



Natural Soda LLC

2017 Project Status Report & Annual Plan of Development January 2018

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Table of Contents

1.0	Introduction and Project Summary	1
2.0	Description of Project Area.....	1
2.1	Location and Regional Setting	1
2.2	Leasehold Status	6
3.0	Project Status.....	6
3.1	2017 Project Activities (Confidential)	6
3.1.1	Items of Significance (Confidential)	6
3.1.2	Cavity Production (Confidential)	7
3.1.3	2017 Monthly Production Tons Summary (Confidential)	7
3.1.4	Regulatory Review (Confidential)	8
3.2	Proposed 2018 Activities and Schedule (Confidential)	11
3.2.1	Processing (Confidential)	11
3.2.2	Well field (Confidential).....	11
3.2.3	EPA Notification – 2018 Schedule of Planned Mechanical Integrity Test (MIT) (Confidential).....	11
3.2.4	EPA Notification – 2018 Schedule of Planned SSMW Logging (GR/CCL) (Confidential)	12
4.0	2017 Project Activities	13
4.1	On-Site Facilities and Process Description.....	13
4.1.1	General Arrangement	13
4.1.2	Lab Operation / Sanitation / ISO.....	13
4.1.3	Process, Utilities, Facilities	13
4.1.4	Wells Associated With the NS Project (Confidential)	15
4.1.5	Other Activities	15
4.2	New Findings or Developments (Confidential)	18
4.3	2017 Operation Results (Confidential).....	18
4.4	Geotechnical Program	20
4.4.1	Subsurface Subsidence Geophysical Logging	20
4.4.2	Surface Subsidence Monitoring.....	20
4.5	Water Well Pumpage	20
5.0	Environmental Monitoring and Protection.....	22
5.1	Hydrology Monitoring.....	22
5.1.1	Introduction.....	22
5.1.2	Stream Gauging Stations	22
5.1.3	Monitoring Wells	24
5.1.4	Process Ponds	24
5.1.5	Potentiometric Surface Maps (Confidential)	24

6.0	Land Disturbance and Reclamation	25
6.1	Summary of 2017 Disturbance	25
6.2	Regulatory Compliance.....	26
6.2.1	Regulatory Activity.....	26
6.3	Reclamation Activity.....	26
6.3.1	Regrading & Scarification	26
6.3.2	Seeding & Weed Control	26
6.3.3	Reclamation Fencing.....	26
6.3.4	Precipitation.....	26
6.3.5	Vegetation Monitoring Results.....	27
6.4	Deer Road Kill Study	27
6.5	Raptor Survey	27
6.6	Other Observations.....	27
6.7	Waste Disposal	28
Appendix A: Groundwater Analytical Results.....		29
Appendix B: Subsidence Monitoring		60
Appendix C: Potentiometric Surface Maps (Confidential)		61
Appendix D: 2016 Vegetation Monitoring Reclamation Status Report.....		62

List of Figures

Figure 1: Natural Soda LLC Vicinity Map	2
Figure 2: Sodium Leases Map	3
Figure 3: Plant and Well Location Map, Section 26 Detail.....	4
Figure 4: Plant and Well Location Map, Expanded View.....	5
Figure 5: General Flow Process	14
Figure 6: Pregnant Assays and Production (Confidential).....	19
Figure 7: NS 2017 Production (Confidential).....	19

List of Tables (Not including tables in Vegetation Monitoring Report)

Table 1: Cavity Production in Tons (Confidential)	7
Table 2: Monthly Production Summary in Tons (Confidential)	7
Table 3: List and Status of Wells Associated with NS	16
Table 4: Mine and Process Data (Confidential)	18
Table 5: Surface Subsidence Monument (SSM) Elevation Monitoring	21
Table 6: Historical Comparison with 2017 Water Year Data	23
Table 7: Yellow and Piceance Creek Discharge Data up to 2017 Water Year	23

Table 8: Disturbed Acreage.....	25
Table 9: Annual Precipitation in inches (10 Year)	27
Table 10: Hazardous Waste Disposal	28
Table 11: 89-3 Annual Perched Aquifer	30
Table 12: IRI-1 Annual Perched Aquifer.....	31
Table 13: IRI-5 Annual Perched Aquifer.....	32
Table 14: 89-2 Annual A-Groove Aquifer	33
Table 15: 90-1 Annual A-Groove Aquifer	34
Table 16: 90-4 Annual A-Groove Aquifer	35
Table 17: AG-1 Annual A-Groove Aquifer	36
Table 18: IRI-4 Annual A-Groove Aquifer.....	37
Table 19: O-GMW-A Annual A-Groove Aquifer.....	38
Table 20: WSW-2 Annual A-Groove Aquifer	39
Table 21: WSW-3 Annual A-Groove Aquifer	40
Table 22: WSW-4 Annual A-Groove Aquifer	41
Table 23: 89-1 Annual B-Groove Aquifer	42
Table 24: 90-3 Annual B-Groove Aquifer	43
Table 25: BG-1 Annual B-Groove Aquifer	44
Table 26: BG-4 Annual B-Groove Aquifer	45
Table 27: BG-5 Annual B-Groove Aquifer	46
Table 28: BG-6 Annual B-Groove Aquifer	47
Table 29: BG-7 Annual B-Groove Aquifer	48
Table 30: BG-8 (DS-4) Annual B-Groove Aquifer –.....	49
Table 31: IRI-6 Annual B-Groove Aquifer.....	50
Table 32: DS-2 Annual Dissolution Surface Aquifer.....	51
Table 33: DS-3 Annual Dissolution Surface Aquifer.....	52
Table 34: DS-5 Annual Dissolution Surface Aquifer.....	53
Table 35: DS-6 Annual Dissolution Surface Aquifer.....	54
Table 36: DS-7 Annual Dissolution Surface Aquifer.....	55
Table 37: DS-8 Annual Dissolution Surface Aquifer.....	56
Table 38: DS-9 Annual Dissolution Surface Aquifer.....	57
Table 39: IRI-7 Annual Dissolution Surface Aquifer	58
Table 40: Summary of 2017 Annual Remote Water Levels.....	59

1.0 Introduction and Project Summary

This 2017 Project Status Report and Annual Plan of Development is submitted to fulfill the requirements of BLM sodium leases, COC-00118326, COC-00118327, COC-0119986, and COC-37474 as stated in Federal Regulations 43 CFR, Subpart 3591 and 3592 and project Record of Decision dated January 20, 1987. This report is also submitted to the Colorado Division of Reclamation Mining and Safety (DRMS) to meet the requirements for an Annual Report per State permit number M-1983-194, and in part to meet the requirements contained in the EPA UIC Class III Area Permits: CO30358-00000 and CO32169-00000.

This report summarizes NS 2017 process operations, production activities, reclamation status, geotechnical and environmental monitoring results, as well as, the status of all surface facilities and wells. Proposed operations for 2018 will be described in this report, including drilling the 17H production well pair, 17H-SSMW well, 12H-IR production well, and the 2018 Plugging and Abandonment Program.

2.0 Description of Project Area

2.1 Location and Regional Setting

The four NS sodium leases are located in the Piceance Creek Basin in Rio Blanco County in northwestern Colorado (Figures 1 and 2). The sodium leases are located primarily between the Yellow Creek and Piceance Creek drainages, approximately 41 miles from Meeker, Colorado and 53 miles from Rifle, Colorado. The climate is semi-arid with annual precipitation averaging 12-14 inches. Precipitation generally occurs as snow from November to March and as rain during the remainder of the year. The vegetation is predominantly pinyon pine, sagebrush, Utah juniper, western wheatgrass, and needle-and-thread grass. The total area contained within the four sodium leases is 8,379 acres more or less. The principle area of operation is located in and around Section 26, T1S, R98W, 6th Principal Meridian. Figure 1 shows the NS leases and regional map setting. Figure 2 shows sodium leases within the Piceance Creek Basin. Figure 3 and Figure 4 show the NS well locations, and proposed well locations.

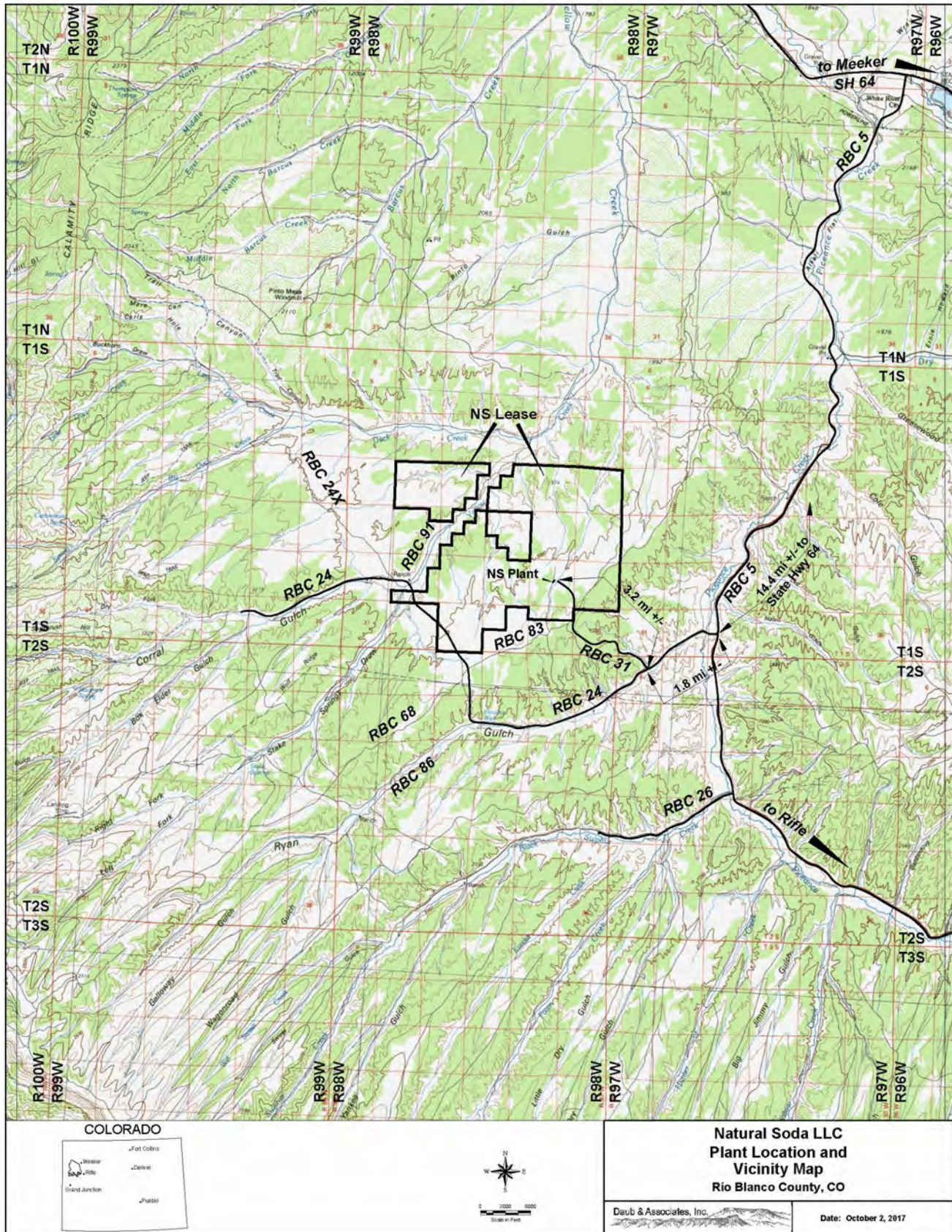


Figure 1: Natural Soda LLC Vicinity Map

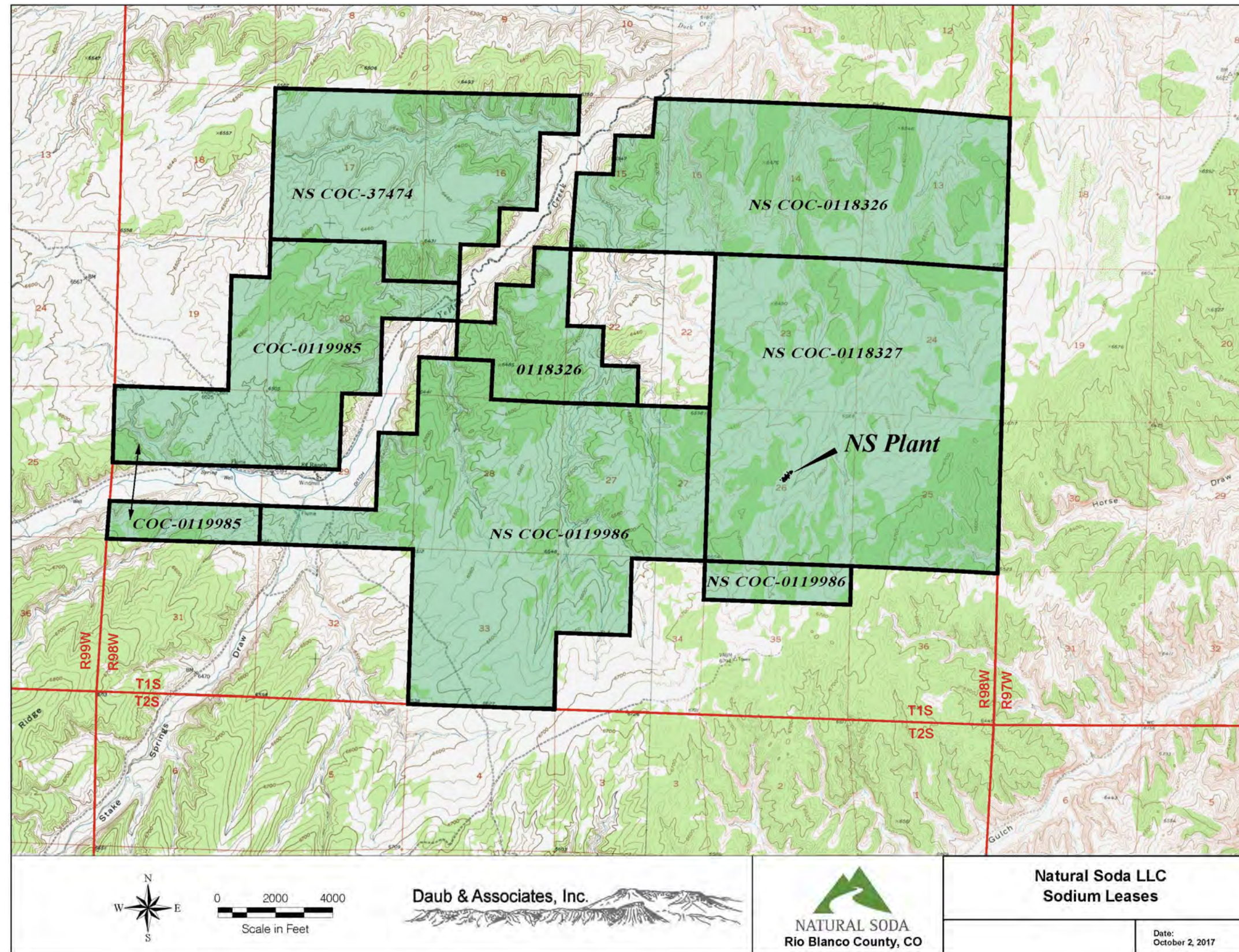


Figure 2: Sodium Leases Map

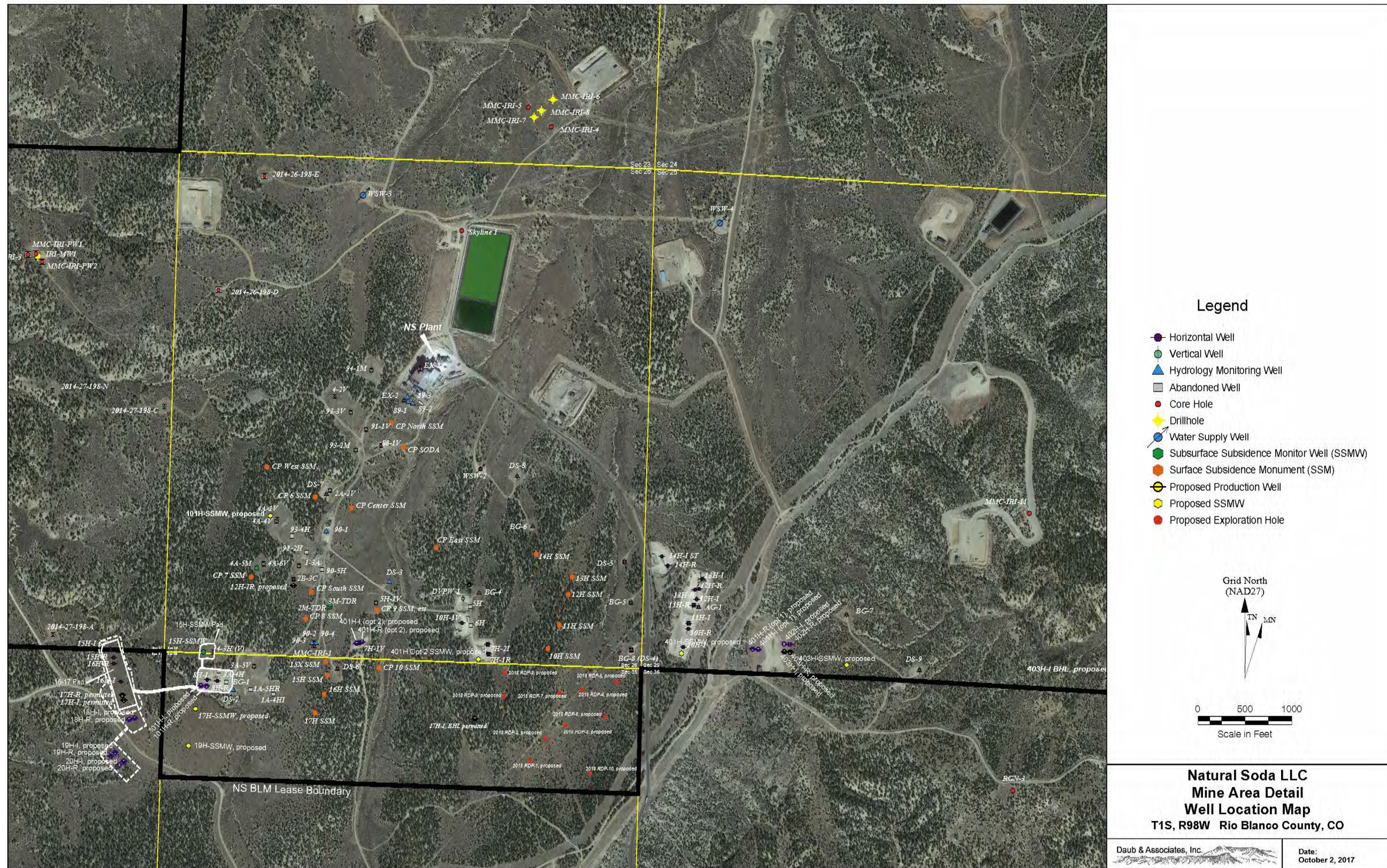


Figure 3: Plant and Well Location Map, Section 26 Detail.

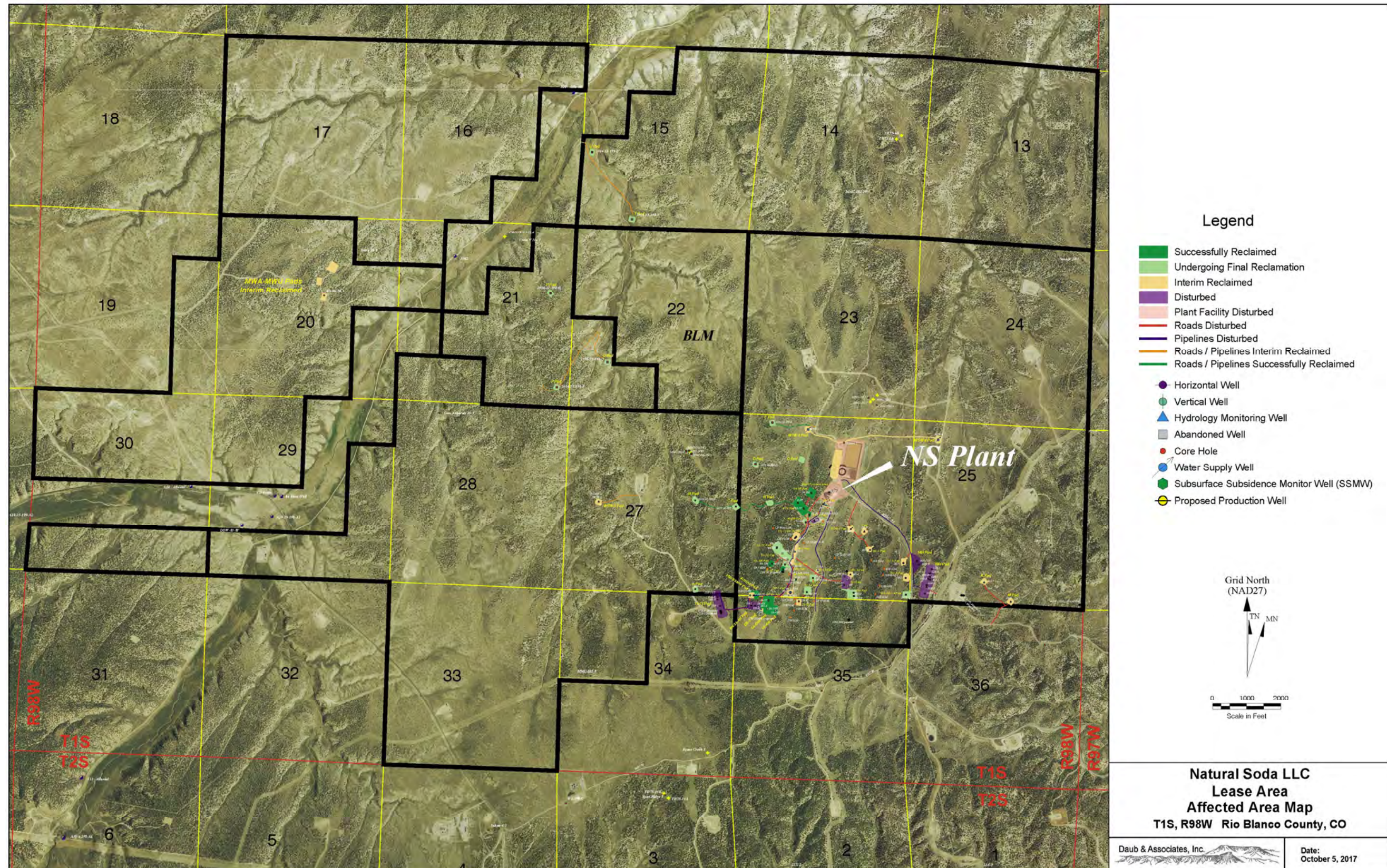


Figure 4: Plant and Well Location Map, Expanded View.

2.2 Leasehold Status

The original four sodium leases were renewed by the BLM, in 2011 for a period of ten years. Annual rental and royalty payments have been submitted to the Mineral Management Service. The NS leases comprise approximately 8,379 acres.

3.0 Project Status

3.1 2017 Project Activities (Confidential)

(See Figure 3 & Figure 4: Plant and Well Location Maps)

In 2017 NS produced 235,839 tons of sodium bicarbonate. This product was produced from the 8H, 10H, 11H, 12H, 13H, 14H, 15H, 16H, and DVPW mining intervals. Routine boil outs were performed in 2017. Various short shut-downs were required for routine maintenance, equipment repair and/or replacement.

3.1.1 Items of Significance (Confidential)

- The 16H production well pair was drilled and completed in July 2017, and began producing in September 2017.
- The 11H-I and 11H-R production wells were P&A'd in May/June of 2017 due to the retirement of the 11H mining interval.
- The 7H-1V, 7H-2I, and 7H-IR production wells were P&A'd in May 2017 due to the retirement of the 7H mining interval.
- Two (2) antiquated monitor wells were P&A'd in May 2017. These were the MMC-IRI-2 and MMC-IRI-10 wells.
- The BG-8(DS-4) B-Groove monitor well was plugged and abandoned per BLM approval in May 2017.
- NS performed cleanouts and re-equipped three groundwater monitor wells in 2017. The three groundwater monitoring wells were the MMC-IRI-1, MMC-IRI-4, and the MMC-IRI-8. In August 2017, following cleanout operations these wells had nitrogen lift sample pumps installed.
- The 90-1 groundwater monitoring well was equipped with a nitrogen lift pump in February 2017.

3.1.2 Cavity Production (Confidential)

Table 1: Cavity Production in Tons (Confidential)

Tons in 2017	Cavity #8H	Cavity #10H	Cavity #11H	Cavity #12H	Cavity #13H	Cavity #14H	Cavity #15H	Cavity #16H	Cavity DVPW1
	24,231	26,183	5,562	142	13,857	68,944	74,484	22,434	0
Total tons	87,139	328,521	331,832	136,033	96,943	203,938	86,368	22,434	1,258

3.1.3 2017 Monthly Production Tons Summary (Confidential)

Table 2: Monthly Production Summary in Tons (Confidential)

Month	Beginning Inventory	Production	Sales	Ending Inventory
January	2,524	21,795	20,292	4,027
February	4,027	20,308	18,842	5,493
March	5,493	25,038	26,489	4,042
April	4,042	17,474	19,336	2,180
May	2,180	15,096	16,927	349
June	349	17,842	17,014	1,177
July	1,177	18,742	18,727	1,192
August	1,192	18,018	17,194	2,016
September	2,016	18,312	17,289	3,039
October	3,039	22,263	21,696	3,606
November	3,606	20,172	19,454	4,324
December	4,324	20,779	20,071	5,032
TOTALS		235,839	233,331	

3.1.4 Regulatory Review (Confidential)

NS submitted routine Sundry Notices, monthly, quarterly, and annual reports to the appropriate agencies. The following summarizes other regulatory related activities:

BLM

- Right of Ways (ROWs) were granted for the 2017 RDP access roads in January 2017.
- NS submitted to the BLM, a Notice of Intent to plug and abandon the BG-8(DS-4) monitor well in February 2017. BLM approval was granted in March 2017. All required documentation of the final plug and abandonment activities was submitted to the BLM in June 2017.
- A Notice of Intent was submitted to the BLM to plug and abandon five production wells; 7H-2I, 7H-IR, 7H-1V, 11H-I, and the 11H-R in March 2017. BLM approval was granted in March 2017. All required documentation of the final plug and abandonment activities was submitted to BLM in June 2017.
- NS submitted to the BLM a Notice of Intent to plug and abandon four groundwater monitor wells; MMC-IRI-2, MMC-IRI-5, MMC-IRI-9, and MMC-IRI-10 in March 2017. BLM approval was granted in April 2017. Only the MMC-IRI-2, and MMC-IRI-10 were plugged and abandoned in 2017, all required documentation post P&A operations was submitted to the BLM in June 2017.
- Construction and location modifications for the 16H production well pair were submitted in March 2017. BLM approval was granted in April 2017. Following construction of the 16H production well pair, all required documentation was submitted to the BLM in August 2017.
- In May 2017 NS requested approval of the EPA to convert the 8H-R recovery production well to the 8H-IR injection/recovery well.
- NS submitted APD documents for the 12H-IR, 403H-I, and 403H-R proposed production wells in May 2017. Approval for these wells was granted by the BLM October of 2017.
- NS notified the BLM of the DRMS Permit M-1983-194 Amendment 04 application changes and review in June 2017.
- June 2017, NS submitted a Notice of Intent to drill and complete the 17H-SSMW well and construction of an access road to the location in summer of 2018 to the BLM. Approval for this well was granted in October of 2017.
- Undesirable Event reports (minor leaks of brine water on the ground surface) were submitted to the BLM in April and December 2017.

EPA

- The EPA approved the Major Area Permit Modification (UIC Permit C030358-00000) in July of 2017.
- NS updated the EPA Financial Assurance in June 2017. This update included the proposed completion of the 8H-R, 12H-IR, and 403H-I wells, plus the plug and abandonment in 2017 of the 7H-2I and 11H-I wells. EPA agreed to the adjustments in June 2017.
- Mechanical Integrity Testing Parts I and II were performed on the 8H-RI during October and December 2017 (respectively).
- Mechanical Integrity Testing Parts I and II were performed on the 16H-I in July and November 2017 (respectively).
- Mechanical Integrity Testing Part I was performed on the 12H-I (EPA mandated, Five Year Anniversary) in January 2017. Part II will be performed following the drilling and completion of the 12H-IR in 2018.
- Final subsurface subsidence monitor well (SSMW) gamma ray and casing collar locator (GR/CCL) logs were collected from the BG-8(DS-4 10H-C) well for the retired 11H mining interval in May 2017. No subsidence was noted.
- NS conducted EPA mandated subsurface subsidence logging, in their DS-5 subsurface subsidence monitor well in April 2017. This well serves as a monitor for the 13H and 14H mining cavities. No subsidence was noted.
- NS conducted a surface subsidence monument survey in 2017, in accordance with UIC Permit C030358-00000 requirements.

Colorado Division of Reclamation and Mine Safety (DRMS)

- On April 26, 2017 the DRMS conducted an inspection of the NS plant and wellfield. No major issues were noted.
- Permit M-1983-194 Amendment 04 and fee was submitted in May 2017 to allow for the following: a permit area increase, the addition of seven new production wells, dual 16 inch production pipelines and a parking area.
- NS notified the DRMS of a modification to Amendment 04 for the construction of a new sodium bicarbonate loadout area and conveyance system to the plant facility in May 2017.
- NS notified the DRMS of the successful abandonment of the BG-8(DS-4), MMC-IRI-2, and MMC-IRI-10 groundwater monitor wells in June 2017.
- NS notified the DRMS of the successful abandonment of the 11H-I, 11H-R, 7H-2I, 7H-1R, and the 7H-1V production wells in June 2017

- September 6, 2017 DRMS notified NS of the approval and updated reclamation cost for the revision of Amendment 04 to the mine plan. This Amendment increases the permit acreage to 12,248 acres to be consistent with areas of historic disturbance and the EPA UIC permit area. Also to allow for the construction of a new loadout area which includes; a new elevator, conveyance system, a new electrical room and a baghouse. The amendment also incorporates a total of seven new wells. Total allowed maximum disturbance remains at 260 acres.

Colorado Division of Water Resources (DWR)

- No items of significance were required between NS and DWR in 2017.

Colorado Department of Public Health & Environment (CDPHE)

- In October 2016 CDPHE issued CDPS General Permit C0G500000 for discharges from sand and gravel mining and processing, authorization to discharge under Colorado discharge permit system. The permit went into effect on January 1, 2017.
- In 2017 NS complied with all reporting requirements for storm water and environmental emissions.

Rio Blanco County (RBC)

- Temporary living quarters were approved for use for the drilling and completion of the 16H production well pair.
- In 2017 NS worked with RBC to acquire proper building permits for the addition of a storage facility and load out to the plant facility.

3.2 Proposed 2018 Activities and Schedule (**Confidential**)

3.2.1 Processing (**Confidential**)

NS anticipates an increase in production in 2018. Brief shut-downs for periodic boil-outs and routine maintenance are also planned in 2018.

3.2.2 Well field (**Confidential**)

- NS anticipates limited production from the DVPW in 2018.
- The 12H-I/R Injection/Recovery well and the two 17H production wells are planned to be drilled, completed, and brought on line in 2018.
- The 17H-SSMW will be drilled and completed in 2018 as a subsurface subsidence monitor well for the 17H and 18H mining intervals per EPA requirements.
- NS anticipates conducting a 2018 Plugging and Abandonment Program. This program is planned to permit and P&A the following wells: MMC-IRI-5, MMC-IRI-8, and MMC-IRI-9.
- The 10H mining interval and associated wells, 10H-1V, 10H-I, and 10H-R will be retired in late 2018.

3.2.3 EPA Notification – 2018 Schedule of Planned Mechanical Integrity Test (MIT) (**Confidential**)

- Per EPA UIC Permit C030358-00000 Final Area Permit requirements the following MIT Part I and MIT Part II testing is planned for 2018.
 - 13H-I Injection Well – routine 5-year anniversary MIT Part II temperature logging will be conducted prior to the anniversary date of December, 3 2018.
 - 17H-I Injection Well – initial, routine MIT Part I pressure testing, and Part II temperature logging will be conducted following well completion operations in 2018 per UIC permit stipulations.
 - 12H-IR Injection/Recovery Well – initial, routine MIT Part I and Part II (pressure testing and temperature logging) will be conducted during well completion operations in 2018 per UIC permit stipulations.
 - 12H-I Injection Well – routine MIT Part II temperature logging will be conducted following 12H-IR well completion operations in 2018 per EPA permit stipulations.

3.2.4 EPA Notification – 2018 Schedule of Planned SSMW Logging (GR/CCL) **(Confidential)**

- Per EPA UIC Permit C030358-00000 Final Area Permit requirements the following SSMW Logging (GR/CCL) is planned for 2018.
 - NS will schedule and collect baseline SSMW logs in 2018 from the planned 17H-SSMW for baseline log data to support the 17H and 18H mining intervals pursuant to UIC permit stipulations.

4.0 2017 Project Activities

4.1 On-Site Facilities and Process Description

4.1.1 General Arrangement

Figure 5 provides an overview of the NS process flow.

4.1.2 Lab Operation / Sanitation / ISO

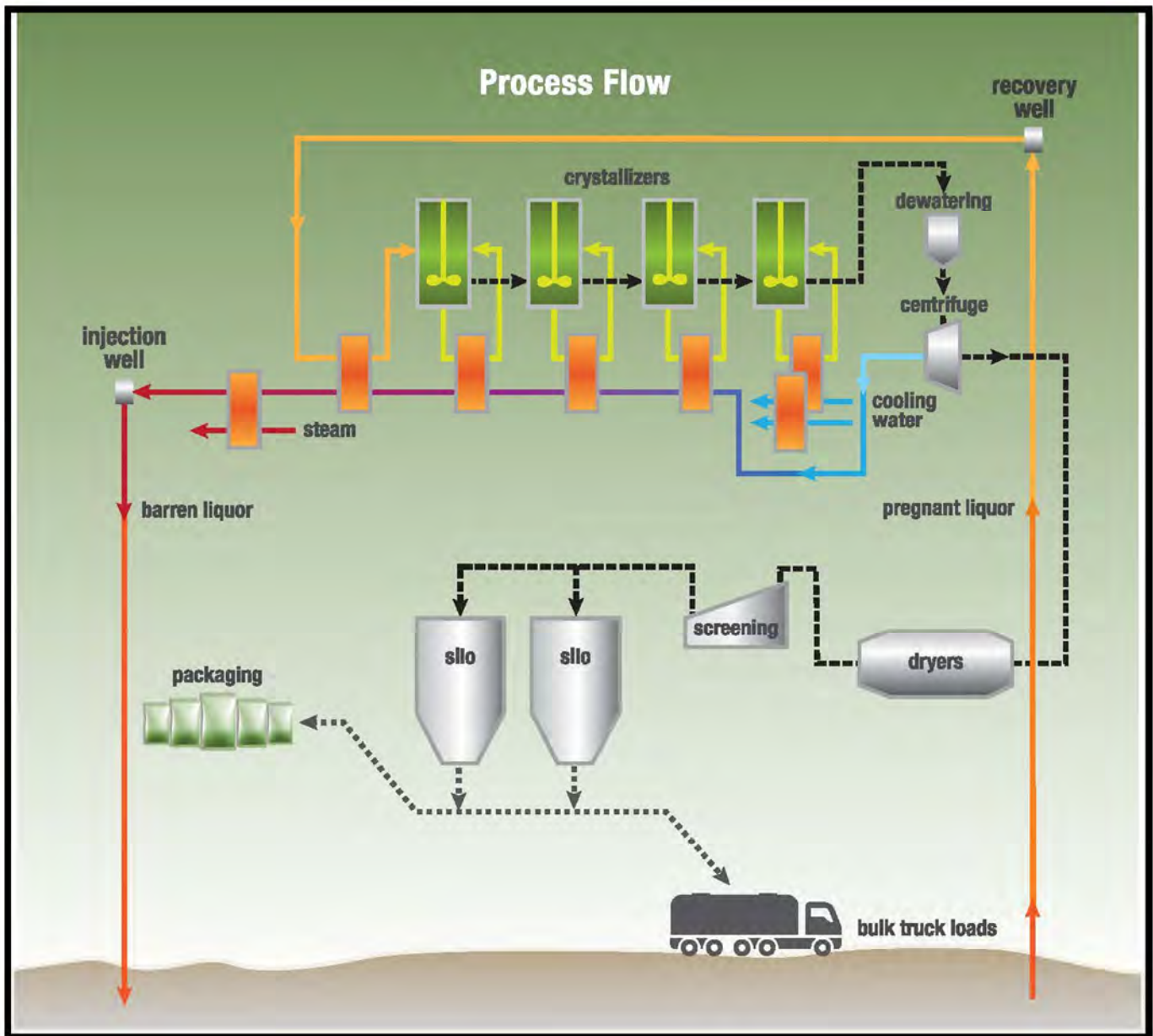
In 2017, activities continued in the laboratory to provide analysis for process control, quality assurance, and regulatory requirements.

- Plant operators performed process control analyses.
- Chloride levels were monitored by both operations and laboratory personnel on all USP grades to ensure USP standards were met.
- The USP test for insoluble materials was conducted on a per lot basis by laboratory personnel and a filter test for insoluble materials was conducted on the dry product, once per shift by operators.
- Pests were controlled with the use of two UV bug lights and rodent traps around the interior and exterior walls of the plant.
- GMP/ISO/Sanitation training was provided for all employees as required.
- A food safety audit for FSSC 22000 was conducted for which Natural Soda maintained GFSI certification.
- CDPHE, NSF, OMRI, Kosher, Halal, and ISO 9001 certifications were maintained.

4.1.3 Process, Utilities, Facilities

In 2017 NS did construct a new load out facility. NS did not make any other significant improvements to process, utilities or facilities. Figure 5 illustrates the general process flow.

Figure 5: General Flow Process



4.1.4 Wells Associated With the NS Project (Confidential)

The following well-field related activities occurred in 2017: Refer to *Figure 3 & Figure 4 Plant and Well Location Map*.

- The 16H production well pair was drilled and completed in July 2017, and began producing in September 2017. Routine Mechanical Integrity Tests (MIT) Parts I & II were completed pursuant to UIC stipulations.
- The 11H-I and 11H-R production wells were P&A'd in May/June of 2017 following the retirement of the 11H mining interval.
- The 7H-1V, 7H-2I, and 7H-IR production wells were P&A'd in May 2017 due to the retirement of the 7H mining interval.
- Two (2) antiquated monitor wells were P&A'd in May 2017. These were the MMC-IRI-2 and MMC-IRI-10 wells.
- The BG-8(DS-4) B-Groove monitor well was plugged and abandoned per BLM approval in May 2017.
- NS performed investigations and remediation operations on the 12H-I well in February/March of 2017 to determine potential causes for diminished production. Due to issues found in the well, NS determined the best course of action is to drill the 12H-IR well to the west of the existing 12H cavity in 2018 to augment production. The 12H-IR will connect to the west end of the existing 12H mining interval. Once the 12H-IR is drilled and completed the 12H mining interval will continue production.
- In March 2017 it was noted that the MMC-IRI-1 had an obstruction in the well bore which disrupted sampling of water quality. In May 2017, NS removed all equipment from the wellbore and cleaned out all obstructions in the well. Following cleanout operations the well was equipped with a nitrogen lift pump in August 2017.
- NS performed cleanouts and installed new sample pumps in the MMC-IRI-4 and MMC-IRI-8 groundwater monitor wells in August 2017.
- The 90-1 groundwater monitoring well was equipped with a nitrogen lift sampling pump in February 2017.

The current status of all wells associated with the NS Project is indicated in *Table 3: List and Status of Wells Associated with NS*.

4.1.5 Other Activities

Continuous water level monitoring of proximal DS aquifer monitor wells provided data for the management of active production mining interval operations. Throughout the year, injection and recovery rates were adjusted to maintain dissolution surface monitoring well water levels near target zones.



Table 3: List and Status of Wells Associated with NS

Well Name	Initial Well Type	Current Well Status	Section	Township	Range	Latitude (NAD 27)	Longitude (NAD 27)	Initial TD, (MD, ft)	Current TD, (MD, ft)	Comments
3M-TDR	Subsidence Monitoring	Subsidence Monitoring	26	1S	98W	39.928794934	108.362551397	1820	1820	
4A-5M	Hydrology/Subsidence Monitoring	Plugged and Abandoned	26	1S	98W	39.929813477	108.365383461	1830	0	P&A June 2012 Currently Operates as TDR Well
7H-1V	Vertical Recovery	Vertical Recovery	26	1S	98W	39.927715239	108.361397318	1935	1935	P&A May 2017
7H-2I	Horizontal Injection	Horizontal Injection	26	1S	98W	39.927792586	108.356508352	3600	3564	P&A May 2017
7H-1R	Horizontal Recovery	Horizontal Recovery	26	1S	98W	39.927509670	108.356465742	2260	2260	P&A May 2017
8H-I	Horizontal Injection	Horizontal-Injection	35	1S	98W	39.926494295	108.367130597	2883	2883	TVD TD=~1940'
8H-R	Horizontal Recovery	Horizontal-Recovery	35	1S	98W	39.926470000	108.366742000	2480	2480	TVD TD=~1928'
10H-I	Horizontal Injection	Horizontal Injection	25	1S	98W	39.927895622	108.349074715	4033	4033	TVD TD=~1995'
10H-R	Horizontal Recovery	Horizontal Recovery	25	1S	98W	39.928427876	108.348902019	2840	2840	TVD TD=~2005'
10H-1V	Slant Recovery	Slant Recovery	26	1S	98W	39.928386480	108.357515700	2038	2038	TVD TD =~2000
11H-I	Horizontal Injection	Horizontal Injection	25	1S	98W	39.928589638	108.348893772	4103.0	4103	P&A June 2017
11H-R	Horizontal Recovery	Horizontal Recovery	25	1S	98W	39.929122136	108.348721121	2591.0	2591	P&A May 2017
12H-I	Horizontal-Injection	Horizontal-Injection	25	1S	98W	39.929304000	108.348621000	4189.0	4189	TVD TD=~1985'
12H-R	Horizontal-Recovery	Horizontal-Recovery	25	1S	98W	39.929598000	108.348538000	2623.0	2623	TVD TD=~2007'
13H-I	Horizontal Injection	Horizontal-Injection	25	1S	98W	39.929917590	108.348444900	4307.0	4307.0	TVD TD=~1988'
13H-R	Horizontal-Recovery	Horizontal-Recovery	25	1S	98W	39.929583170	108.348684400	2549	2549	TVD TD=~2013'
14H-I	Horizontal Injection	Horizontal-Injection	25	1S	98W	39.930529000	108.349996000	3822	3822	TVD TD=~1970'
14H-R	Horizontal Recovery	Horizontal-Recovery	25	1S	98W	39.930265288	108.349763798	2819	2819	TVD TD=~1983'
15H-I	Horizontal Injection	Horizontal-Injection	27	1S	98W	39.927281590	108.370834800	5477	5477	TVD TD=~1877'
15H-R	Horizontal Recovery	Horizontal-Recovery	34	1S	98W	39.927050806	108.370714984	2698	2698	TVD TD=~1850'
15H-SSMW	Subsurface Subsidence Monitoring	Subsurface Subsidence Monitoring	26	1S	98W	39.927297800	108.367304200	1760.5	1760.5	
16H-I	Horizontal Injection	Horizontal-Injection	34	1S	98W	39.926332533	108.371061443	5425	5425	TVD TD=~1910'
16H-R	Horizontal Recovery	Horizontal-Recovery	34	1S	98W	39.926848404	108.371348247	2451	2451	TVD TD=~1856'
89-1	Hydrology Monitoring	Hydrology Monitoring Well	26	1S	98W	39.934818008	108.359830288	1989	1570	
89-2	Hydrology Monitoring	Hydrology Monitoring Well	26	1S	98W	39.934771572	108.359655360	1409	1389	
89-3	Hydrology Monitoring	Hydrology Monitoring Well	26	1S	98W	39.934959857	108.359876003	400	390	Periodic sampling issues.
90-1	Water Supply	Hydrology Monitoring Well	26	1S	98W	39.930942569	108.362786046	1451	1451	Converted to A-Grv MW August 2015
WSW-2 (2010-26-198-2C)	Core Hole	Water Supply	26	1S	98W	39.932913043	108.357000636	1964	1402	Cored July 2010
WSW-3	Water Supply	Water Supply	26	1S	98W	39.940837450	108.361799400	1440	1440	Drilled August 2014
WSW-4	Water Supply	Water Supply	26	1S	98W	39.940358200	108.348198508	1437	1437	Drilled August 2014
90-3	Hydrology Monitoring	Hydrology Monitoring Well	26	1S	98W	39.927659529	108.363196386	1577	1556	
90-4	Hydrology Monitoring	Hydrology Monitoring Well	26	1S	98W	39.927654857	108.363040763	1392	1371	
AG-1	Core Hole 2014-25-198-J	Hydrology Monitoring Well	25	1A	98W	39.929116963	108.348465043	2061	1487	Cemented up to groundwater monitoring well level
BG-4	Hydrology Monitoring	Hydrology Monitoring Well	26	1S	98W	39.929278506	108.356901248	1999.5	1603	
BG-5 (12H-C)	Core Hole	Hydrology Subsidence Monitoring Well	26	1S	98W	39.929138572	108.351120681	3005	1645	Cemented up to groundwater monitoring well level.
BG-6 (2010-26-198-6C)	Core Hole	Hydrology Subsidence Monitoring Well	26	1S	98W	39.931301816	108.354997679	1978	1577	Bladder pump installed December 2010.
BG-7	Core Hole 2014-25-198-K	Hydrology Monitoring Well	25	1S	98W	39.928987896	108.432905289	1967	1593.1	Cemented up to groundwater monitoring well level.
BG-8 (DS-4, 10H-C)	Core Hole, Hydrology Subsidence Monitoring Well	Hydrology Monitoring Well	26	1S	98W	39.927761681	108.351046589	2031.6	1640.5	Previously known as DS-4, Plugged back in 2016 for B-Grv Monitoring. Sampling Issues, P&A May 2017
97 DS2	Hydrology Monitoring	Hydrology Monitoring Well	35	1S	98W	39.926217942	108.366158755	1854	1829	
DS-3	Hydrology Monitoring	Hydrology Subsidence Monitoring Well	26	1S	98W	39.929529067	108.360329121	2100	1874.5	Planned sample pump replacement in 2018
DS-5 (2010-26-198-1C)	Core Hole	Hydrology Subsidence Monitoring Well	26	1S	98W	39.930335423	108.351403951	1973	1903	Cored June 2010.
DVPW-1	Vertical Production	Vertical Production	26	1S	98W	39.929100000	108.357500000	2904.6	2904.6	Limited Production.

