Aquatic Pesticide Application Plan
San Gabriel Valley Municipal Water District

California Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Biological Pesticides and Residual Chemical Pesticide Discharges to Waters of the United States from Aquatic Animal Invasive Species Control Applications

Water Quality Order 2016-0041-DWQ
General Permit CAG 990006

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Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations." (40 C.F.R. §122.22(c)).

Jose Reynoso
General Manager
San Gabriel Valley Municipal Water District

Aquatic Pesticide Application Plan for San Gabriel Valley Municipal Water District

Aquatic Invasive Animal Species Statewide NPDES Permit
Water Quality Order 2016-0041-DWQ
General Permit CAG 990006

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Introduction

San Gabriel Valley Municipal Water District (SGVMWD) is a State Water Contractor, authorized to import supplies from the State Water Project to supplement local supplies for its member cities. Imported water is conveyed through the Devil Canyon–Azusa Pipeline (DCAP) to serve various member cities and treatment plants and is discharged to tributary channels that flow to the San Gabriel River. Because these deliveries are hydraulically connected to the San Gabriel River, a water of the United States, the application of aquatic pesticides may result in residual pesticide discharges that require coverage under the State Water Resources Control Board's Aquatic Invasive Animal Species General NPDES Permit.

SGVMWD imports its water supplies from the State Water Project (SWP) under its water supply contract with the California Department of Water Resources (DWR). Imported water supplements local water resources available within the District's service area.

The delivery system used to serve its member cities is the Devil Canyon-Azusa pipeline, which was constructed in 1972 to deliver water from the State Water Project to the Main San Gabriel Basin. The pipeline (highlighted in red on the map below) is about 38 miles long and runs west from the Devil Canyon Power Plant in the San Bernardino Mountains to the San Gabriel River in Azusa.

The pipeline is gravity fed and has three pressure-reducing stations in Glendora, La Verne, and Fontana to control the speed of water. The diameter of the pipeline ranges from 54″ to 30″ starting at Devil Canyon. The pipeline's capacity is 55 cfs (cubic feet per second) which is the equivalent of 24,684 gallons per minute.

This system allows SGVMWD to provide reliable supplemental water for the communities of Alhambra, Azusa, Monterey Park, and Sierra Madre.

In October 2024, the highly invasive golden mussel (*Limnoperna fortunei*) was identified at a water quality station at Rough and Ready Island in the Delta, the first recorded detection in North America. Golden mussel populations have since been spreading southward, with positive detections confirmed along SWP conveyance structures, including the California Aqueduct, Pyramid Lake, and Silverwood Lake. To date, the invasive zebra mussel (*Dreissena polymorpha*) has not yet been detected in the SWP, CRA or connected waters.

Invasive freshwater mussels have been shown to alter aquatic community structures through their productive filter feeding abilities, which impact water quality and reduce the food source available to existing aquatic species. Zebra, quagga, and golden mussels all form dense colonies that are capable of obstructing and damaging water conveyance structures, including pipelines, pumps, intake structures, and trash racks. Mussel accumulation in pipelines narrows pipe diameter and may constrain flow rates, which could impact water delivery to SGVMWD's service area. The golden mussel exhibits a wider tolerance of environmental conditions compared to other invasive freshwater mussel species, making it especially challenging to control and eradicate once a waterbody has been invaded.

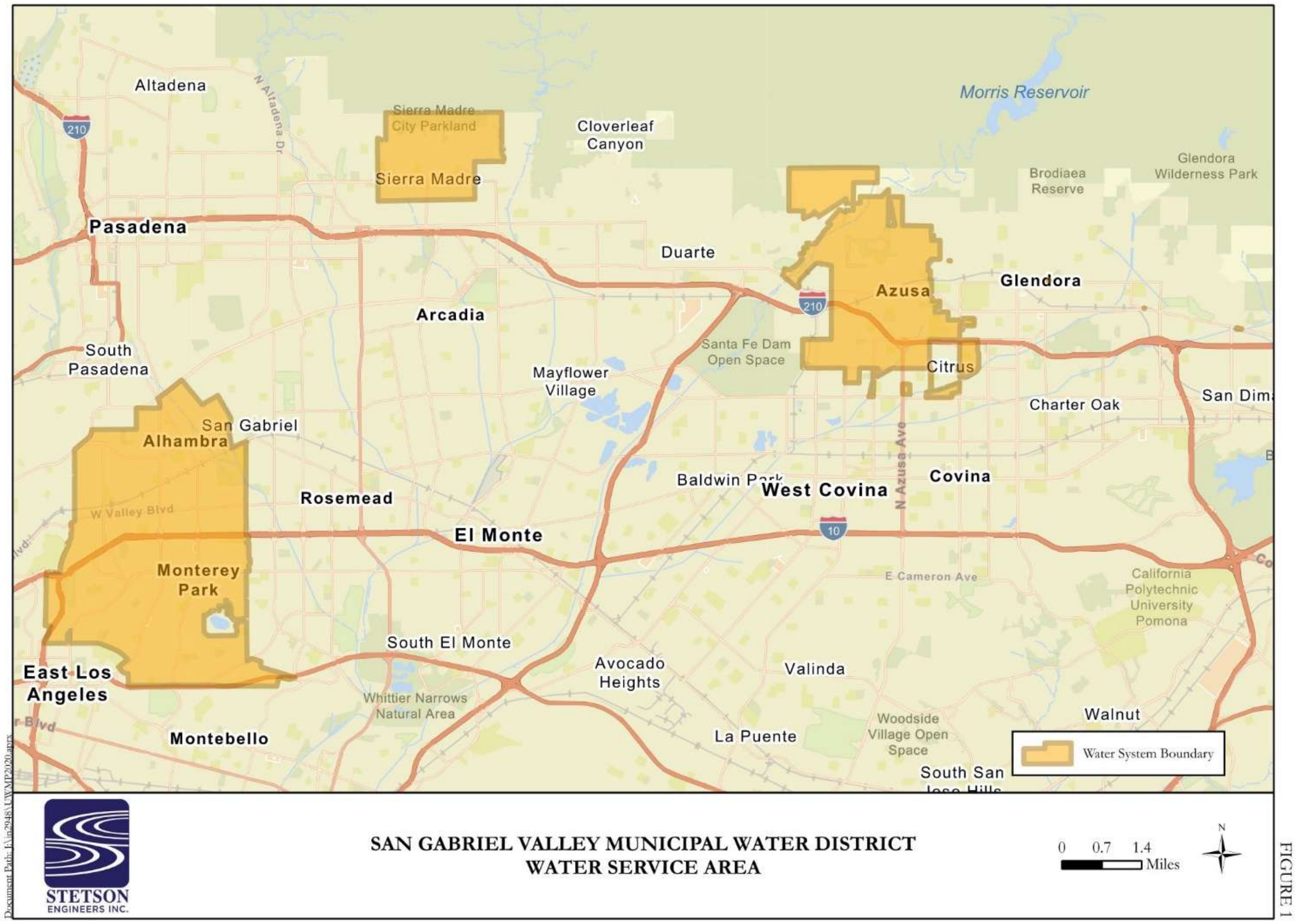
The recent passage of California Assembly Bill No. 149 ("AB 149") amends Sections 2301 and 2302 of California's Fish and Game Code, further expanding its scope to apply to all invasive mussel species known to be present in a water system. These laws require public and private agencies who operate a water supply system to develop comprehensive prevention and control plans for invasive mussels and promptly implement appropriate control measures upon detection to reduce or prevent downstream spread. With an approved plan in place, operators of water supply systems are not liable for the introduction or transportation of invasive mussel species as a result of their normal operations.

SGVMWD is applying for coverage under the National Pollutant Discharge Elimination System (NPDES) Permit for Biological Pesticides and Residual Chemical Pesticide Discharges to Waters of the United States from Aquatic Animal Invasive Species Control Applications (General Permit CAG 990006, Water Quality Order No. 2016-0041-DWQ) ("NPDES Permit" or "Permit"). Coverage under the NPDES Permit allows for the discharge of pesticide residues resulting from the management of invasive aquatic species like golden and quagga mussels. To manage current and future infestations of aquatic invasive animal species, including golden and quagga mussels, SGVMWD is seeking authorization to use copper sulfate pentahydrate as the active ingredient in the aquatic pesticide known as "EarthTec QZ", to prevent mussel settlement in SGVMWD's imported water delivery system and appurtenant infrastructure.

