SECTION 1

EXECUTIVE SUMMARY

1-1 History and Background

Manhattan Beach was initially regarded as a place to vacation. When incorporated on December 7, 1912, Manhattan Beach consisted of roughly 600 permanent residents. After World War II, many servicemen settled in the City to take advantage of the warm climate. Rapid growth during this period can also be attributed to the aerospace and defense industry such as Douglas Aircraft, Hughes Aircraft, Northrop, and North American Aviation, which moved into the nearby area and created many new jobs.

The first municipal water plant and a water system consisting of 23 miles of pipeline were established shortly after the City's incorporation in 1912.

1-2 Objectives and Scope of Work

The objective of this master plan is to evaluate the City's water system and provide a framework for undertaking the construction of new and replacement facilities for serving the water supply and distribution needs in an efficient manner. This Water Master Plan report presents the methodology, analyses, findings, and recommendations of a comprehensive study of the City of Manhattan Beach's potable water system, and describes the water system supplied by the West Basin Municipal Water District. As a planning document, it is general in nature and is predicated upon the best information available at this time.

1-3 Study Area

The City of Manhattan Beach (City) is located on the western edge of Los Angeles County, approximately 22 miles southwest of downtown Los Angeles. It is a coastal community bounded by the approximately 2 miles of beach frontage to the west. Manhattan Beach is 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.

<u>Topography</u>

Service area elevations vary from about 235 feet above mean sea level (amsl) at the intersection of Sepulveda Boulevard and Longfellow Drive to 0.0 feet along the beach frontage. The areas near the high point, east of Ardmore Drive, are considerably higher than the remainder of the City. To provide the required pressures in the water system, a separate pressure zone was created in this area.

<u>Geology</u>

The Los Angeles County Department of Public Works (LACDPW) Hydrology and Sedimentation Appendix detail that the City is primarily located on Oakley fine sand (Soil Type 10), Chino Silt Loam (Soil Type 3), Montezuma Clay Adobe (Soil Type 9), and Ramona Sandy Loam (Soil Type 14).

Climate

The study area has a Mediterranean climate, enjoying plenty of sunshine throughout the year, with an average of 263 sunshine days and only 35 days with measurable precipitation annually. The period of April through November is warm to hot and dry with average high temperatures of 71 - 79°F, and lows of 50 - 62°F. The coolest months are typically December and January with an average minimum temperature of 48° F. The average annual rainfall of about 13.19 inches occurs primarily during the winter months, between November and March.

Land Use

City is comprised of approximately 3.94 square miles (2,524 acres). The primary lad use is residential (1,422 net acres or 56.3 %). Commercial land uses are located along Highland Avenue, Manhattan Beach Boulevard, Sepulveda Boulevard, and in Manhattan Village, which is located south east of Rosecrans Avenue and Sepulveda Boulevard. Industrial land uses primarily consist of the Northrop Grumman and Raleigh Studios, which are located northwest of Aviation Boulevard and Marine Avenue.

According to the 2009 California Department of Finance Housing Estimates, the total number of housing units within the City is approximately 15,580 with a 3.72 percent vacancy rate.

Population

Since its incorporation in 1912, the City of Manhattan Beach has grown from a population of 600 to 36,718 in 2009 (California Department of Finance, Demographic Research Unit). With the total number of housing units at approximately 15,580 and a 3.72 percent vacancy rate, the population per household is estimated to be 2.45 (California Department of Finance, Demographic Research Unit).

1-4 Water Use

Historic Water Production

The City obtains its water supply through groundwater wells in the West Coast Basin and a connection that supplies imported water from Metropolitan Water District of Southern California (MWD). The City currently owns two wells in the West Coast Basin (Well 11A and Well 15).

Over the last fourteen fiscal years, the annual production has averaged a total of 6,687 acre feet per year (AFY). The average production from the West Coast Basin is 1,023 AFY. The City’s adjudicated groundwater right is 1,131 AFY, which does not include any leased water or any surplus water from the previous years. The average amount of imported water purchased is 5,664 AFY.

Generally, the total water use has been steady, with minor variations from year to year. Large annual variations are not expected because the service area has been mostly developed, and because of the mild climate resulting from the City’s proximity to the Pacific Ocean. There has been a slight decrease in water use over the past two fiscal years. This may be attributed to a very conscientious water conservation effort by the customers.

Water Consumption versus Water Purchase/Production

The City typically purchases/produces more water than the quantity measured by the customer meters. Table 1-1 summarizes the difference between the measured consumption and production from FY 95-96 to FY 08-09. On average 96 percent of the water produced and purchased each year was used by consumers. The remaining 4.1 percent of the water supply is unaccounted for water, which is well within the industry standard.

Table 1-1
Water Consumption versus Water Purchase/Production

Fiscal Year	Water Consumption (AFY)	Water Purchase/ Production (AFY)	Percent Unaccounted For Water	Population	Per Capita Consumption (GPD/Person)
95'-96'	6,040	6,505	7.1	32,063	168
96'-97'	6,478	6,803	4.8		
97'-98'	6,362	6,523	2.5		
98'-99'	6,371	6,932	8.1		
99'-00'	6,688	6,960	3.9		
00'-01'	6,447	6,719	4.1	33,852	170
01'-02'	6,358	6,784	6.3		
02'-03'	6,422	6,753	4.9		
03'-04'	6,258	6,863	8.8		
04'-05'	6,424	6,699	4.1		
05'-06'	6,733	6,699	-0.5		
06'-07'	6,611	6,692	1.2		
07'-08'	6,458	6,337	-1.9		
08'-09'	N.A.	6,358	N.A.	36,718	
Average	**6,435**	**6,688**	**4.1**		

Monthly Demand Variations

The City's water consumption exhibits a distinct seasonal pattern. Peak and low monthly consumption occur during the dry summer months and wet winter months, respectively. Peak demands typically occur in July and August. Low demands typically occur in January and February. The highest and lowest monthly demand factors between the FY 95-96 to FY 08-09 are 1.26 and 0.66, respectively.

Hourly Demand Variations

For this study, hourly demand variations were represented by the development of a diurnal demand curve for each pressure zone.

In the Main or Lower Zone, the peak hour demand is approximately 2.26 times the average demand and occurs in the morning around 7:00 am. In the Hill or Upper Zone, the peak hour demand is approximately 2.68 times the average demand and also occurs around 7:00 am.

System Demands and Peaking Factors

Typically, a water system is designed to meet the maximum demands placed on it. Maximum month and maximum day demands are important factors in sizing a system's supply capability. Maximum day demands usually dictate the design criteria for both system transmission and storage needs. Peak hour criterion is a measure of the system's overall adequacy with respect to its transmission and distribution elements, as well as its operational storage capacity. The City of Manhattan Beach water system demands utilized in this study are shown in Table 1-2.

Table 1-2
Water System Demands and Peaking Factors

Demand Description	Existing Demand (gpm)	(mgd)	(AFY)	Peaking Factor
Average Day	3,942	5.68	6,358	1.00
Max Month	4,731	6.81	7,630	1.20
Max Week	5,322	7.66	8,583	1.35
Max Day	5,913	8.52	9,537	1.50
Peak Hour	9,092	5.03	5,637	2.31

Because the City is nearly developed, a large increase in population and water demands is not expected. In addition, any incremental increase in water demands will most likely be offset by conservation efforts. Therefore, the ultimate demands are expected to be similar to the existing demands for this study.

<u>Recycled Water</u>

Currently, the City utilizes approximately 298 AFY of recycled water supplied by the WBMWD's recycled water system.

Water conservation will continue to be an important issue as California's water storage and supply remain at critically low levels and as legislative mandates for reduced water consumption become law. All urban water users will be required to achieve a 20 percent reduction in urban per capita water use in California on or before December 31, 2020. Incremental progress must be shown by reducing per capital water use by 10 percent on or before December 31, 2015.

1-5 Water Supply

<u>Imported Water Supply</u>

MWD is the purveyor of imported water for most of Southern California. It provides supplemental water to 26 member public agencies through a regional distribution network of canals, pipelines, reservoirs, treatment plants, pump stations, hydropower plants and other appurtenances.

West Basin Municipal Water District (WBMWD) is the MWD member agency that provides imported water to agencies in the South Bay portion of Los Angeles County.

The City's water system has one MWD connection, WB-04, which is located at the intersection of Manhattan Beach Boulevard and Redondo Avenue. This turnout can deliver 15 cubic feet per second (cfs) at a minimum pressure of 83.5 pounds per square inch (psi) at the outlet of the turnout meter.

From the MWD connection, flow is conveyed directly to the Block 35 Facility and the Peck Facility. An existing 18-inch pipe extends from the connection, south along Redondo Avenue and west on 8th Street to the Block 35 Facility. An existing 14-inch pipe extends from the connection, west along Manhattan Beach Boulevard to Herrin Avenue and north through Polliwog Park to the Peck Facility.

