Water System Master Plan

Executive Summary

Sandy PUBLIC UTILITIES

September 2022

Sandy City Department of Public Utilities desires to develop an updated master plan for it's water system. This consists of three planning sections for the City's water system:

Supply and Demand Analysis
An examination of water demands expected in the City and the existing and future supplies available to meet those demands.

Conveyance and Storage Analysis
An evaluation of the City's existing conveyance and distribution system and its ability to deliver water when and where it is needed.

Implementation and Capital Facilities Plan
An outline of the timeline and budget required to complete the recommended system improvements.

This update to the Sandy City Water System Master Plan has been completed to address several issues which affect how Sandy meets its water delivery commitments. These issues include:

- **Land Use Changes:** Sandy City is experiencing growth mostly through densification and redevelopment. The current (and projected future) trend is increased residential, commercial, and industrial demands in and around the "Cairns" downtown area. This shifts demands from east to west and changes delivery patterns.
- **Continued Growth and Additional Density:** In addition to the land use changes, Sandy City is still experiencing new land development in the few remaining undeveloped pockets in the City.
- **Conservation:** The City has made tremendous steps and progress toward reducing per capita water use over the past several years. This changes water demand projections and use patterns from what were expected when the system was last analyzed.
- **Drought:** Utah experiences off-and-on droughts regularly, most recently the severe drought in 2021. Drought understandably strains water resources and affects how the system can be optimally managed.
- **Climate Change:** Climate change has the long-term potential of affecting both demands and supplies. It is important to keep city planning up to date with the latest understanding of this phenomenon.
- **Funding:** In addition to planning for the physical system, it is critical for the City to adequately fund operations, maintenance, administration, rehabilitation, replacement, and system enhancement. Changes in water delivery patterns and the cost of doing business (especially inflation) require that the city plan to proactively manage costs and maintain adequate funding levels.

The City requested that Bowen Collins & Associates (BC&A) and Hansen Allen Luce (HAL) address these issues in the updated master plan by:

- Evaluating Sandy's current and future demands and available supplies (Part 1 of the master plan);
- Analyzing the ability of Sandy's storage and conveyance infrastructure to meet existing and future needs (Part 2 of the master plan); and
- Preparing an implementation and capital facilities plan to address how Sandy can carry out the plan and respond to the issues that the water system is facing (Part 3 of the master plan).

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Projected Growth

To predict future water production requirements in this study, all water demands in the service area were grouped into one of four use factor categories:

Residential Population

Representing residential indoor use

Employment Population

Representing commercial and institutional indoor use

Year	Residential Population
2010	85,243
2015	90,061
2020	93,794
2021	94,665
2022	95,070
2023	95,722
2024	96,375
2025	97,030
2026	97,685
2027	98,342
2028	99,200
2029	100,052
2030	101,278
2031	102,479
2040	112,476
2050	120,863
2060	127,044

Year	Employment Population
2010	46,437
2015	54,842
2020	66,477
2021	67,781
2022	70,295
2023	69,844
2024	71,481
2025	72,468
2026	75,622
2027	74,572
2028	77,465
2029	78,327
2030	79,922
2031	80,843
2040	91,112
2050	100,293
2060	105,422

In addition to basing the unit demand for each use component on observed water use patterns, each was evaluated for conservation potential. The City's overall conservation goals from the recently completed 2021 Sandy City Water Conservation Plan were also considered.

Demand Component	2000 Demand	2015 Demand	Buildout Demand (with Conservation)
Residential Population (gpcd)	88.0	71.7	62.8
Employment Population (gpcd)	40.2	32.8	27.7
Industrial Area (gpd per acre)	944	769	708
Irrigated Area (acre-ft per irrigated acre per yr)	4.1	3.3	2.6

Industrial Area

Representing industrial uses

Year	Industrial Area (acres)
2010	482
2015	497
2020	533
2021	536
2022	539
2023	543
2024	546
2025	549
2026	551
2027	552
2028	554
2029	555
2030	557
2031	557
2040	557
2050	557
2060	557

Irrigated Area

Representing outdoor use for all water user types

Year	Irrigated Area (acres)
2010	5,011
2015	5,152
2020	5,251
2021	5,267
2022	5,281
2023	5,295
2024	5,307
2025	5,319
2026	5,347
2027	5,374
2028	5,400
2029	5,426
2030	5,451
2031	5,476
2040	5,677
2050	5,787
2060	5,799

