Professional

Engineering

Services

Distribution System Improvement Projects Preliminary Engineering Report (Contracts 14, 15, and 16) and Final Engineering Report Contract 14

Report

Lake Village Water Association, KY

March 2023

STRAND ASSOCIATES®

STRAND ASSOCIATES®
Excellence in Engineering
Since 1946

Strand Associates, Inc.®
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Lexington, KY 40517
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March 9, 2023

Mr. Mike Sanford
Lake Village Water Association
801 Pleasant Hill Drive
P.O. Box 303
Lexington, KY 40310

Re: Contract 14 Final Engineering Report
Distribution System Improvement Projects

Dear Mike,

Enclosed is a PDF copy of the Final Engineer Report (FER) for the Contract 14–Distribution System Improvement Projects. To be clear, Strand Associates, Inc.® (Strand) has added the FER to the back of the PER. This organization will allow Strand to use the same document continuing into Contracts 15 and 16 in the future and keep Rural Development informed on the status of the full Distribution System Improvement Projects as a whole.

Please call 859-225-8500 with questions.

Sincerely,

STRAND ASSOCIATES, INC.®

Elizabeth A. Dienst, P.E.

Enclosure: Report

Report for
Lake Village Water Association

Distribution System Improvement Projects
Preliminary Engineering Report

Prepared by:

STRAND ASSOCIATES, INC.®
651 Perimeter Drive, Suite 220
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www.strand.com

April 2019
Revised November 2019

STRAND ASSOCIATES®

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The Lake Village Water Association (LVWA) is a customer-owned water utility that provides water to rural areas of southeastern Mercer County, northeastern Boyle County, and select areas in the City of Burgin. LVWA was established in the late 1960s. Several water mains being studied in this project were installed under the first construction contract of the utility. At near 50 years old, several of these lines are in need of replacement.

This Preliminary Engineering Report (PER) reviews 17 different projects. Most of the projects will replace existing lines within existing easements and a few will upsize the line. Each has been reviewed to see whether upsizing the line is recommended to provide benefits to customers. Three options have been studied for each part of the project, with “do nothing” as the third option for each.

Based on the results of the opinions of probable construction cost (OPCC), prioritizing the work, and preferred project size, one project was divided into three smaller contracts. The three contracts will be Contract 14 for the highest priority lines, Contract 15 for the second priority, and Contract 16 for the least priority. Three contracts will enable LVWA to be more likely to get funding and to have projects able to be bid by more Contractors for increased competition and better pricing. The following summarizes the parts of the project under each contract and provides the OPCC.

Part	Project	Construction Subtotal
Part 1	Bellows Mill Road and Montgomery Lane Water Main	$727,600
Part 3	Burgin Road Water Main	$194,100
Part 4	US 127 Water Main	$395,500
Part 7	South Buster Pike Water Main	$75,600
Part 10	Moores Lane Water Main	$18,000
Part 15	Wildwood Road Water Main	$76,300
Part 16	Palisades	$68,000
	Subtotal	$1,555,100
	Contingency and Engineering (35%)	$544,300
	Project Total	**$2,099,400**

Table ES-1 Contract 14: Priority 1–Total Project Cost Opinion

Part	Project	Construction Subtotal
Part 5	Waterworks Road Water Main	$453,400
Part 6	Sunrise Shores Water Main	$339,700
Part 9	Dix Dam Road Water Main	$153,000
Part 11	Spears Creek Water Main Elimination	$12,000
Part 17	Service Replacements	$427,500
	Subtotal	$1,385,600
	Contingency and Engineering (35%)	$485,000
	Project Total	**$1,870,600**

Table ES-2 Contract 15: Priority 2–Total Project Cost Opinion

Part	Project	Construction Subtotal
Part 8	Highway 33 and Burgin Road Water Main	$129,300
Part 12	KY 152 and KY 33 Water Main	$99,000
Part 13	Carmichael Road and Herrington Woods Loop Water Main	$18,900
Part 14	US 127 Connection to the City of Harrodsburg	$95,500
	Subtotal	$342,700
	Contingency and Engineering (35%)	$119,900
	Project Total	**$462,600**

Table ES-3 Contract 16: Priority 3–Total Project Cost Opinion

SECTION 1
PURPOSE AND BACKGROUND

1.01 BACKGROUND

In August 2018, Strand Associates, Inc.® (Strand) was retained by the Lake Village Water Association, Kentucky (LVWA) to perform engineering services for the Distribution System Improvements Project. The project scope includes investigating the following 17 project parts to improve and enhance the LVWA water distribution system. The location of each part of the project can be seen in Figure 1.01-1. Each part of the project will be explored in separate sections of the report.

- Part 1–Bellows Mill Road and Montgomery Lane Water Main
- Part 2–Bellows Mill Road Water Main
- Part 3–Burgin Road Water Main
- Part 4–US 127 Water Main
- Part 5–Waterworks Road Water Main
- Part 6–Sunrise Shores Water Main
- Part 7–South Buster Pike Water Main
- Part 8–Highway 33 and Burgin Road Water Main
- Part 9–Dix Dam Road Water Main
- Part 10–Moores Lane Water Main
- Part 11–Spears Creek Water Main Elimination
- Part 12–KY 152 and KY 33 Water Main
- Part 13–Carmichael Road and Herrington Woods Loop Water Main
- Part 14–US 127 Connection to the City of Harrodsburg (Harrodsburg)
- Part 15–Wildwood Road Water Main
- Part 16–Palisades
- Part 17–Service Replacements (not shown in Figure 1.01-1)

1.02 PROJECT PLANNING AREA

The project planning area includes the LVWA service area, which can be generally described as the rural areas of southeast Mercer County, northeast Boyle County, and select locations in the City of Burgin (Burgin). LVWA currently has approximately 2,466 residential connections and 35 commercial connections, which is estimated to be a service population of approximately 6,677 (2,501 connections). According to its Kentucky Public Service Commission (PSC) 2017 annual report, LVWA sold 157,287,000 gallons (gal) of potable water in 2017 (149,025,000 gal for residential and 8,262,000 gal for commercial).

The LVWA service area has been determined to be nearly built out. LVWA does not anticipate any future development and expects population growth to be minimal over the next several decades.

1.03 DESCRIPTION OF EXISTING FACILITIES

The LVWA water distribution system includes four potable water storage tanks, two booster pumping stations (BPS), and more than 128 miles of water main. The distribution system consists of three pressure zones. Water is purchased from Harrodsburg on US 127 between Harrodsburg and the City of Danville (Danville), Higginbotham Lane, and off Hwy 33. The water from Danville is purchased and enters off Burgin/Danville Road.
Figure 1.03-1 shows the existing LVWA water distribution system infrastructure.

A. Potable Water Storage Tanks (WSTs)

LVWA owns and operates four potable WSTs throughout Mercer and Boyle Counties, Kentucky. Table 1.03-1 provides a summary of each WST in the distribution system.

Tank	Volume (gal)	Overflow Elevation	Base Elevation
Shakertown Standpipe	47,000	1,075	990
Ison Road Standpipe	250,000	1,081	969.5
Crozier Elevated Tank	250,000	1,100	964.5
Northpoint Training Center Elevated Tank	600,000	1,020	900

Table 1.03-1 Potable WST Summary

B. Booster Pumping Stations

There are two BPSs in LVWA's existing water distribution system. The BPSs operate to control the levels in the existing WSTs. The Shakertown BPS was recently renovated and the pumps replaced. The Moores Lane BPS was constructed in 1994. Table 1.03-2 provides a summary of each active BPS in the distribution system.

Booster Pump Station	Number of Pumps	Firm Capacity (gpm)	Total Dynamic Head (ft)	Status
Shakertown	2	350	168	In Service
Moores Lane	2	500	190	In Service

Table 1.03-2 Booster Pumping Station Summary

C. Distribution System Water Mains

The existing distribution system contains approximately 128 miles of water main ranging in size from 2 to 8 inches in diameter. All LVWA's water mains are polyvinyl chloride (PVC) with some water mains dating back to the 1970s. The main goal of this project is to replace portions of PVC water main in the system that are undersized, in need of replacement because of leakage, or both. Table 1.03-3 breaks down the LVWA water distribution system into pipe diameters and provides the length of each size.

Diameter (inch)	Length of Pipe (ft)
2 and less	39,841
3	183,788
4	136,233
6	244,451
8	68,351
TOTAL	672,664

Table 1.03-3 Water Main Size Distribution Summary

1.04 HYDRAULIC WATER MODEL UPDATE

Strand had created and used a model of the LVWA system for previously completed projects. This original model used KY Pipe. For this project, Strand updated the computerized hydraulic water distribution system model previously created and converted it to a WaterGEMs V8i model. The section discusses geographical information system (GIS) infrastructure importation to the model, water demand allocation, model calibration, and simulated evaluations.

A. GIS Importation to WaterGEMs V8i

WaterGEMs V8i was the selected software used to import the previous model and create a newly updated computerized hydraulic model of the water distribution system. GIS information, received from LVWA, was imported into WaterGEMs V8i using the ModelBuilder function.

Upon importing the GIS information, WaterGEMs V8i automatically created a junction node at each end of a water main, excluding water main end points such as tanks or pump stations. These junction nodes serve as points of elevation and water demand sources in the model. Elevation information for each junction node was then imported from a Kentucky mosaic digital elevation model (DEM).

Other items not included in the GIS database that were entered in the computerized hydraulic model include pump curves, master meter locations and hydraulic grade lines, and logical operational controls based on discussions with LVWA.

B. Water Demand Allocation

Daily water usage information from 2014 to 2018 was obtained from LVWA for the analysis. Purchased master meter water usage data was used for the analysis, which includes all revenue and nonrevenue water throughout the distribution system. The average day demand condition was determined as 0.67 million gallons per day (mgd). Water usage information for June 25, 2018, was selected to simulate this average day demand condition. The maximum day demand condition was determined as 1.26 mgd which occurred on June 4, 2018. Discussions with LVWA indicated that population growth within its service area will be minimal over the next several decades. The future average day demand condition and maximum day demand condition were assumed to be consistent with the June 2018 demand data.

Water demand was then evenly distributed to each junction node contained within each respective master meter's distribution area and associated pressure zone. Water demand for the Northpoint Training Center, the largest water user in the LVWA distribution system, was hand placed in the hydraulic model. The Northpoint Training Center is approximate average day demand is approximately 106 gallons per minute (gpm) and maximum day demand is approximately 200 gpm as determined by previous studies completed by Strand.

A specific 24-hour diurnal curve was used from the previous hydraulic model developed by Strand. Figure 1.04-1 shows the diurnal curve.

Figure 1.04-1 LVWA Diurnal Curve

C. Model Calibration

The previous KY Pipe hydraulic model had been calibrated by Strand. Hazen Williams C-factor values determined during this calibration effort were used in the new WaterGEM model for this evaluation. C-factor values range from 130 to 140 for PVC pipe. The new model was not recalibrated.

D. Simulated Evaluations

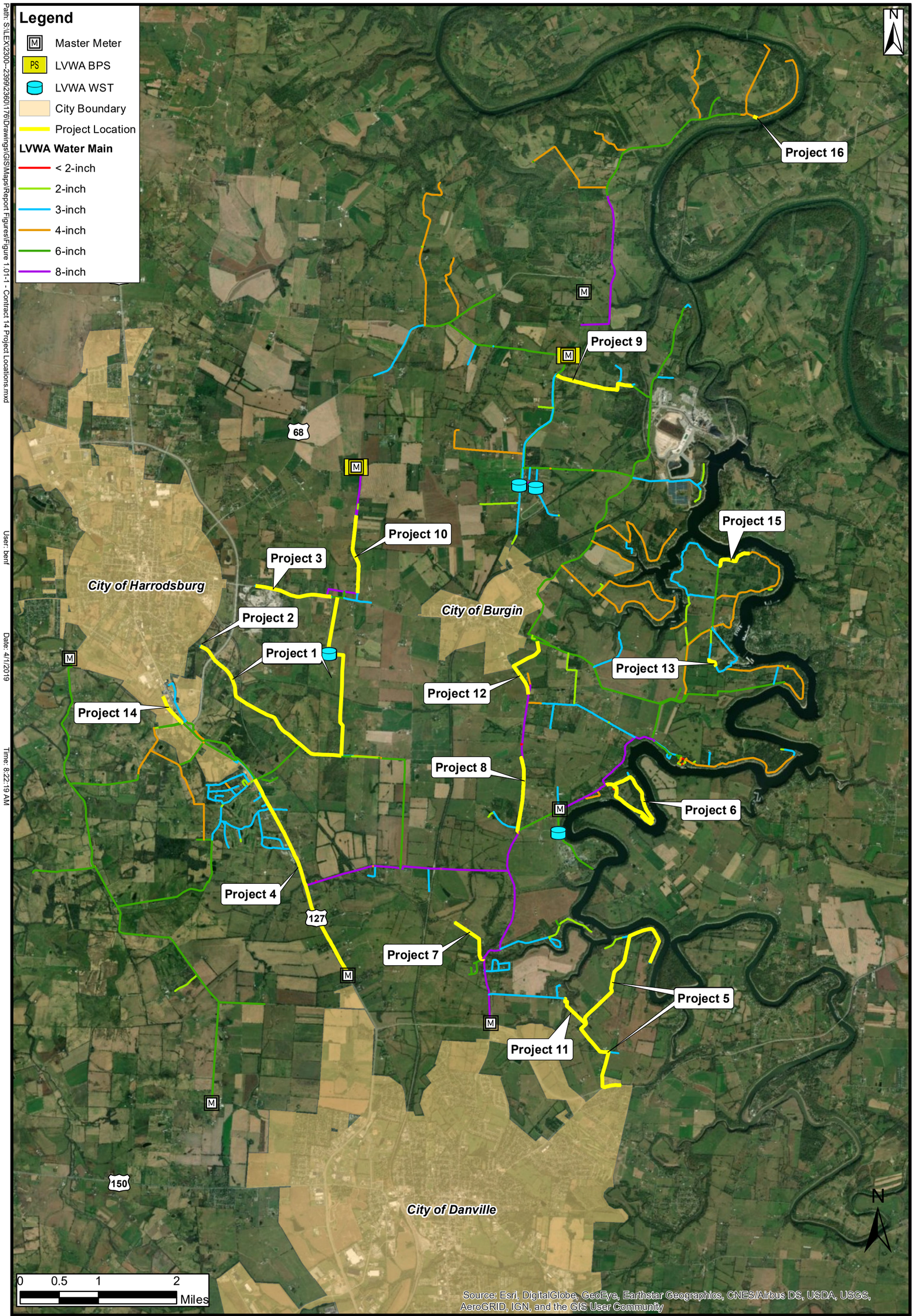
The hydraulic model was then used to run several evaluations for each project part. The evaluations include the following.

- 24-Hour Hydraulic Evaluation
- Fire Flow Evaluation
- 72-Hour Water Quality Evaluation

Kentucky Division of Water (KDOW) design criteria for water distribution systems was followed for each evaluation. Minimum water pressure for the 24-hour hydraulic evaluation was assumed to be 35 pounds per square inch (psi). Minimum water pressure for the fire flow evaluation was assumed to be 20 psi.

1.05 ABBREVIATIONS AND DEFINITIONS

AWWA	American Water Works Association
BPS	booster pump station
Danville	City of Danville, Kentucky
DBP	disinfection byproducts
DEM	digital elevation model
ft/ft	feet per foot
ft/sec	feet per second
gal	gallon
GIS	geographical information system
gpm	gallons per minute
Harrodsburg	City of Harrodsburg, Kentucky
HDD	horizontal directional drilling
IMI	Irving Materials, Inc.
KDOW	Kentucky Division of Water
KY	Kentucky
LVWA	Lake Village Water Association
mgd	million gallons per day
OPCC	opinion of probable construction cost
PSC	Public Service Commission
psi	pounds per square inch
PVC	polyvinyl chloride
Strand	Strand Associates, Inc.®
WST	water storage tank



Path: S:\LEX\2300-2399\2360\176\Drawings\GIS\Maps\Report Figures\Figure 1.01-1 - Contract 14 Project Locations.mxd
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PROJECT LOCATIONS

DISTRIBUTION SYSTEM IMPROVEMENTS PRELIMINARY ENGINEERING REPORT
LAVE VILLAGE WATER ASSOCIATION
MERCER, GARRARD, AND BOYLE COUNTIES

STRAND ASSOCIATES®

FIGURE 1.01-1
2360.176

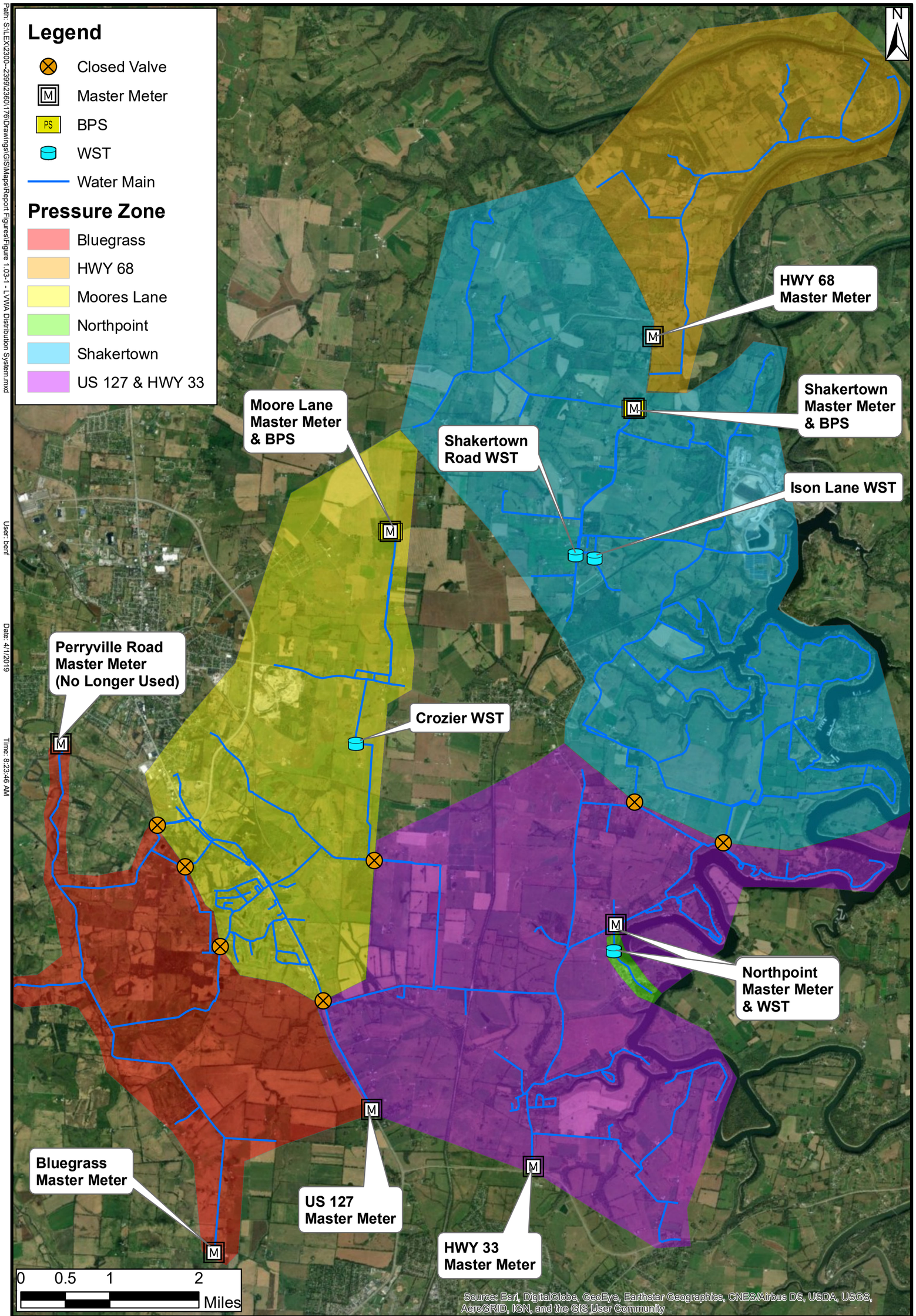

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FIGURE 1.03-1
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LVWA WATER DISTRIBUTION SYSTEM INFRASTRUCTURE

DISTRIBUTION SYSTEM IMPROVEMENTS PRELIMINARY ENGINEERING REPORT
LAKE VILLAGE WATER ASSOCIATION
MERCER, GARRARD, AND BOYLE COUNTIES

SECTION 2
PART 1–BELLOWS MILL ROAD AND MONTGOMERY LANE WATER MAIN

2.01 BACKGROUND

This portion of the project involves replacing approximately 5.11 miles of existing 6-inch water main along Bellows Mill Road and Montgomery Lane. The proposed water main will enhance water supply to the Crozier WST and the surrounding pressure zone. The existing water main has experienced significant water loss due to its age and condition. Figure 2.01-1 shows the location of the project part.

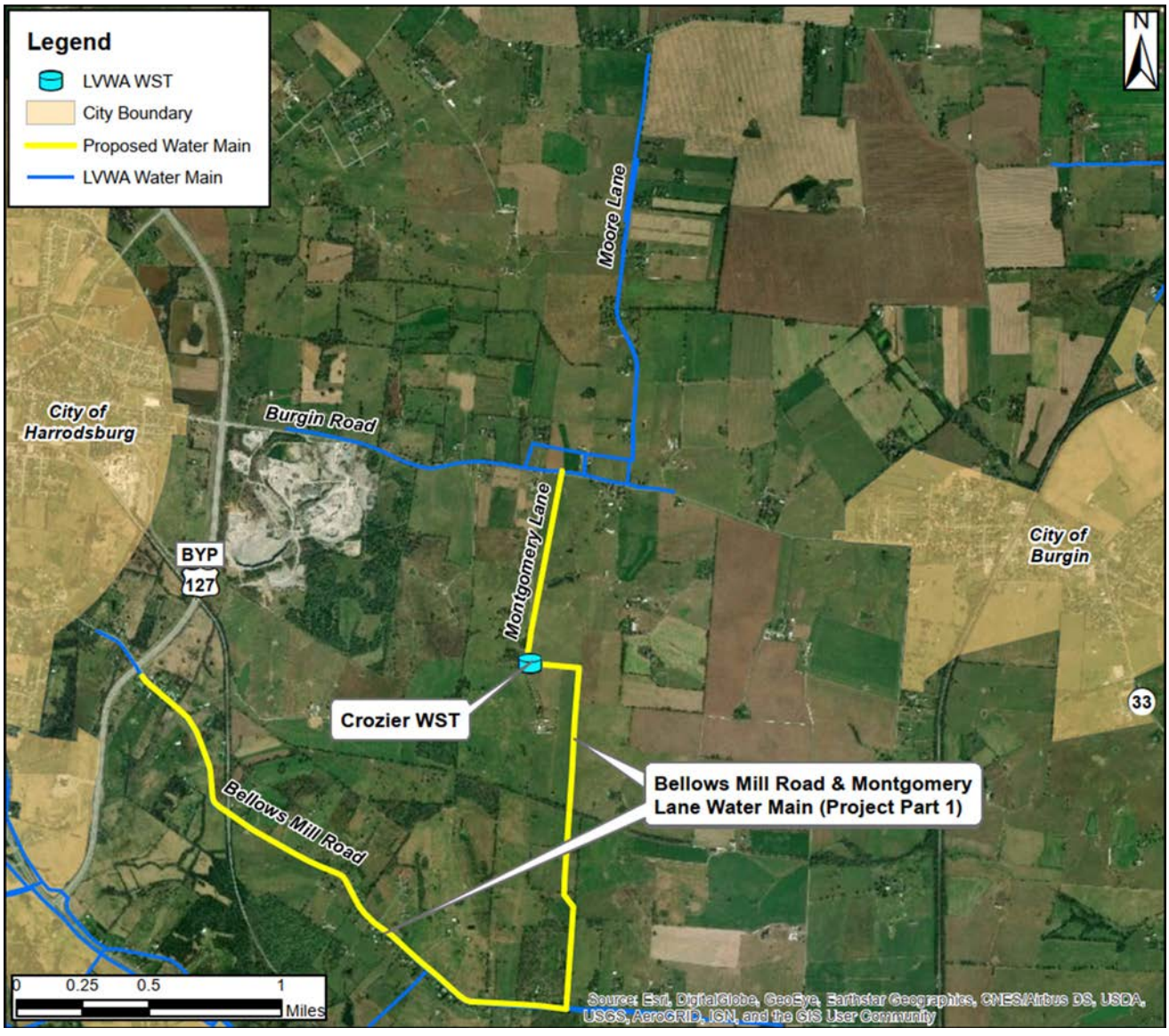

Figure 2.01-1 Montgomery Lane and Bellows Mill Road Water Main Location

2.02 PURPOSE

The Moores Lane Pressure Zone is supplied by the Moores Lane BPS and Crozier WST. The Moores Lane BPS is located on the northern portion of the pressure zone, while the Crozier WST is located near the middle of the pressure zone. A majority of the customers in this pressure zone live along the southern portion of the pressure zone on the US 127 Corridor. One 6-inch water main along Montgomery Lane and Bellows Mill Road supplies water to the Crozier WST and the US 127 Corridor customers.

A portion of the 6-inch water main along Montgomery Lane experiences flow ranging from 450 to 500 gpm because of the Moores Lane BPS feeding the Crozier WST. The 6-inch water main is the sole water supply source for the Crozier WST. Velocities in the 6-inch water main reach upwards of 5.12 feet per second (ft/sec) when the Moores Lane BPS is operating. The maximum headloss experienced by the 6-inch water main reaches 0.016 feet per foot (ft/ft) when the Moores Lane BPS is operating. The American Water Works Association (AWWA) Manual M32 of Water Supply Practices recommends a maximum velocity of 5.0 ft/sec and maximum headloss of 0.01 ft/ft. The 6-inch water main thus reaches the maximum recommended criterion established by AWWA under normal operating conditions. Figure 2.02-1 shows the maximum headloss of water mains near the Crozier WST.

