

Tahoe Keys Lagoons Control Methods Test Sediment Sampling

Project Background

Between May 25 and May 31, 2022, applications of aquatic herbicides (endothall and triclopyr) were made to thirteen (13) treatment areas ("sites") in the Tahoe Keys Lagoons and Lake Tallac to control invasive and non-native aquatic weeds. Six (6) sites in the Tahoe Keys Lagoons were treated using endothall and six (6) sites were treated using triclopyr. One (1) site in Lake Tallac was treated using endothall.

Consistent with the requirements of Lahontan Regional Water Quality Control Board Order R6T-2022-0004 (*Waste Discharge Requirements and National Pollutant Discharge Elimination System (NPDES) Permit for Tahoe Keys Property Owners Association Tahoe Keys Lagoons Aquatic Weed Control Methods Test*) ("Permit"), as well as Tahoe Regional Planning Agency permit File# EIPC2018-0011, sediment monitoring was conducted once pre-project ("background") and twice post-project ("post") at each treatment site and analyzed for residues and degradants of endothall and triclopyr.

Data Collection Methods

Sample Locations

Sediment was collected from two (2) monitoring locations within each treatment site using a decontaminated petite ponar grab sampling device deployed off the side of a small work boat. At each monitoring location, general observations were recorded including the date, time, GPS coordinates, weather conditions, water depth, and visual water quality monitoring observations (e.g., presence or absence of sheens, relative water clarity, and watercolor). A map showing the locations of sediment monitoring locations can be found in the attached **Figure 1**.

Sediment Collection

Grab samples collected using a petite ponar were decanted to reduce the volume of water incorporated in the sediment sample before being brought onboard the boat for processing. Samples were transferred from the petite ponar into clean, laboratory provided containers using decontaminated stainless-steel scoops. Where necessary, multiple ponar grabs were collected to obtain sufficient volume for laboratory analysis. Sample containers were immediately capped, labeled, and stored in an ice-filled cooler.

Site Water Collection

Samples of site water were also collected from each sediment monitoring location, using a peristaltic pump. Decontaminated tubing was loaded into a peristaltic pump head, and a polyethylene-coated downrigger weight was affixed to the end of the tubing. The tubing was lowered to mid-depth of the water column before turning on the pump and purging the tubing with 3 times the volume of the tubing with site water. Once purged, site water was collected directly into a clean, laboratory provided sample container. When adequate volume was collected, sample containers were capped, labeled, and stored in an ice-filled cooler.

Decontamination Procedures

Following sample collection, at each site, all equipment coming into contact with sediment or site water samples (tubing, stainless-steel scoops, petite ponar body, screens, and other parts) were decontaminated using a 2% liquinox solution and rinsed with distilled water. Washing and rinsing waste was collected into a 5-gallon bucket and properly disposed of off-site. Prior to sample collection at the subsequent site, all equipment coming into contact with sediment or site water samples was triple rinsed with site water.

Quality Assurance

Sampling personnel were trained in proper sampling techniques prior to field activity to reduce the potential for cross-contamination. Personnel donned new, clean nitrile gloves prior to each monitoring location and adhered to "clean hands/dirty hands" procedures.

Quality assurance samples were collected to evaluate the precision of sampling and analysis techniques and identify potential sources of contamination. Field duplicate ("FD") samples were collected at a rate of 5%. These were samples collected using the same techniques at the same location as a "primary" sample, collected into a separate container and analyzed separately from the primary sample. Equipment blank ("EB") samples were collected at a rate of 2.5% and were prepared using distilled water (equipment blank media for site water) and clean playground sand (equipment blank media for sediment), both of which were evaluated and known to have non-detectable concentrations of the analytes of interest. Distilled water was pumped through decontaminated tubing and collected into a clean, laboratory provided container to prepare the site water equipment blank. Sand was poured into a decontaminated petite ponar and mixed using a decontaminated stainless-steel scoop to ensure the blank media contacted the petite ponar surfaces before being scooped into clean, laboratory provided containers. Equipment blank samples were capped, labeled, and stored in an ice-filled cooler.