Table 3: List and Status of Wells Associated with NS (continued)

Well Name	Initial Well Type	Current Well Status	Section	Township	Range	Latitude (NAD 27)	Longitude (NAD 27)	Initial TD, (MD, ft)	Current TD, (MD, ft)	Comments
DS-6	Core Hole	Hydrology Monitoring Well	35	1S	98W	39.926942000	108.362195000	2962.6	1870	Cemented up to groundwater monitoring well level.
DS-7	Core Hole	Hydrology Subsidence Monitoring Well	26	1S	98W	39.932036903	108.362826421	1980	1875	Cemented up to groundwater monitoring well level.
DS-8	Core Hole 2014-26-198-I	Hydrology Monitoring Well	26	1S	98W	39.932738295	108.355594975	2000	1881.7	Cemented up to groundwater monitoring well level.
DS-9	Core Hole 2014-25-198-M	Hydrology Monitoring Well	25	1S	98W	39.927447860	108.340064803	1916.5	1842	Cemented up to groundwater monitoring well level
EX-2	Core Hole	Hydrology Monitoring Well	26	1S	98W	39.934857517	108.359996032	1980	1897	
MMC-IRI-1	Core Hole	Hydrology Monitoring Well	26	1S	98W	39.927580161	108.363115621	2981	397	Cemented up to groundwater monitoring well level.
MMC-IRI-2	Core Hole	Hydrology Monitoring Well	27	1S	98W	39.931472813	108.378642620	2904	604	P&A May 2017.
MMC-IRI-4	Core Hole	Hydrology Monitoring Well	23	1S	98W	39.942950000	108.355333333	3001	1411	Cemented up to groundwater monitoring well level.
MMC-IRI-5	Core Hole	Hydrology Monitoring Well	23	1S	98W	39.943578031	108.355623039	2983	378	Planned for P&A 2018.
MMC-IRI-6	Core Hole	Hydrology Monitoring Well	23	1S	98W	39.943733333	108.355316667	1878	1394	
MMC-IRI-7	Core Hole	Hydrology Monitoring Well	23	1S	98W	39.943516667	108.356033333	1880	1395	
MMC-IRI-8	Core Hole	Hydrology Monitoring Well	23	1S	98W	39.943450000	108.355833333	1880	489	Planned for P&A 2018
MMC-IRI-9	Core Hole	Hydrology Monitoring Well	34	1S	98W	39.920759982	108.383119038	2864	1710	Planned for P&A 2018.
MMC-IRI-10	Core Hole	Hydrology Monitoring Well	14	1S	98W	39.960169970	108.355913029	2963	1761	P&A May 2017.
MMC-IRI-11	Core Hole	Hydrology Monitoring Well	25	1S	98W	39.931608050	108.336010982	2963	1550	Cemented up to groundwater monitoring well level.
MWA-2	Hydrology Monitoring	Hydrology Monitoring Well	20	1S	98W	39.952825612	108.412403600	1200	1200	
MWB-2	Hydrology Monitoring	Hydrology Monitoring Well	20	1S	98W	39.953067253	108.412206500	1398	1398	
MWD-1	Hydrology Monitoring	Hydrology Monitoring Well	20	1S	98W	39.953094778	108.411828300	1731	1731	
MWD-2	Hydrology Monitoring	Hydrology Monitoring Well	20	1S	98W	39.952635000	108.412036900	1703	1703	
MWU-2	Hydrology Monitoring	Hydrology Monitoring Well	20	1S	98W	39.933370000	108.350210000	687	687	
O-GMW-A	Core Hole 2014-27-198-O	Hydrology Monitoring Well	27	1S	98W	39.934483259	108.383446479	1786	1294	Cemented up to groundwater monitoring well level
TH75-6A	Hydrology Monitoring	Hydrology Monitoring Well	14	1S	98W	39.964492958	108.353578053	1260	1260	
TH75-6B	Hydrology Monitoring	Hydrology Monitoring Well	14	1S	98W	39.964807700	108.353045189	1755	1755	
TH75-7A	Hydrology Monitoring	Hydrology Monitoring Well	20	1S	98W	39.952321958	108.409207410	1080	1080	
TH75-7B	Hydrology Monitoring	Hydrology Monitoring Well	20	1S	98W	39.953286260	108.409494700	1498	1498	

4.2 New Findings or Developments (Confidential)

In 2017, two older groundwater monitor wells (MMC-IRI-2 and MMC-IRI-10) were plugged and abandoned. The 7H and 11H mining intervals reached the end of their mining life (7H retired 2015, 11H retired 2017). In May/June 2017 the associated production wells for these mining intervals (11H-I, 11H-R, 7H-1V, 7H-1R, and the 7H-2I) were plugged and abandoned. The WSW-2 water supply well is currently pumping at a minimal rate. The water geochemistry of the WSW-2 is currently under review. Due to complications from the 2016 conversion from a DS monitor well to a B-Groove monitor well the BG-8(DS-4) was plugged and abandoned in 2017. In 2017, the 16H production well pair was drilled and completed to enhance NS production capabilities.

4.3 2017 Operation Results (Confidential)

Mining and production activities were continuous in 2017. The following table provides a summary of mining and process results:

Table 4: Mine and Process Data (Confidential)

2017 Month	Recovery Avg. GPM	Recovery Temp.	Assay Bicarb g/l	Assay NaCl g/l	Tons Cavity #8H	Tons Cavity #10H	Tons Cavity #11H	Tons Cavity #12H	Tons Cavity #13H	Tons Cavity #14H	Tons Cavity #15H	Tons Cavity #16H	Tons Cavity DVPW1	Monthly Total Tons
Jan-17	2,116.91	201.76	211.36	21.02	1,833.99	1,608.04	2,764.71	142.49	2,140.53	6,717.01	6,588.29		0.00	21,795.05
Feb-17	2,093.14	200.68	211.90	26.09	1,949.33	1,753.93	2,797.19	0.00	2,188.47	6,203.07	5,415.56		0.00	20,307.55
Mar-17	2,104.06	201.87	213.41	26.09	3,158.49	2,408.40	0.00	0.00	3,363.54	7,530.59	8,576.96		0.00	25,037.98
Apr-17	1,889.03	205.94	211.23	26.09	2,056.64	1,885.99	0.00	0.00	1,784.03	5,939.25	5,808.00		0.00	17,473.90
May-17	1,985.74	207.86	213.20	26.09	1,397.09	892.88	0.00	0.00	1,485.60	5,267.82	6,052.43		0.00	15,095.82
Jun-17	1,967.18	209.38	218.48	26.09	1,887.08	2,798.29	0.00	0.00	1,539.07	5,371.00	6,246.08		0.00	17,841.52
Jul-17	1,941.20	203.26	222.50	26.09	2,518.11	2,375.66	0.00	0.00	444.76	6,108.78	7,295.09		0.00	18,742.39
Aug-17	1,900.36	207.15	221.87	26.09	2,632.42	2,333.60	0.00	0.00	635.14	6,215.80	6,200.90		0.00	18,017.86
Sep-17	1,871.26	200.61	221.46	26.09	1,930.88	2,697.30	0.00	0.00	276.11	5,501.29	5,345.45	2,560.85	0.00	18,311.88
Oct-17	2,209.83	203.64	220.94	26.09	3,081.66	2,755.78	0.00	0.00	0.00	5,213.34	5,772.60	5,439.62	0.00	22,262.99
Nov-17	1,985.58	202.25	222.73	26.09	349.67	2,487.44	0.00	0.00	0.00	4,767.99	6,239.83	6,327.51	0.00	20,172.44
Dec-17	2,075.49	200.29	218.36	26.09	1,436.01	2,185.44	0.00	0.00	0.00	4,108.24	4,943.26	8,106.32	0.00	20,779.27
AVERAGE	2,011.65	203.72	217.29	25.67	2,019.28	2,181.89	463.49	11.87	1,154.77	5,745.35	6,207.04	5,608.57	0.00	19,653.22
TOTAL					24,231.36	26,182.73	5,561.89	142.49	13,857.24	68,944.17	74,484.45	22,434.29	0.00	235,838.63
Key to above headings:		Recovery -	Monthly average house flow rate and pregnant liquor temperature during process operations											
		Assay -	g/L sodium bicarbonate (as total bicarbonate) and sodium chloride in the pregnant liquor (Total bicarbonate = bicarbonate g/L + 1.58 x carbonate g/L)											
		Tons -	Total monthly bicarbonate production from each cavity.											
		Temp. -	Temperature in degrees F, recovered at the pregnant liquor tank.											
		Avg GPM -	Monthly average injection flow rate during process operations.											



CONFIDENTIAL

Figure 6 illustrates 2017 pregnant liquor analytical results. Figure 7 represents monthly production for 2017. NS processed and produced their sodium bicarbonate product during all twelve months of 2017. The balance between injection and recovery rates for mining intervals 8H, 10H, 11H, 12H, 13H, 14H, 15H, 16H, and the DVPW has been continuously monitored using total flow analysis and fluid level indicators (pressure transmitters) installed in existing Dissolution Surface aquifer monitoring wells located near the active mining intervals.

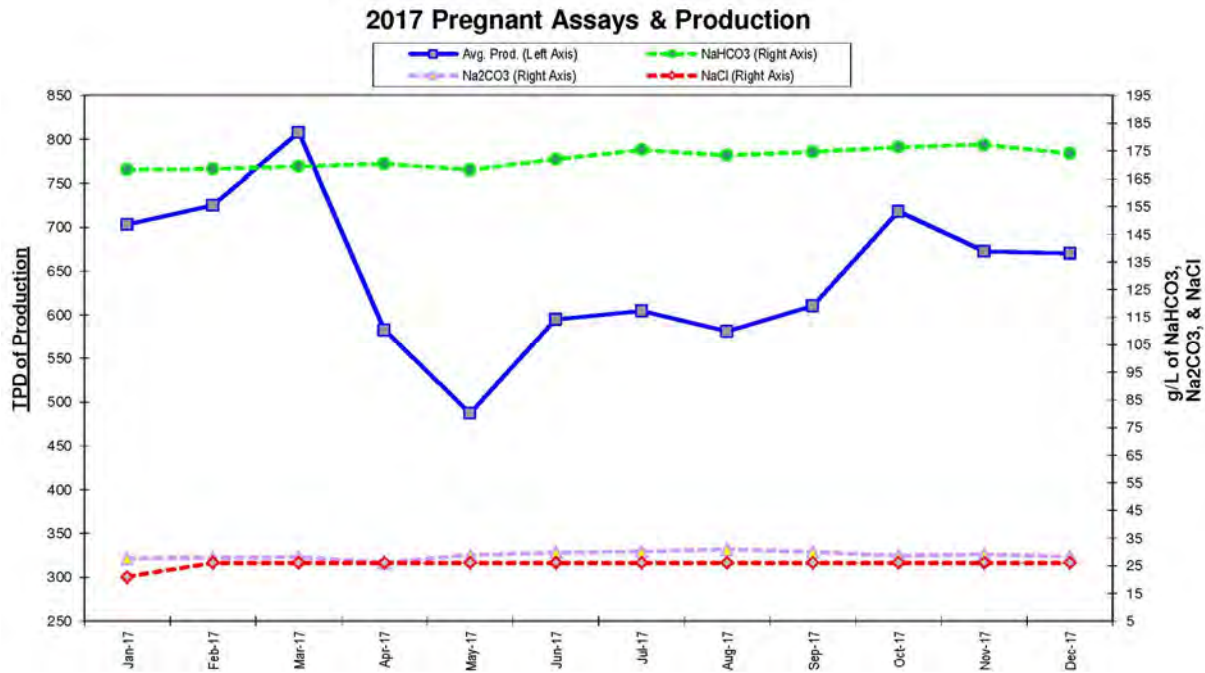


Figure 6: Pregnant Assays and Production (Confidential)

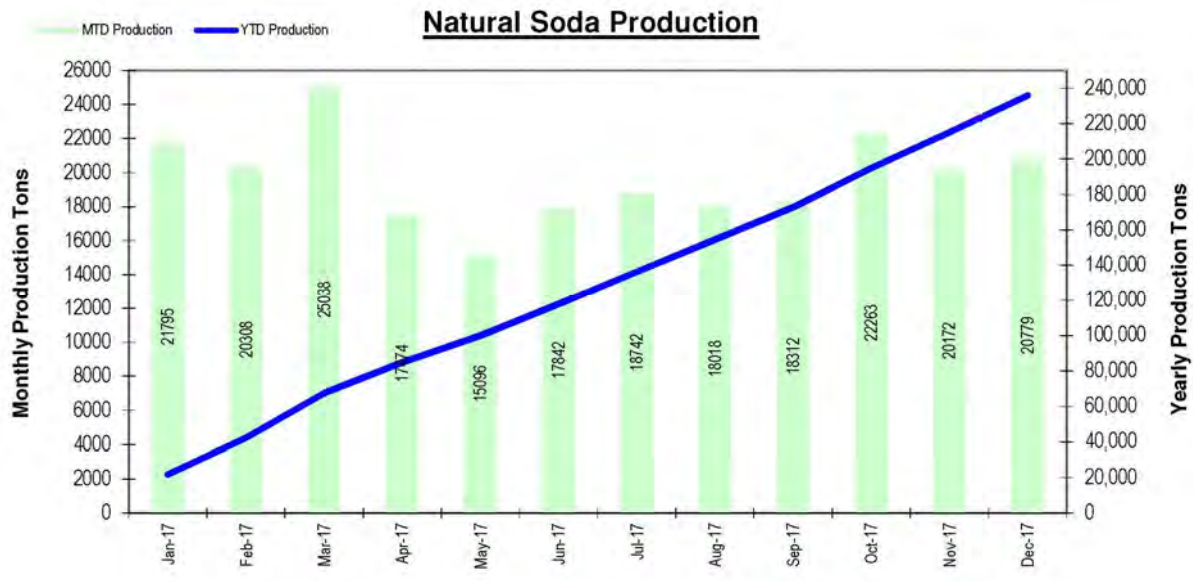


Figure 7: NS 2017 Production (Confidential)



4.4 Geotechnical Program

NS currently monitors two time-domain-reflectometry (TDR) subsurface-subsidence monitor wells, the 4A-5M and 3M-TDR. There has been no indication of surface or subsurface subsidence near the 4A-5M or 3M-TDR wells since installation. One of the TDR cables in the 4A-5M well is showing evidence of water infiltration. Two of the four TDR cables in 3M-TDR subsidence well were corrupted during installation, in 2003, and not operable. In addition to the monthly NS readings, the installation contractor also collects data quarterly.

4.4.1 Subsurface Subsidence Geophysical Logging

NS conducted routine, EPA mandated, subsurface subsidence logging, in their DS-5 (2010-26-198-1C) subsurface subsidence monitor well on April 25, 2017. This subsurface subsidence logging was required due to the 14H production well having reached a mining interval recovery percentage of 50%. No subsurface subsidence was observed.

NS conducted final, EPA mandated, subsurface subsidence logging, in their BG-8 (DS 4, 10H-C) subsurface subsidence monitor well (SSMW) on May 3, 2017. The BG-8 served as the SSMW for the NS 10H and 11H mining intervals. The logging was performed prior to the P&A operations of the 11H production well pair P&A as required by EPA, and the P&A of the BG-8 (DS-4, 10H-C) well. No subsurface subsidence was evident.

4.4.2 Surface Subsidence Monitoring

In June 2017 a new 17H SSM was installed above the proposed 17H lateral wellbore. This installation was performed in compliance with requirements contained within the EPA Underground Injection Control (UIC) Permit # CO30358-00000.

A surface subsidence survey of 15 SSM locations was conducted in June and August of 2017. Two SSM's, the CP6 and CP8 were not surveyed in 2017. The mining intervals that are located below these two surface monuments have been retired for over five years and do not require continued surveying. A review of the 2017 survey indicated no surface subsidence. Results of the 2017 SSM Survey are shown in Table 5 below.

4.5 Water Well Pumpage

In 2017, approximately 106.9 million gallons of water was pumped from water supply wells WSW-2, WSW-3, and WSW-4 with an average of 203.3 gpm. The total pumpage from WSW-2 was 14.8 million gallons, WSW-3 was 40.7 million gallons, and the total pumpage from WSW-4 was 51.4 million gallons.

Table 5: Surface Subsidence Monument (SSM) Elevation Monitoring

SSM Monument	Elevation (ft. AMSL) Initial Monument Installation	Elevation (ft. AMSL) 2017 Survey	Change in Elevation (ft.)
CP Center SSM	6658.99	6658.98	-0.01
CP North SSM	6639.21	6639.18	-0.03
CP East SSM	6669.52	6669.38	-0.14
CP South SSM	6683.84	6683.83	-0.01
CP West SSM	6669.77	6669.63	-0.14
CP 7 SSM	6706.52	6706.47	-0.05
CP 10 SSM	6687.41	6687.39	-0.02
CP 10H SSM	6712.95	6712.78	-0.17
CP 11H SSM	6705.81	6705.62	-0.19
CP 12H SSM	6695.86	6695.68	-0.18
CP 13H SSM	6684.47	6684.25	-0.22
CP 14H SSM	6675.2	6675.04	-0.16
CP 15H SSM	6702.35	6702.39	0.04
CP 16H SSM	6713.03	6713.11	0.08
CP 17H SSM	6719.06	6719.06	N/A



5.0 Environmental Monitoring and Protection

5.1 Hydrology Monitoring

5.1.1 Introduction

NS's hydrology monitoring program concentrates on ground water, as there are no perennial streams or springs located on or near NS's sodium leases. The USGS stream gauging station-monitoring program is conducted, with NS support, to provide regional surface stream flow data on Yellow and Piceance Creeks.

The hydrology-monitoring plan is designed to determine impacts of NS's solution mining operations on underground sources of drinking water, as designated by the US EPA.

Refer to Figure 3 and Figure 4 for the locations of existing monitor wells. Groundwater analytical results are presented in Appendix A.

5.1.2 Stream Gauging Stations

NS continues to contract with the USGS to monitor surface water for water quality and quantity. Monitoring was performed upstream and downstream relative to the mining operations and with respect to Yellow Creek and Piceance Creek at four existing stations with extensive historical data. Historical stream gauging data is reported in this document and discharge data is complete through the 2017 water year (October 2016 – September 2017).

The USGS surface water data are available to the public from the USGS web site at <http://co.water.usgs.gov>. Tables 6 and 7 summarize key 2017 water year data for surface water near the NS site.

A review of USGS stream water quality data indicated no significant change in stream water quality during 2017. The 2017 data showed a decrease in precipitation amounts at the NS location compared to 2016. The water year data discharge (cfs) in this area indicated a similar decrease in average stream discharge levels from 2016 to 2017. The 2017 discharge (cfs) data is similar to discharge levels measured during the 2012 through 2015 years. The 2017 Specific Conductance data from USGS for all four stations was within the range values for the period of record. The 2017 water temperature values were within the range of historic data. No effect on stream water quality was noted from any of the NS operations.

Table 6: Historical Comparison with 2017 Water Year Data

Station	Discharge P of R*	Discharge 2017 WY**	Average Total Discharge P of R	Total Discharge 2017	Specific conductance					Temp (°C.)	
					(µS/cm @ 25° C)						
					P of R	2017 WY	P of R	2017 WY	P of R	2017 WY	
	<u>cfs</u>	<u>cfs</u>	<u>ac ft/yr</u>	<u>ac ft/yr</u>	<u>Max</u>	<u>Max</u>	<u>Min</u>	<u>Min</u>	<u>Max</u>	<u>Max</u>	
6200	26.30 (52 yrs)	11.70	19,052	8,476	2,380	2,120	352	1,390	25.0	22.7	
6222	32.70 (52 yrs)	15.50	23,689	11,221	6,080	3,550	822	1,540	28.0	20.2	
6242	1.57 (43 yrs)	0.55	1,137	398	3,000	1,280	271	1,160	29.0	13.2	
6255	2.46 (52 yrs)	1.71	1,782	1238	5,790	3,600	457	1,080	35.0	18.3	
6200 Piceance Creek below Ryan Gulch					6242 Corral Gulch near Rangely						
6222 Piceance Creek at White River					6255 Yellow Creek near White River						
* P of R = Period of Record for collection of data.					**WY = Water Year (October-September).						
cfs = cubic feet per second, average annual flow.											

Table 7: Yellow and Piceance Creek Discharge Data up to 2017 Water Year

Project Data Comparison															
Discharge for Water Years in cfs															
Station	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
6200	6.9	13.4	14.3	15.2	27.9	16.3	13.4	36.2	17.5	11.3	10.7	15.9	17.0	11.7	
6222	6.6	22.2	16.6	17.8	36.2	20.8	17.6	41.7	19.2	11.8	13.0	19.7	21.2	15.5	
6242	0.3	0.8	0.2	0.5	1.3	0.4	0.3	1.1	0.3	0.2	0.5	0.5	1.9	0.6	
6255	1.8	1.6	1.1	1.2	1.1	1.0	0.9	1.3	1.2	1.1	1.2	1.3	1.3	1.7	
Maximum Specific Conductance (µS/cm @ 25°C)															
Station	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
6200	1,860	1,720	1,800	1,700	1,460	1,620	2,020	1,460	1,610	1,930	2,040	1,770	1,840	2,120	
6222	3,720	3,940	3,910	3,500	1,950	3,130	4,800	2,290	5,350	5,100	3,190	2,790	2,020	3,550	
6242	1,520	1,520	1,500	1,280	1,350	1,320	1,460	1,280	1,480	1,430	1,400	1,330	1,170	1,280	
6255	4,000	4,250	4,320	4,230	3,830	4,050	4,260	4,130	4,170	4,720	4,530	4,070	4,520	3,600	
* P of R = Period of Record for collection of data.				**WY = Water Year (October-September).				cfs = cubic feet per second, average annual flow.							
6200 Piceance Creek below Ryan Gulch				6242 Corral Gulch near Rangely											
6222 Piceance Creek at White River				6255 Yellow Creek near White River											

5.1.3 Monitoring Wells

Per regulatory requirements, dedicated groundwater monitoring wells have been constructed to monitor four water-bearing intervals identified as the Perched, A-Groove, B-Groove, and the Dissolution Surface Aquifers. These aquifers are monitored at several locations across the solution mining area: up and down-gradient, remote down-gradient, and toward the east near the southeast portion of Section 26. Refer to Figure 3 and Figure 4 for well locations.

Baseline and current ground water monitoring data have been obtained from 1991 through present. Within NS's lease boundaries, there are three aquifers defined by US EPA as underground sources of drinking water (USDW): the Perched, A-Groove and B-Groove Aquifers. The Dissolution Surface Aquifer has been exempted as an underground source of drinking water in the NS lease and permit areas.

The Perched Aquifer is characteristically lower in total dissolved solids (TDS), conductivity, fluoride, SAR (sodium absorption ratio) and moderate to higher in sulfate and pH. The A-Groove and B-Groove Aquifers are similar in water quality with moderate TDS, conductivity, SAR, but higher fluoride. However, the B-Groove Aquifer generally has slightly higher levels of TDS, conductivity, SAR, and fluoride. The Dissolution Surface Aquifer is characterized by very high TDS and conductivity (30,000 to >100,000 ppm), higher SAR, magnesium, potassium, moderate pH, and a generally higher fluoride.

In 2017 the results of groundwater monitoring were analyzed for potential anomalies in order to prevent or mitigate potential negative impacts to the USDW's.

Appendix A contains detailed sampling results for all ground water monitoring wells.

5.1.4 Process Ponds

The process ponds at the NS site have a secondary liner, which collect and direct any condensation or leakage to the leak detection tube for removal. Weekly collection and removal of leachate continued in 2017. Process pond information is reported on a monthly basis.

5.1.5 Potentiometric Surface Maps (**Confidential**)

Using groundwater level elevations from NS groundwater monitoring wells and other NS wells, the potentiometric surface has been plotted for the A-Groove and B-Groove Aquifers. Maps representing the potentiometric surface for the A-Groove and B-Groove Aquifers have been included with this report in Appendix C (**Confidential**).

6.0 Land Disturbance and Reclamation

6.1 Summary of 2017 Disturbance

NS did not create any new disturbed acreage in 2017. The total disturbed acreage reported in 2016 was 94.88 acres. In 2017, it was determined that a more accurate accounting of the NS land disturbance would be 97.29 acres. The 1A-4HI, 1A-5HR, and the 3A-5V pads are adjacent to one another and were reported in 2016 as having a combined acreage of 2.30 acres. Following a review in February 2017, it was determined that a more accurate representation of the disturbance for these three pads would be a combined total of 4.71 acres. This 2.41 acre increase accounts for the difference between the 2016 (94.88 acres) and 2017 (97.29 acres) reported totals. The P&A of the BG-8(DS-4) well in May 2017 and subsequent reclamation activities on the pad changed the status of the pad disturbance from interim reclaimed to reclaimed. Table 8 lists the disturbed acreage as of December 2017.

Table 8: Disturbed Acreage

<u>Process Area:</u>	<u>Acres:</u>
Plant Site Disturbed	26.84
Plant Site Interim Reclaimed	4.46
<u>Well Field:</u>	
Roads Disturbed	2.45
Well Pads Disturbed	21.26
Roads/Misc. Interim Reclaimed	5.33
Well Pads Interim Reclaimed	11.71
Well Pad Reclaimed	25.24
<u>Total Disturbance:</u>	<u>97.29</u>

6.2 Regulatory Compliance

6.2.1 Regulatory Activity

In 2017, all required reports were submitted in a timely manner. Required forms were submitted to the appropriate agencies regarding all activities pertaining to the new wells drilled & associated plugging and abandonment operations.

6.3 Reclamation Activity

6.3.1 Regrading & Scarification

Regrading and scarification activities occurred in 2017 at the BG-8(DS-4) location, 7H Pad, 7H-1V Pad, MMC-IRI-2 location, and the MMC-IRI-10 location to support final reclamation.

6.3.2 Seeding & Weed Control

The majority of seeding activity in 2017 focused on the areas disturbed following the 2017 P&A projects on the 7H and 7H-1V pads, BG-8(DS-4), MMC-IRI-2, and MMC-IRI-10 locations. These areas were reseeded with the BLM Approved final seed mix. In 2017 NS applied weed control measures to the DS-6, DS-7, IRI-3, PW-1, PW-2, MU-1, WSW-4, BG-5, DS-5, BG-6, IRI-1, WSW-2 well locations. Additionally weed control was also conducted on the 15H-17H and 15H-SSMW pads. The annual vegetation monitoring continued in 2017 for the areas of study that are currently in final reclamation status. This report, *The 2017 Vegetation Monitoring Reclamation Status Report*, prepared by Mr. Rusty Roberts can found in Appendix D.

6.3.3 Reclamation Fencing

Repair and maintenance was performed, as necessary, on existing fences in 2017 as needed. Fencing is utilized to keep livestock and wildlife out of the reclaimed areas.

6.3.4 Precipitation

Perennial vegetation is an indicator of long-term precipitation, the "normal" precipitation for the NS site is 12-14 inches for the calendar year. The distribution of precipitation is important for proper reclamation. The total precipitation for 2017 was 16.63 inches; the ten year average (2008 – 2017) is 11.61 inches. Table 9 provides a list of the annual precipitation from 2008 – 2017 for the NS mine site:

Table 9: Annual Precipitation in inches (10 Year)

Month/Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	AVG
Jan	0.76	0.65	0.40	0.18	0.18	0.25	0.98	0.47	1.62	1.89	0.71
Feb	1.90	0.50	0.20	0.15	1.15	0.30	0.35	0.39	1.34	1.52	0.74
Mar	1.80	0.60	1.45	1.25	0.30	0.50	0.28	0.82	1.76	1.01	0.99
Apr	1.25	0.75	0.25	1.25	0.40	1.35	0.63	1.71	5.18	1.11	1.25
May	0.45	1.25	0.05	0.95	0.14	1.05	1.66	4.36	2.06	2.17	1.15
Jun	1.05	1.25	0.95	0.00	0.06	0.35	0.01	0.51	0.53	0.47	0.57
Jul	0.20	0.30	0.45	0.23	0.43	1.40	1.34	1.78	1.07	3.36	0.92
Aug	0.30	1.70	0.40	0.00	0.86	0.26	3.17	1.44	2.78	0.85	1.26
Sep	0.50	0.80	0.70	0.13	0.36	2.89	2.14	0.32	2.19	1.55	1.28
Oct	0.43	0.50	1.08	0.87	0.58	1.35	1.09	1.38	1.89	1.62	1.17
Nov	0.30	0.30	0.35	0.05	0.28	1.30	0.80	0.70	1.56	0.64	0.85
Dec	0.70	0.70	1.67	0.32	0.83	0.17	1.00	0.10	1.04	0.44	0.93
Annual Totals	9.64	9.30	7.95	5.38	5.57	11.17	13.44	14.02	23.02	16.63	11.61

6.3.5 Vegetation Monitoring Results

See Appendix D for *2016 Vegetation Monitoring Reclamation Status Report* prepared by Rusty Roberts.

6.4 Deer Road Kill Study

Per the monitoring requirement from the BLM, NS compiled deer road kill data throughout 2017 for vehicles traveling to and from the NS site. Three deer of unknown sex were reported as struck and killed in 2017. One other deer of unknown sex was reported as being struck by a vehicle, but the deer ran off.

6.5 Raptor Survey

The 2016 raptor survey sufficed for the 2017 well field development activities and was reported in the 2017 annual report. A raptor survey will be conducted in the spring of 2018 per BLM requirements for 2018 and 2019 well field development activities.

6.6 Other Observations

Elk, deer, coyotes, rabbits, bobcat, and fox were noted in and around the well-field throughout the year.

6.7 Waste Disposal

Common domestic solid waste was collected in containers and periodically transported to the Rio Blanco County landfill. Sewage from the plant was directed to a septic system with a leach drain field. Process water, including plant wash down, blow down from the boilers, and precipitation runoff, was directed to the process pond. A pump in the process pond allows NS to recycle the water to the barren system. The wastewater pond contains, and evaporates, water from the cooling tower blow down, water softener brine, and boiler ditch. Table 10 indicates hazardous waste that was generated and collected at the NS facilities. Hazardous waste was collected, contained safely, stored separately from day to day waste, and then disposed of properly by Clean Harbors, Inc., a certified hazardous waste handling/disposal company.

Table 10: Hazardous Waste Disposal

Date Shipped	# of Containers	Total Quantity	Contents / Waste	EPA Waste Code
3/9/2017	1	2515 Lbs.	CRANK CASE OIL	N/A
	1	280 Lbs.	Arsenic and Heavy Metal Waste	D004, D005, D006, D007, D008, D011, D038, F005, U196
4/13/2017	1	413 Lbs.	2,2-dibromo-3-nitrilopropionamide	N/A
	3	49 Lbs.	Biocide	D002
	3	51 Lbs.	Biocide	D002
	3	46 Lbs.	Biocide	D002
5/11/2017	1	126 Lbs.	Biocide	D002
8/14/2017	2	493 Lbs.	Arsenic and Heavy Metal Waste	D004, D005, D006, D007, D008, D011, D038, F005, U196
	2	488 Lbs.	Arsenic and Heavy Metal Waste	D004, D005, D006, D007, D008, D011, D038, F005, U196
9/15/2017	3	40 Lbs.	Caustic Commercial Descalent NaOH	D002
	3	40 Lbs.	Caustic Commercial Descalent NaOH	D002
	3	40 Lbs.	Caustic Commercial Descalent NaOH	D002
	1	500 Lbs.	Cl/Br Biocide	D002
	1	55 Lbs.	Unused Commercial Biocide Br/Cl	D002
11/9/2017	1	321 Lbs.	2,2-dibromo-3-nitrilopropionamide	N/A
Reported from Natural Soda by Mr. Gerry Deschaine 1/23/2018				

source: Clean Harbors manifests





Natural Soda LLC

Appendix A: Groundwater Analytical Results

Table 11: 89-3 Annual Perched Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	163	404.00	8/28/13	66.00	9/14/92	205.79	mg/l
Carbonate as CaCO ₃	163	138.00	12/5/12	3.00	6/26/90	28.45	mg/l
Total Alkalinity as Bromide	163	524.00	8/28/13	66.00	9/14/92	226.13	mg/l
Cation-Anion Balance	25	0.60	7/6/00	0.05	10/22/89	0.19	mg/l
Sum of Anions	161	15.70	6/14/17	-13.00	12/16/15	0.29	%
Sum of Cations	140	12.60	8/28/13	5.10	6/14/17	7.56	meq/l
Chemical Oxygen	141	11.80	8/28/13	5.78	9/14/92	7.54	meq/l
Chloride	19	300.00	9/23/10	10.00	10/22/89	51.82	mg/l
Conductivity, Lab	163	75.30	8/28/13	4.00	9/27/90	15.51	mg/l
Fluoride	159	1,210.00	8/28/13	534.00	8/6/92	726.07	µmhos
Hardness as CaCO ₃	163	18.00	7/31/91	0.02	4/19/01	0.49	mg/l
Nitrate as N, dissolved	162	113.00	4/11/06	27.00	3/30/90	80.53	mg/l
Nitrate/Nitrite as N,	27	0.76	7/24/02	0.02	12/5/12	0.14	mg/l
Nitrite as N, dissolved	27	0.85	7/24/02	0.03	7/18/95	0.15	mg/l
Nitrogen, Ammonia	27	0.10	6/26/91	0.01	6/25/07	0.04	mg/l
Nitrogen, Organic	24	13.10	9/23/10	0.11	7/12/96	1.52	mg/l
Nitrogen, Total Kjeldahl	24	13.40	6/26/91	0.10	7/18/95	1.93	mg/l
pH, lab	24	25.40	9/23/10	0.20	7/21/94	3.20	mg/l
Phosphate, total	162	11.50	12/19/91	6.60	9/14/92	8.55	units
Phosphorus, total	22	155.00	6/25/07	0.03	7/2/98	11.12	mg/l
SAR in Water	24	2.33	9/23/10	0.01	6/26/91	0.23	mg/l
Sulfate	152	15.92	3/30/90	4.82	9/14/92	6.82	none
Sulfide	163	296.00	3/30/90	1.00	12/12/08	126.42	mg/l
Total Dissolved Solids	21	4.50	9/23/10	0.03	7/2/98	0.49	mg/l
Conductivity, Field	163	659.00	8/28/13	329.00	6/14/17	441.25	mg/l
pH, Field	180	16,000.00	7/1/90	500.00	2/24/93	778.75	µmhos
Temperature (°C), Field	181	10.23	7/19/09	7.30	9/27/90	8.67	units
Water Level, Field	91	21.10	7/19/09	6.40	12/1/90	11.98	(°C)
	77	341.00	9/1/11	316.20	10/31/17	324.60	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	26	2.12	7/27/01	U	7/7/99	0.42	mg/l
Arsenic, dissolved	25	0.04	10/22/89	0.00	12/5/12	0.01	mg/l
Barium, dissolved	25	0.69	3/30/90	0.01	10/22/89	0.06	mg/l
Beryllium, dissolved	25	0.01	6/26/91	U	6/26/91	0.01	mg/l
Boron, dissolved	163	0.43	8/28/13	0.02	4/24/91	0.06	mg/l
Cadmium, dissolved	25	0.00	9/13/95	U	9/13/95	0.00	mg/l
Calcium, dissolved	163	17.00	9/27/90	4.50	6/25/07	11.76	mg/l
Chromium, dissolved	26	0.01	6/26/91	U	6/26/91	0.01	mg/l
Copper, dissolved	26	0.20	12/5/12	U	3/30/90	0.06	mg/l
Iron, dissolved	25	4.17	9/27/90	U	7/7/99	0.44	mg/l
Lead, dissolved	25	0.06	8/19/09	U	6/26/91	0.04	mg/l
Lithium, dissolved	25	0.05	3/30/90	U	6/26/91	0.03	mg/l
Magnesium, dissolved	163	18.40	7/24/02	3.00	3/30/90	12.41	mg/l
Manganese, dissolved	25	0.14	9/27/90	U	7/7/99	0.03	mg/l
Mercury, dissolved	24	0.00	10/22/89	U	6/26/91	0.00	mg/l
Molybdenum, dissolved	25	0.15	6/26/90	U	7/12/96	0.07	mg/l
Nickel, dissolved	25	0.02	10/22/89	U	10/22/89	0.02	mg/l
Potassium, dissolved	163	10.00	1/31/91	U	4/28/95	1.19	mg/l
Selenium, dissolved	25	0.00	3/30/90	U	9/27/90	0.00	mg/l
Silica, dissolved	163	33.20	7/27/01	4.80	1/21/92	15.74	mg/l
Sodium, dissolved	163	236.00	8/28/13	96.00	9/14/92	134.05	mg/l
Strontium, dissolved	163	1.09	4/11/06	0.17	3/30/90	0.81	mg/l
Vanadium, dissolved	25	U	12/5/12	U	12/5/12	U	mg/l
Zinc, dissolved	25	0.35	3/30/90	U	10/22/89	0.05	mg/l



Table 12: IRI-1 Annual Perched Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	107	548.00	1/8/15	0.00	8/1/90	168.41	mg/l
Carbonate as CaCO ₃	107	300.00	10/25/90	0.00	8/30/08	121.19	mg/l
Total Alkalinity as Bromide	107	900.00	8/1/90	156.00	10/13/92	307.07	mg/l
Cation-Anion Balance	26	1.60	7/21/93	0.06	6/16/11	0.29	mg/l
Sum of Anions	104	63.90	8/14/17	-16.00	3/13/03	1.11	%
Sum of Cations	97	24.97	8/13/90	5.30	6/15/14	9.11	meq/l
Chemical Oxygen	97	50.00	8/14/17	5.70	6/14/11	9.71	meq/l
Chloride	19	300.00	9/21/10	10.00	8/16/94	46.25	mg/l
Conductivity, Lab	107	400.00	4/24/91	14.00	12/15/92	51.12	mg/l
Fluoride	104	2,630.00	1/20/92	467.00	3/23/05	885.11	µmhos
Hardness as CaCO ₃	107	24.00	9/2/98	1.70	4/20/92	6.50	mg/l
Nitrate as N, dissolved	107	553.00	8/1/90	2.00	6/23/10	39.36	mg/l
Nitrate/Nitrite as N,	26	2.77	6/26/02	0.02	6/28/06	0.38	mg/l
Nitrite as N, dissolved	26	2.79	6/26/02	0.03	6/28/06	0.35	mg/l
Nitrogen, Ammonia	26	0.13	8/16/96	0.01	8/1/90	0.05	mg/l
Nitrogen, Organic	25	2.57	7/31/91	0.25	6/9/99	0.76	mg/l
Nitrogen, Total Kjeldahl	25	3.90	7/21/92	0.10	6/16/11	1.03	mg/l
pH, lab	25	5.90	7/31/91	0.50	6/16/11	1.83	mg/l
Phosphate, total	104	11.30	7/31/91	6.60	8/30/08	9.56	units
Phosphorus, total	24	155.00	6/28/06	0.10	8/13/90	18.35	mg/l
SAR in Water	25	1.41	9/21/10	0.03	7/31/91	0.26	mg/l
Sulfate	99	76.00	8/14/17	5.76	8/1/90	22.08	none
Sulfide	107	243.00	12/15/92	41.00	3/9/11	80.54	mg/l
Total Dissolved Solids	24	4.00	6/13/01	0.03	6/2/98	1.08	mg/l
Conductivity, Field	105	1,644.00	8/1/90	335.00	6/15/14	608.13	mg/l
pH, Field	165	3,500.00	8/1/90	643.00	11/27/12	1,187.16	µmhos
Temperature (°C), Field	164	12.80	12/1/90	6.04	8/30/08	10.31	units
Water Level, Field	104	20.10	5/16/07	6.50	12/12/08	12.25	(°C)
	79	387.19	8/14/17	308.80	6/20/17	380.55	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	26	11.10	8/16/96	0.06	7/29/09	3.18	mg/l
Arsenic, dissolved	26	0.01	7/31/91	U	11/27/12	0.00	mg/l
Barium, dissolved	26	0.29	8/14/95	0.01	11/27/12	0.08	mg/l
Beryllium, dissolved	26	0.00	8/14/95	U	8/14/95	0.00	mg/l
Boron, dissolved	107	0.39	1/8/15	U	10/25/90	0.16	mg/l
Cadmium, dissolved	26	0.03	7/21/93	U	7/21/93	0.03	mg/l
Calcium, dissolved	107	223.00	8/1/90	U	6/23/10	12.22	mg/l
Chromium, dissolved	26	0.02	8/1/90	U	8/16/96	0.01	mg/l
Copper, dissolved	26	0.20	6/14/00	U	8/1/90	0.04	mg/l
Iron, dissolved	26	14.10	7/21/93	0.02	7/21/92	3.20	mg/l
Lead, dissolved	26	0.10	7/21/93	U	6/16/97	0.07	mg/l
Lithium, dissolved	26	0.19	8/13/90	U	8/30/08	0.05	mg/l
Magnesium, dissolved	107	31.20	3/14/00	U	9/26/01	2.55	mg/l
Manganese, dissolved	26	0.37	8/14/95	U	8/30/08	0.09	mg/l
Mercury, dissolved	26	0.00	8/14/95	U	8/14/95	0.00	mg/l
Molybdenum, dissolved	26	0.10	8/1/90	U	6/16/97	0.04	mg/l
Nickel, dissolved	26	0.02	10/25/90	U	8/16/96	0.01	mg/l
Potassium, dissolved	107	146.00	8/1/90	1.00	4/24/91	8.02	mg/l
Selenium, dissolved	26	0.00	7/31/91	U	8/13/90	0.00	mg/l
Silica, dissolved	107	99.30	8/14/95	7.10	8/1/90	32.35	mg/l
Sodium, dissolved	107	1,110.00	8/14/17	126.00	6/14/11	203.43	mg/l
Strontium, dissolved	107	2.45	8/1/90	0.02	5/24/94	0.32	mg/l
Vanadium, dissolved	26	0.03	8/14/95	U	6/16/97	0.01	mg/l
Zinc, dissolved	26	0.24	7/21/93	U	6/9/99	0.07	mg/l



