December 30, 2014

Pamela Creedon
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, CA 95670-6114

Subject: Waste Discharge Requirement Order No. 5-01-234, Update of Long Term Drainage Management Plan and submittal of Monitoring Results

Dear Pamela,

The above Waste Discharge Requirements (WDR) require submission of an update of the long-term drainage management plan for the Grassland Bypass Project and monitoring data. The WDR's were issued to the San Luis & Delta-Mendota Water Authority (Water Authority) and the U. S. Bureau of Reclamation. The Water Authority members that participate in the Grassland Bypass Project are hereafter referred to as the Grassland Area Farmers.

The long-term drainage management plan was submitted on September 30, 1998 in compliance with WDR No. 98-171. Following is an update to the plan.

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Milestones since Last Update

The milestones that have occurred for the Grassland Bypass Channel Project since the 2010 update are as follows:

- The Grassland Area Farmers have reduced the discharge of selenium from the Grassland Drainage Area by 97% since the beginning of the project as measured at the end of Water Year 2014. There were no exceedances of monthly selenium load allocations during Water Year 2014.

- The Grassland Area Farmers have continued to develop funding for the Westside Regional Drainage Plan as described in previous reports. Panoche Drainage District received $16.45 million in funding assistance through the U.S. Bureau of Reclamation's San Joaquin River Salinity Management Program including $3.8 million awarded in 2014. These funds continue to be used to implement a number of activities outlined in the Westside Regional Drainage Plan including projects for groundwater management, development of the reuse area, source control projects and environmental mitigation.

- The Grassland Area Farmers continue to utilize and expand the San Joaquin River Water Quality Improvement Project (SJRIP). The total acreage of the SJRIP has been increased to more than 6,000 acres, with approximately 5,200 developed to salt tolerant crops for drainage reuse. More than 27,000 acre feet of drain water were reused on the SJRIP in Water Year 2014.

- The Grassland Area Farmers are continuing to work closely with the U.S. Bureau of Reclamation to develop an in-valley drainage solution for the Grassland Drainage Area. The In-Valley Solution Plan includes irrigation improvements, seepage reduction, land retirement, recirculation, drainage reuse, and drainage treatment. Reclamation is in the process of developing a demonstration level treatment plant on land in the SJRIP to test treatment methods utilizing subsurface agricultural drainage. Construction on this plant began in December 2012, which was completed in the Spring of 2014. The plant is currently undergoing calibration and start-up testing.

- The discharge from the Grassland Bypass Project in Calendar Year 2013 (critical year type) was 557 pounds of selenium with a load limit of 1,075 pounds. The selenium load discharge during Calendar Year 2014 (critical year type) is projected to be 490 pounds of selenium, approximately 54% below the annual load limit of 1,075 pounds. The actual pounds discharged are not available pending receipt of monitoring reports and will be included in the next update report.

Statement of Goals

The principal goal of the Grassland Area Farmers remains is described in the September 30, 1998 long term drainage management plan. This goal is summarized as providing for the achievement of the water quality objectives fixed by the Regional Board and their Basin Plan related to subsurface drainage discharges from the drainage area while maintaining viable agricultural production in the area.

Inflows Not Within the Control of Grassland Area Farmers

The issue of high drainage flows caused by major storm events continues to be a concern. The 2010-2019 Use Agreement provides for mechanisms to deal with rain induced drainage through the high-rainfall and upper watershed exemptions. It also describes a planning process that may evaluate the utilization of a portion of the San Luis Drain to bypass storm water flows around some wetland areas after 2019, in order to minimize the impact of such flows. Under the Use Agreement, development of a formal plan must begin no later than 2016. Another source of inflows to agricultural drainage systems of the Grassland Drainage Area that continues to be of interest is the contribution from seepage out of the San Luis Canal/California Aqueduct. This issue was described in the 2004 annual report and estimated impacts are being updated.

Future Regulation and Milestones

The Regional Board has adopted a TMDL for salt and boron and one for dissolved oxygen. These TMDLs have subsequently been approved by the State Board and the State Office of Administrative Law. These regulations encompass discharges from a much larger area than the Grassland Drainage Area. The Grassland Area Farmers assisted in the development of a real-time program to comply with the salt and boron TMDL. Part of the real-time program was the development of a Memorandum of Understanding (MOU) to allow for participation in the real time program. The San Luis & Delta-Mendota Water Authority (on behalf of the Grassland Basin Drainage Management Activity Agreement) is a signatory to the MOU. The real-time program was approved by the Central Valley Region Board on December 4, 2014. The Grassland Area Farmers are also contributing to the operation of the aerator at the Port of Stockton to maintain high dissolved oxygen levels. The operation of the aerator has been very successful and there are adequate funds to continue operation during 2015.

Discharge during Water Year 2014

Table 1 sets forth discharges from the Grassland Drainage Area for the period Water Year 1995 (October 1994 through September 1995) through Water Year 2014. The Grassland Bypass Project began in Water Year 1997. The volume of drainage has been reduced significantly compared to pre-project (1995) discharges:

- Discharge volume (acre feet) has been reduced by 88%
- Selenium load has been reduced by 97%
- Salt load has been reduced by 81%
- Boron load has been reduced by 72%

Figure 1 shows this historic discharge (acre feet) and selenium concentration from the Grassland Drainage Area since 1995. As expected, the discharged volume has reduced significantly since the project implementation. However, the concentration of selenium has also reduced – by almost 78% since the beginning of the project. The cause of this selenium concentration reduction is likely the combined result of water delivery infrastructure improvements, irrigation system modernization, and reuse activities on the San Joaquin River Improvement Project.

