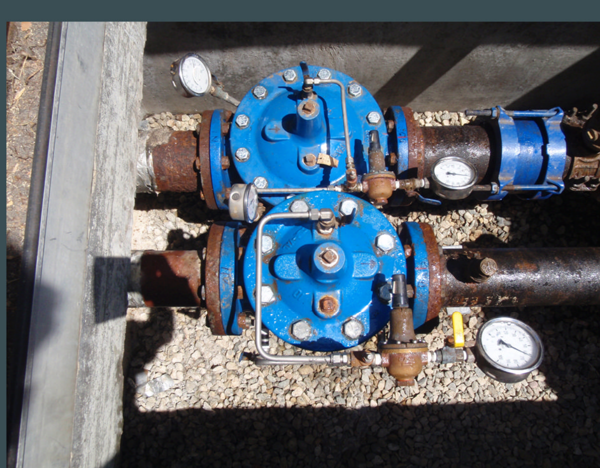
CITY OF NORWALK
Water Master Plan
June 2014



Prepared for:
City of Norwalk
12700 Norwalk Boulevard
Norwalk, CA 90650

Prepared By:
AKM Consulting Engineers
553 Wald
Irvine, CA 92618

CITY OF NORWALK

WATER MASTER PLAN

Date of Signing 6/24/14

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Prepared By:

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12700 Norwalk Boulevard
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E-1 Introduction

The Norwalk Municipal Water System (NMWS) serves an estimated population of 18,500 through 5,362 service connections in portions of the City of Norwalk, the City of Artesia, and a small unincorporated Los Angeles County area. Golden State Water Company, Park Water Company, the City of Santa Fe Springs and the City of Cerritos provide water service to the remaining areas of the City.

In order to operate its system efficiently, reliably, and in the most fiscally responsible manner, the City has obtained pumping rights to supply the entire demand of its service area from groundwater sources. The City desires to eliminate the use of imported water to the maximum extent possible. Accomplishing this goal required evaluation of the capacity of the City's existing system, and development of a capital improvement program through the preparation of the Water Master Plan.

E-2 Existing Water System

The service area covers 1,331 acres (2.1 square miles) and includes nine non-contiguous areas, referred to as Northeast, Northwest, Central, West, East, South, Southeast (2 areas), and Artesia. Portions of the South Service Area are located in unincorporated Los Angeles County territory and the City of Artesia.

The existing water system facilities include the following:

- Approximately 291,800 feet (55.3 miles) of distribution water mains, sized from 2-inches to 16-inches, primarily constructed in the 1940's and 1950's
- 3 operating wells (Well 4, Well 5, and Well 10)
- 7 connections with City of Santa Fe Springs and City of Cerritos
- 1 imported water connection (MWD Turnout No. 16)
- 9 emergency interconnections
- 5 pressure regulating stations
- 5,362 service connections

The system also includes a High Pressure Fire Pipeline System, which was constructed to serve fire flows to portions of the Central and West Service Areas, provide domestic supply to the Central Service Area through pressure regulating stations, and provide emergency backup to the West Service Area. The distribution system is made up of mostly cast iron pipe and asbestos cement pipe. The total demand is 2,134 acre feet per year (AFY)

E-3 Hydraulic Model

The Master Plan work involved the development of a calibrated computer hydraulic model of the NMWS, which mathematically represents the system. The hydraulic model includes all system pipes, wells, pressure regulating stations and connections to other systems. It was used in conducting evaluations of the system under various conditions, and formulating the needed improvements.

E-4 Existing System Analysis

Performance criteria (source of supply, system pressures, pipe velocities, system losses, fire suppression) and the developed hydraulic model were utilized to analyze the NMWS under existing average day demand (ADD) and maximum day demand (MDD) conditions. Necessary improvements were then identified and recommended for inclusion in a Water System Improvement Plan (WSIP).

The existing system meets the minimum pressure criteria of 40 pounds per square inch (psi) under all demand conditions. However, fire flow deficiencies were identified at several locations, and improvement recommendations were developed.

E-5 High Pressure Fire Pipeline System Surge Analysis

The Master Plan study evaluated the pressure surges currently being experienced in the High Pressure Fire Pipeline System during the night time period between 10:00 am and 6:00 am when water is served from the Metropolitan Water District (MWD) connection; and unintended shutoff of Well 10 during operation of fire hydrants near the well. It was determined that the surges occur during the transition from Well 10 to the imported water supply. Modifications to the Well 10 operation and valves, as well as installation of a third pressure reducing valve (4-inch) at the imported water connection were recommended to minimize the surges and unintended well shut down.

E-6 Future System Analysis

Due to the high cost of imported water (~$1,171/AF) and purchased water from neighboring agencies (~$967/AF Cerritos and ~$1700/AF Santa Fe Springs), one of the primary goals of the City is to eliminate imported water use and reduce the amount of water it purchases from the City of Cerritos and the City of Santa Fe Springs. Groundwater can be served at a much lower cost (~$419/AF).

Projected future system analysis concentrated on developing capital improvement projects that would connect some of the non-contiguous service areas and allow the City to eliminate the use of the imported water, as well as supplies from one or more of the connections with neighboring agencies. Numerous alternatives were formulated and evaluated to accomplish this. The recommended improvements are included in the Water System Improvement Plan (WSIP).

E-7 Water System Improvement Plan

A detailed Water System Improvement Plan (WSIP) was developed based on the analyses completed. The WSIP Project locations are shown on Figure E-1 and detailed on Table E-1. The projects are prioritized based upon the City's concerns and the cost benefit of each improvement recommendation. Project costs are sometimes spread over multiple years to account for the time it takes to plan, design and construct projects, as well as projects that will take more than one year to construct.

Cost estimates have been prepared for each recommended project, based upon information from recent similar projects. The improvements recommended herein are conceptual in nature. Further analysis and refinement will be necessary prior to start of work on the final plans, specifications and estimates package for each project. The total WSIP project cost is estimated at $73.4 Million from FY 2014/15 through FY 2031/32.

The WSIP's short term improvement projects are recommended to assist in mitigating the surges currently being experienced in the High Pressure Fire Pipeline System, improving the water quality in the Central Service Area, reducing the use of imported MWD water, and reducing the purchase of water from the City of Cerritos. These projects are scheduled to be completed over the next four (4) years (FY 2014/15 through FY 2017/18). The projects, listed under Phase 1 and Phase 2 on Table E-1, are considered short term improvement projects.

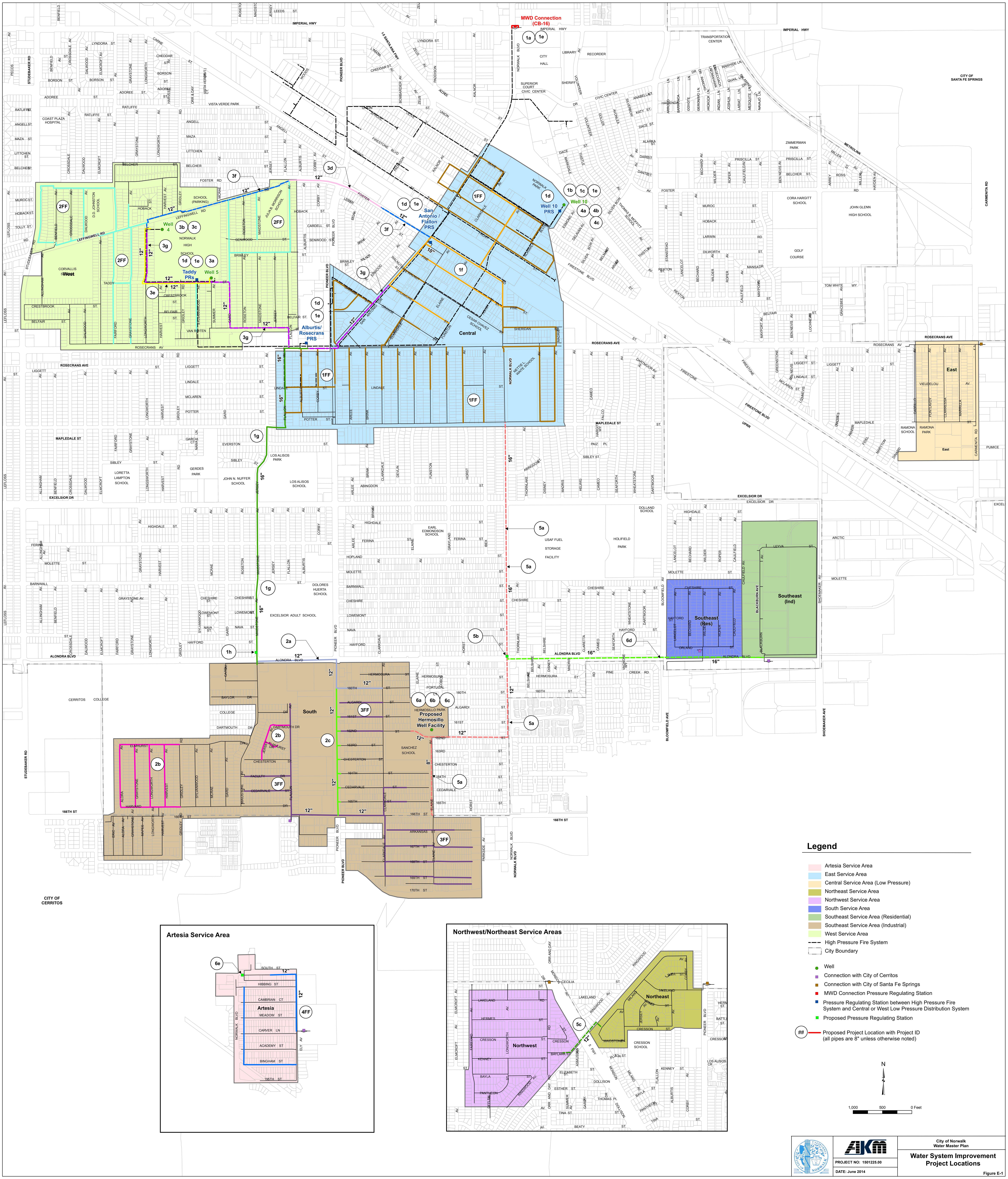
The WSIP's long term improvement projects are recommended to improve the reliability of the system, add redundancy to the system, replace aging facilities, and improve fire flows as well as residual system pressures. The projects listed under Phases 3, 4, 5, and 6 in Table E-1 are the long term improvement projects; which will interconnect the West Service Area with the Central and South Service Areas; improve fire flow and pressures, and add an additional source of water to the South, and the Artesia Service Areas.

Table E-1
Water System Improvement Plan

Project ID	Project Description	Ex Dia (in)	Prop Dia (in)	Quantity	Unit	Unit Cost ($)	Const. Cost ($)	Eng, Admin, and Cont. (35%)	Project Cost ($)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
Phase 1																											
1a	Install 4" valve at MWD Connection								25,000	25,000																	
1b	Valve and Programming/Control Modifications at Well 10								25,000	25,000																	
1c	Construct sequestering agent injection facility at Well 10								125,000	125,000																	
1d	Replace PRVs at Well 10 PRS, Foster/San Antonio PRS, Alburtis/Rosecrans PRS, Taddy/Sylvanwood PRS. Small valves will be pressure reducing valves. Large valves will be hydraulic pressure management control valves.			4	PRS	50,000	200,000	70,000	270,000	270,000																	
1e	Install SCADA System								425,000		425,000																
1f	Replace pipelines in Central Service Area for water quality improvement	4	8	5,613	ft	240	1,347,120	471,492	1,818,612	727,445	1,091,167																
		8	8	1,449	ft	240	347,760	121,716	469,476	187,790	281,686																
		6	8	536	ft	240	128,640	45,024	173,664	69,466	104,198																
		10	10	100	ft	300	30,000	10,500	40,500	16,200	24,300																
1g	Replace pipeline in Rosecrans Ave (Flallon Ave to Rosecrans PRS)	6	16	395	ft	480	189,600	66,360	255,960	102,384	153,576																
	Replace pipeline in Flallon Ave (Rosecrans Ave to Mapledale St)	4, 6	16	1,301	ft	480	624,480	218,568	843,048	337,219	505,829																
	Construct pipeline in Mapledale St, Jersey Ave, and Maidstone Ave (Flallon Ave to Alondra Blvd)		16	4,464	ft	480	2,142,720	749,952	2,892,672	1,590,970	1,301,702																
1h	Construct pressure regulating station at Maidstone Ave and Alondra Blvd			1	PRS	250,000	250,000	87,500	337,500			337,500															
1i	Add emergency connection to Park Water in Southeast Service Area			1	PRS	250,000	250,000	87,500	337,500			337,500															
Phase 2																											
2a	Construct pipeline in Alondra Blvd (Maidstone Ave to Pioneer Blvd)		12	1,405	ft	360	505,800	177,030	682,830			341,415	341,415														
	Construct pipeline in Pioneer Blvd (Alondra Blvd to 160th St)		12	486	ft	360	174,960	61,236	236,196			118,098	118,098														
	Replace pipeline in 160th St (Pioneer Blvd to Clarksdale Ave)		12	780	ft	360	280,800	98,280	379,080			189,540	189,540														
2b	Replace pipelines **already designed** in South Service Area (west side)	4,6,8	8	12,875	ft	240	3,090,000	772,500	3,862,500			1,931,250	1,931,250														
2c	Construct pipeline in Pioneer Blvd (160th St to 166th St), connected to all streets on east and add fire hydrants for multi-family uses on west		12	2,164	ft	360	779,040	272,664	1,051,704			525,852	525,852														
Phase 3																											
3a	Construct well at Well 5 site in West Service Area			1	well	2,500,000	2,500,000	875,000	3,375,000					1,687,500	1,687,500												
3b	Construct reservoir at Well 4 site in West Service Area			500,000	gal	3	1,500,000	525,000	2,025,000					1,012,500	1,012,500												
3c	Construct booster pump station at Well 4 site in West Service Area			1	PS	2,500,000	2,500,000	875,000	3,375,000					1,687,500	1,687,500												
3d	Construct pipeline in Foster Rd, Flallon Ave to west of Kalnor Ave		12	1,700	ft	360	612,000	214,200	826,200							826,200											
3e	Construct well discharge pipeline between new well and new reservoir in Taddy St and Longworth Ave		12	2,056	ft	360	740,160	259,056	999,216							499,608	499,608										
3f	Upsize pipes from new reservoir at Well 4 site to Foster/San Antonio PRS in Leffingwell Rd and Foster Rd	6, 8, 10	12	3,671	ft	360	1,321,560	462,546	1,784,106							892,053	892,053										
3g	Construct pipelines in Central and West Service Areas to loop system	4	12	1,540	ft	360	554,400	194,040	748,440							374,220	374,220										
		6	12	3,817	ft	360	1,374,120	480,942	1,855,062							927,531	927,531										
		8	12	1,051	ft	360	378,360	132,426	510,786							255,393	255,393										

Table E-1 (continued)
Water System Improvement Plan

Project ID	Project Description	Ex Dia (in)	Prop Dia (in)	Quantity	Unit	Unit Cost ($)	Const. Cost ($)	Eng, Admin, and Cont. (35%)	Project Cost ($)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
Phase 4																											
4a	Construct reservoir next to Well 10, half underground			1,000,000	gal	2	2,000,000	700,000	2,700,000									1,350,000	1,350,000								
4b	Construct booster pump station at Well 10 Reservoir (pumping to high pressure)			1	PS	2,500,000	2,500,000	875,000	3,375,000									1,687,500	1,687,500								
4c	Well 10 pump modifications			1	well pump	50,000	50,000	17,500	67,500									33,750	33,750								
Phase 5																											
5a	Construct pipeline in Norwalk Blvd (Mapledale St to Alondra Blvd)		16	4,027	ft	480	1,932,960	676,536	2,609,496											1,304,748	1,304,748						
	Contruct pipeline in Norwalk Blvd (Alondra Blvd to 162nd St) and 162nd St (Norwalk Blvd to Hermosillo Park)		12	2,980	ft	360	1,072,800	375,480	1,448,280											724,140	724,140						
	Construct pipeline in Elaine Ave (Hermosillo Park to 166th St)		8	1,327	ft	240	318,480	111,468	429,948											214,974	214,974						
5b	Construct pressure regulating station at Norwalk Blvd and Alondra Blvd			1	PRS	250,000	250,000	87,500	337,500											337,500							
5c	Construct pipeline to connect Northwest to Northeast Service Areas (railroad right-of-way from Maidstone Avenue to Baylark Street)		12	1,000	ft	360	360,000	126,000	486,000											486,000							
Phase 6																											
6a	Construct well at Hermosillo Park			1	well	2,800,000	2,800,000	980,000	3,780,000													1,134,000	1,134,000	1,512,000			
6b	Construct reservoir at Hermosillo Park			1,000,000	gal	2	2,000,000	700,000	2,700,000													810,000	810,000	1,080,000			
6c	Construct booster pump station at Hermosillo Park			1	PS	2,000,000	2,000,000	700,000	2,700,000													810,000	810,000	1,080,000			
6d	Construct pipeline in Alondra Blvd (Norwalk Blvd to Blackburn Ave)		16	4,400	ft	480	2,112,000	739,200	2,851,200																1,140,480	1,710,720	
6e	Convert Golden State Water Company Connection at Norwalk Blvd and South St to a PRV (Artesia Service Area)			1	PRS	150,000	150,000	52,500	202,500																202,500		
Fireflow Pipeline Replacements																											
1FF	Central Service Area pipe replacements for fire flow	4	8	23,723	ft	240	5,693,520	1,992,732	7,686,252			600,000	1,200,000			300,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	586,252					
		6	8	4,903	ft	240	1,176,720	411,852	1,588,572																		1,588,572
2FF	West Service Area pipe replacements for fire flow	4	8	9,064	ft	240	2,175,360	761,376	2,936,736												700,000	700,000	1,200,000	336,736			
		6	8	6,630	ft	240	1,591,200	556,920	2,148,120																700,000	1,448,120	
3FF	South Service Area pipe replacements for fire flow	2	8	324	ft	240	77,760	27,216	104,976												104,976						
		4	8	6,456	ft	240	1,549,440	542,304	2,091,744																1,000,000	500,000	591,744
		6	8	4,590	ft	240	1,101,600	385,560	1,487,160																1,000,000	400,000	87,160
		8	12	1,593	ft	360	573,480	200,718	774,198																		774,198
4FF	Artesia Service Area pipe replacements for fire flow	2	8	1,319	ft	240	316,560	110,796	427,356																		427,356
		6	8	893	ft	240	214,320	75,012	289,332																		289,332
		8	12	938	ft	360	337,680	118,188	455,868																		455,868
	Total amount to spend on fire flow replacements each year									0	0	600,000	1,200,000	0	0	300,000	1,000,000	1,000,000	1,000,000	1,000,000	1,804,976	1,286,252	1,200,000	336,736	2,700,000	2,348,120	4,214,230
	Grand Total								**73,427,790**	**3,476,474**	**3,887,458**	**4,381,155**	**4,306,155**	**4,387,500**	**4,387,500**	**4,075,005**	**3,948,805**	**4,071,250**	**4,071,250**	**4,067,362**	**4,048,838**	**4,040,252**	**3,954,000**	**4,008,736**	**4,042,980**	**4,058,840**	**4,214,230**