Table 13: IRI-5 Annual Perched Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	57	327.00	6/30/09	2.00	12/18/91	182.94	mg/l
Carbonate as CaCO ₃	57	284.00	12/18/91	0.00	6/14/08	77.90	mg/l
Total Alkalinity as Bromide	57	406.00	3/25/92	181.00	5/29/02	252.61	mg/l
Cation-Anion Balance	27	1.00	8/22/91	0.00	8/12/92	0.21	mg/l
Sum of Anions	54	17.30	6/14/08	-10.20	5/26/04	0.98	%
Sum of Cations	49	15.77	6/16/92	8.43	12/19/95	9.93	meq/l
Chemical Oxygen	49	15.25	6/16/92	7.90	5/26/04	10.19	meq/l
Chloride	24	181.00	11/2/15	0.00	5/29/02	55.29	mg/l
Conductivity, Lab	57	420.00	6/16/92	9.00	12/19/95	21.58	mg/l
Fluoride	57	1,500.00	6/16/92	795.00	8/12/91	977.81	µmhos
Hardness as CaCO ₃	57	0.90	9/16/91	0.00	6/30/95	0.29	mg/l
Nitrate as N, dissolved	57	182.00	6/14/08	1.00	12/20/93	33.19	mg/l
Nitrate/Nitrite as N,	28	12.50	5/29/02	0.00	8/12/92	1.03	mg/l
Nitrite as N, dissolved	28	12.50	5/29/02	0.00	8/12/92	0.91	mg/l
Nitrogen, Ammonia	28	0.06	9/14/92	0.00	8/12/92	0.02	mg/l
Nitrogen, Organic	28	0.87	6/23/94	0.08	5/21/07	0.30	mg/l
Nitrogen, Total Kjeldahl	28	80.00	5/15/98	0.00	8/12/92	5.47	mg/l
pH, lab	28	80.00	5/15/98	0.50	8/12/91	5.20	mg/l
Phosphate, total	57	11.90	6/28/93	2.40	6/16/92	9.22	units
Phosphorus, total	26	155.00	7/29/09	0.06	5/29/02	6.59	mg/l
SAR in Water	28	1.87	6/18/96	0.02	5/29/02	0.20	mg/l
Sulfate	48	90.44	1/20/94	7.50	6/30/09	23.02	none
Sulfide	57	290.00	3/25/92	148.00	3/22/96	202.96	mg/l
Total Dissolved Solids	27	1.20	8/24/17	0.05	6/14/08	0.30	mg/l
Conductivity, Field	56	1,090	6/16/92	504	4/21/94	632	mg/l
pH, Field	69	9,880	5/21/07	715	12/19/95	1,188	µmhos
Temperature (°C), Field	68	12.00	8/12/92	6.33	6/14/08	9.94	units
Water Level, Field	29	17	6/14/08	9.70	11/1/02	12	(°C)
	50	248.06	6/15/10	238.40	12/15/15	241.26	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	27	10.00	8/22/92	U	5/29/03	1.28	mg/l
Arsenic, dissolved	27	0.01	6/18/96	U	5/26/04	0.00	mg/l
Barium, dissolved	27	0.27	5/21/07	0.01	5/26/04	0.04	mg/l
Beryllium, dissolved	27	0.01	8/22/92	U	8/22/92	0.01	mg/l
Boron, dissolved	57	0.11	11/21/05	0.02	8/22/97	0.07	mg/l
Cadmium, dissolved	27	0.01	8/22/92	U	3/22/16	0.00	mg/l
Calcium, dissolved	57	63.60	6/14/08	1.00	6/16/92	7.04	mg/l
Chromium, dissolved	27	0.02	8/22/92	U	6/23/94	0.02	mg/l
Copper, dissolved	27	0.02	8/12/91	U	6/23/94	0.02	mg/l
Iron, dissolved	27	7.30	8/22/92	U	5/26/04	0.72	mg/l
Lead, dissolved	27	0.12	3/22/16	U	8/12/91	0.05	mg/l
Lithium, dissolved	27	0.06	10/3/12	U	5/26/04	0.03	mg/l
Magnesium, dissolved	57	9.10	6/30/09	U	6/30/95	4.47	mg/l
Manganese, dissolved	31	0.07	8/22/92	U	8/22/97	0.02	mg/l
Mercury, dissolved	27	0.00	8/22/92	U	8/22/92	0.00	mg/l
Molybdenum, dissolved	27	0.03	6/14/08	U	6/18/96	0.02	mg/l
Nickel, dissolved	27	0.04	7/29/09	U	8/22/92	0.03	mg/l
Potassium, dissolved	56	22.00	12/18/91	1.00	3/22/16	7.81	mg/l
Selenium, dissolved	27	0.00	8/12/91	U	8/12/91	0.00	mg/l
Silica, dissolved	56	74.00	8/22/92	10.90	3/21/17	18.70	mg/l
Sodium, dissolved	56	336.00	6/16/92	166.00	5/26/04	209.71	mg/l
Strontium, dissolved	56	1.30	6/30/09	0.06	6/16/92	0.48	mg/l
Vanadium, dissolved	27	0.01	8/22/92	U	8/22/92	0.01	mg/l
Zinc, dissolved	27	0.08	8/22/92	U	6/23/94	0.03	mg/l



Table 14: 89-2 Annual A-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	171	903.00	12/12/08	41.00	1/30/97	514.92	mg/l
Carbonate as CaCO ₃	171	566.00	1/30/97	8.00	11/28/90	89.71	mg/l
Total Alkalinity as Bromide	171	926.00	12/12/08	160.00	10/25/90	602.80	mg/l
Cation-Anion Balance	27	3.00	6/26/90	0.05	7/1/97	0.44	mg/l
Sum of Anions	162	63.40	4/14/05	-28.80	8/2/06	1.04	%
Sum of Cations	145	20.10	12/12/08	11.66	11/28/90	14.12	meq/l
Chemical Oxygen	145	67.50	4/14/05	7.80	8/2/06	14.56	meq/l
Chloride	24	220.00	9/22/10	10.00	8/2/06	80.23	mg/l
Conductivity, Lab	170	118.00	10/22/89	2.00	4/24/91	19.96	mg/l
Fluoride	168	1,760.00	12/12/08	1,000.00	5/20/93	1,257.73	µmhos
Hardness as CaCO ₃	171	30.00	12/19/91	1.90	6/26/91	21.38	mg/l
Nitrate as N, dissolved	165	77.00	12/12/08	0.40	10/25/90	8.45	mg/l
Nitrate/Nitrite as N,	28	5.76	8/10/08	0.02	7/18/95	0.53	mg/l
Nitrite as N, dissolved	28	6.26	8/10/08	0.02	7/18/95	0.56	mg/l
Nitrogen, Ammonia	28	0.50	8/10/08	0.01	3/30/90	0.13	mg/l
Nitrogen, Organic	26	3.77	8/10/08	0.54	6/15/92	1.30	mg/l
Nitrogen, Total Kjeldahl	26	14.60	9/27/90	0.10	6/15/92	4.37	mg/l
pH, lab	26	15.40	9/27/90	0.60	6/15/92	5.49	mg/l
Phosphate, total	167	9.70	12/20/94	8.00	7/18/95	8.92	units
Phosphorus, total	22	155.00	6/25/07	0.06	7/2/98	10.79	mg/l
SAR in Water	27	0.46	6/26/90	0.01	8/17/93	0.08	mg/l
Sulfate	128	345.00	4/14/05	9.71	10/25/90	59.59	none
Sulfide	171	445.00	6/26/90	3.47	12/10/14	41.36	mg/l
Total Dissolved Solids	23	2.40	7/24/02	0.02	7/15/04	0.45	mg/l
Conductivity, Field	171	2,040.00	4/14/05	494.00	10/25/90	790.06	mg/l
pH, Field	217	1,980.00	12/12/08	620.00	3/16/94	1,221.73	µmhos
Temperature (°C), Field	217	10.00	8/22/91	6.80	3/10/15	9.11	units
Water Level, Field	97	17.40	7/1/02	9.20	1/30/06	12.20	(°C)
	83	545.20	6/25/14	463.95	4/1/03	492.74	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	26	0.70	10/22/89	0.03	7/1/97	0.12	mg/l
Arsenic, dissolved	26	0.04	6/26/91	0.00	6/15/92	0.01	mg/l
Barium, dissolved	26	0.23	7/15/04	0.01	8/2/06	0.04	mg/l
Beryllium, dissolved	26	0.01	6/26/90	U	6/26/90	0.01	mg/l
Boron, dissolved	164	1.48	4/14/05	0.19	8/2/06	0.37	mg/l
Cadmium, dissolved	26	0.01	6/26/90	U	6/26/90	0.01	mg/l
Calcium, dissolved	163	15.70	12/12/08	U	4/27/04	1.46	mg/l
Chromium, dissolved	26	0.07	7/30/03	U	6/26/90	0.04	mg/l
Copper, dissolved	26	0.01	6/26/90	U	6/26/90	0.01	mg/l
Iron, dissolved	26	0.80	10/22/89	U	7/18/95	0.13	mg/l
Lead, dissolved	26	0.05	10/22/89	U	6/26/90	0.03	mg/l
Lithium, dissolved	26	0.13	7/15/04	U	6/26/90	0.05	mg/l
Magnesium, dissolved	163	9.10	12/12/08	U	4/27/04	1.18	mg/l
Manganese, dissolved	25	0.14	7/30/03	U	6/26/90	0.06	mg/l
Mercury, dissolved	26	0.00	6/15/92	U	6/26/90	0.00	mg/l
Molybdenum, dissolved	26	0.13	10/22/89	U	7/12/96	0.05	mg/l
Nickel, dissolved	26	0.52	7/30/03	U	10/22/89	0.19	mg/l
Potassium, dissolved	164	7.00	10/22/89	U	8/2/06	1.33	mg/l
Selenium, dissolved	26	0.01	9/27/90	U	6/26/90	0.00	mg/l
Silica, dissolved	164	27.70	1/9/01	4.70	8/2/06	13.07	mg/l
Sodium, dissolved	164	1,530.00	4/14/05	176.00	8/2/06	325.62	mg/l
Strontium, dissolved	164	1.34	12/12/08	0.03	4/27/04	0.19	mg/l
Vanadium, dissolved	26	0.01	6/26/90	U	6/26/90	0.01	mg/l
Zinc, dissolved	26	0.03	7/29/09	U	6/26/90	0.02	mg/l



Table 15: 90-1 Annual A-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	91	11,000.00	8/15/17	170.00	6/12/90	1,848.71	mg/l
Carbonate as CaCO ₃	91	6,530.00	12/13/16	9.00	4/27/04	377.32	mg/l
Total Alkalinity as Bromide	91	11,800.00	8/15/17	477.00	4/16/02	2,300.65	mg/l
Cation-Anion Balance	23	0.10	1/31/91	0.08	7/31/09	0.10	mg/l
Sum of Anions	88	30.70	12/13/16	-14.70	2/27/17	-0.14	%
Sum of Cations	88	385.00	8/15/17	11.49	2/24/92	71.10	meq/l
Chemical Oxygen	88	385.00	12/13/16	11.50	9/27/90	69.89	meq/l
Chloride	19	191.00	6/29/16	10.00	10/22/02	61.30	mg/l
Conductivity, Lab	90	5,260.00	8/15/17	10.00	1/31/91	824.81	mg/l
Fluoride	89	29,900.00	8/15/17	1,075.00	1/31/91	6,552.98	µmhos
Hardness as CaCO ₃	91	40.90	8/15/17	1.40	4/27/04	14.70	mg/l
Nitrate as N, dissolved	91	98.00	11/6/14	4.00	9/9/15	43.04	mg/l
Nitrate/Nitrite as N,	23	3.99	1/31/91	0.02	9/27/90	0.70	mg/l
Nitrite as N, dissolved	23	4.00	1/31/91	0.02	9/27/90	0.60	mg/l
Nitrogen, Ammonia	23	0.02	9/27/90	0.01	1/31/91	0.02	mg/l
Nitrogen, Organic	22	5.10	8/21/15	0.08	9/27/90	1.03	mg/l
Nitrogen, Total Kjeldahl	22	2.50	6/29/16	0.10	1/31/91	0.53	mg/l
pH, lab	22	7.10	6/29/16	0.04	9/27/90	1.43	mg/l
Phosphate, total	89	12.80	1/27/16	6.30	7/25/02	8.79	units
Phosphorus, total	19	11.00	6/29/16	0.06	6/28/07	1.35	mg/l
SAR in Water	22	3.40	6/29/16	0.02	6/28/07	0.38	mg/l
Sulfate	87	1,600.00	12/13/16	25.30	8/4/08	131.83	none
Sulfide	91	933.00	9/9/15	10.00	10/4/11	90.83	mg/l
Total Dissolved Solids	23	12.00	10/19/00	0.07	10/22/02	4.14	mg/l
Conductivity, Field	91	21,100.00	8/15/17	700.00	7/21/94	3,833.84	mg/l
pH, Field	308	32,600.00	1/27/16	1,122.70	5/4/10	2,964.49	µmhos
Temperature (°C), Field	92	12.50	4/13/16	7.10	3/16/14	8.52	units
Water Level, Field	64	24.40	7/28/11	7.50	3/4/13	18.81	(°C)
	10	549.12	10/15/15	531.00	4/21/16	539.16	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	23	0.05	6/12/90	U	6/28/07	0.05	mg/l
Arsenic, dissolved	23	0.05	8/21/15	U	10/26/04	0.01	mg/l
Barium, dissolved	23	1.77	11/6/14	0.02	1/31/91	0.47	mg/l
Beryllium, dissolved	23	0.01	6/12/90	U	6/12/90	0.01	mg/l
Boron, dissolved	91	10.10	8/21/15	0.25	6/12/90	1.54	mg/l
Cadmium, dissolved	23	0.01	6/12/90	U	9/27/90	0.01	mg/l
Calcium, dissolved	89	12.00	8/21/15	0.00	5/17/17	4.92	mg/l
Chromium, dissolved	23	0.02	9/28/06	U	6/12/90	0.01	mg/l
Copper, dissolved	23	0.01	6/12/90	U	6/12/90	0.01	mg/l
Iron, dissolved	23	3.00	8/21/15	U	9/27/90	0.23	mg/l
Lead, dissolved	23	0.02	6/12/90	U	6/12/90	0.02	mg/l
Lithium, dissolved	23	0.49	11/6/14	0.01	6/12/90	0.18	mg/l
Magnesium, dissolved	91	19.00	11/6/14	2.00	6/12/90	8.14	mg/l
Manganese, dissolved	23	0.08	10/4/11	0.01	9/22/10	0.02	mg/l
Mercury, dissolved	23	0.0004	10/30/03	U	6/12/90	0.0002	mg/l
Molybdenum, dissolved	23	0.05	6/12/90	U	9/15/07	0.04	mg/l
Nickel, dissolved	23	0.02	6/12/90	U	6/12/90	0.02	mg/l
Potassium, dissolved	91	746.00	12/13/16	0.40	7/18/00	32.19	mg/l
Selenium, dissolved	23	0.0014	8/21/15	U	6/12/90	0.0011	mg/l
Silica, dissolved	91	40.00	9/9/15	7.00	8/10/16	13.28	mg/l
Sodium, dissolved	91	8,550.00	8/15/17	259.00	6/12/90	1,551.30	mg/l
Strontium, dissolved	91	4.93	11/6/14	0.03	9/9/15	1.78	mg/l
Vanadium, dissolved	23	0.01	6/12/90	U	6/12/90	0.01	mg/l
Zinc, dissolved	23	0.02	6/28/07	U	6/12/90	0.01	mg/l



Table 16: 90-4 Annual A-Groove Aquifer

Parameters	No. of	High	Date	Low	Date	Average	Units
Wet Chemistry	Samples						
Bicarbonate as CaCO ₃	111	1,680.00	9/24/03	45.00	6/26/02	800.51	mg/l
Carbonate as CaCO ₃	111	693.00	6/26/02	10.00	12/16/03	83.11	mg/l
Total Alkalinity as	111	1,740.00	9/24/03	142.00	9/28/06	873.15	mg/l
Bromide	29	16.00	6/16/97	0.29	8/1/90	5.56	mg/l
Cation-Anion Balance	108	11.90	6/23/10	-68.80	8/15/17	-1.95	%
Sum of Anions	108	153.40	5/24/94	34.16	8/1/90	88.48	meq/l
Sum of Cations	108	143.00	2/27/97	10.00	8/15/17	85.74	meq/l
Chemical Oxygen	21	840.00	8/16/94	10.00	8/16/96	199.29	mg/l
Chloride	111	4,690.00	5/24/94	700.00	8/1/90	2,555.77	mg/l
Conductivity, Lab	108	14,100.00	2/21/94	309.00	5/27/15	8,818.07	µmhos
Fluoride	111	23.70	8/1/90	5.50	6/14/08	12.66	mg/l
Hardness as CaCO ₃	111	204.00	2/21/94	25.00	8/15/17	91.38	mg/l
Nitrate as N, dissolved	28	0.08	6/26/02	0.02	6/28/06	0.05	mg/l
Nitrate/Nitrite as N,	28	0.09	6/16/11	0.02	6/28/06	0.06	mg/l
Nitrite as N, dissolved	28	0.04	6/16/11	0.01	1/29/91	0.02	mg/l
Nitrogen, Ammonia	27	3.30	8/10/08	0.83	8/13/90	1.90	mg/l
Nitrogen, Organic	27	10.10	3/14/08	0.40	7/21/93	3.48	mg/l
Nitrogen, Total Kjeldahl	27	12.10	3/14/08	1.30	6/14/00	5.12	mg/l
pH, lab	108	8.90	4/24/91	7.70	9/14/04	8.52	units
Phosphate, total	25	155.00	6/28/06	0.06	8/14/95	17.76	mg/l
Phosphorus, total	27	0.11	8/13/90	0.02	7/31/91	0.06	mg/l
SAR in Water	108	4,950.00	6/24/03	19.00	8/15/17	137.84	none
Sulfate	110	2,310.00	6/15/14	4.00	12/16/04	70.78	mg/l
Sulfide	22	5.80	6/26/02	0.02	8/10/08	1.18	mg/l
Total Dissolved Solids	111	8,270.00	2/27/97	2,110.00	8/15/17	5,171.33	mg/l
Conductivity, Field	169	13,600.00	11/17/93	2,900.00	8/1/90	8,794.49	µmhos
pH, Field	164	9.53	7/29/09	7.40	8/26/15	8.55	units
Temperature (°C), Field	112	16.50	5/1/02	7.40	12/15/05	12.22	(°C)
Water Level, Field	92	544.21	3/1/10	516.40	10/1/90	538.09	Ft.
Parameters	No. of	High	Date	Low	Date	Average	Units
Metals	Samples						
Aluminum, dissolved	28	0.80	6/16/05	U	9/21/10	0.28	mg/l
Arsenic, dissolved	28	0.05	1/29/91	0.00	6/28/06	0.01	mg/l
Barium, dissolved	28	1.56	3/14/08	0.09	8/1/90	0.87	mg/l
Beryllium, dissolved	28	U	#N/A	U	#N/A	U	mg/l
Boron, dissolved	111	1.29	7/21/92	0.10	11/20/96	0.32	mg/l
Cadmium, dissolved	28	0.03	7/21/93	U	7/21/93	0.03	mg/l
Calcium, dissolved	111	45.00	12/16/04	3.00	11/20/96	11.20	mg/l
Chromium, dissolved	28	U	11/27/12	U	11/27/12	U	mg/l
Copper, dissolved	28	0.08	6/24/04	U	6/24/04	0.08	mg/l
Iron, dissolved	28	1.67	10/25/90	0.07	9/21/10	0.39	mg/l
Lead, dissolved	28	U	#N/A	U	#N/A	U	mg/l
Lithium, dissolved	27	0.10	6/16/97	U	8/13/90	0.04	mg/l
Magnesium, dissolved	111	37.00	2/21/94	3.90	8/15/17	15.35	mg/l
Manganese, dissolved	27	0.15	10/25/90	0.01	9/21/10	0.05	mg/l
Mercury, dissolved	28	0.00	9/15/07	0.00	8/14/95	0.00	mg/l
Molybdenum, dissolved	28	0.37	8/13/90	0.13	10/25/90	0.24	mg/l
Nickel, dissolved	28	U	#N/A	0.00	#N/A	U	mg/l
Potassium, dissolved	111	10.00	7/31/91	1.70	11/14/16	3.19	mg/l
Selenium, dissolved	28	0.003	1/29/91	0.001	8/13/90	0.002	mg/l
Silica, dissolved	111	63.00	12/16/04	2.10	4/20/92	12.46	mg/l
Sodium, dissolved	111	3,180.00	2/27/97	220.00	8/15/17	1,960.95	mg/l
Strontium, dissolved	111	8.17	2/21/94	0.30	8/15/17	3.31	mg/l
Vanadium, dissolved	28	U	#N/A	U	#N/A	U	mg/l
Zinc, dissolved	28	0.10	7/31/91	U	10/25/90	0.05	mg/l



Table 17: AG-1 Annual A-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	6	406	11/4/14	198	2/10/15	286	mg/l
Carbonate as CaCO ₃	6	273	1/29/15	53	11/4/14	175	mg/l
Total Alkalinity as Bromide	6	556	9/28/17	377	2/10/15	461	mg/l
Cation-Anion Balance	6	0.17	1/29/15	0.17	1/29/15	0.17	mg/l
Sum of Anions	6	0.00	12/15/15	-6.70	2/10/15	-3.13	%
Sum of Cations	6	18.00	1/29/15	15.00	12/15/15	16.17	meq/l
Chemical Oxygen	6	16.00	1/29/15	14.00	2/10/15	15.17	meq/l
Chloride	6	37.00	12/15/15	15.00	1/29/15	22.50	mg/l
Conductivity, Lab	6	140	9/28/17	92	11/4/14	124	mg/l
Fluoride	6	1,750	1/29/15	1,430	11/4/14	1,560	µmhos
Hardness as CaCO ₃	6	6.12	9/28/17	5.52	2/10/15	5.76	mg/l
Nitrate as N, dissolved	6	45.00	11/4/14	15.00	4/5/16	22.38	mg/l
Nitrate/Nitrite as N,	6	0.02	1/29/15	0.02	1/29/15	0.02	mg/l
Nitrite as N, dissolved	6	0.03	1/29/15	0.03	1/29/15	0.03	mg/l
Nitrogen, Ammonia	6	0.01	1/29/15	0.01	1/29/15	0.01	mg/l
Nitrogen, Organic	6	1.51	9/28/17	0.47	4/5/16	0.73	mg/l
Nitrogen, Total Kjeldahl	6	0.50	1/29/15	0.10	4/5/16	0.28	mg/l
pH, lab	6	1.90	9/28/17	0.60	4/5/16	0.95	mg/l
Phosphate, total	6	9.70	1/29/15	8.70	11/4/14	9.47	units
Phosphorus, total	6	0.28	1/29/15	0.09	11/4/14	0.21	mg/l
SAR in Water	6	0.09	1/29/15	0.03	11/4/14	0.07	mg/l
Sulfate	6	39	9/28/17	20.00	11/4/14	32	none
Sulfide	6	210	2/10/15	81.70	9/28/17	148	mg/l
Total Dissolved Solids	6	1.12	9/28/17	0.04	11/4/14	0.59	mg/l
Conductivity, Field	6	987	1/29/15	843	12/15/15	900	mg/l
pH, Field	4	1,882	9/28/17	1,432	4/5/16	1,662	µmhos
Temperature (°C), Field	4	9.37	9/28/17	8.66	4/5/16	9.06	units
Water Level, Field	4	21.37	9/28/17	18.00	4/5/16	19.12	(°C)
	4	581.90	9/28/17	572.10	1/16/15	577.24	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Arsenic, dissolved	6	0.00	11/4/14	U	2/10/15	0.00	mg/l
Barium, dissolved	6	0.02	11/4/14	0.01	12/15/15	0.01	mg/l
Beryllium, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Boron, dissolved	6	0.28	1/29/15	0.21	2/10/15	0.25	mg/l
Cadmium, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Calcium, dissolved	6	7.80	11/4/14	U	4/5/16	2.83	mg/l
Chromium, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Copper, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Iron, dissolved	6	0.86	9/28/17	0.03	11/4/14	0.24	mg/l
Lead, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Lithium, dissolved	6	0.18	9/28/17	0.12	11/4/14	0.14	mg/l
Magnesium, dissolved	6	6.30	11/4/14	U	9/28/17	3.73	mg/l
Manganese, dissolved	6	U	11/4/14	U	4/5/16	U	mg/l
Mercury, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Molybdenum, dissolved	6	0.18	9/28/17	0.06	11/4/14	0.12	mg/l
Nickel, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Potassium, dissolved	6	11.00	9/28/17	5.00	11/4/14	8.20	mg/l
Selenium, dissolved	6	U	9/28/17	U	9/28/17	U	mg/l
Silica, dissolved	6	13.90	11/4/14	0.20	2/10/15	3.24	mg/l
Sodium, dissolved	6	357	1/29/15	303	2/10/15	323	mg/l
Strontium, dissolved	6	0.83	11/4/14	U	12/15/15	0.45	mg/l
Vanadium, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Zinc, dissolved	6	0.06	9/28/17	U	11/4/14	0.04	mg/l



Table 18: IRI-4 Annual A-Groove Aquifer

Parameters	No. of	High	Date	Low	Date	Average	Units
Wet Chemistry	Samples						
Bicarbonate as CaCO ₃	56	1,250.00	3/22/93	34.00	9/8/93	256.38	mg/l
Carbonate as CaCO ₃	56	870.00	3/22/93	24.00	6/30/09	274.18	mg/l
Total Alkalinity as	56	2,120.00	3/22/93	176.00	6/14/08	491.43	mg/l
Bromide	27	2.70	11/29/11	0.07	5/26/00	0.71	mg/l
Cation-Anion Balance	54	13.30	11/6/14	-9.10	3/22/16	2.36	%
Sum of Anions	54	19.49	9/16/91	9.50	5/29/03	13.01	meq/l
Sum of Cations	54	18.34	9/16/91	9.50	5/26/04	13.75	meq/l
Chemical Oxygen	25	1,300.00	5/29/02	90.00	5/26/00	469.52	mg/l
Chloride	56	252.00	6/14/08	21.00	12/20/93	111.63	mg/l
Conductivity, Lab	55	3,320.00	9/15/92	1,010.00	5/29/03	1,523.64	µmhos
Fluoride	56	27.00	12/19/95	2.20	9/15/92	8.66	mg/l
Hardness as CaCO ₃	56	962.00	3/22/93	0.00	1/19/94	35.21	mg/l
Nitrate as N, dissolved	27	3.89	6/14/08	0.02	9/15/92	0.43	mg/l
Nitrate/Nitrite as N,	27	3.90	6/14/08	0.02	9/15/92	0.33	mg/l
Nitrite as N, dissolved	27	0.05	11/6/14	0.01	6/18/96	0.02	mg/l
Nitrogen, Ammonia	27	21.30	9/8/93	0.34	8/23/17	4.09	mg/l
Nitrogen, Organic	27	104.00	5/29/02	0.20	8/23/17	19.10	mg/l
Nitrogen, Total Kjeldahl	27	106.00	5/29/02	0.50	8/23/17	22.01	mg/l
pH, lab	55	11.90	6/16/92	8.60	6/30/09	10.28	units
Phosphate, total	27	155.00	7/29/09	0.03	5/26/99	7.61	mg/l
Phosphorus, total	27	2.95	9/27/90	0.01	5/26/99	0.27	mg/l
SAR in Water	47	190.00	11/14/97	3.83	3/25/92	65.09	none
Sulfate	56	360.00	9/16/91	0.80	2/26/97	32.58	mg/l
Sulfide	27	29.00	3/22/16	0.02	9/15/92	5.04	mg/l
Total Dissolved Solids	55	2,752.00	3/22/93	578.00	9/27/90	849.93	mg/l
Conductivity, Field	72	3,910.00	7/29/09	694.00	6/1/05	1,591.25	µmhos
pH, Field	71	12.90	9/13/95	8.30	5/1/02	10.83	units
Temperature (°C), Field	32	22.50	6/1/05	7.00	7/1/91	12.53	(°C)
Water Level, Field	51	481.90	8/23/17	409.63	11/1/90	424.04	Ft.
Parameters	No. of	High	Date	Low	Date	Average	Units
Metals	Samples						
Aluminum, dissolved	27	1.35	11/6/14	U	8/23/17	0.22	mg/l
Arsenic, dissolved	27	0.01	8/23/17	0.001	5/26/00	0.003	mg/l
Barium, dissolved	27	0.20	7/29/09	U	9/8/93	0.04	mg/l
Beryllium, dissolved	27	U	3/22/16	U	3/22/16	U	mg/l
Boron, dissolved	56	0.47	12/20/93	0.10	3/17/10	0.22	mg/l
Cadmium, dissolved	27	U	3/22/16	U	3/22/16	U	mg/l
Calcium, dissolved	56	27.50	6/30/09	U	11/14/97	4.28	mg/l
Chromium, dissolved	27	0.02	11/6/14	U	6/23/94	0.02	mg/l
Copper, dissolved	27	0.04	7/29/09	U	7/30/91	0.03	mg/l
Iron, dissolved	27	65.10	11/6/14	0.01	6/30/95	3.44	mg/l
Lead, dissolved	27	0.63	9/15/10	U	6/23/94	0.14	mg/l
Lithium, dissolved	27	0.17	9/27/90	0.02	8/23/17	0.07	mg/l
Magnesium, dissolved	56	5.00	9/27/90	U	5/24/05	1.29	mg/l
Manganese, dissolved	27	0.59	11/6/14	U	7/29/09	0.06	mg/l
Mercury, dissolved	27	0.0007	7/30/91	U	9/27/90	0.0004	mg/l
Molybdenum, dissolved	27	0.13	5/24/05	0.01	5/9/01	0.05	mg/l
Nickel, dissolved	27	0.03	9/15/92	U	3/22/16	0.01	mg/l
Potassium, dissolved	56	39.00	3/22/93	0.70	8/23/17	6.18	mg/l
Selenium, dissolved	27	0.001	7/30/91	U	7/30/91	0.001	mg/l
Silica, dissolved	56	44.60	6/16/92	3.40	10/3/12	16.29	mg/l
Sodium, dissolved	56	567.00	3/22/93	153.00	3/25/92	302.68	mg/l
Strontium, dissolved	56	5.10	3/25/92	U	6/28/93	0.31	mg/l
Vanadium, dissolved	27	0.01	6/23/94	U	5/26/00	0.01	mg/l
Zinc, dissolved	27	1.35	11/6/14	U	8/23/17	0.22	mg/l



Table 19: O-GMW-A Annual A-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	2	528.00	10/5/14	528.00	10/5/14	528.00	mg/l
Carbonate as CaCO ₃	2	51.40	10/5/14	51.40	10/5/14	51.40	mg/l
Total Alkalinity as Bromide	2	579.00	10/5/14	579.00	10/5/14	579.00	mg/l
Cation-Anion Balance	2	U	10/5/14	U	10/5/14	U	mg/l
Sum of Anions	2	-3.70	10/5/14	-3.70	10/5/14	-3.70	%
Sum of Cations	2	14.00	10/5/14	14.00	10/5/14	14.00	meq/l
Chemical Oxygen	2	13.00	10/5/14	13.00	10/5/14	13.00	meq/l
Chloride	2	U	10/5/14	U	10/5/14	U	mg/l
Conductivity, Lab	2	18.60	10/5/14	18.60	10/5/14	18.60	mg/l
Fluoride	2	1,270.00	10/5/14	1,270.00	10/5/14	1,270.00	µmhos
Hardness as CaCO ₃	2	16.40	10/5/14	16.40	10/5/14	16.40	mg/l
Nitrate as N, dissolved	2	46.00	10/5/14	46.00	10/5/14	46.00	mg/l
Nitrate/Nitrite as N,	2	U	10/5/14	U	10/5/14	U	mg/l
Nitrite as N, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Nitrogen, Ammonia	2	U	10/5/14	U	10/5/14	U	mg/l
Nitrogen, Organic	2	0.40	10/5/14	0.40	10/5/14	0.40	mg/l
Nitrogen, Total Kjeldahl	2	0.30	10/5/14	0.30	10/5/14	0.30	mg/l
pH, lab	2	0.70	10/5/14	0.70	10/5/14	0.70	mg/l
Phosphate, total	2	8.60	10/5/14	8.60	10/5/14	8.60	units
Phosphorus, total	2	0.06	10/5/14	0.06	10/5/14	0.06	mg/l
SAR in Water	2	0.02	10/5/14	0.02	10/5/14	0.02	mg/l
Sulfate	2	17.00	10/5/14	17.00	10/5/14	17.00	none
Sulfide	2	60.00	10/5/14	60.00	10/5/14	60.00	mg/l
Total Dissolved Solids	2	0.03	10/5/14	0.03	10/5/14	0.03	mg/l
Conductivity, Field	2	746.00	10/5/14	746.00	10/5/14	746.00	mg/l
pH, Field	0	N/A	N/A	N/A	N/A	N/A	µmhos
Temperature (°C), Field	0	N/A	N/A	N/A	N/A	N/A	units
Water Level, Field	0	N/A	N/A	N/A	N/A	N/A	(°C)
	0	N/A	N/A	N/A	N/A	N/A	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Arsenic, dissolved	2	0.02	10/5/14	0.02	10/5/14	0.02	mg/l
Barium, dissolved	2	0.13	10/5/14	U	10/5/14	0.13	mg/l
Beryllium, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Boron, dissolved	2	0.25	10/5/14	0.25	10/5/14	0.25	mg/l
Cadmium, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Calcium, dissolved	2	6.00	10/5/14	U	10/5/14	6.00	mg/l
Chromium, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Copper, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Iron, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Lead, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Lithium, dissolved	2	0.12	10/5/14	0.12	10/5/14	0.12	mg/l
Magnesium, dissolved	2	7.40	10/5/14	U	10/5/14	7.40	mg/l
Manganese, dissolved	2	0.01	10/5/14	U	10/5/14	0.01	mg/l
Mercury, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Molybdenum, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Nickel, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Potassium, dissolved	2	1.30	10/5/14	1.30	10/5/14	1.30	mg/l
Selenium, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Silica, dissolved	2	11.80	10/5/14	11.80	10/5/14	11.80	mg/l
Sodium, dissolved	2	267.00	10/5/14	267.00	10/5/14	267.00	mg/l
Strontium, dissolved	2	1.16	10/5/14	U	10/5/14	1.16	mg/l
Vanadium, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l
Zinc, dissolved	2	U	10/5/14	U	10/5/14	U	mg/l



Table 20: WSW-2 Annual A-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	33	1,850.00	10/18/17	483.00	6/16/14	706.79	mg/l
Carbonate as CaCO ₃	33	138.00	10/18/17	42.60	11/10/14	73.69	mg/l
Total Alkalinity as Bromide	33	1,980.00	10/18/17	534.00	6/16/14	780.33	mg/l
Cation-Anion Balance	4	0.46	7/11/13	0.03	10/4/11	0.15	mg/l
Sum of Anions	32	3.40	6/16/14	-13.40	6/14/11	-2.73	%
Sum of Cations	33	60.00	10/18/17	13.70	10/4/11	20.58	meq/l
Chemical Oxygen	33	54.00	10/18/17	12.60	6/14/11	19.38	meq/l
Chloride	6	20.00	10/4/11	10.00	1/20/11	14.00	mg/l
Conductivity, Lab	33	673.00	10/18/17	11.00	6/14/11	113.15	mg/l
Fluoride	33	5,350	10/18/17	1,250	10/4/11	1,865	µmhos
Hardness as CaCO ₃	33	21.50	3/16/14	13.80	9/17/12	18.17	mg/l
Nitrate as N, dissolved	33	56.00	10/18/17	14.00	11/30/11	22.45	mg/l
Nitrate/Nitrite as N,	2	0.10	11/10/14	0.06	3/30/11	0.08	mg/l
Nitrite as N, dissolved	2	0.10	11/10/14	0.06	3/30/11	0.08	mg/l
Nitrogen, Ammonia	10	U	4/6/16	U	4/6/16	U	mg/l
Nitrogen, Organic	10	1.06	3/23/17	0.39	10/4/11	0.64	mg/l
Nitrogen, Total Kjeldahl	8	0.40	1/20/11	0.10	3/23/11	0.20	mg/l
pH, lab	10	1.00	3/23/17	0.60	3/30/11	0.80	mg/l
Phosphate, total	33	8.90	3/16/14	8.60	10/22/13	8.71	units
Phosphorus, total	10	0.37	3/23/17	0.09	3/23/11	0.13	mg/l
SAR in Water	10	0.12	3/23/17	0.03	3/23/11	0.04	mg/l
Sulfate	33	70.00	10/18/17	31.30	6/14/11	39.08	none
Sulfide	33	60.00	3/30/11	29.81	3/4/13	42.17	mg/l
Total Dissolved Solids	10	3.90	10/4/11	1.67	11/5/15	2.55	mg/l
Conductivity, Field	33	3,160.00	10/18/17	740.00	11/30/11	1,096.76	mg/l
pH, Field	77	6,376	11/14/17	719	3/23/11	1,971	µmhos
Temperature (°C), Field	49	8.90	3/16/16	7.30	5/28/15	8.24	units
Water Level, Field	49	25.00	7/13/16	16.35	5/17/16	21.97	(°C)
	N/A	N/A	N/A	N/A	N/A	N/A	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	10	0.05	3/23/11	U	11/5/15	0.04	mg/l
Arsenic, dissolved	10	U	3/23/17	U	11/5/15	U	mg/l
Barium, dissolved	10	0.36	3/23/17	0.07	11/29/12	0.14	mg/l
Beryllium, dissolved	10	0.00	1/20/11	U	1/20/11	0.00	mg/l
Boron, dissolved	33	1.29	10/18/17	0.36	10/4/11	0.49	mg/l
Cadmium, dissolved	10	U	4/6/16	U	4/6/16	U	mg/l
Calcium, dissolved	33	4.90	10/18/16	2.30	11/30/11	3.00	mg/l
Chromium, dissolved	10	U	4/6/16	U	4/6/16	U	mg/l
Copper, dissolved	10	U	4/6/16	U	4/6/16	U	mg/l
Iron, dissolved	10	0.69	11/10/14	0.05	3/23/11	0.16	mg/l
Lead, dissolved	10	U	4/6/16	U	4/6/16	U	mg/l
Lithium, dissolved	10	0.15	3/23/17	0.06	1/20/11	0.08	mg/l
Magnesium, dissolved	33	11.10	10/18/17	2.00	1/20/11	3.65	mg/l
Manganese, dissolved	10	0.01	3/30/11	U	3/23/11	0.01	mg/l
Mercury, dissolved	10	U	4/6/16	U	4/6/16	U	mg/l
Molybdenum, dissolved	10	U	4/6/16	U	4/6/16	U	mg/l
Nickel, dissolved	10	0.02	7/11/13	U	3/23/11	0.02	mg/l
Potassium, dissolved	33	3.10	1/27/16	U	11/1/12	0.87	mg/l
Selenium, dissolved	10	U	4/6/16	U	4/6/16	U	mg/l
Silica, dissolved	33	12.80	11/5/15	10.60	3/23/17	11.81	mg/l
Sodium, dissolved	33	1,190.00	10/18/17	279.00	6/14/11	427.97	mg/l
Strontium, dissolved	33	2.57	10/18/17	0.44	6/14/11	0.83	mg/l
Vanadium, dissolved	10	U	4/6/16	U	4/6/16	U	mg/l
Zinc, dissolved	10	U	11/29/12	U	11/5/15	U	mg/l



Table 21: WSW-3 Annual A-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	11	529.00	8/22/14	475.00	8/16/16	495.09	mg/l
Carbonate as CaCO ₃	11	72.70	8/27/15	26.70	4/6/16	54.06	mg/l
Total Alkalinity as Bromide	11	578.00	11/5/15	520.00	10/18/16	549.09	mg/l
Cation-Anion Balance	3	1.54	3/23/17	0.10	8/22/14	1.01	mg/l
Sum of Anions	11	4.00	10/18/16	-4.00	8/22/14	-2.18	%
Sum of Cations	11	13.00	8/22/14	12.00	10/18/16	12.91	meq/l
Chemical Oxygen	11	13.00	11/5/15	12.00	8/22/14	12.36	meq/l
Chloride	2	196.00	4/6/16	22.00	8/22/14	109.00	mg/l
Conductivity, Lab	11	20.90	4/6/16	11.60	8/27/15	13.79	mg/l
Fluoride	11	1,250	4/6/16	1,100	8/16/16	1,176	µmhos
Hardness as CaCO ₃	11	19.80	8/22/14	16.50	4/6/16	18.36	mg/l
Nitrate as N, dissolved	11	16.00	8/22/14	12.00	6/27/17	13.40	mg/l
Nitrate/Nitrite as N,	1	0.09	8/22/14	0.09	8/22/14	0.09	mg/l
Nitrite as N, dissolved	1	0.25	8/22/14	0.25	8/22/14	0.25	mg/l
Nitrogen, Ammonia	1	0.16	8/22/14	0.16	8/22/14	0.16	mg/l
Nitrogen, Organic	4	0.52	11/5/15	0.43	4/6/16	0.46	mg/l
Nitrogen, Total Kjeldahl	2	0.40	8/22/14	0.40	8/22/14	0.40	mg/l
pH, lab	4	0.80	8/22/14	0.40	3/23/17	0.63	mg/l
Phosphate, total	11	8.90	3/23/17	8.60	8/22/14	8.75	units
Phosphorus, total	4	0.12	8/22/14	0.09	11/5/15	0.11	mg/l
SAR in Water	4	0.04	8/22/14	0.03	11/5/15	0.04	mg/l
Sulfate	11	34.00	11/5/15	30.00	8/22/14	32.82	none
Sulfide	9	57.90	4/6/16	11.60	1/27/16	27.50	mg/l
Total Dissolved Solids	4	2.20	4/6/16	0.16	8/22/14	1.13	mg/l
Conductivity, Field	11	745.00	4/6/16	661.00	8/27/15	684.00	mg/l
pH, Field	26	1,492	6/20/17	1,146	5/18/16	1,190	µmhos
Temperature (°C), Field	26	8.90	3/16/16	7.60	4/6/16	8.33	units
Water Level, Field	26	23.40	7/17/17	17.80	12/3/15	21.42	(°C)
	N/A	N/A	N/A	N/A	N/A	N/A	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l
Arsenic, dissolved	4	U	8/22/14	U	3/23/17	U	mg/l
Barium, dissolved	4	0.22	11/5/15	0.14	4/6/16	0.18	mg/l
Beryllium, dissolved	4	0.00	8/22/14	U	8/22/14	0.00	mg/l
Boron, dissolved	11	0.27	8/22/14	0.21	4/6/16	0.23	mg/l
Cadmium, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l
Calcium, dissolved	11	3.40	8/22/14	2.20	3/23/17	2.45	mg/l
Chromium, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l
Copper, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l
Iron, dissolved	4	0.13	11/5/15	0.05	3/23/17	0.08	mg/l
Lead, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l
Lithium, dissolved	4	0.13	4/6/16	0.06	8/22/14	0.08	mg/l
Magnesium, dissolved	11	1.90	8/22/14	1.60	6/27/17	1.75	mg/l
Manganese, dissolved	4	0.03	8/22/14	U	4/6/16	0.02	mg/l
Mercury, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l
Molybdenum, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l
Nickel, dissolved	4	0.01	4/6/16	U	8/22/14	0.01	mg/l
Potassium, dissolved	11	29.20	4/6/16	U	10/18/16	3.26	mg/l
Selenium, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l
Silica, dissolved	11	12.80	8/27/15	11.30	4/6/16	12.19	mg/l
Sodium, dissolved	11	280.00	4/6/16	259.00	8/27/15	271.00	mg/l
Strontium, dissolved	11	0.54	8/10/17	0.47	8/22/14	0.52	mg/l
Vanadium, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l
Zinc, dissolved	4	U	8/22/14	U	8/22/14	U	mg/l