Selenium load discharged from the Grassland Drainage Area compared with 2014 monthly targets in WDR 5-01-234 are shown in Figure 2. Figure 3 shows the 2014 discharged load along with historic discharges and the "glidepath" in the Use Agreement incorporating the load values from the August 4, 2005 request for revision of the TMML for selenium. Figure 4 shows an estimate of the impact of control activities that occurred during Water Year 2014. Conservation, which includes improved irrigation application, tiered water pricing, tailwater controls, the tradable loads program, and seasonal land fallowing accounted for a reduction of approximately 6,800 pounds of selenium from historic loads. Reuse and treatment, which includes recycling, use of subsurface drainage water on salt tolerant crops and displacement of subsurface drainage water such as for wetting of roadways for dust control, resulted in a 5,600 pound reduction in discharge in Water Year 2014. The remaining 300 pounds was discharged to the San Joaquin River through the Grassland Bypass Project.

The water quality objective for the San Joaquin River at Crows Landing is a 5-ppb 4-day average selenium concentration. This objective was not exceeded in all months through May 30, 2014 and is not expected to have been exceeded the remainder of the year.

Meeting Water Quality Objectives within Grassland Area Channels

The Regional Board has established a two parts per billion monthly average selenium objective for water delivery channels within the wetland areas. Previous long term drainage management plans discussed the activities within the Grassland Drainage Area to keep their agricultural subsurface drainage out of those channels to meet this water quality objective. The Grassland Area Farmers have caused the objective to be exceeded on a few occasions. During 1997 and 1998 storm water discharges caused by surface runoff from heavy rainfall and discharge from coastal streams overwhelmed the agricultural drainage system and flowed into wetland channels, violating the objectives. In February of 2005, significant storm events required the Grassland Area Farmers to divert water through the Agatha Canal in accordance with their Storm Water Management Plan, exceeding the objective for several days. No storm-related diversions into wetland channels by the Grassland Area Farmers have been made since that time.

The Grassland Area Farmers continue to work with the Regional Board to identify and manage discharges to wetland water delivery channels from outside of the Grassland Drainage Area that may cause exceedances of the selenium water quality objective within the wetland areas. Figure 5 shows the monthly average selenium concentrations for two sites within the wetland area. Exceedances within the last 82 months have shown marked improvements and low exceedance rates (see Table 2).

Tools to be used For Long Term Drainage Management

Conservation, reuse and treatment, and river discharge will continue to be the main tools available to the Grassland Area Farmers during the next several years.

During Water Year 2001, Panoche Drainage District on behalf of the other Grassland Area Farmers implemented the San Joaquin River Water Quality Improvement Project (SJRIP). Table 3 shows the usage of subsurface drainage water within the SJRIP area in Water Year 2014, including drain water reused on the newly expanded area. The project resulted in a displacement of 3,500 pounds of selenium. The SJRIP is a multi-phase project, which was initiated with the purchase of 4,000 acres of land in the year 2000 within the Grassland Drainage Area by Panoche Drainage District. During 2008, an additional 2,000 acres were purchased, of which 480 acres were developed for reuse. Currently the total developed reuse area is approximately 5,500 acres. Future phases call for installing subsurface tile drainage systems in the remainder of the SJRIP area to maintain a salt balance within the soil and for disposal of the collected water through treatment and salt disposal options. A portion of these future phases are budgeted in the Prop 50 $25 million grant and federal appropriations awarded to Panoche Drainage District and the Water Authority. Other funds within this grant will be used to investigate drainage treatment options for final salt disposal.

Future Needs

In order to maintain the drainage control strategy for the Grassland Area Farmers, there are several needs. They are as follows:

- The completion of the SJRIP Project including planting of salt tolerant crops and construction of subsurface drainage systems.

- Purchase of additional SJRIP lands of up to 2000 acres for planting of additional cropping to be irrigated with subsurface drainage water.

- Implementation of treatment and disposal of salt from the SJRIP lands. The U.S. Bureau of Reclamation has begun construction of a demonstration-scale treatment plant within the SJRIP and will receive its source water from tile systems within the SJRIP.

- Retirement of land could be part of the ultimate solution to the problem within the Grassland Drainage Area. The Grassland Area Farmers have developed a land retirement policy that was identified and described in the September 30, 1998 Long Term Drainage Management Plan. In addition to this plan, Broadview Water District has recently been purchased and has been fallowed. Other lands within the Grassland Drainage Area are also being considered for fallowing.

- The Grassland Area Farmers and other local interests have been participating with the USBR in their San Luis Drainage Feature Re-Evaluation Program. The goal of the Grassland Area Farmers is to develop local projects that can be implemented to provide drainage service that meets regulatory requirements, including the selenium load reduction targets, while still maintaining a viable agricultural economy.

- The Grassland Area Farmers continue to work with the USBR, other local stakeholders and interested parties to resolve long standing drainage issues. The main component would be full implementation of the Westside Regional Drainage Plan.

Recent Developments

There are four recent and on-going developments related to efforts of the Grassland Area Farmers to meet the regulatory requirements of the Waste Discharge Permit and the Use Agreement. The first two were indicated in the 2004 annual report.

- The Westside Regional Drainage Plan has been developed by the San Joaquin River Exchange Contractors Water Authority, the Broadview Water District, Panoche Water District and Westlands Water District. This process is meant to complement the USBR San Luis Drain Feature Re-evaluation process and to help resolve longstanding drainage issues within the area. The Grassland Area Farmers are aggressively pursuing funding opportunities to implement the Westside Regional Drainage Plan, and have met on a number of occasions with the USBR to move this plan forward. A number of state and federal grants have help significantly in funding portions of this plan.

- The San Joaquin River Water Quality Management Group was formed out of the "UOP Discussions" between statewide water interests and Delta interests to develop a plan to meet Vernalis salinity objectives. There are many components to this plan that is being developed, one of the major ones being the future reductions of discharge from the Grassland Drainage Area.