MWD Connection (CB-16)
Central
West
East
South
Southeast (Ind)
Southeast (Res)
Artesia Service Area
Artesia
Northwest/Northeast Service Areas
Northwest
Northeast
Taddy PRs
Alburtis/ Rosecrans PRS
San Antonio / Fallon PRS
Well 10 PRS
Well 4
Well 5
Well 10
Proposed Hermosillo Well Facility
CITY OF SANTA FE SPRINGS
CITY OF CERRITOS
Legend
Artesia Service Area
East Service Area
Central Service Area (Low Pressure)
Northeast Service Area
Northwest Service Area
South Service Area
Southeast Service Area (Residential)
Southeast Service Area (Industrial)
West Service Area
High Pressure Fire System
City Boundary
Well
Connection with City of Cerritos
Connection with City of Santa Fe Springs
MWD Connection Pressure Regulating Station
Pressure Regulating Station between High Pressure Fire System and Central or West Low Pressure Distribution System
Proposed Pressure Regulating Station
Proposed Project Location with Project ID (all pipes are 8" unless otherwise noted)
1,000 500 0 Feet
City of Norwalk Water Master Plan
Water System Improvement Project Locations
PROJECT NO: 1501225.00
DATE: June 2014
Figure E-1

SECTION 1

INTRODUCTION

1-1 Background

The Norwalk Municipal Water System (NMWS) is the water enterprise operated by the City of Norwalk (City) and serves portions of the City of Norwalk, the City of Artesia, and a small unincorporated Los Angeles County area. The NMWS serves an estimated population of 18,500 through 5,362 service connections. Other water companies and agencies serving the City of Norwalk include Golden State Water Company, Park Water Company, the City of Santa Fe Springs and the City of Cerritos.

1-2 Past Studies

The City's existing Water System Master Plan was prepared in 1991. The Water System Master Plan provided projected water demands, established system criteria, and recommended system improvements for both existing and ultimate conditions. The planning period extended through the year 2020. The service area population was estimated at 15,493 in 1991 and expected to increase to 16,000 by 2020. These populations did not include the recently acquired southern service areas (Unincorporated Los Angeles County and Artesia). A hydraulic model was developed for the "backbone" system, which generally included pipes 8-inches and larger. Based on the study analysis, a Water System Improvement Plan (WSIP) of $20 Million (1991 dollars) was established. The WSIP was divided into five phases and included approximately 48,000 feet of pipe improvements, 11.5 MG of storage facilities and associated pumping facilities (3 locations), 1 groundwater well, and 3 pressure regulating stations (PRS).

The Water System Improvements Engineering Report was also prepared in 1991, subsequent to the completion of the Water System Master Plan. It provided further details on the improvement recommendations of the Water System Master Plan. Per City Staff, only about ten percent of the recommended projects have been implemented to date. The primary project that did get implemented is the Norwalk Park Well (Well 10), which was put into operation in 2012.

The Southeast Los Angeles Water Conservation and Supply Study was completed in 1996 in collaboration with the United States Army Corps of Engineers (Corps). This study evaluated all of the water systems within the City of Norwalk for deficiencies in the event of a major earthquake event. The analysis indicated severe consequences if the bridges across the freeways collapsed in the earthquake. The recommendations of this study were very conservative and included transmission main looping, new reservoirs and new wells.

The City's 2010 Urban Water Management Plan (UWMP) was published in July 2011. The City's per capita water use 2020 target is 112 gallons per capita per day (gpcd). The 2010 water use was calculated at 104 gpcd.

1-3 Purpose and Scope of Work

In order to operate its system efficiently, reliably, and in the most fiscally responsible manner, the City has obtained pumping rights to supply the entire demand of its service area from groundwater sources. The City desires to eliminate the use of imported water to the maximum extent possible. Accomplishing this goal required evaluation of the capacity of the City's existing system, development of a capital improvement program, and developing the funding needed to implement the program. The primary goals of the water master plan update were as follows:

- Develop a hydraulic model of the NMWS water system
- Analyze existing system operations using the developed model
- Investigate the design of Norwalk Park Well and propose solutions to resolve the surge issues, as well as eliminate the need for imported water for domestic use in the Central Service Area
- Investigate possibilities of connecting some of the service areas, particularly the Central, West, and South Service Areas
- Evaluate and prioritize capital improvements necessary to fully utilize the City's water rights
- Identify existing and future system deficiencies over a planning period of ten (10)-years
- Identify future improvements to the distribution system and supply sources
- Develop a phased Water System Improvement Plan (WSIP) based on analysis and identify project costs
- Develop information for use by the City's Water Rate Consultant on the WSIP and Financing Plan for projects to be considered within the water rate structure for the next five (5) years

SECTION 2

EXISTING SYSTEM

2-1 Service Areas

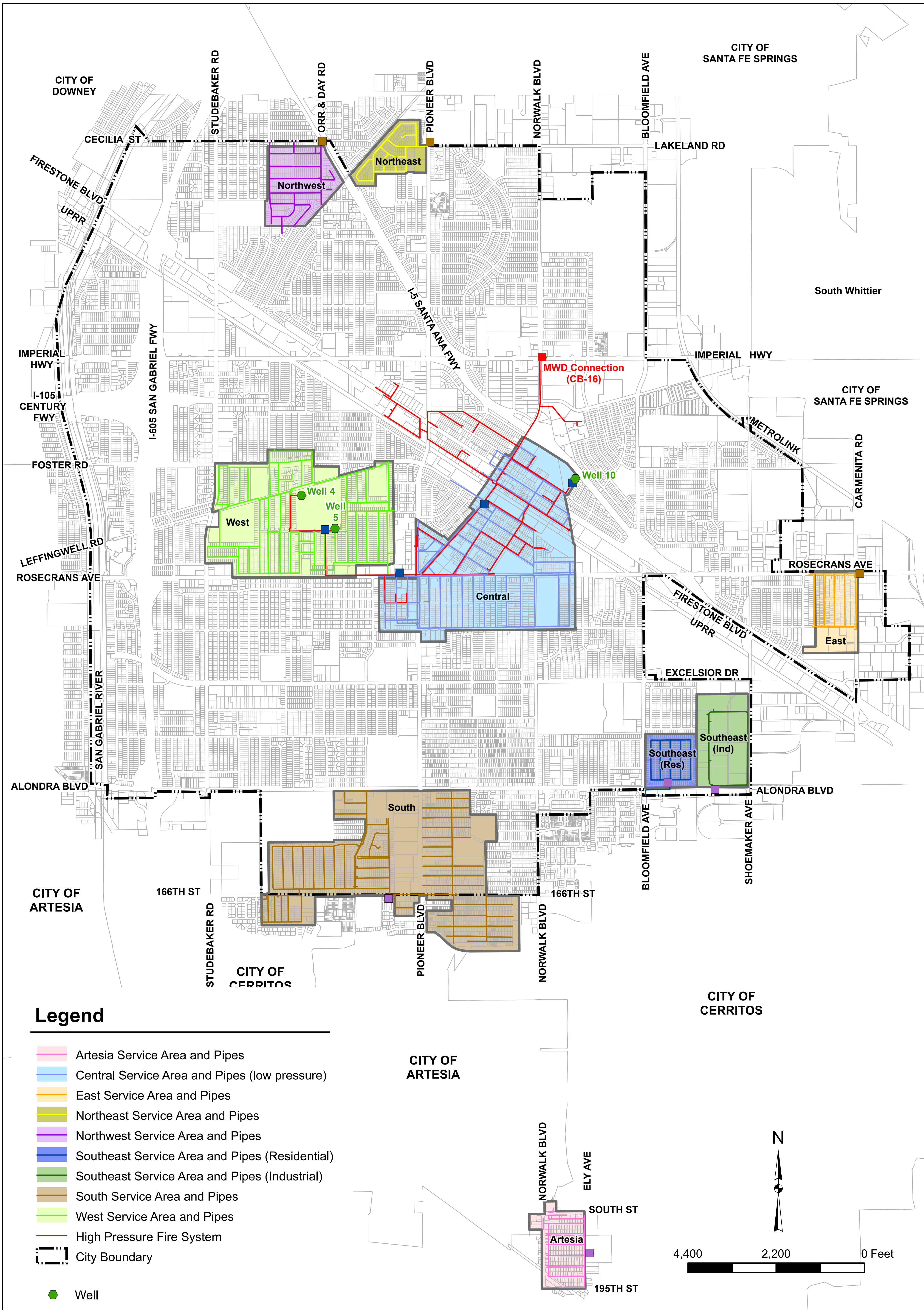
The service area, shown on Figure 2-1, includes nine non-contiguous areas, namely: Northeast, Northwest, Central, West, East, South, Southeast (2 areas), and Artesia. Portions of the South Service Area are located in unincorporated Los Angeles County territory and the City of Artesia.

The Northeast and Northwest Service Areas are located on the east and west sides of the I-5 Freeway south of the City boundaries with Downey and Santa Fe Springs; with no direct connection between the two areas. These two areas are also separated by the Union Pacific (UP) Railroad tracks. The existing system consists of 6”, 8” and 12” asbestos cement (AC) pipe on the west side of the I-5 Freeway, and 4”, 6”, and 8” AC pipe on the east side. These areas are supplied by water purchased from the City of Santa Fe Springs through two separate connections.

The Central Service Area is located south of the I-5 Freeway south and east of San Antonio Drive, Orange Street, Pioneer Boulevard, Rosecrans Avenue, and Jersey Avenue; north of Mapledale Street; and west of Madris Avenue and its northerly extension. The distribution system consists of 2” to 16” cast iron (CI) pipe, AC pipe, steel pipe, and ductile iron (DI) pipe. The supply to this service area is from the recently completed Well 10 located in Norwalk Park, and imported water through the Central Basin Turnout No. 16 (CB16) of Metropolitan Water District of Southern California (MWD), which is located near the south east corner of Imperial Highway and Norwalk Boulevard. The Well 10 and the MWD connections first provide water to the High Pressure Fire Pipeline at 120-130 pounds per square inch (psi), located in Norwalk Boulevard and San Antonio Drive; and then into the Central Service Area low pressure distribution system (60-65 psi) through two primary pressure regulating stations (PRSs): one at San Antonio Drive and Foster Road and one at Rosecrans Avenue and Alburtis Avenue. There is another PRS located near Well 10. Currently, there is a closed valve downstream of this PRS that prevents the water from entering the low pressure system in this area. The system is set up this way due to water quality complaints. Once the water quality issues are addressed, this valve will be opened and water will be allowed to enter the low pressure system through this PRS near Well 10.

Well 10, located in Norwalk Park, was designed to replace the primary domestic supply from the MWD connection and operate with a variable frequency drive (VFD) to vary production based on system demand. It was constructed and put into operation in May 2012. Due to some potential water quality issues discovered during the drilling of the well, its design capacity was limited to 2000 gallons per minute (gpm). The well was designed to provide fire flow to the High Pressure Fire Pipeline along with the MWD connection. The original intention was for Well 10 to provide all the domestic demands of the Central Service Area. Once in operation, it was realized that the night time demands were low and the full range of demands could not reliably supplied by the well, even with a VFD.

The City changed the operation of Well 10 to only pump during the higher system demand periods from 6 am to 10 pm. Well 10 is programmed to maintain a system pressure of 130 psi in the High Pressure Fire Pipeline. The existing MWD connection provides water to the High Pressure Fire Pipeline during the low demand periods from 10 pm to 6 am, through two pressure regulating valves (6-inch and 12-inch). The 6-inch pressure regulating valve setting is 120 psi and the 12-inch valve setting is 110 psi.



AKM

PROJECT NO: 1501225.00

DATE: June 2014

City of Norwalk
Water Master Plan

Existing Water System

Figure 2-1

The pressure reducing station near Well 10 has not been in operation due to aesthetic water quality issues. In addition, surges occur in the high pressure system when the well is not operating and the well has been known to shut down upon opening and closing of fire hydrants in the system (See Section 6-7 for more details).

The West Service Area is generally located south of Foster Road and Belcher Street; west of Fallon Avenue; north of Ruiten Street and Rosecrans Avenue; and east of Studebaker Road. The distribution system consists of 4", 6", and 8" cast iron pipes. The primary supply is from Well 4 (Leffingwell, drilled in 1950) and Well 5 (Taddy, drilled in 1952), each with a 10,000 gallon hydropneumatic tank. This area can also be supplied through a pressure regulating station from the High Pressure Fire Pipe on Taddy Street at Sylvanwood Avenue.

The Southeast Service Area is located south of the I-5 Freeway between Bloomfield Boulevard and Shoemaker Avenue, north of Alondra Boulevard. The westerly portion of this section is single family residential constructed in the mid 1970's; and the easterly section is industrial. The distribution system consists of 6" and 8" AC pipe in the residential area, and 12" AC pipe in the industrial area. Source of supply is from the City of Cerritos through one connection.

The East Service Area is located north of the I-5 Freeway and south of Rosecrans Avenue between Cabrillo Avenue on the west and Carmenita Road on the east. The distribution system consists of 6", 8", 10", and 12" AC pipe. The source of supply is water purchased from the City of Santa Fe Springs through one connection.

The South Service Area is located south of Alondra Boulevard generally between the westerly City boundary/Eric Avenue and Elaine Avenue/Paradise Avenue. The distribution system consists of 4", 6", and 8" AC pipe and CI pipe. Service to this area is provided by water purchased from the City of Cerritos through one connection.

The Artesia Service Area is located between South Street on the north, and 195th Street on the south, bordered generally by Norwalk Boulevard on the west and Ely Avenue on the east. The distribution system consists of 2", 6", and 8" AC pipe. Source of supply to this area is water purchased from the City of Cerritos through one connection.

2-2 Existing System

The existing water system facilities include the following:

- Approximately 291,800 feet (55.3 miles) of distribution water mains, sized from 2-inches to 16-inches, primarily constructed in the 1940's and 1950's
- 3 operating wells (Well 4, Well 5, and Well 10)
- 2 - 10,000 gallon hydropneumatic tanks (at Well 4 and Well 5)
- 7 connections with other purveyors (City of Santa Fe Springs, City of Cerritos), one of which is a pressure regulating station at 166th Street and Flallon Avenue
- 1 imported water connection (MWD Turnout No. 16)
- 9 emergency interconnections (Park Water Company, Golden State Water Company, City of Santa Fe Springs)

- 4 pressure regulating stations from the High Pressure Pipeline to the Central and/or West Service Area (currently, due to water quality issues, one PRS near Well 10 is not used to serve water to the Central Service Area low pressure system)
- 5,362 service connections

The NMWS does not currently have a Supervisory Control and Data Acquisition (SCADA) system in place to monitor and control system operations.

The system also includes an isolated High Pressure Fire Pipeline System, which was constructed to serve fire flows to portions of the Central and West Service Areas, provide domestic supply to the Central Service Area through PRSs, and provide emergency backup to the West Service Area through one PRS.

The total service area covers about 1,331 acres (2.1 square miles). The distribution system pipes are made up of mostly cast iron pipe and asbestos cement pipe. The service area information, including details of the pipes for each service area are provided in Table 2-1.

Table 2-1
Service Area Characteristics

Service Area	Water Supply From	Area (Ac)	No. of Services	Length of Pipe (ft)	Pipe Sizes (in)	Pipe Material	Service Elevations (ft)	Pressure Range (psi)
Northeast	City of Santa Fe Springs	41	205	8,500	4, 6, 8	ACP	111-122	71-72
Northwest	City of Santa Fe Springs	70	331	13,500	6, 8, 12	ACP	111-123	70-72
Central	Well 10 and MWD	359	1,203	71,000	2, 3, 4, 6, 8, 10	ACP, CIP, DIP	86-101	50-65
West	Well 4 and Well 5	290	1,208	50,800	4, 6, 8	CIP	86-97	40-65
High Pressure System	Well 10 and MWD	-	-	46,078	8, 10, 12, 16	[1]DIP, ACP	87-108	120-130
South	City of Cerritos	361	1,638	59,700	4, 6, 8	ACP, CIP	62-73	55-59
Southeast (Residential)	City of Cerritos	39	235	14,200	6, 8	ACP	72-76	73-75
Southeast (Industrial)	City of Cerritos	68	19	6,120	12	ACP	72-77	73-75
East	City of Santa Fe Springs	51	232	9,300	6, 8, 12	ACP	81-85	74-76
Artesia	City of Cerritos	52	291	12,600	2, 6, 8	ACP	45-47	54-57
	Total	**1,331**	**5,362**	**291,798**				

[1] The Well 10 construction plans show 16" DIP in Sproul Street for the high and low pressure system. Per City staff, the remaining materials of the high pressure system are ACP.

