Executive Summary

ES.1 Purpose and Study Area

This report has been prepared to provide the City of Lincoln with an update to the 2014 Facilities Master Plan. Most significantly this report includes a new 12-year capital improvement program, developed based on revised background data for population growth and demand forecast, with consideration for impacts associated with climate change. The recommended improvements plan presented herein will serve as a basis for the planning, design, construction, and financing of facilities to meet the city's anticipated population growth and commercial development through Year 2032. Figure ES-1 presents the study area and anticipated growth tiers for the plan.

Climate change is of ever-increasing concern to the general public given the volatility of recent weather patterns in the State. This facilities master plan update provided an opportunity for the Lincoln Water System (LWS) to consider the impacts of climate change for the first time in their water supply planning process. The specific climate change impacts considered under this study included reduced supply capacity as a result of higher temperatures, reduced stream flows, increased variability in precipitation, and expected increased summer seasonal peak 90-day demand due to longer periods of dry weather.

The principal elements of this master plan study update include evaluation of the following:

- <u>Update Population Projections</u> - Update the population projections to be consistent with the 2040 Comprehensive Plan (*LPlan 2040*) updated and adopted in December 2016. Design Years will include Year 2020, 2025, 2040, and 2060.
- <u>Revise Demand Projections</u> – Evaluate trends in water use and update demand projections taking into account climate change.
- <u>Update Water Supply Projections</u> – Determine 30-day, 60-day, and 90-day water supply yields utilizing existing groundwater model. Utilize basin-wide groundwater modeling tools, with adjustment for climate impacts, to revise streamflow input into the model.
- <u>Evaluate the Water Treatment Plant (WTP)</u> – Review historical records to confirm compliance with regulations. Perform high level condition assessment to determine necessary improvements for ongoing reliable operations. Evaluate timing and need of plant expansion based upon revised demands, condition assessment, and process considerations.
- <u>Distribution System Analysis</u> - Update the computer model of the Lincoln water distribution system in InfoWater hydraulic analysis software and perform analyses for average day, maximum day, and maximum hour scenarios for Years 2020 and 2032.
- <u>Perform Distribution Water Quality Analyses</u> – Evaluate available historical water quality data, perform distribution water age analyses, and develop protocol for system improvements which enhance water quality in the system.
- <u>Update Transmission Condition Assessment</u> – Develop condition assessment program for the transmission system based upon available technology, inspection cost, pipe material, and main criticality.
- <u>Lead Service Line Review</u> – Review existing records to quantify existing lead service lines and provide summary of regulations and replacement strategies.
- <u>Capital Improvement Program</u> – Prepare an update of recommended water system improvements.

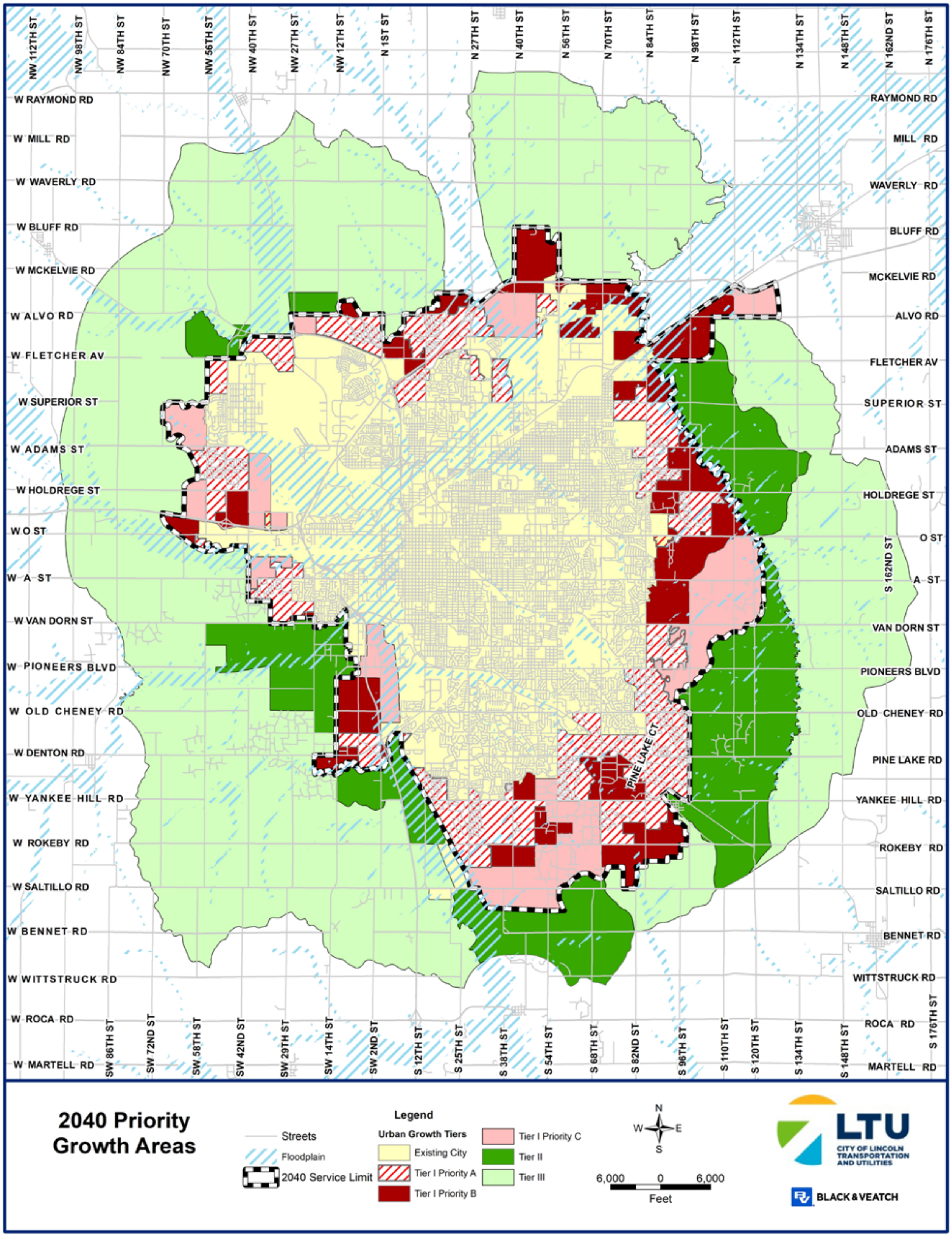

Figure ES-1 Study Area and Priority Growth Areas

ES.2 Population

To accurately predict future water demands, the magnitude, location, and characteristics of future population growth were evaluated. Population projection data for the City of Lincoln was obtained from the current *LPlan 2040*, which delineates the spatial distribution of growth within the growth tiers by Traffic Analysis Zones (TAZ) through Year 2040. Beyond 2040, the *LPlan 2040* uses an extrapolation to develop the 2060 projections. Figure ES-2 presents the historical and projected population through 2060.

