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SPL-W-13-01

# PRELIMINARY ENGINEERING REPORT

FOR

SPIRIT LAKE EAST FIRE FLOW ANALYSIS

SUBMITTED TO

[REDACTED]

JUNE 2014

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IDAHO PUBLIC  
UTILITIES COMMISSION

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## SPIRIT LAKE EAST FIRE FLOW ANALYSIS

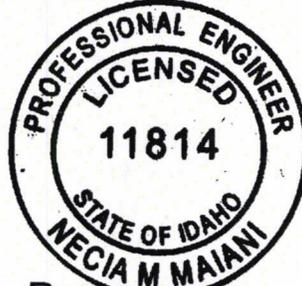
PROJECT NO. 41177

SUBMITTED TO:

**WATER WORKS, INC.**

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# 1. EXECUTIVE SUMMARY

Spirit Lake East Water System currently does not provide fire flow protection for its existing water system. An evaluation of the existing system was conducted to determine the required upgrades for the system necessary to provide fire suppression. Based on the recommended fire flow for the system which was provided by Spirit Lake Fire District<sup>1</sup>, the system was found to be deficient in source capacity, pressure distribution, storage requirements and minimum pipe diameter for hydrant placement when analyzed using Idaho Department of Environmental Quality (IDEQ) requirements for systems designed to provide fire flow.

In order for the system to provide the recommended fire flow, the following system improvements would be required:

## Source

- One (1) additional production well producing 500 gallons/minute (gpm) at 600 feet total dynamic head (TDH)<sup>2</sup>.

## Boosters

A total of four (4) 25-horsepower boosters, 500 gpm each at 125 feet TDH (TDH), replacing the existing two (2) 10-horsepower booster pumps

## Storage

- An additional 23,750 gallons of storage

## Distribution: Replacement of existing water mains (See attached map)

- 6-inch pipe: 12,420 lineal feet
- 8-inch pipe: 41,090 lineal feet
- 10-inch pipe: 4,255 lineal feet
- Hydrants: 54

The total cost of system replacement and upgrades is estimated to be \$5,833,700.

# 2. NEED/OBJECTIVE

## 2.1. PURPOSE

The purpose of this plan is to evaluate the existing water system's ability to provide fire suppression for the Spirit Lake East Subdivision.

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<sup>1</sup> Wayne Nowacki, Fire Marshal and John DeBernardi, Fire Chief were consulted in regards to required fire flow for the Spirit Lake East Development.

<sup>2</sup> Due to substantial modification to the water system, IDEQ requires two production wells for public water systems. IDEQ should be consulted in determining if this requirement could be waived. A savings of an estimated \$354,000 could be saved without the additional well costs.

## 2.2. SCOPE

This analysis is generally prepared following the requirements of IDAPA 58.01.08 Idaho Rules for Public Drinking Water System as well as guidance within the Washington State Department of Health (WSDOH) Water System Design Manual. This plan will include the following topics:

- Projected Growth
  - This project is evaluated at complete buildout of 366 Equivalent Resident (ER)
- Water System Demands
  - Since historical flow data is not available, demands were determined using design guidelines from WSDOH, Water System Design Manual, IDEQ and Spirit Lake Fire District requirements
- Source
  - Review of existing pump capacities and status.
- Storage
  - Evaluate existing storage capacity.
- Distribution System
  - Evaluate existing system capacity.
- Hydraulic Model
  - Modeling based on current capacities and future requirements

## 3. EXISTING SYSTEM

### 3.1. OWNERSHIP AND MANAGEMENT

The Spirit Lake East water system is currently owned and operated by Leslie Abrams, with Water Works, Inc. The system has been in operation since the late 1970's.

### 3.2. DESCRIPTION OF WATER SYSTEM

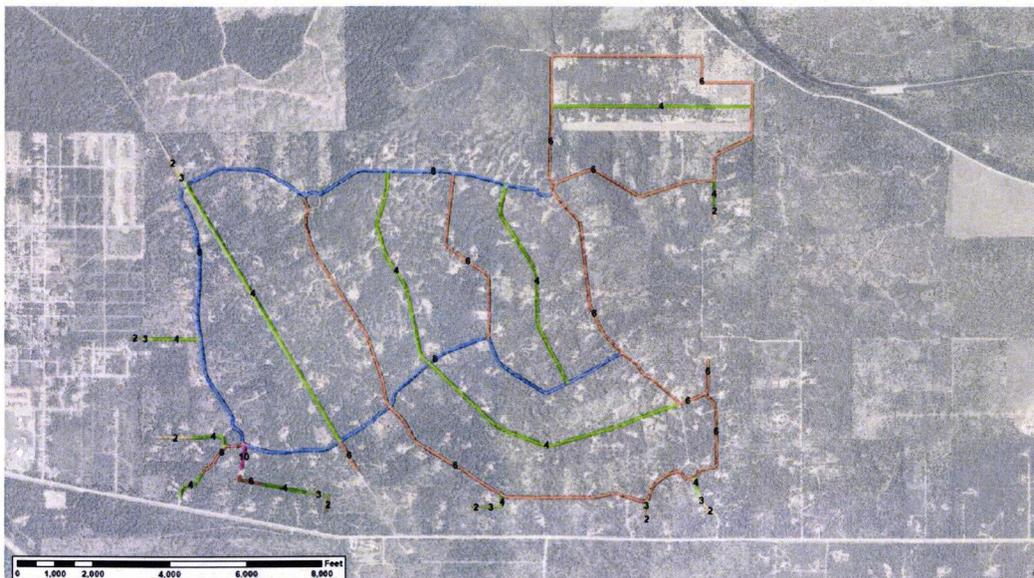
The Spirit Lake East Water System is located in Township 53 North, Range 4 West, Section 2, 3, 4, 9, 10 and 11 in Kootenai County. The water system also serves a small development in Township 54 North, Range 4 West, Section 35 in Bonner County. The system is projected to service 366 residential connections at complete buildout and is currently servicing approximately 293 connections. Figure 3-1 below illustrates the extent of the boundary of Spirit Lake East Development.

Figure 3-1: Spirit Lake East Development



The existing water system is comprised of one (1) 192,400 gallon concrete storage tank, one (1) 100-horsepower submersible pump, three (3) booster pumps, a 175 kilowatt Caterpillar standby generator and 126,585 lineal feet of piping. Figure 3-2 below illustrates the extent of the distribution lines of Spirit Lake East Development.

Figure 3-2: Existing Conditions



**3.2.1. STORAGE**

There is currently one storage tank that is serving the Spirit Lake East Development. The storage tank is located within the southwest corner of the development and was constructed in 1979. The concrete tank is 50 feet in diameter with a total depth of 13.1 feet. The tank has had only one known deficiency within its life time. It was documented to be leaking at a level approximately 5.5 feet below the overflow, limiting the capacity to 112,000 gallons. To remedy the leak, the tank is patched annually and is assumed to operate at its design volume of 192,400 gallons. Table 3-1 below summarizes the characteristics of the storage tank.

Table 3-1: Storage Tank

Tank	Date Constructed	Material	Type	Diameter (ft.)	Depth (ft.)	Usable Volume (gallons)
Spirit Lake East	1979	Concrete	Above Ground	50	13.1	192,400

**3.2.2. PUMP/BOOSTERS**

Spirit Lake East receives water from the Spokane Valley - Rathdrum Prairie Aquifer via a single 100 horsepower submersible well pump. According to the original well log from 1974, the well casing is steel ranging from 16 inches to 20 inches in diameter. The well is approximately 600 feet in depth with a static water level of 558 feet. The well casing was perforated by a Mills knife from 572 through 597 feet with a total of 357 perforations that are approximately 2.5 inches by 0.5 inch in size. The well was unscreened and was not gravel packed.

The pump required replacement in September 2004 and again in June 2013. The problems that led to the pump malfunctioning were never diagnosed. Well sanding has been an issue in the past, according to a 1987 IDEQ report. The report indicated that the well was redeveloped in 1987, but never screened (Welch Comer & Associates, Inc.). Table 3-2 below illustrates the characteristics of the well pump.

Table 3-2: Well Pump

Source	Year Established	Well Diameter (inch)	Motor (Horsepower)	Year Installed	Current Source Capacity (gpm)	Backup Power Supply	Water Source Elevation (ft.)
Well #1	1974	16 - 20	100	2004	480	175 kw Generator	558

Spirit Lake East water system includes three booster pumps that operate on variable frequency drive (VFD) motors. The pumps consist of two (2) 10-horsepower

Berkeley booster pumps and one (1) 25-horsepower Peerless booster pump, which are controlled by pressure switches. The booster pumps draw water from the bottom of the storage tank and pressurize the system. Table 3-3 below illustrates the characteristics of the booster pump system.

Table 3-3: Booster Pumps

Type	Motor (Horsepower)	Number of Pumps	Operating Point	Intake Pressure	Bypass	Generator
Berkeley B2 1/2 TPMS	10	2	250 gpm at 60 psi	~9 psi	No	Yes
Peerless Series C, 830A	25	1	500 gpm at 60 psi	~9 psi	No	Yes

### 3.2.3. PIPING

There is an estimated 126,585 lineal feet of pipe within the Spirit Lake East Water System, comprised of galvanized, PVC and steel. The piping ranges in size from 1 inch to 12 inches in diameter. A majority of the piping consists of Class 160 PVC that was installed prior to 1985. With proper installation Class 160 PVC piping has an expected design life of 60 years. Improper installation (i.e. poor bedding, etc.) can greatly reduce the expected life to less than 20 years. Throughout the life of the system there has been periodic leaks/breaks within the main line and services. However, leaks are difficult to locate due to the granular soil conditions of the service area (Welch Comer & Associates, Inc.). Table 3-4 below summarized the size and piping material within the water system.

Table 3-4: Existing Piping

Size (inches)	(Lineal feet)			
	Galvanized	PVC	Steel	Total
1	495	-	-	495
2	-	2,862	-	2,862
2.5	8	-	-	8
3	-	3,897	-	3,897
4	16	37,202	-	37,218
6	8	56,736	-	56,744
8	-	22,638	-	22,638
10	-	2,698	-	2,698
12	-	-	25	25
<b>Total</b>	<b>527</b>	<b>126,033</b>	<b>25</b>	<b>126,585</b>

### 3.2.4. GENERAL CONDITIONS

The condition of the existing waterlines are unknown. In 2004 Welch Comer Engineers recommended that the condition of the existing pipes and estimated loss be verified and remedied, if required. Information provided by the system's owner and operator, Leslie Abrams, indicated that leak detection has been completed on the system since 2004. It was estimated that the system experiences an overall loss of 8%. Leaks were found to be located on the connection point of the service and main line and were repaired.

## 4. ANALYSIS ASSUMPTIONS

### 4.1. ASSUMPTIONS

Since an accurate measure of historical well data is not available for the Spirit Lake East water system, it will be assumed that approximately 15% of total well production is lost and the system will be evaluated at complete buildout of 366 connections.

The analysis of the system's capacity will be based on values provided in Welch Comer Engineer's 2004 report, the following assumptions were made:

- 1 connection or ER = 430 gallons/day (gpd)
- The estimated ER value assumes a 15% loss

### 4.2. DEMAND AND PLANNING

There are three demands that are required to be calculated, Average Day Demand, Maximum Day Demand and Peak Hour Demand. The following definitions were taken from the WSDOH, December 2009 Water System Design Manual:

Average Day Demand (ADD) – The average gallons of water consumed per day per equivalent residential unit (ERU or ER) over the course of one year. For this report, ADD is equal to 430 gpd and was assumed based on the State of Idaho Technical Guidance Manual.

Maximum Day Demand (MDD) – The maximum amount of water estimated to be used over a period of one year. For this analysis a peak factor of four times the ADD will be used to estimate the MDD.  $MDD = 430 \times 4 = 1700$  gpd per ER.

Peak Hour Demand (PHD) – The maximum amount of water used over a period of one hour in one year. It was estimated using the WSDOH December 2009 Water System Design Manual equation for PHD for systems consisting of between 250 and 500 ER:

Eqn. 5-1: Determined PHD

$$PHD = (MDD/1440)*(C*N+F)+18$$

Where: PHD = 944 gpm, Peak Hour Demand (gallons per minute)  
C = 1.8, Coefficient Associated with Ranges of ER's; Table 5-1  
N = Number of ERU's (366)  
F = 125, Factor Associated with Ranges of ER's; Table 5-1  
MDD = 1700 gpd per ER

## 5. REQUIREMENTS

The IDEQ, IDAPA 58.01.08 Idaho Rules for Public Drinking Water System was used as reference for design requirements for required fire suppression. IDAPA 58.01.08 defines a public water system must meet the following requirements to provide fire flow from its system:

### 5.1. IDEQ: IDAPA 58.01.08 PUBLIC DRINKING WATER SYSTEMS

#### Section 003. Definitions

- 15. Components of Finished Water Storage
  - Dead Storage – Storage that is not available for use in the system.
  - Effective Storage – All storage other than dead storage.
  - Operational Storage – Storage supplies of water, when under normal conditions and sources are not operating consist of the larger of the following:
    - Volume required to prevent excess pump cycling and ensure volume of components are full and ready for use.
    - The volume needed to compensate for the sensitivity of the water level sensors.
  - Equalization Storage – Storage of finished water in sufficient quantity to compensate for the difference between a water system's maximum pumping capacity and peak hour demand.
  - Fire Suppression Storage – Water needed to support fire flow in systems that provide it.
  - Standby Storage – Storage that provides a measure of reliability or safety factor should sources fail or when unusual conditions

impose higher than anticipated demands. Normally used for emergency operation, if standby power is not provided.

## Section 550. Design Standards for Public Drinking Water Systems

- 06. Distribution System
  - In-line booster pumps shall maintain an operating pressure no less than 20 psi, and shall be supplied with automatic cutoff when pressure is equal to or less than 5 psi.
  - Fire hydrants shall not be installed on a line smaller than 6 inches in diameter, and fire hydrants shall not be installed unless fire flow is provided

## Section 552. Operating Criteria for Public Water Systems

- 01. Quantity and Pressure Requirements
  - During maximum hourly demand conditions (excluding fire flow) to maintain a minimum pressure of 20 psi within the system.
  - Any public water system designed to provide fire flows shall be designed to provide such flows in addition to maximum daily demand for all other uses combined.
  - A minimum pressure of 20 psi during all flow conditions.
  - Normal working pressure in a distribution system shall be at least 35 psi.

## 5.2. STORAGE

Under IDEQ requirements, storage is broken into two main categories: Dead Storage and Effective Storage. Dead storage is considered all storage that does not meet minimum supply requirements. Since the water system relies on booster pumps that draw water from the bottom of the storage tank to pressurize the system, the system is considered to be composed of all effective storage.

As defined above, effective storage consists of operational, equalization, fire suppression and standby storage. Each component of effective storage is described in greater detail below.

### 5.2.1. OPERATIONAL STORAGE

Operational storage is determined on the amount of allowable draw down that a tank operates before the well resupplies the tank to full capacity. The draw down depth was assumed to be 2 feet, making the operational storage equal to 29,400 gallons.

### 5.2.2. EQUALIZING STORAGE

Equalizing storage is the difference between the water systems maximum pumping capacity and peak hour demand for a duration of 150 minutes. The current water system produces 500 gpm from their sole producing well. The PHD was calculated at 945 gpm for a deficit of 445 gpm for the system or 66,750 gallons (445 gpm x 150 minutes = 66,750 gallons).

### 5.2.3. STANDBY STORAGE

Standby storage is intended for use during emergency conditions. If a system does not contain standby power, the system is required to provide water for 8 hours of operation at ADD. Since Spirit Lake East provides standby power<sup>3</sup>, they are exempt from this requirement.

### 5.2.4. FIRE SUPPRESSION STORAGE

Spirit Lake Fire District determined that the required fire flow is 1,000 gpm at 20 psi of pressure, for a 2 hour duration.

$$\text{Eqn. 9-4: FSS} \quad \text{FSS} = (\text{FF}) \cdot \text{Tm}$$

Where: FSS = Fire suppression storage  
FF = 1000 gpm, required flow rate  
Tm = 120 min, duration of flow rate

Based on IDEQ requirements, fire suppression storage is calculated at 120,000 gallons.

### 5.2.5. STORAGE CONCLUSION

In conclusion, the system is required to maintain the following storage requirements during fire suppression:

- Dead Storage – 0 gallons, tank is drawn from bottom and booster provide required pressure.
- Effective Storage:
  - Operational Storage – 29,400 gallons (2 ft. draw down)
  - Equalization Storage – 66,750 gallons (445 gpm for 150 minutes)
  - Standby Storage – 0 gallons (standby power is provided)
  - Fire Suppression Storage – 120,000 gallons (1,432 gpm for 120 minutes)

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<sup>3</sup> 175 KW caterpillar generator capable of operating the entire system during emergency conditions.

Total storage required is estimated at 216,150 gallons. The current system supplies 192,400 gallons, which is deficient by 23,750 gallons.

### **5.3.SOURCE**

Spirit Lake East relies on one (1) 100-horsepower submersible well capable of producing 500 gpm with 600 feet of TDH. IDEQ requires that, with the largest pump out of service, the system needs to be able to supply MDD of 1,700 gpd/ER or 432 gpm.

### **5.4.BOOSTERS**

IDEQ requires that, with the largest booster down, the system needs to be able to supply MDD plus fire flow or PHD for a 120 minute duration, whichever is greater.

MDD (432 gpm) plus fire flow (1000 gpm) is considered to be 1,432 gpm, while PHD was calculated at 944 gpm. With that being said, with the largest booster down, the system is required to supply 1,432 gpm for 120 minutes to the system.

## **6. ANALYSIS: STORAGE, WELL PUMP, BOOSTERS AND HYDRANT PLACEMENT**

### **6.1.STORAGE**

The system is required to provide total storage of 216,150 gallons to meet IDEQ requirements for fire flow. Currently the system provides 192,400 gallons for a deficit of 23,750 gallons.

### **6.2.WELL PUMP**

The system is comprised of a single well that produces 500 gpm. IDEQ requires the system to be evaluated to handle the MDD with the largest well out of service. The system is deficient to provide required pump capacity per IDEQ standards. To come into compliance, the system will be required to install an additional well that can supply a minimum of 432 gpm.

### **6.3.BOOSTER PUMPS**

The system is comprised of three booster pumps. IDEQ requires the system to meet MDD plus fire flow with the largest of the three boosters (25-horsepower) out of service. This leaves the system to operate with the two (2) 10-horsepower boosters in operation, with a maximum combined flow of 500 gpm. With the largest booster out of service the system is deficient by 932 gpm.

To be compliant, the system is required to provide a MDD (432 gpm) plus required fire flow (1,000 gpm) for a total flow of 1,432 gpm. The current booster system provides approximately 1,000 gpm between the two (2) 10-horsepower booster pumps at 250 gpm each and one (1) 25-horsepower booster at 500 gpm. Due to space

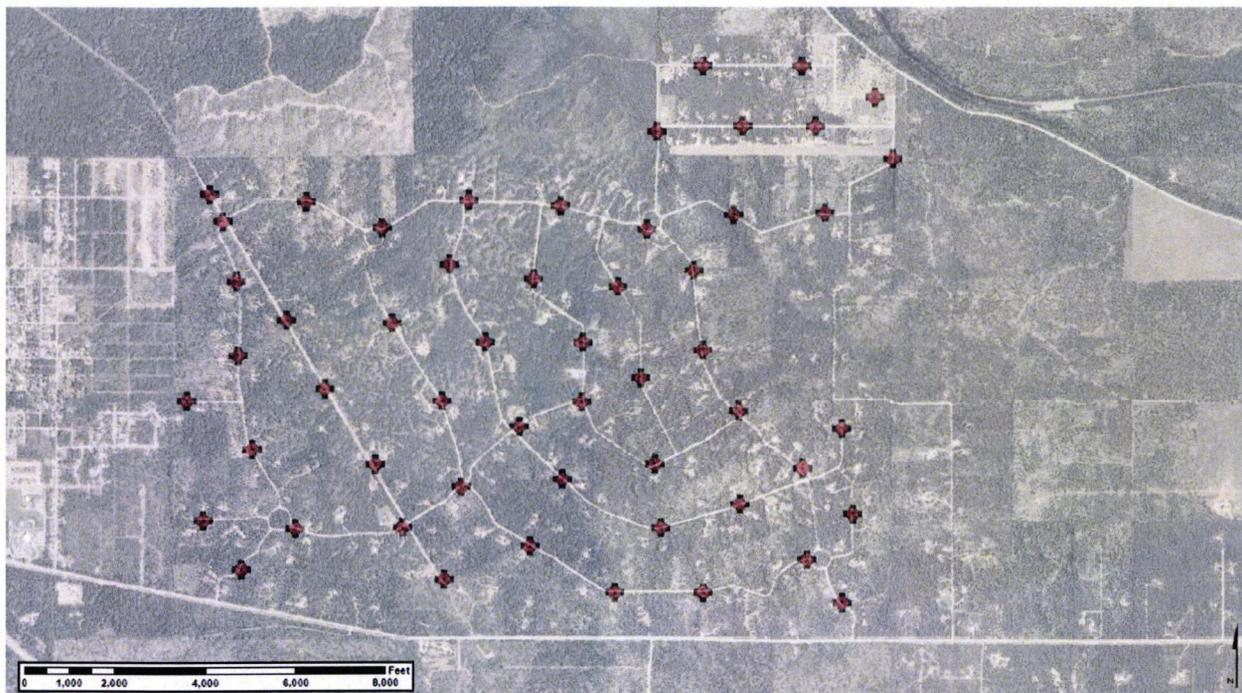
constraints within the pump house, it is recommended that the two (2) 10-horsepower booster pumps be upsized to two (2) 25-horsepower booster and add an additional 25-horsepower booster for a total of four (4), 25-horsepower boosters to achieve a minimum total flow of 1,432 gpm.

#### 6.4. HYDRANT PLACEMENT

Per conversations with Spirit Lake Fire District and IDEQ Public Drinking Water System requirements, the system is required to have fire hydrants located within 1,000 feet of residence and on 6-inch lines or larger.

To meet the requirements, approximately 54 hydrants will have to be installed within Spirit Lake East. Figure 6-1 below illustrates the location of the modeled hydrants.

Figure 6-1: Approximate Fire Hydrant Locations



#### 6.5. SCENARIOS

Fire flow analysis was modeled in four scenarios based on a steady state analysis and an extended period simulation (EPS). The steady state analysis placed the minimum fire flow requirements (1,000 gpm at a pressure of 20 psi) on each hydrant node. The model was used to evaluate the distribution lines contributing to the hydrants and determine if they were adequately sized to handle the increased flows. Once the distribution system was upgraded to meet the minimum flow requirements within steady state, an EPS was then conducted. The EPS was used to evaluate the

system as it would operate under normal conditions, calculating the draw down from the tanks as they supplied water to the system through the booster pumps.

Within all four scenarios modeled, a total of 19 hydrants were placed in representative locations within the distribution system. Representative locations were selected based on distance from sources and elevation. Figure 6-2 below illustrates the location of all hydrants placed within the analysis.

Figure 6-2: Analysis Hydrants



### 6.5.1. SCENARIO 1

Scenario 1 consisted of modeling the existing lines within the system with the required upgraded booster pumps installed and operating. This scenario was conducted to establish baseline conditions for the distribution system.

Baseline conditions consist of providing the minimum storage and flow rate within the system. To meet the requirement the system was modeled in all four scenarios with the following characteristics:

- Flow Rate: MDD (504 gpm) plus fire flow (1,000 gpm)
- Three (3) 25-horsepower VFD booster pumps supplying 500 gpm at 150 ft. TDH
- One (1) 100-horsepower Well supplying 500 gpm at 600 ft. TDH
- One (1) storage tank

Once baseline conditions were established, it could be determined what required upgrades would be needed to the piping to establish the minimum flow and pressure requirements.

Upon completion of the analysis of Scenario 1, it was determined that the system was inadequate to provide the required fire flow. The data determined from Scenario 1 can be found within Appendix E.

#### *6.5.2. SCENARIO 2*

Scenario 2 consisted of replacing all lines within the system that were below the allowable fire hydrant connection size of 6 inches. The system was then evaluated with the same requirements as Scenario 1. The system was found to be inadequate to provide the required pressure and flow rate to all hydrants. The data determined from Scenario 2 can be found within Appendix F.

#### *6.5.3. SCENARIO 3*

Scenario 3 evaluated the same distribution system as Scenario 1 and 2, with the exception of increasing the line size from 6 inches to 8 inches.

A majority of the hydrants analyzed were meeting the required flow rates. Since the total system was not compliant, an additional scenario was conducted. The data determined from Scenario 3 can be found within Appendix G.

#### *6.5.4. SCENARIO 4*

Scenario 4 consisted of increasing the size of the distribution system to get the system to be compliant with all IDEQ fire flow requirements. As with other scenarios, the pipe replacement focused on the existing 4-inch main lines, then upsized additional lines as found necessary to meet compliance to IDEQ standards.