Given the known infestation of the State Water Projects conveyance system, SGVMWD may make treatments consistent with this Aquatic Pesticide Application Plan (APAP) and the Permit to control mussels in its imported water delivery system and appurtenant infrastructure. Depending on the distribution, abundance and proximity to critical infrastructure of mussel infestations indicated by monitoring results, SGVMWD may elect to make continuous, low dose treatments designed to prevent settlement within small diameter pipe infrastructure, or make applications to treat infestations within pipelines, conveyance channels, spillways, and other constructed water distribution infrastructure that could result in discharges that require permit coverage. SGVMWD may also opt to conduct "spot" treatments or treatments in flowing water, as necessary.

This Plan has been prepared to comply with the APAP requirements in section VII.C. of the Permit and is submitted in conjunction with a Notice of Intent (NOI) and application for coverage under the NPDES Permit to control invasive freshwater mussels in SGVMWD's water replenishment delivery infrastructure.

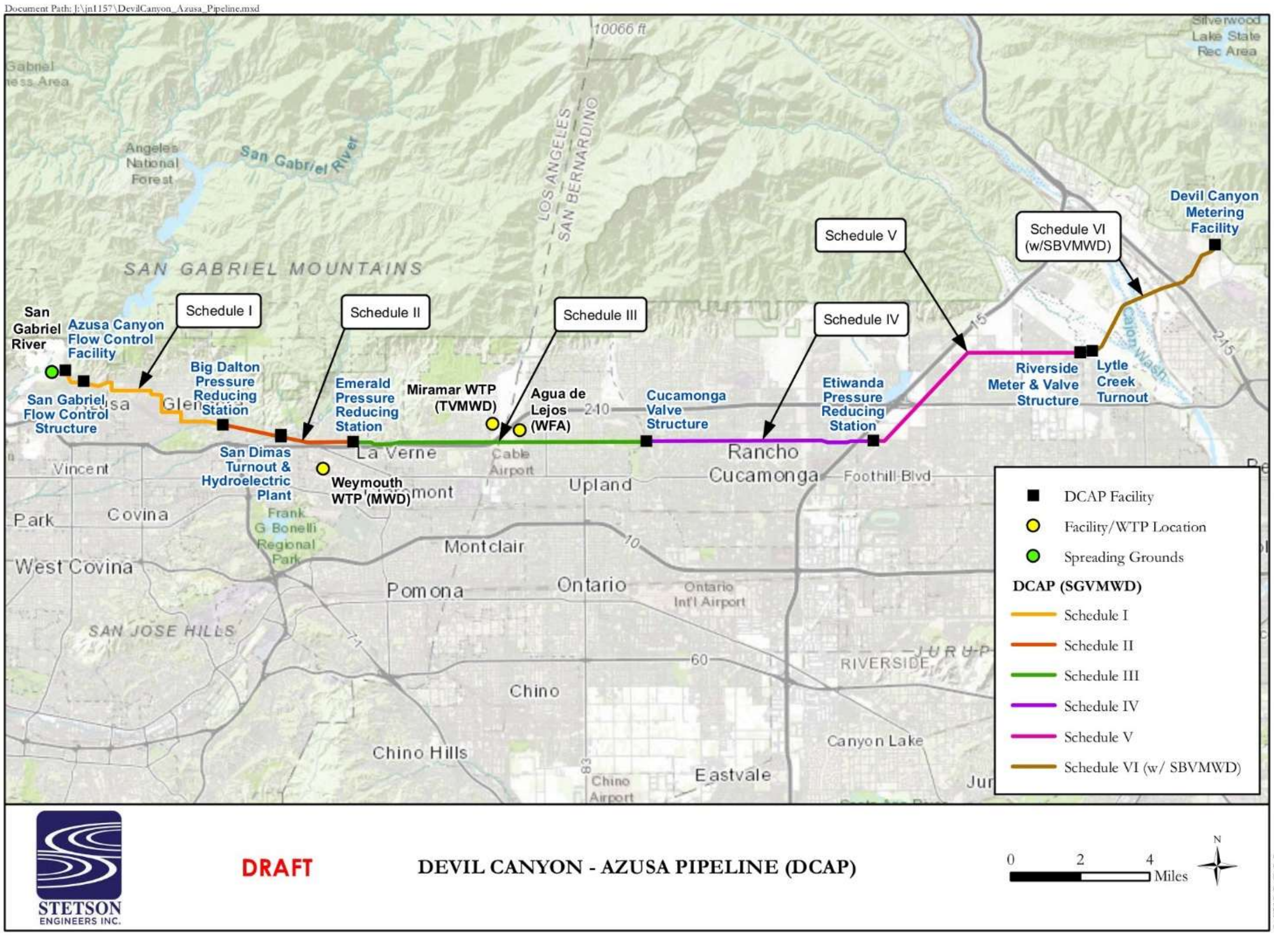
Figure 1: Map of San Gabriel Valley Municipal Water District's Member Cities



Element 1: Description of Waterbodies

. **Figure 1** shows a map of SGVMWD's service area and associated member cities; Figure 2 depicts the Devil Canyon–Azusa Pipeline (DCAP) alignment and major operational facilities associated with the imported water delivery system. A map of the complete water delivery pipeline infrastructure can be found in **Figure 2**.

Figure 2: Map of the Devil Canyon-Azusa Pipeline (DCAP)



Element 1.1: Water Source - State Water Project Water: Devil Canyon Afterbay

The SWP consists of an extensive network of water storage and delivery facilities stretching more than 750 miles across California, supplying drinking water to over 27 million people and 750,000 acres of farmland. Owned by the State of California and managed by the Department of Water Resources, these facilities play a vital role in storing and conveying water across the state. The system relies on a system of canals, tunnels, pumping stations, and natural features like the Delta to transport SWP water to reservoirs and distribution points throughout the state.

Lake Oroville marks the beginning of the SWP. Water from Lake Oroville flows through the Feather River and into the Sacramento River before reaching the Delta, which serves as a key water conveyance hub and environmental resource. At Clifton Court Forebay, water is pumped into the California Aqueduct at Harvey O. Banks Pumping Plant. A portion of the water traveling through the California Aqueduct is diverted into the San Luis Reservoir at O'Neil Forebay, while the remaining water is lifted over the Tehachapi Mountains at A.D. Edmonston Pumping Plant.

The California Aqueduct diverts into two branches after this point, both of which provide raw water to the area serviced by Metropolitan Water District. Water traveling through the West Branch flows into Quail Lake after Oso Pumping Plant before reaching Pyramid Lake in Los Angeles County. Castaic Lake serves as the terminal reservoir of the West Branch. The East Branch travels through a series of pumping plants, reservoirs, and pipelines, including Silverwood Lake, Devil Canyon Pumping Plant, and the Santa Ana Valley Pipeline, before reaching its terminal reservoir at Lake Perris.

Specific to SGVMWD's operations, Devil Canyon Afterbay is located approximately 38 miles east of SGVMWD's service area. The afterbay feeds the DCAP imported water conveyance, described herein.

Element 1.2: Water Conveyance – Devil Canyon-Azusa Pipeline (DCAP)

Beginning at Devil Canyon, the Devil Canyon-Azusa Pipeline (DCAP) conveys SWP water to various turnout locations and ending at SGVMWD's turnout to the San Gabriel River. SGVMWD operates this delivery system on a regular basis to distribute imported water to the San Gabriel River, described herein.

Element 1.3: Water Destination – San Gabriel River

SGVMWD is seeking Permit coverage for discharges from its raw water conveyance systems listed in **Table 1**. The DCAP provides water service to a series of turnouts along its alignment and terminates at its eastern-most turnout into the San Gabriel River, a WOTUS. Discharges from the DCAP flow to washes and channels hydraulicly tied directly or indirectly to the San Gabriel River.