Laboratory Analysis

Samples were transferred to an accredited analytical laboratory in accordance with established chain-of-custody protocols. Analysis for endothall, triclopyr, and degradation byproducts were conducted for whole sediment (sediment as a complete, undisturbed matrix) and for sediment elutriate (water decanted from a mixture of sediment and site water after agitating and left to settle).

Whole sediment analysis was conducted using a custom chromatography (GC) method developed by the analytical laboratory, after extraction using method SW3550B. Whole sediment analysis for triclopyr and its degradation byproducts; TCP (3,5,6-trichloro-2-pyridinol) and TMP (3,5,6-trichloro-2-methoxypyridine), was conducted using EPA Method 8270E after extraction using method SW8151Am.

Elutriate samples were prepared according to the methods described in the EPA and US Army Corps of Engineers Inland Testing Manual. Endothall analysis for elutriate was conducted using the same custom method used for whole sediment analysis after extraction using EPA Method 548.1. Triclopyr, TCP, and TMP analysis for elutriate was conducted using EPA Method 8270E after extraction using SW3510C.

Lab reports received by the laboratory underwent internal review to confirm data validity. Where necessary, samples were re-analyzed to confirm laboratory accuracy and precision.

Evaluation Methods

There were no established compliance limits, benchmarks, or objectives for concentrations of herbicide residues and/or degradants in sediment. Accordingly, sediment samples were evaluated against background concentrations to determine whether conditions were restored to pre-project conditions. The results of background sediment monitoring showed no detections of endothall, triclopyr, TCP, or TMP.

Results

Three (3) separate sediment monitoring events were conducted, as follows:

- Pre-project Monitoring Event
 - Sediment samples collected within seven (7) days in advance of the application event.
 - Collection dates: May 19 through May 21, 2022.
- Post-project Monitoring Event 1
 - Sediment samples collected shortly after water quality monitoring showed no detections of triclopyr, TCP, or TMP at all herbicide monitoring locations.
 - Collection dates: September 24, September 26, September 28, and September 30, 2022.
- Post-project Monitoring Event 2
 - Sediment samples collected no later than required to analyze and provide a Sediment Monitoring Report with the two (2) year post-biological monitoring report and certification.
 - Collection dates: August 27 through August 29, 2024.

There were no detections of endothall, triclopyr, TCP, or TMP in Pre-project Monitoring Event samples.

Endothall was detected in 42% of samples collected during Post-project Monitoring Event 1, at concentrations ranging from 50 to 740 ug/kg. No triclopyr, TCP, or TMP was detected in Post-project Monitoring Event 1 samples.

Because triclopyr, TCP, and TMP were not detected in samples collected during Post-project Monitoring Event 2, samples collected during Post-project Monitoring Event 2 were not analyzed for these constituents. There were no detections of endothall in Post-project Monitoring Event 2 samples.

A full summary of sediment monitoring results can be found in attached **Table 1** and **Table 2**.

