Leeds Domestic Water users Association

Culinary Water Capacity Analysis

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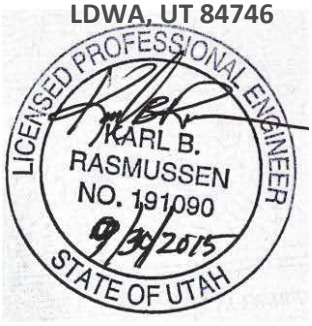


Contents

I. INTRODUCTION

Leeds Domestic Water users Association is a nonprofit shareholder-owned private corporation providing culinary water services since January 1956 to LDWA of Leeds. In 1954, the Leeds Domestic Water users Association, LDWA, made a bold move when they sought to remedy the obvious health & safety hazards resulting from the open ditch. LDWA borrowed $50,000.00 to build a 9-mile pipeline to bring drinking water down to Leeds from a spring high above LDWA, located at the base of Pine Valley Mountain. Until that time, the townspeople's drinking water had been piped and drawn directly from the open Leeds irrigation water ditch.

With the $50,000.00 funding and the men of Leeds supplying much of the back-breaking labor in laying the pipeline, Leeds citizens began to receive clean drinking water delivered in a secure system in January 1956.

The Town of Leeds is located in a beautiful valley and hills adjacent to Interstate 15 about 15 miles northeast of St. George, Utah. The 2010 population of Leeds was 980 people. It's projected to have a population of 1,168 by the year 2020 and 1,666 by the year 2030. Within Leeds Town are the subdivision communities of Silver Reef, El Dorado, and others.

II. DEMOGRAPHICS

A. Existing Water Connections

LDWA currently has 404 allocated water connections. Out of the 404 connections, 334 are in actual usage. There are within the boundaries of Leeds Town and LDWA 172 parcels of land that don't own a water connection. These potentially could need water connections.

B. Population Projections

The growth rate between the year 2000 and the year 2010 was 6%. The projected growth rate used by the State of Utah between 2010 and 2020 is 1.77% for Leeds. The projected growth rate from 2020 to 2030 is 3.615%

Table II-B
Population Projections

YEAR	POPULATION
2000 Census:	547
2010 Census:	980
2015 (DEA estimate)	1,070
2020 (DEA estimate)	1,168
2025 (DEA estimate)	1,395
2030 (DEA estimate)	1,666
2035 (DEA estimate)	1,990

C. Projected Water Connections

By using the existing equivalent residential connections of 334 and the projected growth rate of 1.77% & 3.615%, the number of users that LDWA will have in the future can be projected. This will project the number of users found in Table II-C.

Table II-C
Projected Equivalent Residential Connections (ERC's)

Year	POPULATION	USERS
2015	1,070	334
2016	1,090	340
2017	1,109	346
2018	1,129	352
2019	1,148	358
2020	1,168	365
2021	1,213	379
2022	1,259	393
2023	1,304	407
2024	1,350	421
2025	1,395	435
2026	1,449	452
2027	1,503	469
2028	1,558	486
2029	1,612	503
2030	1,666	520
2031	1,731	540
2032	1,796	560
2033	1,860	581
2034	1,925	601
2035	1,990	621

However, for the capacity analysis, the population data will not be used because LDWA has 70 allocated connections that lot owners are paying for. Therefore, the 334 actual users need to be changed to 404 users that LDWA needs to provide water for. As a rule of thumb for the LDWA service area, all unallocated parcels need to be counted for, also, in order for the water users association to have enough water for build out. There are 172 current parcels of land within the service area that fall into this category and LDWA needs the water in case the parcel owner wants to buy a water connection.

III. WATER SYSTEM ANALYSIS

A. WATER SYSTEM REQUIREMENTS

The State of Utah Rules for Public Drinking Water Systems contains Minimum Sizing Requirements under section R309-510 that are used to analyze the capacity of LDWA's culinary water system. The three primary areas of concern that section R309-510 deals with are source, storage, and distribution system capacity. This section states that source capacity must meet peak daily flow and average yearly flow requirements. It states that storage capacity must meet or exceed average daily flow requirements, which include fire flow storage. Lastly, it states that the distribution system must have the capacity to handle peak instantaneous flows and fire flows with a minimum of 20 psi pressure occurring in the system at all points.

The 2012 International Fire Code, Appendix B, contains quantity requirements for minimum fire flow and flow duration for One- and Two-Family Dwellings and dwellings in excess of 3,600 square feet. The requirements in the code will affect the water storage and distribution system requirements. The Code requires storage capacity for a 2 hour fire flow of 1,000 gallons per minute (g.p.m.) for a one-to two dwelling home, which amounts to 120,000 gallons, and a 2 hour fire flow of 1,500 G.P.M. for a building over 3,600 square feet, which amounts to 180,000 gallons. Since LDWA has buildings with over 3,600 square feet, LDWA should have at least 210,000 gallons of storage capacity for fire protection because buildings this size or bigger need 1,750 G.P.M of fire flow.