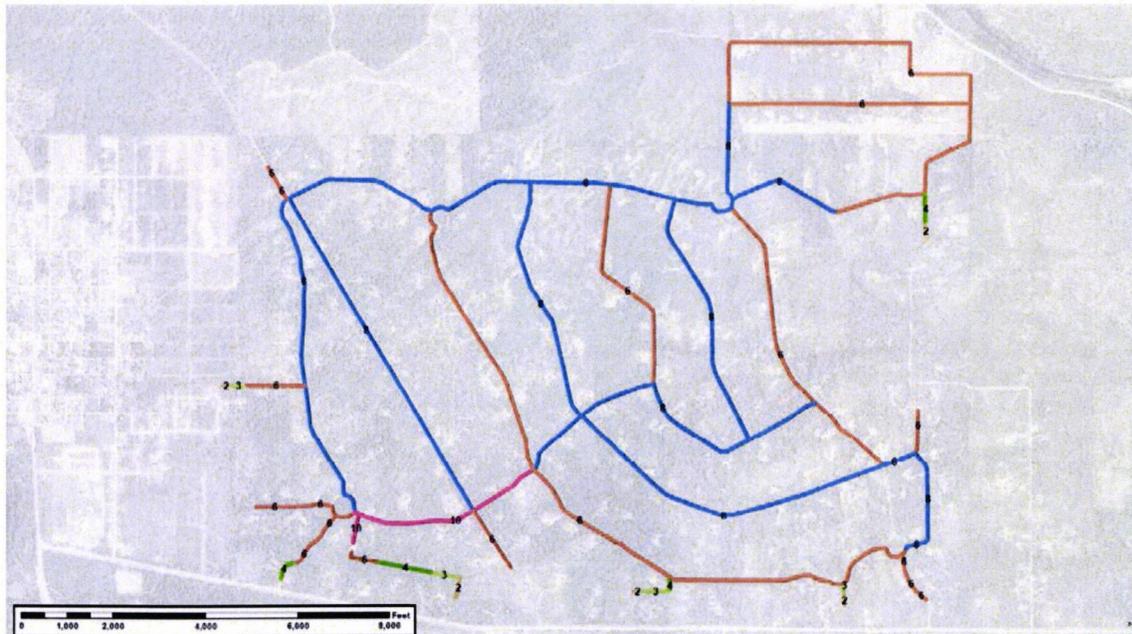
To meet fire flow standards, Spirit Lake East Development will have to replace existing lines with 12,420 feet of 6-inch, 41,090 feet 8-inch and 4,255 feet of 10-inch piping along with an estimated 54 fire hydrants, 500 gpm well and three (3) 25-horsepower booster pumps. An illustration of the line replacement can be found within Appendix H.

## **7. CONCLUSION**

In conclusion, the majority of pipe within the Spirit Lake East Development is undersized, to meet fire flow requirements.

Figure 7-1 below illustrates the modifications required to the existing system to meet the required fire suppression flow rate, the minimum system upgrades are presented below.

Figure 7-1: Scenario 4 System Upgrades



### Source Well

- Additional 500 gpm at 600 feet TDH

### Booster Pumps

- Upgrade two (2) 10-horsepower booster pumps to 25-Horsepower booster
- Add one (1) additional 25-horsepower booster for a total of four (4) 25-horsepower booster pumps

### Storage

The system is deficient by 23,750 gallons of storage capacity. It is our recommendation to add an additional 50,000 gallon above ground tank on the same lot as the existing storage tank. Since the system currently supplies all flow and pressure through booster pumps an above ground concrete tank matching the existing tank is recommended.

### Distribution System

Considerable pipe upsizing is required within the development to meet IDEQ standards.

- 6-inch pipe: 12,420 lineal feet
- 8-inch pipe: 41,090 lineal feet
- 10-inch pipe: 4,255 lineal feet
- Hydrants: 54

The total estimated cost to bring the Spirit Lake East water system in compliance with IDEQ standards is estimated at \$5,833,700. A detailed cost estimate can be found within Appendix I.

## 8. PHASING

As previously mentioned to initiate all recommended improvements an estimated initial capital cost of \$5,833,700 is required.

Currently, Spirit Lake East has approximately 293 connections or ER's. Based on 20 year loan at 3% interest rate distributed over the existing 293 connections, an estimated annual payment per connections is \$1,338 (\$112 per month per connection). Table 8-1 below illustrates the estimated monthly cost for implementing the entire project.

Table 8-1: System Replacement (293 Connections)

Total Estimated Cost	One Time Payment Per Connection	Annual Payment Per Connection	Monthly Payment Per Connection
\$5,833,700	\$19,910	\$1,338	\$112
Terms: 3%, 20 Years, 293 Connections			

Depending upon borrowing requirements of the development, the costs may be distributed over all 366 lots. Based on the same loan requirements as previously mentioned, 20 year loan at 3% interest rate distributed over 366 connections, an estimated annual payment per connection is \$1,071 (\$89 per month). Table 8-2 below illustrates the estimated cost for implementing the entire project based on all service connections.

Table 8-2: System Replacement (366 Connections)

Total Estimated Cost	One Time Payment Per Connection	Annual Payment Per Connection	Monthly Payment Per Connection
\$5,833,700	\$15,939.07	\$1,071	\$89
Terms: 3%, 20 Years, 366 Connections			

Due to the high initial capital costs associated with the required upgrades to meet fire flow compliance, a series of five (5) phases of construction over a twenty (20) year period is recommended. It was estimated that the development would see a growth of approximately 4 connections per year until the total buildout of 366 connections was established in year 20. Table 8-3 illustrates the percentage of buildout assumed for each Phase of system replacement. Total estimated costs were determined assuming an inflation rate of 3% per year. Each phase was modeled as a steady state analysis using WaterCAD.

Table 8-3: Phase Year/Buildout Percentage

Year	Connections	Buildout (%)
0	293	80%
5	312	85%
10	331	90%
15	349	95%
20	366	100%

### 8.1. PHASE I

Phase I of the proposed system upgrades consists of the well and booster upgrades along with an estimated 9,619 lineal feet of 8-inch water main, 4,255 lineal feet of 10-inch water main, and the installation of 18 hydrants. Phase I has a total estimated cost of \$1,911,000. A detailed cost analysis and map depicting the configuration of Phase I can be found within Appendix J.

### 8.2. PHASE II

Phase II was estimated at be at 85% of complete buildout. This phase consists of 13,181 lineal feet of 8-inch water main, eleven (11) additional hydrants and the installation of a 50,000 gallon above ground storage tank<sup>4</sup>. Phase II has a total estimated cost of \$1,699,200. A detailed cost analysis and map depicting the configuration of Phase II can be found within Appendix J.

### 8.3. PHASE III

Phase III was estimated at 90% of complete buildout. This phase consists of 13,330 lineal feet 8-inch water main and the installation of an additional 9 hydrants. Phase III has a total estimated cost of \$1,663,500. A detailed cost analysis and map depicting the configuration of Phase III can be found within Appendix J.

### 8.4. PHASE IV

Phase IV was estimated at 95% of complete buildout. This phase consists of 5,257 lineal feet of 6-inch water main, 4,960 lineal feet of 8-inch water main and the installation of 9 additional hydrants. Phase IV has a total estimated cost of \$1,476,200. A detailed cost analysis and map depicting the configuration of Phase IV can be found within Appendix J.

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<sup>4</sup> Upon completion of the analysis, it was determined that the system was deficient in storage capacity by 23,750 gallons. This quantity was determined using a conservative approach for estimated flow rate for the system. It is recommended to conduct flow monitoring to determine the actual usage rate. If flow rates change substantially the required storage may be reduced.

## 8.5.PHASE V

Phase V was estimated to be at complete buildout. This phase consists of 7,163 lineal feet of 6-inch water main and the installation of an additional 7 hydrants. Phase V has a total estimated cost of \$1,215,700. A detailed cost analysis and map depicting the configuration of Phase V can be found within Appendix J.

## 8.6.PHASING CONCLUSION

If the total project was completed in phases that happened every five (5) years, based on an inflation rate of 3%, interest rate of 3%, and individual terms length of 5 years, the estimated monthly cost for each connection is between \$60 and \$119. Table 8-6 below illustrates the estimated monthly payment amount for each phase on construction.

Table 8-6: Phase Rates

Phase	Total Estimated Cost	Year	Annual Payment Per Connection	Monthly Payment Per Connection	Buildout Percentage
I	\$1,911,000	0	\$1,424	\$119	80%
II	\$1,699,200	5	\$1,189	\$99	85%
III	\$1,663,500	10	\$1,097	\$91	90%
IV	\$1,476,200	15	\$924	\$77	95%
V	\$1,215,700	20	\$725	\$60	100%
<b>Total</b>	<b>\$7,965,600</b>				

Assumptions:

Annual inflation rate of 3% for 20 year loan term

5 year loan term at 3% interest rate

Approximately 4 connections added per year

### 8.6.1. PHASE I FINANCIAL ALTERNATIVES

Due to the high estimated monthly payment amount, Phase I monthly cost was determined on a 20 year and 30 year loan amount based on 293 connections and 366 connections. By constructing only Phase I, the term of the loan could be extended, lower the monthly expenditure for the residents, while still providing limited fire protection for the area.

Based on 20 year and 30 year loan at 3% interest rate distributed over 293 connections, the monthly rate per user was determined to be \$37 and \$26 respectively. Table 8-4 below illustrates the difference between the 20 and 30 year loan amounts.

Table 8-4: Phase I Extend Loan Options 293 connections

Phase	Total Estimated Cost	Term	Annual Payment Per Connection	Monthly Payment Per Connection	Buildout Percentage
IA	\$1,911,000	20	\$438	\$37	80%
IB	\$1,911,000	30	\$312	\$26	80%

Phase I was then evaluated at being distributed over all 366 connections. Based on 20 year and 30 year loan at 3% interest rate distributed over 366 connections, the monthly rate per user was determined to be \$29 and \$22 respectively. Table 8-5 below illustrates the cost difference between the loan options and payment amounts.

Table 8-5: Phase I Extended Loan Options 366 connections

Phase	Total Estimated Cost	Term	Annual Payment Per Connection	Monthly Payment Per Connection	Buildout Percentage
IA	\$1,911,000	20	\$351	\$29	100%
IB	\$1,911,000	30	\$266	\$22	100%

It should be noted that Phase I does not consist of adding the additional storage that was determined to be required. It is recommended that additional flow monitoring be conducted to determine the actual flow rate of the system and to reevaluate the storage requirements upon further data.

## 9. REFERENCES

Welch Comer & Associates, Inc. *Spirit Lake East Water System Analysis*. System Analysis. Coeur d'Alene, ID: Welch Comer & Associates, Inc., 2004. Document.

**APPENDIX A:  
AERIAL MAP**



**Legend**

- Spirit Lake East
- Parcel

**WELCH-COMER**  
ENGINEERS | SURVEYORS

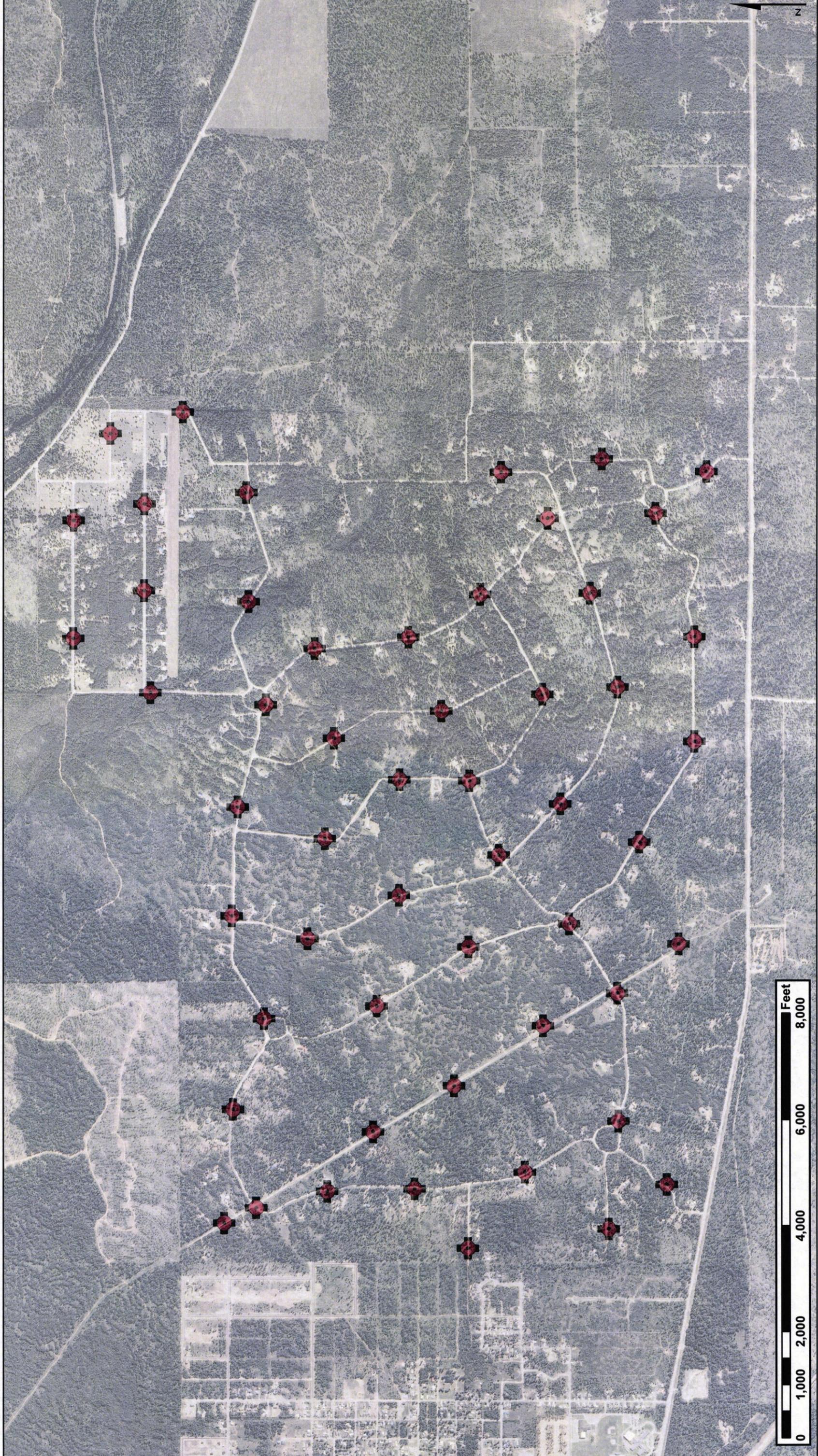
www.welchcomer.com 208-664-9382  
 350 E. Kathleen Ave. (toll free) 877-815-5672  
 Coeur d'Alene, ID 83815 (fax) 208-664-5946

## Spirit Lake East Aerial Map

Sources:  
 Kootenai County GIS Department  
 ESRI, United States Census Bureau

PROJECT NO.....41177  
 DRAWN BY.....CW  
 FILENAME.....SLE  
 DATE.....6/09/2014

**APPENDIX B:  
HYDRANT PLACEMENT MAP**



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 Coeur d'Alene, ID 83815 (fax) 208-664-5946

# Spirit Lake East

## Hydrant Placement

Sources:  
 Kootenai County GIS Department  
 ESRI, United States Census Bureau

PROJECT NO.....41177  
 DRAWN BY.....CW  
 FILENAME.....HydrantPlacement  
 DATE.....5/07/2014

**APPENDIX C:  
MODELED HYDRANTS MAP**



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 Coeur d'Alene, ID 83815 (fax) 208-664-5946

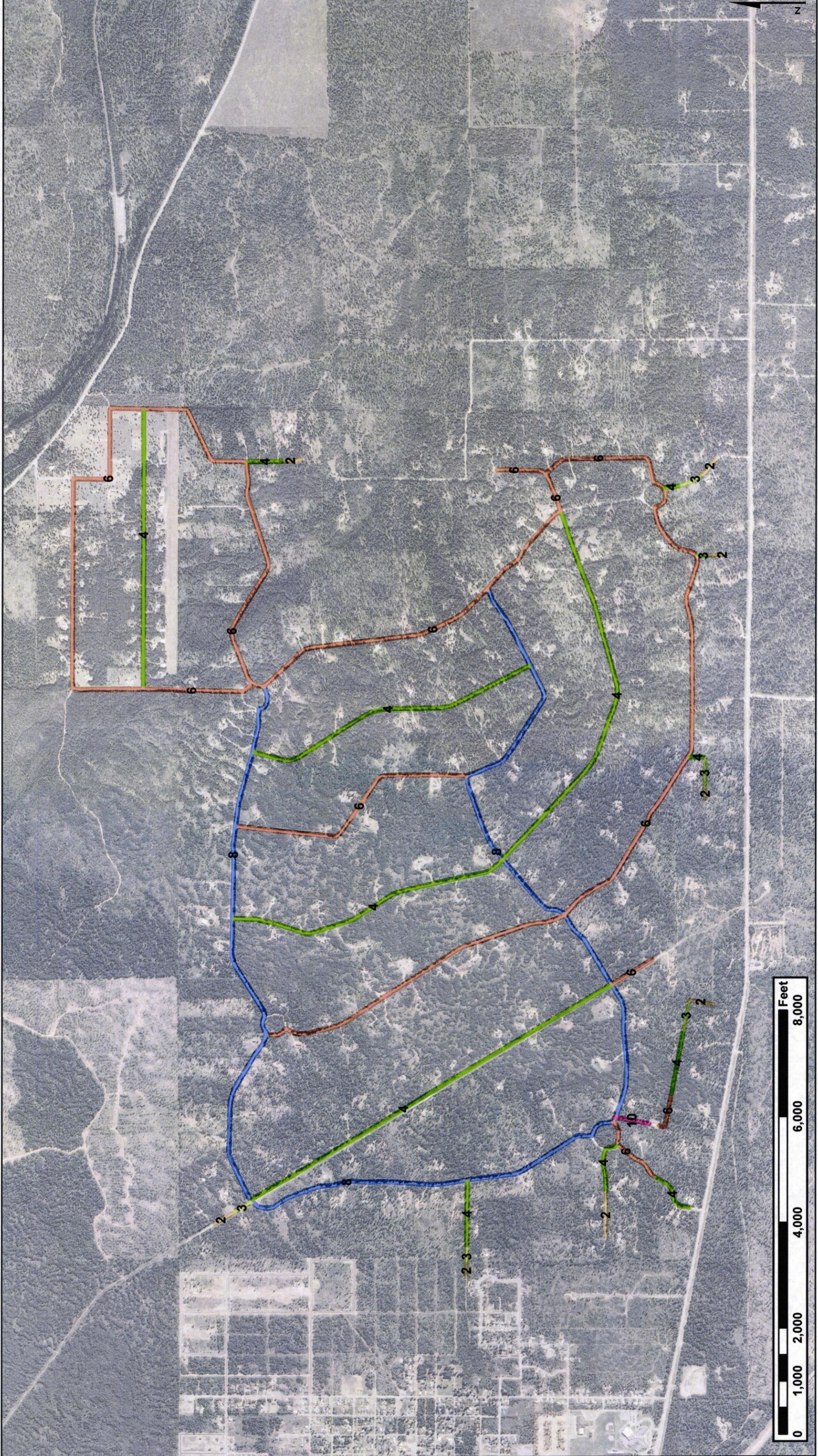
# Spirit Lake East

## Modeled Hydrant Placement

Sources:  
 Kootenai County GIS Department  
 ESRI, United States Census Bureau

PROJECT NO.....41177  
 DRAWN BY.....CW  
 FILENAME.....HydrantPlacement  
 DATE.....6/09/2014

**APPENDIX D:  
EXISTING DISTRIBUTION  
MAP**



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 Coeur d'Alene, ID 83815 (fax) 208-664-5946

# Spirit Lake East

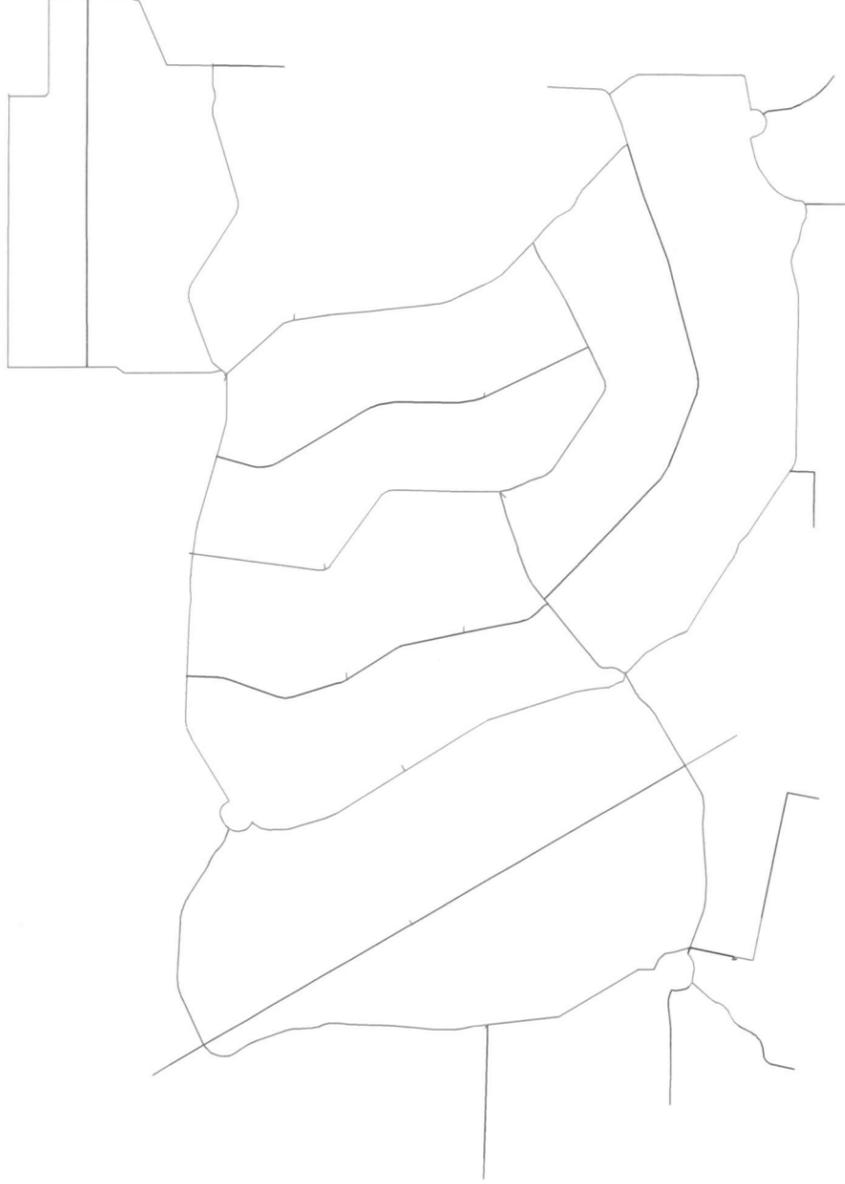
## Existing Conditions

Sources:  
 Kootenai County GIS Department  
 ESRI, United States Census Bureau

PROJECT NO.....41177  
 DRAWN BY.....CW  
 FILENAME.....Existing Conditions  
 DATE.....5/07/2014

**APPENDIX E:  
SCENARIO 1: EXISTING  
LINES**

**Scenario: Scenario 1, Buildout: Peak Day plus Fire Flow**



Color Coding Legend	
Pipe: Diameter (in)	
—	<= 2.0
—	<= 4.0
—	<= 6.0
—	<= 8.0
—	<= 10.0
—	<= 12.0
—	<= 16.0
	Other

Scenario: Scenario 1, Buildout: Peak Day plus Fire Flow  
 Current Time Step: 0.000Hr  
 Fire Flow Node FlexTable: Fire Flow Report

