FINAL REPORT

CITY OF DIXON

2016 Water System Master Plan and Strategic Asset Management Plan

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2016 Water System Master Plan and Strategic Asset Management Plan

Prepared for

City of Dixon

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$M	Million
AC	Acres
Ac-ft/ac/yr	Acre-Foot/Feet Per Year Per Acre Per Year
Ac-ft/yr	Acre-Feet Per Year
ACP	Asbestos Cement Pipe
AF	Acre-Foot/Feet
AWWA	American Water Works Association
bgs	Below Ground Surface
Cal Water	California Water Service Company Dixon
CCI	Construction Cost Index
CDOF	California Department of Finance
CFC	California Fire Code
CIP	Capital Improvement Program
City	City of Dixon
CMMS	Computerized Maintenance Management System
Cr(VI)	Hexavalent Chromium
CVFED	Central Valley Floodplain Evaluation
DDW	State Water Resources Control Board Division of Drinking Water
DIP	Ductile Iron Pipe
DOC	Dissolved Organic Compounds
DWR	Department of Water Resources
ENR	Engineering News Record
EPA	Environmental Protection Agency
EPS	Extended Period Simulation
FF	Fire Flow
Fft/s	Feet Per Second
ft	Foot/Feet
gal	Gallon
GAMA	Groundwater Ambient Monitoring and Assessment
GIS	Geographic Information System
gpm	Gallons Per Minute
GPS	Global Positioning System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HGL	Hydraulic Grade Line

hp	Horsepower
Hrs	Hours
HWL	High Water Level
I-80	Interstate 80
in	Inch
LF	Lineal Foot/Feet
LiDAR	Light Detection and Ranging
MCL	Maximum Contaminant Level
MG	Million Gallons
mg/L	Milligrams Per Liter
mgd	Million Gallons Per Day
MS	Microsoft
MSL	Mean Sea Level
NAVD	North American Vertical Datum
NBA	North Bay Aqueduct
NEQ	North East Quadrant
NPSH	Net Positive Suction Head
O&M	Operations and Maintenance
PDF	Portable Document Format
PLC	Programmable Logic Controller
PS	Pump Station
psi	Pounds Per Square Inch
PVC	Polyvinyl Chloride
SAMP	Strategic Asset Management Plan
SCADA	Supervisory Control and Data Acquisition
SCWA	Solano County Water Agency
SGMA	Sustainable Groundwater Management Act of 2014
SID	Solano Irrigation District
SMCL	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
sq ft	Square Feet
SRI	Silica Resources, Inc.
SSACV	Southern Sacramento Valley
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TM	Technical Memorandum
UAFW	Unaccounted for Water
UPRR	Union Pacific Railroad
USGS	U.S. Geological Survey
V	Volume
VFD	Variable Frequency Drive
VOCs	Volatile Organic Compounds
West Yost	West Yost Associates
WSMP	Water System Master Plan

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EXECUTIVE SUMMARY

The purpose of this Water System Master Plan (WSMP) for the City of Dixon (City) is to identify existing potable water system deficiencies and required potable water system improvements, based on updated demand estimates and system evaluations, and to formulate a comprehensive Capital Improvement Program (CIP) which meets the needs of the City's existing and future water customers. This WSMP was completed based on information for the City's water distribution system at the end of 2016. Updates to the system and operational changes for 2017 have not been incorporated as part of this WSMP.

The resulting WSMP provides the City with a comprehensive and prioritized road map to improve the capacity, operational flexibility, and reliability of the potable water distribution system to meet existing and projected future water demands. Specific objectives and tasks from the WSMP project are listed below with references to specific chapters of the WSMP, which provide additional details.

