Town of Dolores

Water Distribution System Evaluation

November 2023

Prepared by

SGM

118 West Sixth Street, Suite 200
Glenwood Springs, CO 81601
970.945.1004

Town of Dolores

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Prepared By

SCOTT FORRESTER, PE

Reviewed By

CATHERINE CARELLA, PE

SGM Project #: 2017-387.003

Table of Contents

1.0 Executive Summary 1-1
1.1 Hydraulic Model 1-1
1.2 Existing Distribution Pressures and Fire Flow Availability 1-1
1.3 Water Distribution Improvements 1-1
1.4 Water Storage Analysis 1-1
1.5 Priorities and Recommendations 1-2
1.6 Funding 1-2
2.0 Hydraulic Model 2-1
2.1 Updating Hydraulic Model 2-1
2.1.1 Pipe Network 2-1
2.1.2 Storage Tank 2-1
2.1.3 Potable Water Sources: Water Treatment Plant and Well 2-2
2.1.4 Water Demands 2-2
2.1.5 Water Demand Distribution 2-3
2.2 Hydraulic Model Calibration 2-4
2.2.1 Hydrant Flow Tests 2-4
2.2.2 Model Calibration Results 2-5
3.0 Fire Flow Analysis 3-1
3.1 Fire Flow Availability 3-1
3.1.1 Fire Flow Availability: Phase 2 Improvements 3-3
3.1.2 Fire Flow Availability: Phase 3 Improvements 3-3
3.1.3 Fire Flow Availability: Phase 4 Improvements 3-4
3.1.4 Fire Flow Availability: Phase 5 Improvements 3-4
3.2 Fire Flow Availability: Analysis 3-5
4.0 Water Storage Analysis 4-1
4.1 Water Storage Requirements 4-1
4.1.1 Fire Flow Storage 4-1
4.1.2 Emergency Storage 4-1
4.1.3 Storage Analysis 4-2
4.2 Storage Tank Siting Analysis 4-2
4.2.1 Tank Site Alternative 1: Existing Tank Site 4-2
4.2.2 Tank Site Alternative 2: Triangle Parcel 4-4
4.2.3 Tank Site Alternative 3: County Road 31 Parcel 4-5
4.2.4 Tank Site Alternative 4: Across the Dolores River 4-8
4.2.5 Tank Site Alternative 5: Granath Mesa 4-9
4.2.6 Tank Site Alternative Summary 4-11
5.0 Priorities and Recommendations 5-12

List of Figures

Figure 2-1. Demand Distribution Example 2-4
Figure 3-1. Existing Available Fire Flows 3-2
Figure 3-2. Phase 2 Available Fire Flows 3-3
Figure 3-3. Phase 3 Available Fire Flows 3-3
Figure 3-4. Phase 4 Available Fire Flows 3-4
Figure 3-5. Phase 5 Available Fire Flows 3-4
Figure 3-6. Available Fire Flow Summary 3-5
Figure 4-1. Tank Site Alternative 1, Existing Tank Site 4-3
Figure 4-2. Existing Storage Tank 4-3
Figure 4-3. Tank Site Alternative 2, Triangle Parcel 4-5
Figure 4-4. Tank Site Alternative 3, CR31 Parcel 4-6
Figure 4-5. Hydraulic Considerations for Tank Site Alternative 3 4-7
Figure 4-6. Tank Site Alternative 4, Across the Dolores River 4-8
Figure 4-7. Tank Site Alternative 5, Granath Mesa 4-9
Figure 4-8. Hydraulic Considerations for Tank Site Alternative 5 4-10

List of Tables

Table 1-2. Water Distribution and Storage Capital Improvement Projects 1-2
Table 2-1. Pipe Network Summary 2-1
Table 2-2. Storage Tank Summary 2-1
Table 2-3. WTP Control Scheme 2-2
Table 2-4. Average Daily Demand (ADD), Average Fall Demand (AFD), ... 2-3
Table 2-5. Demand Values and Peaking Factors 2-3
Table 2-6. Summary of Hydrant Flow Test Data 2-5
Table 2-7. Hydraulic Model Calibration Results 2-5
Table 4-1.Tank Site Alternative Summary 4-11

List of Appendices

Appendix A. Fire Flow Maps
Appendix B. Engineer's Opinion of Probable Costs
Appendix C. Ph. 2 Distribution Improvements Map

1.0 Executive Summary

The Town of Dolores (Town) retained SGM in March of 2022 to provide preliminary engineering and planning services for the Town's water distribution system. Planning services included updating the Town's hydraulic model, analyzing fire flow availability, evaluating sites for an additional water storage tank, and prioritizing recommended improvements. Then, SGM prepared a project needs assessment (PNA) per the Colorado Department of Public Health & Environment (CDPHE) State Revolving Fund (SRF) Loan program requirements. Below is a summary of our findings and status of the project.

1.1 Hydraulic Model

SGM updated the Town's existing hydraulic model with recent as-built information, recent billing and production data, and corrections to pipe sizes and materials based on input from Town Staff. Then, SGM calibrated the hydraulic model by performing hydrant flow testing. All of the modeled results were within 5% of the actual residual pressures recorded during fire flow testing. The model update and calibration effort provide confidence that the model is an effective planning tool for pipeline replacement and rehabilitation programs.

1.2 Existing Distribution Pressures and Fire Flow Availability

SGM utilized the calibrated hydraulic model to assess the existing distribution system pressures and fire flow availability throughout the Town. The Town maintains relatively low pressure throughout the distribution system compared to industry standards due to the elevation of the storage tank. Under average daily conditions the water pressures range from 45 psi to 75 psi in Town limits and 25 psi to 55 psi outside of Town. SGM typically recommends distribution system pressures from 55 psi to 110 psi. The Colorado Department of Public Health recommends a minimum pressure of 35 psi. Low pressures significantly limit the volume of available fire flow. Additionally, small diameter piping (4-Inch) is prevalent throughout the distribution system which also reduces the available fire flow.

Available fire flow volumes throughout the distribution system are poor. 1,500 gpm is often considered a baseline fire flow volume for fighting a single home structure fire. 79% of model nodes in Town limits do not meet this fire flow volume under existing conditions.

1.3 Water Distribution Improvements

SGM modeled the proposed Phases 2 through 5 distribution system improvements to determine their impact to fire flow availability. SGM walked the proposed Phase 2 improvements with Town Staff to identify surface and utility conflicts and determine the optimal alignments. Fire flow availability maps and estimated costs of Phases 2 through 5 distribution system improvements are presented in **Section 3.0** of this report.

1.4 Water Storage Analysis

A storage analysis was performed to identify a recommended volume of potable water storage for the Town incorporating operational, emergency, and fire storage volumes. The Town has a 350,000 gallon deficiency in available water storage, necessitating construction of an additional tank. An additional tank is also desirable to allow for maintenance of the existing tank. A tank siting analysis was performed to identify potential sites for a new potable water storage tank. Five potential tank sites were analyzed in **Section 4.0** for constructability, hydraulic considerations, and estimated costs.

1.5 Priorities and Recommendations

SGM recommends the capital improvements shown in **Table 1-2** in order of priority.

Table 1-1. Water Distribution and Storage Capital Improvement Projects

Project	Year to Implement	Estimated Cost (2023 Dollars)
Phase 2 distribution system improvements	2025	$4,652,000
350,000 gallon welded steel tank	2025-2030	$1,998,000
Phase 3 distribution system improvements	2035	$2,889,000
Phase 4 distribution system improvements	2040	$2,611,000
Phase 5 distribution system improvements	2045	$2,006,000
Total Cost		**$14,156,000**

The Phase 2 distribution system improvements were prioritized over a redundant water storage tank because the Town's main area of concern is the aging distribution system. The Phase 2 distribution system improvements include:

- Installation of approximately 1,300 LF of new 8-inch C900 PVC pipe to connect dead end lines and eliminate sections of un-looped lines.
- Replacement of approximately 9,800 LF of aging 4-inch and 8-inch lines with new 8-inch C900 PVC pipe.
- Replacement of all fire hydrants, water service lines to the meter, and valves within the project area.
- Addition of new valves and hydrants within the project area.

A map of the proposed Phase 2 Improvements is included in **Appendix C**. An Engineer's Opinion of Probable Cost is in **Appendix B**. The estimated total project cost is $4,652,000.

1.6 Funding

The Town is considering a $2.8M State Revolving Fund (SRF) Loan to help fund the Phase 2 distribution system improvements. The Bipartisan Infrastructure Law Program offers the Town an opportunity to receive 50% principal loan forgiveness. SGM conducted a financial analysis of the proposed distribution improvements project which is included in the SRF Project Needs Assessment (PNA). The Town's water fund is generally healthy. However, based on an example 30-year loan term and 3% interest rate, the proposed loan has a low debt coverage ratio and would create high community debt burden. The estimated yearly loan payment is $73,334.45 for 30 years. To meet the loan's 110% debt coverage ratio requirement, additional annual revenue of approximately $82,890 would be necessary.

Time is of the essence to move forward with engineering design and other loan application requirements to meet the required timeline of the loan application. However, the Town of Dolores also requested an earmark of $750,000 in Congressionally Directed Spending (CDS) in fiscal year 2024. The CDS grant process is more elaborate than the traditional state SRF project process and it will take time for the Town to work through the federal requirements. If or when Congress passes a budget action with earmarked money for Dolores, then the EPA administrators will reach out to discuss the funding program process with the Town.

The next step in the funding process is to meet with Department of Local Affairs (DOLA) and CDPHE Grants and Loans Unit to review the submitted PNA. The Town should be prepared to increase water rates as needed to meet the loan coverage ratio or reduce the scope of the project.

2.0 Hydraulic Model

SGM updated our 2018 hydraulic model of the Town's water system using recent as-built information, recent water production and billing data, and worked closely with Public Works Staff to make necessary corrections to the GIS database. The model was then calibrated using hydrant flow test readings and used to analyze available fire flows throughout the distribution system.

2.1 Updating Hydraulic Model

SGM updated the Town's existing hydraulic model using Innovyze Infowater modeling software. As-built information for recent water line improvements in the distribution system was used to update the pipe network. Water demand and demand scenarios were developed using recent water production and billing data provided by the Town. The following sections detail the methods used to update the hydraulic model.

2.1.1 Pipe Network

The existing pipe network was updated using as-built information and conversations with the Town. The primary updates included the segments of 8" pipe that were recently installed crossing State Highway 145 (Railroad Avenue). All modeled pipes were initially assigned a Hazen-Williams roughness coefficient of 130; these values were calibrated as described later in this report. The model includes all water mains owned and operated by the Town. The complete network consists of 216 pipe segments with 58,137 combined linear feet of 1, 2, 3, 4, 6, 8, and 10-inch pipe, summarized in **Table 2-1**.

Table 2-1. Pipe Network Summary

Pipe Diameter (in.)	Water Line Length (ft.)
10	7,942
8	11,518
6	9,029
4	27,997
3	589
2	718
1	344
Total:	58,137

2.1.2 Storage Tank

The Town uses one 300,000 gallon water storage tank. **Table 2-2** shows the modeled tank characteristics.

Table 2-2. Storage Tank Summary

Tank	Diameter (ft.)	Maximum Level (ft.)	Nominal Storage Volume (gals.)	Base Elevation (ft.)
Welded Steel Tank	44	27	300,000	7,076

2.1.3 Potable Water Sources: Water Treatment Plant and Well

The Town utilizes two sources for potable water: a water treatment plant (WTP) that treats surface water from the Dolores River and a groundwater well located at SH 145 (Railroad Avenue) and 14th Street. The well runs year-round, often 24 hours a day, at an approximate flowrate of 72 gpm. The WTP is turned on during periods of high demands, typically the summer months. The WTP has 40hp and 75hp pumps to pump water to the storage tank, though typically only the 40hp pump is used at an approximate flowrate of 593 gpm. **Table 2-3** summarizes the control setpoints for the WTP.

Table 2-3. WTP Control Scheme

Control Item	Control Value
WTP On	Tank Level < 22’
WTP Off	Tank Level > 26’
WTP Booster Pump On	Clearwell Level > 9.5’
WTP Booster Pump Off	Clearwell Level < 4’
WTP Filters On	Clearwell Level < 8’
WTP Filter Off	Clearwell Level > 9.5’

2.1.4 Water Demands

Water demands were estimated using 2018-2022 production data from the Town’s WTP and well. This data was analyzed to determine the Average Daily Demand (ADD), Average Fall Demand (AFD), Peak Monthly Demand (PMD), and Maximum Daily Demand (MDD). The maximum day demand for that time period was from July 11, 2020 with a demand of 0.40 million gallons per day (MGD). **Table 2-4** and **Table 2-5** summarize the system demands and associated peaking factors.

Table 2-4. Average Daily Demand (ADD), Average Fall Demand (AFD), and Peak Monthly Demand (PMD) for 2018-2022

Month	ADD (MGD)				
	2018	2019	2020	2021	2022
1	0.09	0.11	0.04	0.09	0.09
2	0.09	0.11	0.06	0.10	0.09
3	0.09	0.11	0.09	0.09	0.09
4	0.13	0.12	0.11	0.11	0.11
5	0.23	0.14	0.25	0.19	N/A
6	0.28	0.23	0.28	0.27	N/A
7	0.25	0.31	0.29	0.23	N/A
8	0.24	0.29	0.28	0.22	N/A
9	0.20	0.23	0.22	0.19	N/A
10	0.11	0.11	0.14	0.13	N/A
11	0.11	0.07	0.15	0.09	N/A
12	0.14	0.04	0.09	0.09	N/A
AFD	0.11	0.11	0.11	0.11	N/A
ADD	0.16	0.16	0.17	0.15	N/A
PMD	0.28	0.31	0.29	0.27	N/A

Table 2-5. Demand Values and Peaking Factors

Demand	Demand (MGD)	Demand (gpm)	Peaking Factor (Demand/ADD)	Source[1]
Average Fall Demand (AFD)	0.11	73	0.6	October - November 2021
Average Daily Demand (ADD)	0.16	115	1.0	2019
Peak Monthly Demand (PMD)	0.31	213	1.8	August 2019
Maximum Daily Demand (MDD)	0.40	281	2.4	July 11, 2020

Notes: 1 – The sources listed were chosen as representative timeframes/values for the respective demand type.

2.1.5 Water Demand Distribution

Estimated demands for each meter within the Town's water system were distributed to model nodes using 2019 customer billing data. Billing data provided by the Town contained monthly consumption numbers for each customer. Each customer was tied to a spatial location by geocoding associated customer addresses.

Individual customer average annual consumption numbers were corrected by the average daily water production detailed in the previous section (see Equation 1).

$$V_i^* = \frac{V_i}{V_{Total}} \tag{1}$$

Where

V_i^* = Corrected Consumption for Customer i
V_i = Average Annual Consumption for Customer i (gallons)
V_{Total} = Average Total Billed Annual Water Demand (gallons)

Corrected consumption numbers were then used to distribute calculated demands amongst individual customers (see Equation 2).

$$Q_i = Q_{Total} \cdot V_i^* \tag{2}$$

Where

Q_i = Customer Demand (gpm)
Q_{Total} = Average Annual Water Production (gpm, ADD)

This methodology provides a suitable distribution of water demands throughout the system while capturing the actual demands seen at the WTP and well, accounting for water loss and other unmetered water uses. Individual customer demands were assigned to the nearest model node using InfoWater's built-in Demand Allocation Manager as shown in **Figure 2-1**.

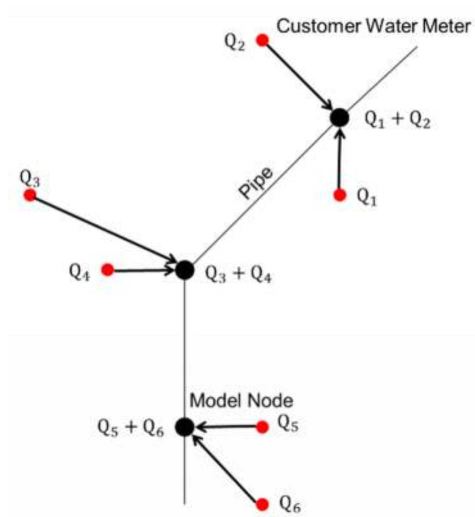


Figure 2-1. Demand Distribution Example

This allocation method was successful, properly distributing the existing ADD customer demands throughout the modeled distribution system. MDD, PMD, and AFD demand scenarios were also developed by applying the peaking factors listed in **Table 2-5** to each ADD model node.

2.2 Hydraulic Model Calibration

With the hydraulic model built, a field calibration effort was performed to refine modeled Hazen-Williams C-factors and improve model performance. The field calibration effort involved performing flow tests at individual fire hydrants within the system while recording residual pressures at nearby monitoring hydrants. The flow tests were then simulated in the hydraulic model and modeled C-factors were adjusted to align the modeled and actual system hydraulics.

2.2.1 Hydrant Flow Tests

On May 12, 2022, SGM conducted six hydrant flow tests throughout the distribution system with assistance from the Town's Maintenance Manager, Randy McGuire. For each test the flow hydrant was equipped with a 2.5" Akron hydrant test kit to estimate flow while the monitoring hydrants were equipped with digital pressure recorders to monitor the residual pressures and pressure loss during the flow event. **Table 2-6** summarizes the data collected during the hydrant flow tests.