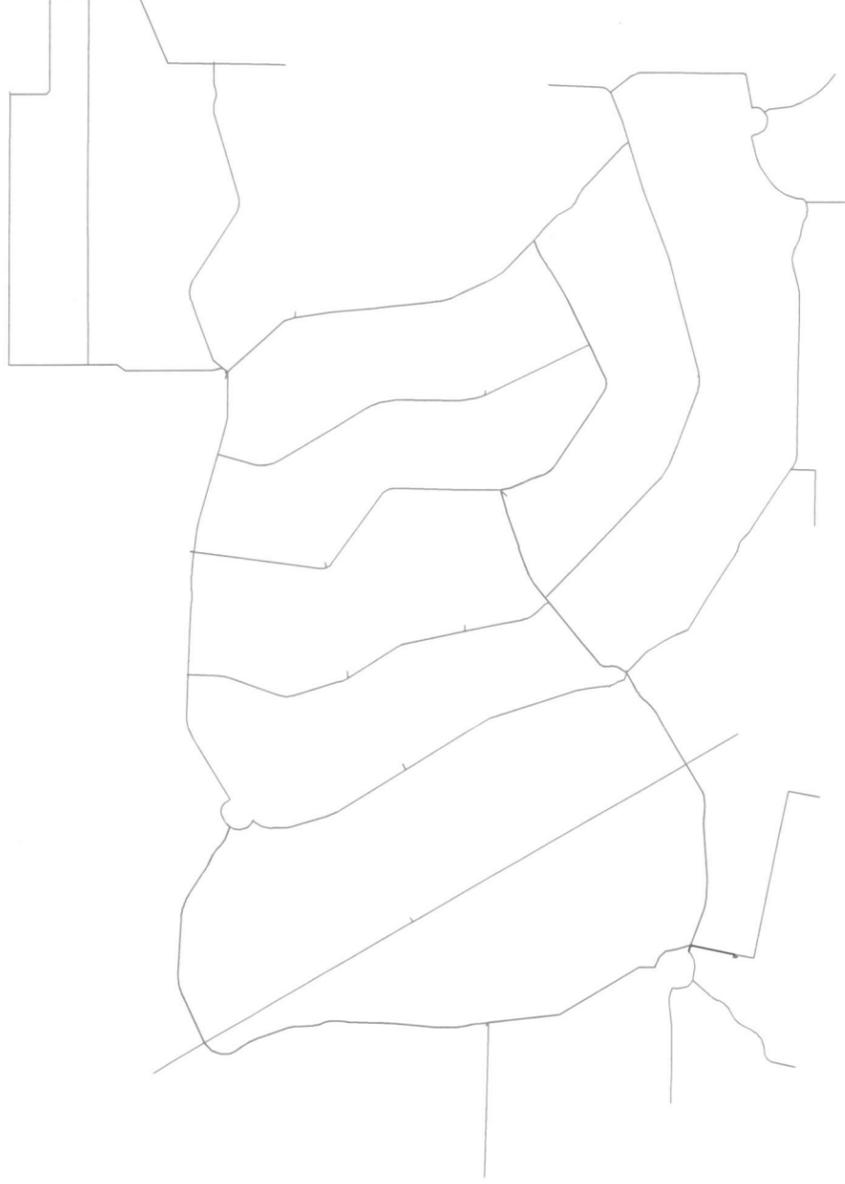
Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)
J-14	Zone-1	1	False	1,000	0	1,000	0	20.0	84.2	20.0	5.2	J-219	(N/A)
J-4	Zone-1	1	False	1,000	0	1,000	0	20.0	87.0	20.0	5.2	J-219	(N/A)
J-9	Zone-1	1	False	1,000	0	1,001	1	20.0	84.5	20.0	5.2	J-219	(N/A)
J-12	Zone-1	1	False	1,000	0	1,003	3	20.0	106.3	20.0	5.2	J-219	(N/A)
J-16	Zone-1	1	False	1,000	0	1,000	0	20.0	90.3	20.0	5.2	J-219	(N/A)
J-19	Zone-1	1	False	1,000	0	1,003	3	20.0	48.6	20.0	5.2	J-219	(N/A)
J-20	Zone-1	1	False	1,000	0	1,003	3	20.0	88.8	20.0	5.2	J-219	(N/A)
J-8	Zone-1	1	False	1,000	0	1,001	1	20.0	83.2	20.0	5.2	J-219	(N/A)
J-11	Zone-1	1	False	1,000	0	1,001	1	20.0	96.5	20.0	5.2	J-219	(N/A)
J-7	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-18	Zone-1	1	False	1,000	0	1,001	1	20.0	48.6	20.0	5.2	J-219	(N/A)
J-15	Zone-1	1	False	1,000	0	1,000	0	20.0	79.9	20.0	5.2	J-219	(N/A)
J-10	Zone-1	1	False	1,000	0	1,003	3	20.0	96.9	20.0	5.2	J-219	(N/A)
J-21	Zone-1	1	False	1,000	0	1,003	3	20.0	87.0	20.0	5.2	J-219	(N/A)
J-13	Zone-1	1	False	1,000	0	1,001	1	20.0	105.0	20.0	5.2	J-219	(N/A)
J-3	Zone-1	1	False	1,000	0	1,006	6	20.0	86.9	20.0	5.2	J-219	(N/A)
J-17	Zone-1	1	False	1,000	0	1,000	0	20.0	90.3	20.0	5.2	J-219	(N/A)
J-45	Zone-1	1	False	1,000	0	1,004	4	20.0	105.1	20.0	5.2	J-219	(N/A)
J-48	Zone-1	1	False	1,000	0	1,000	0	20.0	87.9	20.0	5.2	J-219	(N/A)
J-41	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-42	Zone-1	1	False	1,000	0	1,000	0	20.0	88.1	20.0	5.2	J-219	(N/A)
J-46	Zone-1	1	False	1,000	0	1,009	9	20.0	47.3	20.0	5.2	J-219	(N/A)
J-47	Zone-1	1	False	1,000	0	1,006	6	20.0	88.1	20.0	5.2	J-219	(N/A)
J-86	Zone-1	1	False	1,000	0	1,007	7	20.0	81.3	20.0	5.2	J-219	(N/A)
J-79	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-74	Zone-1	1	False	1,000	0	1,004	4	20.0	96.5	20.0	5.2	J-219	(N/A)
J-78	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-83	Zone-1	1	False	1,000	0	1,021	21	20.0	47.0	20.0	5.2	J-219	(N/A)
J-70	Zone-1	1	False	1,000	0	1,003	3	20.0	82.9	20.0	5.2	J-219	(N/A)
J-82	Zone-1	1	False	1,000	0	1,000	0	20.0	49.9	20.0	5.2	J-219	(N/A)
J-87	Zone-1	1	False	1,000	0	1,009	9	20.0	105.0	20.0	5.2	J-219	(N/A)
J-69	Zone-1	1	False	1,000	0	1,003	3	20.0	87.7	20.0	5.2	J-219	(N/A)
J-73	Zone-1	1	False	1,000	0	1,006	6	20.0	96.4	20.0	5.2	J-219	(N/A)
J-62	Zone-1	1	False	1,000	0	1,012	12	20.0	88.2	20.0	5.2	J-219	(N/A)
J-81	Zone-1	1	False	1,000	0	1,009	9	20.0	87.8	20.0	5.2	J-219	(N/A)
J-63	Zone-1	1	False	1,000	0	1,000	0	20.0	47.3	20.0	5.2	J-219	(N/A)
J-80	Zone-1	1	False	1,000	0	1,006	6	20.0	88.3	20.0	5.2	J-219	(N/A)
J-72	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-61	Zone-1	1	False	1,000	0	1,000	0	20.0	88.3	20.0	5.2	J-219	(N/A)
J-71	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-65	Zone-1	1	False	1,000	0	1,000	0	20.0	105.1	20.0	5.2	J-219	(N/A)
J-77	Zone-1	1	False	1,000	0	1,006	6	20.0	96.3	20.0	5.2	J-219	(N/A)
J-66	Zone-1	1	False	1,000	0	1,006	6	20.0	89.5	20.0	5.2	J-219	(N/A)
J-67	Zone-1	1	False	1,000	0	1,010	10	20.0	99.0	20.0	5.2	J-219	(N/A)
J-76	Zone-1	1	False	1,000	0	1,009	9	20.0	96.2	20.0	5.2	J-219	(N/A)
J-128	Zone-1	1	False	1,000	0	1,012	12	20.0	98.0	20.0	5.2	J-219	(N/A)
J-150	Zone-1	1	False	1,000	0	1,006	6	20.0	98.1	20.0	5.2	J-219	(N/A)
J-138	Zone-1	1	False	1,000	0	1,006	6	20.0	100.8	20.0	5.2	J-219	(N/A)
J-117	Zone-1	1	False	1,000	0	1,004	4	20.0	113.3	20.0	5.2	J-219	(N/A)
J-131	Zone-1	1	False	1,000	0	1,007	7	20.0	84.4	20.0	5.2	J-219	(N/A)
J-142	Zone-1	1	False	1,000	0	1,007	7	20.0	96.9	20.0	5.2	J-219	(N/A)
J-119	Zone-1	1	False	1,000	0	1,000	0	20.0	105.1	20.0	5.2	J-219	(N/A)
J-134	Zone-1	1	False	1,000	0	1,006	6	20.0	46.0	20.0	5.2	J-219	(N/A)
J-145	Zone-1	1	False	1,000	0	1,000	0	20.0	100.8	20.0	5.2	J-219	(N/A)
J-141	Zone-1	1	False	1,000	0	1,009	9	20.0	96.6	20.0	5.2	J-219	(N/A)
J-135	Zone-1	1	False	1,000	0	1,007	7	20.0	105.0	20.0	5.2	J-219	(N/A)
J-152	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-139	Zone-1	1	False	1,000	0	1,010	10	20.0	81.8	20.0	5.2	J-219	(N/A)
J-126	Zone-1	1	False	1,000	0	1,006	6	20.0	81.3	20.0	5.2	J-219	(N/A)
J-124	Zone-1	1	False	1,000	0	1,000	0	20.0	88.8	20.0	5.2	J-219	(N/A)
J-151	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-122	Zone-1	1	False	1,000	0	1,007	7	20.0	57.3	20.0	5.2	J-219	(N/A)
J-158	Zone-1	1	False	1,000	0	1,000	0	20.0	93.6	20.0	5.2	J-219	(N/A)
J-120	Zone-1	1	False	1,000	0	1,000	0	20.0	85.5	20.0	5.2	J-219	(N/A)
J-121	Zone-1	1	False	1,000	0	1,000	0	20.0	22.5	20.0	5.2	J-219	(N/A)
J-127	Zone-1	1	False	1,000	0	1,009	9	20.0	87.9	20.0	5.2	J-219	(N/A)
J-125	Zone-1	1	False	1,000	0	1,013	13	20.0	93.6	20.0	5.2	J-219	(N/A)
J-155	Zone-1	1	False	1,000	0	1,000	0	20.0	18.6	20.0	5.2	J-219	(N/A)
J-136	Zone-1	1	False	1,000	0	1,003	3	20.0	105.0	20.0	5.2	J-219	(N/A)
J-118	Zone-1	1	False	1,000	0	1,000	0	20.0	105.0	20.0	5.2	J-219	(N/A)
J-144	Zone-1	1	False	1,000	0	1,003	3	20.0	86.3	20.0	5.2	J-219	(N/A)
J-157	Zone-1	1	False	1,000	0	1,013	13	20.0	87.4	20.0	5.2	J-219	(N/A)
J-163	Zone-1	1	False	1,000	0	1,019	19	20.0	53.5	20.0	5.2	J-219	(N/A)
J-154	Zone-1	1	False	1,000	0	1,004	4	20.0	79.6	20.0	5.2	J-219	(N/A)
J-133	Zone-1	1	False	1,000	0	1,004	4	20.0	56.4	20.0	5.2	J-219	(N/A)
J-164	Zone-1	1	False	1,000	0	1,000	0	20.0	79.6	20.0	5.2	J-219	(N/A)
J-140	Zone-1	1	False	1,000	0	1,000	0	20.0	100.8	20.0	5.2	J-219	(N/A)
J-153	Zone-1	1	False	1,000	0	1,006	6	20.0	95.4	20.0	5.2	J-219	(N/A)
J-159	Zone-1	1	False	1,000	0	1,009	9	20.0	87.4	20.0	5.2	J-219	(N/A)
J-218	Zone-1	1	False	1,000	0	1,000	0	20.0	86.3	20.0	5.2	J-219	(N/A)
J-228	Zone-1	1	False	1,000	0	1,000	0	20.0	89.9	20.0	5.2	J-219	(N/A)
J-216	Zone-1	1	False	1,000	0	1,006	6	20.0	92.7	20.0	5.2	J-219	(N/A)
J-217	Zone-1	1	False	1,000	0	1,000	0	20.0	79.7	20.0	5.2	J-219	(N/A)
J-215	Zone-1	1	False	1,000	0	1,012	12	20.0	88.8	20.0	5.2	J-219	(N/A)
J-245	Zone-1	1	False	1,000	0	1,003	3	20.0	85.5	20.0	5.2	J-219	(N/A)
J-235	Zone-1	1	False	1,000	0	1,009	9	20.0	83.8	20.0	5.2	J-219	(N/A)
J-219	Zone-1	1	False	1,000	0	1,000	0	20.0	5.2	20.0	18.6	J-155	(N/A)
J-220	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-221	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-224	Zone-1	1	False	1,000	0	1,010	10	20.0	81.0	20.0	5.2	J-219	(N/A)
J-225	Zone-1	1	False	1,000	0	1,015	15	20.0	88.3	20.0	5.2	J-219	(N/A)
J-227	Zone-1	1	False	1,000	0	1,009	9	20.0	89.2	20.0	5.2	J-219	(N/A)
J-229	Zone-1	1	False	1,000	0	1,012	12	20.0	85.0	20.0	5.2	J-219	(N/A)
J-230	Zone-1	1	False	1,000	0	1,010	10	20.0	87.3	20.0	5.2	J-219	(N/A)
J-231	Zone-1	1	False	1,000	0	1,012	12	20.0	88.1	20.0	5.2	J-219	(N/A)
J-232	Zone-1	1	False	1,000	0	1,013	13	20.0	79.1	20.0	5.2	J-219	(N/A)
J-233	Zone-1	1	False	1,000	0	1,007	7	20.0	87.9	20.0	5.2	J-219	(N/A)
J-234	Zone-1	1	False	1,000	0	1,009	9	20.0	96.2	20.0	5.2	J-219	(N/A)
J-236	Zone-1	1	False	1,000	0	1,010	10	20.0	105.6	20.0	5.2	J-219	(N/A)

J-237	Zone-1	1	False	1,000	0	1,009	9	20.0	88.5	20.0	5.2	J-219	(N/A)
J-238	Zone-1	1	False	1,000	0	1,016	16	20.0	57.3	20.0	5.2	J-219	(N/A)
J-239	Zone-1	1	False	1,000	0	1,007	7	20.0	58.6	20.0	5.2	J-219	(N/A)
J-240	Zone-1	1	False	1,000	0	1,000	0	20.0	88.3	20.0	5.2	J-219	(N/A)
H-1	<None>	4	True	1,000	1,251	1,000	1,251	20.0	20.0	20.0	22.8	H-4	(N/A)
H-2	<None>	3	True	1,000	1,030	1,000	1,030	20.0	20.0	20.0	24.0	H-4	(N/A)
H-3	<None>	3	False	1,000	925	1,000	925	20.0	20.0	20.0	33.2	H-4	(N/A)
H-4	<None>	4	False	1,000	549	1,000	549	20.0	20.0	20.0	44.1	H-8	(N/A)
H-5	<None>	4	True	1,000	1,164	1,000	1,164	20.0	20.0	20.0	20.9	H-4	(N/A)
H-6	<None>	5	False	1,000	485	1,000	485	20.0	20.0	20.0	47.3	H-17	(N/A)
H-7	<None>	3	False	1,000	971	1,000	971	20.0	20.0	20.0	36.2	H-4	(N/A)
H-8	<None>	8	False	1,000	544	1,000	544	20.0	20.1	20.0	37.4	H-4	(N/A)
H-9	<None>	3	False	1,000	932	1,000	932	20.0	20.0	20.0	32.4	H-4	(N/A)
H-10	<None>	4	False	1,000	793	1,000	793	20.0	20.0	20.0	29.5	H-17	(N/A)
H-11	<None>	6	True	1,000	1,097	1,000	1,097	20.0	26.8	20.0	20.0	H-4	(N/A)
H-12	<None>	20	True	1,000	1,107	1,000	1,107	20.0	20.2	20.0	20.0	H-4	(N/A)
H-13	<None>	3	False	1,000	859	1,000	859	20.0	20.0	20.0	40.2	H-4	(N/A)
H-14	<None>	4	False	1,000	592	1,000	592	20.0	20.0	20.0	47.3	H-17	(N/A)
H-15	<None>	5	False	1,000	976	1,000	976	20.0	20.6	20.0	20.0	H-3	(N/A)
H-16	<None>	8	False	1,000	477	1,000	477	20.0	20.1	20.0	47.3	H-17	(N/A)
H-17	<None>	4	False	1,000	735	1,000	735	20.0	20.0	20.0	40.7	H-10	(N/A)
H-18	<None>	4	True	1,000	1,408	1,000	1,408	20.0	20.0	20.0	22.4	H-4	(N/A)
H-19	<None>	6	True	1,000	1,718	1,000	1,718	20.0	25.1	20.0	20.0	H-4	(N/A)

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**APPENDIX F:  
SCENARIO 2: 6-INCH LINES  
REPLACEMENT**

# Scenario: Scenario 2: 6-Inch Line Replacement



Color Coding Legend	
Pipe: Diameter (in)	
—	≤ 2.0
—	≤ 4.0
—	≤ 6.0
—	≤ 8.0
—	≤ 10.0
—	≤ 12.0
—	≤ 16.0
	Other

Scenario: Scenario 2: 6-Inch Line Replacement  
 Current Time Step: 0.000Hr  
 Fire Flow Node FlexTable: Fire Flow Report

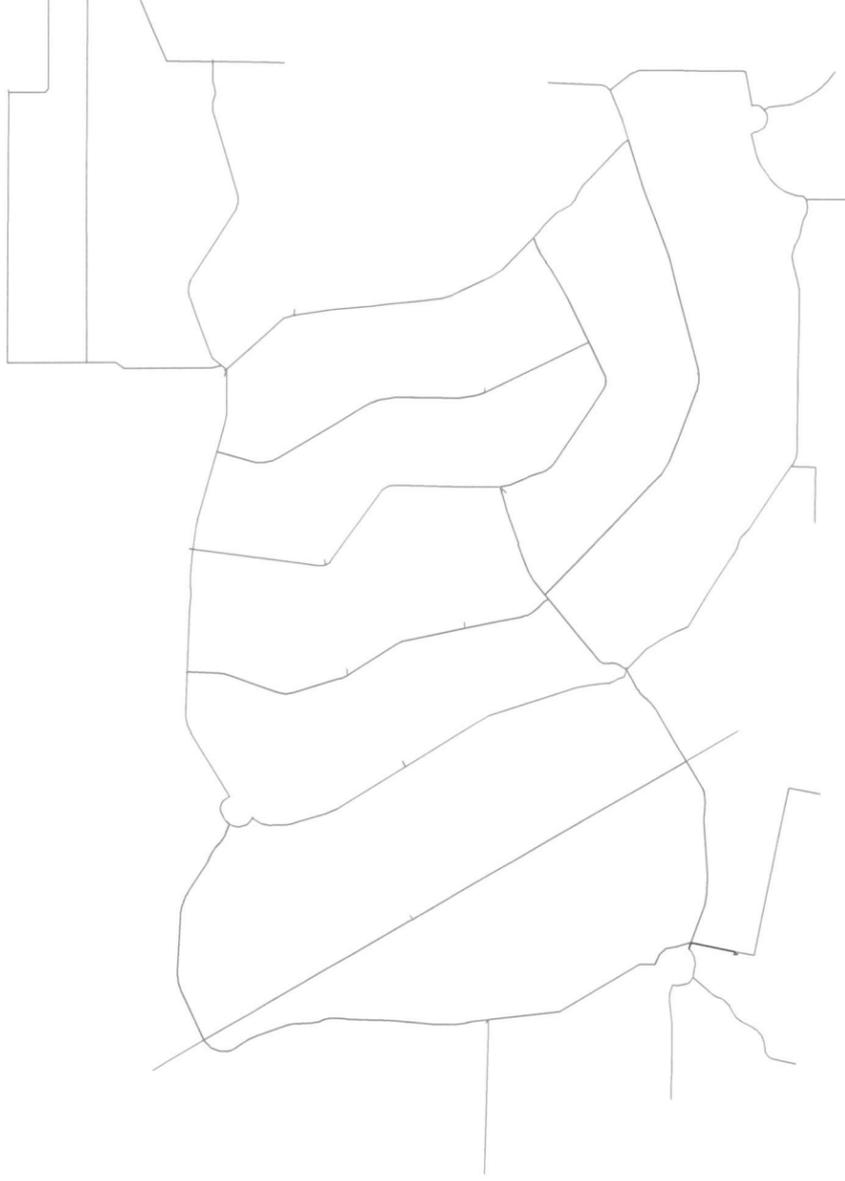
Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)
J-14	Zone-1	1	False	1,000	0	1,000	0	20.0	84.3	20.0	5.2	J-219	(N/A)
J-4	Zone-1	1	False	1,000	0	1,000	0	20.0	87.2	20.0	5.2	J-219	(N/A)
J-9	Zone-1	1	False	1,000	0	1,001	1	20.0	84.6	20.0	5.2	J-219	(N/A)
J-12	Zone-1	1	False	1,000	0	1,003	3	20.0	106.5	20.0	5.2	J-219	(N/A)
J-16	Zone-1	1	False	1,000	0	1,000	0	20.0	90.3	20.0	5.2	J-219	(N/A)
J-19	Zone-1	1	False	1,000	0	1,003	3	20.0	48.7	20.0	5.2	J-219	(N/A)
J-20	Zone-1	1	False	1,000	0	1,003	3	20.0	88.9	20.0	5.2	J-219	(N/A)
J-8	Zone-1	1	False	1,000	0	1,001	1	20.0	83.3	20.0	5.2	J-219	(N/A)
J-11	Zone-1	1	False	1,000	0	1,001	1	20.0	96.6	20.0	5.2	J-219	(N/A)
J-7	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-18	Zone-1	1	False	1,000	0	1,001	1	20.0	48.7	20.0	5.2	J-219	(N/A)
J-15	Zone-1	1	False	1,000	0	1,000	0	20.0	80.0	20.0	5.2	J-219	(N/A)
J-10	Zone-1	1	False	1,000	0	1,003	3	20.0	97.0	20.0	5.2	J-219	(N/A)
J-21	Zone-1	1	False	1,000	0	1,003	3	20.0	87.2	20.0	5.2	J-219	(N/A)
J-13	Zone-1	1	False	1,000	0	1,001	1	20.0	105.2	20.0	5.2	J-219	(N/A)
J-3	Zone-1	1	False	1,000	0	1,006	6	20.0	87.2	20.0	5.2	J-219	(N/A)
J-17	Zone-1	1	False	1,000	0	1,000	0	20.0	90.3	20.0	5.2	J-219	(N/A)
J-45	Zone-1	1	False	1,000	0	1,004	4	20.0	105.2	20.0	5.2	J-219	(N/A)
J-48	Zone-1	1	False	1,000	0	1,000	0	20.0	88.0	20.0	5.2	J-219	(N/A)
J-41	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-42	Zone-1	1	False	1,000	0	1,000	0	20.0	88.2	20.0	5.2	J-219	(N/A)
J-46	Zone-1	1	False	1,000	0	1,009	9	20.0	47.4	20.0	5.2	J-219	(N/A)
J-47	Zone-1	1	False	1,000	0	1,006	6	20.0	88.1	20.0	5.2	J-219	(N/A)
J-86	Zone-1	1	False	1,000	0	1,007	7	20.0	81.2	20.0	5.2	J-219	(N/A)
J-79	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-74	Zone-1	1	False	1,000	0	1,004	4	20.0	96.5	20.0	5.2	J-219	(N/A)
J-78	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-83	Zone-1	1	False	1,000	0	1,021	21	20.0	47.0	20.0	5.2	J-219	(N/A)
J-70	Zone-1	1	False	1,000	0	1,003	3	20.0	82.9	20.0	5.2	J-219	(N/A)
J-82	Zone-1	1	False	1,000	0	1,000	0	20.0	49.9	20.0	5.2	J-219	(N/A)
J-87	Zone-1	1	False	1,000	0	1,009	9	20.0	105.1	20.0	5.2	J-219	(N/A)
J-69	Zone-1	1	False	1,000	0	1,003	3	20.0	87.7	20.0	5.2	J-219	(N/A)
J-73	Zone-1	1	False	1,000	0	1,006	6	20.0	96.5	20.0	5.2	J-219	(N/A)
J-62	Zone-1	1	False	1,000	0	1,012	12	20.0	88.2	20.0	5.2	J-219	(N/A)
J-81	Zone-1	1	False	1,000	0	1,009	9	20.0	88.0	20.0	5.2	J-219	(N/A)
J-63	Zone-1	1	False	1,000	0	1,000	0	20.0	47.4	20.0	5.2	J-219	(N/A)
J-80	Zone-1	1	False	1,000	0	1,006	6	20.0	88.2	20.0	5.2	J-219	(N/A)
J-72	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-61	Zone-1	1	False	1,000	0	1,000	0	20.0	88.3	20.0	5.2	J-219	(N/A)
J-71	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-65	Zone-1	1	False	1,000	0	1,000	0	20.0	105.2	20.0	5.2	J-219	(N/A)
J-77	Zone-1	1	False	1,000	0	1,006	6	20.0	96.5	20.0	5.2	J-219	(N/A)
J-66	Zone-1	1	False	1,000	0	1,006	6	20.0	89.7	20.0	5.2	J-219	(N/A)
J-67	Zone-1	1	False	1,000	0	1,010	10	20.0	99.1	20.0	5.2	J-219	(N/A)
J-76	Zone-1	1	False	1,000	0	1,009	9	20.0	96.4	20.0	5.2	J-219	(N/A)
J-128	Zone-1	1	False	1,000	0	1,012	12	20.0	98.1	20.0	5.2	J-219	(N/A)
J-150	Zone-1	1	False	1,000	0	1,006	6	20.0	98.2	20.0	5.2	J-219	(N/A)
J-138	Zone-1	1	False	1,000	0	1,006	6	20.0	100.9	20.0	5.2	J-219	(N/A)
J-117	Zone-1	1	False	1,000	0	1,004	4	20.0	113.4	20.0	5.2	J-219	(N/A)
J-131	Zone-1	1	False	1,000	0	1,007	7	20.0	84.4	20.0	5.2	J-219	(N/A)
J-142	Zone-1	1	False	1,000	0	1,007	7	20.0	97.0	20.0	5.2	J-219	(N/A)
J-119	Zone-1	1	False	1,000	0	1,000	0	20.0	105.2	20.0	5.2	J-219	(N/A)
J-134	Zone-1	1	False	1,000	0	1,006	6	20.0	46.1	20.0	5.2	J-219	(N/A)
J-145	Zone-1	1	False	1,000	0	1,000	0	20.0	100.9	20.0	5.2	J-219	(N/A)
J-141	Zone-1	1	False	1,000	0	1,009	9	20.0	96.7	20.0	5.2	J-219	(N/A)
J-135	Zone-1	1	False	1,000	0	1,007	7	20.0	105.2	20.0	5.2	J-219	(N/A)
J-152	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-139	Zone-1	1	False	1,000	0	1,010	10	20.0	81.8	20.0	5.2	J-219	(N/A)
J-126	Zone-1	1	False	1,000	0	1,006	6	20.0	81.2	20.0	5.2	J-219	(N/A)
J-124	Zone-1	1	False	1,000	0	1,000	0	20.0	88.8	20.0	5.2	J-219	(N/A)
J-151	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-122	Zone-1	1	False	1,000	0	1,007	7	20.0	57.3	20.0	5.2	J-219	(N/A)
J-158	Zone-1	1	False	1,000	0	1,000	0	20.0	93.7	20.0	5.2	J-219	(N/A)
J-120	Zone-1	1	False	1,000	0	1,000	0	20.0	85.5	20.0	5.2	J-219	(N/A)
J-121	Zone-1	1	False	1,000	0	1,000	0	20.0	22.5	20.0	5.2	J-219	(N/A)
J-127	Zone-1	1	False	1,000	0	1,009	9	20.0	88.0	20.0	5.2	J-219	(N/A)
J-125	Zone-1	1	False	1,000	0	1,013	13	20.0	93.6	20.0	5.2	J-219	(N/A)
J-155	Zone-1	1	False	1,000	0	1,000	0	20.0	18.6	20.0	5.2	J-219	(N/A)
J-136	Zone-1	1	False	1,000	0	1,003	3	20.0	105.1	20.0	5.2	J-219	(N/A)
J-118	Zone-1	1	False	1,000	0	1,000	0	20.0	105.1	20.0	5.2	J-219	(N/A)
J-144	Zone-1	1	False	1,000	0	1,003	3	20.0	86.3	20.0	5.2	J-219	(N/A)
J-157	Zone-1	1	False	1,000	0	1,013	13	20.0	87.5	20.0	5.2	J-219	(N/A)
J-163	Zone-1	1	False	1,000	0	1,019	19	20.0	53.5	20.0	5.2	J-219	(N/A)
J-154	Zone-1	1	False	1,000	0	1,004	4	20.0	79.6	20.0	5.2	J-219	(N/A)
J-133	Zone-1	1	False	1,000	0	1,004	4	20.0	56.4	20.0	5.2	J-219	(N/A)
J-164	Zone-1	1	False	1,000	0	1,000	0	20.0	79.6	20.0	5.2	J-219	(N/A)
J-140	Zone-1	1	False	1,000	0	1,000	0	20.0	100.9	20.0	5.2	J-219	(N/A)
J-153	Zone-1	1	False	1,000	0	1,006	6	20.0	95.4	20.0	5.2	J-219	(N/A)
J-159	Zone-1	1	False	1,000	0	1,009	9	20.0	87.4	20.0	5.2	J-219	(N/A)
J-218	Zone-1	1	False	1,000	0	1,000	0	20.0	86.3	20.0	5.2	J-219	(N/A)
J-228	Zone-1	1	False	1,000	0	1,000	0	20.0	89.9	20.0	5.2	J-219	(N/A)
J-216	Zone-1	1	False	1,000	0	1,006	6	20.0	92.8	20.0	5.2	J-219	(N/A)
J-217	Zone-1	1	False	1,000	0	1,000	0	20.0	79.7	20.0	5.2	J-219	(N/A)
J-215	Zone-1	1	False	1,000	0	1,012	12	20.0	88.8	20.0	5.2	J-219	(N/A)
J-245	Zone-1	1	False	1,000	0	1,003	3	20.0	85.5	20.0	5.2	J-219	(N/A)
J-235	Zone-1	1	False	1,000	0	1,009	9	20.0	83.9	20.0	5.2	J-219	(N/A)
J-219	Zone-1	1	False	1,000	0	1,000	0	20.0	85.2	20.0	18.6	J-155	(N/A)
J-220	Zone-1	1	False	1,000	0	1,000	0	20.0	85.0	20.0	5.2	J-219	(N/A)
J-221	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-224	Zone-1	1	False	1,000	0	1,010	10	20.0	81.2	20.0	5.2	J-219	(N/A)
J-225	Zone-1	1	False	1,000	0	1,015	15	20.0	88.5	20.0	5.2	J-219	(N/A)
J-227	Zone-1	1	False	1,000	0	1,009	9	20.0	89.3	20.0	5.2	J-219	(N/A)
J-229	Zone-1	1	False	1,000	0	1,012	12	20.0	85.0	20.0	5.2	J-219	(N/A)
J-230	Zone-1	1	False	1,000	0	1,010	10	20.0	87.4	20.0	5.2	J-219	(N/A)
J-231	Zone-1	1	False	1,000	0	1,012	12	20.0	88.2	20.0	5.2	J-219	(N/A)
J-232	Zone-1	1	False	1,000	0	1,013	13	20.0	79.2	20.0	5.2	J-219	(N/A)
J-233	Zone-1	1	False	1,000	0	1,007	7	20.0	88.0	20.0	5.2	J-219	(N/A)
J-234	Zone-1	1	False	1,000	0	1,009	9	20.0	96.4	20.0	5.2	J-219	(N/A)
J-236	Zone-1	1	False	1,000	0	1,010	10	20.0	105.7	20.0	5.2	J-219	(N/A)

