San Luis & Delta-Mendota Water Authority
United States Bureau of Reclamation

Grassland Bypass Project

Annual Monitoring Report
2017

Covering the period: January through December 2017

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SECTION 1: EXECUTIVE SUMMARY

This report covers the 2017 calendar year sampling events. This report summarizes the monitoring data collected between January and December 2017.

2017 was classified as a wet hydrologic year type for the westside of the San Joaquin Valley with Federal Water Contractors receiving 100% of their federal water contract allocation. A total of 8.7"[1] of rain fell during the report period, with significant rain events in January, February, March, and April. Drainage management activities were able to dramatically reduce drainage discharge in June through September. Storm activities during the non-irrigation season generated subsurface drainage production that exceeded the capacity of drainage management actions to avoid the need for any discharge, resulting in discharge through the San Luis Drain. These discharges were contained within the San Luis Drain and did not trigger a storm water monitoring event.

During the 2017 monitoring period, approximately 10,900 acre feet of subsurface drain water was discharged through the San Luis Drain to Mud Slough (North). No storm water plan actions were required during this report period. Discharge from the San Luis Drain contributed to selenium, specific conductivity, boron, and molybdenum exceedances in Mud Slough (North) measured at Site D. Wet conditions at the end of 2016 through March of 2017 resulted in discharges that exceeded the monthly selenium load allocation, however the total annual load was well below the annual target. Monthly credits were available and applied so that no monthly incentive fees were due.

Aquatic toxicity samples were collected monthly at Site D for algae, water flea and fathead minnow. No statistically significant aquatic toxicity was observed in any of those samples.

A sediment sample was collected from Site D and tested for sediment toxicity to *Hyalella azteca* in March and September of 2017. No sediment toxicity was observed in either sample.

Sample collection completion was 90%. Weekly samples were not collected at Site R from January through most of April. Heavy rainfall prevented safe access to that site as the access road was impassible. Samples were not collected March 3rd, 2017 as the field vehicle was stuck in the mud and required a tow truck for removal. Samples were not collected on January 3rd, January 19th, March 23rd, and April 7th, 2017, due to extreme weather. Samples were also not collected on September 26th, 2017 due to schedule conflicts. Additionally, samples were not collected from Site N on December 15th, 2017, due to time constraints.

The Grassland Bypass Project has been in operation since 1997. Since that time, agricultural subsurface drainage discharges to the San Joaquin River through Mud Slough North (Site D) have reduced by nearly 90%, resulting in a 96% reduction in the associated load of selenium. Drainage management activities during this report period continued this reduction in discharge, bringing the receiving water bodies closer to compliance with water quality objectives. The Coalition is not recommending any changes at this time.

[1] Average of precipitation totals from CIMIS Station 7 and Station 124.

SECTION 2: MONITORING OBJECTIVES AND DESIGN.

The objectives of this monitoring program are to provide data necessary for implementation of the GBP according to the terms and conditions specified in the Order R5-2015-0094 (Order). Monitoring will provide data necessary to assess environmental conditions in the San Luis Drain, wetland supply channels, Mud Slough (North), and the San Joaquin River.

The monitoring plan is designed to provide data to assess compliance with the Order. Flow, water quality, toxicity and sediment will be monitored to ensure compliance and assess potential impacts the project may have on wetland water supply channels and the San Joaquin River. Monitoring will consist of sample collection and data analysis. Data results will then be compared to historical trends as well as standards set forth in the Order. This will help determine if the program is meeting program objectives.

Storm water monitoring occurs at 4 sites when flows are expected to exceed the capacity of the San Luis Drain. These excess flows would be routed through wetland supply channels via the Agatha Canal and the Camp 13 Ditch. During this period, samples would be collected daily at several locations to monitor water quality and assess impact. Despite the wet conditions of 2017, the Grassland Area Farmers were able to manage all flow so that they were contained within the San Luis Drain and implementation of the storm water monitoring plan was not required.

Table 1 lists the monitoring sites and locations. **Table 2** lists the monitoring parameters and frequency as listed in the MRP for Order R5-2015-0094. All samples were collected using the field sampling standard operating procedures and were collected either directly into the sample container or into a clean bucket and decanted into the sample container.

Table 1: Monitoring Sites and Locations.

Feature	CEDEN Code	Station	Location	Latitude	Longitude
San Luis Drain	NA	B2*	Terminus at Mud Slough	37.26100 N	-120.90520 W
	541SLDGCR	B3	Gun Club Road	37.23159 N	-120.87599 W
Mud Slough (north)	541MER542	D	Downstream of SLD	37.26374 N	-120.90627 W
Wetlands channels	541MER505	J*	Camp 13 Ditch, headworks	36.94117 N	-120.75685 W
	541AGCHWK	K2*	Agatha Canal, headworks	36.93399 N	-120.70258 W
	541MER563	L2*	San Luis Canal upstream of splits	37.09167 N	-120.82306 W
	541MER545	M2*	Santa Fe Canal @ Weir Rd	37.09889 N	-120.82667 W
San Joaquin River	541SLRACI	R	China Island Unit	37.33622 N	-120.96763 W
	NA	H2*	Above Merced River (Hills Ferry)	337.34737 N	-120.97500 W
	535STC504	N	Crows Landing	37.43149 N	-121.01341 W

* Flow measurement only.

Table 2: Monitoring Parameters and Frequency.

Parameter (unit)		Type of Sample	Station	Frequency
Flow (cfs)	**Method**	Daily average	B2*, D, H2*	Daily
Field measurements[2] pH (pH units) Electrical conductivity (µmhos/cm) Temperature (ºC)	 YSI Meter YSI Meter YSI Meter	 Grab Grab Grab	 B3, D, R, N B3, D, R, N B3, D, R, N	 Weekly Weekly Weekly
General physical (EF) Total organic carbon (mg/L)	SM5310 C	Grab	D	Weekly
Selenium (total) (µg/L) (SD)	SM3500-Se-C (fluorometric)	Grab	B3, D, R, N	Weekly
Boron (mg/L) (WET)	EPA 200.7	Grab	B3, D, R, N	Weekly
Molybdenum (µg/L) (WET)	EPA 200.8	Grab	B3, D, R, N	Monthly
Nutrients (WET) Nitrate as N (mg/L) Ammonia as N (mg/L)	 EPA 300.0 SM 4500 NH3 D	Grab	 B3, D B3, D	 Monthly Monthly
Pesticides To be determined		Grab	B3, D, R	To be determined
Chronic Aquatic Toxicity (PER) *Selenastrum capricornutum* (growth)	EPA 821-R-02-013 EPA 600-4-91-02	Grab	D	Monthly
Acute Aquatic Toxicity (PER) *Daphnia magna* (survival) *Pimephales promelas* (survival)	EPA 821-R02-012	Grab	D D	Monthly
Sediment Toxicity (PER) *Hyalella azteca* (Survival) Total Organic Carbon (mg/L) Grain size	EPA 600-R-99-064 Walkley-Black ASTM D4464M	Grab	D	Biannual
Sediment To be determined		Grab	B3	Annual

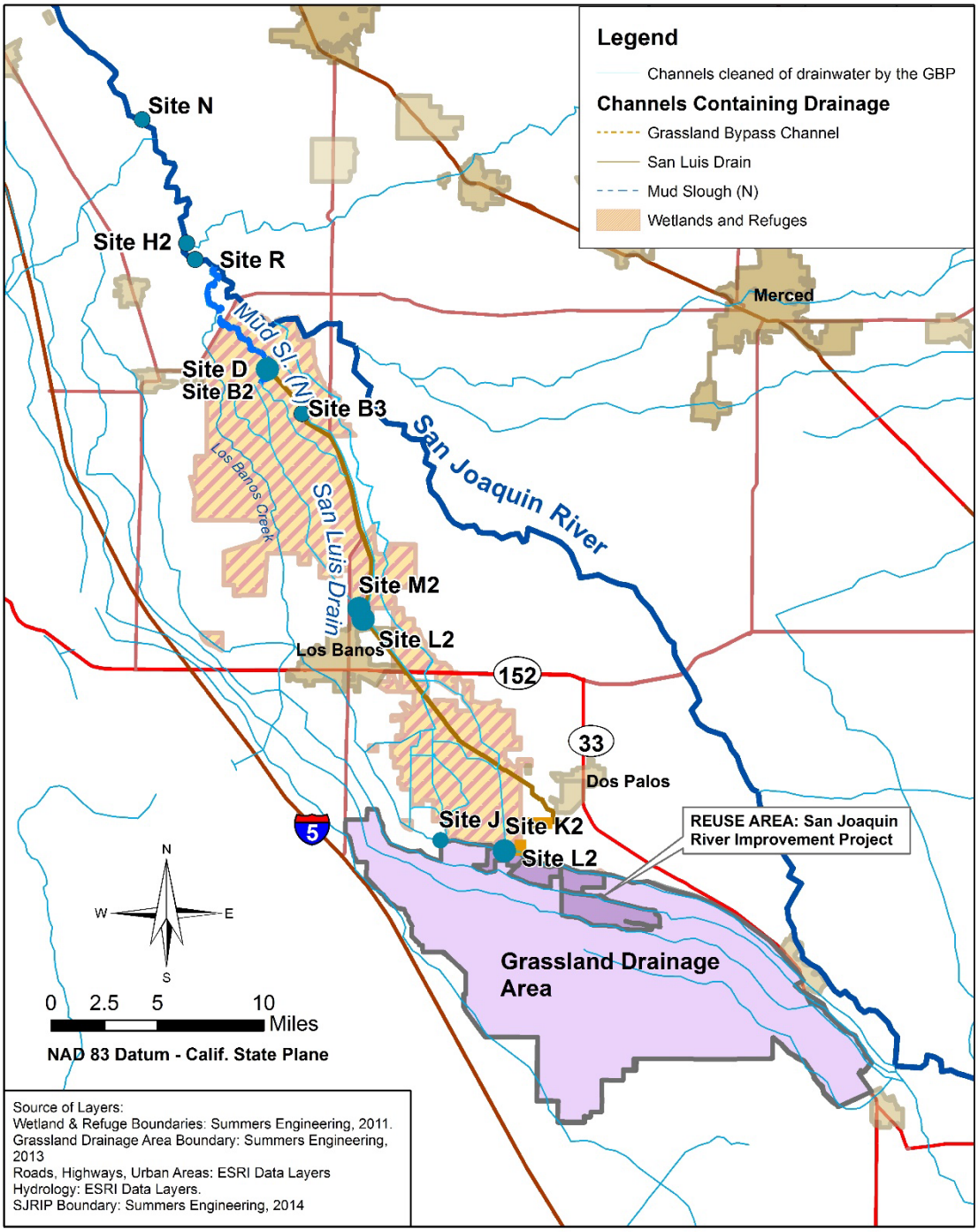
* Flow measurement only.
EF: Eurofins Laboratory
SD: South Dakota Agriculture Laboratory
WET: Western Environmental Testing Laboratory
PER: Pacific Ecorisk Laboratories

[2] Field measurements shall be noted on the Field Sheet, as well as any physical and/or visual observations regarding the water body, the environment, or surrounding area.

SECTION 3: MONITORING SITE DESCRIPTIONS

Figure 1 shows the general area of the Grassland Bypass Project and identifies the Monitoring Sites. The Monitoring Sites are described below.

Figure 1 – Location Map



Grassland Bypass Project Location Map

Prepared by:
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San Luis Drain:

- Station A (No CEDEN Code): This station is located downstream of the inlet of the Grassland Bypass Channel in the San Luis Drain. This station measures the flow into the San Luis Drain from the Grassland Drainage Area. It is not included in the Monitoring Order.
- Station B2 (No CEDEN Code): This station is located at the Mud Slough Terminus of the San Luis Drain (SLD). It is representative of flows coming from the Grassland Drainage Area. Flow is measured at this site over a sharp crested weir. A datalogger on site collects stage data throughout the day, which is used to calculate a daily average discharge.
- Station B3 (541SLDGCR): This station is located in the SLD at the Gun Club Road crossing. This station is representative of water in the SLD. Field measurements, selenium, boron, molybdenum, and nutrients are currently being measured at this site.

Mud Slough (North):

- Station D (541MER542): This station is located in Mud Slough downstream of the SLD discharge. It represents flow, water quality, toxicity, and sediment toxicity in the Mud Slough after mixing with discharges from the drain. Flow, field measurements, TOC, selenium, boron, molybdenum, nutrients, chronic and acute aquatic toxicity, and sediment toxicity are currently being measured at this site. USGS has developed a stage- discharge rating at this site and maintains a monitoring station which provides flow information through CDEC (Station ID: MSG).

Wetland Channels (flow, pH, EC, temperature, selenium and boron are only collected at these sites during storm events):

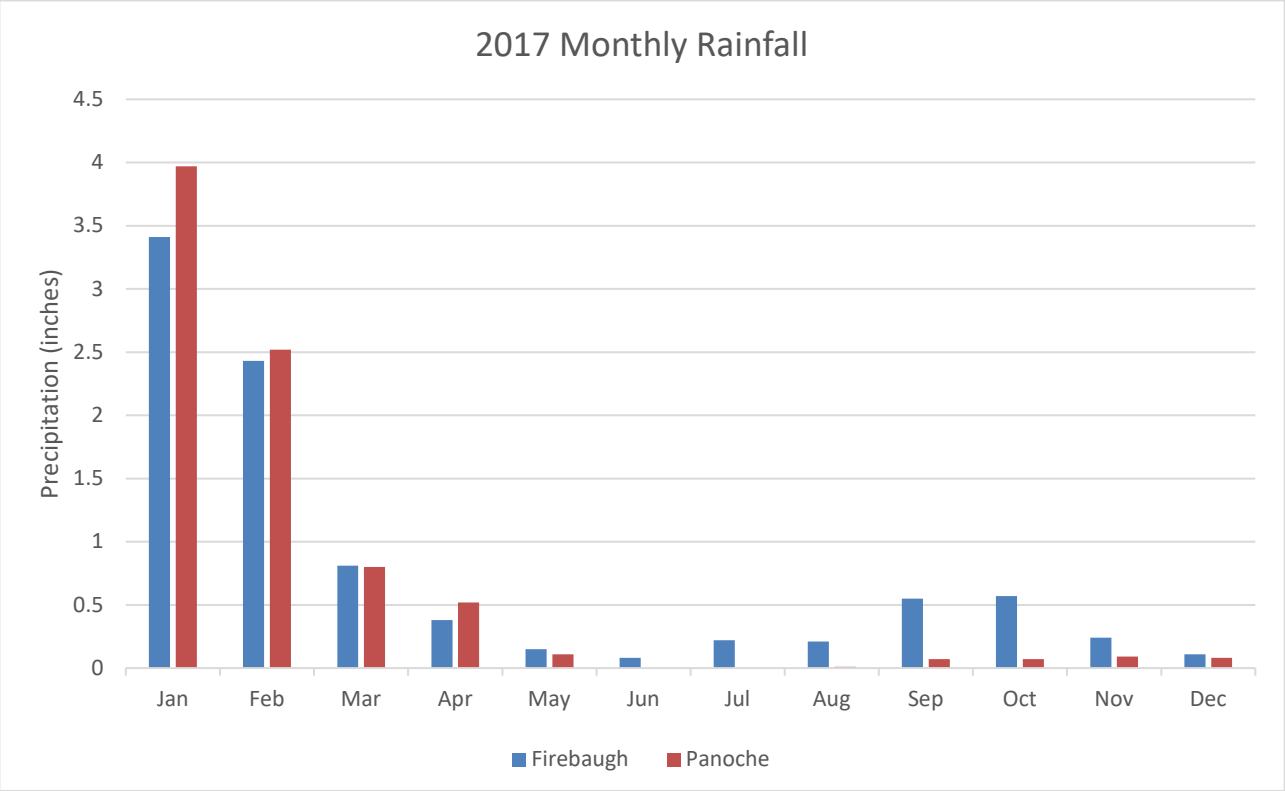
- Site J (541MER505): This station is located at the headworks of the Camp 13 Ditch.
- Site K2 (541AGCHWK): This station in located at the headworks of the Agatha Canal.
- Site L2 (541MER563): This station is located in the San Luis Canal upstream of the splits.
- Site M2 (541MER545): This station is located in the Santa Fe Canal at Weir Road.

San Joaquin River:

- Site R (541SLRACI): This station is located in the San Joaquin River near the China Island Unit. It represents water in the San Joaquin River downstream of discharge from Mud Slough. Field measurements, selenium, boron, molybdenum, and nutrients are measured at this site.
- Site H2 (No CEDEN Code): This station is located in the San Joaquin River near but upstream of the Merced River confluence. It represents flow in the San Joaquin River downstream of discharges from Mud Slough. USGS has developed a stage-discharge rating at this site and maintains a monitoring station which provides flow information through CDEC (Station ID: SMN).
- Site N (535STC504): This station in located in the San Joaquin River near Crows Landing. It is a compliance point for the Basin Plan and represents impacts of the project on the River. Field measurements, selenium, boron, and molybdenum are collected at this site.

Rainfall Records.
Two CIMIS[3] stations were monitored by the Grassland Coalition for rainfall: Firebaugh/Telles and Panoche. **Figure 2** shows the monthly rainfall measured at both stations during the 2016 monitoring period.

Figure 2 – Monthly Rainfall



The Firebaugh/Telles precipitation site measured 9.16" for 2017 and the Panoche site measured 8.24". Table 3 shows the monthly totals for both precipitation sites.

[3] California Irrigation Management Information System, http://wwwcimis.water.ca.gov/cimis/welcome.jsp
CIMIS Site Designations: Firebaugh/Telles – 007, Panoche - 124

Table 3: CIMIS Rainfall Measurements

Month	Firebaugh	Panoche
January	3.41	3.97
February	2.43	2.52
March	0.81	0.8
April	0.38	0.52
May	0.15	0.11
June	0.08	0
July	0.22	0
August	0.21	0.01
September	0.55	0.07
October	0.57	0.07
November	0.24	0.09
December	0.11	0.08
Total:	9.16	8.24

There was not sufficient rainfall during this report period to trigger the Storm Event Plan or cause any storm water monitoring. A total of 10,870 acre feet were discharged from the San Luis Drain to Mud Slough (North) from January 1 to December 31, 2017 (measured at Site B2), compared to 8,822 acre feet discharged into the San Luis Drain from the Grassland Drainage Area (measured at Site A), all of which occurred between January and April as a result of rainfall. Discharged selenium loads exceeded the selenium load allocation in January, February and March. The selenium load in all other months was below the selenium allocations.

SECTION 4: DISCUSSION OF DATA AND EXCEEDANCES

In order to properly understand the data collected as part of MRP Order R5-2015-0094, it is important to understand the source and origin of the water discharged as part of the Grassland Bypass Project. Subsurface drainwater, produced through agricultural irrigation, is collected by subsurface drainage systems[4] and discharged into regional drains within the Grassland Drainage Area. Drainage management activities, including drainage reuse on the SJRIP, minimize the volume of subsurface drainwater. Any drain water that cannot be managed by these drainage activities is discharged to the San Luis Drain (at Site A), where it makes its way to Mud Slough (North) and ultimately to the San Joaquin River.

Water discharged through the San Luis Drain is highly mineralized and contains moderate to high concentrations of dissolved solids including selenium, boron, and molybdenum. However, because the discharged drain water is consolidated into a single channel (the San Luis Drain) with a distinct discharge point (Site D at Mud Slough), effective water quality monitoring is simplified. The existing monitoring program includes sample locations within the source water, receiving water and background water sites and adequately characterizes the water quality affected by the project. Additional monitoring sites are not required.

[4] Typically perforated drainage tubing buried 6 to 10 feet below ground and connected to form a system of drains that will manage shallow water. Also referred to as “Tile Drains” or “Tile Systems”.