The following table summarizes the quantity requirements taken from the two documents referenced above. Another important component of the water system that is added to the table and is analyzed in this plan is Water Right. The water right capacity will depend on the average daily flow for indoor use and average yearly flow for outdoor use.

Table III-A-1
Quantity Requirements

Water System Component	Indoor Use	Outdoor Use	Fire Flow Requirement
Water Right	SYSTEM AVERAGE per ERC or 400 GPD	SYSTEM AVERAGE per ERC or 3.26 Acre-ft/Yr per Irr. Acre	none
Water Source	800 GPD per ERC	4.9 GPM per Irrigation Acre	none
Water Storage	400 GPD per ERC	4,964 Gallons per Irrigation Acre	210,000 gallons
Distribution	$10.8*N^{0.64}$	9.8 GPM per Irrigation Acre	1,750 GPM minimum(1)

(1) Required Fire Flow for one-two dwelling home greater than 3,600 square feet at Fire Hydrant.
GPD = Gallons per Day.
GPM = Gallons per Minute.
ERC = Equivalent Residential Connection.
N = Number of Equivalent Residential Connections.

1. INDOOR USE

LDWA currently has 400 allocated equivalent residential connections with 4 commercial connections plus 71 allocated connections for SITLA reserved lots plus 172 parcels that are potential lots that need to be reserved for water because they can request a connection to the system at any time for their parcel of land. This current residential reserve in connections should be 643 and 4 commercial connections for 3 RV Parks and 1 restaurant. Using table II-C, Projected Equivalent Residential Connections, and estimated figures for RV Parks and restaurants, the following table calculates the number of connections LDWA will have for the years 2025 and 2035.

Table III-A-2
Equivalent Residential Connections (ERC)

YEAR➔	2015		2025		2035	
User	**Units**	**ERC**	**Units**	**ERC**	**Units**	**ERC**
Residential (Connections)	643	643	743	743	928	928
RV Park (100 gpd per pad)	90	11	120	15	150	19
Commercial, Restaurant (35 gallons per seat)	50	2	100	4	150	6
Total ERC		**656**		**762**		**953**
ERC = Equivalent Residential Connection (800 gpd = 1 ERC)						

2. OUTDOOR USE

For the analysis of water rights, source, storage and distribution, quantities for outdoor use are combined with indoor use and fire flow requirements. The analysis for outdoor use will use 0.15 acre per equivalent residential connection. The table below shows the estimated acres of irrigated land in LDWA.

Table III-A-3
Irrigated Acres

YEAR➔	2015		2025		2035	
Culinary Irrigation	ERC	Acres	ERC	Acres	ERC	Acres
	656	98.4	762	114.3	953	142.95
ERC = Equivalent Residential Connection						

B. WATER RIGHTS

1. Existing Water Rights

LDWA receives its water for municipal use from Quail Creek Springs and the Highland well. A copy of these water rights can be found in the water right binder kept by LDWA at their office. Table III-B-1, as follows, shows the water rights that LDWA has.

Table III-B-1
Water Rights

POINT OF DIVERSIONS	ACRE-FEET
Quail Creek Spring	92.83
Leeds 16" Well #5014	276.10
El Dorado Hills 8" Well	91.00

LDWA total valid water right is 459.93 acre-feet.

2. Analysis of Water Rights

The water rights that LDWA needs now and in the future can be estimated by using the quantity requirements for water rights from section III-A or using records of water usage. The State estimates that each user will use 400 gallons per day for indoor use and 3.26 acre-feet per year per irrigated acre for outdoor usage. The water rights will be analyzed using these numbers. Table III-B-3 contains the requirements for water right for the years 2015, 2025 and 2035.

Table III-B-3
Water Right Requirements

YEAR➔	2015		2025		2035	
USE	Units	G.P.M.	Units	G.P.M.	Units	G.P.M.
Indoor Unit =ERC	656	137	762	159	953	199
Outdoor Unit=Acres	98.4	199	114.3	231	142.95	289
TOTAL GPM		336		390		488
Total Acre-Feet/Year		541		629		786

ERC = Equivalent Residential Connection
G.P.M. = Gallons per Minute

Currently, LDWA has 459.93 acre-feet (285.65 gallons per minute) of water right. Using the calculations from the table above, LDWA needs an additional 81.07 acre-feet of water right now and 326.07 acre-feet of water right to meet the 20 year demand. If more water is used, the need for more water is solved by requiring land owners/developers to bring in water rights for

their development. A good analysis to do every year is to tally up all the usage from the current users and see what is actually being used per user.

C. WATER SOURCE

1. Existing Water Source

LDWA currently gets its water from LDWA Springs and Highland Well. The water from these springs is shared with the irrigation company. LDWA portion amounts to about 60 gallons per minute. The well can produce approximately 415 gallons per minute. The total source adds up to 475 gallons per minute.