Table 22: WSW-4 Annual A-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	12	507.00	4/6/16	439.00	8/27/15	471.33	mg/l
Carbonate as CaCO ₃	13	537.00	9/25/14	49.00	10/18/16	99.69	mg/l
Total Alkalinity as Bromide	13	925.00	9/25/14	511.00	6/9/15	564.54	mg/l
Cation-Anion Balance	1	0.09	8/25/14	0.09	8/25/14	0.09	mg/l
Sum of Anions	12	0.00	6/9/15	-7.30	9/25/14	-2.89	%
Sum of Cations	13	22.00	9/25/14	13.00	6/9/15	13.85	meq/l
Chemical Oxygen	13	19.00	9/25/14	12.00	8/27/15	13.08	meq/l
Chloride	3	53.00	8/25/14	13.00	4/6/16	35.33	mg/l
Conductivity, Lab	13	25.00	9/25/14	15.30	8/10/17	19.08	mg/l
Fluoride	13	2,810	9/25/14	1,130	4/6/16	1,351	µmhos
Hardness as CaCO ₃	13	19.20	4/6/16	5.11	9/25/14	15.78	mg/l
Nitrate as N, dissolved	13	17.00	9/25/14	12.00	10/18/16	13.33	mg/l
Nitrate/Nitrite as N,	1	0.03	8/25/14	U	4/6/16	0.03	mg/l
Nitrite as N, dissolved	1	0.08	8/25/14	U	4/6/16	0.08	mg/l
Nitrogen, Ammonia	2	0.05	8/25/14	0.01	9/25/14	0.03	mg/l
Nitrogen, Organic	5	2.28	9/25/14	0.46	3/23/17	0.85	mg/l
Nitrogen, Total Kjeldahl	3	0.30	8/25/14	U	9/25/14	0.20	mg/l
pH, lab	5	1.00	9/25/14	0.30	3/23/17	0.70	mg/l
Phosphate, total	13	11.70	9/25/14	8.70	10/18/16	9.04	units
Phosphorus, total	5	0.28	9/25/14	0.09	8/25/14	0.13	mg/l
SAR in Water	5	0.09	9/25/14	0.03	8/25/14	0.04	mg/l
Sulfate	13	44.00	9/25/14	32.00	8/25/14	35.00	none
Sulfide	13	130.00	9/25/14	20.00	4/6/16	59.99	mg/l
Total Dissolved Solids	5	3.60	3/23/17	0.10	9/25/14	1.88	mg/l
Conductivity, Field	13	1,210.00	9/25/14	700.00	8/27/15	752.62	mg/l
pH, Field	27	1,530	6/20/17	1,073	4/6/16	1,244	µmhos
Temperature (°C), Field	27	8.90	3/16/16	7.70	8/27/15	8.42	units
Water Level, Field	27	29.00	6/20/16	13.80	4/19/17	21.01	(°C)
	N/A	N/A	N/A	N/A	N/A	N/A	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	6	0.42	9/25/14	U	9/25/14	0.42	mg/l
Arsenic, dissolved	5	0.01	9/25/14	U	4/6/16	0.0032	mg/l
Barium, dissolved	5	0.23	4/6/16	0.02	9/25/14	0.10	mg/l
Beryllium, dissolved	5	U	4/6/16	U	4/6/16	U	mg/l
Boron, dissolved	13	0.44	9/25/14	0.18	8/27/15	0.22	mg/l
Cadmium, dissolved	5	U	4/6/16	U	4/6/16	U	mg/l
Calcium, dissolved	13	6.40	9/25/14	1.90	3/23/17	2.49	mg/l
Chromium, dissolved	5	U	4/6/16	U	4/6/16	U	mg/l
Copper, dissolved	5	U	4/6/16	U	4/6/16	U	mg/l
Iron, dissolved	5	0.27	8/25/14	0.02	3/23/17	0.12	mg/l
Lead, dissolved	5	U	4/6/16	U	4/6/16	U	mg/l
Lithium, dissolved	5	0.13	11/5/15	0.07	4/6/16	0.10	mg/l
Magnesium, dissolved	13	2.00	8/27/15	0.30	9/25/14	1.72	mg/l
Manganese, dissolved	5	U	4/6/16	U	4/6/16	U	mg/l
Mercury, dissolved	5	U	4/6/16	U	4/6/16	U	mg/l
Molybdenum, dissolved	5	U	9/25/14	U	9/25/14	U	mg/l
Nickel, dissolved	5	0.00	8/25/14	U	8/25/14	0.00	mg/l
Potassium, dissolved	13	18.30	9/25/14	U	8/16/16	2.31	mg/l
Selenium, dissolved	5	U	3/23/17	U	3/23/17	U	mg/l
Silica, dissolved	13	172.00	9/25/14	10.90	3/23/17	24.05	mg/l
Sodium, dissolved	13	416.00	9/25/14	266.00	10/18/17	289.92	mg/l
Strontium, dissolved	13	0.53	4/6/16	0.39	9/25/14	0.42	mg/l
Vanadium, dissolved	5	U	4/6/16	U	4/6/16	U	mg/l
Zinc, dissolved	5	U	9/25/14	U	9/25/14	U	mg/l



Table 23: 89-1 Annual B-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	171	762.00	3/25/94	144.00	7/30/90	609.51	mg/l
Carbonate as CaCO ₃	171	406.00	5/21/97	25.00	7/1/97	100.43	mg/l
Total Alkalinity as Bromide	171	830.00	7/31/91	200.00	7/30/90	710.12	mg/l
Cation-Anion Balance	27	10.00	6/26/91	0.06	7/1/97	1.15	mg/l
Sum of Anions	166	24.10	4/16/02	-9.10	6/14/17	0.15	%
Sum of Cations	165	18.00	6/14/17	4.29	7/30/90	15.66	meq/l
Chemical Oxygen	165	18.20	4/11/06	4.38	7/30/90	15.51	meq/l
Chloride	29	420.00	6/25/07	30.00	3/30/90	81.07	mg/l
Conductivity, Lab	170	70.50	6/14/17	6.00	9/27/90	15.50	mg/l
Fluoride	163	1,850.00	4/24/91	1,000.00	5/20/93	1,390.05	µmhos
Hardness as CaCO ₃	165	38.20	2/24/92	0.20	9/29/94	23.84	mg/l
Nitrate as N, dissolved	169	65.00	9/27/90	U	7/30/90	11.22	mg/l
Nitrate/Nitrite as N,	29	16.50	6/25/07	0.02	6/26/91	1.01	mg/l
Nitrite as N, dissolved	29	17.00	6/25/07	0.02	6/26/91	1.07	mg/l
Nitrogen, Ammonia	30	0.55	6/25/07	0.01	3/30/90	0.13	mg/l
Nitrogen, Organic	29	7.48	6/25/07	0.06	7/30/90	1.59	mg/l
Nitrogen, Total Kjeldahl	28	29.10	6/26/91	0.10	6/15/92	5.18	mg/l
pH, lab	29	30.10	6/26/91	0.80	6/15/92	6.65	mg/l
Phosphate, total	166	9.80	12/20/94	8.10	10/28/02	8.89	units
Phosphorus, total	25	155.00	6/25/07	0.06	7/18/95	14.00	mg/l
SAR in Water	30	2.90	9/27/90	0.02	7/2/98	0.16	mg/l
Sulfate	141	158.62	6/26/90	16.50	9/27/90	48.44	none
Sulfide	169	140.00	10/25/90	U	8/16/17	20.49	mg/l
Total Dissolved Solids	25	2.10	7/30/90	0.02	7/27/01	0.45	mg/l
Conductivity, Field	171	1,100.00	10/21/89	446.00	7/30/90	866.73	mg/l
pH, Field	188	1,683.00	6/5/12	925.00	8/2/06	1,337.90	µmhos
Temperature (°C), Field	188	10.12	7/29/09	7.60	3/10/15	9.06	units
Water Level, Field	94	19.00	7/31/91	7.60	4/1/06	12.38	(°C)
	78	500.70	6/25/14	432.37	6/25/14	472.73	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	29	1.54	3/30/90	U	7/1/97	0.24	mg/l
Arsenic, dissolved	29	0.30	10/21/89	U	12/3/12	0.02	mg/l
Barium, dissolved	29	0.43	8/2/06	0.02	7/15/04	0.19	mg/l
Beryllium, dissolved	28	0.01	6/26/91	U	6/26/91	0.01	mg/l
Boron, dissolved	166	3.30	3/25/91	0.35	1/27/04	0.68	mg/l
Cadmium, dissolved	28	0.01	10/21/89	U	10/21/89	0.01	mg/l
Calcium, dissolved	163	13.00	9/27/90	0.50	3/16/10	2.32	mg/l
Chromium, dissolved	28	0.01	6/26/91	U	6/26/91	0.01	mg/l
Copper, dissolved	29	0.02	6/25/07	U	3/30/90	0.01	mg/l
Iron, dissolved	29	0.93	3/30/90	U	7/7/99	0.13	mg/l
Lead, dissolved	28	0.10	10/21/89	U	6/26/91	0.06	mg/l
Lithium, dissolved	28	0.20	12/27/90	U	3/30/90	0.13	mg/l
Magnesium, dissolved	165	8.00	9/27/90	U	3/16/10	1.38	mg/l
Manganese, dissolved	28	0.07	6/25/07	0.01	7/1/97	0.03	mg/l
Mercury, dissolved	29	0.0010	6/15/92	0.0001	6/26/91	0.0005	mg/l
Molybdenum, dissolved	28	0.60	10/21/89	0.01	7/27/01	0.14	mg/l
Nickel, dissolved	29	0.03	10/21/89	0.01	12/3/12	0.02	mg/l
Potassium, dissolved	165	13.00	3/25/91	0.70	4/27/04	1.30	mg/l
Selenium, dissolved	29	0.001	10/21/89	0.001	10/21/89	0.001	mg/l
Silica, dissolved	166	35.90	10/21/89	4.00	1/21/92	17.57	mg/l
Sodium, dissolved	166	408.00	4/11/06	102.00	12/27/90	350.18	mg/l
Strontium, dissolved	166	0.83	3/14/12	0.06	10/21/89	0.49	mg/l
Vanadium, dissolved	29	0.03	6/26/91	U	10/21/89	0.02	mg/l
Zinc, dissolved	29	0.07	7/29/09	U	3/30/90	0.02	mg/l



Table 24: 90-3 Annual B-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	110	1,790.00	9/14/04	419.00	3/23/05	772.29	mg/l
Carbonate as CaCO ₃	110	419.00	3/23/05	4.00	6/16/97	87.71	mg/l
Total Alkalinity as Bromide	110	1,790.00	9/14/04	680.00	6/15/14	856.04	mg/l
Cation-Anion Balance	13	1.50	7/21/92	0.10	1/29/91	0.44	mg/l
Sum of Anions	109	36.90	8/10/08	-33.50	9/14/04	-1.44	%
Sum of Cations	100	37.50	9/14/04	15.00	6/26/02	18.92	meq/l
Chemical Oxygen	100	39.50	8/10/08	11.10	11/23/10	18.26	meq/l
Chloride	20	210.00	9/15/07	10.00	8/14/95	75.00	mg/l
Conductivity, Lab	110	293.00	6/14/08	10.00	9/24/03	22.18	mg/l
Fluoride	107	2,200.00	5/16/07	1,280.00	7/21/92	1,588.17	µmhos
Hardness as CaCO ₃	110	98.00	3/24/99	9.00	12/11/01	23.17	mg/l
Nitrate as N, dissolved	106	42.00	4/20/92	1.00	10/25/90	14.67	mg/l
Nitrate/Nitrite as N,	25	0.27	6/24/04	0.04	1/29/91	0.11	mg/l
Nitrite as N, dissolved	25	0.27	6/24/04	0.05	1/29/91	0.12	mg/l
Nitrogen, Ammonia	25	0.03	8/16/94	0.01	1/29/91	0.02	mg/l
Nitrogen, Organic	24	10.90	8/16/96	0.83	6/28/06	1.66	mg/l
Nitrogen, Total Kjeldahl	24	12.00	9/15/07	0.20	1/29/91	3.70	mg/l
pH, lab	24	13.00	9/15/07	0.50	8/14/95	4.37	mg/l
Phosphate, total	107	9.00	4/24/91	7.40	6/16/97	8.68	units
Phosphorus, total	20	155.00	6/28/06	0.09	8/10/08	8.70	mg/l
SAR in Water	23	3.63	8/1/90	0.02	6/28/06	0.29	mg/l
Sulfate	101	198.04	10/25/90	0.08	4/24/91	49.04	none
Sulfide	66	333.00	1/20/92	0.00	5/16/17	45.32	mg/l
Total Dissolved Solids	18	6.21	8/1/90	0.03	6/28/06	0.76	mg/l
Conductivity, Field	108	1,490.00	8/10/08	813.00	11/23/10	1,017.69	mg/l
pH, Field	168	2,200.00	5/16/07	1,135.00	6/16/97	1,545.26	µmhos
Temperature (°C), Field	168	10.60	12/16/02	7.40	8/26/15	8.72	units
Water Level, Field	109	19.70	5/1/02	8.00	12/1/04	12.30	(°C)
	90	547.40	6/14/11	507.30	1/15/16	530.54	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	25	9.47	6/16/97	0.04	6/14/00	1.73	mg/l
Arsenic, dissolved	25	0.0180	8/1/90	0.0003	11/27/12	0.0035	mg/l
Barium, dissolved	25	0.96	6/16/97	0.03	8/8/90	0.36	mg/l
Beryllium, dissolved	25	U	11/27/12	U	11/27/12	U	mg/l
Boron, dissolved	111	0.93	3/18/04	0.31	2/21/94	0.72	mg/l
Cadmium, dissolved	25	0.03	7/21/93	U	7/21/93	0.03	mg/l
Calcium, dissolved	111	7.00	4/20/92	U	12/12/08	2.38	mg/l
Chromium, dissolved	25	U	11/27/16	U	11/27/16	U	mg/l
Copper, dissolved	25	0.40	7/31/91	U	6/24/04	0.21	mg/l
Iron, dissolved	25	12.10	6/16/97	U	6/16/05	1.65	mg/l
Lead, dissolved	25	0.07	6/16/97	U	7/21/92	0.06	mg/l
Lithium, dissolved	24	0.15	6/9/99	0.04	7/21/93	0.13	mg/l
Magnesium, dissolved	111	8.00	10/30/91	U	12/12/08	2.21	mg/l
Manganese, dissolved	24	0.08	6/16/97	U	6/28/06	0.02	mg/l
Mercury, dissolved	25	0.02	7/31/91	U	8/14/95	0.01	mg/l
Molybdenum, dissolved	25	0.14	8/1/90	U	8/16/96	0.07	mg/l
Nickel, dissolved	25	0.02	1/29/91	U	9/21/10	0.02	mg/l
Potassium, dissolved	111	12.00	7/31/91	1.00	5/23/94	1.74	mg/l
Selenium, dissolved	25	0.001	8/8/90	0.001	8/8/90	0.001	mg/l
Silica, dissolved	111	122.00	10/30/91	0.30	4/24/91	20.21	mg/l
Sodium, dissolved	111	882.00	8/10/08	247.00	11/23/10	410.05	mg/l
Strontium, dissolved	111	1.30	4/20/92	0.06	6/14/00	0.67	mg/l
Vanadium, dissolved	25	U	11/27/12	U	11/27/12	U	mg/l
Zinc, dissolved	25	0.53	7/31/91	U	8/1/90	0.09	mg/l



Table 25: BG-1 Annual B-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	127	1,010.00	8/7/97	283.00	2/16/07	641.13	mg/l
Carbonate as CaCO ₃	127	581.00	8/21/03	8.00	5/26/00	128.69	mg/l
Total Alkalinity as Bromide	127	1,160.00	8/21/03	364.00	2/16/07	765.61	mg/l
Cation-Anion Balance	18	3.00	9/2/98	0.10	5/18/06	0.49	mg/l
Sum of Anions	127	42.30	3/17/09	-36.30	8/7/97	-1.34	%
Sum of Cations	127	30.80	8/7/97	9.10	2/16/07	17.31	meq/l
Chemical Oxygen	127	43.20	3/17/09	6.70	2/16/07	16.89	meq/l
Chloride	15	470.00	8/25/05	10.00	9/14/00	148.00	mg/l
Conductivity, Lab	127	249.00	8/7/97	U	11/18/06	24.80	mg/l
Fluoride	127	3,980.00	8/7/97	769.00	2/16/07	1,504.39	µmhos
Hardness as CaCO ₃	127	56.00	3/25/98	12.80	6/14/08	24.11	mg/l
Nitrate as N, dissolved	126	48.00	4/19/01	1.00	2/16/07	11.44	mg/l
Nitrate/Nitrite as N,	18	0.53	9/25/02	0.03	8/30/08	0.20	mg/l
Nitrite as N, dissolved	18	0.53	9/25/02	0.02	5/18/06	0.17	mg/l
Nitrogen, Ammonia	18	0.02	5/18/06	0.02	5/18/06	0.02	mg/l
Nitrogen, Organic	16	5.00	9/29/97	0.72	9/29/06	1.87	mg/l
Nitrogen, Total Kjeldahl	16	28.00	9/25/02	0.30	9/22/99	8.02	mg/l
pH, lab	16	28.00	9/25/02	1.40	9/15/97	9.79	mg/l
Phosphate, total	126	9.60	7/29/09	7.00	12/12/08	8.92	units
Phosphorus, total	14	155.00	5/18/06	0.08	9/15/97	24.26	mg/l
SAR in Water	16	0.51	9/24/03	0.03	9/15/97	0.13	mg/l
Sulfate	126	148.00	11/23/10	19.80	4/19/01	57.94	none
Sulfide	125	70.00	10/30/03	0.70	11/20/00	12.83	mg/l
Total Dissolved Solids	14	1.50	9/24/03	0.03	9/29/06	0.33	mg/l
Conductivity, Field	127	1,510.00	3/17/09	453.00	2/16/07	938.02	mg/l
pH, Field	141	3,980.00	8/7/97	1,310.00	2/8/00	1,526.10	µmhos
Temperature (°C), Field	141	10.69	7/29/09	6.35	8/30/08	8.93	units
Water Level, Field	93	16.20	6/1/07	8.60	12/1/03	12.50	(°C)
	92	539.90	3/20/15	493.67	7/1/01	521.31	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	18	7.96	9/25/02	0.03	11/16/07	1.06	mg/l
Arsenic, dissolved	18	0.0020	9/29/97	0.0002	11/27/12	0.0009	mg/l
Barium, dissolved	18	1.26	9/25/02	0.13	9/29/06	0.31	mg/l
Beryllium, dissolved	18	U	11/27/12	U	11/27/12	U	mg/l
Boron, dissolved	126	1.67	3/17/09	0.22	4/19/01	0.83	mg/l
Cadmium, dissolved	18	U	11/27/12	U	11/27/12	U	mg/l
Calcium, dissolved	125	8.80	12/12/08	0.20	11/23/10	2.31	mg/l
Chromium, dissolved	18	0.02	9/29/97	U	9/29/97	0.02	mg/l
Copper, dissolved	18	0.38	9/25/02	U	9/24/03	0.09	mg/l
Iron, dissolved	18	29.40	9/25/02	0.03	3/14/08	2.66	mg/l
Lead, dissolved	18	0.88	9/25/02	U	9/21/10	0.36	mg/l
Lithium, dissolved	18	0.20	9/2/98	0.12	8/30/08	0.16	mg/l
Magnesium, dissolved	125	9.40	4/19/01	0.20	9/29/06	1.39	mg/l
Manganese, dissolved	17	0.18	9/25/02	U	9/14/00	0.04	mg/l
Mercury, dissolved	18	U	9/2/98	U	9/2/98	U	mg/l
Molybdenum, dissolved	18	0.06	9/29/97	U	9/14/04	0.03	mg/l
Nickel, dissolved	18	0.05	9/29/06	U	9/25/02	0.03	mg/l
Potassium, dissolved	127	12.00	8/7/97	1.20	6/14/01	3.08	mg/l
Selenium, dissolved	18	U	11/27/12	U	11/27/12	U	mg/l
Silica, dissolved	127	50.20	9/25/02	1.40	10/26/04	9.97	mg/l
Sodium, dissolved	127	973.00	3/17/09	152.00	2/16/07	375.46	mg/l
Strontium, dissolved	126	1.58	9/25/02	0.14	2/16/07	0.52	mg/l
Vanadium, dissolved	18	U	11/27/12	U	11/27/12	U	mg/l
Zinc, dissolved	18	0.80	9/25/02	U	9/29/97	0.11	mg/l



Table 26: BG-4 Annual B-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	176	899.00	10/28/02	524.00	9/14/04	684.31	mg/l
Carbonate as CaCO ₃	176	210.00	7/30/03	16.00	11/21/08	92.46	mg/l
Total Alkalinity as Bromide	176	911.00	11/21/05	612.00	4/17/02	773.11	mg/l
Cation-Anion Balance	26	0.10	8/12/04	0.10	8/12/04	0.10	mg/l
Sum of Anions	176	13.40	8/2/06	-11.70	4/29/10	-2.22	%
Sum of Cations	176	20.00	6/7/16	12.60	8/2/06	17.21	meq/l
Chemical Oxygen	176	19.60	8/22/02	13.60	4/29/10	16.47	meq/l
Chloride	26	400.00	8/22/02	10.00	8/2/06	82.33	mg/l
Conductivity, Lab	176	57.90	8/30/06	2.00	8/2/06	18.53	mg/l
Fluoride	175	1,770	9/6/16	1,160	8/2/06	1,518	µmhos
Hardness as CaCO ₃	176	26.90	12/16/03	2.09	6/6/17	22.17	mg/l
Nitrate as N, dissolved	175	47.00	9/30/08	5.00	11/27/02	14.73	mg/l
Nitrate/Nitrite as N,	25	2.06	9/28/06	0.03	11/6/14	1.05	mg/l
Nitrite as N, dissolved	25	2.08	9/28/06	0.02	5/18/06	0.59	mg/l
Nitrogen, Ammonia	25	0.21	8/2/06	0.01	5/18/06	0.08	mg/l
Nitrogen, Organic	26	1.61	9/30/08	0.59	12/20/07	0.89	mg/l
Nitrogen, Total Kjeldahl	24	27.00	8/22/02	0.50	8/2/06	5.19	mg/l
pH, lab	26	28.00	8/22/02	1.00	4/13/16	5.52	mg/l
Phosphate, total	176	9.20	5/21/09	7.50	8/30/08	8.78	units
Phosphorus, total	22	155.00	5/18/06	0.12	8/18/10	48.10	mg/l
SAR in Water	26	0.15	8/16/11	0.03	8/2/06	0.06	mg/l
Sulfate	175	73.30	12/16/02	23.40	9/30/08	42.91	none
Sulfide	174	50.00	9/28/06	U	9/2/15	12.46	mg/l
Total Dissolved Solids	18	0.80	8/22/02	0.03	9/28/06	0.28	mg/l
Conductivity, Field	176	1,050	6/7/16	789	8/2/06	913	mg/l
pH, Field	194	2,874	2/10/16	1,101	10/5/06	1,520	µmhos
Temperature (°C), Field	195	10.01	7/29/09	7.10	5/7/15	8.55	units
Water Level, Field	190	22.70	8/2/16	5.80	1/26/10	12.12	(°C)
	186	547.26	11/10/10	468.30	7/1/02	506.49	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	28	0.67	8/21/03	0.03	5/18/06	0.14	mg/l
Arsenic, dissolved	28	0.0009	9/30/08	0.0004	7/11/13	0.0006	mg/l
Barium, dissolved	28	0.14	7/29/09	U	7/6/17	0.02	mg/l
Beryllium, dissolved	28	U	4/13/16	U	4/13/16	U	mg/l
Boron, dissolved	177	0.97	7/12/07	0.34	8/21/03	0.71	mg/l
Cadmium, dissolved	28	U	4/13/16	U	4/13/16	U	mg/l
Calcium, dissolved	178	11.70	9/30/08	1.10	12/16/02	2.80	mg/l
Chromium, dissolved	28	0.02	9/28/06	U	9/28/06	0.02	mg/l
Copper, dissolved	28	U	4/13/16	U	4/13/16	U	mg/l
Iron, dissolved	28	0.63	9/28/06	0.01	8/12/04	0.12	mg/l
Lead, dissolved	28	U	4/13/16	U	4/13/16	U	mg/l
Lithium, dissolved	28	0.16	8/12/04	0.08	8/21/03	0.14	mg/l
Magnesium, dissolved	177	4.40	9/30/08	0.60	11/27/02	1.88	mg/l
Manganese, dissolved	26	0.19	9/30/08	U	3/14/08	0.03	mg/l
Mercury, dissolved	28	U	9/28/06	U	9/28/06	U	mg/l
Molybdenum, dissolved	28	0.12	8/22/02	U	8/18/10	0.04	mg/l
Nickel, dissolved	28	0.03	9/30/08	U	12/3/12	0.02	mg/l
Potassium, dissolved	178	6.20	7/24/02	0.60	11/21/08	1.69	mg/l
Selenium, dissolved	28	U	4/13/16	U	4/13/16	U	mg/l
Silica, dissolved	177	29.30	4/17/02	5.50	8/21/03	14.52	mg/l
Sodium, dissolved	178	434.00	8/22/02	302.00	9/11/13	365.60	mg/l
Strontium, dissolved	177	0.82	2/7/17	0.06	4/27/04	0.45	mg/l
Vanadium, dissolved	28	U	4/13/16	U	4/13/16	U	mg/l
Zinc, dissolved	28	0.13	8/30/08	U	8/22/02	0.03	mg/l



Table 27: BG-5 Annual B-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	101	1,150.00	12/12/17	447.00	3/22/11	698.59	mg/l
Carbonate as CaCO ₃	101	272.00	3/22/11	43.10	2/10/16	122.75	mg/l
Total Alkalinity as Bromide	101	1,300.00	12/12/17	670.00	5/14/14	821.36	mg/l
Cation-Anion Balance	11	0.94	7/10/13	U	11/10/14	0.47	mg/l
Sum of Anions	101	7.90	10/28/10	-11.10	10/9/13	-2.88	%
Sum of Cations	101	58.60	6/23/10	15.00	5/14/14	21.29	meq/l
Chemical Oxygen	101	51.30	6/23/10	14.90	5/6/13	20.13	meq/l
Chloride	11	320.00	9/22/10	16.00	10/12/15	75.33	mg/l
Conductivity, Lab	101	1,400.00	6/23/10	14.20	11/30/15	128.94	mg/l
Fluoride	101	5,740	6/23/10	1.420	1/11/16	1.992	µmhos
Hardness as CaCO ₃	101	25.80	7/8/14	9.80	2/23/10	21.44	mg/l
Nitrate as N, dissolved	101	44.00	10/28/10	11.00	5/6/13	16.27	mg/l
Nitrate/Nitrite as N,	12	0.07	11/10/14	0.02	10/7/09	0.04	mg/l
Nitrite as N, dissolved	12	0.07	11/10/14	0.02	10/7/09	0.04	mg/l
Nitrogen, Ammonia	12	U	11/10/14	U	11/10/14	U	mg/l
Nitrogen, Organic	12	1.17	9/22/10	0.56	10/7/09	0.84	mg/l
Nitrogen, Total Kjeldahl	12	3.90	9/22/10	0.20	12/13/12	1.17	mg/l
pH, lab	12	5.10	9/22/10	0.80	10/12/15	1.91	mg/l
Phosphate, total	101	9.60	3/22/11	8.50	2/10/16	8.94	units
Phosphorus, total	12	155.00	10/7/09	0.06	10/12/15	23.36	mg/l
SAR in Water	12	0.07	8/18/10	0.02	10/12/15	0.04	mg/l
Sulfate	101	115.00	6/23/10	39.20	11/10/10	49.77	none
Sulfide	101	110.00	11/10/10	U	11/22/11	30.66	mg/l
Total Dissolved Solids	12	1.33	8/11/11	U	11/10/14	0.56	mg/l
Conductivity, Field	101	3,250	6/23/10	829	5/14/14	1,141	mg/l
pH, Field	128	5,492	6/23/10	1,232	6/5/17	2,089	µmhos
Temperature (°C), Field	127	9.66	2/4/11	7.20	3/9/16	8.67	units
Water Level, Field	128	21.00	8/18/10	7.10	2/5/14	12.55	(°C)
	121	540.40	9/7/14	520.81	5/18/10	529.64	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	11	0.10	8/18/10	0.04	8/11/11	0.06	mg/l
Arsenic, dissolved	11	0.01	11/10/10	0.0003	11/10/14	0.0027	mg/l
Barium, dissolved	11	0.46	7/5/17	0.04	10/7/09	0.31	mg/l
Beryllium, dissolved	11	U	4/12/16	U	4/12/16	U	mg/l
Boron, dissolved	101	1.11	7/8/14	0.45	11/19/09	0.73	mg/l
Cadmium, dissolved	11	U	4/12/16	U	4/12/16	U	mg/l
Calcium, dissolved	101	7.70	10/28/10	1.80	9/15/11	2.79	mg/l
Chromium, dissolved	11	U	4/12/16	U	4/12/16	U	mg/l
Copper, dissolved	11	0.07	7/5/17	0.02	10/7/09	0.05	mg/l
Iron, dissolved	11	0.90	10/7/09	0.03	12/4/12	0.16	mg/l
Lead, dissolved	11	U	4/12/16	U	4/12/16	U	mg/l
Lithium, dissolved	11	0.21	11/10/10	0.17	10/7/09	0.18	mg/l
Magnesium, dissolved	101	5.90	10/28/10	1.30	3/9/14	2.24	mg/l
Manganese, dissolved	11	0.03	10/7/09	0.01	7/10/13	0.01	mg/l
Mercury, dissolved	11	U	4/12/16	U	4/12/16	U	mg/l
Molybdenum, dissolved	11	1.31	11/10/10	0.01	10/7/09	0.30	mg/l
Nickel, dissolved	11	U	7/10/13	0.02	7/10/13	U	mg/l
Potassium, dissolved	101	34.80	8/2/10	0.60	11/1/16	1.91	mg/l
Selenium, dissolved	11	0.01	11/10/10	0.001	8/11/11	0.005	mg/l
Silica, dissolved	101	15.80	12/4/12	0.50	2/17/11	12.08	mg/l
Sodium, dissolved	101	1150	6/23/10	332.00	5/6/13	448.34	mg/l
Strontium, dissolved	101	1.44	12/12/17	0.48	8/2/10	0.71	mg/l
Vanadium, dissolved	11	U	4/12/16	U	4/12/16	U	mg/l
Zinc, dissolved	11	0.020	12/4/12	U	10/7/09	0.013	mg/l



Table 28: BG-6 Annual B-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	87	869.00	12/18/13	541.00	12/8/10	666.20	mg/l
Carbonate as CaCO ₃	87	219.00	12/8/10	64.50	11/2/16	95.58	mg/l
Total Alkalinity as Bromide	87	1,040.00	12/18/13	633.00	6/11/14	761.83	mg/l
Cation-Anion Balance	1	U	4/12/16	U	4/12/16	U	mg/l
Sum of Anions	87	5.90	4/9/14	-9.30	4/11/11	-2.58	%
Sum of Cations	87	23.00	12/18/13	14.30	6/11/14	16.89	meq/l
Chemical Oxygen	87	20.00	12/18/13	13.10	4/11/11	16.03	meq/l
Chloride	9	800.00	1/13/11	112.00	10/12/15	279.67	mg/l
Conductivity, Lab	69	70.00	12/8/10	10.00	1/20/11	17.05	mg/l
Fluoride	87	2,000	12/18/13	1,320	7/5/17	1,533	µmhos
Hardness as CaCO ₃	87	25.50	7/8/14	14.60	9/17/12	23.06	mg/l
Nitrate as N, dissolved	87	16.00	9/5/17	10.00	9/11/13	12.67	mg/l
Nitrate/Nitrite as N,	1	0.03	12/27/12	0.03	12/27/12	0.03	mg/l
Nitrite as N, dissolved	1	0.03	12/27/12	0.03	12/27/12	0.03	mg/l
Nitrogen, Ammonia	1	U	4/12/16	U	4/12/16	U	mg/l
Nitrogen, Organic	9	0.95	10/12/15	0.71	1/20/11	0.82	mg/l
Nitrogen, Total Kjeldahl	9	8.30	1/13/11	0.80	10/12/15	2.82	mg/l
pH, lab	9	9.00	1/13/11	1.70	10/12/15	3.63	mg/l
Phosphate, total	87	9.40	12/8/10	8.70	2/10/16	8.88	units
Phosphorus, total	9	77.50	8/11/11	0.09	1/13/11	8.72	mg/l
SAR in Water	9	0.09	7/10/13	0.03	1/13/11	0.04	mg/l
Sulfate	87	56.60	12/18/13	37.80	4/11/11	44.24	none
Sulfide	5	20.00	1/13/11	3.45	11/2/16	12.06	mg/l
Total Dissolved Solids	4	0.10	1/20/11	0.03	7/10/13	0.06	mg/l
Conductivity, Field	87	1,130	12/18/13	799	5/14/14	882	mg/l
pH, Field	86	2,413	9/17/12	1,232	6/5/17	1,515	µmhos
Temperature (°C), Field	86	9.58	3/5/12	7.10	3/9/16	8.43	units
Water Level, Field	86	23.00	9/5/17	4.62	11/22/11	11.46	(°C)
	85	517.10	8/7/17	493.95	10/12/15	508.35	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	2	0.04	1/13/11	0.04	1/13/11	0.04	mg/l
Arsenic, dissolved	10	0.06	1/13/11	0.00	4/12/16	0.01	mg/l
Barium, dissolved	10	0.39	1/13/11	0.31	7/5/17	0.34	mg/l
Beryllium, dissolved	1	0.00	11/10/14	0.00	11/10/14	U	mg/l
Boron, dissolved	87	0.91	12/18/13	0.62	12/8/10	0.72	mg/l
Cadmium, dissolved	10	U	4/12/16	U	4/12/16	U	mg/l
Calcium, dissolved	87	3.40	9/5/17	2.00	9/11/13	2.40	mg/l
Chromium, dissolved	10	U	4/12/16	U	4/12/16	U	mg/l
Copper, dissolved	10	U	4/12/16	U	4/12/16	U	mg/l
Iron, dissolved	8	0.11	7/10/13	0.02	12/4/12	0.05	mg/l
Lead, dissolved	1	0.05	12/4/12	0.05	12/4/12	U	mg/l
Lithium, dissolved	10	0.13	1/13/11	0.11	7/5/17	0.12	mg/l
Magnesium, dissolved	87	1.90	3/9/11	1.30	12/8/10	1.61	mg/l
Manganese, dissolved	1	0.01	1/13/11	0.01	1/13/11	0.01	mg/l
Mercury, dissolved	10	U	4/12/16	U	4/12/16	U	mg/l
Molybdenum, dissolved	1	0.06	1/13/11	0.06	1/13/11	0.06	mg/l
Nickel, dissolved	10	U	4/12/16	U	4/12/16	U	mg/l
Potassium, dissolved	87	2.10	12/8/10	0.60	11/2/16	1.04	mg/l
Selenium, dissolved	10	U	4/12/16	U	4/12/16	U	mg/l
Silica, dissolved	87	16.90	9/15/11	1.10	12/8/10	15.24	mg/l
Sodium, dissolved	87	439.00	12/18/13	292.00	4/11/11	356.26	mg/l
Strontium, dissolved	87	0.83	9/7/14	0.38	12/8/10	0.69	mg/l
Vanadium, dissolved	10	U	4/12/16	U	4/12/16	U	mg/l
Zinc, dissolved	3	0.03	7/5/17	0.01	12/4/12	U	mg/l



Table 29: BG-7 Annual B-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	4	711	10/18/14	501	12/15/15	592	mg/l
Carbonate as CaCO ₃	4	307	12/15/15	125	10/18/14	254	mg/l
Total Alkalinity as Bromide	4	911	9/28/17	808	12/15/15	846	mg/l
Cation-Anion Balance	4	0.14	10/18/14	0.13	9/28/17	0.13	mg/l
Sum of Anions	4	0.00	10/18/14	-2.10	4/5/16	-1.05	%
Sum of Cations	4	24.00	10/18/14	23.00	12/15/15	23.75	meq/l
Chemical Oxygen	4	24.00	10/18/14	23.00	12/15/15	23.25	meq/l
Chloride	4	29.00	12/15/15	14.00	4/5/16	22.25	mg/l
Conductivity, Lab	4	201	12/15/15	171	9/28/17	193	mg/l
Fluoride	4	2,340	10/18/14	2,240	12/15/15	2,278	µmhos
Hardness as CaCO ₃	4	20.40	9/28/17	18.20	12/15/15	19.35	mg/l
Nitrate as N, dissolved	4	13.00	10/18/14	11.00	4/5/16	11.98	mg/l
Nitrate/Nitrite as N,	4	0.02	10/18/14	0.02	10/18/14	0.02	mg/l
Nitrite as N, dissolved	4	0.02	10/18/14	0.02	10/18/14	0.02	mg/l
Nitrogen, Ammonia	4	0.01	12/15/15	0.00	10/18/14	0.01	mg/l
Nitrogen, Organic	4	1.22	10/18/14	1.11	9/28/17	1.17	mg/l
Nitrogen, Total Kjeldahl	4	0.90	9/28/17	0.20	10/18/14	0.45	mg/l
pH, lab	4	2.00	9/28/17	1.40	10/18/14	1.60	mg/l
Phosphate, total	4	9.60	12/15/15	8.90	10/18/14	9.40	units
Phosphorus, total	4	0.40	12/15/15	0.12	4/5/16	0.24	mg/l
SAR in Water	4	0.13	12/15/15	0.04	4/5/16	0.08	mg/l
Sulfate	4	66	4/5/16	64.00	12/15/15	65	none
Sulfide	4	40	10/18/14	7.91	9/28/17	19	mg/l
Total Dissolved Solids	4	0.12	12/15/15	0.12	12/15/15	0.12	mg/l
Conductivity, Field	4	1,350	10/18/14	1,240	12/15/15	1,280	mg/l
pH, Field	4	2,575	12/15/15	2,165	4/5/16	2,321	µmhos
Temperature (°C), Field	4	9.24	12/15/15	8.61	4/5/16	9.00	units
Water Level, Field	4	22.50	10/18/14	12.60	12/15/15	15.97	(°C)
	4	480.10	9/28/17	474.40	1/16/15	477.15	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	4	0.08	10/18/14	U	4/5/16	0.06	mg/l
Arsenic, dissolved	4	0.03	10/18/14	U	9/28/17	0.01	mg/l
Barium, dissolved	4	0.06	10/18/14	0.02	12/15/15	0.04	mg/l
Beryllium, dissolved	4	U	4/5/16	U	4/5/16	U	mg/l
Boron, dissolved	4	0.67	10/18/14	0.56	12/15/15	0.62	mg/l
Cadmium, dissolved	4	U	4/5/16	U	4/5/16	U	mg/l
Calcium, dissolved	4	3.60	10/18/14	U	4/5/16	2.15	mg/l
Chromium, dissolved	4	U	4/5/16	U	4/5/16	U	mg/l
Copper, dissolved	4	U	4/5/16	U	4/5/16	U	mg/l
Iron, dissolved	4	0.36	9/28/17	0.06	12/15/15	0.17	mg/l
Lead, dissolved	4	U	4/5/16	U	4/5/16	U	mg/l
Lithium, dissolved	4	0.17	4/5/16	0.13	10/18/14	0.16	mg/l
Magnesium, dissolved	4	1.90	9/28/17	U	10/18/14	1.63	mg/l
Manganese, dissolved	4	U	9/28/17	U	10/18/14	U	mg/l
Mercury, dissolved	4	U	4/5/16	U	4/5/16	U	mg/l
Molybdenum, dissolved	4	0.14	10/18/14	0.07	9/28/17	0.10	mg/l
Nickel, dissolved	4	U	4/5/16	U	4/5/16	U	mg/l
Potassium, dissolved	4	14.50	10/18/14	9.30	9/28/17	12.48	mg/l
Selenium, dissolved	4	U	10/18/14	U	12/15/15	U	mg/l
Silica, dissolved	4	18.90	10/18/14	0.90	12/15/15	5.45	mg/l
Sodium, dissolved	4	536	10/18/14	497	4/5/16	511	mg/l
Strontium, dissolved	4	0.33	10/18/14	U	12/15/15	0.22	mg/l
Vanadium, dissolved	4	U	10/18/14	U	10/18/14	U	mg/l
Zinc, dissolved	4	0.04	12/15/15	U	12/15/15	0.04	mg/l



**Table 30: BG-8 (DS-4) Annual B-Groove Aquifer –
Formerly DS-4 – P&A'ed May 2017**

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	11	11,100	12/5/16	1,500	10/12/16	7,084	mg/l
Carbonate as CaCO ₃	11	4,730	5/1/17	382	8/3/16	2,842	mg/l
Total Alkalinity as	11	15,800	5/1/17	1,950	10/12/16	9,915	mg/l
Bromide	1	U	7/11/16	U	7/11/16	U	mg/l
Cation-Anion Balance	11	0.80	9/6/16	-8.20	3/1/17	-3.53	%
Sum of Anions	11	459.00	5/1/17	62.00	10/12/16	283.27	meq/l
Sum of Cations	11	413.00	5/1/17	56.00	8/3/16	262.36	meq/l
Chemical Oxygen	1	137.00	7/11/16	137.00	7/11/16	137.00	mg/l
Chloride	11	4,950	5/1/17	748	7/11/16	2,935	mg/l
Conductivity, Lab	11	30,100	1/2/17	5,780	7/11/16	20,215	µmhos
Fluoride	11	66.00	5/1/17	23.00	7/11/16	45.90	mg/l
Hardness as CaCO ₃	11	21.00	7/11/16	5.00	2/1/17	12.95	mg/l
Nitrate as N, dissolved	1	0.87	7/11/16	0.87	7/11/16	0.87	mg/l
Nitrate/Nitrite as N,	1	0.87	7/11/16	0.87	7/11/16	0.87	mg/l
Nitrite as N, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Nitrogen, Ammonia	1	1.99	7/11/16	1.99	7/11/16	1.99	mg/l
Nitrogen, Organic	1	0.90	7/11/16	0.90	7/11/16	0.90	mg/l
Nitrogen, Total Kjeldahl	1	2.90	7/11/16	2.90	7/11/16	2.90	mg/l
pH, lab	11	9.20	9/6/16	8.90	12/5/16	9.08	units
Phosphate, total	1	1.21	7/11/16	1.21	7/11/16	1.21	mg/l
Phosphorus, total	1	0.39	7/11/16	0.39	7/11/16	0.39	mg/l
SAR in Water	8	1,600	2/1/17	130.00	7/11/16	658	none
Sulfate	11	20.00	11/3/16	20.00	11/3/16	20.00	mg/l
Sulfide	1	U	7/11/16	U	7/11/16	U	mg/l
Total Dissolved Solids	11	24,000	5/1/17	3,320	8/3/16	14,975	mg/l
Conductivity, Field	11	31,690	5/1/17	5,748	7/11/16	20,033	µmhos
pH, Field	11	9.00	7/11/16	8.80	1/2/17	8.92	units
Temperature (°C), Field	11	23.20	7/11/16	8.80	1/2/17	12.89	(°C)
Water Level, Field	9	552.30	2/1/17	517.10	8/3/16	545.97	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	1	0.06	7/11/16	0.06	7/11/16	0.06	mg/l
Arsenic, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Barium, dissolved	1	0.25	7/11/16	0.25	7/11/16	0.25	mg/l
Beryllium, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Boron, dissolved	11	15.60	5/1/17	1.71	8/3/16	9.48	mg/l
Cadmium, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Calcium, dissolved	11	8.00	1/2/17	0.30	10/12/16	2.75	mg/l
Chromium, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Copper, dissolved	1	0.16	7/11/16	0.16	7/11/16	0.16	mg/l
Iron, dissolved	1	0.04	7/11/16	0.04	7/11/16	0.04	mg/l
Lead, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Lithium, dissolved	1	0.24	7/11/16	0.24	7/11/16	0.24	mg/l
Magnesium, dissolved	11	2.90	7/11/16	1.90	10/12/16	2.32	mg/l
Manganese, dissolved	1	0.04	7/11/16	0.04	7/11/16	0.04	mg/l
Mercury, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Molybdenum, dissolved	1	0.04	7/11/16	0.04	7/11/16	0.04	mg/l
Nickel, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Potassium, dissolved	11	23.00	5/1/17	6.00	8/3/16	13.34	mg/l
Selenium, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Silica, dissolved	11	16.00	4/3/17	1.80	10/12/16	11.43	mg/l
Sodium, dissolved	11	9,370	5/1/17	1,270	8/3/16	5,953	mg/l
Strontium, dissolved	11	2.46	11/3/16	0.63	10/12/16	1.51	mg/l
Vanadium, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l
Zinc, dissolved	1	U	7/11/16	U	7/11/16	U	mg/l