2-3 Well Facilities

The NMWS includes three (3) wells: Well 4 (Leffingwell), Well 5 (Taddy) and Well 10 (Norwalk). All three wells are located in the City of Norwalk over the Central Groundwater Basin. Existing well data is shown in Table 2-2.

2-4 Pressure Regulating Stations

The NMWS includes five (5) pressure regulating stations (PRS). Four PRS have the ability to provide water from the high pressure fire system to either the Central or West Service Area. One PRS provides water from the City of Cerritos to the South Service Area. The details of each PRS are shown in Table 2-3.

2-5 Connections with Neighboring Agencies

The NMWS has 7 connections with neighboring agencies, including the City of Santa Fe Springs and the City of Cerritos. Only one connection (South Service Area) is a pressure regulating station. The other connections consist of meters and isolation valves only. The service pressure provided to the NMWS is dependent on the pressure in the City of Santa Fe Springs or City of Cerritos water system.

The connections are located as follows:

- Northeast Service Area - connection with the City Santa Fe Springs at Pioneer Boulevard and Lakeland Road
- Northwest Service Area - connection with the City Santa Fe Springs at Orr and Day Road and Cecilia Street
- East Service Area - connection with the City Santa Fe Springs at Rosecrans Avenue and Carmenita Road
- Southeast Service Area (Residential) - connection with the City Cerritos at Alondra Boulevard and Wilder Avenue
- Southeast Service Area (Industrial) - connection with the City of Cerritos at Alondra Boulevard and Blackburn Avenue
- South Service Area - connection with the City of Cerritos at 166th Street and Flallon Avenue. There is a 4-inch and a 6-inch pressure regulating valve at this interconnection. The 4-inch valve setting is 65 psi and the 6-inch valve setting is 60 psi.
- Artesia Service Area - connection with the City of Cerritos at Ely Avenue and Carver Lane

Table 2-2
Existing Well Facilities

General Information					Pump Information									Efficiency Test Data							Controls					
Well No.	Facility Name	Location	Date Drilled	Discharge Zone	Curve Date	Manu-facturer	Model	Stages	Size (in)	Design Capacity (gpm)	Design TDH (ft)	Pump Motor RPM	Motor HP	Date	Capacity (gpm)	TDH (ft)	Draw-down	Static Water Level (ft)	Pumping Water Level (ft)	Motor HP	On Setting (psi)	Off Setting (psi)	High Pressure Setpoint (psi)	Low Pressure Setpoint (psi) low flow	Low Pressure Setpoint (psi) high flow	Comments
4	Leffingwell Well	Leffingwell Road and Longworth Avenue	1950	Central	5/16/00	Goulds	11CLC	5	7.75	680	266	1780	75	5/20/13	543	284	74.7	90.2	164.9	57.9	42	65				10,000 gallon hydropneumatic tank
5	Taddy Well	Taddy Street and Gard Avenue	1952	Central	5/16/01	Goulds	11CLC	6	7.75	800	278	1781	75	5/31/13	682	682	93.1	92.8	185.9	74.3	42	65				10,000 gallon hydropneumatic tank
10	Norwalk Park Well	Sproul Street	2010	High Pressure Fire System	8/22/10	Flowserve	15EMM	6	12	2000	603	1775	400	5/20/23	630	446			141	144.8			130	65	60	VFD Operation

Table 2-3
Pressure Regulating Stations

Facility Name	Location	Upstream System	Downstream System	Valve Diameter (in)	Pressure Setting (psi)
San Antonio/ Foster PRS	Adjacent elevated tank; east side of San Antonio Dr	High Pressure Fire System	Central Service Area	2	65
				6	60
Alburtis/ Rosecrans PRS	Rosecrans Ave at Alburtis Ave	High Pressure Fire System	Central Service Area	2	65
				6	60
Taddy/ Sylvanwood PRS	Taddy St at Sylvanwood Ave	High Pressure Fire System	West Service Area	6	30
Well 10 PRS	Norwalk Park adjacent Well 10	High Pressure Fire System	Central Service Area	4	65
				8	60
166th/Flallon PRS	166th Street at Flallon Avenue	City of Cerritos	South Service Area	4	65
				6	60

SECTION 3

SUPPLY AND DEMAND

3-1 Source of Supply

3-1.1 Groundwater

The NMWS has three (3) production wells that extract groundwater from the Central Groundwater Basin. Leffingwell Well (Well 4) has a capacity of 680 gpm. Taddy Well (Well 5) has a capacity of 640 gpm. Both of these wells provide water to the West Service Area. Norwalk Well (Well 10) was completed in 2012 to provide water to the Central Service Area. Its design capacity is 2000 gpm.

The City previously owned 1,773 AF of water rights in Central Basin, and recently acquired an additional 500 AF of water rights. The current total water right of 2,273 AF per year (Allowed Pumping Allocation from Central Groundwater Basin) is sufficient for the City to serve additional areas of its system with groundwater and reduce imported water costs, through future connections of some of the non-contiguous service areas.

The City pumped a total of 498.37 AF in FY 2011-2012 (Ref: *DWR Central Basin Annual Report 2011-2012*) and 905.51 AF in FY 2012-2013 (Ref: *DWR Central Basin Annual Report 2012-2013*). The increase in groundwater pumped is due to the fact that Well 10 became active in May of 2012, and has been supplying the demands of the Central Service Area between 6 am and 10 pm.

3-1.2 Imported Water

The NMWS has one imported water connection with Central Basin Municipal Water District (Turnout No. 16), located at the intersection of Norwalk Boulevard and Imperial Highway. A 16-inch pipeline conveys Metropolitan Water District (MWD) water south in Norwalk Boulevard to San Antonio Drive and then west in Rosecrans Avenue. This pipeline is a part of the high pressure fire system (120 to 130 psi) that serves the Western and Central Service Areas. The imported water use for FY 2011-2012 was 729 AF (Ref: *DWR Central Basin Annual Report 2011-2012*). Due to the implementation of Well 10 in May 2012, the imported water use was reduced to 318 AF (Ref: *DWR Central Basin Annual Report 2012-2013*). The imported water use can be further reduced with system improvements that are discussed in Section 7 and Section 8 of this report.

3-1.3 Connections with Neighboring Agencies

As previously discussed, the NMWS includes 7 connections with neighboring agencies including the City of Santa Fe Springs and the City of Cerritos. The only connection that is metered through a master meter is the South Service Area. For the Northeast, Northwest, Southeast, East, and Artesia Service areas, water use is metered at each customer connection. The City of Norwalk staff reads these meters and provides the water use to the City of Santa Fe Springs and City of Cerritos. The City of Norwalk is billed by the providing agency for the water used. The amount of water provided in 2012 at each connection is shown in Table 3-1.

3-2 Demands

Based on 2012 billing data, the City provides an average of approximately 2,134 acre feet per year (AFY) of water to its residential, commercial, and industrial customers. Table 3-1 summarizes the estimated demands for each of the service areas.

Table 3-1
Service Area Demands

	Service Area	Serviced Water From	Area (Ac)	No. of Services	Minimum Day Demand		Average Day Demand		Maximum Day Demand	
					gpm	AFY	gpm	AFY	gpm	AFY
1	Northeast	City of Santa Fe Springs	41	205	29	47.2	39	62.9	62	100.7
2	Northwest	City of Santa Fe Springs	70	331	50	79.8	66	106.5	106	170.3
3	Central	Well 10 and MWD	359	1,203	350	565.0	467	753.3	747	1205.2
4	West	Well 4 and Well 5	290	1,208	175	281.9	233	375.8	373	601.3
5	South (includes LA County)	City of Cerritos	361	1,638	254	410.1	339	546.8	542	874.9
6	Southeast (Residential)	City of Cerritos	39	235	35	56.9	47	75.8	75	121.3
7	Southeast (Industrial)	City of Cerritos	68	19	26	42.3	35	56.5	56	90.3
8	East	City of Santa Fe Springs	51	232	38	60.5	50	80.7	80	129.0
9	Artesia	City of Cerritos	52	291	35	56.9	47	75.8	75	121.3
		Total	**1,331**	**5,362**	**992**	**1,601**	**1,323**	**2,134**	**2,117**	**3,414**

[1] *Average Day Demand is based upon 2012 water billing data*

[2] *Minimum Day Demand = 0.75 x Average Day Demand. Factor based on 2011 MWD Purchase Data prior to Well No. 10 Implementation.*

[3] *Maximum Day Demand = 1.60 x Average Day Demand. Factor based on 2011 MWD Purchase Data prior to Well No. 10 Implementation.*

SECTION 4

HYDRAULIC MODEL

4-1 Model Development

A hydraulic model of the NMWS was developed in InfoWater (commercial software developed by Innovyze). The summary of the steps taken to develop the model is described in this section.

4-1.1 Data Capture / Geometry

The City's existing water map in AutoCAD format was used as the basis for the geometry of the model (pipes and junctions). The AutoCAD map had to be corrected and converted into a Geographical Information System (GIS) format so that intelligent data could be assigned to each element and then imported into the modeling software.

4-1.2 Facilities

Available as-built construction plans, pump curves, and efficiency tests were utilized to add facilities such as well pumps, hydropneumatic tanks, and pressure regulating valves to the model.

4-1.3 Operational Controls and Settings

Operational controls and settings were obtained from City staff and input into the model. The well controls are shown in Table 2-2. The pressure regulating valve settings are shown in Table 2-3.

4-1.4 Demands and Peaking Factors

Existing water production and purchase records were analyzed to establish the existing system average day demands. Daily flow data for the Central Basin Turnout No. 16 (MWD Connection) was used to develop the minimum and maximum day demand ratios. Data from 2011 was analyzed because it is a time period prior to when Well 10 began operating and therefore includes the total demand of the Central Service Area. The developed demand ratios were applied to all other service areas. Daily demand data was not available for the other service areas.

The maximum day demand ratio is 1.6 and the minimum day demand ratio is 0.75. In other words, maximum day demand is equal to 1.6 times the average day demand. Minimum day demand is equal to 0.75 times the average day demand.

4-1.5 Allocation of Demands

Water billing information for the entire service area was linked to the service area parcels, and then aggregated and assigned to the appropriate modeling nodes. The demands were then adjusted to match the established average, minimum, and maximum day demands for the corresponding analysis scenarios.

4-1.6 Field Data Collection

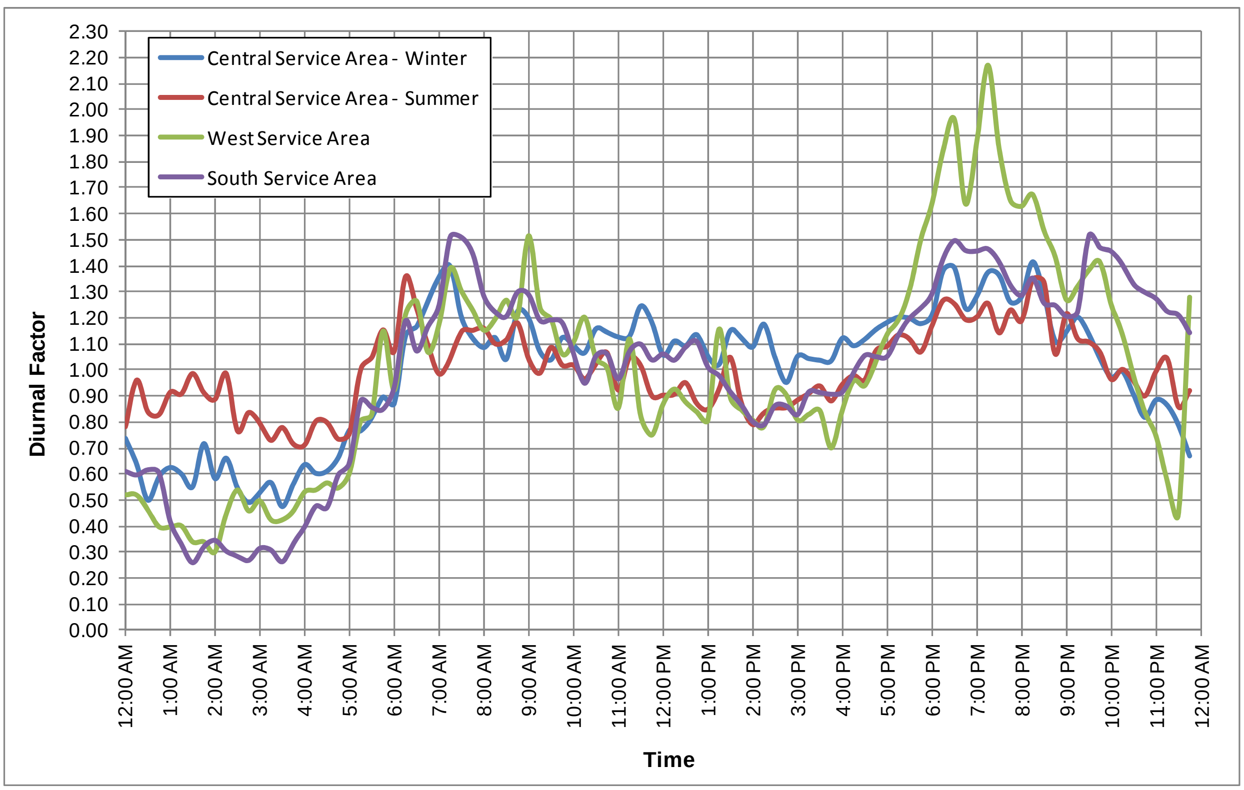
Flow metering equipment was installed from August 29, 2013 to September 16, 2013 at Well 4, Well 5, Well 10 and the pressure regulating station located on 166th Street at Flallon Avenue, serving City of Cerritos water to the South Service Area.

4-1.7 Diurnal Demand Curves

Diurnal demand curves were developed for the Central, West, and South Service Areas based upon the flow meter information collected. These curves represent the pattern of water use during the summer demand period since the flow data was collected in August and September, which are typically the warmest months in Southern California.

A winter diurnal curve was developed for the Central Service Area because the night time demands were found to be lower and this in turn has an effect on the operation of Well 10. The winter curve was based upon MWD flow data prior to the implementation of Well 10 (February 2011 data) so that all of the Central Service Area demands were captured. The developed diurnal demand curves are shown on Figure 4-1.

Figure 4-1
Diurnal Curves



A diurnal demand curve was assigned to each model node depending on its location. Due to the lack of a master meter, flow data was not collected for the Northeast, Northwest, East, Southeast and Artesia Service Areas. The diurnal curve for the South Service Area was applied to these service areas due to the fact that the land uses are similar consisting primarily of single family residential.

4-2 Model Calibration

For the NMWS, model calibration was limited due to the fact that a SCADA system is not in place and several of the service areas (Northeast, Northwest, Southeast, East, and Artesia) are dependent on the pressure in the City of Santa Fe Springs or City of Cerritos water system. The pressure provided by the City of Santa Fe Springs and the City of Cerritos varies from day to day and hour to hour depending upon the conditions within their own system. The diurnal variation in pressure at the interconnections cannot be precisely replicated without modeling the other agencies' entire system. Therefore, for calibration purposes, pressure data loggers were placed just downstream of each of the connections. The average pressure recorded was then input into the model as a constant pressure at each point of connection.

The pressure provided to the South Service Area from the City of Cerritos is controlled by the pressure regulating station on 166th Street at Flallon Avenue. The existing valve settings were input into the model. These valve settings were verified by pressure data loggers.

At the time of this study, the high pressure system was experiencing surges during the night time hours when Well 10 was shut off and the MWD connection was open. Pressure data loggers showed the surges with pressure ranging from 70 psi to 135 psi. Due to software limitations, the surges could not be replicated in the model and therefore the high pressure system was not calibrated. (See Technical Memorandum dated 2/7/14 for more information on the surges in the high pressure system and recommendations for eliminating the problem).

