1.0 EXECUTIVE SUMMARY

1.1 BACKGROUND

The City of Manhattan Beach (City) was incorporated December 7, 1912, when 600 people permanently resided in the City. Shortly after the City was incorporated, the first municipal water plant and water system consisting of 23 miles of pipeline were established; and later, several elevated tanks were added to improve the water system. In the 1940s, the Water Department Building and a water well were constructed through a federal Work Progress Administration project. Today, the only remaining elevated water tank is located at the City's Block 35 facility on Rowell Avenue and 6th Street. The tower was built in late 1948 and retrofitted in 1994. It is primarily used for pressure control and is not used for storage.

In 2010, the City completed its most recent Water Master Plan (WMP), which evaluated the performance of the existing water system; and in 2020, the City completed an Urban Water Management Plan update. The City has been implementing the recommendations from its 2010 WMP, including implementing the improvements identified as high priority and providing recommended annual flushing of the existing water mains.

The City hired Stantec Consulting Services Inc. to prepare the 2021 WMP and update the City's hydraulic water model.

1.2 STUDY OBJECTIVES

The goals of the City are to provide a high-quality potable water supply that meets all applicable regulations, to supply adequate flows and pressures for water service and fire protection, to operate at high efficiency and low cost, and to maintain service reliability through redundancy. To meet these goals, the purpose of this WMP update is to incorporate recent improvements and changes to the City's water infrastructure since the last WMP and to serve as a guide for planning water system improvements through year 2030. This is accomplished through updating and calibrating the existing hydraulic model, analyzing water demand and supply projections, identifying any deficiencies and providing improvement recommendations, evaluating optimization of supply facility operation, and providing a phased capital improvement program (CIP) with planning level cost estimates.

1.3 STUDY AREA AND LAND USE

The City is approximately 3.9 square miles of residential, commercial, and industrial land. The City is a coastal community bordered by the City of El Segundo to the north, the Cities of Hawthorne and Redondo Beach to the east, and the Cities of Redondo Beach and Hermosa Beach to the south. The primary land use in the City is residential (72 percent).

The City has grown significantly since its incorporation in 1912; however, over the last few years, the population has decreased in the City and is closer to what it was 10 years ago. Although population has

varied over the last 10 years, the City's Community Development Department is expecting a steady population growth of about 2 percent over the next 10 years.

1.4 WATER SUPPLY

The City's water supply sources include treated imported water from the Metropolitan Water District of Southern California (MWD), treated groundwater through the West Coast Basin, and recycled water supply from West Basin Municipal Water District (WBMWD). MWD is the regional wholesaler of imported water for most of Southern California, providing water to its member agencies through a regional distribution system. WBMWD is one of MWD's member agencies that provides imported water to agencies in the South Bay portion of Los Angeles County, including the City. WBMWD provides imported water to the City at connection WB-04, located at the intersection of Manhattan Beach Boulevard and Redondo Avenue. The City maintains a metered connection with WBMWD to receive treated imported water. The capacity of this connection is 15 cubic feet per second (cfs).

The City owns three wells in the West Coast Basin (Well 13, Well 11A, and Well 15) and extracts groundwater supplies from the two active wells (Wells 11A and 15). Well 13 was abandoned in 1982 due to deteriorating water quality and failure of its well casing. As of 2014, according to the West Coast Basin Judgement, the City has an adjudicated pumping right of 1,131 acre-feet per year (afy) from the West Coast Basin, and an allowance to pump up to 20 percent more of its annual entitlement, or carry over up to 20 percent of its annual entitlement in any given year. The City's total annual groundwater production cannot exceed 1,357 afy. In addition, the City is allowed to lease West Coast Basin water rights from other West Coast Basin producers.

The recycled water system is owned, operated, and maintained by WBMWD, currently providing approximately 298 afy of recycled water to the City. Note that, recycled water supply analysis is not part of this WMP Update.

Water conservation is an integral part of the City's water planning efforts. Water conservation regulations and requirements are enforced to meet water conservation regulations set forth by the City Council. The City Council approved a Water Conservation Ordinance that became effective on July 2, 2009 and was since amended.

1.5 WATER USE

The City provided daily water production and consumption data for fiscal years (FY) 2013 to 2019. This historical water production and consumption data was analyzed to understand water use trends in the City. The City also provided its most recent annual bi-monthly billing data at the time of this Master Plan, which included data from November 2019 to October 2020. This billing data was used to estimate water duty factors for each land use category, since the billing data provided water use per land use.

The water production data shown in Table ES-1 includes water consumption by customers plus any water loss, and is used to determine water use or demand. The water loss is known as non-revenue water. The water system had approximately 1 to 13 percent of non-revenue water between FYs 2013/14 and 2018/19, with an average water loss equated to 5.2 percent. The highest apparent water loss was in

FY 2013/14, at about 13 percent. In recent years, a lower loss of approximately 3 percent water is observed, which is beneficial for the City.

Per Table ES-1, the historical average annual water production is 4,876 afy, with a high-water production of 5,885 afy in FY 2013/14 and a low-water production of 4,096 afy in FY 2015/16. The low water production reflects the water conservation efforts in response to the drought conditions in 2015. In the last 6 years, the City has increased its imported water supply from 68 percent to 96 percent, while reducing groundwater use from 32 percent to about 4 percent. The reduction in groundwater production is due to pumping limitations and operational concerns.

Table ES-1 – Historical Annual Water Production

FY July to June	Groundwater (afy)				Imported (afy)		Total		
	Well 11A	Well 15	Total Groundwater	% Groundwater	MWD	% MWD	afy	mgd	gpm
2013/14	278	1,597	1,875	32	4,010	68	5,885	5.3	3,648
2014/15	17	1,809	1,826	36	3,178	64	5,004	4.5	3,102
2015/16	0	1,048	1,048	26	3,048	74	4,096	3.7	2,539
2016/17	0	309	309	7	4,314	93	4,623	4.1	2,866
2017/18	39	327	366	7	4,520	93	4,886	4.4	3,029
2018/19	64	138	202	4	4,562	96	4,764	4.3	2,953
Average	**66**	**871**	**938**	**19**	**3,939**	**81**	**4,876**	**4.4**	**3,023**

The daily water production from November 2019 to October 2020 was used to estimate existing average day demand (ADD) and maximum day demand (MDD) in the City service area. The existing ADD was 2,968 gallons per minute (gpm) or 4.27 million gallons per day (mgd) as shown in Table ES-2. The ADD from the last Master Plan was 5.68 mgd. Since then, the City's ADD has been reduced by approximately 24 percent, which is typical due to increased conservation efforts since 2015 in response to the drought. The MDD occurred on September 4, 2020, which was 4,451 gpm, which is 1.5 times the ADD, as shown in Table ES-2. The existing max day peaking factor was 1.5, which is the same as the previous Master Plan. Peak hour demands occur during highest hour of water use and hourly water production data is needed to estimate the peaking factor. Since hourly data was not available, a peaking factor of 2.31 was used from the previous Master Plan to calculate the peak hour demands. The peaking factors are multiplied by ADDs. These demands were used in the model to analyze the existing system conditions.