2. Analysis of Water Source

Quantity requirements from section III-A are used to estimate the required water source capacity for LDWA. The required source will be calculated using a peak daily flow requirement of 800 gallons per day per ERC for indoor use and 4.9 gallons per minute per irrigated acre for outdoor use. Calculations of source capacity are displayed for the respective year in Table III-C-1 below.

Table III-C-1
Water Source Requirements

YEAR➔	2015		2025		2035	
USE	**Units**	**G.P.M.**	**Units**	**G.P.M.**	**Units**	**G.P.M.**
Indoor Unit =ERC	656	364	762	423	953	529
Outdoor Unit=Acres	98.4	482	114.3	560	142.95	700
TOTAL		**846**		**983**		**1229**
ERC = Equivalent Residential Connection ***G.P.M. = Gallons per Minute***						

LDWA needs 846 gallons per minute in source to meet the current demand and 1,229 gallons per minute in source to meet the 20 year demand. The 475 gallons per minute that LDWA has creates a 371 gallon per minute short fall in source.

D. WATER STORAGE

1. Existing Water Storage

Presently, LDWA currently has 1,135,000 gallons of main storage in the main entire system. There are 6 tanks that make up the storage. They are the Highland tank that contains 350,000 gallons; Forest Service property tanks of 60,000 gallons, 30,000 gallons, and 450,000 gallons; El Dorado tank of 120,000 gallons; and Springs tank of 125,000 gallons.

2. Analysis of Water Storage

The required water storage capacity for indoor use, outdoor use, and fire flow is shown in the table III-D-1 below. Storage requirements from section III-A were used to calculate the required water storage capacity.

Table III-D-1
Water Storage Requirements

YEAR➔	2015		2025		2035	
USE	**Units**	**G.P.D.**	**Units**	**G.P.D.**	**Units**	**G.P.D.**
Indoor Unit =ERC	656	262,400	762	304,800	953	381,200
Outdoor Unit=Acres	98.4	488,458	114.3	567,385	142.95	709,604
Fire Flow		210,000		210,000		210,000
TOTAL		**1,170,858**		**1,292,186**		**1,510,806**
ERC = Equivalent Residential Connection ***G.P.D. = Gallons per Day***						

The combined storage capacity of 1,135,000 gallons is a deficient amount of storage now and for the next twenty years. At least another 400,000 gallons in storage is needed to satisfy the requirement for 2035.

E. WATER DISTRIBUTION

1. Existing Water Distribution

The current distribution system contains approximately 99,550 feet (19 miles) of pipeline, 125 fire hydrants, 300 valves, and close to 404 allocated water connections. The main system covers Leeds Town.

2. Map of System

A map of the main system is located in Appendix B. These maps show junctions (nodes) called out as J(# of node) and pipes (links) named as P(# of link). J10 is junction number 10. P10 is pipe number 10.

Also, an aerial background maps of the system is shown in Appendix A. Each pipeline is shown as a 12", 10", 8", or 6" diameter in size.

3. Analysis of System

A computer network analysis of the LDWA existing distribution system was completed using peak instantaneous flows and then running scenarios of fire flows with peak instantaneous flows.

The water distribution system should have the capacity to deliver the combined distribution requirements of table III-A-1, which are peak instantaneous indoor and outdoor flows combined with fire flow. The system should be required to maintain a residual pressure of 20 p.s.i. in the distribution lines. These flows were used to analyze the distribution system and are shown in Table III-E-1.

Table III-E-1
Peak Instantaneous Flow Requirements

YEAR➔	2015		2025		2035	
	Units	G.P.M.	Units	G.P.M.	Units	G.P.M.
Indoor Use (ERC)	656	686	762	755	953	871
Outdoor Use (Acres)	98.4	964	114.3	1,120	142.95	1,401
Fire Flow		1,750		1,750		1,750
TOTAL		**3,400**		**3,625**		**4,022**
ERC = Equivalent Residential Connection ***G.P.M. = Gallons per Minute***						

The peak instantaneous flow requirements from this table were used to analyze the distribution system. There are 4 pressure zones within the distribution system. A computer program called EPAnet2 was used to model the existing system. It calculates the available fire flows at designated points in the system when the peak instantaneous flow was imposed on the system and there was a minimum pressure of 20 p.s.i. in the distribution lines.

Twelve different scenarios were modeled in EPAnet2. The first scenario shows the pressures at each node during peak flows. Fire Flow Scenarios 1 through 12 were ran by picking a different location within the system and applying the fire flow in gallons per minute. The fire flow that created a pressure close to 20 psi at any location in the distribution system is the recorded fire flow for that scenario.

Table III-E-2
Available Fire Flows at Peak Instantaneous Flows

Junction Number	Peak Instantaneous Pressure (psi)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT Number
J88	112	900	31	20	J62
J68	115	820	36	20	J62
J86	76	860	20	20	J86
J37	75	1500	34	20	J90
J49	59	800	20	20	J49
J90	96	560	20	20	J90
J41	66	2900	20	20	J43
J14	87	1510	20	20	J14
J12	101	2250	23	20	J13
J5	113	750	37	20	J90
J19	95	2550	38	20	J20
J56	77	920	20	20	J56

As shown above, Junction J49 is at an elevation that allows 59 pounds of pressure (psi) because it is at a higher elevation within the distribution system in El Dorado. It can only produce a fire flow of 800 gallons per minute. If J90 with an 8" dead-end water line exists, then the available fire flow will only be 560 gallons per minute.