- In December, 2006 the Grassland Area Farmers complied with the requirement in the Use Agreement that a Mud Slough Compliance Plan be developed by 2006 to meet Mud Slough water quality objectives. This letter also outlined a process to continue discharges to the San Joaquin River beyond the term of the then-current Use Agreement, which expired in December, 2009.

- In the summer of 2007 the Grassland Area Farmers initiated discussions with stakeholders regarding a time extension of the Grassland Bypass Project. The discharge of selenium and salinity has significantly reduced since the initiation of the Grassland Bypass Project. The Westside Regional Drainage Plan has been developed and significant funding has been obtained to implement parts of the plan. However, the final funding and technical steps are not yet in place and therefore the Grassland Area Farmers have requested up to a 10 year extension of the Use Agreement. The EIR for this extension was approved by the San Luis & Delta-Mendota Water Authority on October 8, 2009 and the Record of Decision by the US Bureau of Reclamation was issued on December 21, 2009 with a subsequent signing of the new 2010-2019 Use Agreement. This action required a Basin Plan Amendment. The Basin Plan Amendment was approved by the Central Valley Regional Board on May 27, 2010 and by the State Water Resources Control Board on October 5, 2010. The Central Valley Water Board is developing revised Waste Discharge Requirements for the Project which are expected to be considered for approval in 2015.

- The six interceptor sumps along the Delta-Mendota Canal are in the process of being rerouted so that their discharge is reused on the SJRIP rather than discharged to the Delta-Mendota Canal. This work is expected to be completed in the Spring of 2015.

Water Quality Data

In compliance with Order No. 5-01-234, water quality data for tributary and receiving water sites is shown in the attached tables and figures. Table 4 summarizes the monthly water quality data for the San Luis Drain at Site B (discharge into Mud Slough North). Tables 5 through 8 summarize the monthly water quality data for Sites C, D, G, and N (respectively). Table 9 summarizes the aquatic toxicity results for all three species for Sites B, C, and D.

Conclusion

The Grassland Area Farmers have demonstrated their commitment to the project as evidenced by the accomplishments as detailed in this report. They are also committed to the goals and milestones in the new 2010-2019 Use Agreement. This will include maintaining 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.

If you should have any questions please feel free to call. I can be reached at (559) 582-9237.

Very Truly Yours,

Joseph C. McGahan
Drainage Coordinator
Grassland Area Farmers

JCM/jcl

Cc: David Murillo, USBR Sacramento
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Grassland Basin Drainage Steering Committee
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Table 1
Discharge Comparison from Grassland Drainage Area
Values October thru September

	WY 95	WY 96	WY 97	WY 98	WY 99	WY 00	WY 01	WY 02	WY 03	WY 04	WY 05
Volume (AF)	57,574	52,978	39,856	49,289	32,317	31,342	28,235	28,358	27,345	27,640	29,957
Se (lbs)	11,875	10,034	7,096	9,118	5,124	4,603	4,377	3,939	4,032	3,860	4,305
Salt (tons)	237,530	197,526	172,602	213,533	149,081	139,303	142,415	128,411	126,500	121,138	138,908
B (1,000 lbs)	868	723	753	983	630	619	423	544	554	530	585
Se (ppm)	0.076	0.070	0.066	0.068	0.058	0.054	0.057	0.051	0.054	0.051	0.053
Salt (µmhos/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	Reduction from WY 95 to WY 14
Volume (AF)	25,995	18,531	15,665	13,166	14,529	18,513	10,486	10,258	7,125	88%
Se (lbs)	3,563	2,554	1,736	1,264	1,577	2,067	733	638	317	97%
Salt (tons)	119,646	79,094	66,254	55,556	67,661	87,537	38,398	54,663	44,834	81%
B (1,000 lbs)	539	278	269	233	315	440	245	309	244	72%
Se (ppm)	0.050	0.051	0.041	0.035	0.040	0.041	0.026	0.023	0.016	
Salt (µmhos/cm)	4,577	4,244	4,206	4,196	4,631	4,702	3,641	5,299	6,257	
Boron (ppm)	7.6	5.5	6.3	6.5	8.0	8.7	8.6	11.1	12.6	

Note: WY 97, 98, & 05 include discharges through Grasslands
Note: GAF quality data used where RWQCB data was missing or pending.

Table 2

Exceedance of 2 ppb Monthly Mean Water Quality Objective

	Site	
	J	K
% months exceeding 2 ppb monthly mean selenium objective Oct 1996 through Aug 2006	19%	13%
% months exceeding 2 ppb monthly mean selenium objective Sept 2006 through May 2014	2%	2%

Months exceeding 2 ppb but with no flow were excluded from calculations

Table 3
San Joaquin River Improvement Project
Water Year 2014

MONTH	WATER APPLIED (AF) DRAIN	OTHER	TOTAL	SELENIUM LBS	SALT TONS	BORON LBS
OCT 13	2,040	457	2,497	201	9,409	43,342
NOV 13	1,718	234	1,952	173	7,765	45,528
DEC 13	1,535	60	1,595	252	9,042	39,383
JAN 14	1,792	305	2,097	264	10,713	56,646
FEB	2,096	27	2,123	252	11,713	61,214
MAR	1,796	65	1,861	296	10,777	47,138
APR	2,336	180	2,516	408	14,602	67,928
MAY	2,491	632	3,123	419	12,669	68,091
JUN	2,801	571	3,372	426	13,622	63,885
JUL	2,880	531	3,411	416	15,301	68,293
AUG	3,051	346	3,397	352	15,104	68,515
SEP	2,814	603	3,417	194	13,369	65,637
TOTAL	**27,350**	**4,011**	**31,361**	**3,653**	**144,086**	**695,600**