Ground Water Supply

The City of Manhattan Beach has two (2) Wells (Well 11A and Well 15) that extract water from the West Coast Basin, which underlies the southwestern portion of the Los Angeles Coastal Plain. The West Coast Basin is bounded by the Ballona Escarpment to the north, the Newport-Inglewood Uplift to the east, the Santa Monica Bay to the west, and San Pedro Bay and the Palos Verdes Hills to the south.

Currently, the adjudicated water right of the West Coast Basin is approximately 64,468 acre feet per year. The City of Manhattan Beach's adjudicated water right is 1,131 acre feet per year. In the 2008-2009 fiscal year, the City leased an additional 461 AF of groundwater from the City of El Segundo. When combined with the adjudicated right, the City had an allowable extraction of approximately 1,592 AF. In the future, the allowable extractions from the City of El Segundo will be leased by Manhattan Beach. Aside from surplus water which varies from year-to-year, the City will lease El Segundo's adjudicated right of 953 AF, which will provide an allowable extraction of approximately 2,084 acre-feet per year.

1-6 Existing Facilities

The City of Manhattan Beach's domestic water system consists of:

- 106 miles of pipe ranging in size from 2-inch to 27-inches in diameter
- One ground level forebay reservoir with 2.0 mg constructed capacity (Block 35 Ground Level Reservoir)
- One partially buried forebay reservoir with 7.5 mg constructed capacity (Peck Reservoir)
- One elevated tank with 0.3 mg capacity (Block 35 Elevated Tank)
- Four (4) booster pump stations
- One imported water supply connection to 45-inch diameter Metropolitan Water District of Southern California's (MWD) West Basin Feeder
- One emergency connection to 12-inch diameter City of El Segundo transmission main
- One emergency connection to 24-inch diameter California Water Service transmission main
- Two pressure zones

Pressure Zones

To accommodate the variation in the service area elevations, the City's water system consists of two (2) pressure zones.

The low pressure zone or **Main Pressure Zone** serves the majority of the City, and it is typically controlled by the water level in the 300,000 gallon elevated tank, located at Rowell Avenue and 6th Street. This zone covers approximately 2,380 gross acres, which is 94 percent (2,380 ac / 2,524 ac) of the total service area.

The high pressure zone or **Hill Area Pressure Zone**, encompasses areas with elevations as high as 240 feet above mean sea level (amsl). System pressure is maintained primarily by Larsson Street Booster Pump Station, supplemented by the Second Street Booster Pump Station when needed. The zone covers approximately 144 gross acres, which is 6 percent (144 ac / 2,524 ac) of the total area.

Transmission and Distribution System

The potable water system includes 558,862 feet (105.9 miles) of transmission and distribution system pipes ranging in size from 2-inch to 27-inch diameter. Approximately 13 percent of these mains are 4-inch, 40 percent are 6-inch, 25 percent are 8-inch, and 9 percent are 10-inch in diameter. Approximately 25 percent of the system was constructed before 1950. Approximately 43 percent of the system was installed during the 1950's, and 25 percent in the years that followed.

General Operations

All existing storage is located in the Main Pressure 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 Reservoir), and one elevated tank (Block 35 Elevated Tank) with a combined total storage capacity of 9.8 million gallons. The Peck Reservoir and Block 35 Ground Level Reservoir provide emergency storage for the system and act as the forebay reservoir for the adjacent booster pump stations. Block 35 Ground Level Reservoir currently provides minimal storage due to water losses at higher water levels.

The City's extensive SCADA system has the capability to operate the water system by the water level at the Block 35 Elevated Tank as well as the pressures measured at the Peck Facility discharge pipe. The system is typically controlled by the elevated tank water level. The Peck Facility discharge pressures are relied on to control the system, when the elevated tank is taken out of service.

The Block 35 Booster Pump Station pumps water from the ground level reservoir at a rate similar to the inflow into the reservoir. The Peck Booster Pump Station supplements the system when the demands are high, as indicated by the levels in the Block 35 elevated tank.

Emergency Connections

The City has an emergency 12-inch connection with the City of El Segundo's water system and an 18-inch emergency connection with a 24-inch California Water Service main.

City Wells

Currently, the City of Manhattan Beach has two (2) wells in the West Coast Groundwater Basin. These wells are both located along Manhattan Beach Boulevard, in the City of Redondo Beach. The City has experienced manganese levels in its groundwater, which exceed the secondary drinking water standards. The groundwater is currently pumped to the Block 35 groundwater reservoir, where it is blended with imported MWD water by adjusting the imported water flow rate such that the blended water has a final manganese concentration of 45 mg/l.

Well 15

Well 15 was constructed in 1979 to replace Well 13 and Well 14, which were taken out of service due to salt water intrusion and poor water quality. The Well 15 facility is located on the southwest corner of Manhattan Beach Boulevard and Vail Avenue, east of the City's service area in the City of Redondo Beach. The original well capacity was 1,600 gpm. The pump motor is 300 HP. A standby emergency generator and an automatic transfer switch were added in 1999.

Due to the significant drop in production, the City had the pump and column pipe removed. The column pipe had several holes which was recirculating the pumped water, resulting in the drop in capacity. The well is currently being redeveloped. It will be test pumped to determine the new pump capacity. It is the City's desire to re-equip this well to obtain a capacity of 1,500 gpm.

Well 11A

Well 11A was drilled in 1998 and equipped in 2000. Well 11A is located on the southwest corner of Manhattan Beach Boulevard and Green Lane, east of the City's service area in the City of Redondo Beach.

The design capacity of the well pump was 1,800 gpm at 600 feet total dynamic head (TDH) based on pumping to the Block 35 Elevated Tank (high water elevation of 295 feet). It currently pumps into the Block 35 Ground Level Reservoir, which is maintained at approximately 182 feet. The SCADA information and Southern California Edison Company efficiency tests show that the well has been pumping over 120 percent of the most efficient point, which is outside the pump's preferred operating range. This could have significant long term effects on the pump and should be resized when it is replaced due to condition.

Well Transmission Line

Well 15 and Well 11A share a 12-inch and 10-inch transmission line to the Block 35 Facility. At Manhattan Beach Boulevard, west of Well 11A, the well transmission line splits in two different directions. The well water is currently routed to the Block 35 Facility in a 12-inch and 10-inch diameter line. A 16-inch well transmission line was constructed to convey water to the Peck Facility; however, this line it is not used.

Currently, Well 15 cannot be operated simultaneously with Well 11A. The well transmission line to the Block 35 Facility is too small for the combined flows, and he hydraulic grade elevation created by the operation of Well 11A is too high for Well 15 to contribute any flow. A parallel transmission line is required to operate the two wells simultaneously.

Peck Reservoir

Peck Reservoir, located at the southeast corner of Peck Avenue and 19th Street, is a partially buried, composite reservoir that was constructed in 1957. The capacity of the reservoir is 7.5 million gallons. It provides operational storage, and acts as a forebay for the Peck Booster Pump Station.

Peck Reservoir may be filled directly by MWD water, by well water, and/or by water already in the distribution system. There is a control valve and a supply valve on the inlet to the reservoir that controls the flow of water.

Block 35 Ground Level Reservoir

The Block 35 Ground Level Reservoir, located east of Rowell Avenue between 6th Street and 8th Street, was constructed in 1948. It is a circular reinforced concrete reservoir with an inner and an outer compartment. The inner compartment is 69.2 feet in diameter. The entire reservoir is 140 feet in diameter and the outer wall is 20 feet in height. The capacity of the reservoir is 2.0 MG and it acts as a forebay for the Block 35 Booster Pump Station. Currently, the City does fill the Block 35 Ground Level Reservoir due to moderate water losses at upper levels.

The reservoir may be filled with a blend of surface water from MWD and groundwater from Well 15 and Well 11A. Due to elevated levels of manganese in the groundwater, the well production must be blended with imported water before being distributed into the system.

<u>Block 35 Elevated Tank</u>

The Block 35 Elevated Tank is a steel tank with a capacity of 300,000 gallons. The tank is supported by a 5'-5" diameter center column and eight outer columns. Imported MWD water can supply the City's entire demand when the wells are not in operation. To provide strictly MWD water to the distribution system, the City may close Control Valve CV-3501 and convey the water directly to the Block 35 Elevated Tank and the distribution system. MWD water does not require blending and can be conveyed directly to the Block 35 Elevated Tank and the distribution system. When the demands are high, MWD may supply the system directly. When the demands are low, excess MWD water can fill the Block 35 Ground Level Reservoir via the Block 35 Elevated Tank.

<u>Pump Stations</u>

The City operates four (4) water pump stations. The Block 35 Booster Pump Station and the Peck Booster Pump Station pump water into the Main or Low Pressure Zone. The Hill Area Pressure Zone is normally served by the Larsson Booster Pump Station. In the event of high demand, such as a fire in the Hill Area Pressure Zone, the Second Street Booster Pump Station will also provide water to this zone. Existing booster pump data is shown in Table 1-3.