4-2.1 Pressure Data

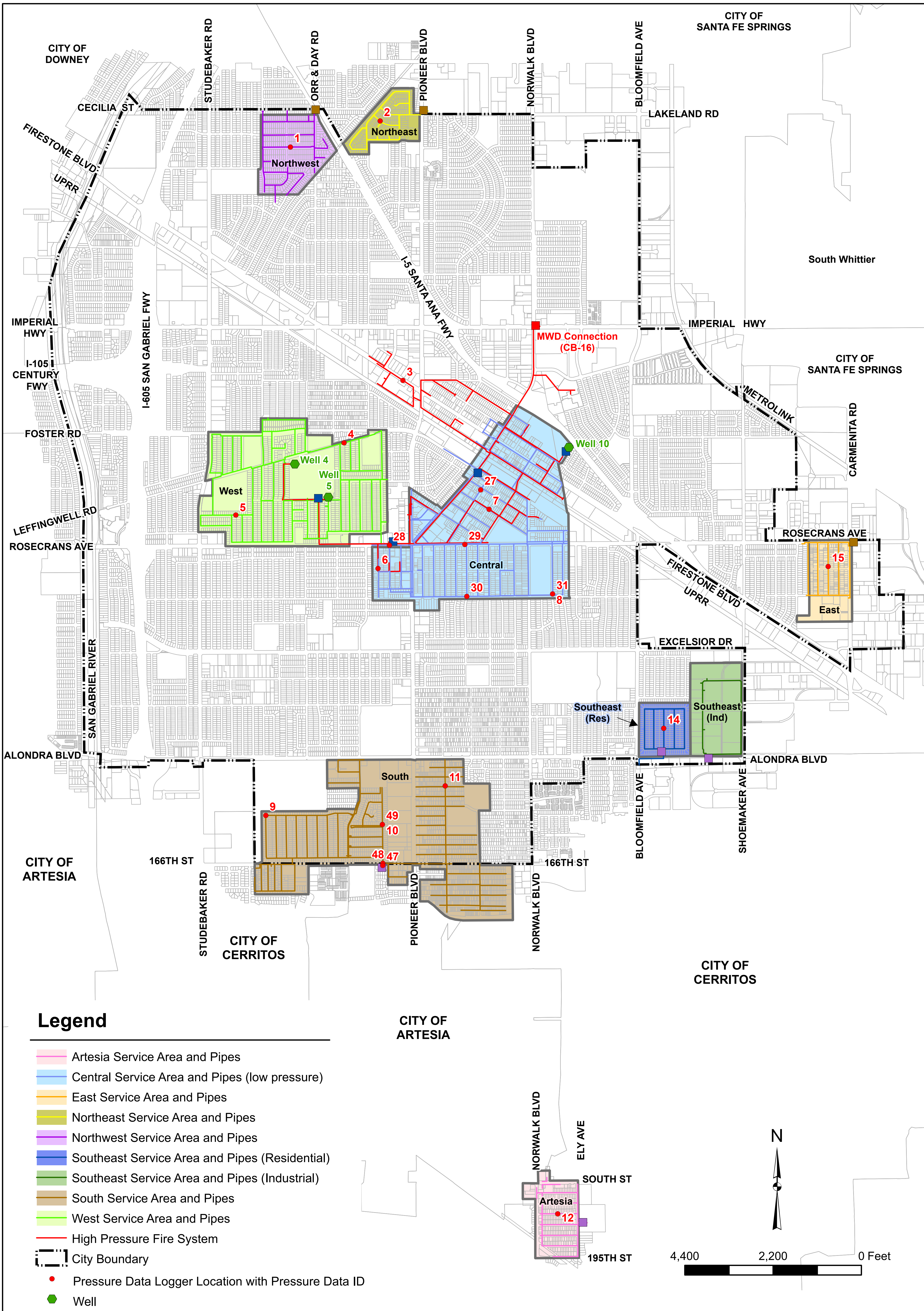
Pressure data loggers were installed at 15 locations throughout the entire service area as shown on Figure 4-2. Some of the data loggers were placed on the high pressure fire system as well. Pressure data was collected at 5 minute intervals from August 29, 2013 to September 16, 2013 and November 7, 2013 to November 9, 2013.

4-2.2 Hydrant Flow Testing

Hydrant flow tests were conducted at nine (9) locations throughout the entire service area at locations shown on Figure 4-3. These tests were conducted in the early morning hours (12 am to 5 am) so as to minimize the disruption to local residents and to keep the complaints to a minimum, since it is known that flushing in certain areas of the water system can cause water quality issues for some customers.

4-2.3 Pipe Roughness Coefficients

Initially, the model was run under the same overall demand conditions, and the results were compared to field measured pressures and hydrant flow test information. Operational settings and pipe roughness coefficients were then adjusted to closely match the field conditions. Roughness coefficients were developed separately for each service area based on pipe diameter and collected pressure data. The developed pipe roughness coefficients implemented in the hydraulic model are shown in Table 4-1.



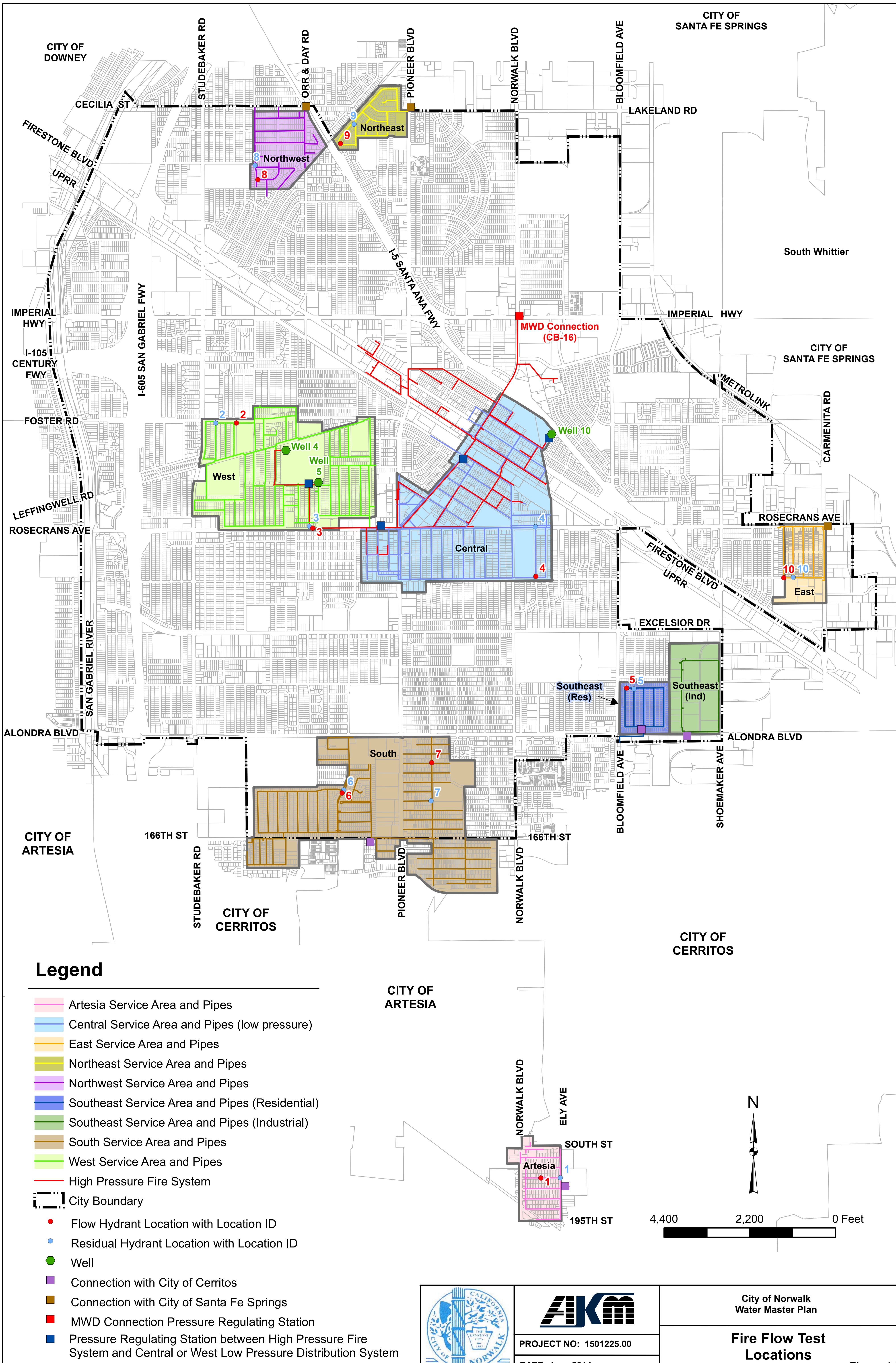
PROJECT NO: 1501225.00

DATE: June 2014

City of Norwalk
Water Master Plan

Pressure Data Logger Locations

Figure 4-2



CITY OF DOWNEY
CITY OF SANTA FE SPRINGS
CECILIA ST
FIRESTONE BLVD
UPRR
STUDEBAKER RD
ORR & DAY RD
PIONEER BLVD
NORWALK BLVD
BLOOMFIELD AVE
LAKELAND RD
Northeast
Northwest
South Whittier
I-5 SANTA ANA FWY
IMPERIAL HWY
I-105 CENTURY FWY
I-605 SAN GABRIEL FWY
MWD Connection (CB-16)
CITY OF SANTA FE SPRINGS
METROLINK
CARMENITA RD
FOSTER RD
Well 10
Well 4
Well 5
West
Central
LEFFINGWELL RD
ROSECRANS AVE
ROSECRANS AVE
FIRESTONE BLVD
UPRR
East
EXCELSIOR DR
SAN GABRIEL RIVER
Southeast (Res)
Southeast (Ind)
ALONDRA BLVD
ALONDRA BLVD
South
BLOOMFIELD AVE
SHOEMAKER AVE
CITY OF ARTESIA
166TH ST
166TH ST
STUDEBAKER RD
PIONEER BLVD
NORWALK BLVD
CITY OF CERRITOS
CITY OF CERRITOS
CITY OF ARTESIA
NORWALK BLVD
ELY AVE
SOUTH ST
Artesia
195TH ST
N
4,400 2,200 0 Feet
Legend
Artesia Service Area and Pipes
Central Service Area and Pipes (low pressure)
East Service Area and Pipes
Northeast Service Area and Pipes
Northwest Service Area and Pipes
Southeast Service Area and Pipes (Residential)
Southeast Service Area and Pipes (Industrial)
South Service Area and Pipes
West Service Area and Pipes
High Pressure Fire System
City Boundary
Flow Hydrant Location with Location ID
Residual Hydrant Location with Location ID
Well
Connection with City of Cerritos
Connection with City of Santa Fe Springs
MWD Connection Pressure Regulating Station
Pressure Regulating Station between High Pressure Fire System and Central or West Low Pressure Distribution System
PROJECT NO: 1501225.00
DATE: June 2014
City of Norwalk Water Master Plan
Fire Flow Test Locations
Figure 4-3

Table 4-1
Pipe Roughness Coefficients

Diameter (in)	Pipe Roughness Coefficients							
	High Pressure	Central	West	Artesia	Southeast	East	Northeast	Northwest
2	-	90	90	90	110	100	90	90
3	-	90	90	-	-	-	-	-
4	-	100	100	-	-	-	-	-
6	-	100	100	100	120	100	100	100
8	-	110	110	110	130	100	110	110
12	120	120	120	120	130	120	120	120
16	130	120	120	-	-	-	-	-
20	140	140	140	-	-	-	-	-
24	140	140	140	-	-	-	-	-

4-2.4 Field Data Versus Model Data

Pressure Data

A summary of the resulting pressure data versus model data is shown in Table 4-2. In general, the pressures calculated by the model are comparable to the pressures measured in the field. The difference in average pressure ranged from zero to 6.5 psi. Typically, the hydraulic model will result in slightly higher pressures than the field measured pressures due to the following:

- The pressure data loggers are installed on fire hydrants which are typically about 2 to 3 feet above the street surface. The model pipe and junction elevations are based on contour information which represents street elevation.

- The model only includes the main lines of the system. The fire hydrant lateral is not included. In the field, additional headloss will be experienced through the hydrant lateral during the hydrant flow tests.

There were three (3) locations in the South Service Area that resulted in average pressure differences of about 6 to 6.5 psi. The pressures in this service area are highly dependent on the setting of the pressure reducing valves located at the 166th Street/Flallon Avenue pressure regulating station. It is recommended that the City periodically check the pressure gauges at the PRS to verify the pressure settings.

For the Northwest, Northeast, East, Southeast, and Artesia Service Areas, the pressure at the point of connection can vary depending on the pressures in the City of Santa Fe Springs or the City of Cerritos water system. It was beyond the scope of work of this project to study and model the providing agency's water system. Therefore, a pressure reducing valve was modeled to represent the connection between the adjacent agency and the NMWS. This provided a constant pressure at the point of connection, which is reflected in Table 4-2.

Fire Hydrant Flow Tests

A summary of the fire hydrant flow test results and model results are shown in Table 4-3. The pressure drop between the static pressure and the residual pressure at the residual hydrant is used for comparison purposes. The pressure drop in the field is typically larger than the drop predicted by the model for the same reasons listed above in the pressure data comparison discussion. The difference in pressure drop between the field data and the model data was 6 psi or less at most of the test locations, which is considered a good match. Larger discrepancies were found at the test locations in the Northwest Service Area and the East Service Area. The pressure drop in the field at the residual hydrant was 30 psi in the Northwest Service Area and 20 psi in the East Service Area. The model predicted pressure drops of 15 psi and 3 psi, respectively. It is recommended that the City investigate the possibility of closed valves or partially closed valves in the system near these test locations.

Table 4-2
Comparison of Pressure Data Logger Results and Model Results

Pressure Data ID	Service Area	Location	Mainline Diameter (in)	Dates	Model ID	Data Logger Pressures			Model Pressures			Difference in Ave Press (psi)	Comments
						Min Press (psi)	Ave Press (psi)	Max Press (psi)	Min Press (psi)	Ave Press (psi)	Max Press (psi)		
1	Northwest	Cresson St east of Longworth Ave, 11303 Cresson	6	8/29/13 - 9/16/13	NW-23165	66	68	70.5	71	71	71	3.0	Service Pressure from Santa Fe Springs set at 68 psi
2	Northeast	Hermes St west of Jerdet Ave, 11616 Hermes	6	8/29/13 - 9/16/13	NE-23015	63	72	85	72	72	72	0.0	Service Pressure from Santa Fe Springs set at 72 psi
4	West	Leffingwell Rd east of Gard Ave, 1150 Leffingwell	6	8/29/13 - 9/16/13	CE-20865	37	47	55	40	51.5	63	4.5	Well 4 and Well 5 Pressure Controls set at 42 psi (on) and 65 psi (off)
5	West	Crestbrook St east of Crossdale, 11113 Crestbrook	6	8/29/13 - 9/16/13	CE-20595	40	58	70	42	53.5	65	4.5	
3	High Pressure	Firestone Blvd east od Pioneer Blvd, 12854 Pioneer	12	8/29/13 - 9/16/13	HP-22240	80	110	140	-	-	-	-	MWD PRVs set at 110 and 120 psi. Surging occurred in high pressure system, which could not be replicated in the model and therefore a comparison was not made.
6	High Pressure	Flallon Ave north of Lindale St, 14361 Flallon	8	8/29/13 - 9/16/13	HP-20955	80	110	140	-	-	-	-	
7	High Pressure	Walnut St southeast of Elaine Ave, 12003 Walnut	4	8/29/13 - 9/16/13	HP-22764	80	107.5	135	-	-	-	-	
8	Central	Disney Ave north of Mapledale St, 14538 Disney	8	8/29/13 - 9/16/13	CE-30990	46	50	57.5	53.5	54.5	55.5	4.5	San Antonio/Foster & Albertis/Rosecrans PRVs set at 50 and 55 psi
27	Central	Pine St and Clarkdale Ave	10	11/7/13 - 11/9/13	CE-21475	52	56	64	55	56	57	0.0	San Antonio/Foster & Albertis/Rosecrans PRVs set at 55 and 60 psi
28	Central	Alburtis St and Rosecrans Ave	6	11/7/13 - 11/9/13	CE-10355	51	59	62	57.5	58.5	59.5	0.5	
29	Central	Elaine Ave and Rosecrans Ave	8	11/7/13 - 11/9/13	CE-21390	51	58	62	56.5	57.5	58.5	0.5	
30	Central	Elaine Ave and Mapledale St	6	11/7/13 - 11/9/13	CE-21410	51	59	62	58	59	60	0.0	
31	Central	Disney Ave north of Mapledale St, 14538 Disney	4	11/7/13 - 11/9/13	CE-30990	50	60	63	58.5	59.5	60.5	0.5	
9	South	Elmhurst Dr and Alora Ave, 11203 Elmhurst	6	8/29/13 - 9/16/13	SO-23470	38	43	49	46	49	52	6.0	166th/Flallon PRVs set at 50 psi and 55 psi
10	South	Flallon Ave north Chesterton, 16326 Flallon	6	8/29/13 - 9/16/13	SO-23995	43	48	55	48	51	53.5	3.0	
11	South	Algardi St and Clark Dale Ave, 12331 Meadow	6	8/29/13 - 9/16/13	SO-24100	41	49	55	43	48	52.5	1.0	
47	South	166th St and Flallon Ave (vault)	6	11/7/13 - 11/9/13	SO-13522	59	60	62	51.5	53.5	55.5	6.5	166th/Flallon PRVs set at 55 and 60 psi
48	South	166th St and Flallon Ave	6	11/7/13 - 11/9/13	SO-13520	57	58.5	61	50	52	55	6.5	
49	South	Flallon Ave and Chesterton	6	11/7/13 - 11/9/13	SO-23995	54	57	60	52.5	55.5	58.5	1.5	
12	Artesia	Meadow St west of Ely Ave, 12331 Meadow	6	8/29/13 - 9/16/13	AR-20135	47	52	56	55	55	55	3.0	Service Pressure from Cerritos set at 55 psi
13	Southeast	Blackburn Ave north of Alondra Blvd, 15421 Blackburn	12	8/29/13 - 9/16/13	SE-23360	65	73	78	74	74	74	1.0	Service Pressure from Cerritos set to 75 psi
14	Southeast	Wilder Ave north of Oland St, 15527 Wilder	6	8/29/13 - 9/16/13	SE-23295	63	72	78	75	75	75	3.0	
15	East	Claressa Ave north of Vieudelou Ave, across from 14360 Claressa	6	8/29/13 - 9/16/13	EA-11485	62	75	83	76	76	76	1.0	
											Average	**2.5**	

Table 4-3
Comparison of Fire Hydrant Flow Test Results and Model Results

					Flow Hydrant Data					Residual Hydrant Data					Residual Hydrant Model Data					
Location ID	Service Area	Location	Date	Time	Model ID	Elev at Model ID (ft)	Static Pressure (psi)	Piot Tube Pressure (psi)	Hydrant Flow (gpm)	Model ID	Elev at Model ID (ft)	Static Pressure (psi)	Piot Tube Pressure (psi)	Test Pressure Drop (psi)	Model ID	Static Pressure (psi)	Residual Pressure (psi)	Model Pressure Drop (psi)	Pressure Drop Difference (psi)	Comment
1	Artesia	12215 Cambrian Ct	10/10/13	10:45 PM	AR-20135	46	55	28	796	AR-20260	47	55	50	5	AR-20260	55	52	3	2	
2	West	13400 Dalwood Ave	10/11/13	12:45 AM	WE-13985	93	54	25	760	CE-20560	93	54	38	16	CE-20560	51	32	19	3	
3	HP	11445 Rosecrans Ave	10/10/13	-	HP-24415	87	90-150	72	1272	HP-22101	87	-	-	-	HP-22101	-	-	-	-	Surging occurred at the time of the test. Results are unreliable.
4	Central	14538 Disney Ave	10/10/13	1:15 AM	CE-30990	87	57.5	12	535	CE-30980	92	55	48	7	CE-30980	57	53	4	3	
5	Southeast	12600-12638 Cheshire St	10/10/13	11:15 PM	SE-23240	74	77	40	961	SE-31425	75	76	62	14	SE-31425	74	64	10	4	
6	South	16327 Maidstone Ave	10/10/13	12:15 AM	SO-23880	69	54	26	760	SO-23905	69	54	36	18	SO-23905	57	37	20	2	
7	South	11815 Algardi St	10/10/13	-	SO-24100	71	-	-	-	SO-31855	67	-	-	-	SO-31855	-	-	-	-	This location was not tested per City's recommendation.
8	Northwest	11202 Pantheon St	10/10/13	2:15 AM	NW-31290	111	77.5	26	760	NW-31255	111	76	46	30	NW-31255	73	58	15	15	Possible closed or partially closed valves in area.
9	Northeast	11158 Maidstone Ave	10/10/13	2:45 AM	NE-22990	118	74	36	899	NE-31140	122	74	56	18	NE-31140	71	59	12	6	
10	East	14526 Cabrillo Ave	10/10/13	11:00 PM	EA-11445	81	84	44	1020	EA-20380	82	84	64	20	EA-20380	76	73	3	17	Possible closed or partially closed valves in area.