Table 4

		Site B (San Luis Drain Discharge into Mud Slough North)												
Parameter Units	Discharge ac-ft	Selenium µg/L	Boron mg/L	Molybdenum mg/L	EC microm	Nitrate mg/L as N	Total Kjeldhal Nitrogen mg/L	Total Phosphorus mg/L	Ortho Phosphate mg/L as P	Ammonia mg/L as N	Ammonia Toxicity Threshold mg/L as N	Temperature deg C	pH	TSS mg/L
Oct-13	777	7.6	11.0	NA	6350	NA	NA	NA	NA	NA	NA	17.3	7.6	37
Nov-13	737	6.3	11.1	21.0	5080	0.2	<0.2	0.2	< 0.010	0.1	NA	12.9	8.0	45
Dec-13	748	11.1	11.0	22.0	5510	0.3	1.4	0.1	< 0.010	0.1	NA	6.9	7.8	10
Jan-14	970	14.0	10.2	31.0	5290	0.5	1.4	0.094 V	0.015 T	0.1	NA	10.1	NA	13
Feb-14	1270	26.0	12.6	24.0	6100	3.7 T	1.7	0.095 T	< 0.010	0.2 L	NA	12.6	NA	139
Mar-14	900	20.8	11.8	26.0	5980	< 0.02	2.6	0.190 T	< 0.010	0.1	0.46	15.0	8.7	50
Apr-14	490	13.8	13.0	21.0	6570	NA	NA	NA	NA	NA	NA	18.1	8.6	72
May-14	400	13.6	12.8	21.0	6740	0.2	3.0	0.190 T	< 0.010	0.3	0.3	22.1	9.1	46
Jun-14	420	22.4	13.3	P	7796	4.8	3.5	0.160	< 0.05	1.1 U	0.4	25.1	8.7	P
Jul-14	349	13.5	18.0	P	9705	< 0.020	3.7	0.150	< 0.010	0.24 V	0.5	29.6	8.4	P
Aug-14	41	10.4	21.0	P	10636	NA	NA	NA	NA	NA	NA	NA	NA	P
Sep-14	26	9.3	25.5	P	13427	< 0.050	3.9	0.130 T	< 0.010 T	0.1	0.8	23.9	8.3	P

NA = no data available
P = pending
H = Result may have high bias
L = Result may have low bias
V = Result may vary excessively
T = Result obtained past holding time
U = Result determined to be outlier at the time of data validation

Table 5

		Site C (Mud Slough North upstream of SLD Discharge)											
Parameter Units	Discharge ac-ft	Selenium µg/L	Boron mg/L	Molybdenum mg/L	EC microm	Nitrates mg/L as N	Total Kjeldhal Nitrogen mg/L	Total Phosphorus mg/L	Ortho Phosphate mg/L as P	Ammonia mg/L as N	Ammonia Toxicity Threshold mg/L as N	Temperature deg C	pH
Oct-13	4630	NA	a	NA	1234	NA	NA	NA	NA	NA	NA	NA	NA
Nov-13	4560	NA	a	NA	1613	NA	NA	NA	NA	NA	NA	NA	NA
Dec-13	4190	NA	a	NA	1992	NA	NA	NA	NA	NA	NA	NA	NA
Jan-14	2400	NA	a	NA	2480	NA	NA	NA	NA	NA	NA	NA	NA
Feb-14	2980	NA	2.0	NA	2870	NA	NA	NA	NA	NA	NA	NA	NA
Mar-14	4500	0.3	**2.5**	9.9	2805	0.0	2.6 U	0.69 T, U	0.35	0.10	1.52	19.5	8.1
Apr-14	1470	0.3	**3.0**	7.5	3310	NA	NA	NA	NA	NA	NA	NA	8.1
May-14	150	0.2	**4.7**	NA	5530	NA	NA	NA	NA	NA	NA	NA	8.3
Jun-14	P	0.2	1.2	NA	P	NA	NA	NA	NA	NA	NA	NA	NA
Jul-14	P	P	1.8	NA	P	NA	NA	NA	NA	NA	NA	NA	NA
Aug-14	P	P	0.9	NA	P	NA	NA	NA	NA	NA	NA	NA	NA
Sep-14	P	P	0.6	NA	P	NA	NA	NA	NA	NA	NA	NA	NA

Table 6

		Site D (Mud Slough North downstream of SLD Discharge)											
Parameter Units	Discharge ac-ft	Selenium µg/L	Boron mg/L	Molybdenum mg/L	EC microm	Nitrates mg/L as N	Total Kjeldhal Nitrogen mg/L	Total Phosphorus mg/L	Ortho Phosphate mg/L as P	Ammonia mg/L as N	Ammonia Toxicity Threshold mg/L as N	Temperature deg C	pH
Oct-13	5405	1.1	a	NA	1980	NA	NA	NA	NA	NA	NA	17.9	NA
Nov-13	5294	1.0	a	NA	2120	0.2	1.5	0.2	0.2	0.2	2.80	13.7	7.9
Dec-13	4760	1.6	a	8.7	2460	0.1	1.2	0.2	0.1	0.2	3.18	8.6	7.8
Jan-14	3360	3.2	a	16	3120	0.2	< 0.5	0.12 V	0.046 T	0.2	3.18	11.0	7.8
Feb-14	4250	6.6	a	16	3600	1.0 T	1.5	0.33 T	0.026	0.2 L	4.19	14.0	7.4
Mar-14	5400	3.7	**3.9**	11	3230	0.02	2.5	0.62 T, U	0.220	0.2	1.53	17.0	8.1
Apr-14	1960	6.8	**6.8**	9	4130	NA	NA	NA	NA	NA	NA	20.0	8.0
May-14	550	9.6	**10.1**	24U	6530	0.31	2.5	0.28 T	< 0.010	0.3	0.65	22.0	8.2
Jun-14	P	16.2	**13.0**	19	P	4.8 U	3.5 U	0.18	< 0.050	0.76 U	0.25	25.1	9.0
Jul-14	P	11.9	**19.4**	11	P	< 0.02	3.5 L U	0.13	< 0.010	0.18 V	0.30	29.2	8.7
Aug-14	P	2.4	**7.7**	NA	P	NA	NA	NA	NA	NA	NA	NA	NA
Sep-14	P	1.6	**5.9**	11	P	< 0.02	2.6	0.20 T	< 0.010 T	0.1	0.94	24.5	8.2

a = objective only applies 15 March through 15 September
Bold = water quality objective exceedance
WQO = water quality objective in mg/L
NA = no data available
P = pending
H = Result may have high bias
L = Result may have low bias
V = Result may vary excessively
T = Result obtained past holding time
U = Result determined to be outlier at the time of data validation