Describe and summarize the City's existing water service area and potable water system facilities	→	*Chapter 2. Existing Water System*
Describe existing and projected future potable water demands	→	*Chapter 3. Water Demands*
Review the capacity and reliability of the City's water supplies, including the need for future treatment systems to address water quality issues	→	*Chapter 4. Water Supply*
Review and refine the City's potable water system planning and design criteria for analyzing the performance of the City's potable water system	→	*Chapter 5. Planning and Design Criteria*
Develop and calibrate the City's potable water system hydraulic model	→	*Chapter 6. Hydraulic Model Development*
Evaluate the ability of the City's potable water system to meet existing demands while meeting the City's planning and design criteria	→	*Chapter 7. Existing Water System Evaluation*
Evaluate the ability of the City's potable water system to meet projected future demands while meeting the City's planning and design criterial	→	*Chapter 8. Future Water System Evaluation*
Develop a Strategic Asset Management Plan for the City's existing water system facilities to provide guidance for the City's preventative maintenance and rehabilitation and replacement programs	→	*Chapter 9. Strategic Asset Management Plan*
Develop a comprehensive Capital Improvement Program identifying the size and location of required improvements to address existing potable water system deficiencies and future potable water system needs	→	*Chapter 10. Capital Improvement Program*

The following sections provide a brief summary of key aspects of the WSMP; details are provided in the individual chapters.

ES.1 EXISTING POTABLE WATER SYSTEM

The City of Dixon is served by two water suppliers: the City and the California Water Service Company (Cal Water). The City's water service area includes approximately 2,700 service connections (2015) serving a population of approximately 8,400 (2015) and is divided into three sub-areas: North Zone, Core Zone, and South Zone. The City's water service area includes predominantly residential (single family and multi-family) customers (comprising approximately 93 percent of the City's connections), with additional commercial, industrial, government, and landscape customers.

The City currently relies solely on groundwater as its water supply. In 2015, 580.5 million gallons (MG) of groundwater was produced in the City's water service area. The City currently operates a total of five groundwater wells capable of producing nearly 12.2 million gallons of water per day (mgd).

The City also has four water storage tanks, three booster pump stations and a water distribution network consisting of approximately 40 miles (211,000 lineal feet) of pipeline ranging from 4 to 14 inches in diameter. In addition, the City has three interties with Cal Water's Dixon District water distribution system that are used for the mutual benefit of increased supply reliability and emergency use.

ES.2 EXISTING AND PROJECTED WATER DEMAND

As described in Chapter 3, since 2008, water consumption within the City's water service area has decreased substantially. Metered consumption in 2008 was 2,378 acre-feet, and in 2015, metered consumption was only 1,502 acre-feet. This is likely due to several factors including the City's successful water conservation efforts implemented in response to the on-going drought. Because of decreased consumption in 2015 due to the drought conditions, the City's 2014 consumption has been assumed to be the City's "existing" water demands for the purposes of evaluating the City's existing water system (see Chapter 7).

As described in Chapter 3 of this WSMP, future water demands were projected through buildout of the City's water service area using a unit demand methodology based on land uses in the General Plan. Unit demand factors were determined using meter data from 2008 to 2015 obtained from the City, parcel data obtained from Solano County, and land use data obtained from the City's General Plan consultant. Table ES-1 provides a summary of the existing (2014) and projected future water demands at 2030 and buildout within the City's water service area.

Table ES-1. City Water Service Area Existing and Projected Future Water Demands, ac-ft/yr

Water Use Type	Existing Demands[a]	Near-Term (by 2030)			Buildout	Total
		Existing Water Service Area Development	Northeast Quadrant SP	Southwest Dixon SP	SOI	
Single Family Residential	1,024	427		612	1,564	3,627
Multi-Family Residential	104	827		75		1,006
Industrial	172	212			120	504
Commercial	156	223	768	244	292	1,683
Government	30	37				67
Landscape	105	21				126
Unaccounted for Water	223	245	108	130	277	982
Subtotal	1,814	1,992	876	1,061	2,253	7,995
Total Existing (2014) Demand						1,814
Total 2030 Demand						5,743
Total Buildout Demand						7,795

[a] Existing demands based on actual billed 2014 demands due to the drought impacts to 2015 demands.

