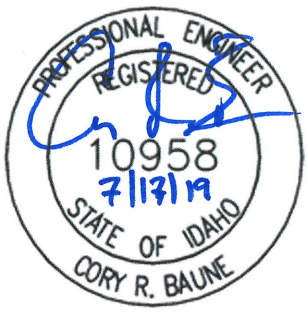
LEWISTON ORCHARDS IRRIGATION DISTRICT

WATER SYSTEM MASTER PLAN

FINAL

July 2019

Prepared by:



J-U-B
THE LANGDON GROUP
GATEWAY MAPPING INC.
OTHER J-U-B COMPANIES

a 201 S Jackson Street, Moscow, ID 83843 *p* 208 746 9010 *f* 844 830 2645 *w* www.jub.com

Executive Summary

ES 1 Background

Introduction

The Lewiston Orchards Irrigation District (LOID) Master Plan has been executed by J-U-B ENGINEERS Inc. as an aid for Board Members and District Staff as they consider system improvements. The Plan builds on previous reports generated in 1965 and 1980 and shows LOID's commitment to the long-term reliability of their system. The District's mission states:

> *"The Lewiston Orchards Irrigation District (LOID) is a dual water purveyor committed to its fundamental objective of providing reliable water service for domestic and irrigation uses.*
>
> *It is the intent of the LOID to provide untreated irrigation water to all patrons within the irrigation district during the irrigation season at adequate pressure in an efficient manner and at a reasonable cost.*
>
> *It is also the intent of the LOID to provide quality and safe domestic water service for drinking at a reasonable cost to the residents of the District and its domestic annexations.*
>
> *The LOID is committed to the long-term reliability of systems."*

This Plan focuses on the domestic system, irrigation system distribution, and required improvements within the next 20 years. The Plan estimates water demands and needs at system build-out. Extensive efforts have been made to update LOID's growth plan through careful review of system records and interviews with District Staff. It is recommended that LOID review and update the Master Plan every five years or as future conditions deviate from discussion presented herein.

LOID is a dual water purveyor committed to provide reliable water service for domestic and irrigation use. The original distribution system was constructed in the early 1900's as a single domestic and irrigation system. The dual system was installed with funding and support from the Department of Interior, Bureau of Reclamation (Reclamation) in the 1940's.

The domestic system now relies on three (3) groundwater wells and an intertie with the City of Lewiston to provide drinking water. Irrigation water is provided from a combination of surface water and groundwater.

Scope, Purpose, and District Goals

Today, LOID continues to expand its groundwater supply while managing continued growth and providing quality water at effective rates. As the District develops outside its irrigation boundary, service must be provided with potable-only supply for both domestic and irrigation purposes.

This growth will have significant impact on the domestic and irrigation systems. In an effort to understand the impact of this growth, the District developed a domestic water model in 2006 – 2007 and an irrigation water model in 2008-2009. Due to increasing interest in development since that time the LOID Board recognized the importance of developing a complete Master Plan. This Plan will build on the existing water model summarized system recommendations and formalize a capital improvement plan.

This document includes a 20-year growth plan for the domestic and irrigation distribution system components and provides the District a tool to address current deficiencies and manage long-term water system planning. This Plan evaluates each component of the LOID system and provides recommendations for water supply, transmission, and storage to meet increasing demands of system users. The Plan recommendations are intended to be used as a tool to plan and budget for immediate and long-term improvements and should be revised on a periodic basis within the planning period to reflect changing District priorities and ratepayer requirements.

Improvement recommendations presented in this Plan are based on meeting the following criteria though the planning period:

Design Criteria

- Usage Behaviors - The most critical design assumption associated with this plan is continued operation of the irrigation system in a manner that is consistent with current usage. Any shift in usage from the irrigation system to the domestic system will have a significant impact on the evaluation and recommendations provided in this report. As such, the District should continue to monitor irrigation and domestic demands on an annual basis to identify said shift in usage behavior.
- Established System Operating Pressure – The District's goal is to maintain a normal operating pressure range of 40 – 100 psi.
- Pipeline Headloss – The LOID Board has established design pipeline headloss goal of less than 5 feet per 1,000 feet of pipe length.

- System Fire Flow Pressure – LOID seeks to maintain minimum pressure of 20 psi during maximum day demand under fire flow conditions as required in accordance with the IAC (IDAPA 58.01.08, Subsection 552.01.b).

Domestic System

- Redundancy – LOID will provide redundant water supply to meet maximum day demands through the planning period with the largest source out of service as required by Idaho Administrative Code (IDAPA 58.01.08, Subsection 501.17).
- Expanded System Operating Pressure – The District seeks to maintain normal operating pressure of 50 – 90 psi in new pressure zones as the District expands outside its existing service boundary.
- Standby Storage - The Idaho Administrative Code requires minimum standby storage of eight (8) hours under average day demand (IDAPA 58.01.08, Subsection 003.16). LOID has expanded this requirement to provide emergency supply through standby storage equivalent to one day at maximum day demand.

Fire Protection

It should be noted that it is neither the legal obligation nor part of LOID's mission statement to provide fire flow protection. Regardless, LOID recognizes the benefit to its patrons of providing water for fire protection, and as such has set the following fire suppression goals where possible within the District as shown in **Table ES-1**:

Table ES-1: Fire Suppression Goals

Land Use & Zoning	Min. Flow Rate (gpm)	Duration (hours)	Fire Storage Goals (gallons)
Residential	1,500	2	180,000
Commercial (from domestic system)	1,500	2	180,000
Commercial (from irrigation system)	1,500	4	360,000

Regulatory Issues

The Lewiston Orchards Irrigation District is a Public Water System as defined by the Idaho Department of Environmental Quality. The District is registered with the U.S. Environmental Protection Agency (US EPA) as water system ID2350015. It is classified as a large system, serving a population of approximately 20,000 (2017 estimate).

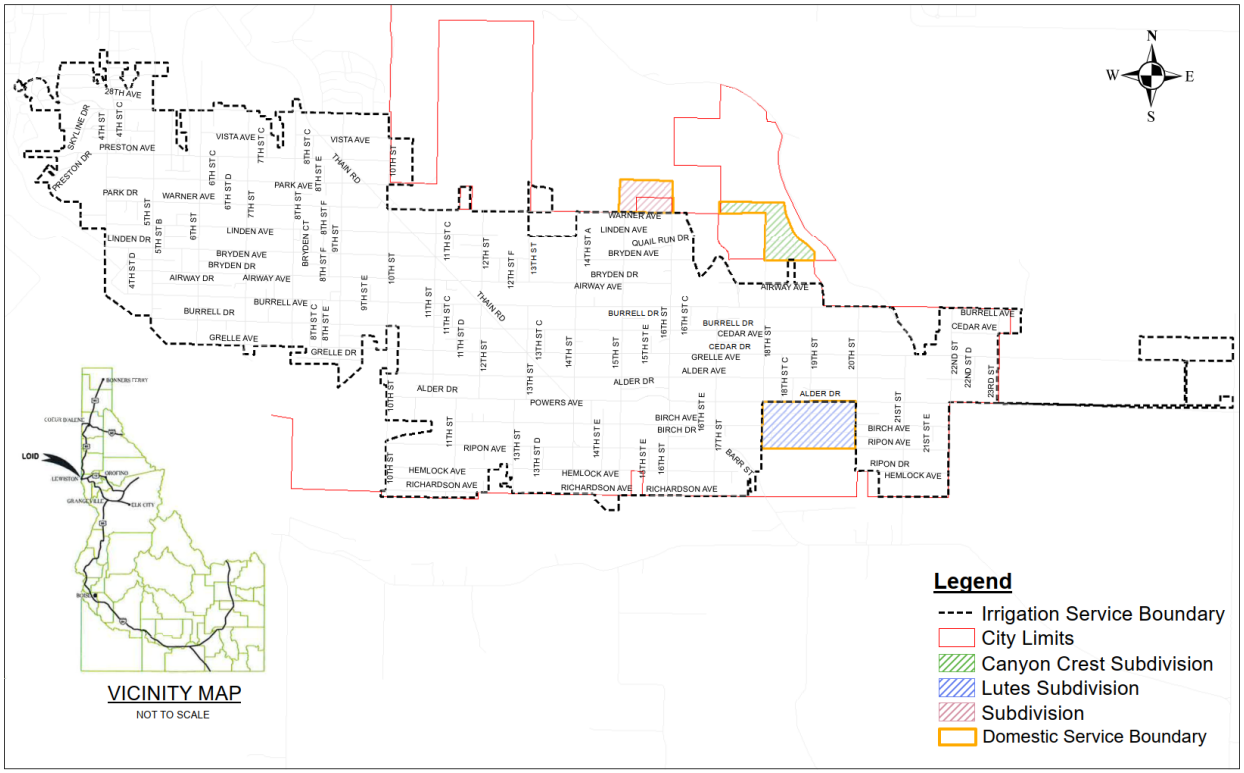
The rules, regulations and requirements for public drinking water systems are established by the Safe Drinking Water Act (SDWA) of 1974. The SDWA was implemented by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. LOID operates within the rules outlined above.

ES 2 Service Area and Population Growth

Service Area Description

The Lewiston Orchards Irrigation District area lies in the southeastern portion of the City of Lewiston, Idaho. The service area for the system covers approximately 4,000 acres on a plateau overlooking the central portion of the City. **Figure ES - 1** provides a vicinity map of the District. The LOID service area is enclosed by two service boundaries; the irrigation boundary and the domestic boundary.

Figure ES – 1 Vicinity Map



Under the agreement with Reclamation, the irrigation boundary is static and will not expand in the future. The domestic boundary, however, is not subject to the restrictions from Reclamation, and may be altered by the LOID Board. At this time, the vicinity map shows that the boundaries are similar, and that a significant portion of the domestic service area is bounded by the irrigation boundary.

Domestic System

Although a significant portion of the District is served by the dual domestic and irrigation system, there are three subdivisions which utilize potable-only service for both domestic and irrigation use.

