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2017-2018 Contingency Planning Analysis

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Purpose

This contingency analysis determines the impact on the High Pressure (HP) System due to the loss of critical gate stations. In some instances, cascading effects from a gate station outage can affect the Intermediate High Pressure (IHP) system and are considered on a case-by-case basis. Scenarios presented are for typical winter days using an unsteady-state model with mean temperatures (T_m) of 30°F and 20°F, with the exception of Washington County having mean temperatures of 41°F and 34°F. Specific remedial steps required by the Emergency Plan per this analysis are provided in Tables A1-A4 in the Appendix. The HP systems covered in this analysis include the Northern, Central, Summit-Wasatch, and Southern systems.

Northern HP System

The gate stations that supply the Northern HP System are the Hyrum, Little Mountain, Porter's Lane, and Sunset gate stations. Each gate station outage is considered in Table 1, including remedial actions to maintain given minimum pressures. It should be noted that the Little Mountain (FL 21) outage was assumed to coincide with the Little Mountain (FL 4) gate station outage, which normally supplies the Central HP System.

Table 1: Northern HP System Gate Station Outage Results

Gate Station Outage	T_m Case	Remedial Actions	P_{min} (psig)
Hyrum	30°F	Reallocate flow to nearby stations	198
	20°F	Reallocate flow to nearby stations Curtail interruptible service (Table A1) Monitor IHP system (Table A1)	177
Sunset	30°F	Reallocate flow to nearby stations	281
	20°F	Reallocate flow to nearby stations	232
Porter's Lane	30°F	Reallocate flow to nearby stations	282
	20°F	Reallocate flow to nearby stations	234
Little Mountain (FL 21)	30°F	Reallocate flow to nearby stations	212
	20°F	Reallocate flow to nearby stations	208

Analysis indicates that for all of the gate station outages in the Northern HP System, gas flow can be reasonably reallocated to nearby stations in order to maintain the minimum pressures above 177 psig. If supply to the Little Mountain gate station is lost, pressure guarantees above 300 psig will not be able to be fulfilled.

In the case that the Hyrum gate station experiences an outage during the 20°F scenario, interruptible service will be curtailed to the HP-NORT zone. Gate station settings used for the scenarios in Table 1 are provided in Tables A5-A8 in the Appendix.

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Central HP System

The gate stations that supply the Central HP System are the Hunter Park, Riverton, Little Mountain, Payson, and Saratoga gate stations. Each gate station is considered in Table 2, including remedial actions to maintain given minimum pressures. As previously mentioned, the Little Mountain (FL 21) outage was assumed to coincide with the Little Mountain (FL 4) gate station outage.

Table 2: Central HP System Gate Station Outage Results

Gate Station Outage	T_m Case	Remedial Actions	P_{min} (psig)
Little Mountain (FL 4)	30°F	Reallocate flow to nearby stations	212
	20°F	Reallocate flow to nearby stations	208
Hunter Park	30°F	Reallocate flow to nearby stations	282
	20°F	Reallocate flow to nearby stations	257
Riverton	30°F	Reallocate flow to nearby stations	273
	20°F	Reallocate flow to nearby stations	224
Payson	30°F	Reallocate flow to nearby stations	162
	20°F	Reallocate flow to nearby stations	190*

*Assumes the loss of IHP regulator stations PV0006 and PV0007

Results show that for all of the gate station outages in the Central HP System, gas can be reasonably reallocated to nearby stations in order to maintain minimum pressures above 162 psig. Gate station settings used for the scenarios in Table 2 are provided in Tables A8-A11 in the Appendix.

A Payson gate station outage would require back-flowing or bypassing gas through the Lindon and Macey's HP regulator stations. Delivery pressures to regulator stations PV0006 and PV0007 may drop below the system minimum required pressure of 125 psig, which in turn will cause the stations to operate at a reduced capacity or may cause them to stop flowing all together. Figure A1 shows the results of an IHP steady-state model for the scenario in which PV0006 and PV0007 stop flowing gas on a 20°F day. The expected minimum IHP pressure in the area is 31 psig.