Table 1-3
Existing Booster Pump Data

General Data						Pump Data							Motor Data	
Pump Station	Year of Const.	Year Pump Replaced	Source of Supply	Discharge Zone	Location	Pump No.	Model	Type of Pump	Impeller Size (in)	No. of Stages	Capacity (gpm)	TDH (ft)	HP	RPM
Block 35	1948	1998	Block 35 Ground Level Reservoir	Low or Main	East of Rowell Ave between 8th Street and 6th Street	1	PACO 29-60124	HC	11.6	1	1,715	131	75	1750
						2	PACO 29-60124	HC	11.6	1	1,715	131	75	1750
						3	PACO 29-60124	HC	11.6	1	1,715	131	75	1750
						4	PACO 29-60124	HC	11.6	1	1,715	131	75	1750
Peck	1957	1998	Peck Reservoir	Low or Main	18th Street east of Peck Avenue	1	Johnston 14CC	ST	10.5625	3	1,715	221	125	1750
						2	Johnston 14CC	ST	10.5625	3	1,715	221	125	1750
						3	Johnston 14CC	ST	10.5625	3	1,715	221	125	1750
						4	Johnston 14CC	ST	10.5625	3	1,715	221	125	1750
Larsson	Pre-1954	1998	Low Pressure Zone	High or Hill	Larsson Street north of Second Street	1	PACO 11-40957	HC	9.4	1	580	78	20	1750
						2	PACO 11-40957	HC	9.4	1	580	78	20	1750
						3	PACO 11-40957	HC	9.4	1	580	78	20	1750
Second St	1977	-	Low Pressure Zone	High or Hill	Second Street between Larsson Street and Sepulveda Boulevard	1	Goulds 3175	HC	11.75	1	2,302	61	80	1800

Note: HC = Horizontal Centrifugal
ST = Submersible Turbine

1-7 Service Criteria

Performance criteria is established to evaluate the adequacy of various water system components through a systematic analysis. Necessary improvements are identified and recommended for inclusion in a Capital Improvement Program (CIP). Some criteria are based upon experience and their application is at the discretion of the water purveyor. This includes service pressures, storage capacity, and sources of supply.

Other criteria, such as water quality and fire protection, are based on federal, state and local jurisdictional requirements.

A summary of the service criteria is listed in Table 1-4.

Table 1-4
Service Criteria

Description	Criteria	Existing Requirement
1. Source of Supply		
a. Total	Maximum Day Demand (except for closed zones which shall be Maximum Day Demand plus Fire Flow Demand or Peak Hour, whichever is greater)	5,913 gpm
b. Local Supply	Average Day Demand	3,942 gpm (5.68 mgd)
2. Reservoir Capacity		
a. Operational Storage	35% of Average Day Demand plus fire flow	2.95 MG
b. Emergency Storage	Seven (7) Average Day Demand less local groundwater well capacity	16.80 MG
c. Fire Suppression		
Single Family Residential	2,000 gpm for 2 hours	0.24 MG
Multi-Family Residential	3,000 gpm for 3 hours	0.54 MG
Schools	3,500 gpm for 4 hours	0.84 MG
Commercial / Industrial	4,000 gpm for 4 hours	0.96 MG
3. Booster Pump Stations	Booster Pump Stations must deliver Maximum Day Demand plus Fire Flow Demand or Peak Hour Demand, whichever is greater	
	Stand-by pump equal in size to the largest duty pump	
	Flow meters, suction and discharge pressure gauges, and telemetry equipment for alarm and status notification at each station	
	Provisions for emergency power at all stations	
4. Minimum Pipe Size	6-inch	
5. Maximum Velocities	5 ft/s at Average Day Demand	
	7 ft/s at Maximum Day Demand	
	10 ft/s at Fire Flow Demand	
6. Static Pressures	Minimum 50 psi	
	Desired 60-80 psi	
	Maximum 120 psi	
7. Dynamic Pressures	Minimum 40 psi during Maximum Day Demand	
8. Fire Flow Demands		
a. Single Family Residential	2,000 gpm for 2 hours with 20 psi residual pressure at fire hydrant	0.24 MG
b. Multi-Family Residential	3,000 gpm for 3 hours with 20 psi residual pressure at fire hydrant	0.54 MG
c. Schools	3,500 gpm for 4 hours with 20 psi residual pressure at fire hydrant	0.84 MG
d. Commercial / Industrial	4,000 gpm for 4 hours with 20 psi residual pressure at fire hydrant	0.96 MG

Water Quality

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 was passed by the Congress in 1974. Amendments to the SDWA were enacted in 1986 and 1996. The SDWA mandated the U.S. Environmental Protection Agency (EPA) to develop primary drinking water standards or maximum contaminant levels (MCL'S) in public water supplies.

The State of California Department of Health Services has the responsibility for the State's drinking water program. It is accountable to the EPA for enforcement of the SDWA and for adoption of standards that are at least as stringent as that of the EPA. Since California conducts independent risk assessments, some of its standards are more stringent than the standards of the Federal Government.

See Section 7 for additional information regarding the water quality requirements.

1-8 System Analysis

The established system criteria and a calibrated system computer model were utilized in analyzing the system, and evaluating its adequacy. The system model was calibrated by simulating actual system conditions and making adjustments to the model. The model was then utilized to analyze the existing system under average day, maximum day, peak hour, and maximum day plus fire flow conditions.

Existing system deficiencies were identified and mitigation projects were formulated based upon the results of the model runs, the survey, and input from City staff. Proposed projects were added in the hydraulic model to test the operation of the system after implementation.

A capital improvement program was developed as a result of these analyses. Recommended projects and cost estimates are discussed in Section 9 of this Master Plan Report.

Source of Supply

The criterion established requires a source of supply equal to one maximum day demand, with one average day demand from local sources. For the City of Manhattan Beach, this is equivalent to a source of supply of 5,913 gpm and 3,942 gpm from local sources.

Since the City has a turnout from MWD's West Coast Feeder, with a capacity of 15 cfs (6,732 gpm), which exceeds the maximum day demand. Well 11A currently provides the only groundwater supply, at approximately 2,275 gpm. Under this condition, an additional 1,667 gpm would be required to supply the average day demand from local sources.

Well 15 was recently redeveloped. Following test pumping, it will be equipped with a new pump, column pipe, and motor. It is expected to produce 1,500 gpm. It is also recommended that Well 11A be resized and replaced to its originally intended capacity of 1,800 gpm when its condition requires it. With these improvements, the total well capacity will be 3,400 gpm. One additional well would be necessary to meet the criteria of one average day demand from local sources. It is therefore recommended that the City conduct a feasibility study to construct a new well.

Emergency Storage

The criterion established requires seven (7) average day demand, less local groundwater well capacity for emergency storage. The amount of emergency storage required for the City's system will depend on the groundwater production. Three scenarios are illustrated below:

Scenario 1

Well 11A current production = 2,275 gpm

Emergency Storage Required = 7 days x (3,942 gpm – 2,275 gpm) = 16.8 MG

Scenario 2

Well 11A production (reduced to originally intended capacity) = 1,800 gpm

Well 15 production (expected capacity) = 1,500 gpm

Total well production = 1,800 gpm + 1,500 gpm = 3,300 gpm

Emergency Storage Required = 7 days x (3,942 gpm – 3,300 gpm) = 6.5 MG

Scenario 3

Well 11A production (reduced to originally intended capacity) = 1,800 gpm

Well 15 production (expected capacity) = 1,500 gpm

New Well production = 1,600 gpm

Total Well production = 1,800 gpm + 1,500 gpm + 1,600 gpm = 4,900 gpm

Emergency Storage Required = none

The City currently has 9.8 MG of storage capacity if its three (3) reservoirs are full at the start of the emergency.

Operational Storage

The operational storage criterion is 35% of average day demand plus fire flow. Average day demand is equivalent to 3,942 gpm. Maximum fire flows were estimated as 4,000 gpm for four hours for commercial and industrial development (0.96 MG).

Currently, the top portions of Peck Reservoir and the Block 35 Ground Level Reservoir cannot be utilized for storage due to leakage problems. The actual total storage capacity of the system is estimated at approximately 6.7 MG, as detailed in Table 8-1. Even though the upper portions of the reservoirs are not currently utilized, the system can provide the operational storage capacity.

Booster Pump Stations

Booster pump stations need to be able to pump the maximum day demand of their service zone, as well as those of the higher zones that are not provided by other sources, with the largest pump out of service. Table 1-5 shows the existing booster pump stations, the required firm capacities, the existing firm capacities, and the surplus/deficiency in the facility. Each zone has two booster pump stations.

Table 1-5
Booster Pump Station Analysis by Zone

Zone	Pump Station	*Total Supply Capacity (No. of Pumps x gpm)	Firm Capacity (gpm)	Zone Firm Capacity (gpm)	Average Demand (gpm)	Average Demand Zone & above (gpm)	Max Day Demand (gpm)	Max Day Demand Zone & Above (gpm)	Fire Flow Required (gpm)	Max Day Demand Zone & Above + Fire Flow (gpm)	Surplus / Deficiency (gpm)
Main or Low	Block 35	6,860	5,220	12,080	3,686	3,942	5,529	5,913	4,000	9,913	2,167
	Peck	6,860	6,860								
Hill or High	Larsson	1,740	1,740	1,740	256	256	384	384	4,000	4,384	-2,644
	Second St	2,302	0								

** Does not consider lower capacity due to multiple pumps operating at one time*

Larsson Pump Station was upgraded in 1982 by adding variable frequency drives and replacing the pumps. It was upgraded again in 1999 with three new pumps and variable frequency drives. A 60 KW diesel standby generator in an underground vault and an automatic transfer switch were added during this improvement project. The existing structure has several cracks, and is in poor condition.