Irrigation System

The service area for the Irrigation System can be referenced in **Figures ES-1.** The District provides irrigation water for a variety of purposes, including lawn care and agricultural use. Land areas within the District can generally be divided into four categories:

- Residential
- Commercial
- Agricultural
- Public

For purposes of this Plan, City parcels were visually categorized using zoning maps, aerial photos, and City of Lewiston GIS data.

Population Growth and Demographics

Demographics and Population projections will form the basis of water use projections for the future growth of the domestic and irrigation systems. As LOID is part of the City of Lewiston, there is no specific population data unique to the District. Anecdotal evidence from the District suggests a population of approximately 20,000 residents and forms the baseline of population projections.

An analysis of US Census Bureau data was conducted from 1960 to the present for the City of Lewiston and Nez Perce County. The analysis showed the areas have experienced growth at an exponentially instantaneous rate ranging from 0.68% to 0.74%. Following discussion with District personnel and the LOID Board, an exponentially instantaneous growth rate of 0.70% is used for this study, based on historical growth observed within the City of Lewiston and Nez Perce County. A graph depicting this projection is provided in **Figure ES-2.** The demographics of District growth are anticipated to mimic those within the existing service area, with predominately residential growth and negligible impact of commerce and industry.

The impact of system growth outside the District boundary has significant impact on the domestic system, as these potable-only connections will utilize domestic water for domestic and irrigation purposes. Based on discussion with LOID personnel, the District projects that

30% of future growth will occur as infill within the irrigation boundary as dual service connections and 70% will occur outside the irrigation boundary as potable-only service connections. **Table ES-2** provides a summary of this growth based on connection type.

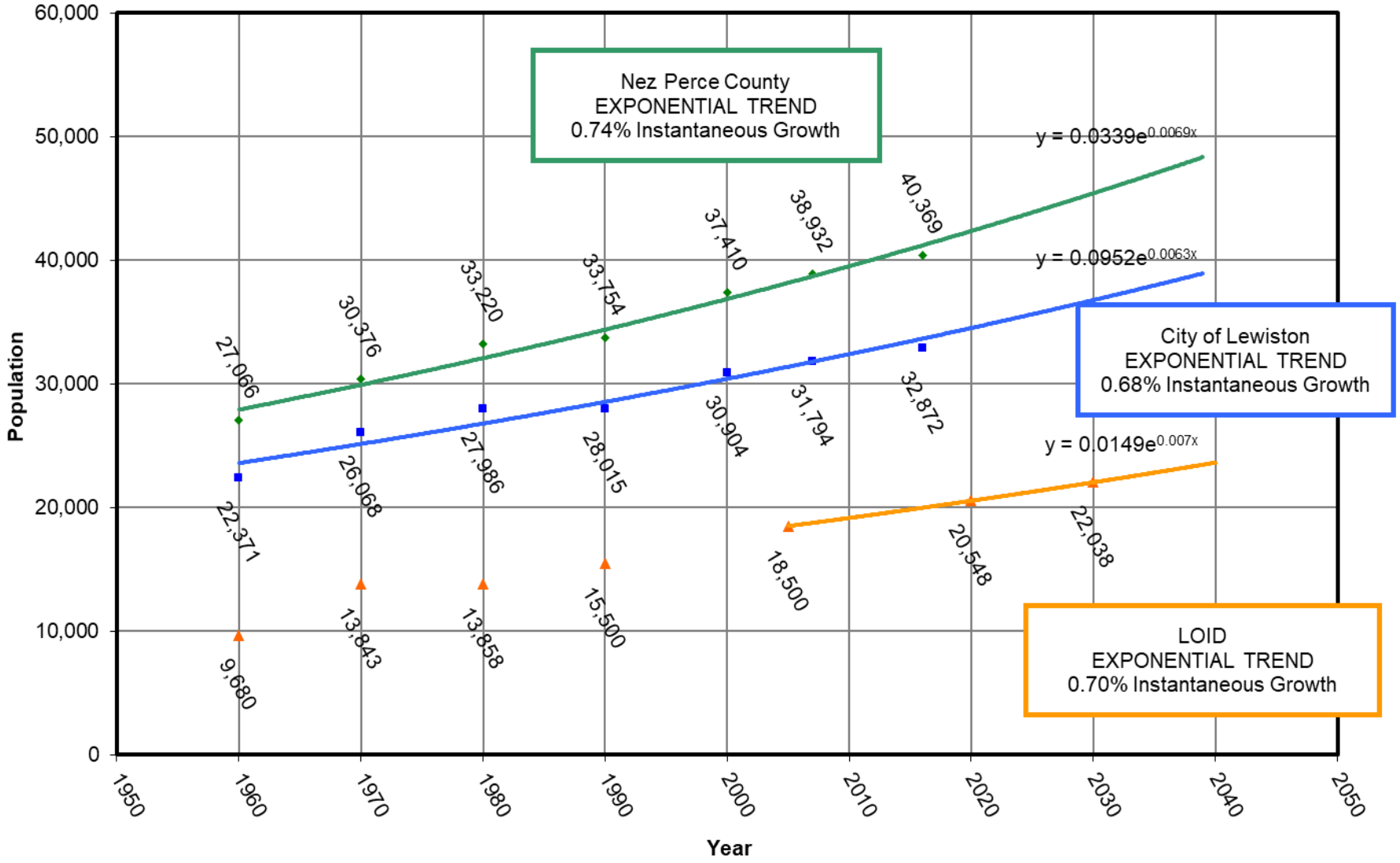
Table ES-2: Population Projection [A]

Year	Total Connections [B]		
	Dual Service	Potable-Only Service	System
2017	8,024	520	8,544
2027	8,207	955	9,162
2037	8,403	1,420	9,823

[A] Based on exponential instantaneous growth of 0.7%.

[B] **Based on projected future growth consisting of 30% dual service and 70% potable-only service connections.**

Figure ES-2: Population Growth



ES 3 Domestic System

Introduction

The LOID Domestic System is comprised of five main components, as listed below:

- Water Supply
- Water Distribution
- Water Storage
- Telemetry and Controls
- Water Rights

Domestic Water Supply

The District currently utilizes three groundwater wells, Well No. 2, 3, and 4, for domestic water supply. The Well No. 5 project was completed in 2017 primarily for irrigation usage, but with additional infrastructure, could be used as a potential future domestic water source. In addition to groundwater sources, the District has an intertie connection to the City of Lewiston. City water is available during emergency situations; the District has both received and transferred water from the City through this connection. Detailed information on each well is in **Table ES-3**.

Table ES-3: District Well Information

Well No.	Construction Year [A]	Water Right [A] cfs (gpm)	Current Pumping Rate (gpm)	Total Well Depth [A] (bgs)	Static Level [B] (bgs)	Pump Chamber Diameter [A]	Cased Depth [A] (ft)
1	1978	1.34 (601)	0	1,795	851	8”	1,520
2	1987	2.13 (956)	520	1,959	501	13 ⅜”	1,376
3	1997	2.76 (1,239)	530	2,617	695	13 ⅜”	1,430
4	2003	3.34 (1,499)	990	1,625	847	16”	1,164
5	2014	18.00 (8,079)	2,000	1900	590	24”	1,705[c]

[A] Per IDWR Records

[B] Per Dale Ralston – Well No 5 Draft Report

A summary of LOID currently active domestic supply is provided in **Table ES-4**:

Table ES-4: Domestic Water Supply

Source	Supply
Well No. 2	520 gpm
Well No. 3	530 gpm
Well No. 4	990 gpm
City of Lewiston Intertie	1,000 gpm
TOTAL	**3,040 gpm**

Domestic Water Distribution

The LOID Water Distribution System consists of seven pressure zones. The specific boundaries of each zone are presented in **Figure ES-3**.

Figure ES-3 Domestic System Infrastructure

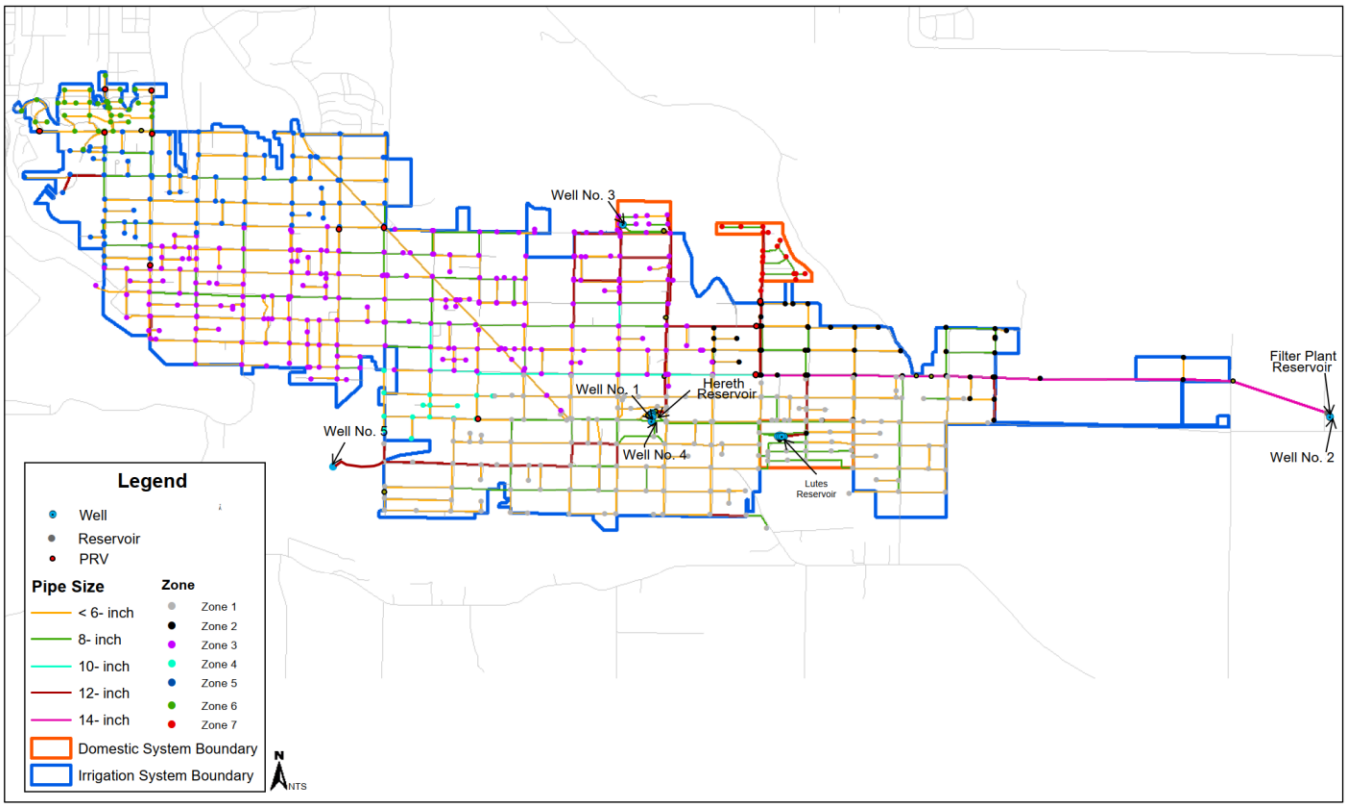


Table ES-5 provides the relative size of these zones on a per-acre basis.