J-237	Zone-1	1	False	1,000	0	1,009	9	20.0	88.5	20.0	5.2	J-219	(N/A)
J-238	Zone-1	1	False	1,000	0	1,016	16	20.0	57.3	20.0	5.2	J-219	(N/A)
J-239	Zone-1	1	False	1,000	0	1,007	7	20.0	58.6	20.0	5.2	J-219	(N/A)
J-240	Zone-1	1	False	1,000	0	1,000	0	20.0	88.4	20.0	5.2	J-219	(N/A)
H-1	<None>	6	True	1,000	1,304	1,000	1,304	20.0	20.2	20.0	20.0	H-4	(N/A)
H-2	<None>	3	True	1,000	1,088	1,000	1,088	20.0	20.0	20.0	20.4	H-4	(N/A)
H-3	<None>	3	False	1,000	955	1,000	955	20.0	20.0	20.0	31.2	H-4	(N/A)
H-4	<None>	3	False	1,000	920	1,000	920	20.0	20.0	20.0	34.8	H-8	(N/A)
H-5	<None>	4	True	1,000	1,168	1,000	1,168	20.0	20.0	20.0	20.9	H-4	(N/A)
H-6	<None>	3	True	1,000	1,013	1,000	1,013	20.0	20.0	20.0	39.4	H-4	(N/A)
H-7	<None>	3	False	1,000	972	1,000	972	20.0	20.0	20.0	36.3	H-4	(N/A)
H-8	<None>	3	False	1,000	965	1,000	965	20.0	20.0	20.0	22.6	H-4	(N/A)
H-9	<None>	3	False	1,000	941	1,000	941	20.0	20.0	20.0	32.1	H-4	(N/A)
H-10	<None>	4	False	1,000	820	1,000	820	20.0	20.0	20.0	31.6	H-17	(N/A)
H-11	<None>	6	True	1,000	1,098	1,000	1,098	20.0	27.1	20.0	20.0	H-4	(N/A)
H-12	<None>	5	True	1,000	1,104	1,000	1,104	20.0	23.2	20.0	20.0	H-4	(N/A)
H-13	<None>	3	False	1,000	879	1,000	879	20.0	20.0	20.0	38.9	H-4	(N/A)
H-14	<None>	3	False	1,000	983	1,000	983	20.0	20.0	20.0	29.2	H-4	(N/A)
H-15	<None>	2	True	1,000	1,000	1,000	1,000	20.0	20.0	20.0	20.6	H-3	(N/A)
H-16	<None>	3	False	1,000	895	1,000	895	20.0	20.0	20.0	35.7	H-4	(N/A)
H-17	<None>	4	False	1,000	793	1,000	793	20.0	20.0	20.0	39.3	H-3	(N/A)
H-18	<None>	4	True	1,000	1,431	1,000	1,431	20.0	20.0	20.0	21.6	H-4	(N/A)
H-19	<None>	6	True	1,000	1,720	1,000	1,720	20.0	25.0	20.0	20.0	H-4	(N/A)

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**APPENDIX G:  
SCENARIO 3: 8-INCH LINES  
REPLACEMENT**

### Scenario: Scenario - 3: 8-Inch Line Replacement



Color Coding Legend	
Pipe: Diameter (in)	
—	<= 2.0
—	<= 4.0
—	<= 6.0
—	<= 8.0
—	<= 10.0
—	<= 12.0
—	<= 16.0
—	Other

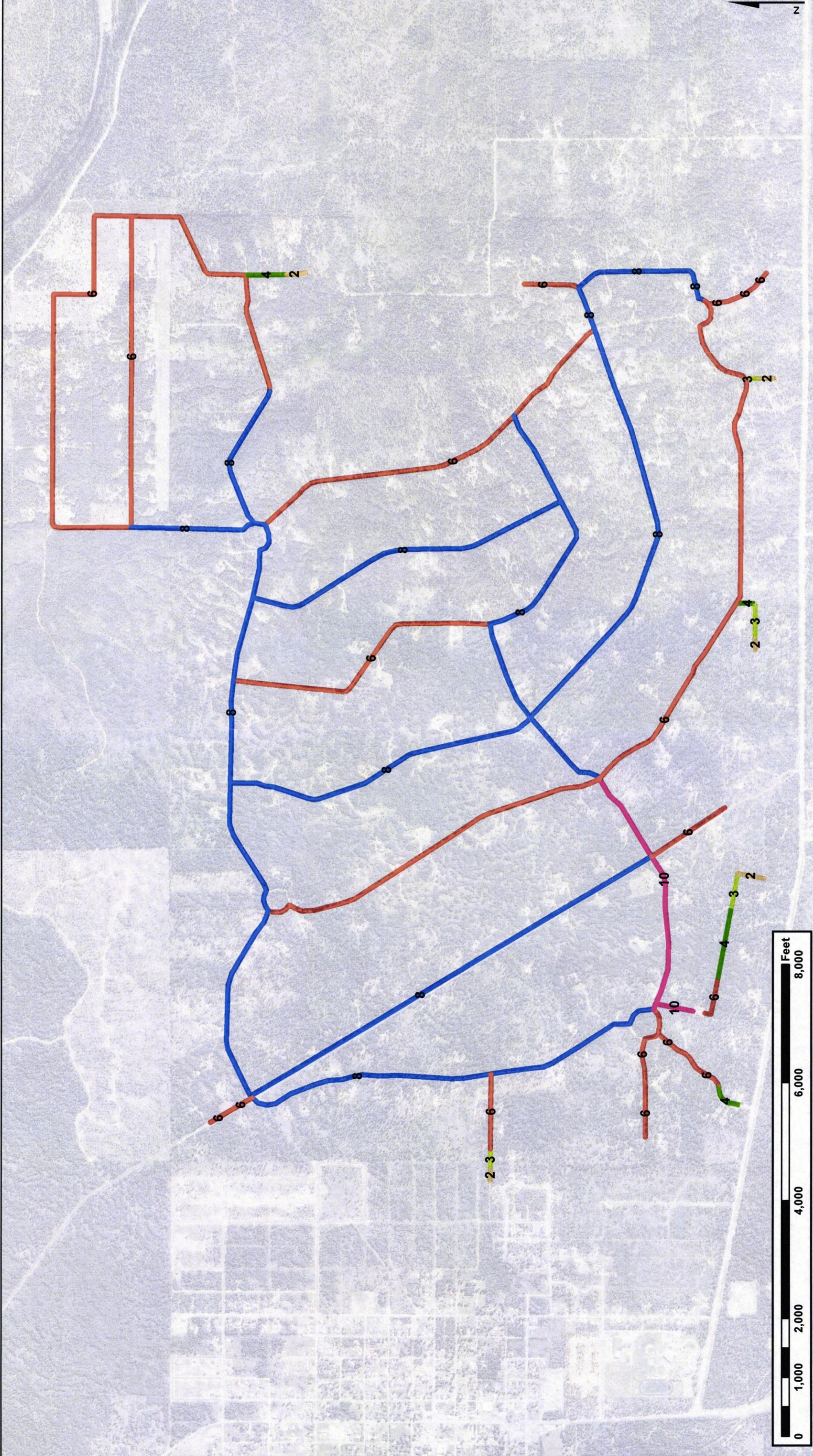
Scenario: Scenario - 3: 8-Inch Line Replacement  
 Current Time Step: 0.000Hr  
 Fire Flow Node FlexTable: Fire Flow Report

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)
J-14	Zone-1	1	False	1,000	0	1,000	0	20.0	84.3	20.0	5.2	J-219	(N/A)
J-4	Zone-1	1	False	1,000	0	1,000	0	20.0	87.2	20.0	5.2	J-219	(N/A)
J-9	Zone-1	1	False	1,000	0	1,001	1	20.0	84.6	20.0	5.2	J-219	(N/A)
J-12	Zone-1	1	False	1,000	0	1,003	3	20.0	106.6	20.0	5.2	J-219	(N/A)
J-16	Zone-1	1	False	1,000	0	1,000	0	20.0	90.3	20.0	5.2	J-219	(N/A)
J-19	Zone-1	1	False	1,000	0	1,003	3	20.0	48.7	20.0	5.2	J-219	(N/A)
J-20	Zone-1	1	False	1,000	0	1,003	3	20.0	88.9	20.0	5.2	J-219	(N/A)
J-8	Zone-1	1	False	1,000	0	1,001	1	20.0	83.3	20.0	5.2	J-219	(N/A)
J-11	Zone-1	1	False	1,000	0	1,001	1	20.0	96.7	20.0	5.2	J-219	(N/A)
J-7	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-18	Zone-1	1	False	1,000	0	1,001	1	20.0	48.7	20.0	5.2	J-219	(N/A)
J-15	Zone-1	1	False	1,000	0	1,000	0	20.0	80.0	20.0	5.2	J-219	(N/A)
J-10	Zone-1	1	False	1,000	0	1,003	3	20.0	97.1	20.0	5.2	J-219	(N/A)
J-21	Zone-1	1	False	1,000	0	1,003	3	20.0	87.2	20.0	5.2	J-219	(N/A)
J-13	Zone-1	1	False	1,000	0	1,001	1	20.0	105.3	20.0	5.2	J-219	(N/A)
J-3	Zone-1	1	False	1,000	0	1,006	6	20.0	87.2	20.0	5.2	J-219	(N/A)
J-17	Zone-1	1	False	1,000	0	1,000	0	20.0	90.3	20.0	5.2	J-219	(N/A)
J-45	Zone-1	1	False	1,000	0	1,004	4	20.0	105.3	20.0	5.2	J-219	(N/A)
J-48	Zone-1	1	False	1,000	0	1,000	0	20.0	88.1	20.0	5.2	J-219	(N/A)
J-41	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-42	Zone-1	1	False	1,000	0	1,000	0	20.0	88.2	20.0	5.2	J-219	(N/A)
J-46	Zone-1	1	False	1,000	0	1,009	9	20.0	47.4	20.0	5.2	J-219	(N/A)
J-47	Zone-1	1	False	1,000	0	1,006	6	20.0	88.2	20.0	5.2	J-219	(N/A)
J-86	Zone-1	1	False	1,000	0	1,007	7	20.0	81.2	20.0	5.2	J-219	(N/A)
J-79	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-74	Zone-1	1	False	1,000	0	1,004	4	20.0	96.6	20.0	5.2	J-219	(N/A)
J-78	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-83	Zone-1	1	False	1,000	0	1,021	21	20.0	47.0	20.0	5.2	J-219	(N/A)
J-70	Zone-1	1	False	1,000	0	1,003	3	20.0	82.9	20.0	5.2	J-219	(N/A)
J-82	Zone-1	1	False	1,000	0	1,000	0	20.0	49.9	20.0	5.2	J-219	(N/A)
J-87	Zone-1	1	False	1,000	0	1,009	9	20.0	105.3	20.0	5.2	J-219	(N/A)
J-69	Zone-1	1	False	1,000	0	1,003	3	20.0	87.7	20.0	5.2	J-219	(N/A)
J-73	Zone-1	1	False	1,000	0	1,006	6	20.0	96.5	20.0	5.2	J-219	(N/A)
J-62	Zone-1	1	False	1,000	0	1,012	12	20.0	88.2	20.0	5.2	J-219	(N/A)
J-81	Zone-1	1	False	1,000	0	1,009	9	20.0	88.1	20.0	5.2	J-219	(N/A)
J-63	Zone-1	1	False	1,000	0	1,000	0	20.0	47.4	20.0	5.2	J-219	(N/A)
J-80	Zone-1	1	False	1,000	0	1,006	6	20.0	88.2	20.0	5.2	J-219	(N/A)
J-72	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-61	Zone-1	1	False	1,000	0	1,000	0	20.0	88.2	20.0	5.2	J-219	(N/A)
J-71	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-65	Zone-1	1	False	1,000	0	1,000	0	20.0	105.3	20.0	5.2	J-219	(N/A)
J-77	Zone-1	1	False	1,000	0	1,006	6	20.0	96.5	20.0	5.2	J-219	(N/A)
J-66	Zone-1	1	False	1,000	0	1,006	6	20.0	89.8	20.0	5.2	J-219	(N/A)
J-67	Zone-1	1	False	1,000	0	1,010	10	20.0	99.3	20.0	5.2	J-219	(N/A)
J-76	Zone-1	1	False	1,000	0	1,009	9	20.0	96.5	20.0	5.2	J-219	(N/A)
J-128	Zone-1	1	False	1,000	0	1,012	12	20.0	98.2	20.0	5.2	J-219	(N/A)
J-150	Zone-1	1	False	1,000	0	1,006	6	20.0	98.3	20.0	5.2	J-219	(N/A)
J-138	Zone-1	1	False	1,000	0	1,006	6	20.0	101.0	20.0	5.2	J-219	(N/A)
J-117	Zone-1	1	False	1,000	0	1,004	4	20.0	113.5	20.0	5.2	J-219	(N/A)
J-131	Zone-1	1	False	1,000	0	1,007	7	20.0	84.4	20.0	5.2	J-219	(N/A)
J-142	Zone-1	1	False	1,000	0	1,007	7	20.0	97.1	20.0	5.2	J-219	(N/A)
J-119	Zone-1	1	False	1,000	0	1,000	0	20.0	105.3	20.0	5.2	J-219	(N/A)
J-134	Zone-1	1	False	1,000	0	1,006	6	20.0	46.1	20.0	5.2	J-219	(N/A)
J-145	Zone-1	1	False	1,000	0	1,000	0	20.0	101.0	20.0	5.2	J-219	(N/A)
J-141	Zone-1	1	False	1,000	0	1,009	9	20.0	96.7	20.0	5.2	J-219	(N/A)
J-135	Zone-1	1	False	1,000	0	1,007	7	20.0	105.3	20.0	5.2	J-219	(N/A)
J-152	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-139	Zone-1	1	False	1,000	0	1,010	10	20.0	81.9	20.0	5.2	J-219	(N/A)
J-126	Zone-1	1	False	1,000	0	1,006	6	20.0	81.2	20.0	5.2	J-219	(N/A)
J-124	Zone-1	1	False	1,000	0	1,000	0	20.0	88.8	20.0	5.2	J-219	(N/A)
J-151	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-122	Zone-1	1	False	1,000	0	1,007	7	20.0	57.3	20.0	5.2	J-219	(N/A)
J-158	Zone-1	1	False	1,000	0	1,000	0	20.0	93.7	20.0	5.2	J-219	(N/A)
J-120	Zone-1	1	False	1,000	0	1,000	0	20.0	85.5	20.0	5.2	J-219	(N/A)
J-121	Zone-1	1	False	1,000	0	1,000	0	20.0	22.5	20.0	5.2	J-219	(N/A)
J-127	Zone-1	1	False	1,000	0	1,009	9	20.0	88.0	20.0	5.2	J-219	(N/A)
J-125	Zone-1	1	False	1,000	0	1,013	13	20.0	93.7	20.0	5.2	J-219	(N/A)
J-155	Zone-1	1	False	1,000	0	1,000	0	20.0	18.6	20.0	5.2	J-219	(N/A)
J-136	Zone-1	1	False	1,000	0	1,003	3	20.0	105.3	20.0	5.2	J-219	(N/A)
J-118	Zone-1	1	False	1,000	0	1,000	0	20.0	105.3	20.0	5.2	J-219	(N/A)
J-144	Zone-1	1	False	1,000	0	1,003	3	20.0	86.3	20.0	5.2	J-219	(N/A)
J-157	Zone-1	1	False	1,000	0	1,013	13	20.0	87.5	20.0	5.2	J-219	(N/A)
J-163	Zone-1	1	False	1,000	0	1,019	19	20.0	53.5	20.0	5.2	J-219	(N/A)
J-154	Zone-1	1	False	1,000	0	1,004	4	20.0	79.6	20.0	5.2	J-219	(N/A)
J-133	Zone-1	1	False	1,000	0	1,004	4	20.0	56.4	20.0	5.2	J-219	(N/A)
J-164	Zone-1	1	False	1,000	0	1,000	0	20.0	79.6	20.0	5.2	J-219	(N/A)
J-140	Zone-1	1	False	1,000	0	1,000	0	20.0	101.0	20.0	5.2	J-219	(N/A)
J-153	Zone-1	1	False	1,000	0	1,006	6	20.0	95.5	20.0	5.2	J-219	(N/A)
J-159	Zone-1	1	False	1,000	0	1,009	9	20.0	87.4	20.0	5.2	J-219	(N/A)
J-218	Zone-1	1	False	1,000	0	1,000	0	20.0	86.3	20.0	5.2	J-219	(N/A)
J-228	Zone-1	1	False	1,000	0	1,000	0	20.0	89.9	20.0	5.2	J-219	(N/A)
J-216	Zone-1	1	False	1,000	0	1,006	6	20.0	92.8	20.0	5.2	J-219	(N/A)
J-217	Zone-1	1	False	1,000	0	1,000	0	20.0	79.7	20.0	5.2	J-219	(N/A)
J-215	Zone-1	1	False	1,000	0	1,012	12	20.0	88.8	20.0	5.2	J-219	(N/A)
J-245	Zone-1	1	False	1,000	0	1,003	3	20.0	85.5	20.0	5.2	J-219	(N/A)
J-235	Zone-1	1	False	1,000	0	1,009	9	20.0	83.9	20.0	5.2	J-219	(N/A)
J-219	Zone-1	1	False	1,000	0	1,000	0	20.0	5.2	20.0	18.6	J-155	(N/A)
J-220	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-221	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-224	Zone-1	1	False	1,000	0	1,010	10	20.0	81.2	20.0	5.2	J-219	(N/A)
J-225	Zone-1	1	False	1,000	0	1,015	15	20.0	88.5	20.0	5.2	J-219	(N/A)
J-227	Zone-1	1	False	1,000	0	1,009	9	20.0	89.4	20.0	5.2	J-219	(N/A)
J-229	Zone-1	1	False	1,000	0	1,012	12	20.0	85.1	20.0	5.2	J-219	(N/A)
J-230	Zone-1	1	False	1,000	0	1,010	10	20.0	87.5	20.0	5.2	J-219	(N/A)
J-231	Zone-1	1	False	1,000	0	1,012	12	20.0	88.2	20.0	5.2	J-219	(N/A)
J-232	Zone-1	1	False	1,000	0	1,013	13	20.0	79.2	20.0	5.2	J-219	(N/A)
J-233	Zone-1	1	False	1,000	0	1,007	7	20.0	88.0	20.0	5.2	J-219	(N/A)
J-234	Zone-1	1	False	1,000	0	1,009	9	20.0	96.5	20.0	5.2	J-219	(N/A)
J-236	Zone-1	1	False	1,000	0	1,010	10	20.0	105.8	20.0	5.2	J-219	(N/A)