The existing three pumps are rated at 580 gpm, and can deliver a maximum of 2,100 gpm, if they have the design rated capacity. With a maximum day demand of 378 gpm, the fire flow available is approximately 1,700 gpm if Second Street Pump Station is out of service. This is only 85 percent of the single family residential fire flow of 2,000 gpm, and 42.5 percent of the commercial fire flow of 4,000 gpm. The fire flow available during the peak hour demand of 713 gpm is significantly lower.

It is recommended that Larsson Pump Station be replaced with a new facility that can provide a total of 4,400 gpm. A preliminary design report should be prepared to develop the final design flows, pump selection, pump station layout, and standby power needs.

Second Street Pump Station is located in a vault structure underneath the sidewalk adjacent to 2nd Street. It is equipped with an 80 horsepower engine driven horizontal centrifugal split case booster pump that supplies backup water system pressure and primary fire protection to the City's Upper Hill Area Pressure Zone.

The pump station's pressure switch type control is slow to respond to system pressure changes resulting in premature starting and stopping of the station. Replacement parts are not readily available, and the control system has exceeded its anticipated service life.

It is recommended that a new solid state control system be installed to mitigate excessive starting and stopping of the station, and extend its service life.

The pump and engine create excessive vibration during operation, which can be felt in the station's vicinity, and inside the adjacent office building. The excessive vibration will reduce the service life of the vault, engine and pumping equipment if left unchecked.

It is recommended that vibration isolators be installed under the engine and pump assembles to mitigate excessive vibration, and extend the life of the booster pump station.

Supervisory Control and Data Acquisition (SCADA) System

The City's Water system is managed and monitored by the Rockwell RSU SCADA equipment. The City's Water System existing SCADA capabilities are detailed in Table 1-6.

Table 1-6
Existing SCADA

Block 35	**Units**	**Wells 15**	**Units**
Elevated Tank Level	feet	Flowrate	gpm
Ground Reservoir Level	feet	Pressure	psi
Pump Station Flowrate (Total from B35 Facility)	gpm	Temperature	°F
Bypass Flow (MWD flow to B35 Ground Reservoir)	gpm	Groundwater Level, below Discharge Head	feet
Discharge Pressure (at B35 Facility)	psi	Status	on/off
CV3501 Valve Position	% Open	**MWD**	**Units**
Chlorine Residual	ppm	Total Flowrate	gpm
Pump VFD Speed (Pumps 1-4)	%	Flowrate to Peck Reservoir	gpm
Peck	**Units**	Pressure	psi
Reservoir Level	feet	Valve Position (All Flow)	% Open
Pump Station Flowrate (Total from Peck Facility)	gpm	Valve Position (Flow to Peck)	% Open
Discharge Pressure (at Peck Facility)	psi	**Larsson**	**Units**
Peck Supply Valve Position	% Open	Flowrate (Total from Larsson Facility)	gpm
Peck Control Valve Position	% Open	Pump Speeds (Pumps 1-3)	rpm
Pump VFD Speed (Pumps 1-4)	%	Suction Pressure	psi
Chlorine Residual	ppm	Discharge Pressure	psi
Wells 11A	**Units**	No. of Pumps in Operation	1-3
Flowrate	gpm	**2nd Street**	**Units**
Discharge Pressure	psi	Status	on/off
Temperature	°F	Suction Pressure	psi
Groundwater Level, below Discharge Head	feet	Discharge Pressure	psi
Status	on/off		

Hydraulic Model

A computer model of the City's water system was developed to aid in the evaluation of the adequacy of the existing facilities under present and future demand conditions.

Hydraulic analyses were performed using MWHSoft's InfoWater program, which is a commercially available hydraulic software package that is designed to simulate steady state and extended period operations of water systems.

The development of the computer model began with the establishment of the network pipes and nodes. Nodes represent points of intersection, changes in diameter, fire hydrant locations, or locations where supply or demands are applied to the system. Modeling information associated with each node includes elevation, water demand, and diurnal pattern of demand. Node and facility elevations were obtained from the City's 1-foot contour information, provided in GIS shapefile format.

Modeling information associated with each pipe includes size, length, and roughness. System pipe information was obtained from as-built construction plans. The model includes nearly all pipes in the City's system, but excludes the service laterals, fire hydrant laterals, and private water lines.

The features included in the water model are as follows:

- 106 miles of transmission and distribution mains, 2-inches to 27-inches in diameter
- 12 pumps at 4 pumping facilities
- 3 reservoirs
- 5 control valves (2 Peck, 1 Block 35, 2 MWD)
- 774 fire hydrant locations (218 of the 774 hydrants are located north of Marine Avenue and east of Sepulveda Boulevard)
- Two wells

Model Calibration

The existing water system model was calibrated by closely matching the demands and pressures to field measured values. The resulting model can be used to analyze the system operation under various operating conditions.

The demands were universally revised to 3,598 gpm, which was the daily production for the calibration day, March 22, 2010.

Data loggers were installed on fire hydrants at 16 locations throughout the system. The selected locations were scattered throughout the service area in order to obtain representative pressure measurements throughout the system. The difference between measured pressures and the model output range from -0.7 psi to 4.1 psi. The average difference for all pressure readings was 1.9 psi. The percentage differences ranged from 0.3 percent to 8.7 percent. On average the percentage difference was 2.7 percent.

Several hydrants throughout the City were tested to observe the available flows and pressures that would be available during a fire flow event. Portable pressure gauges were set up on nearby hydrants in the vicinity of the test hydrant. The recorded pressures were utilized to evaluate the system pressures during fire flow demands. The field measured flow rates at the hydrants were input as demands in the model at the junctions closest to the test fire hydrants. The field pressures were compared to the model pressures. The model is considered to be representative of the existing system. Factors that may have contributed to the higher pressure differential between the model results and the data collected in the field include corroded laterals to the fire hydrants, partially closed valves at the hydrants, inaccurate model node elevations versus actual field elevations, inaccuracies in the pressure monitoring equipment, and inaccurate demand assumptions.

Model Runs and System Pressures

The hydraulic model was utilized to analyze the existing system under average day, maximum day, peak hour, and maximum day plus fire flow conditions.

Average Day Demand - The average day pressures remain above the City's dynamic pressure criteria (40 psi) throughout the service area except near the main facilities, including Block 35 Facility, Peck Facility, and the suction side of Larsson Pump Station and Second Street Pump Station.

Maximum Day Demand - The maximum day demand scenario did not indicate any significant hydraulic deficiencies. The system pressures at the intersection of 13th Street and Highview Avenue do not meet the City's dynamic pressure criteria of 40 psi. The elevation at this area is approximately 190 feet amsl, which is the highest in the main pressure zone. Following the completion of the recommended improvements included in Section 9 of this report, the system pressures in this area will meet the dynamic pressure criteria.

Maximum Day Peak Hour Demand - During the maximum day peak hour demand, the system is not able to provide the dynamic pressure criteria (40 psi) at the following locations even with the improvements included in Section 9 of this report:

1. North of 11th Street, west of John Street, South of 19th Street, east of Fisher Avenue
2. North of 26th Street, west of Grandview Avenue, south of 36th Place, East of Crest Drive
3. Laurel Avenue and 23rd Street
4. Sepulveda Boulevard, between 2nd Street and 5th Street
5. Rowell Avenue and 1st Street
6. Herrin Street, between Voorhees Avenue and Ruhland Avenue
7. Elm Avenue, between Rosecrans Avenue and 35th Street
8. Magnolia Avenue and 22nd Street
9. Meadows Avenue 12th Street
10. Meadows Avenue and Curtis Avenue

Due to the existing high elevations in these areas, there is no practical way to improve the low pressures except by constructing an elevated tank with a high water elevation about 25 feet higher than the existing tank.

Maximum Day Demand plus Fire Flow - The maximum day plus fire flow scenarios revealed deficiencies in the system where the required residual pressure could not be met. The fire flow criterion requires a residual pressure of 20 psi at the fire hydrant outlet. The maximum day plus fire flow run resulted in many deficiencies This is primarily due to the small pipe sizes in the system and high ground elevations. The existing system includes approximately 70,841 feet of 4-inch pipe. When these pipes are replaced with 6-inch or larger pipes, and hydrant service lines are also increased to 6-inch diameter, most of the fire flow deficiencies will be mitigated.

<u>Transmission and Distribution System</u>

The existing distribution system is well looped throughout the service area, providing redundancy as well as reliability.

The system velocities are generally within an acceptable range during the average and peak demand periods. During the low demand periods, the Peck Supply valve opens which allows the system to feed the Peck Reservoir. The model indicates that Block 35 Booster Pump Station supplies the system demands, as well as replenishment water to Peck Reservoir during this period. The additional flows through the reaches near the Block 35 facility increase the velocities to just over 5 ft/s in the reaches between the Block 35 Facility and the Peck Facility.