Table ES-2 – Existing System-Wide Demands and Factors

Demand Description	gpm	mgd	afy	Peaking Factor	Notes
Average Day	2,968	4.27	4,787	1.00	-
Maximum Month	3,383	4.87	5,470	1.14	Occurred in July 2020
Maximum Week	3,561	5.12	5,729	1.20	Occurred the week of 9/4/2020
Maximum Day	4,451	6.41	7,084	1.50	Occurred on Friday 9/4/2020
Peak Hour	6,855	9.86	11,057	2.31	-

Per City's 2003 General Plan, there is very little land use change anticipated from year 2025 to 2030. Therefore, water demand projection for 2030 was estimated using the population demand forecasting methodology. According to the City's Community Development Department, the Southern California Association of Governments (SCAG) forecasts that the population of the City would increase from existing population of 35,991 to approximately 36,546 by 2030. Demand projection was estimated using the City's future population projections and the water use per capita of 122 gpd/capita estimated in this Master Plan. As shown in Table ES-3, the estimated demands for the ultimate planning horizon are 5,125 afy, approximately 6.6 percent increase in demand from existing demands.

Table ES-3 – Future Population and Water Demand Per Capita

Year	Population [a]	Demand per Capita per Day (gpd/capita)	Average Demand	
			Daily (mgd)	Annual (afy)
2030	36,546	122	4.58	5,125

Note: The gpd/capita is based on the 2013-20219 water production data provided by the City.

a) Population based on SCAG information provided by the City.

Table ES-4 summarizes the demands and factors used in the hydraulic model for the entire City water distribution system. The projected demands reflect the near-term and ultimate planning year conditions.

Table ES-4 –System-Wide Demands and Factors

Description	Factor	Existing Demand		Near-Term (2025)		Ultimate (2030)	
Average Year	-	4,787	afy	4,843	afy	5,125	afy
Average Day	-	4.27	mgd	4.32	mgd	4.58	mgd
Average Day	-	2,968	gpm	3,002	gpm	3,177	gpm
Maximum Day	1.5	4,451	gpm	4,504	gpm	4,766	gpm
Peak Hour	2.31	6,856	gpm	6,936	gpm	7,339	gpm

1.6 EXISTING FACILITIES

Currently, the City operates and maintains an extensive water conveyance system, including approximately 140 miles of water pipelines with the largest pipe diameter of 45 inches. Approximately 56 percent of the water pipelines in the system are 6 to 8 inches in diameter. The majority of system pipe material is cast iron pipe, totaling 67 percent of all pipelines. The second most common material is ductile iron pipe, making up 25 percent of the system. A summary of City's existing facilities is shown in Table ES-5.

Table ES-5 – City's Existing Facilities

Facilities (Capacity)	
Water Supply Facilities	• One imported water turnout connection to 45-inch diameter MWD West Basin Feeder (15 cfs) • Well 11A (1,800 gpm) • Well 15 (1,500 gpm)
Water Distribution System	• Two pressure zones • Approximately 140 miles of pipelines • One pressure monitoring station
Pump Stations	• Block 35 Booster Pump Station (four pumps, 1,715 gpm each) • Peck Booster Pump Station (four pumps, 2,200 gpm each) – upgraded, not online during this Master Plan update • Larsson Booster Pump Station (three pumps, 580 gpm each) • 2nd Street Booster Pump Station which serves as a backup for Larsson Pump Station (one pump, 2,302 gpm)
Storage Reservoirs	• One ground level reservoir at Block 35 Facility (2 MG) • One elevated tank at Block 35 Facility (0.3 MG) • One partially buried forebay reservoir at the Peck Facility (8 MG) – upgraded, not online during this Master Plan update
Interagency Connection	• Two emergency connections with City of El Segundo • One emergency connection with California Water Service transmission main • Total capacity for all three connections is approximately 23 cfs

The City's water distribution system is connected from the MWD 45-inch pipeline and turn out at WB-04, located at the intersection of Manhattan Beach Boulevard and Redondo Avenue. From this MWD connection, imported water can be directly delivered to the City's Peck Facility and Block 35 Facility. Groundwater from the City's two wells can be routed to the Block 35 Facility via 12-inch and 10-inch diameter lines. In addition, groundwater can be delivered to the Peck Facility via a 16-inch transmission main. The City has three emergency connections, two with the City of El Segundo and the other with California Water Service. Two emergency connections are located at the intersection of Manhattan Beach Boulevard and Redondo Avenue. The third connection is an 8-inch gate valve at Rosecrans Avenue and Redondo Avenue and is the second connection with the City of El Segundo.

The City's water distribution system consists of two pressure zones which accommodate the variation in the service area: the lower pressure zone is the Main Pressure Zone (Main Zone), and the higher-pressure zone is the Hill Area Pressure Zone (Hill Zone). All existing storage is located in the Main Zone, at the Peck Facility and the Block 35 Facility. The storage facilities consist of one partially buried reservoir (Peck Reservoir), one ground level reservoir (Block 35 Ground Level Tank), and one elevated tank (Block 35 Elevated Tank), with a combined total storage capacity of 10.3 million gallons (MG). The Main Zone serves the majority of the City and is mostly controlled by the Block 35 Elevated Tank. The Block 35 and the Peck Booster Pump stations pump water to the Main Zone. The Main Zone includes a pressure monitoring station (Grandview) near the intersection of 31St Street and Vista Drive. The Hill Zone serves the City's service area with elevations as high as 240 feet above mean sea level (amsl) and is normally

served by the Larsson Booster Pump Station and is backed up by the Second Street Booster Pump Station in the case of higher demands. The Hill Zone is a closed loop system.

The Peck Reservoir and Block 35 Ground Level Tank provide emergency storage for the system and act as the forebay reservoir for the adjacent booster pump stations. The Block 35 Ground Level Tank currently provides minimal storage due to water losses at higher water levels. The Block 35 Elevated Tank is used to control the pressure within the Main Zone. The Peck Facility was under construction as of the date of this Master Plan.

1.7 PLANNING CRITERIA

Planning criteria is established to evaluate the capacity and performance of water distribution systems through a systematic analysis. The criteria provide a means by which the hydraulic performance and reliability of the water distribution system can be evaluated, and for the ability to plan for future facilities to meet future system conditions and demands. Planning and sizing criteria are based on generally accepted standards for reliable, cost-effective, and efficient water systems. Criteria has been recommended considering the previous criteria established in the 2010 WMP as well as American Water Works Association (AWWA) guidelines for potable water system planning.

In addition, other criteria such as water quality and fire protection, are based on federal, state, and local jurisdictional requirements. Planning and fire protection criteria are provided in Chapter 7 and water quality is discussed in this section.

Water Quality

Current Regulations: The quality of water served by the City of Manhattan Beach has to be in accordance with the Federal standards as well as the State of California Department of Public Health (CDPH) standards as set forth in Title 22 of the California Code of Regulations. The basic water quality standards are established by the Safe Drinking Water Act (SDWA), which mandated the U.S. Environmental Protection Agency (USEPA) to develop primary drinking water standards. There are two types of standards. Primary standards protect you from substances that could potentially affect your health. Secondary standards regulate substances that affect the aesthetic qualities of water. Regulations set a Maximum Contaminant Level (MCL) for each of the primary and secondary standards. The MCL is the highest level of a substance that is allowed in your drinking water.

