City of Huntington Beach, CA

Sewer Master Plan Update

50% Draft Submittal

November 2023

Sewer System Master Plan Update

City of Huntington Beach, CA

Project No. 12585300

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Acronyms and Abbreviations

AC	Asbestos concrete pipe
ADS	ADS Consulting Engineers
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
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
MSL	mean sea level
NT	Near-term
OC San	Orange County Sanitation District
O&M	operations and maintenance
PLP	Pipeline projects

PVC	polyvinylchloride
RDI&I	rainfall-derived inflow and infiltration
RHNA	Residential Housing Needs Analysis
RTK	Rate, time, ration of time to recession
sf	square foot (feet)
SMP	Sewer 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)

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1 Introduction

This chapter provides an overview of the Sewer 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.

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 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 pump stations, and 3 miles of force mains. Wastewater treatment and disposal are provided through the Orange County Sanitation District (OC SAN).

1.2 SMP Objectives and Approach

The Sewer System Master Plan, 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 linear and vertical assets as identified as part of the capacity assessment efforts, specifically for gravity sewers, force mains, and pump stations.

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 pump stations and force mains.
- Build and validate an all-pipes dynamic hydraulic model using City 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 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 SMP 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 (OC SAN) 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 (OC SAN) model and flows, and the City's flow and level sensor monitoring programs for model calibration.

Chapter 6. Hydraulic Capacity Analysis. Conveys the 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 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 assessment on 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 presents future studies and recommendations City may consider over the life of the 10-year CIP.

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 Study 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, 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. **Figure 2.1** displays the limits of the service area used in the SMP.

2.2 Existing Sewers, Pump Stations, and Basins

The existing sanitary sewer system currently consists of gravity sewers, pump stations, and force mains, 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. These facilities lift sewage from low points in the collection system to manholes at higher locations.

Orange County Sanitation District (OC SAN) 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, OC San owns, operates and maintains the majority of the "backbone" wastewater collection trunk pipelines. As such, the City's local system generally discharges to larger OC SAN facilities to convey wastewater to the regional treatment plant. Construction of the City's collection 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 collection 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 majority of the City's gravity sewers are vitrified clay pipe (VCP) with some polyvinylchloride (PVC) and ductile iron pipe (DIP). OC SAN does not have a detailed inventory of physical assets by type and age available currently. **Table 2.1** summarizes the approximate length of pipe for each diameter as a percentage within the City's system.

Table 2.1 Sewer System by Diameter and Length

Diameter (inches)	Length (ft)	Percentage of Entire System
4	3,433	0.2%
6	19,193	1.0%
8	1,598,595	83.2%
10	117,844	6.1%
12	83,479	4.3%
14	439	0.0%
15	62,436	3.2%
16	7,814	0.4%
18	15,119	0.8%
21	3,370	0.2%
24	2,862	0.1%
27	5,349	0.3%
30	1,312	0.1%
36	20	0.0%
Grand Total	1,921,266	100%

Approximately 13% of the pipe in the system was replaced utilizing trenchless rehabilitation since the completion of the 2003 master plan. **Table 2.2** summarizes the length of rehabilitated pipe by diameter.

Table 2.2 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

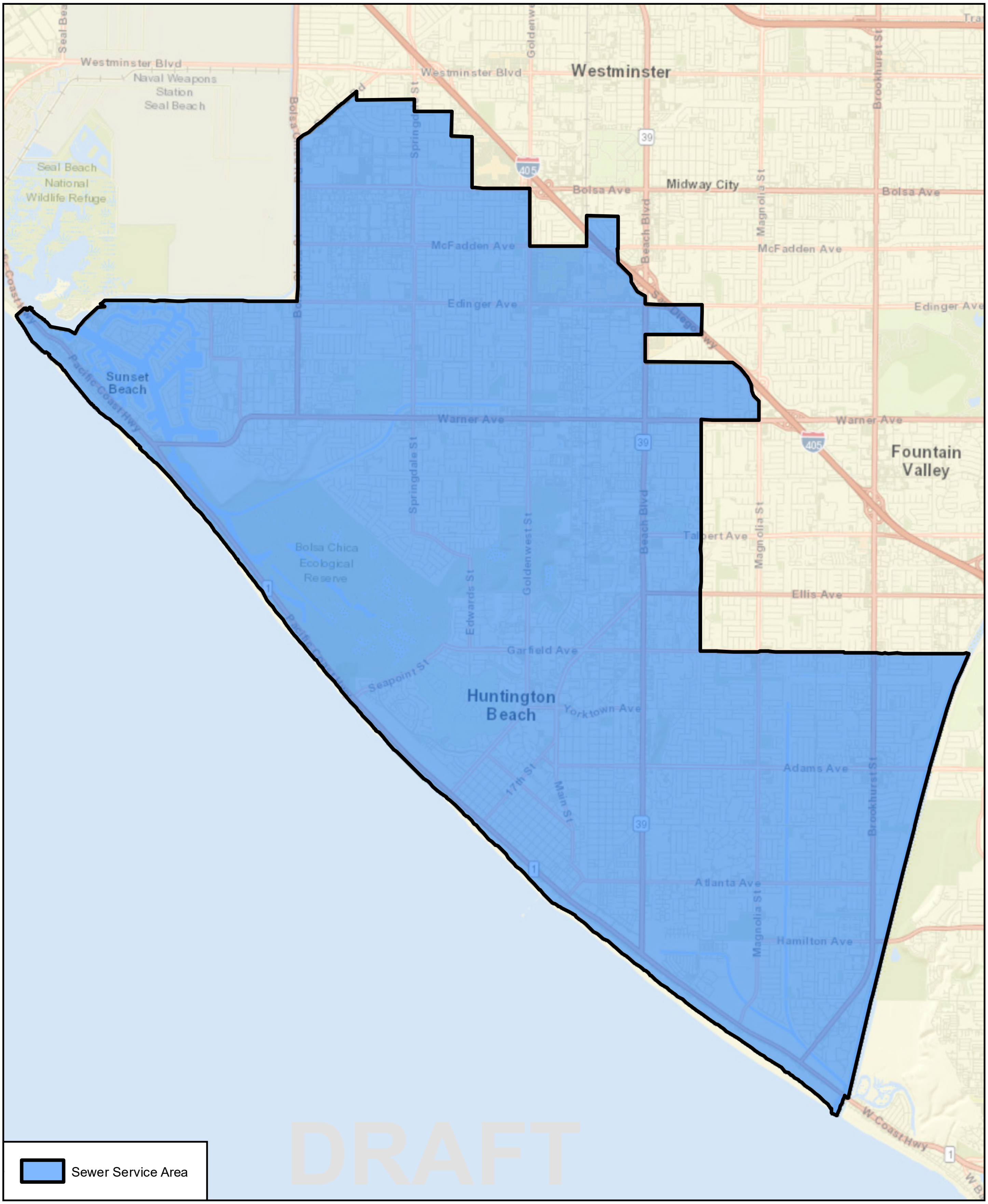
As previously stated, the City also owns and operates twenty-seven lift stations to hydraulically lift flow in low lying area into receiving sewers. **Figure 2.2** shows the location of each lift station and **Table 2.3** provides additional details. The depth of lift stations is based on topographic surface elevation to the invert of the pump station.

Table 2.3 Lift Station Additional Details

City Lift Stations	Name	Address	Depth (ft)	Location	Pumps	Force Main Info
1	Parkside LS	5475 Rivergate Dr.	25	Graham St / Rivergate Dr	2	6" PVC - Approx. 163116 ft
2	Humboldt LS	4076 Humboldt Dr.	21.27	Humboldt Dr / Wayfarer Ln	2	4" SS - Approx. 216 ft
3	Gilbert LS	3332 Gilbert Dr.	16.25	Gilbert Dr / Peale Ln	2	4" CI - Approx. 2412 ft
4	Station "A" LS	16702 PCH	32.63	PCH / 17th St (Sunset Beach)	2	8" HDPE - Approx. 214250 ft
5	Davenport LS	4012 Davenport Dr.	19.36	Davenport Dr / Baruna Ln	2	4" SS - Approx. 227 ft
6	Edgewater LS	16903 Edgewater Ln.	22.00	Edgewater Ln / Davenport Dr	2	8" PVC - Approx. 5537 ft
8	Station "C" LS	3819 Warner Ave.	30.00	Warner Ave / East of PCH	2	12" PVC - Approx. 654500 ft
10	Algonquin LS	16729 Algonquin St.	26.00	Algonquin St / Pearce Dr	2	12" DI - Approx. 1243161 ft
11	Lark LS	16971 Lark Ln.	16.80	Lark Ln / Warner Ave	2	6" AC - Approx. 1345 ft
13	Slater LS	17482 Springdale St.	20.00	Springdale St / Slater Ave	3	4" PVC - Approx. 8390 ft
14	Ellis LS	7165 Ellis Ave.	35.67	Ellis Ave / Ashley Dr	2	10" PVC - Approx. 76547 ft
16	Adams LS	10221 Adams Ave.	15.90	Adams Ave West of Ranger Ln	2	6" PVC - Approx. 710 ft
17	Brookhurst LS	21241 Brookhurst St.	25.83	Brookhurst St / Effingham Dr	2	8" DI -Approx. 56 ft
18	Atlanta LS	8149 Atlanta Ave.	19.00	Atlanta Ave East of Beach Blvd	2	6" AC - Approx. 954 ft
19	Bushard LS	19802 Bushard St.	15.15	Bushard St North of Pettswood Dr	2	6" PVC - Approx. 9485 ft
20	Speer LS	17632 Crabb Ln.	16.99	Crabb Ln / Speer Dr	2	8" PM/DI - Approx. 362195 ft
21	McFadden LS	6832 McFadden Ave.	19.36	McFadden Ave / Dawson Ln	2	6" PVC - Approx. 114590 ft
22	Saybrook LS	16451 Saybrook Ln.	21.58	Saybrook Ln / Heil Ave	2	8" PVC - Approx. 212196 ft
23	New Britain LS	8262 Adams Ave.	15.30	Adams Ave / N. New Britain Ln	2	6" PVC - Approx. 12712 ft
24	Edwards LS	6470 Balmoral Dr.	18.50	Balmoral Dr / Edwards St	2	8" PVC - Approx. 219977 ft
25	Edinger LS	4062 Edinger Ave.	24.00	Edinger Ave / Santa Barbara Ln	2	6" PVC - Approx. 6155 ft
26	Brighton LS	5681 Brighton Dr.	18.00	Brighton Dr / Shoreham Ln	2	6" PVC - Approx. 926897 ft
28	Coral Cay LS	17302 Coral Cay Ln.	18.00	Coral Cay Dr / Bluewater Ln	2	4" PVC - Approx. 9170 ft
29	Trinidad LS	16249 Trinidad Ln	20.00	Trinidad Ln / Aquarius Dr	2	4" SST - Approx. 407631 ft
30	Boeing LS	14700 Bolsa Chica St.	22.88	Bolsa Chica St / Skylab Rd	2	6" HDPE - Approx. 156955 ft
31	Brightwater LS	17413 Oakbluffs Ln.	26.85	Oakbluffs Ln / Brightwater Dr	2	4" PVC - Approx. 1092 ft
32	Station "D" LS	4410 Brightwater Dr.	48.50	Brightwater Dr / Warner Ave	3	(2) 14" PVC - Approx. 43915 ft

The City has 225 outfall connections to the downstream Orange County Sanitation District's (OC San's) system throughout the City. The collected wastewater is ultimately conveyed to OC SAN'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.



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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

Sewer Service Area

Project No. **12585300**
Revision No. **0**
Date **10/12/2023**

FIGURE 2.1

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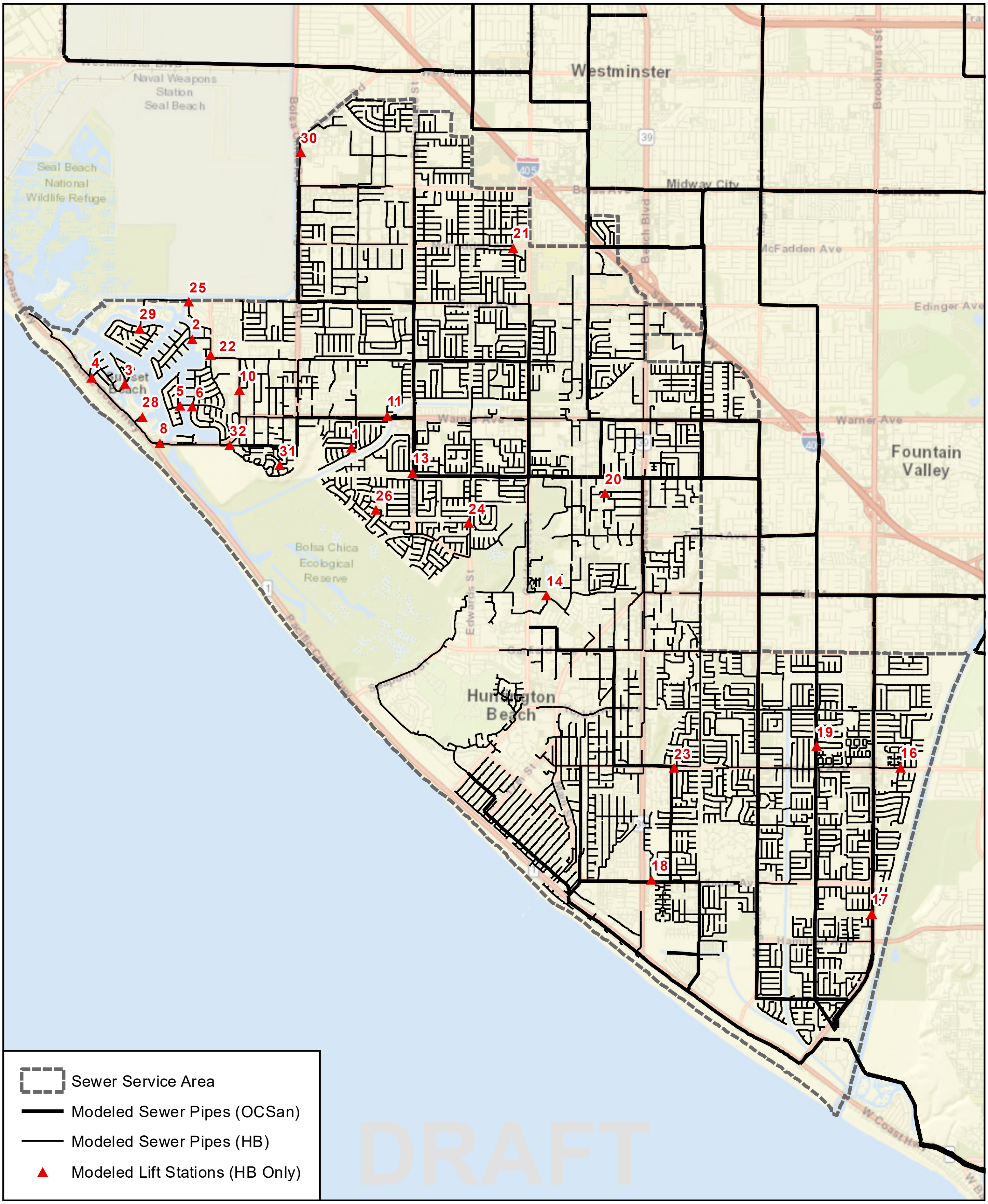
Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