ES.3 WATER SUPPLY

As described in Chapter 4, the City relies exclusively on groundwater for its water supply. The City currently operates a total of five groundwater wells, which have a total capacity of about 8,500 gpm (12.2 mgd). The City's Core and North Zones are hydraulically connected and operate as a single distribution system and are served by the Watson Ranch Well (DW-37), Industrial Well (DW-44) and the School Well (DW-48), all of which are located in the Core Zone; there are no wells in the North Zone. The South Zone is a smaller area, which operates as a hydraulically independent distribution system, and is served by the Valley Glen Well (DW-52) and the Park Lane Well (DW-54); however, water pumped from the Valley Glen Well is high in nitrates and is only used as a back-up supply.

As described in this WSMP, additional new wells are proposed within the City's water service area to meet projected future water demands (see Chapter 8).

Wellhead treatment is currently not provided at any of the City's wells, but is being considered to address hexavalent chromium (Cr(VI)) concentrations in excess of the maximum contaminant level (MCL)[1]. The recommendations the City has received for Cr(VI) treatment have focused on the City's existing system. Based on the existing system configuration and operations, the construction of two centralized treatment facilities appears to be the recommended option. Centralized Cr(VI) treatment plants would be located at the Watson Ranch Well site in the combined Core/North Zones and at the Park Lane Well site in the South Zone (Kennedy Jenks, 2016).

However, the City's future water system has not yet been evaluated for Cr(VI) treatment options. Additional evaluation needs to occur, taking into consideration the City's future demand growth and water system improvements, to ensure facilities will meet the City's existing needs as well as the planned future growth. A comprehensive evaluation for recommended options should include evaluation of impacts to system operations, distribution facility requirements, and existing and future capacity needs. Additional discussion on this topic is provided in Chapter 4.

ES.4 EXISTING WATER SYSTEM EVALUATION AND FINDINGS

The City's existing potable water system was evaluated using the recommended water system planning and design criteria presented in Chapter 5 along with the newly developed potable water system hydraulic model as described in Chapter 6.

Chapter 7 presents the existing potable water system evaluation and explains each of the recommended existing water system improvements. The existing system capacity evaluation includes an analysis of supply capacity, pumping capacity and storage capacity. The hydraulic performance evaluation assesses the existing potable water system's ability to meet recommended performance standards under maximum day demand include peak hour and maximum day demand plus fire flow demand conditions.

Under existing demand conditions, it was found that the City's existing supplies and storage capacity were adequate to meet existing demand conditions. However, a slight pumping capacity deficit was found. Therefore, it is recommended that an additional 1,000 gpm capacity pump be installed at the City's Fitzgerald Drive booster pump station to address the existing pumping capacity deficit in the North and Core Zones.

[1] As described in Chapter 4, the MCL for Cr(VI) of 10 µg/l, which became effective on July 1, 2014, was invalidated as of September 11, 2017. A new MCL for Cr(VI) has not yet been established; however, it is anticipated that SWRCB will establish a new Cr(VI) MCL which may be at the same level as the invalidated MCL. In anticipation that SWRCB will establish a new MCL that may be at the same level as the invalidated MCL, information on the actions previously taken by the City are summarized in this WSMP.

ES.5 FUTURE WATER SYSTEM EVALUATION AND FINDINGS

The City's future potable water system was evaluated based on planned 2030 and buildout conditions using the recommended water system planning and design criteria presented in Chapter 5 along with the newly developed potable water system hydraulic model as described in Chapter 6.

Chapter 8 presents the future potable water system evaluation and explains each of the recommended future water system improvements. The future system capacity evaluation includes an analysis of supply capacity, pumping capacity and storage capacity. The hydraulic performance evaluation assesses the potable water system's ability to meet recommended performance standards under future maximum day demand include peak hour and maximum day demand plus fire flow demand conditions and identifies any water distribution system deficiencies under future conditions. Several recommendations have been made to address identified future system deficiencies.