F. EXISTING FEES

1. Connection Fees

LDWA currently charges a hookup fee of $1,500 per connection.

2. Impact Fees

The impact fee for a residential connection is $6,868 per connection for the month of August and changes monthly.

3. User Fees

The table below shows the current water rate structure for LDWA.

Table III-F-1
LDWA Existing Fee Schedule

Type of Fee	Gallons	Cost
User Fee: Base Rate	For First 20,000 gallons	$20.00
User Fee: Project Fee	None	$20.00
User Fee: Overage Rates	20,001 to 40,000 gallons	$1.00 per thousand gallons
	40,001 to 50,000 gallons	$2..00 per thousand gallons
	40,001 gallons and up	$3.00 per thousand gallons

IV. WATER SYSTEM RECOMMENDATIONS

A. WATER RIGHTS

LDWA is currently deficient with water rights as described in section III-B.
LDWA needs to request and receive water rights for their proposed development.

B. WATER SOURCE

LDWA is deficient in source when using the State of Utah Drinking Water guidelines. It is recommended that a well location and well in the amount of 450 to 500 gallons per minute be secured, drilled and developed.

C. WATER STORAGE

LDWA is deficient in storage at the present time when all allocated and potentially allocated parcels of land have a need for water. It is recommended that the Association look at a location for and build a 450,000 to 500,000 gallon water tank. It is recommended to look at a concrete tank option.

D. WATER DISTRIBUTION

1. Improvements Needed

LDWA is in need of pipeline replacements to replace pipelines that are regularly being repaired or that lack the capacity to create recommended fire flows. Also, new valves are needed to better isolate sections of the distribution system. Due to these problems, LDWA has made a list of improvements that it will prioritize later. The list of improvements is:

1. Downtown Improvements: Replace any 6” bottleneck water lines or dead-end water lines throughout the downtown area with 8” water lines. This includes at least one 8” line along
2. Analyze and require any new development to complete a distribution system analysis to see if any water lines need upgrades and/or loops need to be constructed.
3. Dead-end upgrades: Replace any 6” or smaller pipe with an 8” water pipe in the remainder of the water system.

2. Map of Future System

The proposed system improvements were mapped together to form a map of the proposed system. This map was used to analyze the future system. Appendix E has this map for the analysis of the proposed system.

3. Analysis of Future System

This future system was analyzed the same way the existing system was analyzed. EPAnet was used again. The fire flows were analyzed at the same junctions used for the existing system

analysis. Below is the same table, similar to table III-E-2, which was put together from the existing system analysis. Peak instantaneous flows from 2035 were used to analyze these fire flows. Table IV-D-1 below shows the results of this analysis.

Table IV-D-1
Available Fire Flows at Peak Instantaneous Flows

Junction Number	Peak Instantaneous Pressure (psi)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT Number
J88	112	1260	41	20	J56
J68	120	1180	20	20	J68
J86	76	1100	20	20	J86
J37	75	1800	22	20	J38
J49	59	1350	20	20	J49
J90	118	2230	20	20	J90
J41	66	3020	20	20	J43
J14	84	1400	20	20	J14
J12	99	2200	26	20	J94
J5	113	2000	36	20	J16
J19	93	2400	38	20	J20
J56	80	1260	20	20	J56

Explanation here.

E. RECOMMENDED FEES

1. Connection Fees

The hook-up fee will analyze the average cost it should take for LDWA to install a connection on the average street. The hook-up fee should cover all expenses toward a new connection that a resident wants LDWA to install. This fee will be the average cost for furnishing & installing a saddle, tap, water line tubing, service meter, appurtenances, and street repair. Labor costs are part of the estimated costs for installation. Table IV-E-1 shows the estimated cost for an average connection installation from the centerline of an average street.

Table IV-E-1
Hook-up Fee Estimate

ITEM #	ITEM	UNITS	QUANTITY	UNIT PRICE	COST
1	F&I 3/4" Water Service Connection	Each	1	$450.00	$450.00
2	F&I 3/4" Water Service Line	L.F.	22	$10.00	$220.00
3	F&I 3/4" Water Service Meter & Appurt.	Each	1	$450.00	$450.00
4	F&I Apshalt Street Repair	S.Y.	10	$30.00	$300.00
5	F&I Gravel Street Repair	S.Y.	13.33	$6.00	$80.00
	TOTAL CONSTRUCTION COST				**$1,500.00**

The average estimated cost for a residential 3/4" hook-up to the culinary water system should be **$1,500.00** per connection. This fee should be re-evaluated at the end of each fiscal year.

This fee can be increased to cover additional expenses occurring from inflation and/or actual proof of added costs from material invoices and labor expenses. Fees for other meter sizes should be based on actual costs.