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

City of Huntington Beach
Sewer Master Plan Update

Existing Sewer System

Project No. 12585300
Revision No. 0
Date 10/26/2023

FIGURE 2.2

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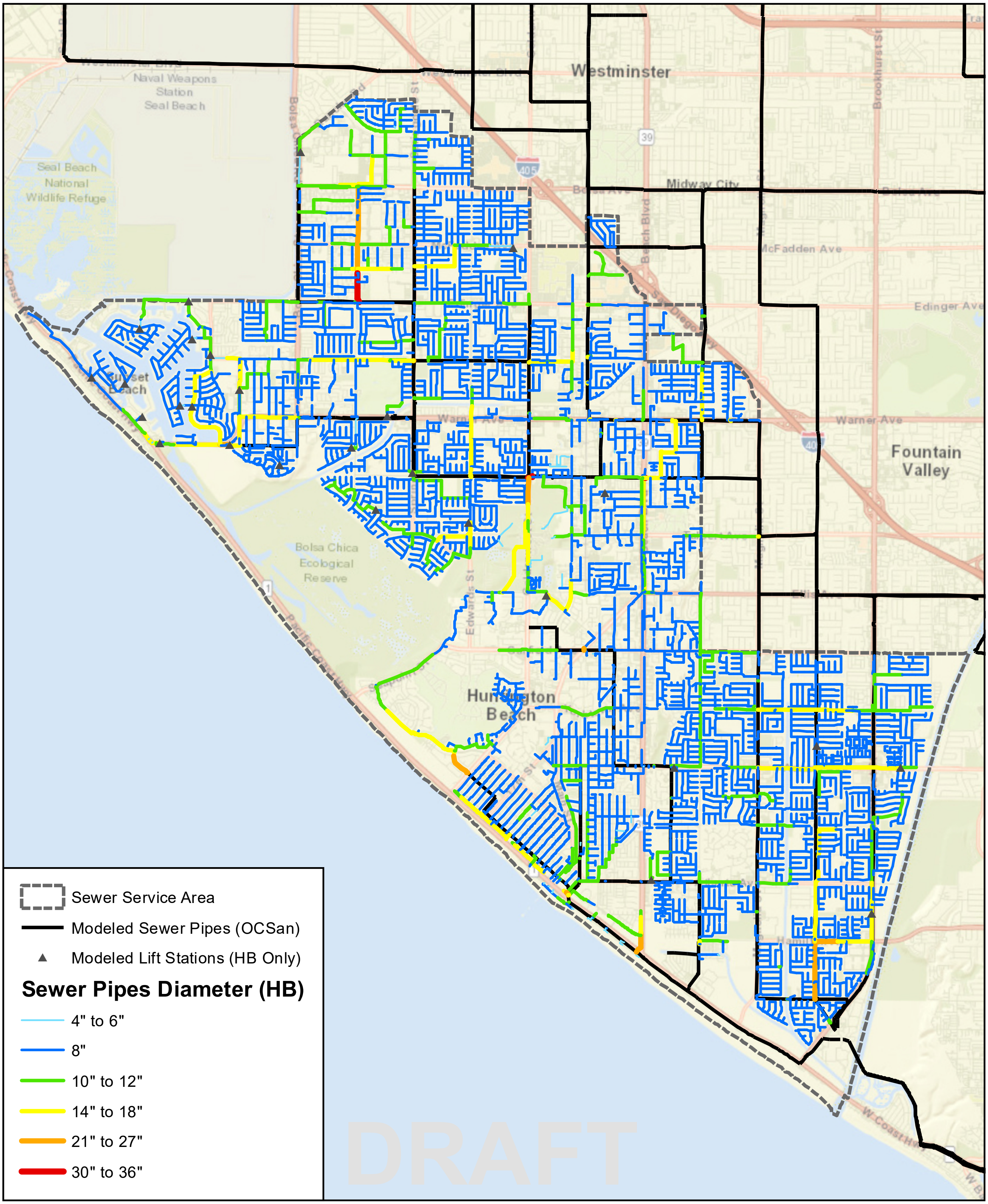
Print date: 26 Oct 2023 - 13:29

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



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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 Sewer System by Diameter

Project No. 12585300
Revision No. 0
Date 11/2/2023

FIGURE 2.3

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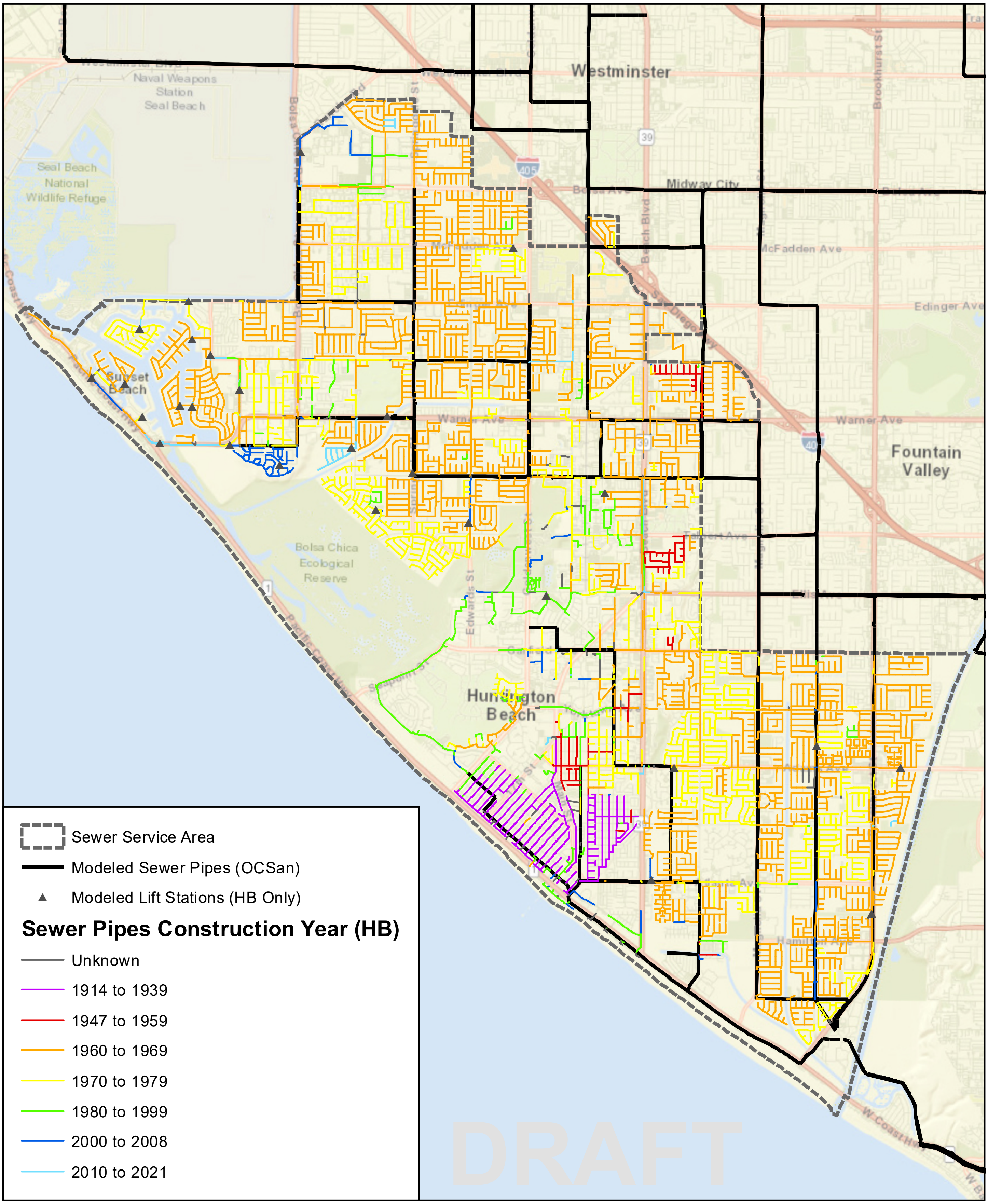

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Map Projection: Lambert Conformal Conic
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City of Huntington Beach
Sewer Master Plan Update

Existing Sewer System
by Construction Year

Project No. 12585300
Revision No. 0
Date 10/26/2023

FIGURE 2.4

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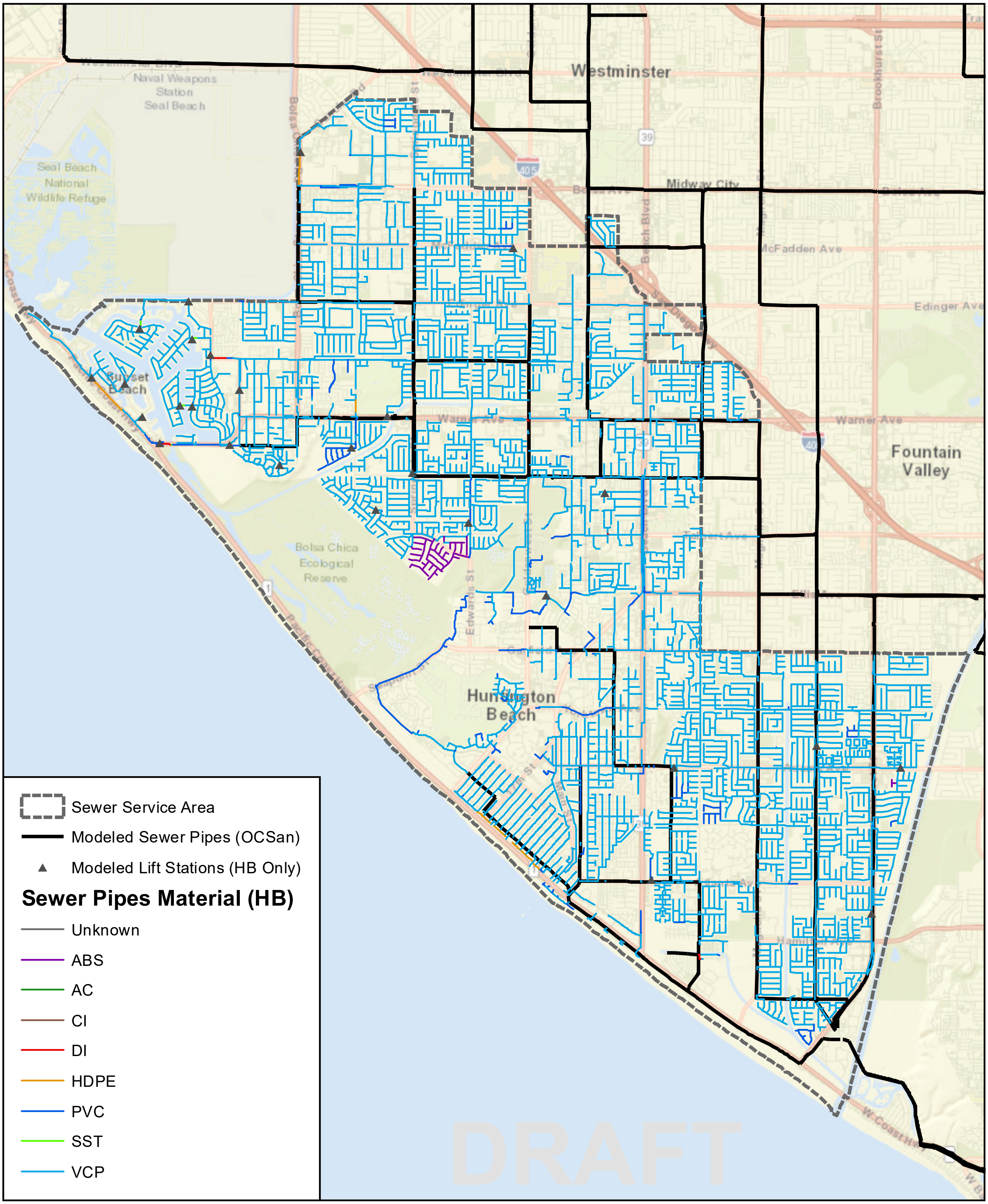

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Map Projection: Lambert Conformal Conic
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City of Huntington Beach
Sewer Master Plan Update

Existing Sewer System by Material

Project No. 12585300
Revision No. 0
Date 10/12/2023

FIGURE 2.5

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Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (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 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 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.
- **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 of 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 Parameters**: The parameters used in the capacity analysis were defined and applied. The parameters included design storm, design flow, I&I inflow and degradation amounts, and hydraulic capacity criteria. Details are provided in Chapters 5 and 6.
- **Existing and Future Model Runs:** The calibrated model was run for existing, near-term, and future flow scenarios under design DWF and WWF conditions. The sewer reaches having capacity deficiencies were identified for evaluation in the alternatives analysis. Details are provided in Chapter 6, 7, and 9.

- **Alternatives Analysis**: As part of the detailed CIP evaluation, alternative solutions were developed and tested. Alternatives analyzed included I&I reductions (from WWF); capacity enhancement projects, such as 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 of Huntington Beach's sanitary sewer system. The core model assets are links and nodes, which represent pipes, maintenance holes, pumps, weirs, orifices, gates, and wet wells. The Huntington Beach sewer system drains to the Orange County Sanitation District's Collection system, connecting at more than two-dozen locations. The City's model was integrated with the existing OC SAN's sanitary system hydraulic model. InfoWorks ICM uses subcatchments to define the hydrologic area tributary to each modeled maintenance hole. Parcels were used as subcatchments. The subcatchments are discussed further in Chapter 3.2.3.

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 maintenance holes, storages (all pump station wet wells), and outfalls. The link total includes gravity mains, pressure/forcemains, pumps, weirs, orifices, and gates. The modeled network is shown on **Figure 3.1** Modeled Network. 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	OC SAN within Huntington Beach	OC SAN outside Huntington Beach	Total
Gravity Mains	8,320	485	4,320	13,125
Maintenance Holes	8,113	459	4,491	13,063
Break Nodes	101	26	168	295
Outfall Nodes	0	4	8	12
Storage Nodes (All Pump Station Wet Wells)	27	0	0	27
Pumps (Links)	54	7	52	113
Forcemains (Links)	74	17	265	356
Weirs/Orifices/Gates (Links)	2	10	196	208
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. OC SAN's sanitary sewer system has fifteen wastewater lift stations. All the lift stations are modeled with wet well storage tanks, rotodynamic and variable frequency drive pumps (head-discharge curves), and on/off set points that mimic the actual operating state of each. Each the City's modeled pumps were given a defined table of discharges that correspond to a range of upstream heads (water levels).

Table 3.2 lists each City pump 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 OC SAN 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 pump 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 of Elevation (Invert In to FM Out) (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
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	9.8
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 pump stations pumps, with station's firm capacity (capacity with one lead pump in operation), and on/off set points for all pumps. The set points were provided by the City.