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Summit-Wasatch HP System

The gate stations that supply the Summit-Wasatch HP System are the Rockport, Jeremy Ranch, and Promontory gate stations. Each gate station outage is considered in Table 3, including remedial actions to maintain given minimum pressures.

Table 3: Summit-Wasatch HP System Gate Station Outage Results

Gate Station Outage	T_m Case	Remedial Actions	P_{min} (psig)
Jeremy Ranch	30°F	Reallocate flow to nearby stations	205
	20°F	Reallocate flow to nearby stations Isolate IHP system (Table A3)	167
Promontory	30°F	Reallocate flow to nearby stations	273
	20°F	Reallocate flow to nearby stations Isolate IHP System (Table A3)	126
Rockport	30°F	Reallocate flow to nearby stations	341
	20°F	Reallocate flow to nearby stations	319

For the Rockport gate station scenario, gas can be reasonably reallocated to nearby stations in order to maintain minimum pressures above 319 psig. Gate station settings used for the scenarios in Table 3 are provided in Table A12 – Table A14 in the Appendix.

Both the Jeremy Ranch and Promontory scenarios required special actions once the average temperatures approached 20°F. Interruptible service may or may not need to be curtailed in either case. Low line pressure can be mitigated in either case by closing strategic regulator stations and using the IHP system to shift supply to different stations.

In the scenario with Jeremy Ranch out of service, it is assumed that there is still available supply for stations fed directly from ML2 and ML14. Shutting in IHP stations WA0982 and WA1350 shifts supply off FL54 and alleviates the low-pressure scenario. The stations nearby that are fed directly off ML2 and ML14 pick up most of the supply. Figure A2 shows the resulting pressures in the IHP model for this scenario.

With Promontory gate station out, the low-pressure location is at the end of FL56 at the Charleston (CH0001) regulator station. Shutting in this station shifts a large portion of the supply upstream to FL16 in Heber.

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Southern HP System

The gate stations that supply the Southern HP System are the Indianola, Wecco, and Central gate stations. Each gate station outage is considered in Table 4, including remedial actions to maintain given minimum pressures.

Table 4: Southern HP System Gate station outage results

Gate Station Outage	T_m Case	Remedial Actions	P_{min} (psig)
Indianola	30°F	Reallocate flow to nearby stations	216
	20°F	Reallocate flow to nearby stations	183
Wecco Tap	30°F	Reallocate flow to nearby stations	462
	20°F	Reallocate flow to nearby stations	
Central	30°F	Reallocate flow to nearby stations Disrupt Termination Priority No. 2 service in the HP-STGE zone	286
	20°F	Reallocate flow to nearby stations Disrupt Termination Priority No. 2 service in the HP-STGE zone Prepare for relight service	125†

†20 hours after loss of station or the beginning of the peak hour morning draw the next day

Results show that for the Indianola and Wecco gate station outages gas can be reasonably reallocated to nearby stations in order to maintain minimum pressures above 182 psig. It may be necessary to manually bypass the Chester HP regulator station to FL69 should the pressure differential across the station drop low enough that the station can no longer flow sufficient gas. Additionally, the system can only maintain useable pressure in the 20°F Indianola outage scenario for approximately 72 hours before line pressure begins to drop below 125 psig. If supply to Indianola is not projected to be restored within the 72-hour period, and the weather forecast does not show anticipate a warming trend, then further interruption as outlined in the emergency plan should commence before loss of customers begins. Gate station settings used for the scenarios in Table 4 are provided in Table A15 – Table A17 in the appendix.

In the case that supply to the Central gate station is lost on a day colder than 30°F, it can be expected that there will be loss of customers before the peak hour of the following morning. If flow to the station is not expected to be restored before then, it is recommended to curtail all customers that fall into termination priority numbers 1-4 as described in the QGC Emergency Plan Section 4.1.1. Preparations should then be made to begin the relighting process.