V. WATER PROJECTS LIST

A. LIST OF REQUIRED IMPROVEMENTS

The list of recommended improvements is:

1. Require deeds and/or purchase of water rights to cover new development.
2. Secure, drill and develop a 450 to 500 gallon per minute well.
3. Build a 450,000 gallon to 500,000 gallon concrete water tank.
4. Downtown Distribution System: Replace all 6" bottlenecked and dead-end water lines with new 8" water lines.
5. Replace any 6" dead-end water lines with new 8" water lines in the remainder of the system. There are a few of these in the El Dorado subdivision.
6. Complete an Inter-town water loop of 8" water lines for added fire flow and protection.

B. PRIORITY OF PROJECTS

The priority of the projects are in the order from 1 to 6 listed above.

C. ESTIMATES OF PROJECTS

Table V-C-1 contains the estimated cost for each project required from the list of projects in section V-A. Each project that is of high priority is placed under the year 2015 to 2020. The rest of the projects are placed under the years 2020 to 2035. Projected build-out total costs are listed in the far right column.

Table V-C-1
Cost Estimate of Required Improvements

LDWA *Capital Facility Plan for Culinary Water System Improvements*		2015-2020	2020 - 2035	Projected Build-out Total
Project No.	Description	Estimated Cost	Estimated Cost	Estimated Cost
CW-1	Drill and Equip a 12" Well	$400,000		$400,000
CW-2	Replace 6" Water lines with 8" Water lines	$500,000	$500,000	$1,000,000
CW-3	Build 500,000 gallon concrete tank	$650,000		$650,000
CW-4	InterTown water Loop with 8"		$950,000	$950,000
TOTAL of Estimated Project Costs		$1,550,000	$1,450,000	$3,000,000

A facility plan project detail for each project can show in detail these projects and can be requested from the engineer.

D. FUNDING SCENARIOS FOR PROJECTS

Funding for projects can be obtained from one of five different sources or a combination of sources. The sources for funding are:

- The Utah Division of Drinking Water @ www.drinkingwater.utah.gov/loan_program_intro.htm
- The Utah Division of Water Resources @ www.water.utah.gov/construction/makeappl.asp
- The Utah Community Impact Board @ http://housing.utah.gov/cib/cib.html
- The Community Development Block Grant Program @ http://housing.utah.gov/cdbg/index.html
- Rural Development (a federal agency) @ www.rurdev.usda.gov/UWEP_HomePage.html

The Division of Drinking Water (DDW) administers two financial assistance programs: the "State Revolving Fund" (State SRF) and the "Federal – State Revolving Fund (Federal SRF). Each program has its own set of criteria and requirements.

VI. CONCLUSION

The service area that LDWA serves has current parcels of land that have or will need allocated water. The demand of water rights, water source, water storage and water distribution to serve these parcels of land put a damper on the future capacity of the Associations resources. LDWA is currently deficient in water rights, water source, water storage and water distribution within certain areas of the Association. The Association needs to create projects to take care of this need and require developers to take care of their fair portion of these projects. The projects needed are listed in section V. Water Projects List.

REFERENCES

Utah Division of Drinking Water Construction Assistance Program:
http://www.drinkingwater.utah.gov/loan_program_intro.htm

Utah DDW – 2010 MAGI by Town:
http://www.drinkingwater.utah.gov/documents/engineering/MAGI_2010_Town.htm

Utah DDW – R309-510 Facility Design and Operation: Minimum Sizing Requirements
http://www.drinkingwater.utah.gov/documents/rules_ddw_version/R309-510_4-27-09.htm