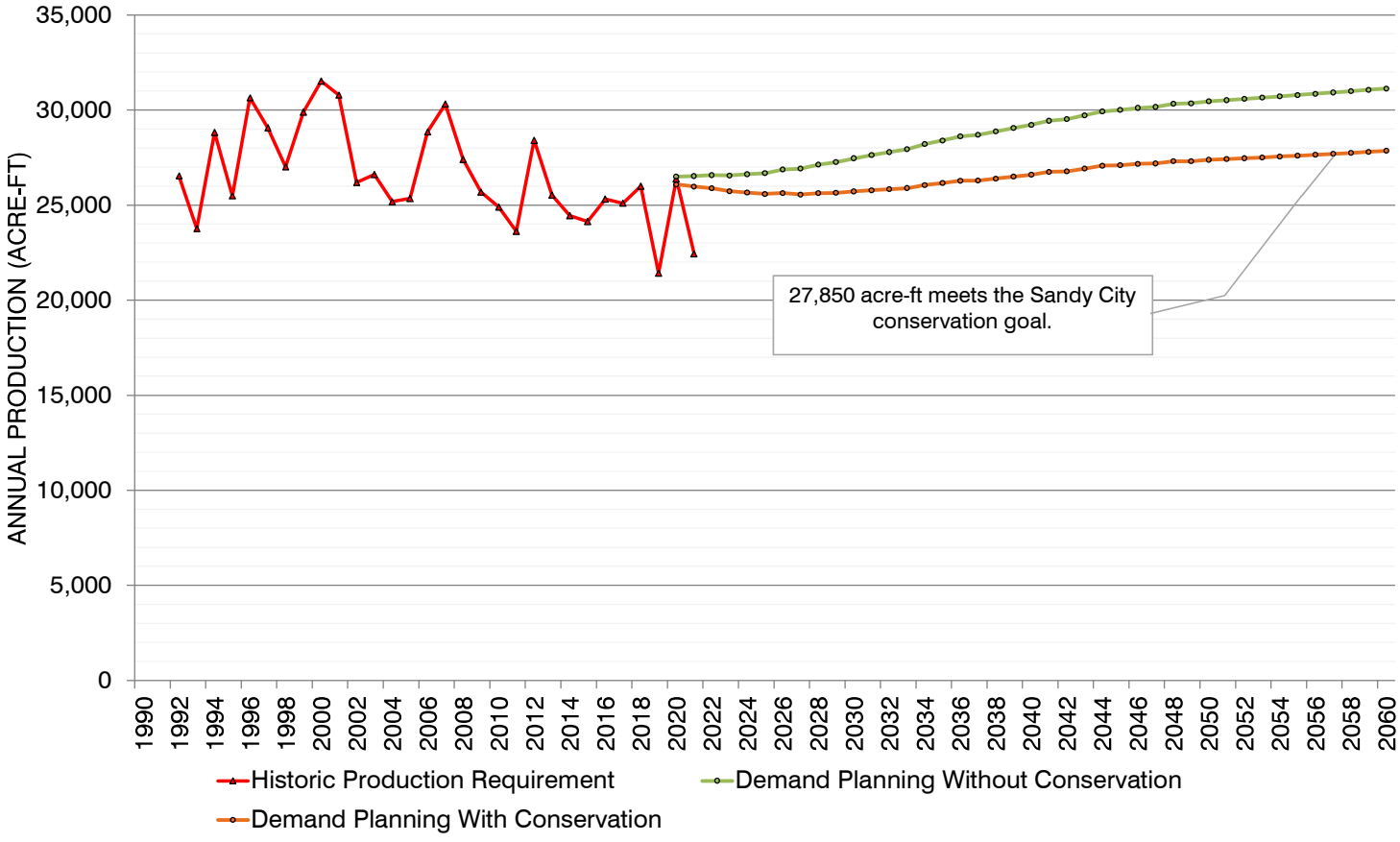
Total Demand

Multiplying the use component projections by the respective water demand factors produces the overall system demand projection. Without any conservation measures, Sandy would need an additional 4,600 acre-ft of water annually at buildout. That's the equivalent of filling more than 2,000 Olympic-sized swimming pools every year.

Conservation & Projected Demand

Sandy City is committed to water conservation. Based on the water production factors presented on the previous page, and if Sandy meets its conservation goals, it is predicted to reduce its overall buildout demands by as much as 3,200 acre-feet. That's as much water as filling REAL Soccer Stadium from the field to the top bleacher 31 times.

Projected Sandy City Annual Production Requirements



To guide future conservation efforts, Sandy has adopted the State of Utah's regional water conservational goal to reduce per capita water use from a baseline amount (as measured in 2015). These conservation goals are the following, measured in gallons used per person per day, or gallons per capita day (gpcd).

Conservation Goals with Milestones Through 2065

Year	Reduction from Year 2015 Water Production	Conservation Goal Milestones (gpcd production)
2015	0%	239
2030	11%	213
2040	15%	203
2065	19%	194

Note: Numbers in this table are as measured at production facilities, not as measured at the point-of-sale individual meters. The City's Conservation Plan discusses both points of measurement, but this master plan is concerned only with production requirements.

Sandy has planned to achieve these goals through several practices, including:

- Public Awareness;
- Education and Training;
- Rebates;
- Incentives and Rewards;
- Ordinances and Standards;
- Water Pricing; and
- Improvements to the Physical System.

Required Outcomes to Achieve Conservation Goals

	Indoor Use				Outdoor Use	
	Faucet and Shower Conversion to High Efficiency	Toilet Conversion to High Efficiency	Washing Machine Conversion to High Efficiency	Reduction in Indoor Leaks	Irrigation Efficiency	Reduction in Use of Higher Water Use Turf
Salt Lake County Average (2015)	80%	63%	46%	-	65%	-
Conservation Goal	95%	80%	80%	30%	80%	40%

Projected Sandy City Supply

Sandy City has a well-diversified portfolio of water sources which it utilizes, and can utilize in the future, to meet demands. This includes:

SURFACE WATER

- **Little Cottonwood Creek -** Sandy City and Salt Lake City are members of the Metropolitan Water District of Salt Lake and Sandy (MWDSLS). Both cities own water rights in Little Cottonwood Creek. This water is treated at MWDSLS's Little Cottonwood Water Treatment Plant (LCWTP) and then distributed to each city.
- **Bell Canyon Creek -** Sandy City owns water rights in Bell Canyon Creek. An aqueduct between Bell Canyon Creek and Little Cottonwood Creek allows this water to be treated at the LCWTP.
- **Ontario Drain Tunnel -** The ODT is a historic mine drain in the Provo River Watershed and can be delivered to the LCWTP or the Point of the Mountain Water Treatment Plant (POMWTP) via the Provo River System. The availability of this source varies from year to year as evidenced in historical flow data.