Table 3.3 Lift Station Pumps and Pumps Settings

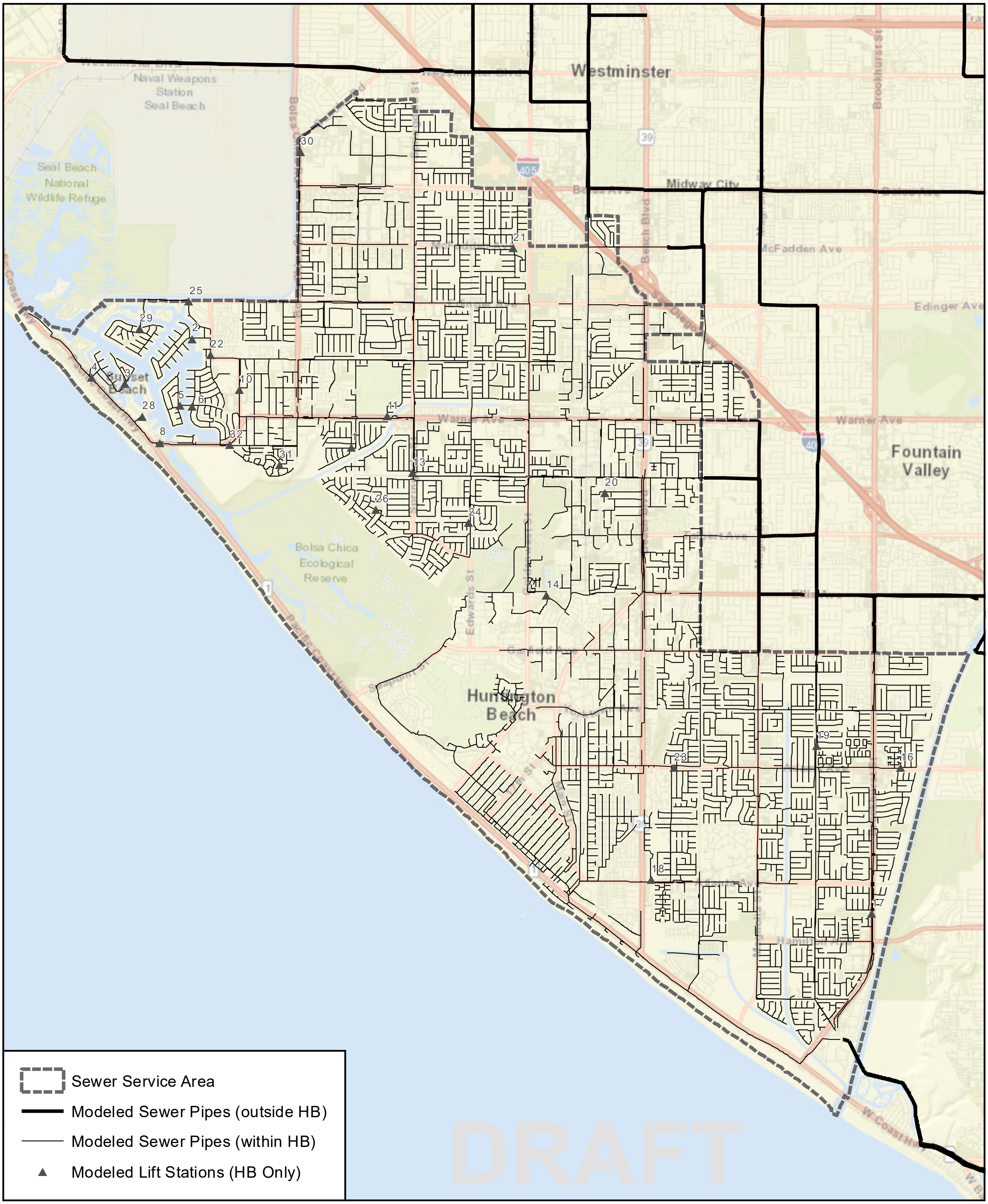
Lift Station ID	Name	Number of Pumps	Firm Capacity (mgd)	Pump(s)	On Level (ft above MSL)	Off Level (ft above MSL)
1	Parkside	2	0.69	Lead	-18.0	-20.5
				Lag	-17.5	-20.5
2	Humboldt	2	0.22	Lead	-4.4	-5.1
				Lag	-3.9	-5.1
3	Gilbert	2	0.14	Lead	-1.9	-2.2
				Lag	-1.2	-2.2
4	Station "A"	2	1.08	Lead	-24.5	-26.8
				Lag	-20.8	-26.8
5	Davenport	2	0.29	Lead	-3.4	-3.8
				Lag	-2.7	-3.8
6	Edgewater	2	1.44	Lead	-10.2	-11.8
				Lag	-9.2	-11.8
8	Station "C"	2	1.73	Lead	-10.9	-12.0
				Lag	-10.2	-12.0
10	Algonquin	2	1.37	Lead	-10.2	-11.0
				Lag	-7.0	-11.0
11	Lark	2	0.18	Lead	-9.3	-10.1
				Lag	-8.8	-10.1
13	Slater	2	1.15	Lead	-18.3	-21.3
				Lag	-17.8	-21.3
14	Ellis	3	0.96	Lead	-1.8	-3.3
				Lag	-1.2	-3.3
				Standby	-0.4	-3.3
16	Adams	2	0.47	Lead	-2.4	-3.9
				Lag	-1.9	-3.4
17	Brookhurst	2	1.84	Lead	-16.9	-17.8
				Lag	-16.1	-17.5
18	Atlanta	2	0.43	Lead	-14.0	-14.8
				Lag	-13.7	-14.8
19	Bushard	2	0.49	Lead	-2.7	-3.5
				Lag	-1.0	-2.7

Lift Station ID	Name	Number of Pumps	Firm Capacity (mgd)	Pump(s)	On Level (ft above MSL)	Off Level (ft above MSL)
20	Speer	2	0.72	Lead	5.7	4.6
				Lag	5.8	4.6
21	McFadden	2	0.17	Lead	1.2	0.6
				Lag	2.0	0.6
22	Saybrook	2	1.08	Lead	-6.2	-8.5
				Lag	-5.2	-8.5
23	New Britain	2	0.26	Lead	-5.2	-5.5
				Lag	-4.7	-5.5
24	Edwards	2	1.15	Lead	-15.7	-17.9
				Lag	-14.7	-17.9
25	Edinger	2	0.32	Lead	-3.8	-6.8
				Lag	-2.8	-6.8
26	Brighton	2	0.29	Lead	-16.1	-16.9
				Lag	-14.9	-16.9
28	Coral Cay	2	0.08	Lead	-5.6	-6.2
				Lag	-5.1	-6.2
29	Trinidad	2	0.36	Lead	-7.0	-8.5
				Lag	-6.4	-8.5
30	Boeing	2	0.30	Lead	-2.7	-3.3
				Lag	-2.2	-3.3
31	Brightwater	2	0.43	Lead	29.4	27.4
				Lag	29.7	27.4
32	Station "D"	3	2.02	Lead	-17.0	-21.0
				Lag	-16.0	-21.0
				Standby	-15.0	-21.0

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 maintenance holes in the modeled system. The sewer basins, shown on **Figure 3.2**, may contain thousands of subcatchments. For the purposes of this SMP, subcatchments were delineated at the parcel level so that each parcel contributed a unique dry and wet loading to the model. The HB portion of the model includes 51,764 subcatchments totaling 13,637 acres with an average size of 0.26 acres. The OC SAN 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 OC SAN trunk sewer. This effort resulted in 225 unique hydraulic networks and basins. These hydraulic basins are shown in **Figure 3.2**.



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

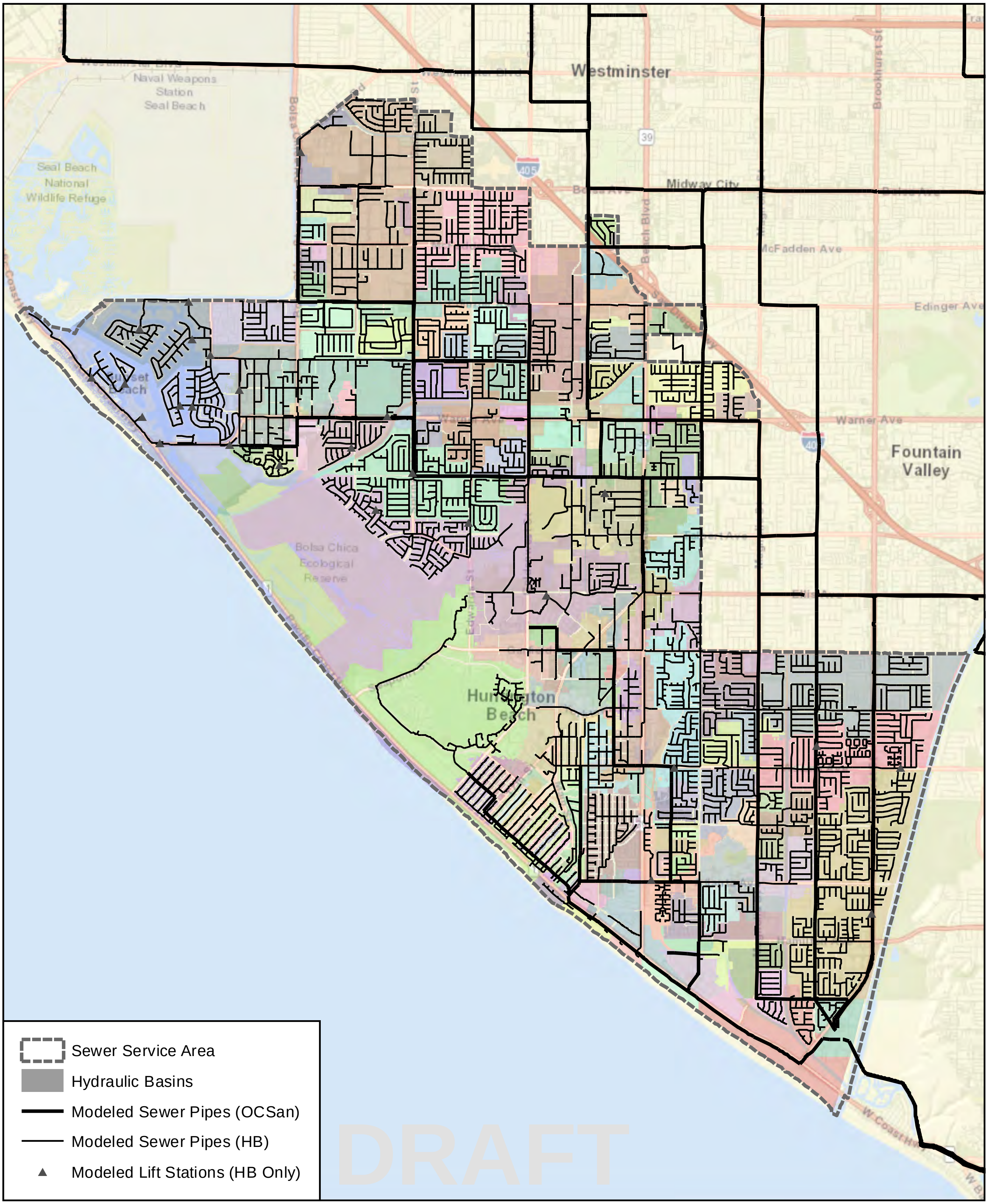
Project No. **12585300**
Revision No. **0**
Date **10/12/2023**

Modeled Sewer Network

FIGURE 3.1

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 3.1 Modeled Network.mxd
Print date: 12 Oct 2023 - 20:29

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



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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

Existing Sewer System and Hydraulic Basins

Project No. 12585300
Revision No. 0
Date 10/26/2023

FIGURE 3.2

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 3.2 Hydraulic Sewer Basins.mxd
Print date: 06 Nov 2023 - 13:22

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

3.3 Network Build and Validation

Network information for the model was provided to GHD by the City as an ESRI geodatabase that included all known linear assets. GHD processed the City's data which became the basis for construction of the hydraulic model.

3.3.1 GIS-Based Hydraulic Model Development

GHD received and reviewed the City's enterprise GIS files. After thorough review, it was determined that the provided GIS did not have pipe invert or manhole rim information. It did have pipe slopes and manhole depths. 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. Estimated slopes were calculated based on the estimated inverts and pipe length. The estimated slopes were compared to the slopes in the GIS data and there was a poor match. So, it was determined that the estimated inverts were not accurate enough to establish pipe inverts for modeling purposes as the correct slope is critical. However, they are generally correct, 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
  - 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 most downstream inverts for all networks were manually entered to start the calculation
    - This is where the Huntington Beach collection system connects to the OC SAN system
    - These downstream inverts were estimated from the Target Inverts (typically in a pipe or two upstream from the connection)
  - 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.

3.3.2 Topology Review and Gap Assessment

After the invert rectification process was complete, the updated GIS files were brought into InfoWorks ICM 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 maintenance holes, and ensured that each pipe’s upstream and downstream maintenance holes were correctly identified and accurately connected from the most downstream point, or the connection to OC SAN, 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 OC SAN system were included in the model to more accurately represent the dynamic interaction between the OC SAN 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 maintenance hole 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.

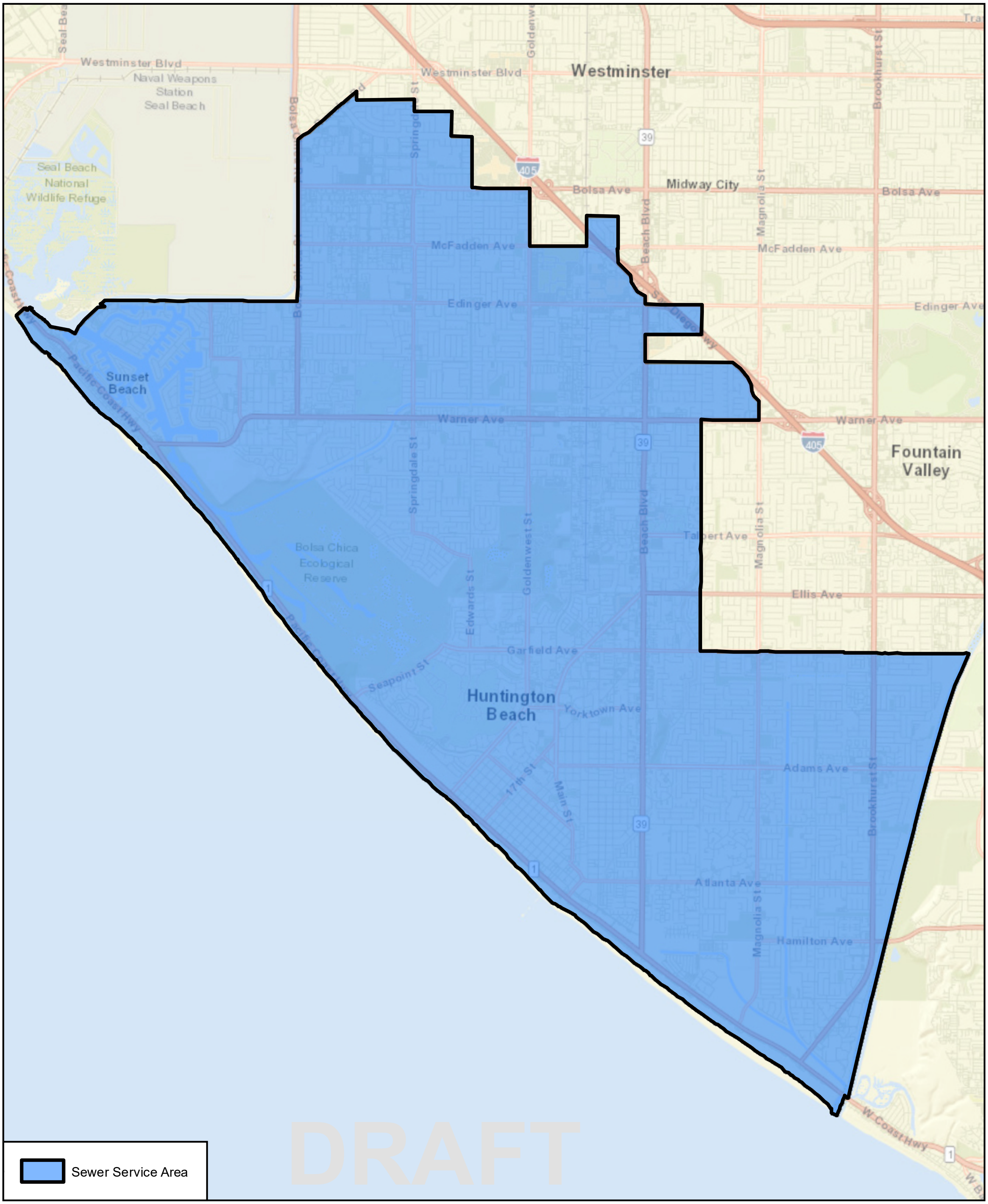
4 Planning Scenarios

This chapter outlines the planning considerations that affect DWF for anticipated development within the planning area. 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 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 (huntingtonbeachca.gov/government/departments/planning/major/). The Huntington Beach General Plan Housing Element 2021-2029 / Residential Housing Needs Analysis (RHNA) identifies housing opportunity locations, densities, and housing growth targets. Where specific project information was available for new development or redevelopment of a property, that information was used.