Utah DEA Growth Projects:
http://governor.utah.gov/dea/People.html

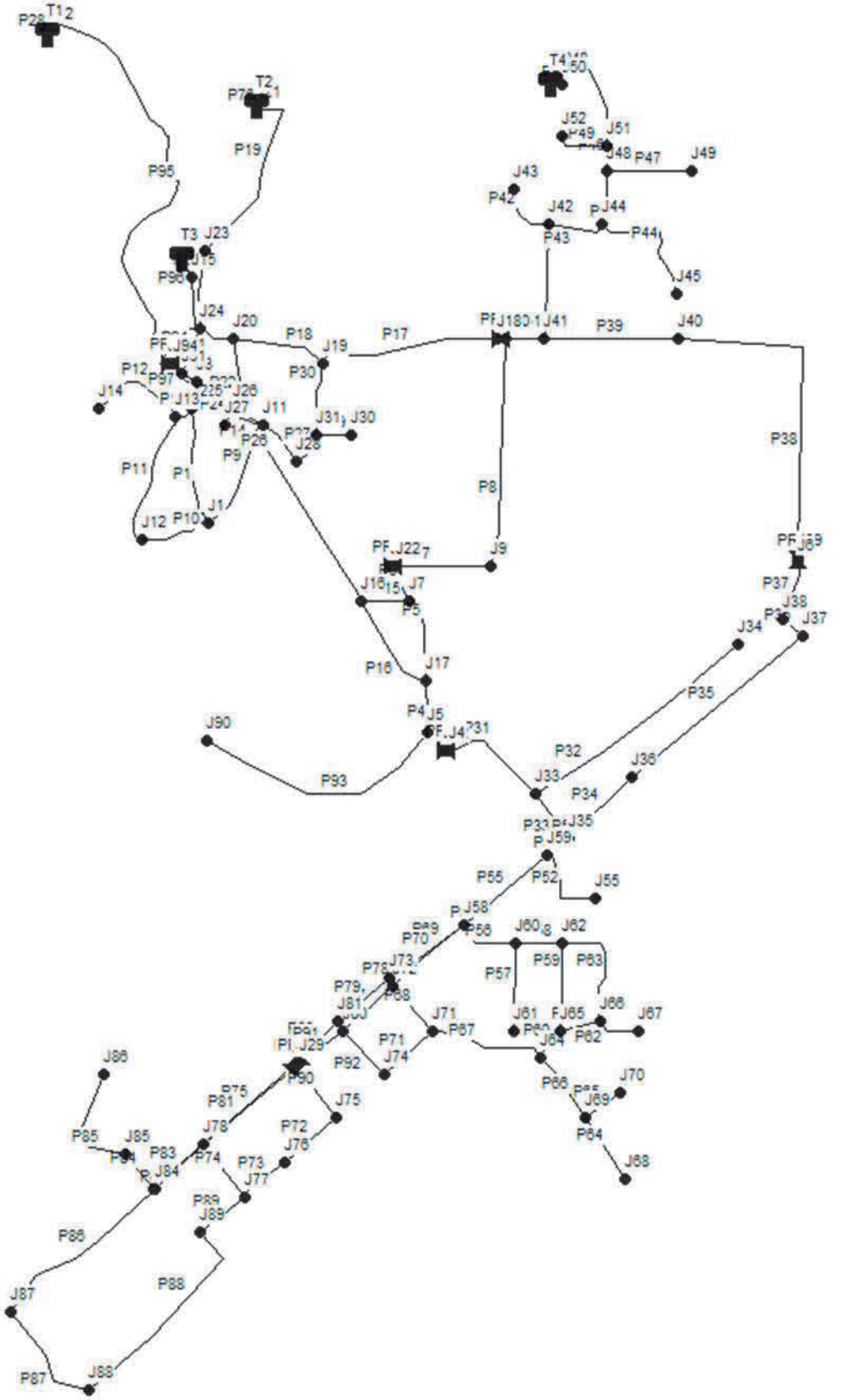
APPENDIX A

WATER SYSTEM MAP

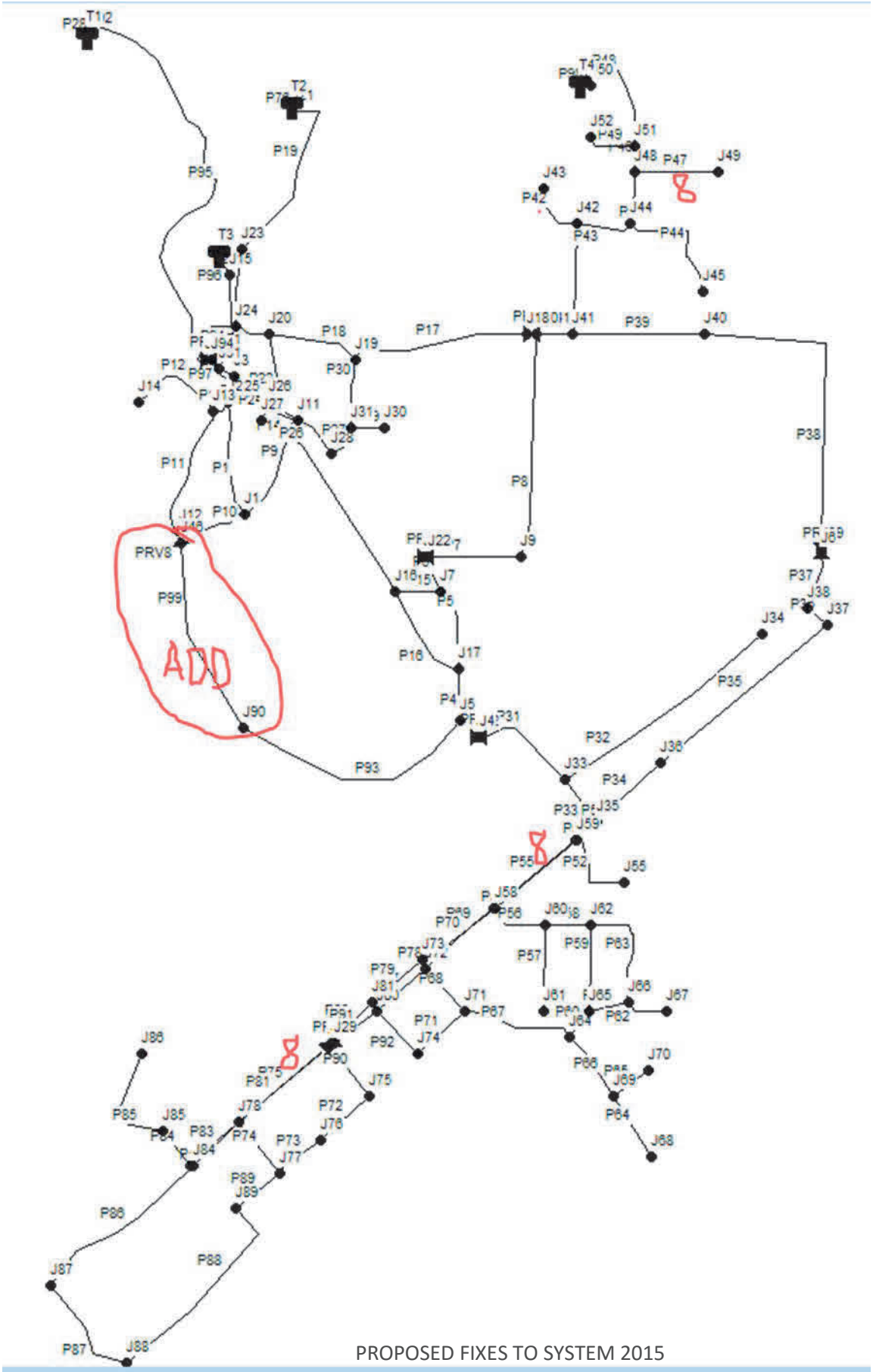

12" WATERLINE
10" WATERLINE
8" WATERLINE