Table 7

		Site G (SJR at Fremont Ford)											
Parameter Units	Discharge ac-ft	Selenium µg/L	Boron mg/L	Molybdenum mg/L	EC microm	Nitrates mg/L as N	Total Kjeldhal Nitrogen mg/L	Total Phosphorus mg/L	Ortho Phosphate mg/L as P	Ammonia mg/L as N	Ammonia Toxicity Threshold mg/L as N	Temperature deg C	pH
Oct-13	5296	NA	a	NA	1515	NA	NA	NA	NA	NA	NA	17.4	NA
Nov-13	7759	NA	a	NA	1504	NA	NA	NA	NA	NA	NA	13.1	NA
Dec-13	7962	NA	a	NA	1666	NA	NA	NA	NA	NA	NA	8.0	NA
Jan-14	6310	NA	a	NA	1990	NA	NA	NA	NA	NA	NA	10	NA
Feb-14	6040	NA	a	NA	2150	NA	NA	NA	NA	NA	NA	14	NA
Mar-14	6900	0.2	1.0	12.0	2270	0.24 T	1	0.24 T	0.24 T	< 0.050	1.83	17	8.0
Apr-14	6670	0.3	0.9	8.9	2230	NA	NA	NA	NA	NA	NA	20	NA
May-14	2270	0.2	0.7	12.0	2310	0.16 T	1	0.16 T	0.16 T	0.12	1.89	23	7.9
Jun-14	P	0.2	0.5	11.0	P	0.28	1	0.28	0.28	< 0.5	0.75	26	8.3
Jul-14	P	0.2	0.4	7.6	P	0.14	1	0.14	0.14	0.098 V	0.27	29	8.8
Aug-14	P	0.2	0.4	NA	P	NA	NA	NA	NA	NA	NA	NA	NA
Sep-14	P	0.2	0.6	5.4	P	0.29 T	1	0.29 T	0.29 T	0.11	1.58	25	7.8

Table 8

		Site N (SJR at Crows Landing Daily Autosamples)											
Parameter Units	Discharge ac-ft	Selenium µg/L	Boron mg/L	Molybdenum mg/L	EC microm	Nitrates mg/L as N	Total Kjeldhal Nitrogen mg/L	Total Phosphorus mg/L	Ortho Phosphate mg/L as P	Ammonia mg/L as N	Ammonia Toxicity Threshold mg/L as N	Temperature deg C	pH
Oct-13	30669	0.5	0.4	NA	1010	NA	NA	NA	NA	NA	NA	17.4	8.0
Nov-13	34332	0.5	0.7	NA	930	NA	NA	NA	NA	NA	NA	14.6	8.1
Dec-13	27630	0.5	0.6	NA	1320	NA	NA	NA	NA	NA	NA	8.0	8.1
Jan-14	22200	0.7	1.1	NA	1620	NA	NA	NA	NA	NA	NA	10	8.0
Feb-14	22450	1.3	**1.4**	NA	1760	NA	NA	NA	NA	NA	NA	13	7.8
Mar-14	22480	1.1	**1.6**	8.8	2180	NA	NA	NA	NA	NA	NA	17	8.1
Apr-14	11060	0.5	1.1	5.9	1710	NA	NA	NA	NA	NA	NA	20	8.0
May-14	21700	1.1	1.1	7.5	2110	1.60	1	0.18 T	0.02	< 0.050	1.47	17	8.2
Jun-14	P	0.7	1.0	7.9	P	3.40	2	0.27	< 0.05	< 0.5	0.69	24	8.4
Jul-14	P	0.7	0.9	6.2	P	2.50	1	0.29	0.11	0.27 V	0.61	29	8.3
Aug-14	P	0.5	0.9	NA	P	NA	NA	NA	NA	NA	NA	NA	NA
Sep-14	P	0.4	0.5	5.6	P	6.5 U	1	0.29 T	0.20 T	0.10	1.68	24	7.8

a = objective only applies 15 March through 15 September
Bold = water quality objective exceedance
WQO = water quality objective in mg/L
NA = no data available
P = pending
H = Result may have high bias
L = Result may have low bias
V = Result may vary excessively
T = Result obtained past holding time
U = Result determined to be outlier at the time of data validation

Table 9

Fathead Minnow (Pimephales promelas) 7-Day Toxicity Test

	Site B		Site C		Site D	
Date	Mean % Survival	Mean Biomass Value (mg)	Mean % Survival	Mean Biomass Value (mg)	Mean % Survival	Mean Biomass Value (mg)
Mar-14	90	0.84	93	0.70	98	0.78
Jun-14	95	0.67	98	0.62	88	0.75
Sep-14	5*	0.01*	95	0.65	98	0.58

Daphnid invertebrate (Daphnia magna) Short-term Toxicity Test

	Site B		Site C		Site D	
Date	Mean % Survival	Mean Reproduction (# Neonates/Female)	Mean % Survival	Mean Reproduction (# Neonates/Female)	Mean % Survival	Mean Reproduction (# Neonates/Female)
Mar-14	100	67.4*	90	72.3	100	86.9
Jun-14	100	72.4	100	88.1	90	53.1*
Sep-14	0*	0*	100	17.9	100	16.6

