F I N A L

2018 Annual Report
Aquatic Pesticides National Pollutant Discharge Elimination System Permit

Prepared for

Byron-Bethany Irrigation District

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Executive Summary

This report fulfills the Byron-Bethany Irrigation District's (BBID or District) annual reporting requirement under California State Water Resources Control Board (SWRCB) Water Quality Order Number 2013-0002-DWQ (as amended by Orders 2014-0078-DWQ, 2015-0029-DWQ, and 2016-0073-EXEC), also referred to as the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications (General Permit). This is the fifth annual report submitted by the District under this General Permit, and the 14th annual report overall. Table ES-1 summarizes the requirements of the annual report and specifies the location within the annual report that addresses each requirement.

The General Permit was adopted by the SWRCB in March 2013. During the 2018 season, BBID chose to use both endothall (Teton) and acrolein (Magnacide H) to control aquatic vegetation within its irrigation canals. Endothall is a safer and generally more environmentally friendly aquatic pesticide; however, several applications of acrolein were required to maintain canal conveyance where weed persistence occurred.

BBID's *Aquatic Pesticide Application Plan and Monitoring Program* (BBID, 2014), specified the water quality protection measures and monitoring requirements, respectively, associated with the application of aquatic pesticides to BBID canals for aquatic weed control. Key to BBID's water quality protection measures is the operation of the system as a closed system during application events. The following briefly summarizes BBID's 2018 aquatic pesticide use and monitoring activities conducted in compliance with the General Permit:

- BBID used both endothall and acrolein for control of aquatic vegetation during 2018
- Endothall applications took place in the following locations on the following dates:
  - North Division – April 30, May 30, June 27, July 24, August 7 and 21, and September 4
  - South Division – April 24, May 14, June 19, July 3 and 17, August 21, and September 5 and 24
- Acrolein applications took place in the following locations on the following dates:
  - North Division – May 15, June 13, and July 10
  - South Division – June 6 and August 1
- BBID performed water quality sampling in accordance with its Aquatic Pesticide Application Plan (APAP)
- Aquatic-pesticide-laden waters were not discharged to Kellogg Creek or Mountain House Creek; therefore, BBID complied with the receiving water limitations specified in the General Permit
- BBID's water quality protection measures and monitoring program are effective in meeting the terms and conditions of the General Permit and, importantly, are protective of the water quality of Kellogg Creek and Mountain House Creek
- At this time, because the water management techniques implemented by the District prevent spill into either Kellogg Creek or Mountain House Creek, no additional best management practices (BMPs) are proposed or recommended; it is recommended that existing BMPs continue to be implemented

Table ES-1 lists the requirements for the Annual Report, as specified on page 8 of the General Permit's Monitoring and Reporting Program, along with information about the location of the information as contained within this report.

Table ES-1. Annual Report Compliance Matrix

Reporting Requirement	Report Location
An Executive Summary discussing compliance or violation of this General Permit and the effectiveness of the APAP	This section
A summary of monitoring data, including the identification of water quality improvements or degradation as a result of the algaecide or aquatic pesticide application	Tables 3-5 and 3-6

Contents

Acronyms and Abbreviations

-	not applicable
°C	degree(s) Celsius
°F	degree(s) Fahrenheit
µg/L	microgram(s) per liter
APAP	Aquatic Pesticide Application Plan
AQ	California Aqueduct
BBID	Byron-Bethany Irrigation District
BMP	best management practice
BTH	Bethany Division/155 Spillway
BYR	Byron Division/45 Canal
$CaCO_3$	calcium carbonate
cfs	cubic feet per second
CoC	chain-of-custody
District	Byron-Bethany Irrigation District
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
General Permit	Statewide General National Pollutant Discharge Elimination System Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications
ID	identification
KLG	Kellogg Creek
LOEL	lowest observed effect level
MCL	maximum concentration level
MRL	method reporting limit
MRP	Monitoring and Reporting Program
mS/cm	microsiemen(s) per centimeter
MTN	Mountain House Creek
MUN	municipal
NA	not applicable
ND	nondetect (less than the method reporting limit)
NOI	Notice of Intent
NR	not recorded
ppm	part(s) per million

PS1N	Pump Station 1-N
PS1S	Pump Station 1-S
psig	pound(s) per square inch gauge
SM	Standard Method
SWRCB	California State Water Resources Control Board

SECTION 1

Requirements of General Permit

The Statewide General National Pollutant Discharge Elimination System Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications (General Permit) specifies receiving water limits for aquatic pesticides, and requires that an application event not result in the exceedance of water quality limits: (1) outside of the Target Treatment Area at any time, or (2) either within or outside of the Target Treatment Area any time after the conclusion of the application event. For aquatic pesticide application within Byron-Bethany Irrigation District (BBID or District), the conclusion of an application event is considered to be 24 hours following the application of the aquatic pesticide.

In 2018 BBID used both endothall and acrolein to control aquatic vegetation. The receiving water limitations for endothall and acrolein are summarized in Table 1-1.

Table 1-1. Receiving Water Limitations for Aquatic Pesticide Applications

Chemical	Beneficial Use Designation	Concentration Limitation (µg/L)	Reference
Endothall	MUN	100	EPA MCL
Acrolein	WARM and COLD	21	EPA National Ambient Water Quality Criteria for Freshwater Aquatic Life Protection LOEL

Source: SWRCB, 2013 (General Permit)

µg/L = microgram(s) per liter
EPA = U.S. Environmental Protection Agency
LOEL = lowest observed effect level
MCL = maximum concentration level
MUN = municipal

Kellogg Creek and Mountain House Creek are designated “WARM and COLD;” therefore, the receiving water limitation of 21 µg/L for acrolein applies.