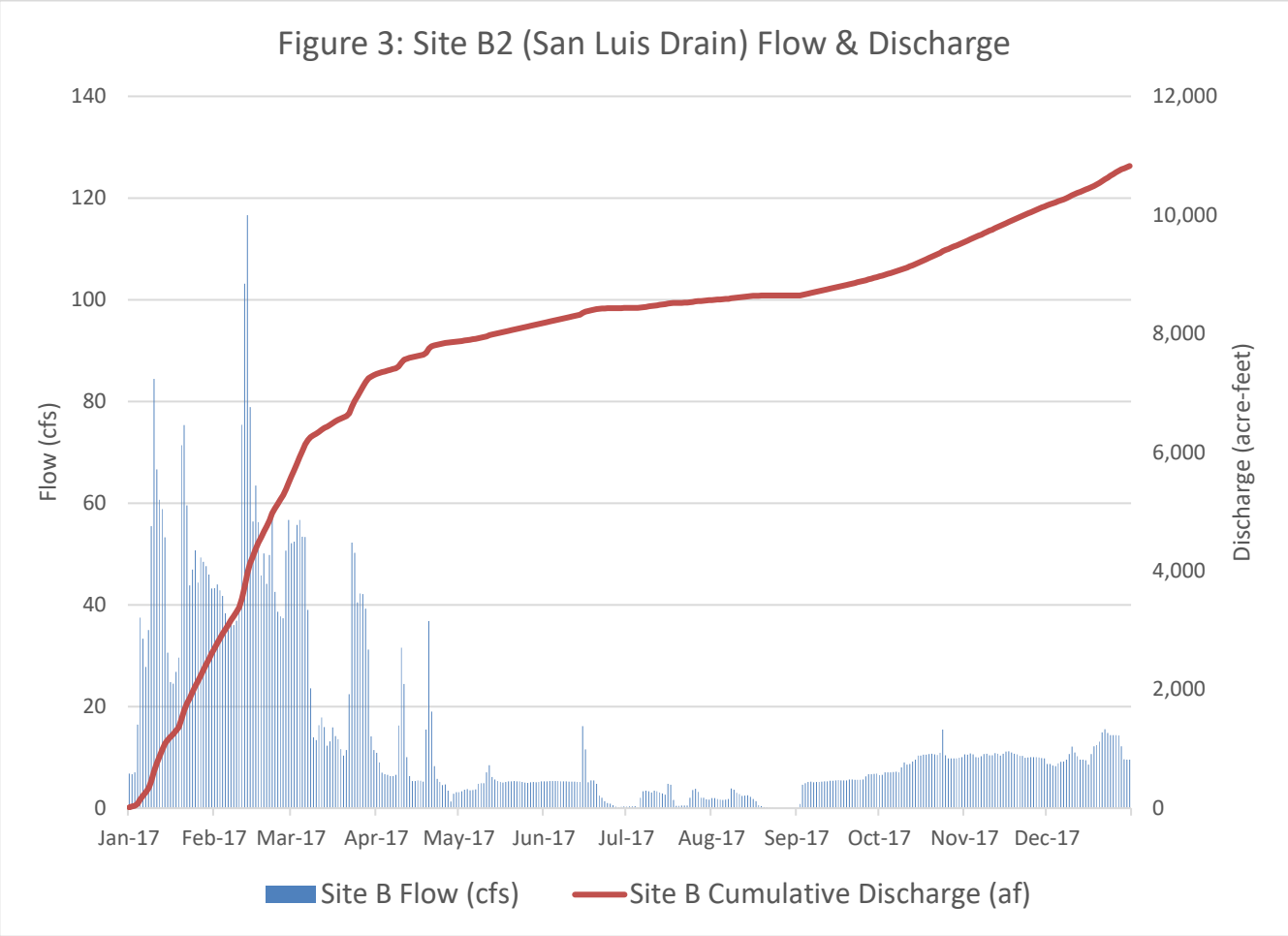
Table 4 shows the Water Quality Objectives for each constituent at each site from the San Joaquin River Basin Plan. In many cases, the WQO is dependent on an average calculation (i.e. monthly mean), the time of year, and even hydraulic year type.

Table 4: Water Quality Objectives

Analyte	Site	Unit	WQO (max)	WQO (min)
pH	B3	s.u.	Not Applicable	NA
	D		8.5	6.5
	R		8.5	6.5
	N		8.5	6.5
EC	B3	uS/cm	Not Applicable	NA
	D		900 (Ca secondary MCL)	NA
	R		900 (Ca secondary MCL)	NA
	N		900 (Ca secondary MCL)	NA
Se	B3	ug/L	Not Applicable	NA
	D		20 max, 15 (monthly mean)*	NA
	R		20 max, 15 (monthly mean)*	NA
	N		12 max, 5 (4-day avg)	NA
B	B3	mg/L	Not Applicable	NA
	D		5.8 max, (2.0 monthy mean, 15 Mar through 15 Sept)	NA
	R		5.8 max, (2.0 monthy mean, 15 Mar through 15 Sept)	NA
B	N	mg/L	2.0 max and 0.8 monthly mean 15 Mar through 15 Sept, 2.6 max and 1.0 monthly mean 16 Sept through 14 Mar, 1.3 monthly mean critical year	NA
Mo	B3	ug/L	Not Applicable	NA
	D		50 ug/L Max - 19 ug/L monthly mean	NA
	R		50 ug/L Max - 19 ug/L monthly mean	NA
	N		15 ug/L Max - 10 ug/L monthly mean	NA
Nitrate	B3	mg/L	Not Applicable	NA
	D		10	NA

* Performance Goal. See San Joaquin River Basin Plan

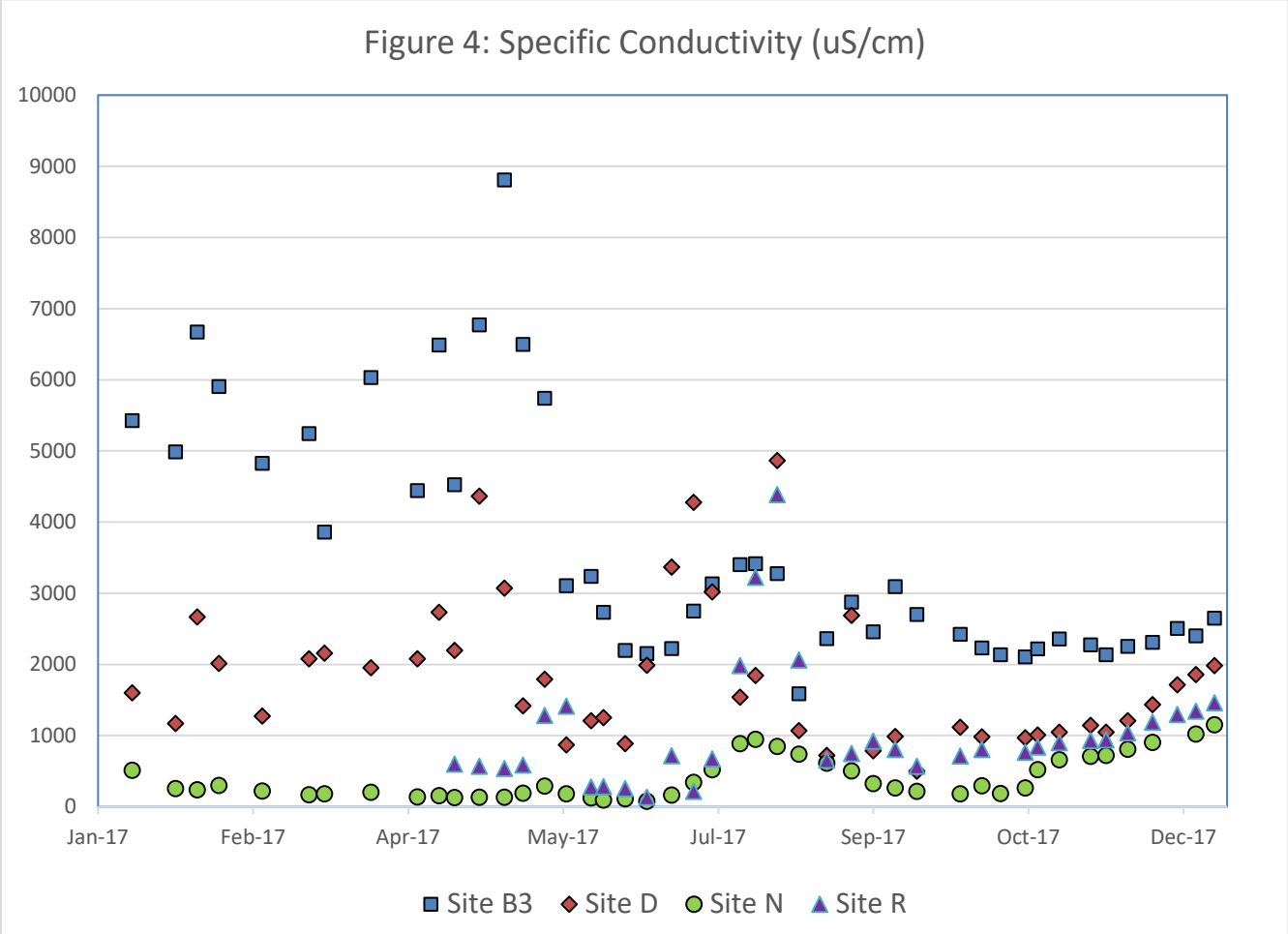
Since 1996, the Grassland Bypass Project has been implemented to manage, reduce, and ultimately eliminate the discharge of this water through the San Luis Drain. For this report period, there was no discharge into the San Luis Drain from April 21 through December 31 at Site A, indicating that all of the drain water generated within the Grassland Drainage Area was managed internally during this period. There was discharge from the San Luis Drain into Mud Slough (Site B2) throughout the year as a result of seepage flows into the Drain[5]. **Figure 3** shows the daily flow and cumulative discharge (in acre feet) for Site B2 for the 2017 monitoring period.



[5] Because of the prevalence of high groundwater throughout the region, the San Luis Drain was constructed with weep-valves in the lining. These valves allow groundwater to seep into the channel to protect the lining from buckling.

Specific Conductivity (µs/cm).

Specific Conductivity (SC) data was collected using field instruments at the time of water sample collection. This data is tabulated as **Attachment 1** along with other field-collected data. **Figure 4** shows the measured results of the SC at each of the monitoring sites.

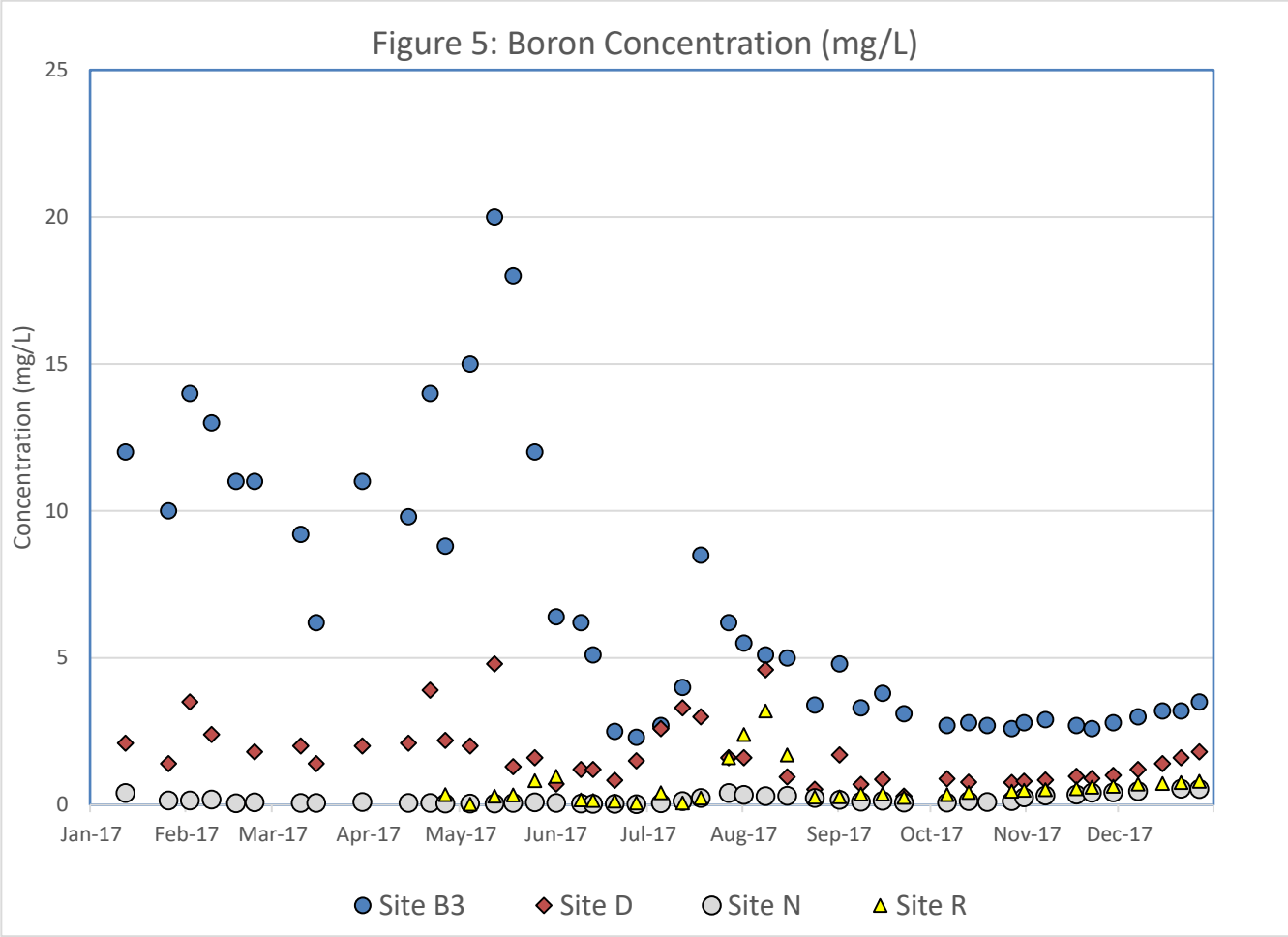


SC is a surrogate measurement for Total Dissolved Solids (TDS) and provides an approximate representation of the salinity of the water tested. As would be expected, the SC for water within the San Luis Drain (Site B3) is elevated (average SC of 4,100 µs/cm, with a range of 2,200 to 9,500 µs/cm). This is consistent with the saline nature of subsurface drain water. The SC range measured during 2017 is considerably lower than that of 2016 (which averaged 6,200 µs/cm). The cause of this difference is not currently know.

When the San Luis Drain is flowing, water from Site B3 is discharged into Mud Slough (North) upstream of Site D. As would be expected, SC at Site D increases once discharge through the San Luis Drain begins.

Boron, Molybdenum, and Selenium (µg/L).
Boron (B), Molybdenum (Mo), and Selenium (Se) are constituents naturally occurring in the soil within the Grassland Drainage Area and throughout the Westside of the San Joaquin Valley. These minerals are dissolved into the subsurface drainage as the water moves through the soil.

Figure 5 shows the boron concentrations measured at each of the monitoring sites during this report period.



The WQO for boron varies according to time of year and location and is based on a monthly mean concentration. For Sites D and R, the WQO is a monthly mean of 2.0 mg/L from March 15 through September 15th and a maximum concentration of 5.8 mg/L for the remainder of the year. Site D exceeded the monthly mean boron WQO in April, May, and July. Site R did not exceed the monthly mean boron WQO in any month.

For Site N, the monthly mean from March 15th through September 15th is 0.8 mg/L with a maximum concentration of 2.0 mg/L. For Site N from September 16th through March 14th, the WQO is a monthly mean of 1.0 mg/L with a maximum concentration of 2.6 mg/L. Site N did not exceed the monthly mean boron WQO in any month. **Table 5a** shows the monthly mean boron concentrations and **Table 5b** shows the grab sample readings.

Table 5a: Boron - Monthly Mean Concentration (mg/L)

Month	Site B3	Site D	Site R	WQO - D&R	Site N	WQO - N
January	11.00	1.75	①	NA*	0.28	1.0
February	12.25	2.57	①	NA*	0.12	1.0
March	8.80	1.80	①	2.0	0.76	0.80
April	10.87	2.73	0.35	2.0	0.60	0.80
May	16.25	2.43	0.37	2.0	0.61	0.80
June	4.50	1.09	0.30	2.0	0.43	0.80
July	5.35	2.63	0.58	2.0	0.21	0.80
August	4.75	1.92	1.89	2.0	0.30	0.80
September	3.75	0.90	0.32	2.0	0.12	0.80
October	2.72	0.81	0.44	NA*	0.13	1.0
November	2.75	0.90	0.58	NA*	0.37	1.0
December	3.23	1.50	0.75	NA*	0.52	1.0

* Monthly average concentration not relevant for WQO at these sites.

① Wet conditions prevented safe access for sample collection

Table 5b shows the boron concentrations by date and associated WQO for Sites D and R from January 1, 2016 through December 31, 2017.

Table 5b: Boron Concentration (mg/L) – January 1 to December 31 2017

Date	Site B3	Site D	Site R	WQO - D & R
1/12/2017	12	2.1	①	5.8
1/26/2017	10	1.4	①	5.8
2/2/2017	14	3.5	①	5.8
2/9/2017	13	2.4	①	5.8
2/17/2017	11	①	①	5.8
2/23/2017	11	1.8	①	5.8
3/10/2017	9	2.0	①	5.8
3/15/2017	6	1.4	①	5.8
3/30/2017	11	2.0	①	5.8
4/14/2017	10	2.1	①	5.8
4/21/2017	14	3.9	①	5.8
4/26/2017	9	2.2	0.35	5.8
5/4/2017	15	2.0	0.02	5.8
5/12/2017	20	4.8	0.30	5.8
5/18/2017	18	1.3	0.34	5.8
5/25/2017	12	1.6	0.82	5.8
6/1/2017	6	0.7	0.97	5.8
6/9/2017	6	1.2	0.17	5.8
6/13/2017	5	1.2	0.15	5.8
6/20/2017	3	0.8	0.13	5.8
6/27/2017	2	1.5	0.06	5.8
7/5/2017	3	2.6	0.41	5.8

Date	Site B3	Site D	Site R	WQO - D & R
7/12/2017	4	3.3	0.07	5.8
7/18/2017	9	3.0	0.24	5.8
7/27/2017	6	1.6	1.60	5.8
8/1/2017	6	1.6	2.40	5.8
8/8/2017	5	4.6	3.20	5.8
8/15/2017	5	1.0	1.70	5.8
8/24/2017	3	0.5	0.27	5.8
9/1/2017	5	1.7	0.28	5.8
9/8/2017	3	0.7	0.37	5.8
9/15/2017	4	0.9	0.37	5.8
9/22/2017	3	0.3	0.26	5.8
10/6/2017	3	0.9	0.35	5.8
10/13/2017	3	0.8	0.42	5.8
10/19/2017	3	No Sample	No Sample	5.8
10/27/2017	3	0.8	0.47	5.8
10/31/2017	3	0.8	0.50	5.8
11/7/2017	3	0.9	0.52	5.8
11/17/2017	3	1.0	0.55	5.8
11/22/2017	3	0.9	0.60	5.8
11/29/2017	3	1.0	0.64	5.8
12/7/2017	3	1.2	0.71	5.8
12/21/2017	3	1.6	0.76	5.8
12/27/2017	4	1.8	0.80	5.8

① Wet conditions prevented safe access for sample collection.

Figure 6 shows the molybdenum concentrations measured at each of the monitoring sites during this report period. The WQO for molybdenum is based on the monthly mean concentration and is dependent on location. The WQO for Sites D and R is a monthly mean of no more than 19 µg/L and the WQO for Site N is a monthly mean of no more than 10 µg/L. Sites N, R, and D did not exceed the monthly mean for molybdenum in any month for this report period.

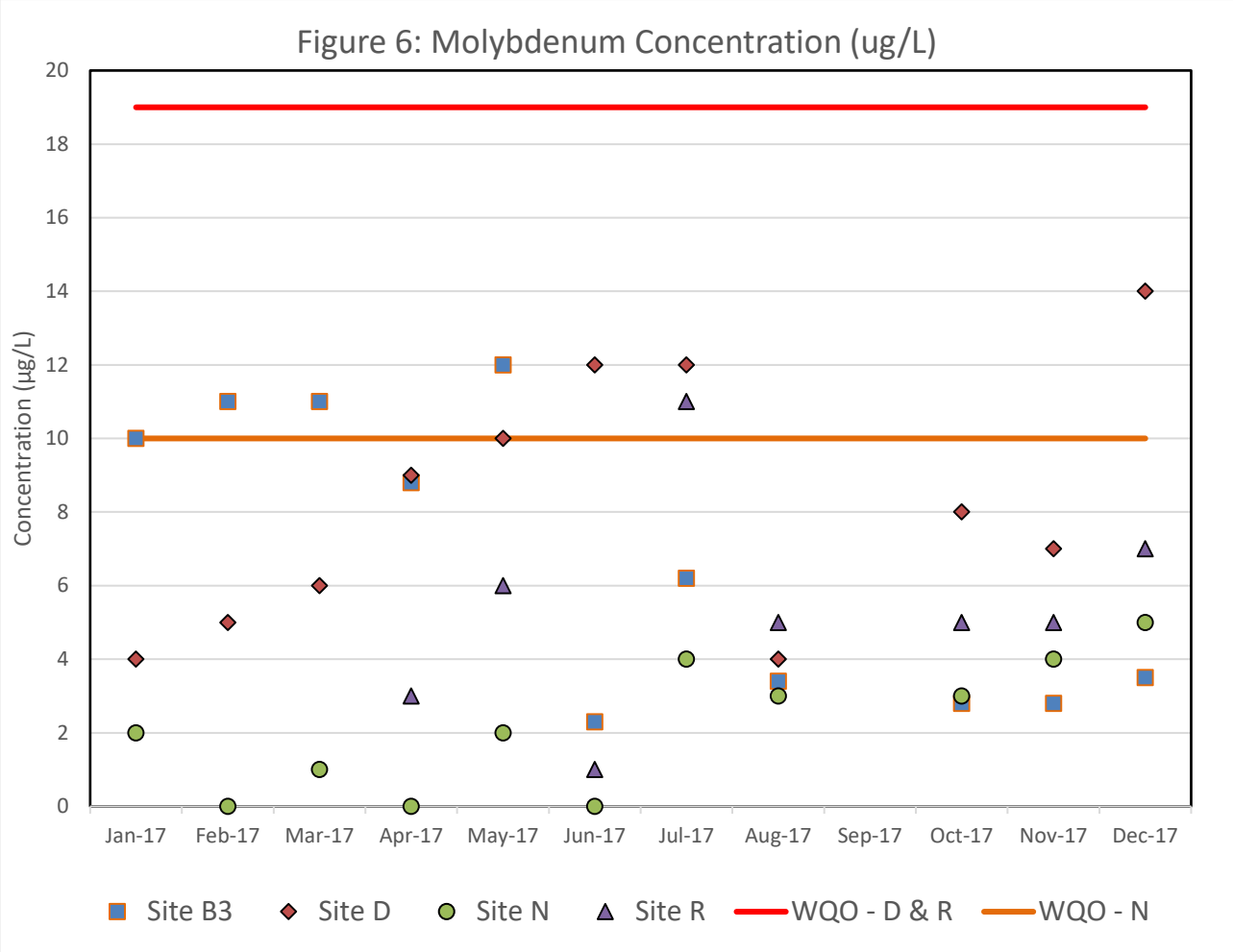


Figure 7 shows the selenium concentrations measured at each of the monitoring sites during this report period. For Site N, the WQO is a 4-day average of no more than 5 µg/L. None of the samples collected from Site N for this report period detected selenium.