The 10-inch well transmission line along 8th Street from Aviation Boulevard to the Block 35 facility is estimated to have velocities of 9.3 ft/s for the current capacity of Well 11A (2,275 gpm). Section 9 of this report recommends increasing the City's groundwater capacity by adding an additional well, which will increase the velocities in the already deficient transmission line. It is recommended that the 10-inch pipe be increased to 18-inch to reduce the velocities for the existing conditions and to accommodate the additional future groundwater flows.

Most of the existing pipes have exceeded their useful lives. The unlined cast iron pipes are expected to be heavily tuberculated, reducing the available flow area and pressures. Approximately 67 percent of the pipes were constructed before 1960, and approximately 72 percent of the pipes are of cast iron. An aggressive annual replacement program is needed to tend to the aging and undersized pipes.

Water Age Analysis

The existing system model was used to determine the age of the water from the various sources in the system. Water that remains in a reservoir or in an oversized large pipe for an extended period of time may be susceptible to water quality problems such as trihalomethanes, haloacetic acids, and nitrification. The model showed that the Peck Reservoir did not show any signs of cycling under the City's existing operations. The following recommended improvements would decrease the detention time in the Peck Reservoir.

1. Decrease the reservoir size from 7.5 million gallons to 4 million gallons
2. Increase Block 35 Ground Level Reservoir size from 2 million gallons to 4 million gallons
3. Convey groundwater to Peck Reservoir through the existing 16-inch transmission main, and construct blending facilities

A detailed study should be performed to determine the maximum efficiency of the system operations.

1-9 Capital Improvement Program

The Capital Improvement Program (CIP) consists of projects that will enhance the system to meet the established criteria, properly maintain the system's assets, and replace the facilities that have reached the end of their useful lives. The goal of the CIP is to provide the City with a long-range planning tool that will allow construction of the recommended projects in an orderly manner to improve the existing system and provide for any future growth. In order to accomplish this goal, it is necessary to determine the estimated cost of the needed water system improvements identified in this report, establish a basis and prioritize each of the projects.

Cost estimates have been prepared for each recommended project, based upon information from recent similar projects. The pipeline replacement costs are based upon $30 per diameter inch per ft. The City of Manhattan Beach is largely occupied, and there are many existing utilities to consider. Therefore, the costs of replacing water facilities will be generally higher than in an area that is undeveloped. Construction costs can be expected to fluctuate as changes occur in the economy. These costs should therefore be reevaluated and updated annually based upon Engineering News Record (ENR) Index for the Los Angeles area (ENRLA), with the base ENRLA Index of 9,760 for February 2010.

It should be noted that some of the improvements recommended herein are conceptual in nature based on existing planning information available. Therefore, they should not be considered as absolute for final design.

Further analysis and refinement will be necessary prior to commencing work on the final plans, specifications and estimates package for each project. Detailed preliminary design studies should be prepared to select the final design projects.

The cost estimates that follow were generated by estimating the quantities of required items for each improvement, and applying typical unit prices to obtain the total estimated construction costs. An amount equal to approximately 35 percent is added to the construction cost estimates to cover contingencies, project design, administration, and construction duration services. The resultant sum is the total estimated project cost. Cost estimates for each recommended project are shown in Table 1-7.

The recommended CIP is shown in Table 1-7. Project locations are shown on Figure 1-1.

The pipe replacement program serves two purposes. The first is to address fire flow deficiencies in the existing system due to small pipe sizes. The second is to replace pipe due to age and condition. Table 1-8 details the recommendations for pipe replacements due to fire flow deficiencies identified in the hydraulic model. Most of the pipes are currently 4 inches in diameter and cannot provide the required fire flows and residual pressures.

Table 1-7
Capital Improvement Program

CIP No.	Project Description	Facility Location Description	Date of Construction for Existing Facility	Justification	Recommended Replacement Year	Recommended Facilities: Firm Capacity (gpm)	Recommended Facilities: Res Size (MG)	Recommended Facilities: Pipe Size (in)	Recommended Facilities: Pipe Length (ft)	Construction Cost ($)	Eng. & Admin. Cost ($)	Total Project Cost ($)
CIP-1	Replacement of Peck Reservoir		1957	Age / Condition	2020		4.0			6,000,000	2,100,000	8,100,000
CIP-2	Replacement of Block 35 Reservoir	8th St and Rowell Ave	1948	Age / Condition	2017		4.0			6,000,000	2,100,000	8,100,000
CIP-3	Replacement of Larsson Pump Station	2nd St and Larsson St	1949	Age / Condition	2011	4,400				3,000,000	1,050,000	4,050,000
CIP-4	2nd Street Booster Pump Station - Install solid state controller	2nd St and Sepulveda Blvd	1977	Age / Condition	2010					200,000	70,000	270,000
CIP-5	2nd Street Booster Pump Station - Install seismic vibration isolators under engine	2nd St and Sepulveda Blvd	1977	Age / Condition	2010					100,000	35,000	135,000
CIP-6	New well at Well Site 13	6th St and Aviation Blvd	-	Supply	2012					4,320,000	1,512,000	5,832,000
CIP-7	New well collection line from Well Site 13 to 8th St	Aviation Blvd	-	Supply	2013			12	500 (approximate)	243,000	85,050	328,050
CIP-8	New well collection line from Well 11A to Block 35	Manhattan Beach Blvd, Aviation Blvd, 8th St	-	Supply	2013			18	5,000	3,645,000	1,275,750	4,920,750
CIP-9	Install new fire hydrants	Varies	-	Criteria	18/yr through 2021, 30/yr thereafter					3,000,000	1,050,000	4,050,000
CIP-10	Pipe replacement program (annually) - small diameter cast iron pipe	Varies	-	Age / Condition Fireflow	$3.45 M/yr 1.5 miles/yr through 2021, 2.5 miles/yr thereafter			6 thru 18	220,600	79,416,000	27,795,600	107,211,600
									Total	**105,924,000**	**37,073,400**	**142,997,400**

Table 1-8
Recommended Pipeline Replacements

Pipe Priority Number	Location Description	Model Pipe ID	Model U/S Node	Model D/S Node	Installation Date	Length (ft)	Existing Size (in)	Replace-ment Size (in)	Unit Cost ($/ft)	Construction Cost ($)	Total Cost ($)
P-1	17th Street, between Meadows Avenue and Rowell Avenue.	24240-24250	24240	24250	1949	548	4	6	180	$98,573	$133,074
		24220-24240	24220	24240	1949	333	4	8	240	$79,886	$107,847
					Project Length	**880**			**Project Cost**	**178,460**	**240,921**
P-2	North of Manhattan Beach Boulevard, West of Peck Avenue. Connect to 15th Street at Manhattan Beach Preschool.	21580-22050	21580	22050	1951	56	4	8	240	$13,558	$18,303
		23100-23710	23100	23710	N.A.	280	New	8	240	$67,200	$90,720
		23710-23711	23710	23720	N.A.	700	New	8	240	$168,000	$226,800
					Project Length	**1,036**			**Project Cost**	**248,758**	**335,823**
P-3	12th Street between Meadows Avenue and Peck Avenue.	22890-22910	22890	22910	1948	571	4	6	180	$102,807	$138,789
		22880-22890	22880	22890	N.A.	778	4	6	180	$139,982	$188,976
					Project Length	**1,349**			**Project Cost**	**242,789**	**327,766**
P-4	11th Street, between John Street and Highview Avenue.	19870-20380	19870	20380	1956	504	4	6	180	$90,749	$122,511
		20720-20650	20720	20650	1947	333	4	6	180	$59,947	$80,929
		20430-20530	20430	20530	1949	57	4	6	180	$10,201	$13,771
		20590-20720	20590	20720	1947	20	4	6	180	$3,524	$4,758
		20380-20430	20380	20430	1956	3	4	8	240	$672	$907
					Project Length	**916**			**Project Cost**	**165,093**	**222,876**
P-5	Homer Street, between Manhattan Avenue and Morningside Drive. Morningside Drive between 1st Street and Francisco Street.	11650-11490	11650	11490	1926	339	4	6	180	$61,038	$82,401
		11850-11630	11850	11630	1926	295	4	6	180	$53,105	$71,692
		12050-12200	12050	12200	1926	63	4	6	180	$11,412	$15,406
		12200-12440	12200	12440	1953	148	4	6	180	$26,654	$35,983
		11880-11850	11880	11850	1926	21	4	6	180	$3,805	$5,137
		11850-12050	11850	12050	1926	44	4	6	180	$7,911	$10,680
		11620-11650	11620	11650	1926	37	4	6	180	$6,669	$9,003
		11630-11620	11630	11620	1926	14	4	6	180	$2,527	$3,412
					Project Length	**962**			**Project Cost**	**173,122**	**233,715**

Table 1-8
Recommended Pipeline Replacements (Continued)