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Conclusion

Contingency analysis indicates that in most cases if a gate station outage occurs, gas supply can be reallocated to nearby stations to maintain system pressures. Station outages that will require additional remedial actions are:

- Hyrum Gate Station
  - T_m = 20°F case:
    Curtail Termination Priority No. 1 as shown in
    - Table A1
- Jeremy Ranch Gate Station
  - T_m = 20°F case:
    - Monitor system pressures and isolate the IHP system as detailed in Table A3
- Promontory Gate Station
  - T_m = 20°F case:
    - Monitor system pressures and isolate the IHP system as detailed in Table A3
- Indianola Gate Station
  - T_m = 20°F case:
    - Curtail Termination Priority No. 1 as shown in
    - Table **A4**
- Central Gate Station
  - T_m = 30°F and T_m = 20°F case:
    - Curtail Termination Priority No. 1-4 as shown in
    - Table **A4**
  - T_m = 20°F case:
    - Monitor system pressures and prepare for relighting should outage last through the following morning draw

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Appendix

Table A1: Northern HP System Gate Station Failure Contingency Plan

Gate Station	Mean Temperature at SLC Airport	Step	Action	Ideal Time (hrs)
Hyrum	30°F	1	Isolate Hyrum Gate Station	0
		2	Increase Sunset flow to 70,000 Dth/day	1
	20°F	1	Isolate Hyrum Gate Station	0
		2	Increase Sunset flow to 80,000 Dth/day	1
		3	Increase Hunter Park to 115,000 Dth/day	1
		4	Increase Riverton to 115,000 Dth/day	1
		5	Curtail Interruptible service to the HP-NORT zone	2
Sunset	30°F | 20°F	1	Isolate Sunset Gate Station	0
		2	Increase flow to Porters Lane as needed	1
Porters Lane	30°F | 20°F	1	Isolate Porters Lane Gate Station	0
		2	Increase Sunset flow to 70,000 Dth/day	1
		3	Increase Hunter Park to 115,000 Dth/day	1
		4	Increase Riverton to 115,000 Dth/day	1
		5	Decrease North Temple to 15,000 Dth/day	1
Little Mountain (FL 21)	30°F | 20°F	1	Isolate Little Mountain Gate Station	0
		2	Increase Porters Lane flow to 145,000 Dth/day	1
		3	Increase Sunset Gate flow to 75,000 Dth/day	1

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Table A2: Central HP System Gate Station Failure Contingency Plan

Gate Station	Mean Temperature at SLC Airport	Step	Action	Ideal Time (hrs)
Little Mountain (FL 4)	30°F	1	Isolate Little Mountain Gate Station	0
		2	Increase Porters Lane flow to 145,000 Dth/day	1
		3	Increase Sunset Gate flow to 75,000 Dth/day	1
		4	Increase Hunter Park flow to 115,000 Dth/day	1
		5	Increase Riverton flow to 115,000 Dth/day	1
	20°F	1	Isolate Little Mountain Gate Station	0
		2	Increase Porters Lane flow to 145,000 Dth/day	1
		3	Increase Sunset Gate flow to 75,000 Dth/day	1
		4	Increase Hunter Park flow to 160,000 Dth/day	1
		5	Increase Riverton flow to 160,000 Dth/day	1
Hunter Park	30°F | 20°F	1	Isolate Hunter Park Gate Station	0
		2	Increase Riverton flow to 115,000 Dth/day	1
Riverton	30°F | 20°F	1	Isolate Riverton Gate Station	0
		2	Increase Hunter Park flow to 115,000 Dth/day	1
Payson	30°F | 20°F	1	Isolate Payson Gate Station	0
		2	Contact Lakeside Power for possible interruption of firm gas from Payson	1
		3	Interrupt Lakeside Power's firm gas from Payson	3
		~~4~~	Increase Hunter Park and Riverton flow to 115,000 Dth/Day	1
		5	Decrease the FL21 side of Little Mountain to flow 20,000 Dth/day	1
		6	Increase Porters Lane flow to 145,000 Dth/day	1
Saratoga	30°F | 20°F	1	Isolate Saratoga Gate Station	0
		2	Contact Lakeside Power for possible interruption of firm gas from Saratoga	1
		3	Interrupt Lakeside Power's firm gas from Saratoga	1
		4	Shift volume to Eagle Mountain	1
		5	Bypass TG0003 regulator station to back feed FL85	1

