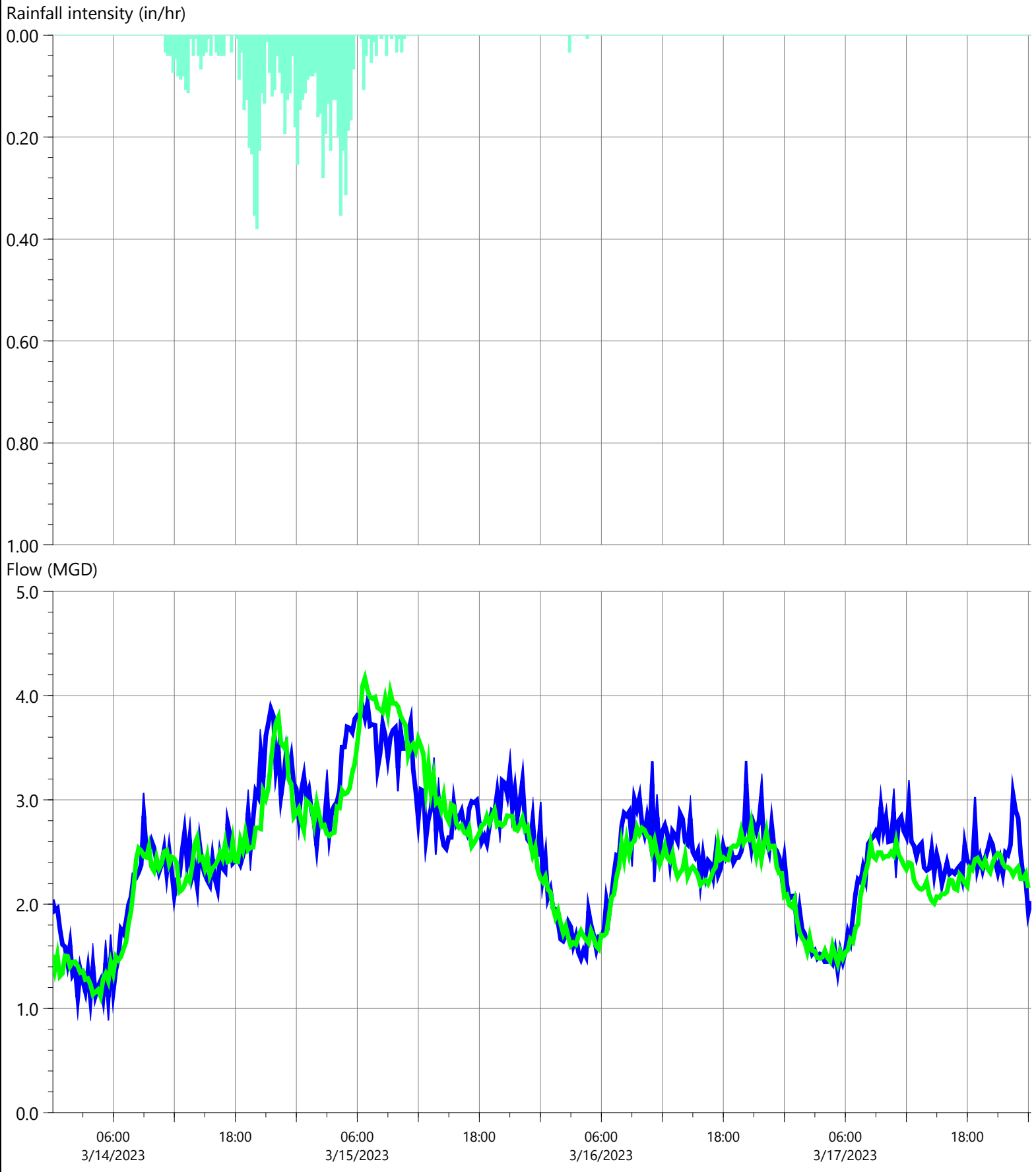
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.198	0.469	0.023			
Observed				0.034	0.250	0.535
Modeled (WWF)				0.049	0.229	0.553

Flow Survey Location (Obs.) KNT0080-0463.1, Model Location (Pred.) D/S KNT0080-0463.1, Rainfall Profile: 21



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.182	0.373	0.023			
Observed				0.135	1.326	1.845
Modeled (WWF)				0.080	0.875	1.576

Flow Survey Location (Obs.) KNT0080-0416.1, Model Location (Pred.) D/S KNT0080-0416.1, Rainfall Profile: 22



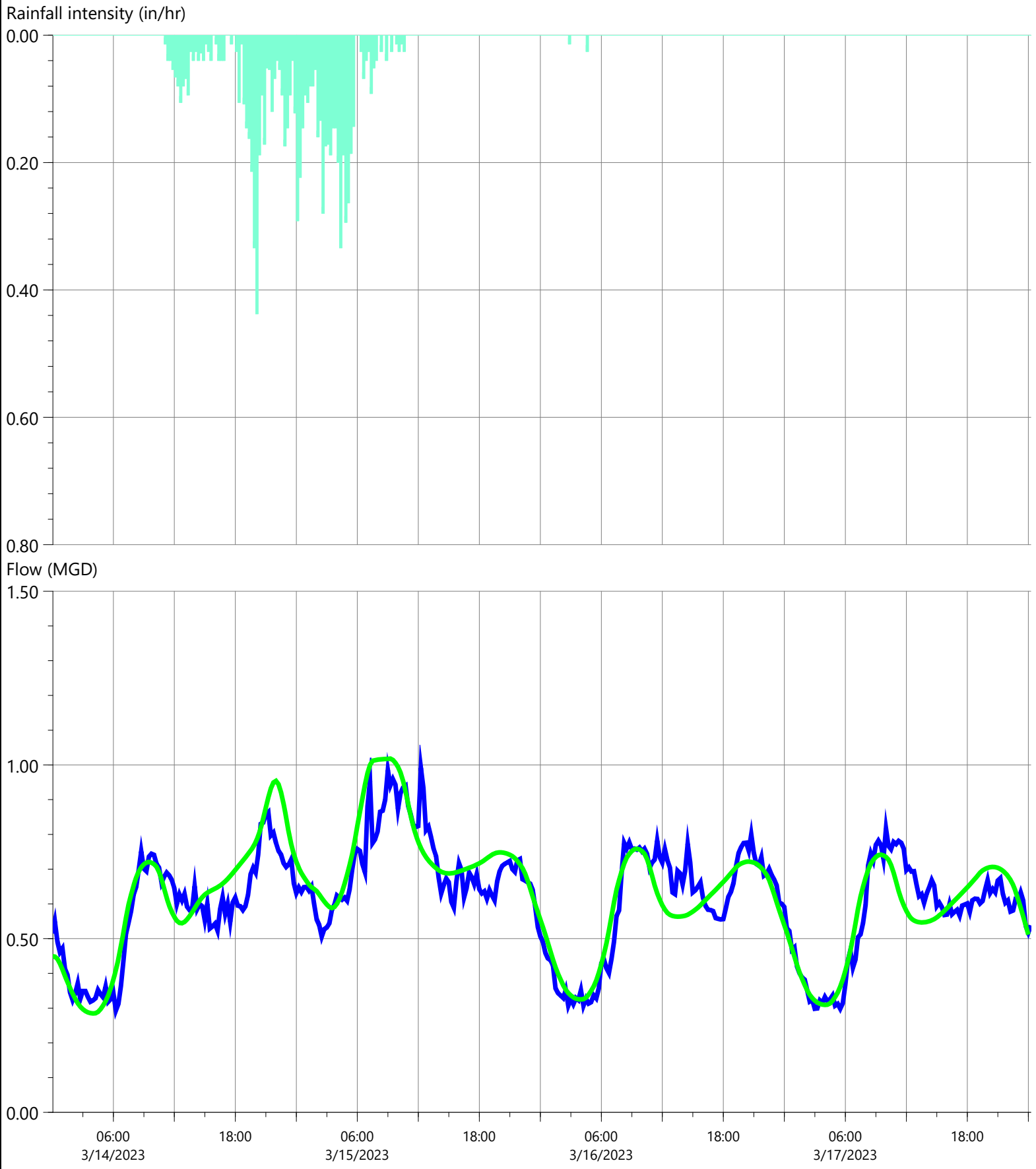
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.183	0.380	0.023			
Observed				1.102	3.926	10.034
Modeled (WWF)				1.117	4.164	9.700

Flow Survey Location (Obs.) KNT0080-0010.1, Model Location (Pred.) D/S KNT0080-0010.1, Rainfall Profile: 23



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.184	0.382	0.023			
Observed				4.240	18.872	44.293
Modeled (WWF)				4.988	17.566	46.081

Flow Survey Location (Obs.) 8295.1, Model Location (Pred.) D/S 8295.1, Rainfall Profile: 24

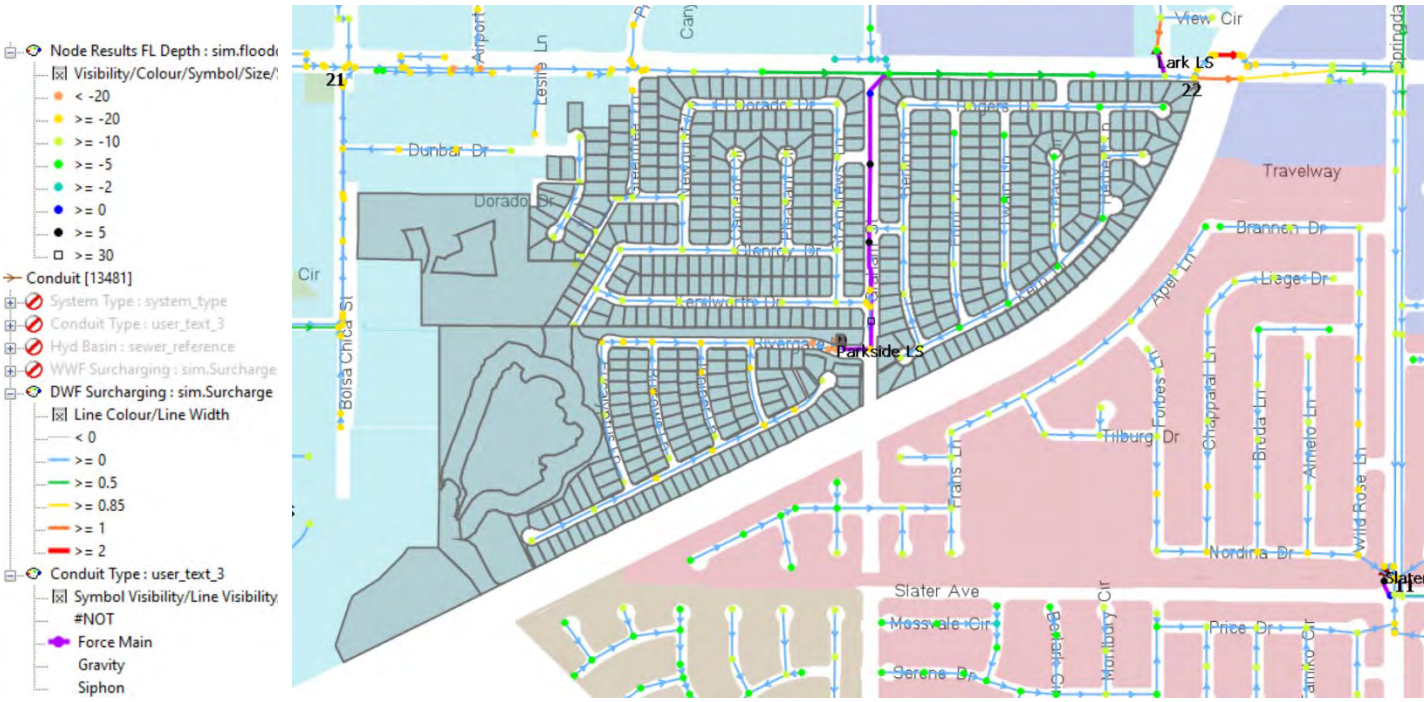


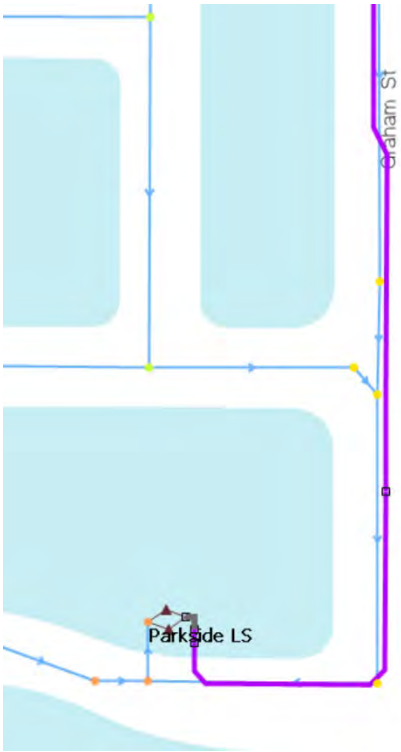
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.193	0.438	0.023			
Observed				0.293	0.991	2.444
Modeled (WWF)				0.285	1.018	2.498

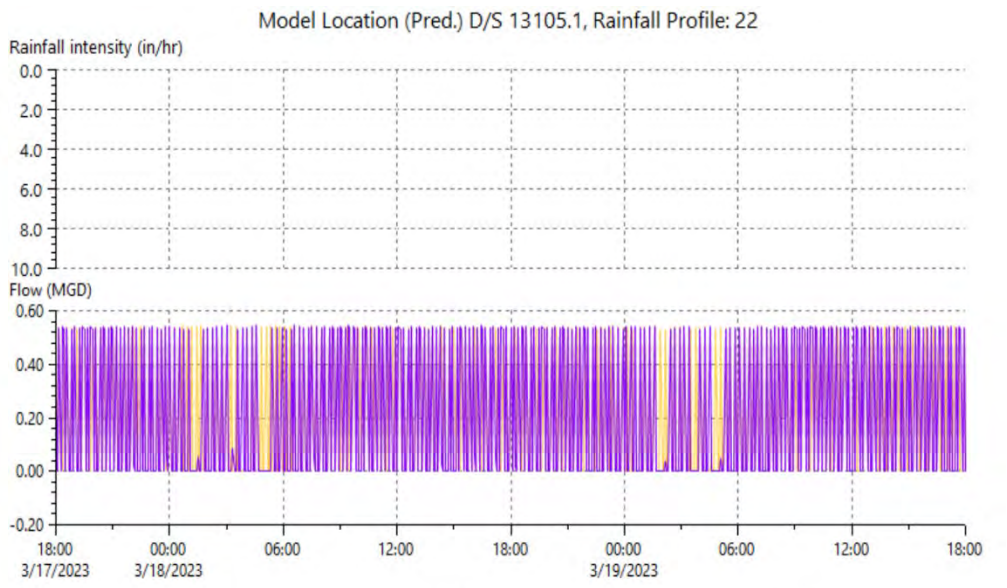
Appendix D

Lift Station Hydraulic Analysis Details

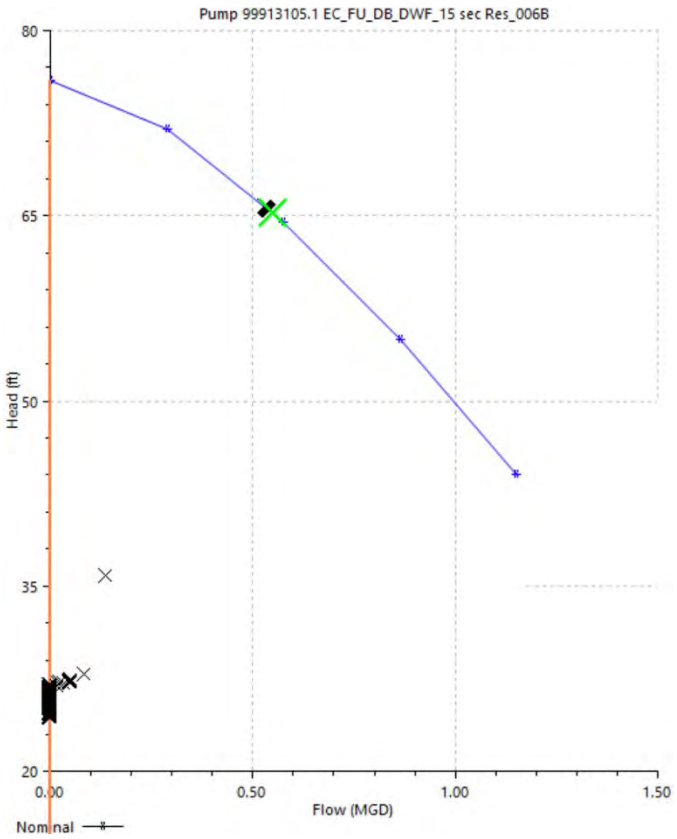
Parkside LS - Design Basis – DWF



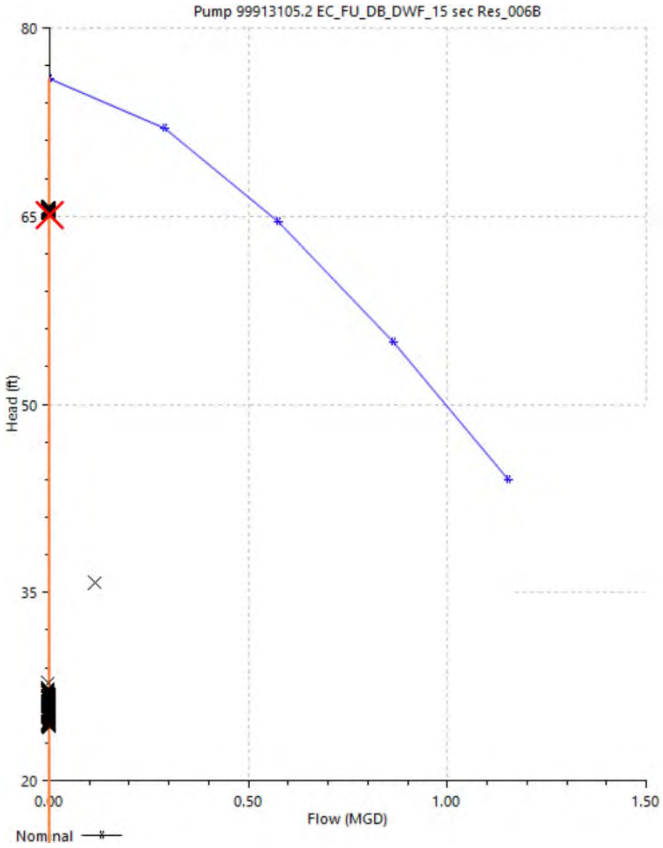




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.549	0.457
Future - DWF				-0.000	0.550	0.445



Parkside Lead Pump

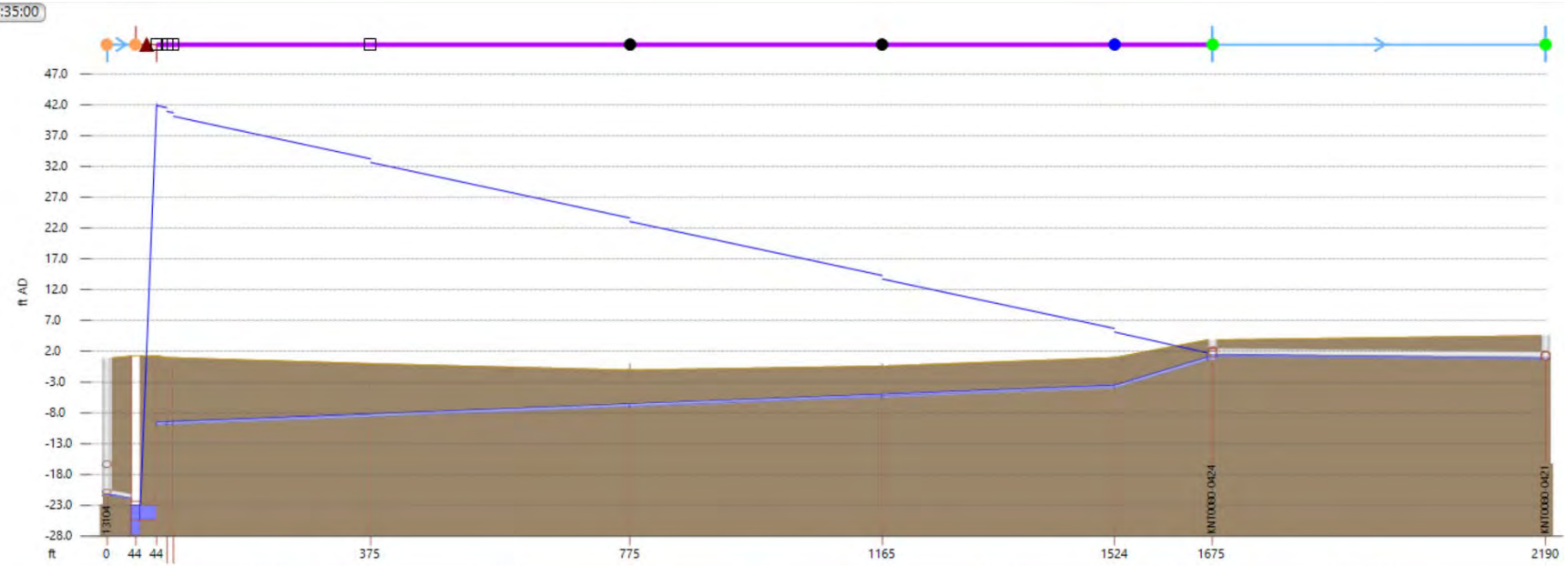


Parkside Lag Pump



Link		99913105.1	13105.1	
width (in)			6.0	
us inv (ft AD)			-10.000	
ds inv (ft AD)			-9.935	
r.pfc (MGD)			-0.23	
surc		1.00	1.00	
US total head (ft AD)		-22.967	42.171	
US velocity (ft/s)		0.000	4.331	
DS flow (MGD)		0.5515	0.5496	
DS cumulative flow (US Mgal)		0.45548	0.45547	
DS total head (ft AD)		42.171	41.803	
DS velocity (ft/s)		0.000	4.331	
Node	99913105		13105	13106
ground (ft AD)	1.230		1.230	0.977
flood dep (ft)	-24.197		40.941	40.244

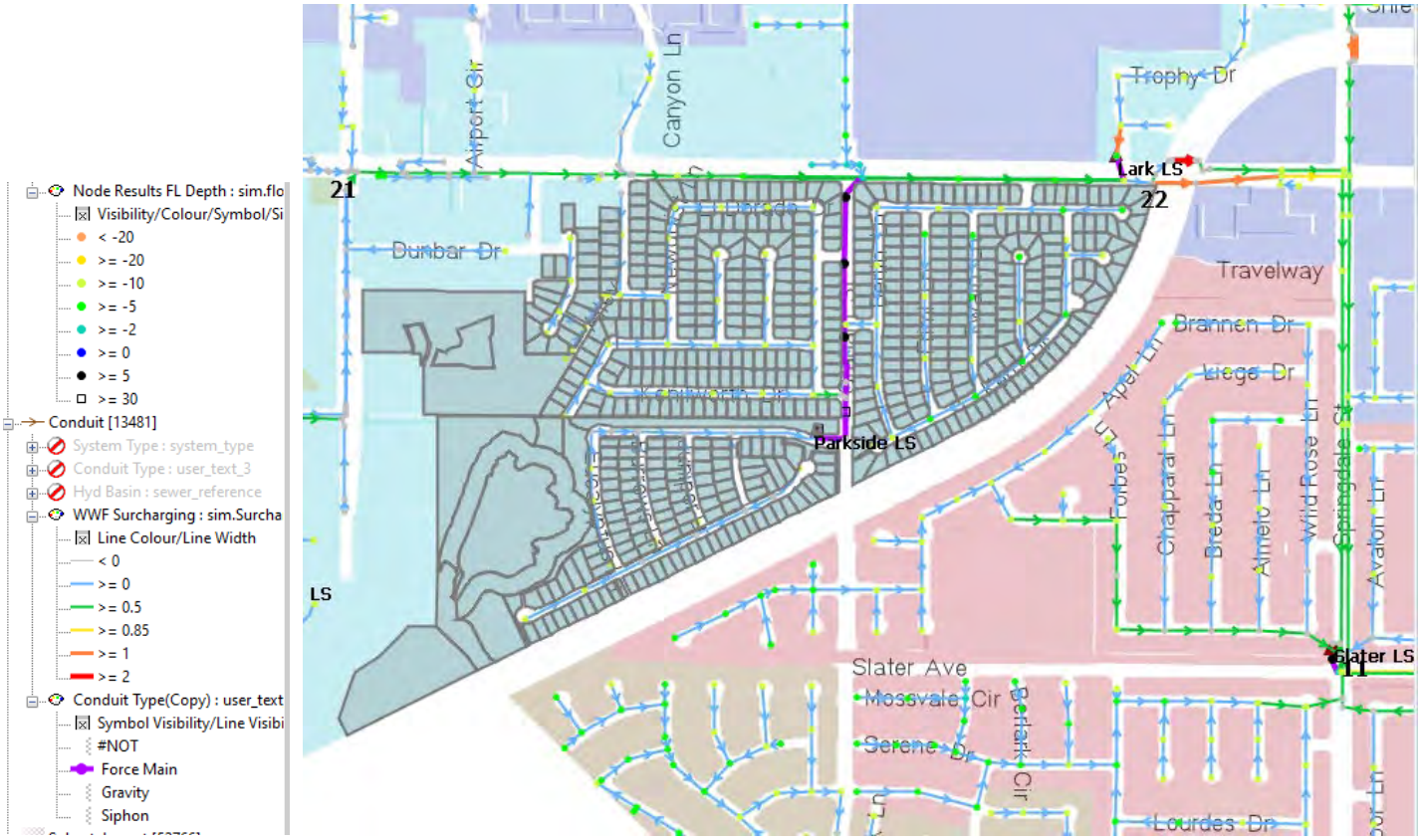
03/18/2023 04:35:00

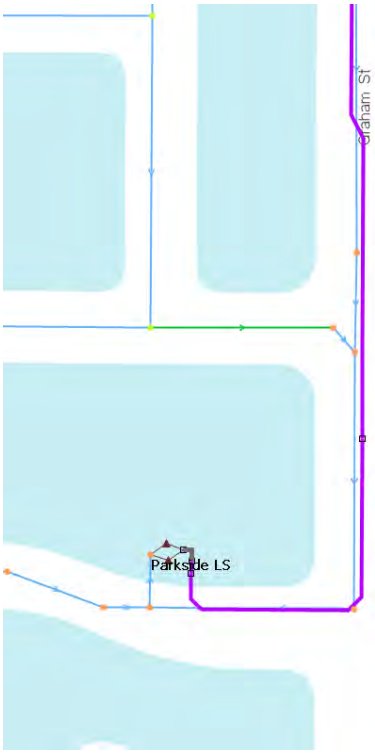


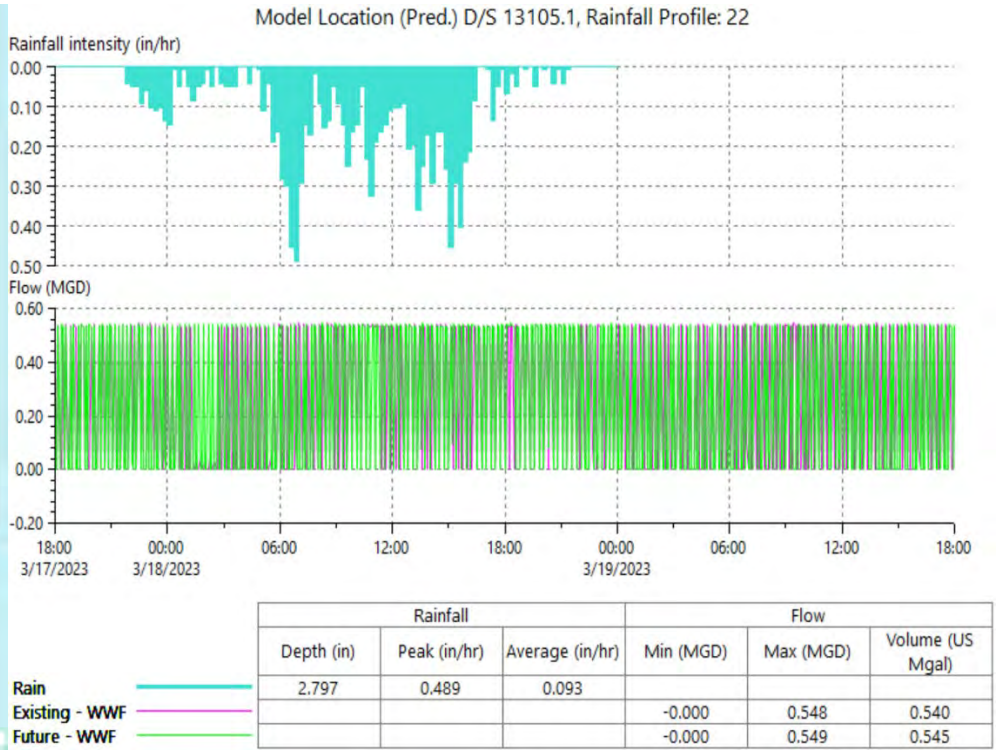
Link	-	-	13107.1	13164.1	13165.1	13166.1	13167.1	KNT0080-0424.2
width (in)	12.0		6.0	6.0	6.0	6.0	6.0	18.0
us inv (ft AD)	-		-9.895	-8.664	-7.047	-5.470	-4.022	1.060
ds inv (ft AD)	-		-8.664	-7.047	-5.470	-4.022	0.560	0.570
r.pfc (MGD)	2.58		-0.23	-0.23	-0.23	-0.23	-0.63	2.09
surc	0.19	-	1.00	1.00	1.00	1.00	1.00	0.27
US total head (ft AD)	-	-	40.413	32.936	23.348	14.015	5.416	1.505
US velocity (ft/s)	-	-	4.302	4.291	4.283	4.278	4.277	1.534
DS flow (MGD)	-	-	0.5460	0.5445	0.5435	0.5429	0.5427	0.2741
DS cumulative flow (US Mgal)	-	-	0.45547	0.45547	0.45546	0.45546	0.45546	1.28502
DS total head (ft AD)	-	-	33.512	23.920	14.585	5.985	2.036	0.976
DS velocity (ft/s)	-	-	4.302	4.291	4.283	4.278	4.277	1.185

Node	-	13107	13164	13165	13166	13167	KNT0080-0424	KNT0080-0421
ground (ft AD)	-	0.962	0.002	-1.040	-0.394	0.978	3.870	4.550
flood dep (ft)	-	39.451	32.935	24.388	14.408	4.439	-2.402	-3.595

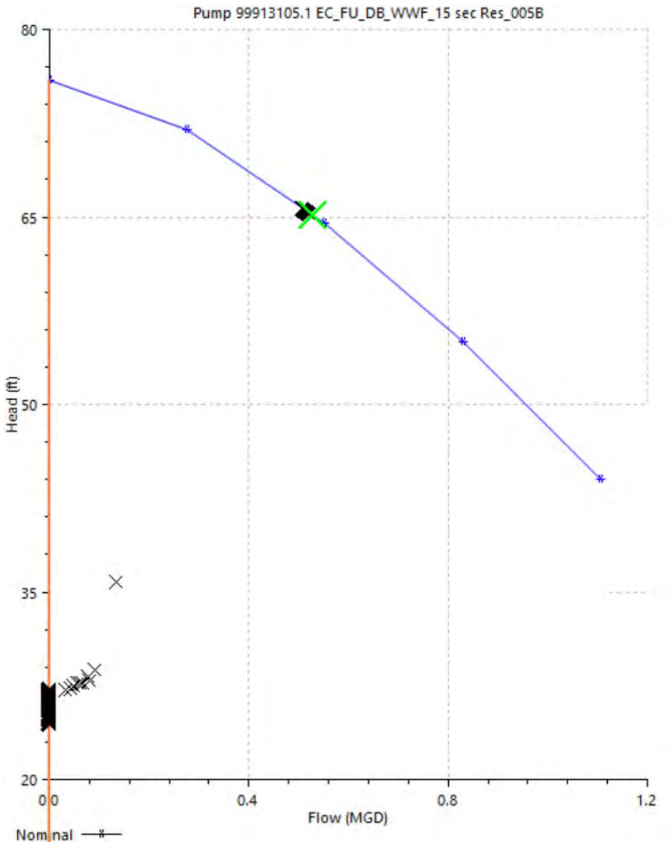
Parkside LS - Design Basis – 10 year 24 hour Storm



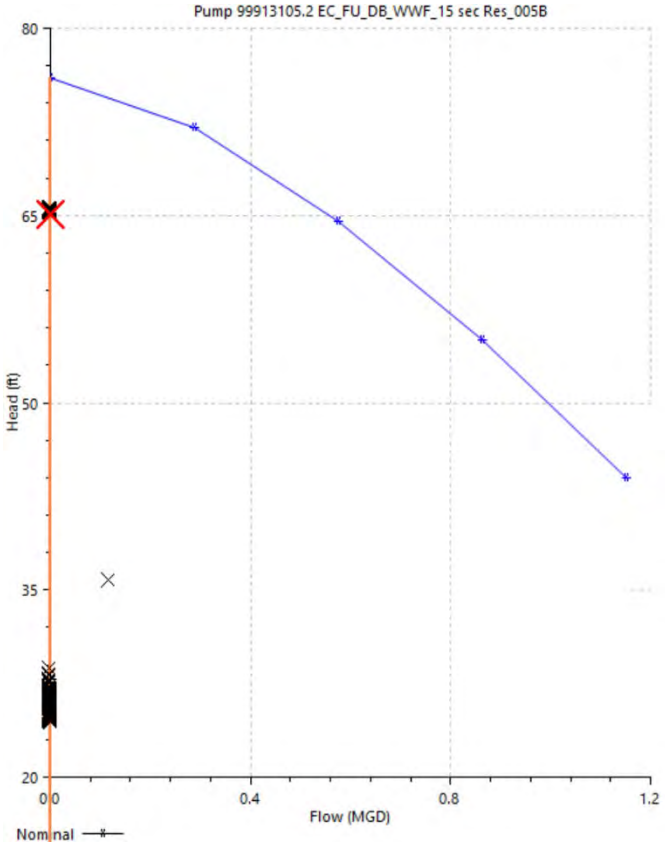




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.797	0.489	0.093			
Existing - WWF				-0.000	0.548	0.540
Future - WWF				-0.000	0.549	0.545



Parkside Lead Pump

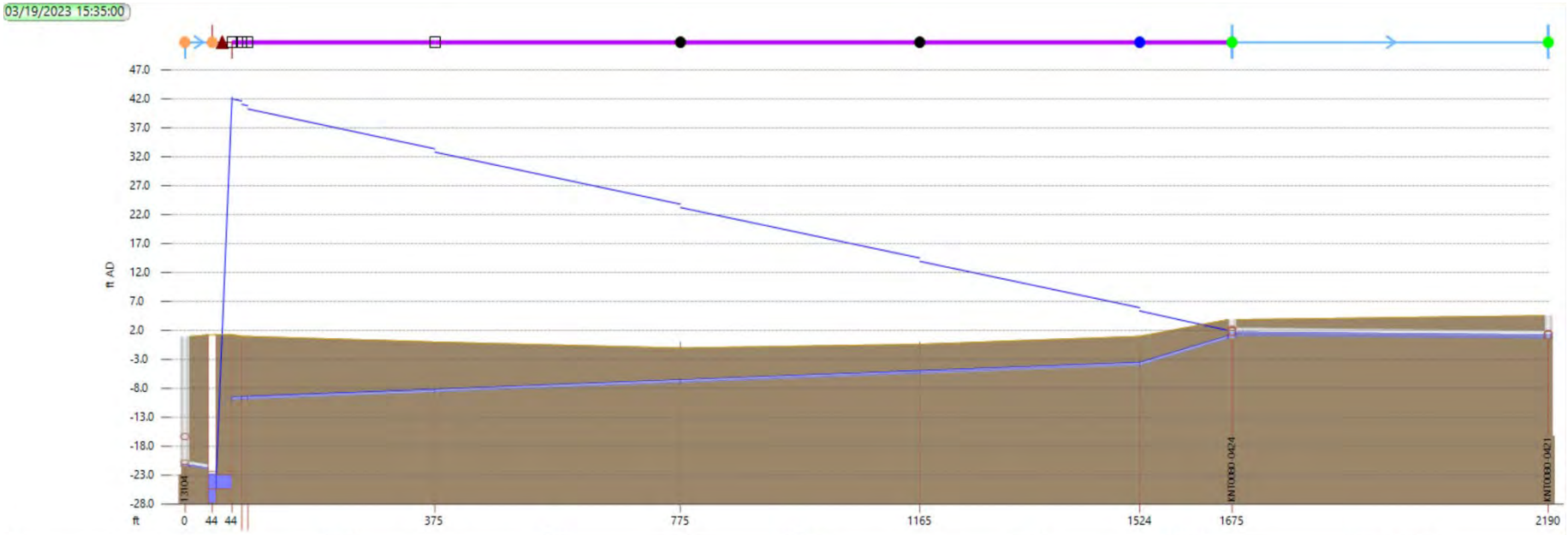


Parkside Lag Pump



Link		99913105.1	13105.1
width (in)			6.0
us inv (ft AD)			-10.000
ds inv (ft AD)			-9.935
r.pfc (MGD)			-0.23
surc		1.00	1.00
US total head (ft AD)		-22.875	42.286
US velocity (ft/s)		0.000	4.324
DS flow (MGD)		0.5506	0.5487
DS cumulative flow (US Mgal)		0.54684	0.54684
DS total head (ft AD)		42.286	41.920
DS velocity (ft/s)		0.000	4.324
Node	99913105		13105
ground (ft AD)	1.230		1.230
flood dep (ft)	-24.105		41.056

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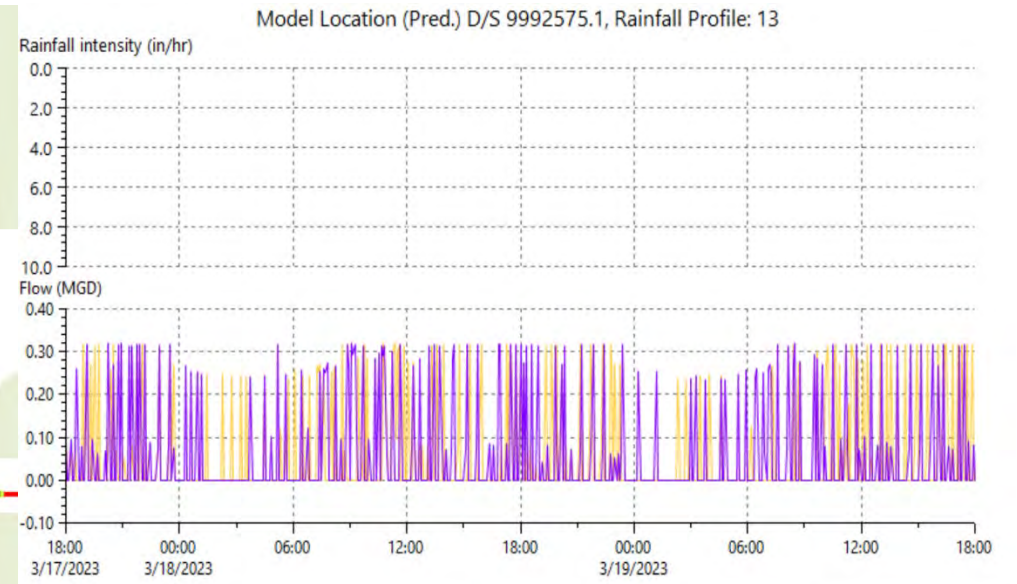
Link	-	-	13107.1	13164.1	13165.1	13166.1	13167.1	KNT0080-0424.2
width (in)	12.0		6.0	6.0	6.0	6.0	6.0	18.0
us inv (ft AD)	-		-9.895	-8.664	-7.047	-5.470	-4.022	1.060
ds inv (ft AD)	-		-8.664	-7.047	-5.470	-4.022	0.560	0.570
r.pfc (MGD)	2.58		-0.23	-0.23	-0.23	-0.23	-0.63	2.09
surc	0.23	-	1.00	1.00	1.00	1.00	1.00	0.45
US total head (ft AD)	-	-	40.534	33.082	23.524	14.221	5.650	1.764
US velocity (ft/s)	-	-	4.295	4.284	4.276	4.271	4.270	1.775
DS flow (MGD)	-	-	0.5451	0.5436	0.5426	0.5420	0.5419	0.8023
DS cumulative flow (US Mgal)	-	-	0.54684	0.54684	0.54684	0.54684	0.54684	1.92453
DS total head (ft AD)	-	-	33.655	24.094	14.789	6.217	2.281	1.285
DS velocity (ft/s)	-	-	4.295	4.284	4.276	4.271	4.270	1.610

Node	-	13107	13164	13165	13166	13167	KNT0080-0424	KNT0080-0421
ground (ft AD)	-	0.962	0.002	-1.040	-0.394	0.978	3.870	4.550
flood dep (ft)	-	39.573	33.080	24.564	14.615	4.673	-2.155	-3.305

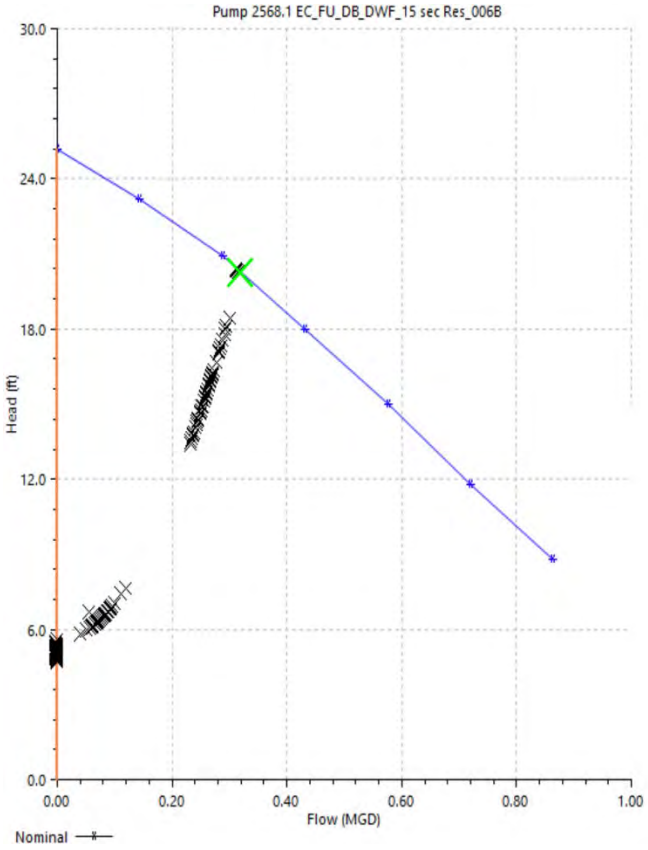
Humbolt LS - Design Basis - DWF



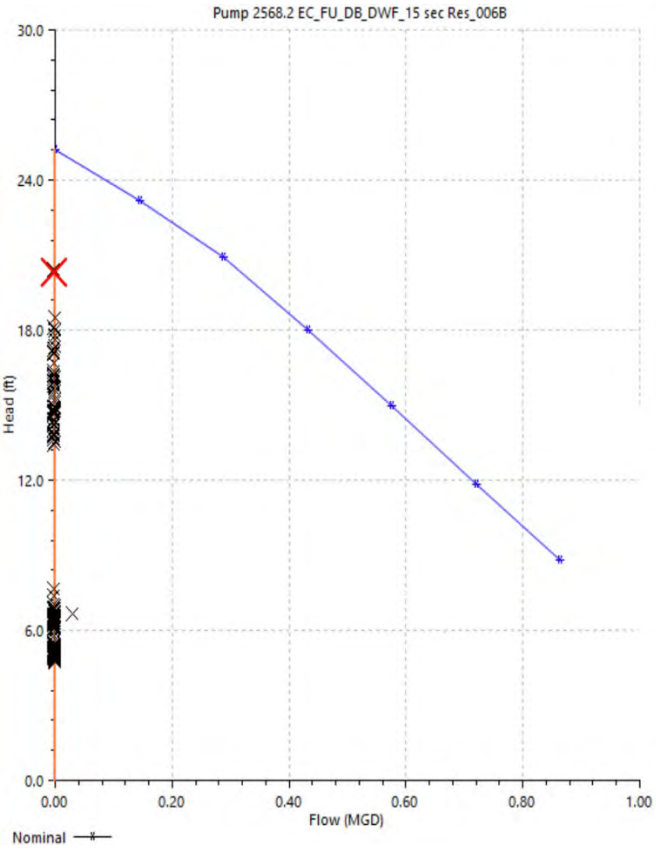




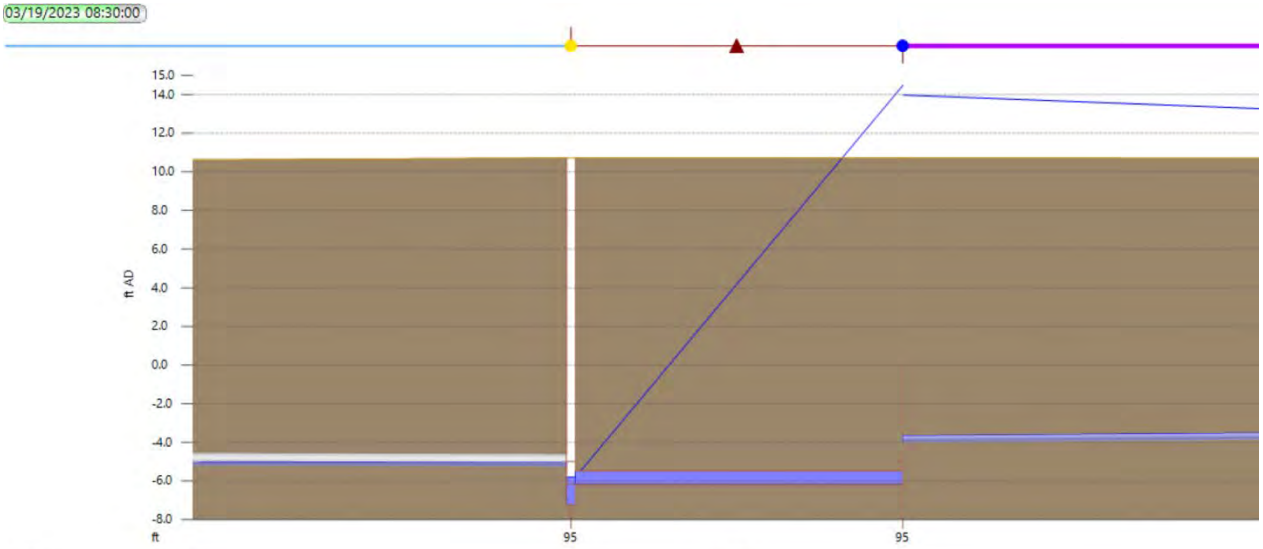
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.319	0.111
Future - DWF				-0.000	0.320	0.118



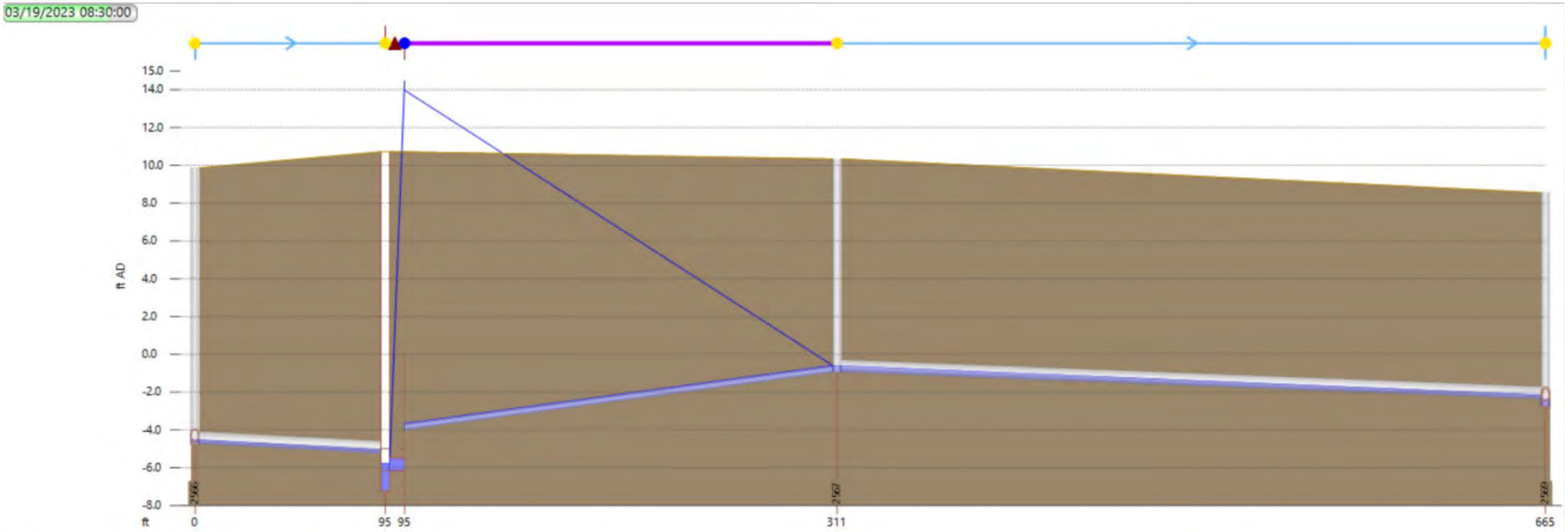
Humbolt Lead Pump



Humbolt Lag Pump



Link		2568.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		-5.788	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.3195	
DS cumulative flow (US Mgal)		0.14587	
DS total head (ft AD)		14.478	
DS velocity (ft/s)		0.000	
Node	2568		9992575
ground (ft AD)	10.720		10.720
flood dep (ft)	-16.508		3.758

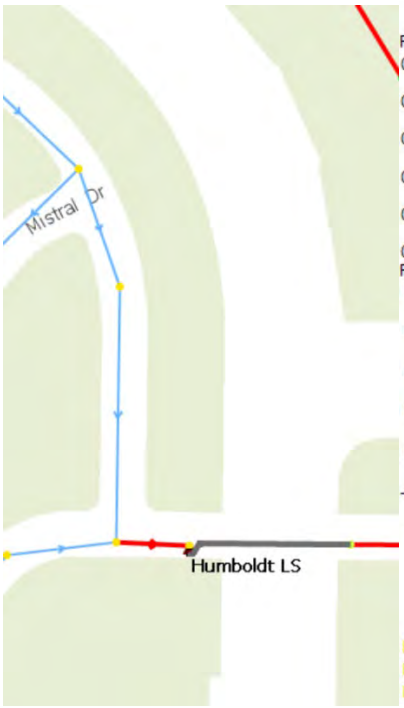


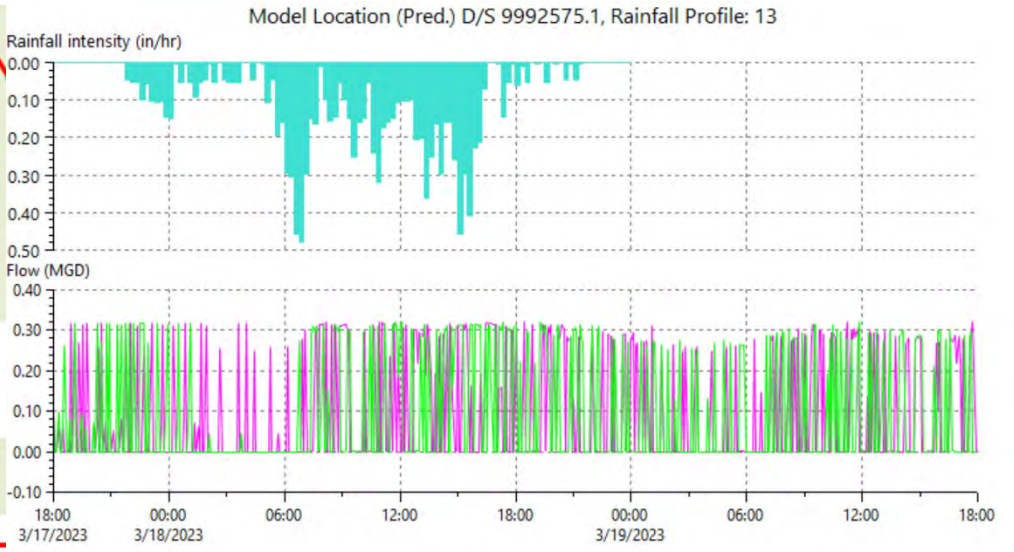
Link	2566.1	-	9992575.1		2567.1
width (in)	8.0		4.0		8.0
us inv (ft AD)	-4.730		-4.000		-0.930
ds inv (ft AD)	-5.240		-0.930		-2.350
r.pfc (MGD)	0.57		-0.15		0.49
surc	0.29	-	1.00		0.47
US total head (ft AD)	-4.493	-	14.477		-0.501
US velocity (ft/s)	1.706	-	5.665		2.696
DS flow (MGD)	0.0911	-	0.3195		0.0994
DS cumulative flow (US Mgal)	0.14590	-	0.14587		0.15519
DS total head (ft AD)	-5.006	-	-0.098		-2.106
DS velocity (ft/s)	1.817	-	5.665		1.895

Node	2566	2568	9992575	2567	2569
ground (ft AD)	9.870	10.720	10.720	10.342	8.552
flood dep (ft)	-14.409	-16.508	3.758	-10.956	-10.943

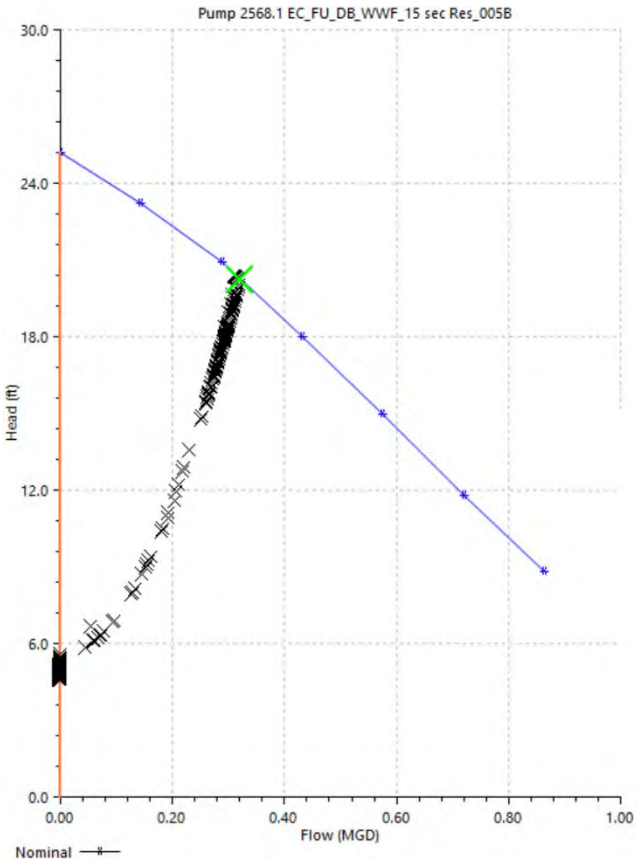
Humboldt LS - Design Basis - 10 year 24 hour Storm



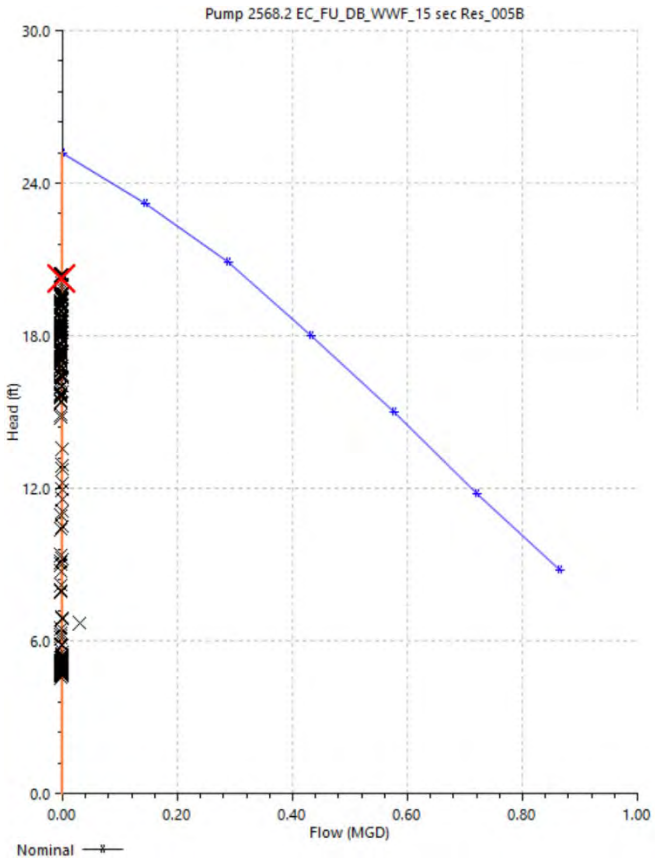




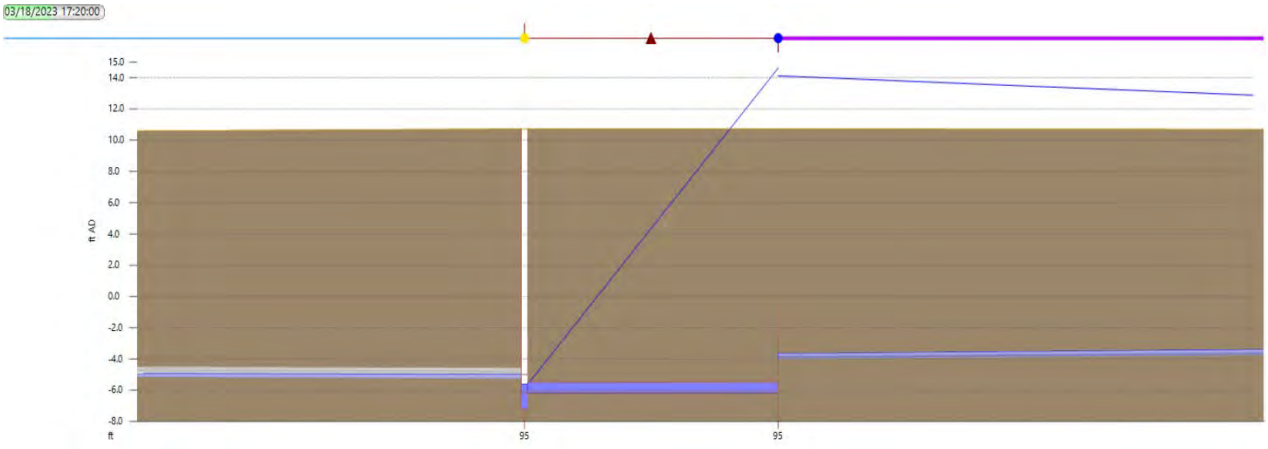
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.795	0.479	0.093			
Existing - WWF				-0.000	0.322	0.187
Future - WWF				-0.000	0.321	0.181



Humbolt Lead Pump

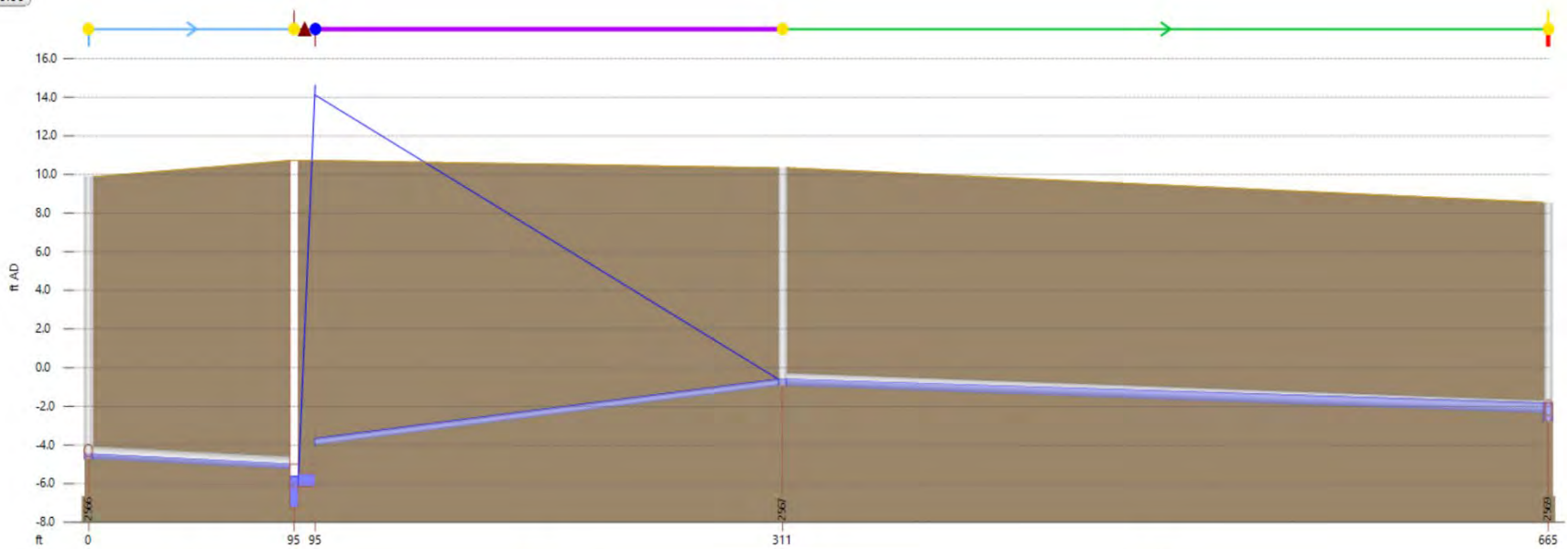


Humbolt Lag Pump



Link		2568.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		-5.618	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.3210	
DS cumulative flow (US Mgal)		0.21420	
DS total head (ft AD)		14.618	
DS velocity (ft/s)		0.000	
Node		2568	9992575
ground (ft AD)		10.720	10.720
flood dep (ft)		-16.338	3.898

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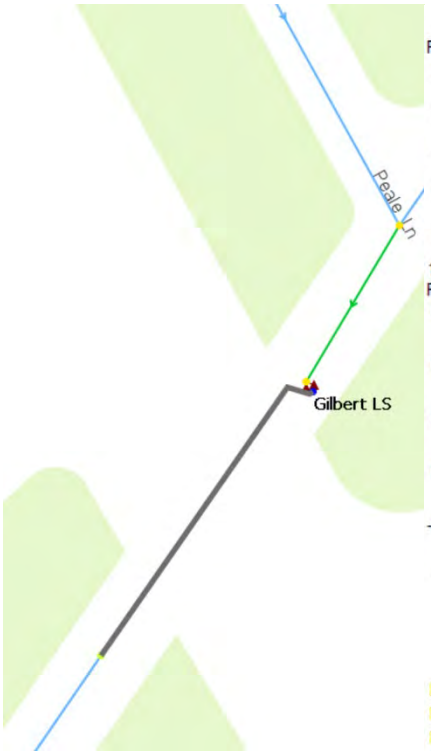


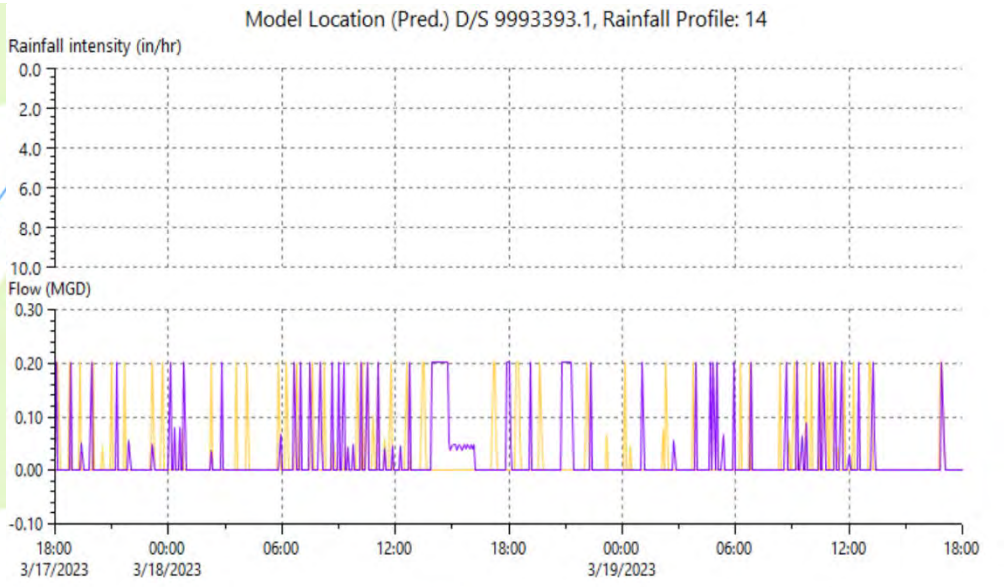
Link	2566.1	-	9992575.1		2567.1
width (in)	8.0		4.0		8.0
us inv (ft AD)	-4.730		-4.000		-0.930
ds inv (ft AD)	-5.240		-0.930		-2.350
r.pfc (MGD)	0.57		-0.15		0.49
surc	0.39	-	1.00		0.77
US total head (ft AD)	-4.401	-	14.618		-0.498
US velocity (ft/s)	2.113	-	5.691		2.582
DS flow (MGD)	0.1719	-	0.3210		0.1867
DS cumulative flow (US Mgal)	0.21425	-	0.21420		0.22309
DS total head (ft AD)	-4.914	-	-0.094		-1.820
DS velocity (ft/s)	2.268	-	5.691		1.000

Node	2566	2568	9992575	2567	2569
ground (ft AD)	9.870	10.720	10.720	10.342	8.552
flood dep (ft)	-14.341	-16.338	3.898	-10.943	-10.388

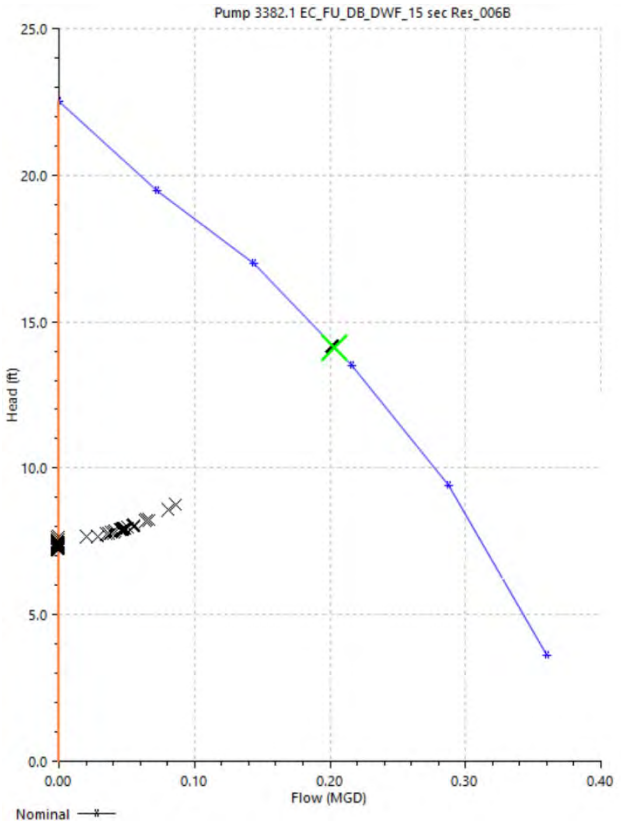
Gilbert LS - Design Basis - DWF



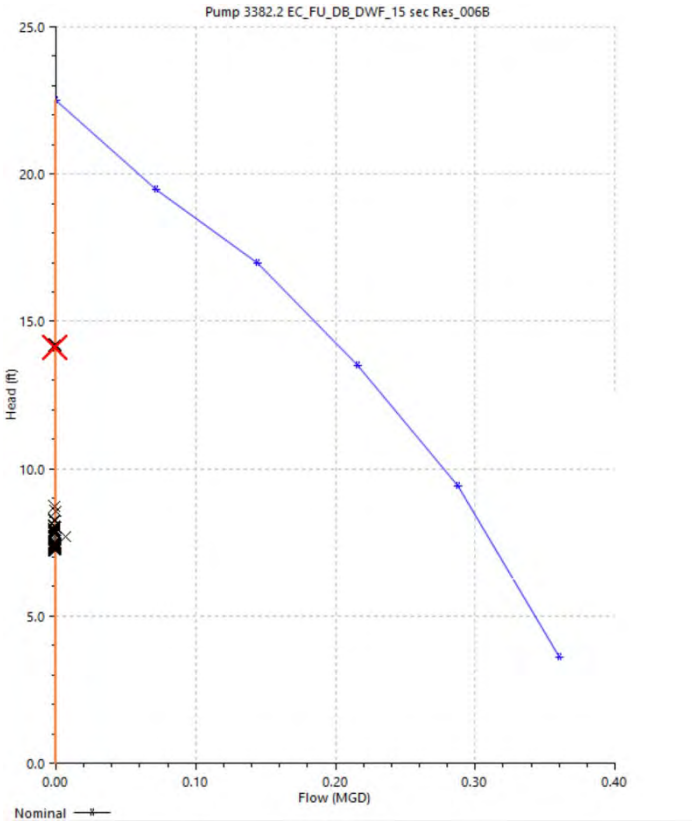




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.203	0.038
Future - DWF				-0.000	0.203	0.046



Gilbert Lead Pump



Gilbert Lag Pump



Link		3382.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		-3.043	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.2037	
DS cumulative flow (US Mgal)		0.04626	
DS total head (ft AD)		11.055	
DS velocity (ft/s)		0.000	
Node	3382		9993393
ground (ft AD)	10.700		10.700
flood dep (ft)	-13.743		0.355

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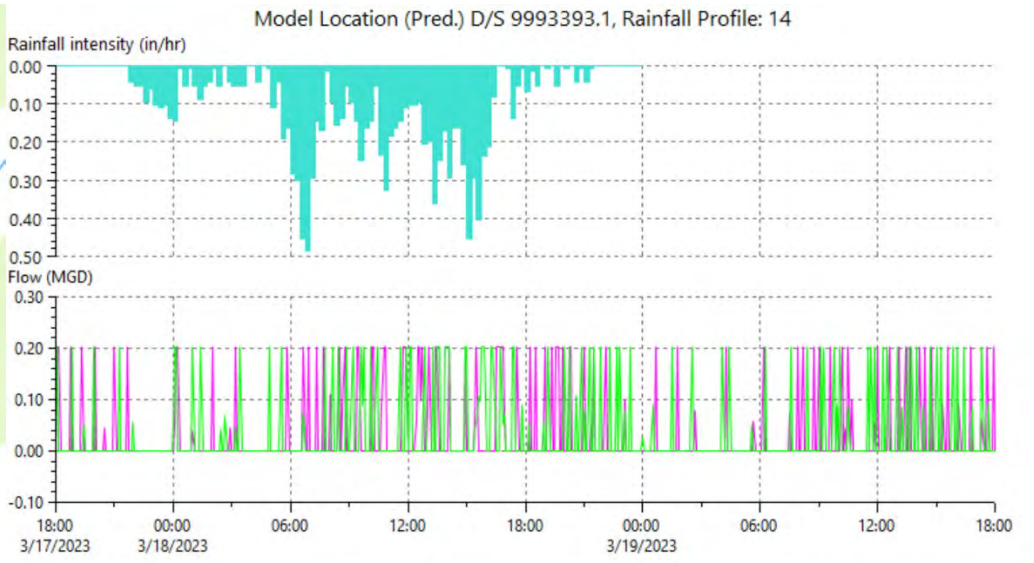
Link	3343.1	-	9993393.1	3442.1	
width (in)	8.0		4.0	8.0	
us inv (ft AD)	-2.730		1.000	3.930	
ds inv (ft AD)	-3.440		3.930	3.200	
r.pfc (MGD)	0.59		-0.14	0.46	
surc	0.60	-	1.00	0.32	
US total head (ft AD)	-2.582	-	11.055	4.224	
US velocity (ft/s)	1.161	-	3.606	2.292	
DS flow (MGD)	0.1487	-	0.2034	0.0160	
DS cumulative flow (US Mgal)	0.04629	-	0.04626	0.05034	
DS total head (ft AD)	-3.026	-	4.465	3.307	
DS velocity (ft/s)	1.062	-	3.606	0.786	

Node	3343	3382	9993393	3442	3524
ground (ft AD)	9.171	10.700	10.700	10.128	8.836
flood dep (ft)	-11.775	-13.743	0.355	-5.985	-5.616

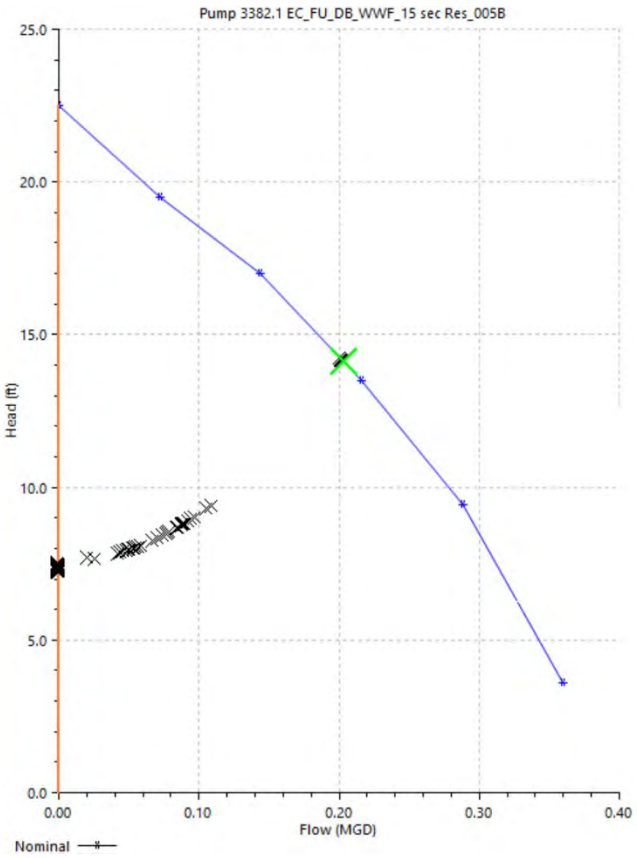
Gilbert LS - Design Basis - 10 year 24 hour Storm



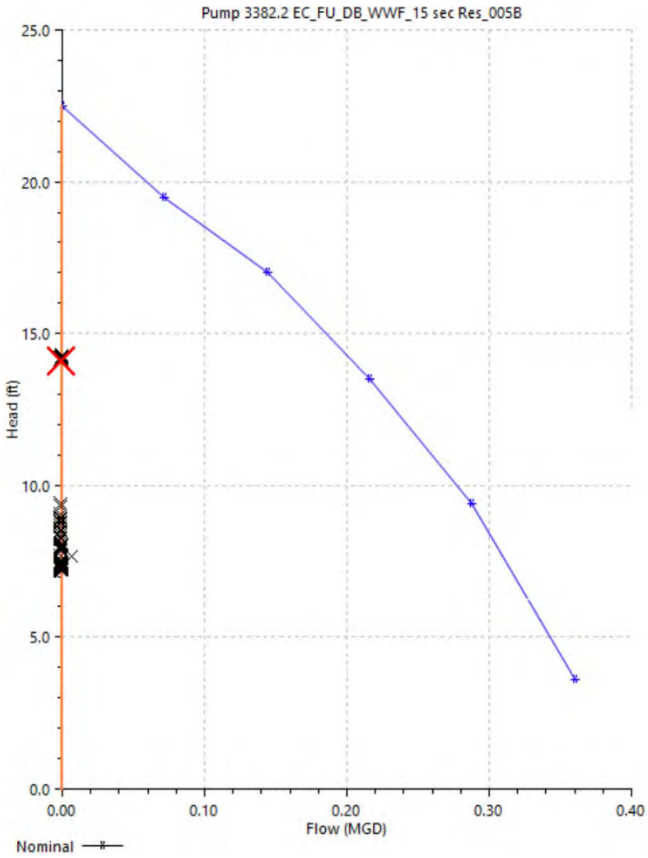




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.797	0.487	0.093			
Existing - WWF				-0.000	0.204	0.061
Future - WWF				-0.000	0.204	0.064



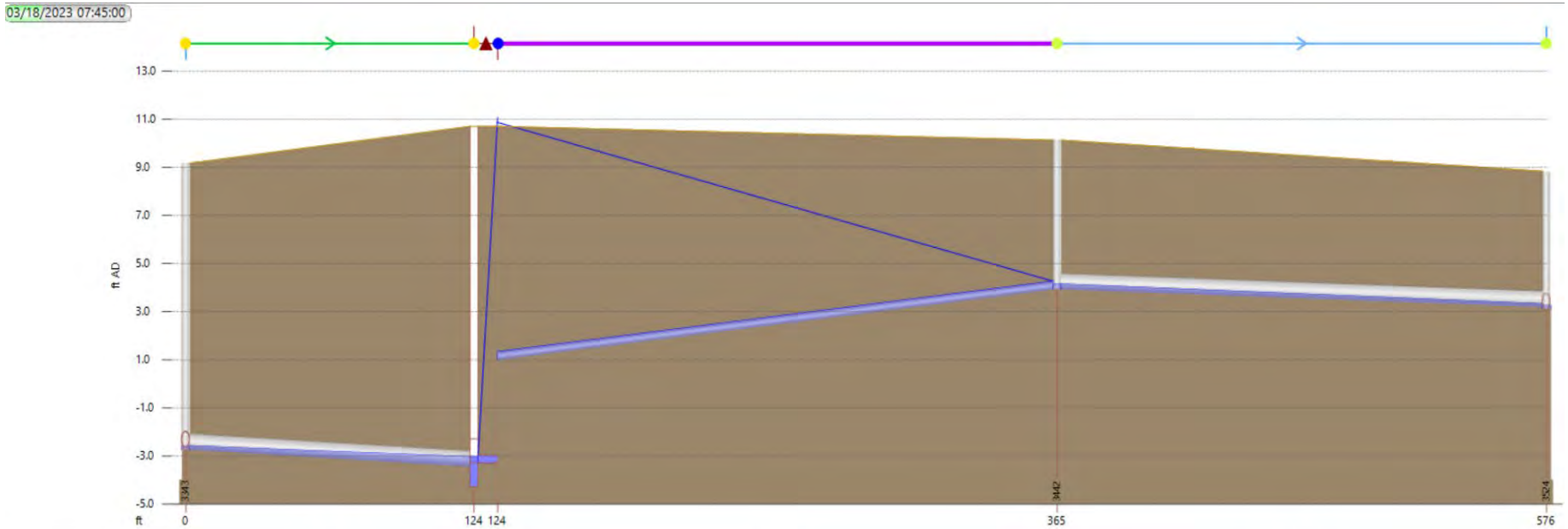
Gilbert Lead Pump



Gilbert Lag Pump



Link		3382.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		-3.027	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.2038	
DS cumulative flow (US Mgal)		0.07094	
DS total head (ft AD)		11.064	
DS velocity (ft/s)		0.000	
Node	3382		9993393
ground (ft AD)	10.700		10.700
flood dep (ft)	-13.727		0.364



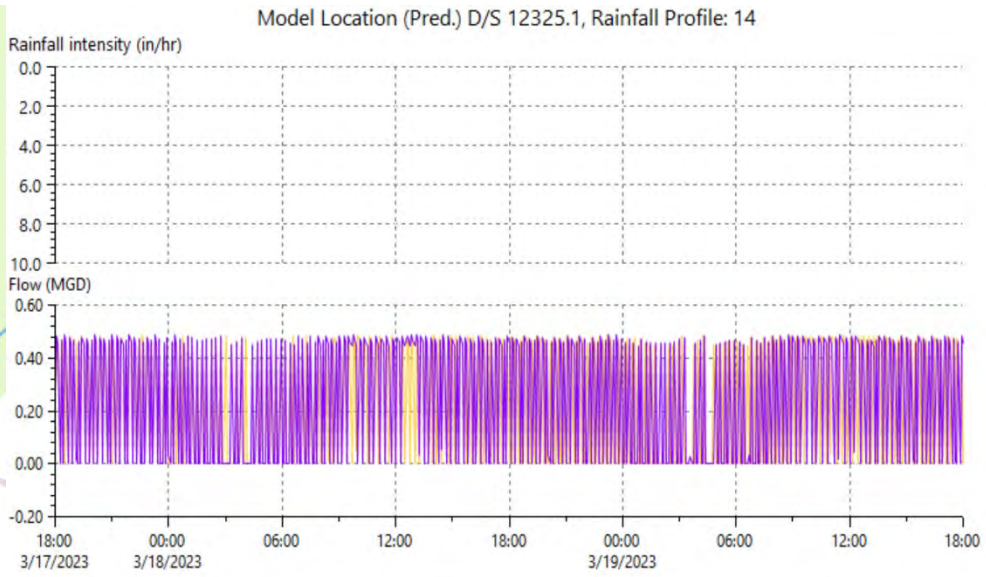
Link	3343.1	-	9993393.1	3442.1
width (in)	8.0		4.0	8.0
us inv (ft AD)	-2.730		1.000	3.930
ds inv (ft AD)	-3.440		3.930	3.200
r.pfc (MGD)	0.59		-0.14	0.46
surc	0.62	1.00	1.00	0.32
US total head (ft AD)	-2.548	-	11.064	4.227
US velocity (ft/s)	1.419	-	3.609	2.287
DS flow (MGD)	0.1539	-	0.2035	0.0353
DS cumulative flow (US Mgal)	0.07096	-	0.07094	0.07618
DS total head (ft AD)	-3.010	-	4.466	3.346
DS velocity (ft/s)	1.047	-	3.609	1.254

Node	3343	3382	9993393	3442	3524
ground (ft AD)	9.171	10.700	10.700	10.128	8.836
flood dep (ft)	-11.750	-13.727	0.364	-5.982	-5.579

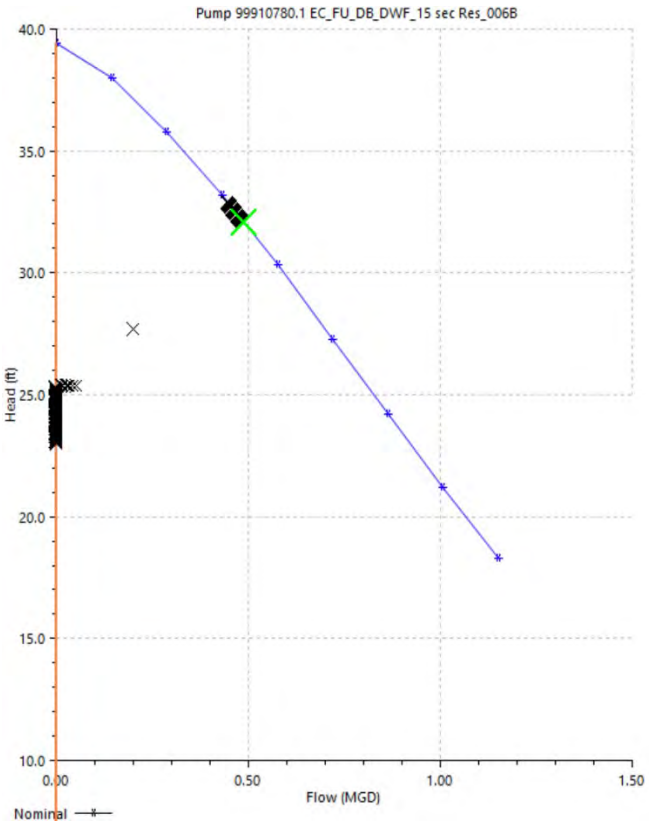
“A” LS - Design Basis - DWF



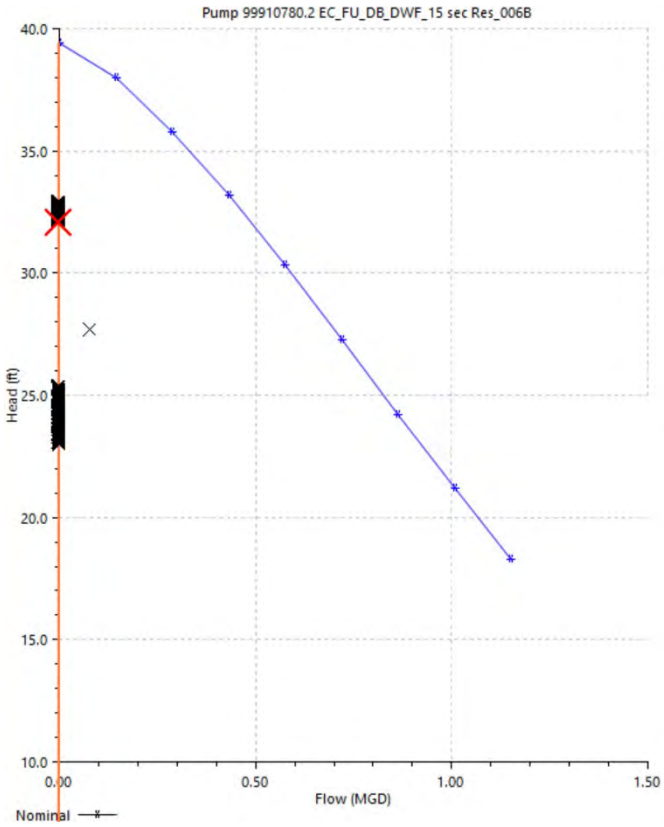




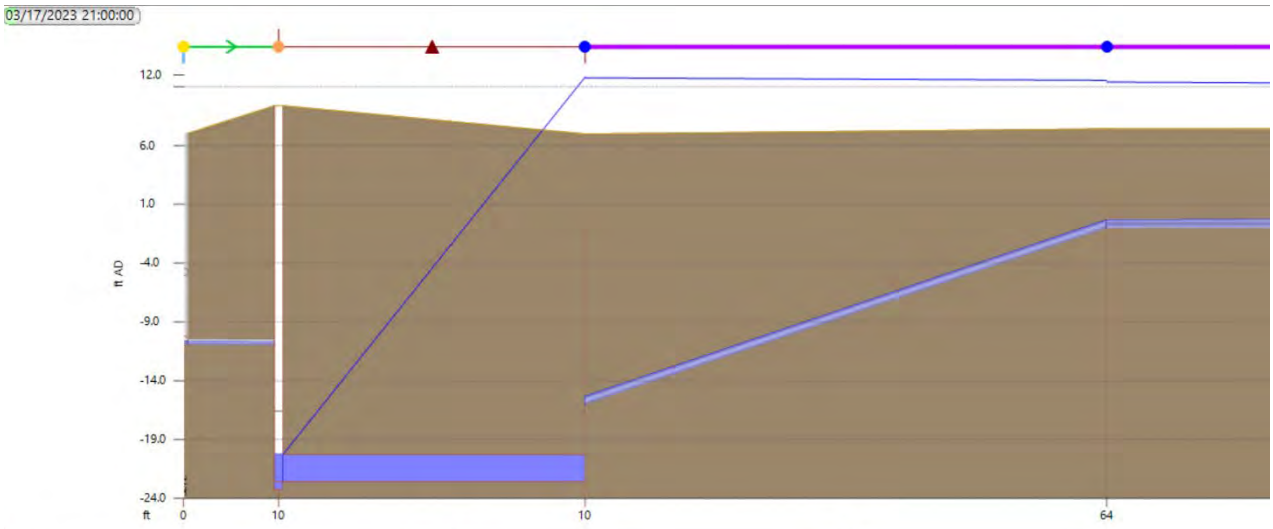
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.487	0.485
Future - DWF				-0.000	0.488	0.498



“A” Lead Pump

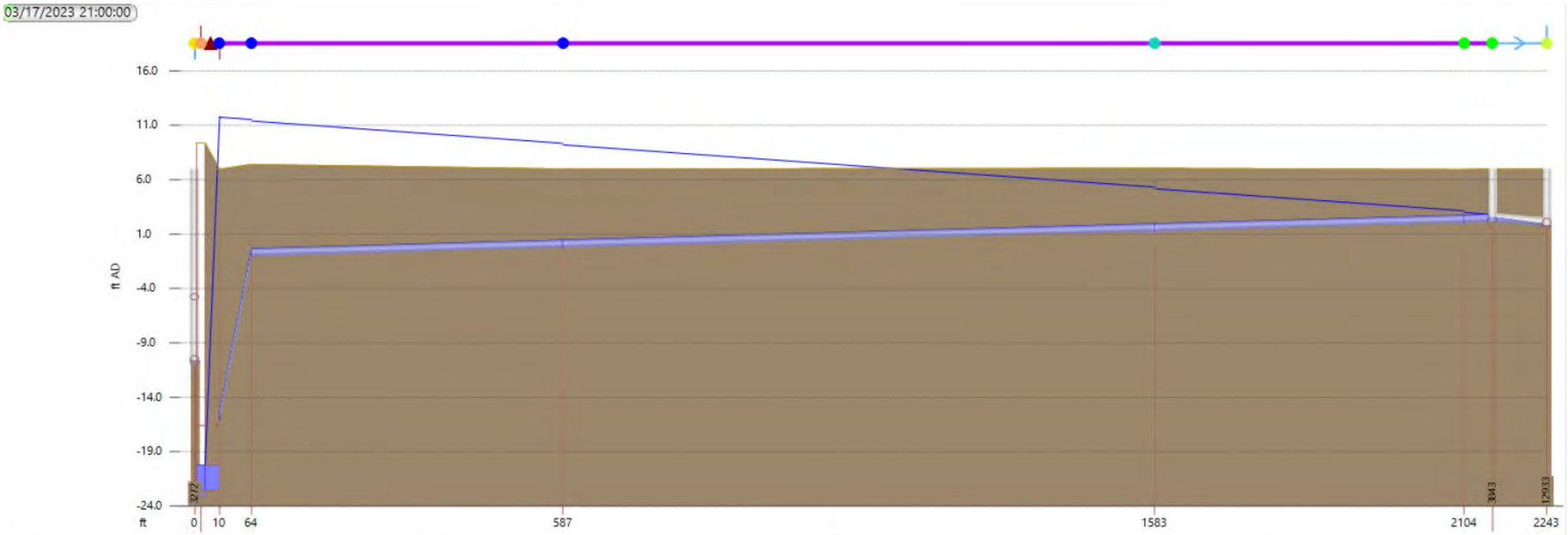


“A” Lag Pump



Link	3272.1	99910780.1	12325.1	
width (in)	6.0		8.0	
us inv (ft AD)	-10.910		-16.000	
ds inv (ft AD)	-10.950		-1.000	
r.pfc (MGD)	0.23		-4.12	
surc	0.54	1.00	1.00	
US total head (ft AD)	-10.569	-20.253	11.819	
US velocity (ft/s)	2.104	0.000	2.163	
DS flow (MGD)	0.2965	0.4880	0.4880	
DS cumulative flow (US Mgal)	0.49575	0.49576	0.49576	
DS total head (ft AD)	-10.615	11.819	11.609	
DS velocity (ft/s)	2.363	0.000	2.163	

Node	3272	99910780	12325	10776
ground (ft AD)	7.025	9.370	6.978	7.411
flood dep (ft)	-	-29.623	4.841	4.052



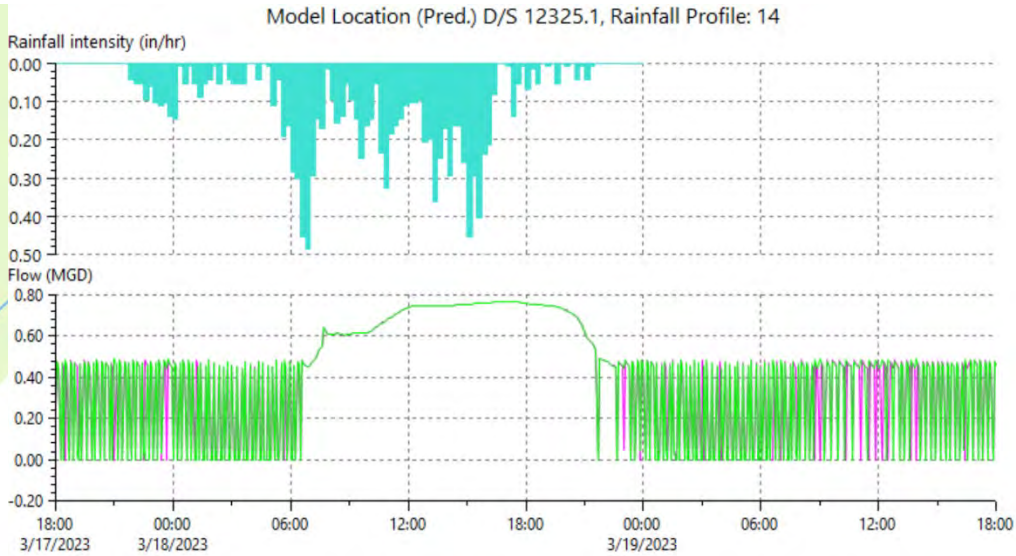
Link	-	-	10776.1		10777.1		10778.1	-	3843.1	
width (in)		8.0	8.0		8.0		8.0	8.0	10.0	
us inv (ft AD)		-	-1.000		-0.213		1.285	-	2.140	
ds inv (ft AD)		-	-0.213		1.285		2.068	-	1.770	
r.pfc (MGD)		-4.12	-0.30		-0.30		-0.30	-	0.90	
surc	-	1.00	1.00		1.00		1.00	1.00	0.44	
US total head (ft AD)	-	-	11.464		9.275		5.244	-	2.653	
US velocity (ft/s)	-	2.163	2.163		2.163		2.163	-	3.058	
DS flow (MGD)	-	-	0.4880		0.4880		0.4880	-	0.0469	
DS cumulative flow (US Mgal)	-	-	0.49576		0.49576		0.49576	-	0.49700	
DS total head (ft AD)	-	-	9.421		5.389		3.212	-	1.928	
DS velocity (ft/s)	-	2.163	2.163		2.163		2.163	-	1.323	

Node	-	10776		10777		10778		10779	3843	-
ground (ft AD)	-	7.411		7.002		7.065		6.946	7.001	-
flood dep (ft)	-	4.052		2.274		-1.822		-3.880	-	-

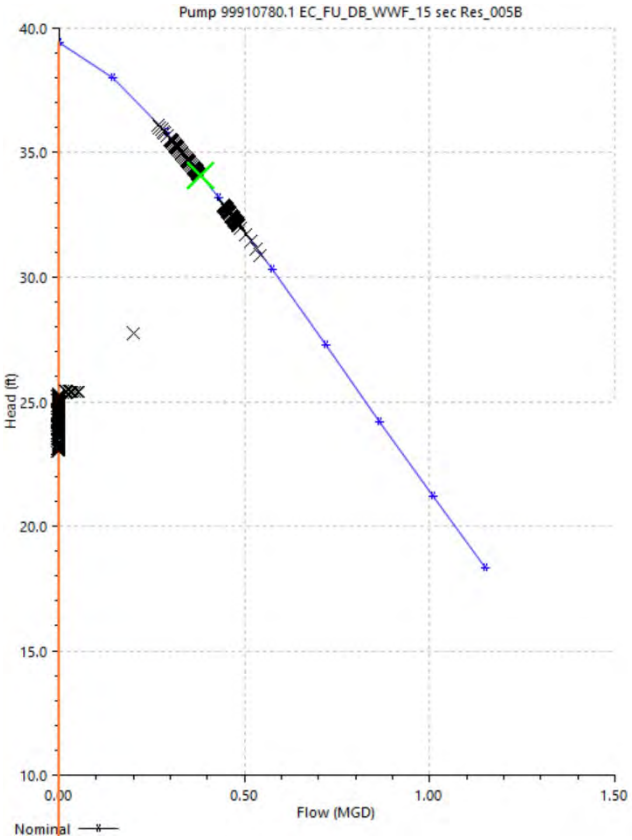
“A” LS - Design Basis - 10 year 24 hour Storm



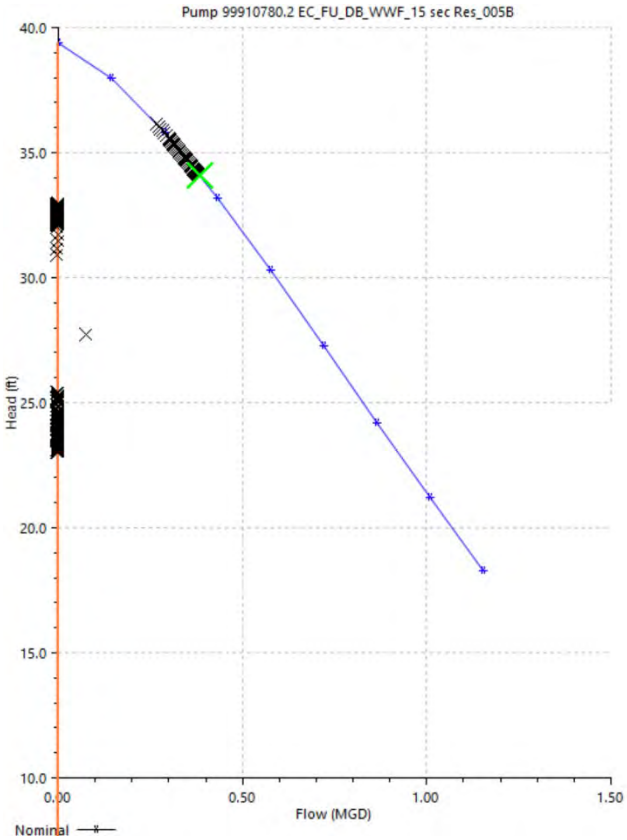




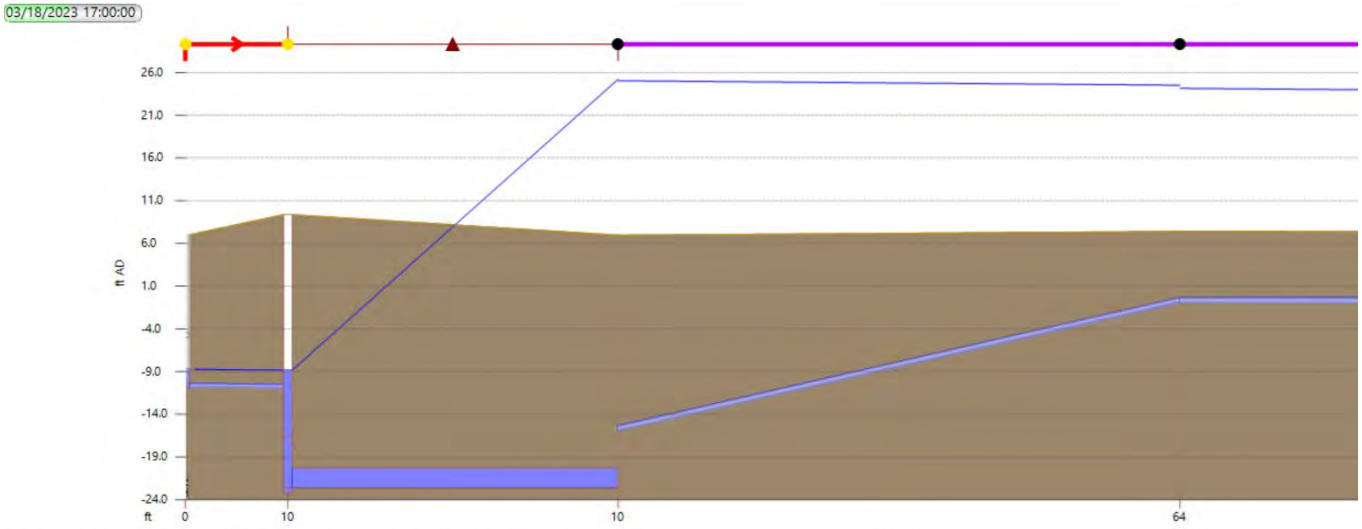
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.797	0.487	0.093			
Existing - WWF				-0.000	0.770	0.810
Future - WWF				-0.000	0.769	0.815



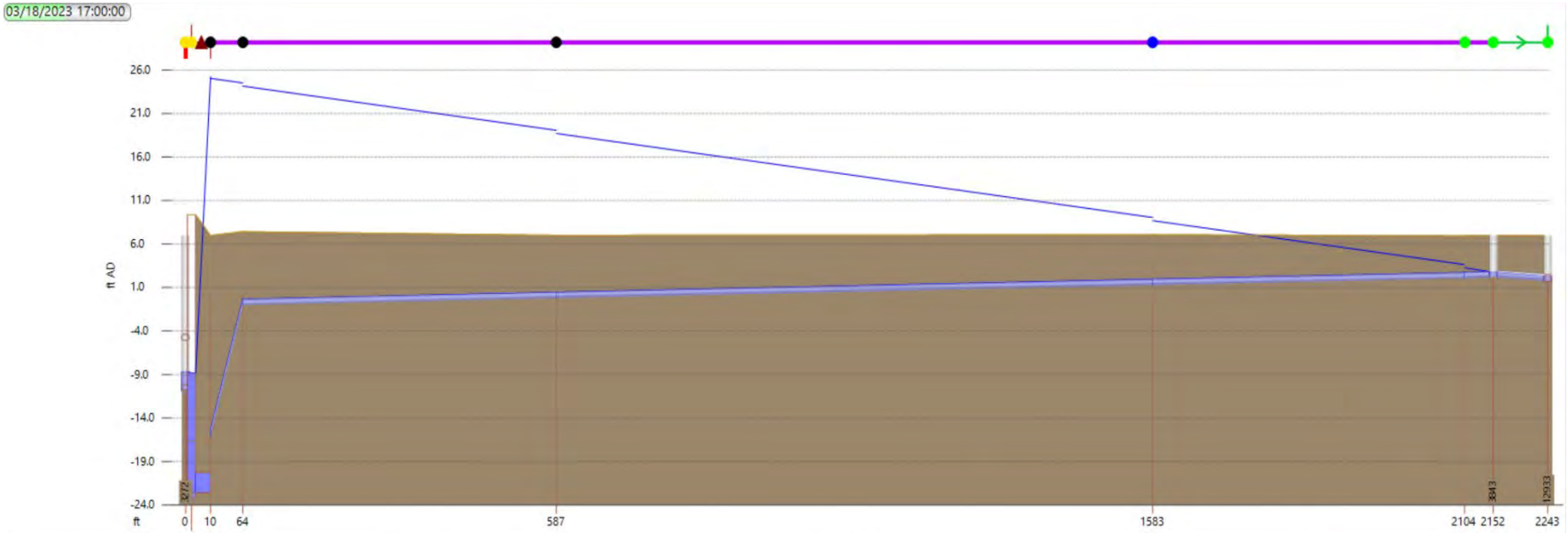
"A" Lead Pump



"A" Lag Pump



Link	3272.1	99910780.1	12325.1	
width (in)	6.0		8.0	
us inv (ft AD)	-10.910		-16.000	
ds inv (ft AD)	-10.950		-1.000	
r.pfc (MGD)	0.23		-4.12	
surc	2.00	1.00	1.00	
US total head (ft AD)	-8.606	-8.839	25.214	
US velocity (ft/s)	2.708	0.000	3.411	
DS flow (MGD)	0.7704	0.3847	0.7695	
DS cumulative flow (US Mgal)	0.81414	0.60737	0.81422	
DS total head (ft AD)	-8.722	25.214	24.691	
DS velocity (ft/s)	2.717	0.000	3.411	
Node	3272	99910780	12325	10776
ground (ft AD)	7.025	9.370	6.978	7.411
flood dep (ft)	-	-18.209	18.236	16.919

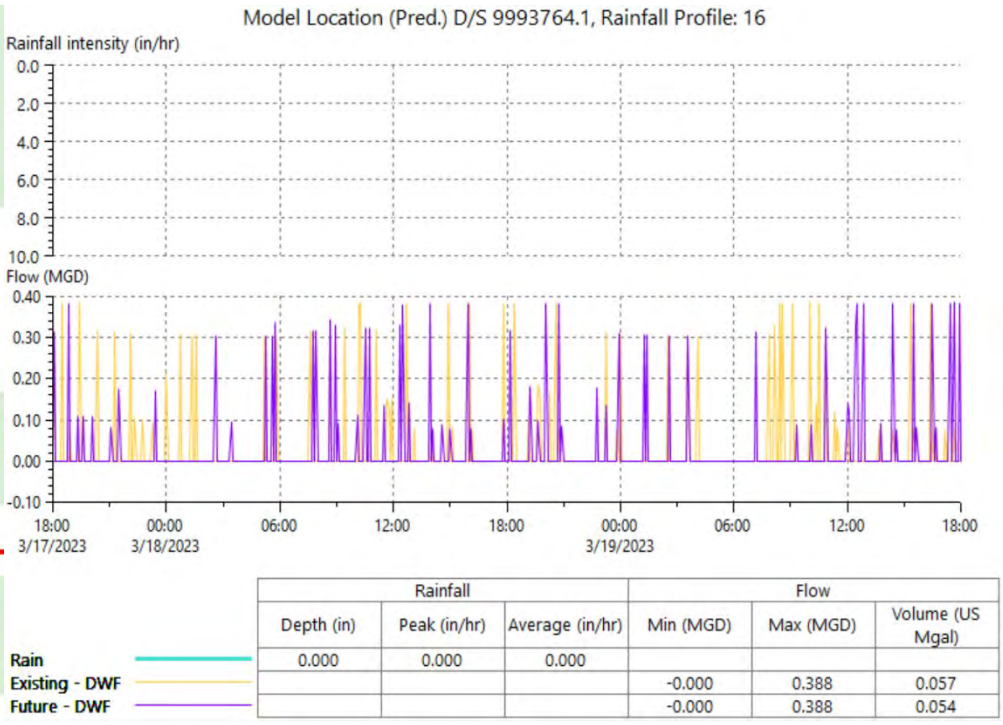

03/18/2023 17:00:00
26.0
21.0
16.0
11.0
6.0
1.0
-4.0
-9.0
-14.0
-19.0
-24.0
ft AD
ft
0
10
64
587
1583
2104
2152
2243
3843
12933

| | | |

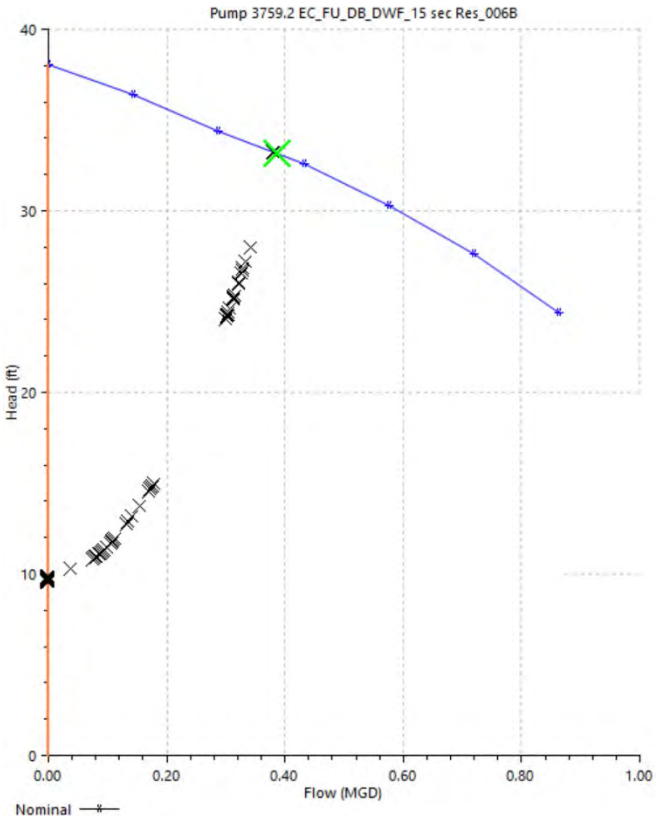
Davenport LS - Design Basis - DWF



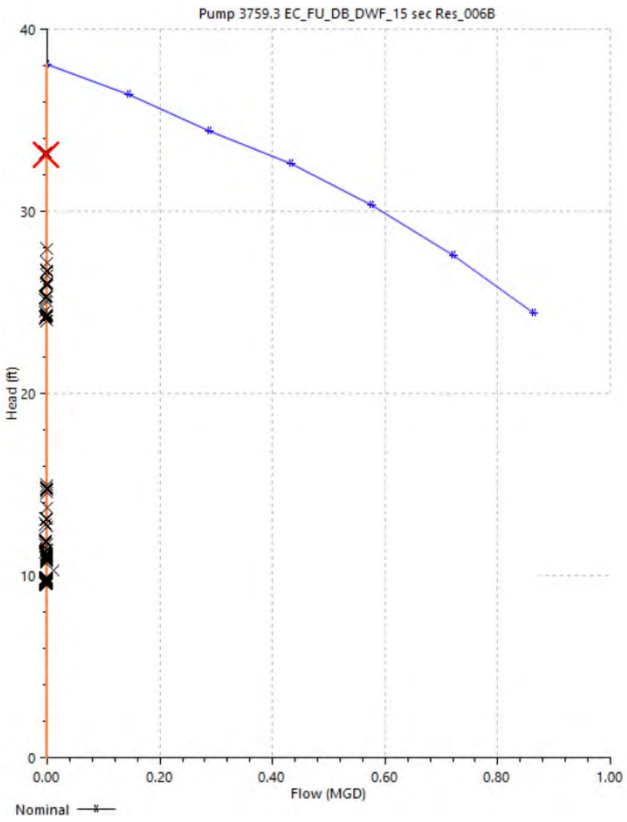




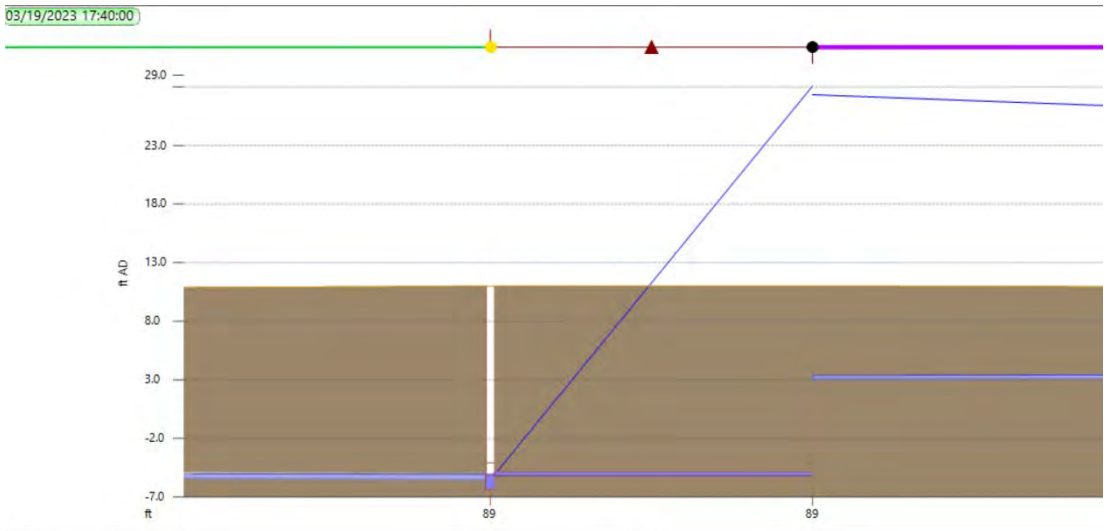
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.388	0.057
Future - DWF				-0.000	0.388	0.054



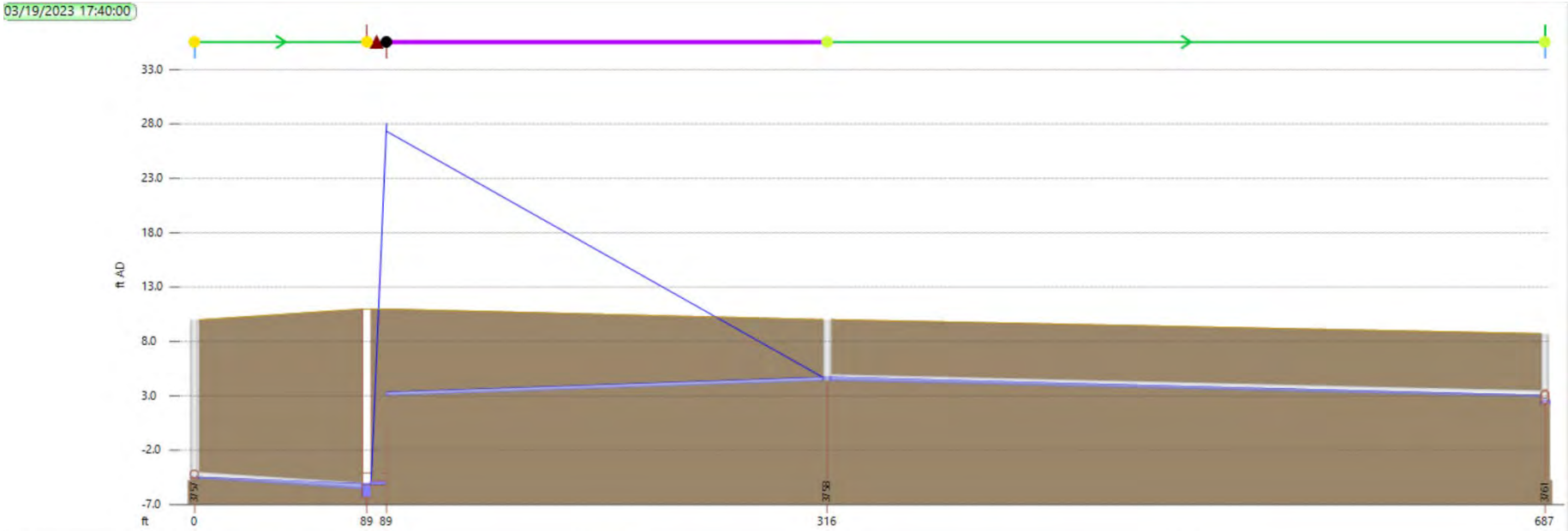
Davenport Lead Pump



Davenport Lag Pump



Link		3759.2	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		-5.087	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.3882	
DS cumulative flow (US Mgal)		0.08013	
DS total head (ft AD)		28.060	
DS velocity (ft/s)		0.000	
Node	3759		9993764
ground (ft AD)	10.987		10.987
flood dep (ft)	-16.074		17.073

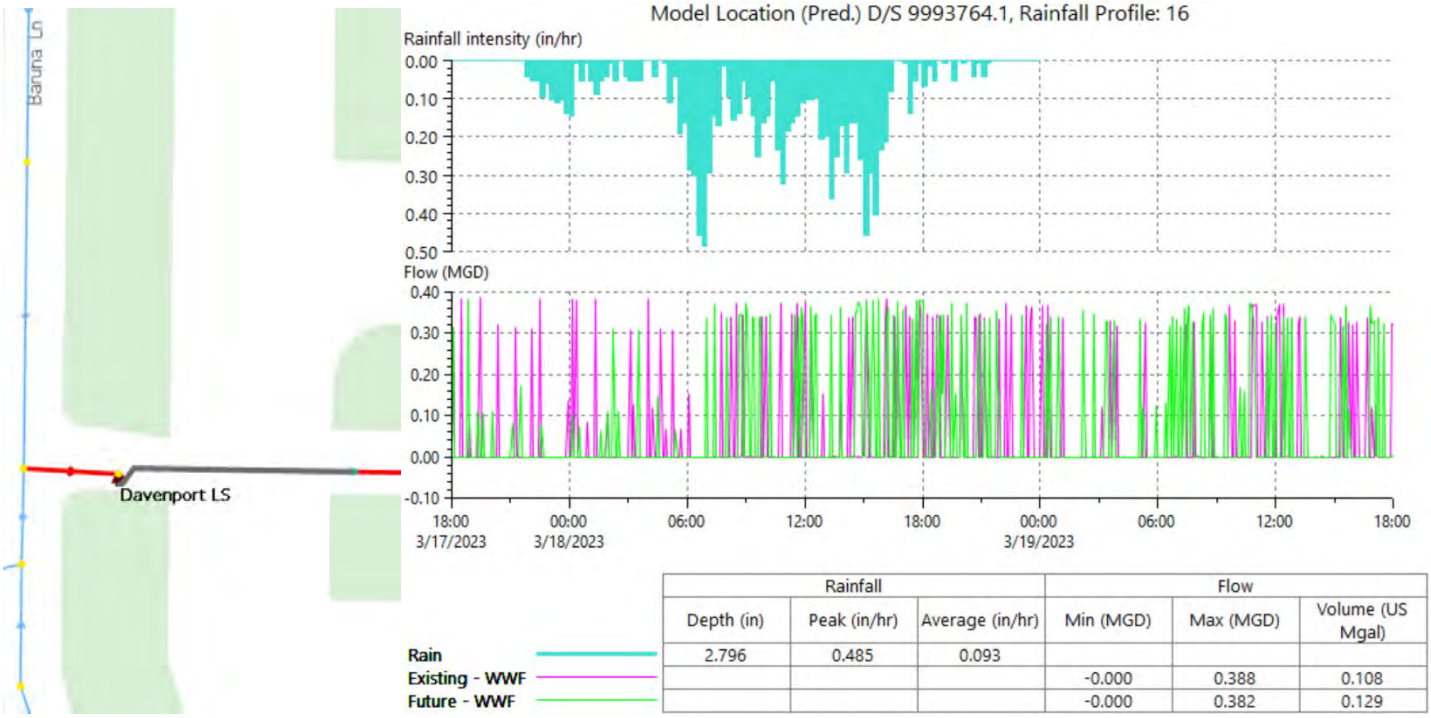


Link	3757.1	-	9993764.1	3758.1	
width (in)	8.0		4.0	8.0	
us inv (ft AD)	-4.610		3.000	4.380	
ds inv (ft AD)	-5.590		4.380	2.890	
r.pfc (MGD)	0.82		-0.10	0.50	
surc	0.75	-	1.00	0.52	
US total head (ft AD)	-4.440	-	28.060	4.858	
US velocity (ft/s)	1.617	-	6.883	2.935	
DS flow (MGD)	0.2606	-	0.3882	0.0633	
DS cumulative flow (US Mgal)	0.08015	-	0.08013	0.09492	
DS total head (ft AD)	-5.056	-	5.449	3.084	
DS velocity (ft/s)	1.428	-	6.883	1.612	

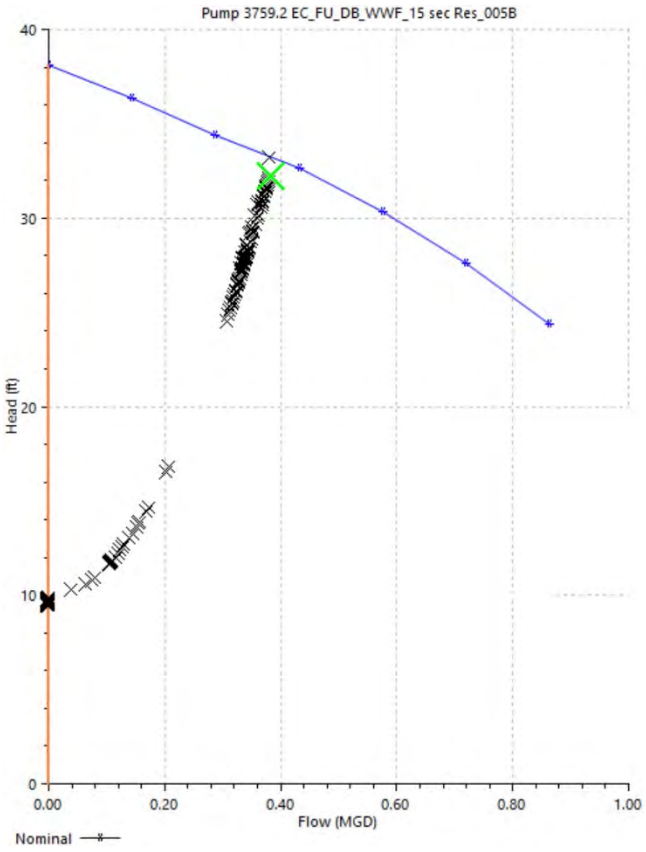
Node	3757	3759	9993764	3758	3761
ground (ft AD)	9.986	10.987	10.987	10.021	8.733
flood dep (ft)	-14.467	-16.074	17.073	-5.297	-6.107

Davenport LS - Design Basis - 10 year 24 hour Storm

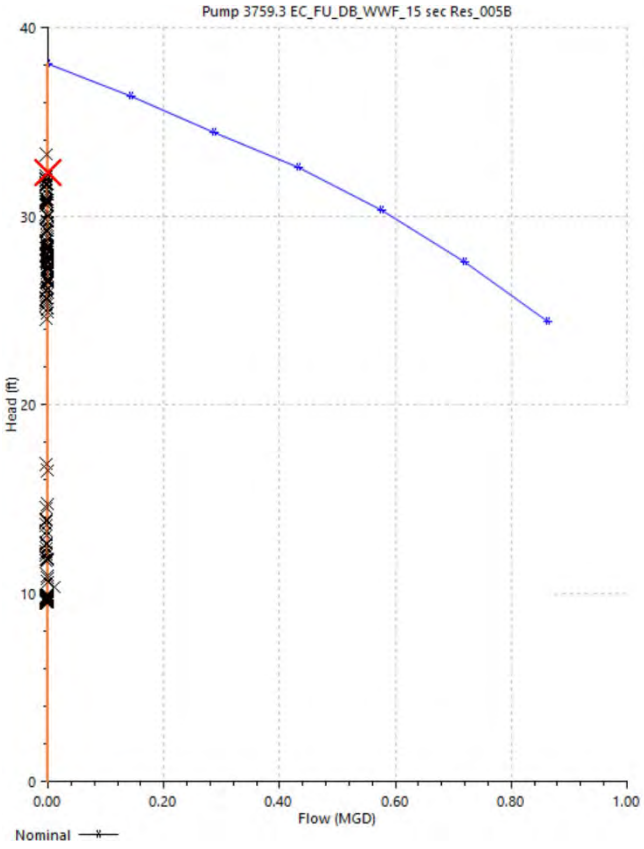




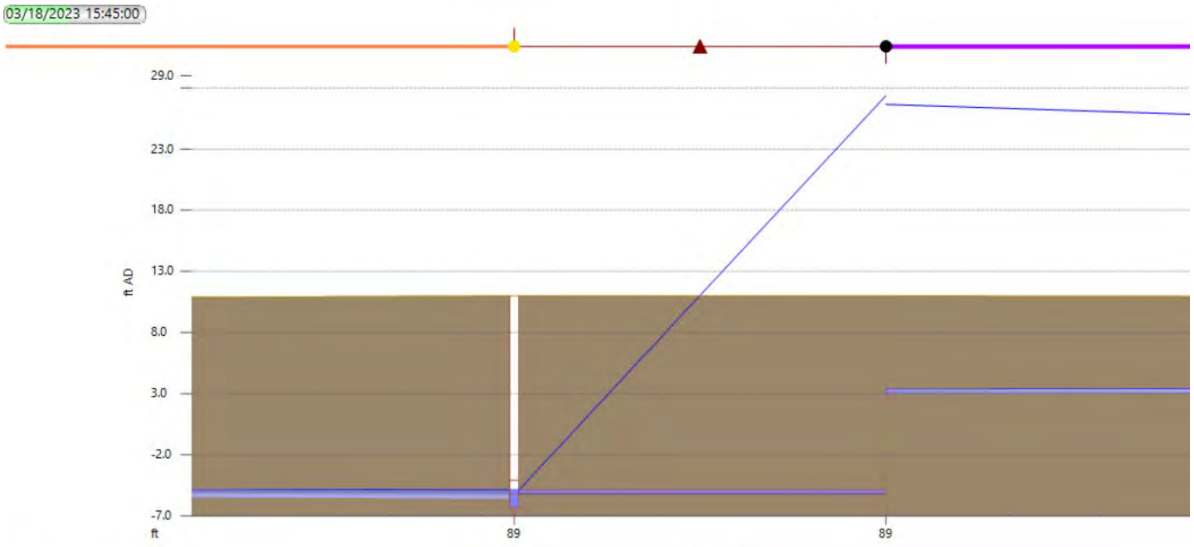
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.796	0.485	0.093			
Existing - WWF				-0.000	0.388	0.108
Future - WWF				-0.000	0.382	0.129



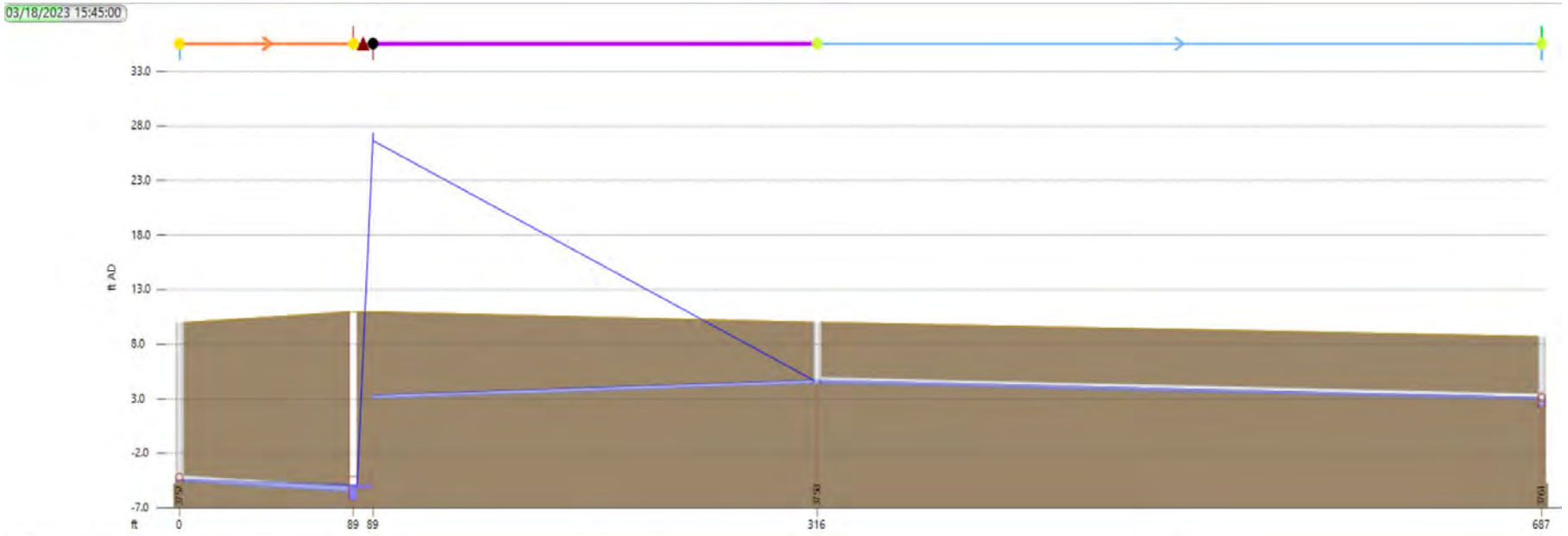
Davenport Lead Pump



Davenport Lag Pump



Link		3759.2	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		-4.892	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.3834	
DS cumulative flow (US Mgal)		0.14948	
DS total head (ft AD)		27.360	
DS velocity (ft/s)		0.000	
Node	3759		9993764
ground (ft AD)	10.987		10.987
flood dep (ft)	-15.879		16.373

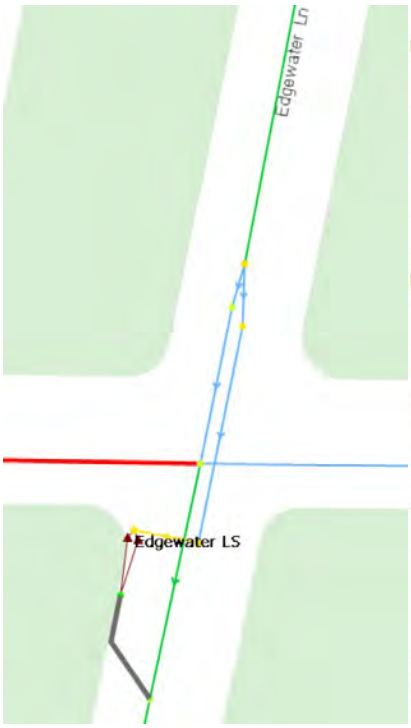


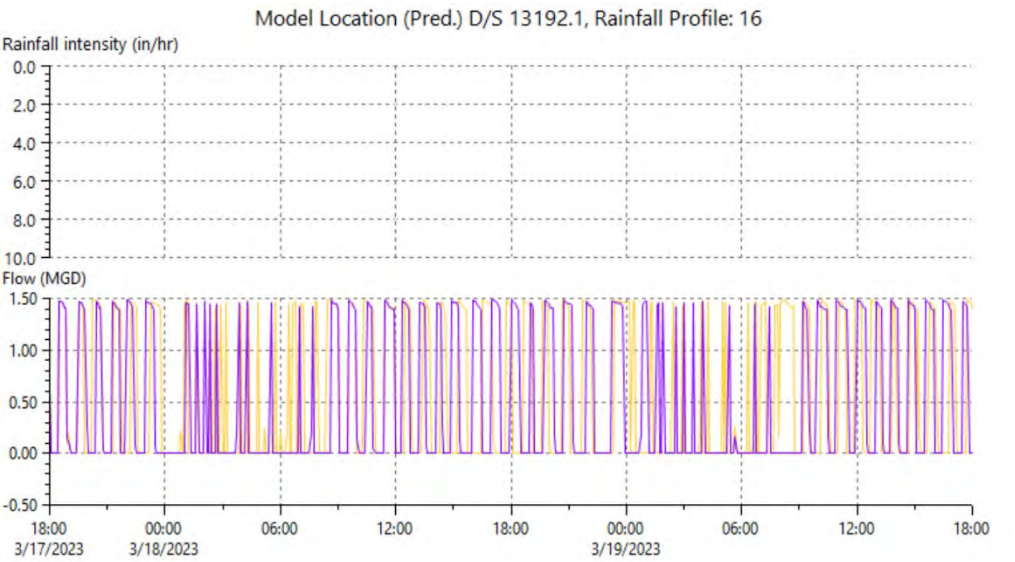
Link	3757.1	-	9993764.1	3758.1	
width (in)	8.0		4.0	8.0	
us inv (ft AD)	-4.610		3.000	4.380	
ds inv (ft AD)	-5.590		4.380	2.890	
r.pfc (MGD)	0.82		-0.10	0.50	
surc	1.00	-	1.00	0.48	
US total head (ft AD)	-4.323	-	27.360	4.827	
US velocity (ft/s)	2.423	-	6.779	2.866	
DS flow (MGD)	0.3065	-	0.3823	0.1374	
DS cumulative flow (US Mgal)	0.14950	-	0.14949	0.16621	
DS total head (ft AD)	-4.864	-	5.427	3.180	
DS velocity (ft/s)	1.325	-	6.779	2.116	

Node	3757	3759	9993764	3758	3761
ground (ft AD)	9.986	10.987	10.987	10.021	8.733
flood dep (ft)	-14.400	-15.879	16.373	-5.321	-5.839

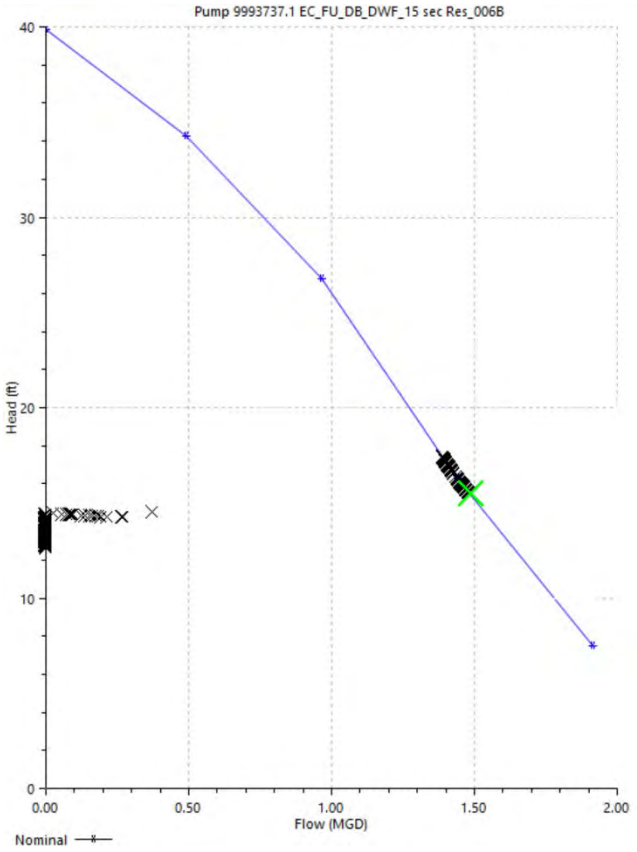
Edgewater LS - Design Basis – DWF



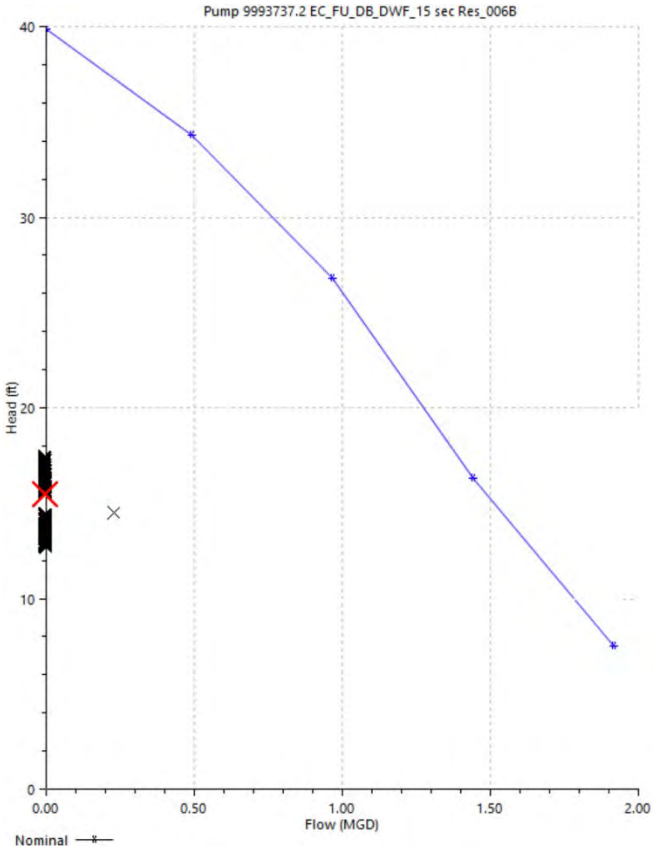




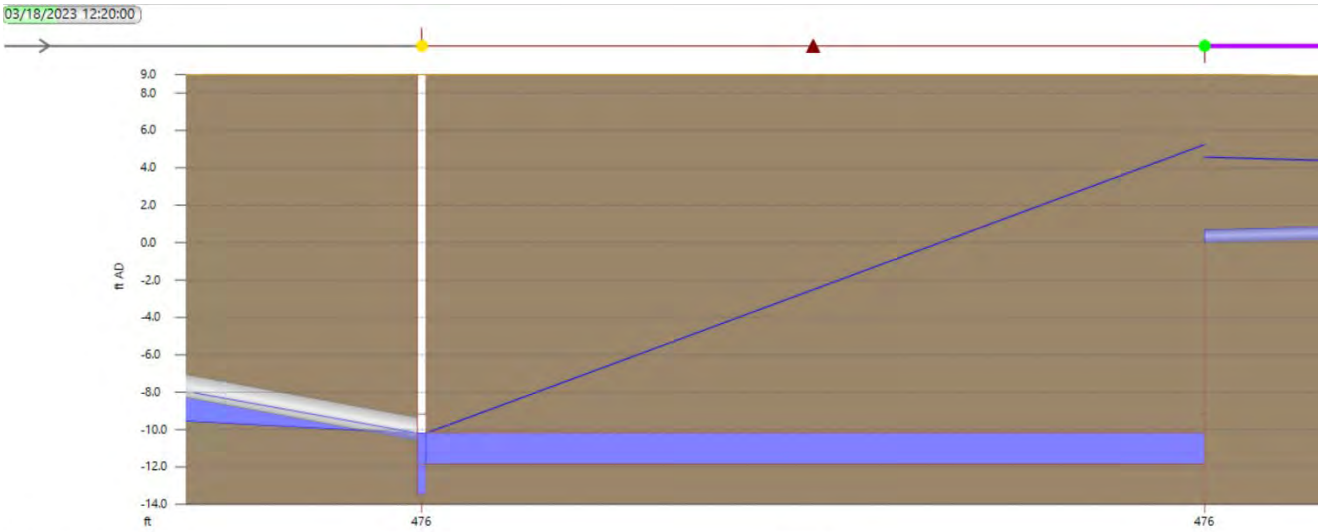
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	1.488	1.080
Future - DWF				-0.000	1.487	0.990



Edgewater Lead Pump



Edgewater Lag Pump



Link 91.1		9993737.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc 32		1.00	
US total head (ft AD)		-10.192	
US velocity (ft/s)		0.000	
DS flow (MGD)		1.4870	
DS cumulative flow (US Mgal)		1.05866	
DS total head (ft AD)		5.254	
DS velocity (ft/s)		0.000	
Node	9993737		13192
ground (ft AD)	8.996		8.996
flood dep (ft)	-19.188		-3.743

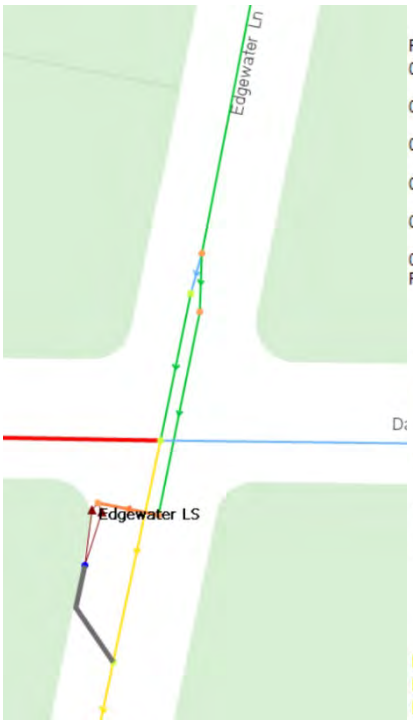


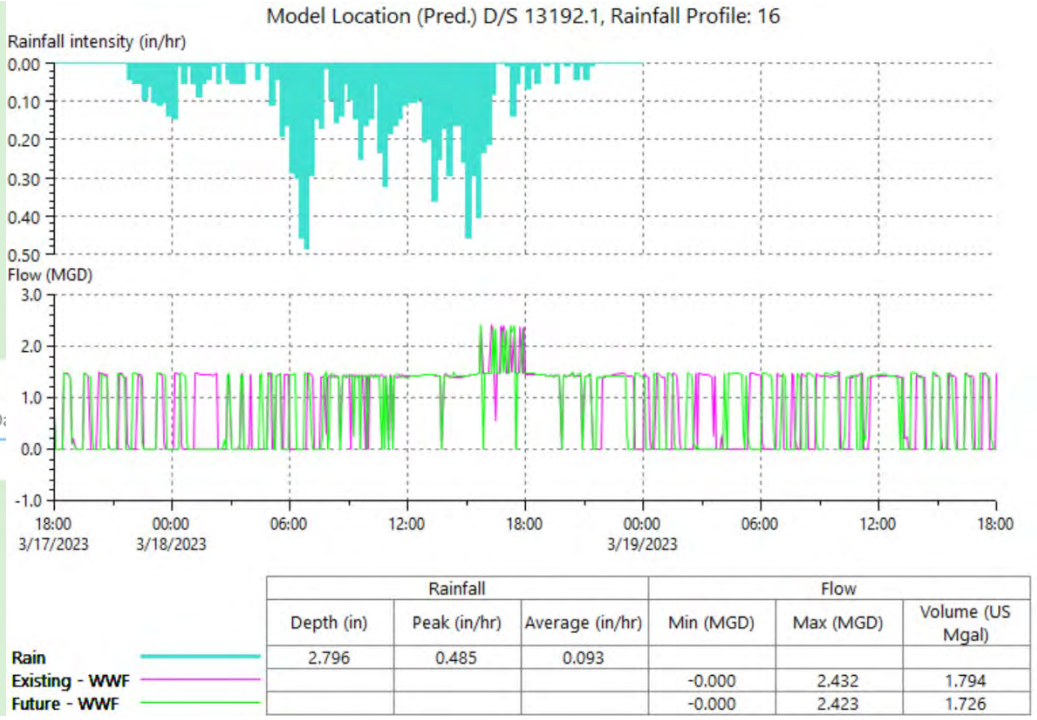
Link		3605.1		3733.2	13190.1	13191.1	-	13192.1	13193.1	3813.1	
width (in)		15.0		15.0	15.0	15.0		8.0	15.0	15.0	
us inv (ft AD)		-2.050		-2.620	-2.790	-3.150		0.000	1.930	1.810	
ds inv (ft AD)		-2.520		-2.690	-3.050	-10.590		1.930	1.810	1.050	
r.pfc (MGD)		1.62		2.04	2.09	20.46		-1.47	2.08	2.10	
surc		0.45		0.37	0.39	0.32	1.00	1.00	0.42	0.38	
US total head (ft AD)		-1.426		-2.052	-2.209	-1.799	-10.192	5.253	2.618	2.372	
US velocity (ft/s)		1.933		2.615	2.416	8.611	0.000	6.591	3.230	2.874	
DS flow (MGD)		0.6957		0.6977	0.7028	0.7391	1.4870	1.4870	0.7610	0.5485	
DS cumulative flow (US Mgal)		1.05729		-	1.05742	1.05751	1.05866	1.05866	1.18280	1.18493	
DS total head (ft AD)		-1.963		-2.132	-2.490	-10.012	5.254	3.272	2.394	1.588	
DS velocity (ft/s)		3.064		3.060	3.066	3.400	0.000	6.591	3.108	1.963	

Node	3605	3733	13190	13191	-	13192	13193	3813	3912
ground (ft AD)	8.752	8.870	8.814	8.918	8.996	8.996	8.226	8.365	9.000
flood dep (ft)	-10.236	-11.028	-11.113	-11.868	-	-3.743	-5.770	-6.120	-7.472

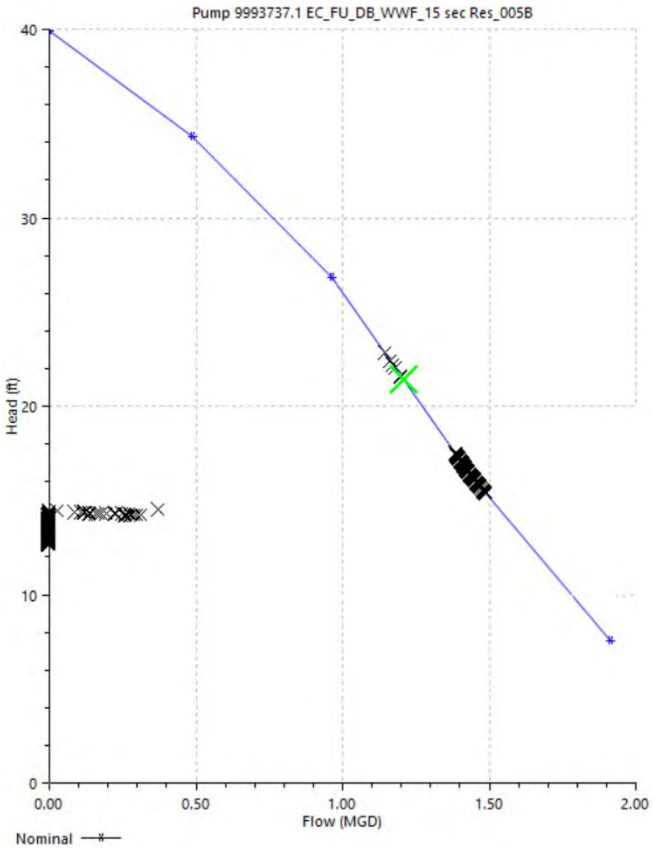
Edgewater LS - Design Basis - 10 year 24 hour Storm



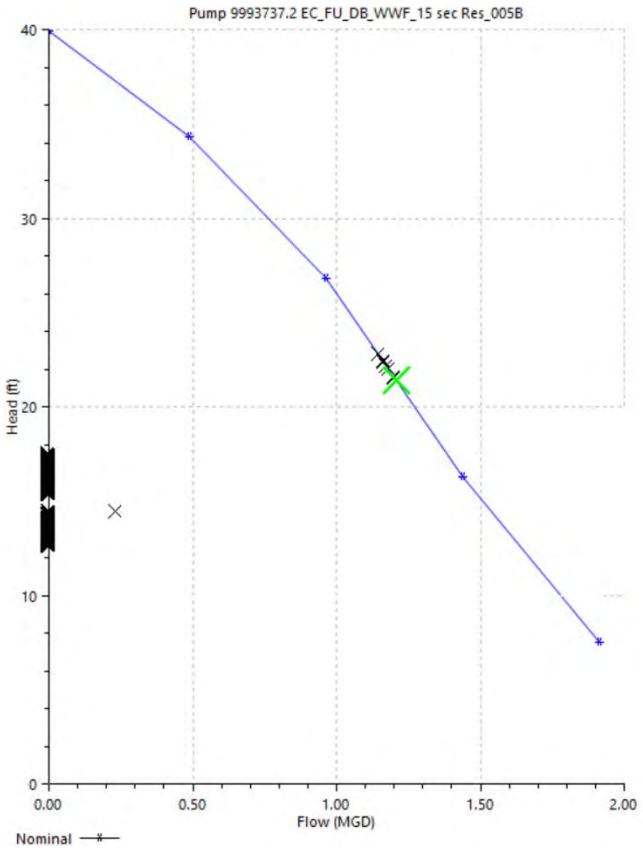




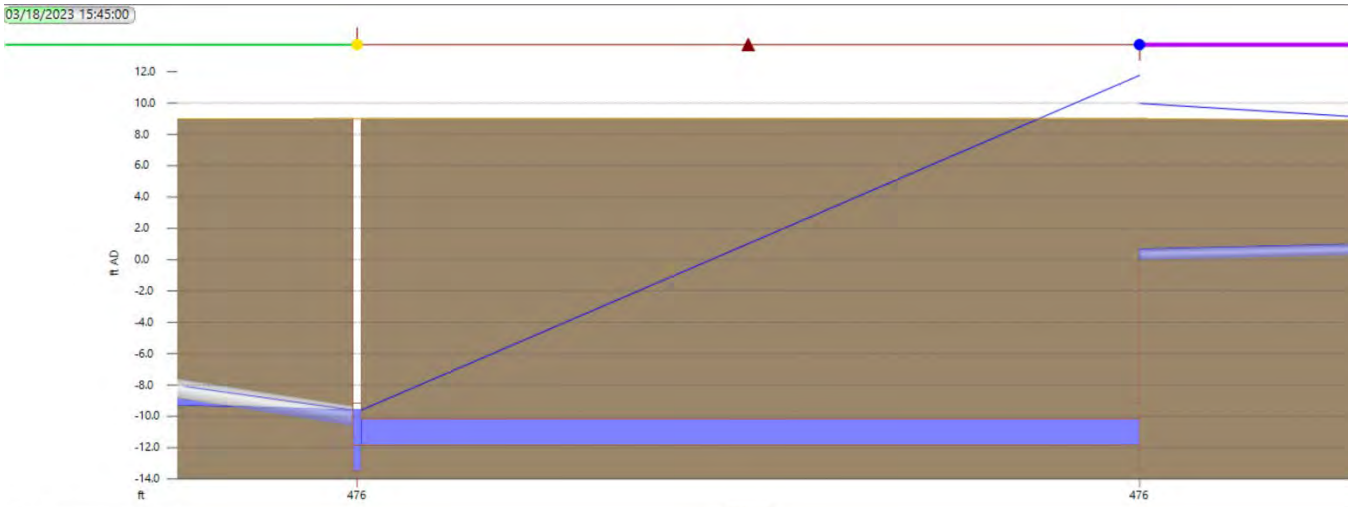
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.796	0.485	0.093			
Existing - WWF				-0.000	2.432	1.794
Future - WWF				-0.000	2.423	1.726