The *LPlan 2040* is currently being updated, and the revised version is expected to include a slightly lower rate of population growth. Therefore, the population projections used in this Master Plan update based on the current *LPlan 2040* (adopted in December 2016) may be slightly higher than future projections from the upcoming *LPlan 2040* update.

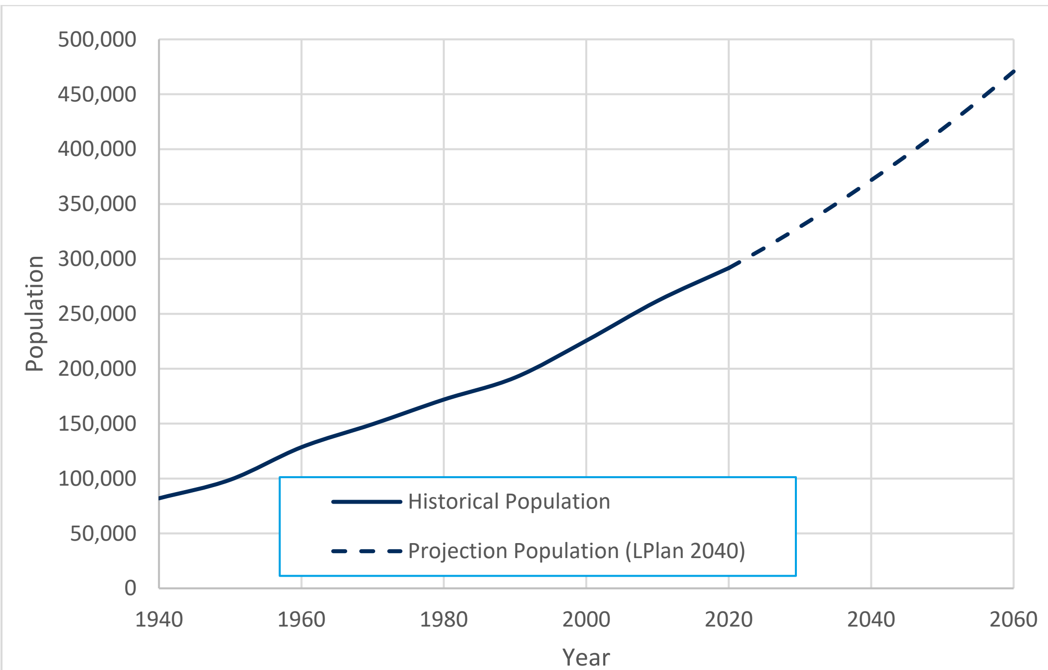

Figure ES-2 City of Lincoln Historical and Projected Population

Census population data was used to update the population by Service Level for Year 2010 and the *LPlan 2040* data was used to develop the population projections by Service Level for the planning period, demonstrated in Figure ES-3.

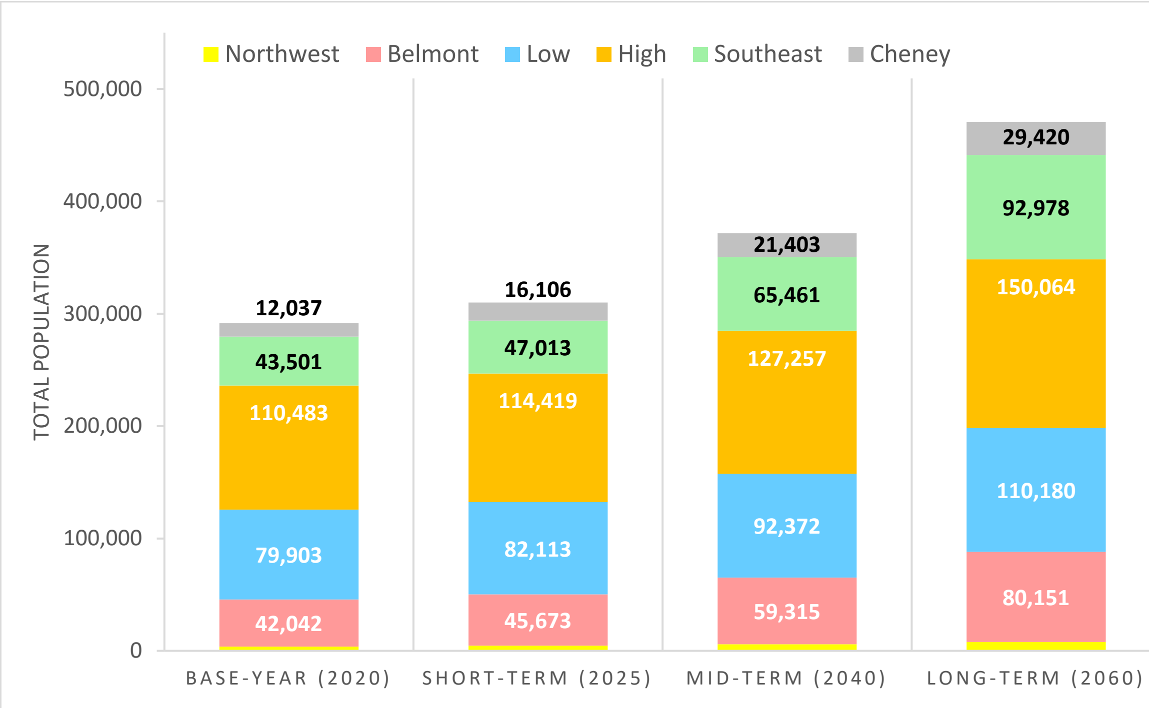

Figure ES-3 Existing and Projected Population by Service Level

ES.3 Water Capacity Requirements

The water capacity assessment focuses on average day demand (AD), seasonal peak demand (SP), maximum day demand (MD), and maximum hour demand (MH), which are typically used for design and operation of WTP and distribution system infrastructure.

- **Average Day (AD)** demand is the total annual water use divided by the number of days in the year.
- **Seasonal Peak (SP)** demand is the average daily use of water over the highest three consecutive months of demand during a given year, generally June through August or July through September.
- **Maximum Day (MD)** demand is the maximum quantity of water used on any one day of the year and is used to size water supply, treatment facilities, and pumping station capacity needs.
- **Maximum Hour (MH)** demand is the peak rate at which water is required during any one hour of the year.

ES.3.1 Historical Water Usage

Historical and current water capacity requirements were updated based on data available from distribution production reports and metered sales reports from 2013 to 2018 and the water treatment plant monthly operating reports from 2013 to 2020. This information was used to characterize historical water usage trends and to establish criteria for future water demand projections, including peaking factors, residential per capita usage, percentage residential usage, and non-revenue water. Figure ES-4 presents a summary of the historical water usage and per capital usage (overall and residential) from Year 2000 to Year 2018.

Historical metered sales data was used to assess the mix of residential and non-residential water use, to determine typical per capita water use rates, and to update non-revenue water characteristics. Analysis of historical meter sales demonstrates that the percentage of residential metered sales has consistently remained around 65 percent of total sales.