Table 1. Raw water conveyance and delivery systems with potential discharge to WOTUS in SGVMWD's distribution system

Site	Source Water	Delivery Location	Potential Receiving Water	RWQCB Regions
Devil Canyon-Azusa Pipeline	SWP	North Azusa Connection	San Gabriel River	4
		Live Oak Turnout	San Gabriel River	4
		San Dimas Turnout	San Gabriel River	4
		San Gabriel Flow Control Structure	San Gabriel River	4
		Big Dalton Pressure Reducing Station	San Gabriel River	4
		Azusa Flow Control Structure	San Gabriel River	4

Element 2: Factors Influencing the Decision to Use Pesticides

Eradication without the use of pesticides may only be possible if a waterbody can be drained and allowed dry to the point where mussels and veligers desiccate and die and only refilled with water free of veligers and adult mussels. While desiccation has been largely successful in the CRA during annual maintenance shutdowns, it is unfeasible as a management option for SGVMWD's imported water replenishment infrastructure which consists of constantly full and flowing pipelines as well as submerged basins and flow control infrastructure. Even after an extended outage, pipelines can provide mussels with enough moisture to survive due to their high humidity level. Golden mussels have exhibited a higher tolerance to desiccation compared to other invasive mussels and require a drawdown period of weeks for successful control. As such, SGVMWD has determined the use of molluscicides as the primary management option to control invasive mussels and limit their downstream spread.

Molluscicide treatments are a commonly implemented mitigation measure for mussel infestations. The efficacy of any selected product is dependent on waterbody characteristics, water chemistry and temperature, species of mussel, and ability to maintain target molluscicide concentration around target mussels. A key component for any treatment using molluscicides is to understand, consider, and minimize environmental impacts while balancing the need to mitigate the impact of mussel infestations on water delivery infrastructure, the environment and long-term ecosystem health.

To date, the only documented molluscicide agents that have high potential for successful control of mussels have been potash, chlorine or copper-based products. Potash-containing products are not currently registered for use as a molluscicide with the United States Environmental Protection Agency (USEPA) or California Department of Pesticide Regulation (CDPR), nor are they permitted for discharge under the Permit in California and are therefore not permissible for use. Molluscicides registered with DPR and available for use under the Permit contain the active ingredients chlorine, copper, or *Pseudomonas fluorescens*, strain CL145A.

The latter is a biological pesticide registered under the trade name Zequanox that uses a dead soil bacterium, *Pseudomonas fluorescens*, strain CL145A, to control dreissenid mussels. Zequanox is not currently NSF/ANSI Standard 60 certified for use in drinking water systems and is therefore currently prohibited from use as a treatment option at the time of this publication. This material may be considered for use in the future as more is learned about its efficacy on golden mussels and impact on drinking water quality as well as approval by the NSF/ANSI.

Chlorine can be effective against invasive freshwater mussels and is currently used by MWD in the CRA; however, its application raises concerns about the formation of disinfection byproducts (DBPs) when treating water from the SWP. Compared to Colorado River water, water sourced from the Delta has a higher chlorine demand due to larger quantities of dissolved organic carbon, reducing chlorine efficacy and increasing DBP formation potential.

Copper has a well-documented history of use to mitigate mussel infestations throughout the United States. Some products available for use are compatible with drinking water systems and are NSF/ANSI Standard 60 certified. Copper molluscicides do not produce DBPs, but copper is a priority pollutant, and Water Boards have specific 303(d) impairments due to copper in some waterbodies. SGGVMWD considers the copper molluscicide copper sulfate pentahydrate, described herein, as the primary product to be used under this APAP.

SGVMWD will review and consider the use of these as well as other molluscicide options as products and data on their efficacy become available.

Element 3: Active Ingredients, Degradation Byproducts, Application Methods, and Adjuvants/Surfactants

SGVMWD is requesting authorization to discharge residues associated with the active ingredient copper sulfate pentahydrate to manage invasive freshwater mussels in its imported water replenishment infrastructure.

SGVMWD is requesting to treat its infrastructure using a copper sulfate pentahydrate-containing molluscicide such as EarthTec QZ®, or similar product. Liquid copper formulations like EarthTec QZ® readily disperse throughout the water column after application and do not have any degradation byproducts. This product has been used in the United States and other countries in open water and enclosed facility settings. SGVMWD may consider the use of other copper-based molluscicides as they become available.

Copper applications are typically made by injecting a copper-based molluscicide directly into targeted raw water pipelines using a metered chemical injection pump, where it is allowed to travel through the water conveyance system. An isolated treatment of pumping plant intakes or other critical infrastructure could be achieved by inserting a hose or other device into the intake structure to inject molluscicide and allowing the product to flow through the system targeted for mussel treatment. Treatments with copper products can be episodic or continual; for example, treating once a threshold of settlement density per square meter has been reached, or treating for the duration of the breeding season to prevent settlement and resultant mussel fouling.

SGVMWD will continue to review and consider the use of other molluscicide options as products become available.

Element 4: Description of Application Areas and Target Areas

SGVMWD may apply molluscicides to the sites described in this APAP and NOI if mussels are detected and site-specific treatment thresholds are met. The application area is defined by the permit as the area to which molluscicides are directly applied. The treatment area is defined as the area being targeted to receive an appropriate rate of molluscicide for the duration of the treatment period. While the specific location of treatment application is defined, the amount, frequency and duration of treatment may be variable and dependent on the detection of mussels targeted for control, specifically the abundance and proximity to critical infrastructure of mussel infestations but also including the ambient water conditions like quality and temperature.

Treatments may also be made with the intent of preventing settlement of veligers and, depending on the concentration used, control adult mussels within pipelines and other raw water infrastructure systems. Treatment frequency will depend on the goals of the treatment and/or impact of the mussel infestation at each potential treatment site. To maintain the molluscicide concentration for the duration of time needed to effectively control mussels, a continuous application of molluscicide may be used. As SGVMWD's operations are connected to the San Gabriel River, treatments made by SGVMWD can be considered to have discharged to receiving waters, requiring permit coverage.

Element 5: Alternative Control Methods

Treatment of mussels by SGVMWD is guided by the application of Integrated Pest Management (IPM) to minimize impacts of invasive mussels on its infrastructure. IPM is a science-based decision-making process that combines management and monitoring tools and strategies to control a pest. One of the primary goals of IPM is to establish practical and actionable control measures that not only aid in managing mussels in SGVMWD's raw water infrastructure, but also take into consideration public health and safety, natural resources, economic impacts, and other relevant factors. A central feature of the IPM decision process is to determine when control action is necessary and when it is not. Control methods may include mechanical, cultural, biological, and/or chemical controls. **Element 15** provides a detailed discussion of the potential control methods SGVMWD is considering.

To date, other water agencies like MWD have implemented select control measures to respond to the infestation of CRA delivery infrastructure, including manual removal, continuous chlorine applications, and desiccation through scheduled system outages. SGVMWD will evaluate the efficacy of these control measures as they pertain to SWP imported water delivery to SGVMWD infrastructure. The following control methods have been implemented at other mussel-infested waterbodies with varying levels of success.

While these approaches are not going to result in eradication, they have proven to be effective at protecting infrastructure and reducing populations within treatment areas. Given this, SGVMWD is examining these strategies as possible alternative control methods:

- Anti-fouling coatings
- Pipeline pigging
- Ultraviolet (UV) radiation exposure
- Hot water injections
- Carbon dioxide
- Other Molluscicide applications
- Filters (bag, cartridge, and/or media)
- Acoustics/vibrations
- Electric currents/fields
- Plasma pulse technology

Element 6: Determination of the Amount of Molluscicide Product Needed

The efficacy of any selected molluscicide product is dependent on waterbody characteristics, water chemistry and temperature, species of mussel being controlled, and the ability to maintain target molluscicide concentration around the mussel population for the duration of treatment. To gather information on the dosing and effective treatment strategies associated with available molluscicides, SGVMWD staff conducts literature reviews and consults with a range of experts experienced with invasive mussels. These include state and federal regulatory and resource agencies, academic researchers, water agency staff, and suppliers and applicators of molluscicide and aquatic pesticide materials.