Table ES-5: Pressure Zones

Zone	Service	Size (Acres)	Relative % of District
1	Dual Service	1,177	29%
	Potable-Only Service (Lutes Subdivision)	75	2%
2	Dual Service	405	10%
3	Dual Service	1,452	36%
4	Dual Service	97	2%
5	Dual Service	672	17%
6	Dual Service	108	3%
7	Dual Service	44	1%

Hereth Booster Station

All water from Hereth Tank is transmitted via this station, which has space for three pumps.

- Hereth Transfer - The Hereth transfer utilizes a 1,400 gpm Cornell pump and 75 HP motor to transport water to the Lutes tank.
- Hereth Booster – The Hereth booster serves the southern portion of the system. This Paco pump with 60 HP motor runs on a VFD.
- Hereth Irrigation Transfer – The irrigation transfer utilizes a 1,000 gpm Cornell pump and a 75 HP motor. A reduced pressure zone assembly provides cross control protection of the potable water system.

Lutes Booster Station

There are four pumps at the Lutes booster station, which is supplied via Lutes tank. The booster station was re-built in 2003, and houses four pumps completing two main functions:

- Lutes Transfer Pump - The Lutes transfer pump consists of one 1,025 gpm centrifugal Cornell pump and 100 HP motor. The pump delivers water to Pressure Zone 2 at the intersection of 19th and Grelle.
- Lutes Booster – The Lutes booster includes two 500 gpm VFD Paco pumps for boosting water to service the southern portion (Zones 1 & 4) of the LOID system. These pumps operate as needed based on pressure when the Hereth Booster cannot maintain pressures to the southern portion of the District. The pumps primarily serve the potable-only service area within the Lutes subdivision.

The final pump in the Lutes booster station is a Paco pump dedicated to fire flows with a capacity of 2,000 gpm. This pump only starts if the two smaller pumps are not able to keep up with system demands. If this pump starts, the two smaller pumps shut down.

Domestic Pipe Network

As irrigation mains were built to meet peak irrigation demands and fire flows when practical, the domestic system mains are smaller than those that might be observed in systems of similar magnitude. Due to the low peaking characteristics of a dual water system, much of the LOID domestic system is constructed of pipes less than 6 inches in diameter, fed by larger trunk lines ranging in size from 10 to 14 inches.

A summary of the sizes and materials within the system is provided in **Table ES-6**.

Table ES-6: LOID Existing Pipe & Material [A]

Pipe Material	Pipe Sizes (in)								
	< 4	4	6	8	10	12	14	36	> 36
Asbestos Cement	0	44613	23634	10859	9218	0	16246	0	0
PVC [B]	1189	75935	146732	91660	644	33287	0	0	0
Ductile Iron	689	0	0	6588	1325	9992	0	111	32
Galvanized iron	32992	894	1133	0	0	0	0	0	0
Steel	0	0	0	158	0	0	0	0	0
Copper	28	0	0	0	0	0	0	0	0
Total (Feet)	**34,898**	**121,442**	**171,499**	**109,265**	**11,187**	**43,279**	**16,246**	**111**	**32**
Total (Miles)	**6.61**	**23.00**	**32.48**	**20.69**	**2.12**	**8.20**	**3.08**	**0.02**	**0.01**

[A] Pipe type, length and sizes were generated by the 2018 WaterGEMS model of LOID domestic system and are approximate.

[B] Information obtained from the model does not separate PVC into 160 psi and C900 material.

Maintenance/Replacement

The District has an ongoing pipe replacement program. From 2014 to 2017, the District had replaced an average of 3,500 linear feet of domestic mainline per year, and replacement within the last 10-15 years had reached as high as 10,000 feet per year (2010) and as low as 3,000 feet per year in 2014. District policy requires replacement at minimum with 8-inch PVC.

Problem Areas

During discussion with LOID operators, several maintenance and pressure issues have been noted throughout the system.

Zone 2

- 19th and Burrell – This area experiences high pressures of greater than 100 psi.

Zone 3

- Thain Road Pipe – One particular area of concern is within Zone 3 along Thain Road. Class 160 PVC pipe with galvanized fittings was installed in this area in the 1970's. The pipe is extremely brittle and operators experience frequent maintenance issues and water main breaks, especially in areas where it was not bedded properly, as is the case along Thain.
- Cedar Avenue from 12th to 14th – Low pressures ranging from 35–40 psi in this area may be associated both with high pressure zone elevations and PRV pressure settings related to the Thain Road pipe.

Zone 5

- North of Park Avenue near Vineyards – Service to this area is challenging due to rapidly changing elevations in the area. The variation in elevation creates high pressures within much of the Zone.

Zone 6

- Vineyards – Although no specific pressure issues have been identified within the Vineyards area, water mains within this area are located in alleys. As such, replacement, repair and maintenance within this area are problematic due to private encroachment on the narrow right-of-way.

Domestic Water Storage

Storage provides the District with flow equalization, pressure stabilization, and emergency storage. Storage is critical to alleviate water shortages during water supply interruptions. The tanks are on a 3-5 year plan to be checked and cleaned if necessary.

The LOID system utilizes three storage reservoirs shown in **Figure ES-4** to provide total storage capacity of 4.6 million gallons as shown in **Table ES-7**.

Figure ES-4

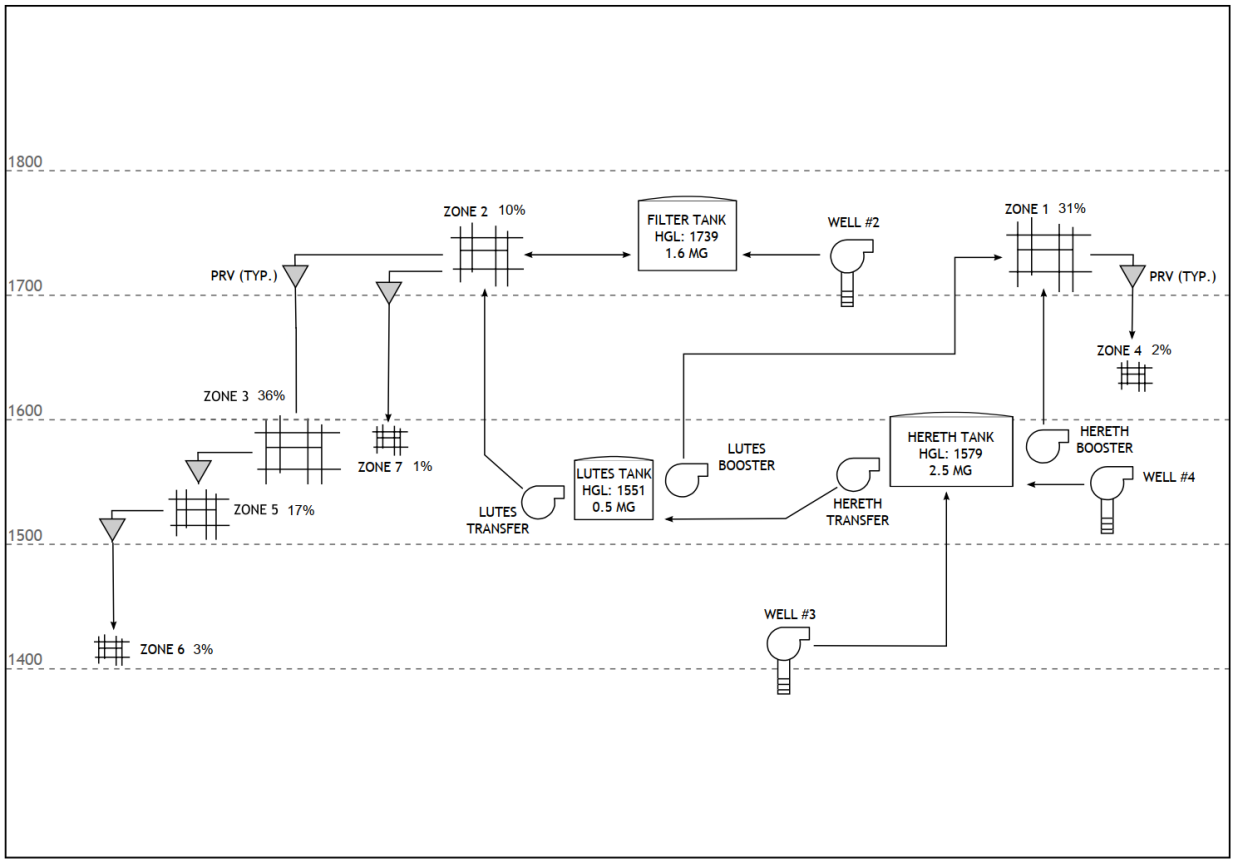


Table ES-7: Domestic System Storage Capacity

Storage	Volume (gallons)
Filter Plant Tank	1,600,000
Hereth Tank	2,500,000
Lutes Tank	500,000
Total	**4,600,000**

Filter Plant Tank

The Filter Plant Tank was constructed by Reclamation as part of the original Lewiston Orchards Project in 1949. It is a buried concrete tank with capacity of 1.6 million gallons.