The General Permit contains a Monitoring and Reporting Program (MRP) that describes the monitoring requirements to be implemented as a condition of permit compliance. The MRP contains provisions specifying sampling procedures, monitoring frequency, retention of records, data to be contained in field records, device calibration and maintenance, sample parameters, sample timing, and reporting. The requirements vary for different pesticides.

The MRP calls for three types of receiving water monitoring: (1) background monitoring, (2) event monitoring, and (3) post-event monitoring. The BBID’s Monitoring Program, as included in the *Aquatic Pesticide Application Plan* (APAP) (BBID, 2014), describes the sampling strategy to address these requirements.

SECTION 2

Aquatic Pesticide Use During 2018

2.1 Background

In 2013, the State Water Resources Control Board (SWRCB) adopted an updated General Permit to replace the General Permit adopted in 2004. In March 2014, BBID submitted its updated APAP; in May 2014, BBID submitted its Notice of Intent (NOI) for the General Permit. Under the terms of the permit, the operations described in the NOI can commence upon submittal of the NOI and annual fee.

BBID was granted a Categorical Exception for acrolein use in 2004 (as noted in Attachment E of the General Permit). Acrolein was used with success by the District from 2004 through 2013 and again in 2015 through 2018. After the 2013 irrigation season, BBID looked into other aquatic pesticide options and decided to use endothall exclusively for the 2014 irrigation season. While exclusive use of endothall was appropriate for the 2014 irrigation season, several applications of acrolein were required in subsequent seasons to control aquatic weed growth and provide for unhindered water flow through the BBID irrigation delivery system. The endothall pesticide used in 2018 was Teton, and the acrolein pesticide used in 2018 was Magnacide H.

BBID applies endothall and acrolein in accordance with its APAP. The APAP includes the following:

- Program oversight and license requirements
- An application schedule
- An applicator education program
- Specific water management measures to prevent the release of aquatic pesticide from treated canals to sensitive habitat
- Public noticing requirements
- Reporting requirements
- Project monitoring

The practices specified in the APAP were developed to prevent the release of aquatic pesticides to Kellogg Creek and Mountain House Creek.

2.2 BBID Aquatic Pesticide Application Practices

This section discusses best management practices used by the BBID to prevent spills and describes their effectiveness.

2.2.1 Aquatic Pesticide Use

Application of aquatic pesticides may begin as early as March and as late as May, and extend through the end of irrigation season, which goes as late as October. Applications occur every 7 to 21 days, depending on the presence of algae and aquatic weeds and their interference with normal delivery of water. The District's General Manager evaluates canal conditions and determines when an application is to occur. In 2018, the BBID commenced application of aquatic pesticides in late April. Visual monitoring reported the presence of algae mats, moss, slime, and other suspended material that could clog and damage pumps if left unmitigated.

Applications were conducted consistent with the manufacturer's application and safety manuals and product registration labels. The rate and duration of dosage was determined based on the application guidance in the manual or product label, and are dependent on weed conditions, flow, and water temperature. Application rates consistent with product label requirements were recorded on the aquatic pesticide application record sheet.

Aquatic pesticides were injected directly into the canals over a period of 4 to 10 hours to form a wave of treated water. The amount of aquatic pesticide used is primarily determined by the water flow and weed density in the canal, although velocity, water temperature, and water quality are also considered. Concentrations in the range of 1 to 3 parts per million (ppm) are typical for endothall, and concentrations up to 15 ppm are allowed for acrolein.

Because the aquatic pesticide is added over a time interval, a wave of treated water is created that moves downstream, temporarily bathing the weeds in pesticide. After the application is complete and treated water in the canal has been diverted for on-farm use, the concentration of pesticide in the canal drops to zero. Flow is maintained in the canal throughout the periods of application and diversion to farms. The aquatic pesticide passes through the canal and out to the fields in a continuous flow that is finished within 21 hours.

2.2.2 Water Management

The BBID treats its conveyance system (treatment area) with aquatic pesticide at two locations: Pump Station 1-N and Pump Station 1-S. Pump Station 1-N supplies 45 Canal (Byron Division), and Pump Station 1-S supplies Canals 45, 70, 120, and 155 (Bethany Division). During application events, the canals were managed to prevent release of aquatic pesticide to Kellogg Creek and Mountain House Creek, which are the two potential receiving waters. These conditions ensure that the BBID system is a closed system during aquatic pesticide application events and all pesticide is contained within the canals or is diverted by water users for on-farm use.

Prior to an application event, water levels in the canals are lowered to minimize risk of release of aquatic pesticide to the creeks. The canals are held in a lower water condition for 24 hours post-application. This prevents release outside of the treatment area to receiving waters. Within the retention period specified by the aquatic pesticide label instructions, all treated water within the canals is diverted by BBID customers and is not discharged outside the treatment area. After the retention period, normal canal operations are resumed, and canals are raised to typical levels.

In addition to the two main treatment locations, the BBID may choose to do spot applications throughout the canal system to control concentrated areas of algae bloom. No spot applications were required in 2018.

2.2.2.1 Byron Division

To understand water delivery operations in the Byron Division, it is critical to understand the operations at the juncture of 45 Canal and Kellogg Creek. Pump Station 1-N supplies 45 Canal, which is the conveyance system for the Byron Division. The 45 Canal flows north from Pump Station 1-N to a radial gate located at the intersection of 45 Canal and Kellogg Creek.

Kellogg Creek has four distinct channel sections, as follows:

- Reach 1: West of the BBID
- Reach 2: From the BBID boundary to Pump Station 4
- Reach 3: From Pump Station 4 to 45 Canal
- Reach 4: From the 45 Canal to Discovery Bay

Reach 1 is in the foothills west of the BBID. This reach was not evaluated because it falls outside the project area.

Reach 2 is an infrequently maintained section of channel that contains some riparian vegetation along the channel levee. Low ephemeral flows limit the establishment of significant wetland and emergent vegetation in the creek bottom. The terminus of this reach is Pump Station 4.