LVWA has already upgraded a portion of the water main along this route to an 8-inch water main. This improvement has greatly helped operation of the Montgomery Lane BPS and Crozier WST. It has enhanced water pressure and water supply to customers in the Moores Lane Pressure Zone.

Discussions with LVWA further indicate that the existing 6-inch water main contains the highest known water loss within the distribution system. It is estimated that this section of water main has experienced approximately 32,675,000 gal of water loss since 2005. The water main has reached the end of its useful life.

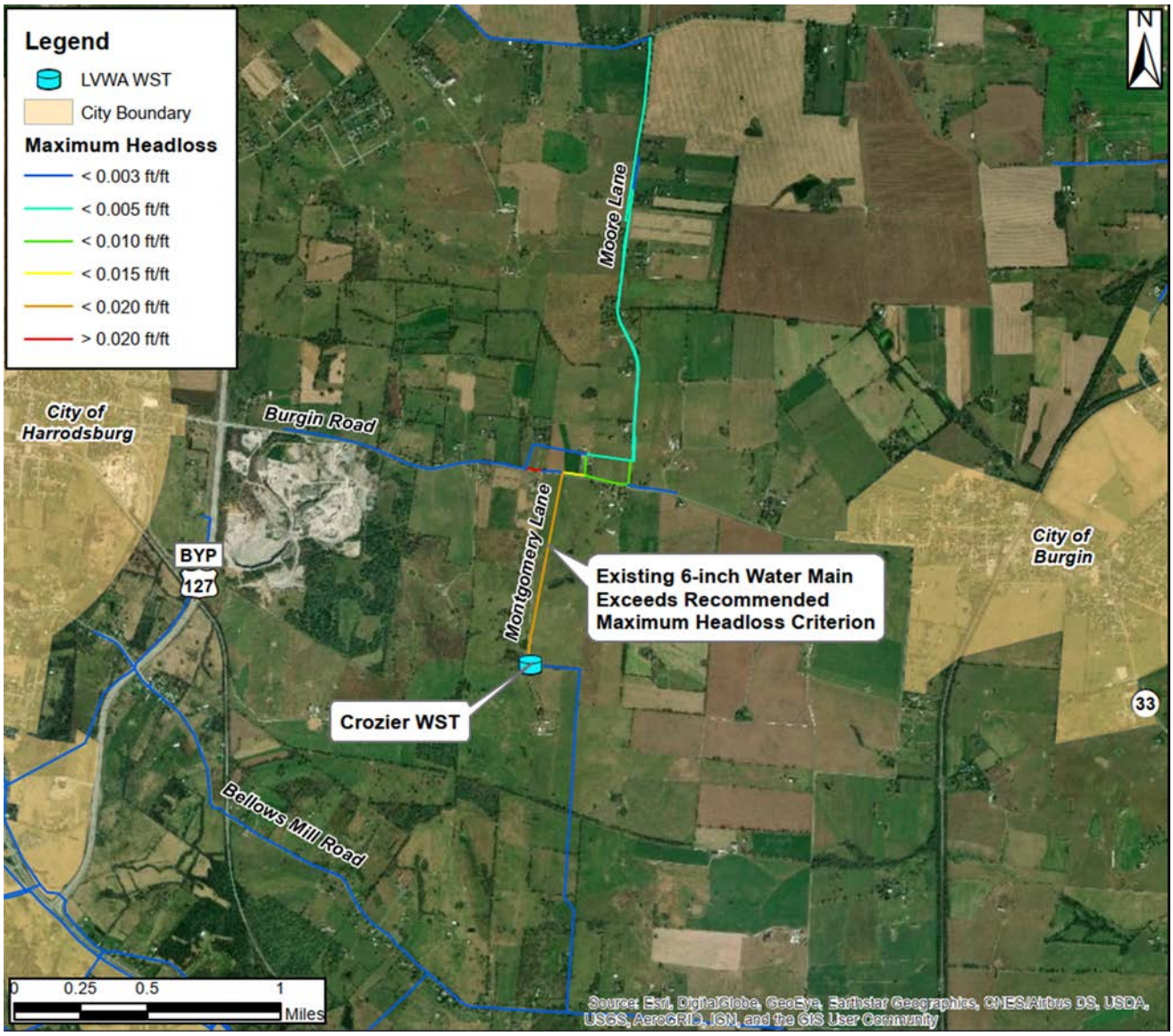

Figure 2.02-1 Montgomery Lane and Bellows Mill Road Water Main Headloss Evaluation

2.03 ALTERNATIVES

Three alternatives were evaluated for the proposed water main along Bellows Mill Road and Montgomery Lane. The alternatives include replacing the existing water main with an 8-inch line, a 6-inch line, or doing nothing. It is recommended to replace the existing 6-inch water main with an 8-inch water main to enhance water supply to the Crozier WST and surrounding customers.

A. Alternative 1: Install an 8-inch PVC water main

Approximately 5.11 miles of 8-inch PVC water main will be installed along Bellows Mill Road and Montgomery Lane. The proposed 8-inch water main will begin at an existing 6-inch and 8-inch water main

at the intersection of Montgomery Lane and Burgin Road, extend south to the Crozier WST and then further to Bellows Mill Road, and will then follow Bellows Mill Road west to the intersection of Bellows Mill Road and the US 127 Bypass. The proposed water main will require 130 linear feet of railroad bore. All water services will be transferred from the existing 6-inch water main to the proposed 8-inch water main. The existing 6-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

As discussed above, installing an 8-inch water main in lieu of a 6-inch water main along Montgomery Lane will allow LVWA to maintain headloss and velocity within AWWA Manual M32 recommendations. Velocities are estimated to reach 3.59 ft/sec with a headloss of 0.006 ft/ft with an 8-inch water main in service. An 8-inch water main will give LVWA a longer pipe lifespan, as less stress will be placed on the water main.

Additionally, installing an 8-inch water main in lieu of a 6-inch water main along Bellows Mill Road will enhance water supply and pressure to customers in the southern portion of the Moores Lane Pressure Zone. It will further allow enhanced fire protection to customers along Bellows Mill Road near the Harrodsburg city limits, the main goal of project part 2. It is anticipated to also reduce water loss.

B. Alternative 2: Install a 6-inch PVC water main

Approximately 5.11 miles of 6-inch PVC water main will be installed along Bellows Mill Road and Montgomery Lane. The proposed 6-inch water main will begin at an existing 6-inch and 8-inch water main at the intersection of Montgomery Lane and Burgin Road, extend south to the Crozier WST and then further to Bellows Mill Road, and will then follow Bellows Mill Road west to the intersection of Bellows Mill Road and the US 127 Bypass. The proposed water main will require 130 linear feet of railroad bore. All water services will be transferred from the existing 6-inch water main to the proposed 6-inch water main. The existing 6-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

It is anticipated that replacing the existing 6-inch water main with a proposed 6-inch water main will reduce water loss along this section of piping. It is anticipated that water supply and pressure will also be slightly improved once the water loss is reduced.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 6-inch water main in service without replacement. The existing 6-inch water main will continue to produce excessive water loss for LVWA.

2.04 COST OPINION

An opinion of probable construction cost (OPCC) for each alternative can be seen in Table 2.04-1.

Part 1: Bellows Mill Road and Montgomery Lane				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 8-in PVC water main	26,981	LF	$22	$593,600
Bore under railroad	130	LF	$150	$19,500
Permit for railroad bore	1	LS	$10,000	$10,000
8-in wet tap with gate valve and tapping sleeve	2	EA	$3,250	$6,500
8-in gate valves (each mile)	4	EA	$2,000	$8,000
Install new customer services	60	EA	$1,500	$90,000
			Subtotal	$727,600
			Contingency and Engineering (35%)	$254,700
			Total	**$982,300**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 6-in PVC water main	26,981	LF	$20	$539,600
Bore under railroad	130	LF	$140	$18,200
Permit for railroad bore	1	LS	$10,000	$10,000
6-in wet tap with gate valve and tapping sleeve	2	EA	$3,000	$6,000
6-in gate valves (each mile)	4	EA	$1,800	$7,200
Install new customer services	60	EA	$1,500	$90,000
			Subtotal	$671,000
			Contingency and Engineering (35%)	$234,900
			Total	**$905,900**

Table 2.04-1 OPCC for Bellows Mill Road and Montgomery Lane Water Main Alternatives

2.05 SELECTED ALTERNATIVE

It is recommended that LVWA select Alternative 1 for the Bellows Mill Road and Montgomery Lane water main project part. Alternative 1 will achieve the AWWA Manual M32 hydraulic recommendations, will enhance water supply and pressure to customers in the southern portion of the Moores Lane Pressure Zone, and will decrease water loss.

SECTION 3
PART 2–BELLOWS MILL ROAD WATER MAIN

3.01 BACKGROUND

This portion of the project involves replacing approximately 1,500 linear feet of existing 3-inch water main along Bellows Mill Road. The existing 3-inch water main is nearing the end of its useful life. Figure 3.01-1 shows the location of the project part.

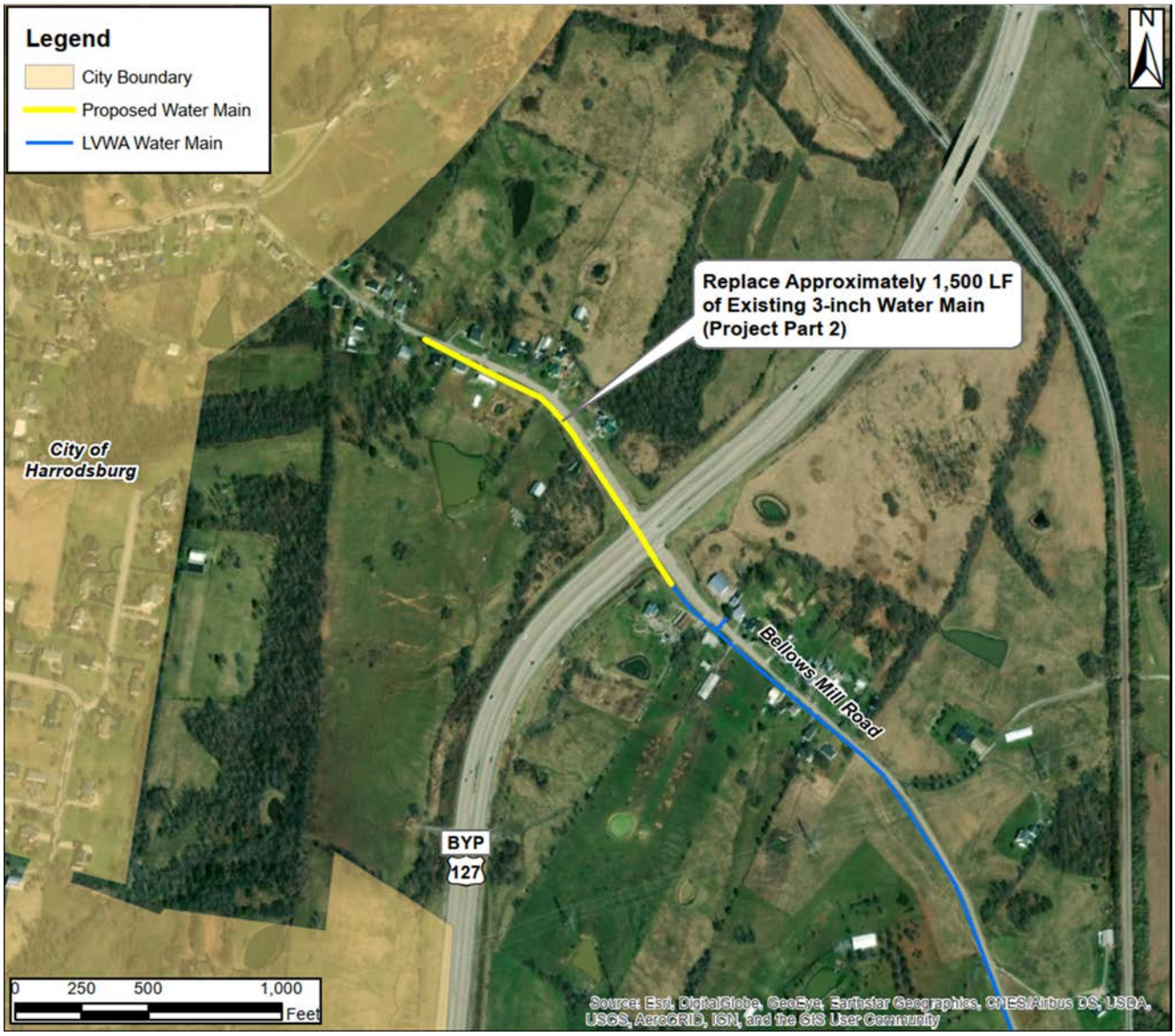

Figure 3.01-1 Bellows Mill Road Water Main Location

3.02 PURPOSE

Just outside the existing Harrodsburg city limits, but within the US 127 Bypass along Bellows Mill Road, there is approximately 1,000 linear feet of 3-inch water main owned by LVWA. It is anticipated that this

area that is served by LVWA's water distribution system will be annexed into the Harrodsburg city limits in the near future. Figure 3.01-1 shows the 10 houses served by LVWA located along Bellows Mill Road within the US 127 Bypass.

The existing 3-inch water main is nearing the end of its useful life. Replacing the water main will reset the life span of the water main and is anticipated to decrease water loss.

3.03 ALTERNATIVES

Three alternatives were evaluated to replace the existing 3-inch water main along Bellows Mill Road. The alternatives include replacing the 3-inch water main with an 8-inch water main, a 6-inch water main, or doing nothing. It is recommended to replace the existing 3-inch water main with an 8-inch water main.

A. Alternative 1: Install an 8-inch PVC Water Main

The proposed 8-inch PVC water main will extend from the intersection of Bellows Mill Road and the US 127 Bypass approximately 1,500 linear feet northwest to a location just within the US 127 Bypass. All water services will be transferred from the existing 3-inch water main to the proposed 8-inch water main. The existing 3-inch water main will be abandoned in place. The proposed alignment will include a 250 linear feet highway bore under the US 127 Bypass. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing the existing 3-inch water main to a proposed 8-inch water main will provide increased volume, therein increasing water age, and will decrease water main velocity and headloss. The increase in water age when using an 8-inch water main, when compared to a 6-inch water main, is minimal and is anticipated to have no impact on existing disinfection byproducts (DBP) formation. Therefore, there is little hydraulic and water quality difference when comparing the proposed 6-inch water main with the proposed 8-inch water main.

Replacing the 3-inch water main with a proposed 8-inch water main is anticipated to decrease water loss and extend the expected life of the water main. The existing water main is nearing the end of its useful life and replacement is necessitated. The proposed 8-inch water main will also allow LVWA to add fire hydrants in the future, if desired.

B. Alternative 2: Install a 6-inch PVC Water Main

The proposed 6-inch PVC water main will extend from the intersection of Bellows Mill Road and the US 127 Bypass approximately 1,500 linear feet northwest to a location just within the US 127 Bypass. All water services will be transferred from the existing 3-inch water main to the proposed 6-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Replacing the 3-inch water main with a proposed 6-inch water main is anticipated to decrease water loss and extend the expected life of the water main. The existing water main is nearing the end of its useful life and replacement is necessitated. The proposed 6-inch water main will also allow LVWA to add fire hydrants in the future, if desired.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing 3-inch water main in service. This alternative is undesirable because the existing water main is nearing the end of its useful life.

3.04 COST OPINION

An OPCC for each alternative can be seen in Table 3.04-1.

Part 2: Bellows Mill Road				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 8-in PVC water main	1,500	LF	$22	$33,000
Bore under US 127	250	LF	$150	$37,500
8-in wet tap with gate valve and tapping sleeve	2	EA	$3,250	$6,500
Install new customer services	10	EA	$1,500	$15,000
			Subtotal	$92,000
			Contingency and Engineering (35%)	$32,200
			Total	**$124,200**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and Install 6-in PVC water main	1,500	LF	$20	$30,000
Bore under us 127	250	LF	$150	$37,500
6-in wet tap with gate valve and tapping sleeve	2	EA	$3,000	$6,000
Install new customer services	10	EA	$1,500	$15,000
			Subtotal	$88,500
			Contingency and Engineering (35%)	$31,000
			Total	**$119,500**

Table 3.04-1 OPCC for Bellows Mill Road Water Main Alternatives

3.05 SELECTED ALTERNATIVE

Both Alternatives 1 and 2 will provide significant improvements for LVWA. The difference between the two options is minimal. It is recommended that LVWA select between these two alternatives for the final submittal.

For this project part, Strand would lean toward selecting Alternative 2 in lieu of Alternative 1. The small number of existing customers along Bellows Mill Road does not warrant the additional cost to further upsize the water main size. The proposed 6-inch water main will also allow LVWA to add fire hydrants in the future, if desired. It is anticipated that Alternative 2 will greatly reduce water loss and extend the water infrastructure service life for many decades to come. After discussion with LVWA, it has not seen enough problems on this line to include it in the project at this time. Therefore, Alternative 3 (to do nothing) will be the selected alternative.

SECTION 4
PART 3–BURGIN ROAD WATER MAIN

4.01 BACKGROUND

This portion of the project involves replacing approximately 1.58 miles of existing 3-inch water main along Burgin Road. It is anticipated that the proposed water main will decrease water loss and enhance water supply and pressure to several customers along Burgin Road. Figure 4.01-1 shows the location of the project part.

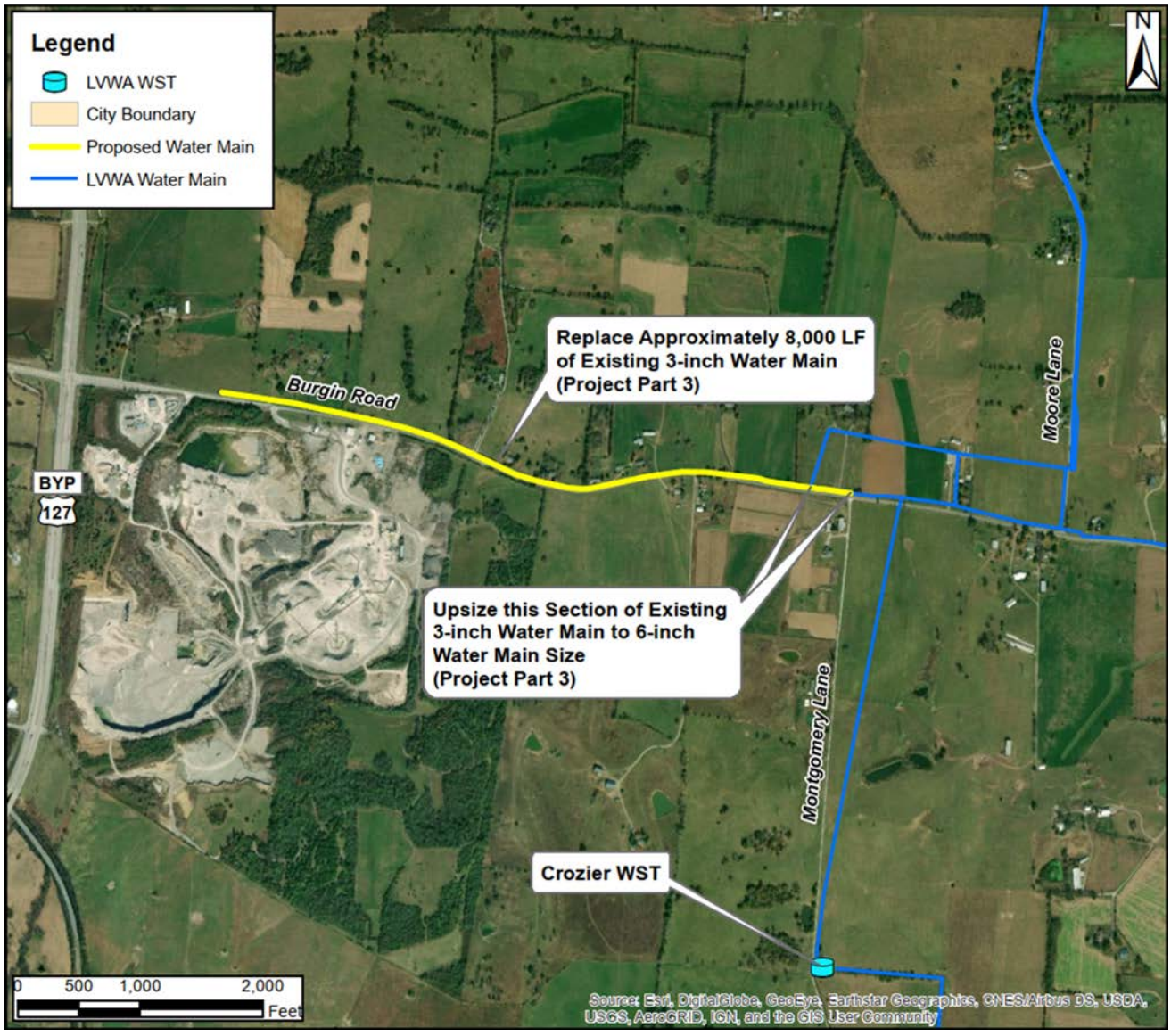

Figure 4.01-1 Burgin Road Water Main Location

4.02 PURPOSE

Approximately 8,350 linear feet of 3-inch water main along Burgin Road supplies water to several residents, a Mercer Stone Company rock quarry, and an Irving Materials, Inc. (IMI) concrete facility. The water main dead ends near the intersection of US 127 Bypass and Burgin Road.

LVWA desires to upsize the existing 3-inch water main in order to enhance water supply and pressure to customers. Approximately 350 linear feet of existing 3-inch water main is surrounded by an existing 8-inch water main and an existing 6-inch water main. This section of water main currently serves as one of three main connections between the Moores Lane BPS and the Crozier WST. The maximum headloss experienced by the 3-inch water main reaches 0.022 ft/ft when the Moores Lane BPS is operating. The AWWA Manual M32 of Water Supply Practices recommends a maximum velocity of 5.0 ft/sec and maximum headloss of 0.01 ft/ft. The 3-inch water main thus reaches the maximum recommended criterion established by AWWA under normal operating conditions. Figure 4.02-1 shows the maximum headloss of water mains along Burgin Road.

Replacing this section of 3-inch water main with a proposed 6-inch water main will decrease the maximum headloss to 0.004 ft/ft, falling below the recommended maximum headloss. It is recommended to replace approximately 350 linear feet of water main with a proposed minimum diameter of 6 inches.

The remaining 8,000 linear feet of 3-inch water main supplies water to several residents and two industrial facilities described above. LVWA desires to also upsize the existing 3-inch water main with a proposed 4-inch water main. Conducting hydraulic and water quality modeling of the system shows no negative impact to the water distribution system with the line size increase. A 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and headloss. As water ages, there is greater potential for DBP formation, especially trihalomethanes. The increase in water age when using a 4-inch water main is so small it is anticipated to have no impact on existing DBP formation. There is therefore little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main.

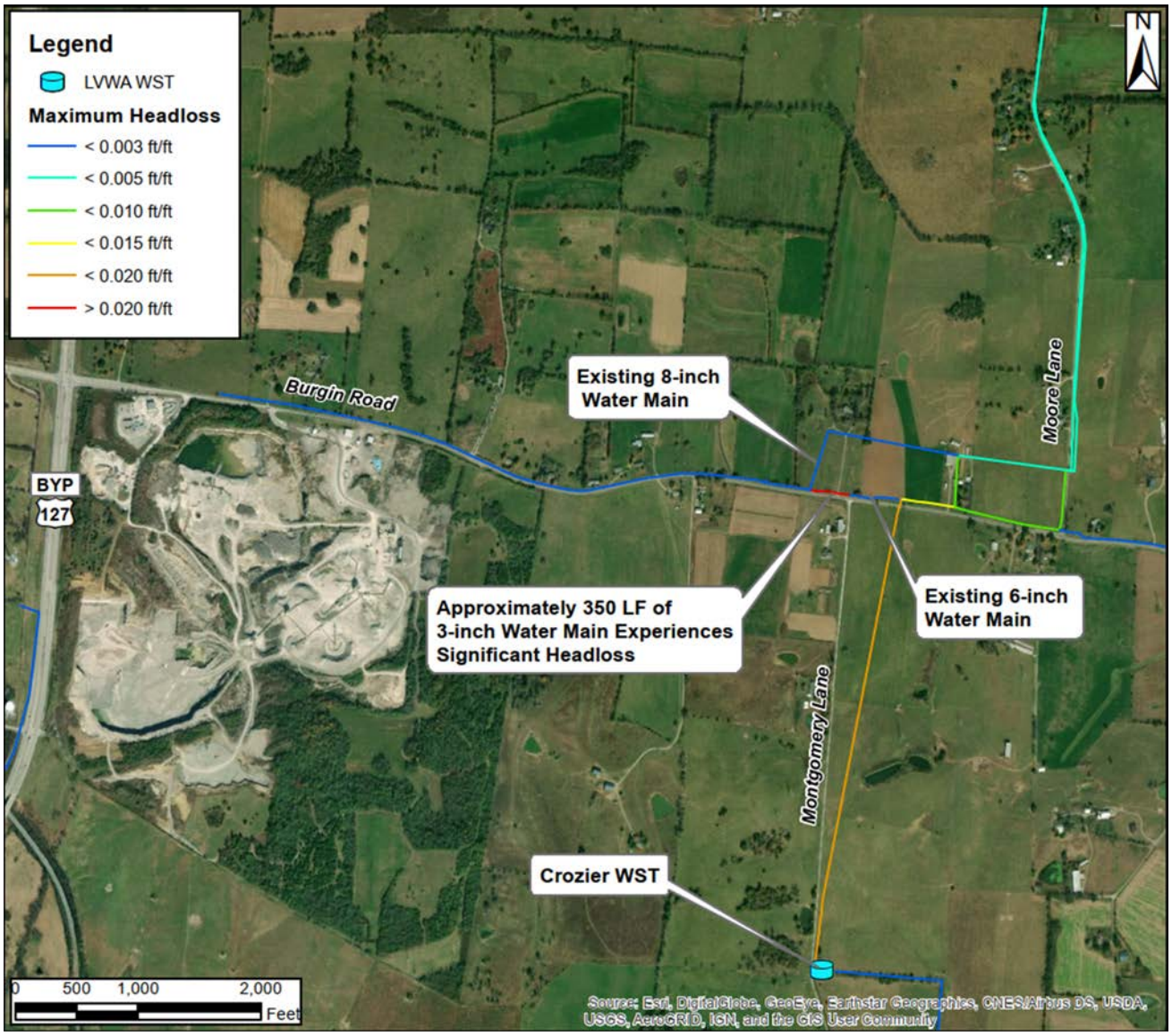

Figure 4.02-1 Burgin Road Water Main Headloss Evaluation

4.03 ALTERNATIVES

Three alternatives were evaluated for the proposed water main along Burgin Road. Alternatives 1 and 2 both include upsizing approximately 350 linear feet of existing 3-inch water main with a 6-inch water main. Alternative 1 also includes the upsizing of the existing water main to a 4-inch water main while Alternative 2 includes replacing the water main with a 3-inch water main. Alternative 3 proposes to do nothing. It is recommended at a minimum to upsize approximately 350 linear feet of 3-inch water main to a proposed 6-inch water main. It is further recommended to upsize the remaining section of 3-inch water main along Burgin Road with a proposed 4-inch water main.