Advisory levels are health-based limits that consider analytical detection levels and are non-enforceable. These are interim guidance levels, which may trigger mitigation action by the water utility. Advisory Levels include California Public Health Goals (PHGs) and Federal Maximum Contaminant Level Goals (MCLGs). PHGs are set by the California Environmental Protection Agency and provide more information on the quality of drinking water to customers, and are like their federal counterparts, MCLGs. Both PHGs and MCLGs are concentrations of a substance below which there are no known or expected health risks.

Primary Standards: A brief review of the Manhattan Beach 2019 Annual Water Quality Report indicated no exceedance of MCL levels in the groundwater or surface water. There were four contaminants that exceeded the MCLG or PHGs limits in the groundwater as shown in Table ES-6, however these

exceedances do not pose any health concerns. They are advisory levels which may trigger mitigation action by the water utility. These contaminants should continue to be monitored and evaluated.

Table ES-6 – Contaminants Exceeding Water Quality Limits in Groundwater Sources

Contaminant	Groundwater Average	Groundwater Range	Limit (MCL)	Limit (MCLG or PHG)	Major Sources in Drinking Water
Primary Standards - Substances Monitored for Public Health					
Arsenic (ug/L)	0.14	ND-0.27	10	0.004	Erosion of natural deposits; glass/electronics production wastes; runoff
Gross alpha particles (pCi/L)	3.3	ND-6.8	15	0	Erosion of natural deposits
Bromate (ug/L)	5.6	ND-8.4	10	0.1	By-product of drinking water disinfection
Secondary Standards - Monitored at the Source for Aesthetic Purposes					
Manganese (ug/L)	52	43-60	50	500	Erosion of natural deposits; glass/electronics production wastes; runoff
Other Parameters					
Hexavalent chromium (ug/L)	0.03	ND-0.07	-	0.02	Erosion of natural deposits; glass/electronics production wastes; runoff

Reference: Manhattan Beach 2019 Annual Water Quality Report

Secondary Standards: A brief review of the Manhattan Beach 2019 Annual Water Quality Report shows the only reported contaminant exceeding the MCL is the manganese level (52 ug/L) as shown in Table ES-6. Manganese exceeded the secondary MCL in one well. Water from the well is blended with imported surface water to reduce concentrations prior to pumping into the distribution system. To mitigate the need for blending water and to reduce dependence on imported water, the City is upgrading the Peck Facility with the treatment ability to remove manganese via a greensand filtration system. The Peck Facility has been in construction since fall of 2020 and is anticipated to be online in the Spring of 2022. Groundwater from the City's wells will be treated through the greensand filtration system.

Upcoming Regulations: The USEPA and the State Water Quality Control Board (State Water Board) have a few upcoming regulations in process or planned. These potential regulations are related to Hexavalent Chromium, Microplastics, Lead and Copper Rule (LCR), and Cross Connection Control. The Hexavalent Chromium regulation may be more applicable to the City than the others. However, it is unknown what the details of any new regulation will be at this time. Therefore, no budgetary recommendations are provided.

1.8 HYDRAULIC MODEL CALIBRATION

The City had an existing hydraulic model from the previous WMP. The hydraulic model was calibrated to improve the accuracy of the model in predicting current system performance. The calibrated model is used to identify any system deficiencies and recommend pipelines and facilities to address these system deficiencies. The hydraulic model was first updated to reflect current operating conditions and recent improvement projects since the previous WMP. Once the model update was complete, field testing was performed to collect flow and pressure data to calibrate the model. Field testing was conducted on January 19, 2021, from 8AM to 4PM. A total of 11 locations were tested for the low (Main) and high (Larsson) pressure zones. Additionally, four pressure loggers were provided at other locations within the tested pressure zones. The results of the field pressure recordings and corresponding pressures from the hydraulic model for the hydrants and the data loggers are summarized in Chapter 8 in Tables 8-2 and 8-3, respectively. The difference between calibration and field test results averaged 4 percent for hydrants and 6 percent for loggers, which is within the 5 to 10 percent desired range for accurately calibrating a model. The hydraulic model has been calibrated for average day conditions only without Peck Reservoir and Pump Station operating. It is recommended that the model be calibrated for MDD conditions during the summer months and with Peck Reservoir and Pump Station operational. Once the model is calibrated, the water system should be re-evaluated at that time for all MDD scenarios.

Hydrant tests 4, 5 and 7 resulted in percentage differences higher than 10. Test 5 and 7 locations resulted in up to 20 psi higher residual pressures in the model compared to the field data. This may be due to valves in the area that may not be fully opened or unknowingly closed. The area also contains older pipes and tuberculation may be worse at these locations than is reasonably assumed for similar pipes in the surrounding area.

It is recommended that operations staff test the valves around these test locations to verify that all valves in the system are fully open. If these are found to be fully open, pipe coupons should be conducted for the pipelines in the area to determine the amount of tuberculation inside the pipe. These locations would include the pipelines in Highland Avenue, Crest Drive, Blanche Road, Ardmore Avenue and 15th Street.

1.9 WATER SYSTEM EVALUATION

The City’s water system was evaluated for distribution performance under ADD, MDD, peak hour for existing, near-term, and ultimate planning horizons MDD and fire flow demand analysis was performed for existing system conditions. In addition to the water distribution system performance evaluation, the City’s reservoirs and booster pump stations were analyzed for adequate capacity and performance to meet the City’s facility sizing criteria and to determine storage required for operational, emergency, and fire flow conditions. Since water distributions systems are among the most essential infrastructure systems, continued reliability is essential. To determine overall system reliability, feasible emergency or facility outage conditions were simulated and evaluated for capacity and performance to meet the City’s planning criteria. Lastly, to determine potential water quality concerns in the system, water age analysis was performed using the updated hydraulic model.

Distribution System Evaluation

The water system was evaluated under normal operating conditions for existing, near-term, and ultimate planning horizons. The results of analysis show that that are no system pressure or pipeline deficiencies under the normal operation conditions. The system evaluations meet City's pressure criteria of minimum 40 psi and maximum 150 psi and velocities don't exceed the maximum velocity criteria of 7 fps. Some areas of the system do exceed 125 psi near the coastal areas and special consideration should be given to the design of new facilities in that area, such as increasing the pressure rating of pipeline, fittings, and other appurtenances.

Fire Flow Analysis

The fire flow analysis resulted in several pipeline locations that require upsizing to meet the City's fire flow requirement criteria of minimum pressure of 20 psi. The total length of fire flow improvements recommended is approximately 35,783 linear feet, ranging from 6-inch to 12-inch diameter pipelines. Recommended pipeline improvements are listed in Table ES-7.