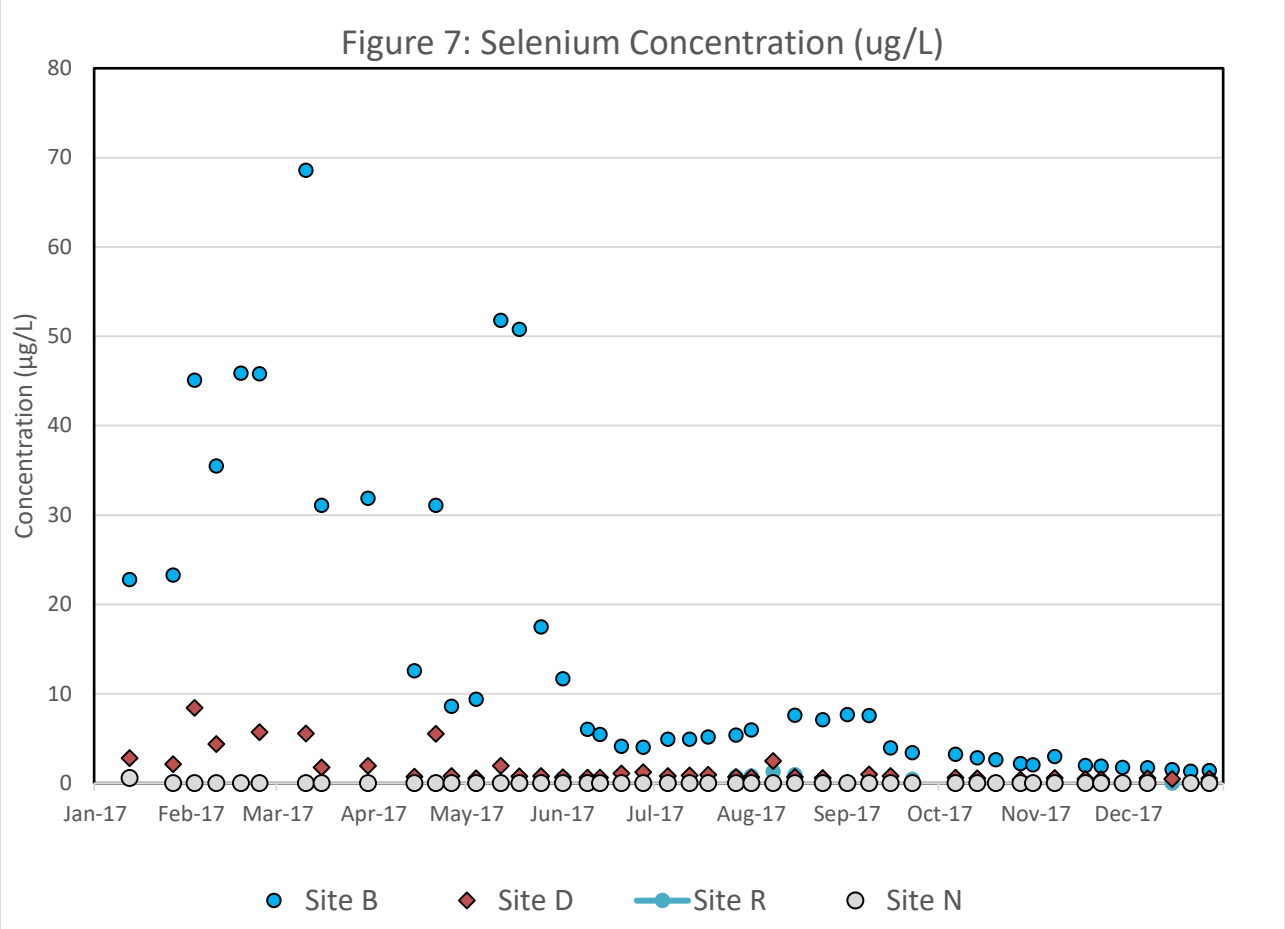


Table 6 lists the monthly average selenium concentration for Site D and Site R. Through December of 2019 the selenium WQO for these two sites is a monthly average of no more than 15 µg/L. As noted earlier, wet conditions prevented safe access to Site R from January through March and no samples were collected at that site during that period.

Table 6: Selenium (µg/L) - Monthly Average

Month	Site D	Site R	WQO - D & R
January	2.47	NS	15
February	6.17	NS	15
March	1.86	NS	15
April	0.80	<0.4	15
May	1.01	0.43	15
June	0.85	0.57	15
July	0.83	0.75	15
August	1.10	0.88	15
September	0.90	0.45	15
October	0.52	<0.4	15
November	0.51	<0.4	15
December	0.51	<0.4	15

NS = No sample collected.

As with the SC measurements, the saline nature of the subsurface drainage water discharged through Site B contributed to elevated concentrations of boron, molybdenum, and selenium in the downstream receiving waterbody. However, the monthly mean WQO of 15 µg/L was not exceeded at Site D or Site R in any month during this report period.

One of the ultimate goals of the Grassland Bypass Project is to meet the 4-day average selenium WQO of 5 µg/L in Mud Slough (North) at Site D. Drainage management actions implement by the Grassland Area Farmers has reduced both the volume of drain water and the selenium concentration discharged into the SLD. This has resulted in a steady improvement in the water quality at Site D. Table 7 shows the count of Site D selenium results in excess of the 5 µg/L 4-day average selenium WQO.

Table 7: Site D Count of Se Results >5 µg/L

Year	Count of Se Results >5 µg/L
2011	16
2012	26
2013	22
2014	24
2015	9
2016	5
2017	4

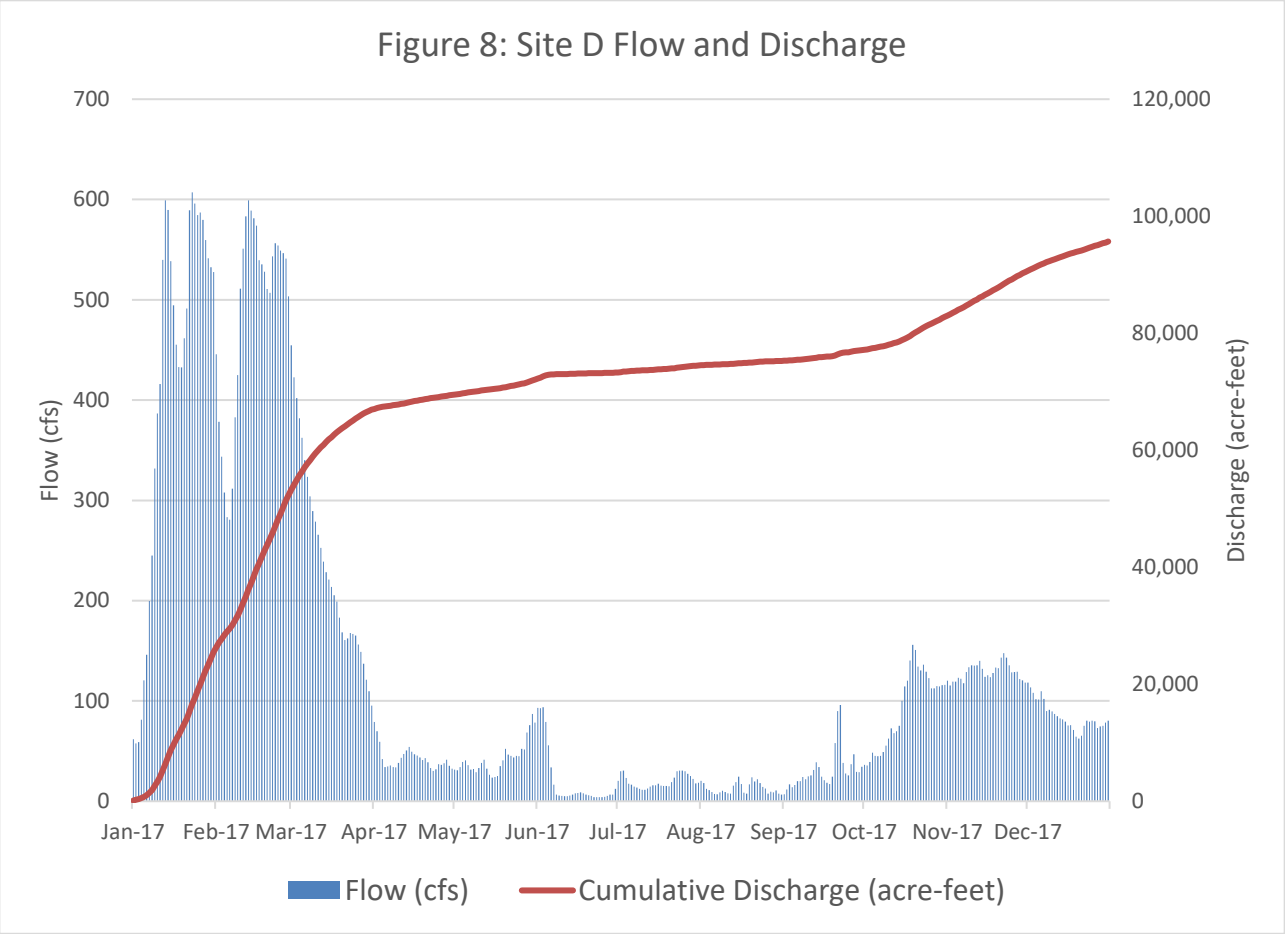
Aquatic Toxicity.
As required by the MRP Order, aquatic toxicity for algae (*Selenastrum capricornutum*), water flea (*Daphnia magna*), and fathead minnow are tested monthly for Site D. During 2017 there were no observations of aquatic toxicity at Site D for any of the three species tested.

Sediment Toxicity.
Sediment samples were collected at Site D on March 15th and September 23rd, 2017 in accordance with the MRP Order. No statistically significant toxicity to *Hyalella azteca* was observed in both sampling events.

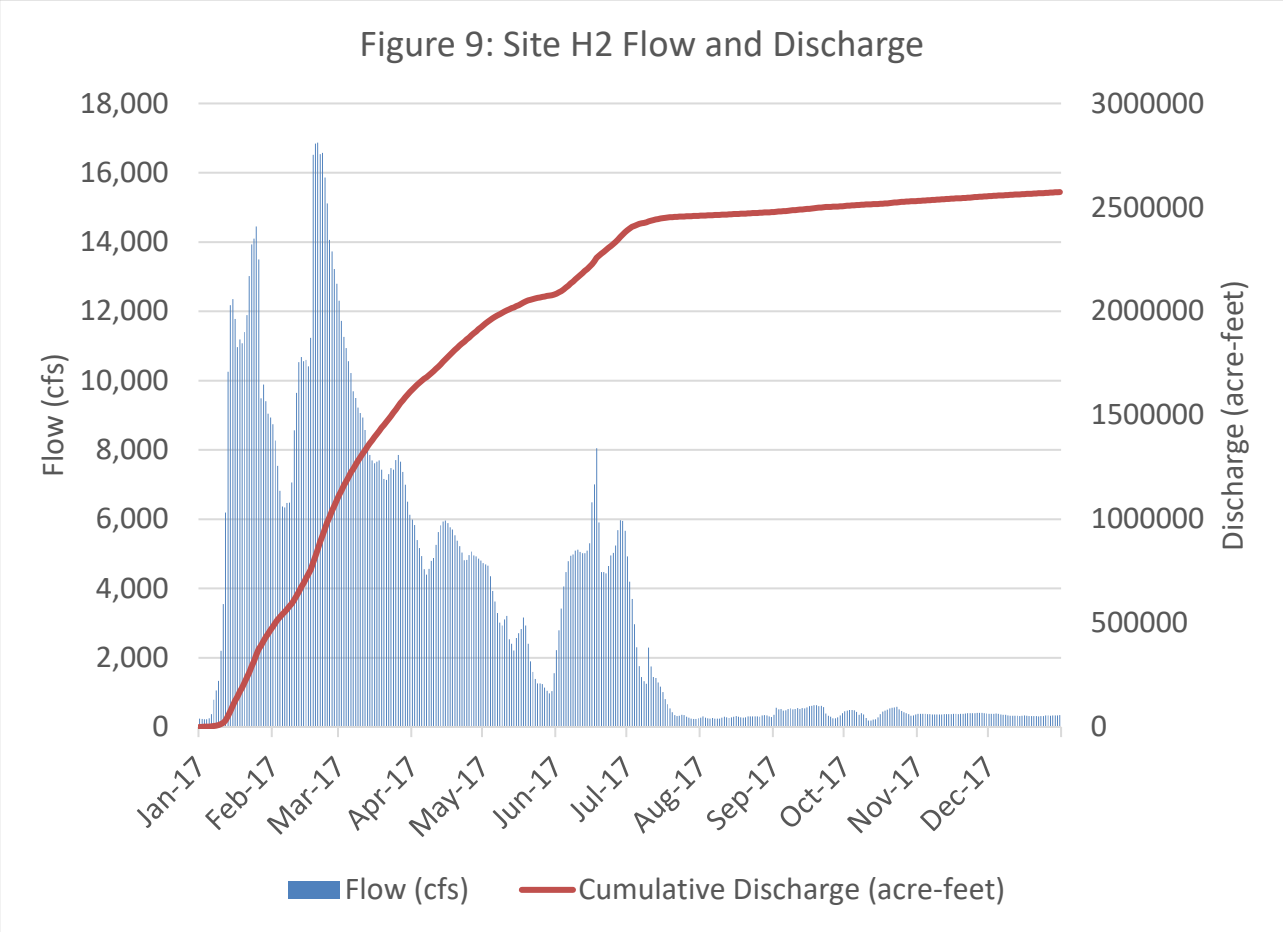
Attachment 1 includes a tabulation of all of the data results at each of the monitoring sites as required in the MRP Order.

Discharge.

The MRP Order requires flow monitoring at Sites B2, D, and H2. Flow at Site B2 is measured by a sharp-crested weir which is maintained by Panoche Drainage District. Flow at Site D (Mud Slough North downstream of the San Luis Drain Discharge) is measured by the U.S. Geological Survey (USGS) and made publically available on the California Data Exchange Center (CDEC) with the Station ID of MSG. Flow through this site is a combination of subsurface drainage discharges from the San Luis Drain (when it is discharging), agricultural surface discharges from areas outside of the Grassland Drainage Area, wetland drainage flows, and accreted shallow groundwater. **Figure 8** shows the Site D daily flows and cumulative discharge for this report period.



Site H2 (the San Joaquin River above the Merced River) is measured by USGS and made publically available through CDEC (station ID SMN). During the irrigation season, flow through this site is mostly made up of agricultural surface discharges and operational spills. During the non-irrigation season, storm water and flood releases can be a significant fraction of the flow, as well as scheduled pulse flows through the San Joaquin River Restoration Program. **Figure 9** shows the Site H2 daily flows and cumulative discharge for this report period.



Monthly selenium load allocations for the Grassland drainage Area were established for the load discharged from the San Luis Drain at Site B, based on the selenium TMDL for the San Joaquin River. Table 8 shows the 2017 volume of drain water discharged from the Grassland Drainage Area into the San Luis Drain (Site A); volume and selenium load discharged from the San Luis Drain to Mud Slough (Site B2); and the selenium load allocation for each month.

Table 8: Discharge & Selenium Load from the Grassland Drainage Area

Month	Discharge into San Luis Drain (Site A) (acre-feet)	Discharge from SLD into Mud Slough (Site B) (acre-feet)	Site B Selenium Load (pounds)	Site B Selenium Load Allocation (pounds)
January 2017	2,916	2,604	187	74
February 2017	3,858	2,885	382	171
March 2017	1,688	1,808	199	171
April 2017	358	566	29	177
May 2017	0	307	8	179
June 2017	0	261	3	124
July 2017	0	131	2	125
August 2017	0	80	1	128
September 2017	0	312	3	116
October 2017	0	572	2	115
November 2017	0	619	3	115
December 2017	0	681	2	74
Totals	8,820	10,826	823	1,570

The 2009 Use Agreement between the San Luis & Delta-Mendota Water Authority and the U. S. Bureau of Reclamation for the use of the San Luis Drain (Use Agreement) sets monthly and annual selenium load values base on year and water year type. 2017 was established as a wet year type for the San Joaquin River and the selenium load values shown in Table 8 are reflective of the corresponding load values established in the Use Agreement. These load values are artificially low based on requirements negotiated between the parties that developed the Use Agreement and the load values in Table 8 are well below the TMDL values in Table 2 of the Grassland Bypass Project Waste Discharge Requirements. In fact the values in Table 8 do not exceed the waste discharge values for a wet year type.

In addition to establishing monthly and annual selenium load allocations, the Use Agreement also includes a system of monthly and annual incentive fees for selenium loads in excess of the allocation as well as credits earned for monthly and annual loads that are less than the allocation. Throughout the period of the Use Agreement, the GAF have earned a substantial amount of selenium load credits. Although the selenium load discharged from the San Luis Drain in January, February and March exceeded the monthly load allocation in the Use Agreement, monthly incentive fee credits were available to offset any charges. The annual selenium load discharged was only 52% of the annual load allocation and therefore no incentive fees were allocated.

SECTION 5: EXCEEDANCES AND ACTIONS TO ADDRESS EXCEEDANCES.

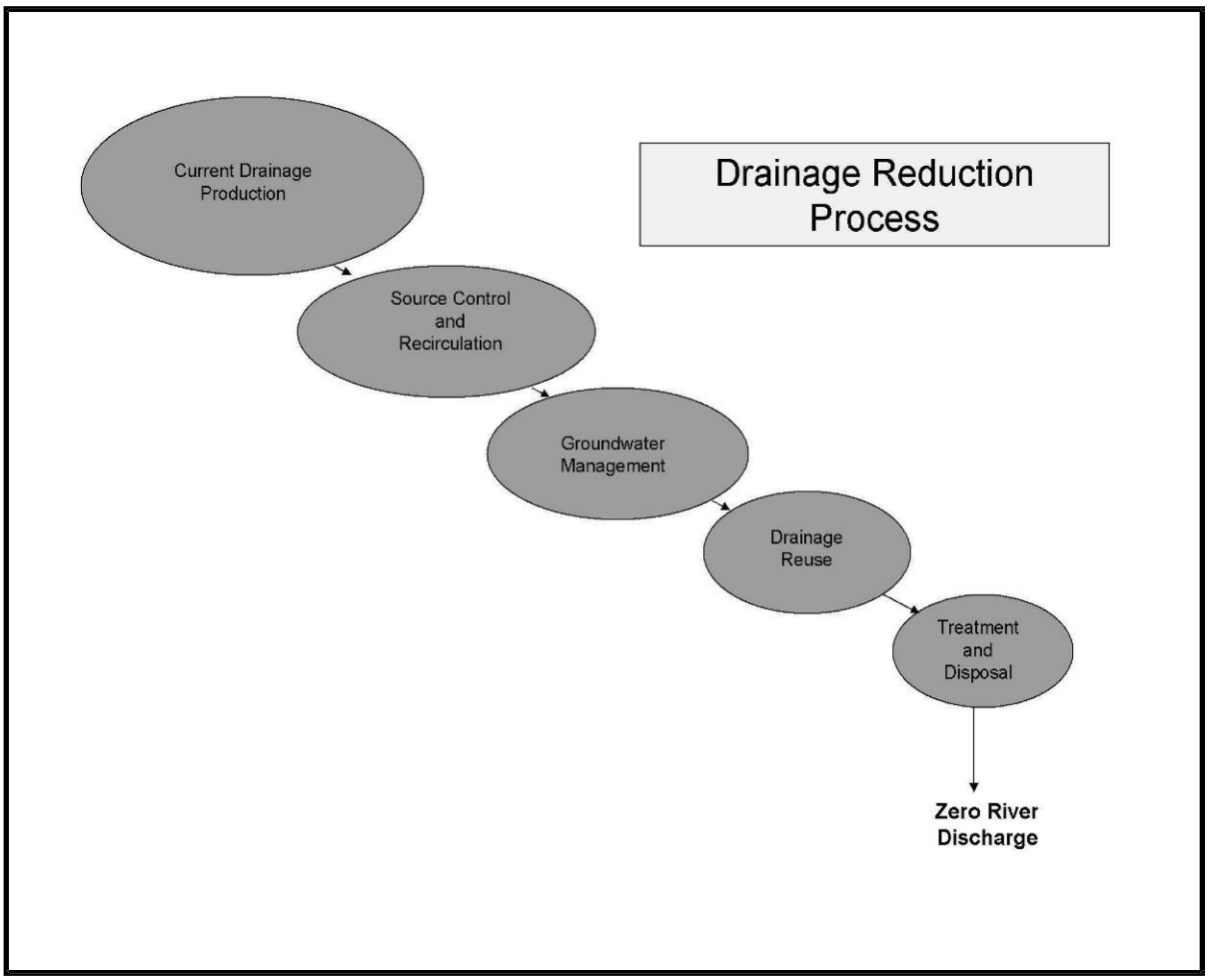
A tabulation of all exceedances is included in **Attachment 2**. Generally, water within the San Luis Drain (Site B3) will always have elevated levels of SC, selenium, and boron, and will often be in excess of the molybdenum WQO for downstream receiving waterbodies. It is important to note that the WQOs for SC, selenium, boron or molybdenum do not apply to the San Luis Drain (Site B3) itself. Further, because none of these constituents are materials that are added or can be controlled by farmers within the Grassland Drainage Area, the drainage management actions implemented within the drainage area have focused on reducing drainage production volume.