Reach 3 is a flat, highly maintained section of the channel approximately 1 mile in length, which was modified long ago from its natural state and incorporated into the District's irrigation delivery system. This reach begins at Pump Station 4 and contains a few landscaped trees along the outside levee and no in-channel vegetation. The terminus of this reach is 45 Canal. A radial gate is located in Kellogg Creek immediately downstream of the perpendicular crossing of 45 Canal and Kellogg Creek. As irrigation water from the 45 Canal south of Kellogg Creek flows into Reach 3, the radial gate prevents irrigation water from flowing downstream into Reach 4 and allows the District to bifurcate irrigation flows between the northern extension of 45 Canal and Reach 3. As irrigation water ponds against the radial gate, the water surface elevation in Reach 3 rises, allowing water to (1) flow north into the continuation of 45 Canal and (2) flow upstream (west) into Reach 3. As water flows upstream into Reach 3, it ponds against a concrete weir located in Kellogg Creek at Pump Station 4. The impounded irrigation water is then conveyed via Pump Station 4 to District customers. During the winter months when irrigation water is not being delivered, the radial gate in Kellogg Creek is kept open to allow any potential storm flows to pass into Reach 4. In 2018, BBID completed the modernization of the Kellogg Creek Radial Gate Project thereby ensuring reliable operations of this critical conveyance structure.

Reach 4, which begins directly downstream of the radial gate, is channelized but is less maintained than Reach 3.

Aquatic pesticides are applied at Pump Station 1-N while canal flows remain in the 20 to 50 cubic feet per second (cfs) range. One day prior to the application event, diversions into 45 Canal are reduced to about 20 to 50 cfs. This flow rate is adjusted as necessary so that at least 12 inches of freeboard is maintained at the radial gate to prevent spill to Reaches 2 and 4 of Kellogg Creek. The system (45 Canal and Reach 3 of Kellogg Creek) is held in this low water condition for 1 day, and no release is made to Kellogg Creek for a minimum of 24 hours. During this time, water users at the end of the canal system divert water for on-farm use. After the 1-day flushing time, water deliveries and canal operations resume normal operations.

2.2.2.2 Bethany Division

Pump Station 1-S supplies three main canals in the Bethany Division: 70 Canal, 120 Canal, and 155 Canal. These canals flow in a generally southeasterly direction from Pump Station 1-S. 70 Canal terminates just north of the Alameda-San Joaquin County line and does not spill into any natural creek or drainage. The drain inlet to the existing BBID drainage system at the terminus of 70 Canal is sealed during aquatic pesticide application. 120 Canal terminates just north of the Alameda-San Joaquin County line and before crossing Mountain House Creek. 155 Canal terminates just north of the Alameda-San Joaquin County line after crossing Mountain House Creek at the Gate 57 Drain. The terminus structure can drain to the new BBID drainage system or can spill into Mountain House Creek. During aquatic pesticide application, spill gates are closed, locked, and monitored to prevent any spills to the creek.

Aquatic pesticides are applied at Pump Station 1-S when flows range from about 20 to 50 cfs. One day prior to the application event at Pump Station 1-S, diversions into 70 Canal are reduced to about 20 to 50 cfs. This flow rate and check structures are adjusted as necessary so that at least of 12 inches of freeboard is maintained at the terminus of all three canals. The system is held in this low water condition for 1 day, and no release is made to the drainage system. During this time, water users along the canal system divert water for on-farm use. After the 1-day flushing time, water deliveries and canal operations resume normal operations.

Tables 2-1 and 2-2 summarize the aquatic pesticide application records as recorded by BBID operators during the 2018 treatments for the Byron and Bethany divisions, respectively. These records indicate that applications did not exceed 3 ppm, which is the maximum suggested application concentration for endothall, or 15 ppm, which is the maximum suggested application of acrolein, during 2018. Tables 2-1 and 2-2 also give information on the volume of aquatic pesticide used at each application event, the dosage, canal flow rate, water temperature, and application rate and time.

Table 2-1. 2018 Aquatic Pesticide Application Log – North (Byron) Division

Application Event:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Application date	4/30/2018	5/15/2018	5/30/2018	6/13/2018	6/27/2018	7/10/2018	7/24/2018	8/7/2018	8/21/2018	9/4/2018
Operator/Certified Applicator	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini
License number	138213	138213	138213	138213	138213	138213	138213	138213	138213	138213
Aquatic weeds present	Algae	Algae	Algae	Algae	Algae	Algae	Algae	Algae	Algae	Algae
Weed growth condition	NA	D	NA	D	NA	D	NA	NA	NA	NA
Pesticide used	Endothall	Magnacide H	Endothall	Magnacide H	Endothall	Magnacide H	Endothall	Endothall	Endothall	Endothall
Application concentration (ppm unless noted)	1.0	1.0	1.0	1.0	2.0	1.0	2.0	2.0	2.0	2.0
Flow rate in canal (cfs)	21	35	37	45	50	35	35	25	15	12
Water temperature (°F)	62	65	65	68	67	69	70	NR	72	71
Quantity used (gallons; actual)	27.6	34	49.2	45.2	133.2	34	93.6	66	39.6	31.2
Time started	7:00	7:30	6:00	7:30	6:00	8:00	6:00	6:00	6:30	6:00
Time ended	19:00	11:30	18:00	11:30	18:00	12:00	18:00	18:00	18:30	18:00
Total treatment time (hours)	12	4	12	4	12	4	12	12	12	12
Orifice size (inches; acrolein applications only)	NA	0.045	NA	0.055	NA	0.045	NA	NA	NA	NA
Pressure setting (psig; acrolein applications only)	NA	10	NA	8	NA	10	NA	NA	NA	NA
Gallons per hour (actual)	2.3	8.5	4.1	11.3	11.1	8.5	7.8	5.5	3.3	2.6
Application concentration (ppm; calculated)	1.0	7.6	1.0	7.9	2.0	7.6	2.0	2.0	2.0	1.9