Table ES-7 – Fire Flow Improvement Recommendations

CIP ID	Facility Description	Existing Size	Proposed Size	Quantity (lf)
FF-001	15th St bw Highland Ave and Valley Dr	6"	8"	511
FF-002	Duncan Ave bw Ardmore Ave and Dianthus St	4"	6"	1,016
FF-003	Duncan Ave bw Dianthus St and Sepulveda Blvd	4"	8"	393
FF-004	Boundary Pl bw Dianthus St & Sepulveda Blvd and bw Boundary & Duncan	6"	10"	825
FF-005	John St bw 3rd St and 2nd St	6"	8"	335
FF-006	3rd St bw Ardmore Ave and Poinsettia Ave	4"	8"	654
FF-007	Poinsettia Ave bw 9th St and 8th St	6"	8"	21
FF-008	17th St bw Pacific Ave and Poinsettia Ave	4"	6"	892
FF-009	Valley Dr bw Marine Ave & Blanche Rd, 21st St bw Blanche Rd & Mandor Dr	4"	6"	1,974
FF-010	18th St bw Laurel Ave and Pacific Ave	6"	8"	281
FF-011	Marine Ave bw Pacific Ave and Palm Ave	6"	8"	594
FF-012	Ritter Rd bw Grandview Ave and Bell Ave	6"	10"	595
FF-013	Lateral off Cedar Wy bw Carlotta Wy and 33rd St	6"	8"	106
FF-014	Near Magnolia Wy bw 33rd St and Santa Cruz Ct	6"	10"	271
FF-015	Village Center Dr bw Malaga Wy and Gateway Dr	8"	10"	230
FF-016	27th Wy bw Cedar Wy and Village Cir	8"	10"	256
FF-017	17th St bw (west of) Magnolia Ave and Chestnut Ave	6"	8"	262
FF-018	15th St near Roswell Ave and 17th St	6"	8"	634
FF-019	8th St bw Rowell Ave and Peck Ave	4"	6"	744
FF-020	Ronda Rd, Longfellow Dr, Kuhn Dr	6"	8"	2,507
FF-021	Chabela Dr bw Keats St and Tennyson St	6"	8"	464
FF-022	Mira Costa HS near Ruhland Ave bw Meadows Ave and Peck Ave	6"	10"	291
FF-023	Mira Costa HS near Ruhland Ave bw Meadows Ave and Peck Ave	8"	10"	398
FF-024	Mira Costa HS near Meadows Ave between Keats St and Artesia Blvd	4"	6"	914
FF-025	Artesia Blvd bw Peck Ave and Aviation Blvd	6"	10"	1,739
FF-026	Artesia Blvd bw Aviation Blvd and Aviation Wy	6"	8"	480
FF-027	Mathews Ave bw Peck Ave and Redondo Ave	6"	8"	1,328
FF-028	Mathews Ave bw Redondo Ave and Aviation Wy	4"	8"	914
FF-029	Aviation Wy bw Ruhland Ave and Artesia Blvd	4"	8"	992

CIP ID	Facility Description	Existing Size	Proposed Size	Quantity (lf)
FF-030	Ruhland Ave bw Peck Ave and Redondo Ave	6"	8"	1,315
FF-031	Curtis Ave bw Peck Ave and Redondo Ave	6"	8"	1,325
FF-032	3rd St bw Peck Ave and Redondo Ave	6"	8"	1,335
FF-033	2nd St bw Aviation Blvd and Aviation Pl	6"	8"	589
FF-034	5th St bw Redondo Ave and Aviation Blvd	4"	6"	1,302
FF-035	Harkness St bw Manhattan Beach Blvd and 11th St	2"	6"	286
FF-036	12th St bw Manzanita Ln and Harkness St	8"	8"	214
FF-037	12th St bw Harkness St and Aviation Blvd, Aviation Blvd bw 12th and Manhattan Beach Blvd	6"	8"	629
FF-038	12th St bw Harkness St and Aviation Blvd, Aviation Blvd bw 12th and Manhattan Beach Blvd	8"	8"	240
FF-039	Harkness St bw 12th St and Manhattan Beach Blvd, Manhattan Beach Blvd bw Harkness St and Aviation Blvd	6"	8"	629
FF-040	Harkness St bw 12th St and Manhattan Beach Blvd, Manhattan Beach Blvd bw Harkness St and Aviation Blvd	8"	8"	238
FF-041	Wendy Wy bw Marine Ave and 12th St	6"	8"	2,429
FF-042	Bell Ave bw Rosecrans Ave and 33rd St	6"	10"	170
FF-043	Phase 1 - New 12-inch Pipeline in Rosecrans Avenue from Laurel Ave to Highland/38th St	-	12"	4,461
			Total	**35,783**

Reservoir and Booster Station Evaluation

The water distribution system was evaluated under MDD conditions for a duration of 24 hours to analyze the tanks for proper water level cycling operation and booster pump station capacities and operation to provide adequate pressures in the distribution system. The evaluation was performed for existing, near-term, and ultimate planning horizons. The analysis results indicated that all active reservoirs and booster stations have sufficient capacity, and the booster stations provide adequate system pressures for the distribution system under existing, near-term, and ultimate planning conditions.

Storage Analysis

Emergency storage is recommended in the event of an interruption in the primary supply source. The City's primary supply source is imported from MWD. The recommended emergency storage volume in the event of an MWD outage is seven days of ADDs. However, it is reasonable to assume groundwater supply sources will be available during a MWD outage for seven days. Therefore, the required emergency storage volumes can be reduced by the groundwater supply capacity. The Block 35 and Peck Reservoir pump stations provide adequate system pressures and have sufficient capacity to meet future demands.

The recommended emergency storage in the event of an MWD water outage is seven ADDs and it is reasonable to assume groundwater supply sources will be available. Therefore, the required emergency storage volumes can be reduced by the groundwater supply capacity. This Master Plan assumes a firm groundwater supply capacity, which is the capacity with the largest well out of service. For existing conditions, the firm groundwater capacity is 1,500 gpm from Well 15 only, or 15.12 MG for seven days. The total emergency storage requirement of seven ADDs (29.89 MG) yields a net requirement of 14.77 MG, which results in overall storge deficit of 6.93 MG. For the City to mitigate this storage deficit, additional groundwater capacity is required. It is recommended the City use both available wells during

emergency conditions, when imported water is out. For the ultimate planning horizon, with both wells operating, the groundwater capacity is 3,300 gpm (1,800 gpm from well 11A and 1,500 gpm from Well 15), or 33.26 MG. With these wells online, groundwater supply will meet the emergency storage requirement. The future required volume based on seven ADDs is 32.06 MG, resulting in a surplus storage of 7.74 MG.

Reliability Analysis

To determine overall system reliability, emergency or facility outage conditions were simulated for a duration of three days (72-hour) and evaluated for capacity and performance to meet the City's planning criteria. The results and recommendations are summarized as follows:

Imported Water Out of Service: Three scenarios were simulated in the hydraulic model to depict circumstances where imported water connection is out of service for 72 hours, and the distribution system is supplied with groundwater only. The scenarios included system evaluations with existing groundwater capacity only and additional groundwater capacity available to determine if the system can be fully supplied with groundwater. In addition, a third scenario was evaluated where all groundwater was routed to the Peck Facility, treated and then distributed to the system. The City was interested in evaluating a proposed 24-inch pipeline between Peck Facility and the Block 35 Facility.

The results indicated that with groundwater pumping capacity of 3,300 gpm (Well 11A and Well 15), the City can rely on groundwater supply only for 72 hours in case of an emergency occurring during ADD for all planning horizons. However, the groundwater pumping capacity is not sufficient for MDD conditions. It is recommended for the City to consider increasing the total well capacity or implement the construction of a new groundwater well to meet the City's system MDD in case imported water goes out of service. The system was evaluated with and without the addition of a new 24-inch pipeline between the two facilities. The model analysis showed that no significant differences in operations or benefits were provided in the system with the proposed 24-inch pipeline.