STORAGE

- **MWDSLS Sandy Preferred PRP Storage -** MWDSLS was one of the original petitioners for water from the Provo River Project (PRP). This water is stored in Deer Creek Reservoir, which stores a total of 153,445 acre-ft with a 100,000 acre-ft annual delivery. While MWDSLS yields from its PRP are sometimes reduced below its full allotment, Sandy's contract with MWDSLS ensures that Sandy's portion (while smaller than Salt Lake City's) is fully allotted first. Therefore, Sandy's Preferred PRP Storage is a very reliable source.
- **MWDSLS Available Excess Storage -** In addition to having storage rights on the Provo River through the PRP and Deer Creek Reservoir, MWDSLS also has storage rights through the Central Utah Project (CUP) and the Jordanelle Reservoir. While this additional storage is prioritized to Salt Lake City, Salt Lake City has not yet grown into its full allotment from these storage sources. Sandy City's agreement with MWDSLS allows Sandy first right to the excess storage water from MWDSLS not needed by Salt Lake City.

GROUNDWATER

- **Peaking Wells -** The City currently has 16 wells which are typically utilized only as needed from an operational perspective to maintain pressures in the system during the peak summer months (thus the term "peaking wells"). However, these wells can also be utilized during dry years to supplement the yields obtained from the surface and storage water sources.
- **Sandy City Aquifer Storage and Recovery (ASR) -** For the past three years Sandy City has operated an ASR process (also referred to as managed aquifer recharge (MAR)). This does not create additional supply beyond what has already been reported for peaking wells, but allows the City to store excess runoff as well as maintain the health of the aquifer. Historically, the City has diverted its share of Bell Canyon flows (959 acre-ft or 312.5 MG) into Dry Creek, where it is allowed to infiltrate into the aquifer.

Sandy has identified several potential new sources, including purchasing new Utah Lake System (ULS) water and/or working with MWDSLS to expand its ASR program. However, based on the projected demands, the City does not require the development of any new sources in the future. Instead, the City should focus on maintaining and preserving its existing sources and advancing its conservation program.

BC&A has evaluated production from each of Sandy City's existing sources. The projected average year and dry year yields of each source are summarized here:

Source	Dry Year (acre-ft)	Average Year (acre-ft)
Existing Surface Water Sources		
Ontario Drain Tunnel	2,000	3,070
Little Cottonwood	8,000	9,700
Bell Canyon	860	980
Sub-Total	*10,860*	*13,750*
Existing Storage Sources		
MWDSLS Sandy Preferred PRP Storage	7,940	7,940
MWDSLS Available Excess Storage	0	8,400
Sub-Total	*7,940*	*16,340*
Existing Groundwater Sources		
Peaking Wells	13,700	9,900
Sub-Total	*13,700*	*9,900*
Total Existing	**32,500**	**39,990**

Water Supply Risk

All water supplies are subject to risks which may diminish or remove the supply from service.

What are the foreseeable risks?

- Natural disasters such as earthquakes and fires can disable treatment and transmission infrastructure.
- Wildfires and chemical spills can lead to contamination of water sources beyond what treatment infrastructure can handle.
- Sudden mechanical failure can limit or eliminate the use of a source until repairs can be made.
- Climate or other environmental changes can reduce supply, increase demand, or both.

How does Sandy City protect itself from these risks?

- Sandy maintains a diversified water source portfolio which utilizes multiple surface water sources and multiple groundwater sources.
- Sandy maintains sufficient sources to always have a reasonable supply buffer. That way, if a source is suddenly lost or slowly diminished, other sources are available to meet Sandy's needs. Sandy City's goal is to maintain a minimum supply buffer of 15%.
- In conjunction with the master plan, Sandy City has a Drought and Water Loss Contingency Plan to address how the City will respond to such situations. This plan creates procedures for defining the level of the emergency and policies governing what the proportional responses need to be to continue providing life-essential water service to its customers.

Storage Evaluation

Three major criteria are generally considered when sizing storage facilities for a water distribution system:

Operational Storage

Operational or equalization storage is the storage required to cover the difference between the maximum rate of supply and the rate of demand during peak conditions. Sources, major conveyance pipelines, and pump stations are usually sized to convey peak day demands. During peak hour demands, storage must be used to meet the increased demands.

Fire Flow Storage

Fire flow storage is the amount of water needed to combat fires occurring in the distribution system. The maximum fire flow requirements varies by development type and size and generally ranges from 1,500 gallons per minute (gpm) for 2 hours in predominantly residential areas up to 9,000 gpm for 6 hours for extremely large buildings.

Emergency Storage

Emergency or standby storage is the storage needed to meet demands when sources are interrupted as the result of unexpected events (power outages, equipment failure, etc.) For this report, it is recommended that standby storage be equal to at least 8 hours of peak day demands.