SGVMWD plans to utilize product label information and data from existing toxicity studies on zebra and quagga mussels as the basis for determining the amount of material required. Flow rate and water volume within the targeted pipelines are also critical pieces of information SGVMWD will use to calculate appropriate dosing amounts. Application methods, rates and total amount of product applied will comply with EPA- and DPR-approved pesticide label instructions and restrictions.

With copper treatments where long durations of exposure are required to achieve efficacy, frequent monitoring of the copper concentration is necessary to check and confirm application amounts to maintain the target concentration.

The golden mussel displays a wider tolerance of environmental conditions compared to other invasive freshwater mussels, including its tolerance to copper. With this in mind, researchers and public agencies in California are currently conducting testing to evaluate the effects of various molluscicide concentrations and exposure times on the golden mussel in a laboratory and small-scale settings to help guide future treatment parameters. SGVMWD will rely on this efficacy data to inform its treatment approach against the golden mussel as it becomes available.

Element 7: Representative Monitoring Locations

Representative monitoring locations are selected for each treatment in alignment with the sampling location and timing guidelines described in Element 10. Element 10 describes SGVMWD's monitoring and reporting procedures, including the parameters used to select and justify representative locations.

Element 8: Gate and Control Structures

SGVMWD operates and maintains numerous water control structures throughout its water delivery infrastructure that are critical to SGVMWD's regular operations. Control structures, gates, and valves at each location along the DCAP will be considered within the treatment area and will be inspected prior to and during treatments to evaluate the presence of leaks. If leaks develop on closed valves or gates, they are stopped as soon as practicable, and discharge is monitored as needed.

Element 9: State Implementation Plan Section 5.3 Exception Status

SGVMWD has not previously been granted a State Implementation Policy (SIP) Section 5.3 Exception for the use of molluscicide treatments. Treatment with copper molluscicides may be made as needed during the year when control thresholds have been exceeded. Based on monitoring results from initial treatments, SGVMWD may elect to apply for SIP Exception if there are challenges with meeting the receiving water limitation (RWL) for dissolved copper following the application of copper-containing molluscicides.

Element 10: Description of the Monitoring and Reporting Program

A description of the Monitoring and Reporting Program is presented herein, which addresses the following two key questions:

- Question 1: Does the residual molluscicide discharge cause an exceedance of the receiving water limitations?

- Question 2: Does the discharge of residual molluscicides, including active ingredients, inert ingredients, and degradation byproducts, in any combination cause or contribute to an exceedance of the "no toxics in toxic amount" narrative toxicity objective?

SGVMWD will use the following itemized strategy to address the aforementioned questions.

Element 10.1: Data Collection

Visual monitoring is performed for all molluscicide treatments at all sites and recorded by qualified personnel.

The Molluscicide Application Log and Molluscicide Field Monitoring and Sampling Forms located in **Appendix A**, or their equivalents, are used to document application and monitoring activities for the purpose of Permit compliance.

Element 10.2: Monitoring Locations and Frequency

Water quality monitoring for molluscicides listed on the Permit is required for a minimum of six treatment events for each active ingredient per year in each environmental setting (e.g., flowing and non-flowing). If there are less than six treatment events in a year for an active ingredient, SGVMWD will collect samples for each application event in each environmental setting.

Monitoring sites will be chosen to represent the variations in treatment that occur, including molluscicide use, hydrology, flowing or non-flowing water setting, conveyance or impoundment type, and seasonal variations. The exact location(s) of sample site(s) will be determined after site scouting, treatment area definition, and the decision to make a molluscicide application are made by SGVMWD's IPM approach.

Element 10.2.1: Sample Locations

Sampling typically includes background (BG), event (Event), and post-event (Post) monitoring, as described below.

Background Monitoring: In flowing water, the BG sample is collected upstream of the treatment area at the time of the application event, or in the treatment area within 24 hours prior to the start of the application.

Event Monitoring: Event samples for flowing water are collected downstream of the treatment area immediately after the application event, but after sufficient time has elapsed to allow for treated water to exit the treatment area. Per the Permit, this should not exceed 24 hours after the application event.

The location and timing for the collection of the Event sample(s) may be based on several factors including but not limited to flow rates, size of the treatment area, presence of any gates or water control structures, and duration of treatment. If Event monitoring inspections indicate that treated water is entirely contained within the treatment area, this will be documented by monitoring staff; sample collection is not required.

Post-Event Monitoring: The Post sample is typically collected within the treatment area within 1 week after project completion or when treatment is complete, as determined by SGVMWD. If the molluscicide application occurs within a pipeline, a Post sample will not be collected, as pipelines cannot be directly sampled from and are not generally considered Waters of the United States.

In addition to one full set of three samples (i.e., BG, Event, and Post), one field duplicate (FD) and one field blank (FB) is collected and submitted for analysis for each analyte, once per year. The FD and FB samples are typically collected during Event monitoring and are helpful in assessing quality assurance and quality control (QA/QC).

See **Appendix A** for examples of the field sampling forms to be used.

Element 10.3: Sample Collection

If the water depth is 6 feet or greater, the sample is collected at a depth of 3 feet. If the water depth is less than 6 feet, the sample is collected at the approximate mid-depth. As necessary, an intermediary sampling device (e.g., Van-Dorn style sampler, Kemmerer sampler, or long-handled sampling pole) is used for locations that are difficult to access. Long-handled sampling poles with attached sampling container are inverted before being lowered into the water to the desired sample depth, where it is turned upright to collect the sample. Appropriate sample equipment cleaning technique is discussed in **Element 10.8.4.**

Element 10.4: Field Measurements

In conjunction with sample collection, temperature and dissolved oxygen are measured in the field. Turbidity, electrical conductivity, and pH may be measured in the field using field meters as available or analyzed in the laboratory. Conductivity, turbidity, pH, and dissolved oxygen meters are calibrated according to manufacturer's specifications at the recommended frequency. The calibration for these meters and for temperature is checked according to manufacturer's specifications with standards throughout the year to evaluate instrument performance. If the calibration is outside the manufacturer's specifications, the probe is recalibrated. Calibration logs are maintained for all instruments to document calibration and equipment performance.

Element 10.5: Sample Preservation and Transportation

Samples are collected directly into preserved containers or collected in unpreserved containers and preserved at the laboratory upon receipt if the analytical method used requires preservation. When monitoring for dissolved copper and hardness, the sample is field filtered at the time of collection or as soon as practically possible; samples are preserved to a pH of less than 2 standard units within 24 hours, as required by EPA Method 200.7 and EPA Method 200.8. Once a sample is collected and labeled, it is immediately placed in a dark, cold (approximately 4°C) environment, typically a cooler with ice. Delivery to the laboratory will occur as soon as practicable after sample collection.

Element 10.6: Sample Analysis

Table 2 includes a list of the constituents that will be analyzed for each sample.

Table 2. Required Sample Analysis

Constituent	Analytical Method[1]	Typical Reporting Limit	Hold Time (Days)	Container	Chemical Preservative
Temperature[2]	SM 2550B, 4500-OG	N/A	Immediately	N/A	None
Dissolved Oxygen[2]	SM 4500-OG	0.0 mg/L	Immediately	N/A	None
Turbidity[3]	EPA 180.1, SM 2130B	0.00 NTU	Immediately	N/A	None
Electrical Conductivity[3]	EPA 120.1	0.0 µS/cm	1 if unpreserved; 28 if preserved	250 mL Glass or HDPE	None[5]
	SM 2510B	0.0 µS/cm	28	500 mL Glass or HDPE	None
pH[3]	EPA 150.2	1-14	Immediately	100 mL Glass or HDPE	None
	SM 4500H+B	1-14	0.08 (2 hours)	100 mL Glass or HDPE	None
Hardness[4]	SM 2340B	0.332 mg/L	1 if unpreserved; 180 if preserved	250 mL HDPE	HNO_3
	SM 2340C	0.332 mg/L	1 if unpreserved; 180 if preserved	250 mL HDPE	HNO_3 or None
*Copper (dissolved[5])	EPA 200.8	0.5 to 2.0 µg/L	1 if unpreserved; 180 if filtered and preserved	250 mL HDPE	HNO_3
**Pseudomonas fluorescens*[6]	EPA 180.1, SM 2130B	0.00 NTU	Immediately	N/A	None

Notes: mg/L = milligrams per liter; NTU = nephelometric turbidity unit; mL = milliliter; HDPE = high-density polyethylene; µS/cm = microsiemens per centimeter; GC/MS = gas chromatography-mass spectrometry; µg/L = micrograms per liter; m = modified extraction or analysis technique; HNO_3 = nitric acid; H_2SO_4 = sulfuric acid; CFR = Code of Federal Regulations.