Groundwater Out of Service: In this scenario all groundwater wells are out of service and the imported water connection is assumed as the only supply to verify the system's capacity. Operational and emergency storage in the reservoirs was assumed available and used for the analysis. The system was evaluated for near-term and ultimate planning horizons. The results indicated that the imported MWD water through WB-04 is required to be 1,800 gpm to the Peck Facility and 2,936 gpm to the Block 35 Facility, with a total of 4,736 gpm, which is within the capacity of the allocation of WB-04 (15 cfs). No improvement recommendations are required.

Block 35 and Pump Station Out of Service: Under this scenario, the Block 35 Facility is out of service and the Peck Facility is operating. This circumstance can potentially occur if the City needs to make upgrades to the Block 35 Facility. The system is evaluated for near term planning horizon under MDD conditions with all water supply routed to the Peck Facility then distributed to the system. To deliver MDD demands, an average imported water of 3,365 gpm is supplied from the MWD connection, and 1,185 gpm groundwater is supplied from Well 15. The results indicate that the Peck Reservoir and Pump Station with three pumps on, provide sufficient capacity and pressure to meet City's system requirements. However, the 16-inch pipeline immediately downstream of the Peck Pump Station, along 18th Street from the Peck

Pump station to North Peck Avenue, has a velocity of approximately 8 fps, slightly surpassing the City's planning criteria of maximum velocity of 7 fps. Since this potential operating condition is temporary, and velocity criteria only is exceeded slightly, improvements are not recommended for the 16-inch pipeline.

Water Age Analysis

Water age refers to the time it takes for water to travel from a water source to consumers and is influenced by water distribution system velocities and pipe lengths. This is an important performance indicator to many utilities because excessive age can cause problems with sediment build up in the pipeline and disinfection by-products.

The average water age for the Manhattan Beach water distribution system, ranges from around two days in the southern section of the system to more than six days in the northwest section of the system, near 44th Street referred to as the El Porto area. The City has indicated that there are water quality issues in the northwestern end of the system. This is consistent with the water age analysis. Typically, water age is used as proxy for chlorine residual. Water age that is greater than six days indicates low chlorine residual. One potential cause for high water age can be explained by the distance from the water supply sources. Other locations that are closer to the reservoir can have high water age due to the age of the water within the reservoirs.

As part of this Master Plan, to address the high water age near the El Porto area, three proposed pipeline alternatives were analyzed for water age to determine the alternative alignment that provided the best water quality improvement in the El Porto area. The recommended El Porto Pipeline Project resulted in Alternative 1 alignment with the following construction phasing:

- Phase 1: Construct a 12-inch pipe paralleling the existing 8-inch pipe along Rosecrans Avenue from Laurel Avenue to 38th Street. (This pipeline is shown as recommendation for fire flow projection as improvement project FF-043)
- Phase 2: Construct a parallel 12-inch main along 38th and Crest Drive from Highland Avenue to 45th Street with interconnections at every intersection.
- Phase 3: Construct a 12-inch pipe paralleling the existing 8-inch pipe along Rosecrans Avenue from Pacific Coast Highway to Laurel Avenue.

These improvements will help circulate the water in the system more frequently and help minimize water quality issues. However, it should be noted that until the entire alternative has been constructed, the City will not notice a decrease in water age between Rosecrans Avenue and 45th Street. If during the initial phase of the project water aging is creating an issue in the system, it is suggested that the City install temporary Autoflushers at the interconnection on Grandview Avenue and Laurel Avenue to reduce the water age until the full project is completed.

Other options for the City to consider in mitigating concern for high water age are as follows. One solution is to cycle the reservoirs more often to reduce age of water in the reservoirs. The second solution is to confirm that chlorine levels are within acceptable ranges by performing chlorine sampling over a

seven-day period at water age locations of more than six days. The third option is to install Auto flushes to increase water turn over, therefore reducing water age and increasing chlorine residual.

1.10 CONDITION ASSESSMENT

A visual inspection of the Block 35 Facility was conducted on November 18, 2020, with the assistance of City staff. The visual inspection was performed on the civil, mechanical, structural, and electrical components and infrastructure at the site. No testing of reliability or performance was conducted on the infrastructure. Table ES-8 summarizes the inspection and recommendations.

Table ES-8– Condition Assessment Recommendations

Observation Type	Block 35 Pump Station and Building	Block 35 Ground Storage	Block 35 Elevated Tank
Mechanical	• Replace corroded pump base plate. • Sandblast and recoat corroded equipment. • The existing pump station valve vault is cramped, hard to work in, and has aged. When the reservoir is replaced, it is recommended to replace the valve vault as well. • Upgrade hypochlorite system to match the new system at Peck.	None	None
Structural	• Repair deteriorating rafters in chemical building. • Secure and/or properly anchor equipment in the chemical building.	• Conduct a detailed structural and seismic evaluation on a fully drained tank. Identify structural rehabilitation or seismic retrofit requirements. • Block 35 Facility Replacement – The Block 35 tank does not currently have any visible or known deficiencies. But it is nearing the end of its useful life and will need to be replaced sometime in the next 15-20 years.	• Regular Inspection and repairs as needed on the elevated tank. Detailed seismic evaluation and if necessary, a seismic retrofit of the structure.
Electrical	• Existing PLC panel and equipment are no longer manufactured. Replace with new panel and equipment. • Conduct an arc-flash study and install arc-flash labels per NFPA 70E on all electrical equipment, such as the Switchboard/MCC. • Install lighting fixtures per the IES Lighting Handbook lighting recommendations to improve internal and external lighting and meet energy use requirements.	None	None

1.11 CAPITAL IMPROVEMENT PROGRAM

The recommended CIP is based on improvements resulting from the hydraulic model analysis and the condition assessment. The CIP identifies the proposed improvement projects, provides the estimated costs of these facilities, and develops an estimate timetable or prioritization for implementing these improvements over the next 10 years. The CIP establishes a comprehensive picture of the improvements based on system hydraulic needs and condition of aging Block 35 Facility. Peck Facility has been recently upgraded and the Larsson and Second Street Booster Pumpstations are being upgraded, therefore only the Block 35 Facility was inspected for condition in this Master Plan.

The CIP is prioritized for improvements needed for immediate, near-term, and future conditions for the next 10 years, beginning at year 2021 to year 2030. Annual CIP projects and costs are provided for years 2021 through 2024. The near-term year 2025 CIP list of projects and budgets assume these improvements are implemented from year 2025 through 2029. Year 2030 is assumed to be a single implementation year for pipeline improvements.

The CIP is categorized for facility improvements, fire flow improvements, and replacement pipeline improvements. Facility improvements are recommended based on the conditions assessment, water quality, and operations based on system reliability. Each improvement project is prioritized as described in Chapter 11.

Facility Improvements

There are eight facility improvement projects recommended. Seven of the projects are to improvement the Block 35 facility based on the condition assessment described in Chapter 10.

Fire Flow Improvements

The fire flow improvement projects are recommended based on the analysis to evaluate if the system can provide minimum residual pressure (20 psi) and not to exceed maximum velocity (10 fps) during MDD and fire flow conditions to meet City’s fire flow requirements. The proposed fire flow improvements have been prioritized as described in Chapter 11, Section 11.2. The most severe deficient locations serving important facilities and customers are considered the highest priority to be constructed within the next 5 years.