A. Alternative 1: Install a 4-inch and 6-inch PVC Water Main

Approximately 8,000 linear feet of 4-inch PVC water main and approximately 350 linear feet of 6-inch water main will be installed along Burgin Road. The proposed 4-inch water main will begin at an existing 8-inch water main near the intersection of Burgin Road and Montgomery Lane and extend west along Burgin Road. The proposed 6-inch water main will tie in to the eastern portion of the proposed 4-inch water main and extend westward for 350 linear feet and then tie in to an existing 6-inch water main. All water services will be transferred from the existing water main to the proposed water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing a portion of the existing 3-inch water main to a proposed 6-inch water main will improve the capacity from the Moores Lane BPS to the Crozier WST. It will further enhance redundancy and decrease the maximum headloss to within the recommended level.

Upsizing a portion of the existing 3-inch water main to a proposed 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and headloss. The increase in water age when using a 4-inch water main is minimal and anticipated to have no impact on existing DBP formation. There is therefore little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main.

B. Alternative 2: Install a 3-inch and 6-inch PVC Water Main

Approximately 8,000 linear feet of 3-inch PVC water main and approximately 350 linear feet of 6-inch water main will be installed along Burgin Road. The proposed 3-inch water main will begin at an existing 8-inch water main near the intersection of Burgin Road and Montgomery Lane and extend west along Burgin Road. The proposed 6-inch water main will tie in to the eastern portion of the proposed 3-inch water main and extend westward for 350 linear feet and then tie in to an existing 6-inch water main. All water services will be transferred from the existing water main to the proposed water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing a portion of the existing 3-inch water main to a proposed 6-inch water main will improve capacity from the Moores Lane BPS to the Crozier WST. It will further enhance redundancy and decrease the maximum headloss to within the recommended level.

Replacing a portion of the existing 3-inch water main is anticipated to decrease water loss and extend the expected life of the water main. The existing water main is nearing the end of its useful life and replacement is necessitated.

C. Alternative 3: Do Nothing

Alternative three proposes to keep the existing LVWA 3-inch water main in service without replacement, leaving the current water supply and pressure issues unaddressed. The water main will continue to yield water loss for LVWA.

4.04 COST OPINION

An OPCC for each alternative can be seen in Table 4.04-1.

Part 3: Burgin Road				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 4-in PVC water main	8,000	LF	$18	$144,000
Furnish and install 6-in PVC water main	350	LF	$20	$7,000
6-in wet tap with gate valve and tapping sleeve	1	EA	$3,000	$3,000
4-in wet tap with gate valve and tapping sleeve	1	EA	$2,500	$2,500
4-in gate valve	1	EA	$1,600	$1,600
Install new customer services	24	EA	$1,500	$36,000
			Subtotal	$194,100
			Contingency and Engineering (35%)	$67,900
			Total	**$262,000**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 3-in PVC water main	8,000	LF	$16	$128,000
Furnish and install 6-in PVC water main	350	LF	$20	$7,000
6-in wet tap with gate valve and tapping sleeve	1	EA	$3,000	$3,000
3-in wet tap with gate valve and tapping sleeve	1	EA	$2,250	$2,300
3-in gate valve	1	EA	$1,500	$1,500
Install new customer services	24	EA	$1,500	$36,000
			Subtotal	$177,800
			Contingency and Engineering 35%	$62,200
			Total	**$240,000**

Table 4.04-1 OPCC for Burgin Road Water Main Alternatives

4.05 SELECTED ALTERNATIVE

Both Alternatives 1 and 2 will provide significant improvements for LVWA. The difference between the two options is minimal. After discussing preferences with LVWA, Alternative 1 is preferred over Alternative 2. Alternative 1 will enhance water supply and pressure to the Mercer Stone Company rock quarry and the IMI concrete facility. The cost comparison between Alternatives 1 and 2 is minimal compared to the additional benefits Alternative 1 provides for these customers. Alternative 1 will also enhance distribution system redundancy and is anticipated to decrease water loss.

SECTION 5
PART 4–US 127 WATER MAIN

5.01 BACKGROUND

This portion of the project involves replacing approximately 2.75 miles of existing 6-inch water main along US 127. It is anticipated that the proposed water main will decrease water loss and enhance water supply and pressure to customers along the US 127 corridor. Figure 5.01-1 shows the location of the project part.

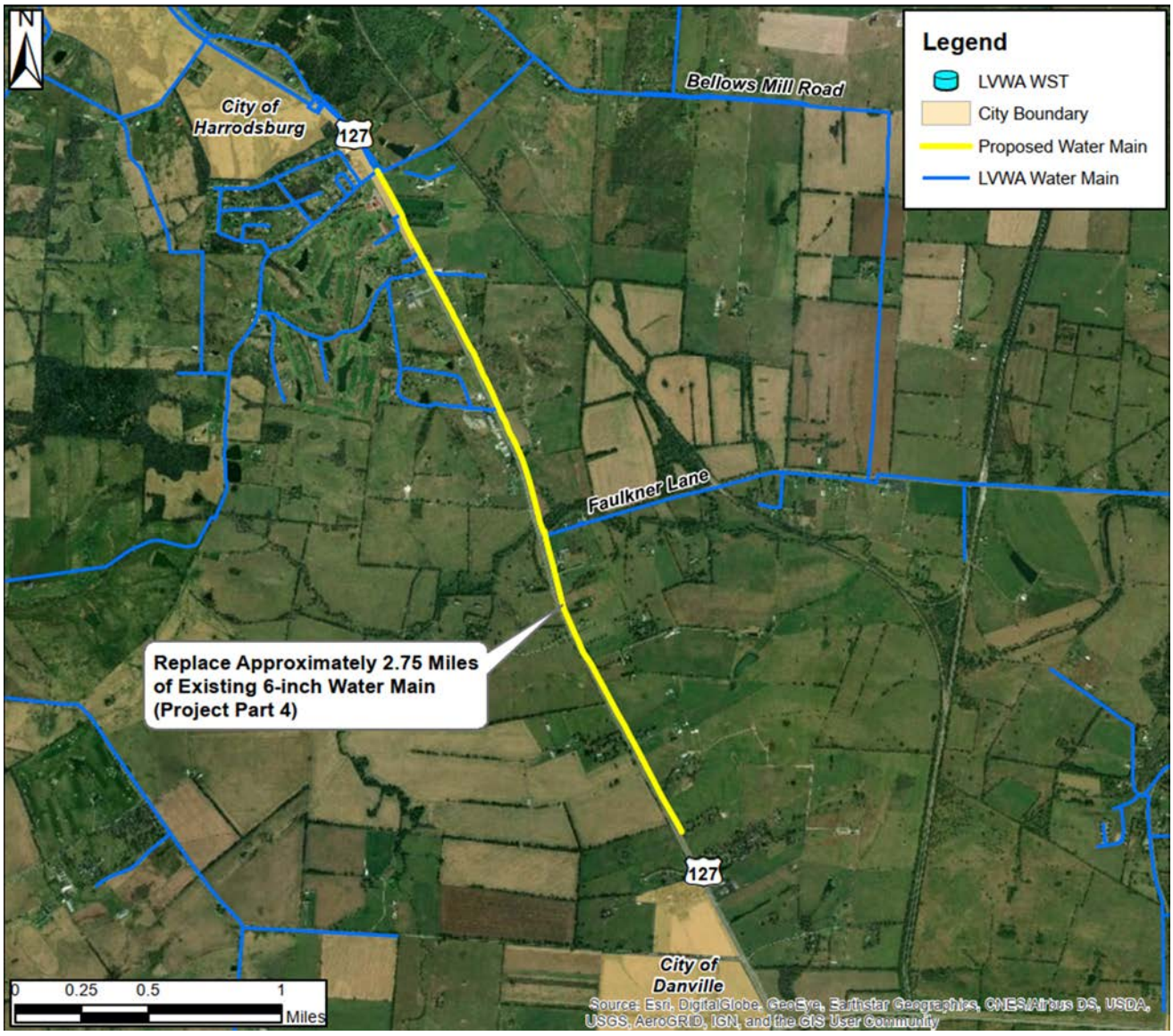

Figure 5.01-1 US 127 Water Main Location

5.02 PURPOSE

The US 127 master meter supplies water to the US 127 and HWY 33 Pressure Zone. Water is routed through this pressure zone to the Northpoint Training Center, the largest water user in the LVWA distribution system. The primary flow path of the pressure zone includes several 8-inch water mains leading to the center of the pressure zone. Approximately 6,500 linear feet of water main along US 127 spanning from the US 127 Master Meter to the intersection of Faulkner Lane and US 127 is currently undersized at 6 inches. LVWA desires to upsize the existing 6-inch water main to an 8-inch water main to improve distribution system hydraulics and connectivity.

LVWA desires to replace an additional 8,000 linear feet of 6-inch with 8-inch water main along US 127 spanning northward from the intersection of Faulkner Lane and US 127 to improve distribution system hydraulics, connectivity, and create redundancy needed for the Moores Lane Pressure Zone to be supplied by the US 127 Master Meter under emergency conditions.

5.03 ALTERNATIVES

Three alternatives were evaluated for the proposed water main along US 127. The alternatives include upsizing the existing 6-inch water main with a proposed 8-inch water main, replacing the 6-inch water main with a proposed 6-inch water main, or do nothing. It is recommended to upsize the existing 6-inch water main with a proposed 8-inch water main to improve distribution system hydraulics and connectivity.

A. Alternative 1: Install an 8-inch PVC Water Main

Approximately 14,500 linear feet of 8-inch PVC water main will be installed along US 127. The proposed water main will begin at the US 127 Master Meter and continue north until the intersection of US 127 and Adams Lane. All water services will be transferred from the existing 6-inch water main to the proposed 8-inch water main. The existing 6-inch water main will be abandoned in place. The proposed alignment will include 60 linear feet of highway bore under Faulkner Lane. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing the existing 6-inch water main will improve distribution system hydraulics and connectivity in the US 127 and Highway 33 Pressure Zone. LVWA will also be able to provide its largest water user, the Northpoint Training Center, enhanced redundancy to its water supply. It will further enhance redundancy needed for the Moores Lane Pressure Zone to be supplied by the US 127 Master Meter under emergency conditions. Replacing the water main is anticipated to decrease water loss and extend the life of the aging water infrastructure.

B. Alternative 2: Install a 6-inch PVC Water Main

Approximately 14,500 linear feet of 6-inch PVC water main will be installed along US 127. The proposed water main will begin at the US 127 master meter and continue north until the intersection of US 127 and Adams Lane. All water services will be transferred from the existing 6-inch water main to the proposed 6-inch water main. The existing 6-inch water main will be abandoned in place. The proposed alignment will include 60 linear feet of highway bore under Faulkner Lane. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Replacing the water main is anticipated to decrease water loss and extend the life of the aging water infrastructure. It will not improve distribution system hydraulics or connectivity.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 6-inch water main in service without replacement. The existing water main, which is near the end of its useful life, will necessitate replacement in the near future.

5.04 COST OPINION

An OPCC for each alternative can be seen in Table 5.04-1.

Part 4: US 127				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 8-in PVC water main	14,500	LF	$22	$319,000
8-in wet tap with gate valve and tapping sleeve	2	EA	$3,250	$6,500
Bore under Faulkner Lane	60	LF	$150	$9,000
8-in gate valve	2	EA	$2,000	$4,000
Install new customer services	38	EA	$1,500	$57,000
			Subtotal	$395,500
			Contingency and Engineering (35%)	$138,400
			Total	**$533,900**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 6-in PVC water main	14,500	LF	$20	$290,000
6-in wet tap with gate valve and tapping sleeve	2	EA	$3,000	$6,000
6-in gate valve	2	EA	$1,800	$3,600
Bore under Faulkner Lane	60	LF	$140	$8,400
Install new customer services	38	EA	$1,500	$57,000
			Subtotal	$365,000
			Contingency and Engineering (35%)	$127,800
			Total	**$492,800**

Table 5.04-1 OPCC for US 127 Water Main Alternatives

5.05 SELECTED ALTERNATIVE

It is recommended that LVWA select Alternative 1 for the US 127 water main project part. Alternative 1 will improve water distribution system hydraulics and connectivity to the US 127 and Highway 33 Pressure Zone and will enhance redundancy for the Moores Lane Pressure Zone. Replacing the water main is anticipated to decrease water loss and extend the life of the aging water infrastructure.

SECTION 6
PART 5–WATERWORKS ROAD WATER MAIN

6.01 BACKGROUND

This portion of the project involves replacing approximately 3.5 miles of existing 3-inch water main along Waterworks Road. It is anticipated that the proposed water main will decrease water loss and enhance water supply and pressure to several customers along Waterworks Road. Figure 6.01-1 shows the location of the project part.

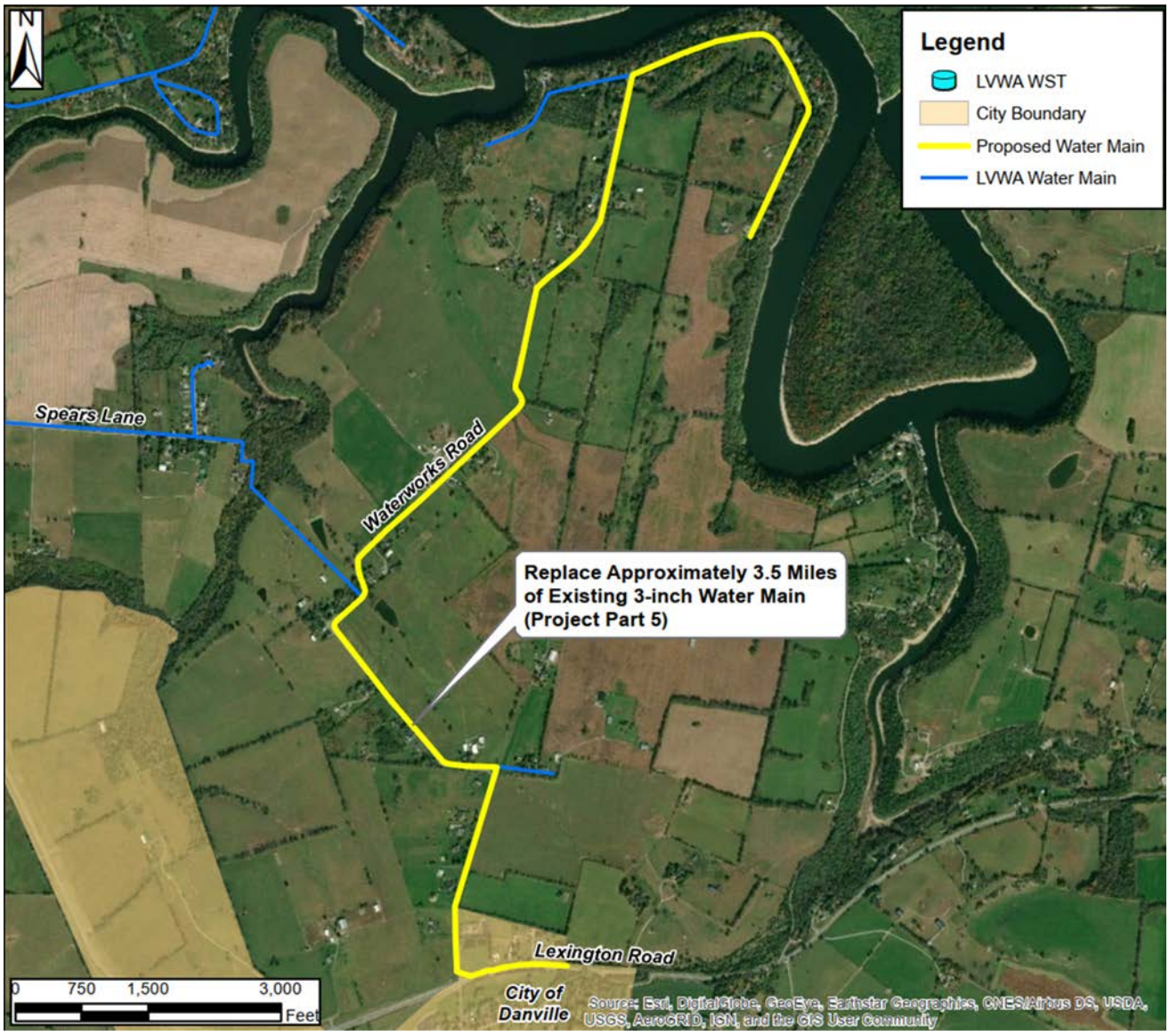

Figure 6.01-1 Waterworks Road Water Main Location

6.02 PURPOSE

The existing 3-inch water main along Waterworks Road has experienced numerous leaks in recent years. Known leaks have been repaired, but the water main is vulnerable to future leakage.

LVWA desires to replace the existing 3-inch water main with a proposed 4-inch water main in order to enhance water supply and pressure to customers. Conducting hydraulic and water quality modeling of the system shows no negative impact to the water distribution system with the increased line size. A 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and headloss. As water ages there is greater potential for DBP formation, especially thihalomethanes. The increase in water age when using a 4-inch water main is minimal and anticipated to have no impact on existing DBP formation. Therefore, there is little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main.

6.03 ALTERNATIVES

Three alternatives were evaluated for the proposed water main along Waterworks Road. The alternatives include upsizing the existing 3-inch water main with a proposed 4-inch water main, replacing the water main with a new 3-inch water main, or do nothing. It is recommended to replace the existing 3-inch water main along Waterworks Road with a new 3-inch water main.

A. Alternative 1: Install a 4-inch PVC Water Main

Approximately 18,400 linear feet of 4-inch PVC water main will be installed along Waterworks Road. The proposed water main will begin near the intersection of Waterworks Road and Lexington Road and continue north to the end of Waterworks Road. All water services will be transferred from the existing 3-inch water main to the proposed 4-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing the existing 3-inch water main to a proposed 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and headloss. The increase in water age when using a 4-inch water main is minimal and it is anticipated to have no impact on existing DBP formation. Therefore, there is little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main. This option is anticipated to reduce water loss and extend the service life of the water infrastructure.

B. Alternative 2: Install a 3-inch PVC Water Main

Approximately 18,400 linear feet of 3-inch PVC water main will be installed along Waterworks Road. The proposed water main will begin near the intersection of Waterworks Road and Lexington Road and continue north to the end of Waterworks Road. All water services will be transferred from the existing 3-inch water main to the proposed 3-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Replacing the existing 3-inch water main is anticipated to decrease water loss and extend the expected life of the water main. The existing water main is nearing the end of its useful life, necessitating replacement.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 3-inch water main in service without replacement. This alternative is undesirable due to the excessive leakage on the line.

6.04 COST OPINION

An OPCC for each alternative can be seen in Table 6.04-1.

Part 5: Waterworks Road				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 4-in PVC water main	18,400	LF	$18	$331,200
4-in wet tap with gate valve and tapping sleeve	2	EA	$2,500	$5,000
4-in gate valve	3	EA	$1,600	$4,800
Install new customer services	100	EA	$1,500	$150,000
			Subtotal	$491,000
			Contingency and Engineering (35%)	$171,900
			Total	**$662,900**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 3-in PVC water main	18,400	LF	$16	$294,400
3-in wet tap with gate valve and tapping sleeve	2	EA	$2,250	$4,500
3-in gate valve	3	EA	$1,500	$4,500
Install new customer services	100	EA	$1,500	$150,000
			Subtotal	$453,400
			Contingency and Engineering 35%	$158,700
			Total	**$612,100**

Table 6.04-1 OPCC for Waterworks Road Water Main Alternatives

6.05 SELECTED ALTERNATIVE

Both Alternatives 1 and 2 will provide significant improvements for LVWA. The difference between the two options is minimal. After discussion with LVWA, Alternative 2 is preferred over Alternative 1. The small number of existing customers along Waterworks Road does not warrant the additional cost to upgrade the water main size. It is anticipated that Alternative 2 will reduce water loss and extend the water infrastructure service life for many decades to come.

SECTION 7
PART 6–SUNRISE SHORES WATER MAIN

7.01 BACKGROUND

This portion of the project involves replacing approximately 2.12 miles of existing 3-inch water main along Sunrise Shores. It is anticipated that the proposed water main will decrease water loss and extend the service life of the water main infrastructure. Figure 7.01-1 shows the location of the project part.

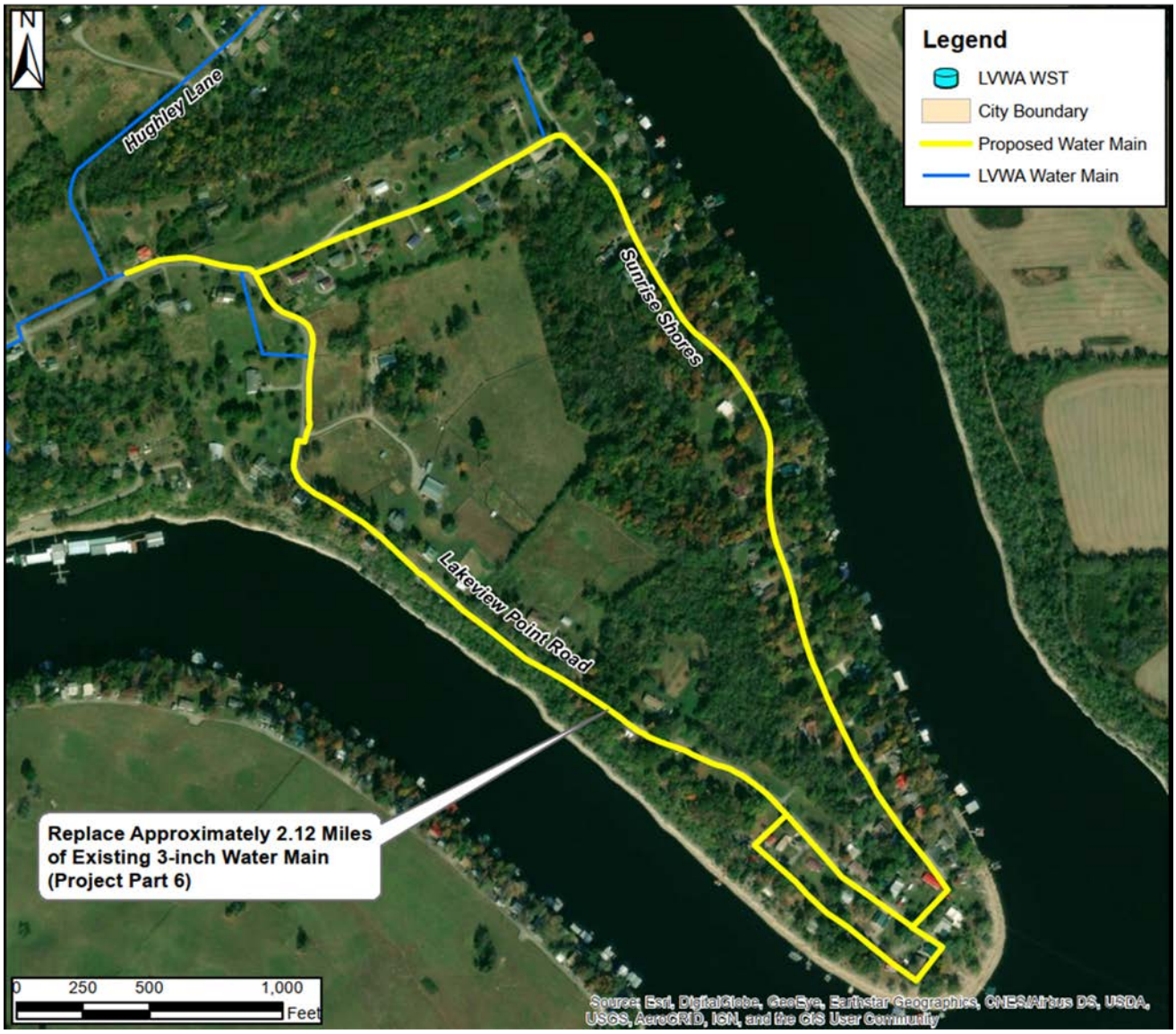

Figure 7.01-1 Sunrise Shores Water Main Location

7.02 PURPOSE

The existing 3-inch water main along Sunrise Shores is nearing the end of its useful life. LVWA desires to replace the line and explore the possibility of upgrading to a 4-inch water main. Pressures in the area are high and LVWA wants to minimize pressure rise with a main size increase. A 24-hour hydraulic

evaluation was conducted to determine the feasibility of replacing the 3-inch water main with a 4-inch water main. The upsized 4-inch water main will have no recognizable impact on water pressure for customers.

Conducting hydraulic and water quality modeling of the system shows no negative impact to the water distribution system with the line size increase. A 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and headloss. As water ages, there is greater potential for DBP formation, especially trihalomethanes. The increase in water age when using a 4-inch water main is minimal and is anticipated to have no impact on existing DBP formation. Therefore there is little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main.