Freshwater algae (Selenastrum capricornutum) 4-Day Growth Test

Location	Site B	Site C	Site D
Units	10^5 Cells/mL	10^5 Cells/mL	10^5 Cells/mL
Mar-14	4.2*	7.2	7.9
Jun-14	2.2*	6.2	2.8*
Sep-14	1.3*	5.5	4.8

* Significantly reduced from Delta Mendota Canal ($p<0.05$)

Figure 1
Grassland Bypass Project - Site B
Annual Average Selenium Concentration

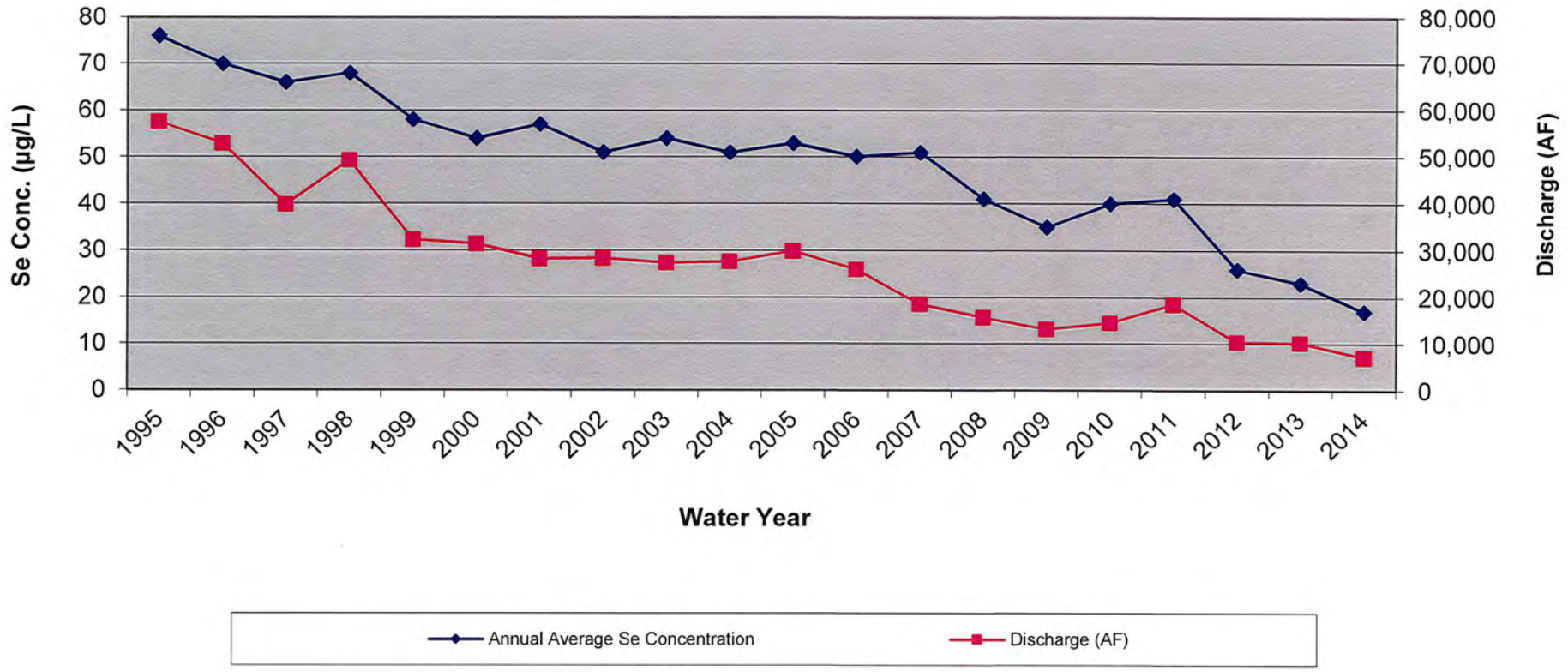


Figure 2
Discharge from the Grassland Drainage Area
October 2013 through September 2014