In general, additional wells will be needed to meet projected future demands (two new wells by 2030 and an additional two wells for buildout demand conditions), additional storage capacity will be needed in the Northeast Quadrant to meet buildout demand conditions, and new pipelines will be needed within proposed new planning areas and to connect the City's North and South Zones and South and Core Zones. As described in Chapter 8, the recommendation for hydraulically connecting the South Zone to the Core Zone has been made in conjunction with the Southwest Dixon Specific Plan to allow the City water system to be evaluated as a single system rather than two independent systems. And, as part of the proposed development on the east side, it is recommended to include a transmission pipeline to hydraulically connect the South Zone to the North Zone to complete a redundant backbone loop around the City's overall water system to improve the reliability of the City's water system to meet future demands.

The recommended future water system improvements are summarized in Table ES-2.

Table ES-2. Summary of Recommended Future Water System Improvements

Improvement Type	2030 System Recommendation	Buildout System Recommendation
Supply (New Wells)	• Construct two new wells (Southwest Dixon Specific Plan and Northeast Quadrant Specific Plan #1)	• Construct two new wells (East development area and Northeast Quadrant Specific Plan #2)
Storage	• No new storage needed for 2030 conditions	• Construct 0.26 MG of usable storage in Northeast Quadrant Specific Plan
Pipelines (see Chapter 8 for recommended pipeline diameter and lengths)	• From Watson Ranch Facilities to West H Street • Within Southwest Dixon Specific Plan area • Within Northeast Quadrant Specific Plan area • Within South Zone development • To connect South and Core Zones	• East of the existing City limits to connect the South and North Zones • North of I-80

ES.6 STRATEGIC ASSET MANAGEMENT PLAN

As described in Chapter 9, a Strategic Asset Management Plan has been developed for the City's existing water system facilities to provide guidance for prioritizing the most urgent capital and maintenance program improvements. West Yost worked with City staff to define the levels of service and associated performance metrics for the City's existing water facilities and then conducted a risk assessment to consider the likelihood of failure along with the consequence of failure of each individual asset. This then provided a ranking of the City's highest risk facilities.

The City will be able to use the results from the risk assessment preventative maintenance and rehabilitation and replacement programs.

ES.7 RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

Based on the evaluations performed for this WSMP, several improvement projects have been recommended for the City's existing, 2030 and buildout water system. The locations of the recommended water system improvements are shown on Figure ES-1.