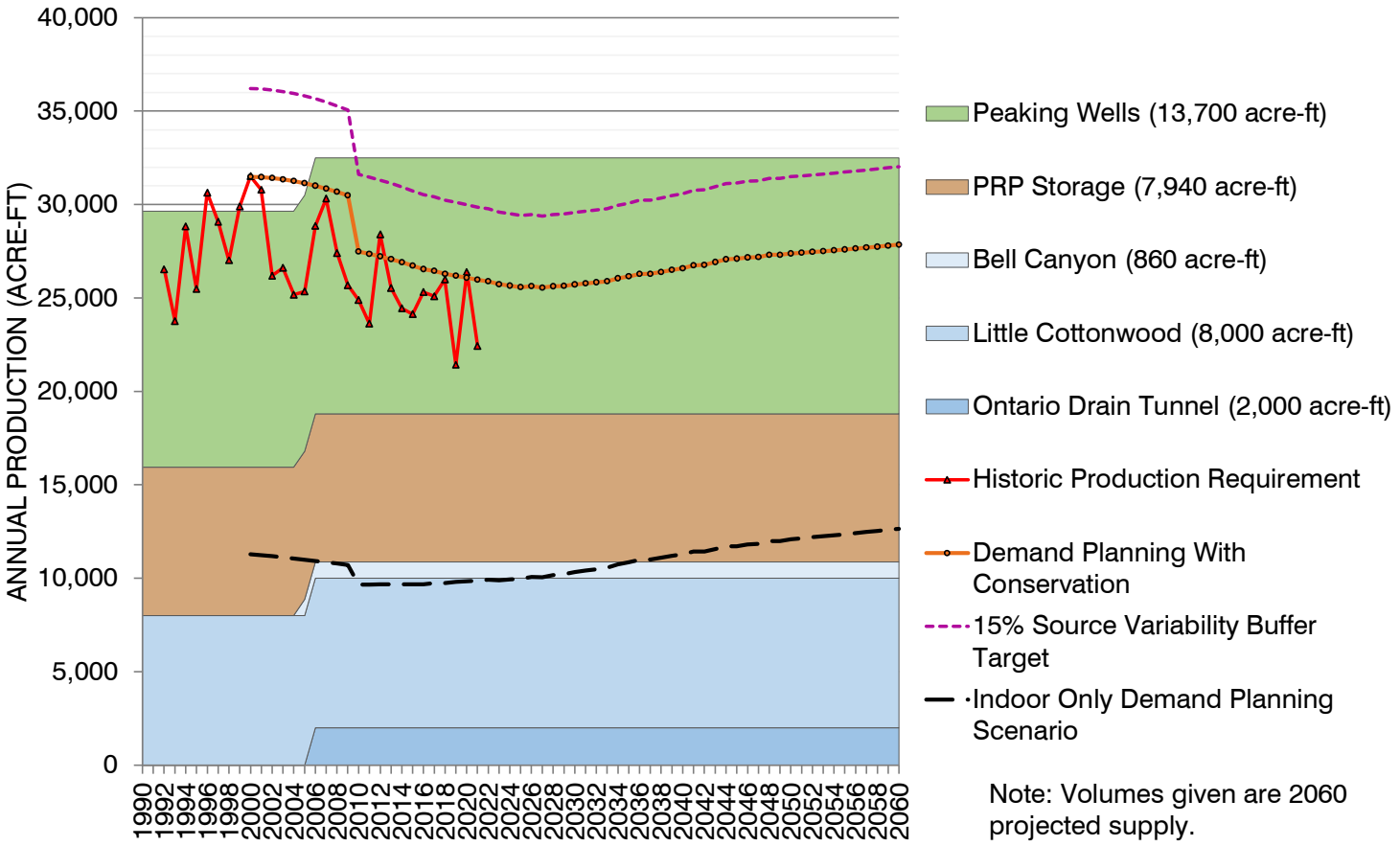
Does Sandy City have sufficient storage to supply current and future needs?

Yes, currently Sandy storage reservoirs supply all its need with a surplus of approximately 11 million gallons. At buildout, the existing reservoirs still supply the City's need with a still-healthy surplus of about 7 million gallons. Thus, no new storage facilities have been recommended in this master plan.

Future Supply Planning

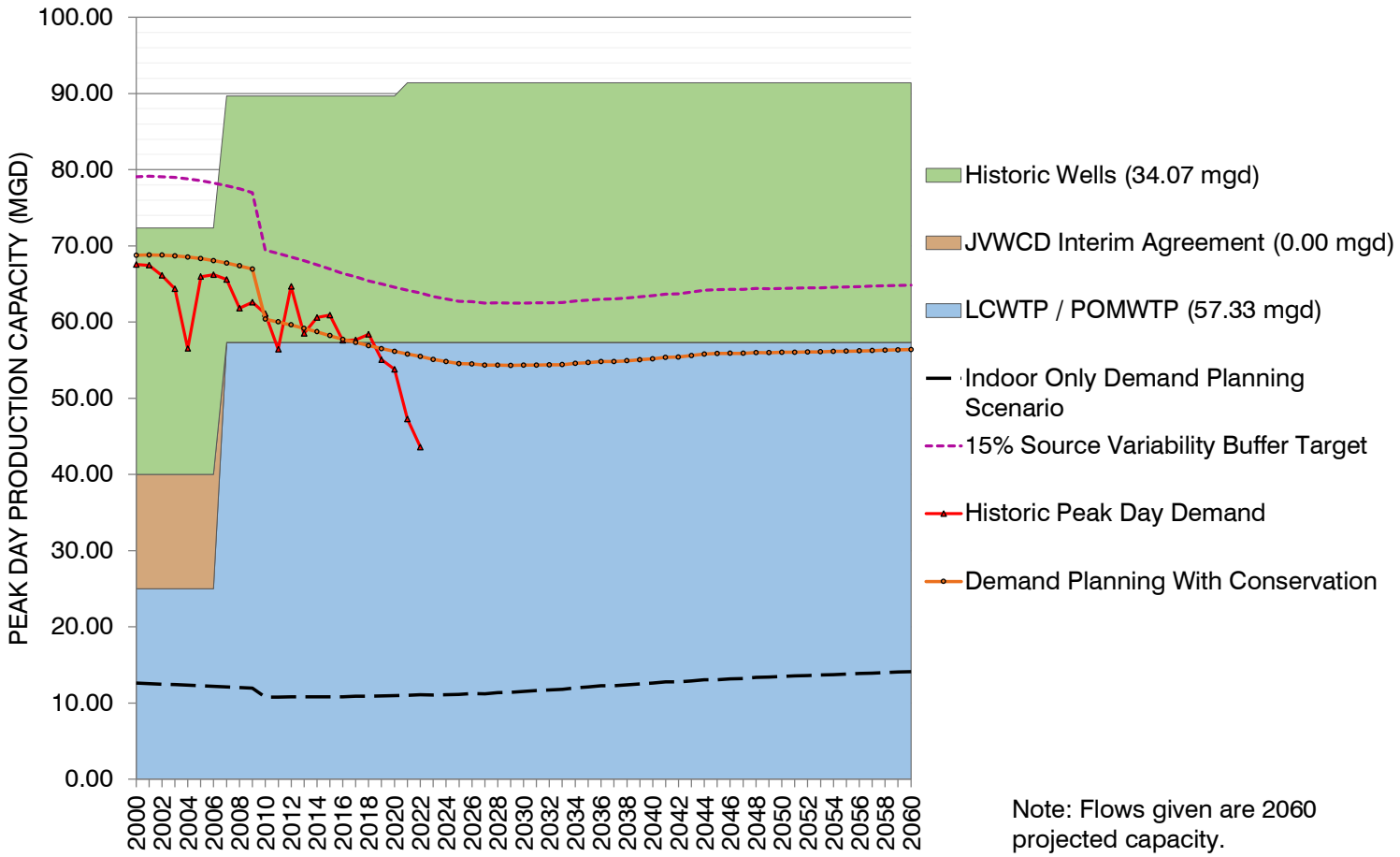
In this study, the dry year condition has been identified as the critical planning condition with respect to water supply. In other words, the goal of City supply planning hinges on whether the supplies are adequate at the time when each source produces the least amount of water. The figures shown here compare the total supply available with the recommended supply planning demand scenario. The recommended supply planning demand scenario includes incorporation of City conservation efforts and an appropriate buffer for supply redundancy/climate change.