Pipe Priority Number	Location Description	Model Pipe ID	Model U/S Node	Model D/S Node	Installation Date	Length (ft)	Existing Size (in)	Replace-ment Size (in)	Unit Cost ($/ft)	Construction Cost ($)	Total Cost ($)
P-6	Ronda Drive, Between Kuhn Drive and Longfellow Drive. Longfellow Drive, between Kuhn Drive and Ronda Drive.	12650-12170	12650	12170	1953	619	4	8	240	$148,603	$200,614
		11320-11300	11320	11300	1953	260	4	8	240	$62,441	$84,295
		11300-11280	11300	11280	1953	161	4	8	240	$38,657	$52,187
		12090-11330	12090	11330	1953	518	4	8	240	$124,262	$167,754
		12170-12090	12170	12090	1953	36	4	8	240	$8,657	$11,687
		11330-11320	11330	11320	1953	42	4	8	240	$9,994	$13,491
					Project Length	**1,636**			**Project Cost**	**392,614**	**530,028**
P-7	14th Street, between Laurel Avenue and east of Ardmore Avenue.	23160-23250	23160	23250	1952	288	4	6	180	$51,820	$69,957
		23110-23160	23110	23160	1952	94	4	6	180	$16,965	$22,903
		23530-23330	23530	23330	N.A.	200	New	8	240	$48,000	$64,800
					Project Length	**582**			**Project Cost**	**116,785**	**157,660**
P-8	Agnes Road, between Ardmore Avenue and 18th Street. Flournoy Road between 19th Street and 18th Street.	27960-28200	27960	28200	1990	109	4	6	180	$19,669	$26,553
		25850-26750	25850	26750	1954	322	4	6	180	$57,890	$78,151
		26720-27920	26720	27920	1926	450	4	6	180	$81,011	$109,365
		25550-25540	25550	25540	1958	19	6	8	240	$4,538	$6,127
		25540-25670	25540	25670	1958	19	6	8	240	$4,675	$6,312
		27920-27960	27920	27960	1926	23	4	6	180	$4,149	$5,601
		25780-26720	25780	26720	1926	328	4	6	180	$59,121	$79,813
					Project Length	**1,271**			**Project Cost**	**231,053**	**311,921**
P-9	22nd and 23rd Street between Herrin Avenue and Redondo Avenue. Herrin Avenue, between 22nd Avenue and 23rd Avenue.	27580-27590	27580	27590	1952	586	4	6	180	$105,392	$142,279
		28250-28220	28250	28220	1952	606	4	6	180	$109,168	$147,377
		28040-28230	28040	28230	1952	66	4	6	180	$11,900	$16,065
		27590-28040	27590	28040	1952	172	4	6	180	$30,881	$41,689
		27570-27580	27570	27580	1952	50	4	6	180	$9,058	$12,228
		28230-28250	28230	28250	1952	30	4	6	180	$5,315	$7,176
					Project Length	**1,510**			**Project Cost**	**271,714**	**366,813**
P-10	19nd and 21st Street between Herrin Avenue and Redondo Avenue. Herrin Avenue, between 19th Avenue and 21st Avenue.	26260-26270	26260	26270	1952	50	4	6	180	$9,005	$12,157
		26390-27110	26390	27110	1952	236	4	6	180	$42,516	$57,397
		26390-26260	26390	26260	1952	586	4	6	180	$105,457	$142,366
		27120-27100	27120	27100	1952	606	4	6	180	$109,028	$147,188
		27110-27120	27110	27120	1952	29	4	6	180	$5,279	$7,127
		26400-26390	26400	26390	1952	20	4	6	180	$3,632	$4,904
		27110-27200	27110	27200	1952	68	4	6	180	$12,256	$16,546
					Project Length	**1,595**			**Project Cost**	**287,174**	**387,685**

Table 1-8
Recommended Pipeline Replacements (Continued)

Pipe Priority Number	Location Description	Model Pipe ID	Model U/S Node	Model D/S Node	Installation Date	Length (ft)	Existing Size (in)	Replace-ment Size (in)	Unit Cost ($/ft)	Construction Cost ($)	Total Cost ($)
P-11	Peck Avenue, between Matthews Avenue and Artesia Boulevard. Artesia Boulevard, between Peck Avenue and Aviation Boulevard.	10150-10260	10150	10260	1949	301	6	10	300	$90,339	$121,958
		10140-10150	10140	10150	1953	5	6	10	300	$1,614	$2,179
		10090-10070	10100	10070	N.A.	385	6	10	300	$115,500	$155,925
		10140-10141	10140	10061	N.A.	680	6	10	300	$204,000	$275,400
		10141-10060	10061	10060	N.A.	1,328	6	10	300	$398,517	$537,998
					Project Length	**2,700**			**Project Cost**	**809,970**	**1,093,460**
P-12	Herrin Avenue, between Curtis Avenue and Artesia Boulevard.	11580-11200	11580	11200	N.A.	340	New	6	180	$61,200	$82,620
		11200-11090	11200	11090	N.A.	340	New	6	180	$61,200	$82,620
		11100-10600	11090	10600	N.A.	340	New	6	180	$61,200	$82,620
		10600-10310	10600	10310	N.A.	340	New	6	180	$61,200	$82,620
		10310-10061	10310	10061	N.A.	340	New	6	180	$61,200	$82,620
					Project Length	**1,700**			**Project Cost**	**306,000**	**413,100**
P-13	Redondo Avenue, between Nelson Avenue and Artesia Boulevard.	10300-10660	10300	10660	1953	341	4	8	240	$81,732	$110,338
		10060-10300	10060	10300	1953	331	4	8	240	$79,409	$107,202
					Project Length	**671**			**Project Cost**	**161,141**	**217,540**
P-14	Miracosta High School between Meadows Avenue and Peck Avenue.	10870-10840	10870	10840	1953	368	8	10	300	$110,496	$149,170
		10860-10850	10860	10850	1953	284	6	10	300	$85,062	$114,834
		10860-10870	10860	10870	1953	35	8	10	300	$10,434	$14,086
		10840-10820	10840	10820	1953	240	8	10	300	$71,898	$97,062
		10850-10830	10850	10830	N.A.	385	6	10	300	$115,500	$155,925
					Project Length	**1,311**			**Project Cost**	**393,390**	**531,077**
P-15	21st Street between Manor Drive and Blanche Road. Valley Drive between Blanche Road and 25th Street.	27390-28160	27390	28160	1938	542	4	6	180	$97,492	$131,614
		27160-27320	27160	27320	1938	143	4	6	180	$25,792	$34,819
		27320-27370	27320	27370	1938	5	4	6	180	$851	$1,149
		27370-27390	27370	27390	1938	7	4	6	180	$1,242	$1,677
		28160-28180	28160	28180	1938	26	4	6	180	$4,599	$6,209
		28190-29580	28190	29580	1953	559	4	6	180	$100,703	$135,949
		26500-27090	26500	27090	N.A.	595	4	6	180	$107,149	$144,651
		27090-27160	27090	27160	N.A.	91	4	6	180	$16,463	$22,225
					Project Length	**1,968**			**Project Cost**	**354,290**	**478,292**

Table 1-8
Recommended Pipeline Replacements (Continued)

Pipe Priority Number	Location Description	Model Pipe ID	Model U/S Node	Model D/S Node	Installation Date	Length (ft)	Existing Size (in)	Replace-ment Size (in)	Unit Cost ($/ft)	Construction Cost ($)	Total Cost ($)
P-16	9th Street, 10th Street, and 11th Street across Sepulveda Boulevard.	20520-20410	20520	20410	N.A.	80	New	6	180	$14,400	$19,440
		19510-19420	19510	19420	N.A.	75	New	6	180	$13,500	$18,225
		18630-18600	18630	18600	N.A.	75	New	6	180	$13,500	$18,225
					Project Length	**230**			**Project Cost**	**41,400**	**55,890**
P-17	Matthews Avenue, between Redondo Avenue and Aviation Boulevard.	10240-10300	10240	10300	1953	554	4	8	240	$132,938	$179,467
		10220-10240	10220	10240	1953	354	4	6	180	$63,799	$86,129
		10300-10290	10300	10290	1953	6	4	8	240	$1,493	$2,015
					Project Length	**915**			**Project Cost**	**198,230**	**267,611**
P-18	Aviation Way, between Ruhland Avenue and Artesia Boulevard.	10220-10580	10220	10580	1953	333	4	6	180	$59,915	$80,885
		10090-10080	10090	10080	1953	17	4	6	180	$3,116	$4,206
		10080-10210	10080	10210	1953	290	4	6	180	$52,121	$70,363
		10210-10220	10210	10220	1953	22	4	6	180	$3,875	$5,232
		10580-11020	10580	11020	1953	324	4	6	180	$58,408	$78,851
					Project Length	**986**			**Project Cost**	**177,435**	**239,537**
P-19	Grandview Avenue, between Marine Avenue and 24th Street.	27190-27240	27190	27240	1958	42	4	6	180	$7,472	$10,087
		27600-28240	27600	28240	1958	239	4	6	180	$43,016	$58,072
		27240-27600	27240	27600	1958	196	4	6	180	$35,231	$47,562
					Project Length	**476**			**Project Cost**	**85,720**	**115,721**
P-20	25th Street, between Alma Avenue and Vista Drive.	28660-28700	28660	28700	1925	14	4	8	240	$3,408	$4,601
		28660-28510	28660	28510	1954	115	6	8	240	$27,643	$37,318
					Project Length	**129**			**Project Cost**	**31,051**	**41,919**
P-21	Sausalito Circle and Santa Rosa Court. Sausalito Circle and Cordoba Court.	33302-31020	33302	31020	N.A.	30	New	12	360	$10,800	$14,580
		33301-32670	33301	32670	N.A.	30	New	12	360	$10,800	$14,580
					Project Length	**60**			**Project Cost**	**21,600**	**29,160**
P-22	9th Street, between Ardmor Avenue and Highview Avenue.	18780-18860	18780	18860	1956	621	4	6	180	$111,749	$150,862
					Project Length	**621**			**Project Cost**	**111,749**	**150,862**
P-23	27th Street, between Bell Avenue and Blanche Road.	31300-31320	31300	31320	1954	463	4	8	240	$111,079	$149,957
	26th Street, between Bell Avenue and Blanche Road.	30450-30400	30450	30400	N.A.	174	4	8	240	$41,748	$56,360
					Project Length	**637**			**Project Cost**	**152,827**	**206,317**