Notes:

D = weed growth condition code D (algae and mature pondweed present); per Table 3 of Alligare, 2013.
°F = degree(s) Fahrenheit
NA = not applicable
NR = not recorded
psig = pound per square inch gauge

Table 2-2. 2018 Aquatic Pesticide Application Log – South (Bethany) Division

Application Event:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Application date	4/24/2018	5/14/2018	6/6/2018	6/19/2018	7/3/2018	7/17/2018	8/1/2018	8/21/2018	9/5/2018	9/24/2018
Operator/Certified Applicator	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini	Tony Papini
License number	138213	138213	138213	138213	138213	138213	138213	138213	138213	138213
Aquatic weeds present	Algae	Algae	Algae	Algae	Algae	Algae	Algae	Algae	Algae	Algae
Weed growth condition	NA	NA	C	NA	NA	NA	D	NA	NA	NA
Pesticide used	Endothall	Endothall	Magnacide H	Endothall	Endothall	Endothall	Magnacide H	Endothall	Endothall	Endothall
Application concentration (ppm unless noted)	1.0	1.0	0.50	2.0	1.5	2.0	1.0	2.0	2.0	1.5
Flow rate in canal (cfs)	18	30	20	24	35	32	35	21	20	19
Water temperature (°F)	68	65	65	67	72	71	73	72	71	71
Quantity used (gallons; actual)	24	19.8	7.2	63.6	69.6	85.2	34	56.4	52.8	37.2
Time started	6:30	7:00	8:00	6:30	6:00	6:00	8:00	6:00	6:00	6:00
Time ended	18:30	13:00	11:00	18:30	18:00	18:00	12:00	18:00	18:00	18:00
Total treatment time (hours)	12	6	3	12	12	12	4	12	12	12
Orifice size (inches; acrolein applications only)	NA	NA	0.20	NA	NA	NA	0.045	NA	NA	NA
Pressure setting (psig; acrolein applications only)	NA	NA	20	NA	NA	NA	10	NA	NA	NA
Gallons per hour (actual)	2.0	3.3	2.40	5.3	5.8	7.1	8.5	4.7	4.4	3.1
Application concentration (ppm; calculated)	1.0	1.0	3.77	2.0	1.5	2.0	7.63	2.0	2.0	1.5

Note:

C = weed growth condition code C (algae and pondweed 12-24” long present); per Table 3 of Alligare, 2013.

SECTION 3

Monitoring and Sampling

3.1 Monitoring Objectives

The Monitoring Program as included in the APAP (BBID, 2014) was designed to meet the following objectives:

- Comply with the requirements of the General Permit MRP
- Provide sufficient monitoring data to assess compliance with water quality limitations contained in the General Permit

3.2 Key Monitoring Locations

Figure 3-1 shows the BBID Canal System and the key water quality monitoring locations. Table 3-1 lists the key water quality monitoring locations and explains the basis for their selection. The General Permit requires that samples be collected at a minimum of two representative sample sites. The selected sites exceed the required minimum number but represent the minimum number necessary to address the intent of the background, event, and post-event monitoring requirements.

Table 3-1. Key Water Quality Monitoring Locations

Station ID	Station Name (location)	Basis for Selection
Background Samples		
AQ	California Aqueduct	The California Aqueduct is the source water for both the Byron and Bethany Divisions.
Byron Division		
BYR	Byron Division/45 Canal (45 Canal upstream of the Radial Gate)	The 45 Canal Radial Gate is the only location within the Byron Division where improper water management could result in the spill of aquatic pesticide into a natural waterbody.
KLG	Kellogg Creek (Kellogg Creek downstream of the Radial Gate)	Kellogg Creek is a natural waterbody. The District's water management measures should prevent the release of aquatic pesticide to Kellogg Creek.
Bethany Division		
BTH	Bethany Division/155 Spillway (155 Canal and the 155 Spillway)	The 155 Spillway is the only location within the Bethany Division where improper water management could result in the spill of aquatic pesticide to a natural waterbody.
MTN	Mountain House Creek (Mountain House Creek downstream of the 120 Spillway)	Mountain House Creek is a natural waterbody. The District's water management measures should prevent the release of aquatic pesticide to Mountain House Creek.

Notes:

AQ = California Aqueduct
BTH = Bethany Division/155 Spillway
BYR = Byron Division/45 Canal
ID = identification
KLG = Kellogg Creek
MTN = Mountain House Creek