Table 31: IRI-6 Annual B-Groove Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	60	806.00	12/16/92	356.00	2/26/91	635.65	mg/l
Carbonate as CaCO ₃	60	754.00	9/27/90	10.00	6/16/92	103.64	mg/l
Total Alkalinity as Bromide	60	1,064.00	9/27/90	375.00	9/7/90	715.07	mg/l
Cation-Anion Balance	30	2.60	9/7/90	0.06	5/26/00	0.82	mg/l
Sum of Anions	58	11.10	5/29/02	-9.40	7/29/09	0.66	%
Sum of Cations	52	24.21	9/27/90	12.00	5/26/04	16.38	meq/l
Chemical Oxygen	52	23.84	9/27/90	13.00	5/26/04	16.53	meq/l
Chloride	22	550.00	7/29/09	11.00	8/24/17	162.14	mg/l
Conductivity, Lab	59	524.00	9/7/90	11.00	6/30/95	41.30	mg/l
Fluoride	58	1,660.00	9/8/93	1,050.00	3/22/93	1,436.47	µmhos
Hardness as CaCO ₃	60	32.00	9/28/94	2.80	5/28/91	21.51	mg/l
Nitrate as N, dissolved	58	59.00	9/27/90	3.00	6/30/09	10.81	mg/l
Nitrate/Nitrite as N,	29	1.99	6/14/08	0.02	6/30/95	0.23	mg/l
Nitrite as N, dissolved	29	2.13	6/14/08	0.02	9/28/94	0.24	mg/l
Nitrogen, Ammonia	29	0.14	6/14/08	0.01	10/3/12	0.08	mg/l
Nitrogen, Organic	29	5.70	5/9/01	0.58	5/21/07	1.17	mg/l
Nitrogen, Total Kjeldahl	29	34.70	7/29/09	0.92	5/9/01	9.60	mg/l
pH, lab	29	35.50	7/29/09	3.40	9/7/90	10.74	mg/l
Phosphate, total	58	11.60	12/20/93	8.40	12/30/96	8.87	units
Phosphorus, total	29	0.90	9/7/90	0.03	5/26/00	0.15	mg/l
SAR in Water	29	0.30	9/7/90	0.01	6/18/96	0.05	mg/l
Sulfate	48	92.00	11/27/02	29.17	9/27/90	53.40	none
Sulfide	60	140.00	6/14/08	2.00	5/28/91	17.55	mg/l
Total Dissolved Solids	29	0.80	9/7/90	0.01	5/26/04	0.14	mg/l
Conductivity, Field	59	1,428.00	9/27/90	690.00	5/29/03	918.20	mg/l
pH, Field	82	3,803.00	9/1/09	982.00	11/21/05	1,544.80	µmhos
Temperature (°C), Field	81	12.00	9/27/90	8.02	11/6/14	9.35	units
Water Level, Field	39	16.20	6/14/08	8.00	12/1/90	12.21	(°C)
	51	435.60	8/24/17	398.45	11/1/90	407.89	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	28	3.79	9/27/90	U	5/26/04	0.72	mg/l
Arsenic, dissolved	28	0.03	9/27/90	U	5/26/04	0.01	mg/l
Barium, dissolved	28	0.43	8/24/17	U	9/7/90	0.21	mg/l
Beryllium, dissolved	28	U	3/22/16	U	3/22/16	U	mg/l
Boron, dissolved	60	0.72	1/31/91	0.19	12/20/93	0.57	mg/l
Cadmium, dissolved	28	U	3/22/16	U	3/22/16	U	mg/l
Calcium, dissolved	60	12.00	9/27/90	0.00	2/26/91	2.27	mg/l
Chromium, dissolved	28	0.01	9/7/90	U	9/7/90	0.01	mg/l
Copper, dissolved	28	U	10/22/13	U	10/22/13	U	mg/l
Iron, dissolved	28	0.24	11/6/14	U	5/26/99	0.05	mg/l
Lead, dissolved	28	0.32	3/22/16	U	6/23/94	0.15	mg/l
Lithium, dissolved	28	0.13	9/7/90	0.06	9/15/92	0.08	mg/l
Magnesium, dissolved	60	7.00	9/27/90	U	2/26/91	1.19	mg/l
Manganese, dissolved	28	0.01	7/31/91	U	7/31/91	0.01	mg/l
Mercury, dissolved	28	U	3/22/16	U	3/22/16	U	mg/l
Molybdenum, dissolved	28	U	3/22/16	U	3/22/16	U	mg/l
Nickel, dissolved	28	0.02	6/23/94	U	6/23/94	0.02	mg/l
Potassium, dissolved	60	13.00	9/7/90	0.90	11/16/04	1.81	mg/l
Selenium, dissolved	28	0.00	9/27/90	U	7/31/91	0.00	mg/l
Silica, dissolved	60	63.00	9/27/90	9.50	12/20/93	17.54	mg/l
Sodium, dissolved	60	508.00	9/27/90	287.00	12/20/93	369.62	mg/l
Strontium, dissolved	60	0.76	8/24/17	U	12/20/93	0.46	mg/l
Vanadium, dissolved	28	0.01	9/7/90	U	6/18/96	0.01	mg/l
Zinc, dissolved	28	0.13	10/22/13	U	5/9/01	0.03	mg/l



Table 32: DS-2 Annual Dissolution Surface Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	138	66,300.00	8/21/03	3,970.00	11/18/06	42,689.56	mg/l
Carbonate as CaCO ₃	138	33,400.00	8/5/99	130.00	11/18/06	3,967.83	mg/l
Total Alkalinity as	138	68,800.00	8/21/03	4,100.00	11/18/06	46,306.57	mg/l
Bromide	18	3.00	5/18/06	3.00	5/18/06	3.00	mg/l
Cation-Anion Balance	138	80.00	11/18/06	-67.20	9/15/07	-2.64	%
Sum of Anions	138	1,420.00	8/21/03	105.00	11/18/06	949.65	meq/l
Sum of Cations	138	1,200.00	5/29/02	193.00	9/15/07	903.31	meq/l
Chemical Oxygen	17	1,100.00	7/29/09	100.00	9/14/00	287.86	mg/l
Chloride	138	1,380.00	10/16/13	105.00	4/11/06	753.70	mg/l
Conductivity, Lab	138	62,100.00	9/25/02	5,220.00	2/8/00	48,556.42	µmhos
Fluoride	138	123.00	3/25/98	8.60	4/11/06	51.79	mg/l
Hardness as CaCO ₃	138	150.00	11/16/07	1.00	3/25/98	36.70	mg/l
Nitrate as N, dissolved	18	0.96	9/25/02	U	9/24/03	0.10	mg/l
Nitrate/Nitrite as N,	18	1.65	9/25/02	U	9/24/03	0.16	mg/l
Nitrite as N, dissolved	18	0.87	9/25/02	U	9/24/03	0.11	mg/l
Nitrogen, Ammonia	17	16.30	9/26/01	3.75	9/14/00	11.74	mg/l
Nitrogen, Organic	17	16.40	7/29/09	1.90	9/24/03	6.33	mg/l
Nitrogen, Total Kjeldahl	17	26.10	7/29/09	1.70	9/14/00	14.60	mg/l
pH, lab	138	9.10	10/14/08	8.20	6/9/99	8.48	units
Phosphate, total	17	77.50	5/18/06	1.55	10/14/08	34.58	mg/l
Phosphorus, total	17	18.80	9/15/07	3.00	10/14/08	10.79	mg/l
SAR in Water	132	7,600.00	3/25/98	801.00	11/16/07	2,291.63	none
Sulfate	138	1,040.00	12/16/02	10.00	9/27/05	132.03	mg/l
Sulfide	17	3.50	9/2/98	0.05	8/25/05	1.56	mg/l
Total Dissolved Solids	138	66,600.00	8/21/03	20,800.00	12/8/00	49,927.01	mg/l
Conductivity, Field	143	62,200.00	2/14/06	26,900.00	12/1/08	51,933.66	µmhos
pH, Field	142	10.29	6/1/09	7.00	3/4/15	8.53	units
Temperature (°C), Field	96	23.77	6/15/11	6.30	3/4/13	13.07	(°C)
Water Level, Field	147	566.13	8/7/14	521.20	1/26/16	553.26	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	18	1.60	9/23/10	U	3/14/08	1.09	mg/l
Arsenic, dissolved	18	U	11/27/12	U	11/27/12	U	mg/l
Barium, dissolved	18	3.85	3/14/08	0.06	10/14/08	1.70	mg/l
Beryllium, dissolved	18	U	11/27/12	U	11/27/12	U	mg/l
Boron, dissolved	137	43.40	1/28/03	6.60	9/15/07	30.26	mg/l
Cadmium, dissolved	18	U	11/27/12	U	11/27/12	U	mg/l
Calcium, dissolved	137	60.00	11/16/07	U	8/12/04	13.29	mg/l
Chromium, dissolved	18	0.40	9/23/10	U	9/23/10	0.40	mg/l
Copper, dissolved	18	0.60	9/14/04	U	9/2/98	0.45	mg/l
Iron, dissolved	18	1.20	9/2/98	0.24	10/14/08	0.64	mg/l
Lead, dissolved	18	0.28	3/14/08	U	3/14/08	0.28	mg/l
Lithium, dissolved	18	12.70	3/14/08	1.00	9/15/07	4.58	mg/l
Magnesium, dissolved	137	10.00	9/8/15	U	3/14/08	4.82	mg/l
Manganese, dissolved	18	0.01	10/14/08	U	10/14/08	0.01	mg/l
Mercury, dissolved	18	U	11/27/12	U	11/27/12	U	mg/l
Molybdenum, dissolved	18	0.50	9/23/10	U	3/14/08	0.40	mg/l
Nickel, dissolved	18	0.23	3/14/08	U	3/14/08	0.23	mg/l
Potassium, dissolved	137	60.00	11/30/11	11.40	10/14/08	30.31	mg/l
Selenium, dissolved	18	0.00	9/30/97	U	9/30/97	0.00	mg/l
Silica, dissolved	137	50.00	6/2/98	3.60	4/11/06	26.98	mg/l
Sodium, dissolved	137	29,800.00	4/19/01	4,370.00	9/15/07	20,562.55	mg/l
Strontium, dissolved	137	0.60	8/4/97	U	10/14/08	0.25	mg/l
Vanadium, dissolved	18	0.20	9/23/10	U	3/14/08	0.10	mg/l
Zinc, dissolved	18	3.00	11/16/07	U	3/14/08	1.51	mg/l



Table 33: DS-3 Annual Dissolution Surface Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	171	43,000	5/24/05	17,400	11/27/02	26,293	mg/l
Carbonate as CaCO ₃	171	23,900	5/3/08	419	6/26/02	3,073	mg/l
Total Alkalinity as Bromide	171	60,100	3/14/08	21,900	6/11/14	29,195	mg/l
Cation-Anion Balance	27	5.00	5/3/08	0.70	8/2/06	2.18	mg/l
Sum of Anions	171	13.50	10/28/02	-93.80	4/10/13	-5.19	%
Sum of Cations	171	1,320.00	3/14/08	511.00	4/29/03	720.75	meq/l
Chemical Oxygen	171	1,730.00	3/14/08	20.70	4/10/13	665.17	meq/l
Chloride	27	1,100.00	7/30/09	140.00	8/21/03	422.50	mg/l
Conductivity, Lab	171	12,200	5/10/16	39	5/24/05	4,772	mg/l
Fluoride	171	67,300	5/10/16	27,200	9/28/06	44,102	µmhos
Hardness as CaCO ₃	171	98.80	5/10/16	2.80	5/24/05	55.64	mg/l
Nitrate as N, dissolved	171	49.00	3/8/11	1.00	1/28/03	15.44	mg/l
Nitrate/Nitrite as N,	27	0.10	8/12/04	0.02	9/28/06	0.05	mg/l
Nitrite as N, dissolved	27	0.14	11/10/14	0.02	9/28/06	0.05	mg/l
Nitrogen, Ammonia	27	0.05	11/10/14	0.01	7/11/13	0.03	mg/l
Nitrogen, Organic	27	24.80	3/14/08	6.11	7/10/17	11.28	mg/l
Nitrogen, Total Kjeldahl	27	28.00	8/22/02	0.80	9/30/08	7.88	mg/l
pH, lab	27	44.00	3/14/08	3.50	9/23/10	17.88	mg/l
Phosphate, total	171	9.20	4/10/08	7.90	10/28/02	8.57	units
Phosphorus, total	27	155.00	7/30/09	3.10	8/16/11	28.20	mg/l
SAR in Water	27	183.00	9/30/08	3.20	6/26/07	13.64	mg/l
Sulfate	149	8,450	5/18/06	0.00	12/9/14	2,466	none
Sulfide	171	1,860	9/23/10	0.00	9/2/15	206	mg/l
Total Dissolved Solids	27	3.20	9/28/06	0.04	8/25/05	1.28	mg/l
Conductivity, Field	171	88,500	3/14/08	18,500	5/29/03	38,260	mg/l
pH, Field	193	66,580	5/10/16	30,600	4/29/03	48,667	µmhos
Temperature (°C), Field	193	9.91	6/30/09	7.00	3/9/16	8.42	units
Water Level, Field	192	24.40	7/5/16	5.30	2/9/12	12.95	(°C)
	190	543.10	9/7/14	484.10	2/4/16	521.75	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	28	79.90	8/12/04	U	3/14/08	17.00	mg/l
Arsenic, dissolved	28	U	12/4/12	U	12/4/12	U	mg/l
Barium, dissolved	28	3.32	8/25/05	0.19	8/19/07	1.84	mg/l
Beryllium, dissolved	28	U	4/12/16	U	4/12/16	U	mg/l
Boron, dissolved	172	46.20	5/10/16	3.69	5/29/03	14.19	mg/l
Cadmium, dissolved	28	U	4/12/16	U	4/12/16	U	mg/l
Calcium, dissolved	172	14.00	7/10/17	U	5/29/03	4.13	mg/l
Chromium, dissolved	28	0.01	5/18/06	U	5/18/06	0.01	mg/l
Copper, dissolved	28	1.20	8/16/11	U	8/12/04	0.85	mg/l
Iron, dissolved	28	3.70	9/15/07	U	5/18/06	1.49	mg/l
Lead, dissolved	28	1.40	8/22/02	U	3/14/08	0.81	mg/l
Lithium, dissolved	28	8.48	3/14/08	2.80	7/12/07	3.43	mg/l
Magnesium, dissolved	172	10.00	1/8/08	U	9/2/15	3.99	mg/l
Manganese, dissolved	28	U	4/12/16	U	4/12/16	U	mg/l
Mercury, dissolved	28	U	4/12/16	U	4/12/16	U	mg/l
Molybdenum, dissolved	28	0.70	8/19/07	U	8/18/10	0.45	mg/l
Nickel, dissolved	28	0.20	9/23/10	U	5/18/06	0.13	mg/l
Potassium, dissolved	172	109.00	3/14/08	0.00	11/21/08	29.18	mg/l
Selenium, dissolved	28	0.01	8/22/02	U	7/12/07	0.01	mg/l
Silica, dissolved	172	79.00	4/11/06	8.90	5/29/03	24.78	mg/l
Sodium, dissolved	172	39,200	3/14/08	450	4/10/13	15,243	mg/l
Strontium, dissolved	172	0.70	2/21/05	U	5/29/03	0.22	mg/l
Vanadium, dissolved	28	0.20	6/26/07	U	5/18/06	0.08	mg/l
Zinc, dissolved	28	1.80	7/10/17	U	3/14/08	0.68	mg/l



Table 34: DS-5 Annual Dissolution Surface Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	85	23,700	7/6/17	15,000	12/10/14	19,135	mg/l
Carbonate as CaCO ₃	85	3,830	6/9/15	528	11/1/17	2,000	mg/l
Total Alkalinity as Bromide	85	24,200	5/10/17	16,100	12/10/14	21,111	mg/l
Cation-Anion Balance	9	U	4/12/16	U	4/12/16	U	mg/l
Sum of Anions	85	4.50	1/20/11	-17.90	10/11/11	-5.40	%
Sum of Cations	85	604.00	1/14/11	374.00	1/6/15	462.38	meq/l
Chemical Oxygen	85	551.00	12/4/17	288.00	12/10/14	415.89	meq/l
Chloride	9	289.00	7/6/17	80.00	8/11/11	128.25	mg/l
Conductivity, Lab	85	2,660	5/10/17	631	6/11/14	1,250	mg/l
Fluoride	85	36,300	5/10/17	24,700	1/11/16	29,161	µmhos
Hardness as CaCO ₃	85	76.60	1/6/15	42.40	9/17/12	60.85	mg/l
Nitrate as N, dissolved	84	41.30	12/10/15	5.00	2/6/17	20.21	mg/l
Nitrate/Nitrite as N,	9	0.04	8/11/11	0.02	12/4/12	0.03	mg/l
Nitrite as N, dissolved	9	0.07	1/14/11	0.03	1/20/11	0.05	mg/l
Nitrogen, Ammonia	9	0.04	1/14/11	0.01	12/4/12	0.02	mg/l
Nitrogen, Organic	9	8.70	1/20/11	4.23	11/10/14	6.36	mg/l
Nitrogen, Total Kjeldahl	9	8.00	7/6/17	0.80	12/13/12	4.51	mg/l
pH, lab	9	14.00	7/6/17	7.80	12/13/12	10.82	mg/l
Phosphate, total	85	8.90	12/18/13	8.40	11/1/17	8.65	units
Phosphorus, total	9	77.50	1/20/11	1.90	7/6/17	18.42	mg/l
SAR in Water	9	4.57	8/11/11	0.60	7/6/17	3.56	mg/l
Sulfate	66	2,000	2/6/17	0.00	9/7/14	948	none
Sulfide	85	6,450	1/14/11	13.30	4/9/14	825	mg/l
Total Dissolved Solids	9	3.20	11/10/14	0.40	1/14/11	1.55	mg/l
Conductivity, Field	85	31,400	1/14/11	18,300	12/10/14	23,736	mg/l
pH, Field	88	54,810	2/10/16	25,060	12/10/14	30,327	µmhos
Temperature (°C), Field	88	9.48	12/14/11	7.20	3/9/16	8.29	units
Water Level, Field	88	24.00	7/8/14	5.00	1/12/12	13.07	(°C)
	86	568.90	10/1/11	443.70	4/10/13	516.77	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	9	0.40	1/14/11	U	1/14/11	0.40	mg/l
Arsenic, dissolved	9	0.02	12/4/12	U	10/12/15	0.01	mg/l
Barium, dissolved	9	2.13	7/6/17	0.99	1/14/11	1.54	mg/l
Beryllium, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Boron, dissolved	85	15.70	12/4/17	10.10	10/11/11	12.58	mg/l
Cadmium, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Calcium, dissolved	85	11.00	6/14/11	U	12/10/14	3.47	mg/l
Chromium, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Copper, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Iron, dissolved	9	2.20	1/14/11	0.50	8/11/11	1.25	mg/l
Lead, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Lithium, dissolved	9	4.70	11/10/14	3.90	12/4/12	4.28	mg/l
Magnesium, dissolved	85	7.00	12/10/15	U	9/2/15	4.03	mg/l
Manganese, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Mercury, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Molybdenum, dissolved	9	1.00	1/14/11	0.20	8/11/11	0.73	mg/l
Nickel, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Potassium, dissolved	85	45.00	1/20/11	18.00	7/13/11	25.15	mg/l
Selenium, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Silica, dissolved	85	30.00	4/11/11	15.00	3/6/17	20.08	mg/l
Sodium, dissolved	85	12,500	12/4/17	6,530	12/10/14	9,432	mg/l
Strontium, dissolved	85	0.52	7/8/15	U	1/14/11	0.23	mg/l
Vanadium, dissolved	9	U	4/12/16	U	4/12/16	U	mg/l
Zinc, dissolved	9	0.30	1/14/11	U	7/6/17	0.27	mg/l



Table 35: DS-6 Annual Dissolution Surface Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	27	8,220	9/27/16	5,770	12/7/17	6,818	mg/l
Carbonate as CaCO ₃	27	4,870	12/7/17	2,730	9/27/16	3,908	mg/l
Total Alkalinity as Bromide	27	11,800	10/4/17	9,650	8/9/16	10,730	mg/l
Cation-Anion Balance	6	U	4/5/16	U	4/5/16	U	mg/l
Sum of Anions	27	1.30	10/4/16	-12.70	10/4/17	-3.86	%
Sum of Cations	27	271.00	12/9/14	224.00	8/9/16	240.65	meq/l
Chemical Oxygen	27	240.00	12/9/14	202.00	3/1/17	222.69	meq/l
Chloride	6	167.00	12/9/14	44.00	4/5/16	79.33	mg/l
Conductivity, Lab	27	1,330	12/9/14	658	9/27/16	784	mg/l
Fluoride	27	19,800	12/9/14	15,400	9/22/16	16,862	µmhos
Hardness as CaCO ₃	27	35.20	11/7/17	26.80	9/8/15	32.47	mg/l
Nitrate as N, dissolved	27	30.00	9/22/16	U	1/3/17	10.87	mg/l
Nitrate/Nitrite as N,	6	U	4/5/16	U	4/5/16	U	mg/l
Nitrite as N, dissolved	6	0.02	12/9/14	0.02	12/9/14	0.02	mg/l
Nitrogen, Ammonia	6	0.03	12/9/14	0.03	12/9/14	0.03	mg/l
Nitrogen, Organic	6	4.04	9/22/16	3.30	12/9/14	3.66	mg/l
Nitrogen, Total Kjeldahl	6	3.50	4/5/16	0.80	7/11/17	2.38	mg/l
pH, lab	6	6.90	10/4/16	4.70	7/11/17	6.02	mg/l
Phosphate, total	27	9.50	3/1/17	9.10	3/25/15	9.30	units
Phosphorus, total	6	7.00	9/27/16	0.71	12/9/14	4.27	mg/l
SAR in Water	6	2.20	9/27/16	0.23	12/9/14	1.37	mg/l
Sulfate	21	1,500	9/6/17	410.00	9/22/16	883	none
Sulfide	27	370	12/9/14	42.90	9/27/16	116	mg/l
Total Dissolved Solids	6	3.00	7/11/17	0.30	4/5/16	1.10	mg/l
Conductivity, Field	27	14,100	12/9/14	12,000	12/29/15	12,565	mg/l
pH, Field	24	19,560	12/16/15	15,380	4/5/16	17,070	µmhos
Temperature (°C), Field	24	9.70	8/9/16	7.50	3/5/15	8.92	units
Water Level, Field	24	16.70	9/6/17	10.20	3/1/17	12.75	(°C)
	24	537.80	3/5/15	498.92	10/4/16	516.85	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Arsenic, dissolved	6	0.01	12/9/14	U	12/9/14	0.01	mg/l
Barium, dissolved	6	0.46	10/4/16	0.05	4/5/16	0.31	mg/l
Beryllium, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Boron, dissolved	26	7.80	10/4/16	6.20	10/4/17	7.32	mg/l
Cadmium, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Calcium, dissolved	26	7.00	9/22/16	U	3/25/15	2.29	mg/l
Chromium, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Copper, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Iron, dissolved	6	0.60	12/9/14	0.20	9/22/16	0.38	mg/l
Lead, dissolved	6	U	4/5/16	U	4/5/16	U	mg/l
Lithium, dissolved	6	2.17	12/9/14	1.94	9/27/16	2.05	mg/l
Magnesium, dissolved	26	4.00	3/25/15	U	9/8/15	2.83	mg/l
Manganese, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Mercury, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Molybdenum, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Nickel, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Potassium, dissolved	26	113.00	12/9/14	68.00	9/27/16	83.23	mg/l
Selenium, dissolved	6	U	9/22/16	U	9/22/16	U	mg/l
Silica, dissolved	26	34.00	7/11/17	7.00	1/27/16	24.27	mg/l
Sodium, dissolved	26	5,380	12/9/14	4,540	3/1/17	5,005	mg/l
Strontium, dissolved	26	0.24	8/8/17	U	12/29/15	0.15	mg/l
Vanadium, dissolved	6	U	10/4/16	U	10/4/16	U	mg/l
Zinc, dissolved	6	0.40	9/22/16	U	7/11/17	0.30	mg/l



Table 36: DS-7 Annual Dissolution Surface Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	34	31,600	12/4/17	17,400	12/30/14	24,035	mg/l
Carbonate as CaCO ₃	34	16,600	8/2/16	608	8/8/17	8,806	mg/l
Total Alkalinity as Bromide	34	41,300	7/7/16	23,300	10/10/17	32,841	mg/l
Cation-Anion Balance	4	U	4/5/16	U	4/5/16	U	mg/l
Sum of Anions	34	6.50	6/17/15	-15.10	12/16/15	-3.39	%
Sum of Cations	34	3,360.00	12/17/14	728.00	10/10/17	1,818.12	meq/l
Chemical Oxygen	34	3,230.00	12/17/14	665.00	9/11/17	1,721.79	meq/l
Chloride	5	3,630.00	11/5/15	836.00	7/11/17	2,211.20	mg/l
Conductivity, Lab	34	96,000	12/30/14	9,250	10/10/17	41,334	mg/l
Fluoride	34	207,000	12/17/14	50,800	5/10/17	103,688	µmhos
Hardness as CaCO ₃	34	90.90	6/12/17	40.40	10/11/16	63.16	mg/l
Nitrate as N, dissolved	34	82.40	12/16/15	U	12/30/14	48.73	mg/l
Nitrate/Nitrite as N,	5	U	4/5/16	U	4/5/16	U	mg/l
Nitrite as N, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Nitrogen, Ammonia	5	40.40	12/17/14	6.66	7/11/17	22.49	mg/l
Nitrogen, Organic	5	4.00	12/30/14	4.00	12/30/14	4.00	mg/l
Nitrogen, Total Kjeldahl	5	33.00	12/30/14	1.10	11/5/15	13.22	mg/l
pH, lab	34	9.10	5/6/15	8.50	10/11/16	8.77	units
Phosphate, total	5	71.00	11/5/15	20.00	7/11/17	52.40	mg/l
Phosphorus, total	5	23.00	11/5/15	6.50	7/11/17	16.92	mg/l
SAR in Water	18	7,600	6/8/16	1,800.00	10/11/16	3,280	none
Sulfate	34	480	12/30/14	110.00	7/11/17	350	mg/l
Sulfide	5	4.20	11/5/15	1.30	12/17/14	2.34	mg/l
Total Dissolved Solids	34	189,676	12/17/14	39,000	10/10/17	100,533	mg/l
Conductivity, Field	33	186,700	12/17/14	47,760	10/10/17	107,631	µmhos
pH, Field	33	9.20	3/10/16	7.10	12/17/14	8.34	units
Temperature (°C), Field	33	16.00	9/9/15	9.00	12/4/17	13.40	(°C)
Water Level, Field	34	643.10	12/12/14	478.76	11/9/16	545.92	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Arsenic, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Barium, dissolved	5	1.90	7/11/17	0.40	11/5/15	0.84	mg/l
Beryllium, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Boron, dissolved	34	66.00	9/9/15	13.50	9/11/17	34.12	mg/l
Cadmium, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Calcium, dissolved	34	30.00	5/6/15	U	12/30/14	13.43	mg/l
Chromium, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Copper, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Iron, dissolved	5	5.00	12/30/14	3.00	12/17/14	4.00	mg/l
Lead, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Lithium, dissolved	5	2.70	7/11/17	1.00	12/30/14	1.60	mg/l
Magnesium, dissolved	34	20.00	6/17/15	U	6/17/15	20.00	mg/l
Manganese, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Mercury, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Molybdenum, dissolved	5	2.00	4/5/16	2.00	4/5/16	2.00	mg/l
Nickel, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Potassium, dissolved	34	140.00	9/9/15	23.00	9/11/17	67.18	mg/l
Selenium, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Silica, dissolved	34	30.00	6/17/15	16.00	9/11/17	23.03	mg/l
Sodium, dissolved	34	73,200	12/17/14	15,100	9/11/17	39,068	mg/l
Strontium, dissolved	34	1.00	8/12/15	U	6/8/16	0.39	mg/l
Vanadium, dissolved	5	U	4/5/16	U	4/5/16	U	mg/l
Zinc, dissolved	5	0.50	7/11/17	U	7/11/17	0.50	mg/l



Table 37: DS-8 Annual Dissolution Surface Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	5	23,300	1/15/2015	17,900	9/28/2017	20,340	mg/l
Carbonate as CaCO ₃	5	7,880	4/5/2016	4,200	1/15/2015	6,180	mg/l
Total Alkalinity as Bromide	5	27,500	1/15/2015	25,300	9/28/2017	26,520	mg/l
Cation-Anion Balance	5	U	4/5/2016	U	4/5/2016	U	mg/l
Sum of Anions	5	-2.40	9/28/2017	-9.50	1/8/2015	-5.00	%
Sum of Cations	5	582.00	1/15/2015	542.00	9/28/2017	563.20	meq/l
Chemical Oxygen Chloride	5	526.00	4/5/2016	477.00	1/8/2015	509.80	meq/l
Conductivity, Lab	5	731.00	1/15/2015	95.00	9/28/2017	252.40	mg/l
Fluoride	5	1,050	12/15/2015	900	1/15/2015	963	mg/l
Hardness as CaCO ₃	5	36,000	1/15/2015	33,200	12/15/2015	34,680	µmhos
Nitrate as N, dissolved	5	66.80	1/15/2015	63.00	1/8/2015	65.48	mg/l
Nitrate/Nitrite as N,	5	U	4/5/2016	U	4/5/2016	U	mg/l
Nitrite as N, dissolved	5	0.03	1/15/2015	0.00	1/8/2015	0.02	mg/l
Nitrogen, Ammonia	5	0.03	1/15/2015	0.00	1/8/2015	0.02	mg/l
Nitrogen, Organic	5	U	1/8/2015	U	1/8/2015	U	mg/l
Nitrogen, Total Kjeldahl	5	10.50	1/15/2015	6.87	9/28/2017	8.39	mg/l
pH, lab	5	6.60	4/5/2016	4.00	1/8/2015	5.46	mg/l
Phosphate, total	5	14.80	1/15/2015	13.00	9/28/2017	13.82	mg/l
Phosphorus, total	5	9.20	4/5/2016	8.70	1/8/2015	8.98	units
SAR in Water	5	21.00	9/28/2017	15.00	12/15/2015	17.80	mg/l
Sulfate	5	6.60	9/28/2017	4.90	12/15/2015	5.74	mg/l
Sulfide	0	N/A	N/A	N/A	N/A	N/A	none
Total Dissolved Solids	5	162	9/28/2017	100.00	1/8/2015	131	mg/l
Conductivity, Field	5	0.80	12/15/2015	0.60	4/5/2016	0.70	mg/l
pH, Field	5	29,400	1/15/2015	28,400	9/28/2017	28,860	mg/l
Temperature (°C), Field	4	39,750	12/15/2015	31,210	4/5/2016	34,750	µmhos
Water Level, Field	4	9.07	4/5/2016	8.20	10/6/2014	8.68	units
	4	14.35	9/28/2017	11.20	10/6/2014	13.14	(°C)
	4	496.60	9/28/2017	81.00	1/8/2015	392.23	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Arsenic, dissolved	5	0.07	1/15/2015	U	4/5/2016	0.03	mg/l
Barium, dissolved	5	1.00	1/15/2015	0.43	1/8/2015	0.71	mg/l
Beryllium, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Boron, dissolved	5	13.30	9/28/2017	12.70	4/5/2016	13.00	mg/l
Cadmium, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Calcium, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Chromium, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Copper, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Iron, dissolved	5	2.70	1/15/2015	0.40	9/28/2017	1.76	mg/l
Lead, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Lithium, dissolved	5	4.70	4/5/2016	4.20	1/8/2015	4.42	mg/l
Magnesium, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Manganese, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Mercury, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Molybdenum, dissolved	5	0.50	1/15/2015	0.50	1/15/2015	0.50	mg/l
Nickel, dissolved	5	U	1/15/2015	U	1/15/2015	U	mg/l
Potassium, dissolved	5	68.00	4/5/2016	43.00	1/8/2015	57.60	mg/l
Selenium, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Silica, dissolved	5	30.00	9/28/2017	18.00	1/8/2015	22.40	mg/l
Sodium, dissolved	5	11,900	4/5/2016	10,800	1/8/2015	11,540	mg/l
Strontium, dissolved	5	0.10	1/15/2015	U	1/8/2015	0.07	mg/l
Vanadium, dissolved	5	U	4/5/2016	U	4/5/2016	U	mg/l
Zinc, dissolved	5	0.70	12/15/2015	U	12/15/2015	0.70	mg/l



Table 38: DS-9 Annual Dissolution Surface Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	6	13,300	11/4/2014	12,300	12/15/2015	12,583	mg/l
Carbonate as CaCO ₃	6	2,810	11/4/2014	1,880	9/28/2017	2,552	mg/l
Total Alkalinity as Bromide	6	16,100	11/4/2014	14,300	9/28/2017	15,150	mg/l
Cation-Anion Balance	6	U	4/5/2016	U	4/5/2016	U	mg/l
Sum of Anions	6	-1.90	9/28/2017	-13.50	2/4/2015	-5.35	%
Sum of Cations	6	438.00	2/4/2015	343.00	9/28/2017	380.33	meq/l
Chemical Oxygen	6	358.00	11/4/2014	330.00	9/28/2017	340.67	meq/l
Chloride	6	132.00	9/28/2017	97.00	4/5/2016	120.33	mg/l
Conductivity, Lab	6	2,470	2/4/2015	1,940	9/28/2017	2,100	mg/l
Fluoride	6	26,900	2/4/2015	24,300	12/15/2015	25,750	µmhos
Hardness as CaCO ₃	6	47.40	4/5/2016	42.70	12/15/2015	45.25	mg/l
Nitrate as N, dissolved	6	36.00	1/28/2015	U	12/15/2015	23.50	mg/l
Nitrate/Nitrite as N,	6	0.03	1/28/2015	0.03	1/28/2015	0.03	mg/l
Nitrite as N, dissolved	6	0.04	1/28/2015	0.04	1/28/2015	0.04	mg/l
Nitrogen, Ammonia	6	0.01	1/28/2015	0.01	1/28/2015	0.01	mg/l
Nitrogen, Organic	6	7.40	1/28/2015	4.05	12/15/2015	5.62	mg/l
Nitrogen, Total Kjeldahl	6	4.50	12/15/2015	1.80	1/28/2015	3.36	mg/l
pH, lab	6	9.70	11/4/2014	7.00	2/4/2015	8.45	mg/l
Phosphate, total	6	8.90	12/15/2015	8.80	11/4/2014	8.85	units
Phosphorus, total	6	7.80	11/4/2014	3.70	2/4/2015	5.43	mg/l
SAR in Water	6	2.51	11/4/2014	1.20	2/4/2015	1.75	mg/l
Sulfate	5	660	2/4/2015	550.00	1/28/2015	617	none
Sulfide	6	2,870	2/4/2015	31.70	9/28/2017	775	mg/l
Total Dissolved Solids	6	U	4/5/2016	U	4/5/2016	U	mg/l
Conductivity, Field	6	22,300	2/4/2015	18,300	9/28/2017	19,900	mg/l
pH, Field	4	29,050	12/15/2015	23,740	4/5/2016	25,738	µmhos
Temperature (°C), Field	4	8.33	4/5/2016	7.20	1/29/2015	8.03	units
Water Level, Field	4	13.50	4/5/2016	12.44	12/15/2015	13.14	(°C)
	5	470.10	10/29/2014	453.70	9/28/2017	459.48	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Arsenic, dissolved	6	0.01	11/4/2014	U	2/4/2015	0.01	mg/l
Barium, dissolved	6	1.87	11/4/2014	0.12	2/4/2015	0.51	mg/l
Beryllium, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Boron, dissolved	6	10.00	11/4/2014	8.70	9/28/2017	9.20	mg/l
Cadmium, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Calcium, dissolved	6	6.00	11/4/2014	U	2/4/2015	3.67	mg/l
Chromium, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Copper, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Iron, dissolved	6	1.20	11/4/2014	0.20	12/15/2015	0.58	mg/l
Lead, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Lithium, dissolved	6	3.20	11/4/2014	2.68	9/28/2017	2.93	mg/l
Magnesium, dissolved	6	7.00	1/28/2015	U	11/4/2014	5.33	mg/l
Manganese, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Mercury, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Molybdenum, dissolved	6	0.30	2/4/2015	0.20	12/15/2015	0.25	mg/l
Nickel, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Potassium, dissolved	6	24.00	1/28/2015	22.00	12/15/2015	22.83	mg/l
Selenium, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Silica, dissolved	6	22.00	9/28/2017	16.00	2/4/2015	18.83	mg/l
Sodium, dissolved	6	8,090	11/4/2014	7,490	9/28/2017	7,712	mg/l
Strontium, dissolved	6	0.30	11/4/2014	U	9/28/2017	0.14	mg/l
Vanadium, dissolved	6	U	4/5/2016	U	4/5/2016	U	mg/l
Zinc, dissolved	6	1.90	12/15/2015	U	9/28/2017	0.83	mg/l



Table 39: IRI-7 Annual Dissolution Surface Aquifer

Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Wet Chemistry							
Bicarbonate as CaCO ₃	59	23,200	9/15/10	294	9/16/91	7,713	mg/l
Carbonate as CaCO ₃	59	4,730	11/2/15	10.00	6/30/95	1,084	mg/l
Total Alkalinity as Bromide	59	24,800	11/2/15	294	9/16/91	8,688	mg/l
Cation-Anion Balance	28	33.00	8/30/90	0.10	5/21/07	7.54	mg/l
Sum of Anions	59	6.00	9/27/17	-26.00	11/2/15	-1.66	%
Sum of Cations	56	511.00	9/15/10	30.69	3/25/92	207.06	meq/l
Chemical Oxygen	56	403.00	9/15/10	31.56	5/28/91	193.63	meq/l
Chloride	25	960.00	6/14/08	37.00	9/27/17	163.36	mg/l
Conductivity, Lab	58	684.00	3/22/17	21.00	8/30/90	325.67	mg/l
Fluoride	57	30,500	9/15/10	2,500	6/16/92	12,553	µmhos
Hardness as CaCO ₃	59	46.20	3/22/17	1.30	5/28/91	26.12	mg/l
Nitrate as N, dissolved	59	135.00	6/14/08	6.00	8/30/90	25.65	mg/l
Nitrate/Nitrite as N,	28	3.22	10/22/13	0.02	5/24/05	0.51	mg/l
Nitrite as N, dissolved	28	4.14	10/22/13	0.02	9/27/17	0.61	mg/l
Nitrogen, Ammonia	28	0.92	10/22/13	0.00	5/21/07	0.15	mg/l
Nitrogen, Organic	28	7.90	11/6/14	1.17	9/15/92	4.06	mg/l
Nitrogen, Total Kjeldahl	28	46.00	6/14/08	0.50	8/22/90	7.59	mg/l
pH, lab	28	51.00	6/14/08	1.90	8/22/90	11.66	mg/l
Phosphate, total	59	9.20	6/16/92	8.30	6/30/95	8.66	units
Phosphorus, total	26	155.00	5/21/07	0.17	9/15/92	16.47	mg/l
SAR in Water	29	4.70	9/15/10	0.05	9/15/92	1.60	mg/l
Sulfate	56	1,020.00	5/21/07	88.89	3/25/92	390.18	none
Sulfide	58	2,031.00	9/16/91	2.50	6/18/96	169.18	mg/l
Total Dissolved Solids	28	3.31	8/30/90	0.00	7/31/91	0.57	mg/l
Conductivity, Field	58	24,500	9/15/10	1,708	9/15/92	9,970	mg/l
pH, Field	75	29,680	3/22/17	1,800	6/1/91	12,399	µmhos
Temperature (°C), Field	74	12.20	9/1/90	7.86	11/7/15	8.95	units
Water Level, Field	39	19.40	8/1/90	7.50	12/1/90	12.42	(°C)
	52	422.70	3/22/16	405.03	4/1/01	409.53	Ft.
Parameters	No. of Samples	High	Date	Low	Date	Average	Units
Metals							
Aluminum, dissolved	28	1.40	9/15/10	U	6/23/94	0.61	mg/l
Arsenic, dissolved	28	0.01	8/22/90	U	9/15/92	0.00	mg/l
Barium, dissolved	28	6.65	9/15/10	0.08	9/15/92	3.83	mg/l
Beryllium, dissolved	28	U	3/22/16	U	3/22/16	U	mg/l
Boron, dissolved	59	7.70	9/27/17	0.03	2/26/91	2.84	mg/l
Cadmium, dissolved	28	U	3/22/16	U	3/22/16	U	mg/l
Calcium, dissolved	59	44.00	6/14/08	1.00	5/28/91	3.52	mg/l
Chromium, dissolved	28	0.20	11/2/15	U	6/23/94	0.11	mg/l
Copper, dissolved	28	0.10	7/29/09	U	7/29/09	0.10	mg/l
Iron, dissolved	28	1.82	7/31/91	0.04	6/23/94	0.30	mg/l
Lead, dissolved	28	0.04	7/31/91	U	6/23/94	0.03	mg/l
Lithium, dissolved	28	3.20	9/15/10	0.32	9/15/92	2.00	mg/l
Magnesium, dissolved	59	10.00	12/30/96	1.00	6/16/92	4.61	mg/l
Manganese, dissolved	28	0.07	5/26/99	U	6/23/94	0.04	mg/l
Mercury, dissolved	28	U	3/22/16	U	3/22/16	U	mg/l
Molybdenum, dissolved	28	0.10	6/23/94	U	6/23/94	0.10	mg/l
Nickel, dissolved	28	0.02	6/23/94	U	6/23/94	0.02	mg/l
Potassium, dissolved	59	26.00	6/30/09	3.00	8/30/90	8.95	mg/l
Selenium, dissolved	28	0.002	7/31/91	0.001	8/30/90	0.002	mg/l
Silica, dissolved	59	34.00	11/20/01	1.50	2/26/91	17.25	mg/l
Sodium, dissolved	59	9,130	9/15/10	710	5/28/91	3,947	mg/l
Strontium, dissolved	59	2.58	3/26/97	0.18	6/16/92	1.26	mg/l
Vanadium, dissolved	28	0.06	5/26/04	U	11/2/15	0.06	mg/l
Zinc, dissolved	28	0.10	11/2/15	U	6/23/94	0.06	mg/l



Table 40: Summary of 2017 Annual Remote Water Levels

For Remote Wells (all levels taken from top of casing)						
Well / Ground Level (ft)	Depth to Water Level ft.					
	2012	2013	2014	2015	2016	2017
IRI-8 / 6573.6	316.20	314.05	314.60	317.70	318.08	317.80
IRI-9 / 6666.3	568.32	468.35	470.10	469.95	469.68	469.50
IRI-10 / 6440.7	133.95	130.30	134.40	134.58	135.54	P&A
IRI-11 / 6613.6	463.25	464.11	465.00	527.44	466.95	466.90
*MWU-2 / 6441.0	187.10	188.32	191.75	194.36	195.00	195.40
*MWA-2 / 6441.0	190.00	191.86	196.20	199.05	199.80	199.60
*MWB-2 / 6441.0	246.55	248.13	251.80	253.28	253.05	254.80
*MWD-1 / 6467.0	326.35	326.75	327.55	328.59	328.83	329.30
*MWD-2 / 6641.0	249.50	250.12	251.65	252.58	247.82	253.50
TH75-6A	283.40	286.10	287.25	293.18	298.16	298.10
TH75-6B	285.15	286.62	287.19	291.46	294.82	295.50
TH75-11A	408.40	408.58	413.30	415.76	414.94	413.70
TH75-11B	495.10	495.75	496.95	500.17	497.28	494.80
EX-2 (WL collected quarterly)	481.49	482.66	486.23	481.56	471.75	472.80



Appendix B: Subsidence Monitoring

**QUARTERLY 3M-TDR READING FOR
DECEMBER 1, 2017**

Prepared for

NATURAL SODA, INC.

December 2017

Prepared by



AGAPITO ASSOCIATES, INC.
715 Horizon Drive, Suite 340
Grand Junction, CO 81506

1726 Cole Blvd., Bldg. 22, Suite 130
Golden, CO 80401

DISCLAIMER: *This report contains professional opinions based on the survey logged with the TDR 100 instrument. AAI makes no warranties, either expressed or implied, as to the accuracy or completeness of the information herein. Opinions are based on subjective interpretations of the survey data; other equally valid interpretations may exist. Identification and control of hazardous conditions are the responsibilities of the Owner.*

1.0 INTRODUCTION

Natural Soda, Inc. (Natural Soda) commissioned Agapito Associates, Inc. (AAI) to take quarterly logs of its time domain reflectometry (TDR) surveys for monitoring subsidence from monitoring well (SMW) 3M TDR. This report presents the TDR surveys logged on December 1, 2017, for Cables #2 (Kyle) and #3 (Matt) from SMW 3M TDR. The completion diagram of SMW 3M TDR is shown in Figure 1 for reference.

2.0 TDR READINGS

The surveys were taken with AAI's Campbell Scientific, Inc. TDR 100 instrument. A propagation velocity factor (v_p) of 0.87 was used in the data processing and 2,048 data points were recorded along each cable. A waveform average of 64 points was used to eliminate background noise. Cables #1 (Blank) and #4 (Kyle2) were corrupted during installation and are not used for monitoring. No readings were taken in these cables.