SECTION 5

PERFORMANCE CRITERIA

5-1 General

Performance criteria are established to evaluate the adequacy of various water system components through a systematic analysis. Necessary improvements are identified and recommended for inclusion in a WSIP. Most minimum criteria are established by Chapter 16 of Title 22 of California Code of Regulations. Some criteria that are above the minimum that are required by Title 22 are based upon special conditions of the system and 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. This section details the criteria which will serve as a benchmark for evaluating the City's water system.

5-2 Source Capacity

The Title 22 requirement for source of supply for a system is one maximum day demand.

5-3 System Pressures

While the Title 22 minimum required pressure is 20 pounds per square inch (psi) for existing systems and 40 psi for new systems, most water utilities set 50 psi as the minimum static pressure throughout the system. The water system should also be capable of maintaining a minimum residual pressure of 40 psi during the peak hour demand period. This is the criterion recommended for the City of Norwalk's system.

Static pressures should not exceed 120 psi, except where system operating conditions and geographical conditions warrant a higher maximum pressure. In areas where pressures exceed 80 psi, the Uniform Plumbing Code requires customers to install "an approved type pressure regulator preceded by an adequate strainer" on their service connections to protect domestic plumbing and water heaters.

5-4 Transmission and Distribution Pipelines

The distribution system should be sized and designed to provide redundant service at adequate pressures for normal use, as well as at fire flow and emergency conditions. In most cases, this can be accomplished by looping the system. Looping through easements or other areas which are not easily accessible should be avoided if possible. Provisions should be made for supplying each service zone or area from at least two sources where practical.

In order to maintain adequate system pressures and prolong the life of the pipe, flow velocities should be limited. The system should operate at velocities of 1 to 3 feet per second (fps) normally, with a maximum velocity of 5 fps at Average Day Demand flows. The pipe velocity should not exceed 7 fps at Maximum Day Demand flows, and 10 fps at Maximum Day Demand plus Fire flows.

The pressure in the system at any given point for a particular flow is dependent on a number of variables including pipe size, roughness and length. These components all contribute to the magnitude of pressure losses in the system. The system should be also designed and operated to maintain system losses less than 3 feet for each 1000 feet of pipe length for transmission pipelines; and 10 feet for each 1000 feet of pipe length for distribution pipelines under Maximum Day Demand conditions.

All pipes should be sized to provide adequate fire flows. To achieve this, when a single, un-looped pipe provides fire service to an area, a minimum diameter of 8-inch should be maintained to the last hydrant. These pipe size recommendations should be adhered to for all new design and construction projects, as well as any waterline replacement/upgrade projects.

5-5 Fire Suppression

The required fire flows are based upon the latest version of Los Angeles County Fire Department's Regulation 8, Fire Flow and Hydrant Requirements (dated December 15, 2004). The fire flow demands utilized for analysis are as shown in Table 5-1.

Table 5-1
Fire Flow Requirements

Landuse	Fireflow (gpm)	Duration (hrs)	Residual Pressure at Hydrant Outlet (psi)	Hydrant Spacing (ft)
Single Family Residential	1,250	2	20	600
Multi-Family Residential	3,000	3	20	300
Commercial	3,000	3	20	300
Schools	3,000	3	20	300
Industrial	4,000	4	20	300

Generally, for single family dwellings with a building square footage less than 5,000 square feet and on a lot less than one acre, Regulation 8 requires a fire flow of 1,250 gpm for 2 hours. The fire flow requirement for multiple family dwellings and other uses are dependent on the building square footage. The established criterion for the NMWS is 3,000 gpm for 3 hours for multi-family residential, commercial uses, and schools. This covers buildings up to 20,000 square feet. The established criterion for industrial uses is 4,000 gpm for 4 hours. This covers buildings up to 30,000 square feet.

A residual pressure of 20 psi must be maintained at the hydrant outlets in developed areas during fire flow. The model does not include laterals from the mainline to the hydrants. The minimum head loss through a lateral and hydrant at 1,000 to 1,500 gpm is estimated to be 6 psi. The system evaluation is therefore based on providing 26 psi at the nearest mainline junction in the model. The analysis revealed deficiencies in the system where the required residual pressure could not be met (residual pressure <26 psi).

SECTION 6

EXISTING SYSTEM ANALYSIS

6-1 General

The developed hydraulic model and the criteria described in Section 5 were utilized to analyze the NMWS.

6-2 Source Capacity

The City is able to meet the source capacity criteria of one maximum day demand (2,117 gpm) with its three (3) wells, seven (7) connections with other purveyors, and one (1) imported water connection. In the future, the City plans to utilize its existing wells and groundwater rights to provide a greater portion of the water served with groundwater instead of imported or purchased water.

6-3 Existing System Analysis Scenarios

The existing system's operation was analyzed utilizing the hydraulic model for the following conditions:

1. Existing Average Day (EXISTING_ADD) - This scenario models the existing facilities and operational controls under the existing average day demand conditions.

2. Existing Maximum Day (EXISTING_MDD) - This scenario models the existing facilities and operational controls under the existing maximum day demand conditions. This scenario was also utilized to run the fire flow analysis.

6-4 System Pressure Analysis

The existing system analyses showed that it met the minimum pressure criteria of 40 psi under all demand conditions. Pressures do not exceed the maximum pressure criteria of 80 psi in the water system. High pressures (greater than 80 psi) are only experienced in the High Pressure Fire Pipeline System. The range of pressures for each service area is shown in Table 2-1.

6-5 System Velocity Analysis

Generally, the existing system met the maximum velocity criteria under average day demand (ADD) and maximum day demand (MDD) conditions. The only locations identified with velocities exceeding 7 feet per second under peak hour conditions (during the maximum day) were at various pressure regulating stations as shown in Table 6-1.

Table 6-1
High Velocity Locations (MDD, Peak Hour)

Pipe ID	Dia (in)	Flow (gpm)	Vel (ft/s)	Location
HP-10718	2	280	29	2" line leading into 2" valve at Foster/San Antonio PRS
HP-10721	2	280	29	2" line leading into 2" valve at Foster/San Antonio PRS
CE-44444	6	788	9	6" line leaving the 6" valve at Foster/San Antonio PRS
CEPIPE3	2	223	23	2" line leaving the 2" valve at Rosecrans/Albertis PRS
CEPIPE4	2	223	23	2" line leaving the 2" valve at Rosecrans/Albertis PRS
SOPIPE2	4	714	18	4" line leading the 4" valve at 166th/Flallon PRS
SOPIPE4	4	714	18	4" line leading the 4" valve at 166th/Flallon PRS
SOPIPE6	6	718	8	6" line leaving the 6" valve at 166th/Flallon PRS

The 2-inch valves and associated piping are recommended for upsizing when these pressure regulating stations are upgraded. The valves and pipes at the 166th/Flallon PRS are not recommended for upgrades because it will become an emergency backup connection to the South Service Area in the future (See Section 7-2.2 for further details).

6-6 Fire Flow Analysis

The fire flow analysis was performed utilizing the average demand period that occurs during the summer scenario (maximum day plus fire flow). Fire flow demands, as listed in Table 5-1, were applied at all nodes located at the intersection of the main line and a fire hydrant lateral. If the fire node was located near multiple land use types, the highest fire flow requirement was utilized.

Initially, the computer hydraulic model simulation supplies the entire fire flow from one fire hydrant. This resulted in low residual pressures at multiple locations. In reality, firefighting often takes place by using multiple fire hydrants. Therefore, the areas identified with low residual pressures were reanalyzed using a feature in the hydraulic model software called “simultaneous fire flow” analysis. The required fire flows were split between multiple hydrants (typically 2 or 3) and the analysis was rerun to determine the residual pressures. Often times, the system was then able to meet fire flow requirements at proper pressures.

There were areas within the system that continued to show low residual pressures even when the simultaneous fire flow analysis function was utilized. These low pressures were typically a result of small pipe sizes (4-inch and 6-inch) and/or end points in the system such as cul-de-sacs. In most cases, the system is well looped, but the pipe sizes are too small for the required fire flows. Improvement recommendations for additional or upsized pipes were formulated to address the remaining fire flow deficiencies. The fire flow pipeline replacement recommendations are shown on Figure 8-1. Associated costs are shown in Table 8-1.

6-7 High Pressure Fire Pipeline System Surge Analysis

Night Time Surges

Surges and large pressure variations are currently experienced in the High Pressure Fire Pipeline System during the night time period between 10:00 am and 6:00 am when water is served from the MWD connection. In order to identify the causes of surges, pressure data loggers were installed and pressures were recorded at the MWD connection vault from November 8, 2013 through November 17, 2013 as shown on Figure 6-1. The recordings verified the surges in the High Pressure Fire Pipeline System during the night time hours when Well 10 is supposed to be off and water is served only from the MWD connection. The recorded pressures ranged from as low as 72 psi to as high as 141 psi. The surges are not experienced during the day time hours (6:00 am to 10:00 pm) when Well 10 is operating. During this period, pressures are maintained at about 125 to 130 psi.

The need for a flow restrictor in the pilot system that allows the pressure reducing valves to close gradually was identified through a field investigation of the pressure reducing valves at the MWD connection. Following the installation of a flow restrictor in the 6-inch valve pilot system and an adjustment of the valve settings (6-inch at 120 psi and 12-inch at 110 psi), pressures were recorded again as shown on Figure 6-2. Pressure fluctuations were recorded from 10:00 pm (when Well 10 shuts down) until about 2:00 am. From 2:00 am to 6:00 am, the pressures are stabilized at about 100 psi. This pressure of 100 psi is currently unexplainable because the setting of the 6-inch valve was 120 psi and the system should have been maintaining about 120 psi. The hydrant where the pressure data logger was installed is about 14 feet higher in elevation, which corresponds to 6 psi. Therefore, the recorded pressure should have been a minimum of about 114 psi. The hydrant is only about 100 yards away from the MWD connection vault and there are no valves in between. Therefore, a large amount of head loss is not expected with the very low flows during this period.

Figure 6-1
Downstream Pressure at MWD Connection

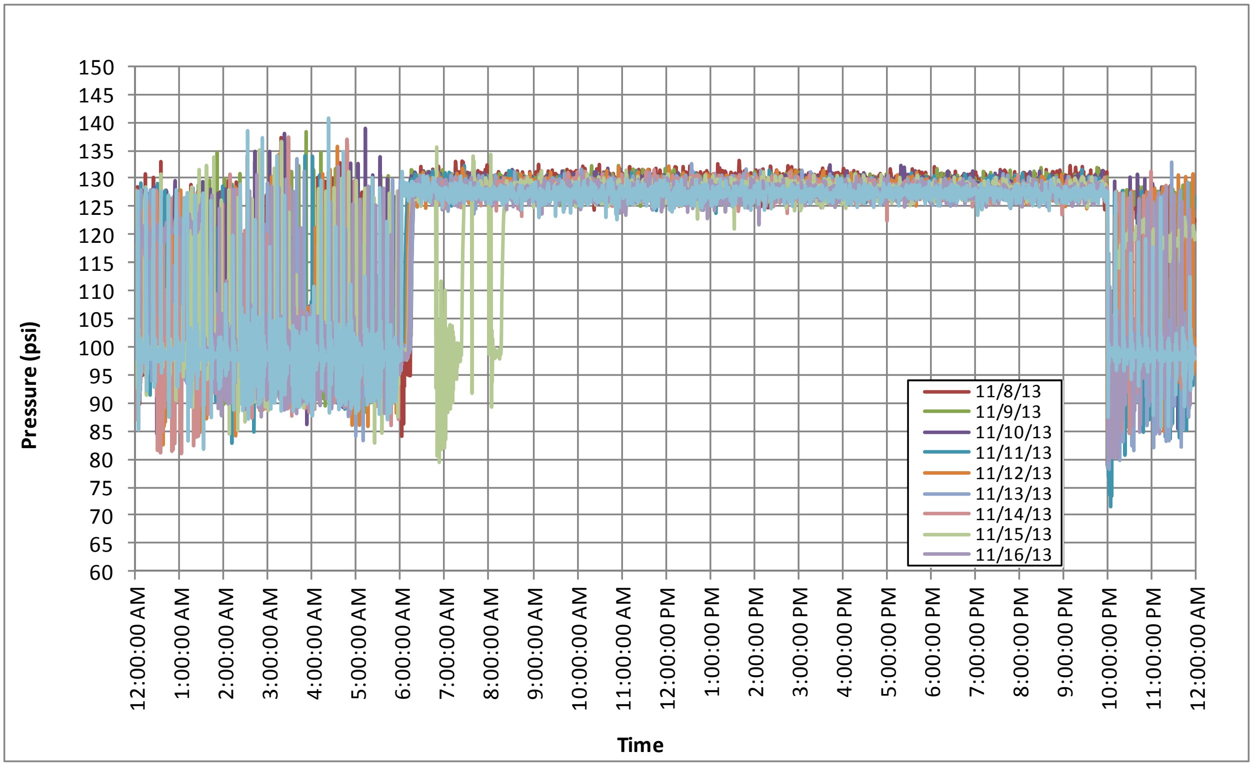
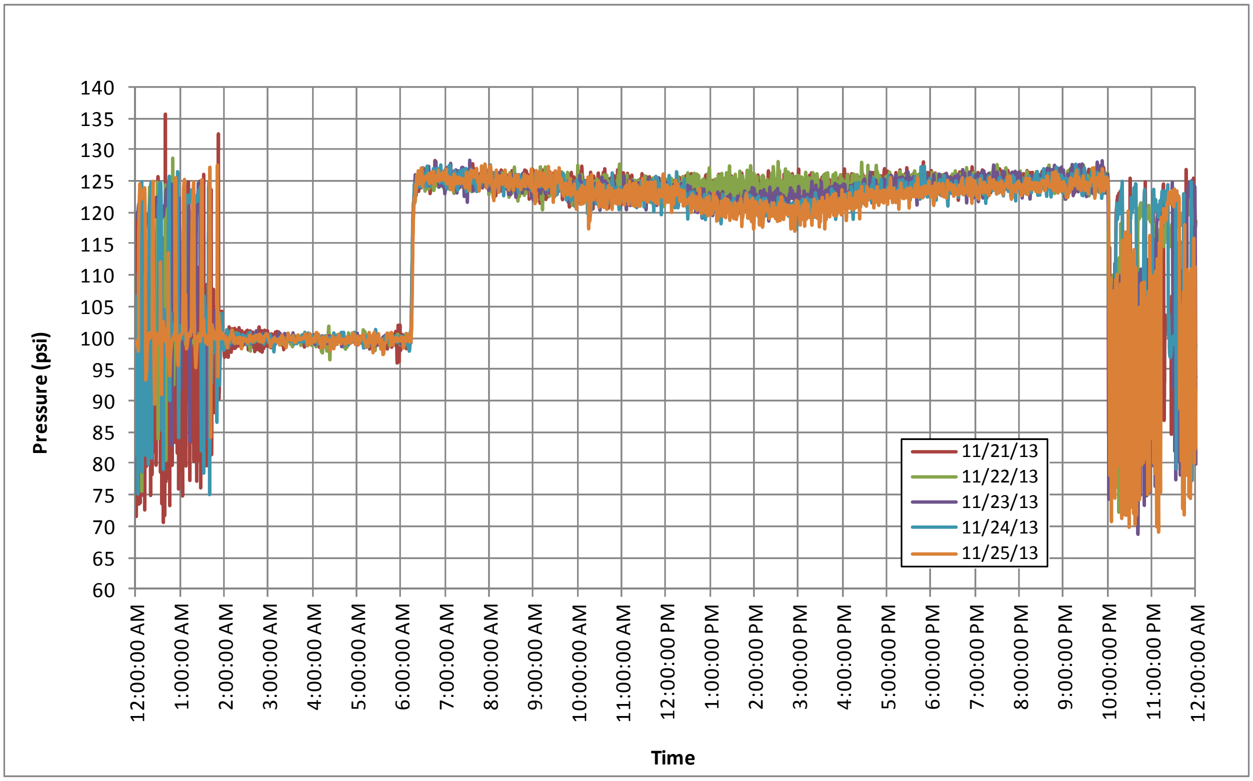


Figure 6-2
High Pressure System Fire Hydrant adjacent MWD Connection Vault



After analyzing the pressure data shown on Figure 6-2, it was concluded that the pressure fluctuations most likely have to do with the transitioning of water source from Well 10 to the MWD connection. The City had previously suspected that the surges had to do with the fact that the MWD connection valves and Well 10 were "fighting" each other. Well 10 is set to start up at a low pressure of 90 psi. It is possible that the well does start at low pressures resulting from surges, supplying unnecessary water into the system, increasing the pressures, and causing the continuation of surges.