Hereth Tank

The Hereth Tank, located in Hereth Park near 16th and Powers, is of glass-lined, bolted steel construction with a capacity of 2.5 million gallons and a diameter of 135 feet.

Lutes Tank

The Lutes Tank was constructed for the Lutes Addition, near Powers Drive, in July 1979. It is a 70-foot diameter welded steel tank with a 500,000-gallon capacity.

Telemetry

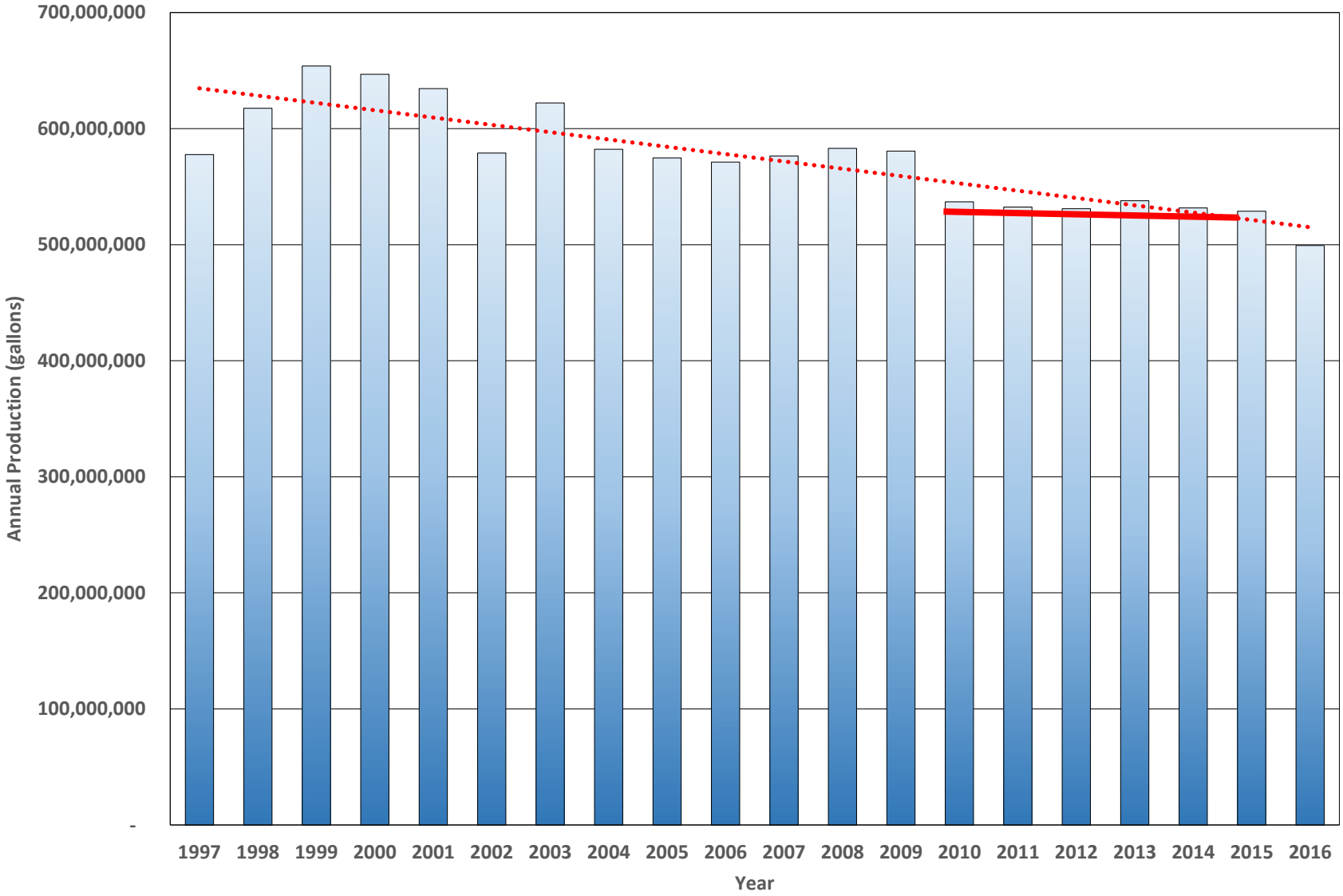
The LOID reservoirs are utilized to call for water from each of the Wells. It is important to note that typical tank settings may change with time based on seasonal fluctuations operational goals, and capital modifications including new source and/or storage supply. LOID personnel use a Supervisory Control and Data Acquisition (SCADA) system to control the system.

Existing Demand

Although the LOID system predominately consists of dual system service connections, water demands must be separated into dual service usage and potable-only service usage to understand the role each plays in the overall system and evaluate the impact of system growth. Water demands are typically calculated based on well production records to account for both usage and unaccounted water.

A historical look at water production, **Figure ES-5**, shows a general decline in water production over the past two decades. It appears the decline has leveled out in the period of 2010-2016 with slight decline again in 2016.

Figure ES-5: Domestic Water Production



Comparison of the 2010-2015 water production to the 2016 water production determined that 2016 was approximately 7% under the four-year average. Detailed water meter records were available for fiscal year 2016 dual and potable-only service connections. This data was analyzed to determine the existing domestic demands parsed out be the connection types. See **Table ES-6**.

Table ES-6: Existing Domestic Demands [A]

Demand Condition	Total System [B]	Dual Service Connections	Potable-only Service Connections
ADD	1.46 mgd	1.26 mgd	0.20 mgd
MDD	2.11 mgd	1.81 mgd	0.30 mgd
PHD		1,823 gpm[C]	520 gpm [D]

[A] Reported per connection values based on domestic units from July through June.

[B] Based on 2016-2017 billing records.

[C] Based on observed peaking factor of 1.45 within Northern portion of the District.

[D] Based on typical literature values (Reynolds, 1996).

Future Demand

Future demand projections are used to understand the impact of population growth on system infrastructure including water supply, system storage, and distribution system capacity. As with any projection, future water demands depend on observed growth and deviation from the growth assumptions presented in **Chapter 2** will correlate with a variation in the future demands presented herein based on actual population growth. Regardless, these future demands represent the culmination of discussions with District personnel and experience to provide a starting point to understand how population growth will impact LOID. **Table ES-7** shows a summary of projected domestic demands based on the existing connection demands presented in **Table ES-6,** and the population growth assumptions of **Chapter 2**.

Table ES-7: Projected Domestic Demands

Year	ADD (mgd)			MDD (mgd)		
	Dual Service	Potable-Only Service	System	Dual Service	Potable-Only Service	System
2027	1.29	0.44	1.73	1.87	0.88	2.75
2037	1.33	0.66	1.99	1.92	1.45	3.37

Water Rights

Water Rights give LOID authority to pump a specified volume of water based on a permitting process through the Idaho Department of Water Resources. In this process, the well location is established, the area of service, and a case is made that the water will have a "beneficial use". Based on an investigation of how much water will be used and stored, a permit is drafted for each point of diversion and an approved diversion rate is permitted to LOID. **Table ES-8** shows the diversion rates that were permitted to each well of the domestic and irrigation systems. **Appendix D** includes copies of Well No. 1 through 5 water rights documents. Well No. 6, currently under design and construction, does not yet have water rights.

Table ES-8: Water Rights

Storage	Diversion Rate cfs (gpm)	Maximum Storage Volume (AF)
Well No. 2	2.13 (956)	NA
Well No. 3	2.76 (1,239)	NA
Well No. 4	3.34 (1,499)	NA
Well No. 5	18.00 (8,079)	11,543.0

Domestic Supply Evaluation

The primary concern associated with any water supply is the quality and quantity of redundant sources. Reliability, as defined by DEQ, requires total supply to be evaluated with the largest source out of service. As displayed in **Table ES-9**, LOID has a redundant supply of 2,040 gpm (2.94 mgd).

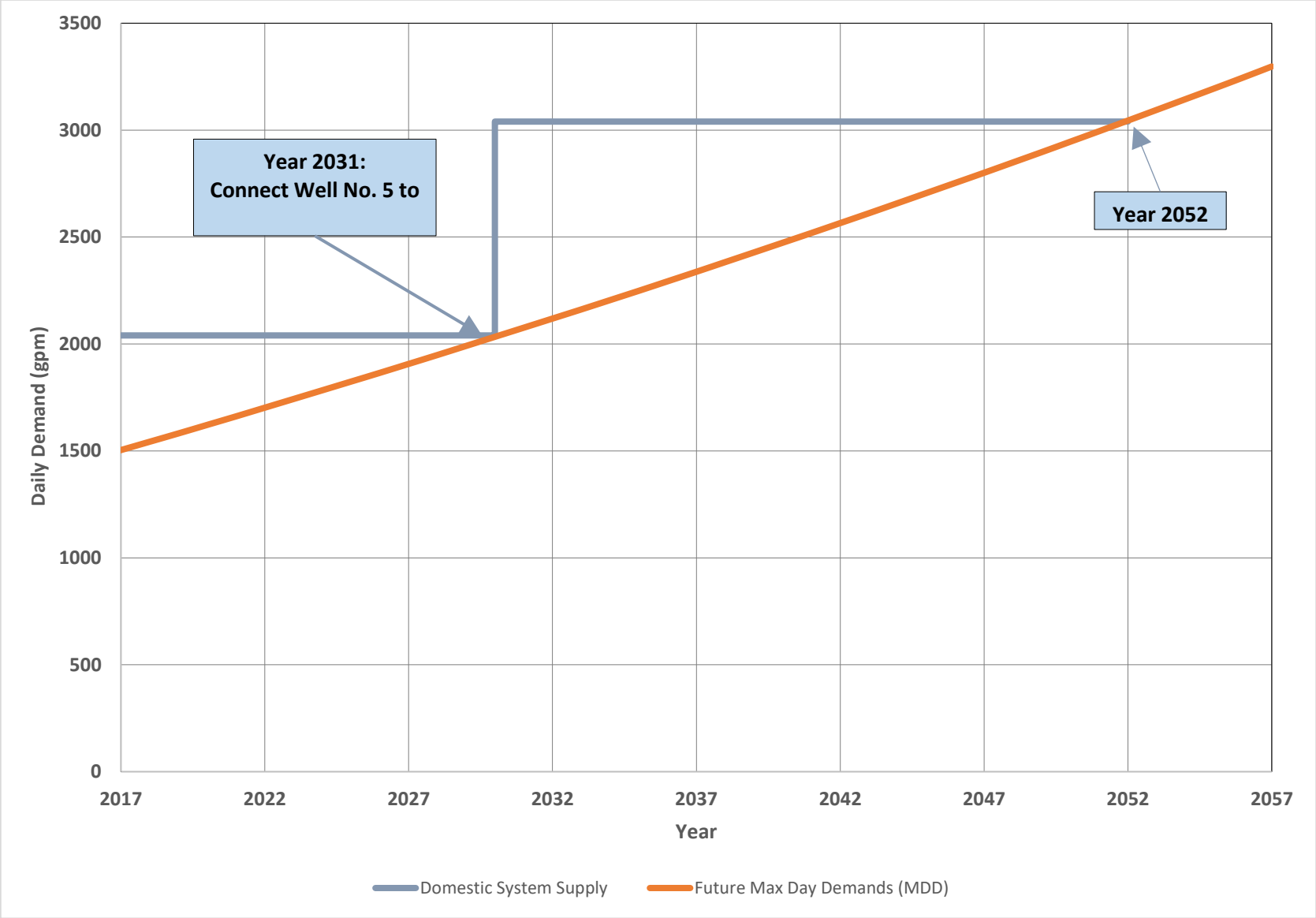
Table ES-9: Redundant Water Supply [A]