Non-revenue water includes water used for flushing, firefighting, water main breaks, leakage and apparent losses (meter inaccuracies). Non-revenue water has varied significantly, ranging from approximately 2 percent (excluding Year 2006) to 15 percent with an average of 9 percent in recent years. The City's non-revenue water was compared with AWWA performance indicators, which characterize non-revenue water as gallons per day of water loss per service connection. The City's 2018 total water loss of 50.5 gal/d per service connection is less than the AWWA median values of 78 gal/d per service connection, meaning that the City is in the lower 50 percent of community water loss based on the audit conducted by AWWA.

A downward trend in per capita usage was observed between Years 2000 and 2018, although the curve appears to start flattening in Year 2014. While the City may continue to see a downward trend in per capita usage, it is anticipated that a limit will be reached over the next decade.

- The following planning criteria were modified based on analysis of historical records:
- Declining trend in residential per capita usage.
- Increased percentage of non-revenue water from 6.7 to 9 percent.
- Reduced MD:AD peaking factor from 2.4 to 2.25.

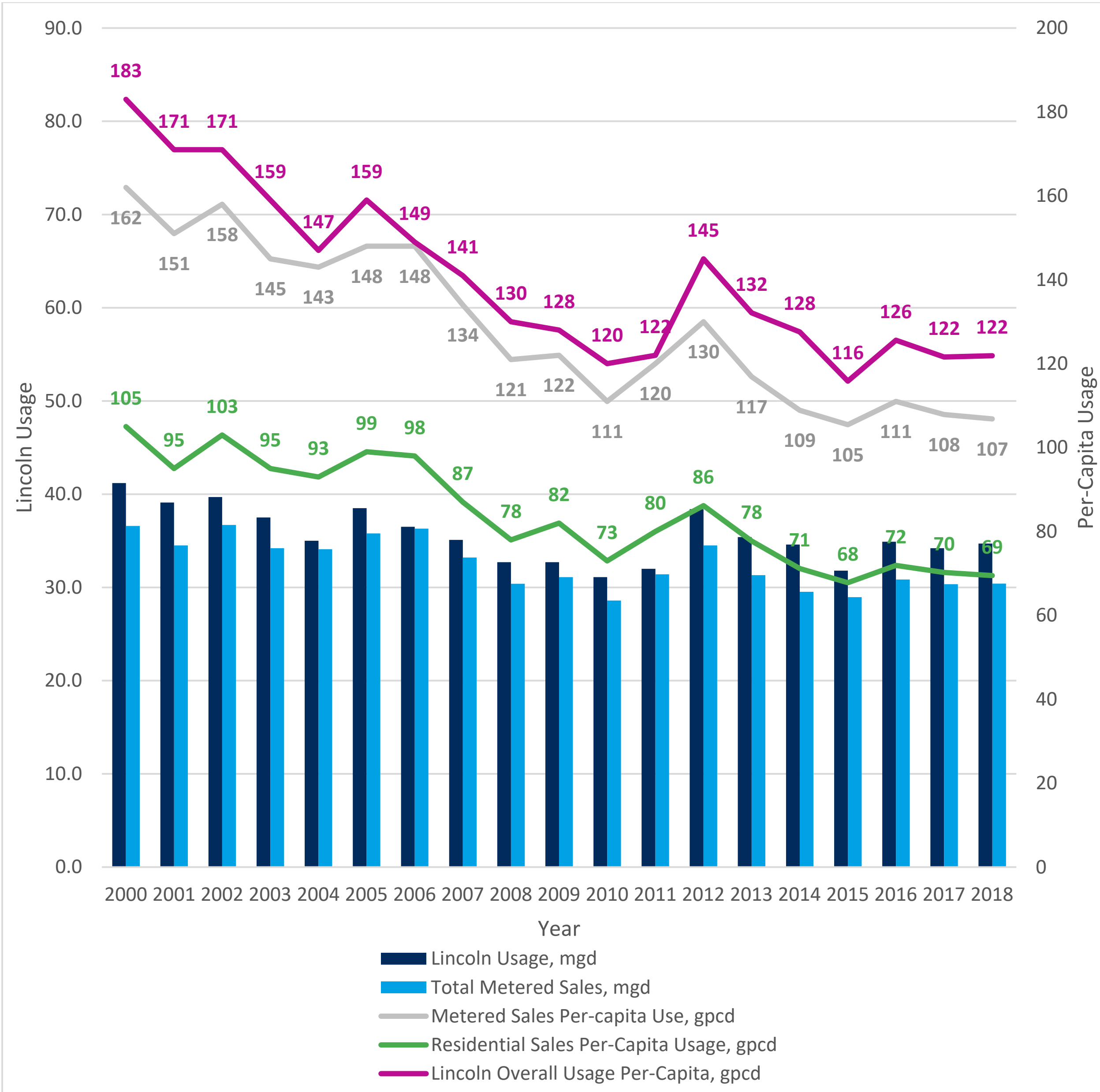

Figure ES-4 Historical Water Use and Per Capita Usage

ES.3.2 Water Demand Projections

Water demands for the planning horizon included Years 2020, 2025, 2040, and 2060 with interpolated demands for interim years (i.e. Year 2032). The water demand projections are based on the population forecasts and historical trends for residential per capita usage, percentage residential usage, non-revenue water, and peaking factors. Figure ES-5 provides a summary of the demand projections based on the planning criteria.

Considerations for climate change were used to evaluate impacts on SP wellfield pumpage. Specifically, water demand projections were adjusted based on the following mid-century (Years 2041 to 2070) climate change projections:

- 4 to 5°F increase in ambient air temperatures year-round.
- 15 to 20 percent increase in precipitation in the winter, spring and fall.
- 15 to 20 percent decrease in precipitation in the summer.