3.0 WAVEFORM ANALYSIS AND RESULTS

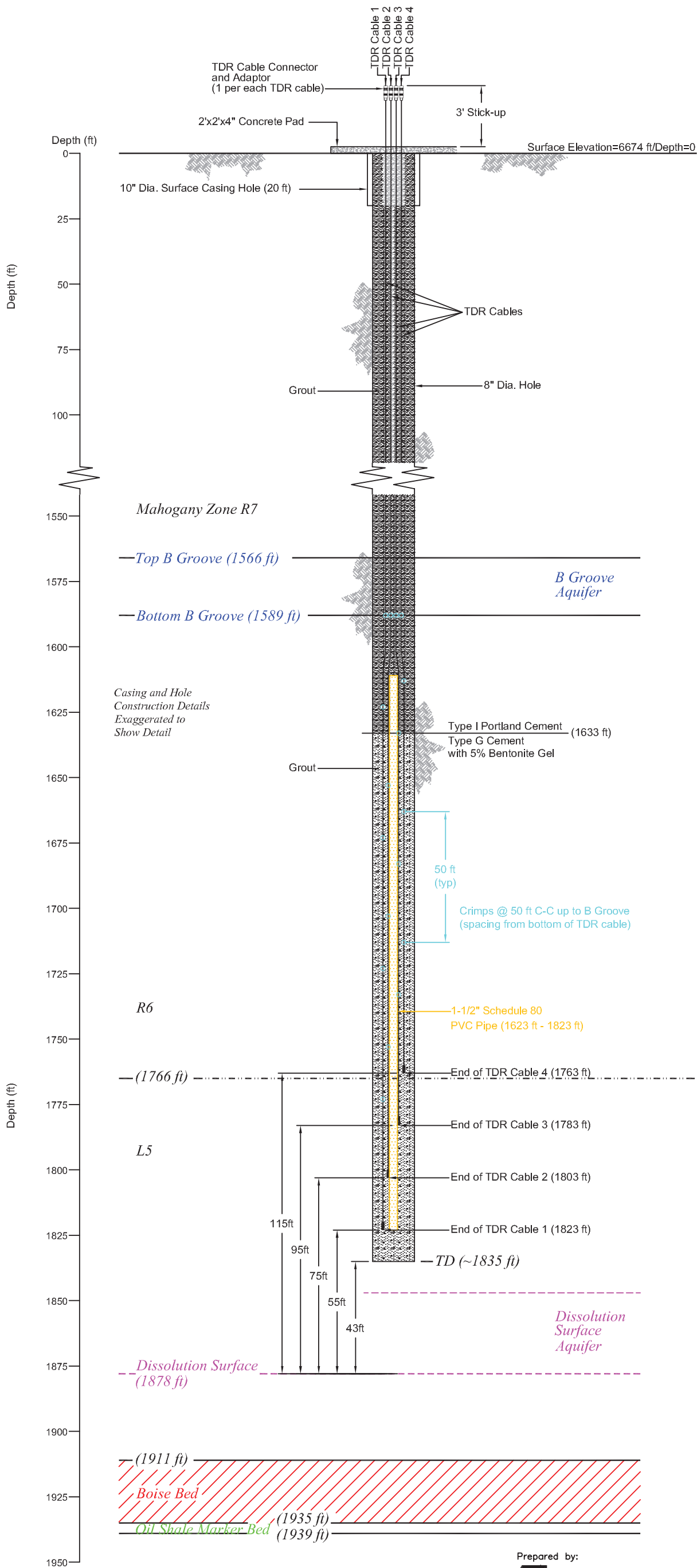
TDR waveform histories for Cables #2 and #3 are shown in Figures 2 and 3, starting with the original waveforms from December 10, 2003. Expanded waveforms are shown in Figures 4 and 5 for Cables #2 and #3, respectively. The close-up figures highlight the zone of interest between 880 and 1,960 ft deep, including the B Groove aquifer located between 1,566 and 1,588 ft.

The December 1, 2017, survey indicates that no significant ground movement has occurred around SWM 3M TDR since the cables were originally installed. This is evidenced by the constant waveform history in Cable #3 (Figure 3).

Cable #2, parallel to Cable #3, shows evidence of water infiltration into the cable starting soon after installation. This is evident in the February 17, 2004, waveform, which shows the first signs of a distorted signal beyond a depth of approximately 1,745 ft. Water causes distortion by changing the dielectric constant of the insulation material in the cable and, thus, the propagation velocity of the reflected signal. Subsequent surveys in Cable #2 show a gradual rise in the distortion elevation, symptomatic of water propagating up the cable under hydraulic pressure from a leak originating at or near the end of the cable. Similar to the most recent results, the December 1, 2017, survey indicates that water has infiltrated the cable up to a depth of about 1,438 ft.

If the cable is not mechanically deformed by ground movement, the signal distortion caused by water infiltration superimposes on the original waveform. This appears to be the process occurring in Cable #2. Cable deformation, including shearing or breakage, normally produces a sharp "spike" in the waveform, which is expected to be recognizable even through the distortion caused by water infiltration. Cable #2 shows no obvious signs of localized damage, suggesting that significant ground movement is not occurring. This is consistent with the results of Cable #3. Water infiltration is likely to continue in Cable #2 and may eventually render the cable inoperative.

Figure 1. Draft TDR String, Crimp and End Locations Relative to Dissolution Surface and R6-L5 Interface—As Built



Prepared by:
AGAPITO ASSOCIATES, INC.
CONSULTING ENGINEERS



CLIENT: Natural Soda, Inc.

TDR BOREHOLE No. Cable 2 (Kyle)

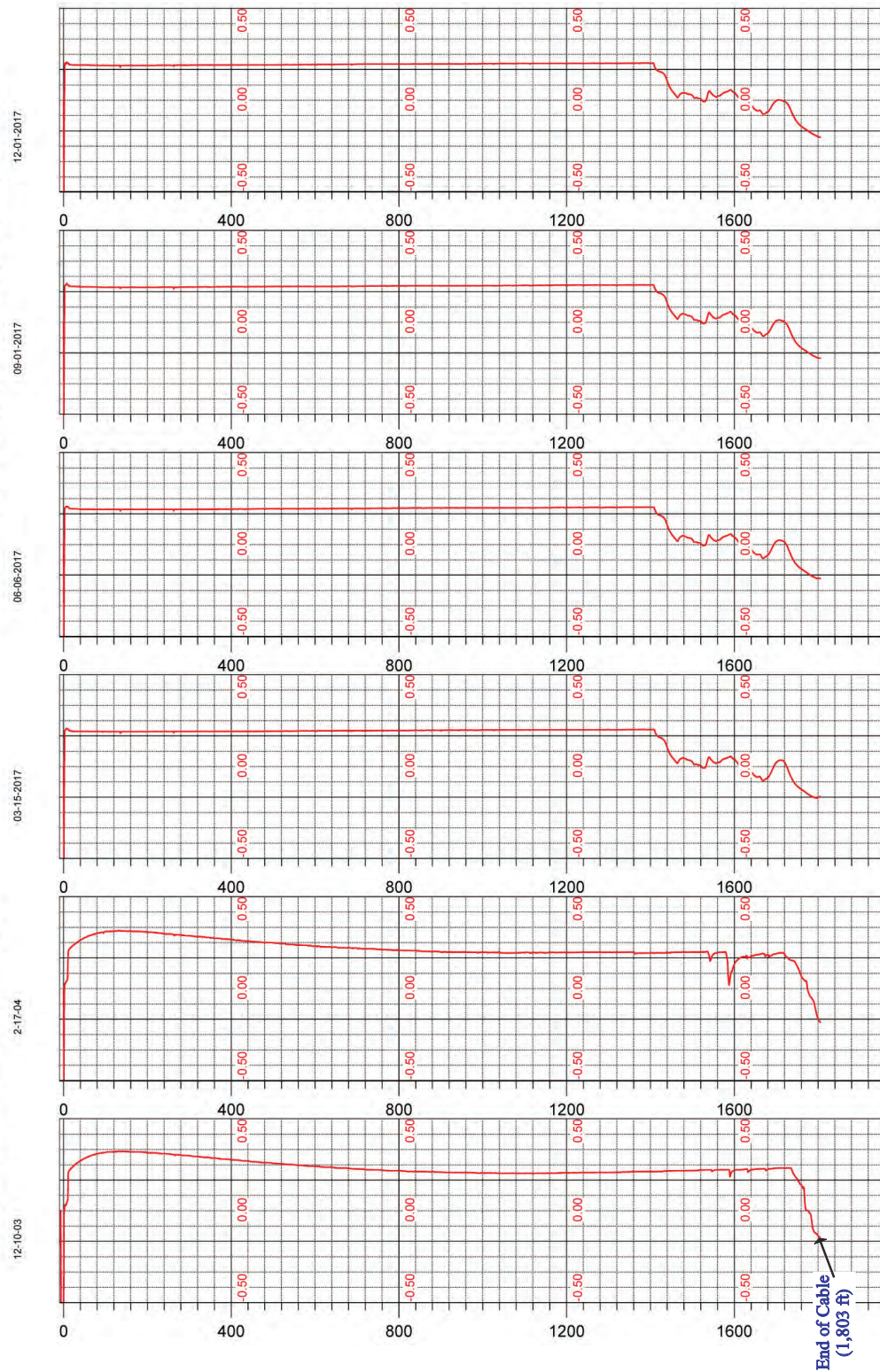


Figure 2. Comparison of Waveforms (December 10, 2003; February 17, 2004; March 15, June 6, September 1, and December 1, 2017) for 3M-TDR Cable #2 (Kyle)



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TDR BOREHOLE No. Cable 3 (Matt)

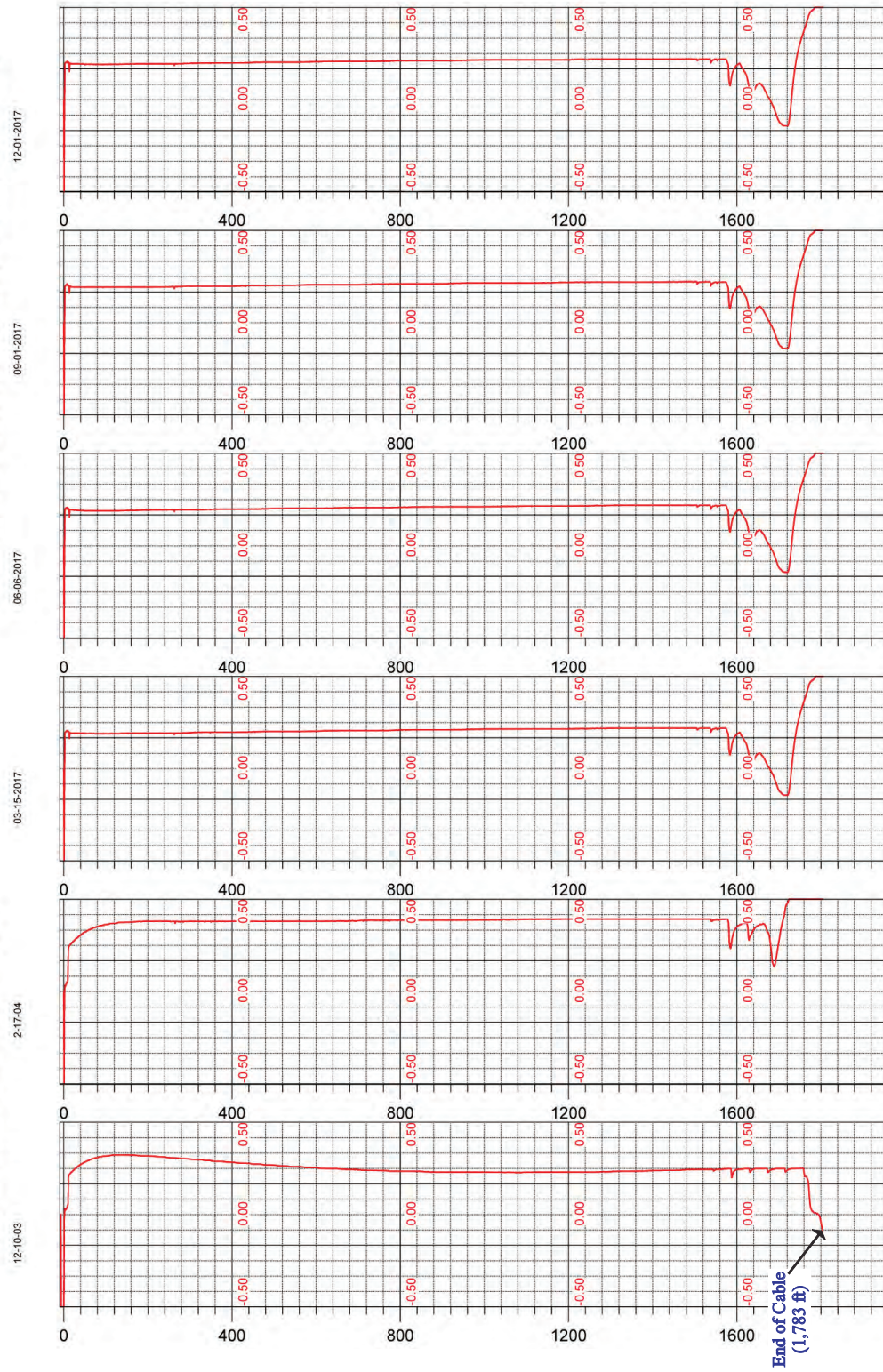


Figure 3. Comparison of Waveforms (December 10, 2003; February 17, 2004; March 15, June 6, September 1, and December 1, 2017) **for 3M-TDR Cable #3 (Matt)**



CLIENT: Natural Soda, Inc.

TDR BOREHOLE No. Cable 2 (Kyle)

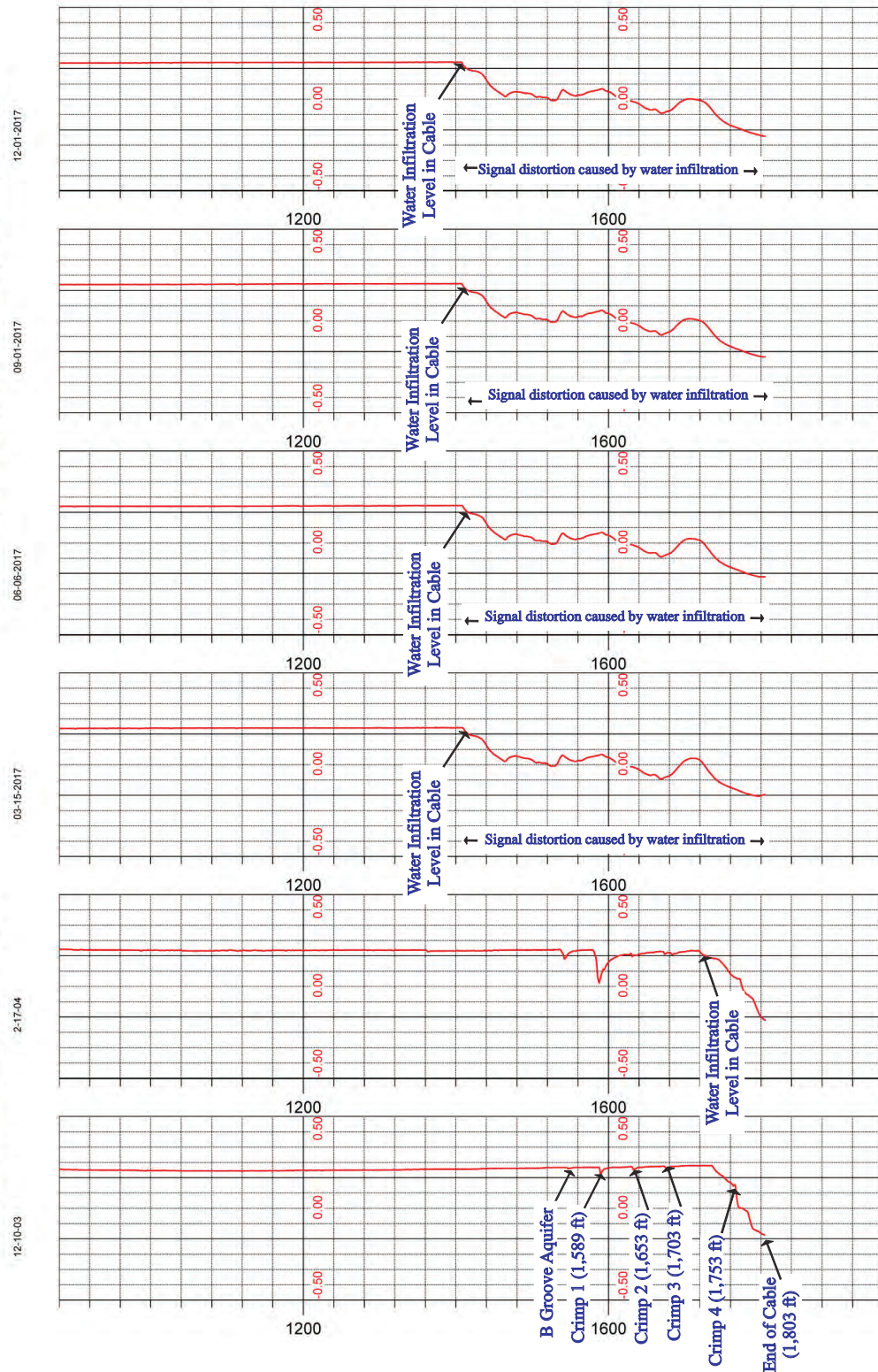


Figure 4. Comparison of Close-Up Waveforms (December 10, 2003; February 17, 2004; March 15, June 6, September 1, and December 1, 2017) for 3M-TDR Cable #2 (Kyle)



CLIENT: Natural Soda, Inc.

TDR BOREHOLE No. Cable 3 (Matt)

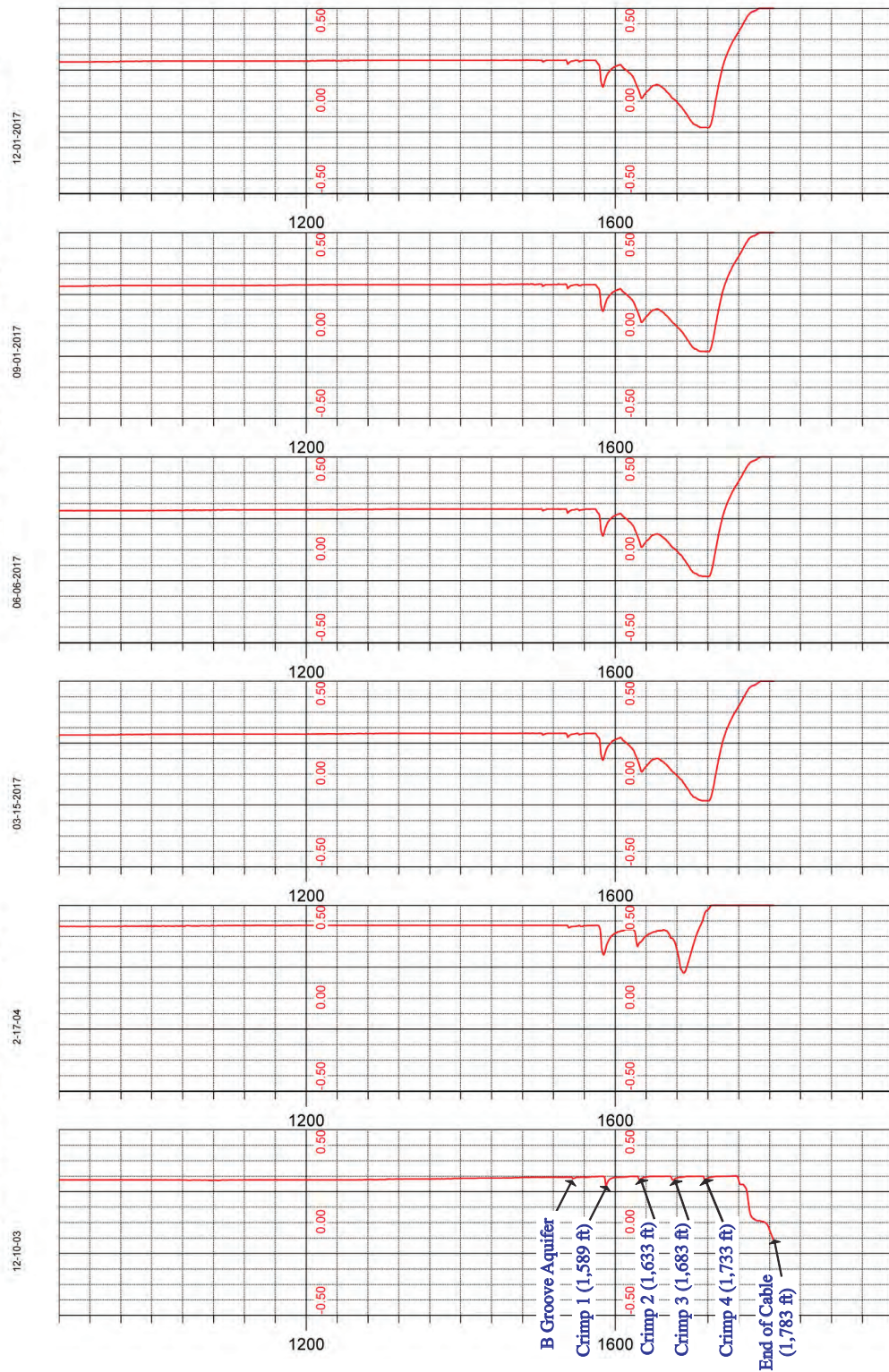


Figure 5. Comparison of Close-Up Waveforms (December 10, 2003; February 17, 2004; March 15, June 6, September 1, and December 1, 2017) for 3M-TDR Cable #3 (Matt)



Agapito Associates, Inc.
Consulting Engineers and Geologists

CLIENT: Natural Soda, Inc.

TDR BOREHOLE No. 4A 5M (Cable B)

03-4-2007

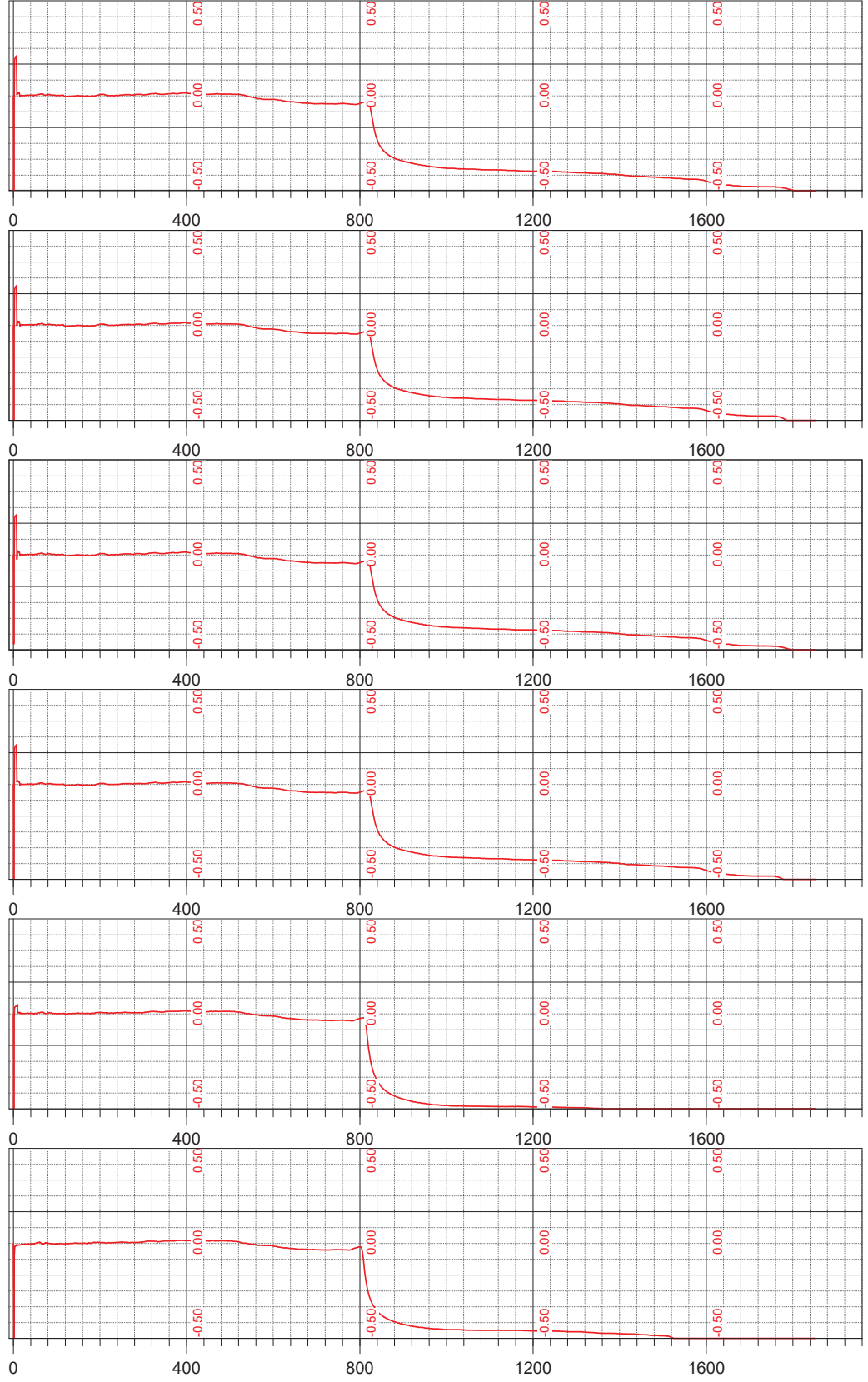
06-29-2007

03-15-2017

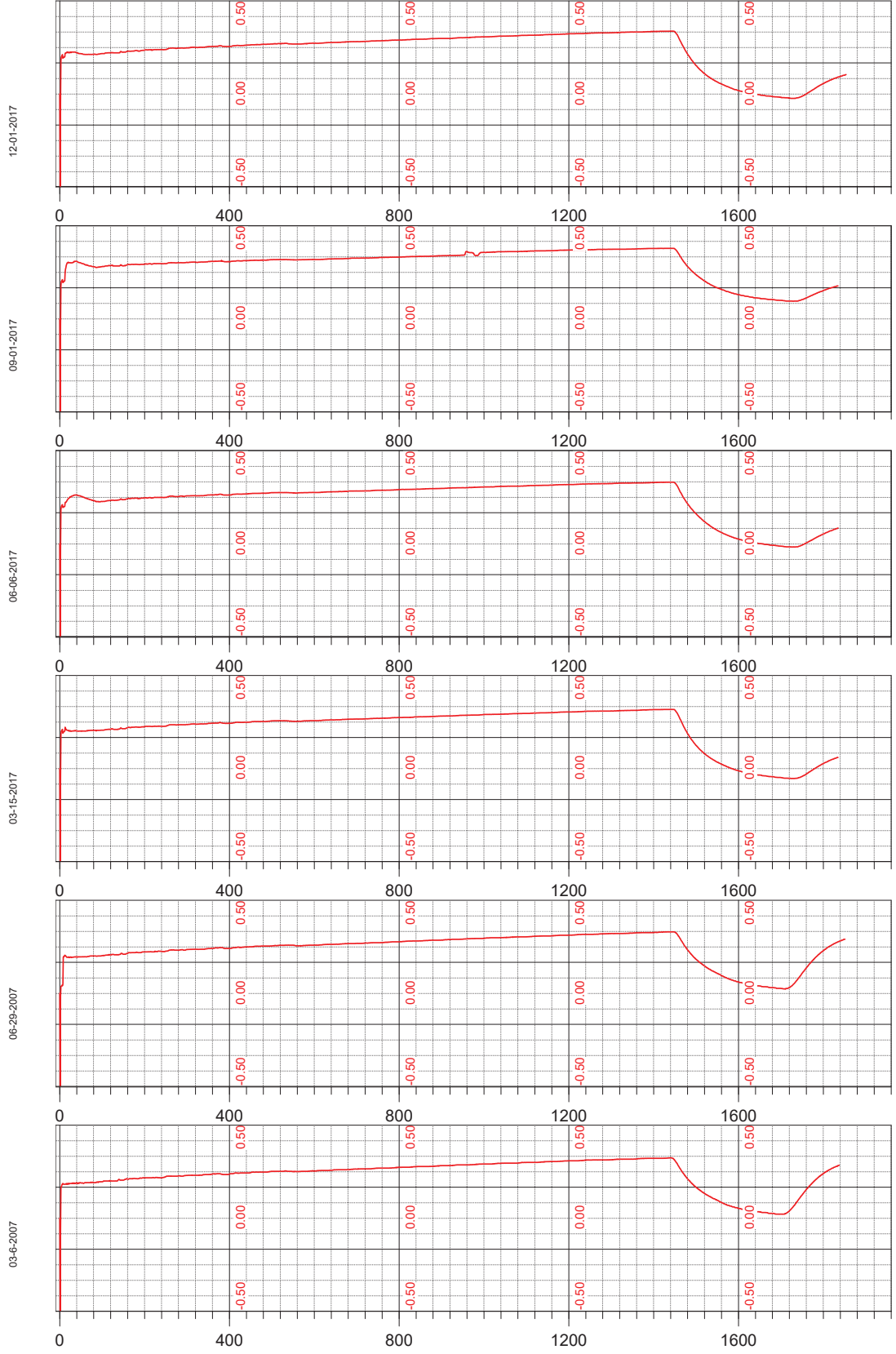
06-06-2017

09-01-2017

12-01-2017

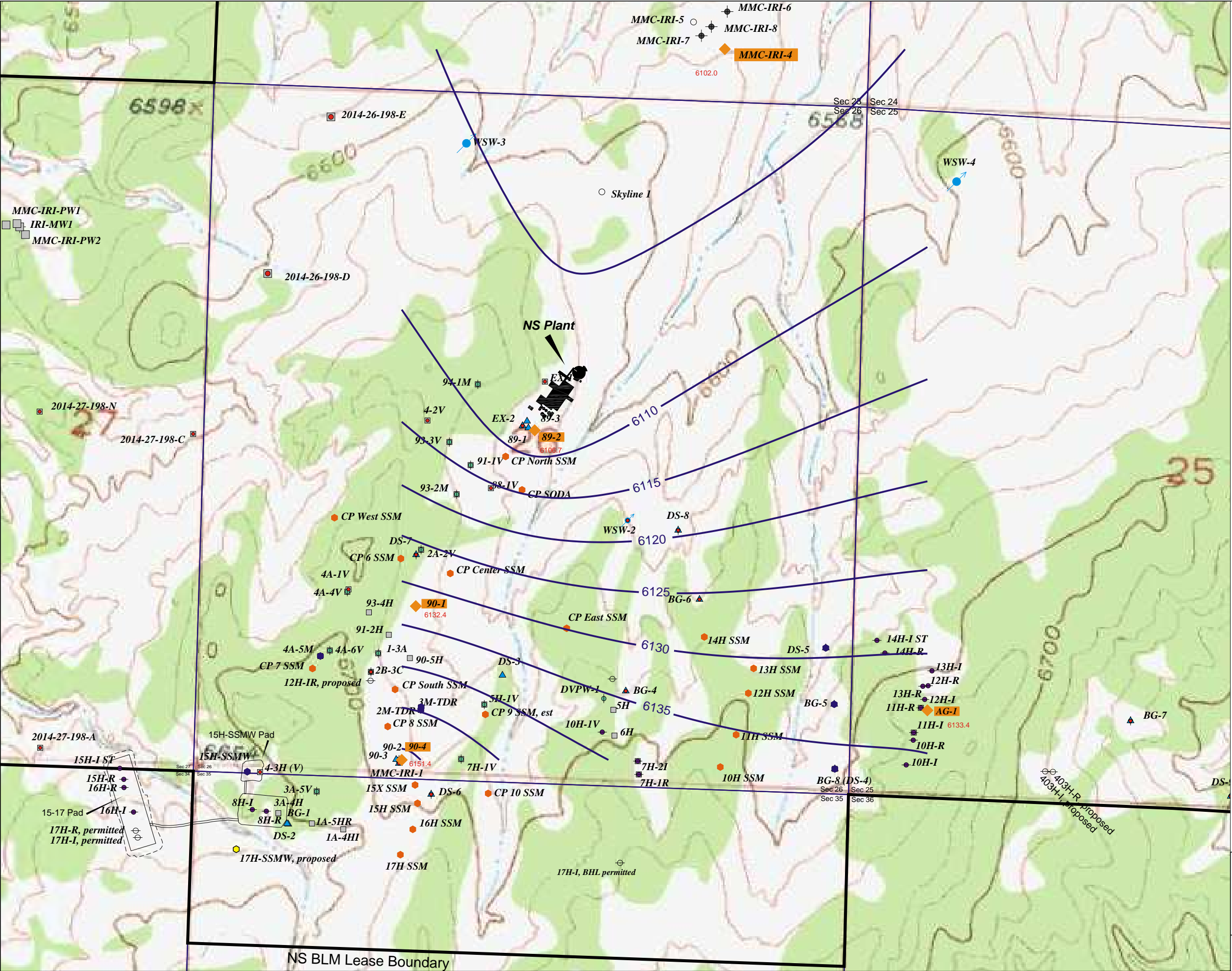


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Appendix C: Potentiometric Surface Maps (**Confidential**)

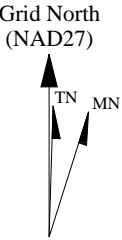
CONFIDENTIAL



Legend

- Horizontal Well
- Vertical Well
- Hydrology Monitoring Well
- Abandoned Well
- Core Hole
- Drillhole
- Water Supply Well
- Subsurface Subsidence Monitor Well (SSMW)
- Surface Subsidence Monument (SSM)
- 89-2 A-Groove Aquifer Water Level

Contour Interval: 5 feet



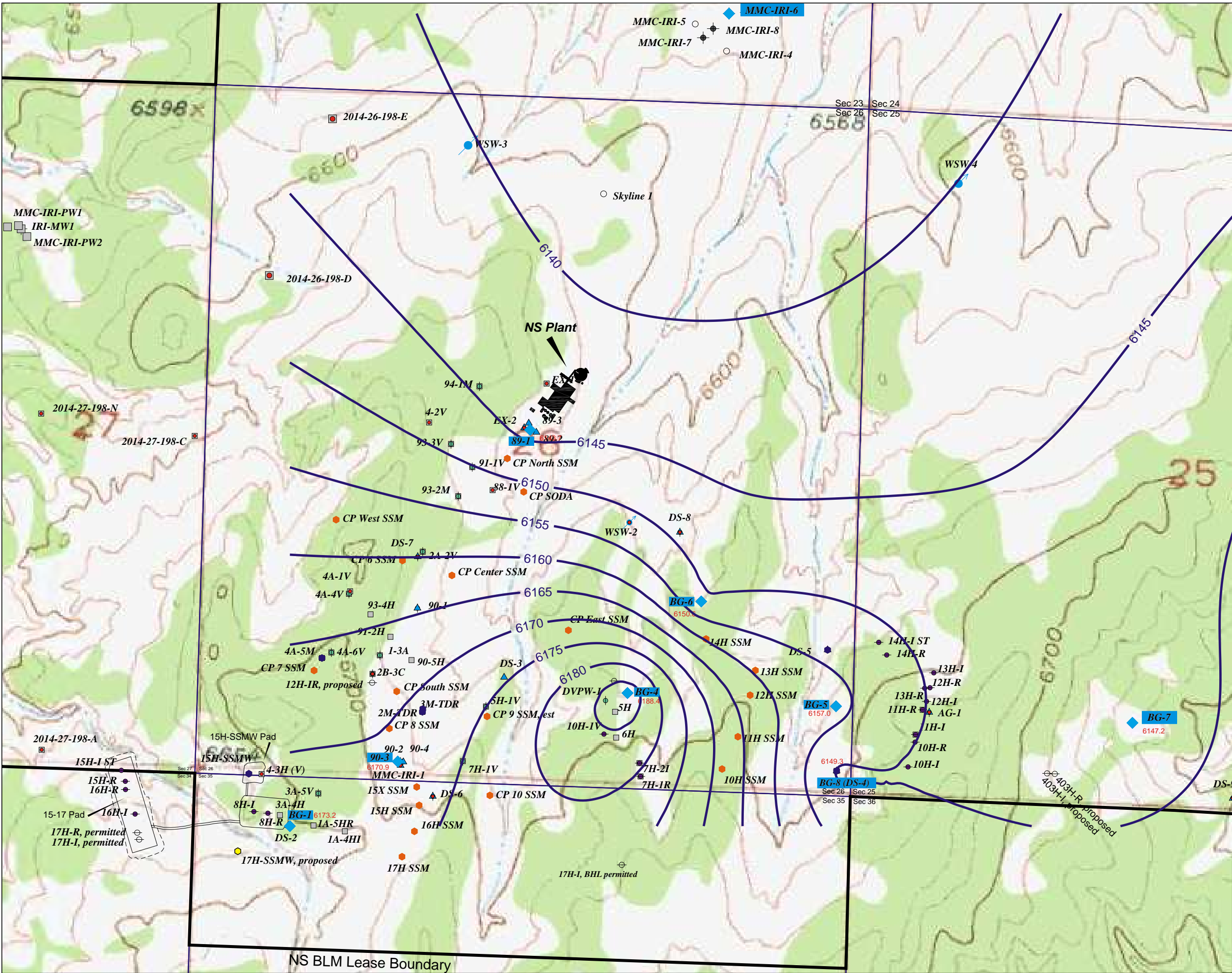
0 250 500
Scale in Feet

Natural Soda LLC
Average 2017 Potentiometric Surface
A-Groove Aquifer
T1S, R98W Rio Blanco County, CO









Daub & Associates, Inc.

Date:
October 5, 2017

CONFIDENTIAL

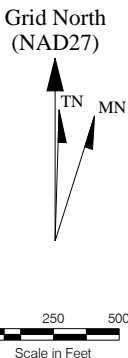


Legend

-  Horizontal Well
-  Vertical Well
-  Hydrology Monitoring Well
-  Abandoned Well
-  Core Hole
-  Drillhole
-  Water Supply Well
-  Subsurface Subsidence Monitor Well (SSMW)
-  Surface Subsidence Monument (SSM)

BG-6 B-Groove Aquifer Water Level

Contour Interval: 5 feet



Natural Soda LLC
Average 2017 Potentiometric Surface
B-Groove Aquifer
T1S, R98W Rio Blanco County, CO

Daub & Associates, Inc.

Date:
October 5, 2017

Appendix D: *2016 Vegetation Monitoring Reclamation Status Report*

Prepared by Rusty Roberts.

**Reclamation Status Report
2017 Vegetation Monitoring Results for Reclaimed Well Pads**

**Evaluating Status of Current Plant Communities on Reclaimed Well Pads in meeting
Criteria for Successful Reclamation**

**Prepared for:
Natural Soda LLC
Rifle, Colorado**

**Prepared by:
Rusty Roberts
Meeker, Colorado**

January 2018

Table of Contents

Introduction.....	1
Criteria for Successful Reclamation of Disturbed Areas	1
Vegetation Sampling Methods Utilized to Measure Criteria for Successful Reclamation.....	1
Summary of Results for Reclaimed Well Pads in Achieving Reclamation Goals	3
Vegetation Sampling Methods and Procedures for Reclaimed Pads and Reference Areas	4
Vegetation Sampling Results for Undisturbed Native Rangeland Reference Areas	5
Monitoring Results and Evaluation of Criteria for Well Pads in Final Reclamation Status.....	6
Well Pad 1-3A.....	6
Well Pad 4A-1V	8
Well Pad 5H-1V	10
Well Pad 91-2H.....	12
Well Pad 93-2M.....	14
Well Pads 93-4H.....	16
Location Map	19
Appendix A – Vegetation Sampling Data Native Rangeland Reference Areas	20
Table A1 - Vegetation Cover, Species Composition, Species Density & Ground Cover	20
Table A2 - Canopy Gap Intercept Data	21
Table A3 - Transect Coordinate Locations	21
Transect Photos Native Rangeland Reference Areas.....	21
Appendix B – Vegetation Sampling Data Reclaimed Well Pad 1-3A.....	22
Table B1 - Vegetation Cover, Species Composition, Species Density & Ground Cover	22
Table B2 - Canopy Gap Intercept Data.....	22
Table B3 - Transect Coordinate Locations	23
Transect Photos and Transect Layout Plot.....	23
Appendix C – Vegetation Sampling Data Reclaimed Well Pads 4A-1V	24
Table C1 - Vegetation Cover, Species Composition, Species Density & Ground Cover	24
Table C2 - Canopy Gap Intercept Data.....	24
Table C3 - Transect Coordinate Locations	25
Transect Photos and Transect Layout Plot.....	25
Appendix D – Vegetation Sampling Data Reclaimed Well Pad 5H-1V	26
Table D1 - Vegetation Cover, Species Composition, Species Density & Ground Cover	26
Table D2 - Canopy Gap Intercept Data	27
Table D3 - Transect Coordinate Locations	27
Transect Photos and Transect Layout Plot.....	27

Appendix E – Vegetation Sampling Data Reclaimed Well Pad 91-2H.....	28
Table E1 - Vegetation Cover, Species Composition, Species Density & Ground Cover	28
Table E2 - Canopy Gap Intercept Data.....	29
Table E3 - Transect Coordinate Locations	29
Transect Photos and Transect Layout Plot.....	29
Appendix F – Vegetation Sampling Data Reclaimed Well Pad 93-2M	30
Table F1 - Vegetation Cover, Species Composition, Species Density & Ground Cover	30
Table F2 - Canopy Gap Intercept Data	31
Table F3 - Transect Coordinate Locations.....	31
Transect Photos and Transect Layout Plot.....	31
Appendix G – Vegetation Sampling Data Reclaimed Pad 93-4H	32
Table G1 - Vegetation Cover, Species Composition, Species Density & Ground Cover	32
Table G2 - Canopy Gap Intercept Data	32
Table G3 - Transect Coordinate Locations	33
Transect Photos and Transect Layout Plot.....	33

Introduction

The Bureau of Land Management (BLM) and the State of Colorado require reclaimed lands to be revegetated in a manner that establishes a diverse, effective, and long-lasting vegetation cover that is equal or nearly so to the natural vegetation of the surrounding areas. Natural Soda's approved mine plan requires periodic monitoring to evaluate the success of revegetation efforts.

Vegetation cover, species composition, species density and ground cover data were collected from undisturbed reference area sites on Natural Soda's lease area near their current mining operations. The data collected from undisturbed areas is used in comparison to the vegetation cover, species composition, species density and ground cover data collected from reclaimed well pad sites to determine if the site have met the criteria for successful reclamation.

Data was collected from six well pad sites that have been plugged and abandoned and are in final reclamation status and from four undisturbed reference area sites near the six well pads. Table 1 lists the well pads in final reclamation status for which data was collected in 2017.

Criteria for Successful Reclamation of Disturbed Areas

BLM approved Natural Soda's plant expansion in August 2015. The approval for the expansion modified the criterion for successful reclamation of disturbances from what had been utilized in prior years. The new criteria for successful reclamation must reflect a plant community of at least five desirable plant species where no one species may exceed 70 percent relative cover and desired foliar cover, bare ground, and shrub and/or forb density must have 80 percent similarity in relation to the identified desired plant community.

The desired plant community referenced in the criteria refers to an ecological site present at or near the area of disturbance. Two ecological sites occur on the parts of the lease area being actively mined, a pinyon and juniper woodland site and a rolling loam rangeland site. Several of the sites were along the fringe of the pinyon and juniper community and had soils of both a woodland site and a rangeland site. The vegetative values in the criteria are based on the capability of a site in an early seral plant community, which is basically an herbaceous species dominated site with varying amounts of shrub species. The rolling loam rangeland site reflects more of the capability of a site in an early seral plant community, thus, data collected from the four rolling loam rangeland reference areas were used to evaluate the success of the plant community on each reclaimed pad in achieving the reclamation criteria.

The scientific and common names of the plant species encountered within the sampling from undisturbed sites and from each well pad site are presented in tables in the appendix.

Vegetation Sampling Methods Utilized to Measure Criteria for Successful Reclamation

Data was collected based upon recommendations in White River Field Office's Surface Reclamation Plan which require that vegetation cover, composition, and diversity data be gathered using quantitative methods to measure the six Core Terrestrial Indicators and Methods

in BLM Technical Note 440. BLM approved sampling methods are found in Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems, Volume I and II: Quick Start.

The six core terrestrial indicators include:

- (1) Bare Ground: The amount of bare ground is accepted as one of the most sensitive indicators of resource condition in rangelands. A large percentage of bare ground can be an indicator of high erosion potential, low forage production, poor wildlife habitat, and increased risk of invasion by nonnative plant species.
- (2) Vegetation Composition: Vegetation composition data, including the cover of groups of species are indicators generated from the same data, and when used together, are sensitive to most changes and are useful when determining the status of key species in a plant community.
- (3) Nonnative Invasive Plant Species: The presence and cover of nonnative species is acquired as a component of vegetation composition. Nonnative invasive species have the ability to significantly alter sustainability and site resilience.
- (4) Plant Species of Management Concern: The presence and cover of plant species of management concern is also acquired as a component of vegetation composition. Plant species of management concern can be sensitive to site disturbance, provide important ecosystem functions, or contribute to biological diversity.
- (5) Vegetation Height: The vertical structure of vegetation which can be used to characterize wildlife habitat and estimate wind erosion potential.
- (6) Proportion of Soil Surface in Large Intercanopy Gaps: Canopy gap intercept measures the proportion of a line covered by large gaps between plant canopies and is an important indicator of the potential for erosion.