Table 2-6. Summary of Hydrant Flow Test Data

Test No.	Flow Hydrant ID	Flow (gpm)	Monitoring Hydrant A ID	Static Pressure (psig)	Residual Pressure (psig)	Pressure Drop (psig)	Monitoring Hydrant B ID	Static Pressure (psig)	Residual Pressure (psig)	Pressure Drop (psig)
1	262	980	256	70.3	53.9	16.4	15	72.4	50.0	22.4
2	262	980	192	63.5	56.6	6.8	217	67.6	56.4	11.2
3	19	810	12	59.4	51.1	8.4	6	56.2	43.9	12.3
4	19	810	6	55.9	43.7	12.2	115	52.9	34.2	18.7
5	2	723	6	55.9	43.1	12.8	119	54.2	36.0	18.2
6	299	518	6	56.0	48.3	7.7	295	48.2	18.9	29.3

2.2.2 Model Calibration Results

The data presented in **Table 2-6** was inputted into Innovyze Infowater's built-in calibration tool and used to simulate the flow quantities and residual pressures recorded during the hydrant flow tests. Additionally, system parameters such as the water level in the tank and flow from the well were inputted into the model to reflect the conditions during the hydrant flow tests.

Hazen-Williams C-factors for individual pipe segments were adjusted throughout the distribution system to bring modeled conditions in agreement with the actual hydrant flow test results. Calibrated C-factors ranged from 94 to 130, all reasonable values for the old and new C900 PVC pipe that is prevalent throughout the distribution system. **Table 2-7** summarizes the results of the calibration effort.

Table 2-7. Hydraulic Model Calibration Results

	Flow Hydrant		Monitoring Hydrant A			Monitoring Hydrant B		
Test No.	Flow Hydrant Number	Field Measured Flow (gpm)	Actual Residual Pressure (psig)	Modeled Residual Pressure (psig)	Percent Difference	Actual Residual Pressure (psig)	Modeled Residual Pressure (psig)	Percent Difference
1	262	980	57.10	59.00	3.3%	58.42	59.22	1.3%
2	262	980	54.12	56.57	4.5%	58.30	59.99	2.9%
3	19	810	52.97	52.30	-1.3%	45.18	46.05	1.9%
4	19	810	45.03	46.05	2.26%	36.07	37.83	4.87%
5	2	723	44.54	46.41	4.18%	37.44	39.04	4.25%
6	299	518	49.67	52.03	4.75%	18.93	18.19	-3.93%

As shown in **Table 2-7**, there is good agreement in the residual pressures recorded during the actual and modeled fire flow tests after calibrating the model. All of the modeled results are within 5% of the actual results. This yields confidence in the effectiveness of the calibration and confidence in using the hydraulic model for future analyses.

3.0 Fire Flow Analysis

SGM utilized the calibrated hydraulic model to assess the existing fire flow availability throughout the Town. Phases 2 through 5 of the phased distribution system replacement program recommended in the Town's 2018 Water and Sewer Master Plan were then modeled to evaluate their impact to the fire flows. Each phase includes replacement of the water distribution mains, service lines, fire hydrants and all appurtenances to a specific geographic block.

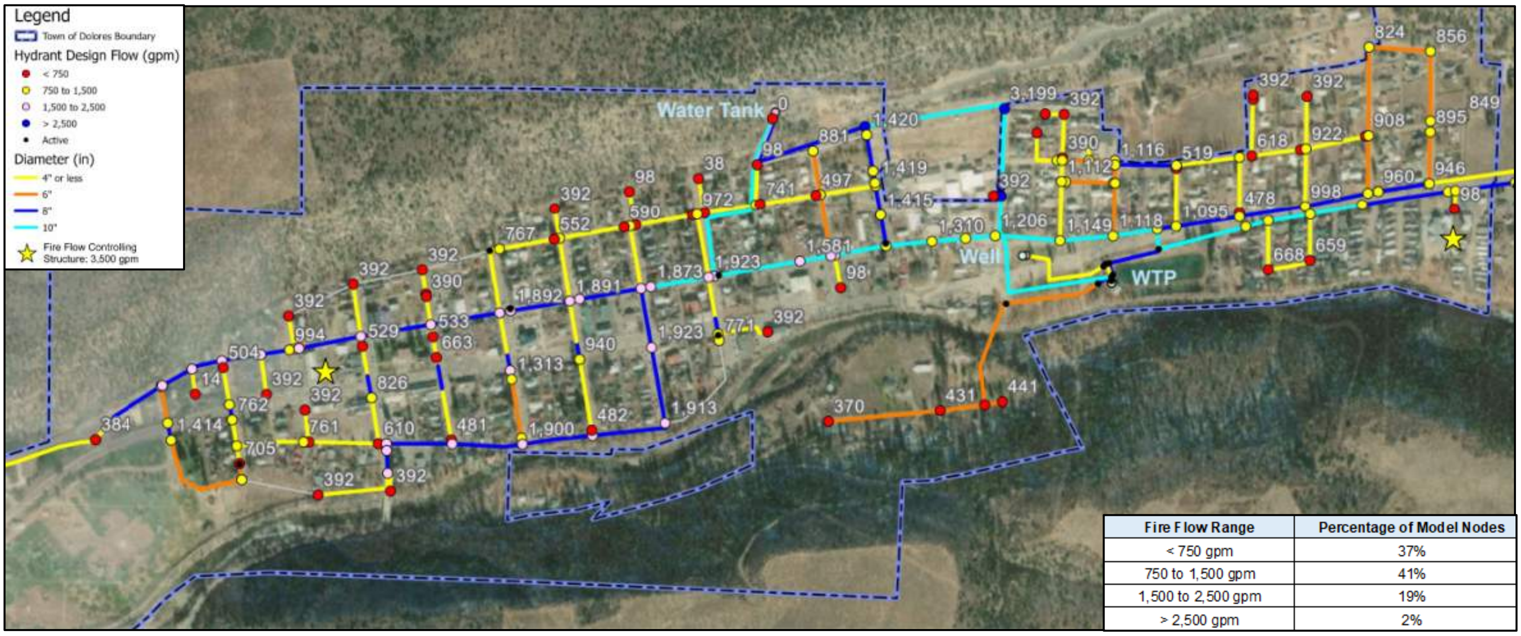
3.1 Fire Flow Availability

Fire flow availability is the amount of flow that the system can deliver under conservation operational and demand conditions. For this study, these conditions are:

1) Demand condition: Maximum Day Demand (MDD) (0.40 mgd)
2) Storage tank levels: 50% full
3) Booster pump to tank: Off
4) Water production facilities: Off
5) Min. Residual Pressure: 20 psi
6) Max. Water Line Velocity: 10 feet per second (fps)

The hydraulic model was used to determine fire flow availability throughout the distribution system utilizing Infowater's built-in fire flow modeling capabilities. The model calculated the volume of flow available at each node while maintaining a residual pressure of 20 psi at other nodes. Properties outside of Town limits were excluded from this analysis. These properties, primarily east of Town along Railroad Avenue, have very low pressures and would significantly limit available fire flows within the Town if included. Negative distribution system pressures may occur in this area during a fire flow event in the Town and may require a flushing program to mitigate.

It is important to note that the modeled fire flow availability at individual model nodes does not indicate the volume of flow that can be expected from a single fire hydrant at that location. Instead, it is an estimate of the flow volume that can be extracted from multiple fire hydrants and/or fire suppression systems in that area. **Figure 3-1** shows the modeled fire flow availability throughout the distribution system under existing conditions. The two stars indicate the two controlling structures in Town (Dolores Hardware to the west, EsoTerra Ciderworks to the east) that require the highest fire flow availability per the adopted 2021 International Fire Code, 3,500 gpm.



Fire Flow Range	Percentage of Model Nodes
< 750 gpm	37%
750 to 1,500 gpm	41%
1,500 to 2,500 gpm	19%
> 2,500 gpm	2%

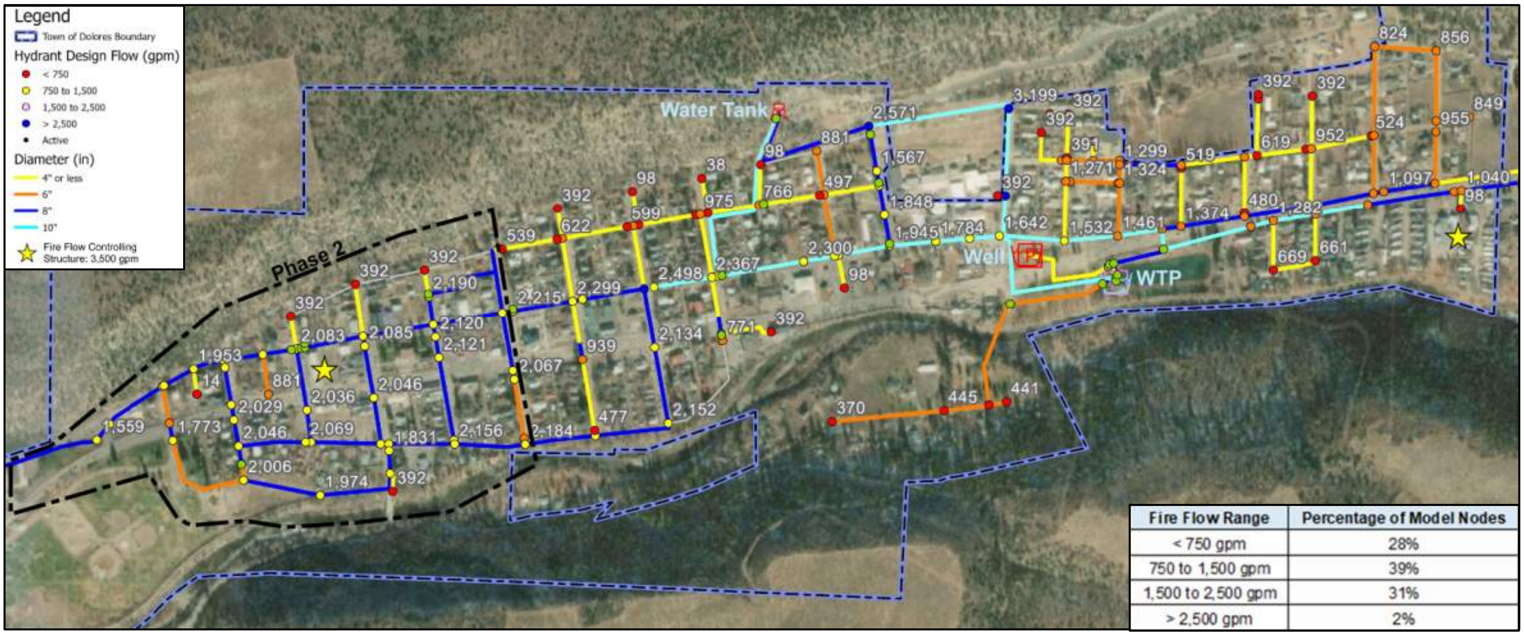
Figure 3-1. Existing Available Fire Flows

As shown in **Figure 3-1**, existing available fire flows throughout large areas of the Town are poor. This is generally due to low distribution system pressures, small diameter piping, and lack of looped piping in critical areas.

SGM modeled multiple improvement phases throughout the Town to determine their impact to fire flow availability. It was assumed that each successive phase includes the improvements performed during the previous phase. Fire flow maps for each improvement phase are included in **Appendix A**.

3.1.1 Fire Flow Availability: Phase 2 Improvements

The Phase 2 water distribution improvements include upsizing of distribution piping and additional pipe loop segments west of 6th Street, a combined 10,300 linear feet of piping at an estimated cost of $4,652,000. **Figure 3-2** reflects the proposed Phase 2 improvements and the associated available fire flows throughout Town.

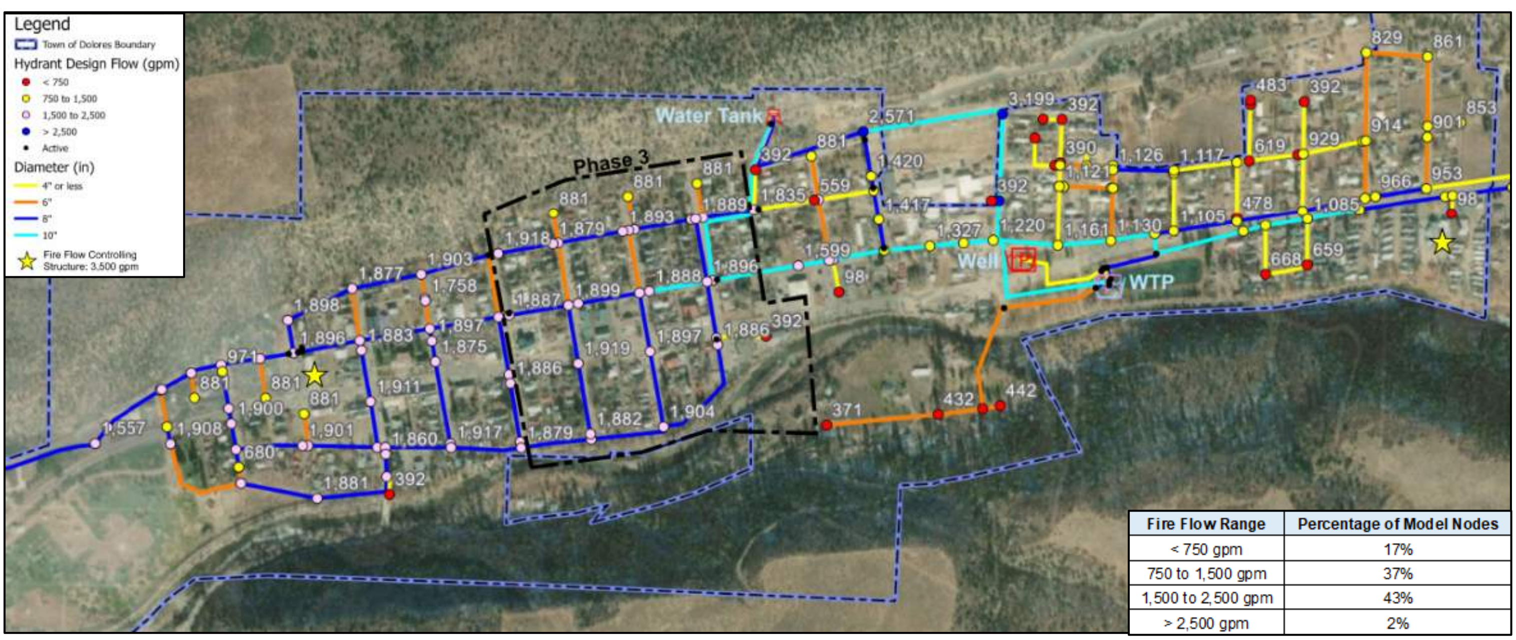


Fire Flow Range	Percentage of Model Nodes
< 750 gpm	28%
750 to 1,500 gpm	39%
1,500 to 2,500 gpm	31%
> 2,500 gpm	2%

Figure 3-2. Phase 2 Available Fire Flows

3.1.2 Fire Flow Availability: Phase 3 Improvements

The Phase 3 improvements include upsizing of distribution piping and additional pipe segments between 6th Street and 12th Street, a combined 6,380 linear feet of piping at an estimated cost of $2,889,000. **Figure 3-3** reflects the proposed Phase 3 improvements and the associated available fire flows throughout Town.

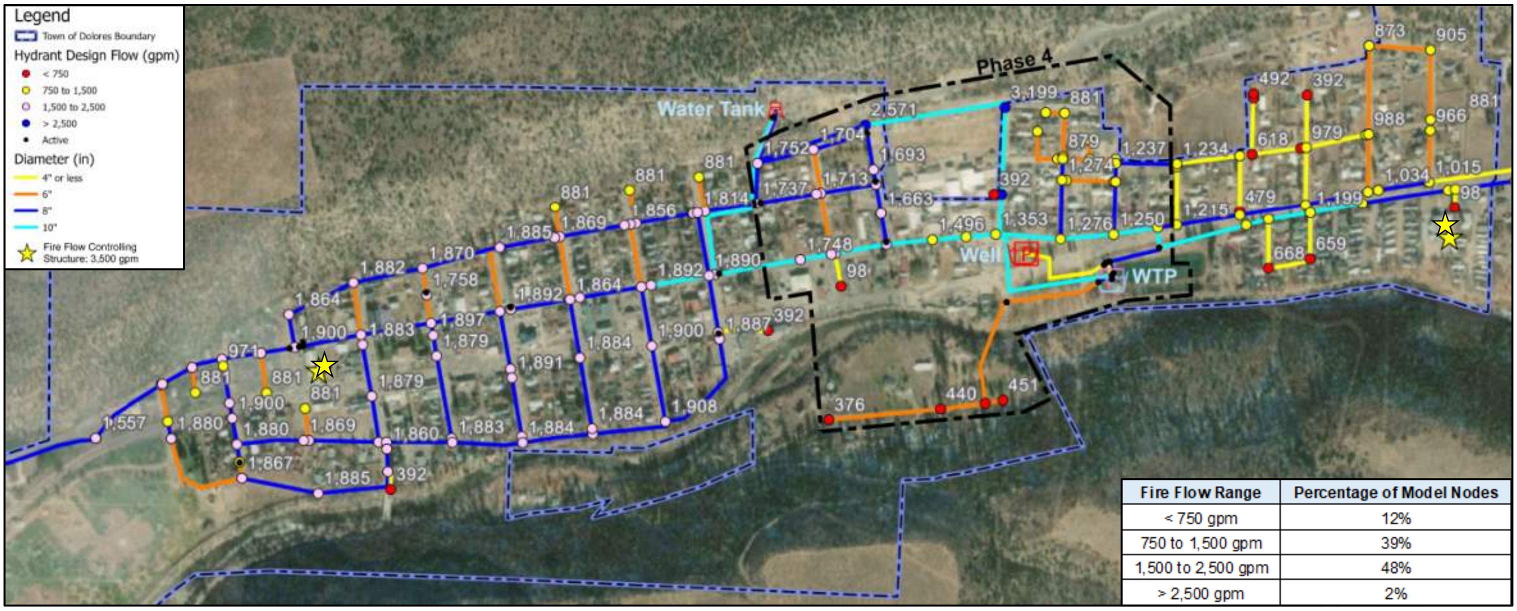


Fire Flow Range	Percentage of Model Nodes
< 750 gpm	17%
750 to 1,500 gpm	37%
1,500 to 2,500 gpm	43%
> 2,500 gpm	2%

Figure 3-3. Phase 3 Available Fire Flows

3.1.3 Fire Flow Availability: Phase 4 Improvements

The Phase 4 improvements include upsizing of distribution piping between 12th Street and 17th Street, a combined 5,100 linear feet of piping at an estimated cost of $2,611,000. **Figure 3-4** reflects the proposed Phase 4 improvements and the associated available fire flows throughout Town.