A third pressure reducing valve (4-inch) is recommended to be installed in the imported water pressure reducing valve vault parallel to the two existing valves **(See Table 8-1, Project 1a**). The 4-inch valve is better sized to handle the low flow conditions (existing minimum demand of the Central Service Area is about 100 gpm) and should be the first to open when transitioning from Well 10 to imported water supply. This, along with the recommended modifications to the Well 10 operation will help minimize the surging that occurs during the transition from Well 10 to the imported water supply.

<u>Inadvertent Well 10 Shutoff</u>

In addition to the night time surges in the High Pressure Fire Pipeline System, Well 10 shuts off upon the opening and closing of a fire hydrant in and around the Well 10 site. The well has a high pressure shutoff setting of 150 psi, which triggers the well to shut off in order to protect the system pipes. City staff has previously been alerted to the fact that the well has shut off due to a hydrant closing, requiring them to go to the well site to manually start it up again, since the City does not have a supervisory control and data acquisition (SCADA) system to handle such an occurrence automatically. This situation has occurred a number of times during routine maintenance of the system and when construction contractors and street sweepers open and close hydrants to use water.

Field testing of Well 10 was conducted on November 7, 2013 by AKM Consulting Engineers and City operations staff to develop additional information on the cause of the well shutdown. A fire hydrant was opened and closed in an attempt to simulate the unintended shut down of the well. The hydrant used for testing is located downstream of the pressure regulating station that is supposed to reduce pressure from Well 10 to the Central Service Area low pressure system. Currently, there is a closed valve separating this hydrant from the low pressure system. The flow through the pressure regulating station is recorded and can be viewed on the Well 10 control screen. For testing purposes, the flow through the pressure regulating station was the flow being released at the hydrant.

Based on the field tests (further details can be found in the Technical Memorandum dated 2/7/14), it was concluded that valve modifications and control adjustments are needed at Well 10 to eliminate possibility of surging and inadvertent shutoff in the future. The following recommendations are made **(Project 1b):**

1. Calibrate all pressure gauges and switches

2. Adjust the high pressure shut down setting to 155 psi or more, with a time delay of 10 seconds. This may be further adjusted based upon field testing.

3. Reduce the dead band to 2 psi and reduce the frequency (speed) adjustment time so that the VFD provides the desired settings faster.

4. Adjust the Cla-Val surge anticipator valve settings to 155 psi and 70 psi

5. Train the water department staff, fire department staff, contract Street Sweeping Companies, and contractors who use hydrants to fill tanks to close the hydrants slowly, in approximately 2 minutes, particularly the second half of the turns. This process should be refined through field testing after all other recommended changes have been implemented.

6. Modify the Cla Val hydraulic check valve to operate as a deep well pump control valve on pump start and shut down. It should start to open as the discharge to waste valve is closing on pump start-up, and start to close as the discharge to waste valve starts to open on pump shut down

7. Test the system again, and refine the settings to verify that the revisions eliminate the pump shutdown on closing of a hydrant.

8. Adjust Surge Anticipator Valve Setting

   A surge analysis cannot accurately determine the setting for the surge anticipator valve. The surge anticipator valve should be set to open on power failure. It is the valve closure time that determines subsequent pressure surges in the system, which in this case is controlled by a needle valve and not a timer. Field testing will have to be conducted to adjust and determine the settings of the surge anticipator valve.

6-8 Water Quality Analysis

The City has recently received colored water complaints from customers within the Central Service Area. The City retained Hazen and Sawyer Environmental Engineers and Scientists (Hazen and Sawyer) to conduct an analysis of the sources of colored water and provide options for alleviating customer concerns. Field and laboratory sampling was conducted to investigate the source of colored water. Site sampling at Well 10 and in the Central Service Area distribution system was conducted with a time series approach to evaluate water movement through the system. Sequestering chemicals were tested to determine their effectiveness in minimizing the color in the water from Well 10. Taste and odor analyses of customer complaint samples were conducted to characterize the taste and odors in the distribution system.

Based on the results of the sampling, Hazen and Sawyer reached the following conclusions:

- The Well 10 water quality was well below the secondary maximum contaminant level (MCL) for iron and manganese.
- High iron and manganese concentrations in the low pressure system are likely caused by release of buildup from the pipes in the low pressure system rather than the water sources or the high pressure system piping.
- Iron and manganese is coming from the distribution system pipes and possibly from customer plumbing.

The following recommendations were made by Hazen and Sawyer:

- Include pipe replacements in the areas near Foster Road and Pine Street as a priority.
- Review pipe age and condition along with the study results to assess the order of pipe replacements.
- Add a blend of orthophosphate and polyphosphate to the water at Well 10 and at the MWD turnout. This will cause sequestration of iron and manganese in the well water and minimize release of iron and manganese buildup on pipes by laying down a protective scale. **(See Table 8-1, Project 1c)**
- Implement a test plan to provide a gradual increase of the sequestrant dose into the system.

SECTION 7

FUTURE SYSTEM ANALYSIS

7-1 Reducing Reliance on Imported Water

The City previously owned 1,773 AF of water rights in Central Basin, and recently acquired an additional 500 AF of water rights. The current total water right of 2,273 AF (Allowed Pumping Allocation from Central Groundwater Basin) is sufficient for City to serve additional areas of its system with groundwater and reduce imported water costs, through future connections of most of the non-contiguous areas.

Imported water costs have been on the rise in recent years, and significantly exceed the cost of serving groundwater. The following is a comparison of imported water costs obtained from three agencies:

- The City currently pays about $1,171/AF in consumption charges for imported water received from Metropolitan Water District (MWD) through the Central Basin Municipal Water District (Tier 2). The consumption rate will increase to $1,194/AF in January 2015.

  This cost does not include the MWD capacity charge of $572/month ($4900/cfs/year x 1.4 cfs meter capacity) or the Central Basin meter service charge of $690/month ($69/cfs x 10 cfs meter capacity). The MWD capacity charge will increase to $653/month ($5600/cfs/year x 1.4 cfs) in January 2015.

- The City pays $967/AF for water received from the City of Cerritos.

- The City pays $1700/AF for water received from the City of Santa Fe Springs.

In comparison, the cost to pump water from the Central Groundwater Basin is approximately $419/AF, including a Replenishment Assessment of $268/AF and an estimated pumping cost of $151/AF (based on October 2013 production and electricity bill). A significant savings to the City can be realized by maximizing groundwater pumping. Therefore, it is a high priority for the City to implement capital improvement projects that will reduce imported water use in most parts of the service area. The City ultimately desires to be completely off of MWD water in the Central Service Area, except for in the event of a fire, and reduce the use of water purchased from adjacent agencies.

7-2 Future Water System Scenarios

7-2.1 Scenario 1: Connection of Central and South Service Areas

In order to accomplish the City's goals of eliminating surges in the high pressure system, eliminating the use of MWD water, and reducing the use of Cerritos water, Well 10 needs to be capable of pumping 24-hours a day.

As stated in Section 6-6, the surges in the high pressure system are caused by the transitioning of water sources from Well 10 to the MWD connection. The surges are not experienced when Well 10 is the sole source of water to the High Pressure Fire Pipeline System. Therefore, by eliminating the need for MWD water, the surges will be eliminated.

Well 10 (design capacity = 2,000 gpm) cannot be used currently during the night time hours because it is oversized for the daily demands of the Central Service Area. If the Central Service Area (ADD=467 gpm) were to be connected to the South Service Area (ADD=339 gpm), the average demands will increase by 73 percent. The total average day demand will be 806 gpm. The total minimum day and maximum day demands are estimated at 604 gpm and 1,290 gpm, respectively. Well 10 will operate more efficiently and closer to its design capacity with the higher demands that a combined Central and South Service Area will require.

The hydraulic model was utilized to determine what system improvements will be needed to combine the Central and South Service Areas and eliminate the regular use of the MWD connection, using it only to supplement the system in the event of a fire.

The improvements recommended for implementing the connection between the Central and South Service Areas are as follows:

Water Quality Related Projects

1. Construct sequestering agent injection facility at Well 10
2. Replace existing pipes in Central Service Area for water quality improvement. The water quality issues in the Central Service Area should be remedied prior to making the connection to the South Service Area so as not to proliferate the problem further. **(See Table 8-1, Project 1f)**

Pressure Regulating Stations and Controls

3. Replace the PRVs at the Well 10 PRS, Foster/San Antonio PRS, Alburtis/Rosecrans PRS, and Taddy/Sylvanwood PRS. It is recommended that each station include a small pressure regulating valve for low flows and a large hydraulic pressure management control valve for high flows and/or fire flow demands. A detailed discussion of these hydraulic pressure management control valves can be found in Section 7-2.2 (No. 9). All valves will have the capability to be connected to a new SCADA system. The 2-inch valves currently located at the Foster/San Antonio PRS and the Alburtis/Rosecrans PRS should be upsized to a minimum of 4-inches to keep velocities below 10 feet per second during peak demand periods. **(See Table 8-1, Project 1d)**
4. Install SCADA system to control and monitor the wells and pressure regulating stations more effectively. **(See Table 8-1, Project 1e)**
5. Construct a new pressure regulating station in the vicinity of Maidstone Avenue and Alondra Boulevard to regulate pressure in the South Service Area below 65 psi. This facility is necessary due to the 30 foot elevation difference between the Central Service Area and the South Service Area. Without a PRS facility, the pressures in the South Service Area may exceed 80 psi, which will require individual pressure regulators at each service connection and could potentially increase the number of pipe breaks experienced. **(See Table 8-1, Project 1h)**

   When this pressure regulating station is designed and constructed, enough room will be allowed to install an additional run of pipe and a check valve if the facilities at Hermosillo Park are planned to be constructed. See Section 7-2.4 (No. 4) for further explanation.

6. Implement new controls at Well 10 that will allow it to be operated 24-hours a day with the MWD connection on stand-by for fire events.

7. When the Central and South Service Areas are connected, the 166th/Flallon PRS will become a backup to the system. The settings at this PRS will have to be lowered so that water will only be allowed to enter the NMWS system on an emergency basis.

Connection Pipelines

8. Replace existing pipes with new 16-inch pipeline in Rosecrans Avenue (395 feet from Flallon Avenue to Alburtis/Rosecrans PRS) and in Flallon Avenue (1,301 feet from Rosecrans Avenue to Mapledale Street). **(See Table 8-1, Project 1g)**

9. Construct new 16-inch pipeline in Mapledale Street, Jersey Avenue, and Maidstone Avenue (4,464 feet from Flallon Avenue to Alondra Boulevard). **(See Table 8-1, Project 1g)**

10. Construct new 12-inch pipeline in Alondra Boulevard (1,405 feet from Maidstone Avenue to Pioneer Boulevard), and Pioneer Boulevard (486 feet from Alondra Boulevard to 160th Street). **(See Table 8-1, Project 2a)**

11. Replace existing pipes with new 12-inch pipeline in 160th Street (780 feet from Pioneer Boulevard to Clarksdale Avenue). **(See Table 8-1, Project 2a)**

12. Replace existing pipes in South Service Area that are already designed (12,875 feet of 8-inch pipe). The upsized pipes will assist in providing the required fire flows to the westerly portion of the South Service Area. **(See Table 8-1, Project 2b)**

13. Construct new 12-inch pipeline in Pioneer Boulevard (2,164 feet from 160th Street to 166th Street). Connect this pipeline to existing water pipes at all street intersections. Provide fire hydrants for properties located on west side of Pioneer Boulevard. This project will provide looping in the South Service Area and help to maintain system pressures. **(See Table 8-1, Project 2c)**

7-2.2 Scenario 2: Connection of Central, South, and West Service Areas

In addition to connecting the Central Service Area (ADD=467 gpm) and South Service Area (ADD=339 gpm), it is desired to connect to the West Service Area (ADD=233 gpm). The total average day demand will be about 1,039 gpm. The total minimum day and maximum day demands are estimated at 779 gpm and 1,662 gpm, respectively.

A new well, reservoir, and booster pump station is recommended to replace the aging Well 4 and Well 5 facilities. The new facilities will be operated as the primary source of water for the Central, South, and West Service Areas. Well 10 will become the backup supply in the event of an emergency or maintenance related activities. The MWD connection and Cerritos connection at 166th Street and Flallon Avenue will become emergency connections. Well 10 will have to be exercised periodically so the facility will not remain stagnant for an extended period of time, which may result in water quality problems, and to flush the High Pressure Fire Pipeline.

The new well will have a minimum capacity of 2,000 gpm. The maximum day peak hour demand of the combined Central, South, and West Service Areas is estimated to reach up to 3,000 gpm (1.8 x MDD). The new reservoir will provide operational storage that will supplement the system during the peak hours. The pump station will be designed with a minimum firm capacity of 3,000 gpm so that the maximum day peak hour demands can be provided.

When the new facilities are out of service, Well 10 will supply water to the system via the High Pressure Fire Pipeline System and the associated pressure regulating stations (Well 10 PRS, Foster/San Antonio PRS, Alburtis/Rosecrans PRS, and Taddy PRS). Under this situation, the Cerritos connection at the 166^{th}/Flallon PRS will provide supplemental water during the maximum day peak hours.

The hydraulic model was utilized to determine the system improvements that will be needed to combine the Central, South and West Service Areas. The improvements recommended are as follows (in addition to the improvements recommended in Section 7-2.1):

<u>New Facilities</u>

1. Construct new well at the existing Well 5 site. **(See Table 8-1, Project 3a)**

   The new well will operate at constant speed and will fill the new reservoir at the Well 4 site based upon the water level in the reservoir.

2. Construct new 500,000 gallon reservoir at the existing Well 4 site. **(See Table 8-1, Project 3b)**

   The new reservoir will provide operational storage (provide supplemental water during peak demand periods) and a limited amount of fire flow storage. It will also be the forebay reservoir for the new booster pump station. The recommended size of 500,000 gallons is based on the Well 4 site dimensions and a height assumption of 30 feet.

   The maximum fire flow criteria in the Central, West, and South Service Areas is applicable to the Central Service Area at 3,000 gpm for 3 hours. This is equivalent to 540,000 gallons of water. The MDD of the Central, West, and South Service Areas is equivalent to 1,662 gpm which is nearly the assumed capacity (2,000 gpm) of the new well. Therefore, in the event of a fire, the water will have to come from the storage reservoir and/or from another source. A 500,000 gallon reservoir would provide most of the fire demand. The MWD connection will need to be used to supplement fire demands. The existing PRS valves between the high pressure fire system and the domestic water system would be set to open upon low pressures.

   If the new well is out of service, the MWD connection will be relied upon to provide the additional fire flow needed. If it is desired to construct a reservoir with enough capacity for the full fire flow storage, the City could investigate the possibility of purchasing land adjacent to the Well 4 site.

3. Construct new booster pump station at the existing Well 4 site. **(See Table 8-1, Project 3c)**

   The booster pump station will take suction from the new reservoir and pump directly into the West Service Area. The firm capacity of the pump station will be 3000 gpm, which is the estimated maximum day peak hour demand of the Central, West, and South Service Areas. The pumps will include variable frequency drives so that a discharge pressure of about 65 - 70 psi can be maintained. Additionally, the pump station will include a 1,500 gpm fire pump.

4. Construct 2,056 feet of 12-inch well discharge pipeline between new well and new reservoir in Taddy Street and Longworth Avenue. Well water will be conveyed directly to the new storage reservoir. **(See Table 8-1, Project 3e)**

<u>Connection Pipelines</u>

5. Construct 1,700 feet of 12-inch pipeline in Foster Road from Flallon Avenue to west of Kalnor Avenue. This pipeline will connect the West Service Area to the Central Service Area. **(See Table 8-1, Project 3d)**

6. Replace existing pipelines (3,671 feet) with 12-inch pipes from new reservoir to Foster/San Antonio PRS, in Leffingwell Road and Foster Road. This project will help to convey the water back and forth between the Central and West Service Areas, helping to sustain pressures during peak hours, minimize velocities, and improve the fire flow conditions. **(See Table 8-1, Project 3f)**

7. Construct 6,408 feet of 12-inch pipelines in Central and West Service Areas to loop the existing system. This project will help to convey the water back and forth between the Central and West Service Areas, helping to sustain pressures during peak hours, minimize velocities, and improve the fire flow conditions**. (See Table 8-1, Project 3g)**

<u>Pressure Regulating Stations and Controls</u>

8. Open the currently closed valve in Flallon Avenue north of Rosecrans Avenue. This recommendation assumes that the water quality issues in the Central Service Area have already been remedied (see Section 7-2.1 for details). The City closed the valve previously to keep the Well 4 and Well 5 water (good water quality) in the West Service Area separate from the Well 10 and MWD water in the Central Service Area (poor water quality).