Table 1-8
Recommended Pipeline Replacements (Continued)

Pipe Priority Number	Location Description	Model Pipe ID	Model U/S Node	Model D/S Node	Installation Date	Length (ft)	Existing Size (in)	Replace-ment Size (in)	Unit Cost ($/ft)	Construction Cost ($)	Total Cost ($)
P-24*	Grandview Avenue, between 31st Street and 36th Street	32810-32930	32810	32930	1926	12	6	12	360	$4,162	$5,618
		32930-33490	32930	33490	1959	229	6	12	360	$82,386	$111,221
		33890-34280	33890	34280	1959	241	6	12	360	$86,893	$117,306
		34310-34930	34310	34930	1959	236	6	12	360	$85,061	$114,832
		34950-34960	34950	34960	1925	3	6	12	360	$990	$1,337
		34930-34950	34930	34950	1925	3	6	12	360	$979	$1,322
		34280-34290	34280	34290	1926	2	8	12	360	$630	$851
		33860-33890	33860	33870	1926	4	8	12	360	$1,487	$2,007
		33510-33860	33510	33860	1959	232	6	12	360	$83,408	$112,601
		33490-33500	33490	33500	1926	3	8	12	360	$983	$1,327
		34960-35400	34960	35400	1959	252	6	12	360	$90,659	$122,389
		33500-33510	33500	33510	N.A.	3	8	12	360	$1,080	$1,458
		34290-34310	34290	34310	N.A.	3	8	12	360	$1,080	$1,458
		33870-33890	33870	33890	N.A.	2	8	12	360	$720	$972
					Project Length	**1,224**			**Project Cost**	**440,518**	**594,699**
P-25	30th Street, between Agnes Road and Laurel Avenue. 29th Street, west of Laurel Avenue.	31890-31900	31890	31900	1957	50	4	6	180	$8,977	$12,118
		32580-32590	32580	32590	1955	465	4	6	180	$83,666	$112,949
					Project Length	**515**			**Project Cost**	**92,642**	**125,067**
P-26	5th Street, between Redondo Avenue and Aviation Boulevard. Harkness Street, between 5th Street and 6th Street.	15240-15250	15240	15250	1953	663	4	6	180	$119,419	$161,216
		15240-15960	15240	15960	1953	234	4	6	180	$42,160	$56,915
		15240-15221	15240	15221	1953	655	4	6	180	$117,873	$159,129
		15960-16130	15960	16130	1953	121	2	6	180	$21,708	$29,306
					Project Length	**1,673**			**Project Cost**	**301,160**	**406,566**
P-27	Faymont Avenue, Between 23rd Street and 12th Street. 19th Street, between Faymont Avenue and Wendy Way.	23910-26290	23910	26290	1950	924	4	6	180	$166,252	$224,440
		26290-28310	26290	28310	1950	717	4	6	180	$129,074	$174,250
		22760-23800	22760	23800	1950	429	4	6	180	$77,191	$104,208
		23800-23820	23800	23820	1950	31	4	6	180	$5,544	$7,484
		23820-23860	23820	23860	1950	8	4	6	180	$1,454	$1,963
		23860-23910	23860	23910	1950	8	4	6	180	$1,372	$1,852
		26290-26250	26290	26250	N.A.	250	New	8	240	$60,000	$81,000
					Project Length	**2,366**			**Project Cost**	**440,887**	**595,198**

* Cannot provide total fire flow demand for land use provided in General Plan. Restrict future development in these areas.

Table 1-8
Recommended Pipeline Replacements (Continued)

Pipe Priority Number	Location Description	Model Pipe ID	Model U/S Node	Model D/S Node	Installation Date	Length (ft)	Existing Size (in)	Replace-ment Size (in)	Unit Cost ($/ft)	Construction Cost ($)	Total Cost ($)
P-28	Valley Drive, between 1st Street and Francisco Street.	12240-12820	12240	12820	1953	415	4	6	180	$74,736	$100,894
		12110-12240	12110	12240	1953	58	4	6	180	$10,447	$14,104
					Project Length	**473**			**Project Cost**	**85,183**	**114,997**
P-29	Duncan Avenue, between Ardmore Avenue and Poinsettia Avenue.	11970-12070	11970	12070	1953	29	4	6	180	$5,143	$6,943
		11970-12000	11970	12000	1953	392	4	6	180	$70,603	$95,314
		12120-12070	12120	12070	1953	12	4	6	180	$2,158	$2,914
		11710-11970	11710	11970	1953	64	4	6	180	$11,522	$15,554
					Project Length	**497**			**Project Cost**	**89,426**	**120,725**
P-30	Easement, north of Manhattan Beach Boulevard, between Magnolia Avenue and Meadows Avenue.	23410-23380	23410	23380	1947	205	4	6	180	$36,941	$49,871
		23370-23360	23370	23360	1947	6	4	6	180	$1,134	$1,531
		23360-23350	23360	23350	1947	215	4	6	180	$38,752	$52,315
		23380-23370	23380	23370	1947	25	4	6	180	$4,455	$6,014
					Project Length	**452**			**Project Cost**	**81,283**	**109,732**
P-31	Keats Street and Tennyson Street, between PCH and Chabela Drive. Chabela Drive, between Keats Street and Tennyson Street.	10470-10410	10470	10410	1953	338	6	8	240	$81,125	$109,518
		10410-10680	10410	10680	1976	217	6	8	240	$51,984	$70,178
		10680-10760	10680	10760	1976	50	6	8	240	$12,043	$16,258
		10760-10970	10760	10970	1976	197	6	8	240	$47,220	$63,747
		10980-10990	10980	10990	1953	159	6	8	240	$38,249	$51,636
		10990-10940	10990	10940	1953	163	6	8	240	$39,170	$52,880
					Project Length	**1,124**			**Project Cost**	**269,791**	**364,218**
P-32	Meadows Avenue, between 2nd Street and 6th Street.	15230-15550	15230	15550	1956	41	6	8	240	$9,797	$13,226
		14030-14640	14030	14640	1953	271	6	8	240	$65,042	$87,807
		14640-15210	14640	15210	1956	316	6	8	240	$75,948	$102,530
		15550-16430	15550	16430	1956	338	6	8	240	$81,046	$109,412
					Project Length	**966**			**Project Cost**	**231,833**	**312,974**
P-33*	Crest Drive between 43rd Street and 38th Sreet, and 38th Street Between Crest Drive and Highland Avenue.	35480-35940	35480	35940	1979	140	8	12	360	$50,526	$68,210
		35940-36190	35940	36190	1979	240	8	12	360	$86,404	$116,645
		36190-36300	36190	36300	1979	274	8	12	360	$98,658	$133,188
		36300-36360	36300	36360	1979	240	8	12	360	$86,411	$116,655
		36360-36400	36360	36400	1979	124	8	12	360	$44,626	$60,245
		36400-36500	36400	36500	1979	116	8	12	360	$41,929	$56,604
		36500-36570	36500	36570	1979	240	8	12	360	$86,245	$116,431
					Project Length	**1,374**			**Project Cost**	**494,798**	**667,978**