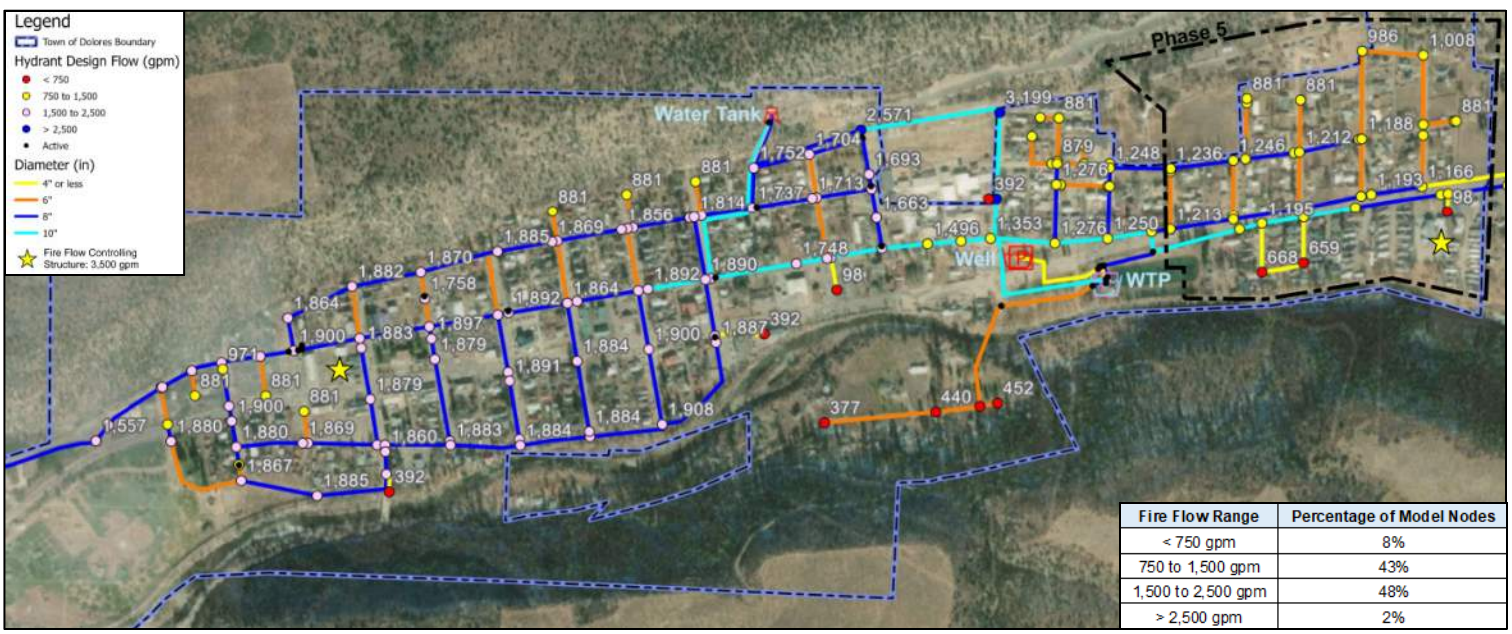


Fire Flow Range	Percentage of Model Nodes
< 750 gpm	12%
750 to 1,500 gpm	39%
1,500 to 2,500 gpm	48%
> 2,500 gpm	2%

Figure 3-4. Phase 4 Available Fire Flows

3.1.4 Fire Flow Availability: Phase 5 Improvements

The Phase 5 improvements include upsizing of distribution piping between 17th Street and 21st Street, a combined 3,550 linear feet of piping at an estimated cost of $2,006,000. **Figure 3-5** reflects the proposed Phase 5 improvements and the associated available fire flows throughout Town.



Fire Flow Range	Percentage of Model Nodes
< 750 gpm	8%
750 to 1,500 gpm	43%
1,500 to 2,500 gpm	48%
> 2,500 gpm	2%

Figure 3-5. Phase 5 Available Fire Flows

3.2 Fire Flow Availability: Analysis

Existing available fire flows throughout the Town are fairly poor due to low distribution system pressures, small diameter piping, and a lack of looped piping in some critical areas. The phased improvements shown in the previous sections increase the available fire flows throughout the Town. The local fire district has indicated that up to 1,000 gpm of fire flow can be obtained throughout the Town by pumping directly from the Dolores River. The model node percentages shown in **Figure 3-6** reflect an added 1,000 gpm of available fire flow at each node.

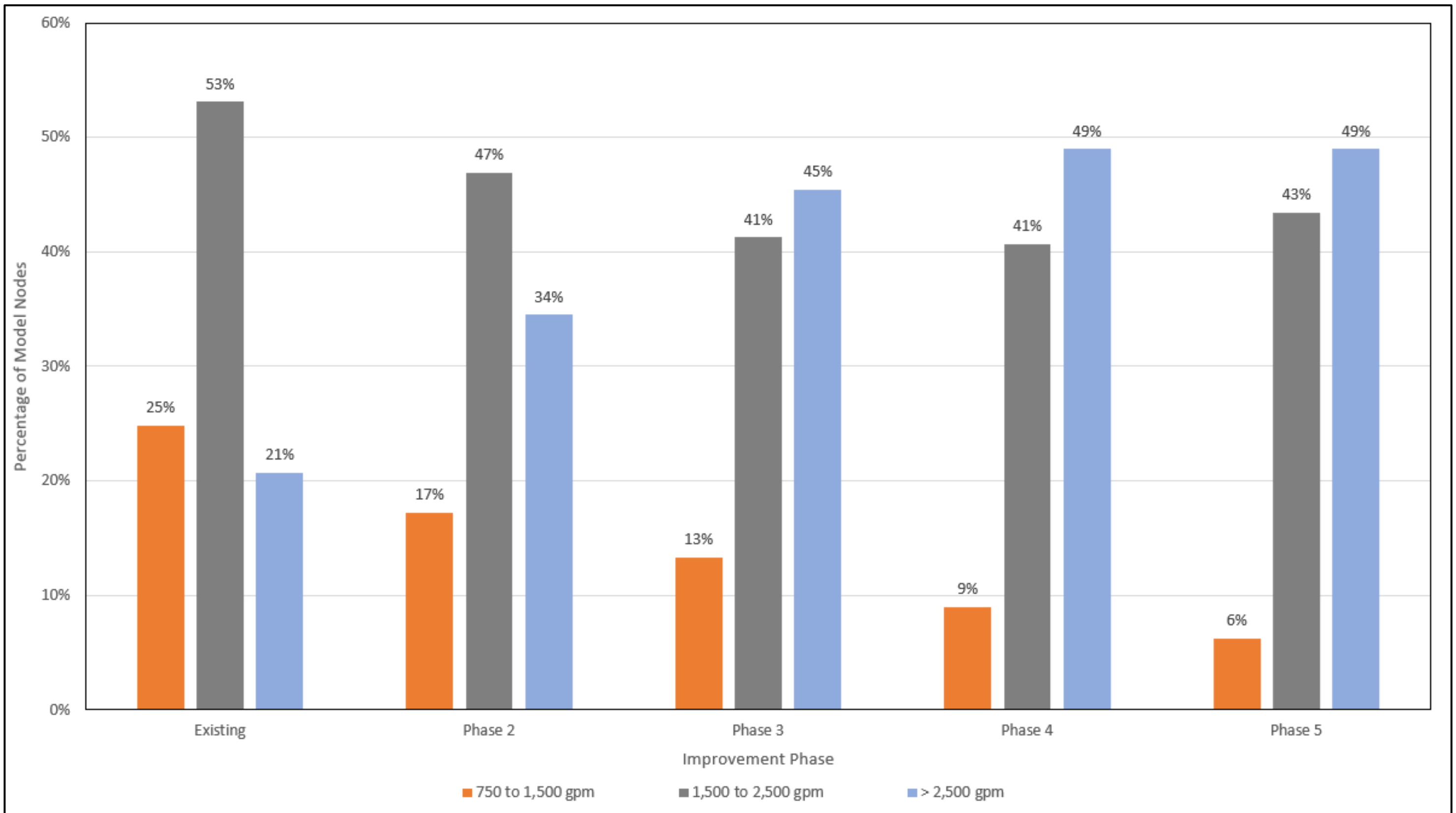


Figure 3-6. Available Fire Flow Summary

Under existing conditions, approximately 25% of model nodes fall below 1,500 gpm in available fire flow, a common minimum required fire flow sought in municipal distribution systems. This value decreases to 6% of model nodes once the phased improvements are implemented.

With 1,000 gpm of fire flow from the Dolores River, the areas surrounding the two controlling structures have existing available fire flows of approximately 1,983 gpm (Dolores Hardware) and 2,024 gpm (EsoTerra Ciderworks), both falling below the required fire flow of 3,500 gpm. With the Phase 1 through 5 Improvements completed, those available fire flows increase to 2,900 gpm and 2,102 gpm, respectively. It is unlikely that fire flows can be significantly improved on the east side of Town, in the area of EsoTerra Ciderworks, without increasing the hydraulic grade in this area.

4.0 Water Storage Analysis

The Town has a single potable water storage tank located north of Hillside Avenue between 10th Street and 11th Street. The existing tank is a welded steel tank with a nominal storage volume of 300,000 gallons. SGM analyzed water storage requirements for the Town's distribution system to determine if additional water storage is needed.

4.1 Water Storage Requirements

Water storage requirements are broken into three categories:

- Fire flow storage: the volume required to meet the controlling firefighting needs in the area served by a given tank (or tanks).
- Emergency Storage: the volume needed to meet water demands during emergency conditions or a planned maintenance activity, which reduces or eliminates the ability to deliver water to an area served by a given tank (or tanks). Such an event might include:
    - a power outage
    - a mechanical failure of a production/pumping facility
    - a break on a critical water transmission line
    - preventative maintenance activities on a production/pumping facility or critical water transmission line
- Equalization Storage: the volume needed to meet the instantaneous water demands in the area served by a given tank (or tanks) that occur at a rate which is greater than the capacity of available water production and pumping facilities serving that area. The difference in instantaneous water demand and delivery capacity is typically calculated as peak hour demand (PHD) less maximum day demand (MDD) since production and pumping systems are often designed with a firm capacity that meets MDD. The combined pumping rate out of the Town's WTP and well is approximately 665 gpm. This exceeds the estimated peak hour demand of the system of 562 gpm, therefore equalization storage is not needed.

4.1.1 Fire Flow Storage

SGM confirmed the controlling structures with the Town and identified the Dolores Hardware and EsoTerra Ciderworks buildings as requiring the greatest volume of fire flows: 3,500 gpm over 3 hours. Since 1,000 gpm of the flow can be obtained through pumping from the Dolores River, 2,500 gpm over 3 hours must be available in the storage tank. This equates to a required volume of fire flow storage of 450,000 gallons.

4.1.2 Emergency Storage

Emergency storage is the volume of water required to meet water demands during emergency conditions or planned maintenance activities. Common emergency storage volume metrics are 1 day of average day demand (ADD) or 50% of 1 day of MDD for the system. Based on the ADD to MDD peaking factor of 2.4, 50% of 1 day of MDD is a more conservative volume and is the recommended emergency storage volume for the Town's system. Given the observed MDD of 0.40 MGD, the required emergency storage is 0.20 MG or 200,000 gallons.

4.1.3 Storage Analysis

The Town's water storage needs can be summarized as follows:

- Fire Flow Storage: 450,000 gallons
- Emergency Storage: 200,000 gallons
- Total Required Storage: 650,000 gallons
- Existing Available Storage: 300,000 gallons
- **Water Storage Deficit: 350,000 gallons**

The Town has a 350,000 gallon deficiency in available water storage, necessitating construction of an additional tank. An additional tank is also desirable to allow for maintenance of the existing tank including recoating, metalwork, modifications, etc.

4.2 Storage Tank Siting Analysis

Having identified the need for a new 350,000 gallon potable water storage tank, SGM then performed a siting analysis for the new tank. The goal of this analysis was to identify multiple possible sites for the tank and develop a recommendation for the site that best balances constructability/accessibility, hydraulics, and cost.

The existing 300,000 gallon welded steel tank has a base elevation of 7,076' and a 27' tall water column. A new tank that serves the same pressure zone will need to match those characteristics. Alternatively, the new tank could be constructed at a higher elevation and establish a new pressure zone. This would allow for improved distribution system pressures and fire flows within portions of the Town but would require a new booster pump station and pressure reducing valves (PRVs) to accommodate a new pressure zone.

4.2.1 Tank Site Alternative 1: Existing Tank Site

The existing tank site, shown in **Figure 4-1**, is located north of Hillside Avenue between 10th Street and 11th Street. Utilizing the existing tank site for the new tank is an attractive alternative because considerable rockfall mitigation has already been performed in the area, there is existing distribution system infrastructure to tie into, and an existing access road.

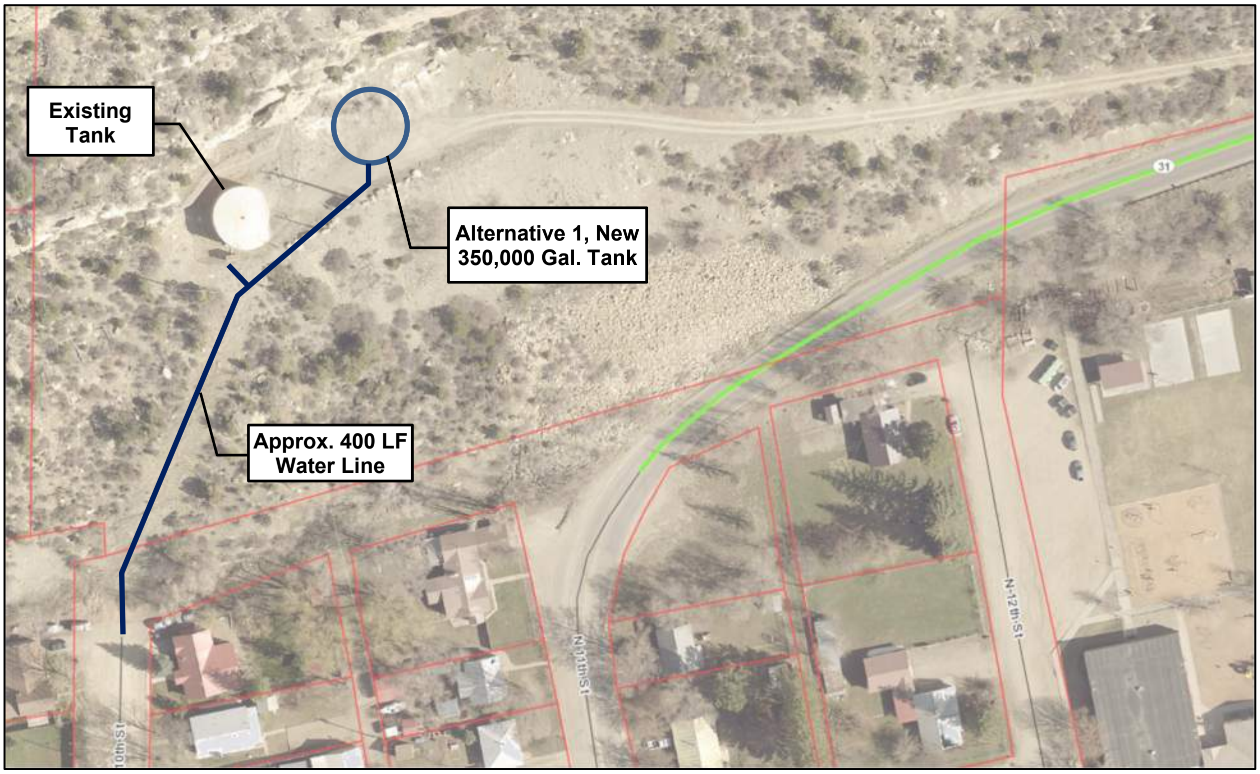


Figure 4-1. Tank Site Alternative 1, Existing Tank Site

Constructability/Accessibility

The existing tank site already has an access road suitable for bringing construction equipment and machinery to the site. As shown in **Figure 4-2**, a retaining wall was installed adjacent to the existing tank to shore up the cliff face.