Projected Sandy City Annual Production Requirements vs. Supply (Dry Year) with Supply Buffer



Note: Volumes given are 2060 projected supply.

Projected Sandy City Peak Day Demands vs Production Capacity with Supply Buffer



Note: Flows given are 2060 projected capacity.

Based on this analysis, the following conclusions can be made:

1 To keep demands within the limits of available supply, the City has established aggressive conservation goals. Meeting those goals will require a concerted effort by City residents and the City itself.

2 The City is expected to have sufficient annual and peak day source production capacity through buildout. This is true in both average and dry years, even without developing additional source capacity. If the City fails to meet its conservation goals, however, additional supply will be needed.

3 Peak day supply capacity does not likely control Sandy decisions regarding source planning. Annual source capacity, while still met, is more critical because the peak capacity of Sandy supplies meet peak day production requirements with a much larger buffer.

4 The conclusions above are for normal system operations. To respond to a temporary/emergency loss of water source or extreme drought, the City should implement the Drought and Water Loss Contingency Plan prepared as part of this study.

Existing Sandy City Water System

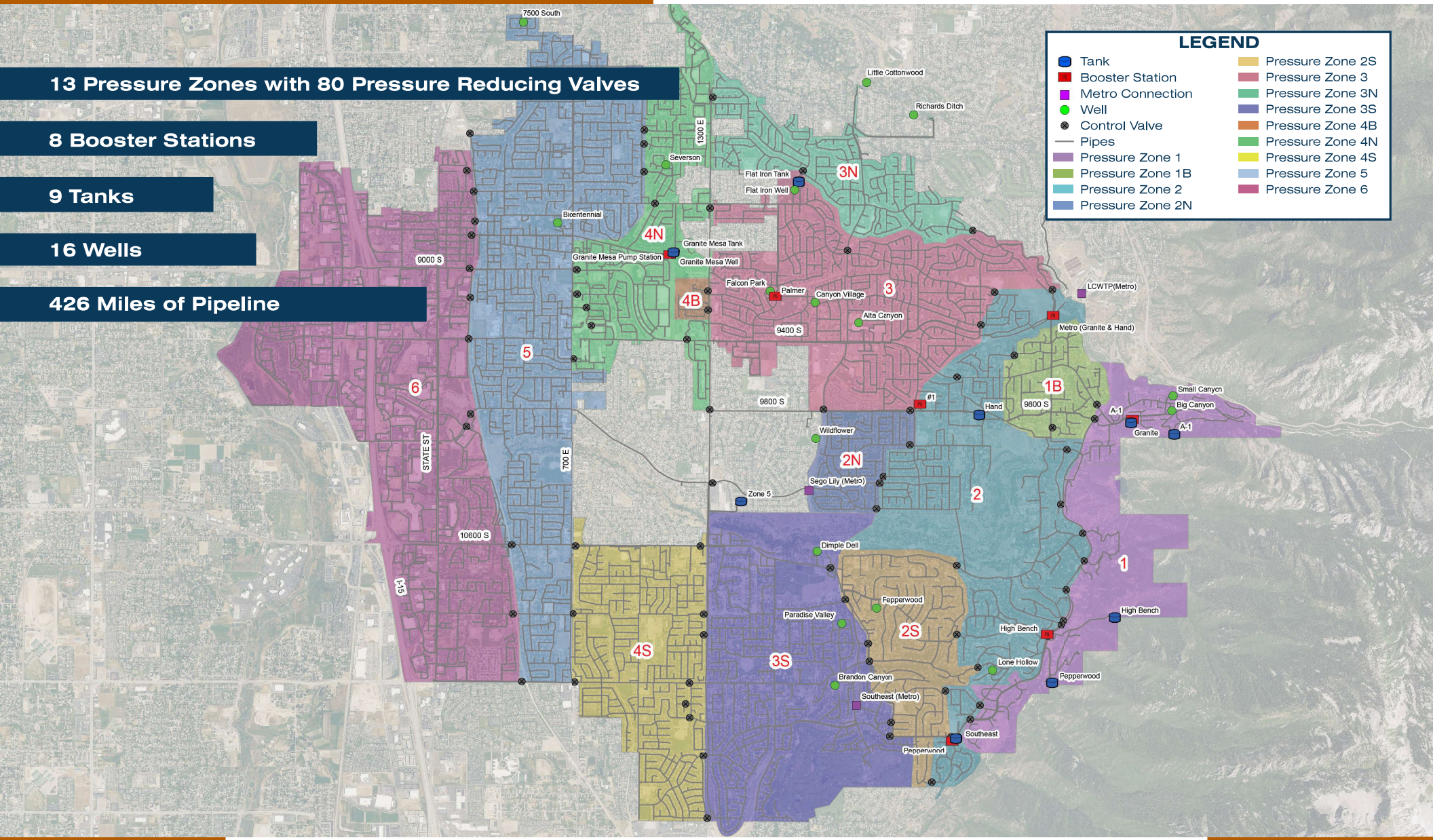
13 Pressure Zones with 80 Pressure Reducing Valves