6" WATERLINE
PRV STATION
N
W
E
S

APPENDIX B

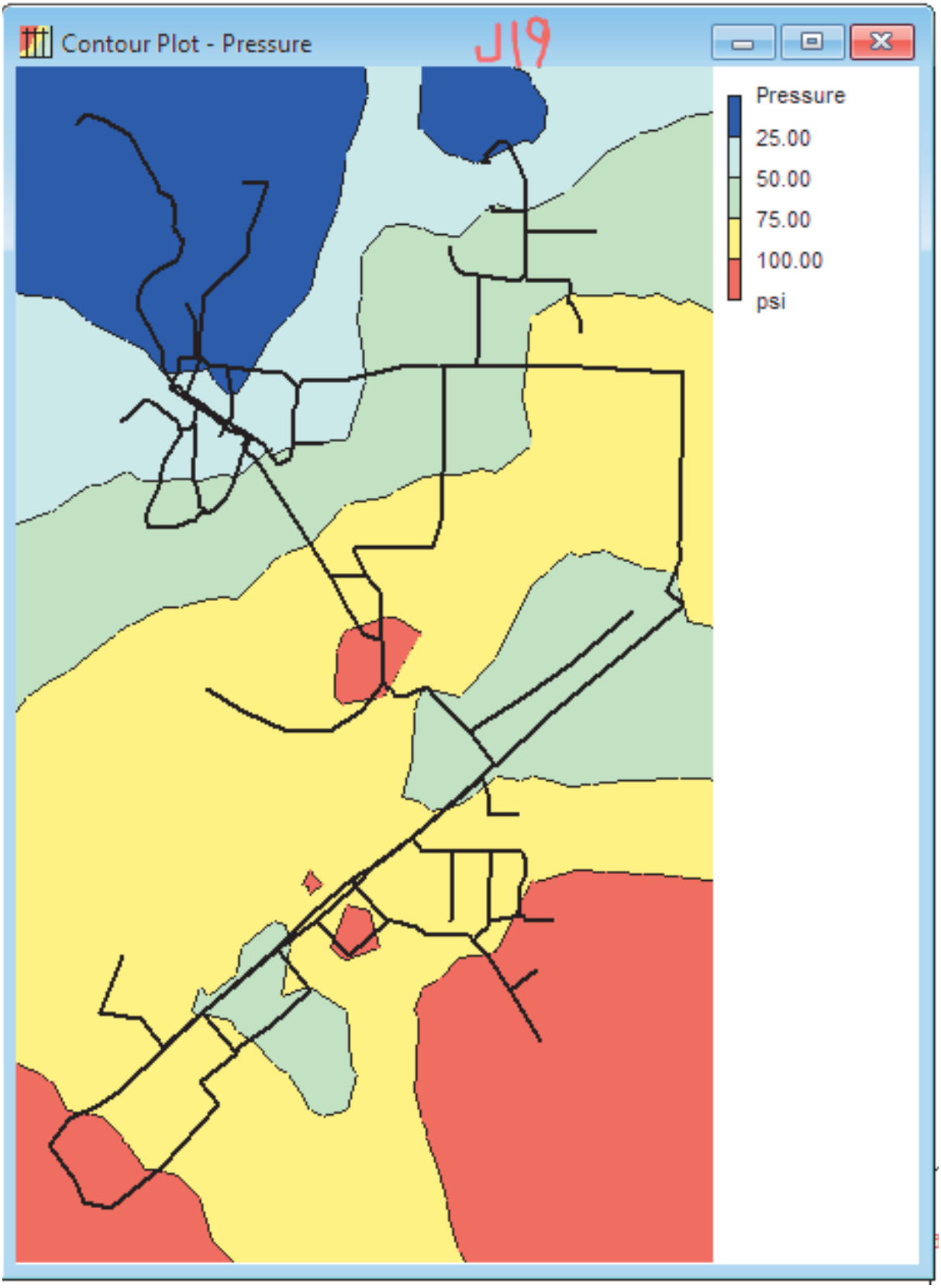
EPANET MAPS & ANALYSIS



EXISTING SYSTEM ANALYSIS MAP



PROPOSED FIXES TO SYSTEM 2015


Contour Plot - Pressure
J19
Pressure