Figure 4-2. Existing Storage Tank

A similar retaining wall would likely be needed to facilitate construction of the new tank at the existing tank site. Additional site grading may also be needed to provide adequate space for construction machinery. Electrical/telemetry poles and cables exist onsite that must be accommodated by a new tank, but do not appear to present significant obstacles.

Hydraulic Considerations
Of all the analyzed tank sites, Alternative 1 presents the simplest hydraulic solution. The existing well and WTP pumps would continue to be utilized to fill both tanks. Some simple site piping and valving would be required between the two tanks that would allow for isolation of individual tanks. The tanks would then “float” with one another providing the same hydraulic grade to the distribution system as the existing tank.

The existing transmission main conveying water from the storage tank to the distribution system is 10” C900 PVC. The maximum capacity of this transmission main while keeping pipe velocities below 10 fps is 2,350 gpm. This limits the volume of fire flow that can be conveyed to the distribution system per ISO standards. As part of a tank project at the Alternative 1 site it is recommended that an additional 400 linear foot (LF) 12” transmission main be installed along the same alignment as the existing 10” main.

Estimated Cost
A full breakdown of the Engineer’s Opinion of Probable Constructions Costs (EOPCC) is included in **Appendix B**. A summary of the estimated costs for Tank Site Alternative 1 is as follows:

- Survey and Design: $90,000
- Mobilization: $141,000
- Site Improvements: $452,000
- 350,000 Gallon Welded Steel Tank: $815,000
- 12” C900 PVC Water Line: $140,000
- Construction Contingency: $310,000
- Construction Engineering: $50,000
- **Total Cost: $1,998,000**

4.2.2 Tank Site Alternative 2: Triangle Parcel

The second tank site analyzed is the “Triangle Parcel” owned by the Town north of Hillside Avenue, shown **in Figure 4-3**. **Figure 4-3** also shows an approximate suitable elevation band for the new tank to match the hydraulic grade established by the existing tank. The Town asked SGM to explore the Triangle Parcel as an alternative because it is a Town-owned parcel and would allow for a separate tank location. In the event of a large rockfall or other event at the existing tank site, a tank in a separate tank location could remain in service.

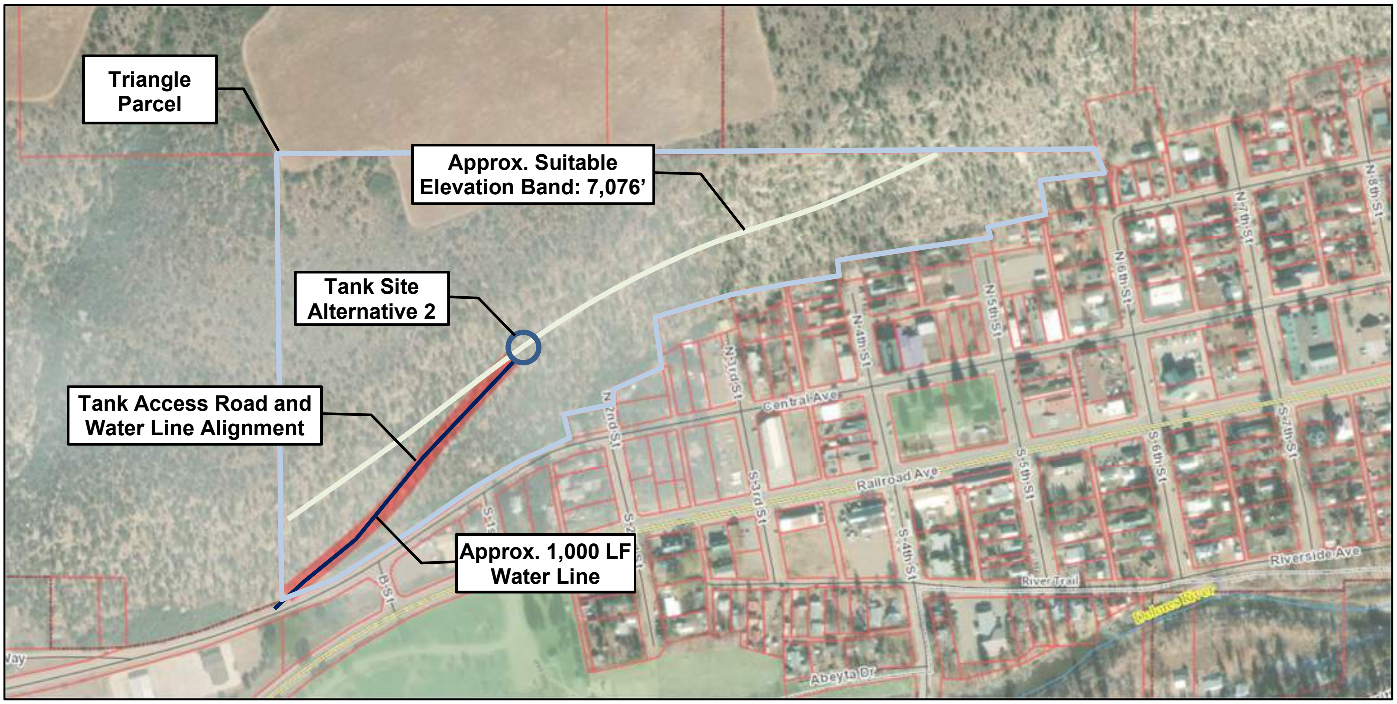


Figure 4-3. Tank Site Alternative 2, Triangle Parcel

Constructability/Accessibility

Tank Site Alternative 2 would require significant grading, rockfall mitigation, and retaining walls to facilitate construction of the new tank. A new access road would need to be cut into the hillside to gain access to a potential site. Site grading, rockfall mitigation, shoring, and retaining walls would then be required to level out a large enough site for construction of the new tank. **Figure 4-3** shows the approximate elevation band and a possible site where the tank could be located.

Hydraulic Considerations

A new tank at this location would float in the same pressure zone as the existing tank. An estimated 1,000 LF water line would need to be constructed, possibly along the tank access road, that would tie into the 8" water line located along Central Avenue. Similar to Tank Site Alternative 1, the existing well and WTP pumps could continue to be used to fill both tanks.

Estimated Cost

A summary of the estimated costs for Tank Site Alternative 2 is as follows:

- Survey and Design: $100,000
- Mobilization: $175,000
- Access Road: $200,000
- Site Improvements: $382,000
- 350,000 Gallon Welded Steel Tank: $815,000
- 12" C900 PVC Water Line: $350,000
- Construction Contingency: $385,000
- Construction Engineering: $50,000
- **Total Cost: $2,457,000**

4.2.3 Tank Site Alternative 3: County Road 31 Parcel

The third tank site analyzed is in a Town-owned parcel located along Country Road 31 (CR31) on the north side of Town, shown in **Figure 4-4**. This site alternative was selected for similar reasons as Tank Site Alternative 2: it is a Town-owned property and would provide a separate tank location.

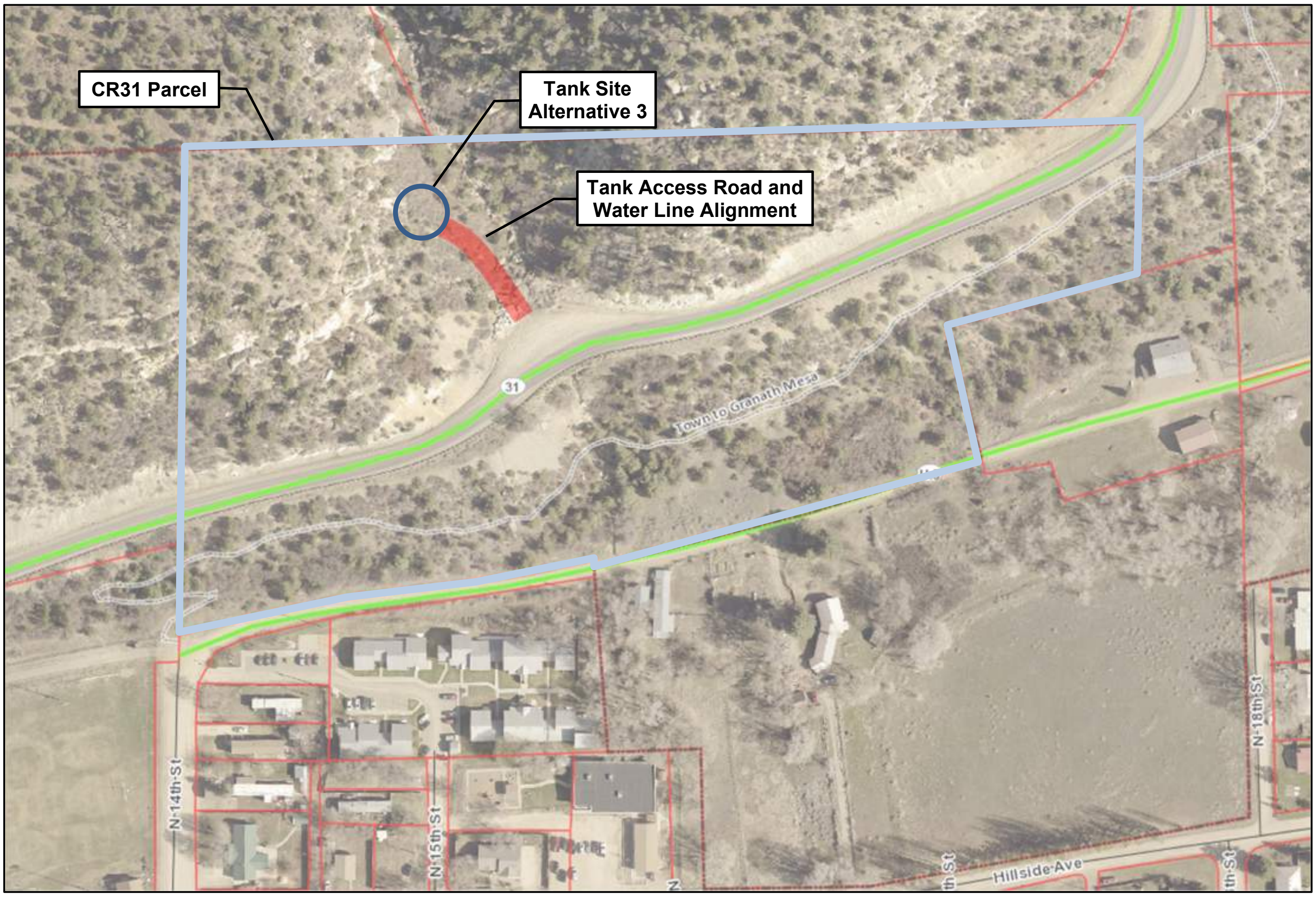


Figure 4-4. Tank Site Alternative 3, CR31 Parcel

Constructability/Accessibility

Tank Site Alternative 3 would require site grading, rockfall mitigation, and retaining walls to facilitate construction of the tank. An access road would need to be graded up to the tank from an existing pullout along CR31. In addition, a drainage gully exists at this site that would need to be accommodated.

Hydraulic Considerations

A new tank located at Tank Site Alternative 3 would have a base elevation of approximately 7,160’ and would establish a new pressure zone in the distribution system. This new pressure zone could serve the east side of Town, likely beginning at 12th Street, and increase system pressures by roughly 35 psi. An increase in system pressures would also increase available fire flows throughout the pressure zone.

A new booster pump station (BPS) would be required that would pump water through an approximately 1,650 LF water line located along CR31. The new pressure zone could tie into the existing 8” water line along 12th Street. A combination of isolation valves and PRVs would be required to isolate the new pressure zone from the existing pressure zone. **Figure 4-5** shows a possible location for the new BPS and water line connections that would be required for Tank Site Alternative 3.

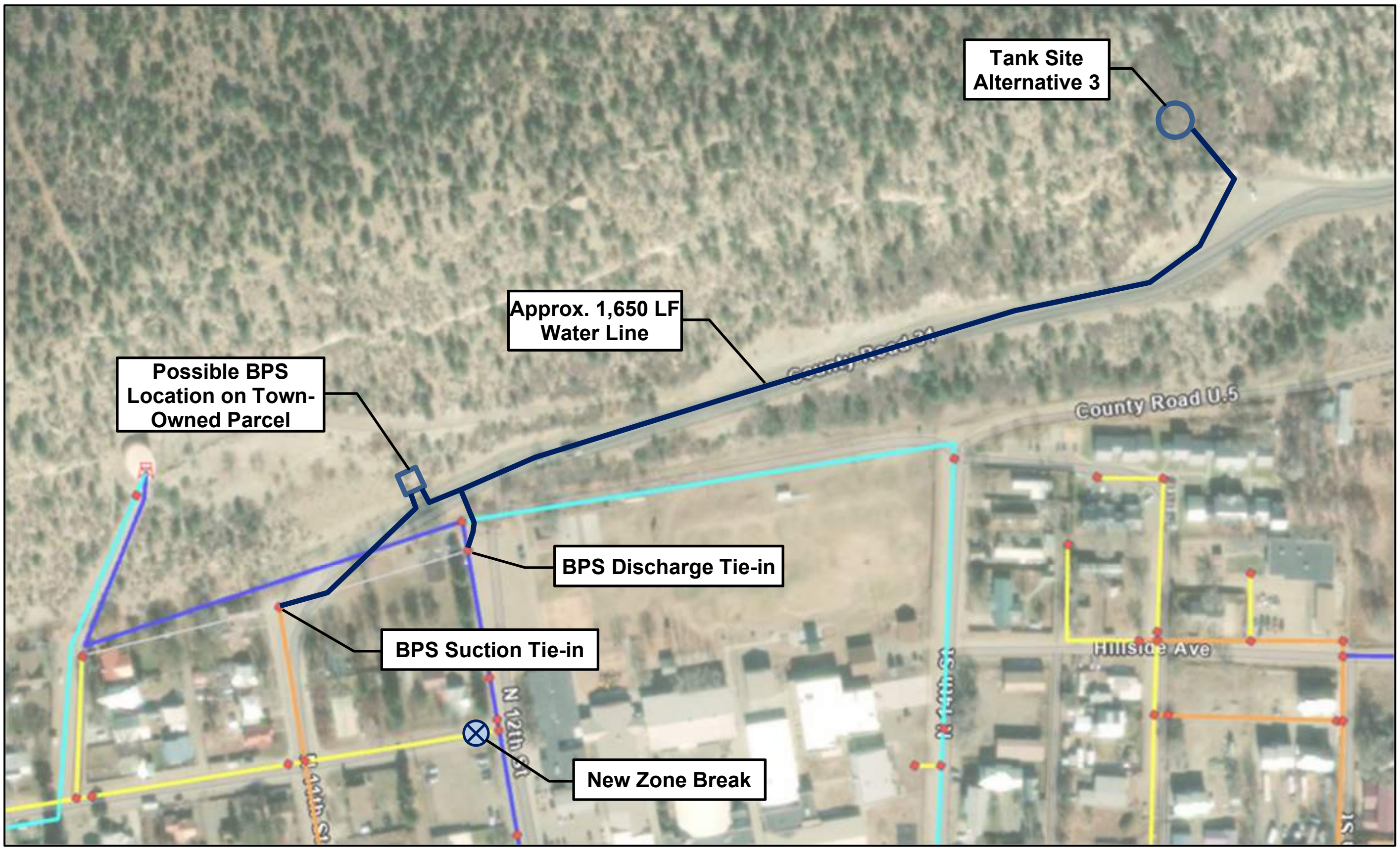


Figure 4-5. Hydraulic Considerations for Tank Site Alternative 3

Estimated Cost

A summary of the estimated costs for Tank Site Alternative 3 is as follows:

- Survey and Design: $135,000
- Mobilization: $264,000
- Access Road: $22,000
- Site Improvements: $387,000
- 350,000 Gallon Welded Steel Tank: $815,000
- 12" DIP Water Line: $578,000
- Asphalt Remove & Replace: $99,000
- Booster Pump Station: $721,000
- Construction Contingency: $546,000
- Construction Engineering: $65,000
- **Total Cost: $3,676,000**

4.2.4 Tank Site Alternative 4: Across the Dolores River

The fourth tank site analyzed lies across the Dolores River on a property owned by Hay Camp Ranch, LLC. The Town expressed interest in a tank site on the south side of the river to mitigate possible rockfall issues at the tank site alternatives on the north side of Town. There is an existing two-track access road off Merritt Way that leads up to Tank Site Alternative 4 that could be improved to facilitate construction of the tank. **Figure 4-6** shows Tank Site Alternative 4 and an approximate suitable elevation band for the new tank to match the hydraulic grade established by the existing tank.