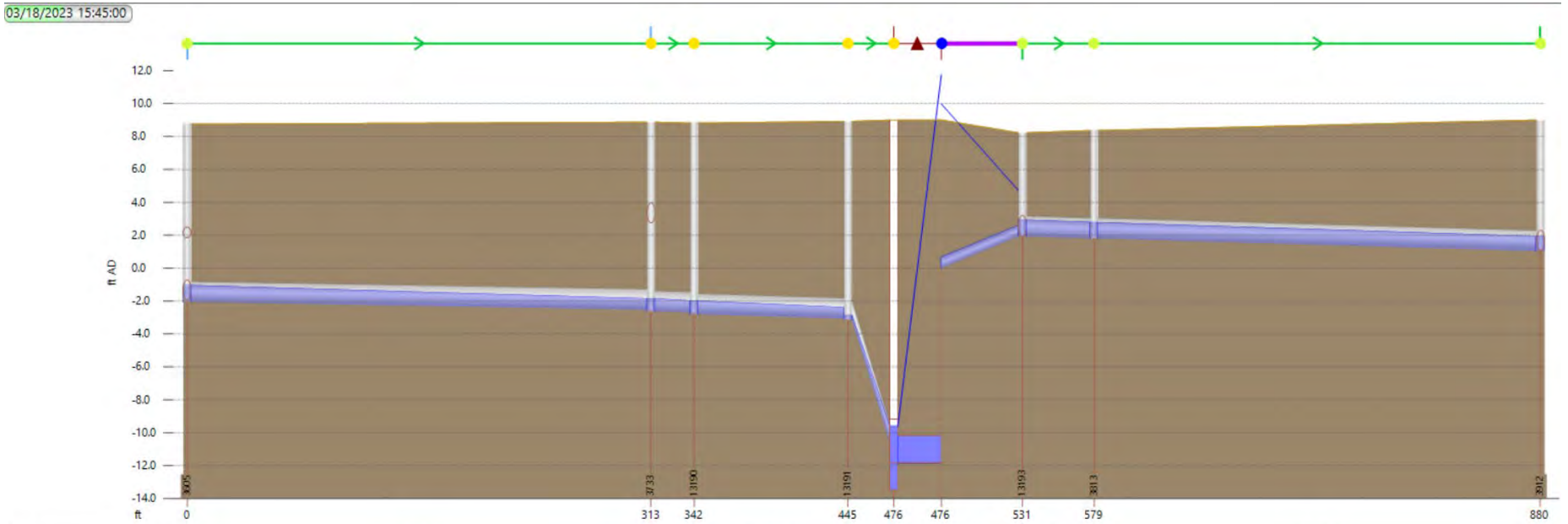
Edgewater Lead Pump



Edgewater Lag Pump



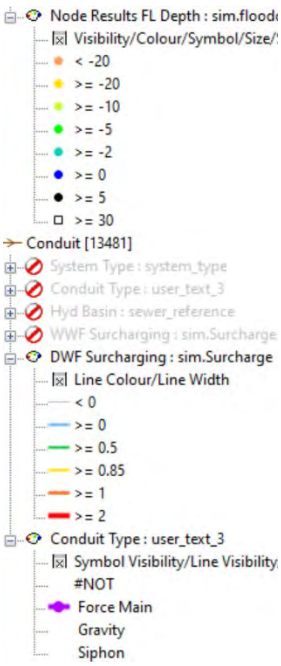
Link		9993737.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		-9.603	
US velocity (ft/s)		0.000	
DS flow (MGD)		1.2115	
DS cumulative flow (US Mgal)		1.68560	
DS total head (ft AD)		11.769	
DS velocity (ft/s)		0.000	
Node	9993737		13192
ground (ft AD)	8.996		8.996
flood dep (ft)	-18.599		2.773



Link	3605.1	3733.2	13190.1	13191.1	-	13192.1	13193.1	3813.1
width (in)	15.0	15.0	15.0	15.0		8.0	15.0	15.0
us inv (ft AD)	-2.050	-2.620	-2.790	-3.150		0.000	1.930	1.810
ds inv (ft AD)	-2.520	-2.690	-3.050	-10.590		1.930	1.810	1.050
r.pfc (MGD)	1.62	2.04	2.09	20.46		-1.47	2.08	2.10
surc	0.79	0.61	0.64	0.79	1.00	1.00	0.79	0.77
US total head (ft AD)	-0.959	-1.684	-1.836	-0.123	-9.603	11.769	3.073	2.931
US velocity (ft/s)	2.542	3.398	3.203	13.317	0.000	10.740	3.211	3.240
DS flow (MGD)	1.6946	1.7041	1.6963	1.7243	1.2115	2.4230	2.1170	1.7488
DS cumulative flow (US Mgal)	1.71326	1.72196	1.72250	1.72264	1.68560	1.72270	1.93278	1.93746
DS total head (ft AD)	-1.613	-1.774	-2.143	-9.501	11.769	6.507	2.938	2.058
DS velocity (ft/s)	3.980	3.732	4.056	2.566	0.000	10.740	3.213	2.962

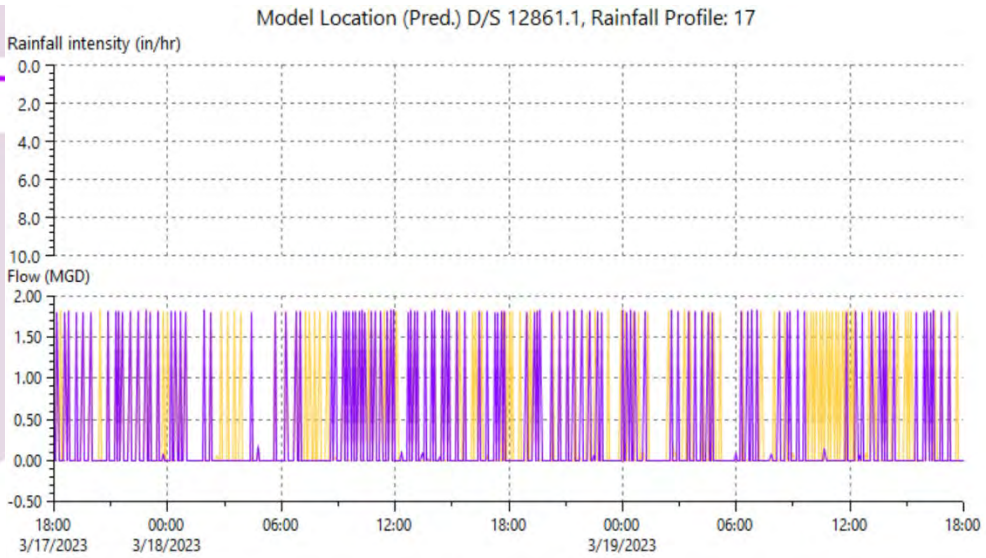
Node	3605	3733	13190	13191	-	13192	13193	3813	3912
ground (ft AD)	8.752	8.870	8.814	8.918	8.996	8.996	8.226	8.365	9.000
flood dep (ft)	-9.806	-10.729	-10.804	-11.793	-	2.773	-5.304	-5.588	-7.079

“C” LS - Design Basis – DWF

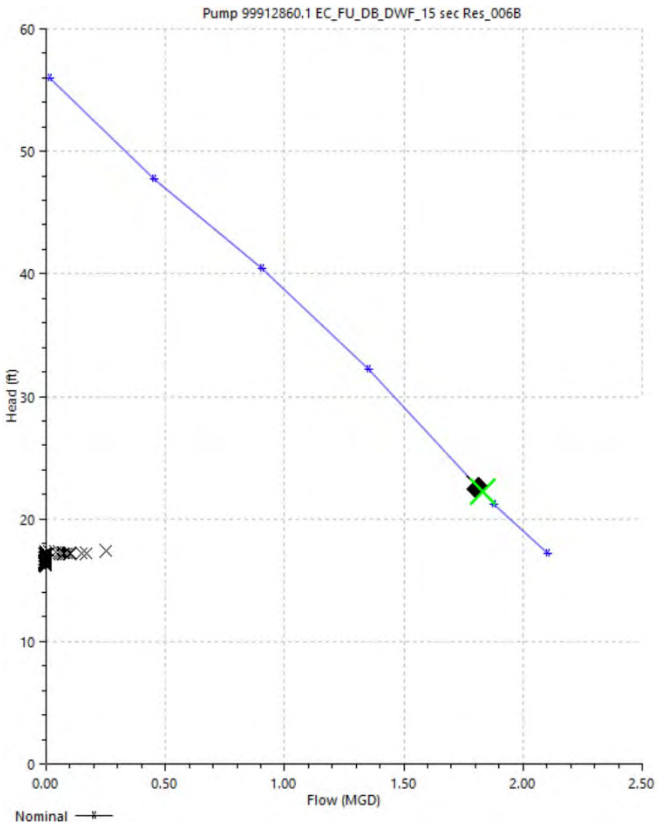




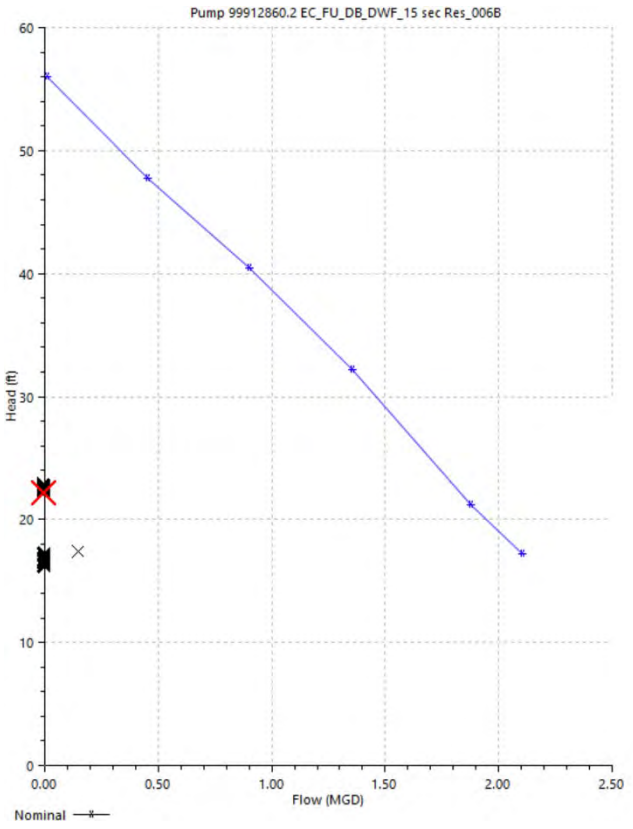




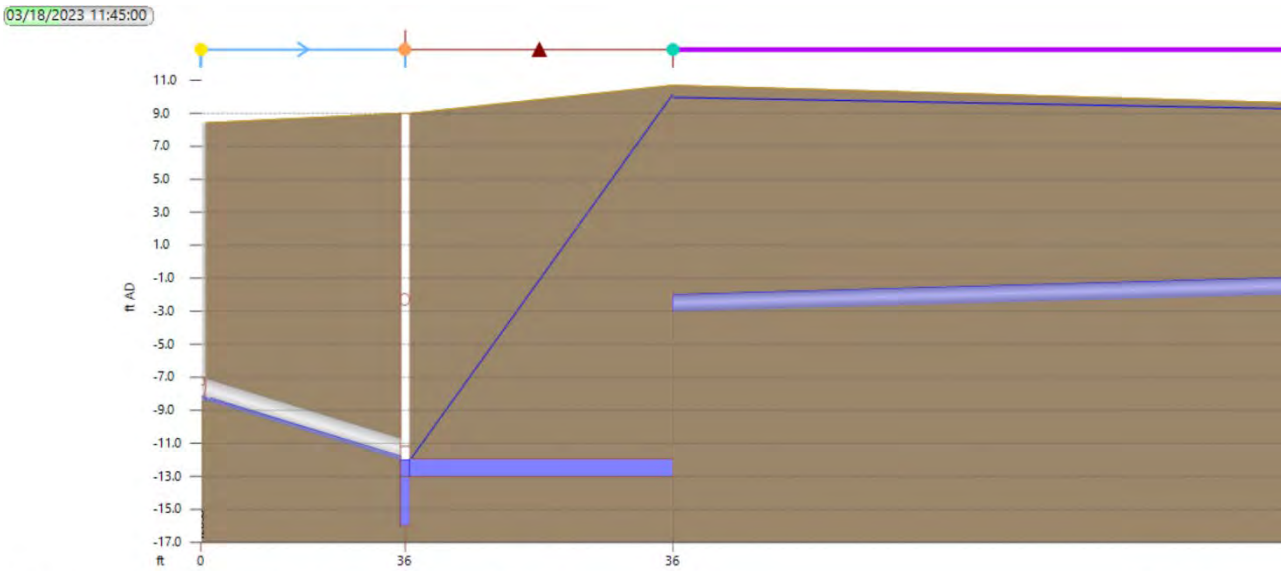
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	1.832	0.810
Future - DWF				-0.000	1.832	0.685



“C” Lead Pump

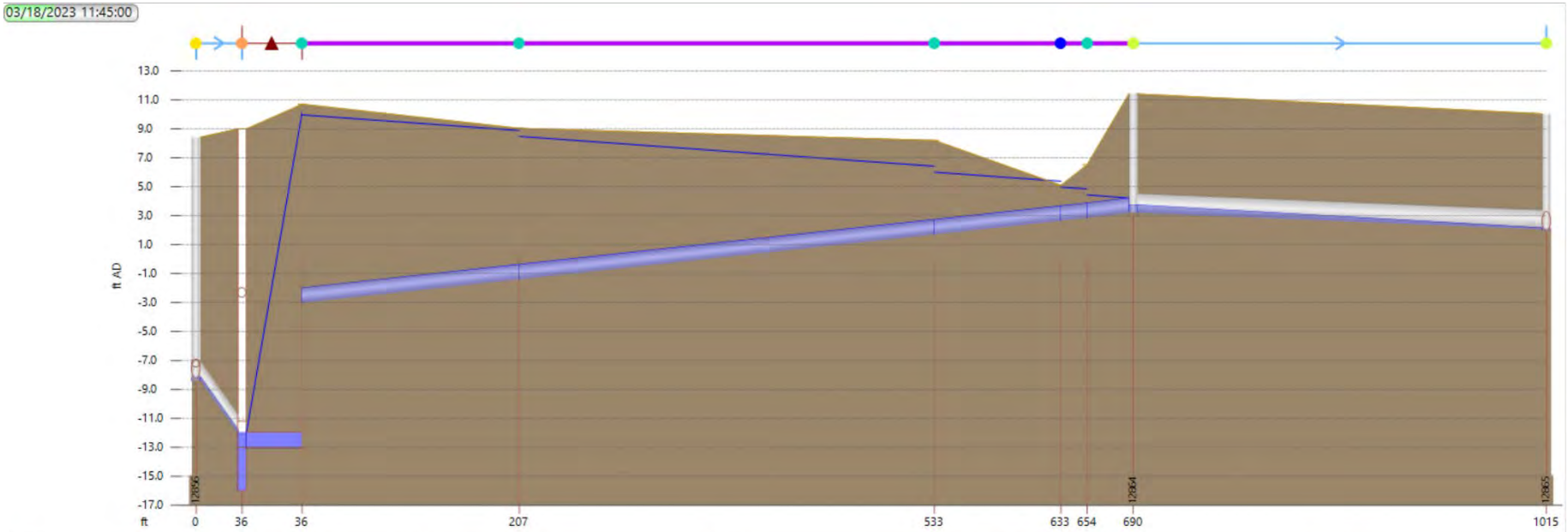


“C” Lag Pump



Link	12856.1	99912860.1	12861.1
width (in)	16.0		12.0
us inv (ft AD)	-8.380		-3.000
ds inv (ft AD)	-12.010		-1.377
r.pfc (MGD)	15.73		-2.25
surc	0.17	1.00	1.00
US total head (ft AD)	-7.480	-12.006	10.163
US velocity (ft/s)	6.573	0.000	3.608
DS flow (MGD)	0.6756	1.8318	1.8316
DS cumulative flow (US Mgal)	0.71492	0.72168	0.72168
DS total head (ft AD)	-11.111	10.163	9.083
DS velocity (ft/s)	6.571	0.000	3.608

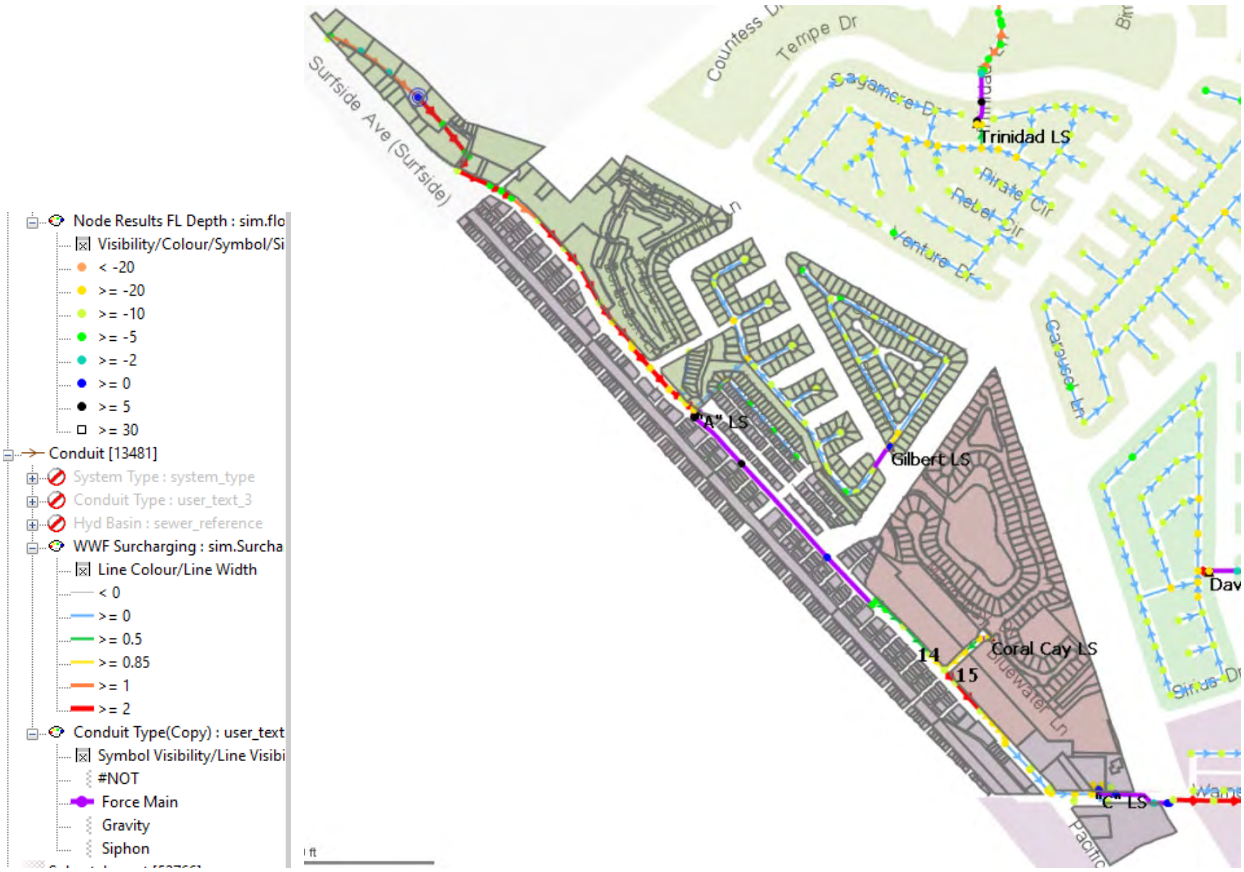
Node	12856	99912860	12861
ground (ft AD)	8.416	8.990	10.695
flood dep (ft)	-16.567	-20.996	-0.533



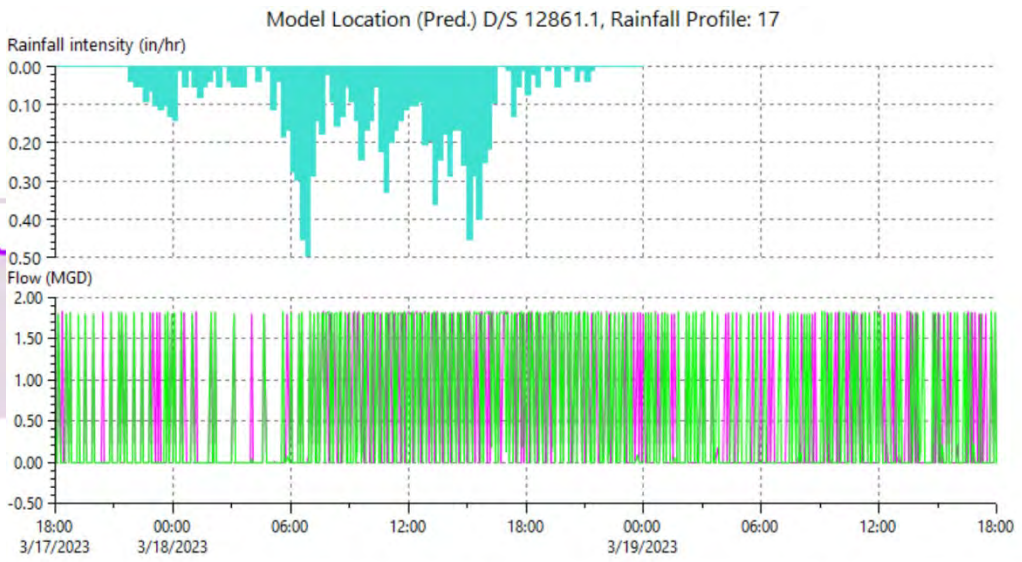
Link	12856.1	-	12861.1	13061.1	12862.1	-	13064.1	12864.1
width (in)	16.0		12.0	12.0	12.0	12.0	12.0	16.0
us inv (ft AD)	-8.380		-3.000	-1.377	1.724	-	2.866	3.210
ds inv (ft AD)	-12.010		-1.377	1.724	2.670	-	3.210	2.070
r.pfc (MGD)	15.73		-2.25	-2.25	-2.25	-	-2.25	2.94
surc	0.17	1.00	1.00	1.00	1.00	1.00	1.00	0.39
US total head (ft AD)	-7.480	-12.006	10.163	8.678	6.210	-	4.641	4.106
US velocity (ft/s)	6.573	0.000	3.608	3.608	3.608	-	3.607	4.916
DS flow (MGD)	0.6756	1.8318	1.8316	1.8313	1.8313	-	1.8312	0.0039
DS cumulative flow (US Mgal)	0.71492	0.72168	0.72168	0.72168	0.72168	-	0.72168	0.75775
DS total head (ft AD)	-11.111	10.163	9.083	6.614	5.580	-	4.412	2.144
DS velocity (ft/s)	6.571	0.000	3.608	3.608	3.608	-	3.607	0.204

Node	-	-	12861	13061	12862	12863	-	12864	12865
ground (ft AD)	-	8.990	10.695	9.026	8.200	5.094	-	11.402	10.036
flood dep (ft)	-	-20.996	-0.533	-0.347	-1.991	0.082	-	-7.671	-7.980

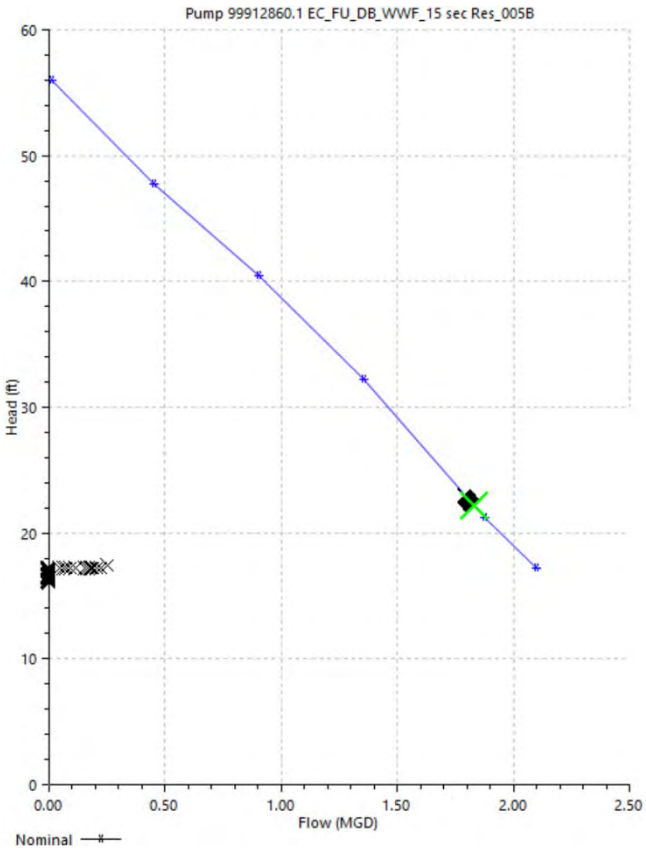
“C” LS - Design Basis - 10 year 24 hour Storm



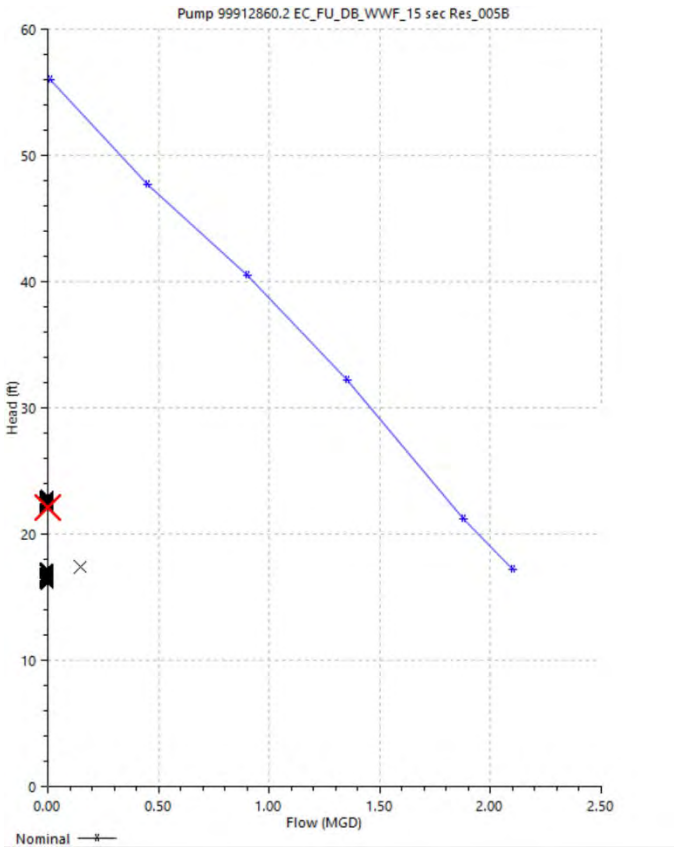




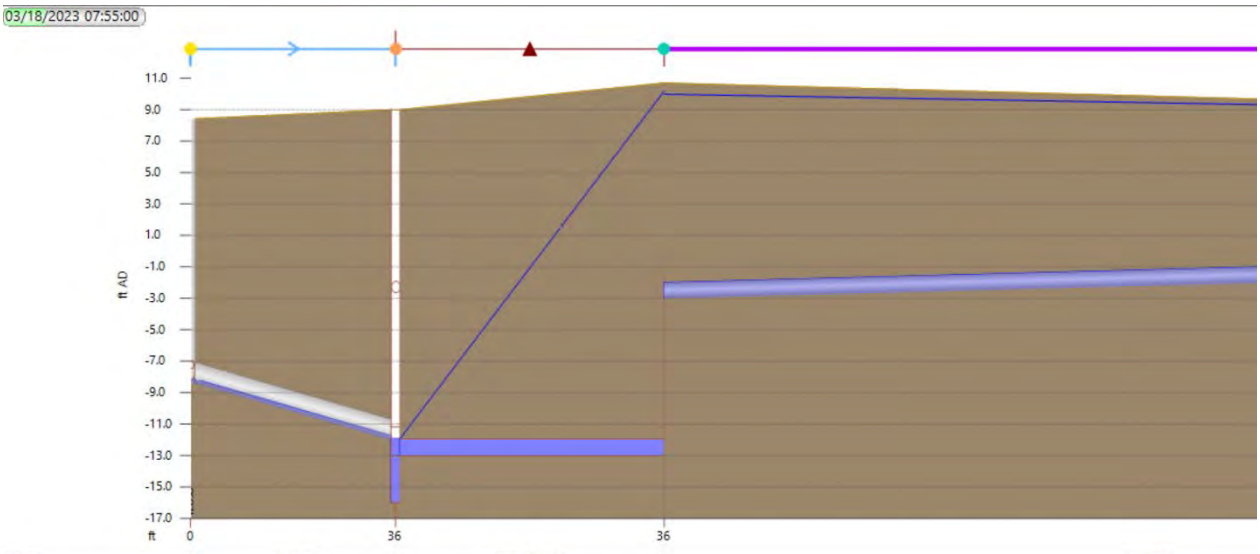
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.798	0.496	0.093			
Existing - WWF				-0.000	1.835	1.253
Future - WWF				-0.000	1.835	1.282



“C” Lead Pump



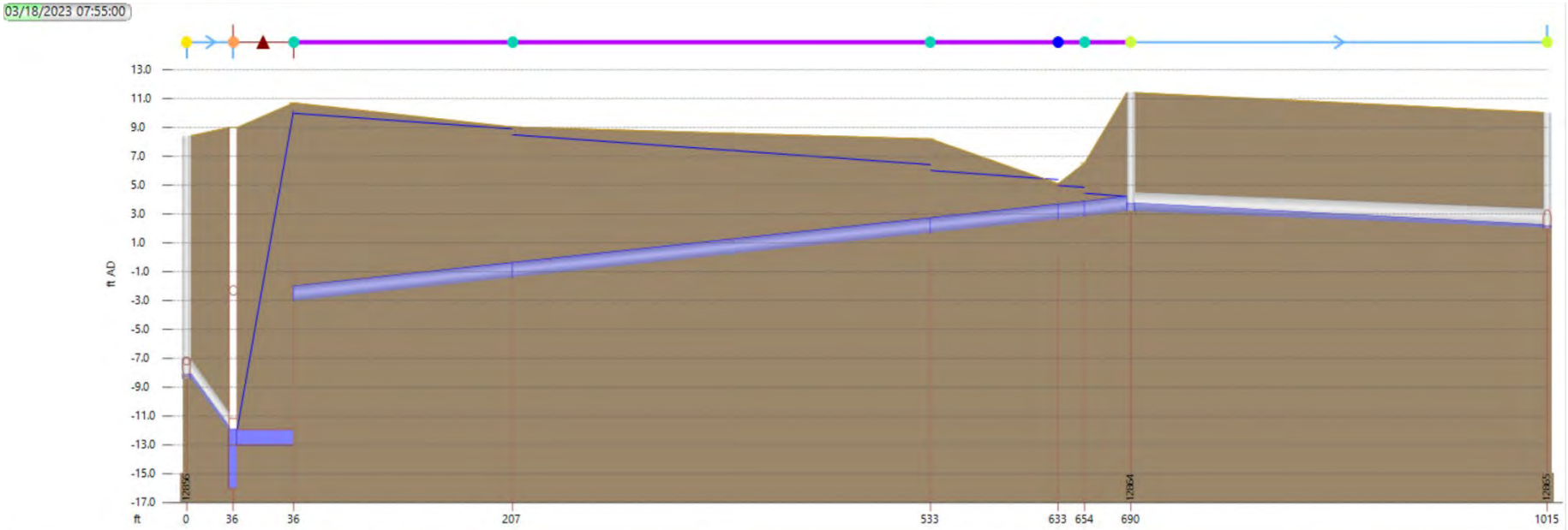
“C” Lag Pump



Link	12856.1	99912860.1	12861.1
width (in)	16.0		12.0
us inv (ft AD)	-8.380		-3.000
ds inv (ft AD)	-12.010		-1.377
r.pfc (MGD)	15.73		-2.25
surc	0.20	1.00	1.00
US total head (ft AD)	-7.083	-11.923	10.182
US velocity (ft/s)	8.147	0.000	3.614
DS flow (MGD)	1.0445	1.8349	1.8346
DS cumulative flow (US Mgal)	1.26335	1.27551	1.27551
DS total head (ft AD)	-10.713	10.183	9.099
DS velocity (ft/s)	8.147	0.000	3.614

Node	12856	99912860	12861
ground (ft AD)	8.416	8.990	10.695
flood dep (ft)	-16.529	-20.913	-0.513

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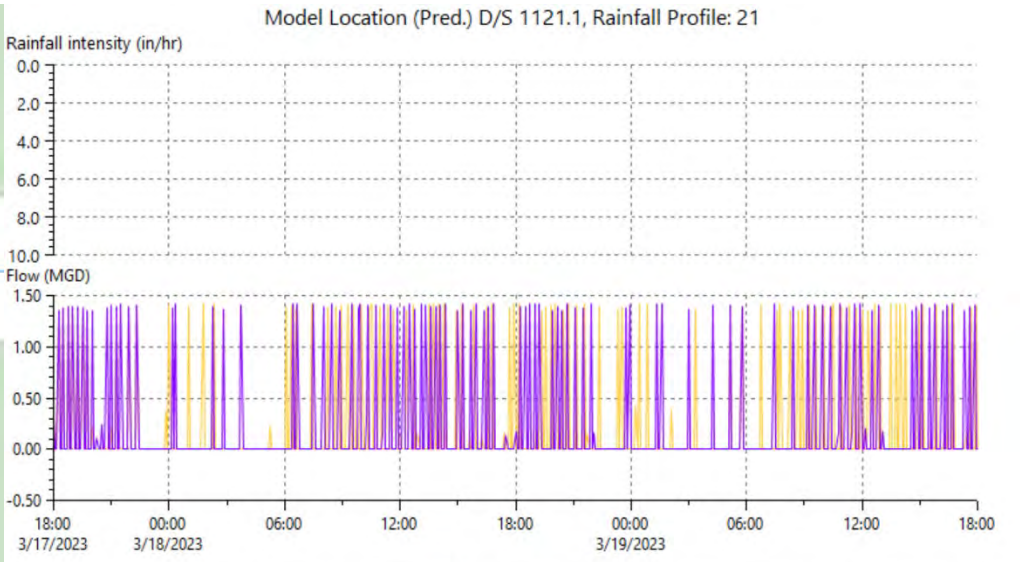
Link	12856.1	-	12861.1	13061.1	12862.1	-	13064.1	12864.1
width (in)	16.0		12.0	12.0	12.0	12.0	12.0	16.0
us inv (ft AD)	-8.380		-3.000	-1.377	1.724	-	2.866	3.210
ds inv (ft AD)	-12.010		-1.377	1.724	2.670	-	3.210	2.070
r.pfc (MGD)	15.73		-2.25	-2.25	-2.25	-	-2.25	2.94
surc	0.20	1.00	1.00	1.00	1.00	1.00	1.00	0.39
US total head (ft AD)	-7.083	-11.923	10.182	8.693	6.216	-	4.642	4.105
US velocity (ft/s)	8.147	0.000	3.614	3.614	3.614	-	3.613	4.884
DS flow (MGD)	1.0445	1.8349	1.8346	1.8344	1.8343	-	1.8342	0.1126
DS cumulative flow (US Mgal)	1.26335	1.27551	1.27551	1.27551	1.27551	-	1.27551	1.29387
DS total head (ft AD)	-10.713	10.183	9.099	6.622	5.585	-	4.413	2.283
DS velocity (ft/s)	8.147	0.000	3.614	3.614	3.614	-	3.613	1.708

Node	-	-	12861	13061	12862	12863	-	12864	12865
ground (ft AD)	-	8.990	10.695	9.026	8.200	5.094	-	11.402	10.036
flood dep (ft)	-	-20.913	-0.513	-0.333	-1.984	0.085	-	-7.668	-7.842

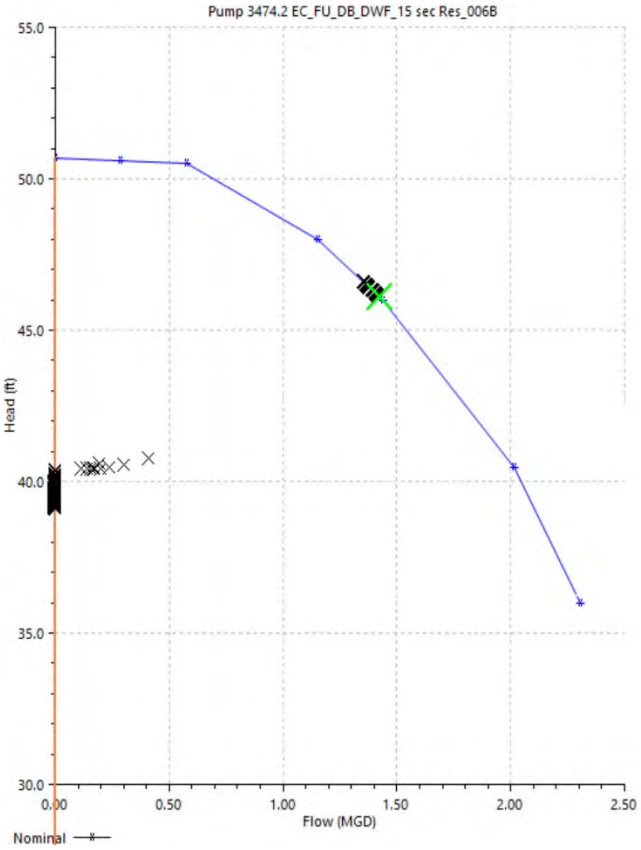
Algonquin LS - Design Basis – DWF



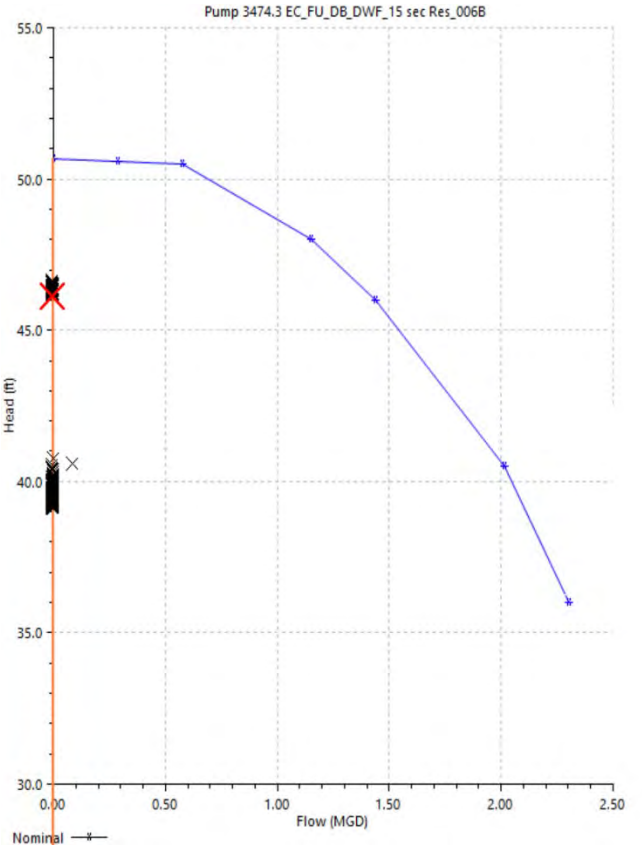




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	1.424	0.441
Future - DWF				-0.000	1.425	0.455



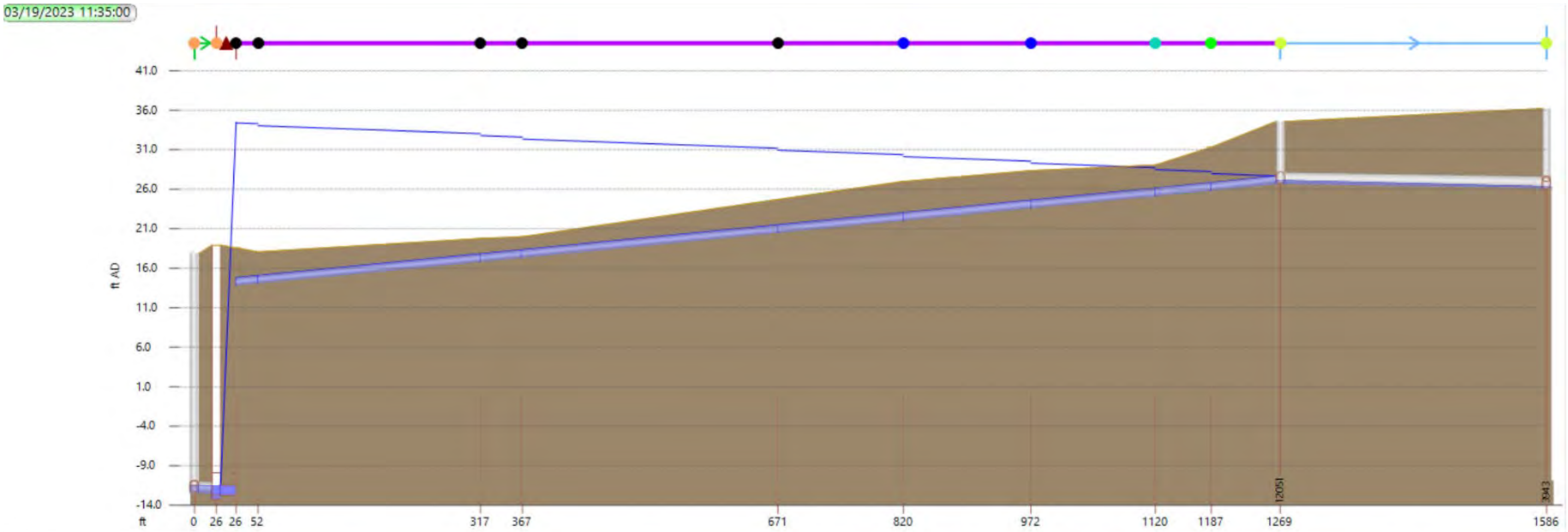
Algonquin Lead Pump



Algonquin Lag Pump



Link		3474.2	1121.1
width (in)			12.0
us inv (ft AD)			13.810
ds inv (ft AD)			14.079
r.pfc (MGD)			-2.34
surc		1.00	1.00
US total head (ft AD)		-11.587	34.514
US velocity (ft/s)		0.000	2.807
DS flow (MGD)		1.4254	1.4251
DS cumulative flow (US Mgal)		0.46417	0.46417
DS total head (ft AD)		34.514	34.415
DS velocity (ft/s)		0.000	2.807
Node	3474		1121
ground (ft AD)	18.907		18.582
flood dep (ft)	-30.494		15.933



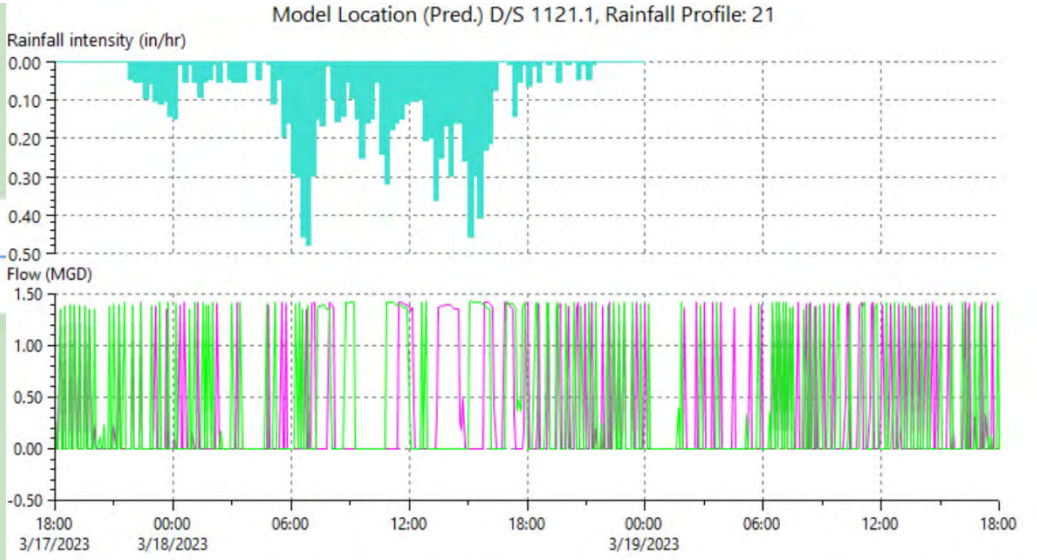
Link	-	-	-	1150.1	-	12556.1	12555.1	12554.1	12553.1	12552.1	12551.1	12051.1
width (in)	-		-	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	18.0
us inv (ft AD)	-		-	14.079	16.823	17.340	20.488	22.037	23.606	25.143	25.830	26.680
ds inv (ft AD)	-		-	16.823	17.340	20.488	22.037	23.606	25.143	25.830	26.680	26.170
r.pfc (MGD)	-		-	-2.34	-2.34	-2.34	-2.34	-2.34	-2.34	-2.34	-2.34	2.72
surc	-	-	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.28
US total head (ft AD)	-	-	-	34.170	32.911	32.474	31.067	30.250	29.426	28.614	28.116	27.297
US velocity (ft/s)	-	-	-	2.807	2.806	2.806	2.806	2.805	2.805	2.805	2.805	3.619
DS flow (MGD)	-	-	-	1.4248	1.4246	1.4243	1.4242	1.4241	1.4240	1.4239	1.4239	0.1012
DS cumulative flow (US Mgal)	-	-	-	0.46417	-	0.46417	0.46417	0.46417	0.46417	0.46417	0.46417	0.48393
DS total head (ft AD)	-	-	-	33.155	32.719	31.312	30.495	29.671	28.859	28.361	27.802	26.368
DS velocity (ft/s)	-	-	-	2.807	2.806	2.806	2.806	2.805	2.805	2.805	2.805	1.535

Node	-	-	1150	12557	12556	12555	12554	12553	12552	12551	12051	3943
ground (ft AD)	-	-	18.067	19.761	19.989	24.711	26.988	28.357	29.065	31.318	34.576	36.225
flood dep (ft)	-	-	16.102	13.149	12.486	6.356	3.262	1.069	-0.450	-3.201	-7.482	-9.895

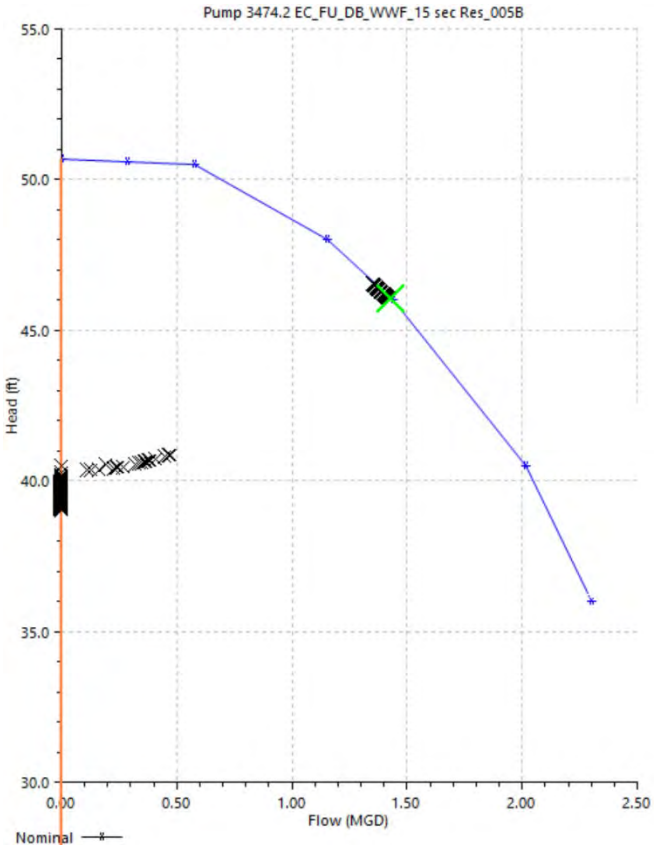
Algonquin LS - Design Basis - 10 year 24 hour Storm



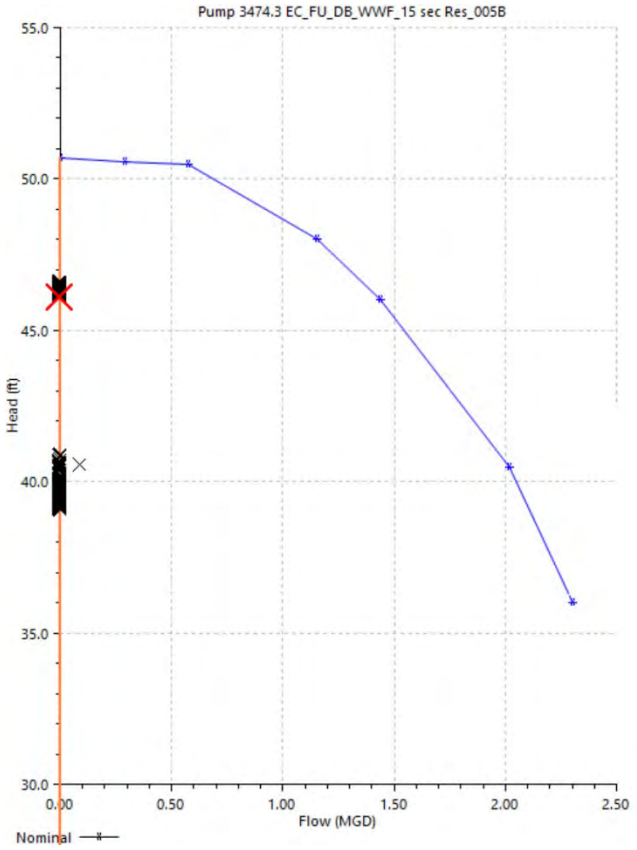




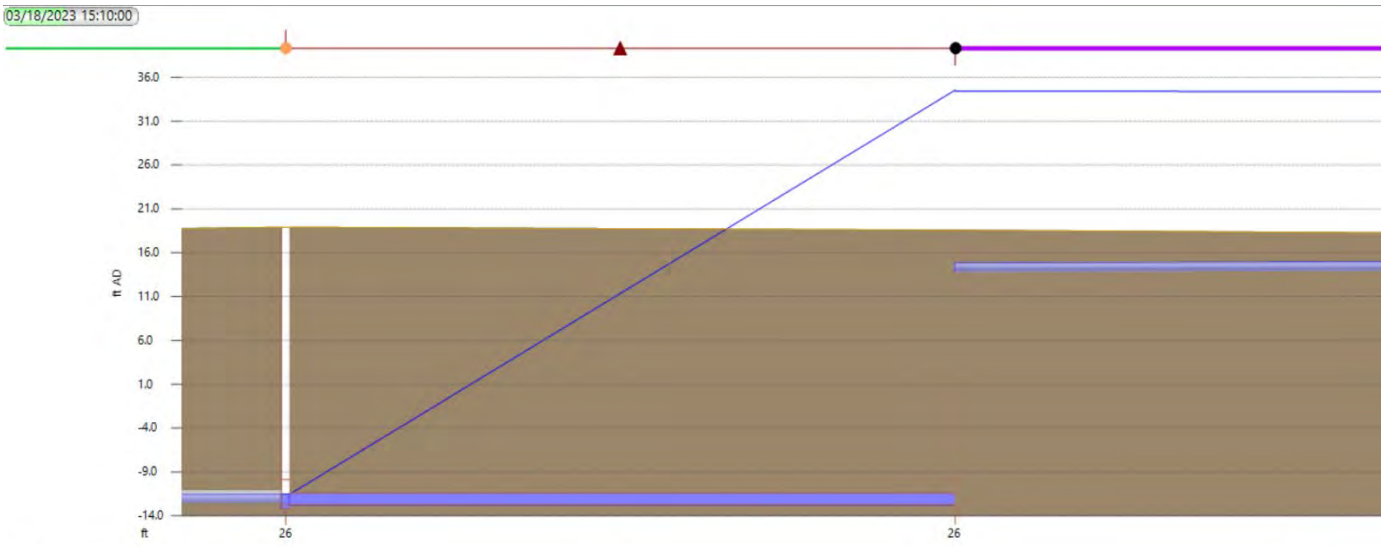
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.796	0.480	0.093			
Existing - WWF				-0.000	1.426	0.607
Future - WWF				-0.000	1.429	0.714



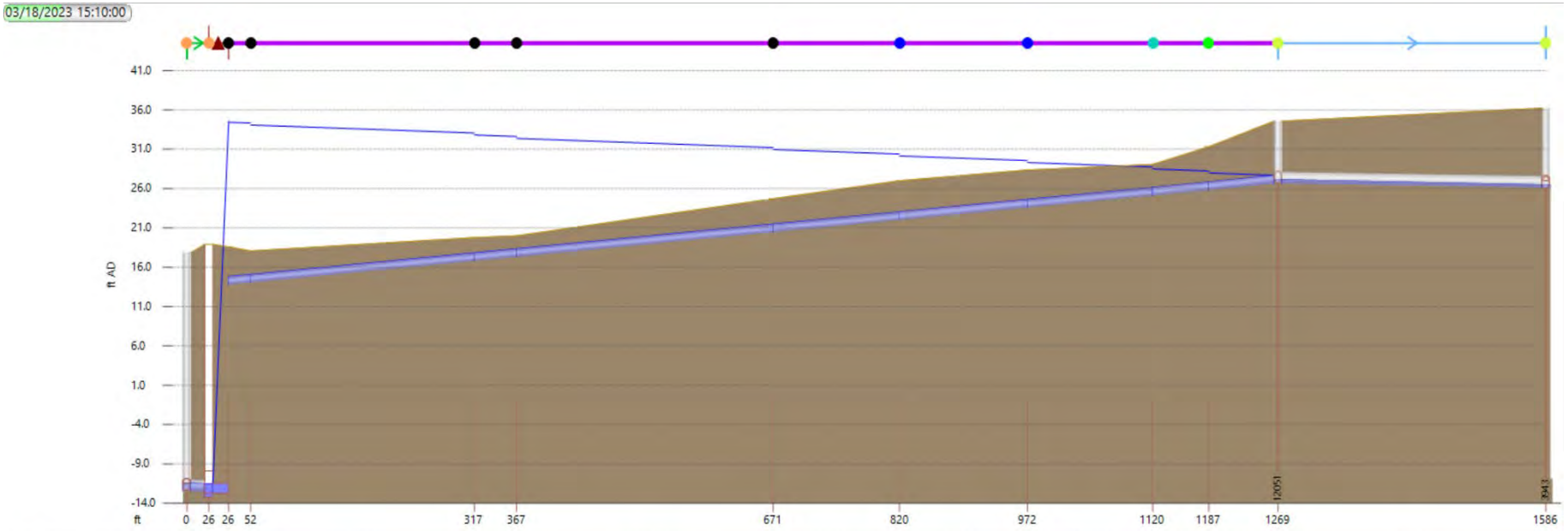
Algonquin Lead Pump



Algonquin Lag Pump



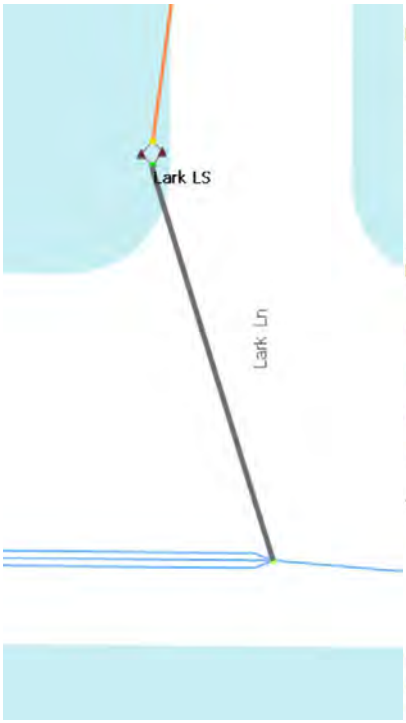
Link		3474.2	1121.1
width (in)			12.0
us inv (ft AD)			13.810
ds inv (ft AD)			14.079
r.pfc (MGD)			-2.34
surc		1.00	1.00
US total head (ft AD)		-11.522	34.552
US velocity (ft/s)		0.000	2.815
DS flow (MGD)		1.4293	1.4290
DS cumulative flow (US Mgal)		0.66579	0.66579
DS total head (ft AD)		34.552	34.451
DS velocity (ft/s)		0.000	2.815
Node	3474		1121
ground (ft AD)	18.907		18.582
flood dep (ft)	-30.429		15.970

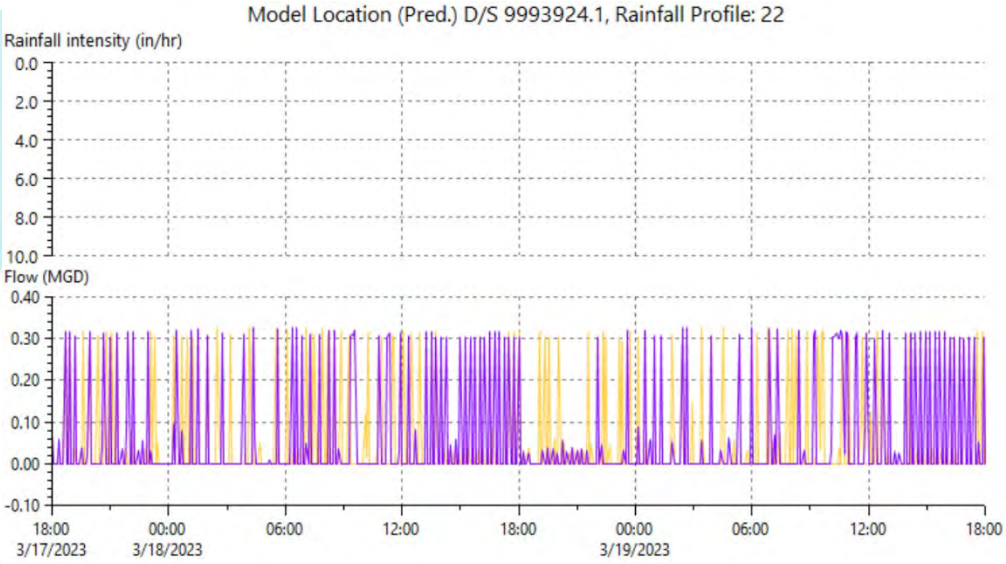


Link	-	-	-	1150.1	-	12556.1	12555.1	12554.1	12553.1	12552.1	12551.1	12051.1			
width (in)	-		-	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	18.0			
us inv (ft AD)	-		-	14.079	16.823	17.340	20.488	22.037	23.606	25.143	25.830	26.680			
ds inv (ft AD)	-		-	16.823	17.340	20.488	22.037	23.606	25.143	25.830	26.680	26.170			
r.pfc (MGD)	-		-	-2.34	-2.34	-2.34	-2.34	-2.34	-2.34	-2.34	-2.34	2.72			
surc	-	-	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.29			
US total head (ft AD)	-	-	-	34.205	32.939	32.501	31.086	30.265	29.436	28.620	28.118	27.293			
US velocity (ft/s)	-	-	-	2.815	2.814	2.814	2.813	2.813	2.813	2.813	2.813	3.378			
DS flow (MGD)	-	-	-	1.4287	1.4285	1.4282	1.4281	1.4280	1.4279	1.4278	1.4278	0.2794			
DS cumulative flow (US Mgal)	-	-	-	0.66579	-	0.66579	0.66579	0.66579	0.66579	0.66579	0.66579	0.68475			
DS total head (ft AD)	-	-	-	33.185	32.747	31.332	30.511	29.682	28.865	28.364	27.803	26.519			
DS velocity (ft/s)	-	-	-	2.815	2.814	2.814	2.813	2.813	2.813	2.813	2.813	1.674			
Node	-	-	1150		12557	12556	12555	12554	12553	12552	12551	12051		3943	
ground (ft AD)	-	-	18.067		19.761	19.989	24.711	26.988	28.357	29.065	31.318	34.576		36.225	
flood dep (ft)	-	-	16.138		13.178	12.512	6.374	3.276	1.079	-0.445	-3.199	-7.460		-9.750	

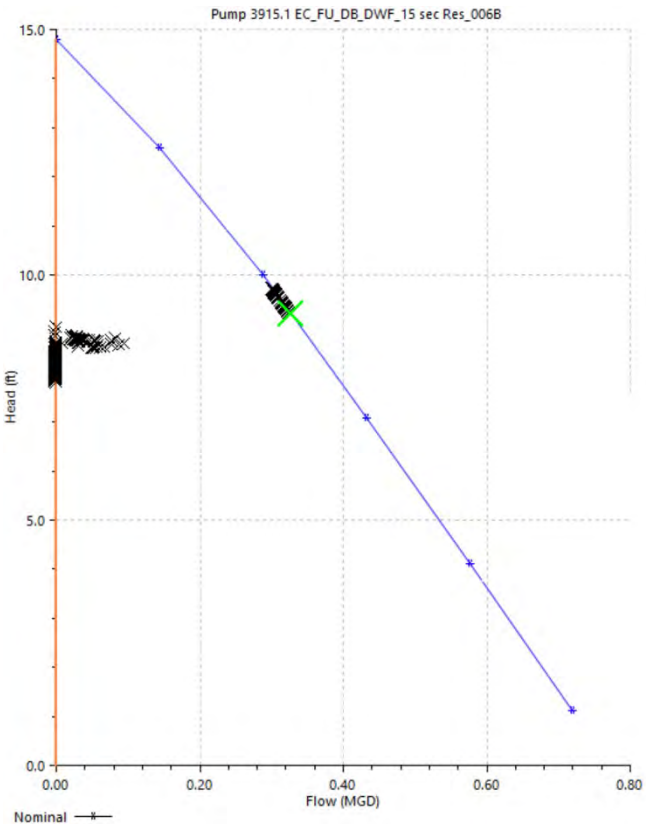
Lark LS - Design Basis – DWF



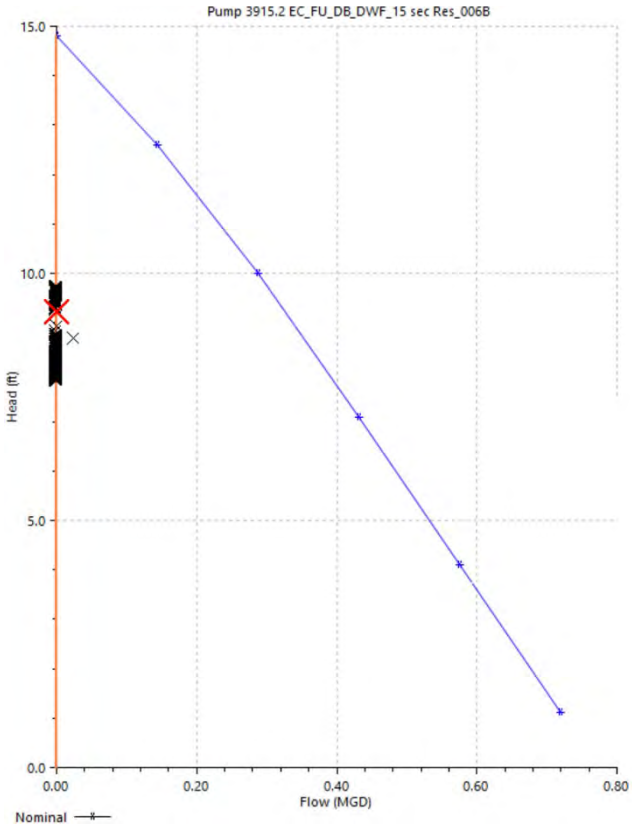




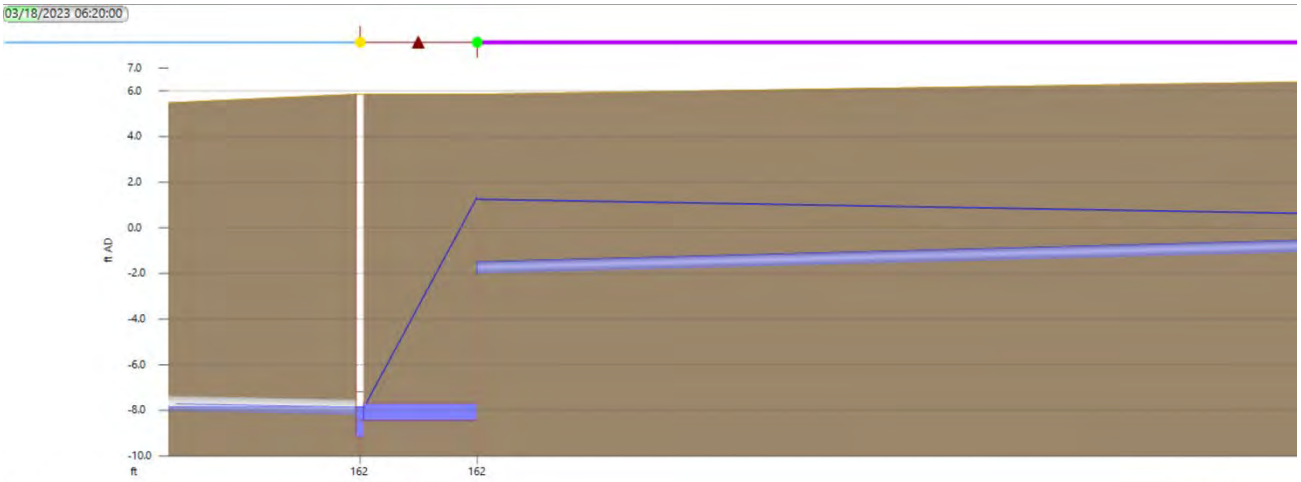
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.328	0.089
Future - DWF				-0.000	0.327	0.114



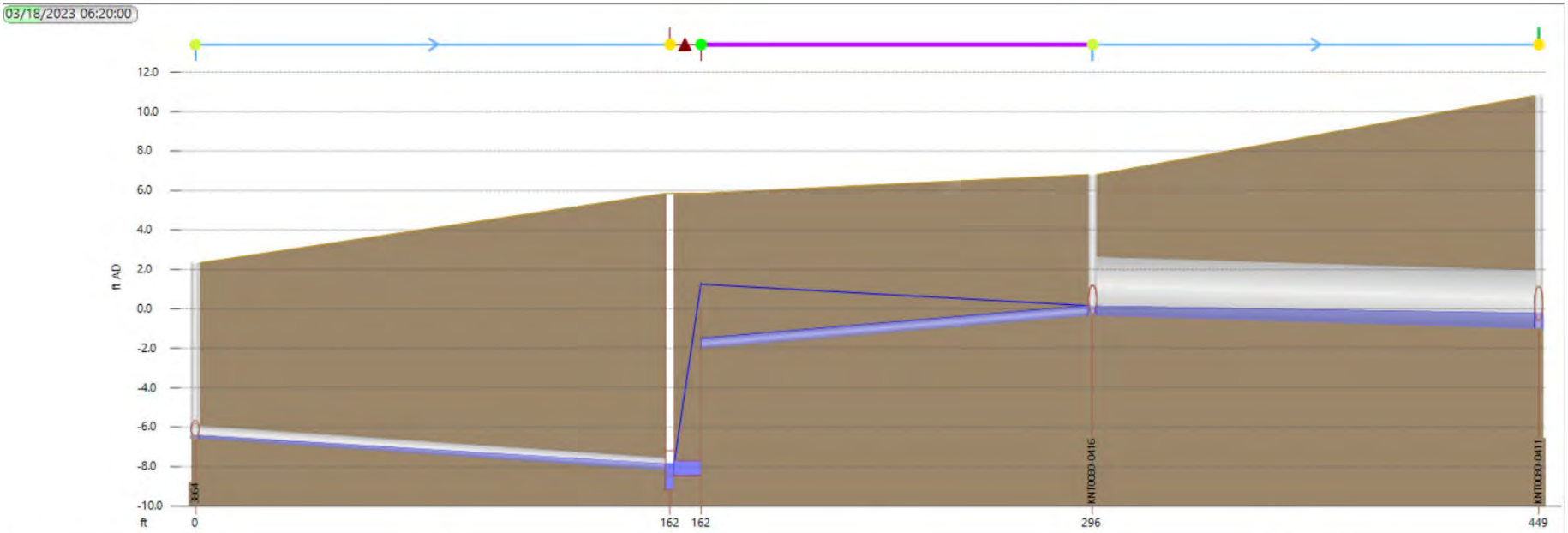
Lark Lead Pump



Lark Lag Pump



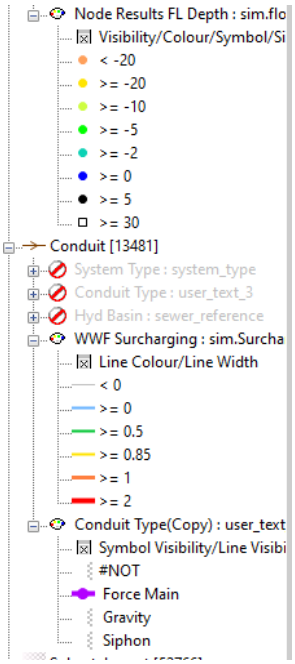
Link		3915.1		9993924.1
width (in)				6.0
us inv (ft AD)				-2.000
ds inv (ft AD)				-0.340
r.pfc (MGD)				-0.40
surc		1.00		1.00
US total head (ft AD)		-7.860		1.352
US velocity (ft/s)		0.000		2.577
DS flow (MGD)		0.3271		0.3271
DS cumulative flow (US Mgal)		0.11702		0.11702
DS total head (ft AD)		1.352		0.263
DS velocity (ft/s)		0.000		2.577
Node	3915		9993924	
ground (ft AD)	5.850		5.850	
flood dep (ft)	-13.710		-4.498	

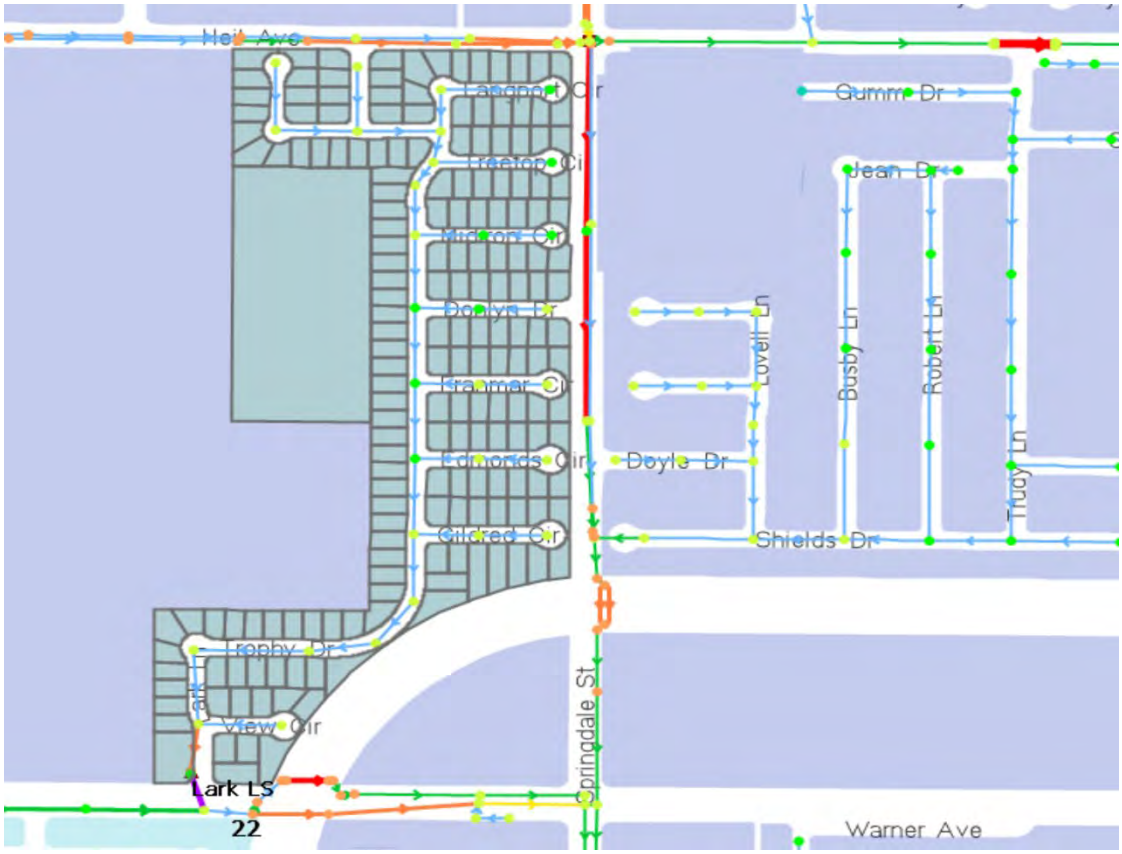


Link	3864.1	-	9993924.1	KNT0080-0416.1
width (in)	8.0		6.0	36.0
us inv (ft AD)	-6.570		-2.000	-0.340
ds inv (ft AD)	-8.190		-0.340	-1.010
r.pfc (MGD)	0.78		-0.40	28.54
surc	0.50	1.00	1.00	0.26
US total head (ft AD)	-6.407	-	1.352	0.243
US velocity (ft/s)	1.533	-	2.577	2.811
DS flow (MGD)	0.2295	-	0.3271	1.1141
DS cumulative flow (US Mgal)	0.11707	-	0.11702	3.97156
DS total head (ft AD)	-7.794	-	0.263	-0.216
DS velocity (ft/s)	2.060	-	2.577	1.199

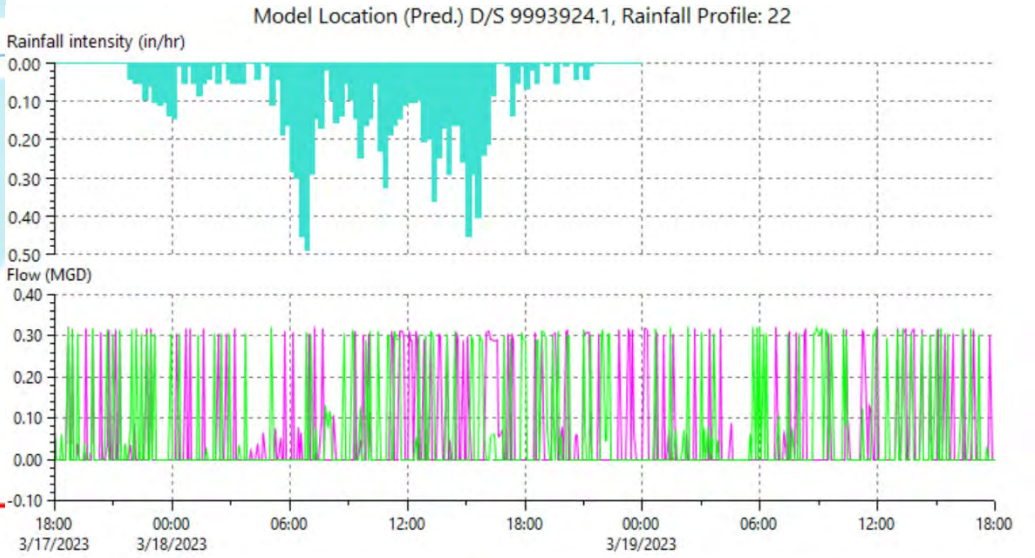
Node	3864	3915	9993924	KNT0080-0416	KNT0080-0411
ground (ft AD)	2.332	5.850	5.850	6.800	10.800
flood dep (ft)	-8.776	-13.710	-4.498	-6.680	-11.039

Lark LS - Design Basis - 10 year 24 hour Storm

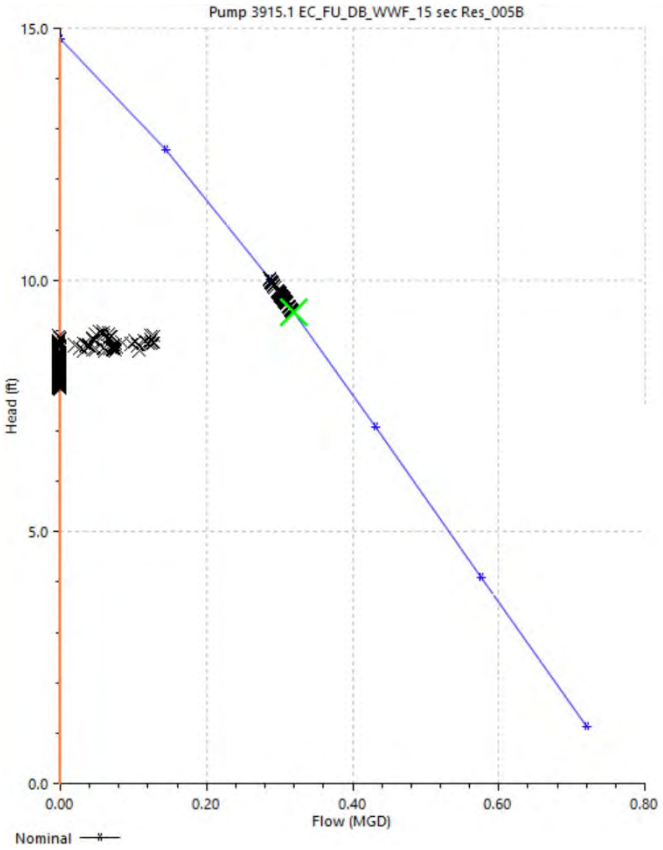




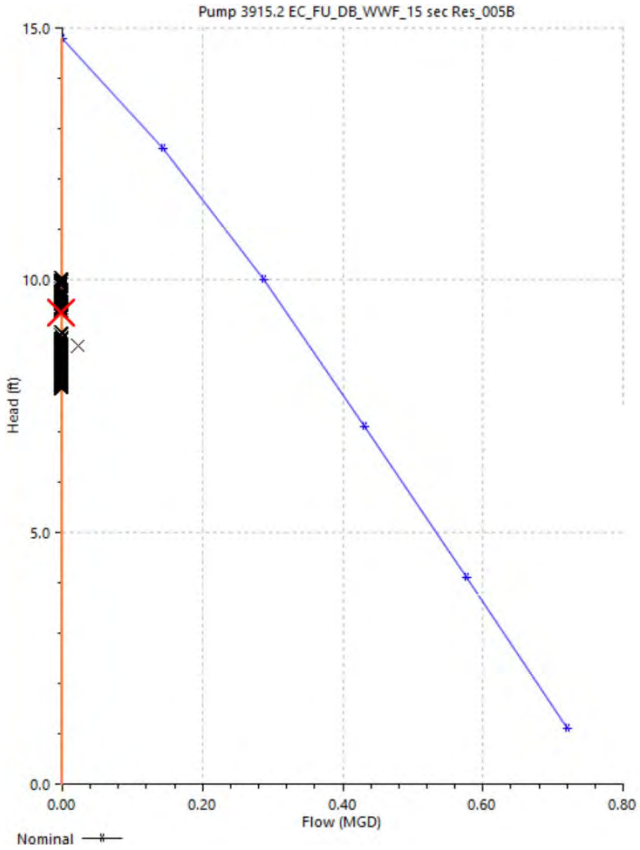




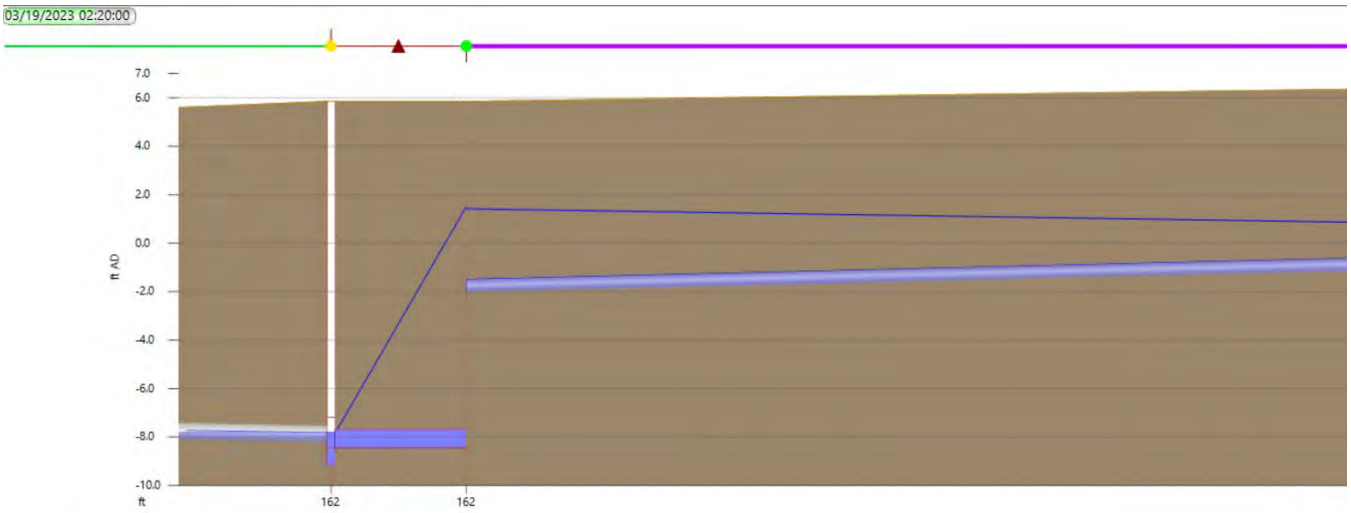
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.797	0.489	0.093			
Existing - WWF				-0.000	0.321	0.124
Future - WWF				-0.000	0.321	0.125



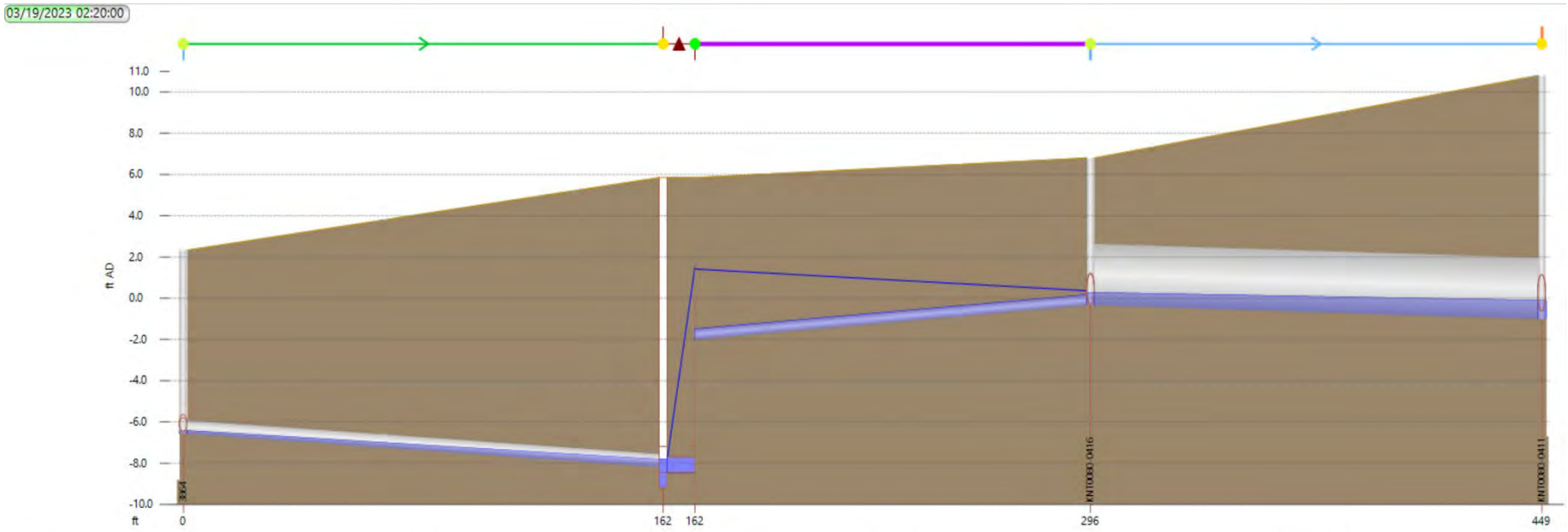
Lark Lead Pump



Lark Lag Pump



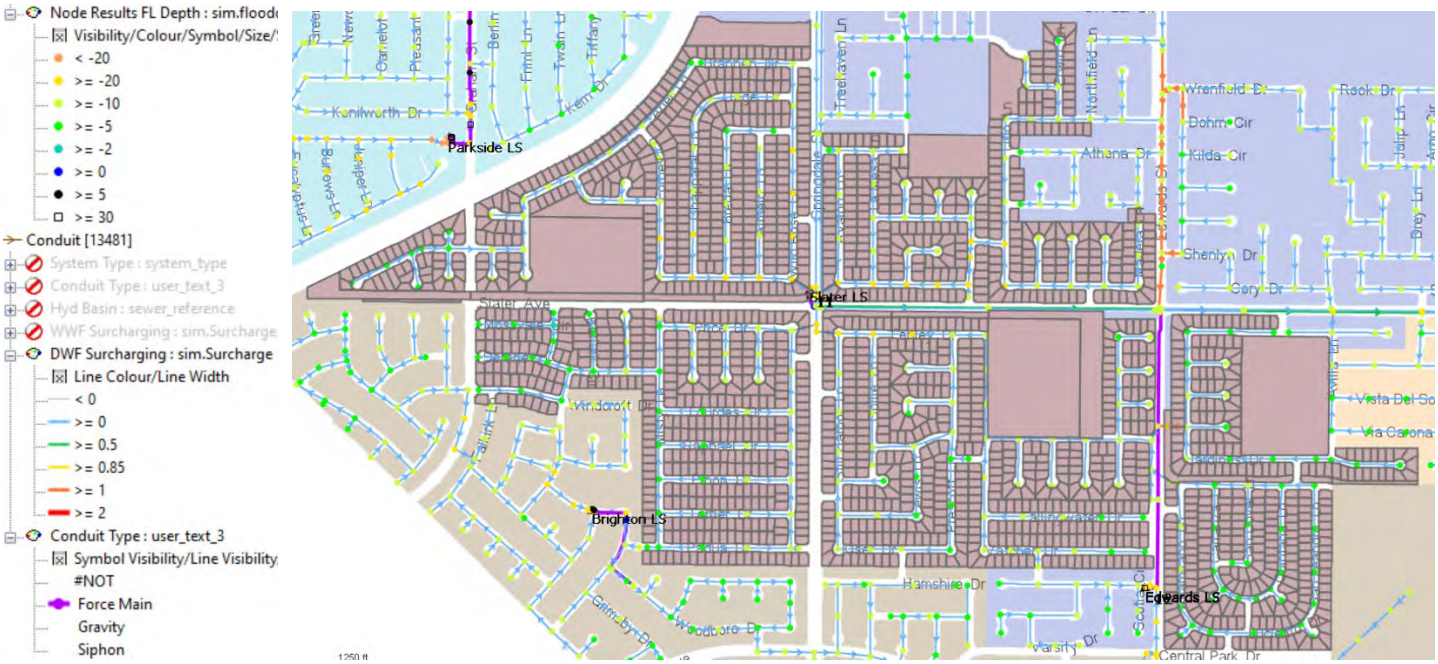
Link		3915.1		9993924.1
width (in)				6.0
us inv (ft AD)				-2.000
ds inv (ft AD)				-0.340
r.pfc (MGD)				-0.40
surc		1.00		1.00
US total head (ft AD)		-7.818		1.514
US velocity (ft/s)		0.000		2.530
DS flow (MGD)		0.3212		0.3211
DS cumulative flow (US Mgal)		0.14295		0.14295
DS total head (ft AD)		1.514		0.465
DS velocity (ft/s)		0.000		2.530
Node	3915		9993924	
ground (ft AD)	5.850		5.850	
flood dep (ft)	-13.668		-4.336	

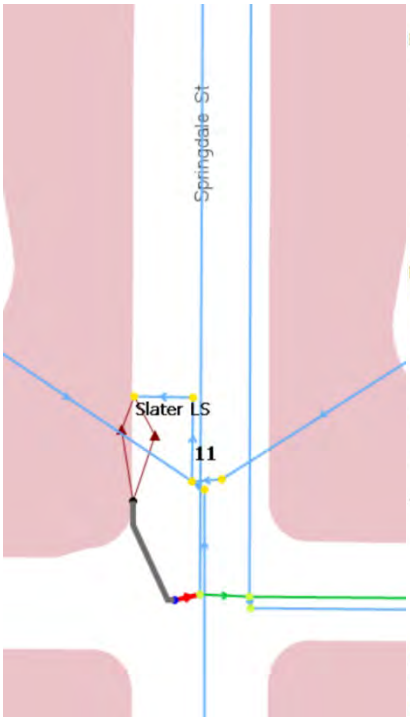


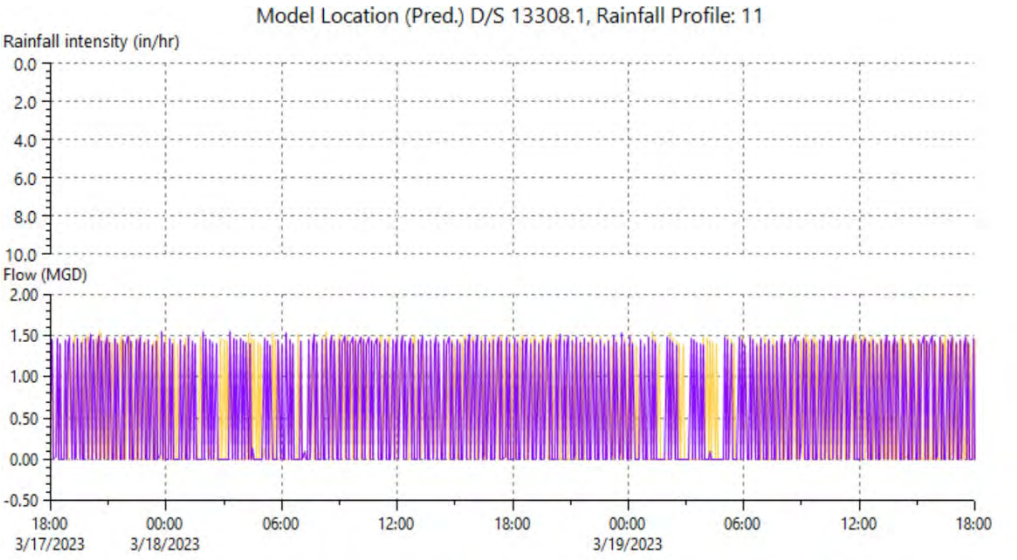
Link	3864.1	-	9993924.1	KNT0080-0416.1
width (in)	8.0		6.0	36.0
us inv (ft AD)	-6.570		-2.000	-0.340
ds inv (ft AD)	-8.190		-0.340	-1.010
r.pfc (MGD)	0.78		-0.40	28.54
surc	0.56	1.00	1.00	0.30
US total head (ft AD)	-6.388	-	1.514	0.441
US velocity (ft/s)	1.696	0.000	2.530	3.356
DS flow (MGD)	0.2342	-	0.3211	2.0967
DS cumulative flow (US Mgal)	0.14298	-	0.14295	5.91473
DS total head (ft AD)	-7.767	1.514	0.465	-0.058
DS velocity (ft/s)	1.807	0.000	2.530	1.815

Node	3864	3915	9993924	KNT0080-0416	KNT0080-0411
ground (ft AD)	2.332	5.850	5.850	6.800	10.800
flood dep (ft)	-8.765	-13.668	-4.336	-6.534	-10.909

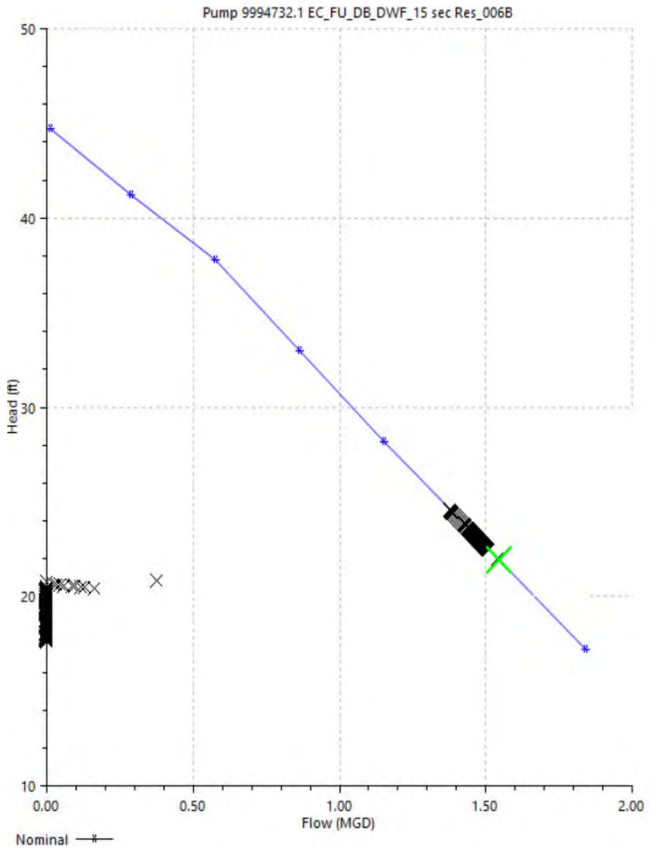
Slater LS - Design Basis – DWF



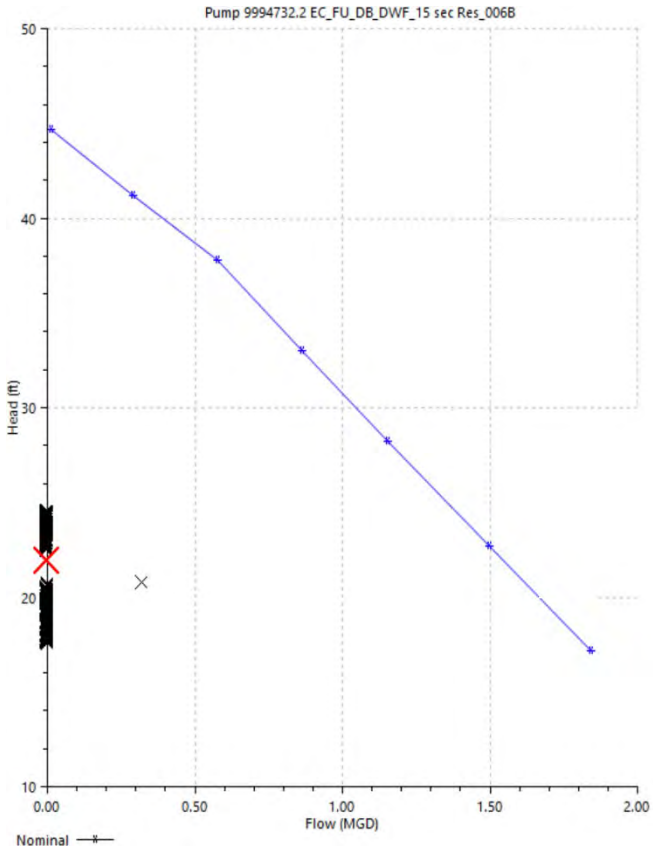




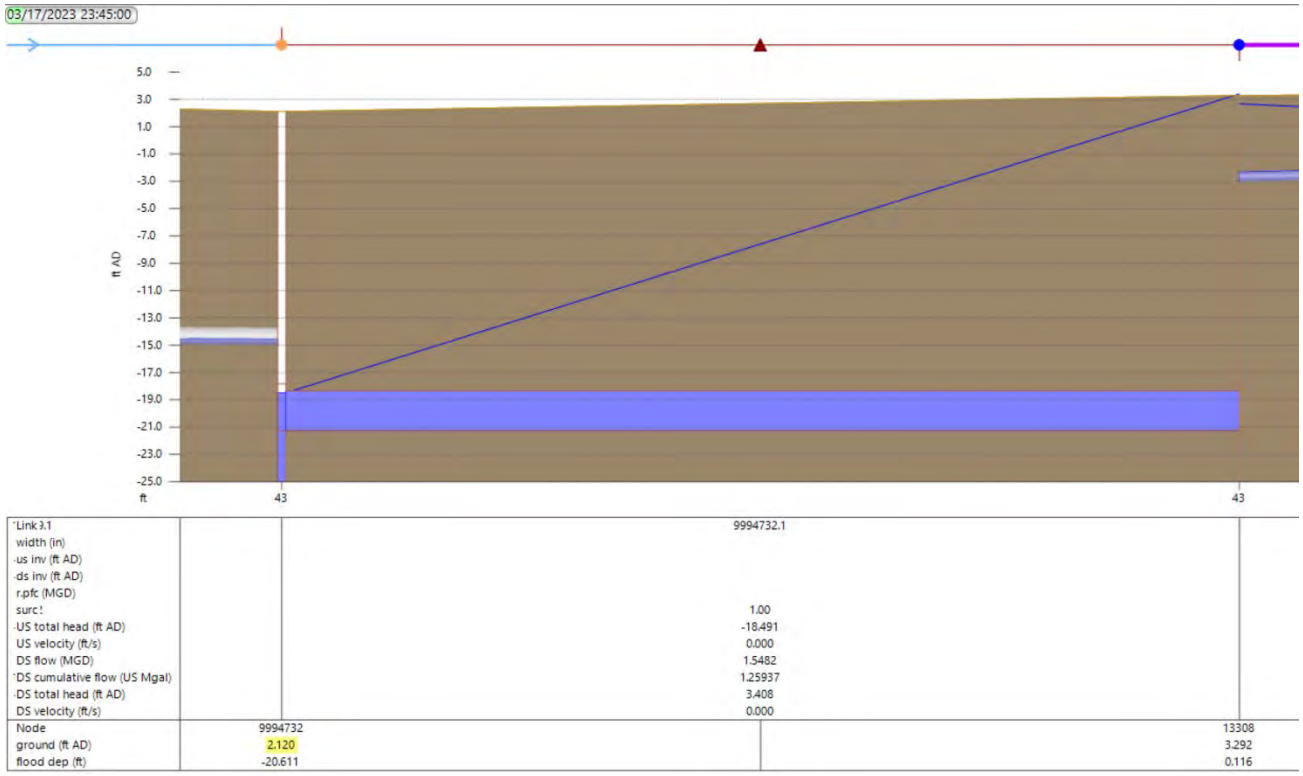
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	1.551	1.219
Future - DWF				-0.000	1.548	1.256



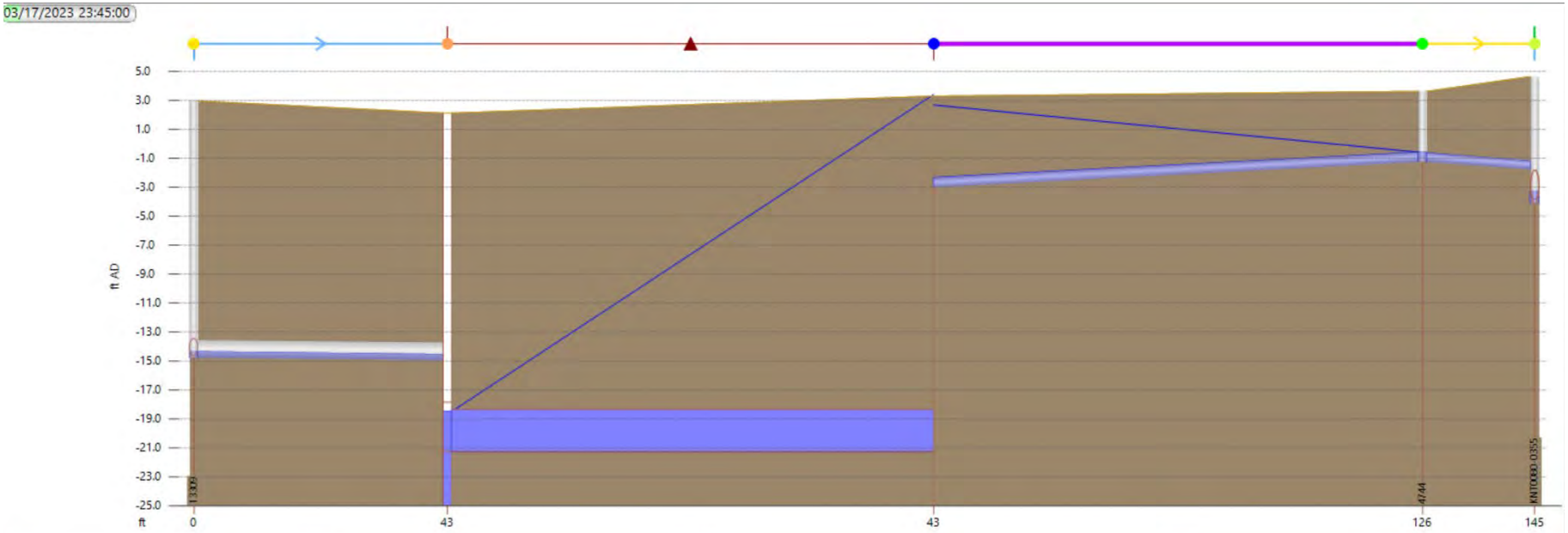
Slater Lead Pump



Slater Lag Pump



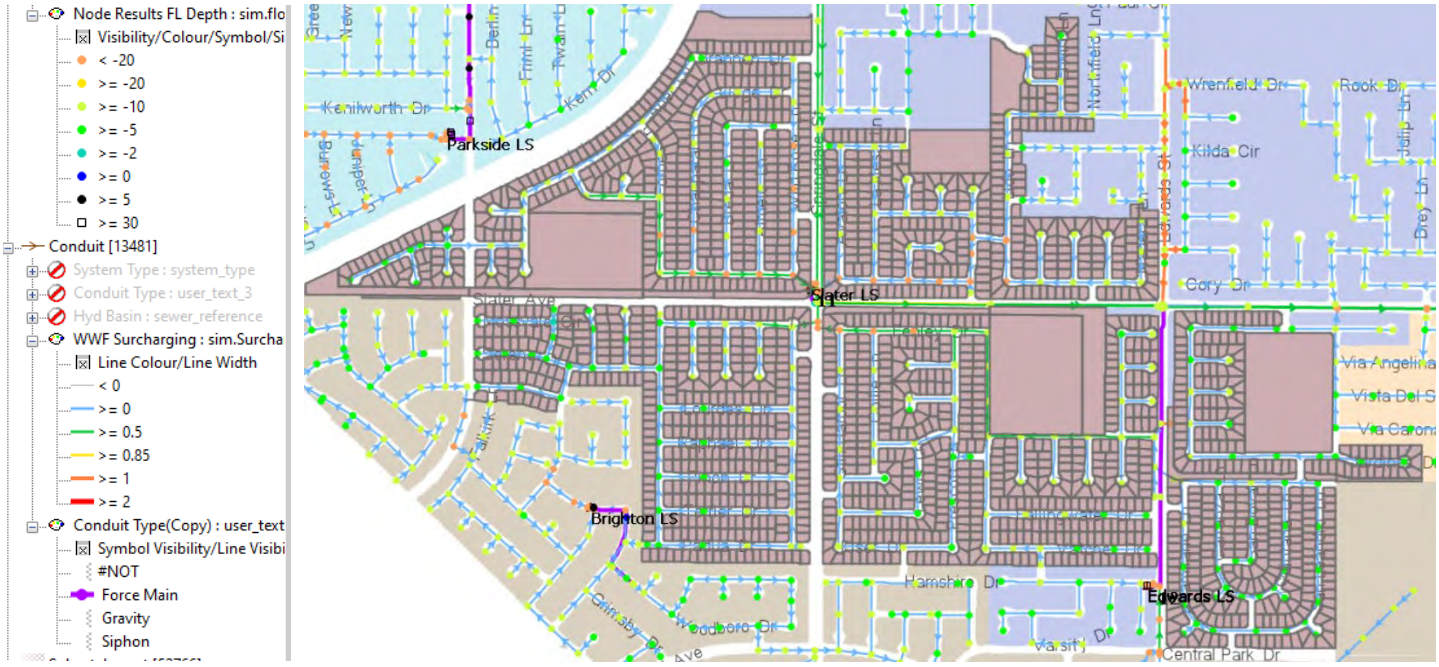
Link 3.1		9994732.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
rpfc (MGD)			
surc		1.00	
US total head (ft AD)		-18.491	
US velocity (ft/s)		0.000	
DS flow (MGD)		1.5482	
DS cumulative flow (US Mgal)		1.25937	
DS total head (ft AD)		3.408	
DS velocity (ft/s)		0.000	
Node	9994732		13308
ground (ft AD)	2.120		3.292
flood dep (ft)	-20.611		0.116

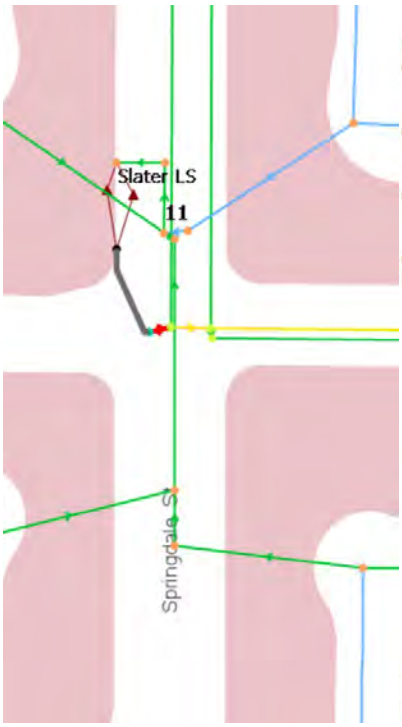


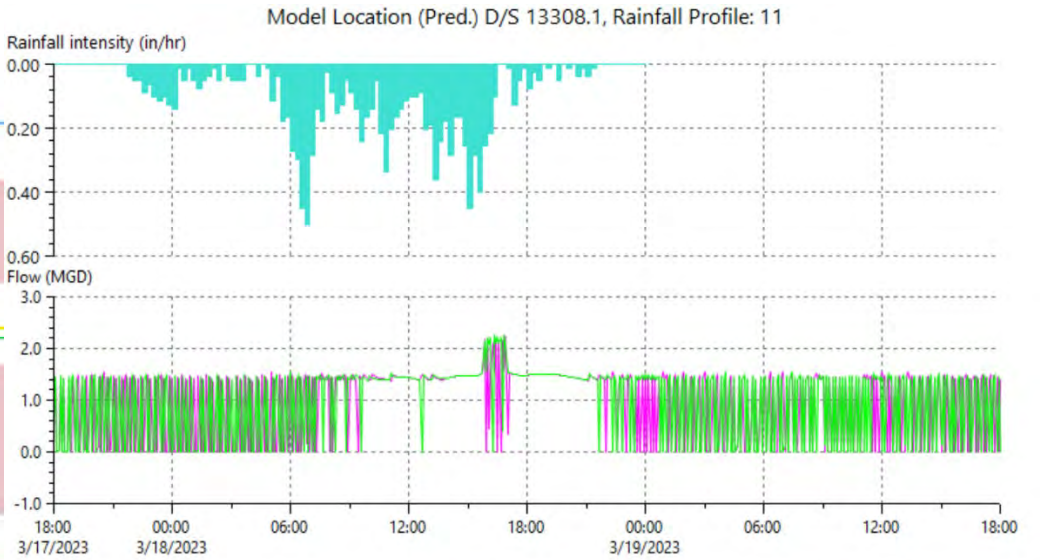
Link	13309.1	9994732.1	13308.1	4744.1
width (in)	15.0		8.0	8.0
us inv (ft AD)	-14.760		-3.000	-1.250
ds inv (ft AD)	-14.930		-1.250	-1.760
r.pfc (MGD)	2.63		-1.13	1.28
surc	0.32	1.00	1.00	0.91
US total head (ft AD)	-14.245	-18.491	3.408	0.020
US velocity (ft/s)	2.684	0.000	6.862	6.543
DS flow (MGD)	0.5935	1.5482	1.5482	1.3006
DS cumulative flow (US Mgal)	1.26001	1.25937	1.25937	1.26037
DS total head (ft AD)	-14.418	3.408	0.148	-0.557
DS velocity (ft/s)	2.904	0.000	6.862	6.442

Node	13309	9994732	13308	4744	-
ground (ft AD)	2.953	2.120	3.292	3.619	4.640
flood dep (ft)	-17.310	-20.611	0.116	-4.197	-7.912

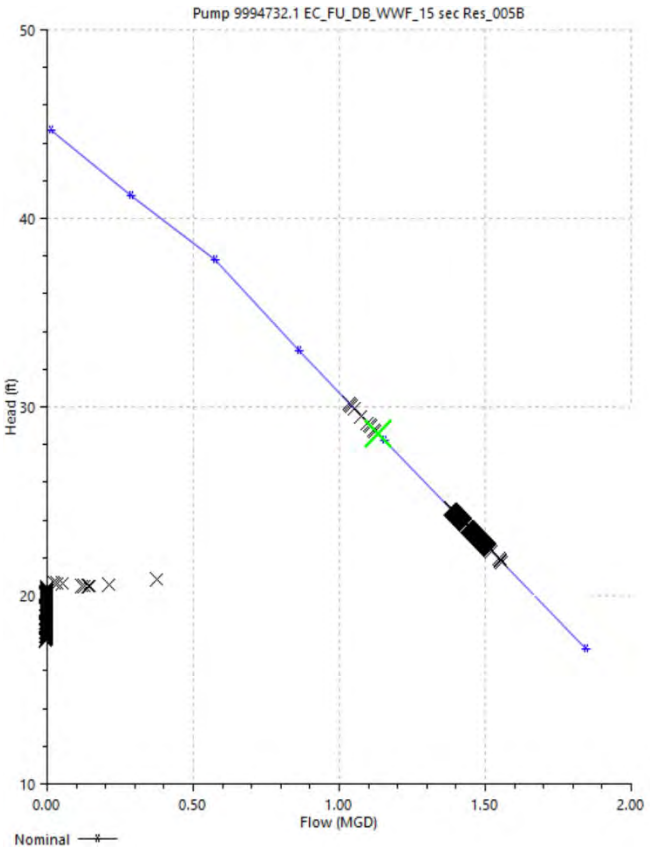
Slater LS - Design Basis - 10 year 24 hour Storm



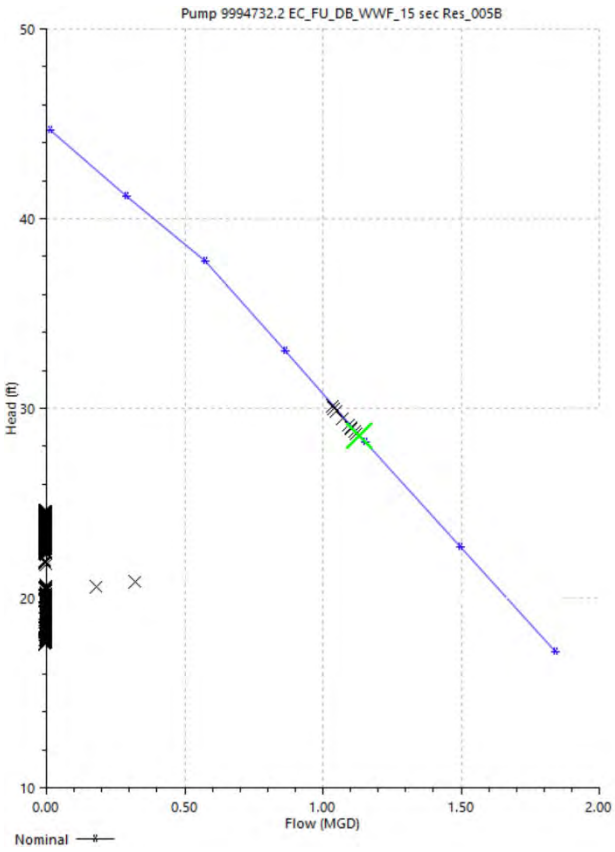




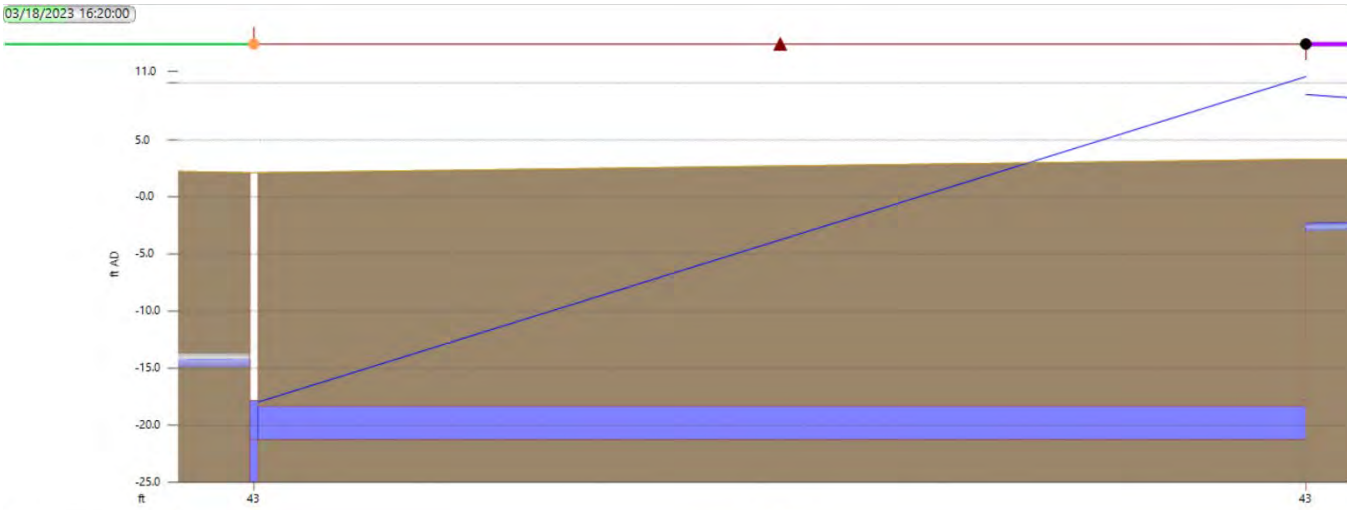
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.799	0.502	0.093			
Existing - WWF				-0.000	2.233	1.935
Future - WWF				-0.000	2.268	1.975



Slater Lead Pump

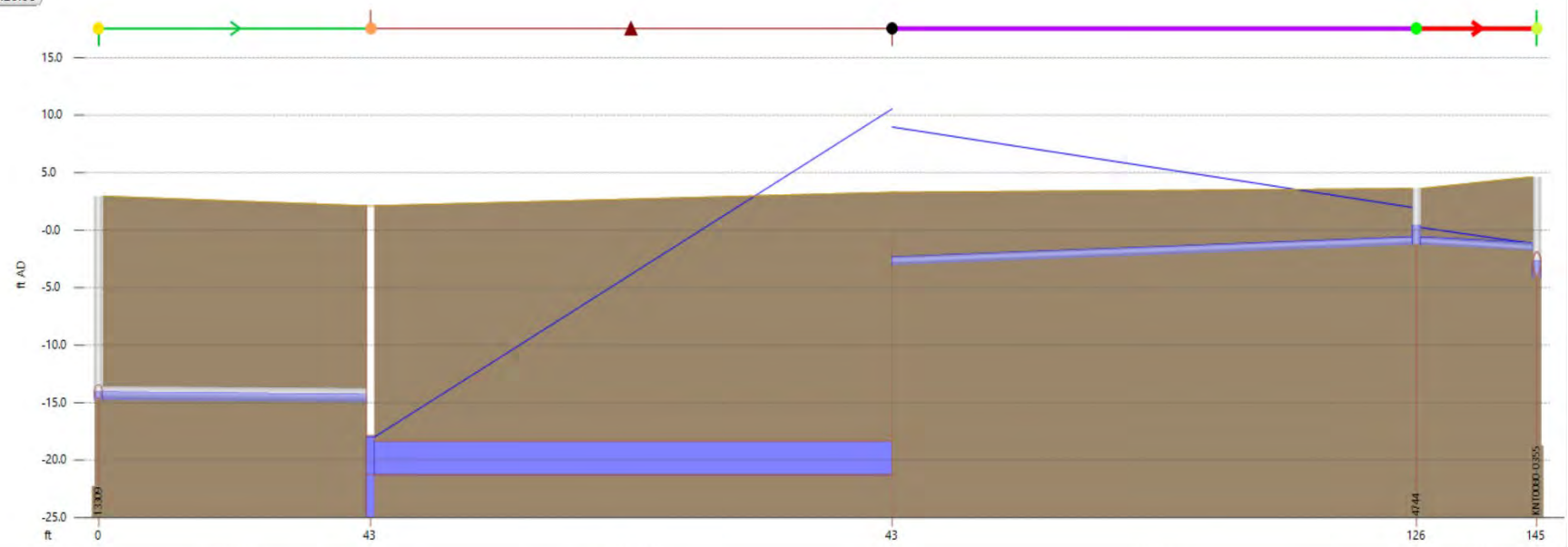


Slater Lag Pump



Link		9994732.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		-17.974	
US velocity (ft/s)		0.000	
DS flow (MGD)		1.1339	
DS cumulative flow (US Mgal)		1.93965	
DS total head (ft AD)		10.545	
DS velocity (ft/s)		0.000	
Node	9994732		13308
ground (ft AD)	2.120		3.292
flood dep (ft)	-20.094		7.253

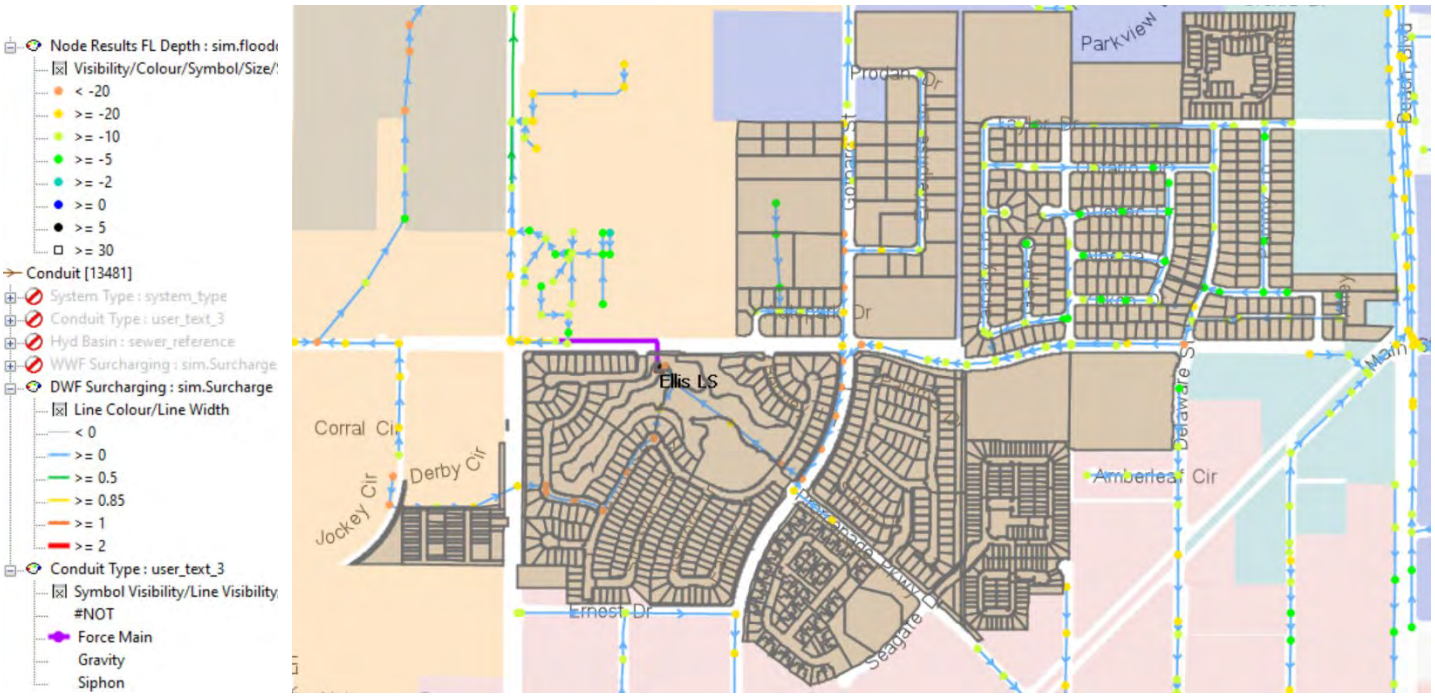
03/18/2023 16:20:00

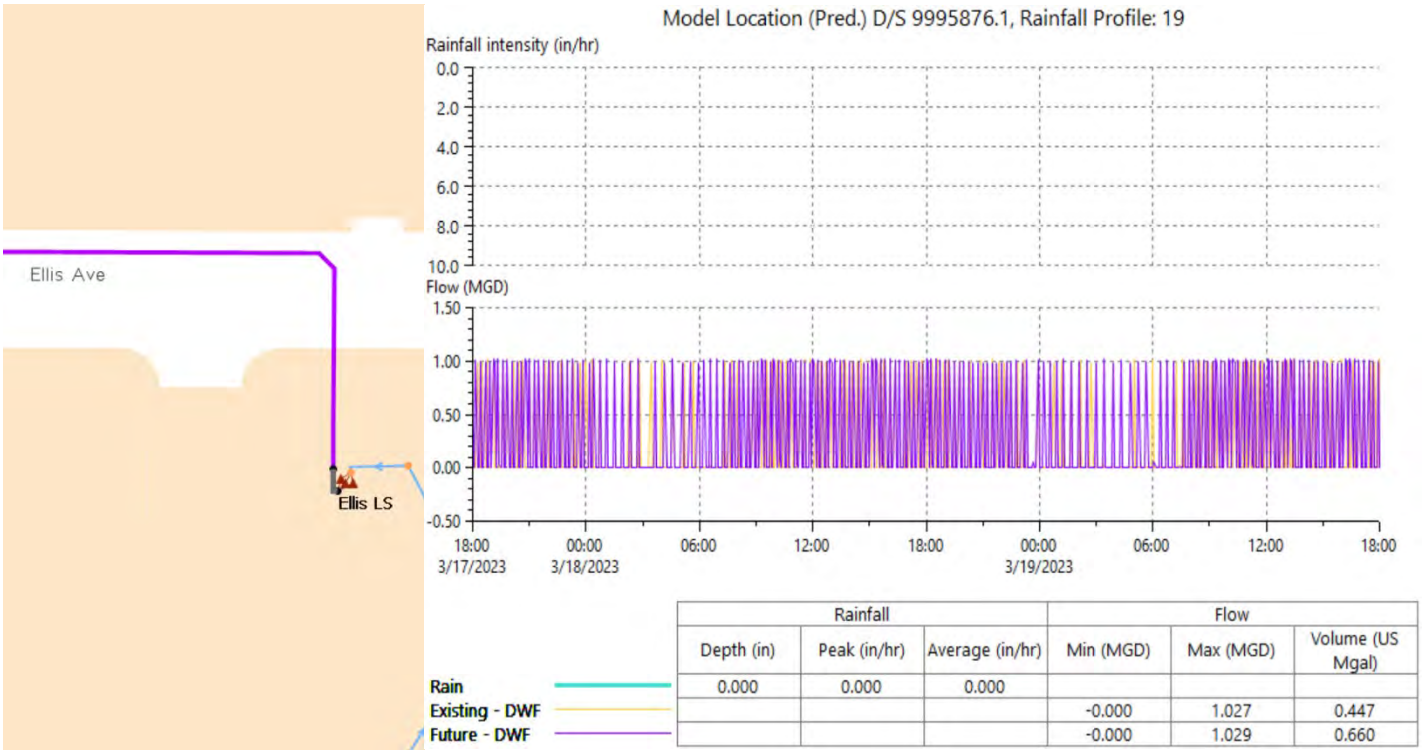


Link	13309.1	9994732.1	13308.1	4744.1
width (in)	15.0		8.0	8.0
us inv (ft AD)	-14.760		-3.000	-1.250
ds inv (ft AD)	-14.930		-1.250	-1.760
r.pfc (MGD)	2.63		-1.13	1.28
surc	0.55	1.00	1.00	2.00
US total head (ft AD)	-13.858	-17.974	10.545	1.410
US velocity (ft/s)	3.688	0.000	10.052	8.696
DS flow (MGD)	1.6578	1.1339	2.2677	2.0893
DS cumulative flow (US Mgal)	1.97369	1.93965	1.97263	1.97337
DS total head (ft AD)	-14.034	10.545	3.551	0.323
DS velocity (ft/s)	4.020	0.000	10.052	9.769

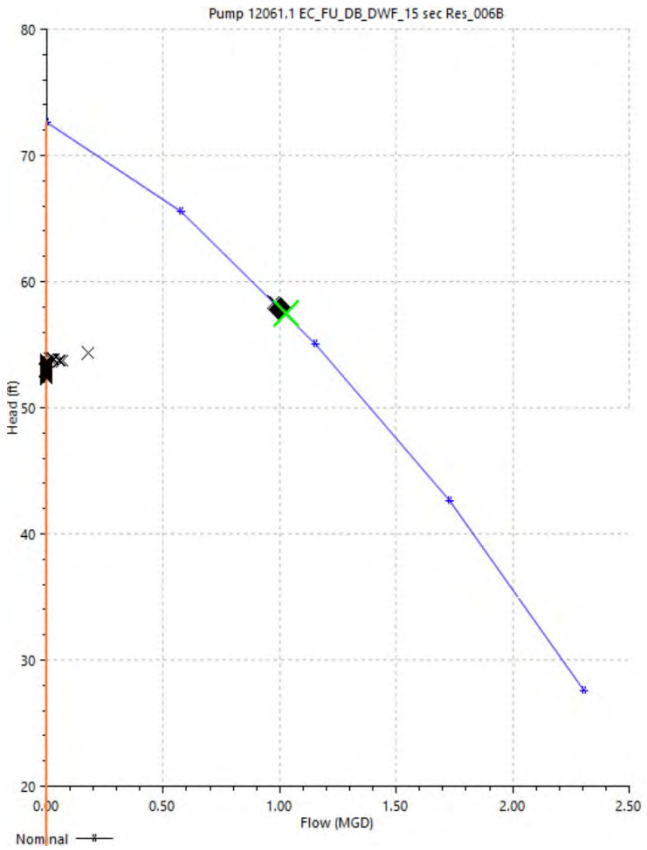
Node	13309	9994732	13308	4744	-
ground (ft AD)	2.953	2.120	3.292	3.619	4.640
flood dep (ft)	-17.020	-20.094	7.253	-3.207	-7.322

Ellis LS - Design Basis – DWF

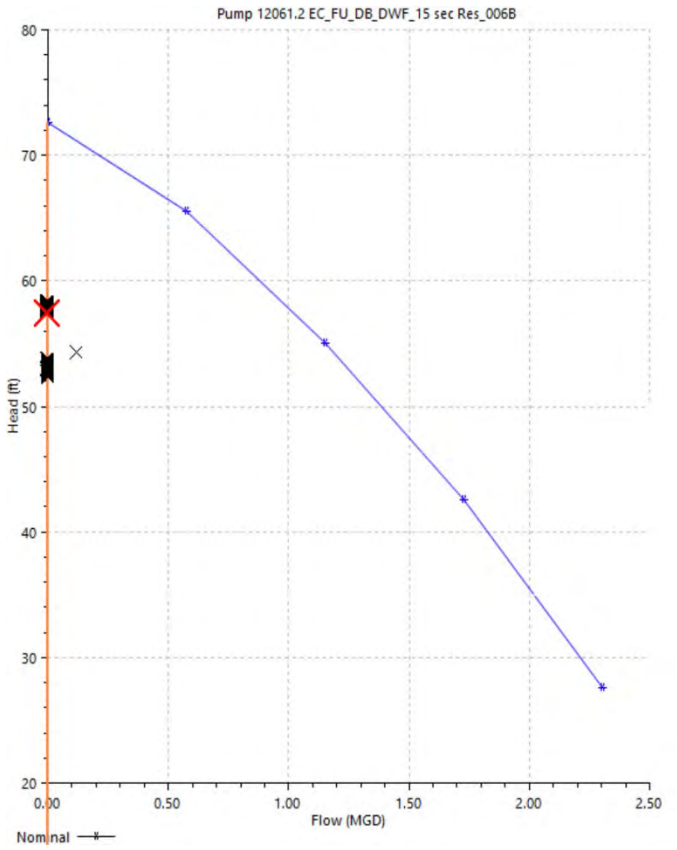




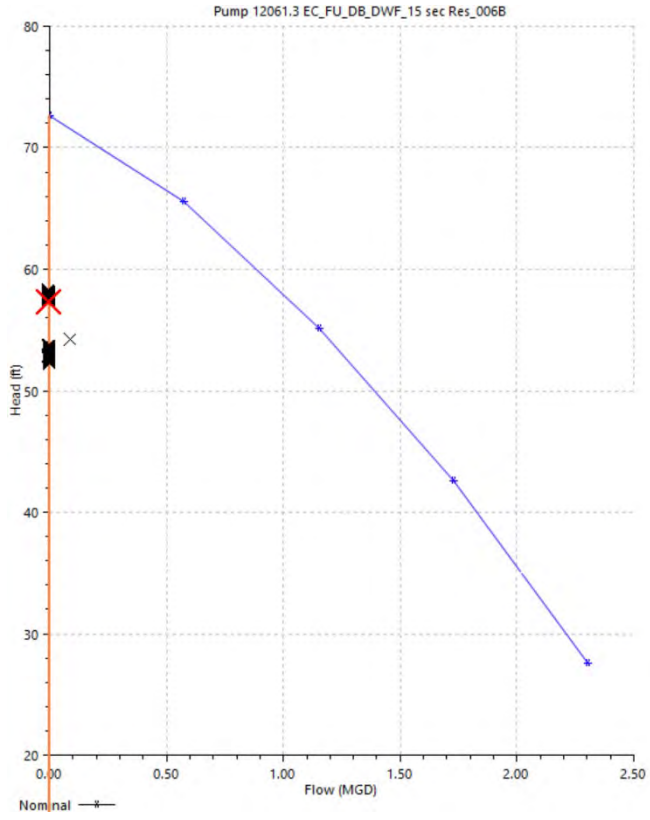
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	1.027	0.447
Future - DWF				-0.000	1.029	0.660



Ellis Lead Pump



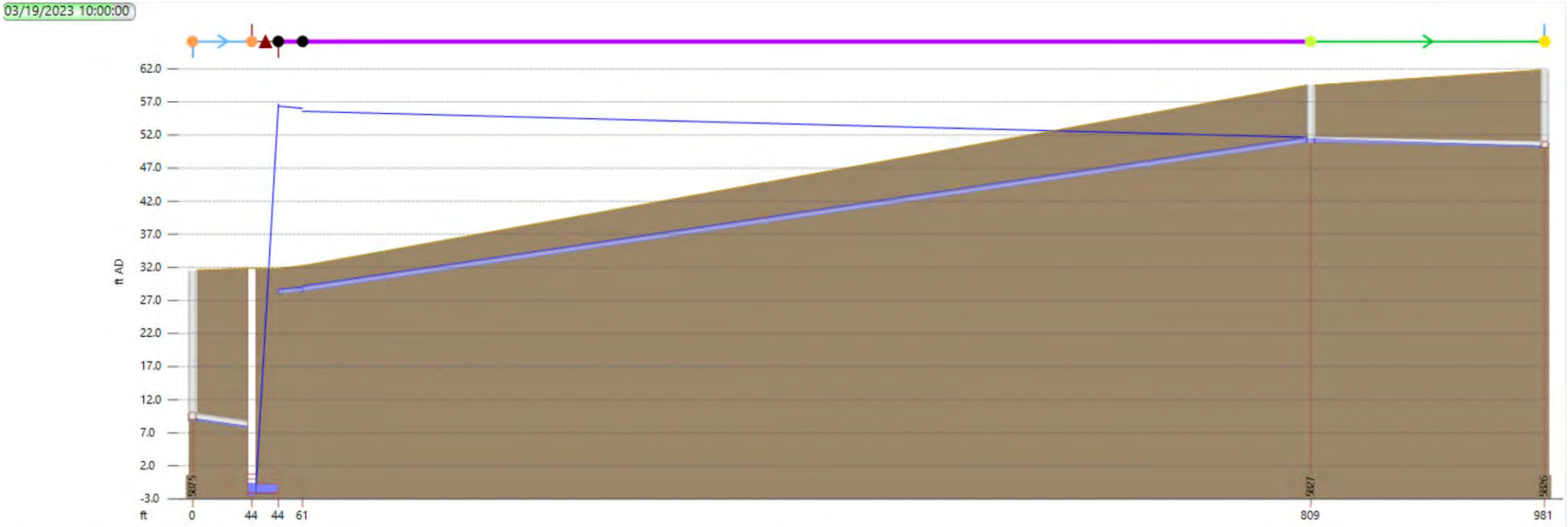
Ellis Lag Pump 1



Ellis Lag Pump 2



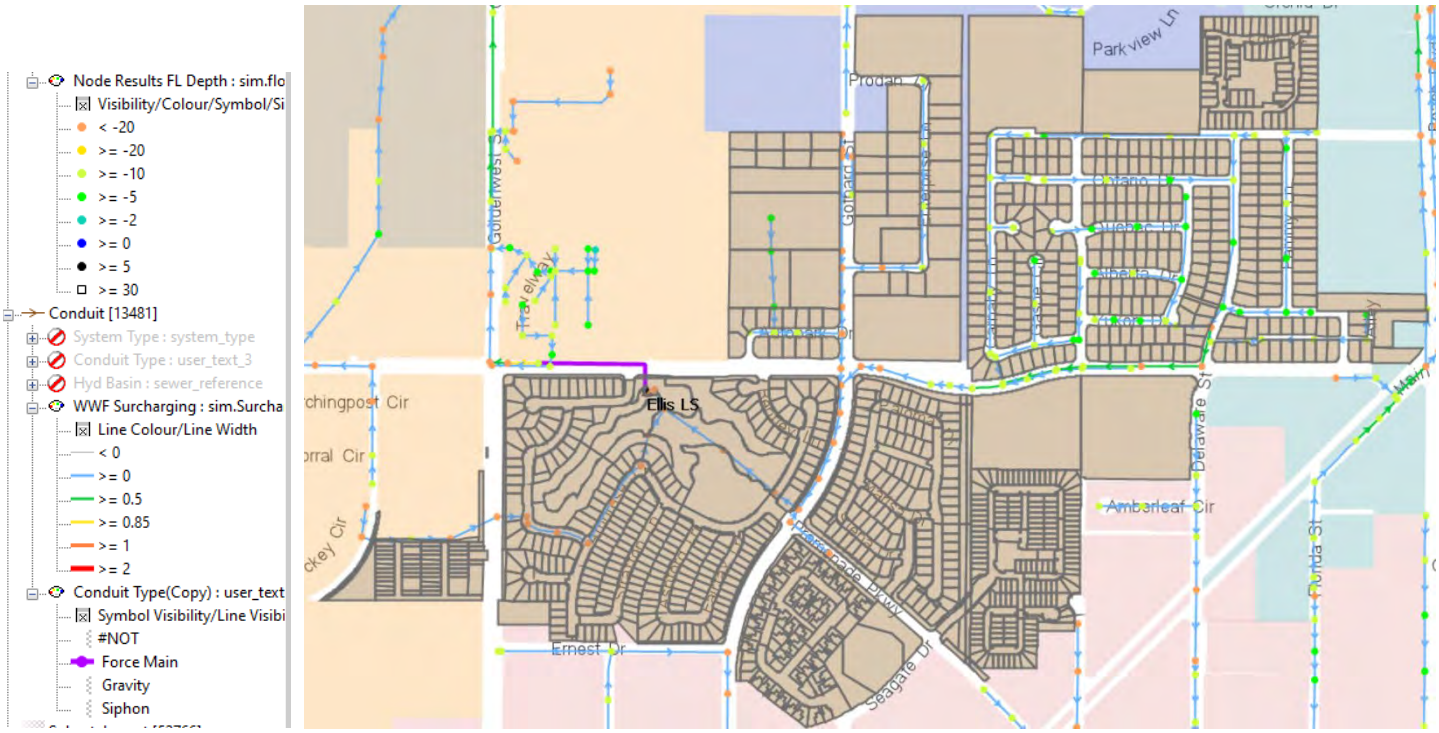
Link		12061.1	9995876.1	
width (in)			8.0	
us inv (ft AD)			28.000	
ds inv (ft AD)			28.310	
r.pfc (MGD)			-1.03	
surc		1.00	1.00	
US total head (ft AD)		-0.671	56.676	
US velocity (ft/s)		0.000	4.560	
DS flow (MGD)		1.0287	1.0287	
DS cumulative flow (US Mgal)		0.65359	0.65359	
DS total head (ft AD)		56.676	56.369	
DS velocity (ft/s)		0.000	4.560	
Node	12061		9995876	12081
ground (ft AD)	31.840		31.840	32.222
flood dep (ft)	-32.511		24.836	23.501



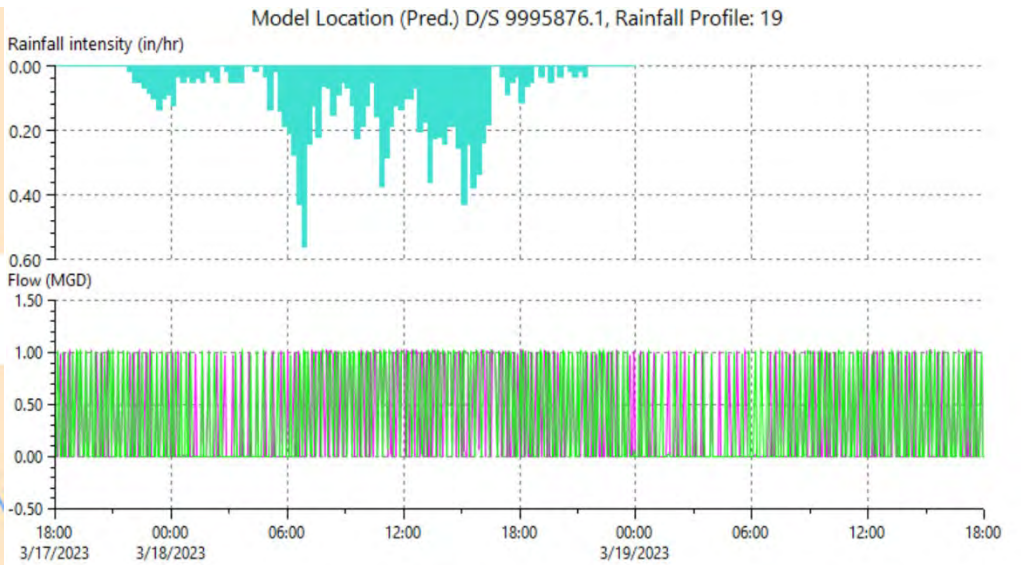
Link	5875.1	-	-	12081.1	5827.1	
width (in)	15.0		8.0	10.0	12.0	
us inv (ft AD)	8.780		-	28.310	50.817	
ds inv (ft AD)	7.670		-	50.817	50.127	
r.pfc (MGD)	6.66		-	-2.46	1.45	
surc	0.21	1.00	-	1.00	0.54	
US total head (ft AD)	9.312	-	-	55.723	51.550	
US velocity (ft/s)	4.163	-	-	2.918	3.558	
DS flow (MGD)	0.5040	-	-	1.0287	0.0131	
DS cumulative flow (US Mgal)	0.65400	-	-	0.65359	0.66023	
DS total head (ft AD)	8.202	-	-	51.782	50.282	
DS velocity (ft/s)	4.163	-	-	2.918	0.262	

Node	-	-	-	12081	5827	5826
ground (ft AD)	-	-	-	32.222	59.539	61.812
flood dep (ft)	-	-	-	23.501	-8.185	-11.718

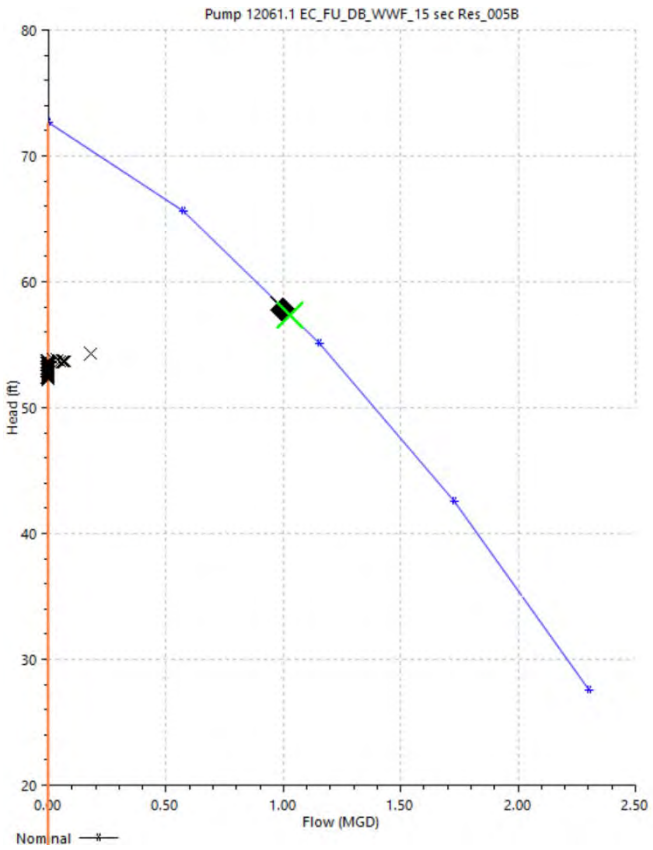
Ellis LS - Design Basis - 10 year 24 hour Storm



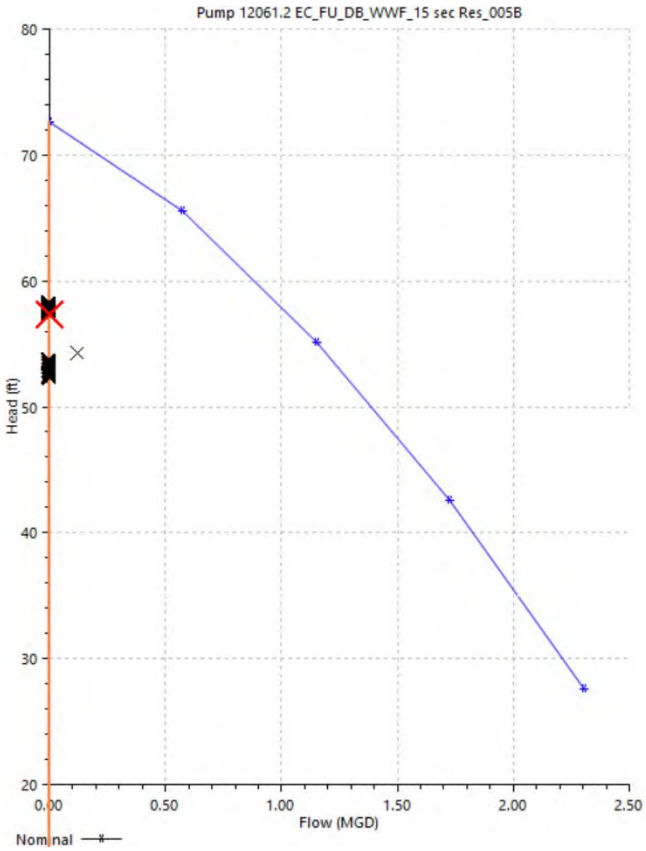




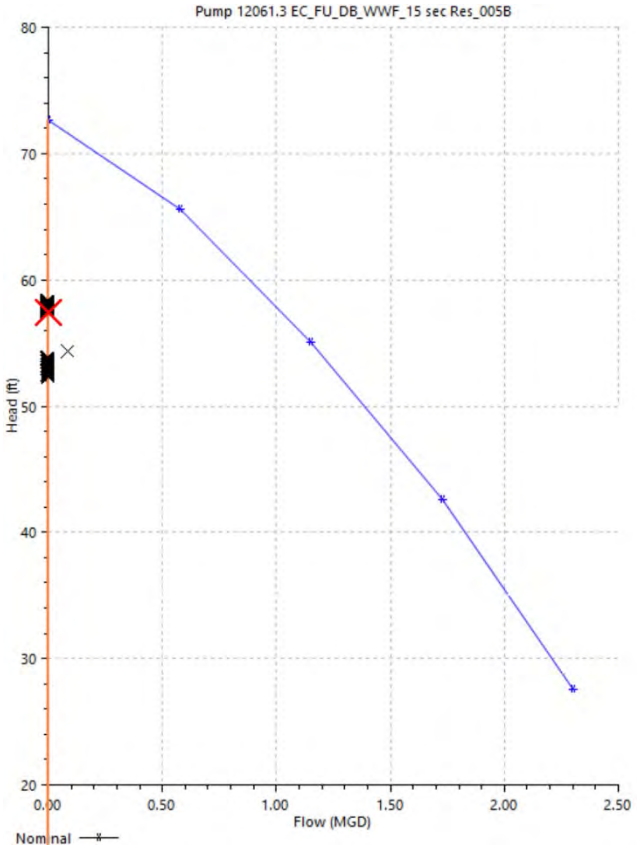
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.809	0.562	0.094			
Existing - WWF				-0.000	1.030	0.691
Future - WWF				-0.000	1.029	0.841



Ellis Lead Pump



Ellis Lag Pump 1

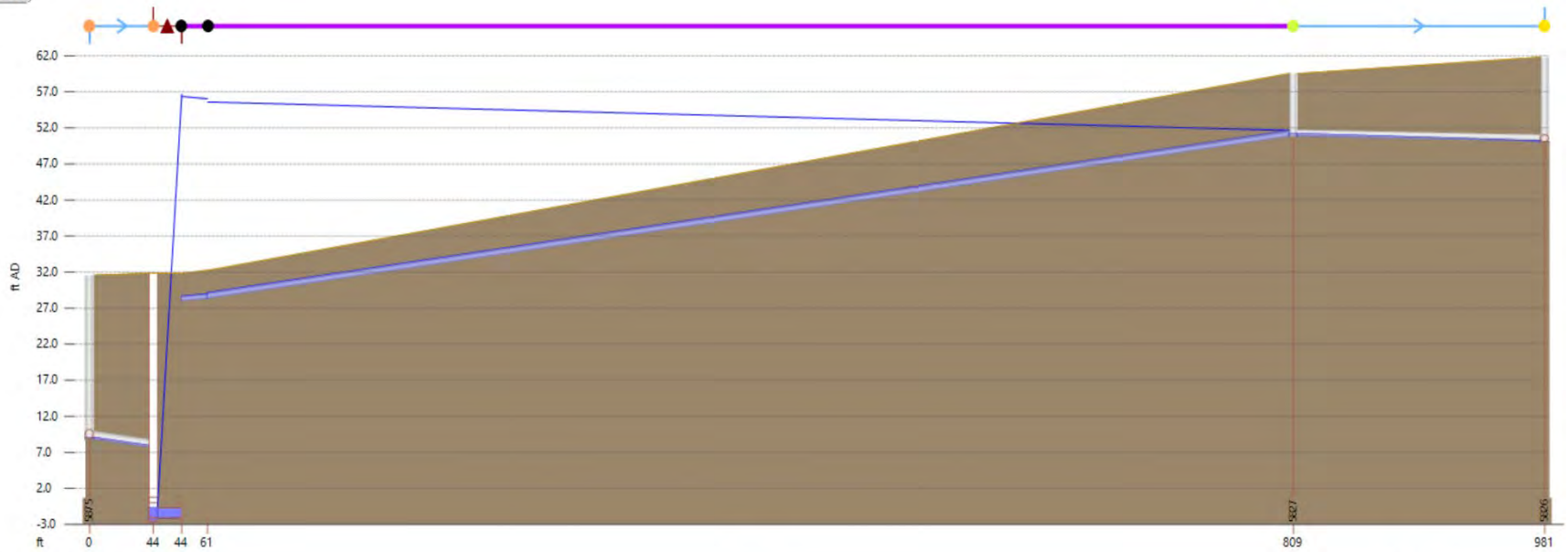


Ellis Lag Pump 2



Link		12061.1	9995876.1	
width (in)			8.0	
us inv (ft AD)			28.000	
ds inv (ft AD)			28.310	
r.pfc (MGD)			-1.03	
surc		1.00	1.00	
US total head (ft AD)		-0.656	56.679	
US velocity (ft/s)		0.000	4.562	
DS flow (MGD)		1.0294	1.0292	
DS cumulative flow (US Mgal)		0.85134	0.85134	
DS total head (ft AD)		56.679	56.372	
DS velocity (ft/s)		0.000	4.562	
Node	12061		9995876	12081
ground (ft AD)	31.840		31.840	32.222
flood dep (ft)	-32.496		24.839	23.504