7.03 ALTERNATIVES

Three alternatives were evaluated for the proposed water main along Sunrise Shores. The alternatives include upsizing the existing 3-inch water main to a proposed 4-inch water main, replacing the water main with a new 3-inch water main, or do nothing. It is recommended to replace the existing 3-inch water main along Sunrise Shores with a new 3-inch water main.

A. Alternative 1: Install a 4-inch PVC Water Main

Approximately 11,200 linear feet of 4-inch PVC water main will be installed along Sunrise Shores and Lakeview Point. The proposed water main will begin near the intersection of Sunrise Shores and Lakeview Point and follow Sunrise Shores and Lakeview Point before completing a loop back at the beginning point. All water services will be transferred from the existing 3-inch water main to the proposed 4-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing the existing 3-inch water main to a proposed 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and headloss. The increase in water age when utilizing a 4-inch water main is minimal and is anticipated to have no impact on existing DBP formation. Therefore there is little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main. This option will not result in increased water pressures to customers.

B. Alternative 2: Install a 3-inch PVC Water Main

Approximately 11,200 linear feet of 3-inch PVC water main will be installed along Sunrise Shores and Lakeview Point. The proposed water main will begin near the intersection of Sunrise Shores and Lakeview Point and follow Sunrise Shores and Lakeview Point before completing a loop back at the beginning point. All water services will be transferred from the existing 3-inch water main to the proposed 3-inch water main. The existing 3-inch water main will be abandoned in place. A pressure reducing valve will be added to the line where it enters the neighborhood. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Replacing the existing 3-inch water main is anticipated to decrease water loss and extend the expected life of the water main. The existing water main is nearing the end of its useful life and replacement is necessitated. This option will upgrade the infrastructure, which is greatly needed.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 3-inch water main in service without replacement. This is undesirable because the existing water main is nearing the end of its useful life.

7.04 COST OPINION

An OPCC for each alternative can be seen in Table 7.04-1.

Part 6: Sunrise Shores				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 4-in PVC water main	11,200	LF	$18	$201,600
4-in wet tap with gate valve and tapping sleeve	2	EA	$2,500	$5,000
4-in gate valve	1	EA	$1,600	$1,600
Install new customer services	103	EA	$1,500	$154,500
			Subtotal	$362,700
			Contingency and Engineering (35%)	$126,900
			Total	**$489,600**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 3-in PVC water main	11,200	LF	$16	$179,200
3-in wet tap with gate valve and tapping sleeve	2	EA	$2,250	$4,500
3-in gate valve	1	EA	$1,500	$1,500
Install new customer services	103	EA	$1,500	$154,500
			Subtotal	$339,700
			Contingency and Engineering (35%)	$118,900
			Total	**$458,600**

Table 7.04-1 OPCC for Sunrise Shores Water Main Alternatives

7.05 SELECTED ALTERNATIVE

Both Alternatives 1 and 2 will provide significant improvements for LVWA. The difference between the two line sizes is minimal, and neither option results in significant pressure changes. Discussion with LVWA led to the selection of Alternative 2 over Alternative 1. The small number of existing customers along Sunrise Shores does not warrant the additional cost to upgrade the water main size. Alternative 2 has the lowest OPCC and will continue to provide customers with excellent water service with new infrastructure.

SECTION 8
PART 7–SOUTH BUSTER PIKE WATER MAIN

8.01 BACKGROUND

This portion of the project involves replacing approximately 3,600 linear feet of existing 3-inch water main along South Buster Pike. It is anticipated that the proposed water main will decrease water loss and enhance water supply and pressure to several customers along South Buster Pike. Figure 8.01-1 shows the location of the project part.

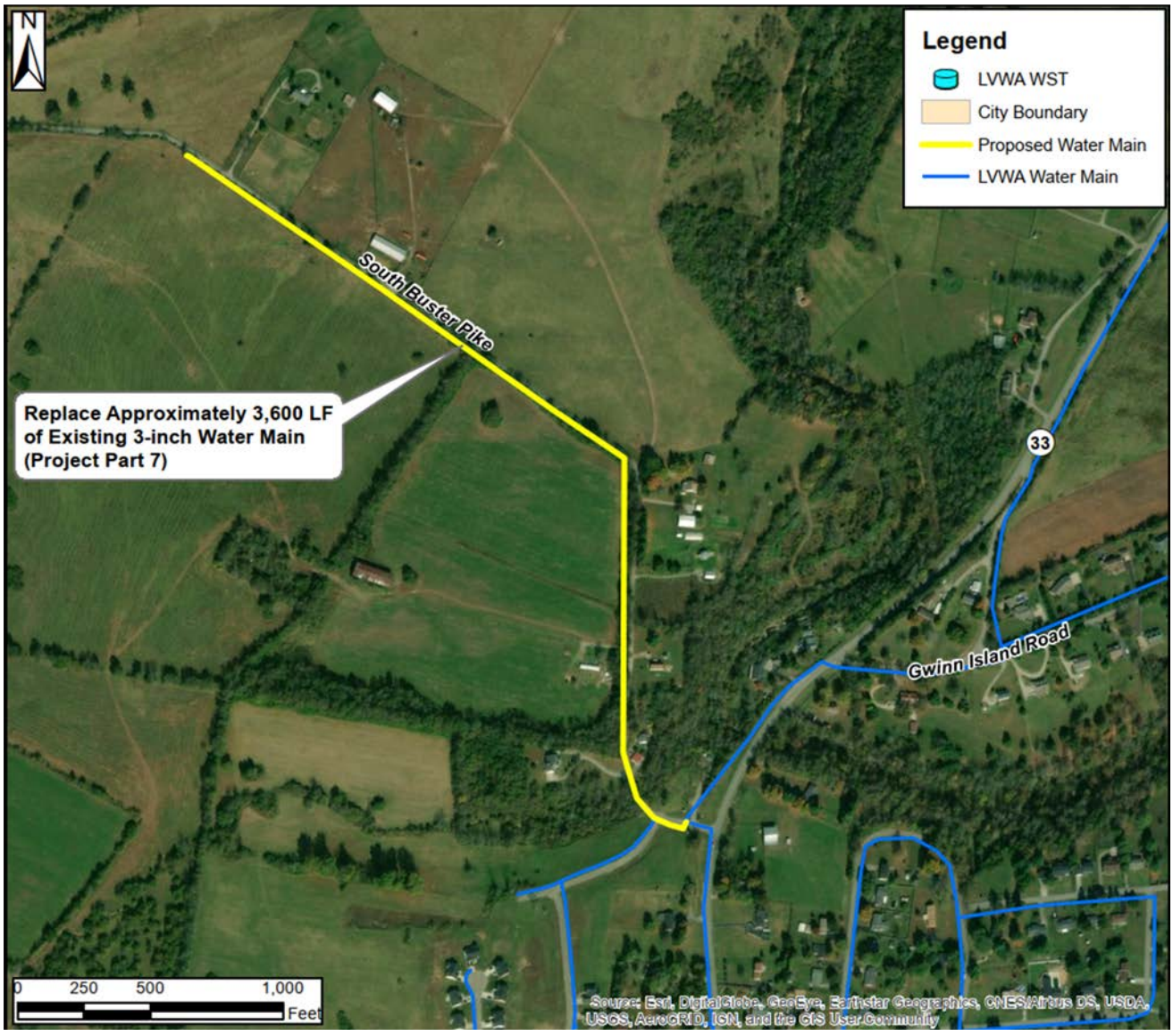

Figure 8.01-1 South Buster Pike Water Main Location

8.02 PURPOSE

The existing 3-inch water main along South Buster Pike is nearing the end of its useful life. LVWA desires to replace the existing 3-inch water main with a proposed 3-inch PVC water main. LVWA requested that

we analyze any hydraulic benefit to upsizing the line. Therefore, a 24-hour hydraulic evaluation was conducted to determine the feasibility of replacing the 3-inch water main with a 4-inch water main. The upsized 4-inch water main will have no recognizable impact on water pressure for customers. It is recommended to replace the existing water main with a 3-inch water main.

Conducting hydraulic and water quality modeling of the system shows no negative impact to the water distribution system with the increased line size. A 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and headloss. As water ages, there is greater potential for DBP formation, especially trihalomethanes. The increase in water age when using a 4-inch water main is so small it is anticipated to have no impact on existing DBP formation. Therefore there is little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main.

8.03 ALTERNATIVES

Three alternatives were evaluated for the proposed water main along South Buster Pike. The alternatives include upsizing the existing 3-inch water main with a proposed 4-inch water main, replacing the water main with a new 3-inch water main, or do nothing. It is recommended to replace the existing 3-inch water main along South Buster Pike with a new 3-inch water main.

A. Alternative 1: Install a 4-inch PVC Water Main

Approximately 3,600 linear feet of 4-inch PVC water main will be installed along South Buster Pike. The proposed water main will begin near the intersection of South Buster Pike and Highway 33 and continue northwest for approximately 3,600 linear feet. All water services will be transferred from the existing 3-inch water main to the proposed 4-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing the existing 3-inch water main to a proposed 4-inch water main will provide slightly increased volume, therein increasing water age, and will slightly decrease water main velocity and headloss. The increase in water age when using a 4-inch water main is minimal and is anticipated to have no impact on existing DBP formation. Therefore there is little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main. This option is anticipated to reduce water loss and extend the service life of the water infrastructure.

B. Alternative 2: Install a 3-inch PVC Water Main

Approximately 3,600 linear feet of 3-inch PVC water main will be installed along South Buster Pike. The proposed water main will begin near the intersection of South Buster Pike and Highway 33 and continue northwest for approximately 3,600 linear feet. All water services will be transferred from the existing 3-inch water main to the proposed 3-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Replacing the existing 3-inch water main is anticipated to decrease water loss and extend the expected life of the water main. The existing water main is nearing the end of its useful life, necessitating replacement.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 3-inch water main in service without replacement. This is undesirable because the existing water main is nearing the end of its useful life.

8.04 COST OPINION

An OPCC for each alternative can be seen in Table 8.04-1.

Part 7: South Buster Pike				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 4-in PVC water main	3,600	LF	$18	$64,800
4-in wet tap with gate valve and tapping sleeve	2	EA	$2,500	$5,000
Install new customer services	9	EA	$1,500	$13,500
			Subtotal	$83,300
			Contingency and Engineering (35%)	$29,200
			Total	**$112,500**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 3-in PVC water main	3,600	LF	$16	$57,600
3-in wet tap with gate valve and tapping sleeve	2	EA	$2,250	$4,500
Install new customer services	9	EA	$1,500	$13,500
			Subtotal	$75,600
			Contingency and Engineering (35%)	$26,500
			Total	**$102,100**

Table 8.04-1 OPCC for South Buster Pike Water Main Alternatives

8.05 SELECTED ALTERNATIVE

Both Alternatives 1 and 2 will provide significant improvements for LVWA. The difference between the two options is minimal. After discussion with LVWA, Alternative 2 is preferred over Alternative 1. The small number of existing customers along South Buster Pike does not warrant the additional cost to upgrade the water main size. Alternative 2 has the lowest OPCC and will continue to provide customers with excellent water service with new infrastructure.

SECTION 9
PART 8–HIGHWAY 33 WATER MAIN

9.01 BACKGROUND

This portion of the project involves replacing approximately 4,900 linear feet of existing 3-inch water main along Highway 33. It is anticipated that the proposed water main will decrease water loss and enhance water supply and pressure to customers within the US 127 and Highway 33 Pressure Zone. Figure 9.01-1 shows the location of the project part.

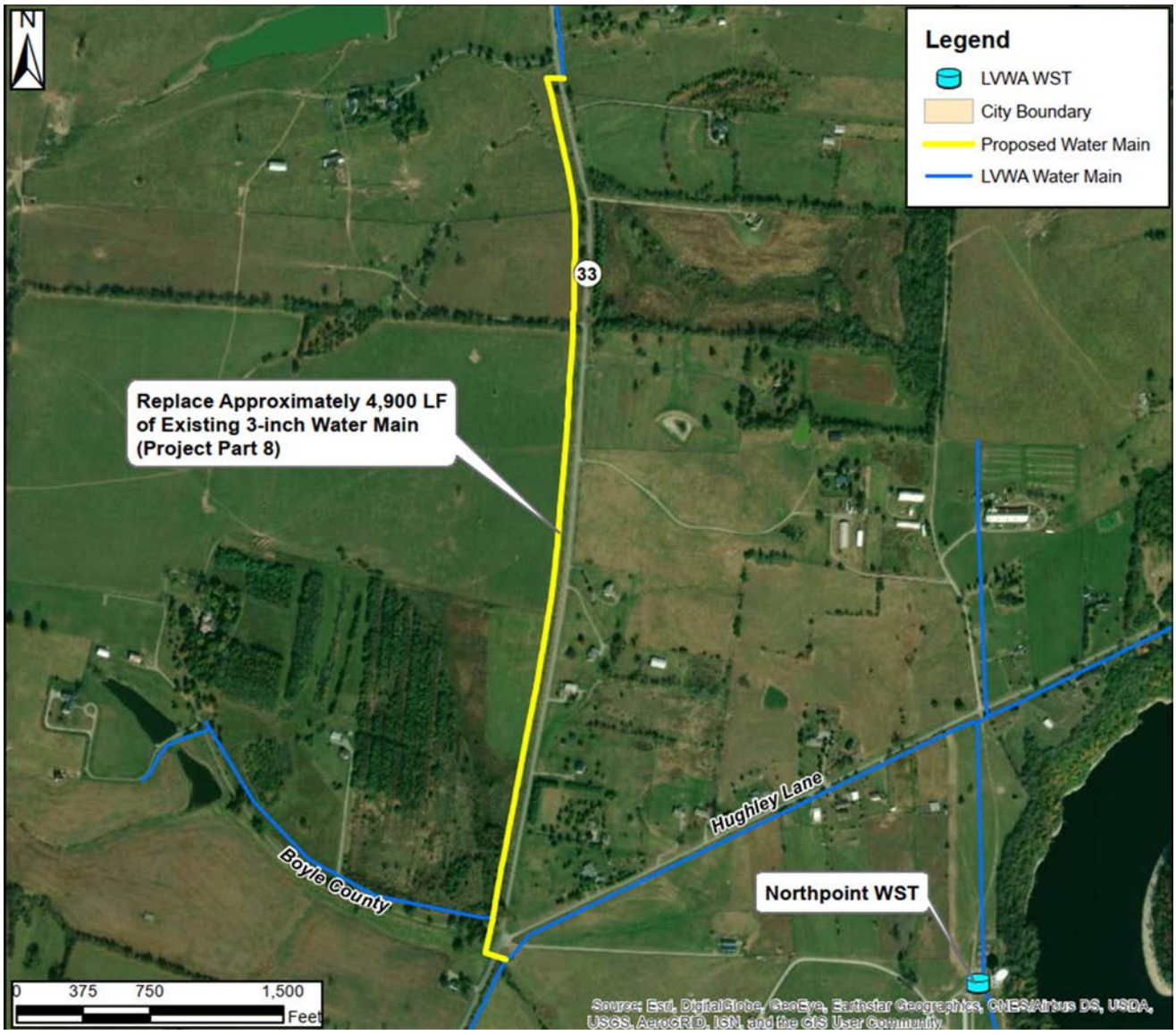

Figure 9.01-1 Highway 33 Water Main Location

9.02 PURPOSE

LVWA desires to improve the connectivity between the Shakertown Pressure Zone and the US 127 and Highway 33 Pressure Zone. LVWA has considered consolidating these two pressure zones into one pressure zone. In 2017, Strand conducted a study which evaluated the existing Shakertown BPS, as the BPS was reaching the end of its useful life. It was determined through the study that replacing the existing Shakertown BPS with a larger pump (pump with a higher flow rate) would not be able to adequately supply water to the combined Shakertown Pressure Zone and US 127 and Highway 33 Pressure Zone. At least one or both of the master meter interconnection points with Danville must be used to serve the consolidated pressure zone.

This project part will upsize a section of water main needed for the interzone connection. Approximately 4,900 linear feet of existing 3-inch water main is proposed to be upsized to an 8-inch water main. Upsizing the water main will also provide LVWA a more robust distribution system network within the existing US 127 and Highway 33 Pressure Zone. Water quality analysis indicated that increasing the diameter will not directly increase water age as the distribution system network is looped and the site is located close to the Northpoint Training Center. Figure 9.02-1 shows the water age comparison between the existing 3-inch water main and the proposed 8-inch water main.

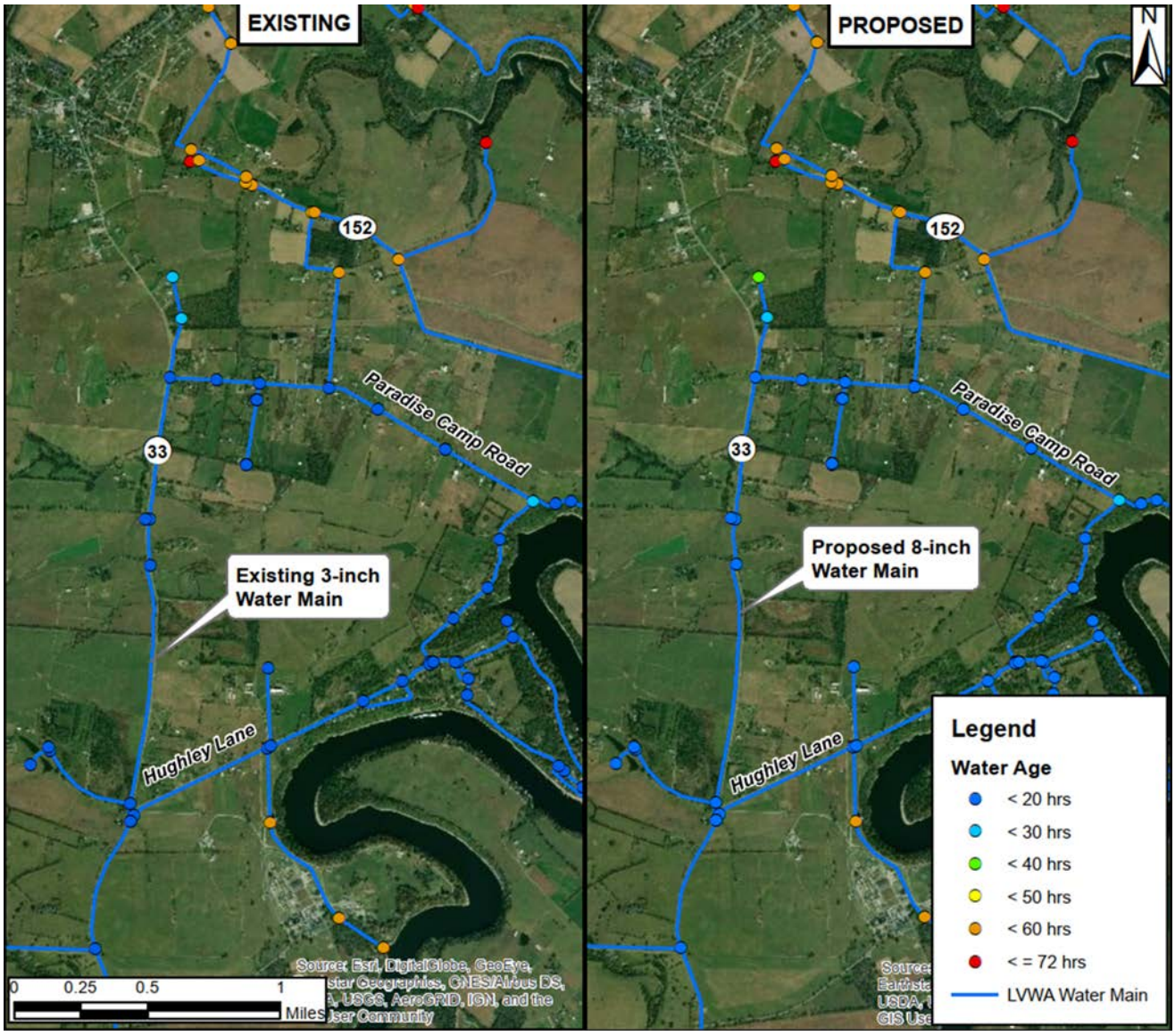

Figure 9.02-1 Highway 33 Water Age Comparison

9.03 ALTERNATIVES

Three alternatives were evaluated for the proposed water main along Highway 33. The alternatives include upsizing the existing 3-inch water main to a proposed 8-inch water main, replacing the 3-inch water main with a proposed 3-inch water main, or doing nothing. It is recommended to upsize the existing 3-inch water main with a proposed 8-inch water main to improve distribution system hydraulics and connectivity.

A. Alternative 1: Install an 8-inch PVC Water Main

Approximately 4,900 linear feet of 8-inch PVC water main will be installed along Highway 33. The proposed water main will begin near the intersection of Highway 33 and Hughley Lane and continue northward approximately 4,900 linear feet. All water services will be transferred from the existing 3-inch water main to the proposed 8-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing the existing 3-inch water main will improve distribution system hydraulics and connectivity in the US 127 and Highway 33 Pressure Zone. Water age is not anticipated to be impacted by the increase in diameter due to the looped distribution system network and location to the Northpoint Training Center. Installing an 8-inch water main will also prepare the water distribution system for a future interzone connection between the Shakertown Pressure Zone and the US 127 and Highway 33 Pressure zone. Replacing the water main is anticipated to decrease water loss and extend the life of the aging water infrastructure.

B. Alternative 2: Install a 3-inch PVC Water Main

Approximately 4,900 linear feet of 3-inch PVC water main will be installed along Highway 33. The proposed water main will begin near the intersection of Highway 33 and Hughley Lane and continue northward approximately 4,900 linear feet. All water services will be transferred from the existing 3-inch water main to the proposed 3-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Replacing the water main is anticipated to decrease water loss and extend the life of the aging water infrastructure. It will limit LVWA on its ability to consolidate the Shakertown Pressure Zone with the US 127 and Highway 33 Pressure Zone.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 3-inch water main in service without replacement. The existing water main, which is near the end of its useful life, will necessitate replacement in the near future.

9.04 COST OPINION

An OPCC for each alternative can be seen in Table 9.04-1.

Part 8: Highway 33				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 8-in PVC water main	4,900	LF	$22	$107,800
8-in wet tap with gate valve and tapping sleeve	2	EA	$3,250	$6,500
Install new customer services	10	EA	$1,500	$15,000
			Subtotal	$129,300
			Contingency and Engineering (35%)	$45,300
			Total	**$174,600**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 3-in PVC water main	4,900	LF	$16	$78,400
3-in wet tap with gate valve and tapping sleeve	2	EA	$2,250	$4,500
Install new customer services	10	EA	$1,500	$15,000
			Subtotal	$97,900
			Contingency and Engineering (35%)	$34,300
			Total	**$132,200**

Table 9.04-1 OPCC for Highway 33 Water Main Alternatives

9.05 SELECTED ALTERNATIVE

It is recommended that LVWA pursue alternative 1 for the Highway 33 water main project part. Alternative 1 will improve the water distribution system hydraulics, create redundancy within the US 127 and Highway 33 Pressure Zone, and allow for future pressure zone consolidation.

SECTION 10
PART 9–DIX DAM ROAD WATER MAIN

10.01 BACKGROUND

This portion of the project involves replacing approximately 4,300 linear feet of existing 3-inch water main along Dix Dam Road. It is anticipated that replacing the water main will improve distribution system hydraulics and enhance redundancy. Figure 10.01-1 shows the location of the project part.

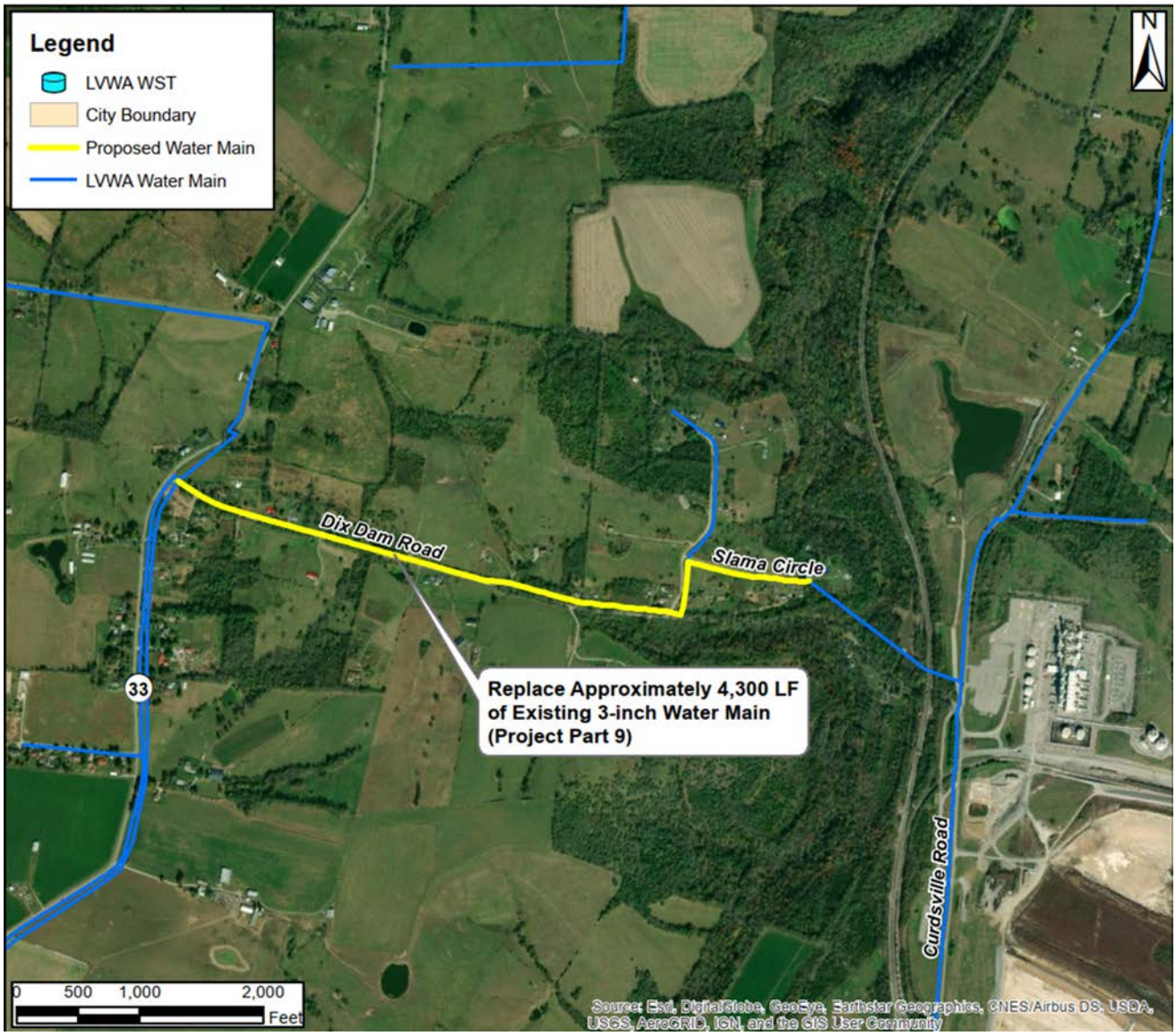

Figure 10.01-1 Dix Dam Road Water Main Location

10.02 PURPOSE

The existing 3-inch water main along Dix Dam Road is nearing the end of its useful life. LVWA desires to replace and upsize the existing 3-inch water main. Upsizing the water main will provide the following benefits to LVWA.