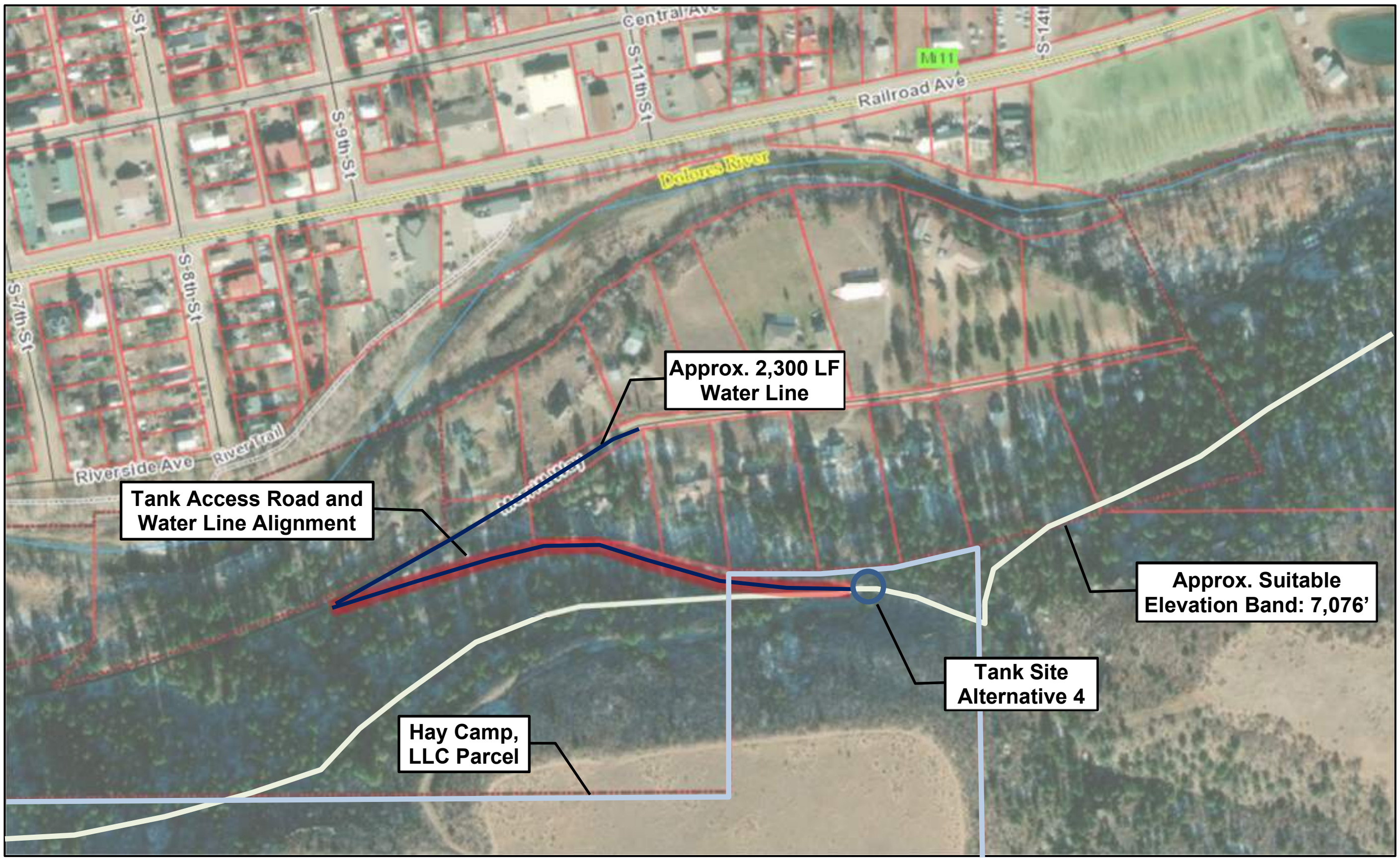


Figure 4-6. Tank Site Alternative 4, Across the Dolores River

<u>*Constructability/Accessibility*</u>
Tank Site Alternative 4 would require significant site grading and road improvements to facilitate construction of the new tank. This alternative would likely require less rockfall mitigation and retaining walls than Alternatives 1-3. A tank at this site would require a land purchase agreement with the property owner.

<u>*Hydraulic Considerations*</u>
A new tank at this location would float in the same pressure zone as the existing tank. An estimated 2,300 LF water line would need to be constructed along Merritt Way and the tank access road tying the tank into the distribution system. In addition, the distribution system piping along Merritt Way is only 6" diameter pipe; approximately 2,000 LF would need to be upsized to at least 8" diameter to allow for adequate fire flow transmission from the new tank. Similar to Tank Site Alternatives 1-3, the existing well and WTP pumps could continue to be used to fill both tanks.

Estimated Cost
A summary of the estimated costs for Tank Site Alternative 4 is as follows:

- Survey and Design: $160,000
- Mobilization: $254,000
- Access Road: $31,000
- Site Improvements: $182,000
- 350,000 Gallon Welded Steel Tank: $815,000
- 12" C900 PVC Water Line: $810,000
- Upsize Merritt Way Water Line: $700,000
- Construction Contingency: $559,000
- Construction Engineering: $65,000
- **Total Cost: $3,571,000**

4.2.5 Tank Site Alternative 5: Granath Mesa

The fifth tank site analyzed lies in the Granath Mesa area north of Town. The Town expressed interest in a tank site at this location to allow for the addition of customers on top of the mesa into the Town's system. **Figure 4-7** shows the location of Tank Site Alternative 5.

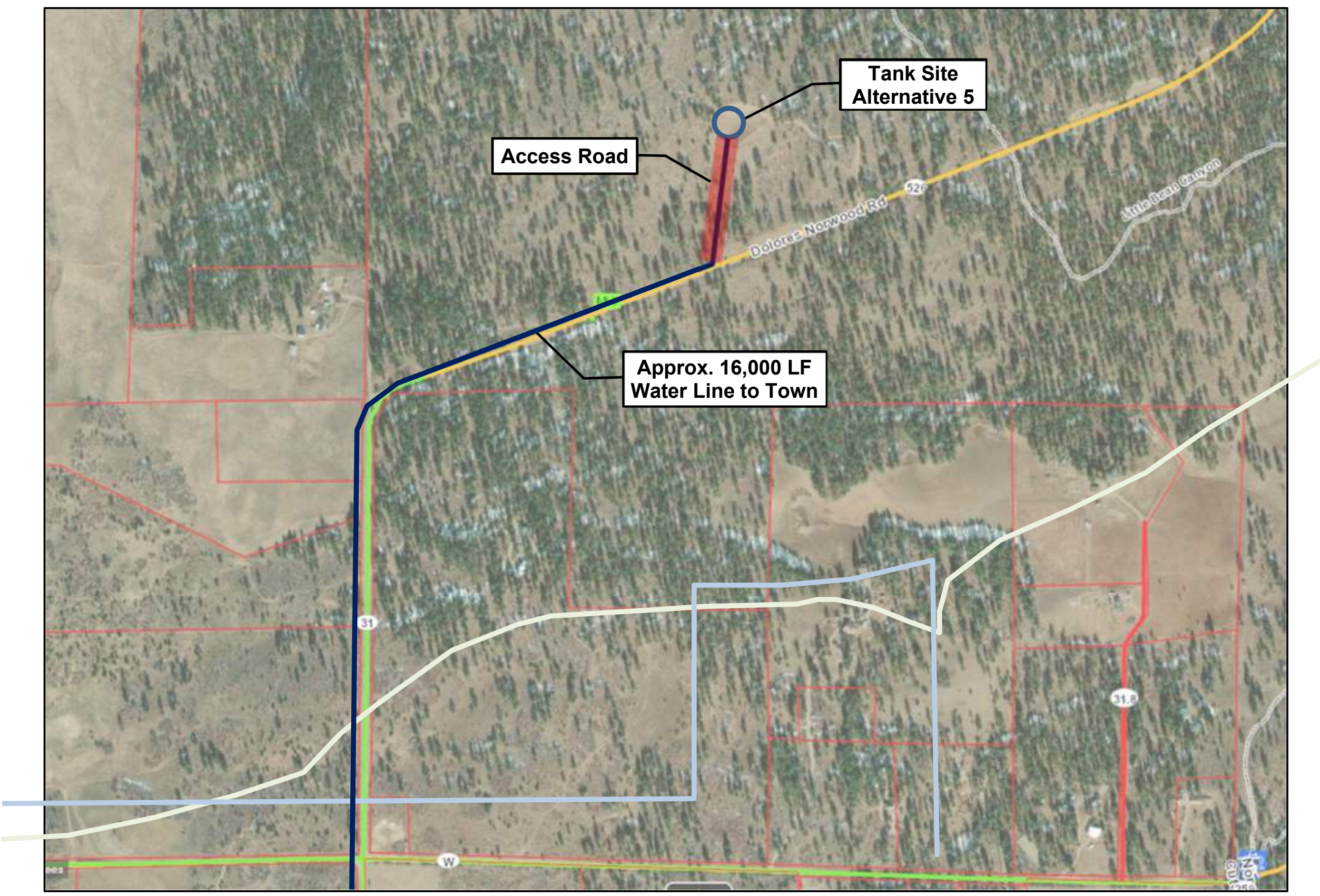


Figure 4-7. Tank Site Alternative 5, Granath Mesa

Constructability/Accessibility
Tank Site Alternative 5 would not require significant site grading to facilitate construction of the new tank. A new access road would need to be constructed to the site. The site is located on a parcel of land owned by the U.S. Forest Service; a land purchase agreement would be required.

Hydraulic Considerations
A new tank at this location would require significant infrastructure to make it viable including approximately 16,000 LF of water line and at least two BPS's. Each BPS would be equipped with a PRV to allow water to be downloaded from the upper pressure zones into the Town's existing distribution system. In addition, the lengthy water line could create water quality issues due to the relatively low water demands that could be expected from the customers on top of the mesa. **Figure 4-8** shows a possible water line alignment and BPS locations for Tank Site Alternative 5.

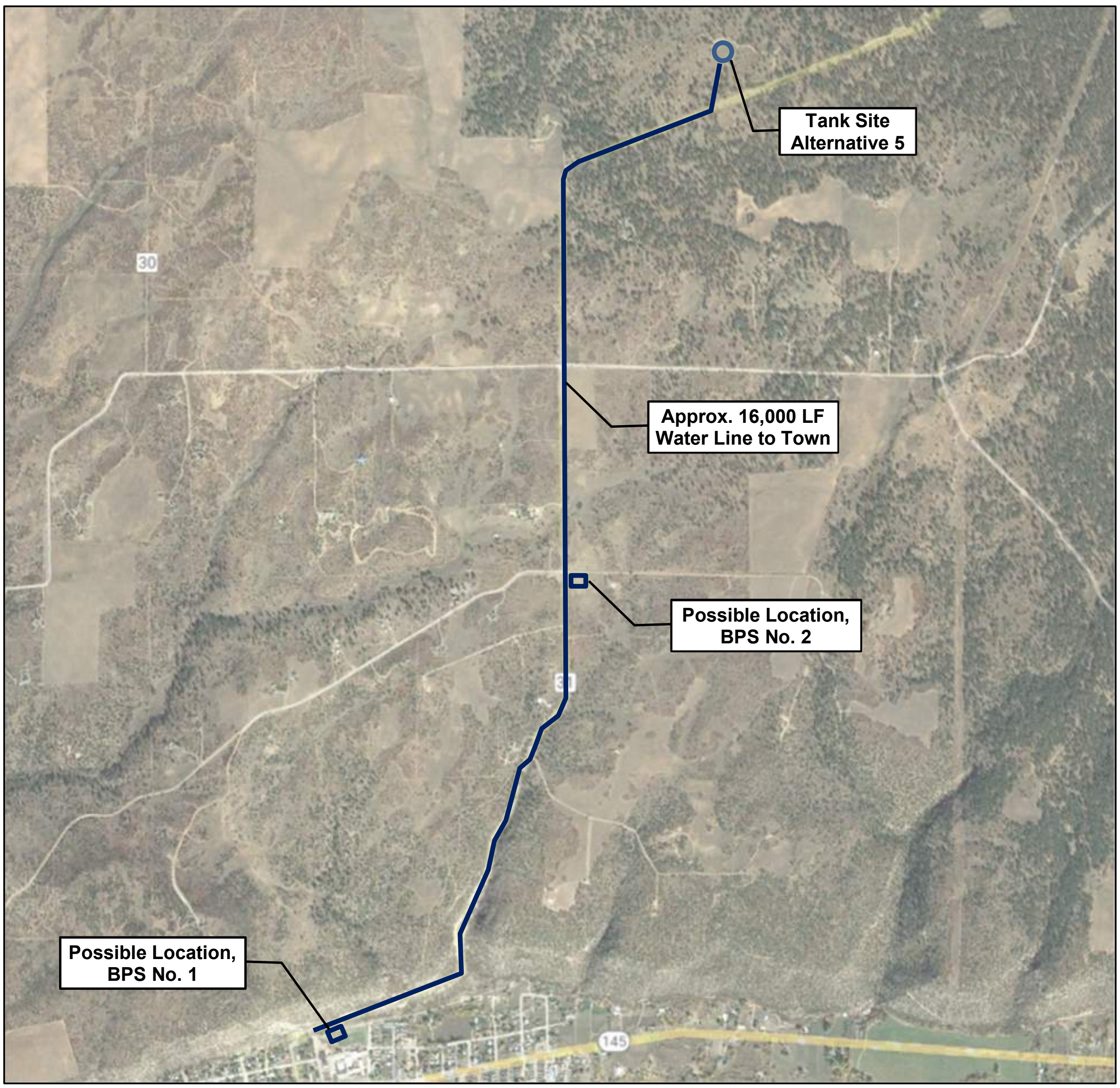


Figure 4-8. Hydraulic Considerations for Tank Site Alternative 5

Estimated Cost

A summary of the estimated costs for Tank Site Alternative 5 is as follows:

- Survey and Design: $160,000
- Mobilization: $829,000
- Access Road: $29,000
- Site Improvements: $132,000
- 350,000 Gallon Welded Steel Tank: $815,000
- 12” C900 PVC Water Line: $5,866,000
- Booster Pump Station (2): $1,442,000
- Construction Contingency: $1,823,000
- Construction Engineering: $75,000
- **Total Cost: $11,171,000**

4.2.6 Tank Site Alternative Summary

Error! Reference source not found. summarizes the five Tank Site Alternatives and their respective constructability considerations, hydraulic considerations, and costs. SGM recommends pursuing Tank Site Alternative 1 due to the estimated costs, ease of connection to the distribution system, and ease of access.

Table 4-1.Tank Site Alternative Summary

Tank Site Alternative	Location	Constructability/ Accessibility	Hydraulic Considerations	Estimated Cost
1	Existing tank site	• Retaining wall • Rockfall mitigation	• Can use existing well and WTP pumps • New 400 LF water line connecting to distribution system	$1,998,000
2	Triangle Parcel	• Retaining wall • Rockfall mitigation • New access road cut into hillside	• Can use existing well and WTP pumps • New 1,000 LF water line connecting to distribution system	$2,457,000
3	C31 Parcel	• Retaining wall • Rockfall mitigation • New access road from road shoulder • Drainage improvements	• New booster pump station • New 1,650 LF water line connecting to distribution system • Would establish a new pressure zone that could increase water service pressures and fire flows on the east side of Town.	$3,676,000
4	Across the Dolores River	• Improvements to existing two-track access road • Site grading	• Can use existing well and WTP pumps • Combined 4,300 LF of new water line connecting to distribution system	$3,576,000
5	Granath Mesa	• Minor site grading • New access road from road shoulder • Extensive water line work along road corridor	• Requires at least two new booster pump stations • Approximately 16,000 LF of new water line connecting to distribution system • Could create water quality issues	$11,171,000

5.0 Priorities and Recommendations

The Town has two major water system infrastructure deficiencies: inadequate distribution system piping and potable water storage. Both issues limit system resiliency and fire flows and should be prioritized. The Town's main area of concern is reportedly the aging distribution system (waterline breaks, leaks, unreliable valves and hydrants, degradation of water quality in dead ends, and galvanized services). Therefore, SGM recommends prioritizing the Phase 2 distribution system improvements, then adding a redundant water storage tank.

Phase 2 is the largest distribution system improvement phase encompassing most of historic downtown where the water system is oldest, most deteriorated, and has the most dead-end pipes. Looping of the water system minimizes the likelihood of consumers being without water in the event of a water main break. The proposed Phase 2 improvements would provide the greatest impact to the Town's fire flow availability as shown in **Figure 3-6**.

A redundant storage tank alone would not improve available fire flow (in gpm) but increases the available emergency and fire flow storage which are currently below the recommended quantities. The local fire department has not raised concerns about the Town's available water storage because they plan to use pumper truck water at every fire event. However, they have raised concerns about the condition of the Town's hydrants which can be addressed during the phased distribution system improvements.

Once the Phase 2 distribution improvements and redundant storage tank are constructed, the Town can focus on the Phase 3 through 5 distribution system improvements. These will progressively increase the available fire flows throughout the Town while addressing aging pipe, dead ends, etc.