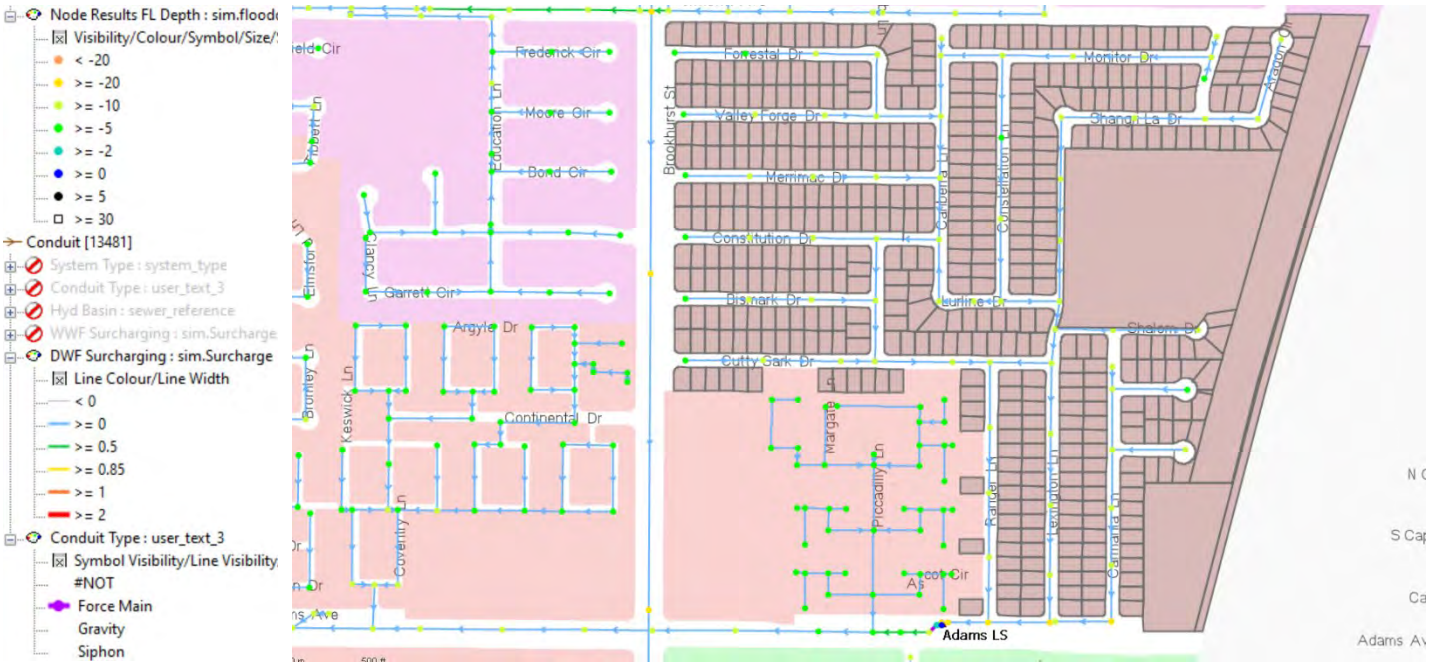
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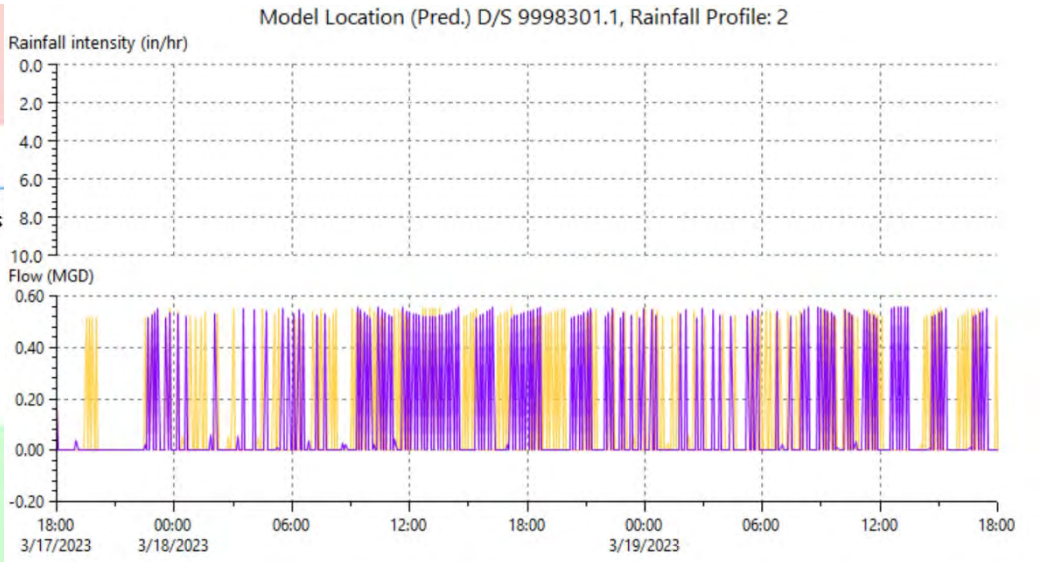
Link	5875.1	-	-	12081.1	5827.1	
width (in)	15.0		8.0	10.0	12.0	
us inv (ft AD)	8.780		-	28.310	50.817	
ds inv (ft AD)	7.670		-	50.817	50.127	
r.pfc (MGD)	6.66		-	-2.46	1.45	
surc	0.24	1.00	1.00	1.00	0.43	
US total head (ft AD)	9.440	-	-	55.725	51.514	
US velocity (ft/s)	4.808	-	-	2.919	4.176	
DS flow (MGD)	0.7070	-	-	1.0290	0.0033	
DS cumulative flow (US Mgal)	0.85299	-	-	0.85134	0.85581	
DS total head (ft AD)	8.330	-	-	51.782	50.200	
DS velocity (ft/s)	4.808	-	-	2.919	0.204	

Node	-	12061	-	12081	5827	5826
ground (ft AD)	-	-	-	32.222	59.539	61.812
flood dep (ft)	-	-	-	23.504	-8.296	-11.708

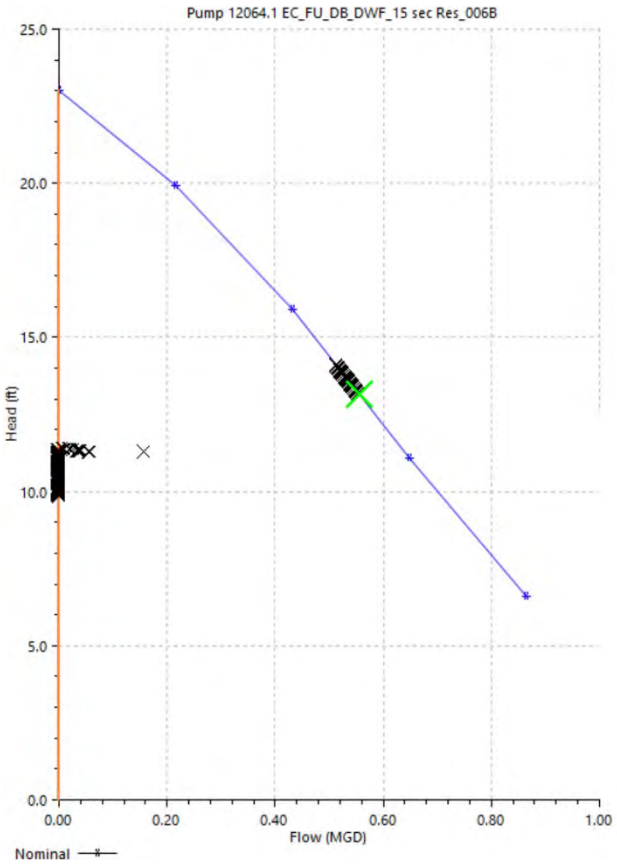
Adams LS - Design Basis – DWF



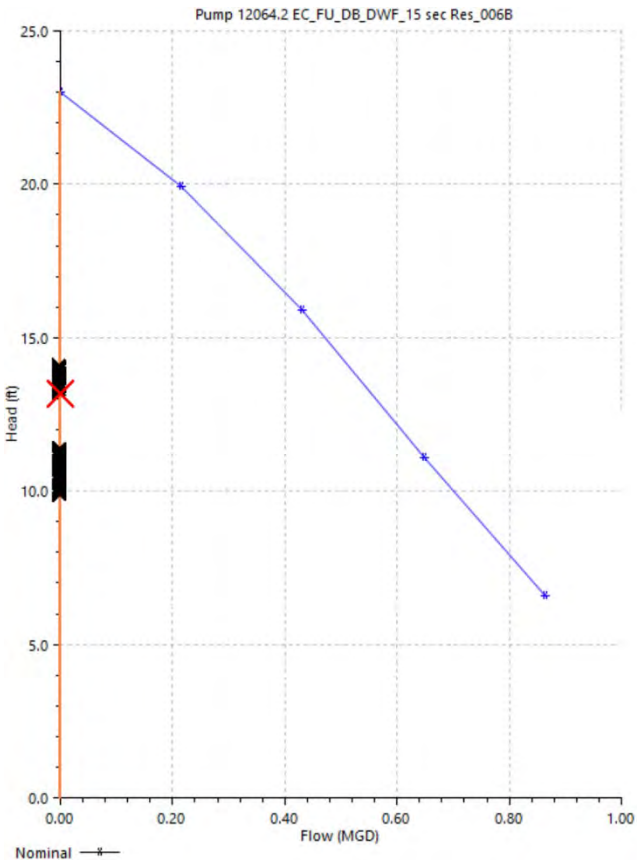




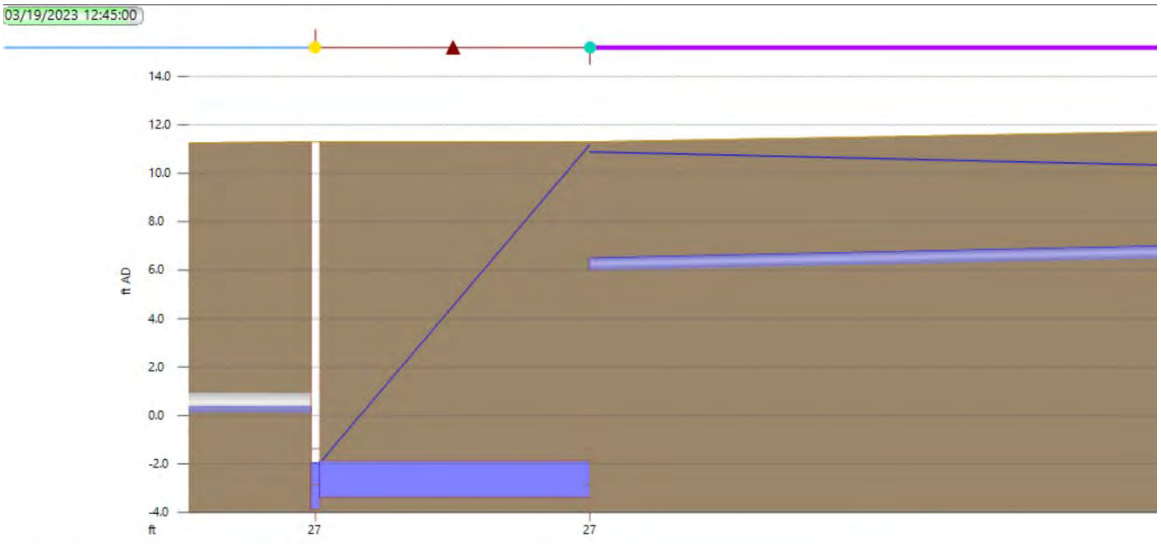
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.556	0.235
Future - DWF				-0.000	0.556	0.234



Adams Lead Pump

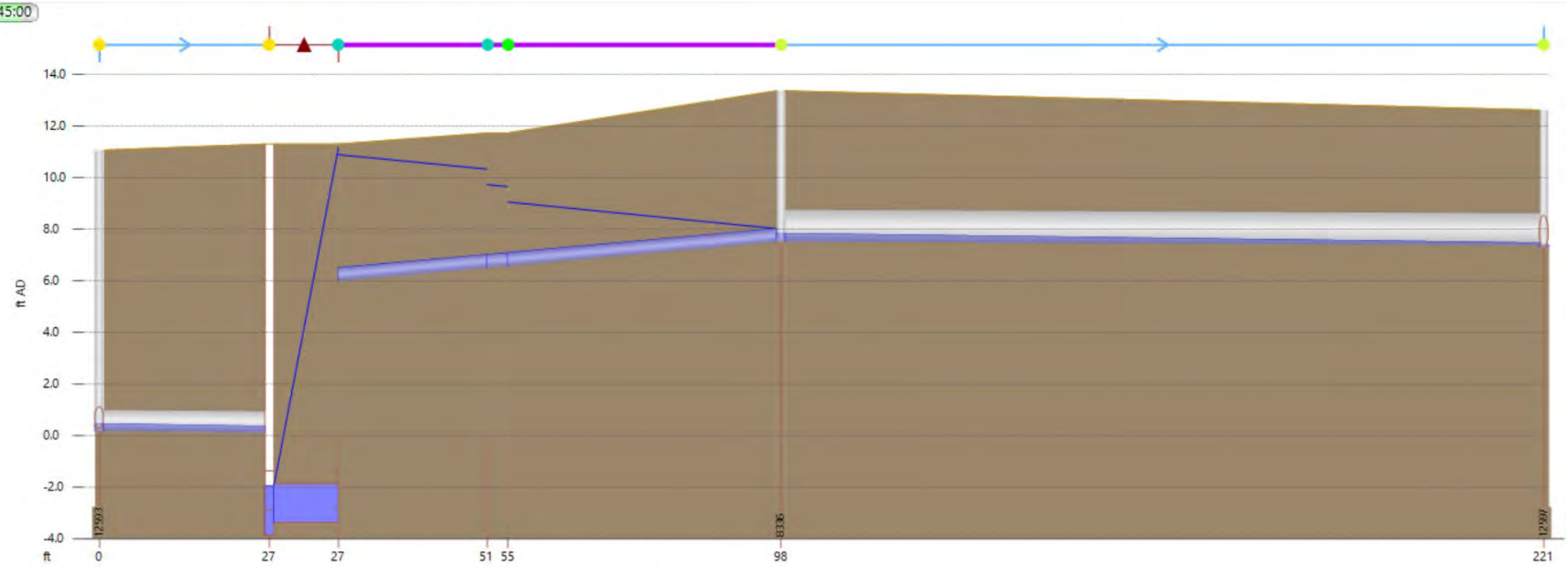


Adams Lag Pump



Link		12064.1	9998301.1
width (in)			6.0
us inv (ft AD)			6.000
ds inv (ft AD)			6.511
r.pfc (MGD)			-0.53
surc		1.00	1.00
US total head (ft AD)		-1.946	11.185
US velocity (ft/s)		0.000	4.385
DS flow (MGD)		0.5566	0.5564
DS cumulative flow (US Mgal)		0.27230	0.27230
DS total head (ft AD)		11.186	10.623
DS velocity (ft/s)		0.000	4.385
Node	12064	9998301	
ground (ft AD)	11.300	11.300	
flood dep (ft)	-13.246	-0.114	

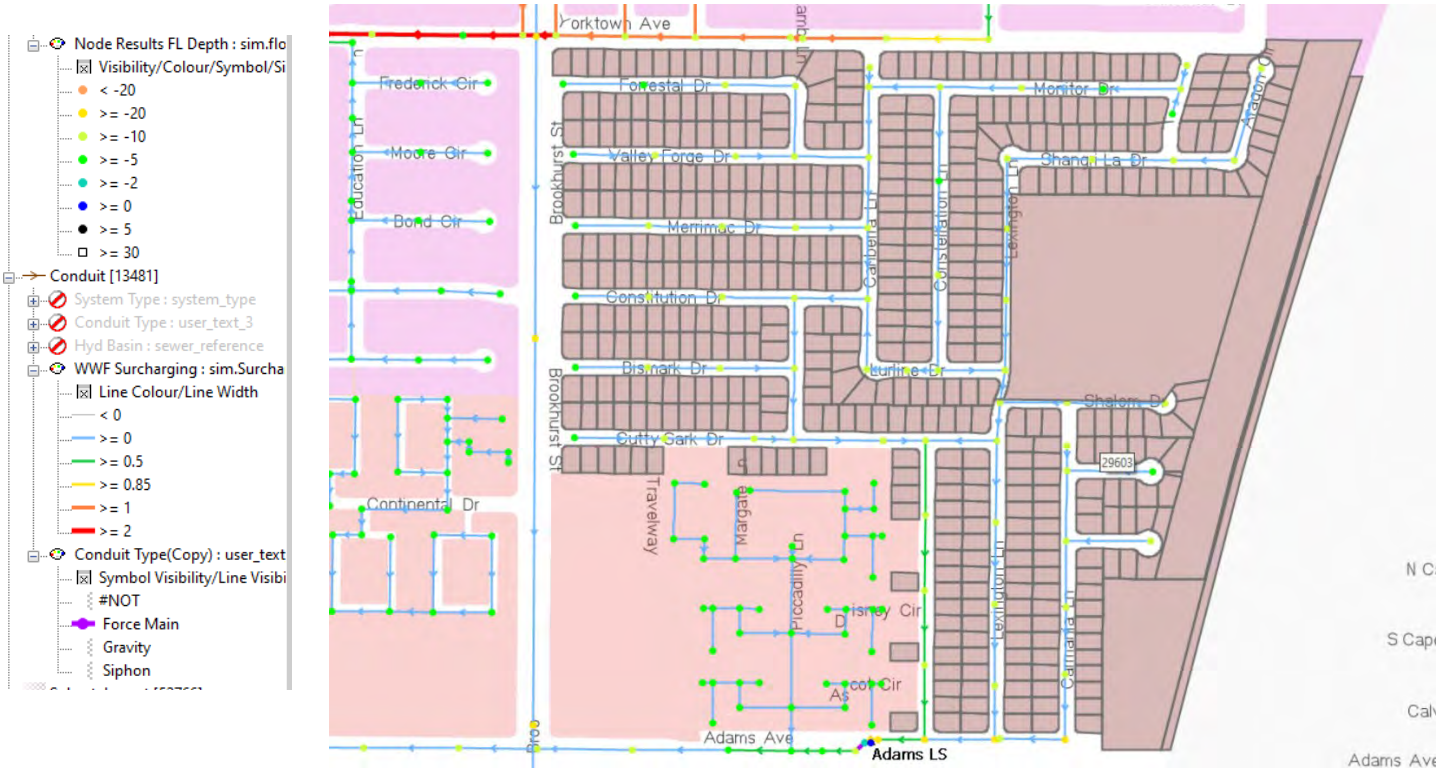
03/19/2023 12:45:00

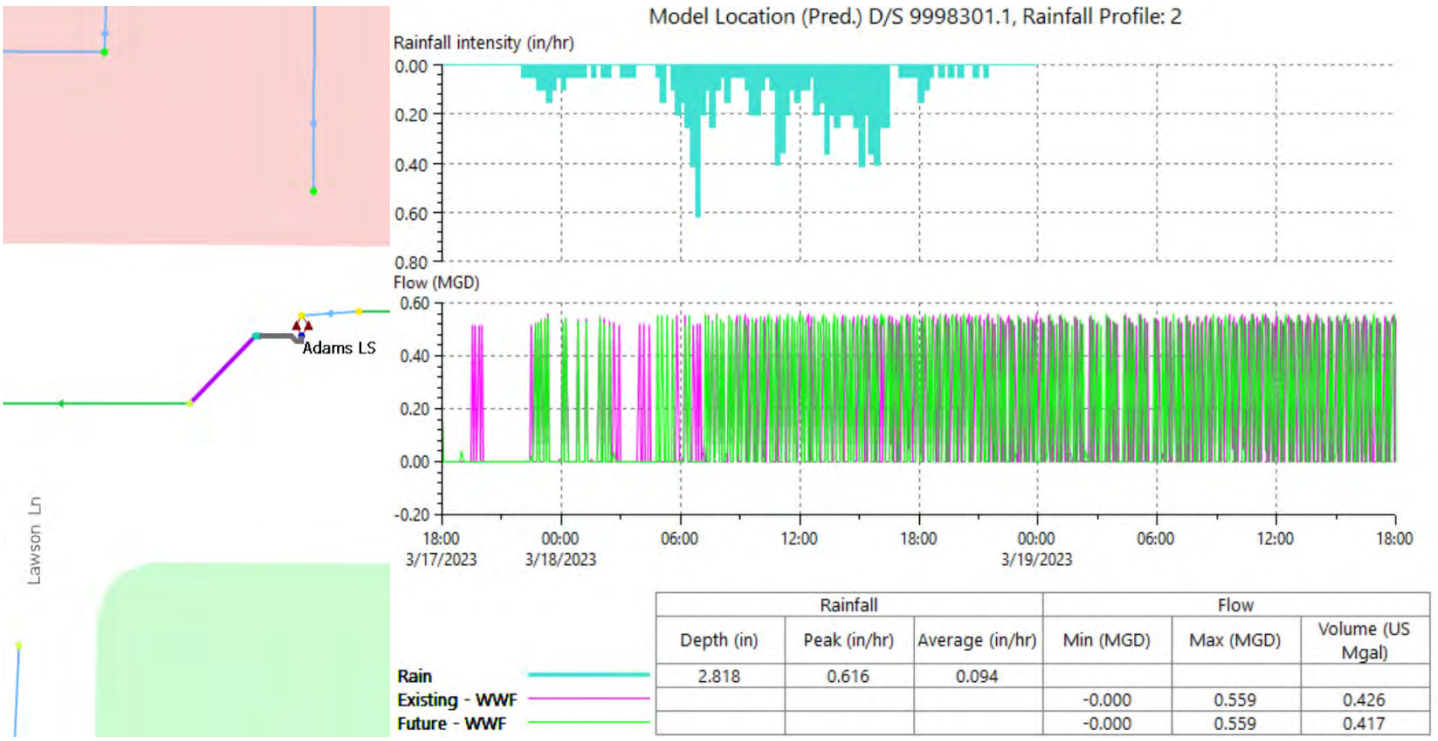


Link	12593.1	12064.1	9998301.1	-	12596.1	8336.1
width (in)	10.0		6.0	6.0	6.0	15.0
us inv (ft AD)	0.180		6.000	-	6.581	7.520
ds inv (ft AD)	0.130		6.511	-	7.520	7.390
r.pfc (MGD)	0.61		-0.53	-	-0.53	1.36
surc	0.33	1.00	1.00	-	1.00	0.25
US total head (ft AD)	0.498	-1.946	11.185	-	9.351	7.959
US velocity (ft/s)	1.641	0.000	4.385	-	4.383	2.867
DS flow (MGD)	0.1674	0.5566	0.5564	-	0.5563	0.0036
DS cumulative flow (US Mgal)	0.27225	0.27230	0.27230	-	0.27230	0.27478
DS total head (ft AD)	0.429	11.186	10.623	-	8.318	7.464
DS velocity (ft/s)	2.175	0.000	4.385	-	4.383	0.195

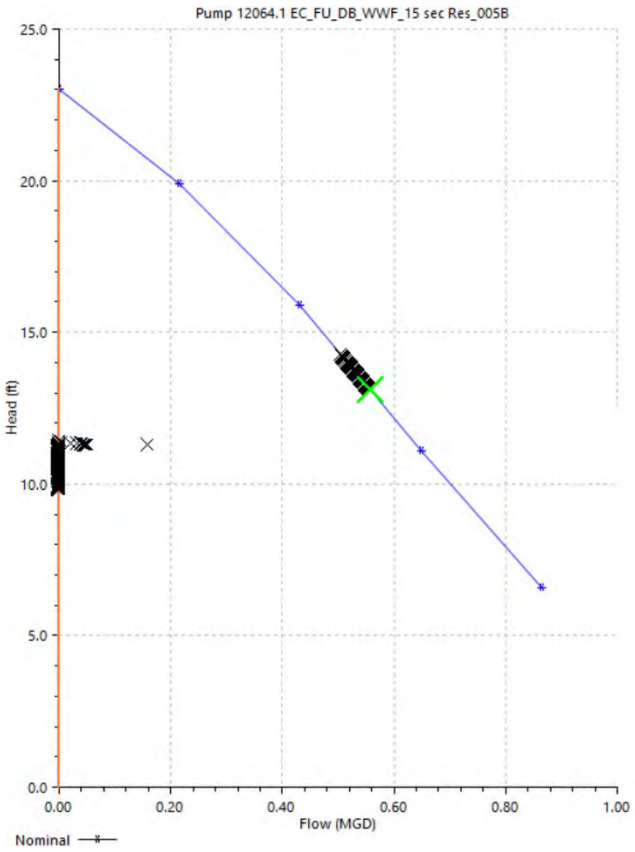
Node	12593	12064	9998301	12595	12596	8336	12597
ground (ft AD)	11.066	11.300	11.300	11.726	11.730	13.363	12.618
flood dep (ft)	-10.610	-13.246	-0.114	-1.700	-2.379	-5.531	-5.231

Adams LS - Design Basis - 10 year 24 hour Storm

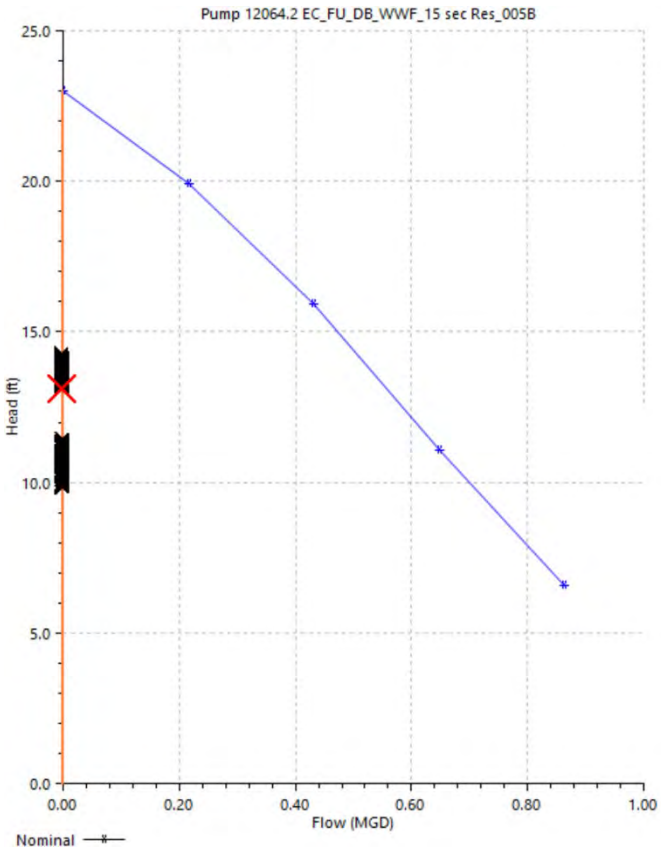




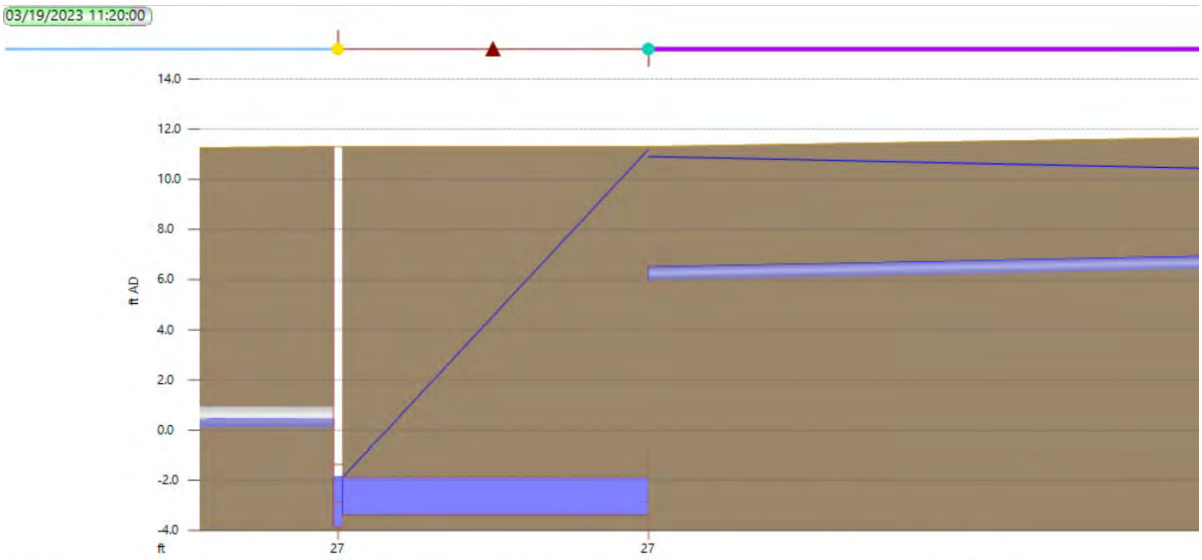
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.818	0.616	0.094			
Existing - WWF				-0.000	0.559	0.426
Future - WWF				-0.000	0.559	0.417



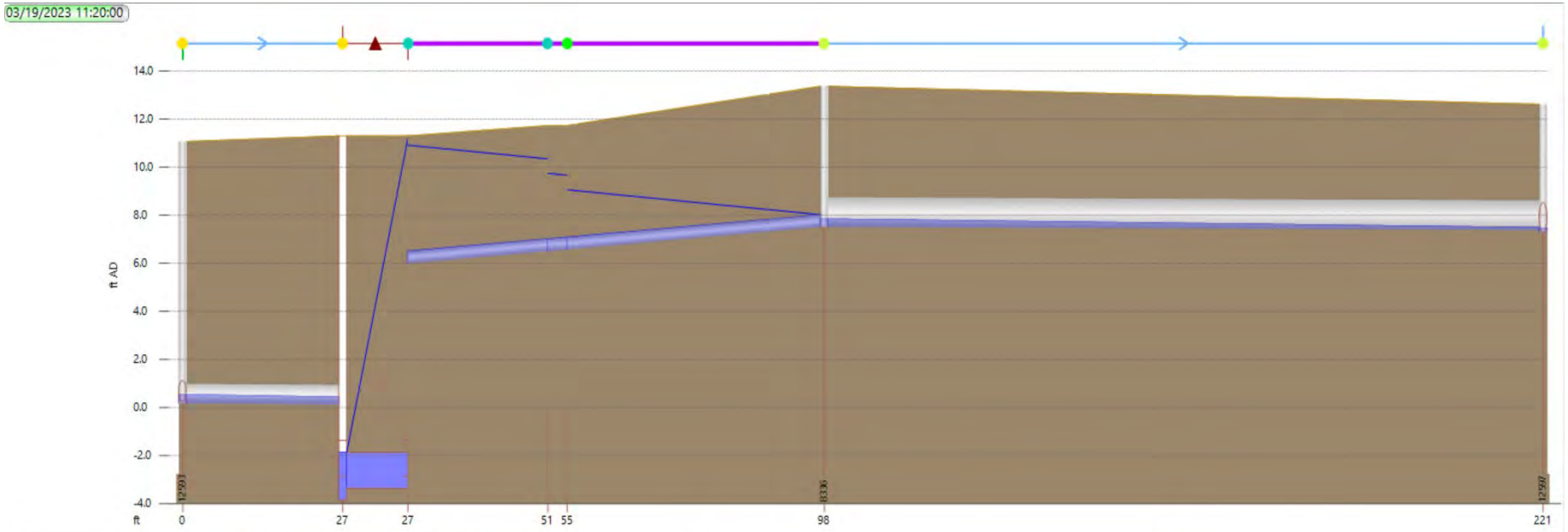
Adams Lead Pump



Adams Lag Pump



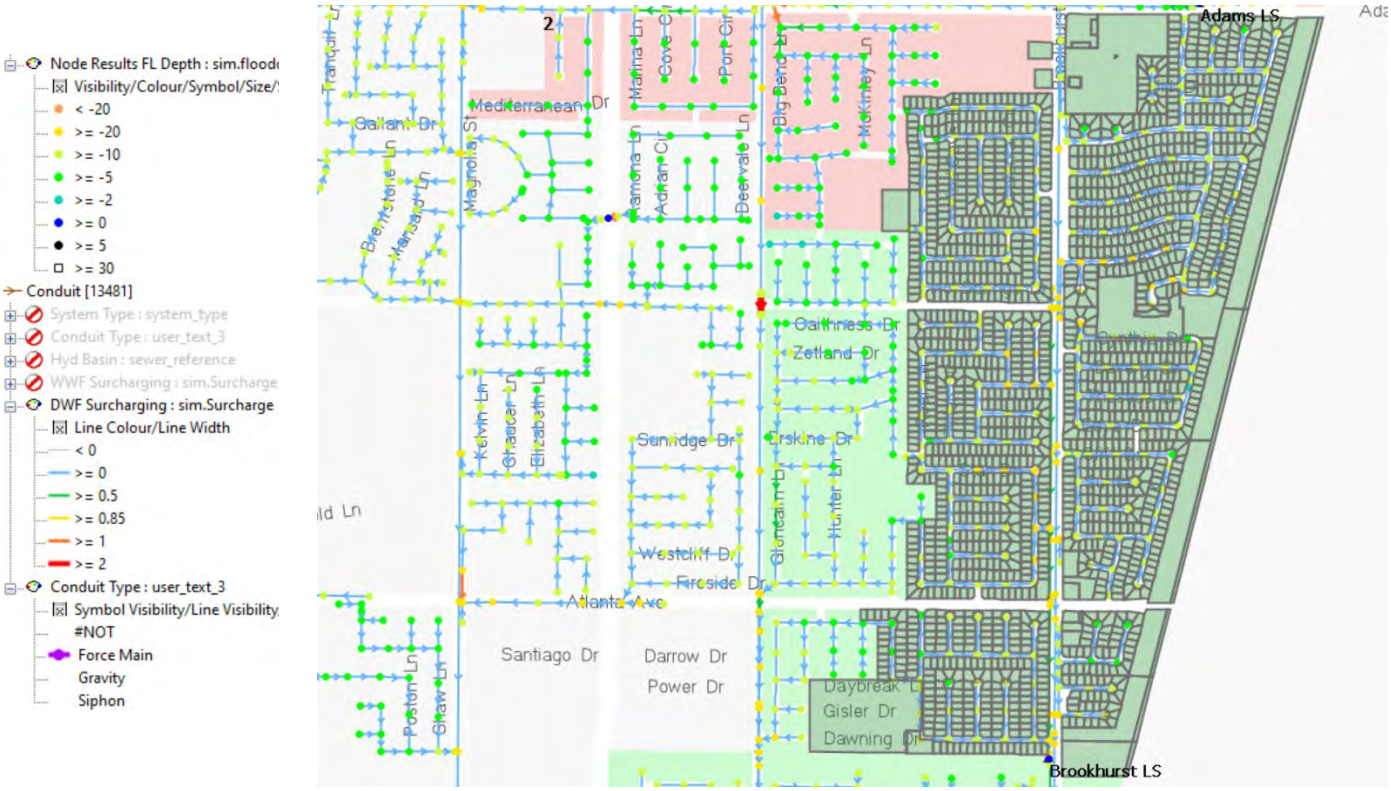
Link		12064.1	9998301.1
width (in)			6.0
us inv (ft AD)			6.000
ds inv (ft AD)			6.511
r.pfc (MGD)			-0.53
surc		1.00	1.00
US total head (ft AD)		-1.871	11.211
US velocity (ft/s)		0.000	4.402
DS flow (MGD)		0.5588	0.5587
DS cumulative flow (US Mgal)		0.44901	0.44901
DS total head (ft AD)		11.211	10.644
DS velocity (ft/s)		0.000	4.402
Node	12064		9998301
ground (ft AD)	11.300		11.300
flood dep (ft)	-13.171		-0.089

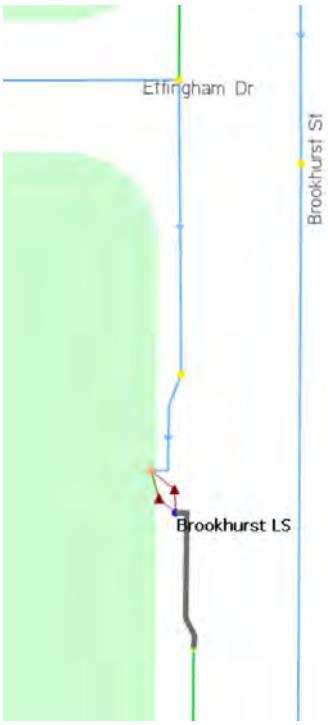


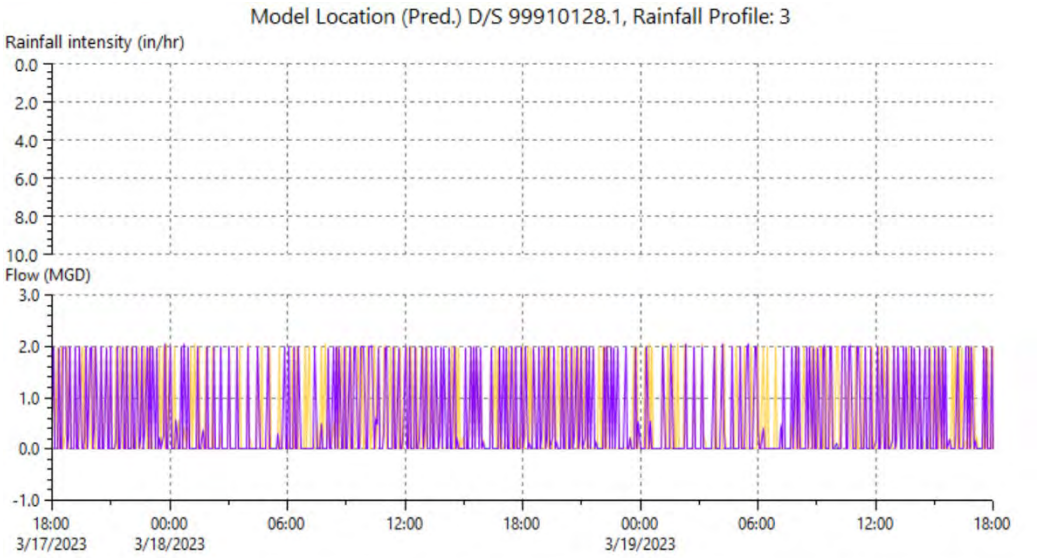
Link	12593.1	12064.1	9998301.1	-	12596.1	8336.1
width (in)	10.0		6.0	6.0	6.0	15.0
us inv (ft AD)	0.180		6.000	-	6.581	7.520
ds inv (ft AD)	0.130		6.511	-	7.520	7.390
r.pfc (MGD)	0.61		-0.53	-	-0.53	1.36
surc	0.43	1.00	1.00	-	1.00	0.26
US total head (ft AD)	0.604	-1.871	11.211	-	9.361	7.962
US velocity (ft/s)	2.024	0.000	4.402	-	4.401	2.787
DS flow (MGD)	0.2958	0.5588	0.5587	-	0.5585	0.0217
DS cumulative flow (US Mgal)	0.44905	0.44901	0.44901	-	0.44901	0.44884
DS total head (ft AD)	0.534	11.211	10.644	-	8.321	7.496
DS velocity (ft/s)	2.596	0.000	4.402	-	4.401	0.756

Node	12593	12064	9998301	12595	12596	8336	12597
ground (ft AD)	11.066	11.300	11.300	11.726	11.730	13.363	12.618
flood dep (ft)	-10.525	-13.171	-0.089	-1.684	-2.368	-5.521	-5.148

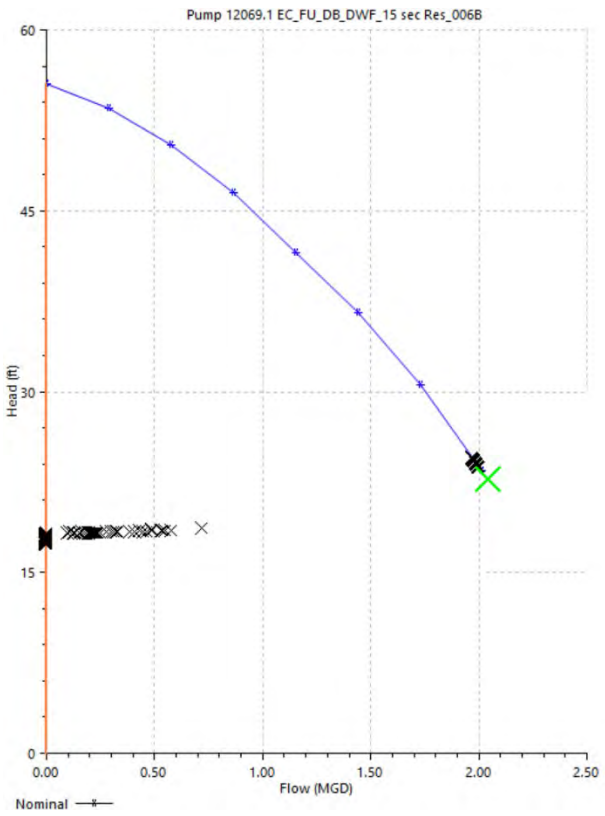
Brookhurst LS - Design Basis – DWF



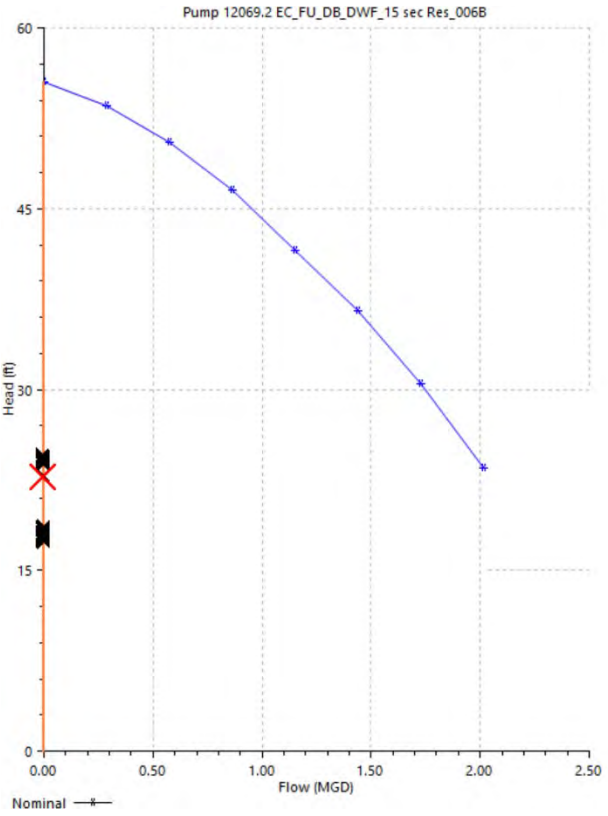




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	2.048	1.172
Future - DWF				-0.000	2.048	1.172



Brookhurst Lead Pump



Brookhurst Lag Pump



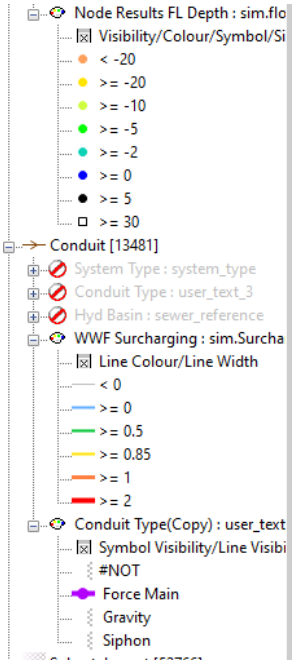
Link		12069.1		99910128.1
width (in)				8.0
us inv (ft AD)				-1.000
ds inv (ft AD)				0.040
r.pfc (MGD)				-1.06
surc		1.00		1.00
US total head (ft AD)		-16.876		5.836
US velocity (ft/s)		0.000		9.078
DS flow (MGD)		2.0484		2.0482
DS cumulative flow (US Mgal)		1.25398		1.25398
DS total head (ft AD)		5.837		1.987
DS velocity (ft/s)		0.000		9.078
Node	12069		99910128	
ground (ft AD)	6.190		6.190	
flood dep (ft)	-23.066		-0.353	

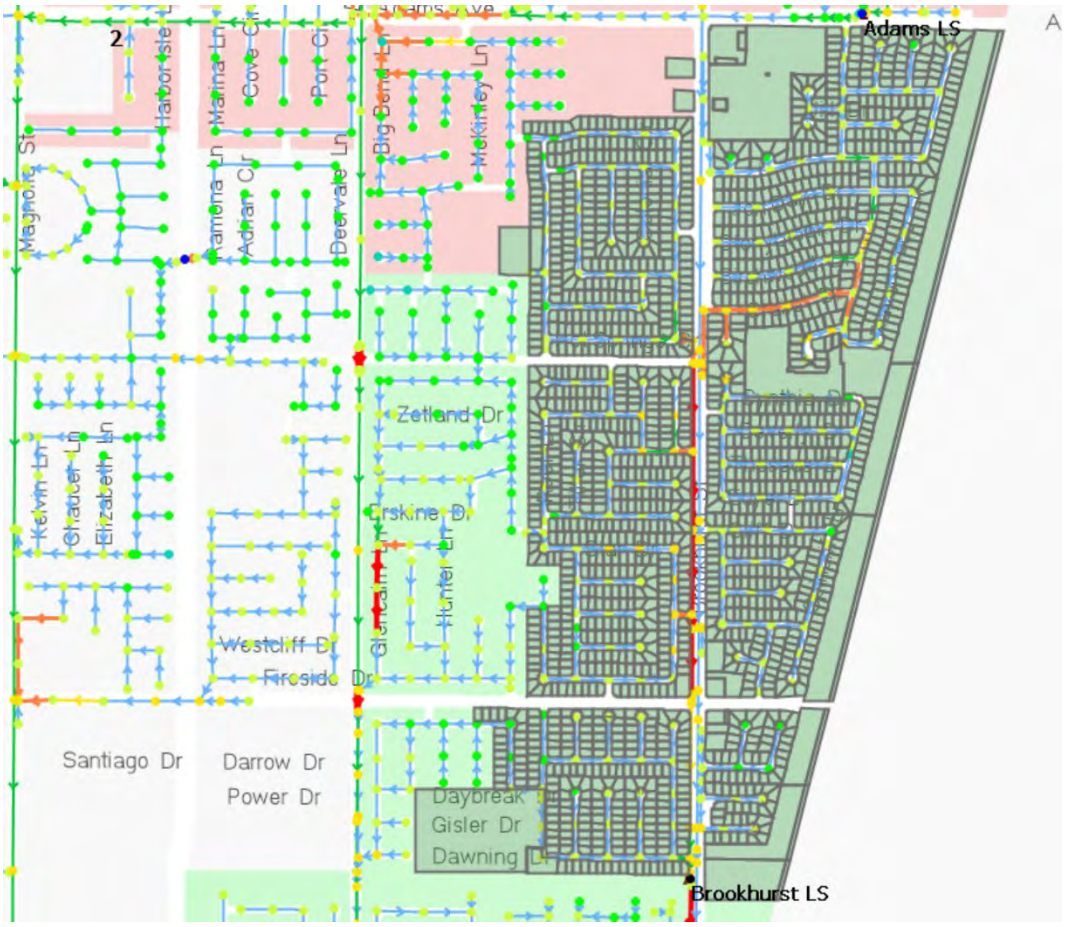


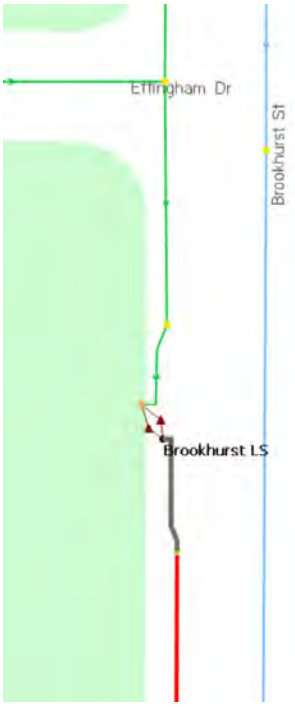
Link	10127.1	-	99910128.1	10131.1
width (in)	15.0		8.0	18.0
us inv (ft AD)	-11.110		-1.000	0.040
ds inv (ft AD)	-11.200		0.040	-0.520
r.pfc (MGD)	1.89		-1.06	2.15
surc	0.33	1.00	1.00	0.42
US total head (ft AD)	-10.622	-	5.836	0.922
US velocity (ft/s)	2.203	0.000	9.078	4.051
DS flow (MGD)	0.5036	2.0484	2.0482	0.4508
DS cumulative flow (US Mgal)	1.25462	-	1.25398	1.26918
DS total head (ft AD)	-10.731	5.837	1.987	-0.073
DS velocity (ft/s)	2.780	0.000	9.078	1.908

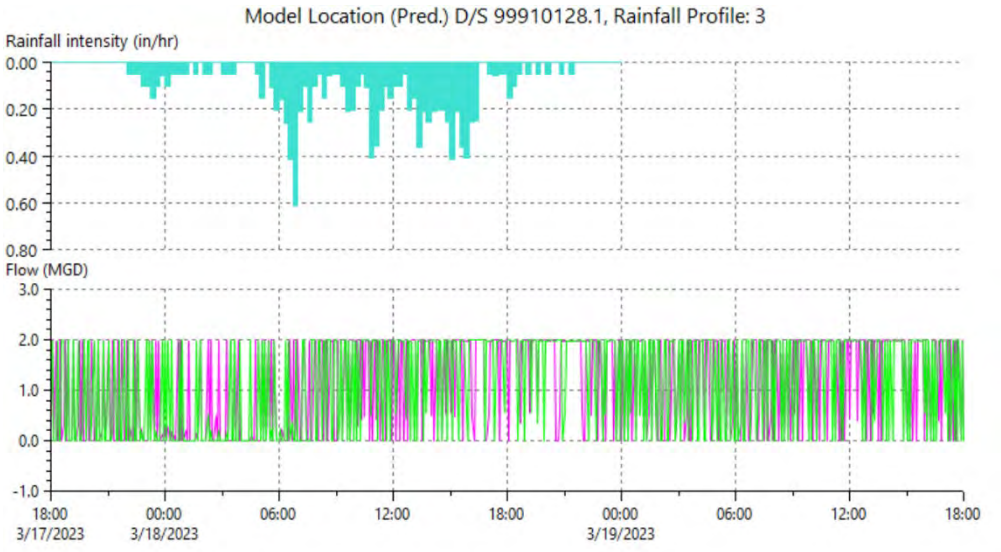
Node	10127	12069	99910128	10131	10228
ground (ft AD)	8.040	6.190	6.190	8.001	8.015
flood dep (ft)	-	-23.066	-0.353	-7.334	-8.145

Brookhurst LS - Design Basis - 10 year 24 hour Storm

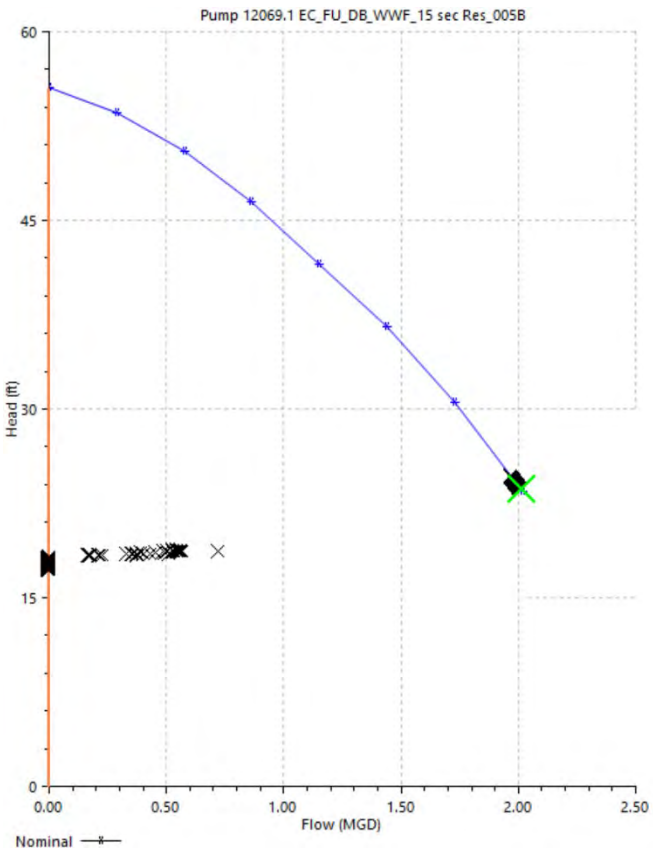




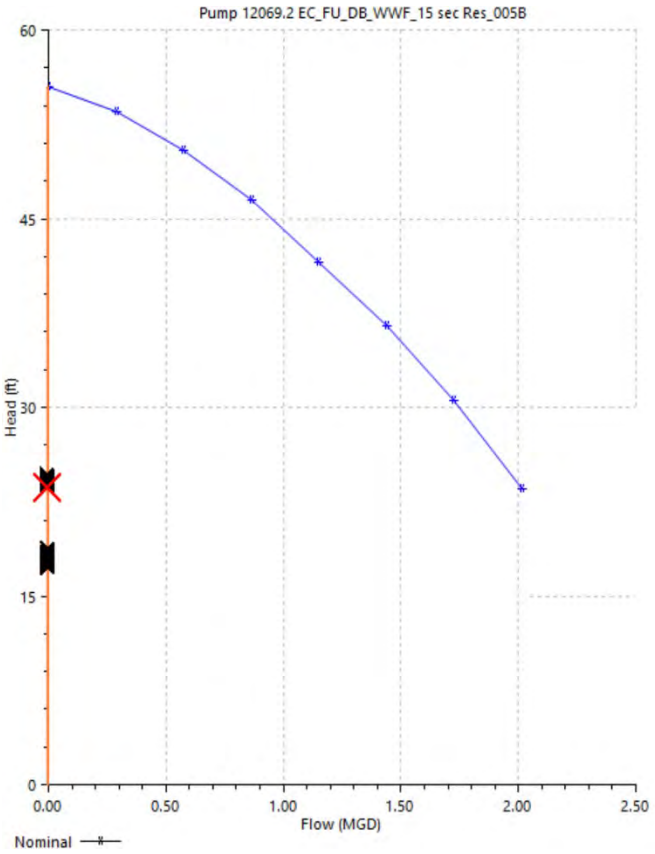




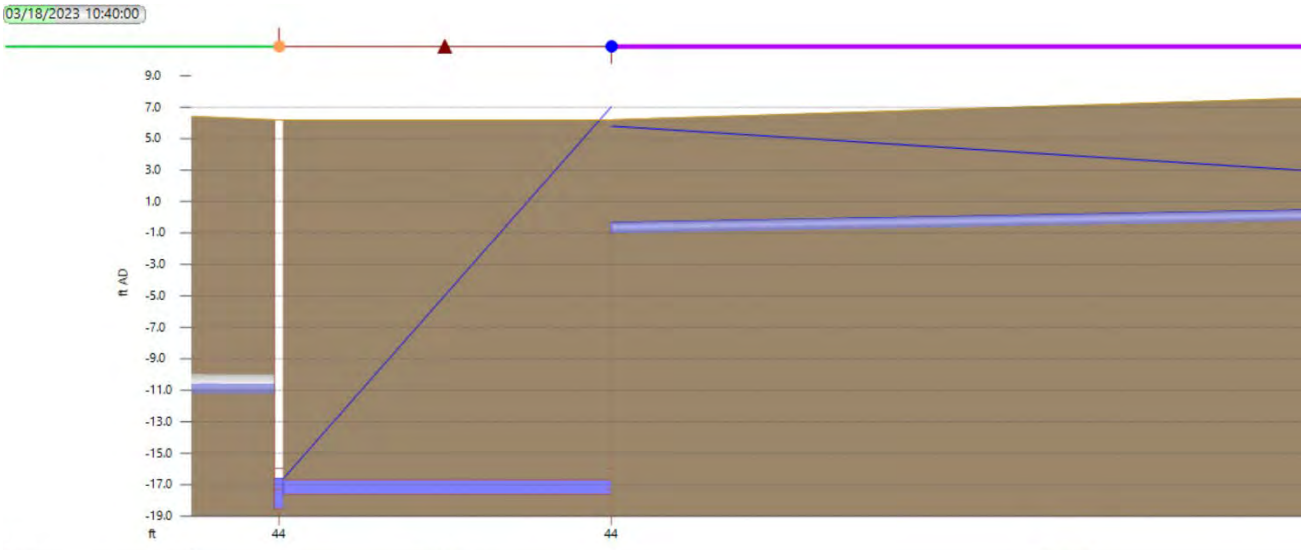
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.818	0.614	0.094			
Existing - WWF				-0.000	2.012	2.267
Future - WWF				-0.000	2.010	2.312



Brookhurst Lead Pump



Brookhurst Lag Pump



Link		12069.1		99910128.1
width (in)				8.0
us inv (ft AD)				-1.000
ds inv (ft AD)				0.040
r.pfc (MGD)				-1.06
surc		1.00		1.00
US total head (ft AD)		-16.601		7.030
US velocity (ft/s)		0.000		8.911
DS flow (MGD)		2.0106		2.0103
DS cumulative flow (US Mgal)		2.31381		2.31381
DS total head (ft AD)		7.031		3.322
DS velocity (ft/s)		0.000		8.911
Node	12069		99910128	
ground (ft AD)	6.190		6.190	
flood dep (ft)	-22.791		0.841	

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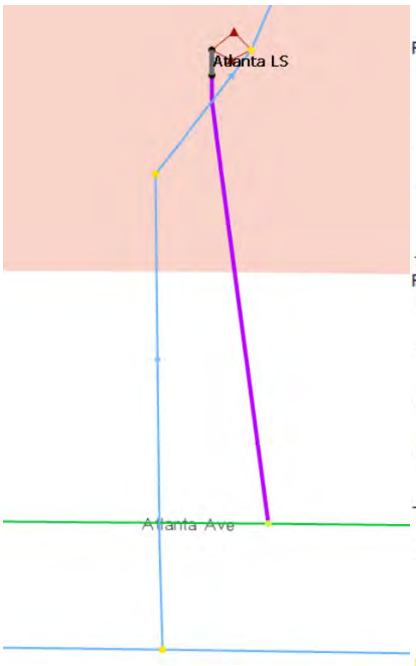


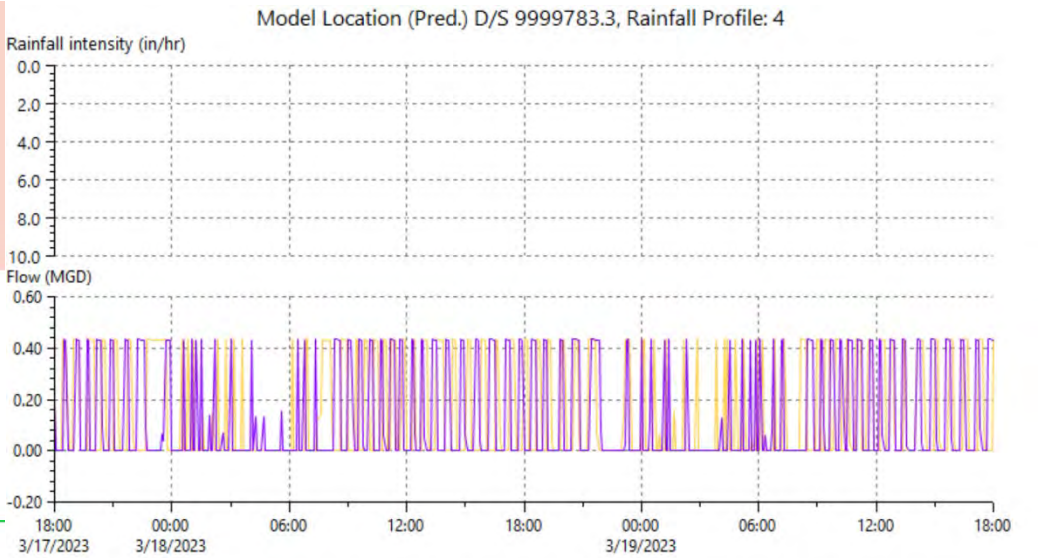
Link	10127.1	-	99910128.1	10131.1
width (in)	15.0		8.0	18.0
us inv (ft AD)	-11.110		-1.000	0.040
ds inv (ft AD)	-11.200		0.040	-0.520
r.pfc (MGD)	1.89		-1.06	2.15
surc	0.54	1.00	1.00	0.54
US total head (ft AD)	-10.287	-	7.030	0.987
US velocity (ft/s)	3.102	0.000	8.911	2.926
DS flow (MGD)	1.3517	2.0106	2.0103	1.3749
DS cumulative flow (US Mgal)	2.31463	-	2.31381	2.32170
DS total head (ft AD)	-10.401	7.031	3.322	0.345
DS velocity (ft/s)	3.760	0.000	8.911	2.275

Node	-	12069	99910128	10131	10228
ground (ft AD)	8.040	6.190	6.190	8.001	8.015
flood dep (ft)	-	-22.791	0.841	-7.147	-7.751

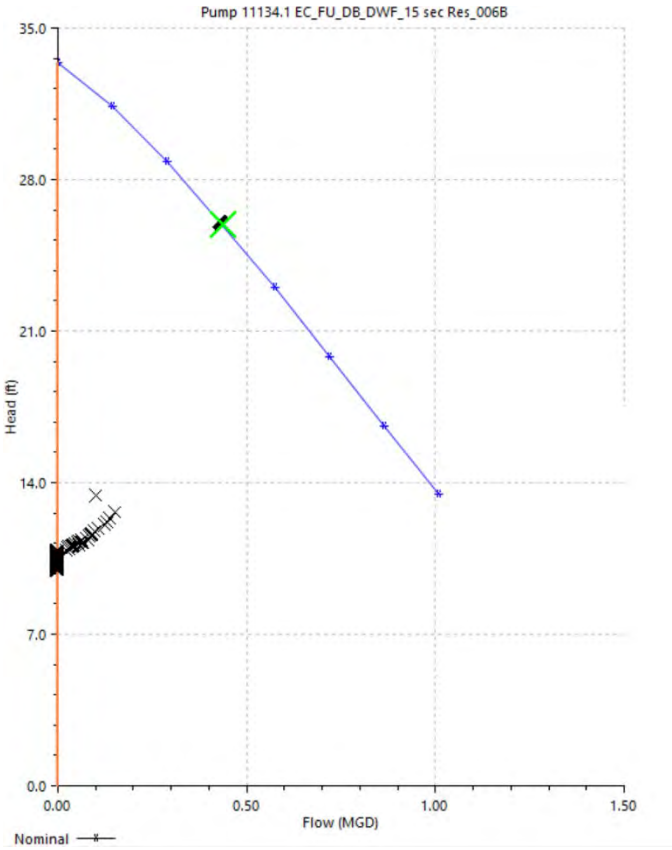
Atlanta LS - Design Basis – DWF



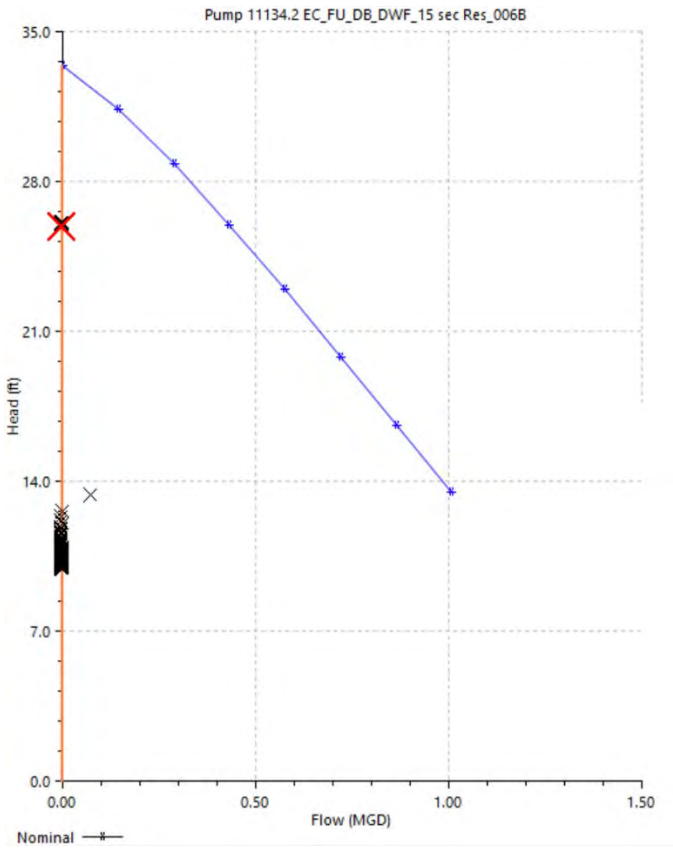




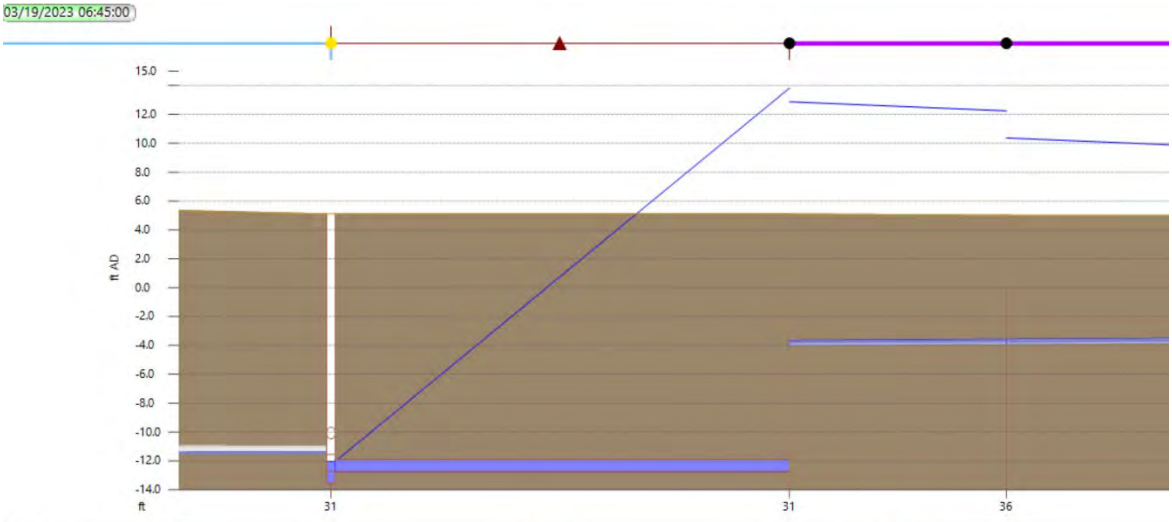
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.438	0.275
Future - DWF				-0.000	0.438	0.251



Atlanta Lead Pump



Atlanta Lag Pump



Link		11134.1	9999783.3	
width (in)			4.0	
us inv (ft AD)			-4.000	
ds inv (ft AD)			-3.910	
r.pfc (MGD)			-0.16	
surc		1.00	1.00	
US total head (ft AD)		-12.042	13.816	
US velocity (ft/s)		0.000	7.768	
DS flow (MGD)		0.4388	0.4381	
DS cumulative flow (US Mgal)		0.27989	0.27989	
DS total head (ft AD)		13.816	13.182	
DS velocity (ft/s)		0.000	7.768	
Node	11134		9999783	12080
ground (ft AD)	5.110		5.110	5.017
flood dep (ft)	-17.152		8.706	6.290

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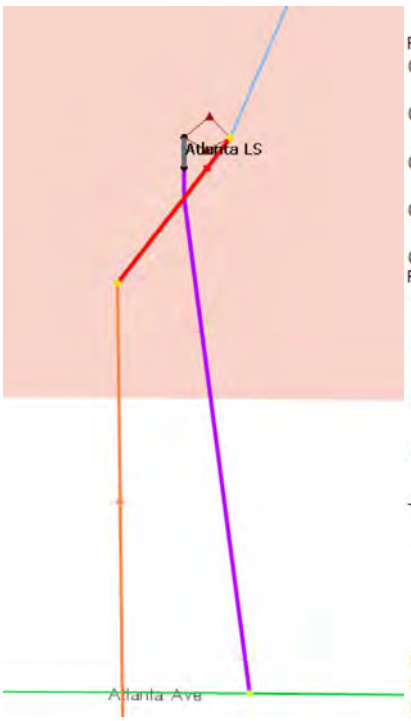


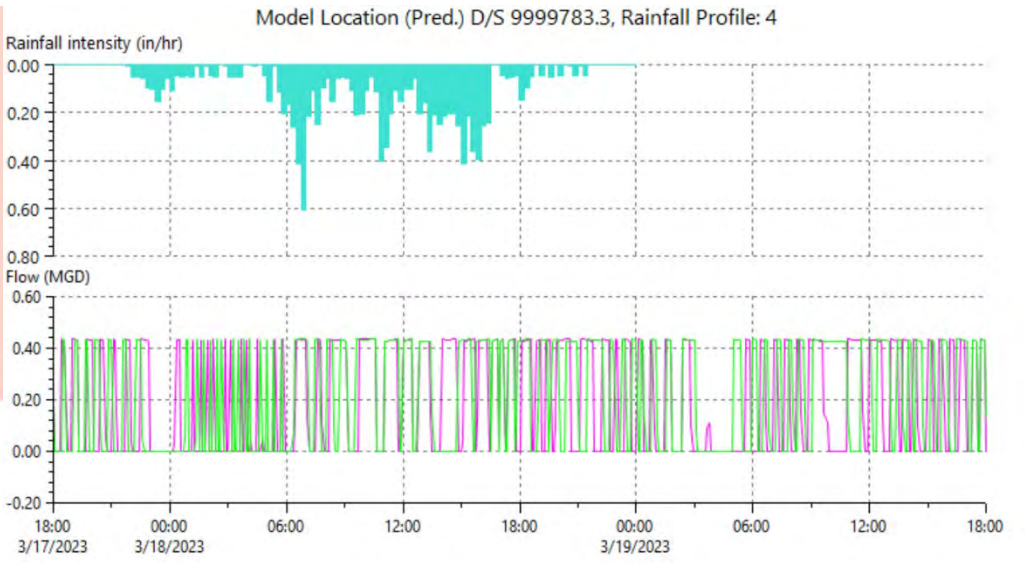
Link	-	-	12080.1	CST0060-0500.1	
width (in)	8.0		4.0	18.0	
us inv (ft AD)	-		-3.910	-2.310	
ds inv (ft AD)	-		-2.300	-3.310	
r.pfc (MGD)	0.34		-0.16	2.30	
surc	0.30	-	1.00	0.26	
US total head (ft AD)	-	-	11.307	-1.864	
US velocity (ft/s)	1.207	-	7.757	2.013	
DS flow (MGD)	0.0683	-	0.4375	0.2727	
DS cumulative flow (US Mgal)	-	-	0.27989	0.93532	
DS total head (ft AD)	-	-	-0.057	-2.987	
DS velocity (ft/s)	1.706	-	7.757	2.244	

Node	-	-	12080	CST0060-0500	CST0060-0190
ground (ft AD)	-	-	5.017	4.890	5.950
flood dep (ft)	-	-	6.290	-6.817	-9.463

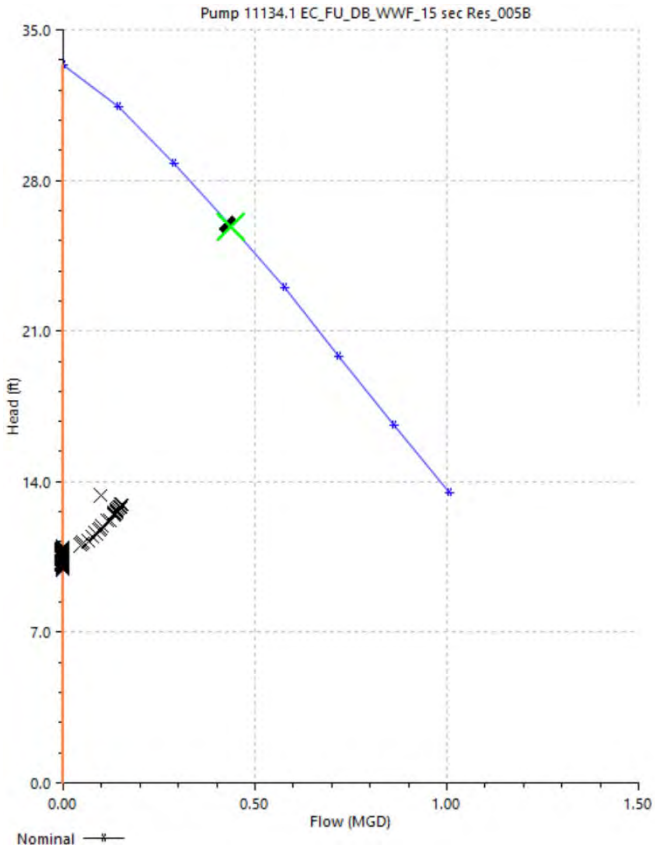
Atlanta LS - Design Basis - 10 year 24 hour Storm



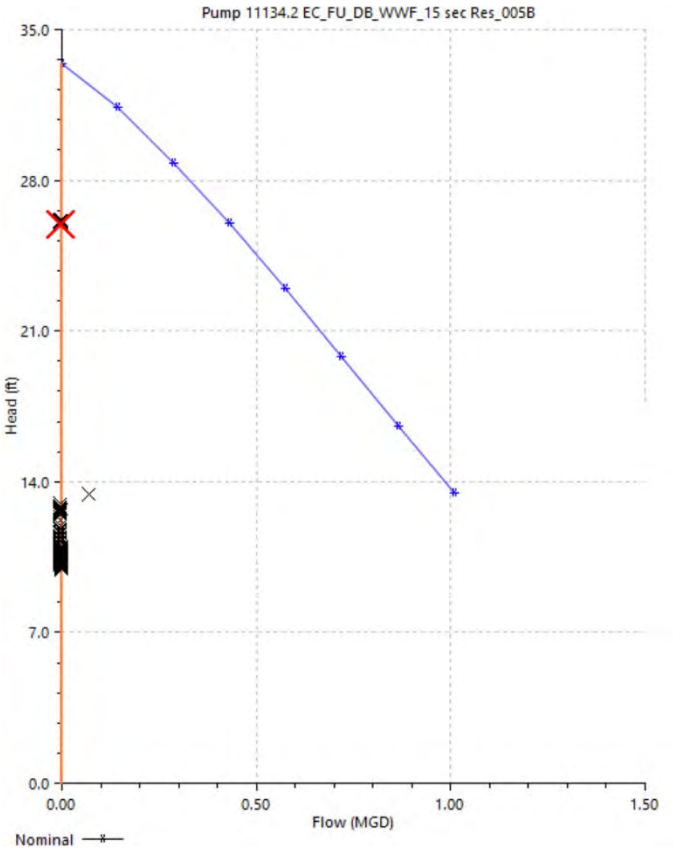




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.817	0.606	0.094			
Existing - WWF				0.000	0.438	0.401
Future - WWF				-0.000	0.438	0.420



Atlanta Lead Pump



Atlanta Lag Pump



Link		11134.1	9999783.3	
width (in)			4.0	
us inv (ft AD)			-4.000	
ds inv (ft AD)			-3.910	
r.pfc (MGD)			-0.16	
surc		1.00	1.00	
US total head (ft AD)		-11.905	13.956	
US velocity (ft/s)		0.000	7.765	
DS flow (MGD)		0.4387	0.4380	
DS cumulative flow (US Mgal)		0.42650	0.42650	
DS total head (ft AD)		13.956	13.322	
DS velocity (ft/s)		0.000	7.765	
Node	11134		9999783	12080
ground (ft AD)	5.110		5.110	5.017
flood dep (ft)	-17.015		8.846	6.432

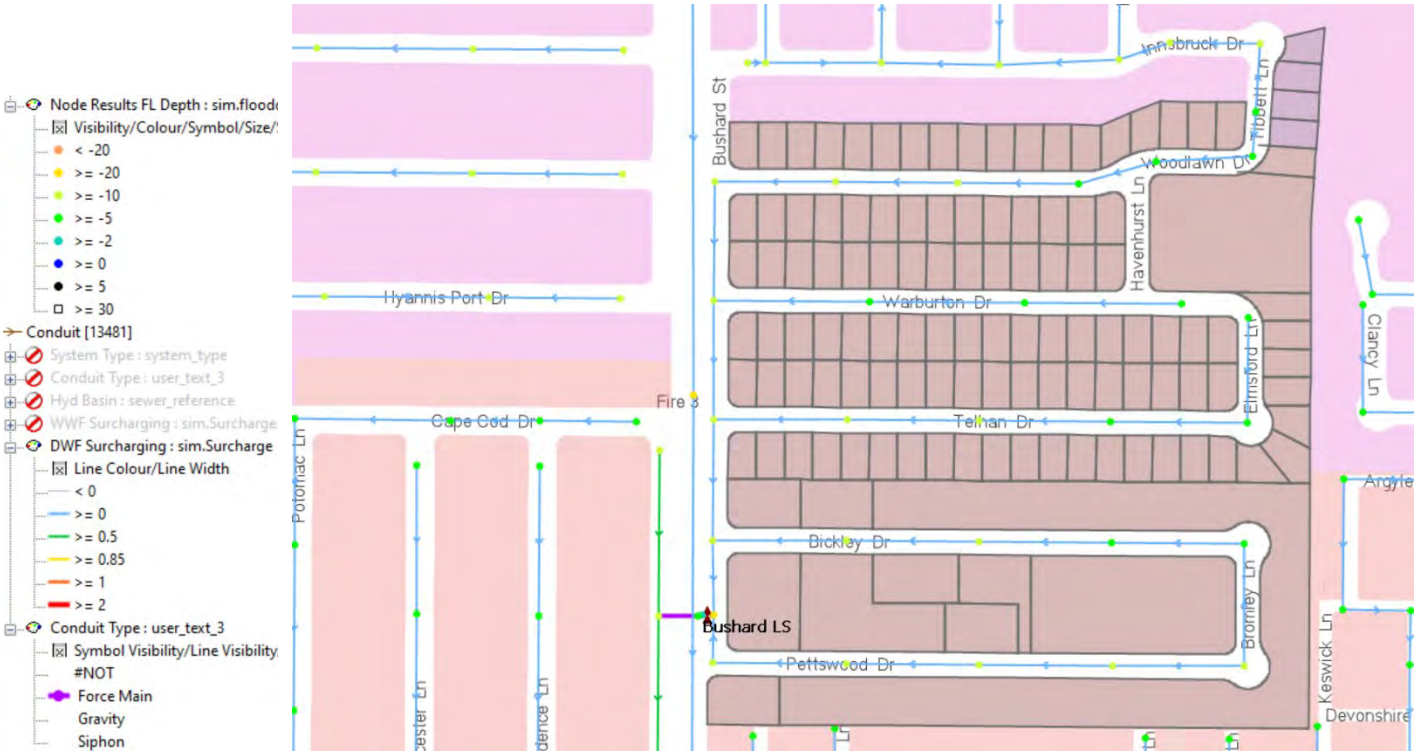
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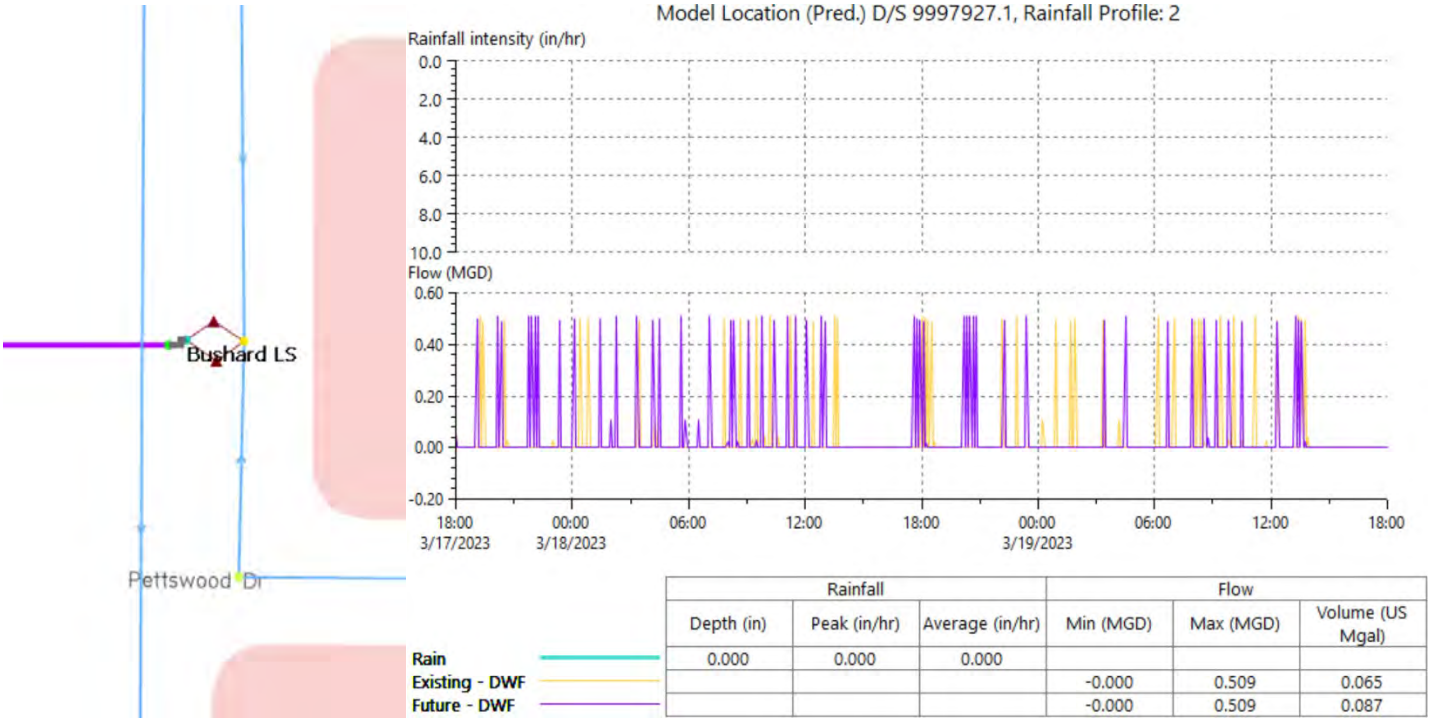


Link	11135.1	-	12080.1		CST0060-0500.1
width (in)	8.0		4.0		18.0
us inv (ft AD)	-11.500		-3.910		-2.310
ds inv (ft AD)	-11.560		-2.300		-3.310
r.pfc (MGD)	0.34		-0.16		2.30
surc	0.44	-	1.00		0.36
US total head (ft AD)	-11.167	-	11.448		-1.713
US velocity (ft/s)	1.653	-	7.754		2.015
DS flow (MGD)	0.1562	-	0.4373		0.6359
DS cumulative flow (US Mgal)	0.32283	-	0.42650		1.38693
DS total head (ft AD)	-11.250	-	0.093		-2.809
DS velocity (ft/s)	2.239	-	7.754		2.867

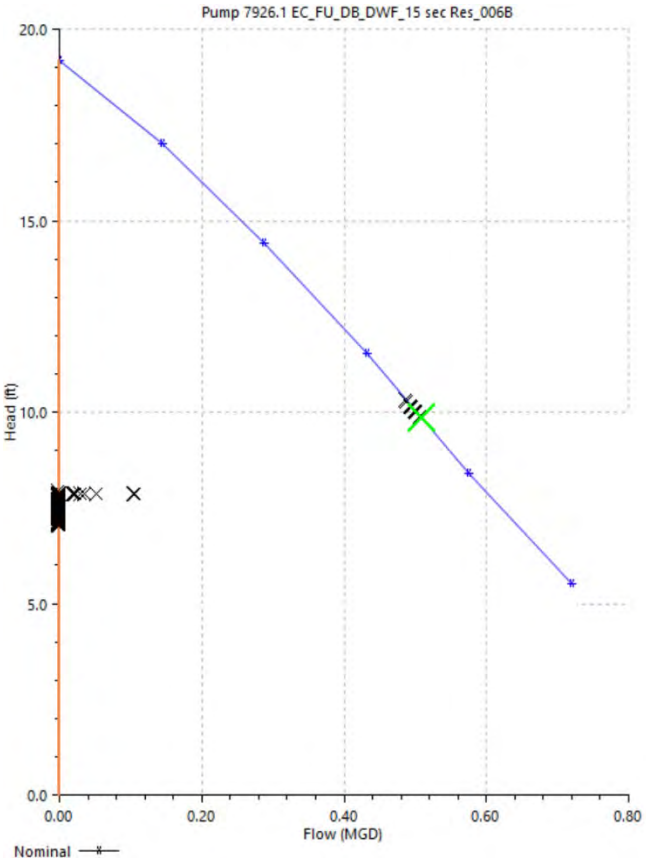
Node	-	-	12080	CST0060-0500	CST0060-0190
ground (ft AD)	-	-	5.017	4.890	5.950
flood dep (ft)	-	-	6.432	-6.666	-9.184

Bushard LS - Design Basis – DWF

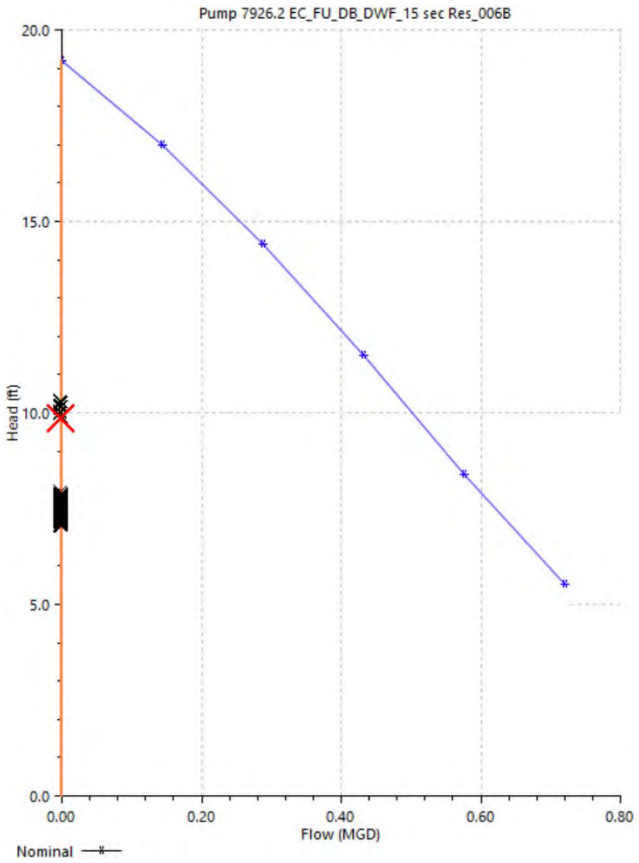




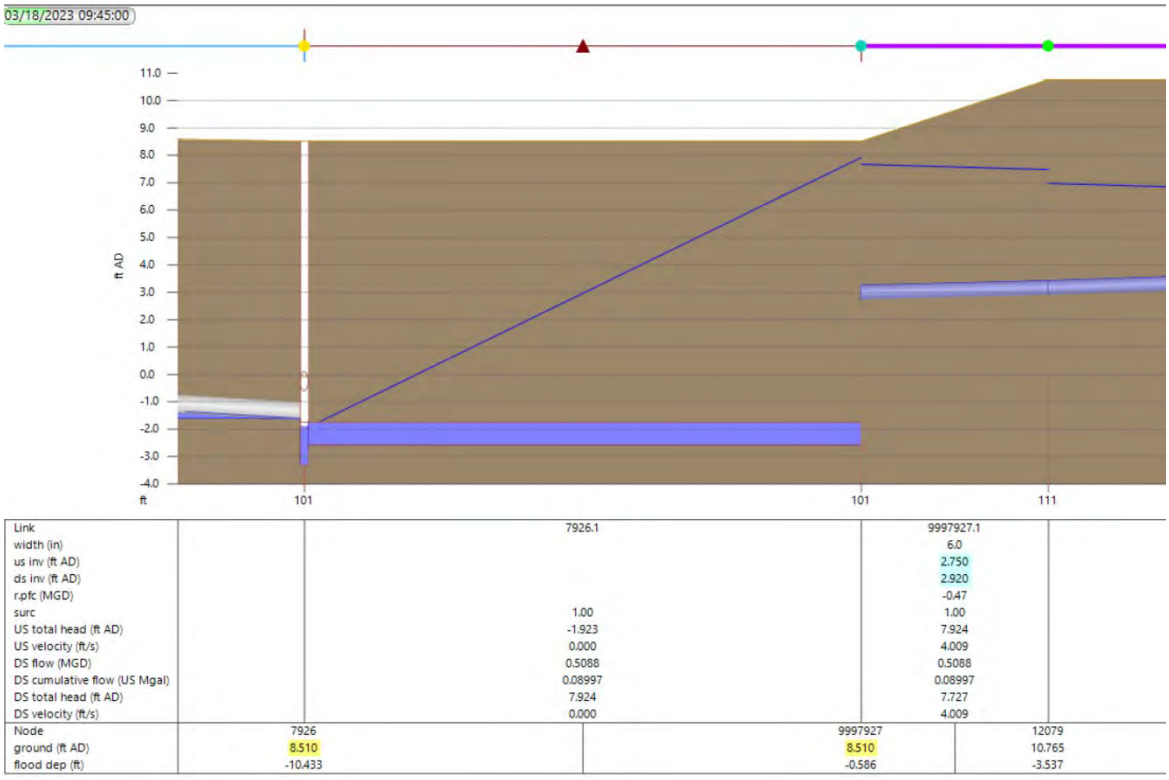
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.509	0.065
Future - DWF				-0.000	0.509	0.087



Bushard Lead Pump



Bushard Lag Pump



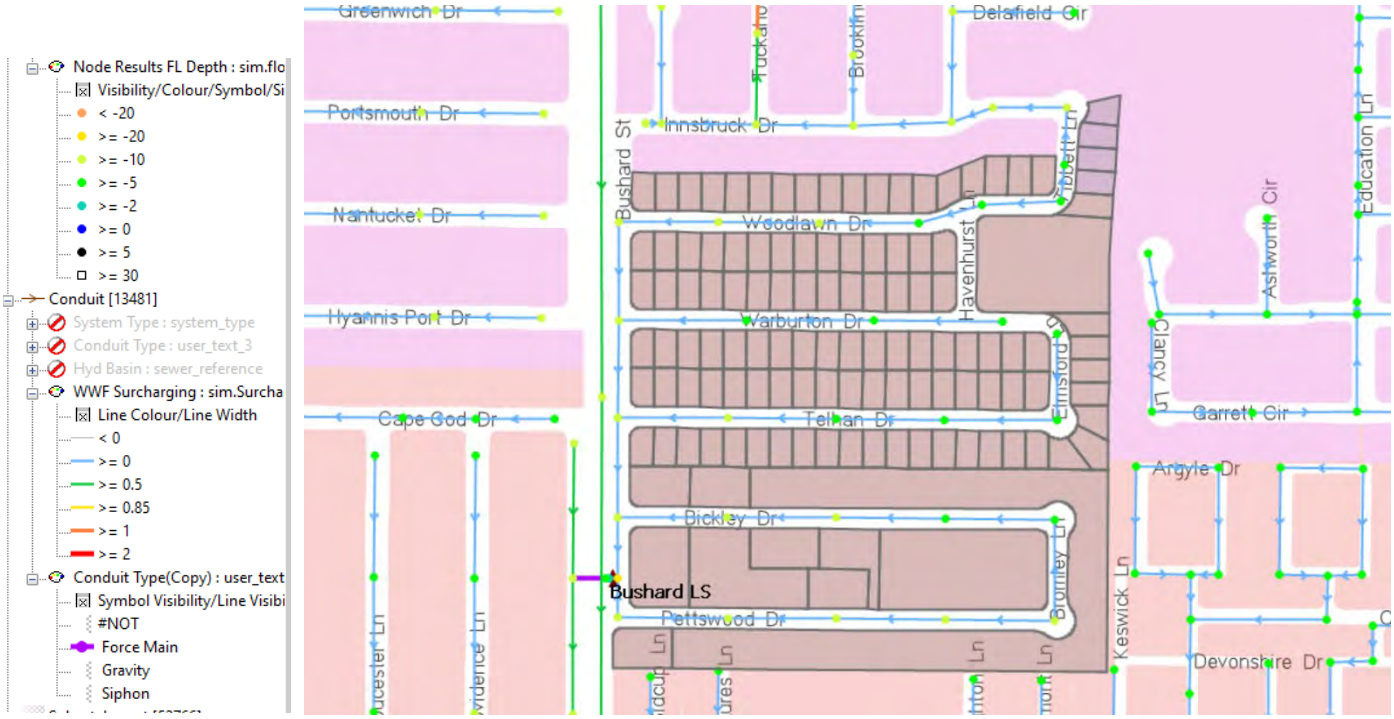
Link		7926.1		9997927.1	
width (in)				6.0	
us inv (ft AD)				2.750	
ds inv (ft AD)				2.920	
r.pfc (MGD)				-0.47	
surc		1.00		1.00	
US total head (ft AD)		-1.923		7.924	
US velocity (ft/s)		0.000		4.009	
DS flow (MGD)		0.5088		0.5088	
DS cumulative flow (US Mgal)		0.08997		0.08997	
DS total head (ft AD)		7.924		7.727	
DS velocity (ft/s)		0.000		4.009	
Node	7926		9997927		12079
ground (ft AD)	8.510		8.510		10.765
flood dep (ft)	-10.433		-0.586		-3.537

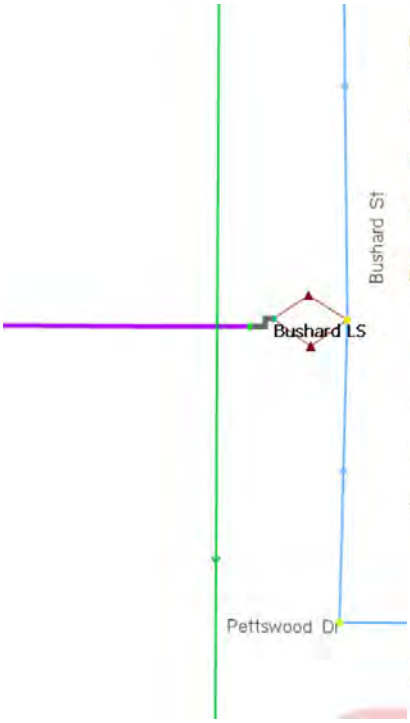


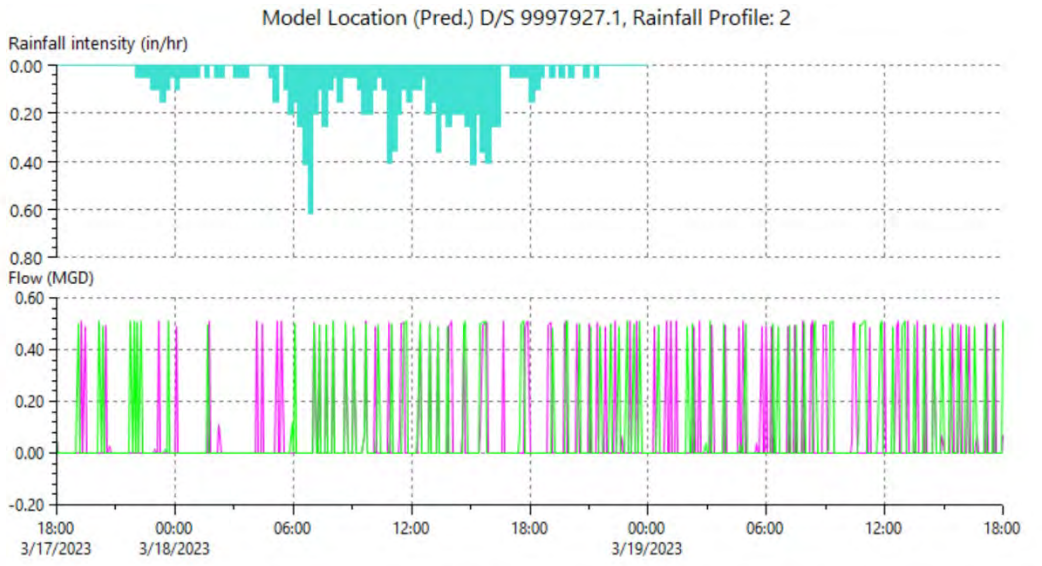
Link	7964.1	7926.1	-	12079.1	7929.1
width (in)	8.0		6.0	6.0	8.0
us inv (ft AD)	2.390		-	2.920	4.820
ds inv (ft AD)	-1.670		-	4.820	4.120
r.pfc (MGD)	1.56		-	-0.54	0.35
surc	0.10	1.00	-	1.00	0.55
US total head (ft AD)	2.457	-1.923	-	7.228	5.290
US velocity (ft/s)	0.020	0.000	-	4.009	2.574
DS flow (MGD)	0.0002	0.5088	-	0.5088	0.0280
DS cumulative flow (US Mgal)	0.00043	0.08997	-	0.08997	0.09866
DS total head (ft AD)	-1.603	7.924	-	5.570	4.252
DS velocity (ft/s)	0.020	0.000	-	4.009	1.106

Node	7964	7926	-	12079	7929	8061
ground (ft AD)	9.589	8.510	8.510	10.765	10.700	9.888
flood dep (ft)	-7.132	-10.433	-0.586	-3.537	-5.511	-5.710

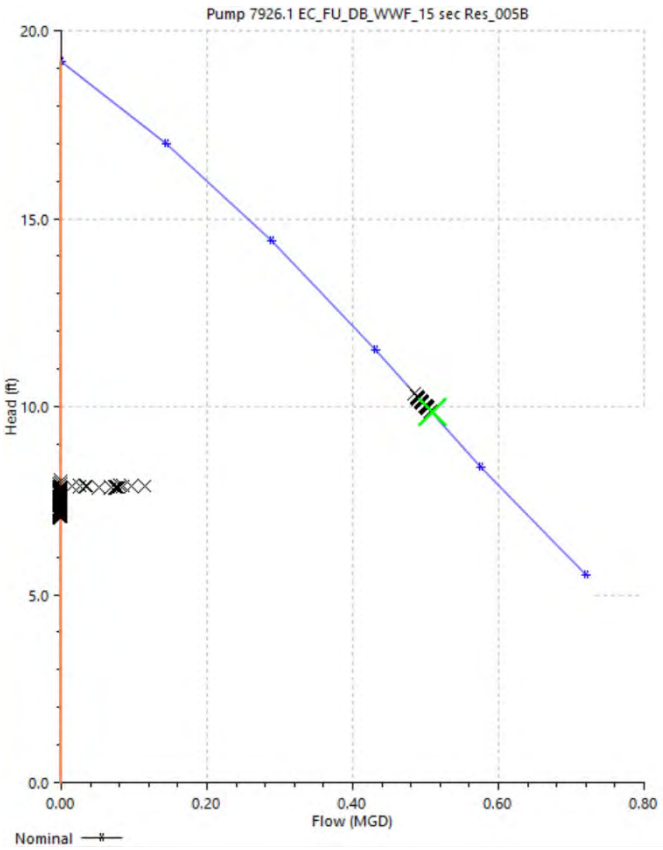
Bushard LS - Design Basis - 10 year 24 hour Storm



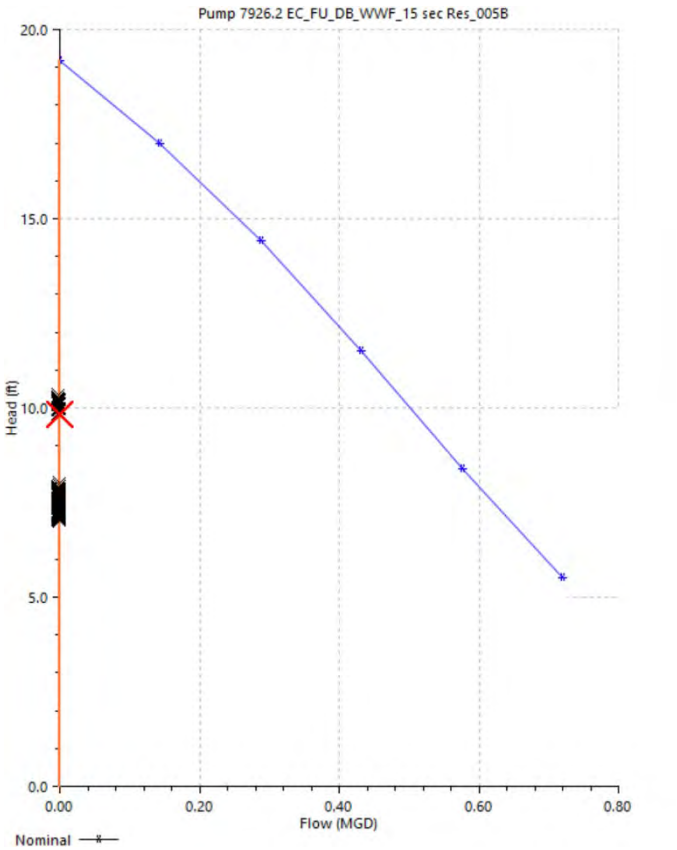




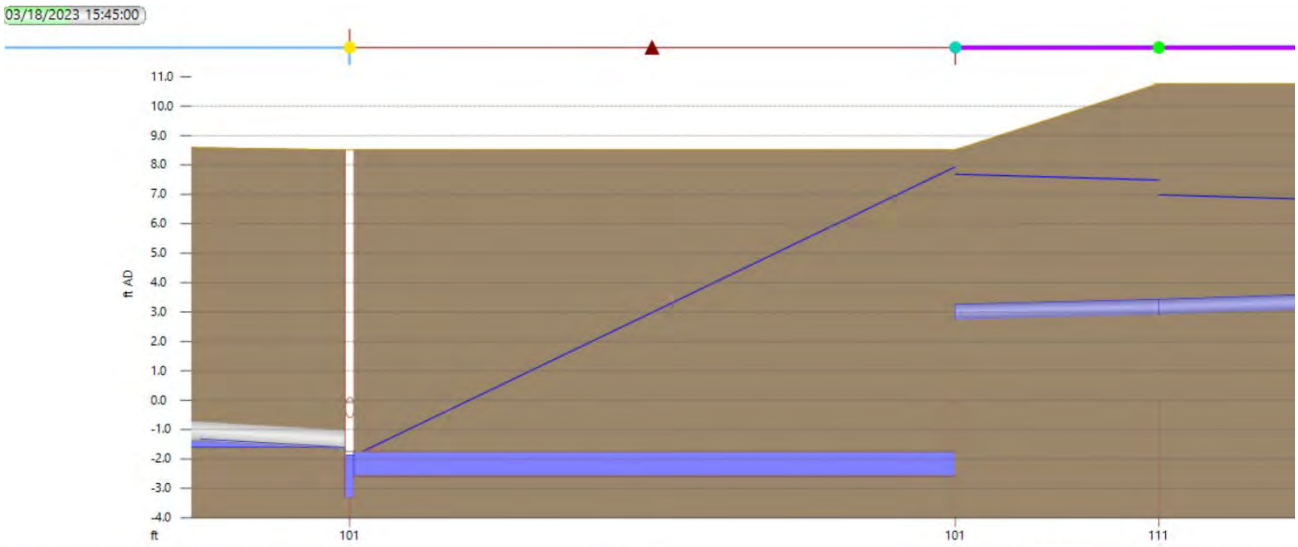
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.818	0.616	0.094			
Existing - WWF				-0.000	0.510	0.145
Future - WWF				-0.000	0.510	0.141



Bushard Lead Pump



Bushard Lag Pump



Link		7926.1	9997927.1	
width (in)			6.0	
us inv (ft AD)			2.750	
ds inv (ft AD)			2.920	
r.pfc (MGD)			-0.47	
surc		1.00	1.00	
US total head (ft AD)		-1.879	7.937	
US velocity (ft/s)		0.000	4.020	
DS flow (MGD)		0.5102	0.5101	
DS cumulative flow (US Mgal)		0.14799	0.14799	
DS total head (ft AD)		7.937	7.739	
DS velocity (ft/s)		0.000	4.020	
Node	7926		9997927	12079
ground (ft AD)	8.510		8.510	10.765
flood dep (ft)	-10.389		-0.573	-3.528

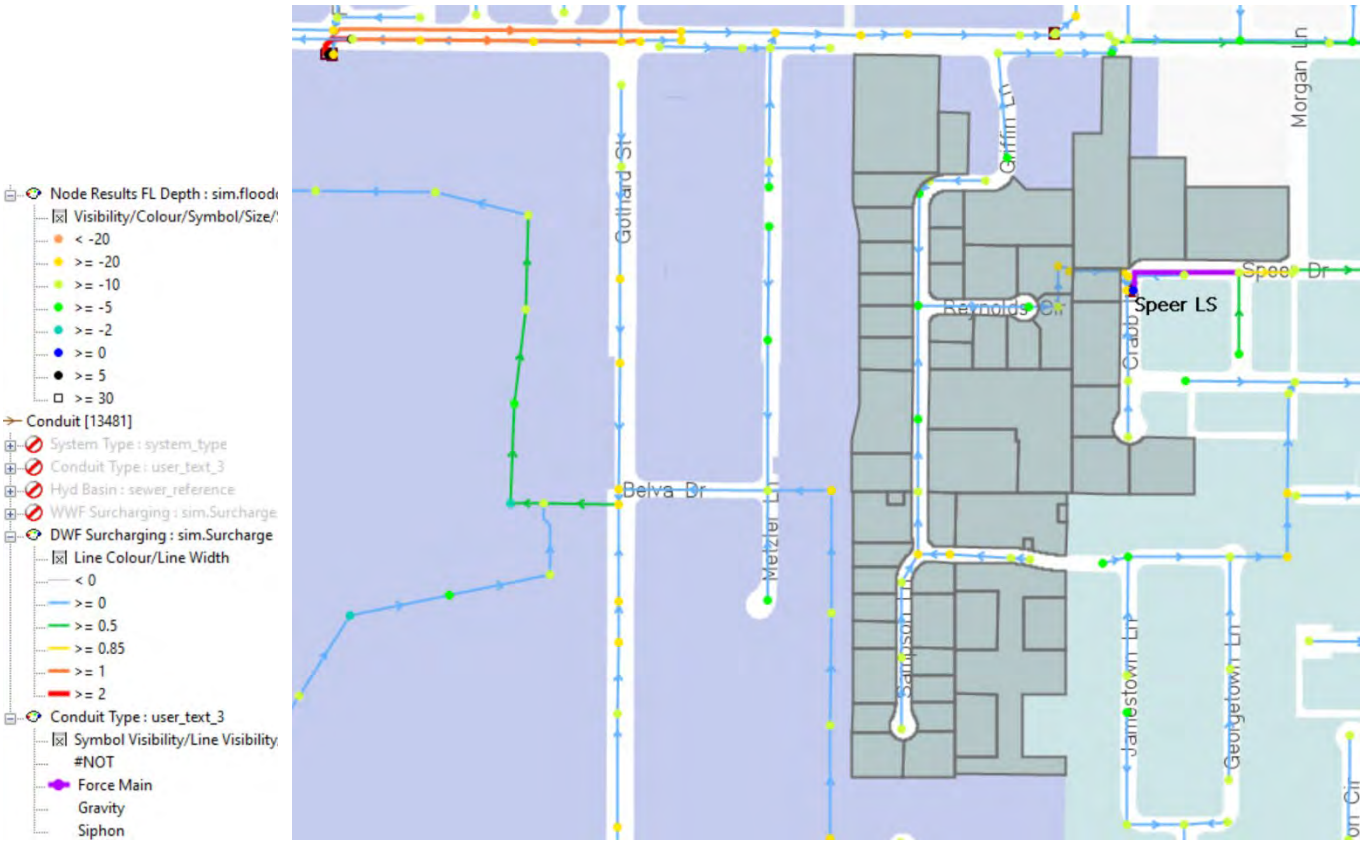
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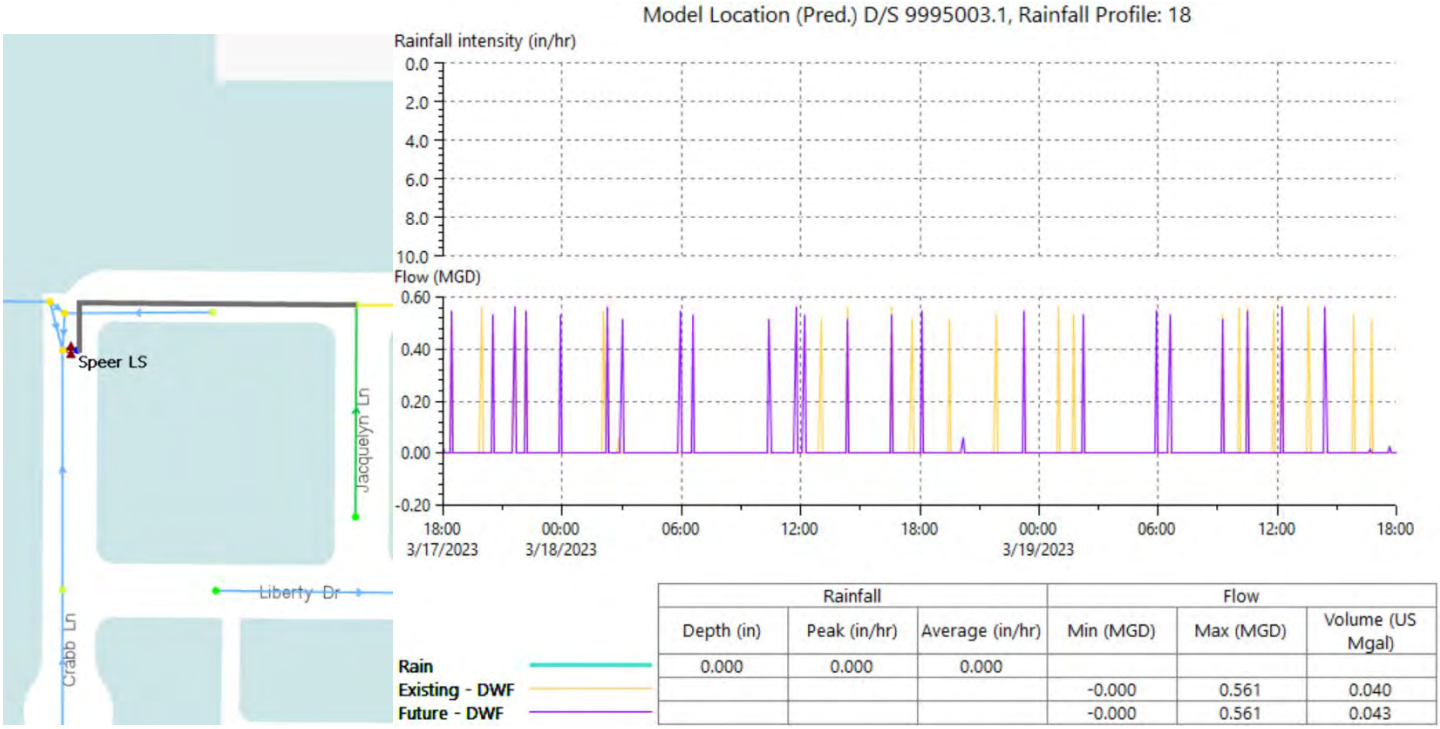


Link	7964.1	7926.1	-	12079.1	7929.1
width (in)	8.0		6.0	6.0	8.0
us inv (ft AD)	2.390		-	2.920	4.820
ds inv (ft AD)	-1.670		-	4.820	4.120
r.pfc (MGD)	1.56		-	-0.54	0.35
surc	0.10	1.00	-	1.00	0.51
US total head (ft AD)	2.458	-1.879	-	7.237	5.279
US velocity (ft/s)	0.075	0.000	-	4.019	2.776
DS flow (MGD)	0.0009	0.5102	-	0.5100	0.0723
DS cumulative flow (US Mgal)	0.00117	0.14799	-	0.14799	0.15859
DS total head (ft AD)	-1.602	7.937	-	5.571	4.327
DS velocity (ft/s)	0.075	0.000	-	4.019	1.738

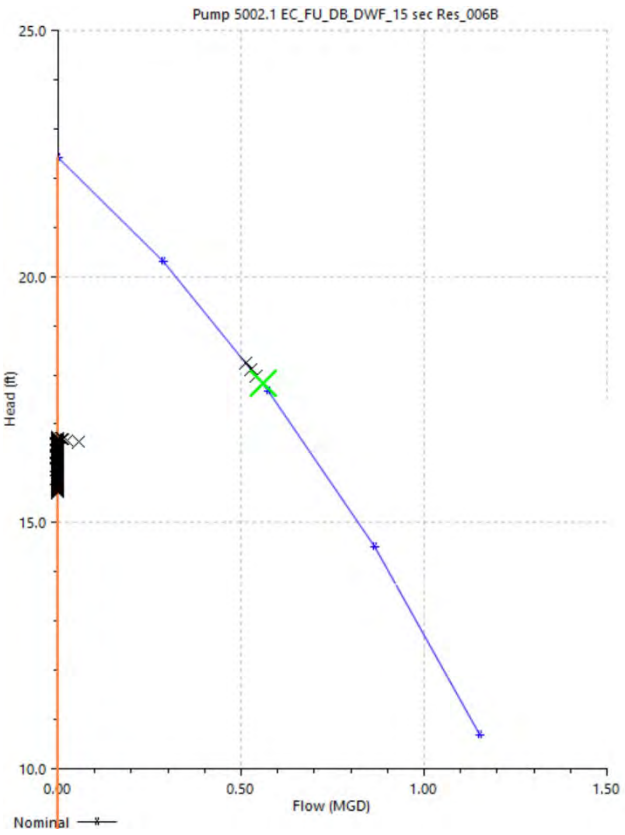
Node	7964	7926	-	12079	7929	8061
ground (ft AD)	9.589	8.510	8.510	10.765	10.700	9.888
flood dep (ft)	-7.132	-10.389	-0.573	-3.528	-5.540	-5.625

Speer LS - Design Basis – DWF

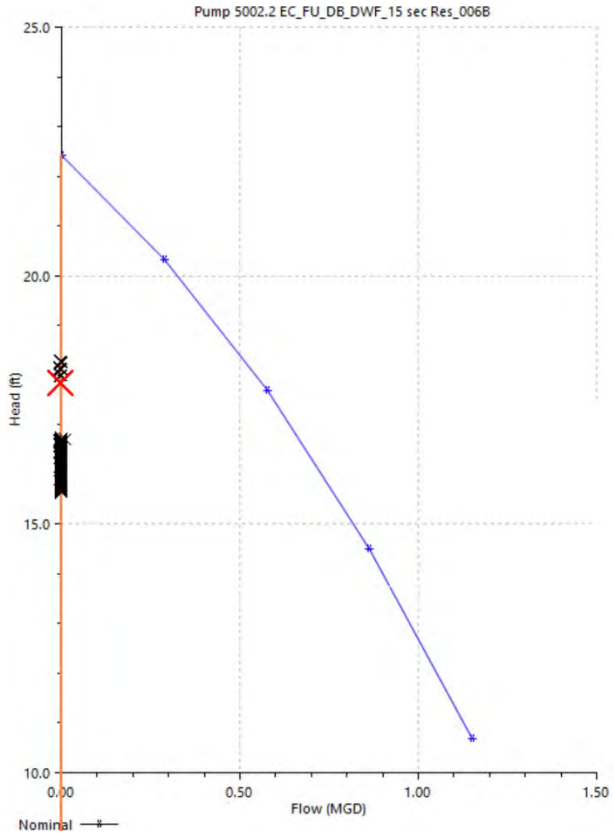




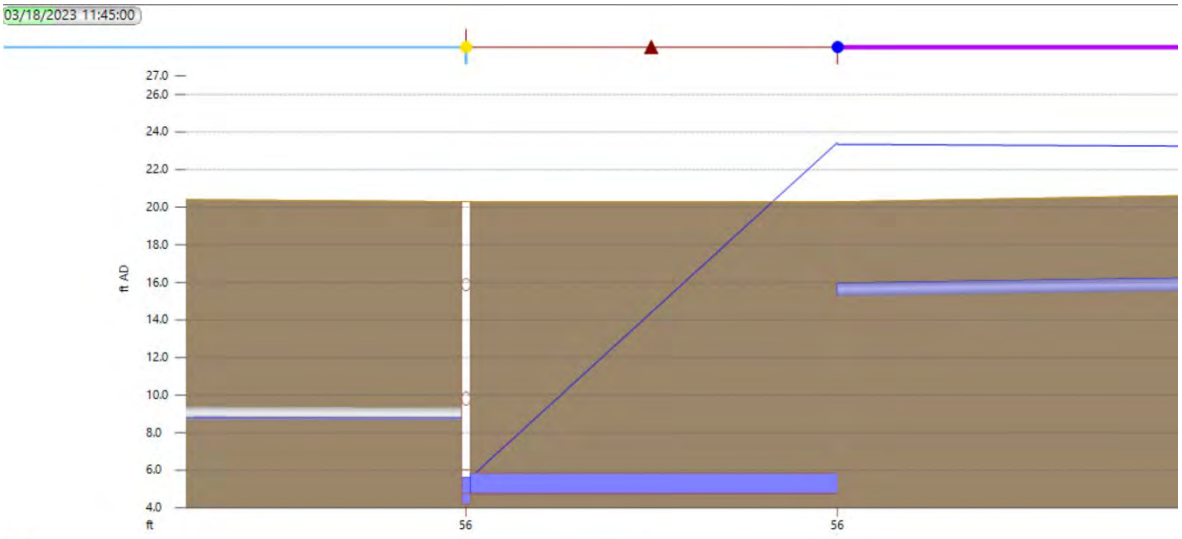
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.561	0.040
Future - DWF				-0.000	0.561	0.043



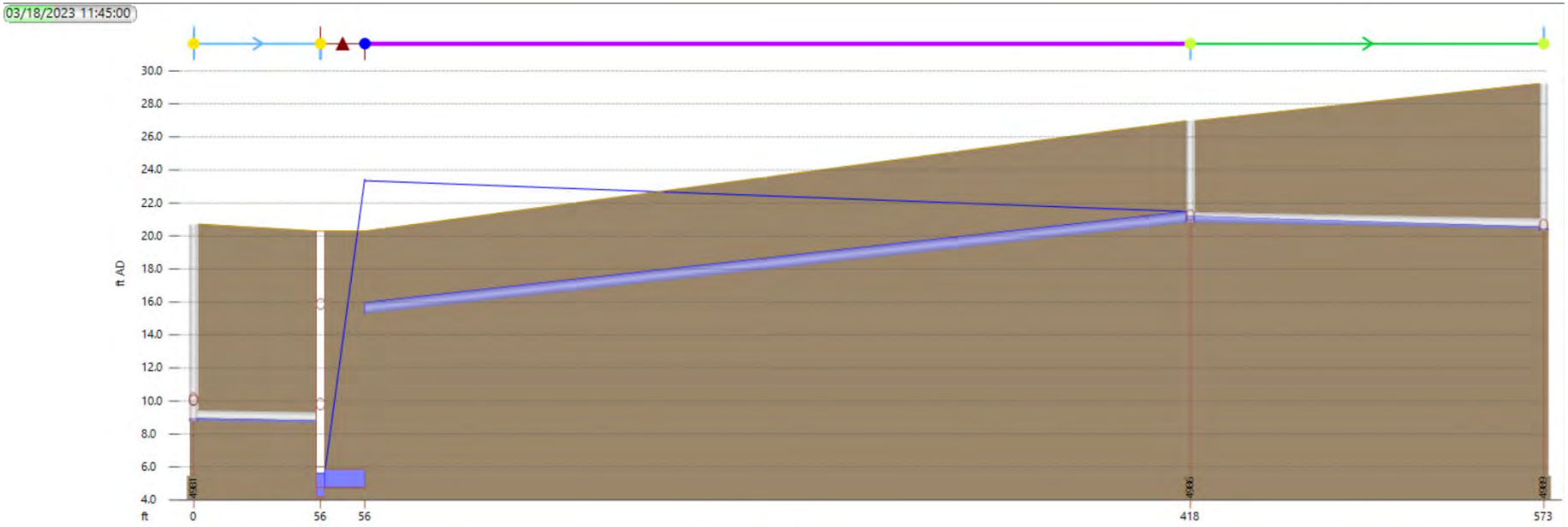
Speer Lead Pump



Speer Lag Pump



Link		5002.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		5.614	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.5615	
DS cumulative flow (US Mgal)		0.03504	
DS total head (ft AD)		23.444	
DS velocity (ft/s)		0.000	
Node	5002		9995003
ground (ft AD)	20.297		20.290
flood dep (ft)	-14.684		3.154

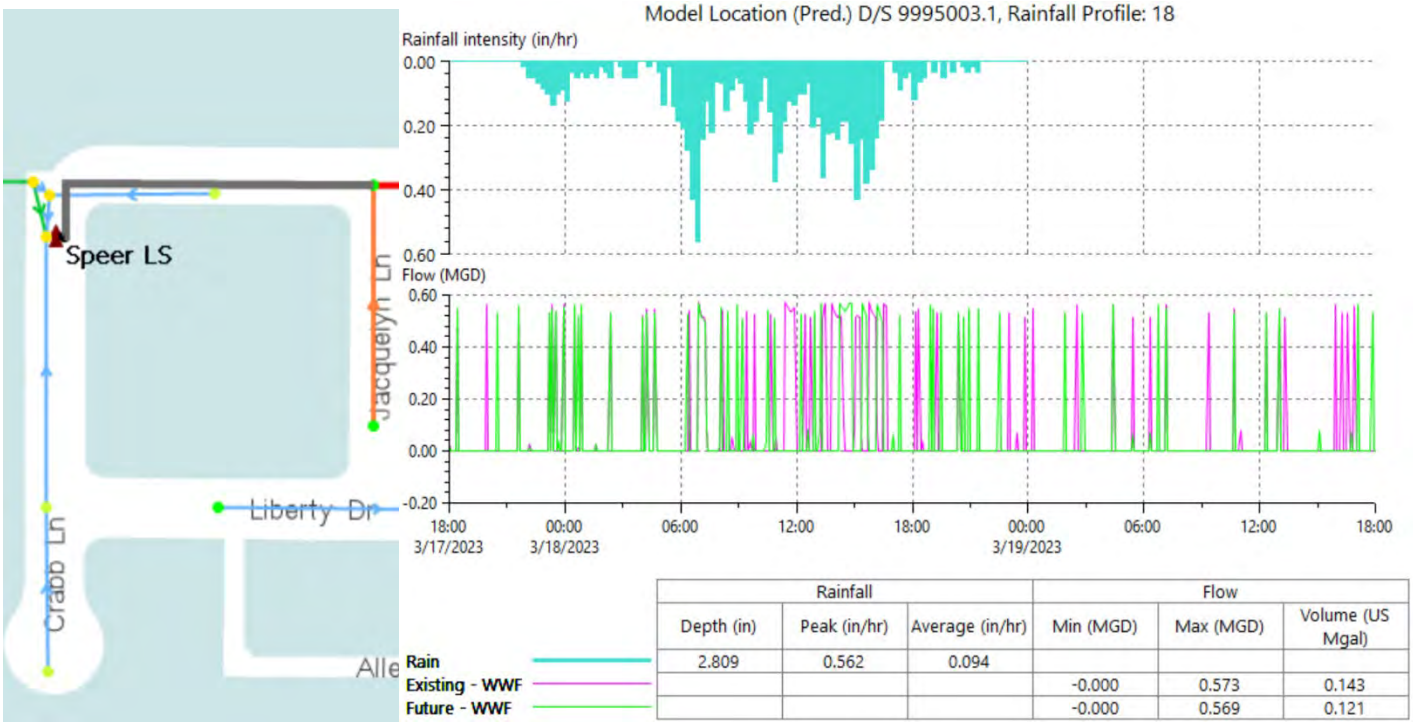


Link	4981.1	5002.1	9995003.1	4986.1
width (in)	8.0		8.0	8.0
us inv (ft AD)	8.800		15.290	20.810
ds inv (ft AD)	8.690		20.810	20.430
r.pfc (MGD)	0.35		-0.96	0.39
surc	0.19	1.00	1.00	0.56
US total head (ft AD)	8.931	5.614	23.444	21.332
US velocity (ft/s)	0.680	0.000	2.488	3.083
DS flow (MGD)	0.0197	0.5615	0.5614	0.0171
DS cumulative flow (US Mgal)	0.03080	0.03504	0.03504	0.05783
DS total head (ft AD)	8.805	23.444	21.573	20.540
DS velocity (ft/s)	0.891	0.000	2.488	0.817

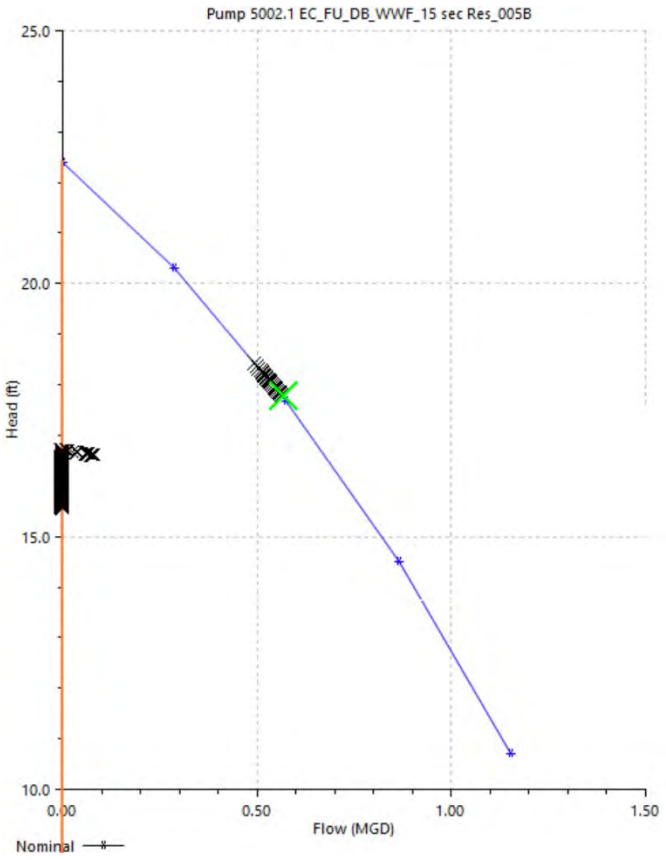
Node	4981	5002	9995003	4986	4989
ground (ft AD)	20.717	20.297	20.290	26.972	29.237
flood dep (ft)	-11.793	-14.684	3.154	-5.785	-8.794

Speer LS - Design Basis - 10 year 24 hour Storm

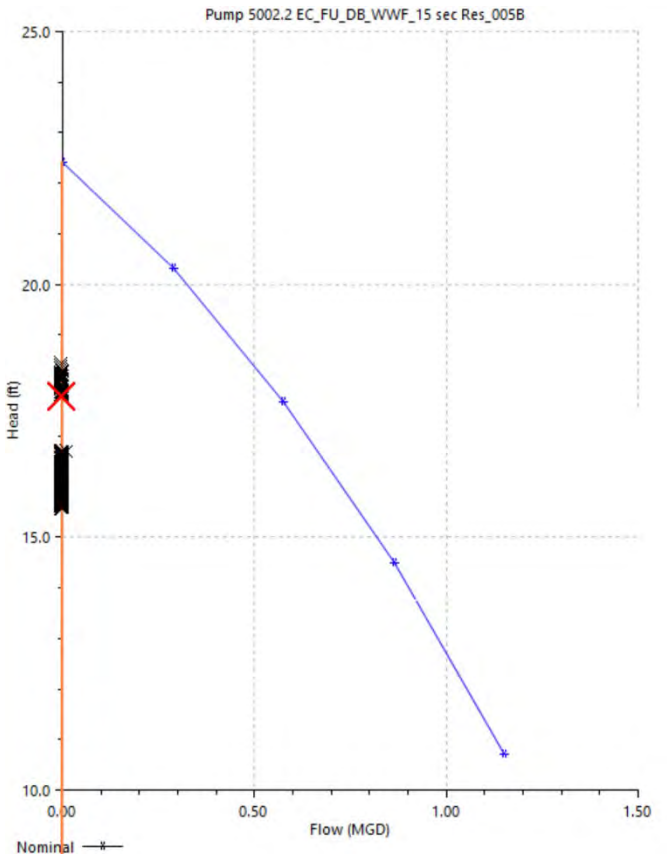




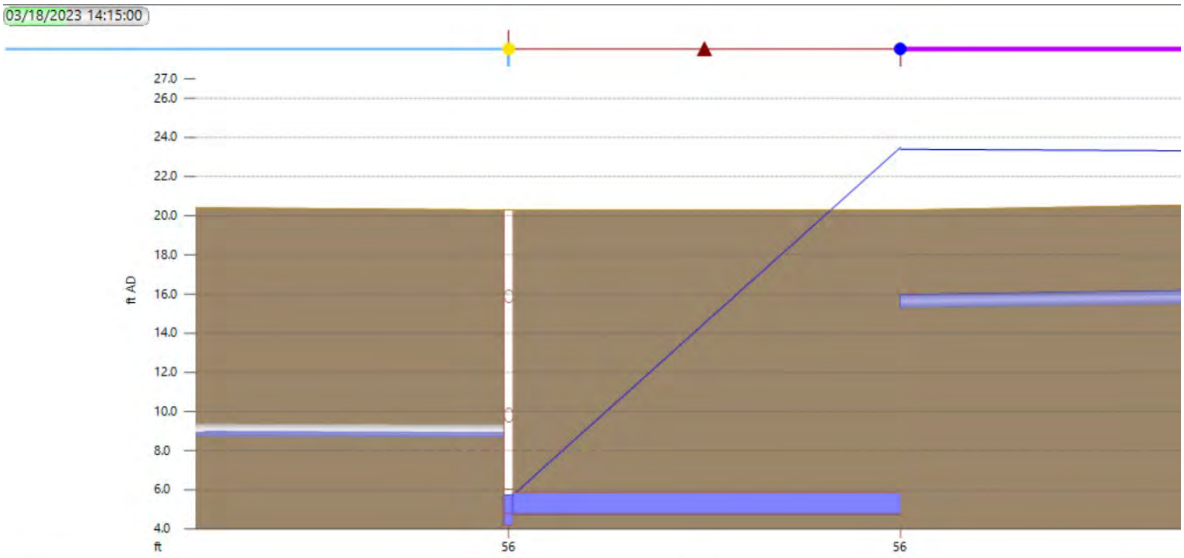
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.809	0.562	0.094			
Existing - WWF				-0.000	0.573	0.143
Future - WWF				-0.000	0.569	0.121



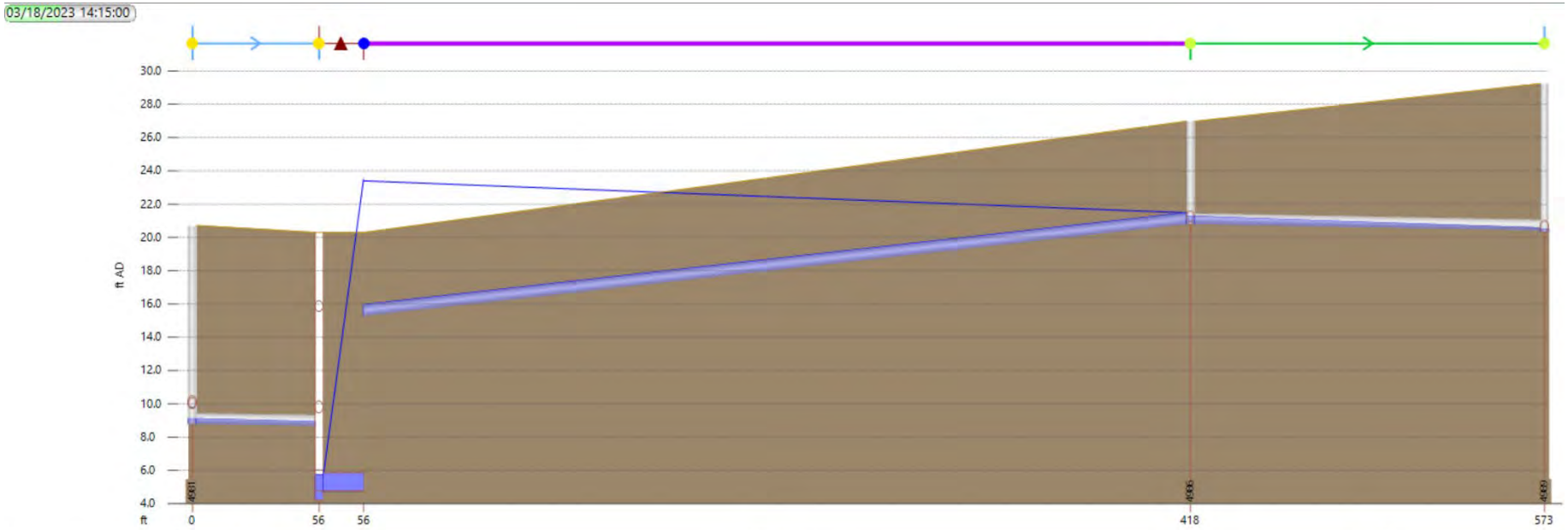
Speer Lead Pump



Speer Lag Pump



Link		5002.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		5.735	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.5690	
DS cumulative flow (US Mgal)		0.12247	
DS total head (ft AD)		23.498	
DS velocity (ft/s)		0.000	
Node	5002		9995003
ground (ft AD)	20.297		20.290
flood dep (ft)	-14.562		3.208

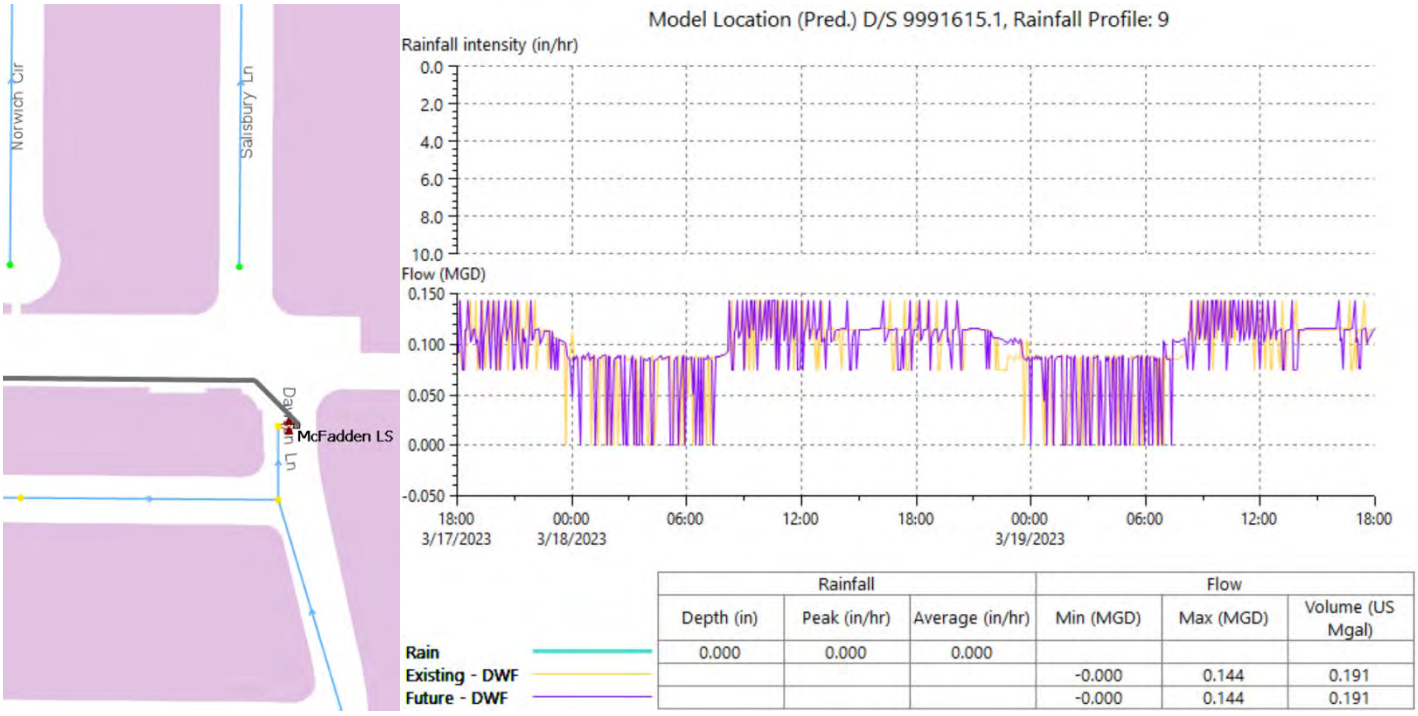


Link	4981.1	5002.1	9995003.1	4986.1
width (in)	8.0		8.0	8.0
us inv (ft AD)	8.800		15.290	20.810
ds inv (ft AD)	8.690		20.810	20.430
r.pfc (MGD)	0.35		-0.96	0.39
surc	0.46	1.00	1.00	0.67
US total head (ft AD)	9.145	5.735	23.498	21.396
US velocity (ft/s)	1.579	0.000	2.522	2.977
DS flow (MGD)	0.1601	0.5690	0.5690	0.0451
DS cumulative flow (US Mgal)	0.10910	0.12247	0.12247	0.15166
DS total head (ft AD)	9.004	23.498	21.575	20.593
DS velocity (ft/s)	2.256	0.000	2.522	1.450

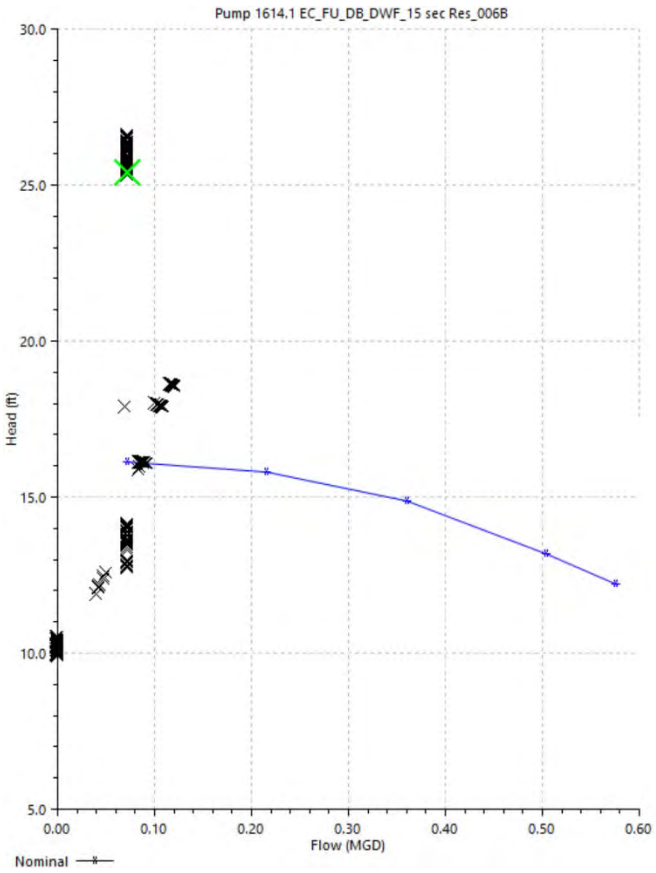
Node	4981	5002	9995003	4986	4989
ground (ft AD)	20.717	20.297	20.290	26.972	29.237
flood dep (ft)	-11.611	-14.562	3.208	-5.708	-8.735

McFadden LS - Design Basis - DWF

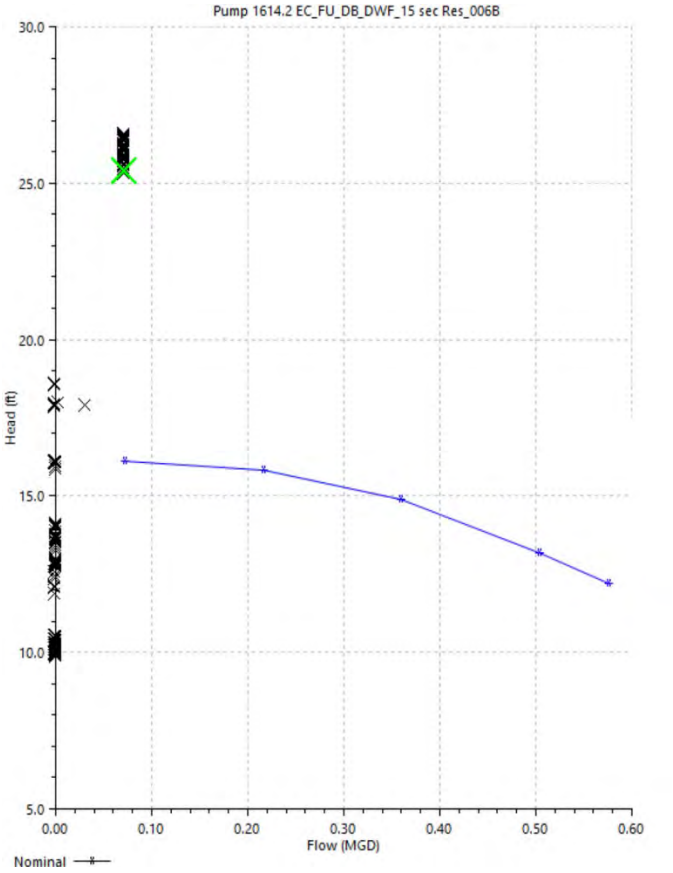




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.144	0.191
Future - DWF				-0.000	0.144	0.191



McFadden Lead Pump

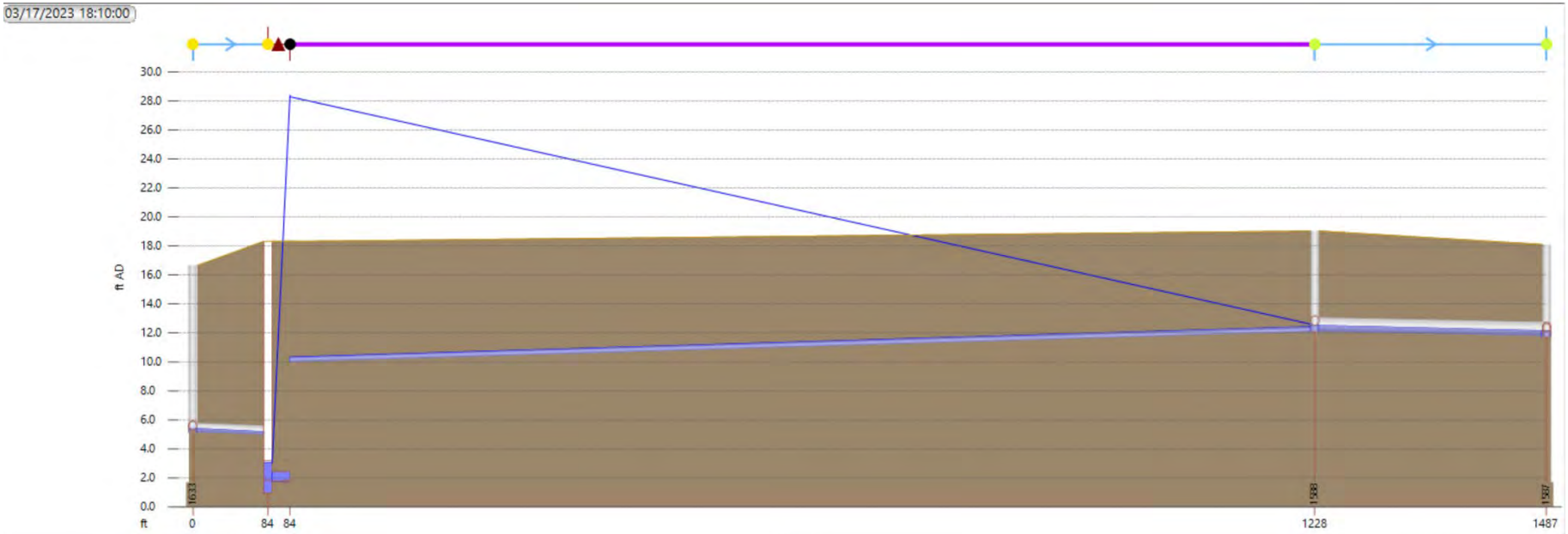


McFadden Lag Pump



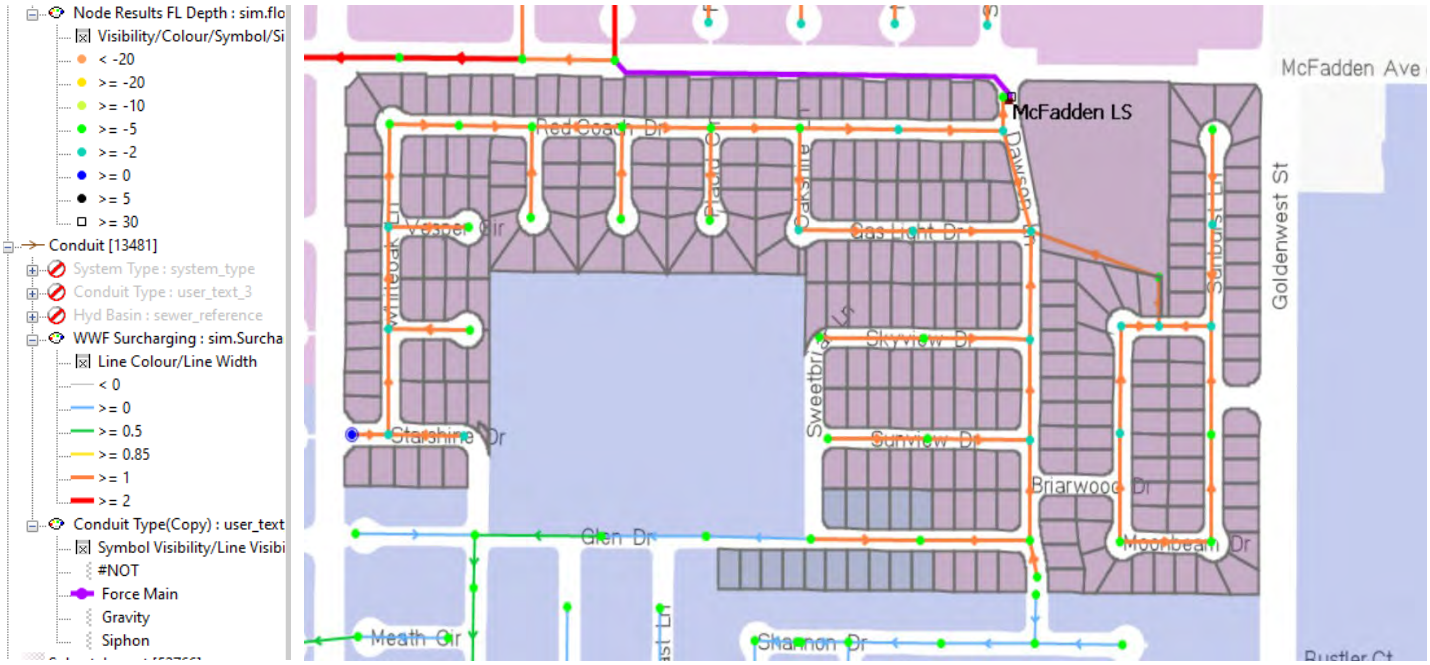
Link		1614.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		3.032	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.0720	
DS cumulative flow (US Mgal)		0.16323	
DS total head (ft AD)		28.388	
DS velocity (ft/s)		0.000	
Node	1614		9991615
ground (ft AD)	18.310		18.310
flood dep (ft)	-15.278		10.078

03/17/2023 18:10:00

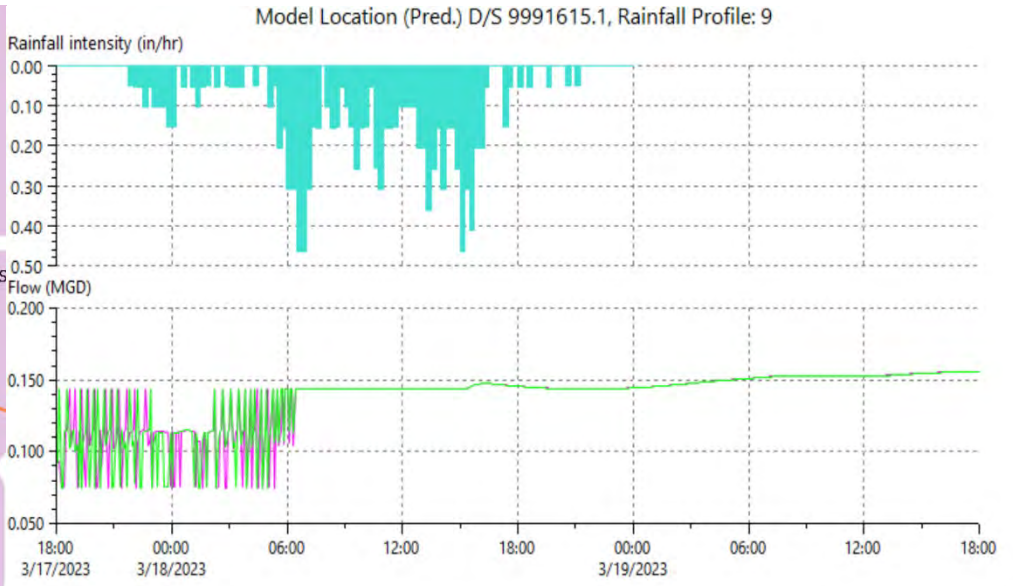


Link	1633.1	-	9991615.1					1588.1		
width (in)	8.0		4.0					12.0		
us inv (ft AD)	5.160		10.000					12.110		
ds inv (ft AD)	4.990		12.100					11.800		
r.pfc (MGD)	0.35		-0.05					0.80		
surc	0.37	-	1.00					0.40		
US total head (ft AD)	5.436	-	28.388					12.545		
US velocity (ft/s)	1.310	-	2.553					1.497		
DS flow (MGD)	0.1009	-	0.1440					0.2366		
DS cumulative flow (US Mgal)	0.17970	-	0.17963					0.43670		
DS total head (ft AD)	5.236	-	12.713					12.183		
DS velocity (ft/s)	1.941	-	2.553					1.510		
Node	-	1614	9991615					1588		1587
ground (ft AD)	-	18.310	18.310					19.026		18.105
flood dep (ft)	-	-	10.078					-6.516		-5.957

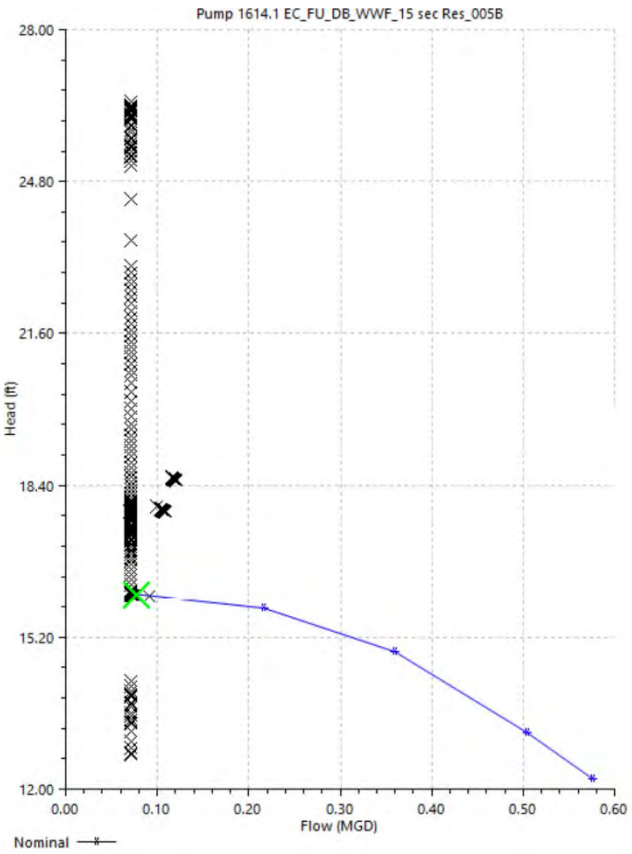
McFadden LS - Design Basis - 10 year 24 hour Storm