In 2003 the Westside Regional Drainage Plan (Westside Plan) was developed to address drainage production and discharge from the Grassland Drainage Area. The Westside Plan is intended to 1) identify scientifically sound projects proven to be effective in reducing drainage; 2) develop an aggressive implementation plan initially utilizing existing projects documented to be environmentally sound; and 3) curtail discharges to the San Joaquin River in accordance with impending regulatory constraints while maintaining the ability to farm.

The plan focuses on regional drainage projects that can be implemented on a short timeline. Drainage must be addressed on a regional basis but must allow for each sub-area's specific needs and resources. The Plan's key management components for the Grassland Drainage Area are: 1) Source Control, 2) Groundwater Management, 3) Drainage Reuse Projects, and 4) Drain Water Treatment and/or Salt Disposal. As drainage projects are implemented, they will be evaluated for long-term sustainability of the complete solution.

In 2016, The Grassland Drainage Area Coalition collected Farm Evaluation (FE) surveys from all of the growers within the Grassland Drainage Area. This FE data provides a baseline for management practices implemented by the growers. In 2017, FE surveys and nitrogen management data were submitted by growers in areas deemed as high vulnerable to groundwater. Analysis of that data is still in progress. Attachment 4 presents a summary of the 2016 FE data.

Figure 10: Westside Regional Drainage Plan



Source Control Projects.
Source control projects are projects that can reduce the volume of water contributing to subsurface drainage production usually by reducing deep percolation. Source control projects can usually be divided into two categories: on-farm irrigation improvements and distribution infrastructure improvements.

On-farm irrigation improvement projects include converting from a low efficiency irrigation system (such as furrow irrigation) to a high efficiency system (such as drip or micro sprinklers). The State of California and the local districts have made financial assistance (in the form of low interest loans) available to growers as an incentive to convert from conventional irrigation practices to high efficiency drip irrigation (and similar systems). Since the beginning of the Grassland Bypass Project, more than 70% of the farmed acreage within the Grassland Drainage Area has converted to high efficiency irrigation systems.

Distribution infrastructure improvement projects typically include the replacement of an unlined irrigation canal with a concrete lined channel or pipeline. Unlined channels within the Grassland Drainage Area can contribute more than 200 acre feet of seepage per year for each unlined mile. More than 30 miles of unlined canals have been lined or converted to pipelines since the beginning of the Grassland Bypass Project.

Drainage Reuse.

In 2001, funds provided from Proposition 13 allowed for the purchase and improvement of 4,000 acres of land within the Grassland Drainage Area as part of the San Joaquin River Improvement Project (SJRIP) for the purpose of drain water reuse. The location of the SJRIP is shown in **Figure 1**. The first phase of the SJRIP was implemented in the winter of WY 2001 with the planting of salt tolerant crops and construction of distribution facilities. In 2007, with funding from California's Proposition 50, an additional 2,000 acres of reuse area was purchased, and funding from Reclamation was used to develop the land to salt tolerant crops. Since the project's inception, the planted acreage has increased from the original 1,821 acres to more than 5,200 acres, which have been irrigated with drainage water or blended water. **Table 9** shows the drainage reuse of the SJRIP since its start of operation in 1998.

Table 9: SJRIP Drainage Reuse.

Year	Reused Drain Water	Reused Selenium	Reused Boron	Reused Salt
	(acre feet)	(pounds)	(pounds)	(tons)
1998¥	1,211	329	NA	4,608
1999¥	2,612	321	NA	10,230
2000¥	2,020	423	NA	7,699
2001	2,850	1,025	61,847	14,491
2002	3,711	1,119	77,134	17,715
2003	5,376	1,626	141,299	27,728
2004	7,890	2,417	193,956	41,444
2005	8,143	2,150	210,627	40,492
2006	9,139	2,825	184,289	51,882
2007	11,233	3,441	210,582	61,412
2008	14,955	3,844	238,435	80,900
2009	11,595	2,807	198,362	60,502
2010	13,119	3,298	370,752	75,362
2011	21,623	4,394	454,675	102,417
2012	23,735	3,293	545,180	118,445
2013	26,170	3,527	568,907	118,883
2014	30,870	3,711	879,800	179,560
2015	31,460	2,644	969,640	178,620
2016	24,573	2,401	886,770	162,421
2017	24,627	3,477	999,716	195,836

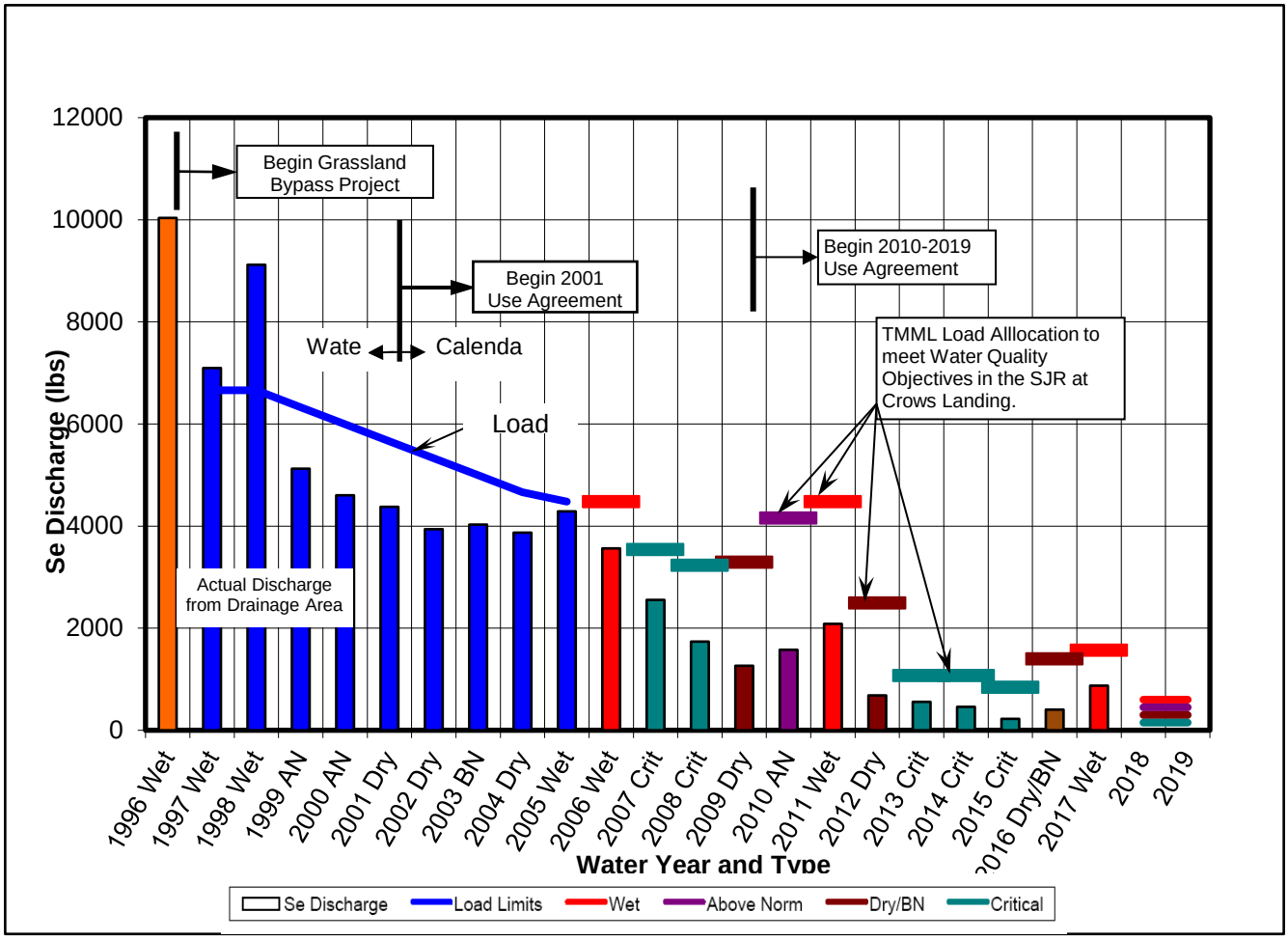
NA = Not Available

¥ PDD drainage reuse project prior to SJRIP

Drainage Reuse on the SJRIP has been key to meeting the Total Maximum Monthly Load (TMML) requirements for selenium as well as approaching the ultimate goal of zero discharge.

Figure 11 shows the annual selenium load discharged through the Grassland Bypass Project since the start of the project in 1996. Also shown are the annual selenium target allocations that are part of the 2009 Use Agreement (Agreement No. 10-WC-20-3975 between the San Luis & Delta-Mendota Water Authority and Reclamation). This Use Agreement established selenium load allocations which are more stringent than the load allocations in the Basin Plan.

Figure 11: Grassland Bypass Project - Selenium Discharge and Targets



Spatial & Temporal Trends.

Using the average of the last four years of discharge, the drainage management activities of the Westside Plan had reduced discharge through Grassland Bypass Project by 86% (compared to 1995) with an associated reduction in selenium (96%), salt (80%) and boron (73%) loads. The Grassland Drainage Area did not discharge into the San Luis Drain from April through December of 2017 and discharge to Mud Slough during this period was due to seepage flows into the San Luis Drain. Drainage management actions have effectively eliminated drainage during the irrigation season. **Figure 3** shows the discharge from the San Luis Drain (Site B2) from January to December 2017. 2017 was a wet year type with Federal water contractors within the GDA receiving a 100% allocation – a condition that has not occurred since 2006.

Discharge from the Drain to Mud Slough (Site B) during this period from January through April was a result of rainfall that produced drainage flows beyond what the management tools could contain. Because of nature of crop water demand, there is limited reuse capacity during the non-irrigation season, which currently results in discharge through the San Luis Drain.

Discharges from the San Luis Drain during the irrigations season were caused by shallow groundwater accretions into the Drain outside of the Grassland Drainage Area. Future plans are expected to expand the reuse area by approximately 2,500 acres and should provide sufficient reuse capacity to eliminate drainage discharge except for storm events.

SECTION 6: SUMMARY OF QUALITY ASSURANCE EVALUATION

The U.S. Bureau of Reclamation reviews laboratory reports as they are received and performs the necessary quality assurance reviews. A summary of these reviews is included as **Attachment 3**.

The Grassland Area Farmers reviews the aquatic and sediment toxicity reports. Aquatic toxicity samples are collected monthly and sediment samples are collected twice per year (spring and fall). For all aquatic and laboratory toxicity samples collected during this report period:

- 71 of the 74 expected toxicity samples were collected and analyzed. Wet conditions prevented safe access to Site R for the March sample event, resulting in the failure to collect samples for the three aquatic toxicity species test.
- Reference toxicants were within expected levels.
- Laboratory control tests were within acceptable limits.

SECTION 7: USE AGREEMENT MITIGATION MEASURES

The 2009 Use Agreement identifies mitigation requirements for the continued use of the San Luis Drain to mitigate for impacts to Mud Slough (North) and the San Joaquin River.

Following is a summary of compliance with these mitigation requirements:

- Management plans have been developed for meeting selenium loads in years 6-10 through a letter report dated 12-26-13 and submitted to the Oversight Committee representatives through the Technical Policy and Review Team (TPRT). Initial data gathering has started to address the issue of long-term stormwater flows. A sediment management plan was included in the 2009 EIS/EIR. Portions of the SLD were cleaned of sediment in 2016 and 2017. Attachment 5 includes a report on the sediment removal activities.
- During anticipated storm flow operations, consistent communication has been provided to downstream users. No recent discharges to wetland channels have occurred however rainfall events in January, February and March caused flows to spike and preliminary downstream notifications were issued. Flows rates and velocities in the San Luis Drain are monitored to prevent suspension and discharge of sediment.
- A memorandum of understanding was completed in 2001 with the State Department of Fish and Wildlife regarding impacts to Mud Slough within the China Island refuge. Ongoing monitoring has been completed.
- Supplemental fees are required starting in 2015 for every pound of selenium discharged. A separate account has been established and funds deposited as load numbers are reported.
- Monthly selenium loads were exceeded in January, February, and March of 2017, however the total annual load was 52% of the annual load allocation (823 pounds discharged compared to a target of 1,570 pounds). Monthly credits were available and applied so that no monthly incentive fees were due.

SECTION 8: CONCLUSIONS AND RECOMMENDATIONS

The Grassland Area Farmers have demonstrated their commitment to the Grassland Bypass Project and the implementation of the Westside Plan as evidenced by the accomplishments as detailed in this report. This includes maintaining and expanding efforts to meet monthly and annual selenium targets while at the same time aggressively pursuing the long term solutions and funding that will be necessary to meet these future requirements by the end of 2019, when it is anticipated that the use of the San Luis Drain will transition into an agreement and permits for the discharge of stormwater flow, but no water arising from the irrigation of agriculture.

Since the start of the Grassland Bypass Project in 1997, the discharge of subsurface drainwater from agricultural operations had reduced dramatically. These drastic reductions in discharge, and the associated improvement in water quality of the receiving water bodies, are a result of the aggressive implementation of the Westside Regional Drainage Plan by the Grassland Drainage Area growers. **Table 10** shows a discharge comparison of each year from 1995 (pre-project) through 2017 on a water year basis (October through September).

Table 10: Grassland Bypass Project Discharge History

		WY 95	WY 96	WY 97	WY 98	WY 99	WY 00	WY 01	WY 02	WY 03	WY 04	WY 05
Volume	acre-feet	57,574	52,978	39,856	49,289	32,317	31,342	28,238	28,358	28,345	27,640	29,967
Selenium	pounds	11,875	10,034	7,096	9,118	5,124	4,603	4,377	3,939	4,032	3,860	4,305
Salts	tons	237,530	197,526	172,602	213,533	146,081	139,303	142,415	128,411	126,500	121,138	138,908
Boron	1,000 lbs	868	723	753	983	630	619	423	544	554	530	585
Selenium	ppm	0.076	0.070	0.066	0.068	0.058	0.054	0.057	0.051	0.051	0.051	0.053
Salt	umhos/cm	4,102	3,707	4,306	4,308	4,587	4,420	5,016	4,503	4,600	4,358	4,611
Boron	ppm	5.5	5.0	7.0	7.3	7.2	7.3	5.5	7.1	7.5	7.1	7.2

		WY 06	WY 07	WY 08	WY 09	WY 10	WY 11	WY 12	WY 13	WY 14	WY 15	WY 16
Volume	acre-feet	25,995	18,531	15,665	13,166	14,529	18,423	10,486	10,258	7,125	6,079	8,361
Selenium	pounds	3,563	2,554	1,736	1,264	1,577	2,067	733	638	317	354	405
Salts	tons	119,646	79,094	66,254	55,556	64,667	87,537	38,398	54,663	44,834	40,779	39,480
Boron	1,000 lbs	539	278	269	233	315	440	245	309	244	212	212
Selenium	ppm	0.050	0.051	0.041	0.035	0.050	0.041	0.025	0.023	0.015	0.021	0.014
Salt	umhos/cm	4,577	4,244	4,206	4,196	4,631	4,702	3,641	5,299	6,257	6,670	6,018
Boron	ppm	7.6	5.5	6.3	6.5	8.0	8.7	8.6	11.1	12.6	12.8	12.5

		WY 17
Volume	acre-feet	10,870
Selenium	pounds	823
Salts	tons	60,660
Boron	1,000 lbs	267
Selenium	ppm	0.015
Salt	umhos/cm	4,806
Boron	ppm	7

Reduction from WY 95 to WY 17			4 yr Avg.
Volume	Acre-ft	81%	86%
Selenium	pounds	93%	96%
Salts	tons	74%	80%
Boron	1,000 lbs	69%	73%

Attachment 1
Data Summary

Field Data Summary

Site	Date	Matrix	Sample Type	Temp	EC	PH	Turbidity	DO
B3	1/12/2017	Surface Water	Grab	13.1	5427	7.6	14	9.2
B3	1/26/2017	Surface Water	Grab	10.8	4988	7.7	37.8	12
B3	2/2/2017	Surface Water	Grab	13.1	6672	7.7	24.5	12.3
B3	2/9/2017	Surface Water	Grab	15.1	5907	7.7	16.2	4.5
B3	2/17/2017	Surface Water	Grab	Not Measurement	Not Measurement	Not Measurement	Not Measurement	Not Measurement
B3	2/23/2017	Surface Water	Grab	14	4829	8.1	42.4	11.7
B3	3/10/2017	Surface Water	Grab	17.8	5246	8.5	13.8	15.9
B3	3/15/2017	Surface Water	Grab	23.8	3859	8.2	11.4	16
B3	3/30/2017	Surface Water	Grab	18.2	6031	8.3	30.7	13.5
B3	4/14/2017	Surface Water	Grab	17.2	4444	8	21	11.4
B3	4/21/2017	Surface Water	Grab	19.4	6490	8.2	13.6	9.4
B3	4/26/2017	Surface Water	Grab	18.2	4528	8.2	9.8	10.6
B3	5/4/2017	Surface Water	Grab	25.2	6774	8.1	19.6	7.2
B3	5/12/2017	Surface Water	Grab	20.6	8811	8	21.3	13.7
B3	5/18/2017	Surface Water	Grab	19.1	6497	8	24.1	8
B3	5/25/2017	Surface Water	Grab	24.1	5740	8.4	22.5	4.6
B3	6/1/2017	Surface Water	Grab	25.9	3107	6.4	30.2	7.5
B3	6/9/2017	Surface Water	Grab	23.1	3239	8.2	49.3	5
B3	6/13/2017	Surface Water	Grab	21.8	2735	8.6	52.6	9.7
B3	6/20/2017	Surface Water	Grab	29.3	2197	8.2	14.8	8.7
B3	6/27/2017	Surface Water	Grab	25.7	2154	8.1	12.9	8.8
B3	7/5/2017	Surface Water	Grab	25.9	2225	8.2	25.1	7
B3	7/12/2017	Surface Water	Grab	25	2750	8.1	33.3	6.6
B3	7/18/2017	Surface Water	Grab	26.3	3135	8.6	24.1	11.5
B3	7/27/2017	Surface Water	Grab	26	3404	8.4	25	6.4
B3	8/1/2017	Surface Water	Grab	26.2	3416	8.4	16	7.2
B3	8/8/2017	Surface Water	Grab	25.7	3277	8.6	8.7	11.5
B3	8/15/2017	Surface Water	Grab	24.6	1588	8.7	9.3	5.5
B3	8/24/2017	Surface Water	Grab	25.6	2363	8.4	Not Measurement	Not Measurement
B3	9/1/2017	Surface Water	Grab	25	2878	8.7	11.1	9.5
B3	9/8/2017	Surface Water	Grab	24.8	2459	8.7	7.6	10.5
B3	9/15/2017	Surface Water	Grab	24.5	3095	8.2	4.8	79.2
B3	9/22/2017	Surface Water	Grab	22.2	2702	8	3.9	127.5
B3	10/6/2017	Surface Water	Grab	21.9	2424	8.2	7.7	7.4
B3	10/13/2017	Surface Water	Grab	18.5	2231	8.2	5.7	Not Measurement
B3	10/19/2017	Surface Water	Grab	19.4	2138	8	3.1	10.3
B3	10/27/2017	Surface Water	Grab	22	2109	8.1	2.6	7
B3	10/31/2017	Surface Water	Grab	17.2	2221	7.9	4.1	13
B3	11/7/2017	Surface Water	Grab	16.6	2361	8	3.2	14.4
B3	11/17/2017	Surface Water	Grab	16.4	2277	8	2.4	11.9
B3	11/22/2017	Surface Water	Grab	14.8	2136	7.9	1.9	13.3
B3	11/29/2017	Surface Water	Grab	13.6	2257	7.8	1.5	Not Measurement
B3	12/7/2017	Surface Water	Grab	10	2312	8	1.5	15.4
B3	12/15/2017	Surface Water	Grab	9.4	2509	7.3	1.9	10.5
B3	12/21/2017	Surface Water	Grab	8.8	2403	8	2.2	16.7
B3	12/27/2017	Surface Water	Grab	10.1	2651	7.8	2.5	10.6
D	1/12/2017	Surface Water	Grab	13.3	1602	7.3	304	8.7
D	1/26/2017	Surface Water	Grab	11.3	1170	7	72.7	13.3
D	2/2/2017	Surface Water	Grab	12.1	2667	7.8	43.2	10.3
D	2/9/2017	Surface Water	Grab	19.3	2017	7.9	63.7	6.7
D	2/23/2017	Surface Water	Grab	14.3	1274	7.8	100	9.3
D	3/10/2017	Surface Water	Grab	11.4	2079	7.7	50.4	9.4
D	3/15/2017	Surface Water	Grab	21.6	2158	7.7	32.6	10
D	3/30/2017	Surface Water	Grab	17.9	1955	7.7	42.4	8.5
D	4/14/2017	Surface Water	Grab	16.3	2082	8.2	59.6	10.2
D	4/21/2017	Surface Water	Grab	18.7	2733	8.2	56.1	10.4
D	4/26/2017	Surface Water	Grab	19.4	2199	7.8	33.9	8.5
D	5/4/2017	Surface Water	Grab	29.8	4366	8.3	42.3	10.9
D	5/12/2017	Surface Water	Grab	20.5	3075	8.2	64.6	11.3
D	5/18/2017	Surface Water	Grab	18	1418	8.3	82.7	9.1
D	5/25/2017	Surface Water	Grab	22.8	1793	8.1	75.4	4.9
D	6/1/2017	Surface Water	Grab	25.7	869	6.1	84.8	7.4
D	6/9/2017	Surface Water	Grab	22	1209	8.1	63.6	4.1
D	6/13/2017	Surface Water	Grab	22.1	1252	8.3	64.7	9.4
D	6/20/2017	Surface Water	Grab	29.2	889	7.7	85.2	6.5
D	6/27/2017	Surface Water	Grab	26.6	1988	8.2	22	9.4
D	7/5/2017	Surface Water	Grab	25.2	3368	7.6	141	6.2
D	7/12/2017	Surface Water	Grab	23.8	4277	8	54.6	9.9
D	7/18/2017	Surface Water	Grab	23.8	3021	8	81.7	11
D	7/27/2017	Surface Water	Grab	25.2	1542	8.1	77.6	8.3
D	8/1/2017	Surface Water	Grab	25	1847	8.3	81.2	8.7