1. Increase capacity to a second flow path to a majority of the southern portion of the existing Shakertown Pressure Zone.

2. Establish redundancy to fill the Shakertown Road WST and Ison Lane WST from the Shakertown BPS.

3. Enhance water supply to the Kentucky Utilities E.W. Brown Generating Station, a major user in the LVWA distribution system.

10.03 ALTERNATIVES

Three alternatives were evaluated for the proposed water main along Dix Dam Road. The alternatives include replacing the existing 3-inch water main with a 6-inch water main, replacing the water main with a 4-inch water main, or do nothing. It is recommended to replace the existing 3-inch water main with a 6-inch water main to create a more robust water distribution system.

A. Alternative 1: Install a 6-inch PVC Water Main

Approximately 5,700 linear feet of 6-inch PVC water main will be installed along Dix Dam Road. The proposed water main will begin near the intersection of Highway 33 and Dix Dam Road and continue eastward approximately 5,700 linear feet. The proposed water main will tie into an existing 6-inch water main at the end of Slama Circle. All water services will be transferred from the existing 3-inch water main to the proposed 6-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing the existing 3-inch water main will improve distribution hydraulics and connectivity in the Shakertown Pressure Zone. Using a 6-inch water main will further establish redundancy to fill the Shakertown Road WST and Ison Lane WST from the Shakertown BPS. Water supply to the Kentucky Utilities E.W. Brown Generating Station will also be enhanced.

B. Alternative 2: Install a 4-inch PVC Water Main

Approximately 5,700 linear feet of 4-inch PVC water main will be installed along Dix Dam Road. The proposed water main will begin near the intersection of Highway 33 and Dix Dam Road and continue eastward approximately 5,700 linear feet. The proposed water main will tie into an existing 6-inch water main at the end of Slama Circle. All water services will be transferred from the existing 3-inch water main to the proposed 4-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

The water main spanning along Dix Dam Road helps provide redundancy to the distribution system in the event of a 6-inch water main break along Highway 33. A 6-inch water main break was simulated for both the proposed 6- and 4-inch water main options. Figure 10.03-1 compares the headloss results between the two proposed sizes. Both the existing 3-inch water main along Highway 33 and the proposed 4-inch water main along Dix Dam Road maintain high headloss, which may cause other concerns in the distribution system. It is recommended to install a 6-inch water main along Dix Dam Road.

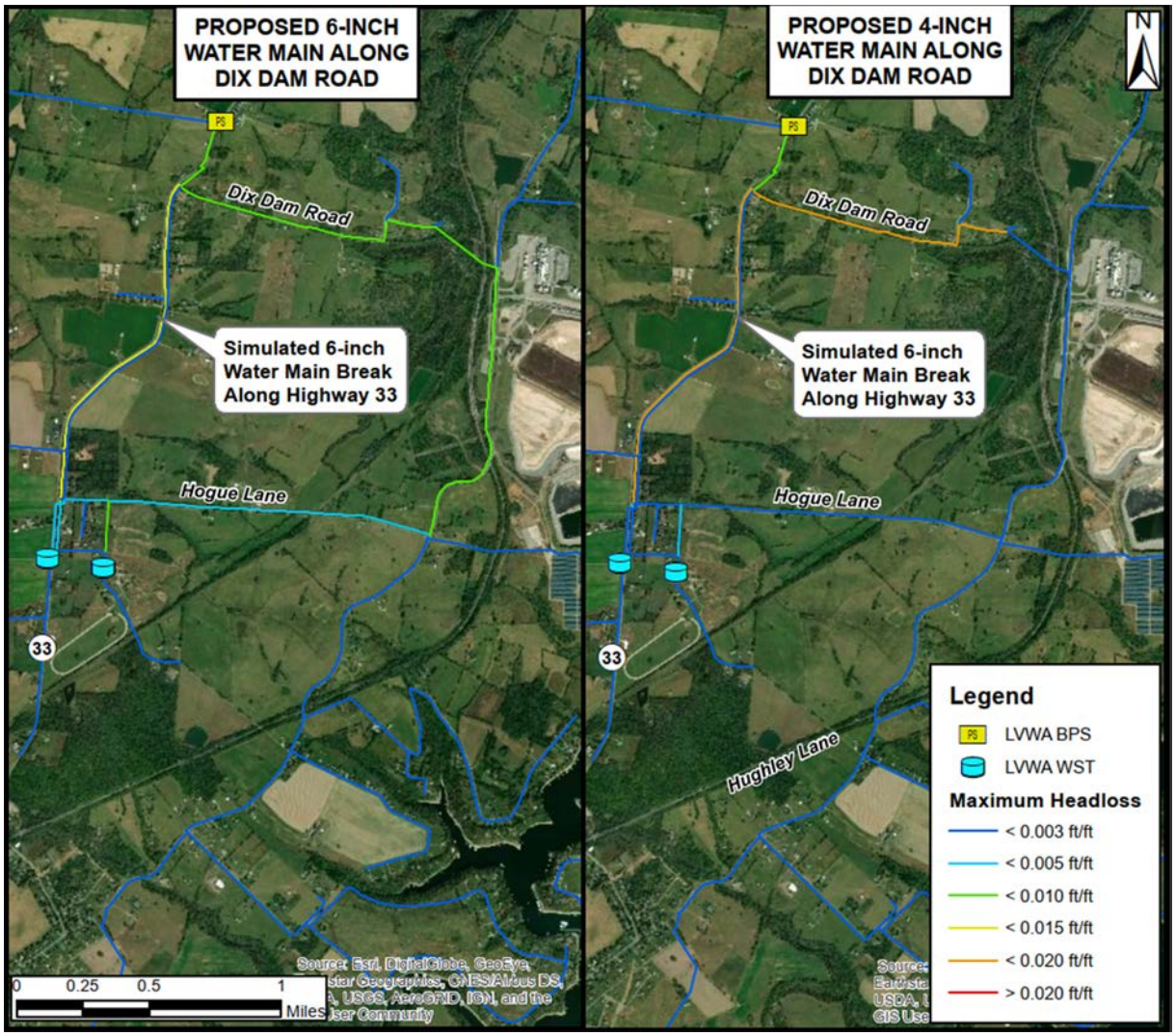

Figure 10.03-1 Dix Dam Road Maximum Headloss Comparison

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 3-inch water main in service without replacement. The existing water main, which is near the end of its useful life, will necessitate replacement soon.

10.04 COST OPINION

An OPCC for each alternative can be seen in Table 10.04-1.

Part 9: Dix Dam Road				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 6-in PVC water main	5,700	LF	$20	$114,000
6-in wet tap with gate valve and tapping sleeve	2	EA	$3,000	$6,000
Install new customer services	22	EA	$1,500	$33,000
			Subtotal	$153,000
			Contingency and Engineering (35%)	$53,600
			Total	**$206,600**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 4-in PVC water main	5,700	LF	$18	$102,600
4-in wet tap with gate valve and tapping sleeve	2	EA	$2,500	$5,000
Install new customer services	22	EA	$1,500	$33,000
			Subtotal	$140,600
			Contingency and Engineering (35%)	$49,200
			Total	**$189,800**

Table 10.04-1 OPCC for Dix Dam Road Water Main Alternatives

10.05 SELECTED ALTERNATIVE

It is recommended that LVWA pursue Alternative 1 for the Dix Dam Road water main project part. Alternative 1 will enhance a second flow path to a majority of the southern portion of the Shakertown Pressure Zone. Alternative 1 will establish redundancy to fill the Shakertown Road WST and Ison Lane WST from the Shakertown BPS. Alternative 1 will add extra protection to LVWA if an emergency 6-inch water main break were to occur along Highway 33.

SECTION 11
PART 10–MOORES LANE WATER MAIN

11.01 BACKGROUND

During the 1990s, LVWA installed an 8-inch water main parallel to an existing 3-inch water main along Moores Lane. The purpose of the 8-inch water main was to enhance capacity to the Crozier WST and provide redundancy to the distribution system. The 8-inch water main was a dedicated transmission main while the 3-inch water main served residents along Moores Lane. This portion of the project involves the abandonment of approximately 1.5 miles of this 3-inch water main. All existing water services will be moved to the existing 8-inch water main along Moores Lane. Figure 11.01-1 shows the location of the project part.

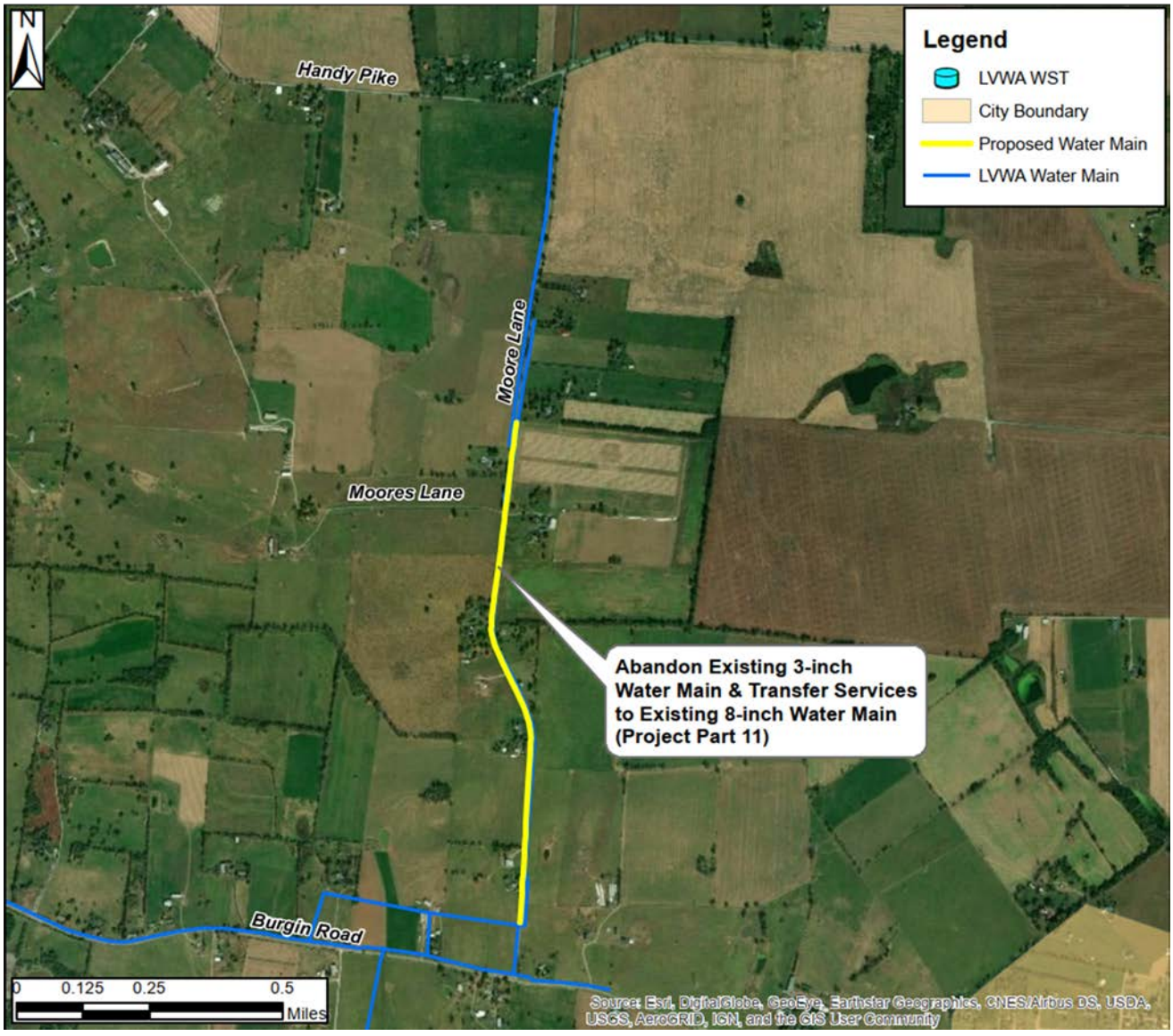

Figure 11.01-1 Moores Lane Water Main Location

11.02 PURPOSE

The existing 3-inch water main on Moores Lanes is nearing the end of its useful life. LVWA desires to abandon the existing 3-inch water main along Moores Lane and transfer all existing water services to the existing 8-inch water main. Eliminating the 3-inch water main will result in O&M savings over the life of the system.

Hydraulic modeling was performed and results show that velocities in the 8-inch water main will increase from 2.67 ft/sec to 2.84 ft/sec, as a majority of the flow from the Moores Lane BPS to the Crozier WST is already carried by the 8-inch water main. The increased velocity is below the recommended maximum velocity of 5.0 ft/sec, affording LVWA additional future flow capacity, if desired.

11.03 ALTERNATIVES

Three alternatives were evaluated for the existing 3-inch water main along Moores Lane. The alternatives include abandon the 3-inch water main, replace the 3-inch water main, or do nothing. It is recommended to abandon the existing 3-inch water main as the water main is nearing the end of its useful life. This recommendation will also include the transfer of all water services to an existing 8-inch water main.

A. Alternative 1: Abandon 3-inch Water Main and Transfer Water Services to 8-inch Water Main

Approximately 7,800 linear feet of 3-inch water main parallels an existing 8-inch water main along Moores Lane. The 3-inch water main spans from the intersection of Moores Lane and Burgin Road approximately 7,800 linear feet northward. The 8-inch water main was originally installed as a transmission main to supply water from the Moores Lane BPS to the Crozier WST. This alternative will relocate all water services to the existing 8-inch water main and abandon the existing 3-inch water main. Hydraulic modeling demonstrates that there are no disadvantages to abandoning the 3-inch water main.

B. Alternative 2: Replace 3-inch PVC Water Main

Alternative 2 will install approximately 7,800 linear feet of 3-inch water main parallel to the existing 3-inch water main and 8-inch water main. All water services will be transferred from the existing 3-inch water main to the proposed 3-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main. There is little to no benefit to replacing the 3-inch water main as the existing 8-inch water main can support the system.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 3-inch water main in service without replacement. The existing 3-inch water main, which is near the end of its useful life, will necessitate replacement in the near future.

11.04 COST OPINION

An OPCC for each alternative can be seen in Table 11.04-1.

Part 10: Moores Lane				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Install new customer services from 3-in to 8-in line	12	EA	$1,500	$18,000
			Subtotal	$18,000
			Contingency and Engineering (35%)	$6,300
			Total	**$24,300**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 3-in PVC water main	7,800	LF	$16	$124,800
3-in wet tap with gate valve and tapping sleeve	2	EA	$2,250	$4,500
3-in gate valve	1	EA	$1,500	$1,500
Install new customer services	12	EA	$1,500	$18,000
			Subtotal	$148,800
			Contingency and Engineering (35%)	$52,100
			Total	**$200,900**

Table 11.04-1 OPCC Moores Lane Water Main Alternatives

11.05 SELECTED ALTERNATIVE

It is recommended that LVWA pursue Alternative 1 for the Moores Lane water main project part. The existing 8-inch water main has sufficient capacity for all water services along Moores Lane as well as can adequately supply water to the Crozier WST. Alternative 1 will decrease existing water loss and consolidate water infrastructure.

SECTION 12
PART 11–SPEARS CREEK WATER MAIN ELIMINATION

12.01 BACKGROUND

This portion of the project involves the abandonment of approximately 2,400 linear feet of a 3-inch water main crossing Spears Creek along Spears Lane. The creek crossing has posed many problems for LVWA since its initial installation. Abandoning the water main is expected to decrease water loss as LVWA suspects this water main to have several minor leaks. Water service along Waterworks Road will be switched to an alternative connection along Lexington Road served by Danville. Figure 12.01-1 shows the location of the project part.

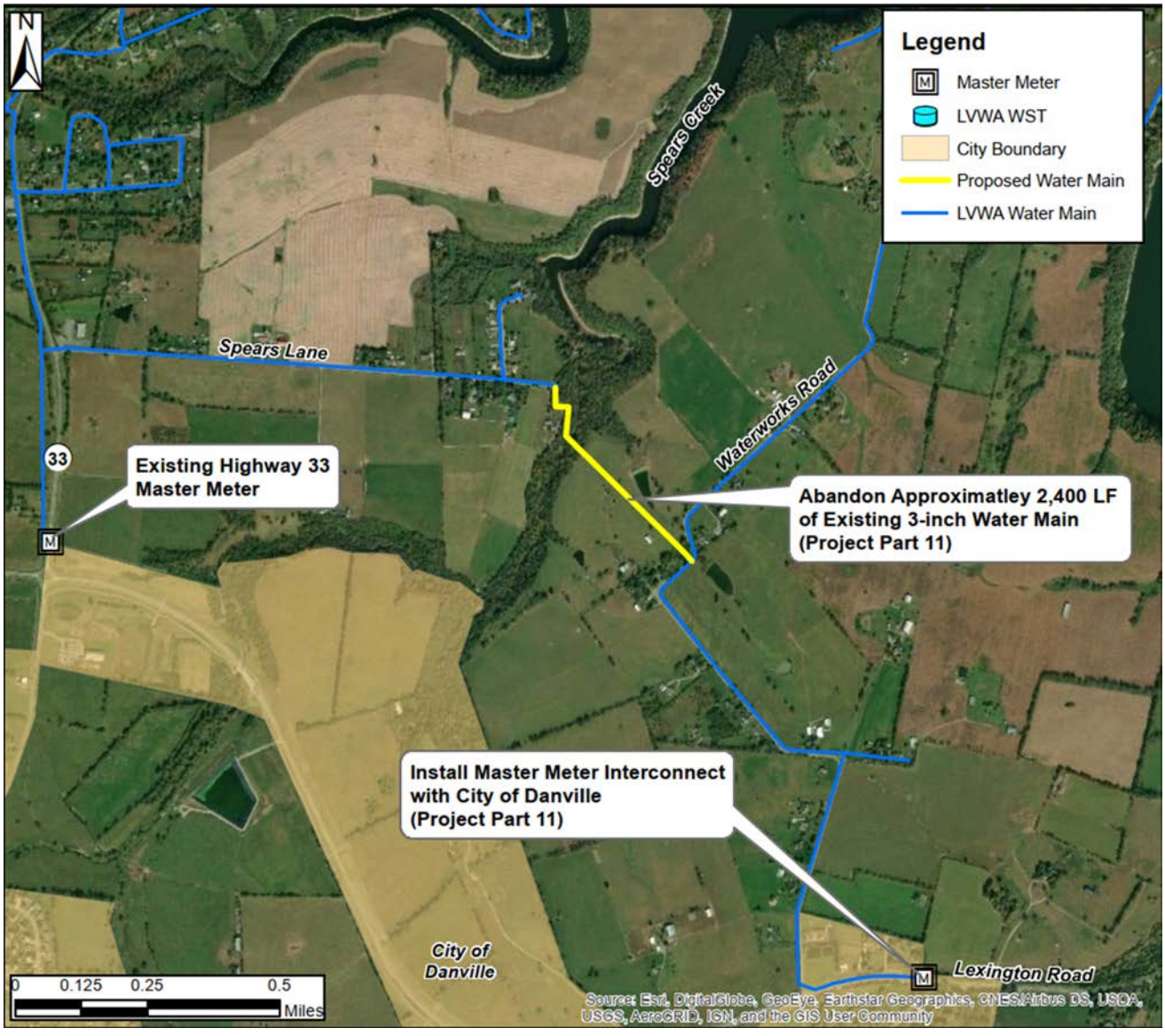

Figure 12.01-1 Spears Creek Water Main Elimination Location

12.02 PURPOSE

Approximately 2,400 linear feet of 3-inch water main currently runs cross country and connects several water mains along Spears Lane and Waterworks Road. The water main is installed in rocky soil and has one major creek crossing at Spears Creek. LVWA has reportedly repaired numerous leaks only to still experience water loss around the creek crossing at Spears Creek. LVWA desires to abandon approximately 2,400 linear feet of 3-inch water main. This will necessitate another master meter connection point with Danville. This will also create a dead end in the water distribution system at the end of Spears Lane.

12.03 ALTERNATIVES

Three alternatives were evaluated for a segment of existing 3-inch water main along Spears Lane. The alternatives include abandoning the existing 3-inch water main, replacing the existing 3-inch water main, or do nothing. It is recommended to abandon the existing 3-inch water main as the water main has experienced numerous leaks since its installation.

A. Alternative 1: Abandon 3-inch PVC Water Main

Alternative 1 will abandon approximately 2,400 linear feet of existing 3-inch water main spanning from the end of Spears Lane continuing east to Waterworks Road. This alternative will eliminate a major creek crossing at Spears Creek, a major source of water loss.

A new master meter interconnect with Danville will be required when the water main is abandoned. The proposed master meter interconnect will be located near the intersection of Lexington Road, Waterworks Road, and Old Lexington Road. It is assumed that LVWA will use its existing water main easement for the proposed master meter interconnect. LVWA already has an agreement with Danville for several other master meter interconnects. It is anticipated that the agreement will need to be modified to include this additional site.

Eliminating the Spears Creek crossing will isolate LVWA customers along Waterworks Road from the remainder of the LVWA US 127 and Highway Pressure Zone. It is recommended to discuss water distribution system hydraulics with Danville before selecting this alternative. At a minimum, LVWA should discuss water pressure and water main supply sizes with Danville to determine whether its customers will continue to receive adequate water pressure and supply. It is anticipated that this interconnection point will provide equal or better service to customers along Waterworks Road as these customers currently receive their water from the Highway 33 master meter interconnect with Danville.

Abandoning the Spears Creek crossing will further eliminate one dead end along the southern portion of Waterworks Road. It will create one new dead end along Spears Lane. It is anticipated that these changes will have minimal impact on water age and water quality for customers. It is anticipated that water loss will be significantly reduced with this alternative.

B. Alternative 2: Replace 3-inch PVC Water Main

Alternative 2 will install approximately 2,400 linear feet of 3-inch PVC water main spanning from the end of Spears Lane continuing east to Waterworks Road. The existing 3-inch water main will be abandoned in place. Approximately 250 linear feet of stream crossing will be required under Spears Creek. It is recommended to use horizontal directional drilling (HDD) with high density polyethylene (HDPE) pipe for this creek crossing as steep, rocky embankments are anticipated. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Replacing the existing 3-inch water main will maintain the existing operation of the water distribution system. It is anticipated that water loss will be reduced once the proposed water main is in service.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 3-inch water main in service without replacement. The existing 3-inch water main is nearing the end of its useful life and currently experiences significant water loss each year. This alternative will not address the current issues and will necessitate replacement of the water main in the near future.

12.04 COST OPINION

An OPCC for each alternative can be seen in Table 12.04-1.

Part 11: Spears Creek				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Master meter with Danville system	1	EA	$12,000	$12,000
			Subtotal	$12,000
			Contingency and Engineering (35%)	$4,200
			Total	**$16,200**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 3-in PVC water main	2,400	LF	$16	$38,400
3-in wet tap with gate valve and tapping sleeve	2	EA	$2,250	$4,500
Install new customer services	1	EA	$1,500	$1,500
HDD, HDPE stream crossing	250	LF		
			Subtotal	$44,400
			Contingency and Engineering (35%)	$15,500
			Total	**$59,900**

Table 12.04-1 OPCC Spears Lane Water Main Alternatives

12.05 SELECTED ALTERNATIVE

It is recommended that LVWA pursue Alternative 1 for the Spears Creek water main elimination project part. It is anticipated that Alternative 1 will decrease the existing water loss observed along this section of piping. Alternative 1 will require a new master meter interconnection with Danville but will remove all creek crossings across Spears Creek. It is recommended to discuss water distribution system hydraulics with Danville before selecting a final alternative.

SECTION 13
PART 12–INTERZONE CONNECTION WATER MAIN

13.01 BACKGROUND

This portion of the project involves the installation of approximately 3,000 linear feet of 8-inch water main along Highway 33 and Burgin Road. The proposed water main will provide a connection between the Shakertown Pressure Zone and the US 127/Highway 33 Pressure Zone. Figure 13.01-1 shows the location of the project part.