Line-point intercept with plot-level species inventory was the vegetation monitoring technique used to measure the core indicators of bare ground, vegetation composition, non-native invasive plant species and plant species of management concern.

Line-point intercept is a rapid, accurate method for quantifying soil cover, including vegetation, litter, rocks and biological crusts. The theory behind this method is that if an infinite number of points are placed in a two-dimensional area, the cover of a plant species can be determined by counting the number of points that hit that species. These measurements are related to wind and water erosion, water infiltration, and the ability of the site to resist and recover from disturbance.

Gap intercept measurements were made along the line-point intercept transect line to provide information about the proportion of the line covered by large gaps between plants. Large gaps between plant canopies are important indicators of increased susceptibility to water erosion and runoff, wind erosion, weed invasion, and wildlife habitat.

A plot-level plant species inventory provides a rapid estimate of species richness. A 50 square meter area search area at each site was utilized to record all plant species occurring within the plot. A thorough search of the plot can detect less-frequently occurring species that may not have been recorded in line-point intercept cover measurements.

Shrub and forb density also a criteria for successful reclamation are not measured by the sampling methods used for the other criteria. Forb and shrub density measurements were taken from one-meter square density quadrants along the same line-point intercept transect line used for the other sampling techniques.

Summary of Results for Reclaimed Well Pads in Achieving Reclamation Goals

Vegetation cover, plant species composition, ground cover and shrub and forb density data were collected from four rolling loam reference areas and from six well pad sites that have been plugged and abandoned and are in final reclamation status. Data was collected from July 26 thru August 1, 2017. Table 1 lists the well pads in final reclamation status for which data was collected in 2017. The location of sites monitored are illustrated on the attached location map.

None of the reclamation efforts on the 6 well pads examined are a failure. The vegetation communities that have established on these reclaimed well pads are mostly the perennial species planted during reclamation. Many of the perennial species especially the grasses, are well established providing a plant community resilient to drought periods. The plant communities on all 6 are providing adequate soil protection and have stabilized each site.

Table 1 is a summary of the progress of each site monitored in achieving successful reclamation. The site specific monitoring results for each site are discussed in detail later.

Table 1 - Summary of Results for Reclaimed Well Pads in Achieving Successful Reclamation Criteria							
Well Pad #	Criteria for Successful Reclamation of Disturbed Areas						Criteria Met
	at least five desirable plant species where no one species may exceed 70 percent relative cover		desired foliar cover, bare ground, and shrub and/or forb density must have 80 percent similarity in relation to the values measured on nearby undisturbed native rangelands				
	the number of desired plant species present	the relative cover of the desired species with the greatest cover	% similarity of desired foliar cover	% similarity of bare ground	% similarity of shrub density	% similarity of forb density	
	2017 Data Collected from Well Pads in Final Reclamation Status						
1-3A	19 species	7.3 %	62 %	36 %	39 %	82 %	no
4A-1V	16 species	10.7 %	46 %	49 %	11 %	110 %	no
5H-1V	21 species	24.0 %	91 %	67 %	36 %	50 %	no
91-2H	20 species	13.3 %	86 %	85 %	86 %	50 %	yes
93-2M	20 species	20.0 %	63 %	67 %	47 %	14 %	no
93-4H	17 species	8.7 %	42 %	54 %	18 %	65 %	no
	2017 Baseline Data Collected from Undisturbed Native Rangeland Reference Areas						
	30 species	24 %	67 %	17.0 %	2.2	5.65	
Note: values in red are below the criteria required for successful reclamation							

Vegetation Sampling Methods and Procedures for Reclaimed Pads and Reference Areas

The line-point intercept with plot-level species inventory was the vegetation sampling protocol used on both the reclaimed pads and associated reference areas. The procedure involves random placement of a transect line (measuring tape) as the base for data collection. Values for foliar cover, basal cover, species composition and bare ground were measured at specific points along the line. Gaps in vegetation canopy were measured along the same tape line. Density quadrants were placed adjacent the line at specific points.

A 50 meter tape was used for the baseline transect for each of the four rolling loam reference areas. A 25 meter tape was used for the baseline for all transects placed on the reclaimed pads. Three transects were placed on each reclaimed pad.

The following techniques were used to collect the sample data:

- The beginning and ending points of each transect were recorded using a GPS receiver. Azimuths from the 0-meter to the 50-meter point were recorded.
- Photographs were taken at each transect that show vegetation features at the time of sampling.
- Point count data were collected at 1-meter intervals along a 50-meter tape or at 0.5-meter intervals along a 25-meter tape using a thin, straight metal rod (pin flag) for a total of fifty samples taken along each transect.
 - The first plant species in the canopy hit by the drop of a pin flag at each sample point was recorded by species in the “Top Layer”. The total of top layer hits were used to determine total foliar cover for the study site and the total foliar cover for each species hit in the top layer.
 - Subsequent plant species and vegetative litter hits were recorded in the “Lower Canopy Layers”. Vegetative litter was recorded as either unattached herbaceous or woody litter.
 - Species composition based upon total of all plant species encountered in the top layer and the lower layers at each sample point and recorded by species and summarized by plant group.
 - Soil surface hits were recorded as plant species basal intercepts, lichen crust, moss, embedded litter, duff or bare soil. Bare ground percent was determined by a bare soil hit with no canopy intercepts in the top and lower canopy layers.
- Canopy gaps were recorded directly below the transect tape line. Only perennial plant species were used in the vegetative canopy. Annual species if present were not included as part of the gap. Gaps larger than 20 centimeters were recorded for the length of each transect. Gaps were totaled into gap sizes (21 to 50; 51 to 100; 101 to 200; >200). Though the gap data is not used in evaluating reclamation criteria, it was collected as a visualization of perennial species cover.
- Forb and shrub density data were taken from one-meter square density quadrants alongside the same line-point intercept transect line used for the other sampling techniques. Quadrants were placed at every 5th sample point along the transect tape for a total of 10 one-meter density quads for each transect. Only forb and shrub densities are required in the criteria for successful reclamation. The total number of forb and shrub

species rooted in each quad were counted and recorded by species and summarized by plant group. Densities for grasses or trees were not collected.

- A plot-level plant species inventory was conducted within approximately 50 square meter search area at each site. In addition to those plant species recorded during sampling, other species not encountered during sampling but were observed in the sample area were recorded for species richness.

Vegetation Sampling Results for Undisturbed Native Rangeland Reference Areas

Vegetation cover, species composition, species density and ground cover data were collected from four rolling loam rangeland sites on July 27 and August 1, 2017. Transects were established in the four rolling loam sites which represent the site characteristic's common in the project area. The pre-disturbance vegetation of the reclaimed well pads examined had pinyon and juniper tree cover over all or portion of the site. Several of the sites were along the fringe of the pinyon and juniper community and had soils of both a woodland site and a rangeland site. The vegetative values in the criteria are based on the capability of a site in an early seral plant community, which is basically an herbaceous species dominated site with varying amounts of shrub species. The rolling loam rangeland site reflects more of the capability of a site in an early seral plant community, thus, data collected from the four rolling loam rangeland reference areas were used to evaluate the success of the plant community on each reclaimed pad in achieving the reclamation criteria.

Values for foliar cover, basal cover, species composition and bare ground were collected from four 50 meter transects for a total of 200 sample points. Values for forb and shrub densities were collected from 40 one-meter square quadrants. The data collected from the four reference areas are summarized in Table 2.

Table 2 - Rolling Loam Reference Areas						
Vegetation Cover, Species Composition, Species Density & Ground Cover						
Plant Group		Line-Point Canopy Intercept Data ¹				Density Data ²
		Number of Species	% Foliar Cover	% Basal Cover	Species Composition	Forb/Shrub Density (#/m ²)
Perennial Grasses		6	43.5	8.0	65.6	Not collected
Invasive Non-Native Grasses		1	1.5	0.0	2.3	Not collected
Desirable Forb Species		17	1.5	0.5	5.3	5.65
Invasive and Non-Native Forbs		2	0.0	0.0	0.0	0.33
Shrubs		7	22.0	0.5	26.8	2.2
Vegetation Totals		33	68.5	9.0	100.0	8.18
Line-Point Intercept Soil Surface Cover Data ³						
Percent Cover Type	Bare Ground	Biotic Crust	Herbaceous Litter	Woody Litter	Duff	Rock
	17.0	3.5	53.0	3.5	0.0	0.0
¹ Sum of data from 4 randomly placed 50 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point.						
² Sum of density data collected from 10 one meter square quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria.						
³ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.						

The specific vegetation sampling data collected from the four rolling loam rangeland sites are presented in Appendix A. Data in the appendix include (1) vegetation cover, ground cover, species composition, and forb and shrub densities; (2) listing of plant species encountered; (3) GPS coordinate data for the transect start and end points; (4) inter-canopy gaps and (5) photographs of each transect.

Monitoring Results and Evaluation of Criteria for Well Pads in Final Reclamation Status

Vegetation cover, species composition, species density and ground cover data were collected from 6 reclaimed disturbed sites from July 26 thru August 1, 2017. The disturbed sites included 6 well pads in final reclamation status: 1-3A, 4A-1V, 5H-1V, 91-2H, 93-2M, and 93-4H. Well pad locations are noted on the attached location map.

In the data collected in 2016 well pads 4A-1V, 91-2H and 93-4H were combined as one site. Upon examining these sites in 2017, differences in the plant communities on these sites were observed, especially the difference in the cover of shrub species. Thus, each site was treated as separate sites for data collection to better evaluate the plant community established on each.

Vegetation sampling data collected for the 6 reclaimed well pads are presented in the Appendix B through Appendix G.

- Appendix B – vegetation sampling data for reclaimed well pad 1-3A.
- Appendix C – vegetation sampling data for reclaimed well pad 4A-1V.
- Appendix D – vegetation sampling data for reclaimed well pad 5H-1V.
- Appendix E – vegetation sampling data for reclaimed well pad 91-2H.
- Appendix F – vegetation sampling data for reclaimed well pad 93-2M.
- Appendix G – vegetation sampling data for reclaimed well pad 93-4H.

Vegetation sampling data in the appendixes include (1) vegetation cover, ground cover, species composition, and forb and shrub densities; (2) listing of plant species encountered; (3) GPS coordinate data for the transect start and end points; (4) inter-canopy gaps; (5) photographs of each transect and (6) plot diagram of transect layouts.

Well Pad 1-3A

This site was within the 4th growing season since being reclaimed when data was collected on July 26, 2017. Three 25 meter transects were placed in a spoke pattern on the pad with 50 sample points on each transect for a total of 150 points for cover data. Ten one meter square density quadrants were placed along each transect for a total of 30 quadrants. Data collected from this site include vegetative foliar and basal cover, species composition, forb and shrub densities and ground cover all summarized by plant group. In addition, ground cover data was collected for dead vegetative litter, bare ground and surface rock. Table 3 compares the data collected in 2016 and in 2017 for this site.

The 2017 data in the Table 3 is summarized from data collected in 2017 which is presented in Appendix Table B1. Each plant species encountered at this site is listed in Table B1. As shown in Table B1 there is a good representation of the seeded species established on the site.

Table 3 - Reclaimed Pad 1-3A Vegetation Cover, Species Composition, Species Density & Ground Cover												
Plant Group	Line-Point Canopy Intercept Data ¹								Density Data ²			
	Number of Species		% Foliar Cover		% Basal Cover		Species Composition		Forb/Shrub Density (#/m ²)			
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017		
Perennial Grasses	9	8	35.3	29.3	6.0	4.0	46.4	56.1	n/a	n/a		
Invasive Non-Native Grasses	1	1	5.3	3.3	0.0	0.0	7.9	6.1	n/a	n/a		
Desirable Forb Species	4	7	27.3	8.0	3.3	1.3	32.5	19.5	1.67	4.63		
Invasive and Non-Native Forbs	4	4	14.0	4.7	0.0	0.0	19.2	8.5	0.51	3.69		
Shrubs	2	4	2.0	4.0	0.0	0.0	2.0	9.8	0.20	0.86		
Vegetation Totals	20	24	78.6	49.3	9.3	5.3	100.0	100.0	2.38	9.18		
Line-Point Intercept Soil Surface Cover Data ³												
Percent Cover by Type	Bare Ground		Biotic Crust		Herbaceous Litter		Woody Litter		Duff		Rock	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
	19.3	26.7	0.0	0.0	44.7	44.0	0.0	0.0	0.0	0.0	0.7	0.0
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point.												
² Sum of density data collected from ten 1-meter square quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria.												
³ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.												

This site was heavily grazed by cattle prior to the time sampling data was collected on July 26, 2017. The site is fenced to exclude livestock but some of the fence appeared to have been damaged by cattle allowing them access to the site. Most of the perennial grasses and forbs were heavily grazed. The climatic conditions in 2017 were unfavorable following the grazing event not providing sufficient soil moisture to allow any regrowth of the grazed species. It also appeared the presence of livestock has resulted in an increase in the amount invasive weedy species on the site.

Substantial changes in foliar cover and bare ground occurred in 2017 as a result of the grazing impacts to the site as compared to those values in 2016. Foliar cover declined 37 percent in 2017. The amount of unprotected bare ground increased 28 percent. A six fold increase in the densities invasive and non-native forb species occurred in 2017. Canopy gaps measured along the transect tapes are an indicator of the cover of perennial species. Canopy gaps between perennial species increased 35 percent. One positive change was that desirable forb densities nearly doubled.

Table 4 is a comparison of the data collected for reclaimed well pad 1-3A with that of the rolling loam rangeland reference areas. Only the data required to access the success of achieving successful reclamation is used in Table 4.

Table 4 – Comparison of Reclamation Criteria Elements with Undisturbed Reference Areas					
Site	# desired plant species	% desired foliar cover	% bare ground	shrub density (#/m ²)	forb density (#/m ²)
Reclaimed Pad 1-3A	19 species	41.3	26.7	0.86	4.63
Reference Area ¹	30 species	67.0	17.0	2.2	5.65
¹ The average of four undisturbed native rangelands reference areas were used as the base for evaluating success of the reclamation criteria.					

Evaluation of successful reclamation of the disturbance on Pad 1-3A:

- There are 19 desirable plant species established on the site (8 perennial grasses, 7 desirable forbs, and 4 shrubs) meeting the required five plant species.
- Russian wildrye (*Psathyrostachys juncea*) was the desired species with the greatest relative cover at 7.3% meeting the requirement that no one species can exceed 70% relative cover.
- The foliar cover of desirable species on the site was 62% of that on the rolling loam rangeland reference areas not meeting the requirement of 80% similarity.
- The amount of unprotected bare ground on the site was 64% greater than on the rolling loam rangeland reference areas which equates to 36% similarity, not meeting the required 80% similarity.
- The density of forbs and shrubs on the site in comparison with the rolling loam rangeland reference areas was 82% and 39%, respectively. The criteria only require either forb density or shrub density meet the requirement of 80% similarity. The forb density has 82% similarity which meets this criteria.

The plant community established on this site is representative of the seed mix utilized, is capable of persisting without continued intervention and should allow plant community successional processes to progress. Increased vigilance to maintain the enclosure fence to protect the site from extensive livestock grazing use, should allow the plant community to meet the criteria established for successful reclamation of the disturbance at this site.

Well Pad 4A-1V

This site was within the 10th growing season since being reclaimed when data was collected on July 28, 2017. Three 25 meter transects were placed in a spoke pattern on the pad with 50 sample points on each transect for a total of 150 points for cover data. Ten one meter square density quadrants were placed along each transect for a total of 30 quadrants. Data collected from this site include vegetative foliar and basal cover, species composition, forb and shrub densities and ground cover all summarized by plant group. In addition, ground cover data was collected for dead vegetative litter, bare ground and surface rock.

Table 5 compares the data collected in 2016 and in 2017 for this site. In the data collected in 2016, well pads 4A-1V, 91-2H and 93-4H were combined as one site. Differences in the plant communities on these sites were observed in 2017 so data was collected from each and treated as a separate site.

The 2017 data in the Table 5 is summarized from data presented in Appendix Table C1. Each plant species encountered at this site is listed in Table C1. As shown in Table C1 there is a good representation of the seeded species established on the site.

Table 5 - Reclaimed Pad 4A-1V Vegetation Cover, Species Composition, Species Density & Ground Cover												
Plant Group	Line-Point Canopy Intercept Data ¹								Density Data ²			
	Number of Species		% Foliar Cover		% Basal Cover		Species Composition		Forb/Shrub Density (#/m ²)			
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017		
Perennial Grasses	10	7	31.3	19.3	4.0	4.0	37.2	53.3	n/a	n/a		
Invasive Non-Native Grasses	1	1	7.3	0.0	0.0	0.0	7.9	0.0	n/a	n/a		
Desirable Forb Species	6	5	16.7	10.7	2.0	2.0	25.5	31.7	1.89	6.23		
Invasive and Non-Native Forbs	5	2	8.7	4.7	0.0	0.0	10.9	13.3	0.57	1.97		
Shrubs	4	4	8.7	0.7	0.0	0.0	9.5	1.7	0.40	0.23		
Vegetation Totals	26	19	72.7	35.3	6.0	6.0	100.0	100.0	2.86	8.43		
Line-Point Intercept Soil Surface Cover Data ³												
Percent Cover by Type	Bare Ground		Biotic Crust		Herbaceous Litter		Woody Litter		Duff		Rock	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
	16.7	34.7	0.0	0.0	46.7	31.3	3.3	4.0	0.0	0.0	2.7	8.0
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point.												
² Sum of density data collected from ten 1-meter square quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria.												
³ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.												

This site was heavily grazed by cattle prior to the time sampling data was collected on July 28, 2017. The site is fenced to exclude livestock but several areas of the fence along the northeast side of the enclosure have been damaged by cattle allowing them access to the site. Most of the perennial grasses and forbs were heavily grazed. The climatic conditions in 2017 were unfavorable following the grazing event not providing sufficient soil moisture to allow any regrowth of the grazed species. It also appeared the presence of livestock has resulted in an increase in the amount invasive weedy species on the site.

Substantial changes in foliar cover and bare ground occurred in 2017 as a result of the grazing impacts to the site as compared to those values in 2016. Total vegetative canopy cover declined 55 percent in 2017. Canopy cover of perennial species declined 46 percent and gaps between canopies of perennial species increased 32 percent. The amount of unprotected bare ground increased 48 percent. A 250 percent increase in the densities invasive and non-native forb species occurred in 2017. One positive change was that desirable forb densities more than doubled.

Table 6 is a comparison of the data collected for reclaimed well pads 4A-1V with that from the rolling loam rangeland reference areas. Only the data required to access the success of achieving successful reclamation is used in Table 6.

Table 6 – Comparison of Reclamation Criteria Elements with Undisturbed Reference Areas					
Site	# desired plant species	% desired foliar cover	% bare ground	shrub density (#/m ²)	forb density (#/m ²)
Reclaimed Pad 4A-1V	16 species	30.6	34.7	0.23	6.23
Reference Area ¹	30 species	67.0	17.0	2.2	5.65
¹ The average of four undisturbed native rangelands reference areas were used as the base for evaluating success of the reclamation criteria.					

Evaluation of successful reclamation of the disturbance on Well Pad sites 4A-1V:

- There are 16 desirable plant species established on the site (7 perennial grasses, 5 desirable forbs, and 4 shrubs) meeting the required five plant species.
- Russian wildrye (*Psathyrostachys juncea*) was the desired species with the greatest relative cover at 10.7% meeting the requirement that no one species can exceed 70% relative cover.
- The foliar cover of desirable species on the site was 46% of that on the rolling loam rangeland reference areas not meeting the requirement of 80% similarity.
- The amount of unprotected bare ground on the site was 51% greater than on the rolling loam rangeland reference areas which equates to 49% similarity, not meeting the required 80% similarity.
- The density of forbs and shrubs on the site in comparison with the rolling loam rangeland reference areas was 110% and 10%, respectively. The criteria only require either forb density or shrub density meet the requirement of 80% similarity. The forb density has 110% similarity which meets this criteria.

The plant community established on this site does not meet the criteria for successful reclamation. It is representative of the seed mix utilized, is capable of persisting without continued intervention and should allow plant community successional processes to progress. Increased vigilance to maintain the enclosure fence to protect the site from extensive livestock grazing use, should allow the plant community to meet the criteria established for successful reclamation of the disturbance at this site.

Well Pad 5H-1V

This well pad was within the 6th growing season since being reclaimed when data was collected on July 26, 2017. Three 25 meter transects were placed in a spoke pattern on the pad with 50 sample points on each transect for a total of 150 points for cover data. Ten one meter square density quadrants were placed along each transect for a total of 30 quadrants. Data collected from this site include vegetative foliar and basal cover, species composition, forb and shrub densities and ground cover all summarized by plant group. In addition, ground cover data was collected for dead vegetative litter, bare ground and surface rock. Table 7 compares the data collected in 2016 and in 2017 for this site.

Prior to 2017, this site was unfenced which resulted in heavy grazing of desirable species established on the site. The grazing impacts to the site resulted in poor representation of perennial forb and shrub species in data collection in previous years. The site has since been fenced protecting the site from livestock grazing. Desirable plant species are showing improved representation in the 2017 data.

The 2017 data in the Table 7 is summarized from data presented in Appendix Table D1. Each plant species encountered at this site is listed in Table D1. As shown in Table D1 there is a good establishment of the perennial grasses with uniform distribution across much of the site.

Table 7 - Reference Area for Reclaimed Pad 5H-1V Vegetation Cover, Species Composition, Species Density & Ground Cover												
Plant Group	Line-Point Canopy Intercept Data ¹								Density Data ²			
	Number of Species		% Foliar Cover		% Basal Cover		Species Composition		Forb/Shrub Density (#/m ²)			
	2016	2017	2016	2017	2016	a2017	2016	2017	2016	2017		
Perennial Grasses	8	8	38.7	55.3	8.7	10.7	73.5	85.0	n/a	n/a		
Invasive Non-Native Grasses	1	1	5.3	2.6	0.0	0.0	9.6	4.7	n/a	n/a		
Desirable Forb Species	5	8	0.7	5.3	0.0	0.7	2.4	8.4	0.92	2.80		
Invasive and Non-Native Forbs	3	4	5.4	0.7	0.7	0.0	12.1	0.9	0.60	0.80		
Shrubs	2	5	1.3	0.7	0.0	0.0	2.4	0.9	0.14	0.80		
Vegetation Totals	19	26	51.3	64.7	9.4	11.4	100.0	100.0	1.66	4.40		
Line-Point Intercept Soil Surface Cover Data ³												
Percent Cover by Type	Bare Ground		Biotic Crust		Herbaceous Litter		Woody Litter		Duff		Rock	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
	22.0	25.3	0.0	0.0	60.0	34.0	1.3	2.7	0.0	0.0	2.0	2.7
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point.												
² Sum of density data collected from ten 1-meter square quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria.												
³ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.												

Substantial positive changes in foliar cover occurred in 2017 as a result of protecting the site from grazing impacts as compared to those values in 2016. Foliar cover increased 34 percent in 2017. The canopy cover of perennial grasses increased 30 percent and a six fold increase in the canopy cover of native forb species occurred in 2017. Canopy gaps between perennial species declined 37 percent. The canopy cover of invasive and non-native weedy species declined 69 percent. The amount of unprotected bare ground did increase 13 percent. In 2017, the densities of desirable forbs increased 67 percent and shrub densities increased 83 percent.

Table 8 is a comparison of the data collected for reclaimed well pad 5H-1V with that of the rolling loam rangeland reference areas. Only the data required to access the success of achieving successful reclamation is used in Table 8.

Table 8 – Comparison of Reclamation Criteria Elements with Undisturbed Reference Areas					
Site	# desired plant species	% desired foliar cover	% bare ground	shrub density (#/m ²)	forb density (#/m ²)
Reclaimed Pad 5H-1V	21 species	61.3	25.3	0.8	2.8
Reference Area ¹	30 species	67.0	17.0	2.2	5.65
¹ The average of four undisturbed native rangelands reference areas were used as the base for evaluating success of the reclamation criteria.					

Evaluation of successful reclamation of the disturbance on Well Pad 5H-1V:

- There are 21 desirable plant species established on the site (8 perennial grasses, 8 desirable forbs, and 5 shrubs) meeting the required five plant species.

- Slender wheatgrass (*Elymus trachycaulus*) was the desired species with the greatest relative cover at 24% meeting the requirement that no one species can exceed 70% relative cover.
- The foliar cover of desirable species on the site was 91% of that on the rolling loam rangeland reference area meeting the requirement of 80% similarity.
- The amount of unprotected bare ground on the site was 33% greater than on the rolling loam rangeland reference area which equates to 67% similarity, not meeting the required 80% similarity.
- The density of forbs and shrubs on the site in comparison with the rolling loam rangeland reference area was 50% and 36%, respectively. Neither forb density nor shrub density have met the requirement of 80% similarity.

The plant community established on this site has a good representation of the perennial grasses used in the seed mix. Perennial forbs and shrubs showed significant improvements in 2017. The plant community does not meet the bare ground, shrub density nor forb density criteria established for successful reclamation of the disturbance at this site. The fenced protection provided to the site in 2017 should result in this site achieving the necessary criteria.

Well Pad 91-2H

This site was within the 10th growing season since being reclaimed when data was collected on July 31, 2017. Three 25 meter transects were placed in a parallel pattern on the pad with 50 sample points on each transect for a total of 150 points for cover data. Ten one meter square density quadrants were placed along each transect for a total of 30 quadrants. Data collected from this site include vegetative foliar and basal cover, species composition, forb and shrub densities and ground cover all summarized by plant group. In addition, ground cover data was collected for dead vegetative litter, bare ground and surface rock. Table 9 compares the data collected in 2016 and in 2017 for this site.

Table 9 - Reclaimed Pad 91-2H Vegetation Cover, Species Composition, Species Density & Ground Cover												
Plant Group	Line-Point Canopy Intercept Data ¹								Density Data ²			
	Number of Species		% Foliar Cover		% Basal Cover		Species Composition		Forb/Shrub Density (#/m ²)			
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017		
Perennial Grasses	10	7	31.3	42.0	4.0	6.7	37.2	71.1	n/a	n/a		
Invasive Non-Native Grasses	1	1	7.3	0.6	0.0	0	7.9	1.0	n/a	n/a		
Desirable Forb Species	6	8	16.7	1.3	2.0	0	25.5	3.1	1.89	2.80		
Invasive and Non-Native Forbs	5	3	8.7	0.7	0.0	2.0	10.9	2.1	0.57	.93		
Shrubs	4	5	8.7	14.0	0.0	0	9.5	22.7	0.40	1.90		
Vegetation Totals	26	24	72.7	58.74	6.0	8.7	100.0	100.0	2.86	5.63		
Line-Point Intercept Soil Surface Cover Data ³												
Percent Cover by Type	Bare Ground		Biotic Crust		Herbaceous Litter		Woody Litter		Duff		Rock	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
	16.7	20.0	0.0	0.0	46.7	39.3	3.3	6.7	0.0	0.0	2.7	2.0
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point.												

² Sum of density data collected from ten 1-meter square quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria.

³ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer through the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.

In the data collected in 2016 well pads 4A-1V, 91-2H and 93-4H were combined as one site. Differences in the plant communities on these sites were observed in 2017 so data was collected from each and treated as a separate site. The 2017 data in the Table 9 is summarized from data presented in Appendix Table E1. Each plant species encountered at this site is listed in Table E1. As shown in Table E1 there is a good representation of the seeded species established on the site.

Part of this site is fenced within the same enclosure as for pads 4A-1V and 93-4H with the remainder not fenced to exclude livestock. Two of the three transects for this site were sampled outside the fenced enclosure with one inside. This site was heavily grazed by cattle both inside and outside the fenced enclosure prior to the time sampling data was collected on July 31, 2017. Most of the perennial grasses and forbs were heavily grazed. The climatic conditions in 2017 were unfavorable following the grazing event not providing sufficient soil moisture to allow any regrowth of the grazed species.

Total vegetative canopy cover declined 25 percent in 2017, however, canopy cover of perennial species increased 1 percent. The amount of unprotected bare ground increased 17 percent. Canopy gaps measured along the transect tapes are an indicator of the cover of perennial species. Canopy cover of perennial species declined 1 percent, however, gaps between canopies of perennial species declined 21 percent in 2017.

Positive changes that occurred in 2017 were the densities of desirable forb increased 33 percent and the densities of shrubs increased 79 percent. Also positive was a 92 percent decline in the densities of invasive and non-native forb species and the canopy cover of cheatgrass declined 89 percent.

Table 10 is a comparison of the data collected for reclaimed well pads 91-2H with that from the pre-disturbance reference area for the site and that of the rolling loam rangeland reference area. Only the data required to access the success of achieving successful reclamation is used in Table 10.

Table 10 – Comparison of Reclamation Criteria Elements with Undisturbed Reference Areas					
Site	# desired plant species	% desired foliar cover	% bare ground	shrub density (#/m²)	forb density (#/m²)
Reclaimed Pad 91-2H	20 species	57.3	20.0	1.9	2.8
Reference Area ¹	30 species	67.0	17.0	2.2	5.65
¹ The average of four undisturbed native rangelands reference areas were used as the base for evaluating success of the reclamation criteria.					

Evaluation of successful reclamation of the disturbance on Well Pad sites 91-2H:

- There are 20 desirable plant species established on the site (7 perennial grasses, 8 desirable forbs, and 5 shrubs) meeting the required five plant species.

- Crested wheatgrass (*Agropyron cristatum*) was the desired species with the greatest relative cover at 13.3% meeting the requirement that no one species can exceed 70% relative cover.
- The foliar cover of desirable species on the site was 86% of that on the rolling loam rangeland reference areas meeting the requirement of 80% similarity.
- The amount of unprotected bare ground on the site was 15% greater than on the rolling loam rangeland reference areas which equates to 85% similarity, meeting the required 80% similarity.
- The density of forbs and shrubs on the site in comparison with the rolling loam rangeland reference areas was 50% and 86%, respectively. The criteria only require either forb density or shrub density meet the requirement of 80% similarity. The shrub density has 86% similarity which meets this criteria.

The plant community established on this site has met all the criteria established for successful reclamation of the disturbance with the exception of desirable forb density. The vegetation community established on this site is representative of the seed mix utilized, and will likely persist without intervention. It is meeting the criteria established for successful reclamation of the disturbance at this site.

Well Pad 93-2M

This site was within the 7th growing season since being reclaimed when data was collected on July 27, 2017. Three 25 meter transects were placed in a spoke pattern on the pad with 50 sample points on each transect for a total of 150 points for cover data. Ten one meter square density quadrants were placed along each transect for a total of 30 quadrants. Data collected from this site include vegetative foliar and basal cover, species composition, forb and shrub densities and ground cover all summarized by plant group. In addition, ground cover data was collected for dead vegetative litter, bare ground and surface rock. Table 11 compares the data collected in 2016 and in 2017 for this site.

The 2017 data in the Table 11 is summarized from data presented in Appendix Table F1. Each plant species encountered at this site is listed in Table F1. As shown in Table F1 there is a good representation of the seeded species established on the site.

Table 11 - Reclaimed Pad 93-2M Vegetation Cover, Species Composition, Species Density & Ground Cover										
Plant Group	Line-Point Canopy Intercept Data ¹								Density Data ²	
	Number of Species		% Foliar Cover		% Basal Cover		Species Composition		Forb/Shrub Density (#/m ²)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Perennial Grasses	8	8	54.7	36.7	9.3	5.4	62.3	81.8	n/a	n/a
Invasive Non-Native Grasses	1	1	13.3	0.0	0	0.0	24.0	1.4	n/a	n/a
Desirable Forb Species	5	7	2.0	0.0	0	0.0	1.9	0.0	0.90	0.77
Invasive and Non-Native Forbs	5	3	6.0	1.3	0	0.0	32.5	2.8	0.57	0.93
Shrubs	4	5	2.7	5.3	0	0.0	3.2	14.1	0.33	1.03
Vegetation Totals	23	24	78.7	43.4	9.3	5.4	100.0	100.0	1.80	2.73

Table 11 - Reclaimed Pad 93-2M Vegetation Cover, Species Composition, Species Density & Ground Cover												
Line-Point Intercept Soil Surface Cover Data ³												
Percent Cover by Type	Bare Ground		Biotic Crust		Herbaceous Litter		Woody Litter		Duff		Rock	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
	20.1	25.3	0.0	0.0	55.1	44.0	2.0	2.0	0.0	0.0	0.0	0.70
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point. ² Sum of density data collected from ten 1-meter square quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria. ³ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.												

This site is fenced to exclude livestock and no livestock grazing was observed at the time of sampling. One very notable change observed was a significant die-off of pubescent wheatgrass (*Thinopyrum intermedium*) across the site. Most of the growth from 2016 was still present but obviously dead and the standing dead was easily uprooted. Canopy cover for this species declined 74 percent from 2016 and basal cover declined 85 percent. It is likely this species could not maintain its' composition in the community due to unfavorable climatic conditions and greater competition from other species.

Total vegetative canopy cover declined 45 percent in 2017, with a decline of 29 percent in canopy cover of perennial species. The amount of unprotected bare ground increased 21 percent. Canopy gaps measured along the transect tapes are an indicator of the cover of perennial species. Canopy cover of perennial species declined 29 percent, however, gaps between canopies of perennial species only declined 12 percent.

Positive changes that occurred in 2017 were the improvements in shrubs with canopy cover increases of 49 percent and densities increases of 68 percent. Also positive was a 78 percent decline in the densities invasive and non-native forb species and the canopy cover of cheatgrass declined 100 percent.

Table 12 is a comparison of the data collected for reclaimed well pads 93-2M with that from the pre-disturbance reference area for the site and that of the rolling loam rangeland reference area. Only the data required to access the success of achieving successful reclamation is used.

Table 12 – Comparison of Reclamation Criteria Elements with Undisturbed Reference Areas					
Site	# desired plant species	% desired foliar cover	% bare ground	shrub density (#/m ²)	forb density (#/m ²)
Reclaimed Pad 93-2M	20 species	42.0	25.3	1.03	0.77
Reference Area ¹	30 species	67.0	17.0	2.2	5.65
¹ The average of four undisturbed native rangelands reference areas were used as the base for evaluating success of the reclamation criteria.					

Evaluation of successful reclamation of the disturbance on Well Pads sites 93-2M:

- There are 20 desirable plant species established on the site (8 perennial grasses, 7 desirable forbs, and 5 shrubs) meeting the required five plant species.

- Russian wildrye (*Psathyrostachys juncea*) was the desired species with the greatest relative cover at 20.0% meeting the requirement that no one species can exceed 70% relative cover.
- The foliar cover of desirable species on the site was 63% of that on the rolling loam rangeland reference areas not meeting the requirement of 80% similarity.
- The amount of unprotected bare ground on the site was 33% greater than on the rolling loam rangeland reference areas which equates to 67% similarity, not meeting the required 80% similarity.
- The density of forbs and shrubs on the site in comparison with the rolling loam rangeland reference areas was 14% and 47%, respectively. The criteria only require either forb density or shrub density meet the requirement of 80% similarity which neither have met the required criteria.

The plant community established on this site has not met the required criteria for foliar cover of desirable species, densities of shrubs or forbs nor the amount of bare ground. This plant community is representative of the seed mix utilized, is capable of persisting without continued intervention and should allow plant community successional processes to progress.

Well Pads 93-4H

This site was within the 10th growing season since being reclaimed when data was collected on July 28, 2017. Three 25 meter transects were placed in a spoke pattern on the pad with 50 sample points on each transect for a total of 150 points for cover data. Ten one meter square density quadrants were placed along each transect for a total of 30 quadrants. Data collected from this site include vegetative foliar and basal cover, species composition, forb and shrub densities and ground cover all summarized by plant group. In addition, ground cover data was collected for dead vegetative litter, bare ground and surface rock. Table 13 compares the data collected in 2016 and in 2017 for this site.

Table 13 - Reclaimed Pad 93-4H Vegetation Cover, Species Composition, Species Density & Ground Cover												
Plant Group		Line-Point Canopy Intercept Data ¹								Density Data ²		
		Number of Species		% Foliar Cover		% Basal Cover		Species Composition		Forb/Shrub Density (#/m ²)		
		2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	
Perennial Grasses		10	6	31.3	16.0	4.0	2.0	37.2	41.4	n/a	n/a	
Invasive Non-Native Grasses		1	1	7.3	0.7	0.0	0.0	7.9	1.7	n/a	n/a	
Desirable Forb Species		6	7	16.7	6.7	2.0	0.7	25.5	20.7	1.89	3.67	
Invasive and Non-Native Forbs		5	5	8.7	8.0	0.0	0.0	10.9	22.4	0.57	4.50	
Shrubs		4	4	8.7	5.3	0.0	0.0	9.5	13.8	0.40	0.40	
Vegetation Totals		26	23	72.7	36.7	6.0	2.7	100.0	100.0	2.86	8.57	
Line-Point Intercept Soil Surface Cover Data ³												
Percent Cover by Type	Bare Ground		Biotic Crust		Herbaceous Litter		Woody Litter		Duff		Rock	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
	16.7	31.3	0.0	0.0	46.7	36.7	3.3	9.3	0.0	0.0	2.7	4.7

Table 13 - Reclaimed Pad 93-4H
Vegetation Cover, Species Composition, Species Density & Ground Cover
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point.
² Sum of density data collected from ten 1-meter square quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria.
³ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.

In the data collected in 2016 well pads 4A-1V, 91-2H and 93-4H were combined as one site. Differences in the plant communities on these sites were observed in 2017 so data was collected from each and treated as a separate sites. The 2017 data in the Table 13 is summarized from data presented in Appendix Table G1. Each plant species encountered at this site is listed in Table G1. As shown in Table G1 there is a good representation of the seeded species established on the site.

This site was heavily grazed by cattle prior to the time sampling data was collected on July 28, 2017. The site is fenced to exclude livestock but several areas of the fence along the northeast side of the enclosure have been damaged by cattle allowing them access to the site. Most of the perennial grasses and forbs were heavily grazed. The climatic conditions in 2017 were unfavorable following the grazing event not providing sufficient soil moisture to allow any regrowth of the grazed species.

Substantial changes in foliar cover and bare ground occurred in 2017 as a result of the grazing impacts to the site as compared to those values in 2016. Total vegetative canopy cover declined 53 percent in 2017. The amount of unprotected bare ground increased 47 percent. Canopy gaps measured along the transect tapes are an indicator of the cover of perennial species. Canopy cover of perennial species declined 51 percent and gaps between canopies of perennial species increased 36 percent in 2017.

An 87 percent increase in the densities invasive and non-native forb species occurred in 2017. Positive changes that occurred in 2017 was that desirable forb densities increased 49 percent and canopy cover of cheatgrass declined 87 percent.

Table 14 is a comparison of the data collected for reclaimed well pads 93-4H with that from the pre-disturbance reference area for the site and that of the rolling loam rangeland reference area. Only the data required to access the success of achieving successful reclamation is used in Table 14.

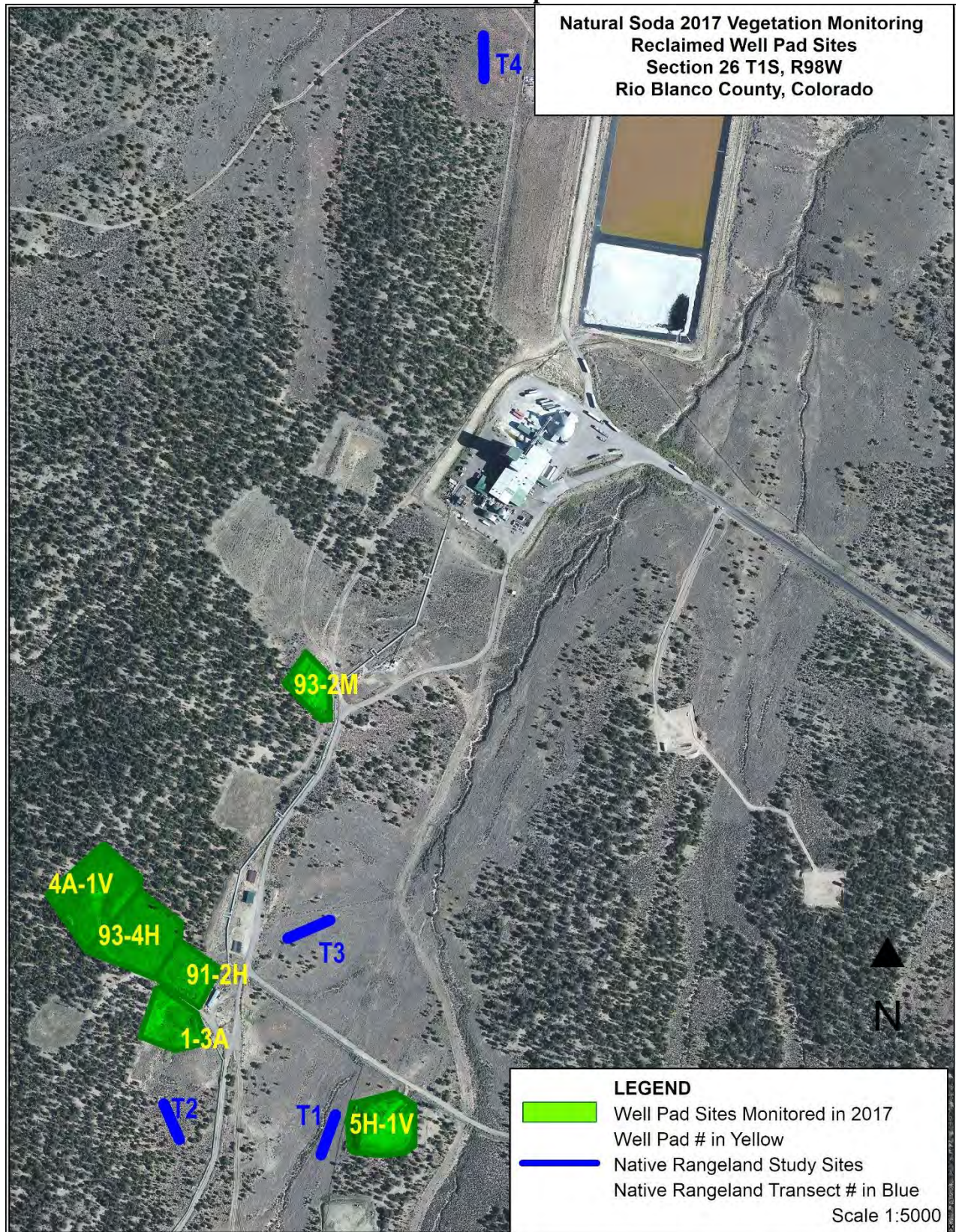
Table 14 – Comparison of Reclamation Criteria Elements with Undisturbed Reference Areas					
Site	# desired plant species	% desired foliar cover	% bare ground	shrub density (#/m²)	forb density (#/m²)
Reclaimed Pad 93-4H	17 species	28.0	31.3	0.4	3.67
Reference Area ¹	30 species	67.0	17.0	2.2	5.65
¹ The average of four undisturbed native rangelands reference areas were used as the base for evaluating success of the reclamation criteria.					

Evaluation of successful reclamation of the disturbance on Well Pads sites 93-4H:

- There are 17 desirable plant species established on the site (6 perennial grasses, 7 desirable forbs, and 4 shrubs) meeting the required five plant species.
- Russian wildrye (*Psathyrostachys juncea*) was the desired species with the greatest relative cover at 8.7 % meeting the requirement that no one species can exceed 70 % relative cover.
- The foliar cover of desirable species on the site was 42% of that on the rolling loam rangeland reference areas not meeting the requirement of 80% similarity.
- The amount of unprotected bare ground on the site was 46% greater than on the rolling loam rangeland reference areas which equates to 54% similarity, not meeting the required 80% similarity.
- The density of forbs and shrubs on the site in comparison with the rolling loam rangeland reference areas was 65% and 18%, respectively. The criteria only require either forb density or shrub density meet the requirement of 80% similarity which neither have met the required criteria.

The plant community established on this site is representative of the seed mix utilized, is capable of persisting without continued intervention and should allow plant community successional processes to progress. Increased vigilance to maintain the enclosure fence to protect the site from extensive livestock grazing use, should allow the plant community to meeting the criteria established for successful reclamation of the disturbance at this site.