Source	Supply	Deficiency
Well No. 2	520 gpm	-
Well No. 3	530 gpm	-
Well No. 4	990 gpm	-
City of Lewiston Intertie[B]	~~1,000 gpm~~	-
TOTAL	**2,040 gpm**	-
Max Day Demand (2017)	1,504 gpm	Not Deficient
Max Day Demand (2027	1,906 gpm	Not Deficient
Max Day Demand (2037)	2,338 gpm	288 gpm

[A] Redundant supply per IDAPA 58.01.08, Subsection 501.17.
[B] Supply is removed from analysis as it is the largest source.

While this supply is capable of meeting current and projected maximum day demands through 2027 the current supply is shy of meeting projected maximum day demands in 2037. Under current growth projections, MDD would be exceeded in approximately 2031. (**Figure ES-6**)

Figure ES-6: Domestic Existing System Supply



Domestic Storage Evaluation

Storage facilities consist of several components per the guidelines of the Idaho Administrative Code (IDAPA 58.01.08). A summary of storage requirements is shown in **Table ES-10** and **Figure ES-7**:

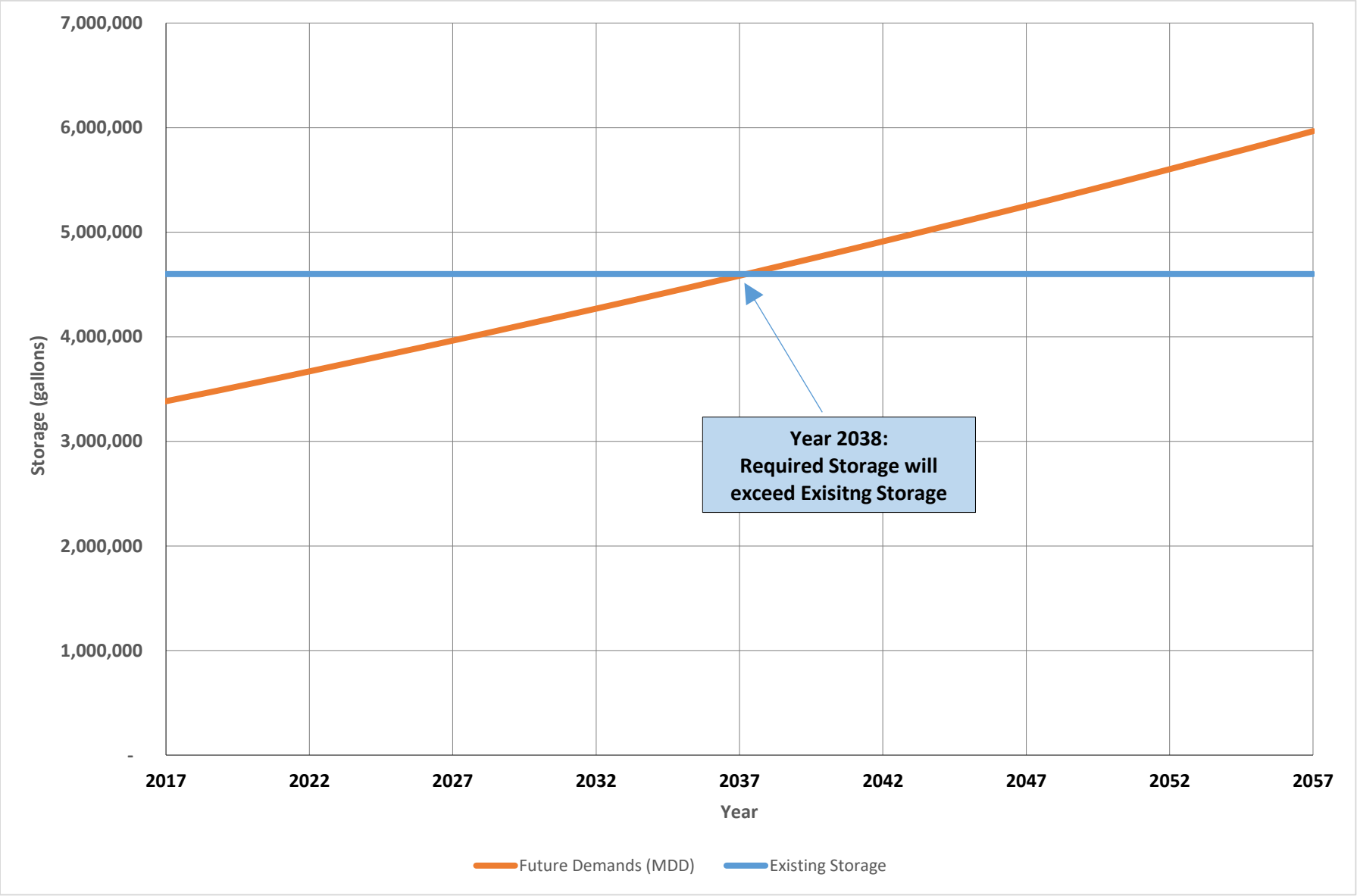
Table ES-10: Storage Volume Summary

Year	Dead Storage [A] (gal)	Operational Storage [B] (gal)	Equalization Storage[C] (gal)	Fire Suppression (gal)	Standby Storage (gal)	Total Storage (gal)
2017	473,000	240,000	145,000	360,000	2,165,836	3,383,836
2037	473,000	240,000	145,000	360,000	3,366,118	4,584,118

[A] Reference **Appendix K** for associated storage calculations.
[B] Storage requirements subject to increase with additional system storage.
[C] Equalization storage is subject to change based on modifications to system infrastructure, including supply and system boosters.

The current amount of storage of 4.6 million gallons is sufficient, but based on observed growth and changes in demands due to new potable-only service connections, LOID should re-evaluate storage requirements in the next 10 to 20 years.

Figure ES-7: Domestic Storage Capacity



Domestic System Distribution Evaluation

The LOID model was utilized to develop pressure profile maps to understand existing pressure issues. In addition, the model was utilized to understand the impact of future demands on pressures within the District. The maps show various pressures, including those outside the target ranges established by the Board.

Domestic Existing Distribution Evaluation

The distribution system generally provides pressures consistent with the target pressures of 40-100 psi. There are a few areas in Zone 1 that have pressures exceeding 100 psi, but have been operating for decades and have not experience maintenance issues. There is a lower pressure areas in Zone 3 on Cedar Ave from 10th to 15th St due to reduced pressures at the PRV stations. Zone 5 also has some high pressure areas due to the topography in the area.

Domestic Future Distribution Evaluation

The evaluation was completed under the following scenarios and design criteria:

1. Build-out Maximum Day Demand Scenario.

   Demand:

   - Maximum day demand for full build-out of existing system and anticipated growth areas.

   Design Criteria:

   - Maintain minimum pressure of 40 psi within existing system.

2. Build-out Fire Flow Scenario.

   Demand:

   - Maximum day demand for full build-out of existing system and anticipated growth areas.
   - Residential Fire flow of 1,500 gpm to anticipated growth area outside existing domestic boundary.

   Design Criteria:

   - Maintain minimum pressure of 20 psi within existing domestic boundary.

The cumulative impact of build-out development in growth Area 1, build-out demands in the existing domestic system and residential fire demand served through Zone 3 result in flows which exceed the capacity of the existing 14-inch main from the Filter Plant Tank and Lutes Transfer.

The build-out analysis to serve future areas was completed to provide distribution recommendations only. Both scenarios were evaluated with the following assumptions:

- Additional supply of 1,000 gpm to Zone 3.
- Increased PRV setting between Zone 2 and Zone 3 to 65 psi.

Maintenance/Replacement

Typical guidelines suggest that the useful life of domestic distribution systems ranges from 65-95 years (Clean, 2002). If replacement continues under the District's more aggressive schedule with annual replacement of 10,000 linear feet of domestic mainline, the entire system would be replaced by 2050. We recommend that LOID increase their replacement programs to keep up with the useful life of the system.

Water Quality

The District's groundwater supply has acceptable water quality, and according to discussion with LOID staff, there are is only one regulatory issues associated with water quality, Fluoride in Well No. 3.

System Reliability

System reliability consists of many items, including operating during a power outage, or operation with a system component out-of-service. By planning for these scenarios, LOID's system can be better prepared to provide service with a portion of its infrastructure out-of-service. Several the capital improvement will address system reliability.