9. Adjust pressure regulating station controls

   a. Normally, each small pressure regulating valve will be closed when the new well in the West Service Area is in operation. This will prevent MWD water from entering the Central Service Area. MWD water will only be used for emergencies and/or fire events.

      When Well 10 is in operation (for exercising or because the new well is off-line), the small pressure regulating valves will be operational and set at about 65 psi. The set point will be controlled by the SCADA system.

   b. Normally, each hydraulic pressure management control valve (larger valve) will be set to open on low pressure (i.e. 40 psi) so that it opens during a fire event or other emergency. It will also have the capability to ramp up the downstream pressure setting (i.e. 65 psi) when the flow increases and ramp back down when the flow decreases. The set points will be controlled by the SCADA system.

If Well 10 is in operation, the hydraulic pressure management control valve (larger valve) will be set to open at and maintain a pressure of about 60 psi (operating as a pressure reducing valve).

7-2.3 Scenario 3: Connection of Central, South, and West Service Areas with a Reservoir and Booster Pump Station at Well 10

Scenario 3 is the same as Scenario 2 but also includes a new reservoir and booster pump station at Well 10 in the Central Service Area. These facilities will provide the City with more reliability and redundancy in the system in the event that the well in the West Service Area becomes non-operational or the MWD Connection is out of service.

The additional improvements recommended are as follows:

1. Construct new 1 million gallon reservoir at the existing Well 10 site. **(See Table 8-1, Project 4a)**

   The new reservoir will provide operational storage (provide supplemental water during peak demand periods) and fire flow storage. It will also be the forebay reservoir for the new booster pump station.

2. Construct new booster pump station at the existing Well 10 site. **(See Table 8-1, Project 4b)**

   The booster pump station will take suction from the new reservoir and pump into the high pressure system. The firm capacity of the pump station will be 3000 gpm, which is the estimated maximum day peak hour demand of the Central, West, and South Service Areas. The pumps will include variable frequency drives so that a discharge pressure of about 130 psi can be maintained. Additionally, the pump station will include a 1,500 gpm fire pump.

3. Modify existing Well 10 pump. **(See Table 8-1, Project 4c)**

   The existing Well 10 pump is currently operating on a variable frequency drive that maintains a discharge pressure of about 130 psi. When the new reservoir is constructed, the well will pump directly into the reservoir. The well pump will be operated to turn on and off based on the water level in the reservoir. The high discharge pressure will not be required. The Well 10 pump will need to be modified (remove stages) to make this adjustment.

7-2.4 Scenario 4: Connection of Central, South, and West Service Areas with a new Well, Reservoir, and Booster Pump Station at Hermosillo Park (South Service Area)

Scenario 4 is the same as Scenario 3 but also includes a new well, reservoir, and booster pump station at Hermosillo Park in the South Service Area. These facilities will provide the City with more reliability and redundancy in the system in the event that one or more of the wells becomes non-operational or if there is ever a break in the pipeline(s) connecting the Central Service Area to the South Service Area. Without these new facilities, the existing Cerritos connection at 166th Street and Flallon will have to be utilized during an emergency. The fire flows and pressures in the South Service Area will also be improved.

The additional improvements recommended are as follows:

Connection Pipelines

4. Construct 4,027 feet of 16-inch pipeline in Norwalk Boulevard from Mapledale Street to Alondra Boulevard. **(See Table 8-1, Project 5a)**

5. Construct 2,980 feet of 12-inch pipeline in Norwalk Boulevard from Alondra Boulevard to 162nd Street and in 162nd Street from Norwalk Boulevard to Hermosillo Park (location of new reservoir and booster pump station). **(See Table 8-1, Project 5a)**

6. Construct 1,327 feet of 8-inch pipeline in Elaine Avenue from Hermosillo Park to 166th Street. **(See Table 8-1, Project 5a)**

New Facilities

7. Construct a new pressure regulating station in the vicinity of Norwalk Boulevard and Alondra Boulevard to regulate pressure in the South Service Area below 65 psi. This facility is necessary due to the 30 foot elevation difference between the Central Service Area and the South Service Area. Without a PRS facility, the pressures in the South Service Area may exceed 80 psi, which will require individual pressure regulators at each service connection and potentially increase the number of pipe breaks experienced. **(See Table 8-1, Project 5b)**

   This pressure regulating station will include an additional run of pipe and a check valve. The check valve will prevent water from flowing from the north to the south without being pressure regulated, thus preventing high pressures in the South Service Area. The check valve feature will allow water to flow from the south to the north when the new well and booster pump station at Hermosillo Park is in operation.

8. Construct new well at Hermosillo Park. **(See Table 8-1, Project 6a)**

   The new well will operate at constant speed and will fill the adjacent forebay reservoir based upon the water level in the forebay reservoir.

9. Construct new 1.0 MG reservoir at Hermosillo Park. **(See Table 8-1, Project 6b)**

   The new reservoir will provide operational storage (provide supplemental water during peak demand periods) and fire flow storage. It will also be the forebay reservoir for the new booster pump station.

   In order to size the reservoir at Hermosillo Park, it was assumed that eventually, the Southeast Service Area would also be connected to the system (See Section 7.2-5 Scenario 5). The maximum fire flow criteria in the Central, West, South, and Southeast Service Areas is applicable to the Southeast Service Area at 4,000 gpm for 4 hours. This is equivalent to 960,000 gallons of water. The MDD of the Central, West, and South Service Areas is equivalent to 1,793 gpm which is nearly the assumed capacity (2,000 gpm) of the new Hermosillo Well. In the event of a fire, the water will have to come from the storage reservoir and/or from another source. Therefore, a 1.0 MG reservoir is recommended and will be sufficient in the event of a fire.

If the new well at Hermosillo Park is out of service, the Cerritos connection at 166th Street and Flallon Avenue will be relied upon to provide the additional fire flow needed.

10. Construct new booster pump station at Hermosillo Park. **(See Table 8-1, Project 6c)**

    The booster pump station will take suction from the new reservoir and pump directly into the South Service Area. The minimum firm capacity of the pump station will be 3000 gpm, which is the estimated maximum day peak hour demand of the Central, West, and South Service Areas. The pumps will include variable frequency drives so that a discharge pressure of about 70-75 psi can be maintained. An evaluation of the existing facilities at the time of design should be conducted. An additional fire pump should be considered for incorporation of the design during the preliminary design stages of the project.

7-2.5 Scenario 5: Connection of Southeast Service Area with Central, West, and South Service Areas

A 16-inch pipeline (4,400 feet) in Alondra Boulevard from Norwalk Boulevard to Blackburn Avenue is needed to connect the South Service Area to the Southeast Service Area, further reducing the amount of water purchased from adjacent agencies. Currently, the Southeast Service Areas are provided water by the City of Santa Fe Springs at a unit cost of $1700/AF. The two existing connections will become emergency connections once the service areas are connected. **(See Table 8-1, Project 6d)**

7-2.6 Scenario 6: Connection of Northeast and Northwest Service Areas

A 12-inch pipeline (1,000 feet) along the railroad right-of-way from Maidstone Avenue to Baylark Street is recommended to connect the Northeast and Northwest Service Areas. Currently, each service area is provided water via a single connection with the City of Santa Fe Springs. The pipeline connection will provide the North Service Areas with source of supply redundancy. **(See Table 8-1, Project 5c)**

7-3 Alternative Scenario

The analysis scenarios discussed in Section 7-2 provided the basis for the capital improvement project recommendations. During the course of the Master Plan study, another alternative was formulated and evaluated, but ultimately discarded. For documentation purposes, this alternative is discussed below.

7-3.1 Connection of Central and West Service Areas

Since Well 10 went into operation, it was realized that the pump was oversized for the daily demands of the Central Service Area and full range of demands cannot be supplied with the well. Currently, the MWD connection provides water through the High Pressure Fire Pipeline System to the Central Service Area during the low demand periods from 10:00 pm to 6:00 am. Expanding the service area and increasing the daily demands will enable the City to use Well 10 more effectively and possibly eliminate the daily use of imported MWD water.

Due to the close proximity of the West Service Area to the Central Service Area, it was initially thought that connecting these two areas will be the simplest and most economical option. The hydraulic model was utilized to simulate the connection of the two service areas and determine the system improvements that will be needed to ensure system pressures and velocities that will meet the established criteria (see Section 5).

Based on analyses run utilizing the hydraulic model, the primary improvements needed to interconnect the West and Central Service Areas, maintain system pressures, and minimize velocities were determined to be as follows:

1. Open the existing valve in Flallon Avenue north of Rosecrans Avenue
2. Construct 5,400 feet of 12-inch pipeline in Foster Road from the Well 4 site to the Foster/San Antonio PRS. The project cost is estimated at about $2.7 Million.
3. Construct 2,800 feet of 12-inch pipeline in Taddy Street, Gard Avenue, Van Ruiten Street, Flallon Avenue, and Rosecrans Avenue from the Well 5 site to the Alburtis/Rosecrans PRS. The project cost is estimated at about $1.3 Million.
4. Convert Well 4 and Well 5 to operation with a variable frequency drive that pumps directly to the low pressure system at about 75 psi. Replace well pump and motor control center and change the system operation so that Well 4 and Well 5 operate from 12:00 am to 5:00 am during the seasonal average and low demand periods (fall, winter, and spring). The project cost is estimated at about $1.6 Million.
5. Change system operation so that Well 10 operates all day long during the high demand periods (summer) and between the hours of 5:00 am and 12:00 am during the seasonal average and low demand periods (fall, winter, and spring).

It was decided that it will be more advantageous to connect the Central Service Area to the South Service Area first based on the following factors:

- The total cost of the improvements needed to interconnect the West and Central Service Areas was estimated at about $5.6 Million. The total cost of the improvements needed to interconnect the South and Central Service Areas was also estimated at about $5.6 Million (See Section 7 and 8, Projects 1g, 1h, and 2a).

- The combined demand of the South and Central Service Area (ADD=1039 gpm) is greater than the combined demand of the West and Central Service Area (ADD=806 gpm), therefore Well 10 can operate more efficiently and closer to its design capacity.

- Well 10 can provide all the demands of the South and Central Service Areas (24 hours per day all year long). The daily use of MWD water will be eliminated.

  Well 10 may not be able to provide water during the low demand periods even if the West and Central Service Areas are combined. MWD water may still be needed to provide water to the system during the low demand periods (night time hours during fall, winter, and spring).

- The amount of water purchased from the City of Cerritos will be reduced if the South and Central Service Area are connected. The 166th/Flallon PRS will become an emergency connection instead of the main source of supply to the South Service Area.

- Well 4 and Well 5 are old but in good condition. The water produced is also of good quality, requiring minimal treatment. These two wells do not need to be immediately replaced.

SECTION 8

WATER SYSTEM IMPROVEMENT PLAN

8-1 General

A detailed Water System Improvement Plan (WSIP) was developed based on the analyses completed and described in Section 6 and Section 7 of this report. The WSIP, shown in Table 8-1, prioritizes the projects based on the concerns of the City and the cost benefit of each improvement recommendation. Project costs are sometimes spread over multiple years to account for the time it takes to design projects as well as projects that will take more than one year to construct. Project locations are shown on Figure 8-1.

8-2 Cost Estimates

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 foot. The City is largely developed and future pipelines will be constructed along alignments with many existing utilities. Therefore, the costs of constructing new or replacement facilities will be generally higher in these areas than those in undeveloped areas. New pump station and well costs include providing permanent back-up power. 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) Construction Cost Index (CCI) for the Los Angeles area (ENR LA), with the base ENR LA Index of 10,736 for May 2014.

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 Reports (PDR) should be prepared to select the final design projects. At a minimum, PDRs for wells and pump stations must address location, system hydraulics, demands and pressures, pump selections, layout, backup power, design criteria, maintaining service to existing areas, construction issues, cost estimates, phasing and scheduling. The pump station firm capacity, number of pumps, and type of pumps must be evaluated and determined during the development of the PDR. The PDRs for pipelines should address alignment; pipe materials; utility interferences and relocations; impact on residences, businesses, and traffic; potential soil and groundwater contamination; permitting; maintaining service to existing customers during construction; phasing and scheduling; and updated cost estimates.

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 8-1.

The total Water System Improvement Project costs are estimated at 73.4 Million dollars.

8-3 Short Term Improvement Projects

The short term improvement projects are recommended to assist in immediately taking care of the surges experienced in the High Pressure Fire Pipeline System, improving the water quality in the Central Service Area, eliminating the use of imported water, and reducing the purchase of water from the City of Cerritos. These projects are scheduled to be completed over the next four years (FY 2014/15 through FY 2017/18).

The projects, listed under Phase 1 and Phase 2 on Table 8-1**,** are considered short term improvement projects. Project 1a and 1b are recommended to immediately eliminate surging in the High Pressure Fire Pipeline. Project 1c and 1f are recommended to resolve the color issues that the City has been receiving complaints about. Project 1d and 1e are recommended to allow the City to better control and monitor the wells and pressure regulating stations. Project 1g and 1h are recommended to interconnect the Central Service Area with the South Service Area. Project 1i is recommended to provide an emergency connection to the Southeast Service Area.

Project 1a

Install 4-inch valve at Central Basin Turnout No. 16 of Metropolitan Water District of Southern California (MWD), located at the intersection of Norwalk Boulevard and Imperial Highway. The City has already initiating this project.

Project Cost = $25,000 Schedule: FY 2014-2015

Project 1b

Valve and programming control modifications at Well 10. The City has already initiated this project.

Project Cost = $25,000 Schedule: FY 2014-2015

Project 1c

Construct sequestering agent injection facility at Well 10.

Project Cost = $125,000 Schedule: FY 2014-2015

Project 1d

Replace PRVs at Well 10 PRS, Foster/San Antonio PRS, Alburtis/Rosecrans PRS, Taddy/Sylvanwood PRS. Small valves will be pressure reducing valves. Large valves will be hydraulic pressure management control valves.

Project Cost = $270,000 Schedule: FY 2014-2015

Project 1e

Install SCADA system.

Project Cost = $425,000 Schedule: FY 2015-2016

Project 1f

Replace pipelines (~7,700 ft) in Central Service Area for water quality improvement purposes. The minimum replacement size recommended is 8-inches.

Project Cost = $2,502,300 Schedule: FY 2014-2015 through FY 2015-2016

Project 1g

Replace and upsize existing pipelines (~1,700 ft) in Rosecrans Avenue and Flallon Avenue to 16-inch diameter pipe. Construct new 16-inch pipelines in Mapledale Street, Jersey Avenue, and Maidstone Avenue.

Project Cost = $3,991,700 Schedule: FY 2014-2015 through FY 2015-2016

Project 1h

Construct pressure regulating station at Maidstone Avenue and Alondra Boulevard.

Project Cost = $337,500 Schedule: FY 2016-2017

Project 1i

Add emergency connection to the Park Water Company system in the Southeast Service Area.

Project Cost = $337,500 Schedule: FY 2016-2017

Project 2a

Construct 12-inch pipelines (2,671 ft) in Alondra Boulevard, Pioneer Boulevard, and 160th Street.

Project Cost = $1,298,100 Schedule: FY 2016-2017 through FY 2017-2018

Project 2b

Replace and upsize existing pipelines (~12,900 ft) already designed in South Service Area (west side) to 8-inch diameter pipe. The project cost excludes the typical 10 percent of the construction cost for design fees.

Project Cost = $3,862,500 Schedule: FY 2016-2017 through FY 2017-2018

Project 2c

Construct 12-inch pipeline (~2,200 ft) in Pioneer Boulevard from 160th Street to 166th Street.

Project Cost = $1,051,700 Schedule: FY 2016-2017 through FY 2017-2018

8-4 Long Term Improvement Projects

The long term improvement projects are recommended to improve the reliability of the system, add redundancy to the system, replace aging facilities, and improve fire flows and residual pressures.

The projects listed under Phase 3, 4, 5 and 6 in Table 8-1 are considered long term improvement projects. Projects 3a, 3b, 3c, 3d, 3e, and 3f are recommended to interconnect the West Service Area with the Central and South Service Areas. Project 3g is recommended to improve fire flow and pressures in the Central and West Service Areas. Projects 4a, 4b, and 4c are recommended to provide redundancy to the system. Project 5a and 5b are recommended to provide an additional connection between the Central and South Service areas, adding redundancy to the system. Project 4d is recommended to interconnect the Northwest and Northeast Service Areas, adding redundancy to the system. Project 6a, 6b, 6c, and 6d are recommended to add an additional source of water to the South Service Area, adding redundancy to the system. Project 6e is recommended to provide a connection to the Artesia Service Area that can provide water automatically in the event of a fire.

Project 3a

Construct well at existing Well 5 site in West Service Area.

Project Cost = $3,375,000 Schedule: FY 2018-2019 through FY 2019-2020

Project 3b

Construct 500,000 gallon reservoir at existing Well 4 site in West Service Area.

Project Cost = $2,025,000 Schedule: FY 2018-2019 through FY 2019-2020

Project 3c

Construct booster pump station at existing Well 4 site in West Service Area.

Project Cost = $3,375,000 Schedule: FY 2018-2019 through FY 2019-2020

Project 3d

Construct 12-inch pipeline (~1,700 ft) in Foster Road from Flallon Avenue to west of Kalnor Avenue.

Project Cost = $826,200 Schedule: FY 2019-2020 through FY 2020-2021

Project 3e

Construct 12-inch well discharge pipeline (~2,100 ft) in Taddy Street and Longworth Avenue between the new well and the new reservoir.

Project Cost = $999,200 Schedule: FY 2020-2021 through FY 2021-2022

Project 3f

Replace and upsize existing pipelines (~3,700 ft) in Leffingwell Road and Foster Road to 12-inch diameter pipe.