Table A3: Summit-Wasatch HP System Gate Station Failure Contingency Plan

Gate Station	Mean Temperature At Park City	Action	Step	Ideal Time (hrs)
Jeremy Ranch	30°F | 20°F	1	Isolate Jeremy Ranch Gate station	0
		2	Increase Promontory gate pressure to 407 psig	1
		3	Increase Rockport gate pressure to 407 psig	1
	20°F	4	Isolate IHP regulator stations WA0982 and WA1350	1-6
Promontory	30°F | 20°F	1	Isolate Promontory Gate station	0
		2	Increase Jeremy Ranch gate pressure to 407 psig	1
		3	Increase Rockport gate pressure to 407 psig	1
	20°F	4	Isolate IHP regulator station CH0001	1-6
Rockport	30°F | 20°F	1	Isolate Rockport Gate station	0
		2	Increase Jeremy Ranch gate pressure to 407 psig	1
		3	Increase Promontory gate pressure to 407 psig	1

Table A4: Southern HP System Gate Station Failure Contingency Plan

Gate Station	Mean Temperature At Cedar City (St George)	Action	Step	Ideal Time (hrs)
Central	30°F (41°F)	1	Isolate Central gate station	0
		2	Increase outlet pressure to Indianola gate station to 720 psig	1
		3	Increase outlet pressure to Wecco gate station 720 psig	1
	20°F (34°F)	4	Curtail termination priority numbers 1-4	2
		5	Prepare for relight procedure	24
Wecco	30°F | 20°F (41°F | 34°F)	1	Isolate Wecco gate station	0
		2	Increase outlet pressure to Central compressor station to 900 psig	1
		3	Increase outlet pressure to Indianola gate station 720 psig	1
Indianola	30°F (41°F)	1	Isolate Indianola gate station	0
		2	Increase Central compressor station outlet pressure 1000 psig	1
		3	Increase outlet pressure to Wecco gate station 720 psig	1
	20°F (34°F)	4	Curtail termination priority number 1	2

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Table A5: Station Settings for the Hyrum gate station outage

	Tm = 30°F				Tm = 20°F			
Gate/*Reg.* Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Hyrum	Shut In	-----	-----	-----	Shut In	-----	-----	-----
Sunset	Flow	404.6	70.0	70.0	Flow	416.8	80.0	80.0
Porters Lane	Pressure	425.0	72.5	138.0	Pressure	443.5	106.2	130.0
Little Mountain (FL21)	Pressure	425.0	94.3	99.3	Pressure	435.0	78.6	106.0
Little Mountain (FL4)	Pressure	339.6	165.0	165.0	Pressure	334.7	169.0	170.0
Hunter Park	Flow	327.1	80.0	80.0	Flow	321.8	111.5	111.5
Riverton	Flow	325.1	80.0	80.0	Flow	322.2	111.5	111.5
Payson	Pressure	700.0	90.8	143.5	Pressure	700.0	98.6	159.6
Payson (Lakeside)	Pressure	700.0	85.7	85.7	Pressure	700.0	85.7	85.7
North Temple	*Pressure*	*326.5*	*8.8*	*30.0*	*Pressure*	*319.5*	*0.0*	*0.0*
Lindon (RE0027)	*Pressure*	*325.6*	*23.5*	*50.0*	*Pressure*	*319.0*	*19.6*	*50.0*
Macey's (RE0026)	*Pressure*	*320.0*	*15.3*	*25.0*	*Pressure*	*310.1*	*15.7*	*25.0*