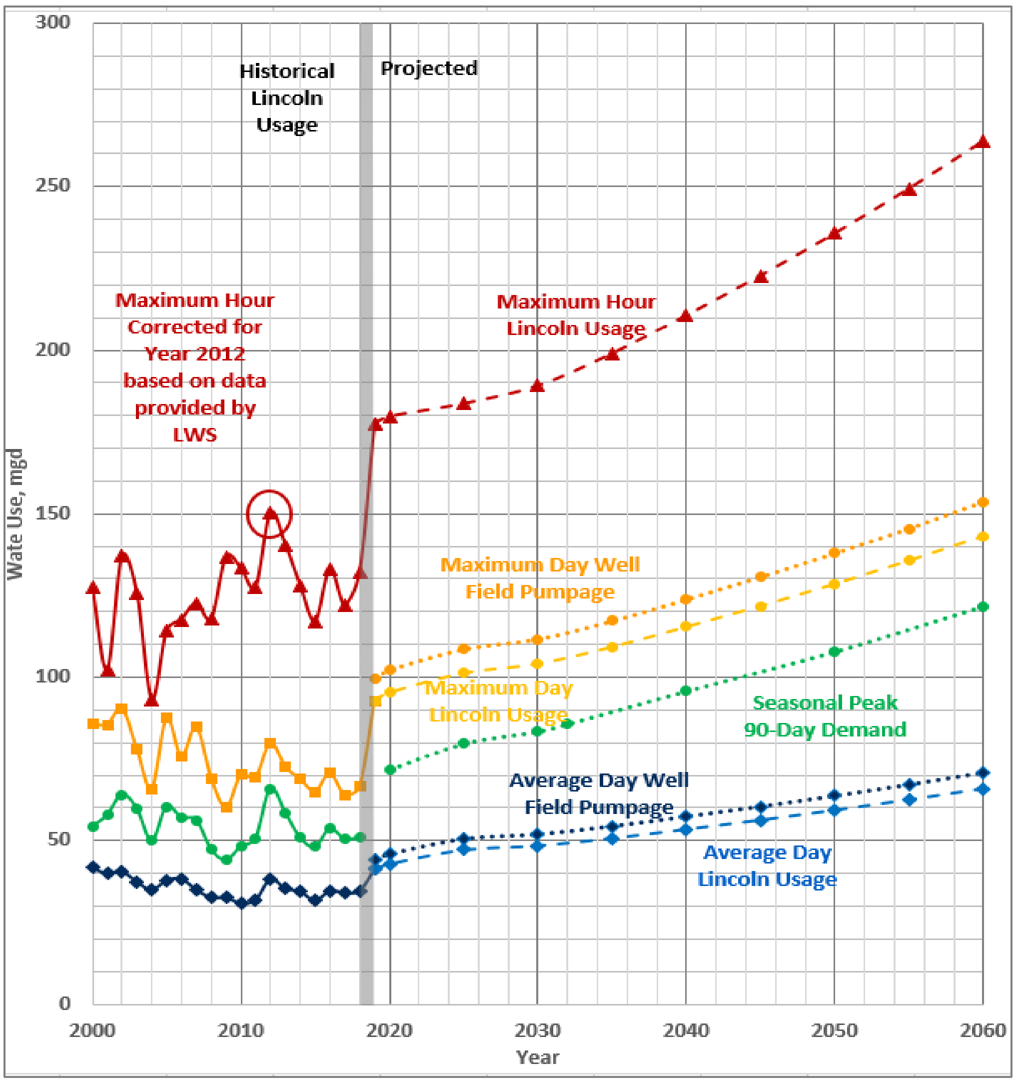

Figure ES-5 Future Demand Projections and Well Field Pumpage Requirements

ES.4 Water Supply

The Lincoln wellfield is heavily dependent on Platte River streamflows that recharge the alluvial aquifer from which water is withdrawn. During periods of normal and high streamflows, the aquifer receives plenty of recharge and the wellfield is easily able to meet demands. However, during periods of lower streamflows, it is possible for withdrawals to begin to exceed the rate at which water is recharged from the stream to the aquifer. The single greatest threat to the wellfield's water supply is extended periods of low river flows, such as those that occurred in early Year 2000 and again in Year 2012. Long-term groundwater flow modeling simulations using regional- scale models were developed to forecast future streamflow conditions and in particular, the impact of streamflows during low-flow conditions.

The groundwater model results demonstrate reductions in streamflow, which primarily occur in the Central Platte River above the confluence with the Loup River. The results of this evaluation for the 90-day low-flow at recurrence intervals between 5 years and 500 years for the 2040 planning horizon are shown in Figure ES-6.

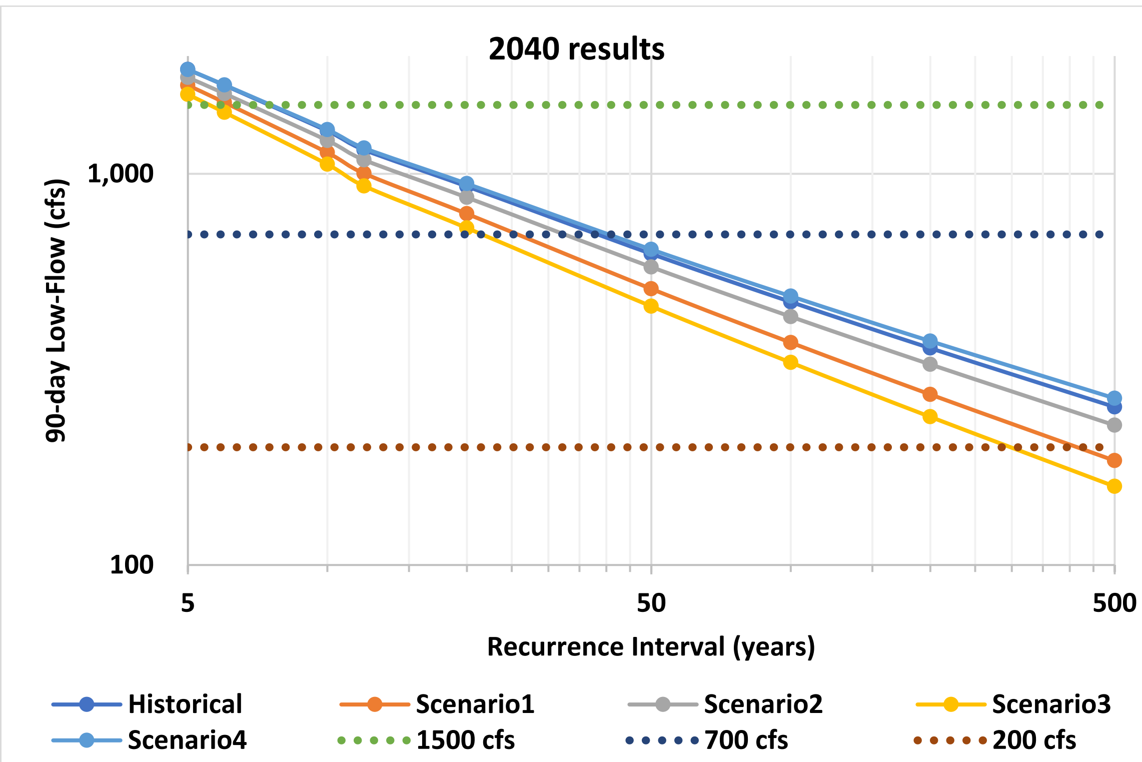

Figure ES-6 90-Day Low-Flow Conditions for the Historical Data and Each Scenario for the 2040 Model Results for Recurrence Intervals Between 5 Years and 500 Years

The benchmark for wellfield expansion is the capability to supply the summer seasonal demands over a 90-day period with the river level at 200 cfs. MODFLOW modeling results determined that the existing system is capable of producing 90 mgd over the 90-day duration. As shown on Figure ES-7, the existing facilities are capable of meeting this hypothetical design condition through Year 2035. Installation of an additional horizontal collector well (HCW-5) by Year 2035 would be considered a "just in time" improvement. It is therefore recommended that the City consider advancing this improvement a few years in the capital improvement plan to be ahead of the demand. MODFLOW modeling was also performed to determine the 90-day system capacity with the implementation of HCW-5 and HCW-6. These analyses indicate that with the two future wells, LWS's projected seasonal capacity would be 105 mgd.