4.1 Service Area

The City currently provides sewer service to customers located within the City Limits and small portions of the Cities of Westminster, Seal Beach, Newport Beach, and Fountain Valley. To expand a bit further on the definitions introduced in Chapter 2, the *service 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. **Figure 4.1** shows the City's service area.



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 **10/13/2023**

Sewer Service Area

FIGURE 4.1

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 4.1 Service Area.mxd
Print date: 13 Oct 2023 - 10:13

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (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 and units:

- Single-Family Residential (SFR)
  - Dwelling Units (DUs)
- Multi-Family Residential (MRF)
  - DUs
- Hotel (H)
  - Rooms
- Commercial/Industrial (CI)
  - 1,000 sf

4.3 Existing Conditions

Existing flow conditions in the hydraulic model are based on billing records and flow monitoring. Water billing records were obtained from the City for December 2022 through March 2023. Flow monitoring was performed by ADS Consulting Engineers (ADS) for the same time period, and results provided to the GHD (ADS, 2023). Analysis of water billing and flow monitoring data is provided in Chapter 5.

4.4 Future Conditions

Future conditions for this hydraulic modeling analysis are based on the following assumptions:

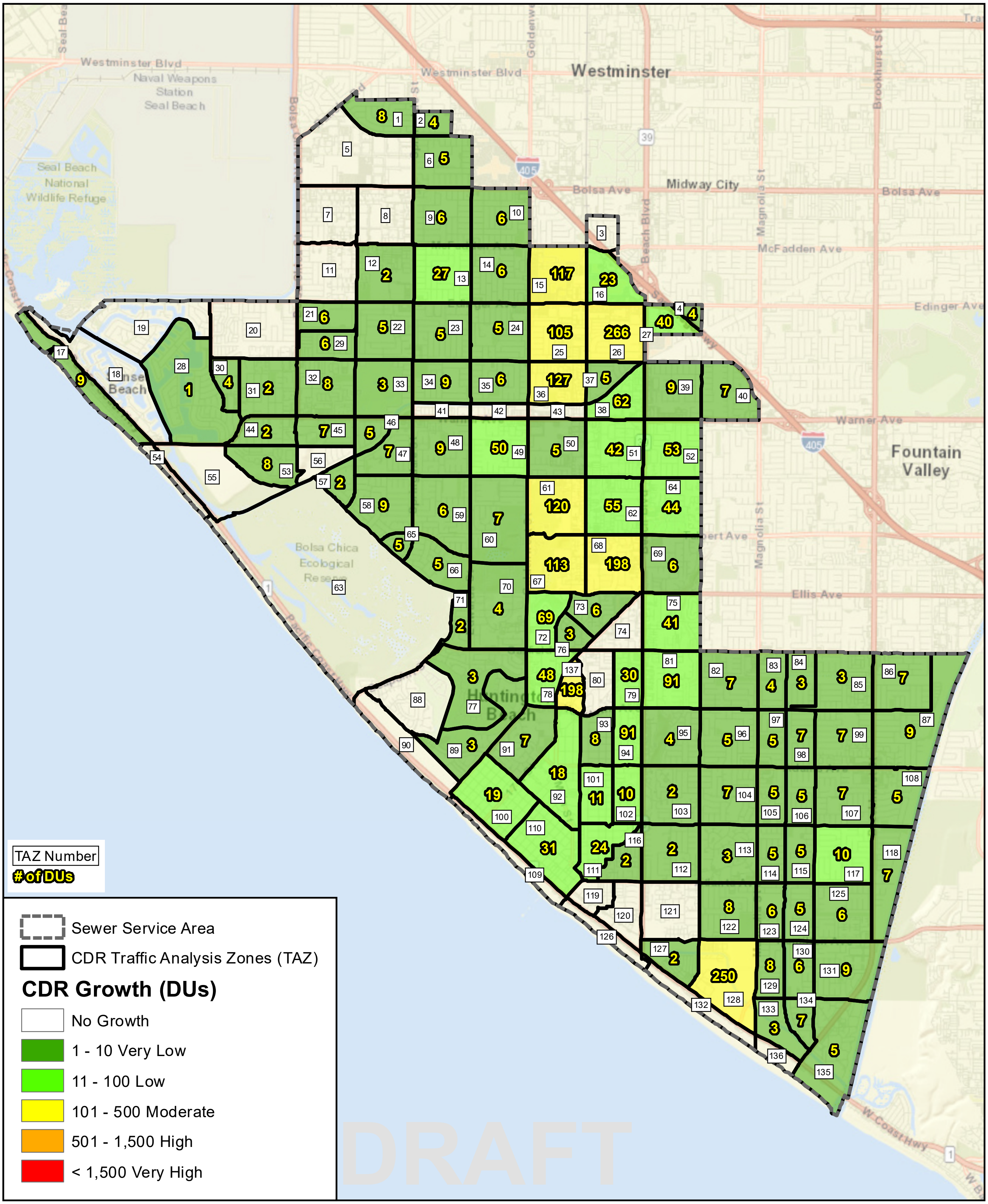
- CDR projections provide target growth for 2040.
- RHNA provides residential target growth through 2029.
- Pipeline Projects (PLP) from the Housing Element will be completed and are Near-Term (NT) development.
- Community Development Major Projects (CDMP) in the planning and approval stages will be completed and are NT development.
- Where RHNA projects and CDMP do not satisfy CDR 2040 targets, Vacant parcels identify additional projects.
- Where RHNA projects, 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

CDR provided Traffic Analysis Zone (TAZ) level data. Each TAZ has associated growth projections for Single-Family Residential, Multi-Family Residential, and Commercial/Industrial. To simplify the presentation of information and because SFR growth is very small, it is combined with MRF for presentation of growth in this document in Dwelling Units (DUs). Additionally, Commercial/Industrial growth is also small, approximately 7% of the residential growth, so is not shown. **Appendix A** has detailed information on each TAZ.

CDR projects a growth of 2,814 DUs from 2022 to 2040 in the TAZs that overlap with the City's sewer collection system. **Figure 4.2** shows the TAZ growth projections. For each TAZ area, CDMPs, PLPs, RHNA projects, and Vacant parcels are combined to attempt to match each TAZ target growth. Where target growth is not met, the projected growth is applied proportionally to existing parcels of the same use within each TAZ. There are 125 TAZ areas that 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

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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

CDR 2022-2040 TAZ
Growth Projections

Project No. 12585300
Revision No. 0
Date 10/16/2023

FIGURE 4.2

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 4.2 CDR 2040 Growth Projections.mxd
Print date: 16 Oct 2023 - 14:00

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (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 NT projects. Project details were provided by the City and parcels associated with the projects were identified. 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 2021-2029/Residential Housing Needs Allocation (RHNA)

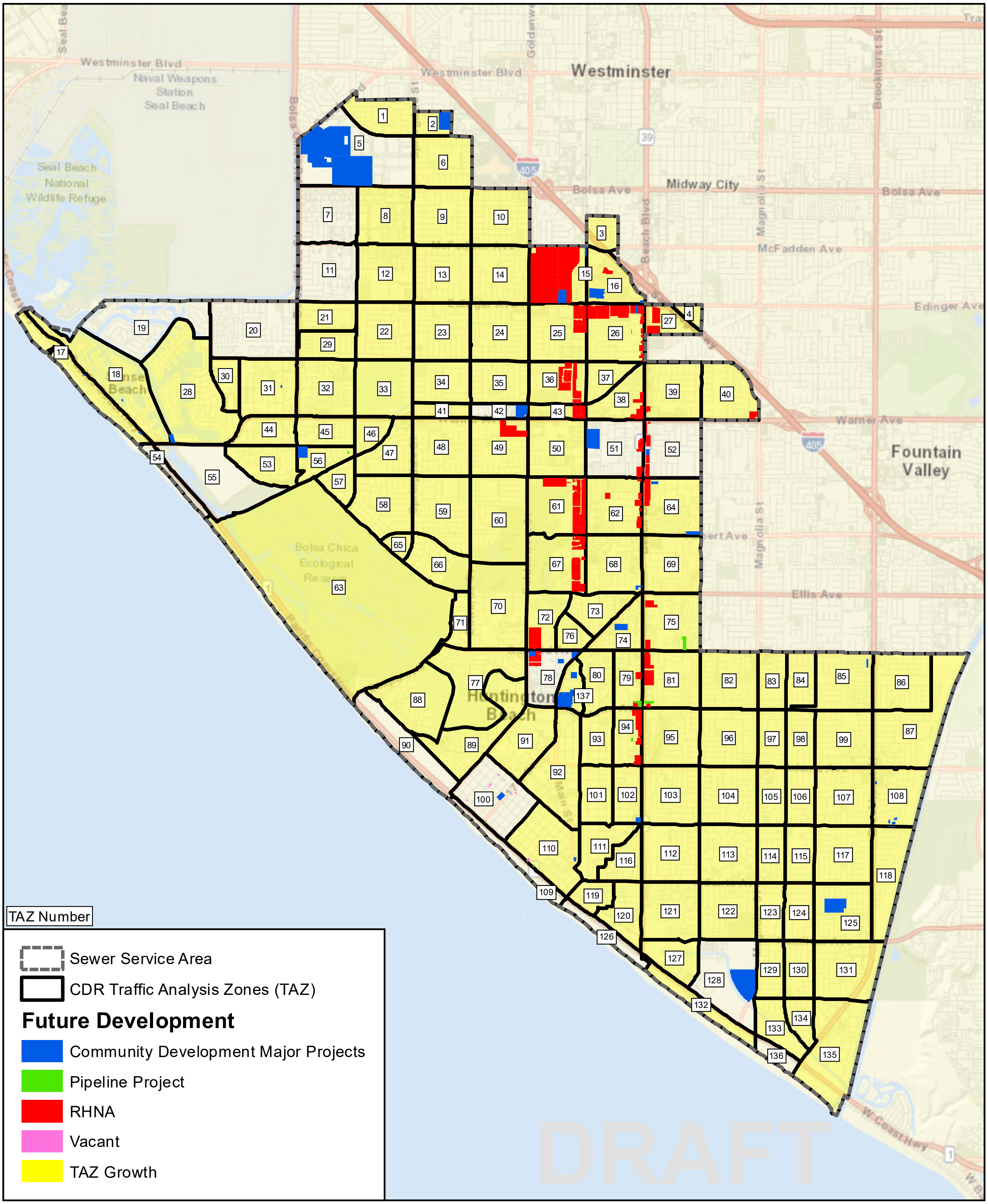
The General Plan Housing Element / Residential Housing Needs Analysis (RHNA) identifies housing needs, both current deficiencies and growth targets. For this analysis, it is assumed that the RHNA housing needs for 2029 are met. RHNA 2029 housing growth equals 13,319 DUs. Note that RHNA is from 2021 – 2029, at the time of this study, 49 DUs have been constructed and are in use, therefore the number presented here is less than the in the Housing Element.

The RHNA also identifies Pipeline Projects (PLPs), which are projects that are in-progress (planning or construction). 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 RHNA identifies potential housing locations and units through an analysis of vacant and underdeveloped parcels along with the location of housing needs. In order to meet 2029 RHNA housing growth it is assumed that all RHNA projects are developed. They are scaled based on their potential to match the projected growth. There are 317 RHNA projects that total 11,924 DUs. See **Appendix A** for assumptions and individual project details. **Figure 4.3** shows the locations RHNA projects 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 projects 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

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

GHD

City of Huntington Beach
Sewer Master Plan Update

Location and Category of Future Development

Project No. **12585300**
Revision No. **0**
Date **10/16/2023**

FIGURE 4.3

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 4.3 Future Development.mxd
Print date: 16 Oct 2023 - 14:53

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (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.

Table 4.1 TAZ Level Data for All Future Development

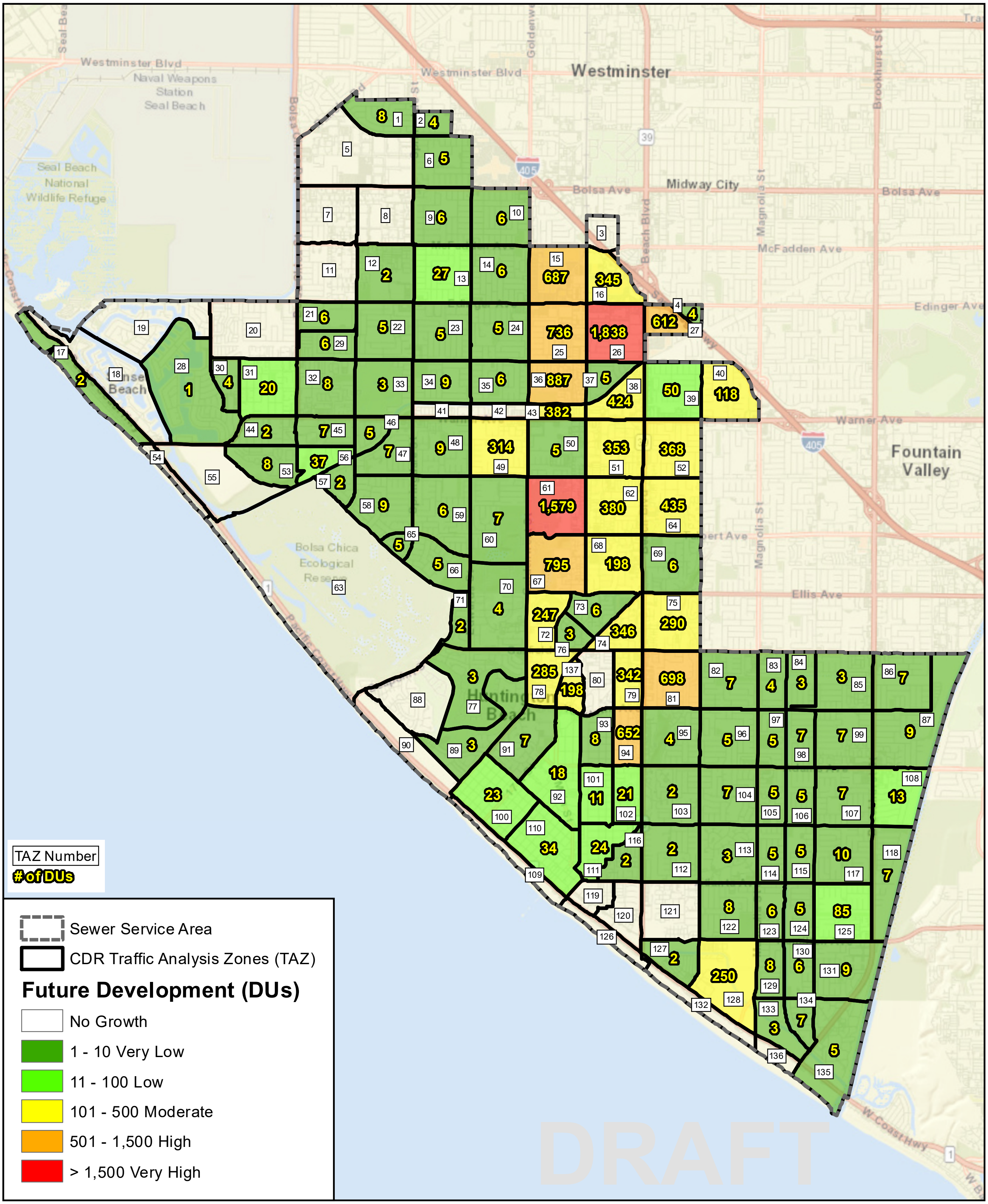
TAZ Number	TAZ ID	CDR Projection DUs	Near Term CDMP DUs	Near Term PLP DUs	Future (2040) RHNA DUs	Future (2040) Vac DUs	Future (2040) TAZ DUs	Total DUs
1	32651200	8	0	0	0	0	8	8
2	32658100	4	0	0	380	0	4	384
4	32689100	4	0	0	383	0	4	387
6	32658200	5	0	0	0	0	5	5
9	32656100	6	0	0	0	0	6	6
10	32664100	6	0	0	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
45	32646200	7	0	0	382	0	7	389