Pipe Replacement Program

The total length of pipeline is approximately 19,970 linear feet of various pipe diameter to be replaced for the planning horizon to 2030. Assuming an annual Pipeline Replacement Program budget of $1.4 million and assuming an average unit cost of $520/linear foot, the total length of pipeline replacement is approximately 1,997 linear feet per year. Since the distribution system contains a significant amount of 4-inch diameter pipe or less that are also aged and cast-iron material, these pipelines are included for the Pipeline Replacement Program.

The total proposed CIP budget is $57,180,000 over the next 10 years with an annual average budget of $5,718,000 as shown in the table ES-9. Annual implementation of proposed CIP is shown on Table ES-10. The proposed Facility and Fire Flow Improvements are show on Figure ES-1 and the Pipeline Replacement Program projects are shown on Figure ES-2.

Table ES-9 – Summary of CIP

CIP Category	Average Annual Costs	Total CIP Costs
Facility Improvements	$1,035,000	$10,348,000
Fire Flow Improvements	$3,274,000	$32,731,000
Pipe Replacement Program	$1,411,000	$14,102,000
Total CIP	**$5,718,000**	**$57,180,000**

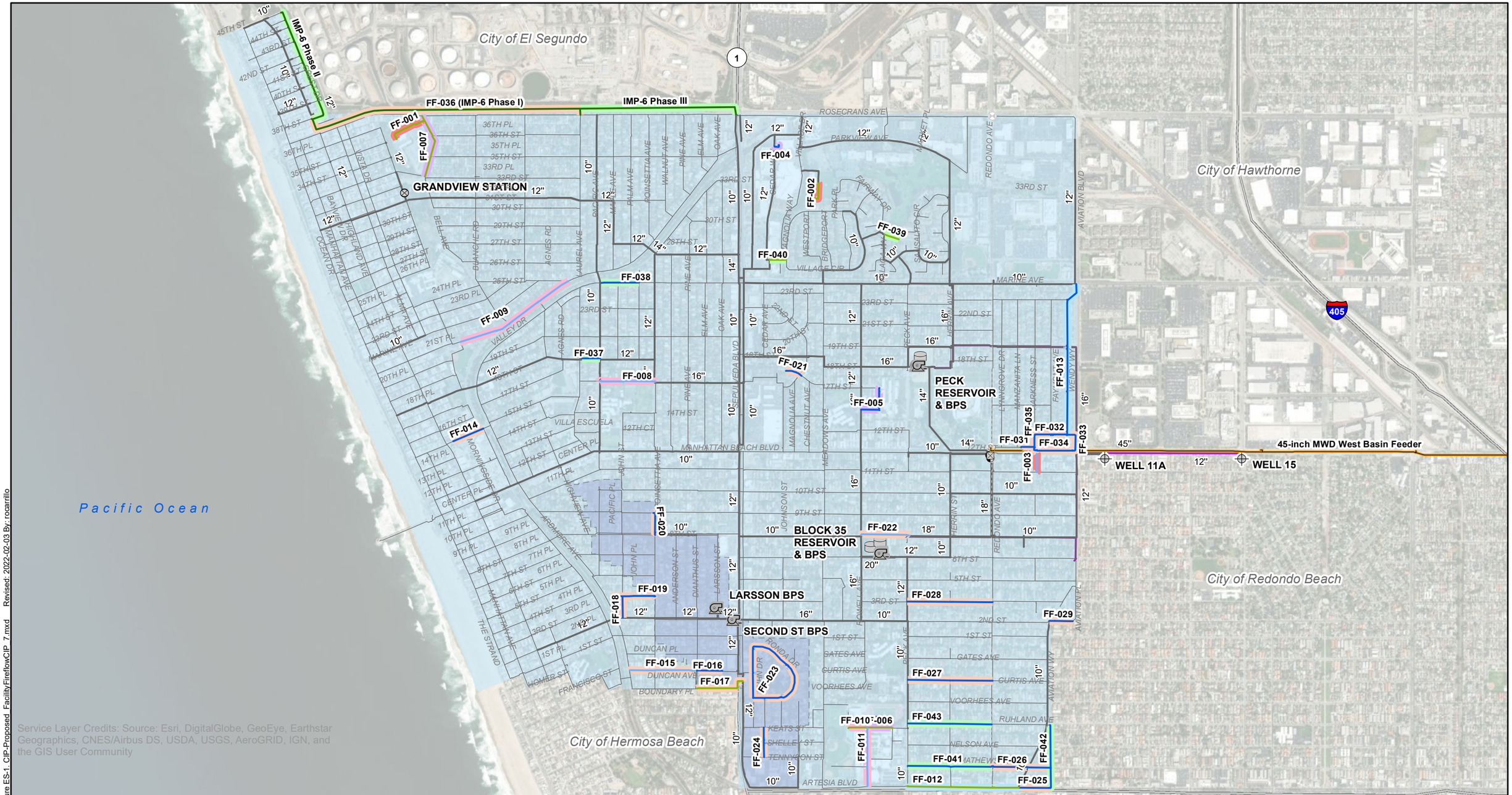
Note:
- Total costs include construction, engineering, administration, management, and contingencies at 35 percent of construction costs. Construction costs for pipelines include pavement, traffic, water pollution control plans, striping, testing and disinfection, and other appurtenant work related to pipeline construction.
- Costs are in 2021 dollars based on ENR Index of 12848 for Los Angeles, California.
- Costs rounded to the nearest one thousand dollars