Regulatory Issues

Fluoride in Well No. 3 is about 3 mg/l which is below the MCL of 4.0 mg/l but above the SMCL of 2.0 mg/l. LOID met the requirements for public notification in 2018 through the Consumer Confidence Report and will continue to do so in the future.

ES 4 Irrigation System

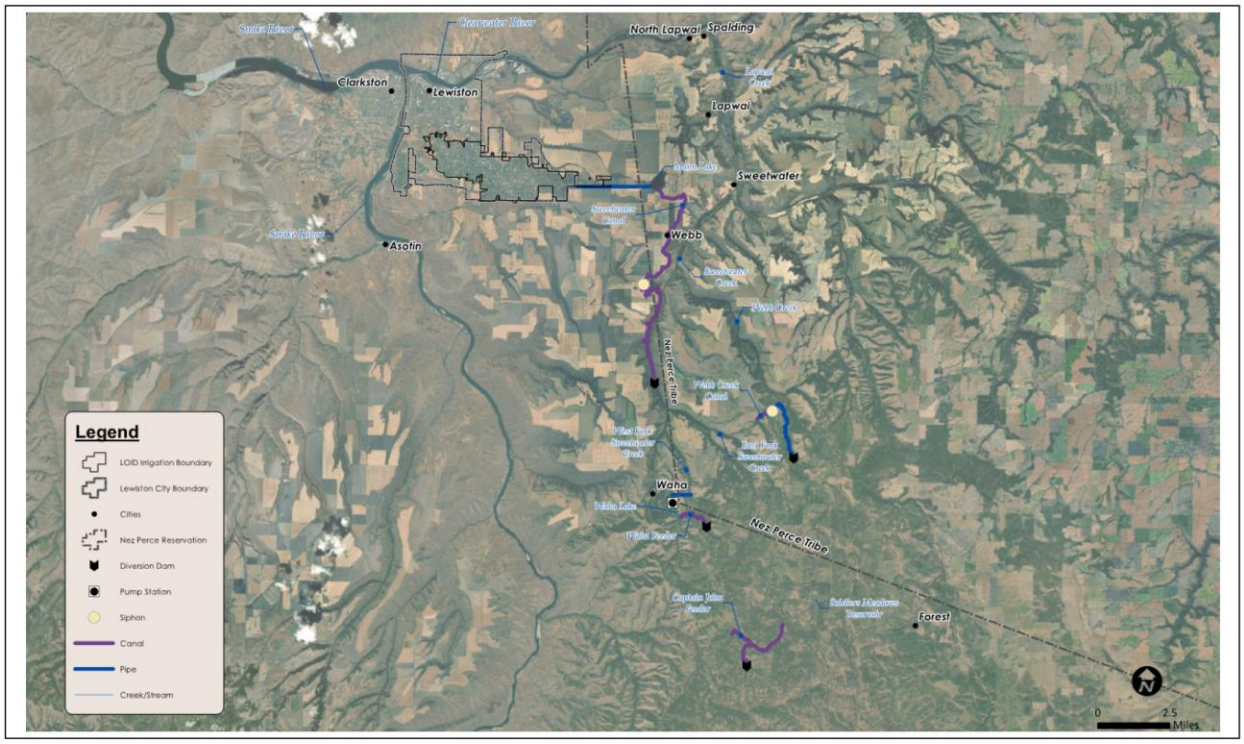
Introduction

The LOID Irrigation System serves the Lewiston Orchards with a surface water collection system and ground water pumping system that utilizes a series of diversion structures, reservoirs, feeder canals, wells, and a distribution network to provide irrigation service. Existing storage facilities and system supply are assumed to be sufficient to meet system demands within the planning period.

Water Supply, Collection and Storage

Surface water collection begins within the Craig Mountain drainage near the headwaters of Sweetwater Creek, located approximately 20 miles southeast of Lewiston. Water from Webb Creek and Captain John Creek is stored in the Soldiers Meadow Reservoir and released as need by the District. These flows run north in Webb Creek to the Webb Creek diversion dam, where water is diverted west to Sweetwater Creek via the Webb Creek canal. Flows are also collected from the west fork of Sweetwater Creek and stored in Waha Lake via the Waha feeder canal. This water is pumped from the lake back into the west fork as needed for irrigation. The final diversion, Sweetwater diversion dam, directs water to Mann Lake via the Sweetwater canal. It is important to note that Mann Lake is also referred to as Reservoir A. Water is drawn from Mann Lake from an underground pipeline penetrating the lake's western levee. A map of this infrastructure is provided in **Figure ES-8**.

Figure ES-8 Irrigation Surface Water Collection System



A summary of the LOID storage reservoirs and diversion dams are provided in **Tables ES-11** and **ES-12**, respectively.

Table ES-11: Irrigation Storage Summary

Reservoir	Total Capacity (Acre-Feet)	Effective Capacity (Acre-Feet)
Mann Lake	2,440 [A]	1,740 [A, C]
Soldier's Meadow	2,369 [A]	2,369 [A]
Lake Waha	3,497 [A]	3,047 [A, B]

[A] Lewiston Orchards Irrigation District Manager's Report, December 30, 2017, Water Storage Report.

[B] Less 450 AC FT (pumping level)

[C] Less 500 AC FT (fire pool)

Table ES-12: Diversion Dam Summary [A]

Diversion Dam	Type	Structural Height	Hydraulic Height	Crest Length	Capacity	Location
Captain John Diversion	Log Crib Catch Basin	NA [B]	NA [B]	NA [B]	<5 cfs	Captain John Creek
West Fork Diversion	Concrete Overflow Weir	NA [B]	NA [B]	NA [B]	<20 cfs	West Fork Sweetwater
Webb Creek Diversion	Rockfill Overflow Weir with Concrete Crest Wall	20 feet	10 feet	75 feet	20 cfs	Webb Creek
Sweetwater Diversion	Rockfill Overflow Weir	12 feet	8 feet	80 feet	77 cfs	Sweetwater Creek

[A] Bureau of Reclamation Website: http://www.usbr.gov/projects

[B] NA (Not Available)

Lake Waha

Lake Waha is a natural lake used for off-stream storage. The lake is located approximately 15 miles from the Lewiston Orchards and west of the west fork of Sweetwater Creek.

Soldiers Meadow

Soldiers Meadow Reservoir is located on Webb Creek approximately 20 miles from the Lewiston Orchards. The Soldiers Meadow dam was originally constructed in 1923, and in 1986, extensive repairs were completed on the dam as part of Reclamation's Safety of Dams Program. The reservoir is owned by Reclamation and operated by LOID.

Mann Lake

Mann Lake, approximately seven miles southeast of Lewiston, is a man-made reservoir constructed in 1923. In 1999, Reclamation completed upgrades to the dam under the Safety of Dams Program. In addition, the dam's operating elevation was restricted, effectively reducing the reservoir capacity by one-third, to 1,960 acre-feet. Reclamation temporarily lifted this restriction in 2010, increasing the capacity to 2,440 acre-feet. Currently, the storage capacity is 2,440 acre-feet, but 500 acre-feet is retained for fire pool storage and the remaining 1,940 acre-feet is usable storage.

Well No. 5

LOID Well No. 5 was drilled in 2014 and completed in early 2017. The well was installed with a 800-foot surface seal and a 24-inch diameter surface casing. The well penetrates at a target depth of 1,900 feet and has a proven yield of 2,000 gpm.

Well No. 6

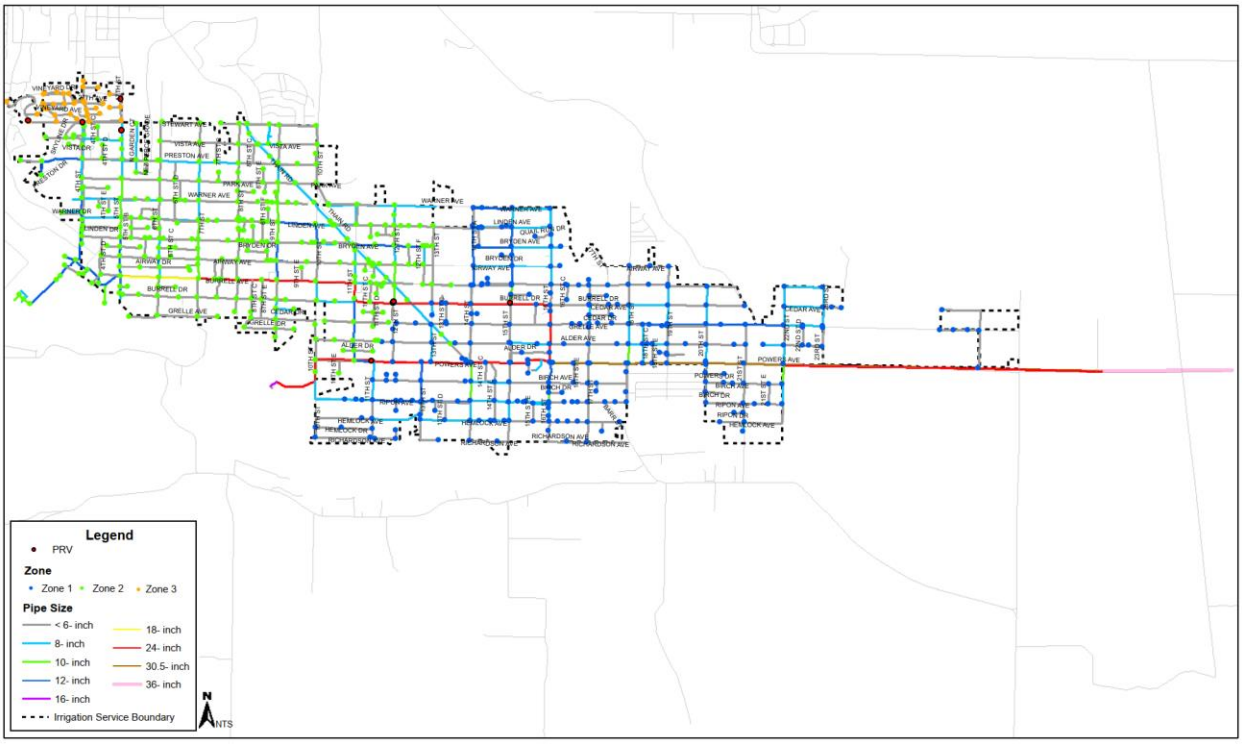
LOID Well No. 6 is currently under contract for design and construction with J-U-B ENGINEERS, Inc.