Figure 1: *Tahoe Keys Control Methods Test Sediment Monitoring Locations*

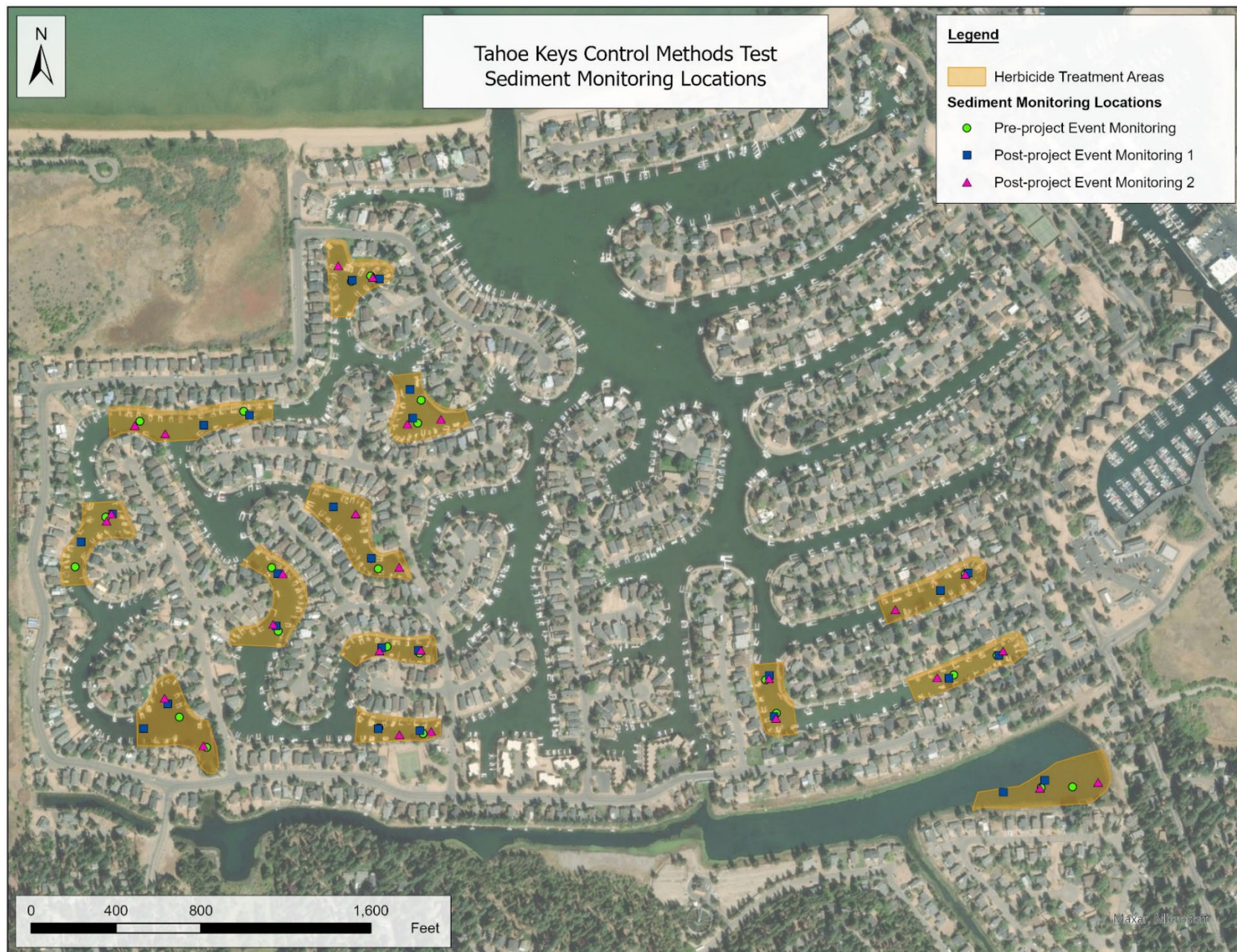


Table 1:

Summary of Sediment Monitoring Results (Whole Sediment Analysis)