Table ES-10 – Annual Implementation of Proposed Capital Improvement Projects

NEW CIP ID	FACILITY DESCRIPTION	FY 21/22	FY 22/23	FY 23/24	FY 24/25	FY 25/26	FY 26/27	FY 27/28	FY 28/29	FY 29/30	FY 30/31
FACILITY IMPROVEMENT PROJECTS											
IMP-1	Ground Storage Tank Valve Vault	$ 101,250									
IMP-2	Block 35 Pump Station Misc Electrical Improvements		$ 81,000								
IMP-3	Block 35 Pump Station Misc Mechanical Improvements			$ 168,750							
IMP-4	Block 35 Ground Storage Tank				$ 337,500						
IMP-5	Block 35 Elevated Tank					$ 337,500					
IMP-6	Phase 2 & 3 - New 12-inch Transmission Main in Rosecrans to Crest Dr										$ 4,596,750
IMP-7	Block 35 Groundwater Treatment System										$ 4,725,000
	Subtotal	**$ 101,250**	**$ 81,000**	**$ 168,750**	**$ 337,500**	**$ 337,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 9,321,750**
FIRE FLOW IMPROVEMENT PROJECTS											
FF-001	Ritter Rd bw Grandview Ave and Bell Ave	$ 683,160									
FF-002	Near Magnolia Wy bw 33rd St and Santa Cruz Ct	$ 310,445									
FF-003	Harkness St bw Manhattan Beach Blvd and 11th St	$ 196,835									
FF-004	Lateral off Cedar Wy bw Carlotta Wy and 33rd St		$ 97,680								
FF-005	15th St near Roswell Ave and 17th St		$ 582,388								
FF-006	Mira Costa HS near Ruhland Ave bw Meadows Ave and Peck Ave		$ 456,836								
FF-007	Bell Ave bw Rosecrans Ave and 33rd St		$ 195,075								
FF-008	17th St bw Pacific Ave and Poinsettia Ave			$ 613,931							
FF-009	Valley Dr bw Marine Ave & Blanche Rd, 21st St bw Blanche Rd & Mandor Dr			$ 1,358,858							
FF-010	Mira Costa HS near Ruhland Ave bw Meadows Ave and Peck Ave			$ 334,312							
FF-011	Mira Costa HS near Meadows Ave between Keats St and Artesia Blvd			$ 629,480							
FF-012	Artesia Blvd bw Peck Ave and Aviation Blvd				$ 1,995,756						
FF-013	Wendy Wy bw Marine Ave and 12th St				$ 2,229,886						
FF-014	15th St bw Highland Ave and Valley Dr						$ 468,678				
FF-015	Duncan Ave bw Ardmore Ave and Dianthus St						$ 699,365				
FF-016	Duncan Ave bw Dianthus St and Sepulveda Blvd						$ 361,059				
FF-017	Boundary Pl bw Dianthus St & Sepulveda Blvd and bw Boundary & Duncan						$ 946,401				
FF-018	John St bw 3rd St and 2nd St						$ 307,337				
FF-019	3rd St bw Ardmore Ave and Poinsettia Ave						$ 600,138				
FF-020	Poinsettia Ave bw 9th St and 8th St							$ 19,315			
FF-021	17th St bw (west of) Magnolia Ave and Chestnut Ave							$ 240,599			
FF-022	8th St bw Rowell Ave and Peck Ave							$ 512,241			
FF-023	Ronda Rd, Longfellow Dr, Kuhn Dr							$ 2,301,313			
FF-024	Chabela Dr bw Keats St and Tennyson St							$ 425,513			
FF-025	Artesia Blvd bw Aviation Blvd and Aviation Wy								$ 440,401		
FF-026	Mathews Ave bw Redondo Ave and Aviation Wy								$ 839,352		
FF-027	Curtis Ave bw Peck Ave and Redondo Ave								$ 1,216,074		
FF-028	3rd St bw Peck Ave and Redondo Ave									$ 1,225,585	
FF-029	2nd St bw Aviation Blvd and Aviation Pl								$ 540,867		

NEW CIP ID	FACILITY DESCRIPTION	FY 21/22	FY 22/23	FY 23/24	FY 24/25	FY 25/26	FY 26/27	FY 27/28	FY 28/29	FY 29/30	FY 30/31
FF-030	5th St bw Redondo Ave and Aviation Blvd									$ 896,505	
FF-031	12th St bw Manzanita Ln and Harkness St									$ 196,718	
FF-032	12th St bw Harkness St and Aviation Blvd, Aviation Blvd bw 12th and Manhattan Beach Blvd									$ 577,798	
FF-033	12th St bw Harkness St and Aviation Blvd, Aviation Blvd bw 12th and Manhattan Beach Blvd									$ 220,650	
FF-034	Harkness St bw 12th St and Manhattan Beach Blvd, Manhattan Beach Blvd bw Harkness St and Aviation Blvd						$ 577,789				
FF-035	Harkness St bw 12th St and Manhattan Beach Blvd, Manhattan Beach Blvd bw Harkness St and Aviation Blvd						$ 218,512				
FF-036	Phase 1 - New 12-inch Pipeline in Rosecrans Avenue from Laurel Ave to Highland/38th St					$ 4,516,763					
FF-037	18th St bw Laurel Ave and Pacific Ave										$ 258,201
FF-038	Marine Ave bw Pacific Ave and Palm Ave										$ 544,845
FF-039	Village Center Dr bw Malaga Wy and Gateway Dr										$ 263,810
FF-040	27th Wy bw Cedar Wy and Village Cir										$ 294,321
FF-041	Mathews Ave bw Peck Ave and Redondo Ave										$ 1,218,821
FF-042	Aviation Wy bw Ruhland Ave and Artesia Blvd										$ 910,270
FF-043	Ruhland Ave bw Peck Ave and Redondo Ave										$ 1,207,069
	Subtotal	**$ 1,190,440**	**$ 1,331,979**	**$ 2,936,582**	**$ 4,225,642**	**$ 4,516,763**	**$ 4,179,278**	**$ 3,498,980**	**$ 3,036,695**	**$ 3,117,257**	**$ 4,697,338**
PIPE REPLACEMENT PROGRAM PROJECTS											
PR-001	Grandview Ave bw 23rd Pl and Marine Ave	$ 327,122									
PR-002	20th St bw Highland Ave and Grandview Ave	$ 446,933									
PR-003	19th St bw Ocean Dr and Highland Ave	$ 300,331									
PR-004	19th St bw Highland Ave and Valley Dr	$ 360,154									
PR-005	17th St bw Ocean Dr and Highland Ave		$ 403,167								
PR-006	17th St bw Highland Ave and Valley Dr		$ 314,954								
PR-007	16th St bw Ocean Dr and Highland Ave		$ 393,446								
PR-008	11th St bw Highland Ave and Morningside Dr		$ 198,102								
PR-009	Ingleside Dr bw Francisco St and Longfellow Dr, Longfellow Dr bw Ingleside Dr and Valley Dr, Valley Dr bw 1st St and Longfellow Dr			$ 819,910							
PR-010	3rd St bw Ardmore Ave and Poinsettia Ave			$ 600,138							
PR-011	Duncan Pl bw Poinsettia Ave and Sepulveda Blvd				$ 784,973						
PR-012	John St bw 8th St and 5th St				$ 425,459						
PR-013	Flournoy Rd bw Ardmore Ave and 19th St				$ 281,872						
PR-014	Gull St bw Highland Ave and Crest Dr					$ 131,324					
PR-015	43rd St bw The Strand and Ocean Dr					$ 86,434					
PR-016	Kelp St bw Ocean Dr and Highland Ave					$ 107,403					
PR-017	Moonstone St bw Highland Ave and Crest Dr					$ 94,049					
PR-018	Rosecrans Pl bw Highland Ave and Alma Ave					$ 184,883					
PR-019	35th St bw Highland Ave and Alma Ave					$ 179,944					
PR-020	29th St bw Highland Ave and Alma Ave					$ 185,571					
PR-021	26th St bw Highland Ave and Vista Dr					$ 272,602					
PR-022	Blanche Rd bw Marine Ave and Valley Dr						$ 191,008				
PR-023	Laurel Ave bw 19th St and 17th St						$ 495,610				