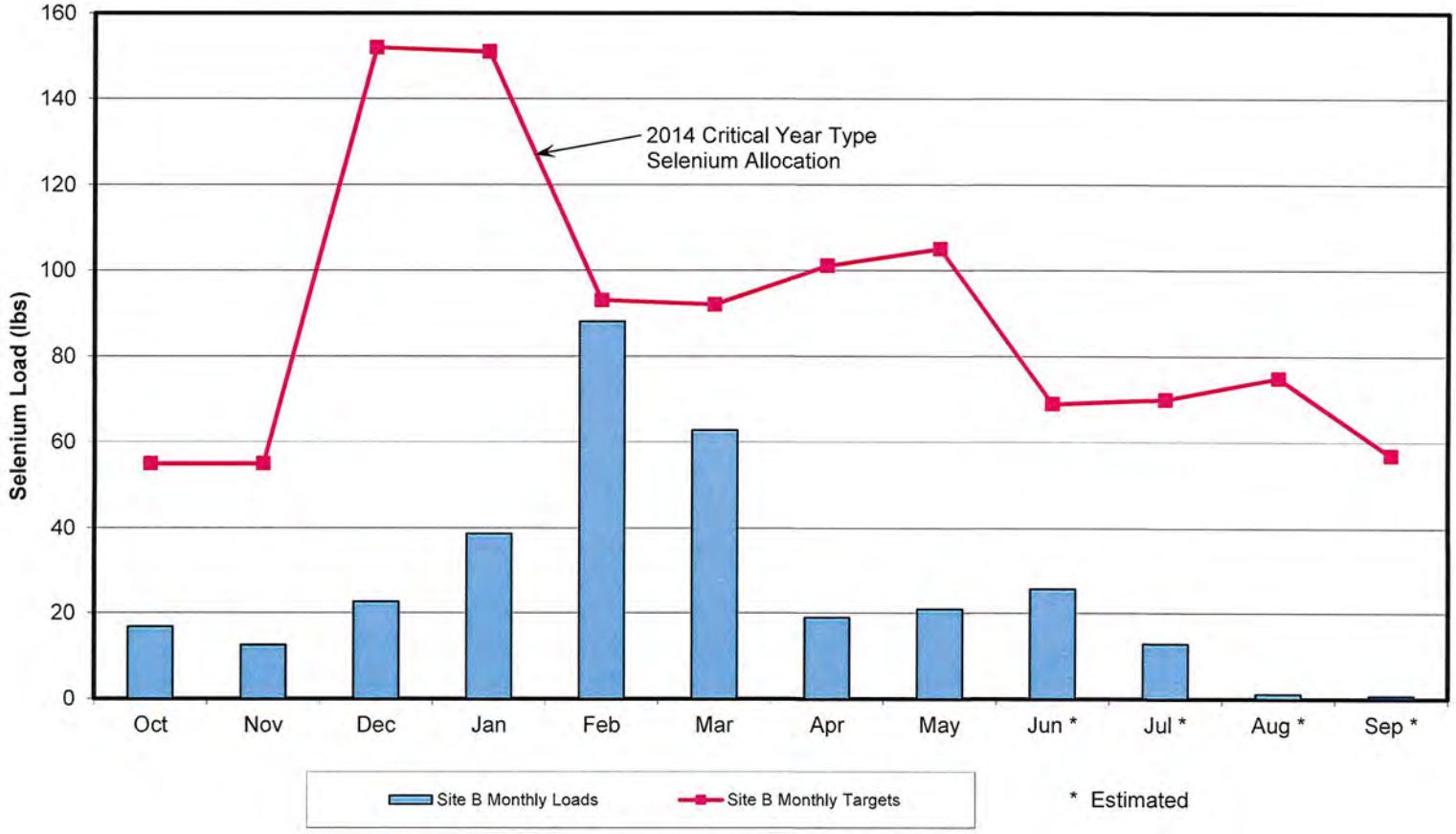


Figure 3
Grassland Drainage Area
Selenium Discharge and Targets

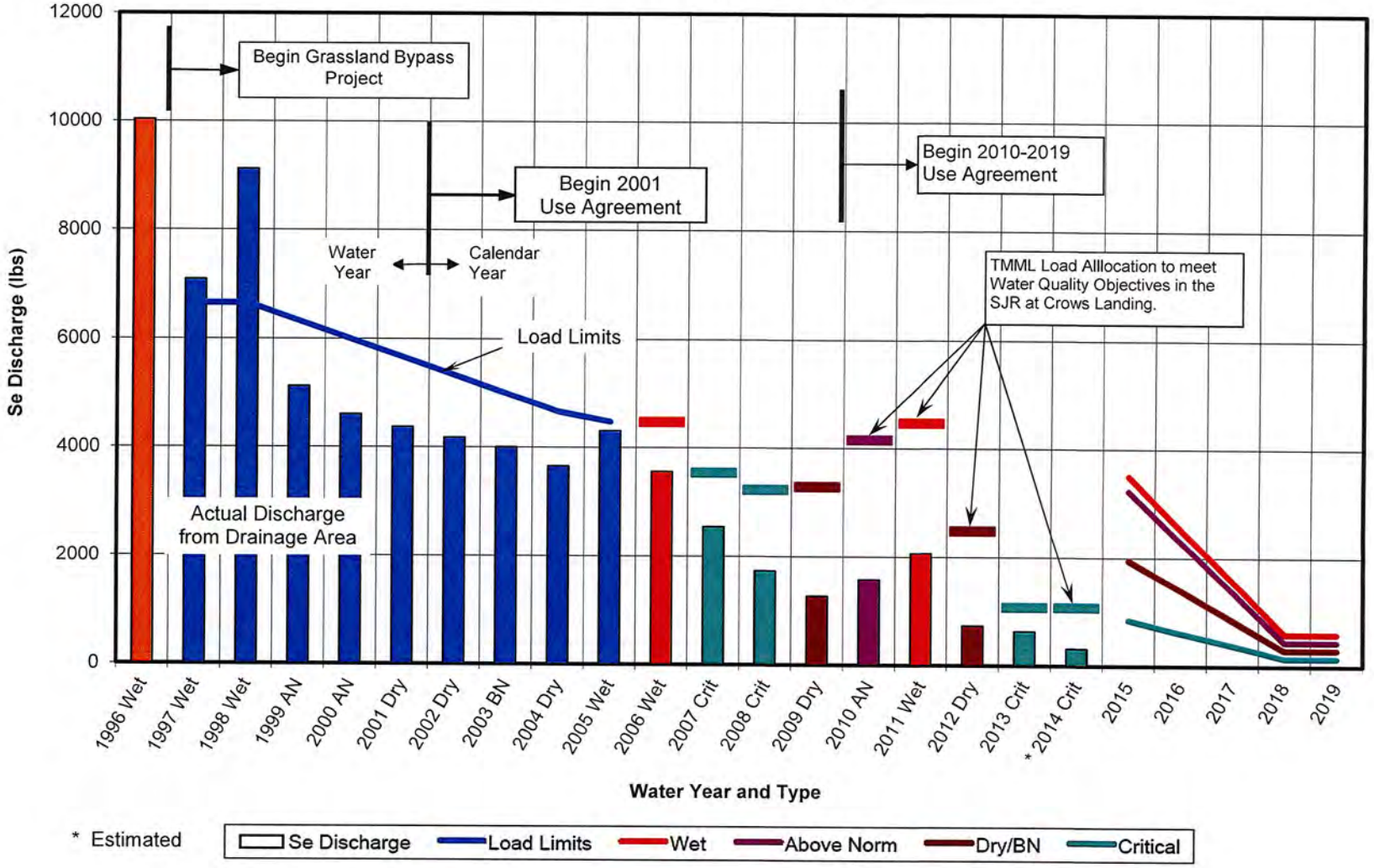
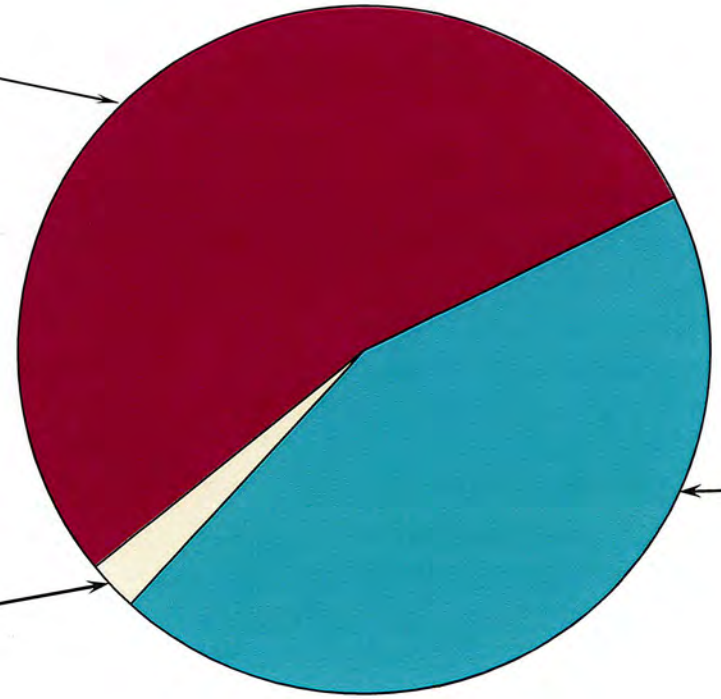