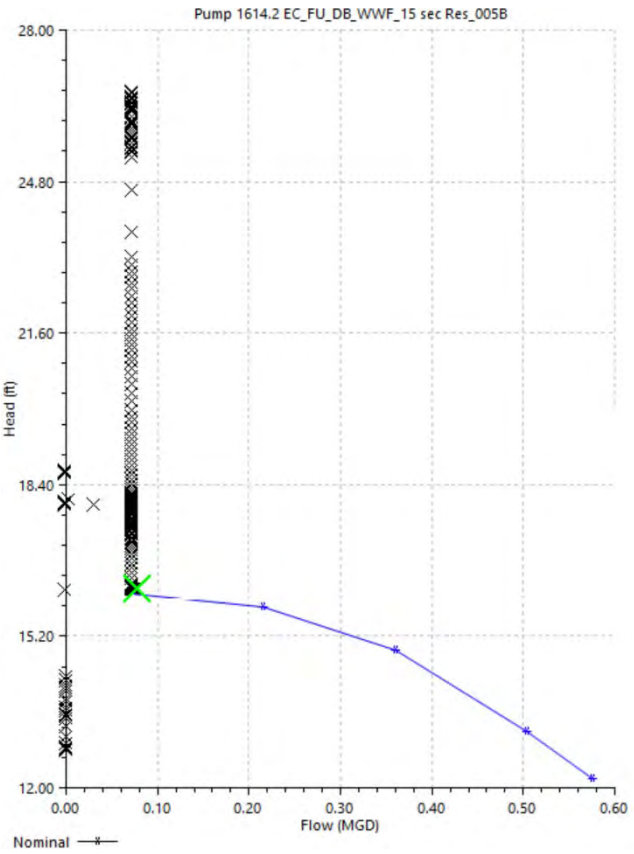




Rainfall			Flow		
Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
2.793	0.464	0.093			
			0.075	0.156	0.277
			0.074	0.156	0.276



McFadden Lead Pump



McFadden Lag Pump



Link		1614.1	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc		1.00	
US total head (ft AD)		15.130	
US velocity (ft/s)		0.000	
DS flow (MGD)		0.0778	
DS cumulative flow (US Mgal)		0.15592	
DS total head (ft AD)		31.218	
DS velocity (ft/s)		0.000	
Node	1614		9991615
ground (ft AD)	18.310		18.310
flood dep (ft)	-3.180		12.908

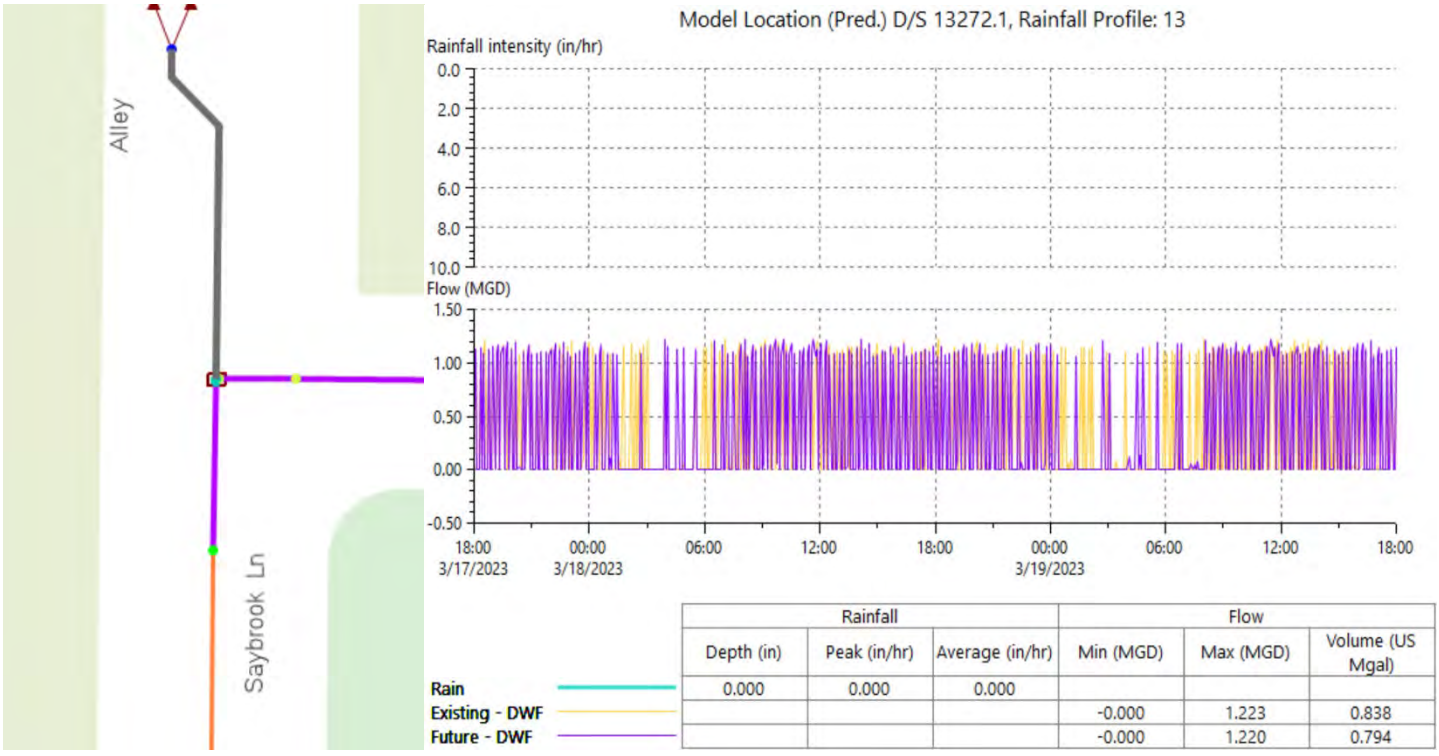


Link	1633.1	-	9991615.1		1588.1
width (in)	8.0		4.0		12.0
us inv (ft AD)	5.160		10.000		12.110
ds inv (ft AD)	4.990		12.100		11.800
r.pfc (MGD)	0.35		-0.05		0.80
surc	1.00	-	1.00		0.66
US total head (ft AD)	15.171	-	31.218		12.726
US velocity (ft/s)	0.495	-	2.758		1.534
DS flow (MGD)	0.1556	-	0.1556		0.4701
DS cumulative flow (US Mgal)	0.27374	-	0.27261		0.90419
DS total head (ft AD)	15.134	-	12.927		12.491
DS velocity (ft/s)	0.494	-	2.758		1.314

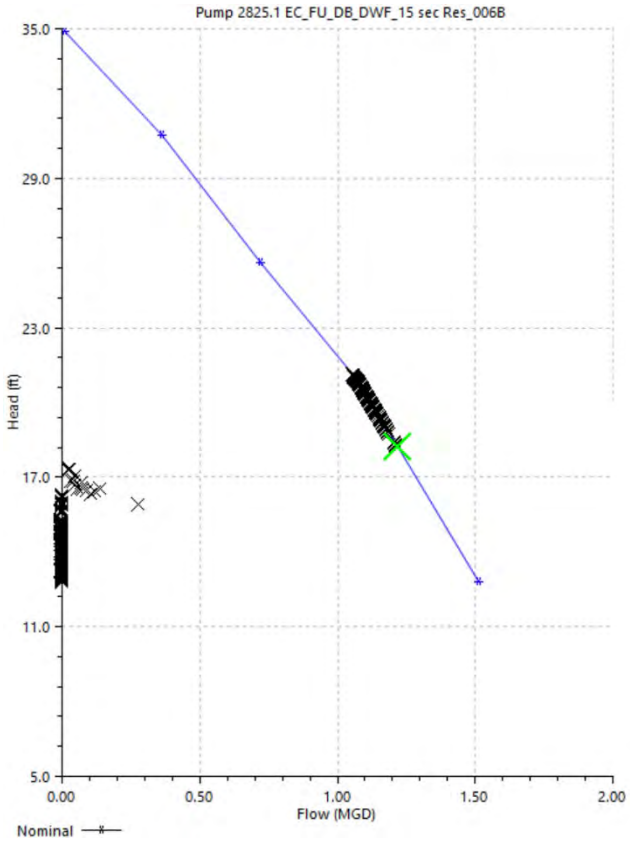
Node	1633	1614	9991615	1588	1587
ground (ft AD)	-	18.310	18.310	19.026	18.105
flood dep (ft)	-	-3.180	12.908	-6.336	-5.641

Saybrook LS - Design Basis - DWF

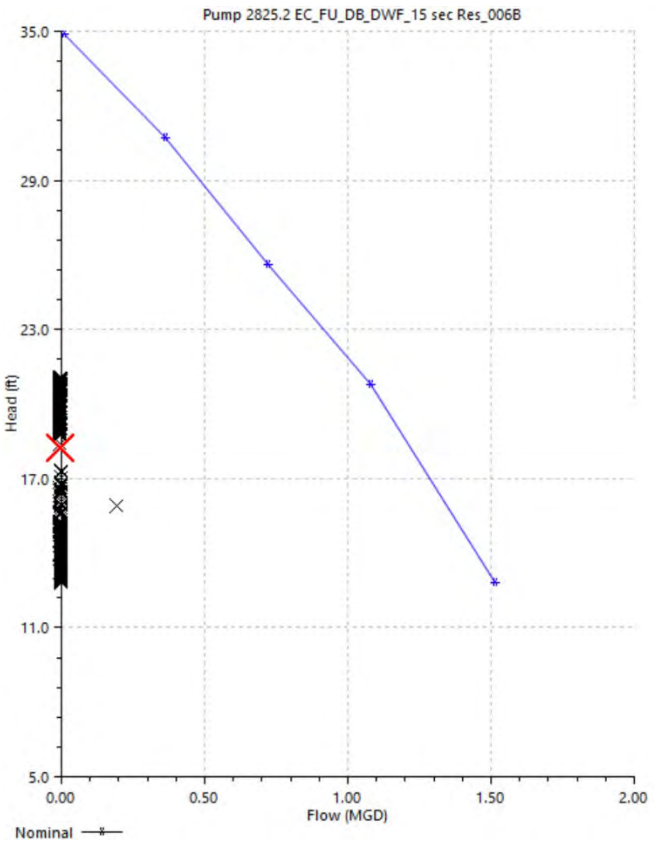




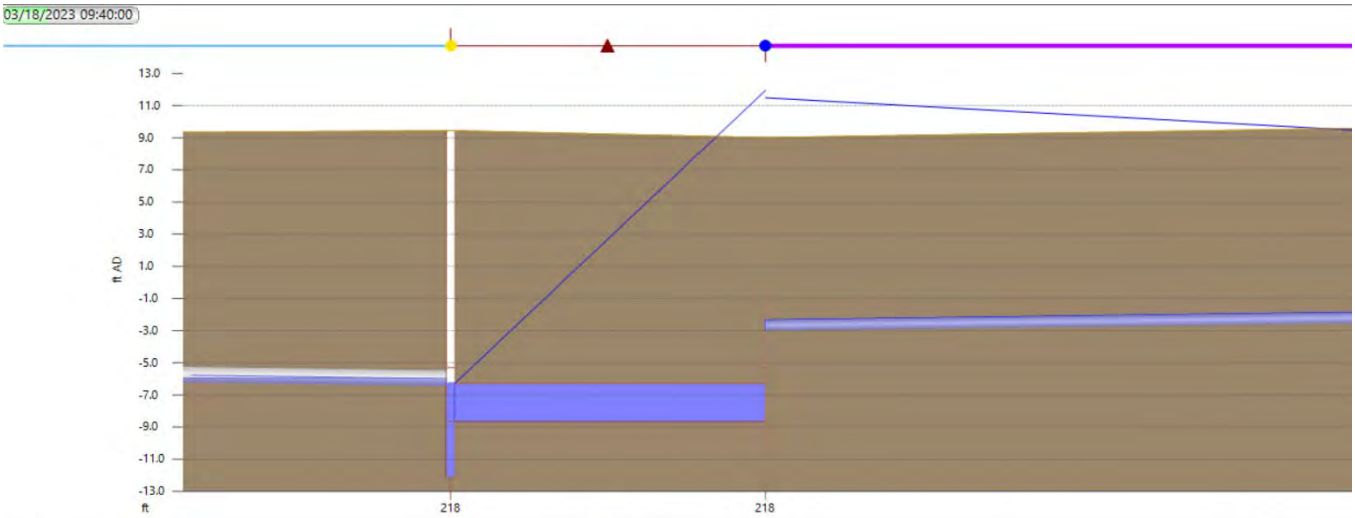
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	1.223	0.838
Future - DWF				-0.000	1.220	0.794



Saybrook Lead Pump

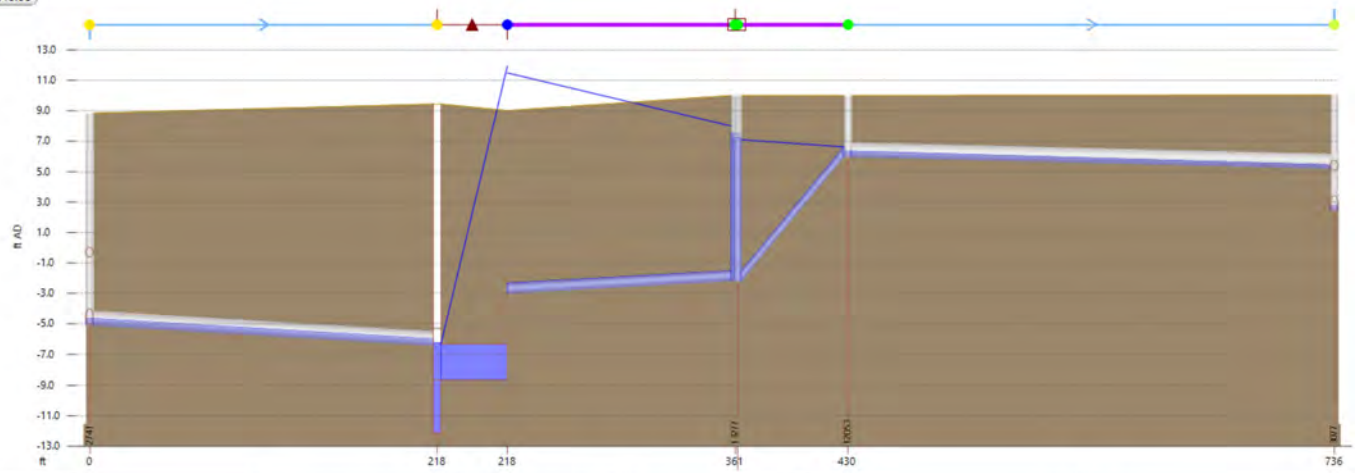


Saybrook Lag Pump



Link		2825.1		13272.1
width (in)				8.0
us inv (ft AD)				-3.000
ds inv (ft AD)				-2.181
r.pfc (MGD)				-0.59
surc		1.00		1.00
US total head (ft AD)		-6.272		11.939
US velocity (ft/s)		0.000		5.409
DS flow (MGD)		1.2204		1.2204
DS cumulative flow (US Mgal)		0.84335		0.84335
DS total head (ft AD)		11.940		8.447
DS velocity (ft/s)		0.000		5.409
Node	2825		13272	
ground (ft AD)	9.440		9.006	
flood dep (ft)	-15.712		2.933	

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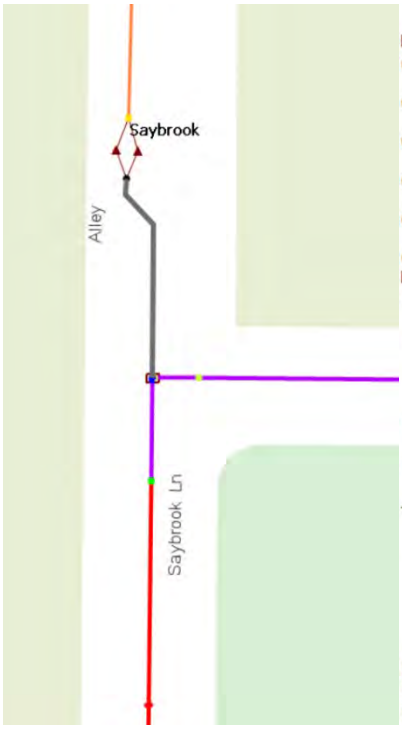


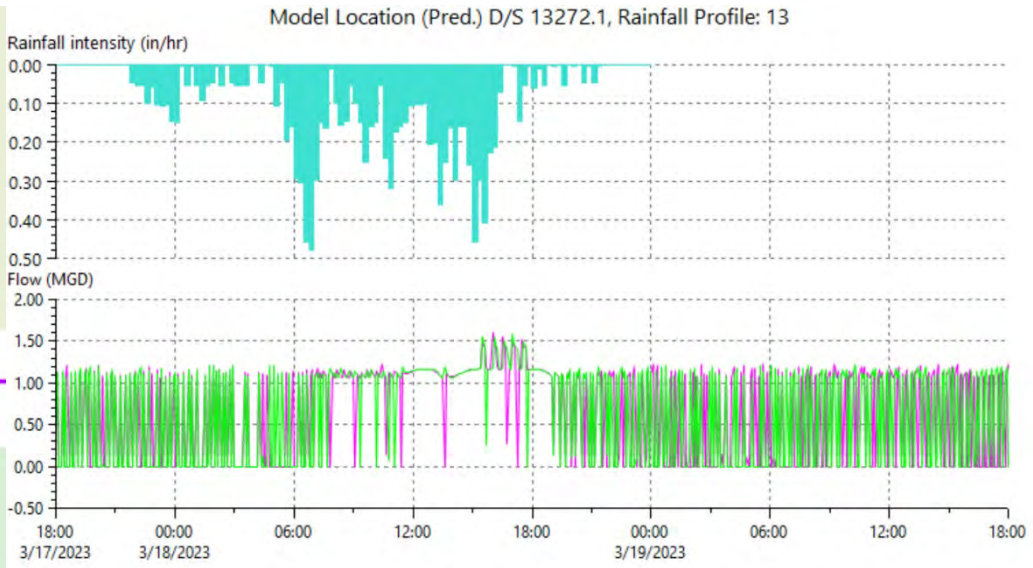
Link	2741.1	2825.1	13272.1	13276.1	12053.1
width (in)	12.0		8.0	8.0	12.0
us inv (ft AD)	-5.110		-3.000	-2.181	5.960
ds inv (ft AD)	-6.440		-2.181	5.960	5.200
r.pfc (MGD)	1.80		-0.59	-2.68	1.15
surc	0.45	1.00	1.00	1.00	0.39
US total head (ft AD)	-4.490	-6.272	11.939	7.229	6.504
US velocity (ft/s)	3.310	0.000	5.409	2.871	3.178
DS flow (MGD)	0.7329	1.2204	1.2204	0.6477	0.1875
DS cumulative flow (US Mgal)	0.84409	0.84335	0.84335	0.84312	0.84545
DS total head (ft AD)	-5.820	11.940	8.447	6.755	5.500
DS velocity (ft/s)	3.310	0.000	5.409	2.871	2.158

Node	2741	2825	13272	13277	13276	12053	3077
ground (ft AD)	8.848	9.440	9.006	10.000	10.000	9.999	10.033
flood dep (ft)	-13.507	-15.712	2.933	-2.462	-2.772	-3.652	-7.275

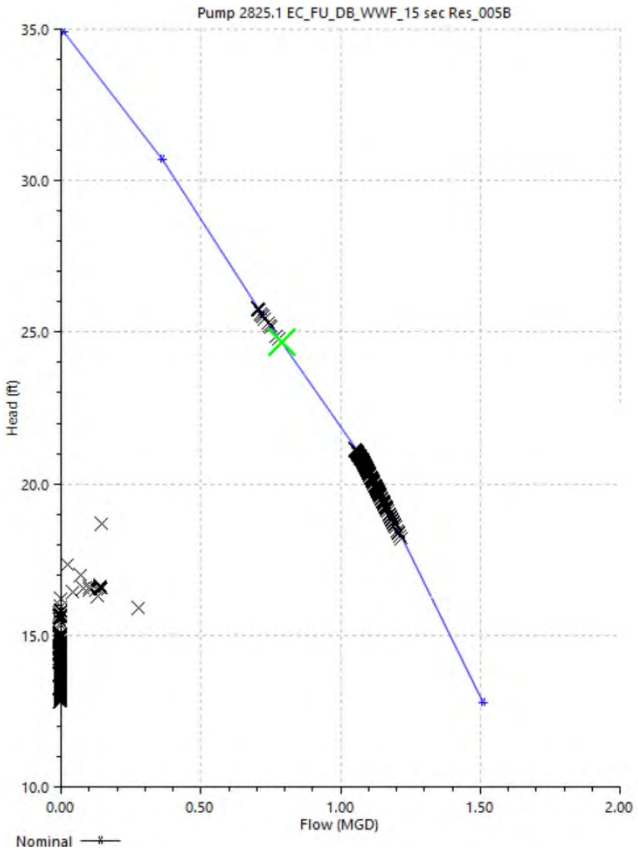
Saybrook LS - Design Basis - 10 year 24 hour Storm



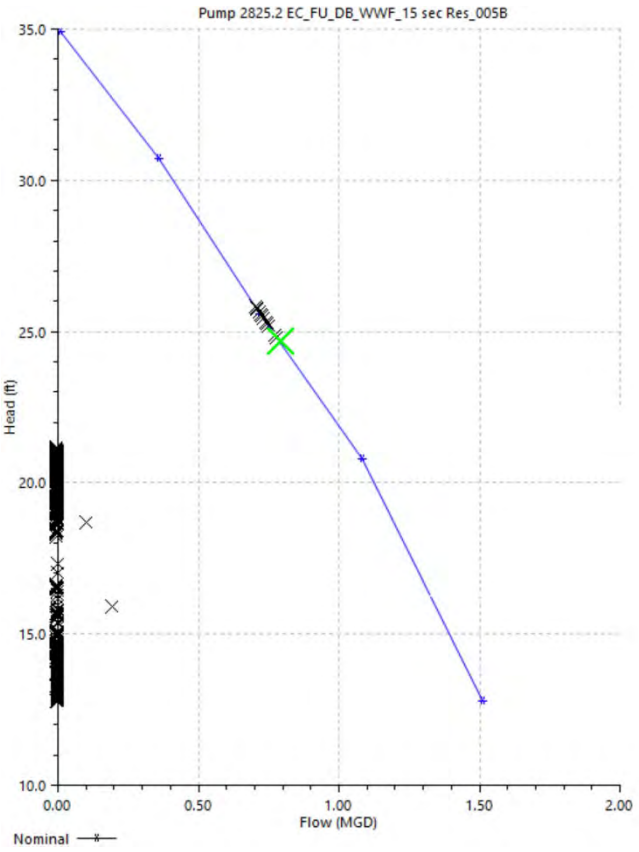




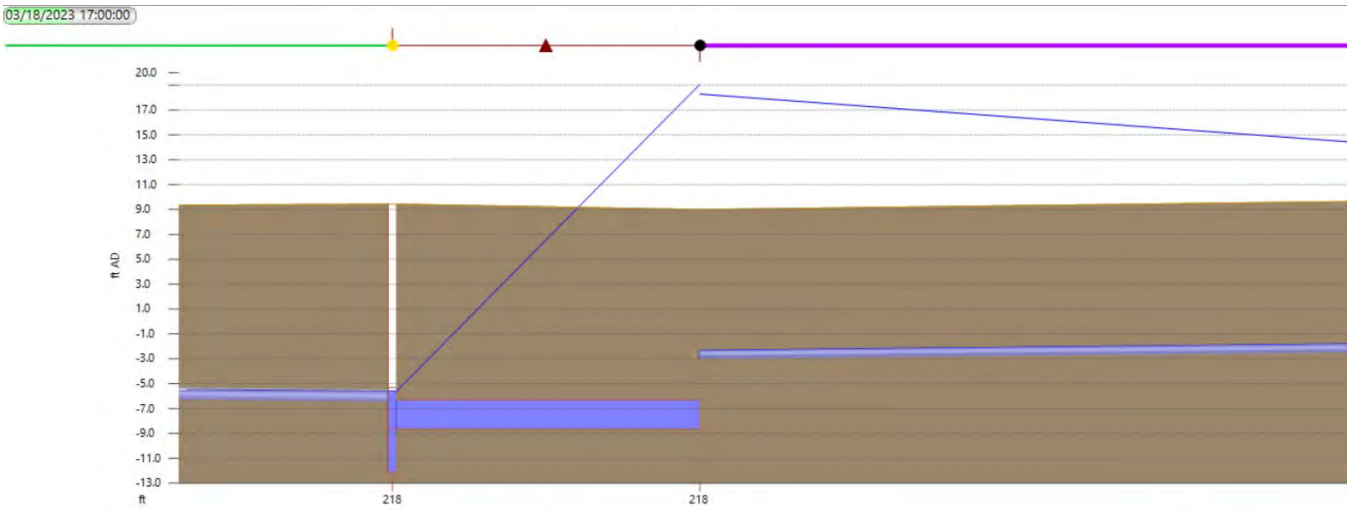
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.795	0.479	0.093			
Existing - WWF				-0.000	1.608	1.344
Future - WWF				-0.000	1.585	1.340



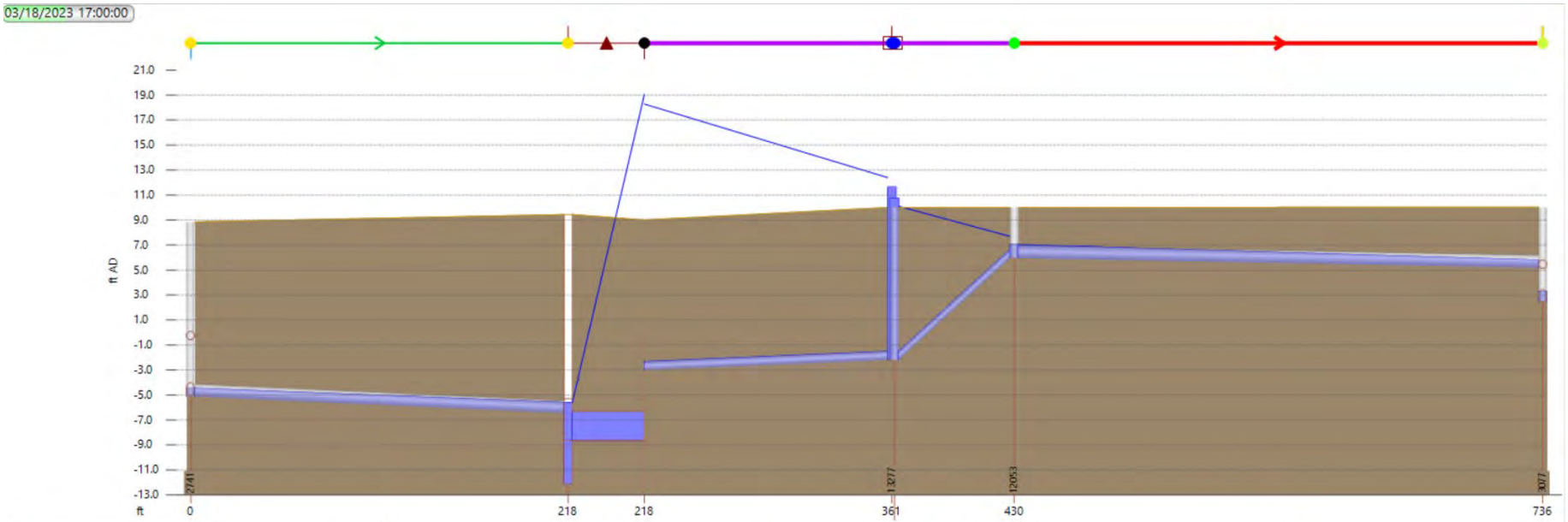
Saybrook Lead Pump



Saybrook Lag Pump



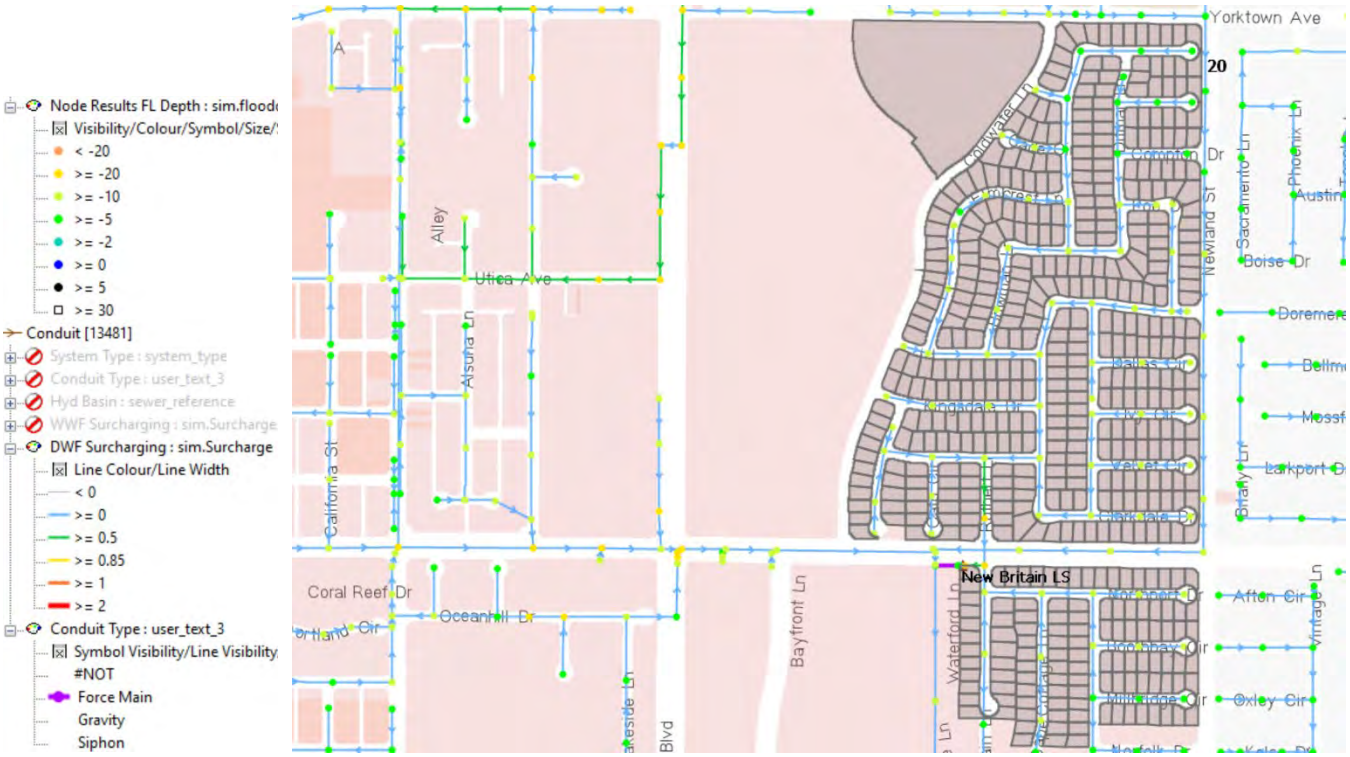
Link		2825.1		13272.1
width (in)				8.0
us inv (ft AD)				-3.000
ds inv (ft AD)				-2.181
r.pfc (MGD)				-0.59
surc		1.00		1.00
US total head (ft AD)		-5.595		19.053
US velocity (ft/s)		0.000		7.024
DS flow (MGD)		0.7924		1.5848
DS cumulative flow (US Mgal)		1.29059		1.32915
DS total head (ft AD)		19.053		13.165
DS velocity (ft/s)		0.000		7.024
Node	2825		13272	
ground (ft AD)	9.440		9.006	
flood dep (ft)	-15.035		10.047	

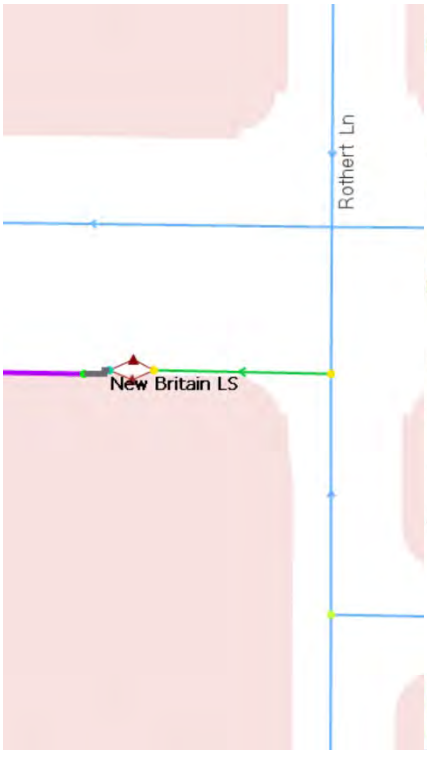


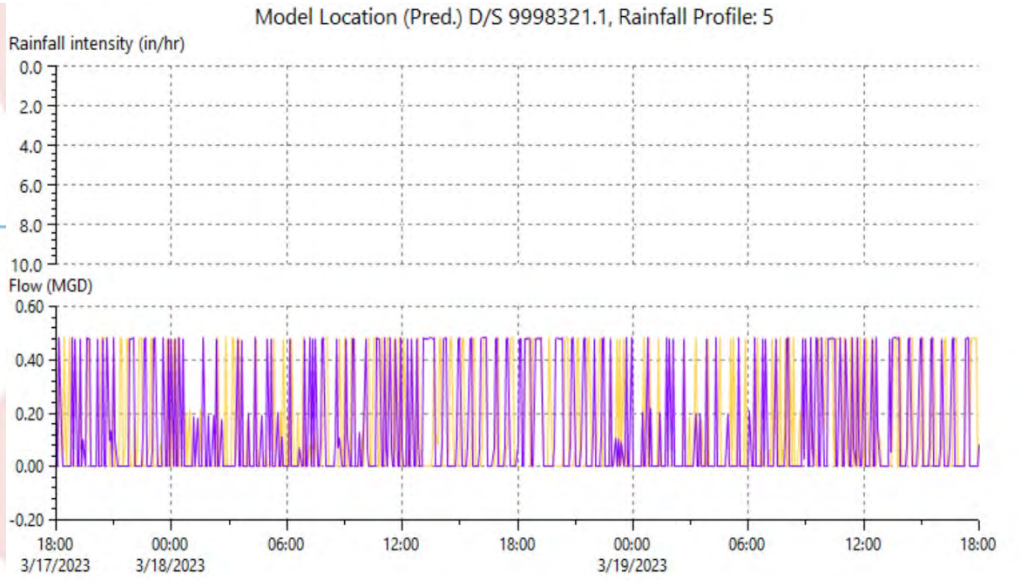
Link	2741.1	2825.1	13272.1	13276.1	12053.1
width (in)	12.0		8.0	8.0	12.0
us inv (ft AD)	-5.110		-3.000	-2.181	5.960
ds inv (ft AD)	-6.440		-2.181	5.960	5.200
r.pfc (MGD)	1.80		-0.59	-2.68	1.15
surc	0.85	1.00	1.00	1.00	2.00
US total head (ft AD)	-4.245	-5.595	19.053	10.759	7.144
US velocity (ft/s)	3.774	0.000	7.024	6.471	2.752
DS flow (MGD)	1.4516	0.7924	1.5848	1.4598	1.2655
DS cumulative flow (US Mgal)	1.32939	1.29059	1.32915	1.32921	1.32864
DS total head (ft AD)	-5.438	19.053	13.165	8.343	6.046
DS velocity (ft/s)	3.168	0.000	7.024	6.471	3.985

Node	2741	2825	13272	13277	13276	12053	3077
ground (ft AD)	8.848	9.440	9.006	10.000	10.000	9.999	10.033
flood dep (ft)	-13.307	-15.035	10.047	1.631	0.760	-2.957	-6.736

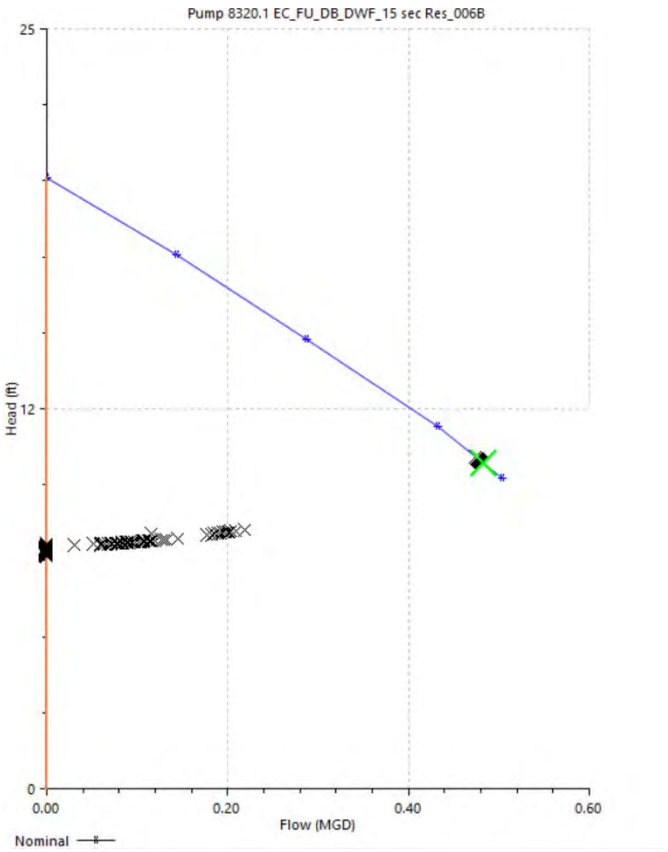
New Britain LS - Design Basis - DWF



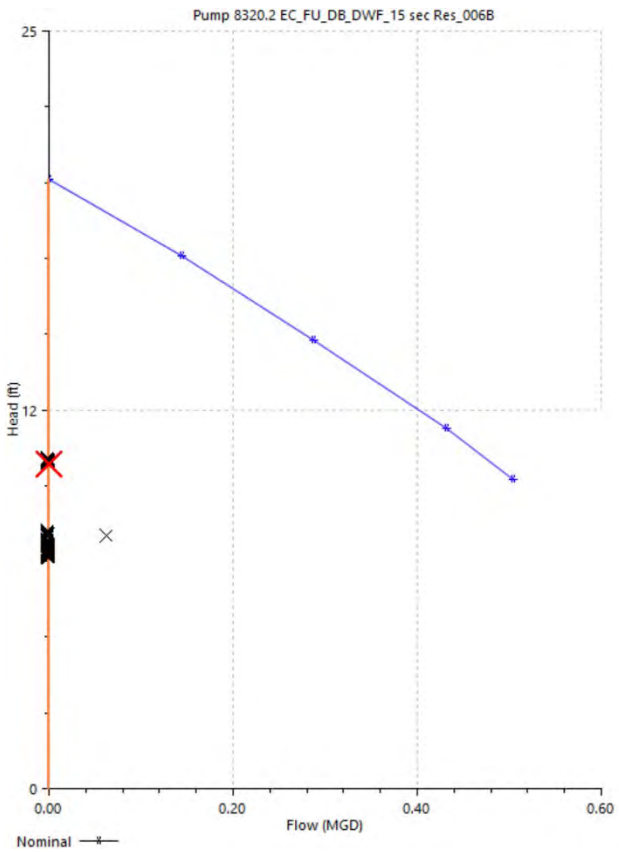




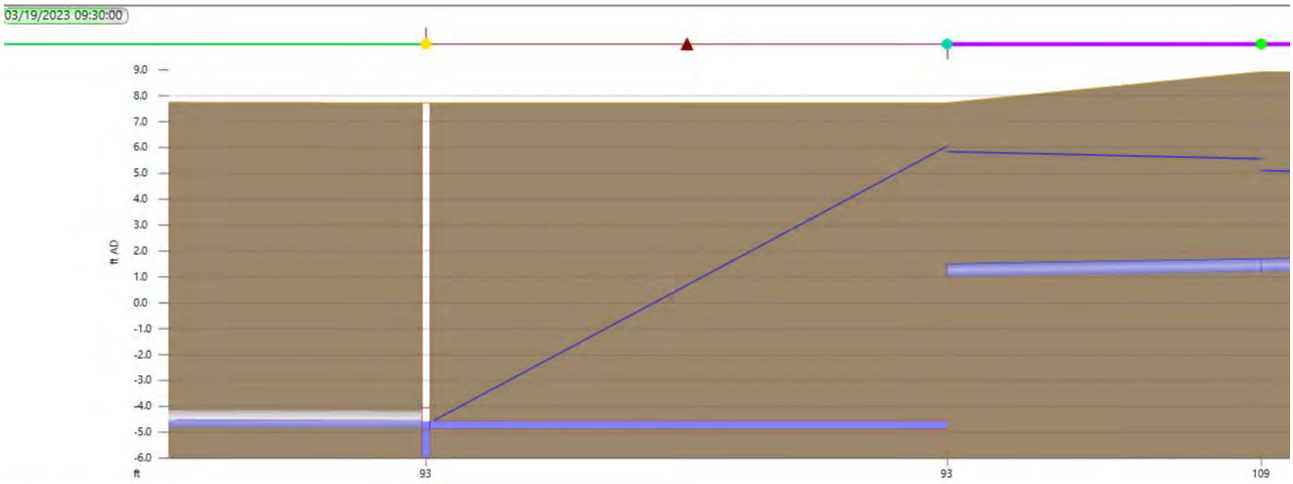
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.484	0.288
Future - DWF				-0.000	0.483	0.277



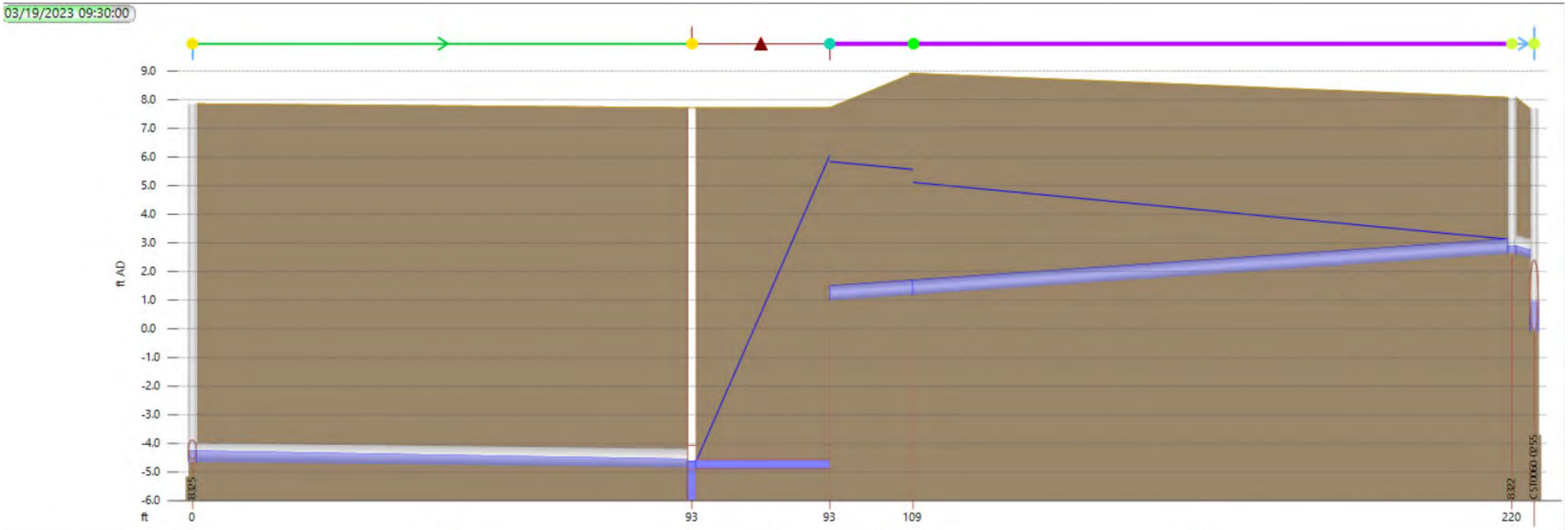
New Britain Lead Pump



New Britain Lag Pump



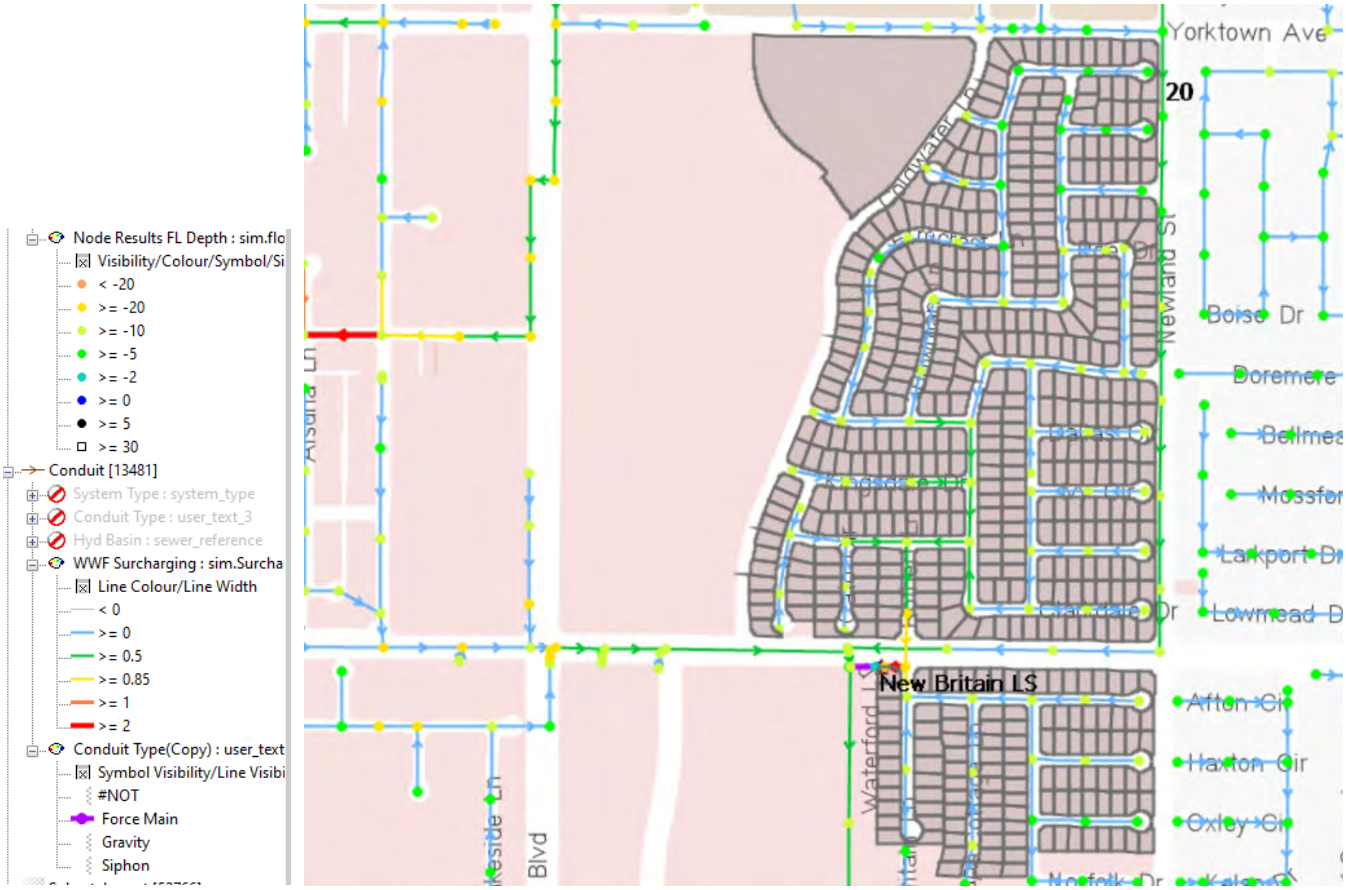
Link		8320.1		9998321.1	
width (in)				6.0	
us inv (ft AD)				1.000	
ds inv (ft AD)				1.199	
r.pfc (MGD)				-0.41	
surc		1.00		1.00	
US total head (ft AD)		-4.620		6.066	
US velocity (ft/s)		0.000		3.810	
DS flow (MGD)		0.4834		0.4834	
DS cumulative flow (US Mgal)		0.30723		0.30723	
DS total head (ft AD)		6.066		5.790	
DS velocity (ft/s)		0.000		3.810	
Node	8320		9998321		12077
ground (ft AD)	7.720		7.720		8.922
flood dep (ft)	-12.340		-1.654		-3.583

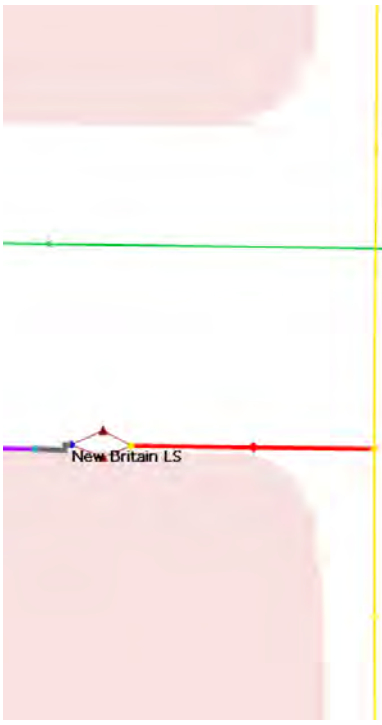


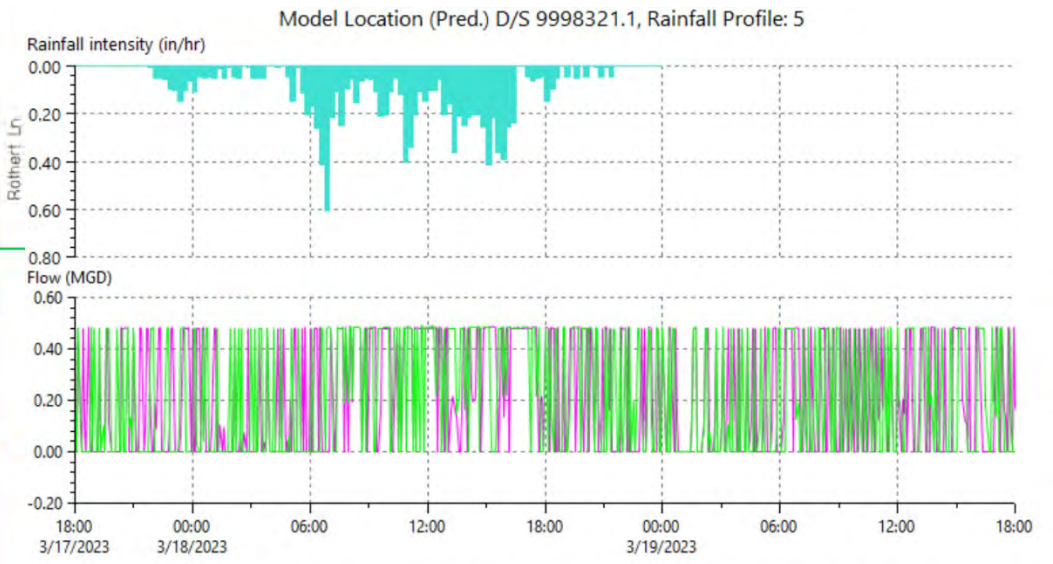
Link	8325.1	8320.1	9998321.1	12077.1	-
width (in)	8.0		6.0	6.0	8.0
us inv (ft AD)	-4.640		1.000	1.199	-
ds inv (ft AD)	-4.830		1.199	2.630	-
r.pfc (MGD)	0.35		-0.41	-0.41	-
surc	0.56	1.00	1.00	1.00	-
US total head (ft AD)	-4.221	-4.620	6.066	5.339	-
US velocity (ft/s)	1.679	0.000	3.810	3.810	-
DS flow (MGD)	0.2259	0.4834	0.4834	0.4834	-
DS cumulative flow (US Mgal)	0.30722	0.30723	0.30723	0.30723	-
DS total head (ft AD)	-4.452	6.066	5.790	3.355	-
DS velocity (ft/s)	2.523	0.000	3.810	3.810	-

Node	8325	8320	9998321	12077	8322
ground (ft AD)	7.856	7.720	7.720	8.922	8.082
flood dep (ft)	-12.121	-12.340	-1.654	-3.583	-5.187

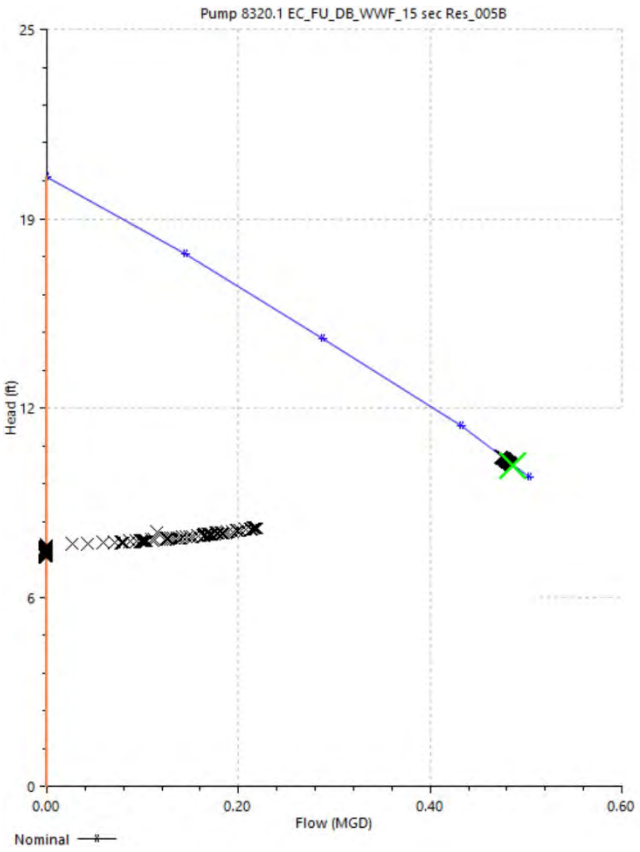
New Britain LS - Design Basis - 10 year 24 hour Storm



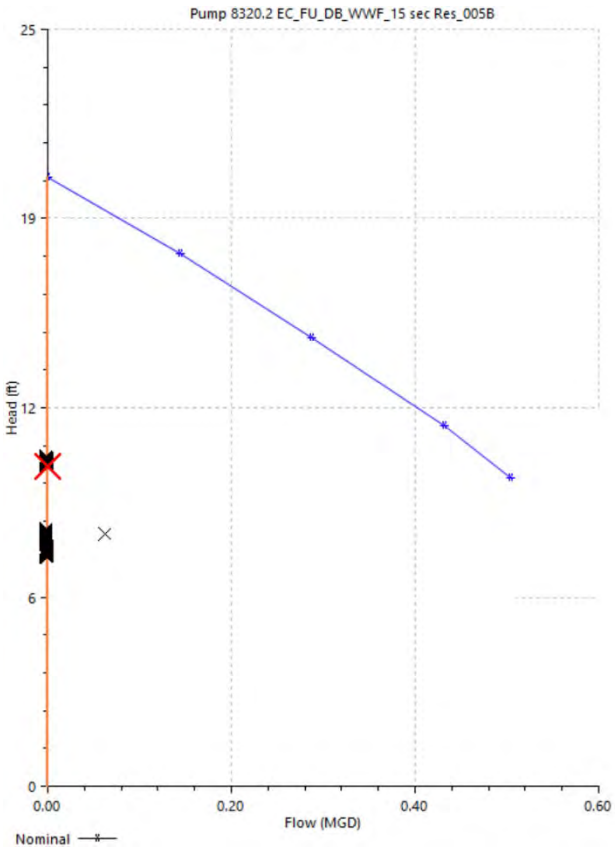




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.816	0.604	0.094			
Existing - WWF				-0.000	0.487	0.453
Future - WWF				-0.000	0.488	0.444



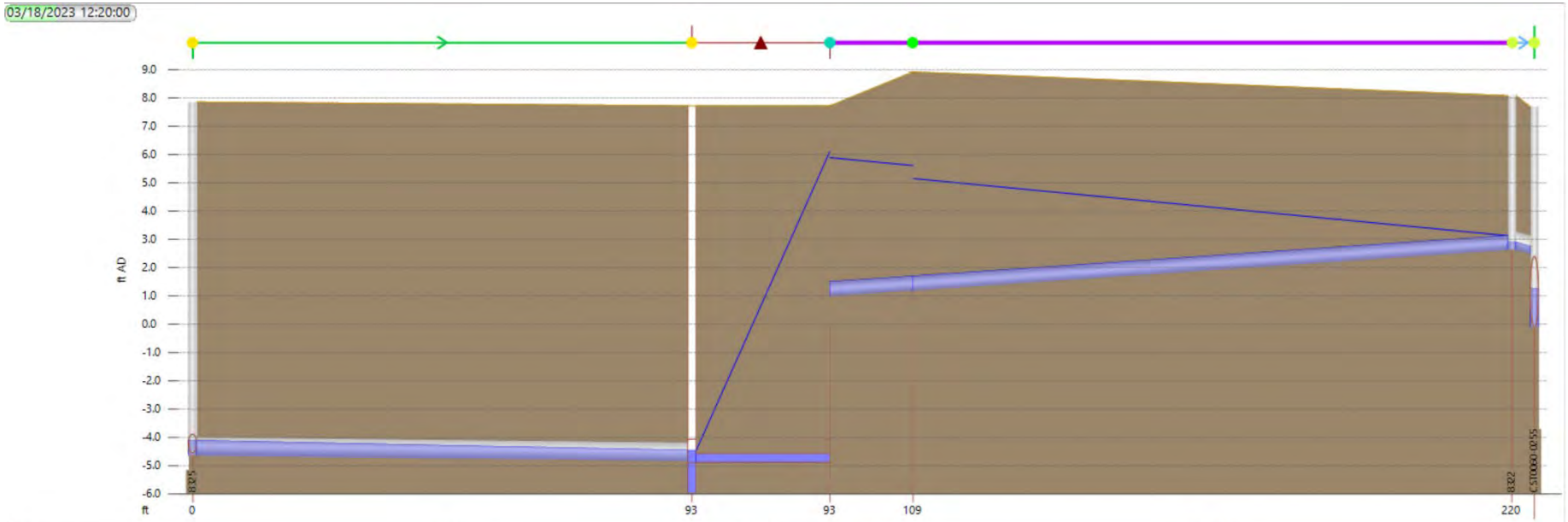
New Britain Lead Pump



New Britain Lag Pump

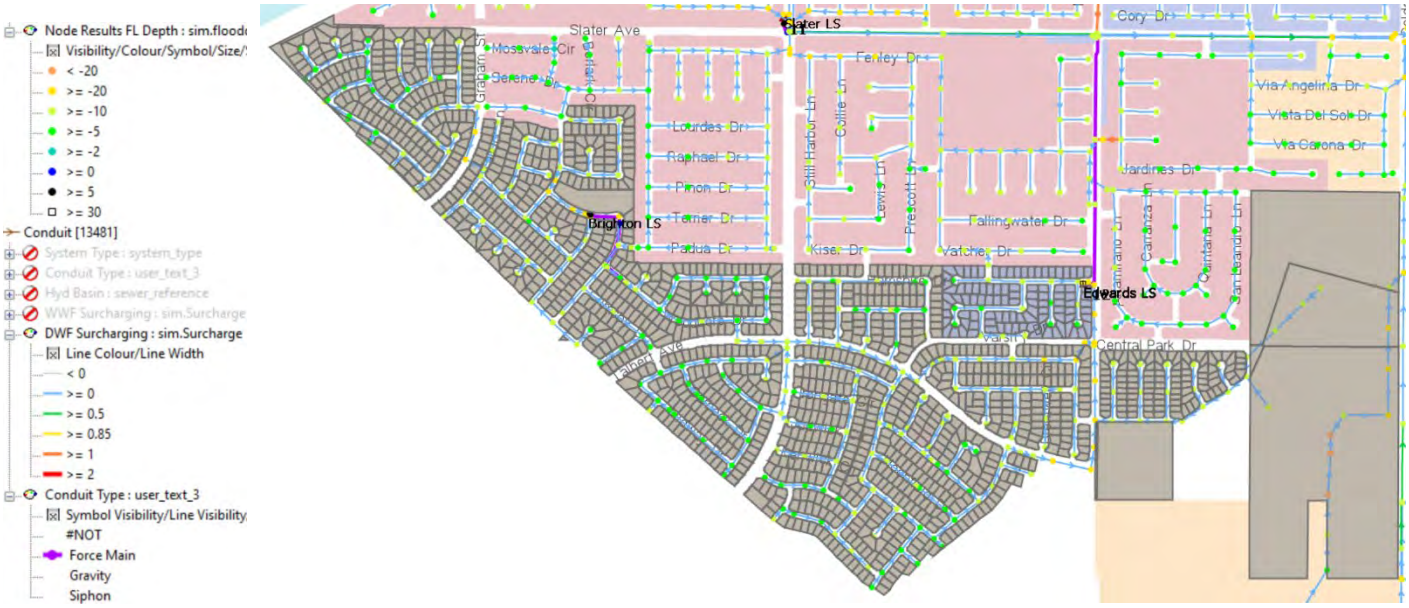


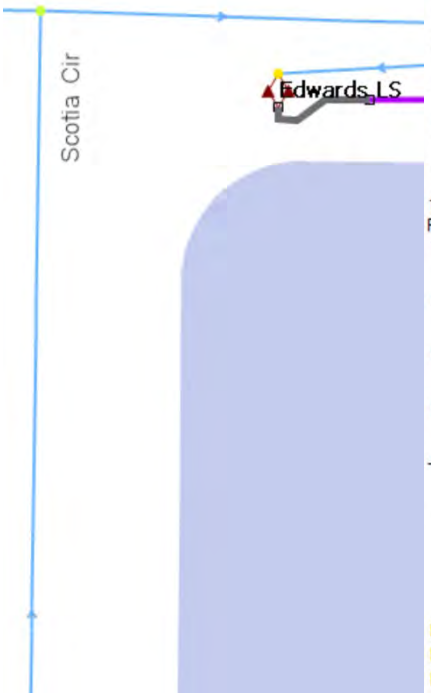
Link		8320.1	9998321.1	
width (in)			6.0	
us inv (ft AD)			1.000	
ds inv (ft AD)			1.199	
r.pfc (MGD)			-0.41	
surc		1.00	1.00	
US total head (ft AD)		-4.461	6.120	
US velocity (ft/s)		0.000	3.845	
DS flow (MGD)		0.4879	0.4879	
DS cumulative flow (US Mgal)		0.45513	0.45513	
DS total head (ft AD)		6.120	5.839	
DS velocity (ft/s)		0.000	3.845	
Node	8320		9998321	12077
ground (ft AD)	7.720		7.720	8.922
flood dep (ft)	-12.181		-1.600	-3.542

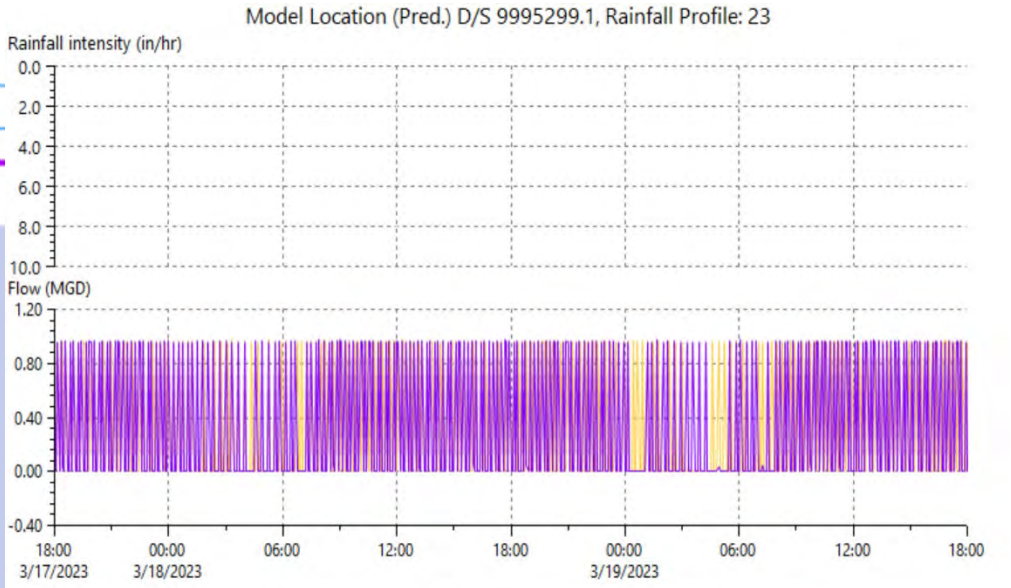


Link		8325.1		8320.1	9998321.1		12077.1		-
width (in)		8.0			6.0		6.0		8.0
us inv (ft AD)		-4.640			1.000		1.199		-
ds inv (ft AD)		-4.830			1.199		2.630		-
r.pfc (MGD)		0.35			-0.41		-0.41		-
surc		0.79		1.00	1.00		1.00		-
US total head (ft AD)		-4.050		-4.461	6.120		5.380		-
US velocity (ft/s)		1.994		0.000	3.845		3.845		-
DS flow (MGD)		0.4011		0.4879	0.4879		0.4879		-
DS cumulative flow (US Mgal)		0.45521		0.45513	0.45513		0.45513		-
DS total head (ft AD)		-4.309		6.120	5.839		3.360		-
DS velocity (ft/s)		3.077		0.000	3.845		3.845		-
Node	8325		8320		9998321	12077		8322	
ground (ft AD)	7.856		7.720		7.720	8.922		8.082	
flood dep (ft)	-11.965		-12.181		-1.600	-3.542		-5.185	

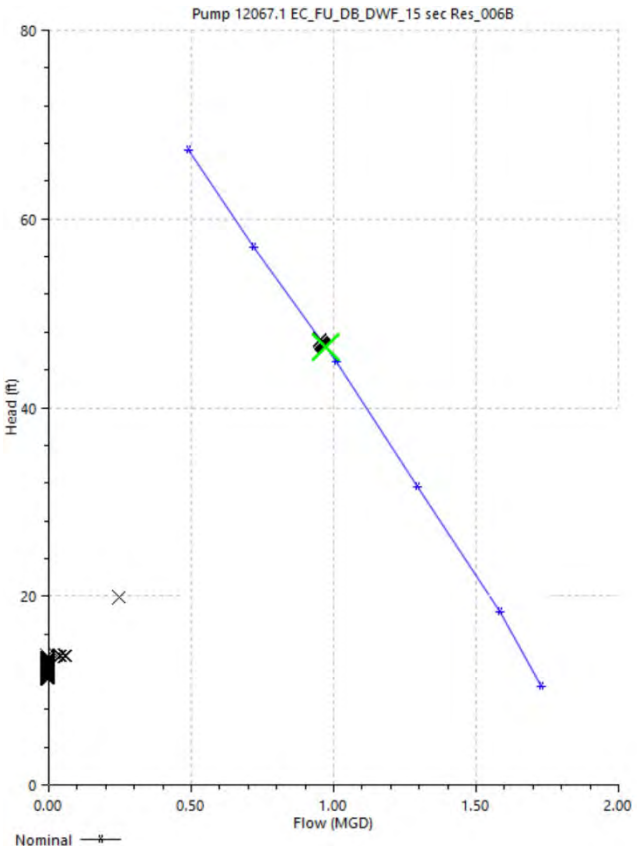
Edwards LS - Design Basis - DWF



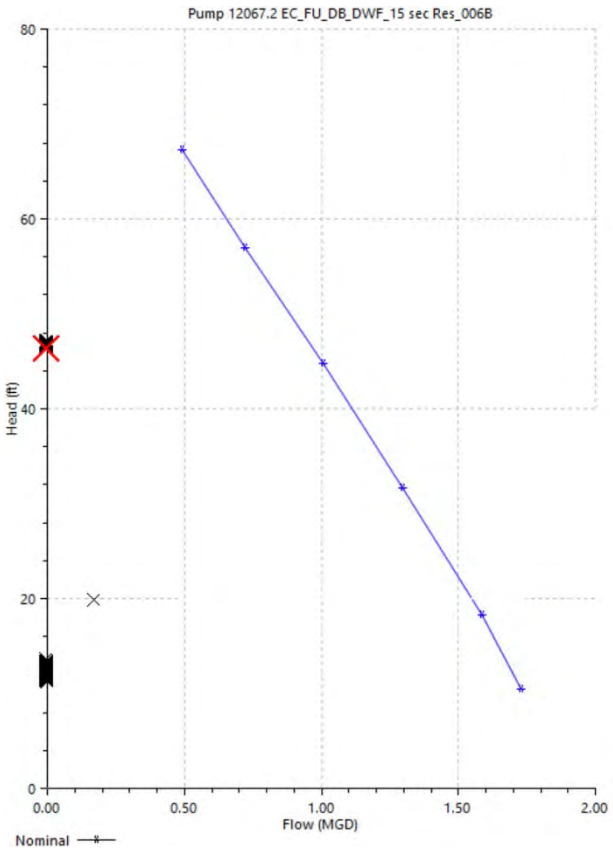




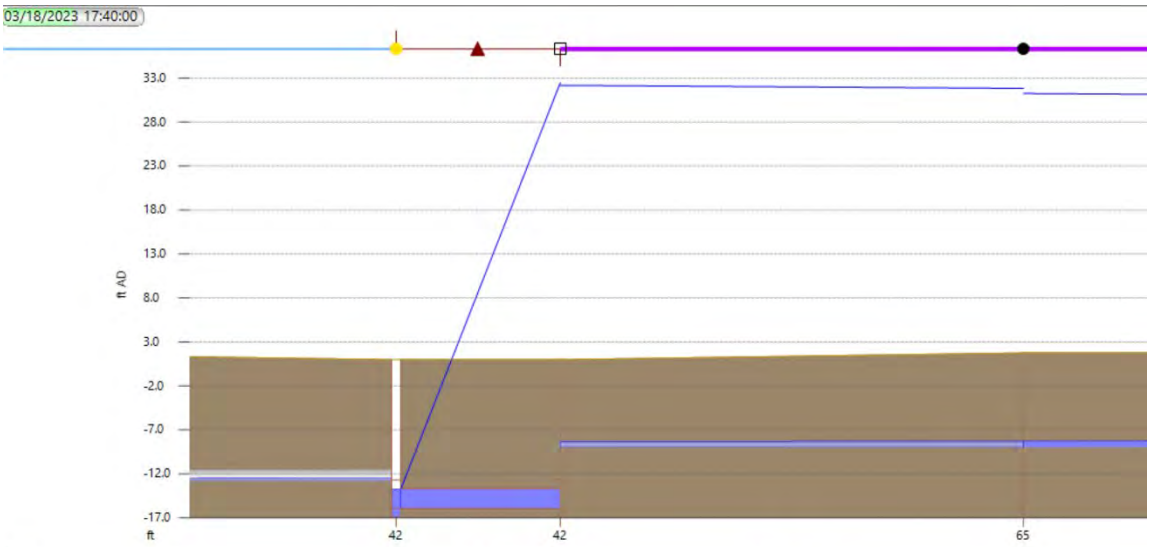
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.973	0.712
Future - DWF				-0.000	0.973	0.714



Edwards Lead Pump



Edwards Lag Pump



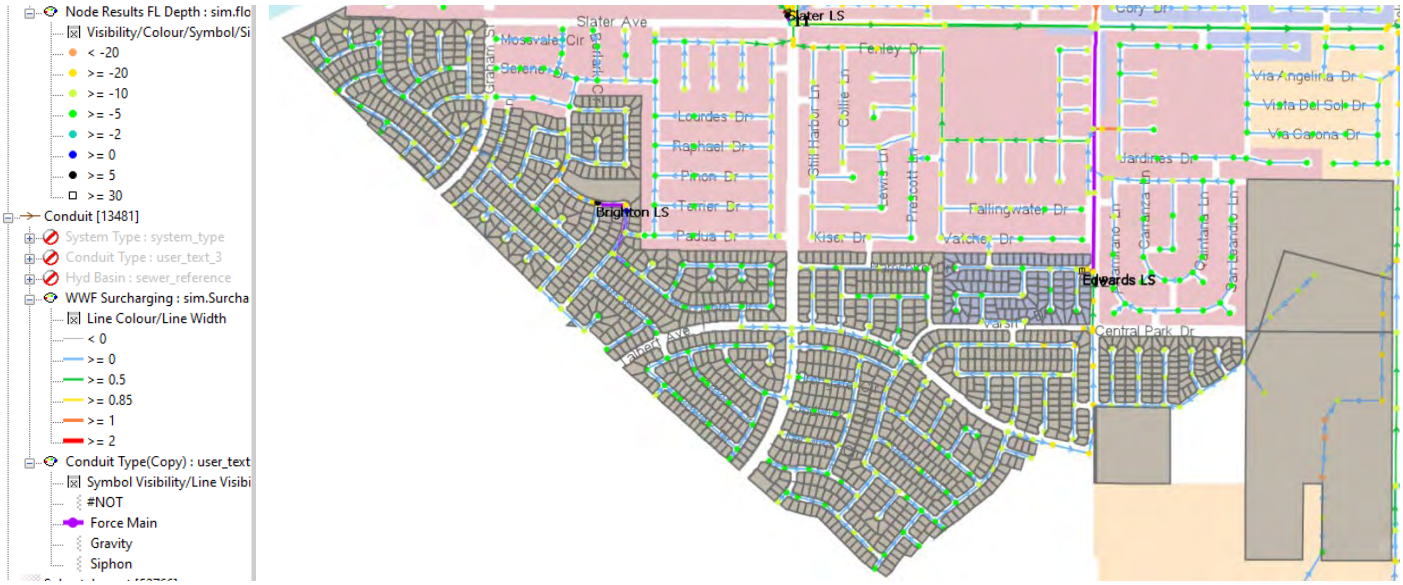
Link		12067.1	9995299.1	
width (in)			8.0	
us inv (ft AD)			-9.000	
ds inv (ft AD)			-8.970	
r.pfc (MGD)			-0.28	
surc		1.00	1.00	
US total head (ft AD)		-13.768	32.463	
US velocity (ft/s)		0.000	4.311	
DS flow (MGD)		0.9742	0.9726	
DS cumulative flow (US Mgal)		0.72577	0.72577	
DS total head (ft AD)		32.463	32.111	
DS velocity (ft/s)		0.000	4.311	
Node	12067	9995299	12076	
ground (ft AD)	0.990	0.990	1.756	
flood dep (ft)	-14.758	31.473	29.777	

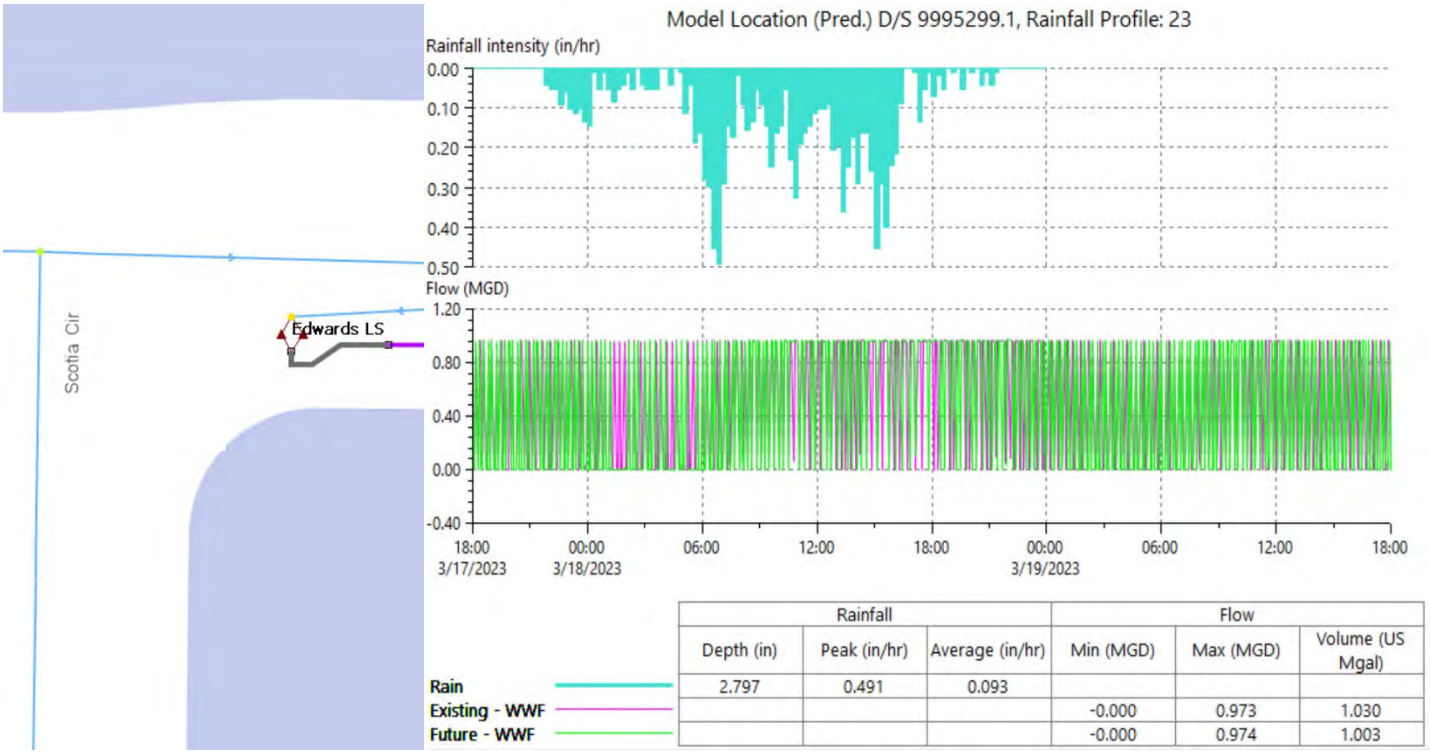
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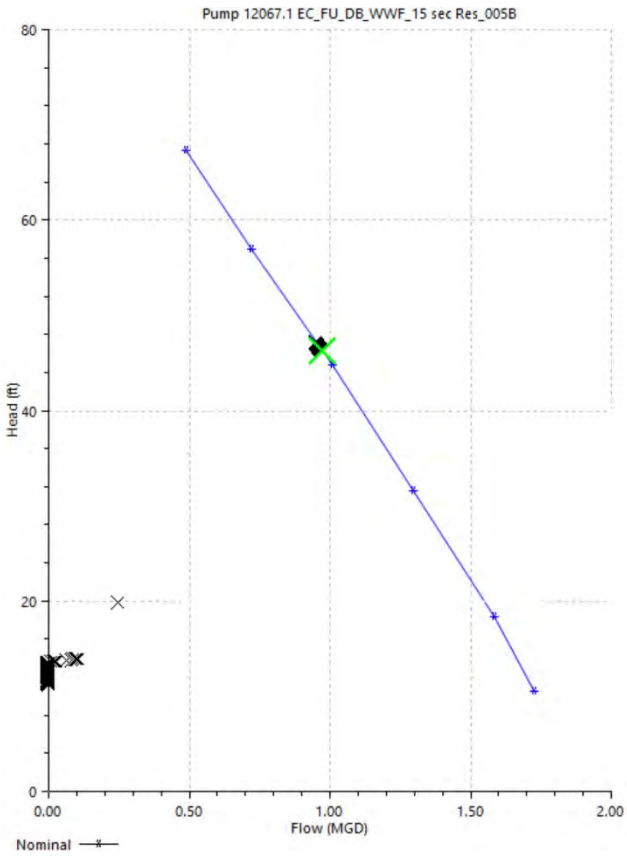
Link	-	-	12076.1		-
width (in)	16.0	-	8.0		-
us inv (ft AD)	-	-	-8.970		-
ds inv (ft AD)	-	-	-3.030		-
r.pfc (MGD)	2.29	-	-0.41		-
surc	0.27	-	1.00		-
US total head (ft AD)	-	-	31.534		-
US velocity (ft/s)	-	-	4.304		-
DS flow (MGD)	-	-	0.9709		-
DS cumulative flow (US Mgal)	-	-	0.72577		-
DS total head (ft AD)	-	-	-2.076		-
DS velocity (ft/s)	-	-	4.303		-
Node			12076		4767
ground (ft AD)			1.756		4.002
flood dep (ft)			29.777		-6.601

Edwards LS - Design Basis - 10 year 24 hour Storm

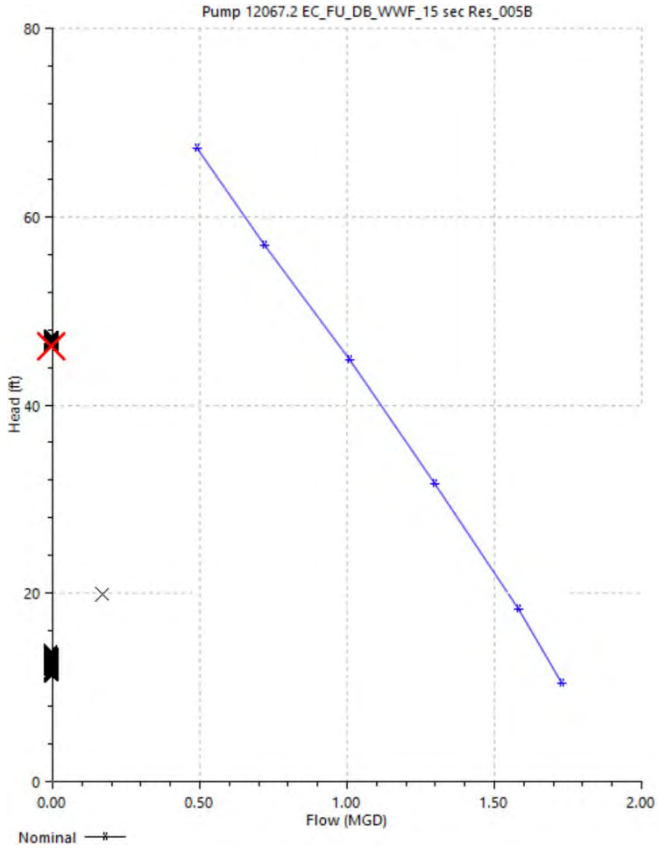




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.797	0.491	0.093			
Existing - WWF				-0.000	0.973	1.030
Future - WWF				-0.000	0.974	1.003



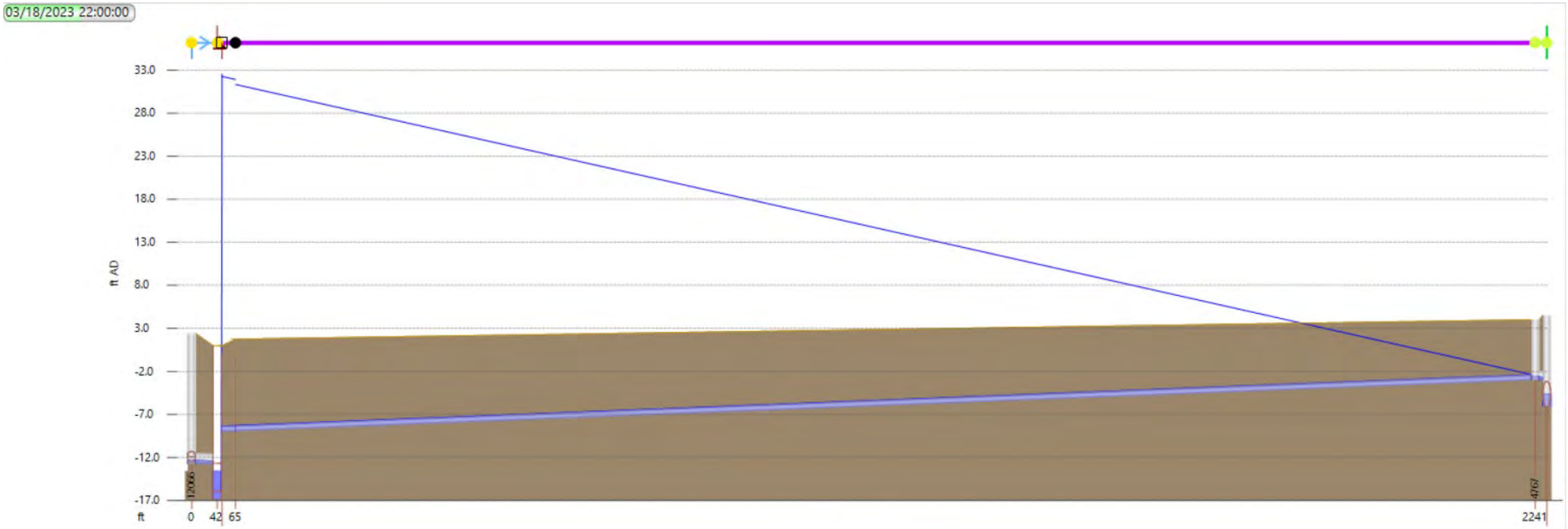
Edwards Lead Pump



Edwards Lag Pump



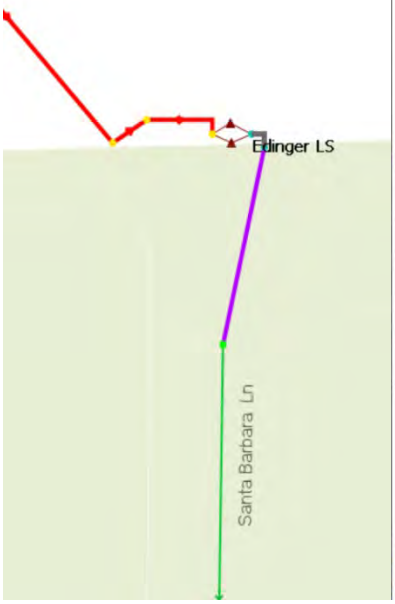
Link		12067.1		9995299.1	
width (in)				8.0	
us inv (ft AD)				-9.000	
ds inv (ft AD)				-8.970	
r.pfc (MGD)				-0.28	
surc		1.00		1.00	
US total head (ft AD)		-13.620		32.556	
US velocity (ft/s)		0.000		4.317	
DS flow (MGD)		0.9755		0.9739	
DS cumulative flow (US Mgal)		1.02328		1.02328	
DS total head (ft AD)		32.556		32.203	
DS velocity (ft/s)		0.000		4.317	
Node	12067		9995299		12076
ground (ft AD)	0.990		0.990		1.756
flood dep (ft)	-14.610		31.566		29.868

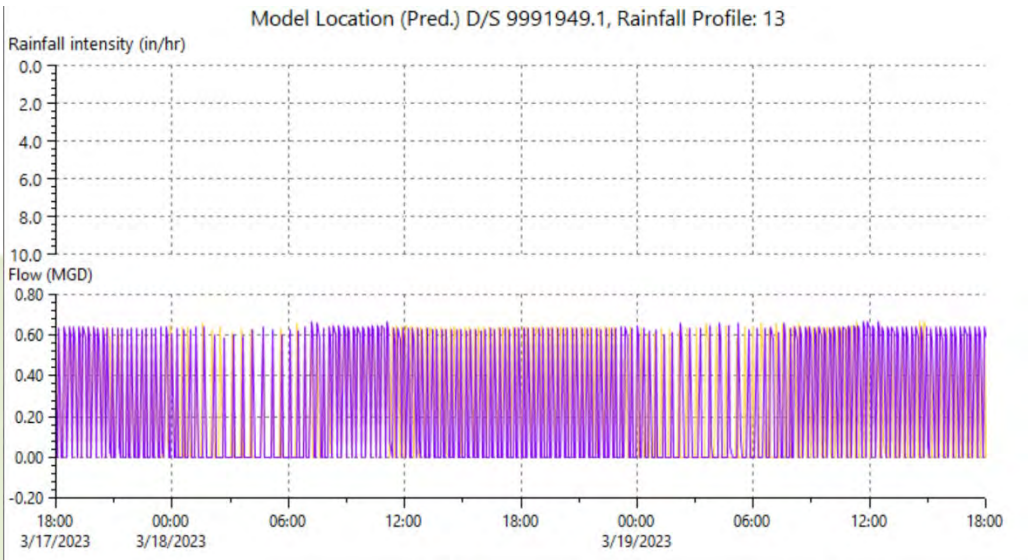


Link	-	-	12076.1	-		
width (in)	16.0	-	8.0	-		
us inv (ft AD)	-	-	-8.970	-		
ds inv (ft AD)	-	-	-3.030	-		
r.pfc (MGD)	2.29	-	-0.41	-		
surc	0.34	-	1.00	-		
US total head (ft AD)	-	-	31.624	-		
US velocity (ft/s)	-	-	4.310	-		
DS flow (MGD)	-	-	0.9722	-		
DS cumulative flow (US Mgal)	-	-	1.02328	-		
DS total head (ft AD)	-	-	-2.075	-		
DS velocity (ft/s)	-	-	4.309	-		
Node			12076			4767
ground (ft AD)			1.756			4.002
flood dep (ft)			29.868			-6.601

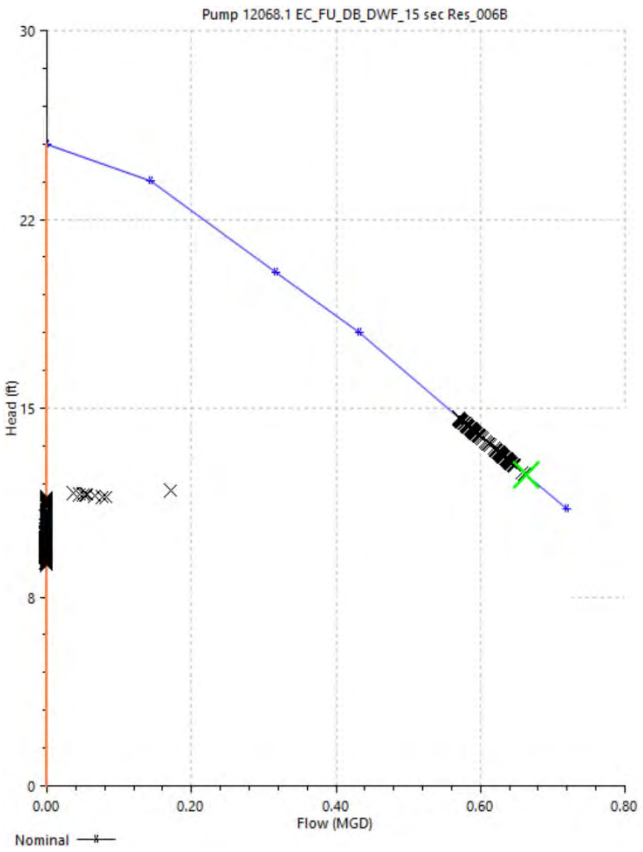
Edinger LS - Design Basis - DWF



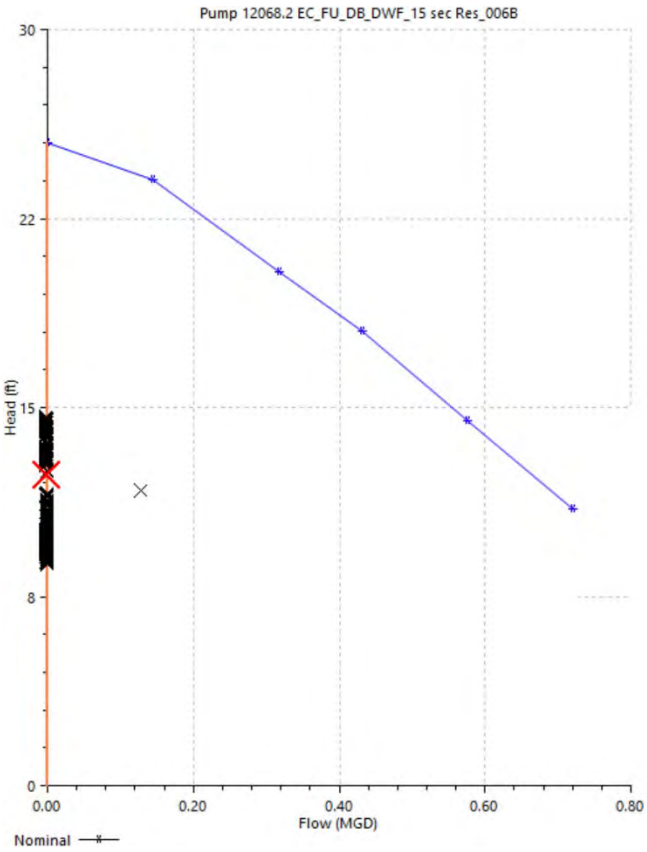




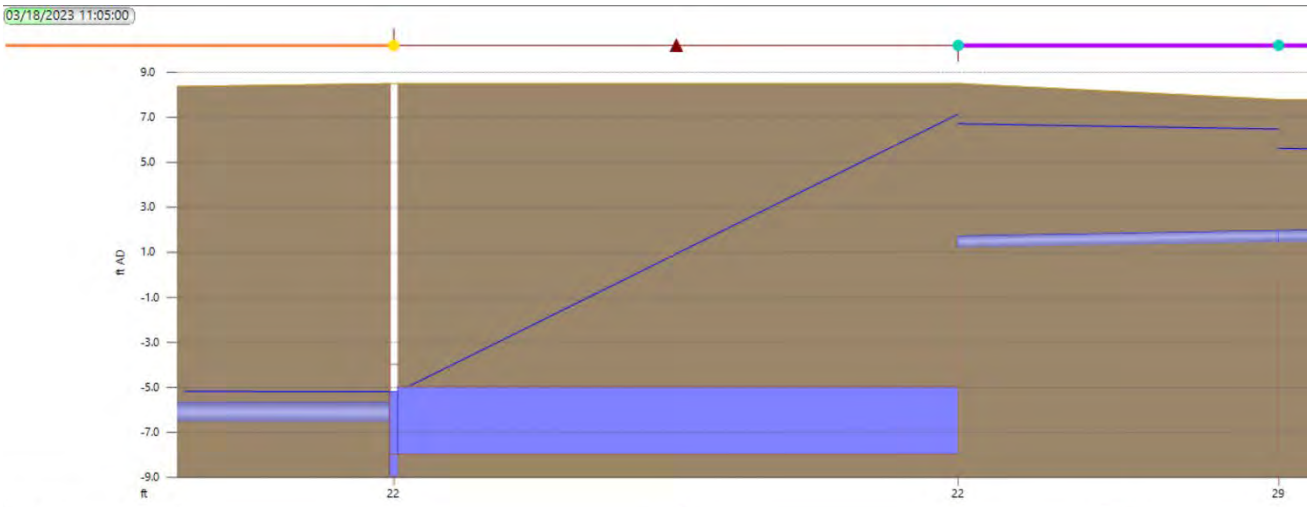
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.665	0.556
Future - DWF				-0.000	0.665	0.522



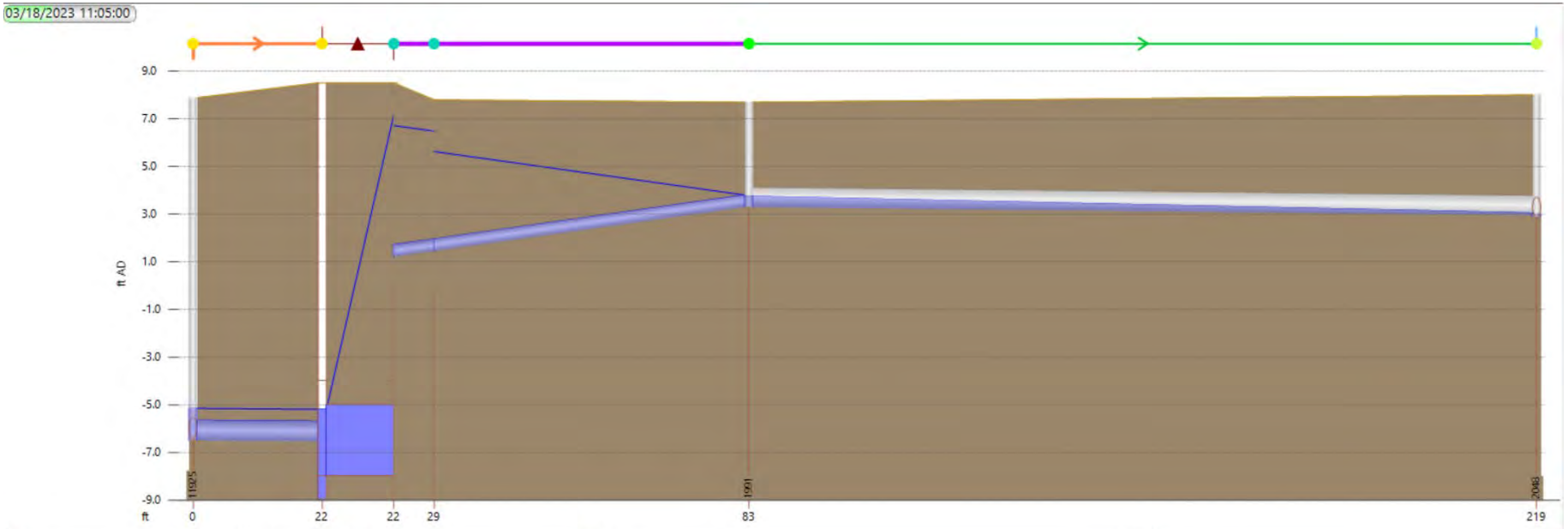
Edinger Lead Pump



Edinger Lag Pump



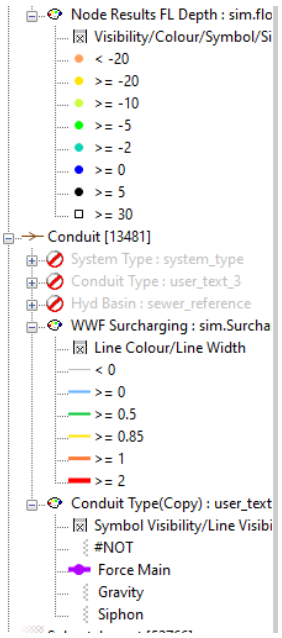
Link		12068.1	9991949.1	
width (in)			6.0	
us inv (ft AD)			1.220	
ds inv (ft AD)			1.460	
r.pfc (MGD)			-0.67	
surc		1.00	1.00	
US total head (ft AD)		-5.186	7.141	
US velocity (ft/s)		0.000	5.243	
DS flow (MGD)		0.6654	0.6654	
DS cumulative flow (US Mgal)		0.53900	0.53900	
DS total head (ft AD)		7.141	6.905	
DS velocity (ft/s)		0.000	5.243	
Node	12068		9991949	12075
ground (ft AD)	8.500		8.500	7.789
flood dep (ft)	-13.686		-1.359	-1.738



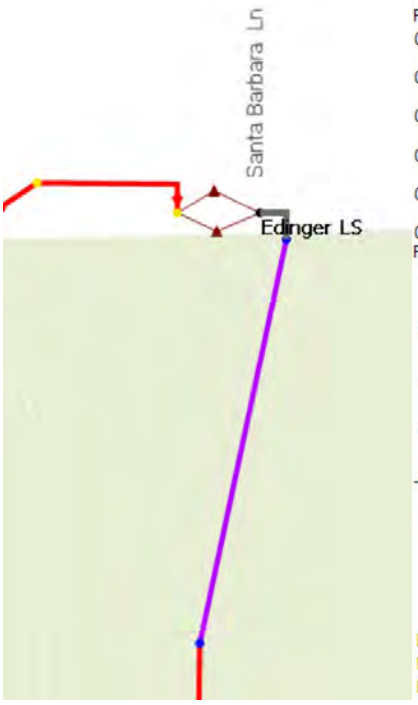
Link	11925.1	12068.1	-	12075.1	1991.1
width (in)	10.0		6.0	6.0	10.0
us inv (ft AD)	-6.480		1.220	1.460	3.300
ds inv (ft AD)	-6.520		1.460	3.300	2.960
r.pfc (MGD)	0.60		-0.67	-0.67	0.71
surc	1.00	1.00	1.00	1.00	0.54
US total head (ft AD)	-5.122	-5.186	7.141	6.051	3.909
US velocity (ft/s)	1.356	0.000	5.243	5.243	3.228
DS flow (MGD)	0.5049	0.6654	0.6654	0.6654	0.0124
DS cumulative flow (US Mgal)	0.53900	0.53900	-	0.53900	0.55338
DS total head (ft AD)	-5.156	7.141	6.905	4.227	3.055
DS velocity (ft/s)	1.364	0.000	5.243	5.243	0.609

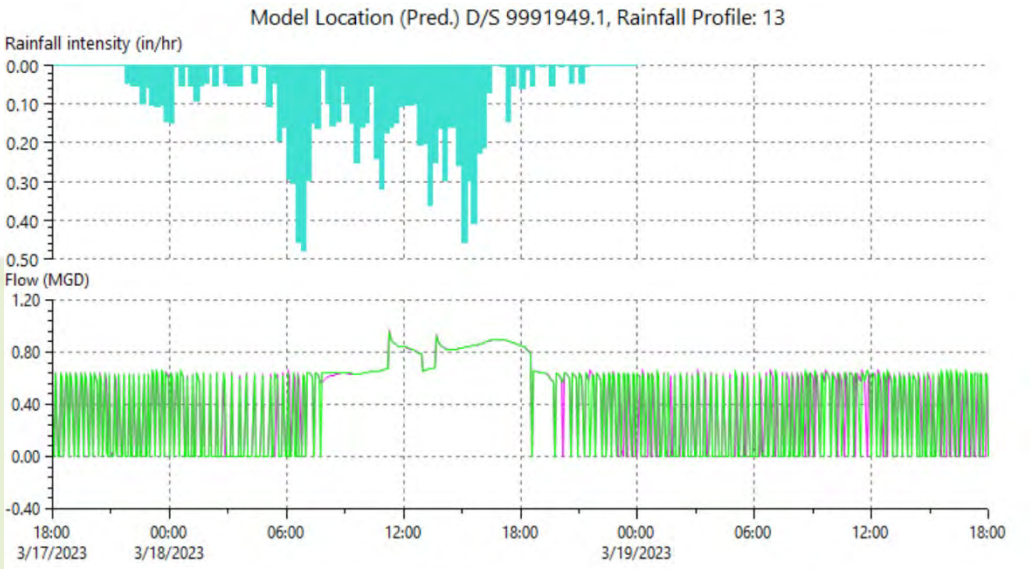
Node	11925	12068	-	12075	1991	2048
ground (ft AD)	7.882	8.500	8.500	7.789	7.689	8.001
flood dep (ft)	-13.025	-13.686	-1.359	-1.738	-3.940	-5.022

Edinger LS - Design Basis - 10 year 24 hour Storm

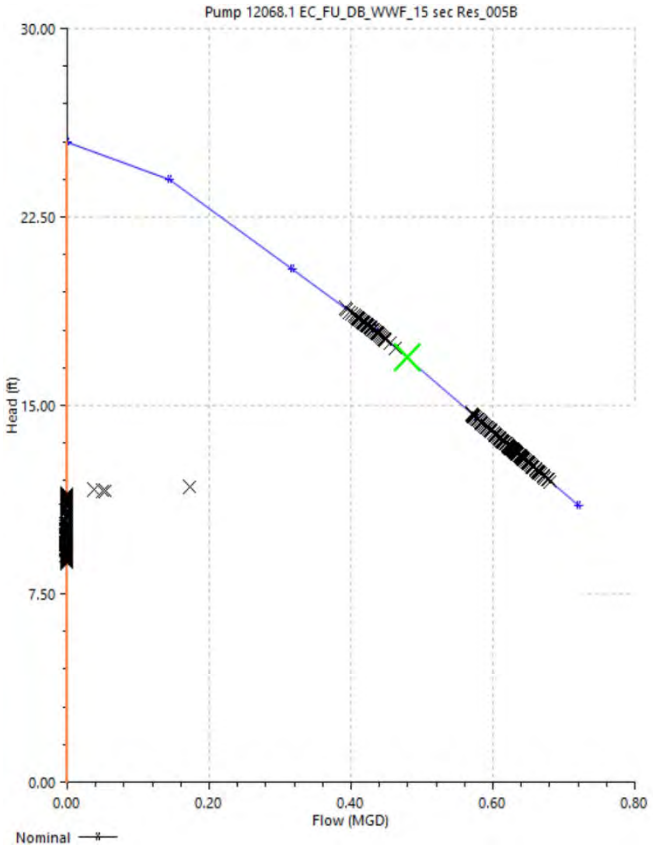




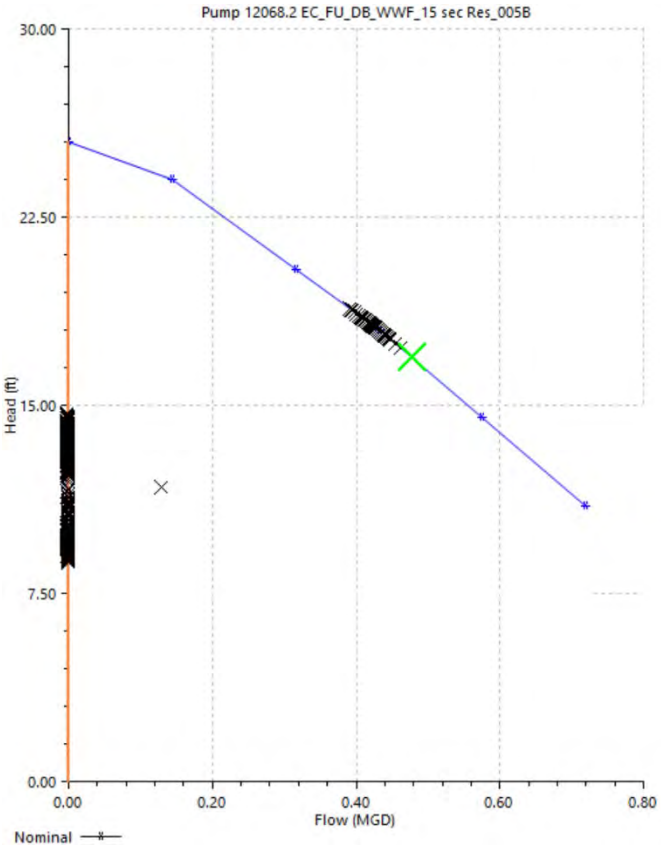




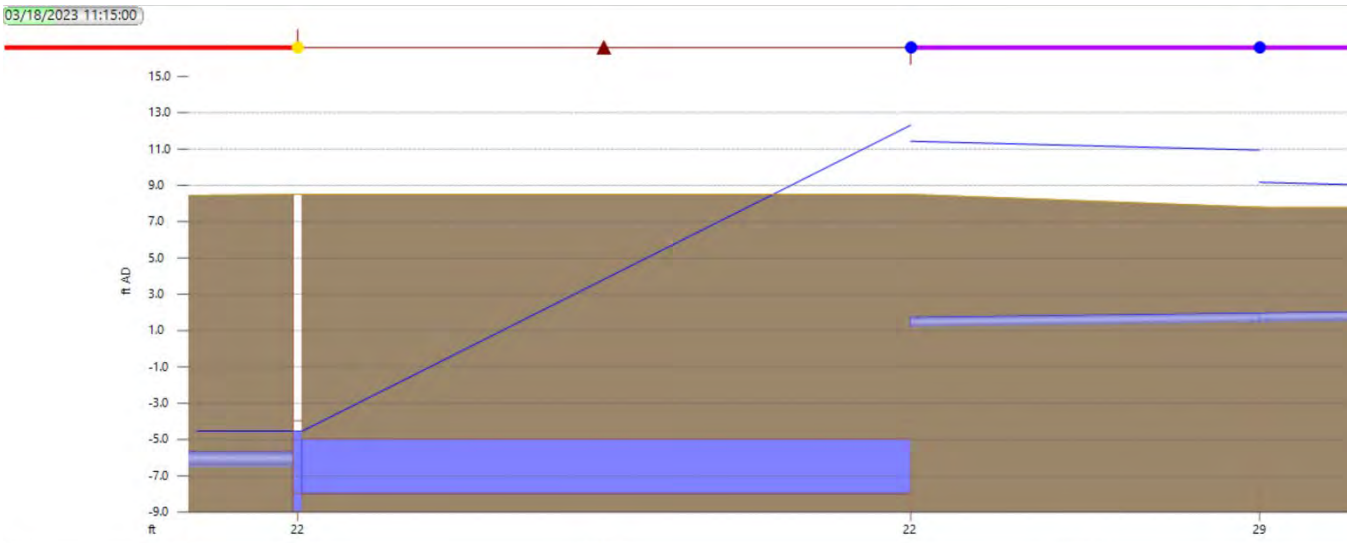
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.795	0.479	0.093			
Existing - WWF				-0.000	0.966	0.853
Future - WWF				-0.000	0.958	0.864



Edinger Lead Pump

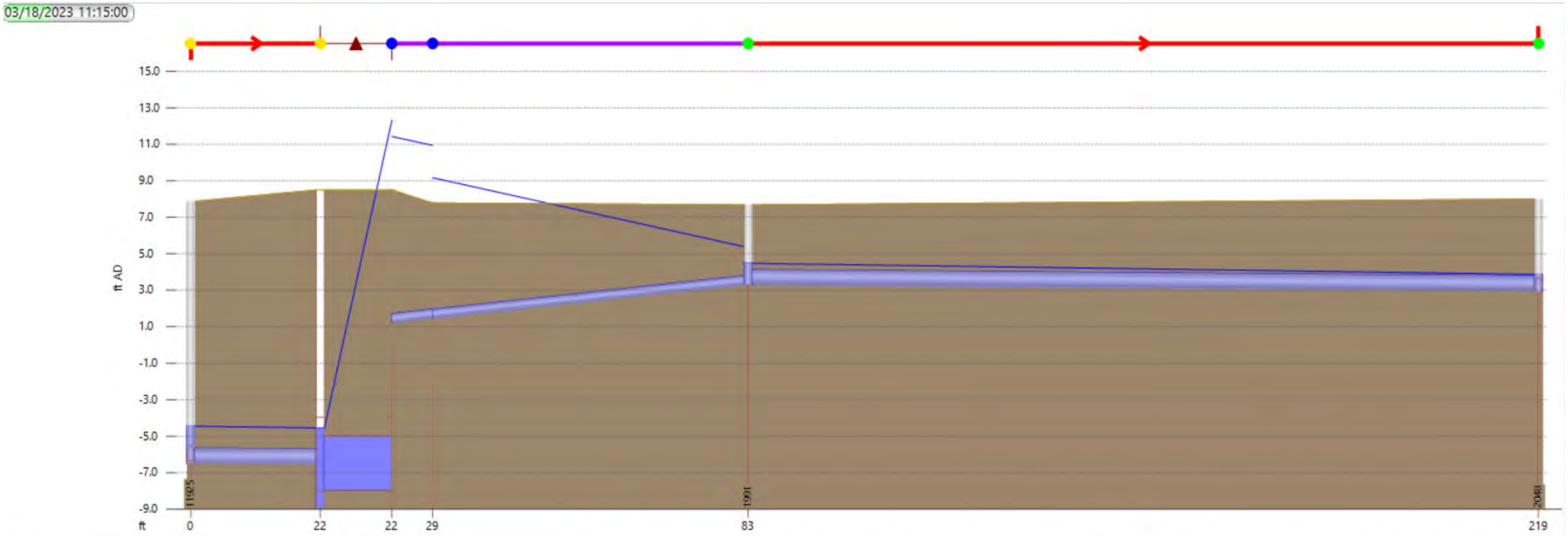


Edinger Lag Pump



Link		12068.1		9991949.1	
width (in)				6.0	
us inv (ft AD)				1.220	
ds inv (ft AD)				1.460	
r.pfc (MGD)				-0.67	
surc		1.00		1.00	
US total head (ft AD)		-4.542		12.314	
US velocity (ft/s)		0.000		7.550	
DS flow (MGD)		0.4790		0.9581	
DS cumulative flow (US Mgal)		0.74676		0.86539	
DS total head (ft AD)		12.314		11.826	
DS velocity (ft/s)		0.000		7.550	
Node	12068		9991949		12075
ground (ft AD)	8.500		8.500		7.789
flood dep (ft)	-13.042		3.814		2.265

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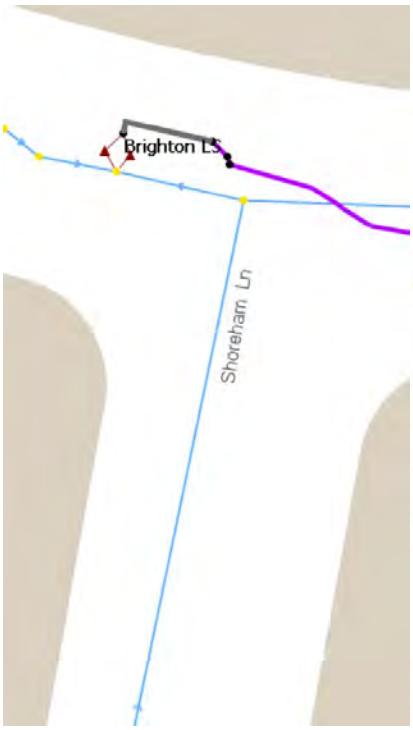


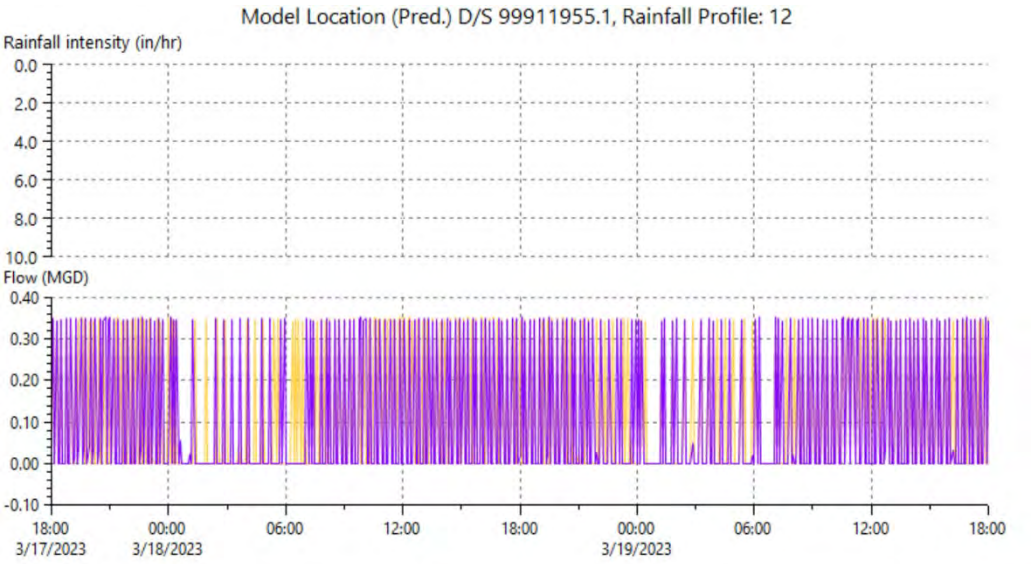
Link	11925.1	12068.1	-	12075.1	1991.1
width (in)	10.0		6.0	6.0	10.0
us inv (ft AD)	-6.480		1.220	1.460	3.300
ds inv (ft AD)	-6.520		1.460	3.300	2.960
r.pfc (MGD)	0.60		-0.67	-0.67	0.71
surc	2.00	1.00	1.00	1.00	2.00
US total head (ft AD)	-4.367	-4.542	12.314	10.054	4.579
US velocity (ft/s)	2.346	0.000	7.550	7.550	2.559
DS flow (MGD)	0.8869	0.4790	0.9581	0.9581	0.9344
DS cumulative flow (US Mgal)	0.86572	0.74676	-	0.86539	0.88772
DS total head (ft AD)	-4.455	12.314	11.826	6.274	3.975
DS velocity (ft/s)	2.352	0.000	7.550	7.550	2.561

Node	11925	12068	-	12075	1991	2048
ground (ft AD)	7.882	8.500	8.500	7.789	7.689	8.001
flood dep (ft)	-12.321	-13.042	3.814	2.265	-3.186	-4.129

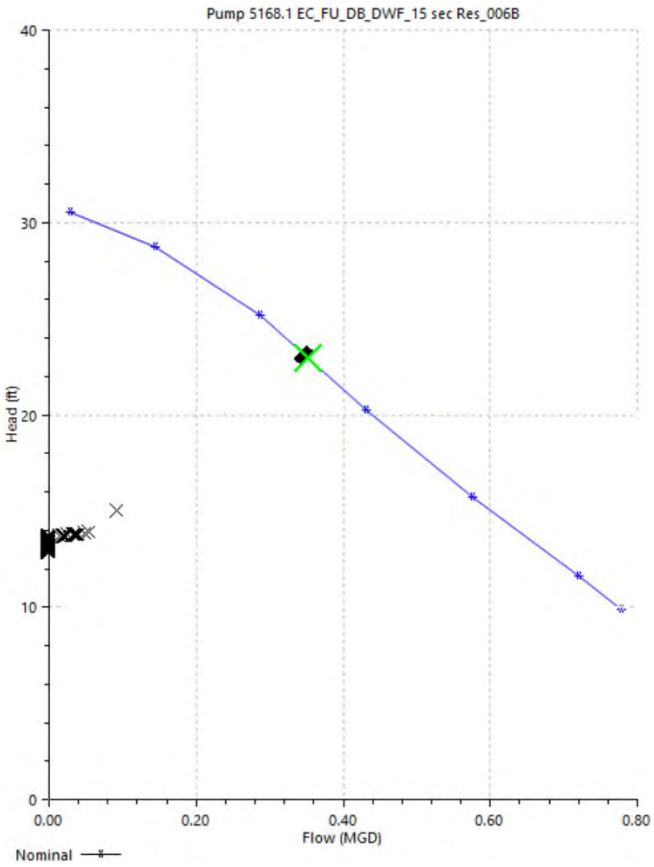
Brighton LS - Design Basis - DWF



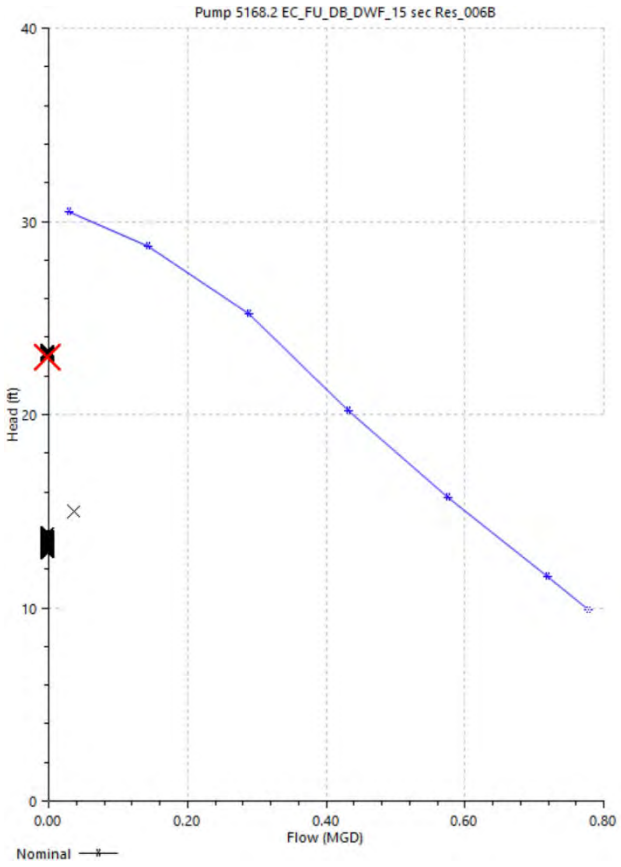




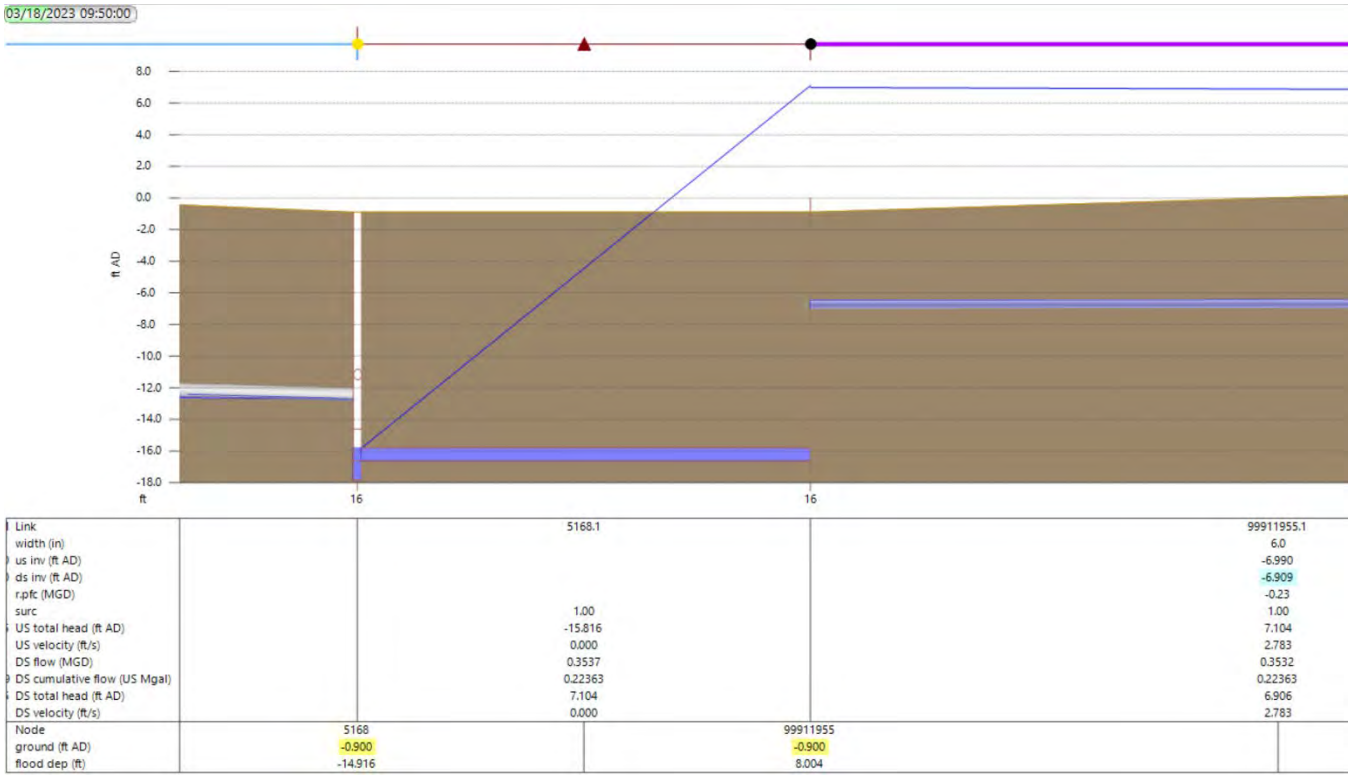
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.352	0.230
Future - DWF				-0.000	0.353	0.213



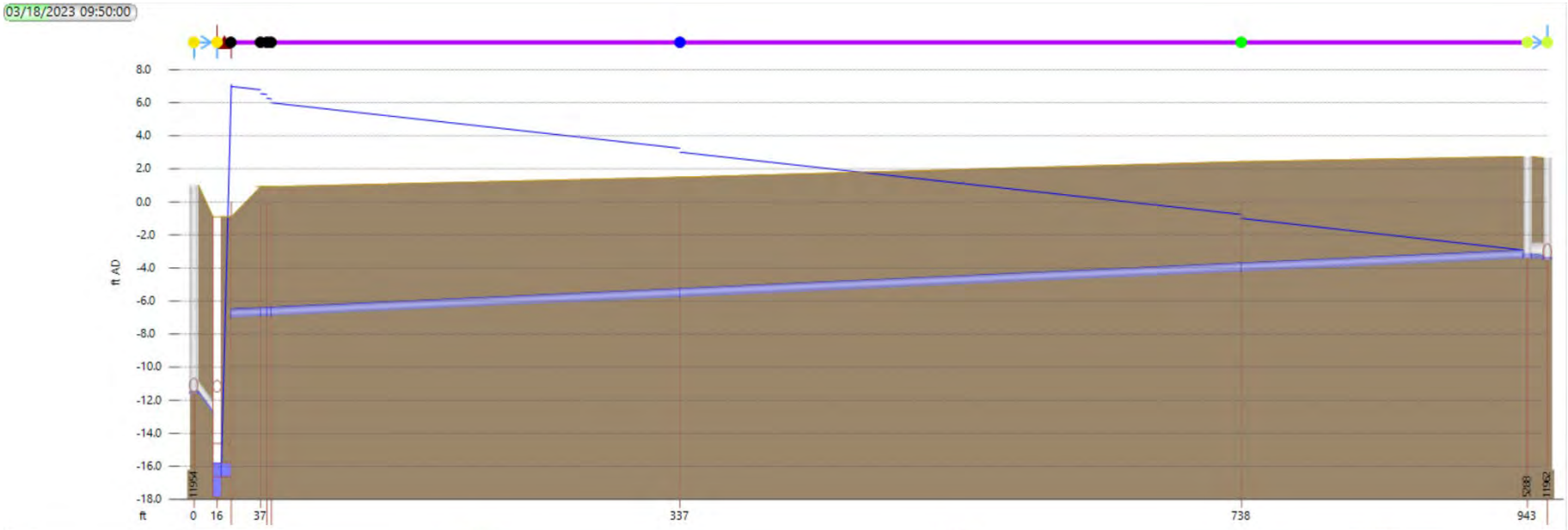
Brighton Lead Pump



Brighton Lag Pump



Link		5168.1	99911955.1
width (in)			6.0
us inv (ft AD)			-6.990
ds inv (ft AD)			-6.909
r.pfc (MGD)			-0.23
surc		1.00	1.00
US total head (ft AD)		-15.816	7.104
US velocity (ft/s)		0.000	2.783
DS flow (MGD)		0.3537	0.3532
DS cumulative flow (US Mgal)		0.22363	0.22363
DS total head (ft AD)		7.104	6.906
DS velocity (ft/s)		0.000	2.783
Node	5168	99911955	
ground (ft AD)	-0.900	-0.900	
flood dep (ft)	-14.916	8.004	

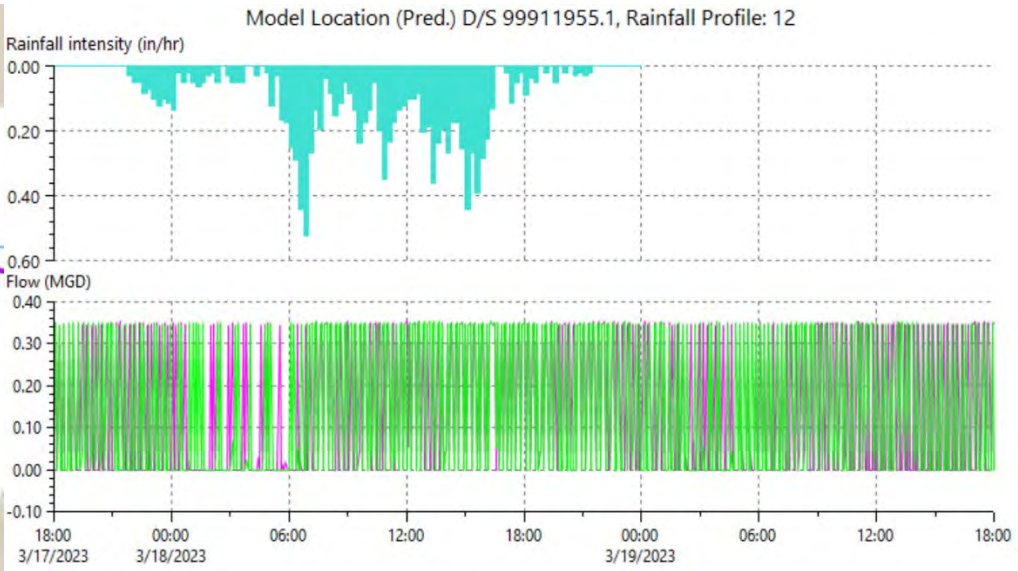

03/18/2023 09:50:00
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
-18.0
ft AD
ft
0
16
37
337
738
943
11954
5288
11962

| | | |

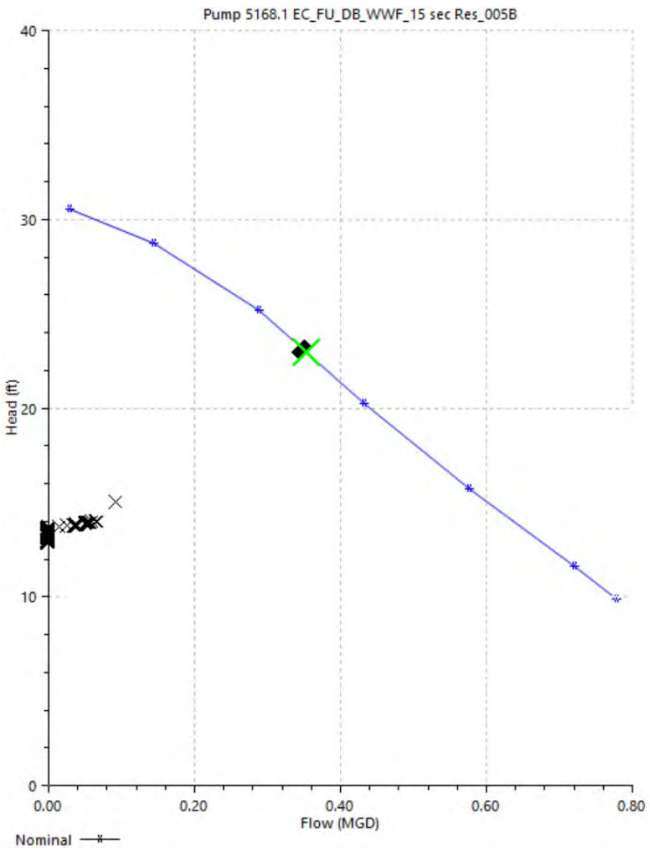
Brighton LS - Design Basis - 10 year 24 hour Storm



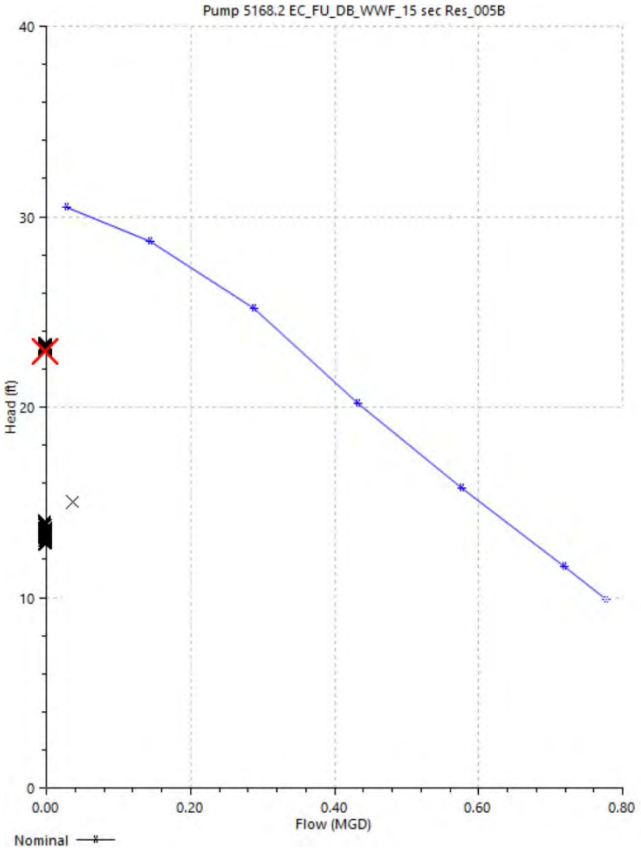




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.803	0.522	0.093			
Existing - WWF				-0.000	0.353	0.304
Future - WWF				-0.000	0.353	0.318



Brighton Lead Pump

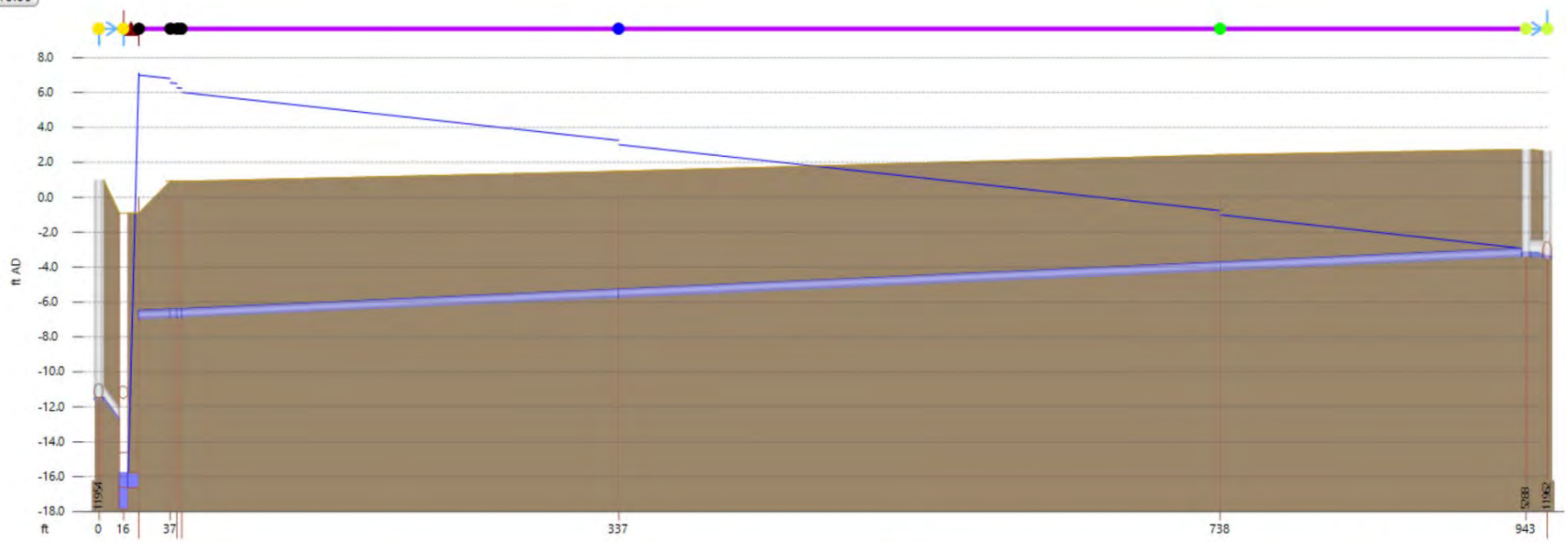


Brighton Lag Pump



Link		5168.1		99911955.1
width (in)				6.0
us inv (ft AD)				-6.990
ds inv (ft AD)				-6.909
r.pfc (MGD)				-0.23
surc		1.00		1.00
US total head (ft AD)		-15.790		7.120
US velocity (ft/s)		0.000		2.785
DS flow (MGD)		0.3539		0.3535
DS cumulative flow (US Mgal)		0.30915		0.30915
DS total head (ft AD)		7.120		6.922
DS velocity (ft/s)		0.000		2.785
Node	5168		99911955	
ground (ft AD)	-0.900		-0.900	
flood dep (ft)	-14.890		8.020	

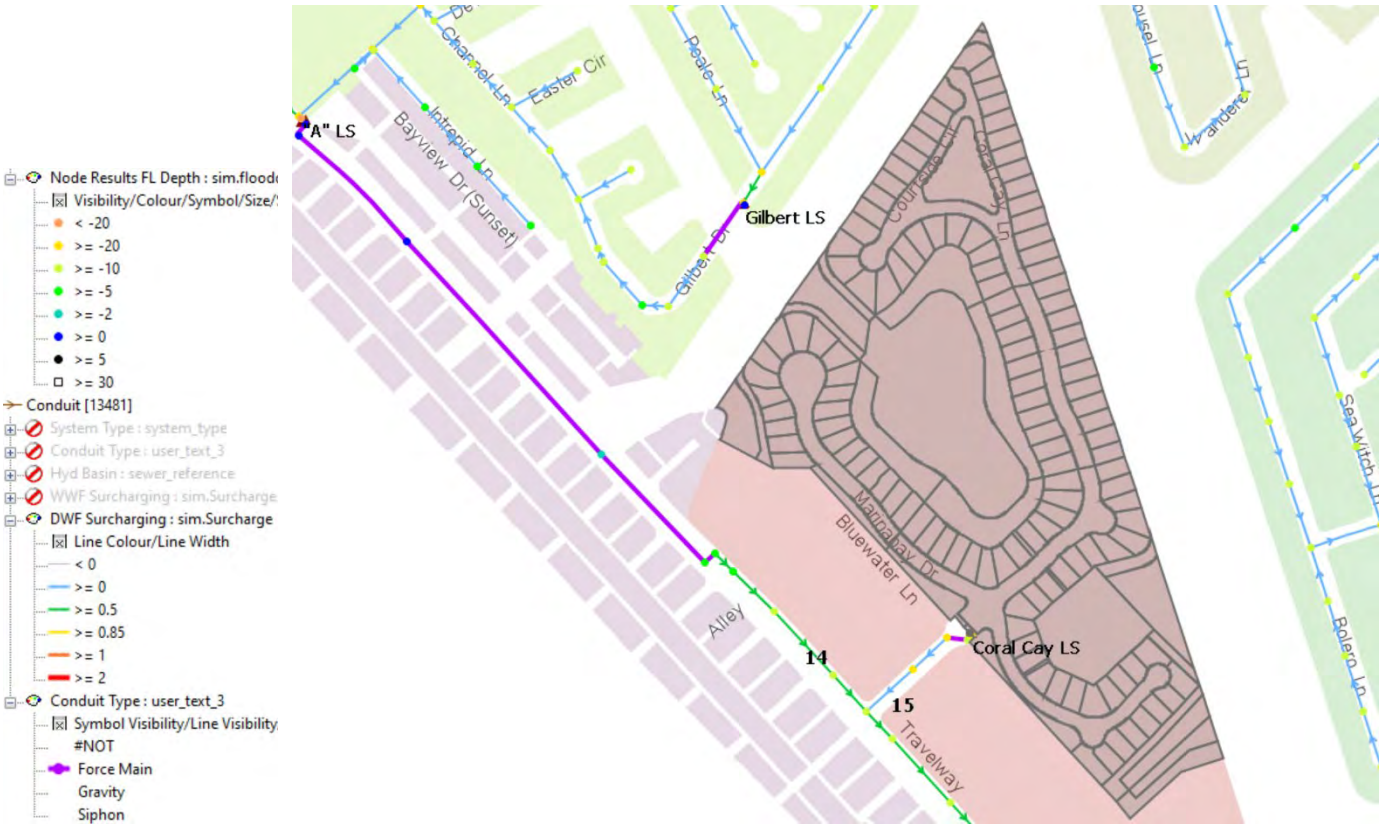
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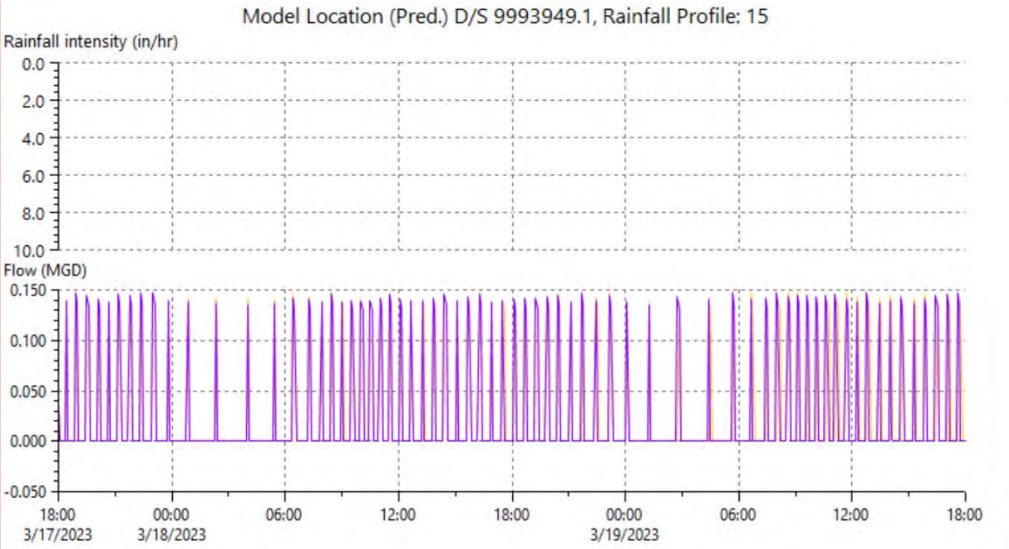
Link	-	-	-	11958.1	11959.1	11960.1	-
width (in)	-		6.0	6.0	6.0	6.0	-
us inv (ft AD)	-		-	-6.879	-5.755	-4.207	-
ds inv (ft AD)	-		-	-5.755	-4.207	-3.420	-
r.pfc (MGD)	-		-	-0.23	-0.23	-0.23	-
surc	-	-	1.00	1.00	1.00	1.00	-
US total head (ft AD)	-	-	-	6.126	3.137	-0.879	-
US velocity (ft/s)	-	-	-	2.775	2.773	2.772	-
DS flow (MGD)	-	-	-	0.3522	0.3519	0.3518	-
DS cumulative flow (US Mgal)	-	-	-	0.30915	0.30915	0.30915	-
DS total head (ft AD)	-	-	-	3.376	-0.640	-2.801	-
DS velocity (ft/s)	-	-	-	2.775	2.773	2.772	-

Node	-	11958	11959	11960	5288
ground (ft AD)	-	0.915	1.489	2.434	2.742
flood dep (ft)	-	5.211	1.648	-3.313	-5.892

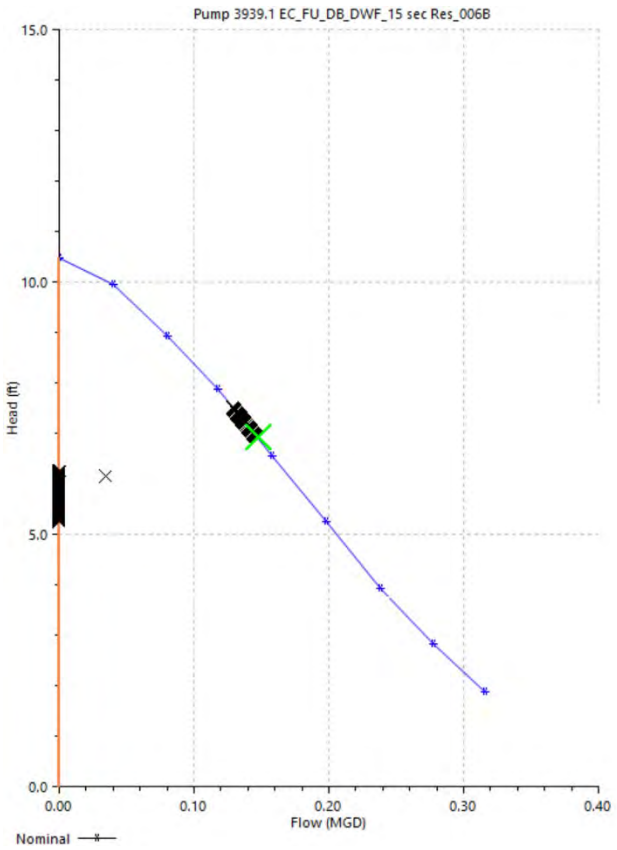
Coral Cay LS - Design Basis - DWF



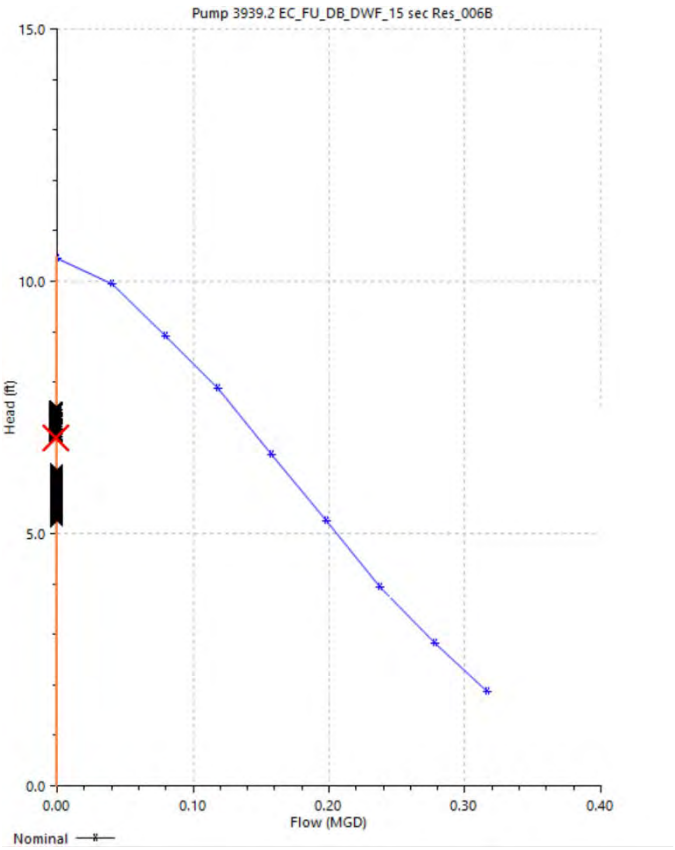




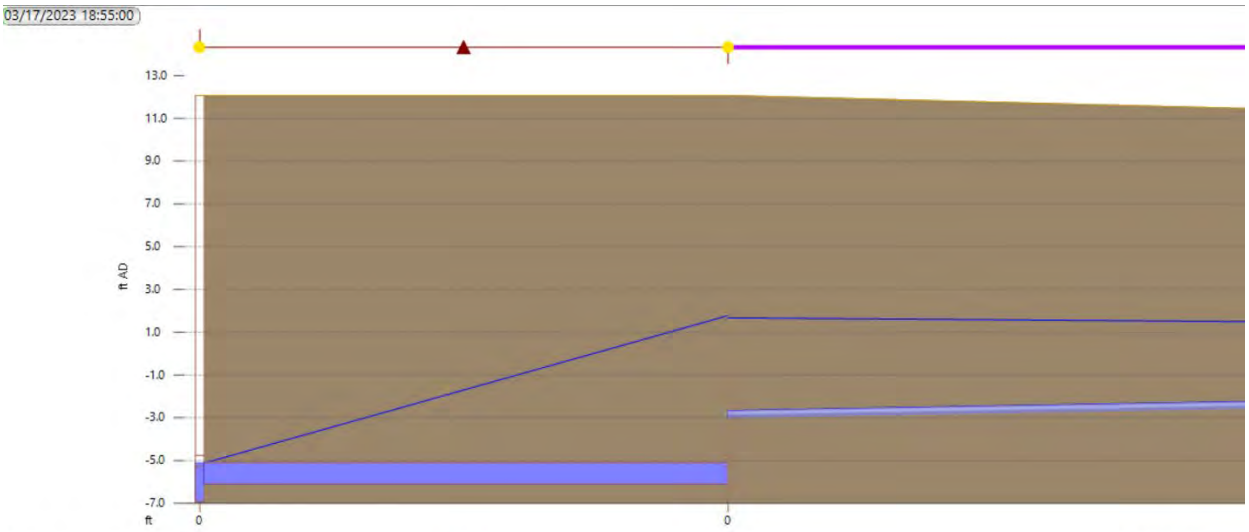
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.148	0.054
Future - DWF				-0.000	0.148	0.054