Site	Date	Matrix	Sample Type	Temp	EC	PH	Turbidity	DO
D	8/8/2017	Surface Water	Grab	23.4	4865	8.1	45.3	10.6
D	8/15/2017	Surface Water	Grab	23.5	1073	8.3	83.3	4.9
D	8/24/2017	Surface Water	Grab	25.6	725	8.2	Not Measurement	Not Measurement
D	9/1/2017	Surface Water	Grab	23.9	2692	7.9	48.3	8.6
D	9/8/2017	Surface Water	Grab	23.8	790	8.2	61.7	10.8
D	9/15/2017	Surface Water	Grab	23.8	988	8	80.8	88.2
D	9/22/2017	Surface Water	Grab	21	499	7.7	56.8	10.4
D	10/6/2017	Surface Water	Grab	20.8	1117	7.7	32.4	5.3
D	10/13/2017	Surface Water	Grab	18.4	983	7.7	27.1	Not Measurement
D	10/27/2017	Surface Water	Grab	20.6	970	7.6	18.2	7.4
D	10/31/2017	Surface Water	Grab	16.8	1010	7.4	76.4	9.3
D	11/7/2017	Surface Water	Grab	15.4	1049	7.7	18.5	11.9
D	11/17/2017	Surface Water	Grab	16.6	1143	7.6	20.9	8.9
D	11/22/2017	Surface Water	Grab	14.5	1048	7.6	24	10.8
D	11/29/2017	Surface Water	Grab	13.1	1209	7.7	17.9	Not Measurement
D	12/7/2017	Surface Water	Grab	10	1435	7.9	14	14.4
D	12/15/2017	Surface Water	Grab	9.8	1715	7.6	12.2	10.1
D	12/21/2017	Surface Water	Grab	9.6	1858	7.8	9.6	14.4
D	12/27/2017	Surface Water	Grab	10.1	1984	7.6	10.3	11.4
N	1/12/2017	Surface Water	Grab	12.3	513	7.7	133	8.7
N	1/26/2017	Surface Water	Grab	10.8	255	8.2	41.4	12.9
N	2/2/2017	Surface Water	Grab	10.8	239	6.5	21.3	11.7
N	2/9/2017	Surface Water	Grab	13.4	301	6.7	51.8	8.5
N	2/17/2017	Surface Water	Grab	Not Measurement	Not Measurement	Not Measurement	Not Measurement	Not Measurement
N	2/23/2017	Surface Water	Grab	13.7	224	8.2	48.6	10.5
N	3/10/2017	Surface Water	Grab	15.1	170	7.3	17.8	10.1
N	3/15/2017	Surface Water	Grab	19.4	185	8	46.4	11.4
N	3/30/2017	Surface Water	Grab	17.7	207	7.7	20.4	9.9
N	4/14/2017	Surface Water	Grab	16	138	8.3	36.4	10.7
N	4/21/2017	Surface Water	Grab	17	159	8.2	14.1	10.6
N	4/26/2017	Surface Water	Grab	16.8	131	6.6	16.8	9.3
N	5/4/2017	Surface Water	Grab	21.7	137	8.1	18.7	9.2
N	5/12/2017	Surface Water	Grab	18.1	137	8.1	25.7	12.6
N	5/18/2017	Surface Water	Grab	16.9	191	8.1	27.4	8.5
N	5/25/2017	Surface Water	Grab	21.4	290	8.1	Not Measurement	7
N	6/1/2017	Surface Water	Grab	22.4	182	5.9	63	9.9
N	6/9/2017	Surface Water	Grab	20.2	127	7.9	32.9	4.5
N	6/13/2017	Surface Water	Grab	20.5	98	7.9	27.4	9.4
N	6/20/2017	Surface Water	Grab	26.6	115	7.4	23.5	8.2
N	6/27/2017	Surface Water	Grab	23.8	78	7	35.9	7.4
N	7/5/2017	Surface Water	Grab	24.4	167	7.9	58.4	7.8
N	7/12/2017	Surface Water	Grab	25.8	345	7.4	65.2	7.7
N	7/18/2017	Surface Water	Grab	25.9	524	7.8	532	10.1
N	7/27/2017	Surface Water	Grab	25	888	8	55.1	9.1
N	8/1/2017	Surface Water	Grab	26.2	949	8.1	42.3	8.4
N	8/8/2017	Surface Water	Grab	25.4	849	8.2	33.8	10.1
N	8/15/2017	Surface Water	Grab	25.1	740	8.2	31	4.2
N	8/24/2017	Surface Water	Grab	26.4	612	7.7	Not Measurement	Not Measurement
N	9/1/2017	Surface Water	Grab	25.6	507	7.7	31	9.6
N	9/8/2017	Surface Water	Grab	23.1	325	8.2	22.6	10.4
N	9/15/2017	Surface Water	Grab	21.5	266	6.6	19.6	96.8
N	9/22/2017	Surface Water	Grab	17.9	220	7.1	18.8	10.9
N	10/6/2017	Surface Water	Grab	16.2	185	6.8	18.3	8.4
N	10/13/2017	Surface Water	Grab	15.6	296	7.6	16.1	Not Measurement
N	10/19/2017	Surface Water	Grab	16.9	188	7.8	25	14
N	10/27/2017	Surface Water	Grab	16.8	265	7.4	16.5	6.9
N	10/31/2017	Surface Water	Grab	16.6	524	7.6	43.6	12
N	11/7/2017	Surface Water	Grab	15.1	664	8	111	15.3
N	11/17/2017	Surface Water	Grab	16.1	711	7.1	22.6	10.7
N	11/22/2017	Surface Water	Grab	14.2	725	7.1	23.4	12.3
N	11/29/2017	Surface Water	Grab	13.1	812	8	23.7	Not Measurement
N	12/7/2017	Surface Water	Grab	9.8	907	7.3	14.9	13.9
N	12/21/2017	Surface Water	Grab	9.1	1024	7.7	14.8	13.1
N	12/27/2017	Surface Water	Grab	9.8	1153	7.4	15.9	10.3
R	4/26/2017	Surface Water	Grab	18.5	600	7.2	28.9	9
R	5/4/2017	Surface Water	Grab	27	569	7.9	31.9	8.4
R	5/12/2017	Surface Water	Grab	20.2	541	7.4	369	11.4
R	5/18/2017	Surface Water	Grab	19.5	586	7.9	48	8.3
R	5/25/2017	Surface Water	Grab	24.1	1283	8.2	Not Measurement	5.6
R	6/1/2017	Surface Water	Grab	23.6	1415	6.2	83.5	2.4
R	6/9/2017	Surface Water	Grab	21.4	280	7.9	26.9	4.6

Site	Date	Matrix	Sample Type	Temp	EC	PH	Turbidity	DO
R	6/13/2017	Surface Water	Grab	22.3	282	8.1	23.7	10.5
R	6/20/2017	Surface Water	Grab	29.5	257	7.8	33.4	8.5
R	6/27/2017	Surface Water	Grab	23.9	134	7.1	45.5	7.5
R	7/5/2017	Surface Water	Grab	28.5	719	7.8	91.9	8.2
R	7/12/2017	Surface Water	Grab	27.7	217	7.5	91.1	7.4
R	7/18/2017	Surface Water	Grab	28.8	674	7.7	53.6	12.8
R	7/27/2017	Surface Water	Grab	25.2	1984	8.3	176	8.7
R	8/1/2017	Surface Water	Grab	26.9	3227	8.3	75.6	9.3
R	8/8/2017	Surface Water	Grab	26.2	4386	8.2	38.7	13.7
R	8/15/2017	Surface Water	Grab	25	2063	8.4	95.9	5.7
R	8/24/2017	Surface Water	Grab	26.1	658	7.7	Not Measurement	Not Measurement
R	9/1/2017	Surface Water	Grab	26.4	749	7.8	64.4	9.3
R	9/8/2017	Surface Water	Grab	24.9	923	8	47.4	10.7
R	9/15/2017	Surface Water	Grab	22.6	807	7.5	57.6	87.1
R	9/22/2017	Surface Water	Grab	20.8	569	7.6	48.1	10.6
R	10/6/2017	Surface Water	Grab	18.3	716	7.7	40.2	7.6
R	10/13/2017	Surface Water	Grab	15.4	807	7.8	38.7	Not Measurement
R	10/27/2017	Surface Water	Grab	18.8	768	7.6	37.6	8.1
R	10/31/2017	Surface Water	Grab	16.8	839	7.6	53.3	12.1
R	11/7/2017	Surface Water	Grab	15.6	900	7.8	52.5	15.6
R	11/17/2017	Surface Water	Grab	15.8	932	7.6	48.3	10.6
R	11/22/2017	Surface Water	Grab	14	941	7.6	42.8	13
R	11/29/2017	Surface Water	Grab	12.9	1041	7.5	50.7	Not Measurement
R	12/7/2017	Surface Water	Grab	9.1	1187	7.7	22.5	14.5
R	12/15/2017	Surface Water	Grab	9.1	1299	7.8	31.5	13
R	12/21/2017	Surface Water	Grab	8.2	1347	7.8	20.4	15.8
R	12/27/2017	Surface Water	Grab	9	1463	7.6	42.1	11.6

Temp = Temperature reported in degrees °C unless otherwise noted.
EC = Electrical Conductivity as Specific Conductance normalized to 25°C and reported as µS/cm.
Turbidity = reported in NTU's
EH = ORP reported in mV
DO = Dissolved oxygen reported in mg/L

Explanation of missing Field data:
February 17, 2017: The field probe was unavailable at the time of sampling.
May 25, 2017: The turbidity probe malfunctioned part way through the sample event.
August 24, 2017: The DO probe was out of range and could not be calibrated. The turbidity probe was unavailable at the time of sampling.
October 13, 2017: The DO probe was out of range and could not be calibrated.
November 29, 2017: The DO probe was out of range and could not be calibrated.

Laboratory Data Summary

Site	Date	Analyte	Result	Units	Report Limit	QA Type	Method
B3	1/26/2017	AMMONIA AS N	0.22	mg/l	0.050	Production	SM 4500 NH3 D
B3	3/30/2017	AMMONIA AS N	0.13	mg/l	0.050	Production	SM 4500 NH3 D
B3	4/26/2017	AMMONIA AS N	0.15	mg/l	0.050	Production	SM 4500 NH3 D
B3	5/25/2017	AMMONIA AS N	0.15	mg/l	0.050	Production	SM 4500 NH3 D
B3	6/27/2017	AMMONIA AS N	0.16	mg/l	0.050	Production	SM 4500 NH3 D
B3	7/27/2017	AMMONIA AS N	0.17 T	mg/l	0.050	Production	SM 4500 NH3 D
B3	8/24/2017	AMMONIA AS N	0.13	mg/l	0.050	Production	SM 4500 NH3 D
B3	10/31/2017	AMMONIA AS N	< 0.050	mg/l	0.050	Production	SM 4500 NH3 D
B3	11/29/2017	AMMONIA AS N	0.064	mg/l	0.050	Production	SM 4500 NH3 D
B3	12/27/2017	AMMONIA AS N	< 0.050	mg/l	0.050	Production	SM 4500 NH3 D
B3	1/12/2017	BORON	12000	ug/l	20	Production	EPA 200.7
B3	1/26/2017	BORON	10000	ug/l	20	Production	EPA 200.7
B3	2/2/2017	BORON	14000	ug/l	200	Production	EPA 200.7
B3	2/9/2017	BORON	13000	ug/l	20	Production	EPA 200.7
B3	2/17/2017	BORON	11000	ug/l	200	Production	EPA 200.7
B3	2/23/2017	BORON	11000	ug/l	200	Production	EPA 200.7
B3	3/10/2017	BORON	9200	ug/l	200	Production	EPA 200.7
B3	3/15/2017	BORON	6200	ug/l	100	Production	EPA 200.7
B3	3/30/2017	BORON	11000	ug/l	200	Production	EPA 200.7
B3	4/14/2017	BORON	9800	ug/l	100	Production	EPA 200.7
B3	4/21/2017	BORON	14000	ug/l	200	Production	EPA 200.7
B3	4/26/2017	BORON	8800	ug/l	200	Production	EPA 200.7
B3	5/4/2017	BORON	15000	ug/l	200	Production	EPA 200.7
B3	5/12/2017	BORON	20000	ug/l	20	Production	EPA 200.7
B3	5/18/2017	BORON	15000	ug/l	200	Production	EPA 200.7
B3	5/25/2017	BORON	12000	ug/l	200	Production	EPA 200.7
B3	6/1/2017	BORON	5400	ug/l	100	Production	EPA 200.7
B3	6/9/2017	BORON	6200	ug/l	100	Production	EPA 200.7
B3	6/13/2017	BORON	5100	ug/l	100	Production	EPA 200.7
B3	6/20/2017	BORON	2500	ug/l	20	Production	EPA 200.7
B3	6/27/2017	BORON	2300	ug/l	20	Production	EPA 200.7
B3	7/5/2017	BORON	2700	ug/l	20	Production	EPA 200.7
B3	7/12/2017	BORON	4000	ug/l	20	Production	EPA 200.7
B3	7/18/2017	BORON	5500	ug/l	20	Production	EPA 200.7
B3	7/27/2017	BORON	6200	ug/l	20	Production	EPA 200.7
B3	8/1/2017	BORON	5500	ug/l	20	Production	EPA 200.7
B3	8/8/2017	BORON	5100	ug/l	20	Production	EPA 200.7
B3	8/15/2017	BORON	5000	ug/l	20	Production	EPA 200.7
B3	8/24/2017	BORON	3400	ug/l	20	Production	EPA 200.7
B3	9/1/2017	BORON	4800	ug/l	20	Production	EPA 200.7
B3	9/8/2017	BORON	3300	ug/l	20	Production	EPA 200.7
B3	9/15/2017	BORON	3800	ug/l	20	Production	EPA 200.7
B3	9/22/2017	BORON	3100	ug/l	20	Production	EPA 200.7
B3	10/6/2017	BORON	2700	ug/l	20	Production	EPA 200.7
B3	10/13/2017	BORON	2800	ug/l	20	Production	EPA 200.7
B3	10/19/2017	BORON	2700	ug/l	20	Production	EPA 200.7
B3	10/27/2017	BORON	2600	ug/l	20	Production	EPA 200.7
B3	10/31/2017	BORON	2800	ug/l	20	Production	EPA 200.7
B3	11/7/2017	BORON	2900	ug/l	20	Production	EPA 200.7
B3	11/17/2017	BORON	2700	ug/l	20	Production	EPA 200.7
B3	11/22/2017	BORON	2600	ug/l	20	Production	EPA 200.7
B3	11/29/2017	BORON	2800	ug/l	20	Production	EPA 200.7
B3	12/7/2017	BORON	3000	ug/l	20	Production	EPA 200.7
B3	12/15/2017	BORON	3200	ug/l	20	Production	EPA 200.7
B3	12/21/2017	BORON	3200	ug/l	20	Production	EPA 200.7
B3	12/27/2017	BORON	3500	ug/l	20	Production	EPA 200.7
B3	1/26/2017	MOLYBDENUM	18	ug/l	1.0	Production	EPA 200.8
B3	2/23/2017	MOLYBDENUM	24	ug/l	1.0	Production	EPA 200.8
B3	3/30/2017	MOLYBDENUM	16	ug/l	2.0	Production	EPA 200.8
B3	4/26/2017	MOLYBDENUM	31	ug/l	1.0	Production	EPA 200.8
B3	5/25/2017	MOLYBDENUM	46	ug/l	1.0	Production	EPA 200.8
B3	6/27/2017	MOLYBDENUM	26	ug/l	1.0	Production	EPA 200.8
B3	7/27/2017	MOLYBDENUM	34	ug/l	1.0	Production	EPA 200.8

B3	8/24/2017	MOLYBDENUM	34	ug/l	1.0	Production	EPA 200.8
B3	10/31/2017	MOLYBDENUM	47	ug/l	1.0	Production	EPA 200.8
B3	11/29/2017	MOLYBDENUM	44	ug/l	1.0	Production	EPA 200.8
B3	12/27/2017	MOLYBDENUM	57	ug/l	1.0	Production	EPA 200.8
B3	1/26/2017	NITRATE AS N (DISSOLVED)	3.7	mg/l	0.010	Production	EPA 300.0
B3	3/30/2017	NITRATE AS N (DISSOLVED)	11 U	mg/l	0.10	Production	EPA 300.0
B3	4/26/2017	NITRATE AS N (DISSOLVED)	0.034	mg/l	0.010	Production	EPA 300.0
B3	5/25/2017	NITRATE AS N (DISSOLVED)	< 0.050 V	mg/l	0.050	Production	EPA 300.0
B3	6/27/2017	NITRATE AS N (DISSOLVED)	0.019	mg/l	0.010	Production	EPA 300.0
B3	7/27/2017	NITRATE AS N (DISSOLVED)	0.012	mg/l	0.010	Production	EPA 300.0
B3	8/24/2017	NITRATE AS N (DISSOLVED)	0.014	mg/l	0.010	Production	EPA 300.0
B3	10/31/2017	NITRATE AS N (DISSOLVED)	< 0.010	mg/l	0.010	Production	EPA 300.0
B3	11/29/2017	NITRATE AS N (DISSOLVED)	< 0.010	mg/l	0.010	Production	EPA 300.0
B3	12/27/2017	NITRATE AS N (DISSOLVED)	< 0.010 T	mg/l	0.010	Production	EPA 300.0
B3	1/12/2017	SELENIUM	22.8	ug/l	0.8	Production	SM3500-Se-C
B3	1/26/2017	SELENIUM	23.3	ug/l	0.8	Production	SM3500-Se-C
B3	2/2/2017	SELENIUM	45.1	ug/l	0.8	Production	SM3500-Se-C
B3	2/9/2017	SELENIUM	35.5	ug/l	0.8	Production	SM3500-Se-C
B3	2/17/2017	SELENIUM	45.9	ug/l	0.8	Production	SM3500-Se-C
B3	2/23/2017	SELENIUM	45.8	ug/l	0.8	Production	SM3500-Se-C
B3	3/10/2017	SELENIUM	68.6 U	ug/l	0.8	Production	SM3500-Se-C
B3	3/15/2017	SELENIUM	31.1	ug/l	0.8	Production	SM3500-Se-C
B3	3/30/2017	SELENIUM	31.9	ug/l	0.8	Production	SM3500-Se-C
B3	4/14/2017	SELENIUM	12.6	ug/l	0.8	Production	SM3500-Se-C
B3	4/21/2017	SELENIUM	31.1	ug/l	0.8	Production	SM3500-Se-C
B3	4/26/2017	SELENIUM	8.55	ug/l	0.8	Production	SM3500-Se-C
B3	5/4/2017	SELENIUM	9.35	ug/l	0.8	Production	SM3500-Se-C
B3	5/12/2017	SELENIUM	51.8	ug/l	0.8	Production	SM3500-Se-C
B3	5/18/2017	SELENIUM	50.8	ug/l	0.8	Production	SM3500-Se-C
B3	5/25/2017	SELENIUM	17.3	ug/l	0.8	Production	SM3500-Se-C
B3	6/1/2017	SELENIUM	11.7	ug/l	0.8	Production	SM3500-Se-C
B3	6/9/2017	SELENIUM	6.02	ug/l	0.8	Production	SM3500-Se-C
B3	6/13/2017	SELENIUM	5.47	ug/l	0.8	Production	SM3500-Se-C
B3	6/20/2017	SELENIUM	4.13	ug/l	0.8	Production	SM3500-Se-C
B3	6/27/2017	SELENIUM	4.01	ug/l	0.8	Production	SM3500-Se-C
B3	7/5/2017	SELENIUM	4.93	ug/l	0.4	Production	SM3500-Se-C
B3	7/12/2017	SELENIUM	4.93	ug/l	0.4	Production	SM3500-Se-C
B3	7/18/2017	SELENIUM	5.16	ug/l	0.4	Production	SM3500-Se-C
B3	7/27/2017	SELENIUM	5.4	ug/l	0.4	Production	SM3500-Se-C
B3	8/1/2017	SELENIUM	5.96	ug/l	0.4	Production	SM3500-Se-C
B3	8/8/2017	SELENIUM	6.04	ug/l	0.4	Production	SM3500-Se-C
B3	8/15/2017	SELENIUM	7.62	ug/l	0.4	Production	SM3500-Se-C
B3	8/24/2017	SELENIUM	7.12	ug/l	0.4	Production	SM3500-Se-C
B3	9/1/2017	SELENIUM	7.66	ug/l	0.8	Production	SM3500-Se-C
B3	9/8/2017	SELENIUM	7.56	ug/l	0.8	Production	SM3500-Se-C
B3	9/15/2017	SELENIUM	3.96	ug/l	0.8	Production	SM3500-Se-C
B3	9/22/2017	SELENIUM	3.42	ug/l	0.8	Production	SM3500-Se-C
B3	10/6/2017	SELENIUM	3.22	ug/l	0.8	Production	SM3500-Se-C
B3	10/13/2017	SELENIUM	2.84	ug/l	0.8	Production	SM3500-Se-C
B3	10/19/2017	SELENIUM	2.62	ug/l	0.4	Production	SM3500-Se-C
B3	10/27/2017	SELENIUM	2.2	ug/l	0.4	Production	SM3500-Se-C
B3	10/31/2017	SELENIUM	2.04	ug/l	0.4	Production	SM3500-Se-C
B3	11/7/2017	SELENIUM	3	ug/l	0.4	Production	SM3500-Se-C
B3	11/17/2017	SELENIUM	1.99	ug/l	0.4	Production	SM3500-Se-C
B3	11/22/2017	SELENIUM	1.91	ug/l	0.4	Production	SM3500-Se-C
B3	11/29/2017	SELENIUM	1.78	ug/l	0.4	Production	SM3500-Se-C
B3	12/7/2017	SELENIUM	1.73	ug/l	0.4	Production	SM3500-Se-C
B3	12/15/2017	SELENIUM	1.54	ug/l	0.4	Production	SM3500-Se-C
B3	12/21/2017	SELENIUM	1.35	ug/l	0.4	Production	SM3500-Se-C
B3	12/27/2017	SELENIUM	1.42	ug/l	0.4	Production	SM3500-Se-C
D	1/26/2017	AMMONIA AS N	0.26	mg/l	0.050	Regular	SM 4500 NH3 D
D	3/30/2017	AMMONIA AS N	0.17	mg/l	0.050	Regular	SM 4500 NH3 D
D	4/26/2017	AMMONIA AS N	0.15	mg/l	0.050	Regular	SM 4500 NH3 D
D	5/25/2017	AMMONIA AS N	0.16	mg/l	0.050	Regular	SM 4500 NH3 D