Table A6: Station Settings for the Sunset gate station outage

	Tm = 30°F				Tm = 20°F			
Gate/*Reg.* Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Hyrum	Pressure	460.0	72.0	84.0	Pressure	460.0	81.2	97.1
Sunset	Shut In	----	----	----	Shut In	----	----	----
Porters Lane	Pressure	424.4	72.6	144.0	Pressure	420.2	108.0	144.0
Little Mountain (FL21)	Pressure	425.0	95.3	110.9	Pressure	425.0	104.3	143.4
Little Mountain (FL4)	Pressure	343.3	165.0	165.0	Pressure	331.2	165.0	165.0
Hunter Park	Flow	331.3	80.0	80.0	Flow	318.7	90.0	90.0
Riverton	Flow	329.0	80.0	80.0	Flow	317.3	90.0	90.0
Payson	Pressure	700.0	88.0	143.5	Pressure	690.6	121.6	143.5
Payson (Lakeside)	Pressure	700.0	85.7	85.7	Pressure	690.6	85.7	85.7
North Temple	*Pressure*	*330.9*	*11.6*	*55.0*	*Pressure*	*318.5*	*24.2*	*55.0*
Lindon (RE0027)	*Pressure*	*329.1*	*21.5*	*50.0*	*Pressure*	*318.8*	*36.2*	*50.0*
Macey's (RE0026)	*Pressure*	*323.5*	*14.5*	*25.0*	*Pressure*	*312.0*	*22.2*	*25.0*

Table A7: Station Settings for the Porters Lane gate station outage

	Tm = 30°F				Tm = 20°F			
Gate/*Reg.* Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Hyrum	Pressure	460.0	78.7	90.6	Pressure	460.0	88.7	103.3
Sunset	Flow	375.9	70.0	70.0	Flow	352.4	70.0	70.0
Porters Lane	Shut In	----	----	----	Shut In	----	----	----
Little Mountain (FL21)	Pressure	375.0	79.6	121.1	Pressure	375.0	113.6	164.3
Little Mountain (FL4)	Pressure	330.0	123.1	165.0	Pressure	322.7	143.3	165.0
Hunter Park	Flow	331.6	111.5	111.5	Flow	317.7	111.5	111.5
Riverton	Flow	332.8	111.5	111.5	Flow	319.7	111.5	111.5
Payson	Pressure	700.0	78.6	153.6	Pressure	700.0	121.5	169.6
Payson (Lakeside)	Pressure	700.0	85.7	85.7	Pressure	700.0	85.7	85.7
North Temple	*Reduced Pressure*	*329.3*	*0.0*	*0.0*	*Reduced Pressure*	*315.5*	*3.0*	*15.0*
Lindon (RE0027)	*Pressure*	*329.8*	*22.7*	*60.0*	*Pressure*	*321.0*	*45.6*	*60.0*
Macey's (RE0026)	*Pressure*	*316.6*	*3.9*	*25.0*	*Pressure*	*306.2*	*12.6*	*25.0*

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Table A8: Station Settings for the Little Mountain gate station outage

	Tm = 30°F				Tm = 20°F			
Gate/*Reg.* Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Hyrum	Pressure	460.0	79.3	94.9	Pressure	460.0	87.3	105.1
Sunset	Flow	365.4	70.0	70.0	Flow	352.2	70.0	70.0
Porters Lane	Pressure	364.9	163.3	165.0	Pressure	354.6	164.4	165.0
Little Mountain (FL21)	Shut In	----	----	----	Shut In	----	----	----
Little Mountain (FL4)	Shut In	----	----	----	Shut In	----	----	----
Hunter Park	Flow	307.3	111.5	111.5	Flow	316.2	160.0	160.0
Riverton	Flow	311.2	111.5	111.5	Flow	325.4	160.0	160.0
Payson	Pressure	700.0	117.0	144.5	Pressure	700.0	118.8	174.4
Payson (Lakeside)	Pressure	700.0	85.7	85.7	Pressure	700.0	85.7	85.7
North Temple	*Pressure*	*310.9*	*84.7*	*123.7*	*Pressure*	*311.6*	*52.0*	*96.3*
Lindon (RE0027)	*Pressure*	*312.0*	*42.4*	*50.0*	*Pressure*	*317.7*	*30.7*	*60.0*
Macey's (RE0026)	*Pressure*	*306.3*	*22.6*	*25.0*	*Pressure*	*310.7*	*24.8*	*30.0*