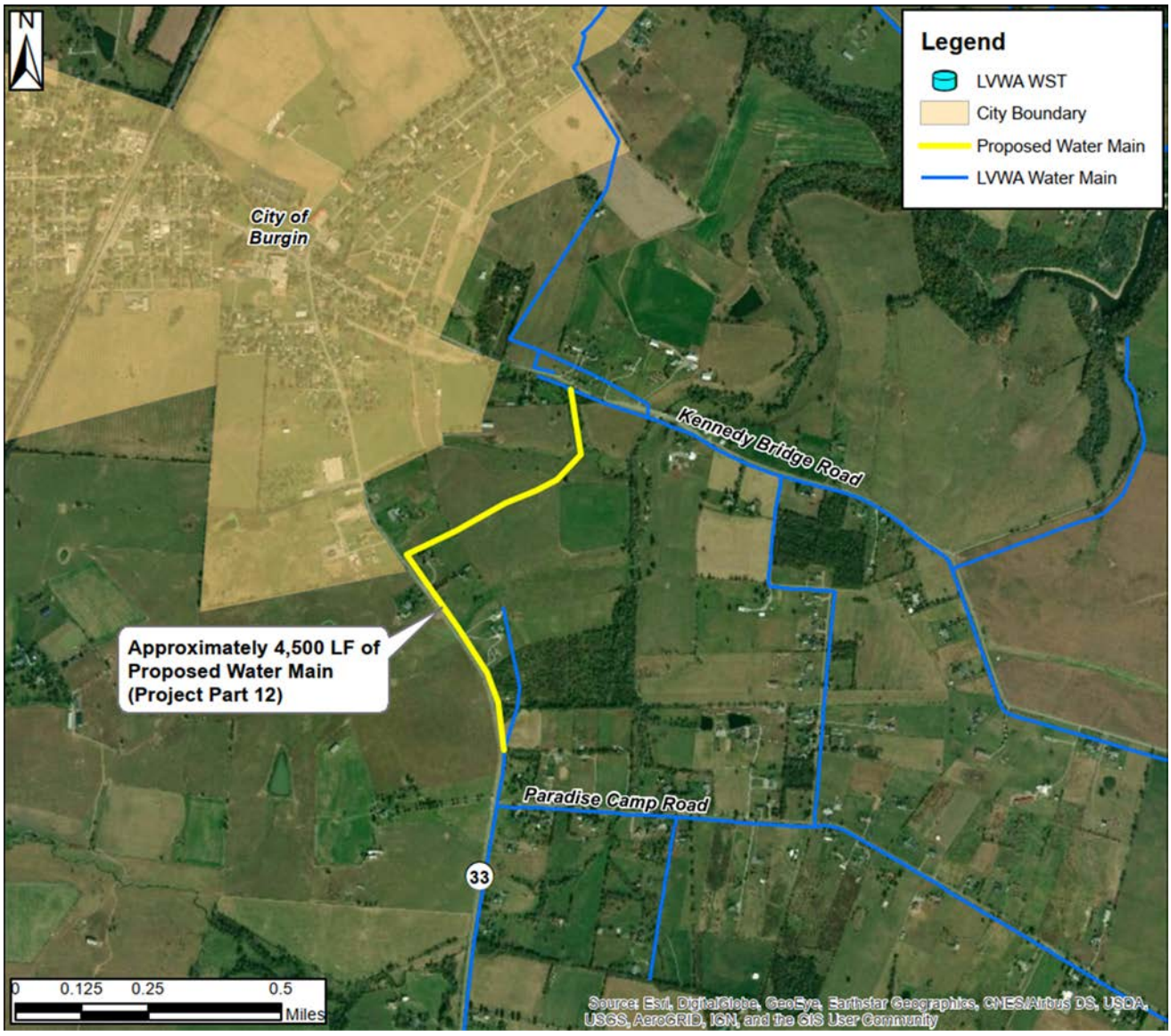

Figure 13.01-1 Interzone Connection Water Main Location

13.02 PURPOSE

LVWA desires to improve the interzone connection between the Shakertown Pressure Zone and the US 127/Highway 33 Pressure Zone. LVWA has considered consolidating these two pressure zones into one pressure zone. In 2017, Strand conducted a study that evaluated the existing Shakertown BPS, as the BPS was reaching the end of its useful life. It was determined through the study that replacing the existing Shakertown BPS with a larger pump (pump with a higher flow rate) will not be able to adequately supply water to the combined Shakertown Pressure Zone and US 127/Highway 33 Pressure Zone. At least one or both of the master meter interconnection points with Danville must be used to serve the consolidated pressure zone.

The construction of part 12 will provide a third interzone connection between the Shakertown Pressure Zone and the US 127/Highway 33 Pressure Zone. The proposed 8-inch water main will be the largest diameter water main connection between the two pressure zones. Part 12 will provide the shortest distance between the Shakertown Pressure Zone and the Northpoint Training Center. The proposed water main, in conjunction with project part 8, will supply water to the centroid of the US 127/Highway 33 Pressure Zone, enhancing water supply and water pressure for all customers in this pressure zone.

13.03 ALTERNATIVES

Three alternatives were evaluated for a proposed interzone connection between the existing Shakertown Pressure Zone and the US 127/Highway 33 Pressure Zone. The alternatives include a proposed 8-inch water main, a proposed 6-inch water main, and do nothing. It is recommended to install a proposed 8-inch water main to prepare the water distribution system for a future pressure zone consolidation. Installing an 8-inch water main will further enhance redundancy for LVWA.

A. Alternative 1: Install an 8-inch PVC Water Main

Approximately 4,500 linear feet of 8-inch PVC water main will be installed along Highway 33 and a cross country route. The proposed water main will begin just north of the intersection of Highway 33 and Paradise Camp Road and continue along Highway 33 for approximately 2,000 linear feet. The proposed alignment will then turn northeastward and travel for approximately 2,500 linear feet. The proposed water main will connect an existing 8-inch water main along Highway 33 with an existing 6-inch water main along Kennedy Bridge Road. It is assumed that LVWA will purchase easements for a portion of the proposed water main and will use the Highway 33 right-of-way for other portions of the project.

The main purpose of the proposed water main is to connect the Shakertown Pressure zone and the US 127/Highway 33 Pressure Zone. LVWA may combine these two pressure zones into one large pressure zone in the future. LVWA will isolate the two pressure zones with an 8-inch valve along the proposed water main alignment in the interim time. If the pressure zones are not consolidated, the proposed water main will have little to no purpose beyond providing an additional redundant connection between the pressure zones for use during emergency conditions.

Pressure zone consolidation will require at least one or both of the existing master meter interconnection points with Danville located on the southern portion of the existing US 127/Highway 33 Pressure Zone to remain in operation. Customers in the southern portion of the water distribution system along Waterworks

Road would experience water pressures below the required 30 psi without one of these master meter interconnection points in service.

B. Alternative 2: Install a 6-inch PVC water main

Approximately 4,500 linear feet of 6-inch PVC water main will be installed along Highway 33 and a cross country route. The proposed water main will begin just north of the intersection of Highway 33 and Paradise Camp Road and continue along Highway 33 for approximately 2,000 linear feet. The proposed alignment will then turn northeastward and travel cross country for approximately 2,500 linear feet. The proposed water main will connect an existing 6-inch water main along Highway 33 with an existing 6-inch water main along Kennedy Bridge Road. It is assumed that LVWA will purchase easements for a portion of the proposed water main and will use the Highway 33 right-of-way for other portions of the project.

The 6-inch water main serves the same purpose as the 8-inch main described in Alternative 1, but the 6-inch main will not convey as much water as an 8-inch water main line. The proposed 8-inch water main will be able to serve as the backbone connection between the two pressure zones and will be able to convey more capacity than the 6-inch water main.

C. Alternative 3: Do Nothing

Alternative three proposes to keep the existing water distribution system in its current state. No proposed water mains will be installed. LVWA will be restricted in the future consolidation of the Shakertown Pressure Zone and US 127/Highway 33 Pressure Zone.

13.04 COST OPINION

An OPCC for each alternative can be seen in Table 13.04-1.

Part 12: Interzone Connection				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 8-in PVC water main	4,500	LF	$22	$99,000
8-in wet tap with gate valve and tapping sleeve	2	EA	$3,250	$6,500
			Subtotal	$99,000
			Contingency and Engineering (35%)	$34,700
			Total	**$133,700**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 6-in PVC water main	4,500	LF	$20	$90,000
6-in wet tap with gate valve and tapping sleeve	2	EA	$3,000	$6,000
			Subtotal	$96,000
			Contingency and Engineering (35%)	$33,600
			Total	**$129,600**

Table 13.04-1 OPCC Interzone Connection Water Main Alternatives

13.05 SELECTED ALTERNATIVE

It is recommended that LVWA pursue Alternative 1 for the interzone connection water main project part. Alternative 1 will allow for future pressure zone consolidation and will establish redundancy to the water distribution system. The proposed 8-inch water main will serve as the backbone connection between the two pressure zones and will be able to convey more capacity than the 6-inch water main.

SECTION 14
PART 13–PANDORA MARINA WATER MAIN LOOP

14.01 BACKGROUND

This portion of the project involves the installation of approximately 900 linear feet of proposed water main near Pandora Marina along Carmichael Drive and Herrington Woods. The proposed water main will eliminate two dead-end water mains by creating a new loop in the water distribution system. Looping can reduce the water age in the water distribution system by allowing older water to mix with newer water and eliminating stagnated water in dead-end mains. As water ages, there is a greater potential for DBP formation, especially trihalomethanes. Reducing the water age in the distribution system can reduce the formation potential of DBPs. Figure 14.01-1 shows the location of the project part.

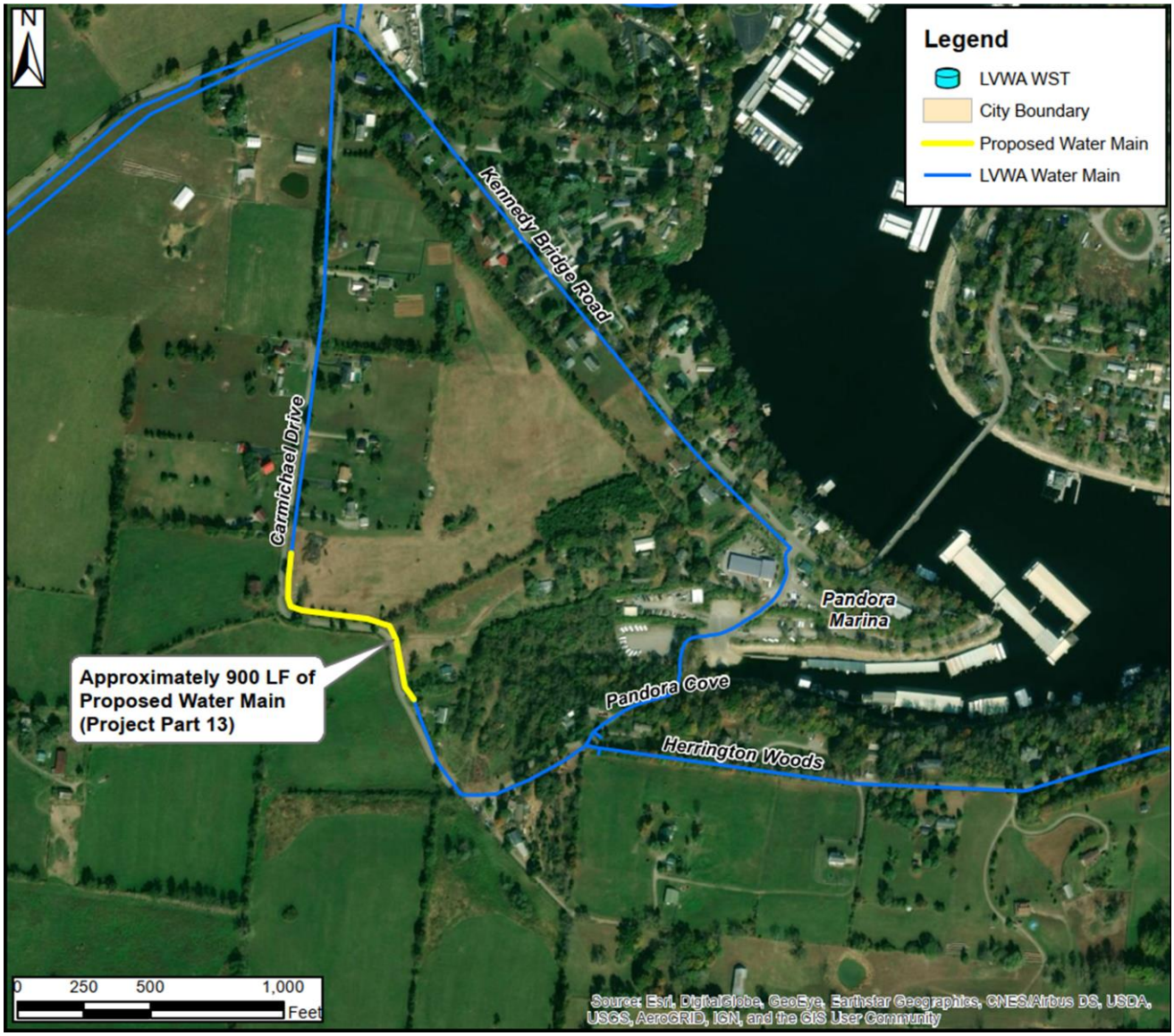

Figure 14.01-1 Pandora Marina Water Main Loop Location

14.02 PURPOSE

Two dead-end water mains currently reside near the Pandora Marina along Carmichael Drive and Herrington Woods. The proposed water main will eliminate two dead-end water mains and create one new loop in the water distribution system. The water quality analysis indicated that water age would decrease under this scenario, decreasing the likelihood of DBP formation.

14.03 ALTERNATIVES

Three alternatives were evaluated for a proposed Pandora Marina dead-end elimination. The alternatives include installing a proposed 4-inch water main, a proposed 3-inch water main, or do nothing. It is recommended to install a proposed 3-inch water main to provide distribution system looping and reduce the overall water age in the system.

A. Alternative 1: Install a 4-inch PVC Water Main

Approximately 900 linear feet of 4-inch PVC water main will be installed near the Pandora Marina along Carmichael Drive and Herrington Woods. It will create one new loop in the water distribution system by connecting two existing 3-inch water mains. It is assumed that LVWA will install the proposed water main in the existing roadway right-of-way.

Hydraulic and water quality modeling was conducted to compare the proposed 4-inch water main with the proposed 3-inch water main. Both diameters will reduce the overall water age when compared to the existing water distribution system conditions. A 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and head loss. The increase in water age when using a 4-inch water main is minimal and is anticipated to have no impact on existing DBP formation when compared to a 3-inch water main. Therefore, there is little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main.

B. Alternative 2: Install a 3-inch PVC Water Main

Approximately 900 linear feet of 3-inch PVC water main will be installed near the Pandora Marina along Carmichael Drive and Herrington Woods. It will create two loops in the water distribution system by connecting two existing 3-inch water mains. It is assumed that LVWA will install the proposed water main in the existing roadway right-of-way.

Hydraulic and water quality modeling was conducted to compare the proposed 4-inch water main with the proposed 3-inch water main. Both diameters will reduce the overall water age when compared to the existing water distribution system conditions. There is therefore little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing water distribution system in its current state. No proposed water mains will be installed. This is undesirable as LVWA wants to reduce water age throughout its water distribution system.

14.04 COST OPINION

An OPCC for each alternative can be seen in Table 14.04-1.

Part 13: Pandora Marina				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 4-in PVC water main	900	LF	$18	$16,200
4-in wet tap with gate valve and tapping sleeve	2	EA	$2,500	$5,000
			Subtotal	$21,200
			Contingency and Engineering (35%)	$7,400
			Total	**$28,600**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 3-in PVC water main	900	LF	$16	$14,400
3-in wet tap with gate valve and tapping sleeve	2	EA	$2,250	$4,500
			Subtotal	$18,900
			Contingency and Engineering (35%)	$6,600
			Total	**$25,500**

Table 14.04-1 OPCC Pandora Marina Water Main Alternatives

14.05 SELECTED ALTERNATIVE

Both Alternatives 1 and 2 will provide significant improvements for LVWA. The difference between the two options is minimal. It is recommended for this project part that LVWA select Alternative 2 over Alternative 1. Alternative 2 will eliminate two dead-end water mains and will decrease water age. Alternative 2 has the lowest OPCC and will continue to provide customers with excellent water service.

15.01 BACKGROUND

This portion of the project involves the installation of approximately 2,500 linear feet of 8-inch water main along US 127 from Harrodsburg Conover Education Center, an extension of Campbellsville University, north to Tim Short Auto Max Store. It is anticipated that the proposed water main will enhance fire protection to the Conover Education Center and the surrounding commercial developments. Figure 15.01-1 shows the location of the project part.

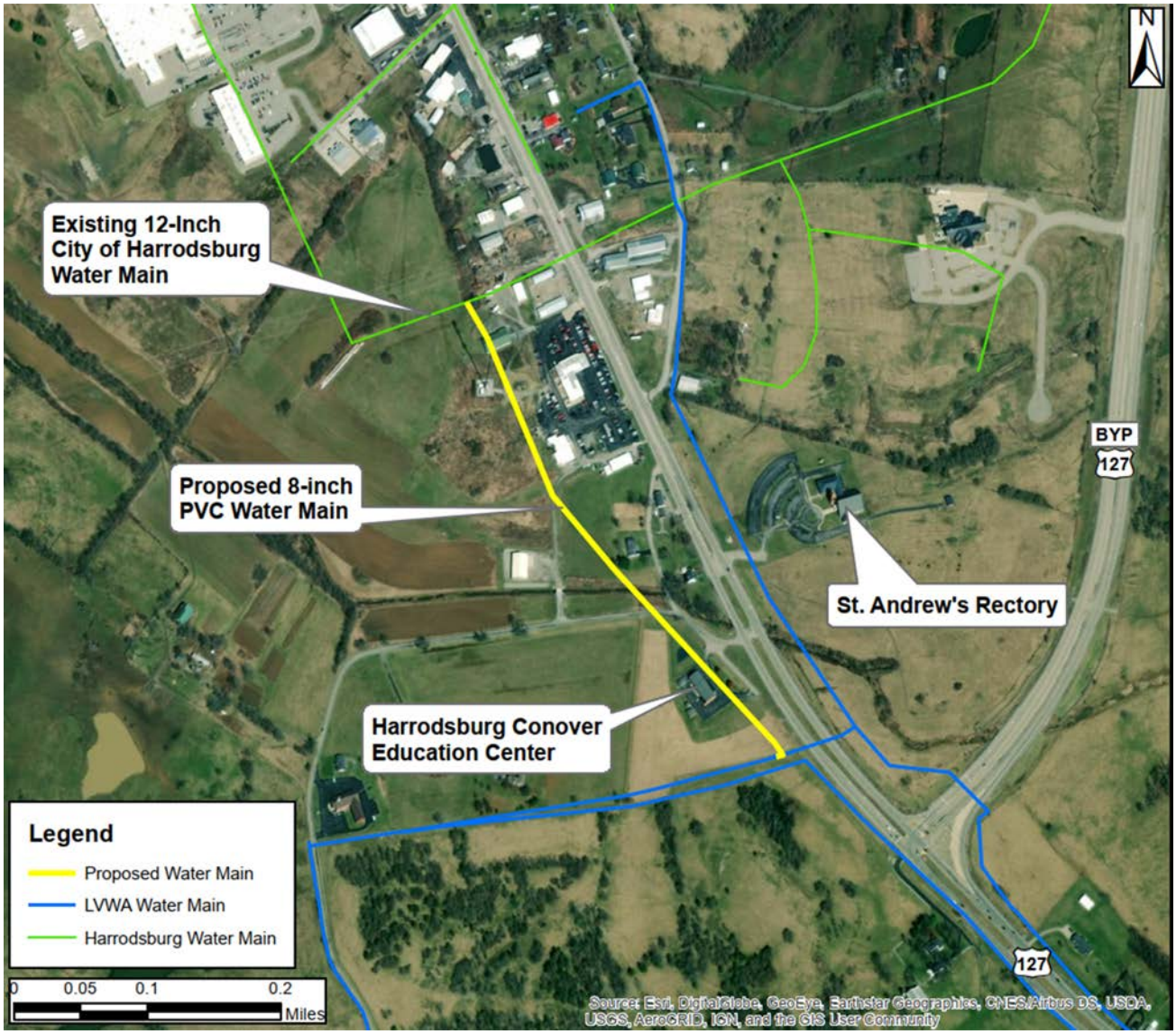

Figure 15.01-1 Enhanced Fire Protection Along US 127 Location

15.02 PURPOSE

LVWA supplies water to the Harrodsburg Conover Education Center that will eventually house up to 650 students each day. Additionally, St. Andrew's Rectory, located just across the street, can house up to 500 people each day. LVWA desires to provide fire protection to these customers and surrounding properties by installing approximately 2,500 linear feet of 8-inch water main along US 127 and potentially connecting into a 12-inch water main with Harrodsburg.

Strand contacted Jason Sanford, the City of Harrodsburg Water and Sewer Maintenance Superintendent, to discuss the hydraulics of the Harrodsburg water distribution system at this point. Jason explained that Harrodsburg has a 12-inch water main going east to west near the car sales lot. Jason then explained that this water main goes east until changing into a 20-inch water main near the intersection of the US 127 Bypass and Bellows Mill Road. The water main is fed from a 1.0 million gallon WST called the East Office Tank. The WST typically drops 10 feet before being refilled by a pump station. Jason indicated that the typical pressures in the area range from 70 to 77 psi.

15.03 ALTERNATIVES

Three alternatives were evaluated for a proposed water main along US 127. The alternatives include installing a proposed 8-inch water main without a new Harrodsburg interconnect, with a new Harrodsburg interconnect, or do nothing. It is recommended to install a proposed 8-inch water main with a new interconnect with Harrodsburg such to provide fire flow capacity to the Harrodsburg Conover Education Center, St. Andrew's Rectory, and surrounding properties.

A. Alternative 1: Install an 8-inch PVC Water Main Without New Harrodsburg Interconnect

The proposed 8-inch PVC water main will extend north from an existing 6-inch water main located on the west side of US 127 halfway between Spears Lane and the US 127 Bypass. The proposed alignment will use an existing LVWA easement along US 127 for approximately 1,000 linear feet. LVWA will purchase additional easement needed to extend the 8-inch water main an additional 1,500 linear feet to an existing 12-inch water main owned by Harrodsburg. The proposed alignment will include a 50 linear feet highway bore under Spears Lane and a 60 linear foot stream crossing. This alternative will not include a new interconnection with Harrodsburg water distribution system.

Figure 15.03-1 shows the available flow for fire protection, assuming project part 1 is installed. It is anticipated that LVWA will be able to provide approximately 500 gpm of flow during an emergency situation. The ISO recommends an absolute minimum NFF of 500 gpm for commercial buildings. The NFF for each building can be calculated if the following items are known.

- Building Construction Class
- Building Occupancy Combustible Factor
- Building Exposure Factor
- Building Communication Factor
- Building Area

Looking at several buildings in the area and performing some preliminary calculations, the NFF would be much greater than 500 gpm.

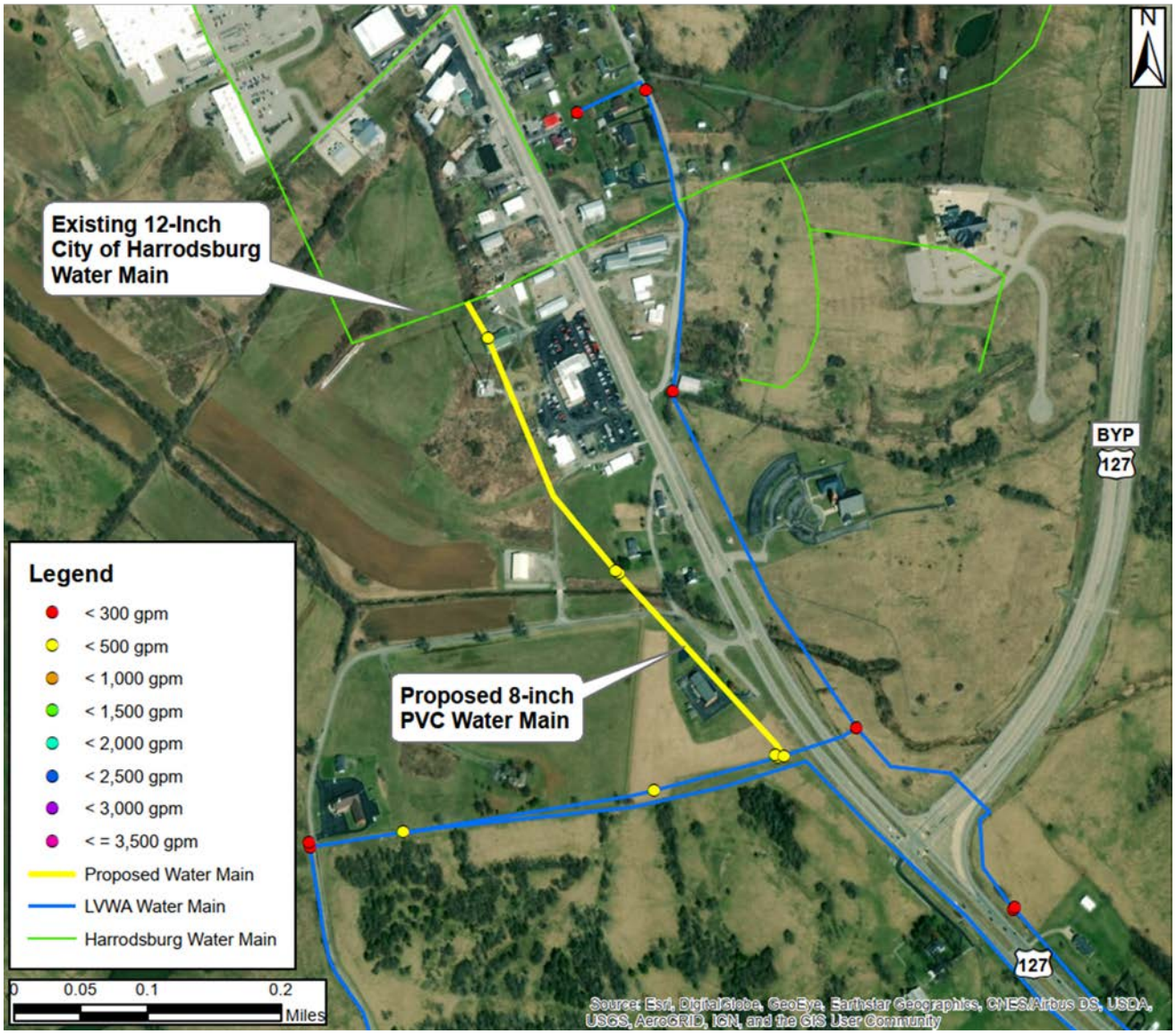

Figure 15.03-1 Available Fire Flow along US 127 without Harrodsburg Interconnect

B. Alternative 2: Install an 8-inch PVC Water Main with New Harrodsburg Interconnect

The proposed 8-inch PVC water main will extend north from an existing 6-inch water main located on the west side of US 127 halfway between Spears Lane and the US 127 Bypass. The proposed alignment will use an existing LVWA easement along US 127 for approximately 1,000 linear feet. LVWA will purchase additional easement needed to extend the 8-inch water main an additional 1,500 linear feet to an existing 12-inch water main owned by Harrodsburg. The proposed alignment will include a 50 linear foot highway bore under Spears Lane and a 60 linear foot stream crossing.