D	6/27/2017	AMMONIA AS N	0.21	mg/l	0.050	Regular	SM 4500 NH3 D
D	7/27/2017	AMMONIA AS N	0.13 T	mg/l	0.050	Regular	SM 4500 NH3 D
D	8/24/2017	AMMONIA AS N	0.086	mg/l	0.050	Regular	SM 4500 NH3 D
D	10/31/2017	AMMONIA AS N	0.26	mg/l	0.050	Regular	SM 4500 NH3 D
D	11/29/2017	AMMONIA AS N	0.19	mg/l	0.050	Regular	SM 4500 NH3 D
D	12/27/2017	AMMONIA AS N	0.15	mg/l	0.050	Regular	SM 4500 NH3 D
D	1/12/2017	BORON	2100	ug/l	20	Regular	EPA 200.7
D	1/26/2017	BORON	1400	ug/l	20	Regular	EPA 200.7
D	2/2/2017	BORON	3500	ug/l	40	Regular	EPA 200.7
D	2/9/2017	BORON	2400	ug/l	40	Regular	EPA 200.7
D	2/23/2017	BORON	1800	ug/l	40	Regular	EPA 200.7
D	3/10/2017	BORON	2000	ug/l	20	Regular	EPA 200.7
D	3/15/2017	BORON	1400	ug/l	20	Regular	EPA 200.7
D	3/30/2017	BORON	2000	ug/l	20	Regular	EPA 200.7
D	4/14/2017	BORON	2100	ug/l	20	Regular	EPA 200.7
D	4/21/2017	BORON	3900	ug/l	40	Regular	EPA 200.7
D	4/26/2017	BORON	2200	ug/l	40	Regular	EPA 200.7
D	5/4/2017	BORON	2000	ug/l	40	Regular	EPA 200.7
D	5/12/2017	BORON	4800	ug/l	100	Regular	EPA 200.7
D	5/18/2017	BORON	1300	ug/l	20	Regular	EPA 200.7
D	5/25/2017	BORON	1600	ug/l	40	Regular	EPA 200.7
D	6/1/2017	BORON	710	ug/l	20	Regular	EPA 200.7
D	6/9/2017	BORON	1200	ug/l	20	Regular	EPA 200.7
D	6/13/2017	BORON	1200	ug/l	20	Regular	EPA 200.7
D	6/20/2017	BORON	840	ug/l	20	Regular	EPA 200.7
D	6/27/2017	BORON	1500	ug/l	20	Regular	EPA 200.7
D	7/5/2017	BORON	2600	ug/l	20	Regular	EPA 200.7
D	7/12/2017	BORON	3300	ug/l	20	Regular	EPA 200.7
D	7/18/2017	BORON	3000	ug/l	20	Regular	EPA 200.7
D	7/27/2017	BORON	1600	ug/l	20	Regular	EPA 200.7
D	8/1/2017	BORON	1600	ug/l	20	Regular	EPA 200.7
D	8/8/2017	BORON	4600	ug/l	20	Regular	EPA 200.7
D	8/15/2017	BORON	950	ug/l	20	Regular	EPA 200.7
D	8/24/2017	BORON	530	ug/l	20	Regular	EPA 200.7
D	9/1/2017	BORON	1700	ug/l	20	Regular	EPA 200.7
D	9/8/2017	BORON	700	ug/l	20	Regular	EPA 200.7
D	9/15/2017	BORON	870	ug/l	20	Regular	EPA 200.7
D	9/22/2017	BORON	300	ug/l	20	Regular	EPA 200.7
D	10/6/2017	BORON	890	ug/l	20	Regular	EPA 200.7
D	10/13/2017	BORON	770	ug/l	20	Regular	EPA 200.7
D	10/27/2017	BORON	760	ug/l	20	Regular	EPA 200.7
D	10/31/2017	BORON	800	ug/l	20	Regular	EPA 200.7
D	11/7/2017	BORON	850	ug/l	20	Regular	EPA 200.7
D	11/17/2017	BORON	970	ug/l	20	Regular	EPA 200.7
D	11/22/2017	BORON	910	ug/l	20	Regular	EPA 200.7
D	11/29/2017	BORON	1000	ug/l	20	Regular	EPA 200.7
D	12/7/2017	BORON	1200	ug/l	20	Regular	EPA 200.7
D	12/15/2017	BORON	1400	ug/l	20	Regular	EPA 200.7
D	12/21/2017	BORON	1600	ug/l	20	Regular	EPA 200.7
D	12/27/2017	BORON	1800	ug/l	20	Regular	EPA 200.7
D	1/26/2017	MOLYBDENUM	4	ug/l	1.0	Regular	EPA 200.8
D	2/23/2017	MOLYBDENUM	5	ug/l	1.0	Regular	EPA 200.8
D	3/30/2017	MOLYBDENUM	6	ug/l	1.0	Regular	EPA 200.8
D	4/26/2017	MOLYBDENUM	9	ug/l	1.0	Regular	EPA 200.8
D	5/25/2017	MOLYBDENUM	10	ug/l	1.0	Regular	EPA 200.8
D	6/27/2017	MOLYBDENUM	12	ug/l	1.0	Regular	EPA 200.8
D	7/27/2017	MOLYBDENUM	12	ug/l	1.0	Regular	EPA 200.8
D	8/24/2017	MOLYBDENUM	4	ug/l	1	Regular	EPA 200.8
D	10/31/2017	MOLYBDENUM	8	ug/l	1	Regular	EPA 200.8
D	11/29/2017	MOLYBDENUM	7	ug/l	1	Regular	EPA 200.8
D	12/27/2017	MOLYBDENUM	14	ug/l	1.0	Regular	EPA 200.8
D	1/26/2017	NITRATE AS N (DISSOLVED)	0.96	mg/l	0.010	Regular	EPA 300.0
D	3/30/2017	NITRATE AS N (DISSOLVED)	0.65	mg/l	0.010	Regular	EPA 300.0
D	4/26/2017	NITRATE AS N (DISSOLVED)	0.022	mg/l	0.010	Regular	EPA 300.0

D	5/25/2017	NITRATE AS N (DISSOLVED)	0.33 H, V	mg/l	0.010	Regular	EPA 300.0
D	6/27/2017	NITRATE AS N (DISSOLVED)	0.021	mg/l	0.010	Regular	EPA 300.0
D	7/27/2017	NITRATE AS N (DISSOLVED)	0.3	mg/l	0.010	Regular	EPA 300.0
D	8/24/2017	NITRATE AS N (DISSOLVED)	0.2	mg/l	0.010	Regular	EPA 300.0
D	10/31/2017	NITRATE AS N (DISSOLVED)	0.023	mg/l	0.010	Regular	EPA 300.0
D	11/29/2017	NITRATE AS N (DISSOLVED)	0.13	mg/l	0.010	Regular	EPA 300.0
D	12/27/2017	NITRATE AS N (DISSOLVED)	0.034 T	mg/l	0.010	Regular	EPA 300.0
D	1/12/2017	SELENIUM	2.8	ug/l	0.4	Regular	SM3500-Se-C
D	1/26/2017	SELENIUM	2.13	ug/l	0.4	Regular	SM3500-Se-C
D	2/2/2017	SELENIUM	8.44 U	ug/l	0.4	Regular	SM3500-Se-C
D	2/9/2017	SELENIUM	4.37 U	ug/l	0.4	Regular	SM3500-Se-C
D	2/23/2017	SELENIUM	5.69 U	ug/l	0.4	Regular	SM3500-Se-C
D	3/10/2017	SELENIUM	5.55 U	ug/l	0.4	Regular	SM3500-Se-C
D	3/15/2017	SELENIUM	1.78	ug/l	0.4	Regular	SM3500-Se-C
D	3/30/2017	SELENIUM	1.94	ug/l	0.4	Regular	SM3500-Se-C
D	4/14/2017	SELENIUM	0.726	ug/l	0.4	Regular	SM3500-Se-C
D	4/21/2017	SELENIUM	5.52 U	ug/l	0.4	Regular	SM3500-Se-C
D	4/26/2017	SELENIUM	0.8	ug/l	0.4	Regular	SM3500-Se-C
D	5/4/2017	SELENIUM	0.559	ug/l	0.4	Regular	SM3500-Se-C
D	5/12/2017	SELENIUM	1.95	ug/l	0.4	Regular	SM3500-Se-C
D	5/18/2017	SELENIUM	0.75	ug/l	0.4	Regular	SM3500-Se-C
D	5/25/2017	SELENIUM	0.793	ug/l	0.4	Regular	SM3500-Se-C
D	6/1/2017	SELENIUM	0.665	ug/l	0.4	Regular	SM3500-Se-C
D	6/9/2017	SELENIUM	0.622	ug/l	0.4	Regular	SM3500-Se-C
D	6/13/2017	SELENIUM	0.638	ug/l	0.4	Regular	SM3500-Se-C
D	6/20/2017	SELENIUM	1.08	ug/l	0.4	Regular	SM3500-Se-C
D	6/27/2017	SELENIUM	1.24	ug/l	0.4	Regular	SM3500-Se-C
D	7/5/2017	SELENIUM	0.792	ug/l	0.4	Regular	SM3500-Se-C
D	7/12/2017	SELENIUM	0.889	ug/l	0.4	Regular	SM3500-Se-C
D	7/18/2017	SELENIUM	0.949	ug/l	0.4	Regular	SM3500-Se-C
D	7/27/2017	SELENIUM	0.68	ug/l	0.4	Regular	SM3500-Se-C
D	8/1/2017	SELENIUM	0.668	ug/l	0.4	Regular	SM3500-Se-C
D	8/8/2017	SELENIUM	2.47	ug/l	0.4	Regular	SM3500-Se-C
D	8/15/2017	SELENIUM	0.687	ug/l	0.4	Regular	SM3500-Se-C
D	8/24/2017	SELENIUM	0.582	ug/l	0.4	Regular	SM3500-Se-C
D	9/1/2017	SELENIUM	< 0.4	ug/l	0.4	Regular	SM3500-Se-C
D	9/8/2017	SELENIUM	0.992	ug/l	0.4	Regular	SM3500-Se-C
D	9/15/2017	SELENIUM	0.792	ug/l	0.4	Regular	SM3500-Se-C
D	9/22/2017	SELENIUM	< 0.4	ug/l	0.4	Regular	SM3500-Se-C
D	10/6/2017	SELENIUM	0.618	ug/l	0.4	Regular	SM3500-Se-C
D	10/13/2017	SELENIUM	0.535	ug/l	0.4	Regular	SM3500-Se-C
D	10/27/2017	SELENIUM	0.404	ug/l	0.4	Regular	SM3500-Se-C
D	10/31/2017	SELENIUM	< 0.4	ug/l	0.4	Regular	SM3500-Se-C
D	11/7/2017	SELENIUM	0.58	ug/l	0.4	Regular	SM3500-Se-C
D	11/17/2017	SELENIUM	0.478	ug/l	0.4	Regular	SM3500-Se-C
D	11/22/2017	SELENIUM	0.456	ug/l	0.4	Regular	SM3500-Se-C
D	11/29/2017	SELENIUM	< 0.4	ug/l	0.4	Regular	SM3500-Se-C
D	12/7/2017	SELENIUM	0.538	ug/l	0.4	Regular	SM3500-Se-C
D	12/15/2017	SELENIUM	0.475	ug/l	0.4	Regular	SM3500-Se-C
D	12/21/2017	SELENIUM	< 0.4	ug/l	0.4	Regular	SM3500-Se-C
D	12/27/2017	SELENIUM	0.512	ug/l	0.4	Regular	SM3500-Se-C
D	1/12/2017	TOC	11	mg/l	1	Regular	SM5310C/E415.3
D	1/26/2017	TOC	10	mg/l	1	Regular	SM5310C/E415.3
D	2/2/2017	TOC	14	mg/l	1	Regular	SM5310C/E415.3
D	2/9/2017	TOC	14	mg/l	1	Regular	SM5310C/E415.3
D	2/23/2017	TOC	6.4	mg/l	1.5	Regular	SM5310C/E415.3
D	3/10/2017	TOC	14	mg/l	1.5	Regular	SM5310C/E415.3
D	3/15/2017	TOC	15	mg/l	1	Regular	SM5310C/E415.3
D	3/30/2017	TOC	14	mg/l	1	Regular	SM5310C/E415.3
D	4/14/2017	TOC	14	mg/l	1	Regular	SM5310C/E415.3
D	4/21/2017	TOC	12	mg/l	1	Regular	SM5310C/E415.3
D	4/26/2017	TOC	15	mg/l	1	Regular	SM5310C/E415.3
D	5/4/2017	TOC	12	mg/l	1	Regular	SM5310C/E415.3
D	5/12/2017	TOC	9.8	mg/l	1	Regular	SM5310C/E415.3

D	5/18/2017	TOC	7.8	mg/l	1	Regular	SM5310C/E415.3
D	5/25/2017	TOC	9.6	mg/l	1	Regular	SM5310C/E415.3
D	6/1/2017	TOC	9.1	mg/l	1	Regular	SM5310C/E415.3
D	6/9/2017	TOC	11	mg/l	1	Regular	SM5310C/E415.3
D	6/13/2017	TOC	8.2	mg/l	1	Regular	SM5310C/E415.3
D	6/20/2017	TOC	6.8	mg/l	1	Regular	SM5310C/E415.3
D	6/27/2017	TOC	12	mg/l	1	Regular	SM5310C/E415.3
D	7/5/2017	TOC	8.8	mg/l	1	Regular	SM5310C/E415.3
D	7/12/2017	TOC	10	mg/l	1	Regular	SM5310C/E415.3
D	7/18/2017	TOC	5.2	mg/l	1	Regular	SM5310C/E415.3
D	7/27/2017	TOC	5.2	mg/l	1	Regular	SM5310C/E415.3
D	8/1/2017	TOC	4.9	mg/l	1.5	Regular	SM5310C/E415.3
D	8/8/2017	TOC	10	mg/l	1.5	Regular	SM5310C/E415.3
D	8/15/2017	TOC	7.5 T	mg/l	1.5	Regular	SM5310C/E415.3
D	8/24/2017	TOC	6.1	mg/l	1.5	Regular	SM5310C/E415.3
D	9/1/2017	TOC	7.2 T	mg/l	1.5	Regular	SM5310C/E415.3
D	9/8/2017	TOC	8.3	mg/l	1.5	Regular	SM5310C/E415.3
D	9/15/2017	TOC	7.4	mg/l	1.5	Regular	SM5310C/E415.3
D	9/22/2017	TOC	6.2	mg/l	1.5	Regular	SM5310C/E415.3
D	10/6/2017	TOC	15	mg/l	1.5	Regular	SM 5310C
D	10/13/2017	TOC	13	mg/l	1.5	Regular	SM 5310C
D	10/27/2017	TOC	16	mg/l	1.5	Regular	SM 5310C
D	10/31/2017	TOC	17	mg/l	1.5	Regular	SM 5310C
D	11/7/2017	TOC	14 T	mg/l	1.5	Regular	SM 5310C
D	11/17/2017	TOC	14	mg/l	1.5	Regular	SM 5310C
D	11/22/2017	TOC	13	mg/l	1.5	Regular	SM 5310C
D	11/29/2017	TOC	13	mg/l	1.5	Regular	SM 5310C
D	12/7/2017	TOC	13	mg/l	1.5	Regular	SM 5310C
D	12/15/2017	TOC	12	mg/l	1.5	Regular	SM 5310C
D	12/21/2017	TOC	14	mg/l	1.5	Regular	SM 5310C
D	12/27/2017	TOC	14	mg/l	1.5	Regular	SM 5310C
N	1/26/2017	AMMONIA AS N	0.2	mg/l	0.050	Production	SM 4500 NH3 D
N	3/30/2017	AMMONIA AS N	0.082	mg/l	0.050	Production	SM 4500 NH3 D
N	4/26/2017	AMMONIA AS N	0.055	mg/l	0.050	Production	SM 4500 NH3 D
N	5/25/2017	AMMONIA AS N	0.093	mg/l	0.050	Production	SM 4500 NH3 D
N	6/27/2017	AMMONIA AS N	0.11	mg/l	0.050	Production	SM 4500 NH3 D
N	7/27/2017	AMMONIA AS N	0.14 T	mg/l	0.050	Production	SM 4500 NH3 D
N	8/24/2017	AMMONIA AS N	0.056	mg/l	0.050	Production	SM 4500 NH3 D
N	10/31/2017	AMMONIA AS N	0.094	mg/l	0.050	Production	SM 4500 NH3 D
N	11/29/2017	AMMONIA AS N	0.16	mg/l	0.050	Production	SM 4500 NH3 D
N	12/27/2017	AMMONIA AS N	0.1	mg/l	0.050	Production	SM 4500 NH3 D
N	1/12/2017	BORON	400	ug/l	20	Production	EPA 200.7
N	1/26/2017	BORON	150	ug/l	20	Production	EPA 200.7
N	2/2/2017	BORON	150	ug/l	20	Production	EPA 200.7
N	2/9/2017	BORON	180	ug/l	20	Production	EPA 200.7
N	2/17/2017	BORON	60	ug/l	20	Production	EPA 200.7
N	2/23/2017	BORON	88	ug/l	20	Production	EPA 200.7
N	3/10/2017	BORON	70	ug/l	20	Production	EPA 200.7
N	3/15/2017	BORON	65	ug/l	20	Production	EPA 200.7
N	3/30/2017	BORON	94	ug/l	20	Production	EPA 200.7
N	4/14/2017	BORON	68	ug/l	20	Production	EPA 200.7
N	4/21/2017	BORON	63	ug/l	20	Production	EPA 200.7
N	4/26/2017	BORON	48	ug/l	20	Production	EPA 200.7
N	5/4/2017	BORON	45	ug/l	20	Production	EPA 200.7
N	5/12/2017	BORON	43	ug/l	20	Production	EPA 200.7
N	5/18/2017	BORON	64	ug/l	20	Production	EPA 200.7
N	5/25/2017	BORON	92	ug/l	20	Production	EPA 200.7
N	6/1/2017	BORON	63	ug/l	20	Production	EPA 200.7
N	6/9/2017	BORON	50	ug/l	20	Production	EPA 200.7
N	6/13/2017	BORON	40	ug/l	20	Production	EPA 200.7
N	6/20/2017	BORON	38	ug/l	20	Production	EPA 200.7
N	6/27/2017	BORON	26	ug/l	20	Production	EPA 200.7
N	7/5/2017	BORON	59	ug/l	20	Production	EPA 200.7
N	7/12/2017	BORON	130	ug/l	20	Production	EPA 200.7