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Table A9: Station Settings for the Hunter Park gate station outage

	Tm = 30°F				Tm = 20°F			
Gate/*Reg.* Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Hyrum	Pressure	460.0	73.8	85.1	Pressure	460.0	81.4	96.8
Sunset	Flow	397.6	70.0	70.0	Flow	388.7	70.0	70.0
Porters Lane	Pressure	398.5	40.4	115.0	Pressure	392.9	90.0	144.0
Little Mountain (FL21)	Pressure	400.0	93.2	127.3	Pressure	400.0	103.4	156.7
Little Mountain (FL4)	Pressure	340.6	165.0	165.0	Pressure	340.8	180.0	180.0
Hunter Park	Shut In	----	----	----	Shut In	----	----	----
Riverton	Flow	330.6	111.5	111.5	Flow	324.8	111.5	111.5
Payson	Pressure	700.0	99.1	144.5	Pressure	700.0	123.9	159.6
Payson (Lakeside)	Pressure	700.0	85.7	85.7	Pressure	700.0	85.7	85.7
North Temple	*Pressure*	*330.0*	*49.1*	*121.9*	*Pressure*	*328.1*	*75.4*	*145.3*
Lindon (RE0027)	*Pressure*	*329.3*	*29.5*	*50.0*	*Pressure*	*324.9*	*37.9*	*50.0*
Macey's (RE0026)	*Pressure*	*323.8*	*17.5*	*25.0*	*Pressure*	*318.2*	*22.8*	*25.0*

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Table A10: Station Settings for the Riverton gate station outage

	Tm = 30°F				Tm = 20°F			
Gate/*Reg.* Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Hyrum	Pressure	460.0	59.7	74.3	Pressure	460.0	81.2	96.1
Sunset	Flow	441.4	80.0	80.0	Flow	389.8	70.0	70.0
Porters Lane	Pressure	442.3	55.2	130.0	Pressure	394.1	87.0	144.0
Little Mountain (FL21)	Pressure	435.0	81.2	124.8	Pressure	400.0	102.3	148.5
Little Mountain (FL4)	Pressure	336.5	170.0	170.0	Pressure	333.0	170.0	170.0
Hunter Park	Flow	321.4	80.0	80.0	Flow	319.2	111.5	111.5
Riverton	Shut In	----	----	----	Shut In	----	----	----
Payson	Pressure	700.0	127.0	144.5	Pressure	700.0	138.2	159.6
Payson (Lakeside)	Pressure	700.0	85.7	85.7	Pressure	700.0	85.7	85.7
North Temple	*Pressure*	*324.5*	*47.7*	*130.0*	*Pressure*	*324.0*	*71.1*	*130.0*
Lindon (RE0027)	*Pressure*	*320.1*	*50.0*	*50.0*	*Pressure*	*312.5*	*50.0*	*50.0*
Macey's (RE0026)	*Pressure*	*316.4*	*25.0*	*25.0*	*Pressure*	*306.4*	*25.0*	*25.0*

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Table A11: Station Settings for the Payson gate station outage

	Tm = 30°F				Tm = 20°F			
Gate/*Reg.* Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Hyrum	Pressure	460.0	61.2	82.3	Pressure	460.0	81.8	102.8
Sunset	Flow	433.5	70.0	70.0	Flow	375.5	70.0	70.0
Porters Lane	Pressure	435.9	96.6	145.0	Pressure	379.1	143.7	145.0
Little Mountain (FL21)	Reduced Pressure	414.6	20.0	20.0	Reduced Pressure	358.4	20.0	20.0
Little Mountain (FL4)	Pressure	340.0	182.9	220.4	Pressure	340.0	207.0	270.8
Hunter Park	Flow	321.2	111.5	111.5	Flow	309.3	111.5	111.5
Riverton	Flow	316.0	111.5	111.5	Flow	300.5	111.5	111.5
Payson	Shut In	----	----	----	Shut In	----	----	----
Payson (Lakeside)	Shut In	----	----	----	Shut In	----	----	----
North Temple	*Pressure*	*320.5*	*19.3*	*70.0*	*Pressure*	*310.1*	*46.8*	*70.0*
Lindon (RE0027)	*Bypass*	*0.0*	*0.0*	*0.0*	*Bypass*	*0.0*	*0.0*	*0.0*
Macey's (RE0026)	*Bypass*	*0.0*	*0.0*	*0.0*	*Bypass*	*0.0*	*0.0*	*0.0*