Coral Cay Lead Pump



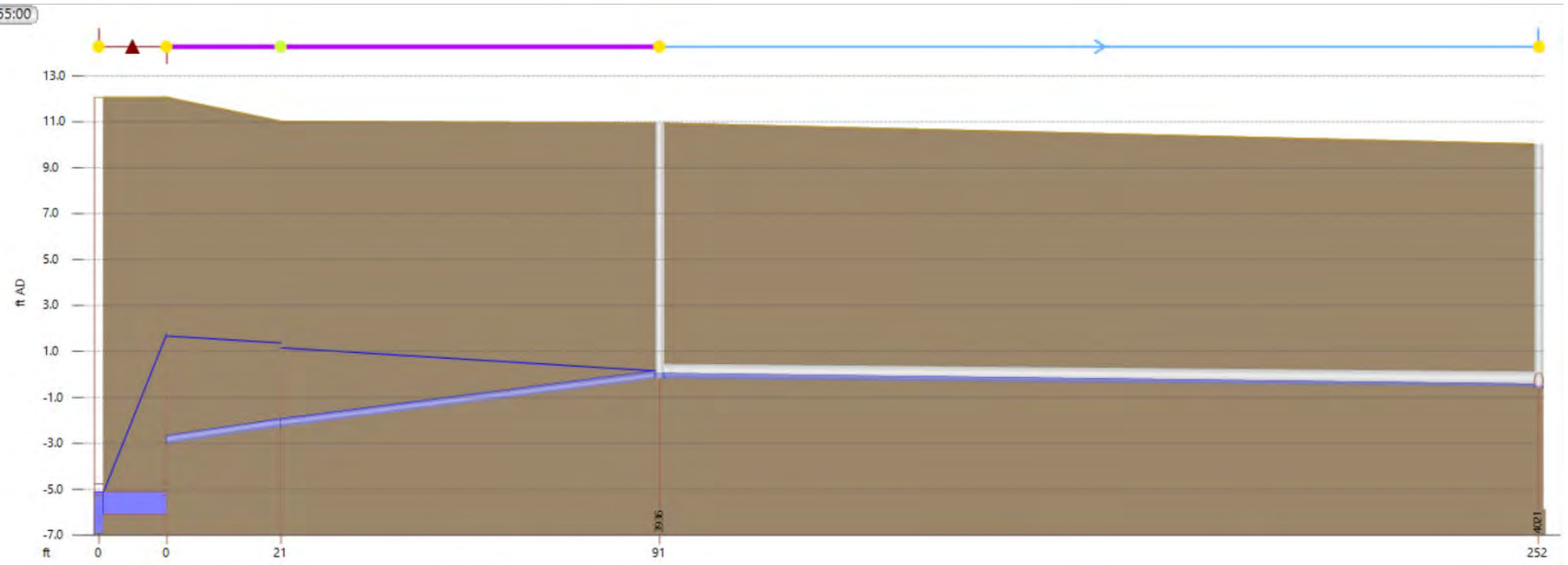
Coral Cay Lag Pump



Link	3939.1	9993949.1
width (in)		4.0
us inv (ft AD)		-3.000
ds inv (ft AD)		-2.270
r.pfc (MGD)		-0.23
surc	1.00	1.00
US total head (ft AD)	-5.118	1.780
US velocity (ft/s)	0.000	2.620
DS flow (MGD)	0.1478	0.1478
DS cumulative flow (US Mgal)	0.05603	0.05603
DS total head (ft AD)	1.780	1.477
DS velocity (ft/s)	0.000	2.620

Node	3939	9993949
ground (ft AD)	12.070	12.070
flood dep (ft)	-17.188	-10.290

03/17/2023 18:55:00

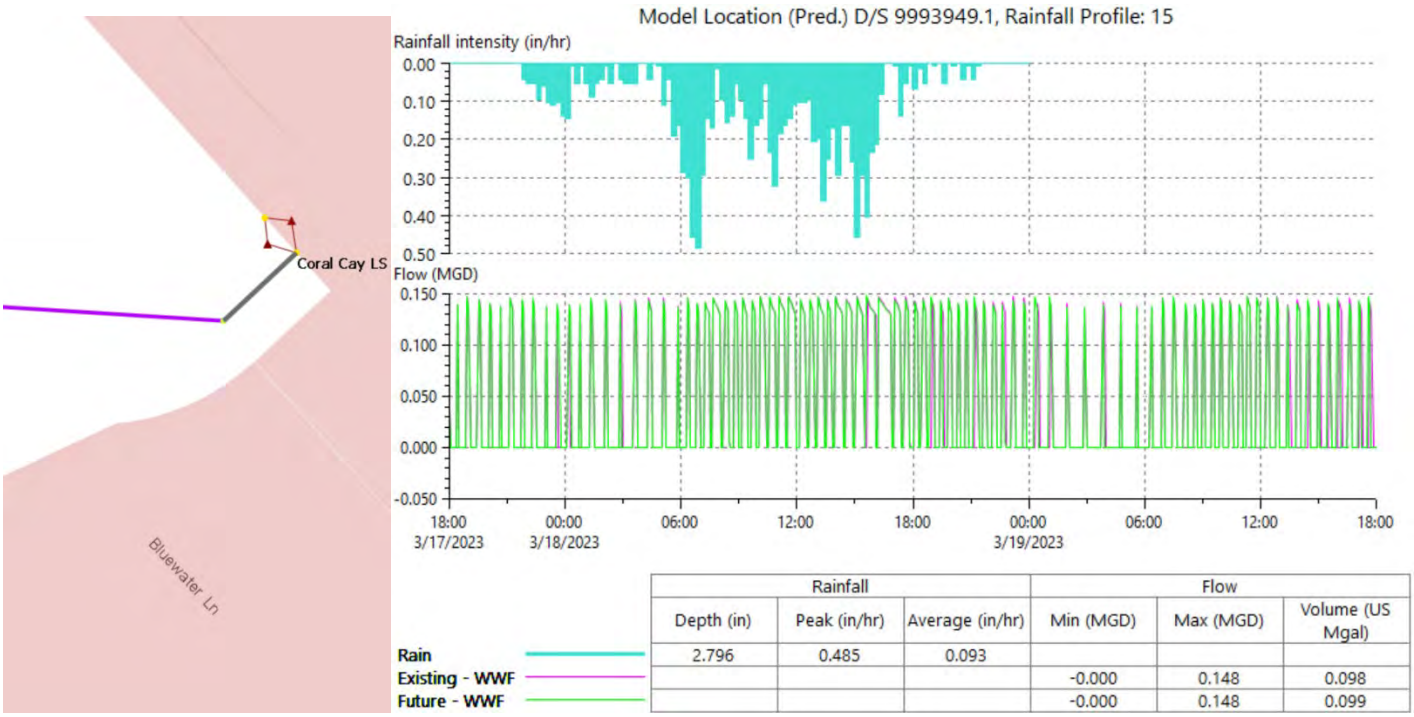


Link	3939.1	9993949.1	12071.1	3936.1
width (in)		4.0	4.0	8.0
us inv (ft AD)		-3.000	-2.270	-0.180
ds inv (ft AD)		-2.270	-0.180	-0.510
r.pfc (MGD)		-0.23	-0.21	0.35
surc	1.00	1.00	1.00	0.34
US total head (ft AD)	-5.118	1.780	1.264	0.103
US velocity (ft/s)	0.000	2.620	2.620	1.918
DS flow (MGD)	0.1478	0.1478	0.1478	0.0077
DS cumulative flow (US Mgal)	0.05603	0.05603	0.05603	0.06862
DS total head (ft AD)	1.780	1.477	0.260	-0.423
DS velocity (ft/s)	0.000	2.620	2.620	0.470

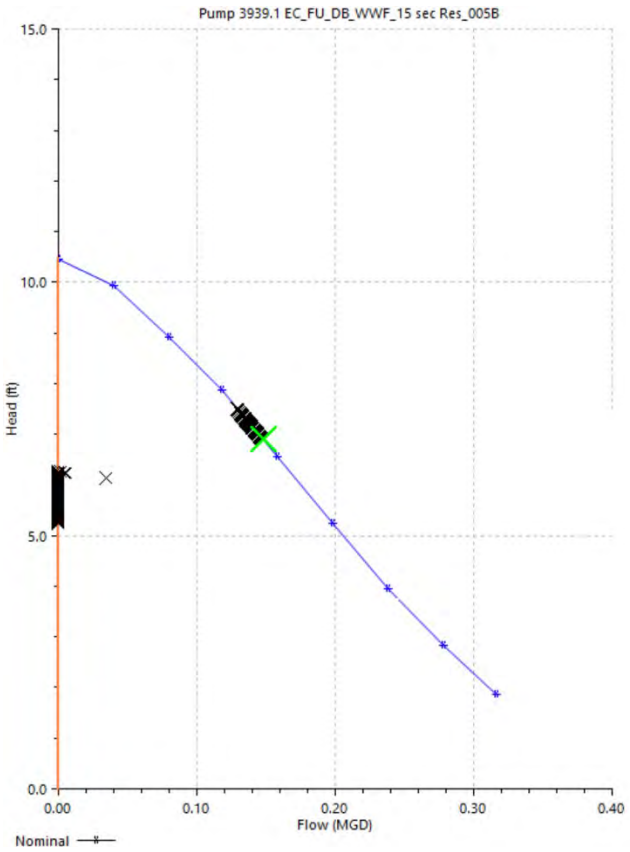
Node	-	9993949	12071	3936	4021
ground (ft AD)	-	12.070	11.027	10.949	10.037
flood dep (ft)	-	-10.290	-9.763	-10.904	-10.549

Coral Cay LS - Design Basis - 10 year 24 hour Storm

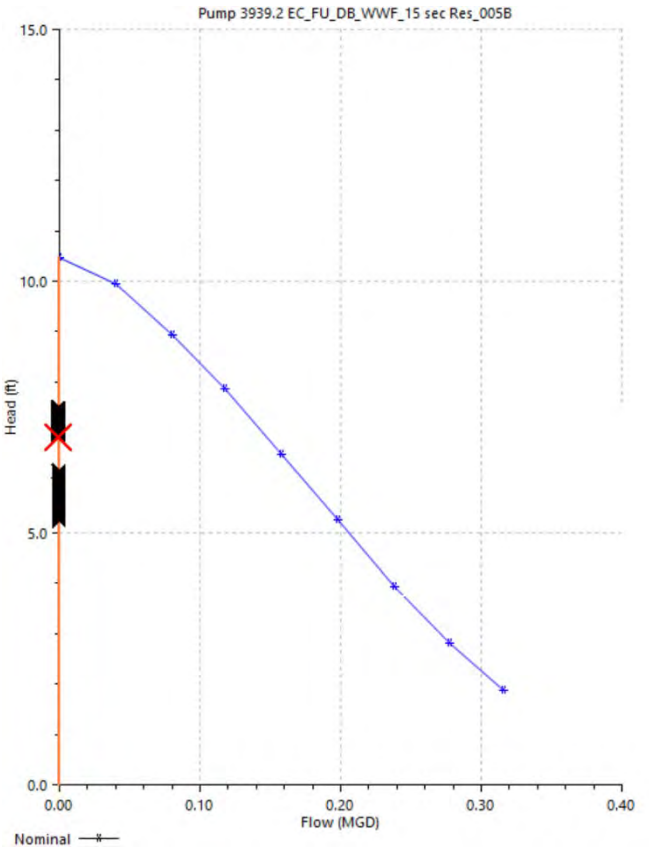




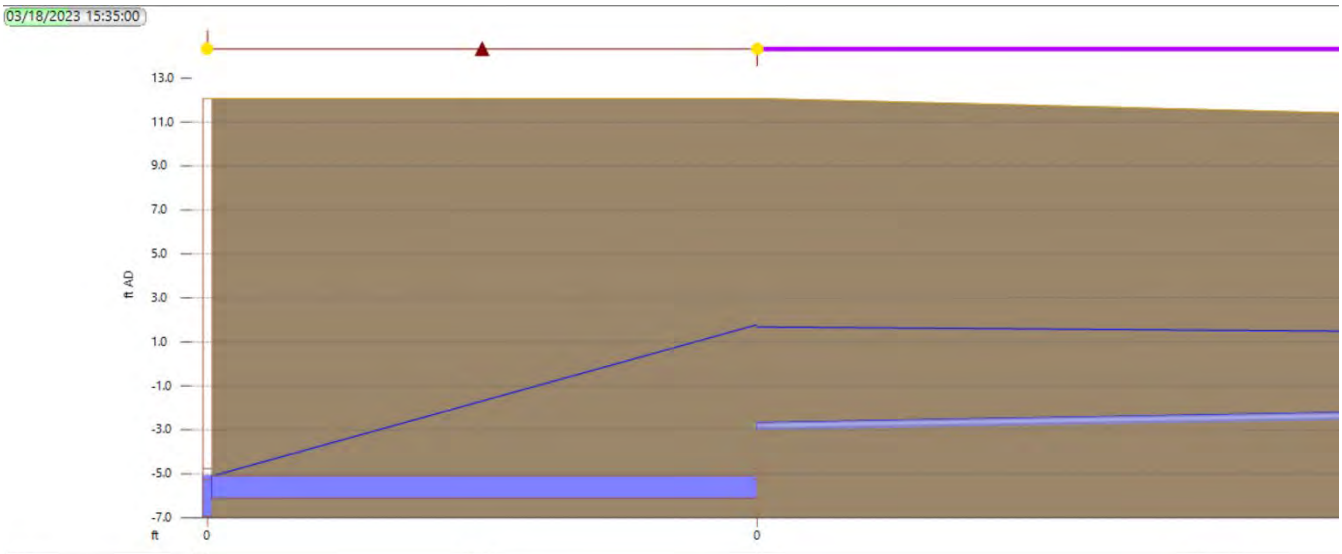
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.796	0.485	0.093			
Existing - WWF				-0.000	0.148	0.098
Future - WWF				-0.000	0.148	0.099



Coral Cay Lead Pump



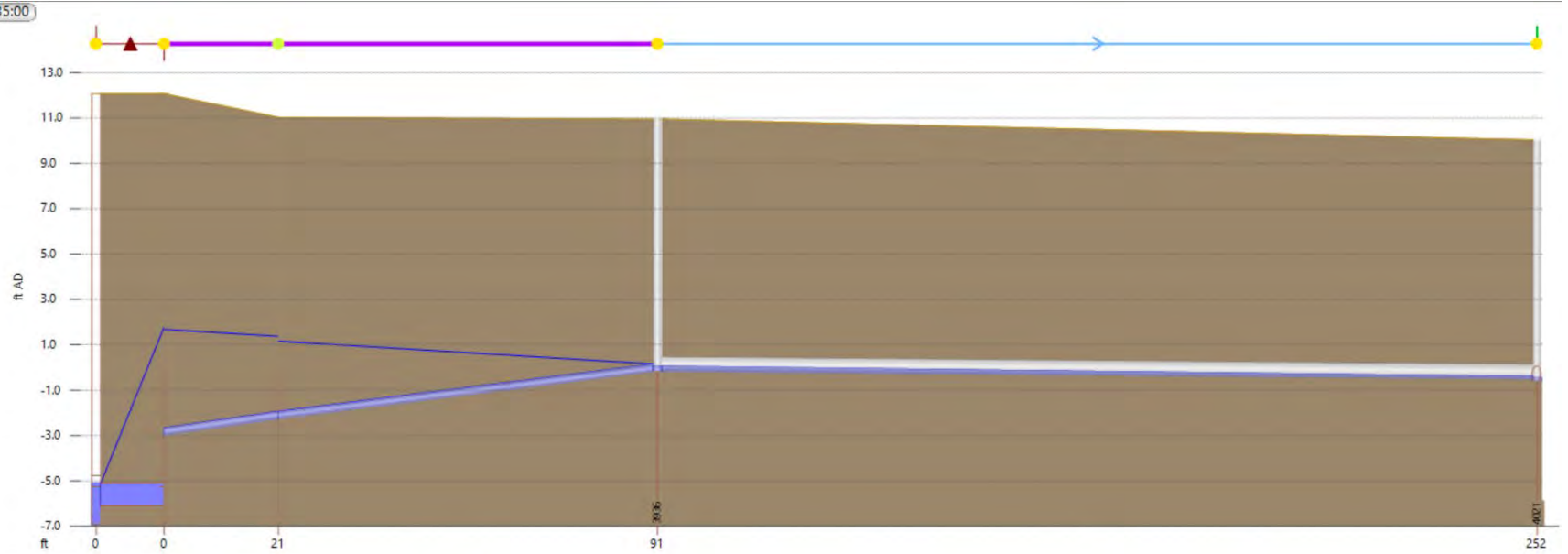
Coral Cay Lag Pump



Link	3939.1	9993949.1
width (in)		4.0
us inv (ft AD)		-3.000
ds inv (ft AD)		-2.270
r.pfc (MGD)		-0.23
surc	1.00	1.00
US total head (ft AD)	-5.102	1.786
US velocity (ft/s)	0.000	2.625
DS flow (MGD)	0.1481	0.1481
DS cumulative flow (US Mgal)	0.10091	0.10091
DS total head (ft AD)	1.786	1.482
DS velocity (ft/s)	0.000	2.625

Node	3939	9993949
ground (ft AD)	12.070	12.070
flood dep (ft)	-17.172	-10.284

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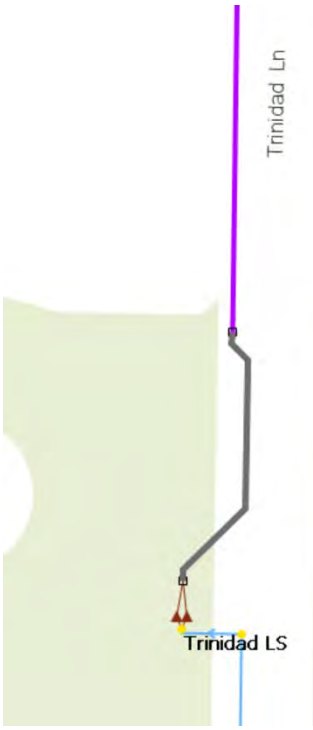


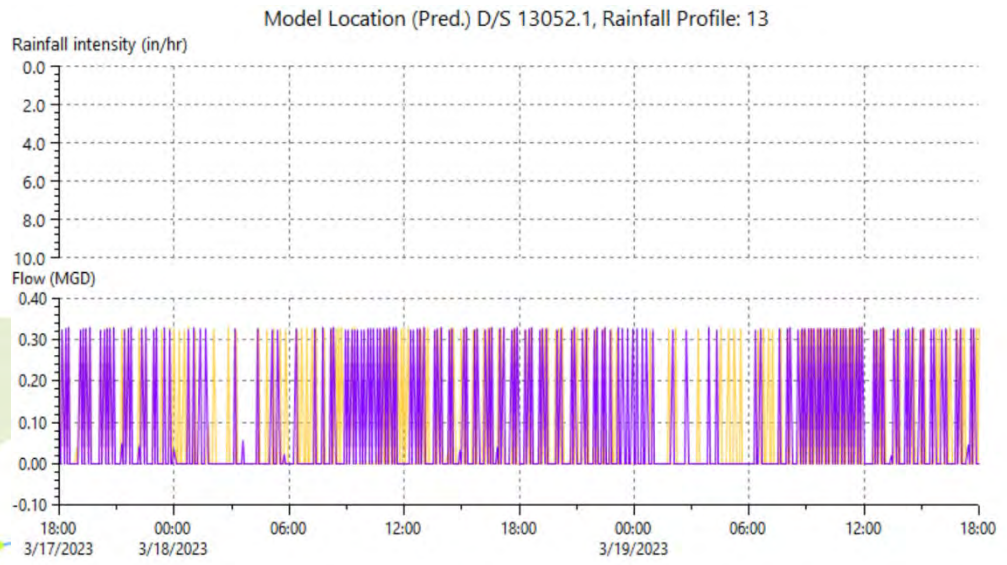
Link	3939.1	9993949.1	12071.1	3936.1
width (in)		4.0	4.0	8.0
us inv (ft AD)		-3.000	-2.270	-0.180
ds inv (ft AD)		-2.270	-0.180	-0.510
r.pfc (MGD)		-0.23	-0.21	0.35
surc	1.00	1.00	1.00	0.36
US total head (ft AD)	-5.102	1.786	1.268	0.115
US velocity (ft/s)	0.000	2.625	2.625	1.903
DS flow (MGD)	0.1481	0.1481	0.1481	0.0238
DS cumulative flow (US Mgal)	0.10091	0.10091	0.10091	0.12441
DS total head (ft AD)	1.786	1.482	0.260	-0.386
DS velocity (ft/s)	0.000	2.625	2.625	1.003

Node	-	9993949	12071	3936	4021
ground (ft AD)	-	12.070	11.027	10.949	10.037
flood dep (ft)	-	-10.284	-9.759	-10.890	-10.484

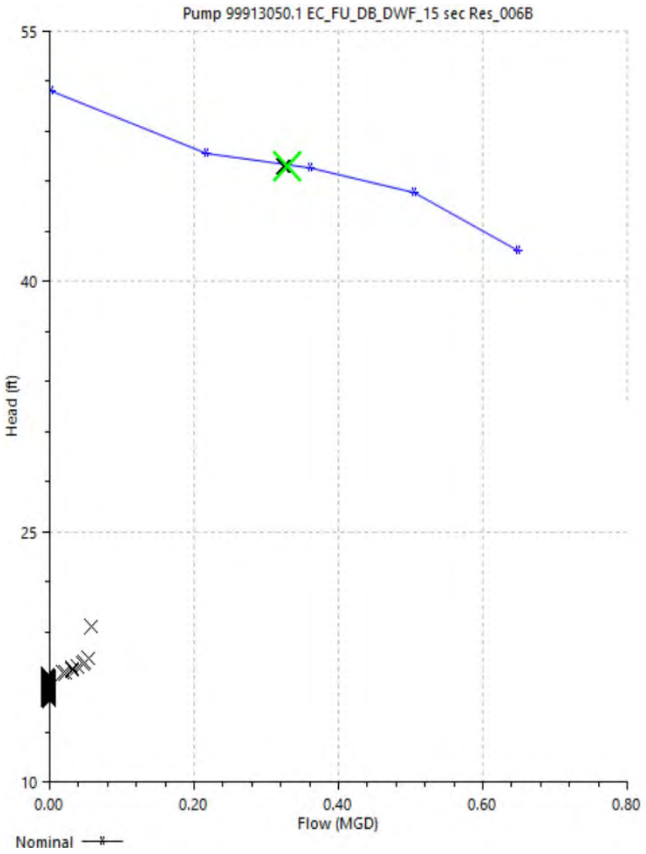
Trinidad LS - Design Basis - DWF



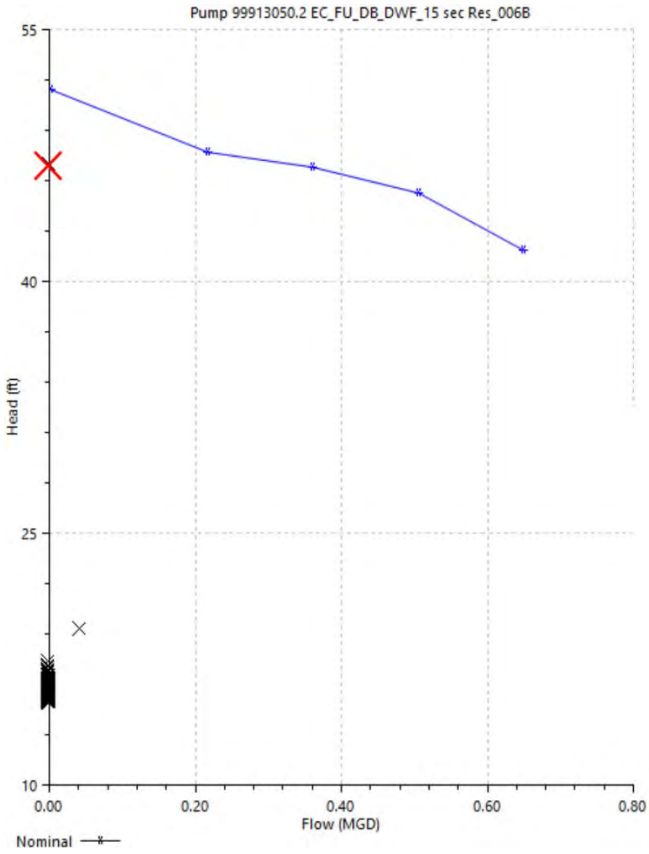




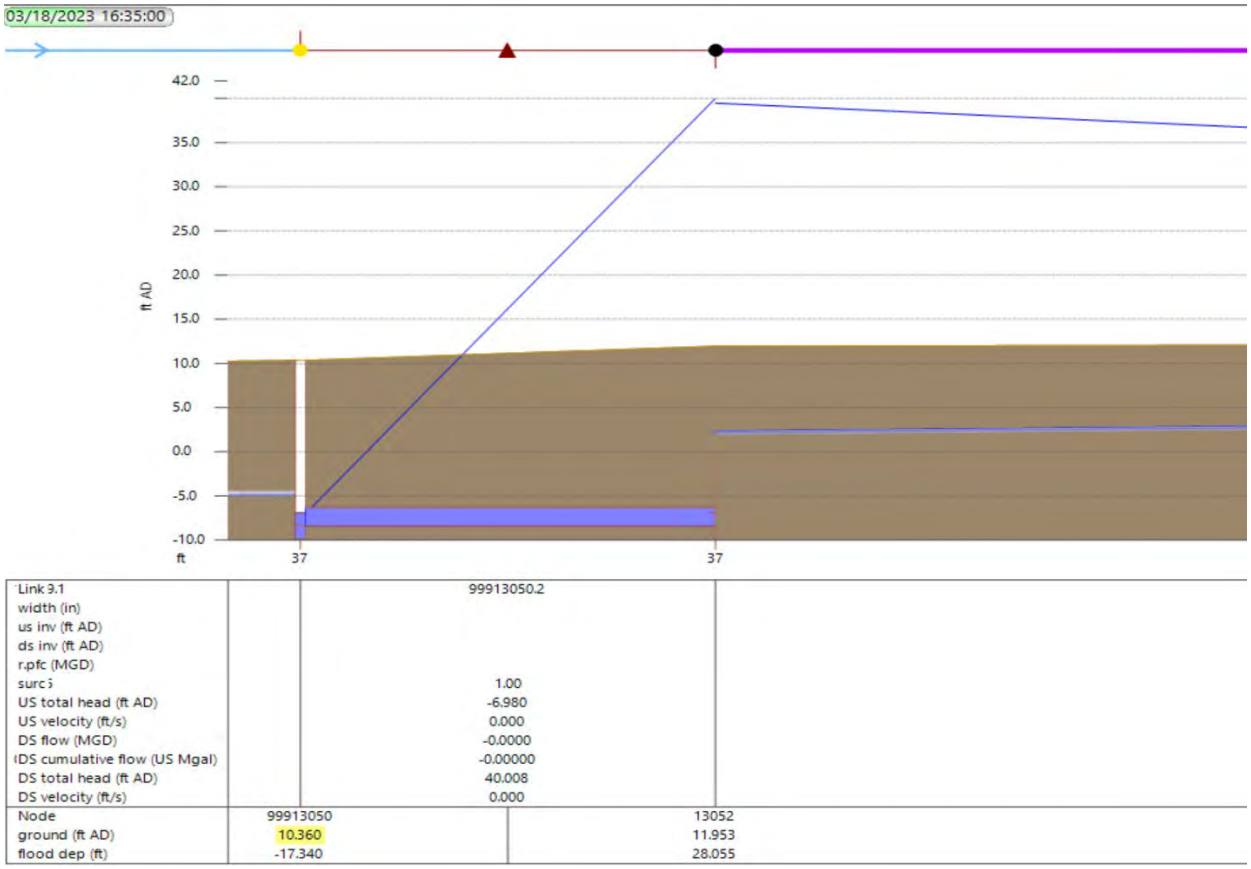
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.330	0.163
Future - DWF				-0.000	0.330	0.168



Trinidad Lead Pump

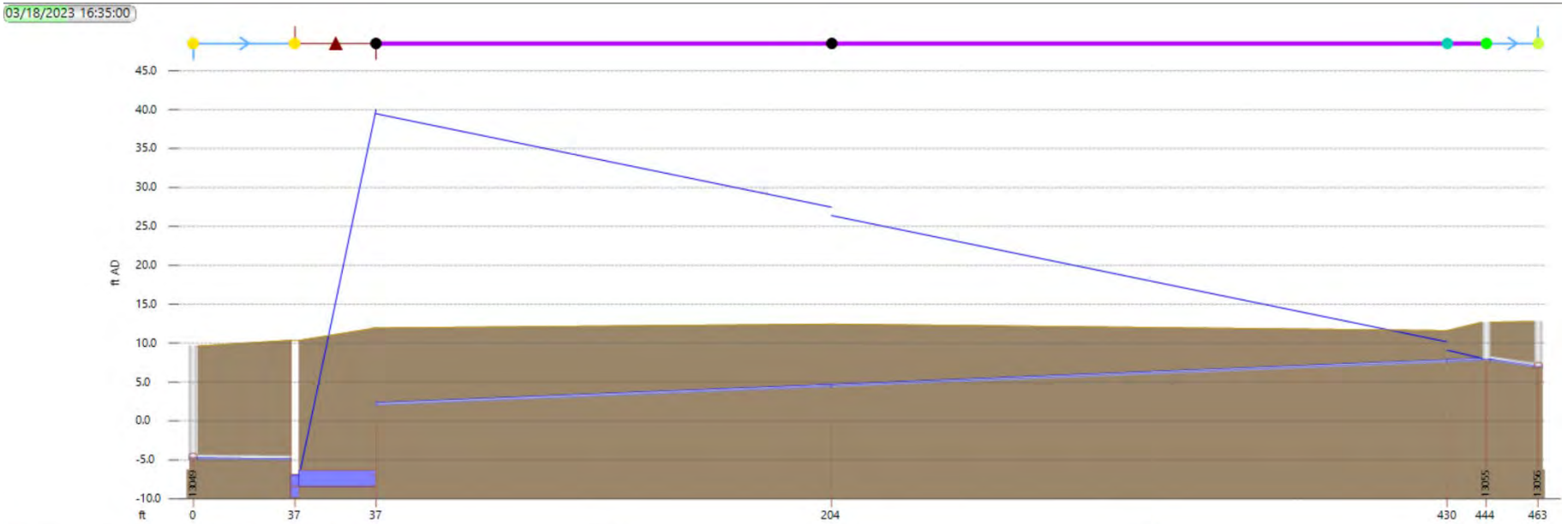


Trinidad Lag Pump



Link 9.1		99913050.2	
width (in)			
us inv (ft AD)			
ds inv (ft AD)			
r.pfc (MGD)			
surc ɜ		1.00	
US total head (ft AD)		-6.980	
US velocity (ft/s)		0.000	
DS flow (MGD)		-0.0000	
DS cumulative flow (US Mgal)		-0.00000	
DS total head (ft AD)		40.008	
DS velocity (ft/s)		0.000	
Node	99913050		13052
ground (ft AD)	10.360		11.953
flood dep (ft)	-17.340		28.055

03/18/2023 16:35:00

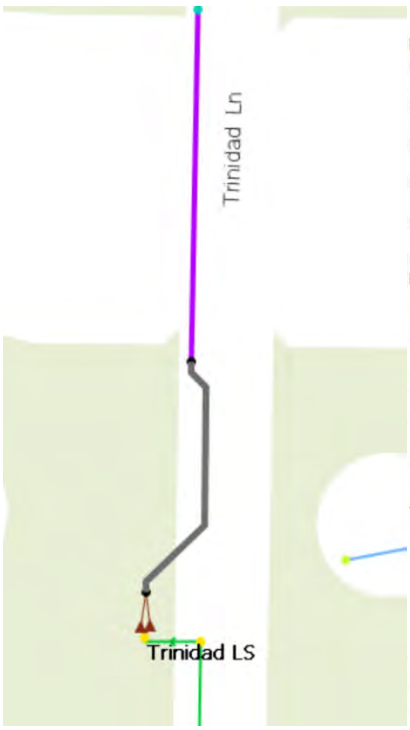


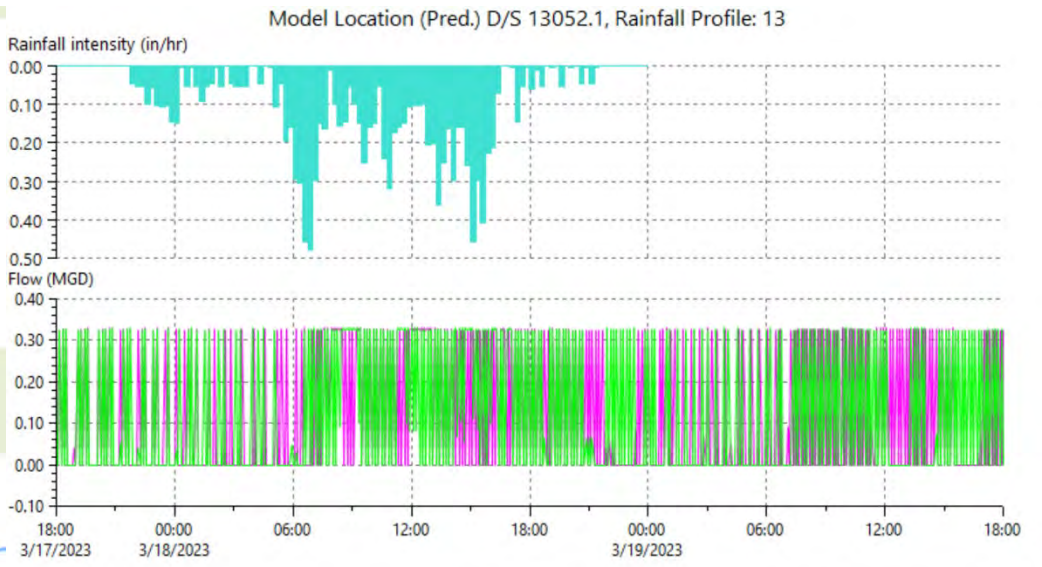
Link	13049.1	99913050.2	13052.1	13053.1	-	13055.1
width (in)	8.0		4.0	4.0	4.0	8.0
us inv (ft AD)	-4.960		2.000	4.351	7.528	7.730
ds inv (ft AD)	-5.040		4.351	7.528	7.730	6.900
r.pfc (MGD)	0.36		-0.15	-0.15	-0.15	1.63
surc	0.35	1.00	1.00	1.00	1.00	0.32
US total head (ft AD)	-4.700	-6.980	40.008	26.930	9.626	8.369
US velocity (ft/s)	1.378	0.000	5.855	5.855	5.855	5.252
DS flow (MGD)	0.0955	-0.0000	0.3302	0.3302	0.3302	0.3065
DS cumulative flow (US Mgal)	0.16704	-0.00000	0.16693	0.16693	-	0.16744
DS total head (ft AD)	-4.801	40.008	27.996	10.691	8.596	7.518
DS velocity (ft/s)	1.903	0.000	5.855	5.855	5.855	5.143

Node	13049	99913050	13052	13053	13054	13055	-
ground (ft AD)	9.625	10.360	11.953	12.441	11.611	-	-
flood dep (ft)	-	-17.340	28.055	14.489	-1.985	-4.747	-

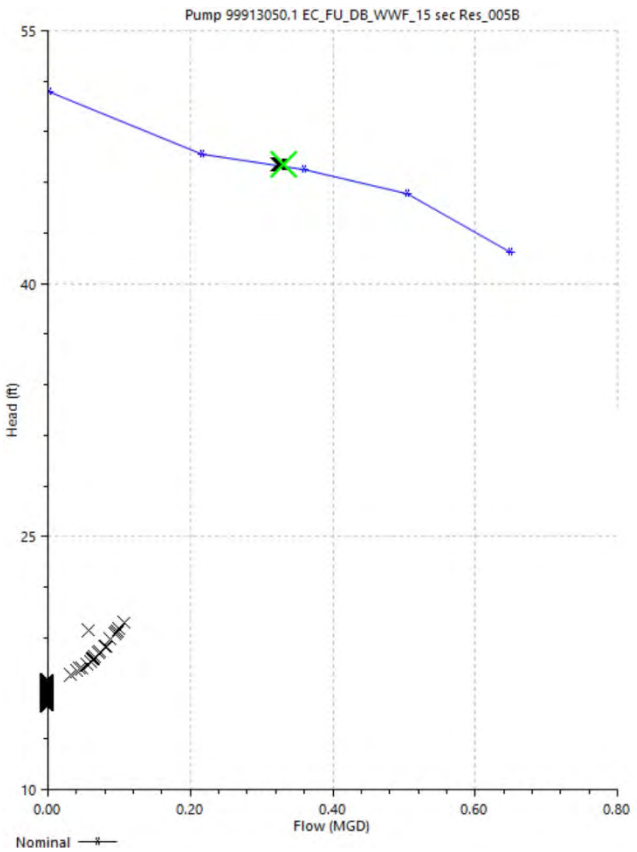
Trinidad LS - Design Basis - 10 year 24 hour Storm



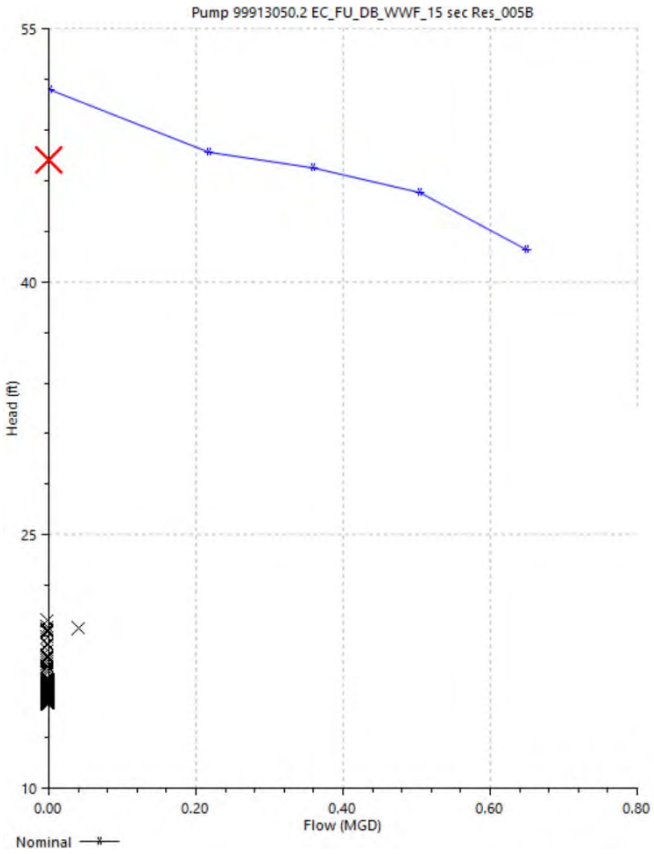




	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.795	0.479	0.093			
Existing - WWF				-0.000	0.331	0.250
Future - WWF				-0.000	0.331	0.251

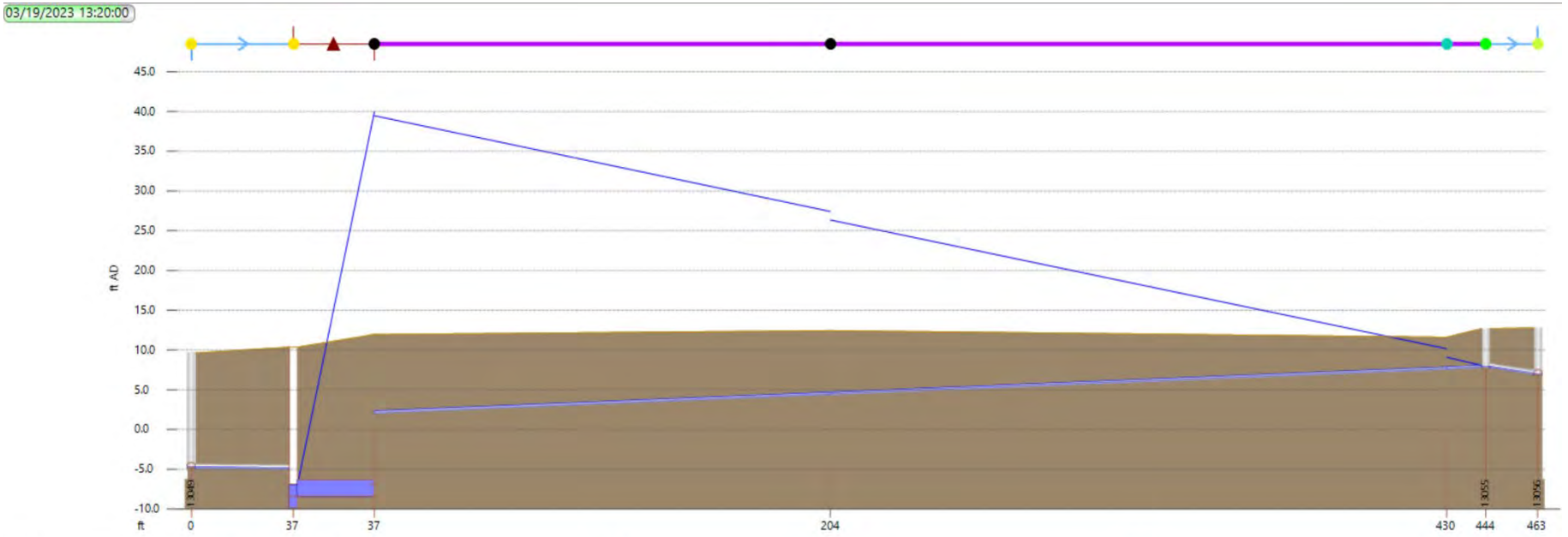


Trinidad Lead Pump



Trinidad Lag Pump



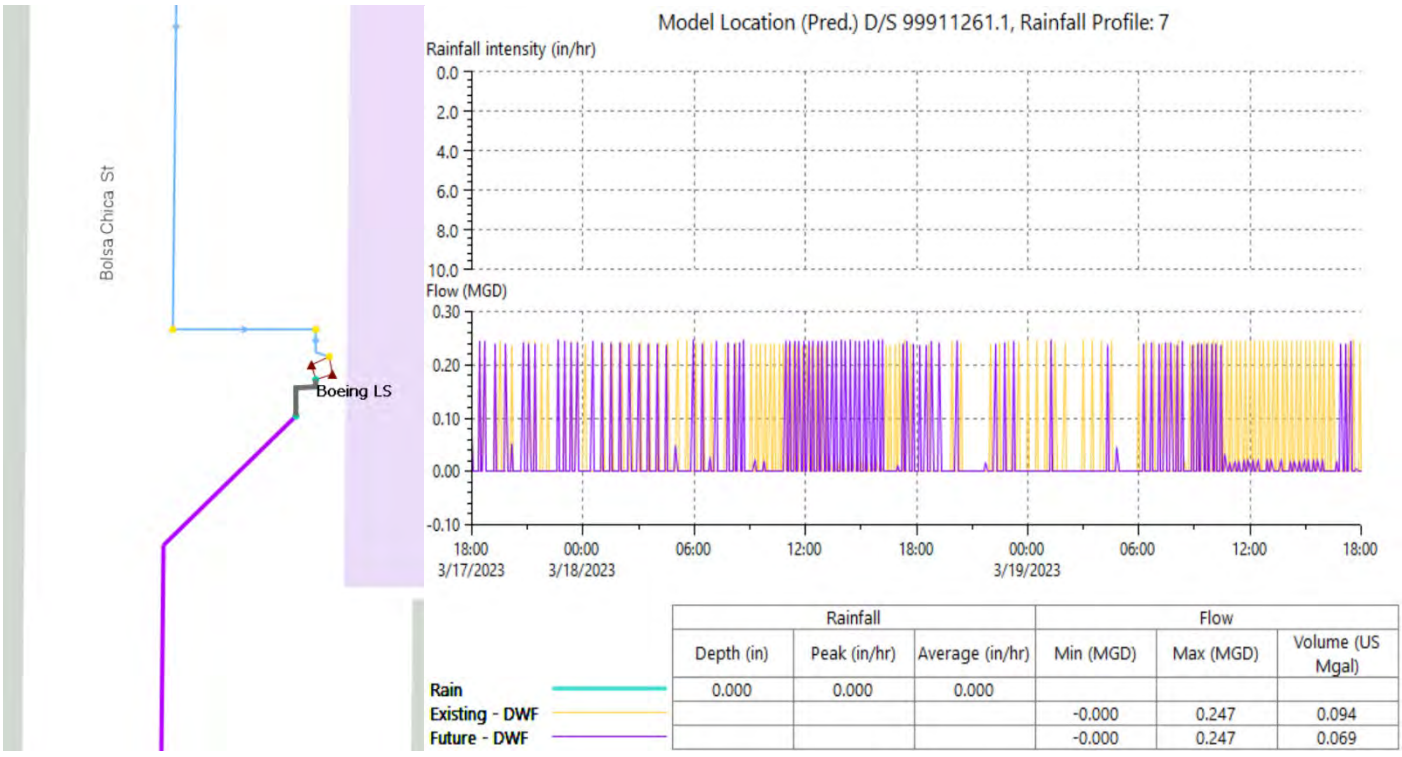


Link	13049.1	99913050.2	13052.1	13053.1	-	13055.1
width (in)	8.0		4.0	4.0	4.0	8.0
us inv (ft AD)	-4.960		2.000	4.351	7.528	7.730
ds inv (ft AD)	-5.040		4.351	7.528	7.730	6.900
r.pfc (MGD)	0.36		-0.15	-0.15	-0.15	1.63
surc	0.40	1.00	1.00	1.00	1.00	0.29
US total head (ft AD)	-4.660	-6.976	39.999	26.884	9.621	8.322
US velocity (ft/s)	1.531	0.000	5.863	5.848	5.846	5.080
DS flow (MGD)	0.1271	0.0000	0.3307	0.3298	0.3297	0.2007
DS cumulative flow (US Mgal)	0.24950	-0.00000	0.24930	0.24930	-	0.24973
DS total head (ft AD)	-4.762	39.999	27.953	10.684	8.594	7.371
DS velocity (ft/s)	2.091	0.000	5.863	5.848	5.846	4.395

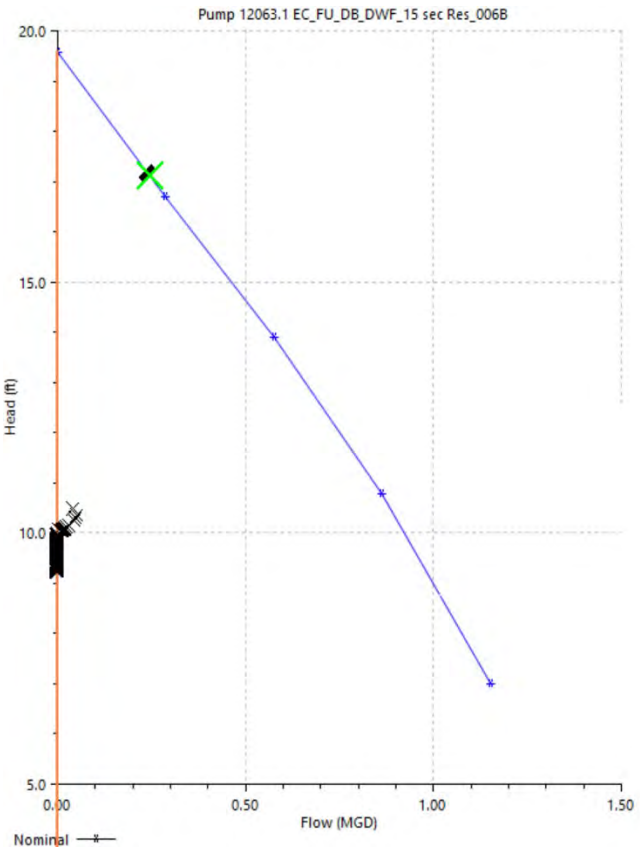
Node	13049	99913050	13052	13053	13054	13055	-
ground (ft AD)	9.625	10.360	11.953	12.441	11.611	-	-
flood dep (ft)	-14.321	-17.336	28.046	14.443	-1.989	-4.766	-

Boeing LS - Design Basis - DWF

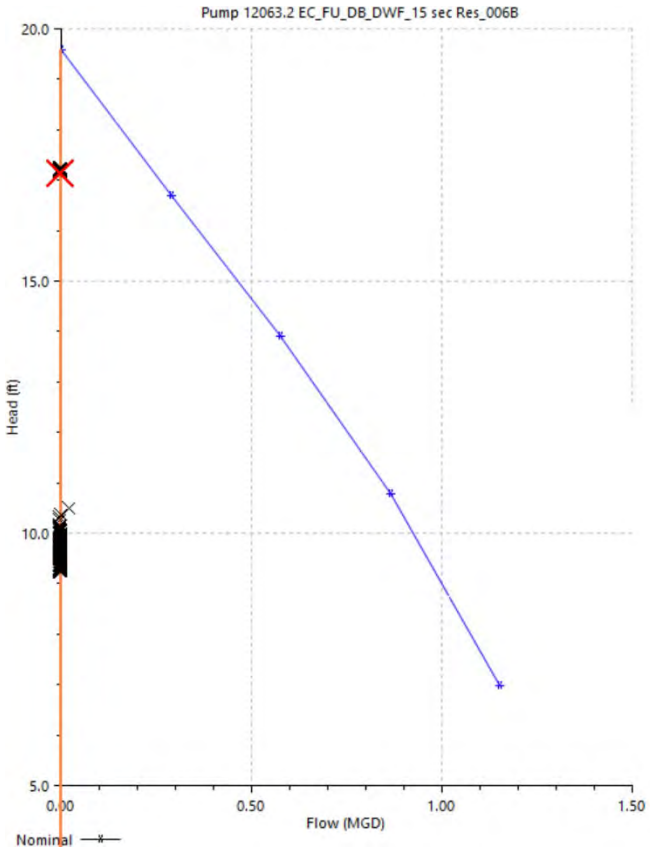




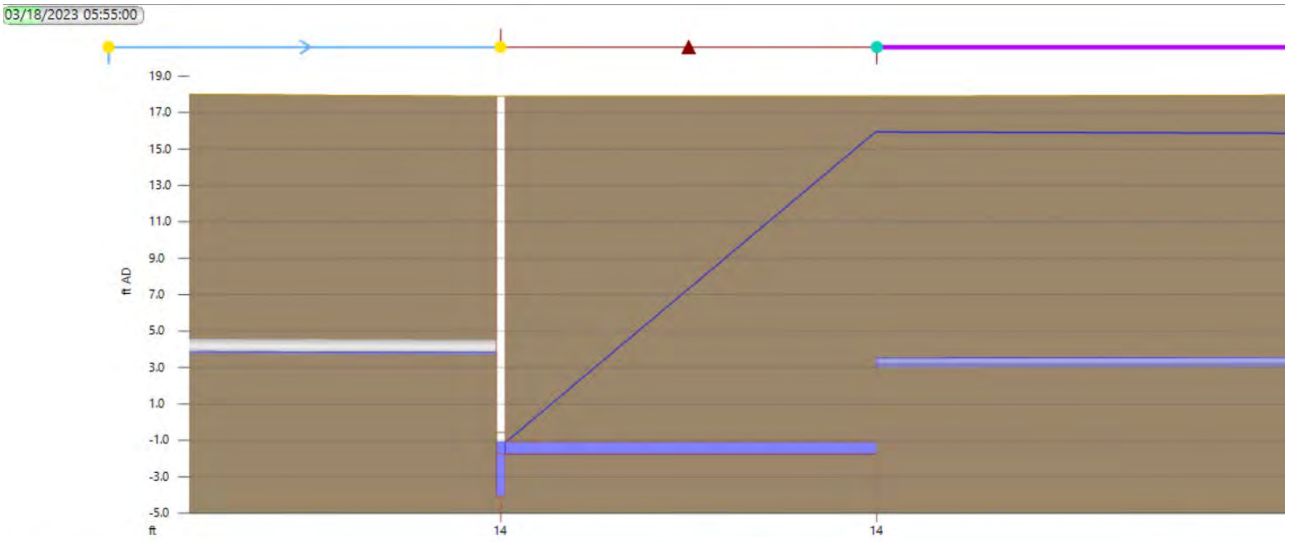
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.247	0.094
Future - DWF				-0.000	0.247	0.069



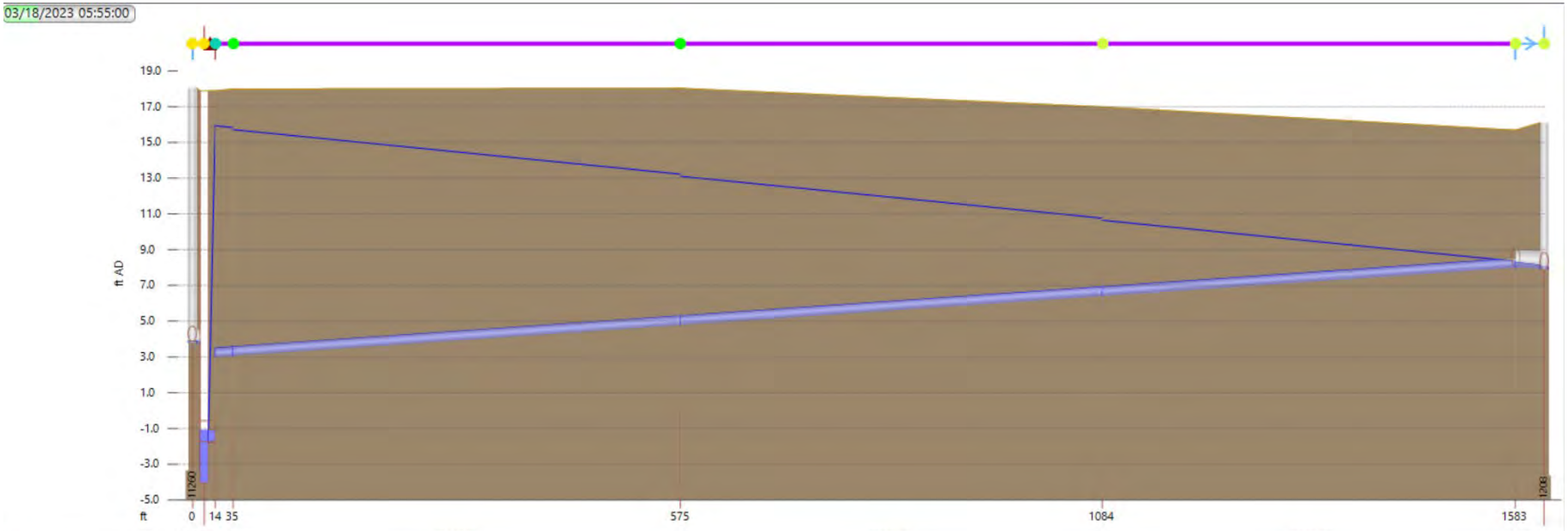
Boeing Lead Pump



Boeing Lag Pump



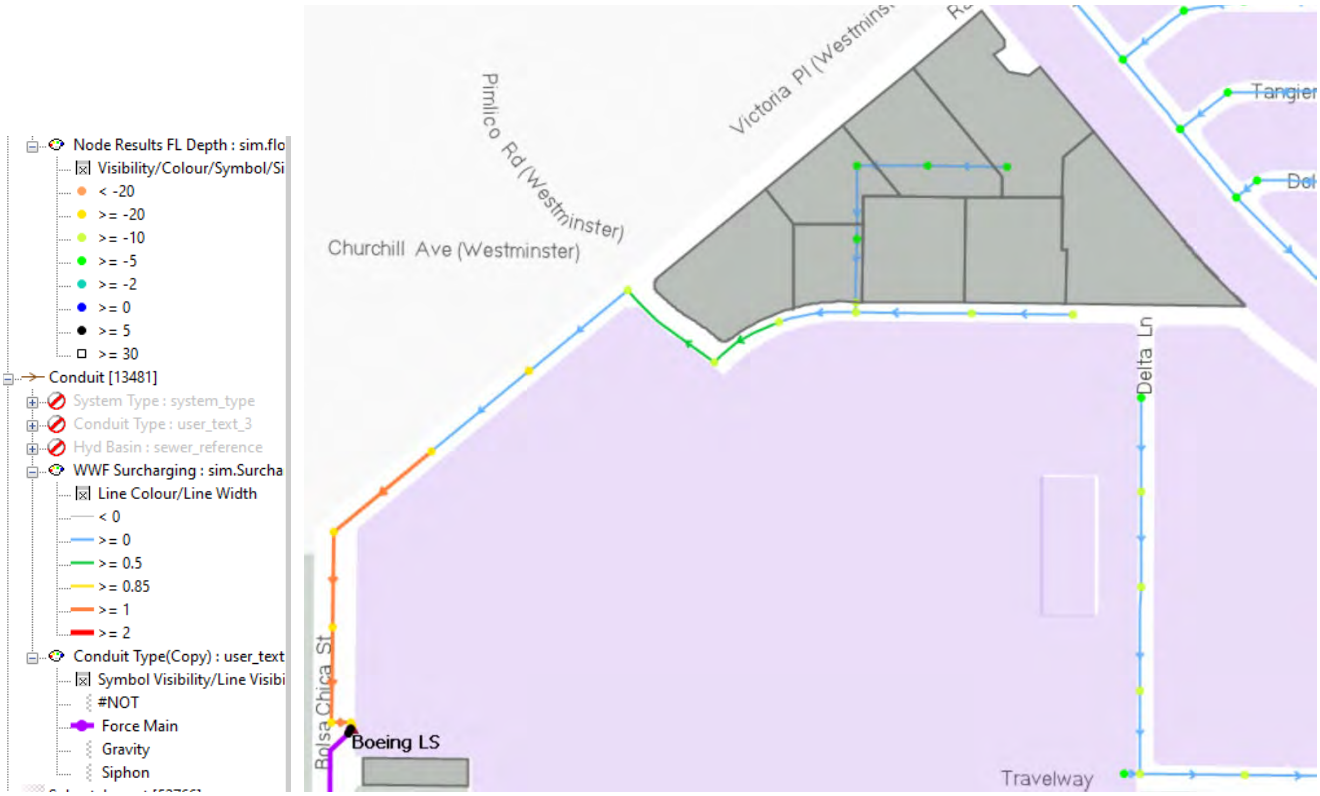
Link		11260.1	12063.1	99911261.1
width (in)		10.0		6.0
us inv (ft AD)		3.780		3.000
ds inv (ft AD)		3.710		3.069
r.pfc (MGD)		1.01		-0.20
surc		0.14	1.00	1.00
US total head (ft AD)		3.907	-1.120	15.991
US velocity (ft/s)		0.952	0.000	1.945
DS flow (MGD)		0.0272	0.2472	0.2468
DS cumulative flow (US Mgal)		0.08664	0.08618	0.08618
DS total head (ft AD)		3.834	15.991	15.891
DS velocity (ft/s)		1.008	0.000	1.945
Node	11260		12063	99911261
ground (ft AD)	18.031		17.890	17.890
flood dep (ft)	-14.138		-19.010	-1.899

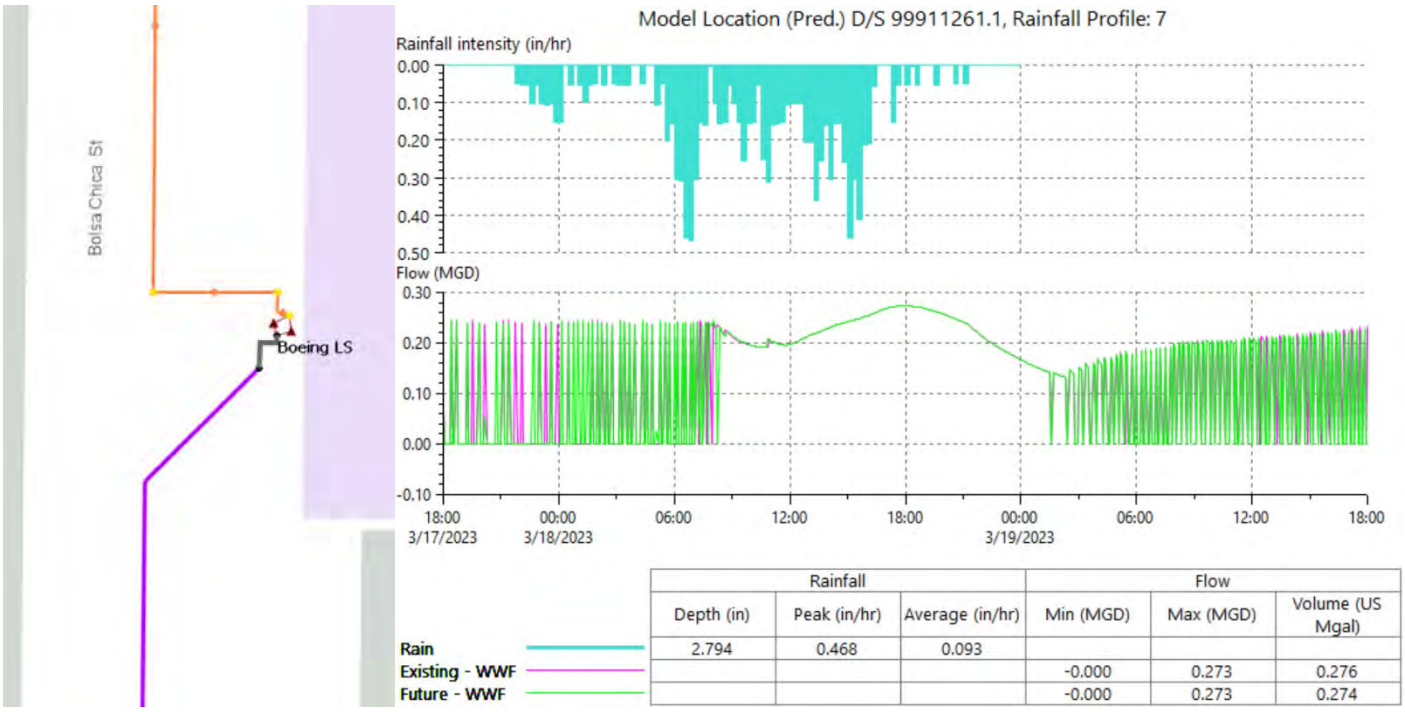


Link	-	-	-	12060.1	11262.1	11263.1	-	
width (in)	-	-	-	6.0	6.0	6.0	12.0	
us inv (ft AD)	-	-	-	3.069	4.793	6.418	-	
ds inv (ft AD)	-	-	-	4.793	6.418	8.010	-	
r.pfc (MGD)	-	-	-	-0.20	-0.20	-0.20	0.78	
surc	-	-	-	1.00	1.00	1.00	0.28	
US total head (ft AD)	-	-	-	15.774	13.164	10.703	-	
US velocity (ft/s)	-	-	-	1.942	1.940	1.939	-	
DS flow (MGD)	-	-	-	0.2465	0.2462	0.2461	-	
DS cumulative flow (US Mgal)	-	-	-	0.08618	0.08618	0.08618	-	
DS total head (ft AD)	-	-	-	13.282	10.820	8.408	-	
DS velocity (ft/s)	-	-	-	1.942	1.940	1.939	-	

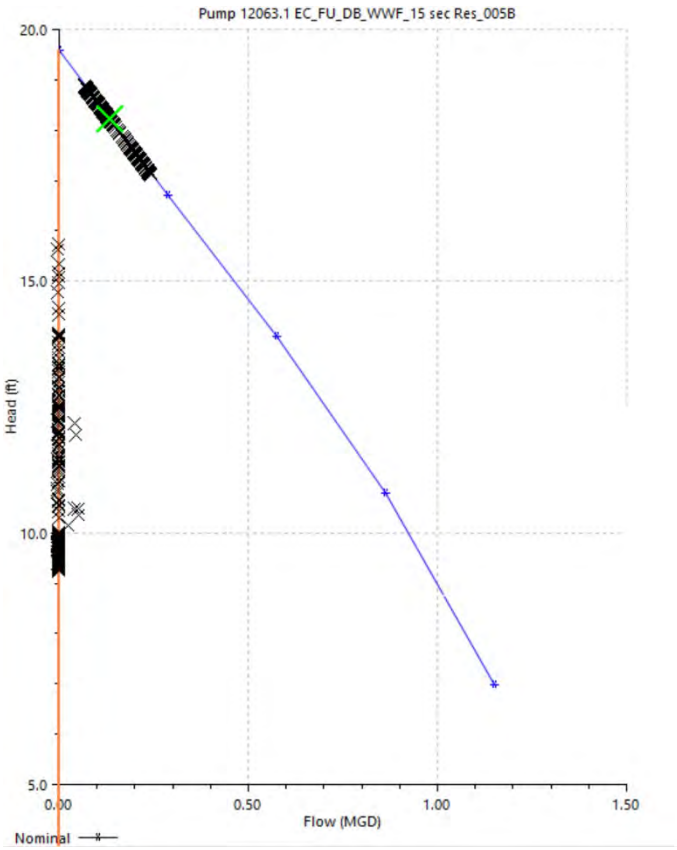
Node	12060	11262	11263	11264
ground (ft AD)	17.990	18.029	16.988	15.687
flood dep (ft)	-2.216	-4.864	-6.285	-7.396

Boeing LS - Design Basis - 10 year 24 hour Storm

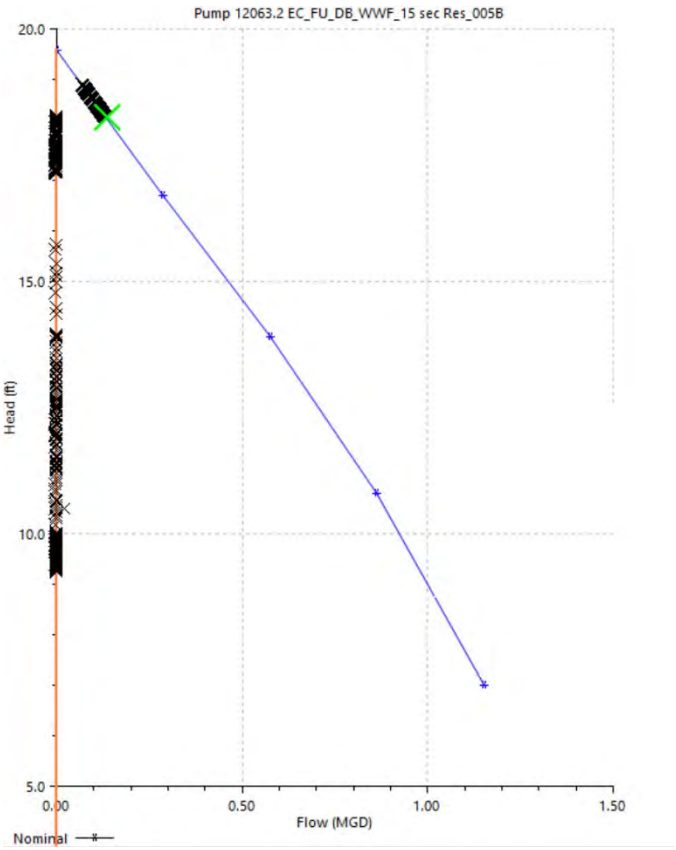




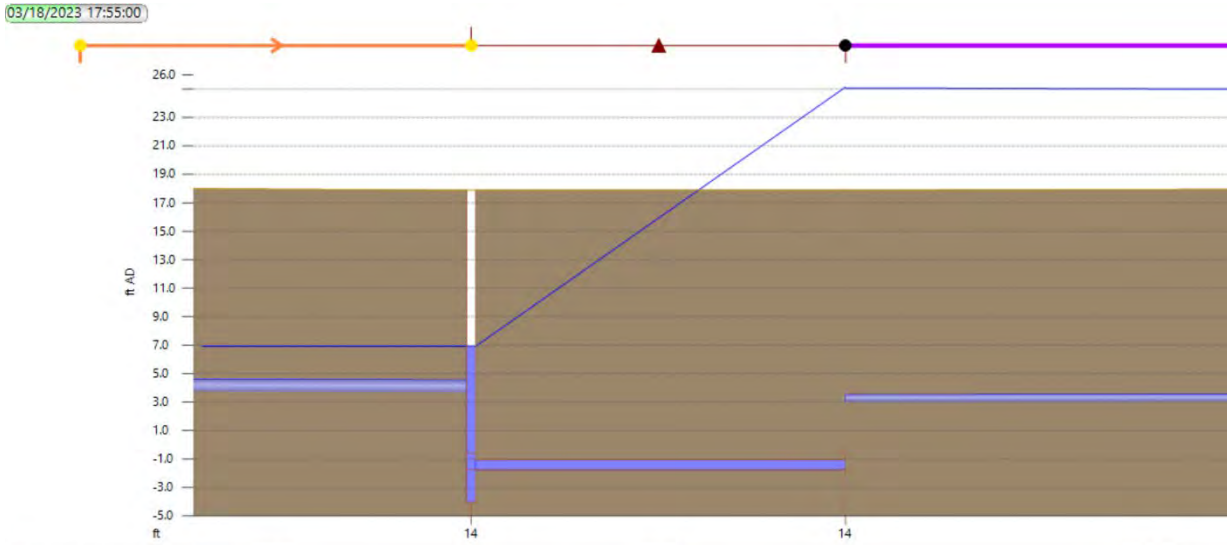
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.794	0.468	0.093			
Existing - WWF				-0.000	0.273	0.276
Future - WWF				-0.000	0.273	0.274



Boeing Lead Pump



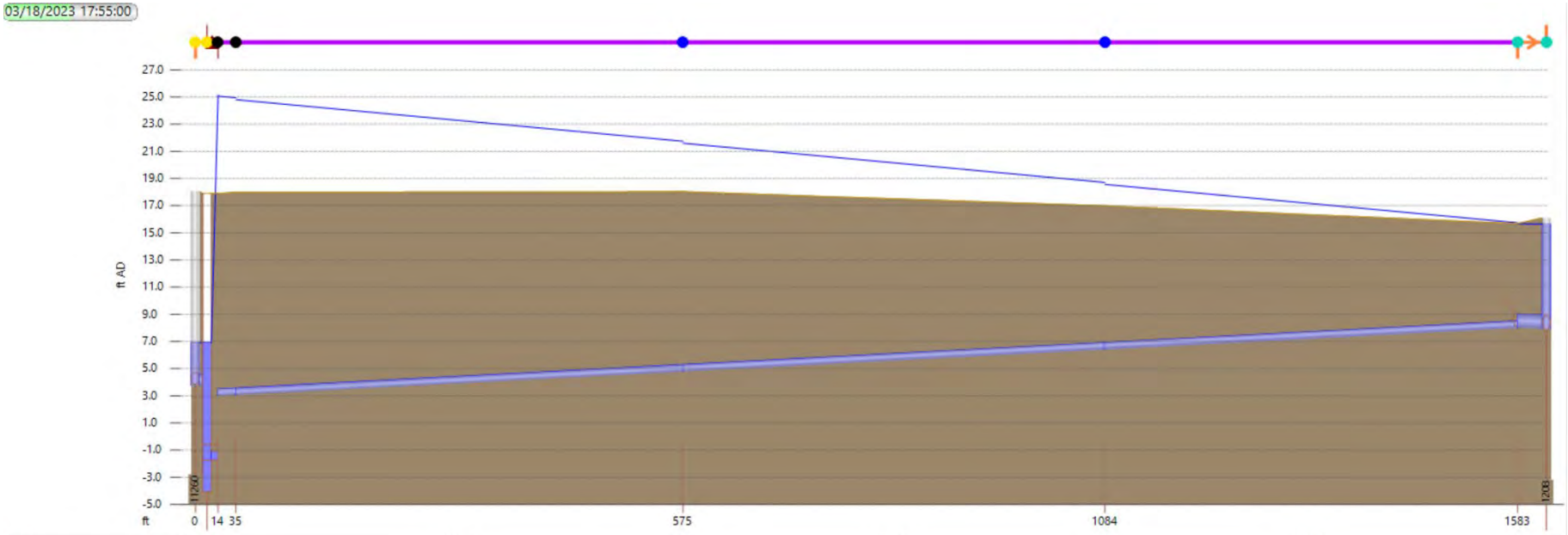
Boeing Lag Pump



Link	11260.1	12063.1	99911261.1
width (in)	10.0		6.0
us inv (ft AD)	3.780		3.000
ds inv (ft AD)	3.710		3.069
r.pfc (MGD)	1.01		-0.20
surc	1.00	1.00	1.00
US total head (ft AD)	6.929	6.916	25.140
US velocity (ft/s)	0.702	0.000	2.153
DS flow (MGD)	0.2736	0.1366	0.2732
DS cumulative flow (US Mgal)	0.27835	0.20913	0.27792
DS total head (ft AD)	6.923	25.140	25.018
DS velocity (ft/s)	0.701	0.000	2.153

Node 11260	12063	99911261
ground (ft AD) 031	17.890	17.890
flood dep (ft) 1.109	-10.974	7.250

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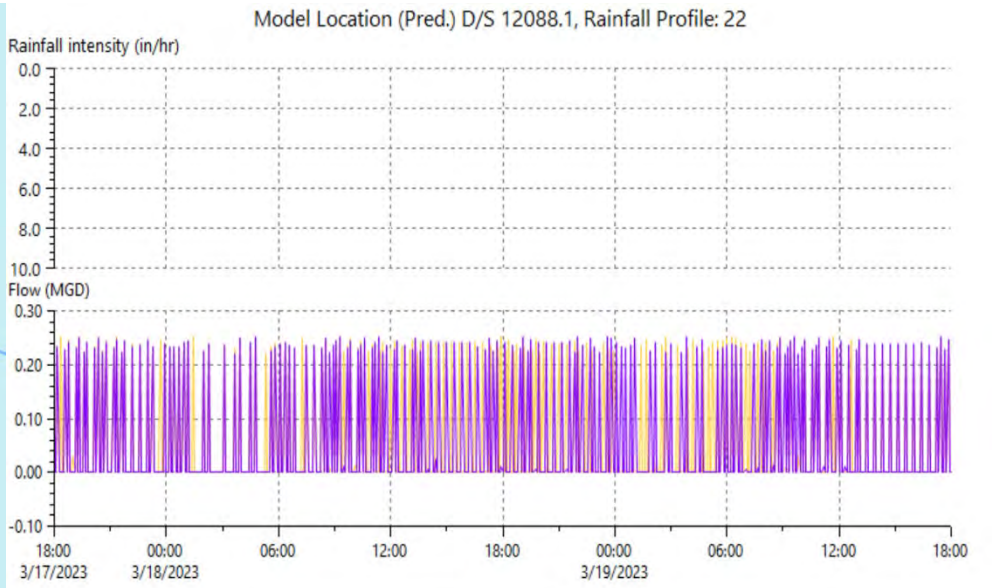


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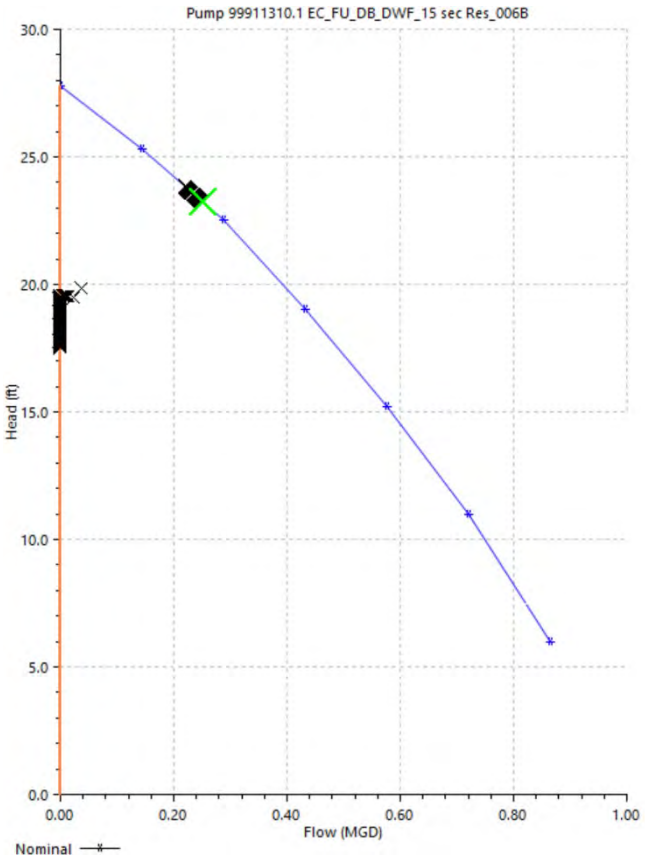
Brightwater LS - Design Basis - DWF



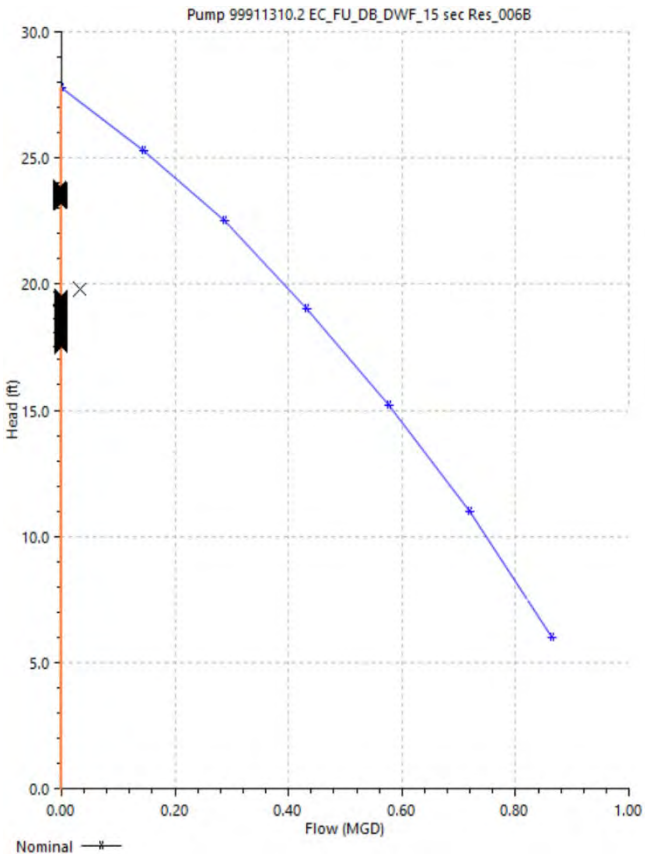




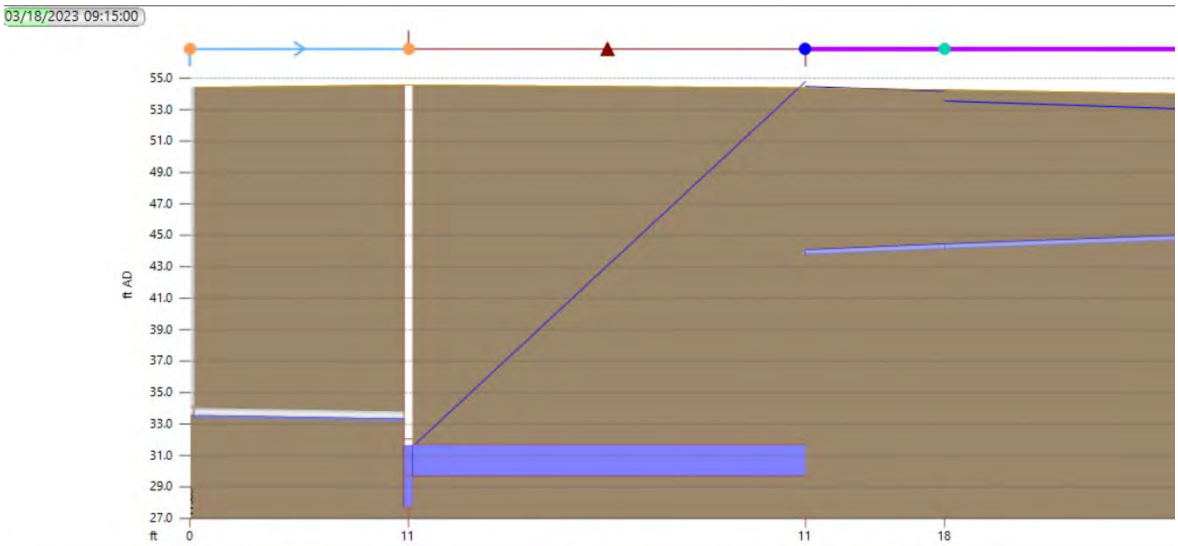
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	0.253	0.123
Future - DWF				-0.000	0.253	0.123



Brightwater Lead Pump



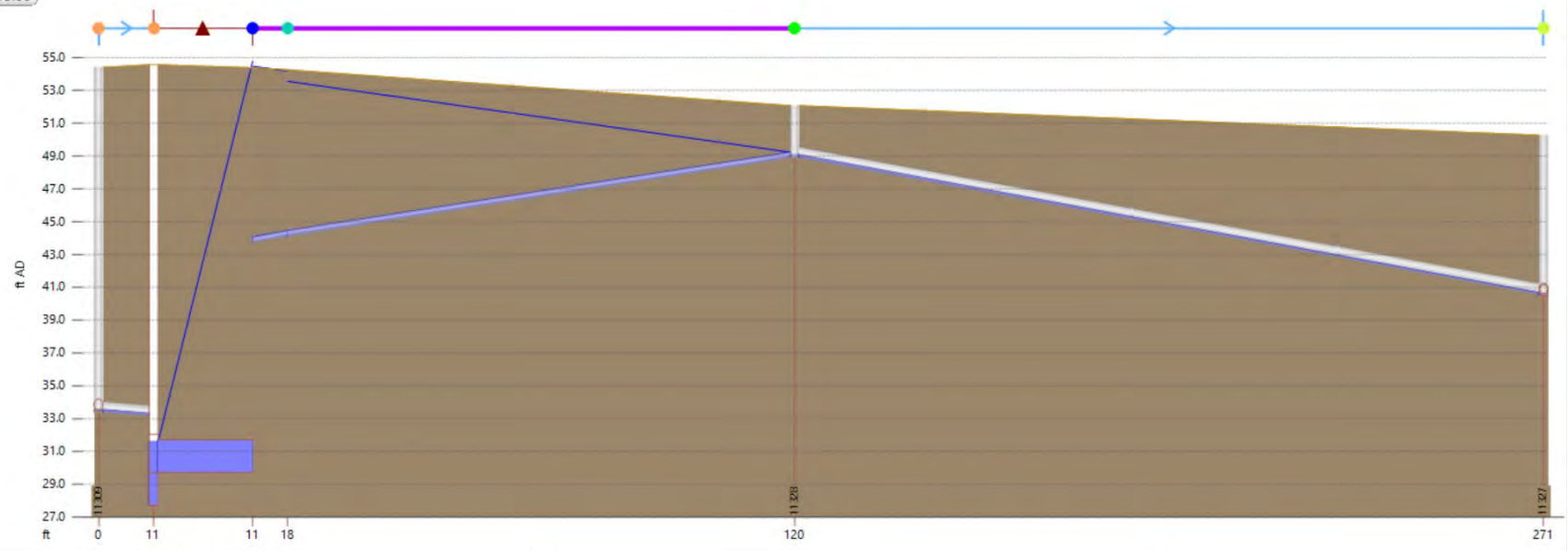
Brightwater Lag Pump



Link	11309.1	99911310.1	12088.1
width (in)	8.0		4.0
us inv (ft AD)	33.400		43.750
ds inv (ft AD)	33.180		44.120
r.pfc (MGD)	1.10		-0.28
surc	0.21	1.00	1.00
US total head (ft AD)	33.632	31.598	54.781
US velocity (ft/s)	2.428	0.000	4.483
DS flow (MGD)	0.0836	0.2529	0.2529
DS cumulative flow (US Mgal)	0.12905	0.12873	0.12873
DS total head (ft AD)	33.412	54.781	54.486
DS velocity (ft/s)	2.428	0.000	4.483

Node	11309	99911310	12088	12089
ground (ft AD)	54.399	54.560	54.375	54.250
flood dep (ft)	-20.859	-22.962	0.406	-0.389

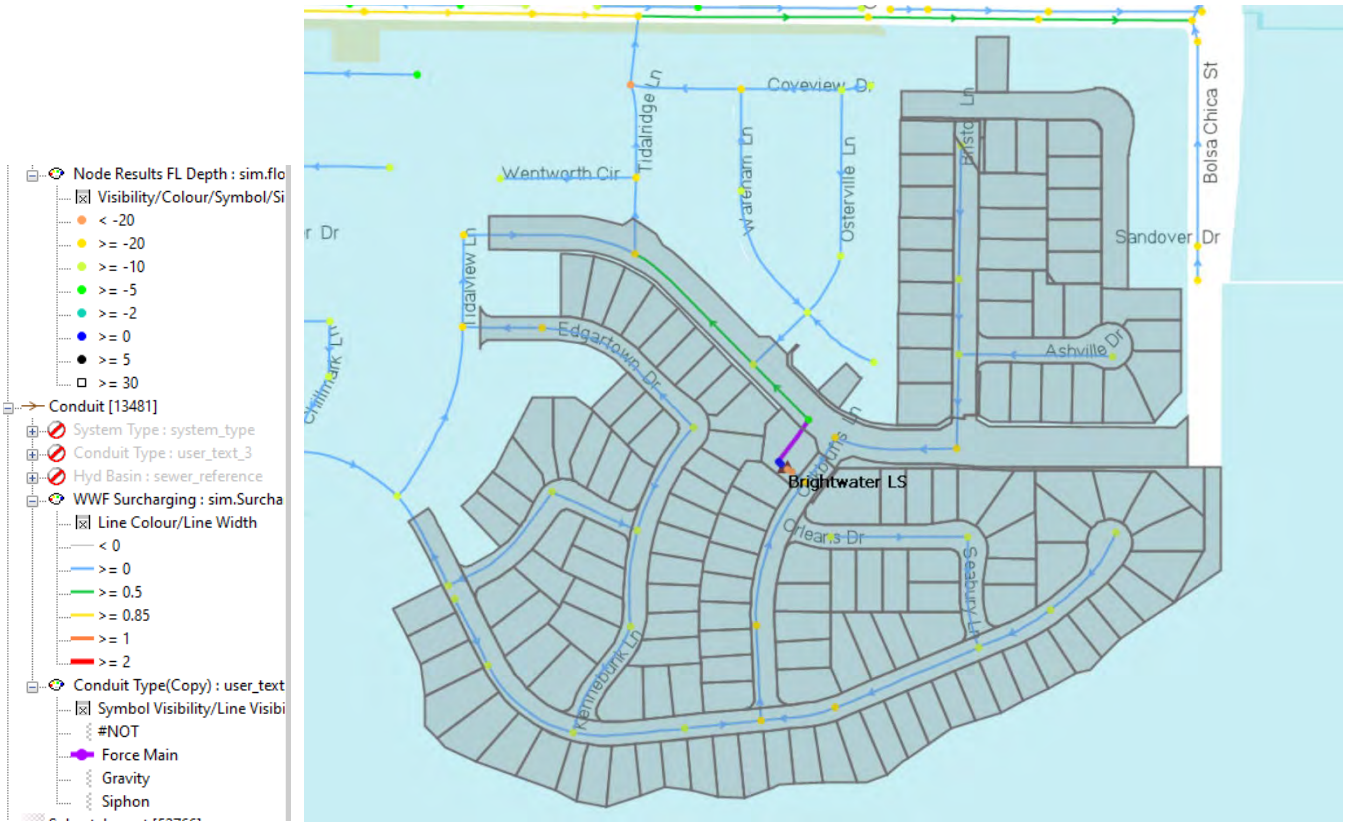
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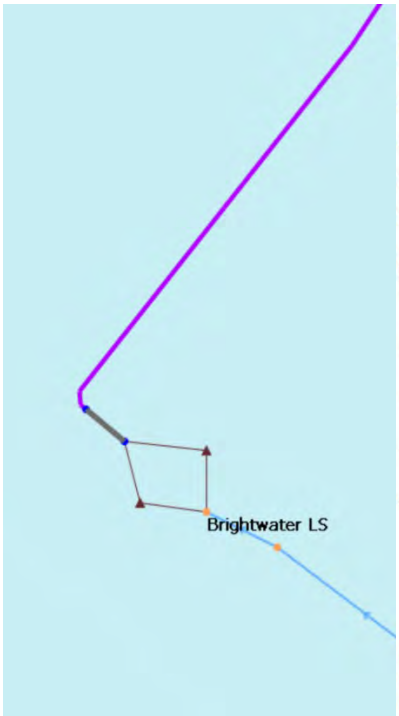


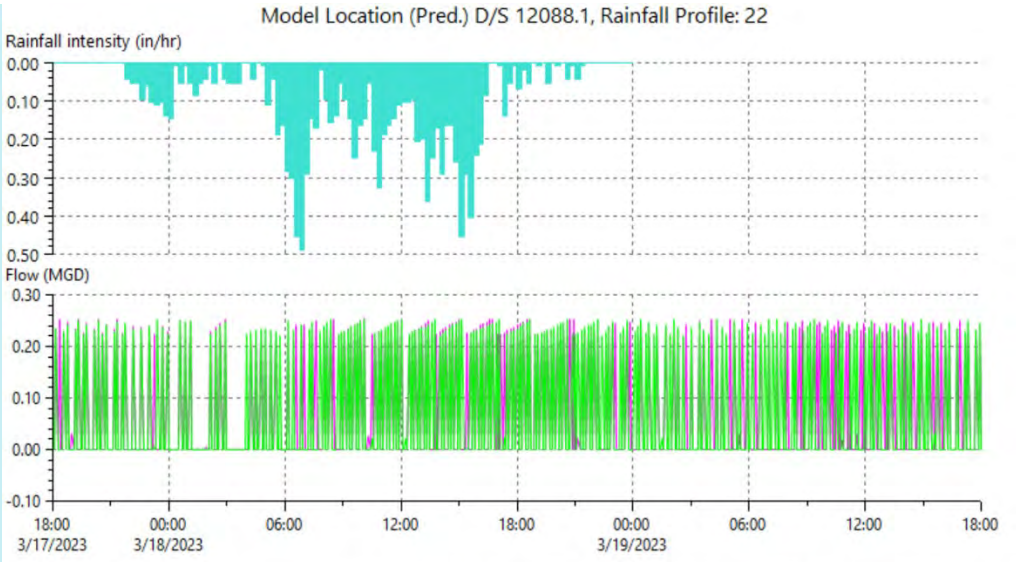
Link	11309.1	99911310.1	-	12089.1		11328.1
width (in)	8.0		4.0	4.0		8.0
us inv (ft AD)	33.400		-	44.120		48.900
ds inv (ft AD)	33.180		-	48.900		40.590
r.pfc (MGD)	1.10		-0.28	-0.27		1.83
surc	0.21	1.00	1.00	1.00		0.27
US total head (ft AD)	33.632	31.598	-	53.861		49.491
US velocity (ft/s)	2.428	0.000	4.483	4.483		5.162
DS flow (MGD)	0.0836	0.2529	-	0.2529		0.0154
DS cumulative flow (US Mgal)	0.12905	0.12873	-	0.12873		0.12891
DS total head (ft AD)	33.412	54.781	-	49.546		40.685
DS velocity (ft/s)	2.428	0.000	4.483	4.483		1.029

Node	-	99911310	12088	12089	11328	11327
ground (ft AD)	-	54.560	54.375	54.250	52.068	50.266
flood dep (ft)	-	-22.962	0.406	-0.389	-2.990	-9.688

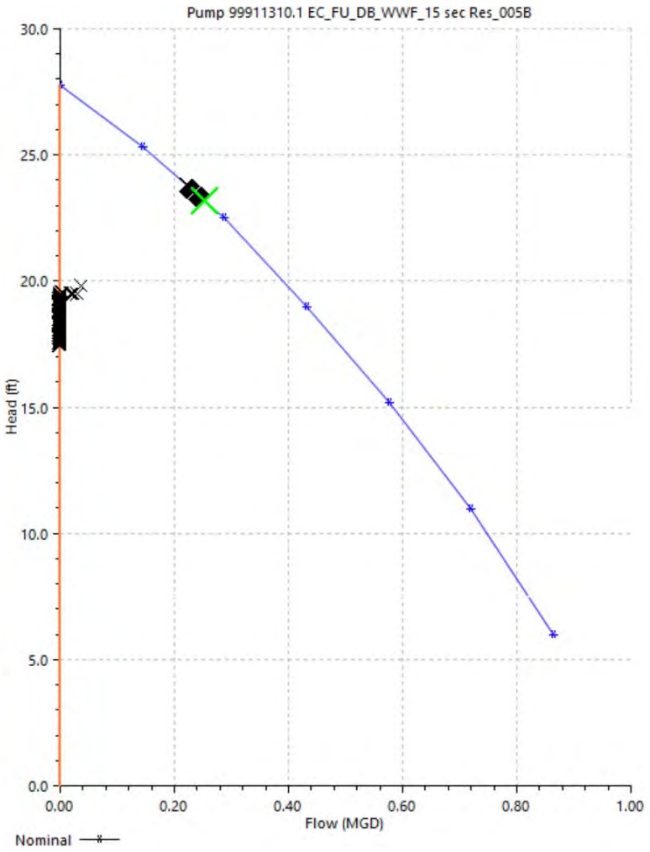
Brightwater LS - Design Basis - 10 year 24 hour Storm



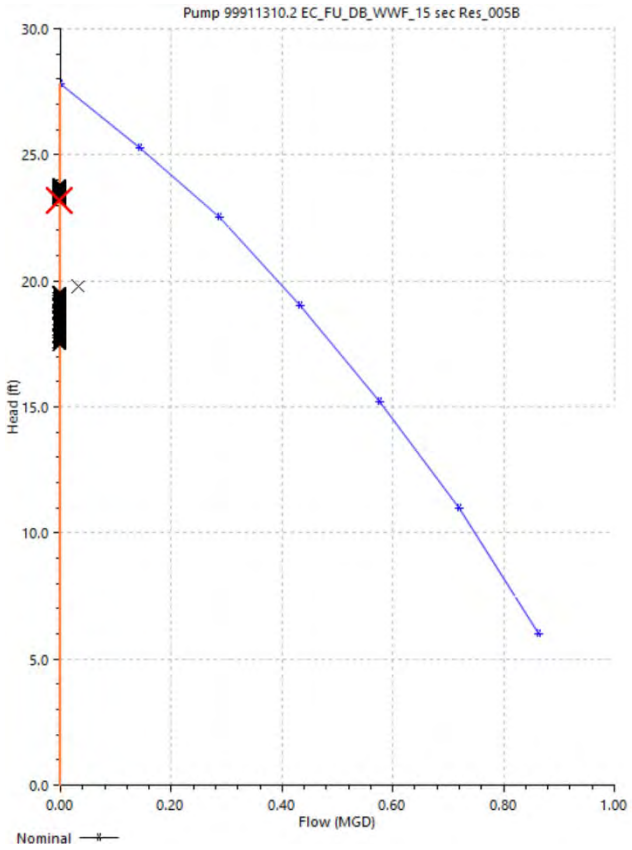




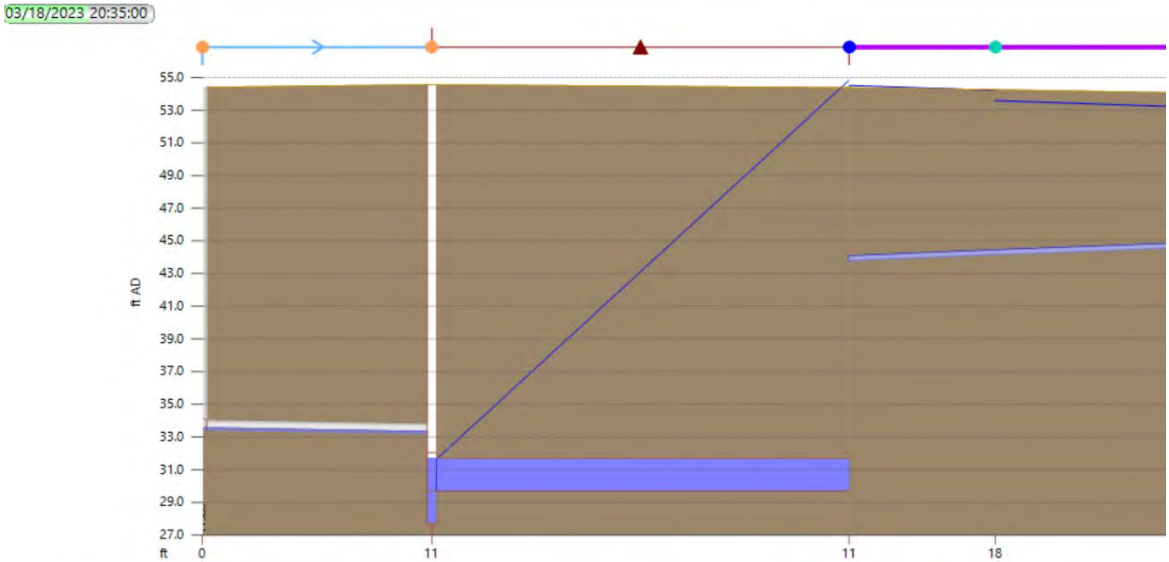
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.797	0.489	0.093			
Existing - WWF				-0.000	0.254	0.155
Future - WWF				-0.000	0.254	0.160



Brightwater Lead Pump



Brightwater Lag Pump



Link	11309.1	99911310.1	12088.1
width (in)	8.0		4.0
us inv (ft AD)	33.400		43.750
ds inv (ft AD)	33.180		44.120
r.pfc (MGD)	1.10		-0.28
surc	0.23	1.00	1.00
US total head (ft AD)	33.665	31.664	54.827
US velocity (ft/s)	2.680	0.000	4.502
DS flow (MGD)	0.1050	0.2539	0.2539
DS cumulative flow (US Mgal)	0.15776	0.15765	0.15765
DS total head (ft AD)	33.445	54.827	54.529
DS velocity (ft/s)	2.680	0.000	4.502

Node	11309	99911310	12088	12089
ground (ft AD)	54.399	54.560	54.375	54.250
flood dep (ft)	-20.846	-22.896	0.452	-0.351

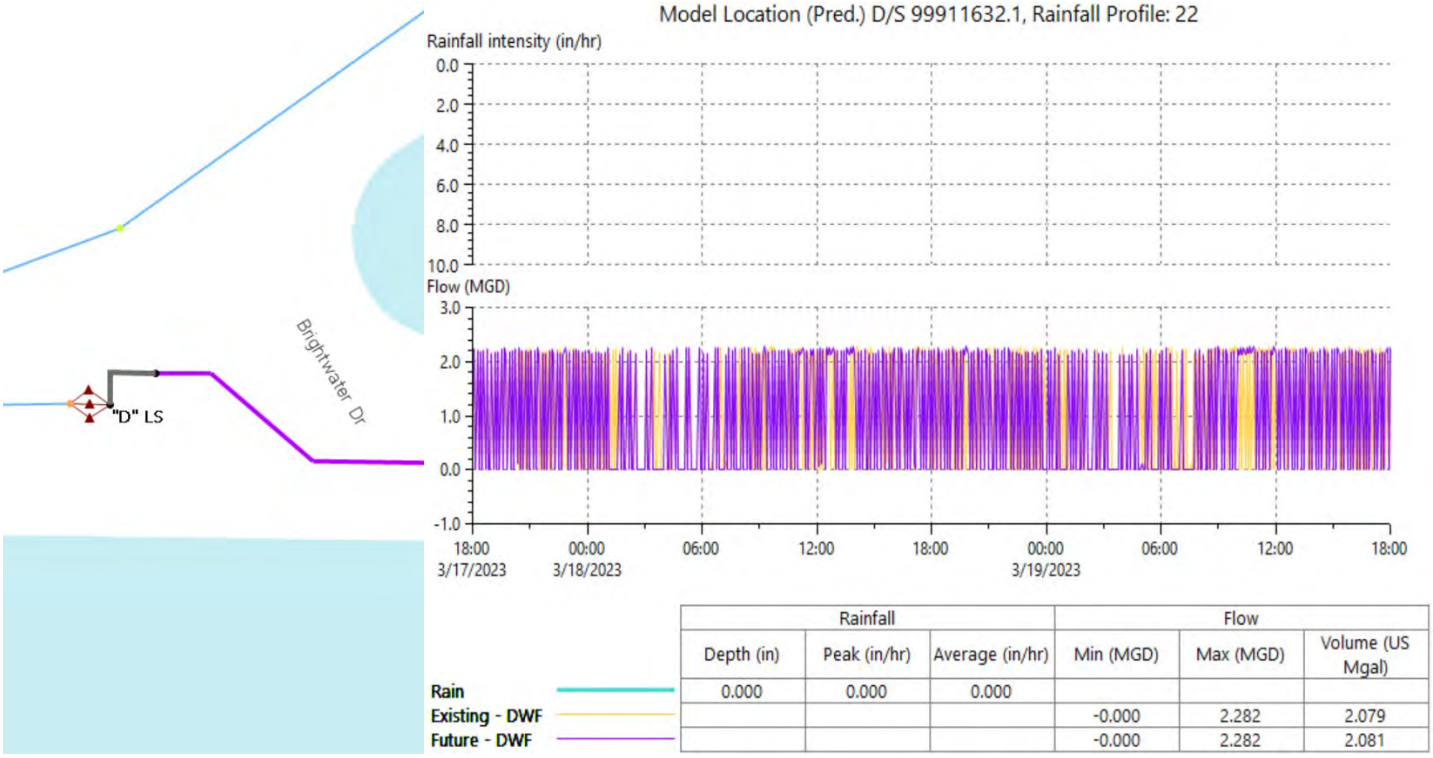


Link	11309.1	99911310.1	-	12089.1	11328.1	
width (in)	8.0		4.0	4.0	8.0	
us inv (ft AD)	33.400		-	44.120	48.900	
ds inv (ft AD)	33.180		-	48.900	40.590	
r.pfc (MGD)	1.10		-0.28	-0.27	1.83	
surc	0.23	1.00	1.00	1.00	0.25	
US total head (ft AD)	33.665	31.664	-	53.899	49.478	
US velocity (ft/s)	2.680	0.000	4.502	4.502	5.128	
DS flow (MGD)	0.1050	0.2539	-	0.2539	0.0429	
DS cumulative flow (US Mgal)	0.15776	0.15765	-	0.15765	0.15798	
DS total head (ft AD)	33.445	54.827	-	49.548	40.758	
DS velocity (ft/s)	2.680	0.000	4.502	4.502	2.156	

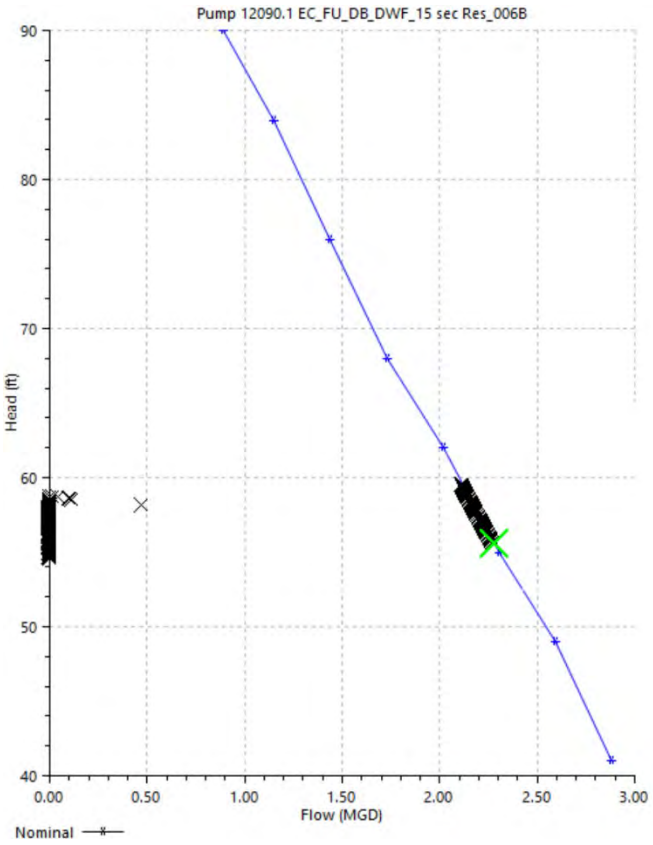
Node	-	99911310	12088	12089	11328	11327
ground (ft AD)	-	54.560	54.375	54.250	52.068	50.266
flood dep (ft)	-	-22.896	0.452	-0.351	-2.998	-9.660

“D” LS - Design Basis - DWF

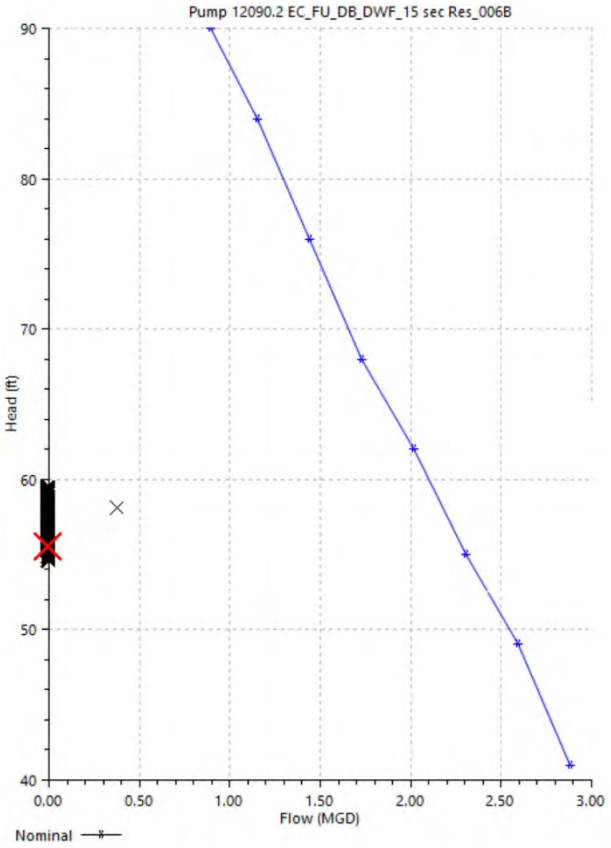




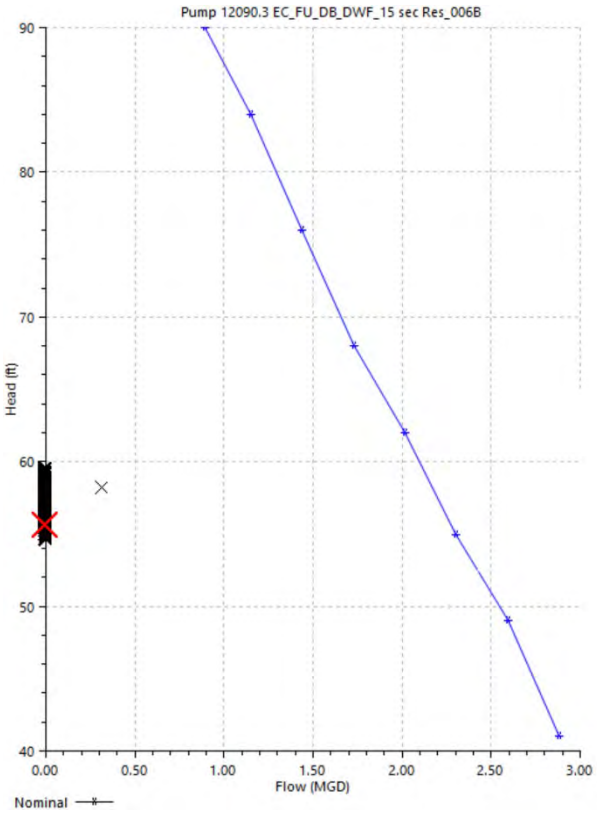
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Existing - DWF				-0.000	2.282	2.079
Future - DWF				-0.000	2.282	2.081



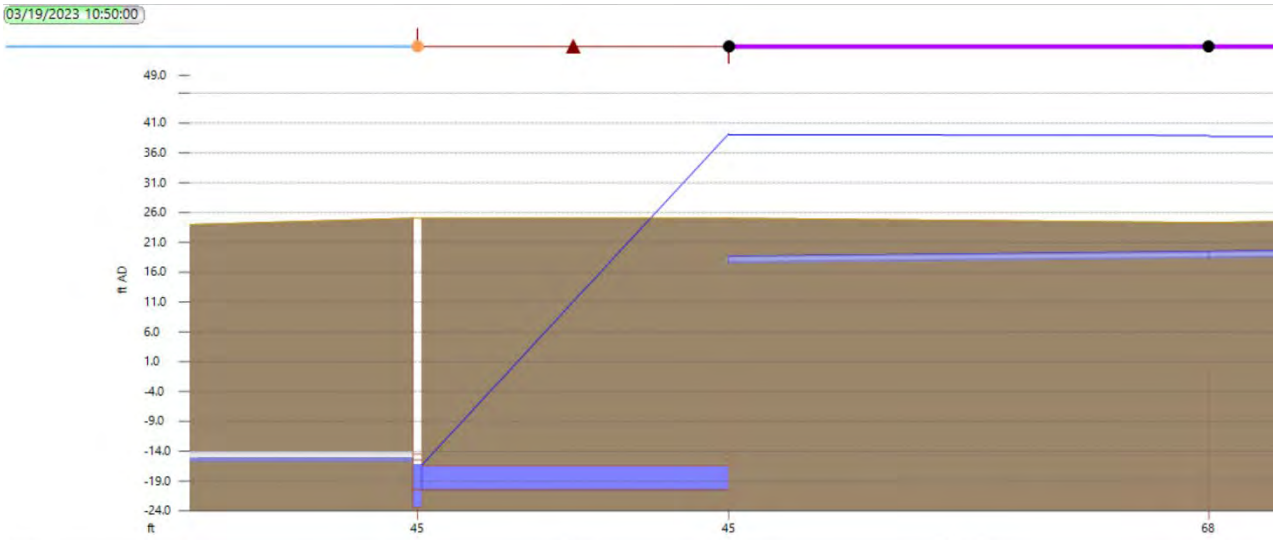
"D" Lead Pump



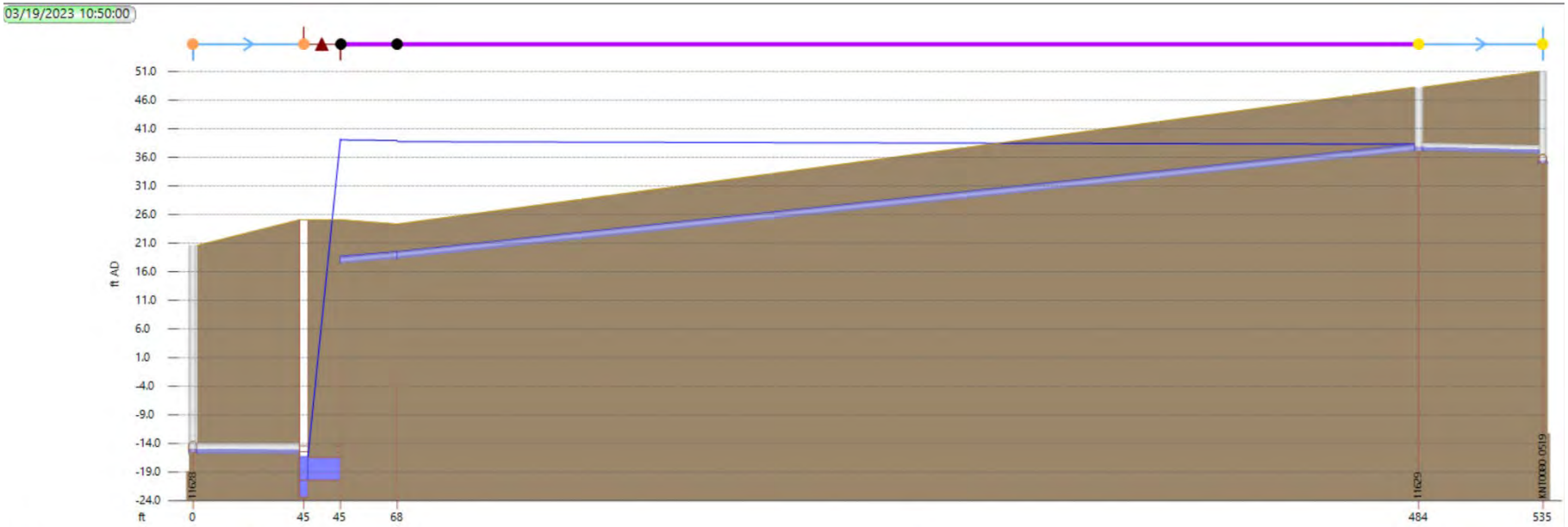
"D" Lag Pump 1



"D" Standby Pump



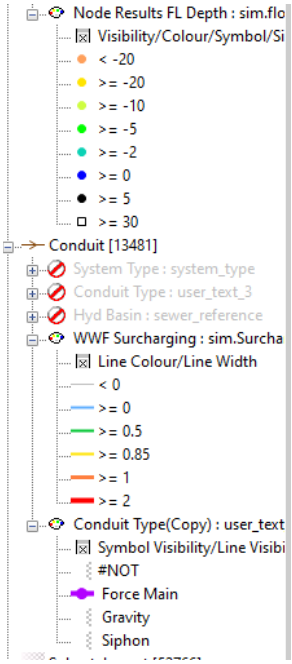
Link		12090.1	99911632.1	
width (in)			14.0	
us inv (ft AD)			17.500	
ds inv (ft AD)			18.320	
r.pfc (MGD)			-6.55	
surc		1.00	1.00	
US total head (ft AD)		-16.317	39.216	
US velocity (ft/s)		0.000	3.303	
DS flow (MGD)		2.2821	2.2821	
DS cumulative flow (US Mgal)		2.09851	2.09851	
DS total head (ft AD)		39.216	39.117	
DS velocity (ft/s)		0.000	3.303	
Node	12090	99911632	12091	
ground (ft AD)	25.060	25.060	24.319	
flood dep (ft)	-41.377	14.156	14.459	



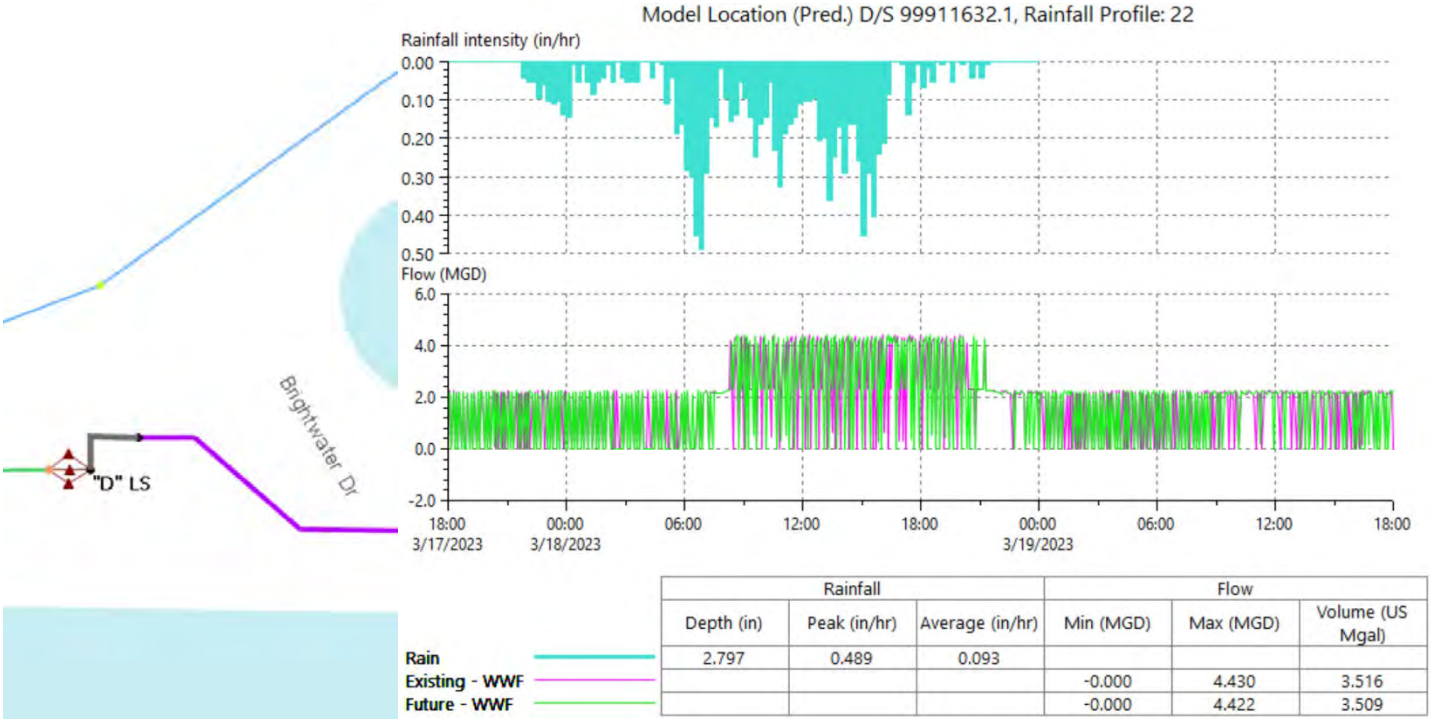
Link	11628.1	-	-	12091.1	11629.1
width (in)	24.0		14.0	14.0	18.0
us inv (ft AD)	-15.750		17.500	18.320	37.120
ds inv (ft AD)	-15.790		18.320	37.120	36.700
r.pfc (MGD)	4.36		-6.55	-7.39	6.18
surc	0.33	1.00	1.00	1.00	0.39
US total head (ft AD)	-14.957	-	39.216	38.778	38.157
US velocity (ft/s)	2.816	0.000	3.303	1.651	5.430
DS flow (MGD)	1.6834	-	2.2821	2.2821	1.4050
DS cumulative flow (US Mgal)	2.10084	-	2.09851	2.09851	2.11237
DS total head (ft AD)	-15.027	-	39.117	38.329	37.481
DS velocity (ft/s)	3.567	0.000	3.303	1.651	4.314

Node	11628	12090	-	12091	11629	-
ground (ft AD)	20.603	25.060	25.060	24.319	48.220	50.990
flood dep (ft)	-35.683	-41.377	14.156	14.459	-10.520	-15.680

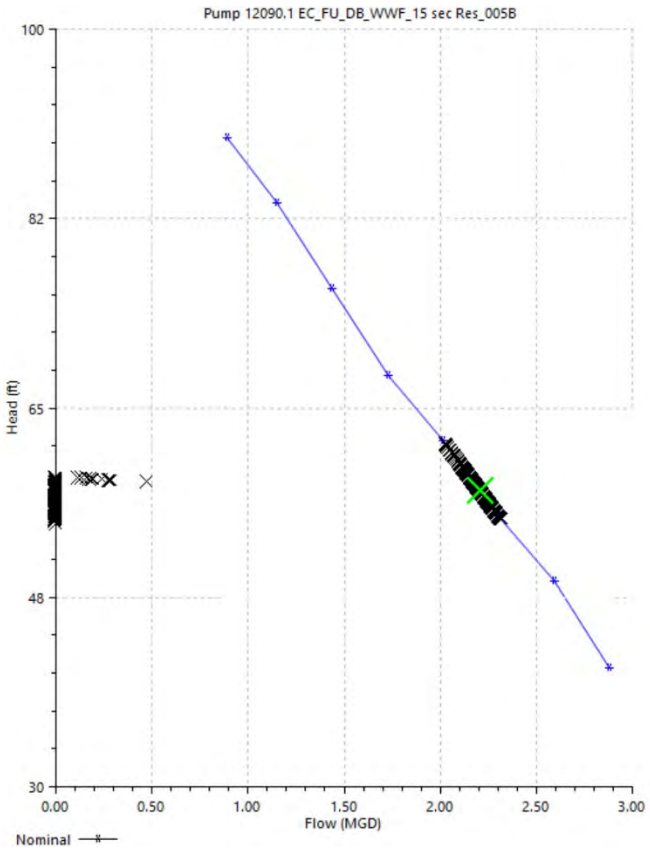
“D” LS - Design Basis - 10 year 24 hour Storm



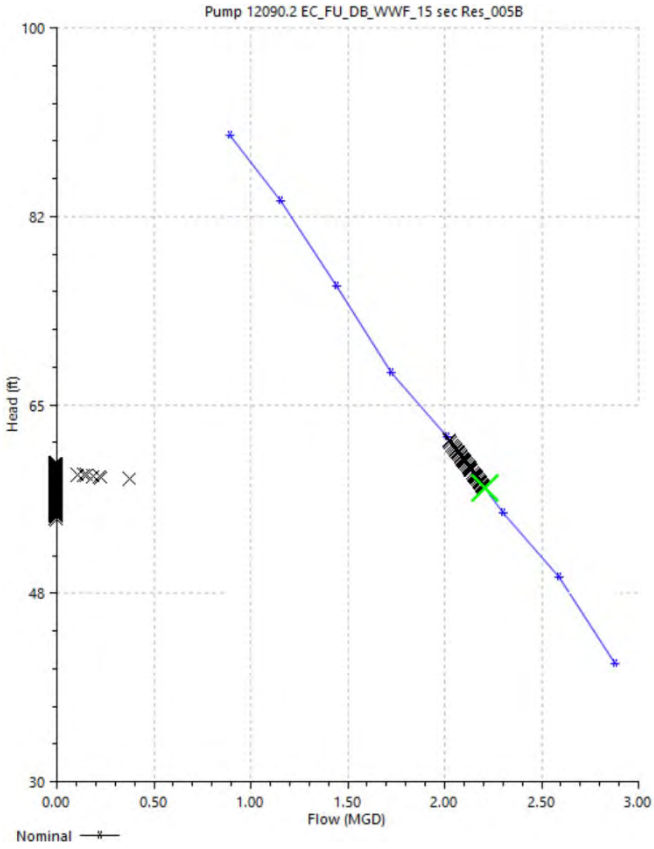




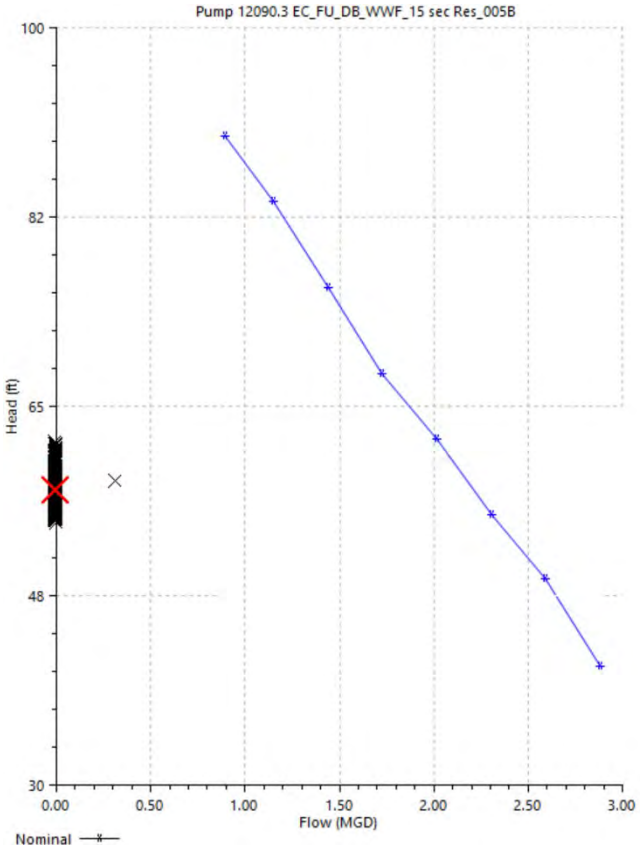
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	2.797	0.489	0.093			
Existing - WWF				-0.000	4.430	3.516
Future - WWF				-0.000	4.422	3.509



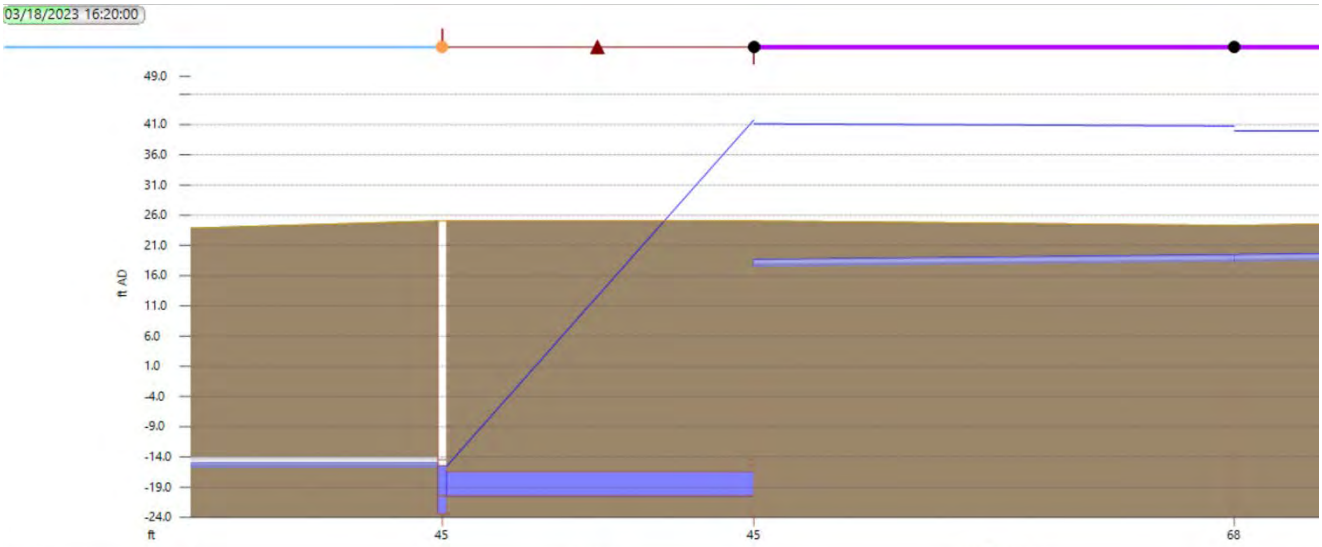
"D" Lead Pump



"D" Lag Pump 1

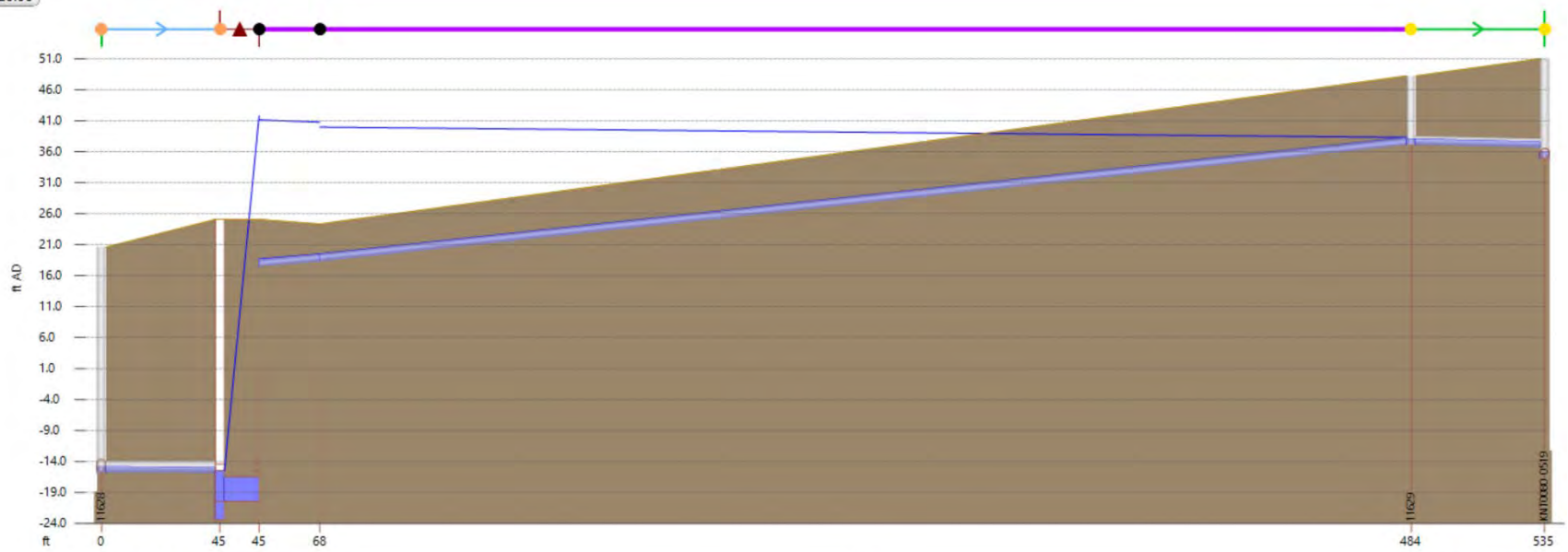


"D" Standby Pump



Link		12090.1	99911632.1	
width (in)			14.0	
us inv (ft AD)			17.500	
ds inv (ft AD)			18.320	
r.pfc (MGD)			-6.55	
surc		1.00	1.00	
US total head (ft AD)		-15.485	41.777	
US velocity (ft/s)		0.000	6.400	
DS flow (MGD)		2.2109	4.4219	
DS cumulative flow (US Mgal)		2.91091	3.51082	
DS total head (ft AD)		41.777	41.403	
DS velocity (ft/s)		0.000	6.400	
Node	12090	99911632	12091	
ground (ft AD)	25.060	25.060	24.319	
flood dep (ft)	-40.545	16.717	15.811	

03/18/2023 16:20:00

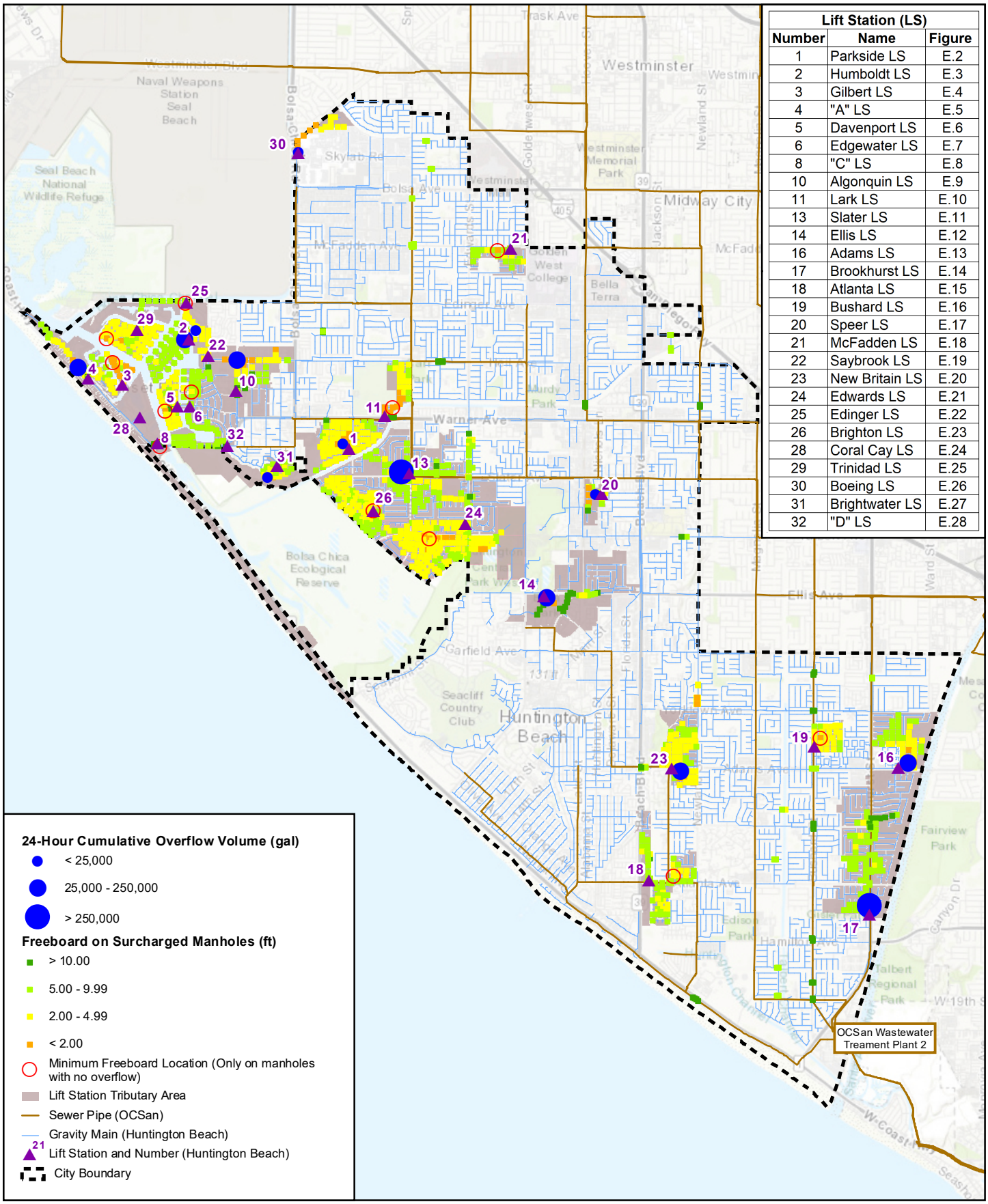


Link	11628.1	-	-	12091.1	11629.1
width (in)	24.0		14.0	14.0	18.0
us inv (ft AD)	-15.750		17.500	18.320	37.120
ds inv (ft AD)	-15.790		18.320	37.120	36.700
r.pfc (MGD)	4.36		-6.55	-7.39	6.18
surc	0.46	1.00	1.00	1.00	0.60
US total head (ft AD)	-14.614	-	41.777	40.130	38.598
US velocity (ft/s)	3.651	0.000	6.400	3.200	6.100
DS flow (MGD)	3.3506	-	4.4219	4.4219	3.9198
DS cumulative flow (US Mgal)	3.51349	-	3.51082	3.51082	3.51983
DS total head (ft AD)	-14.687	-	41.403	38.446	38.075
DS velocity (ft/s)	4.379	0.000	6.400	3.200	5.694

Node	11628	12090	-	12091	11629	-
ground (ft AD)	20.603	25.060	-	24.319	48.220	50.990
flood dep (ft)	-35.424	-40.545	-	15.811	-10.186	-15.044

Appendix E

Lift Station Emergency Storage Analysis Details



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

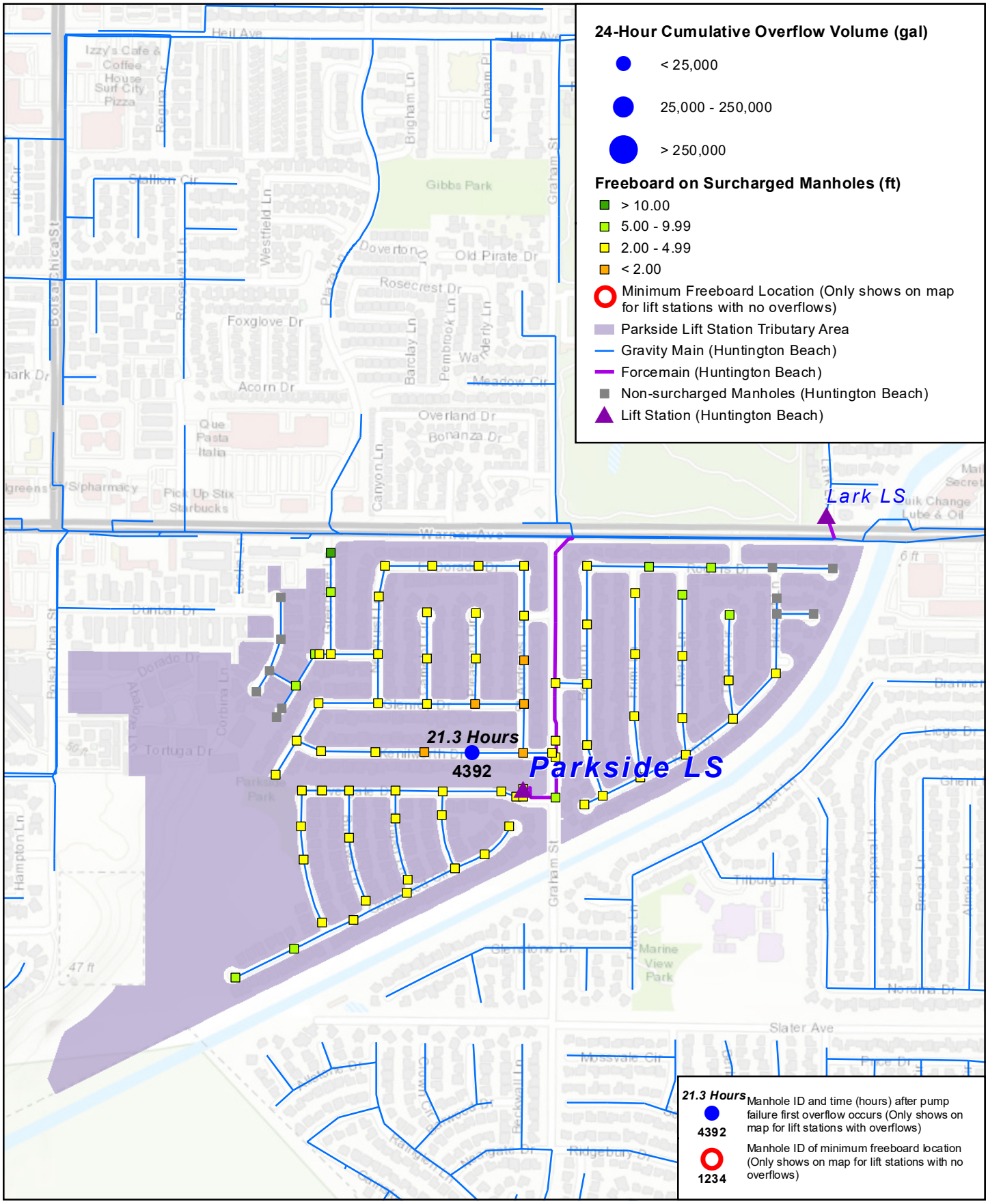
24-Hour Dry Weather Flow Emergency Storage after Systemwide Pump Failure

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.1

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.1_24HrDWF Emergency Storage Overall Map.mxd
Print date: 15 Mar 2024 - 10:53

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

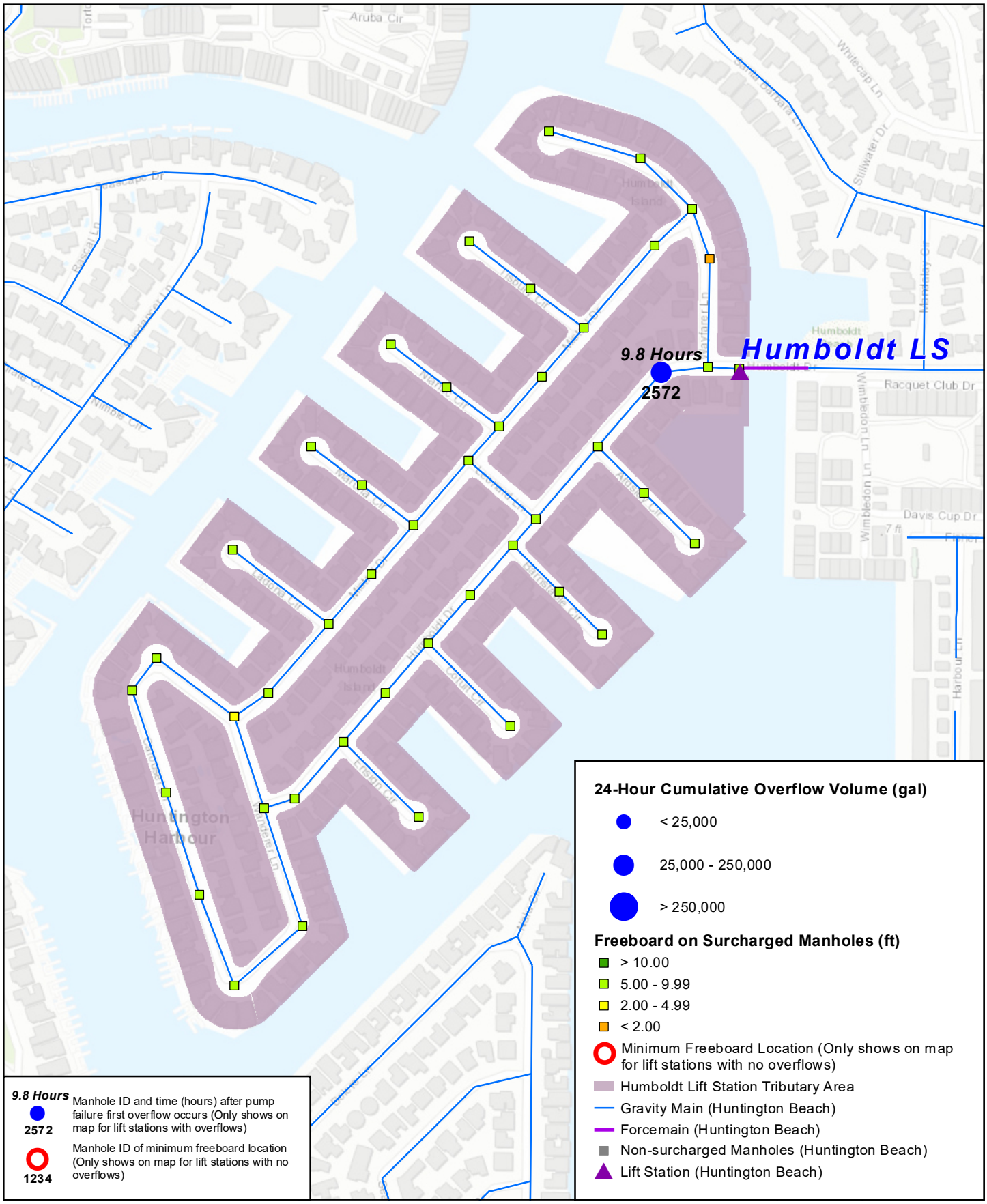
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Parkside Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.2

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.2_Parkside DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:21

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

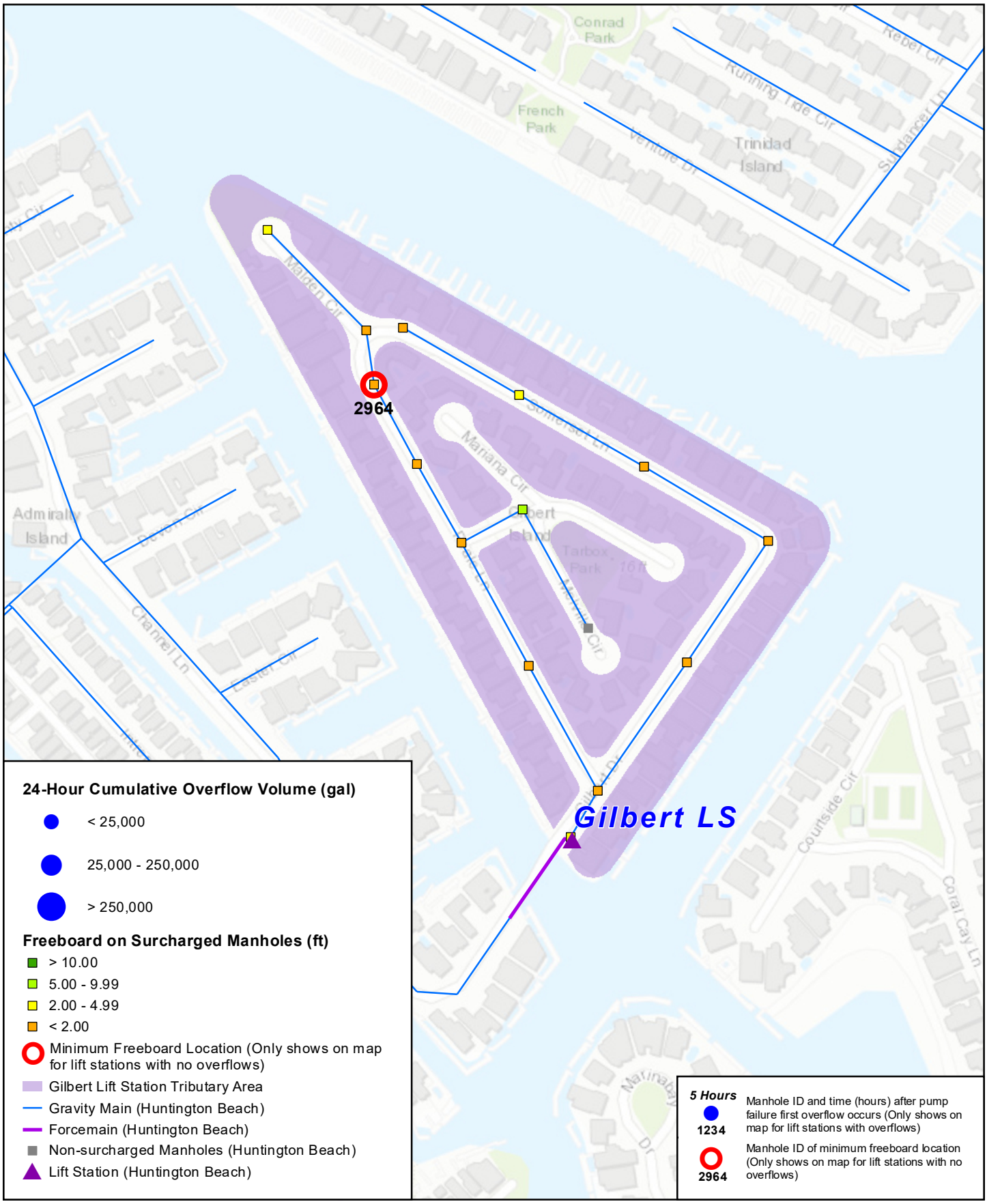
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Humboldt Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.3

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.3_Humboldt DWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 15:04

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 75 150 225 300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

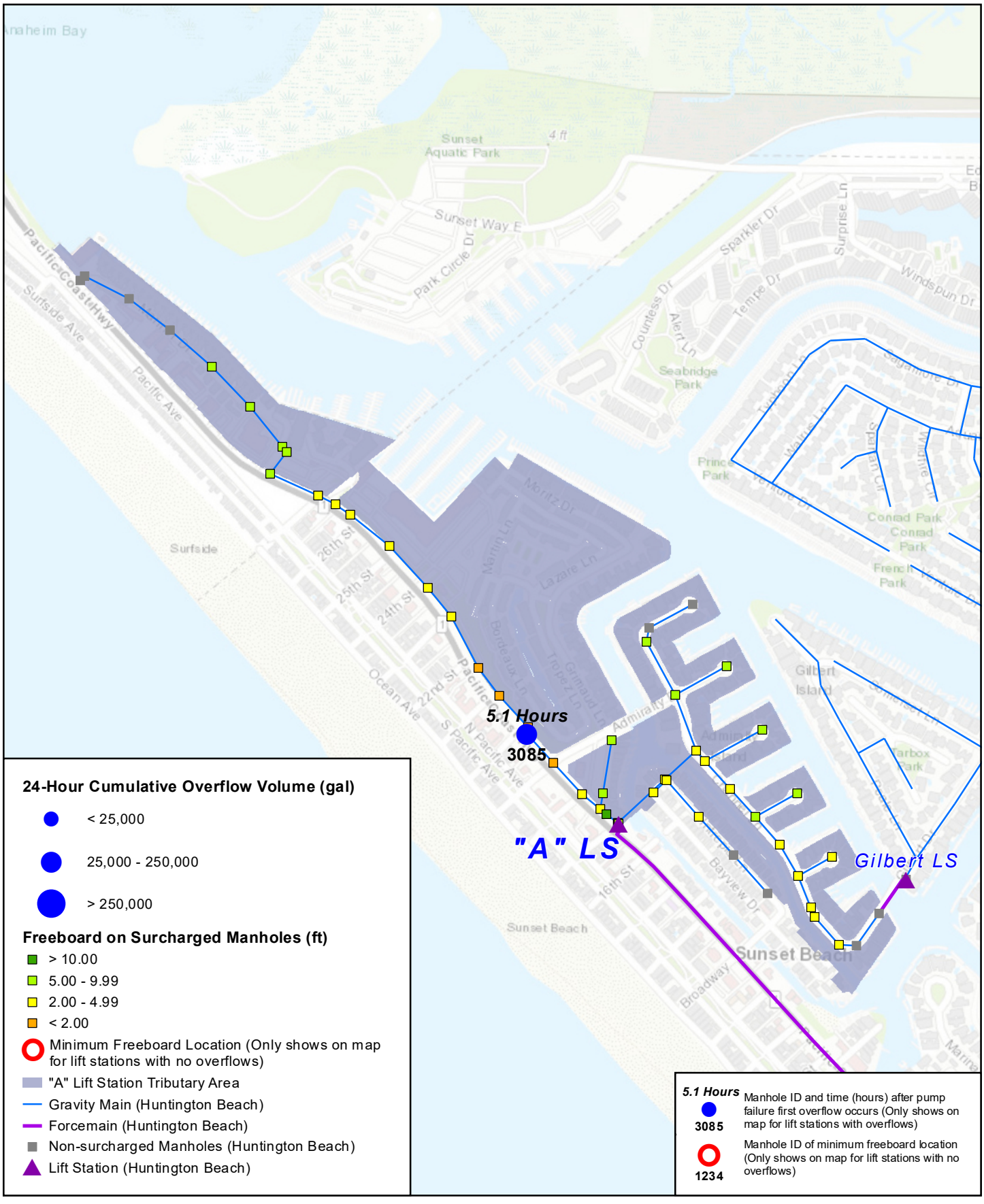
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Gilbert Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.4

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.4_Gilbert DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:22