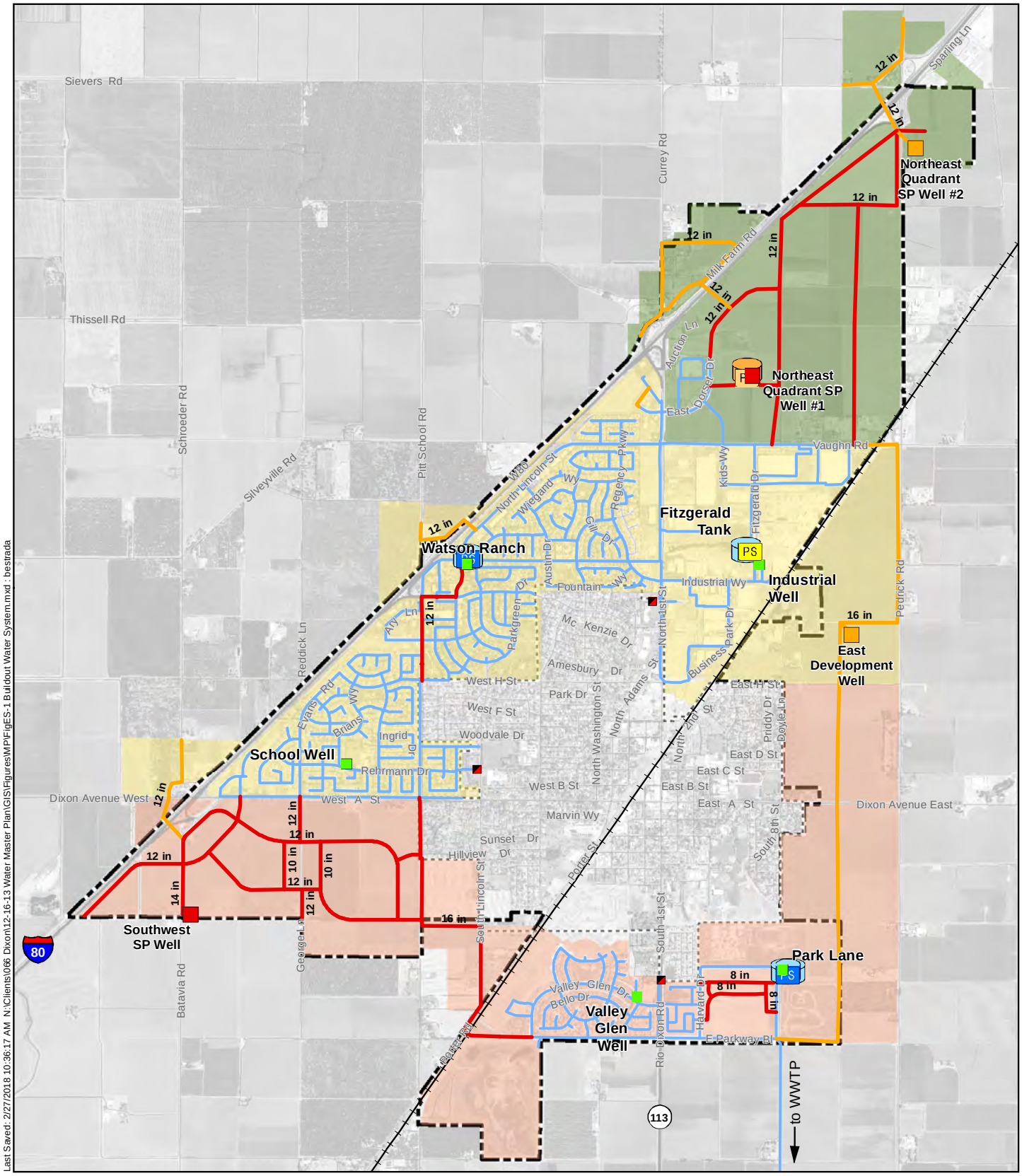
The estimated costs for the recommended Capital Improvement Program (CIP) are described in Chapter 10 and are summarized in Table ES-3 below. Additional details on the assumptions used in the development of the estimated costs are provided in Appendix E.

Table ES-3. Summary of Recommended Water System CIP Cost[a,b]

Improvement Type	Existing System	2030 System	Buildout System	Total Capital Cost
Pipeline		$13,391,000	$10,017,000	$23,408,000
Booster Pump Station	$93,000		$3,606,000	$3,699,000
Supply		$5,820,000	$5,820,000	$11,640,000
Storage			$2,106,000	$2,106,000
Total	$93,000	$19,211,000	$21,549,000	$40,853,000

(a) Costs shown are based on the December 2016 San Francisco ENR CCI of 11,609.
(b) Capital costs include mark-ups equal to 176 percent (Design and Construction contingency: 30 percent; Engineering, Administrative, and Legal: 25 percent; Environmental 10 percent).

The recommended existing system improvements at the Fitzgerald Drive booster pump station should be completed as soon as possible to ensure adequate pumping capacity to meet existing demand conditions. The construction of the recommended future system improvements should be coordinated with the proposed schedules of future development to ensure that the required infrastructure will be in place to serve future customers. It should be noted that the recommended potable water system improvements are identified at a master planning level and subsequent, more detailed evaluations may be needed prior to the design and construction of these improvements to confirm the sizing and locations that will also meet the City's future water system requirements.



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Symbology

Existing Facilities

- Well
- PS — Booster Pump Station
- Tank
- Emergency Intertie
- Existing Pipelines
- PS — Proposed Existing System Pump

Proposed Future Facilities

- New Well 2030
- New Well Buildout
- PS — Proposed Buildout BPS
- Proposed Buildout Tank
- 2030 New Pipeline
- Buildout New Pipeline

N

0 1,500 3,000

Scale in Feet

DIXON CALIFORNIA

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Figure ES-1

Buildout Water System

City of Dixon
Water System Master Plan and
Hydraulic Model Update

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