* Signifies molluscicide. Chemical analysis is only required for the active ingredient(s) used in treatment.

1 Examples of methods commonly used for sample analysis. Method details obtained from NEMI (2021). Analytes may be analyzed using analytical methods described in 40 CFR Part 136 or equivalent methods that are commercially and reasonably available and that provide quantification of sampling parameters and constituents sufficient to evaluate compliance with applicable effluent limits and to perform reasonable potential analysis. Equivalent methods must be more sensitive than those specified in 40 CFR Part 136 if the method is available in 40 CFR Part 136 and must be approved for use by the Regional Water Board Executive Officer. Methods not specified in 40 CFR Part 136 may include modifications to methods specified in 40 CFR Part 136 or other methods as deemed appropriate by the analytical laboratory.

2 Field measured.

3 May be field or laboratory measured.

4 Required for copper applications only.

5 Preservation via filtration through a 0.45 micron filter and storage at 4˚C.

6 The concentration of *Pseudomonas fluorescens* will be measured using turbidity and as described in the Zequanox label

Element 10.7: Reporting Procedures

Element 10.7.1: Annual Report

An annual report for each reporting period (i.e., January 1 to December 31) is to be prepared by March 1 of the following year and submitted to the SWRCB and appropriate RWQCB(s). In years when no molluscicides are used, a letter stating no discharges occurred is to be sent to the SWRCB and appropriate RWQCB(s) in lieu of an annual report.

The annual report will contain the following information:

- An Executive Summary discussing compliance or violation of the Permit and the effectiveness of the APAP to reduce or prevent the discharge of pollutants associated with molluscicide applications;
- A summary of monitoring data, including the identification of water quality improvements or degradation, recommendations for improvements to the APAP and monitoring program based on the monitoring results. All receiving water monitoring data shall be compared to applicable water quality standards;
- Identification of Best Management Practices, or "BMPs" and a discussion of their effectiveness in meeting the Permit requirements;
- A discussion of BMP modifications addressing violations of the Permit;
- A map showing the location of each treatment area;
- Types and amounts of molluscicide used at each application event during each application;
- Information on surface area and/or volume of treatment area and any other information used to calculate dosage, concentration, and quantity of each molluscicide used;
- Sampling results shall indicate the name of the sampling agency or organization, detailed sampling location information (including latitude and longitude or township/range/section if available), detailed map or description of each sampling area (e.g., address, cross roads), collection date, name of constituent/parameter and its concentration detected, minimum levels, method detection limits for each constituent analysis, name or description of water body sampled, and a comparison with applicable water quality standards, description of analytical QA/QC plan. Sampling results shall be tabulated so that they are readily discernible;
- Recommendations to improve the monitoring program, BMPs, and APAP to ascertain compliance with this Order; and

- A summary of Molluscicide Application Log(s).

Element 10.7.2: Noncompliance Reporting

SGVMWD will report to SWRCB and appropriate RWQCB(s) any noncompliance that may endanger health or the environment, including any unexpected or unintended effect of an molluscicides. Compliance with receiving water limitations and monitoring triggers is determined through Event and Post monitoring results.

A **Twenty-Four-Hour Report** is provided by SGVMWD orally, by way of a phone call, to SWRCB and appropriate RWQCB(s) within 24 hours from the time SGVMWD becomes aware of the circumstances. The Twenty-Four-Hour Report includes the following information:

- The caller's name and telephone number;
- Applicator name and mailing address;
- Waste Discharge Identification number;
- How and when the discharger became aware of the noncompliance;
- Description of the location of the noncompliance;
- Description of the noncompliance identified and the EPA pesticide registration number for each product the discharger applied in the area of noncompliance; and,
- Description of the steps that the discharger has taken or will take to correct, repair, remedy, cleanup, or otherwise address any adverse effects.

If SGVMWD is unable to notify SWRCB and appropriate RWQCB(s) within 24 hours, SGVMWD will do so as soon as possible and provide a rationale for why it was unable to provide notification of noncompliance within 24 hours.

In addition to the Twenty-Four Hour Report, SGVMWD shall provide a written submission within five (5) days of the time it becomes aware of the noncompliance. The **Five-Day Written Report** contains the following information:

- Date and time SGVMWD notified the SWRCB and appropriate RWQCB(s) of the noncompliance and any instructions received from SWRCB and/or RWQCB(s);
- Information required to be provided in Section C.2.a. (Twenty-Four Hour Report) of the Permit;
- A description of the noncompliance and its cause, including exact date and time and species affected, estimated number of individual and approximate size of dead or distressed organisms (other than the pests to be eliminated);

- Location of incident, including the names of any waters affected and appearance of those waters (e.g., sheen, color, clarity);
- Magnitude and scope of the affected area (e.g., aquatic square area or total stream distance affected);
- Pesticide application rate, intended use site (e.g., direct to water), method of application, name of pesticide product, description of pesticide ingredients, and EPA registration number;
- Description of the habitat and the circumstances under which the noncompliance activity occurred including any available ambient water data for pesticides applied;
- Laboratory tests performed, if any, and timing of tests; SGVMWD will provide a summary of the test results within five days after they become available;
- If applicable, explanation why the discharger believes the noncompliance could not have been caused by exposure to the molluscicides from SGVMWD's application; and,
- Actions to be taken to prevent recurrence of adverse incidents.

The Five-Day Written Report is submitted within 5 days of the time SGVMWD becomes aware of the noncompliance unless SWRCB staff or RWQCB staff waive the above-described report if an oral report has been received within 24 hours.

An **Immediate Notification** may be given by SGVMWD if it becomes aware of an adverse incident to a federally listed threatened or endangered species or its federally designated critical habitat that may have resulted from an molluscicide application. This notification is provided to NMFS in the case of an anadromous or marine species incident, or USFWS in the case of a terrestrial or freshwater species incident.

Element 10.8: Sampling Methods and Guidance

The purpose of this section is to present methods and guidelines for the collection and analysis of samples necessary to meet the APAP objective of assessing adverse impacts, if any, to beneficial uses of water bodies treated with molluscicides.

This section includes a description of the techniques, equipment, analytical methods, and QA/QC procedures for sample collection and analysis. Guidance for the preparation of this section included the NPDES Storm Water Sampling Guidance Document (EPA 1992), Guidelines and Specifications for Preparing Quality Assurance Project Plans (EPA 1983), and U.S. Geological Survey National Field Manual for the Collection of Water Quality Data (USGS 2015).

Element 10.8.1: Surface Water Sampling Techniques

As discussed in **Element 10.3**, if the water depth is 6 feet or greater, the sample is collected at a depth of 3 feet. If the water depth is less than 6 feet, the sample will be collected at the approximate mid-depth.

As necessary, an intermediary sampling device (e.g., Van-Dorn style sampler, Kemmerer sampler, or long-handled sampling pole) may be used for locations that are difficult to access. Long-handled sampling poles with attached sampling container are inverted before being lowered into the water to the desired sample depth, where they are turned upright to collect the sample. Appropriate cleaning technique is discussed in **Element 10.8.4** of this document.

During collection, the samples are collected in a manner that minimizes the amount of suspended sediment and debris in the sample. Surface water grab samples are collected directly by the sample container, or by an intermediary container in the event that the sample container cannot be appropriately or safely used. Intermediary samplers may be constructed of high-density polyethylene (HDPE) plastic, stainless steel, glass, or other suitable material. Any container that will be reused between sites will be cleaned thoroughly and triple rinsed before collection of the next sample as described in **Element 10.8.4**. Alternatively, disposable HDPE or glass intermediary sample containers may be used.