TAZ Number	TAZ ID	CDR Projection	Near Term		Future (2040)			Total
			CDMP	PLP	RHNA	Vac	TAZ	
		DUs	DUs	DUs	DUs	DUs	DUs	DUs
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

TAZ Number	TAZ ID	CDR Projection	Near Term		Future (2040)			Total
			CDMP	PLP	RHNA	Vac	TAZ	
		DUs	DUs	DUs	DUs	DUs	DUs	DUs
91	32669200	7	0	0	158	0	7	165
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

TAZ Number	TAZ ID	CDR Projection	Near Term		Future (2040)			Total
			CDMP	PLP	RHNA	Vac	TAZ	
		DUs	DUs	DUs	DUs	DUs	DUs	DUs
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 CDA growth by approximately 500%. This is due to the assumption that RHNA projections will be met. **Figure 4.4** shows the future development projections within each TAZ.



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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
2022-2040

Project No. 12585300
Revision No. 0
Date 10/16/2023

FIGURE 4.4

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 4.4 Future Development by TAZ.mxd
Print date: 16 Oct 2023 - 18:48

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

5 System Flows and Model Calibration

This chapter also outlines the fundamental components and concepts of wastewater flow to provide a basis for the development of these flow rates, as well as a discussion and presentation of results for the calibration of the model 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. Existing condition wastewater flow rates were based on results from flow monitoring completed as part of this master plan and city-wide water billing records. Future condition wastewater flow rates considered buildout of known or anticipated development projects.

5.1 Flow Monitoring and Rainfall

As part of this master planning effort, ADS Environmental Services, under subcontract to GHD, performed temporary flow monitoring December 2022 through March 2023 at 24 sites throughout the City's service area for model development and verification. **Table 5.1** lists all the flow monitoring sites. Unless noted otherwise, all flow monitors were located at the downstream end of the pipe.

Table 5.1 Flow Monitoring Locations

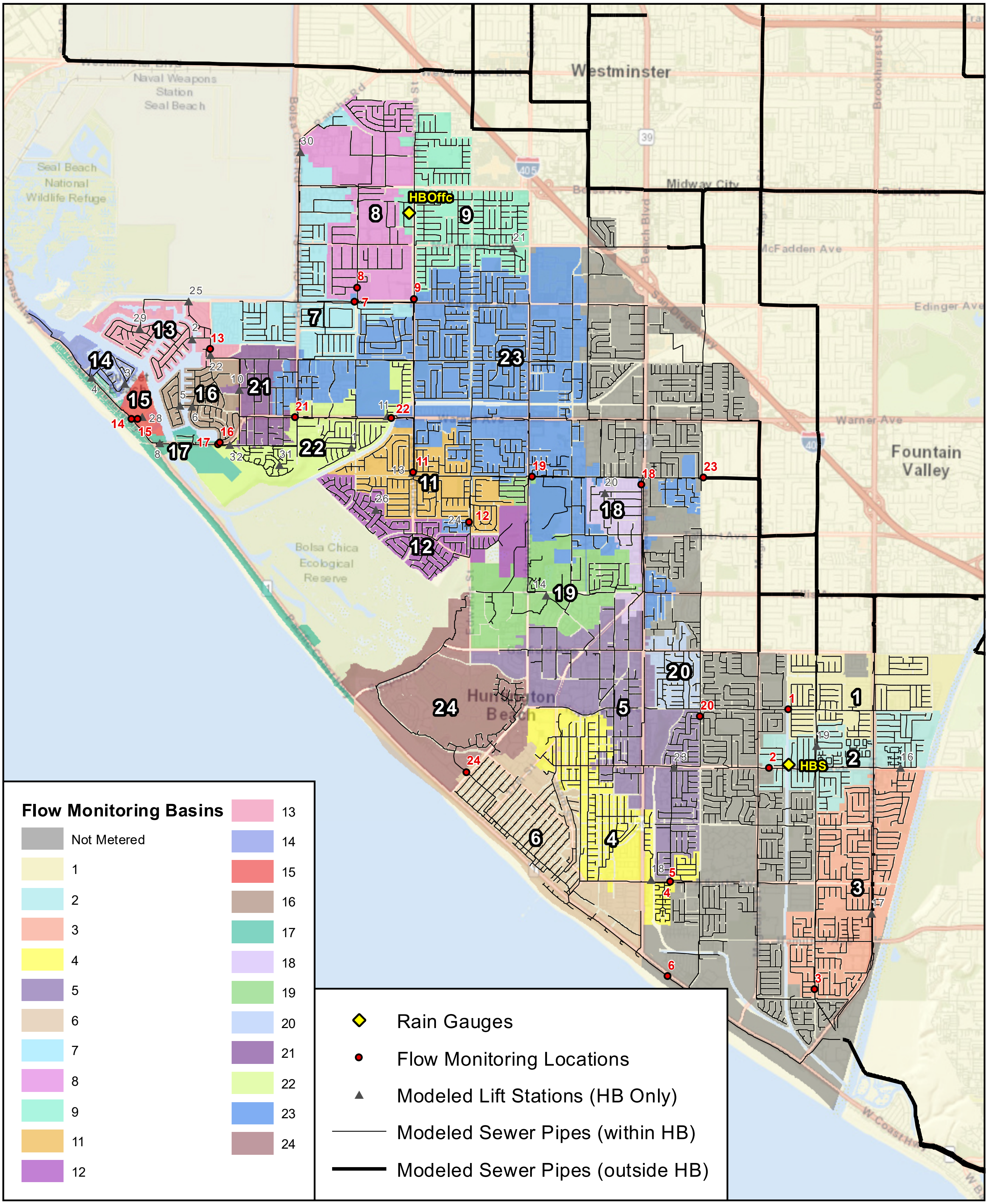
Flow Monitoring ID	Model Pipe ID	GIS ID	Diameter (in)	Address	Owner	Date Installed	Date Removed
1	7363.1 (Upstream)	6344	18	9347 Yorktown Ave	City	12/20/2022	3/28/2023
2	8347.1	7244	18	9116 Adams Ave	City	12/20/2022	3/28/2023
3	10499.1	11596	27	21934 Bushard St	City	12/20/2022	3/28/2023
4	CST0060-0500.1	n/a	18	8234 Atlanta Ave	OC SAN	12/20/2022	3/28/2023
5	CST0060-0195.1	n/a	33	8234 Atlanta Ave	OC SAN	12/20/2022	3/28/2023
6	CST0068-0000.1	n/a	54	21779-21899 PCH Parking/Inside Parking Stall	OC SAN	12/30/2022	3/28/2023
7	KNT0080-0735.1	n/a	15	5452 Edinger Ave	OC SAN	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	OC SAN	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	OC SAN	12/20/2022	3/28/2023
22	KNT0080-0416.1	n/a	36	5700 Warner Ave	OC SAN	12/20/2022	3/28/2023
23	KNT0080-0010.1	n/a	42	8500 Slater Ave	OC SAN	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. **Figure 5.1** shows the flow meters and basins used for the dry and wet weather flow calibration, as well as locations of rain gauges.

Table 5.2 Calibration Rainfall Totals

Item	RG HBOffc	RG 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.



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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

Flow Monitoring Locations,
Meter Basins and Rain Gauges

Project No. 12585300
Revision No. 0
Date 10/16/2023

FIGURE 5.1

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 5.1 Flow Monitoring Locations and Basins.mxd
Print date: 16 Oct 2023 - 20:12

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

5.2 Wastewater Flow Concepts

Wastewater flows generally includes three major components: base wastewater flow (BWF), groundwater infiltration (GWI), and RDI&I. BWF is comprised of sanitary and process flow outputs 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 composed of groundwater that infiltrates into the system through defects in maintenance holes and pipes. The inflow portion of RDI&I is flow entering the system directly from rainfall and typically enters through holes or cracks in maintenance hole covers or 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 maintenance holes, sewers, and laterals. RDI&I typically results in spikes in peak flow that recede quickly after rainfall subsides. **Figure 5.2** shows these basic concepts through a typical sewer response hydrograph.

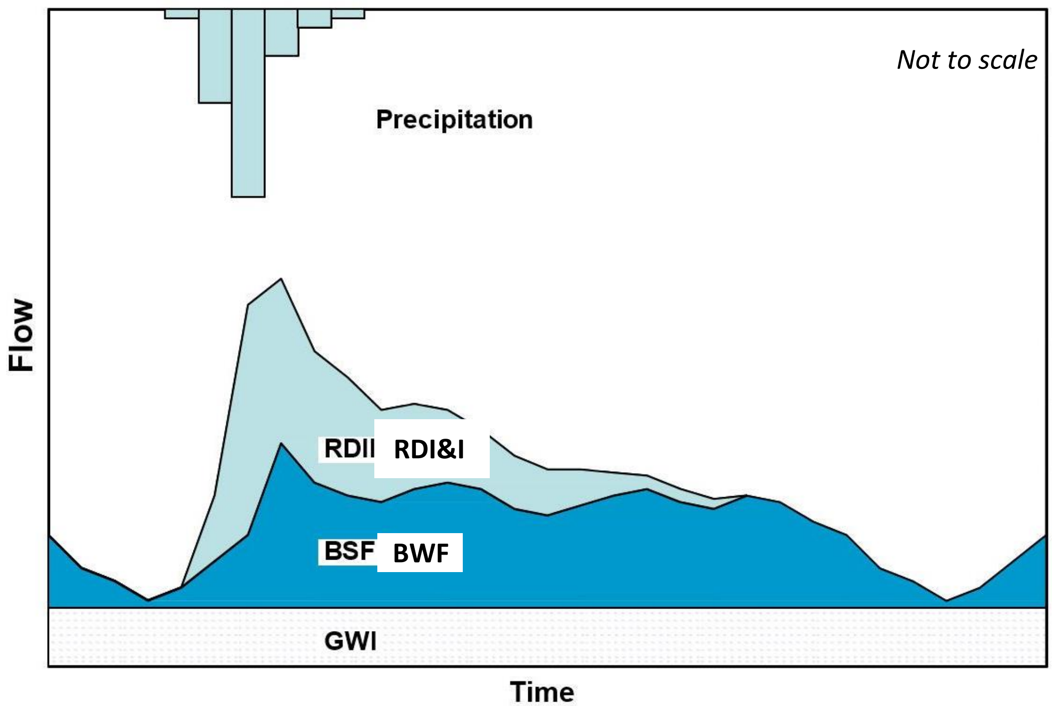


Figure 5.2 Components of Sanitary Sewer Flow[1]

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 dry and WWF tributary areas to a maintenance hole 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

[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/

were compared to model flows to refine the magnitude and timing of model flows. The following sub-sections summarize the development and assumptions for each flow component.

5.3.1 Diurnal Curves

BWF vary by time of day and type of generator (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. The analysis of land use identified 64 unique land use classifications.

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 groupings and the 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 and land use data. Specifically, this was from December through March of winter season water use records for both residential and commercial sources from 2022-2023. 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) of at any time during the year.

A total of 50,750 water consumption 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 and their associated diurnal curve category area shown in **Table 5.4** for each of the 64 land use types.

Table 5.4 Water Billing Business ClassLand Use Categories

Land Use	Winter 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 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**

This water consumption 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).

For initial model simulation, GHD used systemwide wastewater-return-to-sewer factors based on other recent master planning work. **Table 5.5** shows the initial return-to-sewer factors for each model diurnal curve.

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, lower than the industry average of 0.88. 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	0.830
Multi-family Residential	2	0.827
Lodging Commercial, Mobile Home	3	0.840
Office Commercial, Public/Government, School	10	0.818
General Commercial, Automobile Commercial	11	0.757
Industrial, Light Industrial, Warehouse	20	0.673
Parks, Open Space	30	0.746

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 GHD estimated it 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.

5.3.4 Rainfall-derived Inflow and Infiltration

Rainfall-derived 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 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 representing 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

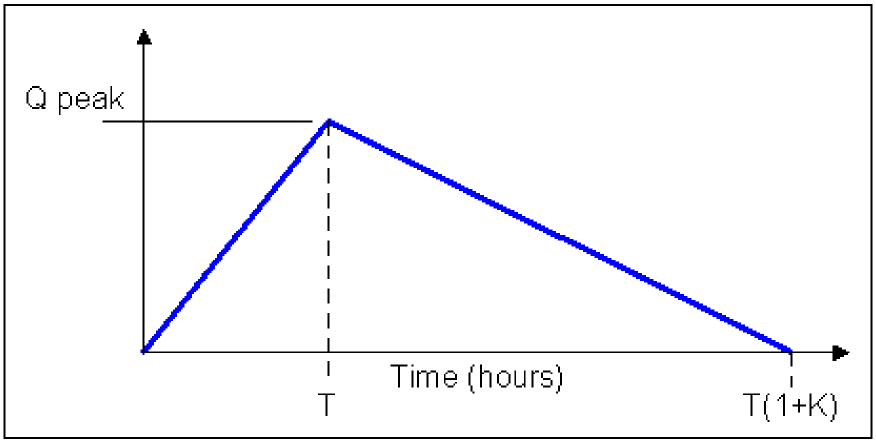


Figure 5.3 Basic Parameters of the Triangular RTK Hydrograph[2]

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.