Table A12: Station Settings for the Jeremy Ranch gate station outage

	Tm = 30°F				Tm = 20°F			
Gate Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Jeremy Ranch	Shut in	-----	-----	-----	Shut in	-----	-----	-----
Promontory	Pressure	400.0	23.5	28.8	Pressure	390.0	26.2	32.9
Rockport	Pressure	395.0	3.4	6.9	Pressure	395.0	5.3	8.8

Table A13: Station Settings for the Promontory gate station outage

	Tm = 30°F				Tm = 20°F			
Gate Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Jeremy Ranch	Pressure	400.0	11.1	14.3	Pressure	400.0	16.3	19.8
Promontory	Shut in	-----	-----	-----	Shut in	-----	-----	-----
Rockport	Pressure	391.9	13.3	14.0	Flow	320.7	14.0	14.0

Table A14: Station Settings for the Rockport gate station outage

	Tm = 30°F				Tm = 20°F			
Gate Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Jeremy Ranch	Pressure	400.0	8.5	11.5	Pressure	400.0	11.9	15.7
Promontory	Pressure	400.0	15.9	21.3	Pressure	385.0	19.5	26.5
Rockport	Shut in	-----	-----	-----	Shut in	-----	-----	-----

Table A15: Station Settings for the Central gate station outage

	Tm = 30°F (41°F in St. George)				Tm = 20°F (34°F in St. George)			
Gate/Reg. Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Central	Shut in	----	----	----	Shut in	----	----	----
Wecco	Pressure	720	21.8	20.9	Pressure	720	22.3	24.3
Indianola	Pressure	720	18.7	23.3	Pressure	720	20.5	25.2

Table A16: Station Settings for the Wecco gate station outage

	Tm = 30°F (41°F in St. George)				Tm = 20°F (34°F in St. George)			
Gate/Reg. Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Central	Pressure	750.0	24.7	26.6	Pressure	1000.0	31.8	35.2
Wecco	Shut in	----	----	----	Shut in	----	----	----
Indianola	Pressure	700.0	19.8	21.9	Pressure	715.0	21.8	24.2

Table A17: Station Settings for the Indianola gate station outage

	Tm = 30°F (41°F in St. George)				Tm = 20°F (34°F in St. George)			
Gate/Reg. Station	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**	**Station Setting**	**Avg. Pressure (psig)**	**Avg. Flow (MMcfd)**	**Peak Hour Flow (MMcfd)**
Central	Pressure	1000.0	27.6	30.9	Pressure	1000.0	26.1	33.2
Wecco	Pressure	650.0	16.7	18.1	Pressure	720.0	20.0	27.0
Indianola	Shut in	----	----	----	Shut in	----	----	----