Project Cost = $1,784,100 Schedule: FY 2020-2021 through FY 2021-2022

Project 3g

Replace and upsize existing pipelines (~6,400 ft) in Central and West Service Area to loop the system.

Project Cost = $3,114,300 Schedule: FY 2020-2021 through FY 2021-2022

Project 4a

Construct 1 MG reservoir at existing Well 10 site in Central Service Area.

Project Cost = $2,700,000 Schedule: FY 2022-2023 through FY 2023-2024

Project 4b

Construct booster pump station at existing Well 10 site in Central Service Area.

Project Cost = $3,375,000 Schedule: FY 2022-2023 through FY 2023-2024

Project 4c

Modify Well 10 pump to pump into new reservoir instead of directly into high pressure pipeline.

Project Cost = $67,500 Schedule: FY 2022-2023 through FY 2023-2024

Project 5a

Construct 16-inch pipeline (~4,000 ft) Norwalk Boulevard from Mapledale Street to Alondra Boulevard. Construct 12-inch pipeline (~3,000 ft) in Norwalk Boulevard and 162nd Street from Alondra Boulevard to Hermosillo Park. Construct 8-inch pipeline (~1,300 ft) in Elaine Avenue from Hermosillo Park to 166th Street.

Project Cost = $4,487,700 Schedule: FY 2024-2025 through FY 2025-2026

Project 5b

Construct pressure regulating station at Norwalk Boulevard and Alondra Boulevard.

Project Cost = $337,500 Schedule: FY 2024-2025

Project 5c

Construct 12-inch pipeline (~1,000 ft) in railroad right-of-way from Maidstone Avenue to Baylark Street.

Project Cost = $486,000 Schedule: FY 2024-2025

Project 6a

Construct well at Hermosillo Park.

Project Cost = $3,780,000 Schedule: FY 2026-2027 through FY 2028-2029

Project 6b

Construct 1.0 MG reservoir at Hermosillo Park.

Project Cost = $2,700,000 Schedule: FY 2026-2027 through FY 2028-2029

Project 6c

Construct booster pump station at Hermosillo Park.

Project Cost = $2,700,000 Schedule: FY 2026-2027 through FY 2028-2029

Project 6d

Construct 16-inch pipeline (~4,400 ft) in Alondra Boulevard from Norwalk Boulevard to Blackburn Avenue.

Project Cost = $2,851,200 Schedule: FY 2029-2030 through FY 2030-2031

Project 6e

Convert Golden State Water Company connection at Norwalk Boulevard and South Street to a pressure reducing valve (Artesia Service Area). This will enable the valve to open based upon a pressure setting and allow water to flow into the Artesia Service Area in the event of a fire.

Project Cost = $205,500 Schedule: FY 2029-2030

8-5 Fire Flow Improvement Projects

In addition to the short term and long term improvement projects, pipeline upgrades needed to meet fire flow and residual pressure requirements were identified in the Central, West, South, and Artesia Service Areas. These projects are listed at the bottom of Table 8-1 and the locations are shown on Figure 8-1. The amount of pipe replaced each year will be dependent on what short term and long term projects are initiated and level of funding available in that year. The identified fire flow improvement projects provides the City with a minimum amount of pipe to be replaced and upsized for the system to meet the established fire flow criteria.

Project 1FF

Replace and upsize approximately 28,600 feet of pipe in the Central Service Area.

Project Cost = $9,274,800

Project 2FF

Replace and upsize approximately 15,700 feet of pipe in the West Service Area.

Project Cost = $5,084,900

Project 3FF

Replace and upsize approximately 13,000 feet of pipe in the South Service Area.

Project Cost = $4,458,100

Project 4FF

Replace and upsize approximately 3,150 feet of pipe in the Artesia Service Area.

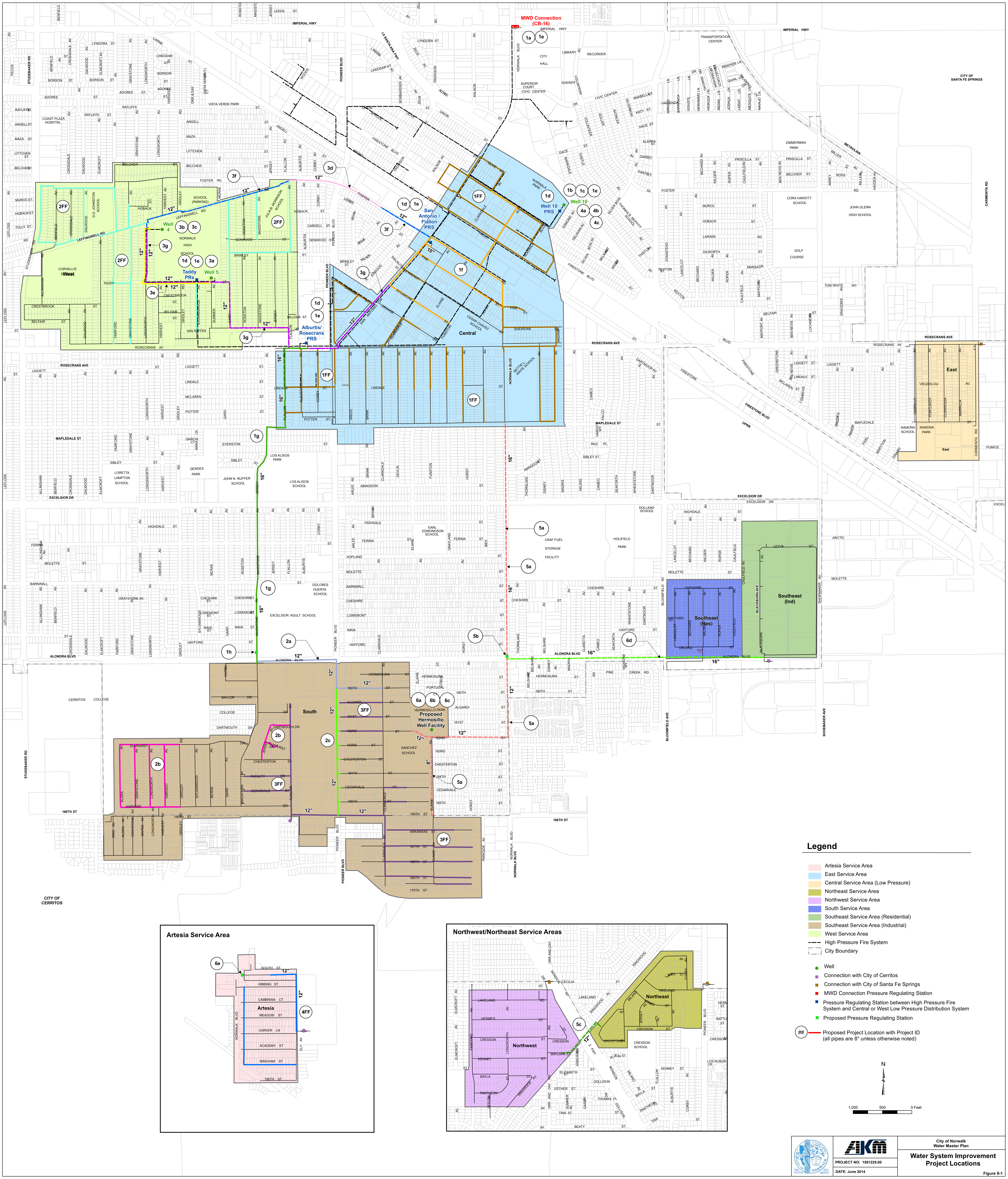
Project Cost = $1,172,600

Table 8-1
Water System Improvement Plan

Project ID	Project Description	Ex Dia (in)	Prop Dia (in)	Quantity	Unit	Unit Cost ($)	Const. Cost ($)	Eng, Admin, and Cont. (35%)	Project Cost ($)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
Phase 1																											
1a	Install 4" valve at MWD Connection								25,000	25,000																	
1b	Valve and Programming/Control Modifications at Well 10								25,000	25,000																	
1c	Construct sequestering agent injection facility at Well 10								125,000	125,000																	
1d	Replace PRVs at Well 10 PRS, Foster/San Antonio PRS, Alburtis/Rosecrans PRS, Taddy/Sylvanwood PRS. Small valves will be pressure reducing valves. Large valves will be hydraulic pressure management control valves.			4	PRS	50,000	200,000	70,000	270,000	270,000																	
1e	Install SCADA System								425,000		425,000																
1f	Replace pipelines in Central Service Area for water quality improvement	4	8	5,613	ft	240	1,347,120	471,492	1,818,612	727,445	1,091,167																
		8	8	1,449	ft	240	347,760	121,716	469,476	187,790	281,686																
		6	8	536	ft	240	128,640	45,024	173,664	69,466	104,198																
		10	10	100	ft	300	30,000	10,500	40,500	16,200	24,300																
1g	Replace pipeline in Rosecrans Ave (Flallon Ave to Rosecrans PRS)	6	16	395	ft	480	189,600	66,360	255,960	102,384	153,576																
	Replace pipeline in Flallon Ave (Rosecrans Ave to Mapledale St)	4, 6	16	1,301	ft	480	624,480	218,568	843,048	337,219	505,829																
	Construct pipeline in Mapledale St, Jersey Ave, and Maidstone Ave (Flallon Ave to Alondra Blvd)		16	4,464	ft	480	2,142,720	749,952	2,892,672	1,590,970	1,301,702																
1h	Construct pressure regulating station at Maidstone Ave and Alondra Blvd			1	PRS	250,000	250,000	87,500	337,500			337,500															
1i	Add emergency connection to Park Water in Southeast Service Area			1	PRS	250,000	250,000	87,500	337,500			337,500															
Phase 2																											
2a	Construct pipeline in Alondra Blvd (Maidstone Ave to Pioneer Blvd)		12	1,405	ft	360	505,800	177,030	682,830			341,415	341,415														
	Construct pipeline in Pioneer Blvd (Alondra Blvd to 160th St)		12	486	ft	360	174,960	61,236	236,196			118,098	118,098														
	Replace pipeline in 160th St (Pioneer Blvd to Clarksdale Ave)		12	780	ft	360	280,800	98,280	379,080			189,540	189,540														
2b	Replace pipelines **already designed** in South Service Area (west side)	4,6,8	8	12,875	ft	240	3,090,000	772,500	3,862,500			1,931,250	1,931,250														
2c	Construct pipeline in Pioneer Blvd (160th St to 166th St), connected to all streets on east and add fire hydrants for multi-family uses on west		12	2,164	ft	360	779,040	272,664	1,051,704			525,852	525,852														
Phase 3																											
3a	Construct well at Well 5 site in West Service Area			1	well	2,500,000	2,500,000	875,000	3,375,000					1,687,500	1,687,500												
3b	Construct reservoir at Well 4 site in West Service Area			500,000	gal	3	1,500,000	525,000	2,025,000					1,012,500	1,012,500												
3c	Construct booster pump station at Well 4 site in West Service Area			1	PS	2,500,000	2,500,000	875,000	3,375,000					1,687,500	1,687,500												
3d	Construct pipeline in Foster Rd, Flallon Ave to west of Kalnor Ave		12	1,700	ft	360	612,000	214,200	826,200							826,200											
3e	Construct well discharge pipeline between new well and new reservoir in Taddy St and Longworth Ave		12	2,056	ft	360	740,160	259,056	999,216							499,608	499,608										
3f	Upsize pipes from new reservoir at Well 4 site to Foster/San Antonio PRS in Leffingwell Rd and Foster Rd	6, 8, 10	12	3,671	ft	360	1,321,560	462,546	1,784,106							892,053	892,053										
3g	Construct pipelines in Central and West Service Areas to loop system	4	12	1,540	ft	360	554,400	194,040	748,440							374,220	374,220										
		6	12	3,817	ft	360	1,374,120	480,942	1,855,062							927,531	927,531										
		8	12	1,051	ft	360	378,360	132,426	510,786							255,393	255,393										

Table 8-1 (continued)
Water System Improvement Plan

Project ID	Project Description	Ex Dia (in)	Prop Dia (in)	Quantity	Unit	Unit Cost ($)	Const. Cost ($)	Eng, Admin, and Cont. (35%)	Project Cost ($)	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
Phase 4																											
4a	Construct reservoir next to Well 10, half underground			1,000,000	gal	2	2,000,000	700,000	2,700,000									1,350,000	1,350,000								
4b	Construct booster pump station at Well 10 Reservoir (pumping to high pressure)			1	PS	2,500,000	2,500,000	875,000	3,375,000									1,687,500	1,687,500								
4c	Well 10 pump modifications			1	well pump	50,000	50,000	17,500	67,500									33,750	33,750								
Phase 5																											
5a	Construct pipeline in Norwalk Blvd (Mapledale St to Alondra Blvd)		16	4,027	ft	480	1,932,960	676,536	2,609,496											1,304,748	1,304,748						
	Contruct pipeline in Norwalk Blvd (Alondra Blvd to 162nd St) and 162nd St (Norwalk Blvd to Hermosillo Park)		12	2,980	ft	360	1,072,800	375,480	1,448,280											724,140	724,140						
	Construct pipeline in Elaine Ave (Hermosillo Park to 166th St)		8	1,327	ft	240	318,480	111,468	429,948											214,974	214,974						
5b	Construct pressure regulating station at Norwalk Blvd and Alondra Blvd			1	PRS	250,000	250,000	87,500	337,500											337,500							
5c	Construct pipeline to connect Northwest to Northeast Service Areas (railroad right-of-way from Maidstone Avenue to Baylark Street)		12	1,000	ft	360	360,000	126,000	486,000											486,000							
Phase 6																											
6a	Construct well at Hermosillo Park			1	well	2,800,000	2,800,000	980,000	3,780,000													1,134,000	1,134,000	1,512,000			
6b	Construct reservoir at Hermosillo Park			1,000,000	gal	2	2,000,000	700,000	2,700,000													810,000	810,000	1,080,000			
6c	Construct booster pump station at Hermosillo Park			1	PS	2,000,000	2,000,000	700,000	2,700,000													810,000	810,000	1,080,000			
6d	Construct pipeline in Alondra Blvd (Norwalk Blvd to Blackburn Ave)		16	4,400	ft	480	2,112,000	739,200	2,851,200																1,140,480	1,710,720	
6e	Convert Golden State Water Company Connection at Norwalk Blvd and South St to a PRV (Artesia Service Area)			1	PRS	150,000	150,000	52,500	202,500																202,500		
Fireflow Pipeline Replacements																											
1FF	Central Service Area pipe replacements for fire flow	4	8	23,723	ft	240	5,693,520	1,992,732	7,686,252			600,000	1,200,000			300,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	586,252					
		6	8	4,903	ft	240	1,176,720	411,852	1,588,572																		1,588,572
2FF	West Service Area pipe replacements for fire flow	4	8	9,064	ft	240	2,175,360	761,376	2,936,736												700,000	700,000	1,200,000	336,736			
		6	8	6,630	ft	240	1,591,200	556,920	2,148,120																700,000	1,448,120	
3FF	South Service Area pipe replacements for fire flow	2	8	324	ft	240	77,760	27,216	104,976												104,976						
		4	8	6,456	ft	240	1,549,440	542,304	2,091,744																1,000,000	500,000	591,744
		6	8	4,590	ft	240	1,101,600	385,560	1,487,160																1,000,000	400,000	87,160
		8	12	1,593	ft	360	573,480	200,718	774,198																		774,198
4FF	Artesia Service Area pipe replacements for fire flow	2	8	1,319	ft	240	316,560	110,796	427,356																		427,356
		6	8	893	ft	240	214,320	75,012	289,332																		289,332
		8	12	938	ft	360	337,680	118,188	455,868																		455,868
	Total amount to spend on fire flow replacements each year									0	0	600,000	1,200,000	0	0	300,000	1,000,000	1,000,000	1,000,000	1,000,000	1,804,976	1,286,252	1,200,000	336,736	2,700,000	2,348,120	4,214,230
	Grand Total								**73,427,790**	**3,476,474**	**3,887,458**	**4,381,155**	**4,306,155**	**4,387,500**	**4,387,500**	**4,075,005**	**3,948,805**	**4,071,250**	**4,071,250**	**4,067,362**	**4,048,838**	**4,040,252**	**3,954,000**	**4,008,736**	**4,042,980**	**4,058,840**	**4,214,230**


MWD Connection (CB-16)
West
Central
South
East
Southeast (Res)
Southeast (Ind)
Well 4
Well 5
Well 10
Taddy PRs
San Antonio / Fallon PRS
Alburtis/ Rosecrans PRS
Well 10 PRS
Proposed Hermosillo Well Facility
CITY OF SANTA FE SPRINGS
CITY OF CERRITOS
Artesia Service Area
Artesia
Northwest/Northeast Service Areas
Northwest
Northeast
Legend
Artesia Service Area
East Service Area
Central Service Area (Low Pressure)
Northeast Service Area
Northwest Service Area
South Service Area
Southeast Service Area (Residential)
Southeast Service Area (Industrial)
West Service Area
High Pressure Fire System
City Boundary
Well
Connection with City of Cerritos
Connection with City of Santa Fe Springs
MWD Connection Pressure Regulating Station
Pressure Regulating Station between High Pressure Fire System and Central or West Low Pressure Distribution System
Proposed Pressure Regulating Station
Proposed Project Location with Project ID (all pipes are 8" unless otherwise noted)
N
1,000
500
0 Feet
PROJECT NO: 1501225.00
DATE: June 2014
City of Norwalk
Water Master Plan
Water System Improvement Project Locations
Figure 8-1

CITY OF NORWALK CALIFORNIA

THE KEYSTONE CITY inc. 1957

AKM Consulting Engineers - City of Norwalk Water Master Plan

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