This alternative will include a new interconnection with Harrodsburg water distribution system. The proposed connection point will be at a 12-inch water main owned by Harrodsburg located west of US 127 near an overhead electric transmission main easement. LVWA already has an agreement with Harrodsburg for other master meter interconnects. It is anticipated that the agreement will need to be modified to include this additional site.

It is estimated that the interconnection with Harrodsburg will provide additional fire flow capacity up to 1,500 gpm. This fire flow capacity should meet the ISO recommended NFF during an emergency event. Additional discussions with LVWA will be needed to determine the actual NFF for this area.

Connecting the US 127/Highway 33 Pressure Zone with Harrodsburg water distribution system will necessitate the installation of a pressure reducing valve (PRV) or gate valve on the south side of the proposed 8-inch water main. These two pressure zones are currently at different hydraulic grade lines (HGL) and will not operate as intended unless a PRV or gate valve is installed. The normal HGL of the Harrodsburg East Office WST is approximately 1,033 feet. The overflow elevation of the Crozier WST is approximately 1,095 feet. Installing a PRV on the southern portion of the proposed 8-inch water main will allow the proposed 8-inch water main to be supplied from both Harrodsburg interconnect and the Crozier WST. A gate valve will isolate the two systems.

C. Alternative 3: Do Nothing

Alternative 3 proposes to not enhance fire protection to customers along US 127. This alternative will keep the existing water distribution system in its current state.

15.04 COST OPINION

An OPCC for each alternative can be seen in Table 15.04-1.

Part 14: Enhanced Fire Protection along US 127				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 8-in PVC water main	2,500	LF	$22	$55,000
8-in wet tap with gate valve and tapping sleeve	2	EA	$3,250	$6,500
Bore under Spears Lane	50	LF	$150	$7,500
Stream crossing	60	LF	$100	$6,000
			Subtotal	$61,500
			Contingency and Engineering (35%)	$21,500
			Total	**$83,000**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 8-in PVC water main	2,500	LF	$22	$55,000
8-in wet tap with gate valve and tapping sleeve	2	EA	$3,520	$7,000
Bore under Spears Lane	50	LF	$150	$7,500
Stream crossing	60	LF	$100	$6,000
Interconnect with Harrodsburg 12-in pipe	1	EA	$20,000	$20,000
			Subtotal	$95,500
			Contingency and Engineering (35%)	$33,400
			Total	**$128,900**

Table 15.04-1 OPCC for Enhanced Fire Protection along US 127

15.05 SELECTED ALTERNATIVE

It is recommended that LVWA pursue Alternative 2 for the enhanced fire protection along US 127 project part. Alternative 2 will provide adequate fire flow capacity to the Harrodsburg Conover Education Center and the surrounding commercial developments. Alternative 2 will require the installation of a new master meter interconnect with Harrodsburg.

SECTION 16
PART 15–WILDWOOD ROAD WATER MAIN

16.01 BACKGROUND

This portion of the project involves the replacement of approximately 2,800 linear feet of existing 3-inch water main along Wildwood Road. It is anticipated that the proposed water main will decrease water loss and enhance water supply and pressure to several customers along Wildwood Road. Figure 16.01-1 shows the location of the project part.

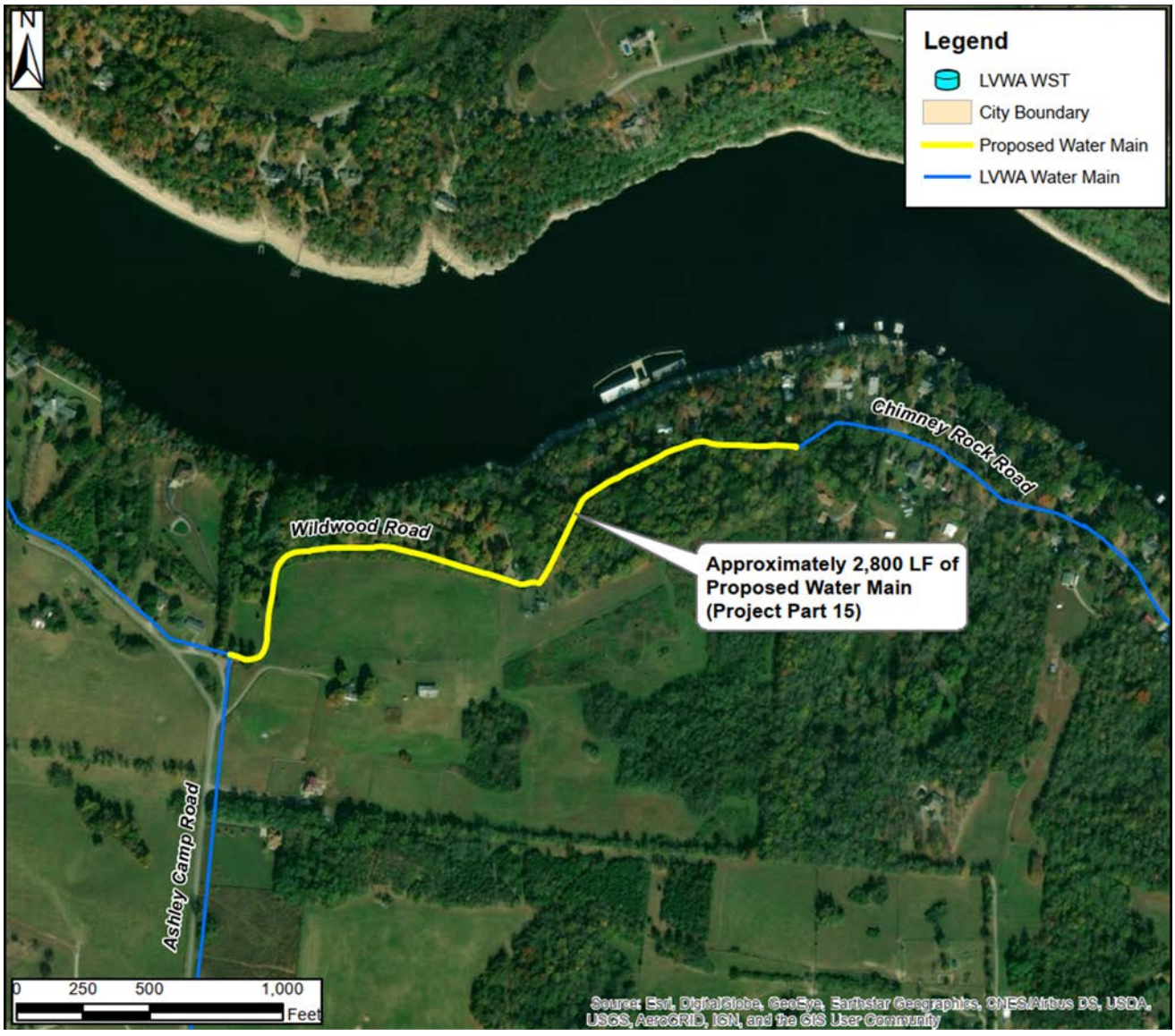

Figure 16.01-1 Wildwood Road Water Main Location

16.02 PURPOSE

The existing 3-inch water main along Wildwood Road is nearing the end of its useful life. LVWA desires to replace the existing 3-inch water main with a proposed 3-inch PVC water main. LVWA requested that Strand analyze any hydraulic benefit to upsizing the line. Therefore, a 24-hour hydraulic evaluation was conducted to determine the feasibility of replacing the 3-inch water main with a 4-inch water main. The upsized 4-inch water main will have no recognizable impact on water pressure for customers. It is recommended to replace the existing water main with a 3-inch water main.

Conducting hydraulic and water quality modeling of the system shows no negative impact to the water distribution system with the increased line size. A 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and headloss. As water ages, there is greater potential for DBP formation, especially trihalomethanes. The increase in water age when using a 4-inch water main is minimal and is anticipated to have no impact on existing DBP formation. Therefore, there is little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main.

16.03 ALTERNATIVES

Three alternatives were evaluated for the proposed water main along Wildwood Road. The alternatives include upsizing the existing 3-inch water main with a proposed 4-inch water main, replacing the water main with a new 3-inch water main, or doing nothing. It is recommended to replace the existing 3-inch water main along Wildwood Road with a new 3-inch water main.

A. Alternative 1: Install a 4-inch PVC Water Main

Approximately 2,800 linear feet of 4-inch PVC water main will be installed along Wildwood Road. The proposed water main will begin near the intersection of Wildwood Road and Ashley Camp Road and continue east for approximately 2,800 linear feet. All water services will be transferred from the existing 3-inch water main to the proposed 4-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

Upsizing the existing 3-inch water main to a proposed 4-inch water main will provide slightly increased water supply, therein increasing water age, and will slightly decrease water main velocity and headloss. The increase in water age when using a 4-inch water main is minimal and is anticipated to have no impact on existing DBP formation. Therefore there is little hydraulic and water quality difference when comparing the proposed 3-inch water main with the proposed 4-inch water main. This option is anticipated to reduce water loss and extend the service life of the water infrastructure.

B. Alternative 2: Install a 3-inch PVC Water Main

Approximately 2,800 linear feet of 3-inch PVC water main will be installed along Wildwood Road. The proposed water main will begin near the intersection of Wildwood Road and Ashley Camp Road and continue east for approximately 2,800 linear feet. All water services will be transferred from the existing 3-inch water main to the proposed 3-inch water main. The existing 3-inch water main will be abandoned in place. It is assumed that LVWA will use its existing water main easement for the proposed water main.

The existing water main along Wildwood Road provides a loop in the distribution system that allows water to be supplied to customers in two direction. A looped 3-inch water main will provide ample water supply and pressure for existing customers. Replacing the existing 3-inch water main is anticipated to decrease water loss and extend the expected life of the water main. The existing water main is nearing the end of its useful life, necessitating replacement.

C. Alternative 3: Do Nothing

Alternative 3 proposes to keep the existing LVWA 3-inch water main in service without replacement. This is undesirable because the existing water main is nearing the end of its useful life.

16.04 COST OPINION

An OPCC for each alternative can be seen in Table 16.04-1.

Part 15: Wildwood Road				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 4-in PVC water main	2,800	LF	$18	$50,400
4-in wet tap with gate valve and tapping sleeve	2	EA	$2,500	$5,000
Install new customer services	18	EA	$1,500	$27,000
			Subtotal	$82,400
			Contingency and Engineering (35%)	$28,800
			Total	**$111,200**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 3-in PVC water main	2,800	LF	$16	$44,800
3-in wet tap with gate valve and tapping sleeve	2	EA	$2,250	$4,500
Install new customer services	18	EA	$1,500	$27,000
			Subtotal	$76,300
			Contingency and Engineering (35%)	$26,700
			Total	**$103,000**

Table 16.04-1 OPCC for Wildwood Road Water Main Alternatives

16.05 SELECTED ALTERNATIVE

Both Alternatives 1 and 2 will provide significant improvements for LVWA. The difference between the two options is minimal. After discussion with LVWA, Alternative 2 is preferred over Alternative 1. The small number of existing customers along Wildwood Road does not warrant the additional cost to upgrade the water main size. Maintaining the existing looped connection along Wildwood Road with a 3-inch water main will provide ample water supply and pressure for existing customers. Alternative 2 has the lowest OPCC and will continue to provide customers with excellent water service with new infrastructure.

SECTION 17
PART 16–PALISADES

17.01 BACKGROUND

A project in 2006 provided water service to the residents along Palisades Road. A 4-inch ductile iron water main was installed to serve the area, but the waterline changes elevation by approximately 190 feet as it travels down a steep embankment. In order to install the waterline on this steep terrain, approximately 300 feet was installed using horizontal directional drilling (HDD) and fused joint HDPE pipe. LVWA staff have reported leaks at the fused joints of the HDPE pipe, indicating that there was a fusion error. Given the conditions, it is very difficult to repair this pipe. LVWA would like to replace the HDPE pipe with something that it can have confidence in lasting long term and feel better about accessing for maintenance. Figure 17.01-1 shows the Palisades Road Water Main Location.

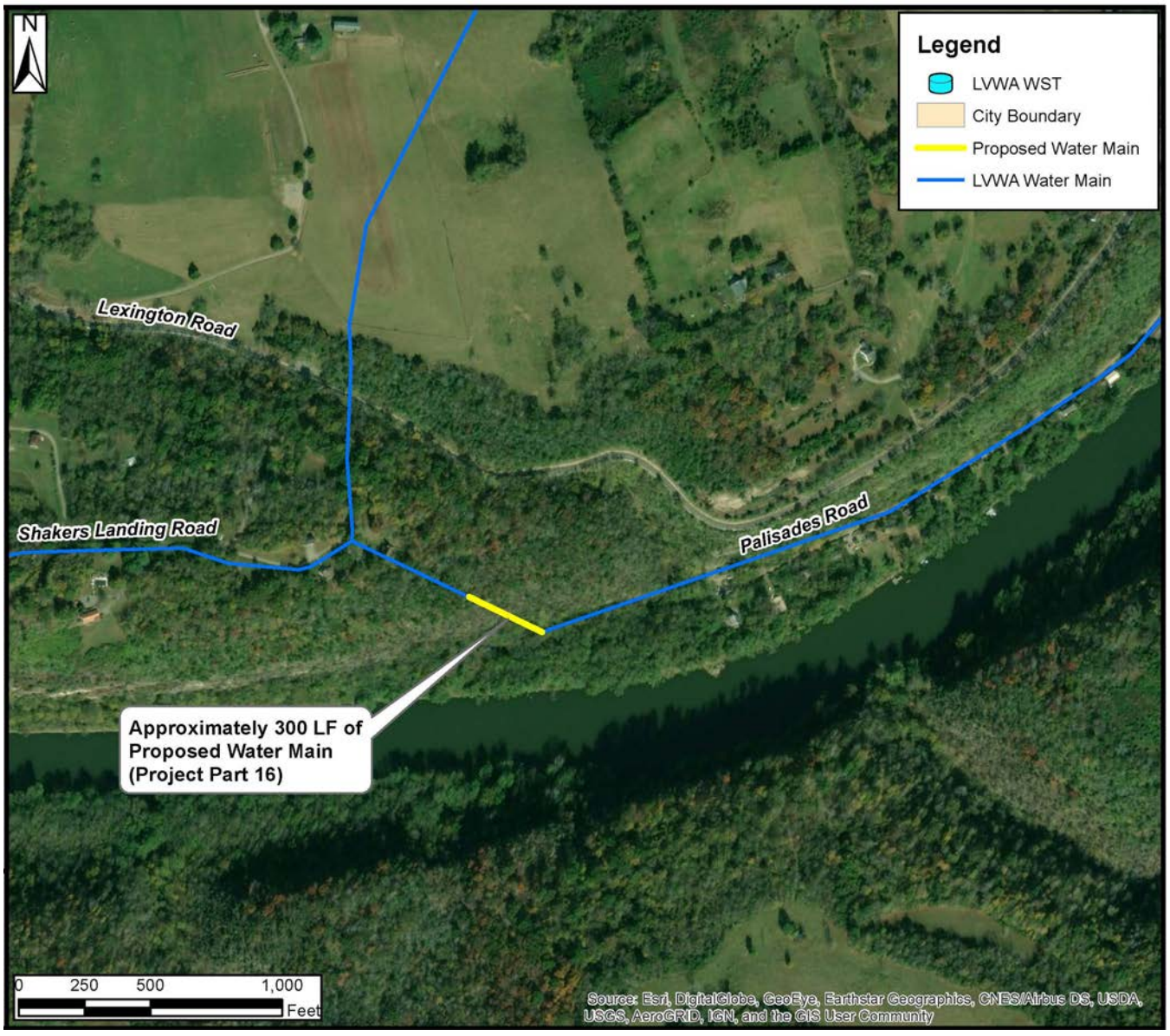

Figure 17.01-1 Palisades Road Water Main Location

17.02 PURPOSE

The rocky, wooded terrain of the project site slopes approximately 68 percent from top to bottom. This terrain does not allow for typical open trench construction of a water line. LVWA would like to replace 300 feet of 4-inch HDPE pipe to avoid additional leaks in this hard to reach, hard to repair area.

17.03 ALTERNATIVES

An option that was discussed is to feed a 2-inch high pressure, no joint pipe through the existing 4-inch line so that the 4-inch line would serve as a casing pipe. To reduce the overall pressures the line experiences as it goes downhill, this option would also install a pressure reducing valve at the top of the slope. As the water travels down the slope it gains 80 to 90 psi of pressure. Therefore, the lowest pressure that could be experienced by residents at the low end is 100 to 110 psi depending on how the pressure reducing valve is set.

The results of modeling a 2-in line show the velocity in the line to be 5.56 feet per second (ft/sec) and the maximum head loss gradient being 0.067 foot per feet (ft/ft). The American Water Works Association (AWWA) Manual M32 of Water Supply Practices recommends a maximum velocity of 5.0 ft/sec and maximum headloss of 0.01 ft/ft. Therefore the 2-inch water main is right over the maximum recommended criterion established by AWWA under normal operating conditions. In addition, a 2-inch water main will require additional approval from the Kentucky Division of Water (KDOW). Justification of the selection with a hydraulic analysis and future water use will be required. It is very unlikely for KDOW to approve using a 2-inch water main that does not meet the AWWA-recommended velocity standards. A 3-inch line is the minimum that is acceptable by KDOW and Ten States Standards without further justification.

Because of the size of the line and the non-conformance with AWWA recommendations, this option is not being considered as one of the alternatives in this report.

A. Alternative 1: Install a Pressure Reducing Valve and 8-inch HDPE Casing with 4-inch HDPE Waterline

The existing HDPE line that is installed is a 4-inch line. This alternative would remove the existing line and replace the waterline with a new 4-inch line fed through an 8-inch HDPE pipe serving as a casing pipe. The pipe would be installed by horizontal directional drilling. To reduce the overall pressures the line sees as it goes downhill, this option would also install a pressure reducing valve at the top of the slope. As the water travels down the slope, it gains 80 to 90 psi of pressure. Therefore, the lowest pressure that could be experienced by residents at the low end is 100 to 110 psi depending on how the pressure reducing valve is set.

No modeling was done on this option because the line size is not changing. This option would maintain the service the residents rely on while reducing the pressure in the 4-inch line and replacing the pipe with a new pipe. An extended warranty and performance verifications could be written into the specifications to provide confidence in the fused joints.

B. Alternative 2: Install 4-inch DI, Restrained Joint Pipe Using Horizontal Direction Drilling

This alternative would replace the existing 4-inch HDPE pipe that was installed by horizontal direction drilling (HDD) and install 4-inch DI, restrained joint piping in its place. Hydraulically there would be no change between the existing service and the proposed service, but there would be an improvement in the confidence of the line. Currently the existing HDPE pipe has experienced pipe failures at the fused joints. Repairing the pipe when this occurs is very difficult due to the terrain and access. Replacing the pipe with DI would provide a level of confidence in the performance of the pipe that is not currently there. Should a leak occur, access and terrain would still be difficult, but the chance of failure is greatly reduced.

The pipe would be installed with horizontal directional drilling. Because of the weight of the ductile iron pipe, a large machine would be needed to pull this pipe through the bored hole. This adds cost to the overall project.

C. Alternative 3: Do Nothing

Alternative 3 proposes to not replace the existing pipe. This option could lead to future water main leakage at this location with no access to repair the problems. This is not recommended.

17.04 COST OPINION

An OPCC for each alternative can be seen in Table 17.04-1.

Part 16: Palisades				
Alternative 1				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 4-in HDPE water main inside 8-in HDPE horizontal directionally drilled casing pipe	300	LF	$160	$48,000
Pressure Reducing Valve	1	EA	$20,000	$20,000
			Subtotal	$68,000
			Contingency and Engineering (35%)	$23,800
			Total	**$91,800**
Alternative 2				
Item	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**
Furnish and install 4-in DI restrained joint water main by horizontal direction drilling	300	LF	$300	$90,000
			Subtotal	$90,000
			Contingency and Engineering (35%)	$31,500
			Total	**$121,500**

Table 17.04-1 OPCC for Palisades Alternatives

17.05 SELECTED ALTERNATIVE

It is recommended that LVWA pursue Alternative 1 to improve the long-term reliability of service to Palisades Road. This alternative keeps the same size line that is currently in service and meets the KDOW and AWWA requirements. It uses the same piping system that is currently in place but with an extended warranty and performance requirements along with an 8-inch casing pipe the confidence of the overall system is improved while still providing a system that could be accessed for repairs in the future.

18.01 BACKGROUND

This portion of the project involves several areas where pipe was installed in 2008. This project would replace old services that were connected into a new water main that was laid in 2008. The original project was Contract 13–East Zone Update–Water Main Extension. That project laid new water main but reused the existing services to connect customers back to the system. Current failures on the various lines occur at these old service connections.

18.02 PURPOSE

LVWA would like to reduce water loss at the old service connections from the East Zone Update project. It will consider each area based on cost to determine how many services will be updated.

18.03 ALTERNATIVES

There are not other alternatives to replacing the services, it is either replace or do nothing. Based on the cost and where the most leakage occurs, LVWA can decide which areas to focus on if it cannot afford to change out all the services.

18.04 COST OPINION

An OPCC detailing the number of connections along each line can be seen in Table 18.04-1.

Part 17: New services				
Item	Quantity	Unit	Cost/Unit	Total Cost
Install new customer services Hughley Lane	59	EA	$1,500	$88,500
Install new customer services Cedar Lane	13	EA	$1,500	$19,500
Install new customer services Paradise Camp	96	EA	$1,500	$144,000
Install new customer services Norman Camp	48	EA	$1,500	$72,000
Install new customer services Lovette Lane	4	EA	$1,500	$6,000
Install new customer services Beams Drive	7	EA	$1,500	$10,500
Install new customer services Curdsville	34	EA	$1,500	$51,000
Install new customer services Kennedy Bridge	20	EA	$1,500	$30,000
Install new customer services Hogue Road	4	EA	$1,500	$6,000
			Subtotal	$427,500
			Contingency and Engineering (35%)	$149,600
			Total	**$577,100**

Table 18.04-1 OPCC for New Services

18.05 SELECTED ALTERNATIVE

It is recommended that LVWA replace as many aging service connections as it can afford. This will reduce water loss and line breakages in the system.

SECTION 19
RECOMMENDATIONS

19.01 BASIC DESIGN INFORMATION

A. Hydraulic Considerations

Hydraulic calculations are based on the Hazen-Williams formula with a “C” value of 130 to 140 for PVC. PVC DR21 (200 psi) AWWA C905 pipe is the proposed pipe for all alternatives. Water main size selections and pressure rating were based on existing pipe diameters that proposed infrastructure will connect to and based on the ability for proposed infrastructure to adequately serve LVWA customers based on Ten States Standards and KDOW design criteria. If hydraulic calculations during detailed design indicate that this pressure rating is inadequate, the selected PVC DR will be adjusted accordingly.

B. Construction Considerations

The proposed water mains will be constructed on existing private easements owned by LVWA or newly acquired easements along with encroachment permits as needed.

19.02 SELECTED ALTERNATIVE SUMMARY

Tables 19.02-1 and 19.02-2 summarize which alternative was selected for each project part and the criteria behind that selection. Each project part has been ranked for prioritization, according to a discussion with LVWA. Project parts contained in the first and second priority grouping were installed over 40 years ago and are nearing the end of their useful life. Priority groupings three contain improvements to the water distribution system that will enhance service to LVWA customers.

Project Part	Part Name	Priority	Selected Alternative	Selection Criteria
1	Bellows Mill Road and Montgomery Lane Water Main	1	1	-Achieves AWWA Manual M32 hydraulic recommendations -Enhances water supply and pressure to customers in southern portion of Moores Lane Pressure Zone -Decreased water loss
2	Bellows Mill Road Water Main	3	3	-Not having significant problems on this line.
3	Burgin Road Water Main	1	1	-Enhances water supply and pressure to customers
4	US 127 Water Main	1	1	-Improves water distribution system hydraulics and connectivity to US 127/Highway 33 Pressure Zone -Creates redundancy for the Moores Lane Pressure Zone

Table 19.02-1 Selected Alternative(s) Project Part 1 Through 4

Project Part	Part Name	Priority	Selected Alternative	Selection Criteria
5	Waterworks Road Water Main	2	2	-Lowest OPCC -Decreases water loss
6	Sunrise Shores Water Main	2	2	-Lowest OPCC
7	South Buster Pike Water Main	1	2	-Lowest OPCC
8	Highway 33 Water Main	3	1	-Improves water distribution system hydraulics and redundancy within the US 127/Highway 33 Pressure Zone -Allows for future pressure zone consolidation
9	Dix Dam Road Water Main	2	1	-Enhances a second flow path to a majority of the southern portion of the Shakertown Pressure Zone -Establishes redundancy to fill Shakertown Road WST and Ison Road WST from Shakertown BPS
10	Moores Lane Water Main	1	1	-Decreases water loss -Consolidates water infrastructure -Increases water supply and pressure to customers
11	Spears Creek Water Main Elimination	2	1	-Decreases water loss
12	Interzone Connection Water Main	3	1	-Allows for future pressure zone consolidation -Establishes redundancy to water distribution system
13	Pandora Marina Water Main Loop	3	2	-Lowest OPCC -Eliminates two dead-end water mains
14	Enhanced Fire Protection Along US 127	3	2	-Provides fire protection to customers
15	Wildwood Road Watermain	1	2	-Lowest OPCC
16	Palisades	1	1	-Lower OPCC -Provides future access to water main -Extended warranty and performance requirements provide confidence
17	Service Replacements	2	NA	-Cost

Table 19.02-2 Selected Alternative(s) Project Part 5 Through 17

The selected alternatives provide LVWA a cost-effective, long-term solution to maintaining the excellent service its water customers have come to expect.