Irrigation Water Distribution

Irrigation Pipe Network

The LOID Irrigation System is divided by three pressure zones, separated by pressure reducing valves (PRVs). **Figure ES-9** shows existing irrigation system pipe sizes.

Figure ES-9 Irrigation Existing Distribution System



A summary of the sizes and materials within the system is provided in **Table ES-13**.

Table ES-13: LOID Irrigation Pipe Size and Materials [A]

Pipe Material	Pipe Size (in)										
	< 4	4	6	8	10	12	16	18	24	30.5	36
Asbestos Cement [B]	0	9252	0	0	0	0	0	0	0	0	0
PVC [C]	3501	58718	112852	83940	1977	25547	100	0	10604	0	0
Ductile Iron [D]	2785	5033	1873	1047	744	5524	0	0	0	0	0
Steel	11735	49080	20165	10820	10023	6654	0	2652	14502	18734	4411
Copper	0	0	0	0	0	0	0	0	0	0	0
Total (Feet)	**41,947**	**122,514**	**134,890**	**96,424**	**12,744**	**37,827**	**100**	**2,652**	**25,106**	**18,734**	**4,411**
Total (Miles)	**7.94**	**23.20**	**25.55**	**18.26**	**2.41**	**7.16**	**0.02**	**0.50**	**4.75**	**3.55**	**0.84**

[A] Pipe type, length and sizes were generated by the 2018 WaterGEMS model of LOID irrigation system and are approximate.
[B] Information obtained from the model does not separate PVC into 160 psi and C900 material.

Maintenance/Replacement

The District has an ongoing pipe replacement program. From 2014-2017, the District has replaced an average of nearly 5,400 linear feet of irrigation mainline per year, and staff replacement within the last 10-15 years has reached as high as 10,000 feet per year. District policy currently requires replacement at minimum with 8-inch PVC.

Problem Areas

During discussion with LOID operators, one main pressure issue was noted within the system.

Zone 1

- 16th & Richardson – LOID staff receives consistent complaints within this area during peak demands, when residents do not have sufficient pressure to irrigate.

LOID staff also identified a recurrent main maintenance issue in the vineyards area:

Zone 3

- Vineyards – Although no specific pressure issues have been identified within the Vineyards vicinity, LOID staff indicated that water mains within this area are located in alleys. As such, replacement, repair and maintenance within this area are problematic due to private encroachment in the narrow right-of-way.

Irrigation Water Demand

The Filter Plant flow meter provides the best information regarding water delivery in the irrigation system, as all irrigation water flows through this line prior to service. Delivery and peaking factor are summarized in **Table ES-14**.

Table ES-14: Irrigation Delivery [A]

Description	Acreage	ADD Acre-ft/day (gpm) [gpm/acre]	MDD Acre-ft/day (gpm) [gpm/acre]	PHD Acre-ft/day (gpm) [gpm/acre]
Total System	3,707	23.98 (5,430) [1.45]	49.4 (11,200) [2.99]	(16,900) [4.52]
Residential	2,652	[1.53]	[3.15]	[4.76]
Commercial	599	[0.40]	[0.82]	[1.24]
Agricultural	300	[2.36]	[4.86]	[7.34]
Public	156	[3.00]	[6.18]	[9.33]

[A] Reference **Appendix F**

Irrigation Distribution System Evaluation

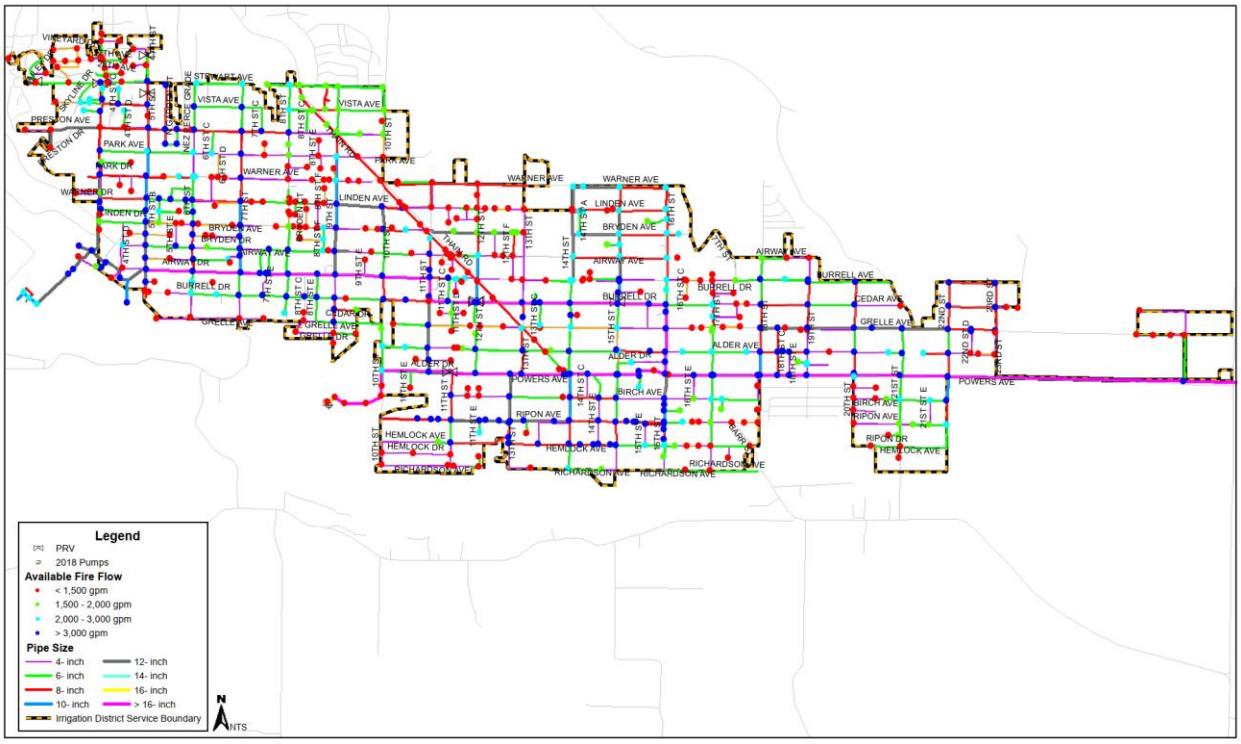
The LOID model was utilized to develop pressure maps to understand existing pressure issues. In addition, the model was utilized to understand the impact of future deliveries on pressures within the District. The maps show various pressures, including those outside the target ranges established by the Board. The most significant issue with the irrigation system distribution system is the undersized main from Mann Lake to 16th St. on Powers Ave.

Fire Flow

Available fire flow under the following conditions has been prepared in **Figure ES-10:**

- Minimum system pressure of 20 psi.
- Maximum day demand conditions.

Figure ES-10: Irrigation Available Fire Flow at Maximum Day Delivery



The figure shows that in general, residential fire flows of 1,500 gpm is not available near the boundary of the LOID Irrigation boundary. This is likely due to the prevalence of small diameter pipe of less than 8-inches in these areas.

Maintenance/Replacement

Typical guidelines suggest that the useful life of domestic distribution systems ranges from 65-95 years (Clean, 2002). If replacement continues under the District's more aggressive schedule with annual replacement of 10,000 linear feet of domestic mainline, the entire system would be replaced by 2050. We recommend that LOID increase their replacement programs to keep up with the useful life of the system.

Regulatory Issues

LOID does not have any regulatory issues associated with the Clean Water Act.

ES 5 Capital Improvement Plan

Domestic System Capital Improvements

Table ES-15 provides summary of major capital improvements anticipated over the next 20 years. Detailed opinions of probable costs for each project are presented in **Appendix Q.**