[2] Infoworks ICM Help Documentation (2021):

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

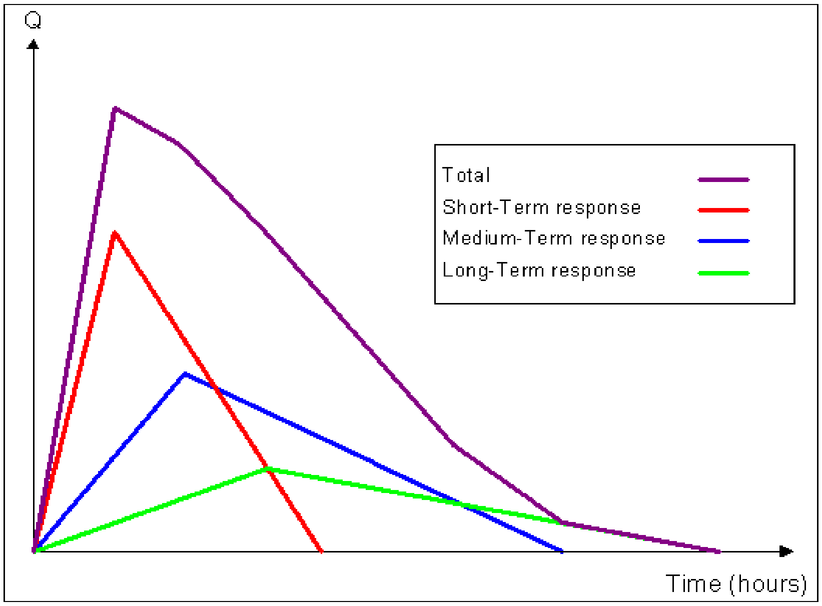


Figure 5.4 Fast, Medium, and Slow Components RTK Hydrograph[2]

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.

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. **Table 5.6** lists the observed and modeled flows for all meters. Overall, the dry weather calibration produced very close alignment between the observed and modeled flows. One meter site had outlier results, however, it did not impact the calibration accuracy and is explained as follows.

The calibration process resulted in a good match at all but one meter, flow monitoring site 16. After calibration, the model results show this location overpredicting the observed flow meter data by 22%. The return-to-sewer factor for this basin is 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 5.5** shows the FM 16 observed vs modeled hydrograph for dry weather and

[2] Infoworks ICM Help Documentation (2021):

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

Figure 5.6 shows the FM 23 (this is the largest basin and is downstream of many other basins) hydrograph. See **Appendix B** for all the DWF hydrographs.

Table 5.6 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)	0.462	0.468	-1%
2	8347.1	0.415	0.405	2%
3	10499.1	0.911	0.905	1%
4	CST0060-0500.1	0.452	0.449	1%
5	CST0060-0195.1	1.552	1.582	-2%
6	CST0068-0000.1	1.686	1.637	3%
7	KNT0080-0735.1	0.522	0.549	-5%
8	1868.1 (Upstream)	0.194	0.204	-5%
9	KNT0080-0265.1	0.426	0.449	-5%
11	5294.1	0.380	0.400	-5%
12	2741.1 (Upstream)	0.271	0.283	-4%
13	3903.1	0.407	0.407	0%
14	4021.1 (Upstream)	0.230	0.245	-6%
15	4355.1	0.032	0.033	-3%
16	12870.1	0.616	0.504	22%
17	4988.1	0.334	0.369	-9%
18	11726.1	0.187	0.197	-5%
19	7345.1	0.358	0.371	-4%
20	KNT0080-0463.1	0.128	0.122	5%
21	KNT0080-0416.1	0.323	0.323	0%
22	KNT0080-0010.1	1.595	1.547	3%
23	8295.1	5.602	5.187	8%
24	7363.1 (Upstream)	0.513	0.504	2%

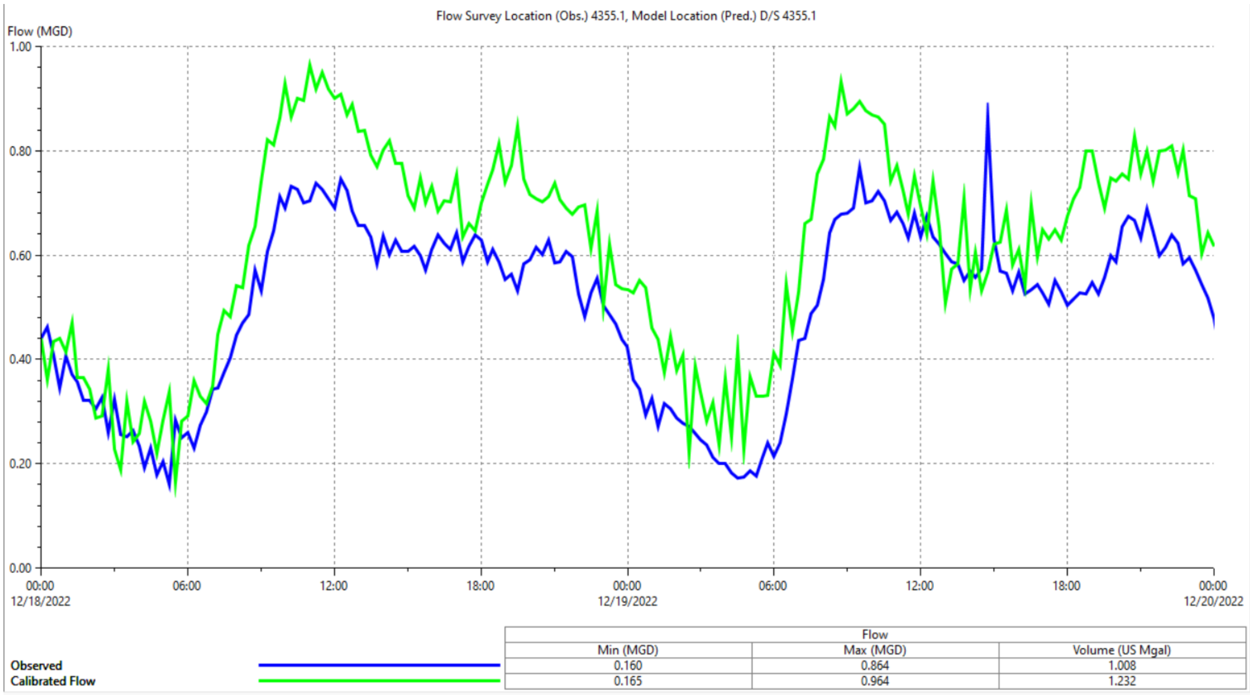


Figure 5.5 Example DWF Calibration Graph for Flow Meter 16

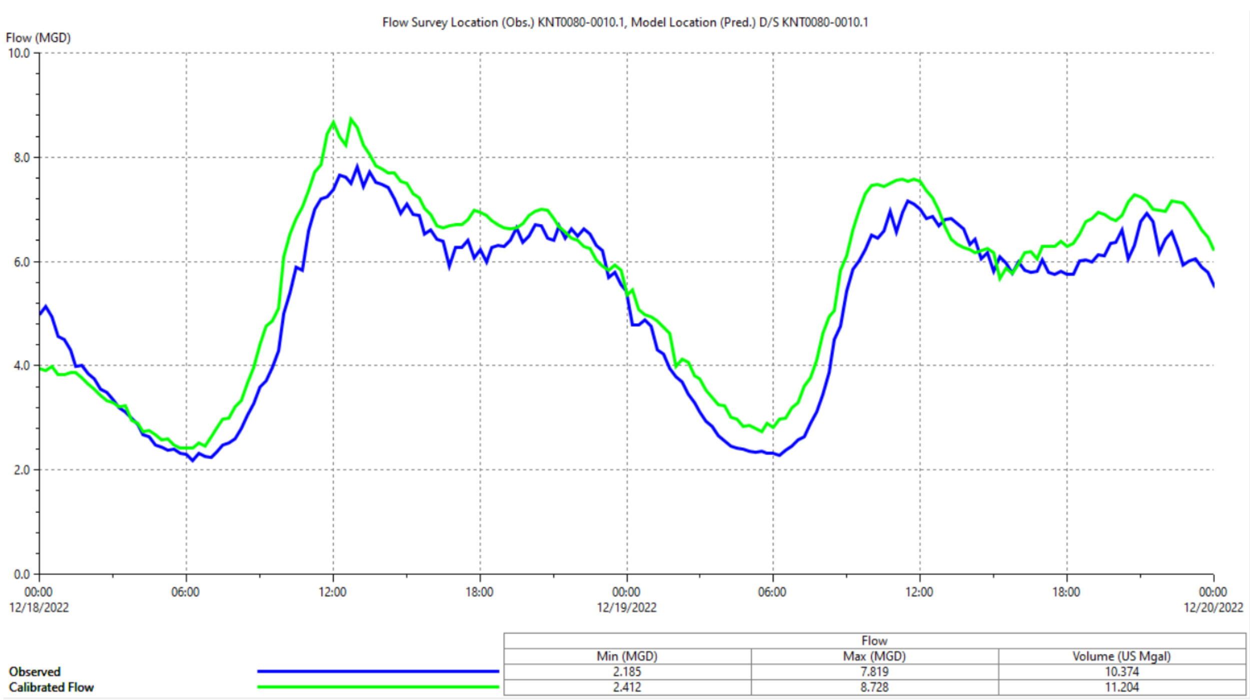


Figure 5.6 Example DWF Calibration Graph for Flow Meter 23

Final statistics for the net contributions for all of the City's sewer basins are shown below in **Table 5.7.**

Table 5.7 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	22[1]	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

Figure 5.7 WWF Calibration Graph

Table 5.8 Wet Weather Flow Calibration Results

Table 5.9 WWF Calibration Sewer Basin Statistics

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 CDMPs, PLPs, RHNA projects, development of select vacant parcels, and 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 aggregate, these modified BWFs 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 developed was assumed to be completed for the future (2040) scenario.

Once BWF was estimated for each future development, a diurnal curve id was assigned.

5.5.1 Unit Flows for Development

Unit flows were used to estimate future flows based on an assumed sewer contribution per residence, 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 are provided in **Table 5.10**.

Table 5.10 Unit Flows for Future Development

Development Type	Units	Unit Flow
Single-Family Residential	gpd/DU	170
Multi-Family Residential[1]	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 5.11 summarize the BWF for developments presented in Chapter 4, which are included in the future flows model **Figure 5.8**, **Figure 5.9**, and **Figure 5.10** illustrate the quantity of development attributed BWF added to the future flows model scenarios. See **Appendix A** for specific development details and projected BWF.

Table 5.11 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)
2	32651200	Near-Term	-	-	-	-	**1,171**
		2040	-	1,080	91	1,171	
3	32658100	Near-Term	-	-	1,235	1,235	**1,775**
		2040	-	540	-	540	
4	32681100	Near-Term	-	-	-	-	**(7)**
		2040	-	-	(7)	(7)	
5	32689100	Near-Term	-	-	-	-	**547**
		2040	-	540	7	547	
6	32651400	Near-Term	-	-	138,020	138,020	**138,020**
		2040	-	-	-	-	
7	32658200	Near-Term	-	-	-	-	**892**
		2040	170	540	182	892	
9	32652200	Near-Term	-	-	-	-	**1,755**
		2040	-	-	1,755	1,755	
10	32656100	Near-Term	-	-	-	-	**1,168**
		2040	-	810	358	1,168	
11	32664100	Near-Term	-	-	-	-	**999**
		2040	-	810	189	999	
13	32652400	Near-Term	-	-	-	-	**1,226**
		2040	-	270	956	1,226	
14	32656200	Near-Term	-	-	-	-	**3,749**
		2040	-	3,645	104	3,749	
15	32664200	Near-Term	-	-	-	-	**953**
		2040	-	810	143	953	
16	32664300	Near-Term	-	17,550	648	18,198	**95,214**
		2040	-	75,201	1,815	77,016	
17	32682400	Near-Term	-	45,500	1,957	47,457	**54,257**
		2040	340	5,765	695	6,800	
18	32641100	Near-Term	-	-	3,598	3,598	**3,733**
		2040	-	135	-	135	
19	32642100	Near-Term	270	-	-	270	**264**
		2040	-	-	(7)	(7)	
22	32648100	Near-Term	-	-	-	-	**897**
		2040	170	675	52	897	
23	32654100	Near-Term	-	-	-	-	**827**
		2040	170	540	117	827	
24	32661100	Near-Term	-	-	-	-	**788**
		2040	170	540	78	788	

TAZ Number	TAZ ID	Scenario	Single-Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
25	32661200	Near-Term	-	-	-	-	**437**
		2040	170	540	(273)	437	
26	32672100	Near-Term	-	-	-	-	**99,820**
		2040	-	99,307	514	99,820	
27	32672200	Near-Term	680	-	816	1,496	**249,225**
		2040	510	247,219	-	247,729	
28	32689200	Near-Term	-	-	-	-	**82,781**
		2040	85	82,566	130	82,781	
29	32644200	Near-Term	-	-	512	512	**682**
		2040	170	-	-	170	
30	32648200	Near-Term	-	-	-	-	**572**
		2040	170	675	(273)	572	
31	32645200	Near-Term	-	-	-	-	**998**
		2040	170	405	423	998	
32	32647100	Near-Term	3,400	-	-	3,400	**3,511**
		2040	-	-	111	111	
33	32648300	Near-Term	-	-	-	-	**1,378**
		2040	340	810	228	1,378	
34	32654200	Near-Term	-	-	-	-	**613**
		2040	-	405	208	613	
35	32660100	Near-Term	-	-	-	-	**1,363**
		2040	340	945	78	1,363	
36	32660200	Near-Term	-	-	-	-	**962**
		2040	170	675	117	962	
37	32673100	Near-Term	-	-	-	-	**120,837**
		2040	170	119,614	1,053	120,837	
38	32673200	Near-Term	-	-	-	-	**662**
		2040	-	675	(13)	662	
39	32673300	Near-Term	-	-	-	-	**57,610**
		2040	340	56,990	280	57,610	
40	32690100	Near-Term	-	-	-	-	**7,222**
		2040	-	6,813	410	7,222	
41	32690200	Near-Term	-	-	-	-	**16,133**
		2040	-	15,983	150	16,133	
42	32660300	Near-Term	-	-	-	-	**(65)**
		2040	-	-	(65)	(65)	
43	32660400	Near-Term	-	-	624	624	**624**
		2040	-	-	-	-	
44	32673400	Near-Term	-	-	-	-	**51,814**
		2040	-	51,619	195	51,814	