J-237	Zone-1	1	False	1,000	0	1,009	9	20.0	88.5	20.0	5.2	J-219	(N/A)
J-238	Zone-1	1	False	1,000	0	1,016	16	20.0	57.3	20.0	5.2	J-219	(N/A)
J-239	Zone-1	1	False	1,000	0	1,007	7	20.0	58.6	20.0	5.2	J-219	(N/A)
J-240	Zone-1	1	False	1,000	0	1,000	0	20.0	88.4	20.0	5.2	J-219	(N/A)
H-1	<None>	6	True	1,000	1,309	1,000	1,309	20.0	23.7	20.0	20.0	H-4	(N/A)
H-2	<None>	5	True	1,000	1,096	1,000	1,096	20.0	23.6	20.0	20.0	H-4	(N/A)
H-3	<None>	3	False	1,000	977	1,000	977	20.0	20.0	20.0	29.4	H-4	(N/A)
H-4	<None>	3	True	1,000	1,038	1,000	1,038	20.0	20.0	20.0	31.2	H-8	(N/A)
H-5	<None>	4	True	1,000	1,170	1,000	1,170	20.0	20.0	20.0	20.8	H-4	(N/A)
H-6	<None>	4	True	1,000	1,290	1,000	1,290	20.0	20.0	20.0	22.2	H-4	(N/A)
H-7	<None>	3	False	1,000	973	1,000	973	20.0	20.0	20.0	36.3	H-4	(N/A)
H-8	<None>	5	True	1,000	1,068	1,000	1,068	20.0	24.7	20.0	20.0	H-4	(N/A)
H-9	<None>	3	False	1,000	946	1,000	946	20.0	20.0	20.0	31.6	H-4	(N/A)
H-10	<None>	4	False	1,000	820	1,000	820	20.0	20.0	20.0	31.6	H-17	(N/A)
H-11	<None>	6	True	1,000	1,097	1,000	1,097	20.0	27.5	20.0	20.0	H-4	(N/A)
H-12	<None>	5	True	1,000	1,100	1,000	1,100	20.0	25.3	20.0	20.0	H-4	(N/A)
H-13	<None>	3	False	1,000	896	1,000	896	20.0	20.0	20.0	37.7	H-4	(N/A)
H-14	<None>	5	True	1,000	1,099	1,000	1,099	20.0	21.4	20.0	20.0	H-4	(N/A)
H-15	<None>	3	True	1,000	1,014	1,000	1,014	20.0	20.0	20.0	21.3	H-3	(N/A)
H-16	<None>	3	True	1,000	1,077	1,000	1,077	20.0	20.0	20.0	22.0	H-4	(N/A)
H-17	<None>	4	False	1,000	793	1,000	793	20.0	20.0	20.0	41.3	H-3	(N/A)
H-18	<None>	4	True	1,000	1,451	1,000	1,451	20.0	20.0	20.0	20.8	H-4	(N/A)
H-19	<None>	6	True	1,000	1,720	1,000	1,720	20.0	25.0	20.0	20.0	H-4	(N/A)

\\NAS-01\Projects\K4141177 Spirit Lake East Fireflow\Report\Appendices\Analysis\SpiritLakeEastFireFlow Model2.wtg

**APPENDIX H:  
SCENARIO 4: 10-INCH  
LINES REPLACEMENT**



www.welchcomer.com 208-664-9382  
 350 E. Kathleen Ave. (toll free) 877-815-5672  
 Coeur d'Alene, ID 83815 (fax) 208-664-5946

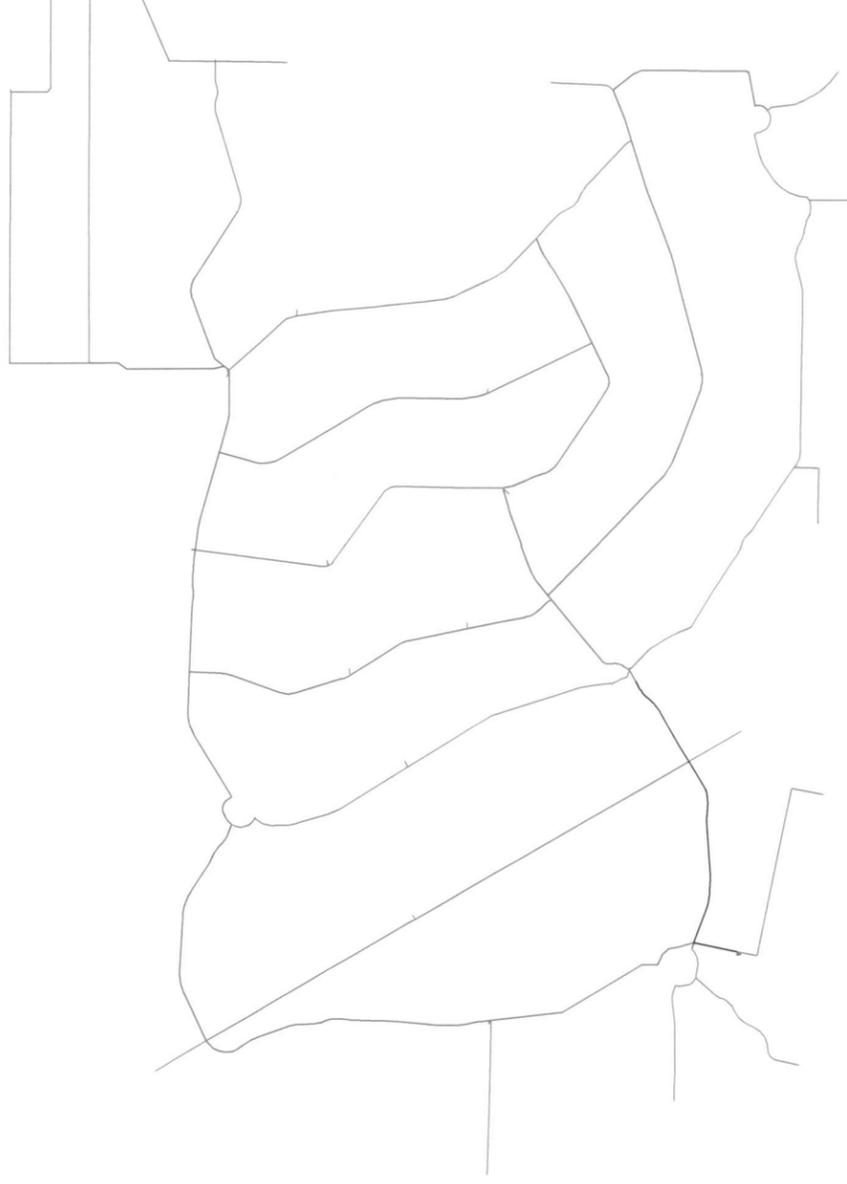
# Spirit Lake East

## Scenario 4

Sources:  
 Kootenai County GIS Department  
 ESRI, United States Census Bureau

PROJECT NO.....41177  
 DRAWN BY.....CW  
 FILENAME.....Scenario4  
 DATE.....5/07/2014

# Scenario: Scenario - 4: 10-Inch Line Replacement



Color Coding Legend	
Pipe: Diameter (in)	
—	≤ 2.0
—	≤ 4.0
—	≤ 6.0
—	≤ 8.0
—	≤ 10.0
—	≤ 12.0
—	≤ 16.0
	Other

Scenario: Scenario - 4: 10-Inch Line Replacement  
 Current Time Step: 0.000Hr  
 Fire Flow Node FlexTable: Fire Flow Report

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)
J-14	Zone-1	1	False	1,000	0	1,000	0	20.0	85.5	20.0	5.1	J-219	(N/A)
J-4	Zone-1	1	False	1,000	0	1,000	0	20.0	87.0	20.0	5.1	J-219	(N/A)
J-9	Zone-1	1	False	1,000	0	1,001	1	20.0	84.3	20.0	5.1	J-219	(N/A)
J-12	Zone-1	1	False	1,000	0	1,003	3	20.0	107.8	20.0	5.1	J-219	(N/A)
J-16	Zone-1	1	False	1,000	0	1,000	0	20.0	90.4	20.0	5.1	J-219	(N/A)
J-19	Zone-1	1	False	1,000	0	1,003	3	20.0	48.8	20.0	5.1	J-219	(N/A)
J-20	Zone-1	1	False	1,000	0	1,003	3	20.0	89.6	20.0	5.1	J-219	(N/A)
J-8	Zone-1	1	False	1,000	0	1,001	1	20.0	83.0	20.0	5.1	J-219	(N/A)
J-11	Zone-1	1	False	1,000	0	1,001	1	20.0	97.9	20.0	5.1	J-219	(N/A)
J-7	Zone-1	1	False	1,000	0	1,003	3	20.0	84.4	20.0	5.1	J-219	(N/A)
J-18	Zone-1	1	False	1,000	0	1,001	1	20.0	48.8	20.0	5.1	J-219	(N/A)
J-15	Zone-1	1	False	1,000	0	1,000	0	20.0	81.2	20.0	5.1	J-219	(N/A)
J-10	Zone-1	1	False	1,000	0	1,003	3	20.0	98.3	20.0	5.1	J-219	(N/A)
J-21	Zone-1	1	False	1,000	0	1,003	3	20.0	87.9	20.0	5.1	J-219	(N/A)
J-13	Zone-1	1	False	1,000	0	1,001	1	20.0	106.5	20.0	5.1	J-219	(N/A)
J-3	Zone-1	1	False	1,000	0	1,006	6	20.0	87.0	20.0	5.1	J-219	(N/A)
J-17	Zone-1	1	False	1,000	0	1,000	0	20.0	90.4	20.0	5.1	J-219	(N/A)
J-45	Zone-1	1	False	1,000	0	1,004	4	20.0	106.5	20.0	5.1	J-219	(N/A)
J-48	Zone-1	1	False	1,000	0	1,000	0	20.0	88.7	20.0	5.1	J-219	(N/A)
J-41	Zone-1	1	False	1,000	0	1,003	3	20.0	84.3	20.0	5.1	J-219	(N/A)
J-42	Zone-1	1	False	1,000	0	1,000	0	20.0	89.4	20.0	5.1	J-219	(N/A)
J-46	Zone-1	1	False	1,000	0	1,009	9	20.0	47.5	20.0	5.1	J-219	(N/A)
J-47	Zone-1	1	False	1,000	0	1,006	6	20.0	88.3	20.0	5.1	J-219	(N/A)
J-86	Zone-1	1	False	1,000	0	1,007	7	20.0	81.9	20.0	5.1	J-219	(N/A)
J-79	Zone-1	1	False	1,000	0	1,000	0	20.0	84.3	20.0	5.1	J-219	(N/A)
J-74	Zone-1	1	False	1,000	0	1,004	4	20.0	97.9	20.0	5.1	J-219	(N/A)
J-78	Zone-1	1	False	1,000	0	1,000	0	20.0	88.7	20.0	5.1	J-219	(N/A)
J-83	Zone-1	1	False	1,000	0	1,021	21	20.0	47.1	20.0	5.1	J-219	(N/A)
J-70	Zone-1	1	False	1,000	0	1,003	3	20.0	82.7	20.0	5.1	J-219	(N/A)
J-82	Zone-1	1	False	1,000	0	1,000	0	20.0	50.1	20.0	5.1	J-219	(N/A)
J-87	Zone-1	1	False	1,000	0	1,009	9	20.0	106.5	20.0	5.1	J-219	(N/A)
J-69	Zone-1	1	False	1,000	0	1,003	3	20.0	87.4	20.0	5.1	J-219	(N/A)
J-73	Zone-1	1	False	1,000	0	1,006	6	20.0	97.9	20.0	5.1	J-219	(N/A)
J-62	Zone-1	1	False	1,000	0	1,012	12	20.0	89.4	20.0	5.1	J-219	(N/A)
J-81	Zone-1	1	False	1,000	0	1,009	9	20.0	89.3	20.0	5.1	J-219	(N/A)
J-63	Zone-1	1	False	1,000	0	1,000	0	20.0	47.5	20.0	5.1	J-219	(N/A)
J-80	Zone-1	1	False	1,000	0	1,006	6	20.0	89.4	20.0	5.1	J-219	(N/A)
J-72	Zone-1	1	False	1,000	0	1,000	0	20.0	87.8	20.0	5.1	J-219	(N/A)
J-61	Zone-1	1	False	1,000	0	1,000	0	20.0	89.4	20.0	5.1	J-219	(N/A)
J-71	Zone-1	1	False	1,000	0	1,000	0	20.0	87.8	20.0	5.1	J-219	(N/A)
J-65	Zone-1	1	False	1,000	0	1,000	0	20.0	106.5	20.0	5.1	J-219	(N/A)
J-77	Zone-1	1	False	1,000	0	1,006	6	20.0	97.9	20.0	5.1	J-219	(N/A)
J-66	Zone-1	1	False	1,000	0	1,006	6	20.0	91.0	20.0	5.1	J-219	(N/A)
J-67	Zone-1	1	False	1,000	0	1,010	10	20.0	100.5	20.0	5.1	J-219	(N/A)
J-76	Zone-1	1	False	1,000	0	1,009	9	20.0	97.8	20.0	5.1	J-219	(N/A)
J-128	Zone-1	1	False	1,000	0	1,012	12	20.0	99.6	20.0	5.1	J-219	(N/A)
J-150	Zone-1	1	False	1,000	0	1,006	6	20.0	99.6	20.0	5.1	J-219	(N/A)
J-138	Zone-1	1	False	1,000	0	1,006	6	20.0	102.2	20.0	5.1	J-219	(N/A)
J-117	Zone-1	1	False	1,000	0	1,004	4	20.0	114.8	20.0	5.1	J-219	(N/A)
J-131	Zone-1	1	False	1,000	0	1,007	7	20.0	85.3	20.0	5.1	J-219	(N/A)
J-142	Zone-1	1	False	1,000	0	1,007	7	20.0	98.6	20.0	5.1	J-219	(N/A)
J-119	Zone-1	1	False	1,000	0	1,000	0	20.0	106.5	20.0	5.1	J-219	(N/A)
J-134	Zone-1	1	False	1,000	0	1,006	6	20.0	46.2	20.0	5.1	J-219	(N/A)
J-145	Zone-1	1	False	1,000	0	1,000	0	20.0	102.2	20.0	5.1	J-219	(N/A)
J-141	Zone-1	1	False	1,000	0	1,009	9	20.0	98.0	20.0	5.1	J-219	(N/A)
J-135	Zone-1	1	False	1,000	0	1,007	7	20.0	106.5	20.0	5.1	J-219	(N/A)
J-152	Zone-1	1	False	1,000	0	1,000	0	20.0	88.7	20.0	5.1	J-219	(N/A)
J-139	Zone-1	1	False	1,000	0	1,010	10	20.0	82.7	20.0	5.1	J-219	(N/A)
J-126	Zone-1	1	False	1,000	0	1,006	6	20.0	81.9	20.0	5.1	J-219	(N/A)
J-124	Zone-1	1	False	1,000	0	1,000	0	20.0	89.6	20.0	5.1	J-219	(N/A)
J-151	Zone-1	1	False	1,000	0	1,000	0	20.0	84.3	20.0	5.1	J-219	(N/A)
J-122	Zone-1	1	False	1,000	0	1,007	7	20.0	57.5	20.0	5.1	J-219	(N/A)
J-158	Zone-1	1	False	1,000	0	1,000	0	20.0	94.9	20.0	5.1	J-219	(N/A)
J-120	Zone-1	1	False	1,000	0	1,000	0	20.0	85.3	20.0	5.1	J-219	(N/A)
J-121	Zone-1	1	False	1,000	0	1,000	0	20.0	22.5	20.0	5.1	J-219	(N/A)
J-127	Zone-1	1	False	1,000	0	1,009	9	20.0	89.3	20.0	5.1	J-219	(N/A)
J-125	Zone-1	1	False	1,000	0	1,013	13	20.0	94.9	20.0	5.1	J-219	(N/A)
J-155	Zone-1	1	False	1,000	0	1,000	0	20.0	18.6	20.0	5.1	J-219	(N/A)
J-136	Zone-1	1	False	1,000	0	1,003	3	20.0	106.5	20.0	5.1	J-219	(N/A)
J-118	Zone-1	1	False	1,000	0	1,000	0	20.0	106.5	20.0	5.1	J-219	(N/A)
J-144	Zone-1	1	False	1,000	0	1,003	3	20.0	86.1	20.0	5.1	J-219	(N/A)
J-157	Zone-1	1	False	1,000	0	1,013	13	20.0	87.8	20.0	5.1	J-219	(N/A)
J-163	Zone-1	1	False	1,000	0	1,019	19	20.0	53.6	20.0	5.1	J-219	(N/A)
J-154	Zone-1	1	False	1,000	0	1,004	4	20.0	80.7	20.0	5.1	J-219	(N/A)
J-133	Zone-1	1	False	1,000	0	1,004	4	20.0	56.6	20.0	5.1	J-219	(N/A)
J-164	Zone-1	1	False	1,000	0	1,000	0	20.0	80.7	20.0	5.1	J-219	(N/A)
J-140	Zone-1	1	False	1,000	0	1,000	0	20.0	102.3	20.0	5.1	J-219	(N/A)
J-153	Zone-1	1	False	1,000	0	1,006	6	20.0	96.7	20.0	5.1	J-219	(N/A)
J-159	Zone-1	1	False	1,000	0	1,009	9	20.0	88.4	20.0	5.1	J-219	(N/A)
J-218	Zone-1	1	False	1,000	0	1,000	0	20.0	87.4	20.0	5.1	J-219	(N/A)
J-228	Zone-1	1	False	1,000	0	1,000	0	20.0	91.1	20.0	5.1	J-219	(N/A)
J-216	Zone-1	1	False	1,000	0	1,006	6	20.0	94.0	20.0	5.1	J-219	(N/A)
J-217	Zone-1	1	False	1,000	0	1,000	0	20.0	80.8	20.0	5.1	J-219	(N/A)
J-215	Zone-1	1	False	1,000	0	1,012	12	20.0	89.6	20.0	5.1	J-219	(N/A)
J-245	Zone-1	1	False	1,000	0	1,003	3	20.0	85.3	20.0	5.1	J-219	(N/A)
J-235	Zone-1	1	False	1,000	0	1,009	9	20.0	85.1	20.0	5.1	J-219	(N/A)
J-219	Zone-1	1	False	1,000	0	1,000	0	20.0	5.1	20.0	18.6	J-155	(N/A)
J-220	Zone-1	1	False	1,000	0	1,000	0	20.0	88.8	20.0	5.1	J-219	(N/A)
J-221	Zone-1	1	False	1,000	0	1,000	0	20.0	84.4	20.0	5.1	J-219	(N/A)
J-224	Zone-1	1	False	1,000	0	1,010	10	20.0	81.9	20.0	5.1	J-219	(N/A)
J-225	Zone-1	1	False	1,000	0	1,015	15	20.0	89.2	20.0	5.1	J-219	(N/A)
J-227	Zone-1	1	False	1,000	0	1,009	9	20.0	90.0	20.0	5.1	J-219	(N/A)
J-229	Zone-1	1	False	1,000	0	1,012	12	20.0	85.5	20.0	5.1	J-219	(N/A)
J-230	Zone-1	1	False	1,000	0	1,010	10	20.0	88.2	20.0	5.1	J-219	(N/A)
J-231	Zone-1	1	False	1,000	0	1,012	12	20.0	89.4	20.0	5.1	J-219	(N/A)
J-232	Zone-1	1	False	1,000	0	1,013	13	20.0	80.3	20.0	5.1	J-219	(N/A)
J-233	Zone-1	1	False	1,000	0	1,007	7	20.0	89.3	20.0	5.1	J-219	(N/A)
J-234	Zone-1	1	False	1,000	0	1,009	9	20.0	97.8	20.0	5.1	J-219	(N/A)
J-236	Zone-1	1	False	1,000	0	1,010	10	20.0	107.3	20.0	5.1	J-219	(N/A)

J-237	Zone-1	1	False	1,000	0	1,009	9	20.0	89.7	20.0	5.1	J-219	(N/A)
J-238	Zone-1	1	False	1,000	0	1,016	16	20.0	57.5	20.0	5.1	J-219	(N/A)
J-239	Zone-1	1	False	1,000	0	1,007	7	20.0	58.8	20.0	5.1	J-219	(N/A)
J-240	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.1	J-219	(N/A)
H-1	<None>	6	True	1,000	1,453	1,000	1,453	20.0	20.8	20.0	20.0	H-4	(N/A)
H-2	<None>	6	True	1,000	1,305	1,000	1,305	20.0	24.5	20.0	20.0	H-4	(N/A)
H-3	<None>	4	True	1,000	1,279	1,000	1,279	20.0	20.0	20.0	21.5	H-4	(N/A)
H-4	<None>	8	True	1,000	1,211	1,000	1,211	20.0	20.0	20.0	32.1	H-8	(N/A)
H-5	<None>	4	True	1,000	1,380	1,000	1,380	20.0	20.0	20.0	21.0	H-4	(N/A)
H-6	<None>	4	True	1,000	1,394	1,000	1,394	20.0	20.0	20.0	24.7	H-4	(N/A)
H-7	<None>	3	True	1,000	1,062	1,000	1,062	20.0	20.0	20.0	39.9	H-4	(N/A)
H-8	<None>	6	True	1,000	1,257	1,000	1,257	20.0	23.9	20.0	20.0	H-4	(N/A)
H-9	<None>	3	True	1,000	1,087	1,000	1,087	20.0	20.0	20.0	34.2	H-4	(N/A)
H-10	<None>	2	True	1,000	1,008	1,000	1,008	20.0	20.0	20.0	38.0	H-17	(N/A)
H-11	<None>	6	True	1,000	1,298	1,000	1,298	20.0	26.8	20.0	20.0	H-4	(N/A)
H-12	<None>	6	True	1,000	1,303	1,000	1,303	20.0	24.9	20.0	20.0	H-4	(N/A)
H-13	<None>	3	True	1,000	1,076	1,000	1,076	20.0	20.0	20.0	37.0	H-4	(N/A)
H-14	<None>	6	True	1,000	1,301	1,000	1,301	20.0	21.5	20.0	20.0	H-4	(N/A)
H-15	<None>	4	True	1,000	1,227	1,000	1,227	20.0	20.0	20.0	25.1	H-4	(N/A)
H-16	<None>	4	True	1,000	1,237	1,000	1,237	20.0	20.0	20.0	24.8	H-4	(N/A)
H-17	<None>	3	True	1,000	1,026	1,000	1,026	20.0	20.0	20.0	38.1	H-4	(N/A)
H-18	<None>	4	True	1,000	1,470	1,000	1,470	20.0	20.0	20.0	24.4	H-4	(N/A)
H-19	<None>	6	True	1,000	1,663	1,000	1,663	20.0	23.7	20.0	20.0	H-4	(N/A)

\\NAS-01\Projects\K4141177 Spirit Lake East Fireflow\Report\Appendices\Analysis\SpiritLakeEastFireFlow Model2.wtg