3.3 Monitoring Types

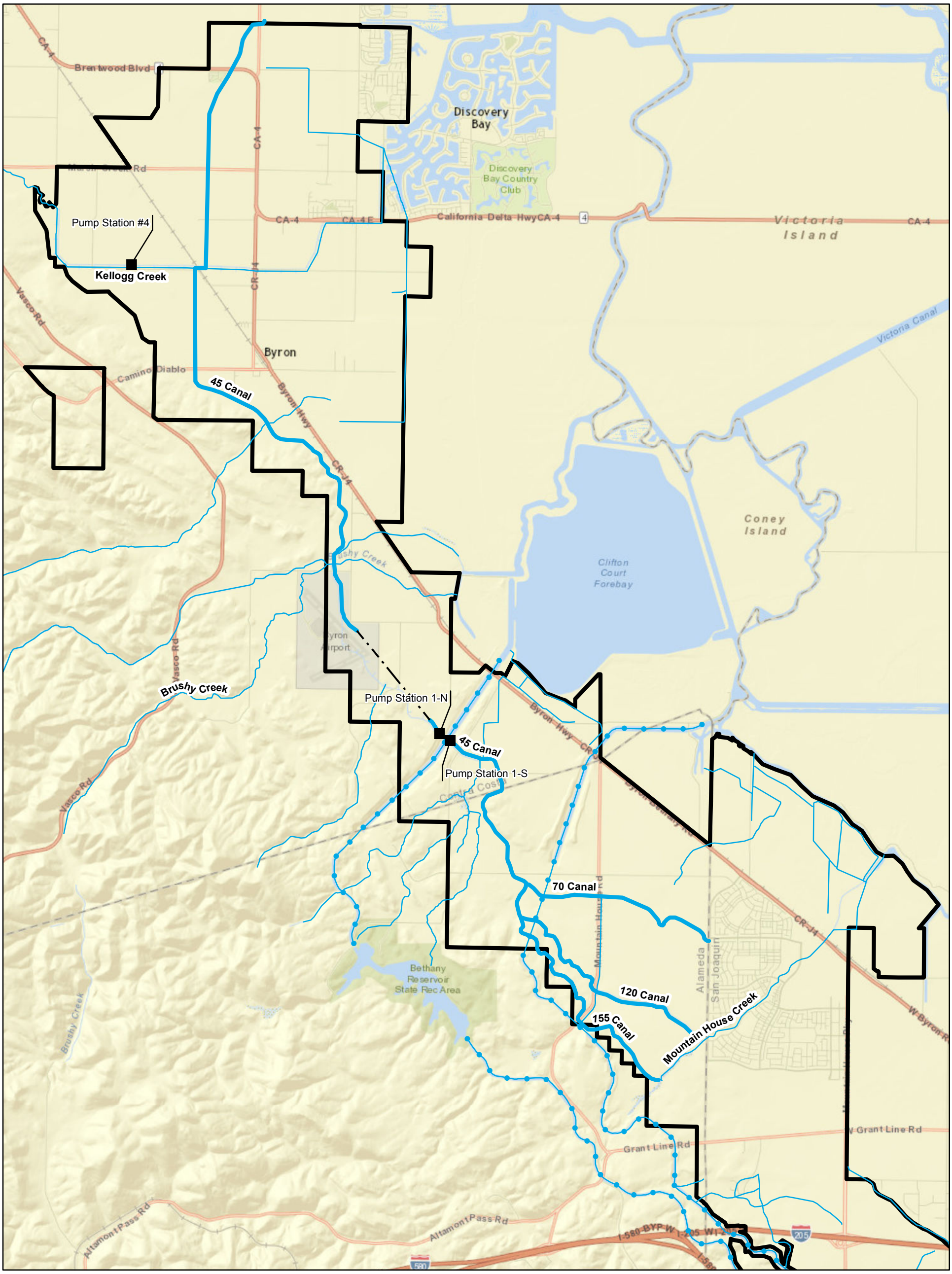
The MRP calls for three types of receiving water monitoring: (1) background monitoring, (2) event monitoring, and (3) post-event monitoring. The following describes the assumed purpose of each type of monitoring:

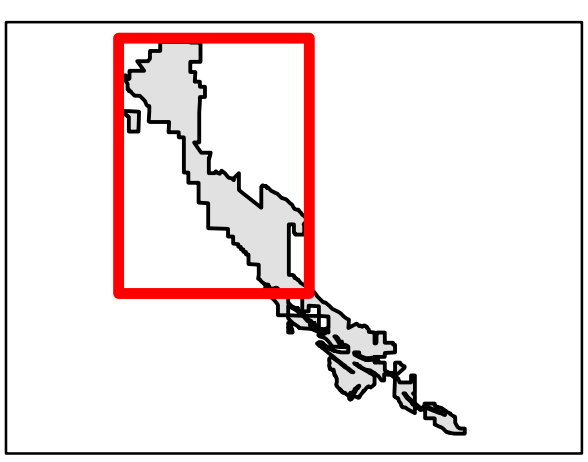
- **Background Monitoring:** Background samples are to be collected upstream of the application event, or they may be collected at the treatment area just prior to the application event (up to 24 hours in advance). The purpose of background monitoring is to characterize the quality of the source water. In the case of the BBID, the source water is the California Aqueduct. Background samples are to be taken before the application of aquatic pesticide commences.
- **Event Monitoring:** Event samples are to be collected immediately downstream of the treatment area in flowing waters. They are to be taken immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area. The purpose of event monitoring is to characterize the quality of the receiving waters (that is, Kellogg Creek and Mountain House Creek) following the application event. The intent of this monitoring is to detect if residual aquatic pesticides are discharged to receiving waters (outside the treatment area) in levels exceeding receiving water limits during the application event. Because the BBID operates as a closed system during its application events, event monitoring only applies in the event of an observed spill during the application event.
- **Post-Event Monitoring:** Post-event samples are collected within the treatment area within 1 week after the application event. The purpose of post-event monitoring is to characterize the quality of the canal water within 1 week of the resumption of normal canal operations. It is during normal canal operations that spills to Kellogg Creek and Mountain House Creek could occur. The post-event monitoring occurs when there is 3 feet of freeboard at the sample location. This typically occurs on the day following the aquatic pesticide treatment.

3.4 Monitoring Frequency

The operation of the BBID canal system as a closed system during the treatment event informs the monitoring frequency determination. The following frequencies are used:

- **Background Monitoring:** Conducted for each event.
- **Event Monitoring**: Required for a minimum of six application events in each environmental setting per year. Under the BBID's APAP, a discharge would occur only if the closed system operation failed, resulting in a spill to a receiving water. To determine the need for event sampling, an event inspection of the monitoring sites is conducted (and photos taken) for each application event. If a spill is not occurring or anticipated to occur, event water quality samples are not required because there is no discharge to receiving waters outside of the treatment area.
- **Post-Event Monitoring:** Conducted to determine if water quality standards are met following the conclusion of an application event. Within the BBID, this event is defined as the time at which canal operations are no longer tightly controlled as a closed system, and a spill to natural waterbodies could occur. Post-event monitoring is conducted for each application event.