Appendix A. Fire Flow Maps

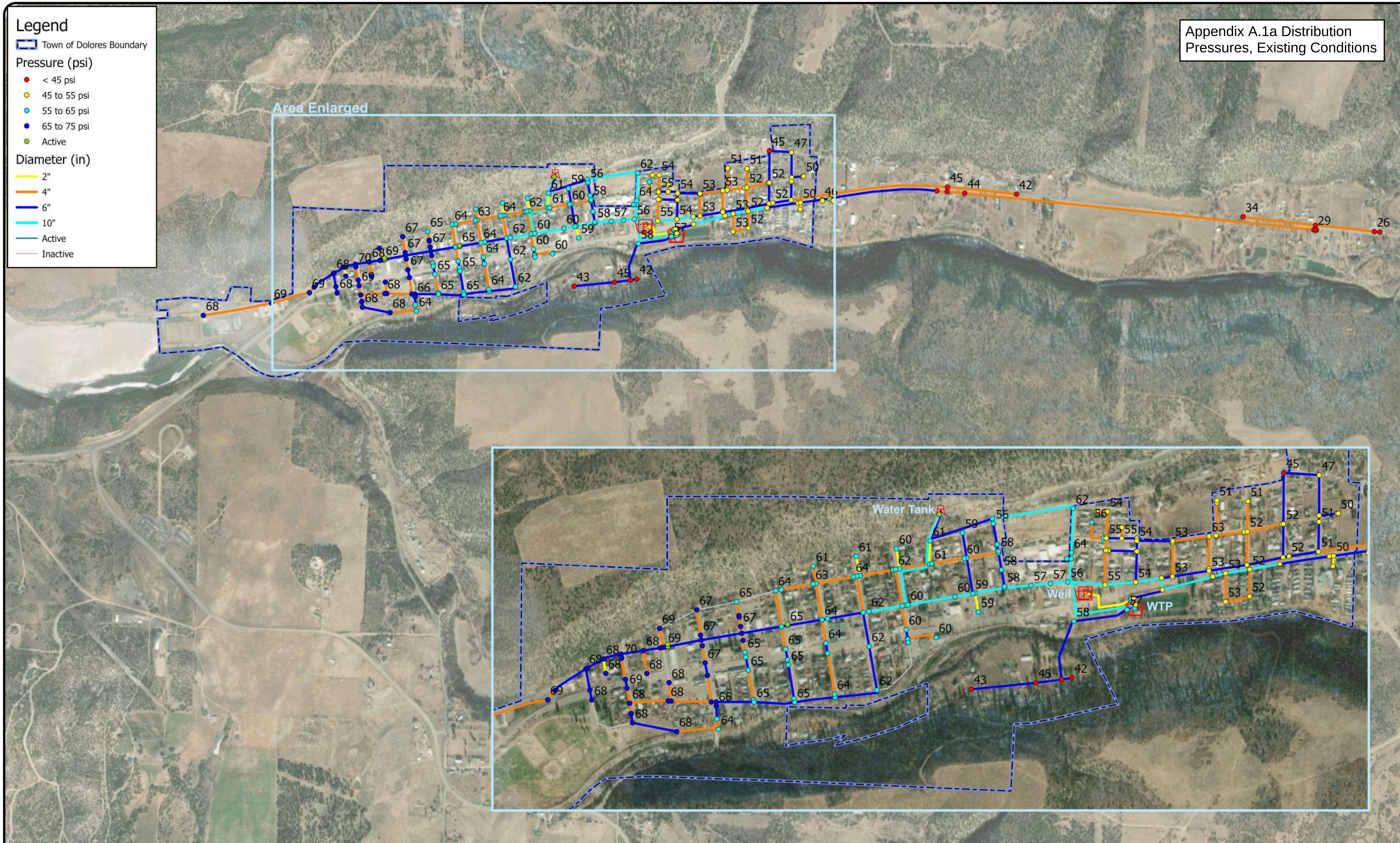
A.1: Available Fire Flows, Existing Conditions

A.2: Available Fire Flows, Phase 2 Improvements

A.3: Available Fire Flows, Phase 3 Improvements

A.4: Available Fire Flows, Phase 4 Improvements

A.5: Available Fire Flows, Phase 5 Improvements



SGM
118 W. Sixth St., Suite 200
Glenwood Springs, CO 81601
970.945.1004
www.sgm-inc.com

Town of Dolores
Existing Conditions

Date: 10/31/2022	Job No. 2017-387.003	Map by: SF	
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Data Sources:	As-builts	Page:	
File:	Z:\2017-387-TownofDolores\003-WaterlinePh.2-TankStudy\B-Calcs\Water Model\Dolores Model.aprx		

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

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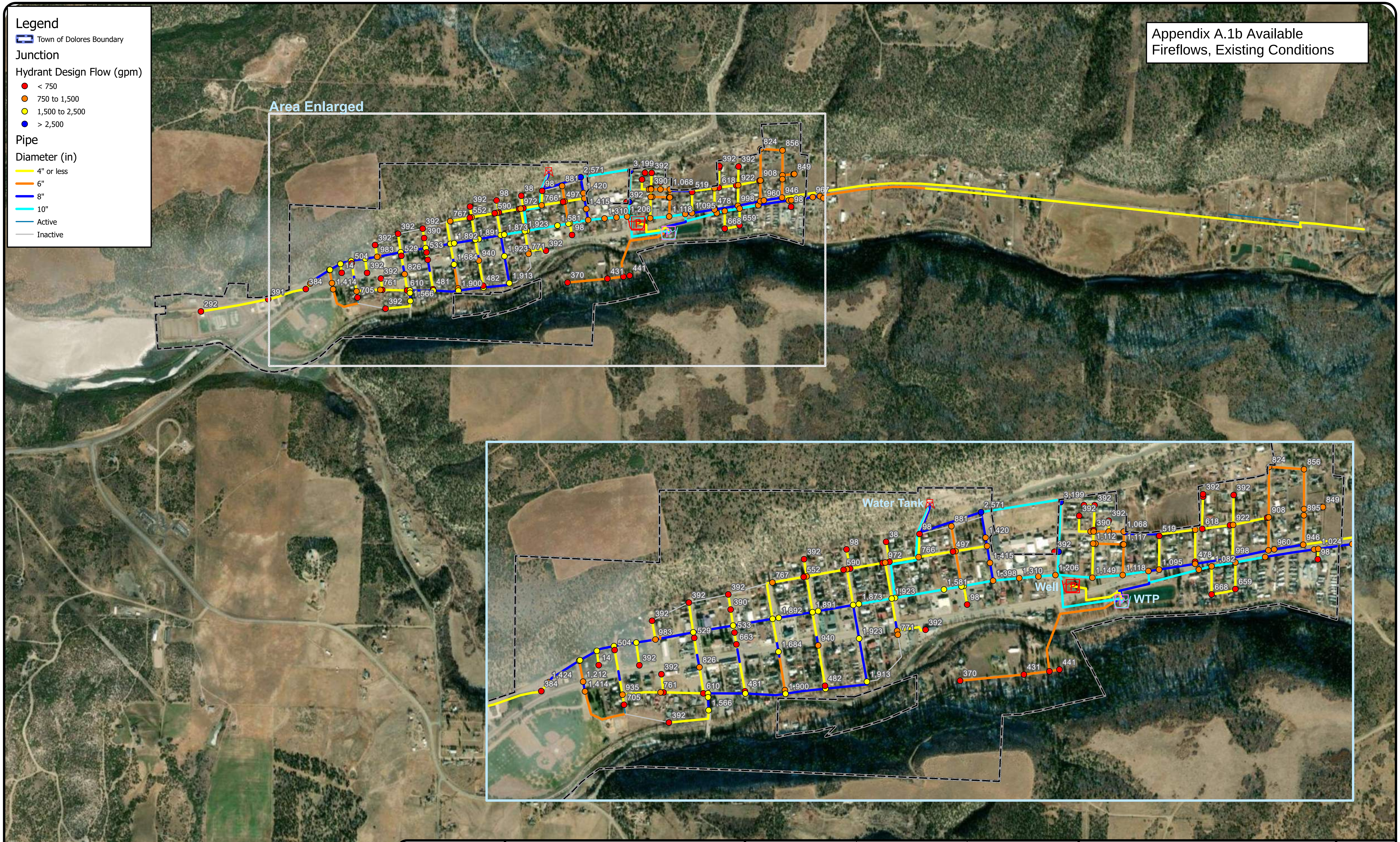
Appendix A.1b Available Fireflows, Existing Conditions



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The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

Town of Dolores

Available Fire Flows: Existing

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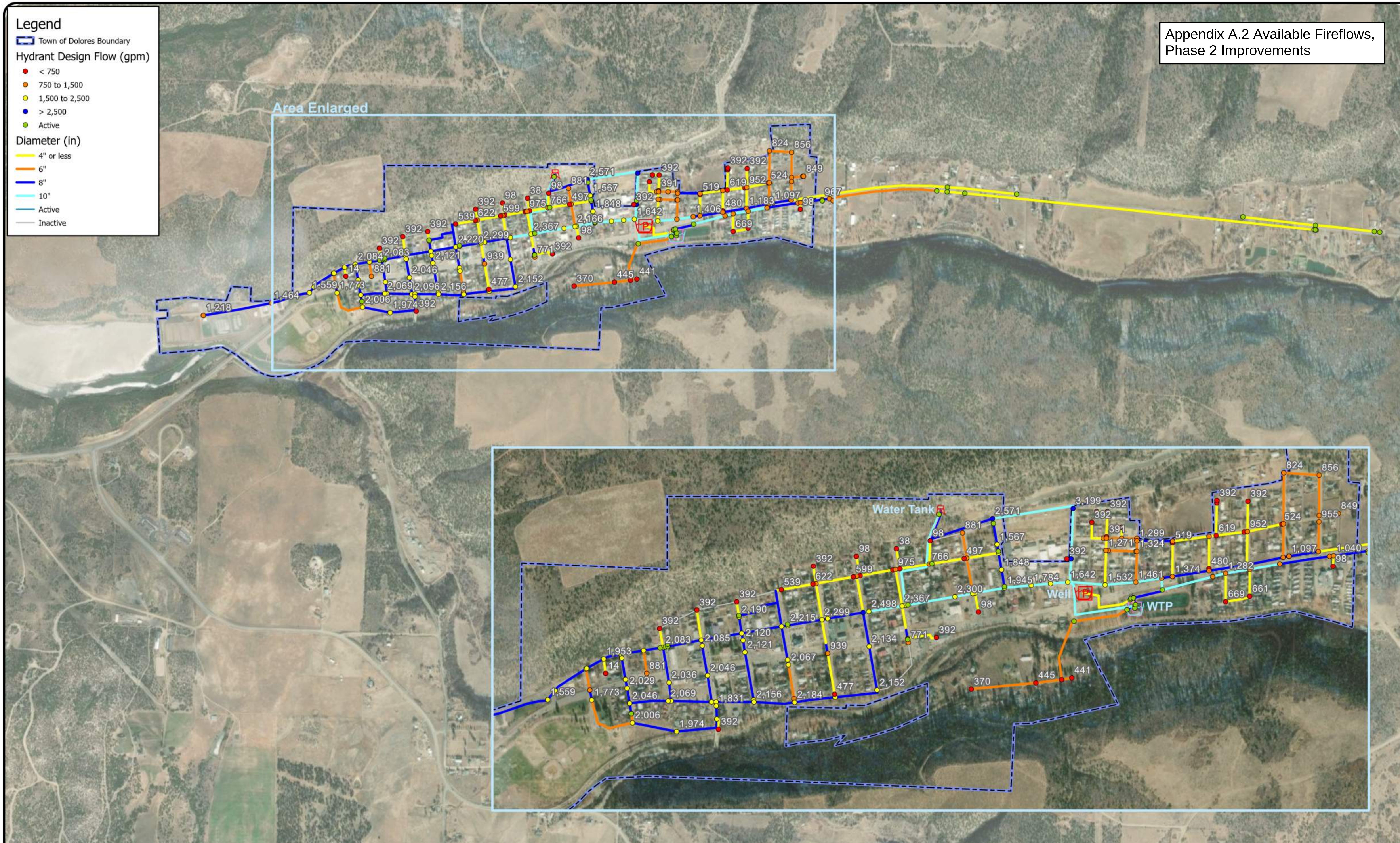

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Data Sources:			As-builts	Page:	
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Town of Dolores

Available Fire Flows: Phase 2 Improvements

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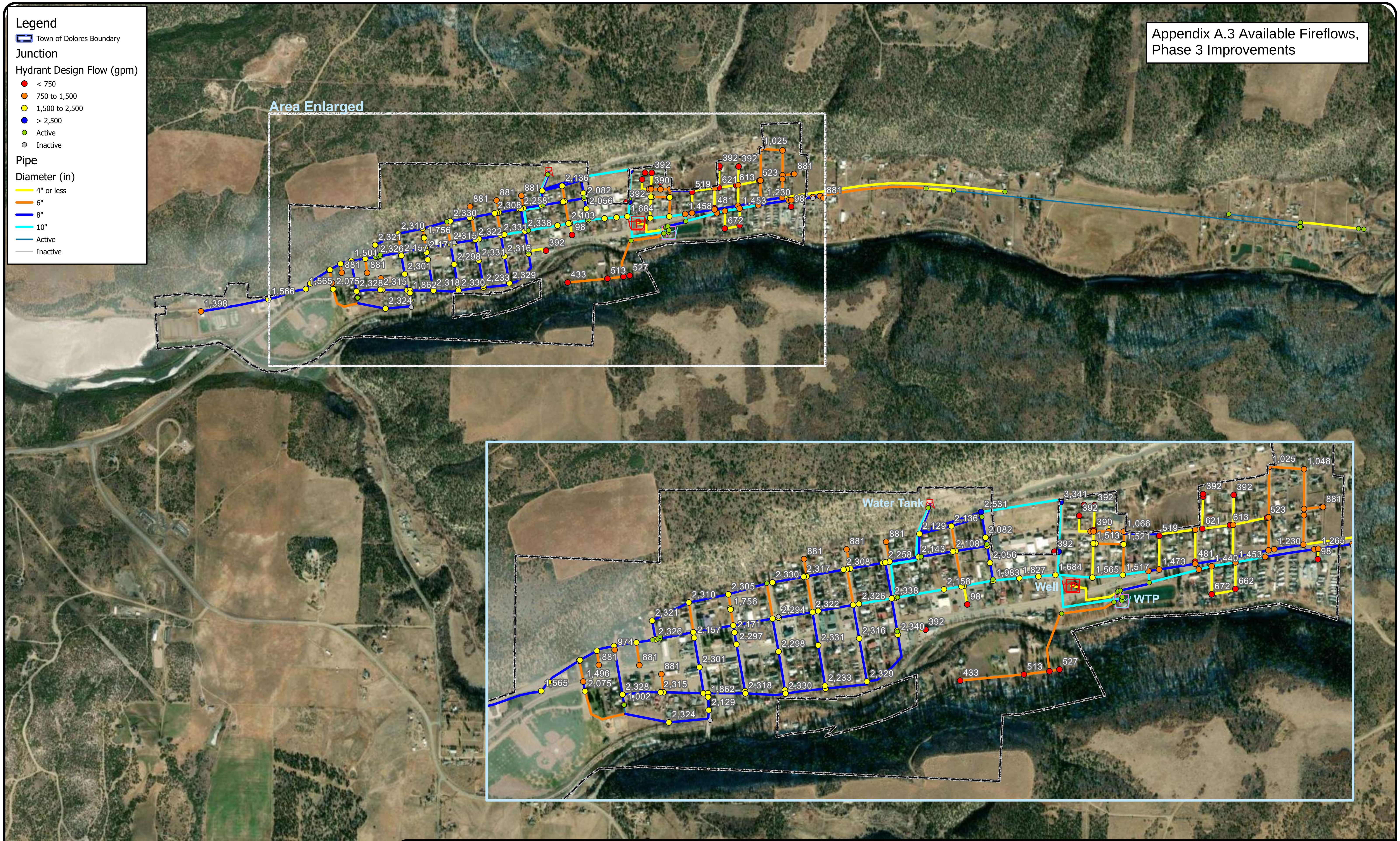

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Town of Dolores

Available Fire Flows: Phase 3 Looping and Upsizing

Date: 06/14/2022	Job No. 2017-387.003	Map by: SF	
Coordinate System:		Projection:	
Data Sources: As-builts		Page: XX/XX/XXXX	
File: I:\2015\2015-373-TownOfVail\001-StormWaterMap\H-Dwgs\GIS\MXDs\Mapbooks\Vail_SW_Mapbook_Overview_042715.mxd			
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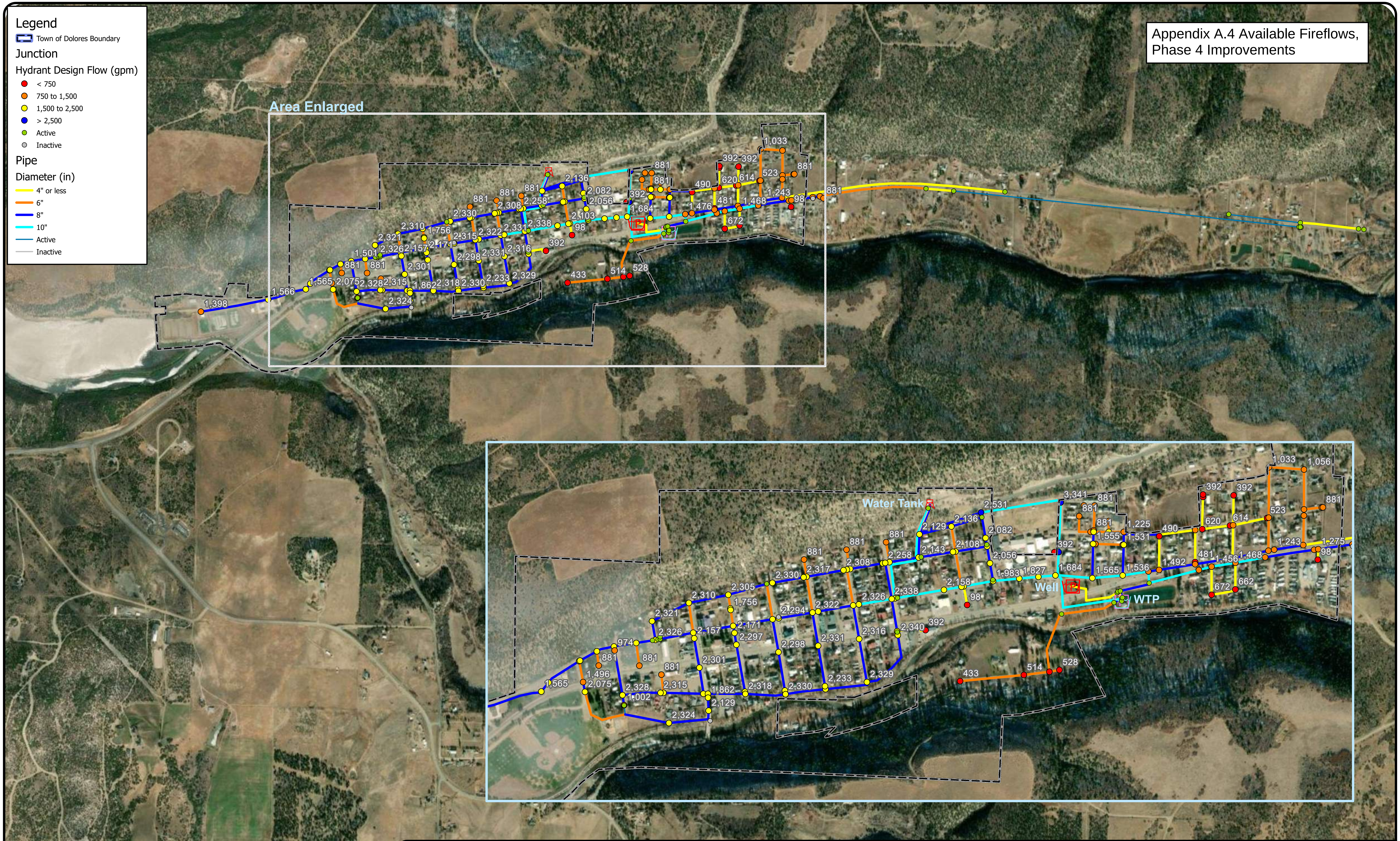