**APPENDIX I:  
ESTIMATED INITIAL CAPITAL  
COSTS**

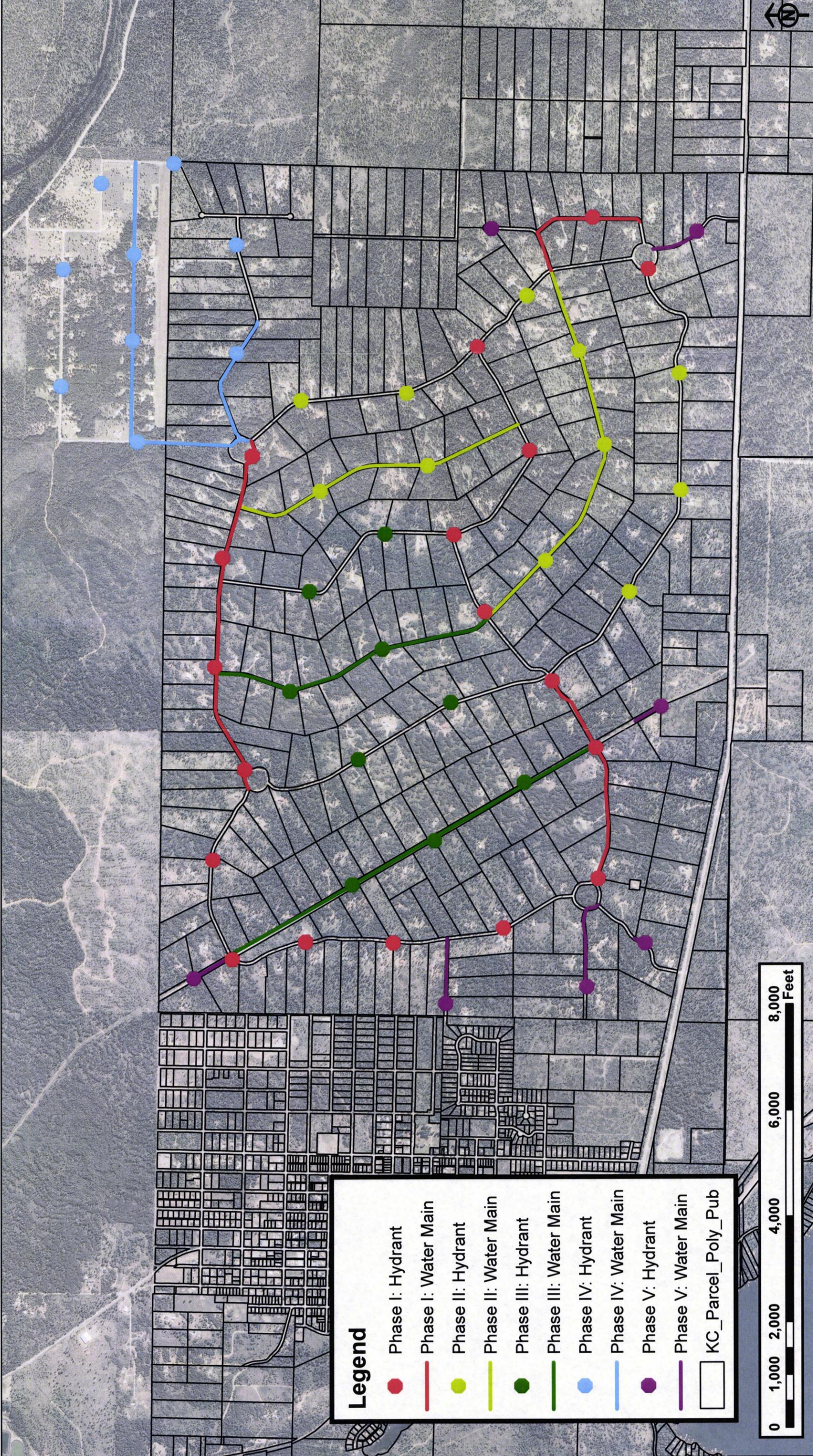
**Spirit Lake East  
Fire Flow Analysis**

**ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST**

Prepared By:	Casey Walton, EIT	Date:	6/6/2014		
PM Approval:		Date:			
Pay Item	Description	Pay Unit	Estimated Quantity	Unit Price	Total
	Mobilization	LS	1	\$151,525	\$151,525
	Site Control	LS	1	\$15,000	\$15,000
	Traffic Control	LS	1	\$5,000	\$5,000
	Unsuitable Excavation & Haul	CY	100	\$25	\$2,500
	Exploratory Excavation & Backfill	HR	10	\$175	\$1,750
	Tie-in to Existing Water	EA	1	\$2,000	\$2,000
	6-inch AWWA C900 DR-18 Water Line	LF	12,421	\$40	\$496,840
	8-inch AWWA C900 DR-18 Water Line	LF	41,090	\$45	\$1,849,050
	10-inch AWWA C900 DR-18 Water Line	LF	4,255	\$50	\$212,750
	Water Service Reconnection	EA	231	\$800	\$184,851
	Gravel Restoration Type A3 - 3/4" Minus Crushed	TON	12,837	\$25	\$320,922
	Hydrant (1,000 ft. spacing)	EA	52	\$5,000	\$260,000
	Hydorseeding	SY	4,529	\$3	\$13,587
	25 Hp. Booster Pump (500 gpm at 60 psi)	EA	3	\$20,000	\$60,000
	100 Hp Well Pump 500 gpm @ 600' TDH	EA	1	\$42,000	\$42,000
	12-Inch Well Drilling	VF	600	\$115	\$69,000
	12-Inch Stainless Steel Well Screen	VF	17	\$410	\$6,970
	12-Inch Blank Well Screen	VF	5	\$130	\$650
	12-Inch Permanent Well Casing	VF	585	\$50	\$29,250
	Pump Control Discharge Structure	LS	1	\$10,000	\$10,000
	Dry-Wells	EA	5	\$3,200	\$16,000
	Electrical	LS	1	\$120,000	\$120,000
	50,000 gallon Water Tank	LS	1	\$150,000	\$150,000
<b>ESTIMATED TOTAL CONSTRUCTION COST</b>					<b>\$4,019,700</b>
					15% Contingency
<b>ESTIMATED TOTAL CONSTRUCTION COST</b>					<b>\$4,622,700</b>

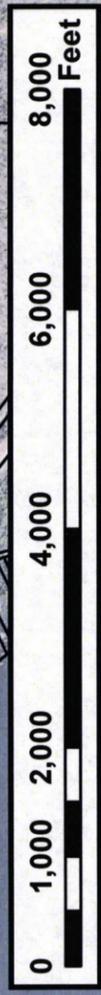
Pay Item	Description	Pay Unit	Estimated Quantity	Unit Price	Total
ENGINEERING					
	Preliminary Engineering				\$0
	Design Phase Services				\$555,000
	Geotechnical Subconsultant Materials Testing				\$0
	Electrical Subconsultant				\$35,000
	Test Holes/Exploratory Excavation				\$0
	Bidding Phase Services (2- Bidding Packages)				\$10,000
	Construction Phase Services				\$601,000
	Construction Staking				\$0
	Railroad Permit Application				\$0
	Start-Up/O&M Manuals				\$0
	Post Construction Phase				\$5,000
	Right of Way Permitting				\$5,000
<b>ESTIMATED TOTAL PROJECT COST</b>					<b>\$5,833,700</b>
	<b>Assumptions</b>				
	1 Additional Well is Required.				
	2 Minimal piping upgrades required for booster pump installation				
	3 New well is approximately the same depth as existing well				
	4 New pump house is not required				
	5 Gravel Restoration based on 12ft. In width at 6 inch depth for duration of pipe length				
	6 Minimal Electrical Upgrades required				
	7 Hydrants placing based on 1,000 radius or 2,000 ft. spacing				
	8 One (1) service replacement per 250 lineal feet of pipe replaced				
	9 Hydro-Seeding based 144 Sq. ft. per service connection and hydrant placement				

**APPENDIX J:  
PHASE INFORMATION**



**Legend**

- Phase I: Hydrant
- Phase I: Water Main
- Phase II: Hydrant
- Phase II: Water Main
- Phase III: Hydrant
- Phase III: Water Main
- Phase IV: Hydrant
- Phase IV: Water Main
- Phase V: Hydrant
- Phase V: Water Main
- KC\_Parcel\_Poly\_Pub



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# Spirit Lake East

## Phase I-V

Sources:  
Kootenai County GIS Department  
ESRI, United States Census Bureau

PROJECT NO.....41177  
DRAWN BY.....CW  
FILENAME.....Phases  
DATE.....06/17/2014



Pay Item	Description	Pay Unit	Estimated Quantity	Unit Price	Total
ENGINEERING					
	Preliminary Engineering				\$0
	Design Phase Services				\$179,000
	Geotechnical Subconsultant Materials Testing				\$0
	Electrical Subconsultant				\$35,000
	Test Holes/Exploratory Excavation				\$0
	Bidding Phase Services (2- Bidding Packages)				\$10,000
	Construction Phase Services				\$193,000
	Construction Staking				\$0
	Railroad Permit Application				\$0
	Start-Up/O&M Manuals				\$0
	Post Construction Phase				\$5,000
	Right of Way Permitting				\$5,000
<b>ESTIMATED TOTAL PROJECT COST</b>					<b>\$1,911,000</b>
	<b>Assumptions</b>				
	1 Additional Well is Required.				
	2 Minimal piping upgrades required for booster pump installation				
	3 New well is approximately the same depth as existing well				
	4 New pump house is not required				
	5 Gravel Restoration based on 12ft. In width at 6 inch depth for duration of pipe length				
	6 Minimal Electrical Upgrades required				
	7 Hydrants placing based on 1,000 radius or 2,000 ft. spacing				
	8 One (1) service replacement per 250 lineal feet of pipe replaced				
	9 Hydro-Seeding based 144 Sq. ft. per service connection and hydrant placement				



Pay Item	Description	Pay Unit	Estimated Quantity	Unit Price	Total
ENGINEERING					
	Preliminary Engineering				\$0
	Design Phase Services				\$136,000
	Geotechnical Subconsultant Materials Testing				\$0
	Electrical Subconsultant				\$35,000
	Test Holes/Exploratory Excavation				\$0
	Bidding Phase Services (2- Bidding Packages)				\$10,000
	Construction Phase Services				\$147,000
	Construction Staking				\$0
	Railroad Permit Application				\$0
	Start-Up/O&M Manuals				\$0
	Post Construction Phase				\$5,000
	Right of Way Permitting				\$5,000
<b>ESTIMATED TOTAL PROJECT COST</b>					<b>\$1,699,200</b>
	<b>Assumptions</b>				
1	Inflation 3%, 5 year				
2	Gravel Restoration based on 12ft. In width at 6 inch depth for duration of pipe length				
3	Minimal Electrical Upgrades required				
4	Hydrants placing based on 1,000 radius or 2,000 ft. spacing				
5	One (1) service replacement per 250 lineal feet of pipe replaced				
6	Hydro-Seeding based 144 Sq. ft. per service connection and hydrant placement				



Pay Item	Description	Pay Unit	Estimated Quantity	Unit Price	Total
ENGINEERING					
	Preliminary Engineering				\$0
	Design Phase Services				\$114,000
	Geotechnical Subconsultant Materials Testing				\$0
	Electrical Subconsultant				\$35,000
	Test Holes/Exploratory Excavation				\$0
	Bidding Phase Services (2- Bidding Packages)				\$10,000
	Construction Phase Services				\$123,000
	Construction Staking				\$0
	Railroad Permit Application				\$0
	Start-Up/O&M Manuals				\$0
	Post Construction Phase				\$5,000
	Right of Way Permitting				\$5,000
<b>ESTIMATED TOTAL PROJECT COST</b>					<b>\$1,663,500</b>
	<b>Assumptions</b>				
	1 Inflation 3%, 10 years				
	2 Gravel Restoration based on 12ft. In width at 6 inch depth for duration of pipe length				
	3 Hydrants placing based on 1,000 radius or 2,000 ft. spacing				
	4 One (1) service replacement per 250 lineal feet of pipe replaced				
	5 Hydro-Seeding based 144 Sq. ft. per service connection and hydrant placement				



Pay Item	Description	Pay Unit	Estimated Quantity	Unit Price	Total
ENGINEERING					
	Preliminary Engineering				\$0
	Design Phase Services				\$86,000
	Geotechnical Subconsultant Materials Testing				\$0
	Electrical Subconsultant				\$35,000
	Test Holes/Exploratory Excavation				\$0
	Bidding Phase Services (2- Bidding Packages)				\$10,000
	Construction Phase Services				\$93,000
	Construction Staking				\$0
	Railroad Permit Application				\$0
	Start-Up/O&M Manuals				\$0
	Post Construction Phase				\$5,000
	Right of Way Permitting				\$5,000
<b>ESTIMATED TOTAL PROJECT COST</b>					<b>\$1,476,200</b>
	<b>Assumptions</b>				
	1 Inflation 3%, 15 years				
	2 Gravel Restoration based on 12ft. In width at 6 inch depth for duration of pipe length				
	3 Hydrants placing based on 1,000 radius or 2,000 ft. spacing				
	4 One (1) service replacement per 250 lineal feet of pipe replaced				
	5 Hydro-Seeding based 144 Sq. ft. per service connection and hydrant placement				



Pay Item	Description	Pay Unit	Estimated Quantity	Unit Price	Total
ENGINEERING					
	Preliminary Engineering				\$0
	Design Phase Services				\$60,000
	Geotechnical Subconsultant Materials Testing				\$0
	Electrical Subconsultant				\$35,000
	Test Holes/Exploratory Excavation				\$0
	Bidding Phase Services (2- Bidding Packages)				\$10,000
	Construction Phase Services				\$65,000
	Construction Staking				\$0
	Railroad Permit Application				\$0
	Start-Up/O&M Manuals				\$0
	Post Construction Phase				\$5,000
	Right of Way Permitting				\$5,000
<b>ESTIMATED TOTAL PROJECT COST</b>					<b>\$1,215,700</b>
<b>Assumptions</b>					
1	Inflation 3%, 20 years				
2	Gravel Restoration based on 12ft. In width at 6 inch depth for duration of pipe length				
3	Hydrants placing based on 1,000 radius or 2,000 ft. spacing				
4	One (1) service replacement per 250 lineal feet of pipe replaced				
5	Hydro-Seeding based 144 Sq. ft. per service connection and hydrant placement				

Scenario: Phase I  
 Current Time Step: 0.000Hr  
 Fire Flow Node FlexTable: Fire Flow Report

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)
J-14	Zone-1	1	False	1,000	0	1,000	0	20.0	85.7	20.0	5.2	J-219	(N/A)
J-4	Zone-1	1	False	1,000	0	1,000	0	20.0	87.0	20.0	5.2	J-219	(N/A)
J-9	Zone-1	1	False	1,000	0	1,001	1	20.0	84.5	20.0	5.2	J-219	(N/A)
J-12	Zone-1	1	False	1,000	0	1,003	3	20.0	107.9	20.0	5.2	J-219	(N/A)
J-16	Zone-1	1	False	1,000	0	1,000	0	20.0	90.6	20.0	5.2	J-219	(N/A)
J-19	Zone-1	1	False	1,000	0	1,003	3	20.0	48.6	20.0	5.2	J-219	(N/A)
J-20	Zone-1	1	False	1,000	0	1,003	3	20.0	89.5	20.0	5.2	J-219	(N/A)
J-8	Zone-1	1	False	1,000	0	1,001	1	20.0	83.2	20.0	5.2	J-219	(N/A)
J-11	Zone-1	1	False	1,000	0	1,001	1	20.0	98.0	20.0	5.2	J-219	(N/A)
J-7	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-18	Zone-1	1	False	1,000	0	1,001	1	20.0	48.6	20.0	5.2	J-219	(N/A)
J-15	Zone-1	1	False	1,000	0	1,000	0	20.0	81.4	20.0	5.2	J-219	(N/A)
J-10	Zone-1	1	False	1,000	0	1,003	3	20.0	98.4	20.0	5.2	J-219	(N/A)
J-21	Zone-1	1	False	1,000	0	1,003	3	20.0	87.7	20.0	5.2	J-219	(N/A)
J-13	Zone-1	1	False	1,000	0	1,001	1	20.0	106.6	20.0	5.2	J-219	(N/A)
J-3	Zone-1	1	False	1,000	0	1,006	6	20.0	86.9	20.0	5.2	J-219	(N/A)
J-17	Zone-1	1	False	1,000	0	1,000	0	20.0	90.6	20.0	5.2	J-219	(N/A)
J-45	Zone-1	1	False	1,000	0	1,004	4	20.0	106.6	20.0	5.2	J-219	(N/A)
J-48	Zone-1	1	False	1,000	0	1,000	0	20.0	88.7	20.0	5.2	J-219	(N/A)
J-41	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-42	Zone-1	1	False	1,000	0	1,000	0	20.0	89.6	20.0	5.2	J-219	(N/A)
J-46	Zone-1	1	False	1,000	0	1,009	9	20.0	47.3	20.0	5.2	J-219	(N/A)
J-47	Zone-1	1	False	1,000	0	1,006	6	20.0	88.4	20.0	5.2	J-219	(N/A)
J-86	Zone-1	1	False	1,000	0	1,007	7	20.0	82.2	20.0	5.2	J-219	(N/A)
J-79	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-74	Zone-1	1	False	1,000	0	1,004	4	20.0	98.0	20.0	5.2	J-219	(N/A)
J-78	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-83	Zone-1	1	False	1,000	0	1,021	21	20.0	47.0	20.0	5.2	J-219	(N/A)
J-70	Zone-1	1	False	1,000	0	1,003	3	20.0	82.9	20.0	5.2	J-219	(N/A)
J-82	Zone-1	1	False	1,000	0	1,000	0	20.0	49.9	20.0	5.2	J-219	(N/A)
J-87	Zone-1	1	False	1,000	0	1,009	9	20.0	106.6	20.0	5.2	J-219	(N/A)
J-69	Zone-1	1	False	1,000	0	1,003	3	20.0	87.7	20.0	5.2	J-219	(N/A)
J-73	Zone-1	1	False	1,000	0	1,006	6	20.0	97.9	20.0	5.2	J-219	(N/A)
J-62	Zone-1	1	False	1,000	0	1,012	12	20.0	89.5	20.0	5.2	J-219	(N/A)
J-81	Zone-1	1	False	1,000	0	1,009	9	20.0	89.4	20.0	5.2	J-219	(N/A)
J-63	Zone-1	1	False	1,000	0	1,000	0	20.0	47.3	20.0	5.2	J-219	(N/A)
J-80	Zone-1	1	False	1,000	0	1,006	6	20.0	89.7	20.0	5.2	J-219	(N/A)
J-72	Zone-1	1	False	1,000	0	1,000	0	20.0	88.0	20.0	5.2	J-219	(N/A)
J-61	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.2	J-219	(N/A)
J-71	Zone-1	1	False	1,000	0	1,000	0	20.0	88.0	20.0	5.2	J-219	(N/A)
J-65	Zone-1	1	False	1,000	0	1,000	0	20.0	106.6	20.0	5.2	J-219	(N/A)
J-77	Zone-1	1	False	1,000	0	1,006	6	20.0	97.9	20.0	5.2	J-219	(N/A)
J-66	Zone-1	1	False	1,000	0	1,006	6	20.0	91.0	20.0	5.2	J-219	(N/A)
J-67	Zone-1	1	False	1,000	0	1,010	10	20.0	100.5	20.0	5.2	J-219	(N/A)
J-76	Zone-1	1	False	1,000	0	1,009	9	20.0	97.9	20.0	5.2	J-219	(N/A)
J-128	Zone-1	1	False	1,000	0	1,012	12	20.0	99.7	20.0	5.2	J-219	(N/A)
J-150	Zone-1	1	False	1,000	0	1,006	6	20.0	99.7	20.0	5.2	J-219	(N/A)
J-138	Zone-1	1	False	1,000	0	1,006	6	20.0	102.3	20.0	5.2	J-219	(N/A)
J-117	Zone-1	1	False	1,000	0	1,004	4	20.0	114.8	20.0	5.2	J-219	(N/A)
J-131	Zone-1	1	False	1,000	0	1,007	7	20.0	85.5	20.0	5.2	J-219	(N/A)
J-142	Zone-1	1	False	1,000	0	1,007	7	20.0	98.7	20.0	5.2	J-219	(N/A)
J-119	Zone-1	1	False	1,000	0	1,000	0	20.0	106.6	20.0	5.2	J-219	(N/A)
J-134	Zone-1	1	False	1,000	0	1,006	6	20.0	46.0	20.0	5.2	J-219	(N/A)
J-145	Zone-1	1	False	1,000	0	1,000	0	20.0	102.3	20.0	5.2	J-219	(N/A)
J-141	Zone-1	1	False	1,000	0	1,009	9	20.0	98.1	20.0	5.2	J-219	(N/A)
J-135	Zone-1	1	False	1,000	0	1,007	7	20.0	106.6	20.0	5.2	J-219	(N/A)
J-152	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-139	Zone-1	1	False	1,000	0	1,010	10	20.0	82.8	20.0	5.2	J-219	(N/A)
J-126	Zone-1	1	False	1,000	0	1,006	6	20.0	82.2	20.0	5.2	J-219	(N/A)
J-124	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.2	J-219	(N/A)
J-151	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-122	Zone-1	1	False	1,000	0	1,007	7	20.0	57.3	20.0	5.2	J-219	(N/A)
J-158	Zone-1	1	False	1,000	0	1,000	0	20.0	95.1	20.0	5.2	J-219	(N/A)
J-120	Zone-1	1	False	1,000	0	1,000	0	20.0	85.5	20.0	5.2	J-219	(N/A)
J-121	Zone-1	1	False	1,000	0	1,000	0	20.0	22.5	20.0	5.2	J-219	(N/A)
J-127	Zone-1	1	False	1,000	0	1,009	9	20.0	89.4	20.0	5.2	J-219	(N/A)
J-125	Zone-1	1	False	1,000	0	1,013	13	20.0	95.1	20.0	5.2	J-219	(N/A)
J-155	Zone-1	1	False	1,000	0	1,000	0	20.0	18.6	20.0	5.2	J-219	(N/A)
J-136	Zone-1	1	False	1,000	0	1,003	3	20.0	106.6	20.0	5.2	J-219	(N/A)
J-118	Zone-1	1	False	1,000	0	1,000	0	20.0	106.6	20.0	5.2	J-219	(N/A)
J-144	Zone-1	1	False	1,000	0	1,003	3	20.0	86.3	20.0	5.2	J-219	(N/A)
J-157	Zone-1	1	False	1,000	0	1,013	13	20.0	87.8	20.0	5.2	J-219	(N/A)
J-163	Zone-1	1	False	1,000	0	1,019	19	20.0	53.5	20.0	5.2	J-219	(N/A)
J-154	Zone-1	1	False	1,000	0	1,004	4	20.0	81.0	20.0	5.2	J-219	(N/A)
J-133	Zone-1	1	False	1,000	0	1,004	4	20.0	56.4	20.0	5.2	J-219	(N/A)
J-164	Zone-1	1	False	1,000	0	1,000	0	20.0	81.0	20.0	5.2	J-219	(N/A)
J-140	Zone-1	1	False	1,000	0	1,000	0	20.0	102.3	20.0	5.2	J-219	(N/A)
J-153	Zone-1	1	False	1,000	0	1,006	6	20.0	96.8	20.0	5.2	J-219	(N/A)
J-159	Zone-1	1	False	1,000	0	1,009	9	20.0	88.6	20.0	5.2	J-219	(N/A)
J-218	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-228	Zone-1	1	False	1,000	0	1,000	0	20.0	91.4	20.0	5.2	J-219	(N/A)
J-216	Zone-1	1	False	1,000	0	1,006	6	20.0	94.2	20.0	5.2	J-219	(N/A)
J-217	Zone-1	1	False	1,000	0	1,000	0	20.0	81.1	20.0	5.2	J-219	(N/A)
J-215	Zone-1	1	False	1,000	0	1,012	12	20.0	89.7	20.0	5.2	J-219	(N/A)
J-245	Zone-1	1	False	1,000	0	1,003	3	20.0	85.5	20.0	5.2	J-219	(N/A)
J-235	Zone-1	1	False	1,000	0	1,009	9	20.0	85.3	20.0	5.2	J-219	(N/A)
J-219	Zone-1	1	False	1,000	0	1,000	0	20.0	5.2	20.0	18.6	J-155	(N/A)
J-220	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-221	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-224	Zone-1	1	False	1,000	0	1,010	10	20.0	81.9	20.0	5.2	J-219	(N/A)
J-225	Zone-1	1	False	1,000	0	1,015	15	20.0	89.1	20.0	5.2	J-219	(N/A)
J-227	Zone-1	1	False	1,000	0	1,009	9	20.0	89.9	20.0	5.2	J-219	(N/A)
J-229	Zone-1	1	False	1,000	0	1,012	12	20.0	85.5	20.0	5.2	J-219	(N/A)
J-230	Zone-1	1	False	1,000	0	1,010	10	20.0	88.1	20.0	5.2	J-219	(N/A)
J-231	Zone-1	1	False	1,000	0	1,012	12	20.0	89.5	20.0	5.2	J-219	(N/A)
J-232	Zone-1	1	False	1,000	0	1,013	13	20.0	80.4	20.0	5.2	J-219	(N/A)
J-233	Zone-1	1	False	1,000	0	1,007	7	20.0	89.4	20.0	5.2	J-219	(N/A)
J-234	Zone-1	1	False	1,000	0	1,009	9	20.0	97.9	20.0	5.2	J-219	(N/A)
J-236	Zone-1	1	False	1,000	0	1,010	10	20.0	107.4	20.0	5.2	J-219	(N/A)