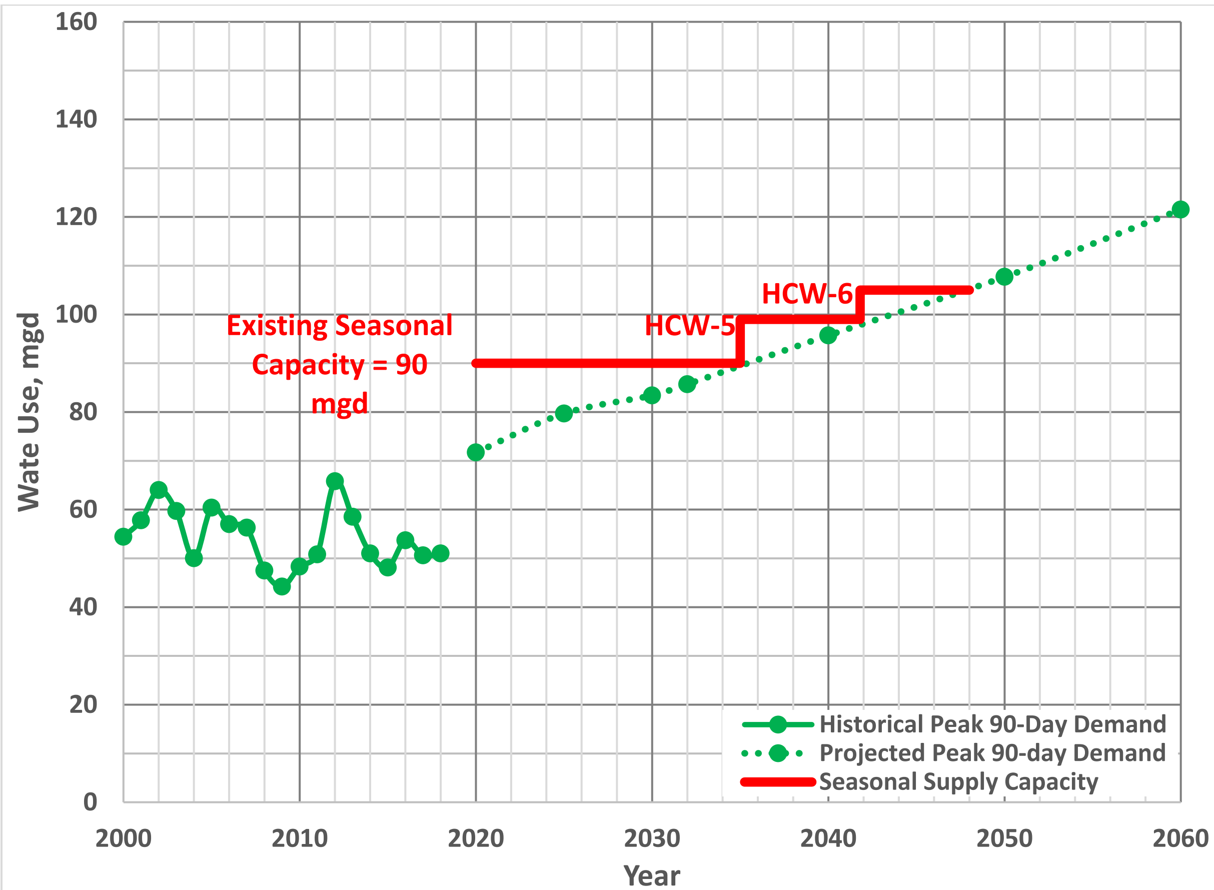

Figure ES-7 Future Supply Expansion

ES.5 Water Treatment

LWS owns and operates two water treatment facilities co-located near Ashland. The East Plant consists of ozone and chlorine for primary disinfection, followed by dual media filtration and chloramines for secondary disinfection. The West Plant consists of aeration, chlorine for primary disinfection, sand filtration and chloramines for secondary disinfection.

ES.5.1 Water Quality Trends

Based on an analysis of the water quality and operating data received, the LWS Ashland plants appear to be in compliance with the applicable rules and regulations. However, as the City continues to expand the use of HCWs, WTP improvements will be required to address more challenging water quality conditions. Since the HCWs are hydraulically connected with the Platte River, water quality from the HCWs is characterized by warmer water temperatures and higher concentrations of atrazine, arsenic, and total organic carbon (TOC). Given these trends in water quality and future installation of HCWs, additional treatment measures will be required to address arsenic and atrazine levels in the future.

Given the relatively high concentrations of atrazine in the Platte River, LWS has undertaken atrazine management practices during the spring and summer when agricultural runoff contributes to elevated atrazine levels. Atrazine management practices include ozonation and limiting the use of the HCWs, which experience higher concentrations of atrazine.

As with atrazine, LWS has had to implement wellfield management practices to maintain compliance with the arsenic MCL. While LWS has maintained regulatory compliance for arsenic, the concentration of arsenic in the raw water supplied from the HCWs appears to be increasing over time, trending towards the MCL of 10 μg/L. Figure ES-8 shows the concentration of arsenic in raw water samples collected from the East and West Plants from January 2017 through August 2019.

LWS will likely need to implement a treatment system in the future to address the relatively high concentrations of arsenic in the HCWs and expected concentrations of arsenic in the future HCWs. Additional bench-scale testing is recommended to further investigate treatment alternatives and identify a cost-effective solution for arsenic treatment.