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

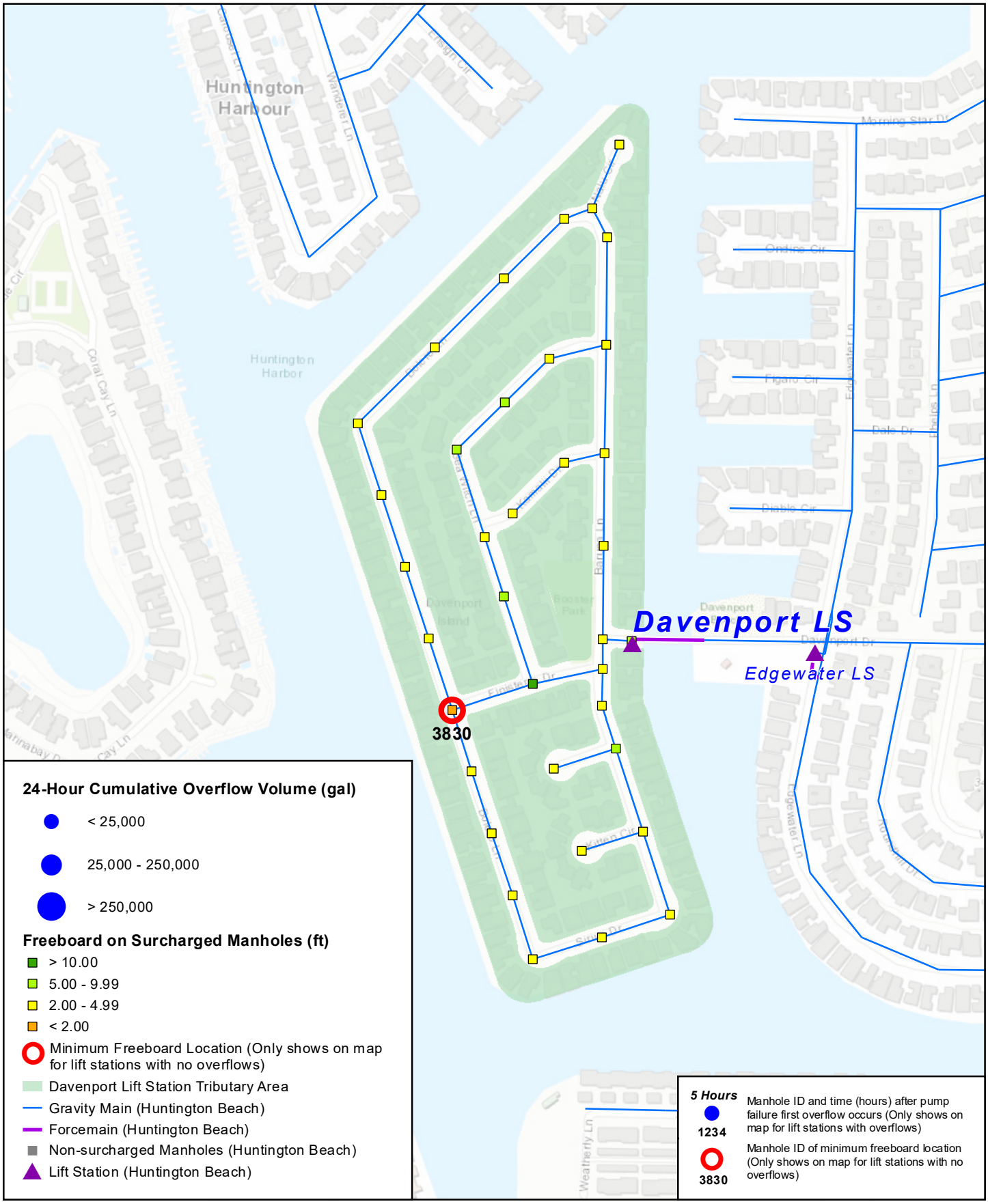
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Lift Station "A"

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.5

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.5_LSA DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:25

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

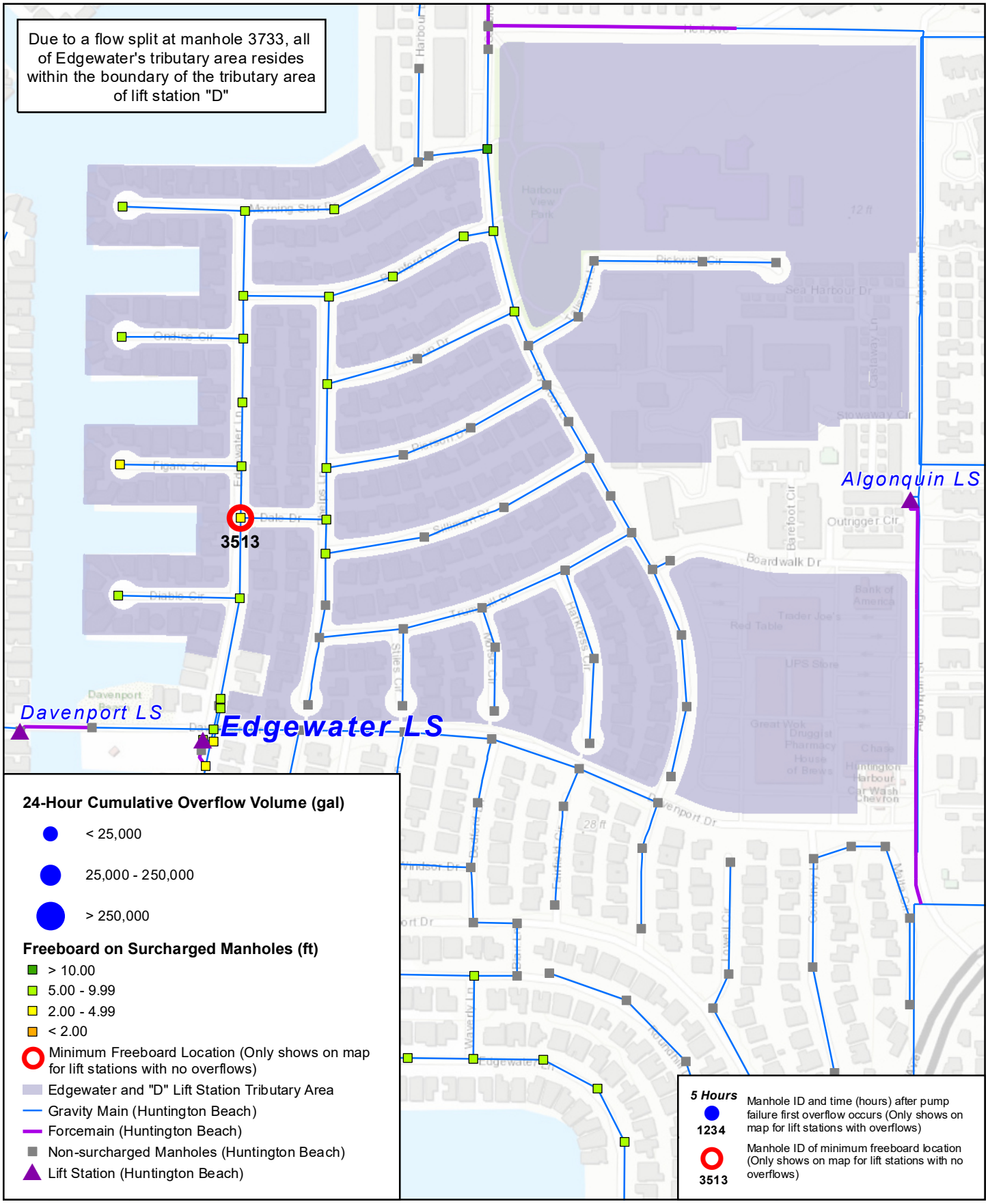
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Davenport Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.6

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.6_Davenport DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:28

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

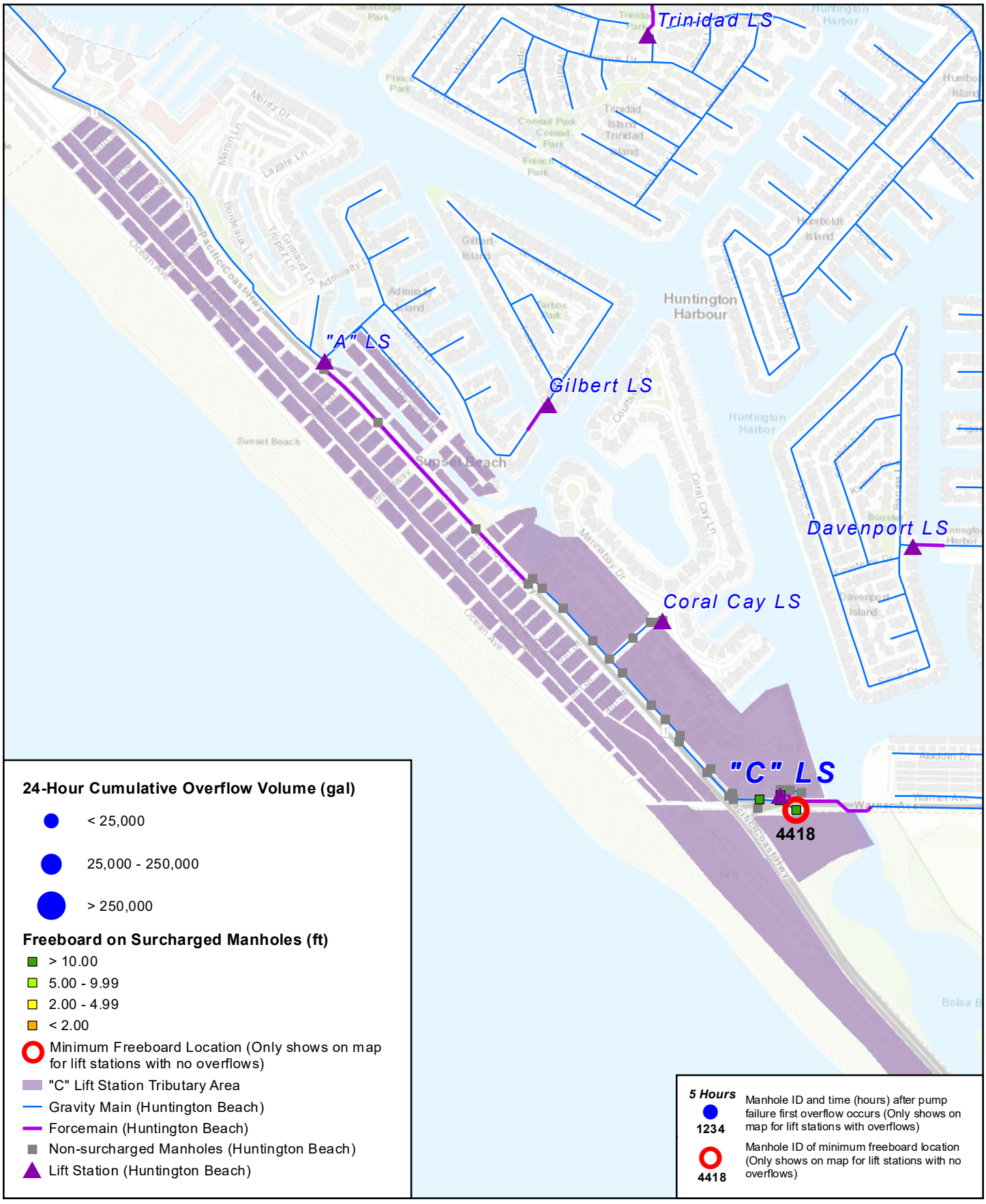
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Edgewater Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.7

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.7_Edgewater DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:32

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

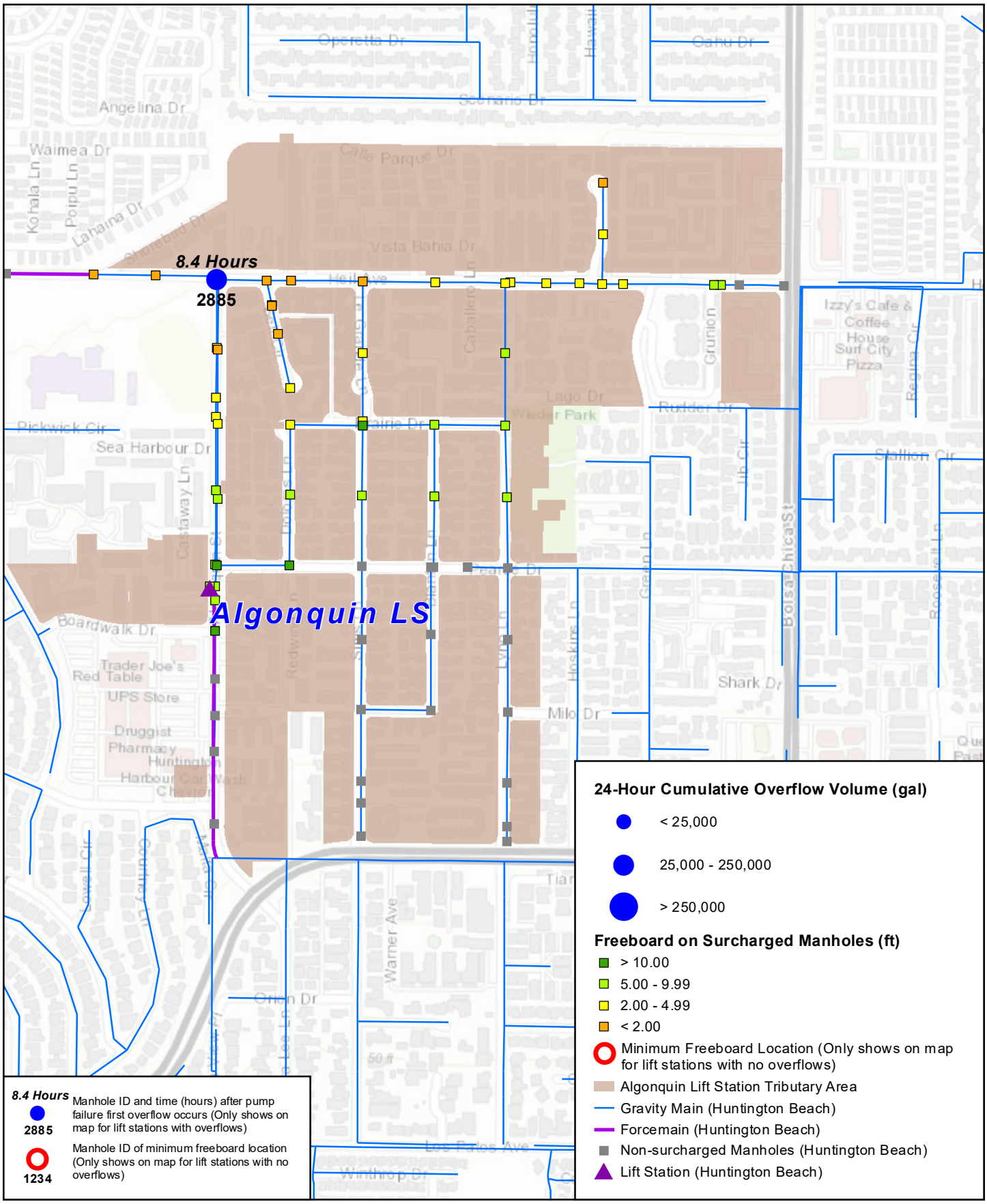
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Lift Station "C"

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.8

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.8_LS C DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:33

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

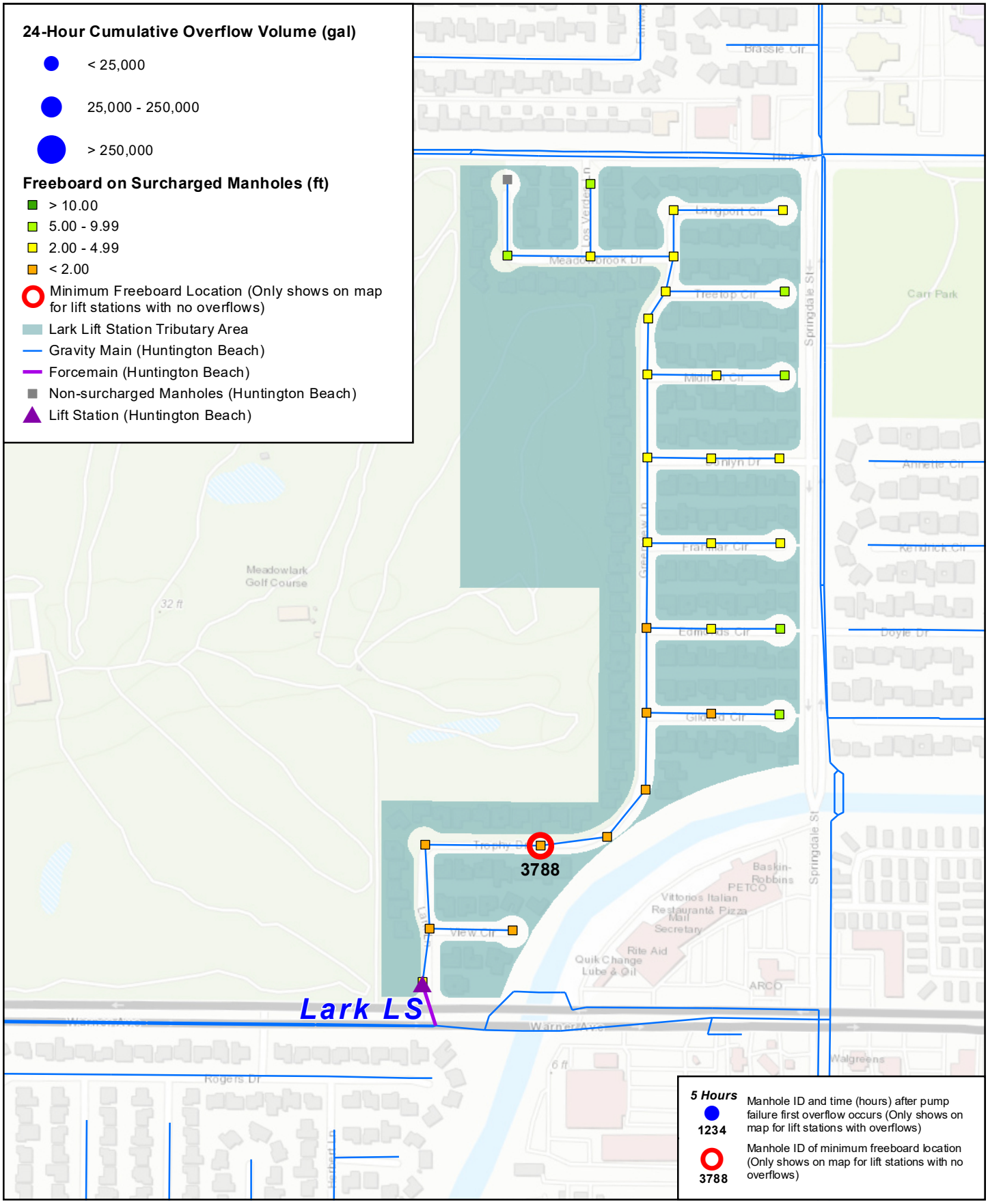
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Algonquin Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.9

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.9_Algonquin DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:40

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

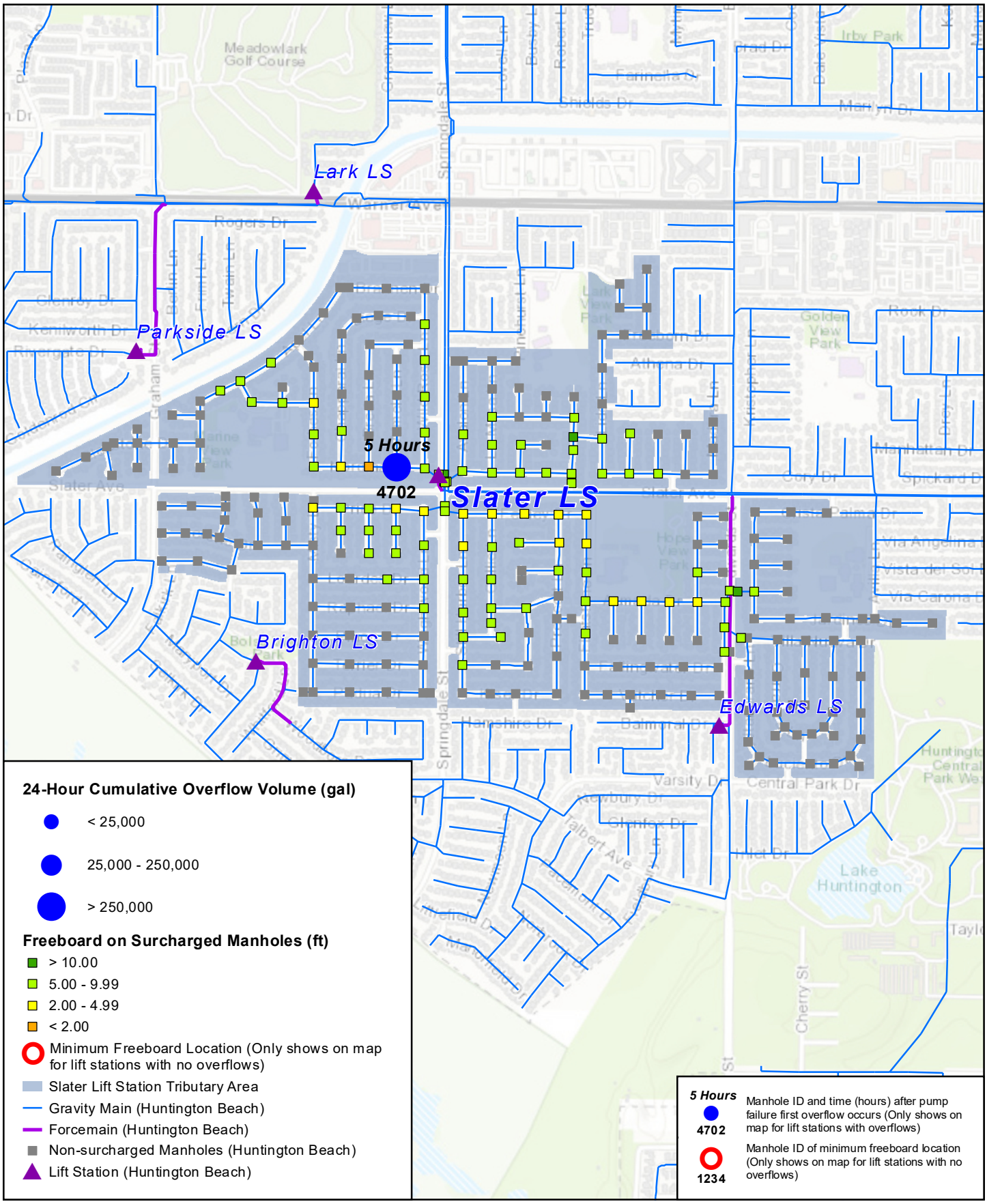
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Lark Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.10

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.10_Lark DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:41

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

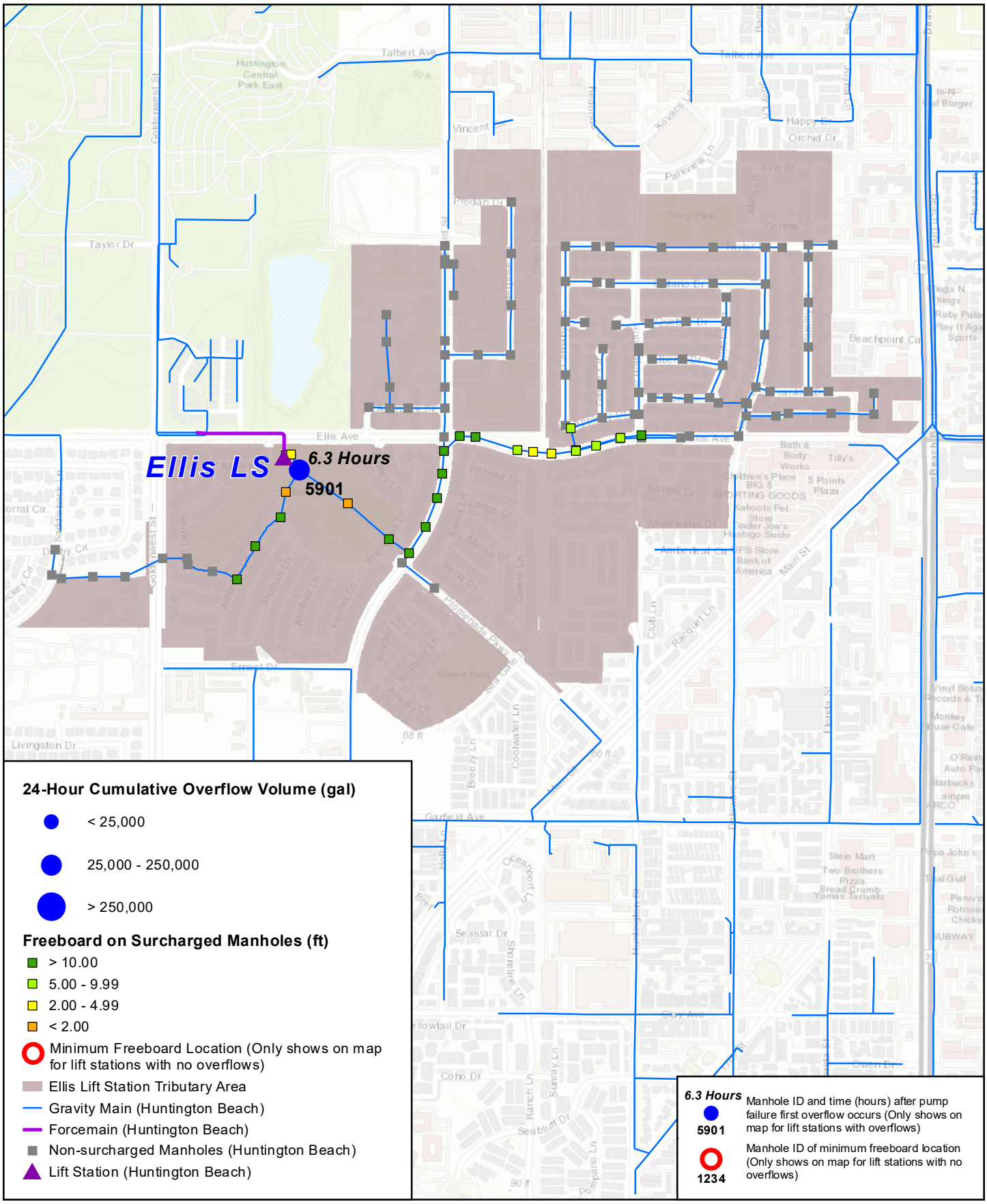
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Slater Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.11

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.11_Slater DWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 09:16

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 225 450 675 900

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

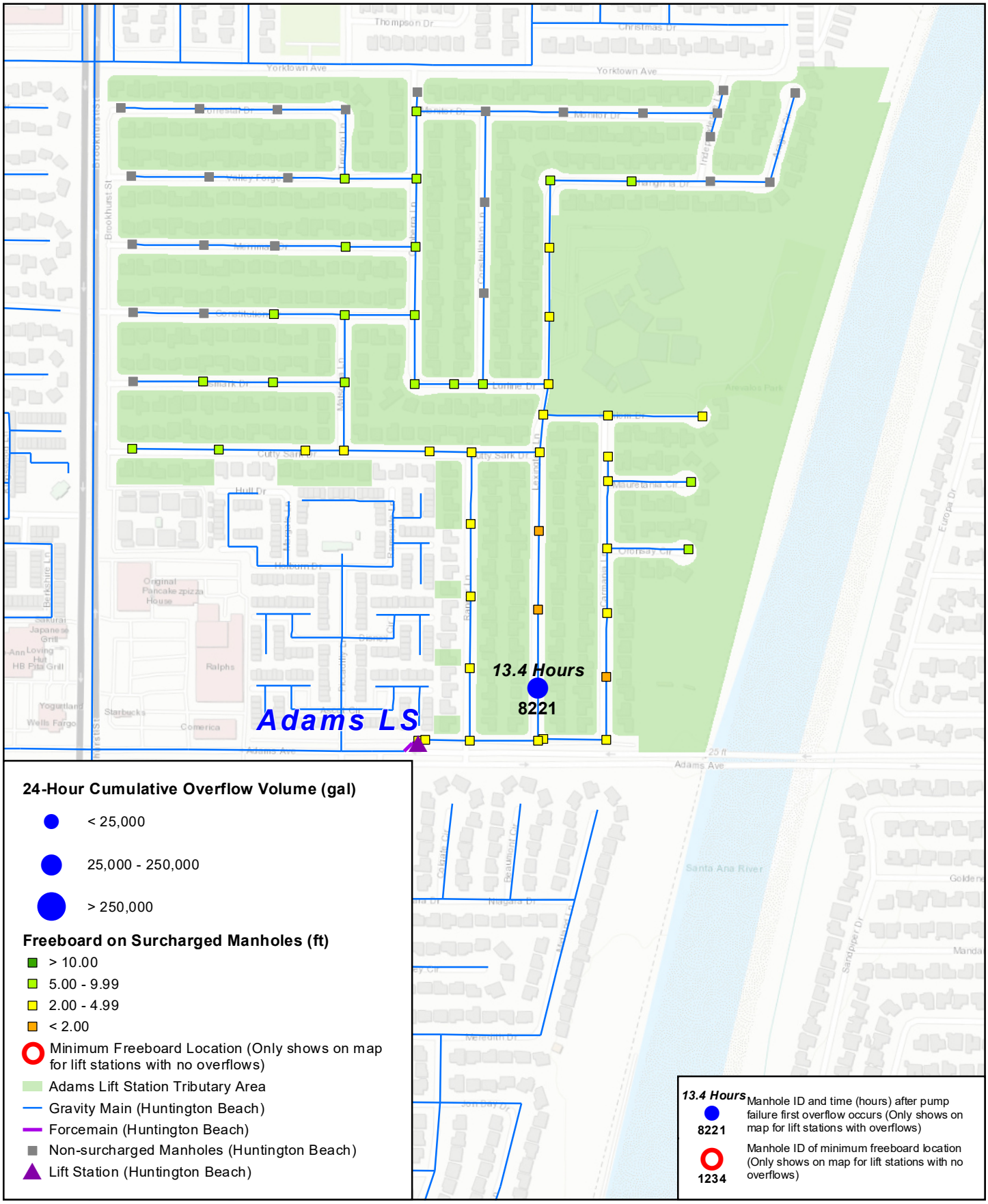
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Ellis Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.12

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.12_Ellis DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:43

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 125 250 375 500

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

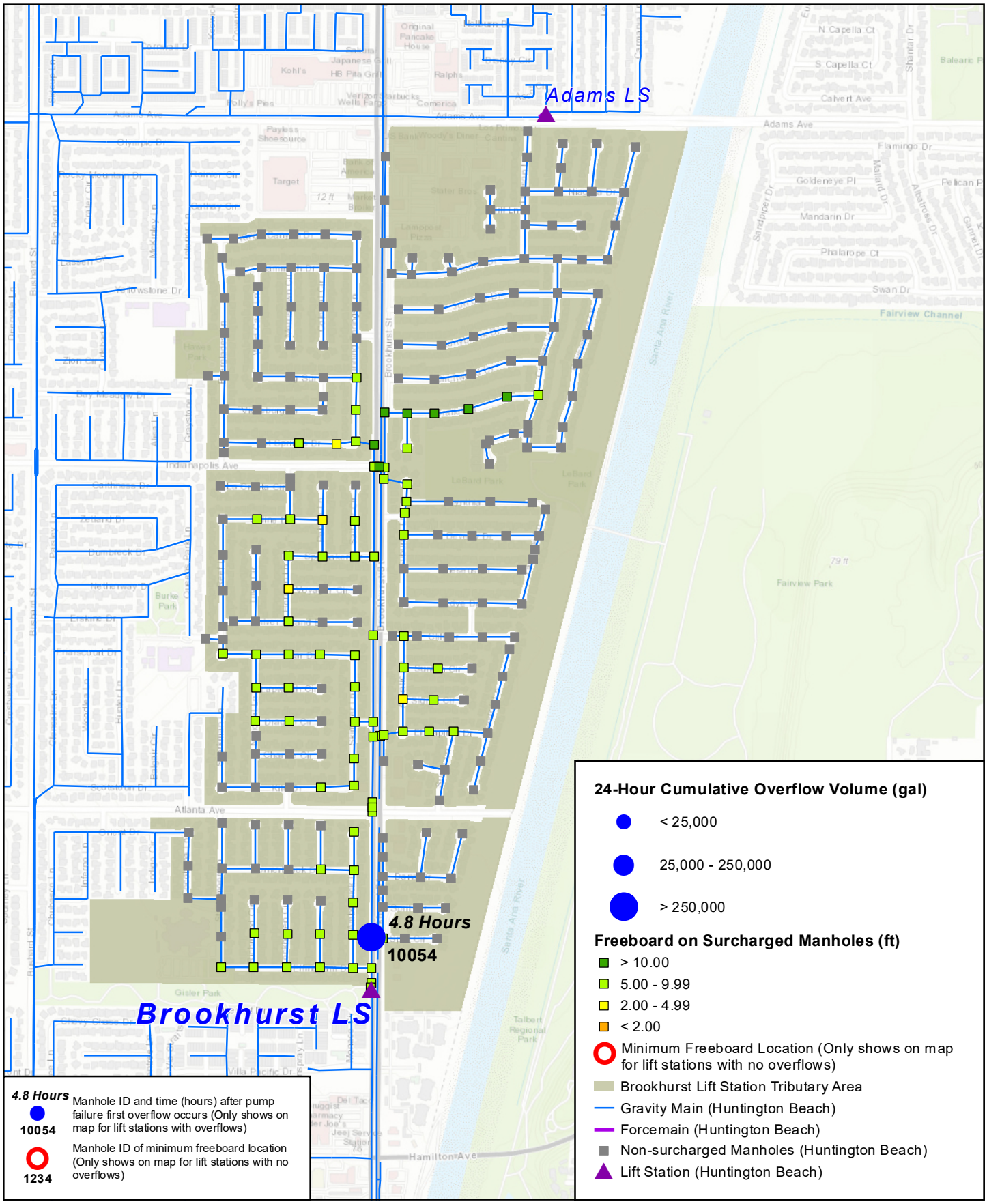
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Adams Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.13

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.13_Adams DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:47

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

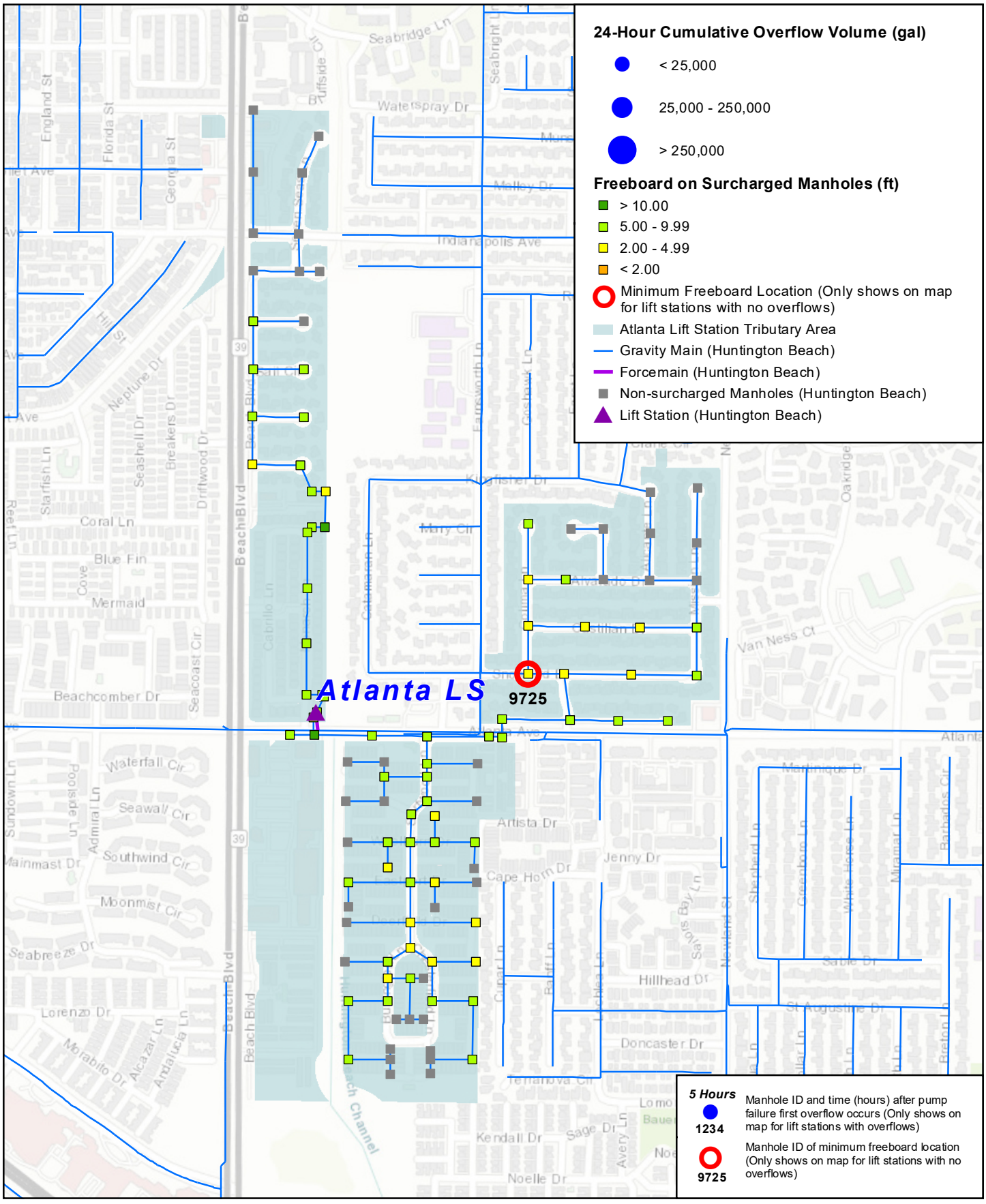
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Brookhurst Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.14

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.14_Brookhurst DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:51

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

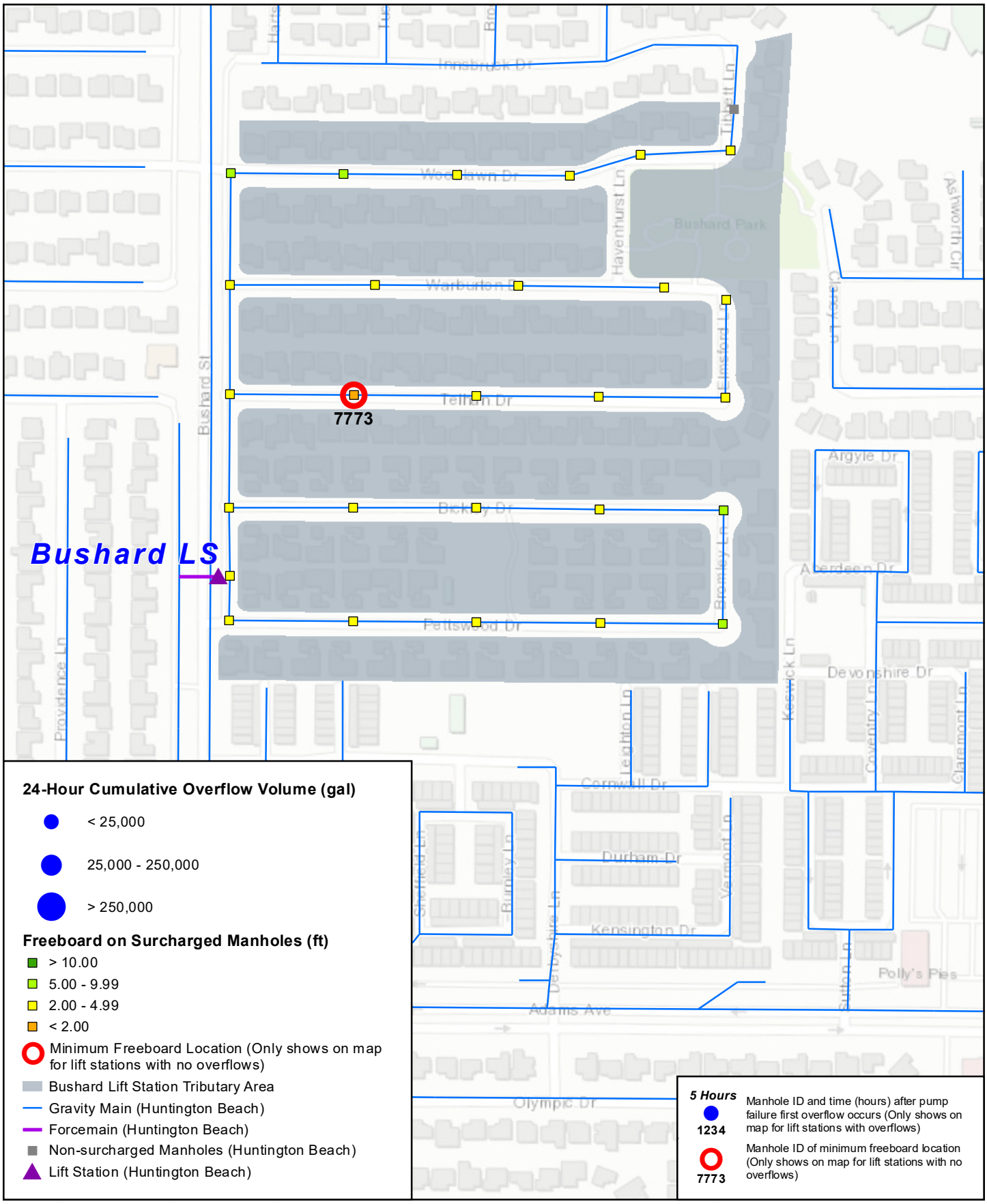
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Atlanta Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.15

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.15_Atlanta DWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 10:30

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 75 150 225 300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

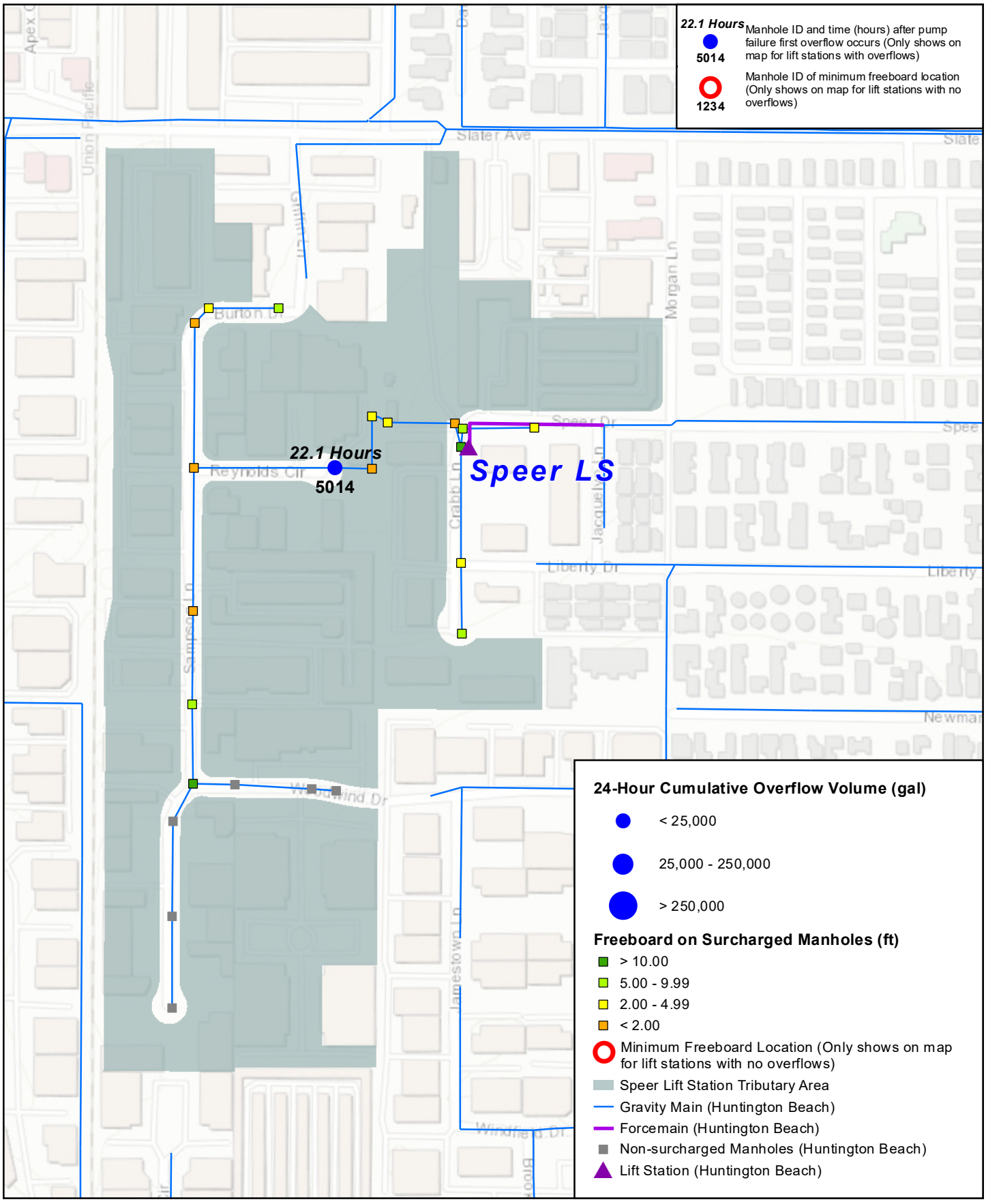
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Bushard Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.16

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.16_Bushard DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:52

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 75 150 225 300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

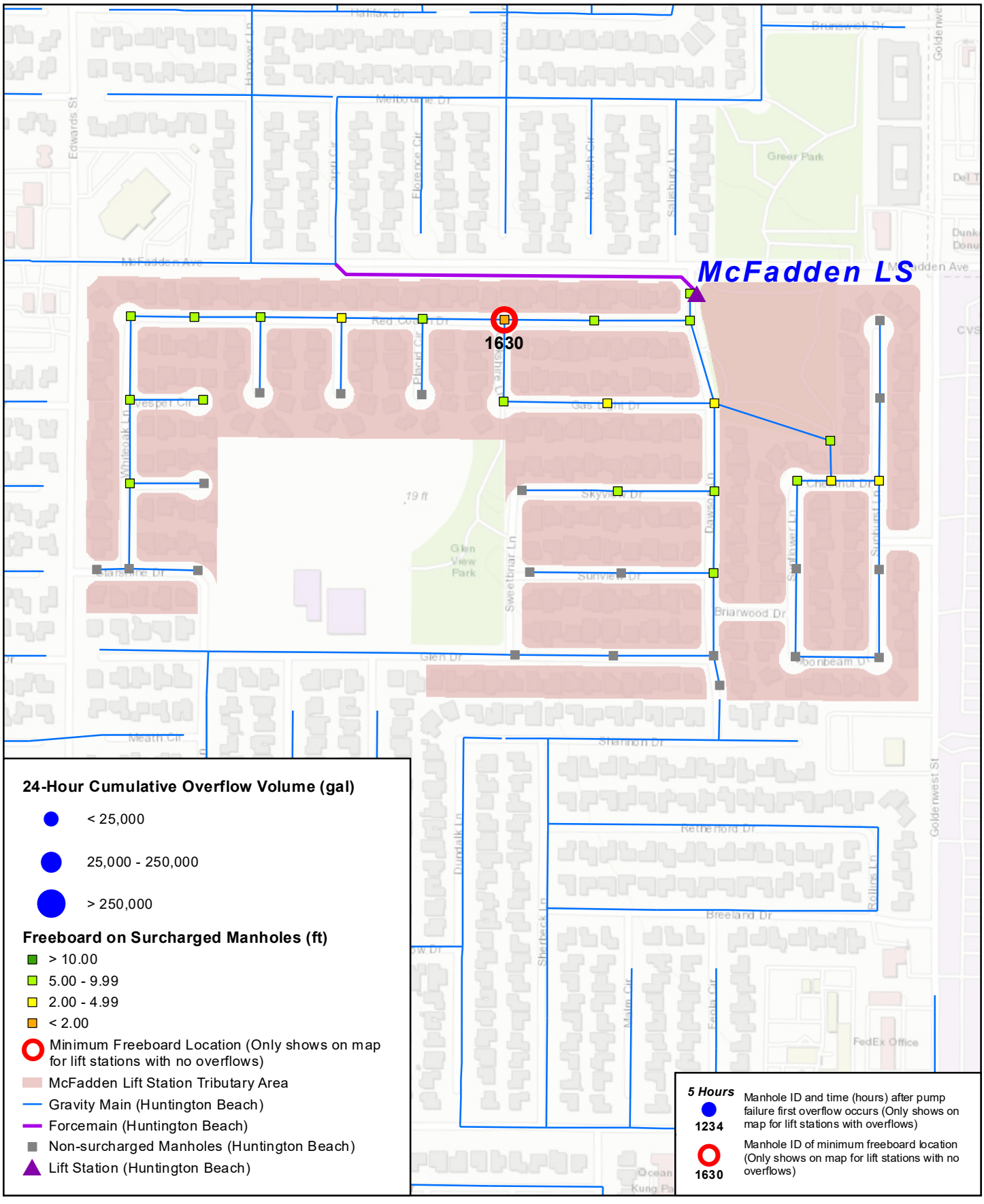
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Speer Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.17

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.17_Speer DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:57

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

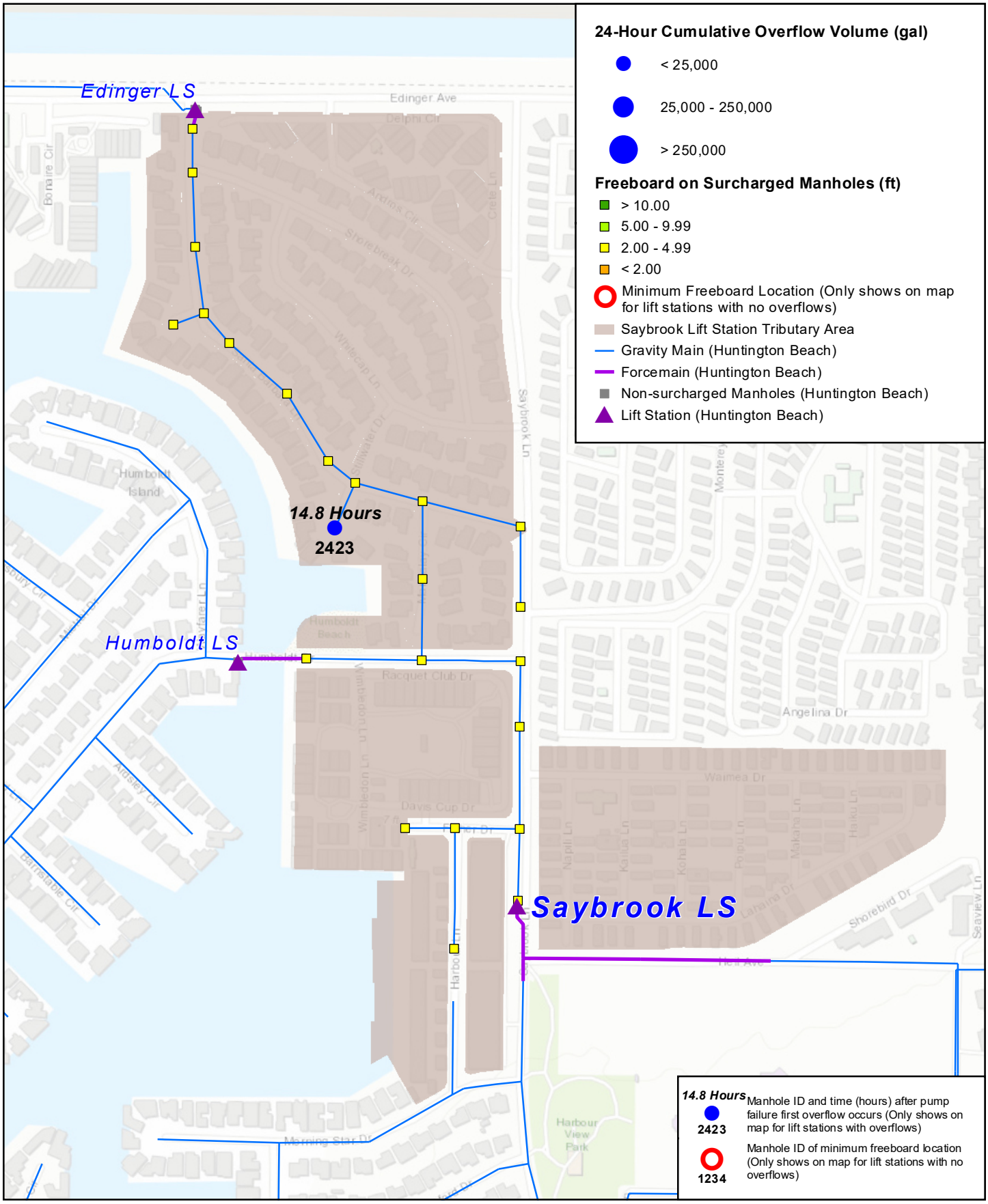
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at McFadden Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.18

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.18_McFadden DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:58

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

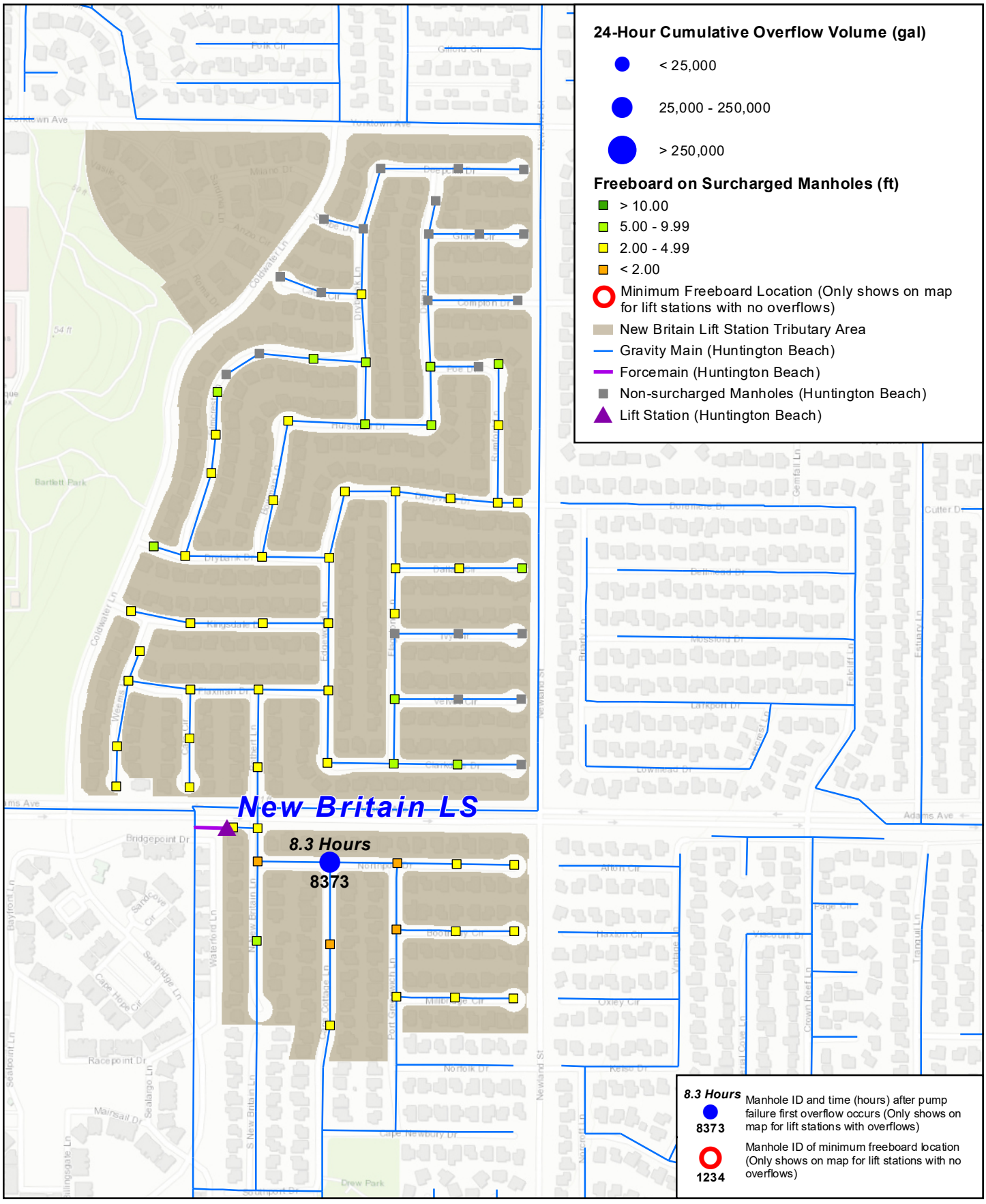
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Saybrook Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.19

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.19_Saybrook DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 11:59

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 125 250 375 500

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

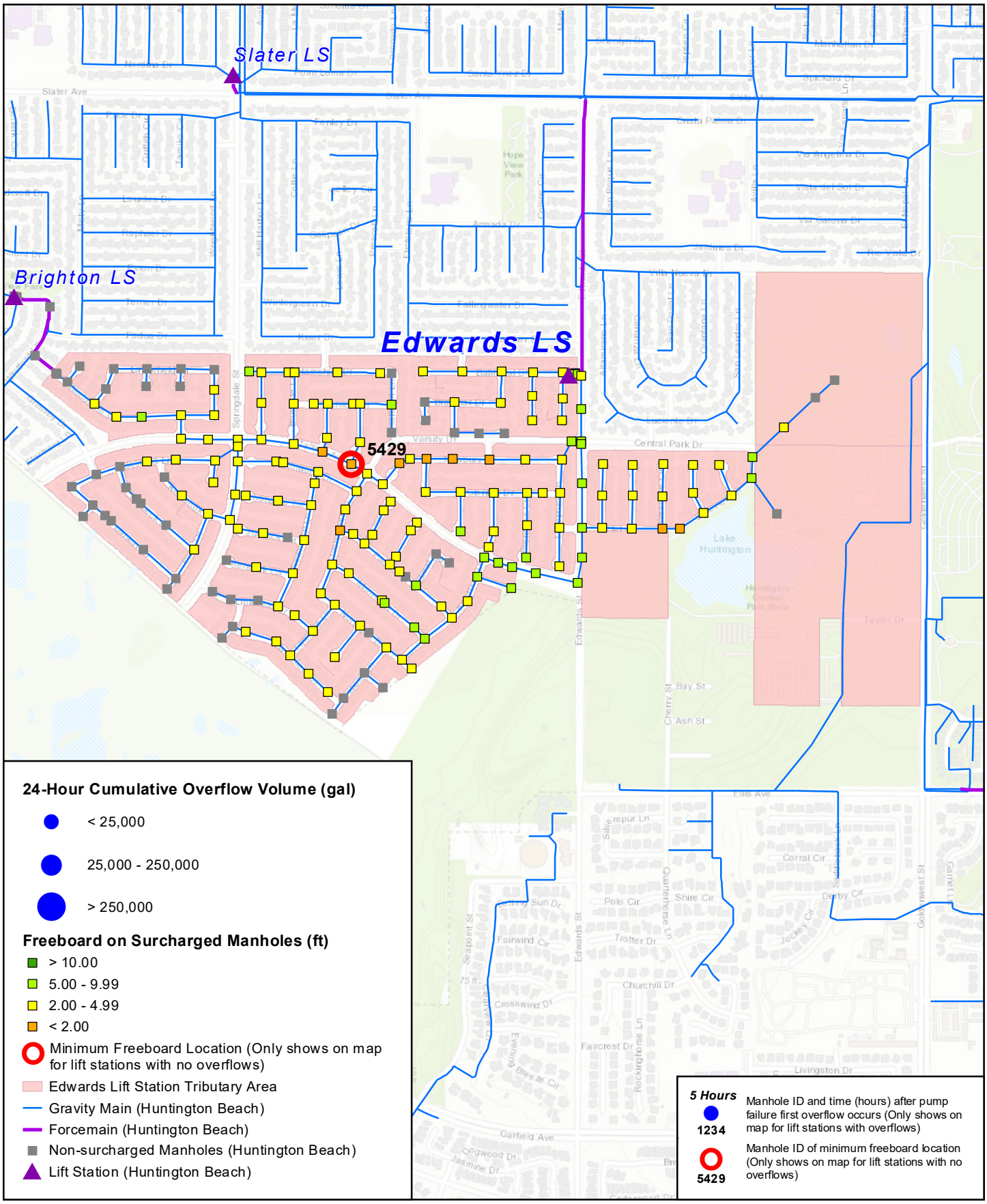
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at New Britain Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.20

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.20_New Britain DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:04

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 250 500 750 1,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

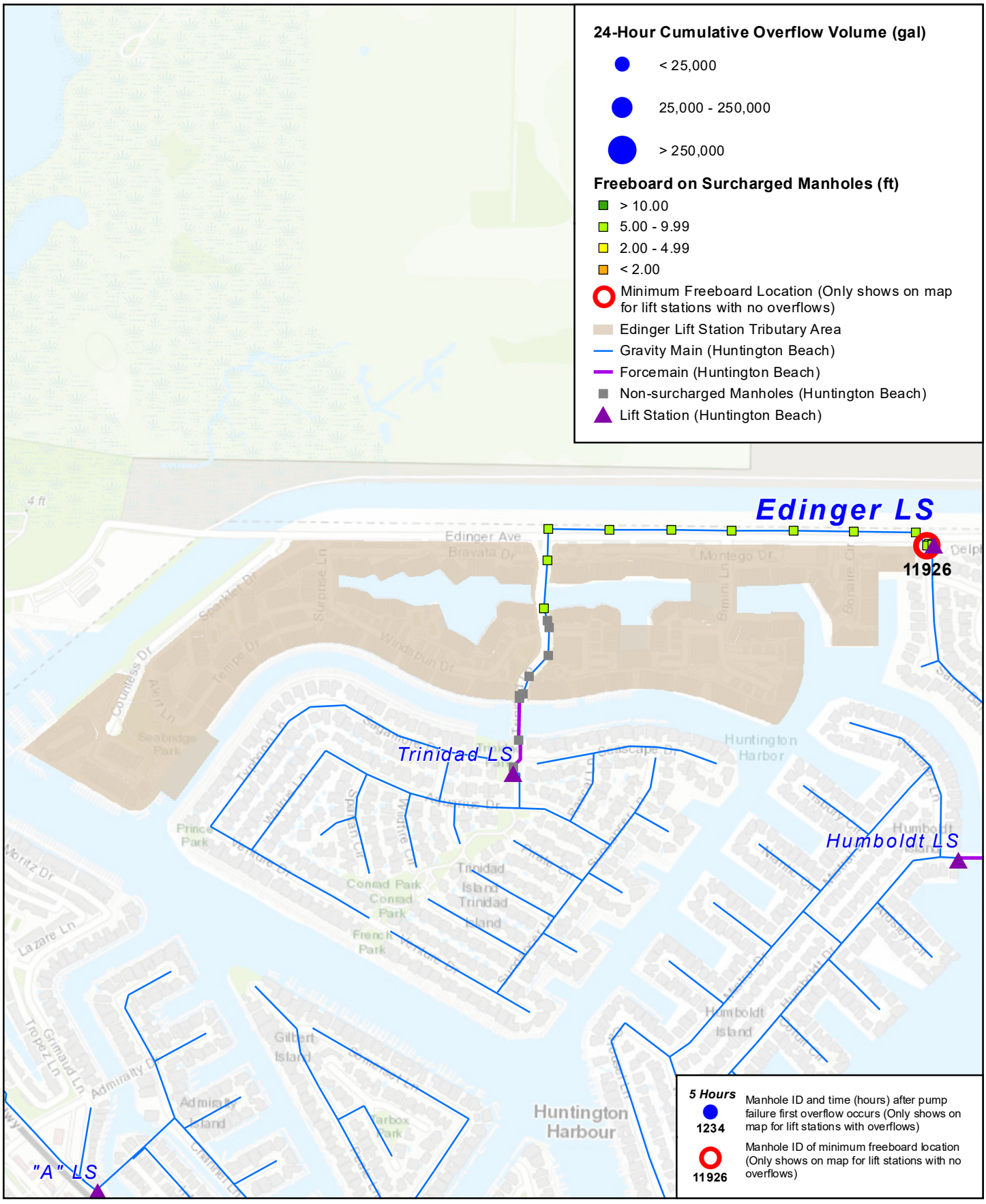
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Edwards Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.21

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.21_Edwards DWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 12:34

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

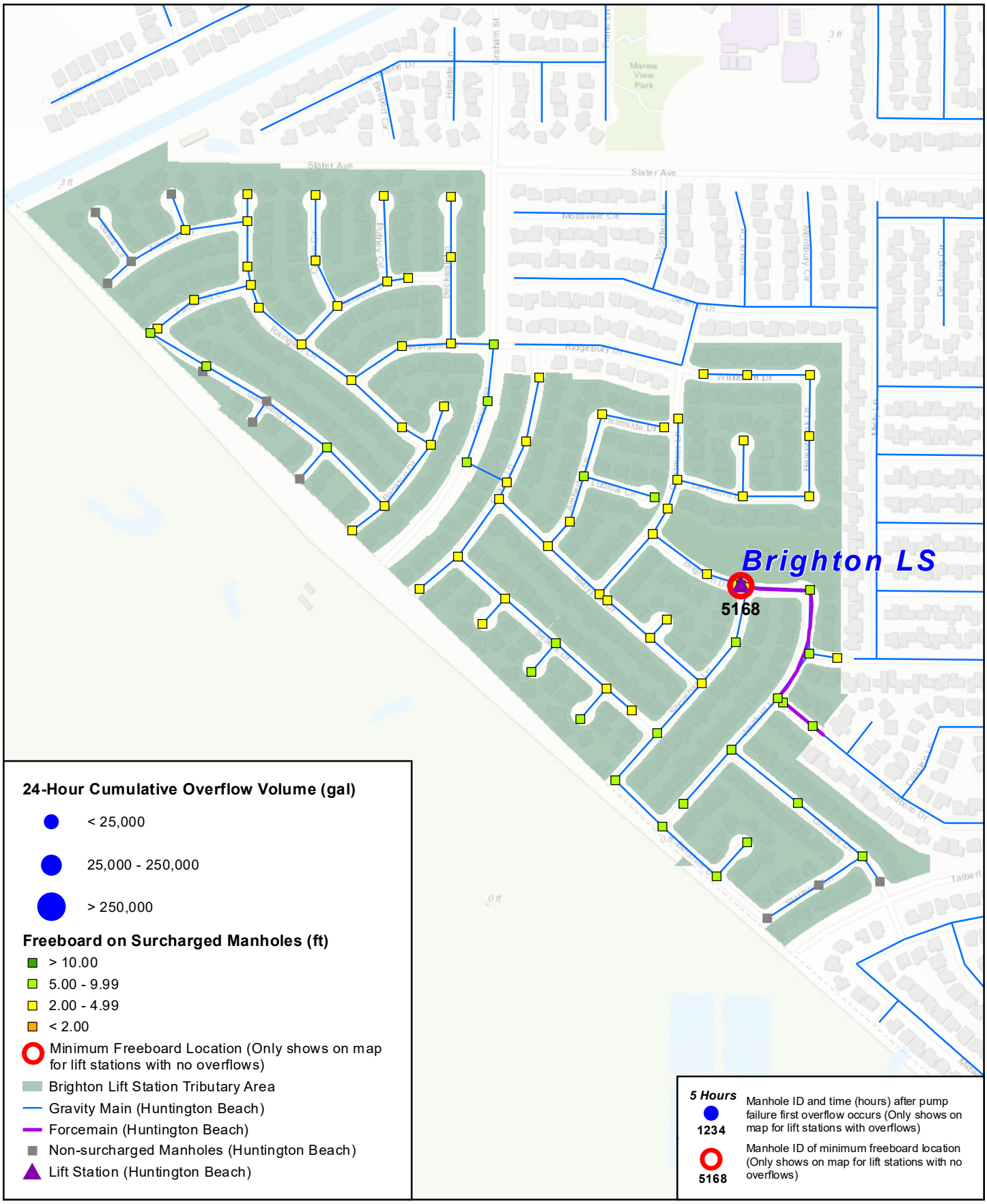
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Edinger Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.22

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.22_Edinger DWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 12:56

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 125 250 375 500

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

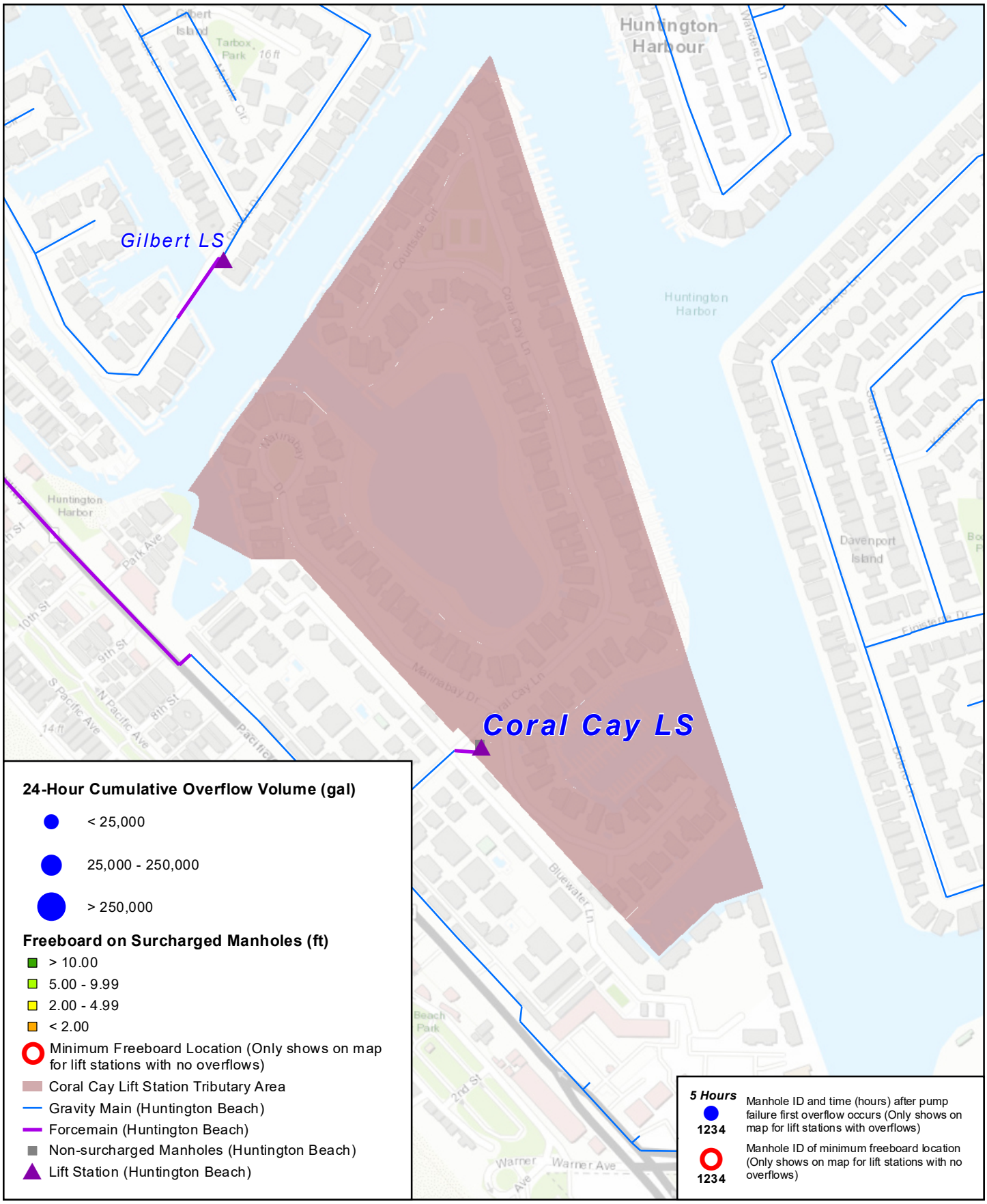
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Brighton Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.23

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.23_Brighton DWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 13:11

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

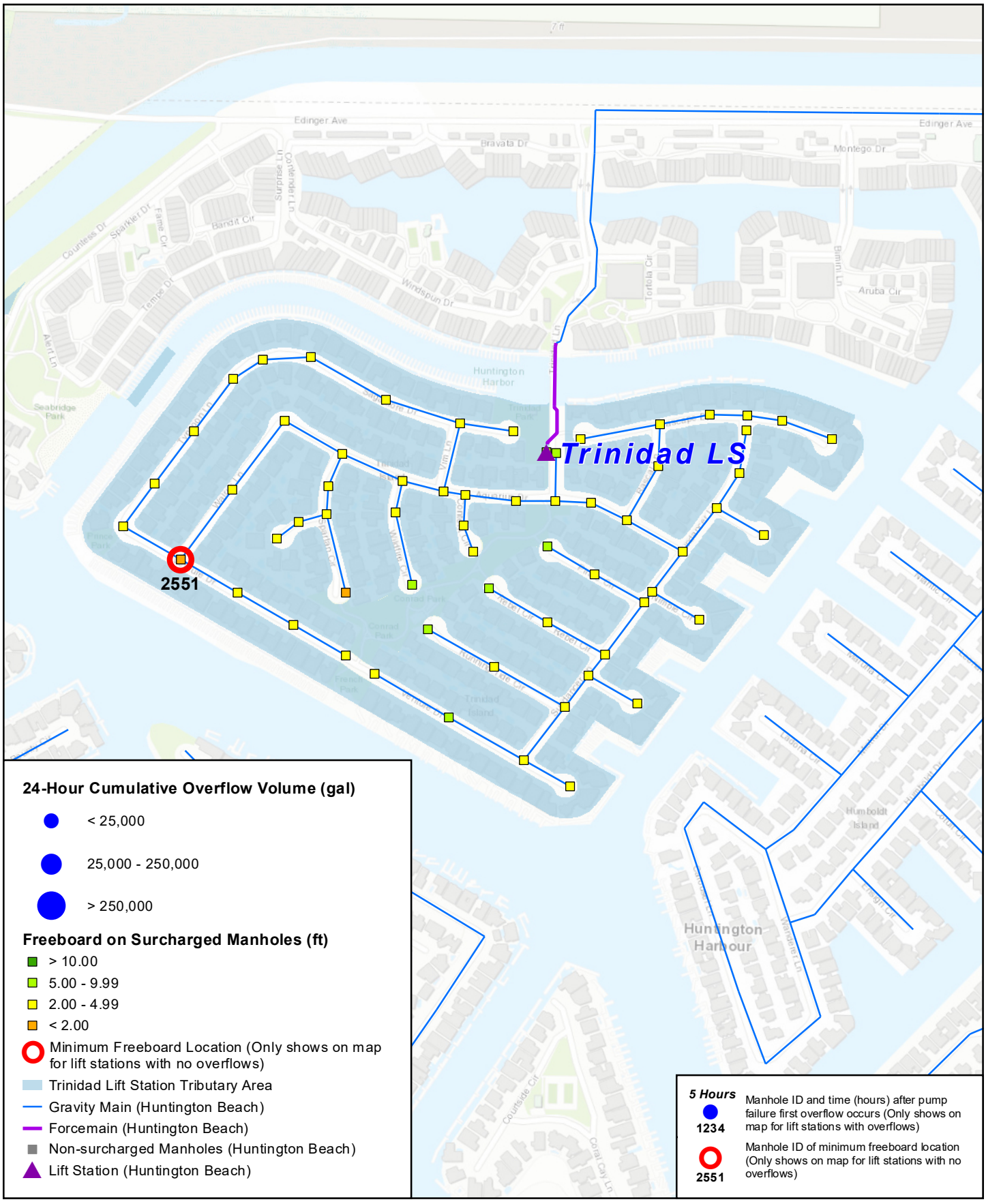
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Coral Cay Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.24

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.24_Coral Cay DWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 13:28

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 125 250 375 500

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

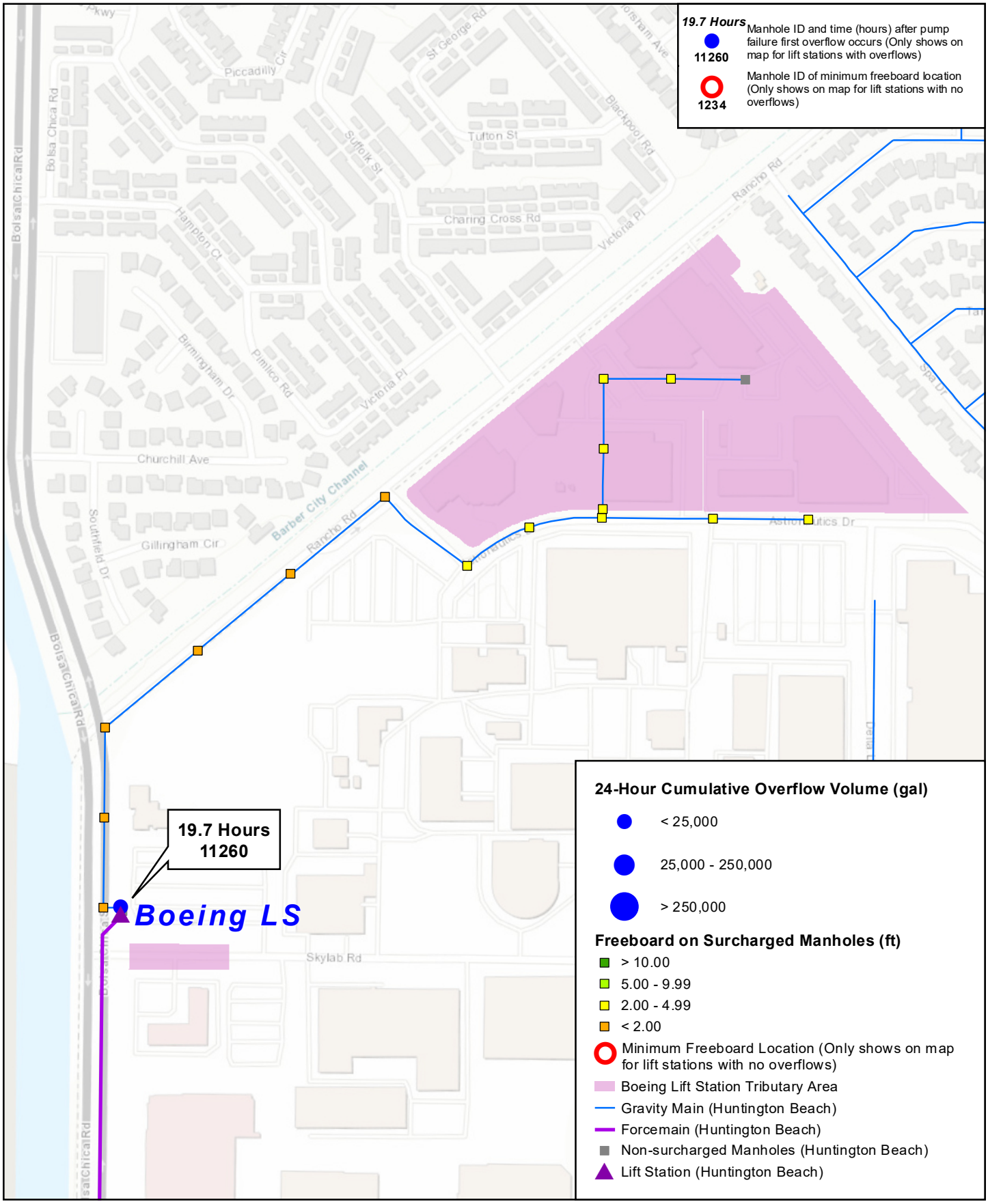
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Trinidad Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.25

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.25_Trinidad DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:07

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

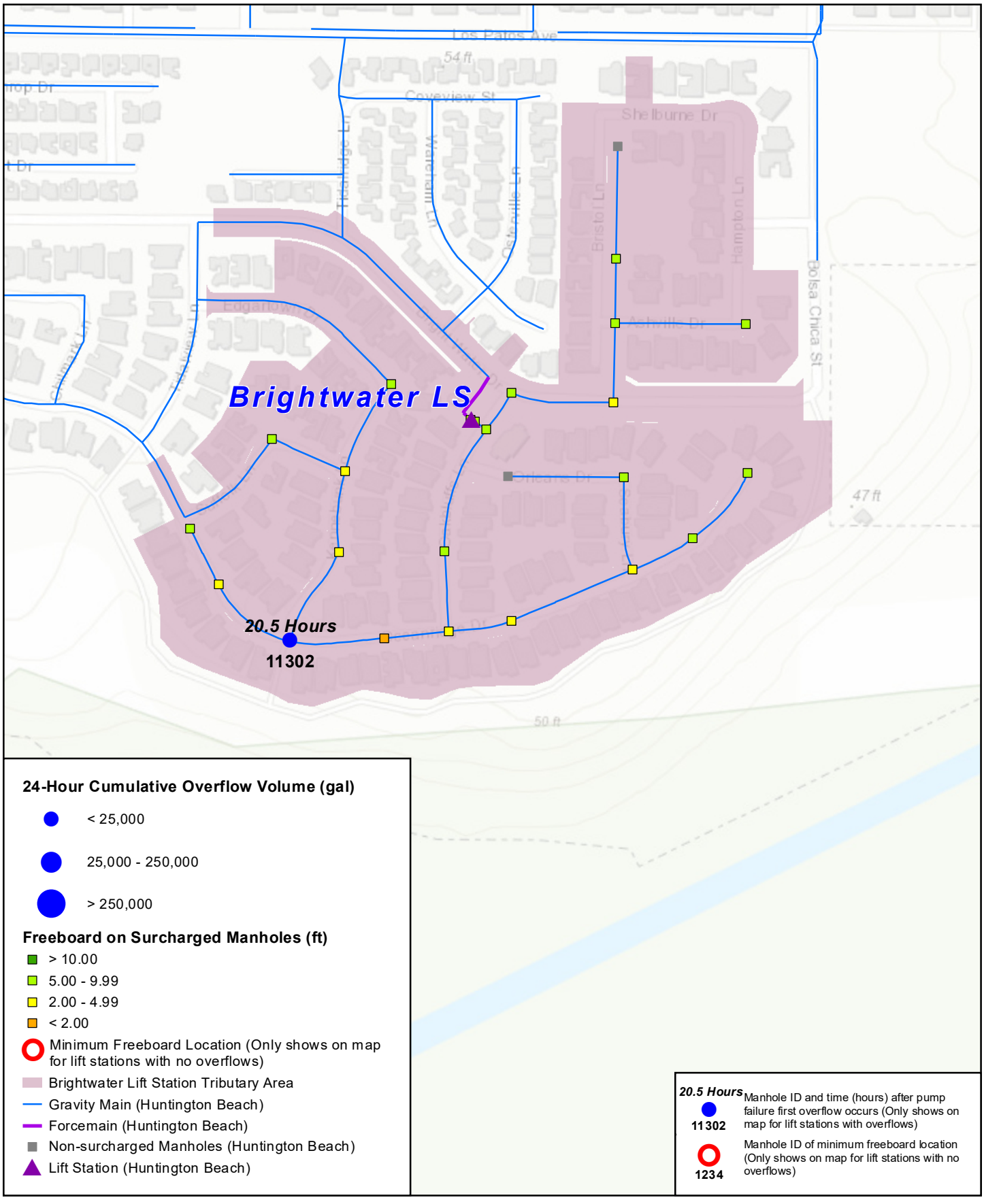
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Boeing Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.26

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.26_Boeing DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:08

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 75 150 225 300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

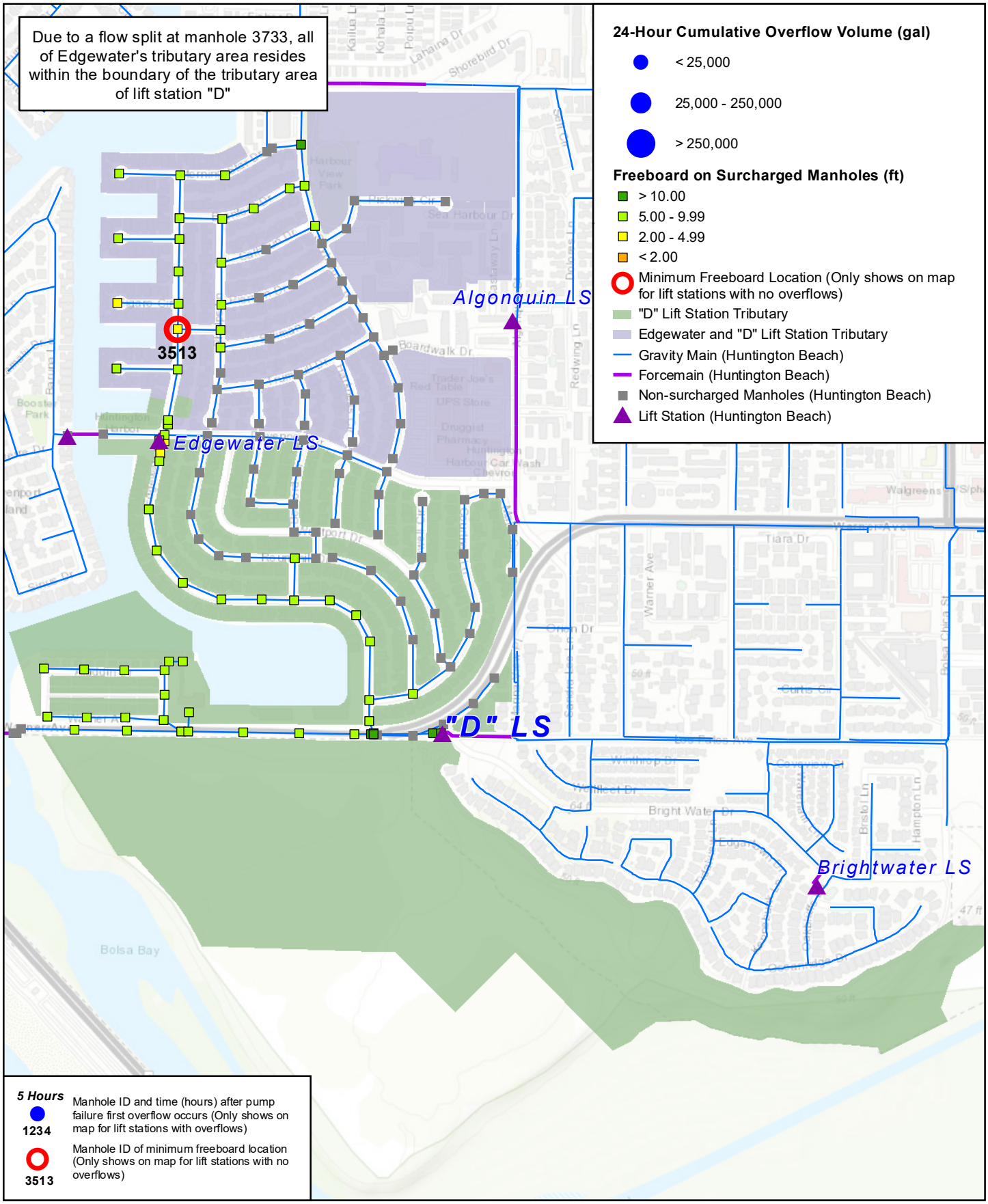
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Brightwater Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.27

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.27_Brightwater DWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 14:17

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 200 400 600 800

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

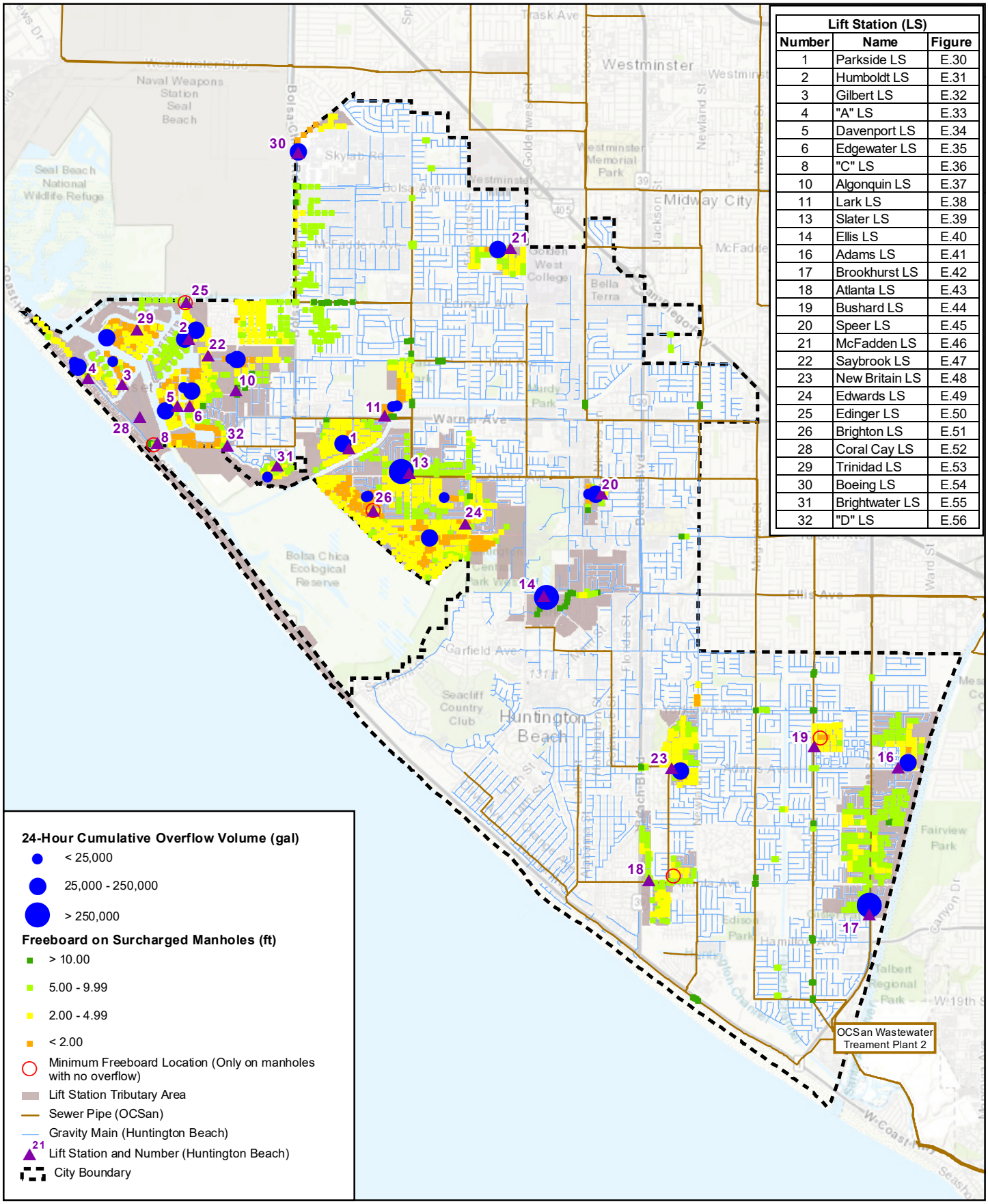
24-Hour Dry Weather Flow Emergency Storage after Pump Failure at Lift Station "D"

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.28

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.28_LS D DWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:12

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

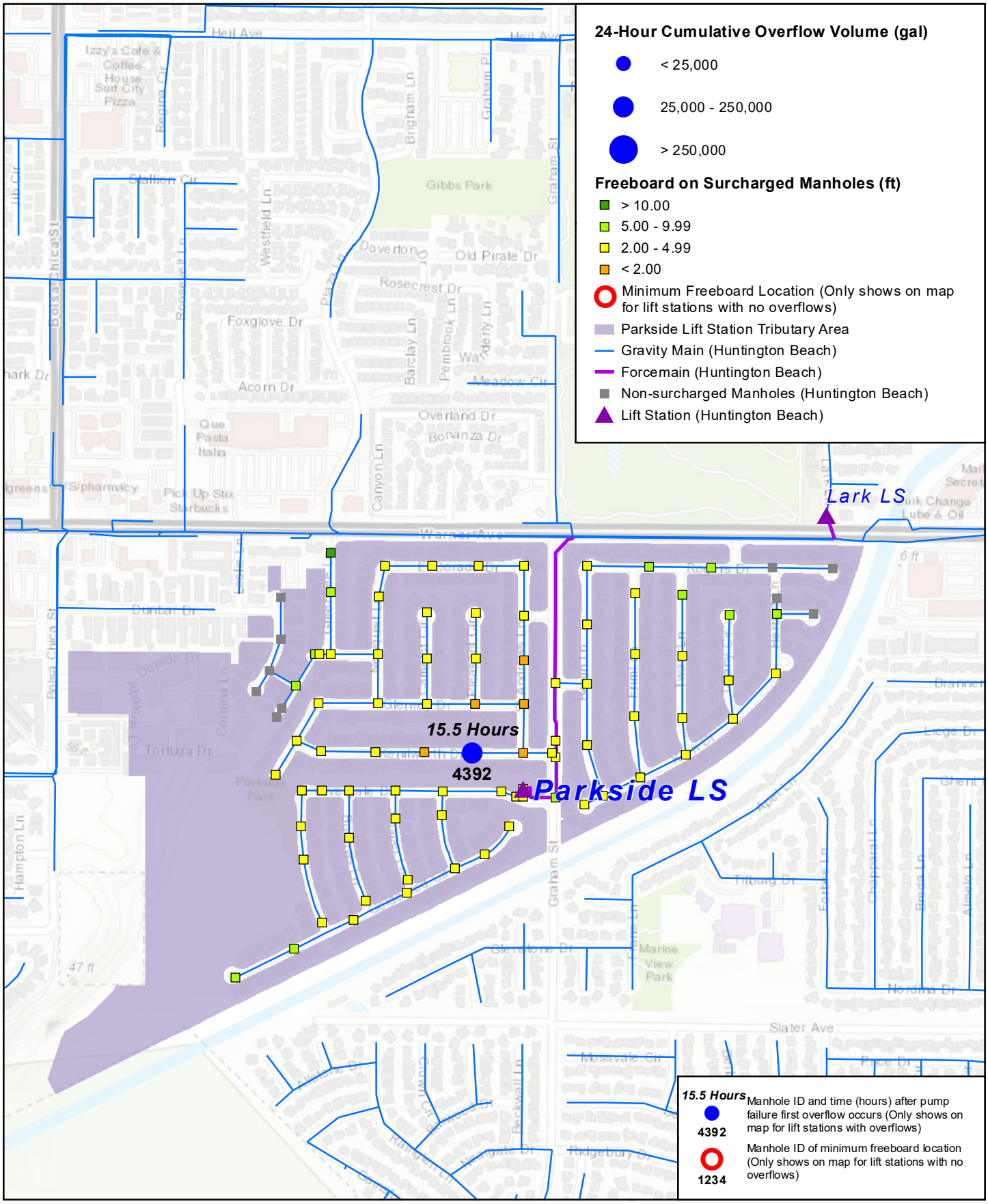
24-Hour Wet Weather Flow Emergency Storage after Systemwide Pump Failure

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.29

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.29_24HrWWF Emergency Storage Overall Map.mxd
Print date: 19 Mar 2024 - 08:54

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

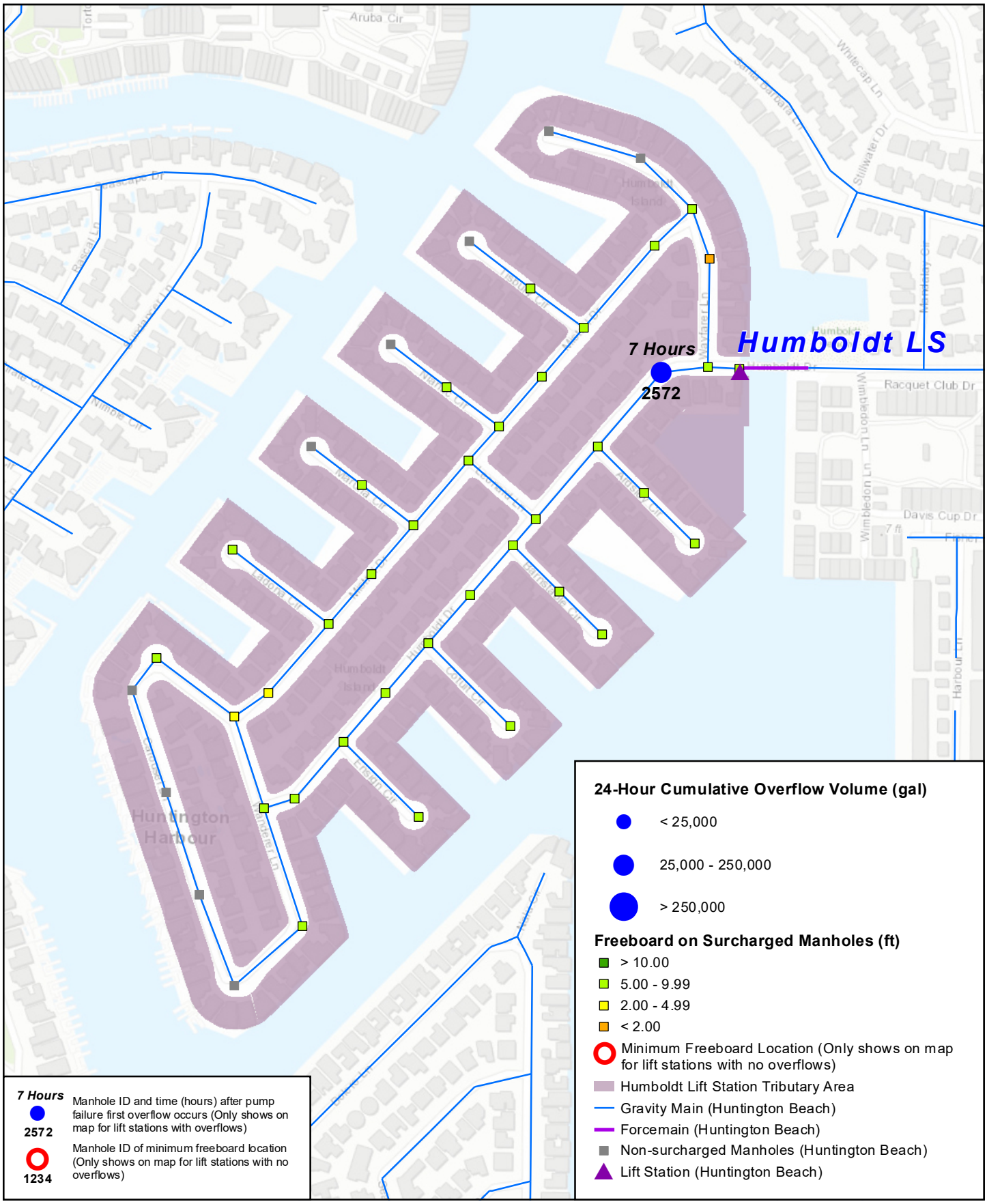
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Parkside Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.30

N:\US\Irvine\Projects\56\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.30_Parkside WWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 14:54

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

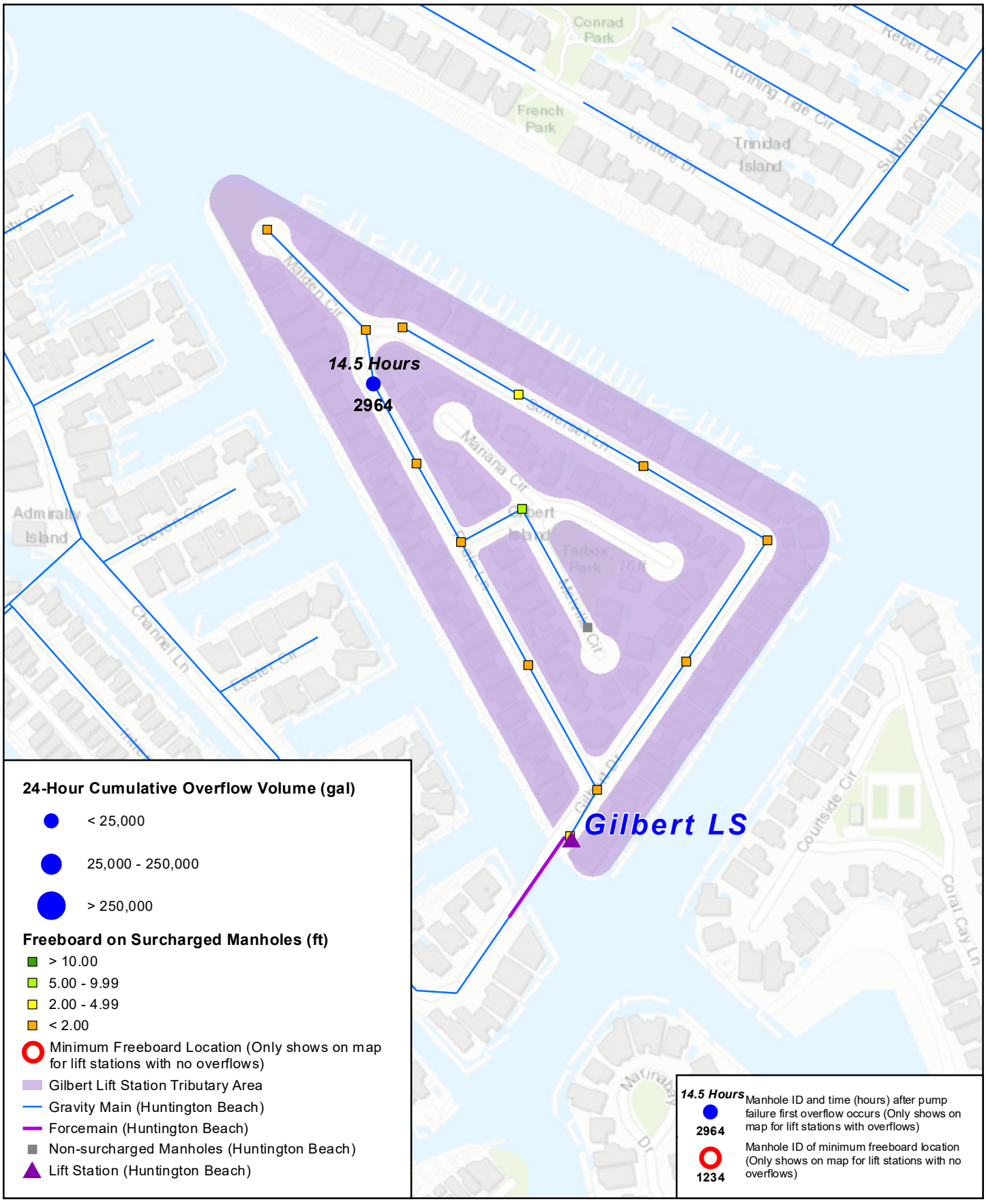
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Humboldt Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.31

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.31_Humboldt WWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 15:03

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 75 150 225 300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

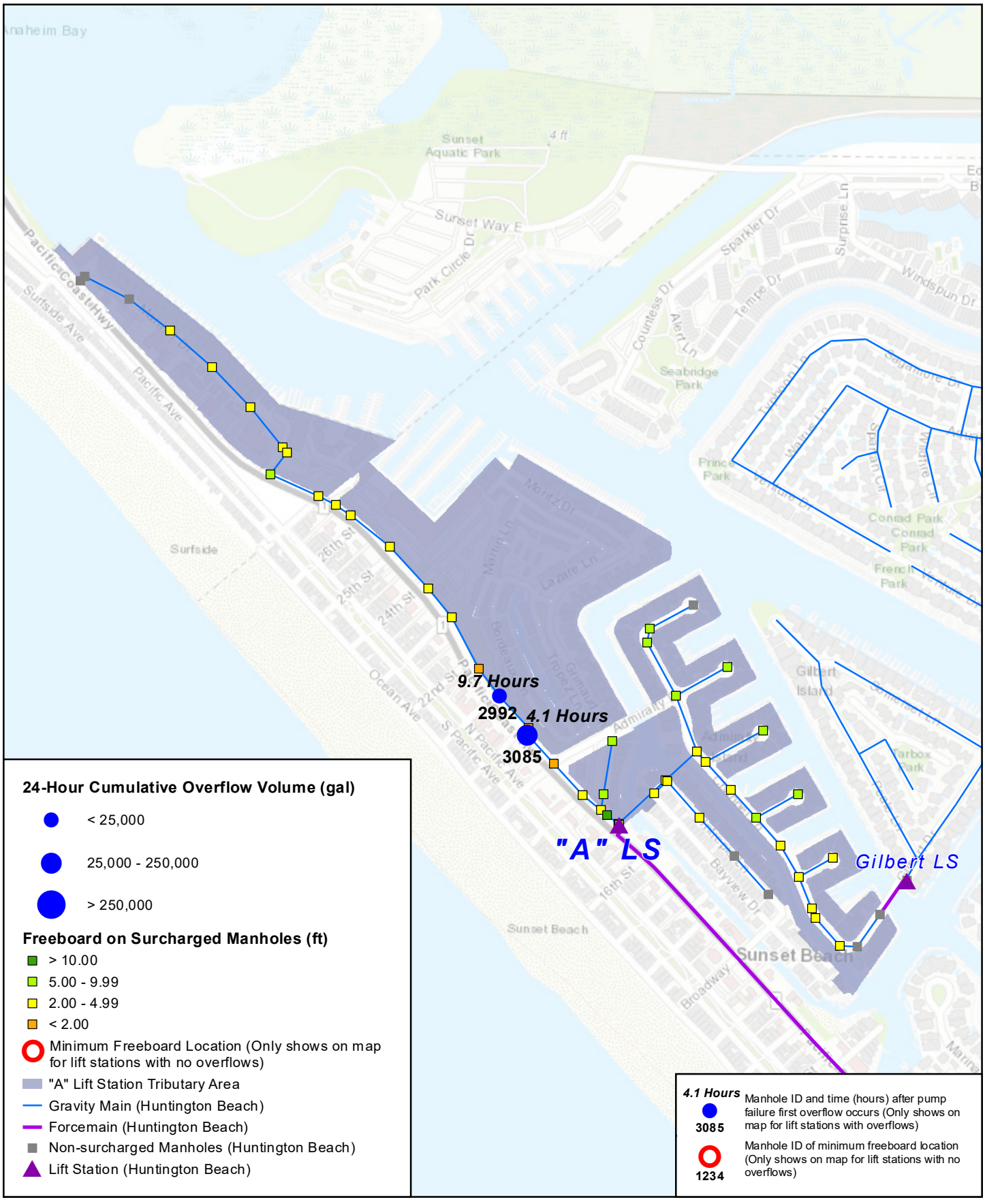
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Gilbert Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.32

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.32_Gilbert WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:23

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

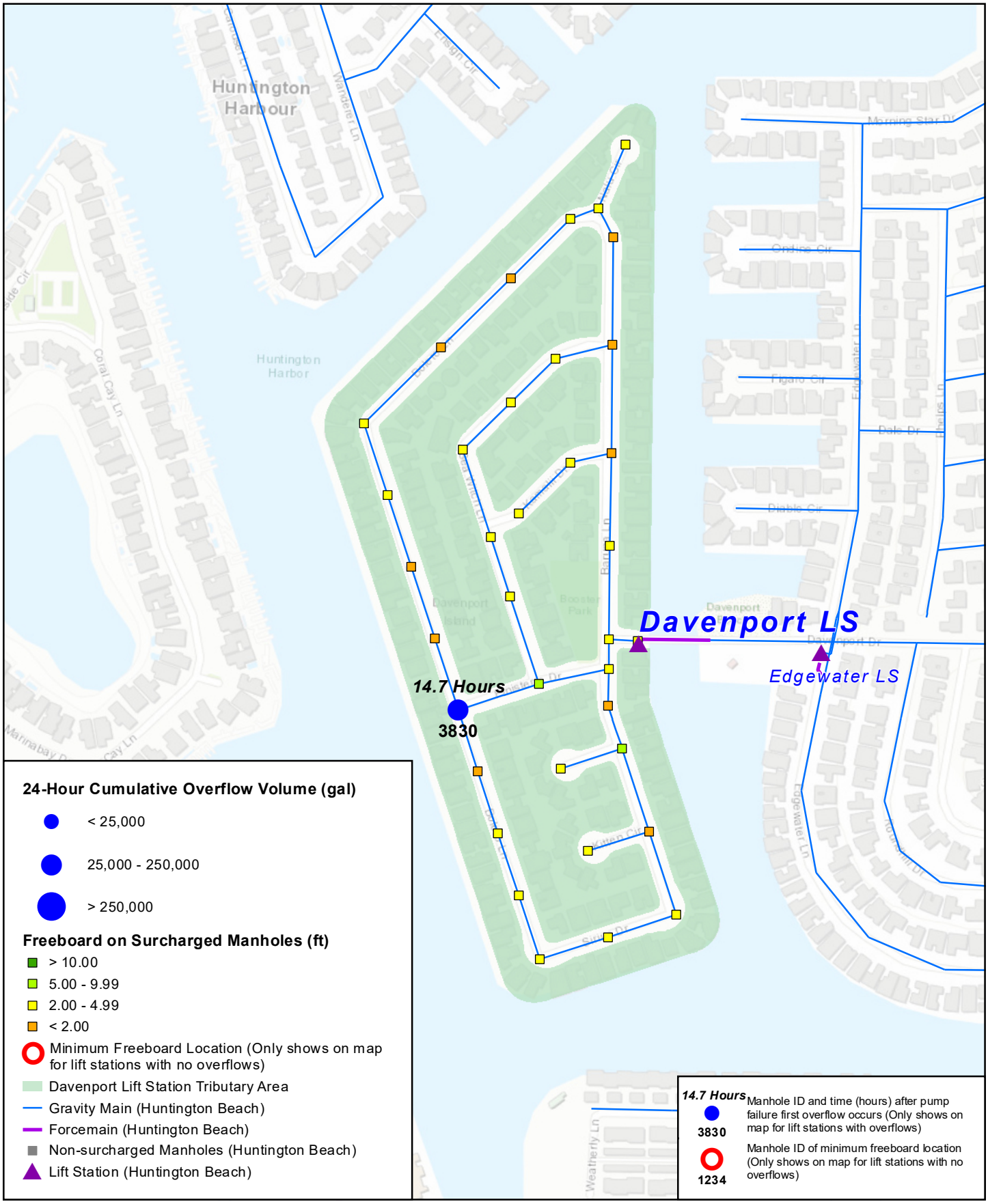
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Lift Station "A"

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.33

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.33_LS A WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:25

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

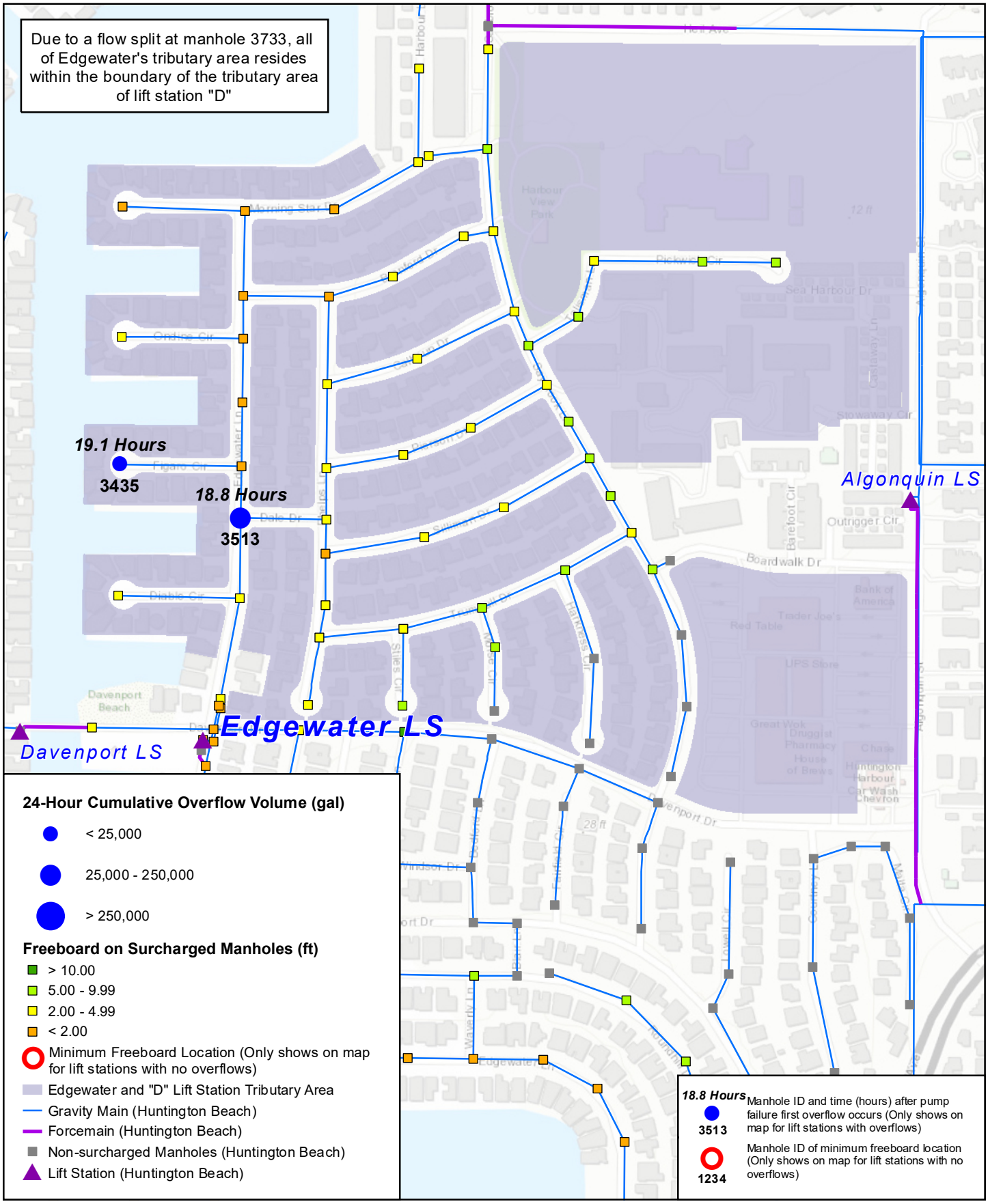
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Davenport Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.34

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.34_Davenport WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:26

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

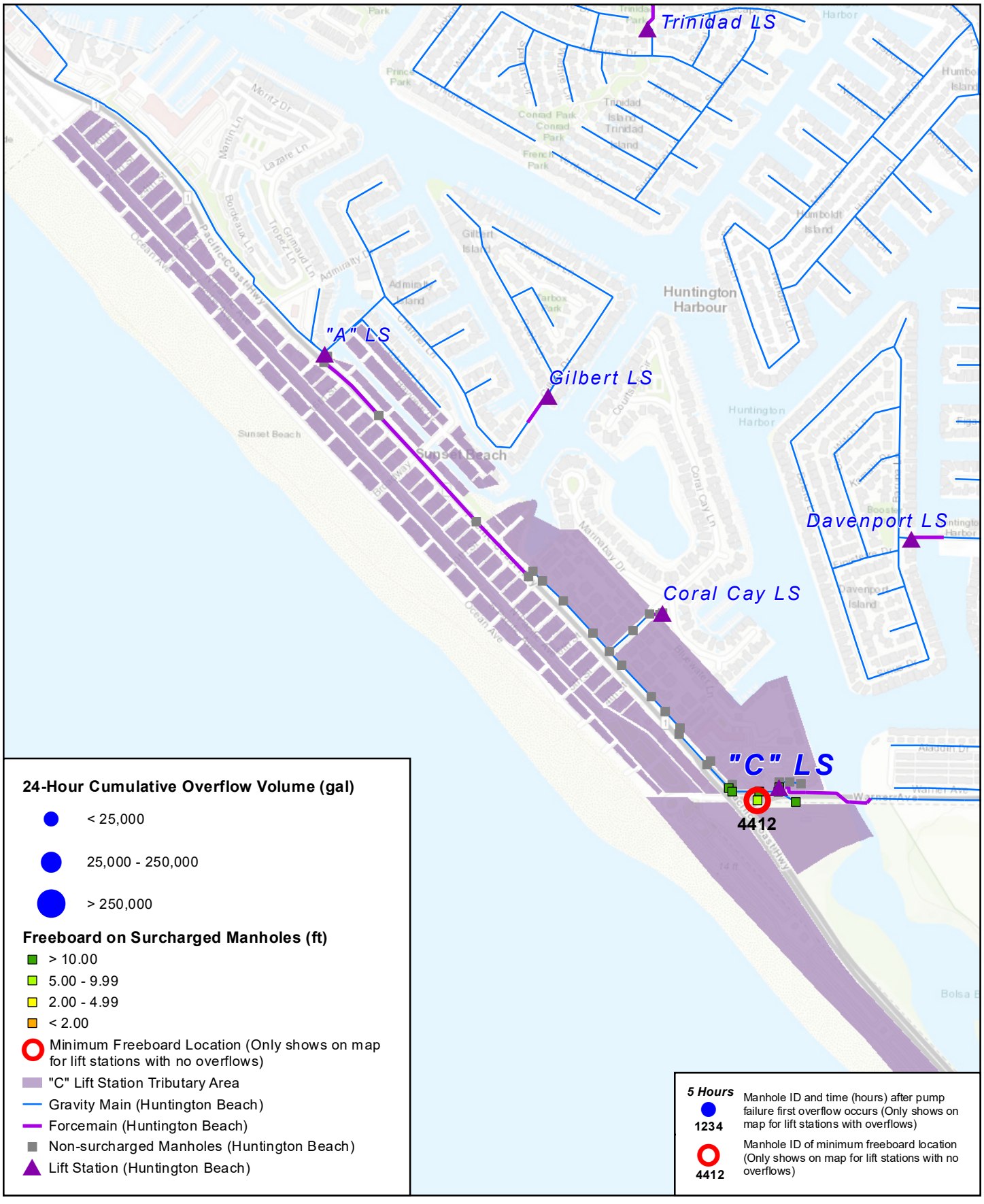
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Edgewater Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.35

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.35_Edgewater WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:31

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 225 450 675 900

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

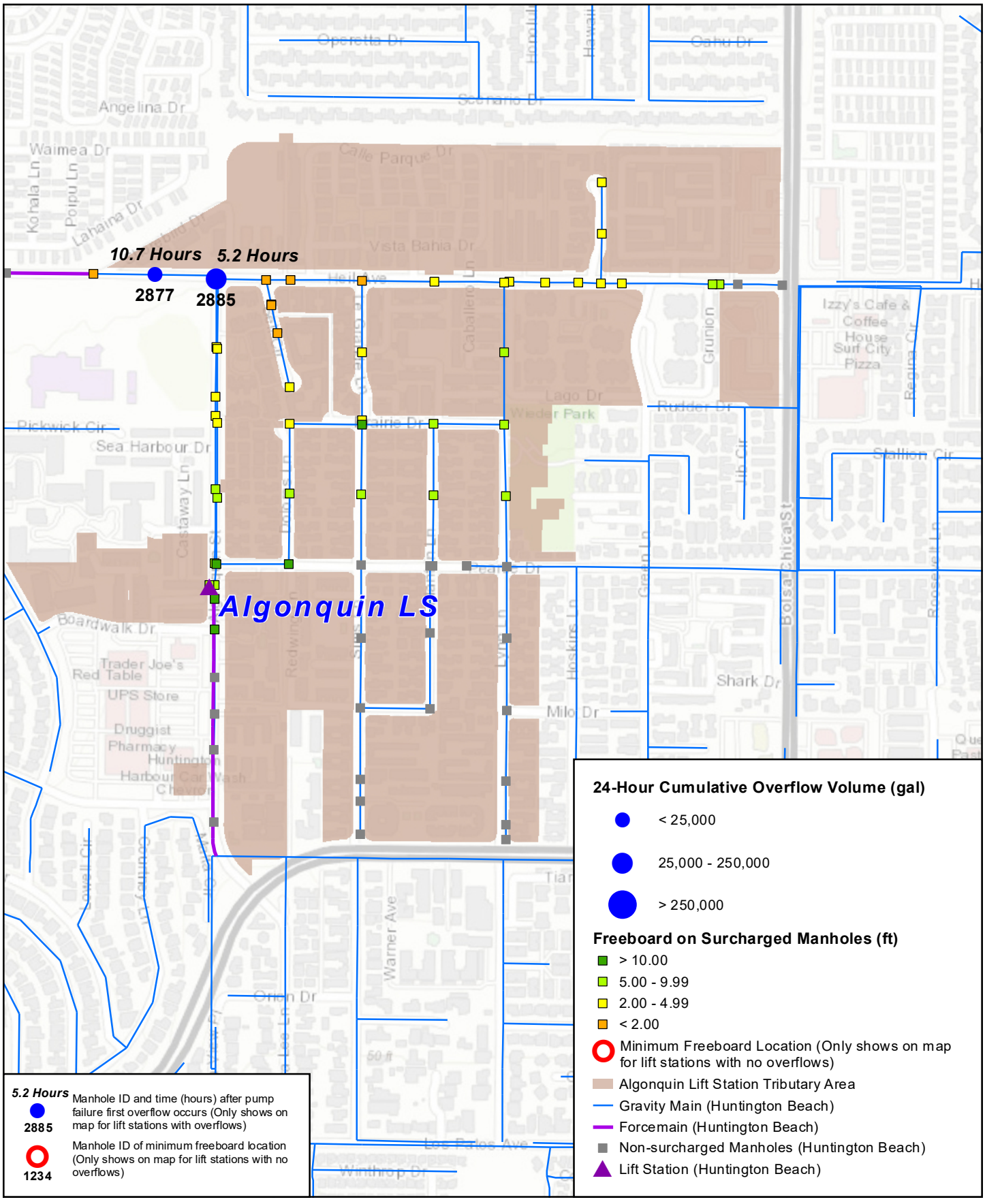
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Lift Station "C"

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.36

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.36_LS C WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:31

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 150 300 450 600

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

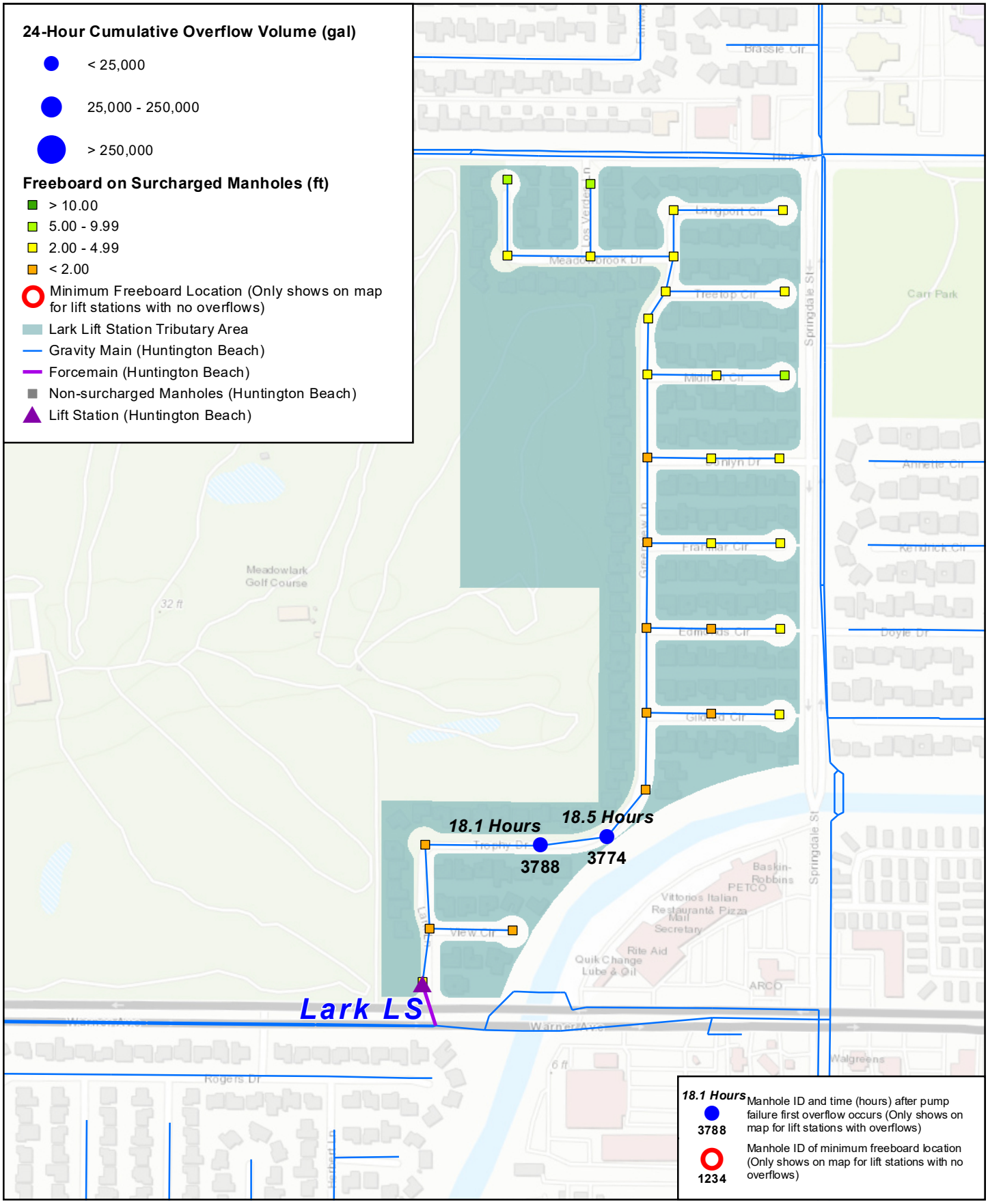
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Algonquin Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.37

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.37_Algonquin WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:35

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

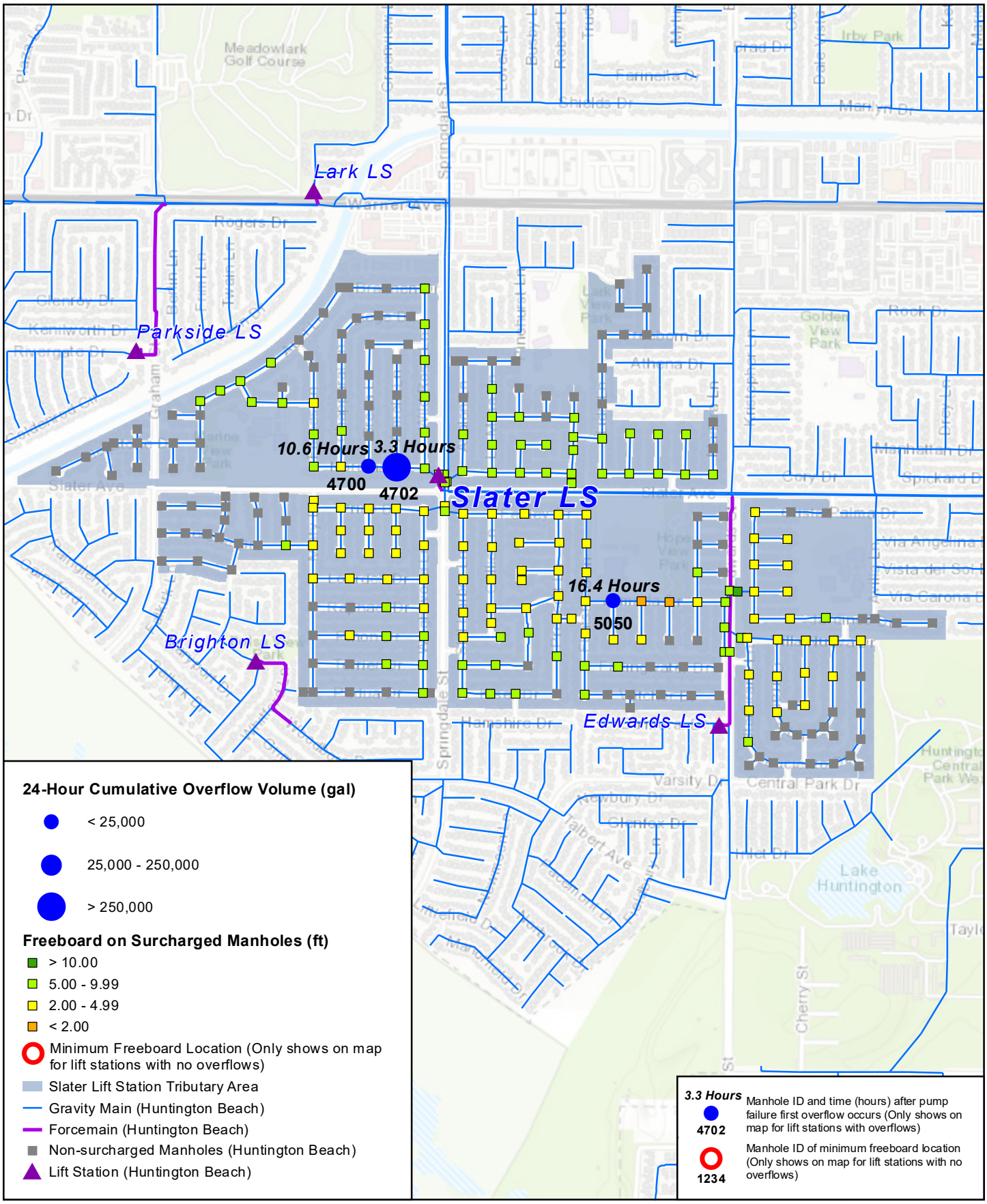
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Lark Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.38

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.38_Lark WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:36

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 300 600 900 1,200

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

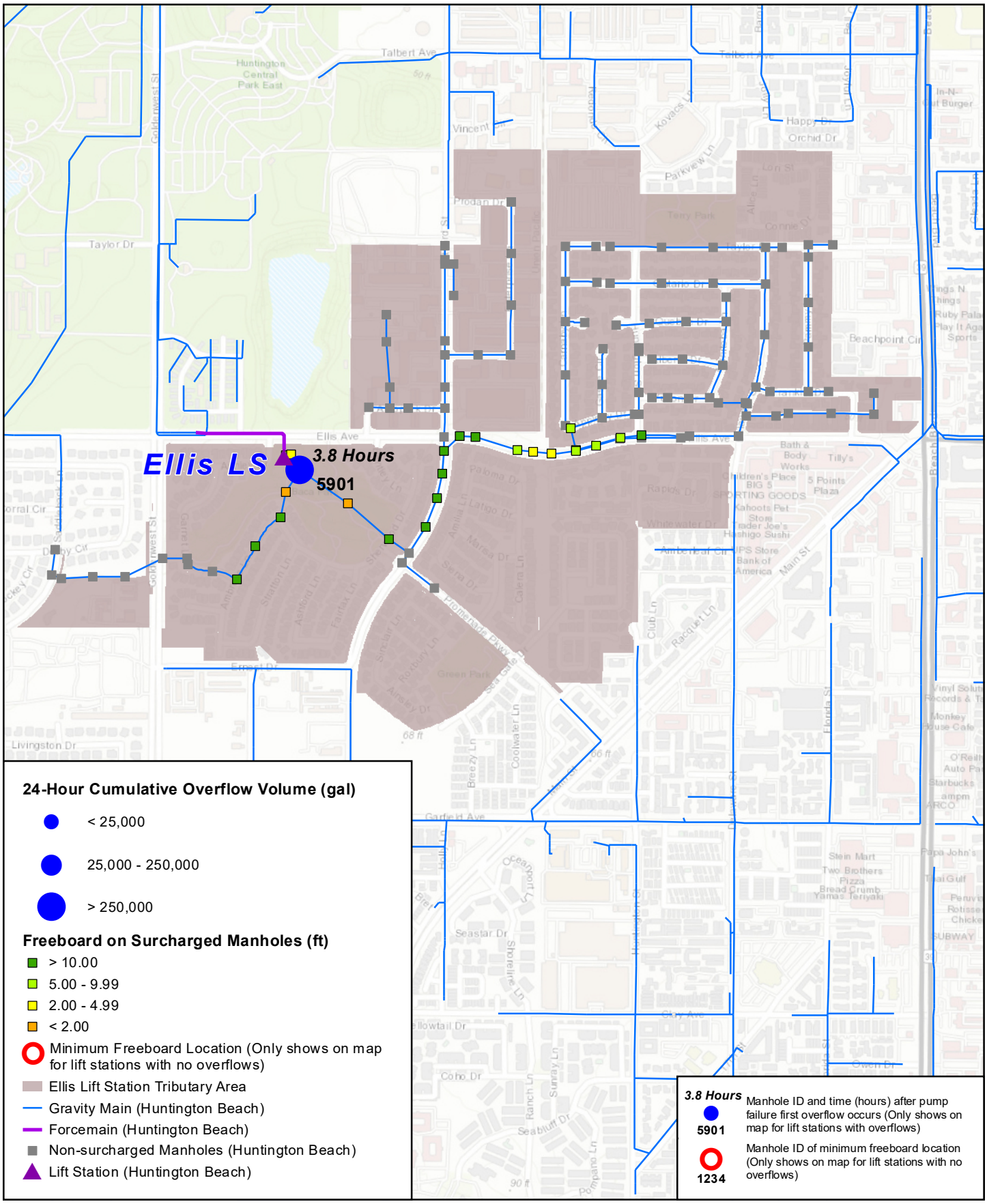
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Slater Lift Station

Project No. 12585300
Revision No. 1
Date 3/12/2024

FIGURE E.39

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.39_Slater WWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 09:32

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 225 450 675 900

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

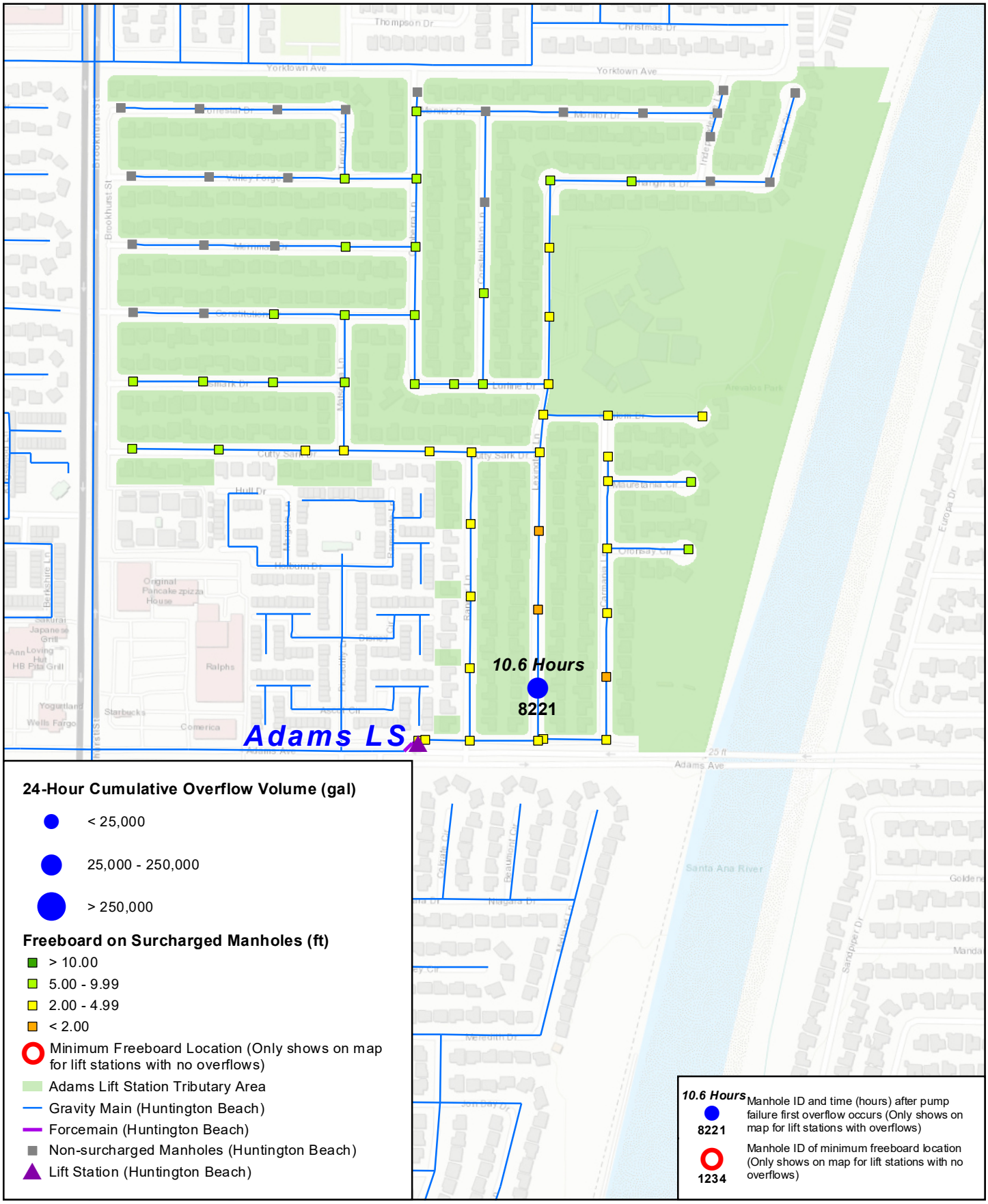
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Ellis Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.40

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.40_Ellis WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:39

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 125 250 375 500

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

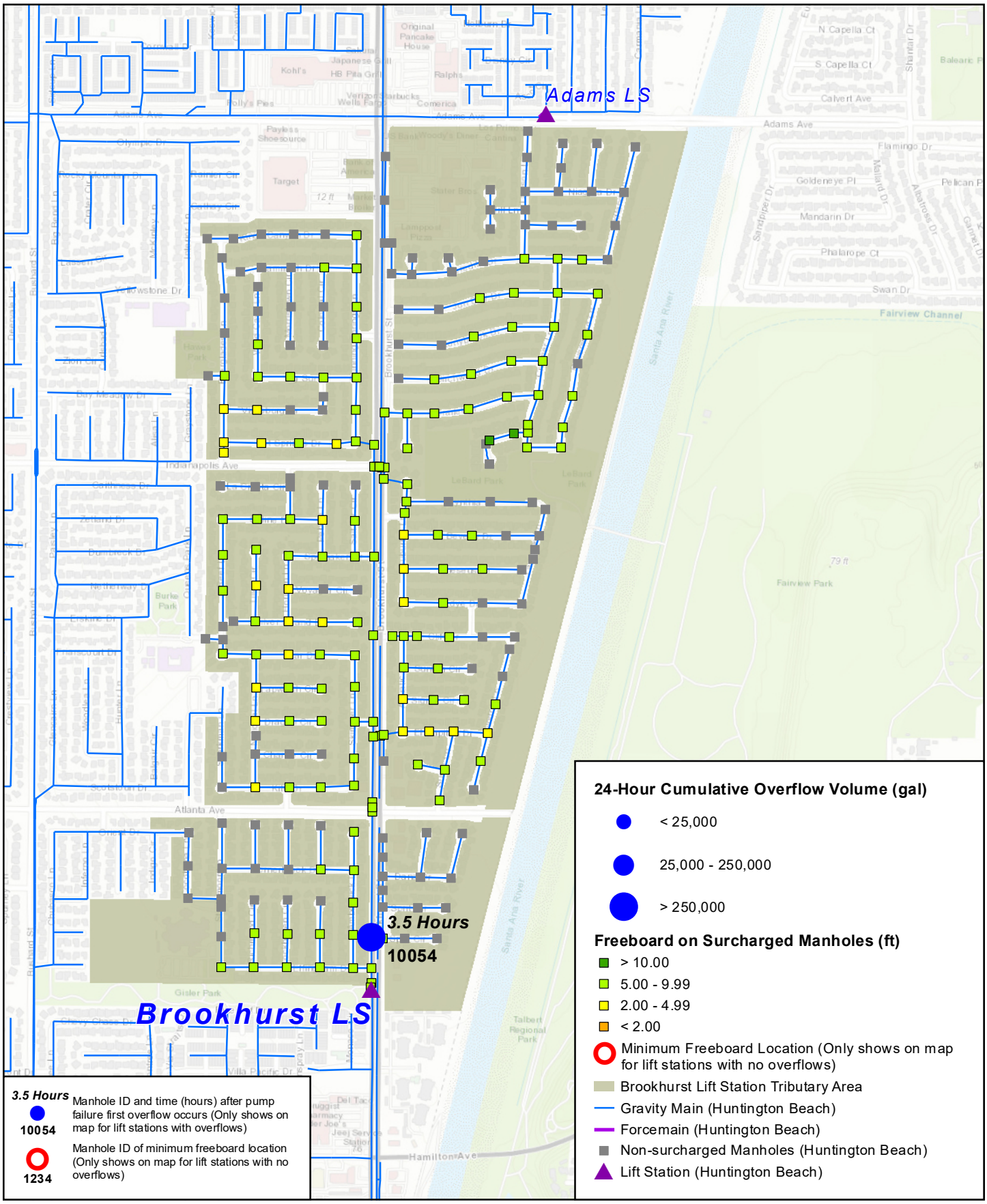
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Adams Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.41

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.41_Adams WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:41

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 250 500 750 1,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

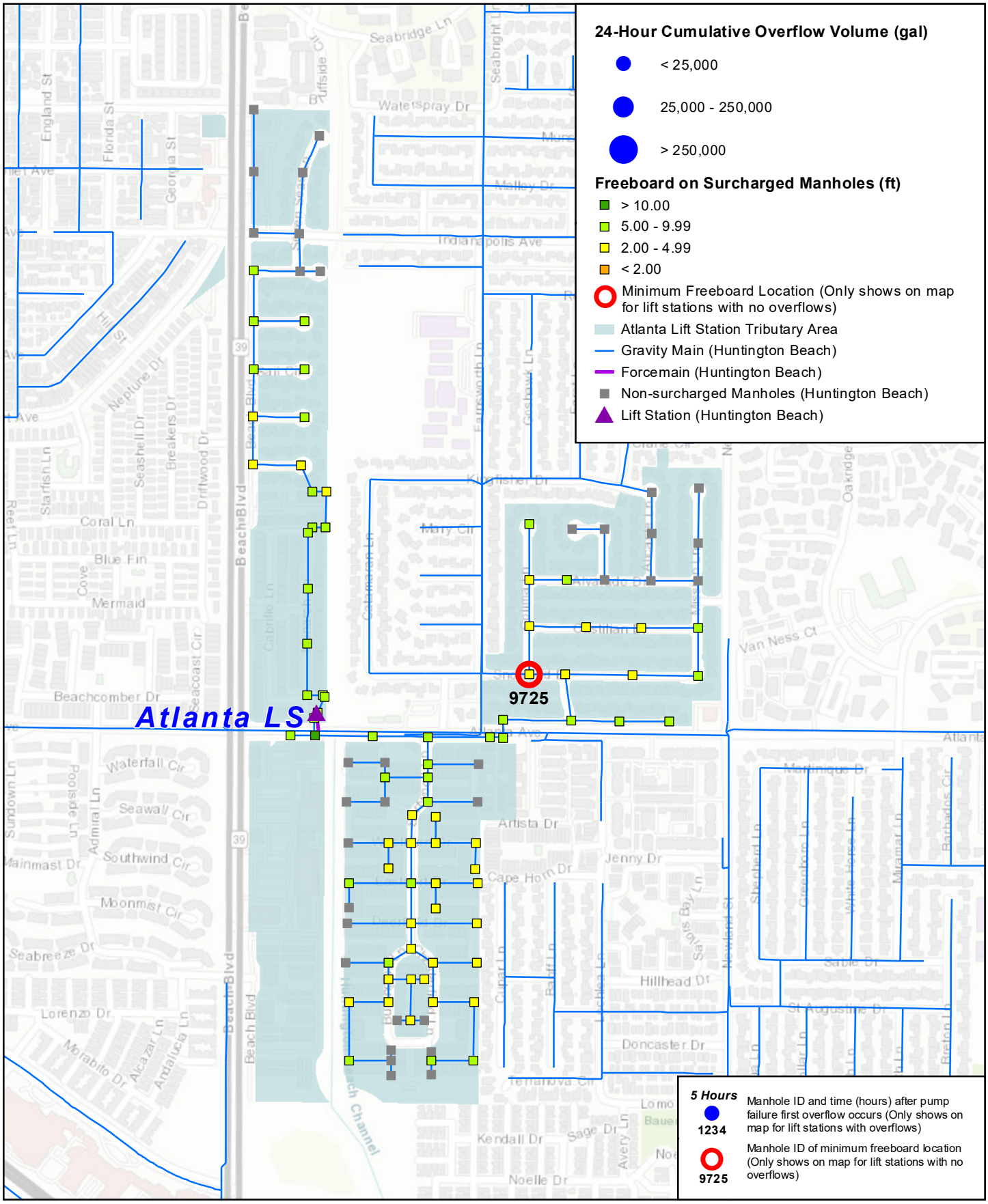
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Brookhurst Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.42

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.42_Brookhurst WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:42

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

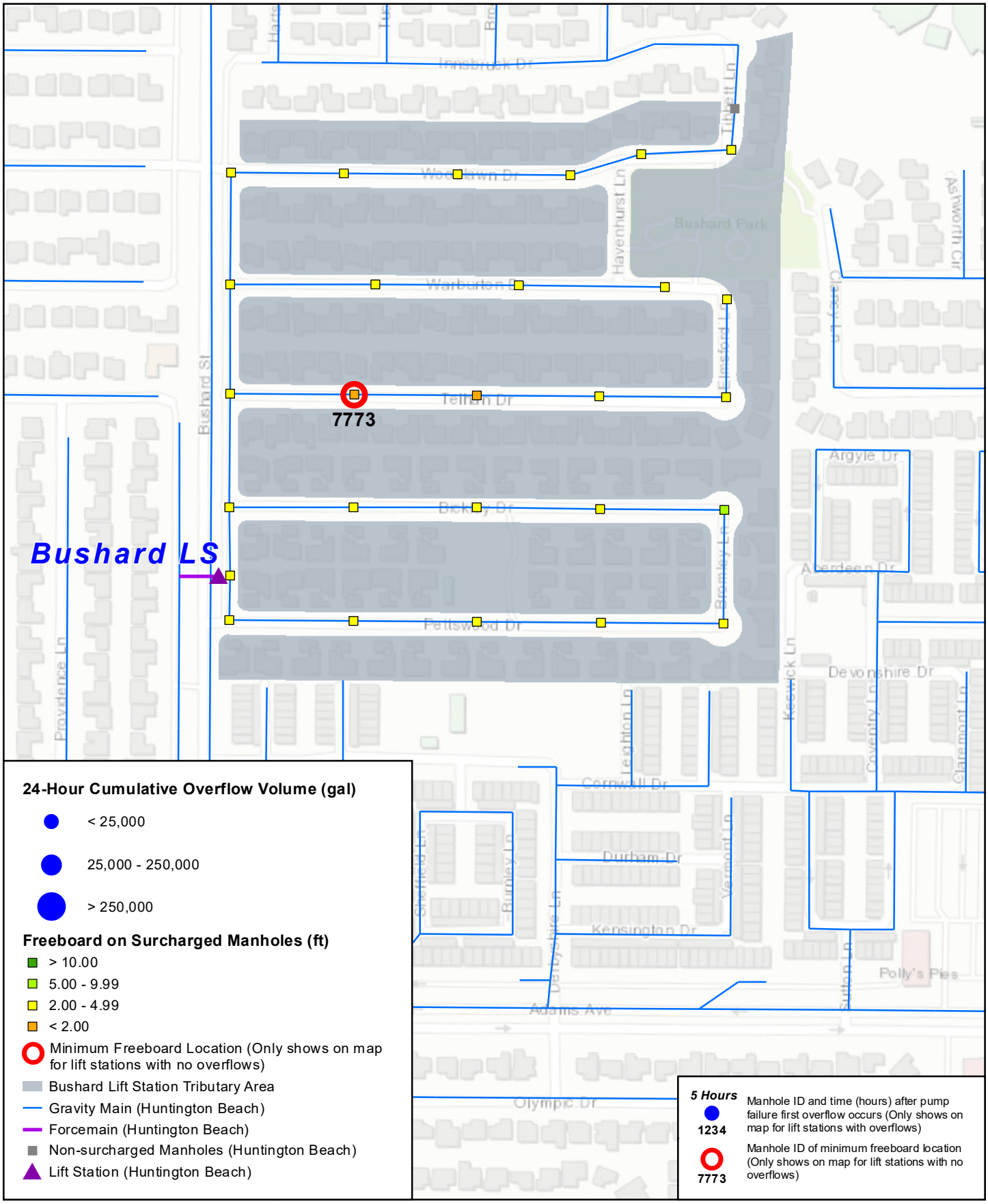
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Atlanta Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.43

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.43_Atlanta WWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 10:32

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 75 150 225 300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

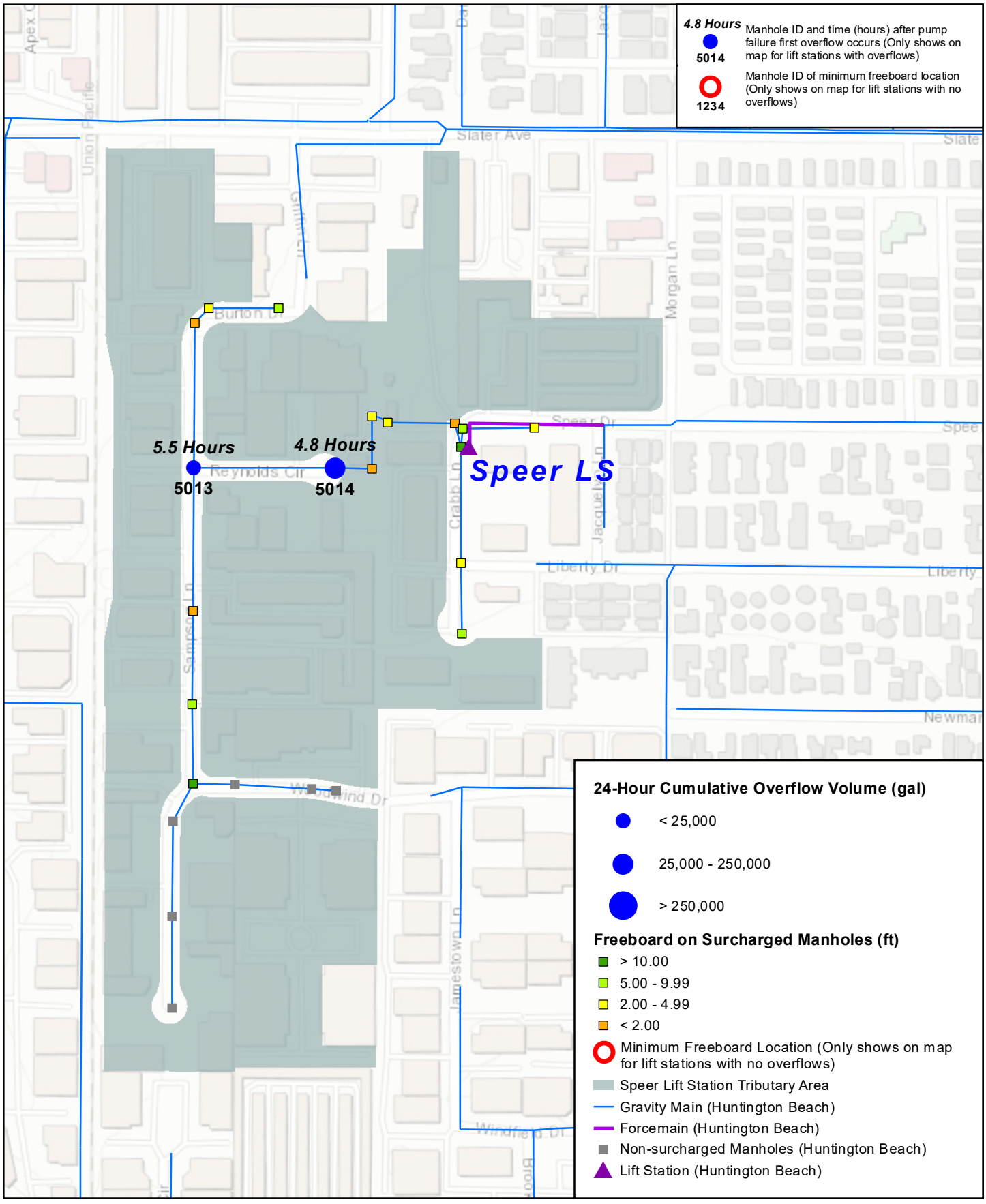
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Bushard Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.44