NEW CIP ID	FACILITY DESCRIPTION	FY 21/22	FY 22/23	FY 23/24	FY 24/25	FY 25/26	FY 26/27	FY 27/28	FY 28/29	FY 29/30	FY 30/31
PR-024	John St bw Marine Ave and 18th St						$ 829,946				
PR-025	Palm Ave bw Ardmore Ave and 18th St							$ 961,708			
PR-026	31st St bw Bell Ave and Blanche Rd							$ 272,843			
PR-027	30th St bw Bell Ave and Branche Rd							$ 452,400			
PR-028	30th St bw Agnes Rd and Laurel Ave								$ 320,022		
PR-029	31st St bw Agnes Rd and Laurel Ave								$ 307,456		
PR-030	Maple Ave bw 30st St and Valley Rd								$ 536,617		
PR-031	35th St bw Laurel Ave and Pacific Ave								$ 155,076		
PR-032	Maple Ave bw Rosecrans Ave and 35th St									$ 433,478	
PR-033	21st St bw Chestnut Ave and Meadows Ave									$ 157,116	
PR-034	Rowell Ave bw Manhattan Beach Blvd and 9th St									$ 668,697	
PR-035	Peck Ave bw Manhattan Beach Blvd and 11th St										$ 143,848
PR-036	6th St bw Rowell Ave and Peck Ave										$ 402,222
PR-037	Johnson St bw 6th St and 5th St										$ 217,924
PR-038	5th St bw Johnson St and Camino Cardinell										$ 178,120
PR-039	Harkness St bw 6th St and 5th St										$ 244,294
PR-040	Harkness St bw 10th St and 9th St										$ 234,090
	Subtotal	**$ 1,434,540**	**$ 1,309,669**	**$ 1,420,048**	**$ 1,492,303**	**$ 1,242,212**	**$ 1,516,563**	**$ 1,686,951**	**$ 1,319,171**	**$ 1,259,290**	**$ 1,420,497**
	Total	**$ 2,726,230**	**$ 2,722,649**	**$ 4,525,380**	**$ 6,055,445**	**$ 6,096,475**	**$ 5,695,841**	**$ 5,185,932**	**$ 4,355,866**	**$ 4,376,548**	**$ 15,439,585**



Reservoir
Groundwater Well
Import Water Turnout
Interagency Connection (Intertie)
Pressure Monitoring Station
Flow Control Valve
Booster Pump Station (BPS)
Hill Zone
Main Zone
City of Manhattan Beach
Outside Agency Pipeline

Existing Pipelines
Less than 10" Diameter
10" Diameter and Greater
MWD Distribution Main
Well Transmission Main

Implementation Year
2021
2022
2023
2024
2025
2030

Facility and Fire Flow CIP
6
8
10
12

Note:
MWD = Metropolitan Water District

N

1,500 750 0 1,500 Feet

Date: 2/3/2022

TITLE: **Figure ES-1 – Proposed Facility Fire Flow Pipeline CIP**

PROJECT: City of Manhattan Beach Water Master Plan

COORDINATE SYSTEM: NAD 1983 StatePlane California V FIPS 0405 Feet

Stantec

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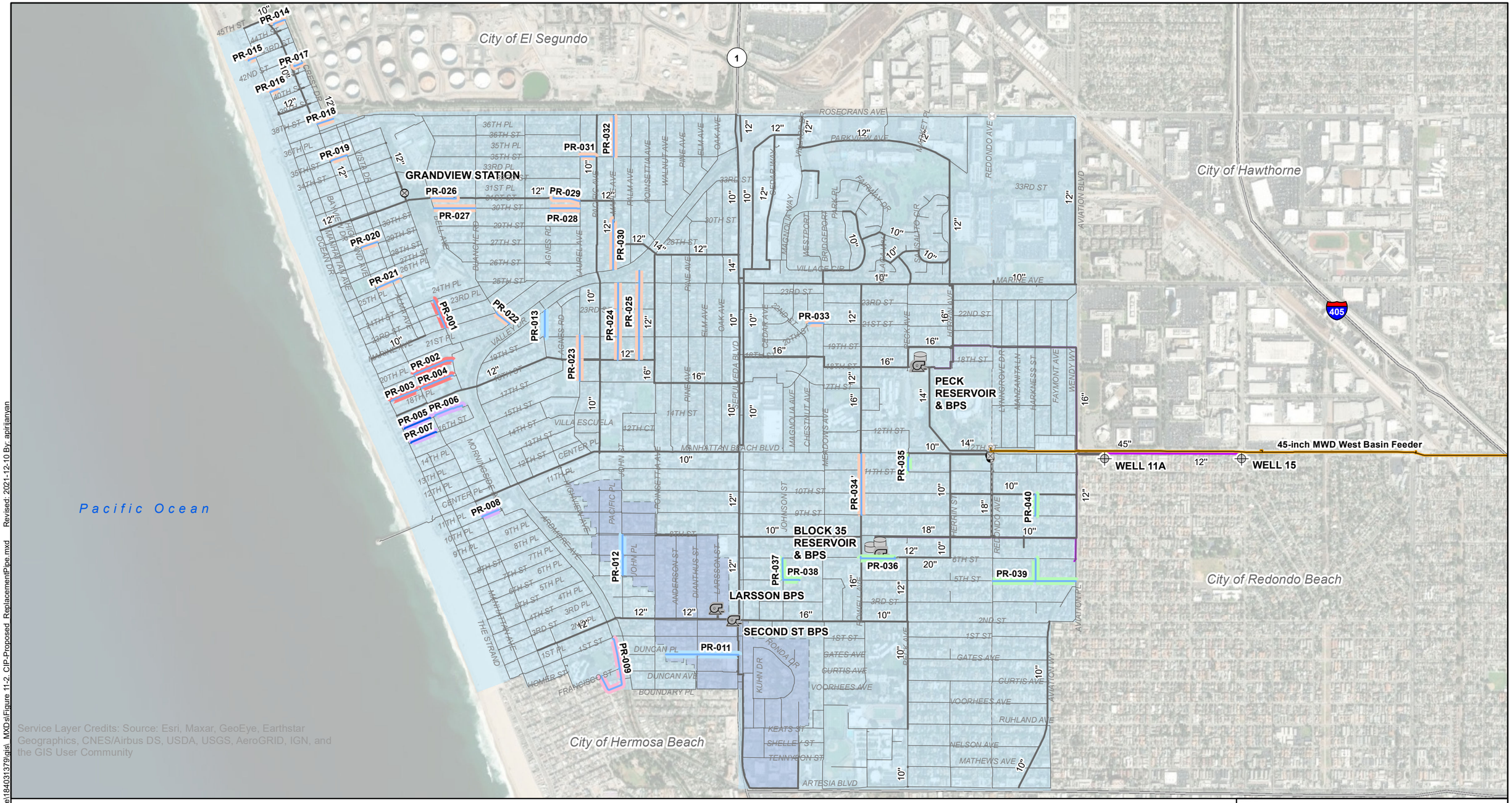

Reservoir
Groundwater Well
Import Water Turnout
Interagency Connection (Intertie)
Pressure Monitoring Station
Flow Control Valve
Booster Pump Station (BPS)
Hill Zone
Main Zone
City of Manhattan Beach
Outside Agency Pipeline

Existing Pipelines
Less than 10" Diameter
10" Diameter and Greater
MWD Distribution Main
Well Transmission Main

Pipe Replacement CIP
6
8

Implementation Year
2021
2022
2023
2024
2025
2030

Note:
MWD = Metropolitan Water District

N

1,500 750 0 1,500 Feet

Date: 12/10/2021

TITLE: **Figure ES-2 – Proposed Pipeline Replacement CIP**

PROJECT: City of Manhattan Beach Water Master Plan

COORDINATE SYSTEM: NAD 1983 StatePlane California V FIPS 0405 Feet

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\\Us0300-ppfss01\workgroup\1840\active\184031379\gis_MXDs\Figure 11-2_CIP-Proposed_ReplacementPipe.mxd Revised: 2021-12-10 By: apirjanyan