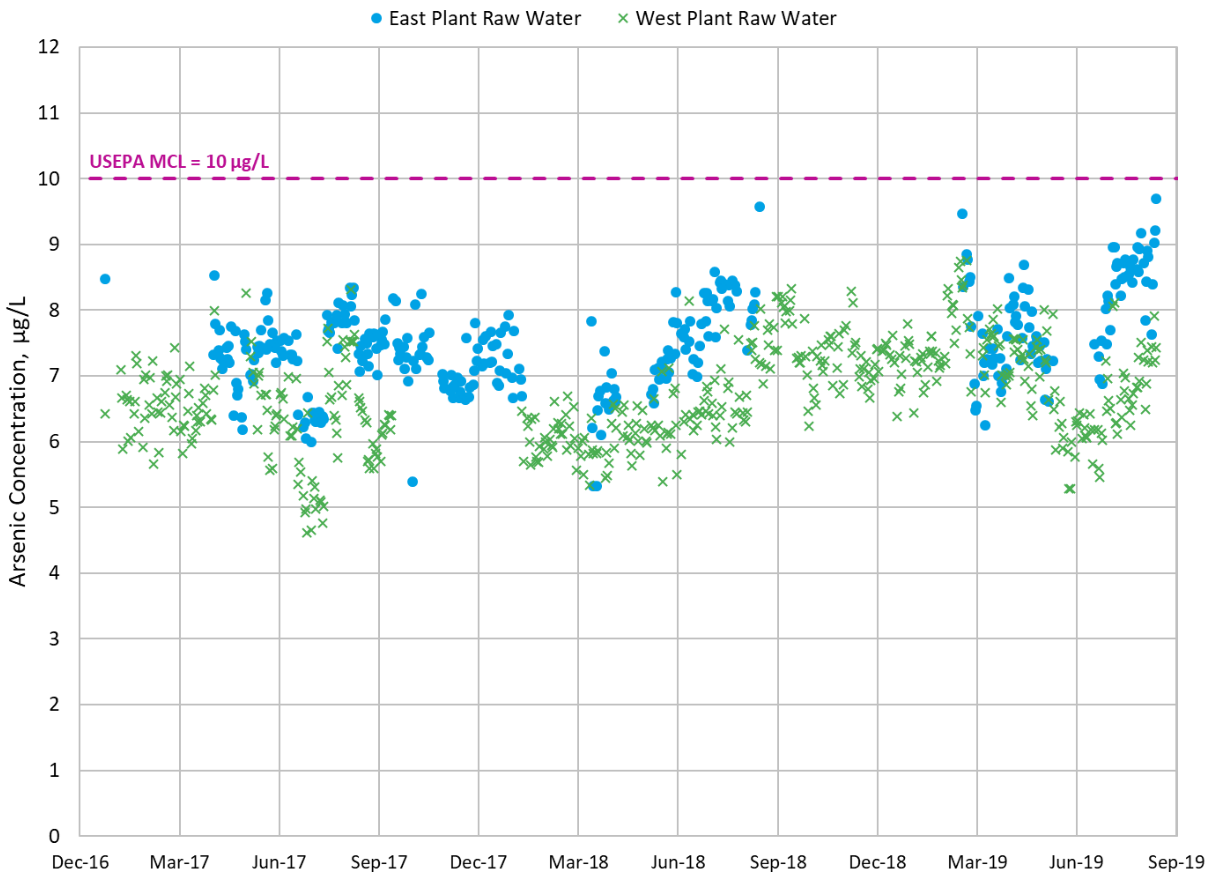

Figure ES-8 Raw Water Arsenic Concentration from January 2017 through August 2019

ES.6 Potential Future Regulations

ES.6.1 Proposed Lead and Copper Rule Revisions

The U.S. Environmental Protection Agency (EPA) announced proposed revisions to the Lead and Copper Rule (LCR) in October 2019 with promulgation of the final rule anticipated in Year 2020. The proposed LCR includes several revisions with a focus on proactive measures to improve finished water quality at the customers' tap. While final revisions to LCR are still being developed, major changes in the proposed LCR revisions include:

- Public water systems (PWSs) must develop a publicly available lead service line (LSL) inventory (including lead goosenecks and downstream galvanized iron service lines on both PWS's side and homeowner's side).
- Retain the current lead AL of 15 µg/L, and add a new lead trigger level of 10 µg/L. If the 90th percentile lead concentration exceeds the new trigger level of 10 µg/L, the PWS would be required to conduct a corrosion control study to optimize or develop a CCT, complete annual LCR monitoring, conduct public outreach and establish an annual goal for LSL replacement.
- If the 90th percentile lead level exceeds the AL, then the PWS must fully replace 3 percent of LSLs annually for consecutive 6-month monitoring periods.

- PWSs must "find-and-fix" sites with lead levels greater than the AL, conduct additional sampling, and work with their Primacy Agency to identify if corrective actions are needed.
- Partial LSL replacements would no longer be allowed except in rare circumstances.
- LCR compliance sampling modifications would include a new Tier structure with LSLs as Tier 1 and copper pipe with lead solder as Tier 3; additionally, pre-flushing and removal of aerators would be prohibited, and the use of wide-mouth sample bottles would be required.
- PWSs must test for lead at 20 percent of schools and 20 percent of childcare facilities.

ES.6.2 PFAS Action Plan and Regulatory Determination

Per- and polyfluoroalkyl substances are a class of thousands of man-made chemicals that are used in the manufacture of many industrial and consumer products. PFAS chemicals are heat stable, non-biodegradable, bioaccumulative, and very persistent in the environment. Due to their widespread application, PFAS are now found in many drinking water sources across the United States. In 2016 the EPA established non-enforceable drinking water health advisory levels for two prevalent PFAS chemicals, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) as a total concentration of 70 ng/L.

In February 2019, the EPA issued a PFAS Action Plan, aimed at comprehensively addressing PFAS in the environment. The EPA has proposed regulating PFAS under the Safe Drinking Water Act (SDWA), the Toxic Substances Control Act (TSCA), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, also known as Superfund), and the Clean Air Act. Currently, there are no federal MCLs established for PFAS chemicals under the SDWA. However, in February 2020, the EPA announced that it intends to regulate both PFOA and PFOS under the SDWA.

ES.6.3 Water Plant Expansion

The existing treatment capacity of 120 mgd for the combined East and West Plants is capable of meeting projected demands through the Year 2037. The *2014 Facilities Master Plan* had identified the next plant expansion to occur at the West Treatment Plant by means of filter rehabilitation. The scope of this master plan update included additional focus on condition assessment of the existing treatment plants, along with input from operations, to take a second look at this approach and compare expansion of the two plants.

Concerns have been raised by plant staff about the feasibility of treating over 70 mgd through the West Plant. In order to expand the West WTP, additional modifications beyond filter rehabilitation would be required. Other recommended improvements include replacement of the existing clearwell transfer pumps, addition of a fourth aerator and chlorine contact basin, chemical feed modifications, and an allowance for hydraulic improvements.

Alternatively, the East WTP currently has a capacity of 60 mgd and is expandable in increments of 30 mgd to provide an ultimate capacity of 180 mgd. East Plant expansion alternatives considered the addition of either two filters (15 mgd) or four filters (30 mgd), additional ozone capacity and associated infrastructure. The cost to add only two filters was not deemed to be in the City's best interest as it would be inefficient with respect to building walls, foundations, ozone system expansion, etc. Therefore, expansion of the East Plant by an additional 30 mgd is recommended.

ES.7 Distribution System Facilities

The LWS service area is currently divided into the following service levels: Low, High, Belmont, Southeast, Cheney and Northwest. Service level boundaries are established to maintain acceptable distribution system pressures.

A desktop evaluation was conducted to determine whether the existing distribution system facilities have sufficient pumping capacity and storage capacity to meet future demands for the 2032 planning period. Based on a capacity evaluation, there are no pumping capacity deficits through the 12-year CIP that need to be addressed. The desktop evaluation suggests that there are storage deficiencies under emergency conditions in the High, Northwest and Cheney Service Levels. These storage deficiencies can be addressed through operational practices, “smart watering” programs and planned infrastructure improvement projects.

ES.7.1 Focus Areas

Distribution system modeling was conducted using extended period simulations (EPS) for maximum day demand conditions. Three focus areas were assessed specifically in this Master Plan update.