Date	Location	Event Type	Endothall (ug/kg)	Triclopyr (ug/kg)	TCP (ug/kg)	TMP (ug/kg)
5/19/2022	TA5-SED1	Pretreatment	ND (< 20)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA5-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA8-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA8-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA9-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA9-SED2	Pretreatment	ND (< 72)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA10-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA10-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA11-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA11-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA15-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/19/2022	TA15-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 10)	ND (< 10)
5/20/2022	TA1-SED1	Pretreatment	ND (< 50)	ND (< 20)	ND (< 20)	ND (< 20)
5/20/2022	TA1-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/20/2022	TA2-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/20/2022	TA2-SED2	Pretreatment	ND (< 50)	ND (< 20)	ND (< 20)	ND (< 20)
5/20/2022	TA3-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/20/2022	TA3-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/20/2022	TA12-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/20/2022	TA12-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/20/2022	TA19-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/20/2022	TA19-SED2	Pretreatment	ND (< 50)	ND (< 20)	ND (< 20)	ND (< 20)
5/21/2022	TA13-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/21/2022	TA13-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/21/2022	TA14-SED1	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/21/2022	TA14-SED2	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/21/2022	TA14-SED2-FD	Pretreatment	ND (< 50)	ND (< 10)	ND (< 7.6)	ND (< 5.8)
5/21/2022	TA14-SED2-EB	Pretreatment	ND (< 10)	ND (< 5.1)	ND (< 3.8)	ND (< 2.9)
9/24/2022	TA8-SED1	Post Treatment	ND (< 16)	ND (< 50)	ND (< 50)	ND (< 50)
9/24/2022	TA8-SED2	Post Treatment	ND (< 16)	ND (< 50)	ND (< 50)	ND (< 50)
9/24/2022	TA8-SED2-FD	Post Treatment	ND (< 16)	ND (< 50)	ND (< 50)	ND (< 50)
9/24/2022	TA8-SED2-EB	Post Treatment	ND (< 3.1)	ND (< 50)	ND (< 50)	ND (< 50)
9/24/2022	TA9-SED1	Post Treatment	ND (< 16)	ND (< 50)	ND (< 50)	ND (< 50)
9/24/2022	TA9-SED2	Post Treatment	ND (< 16)	ND (< 50)	ND (< 50)	ND (< 50)
9/24/2022	TA15-SED1	Post Treatment	DNQ (Est. = 32)	ND (< 50)	ND (< 50)	ND (< 50)
9/24/2022	TA15-SED2	Post Treatment	DNQ (Est. = 38)	ND (< 50)	ND (< 50)	ND (< 50)
9/26/2022	TA1-SED1	Post Treatment	68	ND (< 50)	ND (< 50)	ND (< 50)
9/26/2022	TA1-SED2	Post Treatment	50	ND (< 50)	ND (< 50)	ND (< 50)
9/26/2022	TA2-SED1	Post Treatment	100	ND (< 50)	ND (< 50)	ND (< 50)
9/26/2022	TA2-SED2	Post Treatment	420	ND (< 50)	ND (< 50)	ND (< 50)
9/26/2022	TA3-SED1	Post Treatment	740	ND (< 50)	ND (< 50)	ND (< 50)
9/26/2022	TA3-SED2	Post Treatment	270	ND (< 50)	ND (< 50)	ND (< 50)
9/26/2022	TA3-SED2-FD	Post Treatment	220	ND (< 50)	ND (< 50)	ND (< 50)
9/28/2022	TA5-SED1	Post Treatment	ND (< 16)	ND (< 50)	ND (< 50)	ND (< 50)
9/28/2022	TA5-SED2	Post Treatment	DNQ (Est. = 6.8)	ND (< 50)	ND (< 50)	ND (< 50)
9/28/2022	TA10-SED1	Post Treatment	220	ND (< 50)	ND (< 50)	ND (< 50)
9/28/2022	TA10-SED2	Post Treatment	140	ND (< 50)	ND (< 50)	ND (< 50)
9/28/2022	TA11-SED1	Post Treatment	ND (< 16)	ND (< 50)	ND (< 50)	ND (< 50)
9/28/2022	TA11-SED2	Post Treatment	ND (< 16)	ND (< 50)	ND (< 50)	ND (< 50)
9/30/2022	TA12-SED1	Post Treatment	220	ND (< 50)	ND (< 50)	ND (< 50)
9/30/2022	TA12-SED2	Post Treatment	210	ND (< 50)	ND (< 50)	ND (< 50)

Date	Location	Event Type	Endothall (ug/kg)	Triclopyr (ug/kg)	TCP (ug/kg)	TMP (ug/kg)
9/30/2022	TA13-SED1	Post Treatment	ND (< 50)	ND (< 50)	ND (< 50)	ND (< 50)
9/30/2022	TA13-SED2	Post Treatment	ND (< 50)	ND (< 50)	ND (< 50)	ND (< 50)
9/30/2022	TA14-SED1	Post Treatment	ND (< 50)	ND (< 50)	ND (< 50)	ND (< 50)
9/30/2022	TA14-SED2	Post Treatment	ND (< 50)	ND (< 50)	ND (< 50)	ND (< 50)
9/30/2022	TA19-SED1	Post Treatment	ND (< 50)	ND (< 50)	ND (< 50)	ND (< 50)
9/30/2022	TA19-SED2	Post Treatment	ND (< 50)	ND (< 50)	ND (< 50)	ND (< 50)
8/27/2024	TA5-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA5-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA10-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA10-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA11-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA11-SED1-FD	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA11-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA13-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA13-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA14-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/27/2024	TA14-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA1-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA1-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA2-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA2-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA3-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA3-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA8-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA8-SED1-FD	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA8-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA9-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA9-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA12-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA12-SED1-EB	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA12-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA15-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/28/2024	TA15-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS
8/29/2024	TA19-SED1	Post Treatment 2	ND (< 50)	NS	NS	NS
8/29/2024	TA19-SED2	Post Treatment 2	ND (< 50)	NS	NS	NS