To make the projects easier to construct and to fund the project parts have been broken into their priority groups. Priority 1 projects will become Contract 14, priority 2 projects will become Contract 15 and Priority 3 projects will become Contract 16.

19.03 TOTAL CONSTRUCTION AND PROJECT COSTS

The three separate construction and project cost estimates are presented in Tables 19.03-1 to 19.03-3.

Part	Project	Construction Subtotal
Part 1	Bellows Mill Road and Montgomery Lane Water Main	$727,600
Part 3	Burgin Road Water Main	$194,100
Part 4	US 127 Water Main	$395,500
Part 7	South Buster Pike Water Main	$75,600
Part 10	Moores Lane Water Main	$18,000
Part 15	Wildwood Road Water Main	$76,300
Part 16	Palisades	$68,000
	Subtotal	$1,555,100
	Contingency and Engineering (35%)	$544,300
	Project Total	**$2,099,400**

Table 19.03-1 Contract 14: Priority 1–Total Project Cost Opinion

Part	Project	Construction Subtotal
Part 5	Waterworks Road Water Main	$453,400
Part 6	Sunrise Shores Water Main	$339,700
Part 9	Dix Dam Road Water Main	$153,000
Part 11	Spears Creek Water Main Elimination	$12,000
Part 17	Service Replacements	$427,500
	Subtotal	$1,385,600
	Contingency and Engineering (35%)	$485,000
	Project Total	**$1,870,600**

Table 19.03-2 Contract 15: Priority 2–Total Project Cost Opinion

Part	Project	Construction Subtotal
Part 8	Highway 33 and Burgin Road Water Main	$129,300
Part 12	KY 152 and KY 33 Water Main	$99,000
Part 13	Carmichael Road and Herrington Woods Loop Water Main	$18,900
Part 14	US 127 Connection to the City of Harrodsburg	$95,500
	Subtotal	$342,700
	Contingency and Engineering (35%)	$119,900
	Project Total	**$462,600**

Table 19.03-3 Contract 16: Priority 3–Total Project Cost Opinion

Strand recommends that LVWA proceed with three projects with each of the selected alternatives. The alternatives have been reviewed and the proposed alternatives provide a cost-effective approach to meet LVWA's goals for this project.

19.04 ENGINEER'S RECOMMENDATION

Strand recommends that LVWA proceed with three projects with each of the alternatives noted in the Selected Alternatives section. The alternatives have been reviewed and the proposed alternatives provide a cost-effective approach to meet LVWA's goals for this project. Splitting the work into three separate projects based on priority is an appropriate way to approach this work.

Strand understands that funding for this project is anticipated to be covered completely by United States Rural Development Agency (USDA) RUS Water and Waste Loan and Grant.

Report for

Lake Village Water Association, Kentucky

Contract 14–Distribution System Improvement Projects, Final Engineering Report

Prepared by:

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March 2023

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Excellence in Engineering
Since 1946

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FINAL ENGINEERING REPORT (FER) FOR CONTRACT 14

As the Preliminary Engineering Report recommended, the Distribution System Improvement Projects were split into three contracts. Contract 14 contained the highest priority projects and, therefore, was designed and implemented first. The project, as designed, contained the following sections of work:

1. Palisades
2. South Buster Pike Water Main
3. US 127 Water Main
4. Bellows Mill Road and Montgomery Lane Water Mains
5. Burgin Road Water Main
6. Moores Lane Water Main
7. Wildwood Road Water Main

The first time the project was released for bids no bidders responded to the project. The project was bid a second time in 2021, with two bidders responding. However, due to supply chain issues, the project was not awarded. The project was bid for a third time in 2023 and received one bid. This FER describes the resulting bid prices and adjustments to Contract 14 to fit it within budget.

A. Funding

The LVWA received a grant for the project from the Clean Water funds in the amount of $350,000. LVWA had previously secured a Rural Development (RD) loan for $1,996,400. Altogether, $2,346,400 is available to complete Contract 14.

Bids were opened on January 26, 2023, with one bid from Lagco, Inc. The bid was for $4,518,775. Being that the amount was greater than the available budget, the LVWA discussed options including getting additional RD funding or constructing only a portion of the project. The Board decided to keep the project budget as planned in order to limit any large rate increases to its customers all at one time.

B. Project Revisions

In order to keep the project on budget, the following portions of the project will be removed via change order at the time Contract 14 is signed:

1. Palisades
2. 8,000 feet of US 127 Water Main
3. Bellows Mill Road Water Main
4. Moores Lane Water Main
5. Wildwood Road Water Main

These areas of work will need to be added into either Contracts 15 or 16 unless additional funding becomes available during the Contract 14 project time frame allowing them to be added back into the project. The construction total after the change order will be $1,875,521.

C. Rates

In order to maintain the financial coverage that the Kentucky Public Service Commission has demonstrated to LVWA, the rates to the customers will need to be raised 3.25 percent. The LVWA budgets for 2023 through 2028 are provided in the Summary Addendum pages listed an appendix to this report. The Summary Addendum provides further information related to the breakdown of the full project budget.

APPENDIX
SUMMARY ADDENDUM

KENTUCKY GUIDE 7
MAY 1998

SUMMARY ADDENDUM

TO

PRELIMINARY ENGINEERING REPORT

DATED April 9, 2019

FOR

Distribution System Improvement Projects
(Name of Project)

APPLICANT CONTACT PERSON Mike Sanford

APPLICANT PHONE NUMBER (859) 748-9654

APPLICANT TAX IDENTIFICATION NUMBER (TIN) 61-071-6901

ITEMS IN BOLD ITALIC PRINT ARE APPLICABLE TO SEWER SYSTEMS.

In order to avoid unnecessary delays in application processing, the applicant and its consulting engineer should prepare a summary of the preliminary report in accordance with this Guide.

Please complete the applicable sections of the Summary Addendum. ***Please note, if water and sewer revenue will both be taken as security for the loan, all user information and characteristics of both utility systems will be needed even though the project will benefit only one utility.***

Feasibility reviews and grant determinations may be processed more accurately and more rapidly if the Summary/Addendum is submitted simultaneously with the preliminary engineering report, or as soon thereafter as possible.

I. GENERAL

A. Proposed Project: Provide a brief description of the proposed project. In addition to this summary, the applicant/engineer should submit a project map of the service area.

The proposed project will replace existing water mains that are at the end of their useful life.

II. *FACILITY CHARACTERISTICS OF EXISTING SEWER SYSTEM*

A. ***Sewage Treatment:***

1. Type ***NA***

2. Method of Sludge Disposal ***NA***

3. Cost per 1,000 gallons if sewage is contracted: NA

4. Date Constructed ***NA***

B. ***Treatment Capacity of Sewage Treatment Plant*** ***NA***

C. ***Type of Sewage Collector System (Describe)*** ***NA***

D. ***Number and Capacity of Sewage Lift Stations*** ***NA***

E. ***Sewage Collection System: NA***

Lineal Feet of Collector Lines, by Size ***6"*** ***0*** ***8"*** ***0***

10" ***0*** ***12"*** ***0*** ***Larger*** ***0***

Date(s) Constructed

F. ***Conditions of Existing System: Briefly describe the conditions and suitability for continued use of facility now owned by the applicant. Include any major renovation that will be needed within five to ten years.***

III. FACILITY CHARACTERISTICS OF EXISTING WATER SYSTEM

1. Water Source: Describe adequacy of source (quality and quantity). Include an explanation of raw water source, raw water intake structure, treatment plant capacity, and current level of production (WTP). Also describe the adequacy of

Water Purchase Contract if applicable.

LVWA presently purchases all its water from the cities of Harrodsburg and Danville. Danville's raw water supply is drawn from Herrington Lake, and its treatment plant has a capacity of 10 mgd. Harrodsburg's raw water supply is drawn from the Kentucky River, and its treatment plant has a capacity of 4 mgd.

If the applicant purchases water:

Seller(s):

1. City of Harrodsburg
2. City of Danville
3.

Price/1,000 gallons:

1. $2.71/1000 gallons (Harrodsburg)
2. $2.41/1000 gallons (Danville)
3.

Present Estimated Market Value of Existing System: $5,315,664

2. Water Storage:

Type:	Ground Storage Tank	0	Elevated Tank	2	
	Standpipe	2	Other	0	
Number of Storage Structures		4			
Total Storage Volume Capacity		1,147,000 gal			
Date Storage Tank(s) Constructed		1970, 1994, 1994, 1999, Rehab in 2016			

3. Water Distribution System:

Pipe Material				
Lineal Feet of Pipe:	2" Diameter	0.4 miles	3"	35.3 miles
	4"	26.4 miles	6"	37 miles
	8"	10.6 miles	10"	None
Dates(s) Water Lines Constructed		1969-2012		
Number and Capacity of Pump Station(s)		Two pumps stations, one with 350 gpm capacity and one with 500 gpm capacity.		

4. Condition of Existing Water System:

Briefly describe the condition and suitability for continued use of facility now owned by the applicant. Include any major renovation that will be needed within five to ten years.

The existing water system is in good shape generally. The Preliminary engineering report details 17 small areas where water lines are ready for replacement or upgrades. LVWA has prioritized this into 3 distinct design/construction contracts.

E. Percentage of Water Loss Existing System: 27.02% in 2022

IV. EXISTING LONG-TERM INDEBTEDNESS

I. List of Bonds and Notes:

Date of Issue	Bond/Note Holder	Principal Balance	Payment Date	Bond Type Water/Sewer*		Amount on Deposit in Reserve Account
20 15 Issue	KRWFC	855,000	2041	3 %	%	8816.06
20 16 Issue	USDA RD	625,155	2056	2.75 %	%	10,013.89
20 18 Issue	KRWFC	2,250,000	2050	2.2 %	%	10,013.89
20 Issue				%	%	
20 Issue				%	%	

* If a combined issue, show attributable portion to each system.
**Rate varies from 3.0% to 4.25% over the life of the loan

II. Principal and Interest Payments:

Date of Issue	Bond/Note Holder	Payment Year 20__ Principal Payment	Payment Year 20__ Interest Payment	Payment Year 20__ Principal Payment	Payment Year 20__ Interest Payment	Payment Year 20__ Principal Payment	Payment Year 20__ Interest Payment
20 Issue							
20 Issue							
19 Issue							
19 Issue							
20 Issue							
20 Issue							
20 Issue							
Issue							

V. EXISTING SHORT-TERM INDEBTEDNESS

A. List of All Short Term Debts:

Lender or Lessor	Date of Issue (Month & Year)	Principal Balance	Purpose (Water and/ or Sewer)	Payment Date	Principal & Interest Payment (P & I)	Date to Be Paid In Full

VI. LAND AND RIGHTS - EXISTING SYSTEM(S)

Number of Treatment Plant Sites:	Water	0	***Sewer***	***NA***
Number of Storage Tank Sites:	Water	4	***Sewer***	***NA***
Number of Pump Stations:	Water	2	***Sewer***	***NA***
Total Acreage:	Water	2.7	***Sewer***	***NA***
Purchase Price:	Water	Unknown	***Sewer***	***NA***

VII. NUMBER OF EXISTING USERS

	Water (as of 03/2023)	***Sewer*** (as of 10/2007)
Residential (In Town)	2590	***NA***
Residential (Out of Town)	0	***NA***
Non-Residential (In Town)	35	***NA***
Non-Residential (Out of Town)	0	***NA***
Total	2625	***NA***

*Note: Residential Users: Classify by type of user regardless of quantity of water used. This Classification should include those meters serving individual residence.

**Note: Two wholesale clients, Burgin and Northpoint Training Center. Burgin had no usage in 2014.

VIII. CURRENT WATER AND SEWER CONNECTION FEES FOR EACH SIZE WATER METER CONNECTION

Meter Size	Water Connection Fee	*Sewer Connection Fee*
3/4" - Inch	$895.00	***$ N/A***
7/8" - Inch	At Cost	***$ N/A***
1" - Inch	At Cost	***$ N/A***
1" - 1/2 Inch	At Cost	***$ N/A***
2" - Inch	At Cost	***$ N/A***
3" - Inch	At Cost	***$ N/A***
4" - Inch	At Cost	***$ 500***
6" - Inch	At Cost	***$ N/A***

IX. SEWER RATES - EXISTING SYSTEM

Percentage of Water Bill ***NA*** ***%*** ***Minimum Charge*** ***NA***

Other: (If Charge Not Based on Water Bill) ***NA***

X. WATER RATES - EXISTING SYSTEM
See attached rate schedule.

XI ***ANALYSIS OF ACTUAL SEWER USAGE – EXISTING SYSTEM – 12 MONTH PERIOD***

XII. ANALYSIS OF ACTUAL WATER USAGE – EXISTING SYSTEM – 12 MONTH PERIOD (See Attached Spreadsheet for Water Usage)

XIII. FACILITY CHARACTERISTICS OF PROPOSED SEWER SYSTEM

A. Sewage Treatment ***NA***

1. Type ***NA***

2. Method of Sludge Disposal ***NA***

3. Cost per 1,000 gallons if sewage is contracted:

B. Treatment Capacity of Sewage Treatment Plant ***NA***

C. Type of Sewage Collector System (Describe) NA

D. Number and Capacity of Sewage Lift Stations NA

E. Sewage Collection System:

Lineal Feet of Collector Lines, by Size 2" NA 3" NA

10" NA 12" NA Larger NA

XIV. LAND AND RIGHTS - PROPOSED SEWER SYSTEM

Number of Treatment Plant Sites	*NA*	
Number of Pump Sites	*NA*	
Number of Other Sites	*NA*	
Total Acreage	*NA*	*Acres*
Purchase Price	*NA*	

XV. FACILITY CHARACTERISTICS OF PROPOSED WATER SYSTEM

A. Water Source: Describe adequacy of source (quality and quantity). Include an explanation of raw water source, raw water intake structure, treatment plant capacity, and current level of production (WTP). Also describe the adequacy of Water Purchase Contract if applicable.

Water source will not change from existing system.

B. Water Storage:

Type:	Ground Storage Tank	NA	Elevated Tank	NA
	Standpipe	NA	Other	NA
Number of Storage Structures		NA		
Total Storage Volume Capacity		NA		

C. Water Distribution System:

Pipe Material		PVC/HDPE		
Lineal Feet of Pipe:	3" Diameter	3,600	4"	8,300
	6"	350	8"	41,481
	10"	NA	12"	NA
Number and Capacity of Pump Station(s)		None		

XVI. LAND AND RIGHTS- PROPOSED WATER SYSTEM

Number of Treatment Plant Sites	NA
Number of Pump Sites	NA
Number of Other Sites	NA
Total Acreage	NA
Purchase Price	NA

XVII. NUMBER OF NEW SEWER USERS

Residential (In Town) *	***NA***
Residential (Out of Town) *	***NA***
Non-Residential (In Town)	***NA***
Non-Residential (Out of Town)	***NA***
Total	***NA***

*Note: Residential Users: Classify by type of user regardless of quantity of water used. This classification should include those meters serving individual rural residences.

XVIII. PROPOSED SEWER CONNECTION FEES FOR EACH SIZE WATER METER CONNECTION N/A

Meter Size	***Connection Fee***
5/8" x 3/4"	*$0*
1 - Inch	*$0*
1 - ½ Inch	*$0*
2 - Inch	*$0*
3 – Inch	*$0*
4 – Inch	*$0*
5 - Inch	*$0*

XIX. NUMBER OF NEW WATER USERS

Residential (In Town)	N/A
Residential (Out of Town)[2]	N/A
Non-Residential (In Town)	N/A
Non-Residential (Out of Town)	N/A
Total	N/A
Number to Total Potential Users Living in the Service Area	N/A

*Note: Residential Users: Classify by type of user regardless of quantity of water used. This classification should include those meters serving individual rural residences.

XX. PROPOSED WATER CONNECTION FEES FOR EACH SIZE WATER METER CONNECTION:

Meter Size	Water Connection Fee	*Sewer Connection Fee*
3/4" - Inch	$895	***$ N/A***
7/8" - Inch	At Cost	***$ N/A***
1" - Inch	At Cost	***$ N/A***
1" - 1/2 Inch	At Cost	***$ N/A***
2" - Inch	N/A	***$ N/A***
3" - Inch	N/A	***$ N/A***
4" - Inch	N/A	***$ N/A***
6" - Inch	N/A	***$ N/A***

XXI. SEWER RATES - PROPOSED

A. Proposed Rate Schedule :

Percentage of Water Bill ***NA*** ***%*** ***NA***

NA

The above proposed rate, without RD grant, must be completed for each grant. If the applicant/engineer desires, there is no objection to recommending a proposed rate with an estimated RD grant in the Table below. However, the preparer should remember that the Table (A) above must be completed prior to Table (B).

B. Recommended Rate Schedule with $ N/A RD Grant:

Percentage of Water Bill _____ ***%***

XXII. WATER RATES- PROPOSED See attachment for rate schedule and budgets.

XXIII. FORECAST OF SEWER USAGE – INCOME – EXISTING SYSTEM – EXISTING

XXIV. FORECAST OF SEWER USAGE – INCOME – NEW USERS – EXTENSION ONLY

XXV. FORECAST OF WATER USAGE – INCOME – EXISTING SYSTEM – EXISTING USERS
See Water Usage Spreadsheet

XXVI. FORECAST OF WATER USAGE – INCOME – NEW IMPROVEMENTS
N/A

XXXVII. ESTIMATED PROJECT COST - SEWER NA

	Collection	***Treatment***	***Total***
Development			
Planning, Land and Rights			
Resident Observation			
Legal			
Engineering			
Interest			
Contingencies (I/I Study)			
Initial Operating and Maintenance			
Other including equipment			
TOTAL (rounded)			

XXXVIII. PROPOSED PROJECT FUNDING - SEWER *NA*

	Collection	*Treatment*	*Total*
Applicant - User Contribution Fees			
Other - Applicant Contribution			
RD Loan			
RD Grant			
ARC Grant (If applicable)			
KIA Grant			
US-EPA Grant			
Additional RD Loan/Grant			
TOTAL			

XXXIX. ESTIMATED PROJECT COST - WATER

Development	$	1,875,521
Land and Rights		
Legal and Administrative		10,000
Engineering		349,463
Interest		40,500
Contingencies		163,807
Administrative and Planning		
Other		
TOTAL	$	2,439,290

XXXX. PROPOSED PROJECT FUNDING – WATER

Applicant - User Contribution Fees	$	
Other – Local Contribution		
RD Loan		2,089,290
RD Grant		
Tobacco Settlement (If applicable)		
CDBG (If applicable)		
HB 502		
SB 409		
Other		350,000
TOTAL	$	2,439,290

LVWA Existing Water Usage Analysis 2024

Rate Schedule	Current (End of 2023)	Current (March 2023)	
Minimum: First 2000 gallons	$29.85	$28.29	
2000-20,000 gallons	$11.62	$11.01	
over 20,000 gallons	$9.38	$8.89	
Wholesale	$4.50	$4.26	

User Type	Average Usage Per User (gallons)	No of Users/Year	Annual Income
R1-0	0.00	2,332	$69,610.20
R1-1000	538.93	4,587	$136,921.95
R1-2000	1,652.30	4,330	$129,250.50
R1-3000	2,683.71	4,480	$169,320.44
R1-4000	3,717.46	3,163	$157,539.17
R1-5000	4,774.21	2,030	$126,035.20
R1-6000	5,848.51	1,304	$97,238.88
R1-7000	6,922.51	747	$65,026.06
R1-8000	7,981.91	448	$44,513.19
R1-9000	9,012.66	276	$30,729.06
R1-10,000	10,085.23	190	$23,522.08
R1-11,000	11,129.09	160	$21,748.81
R1-12,000	12,209.41	135	$20,045.25
R1-13,000	13,262.51	101	$16,232.76
R1-14,000	14,319.79	79	$13,667.47
R1-15,000	15,348.00	61	$11,282.18
R1-16,000	16,542.34	46	$9,146.27
R1-17,000	17,555.66	50	$10,530.34
R1-18,000	18,612.67	51	$11,367.35
R1-19,000	19,519.31	28	$6,535.88
R1-20,000	20,654.75	33	$8,138.40
R1-30,000	25,731.39	193	$56,504.70
R1-40,000	36,717.03	62	$24,540.58
R1-50,000	45,910.61	41	$19,764.11
R1-100,000	75,893.87	54	$41,217.90
R1-100,000,000,000	240,400.49	34	$78,416.47
Total			*$1,398,845.20*
Wholesale customer			
Northpoint Training Center	4,571,709.41	12	$246,872.31
Totals			$1,645,717.50

Notes:

5.911300000% Percentage the usage was adjusted to model the sales forcasted

Lake Village Water Association Contract 14 Summary Addendum

2023 Budget

A.	**Operating Income:**		
	Sales to Customers		$1,645,718.00
	Management Fee Income		$41,400
	Other Operating Revenues		$162,999
		Total Operating Income	$1,850,117
B.	**Operation and Maintenance Expenses:**		
	Water Purchase		$600,000
	Maintenance		$58,000
	Other Operating Expenses		$0
	Personal Services		$527,514
	Utilities		$35,000
	Engineering		$5,500
	Supplies		$40,000
	Insurance		$35,000
	Other		$108,636
		Total Operating Expenses	$1,409,650
		Operating Income	$440,467
C.	**Non-Operating Income (Expenses)**		
	Interest Income		$500
	Loss on Asset Disposal		$0
		Total non-operating revenues (expenses)	$500
D.	**Income Before Operating Transfers**		$440,967
E.	**Operating Transfers**		
	Transfers In		$0
	Transfers Out		$0
		Total Operating Transfers	$0
F.	**Debt Repayment**		
2021 B	KRWFC		33,138.75
	RD		28,044.00
2021 B	KRWFC		92,688.75
2015 C	KRWFC		75,006.25
2015 C	KRWFC		13,656.25
Debt Reserve Account Funding[1]			
2010 RD			$8,580
		Total Debt Repayment	$251,114
G.	**Balance Available for Coverage**		$189,353

Lake Village Water Association Contract 14 Summary Addendum

		2023	2024	2025	2026	2027	2028
A.	**Operating Income:**						
	Sales to Customers	$1,645,718	$1,645,718	$1,645,718	$1,645,718	$1,645,718	$1,645,718
	Management Fee Income	$41,400	$42,228	$43,073	$43,934	$44,813	$45,709
	Other Operating Revenues	$162,999	$166,259	$169,584	$172,976	$176,435	$179,964
	Total Operating Income	$1,850,117	$1,854,204	$1,858,374	$1,862,627	$1,866,966	$1,871,391
B.	**Operation and Maintenance Expenses:**						
	Water Purchase	$600,000	$600,000	$600,000	$600,000	$600,000	$600,000
	Maintenance	$58,000	$59,160	$60,343	$61,550	$62,781	$64,037
	Other Operating Expenses	$0					
	Personal Services	$527,514	$538,064	$548,826	$559,802	$570,998	$582,418
	Utilities	$35,000	$35,700	$36,414	$37,142	$37,885	$38,643
	Engineering	$5,500	$5,610	$5,722	$5,837	$5,953	$6,072
	Supplies	$40,000	$40,800	$41,616	$42,448	$43,297	$44,163
	Insurance	$35,000	$35,700	$36,414	$37,142	$37,885	$38,643
	Other	$108,636	$110,809	$113,025	$115,285	$117,591	$119,943
	Total Operating Expenses	$1,409,650	$1,425,843	$1,442,360	$1,459,207	$1,476,391	$1,493,919
	Operating Income	$440,467	$428,361	$416,014	$403,420	$390,574	$377,471
C.	**Non-Operating Income (Expenses)**						
	Interest Income	$500	$510	$520	$531	$541	$552
	Loss on Asset Disposal	$0					
	Total non-operating revenues (expenses)	$500	$510	$520	$531	$541	$552
D.	**Income Before Operating Transfers**	$440,967	$428,871	$416,535	$403,951	$391,116	$378,024
E.	**Operating Transfers**						
	Transfers In	$0					
	Transfers Out	$0					
	Total Operating Transfers	$0					
F.	**Debt Repayment**						
	KRWFC 2021 B	$33,139	$33,139	$33,139	$33,139	$33,139	$33,139
	RD	$28,044	$28,044	$28,044	$28,044	$28,044	$28,044
	KRWFC 2021 B	$92,689	$92,689	$92,689	$92,689	$92,689	$92,689
	KRWFC 2015 C	$75,006	$75,006	$75,006	$75,006	$75,006	$75,006
	KRWFC 2015 C	$13,656	$13,656	$13,656	$13,656	$13,656	$13,656
	2020 RD-a		$78,079	$78,079	$78,079	$78,079	$78,079
	Total	$242,534	$320,613	$320,613	$320,613	$320,613	$320,613
	Debt Reserve Account Funding[1]						
	2010 RD	$8,580	$8,580	$8,580	$8,580	$8,580	$8,580
	2020 RD-a		$8,160	$8,160	$8,160	$8,160	$8,160
	Total Debt Repayment	$251,114	$337,353	$337,353	$337,353	$337,353	$337,353
	New loan (s)						
G.	**Balance Available for Coverage (one RD loan)** (Target coverage is $190,000)	$189,353	$148,989	$136,642	$124,048	$111,202	$98,099

For more location information
please visit www.strand.com

Office Locations

Brenham, Texas | 979.836.7937

Cincinnati, Ohio | 513.861.5600

Columbus, Indiana | 812.372.9911

Columbus, Ohio | 614.835.0460

Indianapolis, Indiana | 317.423.0935

Joliet, Illinois | 815.744.4200

Lexington, Kentucky | 859.225.8500

Louisville, Kentucky | 502.583.7020

Madison, Wisconsin* | 608.251.4843

Milwaukee, Wisconsin | 414.271.0771

Phoenix, Arizona | 602.437.3733

*Corporate Headquarters

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