- North 56th Street and I-80.
- Folsom and Old Cheney.
- 27th and Rokeby.

Hydraulic modeling scenarios were performed for Year 2020 and 2032 to evaluate potential improvements required for localized large user demands near North 56th St and I-80. Recommended improvements include implementation of a booster pump station south of I-80 near Arbor Rd and 56th St and implementation of a 24-inch north loop to provide full redundancy.

The area around Folsom and Old Cheney is expected to grow from a population of 550 to over 4,000 between Year 2026 and Year 2040. This area is served by a long 16-inch main and has no other redundant feed. Modeling results indicate that a pipe improvement along Old Cheney through Wilderness Park and installation of a bi-directional control valve could allow for bi-directional flow between High and Belmont Service Levels, providing the level of redundancy needed.

ES.7.2 Distribution System Modeling

The goal of the EPS modeling was to verify the desktop evaluations for storage and pumping capacities and see how the system responds to a design (extremely hot and dry year) demand condition. The model results support the desktop evaluation in that there is generally excess pumping capacity and storage to meet Year 2020 maximum day demands and the ability to refill storage during replenishment conditions exists. However, the rapid draft rate of Southeast and S. 56th Street tanks during peak hourly demands indicate that hydraulic restrictions do occur when pumping into the High Service Level. The addition of a pump at the Vine East Station, scheduled for Year 2020, will allow for more pumping from the Low Service Level to the Southeast Service Level, reducing flows from High to Southeast and associated hydraulic restrictions. Additionally, the Adams Street Reservoir, scheduled in Year 2030, will provide equalization and emergency storage in the High Service Level.

The results of the 2020 maximum day EPS scenario support the addition of Pump No. 8 at the Vine East Pumping Station East and the addition of the Adams Road Reservoir and pipelines in the 12-year CIP. Pipeline improvements in the Belmont Service Level between "O" Street and Partridge are recommended in the 6-year CIP and will provide support to an area which could experience low pressure.

Several areas in the distribution system with pressures ranging from 30 to 35 psi were identified, whereas only two areas with pressures above 120 psi were identified. The areas along boundaries should be monitored during design years and if it is determined that low pressures are resulting in customer complaints, pressure reducing valves could be added at the boundary locations. The same notable lower-pressure areas in the distribution system also occurred in the 2032 EPS scenario with the exception of the high ground area in the Cheney Service Level which has improved to above 40-psi.

Several of the items in the CIP were evaluated through the 2020 EPS and 2032 EPS base modeling scenarios. Others were individually evaluated to determine their need and usefulness. Several additional scenarios were performed, unique to the improvement being evaluated. Modeling scenarios include construction of new pumps, pumping stations, reservoirs, water mains, and PRVs, as well as other infrastructure improvements, rehabilitation efforts and decommissioning of existing pumping stations.

ES.8 Distribution Water Quality

Based on a review of distribution water quality data, LWS has demonstrated effective management of DBPs and as a result, is on reduced monitoring for bromate, TTHM and HAA5. LWS has maintained a bromate RAA of less than 25 percent of the MCL since 2013. Similarly, the LRAA for TTHMs has consistently been less than 40 μg/L (50 percent of the MCL), and the LRAA for HAA5s has been maintained at less than 20 μg/L (33 percent of the MCL).

LWS is also on reduced monitoring for lead and copper, which requires LCR compliance data to be collected every three years. The 90th percentile values for lead and copper compliance monitoring in 2013, 2016 and 2019 have been below the action levels of 15 μg/L and 1300 μg/L, respectively. The proposed LCR revisions have proposed a new lead trigger level of 10 μg/L to prompt water systems to take proactive actions to reduce lead levels prior to exceeding the lead AL. Since 2004, the 90th percentile value for lead has been less than 5 μg/L, which is well below the proposed trigger level. Additionally, given the LWS's existing LSL inventory and replacement plan, LWS is well-positioned to comply with the potential requirements for implementing a publicly available LSL inventory and proactive, full LSL replacement program.

Between 2014 and 2017, LWS experienced challenges with nitrification between the months of August and December. Nitrification was characterized by rising water temperatures, loss of chlorine residual, increases in nitrite concentration, and in some locations, occurrences of HPCs. In 2018, LWS made significant improvements in distribution system water quality through various nitrification control measures, which resulted in increased chlorine residuals throughout the distribution system and reduced nitrite and nitrate concentrations. The nitrification control measures included increasing the chlorine residual at the POE, taking the East Plant out of service during peak nitrification season, and reducing water age in the distribution system by isolating and reducing operating volumes in reservoirs.

This resulted in considerable improvements to distribution system water quality in the High, Low and Southeast Service Levels. However, the areas surrounding Air Park, Northwest, Cheney, and southern parts of Southeast still had difficulty maintaining chlorine residuals greater than 0.5 mg/L at the distribution system monitoring sites. Additionally, alternative long-term solutions should be investigated, since taking the East Plant out of service limits the overall plant capacity and is not sustainable for future operations. Potential long-term solutions include:

- Chloramine booster systems within the distribution system.
- Improvements to tank mixing in distribution system reservoirs.
- Biological filtration at the East Plant.
- Sodium chlorite feed at the East and West Plant.

Given the continued challenges in Air Park, Northwest, Cheney and southern parts of Southeast Service Levels; a source trace analysis was conducted to identify optimal locations for chloramine booster systems. Source trace analysis is used to identify the percentage of water that comes from a given source, allowing for easier identification of areas that can provide a high impact on water quality. Based on the source trace analysis, it was determined that chloramine booster systems should be implemented at Yankee Hill and Pioneers.

- **Yankee Hill** – Most of the water in the Cheney SL and southern parts of Southeast SL has passed through the Yankee Hill reservoir, making it an ideal location for rechloramination. It is also recommended that a PRV be installed around 84th and South Street to allow rechloraminated water to be transferred to the High SL to address pockets with low chlorine residual.
- **Pioneers** – The source trace analysis found that during winter operations, over 80 percent of the water in Air Park and at least 60 to 80 percent of the water in the Northwest SL has been pumped through Pioneers Pumping Station. With such a high proportion of water from Pioneers being delivered to these areas, there is a meaningful opportunity to improve distribution water quality through rechloramination at Pioneers.

For the time being, it is recommended that LWS continue with their current nitrification control measures, while other in-plant treatment and distribution system management alternatives are evaluated. The following alternatives for distribution system water quality improvements are recommended for further evaluation through pilot testing. Each of the proposed treatment alternatives should be compared with the plant's current operating conditions to establish a baseline and determine the preferred approach for nitrification control.

- **Biological filtration** – This alternative considers implementation of biological filtration in the East Plant to reduce the concentration of AOC, which is increased during the ozonation process. Reducing the AOC in the finished water will improve biological stability in the distribution system, which could allow for continued use of the East Plant during peak nitrification seasons.
- **Sodium chlorite** – This alternative considers feeding 0.3 mg/L of sodium chlorite to the plant finished water. Sodium chlorite is particularly effective at inactivating ammonia oxidizing bacteria and has proven to be effective for nitrification control for other utilities in the Midwest.
- **Improvements to Tank Mixing** – This alternative considers field-testing to evaluate the performance of existing distribution system tank mixing systems to provide guidance on future implementation strategies to reduce potential for stratification.