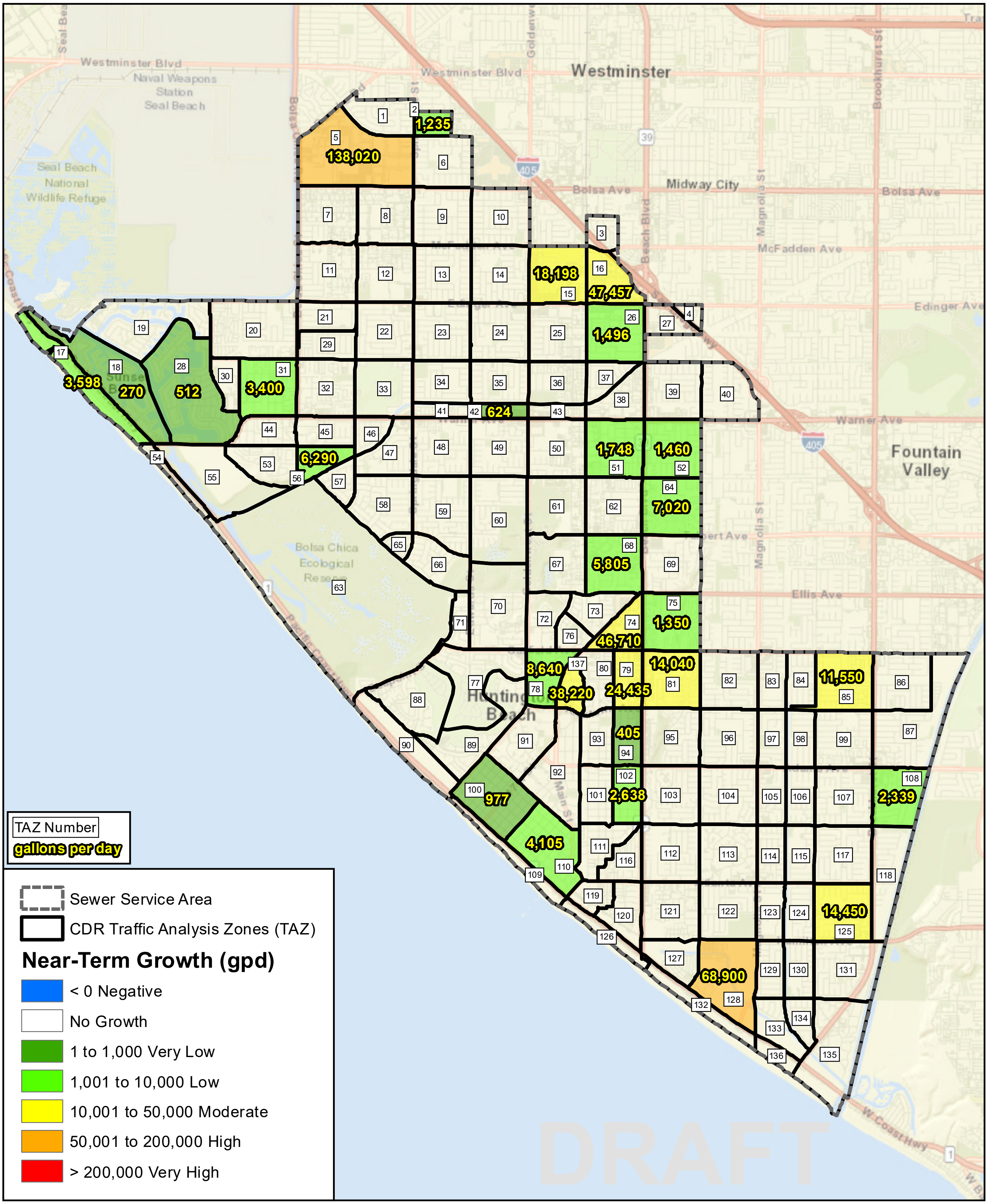
TAZ Number	TAZ ID	Scenario	Single-Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
45	32646100	Near-Term	-	-	-	-	**335**
		2040	-	270	65	335	
46	32646200	Near-Term	-	-	-	-	**1,100**
		2040	340	675	85	1,100	
47	32646300	Near-Term	-	-	-	-	**662**
		2040	-	675	(13)	662	
48	32649100	Near-Term	-	-	-	-	**1,052**
		2040	170	810	72	1,052	
49	32657100	Near-Term	-	-	-	-	**1,402**
		2040	340	945	117	1,402	
50	32665100	Near-Term	-	-	-	-	**42,792**
		2040	170	42,317	306	42,792	
51	32674100	Near-Term	-	-	-	-	**1,007**
		2040	-	675	332	1,007	
52	32674200	Near-Term	-	-	1,748	1,748	**49,436**
		2040	-	47,688	-	47,688	
53	32685100	Near-Term	-	-	1,460	1,460	**51,113**
		2040	-	49,653	-	49,653	
54	32646400	Near-Term	-	-	-	-	**1,271**
		2040	1,020	270	(20)	1,271	
57	32646700	Near-Term	6,290	-	-	6,290	**6,303**
		2040	-	-	13	13	
58	32649200	Near-Term	-	-	-	-	**257**
		2040	-	270	(13)	257	
59	32649300	Near-Term	-	-	-	-	**1,220**
		2040	340	945	(65)	1,220	
60	32657200	Near-Term	-	-	-	-	**1,183**
		2040	170	675	338	1,183	
61	32665200	Near-Term	-	-	-	-	**1,240**
		2040	170	810	260	1,240	
62	32674300	Near-Term	-	-	-	-	**213,578**
		2040	-	213,156	423	213,578	
63	32674400	Near-Term	-	-	-	-	**52,767**
		2040	-	51,357	1,411	52,767	
64	32649400	Near-Term	-	-	-	-	**7**
		2040	-	-	7	7	
65	32685200	Near-Term	-	7,020	-	7,020	**58,783**
		2040	-	51,750	13	51,763	
66	32649500	Near-Term	-	-	-	-	**675**
		2040	-	675	-	675	

TAZ Number	TAZ ID	Scenario	Single-Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
67	32649600	Near-Term	-	-	-	-	**545**
		2040	-	675	(130)	545	
68	32666100	Near-Term	-	-	-	-	**107,695**
		2040	-	107,299	397	107,695	
69	32675100	Near-Term	-	5,805	-	5,805	**27,888**
		2040	510	20,520	1,053	22,083	
70	32684100	Near-Term	-	-	-	-	**966**
		2040	-	810	156	966	
71	32666200	Near-Term	-	-	-	-	**644**
		2040	-	540	104	644	
72	32649700	Near-Term	-	-	-	-	**257**
		2040	-	270	(13)	257	
73	32666300	Near-Term	-	-	-	-	**33,505**
		2040	-	33,408	98	33,505	
74	32675200	Near-Term	-	-	-	-	**1,109**
		2040	-	810	299	1,109	
75	32675300	Near-Term	-	46,710	-	46,710	**47,211**
		2040	-	-	501	501	
76	32684200	Near-Term	-	1,350	-	1,350	**39,095**
		2040	-	37,862	(117)	37,745	
77	32675400	Near-Term	-	-	-	-	**386**
		2040	-	405	(20)	386	
78	32659100	Near-Term	-	-	-	-	**496**
		2040	-	405	91	496	
79	32669100	Near-Term	-	7,560	1,080	8,640	**39,559**
		2040	-	30,919	-	30,919	
80	32678100	Near-Term	-	24,435	-	24,435	**46,508**
		2040	510	21,355	208	22,073	
81	32678200	Near-Term	-	-	-	-	**228**
		2040	-	-	228	228	
82	32686100	Near-Term	-	14,040	-	14,040	**94,635**
		2040	340	79,917	338	80,595	
83	32694100	Near-Term	-	-	-	-	**1,605**
		2040	680	405	520	1,605	
84	32702100	Near-Term	-	-	-	-	**638**
		2040	-	540	98	638	
85	32702200	Near-Term	-	-	-	-	**412**
		2040	-	405	7	412	
86	32702300	Near-Term	-	-	11,550	11,550	**11,890**
		2040	-	405	(65)	340	

TAZ Number	TAZ ID	Scenario	Single-Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
87	32715100	Near-Term	-	-	-	-	**1,119**
		2040	340	675	104	1,119	
88	32715200	Near-Term	-	-	-	-	**1,524**
		2040	680	675	169	1,524	
89	32659200	Near-Term	-	-	-	-	**163**
		2040	-	-	163	163	
90	32659300	Near-Term	-	-	-	-	**308**
		2040	-	405	(98)	308	
92	32669200	Near-Term	-	-	-	-	**1,670**
		2040	680	405	585	1,670	
93	32669300	Near-Term	-	-	-	-	**3,984**
		2040	-	2,430	1,554	3,984	
94	32678300	Near-Term	-	-	-	-	**1,242**
		2040	850	405	(13)	1,242	
95	3267840	Near-Term	-	405	-	405	**88,702**
		2040	340	87,385	572	88,297	
96	32686200	Near-Term	-	-	-	-	**(958)**
		2040	680	-	(1,638)	(958)	
97	32694200	Near-Term	-	-	-	-	**999**
		2040	340	405	254	999	
98	32703100	Near-Term	-	-	-	-	**745**
		2040	340	405	-	745	
99	32703200	Near-Term	-	-	-	-	**948**
		2040	170	810	(33)	948	
100	32703300	Near-Term	-	-	-	-	**1,444**
		2040	340	675	429	1,444	
101	32662100	Near-Term	-	540	437	977	**3,822**
		2040	1,360	1,485	-	2,845	
102	32677100	Near-Term	-	-	-	-	**1,857**
		2040	510	1,080	267	1,857	
103	32677200	Near-Term	-	2,638	-	2,638	**3,194**
		2040	510	-	46	556	
104	32687100	Near-Term	-	-	-	-	**348**
		2040	-	270	78	348	
105	32693100	Near-Term	-	-	-	-	**1,061**
		2040	340	675	46	1,061	
106	32700100	Near-Term	-	-	-	-	**1,020**
		2040	-	675	345	1,020	
107	32700200	Near-Term	-	-	-	-	**857**
		2040	-	675	182	857	

TAZ Number	TAZ ID	Scenario	Single-Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
108	32709100	Near-Term	-	-	-	-	**1,126**
		2040	340	675	111	1,126	
109	32711100	Near-Term	1,360	-	979	2,339	**3,084**
		2040	340	405	-	745	
111	32670200	Near-Term	-	4,105	-	4,105	**5,545**
		2040	-	1,485	(46)	1,440	
112	32677300	Near-Term	-	-	-	-	**3,240**
		2040	-	3,240	-	3,240	
113	32687200	Near-Term	-	-	-	-	**439**
		2040	-	270	169	439	
114	32693200	Near-Term	-	-	-	-	**373**
		2040	-	405	(33)	373	
115	32700300	Near-Term	-	-	-	-	**734**
		2040	-	675	59	734	
116	32700400	Near-Term	-	-	-	-	**818**
		2040	-	675	143	818	
117	32676100	Near-Term	-	-	-	-	**257**
		2040	-	270	(13)	257	
118	32709200	Near-Term	-	-	-	-	**1,471**
		2040	680	810	(20)	1,471	
119	32711200	Near-Term	-	-	-	-	**1,238**
		2040	-	945	293	1,238	
120	32676200	Near-Term	-	-	-	-	**1,586**
		2040	-	-	1,586	1,586	
121	32676300	Near-Term	-	-	-	-	**696**
		2040	-	-	696	696	
122	32691100	Near-Term	-	-	-	-	**(169)**
		2040	-	-	(169)	(169)	
123	32691200	Near-Term	-	-	-	-	**1,232**
		2040	170	945	117	1,232	
124	32701100	Near-Term	-	-	-	-	**843**
		2040	-	810	33	843	
125	32701200	Near-Term	-	-	-	-	**643**
		2040	-	675	(33)	643	
126	32705100	Near-Term	14,450	-	-	14,450	**14,671**
		2040	-	-	221	221	
128	32691300	Near-Term	-	-	-	-	**390**
		2040	170	135	85	390	
129	32691400	Near-Term	-	1,055	67,845	68,900	**68,900**
		2040	-	-	-	-	

TAZ Number	TAZ ID	Scenario	Single-Family Residential (gpd)	Multi-Family Residential (gpd)	Non-Residential (gpd)	Scenario Total (gpd)	Total (gpd)
130	32701300	Near-Term	-	-	-	-	**1,219**
		2040	170	945	104	1,219	
131	32701400	Near-Term	-	-	-	-	**934**
		2040	-	810	124	934	
132	32705200	Near-Term	-	-	-	-	**1,357**
		2040	340	945	72	1,357	
133	32691500	Near-Term	-	-	-	-	**39**
		2040	-	-	39	39	
134	32701500	Near-Term	-	-	-	-	**531**
		2040	170	270	91	531	
135	32701600	Near-Term	-	-	-	-	**(918)**
		2040	170	810	(1,898)	(918)	
136	32705300	Near-Term	-	-	-	-	**1,137**
		2040	-	675	462	1,137	
138	32669400	Near-Term	-	4,320	33,900	38,220	**60,851**
		2040	-	22,410		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	



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

GHD

City of Huntington Beach
Sewer Master Plan Update

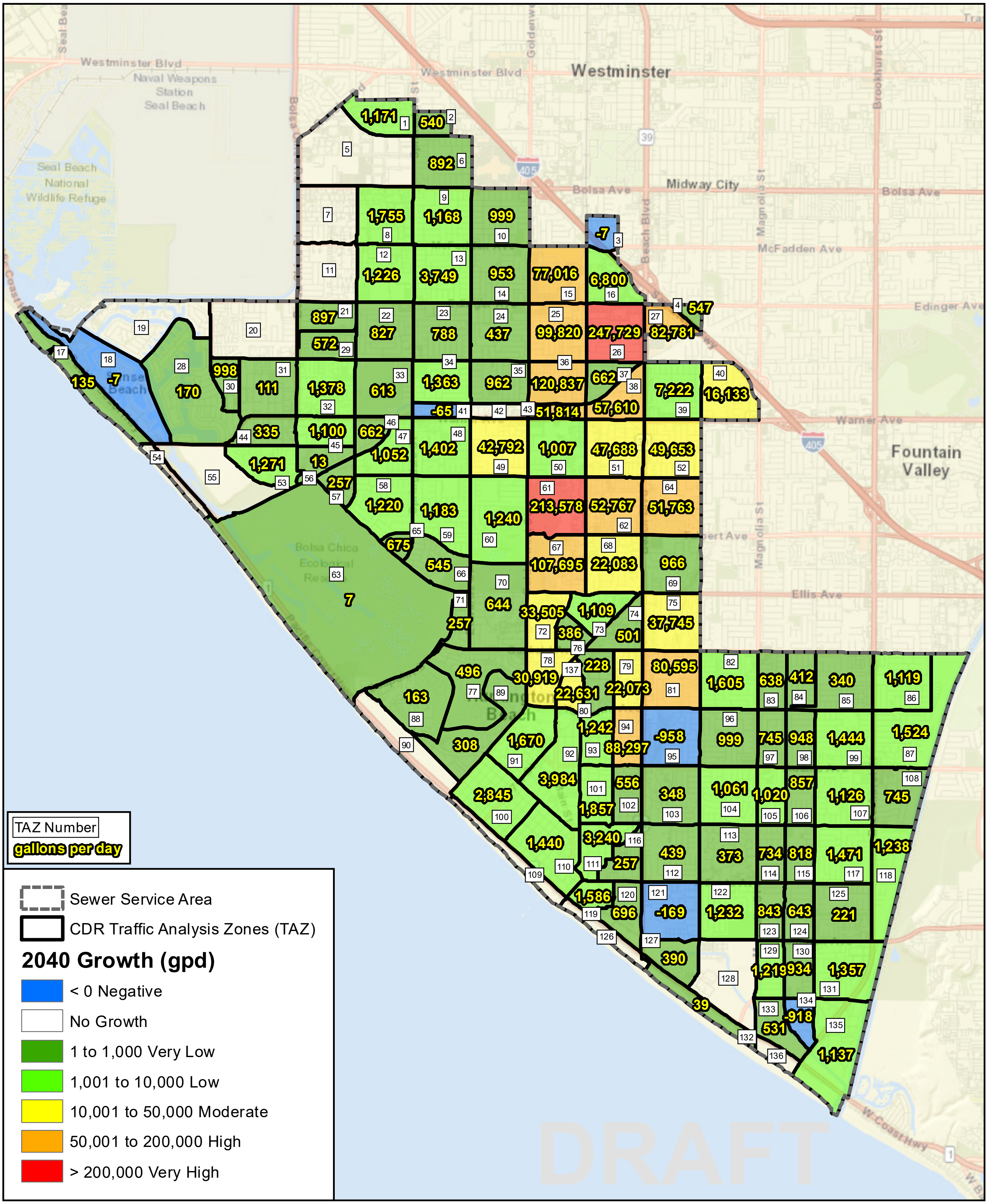
Future Development
Near-Term Growth

Project No. 12585300
Revision No. 0
Date 10/17/2023

FIGURE 5.8

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 5.8 Future Development Near Term.mxd
Print date: 17 Oct 2023 - 14:06