Notes

No compliance limits are established for endothall, triclopyr, TCP, or TMP in sediment.

Samples were not analyzed for triclopyr or degradants of triclopyr for the Post Treatment 2 sampling event because all samples collected during the Post Treatment sampling event were non-detect for these analytes.

Event Types

Pretreatment = Monitoring conducted within seven (7) days of the start of herbicide application.

Post Treatment = Monitoring conducted at a date no later than required to analyze and provide a Sediment Monitoring Report with the two (2) year post-biological monitoring report and certification.

Definitions and Abbreviations

DNQ = Detected, Not Quantifiable. Analyte was detected above the Method Detection Limit, but under the Reporting Limit (RL). The estimated value is included in parentheses using the format "DNQ (Est. = [RL])".

EB = Equipment Blank

FD = Field Duplicate

ND = Not Detected. Not detected above the method detection limit ("MDL"). MDL is included in parenthesis using the format "ND (< [MDL])".

NS = Not Sampled

TCP = TCP = 3,5,6-trichloro-2-pyridinol, a degradant of triclopyr

TMP = 3,5,6-trichloro-2-methoxypyridine, a degradant of triclopyr

ug/kg = micrograms per kilogram.

Summary of Sediment Monitoring Results (Sediment Elutriate Analysis)

[illegible]

Date	Location	Event Type	Endothall (ug/L)	Triclopyr (ug/L)	TCP (ug/L)	TMP (ug/L)
9/30/2022	TA13-SED1	Post Treatment	ND (< 10)	ND (< 1.0)	ND (< 1.0)	ND (< 1.0)
9/30/2022	TA13-SED2	Post Treatment	ND (< 10)	ND (< 1.0)	ND (< 1.0)	ND (< 1.0)
9/30/2022	TA14-SED1	Post Treatment	ND (< 10)	ND (< 1.0)	ND (< 1.0)	ND (< 1.0)
9/30/2022	TA14-SED2	Post Treatment	ND (< 10)	ND (< 1.0)	ND (< 1.0)	ND (< 1.0)
9/30/2022	TA19-SED1	Post Treatment	ND (< 10)	ND (< 1.0)	ND (< 1.0)	ND (< 1.0)
9/30/2022	TA19-SED2	Post Treatment	ND (< 10)	ND (< 1.0)	ND (< 1.0)	ND (< 1.0)
8/27/2024	TA5-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA5-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA10-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA10-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA11-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA11-SED1-FD	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA11-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA13-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA13-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA14-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/27/2024	TA14-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA1-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA1-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA2-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA2-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA3-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA3-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA8-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA8-SED1-FD	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA8-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA9-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA9-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA12-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA12-SED1-EB	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA12-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA15-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/28/2024	TA15-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS
8/29/2024	TA19-SED1	Post Treatment 2	ND (< 10)	NS	NS	NS
8/29/2024	TA19-SED2	Post Treatment 2	ND (< 10)	NS	NS	NS

Notes

No compliance limits are established for endothall, triclopyr, TCP, or TMP in sediment elutriate.

Samples were not analyzed for triclopyr or degradants of triclopyr for the Post Treatment 2 sampling event because all samples collected during the Post Treatment sampling event were non-detect for these analytes.

Event Types

Pretreatment = Monitoring conducted within seven (7) days of the start of herbicide application.

Post Treatment = Monitoring conducted at a date no later than required to analyze and provide a Sediment Monitoring

Definitions and Abbreviations

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TMP = 3,5,6-trichloro-2-methoxypyridine, a degradant of triclopyr

ug/L = micrograms per liter. Equivalent to parts per billion (ppb).