J-237	Zone-1	1	False	1,000	0	1,009	9	20.0	89.9	20.0	5.2	J-219	(N/A)
J-238	Zone-1	1	False	1,000	0	1,016	16	20.0	57.3	20.0	5.2	J-219	(N/A)
J-239	Zone-1	1	False	1,000	0	1,007	7	20.0	58.6	20.0	5.2	J-219	(N/A)
J-240	Zone-1	1	False	1,000	0	1,000	0	20.0	89.8	20.0	5.2	J-219	(N/A)
H-1	<None>	4	True	1,000	1,353	1,000	1,353	20.0	20.0	20.0	27.0	H-4	(N/A)
H-2	<None>	4	True	1,000	1,299	1,000	1,299	20.0	20.0	20.0	22.8	H-4	(N/A)
H-3	<None>	4	True	1,000	1,246	1,000	1,246	20.0	20.0	20.0	26.4	H-4	(N/A)
H-4	<None>	4	False	1,000	590	1,000	590	20.0	20.0	20.0	46.4	H-8	(N/A)
H-5	<None>	4	True	1,000	1,429	1,000	1,429	20.0	20.0	20.0	21.0	H-4	(N/A)
H-6	<None>	4	False	1,000	498	1,000	498	20.0	20.0	20.0	47.3	H-17	(N/A)
H-7	<None>	3	True	1,000	1,074	1,000	1,074	20.0	20.0	20.0	40.9	H-4	(N/A)
H-8	<None>	4	False	1,000	580	1,000	580	20.0	20.0	20.0	40.3	H-4	(N/A)
H-9	<None>	3	True	1,000	1,099	1,000	1,099	20.0	20.0	20.0	35.6	H-4	(N/A)
H-10	<None>	3	False	1,000	793	1,000	793	20.0	20.0	20.0	29.5	H-17	(N/A)
H-11	<None>	6	True	1,000	1,336	1,000	1,336	20.0	25.6	20.0	20.0	H-4	(N/A)
H-12	<None>	4	True	1,000	1,329	1,000	1,329	20.0	20.0	20.0	21.4	H-4	(N/A)
H-13	<None>	3	True	1,000	1,022	1,000	1,022	20.0	20.0	20.0	40.5	H-21	(N/A)
H-14	<None>	3	False	1,000	639	1,000	639	20.0	20.1	20.0	47.3	H-17	(N/A)
H-15	<None>	3	True	1,000	1,225	1,000	1,225	20.0	20.1	20.0	27.9	H-4	(N/A)
H-16	<None>	4	False	1,000	505	1,000	505	20.0	20.0	20.0	47.3	H-17	(N/A)
H-17	<None>	3	False	1,000	735	1,000	735	20.0	20.0	20.0	40.7	H-10	(N/A)
H-18	<None>	4	True	1,000	1,456	1,000	1,456	20.0	20.0	20.0	27.0	H-4	(N/A)
H-19	<None>	6	True	1,000	1,743	1,000	1,743	20.0	23.7	20.0	20.0	H-4	(N/A)
H-21	<None>	3	True	1,000	1,100	1,000	1,100	20.0	20.0	20.0	26.5	H-13	(N/A)

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Scenario: Phasell  
 Current Time Step: 0.000Hr  
 Fire Flow Node FlexTable: Fire Flow Report

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)
J-14	Zone-1	1	False	1,000	0	1,000	0	20.0	85.8	20.0	5.2	J-219	(N/A)
J-4	Zone-1	1	False	1,000	0	1,000	0	20.0	87.0	20.0	5.2	J-219	(N/A)
J-9	Zone-1	1	False	1,000	0	1,001	1	20.0	84.5	20.0	5.2	J-219	(N/A)
J-12	Zone-1	1	False	1,000	0	1,003	3	20.0	108.0	20.0	5.2	J-219	(N/A)
J-16	Zone-1	1	False	1,000	0	1,000	0	20.0	90.6	20.0	5.2	J-219	(N/A)
J-19	Zone-1	1	False	1,000	0	1,003	3	20.0	48.6	20.0	5.2	J-219	(N/A)
J-20	Zone-1	1	False	1,000	0	1,003	3	20.0	89.5	20.0	5.2	J-219	(N/A)
J-8	Zone-1	1	False	1,000	0	1,001	1	20.0	83.2	20.0	5.2	J-219	(N/A)
J-11	Zone-1	1	False	1,000	0	1,001	1	20.0	98.1	20.0	5.2	J-219	(N/A)
J-7	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-18	Zone-1	1	False	1,000	0	1,001	1	20.0	48.6	20.0	5.2	J-219	(N/A)
J-15	Zone-1	1	False	1,000	0	1,000	0	20.0	81.5	20.0	5.2	J-219	(N/A)
J-10	Zone-1	1	False	1,000	0	1,003	3	20.0	98.6	20.0	5.2	J-219	(N/A)
J-21	Zone-1	1	False	1,000	0	1,003	3	20.0	87.8	20.0	5.2	J-219	(N/A)
J-13	Zone-1	1	False	1,000	0	1,001	1	20.0	106.7	20.0	5.2	J-219	(N/A)
J-3	Zone-1	1	False	1,000	0	1,006	6	20.0	86.9	20.0	5.2	J-219	(N/A)
J-17	Zone-1	1	False	1,000	0	1,000	0	20.0	90.6	20.0	5.2	J-219	(N/A)
J-45	Zone-1	1	False	1,000	0	1,004	4	20.0	106.8	20.0	5.2	J-219	(N/A)
J-48	Zone-1	1	False	1,000	0	1,000	0	20.0	88.7	20.0	5.2	J-219	(N/A)
J-41	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-42	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.2	J-219	(N/A)
J-46	Zone-1	1	False	1,000	0	1,009	9	20.0	47.3	20.0	5.2	J-219	(N/A)
J-47	Zone-1	1	False	1,000	0	1,006	6	20.0	88.4	20.0	5.2	J-219	(N/A)
J-86	Zone-1	1	False	1,000	0	1,007	7	20.0	82.2	20.0	5.2	J-219	(N/A)
J-79	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-74	Zone-1	1	False	1,000	0	1,004	4	20.0	98.1	20.0	5.2	J-219	(N/A)
J-78	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-83	Zone-1	1	False	1,000	0	1,021	21	20.0	47.0	20.0	5.2	J-219	(N/A)
J-70	Zone-1	1	False	1,000	0	1,003	3	20.0	82.9	20.0	5.2	J-219	(N/A)
J-82	Zone-1	1	False	1,000	0	1,000	0	20.0	49.9	20.0	5.2	J-219	(N/A)
J-87	Zone-1	1	False	1,000	0	1,009	9	20.0	106.8	20.0	5.2	J-219	(N/A)
J-69	Zone-1	1	False	1,000	0	1,003	3	20.0	87.7	20.0	5.2	J-219	(N/A)
J-73	Zone-1	1	False	1,000	0	1,006	6	20.0	98.1	20.0	5.2	J-219	(N/A)
J-62	Zone-1	1	False	1,000	0	1,012	12	20.0	89.6	20.0	5.2	J-219	(N/A)
J-81	Zone-1	1	False	1,000	0	1,009	9	20.0	89.6	20.0	5.2	J-219	(N/A)
J-63	Zone-1	1	False	1,000	0	1,000	0	20.0	47.3	20.0	5.2	J-219	(N/A)
J-80	Zone-1	1	False	1,000	0	1,006	6	20.0	89.7	20.0	5.2	J-219	(N/A)
J-72	Zone-1	1	False	1,000	0	1,000	0	20.0	88.0	20.0	5.2	J-219	(N/A)
J-61	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.2	J-219	(N/A)
J-71	Zone-1	1	False	1,000	0	1,000	0	20.0	88.0	20.0	5.2	J-219	(N/A)
J-65	Zone-1	1	False	1,000	0	1,000	0	20.0	106.8	20.0	5.2	J-219	(N/A)
J-77	Zone-1	1	False	1,000	0	1,006	6	20.0	98.1	20.0	5.2	J-219	(N/A)
J-66	Zone-1	1	False	1,000	0	1,006	6	20.0	91.3	20.0	5.2	J-219	(N/A)
J-67	Zone-1	1	False	1,000	0	1,010	10	20.0	100.7	20.0	5.2	J-219	(N/A)
J-76	Zone-1	1	False	1,000	0	1,009	9	20.0	98.0	20.0	5.2	J-219	(N/A)
J-128	Zone-1	1	False	1,000	0	1,012	12	20.0	99.8	20.0	5.2	J-219	(N/A)
J-150	Zone-1	1	False	1,000	0	1,006	6	20.0	99.8	20.0	5.2	J-219	(N/A)
J-138	Zone-1	1	False	1,000	0	1,006	6	20.0	102.5	20.0	5.2	J-219	(N/A)
J-117	Zone-1	1	False	1,000	0	1,004	4	20.0	115.0	20.0	5.2	J-219	(N/A)
J-131	Zone-1	1	False	1,000	0	1,007	7	20.0	85.5	20.0	5.2	J-219	(N/A)
J-142	Zone-1	1	False	1,000	0	1,007	7	20.0	98.8	20.0	5.2	J-219	(N/A)
J-119	Zone-1	1	False	1,000	0	1,000	0	20.0	106.8	20.0	5.2	J-219	(N/A)
J-134	Zone-1	1	False	1,000	0	1,006	6	20.0	46.0	20.0	5.2	J-219	(N/A)
J-145	Zone-1	1	False	1,000	0	1,000	0	20.0	102.5	20.0	5.2	J-219	(N/A)
J-141	Zone-1	1	False	1,000	0	1,009	9	20.0	98.2	20.0	5.2	J-219	(N/A)
J-135	Zone-1	1	False	1,000	0	1,007	7	20.0	106.8	20.0	5.2	J-219	(N/A)
J-152	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-139	Zone-1	1	False	1,000	0	1,010	10	20.0	82.8	20.0	5.2	J-219	(N/A)
J-126	Zone-1	1	False	1,000	0	1,006	6	20.0	82.2	20.0	5.2	J-219	(N/A)
J-124	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.2	J-219	(N/A)
J-151	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-122	Zone-1	1	False	1,000	0	1,007	7	20.0	57.3	20.0	5.2	J-219	(N/A)
J-158	Zone-1	1	False	1,000	0	1,000	0	20.0	95.1	20.0	5.2	J-219	(N/A)
J-120	Zone-1	1	False	1,000	0	1,000	0	20.0	85.5	20.0	5.2	J-219	(N/A)
J-121	Zone-1	1	False	1,000	0	1,000	0	20.0	22.5	20.0	5.2	J-219	(N/A)
J-127	Zone-1	1	False	1,000	0	1,009	9	20.0	89.5	20.0	5.2	J-219	(N/A)
J-125	Zone-1	1	False	1,000	0	1,013	13	20.0	95.1	20.0	5.2	J-219	(N/A)
J-155	Zone-1	1	False	1,000	0	1,000	0	20.0	18.6	20.0	5.2	J-219	(N/A)
J-136	Zone-1	1	False	1,000	0	1,003	3	20.0	106.8	20.0	5.2	J-219	(N/A)
J-118	Zone-1	1	False	1,000	0	1,000	0	20.0	106.8	20.0	5.2	J-219	(N/A)
J-144	Zone-1	1	False	1,000	0	1,003	3	20.0	86.3	20.0	5.2	J-219	(N/A)
J-157	Zone-1	1	False	1,000	0	1,013	13	20.0	87.9	20.0	5.2	J-219	(N/A)
J-163	Zone-1	1	False	1,000	0	1,019	19	20.0	53.5	20.0	5.2	J-219	(N/A)
J-154	Zone-1	1	False	1,000	0	1,004	4	20.0	81.0	20.0	5.2	J-219	(N/A)
J-133	Zone-1	1	False	1,000	0	1,004	4	20.0	56.4	20.0	5.2	J-219	(N/A)
J-164	Zone-1	1	False	1,000	0	1,000	0	20.0	81.0	20.0	5.2	J-219	(N/A)
J-140	Zone-1	1	False	1,000	0	1,000	0	20.0	102.5	20.0	5.2	J-219	(N/A)
J-153	Zone-1	1	False	1,000	0	1,006	6	20.0	96.9	20.0	5.2	J-219	(N/A)
J-159	Zone-1	1	False	1,000	0	1,009	9	20.0	88.6	20.0	5.2	J-219	(N/A)
J-218	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-228	Zone-1	1	False	1,000	0	1,000	0	20.0	91.3	20.0	5.2	J-219	(N/A)
J-216	Zone-1	1	False	1,000	0	1,006	6	20.0	94.3	20.0	5.2	J-219	(N/A)
J-217	Zone-1	1	False	1,000	0	1,000	0	20.0	81.0	20.0	5.2	J-219	(N/A)
J-215	Zone-1	1	False	1,000	0	1,012	12	20.0	89.7	20.0	5.2	J-219	(N/A)
J-245	Zone-1	1	False	1,000	0	1,003	3	20.0	85.5	20.0	5.2	J-219	(N/A)
J-235	Zone-1	1	False	1,000	0	1,009	9	20.0	85.4	20.0	5.2	J-219	(N/A)
J-219	Zone-1	1	False	1,000	0	1,000	0	20.0	5.2	20.0	18.6	J-155	(N/A)
J-220	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-221	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-224	Zone-1	1	False	1,000	0	1,010	10	20.0	81.9	20.0	5.2	J-219	(N/A)
J-225	Zone-1	1	False	1,000	0	1,015	15	20.0	89.1	20.0	5.2	J-219	(N/A)
J-227	Zone-1	1	False	1,000	0	1,009	9	20.0	90.0	20.0	5.2	J-219	(N/A)
J-229	Zone-1	1	False	1,000	0	1,012	12	20.0	85.5	20.0	5.2	J-219	(N/A)
J-230	Zone-1	1	False	1,000	0	1,010	10	20.0	88.2	20.0	5.2	J-219	(N/A)
J-231	Zone-1	1	False	1,000	0	1,012	12	20.0	89.5	20.0	5.2	J-219	(N/A)
J-232	Zone-1	1	False	1,000	0	1,013	13	20.0	80.4	20.0	5.2	J-219	(N/A)
J-233	Zone-1	1	False	1,000	0	1,007	7	20.0	89.5	20.0	5.2	J-219	(N/A)
J-234	Zone-1	1	False	1,000	0	1,009	9	20.0	98.0	20.0	5.2	J-219	(N/A)
J-236	Zone-1	1	False	1,000	0	1,010	10	20.0	107.5	20.0	5.2	J-219	(N/A)

J-237	Zone-1	1	False	1,000	0	1,009	9	20.0	89.9	20.0	5.2	J-219	(N/A)
J-238	Zone-1	1	False	1,000	0	1,016	16	20.0	57.3	20.0	5.2	J-219	(N/A)
J-239	Zone-1	1	False	1,000	0	1,007	7	20.0	58.6	20.0	5.2	J-219	(N/A)
J-240	Zone-1	1	False	1,000	0	1,000	0	20.0	89.9	20.0	5.2	J-219	(N/A)
H-1	<None>	4	True	1,000	1,364	1,000	1,364	20.0	20.0	20.0	26.3	H-4	(N/A)
H-2	<None>	4	True	1,000	1,331	1,000	1,331	20.0	20.0	20.0	20.4	H-4	(N/A)
H-3	<None>	4	True	1,000	1,302	1,000	1,302	20.0	20.0	20.0	22.3	H-4	(N/A)
H-4	<None>	4	False	1,000	590	1,000	590	20.0	20.0	20.0	46.4	H-8	(N/A)
H-5	<None>	4	True	1,000	1,429	1,000	1,429	20.0	20.0	20.0	21.0	H-4	(N/A)
H-6	<None>	4	False	1,000	498	1,000	498	20.0	20.0	20.0	47.3	H-17	(N/A)
H-7	<None>	3	True	1,000	1,077	1,000	1,077	20.0	20.0	20.0	40.7	H-4	(N/A)
H-8	<None>	8	False	1,000	580	1,000	580	20.0	20.1	20.0	40.2	H-4	(N/A)
H-9	<None>	3	True	1,000	1,106	1,000	1,106	20.0	20.0	20.0	35.0	H-4	(N/A)
H-10	<None>	3	False	1,000	793	1,000	793	20.0	20.0	20.0	29.5	H-17	(N/A)
H-11	<None>	6	True	1,000	1,333	1,000	1,333	20.0	26.6	20.0	20.0	H-4	(N/A)
H-12	<None>	6	True	1,000	1,338	1,000	1,338	20.0	24.3	20.0	20.0	H-4	(N/A)
H-13	<None>	3	True	1,000	1,093	1,000	1,093	20.0	20.0	20.0	37.9	H-4	(N/A)
H-14	<None>	6	True	1,000	1,336	1,000	1,336	20.0	20.8	20.0	20.0	H-4	(N/A)
H-15	<None>	4	True	1,000	1,247	1,000	1,247	20.0	20.0	20.0	26.0	H-4	(N/A)
H-16	<None>	4	True	1,000	1,261	1,000	1,261	20.0	20.0	20.0	25.1	H-4	(N/A)
H-17	<None>	3	False	1,000	735	1,000	735	20.0	20.0	20.0	40.7	H-10	(N/A)
H-18	<None>	4	True	1,000	1,460	1,000	1,460	20.0	20.0	20.0	26.7	H-4	(N/A)
H-19	<None>	6	True	1,000	1,743	1,000	1,743	20.0	23.7	20.0	20.0	H-4	(N/A)
H-21	<None>	3	True	1,000	1,234	1,000	1,234	20.0	20.0	20.0	25.8	H-13	(N/A)

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Scenario: Phaselll  
 Current Time Step: 0.000Hr  
 Fire Flow Node FlexTable: Fire Flow Report

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)
J-14	Zone-1	1	False	1,000	0	1,000	0	20.0	85.8	20.0	5.2	J-219	(N/A)
J-4	Zone-1	1	False	1,000	0	1,000	0	20.0	87.0	20.0	5.2	J-219	(N/A)
J-9	Zone-1	1	False	1,000	0	1,001	1	20.0	84.5	20.0	5.2	J-219	(N/A)
J-12	Zone-1	1	False	1,000	0	1,003	3	20.0	108.0	20.0	5.2	J-219	(N/A)
J-16	Zone-1	1	False	1,000	0	1,000	0	20.0	90.7	20.0	5.2	J-219	(N/A)
J-19	Zone-1	1	False	1,000	0	1,003	3	20.0	48.6	20.0	5.2	J-219	(N/A)
J-20	Zone-1	1	False	1,000	0	1,003	3	20.0	89.8	20.0	5.2	J-219	(N/A)
J-8	Zone-1	1	False	1,000	0	1,001	1	20.0	83.2	20.0	5.2	J-219	(N/A)
J-11	Zone-1	1	False	1,000	0	1,001	1	20.0	98.1	20.0	5.2	J-219	(N/A)
J-7	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-18	Zone-1	1	False	1,000	0	1,001	1	20.0	48.6	20.0	5.2	J-219	(N/A)
J-15	Zone-1	1	False	1,000	0	1,000	0	20.0	81.5	20.0	5.2	J-219	(N/A)
J-10	Zone-1	1	False	1,000	0	1,003	3	20.0	98.6	20.0	5.2	J-219	(N/A)
J-21	Zone-1	1	False	1,000	0	1,003	3	20.0	88.0	20.0	5.2	J-219	(N/A)
J-13	Zone-1	1	False	1,000	0	1,001	1	20.0	106.8	20.0	5.2	J-219	(N/A)
J-3	Zone-1	1	False	1,000	0	1,006	6	20.0	86.9	20.0	5.2	J-219	(N/A)
J-17	Zone-1	1	False	1,000	0	1,000	0	20.0	90.7	20.0	5.2	J-219	(N/A)
J-45	Zone-1	1	False	1,000	0	1,004	4	20.0	106.8	20.0	5.2	J-219	(N/A)
J-48	Zone-1	1	False	1,000	0	1,000	0	20.0	88.9	20.0	5.2	J-219	(N/A)
J-41	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-42	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.2	J-219	(N/A)
J-46	Zone-1	1	False	1,000	0	1,009	9	20.0	47.3	20.0	5.2	J-219	(N/A)
J-47	Zone-1	1	False	1,000	0	1,006	6	20.0	88.5	20.0	5.2	J-219	(N/A)
J-86	Zone-1	1	False	1,000	0	1,007	7	20.0	82.1	20.0	5.2	J-219	(N/A)
J-79	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-74	Zone-1	1	False	1,000	0	1,004	4	20.0	98.1	20.0	5.2	J-219	(N/A)
J-78	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-83	Zone-1	1	False	1,000	0	1,021	21	20.0	47.0	20.0	5.2	J-219	(N/A)
J-70	Zone-1	1	False	1,000	0	1,003	3	20.0	82.9	20.0	5.2	J-219	(N/A)
J-82	Zone-1	1	False	1,000	0	1,000	0	20.0	49.9	20.0	5.2	J-219	(N/A)
J-87	Zone-1	1	False	1,000	0	1,009	9	20.0	106.8	20.0	5.2	J-219	(N/A)
J-69	Zone-1	1	False	1,000	0	1,003	3	20.0	87.7	20.0	5.2	J-219	(N/A)
J-73	Zone-1	1	False	1,000	0	1,006	6	20.0	98.1	20.0	5.2	J-219	(N/A)
J-62	Zone-1	1	False	1,000	0	1,012	12	20.0	89.7	20.0	5.2	J-219	(N/A)
J-81	Zone-1	1	False	1,000	0	1,009	9	20.0	89.6	20.0	5.2	J-219	(N/A)
J-63	Zone-1	1	False	1,000	0	1,000	0	20.0	47.3	20.0	5.2	J-219	(N/A)
J-80	Zone-1	1	False	1,000	0	1,006	6	20.0	89.7	20.0	5.2	J-219	(N/A)
J-72	Zone-1	1	False	1,000	0	1,000	0	20.0	88.1	20.0	5.2	J-219	(N/A)
J-61	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.2	J-219	(N/A)
J-71	Zone-1	1	False	1,000	0	1,000	0	20.0	88.1	20.0	5.2	J-219	(N/A)
J-65	Zone-1	1	False	1,000	0	1,000	0	20.0	106.8	20.0	5.2	J-219	(N/A)
J-77	Zone-1	1	False	1,000	0	1,006	6	20.0	98.1	20.0	5.2	J-219	(N/A)
J-66	Zone-1	1	False	1,000	0	1,006	6	20.0	91.3	20.0	5.2	J-219	(N/A)
J-67	Zone-1	1	False	1,000	0	1,010	10	20.0	100.8	20.0	5.2	J-219	(N/A)
J-76	Zone-1	1	False	1,000	0	1,009	9	20.0	98.1	20.0	5.2	J-219	(N/A)
J-128	Zone-1	1	False	1,000	0	1,012	12	20.0	99.8	20.0	5.2	J-219	(N/A)
J-150	Zone-1	1	False	1,000	0	1,006	6	20.0	99.8	20.0	5.2	J-219	(N/A)
J-138	Zone-1	1	False	1,000	0	1,006	6	20.0	102.5	20.0	5.2	J-219	(N/A)
J-117	Zone-1	1	False	1,000	0	1,004	4	20.0	115.0	20.0	5.2	J-219	(N/A)
J-131	Zone-1	1	False	1,000	0	1,007	7	20.0	85.6	20.0	5.2	J-219	(N/A)
J-142	Zone-1	1	False	1,000	0	1,007	7	20.0	98.9	20.0	5.2	J-219	(N/A)
J-119	Zone-1	1	False	1,000	0	1,000	0	20.0	106.8	20.0	5.2	J-219	(N/A)
J-134	Zone-1	1	False	1,000	0	1,006	6	20.0	46.0	20.0	5.2	J-219	(N/A)
J-145	Zone-1	1	False	1,000	0	1,000	0	20.0	102.5	20.0	5.2	J-219	(N/A)
J-141	Zone-1	1	False	1,000	0	1,009	9	20.0	98.2	20.0	5.2	J-219	(N/A)
J-135	Zone-1	1	False	1,000	0	1,007	7	20.0	106.8	20.0	5.2	J-219	(N/A)
J-152	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-139	Zone-1	1	False	1,000	0	1,010	10	20.0	83.0	20.0	5.2	J-219	(N/A)
J-126	Zone-1	1	False	1,000	0	1,006	6	20.0	82.1	20.0	5.2	J-219	(N/A)
J-124	Zone-1	1	False	1,000	0	1,000	0	20.0	89.9	20.0	5.2	J-219	(N/A)
J-151	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-122	Zone-1	1	False	1,000	0	1,007	7	20.0	57.3	20.0	5.2	J-219	(N/A)
J-158	Zone-1	1	False	1,000	0	1,000	0	20.0	95.2	20.0	5.2	J-219	(N/A)
J-120	Zone-1	1	False	1,000	0	1,000	0	20.0	85.5	20.0	5.2	J-219	(N/A)
J-121	Zone-1	1	False	1,000	0	1,000	0	20.0	22.5	20.0	5.2	J-219	(N/A)
J-127	Zone-1	1	False	1,000	0	1,009	9	20.0	89.5	20.0	5.2	J-219	(N/A)
J-125	Zone-1	1	False	1,000	0	1,013	13	20.0	95.2	20.0	5.2	J-219	(N/A)
J-155	Zone-1	1	False	1,000	0	1,000	0	20.0	18.6	20.0	5.2	J-219	(N/A)
J-136	Zone-1	1	False	1,000	0	1,003	3	20.0	106.8	20.0	5.2	J-219	(N/A)
J-118	Zone-1	1	False	1,000	0	1,000	0	20.0	106.8	20.0	5.2	J-219	(N/A)
J-144	Zone-1	1	False	1,000	0	1,003	3	20.0	86.3	20.0	5.2	J-219	(N/A)
J-157	Zone-1	1	False	1,000	0	1,013	13	20.0	88.0	20.0	5.2	J-219	(N/A)
J-163	Zone-1	1	False	1,000	0	1,013	13	20.0	53.5	20.0	5.2	J-219	(N/A)
J-154	Zone-1	1	False	1,000	0	1,004	4	20.0	81.0	20.0	5.2	J-219	(N/A)
J-133	Zone-1	1	False	1,000	0	1,004	4	20.0	56.4	20.0	5.2	J-219	(N/A)
J-164	Zone-1	1	False	1,000	0	1,000	0	20.0	81.0	20.0	5.2	J-219	(N/A)
J-140	Zone-1	1	False	1,000	0	1,000	0	20.0	102.5	20.0	5.2	J-219	(N/A)
J-153	Zone-1	1	False	1,000	0	1,006	6	20.0	97.0	20.0	5.2	J-219	(N/A)
J-159	Zone-1	1	False	1,000	0	1,009	9	20.0	88.7	20.0	5.2	J-219	(N/A)
J-218	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-228	Zone-1	1	False	1,000	0	1,000	0	20.0	91.3	20.0	5.2	J-219	(N/A)
J-216	Zone-1	1	False	1,000	0	1,006	6	20.0	94.3	20.0	5.2	J-219	(N/A)
J-217	Zone-1	1	False	1,000	0	1,000	0	20.0	81.0	20.0	5.2	J-219	(N/A)
J-215	Zone-1	1	False	1,000	0	1,012	12	20.0	89.9	20.0	5.2	J-219	(N/A)
J-245	Zone-1	1	False	1,000	0	1,003	3	20.0	85.5	20.0	5.2	J-219	(N/A)
J-235	Zone-1	1	False	1,000	0	1,009	9	20.0	85.4	20.0	5.2	J-219	(N/A)
J-219	Zone-1	1	False	1,000	0	1,000	0	20.0	5.2	20.0	18.6	J-155	(N/A)
J-220	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-221	Zone-1	1	False	1,000	0	1,010	10	20.0	84.6	20.0	5.2	J-219	(N/A)
J-224	Zone-1	1	False	1,000	0	1,010	10	20.0	82.1	20.0	5.2	J-219	(N/A)
J-225	Zone-1	1	False	1,000	0	1,015	15	20.0	89.4	20.0	5.2	J-219	(N/A)
J-227	Zone-1	1	False	1,000	0	1,009	9	20.0	90.2	20.0	5.2	J-219	(N/A)
J-229	Zone-1	1	False	1,000	0	1,012	12	20.0	85.7	20.0	5.2	J-219	(N/A)
J-230	Zone-1	1	False	1,000	0	1,010	10	20.0	88.4	20.0	5.2	J-219	(N/A)
J-231	Zone-1	1	False	1,000	0	1,012	12	20.0	89.7	20.0	5.2	J-219	(N/A)
J-232	Zone-1	1	False	1,000	0	1,013	13	20.0	80.6	20.0	5.2	J-219	(N/A)
J-233	Zone-1	1	False	1,000	0	1,007	7	20.0	89.5	20.0	5.2	J-219	(N/A)
J-234	Zone-1	1	False	1,000	0	1,009	9	20.0	98.1	20.0	5.2	J-219	(N/A)
J-236	Zone-1	1	False	1,000	0	1,010	10	20.0	107.5	20.0	5.2	J-219	(N/A)