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



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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

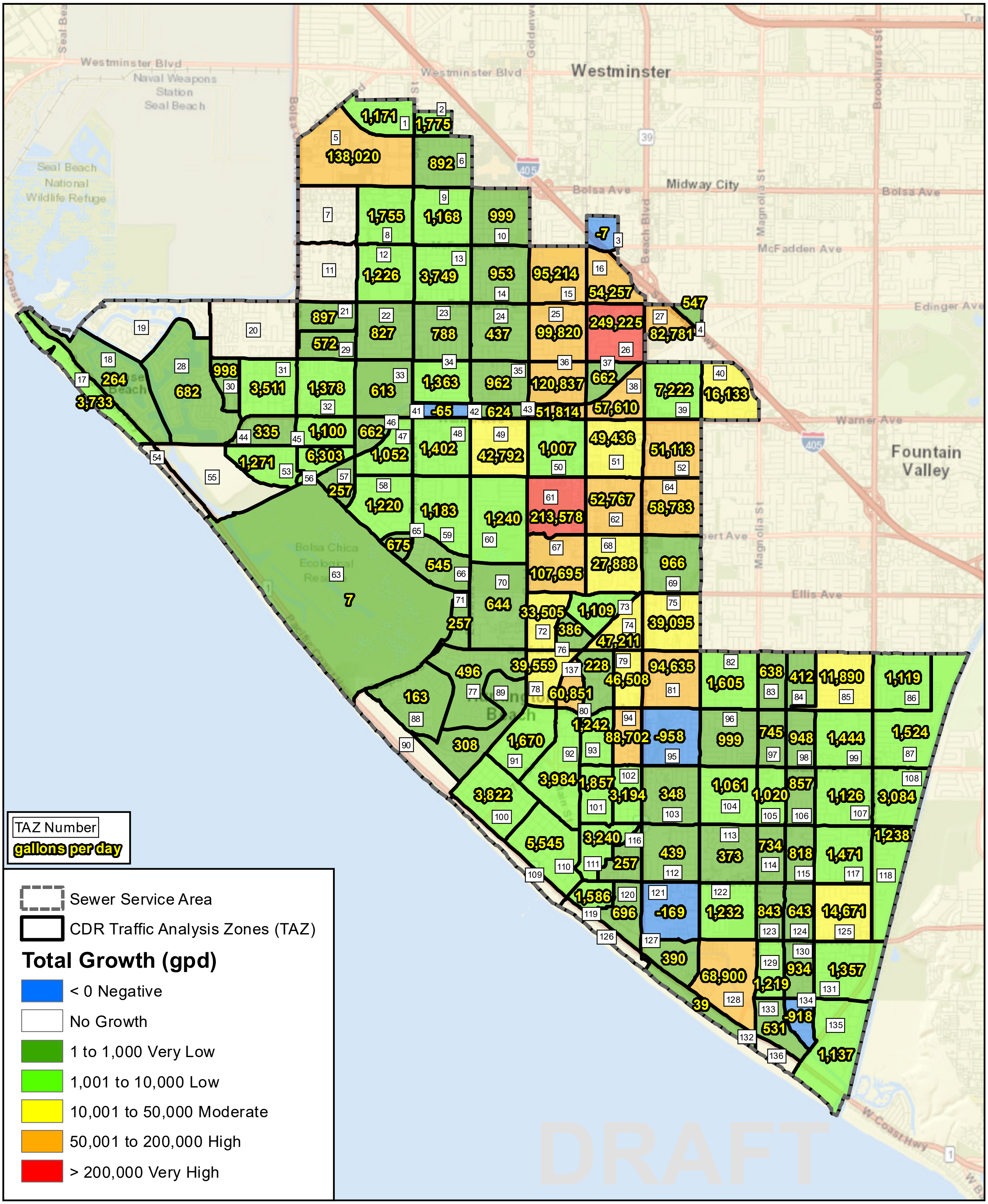
Future Development
2040 Growth

Project No. 12585300
Revision No. 0
Date 10/17/2023

FIGURE 5.9

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 5.9 Future Development 2040.mxd
Print date: 17 Oct 2023 - 14:20

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2



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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

Future Development
Total Growth

Project No. 12585300
Revision No. 0
Date 10/17/2023

FIGURE 5.10

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 5.10 Future Development Total.mxd
Print date: 17 Oct 2023 - 14:44

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

6 Hydraulic Capacity Analysis

6.1 Design Basis Criteria

6.1.1 Future Development Loads

6.1.2 Rainfall

6.1.3 Boundary Conditions

6.1.4 Future Conditions I&I

6.2 Capacity Analysis Criteria

6.3 Calibration Scenario Hydraulic Results

6.3.1 Dry Weather Calibration Flow Results

6.3.2 Wet Weather Calibration Flow Results

Figure 6.1 Calibration Period Wet Weather Flow Hydraulic Results

6.4 Existing Condition Scenario Hydraulic Results

6.4.1 Existing Dry Weather Flow Results

6.4.2 Existing Wet Weather Flow Results

Figure 6.2 Existing Condition Dry Weather Flow Hydraulic Results

Figure 6.3 Existing Condition 10 yr 24 hr Design Storm Hydraulic Results

6.5 Near-Term Condition Scenario Hydraulic Results

6.5.1 Near-Term Dry Weather Flow Results

6.5.2 Near-Term Wet Weather Flow Results

Figure 6.4 Near-Term Condition Dry Weather Flow Hydraulic Results

Figure 6.5 Near-Term Condition 10 yr 24 hr Design Storm Hydraulic Results

6.6 Future Condition Scenario Hydraulic Results

6.6.1 Future Dry Weather Flow Results

6.6.2 Future Wet Weather Flow Results

Figure 6.6 Future Condition Dry Weather Flow Hydraulic Results

Figure 6.7 Future Condition 10 yr 24 hr Design Storm Hydraulic Results

7 Inflow & Infiltration

7.1 I&I Reduction Program Results

7.2 GWI Characterization

Figure 7.1 Existing Condition 10 yr 24 hr Design Storm Groundwater Infiltration Rates

Figure 7.2 Existing Condition 10 yr 24 hr Design Storm Groundwater Infiltration Rates per Acre

7.3 RDI&I Characterization

Figure 7.3 Existing Condition 10 yr 24 hr Design Storm Rainfall Dependent Inflow & Infiltration Rates

Figure 7.4 Existing Condition 10 yr 24 hr Design Storm Rainfall Dependent Inflow & Infiltration Rates per Acre

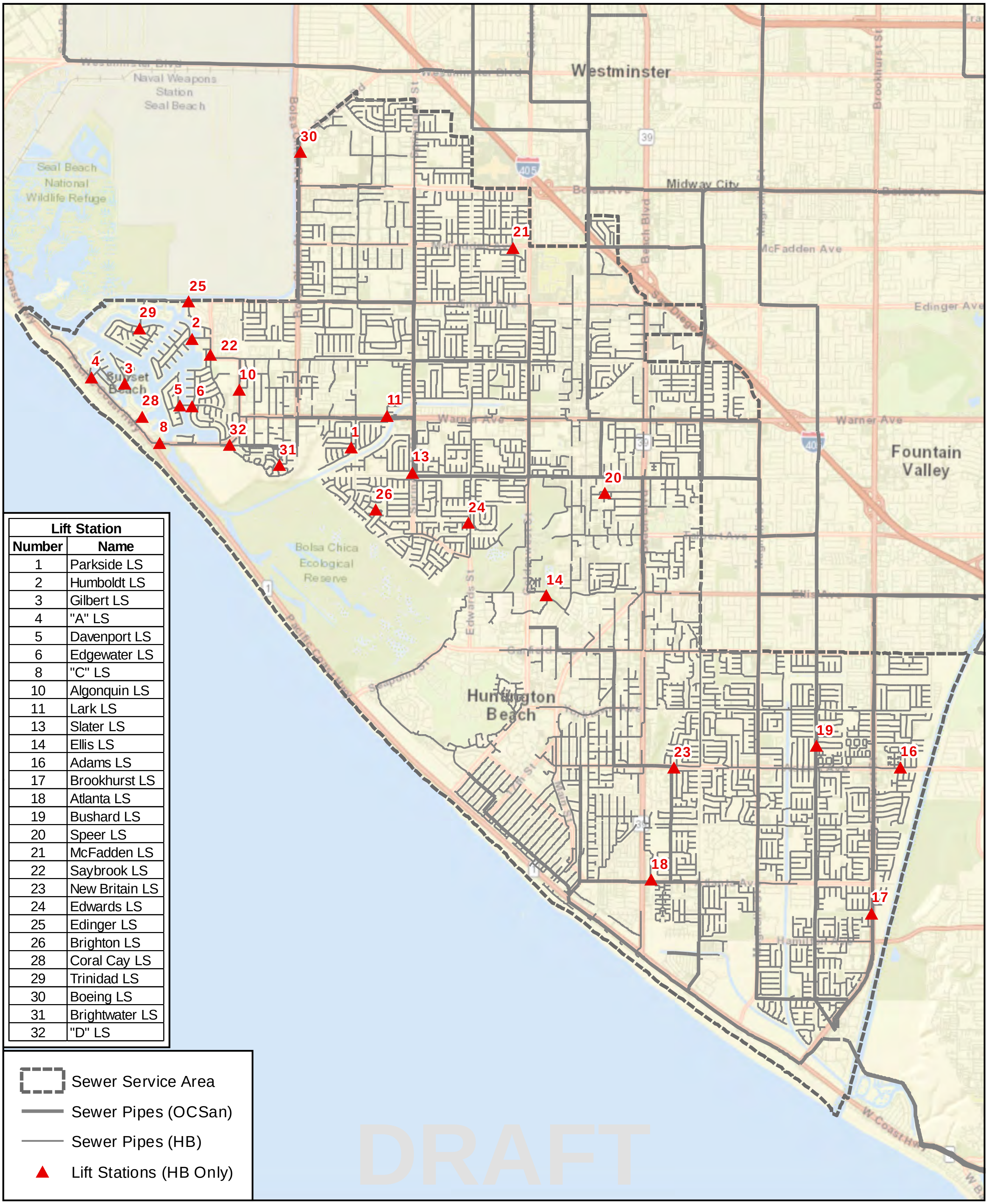
8 Assessment of Wastewater Lift Stations

This chapter summarizes the desktop condition assessment of the City's lift stations. Assessment forms were completed by City personnel and provided to GHD for the basis of this section. The recommended improvements have been detailed in the following sections.

8.1 Lift Station Condition Assessment

GHD was provided assessment forms for twenty-seven (27) lift stations as shown in **Figure 8.1** on the following page and listed below:

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



Lift Station	
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

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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

Lift Station Locations

Project No. 12585300
Revision No. 0
Date 11/7/2023

FIGURE 8.1

\\ghdnet\ghd\US\Irvine\Projects\561\12585300\GIS\Maps\Deliverables\SMP\Draft\Figure 8.1 Lift Station Locations.mxd
Print date: 08 Nov 2023 - 11:25

Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: afisher2

8.1.1 Lift Station Condition

A brief description of issues found at each assessed lift station is presented below.

#1 Parkside LS

There are no significant issues with the lift station itself at this site. However, security fencing or a wall should be installed to protect the site from outside influence. A permanent 150 kW emergency power generator is also recommended to be installed on-site in case of a localized power outage.

#2 Humboldt LS

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. Due to these structural defects as well as the advanced age of the intake and discharge piping, GHD recommends a full rehabilitation of the lift station along with a new flow meter installed after the station has been rehabilitated.

#3 Gilbert LS

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. As the pumps are past their useful life, GHD recommends completely rehabilitating the station. Once the station has been rehabilitated, an emergency generator should be installed in case of a localized power outage.

#4 Station A LS

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, an emergency generator should be installed in case of a localized power outage.

#5 Davenport LS

The lift station has had past issues with the force main. As the station is aging, the City has requested to relocate the station to the Park area.

#6 Edgewater LS

There are no notable improvements to be made at this station.

#8 Station C LS

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 LS

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 LS

The lift station is beginning to settle under the structure due to its age. There is also notable corrosion on the force main, internal piping, and intake pipe. Due to these issues, the lift station should be replaced in its entirety. Once the lift station has been replaced, an emergency generator should be installed in case of a localized power outage.

#13 Slater LS

There are no notable improvements to be made at this station.

#14 Ellis LS

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. During this rehabilitation process, an emergency generator should be installed in case of a localized power outage.

#16 Adams LS

The lift station requires new epoxy coating for preventative maintenance around the entire structure. The dry pmps are approaching their end of life. An emergency generator should also be installed in case of a localized power outage.

#17 Brookhurst LS

The lift station should be recoated using a polyurethane base. An emergency generator should also be installed at this time in case of a localized power outage.

#18 Atlanta LS

Due to the age of the lift station, GHD recommends a complete replacement. An emergency generator should be installed at this time as well in case of a localized power outage.

#19 Bushard LS

This lift station has multiple required structural and mechanical improvements currently. As such, GHD recommends replacing the lift station. An emergency generator should also be installed in case of a localized power outage.

#20 Speer LS

The lift station requires maintenance within the next 3 to 5 years. The epoxy liner in the wet well needs to be rehabilitated along with the piping and discharge valves requiring replacement. An emergency generator should also be installed in case of a localized power outage.

#21 McFadden LS

There are no notable improvements to be made at this station.

#22 Saybrook LS

The lift station requires an odor scrubber for future potential odor issues.

#23 New Britain LS

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 LS

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 LS

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. An emergency generator should be installed on site in case of a localized power outage.

#26 Brighton LS

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. An emergency generator should be installed on site in case of a localized power outage.

#28 Coral Cay LS

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. An emergency generator should be installed on site in case of a localized power outage.

#29 Trinidad LS

The lift station requires an odor scrubber for future potential odor issues.

#30 Boeing LS

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.

#31 Brightwater LS

There are no notable improvements to be made at this station.

#32 Station D LS

The generator at this lift station has reached the end of its useful life.

9 Capital Improvement Program Development Strategy

9.1 Design Basis Model Scenarios

9.2 CIP Solution Model Scenarios

9.3 CIP Cost Basis

10 CIP Implementation and Recommendations

10.1 CIP Prioritization Strategy

10.2 CIP Implementation Strategy

10.3 Future Studies and Recommendations

Appendices

Appendix A

Detailed Planning Scenarios

Appendix B

DWF Calibration Plots

Appendix C

WWF Calibration Plots

Appendix D

Gravity Sewer Main CIP Project Details

Appendix E

Lift Station CIP Project Details