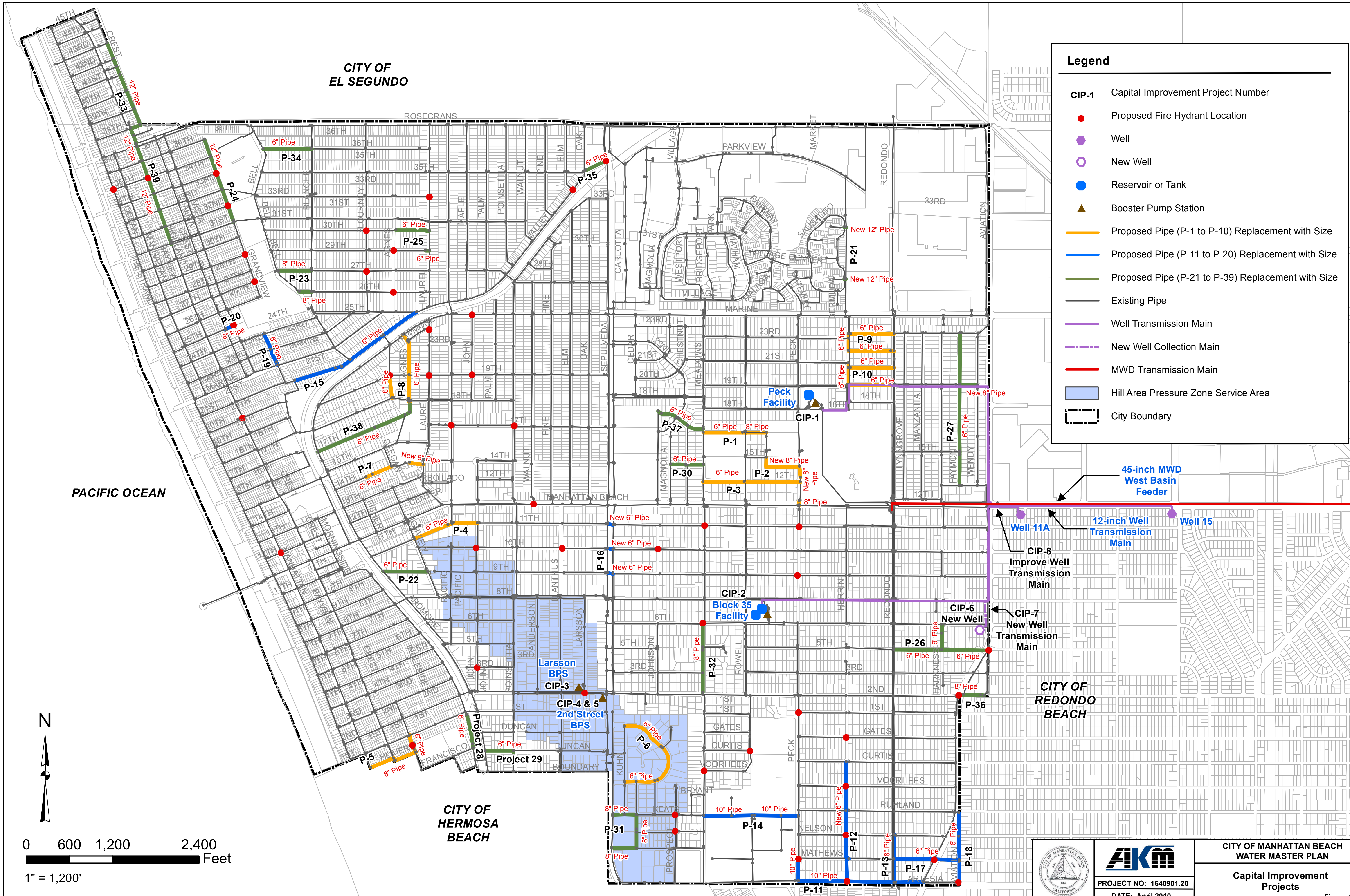
* Cannot provide total fire flow demand for land use provided in General Plan. Restrict future development in these areas.

Table 1-8
Recommended Pipeline Replacements (Continued)

Pipe Priority Number	Location Description	Model Pipe ID	Model U/S Node	Model D/S Node	Installation Date	Length (ft)	Existing Size (in)	Replace-ment Size (in)	Unit Cost ($/ft)	Construction Cost ($)	Total Cost ($)
P-34	36th Street, between Bell Avenue and Blanche Road.	35250-35260	35250	35260	1940	678	4	6	180	$121,981	$164,674
					Project Length	**678**			**Project Cost**	**121,981**	**164,674**
P-35	Valley Drive, between Oak Avenue and Sepulveda Boulevard.	34810-34640	34810	34640	1953	296	4	6	180	$53,357	$72,032
					Project Length	**296**			**Project Cost**	**53,357**	**72,032**
P-36	2nd Street, between Aviation Place and Aviation Boulevard.	13510-13490	13490	13500	1953	43	6	8	240	$10,318	$13,929
		13560-13501	13560	13501	1956	309	6	8	240	$74,045	$99,960
		13580-13560	13580	13560	N.A.	14	6	8	240	$3,396	$4,585
		13501-13500	13501	13500	N.A.	224	6	8	240	$53,645	$72,420
					Project Length	**589**			**Project Cost**	**141,403**	**190,894**
P-37	17th Street between Meadows Avenue and west of Magnolia Avenue.	24920-24860	24920	24860	1949	218	6	8	240	$52,382	$70,716
		24590-24370	24590	24370	1949	226	6	8	240	$54,120	$73,062
		24660-24590	24660	24590	1949	7	6	8	240	$1,608	$2,171
		24800-24660	24800	24660	1949	150	6	8	240	$35,899	$48,464
		24860-24800	24860	24800	1949	37	6	8	240	$8,878	$11,985
		24930-24920	24930	24920	1949	7	6	8	240	$1,642	$2,216
		24930-25000	24930	25000	N.A.	60	New	8	240	$14,400	$19,440
					Project Length	**704**			**Project Cost**	**168,929**	**228,054**
P-38	17th Street, between Ardmore Avenue and 18th Street.	24990-25550	24990	25550	1958	152	6	8	240	$36,360	$49,086
		23900-24390	23900	24390	1958	855	6	8	240	$205,238	$277,072
		24900-24990	24900	24990	1958	74	6	8	240	$17,741	$23,950
		24390-24900	24390	24900	1958	461	6	8	240	$110,520	$149,202
					Project Length	**1,541**			**Project Cost**	**369,859**	**499,310**

Table 1-8
Recommended Pipeline Replacements (Continued)

Pipe Priority Number	Location Description	Model Pipe ID	Model U/S Node	Model D/S Node	Installation Date	Length (ft)	Existing Size (in)	Replace-ment Size (in)	Unit Cost ($/ft)	Construction Cost ($)	Total Cost ($)
P-39	Highland Avenue, between 38th Street and 30th Street.	35310-35320	35310	35320	1926	9	6	12	360	$3,226	$4,355
		35320-35330	35320	35330	1926	3	8	12	360	$1,256	$1,696
		32700-33430	32700	33430	1925	237	8	12	360	$85,144	$114,944
		33840-33450	33840	33450	1935	237	8	12	360	$85,324	$115,187
		33840-34170	33840	34170	1935	235	8	12	360	$84,719	$114,370
		34800-35300	34800	35300	1925	205	8	12	360	$73,966	$99,854
		35340-35490	35430	35480	1979	254	6	12	360	$91,267	$123,211
		32050-32130	32050	32130	1925	15	8	12	360	$5,267	$7,110
		35300-35310	35300	35310	1926	8	6	12	360	$2,812	$3,796
		32130-32150	32130	32150	N.A.	10	8	12	360	$3,600	$4,860
		32150-32200	32150	32200	N.A.	28	8	12	360	$10,080	$13,608
		33450-33430	33450	33430	N.A.	7	8	12	360	$2,340	$3,159
		35330-35340	35330	35340	N.A.	4	8	12	360	$1,440	$1,944
		35340-35360	35340	35360	N.A.	29	6	12	360	$10,440	$14,094
		35360-35430	35360	35430	N.A.	227	6	12	360	$81,691	$110,283
		32200-32680	32200	32680	N.A.	203	8	12	360	$73,080	$98,658
		32680-32700	32680	32700	N.A.	8	8	12	360	$2,880	$3,888
		34800-34170	34800	34170	1925	100	8	12	360	$36,000	$48,600
					Project Length	**1,818**			**Project Cost**	**654,530**	**883,616**
					Grand Total	**37,073**			**Grand Total**	**$9,189,946**	**$12,406,427**


Legend
CIP-1 Capital Improvement Project Number
Proposed Fire Hydrant Location
Well
New Well
Reservoir or Tank
Booster Pump Station
Proposed Pipe (P-1 to P-10) Replacement with Size
Proposed Pipe (P-11 to P-20) Replacement with Size
Proposed Pipe (P-21 to P-39) Replacement with Size
Existing Pipe
Well Transmission Main
New Well Collection Main
MWD Transmission Main
Hill Area Pressure Zone Service Area
City Boundary
CITY OF EL SEGUNDO
PACIFIC OCEAN
CITY OF HERMOSA BEACH
CITY OF REDONDO BEACH
Peck Facility
CIP-1
CIP-2
Block 35 Facility
Larsson BPS
CIP-3
CIP-4 & 5
2nd Street BPS
CIP-6
New Well
CIP-7
New Well Transmission Main
CIP-8
Improve Well Transmission Main
45-inch MWD West Basin Feeder
12-inch Well Transmission Main
Well 11A
Well 15
Project 28
Project 29
N
0 600 1,200 2,400 Feet
1" = 1,200'
CITY OF MANHATTAN BEACH WATER MASTER PLAN
PROJECT NO: 1640901.20
DATE: April 2010
Capital Improvement Projects
Figure 1-1