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Town of Dolores

Available Fire Flows: Phase 4 Upsizing

Date: 06/14/2022	Job No. 2017-387.003	Map by:	SF
Coordinate System:		Projection:	
Data Sources:	As-builts	Page:	XX/XX/XXXX
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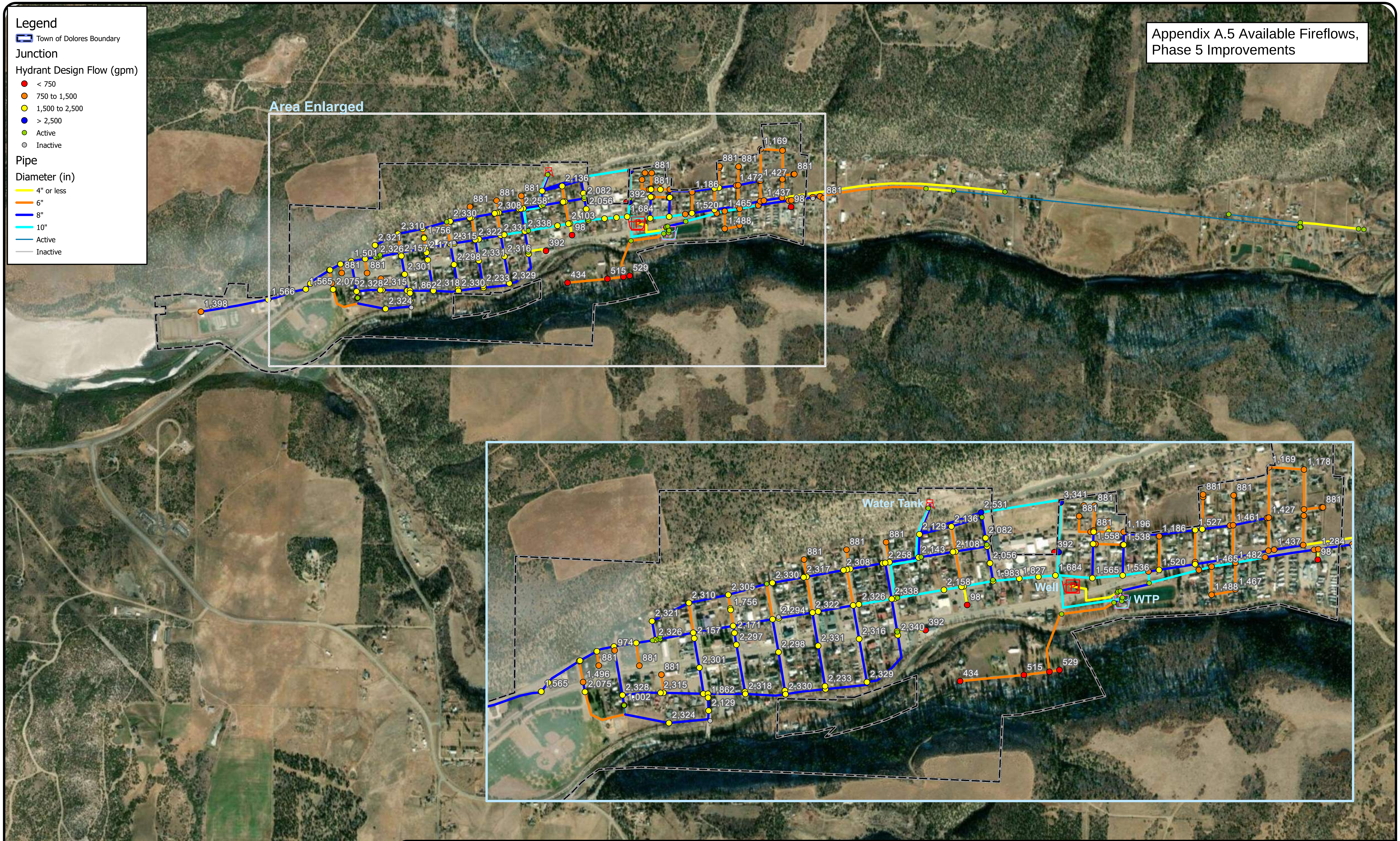
The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

Appendix A.5 Available Fireflows, Phase 5 Improvements



SGM 118 W. Sixth St., Suite 200 Glenwood Springs, CO 81601 970.945.1004 www.sgm-inc.com	Town of Dolores Available Fire Flows: Phase 5 Upsizing

Date: 06/14/2022	Job No. 2017-387.003	Map by: SF	
Coordinate System:		Projection:	
Data Sources: As-builts		Page: XX/XX/XXXX	
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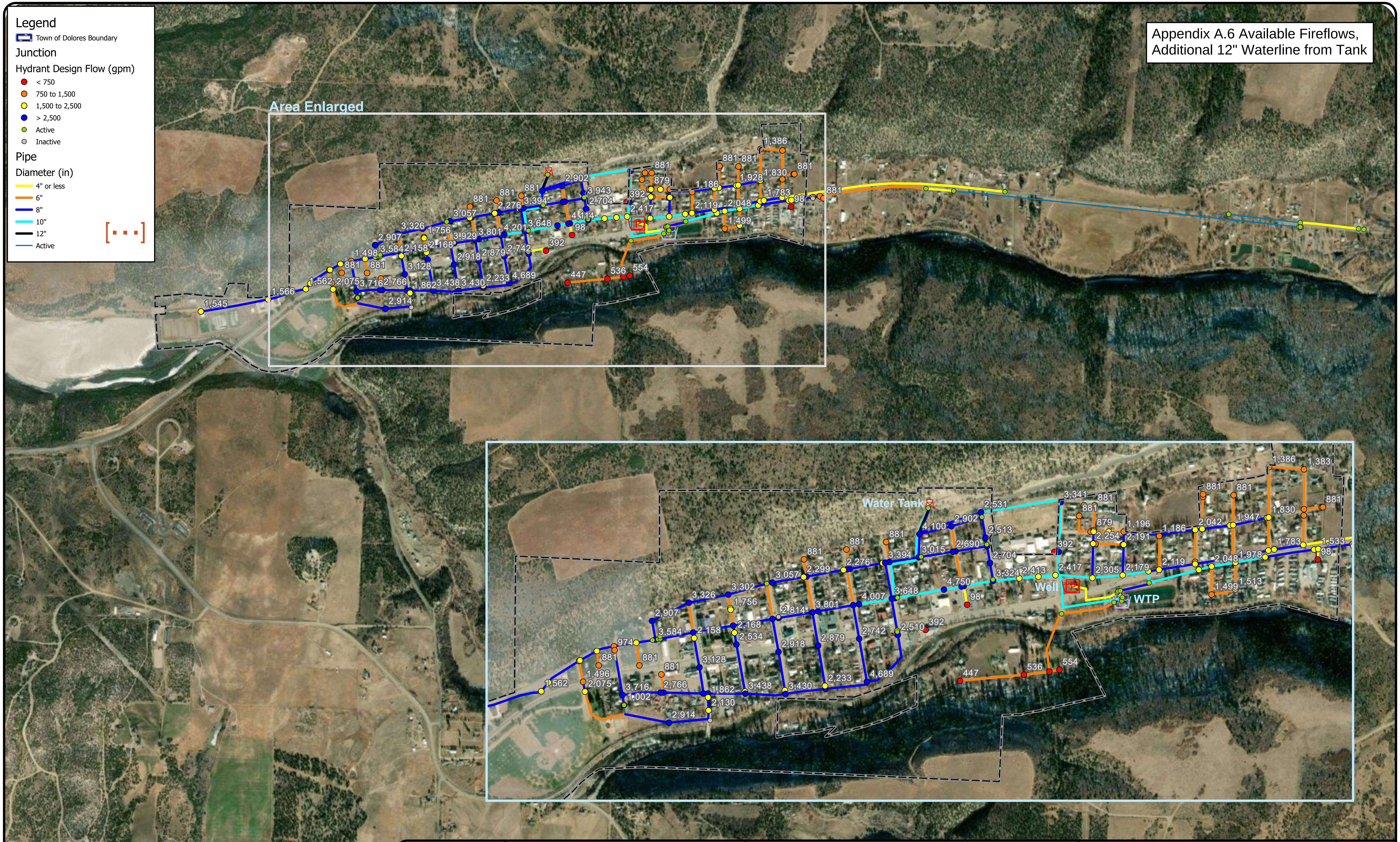

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118 W. Sixth St., Suite 200
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Town of Dolores

Available Fire Flows: Add'l 12" Line from Tank

Date: 06/14/2022	Job No. 2017-387.003	Map by: SF	
Coordinate System:		Projection:	
Data Sources: As-builts		Page: XX/XX/XXXX	
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The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.			

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Appendix B. Engineer's Opinion of Probable Construction Costs

B.1: Tank Site Alternative 1

B.2: Tank Site Alternative 2

B.3: Tank Site Alternative 3

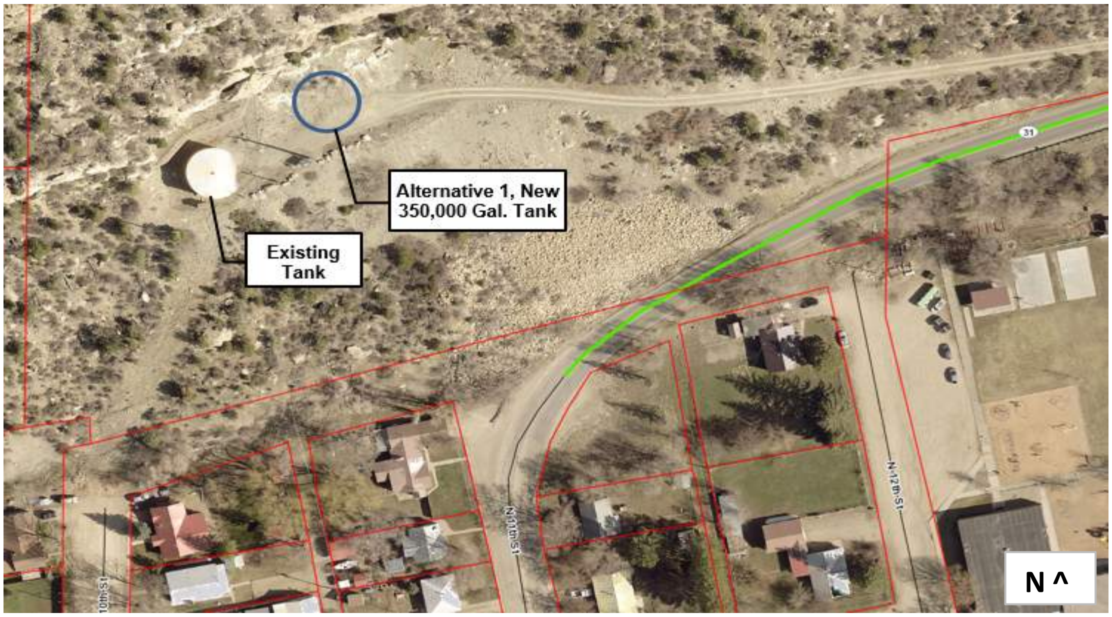
B.4: Tank Site Alternative 4

B.5: Tank Site Alternative 5

B.6: Phase 2 Water Distribution System Improvements

Town of Dolores

Tank Site Alternative 1 Engineer's Opinion of Probable Construction Costs
Prepared by: Scott Forrester, PE
Date: September 2, 2022



Tank Site Alternative 1: Existing Tank Site

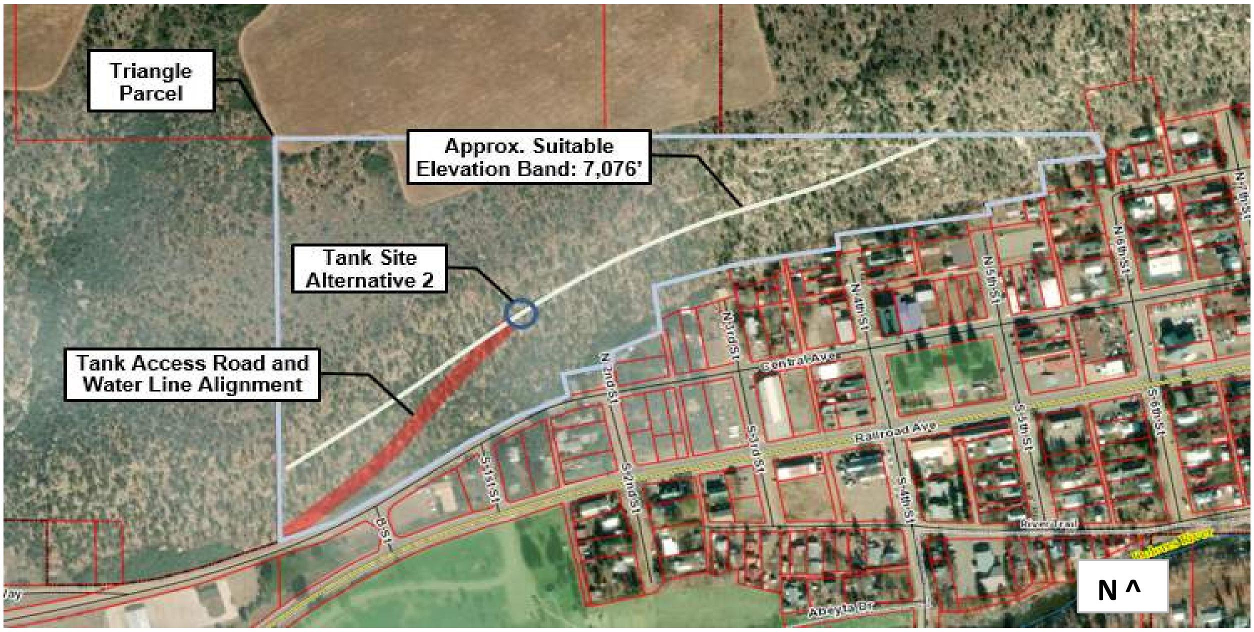
Mobilization (10%)	1	LS	10%	$141,000.00
Erosion Control	1	LS	$5,000.00	$5,000.00
Site Grading	650	SY	$40.00	$26,000.00
Rockfall Mitigation	1	LS	$50,000.00	$50,000.00
Unclassified Excavation	1500	CY	$40.00	$60,000.00
Structural Fill (Class 6)	225	SY	$45.00	$11,000.00
Soil Nail Wall	1	LS	$200,000.00	$200,000.00
0.35 MG Welded Steel Tank	1	LS	$800,000.00	$800,000.00
Cathodic Protection	1	LS	$15,000.00	$15,000.00
Site Work (Piping, valving, etc.)	1	LS	$100,000.00	$100,000.00
12" DIP Water Line	400	LF	$350.00	$140,000.00
			Sub Total	$1,548,000.00

Design Engineering				$70,000.00
Survey				$20,000.00
Construction Engineering				$50,000.00
Construction Contingency	20.0%			$310,000.00
			Total Cost	$1,998,000.00

AACE Class 4 Construction Cost Ranges =	**-15%**	**$1,698,300.00**
	30%	**$2,597,400.00**

Town of Dolores

Tank Site Alternative 2 Engineer's Opinion of Probable Construction Costs
Prepared by: Scott Forrester, PE
Date: September 2, 2022



Tank Site Alternative 2: Triangle Parcel

Mobilization (10%)	1	LS	10%	$175,000.00
Erosion Control	1	LS	$10,000.00	$10,000.00
Road Grading	2000	SY	$75.00	$150,000.00
Rockfall Mitigation	1	LS	$100,000.00	$100,000.00
Site Grading	650	SY	$40.00	$26,000.00
Unclassified Excavation	1500	CY	$40.00	$60,000.00
Structural Fill (Class 6)	225	SY	$45.00	$11,000.00
Soil Nail Wall	1	LS	$200,000.00	$200,000.00
0.35 MG Welded Steel Tank	1	LS	$800,000.00	$800,000.00
Cathodic Protection	1	LS	$15,000.00	$15,000.00
Site Work (Piping, valving, etc.)	1	LS	$25,000.00	$25,000.00
12" DIP Water Line	1000	LF	$350.00	$350,000.00
			Sub Total	$1,922,000.00