Location Map



Appendix A – Vegetation Sampling Data Native Rangeland Reference Areas

Table A1 - Vegetation Cover, Species Composition, Species Density & Ground Cover Native Rangeland Reference Area						
Plant Species Observed within Study Area			Line-Point Canopy Intercept Data ¹			Density Data ²
Species Symbol	Scientific Name	Common Name	% Foliar Cover	% Basal Cover	Species Composition	Forb/Shrub Density (#/m ²)
ACHY	<i>Achnatherum hymenoides</i>	Indian ricegrass	1.0	0.0	2.3	
ELELE	<i>Elymus elymoides</i> ssp. <i>elymoides</i>	bottlebrush squirreltail	1.0	1.0	2.9	
HECO26	<i>Hesperostipa comata</i>	needle & thread	24.0	4.5	33.7	
KOMA	<i>Koeleria macrantha</i>	prairie junegrass	3.5	2.0	8.1	
PASM	<i>Pascopyrum smithii</i>	western wheatgrass	9.0	0.0	12.2	
POSE	<i>Poa secunda</i>	Sandberg bluegrass	5.0	0.5	6.4	
Totals for Perennial Grasses			43.5	8.0	65.6	
ANDI2	<i>Antennaria dimorpha</i>	low pussytoes	0.0	0.0	0.0	0.15
ASCO12	<i>Astragalus convallarius</i>	lesser-rushy mlkvetch	0.0	0.0	0.0	0.10
CAFI	<i>Carex filifolia</i>	threadleaf sedge	0.0	0.0	0.0	0.15
CALI4	<i>Castilleja linariifolia</i>	Wyoming Indian paintbrush	0.0	0.0	0.6	0.03
CRAC	<i>Crepis acuminata</i>	longleaf hawksbeard	0.0	0.0	0.0	0.08
CRFL6	<i>Cryptantha flavoculata</i>	roughseed cryptanth	0.0	0.0	0.0	0.03
CRSE	<i>Cryptantha sericea</i>	silky catseye	0.0	0.0	0.0	0.10
EREA	<i>Erigeron eatonii</i>	Eaton's fleabane	0.0	0.0	0.6	0.53
HEBO	<i>Hedysarum boreale</i>	Utah sweetvetch	0.5	0.5	0.6	0.03
LEER	<i>Leucelene ericoides</i>	heath aster	0.0	0.0	0.0	0.10
MAGR2	<i>Machaeranthera grindelioides</i>	rayless tansyaster	0.0	0.0	0.0	0.10
OPPO	<i>Opuntia polyacantha</i>	plains pricklypear cactus	0.0	0.0	0.0	0.05
PAMU11	<i>Pakera multilobata</i>	lobeleaf groundsel	0.0	0.0	0.0	0.05
PEFRF5	<i>Penstemon fremontii</i> var. <i>fremontii</i>	Fremont beardtongue	0.0	0.0	0.0	0.03
PHHO	<i>Phlox hoodii</i>	Hood's phlox	1.0	0.0	1.7	1.10
PHLO2	<i>Phlox longifolia</i>	longleaf phlox	0.0	0.0	0.6	0.00
SPCO	<i>Sphaeralcea coccinea</i>	scarlet globemallow	0.0	0.0	1.2	3.05
Totals for Desirable Forb Species			1.5	0.5	5.3	5.65
ARTRW	<i>Artemisia tridentata</i> var. <i>wyomingensis</i>	Wyoming big sagebrush	19.0	0.5	23.3	1.38
CHDE2	<i>Chrysothamnus depressus</i>	longflower rabbitbrush	0.0	0.0	0.0	0.03
CHVI8 ³	<i>Chrysothamnus viscidiflorus</i>	yellow rabbitbrush	0.0	0.0	0.0	0.00
GUSA2	<i>Gutierrezia sarothrae</i>	broom Snakeweed	2.5	0.0	2.9	0.75
JUOS	<i>Juniperus osteosperma</i>	Utah juniper	0.5	0.0	0.6	0.03
KRLA2 ³	<i>Krascheninnikovia lanata</i>	winterfat	0.0	0.0	0.0	0.00
SAVE4	<i>Sarcobatus vermiculatus</i>	greasewood	0.0	0.0	0.0	0.03
Totals for Shrubs			22.0	0.5	26.8	2.20
ALDE	<i>Alyssum desertorum</i>	desert madwort	0.0	0.0	0.0	0.28
BRTE	<i>Bromus tectorum</i>	cheatgrass	1.5	0.0	2.3	not collected
LECA5	<i>Lepidium campestre</i>	field pepperweed	0.0	0.0	0.0	0.05
Totals for Invasive and Non-Native Species			1.5	0.0	2.3	0.33
Vegetation Totals			68.5	9.0	100.0	8.18
¹ Sum of data from 4 randomly placed 50 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point. ² Sum of density data collected from 10 one-square meter quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria. ³ Plant species not encountered in sampling data but were present within the study area. ⁴ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.			Percent Ground Cover by Cover Type ⁴			
			Bare Ground		17.0	
			Biotic Crust		3.5	
			Herbaceous Litter		53.0	
			Woody Litter		3.5	
			Duff		0.0	
			Rock		0.0	

Table A2 - Canopy Gap Intercept Data Native Rangeland Reference Areas					
	Total of Gaps > 20 cm	Gaps 21-50 cm	Gaps 51-100 cm	Gaps 101-200 cm	Gaps >200 cm
Transect 1	1036	639	397	0	0
Transect 2	970	747	223	0	0
Transect 3	1054	827	227	0	0
Transect 4	1043	718	325	0	0
Total Gaps (cm)	4103	2931	1172	0	0
% Line in Gaps	20.52	14.66	5.86	0.00	0.00
Line length for each transect was 50 meters for site total length of 200 meters					

Table A3 - Transect Coordinate Locations Native Rangeland Reference Areas (Datum: UTM Zone 12, WGS 84)						
Site	Azimuth from starting point (true N)	Transect Starting Point		Transect Ending Point		Length
		Northing (mN)	Easting (mE)	Northing (mN)	Easting (mE)	
Transect 1	023°	4423160.586	725398.2138	4423207.123	725412.6625	50 meters
Transect 2	152°	4423213.988	725216.4047	4423172.572	725236.1048	50 meters
Transect 3	073°	4423404.413	725351.3151	4423424.434	725397.1694	50 meters
Transect 4	176°	4424431.522	725544.0816	4424382.176	725547.3382	50 meters

Transect Photos Native Rangeland Reference Areas



Figure A1 Rolling Loam Rangeland Reference Area Transect #1



Figure A2 Rolling Loam Rangeland Reference Area Transect #2



Figure A3 Rolling Loam Rangeland Reference Area Transect #3



Figure A4 Rolling Loam Rangeland Reference Area Transect #4

Appendix B – Vegetation Sampling Data Reclaimed Well Pad 1-3A

Table B1 - Vegetation Cover, Species Composition, Species Density & Ground Cover Reclaimed Pad 1-3A						
Plant Species Observed within Study Area			Line-Point Canopy Intercept Data ¹			Density Data ²
Species Symbol	Scientific Name	Common Name	% Foliar Cover	% Basal Cover	Species Composition	Forb/Shrub Density (#/m ²)
AGCR	<i>Agropyron cristatum</i>	crested wheatgrass	1.3	0.0	2.4	
ELLAL	<i>Elymus lanceolatus</i>	thickspike wheatgrass	2.7	0.7	4.9	
ELTR7	<i>Elymus trachycaulus</i>	slender wheatgrass	6.7	1.3	13.4	
LECI4	<i>Leymus cinereus</i>	basin wildrye	1.3	0.7	2.4	
NAVI4	<i>Nassella viridula</i>	green needlegrass	7.3	1.3	13.4	
PASM	<i>Pascopyrum smithii</i>	western wheatgrass	2.0	0.0	3.7	
PSJU3	<i>Psathyrostachys juncea</i>	Russian wildrye	7.3	0.0	14.6	
THIN6	<i>Thinopyrum intermedium</i>	pubescent wheatgrass	0.7	0.0	1.2	
Totals for Perennial Grasses			29.3	4.0	56.1	
ASCI4	<i>Astragalus cicer</i>	cicer milkvetch	0.0	0.0	1.2	0.43
CRFL6	<i>Cryptantha flavoculata</i>	roughseed cryptanth	0.0	0.0	0.0	0.07
LILE3	<i>Linum lewisii</i>	Lewis flax	2.7	0.0	6.1	1.33
MACA2	<i>Machaeranthera canescens</i>	hoary tansyaster	1.3	0.0	2.4	0.90
MESA	<i>Medicago sativa</i>	alfalfa	4.0	1.3	8.5	1.87
PEPA8	<i>Penstemon palmeri</i>	Palmer's penstemon	0.0	0.0	1.2	0.00
SPCO	<i>Sphaeralcea coccinea</i>	scarlet globemallow	0.0	0.0	0.0	0.03
Totals for Desirable Forb Species			8.0	1.3	19.5	4.63
ATCA2	<i>Atriplex canescens</i>	four-wing saltbush	2.0	0.0	3.7	0.43
CHV18	<i>Chrysothamnus viscidiflorus</i>	yellow rabbitbrush	0.7	0.0	1.2	0.17
ERNA10	<i>Ericameria nauseosa</i>	rubber rabbitbrush	0.0	0.0	0.0	0.03
KRLA2	<i>Krascheninnikovia lanata</i>	winterfat	1.3	0.0	4.9	0.23
Totals for Shrubs			4.0	0.0	9.8	0.86
BRTE	<i>Bromus tectorum</i>	cheatgrass	3.3	0.0	6.1	0.00
DESO2	<i>Descurainia sophia</i>	yellow mustard	0.7	0.0	1.2	0.13
MEOF	<i>Melilotus officinalis</i>	yellow sweetclover	1.3	0.0	2.4	1.83
SATR12	<i>Salsola tragus</i>	Russian thistle	2.7	0.0	4.9	1.73
Totals for Invasive and Non-Native Species			8.0	0.0	14.6	3.69
Vegetation Totals			49.3	5.3	100.0	9.18
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point. ² Sum of density data collected from 10 one-square meter quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria. ³ Plant species not encountered in sampling data but were present within the study area. ⁴ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.					Percent Ground Cover by Cover Type ⁴	
					Bare Ground	26.7
					Biotic Crust	0.0
					Herbaceous Litter	44.0
					Woody Litter	0.0
					Duff	0.0
					Rock	0.0

Table B2 - Canopy Gap Intercept Data Reclaimed Pad 1-3A										
Canopy Gaps > 20 centimeters	Total of Gaps > 20 cm		Gaps 21-50 cm		Gaps 51-100 cm		Gaps 101-200 cm		Gaps >200 cm	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Transect 1	974	1190	230	276	600	504	144	410	0	0
Transect 2	431	955	197	320	234	485	0	150	0	0
Transect 3	704	1108	296	152	181	427	0	306	227	223
Total Gaps (cm)	2109	3253	723	748	1015	1416	144	866	227	223
% Line in Gaps	28.12	43.37	9.64	9.97	13.53	18.88	1.92	11.55	3.03	2.97
Line length for each transect was 25 meters for site total length of 75 meters										

Table B3 - Transect Coordinate Locations Reclaimed Pad 1-3A (Datum: UTM Zone 12, WGS 84)						
Site	Azimuth from starting point (true N)	Transect Starting Point		Transect Ending Point		Length
		Northing (mN)	Easting (mE)	Northing (mN)	Easting (mE)	
Transect 1	146°	4423297.316	725216.3378	4423281.145	725233.0678	25 meters
Transect 2	208°	4423297.059	725207.6206	4423280.97	725197.0615	25 meters
Transect 3	318°	4423302.425	725208.7451	4423327.68	725202.3535	25 meters

Transect Photos and Transect Layout Plot



Figure B1 Transect 1 Reclaimed Pad 1-3A



Figure B2 Transect 2 Reclaimed Pad 1-3A



Figure B3 Transect 3 Reclaimed Pad 1-3A

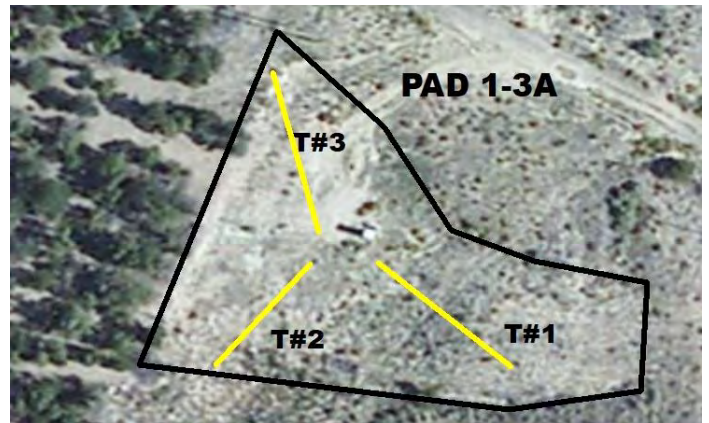


Figure B4 Pad 1-3A Transect Layout

Appendix C – Vegetation Sampling Data Reclaimed Well Pads 4A-1V

**Table C1 - Vegetation Cover, Species Composition, Species Density & Ground Cover
Reclaimed Pad 4A-1V**

Plant Species Observed within Study Area			Line-Point Canopy Intercept Data ¹			Density Data ²
Species Symbol	Scientific Name	Common Name	% Foliar Cover	% Basal Cover	Species Composition	Forb/Shrub Density (#/m ²)
ACHY	<i>Achnatherum hymenoides</i>	Indian ricegrass	0.7	0.0	1.7	
ELLAL	<i>Elymus lanceolatus</i>	thickspike wheatgrass	0.0	0.0	1.7	
ELTR7	<i>Elymus trachycaulus</i>	slender wheatgrass	6.0	1.3	15.0	
LECI4	<i>Leymus cinereus</i>	basin wildrye	0.7	0.0	1.7	
NAVI4	<i>Nassella viridula</i>	green needlegrass	0.7	0.0	1.7	
PASM	<i>Pascopyrum smithii</i>	western wheatgrass	0.7	0.0	1.7	
PSJU3	<i>Psathyrostachys juncea</i>	Russian wildrye	10.7	2.7	30.0	
Totals for Perennial Grasses			19.3	4.0	53.3	
ASCI4	<i>Astragalus cicer</i>	cicer milkvetch	0.0	0.0	0.0	0.17
GRSQ	<i>Grindelia squarrosa</i>	curlycup gumweed	0.0	0.0	0.0	0.33
LILE3	<i>Linum lewisii</i>	Lewis flax	1.3	0.0	3.3	1.50
MESA	<i>Medicago sativa</i>	alfalfa	9.3	2.0	28.3	4.23
SPPA2 ³	<i>Sphaeralcea parvifolia</i>	small-leaf globemallow	0.0	0.0	0.0	0.00
Totals for Desirable Forb Species			10.7	2.0	31.7	6.23
ATCA2	<i>Atriplex canescens</i>	four-wing saltbush	0.7	0.0	1.7	0.03
CHVI8 ³	<i>Chrysothamnus viscidiflorus</i>	yellow rabbitbrush	0.0	0.0	0.0	0.00
ERNA10 ³	<i>Ericameria nauseosa</i>	rubber rabbitbrush	0.0	0.0	0.0	0.00
GUSA2	<i>Gutierrezia sarothrae</i>	broom Snakeweed	0.0	0.0	0.0	0.20
Totals for Shrub			0.7	0.0	1.7	0.23
BRTE	<i>Bromus tectorum</i>	cheatgrass	0.0	0.0	0.0	n/a
BASC5 ³	<i>Bassia scoparia</i>	burningbush	0.0	0.0	0.0	0.00
MEOF	<i>Melilotus officinalis</i>	yellow sweetclover	1.3	0.0	3.3	0.87
SATR12	<i>Salsola tragus</i>	Russian thistle	3.3	0.0	10.0	1.10
Totals for Invasive and Non-Native Species			4.7	0.0	13.3	1.97
Vegetation Totals			35.3	6.0	100.0	8.43
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point. ² Sum of density data collected from 10 one-square meter quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria. ³ Plant species not encountered in sampling data but were present within the study area. ⁴ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.					Percent Ground Cover by Cover Type ⁴	
					Bare Ground	34.7
					Biotic Crust	0.0
					Herbaceous Litter	31.3
					Woody Litter	4.0
					Duff	0.0
					Rock	8.0

**Table C2 - Canopy Gap Intercept Data
Reclaimed Pad 4A-1V**

Canopy Gaps > 20 centimeters	Total of Gaps > 20 cm		Gaps 21-50 cm		Gaps 51-100 cm		Gaps 101-200 cm		Gaps >200 cm	
	2016 ¹	2017 ²	2016 ¹	2017 ²	2016 ¹	2017 ²	2016 ¹	2017 ²	2016 ¹	2017 ²
Transect 1	1632	1200	226	231	745	818	661	151	0	0
Transect 2	2061	1621	688	223	642	647	249	468	482	283
Transect 3	2180	1474	383	288	960	935	837	251	0	0
Total Gaps (cm)	5873	4295	1297	742	2347	2400	1747	870	482	283
% Line in Gaps	39.15	57.27	8.65	9.89	15.65	32.00	11.65	11.60	3.21	3.77
¹ Line length for each transect was 50 meters for site total length of 150 meters ² Line length for each transect was 25 meters for site total length of 75 meters										

Table C3 - Transect Coordinate Locations Reclaimed Pad 4A-1V (Datum: UTM Zone 12, WGS 84)						
Site	Azimuth from starting point (true N)	Transect Starting Point		Transect Ending Point		Length
		Northing (mN)	Easting (mE)	Northing (mN)	Easting (mE)	
Transect 1	201°	4423439.43	725130.1098	4423420.939	725117.2268	25 meters
Transect 2	140°	4423437.21	725137.7026	4423421.321	725156.4767	25 meters
Transect 3	064°	4423451.389	725140.0209	4423465.603	725158.59	25 meters

Transect Photos and Transect Layout Plot



Figure C1 Pad 4A-1V Transect 1



Figure C2 Pad 4A-1V Transect 2



Figure C3 Pad 4A-1V Transect 3

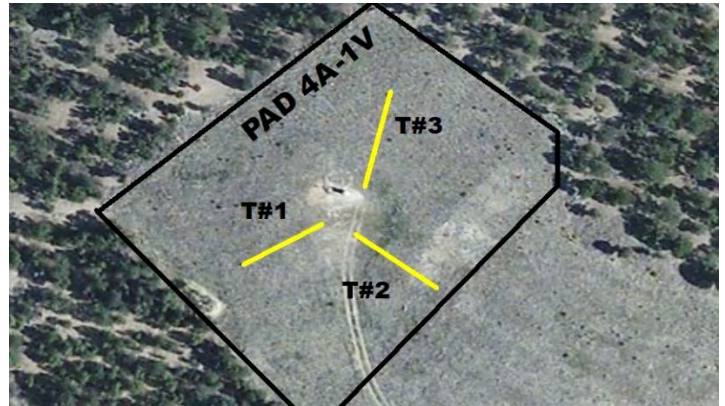


Figure C4 Pad 4A-1V Transect Layout

Appendix D – Vegetation Sampling Data Reclaimed Well Pad 5H-1V

Table D1 - Vegetation Cover, Species Composition, Species Density & Ground Cover Reclaimed Pad 5H-1V						
Plant Species Observed within Study Area			Line-Point Canopy Intercept Data ¹			Density Data ²
Species Symbol	Scientific Name	Common Name	% Foliar Cover	% Basal Cover	Species Composition	Forb/Shrub Density (#/m ²)
ELLAL	<i>Elymus lanceolatus</i>	thickspike wheatgrass	10.7	1.3	16.8	
ELTR7	<i>Elymus trachycaulus</i>	slender wheatgrass	24.0	4.0	36.4	
HECO26	<i>Hesperostipa comata</i>	needle & thread needlegrass	0.7	0.0	0.9	
LECI4	<i>Leymus cinereus</i>	basin wildrye	0.7	0.0	0.9	
NAVI4	<i>Nassella viridula</i>	green needlegrass	0.7	0.0	0.9	
PASM	<i>Pascopyrum smithii</i>	western wheatgrass	3.3	0.0	4.7	
PSJU3	<i>Psathyrostachys juncea</i>	Russian wildrye	8.0	2.7	14.0	
THIN6	<i>Thinopyrum intermedium</i>	pubescent wheatgrass	7.3	2.7	10.3	
Totals for Perennial Grasses			55.3	10.7	85.0	
ASCI4	<i>Astragalus cicer</i>	cicer milkvetch	2.0	0.7	3.7	0.20
EREA	<i>Erigeron eatonii</i>	Eaton fleabane	0.0	0.0	0.0	0.10
HEBO ³	<i>Hedysarum boreale</i>	Utah sweetvetch	0.0	0.0	0.0	0.00
LILE3	<i>Linum lewisii</i>	Lewis flax	0.7	0.0	0.9	0.57
MACA2	<i>Machaeranthera canescens</i>	hoary tansyaster	1.3	0.0	1.9	1.23
MESA	<i>Medicago sativa</i>	alfalfa	1.3	0.0	1.9	0.17
PEPA8	<i>Penstemon palmeri</i>	Palmer's penstemon	0.0	0.0	0.0	0.23
SPCO	<i>Sphaeralcea coccinea</i>	scarlet globemallow	0.0	0.0	0.0	0.30
Totals for Desirable Forb Species			5.3	0.7	8.4	2.80
ATCA2	<i>Atriplex canescens</i>	four-wing saltbush	0.0	0.0	0.0	0.07
CHVI8	<i>Chrysothamnus viscidiflorus</i>	yellow rabbitbrush	0.0	0.0	0.0	0.07
GUSA2	<i>Gutierrezia sarothrae</i>	broom Snakeweed	0.7	0.0	0.9	0.60
KRLA2	<i>Krascheninnikovia lanata</i>	winterfat	0.0	0.0	0.0	0.03
PUTR2	<i>Purshia tridentata</i>	antelope bittrebrush	0.0	0.0	0.0	0.03
Totals for Shrubs			0.7	0.0	0.0	0.80
BRTE	<i>Bromus tectorum</i>	cheatgrass (annual grass)	2.7	0.0	4.7	n/a
CIVU	<i>Cirsium vulgare</i>	bull thistle	0.0	0.0	0.0	0.03
DESO2	<i>Descurainia sophia</i>	yellow mustard	0.0	0.0	0.0	0.03
LECA5	<i>Lepidium campestre</i>	field pepperweed	0.0	0.0	0.0	0.67
MEOF	<i>Melilotus officinalis</i>	yellow sweetclover	0.7	0.0	0.9	0.07
Totals for Invasive and Non-Native Species			3.3	0.0	5.6	0.80
Vegetation Totals			64.7	11.4	100.0	4.40
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point. ² Sum of density data collected from 10 one-square meter quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria. ³ Plant species not encountered in sampling data but were present within the study area. ⁴ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.			Percent Ground Cover by Cover Type ⁴			
			Bare Ground			25.3
			Biotic Crust			0.0
			Herbaceous Litter			34.0
			Woody Litter			2.7
			Duff			0.0
			Rock			2.7

Table D2 - Canopy Gap Intercept Data Reclaimed Pad 5H-1V										
Canopy Gaps > 20 centimeters	Total of Gaps > 20 cm		Gaps 21-50 cm		Gaps 51-100 cm		Gaps 101-200 cm		Gaps >200 cm	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Transect 1	1386	745	290	441	709	304	146	0	241	0
Transect 2	734	423	590	152	144	271	0	0	0	0
Transect 3	936	748	497	372	439	376	0	0	0	0
Total Gaps (cm)	3056	1916	1377	965	1292	951	146	0	241	0
% Line in Gaps	20.37	12.77	9.18	6.43	8.61	6.34	0.97	0.00	1.61	0.00
<i>Line length for each transect was 25 meters for site total length of 75 meters</i>										

Table D3 - Transect Coordinate Locations Reclaimed Pad 5H-1V (Datum: UTM Zone 12, WGS 84)						
Site	Azimuth from starting point (true N)	Transect Starting Point		Transect Ending Point		Length
		Northing (mN)	Easting (mE)	Northing (mN)	Easting (mE)	
Transect 1	341°	4423199.237	725476.6222	4423221.794	725465.4337	25 meters
Transect 2	239°	4423194.882	725468.3682	4423181.378	725447.5539	25 meters
Transect 3	130°	4423192.471	725476.9934	4423177.233	725495.2363	25 meters

Transect Photos and Transect Layout Plot



Figure D1 Transect 1 Reclaimed Pad 5H-1V



Figure D2 Transect 2 Reclaimed Pad 5H-1V



Figure D3 Transect 3 Reclaimed Pad 5H-1V

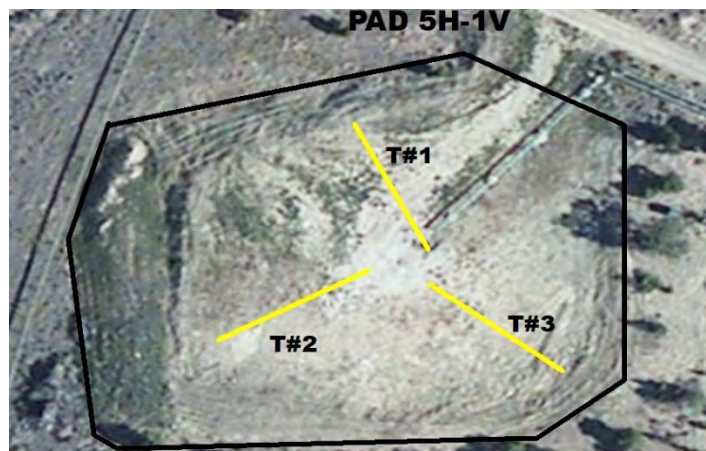


Figure D4 Pad 5H-1V Transect Layout

Appendix E – Vegetation Sampling Data Reclaimed Well Pad 91-2H

Table E1 - Vegetation Cover, Species Composition, Species Density & Ground Cover Reclaimed Pad 91-2H						
Plant Species Observed within Study Area			Line-Point Canopy Intercept Data ¹			Density Data ²
Species Symbol	Scientific Name	Common Name	% Foliar Cover	% Basal Cover	Species Composition	Forb/Shrub Density (#/m ²)
ACHY	<i>Achnatherum hymenoides</i>	Indian ricegrass	0.7	0.0	1.0	
AGCR	<i>Agropyron cristatum</i>	crested wheatgrass	13.3	3.3	21.6	
ELTR7	<i>Elymus trachycaulus</i>	slender wheatgrass	8.0	0.7	13.4	
LECI4	<i>Leymus cinereus</i>	basin wildrye	1.3	0.0	2.1	
PASM	<i>Pascopyrum smithii</i>	western wheatgrass	2.0	0.0	3.1	
PSJU3	<i>Psathyrostachys juncea</i>	Russian wildrye	8.7	2.0	14.4	
THIN6	<i>Thinopyrum intermedium</i>	pubescent wheatgrass	8.0	0.7	15.5	
Totals for Perennial Grasses			42.0	6.7	71.1	
ASCH	<i>Astragalus chamaeleuce</i>	cicada milkvetch	0.0	0.0	0.0	0.10
ASCI4	<i>Astragalus cicer</i>	cicer milkvetch	0.0	0.0	0.0	0.07
LILE3	<i>Linum lewisii</i>	Lewis flax	1.3	0.0	2.1	0.70
MACA2	<i>Machaeranthera canescens</i>	hoary tansyaster	0.0	0.0	0.0	0.13
MESA	<i>Medicago sativa</i>	alfalfa	0.0	0.0	1.0	1.70
PEPA8	<i>Penstemon palmeri</i>	Palmer's penstemon	0.0	0.0	0.0	0.00
SPCO	<i>Sphaeralcea coccinea</i>	scarlet globemallow	0.0	0.0	0.0	0.03
SPPA2	<i>Sphaeralcea parvifolia</i>	small-leaf globemallow	0.0	0.0	0.0	0.07
Totals for Desirable Forb Species			1.3	0.0	3.1	2.80
ARTRW	<i>Artemisia tridentata</i> var. <i>wyomingensis</i>	Wyoming big sagebrush	0.0	0.0	0.0	0.03
ATCA2	<i>Atriplex canescens</i>	four-wing saltbush	4.7	0.0	7.2	0.30
CHVI8	<i>Chrysothamnus viscidiflorus</i>	yellow rabbitbrush	5.3	0.0	8.2	0.63
ERNA10	<i>Ericameria nauseosa</i>	rubber rabbitbrush	2.0	1.3	3.1	0.40
GUSA2	<i>Gutierrezia sarothrae</i>	broom Snakeweed	2.0	0.7	4.1	0.53
Totals for Shrubs			14.0	2.0	22.7	1.90
BRTE	<i>Bromus tectorum</i>	cheatgrass	0.7	0.0	1.0	n/a
ALDE	<i>Alyssum desertorum</i>	desert madwort	0.0	0.0	0.0	0.10
DESO2	<i>Descurainia sophia</i>	yellow mustard	0.0	0.0	0.0	0.10
MEOF	<i>Melilotus officinalis</i>	yellow sweetclover	0.7	0.0	2.1	0.73
Totals for Invasive and Non-Native Species			1.3	0.0	3.1	0.93
Vegetation Totals			58.7	8.7	100.0	5.63
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point. ² Sum of density data collected from 10 one-square meter quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria. ³ Plant species not encountered in sampling data but were present within the study area. ⁴ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.			Percent Ground Cover by Cover Type ⁴			
			Bare Ground		20.0	
			Biotic Crust		0.0	
			Herbaceous Litter		39.3	
			Woody Litter		6.7	
			Duff		0.0	
			Rock		2.0	

Table E2 - Canopy Gap Intercept Data Reclaimed Pad 91-2H										
Canopy Gaps > 20 centimeters	Total of Gaps > 20 cm		Gaps 21-50 cm		Gaps 51-100 cm		Gaps 101-200 cm		Gaps >200 cm	
	2016 ¹	2017 ²	2016 ¹	2017 ²	2016 ¹	2017 ²	2016 ¹	2017 ²	2016 ¹	2017 ²
Transect 1	1632	716	226	286	745	324	661	106	0	0
Transect 2	2061	860	688	335	642	383	249	142	482	0
Transect 3	2180	758	383	420	960	193	837	145	0	0
Total Gaps (cm)	5873	2334	1297	1041	2347	900	1747	393	482	0
% Line in Gaps	39.15	31.12	8.65	13.88	15.65	12.00	11.65	5.24	3.21	0.00
¹ Line length for each transect was 50 meters for site total length of 150 meters										
² Line length for each transect was 25 meters for site total length of 75 meters										

Table E3 - Transect Coordinate Locations Reclaimed Pad 91-2H (Datum: UTM Zone 12, WGS 84)						
Site	Azimuth from starting point (true N)	Transect Starting Point		Transect Ending Point		Length
		Northing (mN)	Easting (mE)	Northing (mN)	Easting (mE)	
Transect 1	034°	4423349.298	725249.6156	4423371.215	725261.884	25 meters
Transect 2	021°	4423352.885	725235.6526	4423376.422	725242.5699	25 meters
Transect 3	012°	4423356.888	725224.5	4423377.819	725229.6981	25 meters

Transect Photos and Transect Layout Plot



Figure E1 Transect 1 Reclaimed Pad 91-2H



Figure E2 Transect 2 Reclaimed Pad 91-2H



Figure E3 Transect 3 Reclaimed Pad 91-2H



Figure E4 Pad 91-2H Transect Layout

Appendix F – Vegetation Sampling Data Reclaimed Well Pad 93-2M

Table F1 - Vegetation Cover, Species Composition, Species Density & Ground Cover Reclaimed Pad 93-2M						
Plant Species Observed within Study Area			Line-Point Canopy Intercept Data ¹			Density Data ²
Species Symbol	Scientific Name	Common Name	% Foliar Cover	% Basal Cover	Species Composition	Forb/Shrub Density (#/m ²)
AGCR	<i>Agropyron cristatum</i>	crested wheatgrass	0.7	0.0	2.8	
ELLAL	<i>Elymus lanceolatus</i>	thickspike wheatgrass	6.0	0.7	12.7	
ELTR7	<i>Elymus trachycaulus</i>	slender wheatgrass	0.7	0.0	1.4	
LECI4	<i>Leymus cinereus</i>	basin wildrye	0.7	0.0	1.4	
NAVI4	<i>Nassella viridula</i>	green needlegrass	4.0	0.0	8.5	
PASM ³	<i>Pascopyrum smithii</i>	western wheatgrass	0.0	0.0	0.0	
PSJU3	<i>Psathyrostachys juncea</i>	Russian wildrye	20.0	4.0	42.3	
THIN6	<i>Thinopyrum intermedium</i>	pubescent wheatgrass	4.7	0.7	12.7	
Totals for Perennial Grasses			36.7	5.4	81.8	
ASCI4	<i>Astragalus cicer</i>	cicer milkvetch	0.0	0.0	0.0	0.07
CROC ³	<i>Crepis occidentalis</i>	largeflower hawksbeard	0.0	0.0	0.0	0.00
GRSQ	<i>Grindelia squarrosa</i>	curlycup gumweed	0.0	0.0	0.0	0.43
LILE3	<i>Linum lewisii</i>	Lewis flax	0.0	0.0	0.0	0.13
MESA	<i>Medicago sativa</i>	alfalfa	0.0	0.0	0.0	0.07
PEPA8 ³	<i>Penstemon palmeri</i>	Palmer's penstemon	0.0	0.0	0.0	0.00
SPCO	<i>Sphaeralcea coccinea</i>	scarlet globemallow	0.0	0.0	0.0	0.07
Totals for Desirable Forb Species			0.0	0.0	0.0	0.77
ARTRW	<i>Artemisia tridentata</i> var. <i>wyomingensis</i>	Wyoming big sagebrush	0.0	0.0	0.0	0.13
ATCA2	<i>Atriplex canescens</i>	four-wing saltbush	0.0	0.0	0.0	0.03
CHVI8	<i>Chrysothamnus viscidiflorus</i>	yellow rabbitbrush	3.3	0.0	7.0	0.13
ERNA10	<i>Ericameria nauseosa</i>	rubber rabbitbrush	1.3	0.0	2.8	0.03
GUSA2	<i>Gutierrezia sarothrae</i>	broom Snakeweed	0.7	0.0	4.2	0.70
Totals for Shrubs			5.3	0.0	14.1	1.03
BRTE	<i>Bromus tectorum</i>	cheatgrass	0.0	0.0	1.4	N/A
DESO2	<i>Descurainia sophia</i>	yellow mustard	0.7	0.0	1.4	0.27
LASE ³	<i>Lactuca serriola</i>	prickly lettuce	0.0	0.0	0.0	0.00
MEOF	<i>Melilotus officinalis</i>	yellow sweetclover	0.7	0.0	1.4	0.27
SATR12	<i>Salsola tragus</i>	Russian thistle	0.0	0.0	0.0	0.40
Totals for Invasive and Non-Native Species			1.4	0.0	4.2	0.93
Vegetation Totals			43.4	5.4	100.0	2.73
¹ Sum of data from 3 randomly placed 25 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point. ² Sum of density data collected from 10 one-square meter quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria. ³ Plant species not encountered in sampling data but were present within the study area. ⁴ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.					Percent Ground Cover by Cover Type ⁴	
					Bare Ground	25.3
					Biotic Crust	0.0
					Herbaceous Litter	44.0
					Woody Litter	2.0
					Duff	0.0
					Rock	0.70

Table F2 - Canopy Gap Intercept Data Reclaimed Pad 93-2M										
Canopy Gaps > 20 centimeters	Total of Gaps > 20 cm		Gaps 21-50 cm		Gaps 51-100 cm		Gaps 101-200 cm		Gaps >200 cm	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Transect 1	557	510	269	315	288	195	0	0	0	0
Transect 2	975	1130	292	330	360	668	323	132	0	0
Transect 3	688	877	388	285	300	592	0	0	0	0
Total Gaps (cm)	2220	2517	949	930	948	1455	323	132	0	0
% Line in Gaps	29.60	33.56	12.65	12.40	12.64	19.40	4.31	1.76	0.00	0.00
Line length for each transect was 25 meters for site total length of 75 meters										

Table F3 - Transect Coordinate Locations Reclaimed Pad 93-2M (Datum: UTM Zone 12, WGS 84)						
Site	Azimuth from starting point (true N)	Transect Starting Point		Transect Ending Point		Length
		Northing (mN)	Easting (mE)	Northing (mN)	Easting (mE)	
Transect 1	171°	4423685.9	725375.6666	4423662.669	725382.8542	25 meters
Transect 2	252°	4423691.841	725369.9313	4423687.72	725347.0446	25 meters
Transect 3	333°	4423696.047	725373.1427	4423716.376	725361.7644	25 meters

Transect Photos and Transect Layout Plot



Figure F1 Transect 1 Reclaimed Pad 93-2M



Figure F2 Transect 2 Reclaimed Pad 93-2M



Figure F3 Transect 3 Reclaimed Pad 93-2M

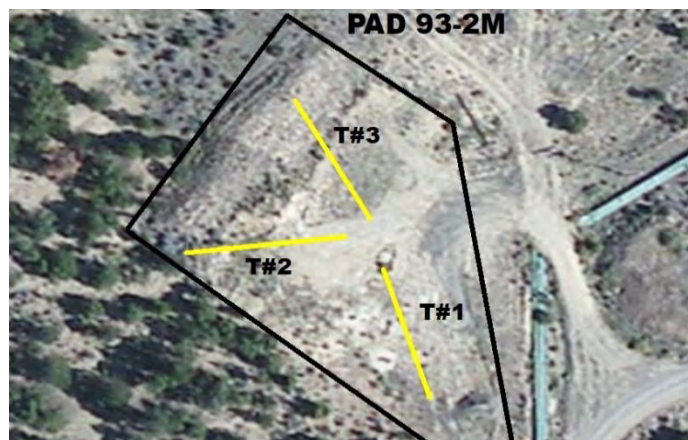


Figure F4 Pad 93-2M Transect Layout

Appendix G – Vegetation Sampling Data Reclaimed Pad 93-4H

Table G1 - Vegetation Cover, Species Composition, Species Density & Ground Cover Reclaimed Pad 93-4H						
Plant Species Observed within Study Area			Line-Point Canopy Intercept Data ¹			Density Data ²
Species Symbol	Scientific Name	Common Name	% Foliar Cover	% Basal Cover	Species Composition	Forb/Shrub Density (#/m ²)
AGCR	<i>Agropyron cristatum</i>	crested wheatgrass	1.3	0.7	3.4	
ELTR7	<i>Elymus trachycaulus</i>	slender wheatgrass	5.3	0.7	13.8	
LECI4	<i>Leymus cinereus</i>	basin wildrye	0.0	0.0	0.0	
NAVI4	<i>Nassella viridula</i>	green needlegrass	0.0	0.0	0.0	
PSJU3	<i>Psathyrostachys juncea</i>	Russian wildrye	8.7	0.7	22.4	
THIN6	<i>Thinopyrum intermedium</i>	pubescent wheatgrass	0.7	0.0	1.7	
Totals for Perennial Grasses			16.0	2.0	41.4	
ASCH	<i>Astragalus chamaeleuce</i>	cicada milkvetch	0.0	0.0	0.0	0.03
ASCI4	<i>Astragalus cicer</i>	cicer milkvetch	1.3	0.0	3.4	0.17
GRSQ	<i>Grindelia squarrosa</i>	curlycup gumweed	0.7	0.0	1.7	0.13
LILE3	<i>Linum lewisii</i>	Lewis flax	0.0	0.0	0.0	0.50
MESA	<i>Medicago sativa</i>	alfalfa	4.7	0.7	15.5	2.70
PEPA8 ³	<i>Penstemon palmeri</i>	Palmer's penstemon	0.0	0.0	0.0	0.00
SPPA2	<i>Sphaeralcea parvifolia</i>	small-leaf globemallow	0.0	0.0	0.0	0.13
Totals for Desirable Forb Species			6.7	0.7	20.7	3.67
ATCA2	<i>Atriplex canescens</i>	four-wing saltbush	1.3	0.0	3.4	0.10
CHVI8	<i>Chrysothamnus viscidiflorus</i>	yellow rabbitbrush	3.3	0.0	8.6	0.27
ERNA10	<i>Ericameria nauseosa</i>	rubber rabbitbrush	0.7	0.0	1.7	0.03
GUSA2	<i>Gutierrezia sarothrae</i>	broom Snakeweed	0.0	0.0	0.0	0.00
Totals for Shrubs			5.3	0.0	13.8	0.40
BRTE	<i>Bromus tectorum</i>	cheatgrass	0.7	0.0	1.7	n/a
ALDE	<i>Alyssum desertorum</i>	desert madwort	0.7	0.0	1.7	0.60
BASC5	<i>Bassia scoparia</i>	burningbush	0.7	0.0	1.7	0.03
MEOF	<i>Melilotus officinalis</i>	yellow sweetclover	0.7	0.0	3.4	0.63
SATR12	<i>Salsola tragus</i>	Russian thistle	6.0	0.0	15.5	3.20
TAOF	<i>Taraxacum officinale</i>	dandelion	0.0	0.0	0.0	0.03
Totals for Invasive and Non-Native Species			8.7	0.0	24.1	4.50
Vegetation Totals			36.7	2.7	100.0	8.57
¹ Sum of data from 3 randomly placed 50 meter transects with 50 sample points collected from each transect. Foliar cover based upon 1 st plant species encountered in the canopy at each sample point. Species composition based upon total of all plant species encountered at each sample point. ² Sum of density data collected from 10 one-square meter quadrants along each transect. Only forb and shrub densities were recorded based upon reclamation criteria. ³ Plant species not encountered in sampling data but were present within the study area. ⁴ Percentages are not cumulative with vegetation totals, rather a measure by layer of ground cover from the top layer thru the lower layers to the soil surface. Values for bare ground have no vegetative, litter or rock cover above the soil surface.					Percent Ground Cover by Cover Type ⁴	
					Bare Ground	31.3
					Biotic Crust	0.0
					Herbaceous Litter	36.7
					Woody Litter	9.3
					Duff	0.0
					Rock	4.7

Table G2 - Canopy Gap Intercept Data Reclaimed Pad 93-4H										
Canopy Gaps > 20 centimeters	Total of Gaps > 20 cm		Gaps 21-50 cm		Gaps 51-100 cm		Gaps 101-200 cm		Gaps >200 cm	
	2016 ¹	2017 ²	2016 ¹	2017 ²	2016 ¹	2017 ²	2016 ¹	2017 ²	2016 ¹	2017 ²
Transect 1	1632	1529	226	166	745	749	661	366	0	248
Transect 2	2061	1311	688	181	642	759	249	149	482	222
Transect 3	2180	1750	383	210	960	839	837	449	0	252
Total Gaps (cm)	5873	4590	1297	557	2347	2347	1747	964	482	722
% Line in Gaps	39.15	61.20	8.65	7.43	15.65	31.29	11.65	12.85	3.21	9.63
¹ Line length for each transect was 50 meters for site total length of 150 meters										
² Line length for each transect was 25 meters for site total length of 75 meters										

Table G3 - Transect Coordinate Locations Reclaimed Pad 93-4H (Datum: UTM Zone 12, WGS 84)						
Site	Azimuth from starting point (true N)	Transect Starting Point		Transect Ending Point		Length
		Northing (mN)	Easting (mE)	Northing (mN)	Easting (mE)	
Transect 1	003°	4423402.835	725185.1642	4423428.837	725185.2514	25 meters
Transect 2	091°	4423397.114	725194.5712	4423409.156	725214.8297	25 meters
Transect 3	149°	4423390.854	725185.7748	4423372.939	725199.9044	25 meters

Transect Photos and Transect Layout Plot



Figure E1 Transect 1 Reclaimed Pad 93-4H



Figure E2 Transect 2 Reclaimed Pad 93-4H



Figure E3 Transect 3 Reclaimed Pad 93-4H

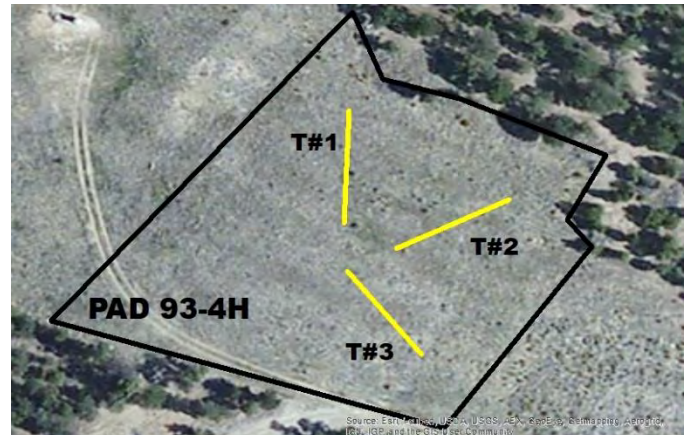


Figure E4 Pad 93-4H Transect Layout