Table ES-15: Domestic System Major Capital Projects Summary

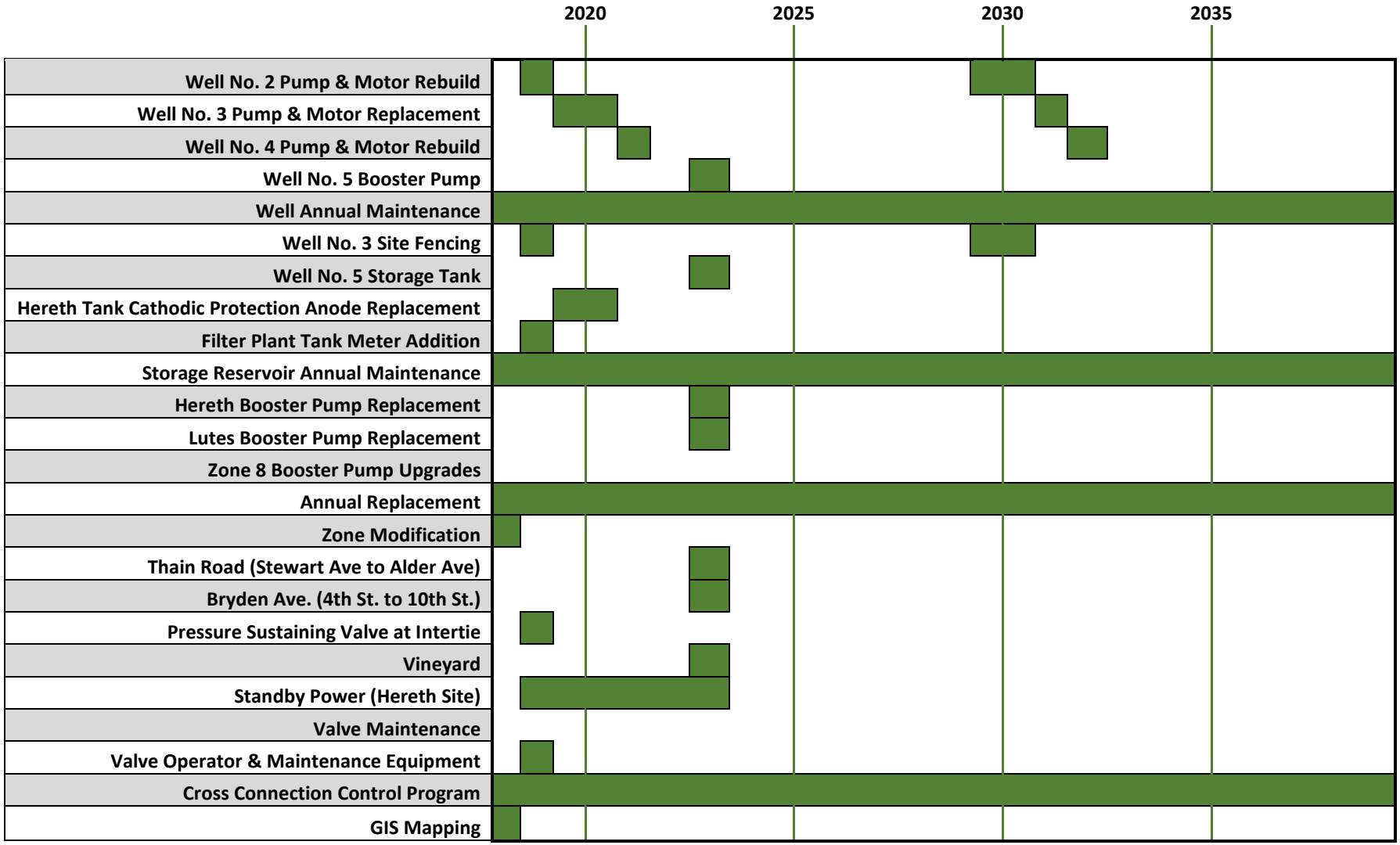
Item	Work Completed By	20-Year Total Capital Cost [A]
Supply		
Well No. 2 Pump & Motor Rebuild	Public Works Contractor [B]	$ 164,000
Well No. 3 Pump & Motor Replacement	Public Works Contractor [B]	$ 338,000
Well No. 4 Pump & Motor Rebuild	Public Works Contractor [B]	$ 378,000
Well No. 5 Booster Pump	Public Works Contractor [B]	$ 392,000
Well Annual Maintenance		$ 300,000
Well No. 3 Site Fencing	Public Works Contractor [B]	$ 10,700
Storage		
Well No. 5 Storage Tank	Public Works Contractor [B]	$ 1,500,000
Hereth Tank Cathodic Protection Anode Replacement	Public Works Contractor [B]	$ 25,000
Filter Plant Tank Meter Addition	Public Works Contractor [B]	$ 45,000
Storage Reservoir Annual Maintenance		$ 100,000
Booster Pump Stations		
Hereth Booster Pump Replacement	Public Works Contractor [B]	$ 101,000
Lutes Booster Pump Replacement	Public Works Contractor [B]	$ 203,000
Zone 8 Booster Pump Upgrades		
Distribution		
Annual Replacement		$ 10,000,000
Zone Modification	Public Works Contractor [B]	$ 475,000
Thain Road (Stewart Ave to Alder Ave)	Public Works Contractor [B]	$ 2,601,000
Bryden Ave. (4th St. to 10th St.)	Public Works Contractor [B]	$ 2,247,000
Pressure Sustaining Valve at Intertie	Public Works Contractor [B]	$ 1,000
Vineyard	Public Works Contractor [B]	$ 850,000
Well No. 5 to Zone 3	Public Works Contractor [B]	$978,000
Operation and Maintenance		
Standby Power (Hereth Site)	Public Works Contractor [B]	$ 556,000
Valve Maintenance		$ 980,000
Valve Operator & Maintenance Equipment	Public Works Contractor [B]	$ 33,000
Cross Connection Control Program		$ 1,960,000
GIS Mapping	Public Works Contractor [B]	$ 15,000

[A] Opinion of Probable Cost is presented in 2018 dollars. See **Appendix Q**.

[B] Opinion of Probable Cost for work completed by public works contractor includes contingency, engineering, and administrative fees.

The implementation schedule is presented in **Figure ES-11**.

Figure ES-11: Domestic System Contracted Projects Implementation Schedule [A]



[A] All dates are labelled only with beginning years, not entire duration, after 2023.

Rate Impact

The District does not have sufficient reserves to fund the major capital improvements listed in **Table ES-15** without a rate increase. A rate analysis was performed by LOID's Financial Director utilizing the Domestic System Capital Project Summary and Implementation Schedule. Rate increase of 4% - 7% each year over the next five (5) years will be needed to fund the recommendations in **Table ES-15**. These increases take into account utilizing LOID's designated investment funds.

Irrigation System Capital Improvements

Table ES-16 provides summary of major capital improvements. Detailed opinions of probable costs for each project are presented in **Appendix R.**

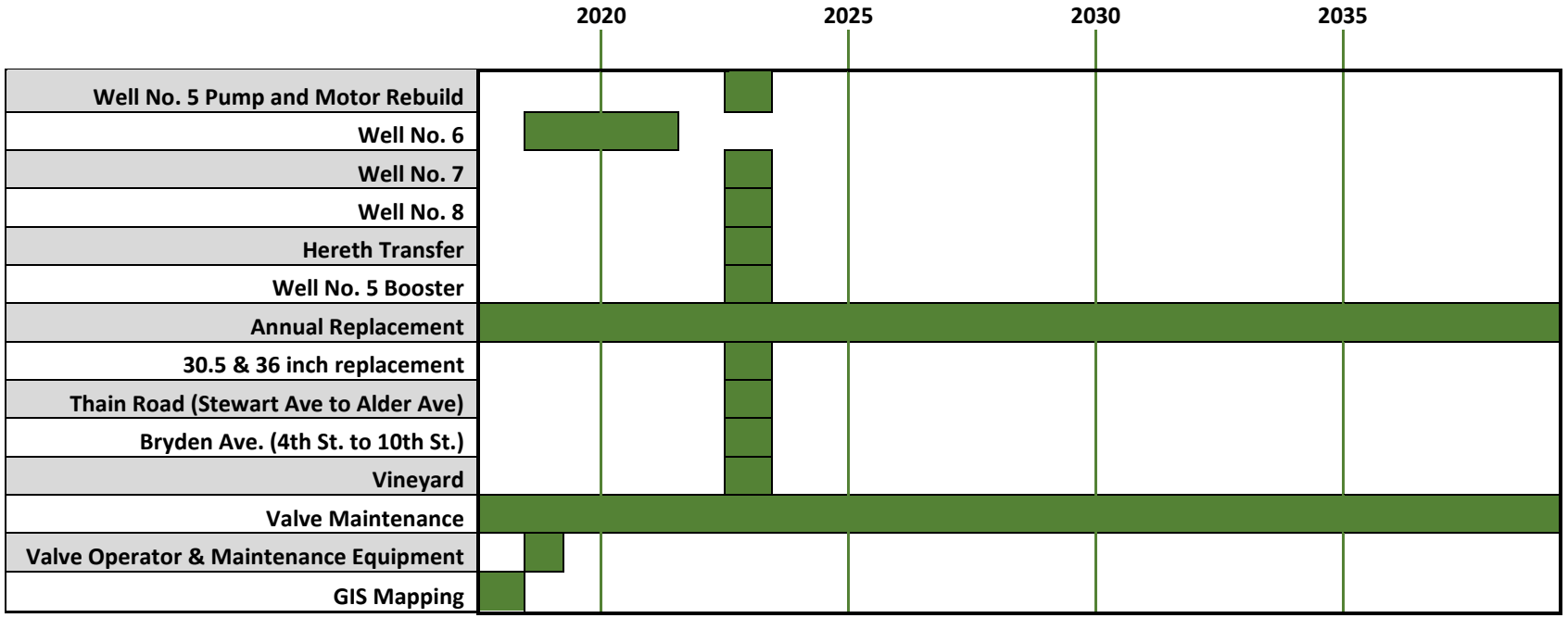
Table ES-16: Irrigation System Major Capital Projects Summary

Item	Work Completed By	20-Year Total Capital Cost [A]
Supply		
Well No. 5 Pump and Motor Rebuild	Public Works Contractor [B]	$ 234,000
Well No. 6	Public Works Contractor [B]	$ 7,294,000
Well No. 7	Public Works Contractor [B]	$ 7,294,000
Well No. 8	Public Works Contractor [B]	$ 7,294,000
Booster Pump Stations		
Hereth Transfer	Public Works Contractor [B]	$ 52,000
Well No. 5 Booster	Public Works Contractor [B]	$ 110,000
Distribution		
Annual Replacement		$ 10,000,000
30.5 & 36 inch replacement	Public Works Contractor [B]	$ 8,884,000
Thain Road (Stewart Ave to Alder Ave)	Public Works Contractor [B]	$ 2,601,000
Bryden Ave. (4th St. to 10th St.)	Public Works Contractor [B]	$ 2,092,000
Vineyard	Public Works Contractor [B]	$ 850,000
Operation and Maintenance		
Valve Maintenance		$ 980,000
Valve Operator & Maintenance Equipment	Public Works Contractor [B]	$ 33,000
GIS Mapping	Public Works Contractor [B]	$ 15,000

[A] Opinion of Probable Cost is presented in 2018 dollars. See **Appendix R**.
[B] Opinion of Probable Cost for work completed by public works contractor includes contingency, engineering, and administrative fees.

A rate analysis was performed by LOID's Financial Director utilizing the Irrigation System Major Capital Projects Summary and Implementation Schedule. Rate increases of 5% - 8% annually will be required to fund the recommendations in **Table ES-16**.

Figure ES-16: Irrigation System Contracted Projects Implementation Schedule [A]



[A] All dates are labelled only with beginning years, not entire duration, after 2023.