LEGEND

- BBID District Boundary
- Pump Station
- Aqueduct
- Canal
- Waterway
- 96" Canal Siphon

N

0 2,500 5,000 10,000

Feet

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

FIGURE 3-1
BBID Canal System
Byron Bethany Irrigation District, California

Samples are to be collected from a minimum of six application events for each active ingredient in each environmental setting per year. The BBID only includes one environmental setting, flowing water. If there are less than six application events in a year, samples are collected during each application event for each active ingredient. If the results from six consecutive sampling events show concentrations that are less than the receiving water limitation or trigger for an active ingredient, sampling may be reduced to one application event per year for that active ingredient. If the annual sampling event shows an exceedance of the receiving water limitation or trigger for an active ingredient, then sampling returns to six application events for that active ingredient.

In other words, sampling is required at 100 percent of applications up to six applications, after which sampling may be reduced to one annual sampling event if results are less than the receiving water limitation or trigger for that active ingredient. Visual monitoring occurs at 100 percent of the sites for all application events.

If visual monitoring indicates that a spill has occurred, event monitoring is required. Event monitoring in the case of a spill includes visual, physical, and chemical monitoring, as described in Table 3-2. In addition, noncompliance reporting must begin.

Table 3-2. Monitoring Parameters

Sample Type	Constituent/Parameter	Sample Method	Laboratory Method	Frequency
Visual	1. Site description 2. Appearance of waterway 3. Weather conditions	Visual observation	-	Every application event, for background, event, and post-event monitoring, at both the Byron and Bethany Division sites
Physical	1. Temperature[a] 2. pH[a] 3. Turbidity[a] 4. Electrical conductivity/ salinity[a]	Field measurement	-	Every application event, up to six events annually, for background and post-event monitoring at both the Byron and Bethany Division sites
Chemical	1. Active ingredient (endothall)	Grab[b] (lab analysis)	Per EPA guidelines (Method 548.1)	Every application event, up to six events annually, for background and post-event monitoring at both the Byron Division site and the Bethany Division sites
	2. Nonylphenol or other surfactant	Grab[b] (lab analysis)	Per EPA guidelines	
	3. Hardness (C_aCO_3; dissolved)[c]	Grab[b] (lab analysis)	Per SM23408	
	4. DO[a]	Field measurement	Not applicable	

[a] These parameters are determined in the field using the Horiba U-10 water quality checker.
[b] Grab samples are collected at 3 feet below the surface, or mid-depth if the canal or creek is less than 3 feet deep.
[c] The BBID does not use surfactants in its aquatic pesticide application. Consistent with past practice, the District's sampling and analysis does not include monitoring for surfactants.

Notes:

$CaCO_3$ = calcium carbonate
DO = dissolved oxygen
SM = Standard Method

The purpose of the water quality monitoring is not to verify treatment concentrations; rather, results are used to determine that a spill does not occur, and that the aquatic pesticide is completely diluted and diverted from the canal prior to the resumption of normal irrigation delivery operations.

Tables 3-3 and 3-4 show the required sampling events for stations within the Byron and Bethany Divisions, respectively. The first sample, taken at time T2, is a background sample used to characterize the quality of the source water. The second sample, taken at time T3, is the event sample. Event samples need only be taken if visual monitoring indicates a spill. Visual monitoring during 2018 did not indicate a spill, so no event monitoring was necessary. The third sample, taken at time T5, is a post-event sample used to verify that the pulse of aquatic pesticide has been completely removed from the canal through dilution and diversion.

Table 3-3. Byron Division Sampling Events

Time	Event	Required Sampling Station	Sampling Type	Frequency
T1	Canal level is lowered.	-	-	-
T2	Aquatic pesticide is applied.	AQ	Background	All events
T3	Aquatic pesticide wave reaches the radial gate (BYR). Kellogg Creek is examined for spill.	KLG	Event	Only if spill to Kellogg Creek is observed
T4	Normal pumping begins at Pump Station 1-N.	-	-	-
T5	Freeboard at the radial gate (BYR) reduced to 3 feet or less.	BYR	Post-event	All events

Table 3-4. Bethany Division Sampling Events

Time	Event	Required Sampling Station	Sampling Type	Frequency
T1	Canal level is lowered.	-	-	-
T2	Aquatic pesticide is applied.	AQ	Background	All events
T3	Aquatic pesticide wave reaches the 155 Spillway (BTH). Mountain House Creek is examined for spill.	MTN	Event	Only if spill to Mountain House Creek is observed
T4	Normal pumping begins at Pump Station 1-S.	None	-	-
T5	Freeboard at the 155 Spillway (BTH) reduced to 3 feet or less.	-	Post-event	All events

The General Permit includes a provision requiring certification by a qualified biologist that beneficial uses of receiving waters accepting aquatic pesticides were restored following project completion. There were no spills to the receiving waters during the 2018 irrigation season, so the receiving waters did not accept aquatic pesticides and beneficial uses were not altered. Therefore, a biologist evaluation was not necessary at the completion of the project to verify that beneficial uses had been restored.

3.5 Procedures

The procedures described in this section for sampling and sample custody were developed to provide consistent, accurate results.

3.5.1 Surface Water Sampling

Surface water samples were collected so as not to cause cross-contamination. The District's water quality monitoring probe was used to measure temperature, pH, specific conductance, and DO. Sampling for aquatic pesticides was completed in accordance with the Monitoring Program as included in the APAP (BBID, 2014) and laboratory requirements.