8 Booster Stations

9 Tanks

16 Wells

426 Miles of Pipeline



Sandy City Conveyance

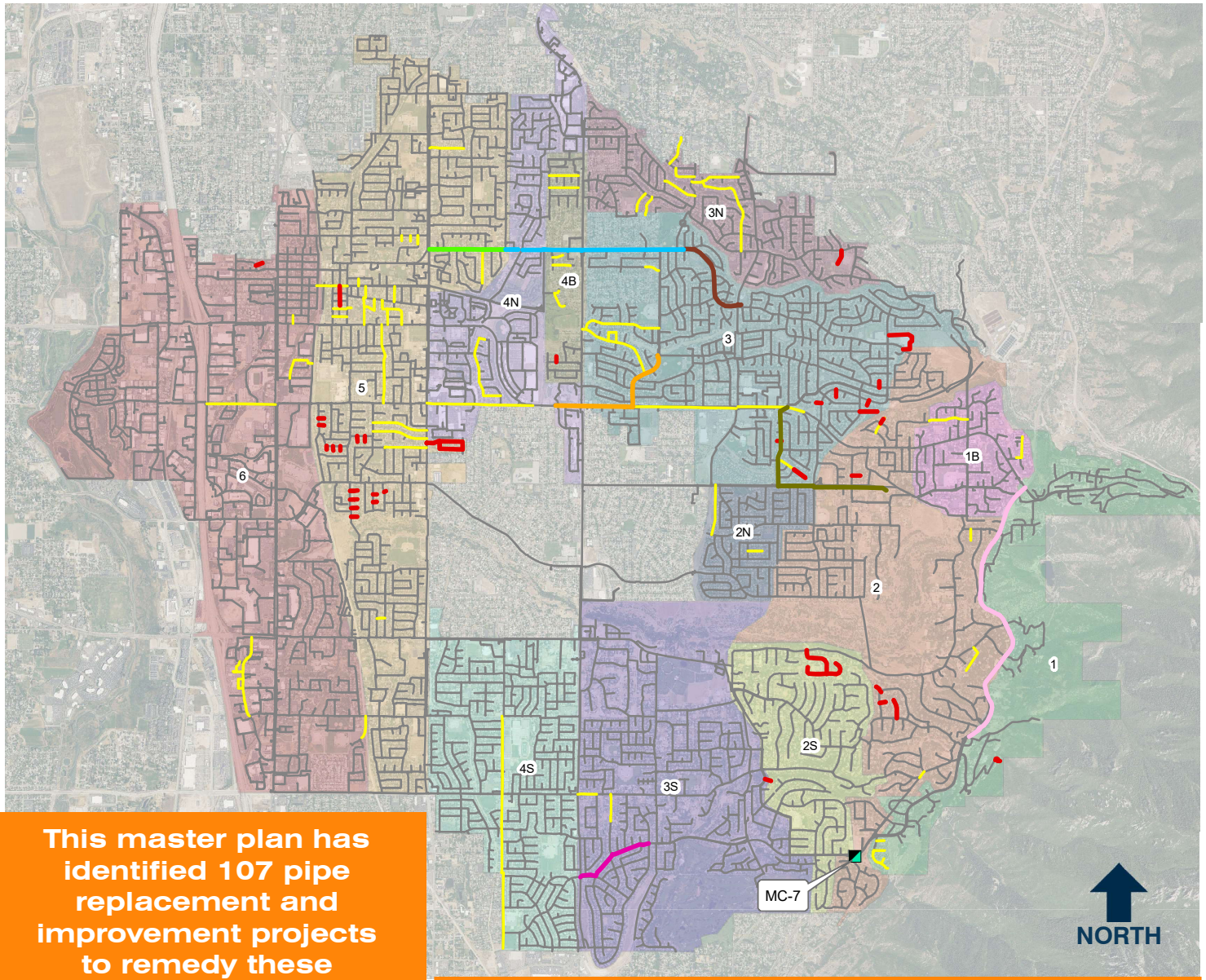
A computer model of the City's water system was developed to analyze the City conveyance system. The conveyance system is the network of pipes, pumps, and tanks which get the water from the sources to customers. This system must have sufficient capacity to get the water to where it is needed and do so in a way which does not cause pressures to be too low or cause excessive pressure fluctuations at service connections. The system must also be able to convey sufficient flow to each fire hydrant in the system in case of a fire.