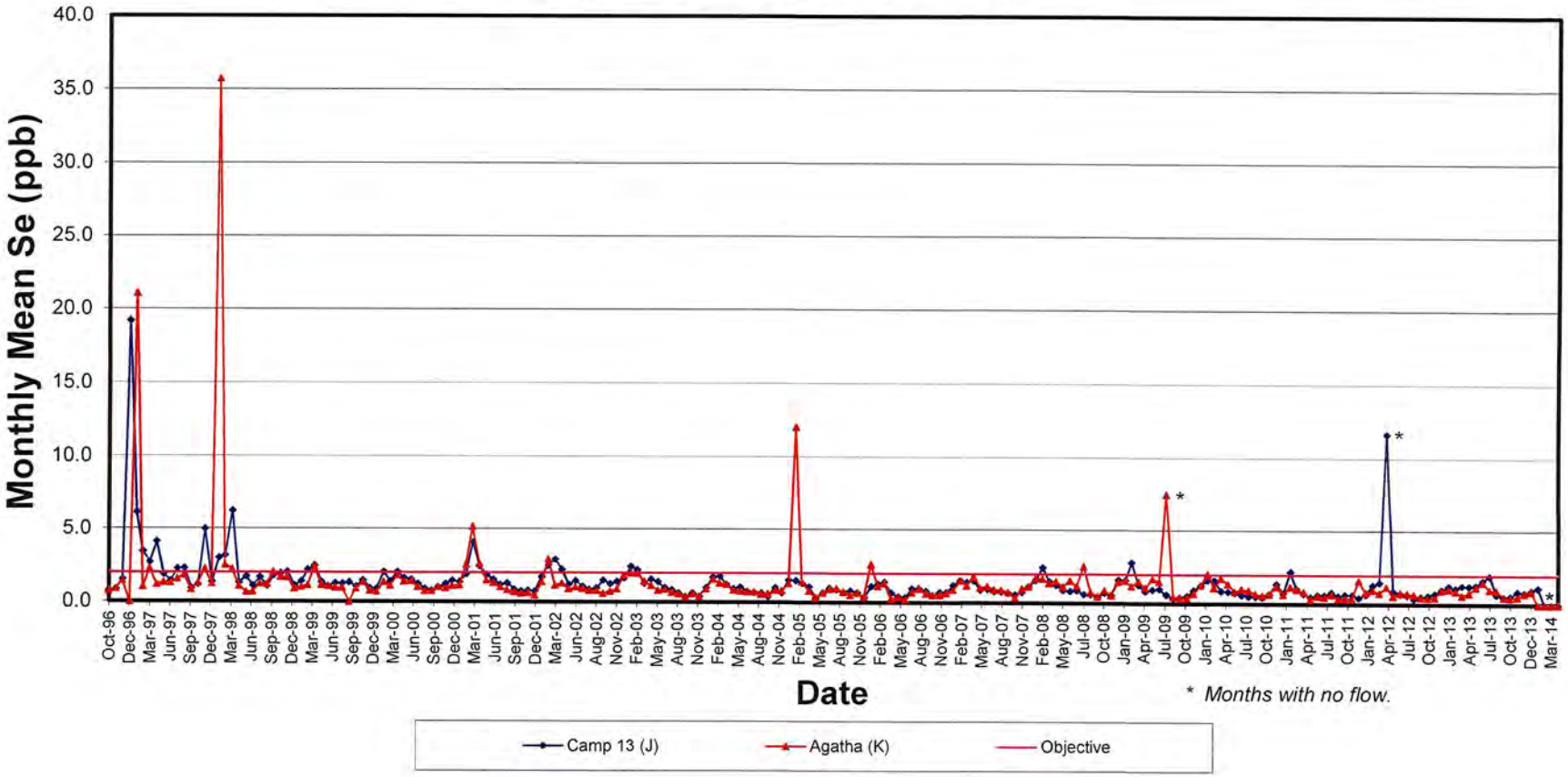
Figure 4

Historic Drainage Water (lbs selenium)
57,000 AF 12,700 lbs Se 240,000 Tons Salt



2014 Drainage Management

Figure 5
Camp 13 (J) and Agatha Canal (K)



* *Months with no flow.*