N	7/18/2017	BORON	230	ug/l	20	Production	EPA 200.7
N	7/27/2017	BORON	400	ug/l	20	Production	EPA 200.7
N	8/1/2017	BORON	340	ug/l	20	Production	EPA 200.7
N	8/8/2017	BORON	300	ug/l	20	Production	EPA 200.7
N	8/15/2017	BORON	310	ug/l	20	Production	EPA 200.7
N	8/24/2017	BORON	230	ug/l	20	Production	EPA 200.7
N	9/1/2017	BORON	170	ug/l	20	Production	EPA 200.7
N	9/8/2017	BORON	110	ug/l	20	Production	EPA 200.7
N	9/15/2017	BORON	140	ug/l	20	Production	EPA 200.7
N	9/22/2017	BORON	78	ug/l	20	Production	EPA 200.7
N	10/6/2017	BORON	74	ug/l	20	Production	EPA 200.7
N	10/13/2017	BORON	130	ug/l	20	Production	EPA 200.7
N	10/19/2017	BORON	96	ug/l	20	Regular	EPA 200.7
N	10/27/2017	BORON	130	ug/l	20	Production	EPA 200.7
N	10/31/2017	BORON	260	ug/l	20	Production	EPA 200.7
N	11/7/2017	BORON	320	ug/l	20	Production	EPA 200.7
N	11/17/2017	BORON	350	ug/l	20	Production	EPA 200.7
N	11/22/2017	BORON	410	ug/l	20	Production	EPA 200.7
N	11/29/2017	BORON	420	ug/l	20	Production	EPA 200.7
N	12/7/2017	BORON	470	ug/l	20	Production	EPA 200.7
N	12/21/2017	BORON	550	ug/l	20	Production	EPA 200.7
N	12/27/2017	BORON	540	ug/l	20	Production	EPA 200.7
N	1/26/2017	MOLYBDENUM	2	ug/l	1.0	Production	EPA 200.8
N	2/23/2017	MOLYBDENUM	< 2.0	ug/l	2.0	Production	EPA 200.8
N	3/30/2017	MOLYBDENUM	1	ug/l	1.0	Production	EPA 200.8
N	4/26/2017	MOLYBDENUM	< 1.0	ug/l	1.0	Production	EPA 200.8
N	5/25/2017	MOLYBDENUM	2	ug/l	1.0	Production	EPA 200.8
N	6/27/2017	MOLYBDENUM	< 1.0	ug/l	1.0	Production	EPA 200.8
N	7/27/2017	MOLYBDENUM	4	ug/l	1	Production	EPA 200.8
N	8/24/2017	MOLYBDENUM	3	ug/l	1	Production	EPA 200.8
N	10/31/2017	MOLYBDENUM	3	ug/l	1	Production	EPA 200.8
N	11/29/2017	MOLYBDENUM	4	ug/l	1	Production	EPA 200.8
N	12/27/2017	MOLYBDENUM	5	ug/l	1	Production	EPA 200.8
N	1/26/2017	NITRATE AS N (DISSOLVED)	0.65	mg/l	0.010	Production	EPA 300.0
N	3/30/2017	NITRATE AS N (DISSOLVED)	0.19	mg/l	0.010	Production	EPA 300.0
N	5/25/2017	NITRATE AS N (DISSOLVED)	0.34 H, V	mg/l	0.010	Production	EPA 300.0
N	6/27/2017	NITRATE AS N (DISSOLVED)	0.13	mg/l	0.010	Production	EPA 300.0
N	7/27/2017	NITRATE AS N (DISSOLVED)	2.2	mg/l	0.010	Production	EPA 300.0
N	8/24/2017	NITRATE AS N (DISSOLVED)	2.5	mg/l	0.010	Production	EPA 300.0
N	10/31/2017	NITRATE AS N (DISSOLVED)	1.6	mg/l	0.010	Production	EPA 300.0
N	11/29/2017	NITRATE AS N (DISSOLVED)	1.8	mg/l	0.020	Production	EPA 300.0
N	12/27/2017	NITRATE AS N (DISSOLVED)	1.6 T	mg/l	0.010	Production	EPA 300.0
N	1/12/2017	SELENIUM	0.597	ug/l	0.4	Production	SM3500-Se-C
N	1/26/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	2/2/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	2/9/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	2/17/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	2/23/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	3/10/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	3/15/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	3/30/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	4/14/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	4/21/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	4/26/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	5/4/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	5/12/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	5/18/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	5/25/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	6/1/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	6/9/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	6/13/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	6/20/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	6/27/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	7/5/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C

N	7/12/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	7/18/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	7/27/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	8/1/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	8/8/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	8/15/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	8/24/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	9/1/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	9/8/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	9/15/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	9/22/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	10/6/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	10/13/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	10/19/2017	SELENIUM	< 0.4	ug/l	0.4	Regular	SM3500-Se-C
N	10/27/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	10/31/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	11/7/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	11/17/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	11/22/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	11/29/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	12/7/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	12/21/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
N	12/27/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	4/26/2017	AMMONIA AS N	0.092	mg/l	0.050	Production	SM 4500 NH3 D
R	5/25/2017	AMMONIA AS N	0.15	mg/l	0.050	Production	SM 4500 NH3 D
R	6/27/2017	AMMONIA AS N	0.12	mg/l	0.050	Production	SM 4500 NH3 D
R	7/27/2017	AMMONIA AS N	0.17 T	mg/l	0.050	Production	SM 4500 NH3 D
R	8/24/2017	AMMONIA AS N	0.11	mg/l	0.050	Production	SM 4500 NH3 D
R	10/31/2017	AMMONIA AS N	0.17	mg/l	0.050	Production	SM 4500 NH3 D
R	11/29/2017	AMMONIA AS N	0.16	mg/l	0.050	Production	SM 4500 NH3 D
R	12/27/2017	AMMONIA AS N	0.11	mg/l	0.050	Production	SM 4500 NH3 D
R	4/26/2017	BORON	350	ug/l	20	Production	EPA 200.7
R	5/4/2017	BORON	23	ug/l	20	Production	EPA 200.7
R	5/12/2017	BORON	300	ug/l	20	Production	EPA 200.7
R	5/18/2017	BORON	340	ug/l	20	Production	EPA 200.7
R	5/25/2017	BORON	820	ug/l	20	Production	EPA 200.7
R	6/1/2017	BORON	970	ug/l	20	Production	EPA 200.7
R	6/9/2017	BORON	170	ug/l	20	Production	EPA 200.7
R	6/13/2017	BORON	150	ug/l	20	Production	EPA 200.7
R	6/20/2017	BORON	130	ug/l	20	Production	EPA 200.7
R	6/27/2017	BORON	64	ug/l	20	Production	EPA 200.7
R	7/5/2017	BORON	410	ug/l	20	Production	EPA 200.7
R	7/12/2017	BORON	67	ug/l	20	Production	EPA 200.7
R	7/18/2017	BORON	240	ug/l	20	Production	EPA 200.7
R	7/27/2017	BORON	1600	ug/l	20	Production	EPA 200.7
R	8/1/2017	BORON	2400	ug/l	20	Production	EPA 200.7
R	8/8/2017	BORON	3200	ug/l	20	Production	EPA 200.7
R	8/15/2017	BORON	1700	ug/l	20	Production	EPA 200.7
R	8/24/2017	BORON	270	ug/l	20	Production	EPA 200.7
R	9/1/2017	BORON	280	ug/l	20	Production	EPA 200.7
R	9/8/2017	BORON	370	ug/l	20	Production	EPA 200.7
R	9/15/2017	BORON	370	ug/l	20	Production	EPA 200.7
R	9/22/2017	BORON	260	ug/l	20	Production	EPA 200.7
R	10/6/2017	BORON	350	ug/l	20	Production	EPA 200.7
R	10/13/2017	BORON	420	ug/l	20	Production	EPA 200.7
R	10/27/2017	BORON	470	ug/l	20	Production	EPA 200.7
R	10/31/2017	BORON	500	ug/l	20	Production	EPA 200.7
R	11/7/2017	BORON	520	ug/l	20	Production	EPA 200.7
R	11/17/2017	BORON	550	ug/l	20	Production	EPA 200.7
R	11/22/2017	BORON	600	ug/l	20	Production	EPA 200.7
R	11/29/2017	BORON	640	ug/l	20	Production	EPA 200.7
R	12/7/2017	BORON	710	ug/l	20	Production	EPA 200.7
R	12/15/2017	BORON	730	ug/l	20	Production	EPA 200.7
R	12/21/2017	BORON	760	ug/l	20	Production	EPA 200.7

R	12/27/2017	BORON	800	ug/l	20	Production	EPA 200.7
R	4/26/2017	MOLYBDENUM	3	ug/l	1.0	Production	EPA 200.8
R	5/25/2017	MOLYBDENUM	6	ug/l	1.0	Production	EPA 200.8
R	6/27/2017	MOLYBDENUM	1	ug/l	1.0	Production	EPA 200.8
R	7/27/2017	MOLYBDENUM	11	ug/l	1.0	Production	EPA 200.8
R	8/24/2017	MOLYBDENUM	5	ug/l	2	Production	EPA 200.8
R	10/31/2017	MOLYBDENUM	5	ug/l	1	Production	EPA 200.8
R	11/29/2017	MOLYBDENUM	5	ug/l	1	Production	EPA 200.8
R	12/27/2017	MOLYBDENUM	7	ug/l	1	Production	EPA 200.8
R	4/26/2017	NITRATE AS N (DISSOLVED)	< 0.010	mg/l	0.010	Production	EPA 300.0
R	5/25/2017	NITRATE AS N (DISSOLVED)	0.40 H, V	mg/l	0.010	Production	EPA 300.0
R	6/27/2017	NITRATE AS N (DISSOLVED)	0.013	mg/l	0.010	Production	EPA 300.0
R	7/27/2017	NITRATE AS N (DISSOLVED)	0.69	mg/l	0.010	Production	EPA 300.0
R	8/24/2017	NITRATE AS N (DISSOLVED)	0.31	mg/l	0.010	Production	EPA 300.0
R	10/31/2017	NITRATE AS N (DISSOLVED)	0.11	mg/l	0.010	Production	EPA 300.0
R	11/29/2017	NITRATE AS N (DISSOLVED)	0.33	mg/l	0.010	Production	EPA 300.0
R	12/27/2017	NITRATE AS N (DISSOLVED)	0.26 T	mg/l	0.010	Production	EPA 300.0
R	4/26/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	5/4/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	5/12/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	5/18/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	5/25/2017	SELENIUM	0.503	ug/l	0.4	Production	SM3500-Se-C
R	6/1/2017	SELENIUM	0.573	ug/l	0.4	Production	SM3500-Se-C
R	6/9/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	6/13/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	6/20/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	6/27/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	7/5/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	7/12/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	7/18/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	7/27/2017	SELENIUM	0.746	ug/l	0.4	Production	SM3500-Se-C
R	8/1/2017	SELENIUM	0.808	ug/l	0.4	Production	SM3500-Se-C
R	8/8/2017	SELENIUM	1.31 U	ug/l	0.4	Production	SM3500-Se-C
R	8/15/2017	SELENIUM	0.944	ug/l	0.4	Production	SM3500-Se-C
R	8/24/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	9/1/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	9/8/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	9/15/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	9/22/2017	SELENIUM	0.449	ug/l	0.4	Production	SM3500-Se-C
R	10/6/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	10/13/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	10/27/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	10/31/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	11/7/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	11/17/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	11/22/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	11/29/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	12/7/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	12/15/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	12/21/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C
R	12/27/2017	SELENIUM	< 0.4	ug/l	0.4	Production	SM3500-Se-C

T - Result obtained past the holding time.
U - Result determined to be an outlier at the time of data validation.
V - Result may vary excessively from the true value.
H - Result may have a high bias.
< - Result measured below the reporting limit as listed.

Explanation of missing Lab data:

February: Missing Ammonia and Nitrate results for Site B3 and Site D. The sample collection vehicle got stuck and was unable to collect the sample.

September: Missing Ammonia and Nitrate at Site B3 and Site D. Missing Molybdenum at Site B3, Sit D, Site N, and Site R. The sampling crew had a scheduling conflict and could not make the sample run.

Aquatic and Sediment Toxicity Summary

Site	Date	*Selenastrum capricornutum* (cells x10^6)	(% of lab control)	*Daphnia magna* (% survival)	(% of lab control)	Fathead Minnow (% survival)	(% of lab control)	*Hyalella azteca* (% survival)	(% of lab control)
Lab control	1/18/2017	2.77	NA	100	NA	100	NA	No Test	
D		7.29	263%	100	100%	100	100%		
Lab control	2/16/2017	2.97	NA	100	NA	100	NA	No Test	
D		7.52	253%	100	100%	97.5	98%		
Lab control	3/16/2017	2.54	NA	100	NA	97.5	NA	100	NA
D		7.11	280%	100	100%	100	103%	100	100%
B3		5.09	200%	100	100%	97.5	98%	No Test	NA
F		7.04	277%	100	100%	100	103%	No Test	NA
R		No Test	NA	No Test	NA	No Test	NA	No Test	NA
Lab control	4/6/2017	2.13	NA	100	NA	100	NA	No Test	
D		5.92	278%	100	100%	97.5	98%		
Lab control	5/25/2017	2.64	NA	100	NA	100	NA	No Test	
D		5.86	222%	100	100%	97.5	98%		
Lab control	6/29/2017	2.77	NA	100	NA	100	NA	No Test	
D		5.03	182%	100	100%	100	100%		
B3		3.94	142%	100	100%	100	100%		
F		4.94	178%	100	100%	100	100%		
R		4.74	171%	100	100%	100	100%		
Lab control	7/27/2017	2.57	NA	100	NA	100	NA	No Test	
D		4.93	192%	100	100%	100	100%		
Lab control	8/17/2017	2.86	NA	100	NA	100	NA	No Test	
D		5.25	184%	100	100%	100	100%		
Lab control	9/20/2017	2.52	NA	100	NA	100	NA	98.8	NA
D		5.98	237%	100	100%	100	100%	97.5	99%
B3		4.22	167%	100	100%	100	100%	No Test	NA
F		5.27	209%	100	100%	97.5	98%	No Test	NA
R		5.26	209%	100	100%	100	100%	No Test	NA
Lab control	10/11/2017	2.32	NA	95	NA	100	NA	No Test	
D		6.02	259%	95	100%	100	100%		
Lab control	11/16/2017	2.43	NA	100	NA	100	NA	No Test	
D		6.01	247%	90	90%	100	100%		
B3		4.09	168%	100	100%	100	100%		
F		5.1	210%	80	80%	100	100%		
R		5.08	209%	95	95%	100	100%		
Lab control	12/12/2017	2.81	NA	95	NA	100	NA	No Test	
D		5.78	206%	100	105%	100	100%		

Site D Sediment Sample Physical Data

Constituent	Unit	3/15/17	9/20/2016
Clay	% <0.005 mm	25.65	
Silt	% 0.005 to <0.075 mm	61.77	17.56
Sand	% Fine 0.075 to <0.425 mm	11.77	78.36
Sand	% Medium 0.425 to <2.0 mm	1.42	3.73
Sand	% Coarse 2.0 to <4.75 mm	<0.01	.02
Gravel	% 4.75 to <75 mm	<0.01	<0.01
Total Organic Carbon	mg/Kg dw	24,100	3,100

Attachment 2
Summary of Exceedances

Field Data Exceedances

Site	Date	Matrix	Sample Type	EC	Unit	Exceedance Limit
D	1/12/2017	Surface Water	Grab	1602	µS/cm	900
D	1/26/2017	Surface Water	Grab	1170	µS/cm	900
D	2/2/2017	Surface Water	Grab	2667	µS/cm	900
D	2/9/2017	Surface Water	Grab	2017	µS/cm	900
D	2/23/2017	Surface Water	Grab	1274	µS/cm	900
D	3/10/2017	Surface Water	Grab	2079	µS/cm	900
D	3/15/2017	Surface Water	Grab	2158	µS/cm	900
D	3/30/2017	Surface Water	Grab	1955	µS/cm	900
D	4/14/2017	Surface Water	Grab	2082	µS/cm	900
D	4/21/2017	Surface Water	Grab	2733	µS/cm	900
D	4/26/2017	Surface Water	Grab	2199	µS/cm	900
D	5/4/2017	Surface Water	Grab	4366	µS/cm	900
D	5/12/2017	Surface Water	Grab	3075	µS/cm	900
D	5/18/2017	Surface Water	Grab	1418	µS/cm	900
D	5/25/2017	Surface Water	Grab	1793	µS/cm	900
D	6/9/2017	Surface Water	Grab	1209	µS/cm	900
D	6/13/2017	Surface Water	Grab	1252	µS/cm	900
D	6/27/2017	Surface Water	Grab	1988	µS/cm	900
D	7/5/2017	Surface Water	Grab	3368	µS/cm	900
D	7/12/2017	Surface Water	Grab	4277	µS/cm	900
D	7/18/2017	Surface Water	Grab	3021	µS/cm	900
D	7/27/2017	Surface Water	Grab	1542	µS/cm	900
D	8/1/2017	Surface Water	Grab	1847	µS/cm	900
D	8/8/2017	Surface Water	Grab	4865	µS/cm	900
D	8/15/2017	Surface Water	Grab	1073	µS/cm	900
D	9/1/2017	Surface Water	Grab	2692	µS/cm	900
D	9/15/2017	Surface Water	Grab	988	µS/cm	900
D	10/6/2017	Surface Water	Grab	1117	µS/cm	900
D	10/13/2017	Surface Water	Grab	983	µS/cm	900
D	10/27/2017	Surface Water	Grab	970	µS/cm	900
D	10/31/2017	Surface Water	Grab	1010	µS/cm	900
D	11/7/2017	Surface Water	Grab	1049	µS/cm	900
D	11/17/2017	Surface Water	Grab	1143	µS/cm	900
D	11/22/2017	Surface Water	Grab	1048	µS/cm	900
D	11/29/2017	Surface Water	Grab	1209	µS/cm	900
D	12/7/2017	Surface Water	Grab	1435	µS/cm	900
D	12/15/2017	Surface Water	Grab	1715	µS/cm	900
D	12/21/2017	Surface Water	Grab	1858	µS/cm	900
D	12/27/2017	Surface Water	Grab	1984	µS/cm	900
N	8/1/2017	Surface Water	Grab	949	µS/cm	900
N	12/7/2017	Surface Water	Grab	907	µS/cm	900
N	12/21/2017	Surface Water	Grab	1024	µS/cm	900
N	12/27/2017	Surface Water	Grab	1153	µS/cm	900
R	5/25/2017	Surface Water	Grab	1283	µS/cm	900
R	6/1/2017	Surface Water	Grab	1415	µS/cm	900
R	7/27/2017	Surface Water	Grab	1984	µS/cm	900
R	8/1/2017	Surface Water	Grab	3227	µS/cm	900
R	8/8/2017	Surface Water	Grab	4386	µS/cm	900
R	8/15/2017	Surface Water	Grab	2063	µS/cm	900
R	9/8/2017	Surface Water	Grab	923	µS/cm	900
R	11/17/2017	Surface Water	Grab	932	µS/cm	900

R	11/22/2017	Surface Water	Grab	941	µS/cm	900
R	11/29/2017	Surface Water	Grab	1041	µS/cm	900
R	12/7/2017	Surface Water	Grab	1187	µS/cm	900
R	12/15/2017	Surface Water	Grab	1299	µS/cm	900
R	12/21/2017	Surface Water	Grab	1347	µS/cm	900
R	12/27/2017	Surface Water	Grab	1463	µS/cm	900

Temp = Temperature reported in degrees °C unless otherwise noted.
EC = Electrical Conductivity as Specific Conductance normalized to 25°C and reported as µS/cm.
Turbidity = reported in NTU's
EH = ORP reported in mV
DO = Dissolved oxygen reported in mg/L

Laboratory Data Exceedances

Site	Date	Analyte	Result	Units	Exceedance Limit
D	April	Boron	2733	µg/L	2000 monthly mean
D	May	Boron	2425	µg/L	2000 monthly mean
D	July	Boron	2625	µg/L	2000 monthly mean

Attachment 3
USBR Laboratory Results Quality Assurance

USBR Incorporated - QA Acceptance Criteria

Calculations demonstrated below are used to determine if data meets the "USBR incorporated" QA standards listed in Table A-8 of the *Quality Assurance Project Plan for the Monitoring and Reporting Program and Waste Discharge Requirements for the Surface Water Discharges from the Grasslands Bypass Project.*

Precision			
Aqueous		Solid	
Result ≥ 5 x RL	Result < 5 x RL	Result ≥ 5 x RL	Result < 5 x RL
≤ 20% RPD	± 1 x RL	≤ 35% RPD	± 2 x RL

The RPD is calculated as follows:

$$RPD = \frac{|R - D|}{\left(\frac{(R + D)}{2}\right)}(100)$$

RPD = Relative Percent Difference

R = Regular Sample Result

D = Duplicate Sample Result

Accuracy – Matrix Spike	
Aqueous	
Spike Concentration ≥ 5 x RL	Spike Concentration < 5 x RL
80%-120% Recovery	± 1 x RL

The PR for a spike sample is calculated as follows:

$$PR = \frac{(S - R)}{A}(100)$$

PR = Percent Recovery

S = Spike Sample Result

R = Regular Sample Result

A = Amount of Spike Added (Spike Concentration)

Accuracy – Whole Volume Reference			
Aqueous		Solid	
Reference Concentration ≥ 5 x RL	Reference Concentration < 5 x RL	Reference Concentration ≥ 5 x RL	Reference Concentration < 5 x RL
80%-120% Recovery or within Vendor's Acceptance Limit	± 1 x RL or within Vendor's Acceptance Limit	65%-135% Recovery or within Vendor's Acceptance Limit	± 2 x RL or within Vendor's Acceptance Limit

The PR for a reference sample is calculated as follows:

$$PR = \left(\frac{F}{MPV}\right)(100)$$

PR = Percent Recovery

F = Reference Sample Result

MPV = Most Probable Value or certified value

(Reference Concentration)

Blank – Contamination
Aqueous and Solid
≤ 2 x RL, ≤ 10% of the lowest production sample result, or < than the Manufacturer's Performance Testing Limits

Contract Laboratories - QA Acceptance Criteria

Standards listed below are used to assess if data meets the "laboratory internal" QA standards listed in page 15 of the *Quality Assurance Project Plan for the Monitoring and Reporting Program and Waste Discharge Requirements for the Surface Water Discharges from the Grasslands Bypass Project.*

Western Environmental Laboratory (WET)					
Parameter	Blank	LCS	MS Rec	MSD Rec*	MS/MSD RPD
Boron[¥]	< RL	85% - 115%	70% -130%	70% -130%	< 20%
Molybdenum[¥]	< RL	85% - 115%	70% -130%	70% -130%	< 20%
Ammonia	< RL	80% - 120%	80% -120%	80% -120%	< 20%
Nitrate as N	< RL	90% - 110%	80% -120%	80% -120%	< 20%

*Failure of MSD recovery acceptance limit is negligible if MS recovery and MS/MSD RPD are within limits

[¥] MS and MSD recovery ranges reflect the WET accepted limits per the laboratory's SOP.