J-237	Zone-1	1	False	1,000	0	1,009	9	20.0	89.9	20.0	5.2	J-219	(N/A)
J-238	Zone-1	1	False	1,000	0	1,016	16	20.0	57.3	20.0	5.2	J-219	(N/A)
J-239	Zone-1	1	False	1,000	0	1,007	7	20.0	58.6	20.0	5.2	J-219	(N/A)
J-240	Zone-1	1	False	1,000	0	1,000	0	20.0	90.0	20.0	5.2	J-219	(N/A)
H-1	<None>	4	True	1,000	1,496	1,000	1,496	20.0	20.0	20.0	20.1	H-4	(N/A)
H-2	<None>	6	True	1,000	1,346	1,000	1,346	20.0	24.1	20.0	20.0	H-4	(N/A)
H-3	<None>	4	True	1,000	1,309	1,000	1,309	20.0	20.0	20.0	22.3	H-4	(N/A)
H-4	<None>	4	True	1,000	1,246	1,000	1,246	20.0	20.0	20.0	32.2	H-8	(N/A)
H-5	<None>	4	True	1,000	1,431	1,000	1,431	20.0	20.0	20.0	21.0	H-4	(N/A)
H-6	<None>	4	True	1,000	1,424	1,000	1,424	20.0	20.0	20.0	25.4	H-4	(N/A)
H-7	<None>	3	True	1,000	1,083	1,000	1,083	20.0	20.0	20.0	40.9	H-4	(N/A)
H-8	<None>	6	True	1,000	1,295	1,000	1,295	20.0	23.5	20.0	20.0	H-4	(N/A)
H-9	<None>	3	True	1,000	1,110	1,000	1,110	20.0	20.0	20.0	35.1	H-4	(N/A)
H-10	<None>	3	False	1,000	793	1,000	793	20.0	20.0	20.0	29.5	H-17	(N/A)
H-11	<None>	6	True	1,000	1,339	1,000	1,339	20.0	26.4	20.0	20.0	H-4	(N/A)
H-12	<None>	6	True	1,000	1,344	1,000	1,344	20.0	24.1	20.0	20.0	H-4	(N/A)
H-13	<None>	3	True	1,000	1,095	1,000	1,095	20.0	20.0	20.0	38.2	H-4	(N/A)
H-14	<None>	6	True	1,000	1,342	1,000	1,342	20.0	20.6	20.0	20.0	H-4	(N/A)
H-15	<None>	4	True	1,000	1,251	1,000	1,251	20.0	20.0	20.0	26.2	H-4	(N/A)
H-16	<None>	4	True	1,000	1,267	1,000	1,267	20.0	20.0	20.0	25.4	H-4	(N/A)
H-17	<None>	3	False	1,000	735	1,000	735	20.0	20.0	20.0	40.7	H-10	(N/A)
H-18	<None>	4	True	1,000	1,504	1,000	1,504	20.0	20.0	20.0	25.8	H-4	(N/A)
H-19	<None>	6	True	1,000	1,745	1,000	1,745	20.0	23.6	20.0	20.0	H-4	(N/A)
H-21	<None>	3	True	1,000	1,236	1,000	1,236	20.0	20.0	20.0	25.7	H-13	(N/A)

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Scenario: Phase IV  
 Current Time Step: 0.000Hr  
 Fire Flow Node FlexTable: Fire Flow Report

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)
J-14	Zone-1	1	False	1,000	0	1,000	0	20.0	85.8	20.0	5.2	J-219	(N/A)
J-4	Zone-1	1	False	1,000	0	1,000	0	20.0	87.0	20.0	5.2	J-219	(N/A)
J-9	Zone-1	1	False	1,000	0	1,001	1	20.0	84.5	20.0	5.2	J-219	(N/A)
J-12	Zone-1	1	False	1,000	0	1,003	3	20.0	108.0	20.0	5.2	J-219	(N/A)
J-16	Zone-1	1	False	1,000	0	1,000	0	20.0	90.7	20.0	5.2	J-219	(N/A)
J-19	Zone-1	1	False	1,000	0	1,003	3	20.0	48.8	20.0	5.2	J-219	(N/A)
J-20	Zone-1	1	False	1,000	0	1,003	3	20.0	89.8	20.0	5.2	J-219	(N/A)
J-8	Zone-1	1	False	1,000	0	1,001	1	20.0	83.2	20.0	5.2	J-219	(N/A)
J-11	Zone-1	1	False	1,000	0	1,001	1	20.0	98.1	20.0	5.2	J-219	(N/A)
J-7	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-18	Zone-1	1	False	1,000	0	1,001	1	20.0	48.8	20.0	5.2	J-219	(N/A)
J-15	Zone-1	1	False	1,000	0	1,000	0	20.0	81.5	20.0	5.2	J-219	(N/A)
J-10	Zone-1	1	False	1,000	0	1,003	3	20.0	98.6	20.0	5.2	J-219	(N/A)
J-21	Zone-1	1	False	1,000	0	1,003	3	20.0	88.0	20.0	5.2	J-219	(N/A)
J-13	Zone-1	1	False	1,000	0	1,001	1	20.0	106.8	20.0	5.2	J-219	(N/A)
J-3	Zone-1	1	False	1,000	0	1,006	6	20.0	86.9	20.0	5.2	J-219	(N/A)
J-17	Zone-1	1	False	1,000	0	1,000	0	20.0	90.7	20.0	5.2	J-219	(N/A)
J-45	Zone-1	1	False	1,000	0	1,004	4	20.0	106.8	20.0	5.2	J-219	(N/A)
J-48	Zone-1	1	False	1,000	0	1,000	0	20.0	88.9	20.0	5.2	J-219	(N/A)
J-41	Zone-1	1	False	1,000	0	1,003	3	20.0	84.6	20.0	5.2	J-219	(N/A)
J-42	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.2	J-219	(N/A)
J-46	Zone-1	1	False	1,000	0	1,009	9	20.0	47.5	20.0	5.2	J-219	(N/A)
J-47	Zone-1	1	False	1,000	0	1,006	6	20.0	88.5	20.0	5.2	J-219	(N/A)
J-86	Zone-1	1	False	1,000	0	1,007	7	20.0	82.1	20.0	5.2	J-219	(N/A)
J-79	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-74	Zone-1	1	False	1,000	0	1,004	4	20.0	98.1	20.0	5.2	J-219	(N/A)
J-78	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-83	Zone-1	1	False	1,000	0	1,021	21	20.0	47.1	20.0	5.2	J-219	(N/A)
J-70	Zone-1	1	False	1,000	0	1,003	3	20.0	82.9	20.0	5.2	J-219	(N/A)
J-82	Zone-1	1	False	1,000	0	1,000	0	20.0	50.1	20.0	5.2	J-219	(N/A)
J-87	Zone-1	1	False	1,000	0	1,009	9	20.0	106.8	20.0	5.2	J-219	(N/A)
J-69	Zone-1	1	False	1,000	0	1,003	3	20.0	87.7	20.0	5.2	J-219	(N/A)
J-73	Zone-1	1	False	1,000	0	1,006	6	20.0	98.1	20.0	5.2	J-219	(N/A)
J-62	Zone-1	1	False	1,000	0	1,012	12	20.0	89.7	20.0	5.2	J-219	(N/A)
J-81	Zone-1	1	False	1,000	0	1,009	9	20.0	89.6	20.0	5.2	J-219	(N/A)
J-63	Zone-1	1	False	1,000	0	1,000	0	20.0	47.5	20.0	5.2	J-219	(N/A)
J-80	Zone-1	1	False	1,000	0	1,006	6	20.0	89.7	20.0	5.2	J-219	(N/A)
J-72	Zone-1	1	False	1,000	0	1,000	0	20.0	88.1	20.0	5.2	J-219	(N/A)
J-61	Zone-1	1	False	1,000	0	1,000	0	20.0	89.7	20.0	5.2	J-219	(N/A)
J-71	Zone-1	1	False	1,000	0	1,000	0	20.0	88.1	20.0	5.2	J-219	(N/A)
J-65	Zone-1	1	False	1,000	0	1,000	0	20.0	106.8	20.0	5.2	J-219	(N/A)
J-77	Zone-1	1	False	1,000	0	1,006	6	20.0	98.1	20.0	5.2	J-219	(N/A)
J-66	Zone-1	1	False	1,000	0	1,006	6	20.0	91.3	20.0	5.2	J-219	(N/A)
J-67	Zone-1	1	False	1,000	0	1,010	10	20.0	100.8	20.0	5.2	J-219	(N/A)
J-76	Zone-1	1	False	1,000	0	1,009	9	20.0	98.1	20.0	5.2	J-219	(N/A)
J-128	Zone-1	1	False	1,000	0	1,012	12	20.0	99.8	20.0	5.2	J-219	(N/A)
J-150	Zone-1	1	False	1,000	0	1,006	6	20.0	99.8	20.0	5.2	J-219	(N/A)
J-138	Zone-1	1	False	1,000	0	1,006	6	20.0	102.5	20.0	5.2	J-219	(N/A)
J-117	Zone-1	1	False	1,000	0	1,004	4	20.0	115.0	20.0	5.2	J-219	(N/A)
J-131	Zone-1	1	False	1,000	0	1,007	7	20.0	85.6	20.0	5.2	J-219	(N/A)
J-142	Zone-1	1	False	1,000	0	1,007	7	20.0	98.9	20.0	5.2	J-219	(N/A)
J-119	Zone-1	1	False	1,000	0	1,000	0	20.0	106.8	20.0	5.2	J-219	(N/A)
J-134	Zone-1	1	False	1,000	0	1,006	6	20.0	46.2	20.0	5.2	J-219	(N/A)
J-145	Zone-1	1	False	1,000	0	1,000	0	20.0	102.5	20.0	5.2	J-219	(N/A)
J-141	Zone-1	1	False	1,000	0	1,009	9	20.0	98.2	20.0	5.2	J-219	(N/A)
J-135	Zone-1	1	False	1,000	0	1,007	7	20.0	106.8	20.0	5.2	J-219	(N/A)
J-152	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-139	Zone-1	1	False	1,000	0	1,010	10	20.0	83.0	20.0	5.2	J-219	(N/A)
J-126	Zone-1	1	False	1,000	0	1,006	6	20.0	82.1	20.0	5.2	J-219	(N/A)
J-124	Zone-1	1	False	1,000	0	1,000	0	20.0	89.9	20.0	5.2	J-219	(N/A)
J-151	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-122	Zone-1	1	False	1,000	0	1,007	7	20.0	57.5	20.0	5.2	J-219	(N/A)
J-158	Zone-1	1	False	1,000	0	1,000	0	20.0	95.2	20.0	5.2	J-219	(N/A)
J-120	Zone-1	1	False	1,000	0	1,000	0	20.0	85.5	20.0	5.2	J-219	(N/A)
J-121	Zone-1	1	False	1,000	0	1,000	0	20.0	22.5	20.0	5.2	J-219	(N/A)
J-127	Zone-1	1	False	1,000	0	1,009	9	20.0	89.5	20.0	5.2	J-219	(N/A)
J-125	Zone-1	1	False	1,000	0	1,013	13	20.0	95.2	20.0	5.2	J-219	(N/A)
J-155	Zone-1	1	False	1,000	0	1,000	0	20.0	18.6	20.0	5.2	J-219	(N/A)
J-136	Zone-1	1	False	1,000	0	1,003	3	20.0	106.8	20.0	5.2	J-219	(N/A)
J-118	Zone-1	1	False	1,000	0	1,000	0	20.0	106.8	20.0	5.2	J-219	(N/A)
J-144	Zone-1	1	False	1,000	0	1,003	3	20.0	86.3	20.0	5.2	J-219	(N/A)
J-157	Zone-1	1	False	1,000	0	1,013	13	20.0	88.0	20.0	5.2	J-219	(N/A)
J-163	Zone-1	1	False	1,000	0	1,019	19	20.0	53.6	20.0	5.2	J-219	(N/A)
J-154	Zone-1	1	False	1,000	0	1,004	4	20.0	81.0	20.0	5.2	J-219	(N/A)
J-133	Zone-1	1	False	1,000	0	1,004	4	20.0	56.6	20.0	5.2	J-219	(N/A)
J-164	Zone-1	1	False	1,000	0	1,000	0	20.0	81.0	20.0	5.2	J-219	(N/A)
J-140	Zone-1	1	False	1,000	0	1,000	0	20.0	102.5	20.0	5.2	J-219	(N/A)
J-153	Zone-1	1	False	1,000	0	1,006	6	20.0	97.0	20.0	5.2	J-219	(N/A)
J-159	Zone-1	1	False	1,000	0	1,009	9	20.0	88.7	20.0	5.2	J-219	(N/A)
J-218	Zone-1	1	False	1,000	0	1,000	0	20.0	87.7	20.0	5.2	J-219	(N/A)
J-228	Zone-1	1	False	1,000	0	1,000	0	20.0	91.3	20.0	5.2	J-219	(N/A)
J-216	Zone-1	1	False	1,000	0	1,006	6	20.0	94.3	20.0	5.2	J-219	(N/A)
J-217	Zone-1	1	False	1,000	0	1,000	0	20.0	81.0	20.0	5.2	J-219	(N/A)
J-215	Zone-1	1	False	1,000	0	1,012	12	20.0	89.9	20.0	5.2	J-219	(N/A)
J-245	Zone-1	1	False	1,000	0	1,003	3	20.0	85.5	20.0	5.2	J-219	(N/A)
J-235	Zone-1	1	False	1,000	0	1,009	9	20.0	85.4	20.0	5.2	J-219	(N/A)
J-219	Zone-1	1	False	1,000	0	1,000	0	20.0	5.2	20.0	18.6	J-155	(N/A)
J-220	Zone-1	1	False	1,000	0	1,000	0	20.0	89.0	20.0	5.2	J-219	(N/A)
J-221	Zone-1	1	False	1,000	0	1,000	0	20.0	84.6	20.0	5.2	J-219	(N/A)
J-224	Zone-1	1	False	1,000	0	1,010	10	20.0	82.1	20.0	5.2	J-219	(N/A)
J-225	Zone-1	1	False	1,000	0	1,015	15	20.0	89.4	20.0	5.2	J-219	(N/A)
J-227	Zone-1	1	False	1,000	0	1,009	9	20.0	90.2	20.0	5.2	J-219	(N/A)
J-229	Zone-1	1	False	1,000	0	1,012	12	20.0	85.7	20.0	5.2	J-219	(N/A)
J-230	Zone-1	1	False	1,000	0	1,010	10	20.0	88.4	20.0	5.2	J-219	(N/A)
J-231	Zone-1	1	False	1,000	0	1,012	12	20.0	89.7	20.0	5.2	J-219	(N/A)
J-232	Zone-1	1	False	1,000	0	1,013	13	20.0	80.6	20.0	5.2	J-219	(N/A)
J-233	Zone-1	1	False	1,000	0	1,007	7	20.0	89.5	20.0	5.2	J-219	(N/A)
J-234	Zone-1	1	False	1,000	0	1,009	9	20.0	98.1	20.0	5.2	J-219	(N/A)
J-236	Zone-1	1	False	1,000	0	1,010	10	20.0	107.5	20.0	5.2	J-219	(N/A)

J-237	Zone-1	1	False	1,000	0	1,009	9	20.0	89.9	20.0	5.2	J-219	(N/A)
J-238	Zone-1	1	False	1,000	0	1,016	16	20.0	57.5	20.0	5.2	J-219	(N/A)
J-239	Zone-1	1	False	1,000	0	1,007	7	20.0	58.8	20.0	5.2	J-219	(N/A)
J-240	Zone-1	1	False	1,000	0	1,000	0	20.0	90.0	20.0	5.2	J-219	(N/A)
H-1	<None>	4	True	1,000	1,496	1,000	1,496	20.0	20.0	20.0	20.1	H-4	(N/A)
H-2	<None>	6	True	1,000	1,346	1,000	1,346	20.0	24.1	20.0	20.0	H-4	(N/A)
H-3	<None>	4	True	1,000	1,309	1,000	1,309	20.0	20.0	20.0	22.3	H-4	(N/A)
H-4	<None>	4	True	1,000	1,246	1,000	1,246	20.0	20.0	20.0	32.2	H-8	(N/A)
H-5	<None>	4	True	1,000	1,431	1,000	1,431	20.0	20.0	20.0	21.0	H-4	(N/A)
H-6	<None>	4	True	1,000	1,424	1,000	1,424	20.0	20.0	20.0	25.4	H-4	(N/A)
H-7	<None>	3	True	1,000	1,083	1,000	1,083	20.0	20.0	20.0	40.9	H-4	(N/A)
H-8	<None>	6	True	1,000	1,295	1,000	1,295	20.0	23.5	20.0	20.0	H-4	(N/A)
H-9	<None>	3	True	1,000	1,110	1,000	1,110	20.0	20.0	20.0	35.1	H-4	(N/A)
H-10	<None>	2	True	1,000	1,008	1,000	1,008	20.0	20.0	20.0	38.0	H-17	(N/A)
H-11	<None>	6	True	1,000	1,339	1,000	1,339	20.0	26.4	20.0	20.0	H-4	(N/A)
H-12	<None>	6	True	1,000	1,344	1,000	1,344	20.0	24.1	20.0	20.0	H-4	(N/A)
H-13	<None>	3	True	1,000	1,095	1,000	1,095	20.0	20.0	20.0	38.2	H-4	(N/A)
H-14	<None>	6	True	1,000	1,342	1,000	1,342	20.0	20.6	20.0	20.0	H-4	(N/A)
H-15	<None>	4	True	1,000	1,251	1,000	1,251	20.0	20.0	20.0	26.2	H-4	(N/A)
H-16	<None>	4	True	1,000	1,267	1,000	1,267	20.0	20.0	20.0	25.4	H-4	(N/A)
H-17	<None>	3	True	1,000	1,026	1,000	1,026	20.0	20.0	20.0	40.2	H-4	(N/A)
H-18	<None>	4	True	1,000	1,504	1,000	1,504	20.0	20.0	20.0	25.8	H-4	(N/A)
H-19	<None>	6	True	1,000	1,745	1,000	1,745	20.0	23.6	20.0	20.0	H-4	(N/A)
H-21	<None>	3	True	1,000	1,236	1,000	1,236	20.0	20.0	20.0	25.7	H-13	(N/A)

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**APPENDIX K:  
CORRESPONDENCE**

I have a few questions regarding the Fire Flow Analysis for Spirit Lake East. I am gathering my information from the *Spirit Lake East Water System Analysis* we conducted in October 2004 and want to make sure the information is still relevant. Can we please confirm the following information?

- **Connections**

- Complete system build out is 366 connections  
Correct
- Current 80% or 293 connections (used for modeling purposes)  
Correct

- **Water Storage Tank**

- One tank  
Correct
- Capacity 192,000 gallons  
Correct
- Crack has been fixed  
Isn't a "crack" rather a seam and it is patched annually

- **Pumps/Boosters – Total electrical system upgrade was performed approx. 5 years ago will drop off final submittals if needed.**

- (1) 100 Hp. submersible pump (installed September 2004), capacity of 500 gpm Replaced June 2013 with same spec pump approx. 480 gpm
- (2) 10 Hp. Berkeley B½ TPMS boosters, 250 gpm @ 60 psi yes
- (1) 25 Hp. Peerless Series C, 830A, booster, 500 gpm @ 60psi yes

- **Bladder Tanks**

- (20) Well-X-trolWX252, total capacity 1,720 gallons, operating range of 35 psi to 50 psi No longer using. System runs on VFDS and pressure transducer. A handful of tanks were kept in place redundancy.

- System does not contain standby power (generators) New CAT 175 KW Gen set installed approx. 5 years ago capable of running all components concurrently

- Is there flow data available on the system or should I use the same estimates that we used in 2004. **I don't see why not. Would it would have changed??**
- We assumed 15% system loss within our original analysis (2004), and recommended that NKWD verify the condition of the existing pipes and verify the estimated loss within the system. Has this been done or are we still assuming a 15% loss on the system or greater since it has been 10 years since the analysis. **Complete leak detection was done on entire system. Loss at approx. 8% and mainlines that have been exposed have been in good shape. All leaks were located on service line connections to main line.**

I am assuming that we are looking at getting the system as a whole in compliance with required fire flow demands. According to the Spirit Lake Fire Chief, Jon DeBernardi and the Fire Marshal, Wayne Nowacki that would place hydrant no further than 1,000 ft. from any residents, with a required flow of 1,000 gpm plus maximum daily demand for 2 hours. Since the system is composed of 2 inch through 10 inch piping we will be focusing on installing hydrants on 6 inch lines or larger, and will not be considering enlarging and replacing lines. By not replacing lines some properties will not be cover. I have attached a map of Spirit Lake East with hydrants placed on their lines that are 6 inches or larger. The red circles are 1000 ft. radius from the hydrants.

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