Evaluation criteria include:

- Maintaining at least 40 pounds per square inch (psi) at each service connection during peak day demands;
- Maintaining at least 30 psi at each connection during peak hour demands;
- Providing at least 2,000 gpm at each fire hydrant with a select number of hydrants in commercial areas required to provide even more flow as required by the Fire Chief; and
- Identifying any service connections with pressure fluctuations in excess of 40 psi as locations likely requiring increased conveyance capacity.

How does Sandy City's Conveyance System Perform?

Sandy's system performs well for most of its service area both now and in the future. However, there are some areas which do not fully meet all of the analysis criteria. This includes pipes that are too small to meet fire flow requirements, supply normal demands without significant pressure fluctuations, or both. There are also some lines which, according to Sandy maintenance records, are in poor condition and experience frequent pipe breaks.



This master plan has identified 107 pipe replacement and improvement projects to remedy these deficiencies. These are grouped into Major Conveyance, Pipeline Replacement, and Fire Flow Projects. The estimated cost for these projects is $63.3 million.

Implementation

In order to implement the recommendations made in this master plan, a proposed 10-year capital improvement program has been developed. This program prioritizes projects, recommends the appropriate level of investment for Sandy, and defines the actions necessary to adequately fund the plan.

Project ID	Project Description	Project Total (FY 2021-2022 %'s)	FY 2022 – 2023	FY 2023-2024	FY 2024 - 2025	FY 2025 - 2026	FY 2026 - 2027	FY 2027 - 2028	FY 2028 - 2029	FY 2029 - 2030	FY 2030 - 2031	FY 2031 - 2032
Planned Major Conveyance Projects												
MC-1	Install a new 24-inch diameter pipeline in New Castle Drive up to Highland Drive. Including the installation of a new connection to MWDSLS at Falcon Park.	$2,968,000				$394,610	$2,573,390					
MC-2	Replace existing 16-inch diameter pipeline in 8600 South from 1000 East to Piper Lane with a new 36-inch diameter pipeline.	$6,783,000			$678,300	$6,104,700						
MC-3	Replace existing 10-inch diameter pipeline in 8600 South from 700 East to 1000 East with a 24-inch diameter pipeline.	$1,960,000	$163,322	$1,796,679								
MC-4	Install a new 16-inch diameter pipeline in Sterling Drive to 9400 South. Install a new 16-inch diameter pipeline west from Sterling Drive to 9300 South. Tie in below the existing PRV in 9400 South.	$2,592,000						$311,040	$2,280,960			
MC-7	Install a new 8-inch diameter PRV and 10-inch pipeline from the upstream side of the Pepperwood pump station to the neighborhood off Hidden Valley Drive. Disconnect the neighborhood from the existing pressure zone.	$168,000	$20,160	$147,840								
MC-8	Install a new 20-inch diameter pipeline in Hidden Valley Road from 1700 East to Hidden Valley Drive.	$1,972,000								$236,640	$1,735,360	
	Subtotal	***$16,443,000***	***$183,482***	***$1,944,519***	***$678,300***	***$6,499,310***	***$2,573,390***	***$311,040***	***$2,280,960***	***$236,640***	***$1,735,360***	***$0***
Planned Pipeline Replacement Projects												
LR-…	Complete 6 to 7 of the identified Pipeline Replacement Projects each year	$38,425,902	$6,180,000	$3,544,204	$3,650,530	$0	$3,872,848	$3,989,033	$4,108,704	$4,231,965	$4,358,924	$4,489,692
	Subtotal	***$32,726,020***	***$38,425,902***	***$6,180,000***	***$3,544,204***	***$3,650,530***	***$0***	***$3,872,848***	***$3,989,033***	***$4,108,704***	***$4,231,965***	***$4,358,924***
Planned Fire Flow Projects												
FF- …	Complete 3 to 4 of the identified Fire Flow projects each year	$6,035,831	$0	$1,081,777	$557,115	$573,829	$591,043	$608,775	$627,038	$645,849	$665,225	$685,181
	Subtotal	***$6,035,831***	***$0***	***$1,081,777***	***$557,115***	***$573,829***	***$591,043***	***$608,775***	***$627,038***	***$645,849***	***$665,225***	***$685,181***
TOTAL		***$60,904,733***	***$6,363,482***	***$6,570,500***	***$4,885,945***	***$7,073,139***	***$7,037,281***	***$4,908,848***	***$7,016,702***	***$5,114,454***	***$6,759,509***	***$5,174,873***

Note: *Costs in future years include 6%/yr inflation from FY 2021-2022 to FY 2022-2023 and 3% for each year thereafter*