South Dakota Agricultural Laboratory (SD Ag)		
Parameter	LCS	MS
Selenium	80% - 120%	80% - 120%

Eurofins Eaton Analytical (EUROFINS)						
Parameter	LCS Rec	LCS RPD	Blank	RL Check	MS Rec*	MS RPD*
TOC	90% - 110%	< 20%	< RL	50% - 150%	80% - 120%	< 20%

*Criteria for MS and Dup are advisory only, batch control is based on LCS.

Summary Table of QA/QC Results that do not meet objectives

	Outliers					
Sample ID	Date	Location	Parameter	Result	Reanalysis	Historical Average
GBW5460	2/2/2017	Site D	Selenium	8.44 µg/L	8.06 µg/L	1.07 µg/L
GBW5470	2/9/2017	Site D	Selenium	4.37 µg/L	4.37 µg/L	1.07 µg/L
GBW5490	2/23/2017	Site D	Selenium	5.69 µg/L	5.56 µg/L	1.07 µg/L
GBW5510	3/10/2017	Site D	Selenium	5.55 µg/L	5.40 µg/L	1.07 µg/L
GBW5512	3/10/2017	Site B3	Selenium	68.6 µg/L	68.8 µg/L	1.07 µg/L
GBW5560	4/21/2017	Site D	Selenium	5.52 µg/L	5.59 µg/L	1.07 µg/L
GBW5542	3/30/2017	Site B3	Nitrate as N	11 mg/L	10 mg/L	1.23 mg/L
GBW5725	8/8/2017	Site R	Selenium	1.31 µg/L	1.38 µg/L	0.77 µg/L

USBR flagged outliers are analytical results that are outside of the established historical range and do not, necessarily fail to meet QA/QC objective. These results have been confirmed by reanalysis and may represent an environmental fluctuation or potentially, an isolated sample contamination. A result is determined to be an outlier if it is greater than three standard deviations from the average, or greater than the reporting limit from the average if the result is less than five times the reporting limit.

Holding Time Exceedances				
Sample ID	Date	Location	Parameter	Report
GBW5730	8/15/2017	Site D	Total Organic Carbon	683292
GBW5737	8/15/2017	Site D	Total Organic Carbon	683292
GBW5738	8/15/2017	Site D	Total Organic Carbon	683292
GBW5739	8/15/2017	Site D	Total Organic Carbon	683292
GBW5750	9/1/2017	Site D	Total Organic Carbon	689385
GBW5757	9/1/2017	Site D	Total Organic Carbon	689385
GBW5758	9/1/2017	Site D	Total Organic Carbon	689385
GBW5840	11/7/2017	Site D	Total Organic Carbon	701215
GBW5700	7/27/2017	Site D	Ammonia as Nitrogen	1709023
GBW5702	7/27/2017	Site B	Ammonia as Nitrogen	1709023
GBW5705	7/27/2017	Site R	Ammonia as Nitrogen	1709023
GBW5706	7/27/2017	Site N	Ammonia as Nitrogen	1709023
GBW5707	7/27/2017	Site D	Ammonia as Nitrogen	1709023
GBW5708	7/27/2017	Site D	Ammonia as Nitrogen	1709023
GBW5709	7/27/2017	Site D	Ammonia as Nitrogen	1709023
GBW5910	12/27/2017	Site D	Nitrate as Nitrogen	1801636
GBW5912	12/27/2017	Site B	Nitrate as Nitrogen	1801636
GBW5915	12/27/2017	Site R	Nitrate as Nitrogen	1801636
GBW5916	12/27/2017	Site N	Nitrate as Nitrogen	1801636
GBW5917	12/27/2017	Site D	Nitrate as Nitrogen	1801636
GBW5918	12/27/2017	Site D	Nitrate as Nitrogen	1801636
GBW5919	12/27/2017	Site D	Nitrate as Nitrogen	1801636

USBR holding time exceedances are analytical results that are outside the established time frame between sample collection and sample analysis. These results may not accurately reflect the true environmental concentration due to changes in the sample. Results may be useful for management decisions, but should be used at the discretion of the project manager.

USBR Incorporated QA Exceedances			
Samples	Dates	Parameter	Qualification
GBW5610	5/25/2017	Nitrate as N	HV–External QA Dups, poor precision; External QA Blank Spike, high recovery; & External QA Blank, contamination
GBW5612	5/25/2017	Nitrate as N	V–External QA Dups, poor precision
GBW5615	5/25/2017	Nitrate as N	HV–External QA Dups, poor precision; External QA Blank Spike, high recovery; & External QA Blank, contamination
GBW5616	5/25/2017	Nitrate as N	HV–External QA Dups, poor precision; External QA Blank Spike, high recovery; & External QA Blank, contamination

H – result possibly biased high. V – result may vary excessively from the true value.

Qualified results are analytical results that do not meet the QA criteria established in the *Quality Assurance Project Plan for the Monitoring and Reporting Program and Waste Discharge Requirements for the Surface Water Discharges from the Grasslands Bypass Project*. Results may be useful for management decisions, but should be used at the discretion of the project manager. For example, nitrate data marked HV may be both higher and less accurate than expected, so the project manager should use caution when deciding if these values exceed any relevant water quality objectives.

Completeness

Completeness – Completeness is the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal operations. A completeness criteria of 90% per sample batch has been established for this program.

$$\% \text{ Completeness} = V/N \times 100$$

V = number of valid results for 2017	1289
N = number of collected results	1312
Average Completeness	98%

Total planned data points for 2017	1644
Samples collected by field personnel	1312
Sample results that passed QA	1297
Sample results that passed QA (no Outliers)	1289

Planned sample events were not collected during 2017 due to very wet winter conditions, equipment failures, lack of site access, and scheduling conflicts. Of collected samples, completeness was 98%.

Corrective Actions:
The causes of failed sample collections were reviewed so that corrective actions could be implemented. The general causes of failed collection are listed below, along with the proposed corrective action.

- Field parameters – probe unavailable: A backup probe has been provided for sampling crew use if necessary.
- Field parameters – DO probe failed to calibrate. The DO probe has been replaced.
- Field parameters – Turbidity probe malfunction. The turbidity probe has been repaired or replaced.
- Sample Collection – Site inaccessible due to flooding or wet conditions. This is a safety and property protection issue and there is not a corrective action that can be applied to this condition.

Impact of Failed Sample Collection:
The impact of the failed sample collects and resulting missing data is minimal. Field parameters (Temperature, SC, DO, pH, and turbidity) are collected weekly and the missing data represents a very small fraction of the field parameter dataset. Ammonia, Nitrate and Molybdenum are sampled less frequently so the missing samples represent a larger fraction of the data set for those constituents. However, available data indicate that the results for all three of these constituents are well below trigger limits, implying that the missing data is unlikely to be an unmeasured exceedance.

Attachment 4
Farm Evaluation Data Summary

Grassland Basin Drainage Steering Committee

Grassland Drainage Area Coalition

Summary of Management Practice Information
Collected from Farm Evaluations and Managed Wetland Evaluations
For 2016 Growing Season

April 30, 2018

Summers Engineering, Inc
Since 1962

G:\data\NEW Wordpro\SLDMWA\73c GDA Coalition\reports\2018\04-30-18-970-2016 FE Data Summary Report.docx

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Executive Summary

The Grassland Drainage Area Coalition (GDA Coalition) serves as the Third Party Group for growers within the Grassland Drainage Area, for the purpose of implementing applicable portions of the Irrigated Lands Regulatory Program (IRLP) as specified in Order Number R5-2015-0095 (Order). All growers in the GDA Coalition were required to submit a Farm Evaluation Plan (FE) survey in 2016.

To satisfy this requirement, the GDA Coalition prepared and sent FE surveys to all current members. 108 sets of forms were prepared for approximately 650 parcels. The mailing was done in January of 2017. The surveys were prepopulated with Assessor's Parcel Number (APN) and included map of those parcels. The completed forms were due by March 1, 2017. Surveys were received for 100% of the parcels within the GDA Coalition.

The purpose of the FE survey is to provide the GDA Coalition and the Central Valley Regional Board (Regional Board) with management practices intended to protect water quality on a site-specific basis. The site-specific information will be used in conjunction with representative surface and groundwater quality information to determine the effects that irrigated agricultural practices have on water quality.

Survey responses including crop, acreage, and associated management practices were recorded in a Microsoft Access database. The crop information was normalized and subsequently summarized on a coalition-wide basis. The data has been compiled in one table, which includes all question/response combinations for each member.

The Farm Evaluation Surveys included these four sections:

- Part A - Whole Farm Evaluation
- Part B - Irrigation and Nitrogen Practices
- Part C - Well Information
- Part D - Sediment and Erosion Control Practices

The FE survey result table includes:

- Township – The township and range in which land resides
- Question – FE survey question
- Response – Management Practice response to each FE survey question
- Result Acreage – Acreage for which the question/response combination applies
- Result Crop – The crop for which each question/response applies
- Normalized Crop – Crop designation assigned to each Result Crop by Coalition
- Valid – Data quality assessment field used to assess data gaps by township

Technical assistance was provided to coalition members in completing the FE forms in the Fall of 2015 and is summarized as follows:

- Outreach meetings held in Fall of 2016

- Assistance filling out the FE surveys by water district and Coalition staff

Farm Evaluation Participation Summary

The GDA Coalition's 2016 membership roster submitted to the State Water Resources Control Board on July 31, 2016, was used as a baseline. The enrolled acreage in the GDA Coalition at the time of the survey was 80,858 acres. All coalition members returned a FE survey. The total response acreage was 77,942 acres. The response acreage includes 210 management units. All lands in the Coalition were surveyed, regardless of high vulnerability status.

The response acreage is less than the enrolled acreage because a parcel is typically not 100% farmable. The non-farmable portion of a given parcel may include canals, roads, shop buildings and the like. Secondly, some surveys were returned but did not include response acreages because the land is not devoted to irrigated agriculture or is covered by an alternate waste discharge requirement (WDR) such as the dairy program.

Table 1: FE/MWE Participation Summary

FE Surveys Received for Irrigated Land	101	
FE Surveys Received for Non-irrigated Land	6	
FE Surveys Received for Lands covered under alternate WDR	1	
Total Members Surveyed	108	
Total Surveyed Acreage	80,858	acres
Response Acreage	77,942	acres
Acreage not farmed or covered under Alternate WDR	2,916	acres

Coalition Crop Information

Cropping patterns for the 2016 growing season were developed from the FE surveys. The reported crop was normalized so that a meaningful summary could be developed. In many instances, multiple crops were reported for a single acreage. To normalize data reported in this manner, the following criteria were used:

- If a clear summer crop was identified along with a winter crop (ex. tomatoes/ wheat), the summer crop (tomatoes) was assigned as the normalized crop.
- In situations where no clear summer crop was identified (Corn/Tomatoes or Almonds/Cotton), the first crop listed was assigned as the normalized crop.

The resulting data identifies the major crops in the Coalition. However, their rank, relative to each other, is not accurate due to the methodology discussed above.

Table 2: Crop Summary

Primary Crop	Acres
Cotton	12,413
Tomatoes	10,921
Pistachios	10,576
Almonds	8,300
Wheatgrass	6,805
Alfalfa	3,801
Melons	3,705
Grapes	3,463
Wheat	2,439
Pomegranates	919
Asparagus	682
Rice	582
Onions	528
Barley	434
Cover Crop	328
Watermelons	309
Oats	71
Pasture	26
Vegetable Transplants	20
2016 Total Reported Farmed Acreage	66,322
Fallow	7,095
No Crop Specified	4,226
Not Irrigated	212
WSJWQC	87
Response Acreage	77,942

Part A - Whole Farm Evaluation

The management practices reported in Part A of the FE survey are summarized below. These management practices are not crop-specific but apply on an operation-wide basis. Coalition members were asked to list their pesticide application practices, the consultants they utilize and assess their farm's potential to discharge sediment off-site.

Table 3: Whole Farm Evaluation

Question/Response	Acreage
Pesticide Application Practices	
County Permit Followed	77,094
Follow Label Restrictions	77,062
Attend Trainings	75,419
Use Drift Control Agents	74,724
Monitor Wind Conditions	74,577
Use PCA Recommendations	74,276
Use Appropriate Buffer Zones	72,447
Avoid Surface Water When Spraying	70,943
Monitor Rain Forecasts	68,305
End of Row Shutoff When Spraying	67,852
Reapply Rinsate to Treated Field	49,708
Sensitive Areas Mapped	48,660
Chemigation	46,234
Target Sensing Sprayer used	30,066
Use Vegetated Drain Ditches	21,761
No Pesticides Applied	531
Other – See Note	477
No Selection	244

Note - These are survey responses were completed by the member. All written-in responses named specialized spraying equipment (ex. low volume sprayer).

Who do you have help develop your crop fertility plan?	
Pest Control Advisor (PCA)	68,422
Certified Crop Advisor (CCA)	48,090
Professional Agronomist	31,892
Independently Prepared by Member	19,075
Professional Soil Scientist	17,505
UC Farm Advisor	13,002
None of the above	599
No Selection	249
Certified Technical Service Providers by NRCS	129
Does your farm have the potential to discharge sediment to off-farm surface waters?	
No	68,319
Yes	5,236
No Selection	4,387

Part B - Irrigation and Nitrogen Management Practices

The responses from Part B are summarized in Tables 4, 5, and 6. As with previous survey years, about half of the surveyed acreage is irrigated using high-efficiency irrigation systems (drip and micro sprinkler) and the other half utilizes conventional irrigation methods. The acreage total from irrigation practices is larger than the total reported 2016 Farm Evaluation acreage. There were cases in which more than one primary irrigation practice was selected per management unit. Similar to the data collected in past years, a majority of tomatoes and almonds were irrigated using high-efficiency systems, while the majority of cotton and alfalfa was irrigated with conventional irrigation methods.

Table 4: Irrigation Practices

Question/Response	Acreage
Irrigation Practices	
Drip*	55,434
Flood	10,060
Furrow	5,007
No Selection	4,379
Sprinkler	1,102
Border Strip	1005
Micro Sprinkler*	955

*High-efficiency irrigation method

Table 5: Secondary Irrigation Practices

Secondary Irrigation	
No Selection	38,092
Sprinkler	32,925
Furrow	3,057
Micro Sprinkler*	1,602
Flood	1,539
Drip*	727

*High-efficiency irrigation method

Table 6: Irrigation Efficiency and Nitrogen Management

Irrigation Efficiency Practices	
Water application scheduled to need	67,156
Use of moisture probe	57,525
Use of ET in scheduling irrigations	45,719
Laser Leveling	29,900
Soil Moisture Neutron Probe	18,347
Pressure Bomb	17,892
No Selection	4,644
Other (responses noted no irrigation water was applied or no water was unavailable)	150
Nitrogen Management Methods to Minimize Leaching Past The Root Zone	
Soil Testing	69,139
Tissue/Petiole Testing	63,845
Split Fertilizer Applications	58,950
Fertigation	52,216
Irrigation Water N Testing	45,353
Foliar N Application	37,404
Cover Crops	13,925
Variable Rate Applications using GPS	3,643
Do Not Apply Nitrogen	2,938
No Selection	2,717
Other (responses noted that there was no crop or anaerobic conditions present)	488

Part C - Well Information

A total of 76 production wells were reported on the FE/MWE surveys. Some members indicated that the well was abandoned but reported wellhead protection practices. It is assumed these wells are idle and may be used in the future. Wells assumed idle are excluded from the abandoned well count and included in the wellhead protection count. A total of 62 wells were considered protected, meeting the criteria below. The remaining 14 were not protected.

A well is considered protected if the following criteria are met:

1. Either a Backflow Preventer/Check Valve or an Air Gap is reported for a given well.
2. Either the ground is sloped away from or standing water is avoided around the wellhead for a given well.

A total of 6 abandoned wells were reported. Four wells were abandoned in or after 1995. One well was reported to have been abandoned in the 1960's and one well did not have an abandoned year reported.

Table 7: Well Information

Question/Response	Count of Wells
Wellhead Protection Practices	
Air Gap (for non-pressurized systems	42
Backflow Preventive / Check Valve	62
Good "Housekeeping" Practices*	75
Ground Sloped Away from Wellhead	73
Standing water avoided around wellhead	73
Abandoned Well Practices	
No Data Entered	4
Destroyed - Unknown method	1
Destroyed by licensed professional	1
Destroyed – certified by county	0

Part D - Sediment Management Practices

Sediment management practices are summarized below. Surface water in the Grassland Drainage Area is not regulated by the ILRP, but is covered under a separate WDR. As such, growers in the GDA were not required to complete part D of the Farm Evaluation Survey. However, a strong majority of growers did complete this portion of the survey and the data is summarized below.

Table 8: Sediment and Erosion Control Practices

Irrigation Practices for Managing Sediment and Erosion	
Use drip or micro-irrigation to eliminate irrigation drainage.	51,035
The time between pesticide applications and the next irrigation is lengthened as much as possible to mitigate runoff of pesticide residue.	40,138
No irrigation drainage due to field or soil conditions.	26,967
Shorter irrigation runs are used with checks to manage and capture flows.	25,260
No Selection	15,364
Catchment Basin.	13,993
Tailwater Return System.	11,457
In-furrow dams are used to increase infiltration and settling out of sediment prior to entering the tail ditch.	8,856
Use of flow dissipaters to minimize erosion at discharge point.	3,143
PAM (polyacrylamide) used in furrow and flood irrigated fields to help bind sediment and increase infiltration.	129

Cultural Practices to Manage Sediment and Erosion	
Soil water penetration has been increased through the use of amendments, deep ripping and/or aeration.	47,861
Minimum tillage incorporated to minimize erosion.	36,764
Crop rows are graded, directed and at a length that will optimize the use of rain and irrigation water.	28,647
Storm water is captured using field borders.	23,181
No storm drainage due to field or soil conditions.	22,166
Berms are constructed at low ends of fields to capture runoff and trap sediment.	19,888
Field is lower than surrounding terrain.	17,357
No Selection	15,213
Vegetated ditches are used to remove sediment as well as water soluble pesticides, phosphate fertilizers and some forms of nitrogen.	13,427
Sediment basins / holding ponds are used to settle out sediment and hydrophobic pesticides such as pyrethroids from irrigation and storm runoff.	11,197
Subsurface pipelines are used to channel runoff water.	9,568
Cover crops or native vegetation are used to reduce erosion.	2,777
Creek banks and stream banks have been stabilized.	2,415
Vegetative filter strips and buffers are used to capture flows.	140
Hedgerows or trees are used to help stabilize soils and trap sediment movement.	28

Data Quality Assessment of Collected Information

The quality of the management practice data was assessed on a township/range (township) level and is summarized in Table 9. The assessment quantifies both missing data and incorrect/inaccurate reporting as an acreage percentage by township. For 2016, the entire Coalition was surveyed. The Coalition boundary includes 12 townships. All surveys were received for the 2016 growing season. However, some crop designations were unclear. Each record was reviewed and said to be either valid or unclear (see table 9). Table 10 summarizes the quality assessment by township.

Table 9: Data Validation Criteria

Criteria	Designation
Single crop listed	valid
Multiple crops listed	
Permanent Crops	
Single permanent crop with grain/forage crop (ex: almonds and wheat)	valid
Multiple permanent crops of same type (ex: nut trees, fruit trees etc.)	valid
Multiple permanent crop types (ex: nut trees and fruit trees, nut trees and vines)	unclear
Permanent crop types with row crops (ex: almonds and tomatoes)	unclear
Row Crops	
Single row crop with grain/forage crop (ex: tomatoes and wheat)	valid
Multiple row crops	unclear
Other Crop Designations	
No Irrigated Agriculture	valid
Fallow	valid
No Crop Specified	unclear

Table 10: Quality Assessment by Township

Township	Percent Complete	Percent Valid
11S 10E	100%	100%
11S 11E	100%	95%
11S 12E	100%	87%
12S 11E	100%	85%
12S 12E	100%	88%
12S 13E	100%	83%
12S 14E	100%	73%
13S 11E	100%	100%
13S 12E	100%	69%
13S 13E	100%	46%
13S 14E	100%	99%
13S 15E	100%	100%

Most of the unclear data was due the omission of crop type on returned surveys. Given that two sources of information regarding crop information for a given parcel will be available for the 2017 growing season (Farm Evaluation and Nitrogen Management Plan Summary Report), it is anticipated that data gaps in crop type will be minimal. In event crop type is still omitted, the Coalition will attempt to ascertain the missing crop information via outreach.

Attachment 5
San Luis Drain Sediment Removal

Appendix A
Laboratory Reports & EDDs

Appendix B
Sample Event Photographs

Appendix C
Monitoring Map GIS Files