Element 10.8.2: Sample Containers

Clean, empty sample containers with caps are supplied in protective cardboard cartons or ice chests by the analytical laboratory. The containers are certified clean by either the laboratory or the container supplier. To support data quality control, the sampler uses the appropriate sample container as specified by the laboratory for each sample type. Typical sample container type, holding time, and appropriate preservatives are listed in **Table 2**. Each container is affixed with a label indicating a discrete sample number for each sample location. The label also indicates the date.

Element 10.8.3: Sample Preservation and Filtering

Samples may either be collected with bottles containing the correct preservative(s) or collected in unpreserved bottles and preserved upon receipt at the analytical lab. If monitoring for dissolved copper or hardness, the sample should be field filtered at the time of collection or as soon as practically possible; samples should be preserved to a pH of less than 2 within 24 hours, as required by EPA Method 200.7 or EPA Method 200.8. After collection, samples are cooled to approximately 4°C and stored in a dark place like a cooler and transported to the laboratory for analysis. Refer to **Table 2.**

Element 10.8.4: Sampling Equipment Cleaning

In the event that sampling equipment will be used in more than one sample location, the equipment is thoroughly cleaned with a non-phosphate cleaner, triple-rinsed with distilled water, and then rinsed once with the water being sampled prior to its first use at a new sample collection location.

Element 10.9: Field Sampling Operations

Element 10.9.1: Field Logbook

A three-ring binder, bound logbook, or other suitable recording media is maintained by members of the sampling team to provide a record of sample location, significant events, observations, and measurements taken during sampling. Sample records are intended to provide sufficient data and observations to enable project team members to reconstruct events that occurred during the sampling, and must be legible, factual, detailed, and objective. As appropriate and at the discretion of SGVMWD's field staff or contractors, observations and measurements may be supplemented with pictures of site conditions at the time of sampling.

When recording observations in the field book, the sampling team notes the presence or absence of the following:

- Floating or suspended matter
- Discoloration
- Bottom deposits
- Aquatic life
- Visible films, sheens, or coatings
- Fungi, slimes, or objectionable growths
- Potential nuisance conditions

See **Appendix A** for examples of the forms to be used to record relevant field data when sampling.

Element 10.9.2: Alteration of Sampling Techniques

It is possible that actual field conditions may require a modification of the procedures outlined herein. Specifically, water levels, weather, and other environmental parameters and hazards including flow, pump operation, and water use may pose access and/or sampling challenges. In such instances, variations from standard procedures and planned sampling locations and frequencies will be documented by means of appropriate entry into the field logbook.

Element 10.9.3: Flow Estimation

SGVMWD's flowrates are already measured, reported and recorded at regular intervals through their SCADA operations network.

Element 10.9.4: Chain-of-Custod0y

The chain-of-custody (COC) record is employed as physical evidence of sample custody. The sampler completes a COC record to accompany each sample shipment from the field to the laboratory. The COC record specifies the following information:

- Time, date, and location of sample collection
- Unique sample name or identifier
- Requested analysis
- Sampler name
- Whether the sample has been filtered and/or preserved
- Preservative used, if any
- Required turn-around-time for analysis
- Time and date of sample transaction between field and laboratory staff
- Name of receiving party at the laboratory

Corrections to the COC record are made by drawing a line through, initialing, and dating the error, and entering the correct information. Erasures are not permitted.

Upon receipt of the samples, laboratory personnel check to confirm that the samples and requested analyses are accurately described by the COC record. Upon verification of the number and type of samples and the requested analysis, a laboratory representative signs the COC record, indicating receipt of the samples, and returns a copy of the COC to SGVMWD.

Element 10.9.5: Sample Label

The sample label contains information indicating the specific project, the unique sample ID, and the date and time the sample was collected.

Element 10.10: Quality Assurance and Quality Control

The purpose of QA/QC is to ensure and control the quality of data generated during sample collection and analysis as described earlier in this document. QA/QC are measured in a variety of ways, as described in the following subsections.

Element 10.10.1: Precision

Precision is a measure of the reproducibility of measurements under a given set of conditions. It is a quantitative measure of the variability of a group of measurements compared to the average value of the group and is expressed as the relative percent difference (RPD). Sources of error in precision can be related to both laboratory and/or field techniques. Specifically, lack of precision is caused by inconsistencies in instrument setting, measurement and sampling techniques, and record keeping.

Laboratory precision is estimated by generating analytical laboratory matrix spike (MS) and matrix spike duplicate (MSD) sample results and calculating RPD. Alternatively, laboratory control spike (LCS) and laboratory control spike duplicate (LCSD) may be used to calculate RPD. Laboratory RPD values vary by analysis method, but, generally, an RPD of less than 25% is considered acceptable. Precision can also be determined at the laboratory by running duplicate analysis on the same sample.

Field precision is estimated by collecting FDs in the field and calculating RPD. In general, field RPD values of less than 35% will be considered acceptable. Refer to the discussion of FDs in **Element 10.10.5.**

Element 10.10.2: Accuracy

Accuracy is a measure of how close data are to their true values and is expressed as percent recovery (%R), which is the difference between the mean and the true value expressed as a percentage of the true value. Sources of error (inaccuracy) are the sampling process, field contamination, preservation, handling, sample matrix effects, sample preparation, analytical techniques, and instrument error.

Laboratory accuracy is estimated using reference standards, as well as MS/MSD and/or LCS/LCSD samples. Acceptable accuracy is generally between 75% and 125%. Refer to **Element 10.10.5** for additional discussion of MS/MSD and LCS/LCSD.

Element 10.10.3: Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid measurements. The completeness objective is that the sufficiently valid data is generated to allow for submittal to SWRCB and RWQCB(s). Completeness is assessed by comparing the number of valid sample results to the number of samples collected. The objective for completeness is $\geq$80 %.

Element 10.10.4: Representativeness

Representativeness refers to a sample or group of samples that reflects the predominant characteristics of the media at the sampling point. The objective in addressing representativeness is to assess whether the information obtained during the sampling and analysis represents the actual site conditions.

Element 10.10.5: Field Duplicate

The purpose of the FD is to quantify the precision, or reproducibility, of the field sampling technique. It involves the duplication of the technique used for a particular field sample collection method and the subsequent comparison of the original and duplicate values. This comparison is measured as RPD. RPD is calculated as follows:

$$\boldsymbol{RPD = \left[\frac{(Sample\ 1 - Sample\ 2)}{Average\ of\ Samples\ 1\ and\ 2)}\right] * 100}$$

An acceptable field RPD value is ≤35%. The FD is collected at the same time as the actual field sample and one FD per year per active ingredient applied is collected.

Element 10.10.6: Field Blank

The purpose of the FB is to ensure that the field sampling technique, equipment, or equipment cleaning technique or materials do not impart a false positive or false negative result during the collection of the sample. The FB is prepared with distilled water and allowed to come into contact with the sampling device in a manner identical to the actual sample. Analyte concentrations in an acceptable FB should be non-detect (ND) above the method reporting limit.

The FB is collected at the same time as the actual field sample and one FB per year per active ingredient applied is collected.

Element 10.10.7: Laboratory Quality Assurance and Quality Control

Laboratory precision and accuracy is monitored by a series of laboratory-generated quality control samples. As long as sufficient sample volume is collected and submitted to the laboratory, no additional effort is required by field activities to generate laboratory quality control samples. For most analytical methods, field samples have an associated set of laboratory quality control samples.

Element 10.10.7.1: Method Blank

The purpose of the method blank (MB) is to ensure that the analytical technique does not impart a false positive result during the preparation or analysis of the sample. An MB is prepared by the laboratory from high-purity distilled or deionized water. Analyte concentrations in an acceptable MB should be ND above the method reporting limit.

Element 10.10.7.2: Matrix Spike or Laboratory Control Spike

The purpose of an MS is to quantify accuracy and to ensure that the analytical technique does not impart a false negative or false positive result during the preparation or analysis of the sample. The MS involves the introduction of the analyte (or an analyte surrogate) of interest into the actual sample matrix and then quantitating it.