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.44_Bushard WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:45

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 75 150 225 300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

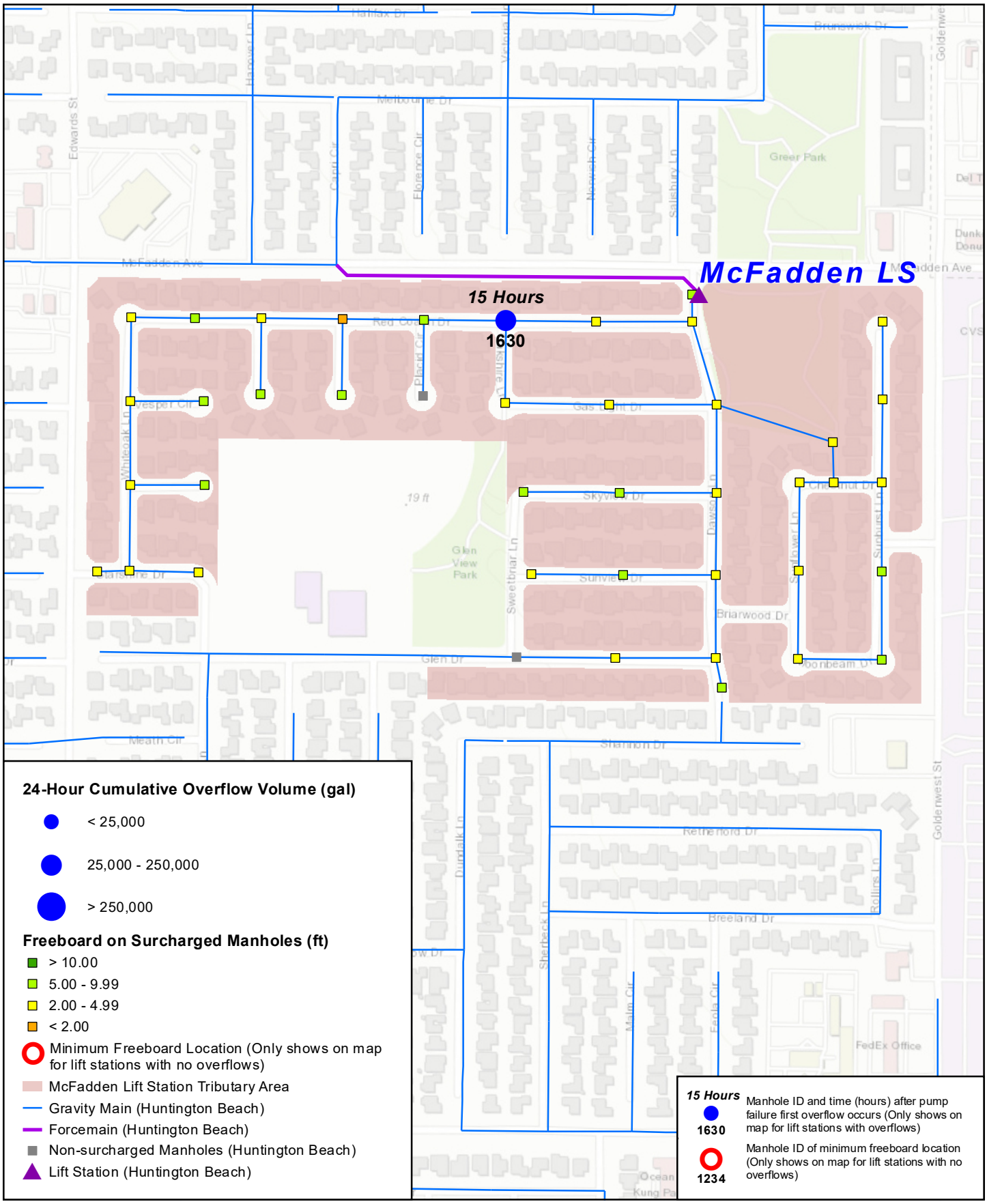
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Speer Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.45

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.45_Speer WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:46

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

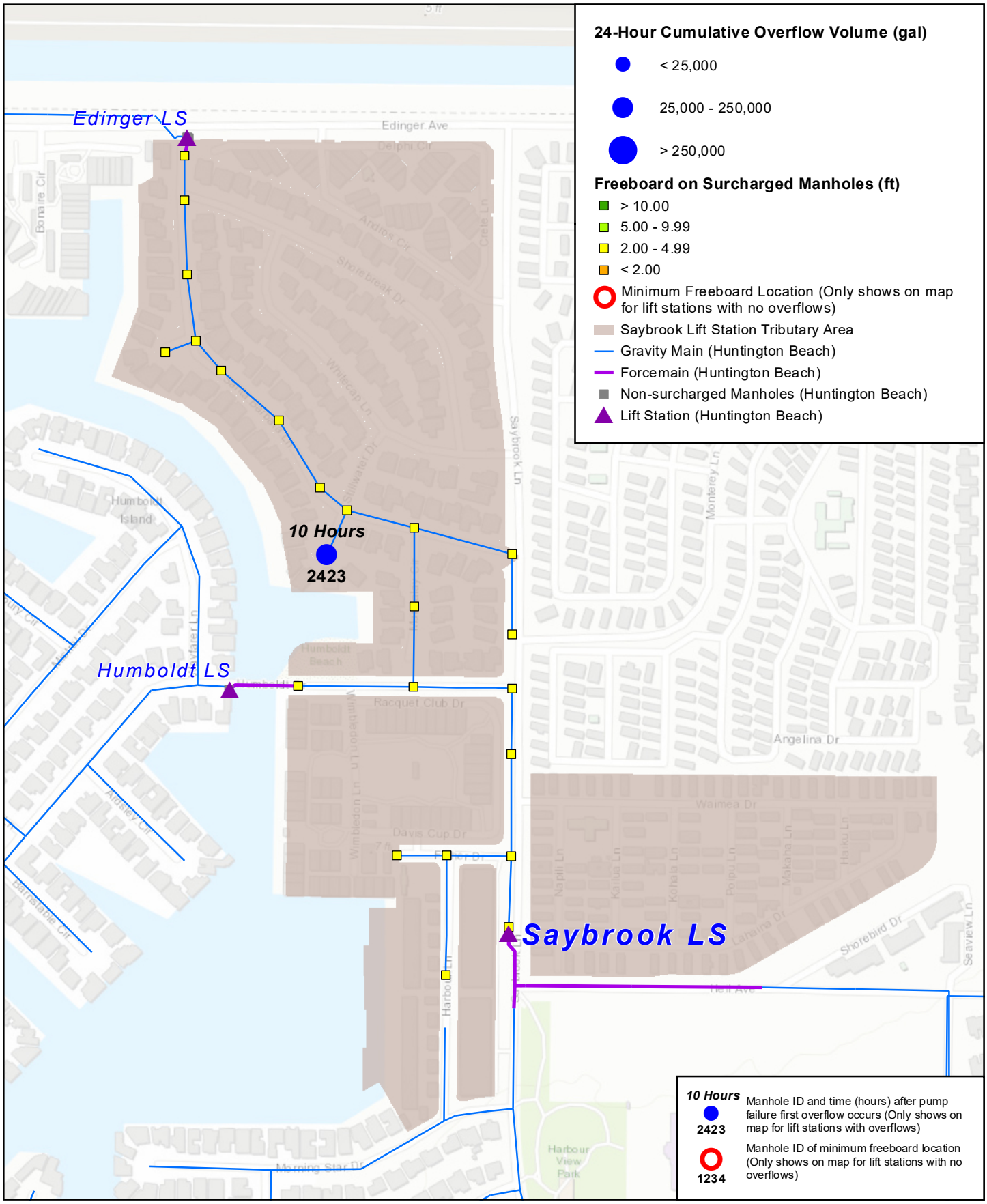
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at McFadden Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.46

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.46_McFadden WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:46

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

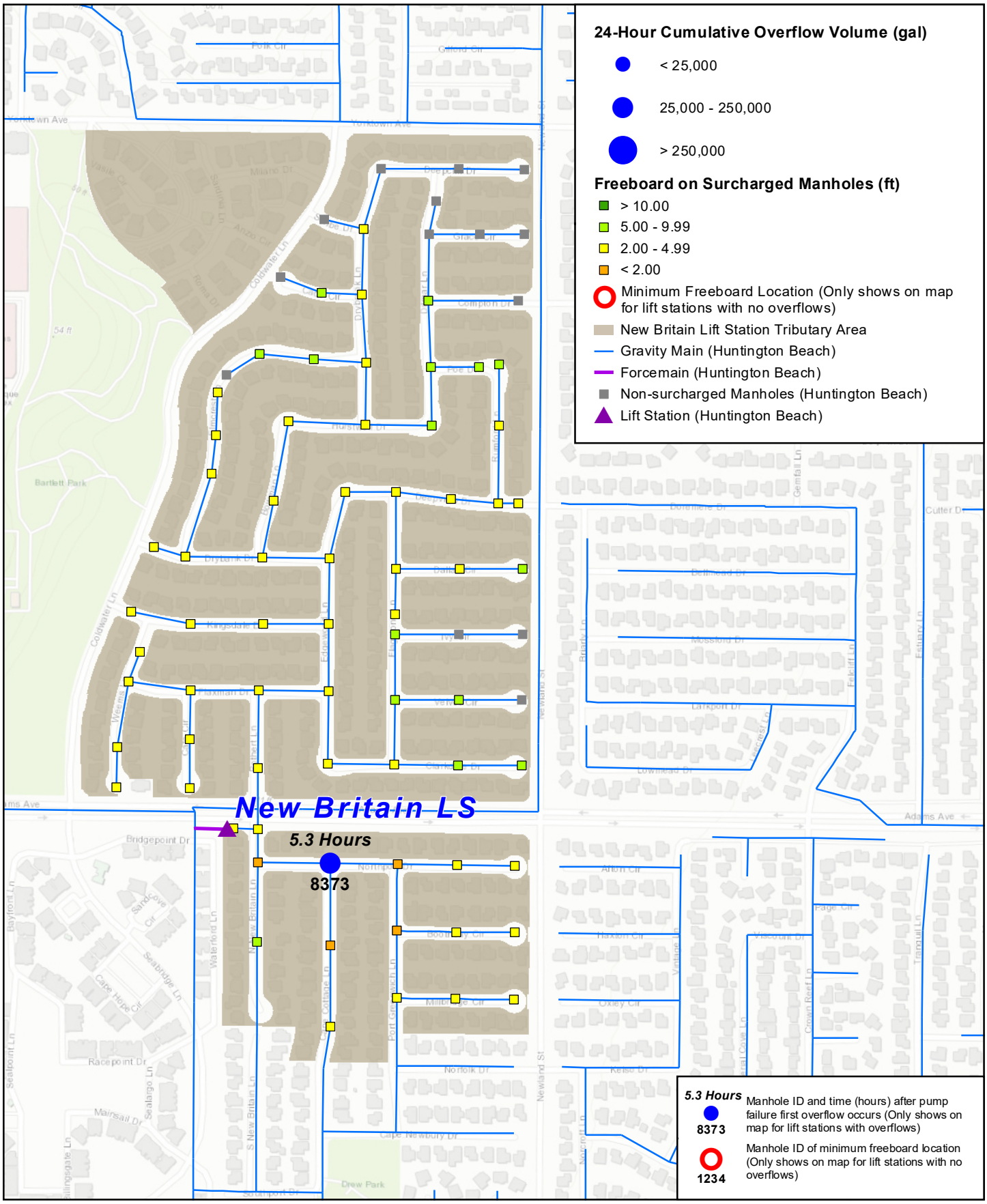
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Saybrook Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.47

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.47_Saybrook WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:51

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 125 250 375 500

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

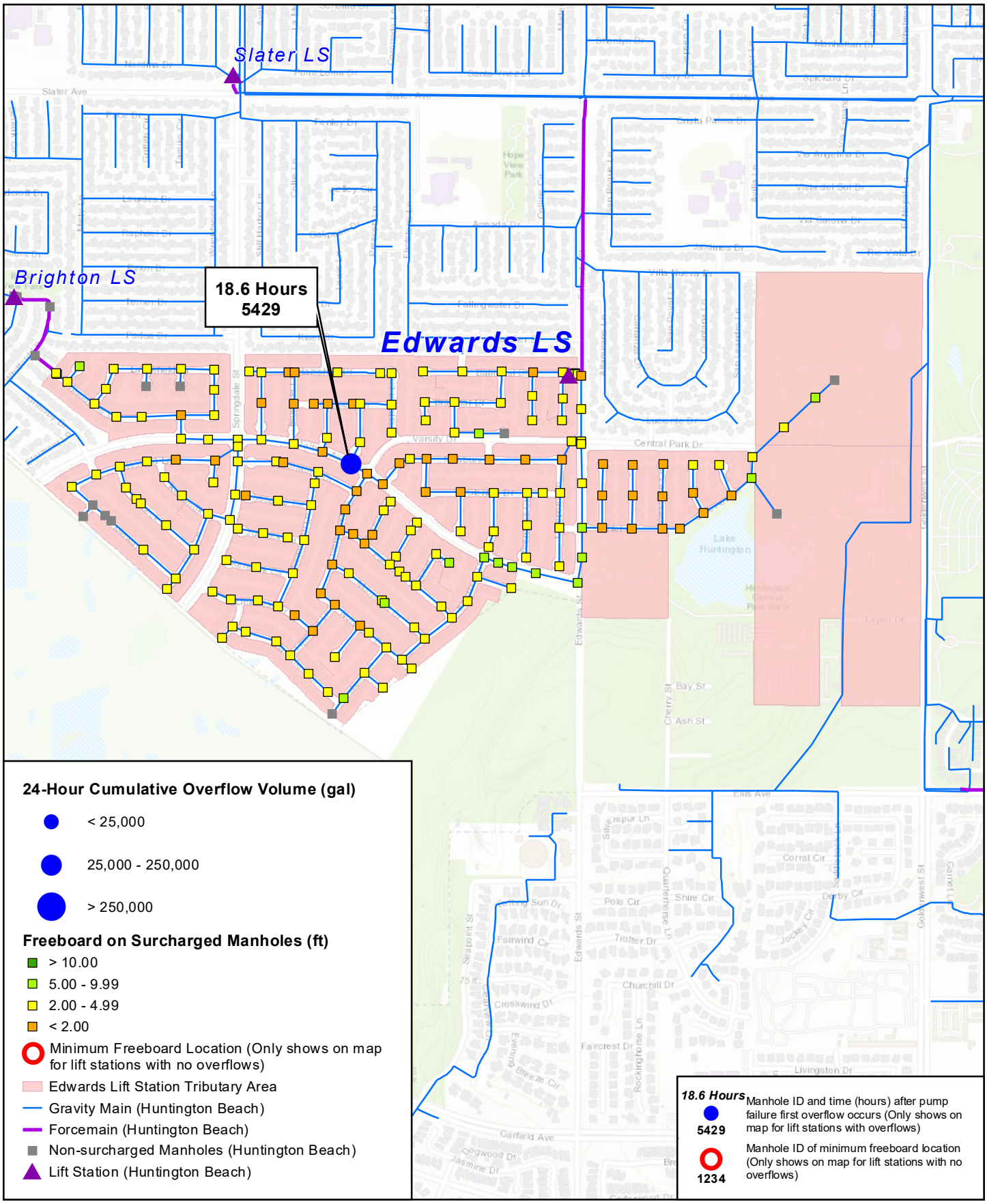
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at New Britain Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.48

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.48_New Britain WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:54

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 250 500 750 1,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

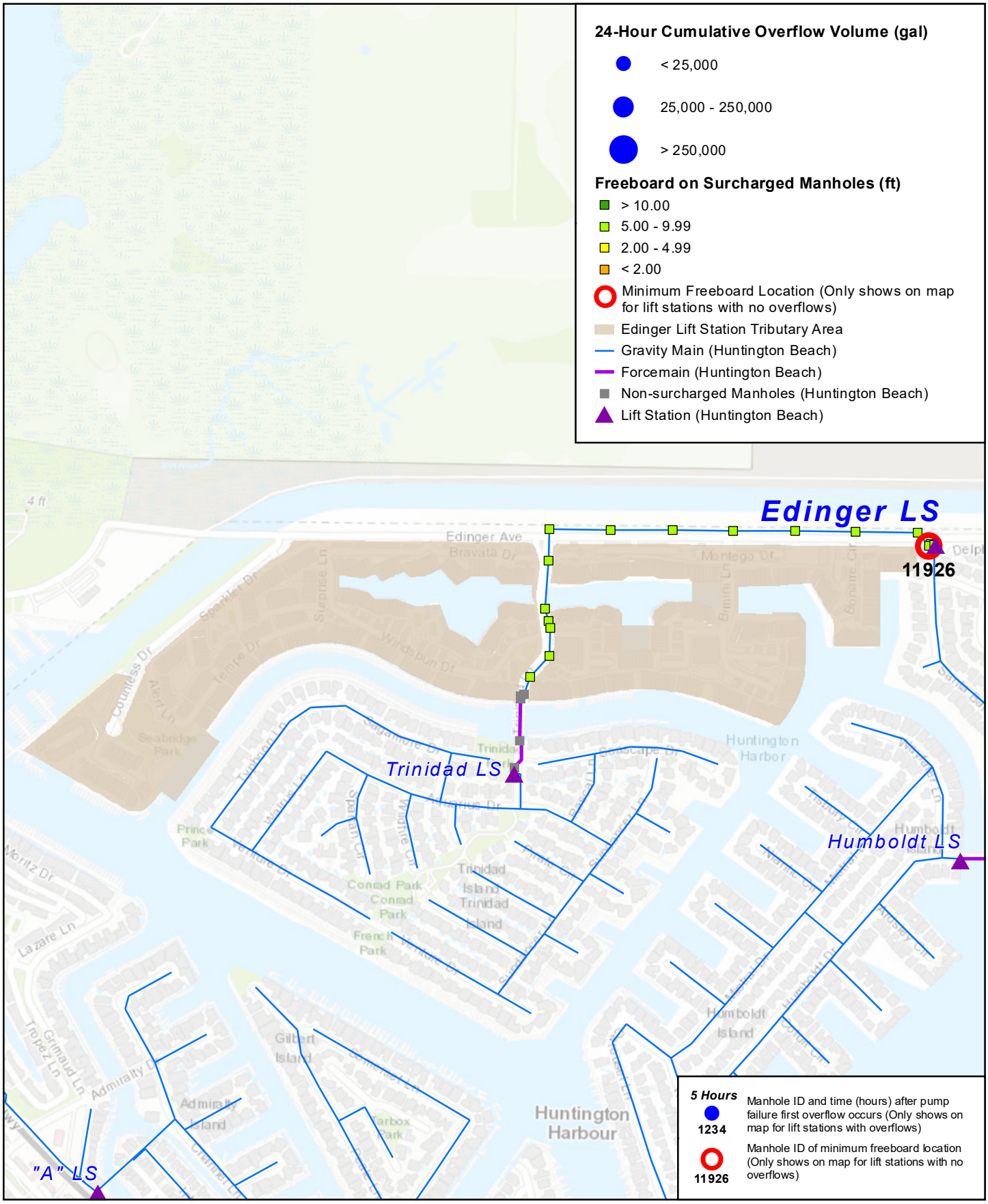
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Edwards Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.49

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.49_Edwards WWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 12:49

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

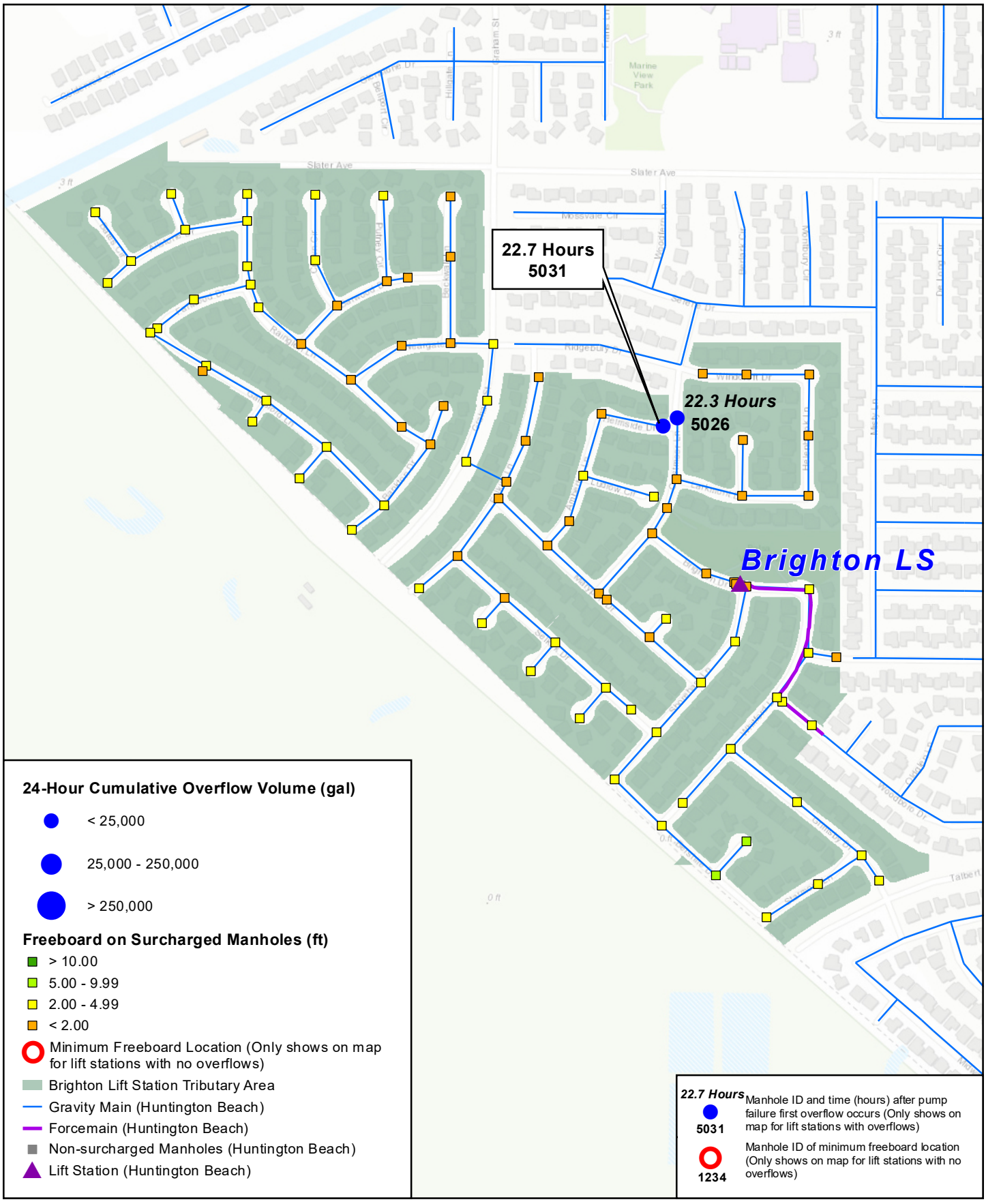
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Edinger Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.50

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.50_Edinger DWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 12:59

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 125 250 375 500

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

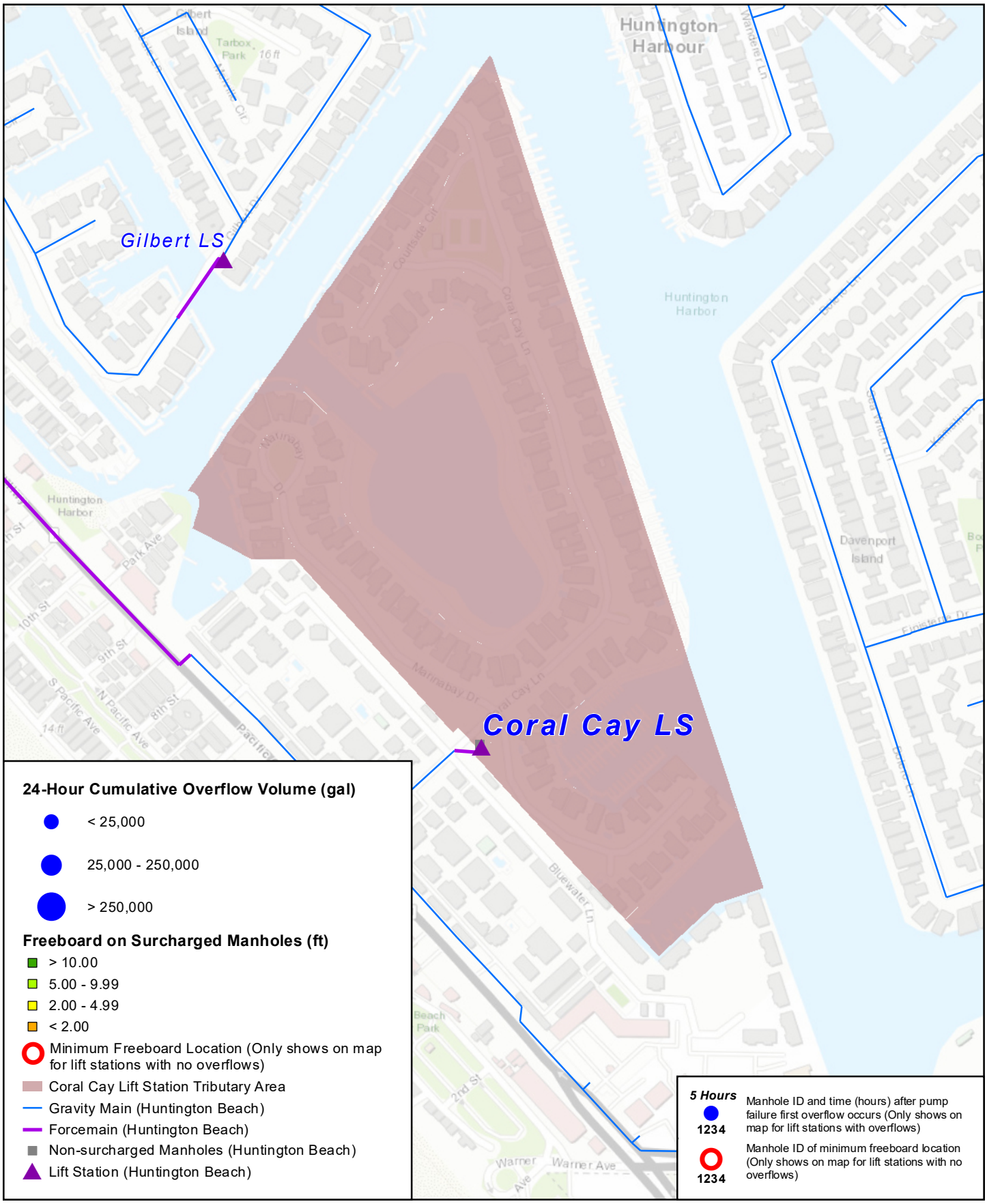
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Brighton Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.51

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.51_Brighton WWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 13:18

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

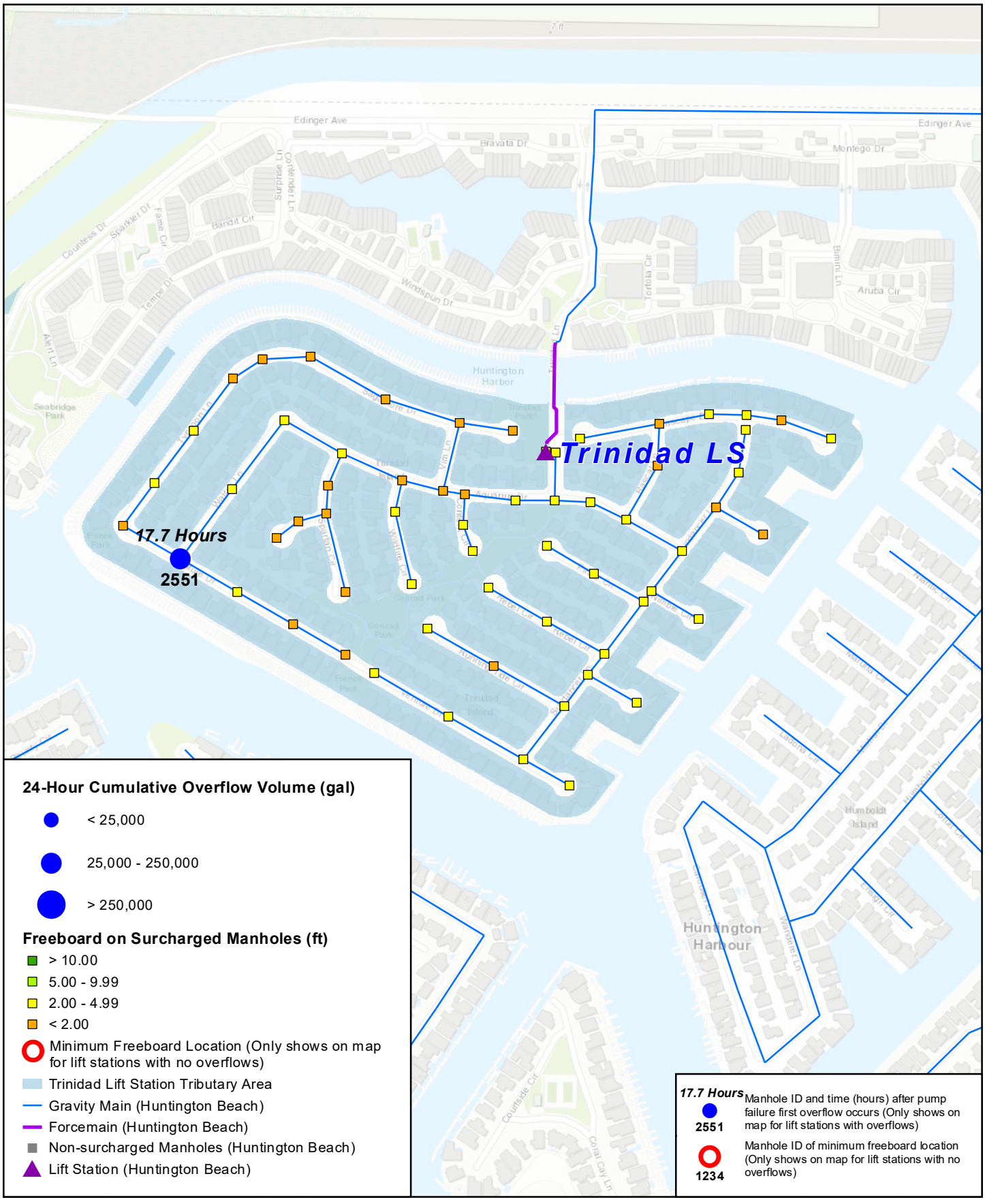
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Coral Cay Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.52

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.52_Coral Cay WWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 13:30

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 125 250 375 500

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

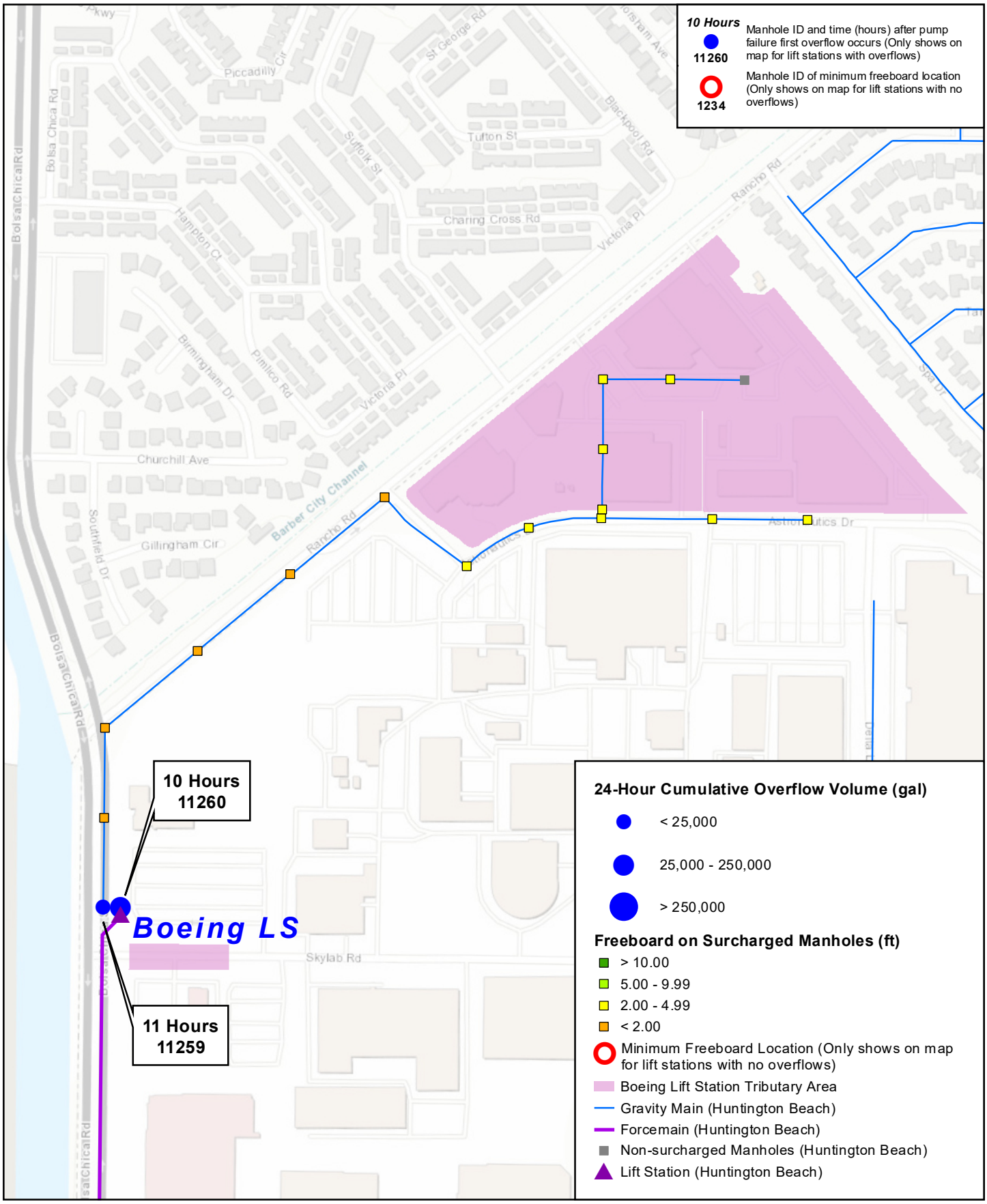
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Trinidad Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.53

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.53_Trinidad WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:50

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

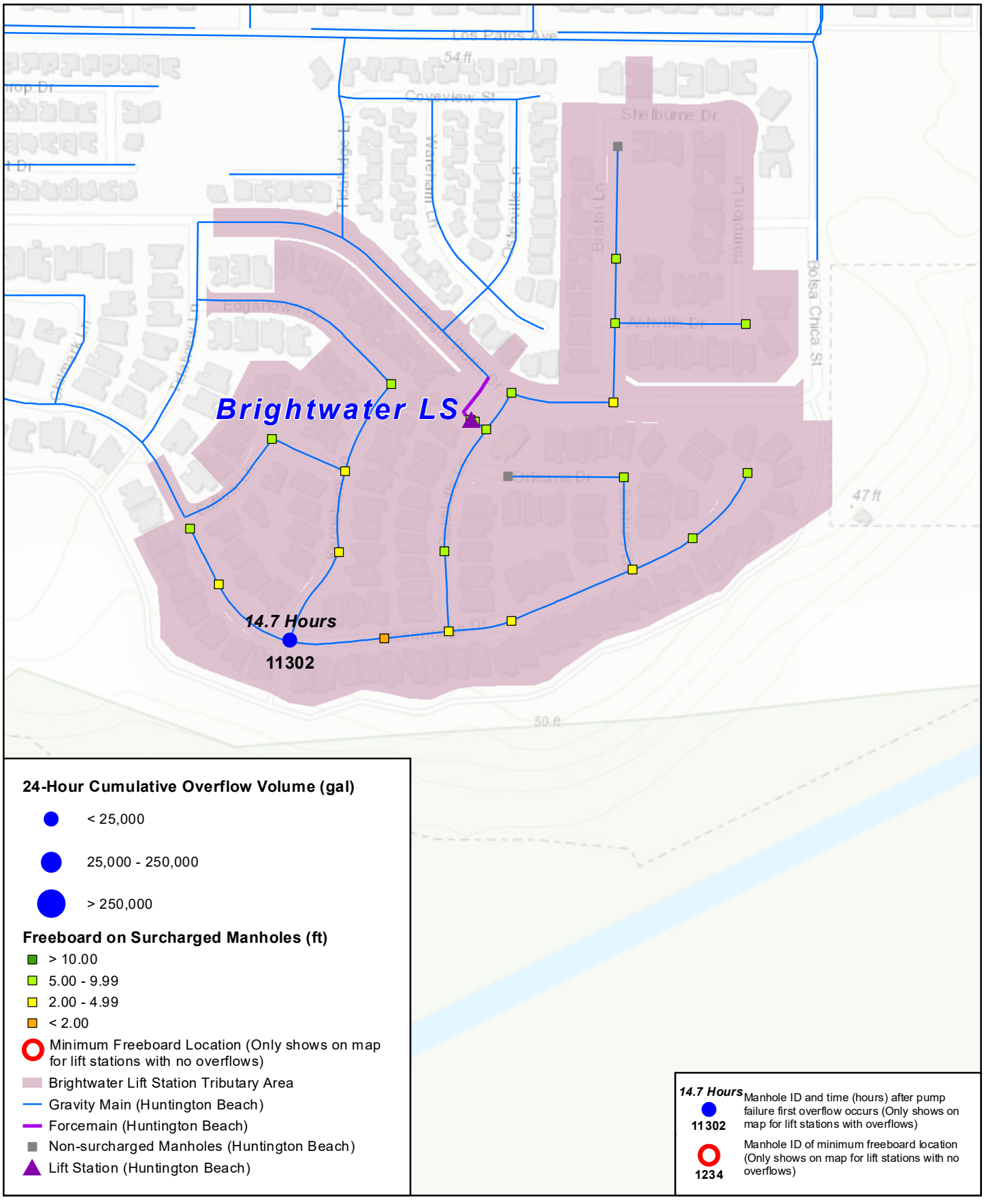
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Boeing Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.54

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.54_Boeing WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:57

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 75 150 225 300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

N

GHD

City of Huntington Beach
Sewer Master Plan Update

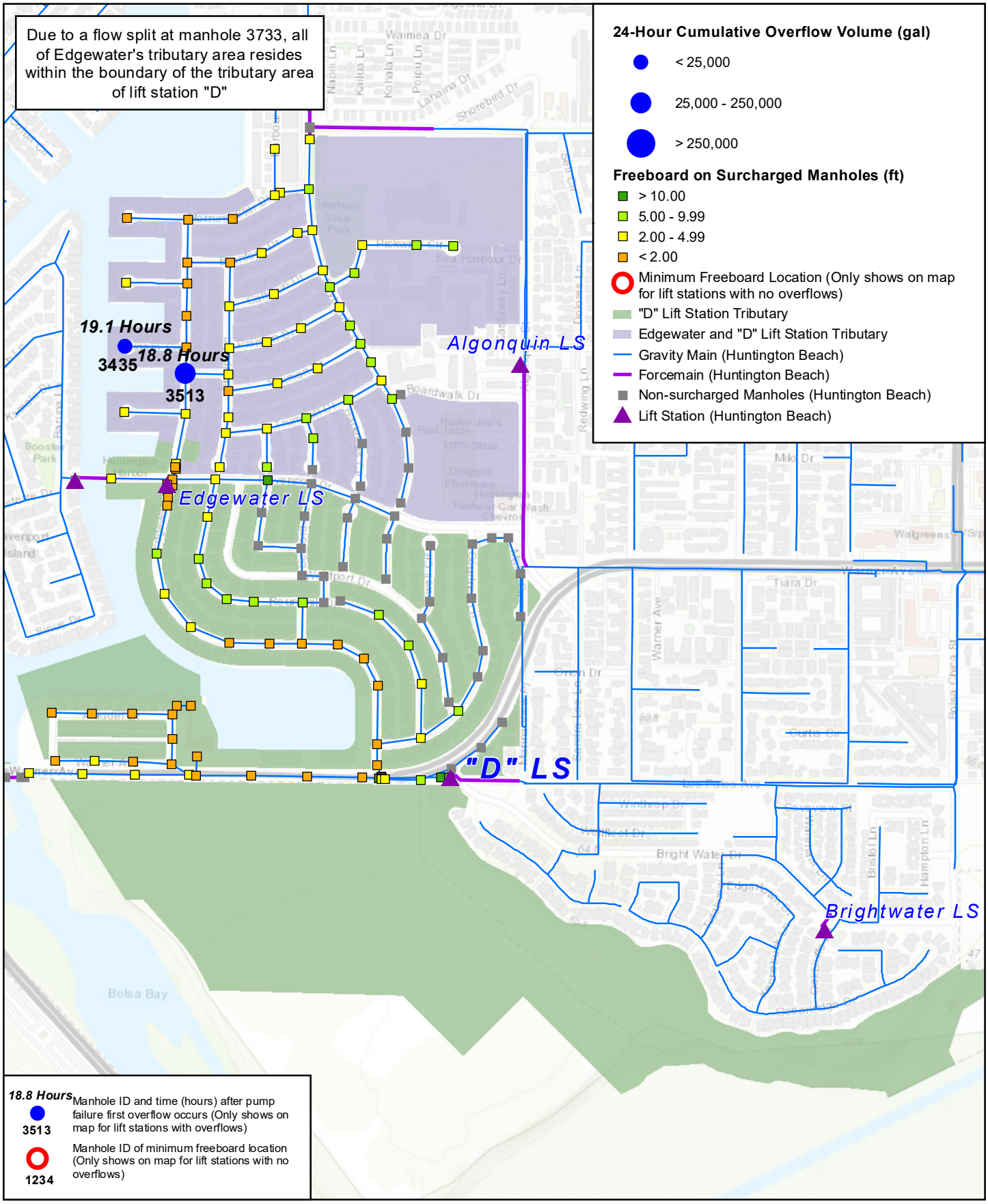
24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Brightwater Lift Station

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.55

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure E.55_Brightwater WWF Emergency Storage.mxd
Print date: 14 Mar 2024 - 14:22

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Paper Size ANSI A

0 200 400 600 800

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

24-Hour Wet Weather Flow Emergency Storage after Pump Failure at Lift Station "D"

Project No. 12585300
Revision No. 0
Date 3/12/2024

FIGURE E.56

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\90%\Appendix E\Figure E.56_LS D WWF Emergency Storage.mxd
Print date: 21 Mar 2024 - 12:58

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

Appendix F

Gravity Sewer Main CIP Project Details

Capital Improvement Program
Gravity CIP Project Details

Appendix F to Sewer Master Plan Update
Project No. 12585300

Prepared for:

City of Huntington Beach
1800 E. Wardlow Road
Long Beach, CA 90807

April 2024

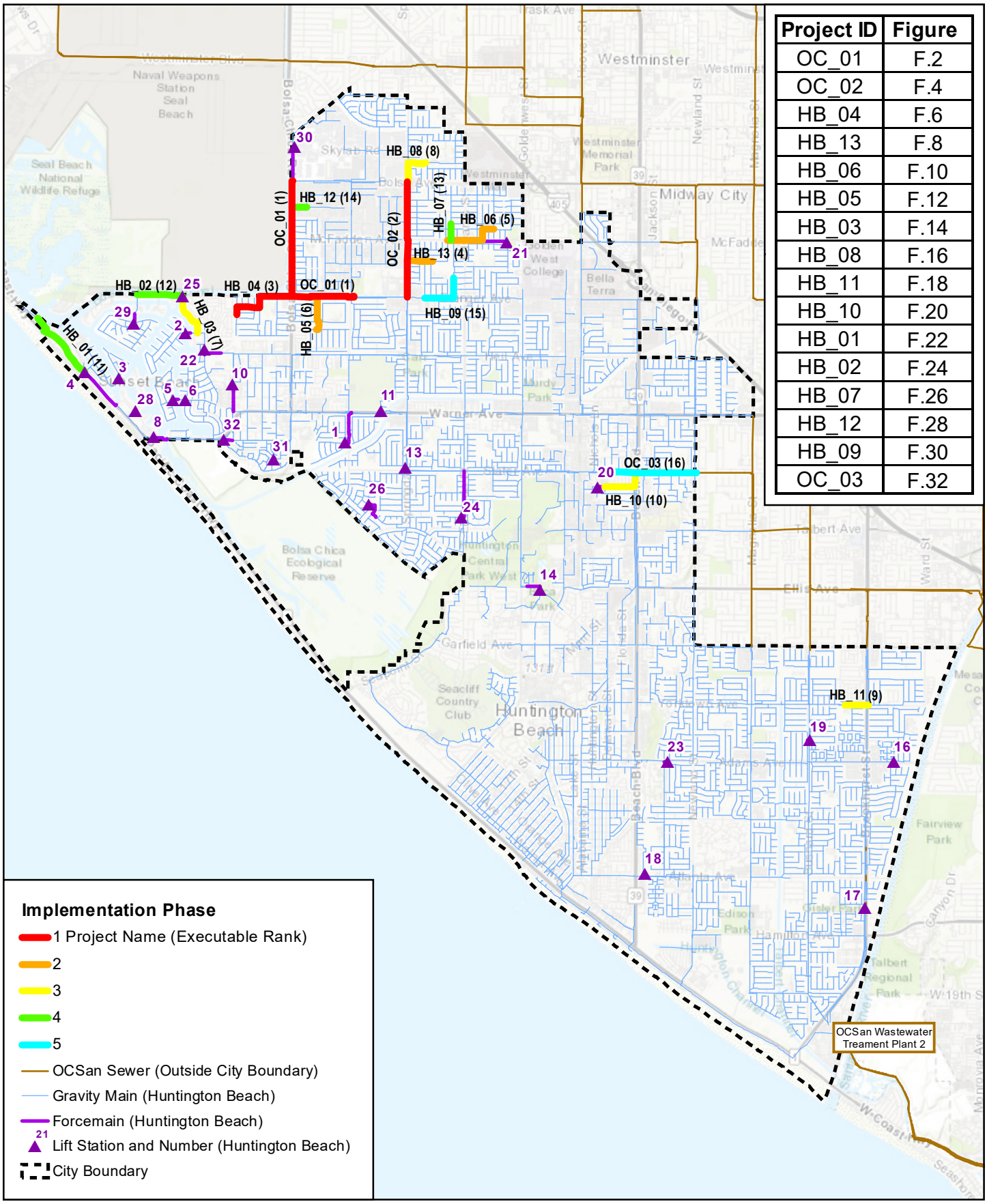
This Appendix presents the Capital Improvement Program (CIP) gravity sewer capacity improvement projects for the City of Huntington Beach 2024 Sewer Master Plan (SMP). GHD worked with the City of Huntington Beach (City) to develop 16 gravity sewer capacity improvement projects that provided increased capacity in the most deficient areas of the sanitary sewer system. Table F.1 summarizes all of the major criteria considered in generating and ranking each project, as well as project details. Figure F.1 displays these 16 projects spatially throughout the City. The prioritized and phased implementation plan advocates that 14 of the 16 projects be built within the next 10 years, while the last two are conditional projects (HB_09 and OC_03), suggesting a wait-and-see approach to their viability.

Each project is then introduced with a detailed cost breakdown as shown in dedicated figure and table sections. Then, each project's specific location with plan view hydraulic results from pre and post capacity upsizing are shown in a single figure. The plan view figures are followed by hydraulic flow profiles of the pre and post upsizing as well. The blue hydraulic grade line (HGL) and 'Width' field in the profile X-Axis show the recommended upsize diameter and flow characteristics. The field 'Design Group' shows the current pipe diameter, and the yellow line in each figure represents the current system's HGL (no upsizing).

Table F.1 Capital Improvement Program – Gravity CIP Projects

				Within Tributary Area					*Within CIP Project*						
Gravity Project ID	**Project Name**	**Project Location**	**Project Description**	**Count of Pipe Segments**	***Length (ft)**	***Peak WWF (MGD)**	***SSOs Upstream**	***Eliminates Deficiencies and SSOs**	**Count of Pipe Segments**	***Max Diameter in Project (in)**	**Length (ft)**	**Total Cost**	**Quartile Score**	**Executable Rank**	**Implementation Phase**
OC_01	Bolsa Chica St Sewer Improvement	From intersection of Bolsa Chica St and Tasman Dr to intersection of Edinger Ave and Graham St	Upsize 1,254 feet of 12-inch sewer to 15-inch, 2,303 feet of 12-inch to 18-inch, 465 feet of 12-inch to 24-inch, 3,946 feet of 15-inch to 24-inch, and 248 feet of 18-inch to 24-inch	333	89,645	7.20	Yes	Yes	21	24	8,216	$14,295,000	36	1	1
OC_02	Springdale St Sewer Improvement	From intersection of Springdale St and Bolsa Ave to Intersection of Springdale St and Edinger Ave	Upsize 2078 feet of 12-inch sewer to 15-inch, 1,794 feet of 15-inch to 18-inch, and 1,321 feet of 15-inch to 21-inch	425	107,382	1.36	Yes	Yes	13	21	5,193	$8,366,000	28	2	1
HB_04	Prelude Dr Sewer Improvement	From intersection of Fantasia Ln and Tenor Dr to intersection of Edinger Ave and Bolsa Chica St	Upsize 1,424 feet of 8-inch sewer to 12-inch, 1,966 feet of 12-inch to 15-inch	73	19,099	0.79	Yes	Yes	13	15	3,390	$4,932,000	22	3	1
HB_13	Priscilla Dr Sewer Improvement	From intersection of Priscilla Dr and Willett Ln to intersection of Priscilla Dr and Springdale St	Upsize 1,141 feet of 15-inch sewer to 18-inch sewer	240	61,144	1.26	Yes	Yes	4	18	1,141	$1,848,000	21	4	2
HB_06	McFadden Ave Sewer Improvement	From intersection of Melbourne Dr and Victoria Ln to intersection of McFadden Ave and Mayflower Ln	Upsize 1,034 feet of 8-inch sewer to 12-inch, 1,594 feet of 12-inch to 15-inch	198	50,579	1.08	Yes	Yes	11	15	2,628	$3,833,000	19	5	2
HB_05	Warren Ln Sewer Improvement	From just west of intersection of Edinger Ave and Warren Ln to intersection of Meadowlark Dr and Golden Gate Ln	Upsize 377 feet of 8-inch sewer to 10-inch, 1,178 feet of 10-inch to 12-inch, 323 feet of 12-inch to 15-inch	114	30,101	0.81	No	No	11	15	1,878	$2,610,000	14	6	2
HB_03	Santa Barbara Ln Sewer Improvement	From northern end of Santa Barbara Ln to the intersection of Mandalay Cir and Humboldt Dr	Upsize 1,971 feet of 10-inch sewer to 12-inch	99	19,250	0.80	No	No	10	12	1,971	$2,734,000	12	7	3
HB_08	Larchwood Dr Sewer Improvement	From just west of intersection of Larchwood Dr and Northridge Ln to intersection of Springdale St and Bolsa Ave	Upsize 821 feet of 10-inch sewer to 12-inch, and 888 feet of 12-inch to 15-inch	103	25,924	0.92	No	No	8	15	1,709	$2,475,000	15	8	3
HB_11	Yorktown Ave Sewer Improvement	From intersection of Yorktown Ave and Brigantine Ln to intersection of Yorktown Ave and Brookhurst St	Upsize 1,071 feet of 12-inch sewer to 15-inch	101	26,543	1.02	No	No	5	15	1,071	$1,610,000	15	9	3

				Within Tributary Area					*Within CIP Project*						
Gravity Project ID	**Project Name**	**Project Location**	**Project Description**	**Count of Pipe Segments**	***Length (ft)**	***Peak WWF (MGD)**	***SSOs Upstream**	***Eliminates Deficiencies and SSOs**	**Count of Pipe Segments**	***Max Diameter in Project (in)**	**Length (ft)**	**Total Cost**	**Quartile Score**	**Executable Rank**	**Implementation Phase**
HB_10	Speer Dr Sewer Improvement	From intersection of Speer Dr and Jacquelyn Ln to intersection of Beach Blvd and Slater Ave	Upsize 1,401 feet of 8-inch sewer to 10-inch sewer, 666 feet of 12-inch to 15-inch	112	24,524	1.44	No	No	8	15	2,067	$2,556,000	14	10	3
HB_01	Pacific Coast Highway Sewer Improvement	From Intersection of Pacific Coast Highway and Mariner Dr to intersection of Pacific Coast Highway and Admiralty Dr	Upsize 10 feet of 6-inch sewer to 10-inch, 3,507 feet of 8-inch to 10-inch	66	13,960	0.75	No	No	20	10	3,517	$3,901,000	10	11	4
HB_02	Edinger Ave Sewer Improvement	From intersection of Edinger Ave and Trinidad Ln to just east of intersection of Edinger Ave and Bonaire Cir	Upsize 2,095 feet of 10-inch sewer to 12-inch	83	13,481	0.70	No	No	9	12	2,095	$2,909,000	9	12	4
HB_07	Columbia Ln Sewer Improvement	From intersection of Columbia Ln and Brown Cir to just east of intersection of W McFadden Ave and Mayflower Ln	Upsize 775 feet of 8-inch sewer to 10-inch	47	11,554	0.32	No	No	4	10	775	$859,000	9	13	4
HB_12	Argosy Ave Sewer Improvement	From intersection of Argosy Ave and Triton Ln to intersection of Argosy Ave and Bolsa Chica St	Upsize 684 feet of 10-inch sewer to 12-inch	17	4,771	0.57	No	No	3	12	684	$950,000	9	14	4
HB_09	Carrie Ln Sewer Improvement	From intersection of Carrie Ln and Hughes Dr to intersection of Edinger Ave and Plymouth Ln		60	15,969	0.39	No	No	8	12	2,216	$2,418,000	11	15	5
OC_03	Slater Ave Sewer Improvement	From intersection of Slater Ave and Koledo Ln to intersection of Slater Ave and Newland St	Upsize 3,975 feet of 42-inch sewer to 48-inch (Conditional~depends on success of upstream projects	4,201	1,007,685	21.50	Yes	Yes	8	48	3,975	$10,058,000	22	16	5
Grand Total	-	-	-	6,272	1,521,611	21.50	-	-	156	48	42,573	$66,354,000	-	-	-
Conditional Total	-	-	-	4,261	1,023,654	21.50	-	-	16	48	6,187	$12,476,000	-	-	-
Recommended Total	-	-	-	2,011	497,957	7.20	-	-	140	24	36,386	$53,878,000	-	-	-



Project ID	Figure
OC_01	F.2
OC_02	F.4
HB_04	F.6
HB_13	F.8
HB_06	F.10
HB_05	F.12
HB_03	F.14
HB_08	F.16
HB_11	F.18
HB_10	F.20
HB_01	F.22
HB_02	F.24
HB_07	F.26
HB_12	F.28
HB_09	F.30
OC_03	F.32

Paper Size ANSI A

0 1,500 3,000 4,500 6,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

Gravity Sewer CIP Projects Prioritized and Phased Implementation Plan

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.1

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure F.1_Phase and Prioritized Gravity CIP.mxd
Print date: 25 Mar 2024 - 08:23

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa

Project OC_01: Bolsa Chica St Sewer Improvement

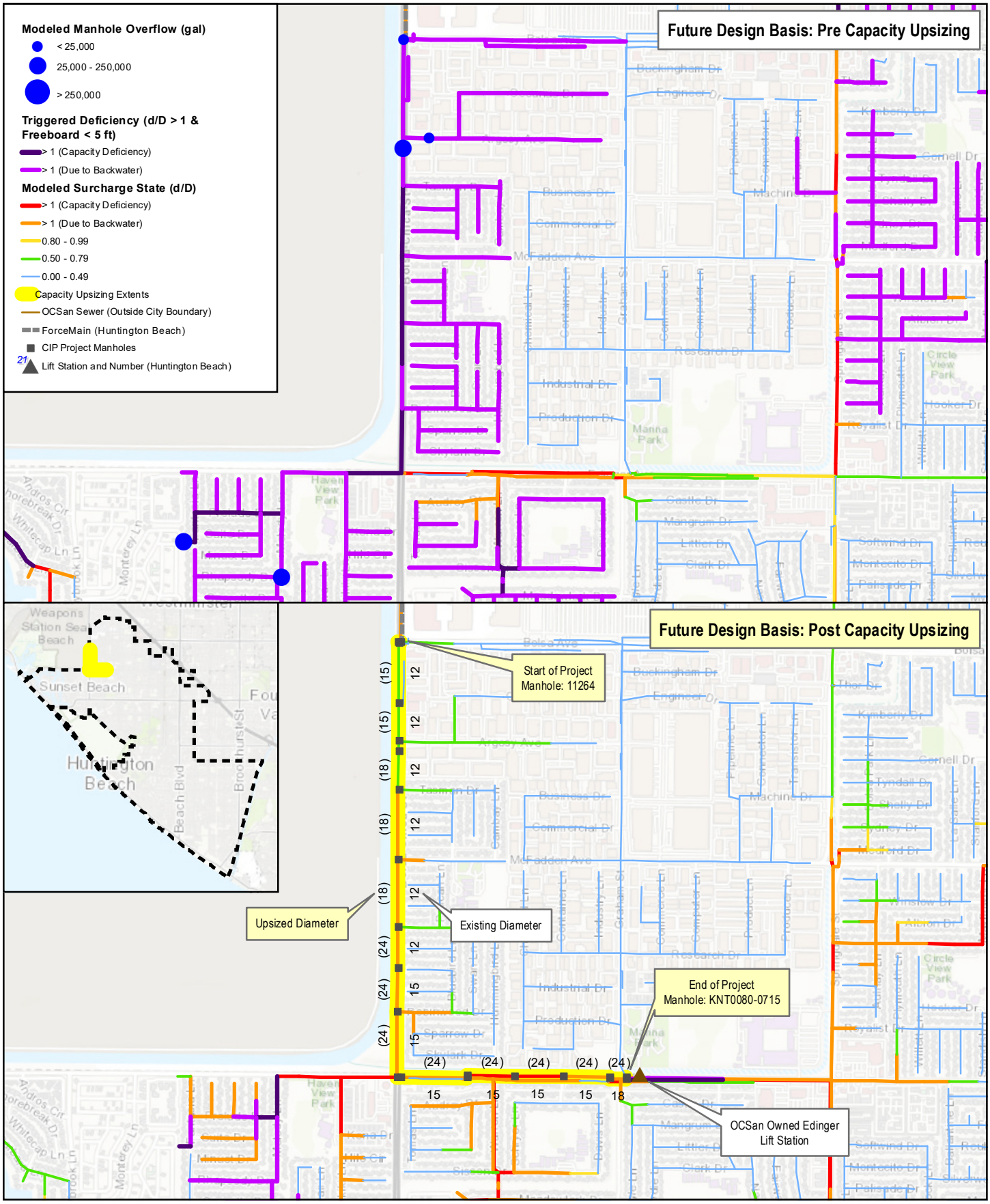
Project Description	
Project ID	OC_01
Project Name	Bolsa Chica St Sewer Improvement
Project Location	From intersection of Bolsa Chica St and Tasman Dr to intersection of Edinger Ave and Graham St
Description	Upsize 1,254 feet of 12-inch sewer to 15-inch, 2,303 feet of 12-inch to 18-inch, 465 feet of 12-inch to 24-inch, 3,946 feet of 15-inch to 24-inch, and 248 feet of 18-inch to 24-inch
Tributary Area Details	
Tributary Pipe Length (ft)	89,645
Peak WWF (MGD)	7.20
SSOs Upstream	Yes
Eliminates Upstream Deficiencies	Yes
Project Pipe Details	
Count of Project Pipe Segments	21
Maximum Diameter in Project (in)	24
Total Baseline Project Length (ft)	8,216
Estimated Capital Improvement Cost	$14,295,000
Quartile Score (Priority Score)	36
Executable Rank (1-16)	1
Phase (1 of 5)	1
Assumptions	Cost Estimates are based on the August 2022 ENR Cost Index for the Los Angeles area
Alternatives	Consider parallel piping or implement project by pipe bursting

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
11264	1208	9404	12	15	35	0.12	7.9	Open Cut	636	$23,000
1208	KNT0080-0785	9405	12	15	23	0.14	8.2	Open Cut	636	$15,000
KNT0080-0785	KNT0080-0780	KNT0080-0780:KNT0080-0785	12	15	731	0.19	11.1	Open Cut	636	$465,000
KNT0080-0780	KNT0080-0777	KNT0080-0777:KNT0080-0780	12	15	465	0.14	11.5	Open Cut	636	$296,000
KNT0080-0777	KNT0080-0775	KNT0080-0775:KNT0080-0777	12	18	123	0.33	8.8	Open Cut	685	$85,000
KNT0080-0775	KNT0080-0773	KNT0080-0773:KNT0080-0775	12	18	465	0.16	9.1	Open Cut	685	$319,000
KNT0080-0773	KNT0080-0770	KNT0080-0770:KNT0080-0773	12	18	855	0.19	11.4	Open Cut	685	$586,000
KNT0080-0770	KNT0080-0767	KNT0080-0767:KNT0080-0770	12	18	860	0.19	12.7	Open Cut	685	$590,000
KNT0080-0767	KNT0080-0765	KNT0080-0765:KNT0080-0767	12	24	465	0.17	13.3	Open Cut	784	$365,000
KNT0080-0765	KNT0080-0763	KNT0080-0763:KNT0080-0765	15	24	540	0.14	14.0	Open Cut	784	$424,000
KNT0080-0763	KNT0080-0760	KNT0080-0760:KNT0080-0763	15	24	792	0.11	14.2	Open Cut	784	$621,000
KNT0080-0760	KNT0080-0755	KNT0080-0755:KNT0080-0760	15	24	40	0.50	15.1	Open Cut	784	$32,000
KNT0080-0755	KNT0080-0750	KNT0080-0750:KNT0080-0755	15	24	815	0.16	16.3	Open Cut	784	$639,000
KNT0080-0750	KNT0080-0745	KNT0080-0745:KNT0080-0750	15	24	24	0.58	17.3	Open Cut	784	$19,000
KNT0080-0745	KNT0080-0740	KNT0080-0740:KNT0080-0745	15	24	576	0.15	17.3	Open Cut	784	$452,000
KNT0080-0740	KNT0080-0735	KNT0080-0735:KNT0080-0740	15	24	600	0.14	17.8	Open Cut	784	$471,000
KNT0080-0735	KNT0080-0730	KNT0080-0730:KNT0080-0735	15	24	559	0.25	19.1	Open Cut	784	$439,000
KNT0080-0730	KNT0080-0725	KNT0080-0725:KNT0080-0730	18	24	18	0.00	20.0	Open Cut	784	$15,000

Project Cost Detail										
US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
KNT0080-0725	KNT0080-0720	KNT0080-0720:KNT0080-0725	18	24	208	0.43	20.7	Open Cut	784	$163,000
KNT0080-0720	KNT0080-0715	KNT0080-0715:KNT0080-0720	18	24	22	0.70	21.9	Open Cut	784	$17,000

Total Baseline Project Length	$	8,216
Total Raw Open Cut Cost	$	6,036,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	1,209,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	484,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	605,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	121,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	907,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	363,000
Post Construction CCTV Cost ($8/lf)	$	66,000
Baseline Construction Cost	$	9,791,000
Mobilization/Demobilization (4% of Baseline Construction)	$	392,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	980,000
Construction Management (7% of Baseline Construction)	$	686,000
Contingencies (25% of Construction Cost)	$	2,448,000
Estimated Capital Improvement Cost:	**$**	14,295,000



Paper Size ANSI A

0 400 800 1,200 1,600

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

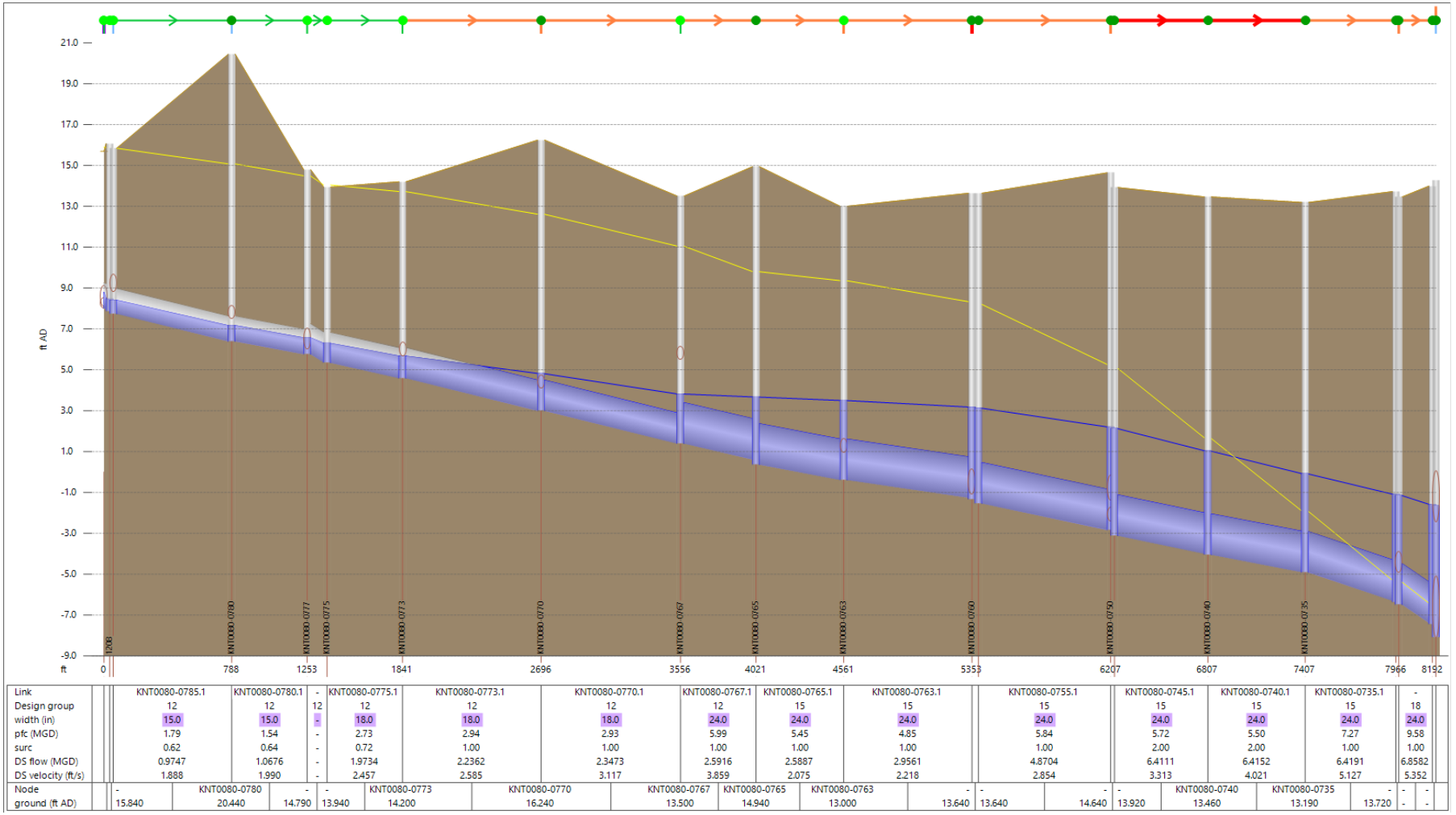
Gravity CIP Project: OC_01
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.2

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure F.X_Duo Project OC_01.mxd
Print date: 20 Mar 2024 - 12:44

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link		KNT0080-0785.1	KNT0080-0780.1	-	KNT0080-0775.1	KNT0080-0773.1	KNT0080-0770.1	KNT0080-0767.1	KNT0080-0765.1	KNT0080-0763.1	KNT0080-0755.1	KNT0080-0745.1	KNT0080-0740.1	KNT0080-0735.1	-
Design group		12	12	12	12	12	12	12	15	15	15	15	15	15	18
width (in)		15.0	15.0	-	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
pfc (MGD)		1.79	1.54	-	2.73	2.94	2.93	5.99	5.45	4.85	5.84	5.72	5.50	7.27	9.58
surc		0.62	0.64	-	0.72	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	1.00	1.00
DS flow (MGD)		0.9747	1.0676	-	1.9734	2.2362	2.3473	2.5916	2.5887	2.9561	4.8704	6.4111	6.4152	6.4191	6.8582
DS velocity (ft/s)		1.888	1.990	-	2.457	2.585	3.117	3.859	2.075	2.218	2.854	3.313	4.021	5.127	5.352
Node	-		KNT0080-0780	-	-	KNT0080-0773	KNT0080-0770	KNT0080-0767	KNT0080-0765	KNT0080-0763	-	-	-	KNT0080-0740	KNT0080-0735	-	-	-
ground (ft AD)	15.840		20.440	14.790	13.940	14.200	16.240	13.500	14.940	13.000	13.640	13.640	14.640	13.920	13.460	13.190	13.720	-	-

Figure F.3 Gravity Sewer CIP Project OC_01: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

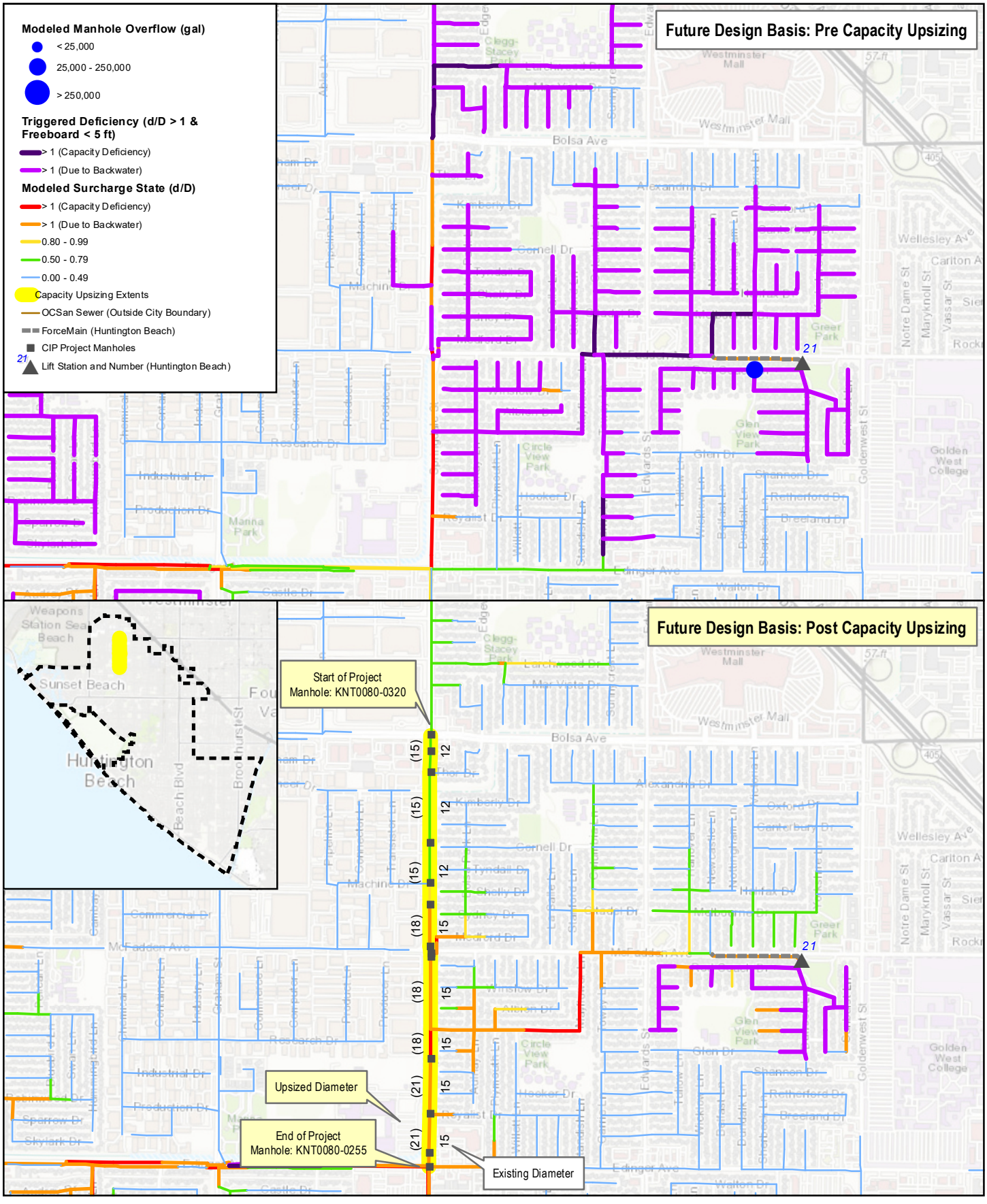
Project OC_02: Springdale St Sewer Improvement

Project Description	
Project ID	OC_02
Project Name	Springdale St Sewer Improvement
Project Location	From intersection of Springdale St and Bolsa Ave to Intersection of Springdale St and Edinger
Description	Upsize 2078 feet of 12-inch sewer to 15-inch, 1,794 feet of 15-inch to 18-inch, and 1,321 feet of 15-inch to 21-inch
Tributary Area Details	
Tributary Pipe Length (ft)	107,382
Peak WWF (MGD)	1.36
SSOs Upstream	Yes
Eliminates Upstream Deficiencies	Yes
Project Pipe Details	
Count of Project Pipe Segments	13
Maximum Diameter in Project (in)	21
Total Baseline Project Length (ft)	5,193
Estimated Capital Improvement Cost	$8,366,000
Quartile Score (Priority Score)	28
Executable Rank (1-16)	2
Phase (1 of 5)	1
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
KNT0080-0320	KNT0080-0315	KNT0080-0315:KNT0080-0320	12	15	196	0.22	10.7	Open Cut	636	$125,000
KNT0080-0315	KNT0080-0310	KNT0080-0310:KNT0080-0315	12	15	260	0.17	11.2	Open Cut	636	$166,000
KNT0080-0310	KNT0080-0305	KNT0080-0305:KNT0080-0310	12	15	866	0.27	11.0	Open Cut	636	$551,000
KNT0080-0305	KNT0080-0300	KNT0080-0300:KNT0080-0305	12	15	495	0.16	10.7	Open Cut	636	$315,000
KNT0080-0300	KNT0080-0295	KNT0080-0295:KNT0080-0300	12	15	261	0.39	10.2	Open Cut	636	$166,000
KNT0080-0295	KNT0080-0290	KNT0080-0290:KNT0080-0295	15	18	506	0.16	9.9	Open Cut	685	$347,000
KNT0080-0285	KNT0080-0280	KNT0080-0280:KNT0080-0285	15	18	38	0.54	10.3	Open Cut	685	$26,000
KNT0080-0280	KNT0080-0275	KNT0080-0275:KNT0080-0280	15	18	847	0.13	11.3	Open Cut	685	$581,000
KNT0080-0275	KNT0080-0270	KNT0080-0270:KNT0080-0275	15	18	403	0.25	12.3	Open Cut	685	$277,000
KNT0080-0270	KNT0080-0265	KNT0080-0265:KNT0080-0270	15	21	680	0.19	12.5	Open Cut	735	$500,000
KNT0080-0265	KNT0080-0260	KNT0080-0260:KNT0080-0265	15	21	483	0.12	12.5	Open Cut	735	$355,000
KNT0080-0260	KNT0080-0255	KNT0080-0255:KNT0080-0260	15	21	158	0.16	12.8	Open Cut	735	$116,000

Total Baseline Project Length	$	5,193
Total Raw Open Cut Cost	$	3,525,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	707,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	283,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	354,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	71,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	530,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	212,000
Post Construction CCTV Cost ($8/lf)	$	42,000
Baseline Construction Cost	$	5,724,000
Mobilization/Demobilization (4% of Baseline Construction)	$	230,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	573,000
Construction Management (7% of Baseline Construction)	$	402,000
Contingencies (25% of Construction Cost)	$	1,433,000
Estimated Capital Improvement Cost:	**$**	8,366,000



Paper Size ANSI A

0 400 800 1,200 1,600

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

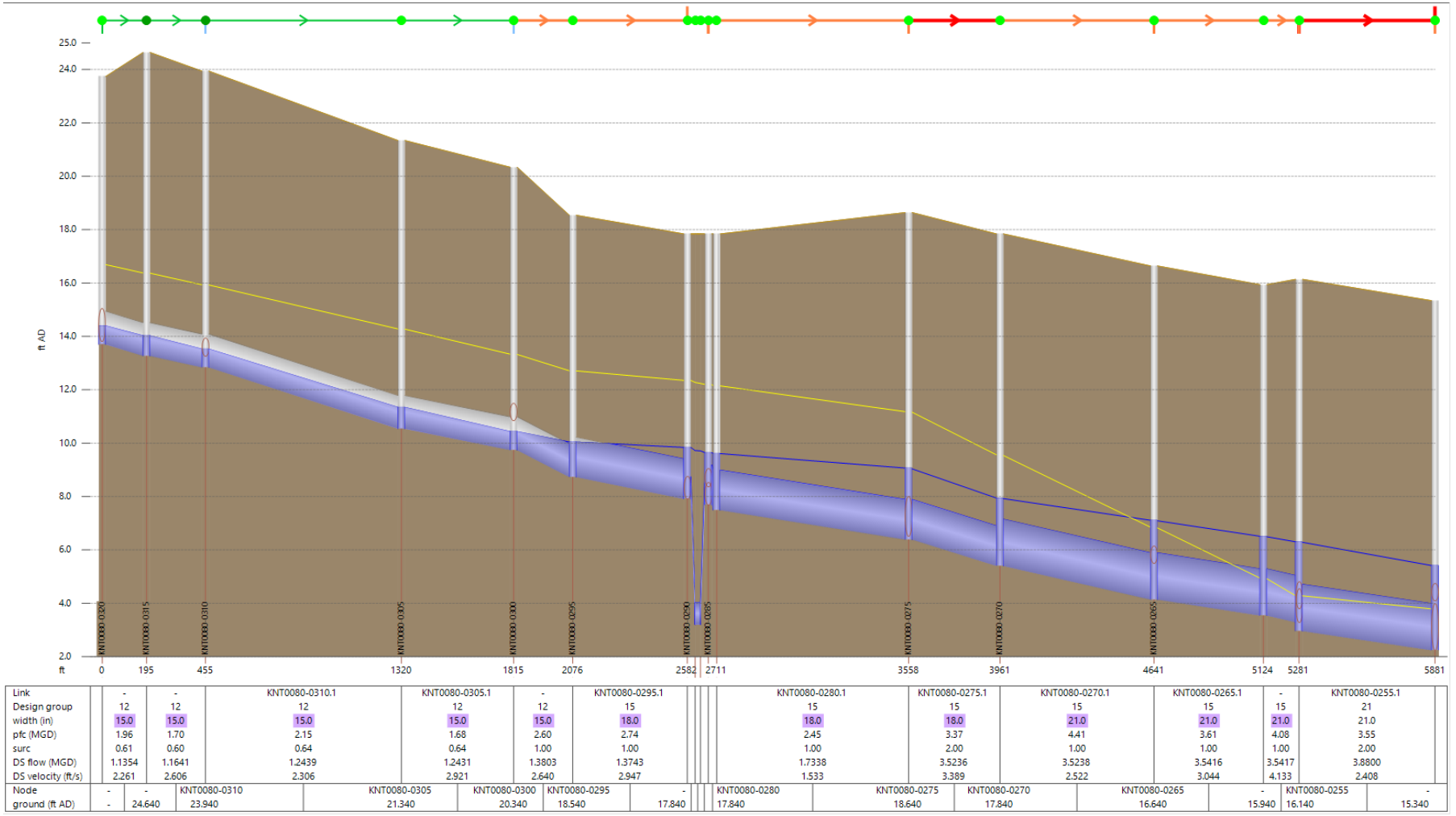
Gravity CIP Project: OC_02
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.4

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Print date: 22 Mar 2024 - 17:02

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	-	-	KNT0080-0310.1	KNT0080-0305.1	-	KNT0080-0295.1		KNT0080-0280.1	KNT0080-0275.1	KNT0080-0270.1	KNT0080-0265.1	-	KNT0080-0255.1		
Design group	12	12	12	12	12	15		15	15	15	15	15	21		
width (in)	15.0	15.0	15.0	15.0	15.0	18.0		18.0	18.0	21.0	21.0	21.0	21.0		
pfc (MGD)	1.96	1.70	2.15	1.68	2.60	2.74		2.45	3.37	4.41	3.61	4.08	3.55		
surc	0.61	0.60	0.64	0.64	1.00	1.00		1.00	2.00	1.00	1.00	1.00	2.00		
DS flow (MGD)	1.1354	1.1641	1.2439	1.2431	1.3803	1.3743		1.7338	3.5236	3.5238	3.5416	3.5417	3.8800		
DS velocity (ft/s)	2.261	2.606	2.306	2.921	2.640	2.947		1.533	3.389	2.522	3.044	4.133	2.408		
Node	-	-	KNT0080-0310	KNT0080-0305	KNT0080-0300	KNT0080-0295	-	KNT0080-0280	KNT0080-0275	KNT0080-0270	KNT0080-0265	-	KNT0080-0255	-	
ground (ft AD)	-	24.640	23.940	21.340	20.340	18.540	17.840	17.840	18.640	17.840	16.640	15.940	16.140	15.340	

Figure F.5 Gravity Sewer CIP Project OC_02: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

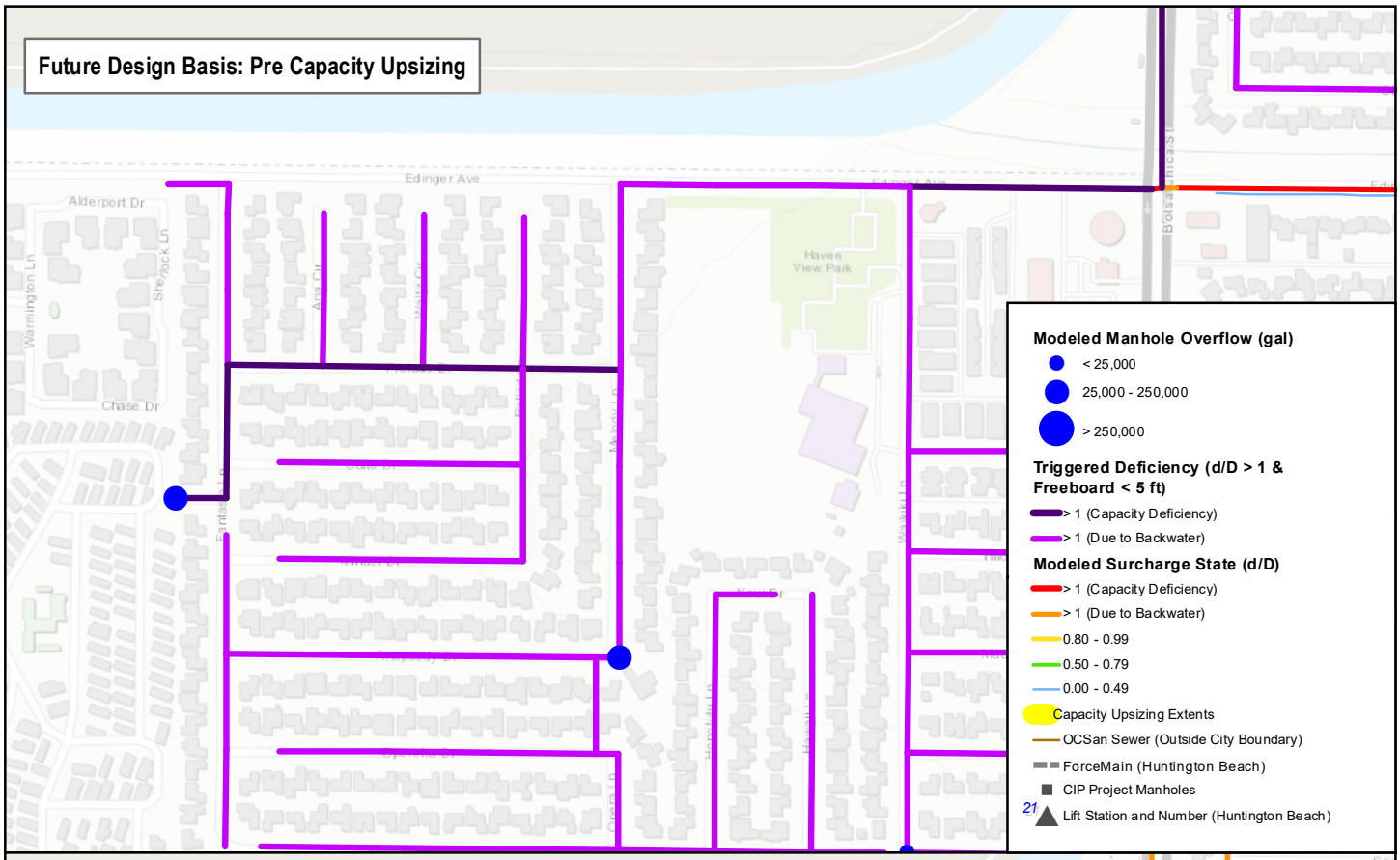
Project HB_04: Prelude Dr Sewer Improvement

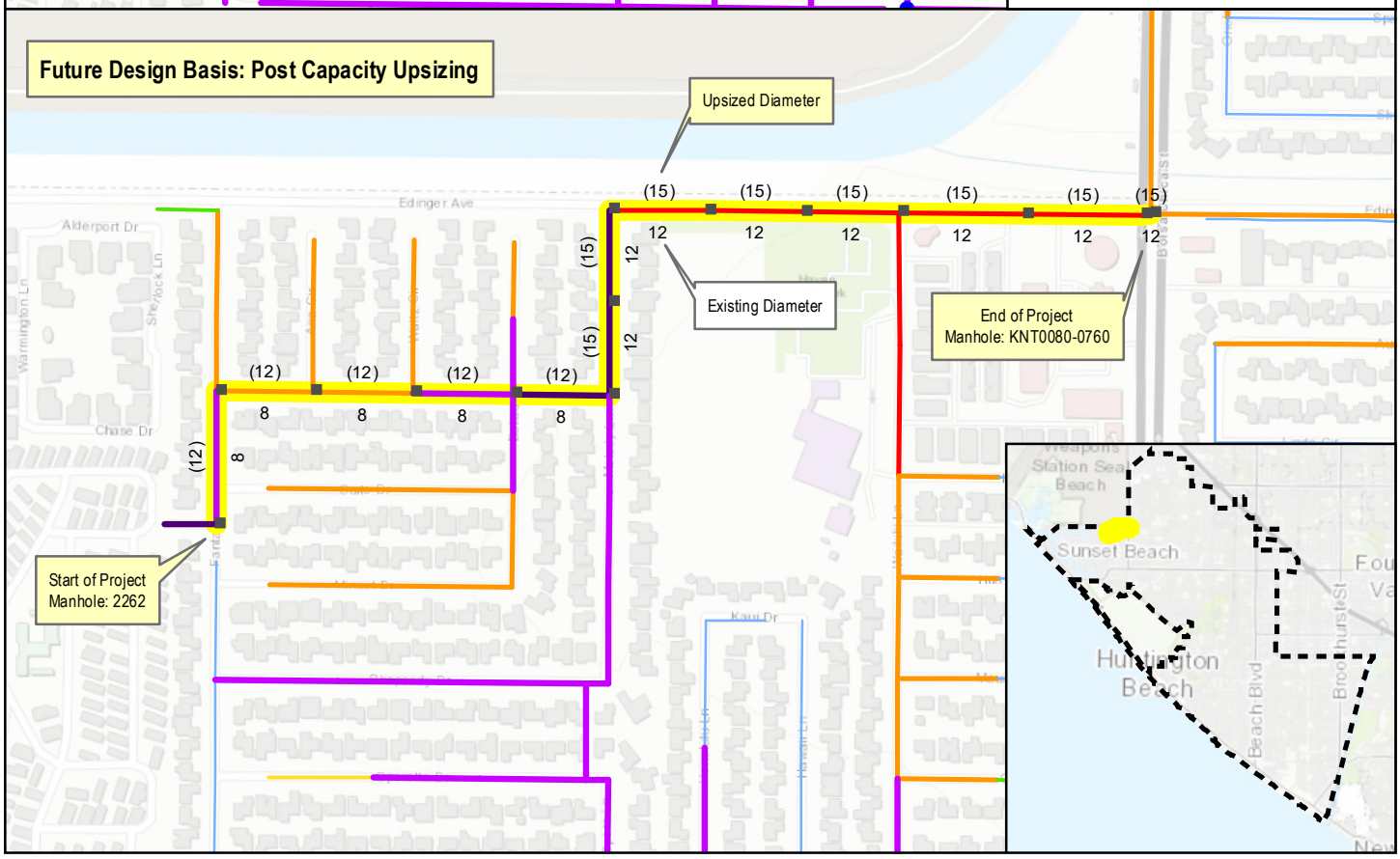
Project Description	
Project ID	HB_04
Project Name	Prelude Dr Sewer Improvement
Project Location	From intersection of Fantasia Ln and Tenor Dr to intersection of Edinger Ave and Bolsa Chica St
Description	Upsize 1,424 feet of 8-inch sewer to 12-inch, 1,966 feet of 12-inch to 15-inch
Tributary Area Details	
Tributary Pipe Length (ft)	19,099
Peak WWF (MGD)	0.79
SSOs Upstream	Yes
Eliminates Upstream	Yes
Project Pipe Details	
Count of Project Pipe	13
Maximum Diameter in Project	15
Total Baseline Project Length	3,390
Estimated Capital Improvement Cost	$4,932,000
Quartile Score (Priority Score)	22
Executable Rank (1-16)	3
Phase (1 of 5)	1
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
2262	2133	2127	8	12	361	0.20	6.7	Open Cut	587	$212,000
2133	2136	2039	8	12	260	0.20	7.5	Open Cut	587	$153,000
2136	2137	2041	8	12	271	0.20	7.7	Open Cut	587	$159,000
2137	2138	2043	8	12	271	0.20	7.5	Open Cut	587	$159,000
2138	2139	2045	8	12	261	0.20	8.2	Open Cut	587	$153,000
2139	2057	2044	12	15	250	0.10	8.9	Open Cut	636	$159,000
2057	1942	1984	12	15	251	0.10	9.0	Open Cut	636	$160,000
1942	1944	1877	12	15	263	0.10	10.5	Open Cut	636	$167,000
1944	1947	1880	12	15	260	0.10	11.7	Open Cut	636	$165,000
1947	1948	1881	12	15	260	0.10	12.5	Open Cut	636	$166,000
1948	1952	1884	12	15	337	0.10	13.2	Open Cut	636	$214,000
1952	11623	1889	12	15	320	0.10	14.5	Open Cut	636	$203,000
11623	KNT0080-0760	11865	12	15	25	0.04	15.3	Open Cut	636	$16,000

Total Baseline Project Length	$	3,390
Total Raw Open Cut Cost	$	2,086,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	417,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	167,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	209,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	42,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	313,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	125,000
Post Construction CCTV Cost ($8/lf)	$	28,000
Baseline Construction Cost	$	3,387,000
Mobilization/Demobilization (4% of Baseline Construction)	$	136,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	338,000
Construction Management (7% of Baseline Construction)	$	237,000
Contingencies (25% of Construction Cost)	$	845,000
Estimated Capital Improvement Cost:	**$**	4,932,000





Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

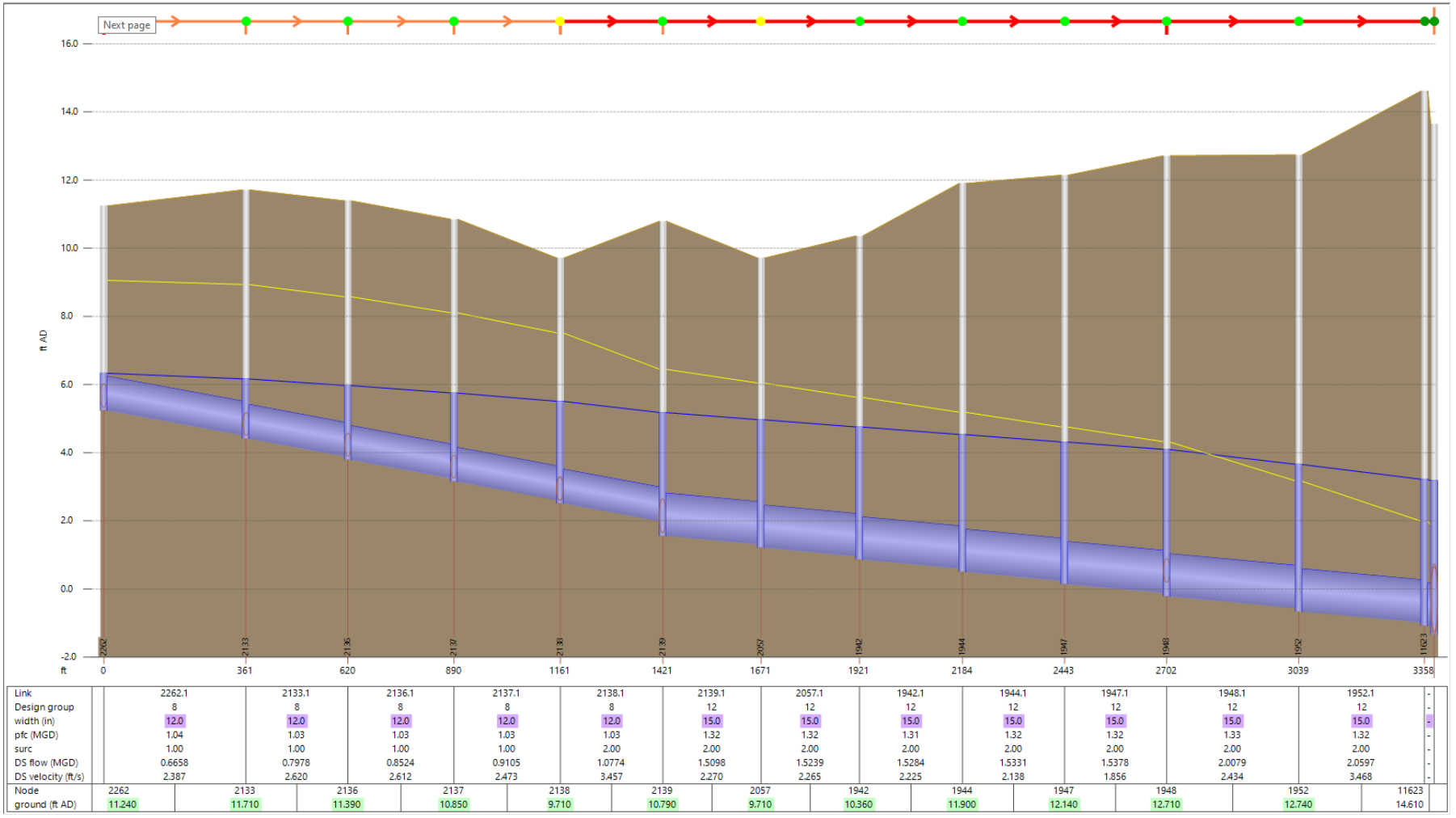
Gravity CIP Project: HB_04
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.6

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Print date: 20 Mar 2024 - 14:17

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	2262.1	2133.1	2136.1	2137.1	2138.1	2139.1	2057.1	1942.1	1944.1	1947.1	1948.1	1952.1	-
Design group	8	8	8	8	8	12	12	12	12	12	12	12	-
width (in)	12.0	12.0	12.0	12.0	12.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	-
pfc (MGD)	1.04	1.03	1.03	1.03	1.03	1.32	1.32	1.31	1.32	1.32	1.33	1.32	-
surc	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	-
DS flow (MGD)	0.6658	0.7978	0.8524	0.9105	1.0774	1.5098	1.5239	1.5284	1.5331	1.5378	2.0079	2.0597	-
DS velocity (ft/s)	2.387	2.620	2.612	2.473	3.457	2.270	2.265	2.225	2.138	1.856	2.434	3.468	-
Node	2262	2133	2136	2137	2138	2139	2057	1942	1944	1947	1948	1952	11623
ground (ft AD)	11.240	11.710	11.390	10.850	9.710	10.790	9.710	10.360	11.900	12.140	12.710	12.740	14.610

Figure F.7 Gravity Sewer CIP Project HB_04: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

Project HB_13: Priscilla Dr Sewer Improvement

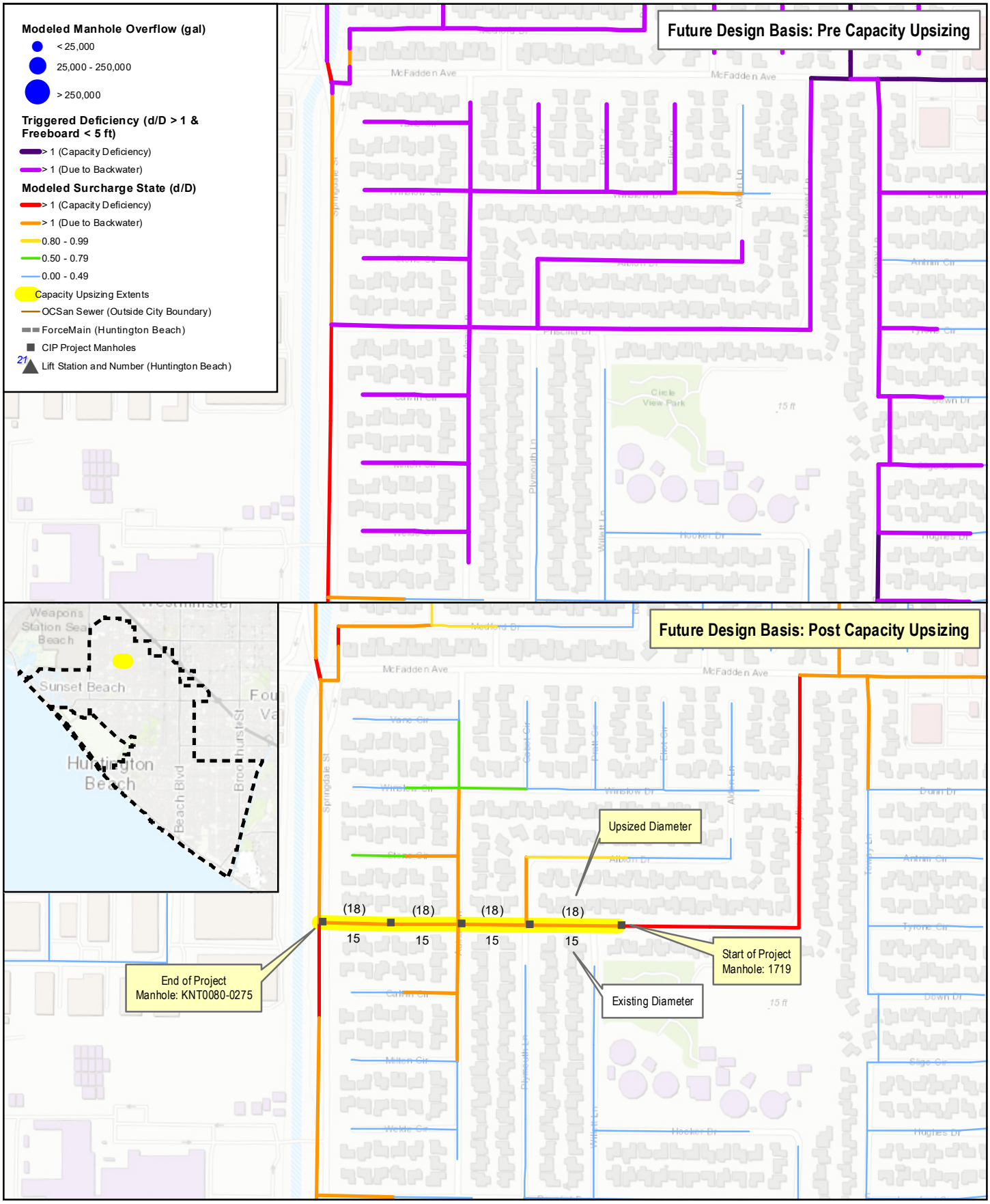
Project Description	
Project ID	HB_13
Project Name	Priscilla Dr Sewer Improvement
Project Location	From intersection of Priscilla Dr and Willett Ln to intersection of Priscilla Dr and Springdale St
Description	Upsize 1,141 feet of 15-inch sewer to 18-inch sewer
Tributary Area Details	
Tributary Pipe Length (ft)	61,144
Peak WWF (MGD)	1.26
SSOs Upstream	Yes
Eliminates Upstream Deficiencies	Yes
Project Pipe Details	
Count of Project Pipe Segments	4
Maximum Diameter in Project (in)	18
Total Baseline Project Length (ft)	1,141
Estimated Capital Improvement Cost	$1,848,000
Quartile Score (Priority Score)	21
Executable Rank (1-16)	4
Phase (1 of 5)	2
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
1719	1716	1667	15	18	350	0.12	8.7	Open Cut	685	$240,000
1716	1712	1664	15	18	261	0.12	8.3	Open Cut	685	$179,000
1712	1710	1659	15	18	270	0.12	8.4	Open Cut	685	$185,000
1710	KNT0080-0275	1656	15	18	260	0.13	10.4	Open Cut	685	$178,000

Total Baseline Project Length	$	1,141
Total Raw Open Cut Cost	$	782,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	157,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	63,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	79,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	16,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	118,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	47,000

Post Construction CCTV Cost ($8/lf)	$	10,000
Baseline Construction Cost	$	1,272,000
Mobilization/Demobilization (4% of Baseline Construction)	$	51,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	127,000
Construction Management (7% of Baseline Construction)	$	89,000
Contingencies (25% of Construction Cost)	$	317,000
Estimated Capital Improvement Cost:	**$**	1,848,000



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
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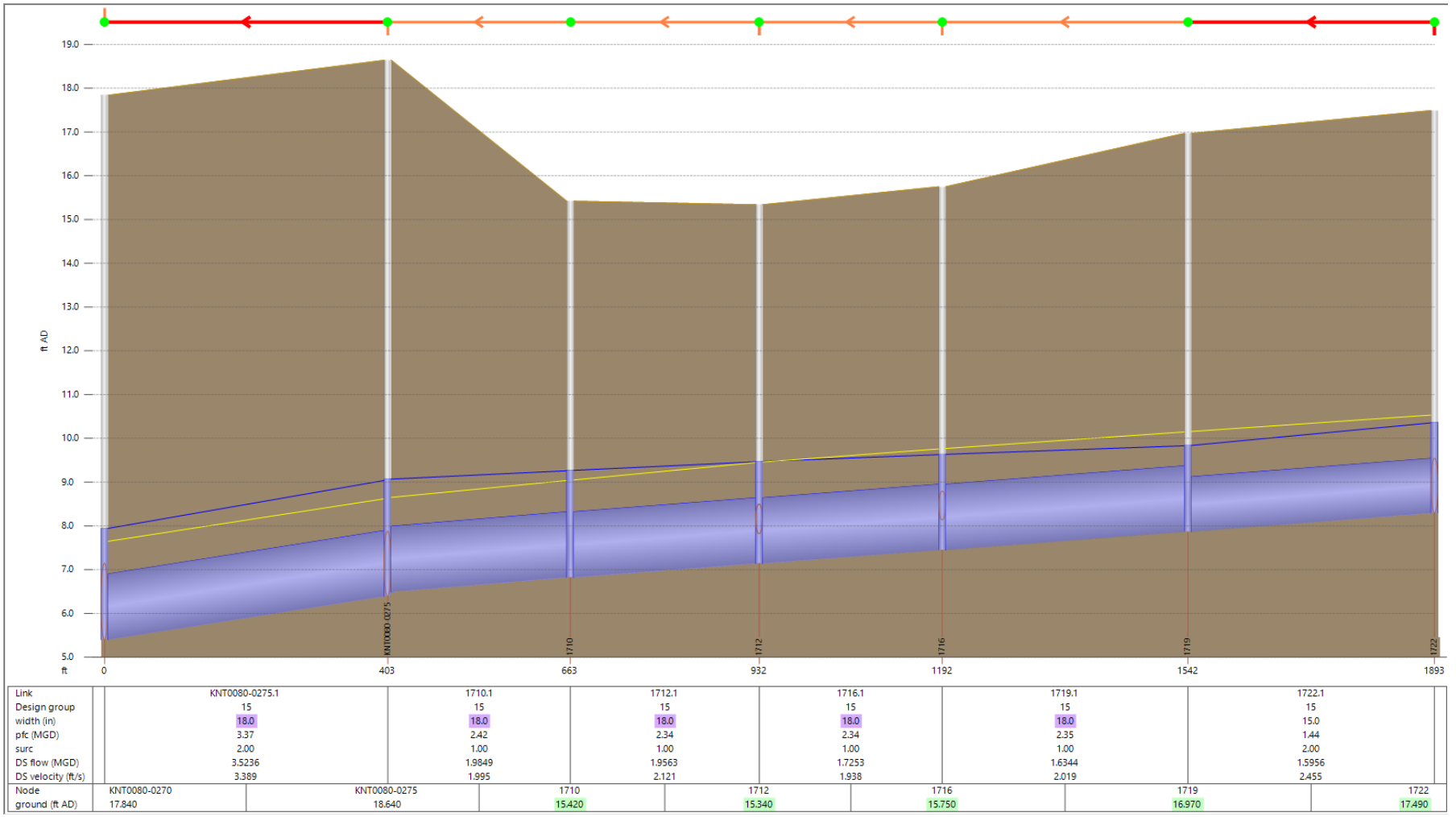
Gravity CIP Project: HB_13
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.8

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Print date: 21 Mar 2024 - 08:59

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	KNT0080-0275.1	1710.1	1712.1	1716.1	1719.1	1722.1
Design group	15	15	15	15	15	15
width (in)	18.0	18.0	18.0	18.0	18.0	15.0
pfc (MGD)	3.37	2.42	2.34	2.34	2.35	1.44
surc	2.00	1.00	1.00	1.00	1.00	2.00
DS flow (MGD)	3.5236	1.9849	1.9563	1.7253	1.6344	1.5956
DS velocity (ft/s)	3.389	1.995	2.121	1.938	2.019	2.455

Node	KNT0080-0270	KNT0080-0275	1710	1712	1716	1719	1722
ground (ft AD)	17.840	18.640	15.420	15.340	15.750	16.970	17.490

Figure F.9 Gravity Sewer CIP Project HB_013: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

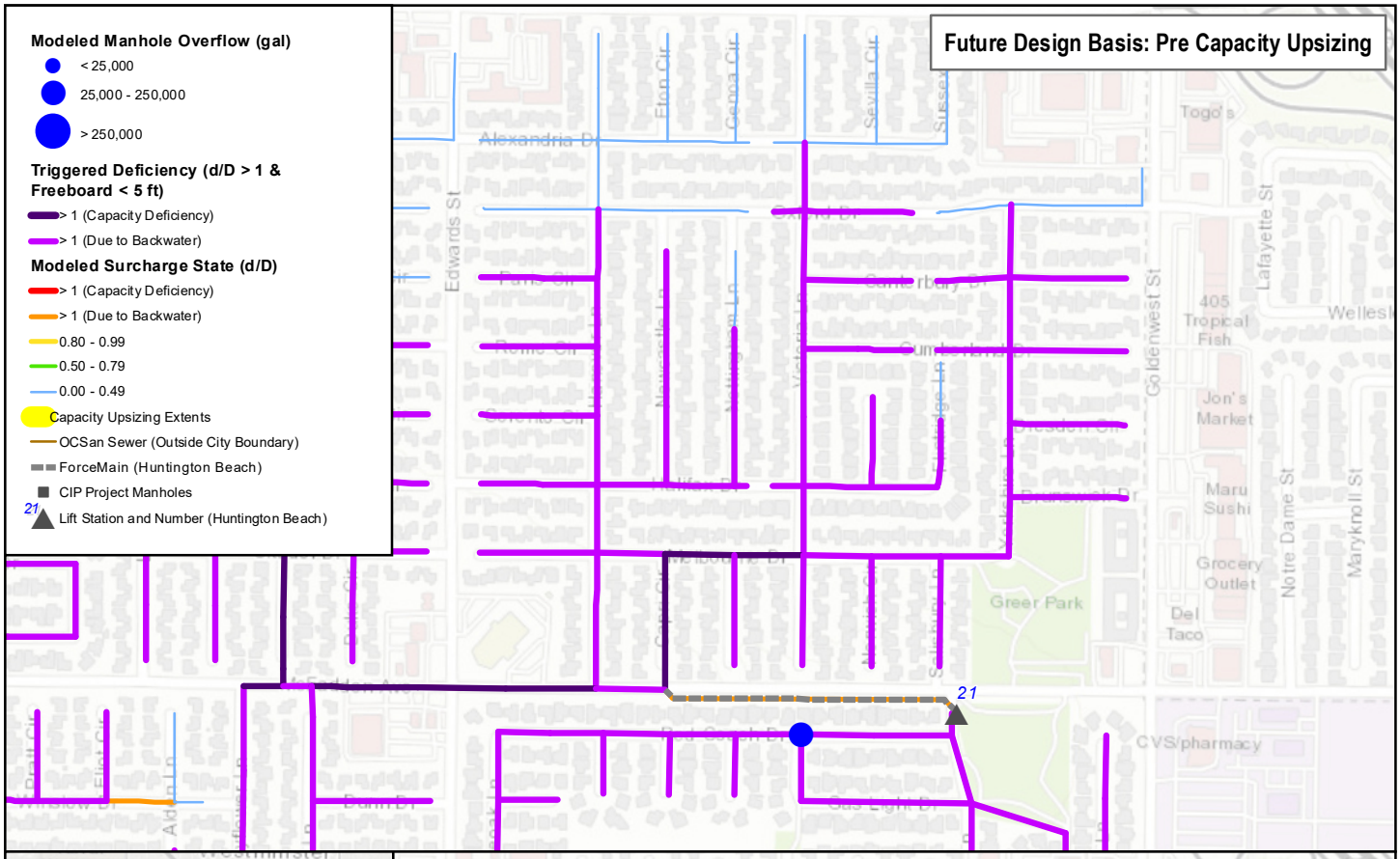
Project HB_06: McFadden Ave Sewer Improvement

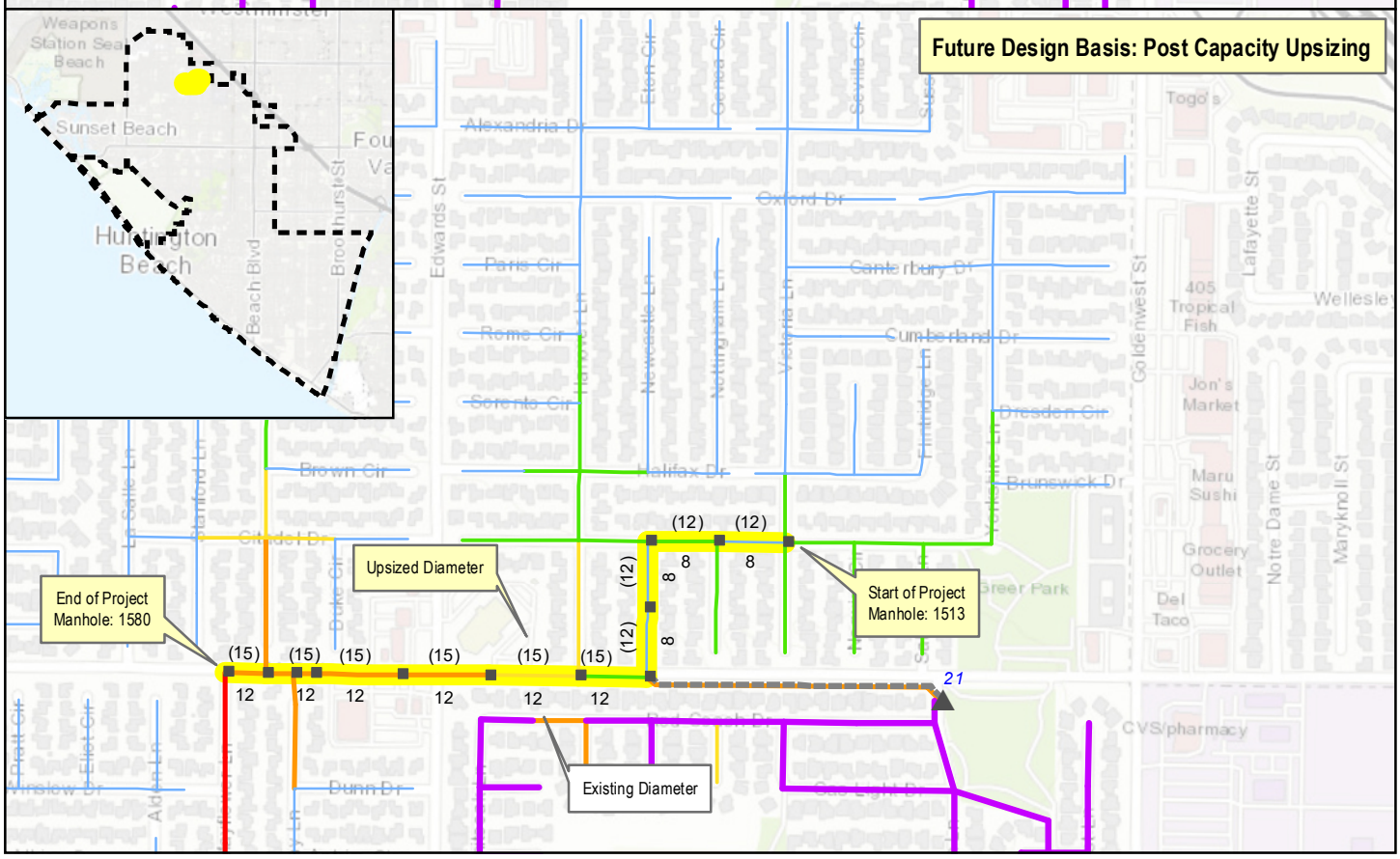
Project Description	
Project ID	HB_06
Project Name	McFadden Ave Sewer Improvement
Project Location	From intersection of Melbourne Dr and Victoria Ln to intersection of McFadden Ave and Mayflower Ln
Description	Upsize 1,034 feet of 8-inch sewer to 12-inch, 1,594 feet of 12-inch to 15-inch
Tributary Area Details	
Tributary Pipe Length (ft)	50,579
Peak WWF (MGD)	1.08
SSOs Upstream	Yes
Eliminates Upstream	Yes
Project Pipe Details	
Count of Project Pipe	11
Maximum Diameter in Project	15
Total Baseline Project Length	2,628
Estimated Capital Improvement Cost	$3,833,000
Quartile Score (Priority Score)	19
Executable Rank (1-16)	5
Phase (1 of 5)	2
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
1513	1512	1461	8	12	260	0.20	6.3	Open Cut	587	$153,000
1512	1511	1459	8	12	261	0.20	6.5	Open Cut	587	$153,000
1511	1543	1492	8	12	254	0.24	6.8	Open Cut	587	$149,000
1543	1588	1542	8	12	259	0.23	6.9	Open Cut	587	$152,000
1588	1587	1543	12	15	259	0.12	7.1	Open Cut	636	$165,000
1587	1585	1541	12	15	342	0.12	7.2	Open Cut	636	$217,000
1585	1584	1538	12	15	331	0.12	7.3	Open Cut	636	$211,000
1584	1583	1537	12	15	330	0.12	7.7	Open Cut	636	$210,000
1583	1582	1536	12	15	76	0.12	7.9	Open Cut	636	$49,000
1582	1581	1535	12	15	106	0.12	7.9	Open Cut	636	$67,000
1581	1580	1534	12	15	150	0.12	8.0	Open Cut	636	$96,000

Total Baseline Project Length	$	2,628
Total Raw Open Cut Cost	$	1,622,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	324,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	130,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	162,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	33,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	243,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	98,000
Post Construction CCTV Cost ($8/lf)	$	21,000
Baseline Construction Cost	$	2,633,000
Mobilization/Demobilization (4% of Baseline Construction)	$	105,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	263,000
Construction Management (7% of Baseline Construction)	$	184,000
Contingencies (25% of Construction Cost)	$	657,000
Estimated Capital Improvement Cost:	**$**	3,833,000





Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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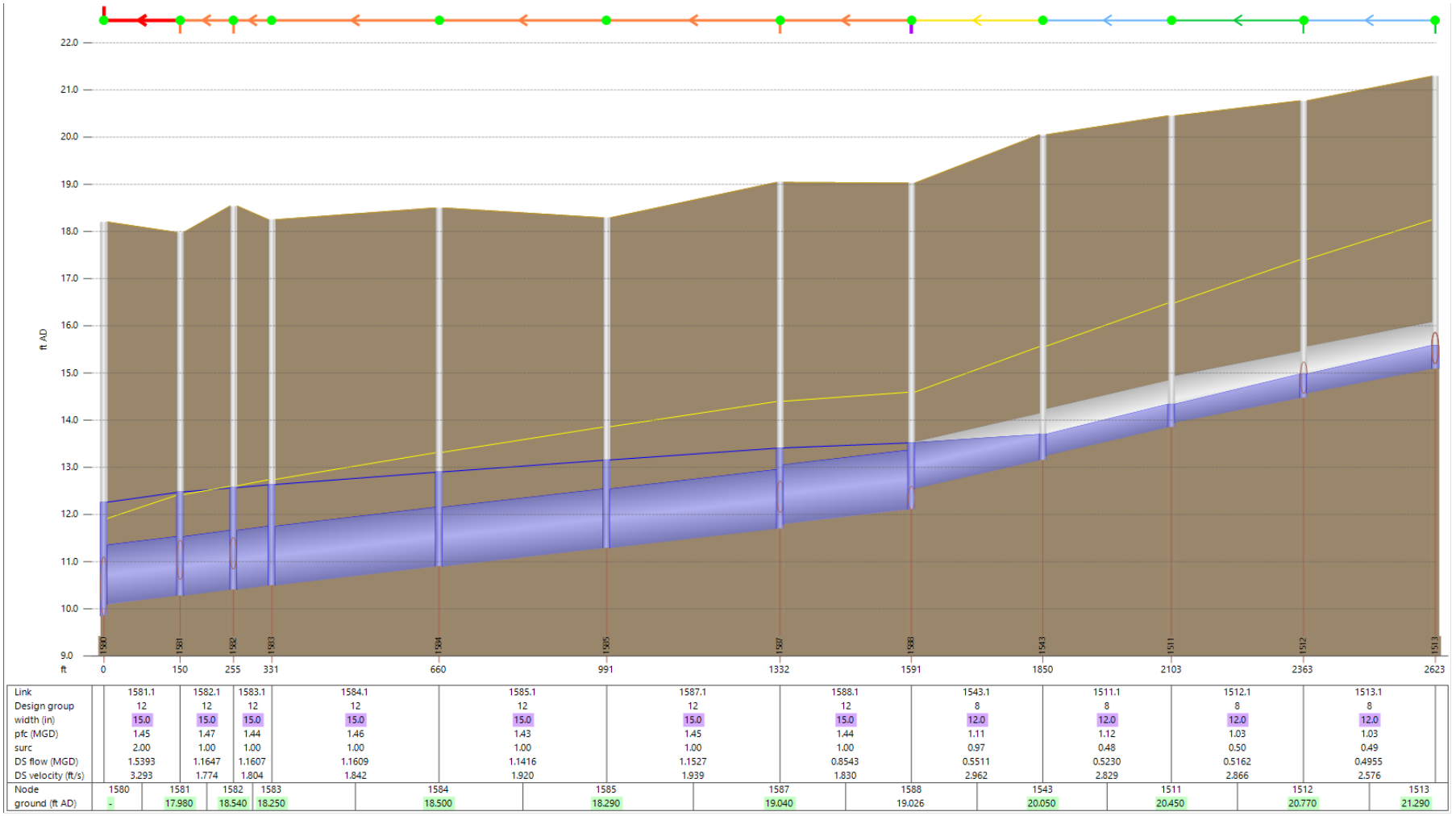
Gravity CIP Project: HB_06
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.10

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Print date: 20 Mar 2024 - 15:06

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	1581.1	1582.1	1583.1	1584.1	1585.1	1587.1	1588.1	1543.1	1511.1	1512.1	1513.1
Design group	12	12	12	12	12	12	12	8	8	8	8
width (in)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	12.0	12.0	12.0	12.0
pfc (MGD)	1.45	1.47	1.44	1.46	1.43	1.45	1.44	1.11	1.12	1.03	1.03
surc	2.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.48	0.50	0.49
DS flow (MGD)	1.5393	1.1647	1.1607	1.1609	1.1416	1.1527	0.8543	0.5511	0.5230	0.5162	0.4955
DS velocity (ft/s)	3.293	1.774	1.804	1.842	1.920	1.939	1.830	2.962	2.829	2.866	2.576

Node	1580	1581	1582	1583	1584	1585	1587	1588	1543	1511	1512	1513
ground (ft AD)	-	17.980	18.540	18.250	18.500	18.290	19.040	19.026	20.050	20.450	20.770	21.290

Figure F.11 Gravity Sewer CIP Project HB_06: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

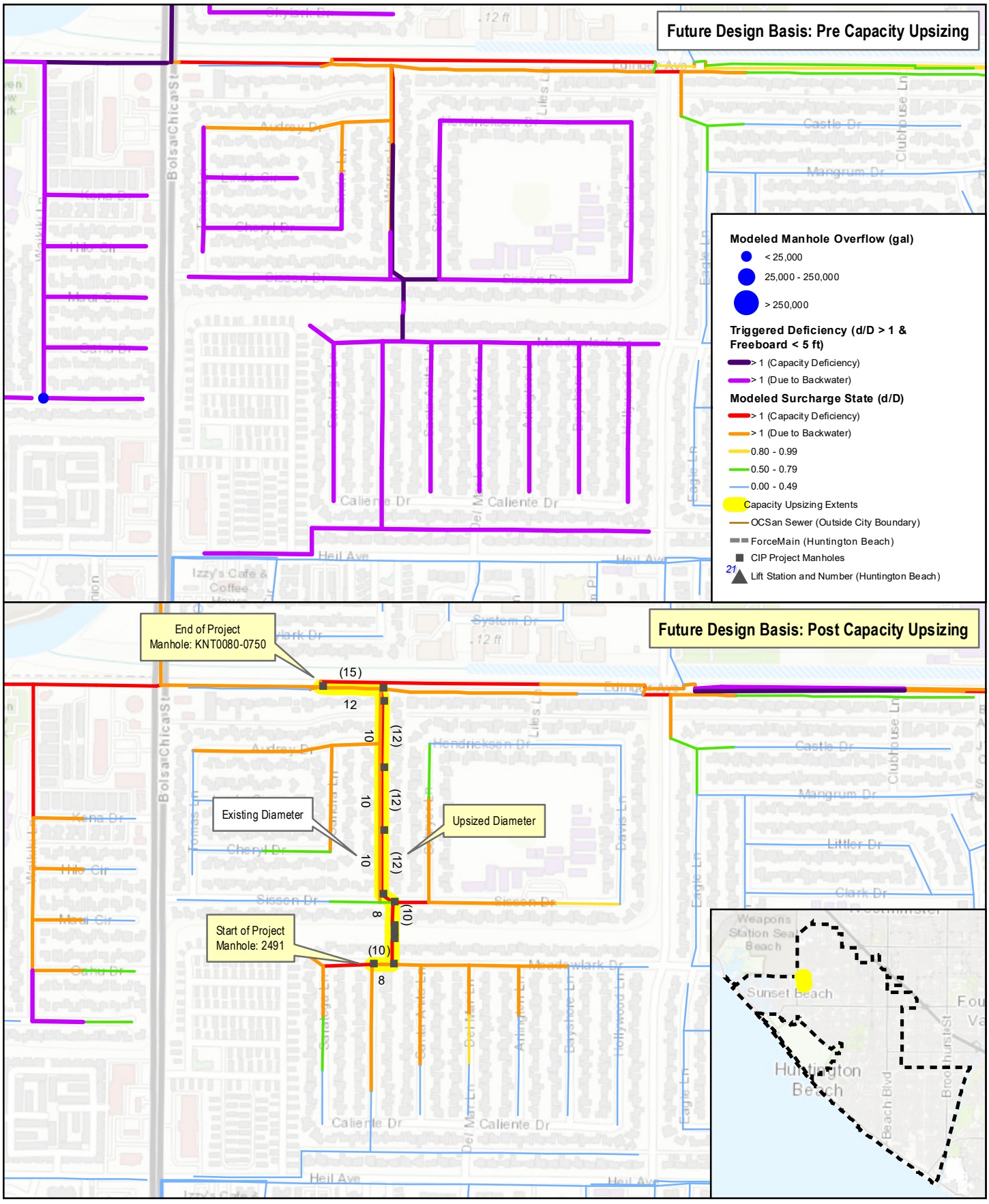
Project HB_05: Warren Ln Sewer Improvement

Project Description	
Project ID	HB_05
Project Name	Warren Ln Sewer Improvement
Project Location	From just west of intersection of Edinger Ave and Warren Ln to intersection of Meadowlark Dr and Golden Gate Ln
Description	Upsize 377 feet of 8-inch sewer to 10-inch, 1,178 feet of 10-inch to 12-inch, and 323 feet of 12-inch to 15-inch
Tributary Area Details	
Tributary Pipe Length (ft)	30,101
Peak WWF (MGD)	0.81
SSOs Upstream	No
Eliminates Upstream	No
Project Pipe Details	
Count of Project Pipe	11
Maximum Diameter in Project	15
Total Baseline Project Length	1,878
Estimated Capital Improvement Cost	$2,610,000
Quartile Score (Priority Score)	14
Executable Rank (1-16)	6
Phase (1 of 5)	2
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
2491	2492	2354	8	10	109	0.19	7.6	Open Cut	468	$51,000
2492	2444	2353	8	10	139	0.20	9.2	Open Cut	468	$65,000
2429	2378	2296	8	10	129	0.20	9.8	Open Cut	468	$61,000
2378	10771	10980	10	12	73	0.21	9.0	Open Cut	587	$43,000
10771	10772	10983	10	12	341	0.20	9.6	Open Cut	587	$201,000
10772	10774	10982	10	12	338	0.20	11.1	Open Cut	587	$199,000
10774	10770	10981	10	12	355	0.20	12.6	Open Cut	587	$209,000
10770	1960	10979	10	12	71	0.20	13.6	Open Cut	587	$42,000
1960	KNT0080-0750	1893	12	15	323	0.34	15.8	Open Cut	636	$205,000

Total Baseline Project Length	$	1,878
Total Raw Open Cut Cost	$	1,076,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	221,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	89,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	111,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	23,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	166,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	67,000
Post Construction CCTV Cost ($8/lf)	$	16,000
Baseline Construction Cost	$	1,769,000
Mobilization/Demobilization (4% of Baseline Construction)	$	72,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	179,000
Construction Management (7% of Baseline Construction)	$	126,000
Contingencies (25% of Construction Cost)	$	447,000
Estimated Capital Improvement Cost:	**$**	2,610,000



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

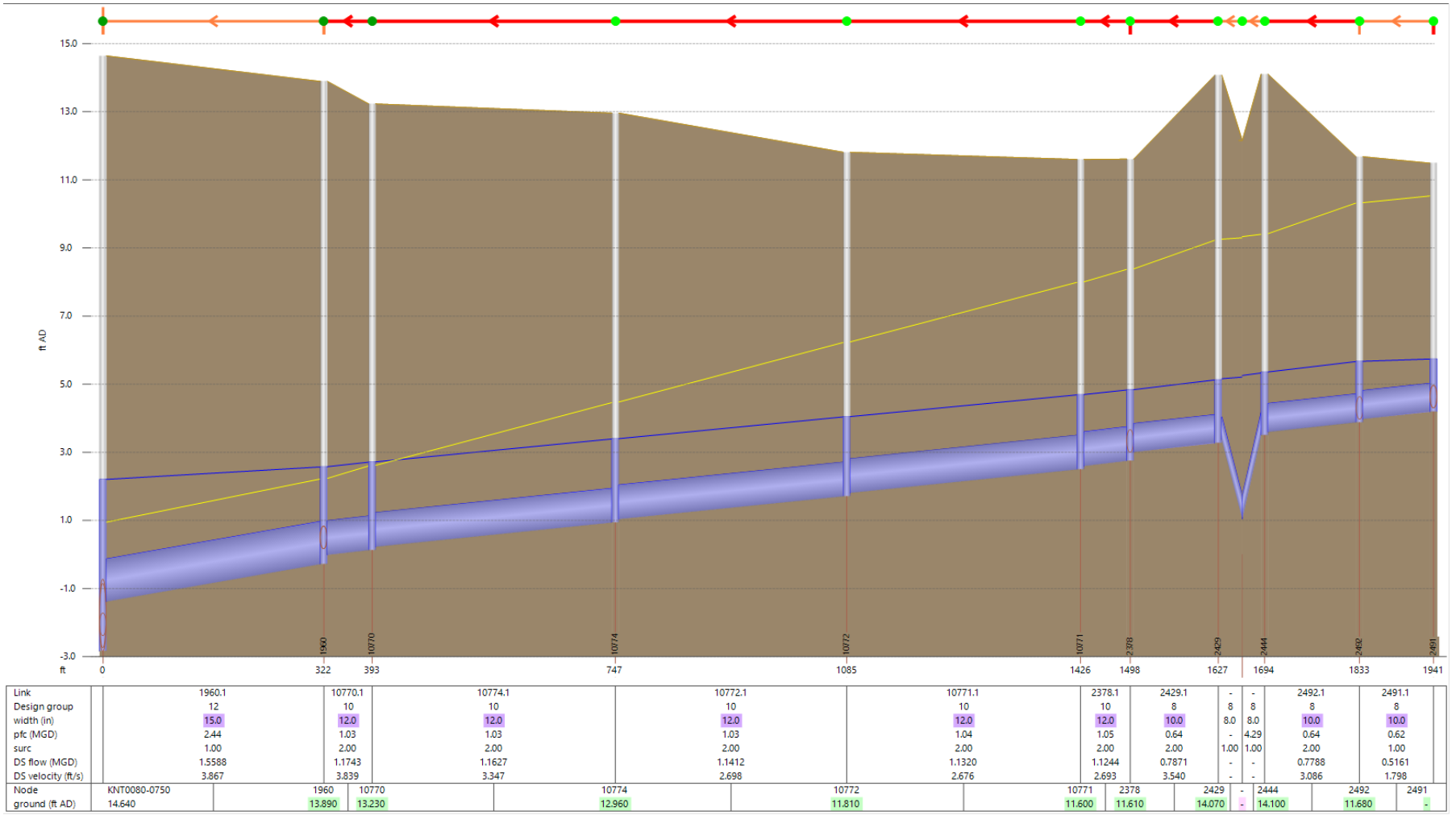
Gravity CIP Project: HB_05
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.12

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Print date: 20 Mar 2024 - 14:48

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	1960.1	10770.1	10774.1	10772.1	10771.1	2378.1	2429.1	-	-	2492.1	2491.1
Design group	12	10	10	10	10	10	8	8	8	8	8
width (in)	15.0	12.0	12.0	12.0	12.0	12.0	10.0	8.0	8.0	10.0	10.0
pfc (MGD)	2.44	1.03	1.03	1.03	1.04	1.05	0.64	-	4.29	0.64	0.62
surc	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	2.00	1.00
DS flow (MGD)	1.5588	1.1743	1.1627	1.1412	1.1320	1.1244	0.7871	-	-	0.7788	0.5161
DS velocity (ft/s)	3.867	3.839	3.347	2.698	2.676	2.693	3.540	-	-	3.086	1.798

Node	KNT0080-0750	1960	10770	10774	10772	10771	2378	2429	-	2444	2492	2491
ground (ft AD)	14.640	13.890	13.230	12.960	11.810	11.600	11.610	14.070	-	14.100	11.680	-

Figure F.13 Gravity Sewer CIP Project HB_05: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

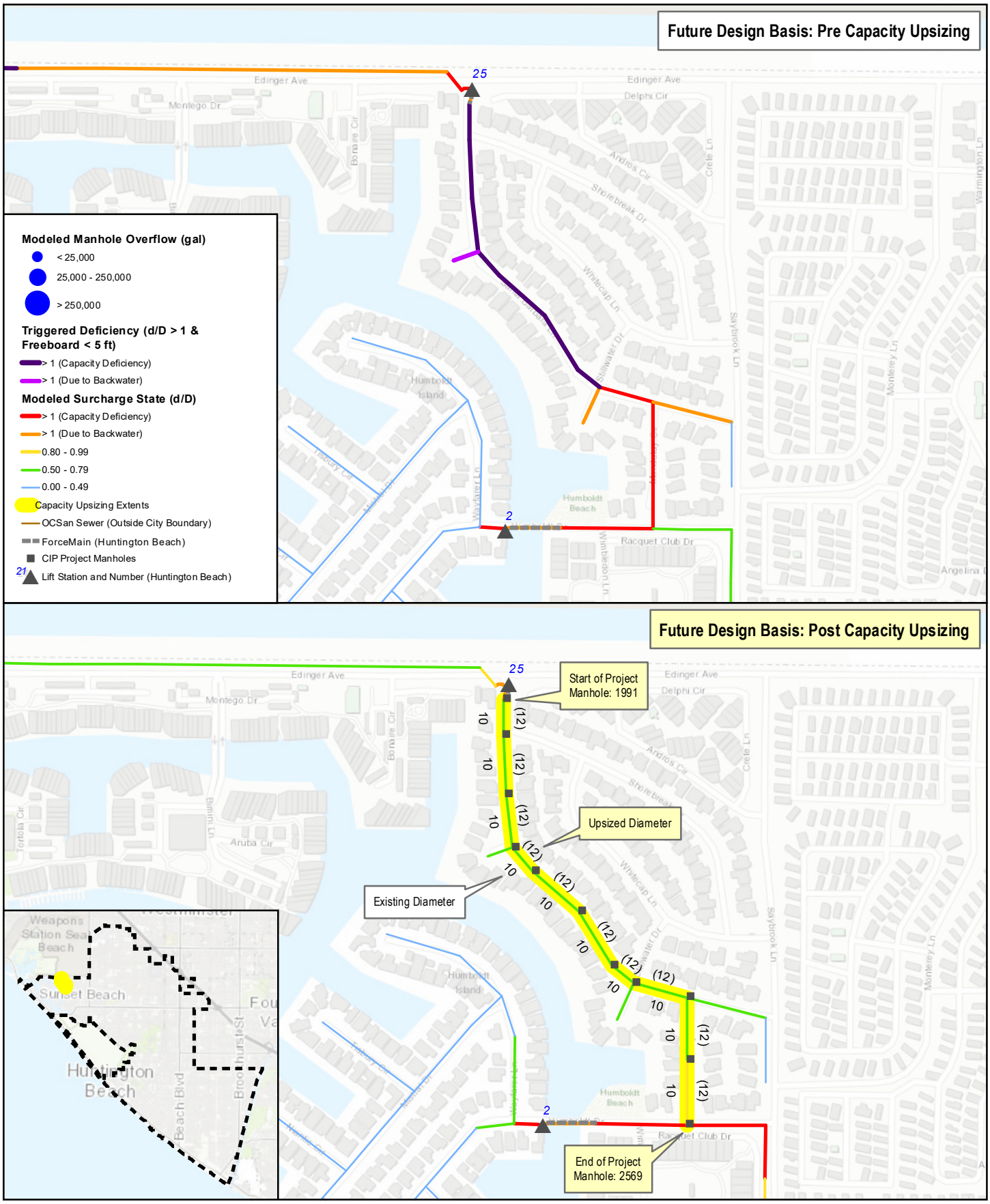
Project HB_03: Santa Barbara Ln Sewer Improvement

Project Description	
Project ID	HB_03
Project Name	Santa Barbara Ln Sewer Improvement
Project Location	From northern end of Santa Barbara Ln to the intersection of Mandalay Cir and Humboldt Dr
Description	Upsize 1,971 feet of 10-inch sewer to 12-inch
Tributary Area Details	
Tributary Pipe Length (ft)	19,250
Peak WWF (MGD)	0.80
SSOs Upstream	No
Eliminates Upstream	No
Project Pipe Details	
Count of Project Pipe	10
Maximum Diameter in Project	12
Total Baseline Project Length	1,971
Estimated Capital Improvement Cost	$2,734,000
Quartile Score (Priority Score)	12
Executable Rank (1-16)	7
Phase (1 of 5)	3
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
1991	2048	1977	10	12	136	0.25	5.3	Open Cut	587	$80,000
2048	2117	2026	10	12	227	0.25	6.8	Open Cut	587	$133,000
2117	2190	2086	10	12	204	0.25	7.8	Open Cut	587	$120,000
2190	2224	2106	10	12	121	0.25	8.1	Open Cut	587	$71,000
2224	2279	2141	10	12	234	0.25	8.0	Open Cut	587	$138,000
2279	2337	2202	10	12	241	0.25	8.0	Open Cut	587	$141,000
2337	2369	2229	10	12	108	0.25	8.3	Open Cut	587	$64,000
2369	2389	2250	10	12	213	0.25	9.6	Open Cut	587	$125,000
2389	2469	2334	10	12	239	0.25	10.7	Open Cut	587	$140,000
2469	2569	2421	10	12	248	0.25	11.2	Open Cut	587	$146,000

Total Baseline Project Length	$	1,971
Total Raw Open Cut Cost	$	1,158,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	231,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	93,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	116,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	24,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	173,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	70,000
Post Construction CCTV Cost ($8/lf)	$	16,000
Baseline Construction Cost	$	1,881,000
Mobilization/Demobilization (4% of Baseline Construction)	$	75,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	188,000
Construction Management (7% of Baseline Construction)	$	132,000
Contingencies (25% of Construction Cost)	$	469,000
Estimated Capital Improvement Cost:	**$**	2,734,000



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

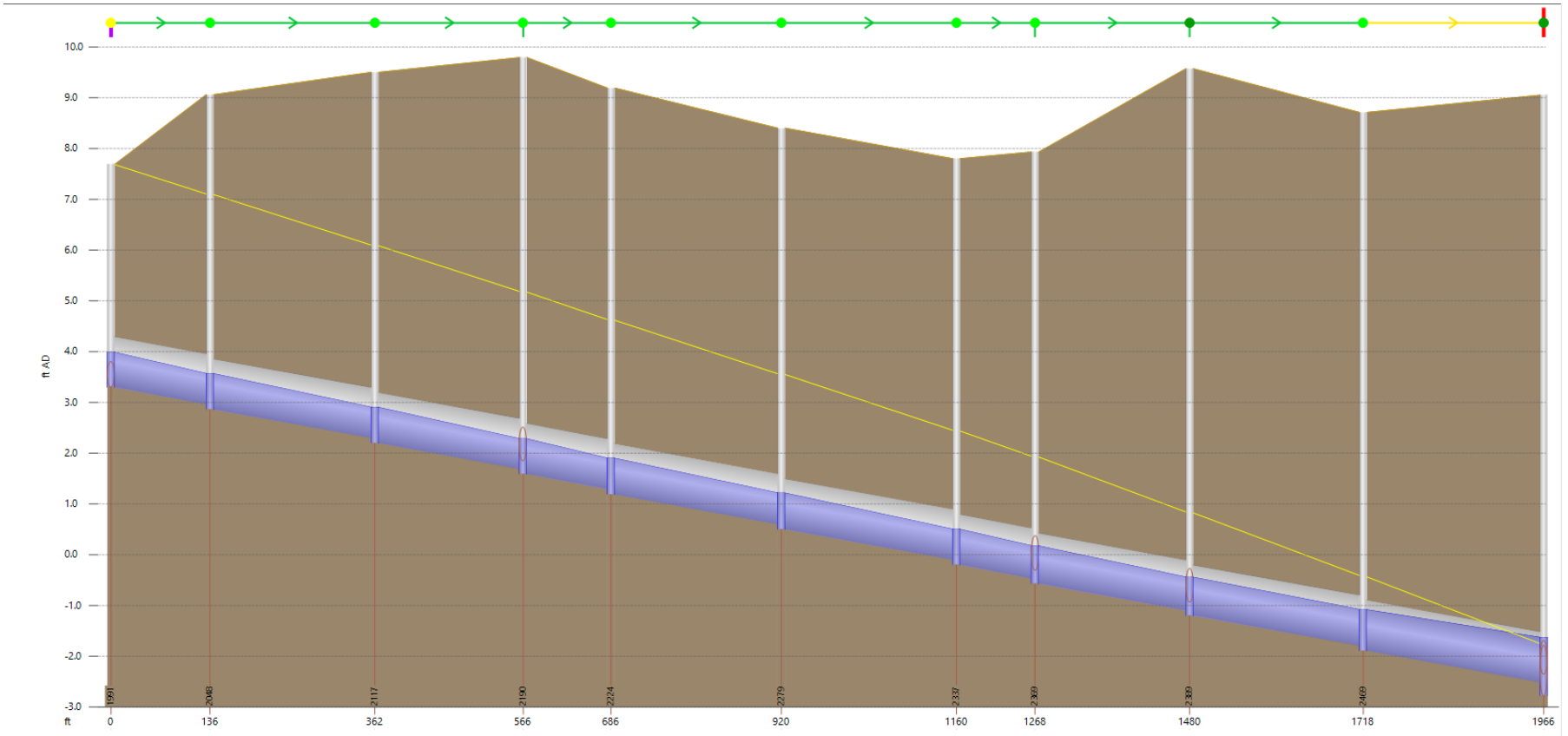
Gravity CIP Project: HB_03
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.14

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Print date: 20 Mar 2024 - 13:58

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	1991.1	2048.1	2117.1	2190.1	2224.1	2279.1	2337.1	2369.1	2389.1	2469.1
Design group	10	10	10	10	10	10	10	10	10	10
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
pfc (MGD)	1.15	1.15	1.15	1.15	1.16	1.15	1.15	1.15	1.15	1.15
surc	0.68	0.70	0.70	0.69	0.71	0.71	0.70	0.74	0.75	0.88
DS flow (MGD)	0.9548	0.9694	0.9724	0.9781	0.9820	0.9888	0.9909	1.0432	1.0552	1.0942
DS velocity (ft/s)	3.365	3.323	3.382	3.197	3.137	3.229	3.040	3.083	3.079	3.650

Node	1991	2048	2117	2190	2224	2279	2337	2369	2389	2469	2569
ground (ft AD)	7.689	9.060	9.500	9.790	9.190	8.400	7.800	7.930	9.570	8.710	9.050

Figure F.15 Gravity Sewer CIP Project HB_03: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

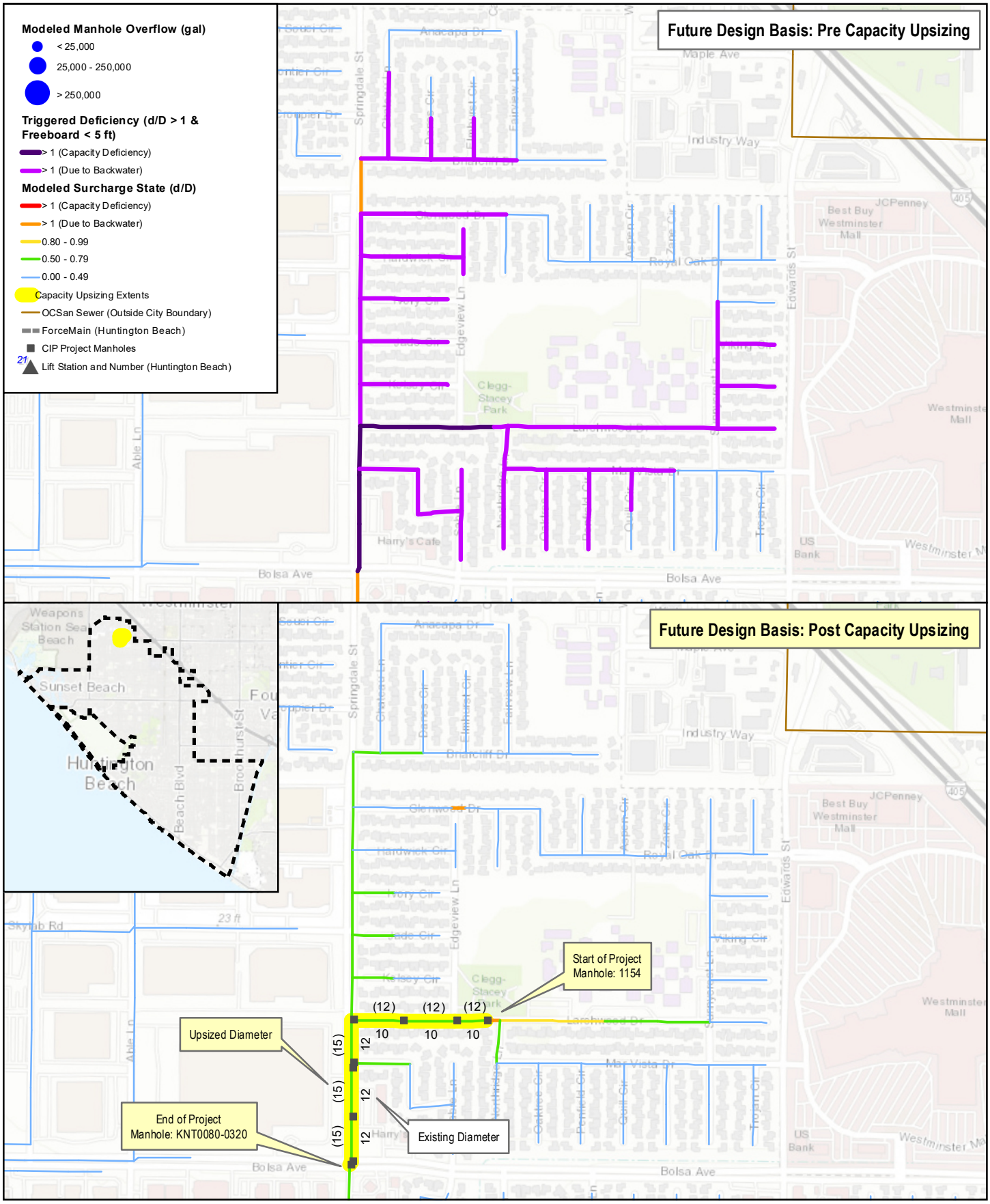
Project HB_08: Larchwood Dr Sewer Improvement

Project Description	
Project ID	HB_08
Project Name	Larchwood Dr Sewer Improvement
Project Location	From just west of intersection of Larchwood Dr and Northridge Ln to intersection of Springdale St and Bolsa Ave
Description	Upsize 821 feet of 10-inch sewer to 12-inch, and 888 feet of 12-inch to 15-inch
Tributary Area Details	
Tributary Pipe Length (ft)	25,924
Peak WWF (MGD)	0.92
SSOs Upstream	No
Eliminates Upstream	No
Project Pipe Details	
Count of Project Pipe	8
Maximum Diameter in Project	15
Total Baseline Project Length	1,709
Estimated Capital Improvement Cost	$2,475,000
Quartile Score (Priority Score)	15
Executable Rank (1-16)	8
Phase (1 of 5)	3
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
1154	1158	1138	10	12	191	0.10	7.0	Open Cut	587	$113,000
1158	1156	1139	10	12	326	0.10	7.2	Open Cut	587	$192,000
1156	1152	1136	10	12	304	0.10	7.6	Open Cut	587	$178,000
1152	1168	1149	12	15	263	0.10	8.7	Open Cut	636	$167,000
1168	1177	1157	12	15	34	0.09	9.1	Open Cut	636	$22,000
1177	1190	1170	12	15	299	0.10	8.8	Open Cut	636	$191,000
1190	1224	1193	12	15	271	0.10	7.7	Open Cut	636	$173,000
1224	KNT0080-0320	1194	12	15	21	0.15	8.4	Open Cut	636	$13,000