3.5.2 Sample Custody

Sample custody requirements include procedures to assure the custody and integrity of the samples, beginning at the time of sampling and continuing through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal.

The following minimum information concerning the sample was documented on the chain-of-custody (CoC) form:

- Unique sample identification
- Date and time of sample collection
- Sample matrix (for example, water)
- Source of sample (including name, location, and sample type)
- Designation of matrix spike and matrix spike duplicate
- Preservative used
- Analyses required
- Name of collector(s)
- Custody transfer signatures, and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories
- Any comments to identify special conditions or requests

All samples were uniquely identified, labeled, and documented in the field at the time of collection.

Samples collected in the field were transported to the laboratory as expeditiously as possible; the samples were packed in ice or chemical refrigerant to keep them cool during collection and transportation. Electronic CoC forms were prepared prior to initiating field efforts. A copy of the signed CoC form that was sent to the lab is in the project file.

The coolers used to transport the samples to the laboratory were prepared as follows:

1. All previous labels used on the cooler were removed.
2. All drain plugs were sealed with tape (inside and outside).
3. All ice was double-bagged in resealable plastic bags and sealed.

The samples were packed into the coolers using the following procedure:

1. Glass jars were wrapped with bubble wrap to prevent or minimize breakage.
2. The CoC form was placed in the resealable plastic bag and taped to the underside of the cooler lid.
3. Ice was placed on top of and between the samples.

Coolers were packed with ice in resealable plastic bags to prevent melting ice from soaking the samples. Sample documentation was enclosed in sealed plastic bags taped to the underside of the cooler lid. Coolers were secured with packing tape and custody seals, as follows:

1. The cooler lid was taped with strapping tape, encircling the cooler several times.
2. CoC seals were placed on two sides of the lid (one in front and one on the side).
3. "This Side Up" arrows were placed on the sides of the cooler.

The coolers were delivered to the laboratory by the sampling team the day of sample collection.

3.6 Laboratory Requirements

Samples were analyzed at two different labs, depending on the pesticide applied. Samples from events where endothall was applied were analyzed at Fruit Growers Laboratory, Inc., and samples from events where acrolein was applied were analyzed at McCampbell Analytical, Inc. All analyses were conducted in accordance with the latest edition of *Guidelines Establishing Test Procedures for Analysis of Pollutants*, promulgated by EPA in Title 40 of the Code of Federal Regulations, Part 136 (EPA, 2017).

3.7 Sample Results and Analysis

3.7.1 Monitoring Results

Table 3-5 shows the results of BBID's background physical water sampling during 2018.

Table 3-5. 2018 Physical Sampling Results (Water Quality Monitoring Probe; in Order by Sample Date)

Application Event*	Sampling Station	Sample Date/Time	pH	Conductivity (mS/cm)	Temperature (°C)	DO (mg/L)	Flow (cfs)
1 S	PS1S Intake	4/24/2018 06:00	7.92	0.215	20.01	8.14	18
1 N	PS1N Intake	4/30/2018 06:30	7.60	0.233	16.96	8.80	21
2 S	PS1S Intake	5/14/2018 06:30	7.63	0.223	18.51	7.85	30
2 N	PS1N Intake	5/15/2018 06:00	7.60	0.228	18.49	7.77	35
3 N	PS1N Intake	5/30/2018 06:00	7.68	0.233	18.41	7.91	36
3 S	PS1S Intake	6/6/2018 06:00	7.51	0.221	18.42	7.76	20
4 N	PS1N Intake	6/13/2018 07:00	7.44	0.223	20.11	7.81	45
4 S	PS1S Intake	6/19/2018 06:00	7.32	0.226	19.91	7.76	24
5 N	PS1N Intake	6/27/2018 06:30	7.21	0.224	19.87	7.64	50
5 S	PS1S Intake	7/3/2018 06:00	7.69	0.254	22.53	6.26	35
6 N	PS1N Intake	7/10/2018 06:30	7.62	0.251	21.86	6.19	35
6 S	PS1S Intake	7/17/2018 06:30	7.54	0.243	22.93	5.86	32
7 N	PS1N Intake	7/24/2018 06:00	7.59	0.249	21.22	5.93	35
7 S	PS1S Intake	8/1/2018 07:00	7.97	0.248	22.91	7.81	35
8 N	PS1N Intake	8/7/2018 07:00	7.82	0.239	22.11	7.78	25
8 S	PS1S Intake	8/21/2018 06:15	7.79	0.351	22.35	7.68	21
9 N	PS1N Intake	8/21/2018 06:00	7.79	0.351	22.35	7.68	15

Table 3-5. 2018 Physical Sampling Results (Water Quality Monitoring Probe; in Order by Sample Date)

Application Event*	Sampling Station	Sample Date/Time	pH	Conductivity (mS/cm)	Temperature (°C)	DO (mg/L)	Flow (cfs)
10 N	PS1N Intake	9/4/2018 06:30	NR	0.358	22.32	7.66	12
9 S	PS1S Intake	9/5/2018 06:15	7.68	0.352	22.12	7.65	20
10 S	PS1S Intake	9/24/2018 06:00	7.51	0.341	22.19	7.56	19

* Application event numbers coordinate with Tables 2-1 (North Division applications) and 2-2 (South Division applications).

Notes:

°C = degrees Celsius
mS/cm = microsiemens per centimeter
NR = not recorded
PS1N = Pump Station 1-N
PS1S = Pump Station 1-S

Table 3-6 shows the results of the BBID's surface water sampling for aquatic pesticides.