Design Engineering				$80,000.00
Survey				$20,000.00
Construction Engineering				$50,000.00
Construction Contingency	20.0%			$385,000.00
			Total Cost	$2,457,000.00

AACE Class 4 Construction Cost Ranges =	**-15%**	**$2,088,450.00**
	30%	**$3,194,100.00**

Town of Dolores

Tank Site Alternative 3 Engineer's Opinion of Probable Construction Costs
Prepared by: Scott Forrester, PE
Date: September 2, 2022

Tank Site Alternative 3: CR31 Parcel

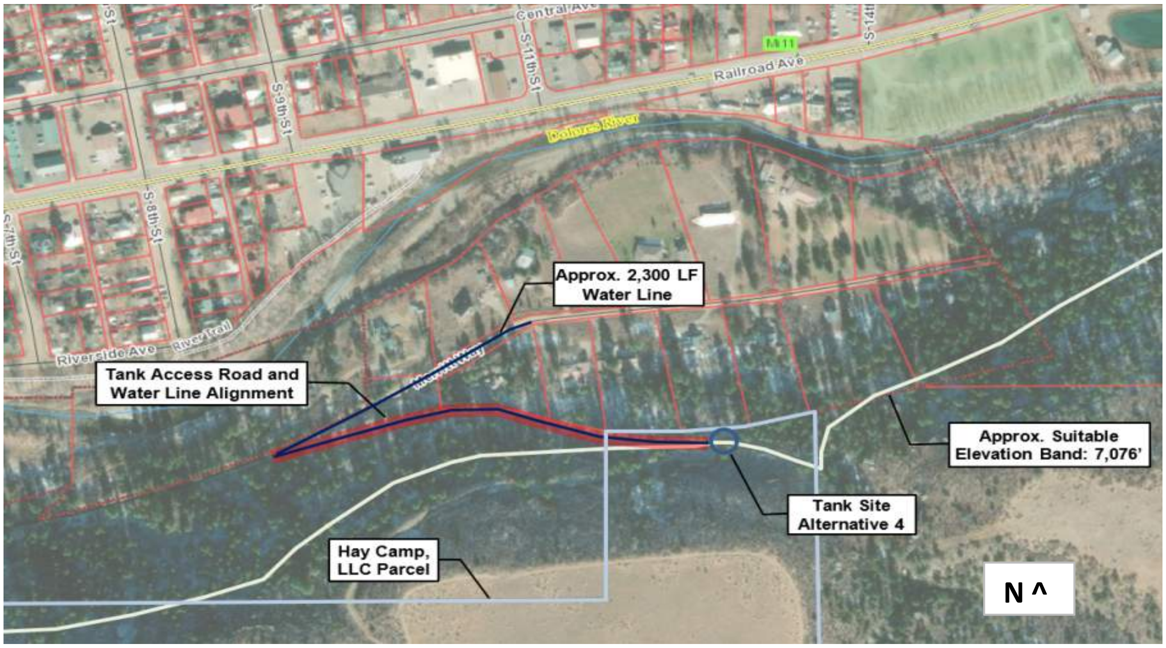
Mobilization (10%)	1	LS	10%	$264,000.00
Erosion Control	1	LS	$10,000.00	$10,000.00
Road Grading	285	SY	$75.00	$22,000.00
Drainage Culvert	1	LS	$5,000.00	$5,000.00
Rockfall Mitigation	1	LS	$50,000.00	$50,000.00
Site Grading (Tank)	650	SY	$40.00	$26,000.00
Unclassified Excavation	1500	CY	$40.00	$60,000.00
Structural Fill (Class 6)	225	SY	$45.00	$11,000.00
Soil Nail Wall	1	LS	$200,000.00	$200,000.00
0.35 MG Welded Steel Tank	1	LS	$800,000.00	$800,000.00
Cathodic Protection	1	LS	$15,000.00	$15,000.00
Site Work (Piping, valving, etc.)	1	LS	$25,000.00	$25,000.00
12" DIP Water Line	1650	LF	$350.00	$578,000.00
Tie In to Distribution System	2	LS	$5,000.00	$10,000.00
Asphalt Remove & Replace	1800	SY	$55.00	$99,000.00
Site Grading (BPS)	100	SY	$40.00	$4,000.00
Excavation	50	CY	$40.00	$2,000.00
CMU Structure, S-O-G	1	LS	$250,000.00	$250,000.00
Booster Pumps	2	EA	$52,500.00	$105,000.00
Process Piping	1	LS	$200,000.00	$200,000.00
Electrical and Controls	1	LS	$100,000.00	$100,000.00
HVAC	1	LS	$60,000.00	$60,000.00
			Sub Total	$2,896,000.00

Design Engineering				$115,000.00
Survey				$20,000.00
Construction Engineering				$65,000.00
Construction Contingency	20.0%			$580,000.00
			Total Cost	$3,676,000.00

AACE Class 4 Construction Cost Ranges =	**-15%**	**$3,124,600.00**
	30%	**$4,778,800.00**

Town of Dolores

Tank Site Alternative 4 Engineer's Opinion of Probable Construction Costs
Prepared by: Scott Forrester, PE
Date: November 9, 2022



Tank Site Alternative 4: Across the Dolores River

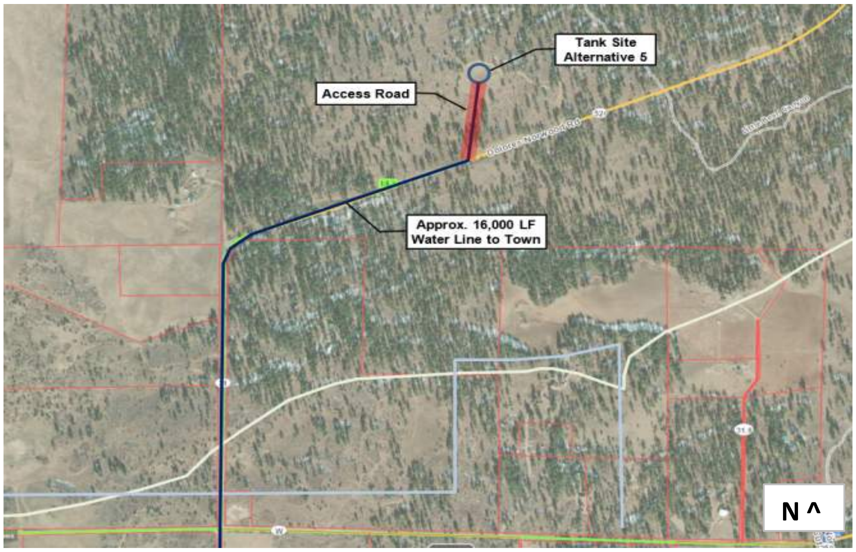
Mobilization (10%)	1	LS	10%	$254,000.00
Erosion Control	1	LS	$10,000.00	$10,000.00
Road Grading	615	SY	$50.00	$31,000.00
Rockfall Mitigation	1	LS	$50,000.00	$50,000.00
Site Grading (Tank)	650	SY	$40.00	$26,000.00
Unclassified Excavation	1500	CY	$40.00	$60,000.00
Structural Fill (Class 6)	225	SY	$45.00	$11,000.00
0.35 MG Welded Steel Tank	1	LS	$800,000.00	$800,000.00
Cathodic Protection	1	LS	$15,000.00	$15,000.00
Site Work (Piping, valving, etc.)	1	LS	$25,000.00	$25,000.00
12" DIP Water Line	2300	LF	$350.00	$805,000.00
Upsize Merritt Way Water Line	2000	LF	$350.00	$700,000.00
Tie In to Distribution System	1	LS	$5,000.00	$5,000.00
			Sub Total	$2,792,000.00

Design Engineering				$120,000.00
Survey				$40,000.00
Construction Engineering				$65,000.00
Construction Contingency	20.0%			$559,000.00
			Total Cost	$3,576,000.00

AACE Class 4 Construction Cost Ranges =	**-15%**	**$3,039,600.00**
	30%	**$4,648,800.00**

Town of Dolores

Tank Site Alternative 5 Engineer's Opinion of Probable Construction Costs
Prepared by: Scott Forrester, PE
Date: November 9, 2022



Tank Site Alternative 5: Boggy Draw

Mobilization (10%)	1	LS	10%	$829,000.00
Erosion Control	1	LS	$10,000.00	$10,000.00
Road Grading	375	SY	$75.00	$29,000.00
Site Grading (Tank)	650	SY	$40.00	$26,000.00
Unclassified Excavation	1500	CY	$40.00	$60,000.00
Structural Fill (Class 6)	225	SY	$45.00	$11,000.00
0.35 MG Welded Steel Tank	1	LS	$800,000.00	$800,000.00
Cathodic Protection	1	LS	$15,000.00	$15,000.00
Site Work (Piping, valving, etc.)	1	LS	$25,000.00	$25,000.00
12" DIP Water Line	16000	LF	$350.00	$5,600,000.00
Tie In to Distribution System	1	LS	$5,000.00	$5,000.00
Asphalt Remove & Replace	4745	SY	$55.00	$261,000.00
Site Grading (BPS)	200	SY	$40.00	$8,000.00
Excavation	100	CY	$40.00	$4,000.00
CMU Structure, S-O-G	2	LS	$250,000.00	$500,000.00
Booster Pumps	4	EA	$52,500.00	$210,000.00
Process Piping	2	LS	$200,000.00	$400,000.00
Electrical and Controls	2	LS	$100,000.00	$200,000.00
HVAC	2	LS	$60,000.00	$120,000.00
			Sub Total	$9,113,000.00

Design Engineering				$120,000.00
Survey				$40,000.00
Construction Engineering				$75,000.00
Construction Contingency	20.0%			$1,823,000.00

Total Cost	$11,171,000.00

AACE Class 4 Construction Cost Ranges =

-15%	**$9,495,350.00**
30%	**$14,522,300.00**

Town of Dolores

Engineer's Opinion of Probable Costs
EOPC Level: Planning
Prepared by: Catherine Carella, PE
Date: August 2, 2023

Ph. 2 Waterline Upgrades
Alternative 1: Water Dock to 6th Street

Item Description	Unit	Quantity	Unit Cost	Estimated Costs
Mobilization (10%)	1	LS	10%	$289,000.00
Construction Staking	1	LS	0.5%	$15,000.00
Erosion Control/Stormwater Management	150	DAY	$100.00	$15,000.00
Traffic Control Management & Devices	150	DAY	$100.00	$15,000.00
6” Fire Hydrant Assembly incl. GV and feed line	28	EA	$10,000.00	$280,000.00
8" PVC C900 Dr14 Water Line, Fittings, and Gate Valves incl. Tracer Wire, Bedding, Cl. 6 Backfill, Min. 5-ft Cover	10,292	LF	$215.00	$2,212,780.00
3/4" HDPE Pure Core Water Service Lines. Incl. tracer wire, boring under sidewalks, Min. 3-ft cover, Assumes 30 LF per service connection.	4020	LF	$60.00	$241,200.00
Reconnect Existing 3/4" Services to New Main includes 3/4" Saddle Tap	134	EA	$400.00	$53,600.00
Connection to Existing Waterline. Includes water shutoff coordination, cut and abandon existing main, fittings to connect to existing system.	6	EA	$6,000.00	$36,000.00
Cross Over/Under Existing Sanitary Sewer or Storm Sewer within 18-In., Assume 3 CY Flow fill	14	EA	$1,500.00	$21,000.00
Gravel Replace 3" Depth	8,800	SY	$10.00	$88,000.00
Asphalt Replace 3" Depth	860	TON	$300.00	$258,000.00
Landscape Restoration (Backfill, Seed, Sod)	150	SY	$48.00	$7,200.00
			Sub Total	$3,531,780.00

Planning, Subsurface Utility Engineering, Design Engineering			10.0%	$353,178.00
Survey, Easements, Legal			2.0%	$70,635.60
Construction Engineering			2.0%	$70,635.60
Construction Contingency			18.0%	$635,720.40
			Total Cost	$4,661,949.60

NOTES:

1. Unit prices used in developing this EOPC were based on recent, local projects by SGM.

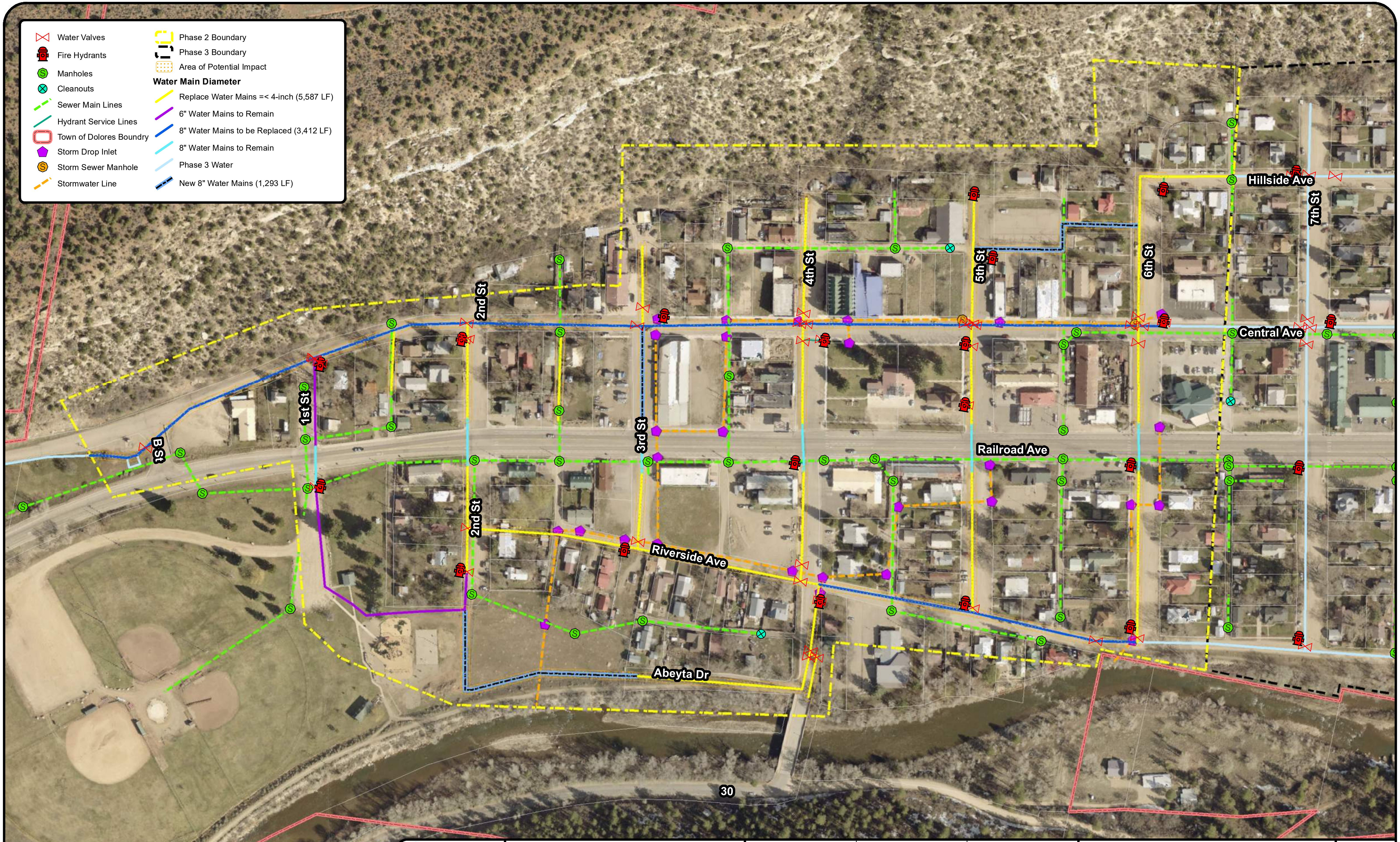
2. Contingency budget is for unanticipated costs during construction. Contingency is intentionally set high because this is a planning level cost estimate.

3. Unit prices and total costs were based on Present Value dollars, assuming project will occur in 2024. Adjustments should be made for years beyond this calendar year if actual construction occurs in a later year.

4. This EOPC was prepared on the basis of SGM’s experience and qualifications and represents SGM's judgment as a professional generally familiar with the industry. However, since SGM has no control over the cost of labor, materials, equipment, or services furnished by others, over contractor’s methods of determining prices, or over competitive bidding or market conditions, SGM cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from SGM's EOPC.

Appendix C. Ph. 2 Distribution Improvements Map

C.1: Phase 2 Water Distribution System Improvements Conceptual Plan and Quantities



SGM
118 W. Sixth St., Suite 200
Glenwood Springs, CO 81601
970.945.1004
www.sgm-inc.com

Town of Dolores
Phase 2 Water System Improvements

Date: 06/06/2023	Job No. 2017-387.003 Ph. 04	Map by: S.Kirk	
Data Sources: Town of Dolores, SGM Inc, Montezuma Co, CDOT, Esri			
File: J:\Projects_Replica\2017\2017-387-TownofDolores\001-CapitalImprv\H-Dwgs\GIS\MXDs\Dolores_Phase2_230316_NickT.mxd			
The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.			

0 200 400 Feet
1 inch = 200 feet