In addition to or in lieu of the MS, an LCS may be prepared to quantify accuracy and to provide assurance of the laboratory's capability to report unbiased measurements. The LCS involves the introduction of the analyte (or an analyte surrogate) of interest into a purified sample material such as deionized water and then quantitating it.

The amount detected divided by the amount added to the matrix is expressed as %R. Depending on the analysis, acceptable values of %R generally range from 75% to 125%. %R is calculated as follows:

$$\%\boldsymbol{R} = \left[\frac{(\boldsymbol{Spike\ Amount\ Detected - Sample\ Value})}{\boldsymbol{Amount\ Spiked}}\right] * \mathbf{100}$$

Element 10.10.7.3: Matrix Spike Duplicate or Laboratory Control Spike Duplicate

The purpose of an MSD and/or LCSD is to quantify laboratory precision. An acceptable RPD is generally less than or equal to 25%, but may vary depending on the analysis. The spike duplicate involves replication of the MS or LCS resulting in two data points from which RPD is calculated as follows:

$$\boldsymbol{RPD} = \left| \left[\frac{(\boldsymbol{Spike} - \ \boldsymbol{Spike\ Duplicate})}{(\boldsymbol{Average\ of\ Spike\ and\ Spike\ Duplicate})}\right] * \mathbf{100} \right|$$

Where:

- Spike = Analyte concentration measured in the MS or LCS
- Spike Duplicate = Analyte concentration measured in the MSD or LCSD

Element 10.10.8: Data Validation

Data validation uses data generated from the analytical laboratory and the field. References that can be used to assist in data validation include USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA 1994) and USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA 1999).

The purpose of data validation is to verify that data collected are of sufficient quality for inclusion in reports to RWQCB(s). In order to serve this purpose, the following information must be available to evaluate data validity:

- **Date of Sample Collection.** This is required to uniquely identify a sample and holding time.
- **Location of Samples**. This is required to identify a sample.
- **Laboratory QA/QC Procedures.** These are required to assess analytical accuracy, precision, and sample integrity. A laboratory QA/QC sample set typically consists of an MS, an MSD, and an MB. A laboratory QA/QC sample set is analyzed by the laboratory for each field sample batch. Sufficient sample volume and number is supplied to the laboratory in order to prepare and evaluate the laboratory QA/QC sample set.

- **Analytical Methods.** These are required to assess appropriateness and acceptability of analytical method used.
- **Detection Limits.** These are required to assess lower limit of parameter identification.
- **Holding Times, Preservation, and Dates of Extraction and Analysis.** These are required to assess if a sample was extracted and analyzed within the specified time limits and if a sample was stored at the appropriate temperature.
- **Field QA/QC Procedures.** These are required to assess field precision and sample integrity. A field QA/QC sample set consists of FB and FD samples. A field QA/QC sample set is analyzed by the laboratory for one sampling event per active ingredient applied per year. Sufficient sample volume and number are collected in the field and supplied to each laboratory in order to prepare and evaluate the field QA/QC sample set.

Element 10.10.9: Data Qualification

Data collected for compliance with the Permit is qualified through the analytical lab validation process described in **Element 10.10.8**. This process is used to document that all data has been thoroughly reviewed and qualified as valid. During the data validation process, data qualifiers are used to classify sample data. The following qualifiers are used:

- **Acceptable (A).** The data has satisfied each of the requirements and is quantitatively acceptable (i.e., valid). Valid data is presented in reports.
- **Reject (R).** Data is not valid. This qualifier will be used for samples that cannot be uniquely identified by date of collection or sample location or that fail holding time or detection limit requirements. Invalid data is not presented in reports submitted to the RWQCB.

Element 10.10.10: QA/QC Corrective Action

If previously described criteria for valid data are not met, then corrective action as follows is taken:

1. The laboratory is asked to check their QA/QC data and calculations associated with the sample in question. If the error is not found and resolved, then:
    a. The extracts or the actual samples, which are saved until the data are validated, are reanalyzed by the laboratory if they are within holding time limitations. These new results are compared with the previous results. If the error is not found and resolved, then:

   b. If field analytical equipment is used, calibration records are reviewed. If the error is not found, then:

   c. The sampling procedure and sample preparation is rechecked and verified. If the procedures appear to be in order and the error is not resolved, then:

   d. The data is deemed invalid and not used.

2. Upon discovery of the source of an error, every attempt is made to address the cause of the error and remedy the problem.

Element 10.10.11: Data Reporting

The results of sampling and analysis are summarized in the Annual Report. The data is tabulated so that they are readily discernible.

Element 11: Procedures to Prevent Sample Contamination

Water quality sampling is conducted by trained staff following established procedures designed to prevent contamination of samples. The following procedures prevent sample contamination:

- Samplers use clean, laboratory-provided sample bottles or intermediary sampling devices that are non-reactive. Glass and polyethylene bottles are generally used for SGVMWD water samples.
- Samplers wear gloves that are nitrile or powder-free vinyl to avoid potential contamination potentially associated with latex gloves. New gloves are donned immediately prior to sample collection.
- Samples are placed in resealable bags and placed in an ice chest away from contaminants immediately following collection.
- Sample collection is conducted outside of the influence of application equipment, and in a manner that prevents contact with molluscicide application equipment, containers, or used personal protective equipment.
- Samplers minimize contact with treated mussels and treated water.
- Sampling equipment, such as intermediary sampling containers, is thoroughly cleaned between sites if that equipment is used at more than one location.

For additional information, refer to **Element 10.8.**

Element 12: Evaluation of Best Management Practices (BMPs) and Feasible Alternatives

SGVMWD has evaluated alternative methods for invasive mussel control as well as alternative molluscicide products and application techniques. Based on the review of available literature and the results of pilot studies in systems with similar characteristics as SGVMWD's water system, there are not currently feasible alternatives to the use of molluscicides. Additional evaluations will be conducted before a molluscicide treatment is chosen to make site-specific determinations if any non-chemical molluscicide controls can be implemented and to reduce the potential impact to water quality. Application of molluscicide will be conducted in a manner that is consistent with label language and follows regulations of the U.S. EPA, CalEPA, California Occupational Safety and Health Administration (OSHA), DPR, and the local County Agricultural Commissioner.

Best management practices for the control of invasive mussels in vulnerable infrastructure are outlined in **Table 3.**

Table 3. Typical infrastructure components at risk and BMPs for mussel infestation

Infrastructure Components at Risk	Vulnerability	Best Management Practices
Trash Racks, Grates	Partial plugging or plugged openings.	Mechanical removal of mussels using tule rake or scraping tool effective on large accumulations. Divers may be used for more thorough manual cleaning, or locations inaccessible from a catwalk or other structure. Anti-fouling coatings may help extend time between cleaning.
Gates, Stop Logs	Leakage from trapped shells. Increased wear on seals.	Cycle gates to flush gate tracks.
Discharge Pipelines	Increased hydraulic friction.	Manual cleaning when friction creates unacceptable losses of power or flow.
Intake Tubes, Tunnels, Penstocks	Increased hydraulic friction.	Manual cleaning when friction creates unacceptable losses of power or flow.
Small Pipes and Tubes for Pressure or Level Sensing	Can plug quickly resulting in inaccurate readings.	Manual cleaning or hot water flush.
Air Vents or Air Release Valves in Piping	Slow draining or pressure balancing. Leaking air release valves.	Check operation when vents are in use and clean as necessary.
Strainers, Filters	Increased plugging.	Increased manual cleaning frequency; or install self-cleaning strainers.
Valves	Increased leakage especially air vent valves.	Manual cleaning.
Pump Intake Screens	Plugged screens cause cavitation.	Manual cleaning.

Element 13: Description of BMPs

SGVMWD intends to implement a number of BMPs to protect the environment, public, and to minimize constraints on downstream water use. Initial treatments will be made by or conducted under the supervision of the qualified applicator, following a Pest Control Recommendation (PCR) prepared by a licensed Pest Control Adviser (PCA). Once properly trained, SGVMWD will administer molluscicide treatments in-house following pesticide label directions, employing safe and effective practices.