Table 3-6. 2018 Surface Water Sampling Laboratory Results (in Order by Sample Date)

Application Event*	Applied Pesticide	Sampling Station	Sample Date and Time	Sample Result (µg/L)
1 S	Endothall	PS1S Intake	4/24/2018 06:00	ND
		PS1S Discharge	4/25/2018 06:15	ND
		120 High Point	4/26/2018 06:30	ND
1 N	Endothall	PS1N Intake	4/30/2018 06:30	ND
		PS1N Discharge	5/1/2018 07:00	ND
		Radial Gate	5/2/2018 07:30	ND
2 S	Endothall	PS1S Intake	5/14/2018 06:30	ND
		PS1S Discharge	5/15/2018 06:00	ND
		120 High Point	5/16/2018 07:00	ND
2 N	Acrolein	PS1N Intake	5/15/2018 06:00	ND
		PS1N Discharge	5/16/2018 07:00	ND
		Radial Gate	5/17/2018 07:30	ND
3 N	Endothall	PS1N Intake	5/30/2018 06:00	ND
		PS1N Discharge	5/31/2018 06:30	ND
		Radial Gate	6/1/2018 07:00	ND
3 S	Acrolein	PS1S Intake	6/6/2018 06:00	ND
		PS1S Discharge	6/7/2018 07:00	ND
		120 High Point	6/8/2018 07:30	ND
4 N	Acrolein	PS1N Intake	6/13/2018 07:00	ND
		PS1N Intake	6/14/2018 07:30	ND
		Radial Gate	6/15/2018 08:00	ND
4 S	Endothall	PS1S Intake	6/19/2018 06:00	ND
		PS1S Discharge	6/20/2018 06:30	ND
		120 High Point	6/21/2018 07:00	ND

Table 3-6. 2018 Surface Water Sampling Laboratory Results (in Order by Sample Date)

Application Event*	Applied Pesticide	Sampling Station	Sample Date and Time	Sample Result (µg/L)
5 N	Endothall	PS1N Intake	6/27/2018 06:30	ND
		PS1N Intake	6/28/2018 07:00	ND
		Radial Gate	6/29/2018 07:30	ND
5 S	Endothall	PS1S Intake	7/3/2018 06:00	ND
		PS1S Discharge	7/4/2018 06:30	ND
		120 High Point	7/5/2018 07:00	ND
6 N	Acrolein	PS1N Intake	7/10/2018 06:30	ND
		PS1N Discharge	7/11/2018 07:00	ND
		Radial Gate	7/12/2018 07:30	ND
6 S	Endothall	PS1S Intake	7/17/2018 06:30	ND
		PS1S Discharge	7/18/2018 07:00	ND
		120 High Point	7/19/2018 07:30	ND
7 N	Endothall	PS1N Intake	7/24/2018 06:00	ND
		PS1N Discharge	7/25/2018 06:30	ND
		Radial Gate	7/26/2018 07:00	ND
7 S	Acrolein	PS1S Intake	8/1/2018 07:00	ND
		PS1S Intake	8/2/2018 07:30	ND
		120 High Point	8/3/2018 08:00	ND
8 N	Endothall	PS1N Intake	8/7/2018 07:00	ND
		PS1N Discharge	8/8/2018 07:30	ND
		Radial Gate	8/9/2018 08:00	ND
8 S	Endothall	PS1S Intake	8/21/2018 06:15	ND
		PS1S Discharge	8/22/2018 07:15	ND
		120 High Point	8/23/2018 07:30	ND
9 N	Endothall	PS1N Intake	8/21/2018 06:00	ND
		PS1N Discharge	8/22/2018 06:30	ND
		Radial Gate	8/23/2018 07:00	ND
10 N	Endothall	PS1N Intake	9/4/2018 06:30	ND
		PS1N Discharge	9/5/2018 07:00	ND
		Radial Gate	9/6/2018 07:30	ND
9 S	Endothall	PS1S Intake	9/5/2018 06:15	ND
		PS1S Discharge	9/6/2018 06:30	ND
		120 High Point	9/7/2018 06:45	ND
10 S	Endothall	PS1S Intake	9/24/2018 06:00	ND
		PS1S Discharge	9/25/2018 06:30	ND
		120 High Point	9/26/2018 07:00	ND

* Application event numbers coordinate with Tables 2-1 (North Division applications) and 2-2 (South Division applications).

Notes:

MRL = method reporting limit
ND = non-detect less than the MRL (MRL for endothall is 40 µg/L; MRL for acrolein is 5.0 µg/L)

3.7.2 Analysis of Results

As shown in Table 3-6, the aquatic pesticides endothall and acrolein were not detected in any of the event or post-event samples collected during the 2018 monitoring season. This indicates that all application events and sampling were conducted per the protocols and requirements defined in the APAP and General Permit, and no spills occurred.

SECTION 4

Conclusions and Recommendations

This was the fifth year of sampling under the new General Permit, APAP and Monitoring Program (BBID, 2014). Because of the BBID's attention and adherence to the training programs, monitoring, and water management techniques refined over the last decade, no spills occurred in 2018.

Endothall was used with success again in 2018. Occasional use of acrolein supplemented endothall use and allowed the BBID to successfully control weed growth and maintain flows through its canal system.

SECTION 5

Works Cited

Alligare, LLC. 2013. Magnacide H Herbicide Application and Safety Manual. April 2013. Available at http://alligare.com/wp-content/uploads/2018/03/magnacide_h_manual.pdf. Verified February 11, 2019.

Byron-Bethany Irrigation District (BBID). 2014. *Aquatic Pesticide Application Plan* and *Monitoring Program*.

California State Water Resources Control Board (SWRCB). 2013. *Statewide General National Pollutant Discharge Elimination System Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications*. Water Quality Order Number 2013-0002-DWQ. Amended by Orders 2014-0078-DWQ, 2015-0029-DWQ, and 2016-0073-EXEC.

U.S. Environmental Protection Agency (EPA). 2017. *Guidelines Establishing Test Procedures for Analysis of Pollutants*. Shown in Title 40 of the Code of Federal Regulations in Part 136.