Implementation, continued

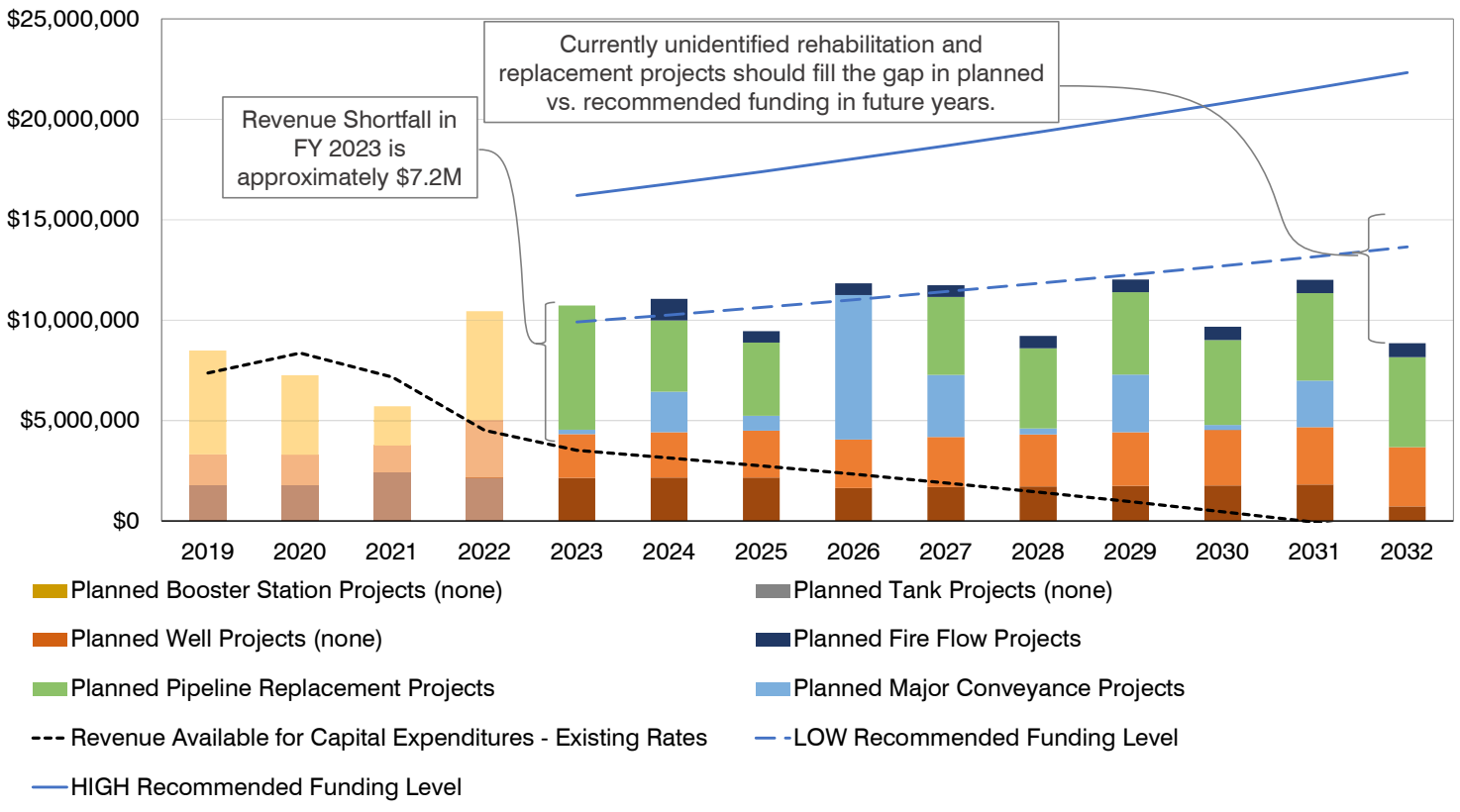
How much should Sandy be investing in its water system to continue to provide adequate service?

The recommended funding level for capital investment is the level at which all components of the system will be rehabilitated or replaced at the end of their useful service life. No infrastructure lasts forever. Pipes rust, gaskets leak, mechanical equipment wears out, and even concrete eventually fails. To replace the entire Sandy system today would cost approximately $1 billion. Based on the expected life span of the system, it is recommended that 1% to 1.5% of that amount or $9.9 million to $16 million be invested annually to keep the system refreshed. Doing so helps the City avoid the catastrophic and costly failures that are associated with neglecting system reinvestment.

How does the proposed implementation plan compare to recommended funding levels?

The current plan for capital projects compared to recommended funding levels is shown below. As can be seen, the proposed implementation plan would provide funding near the lower end of the recommended long-term funding range. This is likely okay as much of Sandy's system is still new and in relatively good condition. This also leaves a little room to add additional rehabilitation projects as they are identified in future years.

Available Revenue for Capital Expenses (Excluding MWDSLS)



Does Sandy City have funds to complete the necessary improvement projects?

Fortunately, good water years and a slowdown in capital expenditures during the pandemic years has allowed the water system to develop a larger-than-typical reserve account balance. However, available funding has decreased rapidly in recent years and is expected to continue to fall. The City reserves are projected to be depleted by FY 2023 and no funding for capital costs will be available within 10 years if no adjustments to user rates are made.

Why are available funds for capital decreasing?

Finances in the Sandy City water system have been dramatically impacted by two issues over the last few years:

- Inflation - Recent inflation in the general economy is well documented. Inflation in construction costs have been even more severe. Increases in operation and maintenance have resulted in less money being available for capital. And increases in construction costs means the funding that is available doesn't go as far.
- Reduced Water Sales - In response to drought conditions over the past two years, Sandy City residents have done an excellent job in conserving water. While this is desirable and will reduce costs for residents in the long-term, it does mean less revenue from water sales in the short-term. This contributes to the reduced funding projected in the water system.

How can Sandy City sustainably fund its water system moving forward?

Sandy's water system is meant to be financially self-sufficient. This means that user rates are the main (and virtually only) source of revenue. Thus, Sandy will need to implement rate increases soon to sustainably fund the capital improvement implementation plan. A technical memorandum titled Recommended Sandy City Rate Revenue Increases 2022 that identifies recommended rate increases has been produced and is appended to this master plan.

Our hope is that this executive summary will allow stakeholders to have a better understanding of the Sandy City water system. This includes understanding where the City's water comes from, what challenges face the water system moving forward, and how the City can be prepared to meet those challenges.

BOWEN COLLINS & ASSOCIATES

801.495.2224
154 E 14075 S
Draper, UT 84020
www.bowencollins.com