Total Baseline Project Length	$	1,709
Total Raw Open Cut Cost	$	1,049,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	209,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	84,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	105,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	21,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	157,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	63,000
Post Construction CCTV Cost ($8/lf)	$	14,000
Baseline Construction Cost	$	1,702,000
Mobilization/Demobilization (4% of Baseline Construction)	$	68,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	170,000
Construction Management (7% of Baseline Construction)	$	119,000
Contingencies (25% of Construction Cost)	$	424,000
Estimated Capital Improvement Cost:	**$**	2,475,000



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

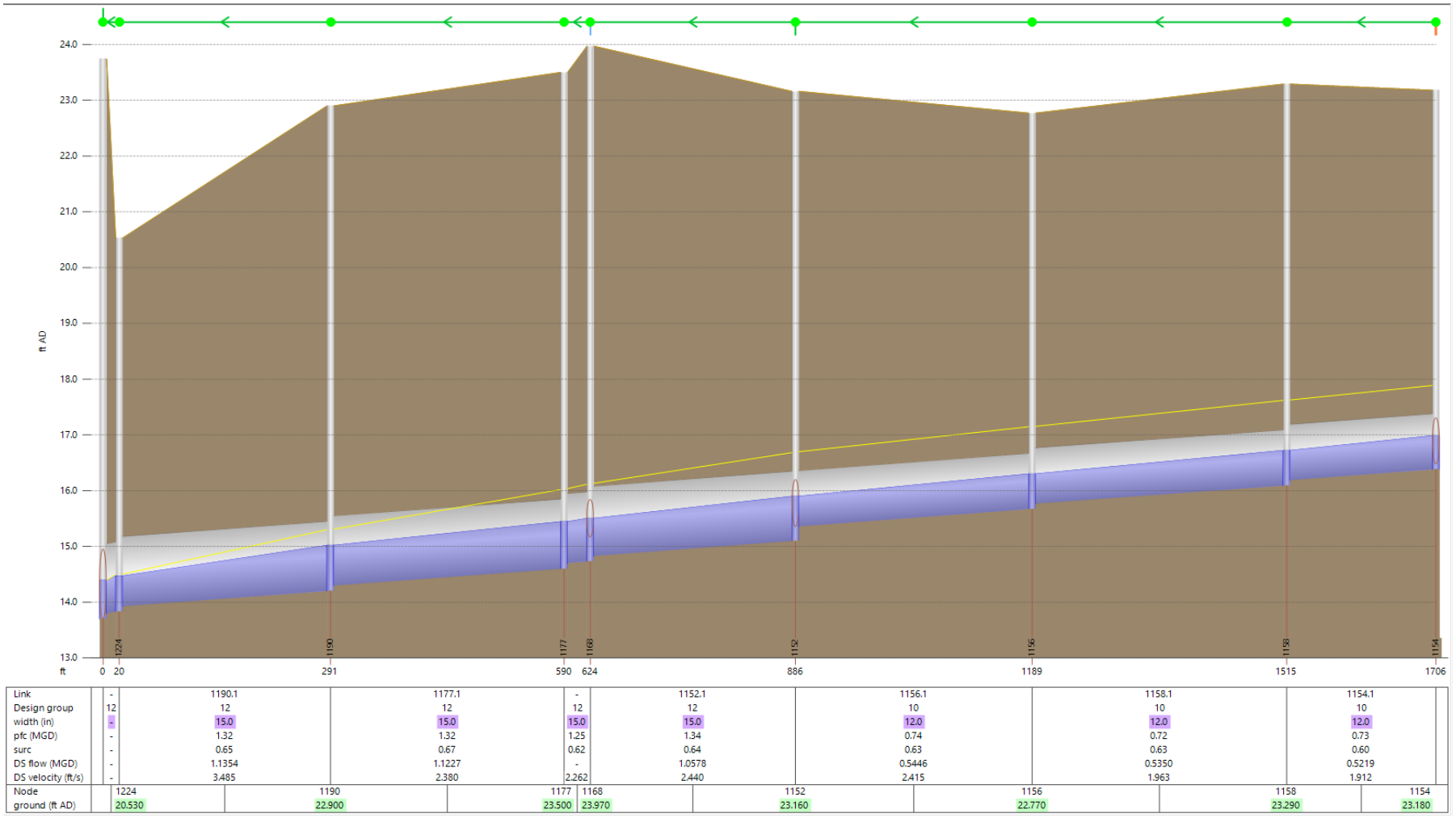
Gravity CIP Project: HB_08
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.16

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Print date: 20 Mar 2024 - 15:41

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	-	1190.1	1177.1	-	1152.1	1156.1	1158.1	1154.1	
Design group	12	12	12	12	12	10	10	10	
width (in)	-	15.0	15.0	15.0	15.0	12.0	12.0	12.0	
pfc (MGD)	-	1.32	1.32	1.25	1.34	0.74	0.72	0.73	
surc	-	0.65	0.67	0.62	0.64	0.63	0.63	0.60	
DS flow (MGD)	-	1.1354	1.1227	-	1.0578	0.5446	0.5350	0.5219	
DS velocity (ft/s)	-	3.485	2.380	2.262	2.440	2.415	1.963	1.912	
Node	1224	1190	1177	1168	1152	1156	1158	1154	
ground (ft AD)	20.530	22.900	23.500	23.970	23.160	22.770	23.290	23.180	

Figure F.17 Gravity Sewer CIP Project HB_08: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

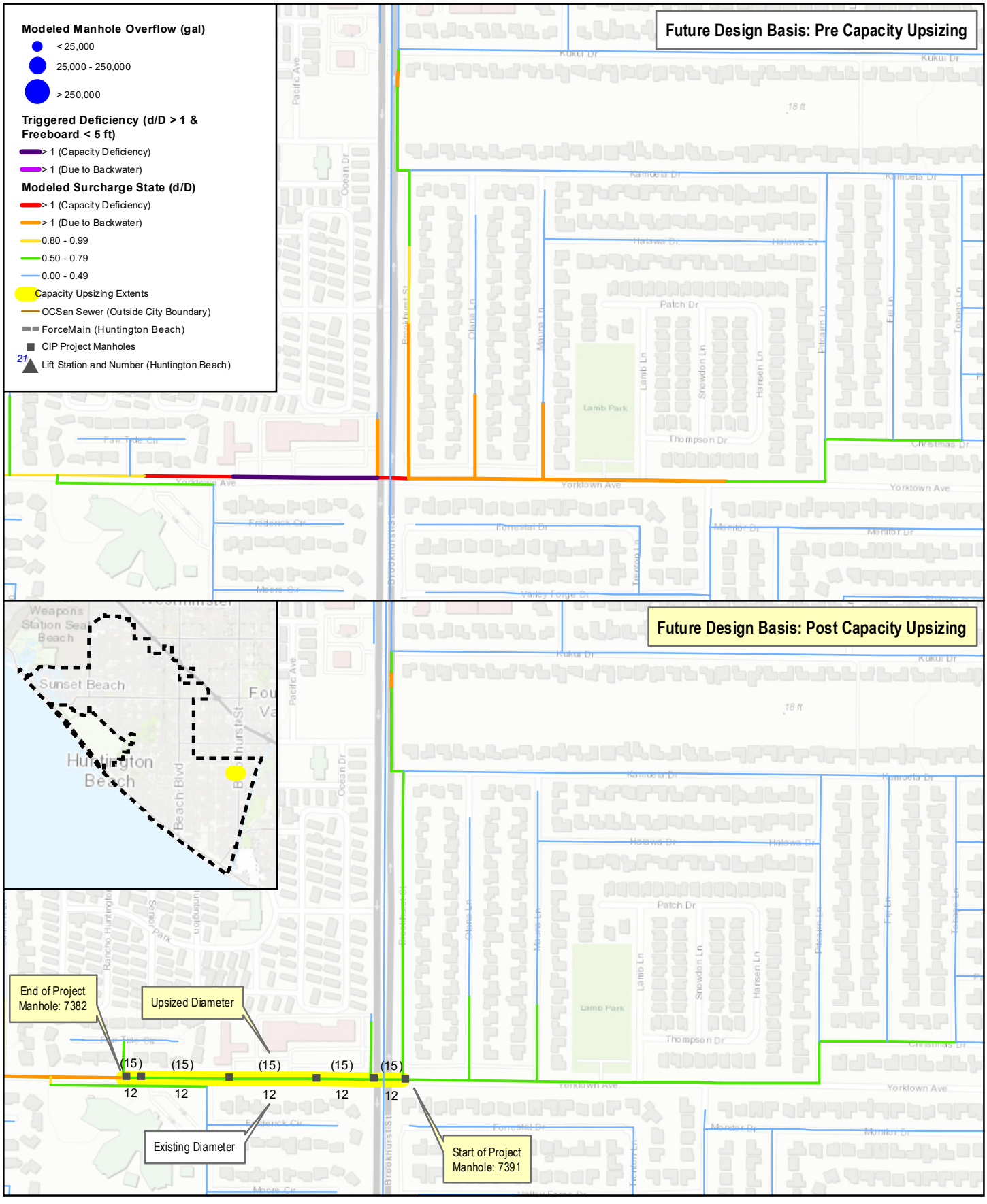
Project HB_11: Yorktown Ave Sewer Improvement

Project Description	
Project ID	HB_11
Project Name	Yorktown Ave Sewer Improvement
Project Location	From intersection of Yorktown Ave and Brigantine Ln to intersection of Yorktown Ave and Brookhurst St
Description	Upsize 1,071 feet of 12-inch sewer to 15-inch
Tributary Area Details	
Tributary Pipe Length (ft)	26,543
Peak WWF (MGD)	1.02
SSOs Upstream	No
Eliminates Upstream	No
Project Pipe Details	
Count of Project Pipe	5
Maximum Diameter in Project	15
Total Baseline Project Length	1,071
Estimated Capital Improvement Cost	$1,610,000
Quartile Score (Priority Score)	15
Executable Rank (1-16)	9
Phase (1 of 5)	3
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
7391	10762	11108	12	15	121	0.10	10.4	Open Cut	636	$77,000
10762	7389	9339	12	15	221	0.10	8.2	Open Cut	636	$140,000
7389	7388	6458	12	15	335	0.20	6.6	Open Cut	636	$213,000
7388	7384	6457	12	15	336	0.10	6.5	Open Cut	636	$214,000
7384	7382	6455	12	15	58	0.10	6.6	Open Cut	636	$37,000

Total Baseline Project Length	$	1,071
Total Raw Open Cut Cost	$	681,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	136,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	55,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	68,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	14,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	102,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	41,000
Post Construction CCTV Cost ($8/lf)	$	9,000
Baseline Construction Cost	$	1,106,000
Mobilization/Demobilization (4% of Baseline Construction)	$	45,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	111,000
Construction Management (7% of Baseline Construction)	$	78,000
Contingencies (25% of Construction Cost)	$	276,000
Estimated Capital Improvement Cost:	**$**	1,610,000



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

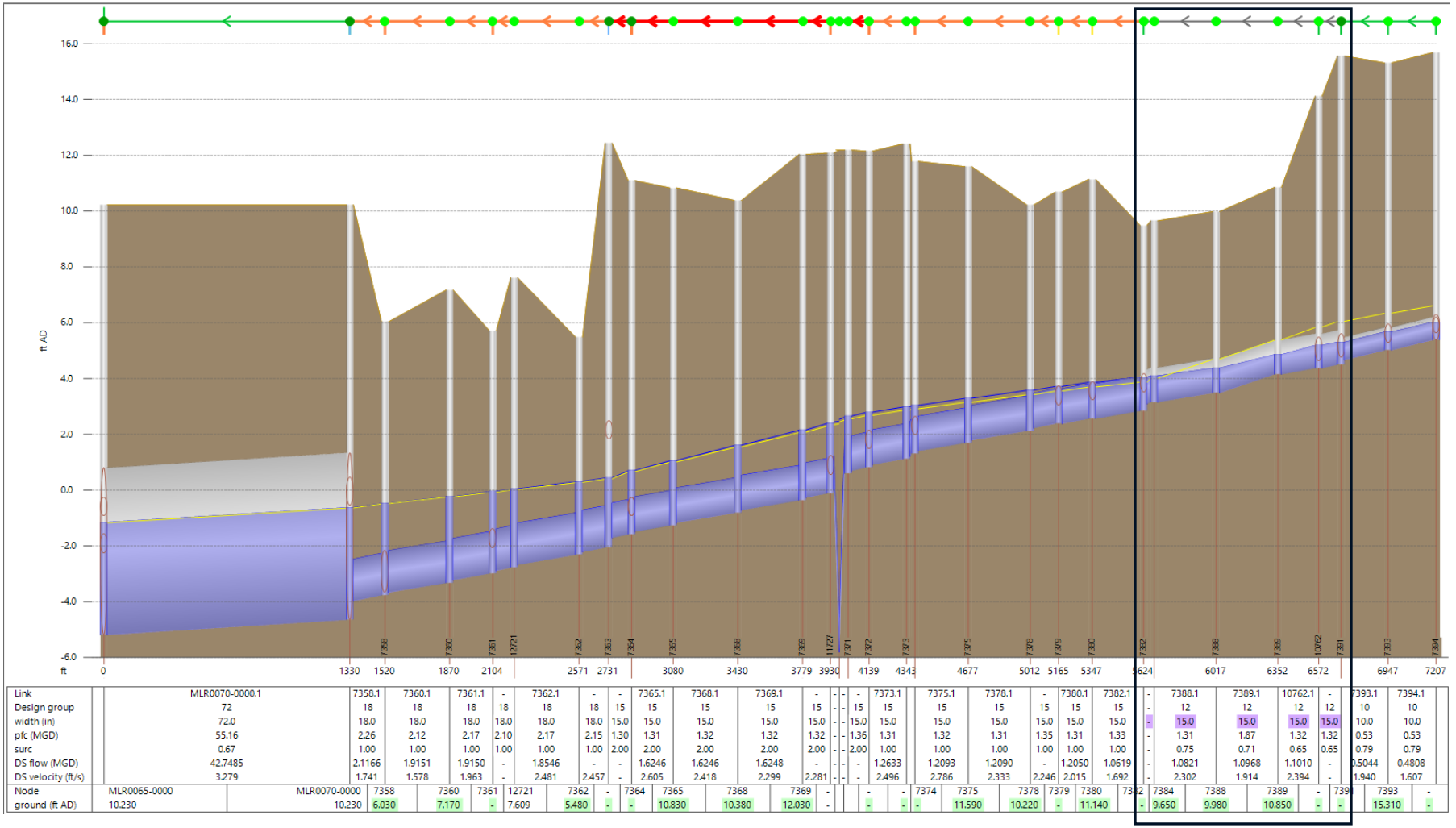
Gravity CIP Project: HB_11
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **3/18/2024**

FIGURE F.18

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Print date: 21 Mar 2024 - 08:53

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa


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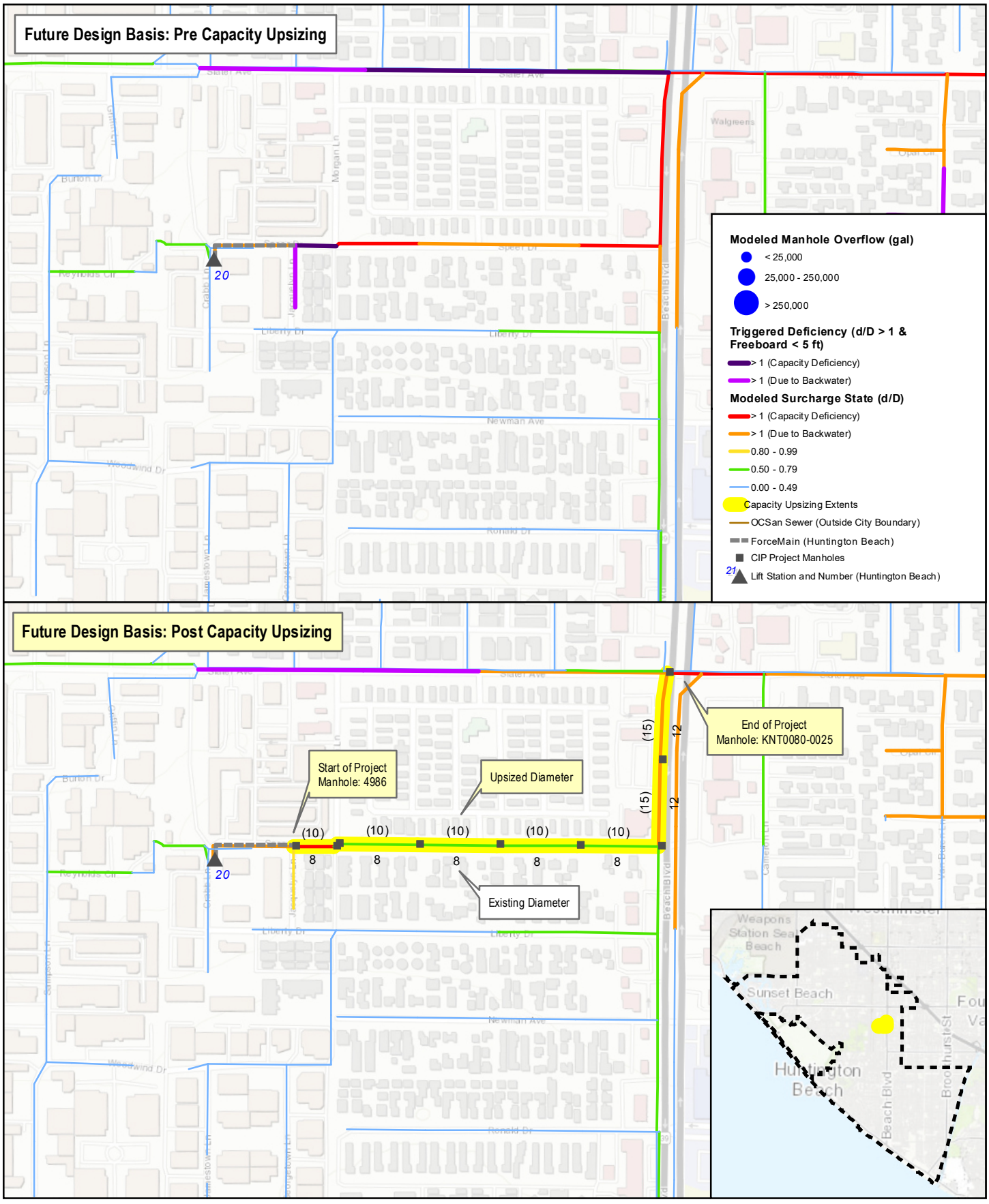
Project HB_10: Speer Dr Sewer Improvement

Project Description	
Project ID	HB_10
Project Name	Speer Dr Sewer Improvement
Project Location	From intersection of Speer Dr and Jacquelyn Ln to intersection of Beach Blvd and Slater Ave
Description	Upsize 1,401 feet of 8-inch sewer to 10-inch sewer, 666 feet of 12-inch to 15-inch
Tributary Area Details	
Tributary Pipe Length (ft)	24,524
Peak WWF (MGD)	1.44
SSOs Upstream	No
Eliminates Upstream	No
Project Pipe Details	
Count of Project Pipe	8
Maximum Diameter in Project	15
Total Baseline Project Length	2,067
Estimated Capital Improvement Cost	$2,556,000
Quartile Score (Priority Score)	14
Executable Rank (1-16)	10
Phase (1 of 5)	3
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
4986	4989	4572	8	10	156	0.25	7.9	Open Cut	468	$73,000
4989	4977	4571	8	10	15	0.21	9.9	Open Cut	468	$7,000
4977	4979	4561	8	10	308	0.20	10.4	Open Cut	468	$144,000
4979	4980	4562	8	10	306	0.20	11.0	Open Cut	468	$144,000
4980	4983	4565	8	10	307	0.20	11.6	Open Cut	468	$144,000
4983	4988	4570	8	10	309	0.20	11.2	Open Cut	468	$145,000
4988	4900	4569	12	15	331	0.32	10.2	Open Cut	636	$211,000
4900	KNT0080-0025	4483	12	15	335	0.31	12.0	Open Cut	636	$213,000

Total Baseline Project Length	$	2,067
Total Raw Open Cut Cost	$	1,081,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	216,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	87,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	108,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	22,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	162,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	65,000
Post Construction CCTV Cost ($8/lf)	$	17,000
Baseline Construction Cost	$	1,758,000
Mobilization/Demobilization (4% of Baseline Construction)	$	71,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	176,000
Construction Management (7% of Baseline Construction)	$	123,000
Contingencies (25% of Construction Cost)	$	438,000
Estimated Capital Improvement Cost:	**$**	2,556,000



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

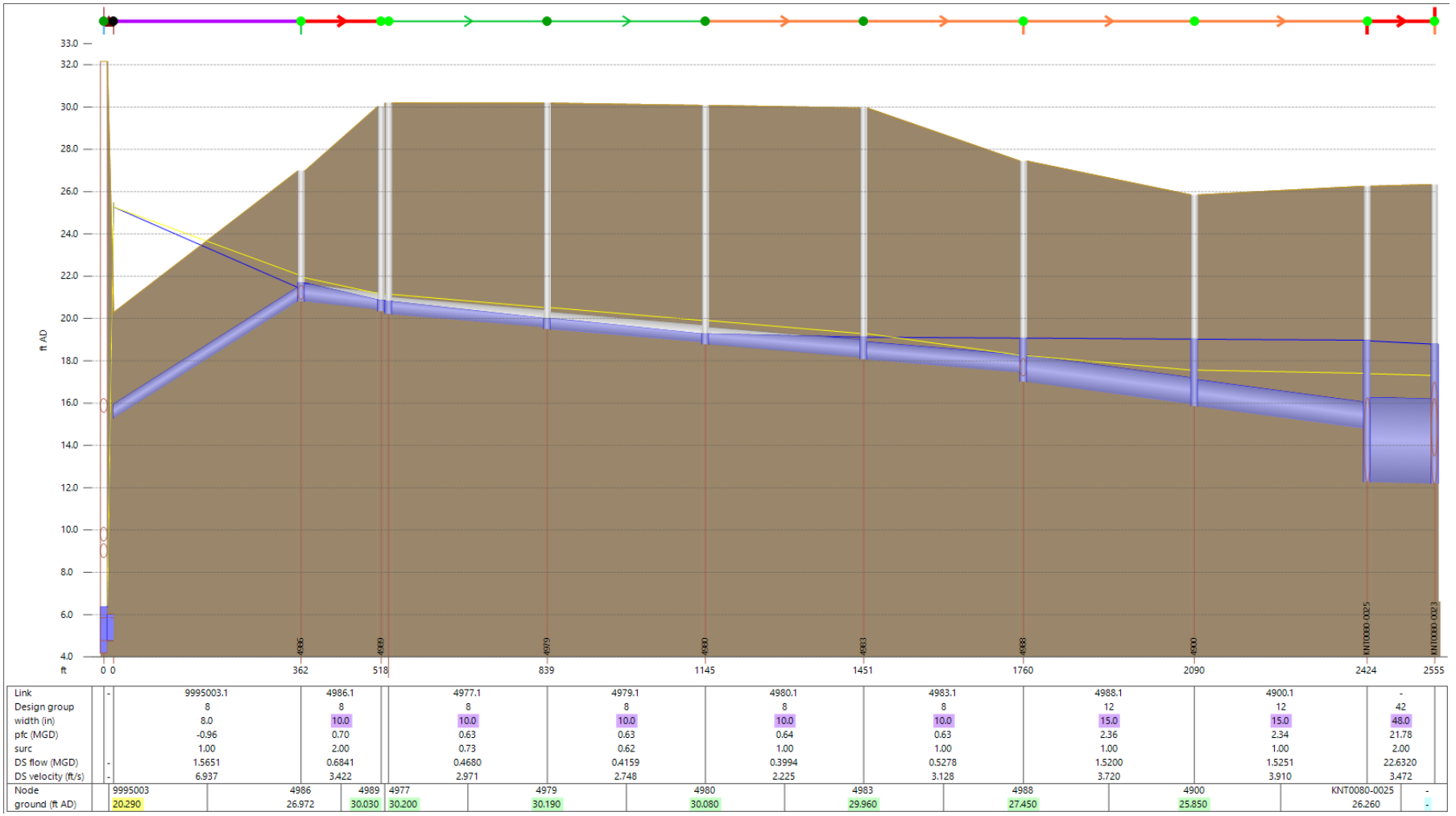
Gravity CIP Project: HB_10
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.20

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Print date: 21 Mar 2024 - 08:02

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	-	9995003.1	4986.1	4977.1	4979.1	4980.1	4983.1	4988.1	4900.1	-	
Design group		8	8	8	8	8	8	12	12	42	
width (in)		8.0	10.0	10.0	10.0	10.0	10.0	15.0	15.0	48.0	
pfc (MGD)		-0.96	0.70	0.63	0.63	0.64	0.63	2.36	2.34	21.78	
surc		1.00	2.00	0.73	0.62	1.00	1.00	1.00	1.00	2.00	
DS flow (MGD)	-	1.5651	0.6841	0.4680	0.4159	0.3994	0.5278	1.5200	1.5251	22.6320	
DS velocity (ft/s)	-	6.937	3.422	2.971	2.748	2.225	3.128	3.720	3.910	3.472	

Node	9995003	4986	4989	4977	4979	4980	4983	4988	4900	KNT0080-0025	-
ground (ft AD)	20.290	26.972	30.030	30.200	30.190	30.080	29.960	27.450	25.850	26.260	-

Figure F.21 Gravity Sewer CIP Project HB_10: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

Project HB_01: Pacific Coast Highway Sewer Improvement

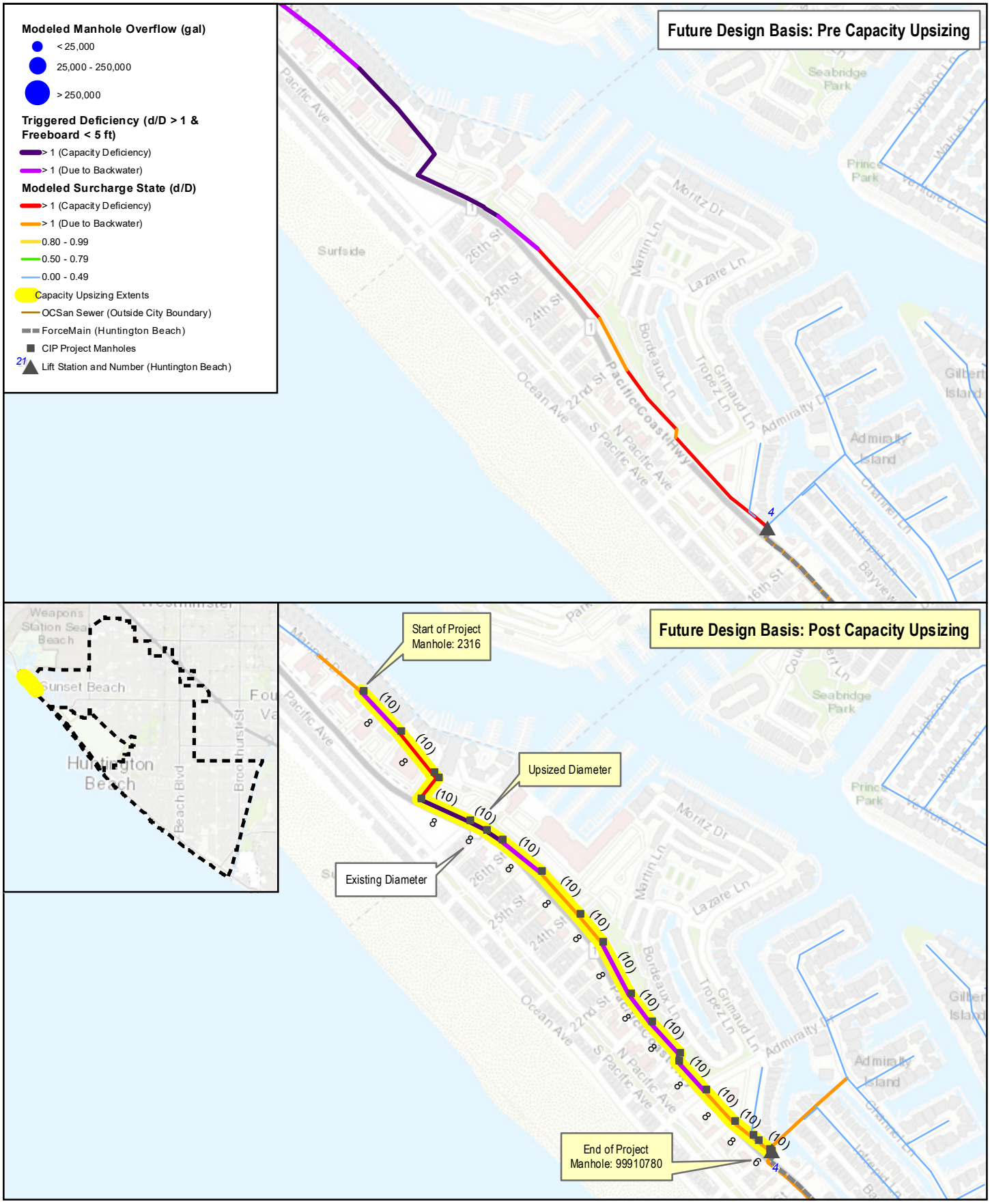
Project Description	
Project ID	HB_01
Project Name	Pacific Coast Highway Sewer Improvement
Project Location	From Intersection of Pacific Coast Highway and Mariner Dr to intersection of Pacific Coast Highway and Admiralty Dr
Description	Upsize 10 feet of 6-inch sewer to 10-inch, 3,507 feet of 8-inch to 10-inch
Tributary Area Details	
Tributary Pipe Length (ft)	13,960
Peak WWF (MGD)	0.75
SSOs Upstream	No
Eliminates Upstream	No
Project Pipe Details	
Count of Project Pipe	20
Maximum Diameter in Project	10
Total Baseline Project Length	3,517
Estimated Capital Improvement Cost	$3,901,000
Quartile Score (Priority Score)	10
Executable Rank (1-16)	11
Phase (1 of 5)	4
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
2316	2394	2255	8	10	295	0.30	6.4	Open Cut	468	$138,000
2394	2458	2328	8	10	280	0.25	7.0	Open Cut	468	$131,000
2458	2472	2337	8	10	36	0.23	6.9	Open Cut	468	$17,000
2472	2535	2398	8	10	146	0.26	8.3	Open Cut	468	$68,000
2535	2574	2427	8	10	287	0.25	7.9	Open Cut	468	$134,000
3231	3248	9461	8	10	42	0.38	15.5	Open Cut	468	$20,000
2574	2585	2438	8	10	101	0.25	6.5	Open Cut	468	$48,000
2585	2618	2473	8	10	99	0.25	7.0	Open Cut	468	$47,000
2618	11881	2597	8	10	271	0.66	7.9	Open Cut	468	$127,000
11881	2743	12141	8	10	305	0.34	9.7	Open Cut	468	$143,000
2743	2792	2646	8	10	196	0.34	10.4	Open Cut	468	$92,000
2792	2884	2734	8	10	312	0.47	9.9	Open Cut	468	$146,000
2884	2992	9386	8	10	188	0.37	9.5	Open Cut	468	$88,000

Project Cost Detail										
US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
2992	3065	2841	8	10	226	0.39	10.2	Open Cut	468	$106,000
3065	3085	2855	8	10	41	1.62	11.0	Open Cut	468	$20,000
3085	3128	2897	8	10	209	0.40	11.6	Open Cut	468	$98,000
3128	3201	9464	8	10	230	0.40	14.7	Open Cut	468	$108,000
3201	3248	9463	8	10	166	0.40	21.2	Open Cut	468	$78,000
3248	3272	9462	8	10	77	0.40	21.6	Open Cut	468	$36,000
3272	99910780	10989	6	10	10	0.41	25.3	Open Cut	468	$5,000

Total Baseline Project Length	$	3,517
Total Raw Open Cut Cost	$	1,650,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	329,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	132,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	165,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	33,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	247,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	99,000
Post Construction CCTV Cost ($8/lf)	$	29,000
Baseline Construction Cost	$	2,684,000
Mobilization/Demobilization (4% of Baseline Construction)	$	107,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	268,000
Construction Management (7% of Baseline Construction)	$	188,000
Contingencies (25% of Construction Cost)	$	668,000
Estimated Capital Improvement Cost:	**$**	3,901,000



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

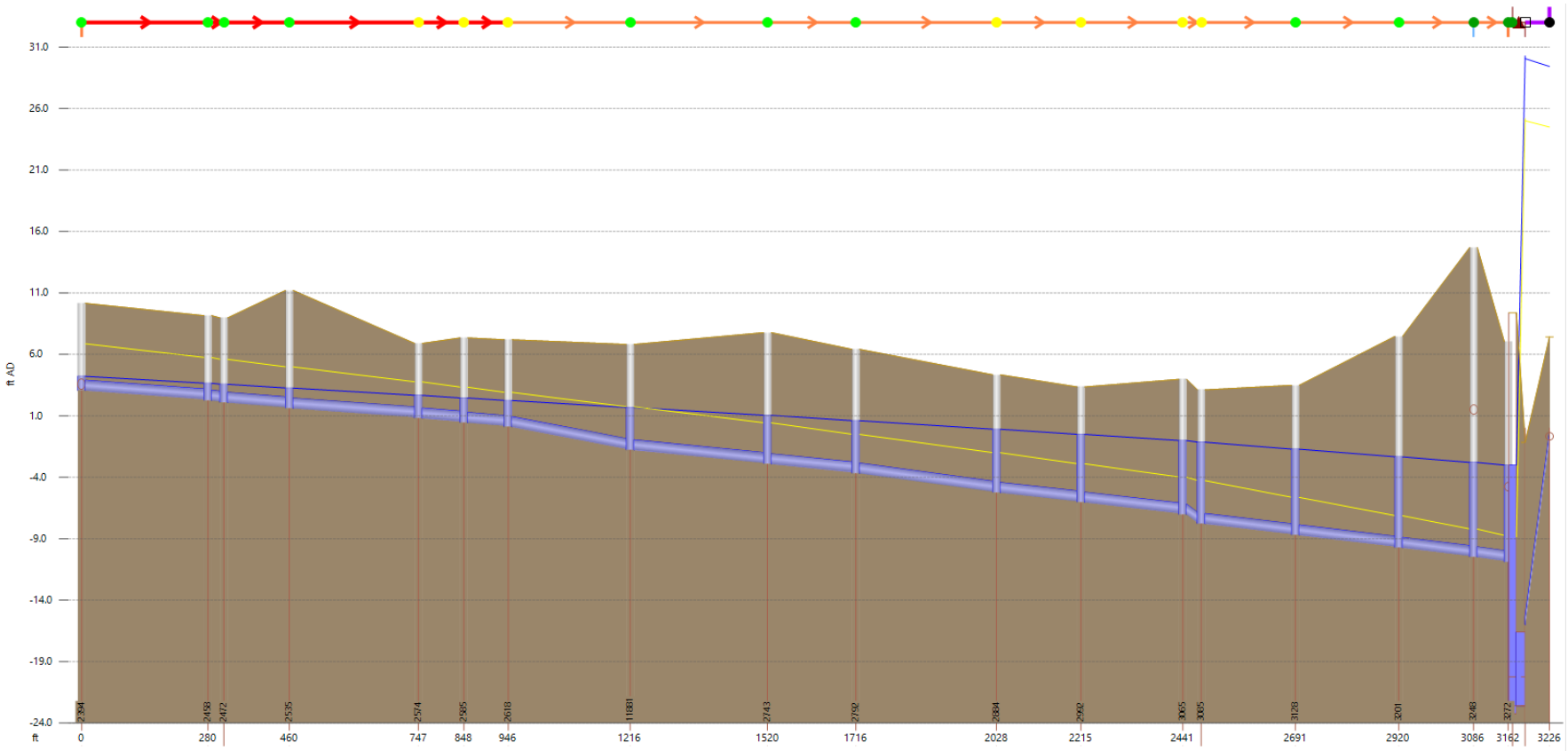
Gravity CIP Project: HB_01
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.22

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Print date: 20 Mar 2024 - 13:12

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	2394.1	-	2472.1	2535.1	2574.1	2585.1	2618.1	11881.1	2743.1	2792.1	2884.1	2992.1	-	3085.1	3128.1	3201.1	3248.1	-	-
Design group	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8		8
width (in)	10.0	-	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	-	10.0	10.0	10.0	10.0		8.0
pfc (MGD)	0.71	-	0.72	0.71	0.71	0.71	1.15	0.83	0.82	0.97	0.86	0.88	-	0.89	0.90	0.89	0.90		-
surc	2.00	-	2.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	-	1.00	1.00	1.00	1.00		1.00
DS flow (MGD)	0.7380	-	0.7485	0.7429	0.7387	0.7381	0.7143	0.7073	0.7267	0.7195	0.7131	0.7064	-	0.7350	0.7301	0.7306	0.7387	-	-
DS velocity (ft/s)	3.119	-	2.786	2.922	3.014	3.518	3.220	3.097	3.455	3.350	3.338	3.321	-	3.454	3.438	3.428	3.440	-	-

Node	2394	2458	2472	2535	2574	2585	2618	11881	2743	2792	2884	2992	3065	3085	3128	3201	3248	-	-
ground (ft AD)	10.150	9.150	8.970	11.200	6.890	7.340	7.190	6.810	7.770	6.410	4.340	3.350	3.970	3.110	3.480	7.460	14.690	-	-

Figure F.23 Gravity Sewer CIP Project HB_01: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

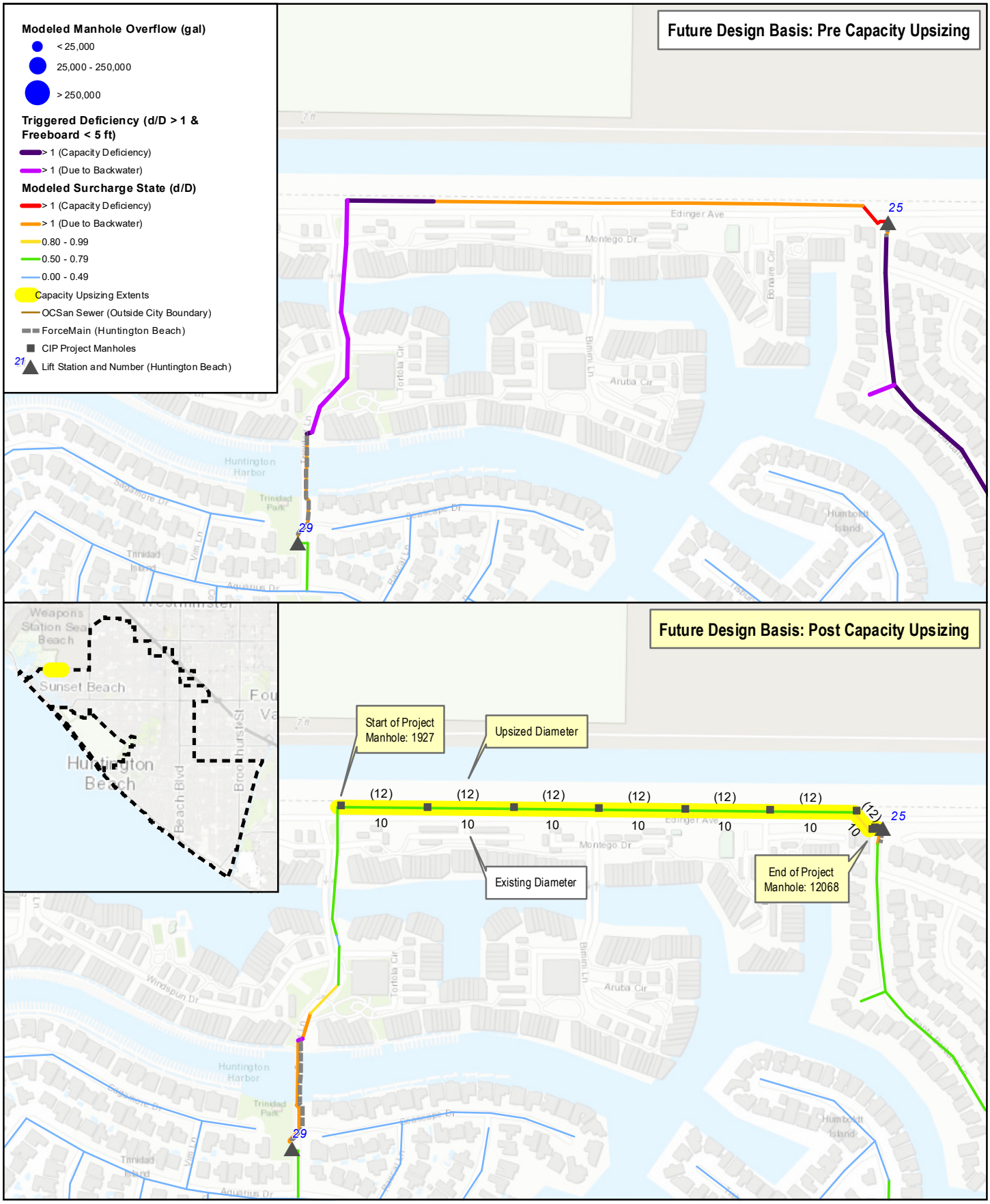
Project HB_02: Edinger Ave Sewer Improvement

Project Description	
Project ID	HB_02
Project Name	Edinger Ave Sewer Improvement
Project Location	From intersection of Edinger Ave and Trinidad Ln to just east of intersection of Edinger Ave and Bonaire Cir
Description	Upsize 2,095 feet of 10-inch sewer to 12-inch
Tributary Area Details	
Tributary Pipe Length (ft)	13,481
Peak WWF (MGD)	0.70
SSOs Upstream	No
Eliminates Upstream	No
Project Pipe Details	
Count of Project Pipe	9
Maximum Diameter in Project	12
Total Baseline Project Length	2,095
Estimated Capital Improvement Cost	$2,909,000
Quartile Score (Priority Score)	9
Executable Rank (1-16)	12
Phase (1 of 5)	4
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
1927	1928	1865	10	12	330	0.25	10.5	Open Cut	587	$194,000
1928	1930	1867	10	12	330	0.25	11.1	Open Cut	587	$194,000
1930	1931	1868	10	12	323	0.25	12.6	Open Cut	587	$190,000
1931	1933	1870	10	12	330	0.25	13.9	Open Cut	587	$194,000
1933	1936	1873	10	12	326	0.25	14.7	Open Cut	587	$191,000
1936	1937	1874	10	12	331	0.25	15.1	Open Cut	587	$195,000
1937	11926	1882	10	12	90	0.17	14.6	Open Cut	587	$53,000
11926	11925	12189	10	12	12	0.18	15.1	Open Cut	587	$7,000
11925	12068	12188	10	12	23	0.18	16.7	Open Cut	587	$14,000

Total Baseline Project Length	$	2,095
Total Raw Open Cut Cost	$	1,232,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	246,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	99,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	123,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	25,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	185,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	74,000
Post Construction CCTV Cost ($8/lf)	$	17,000
Baseline Construction Cost	$	2,001,000
Mobilization/Demobilization (4% of Baseline Construction)	$	80,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	200,000
Construction Management (7% of Baseline Construction)	$	140,000
Contingencies (25% of Construction Cost)	$	499,000
Estimated Capital Improvement Cost:	**$**	2,909,000



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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City of Huntington Beach
Sewer Master Plan Update

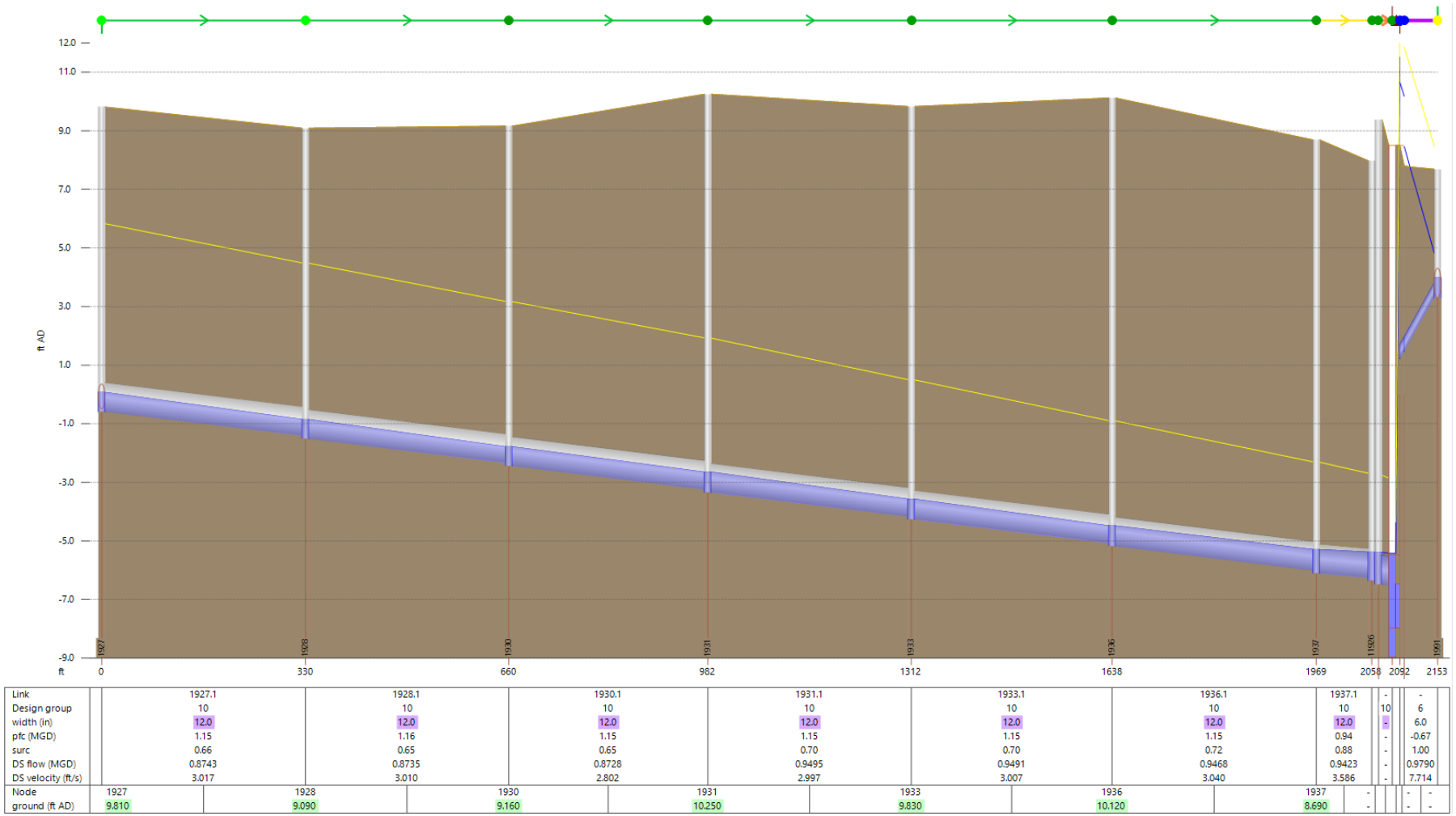
Gravity CIP Project: HB_02
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.24

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Print date: 20 Mar 2024 - 13:30

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	1927.1	1928.1	1930.1	1931.1	1933.1	1936.1	1937.1	-	-
Design group	10	10	10	10	10	10	10	10	6
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	-	6.0
pfc (MGD)	1.15	1.16	1.15	1.15	1.15	1.15	0.94	-	-0.67
surc	0.66	0.65	0.65	0.70	0.70	0.72	0.88	-	1.00
DS flow (MGD)	0.8743	0.8735	0.8728	0.9495	0.9491	0.9468	0.9423	-	0.9790
DS velocity (ft/s)	3.017	3.010	2.802	2.997	3.007	3.040	3.586	-	7.714
Node	1927	1928	1930	1931	1933	1936	1937	-	-
ground (ft AD)	9.810	9.090	9.160	10.250	9.830	10.120	8.690	-	-

Figure F.25 Gravity Sewer CIP Project HB_02: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

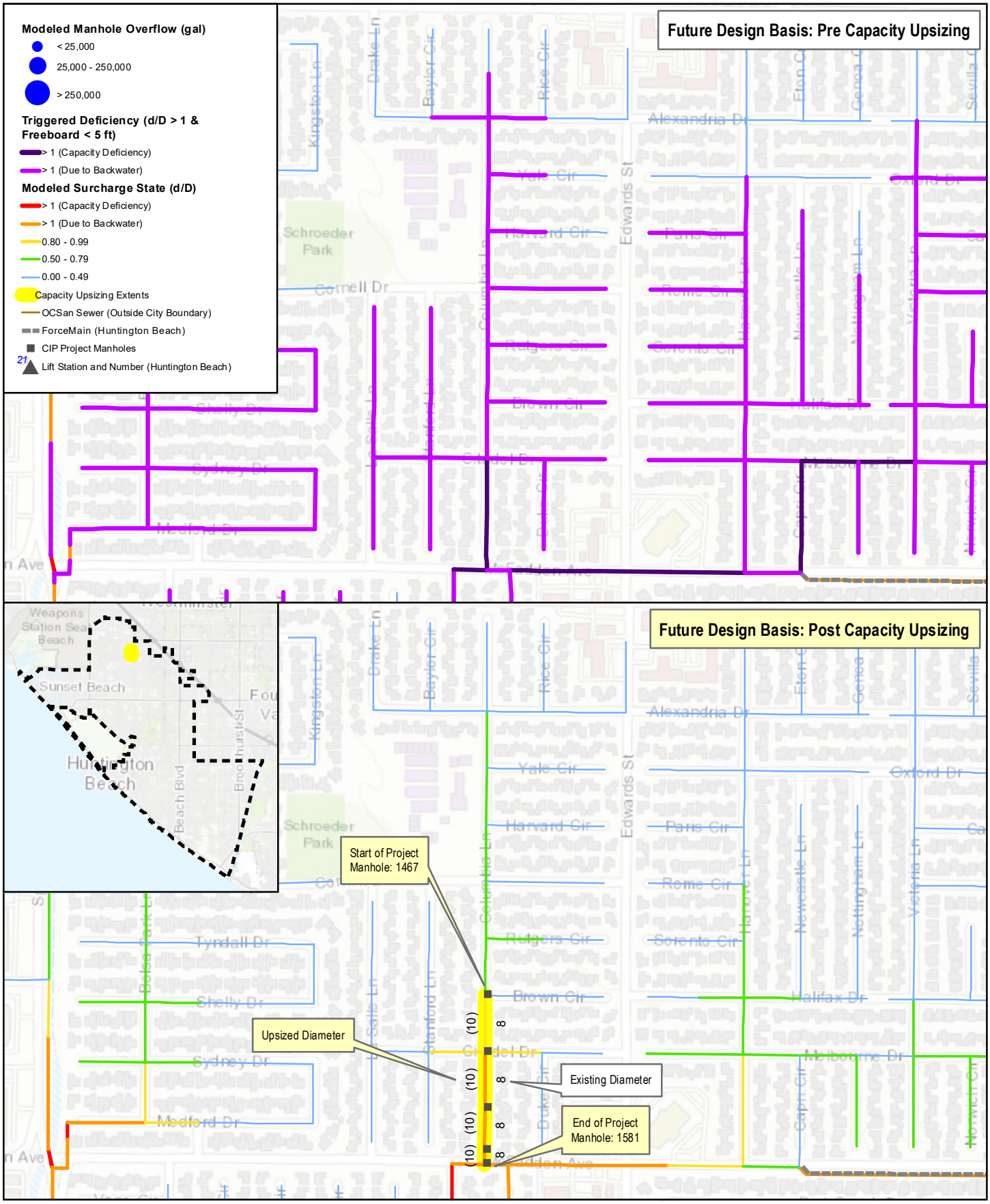
Project HB_07: Columbia Ln Sewer Improvement

Project Description	
Project ID	HB_07
Project Name	Columbia Ln Sewer Improvement
Project Location	From intersection of Columbia Ln and Brown Cir to just east of intersection of W McFadden Ave and Mayflower Ln
Description	Upsize 775 feet of 8-inch sewer to 10-inch
Tributary Area Details	
Tributary Pipe Length (ft)	11,554
Peak WWF (MGD)	0.32
SSOs Upstream	No
Eliminates Upstream	No
Project Pipe Details	
Count of Project Pipe	4
Maximum Diameter in Project	10
Total Baseline Project Length	775
Estimated Capital Improvement Cost	$859,000
Quartile Score (Priority Score)	9
Executable Rank (1-16)	14
Phase (1 of 5)	4
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
1467	1505	1451	8	10	259	0.20	7.6	Open Cut	468	$122,000
1505	1541	1490	8	10	255	0.20	7.6	Open Cut	468	$120,000
1541	1560	1510	8	10	193	0.20	7.6	Open Cut	468	$90,000
1560	1581	1533	8	10	68	0.16	7.6	Open Cut	468	$32,000

Total Baseline Project Length	$	775
Total Raw Open Cut Cost	$	364,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	73,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	29,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	37,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	8,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	55,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	22,000
Post Construction CCTV Cost ($8/lf)	$	7,000
Baseline Construction Cost	$	595,000
Mobilization/Demobilization (4% of Baseline Construction)	$	24,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	59,000
Construction Management (7% of Baseline Construction)	$	42,000
Contingencies (25% of Construction Cost)	$	148,000
Estimated Capital Improvement Cost:	**$**	859,000



Paper Size ANSI A

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

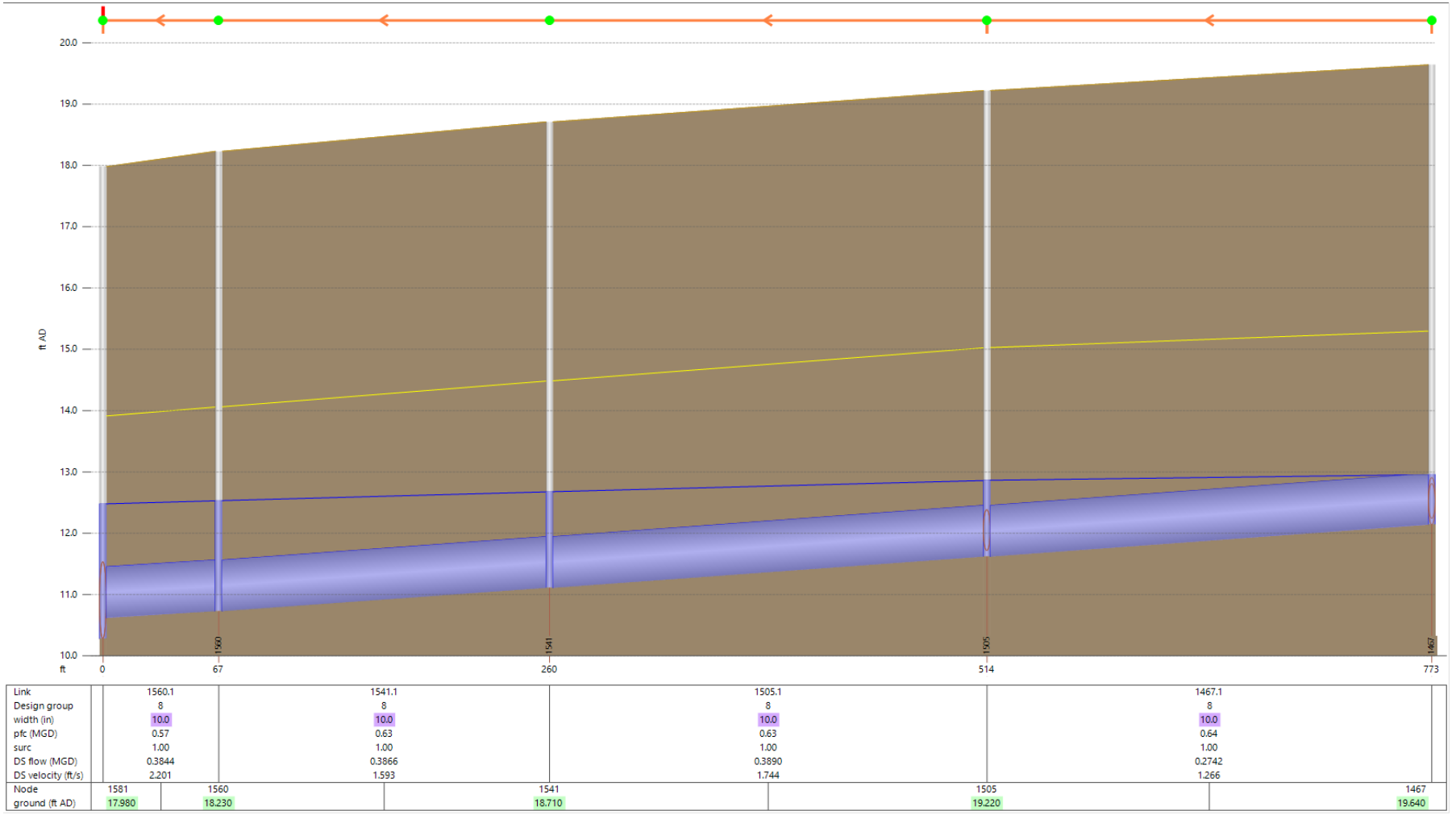
Gravity CIP Project: HB_07
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.26

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Print date: 25 Mar 2024 - 07:25

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	1560.1	1541.1	1505.1	1467.1
Design group	8	8	8	8
width (in)	10.0	10.0	10.0	10.0
pfc (MGD)	0.57	0.63	0.63	0.64
surc	1.00	1.00	1.00	1.00
DS flow (MGD)	0.3844	0.3866	0.3890	0.2742
DS velocity (ft/s)	2.201	1.593	1.744	1.266

Node	1581	1560	1541	1505	1467
ground (ft AD)	17.980	18.230	18.710	19.220	19.640

Figure F.27 Gravity Sewer CIP Project HB_07: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

Project HB_12: Argosy Ave Sewer Improvement

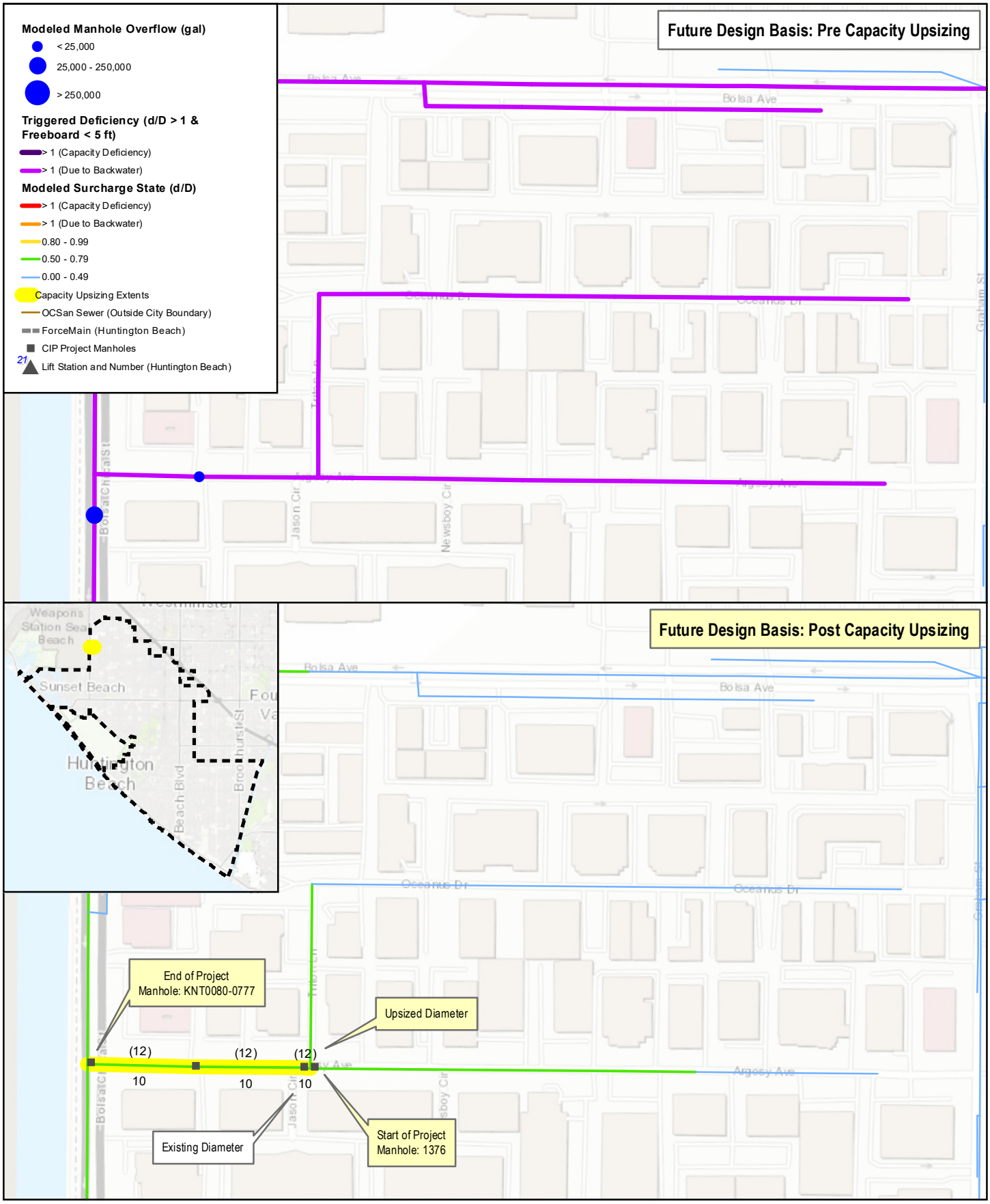
Project Description	
Project ID	HB_12
Project Name	Argosy Ave Sewer Improvement
Project Location	From intersection of Argosy Ave and Triton Ln to intersection of Argosy Ave and Bolsa Chica St
Description	Upsize 684 feet of 10-inch sewer to 12-inch
Tributary Area Details	
Tributary Pipe Length (ft)	4,771
Peak WWF (MGD)	0.57
SSOs Upstream	No
Eliminates Upstream	No
Project Pipe Details	
Count of Project Pipe	3
Maximum Diameter in Project	12
Total Baseline Project Length	684
Estimated Capital Improvement Cost	$950,000
Quartile Score (Priority Score)	9
Executable Rank (1-16)	15
Phase (1 of 5)	4
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Consider parallel piping or I&I rehabilitation of poor condition tributary sewers

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
1376	1375	1328	10	12	34	0.21	8.6	Open Cut	587	$20,000
1375	1371	1326	10	12	330	0.20	8.5	Open Cut	587	$194,000
1371	KNT0080-0777	1322	10	12	320	0.21	8.7	Open Cut	587	$188,000

Total Baseline Project Length $ 684

Total Raw Open Cut Cost	$	402,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	81,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	33,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	41,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	9,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	61,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	25,000
Post Construction CCTV Cost ($8/lf)	$	6,000
Baseline Construction Cost	$	658,000
Mobilization/Demobilization (4% of Baseline Construction)	$	27,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	66,000
Construction Management (7% of Baseline Construction)	$	46,000
Contingencies (25% of Construction Cost)	$	163,000
Estimated Capital Improvement Cost:	**$**	950,000



Paper Size ANSI A

0 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

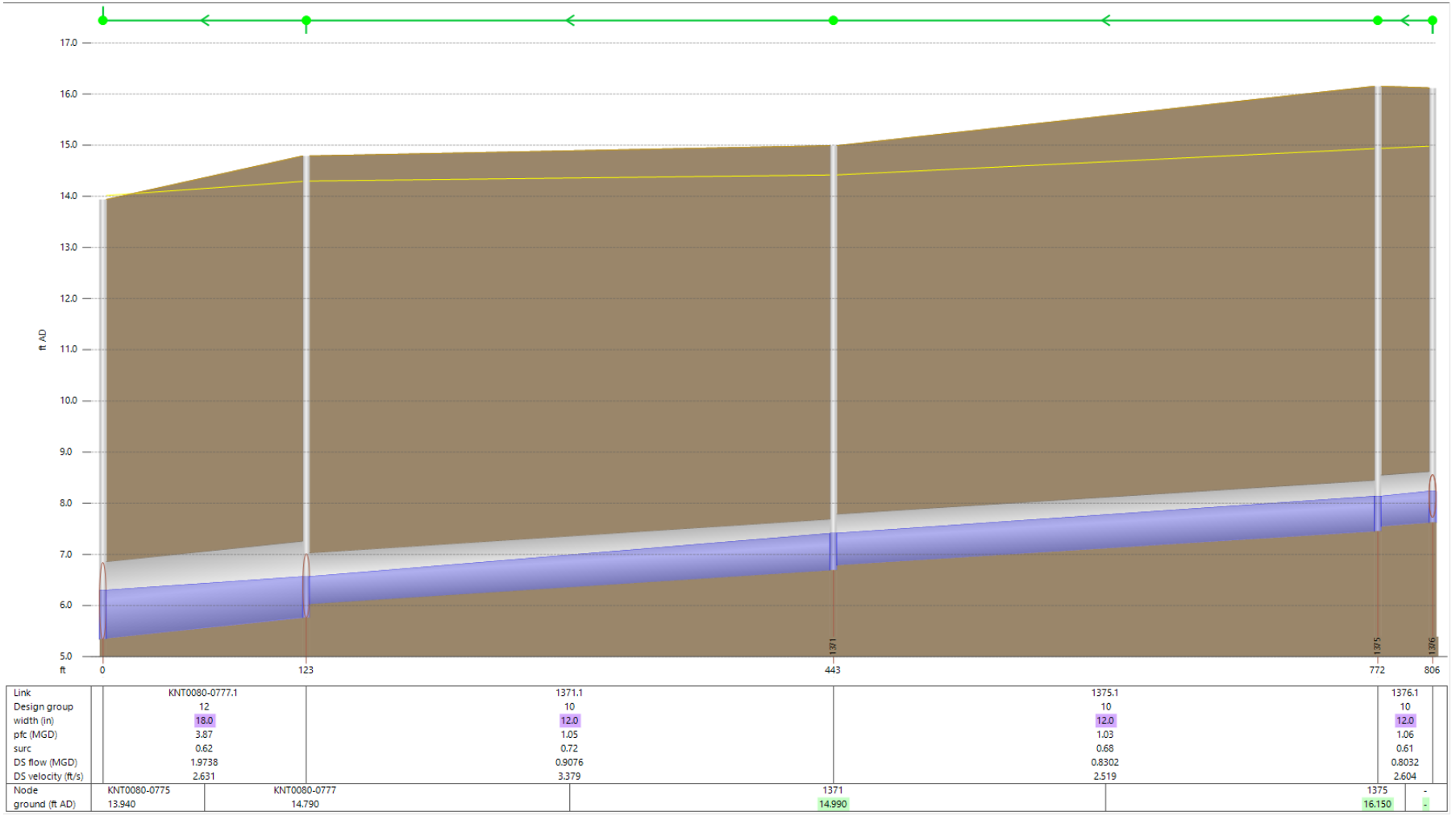
Gravity CIP Project: HB_12
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. 12585300
Revision No. 0
Date 3/18/2024

FIGURE F.28

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Print date: 25 Mar 2024 - 07:15

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	KNT0080-0777.1	1371.1	1375.1	1376.1	
Design group	12	10	10	10	
width (in)	18.0	12.0	12.0	12.0	
pfc (MGD)	3.87	1.05	1.03	1.06	
surc	0.62	0.72	0.68	0.61	
DS flow (MGD)	1.9738	0.9076	0.8302	0.8032	
DS velocity (ft/s)	2.631	3.379	2.519	2.604	
Node	KNT0080-0775	KNT0080-0777	1371	1375	-
ground (ft AD)	13.940	14.790	14.990	16.150	-

Figure F.29 Gravity Sewer CIP Project HB_12: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

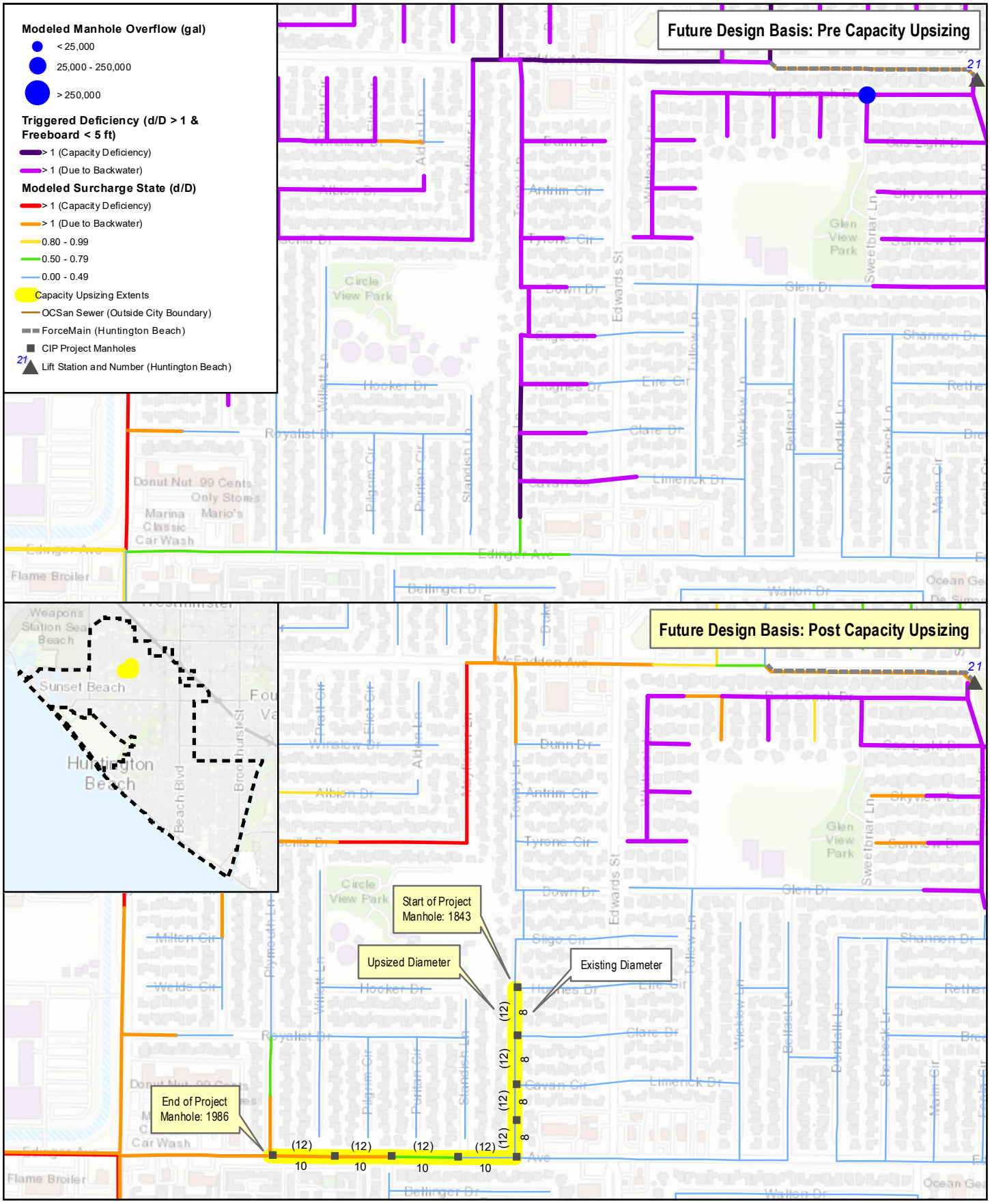
Project HB_09: Carrie Ln Sewer Improvement (Conditional~Flow Monitor First)

Project Description	
Project ID	HB_09
Project Name	Carrie Ln Sewer Improvement
Project Location	From intersection of Carrie Ln and Hughes Dr to intersection of Edinger Ave and Plymouth Ln
Description	Upsize 110 feet of 8-inch sewer to 12-inch, 3,673 feet of 12-inch to 15-inch, and 1,624 feet of 18-inch to 21-inch along E Wardlow Rd and Cherry Ave
Tributary Area Details	
Tributary Pipe Length (ft)	15,969
Peak WWF (MGD)	0.39
SSOs Upstream	No
Eliminates Upstream Deficiencies	No
Project Pipe Details	
Count of Project Pipe Segments	8
Maximum Diameter in Project (in)	10
Total Baseline Project Length (ft)	2,216
Estimated Capital Improvement Cost	$2,418,000
Quartile Score (Priority Score)	11
Executable Rank (1-16)	15
Phase (1 of 5)	5
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Flow monitor the 12-inch sewer going west on Edinger into 21-inch OCSan trunk first to verify flows

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
1843	1878	1814	8	12	260	0.20	7.1	Open Cut	448	$117,000
1878	1904	1843	8	12	261	0.20	7.1	Open Cut	448	$117,000
1904	1923	1862	8	12	192	0.20	7.3	Open Cut	448	$86,000
1923	2000	1933	8	12	198	0.20	7.8	Open Cut	448	$89,000
2000	1998	1934	10	12	313	0.16	9.0	Open Cut	468	$147,000
1998	1996	1932	10	12	356	0.16	10.0	Open Cut	468	$167,000
1996	1990	1930	10	12	306	0.16	10.1	Open Cut	468	$143,000
1990	1986	1923	10	12	330	0.16	10.4	Open Cut	468	$155,000

Total Baseline Project Length	$	2,216
Total Raw Open Cut Cost	$	1,021,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	204,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	82,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	102,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	21,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	153,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	62,000
Post Construction CCTV Cost ($8/lf)	$	18,000
Baseline Construction Cost	$	1,663,000
Mobilization/Demobilization (4% of Baseline Construction)	$	67,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	166,000
Construction Management (7% of Baseline Construction)	$	116,000
Contingencies (25% of Construction Cost)	$	414,000
Estimated Capital Improvement Cost:	**$**	2,418,000



Paper Size ANSI A

0 175 350 525 700

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

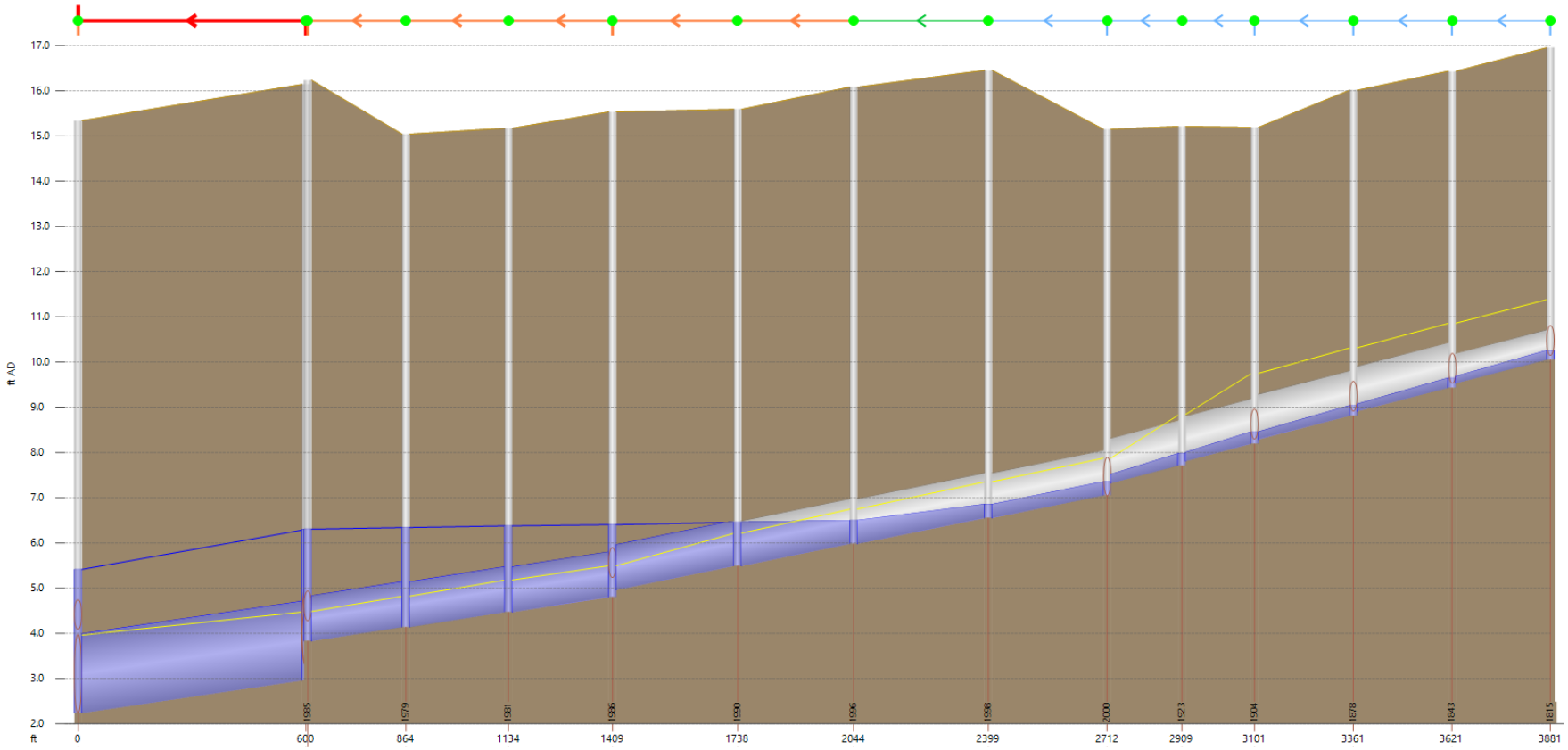
Gravity CIP Project: HB_09
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **3/18/2024**

FIGURE F.30

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure F.26_Duo Project HB_09.mxd
Print date: 25 Mar 2024 - 07:59

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	KNT0080-0255.1		1979.1	1981.1	1986.1	1990.1	1996.1	1998.1	2000.1	1923.1	1904.1	1878.1	1843.1	1815.1	
Design group	21		12	12	12	10	10	10	10	8	8	8	8	8	
width (in)	21.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	8.0	
pfc (MGD)	3.55		0.80	0.81	0.80	0.57	0.57	0.57	0.57	0.35	0.35	0.35	0.35	0.35	
surc	2.00		1.00	1.00	1.00	1.00	1.00	0.62	0.36	0.40	0.40	0.34	0.32	0.31	
DS flow (MGD)	3.8800		0.3784	0.3709	0.3182	0.2172	0.1548	0.1530	0.1521	0.1091	0.1081	0.0789	0.0714	0.0637	
DS velocity (ft/s)	2.408		2.146	1.387	1.122	2.166	1.063	1.250	1.313	1.993	1.987	1.790	1.731	1.664	
Node	KNT0080-0250	KNT0080-0255	1985	1979	1981	1986	1990	1996	1998	2000	1923	1904	1878	1843	1815
ground (ft AD)	15.340	16.140	16.230	15.040	15.170	15.530	15.590	16.080	16.450	15.150	15.210	15.190	16.010	16.430	16.950

Figure F.31 Gravity Sewer CIP Project HB_09: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

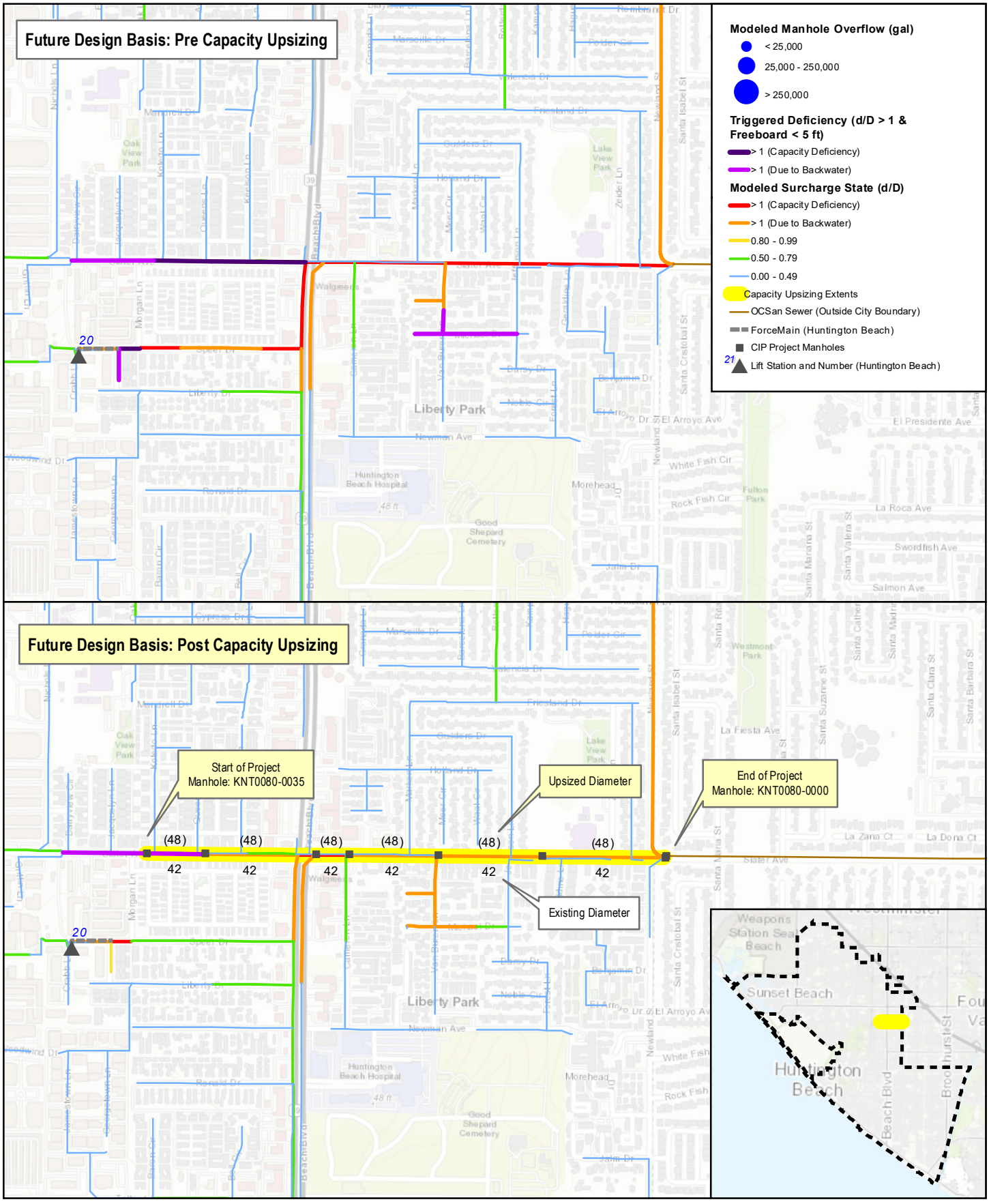
Project OC_03: Slater Ave Sewer Improvement (Conditional)

Project Description	
Project ID	OC_03
Project Name	Slater Ave Sewer Improvement
Project Location	From intersection of Slater Ave and Koledo Ln to intersection of Slater Ave and Newland St
Description	Upsize 3,975 feet of 42-inch sewer to 48-inch
Tributary Area Details	
Tributary Pipe Length (ft)	1,007,685
Peak WWF (MGD)	21.50
SSOs Upstream	Yes
Eliminates Upstream	Yes
Project Pipe Details	
Count of Project Pipe	8
Maximum Diameter in Project	48
Total Baseline Project Length	3,975
Estimated Capital Improvement Cost	$10,058,000
Quartile Score (Priority Score)	22
Executable Rank (1-16)	16
Phase (1 of 5)	5
Assumptions	Cost estimates are based on real Huntington Beach construction project bids from 2023
Alternatives	Conditional project dependent on upstream project success

Project Cost Detail

US MH ID	DS MH ID	Asset ID	Exist Diam (inches)	Prop Diam (inches)	Length (ft)	Slope (%)	Pipe Depth (ft)	Construction Method	Unit Cost ($/LF)	Total Cost ($)
KNT0080-0035	KNT0080-0030	KNT0080-0030:KNT0080-0035	42	48	440	0.07	9.5	Open Cut	1,072	$472,000
KNT0080-0030	KNT0080-0025	KNT0080-0025:KNT0080-0030	42	48	723	0.07	12.1	Open Cut	1,072	$775,000
KNT0080-0025	KNT0080-0023	KNT0080-0020:KNT0080-0025	42	48	131	0.06	14.1	Open Cut	1,072	$141,000
KNT0080-0023	KNT0080-0020	KNT0080-0020:KNT0080-0025	42	48	251	0.06	14.2	Open Cut	1,072	$270,000
KNT0080-0020	KNT0080-0015	KNT0080-0015:KNT0080-0020	42	48	682	0.09	13.3	Open Cut	1,072	$731,000
KNT0080-0015	KNT0080-0010	KNT0080-0010:KNT0080-0015	42	48	794	0.07	12.8	Open Cut	1,072	$851,000
KNT0080-0010	KNT0080-0005	KNT0080-0005:KNT0080-0010	42	48	937	0.07	16.3	Open Cut	1,072	$1,004,000
KNT0080-0005	KNT0080-0000	KNT0080-0000:KNT0080-0005	42	48	17	0.59	21.5	Open Cut	1,072	$19,000

Total Baseline Project Length	$	3,975
Total Raw Open Cut Cost	$	4,263,000
Total Manhole and Sewer Remove/Replace Cost (20% of Raw Open Cut Cost)	$	852,000
Total Lateral Replacement Cost (8% of Raw Open Cut Cost)	$	341,000
Total Pre-Construction Survey/Stake/Safety/Env Plan Cost (10% of Raw Open Cut Cost)	$	426,000
Bypass Pumping Cost (2% of Raw Open Cut Cost)	$	86,000
Non-Sewer Remove & Replace (15% of Raw Open Cut Cost)	$	639,000
Traffic Control Cost (6% of Raw Open Cut Cost)	$	256,000
Post Construction CCTV Cost ($8/lf)	$	32,000
Baseline Construction Cost	$	6,895,000
Mobilization/Demobilization (4% of Baseline Construction)	$	276,000
Engineering, Administration, Legal (25% of Baseline Construction)	$	689,000
Construction Management (7% of Baseline Construction)	$	483,000
Contingencies (25% of Construction Cost)	$	1,723,000
Estimated Capital Improvement Cost:	**$**	10,058,000



Paper Size ANSI A

0 250 500 750 1,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: Lambert Conformal Conic

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GHD

City of Huntington Beach
Sewer Master Plan Update

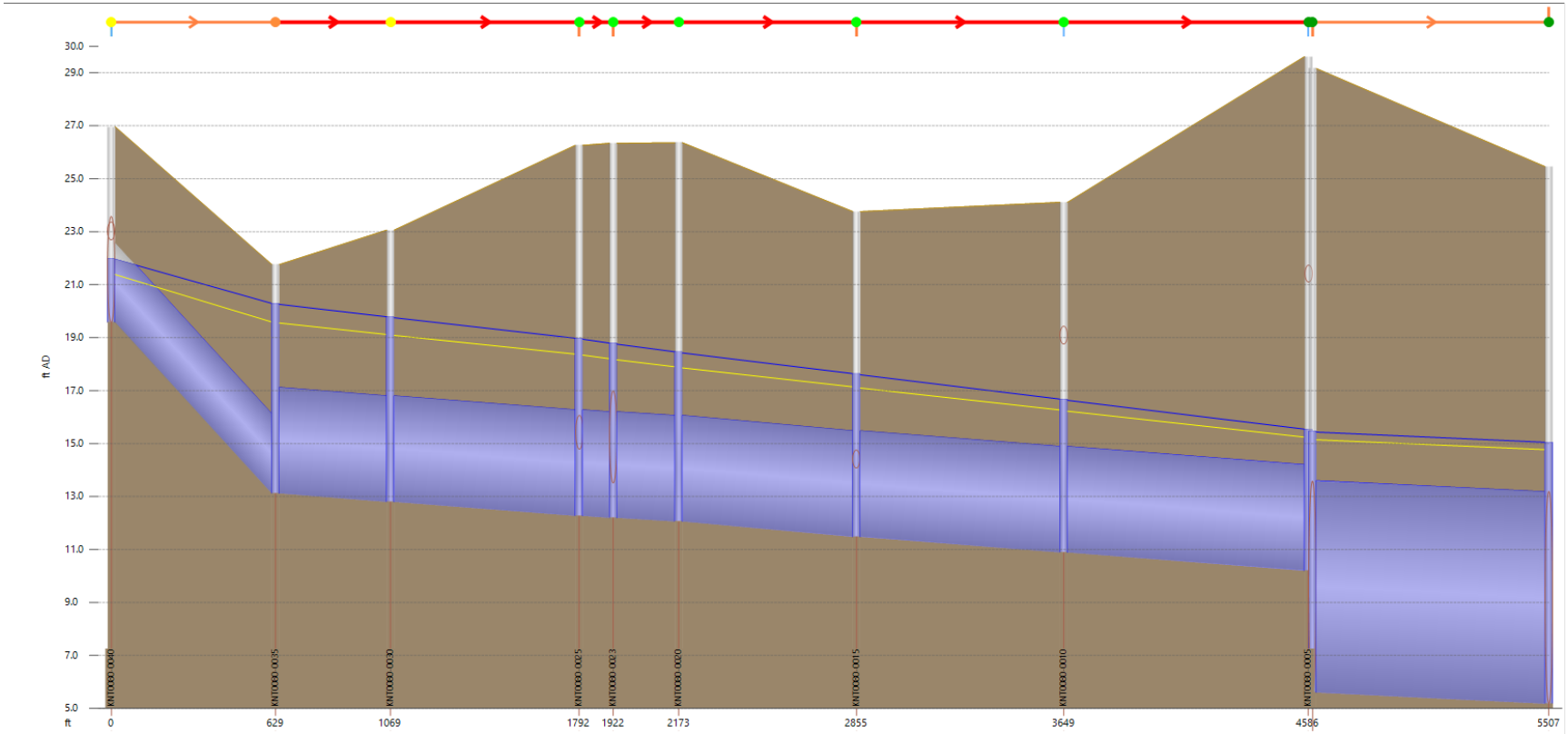
Gravity CIP Project: OC_03
Pre vs Post Capacity Upsizing
Hydraulic Results

Project No. **12585300**
Revision No. **0**
Date **3/18/2024**

FIGURE F.32

N:\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure F.X_Duo Project OC_03.mxd
Print date: 21 Mar 2024 - 09:20

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Created by: tmendonsa



Link	KNT0080-0040.1	KNT0080-0035.1	KNT0080-0030.1	-	-	KNT0080-0020.1	KNT0080-0015.1	KNT0080-0010.1	KNT0080-0000.1
Design group	36	42	42	42	42	42	42	42	96
width (in)	36.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	96.0
pfc (MGD)	43.73	25.04	25.15	21.78	21.77	27.08	25.32	25.20	127.04
surc	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00
DS flow (MGD)	21.8974	21.9041	21.9132	-	23.0226	23.0102	22.9836	23.0264	120.6873
DS velocity (ft/s)	4.518	3.349	3.358	3.472	3.539	3.644	4.052	6.846	4.117

Node	KNT0080-0040	KNT0080-0035	KNT0080-0030	KNT0080-0025	-	KNT0080-0020	KNT0080-0015	KNT0080-0010	KNT0080-0005	KNT0080-0000	KNT0075-0000
ground (ft AD)	26.960	21.760	23.060	26.260	26.339	26.360	23.760	24.110	29.610	29.160	25.460

Figure F.33 Gravity Sewer CIP Project OC_03: Hydraulic Grade Line (HGL) Results from Pre (Yellow HGL) and Post (Blue HGL) Capacity Upsizing Scenarios

Appendix G

Lift Station Assessment Forms

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #1 Parkside
2. Address: 5475 Rivergate Drive (Graham St / Rivergate Dr)
3. Wet Well – Depth 25 Feet

Background Information:

4. Year Built: 2019
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☒Concrete Wet Well/Dry Well (Both Concrete Structures)

☐Steel Dry Well / Concrete Wet Well

☒Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐Other:	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/ Torque Flow	Wemco/ Torque Flow		
Pump Model	4x11 Model CLCESR	4x11 Model CLCESR		
Design Flow (nameplate)	480 gpm	480 gpm		
Design TDH (nameplate)	61 feet	61 feet		
VFD?	No (?)	No (?)		
Motor Horsepower	20 HP/480V	20 HP/480V		
Date Installed	2019	2019		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	Needs Fencing or wall
3. Turnaround provided	☒ Y ☐ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 150KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch (1,616 feet)
34. Material PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☐ None ☒ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☒ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	**N/A shallow**
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	**N/A**

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   Station needs onsite stationary generator and security fencing.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   No access or parking issues

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   NO

4. **Dry Well Assessment. What condition is the Dry Well in?**

   New Condition

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   New Condition

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement**
   6" to 8" New piping no issues

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**
   Running well newer pumps

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   6” discharge to 6” forcemain 6” kennedy check valves 6” DEZURIK . (NEW) no issues

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #2 Humbolt
2. Address: 4076 Humboldt Drive (Humboldt Dr / Wayfarer Ln)
3. Wet Well – Depth 21.27 Feet

Background Information:

4. Year Built: 1964
5. Year of 1st Rehabilitation: N/A
6. Scope of Rehabilitation: N/A
7. Year of 2nd Rehabilitation: N/A
8. Scope of Rehabilitation: N/A
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well ☐Self-Priming

Pumps Above Concrete Wet Well ☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco	Wemco		
Pump Model	3x11 Model CLCESR	3x11 Model CLCESR		
Design Flow (nameplate)	155 gpm	155 gpm		
Design TDH (nameplate)	22.8 feet	22.8 feet		
VFD?	No	No		
Motor Horsepower	3 HP	3 HP		

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

Date Installed	2024	2024		

Criteria		**Comments**
1. Station accessible by boom truck	☒Y ☐N	
2. Security (fences and gates)	☐Y ☒N	
3. Turnaround provided	☐Y ☒N	
4. Bollard protection of critical structures	☐Y ☒N	
5. Drainage Sufficient	☒Y ☐N	
6. Space available for future expansion	☐Y ☒N	

Flow Bypass

19. Back-up Power: ☒None ☐Redundant Power Service ☐Emergency Generator
20. Generator Location: ☐On-Site ☒Portable (quick connect) ☐Portable (not quick connect)
21. Generator Startup: ☐Manual ☐Automatic

Pump Controls

29. Level Sensor: ☐Bubbler ☐Floats ☒Ultrasonic ☐Other _____
30. Level Sensor Redundancy: ☐Y ☐N
31. Pump Start: ☒Constant Speed ☐Variable Speed
32. Operation: ☒Lead/Lag ☐Duty/Standby

    ☐Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 4-inch
34. Material steel/ partial slip line
35. ☐ARV
36. ☐CAV
37. ☐Surge Control System

Other

38. Odor Control Facilities: ☒None ☐Activated Carbon ☐Chemical Addition using _____ ☐ Other_____
39. Hoists: ☐None ☐Monorail ☐Hoist
40. Bar Screen: ☐None ☐Trash Rack (manual clean) ☐Automatic Bar Screen ☐Muffin Monster

41. Flow Meter: ☐None ☐Ultrasonic ☒Mag ☐Other_____

42. Wet Well Isolation: ☒None ☐Sluice Gate Operator ☐Slide Gates ☐Stop Logs

43. Dry Well Sump Pumps: ☒None ☐Single ☐Duplex

44. Wet Well Protection: ☐None ☐Lining ☒Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	**N/A**
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	
Flow Meter		
1. Reliable Output	Y N	**N/A needs one during rehab**
2. Sufficient Straight Run	Y N	**N/A**
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   The Station runs well however the age and location are in need of improvement

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   There is access however the location can be tight at the bridge during maintenance operations

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   There is evidence of settling and some cracking

4. **Dry Well Assessment. What condition is the Dry Well in**

   There is evidence of " Creeping" common to aging concrete in a moist environment.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?** **Polymer Coating is aging and may need to be refurbished however the wet well seems to be in good condition**

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   4" gate valves and 4" kennedy check valves we maintenance them routinely they are aging we replace them when needed

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   The pumps perform well at this location ragging is normal and does not impede flow.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   Piping has had some areas replaced but intakes are old and discharge is old as well probably original to station. Piping is 4 to 6" within station.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #3 Gilbert
2. Lift Station Name: #3 Gilbert Lift Station Name: #3 Gilbert
3.
4. Address: 3332 Gilbert Drive (Gilbert Dr / Peale Ln)
5. Dry Well – Depth 16.25 feet Lift Station Name: #3 Gilbert
6.

Background Information:

7. Year Built: 1970
8. Year of 1st Rehabilitation:
9. Scope of Rehabilitation:
10. Year of 2nd Rehabilitation:
11. Scope of Rehabilitation:
12. Pump Station Type:
    - ☐Submersible
    - ☒Concrete Wet Well/Dry Well
    - ☐Steel Dry Well / Concrete Wet Well
    - ☐Self-Priming Pumps Above Concrete Wet Well
    - ☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	65 gpm	65 gpm		
Design TDH (nameplate)	19 feet	feet		

VFD?	No	No		
Motor Horsepower	2 HP/240V	2 HP/240V		
Date Installed	1971	1971		

Criteria		**Comments**
1. Station accessible by boom truck	☐ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☐ Y ☒ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70 KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☒ Ultrasonic ☐ Other _____
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☐ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby

    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 4-inch (242 feet)
34. Material Cast Iron
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System
38. **Other**
39. **Other**
40. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____

    ☐ Other_____

41. Hoists: ☐ None ☐ Monorail ☐ Hoist
42. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
43. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
44. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs
45. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex
46. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		Comments
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	**Handheld personal monitor**
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	**No flow meter**
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   The lift station is older but it runs well. It should be rehabilitated because of the age as well as its location next to the Harbor.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   There is access

3. **Structural Assessment. Are there any Structural Issues with the LS?**
   The Concrete is older and some corrosion is occurring.

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Concrete is aging and getting porous.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   The wet well is lined with epoxy sprayed in liner it will need to be rehabbed for preventative maintenance purposes.

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   4" kennedy check valves we maintain them every other month or when clogging occours.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   The pumps are operation and perform as they should however they are older model less efficient pumps.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   4" gate Valve/ check valves "4" discharge to force main. Approximately 53yrs old. Check valves are maintained every other month. The ragging is minimal at this location.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #4 Station A
2. Address: 16702 PCH (PCH / 17th St (Sunset Beach)
3. Wet Well – Depth 32.63 feet

Background Information:

4. Year Built: 2007
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐Other:	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	Gpm 335	Gpm 335		
Design TDH (nameplate)	Feet 24	Feet 24		
VFD?	No	No		
Motor Horsepower	50HP/480V	50 HP/480V		
Date Installed	2008	2008		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☐ Y ☐ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☐ Y ☒ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70 KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☐ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 8-inch 2,150 feet
34. Material HDP
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☐ None ☒ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☒ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	**Bypass piping needs replacement**
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   Station works well will need bypass pipes and valve replaced and pump maintenance.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**

   There is street access to lift station

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   No major defects detected at this time.

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Dry well is subject to salt environment at this time it looks fair.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**

   Wet well is in fair condition epoxy spray coating was applied in 2014. Re- habilitation may be needed soon. However, nothing looks bad at this time.

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   Kennedy 8” check valve and 8” AWWA gate Valve. In fair condition at this time replacement will be needed within 3yrs.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   The pumps are running well at this time.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   8” discharge pipes they look good however the discharge gate valve may need to be replaced soon.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #5 Davenport
2. Address: 4012 Davenport Drive (Davenport Dr / Baruna Ln)
3. Wet Well – Depth 19.36 Feet

Background Information:

4. Year Built: 1963
5. Year of 1st Rehabilitation: On going
6. Scope of Rehabilitation: R/R pumps, replace check valves gate vales, coat wet well. "Maintenance"
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☒Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☒Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	106 gpm	106 gpm		
Design TDH (nameplate)	19 feet	feet		
VFD?	No	No		
Motor Horsepower	3 HP U.S electric	3 HP U.S electric		

Date Installed	1963	1963		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☒ Y ☐ N	**Street access**
4. Bollard protection of critical structures	☐ Y ☐ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☐ Y ☒ N	**Park location is better**

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☒ Emergency Generator
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 4 inch stainless steel
34. Material stainless steel/ it was replaced.
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster

41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs
43. Dry Well Sump Pumps: ☒ None ☐ Single ☐ Duplex
44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	**N/A**
2. Separate from drywell	Y N	**N/A**
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	**Needs meter**
2. Sufficient Straight Run	Y N	**Needs Meter**
Piping		
3. Evidence of Corrosion	Y N	**Minor corrosion**
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   The station works well, However because of its age and past problems with force main it is recommended for replacement and relocation to Park area as planned.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   The current location has limited street access but we have made it work.

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   Because of the structures age it is recommended for replacement as scheduled.

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Dry well is in fair condition but aging.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   The wet well is in fair condition a poly urethane spray coating was used.

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**
   4' kennedy check valves and 4' AWWA gate vales. These are replaced using our maintenance crew as needed. There present condition is fair.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**
   The pumps work well they are "Antiquated" they perform well but are less efficient than the newer style pumps.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   4" intakes 4" discharge to 6" force main piping sizes. The age of the piping will require replacement this station is planned for a rebuild.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #6 Edgewater
2. Address: 16903 Edgewater Lane (Davenport Dr / Baruna Ln)
3. Wet Well – 22 Feet Depth

Background Information:

4. Year Built: 2020
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☐Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☒Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐Other:	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	6x11s Model CLCESR	6x11 Model CLCESR		
Design Flow (nameplate)	1000gpm	1000 gpm		
Design TDH (nameplate)	25 feet	25 feet		
VFD?	No	No		
Motor Horsepower	40HP/240V	40HP/240V		
Date Installed	2020	2020		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☒ Y ☐ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☐ Y ☒ N	

Flow Bypass

19. Back-up Power: ☐ None ☐ Redundant Power Service ☒ Emergency Generator (120KW Dual Fuel Natural Gas/LPG Generator)
20. Generator Location: ☒ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☒ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 8-inch (37 Feet)
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☐ None ☒ Activated Carbon ☐ Chemical Addition using _____
    ☒ Other Air Scrubber (Installed 2023)
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☒ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☒ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	**N/A**

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   The lift station is new and runs well

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   No Issues at this time

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   NO

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Excellent Condition

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**

   T Lock liner used wet well is new and in good condition.

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   8" keened swing check valves 8" Dezurik plug/ gate Vales brand new.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   Pumps run as intended and are relatively new.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   This station is new and everything is in working order at this time

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #8 Station C
2. Address: 3819 Warner Ave (Warner Ave / East of PCH)
3. Wet Well – Depth 30 feet

Background Information:

4. Year Built: 2017
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☐Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	6x11s Model E 2-1/2" Model	6x11 Model CLCESR		
Design Flow (nameplate)	1200 gpm	1200 gpm		
Design TDH (nameplate)	25 feet	25feet		
VFD?	No	No		
Motor Horsepower	40 HP/480V	40 HP/480V		
Date Installed	2017	2017		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☒ Y ☐ N	
3. Turnaround provided	☒ Y ☐ N	
4. Bollard protection of critical structures	☒ Y ☐ N	**Re furbishing because of proximity to ocean.**
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☐ None ☐ Redundant Power Service ☒ Emergency Generator
20. Generator Location: ☒ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☒ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☒ Ultrasonic ☐ Other _____
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☐ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby

    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 12-inch (500 Feet)
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____

    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y **N**	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	**Proximity to ocean**
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   The major issues of this lift station are high levels of "H2S" which are known to cause maintenance issues with equipment.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   There needs to be curbs re marked with red paint at station facing west

3. **Structural Assessment. Are there any Structural Issues with the LS?**
   There are no structural issues at this time.

4. **Dry Well Assessment. What condition is the Dry Well in?**

   The dry well is in very good condition at this time.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   Interlocking epoxy coating because of the amount of H2S this well will need to be coated more often. At this time it looks ok.

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**
   12 Kennedy check valves no major issue with any piping at this time.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**
   The pumps perform well

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**
   All the piping and Valves are in good condition.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #10 Algonquin
2. Address: 16729 Algonquin (Algonquin St / Pearce Dr)
3. Wet Well – Depth 26 Feet

Background Information:

4. Year Built: 2019
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐Other:	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Hayward Gordon	Hayward Gordon		
Pump Model	XR6(12)-s 6x8x 12”	XR6(12)-s 6x8x12”		
Design Flow (nameplate)	954 gpm	954 gpm		
Design TDH (nameplate)	46 feet	46 feet		
VFD?	No	No		
Motor Horsepower	40 HP/480V	40 HP/ 480v		
Date Installed	2012 R/R after this date 2017	2012/ R/R		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☒ Y ☐ N	**Street side**
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☐ Y ☒ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 150 KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☐ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 12-inch 1,161 feet
34. Material Ductile Iron
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☐ None ☒ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	**N/A Large open pit**

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   station is in good working order/ However Dry pit vault doors could be changed out to heavy

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   Light smell

3. **Structural Assessment. Are there any Structural Issues with the LS?**

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Good Condition

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
6. **Spray epoxy**
   Fair condition it may need a relining for preventative maintenance at manufactures recommendation

7. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   Piping is in good working order so are the 8" kennedy Check Valves/ 8" USA Plug Valve in good condition at this time.

8. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   Pumps are in good working order but will probably need an R/R within 3yrs approaching life span

9. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   The pipe ranges from 6 to 8" and there is no issues at this time.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #11 Lark
2. Address: 16971 Lark Lane (Lark Ln / Warner Ave)
3. Dry Well – Depth 16.8 feet

Background Information:

4. Year Built: 1969
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	125 gpm	125 gpm		
Design TDH (nameplate)	12 feet	12 feet		
VFD?	No	No		
Motor Horsepower	2 HP/240V	2 HP		
Date Installed	1969	1969		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	Street Side
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70 KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydro Static
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch 135 feet
34. Material Abestos Cement
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☐ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☒ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria			**Comments**
Wet Well Ventilation			
1. Mechanical ventilation provided	No	Y N	
2. Separate from drywell	Yes	Y N	
Drywell Ventilation			
3. Mechanical ventilation provided	Yes	Y N	
4. Gas detection equipment	No	Y N	
5. Ventilation requirements meet NFPA 820	Yes	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   This station works well however the age of the station will require replacement

2. **Lift Station Access. Is there any issues accessing the LS? Parking, surrounding area users, businesses.**

   No Access Issue

3. **Structural Assessment. Are there any Structural Issues with the LS?**
   There is evidence of settling because of station age.

4. **Dry Well Assessment. What condition is the Dry Well in?**
   The wet well will need refurbishment within 3 yrs

5.) **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   Spray in Epoxy Liner

6.) **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**
   4" Check Valves kennedy, 4" USA Gate valves

7.) **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

Pumps Are running well minimal ragging we can rebuild these style pumps.

8.) **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

8” force main, 6” piping and 4” intakes, Gate Valves are 4” and Check valves are 4” piping in station is in fair condition some evidence of corrosion do to age of station most likely. Replacement is recommended within 5yrs or pending future development.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #13 Slater
2. Address: 16971 Lark Lane (Springdale St / Slater Ave)
3. Wet Well

Background Information:

4. Year Built: 2021
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☐Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	65 gpm	185 gpm		
Design TDH (nameplate)	19 feet	feet		
VFD?	No	No		
Motor Horsepower	20 HP/480V	HP		
Date Installed	2021	1963		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☒ Y ☐ N	Onsite Generator
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☐ Y ☒ N	Not required
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☐ None ☐ Redundant Power Service ☒ Emergency Generator (Kohler Power 30 RCL (30kW))
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☐ Other _____
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☐ Constant Speed ☐ Variable Speed
32. Operation: ☐ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 4-inch
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☐ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☐ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☐ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**

3. **Structural Assessment. Are there any Structural Issues with the LS?**

4. **Dry Well Assessment. What condition is the Dry Well in?**

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #14 Ellis
2. Address: 7165 Ellis Ave (Ellis Ave / Ashley Dr)
3. Dry Well – Depth 35.67 feet

Background Information:

4. Year Built: 1963
5. Year of 1st Rehabilitation: 1993
6. Scope of Rehabilitation: Completely redone and relocated
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☐Vertical ☒Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☒Vertical ☒Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow	Wemco	
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR	Wemco	
Design Flow (nameplate)	65 gpm	185 gpm		
Design TDH (nameplate)	19 feet	feet		
VFD?	No	No		
Motor Horsepower	30 HP/480V	HP		
Date Installed	1963	1963		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☒ Y ☐ N	
3. Turnaround provided	☒ Y ☐ N	
4. Bollard protection of critical structures	☒ Y ☐ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70 KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☒ Ultrasonic ☐ Other _____
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby

    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 10-inch, Length 747 Feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____

    ☐ Other_____
39. Hoists: ☐ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	**N/A**
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	**Hand held**
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	**Suction/ Inspection 90. (Minor)**
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   Station has concrete settling above wetwell some cracking and it will need to be rehabilitated in the next 3yrs

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   No

3. **Structural Assessment. Are there any Structural Issues with the LS?**
   Yes the concrete has some cracking above the wet well it looks like settling (I am not an engineer) also the station floor is becoming un-even. Lastly the station wet well will need re coating within the next 3 yrs.

4. **Dry Well Assessment. What condition is the Dry Well in?**
   Some evidence of the floor settling as well as oxidation. This area has a high water table and was former swamp land the soil is soft.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?** **The wet well has a sprayed in liner I believe its epoxy it needs to be redone.**

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   The piping is aging 6" check valves / 8" gate valves the from a maintenance stand point but because of the age a refurbishing assessment should be made.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   These pumps run well they rag up a lot however. Our crew is able to re build these older style pumps

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   Kennedy check valves 6" and AWWA rated Gate vales 8". We replace them as needed. At this the time they are good.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #16 Adams
2. Address: 10221 Adams Ave (Adams Ave West of Ranger Ln)
3. Dry Well – Depth 15.9 feet

Background Information:

4. Year Built: 2012
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	4”x4” Model EVS	4”x4” Model EVS		
Design Flow (nameplate)	325 gpm	325 gpm		
Design TDH (nameplate)	15 feet	15 feet		
VFD?	No	No		
Motor Horsepower	7.5 HP/240V	7.5HP		
Date Installed	2012	2012		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☒ Y ☐ N	
4. Bollard protection of critical structures	☒ Y ☐ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70 KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch, Length 70 feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☒ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		Comments
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   This Station is in good working order and is relatively new. SCADA is working on COMM fail Issues. Verizon has poor reception in that area

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   There Is good access

3. **Structural Assessment. Are there any Structural Issues with the LS?**
   All structures are in good condition

4. **Dry Well Assessment. What condition is the Dry Well in?**
   Good Condition

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   Spray in Epoxy coating was used wet well is in good condition but will need refurbishing for preventive maintenance Refer to lining contractor recommendations

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**
   4" Mueller Check valves 6" dezurik plug/gate valves all in good condition including piping.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**
   Pumps are operational and have little ragging they are running well at this time and perform as intended.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   ” piping, and valves Mueller checks/ Dezurik Plug-Gate valves. All in working order including piping. At this time.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #17 Brookhurst
2. Address: Brookhurst/Effingham Dr.
3. Dry Well – Depth 25.83 feet

Background Information:

4. Year Built: 2007
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	335 gpm	335 gpm		
Design TDH (nameplate)	19 feet	feet		
VFD?	No	No		
Motor Horsepower	30 HP/480V	HP		
Date Installed	2017	1963		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☒ Y ☐ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☐ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70 KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☒ Ultrasonic ☐ Other _____
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby

    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 8-inch, Length 56 feet
34. Material Ductile Iron
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____

    ☐ Other_____
39. Hoists: ☐ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☒ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   This station runs well an on-site generator is recommended

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**

   Access is good parking is good as well.

3. **Structural Assessment. Are there any Structural Issues with the LS?**
   No issues at this time

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Wet well is in good condition re coating is recommended follow applicators recommendations.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**

   Wet well is in good condition at this time it is coated with a spray coat using polyurethane base

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   Piping and valves are in good condition size ranges from 6 to 8”

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   Yes pumps are operational ragging is minimal at this station

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   Kennedy check valves 8” and 8” AWWA Gate valves all in good condition. Replacement is not recommended at this time.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #18 Atlanta
2. Address: 8149 Atlanta Avenue (Atlanta Ave East of Beach Blvd)
3. Wet Well – Depth 19 Feet

Background Information:

4. Year Built: 1969
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☐Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☐Self-Priming ☐Other:	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	300 gpm	300 gpm		
Design TDH (nameplate)	19 feet	feet		
VFD?	No	No		
Motor Horsepower	20 HP/240V	HP		
Date Installed	1963	1963		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☒ Y ☐ N	
3. Turnaround provided	☒ Y ☐ N	
4. Bollard protection of critical structures	☒ Y ☐ N	**Contained inside of walls**
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70KW)
20. Generator Location: ☐ On-Site ☒ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☒ Bubbler ☐ Floats ☒ Ultrasonic ☐ Other _____
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☐ Constant Speed ☒ Variable Speed
32. Operation: ☐ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch, Length 94 feet
34. Material Abestos Cement
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☒ None ☐ Ultrasonic ☐ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	**N/A**
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	**No flow meter**
2. Sufficient Straight Run	Y N	**N/A**
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   This lift stations runs well panels were refurbished, that said the coating will need to be re done and concrete well walls will need to be checked.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   The lift Station has good access.

3. **Structural Assessment. Are there any Structural Issues with the LS?**
   The lift station has no visual structural issues at this time.

4. **Dry Well Assessment. What condition is the Dry Well in?**
   The dry well as no issues at this time.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   The wet well has a polyurethane coating and is in satisfactory condition. However, the structure is old and should have a structural engineer check behind the coating.

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   Kennedy 4" swinging check valves, AWWA 4" Gate valves

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   These pumps are performing well at this time.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   Everything appears to be in good condition. However, the age will require some form of rehabilitation and this station may be on a replacement schedule because of its age?

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #19 Bushard
2. Address: 19802 Bushard Street (Bushard St North of Pettswood Dr)
3. Dry Well – Depth 15.15 Feet

Background Information:

4. Year Built: 1976
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	4”x 4”Model E 2-1/2” Model	4”x$’ Model CLCESR		
Design Flow (nameplate)	330 gpm	330 gpm		
Design TDH (nameplate)	10.1 feet	10.1 feet		
VFD?	No	No		
Motor Horsepower	3HP/240V	HP 3hp, 240v		
Date Installed	1976	1976		

Criteria		Comments
1. Station accessible by boom truck	☐ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☒ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch, Length 85 feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	**Minor**
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   Station runs well will need recoating of wet well within 3to 5yrs for maintenance.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**

   Access is good no issues.

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   Structure visually in good condition

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Dry well will need refurbishment or replacement within 5 to 10yrs as a preventative recommendation.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**

   Spray epoxy liner in wet well will need to be redone within 5 yrs as a preventative measure.

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   This station runs well it has 6" intake piping and 6" discharge all the piping is fair at this time.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   The pumps work well they are older model pumps we R/R/ them as needed,
   Newer pumps are more efficient

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   4" check valves Kennedy, 6" ballcentric Gate valves replaced, 6" discharge piping. Maintenance performed every other month. Station is aging may need to be refurbished within 5, 10 yrs.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #20 Speer
2. Address: 17632 Crabb Lane (Crabb Ln / Speer Dr)
3. Dry Well – Depth 16.99 Feet

Background Information:

4. Year Built: 1968
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	6x6 Model EVP	6x6 Model EVP		
Design Flow (nameplate)	500/300 gpm	500/300 gpm		
Design TDH (nameplate)	14/13 feet	14/13feet		
VFD?	No	No		
Motor Horsepower	15HP/480v	15hp/480v		
Date Installed	1968	1968		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☒ Y ☐ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☒ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 8-inch, Length 195 feet
34. Material Plastic Mortor/ Ductile Iron
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☐ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	**NO FLOW METER**
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   This station runs well for its age and has no issues.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   No Issues
3. **Structural Assessment. Are there any Structural Issues with the LS?**

   Some concrete settling "Minor" visual inspection

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Some settling very minor Visual inspection only

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**

   Spray epoxy liner will need rehab within 3 to 5 yrs

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   6" kenedy Check Valves 6" homestead Gate valves. These have been replaced refer to SMS

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   Pumps get little hours and have been R/R'd we can rebuild with our facilities.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   6" piping and Discharge Valves are 6" may need replacement as part of preventative maintenance within 5Yrs.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #21 McFadden
2. Address: 6832 McFadden Avenue (McFadden Ave / Dawson Ln)
3. Wet Well – Depth 19.36 feet

Background Information:

4. Year Built: 2024
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☐Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☐Vertical ☐Dry ☐Centrifugal ☒Submersible ☐Self-Priming ☐Other:	☐Vertical ☐Dry ☐Centrifugal ☒Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	185 gpm/ UNDER CONSTRUCTION	185 gpm/ UNDER CONSTRUCTION		
Design TDH (nameplate)	19 feet	feet		
VFD?	No	No		
Motor Horsepower	HP	HP		

Date Installed	2024	2024		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☒ Y ☐ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☐ Y ☒ N	Not Required
5. Drainage Sufficient	☐ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☐ None ☐ Redundant Power Service ☒ Emergency Generator (NOTES: Kohler KG 45 Generator Set)
20. Generator Location: ☒ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☒ Automatic

Pump Controls

29. Level Sensor: ☒ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby

    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch, Length 90 feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☐ None ☐ Activated Carbon ☐ Chemical Addition using _____

    ☐ Other_____
39. Hoists: ☐ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster

41. Flow Meter: ☐ None ☐ Ultrasonic ☐ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs
43. Dry Well Sump Pumps: ☐ None ☒ Single ☐ Duplex
44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	**NO METER**
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	**UNDER CONSTRUCTION**
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   UNDER CONSTRUCTION

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**

   UNDER CONSTRUCTION

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   UNDER CONSTRUCTION

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Evidence of settling

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   Spray Liner Epoxy will need replacement

Spray epoxy Coating UNDER CONSTRUCTION

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   Under Construction currently has 6" gate valves 6" kennedy Check Valves

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   Running well we have the facilities to R/R if needed.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   6" piping all in satisfactory condition "UNDER CONDSTRUCTION"

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #22 Saybrook
2. Address: 16451 Saybrook Lane (Saybrook Ln / Heil Ave)
3. Wet Well – Depth 21.58 feet

Background Information:

4. Year Built: 2022
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐Other:	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☒Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	6x11s" Model E CLCER	6x11" Model CLCESR		
Design Flow (nameplate)	750 gpm	750 gpm		
Design TDH (nameplate)	20 feet	20 feet		
VFD?	No	No		
Motor Horsepower	15 HP	15HP		
Date Installed	2022	2022		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	Street Side Large area
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☐ None ☐ Redundant Power Service ☒ Emergency Generator (NOTES: Kohler Power 125REZGC (125 kW))
20. Generator Location: ☒ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☒ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☒ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 8-inch, Length 196 Feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☒ Other Anticipate "Odor Scrubber Install"
39. Hoists: ☐ None ☒ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	**Shallow open Vault**
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	**N/A**

Flow Meter		
1. Reliable Output	Y N	**SCADA Crew repairing on Computer**
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   New Station "ODOR scrubber" recommended

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   Access Is good

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   New station in great condition

4. **Dry Well Assessment. What condition is the Dry Well in?**

   New great Condition

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**

   T Lock liner used great condition its new.

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   6" Kennedy clow chek valve, 6" dezurik Hate Valve 6" piping to 8" ALL IN NEW CONDITION

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   Pumps are new and working great no major issues at this time.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**
   6" Check valves Kennedy clow, 6" gate valves Dezurik brand new.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #23 New Britain
2. Address:
3. Dry Well – Depth 15.3 feet

Background Information:

4. Year Built: 1972
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	4x9" EVP model	4x9" EVP model		
Design Flow (nameplate)	179 gpm	179 gpm		
Design TDH (nameplate)	11.1 feet	11.1 feet		
VFD?	No	No		
Motor Horsepower	5HP/240V	5hp HP		
Date Installed	72, R/R by crew numerous times	72, R/R by Crew Numerous times		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	Street Side
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☒ Emergency Generator
20. Generator Location: ☒ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☒ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☒ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☐ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch, Length 112 Feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____

- Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

42. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

43. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	**NO METER**
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	**Concrete water intrusion "Ground"**
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   Station works well but structure is aging evidence of corrosion with concrete.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   Access is good

3. **Structural Assessment. Are there any Structural Issues with the LS?**
   Concrete is becoming porous some groundwater infiltration.

4. **Dry Well Assessment. What condition is the Dry Well in?**
   Porous concrete some minor cracking groundwater infiltration.

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   Spray epoxy liner will need rehab of entire wet well within 2yrs estimated because of age.
6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   6" piping 6 to 4" valves. USA 6" plug valves, 6" Kennedy Check Valves. We replaced them within the last 5yrs check "SMS" system. Piping is aging and will need to be replaced

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   Pumps are working good we have the facilities to R/R/ in house.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   All Valves 4" gate and 4" check valves have been replaced within the last 5yrs. Discharge 6" will need rehab shortly this station runs well but will need to be updated.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #24 Edwards
2. Address: 6470 Balmoral Drive (Balmoral Dr / Edwards St)
3. Dry Well – Depth 18.5 feet

Background Information:

4. Year Built: 1963
5. Year of 1st Rehabilitation: 2013
6. Scope of Rehabilitation: Completely replaced
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☐Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	920/940 gpm	920/940 gpm		
Design TDH (nameplate)	19 feet	Feet 19		
VFD?	No	No		
Motor Horsepower	HP	HP		
Date Installed	2013	2013		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	N/A
3. Turnaround provided	☐ Y ☒ N	Not needed here
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☐ Y ☒ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☒ Floats ☒ Ultrasonic ☐ Other hydrostatic sensors
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 8-inc, Length 2,177 feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☐ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☒ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   This station will need motor/ pump replacements or Rebuilds as well as wet well relining

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**

   No

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   No

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Good

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?** **The wet well is coated with epoxy the condition is fair. (recommend to coat within the next 2/3 yrs) Preventative maintenance.**

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

   The piping is good at this time but will need epoxy coating reapplied within next 2 yrs

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**
   The pumps are performing well and performing at optimum capacity. However, they are at an age where problems may start. 5 to 13 yrs is a typical life span for a sewage pump.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   The check valves and gate valves 8" will need to re-placed within the next 3yrs.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #25 Edinger
2. Address: 4062 Edinger Avenue (Edinger Ave / Santa Barbara Ln)
3. Dry Well – Depth 24 Feet

Background Information:

4. Year Built: 2008
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	Model E 4x11" ev Model	4x 11" ev Model CLCESR		
Design Flow (nameplate)	220/360 gpm	220/ 360 gpm		
Design TDH (nameplate)	25 feet	25 feet		
VFD?	No	No		
Motor Horsepower	15HP/480V	HP		
Date Installed	1963	1963		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	**Minimal**

Flow Bypass (No ByPass Pumping)

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☒ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch, Length 55 Feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☐ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☒ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria		Comments
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   The station works well minimal problems, only tide influx from street level "King Tide".

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   No Issues

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   Good condition

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Good Condition

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   Sprayed epoxy liner will need to be refurbished 3to 5yrs preventative Maintenance.
   Wet well is in good condition.

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**
   6" gate plug/Valve USA(AWWA) 6" Kennedy check Valves. 6" piping within station.
   Replacement is not needed at this time. Within 5 to 10 yrs estimation preventative Maint.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   The pumps are in good working order average ragging may need to be replaced within 3yrs manufacturer's recommendations.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   No issues with 6" valves or discharge piping at this time.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #26 Brighton
2. Address: 5681 Brighton Drive (Brighton Dr / Shoreham Ln)
3. Dry Well – Depth 18 Feet

Background Information:

4. Year Built: 2010
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Baldor Reliance Motor	Baldor Reliance Motor		
Pump Model	RPM 1166	RPM 1166		
Design Flow (nameplate)	185gpm	185 gpm		
Design TDH (nameplate)	19 feet	feet		
VFD?	No	No		
Motor Horsepower	7.5HP/240V	HP7.5/240V		
Date Installed	2010	2010		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☒ N	

Flow Bypass (Use Bypass Pumping)

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70KW)
20. Generator Location: ☐ On-Site ☒ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☒ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☐ Other __Transducer
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☐ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby

    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch, Length 897 feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____

    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☒ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☒ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)** **Station is a good running station very low maintenance pumps have been replaced only once in the 13 years that the stations has been operating.**

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.** **Station has good access and lots of parking.**

3. **Structural Assessment. Are there any Structural Issues with the LS?**
No station in great condition.

4. **Dry Well Assessment. What condition is the Dry Well in?** **It is in good condition.**

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?** **Wet well it's in good shape it's coated with epoxy coating.**

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

Piping is still good condition we have replaced both check valves once.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

Pumps have been running great we have replaced both pumps once in the last 13 years.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

We clean check valves every 2 months and wet well every 6 months.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #28 Coral Cay
2. Address: 17302 Coral Cay Lane (Coral Cay Dr / Bluewater Ln)
3. Wet Well – Depth 18 Feet

Background Information:

4. Year Built: 2010
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☐Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☒Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☐Self-Priming ☐Other:	☒Vertical ☐Dry ☒Centrifugal ☒Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	KSB	KSB		
Pump Model	KRTF 6x6" 80-200424xg	KRTF6x6" 80-200424xg		
Design Flow (nameplate)	87 gpm, design flow	87 gpm design flow		
Design TDH (nameplate)	24 feet	24 feet		
VFD?	No	No		
Motor Horsepower	2.0HP/240V	2.0 HP		
Date Installed	2010	2010		

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☒ Y ☐ N	**Dead End**
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70 KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☒ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 4-inch, Length 70 Feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☐ None ☒ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other Not Needed at this site no odor issues at all.
39. Hoists: ☐ None ☒ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☒ None ☐ Ultrasonic ☐ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	**Shallow not needed**
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	**N/A**

Flow Meter		
1. Reliable Output	Y N	**No Meter**
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	**Minor rust**
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   This station operates well.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   No Issues

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   The station is structurally sound upon visual inspection at this time.

4. **Dry Well Assessment. What condition is the Dry Well in?**
   Good Condition just no drainage or sump pump to wet well

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**

   Wet well is in good condition Spray epoxy was used

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**
   4" kennedy check valves 4" USA Gate/ Plug valves. No issues at this time.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   The pumps are working well at this time.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   4" check valves, 4" gate valves no need to take out every other month maintenance program.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #29 Trinidad
2. Address: 16249 Trinidad Ln (Trinidad Ln / Aquarius Dr)
3. Wet Well – Depth 20 Feet

Background Information:

4. Year Built: 2016
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☐Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☒Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☒Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	4x11s Model E Model	4x11 Model CLCESR		
Design Flow (nameplate)	250 gpm	250 gpm		
Design TDH (nameplate)	44 feet	44 feet		
VFD?	No	No		
Motor Horsepower	10HP/480V	HP		
Date Installed				

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☐ None ☐ Redundant Power Service ☒ Emergency Generator
20. Generator Location: ☒ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☒ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☐ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 4-inch, Length 631
34. Material Stainless Steel
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☐ None ☒ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☒ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	**Open Pit not needed**
4. Gas detection equipment	Y N	
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**

   The station is new and runs great.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   No Issues

3. **Structural Assessment. Are there any Structural Issues with the LS?**

   No Issues

4. **Dry Well Assessment. What condition is the Dry Well in?**

   Newer dry well good condition

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   T lock liner good condition

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement**
   New 4" force main PVC, 6" internal piping 4" dezurik Plug valves, 4"

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   Pumps are newer models running well little to no ragging.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   4” Dezurik Check valves/ Dezurik Plug valves. In good condition relatively new

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #30 Boeing
2. Address: Boeing – 14700 Bolsa Chica Street (Bolsa Chica St / Skylab Rd)
3. Wet Well – Depth 22.88 Feet

Background Information:

4. Year Built: 2006
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☐Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☒Dry ☒Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	6x11s Model E CLCESR Model	6x11 Model CLCESR		
Design Flow (nameplate)	200/ 166 gpm	200/166 gpm		
Design TDH (nameplate)	16 feet	16 feet		
VFD?	No	No		
Motor Horsepower	3HP/480V	3HP		
Date Installed	2004	2004		

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☐ Y ☒ N	
3. Turnaround provided	☒ Y ☐ N	
4. Bollard protection of critical structures	☐ Y ☒ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☒ None ☐ Redundant Power Service ☐ Emergency Generator (NOTES: Generator Size Required – 70 KW)
20. Generator Location: ☐ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☒ Floats ☐ Ultrasonic ☒ Other Hydrostatic
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☒ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 6-inch, Length 1,555 Feet
34. Material HDP
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☒ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☒ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☒ Coating

Criteria			**Comments**
Wet Well Ventilation			
1. Mechanical ventilation provided		Y N	
2. Separate from drywell		Y N	
Drywell Ventilation			
3. Mechanical ventilation provided		Y N	
4. Gas detection equipment		Y N	
5. Ventilation requirements meet NFPA 820		Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   The station runs well because of the industrial discharge we may need to investigate newer pumps in the future. (Dry Pit Submersible Style)

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses.**
   The surrounding development is under construction we have a wee problem will need a new parking area poured concrete; asphalt, or other suggested foundation

3. **Structural Assessment. Are there any Structural Issues with the LS?**
   The above grade area needs a new foundation pad for parking.

4. **Dry Well Assessment. What condition is the Dry Well in?**
   Good condition

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used?**
   Spray epoxy liner was used the well is in good condition but a refurbishment will be needed within 3 to 5yrs as a preventive measure (recommended)

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?**

6” risiliant Check valves/ 6” AWWA USA gate valves piping veries from 6” to 8” in good condition

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

   The pumps perform as intended, the nature of industrial discharge may require an upgrade because of the increase of maintenance costs?

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

   The piping and valves will need to be replaced within 5 to 10 yrs “Preventative maintenance”

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #31 Brightwater
2. Address: 17413 Oakbluffs Lane (Oakbluffs Ln / Brightwater Dr)
3. Wet Well – Depth 26.85 feet

Background Information:

4. Year Built: 2013
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

☒Submersible

☐Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Wemco/Torque-Flow	Wemco/Torque-Flow		
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	65 gpm	185 gpm		
Design TDH (nameplate)	19 feet	feet		
VFD?	No	No		
Motor Horsepower	10HP/480V	HP		
Date Installed				

Criteria		Comments
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☒ Y ☐ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☒ Y ☐ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☒ Y ☐ N	

Flow Bypass

19. Back-up Power: ☐ None ☐ Redundant Power Service ☒ Emergency Generator
20. Generator Location: ☒ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☐ Other Transducer
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☐ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby

    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 4-inch, Length 102 Feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____

    ☐ Other_____
39. Hoists: ☒ None ☐ Monorail ☐ Hoist
40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☒ Mag ☐ Other_____
42. Wet Well Isolation: ☒ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs

43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex

44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	**Operators carry gas detectors**
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
This station has been a low maintenance station.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users,**
businesses. Good access for service trucks.

3. **Structural Assessment. Are there any Structural Issues with the LS? NO**

4. **Dry Well Assessment. What condition is the Dry Well in? No dry station.**

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of liner is used? Wet well still good condition Epoxy coating.**

6. **Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement? Have**

replaced motors once in 2020 and the other in 2021.

7. **Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?**

Pumps lasted between 8 and 9 years.

8. **Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?**

Piping and valves still good. We clean check valves every 2 months.

City of Huntington Beach Sewer Master Plan Update
Lift Station Desktop Assessment

1. Lift Station Name: #32 Station D
2. Address: 4410 Brightwater Dr (Brightwater Dr / Warner Ave)
3. Dry Well

Background Information:

4. Year Built: 2013
5. Year of 1st Rehabilitation:
6. Scope of Rehabilitation:
7. Year of 2nd Rehabilitation:
8. Scope of Rehabilitation:
9. Pump Station Type:

Submersible

☒Concrete Wet Well/Dry Well

☐Steel Dry Well / Concrete Wet Well

☐Self-Priming Pumps Above Concrete Wet Well

☐Other:

Pump Equipment

	Pump 1	Pump 2	Pump 3	Pump 4
Pump Type	☒Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐Other:	☒Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☒Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____	☐Vertical ☐Dry ☐Centrifugal ☐Submersible ☐Self-Priming ☐ Other_____
Pump Manufacturer	Hidrostal	Hidrostal	Hidrostal	
Pump Model	2x11s Model E 2-1/2" Model	3x11 Model CLCESR		
Design Flow (nameplate)	65 gpm	185 gpm		
Design TDH (nameplate)	19 feet	feet		
VFD?	No	No	No	
Motor Horsepower	32.2HP/480V	32.2HP	32.2 HP	

Date Installed				

Criteria		**Comments**
1. Station accessible by boom truck	☒ Y ☐ N	
2. Security (fences and gates)	☒ Y ☐ N	
3. Turnaround provided	☐ Y ☒ N	
4. Bollard protection of critical structures	☒ Y ☐ N	
5. Drainage Sufficient	☒ Y ☐ N	
6. Space available for future expansion	☐ Y ☒ N	

Flow Bypass

19. Back-up Power: ☐ None ☐ Redundant Power Service ☒ Emergency Generator (120K Dual Fuel Natural Gas/LPG Generator
20. Generator Location: ☒ On-Site ☐ Portable (quick connect) ☐ Portable (not quick connect)
21. Generator Startup: ☐ Manual ☐ Automatic

Pump Controls

29. Level Sensor: ☐ Bubbler ☐ Floats ☐ Ultrasonic ☒ Other _Tranduser_____
30. Level Sensor Redundancy: ☒ Y ☐ N
31. Pump Start: ☐ Constant Speed ☐ Variable Speed
32. Operation: ☒ Lead/Lag ☐ Duty/Standby
    ☐ Other Alternate pump control in addition to Lead/Lag _____

Force Main

33. Diameter (in.) 14-inch, Length 415 feet
34. Material C900 DR14 PVC
35. ☐ ARV
36. ☐ CAV
37. ☐ Surge Control System

Other

38. Odor Control Facilities: ☒ None ☐ Activated Carbon ☐ Chemical Addition using _____
    ☐ Other_____
39. Hoists: ☐ None ☐ Monorail ☒ Hoist

40. Bar Screen: ☐ None ☐ Trash Rack (manual clean) ☐ Automatic Bar Screen ☐ Muffin Monster
41. Flow Meter: ☐ None ☐ Ultrasonic ☐ Mag ☐ Other_____
42. Wet Well Isolation: ☐ None ☐ Sluice Gate Operator ☐ Slide Gates ☐ Stop Logs
43. Dry Well Sump Pumps: ☐ None ☐ Single ☐ Duplex
44. Wet Well Protection: ☐ None ☐ Lining ☐ Coating

Criteria		**Comments**
Wet Well Ventilation		
1. Mechanical ventilation provided	Y N	
2. Separate from drywell	Y N	
Drywell Ventilation		
3. Mechanical ventilation provided	Y N	
4. Gas detection equipment	Y N	**Operators carry gas detectors.**
5. Ventilation requirements meet NFPA 820	Y N	

Flow Meter		
1. Reliable Output	Y N	
2. Sufficient Straight Run	Y N	
Piping		
3. Evidence of Corrosion	Y N	
4. Evidence of leaks	Y N	
5. Hydraulic transient effects	Y N	

Qualitative Assessment

1. **General Discussion with Operations Staff (how is the lift station to operate, major issues, etc)**
   Station is in good working order the Hidrostal pumps are lasting about 8 years. We have replaced all three pumps and they are $ 46,000.00.

2. **Lift Station Access. I there any issues accessing the LS? Parking, surrounding area users, businesses. Good station access lots of parking space.**

3. **Structural Assessment. Are there any Structural Issues with the LS? NO**

4. **Dry Well Assessment. What condition is the Dry Well in? Very good no leaks.**

5. **Wet Well Assessment. What condition is the Wet Well in? is the Wet Well lined? What type of**

liner is used? Well has the T lock liner still in good condition.

6. Piping and Valves: Section. Size, type, maintenance schedule, issues, age, Replacement?
   All piping in good condition. We have replaced check valves/gate valves and pumps but overall station is in good working order right now.

7. Pump Assessment. Is the pump operational? How does it perform (overheating, ragging etc.)?
   Hidrostals have been great pumps they been lasting between 8 to 10 years.

8. Piping and Valves: Discharge. Size, type, maintenance schedule, issues, age, Replacement?
   We clean check valves every month at this station.

Appendix H

Lift Station CIP Project Details

#1 Parkside

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Site Improvements					
There is no security fencing protecting the site	Install new security fencing or wall fully around site	LF	200	$ 300	$ 60,000
				Subtotal	**$ 60,000**
Electrical Improvements					
No backup generator present on-site. An emergency generator is recommended in case of power outages in the future.	Install 150 KW on-site stationary generator	LS	1	$ 250,000	$ 250,000
				Subtotal	**$ 250,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 16,000
				Subtotal	**$ 26,000**

All Improvements Subtotal	**$ 336,000**
Indirect Costs (25%)	$ 84,000
Contingency (30%)	$ 100,800
Total Improvements Cost	**$ 521,000**

#2 Humboldt

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Complete station replacement					$ 4,933,000

Total Improvements Cost **$ 4,933,000**

#3 Gilbert

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Complete station replacement					$ 4,350,000
				Subtotal	**$ 4,350,000**

Total Improvements Cost	**$ 4,350,000**

#4 Station A

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
There is street access to the lift station	Install fence barrier or wall to limit public access.	LF	50	$ 300	$ 15,000
Epoxy coating needs to be reapplied	Apply epoxy coating for the wet well within 3 years	SF	900	$ 30	$ 27,000
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 57,000**
Mechanical Improvements					
Bypass piping and valves need replacement	Remove existing 8" piping and install new bypass 8" piping	LF	50	$ 350	$ 17,500
Kennedy check valve and AWWA Gate Valve will need to be replaced within 3 years	Possibly replace 8" valves during this rehabilitation	EA	2	$ 15,000	$ 30,000
Discharge gate valve may need to be replaced soon	Replace 8" gate valve	EA	1	$ 15,000	$ 15,000
				Subtotal	**$ 63,000**
Electrical Improvements					
				Subtotal	**$ -**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 6,000
				Subtotal	**$ 16,000**

All Improvements Subtotal	**$ 136,000**
Indirect Costs (25%)	$ 34,000
Contingency (30%)	$ 40,800
Total Improvements Cost	**$ 211,000**

#5 Davenport

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Complete Station Replacement					$ 4,500,000
				Subtotal	**$ 4,500,000**

Total Improvements Cost	**$ 4,500,000**

#6 Edgewater

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 15,000**
Mechanical Improvements					
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 5,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 5,000	$ 5,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 1,000
				Subtotal	**$ 6,000**

All Improvements Subtotal	**$ 26,000**
Indirect Costs (25%)	$ 6,500
Contingency (30%)	$ 7,800
Total Improvements Cost	**$ 41,000**

#8 Station C

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Site Improvements					
				Subtotal	**$ -**
Structural Improvements					
Epoxy coating should be repaired	Remove and replace epoxy coating in wet well.	SF	700	$ 30	$ 21,000
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 36,000**
Mechanical Improvements					
Valves and pipeline are aging	Replace valves and piping within 3-5 years.	LS	1	$ 150,000	$ 150,000
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 200	$ 2,000
				Subtotal	**$ 152,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 9,000
				Subtotal	**$ 19,000**

All Improvements Subtotal	**$ 207,000**
Indirect Costs (25%)	$ 51,750
Contingency (30%)	$ 62,100
Total Improvements Cost	**$ 321,000**

#10 Algonquin

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Site Improvements					
				Subtotal	**$ -**
Structural Improvements					
Dry pit vault doors are very heavy	Replace doors with lighter alternative.	EA	1	$ 60,000	$ 60,000
Reline wet well for preventative maintenance	Spray epoxy	SF	1280	$ 30	$ 38,400
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 114,000**
Mechanical Improvements					
Pumps are working, but are approaching the recommended life span	Replace pumps within 3 years and include a spare	EA	3	$ 250,000	$ 750,000
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 755,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 43,000
				Subtotal	**$ 53,000**

All Improvements Subtotal	**$ 922,000**
Indirect Costs (25%)	$ 230,500
Contingency (30%)	$ 276,600
Total Improvements Cost	**$ 1,430,000**

#11 Lark

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Complete Station Replacement					$ 5,050,000
				Subtotal	**$ 5,050,000**

Total Improvements Cost	**$ 5,050,000**

#13 Slater

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 5,000**

All Improvements Subtotal	**$**	**5,000**
Indirect Costs (25%)	$	1,250
Contingency (30%)	$	1,500
Total Improvements Cost	**$**	**8,000**

#14 Ellis

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Site Improvements					
				Subtotal	**$ -**
Structural Improvements					
Concrete has begun settling above the wetwell and has cracking	Rehabilitate the lift station within 3 years	SF	112	$ 150	$ 16,800
Station floor has become uneven	Rehabilitate the lift station within 3 years	SF	112	$ 150	$ 16,800
Recoat wet well within 3 years	Reapply epoxy spray coating	SF	704	$ 30	$ 21,120
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 70,000**
Mechanical Improvements					
Piping, 6" check valves, and 8" gate valves are aging	Replace pipe and valves within the next 3-5 years	LS	1	$ 100,000	$ 100,000
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 105,000**
Electrical Improvements					
				Subtotal	**$ -**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 9,000
				Subtotal	**$ 19,000**

All Improvements Subtotal	**$ 194,000**
Indirect Costs (25%)	$ 48,500
Contingency (30%)	$ 58,200
Total Improvements Cost	**$ 301,000**

#16 Adams

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Epoxy coating will need to be refurbished for preventative maintenance	Re-spray the Epoxy coating	SF	1200	$ 30	$ 36,000
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 51,000**
Mechanical Improvements					
Dry Pumps are approaching the end of life	Replace pumps within 3-5 years and include a spare	EA	3	$ 100,000	$ 300,000
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 305,000**
Electrical Improvements					
No backup generator present on-site. An emergency generator is recommended in case of power outages in the future.	Install 70 KW on-site stationary generator	LS	1	$ 200,000	$ 200,000
				Subtotal	**$ 200,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 28,000
				Subtotal	**$ 38,000**

All Improvements Subtotal	**$ 594,000**
Indirect Costs (25%)	$ 148,500
Contingency (30%)	$ 178,200
Total Improvements Cost	**$ 921,000**

#17 Brookhurst

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Wet well recoating is recommended using a polyurethane base	Reapply epoxy coating with polyurethane base withing 5-8 years	SF	1136	$ 30	$ 34,080
				Subtotal	**$ 35,000**
Mechanical Improvements					
Dry Pumps are approaching the end of life	Replace pumps within 3-5 years	EA	2	$ 100,000	$ 200,000
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 205,000**
Electrical Improvements					
No backup generator present on-site. An emergency generator is recommended in case of power outages in the future.	Install 70 KW on-site stationary generator	LS	1	$ 250,000	$ 250,000
				Subtotal	**$ 250,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 25,000
				Subtotal	**$ 35,000**

All Improvements Subtotal	**$ 525,000**
Indirect Costs (25%)	$ 131,250
Contingency (30%)	$ 157,500
Total Improvements Cost	**$ 814,000**

#18 Atlanta

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Complete Station Replacement					$ 5,550,000
				Subtotal	**$ 5,550,000**

Total Improvements Cost	**$ 5,550,000**

#19 Bushard

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Complete Station Replacement					$ 4,550,000
				Subtotal	**$ 4,550,000**

Total Improvements Cost	**$ 4,550,000**

#20 Speer

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Complete Station Replacement					$ 4,550,000
				Subtotal	**$ 4,550,000**

Total Improvements Cost	**$ 4,550,000**

#21 McFadden

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Complete Station Replacement					$ 2,732,000
				Subtotal	**$ 2,732,000**

Total Improvements Cost	**$ 2,732,000**

#22 Saybrook

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Odor scrubber needed	Install new Odor scrubber	LS	1	$ 70,000	$ 70,000
				Subtotal	**$ 70,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 5,000	$ 5,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 3,000
				Subtotal	**$ 8,000**

All Improvements Subtotal	**$ 78,000**
Indirect Costs (25%)	$ 19,500
Contingency (30%)	$ 23,400
Total Improvements Cost	**$ 121,000**

#23 New Britain

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Mechanical Improvements					
Complete Station Replacement				.	$ 5,350,000
				Subtotal	**$ 5,350,000**

Total Improvements Cost	**$ 5,350,000**

#24 Edwards

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Wet well epoxy is in fair condition.	Replace epoxy within 2-3 years as preventative maintenance.	SF	750	$ 30	$ 22,500
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 38,000**
Mechanical Improvements					
Motor and pump replacements required due to age.	To be replaced with 8" Balboral pump	EA	1	$ 250,000	$ 250,000
Epoxy coating on the piping needs to be replaced	Replace coating within 2 years	LS	1	$ 5,000	$ 5,000
8" check valves and gate valves to be replaced	Replace valves within 3 years.	EA	4	$ 15,000	$ 60,000
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 320,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 18,000
				Subtotal	**$ 28,000**

All Improvements Subtotal	**$ 386,000**
Indirect Costs (25%)	$ 96,500
Contingency (30%)	$ 115,800
Total Improvements Cost	**$ 599,000**

#25 Edinger

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
Rehabilitate epoxy liner in Wet well	Replace liner within 3-5 years as preventative maintenance	SF	775	$ 30	$ 23,250
				Subtotal	**$ 39,000**
Mechanical Improvements					
Pumps have average ragging and are inefficient due to high modeled flow.	Replace within 3 years and include a spare	EA	3	$ 250,000	$ 750,000
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 200	$ 2,000
				Subtotal	**$ 752,000**
Electrical Improvements					
				Subtotal	**$ -**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 40,000
				Subtotal	**$ 50,000**

All Improvements Subtotal	**$ 841,000**
Indirect Costs (25%)	$ 210,250
Contingency (30%)	$ 252,300
Total Improvements Cost	**$ 1,304,000**

#26 Brighton

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
Wet well epoxy is in fair condition.	Replace epoxy within 2-3 years as preventative maintenance.	SF	850	$ 30	$ 25,500
				Subtotal	**$ 41,000**
Mechanical Improvements					
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 5,000	$ 50,000
				Subtotal	**$ 50,000**
Electrical Improvements					
No backup generator present on-site. An emergency generator is recommended in case of power outages in the future.	Install 70 KW on-site stationary generator	LS	1	$ 200,000	$ 200,000
				Subtotal	**$ 200,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 5,000	$ 5,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 14,000
				Subtotal	**$ 19,000**

All Improvements Subtotal	**$ 310,000**
Indirect Costs (25%)	$ 77,500
Contingency (30%)	$ 93,000
Total Improvements Cost	**$ 481,000**

#28 Coral Cay

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Wet well epoxy is in fair condition.	Replace epoxy within 2-3 years as preventative maintenance.	SF	700	$ 30	$ 21,000
				Subtotal	**$ 21,000**
Mechanical Improvements					
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 5,000**
Electrical Improvements					
				Subtotal	**$ -**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 1,000
				Subtotal	**$ 11,000**

All Improvements Subtotal	**$ 37,000**
Indirect Costs (25%)	$ 9,250
Contingency (30%)	$ 11,100
Total Improvements Cost	**$ 58,000**

#29 Trinidad

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 15,000**
Mechanical Improvements					
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 5,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 5,000	$ 5,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 1,000
				Subtotal	**$ 6,000**

All Improvements Subtotal	**$ 26,000**
Indirect Costs (25%)	$ 6,500
Contingency (30%)	$ 7,800
Total Improvements Cost	**$ 41,000**

#30 Boeing

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Site Improvements					
New parking lot area required	Pour concrete and line new parking area	SF	1700	$ 50	$ 85,000
				Subtotal	**$ 85,000**
Structural Improvements					
Wet well epoxy liner needs refurbishment.	Spray new liner within 3 to 5 years	SF	900	$ 30	$ 27,000
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 42,000**
Mechanical Improvements					
Piping and valves to be replaced for preventative maintenance	Piping and valves to be replaced within 3 to 5 years	LS	1	$ 100,000	$ 100,000
Maintenance costs may increase due to the nature of industrial discharge	Upgrade pumps to address industrial discharge and upsize motors within 3-5 years, include a spare	EA	3	$ 250,000	$ 750,000
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 855,000**
Electrical Improvements					
				Subtotal	**$ -**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 10,000	$ 10,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 49,000
				Subtotal	**$ 59,000**

All Improvements Subtotal	**$ 1,041,000**
Indirect Costs (25%)	$ 260,250
Contingency (30%)	$ 312,300
Total Improvements Cost	**$ 1,614,000**

#31 Brightwater

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 15,000**
Mechanical Improvements					
Pumps are inefficient due to high modeled flow	Perform in-situ pump operation test	HRS	10	$ 500	$ 5,000
				Subtotal	**$ 5,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 5,000	$ 5,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 1,000
				Subtotal	**$ 6,000**

All Improvements Subtotal	**$ 26,000**
Indirect Costs (25%)	$ 6,500
Contingency (30%)	$ 7,800
Total Improvements Cost	**$ 41,000**

#32 Station D

Lift Station Improvement Planning Level Cost Estimate

Component Observation	Improvement Description / Item	Unit	Quantity	Unit Price	Estimate
Structural Improvements					
Fall protection is inadequate	Install fall protection grating at valve vault	LS	1	$ 15,000	$ 15,000
				Subtotal	**$ 15,000**
Mechanical Improvements					
Pump station is system critical to remain in operation.	Install a packaged bypass pump system for redundancy	LS	1	$ 120,000	$ 120,000
				Subtotal	**$ 120,000**
Other Items					
Permits and Inspection Reimbursement	Reimbursement for permit and inspection fees required by governing agencies, including inspection requirements for work at the project site.	Allowance		$ 5,000	$ 5,000
Mobilization / Demobilization	Shall not exceed 5% of bid amount	%	5		$ 7,000
				Subtotal	**$ 12,000**

All Improvements Subtotal	**$ 147,000**
Indirect Costs (25%)	$ 36,750
Contingency (30%)	$ 44,100
Total Improvements Cost	**$ 228,000**



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