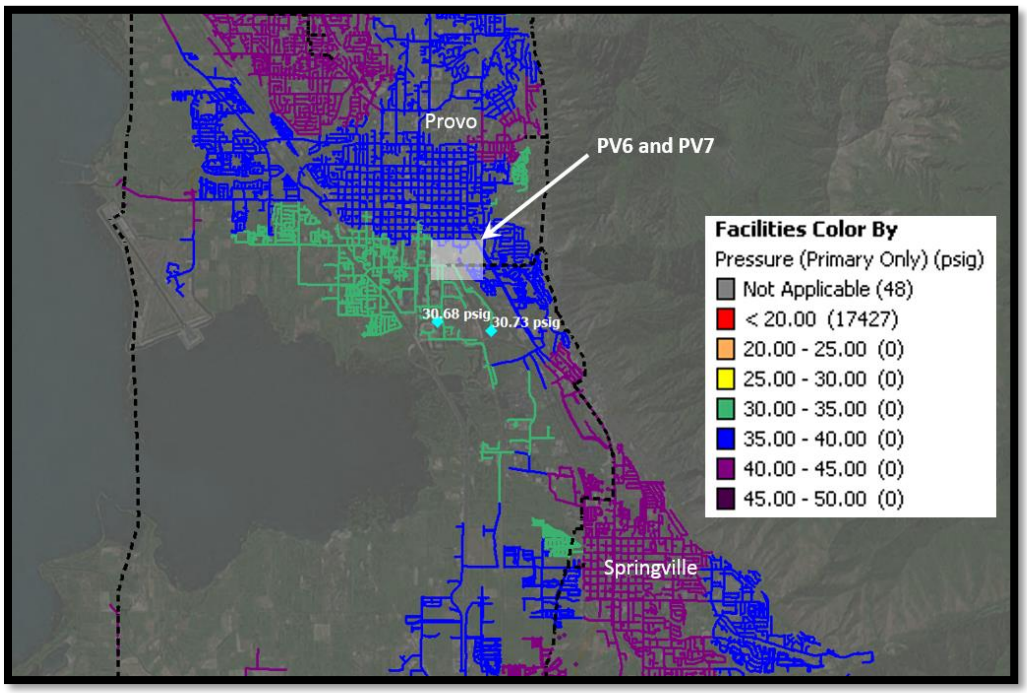

Figure A1: Resulting pressure in the Utah County IHP model with T_m = 20°F and PV0006 and PV0007 shut in

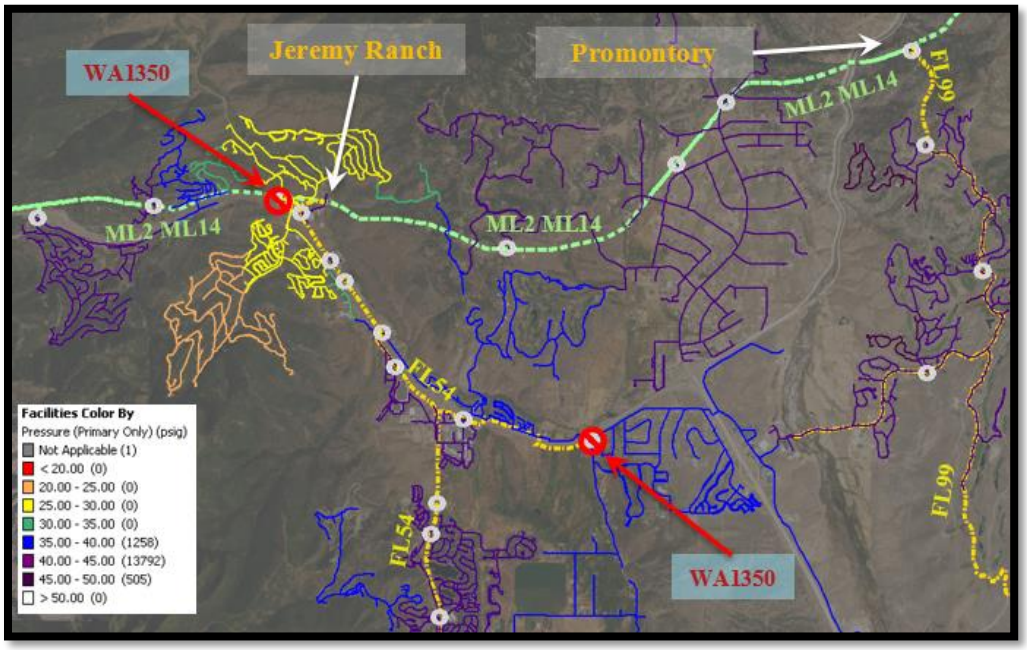

Figure A2: Resulting pressure in the Summit Wasatch IHP model with T_m = 20°F and the Jeremy Ranch gate station out of service