ES.9 Recommended Improvements

A comprehensive capital improvements program was prepared based on findings from the hydraulic analyses, plant and distribution water quality analyses, WTP condition assessment, transmission main criticality assessments, and projections for overall system growth. The recommended phased improvements summarized in this report represent an update to the *2014 Facilities Master Plan*. Changes to the CIP are a result of updated demand projections, which impact the schedule for implementation. Other changes to the CIP were predicated on additional input from the City, along with alternative analysis by the Black & Veatch.

The phases of the program are summarized below:

- **Phase I – Immediate Improvements:** Phase I improvements have been identified as higher priority as a result of their immediate need or as a result of currently anticipated development and correspond to FY 2019/2020 thru 2025/2026. These improvements are intended to meet the needs of the Comprehensive Plan – Tier 1 (Priority A) growth areas.
- **Phase II – 12-Year Short-Term Improvements:** Phase II improvements are recommended to meet projected water demands from FY 2026/2027 through FY 2031/2032. The Phase II improvements will extend service to the limits of the Tier I –Priority B area.

Table ES-1 summarizes the recommended immediate and short-term improvements included in the 12-Year CIP, as well as the proposed schedule for implementation and opinion of probable construction costs for each activity. Phase I improvements are identified by the code "IM" for immediate improvements. Phase II improvements are identified by the code "ST" for short-term improvements. Other improvements that extend beyond the 12-Year CIP planning period are identified by the code "LT" for long-term improvements.

Table ES-1 Recommended Improvements – Schedule and Cost Summary

Recommended Improvements				
Year	**CIP Tag**	**Description**	**Improvement Type**	**Total Capital Cost (FY 2020)**
Phase I – Immediate Improvements				
2020	IM-1	Valve Replacement and Automation at 51st Street PS	Facility	$380,000
2020	IM-2	NW 12th Street Pumping Station	Pumping	$4,608,000
2020	IM-3	Vine Street Pumping Station East - Add Pump No. 8 w/ AFD	Pumping	$2,357,000
2020	IM-4	Innovation Campus - Phase 1 - 16-inch Main	Distribution	$1,172,000
2021	IM-5	I-80 & 56th Street Pumping Station - Supply Main and PS	Pumping	$5,760,000
2021	IM-6	I-80 & 56th Street Pumping Station - Belmont Loop	Distribution	$5,607,000
2021	IM-7	Arsenic/Atrazine Study and Preliminary Design	Treatment	$250,000

Recommended Improvements				
Year	CIP Tag	Description	Improvement Type	Total Capital Cost (FY 2020)
2022	IM-8	Distribution Water Quality Improvements - Phase 1	Distribution	$3,013,000
2022	IM-9	16-inch Main on NW 56th Street, "O" St. to Partridge Lane	Distribution	$1,439,000
2022	IM-10	Decommission Merrill Street Pumping Station	Pumping	$306,000
2022	IM-11	Rehabilitate Eddy Current Drive - Northeast #6	Pumping	$121,000
2022	IM-12	West Water Treatment Plant Rehabilitation	Treatment	$2,285,000
2023	IM-13	31st and Randolph Valve Vault Relocation to "A" street	Facility	$343,000
2023	IM-14	Add 20.9 mgd WTP South Pumping Station Pump No. 13	Pumping	$1,806,000
2023	IM-15	2023 Master Plan	System	$1,000,000
2024	IM-16	Add AFD's at Pioneers Pumping Station	Pumping	$236,000
2024	IM-17	Pressure Monitoring Stations	Distribution	$165,000
2024	IM-18	East Plant Overall Rehab	Treatment	$669,000
2024	IM-19	Decommission South 56th Street PS	Pumping	$300,000
2024	IM-20	Condition Assessment of 36-inch Cast Iron from 51st to A Street	Condition	$223,000
2024	IM-21	Condition Assessment of 48-inch PCCP from Ashland to NE	Condition	$310,000
2024	IM-22	Condition Assessment of 54-inch PCCP from Northeast to Vine	Condition	$471,000
2025	IM-23	Arsenic Treatment - Adsorber	Treatment	$40,704,000
			Subtotal	**$73,525,000**
Phase II – Short-Term Improvements				
2026	ST-1	Northwest Reservoir (2 MG) and Pipeline	Storage	$5,918,000
2026	ST-2	Belmont to Low PRV Station ("O" Street and N 12th Street)	Distribution	$180,000
2027	ST-3	Decommission NW 12th Street Pumping Station	Pumping	$320,000
2027	ST-4	Decommission Cheney Pumping Station	Pumping	$313,000
2027	ST-5	Yankee Hill Pumping Station - Add 6 mgd Pump	Pumping	$518,000

Recommended Improvements				
Year	CIP Tag	Description	Improvement Type	Total Capital Cost (FY 2020)
2027	ST-6	PRV Southeast SL to High SL - Vault near Southeast PS	Distribution	$180,000
2027	ST-7	Innovation Campus - Phase 2 - 12-inch Main	Distribution	$729,000
2028	ST-8	Distribution Water Quality Improvements - Phase 2 (Pioneers WQ)	Distribution	$1,382,000
2030	ST-9	Adams Street Reservoir and Pipelines for HSL (5 MG)	Storage	$11,985,000
2032	ST-10	54-inch Main from Northeast PS to 88th and Holdrege	Transmission	$26,695,000
			Subtotal	**$48,220,000**
Long-Term Improvements				
2033	LT-1	36-inch Transfer Main from Vine Street Reservoir to A Street Reser	Transmission	$17,518,000
2033	LT-2	Horizontal Collector Well No. 5 - Site 7	Supply	$12,136,000
2034	LT-3	Water Treatment Plant Expansion - Ozone and East Filters	Treatment	$24,804,000
2041	LT-4	Horizontal Collector Well No. 6 - South Site	Supply	$11,922,000
		New Source of Supply Reserve Fund	Supply	$22,000,000
		Lead Service Line Replacement Program	Distribution	$35,280,000
			Subtotal	**$123,660,000**
Total Cost				**$245,405,000**

In addition to these improvements for supply, treatment, transmission capacity, and storage, system growth requires distribution system "main extensions" to serve developing areas. These main extensions, as well as recommended fire flow improvements, required over the next 12 years are summarized in Table ES-2.

Table ES-2 Recommended Fire Flow and Main Extension Improvements

Year	Description	Total Capital Cost (FY 2020)
Immediate	Fire Flow	$1,110,000
Immediate	Main Extensions	$14,263,000
Year 2020-2026	6-Yr Main Extensions	$27,966,000
Year 2027-2032	12-Yr Main Extensions	$41,215,000
Total Cost		**$84,554,000**