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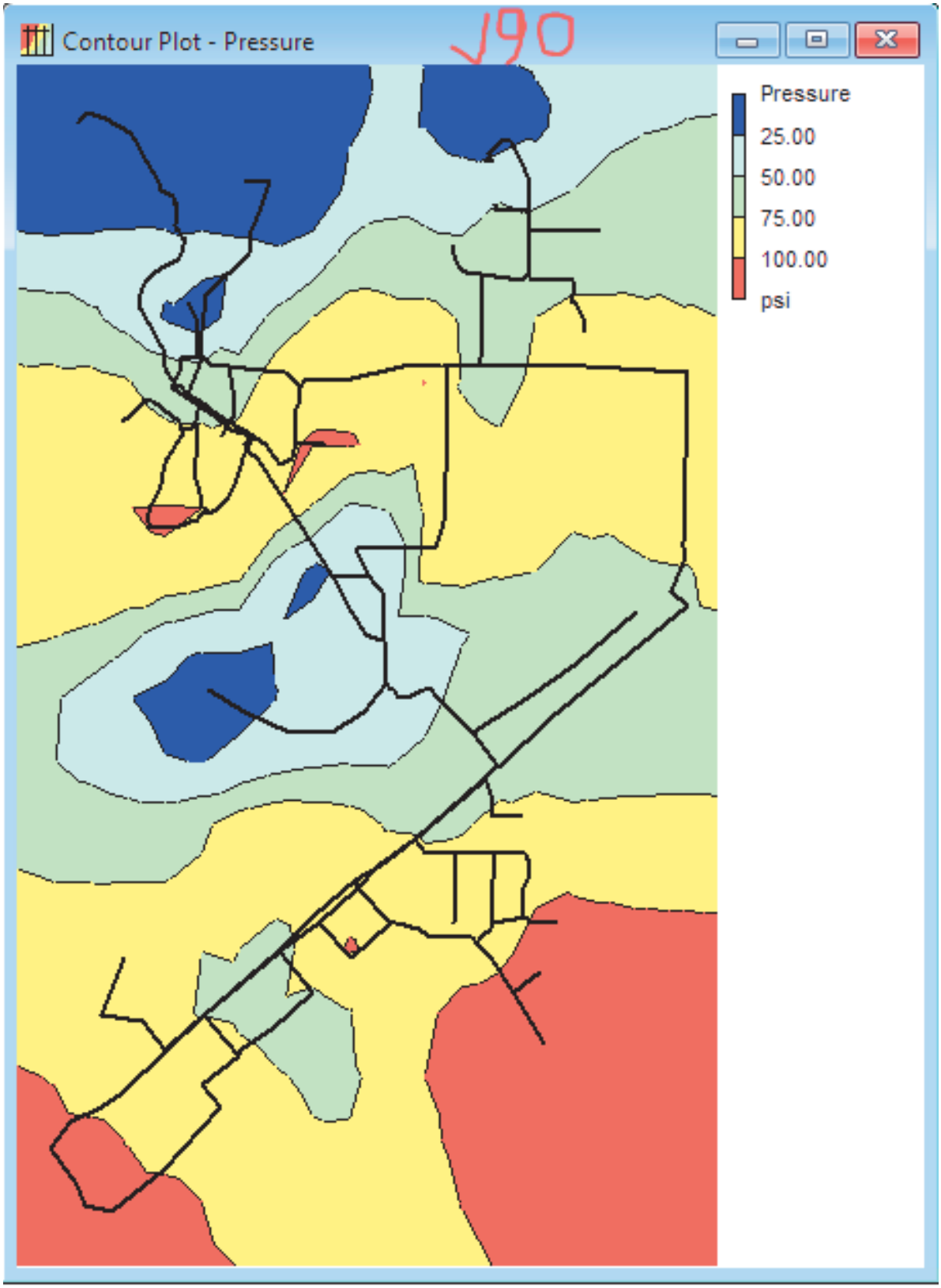
75.00
100.00
psi


Contour Plot - Pressure
J90
Pressure
25.00
50.00
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psi