Element 13.1: Measures to Prevent Spills

SGVMWD will utilize secondary containment for the storage of chemical totes, and applicators will apply molluscicides according to label instructions in order to prevent spills. In the event of a spill, staff follow SGVMWD's established emergency response procedures and refer to the applicable safety data sheet for instructions on containing and cleaning up the spill. Emergency response and safety data sheet procedures are reviewed regularly with staff. A copy of the emergency response procedures and safety data sheets will be available during each treatment.

Cleanup equipment and appropriate PPE are kept in good working order and will be readily available at each treatment site. SGVMWD staff are trained to contain any spilled material and are familiar with the use of absorbent materials (e.g. cat litter, "pigs," and "pillows"). Spills are cleaned up according to label instructions, and equipment used to remove spills is properly contained and disposed of or decontaminated, as appropriate.

As necessary, and taking into consideration the quantity, type, or location of an accidental spill or release, SGVMWD will notify appropriate regulatory agencies.

Element 13.2: Measures to Ensure Appropriate Use Rate

In areas selected for molluscicide treatment, an in-house or contracted PCA checks applicable product label(s) for control efficacy. In collaboration with SGVMWD's staff to understand treatment objectives, the PCA prepares a written recommendation, including rates of application and any warnings or conditions to minimize impacts to non-target flora and fauna, if relevant. Licensed PCAs must complete 40 hours of continuing education every 2 years to stay licensed and therefore are up to date on the latest techniques for pest control.

Molluscicides are applied by or under the direct supervision of a certified applicator. These individuals are trained to confirm that molluscicide treatments are applied at rates consistent with label requirements in a manner that avoids potential adverse effects (including, but not limited to, fish kills), and follow proper application, storage, and disposal practices. Staff holding QACs and QALs must complete 20 hours of continuing education every two years to maintain certification.

All molluscicide treatments are made according to the product label in accordance with the regulations of the EPA, CalEPA, DPR, OSHA, and local Agricultural Commissioner. Additionally, all treatments of molluscicide will be made implementing industry standard equipment (e.g., chemical metering pumps equipped with interlocks and flow meters for enclosed pipes) to ensure that dosages do not exceed label maximum or targeted concentrations and target dosing rates are met.

Element 13.3: Application Coordination to Minimize Impact of Application on Water Users

Treated imported water from the DCAP is delivered to various treatment plants along its alignment, and discharges to the washes and channels tributary to the San Gabriel River. SGVMWD is prepared to notify any interested parties, agencies or entities of its activities under this permit. The notification can include information such as the type of molluscicide to be applied, treatment dates and relevant water use restrictions, as appropriate. As discussed in **Element 8**, gates, weirs, and other structures are closed to prevent discharge of residual pesticides as necessary.

Element 13.4: Restrictions on Public Access During Applications

SGVMWD do not have facilities open to the public during molluscicide treatment. As appropriate, facilities are posted with precautionary signage to advise water users about site-specific hazards or water use restrictions.

Element 13.5: Educating Staff and Applicators on Avoiding Any Potential Adverse Effects from Applications

All molluscicide treatments will be conducted by or under the direct supervision of the qualified applicator that will be knowledgeable of the potential adverse effects to waters of the U.S. from molluscicide use. Prior to application activities, the applicator will provide a pre-project briefing in the form of a meeting or tailgate safety talk to all participants involved in conducting the application activities. The briefing will include a description of planned treatment activities, discussion of precautions to be employed including personal protection equipment, expectation for response to accidental spill events, communication, coordination or other actions needed to prevent the discharge of treated water to unintended locations, and any other measures considered appropriate for safe and effective molluscicide treatment.

Element 14: Identification of the Problem

As described in the introduction, SGVMWD facilities are currently exposed to infestation by quagga and golden mussels. These invasive mussel species form dense beds that can obstruct and damage intake structures, pumps, pipelines, trash racks, screens, reduce flow or increase system roughness, and degrade infrastructure used to convey water and/or generate power. Descriptions of the invasive mussel species at risk of invading SGVMWD’s raw water system are found in **Table 4**.

Table 4: Characteristics and Description of Freshwater Invasive Mussel Species

Area of Focus	Golden Mussel *(Limnoperna fortunei)*	Zebra Mussel *(Dreissena polymorpha)*	Quagga Mussel *(Dreissena bugensis)*
Biology	Bivalve; byssal threads	Bivalve; byssal threads	Bivalve; byssal threads
Life Stages	Dioecious and can spawn multiple times a year in warm conditions. Peak reproduction period is between June and October. Ability to reproduce within first year of life. After spawning and fertilization, *L. fortunei* enter planktonic stage. Planktonic veliger stages (7 to 15 days). Then settle as plantigrade mussels, attaching to substrate. Most vulnerable to environmental conditions during planktonic veliger stage.	Dioecious. Egg development begins in the fall, release and fertilization occurs in the spring. Reproduction can occur continuously if water temperatures are warm enough. Ability to reproduce after two years for females. After fertilization (3-5 days) they enter veliger stage and are free floating for up to a month. Then settle as plantigrade mussels, attaching to substrate. Most vulnerable to environmental conditions during planktonic veliger stage.	Dioecious. Similar life stages as zebra; veligers, settler, adults. Reproduction from May – October (water temperatures greater than 12°C)
Environment	Rivers, streams, lakes, dams and estuaries. pH tolerance range 5.8-9.3. Capable of inhabiting brackish waters / estuarine habitats. Tolerant of polluted water, high salinity, low calcium and pH levels. Turbidity interferes with filter-feeding and attachment to substrate. Colonize most solid surfaces that are submerged. Some preferences to surfaces with algae.	Rivers, streams, lakes, dams and estuaries. Can be tolerant of anaerobic conditions for short periods. pH tolerance dependent on life stage (optimal adult growth is 7.4-8.0, larval survival =8.4.) North American populations require calcium concentrations 10 – 25 mg Ca2+/L. Low salinity tolerance. Turbidity interferes with filter-feeding and attachment to substrate. Colonize most solid surfaces that are submerged.	Freshwater rivers, lakes, and reservoirs. North American populations do not tolerate salinities more than 5 ppt. ability to attach to hard and soft surfaces. Found in depths of water up to 400 feet.

Area of Focus	Golden Mussel *(Limnoperna fortunei)*	Zebra Mussel *(Dreissena polymorpha)*	Quagga Mussel *(Dreissena bugensis)*
Impacts	Filter feeding capacity similar to Zebra mussels. Macrofouling and water clarity. Nutrient imbalance. May competitively release Microcystis and cause increased frequency of harmful algae blooms. Clogging pipes and water conveyance systems. Pseudofeces can cause corrosion. Damage to recreational/boating economies.	Filter nutrients and particulate suspended in water column. Outcompeting native species for nutrients. Increasing water clarity. Potential for macrophyte growths. Imbalance of N & P ratios in water column. Clogging pipes and water conveyance systems. Damage to recreational boating and fishing economies.	Filter feeding capacity similar to Zebra mussels. Macrofouling and water clarity. Nutrient imbalance. Accumulated organic pollutants are found in their pseudofeces and have potential of being passed further into the food chain or cause corrosion of infrastructure. Clogging pipes and water conveyance systems. Damage to recreational/boating economies.
Distribution	<u>Native:</u> Southeast Asia <u>Non-native:</u> South America (Brazil, Argentina, Paraguay, Uruguay). North America (California)	<u>Native:</u> Eastern Europe and Western Asia. <u>Non-native:</u> North America, including California (San Justo Reservoir)	<u>Native:</u> Eastern Europe. <u>Non-native:</u> North America, including California.

Element 15: Examination of Alternatives

Element 15.1: No action

Invasive freshwater mussels pose a serious threat to both infrastructure and aquatic ecosystems and are capable of infesting a wide range of aquatic habitats. Taking no action on control measures for invasive mussels in SGVMWD's raw water treatment and delivery infrastructure would result in an increased infestation level of invasive mussels. Invasive mussels will create adverse impacts on SGVMWD's operations and ability to deliver water to its member cities, which is unacceptable for a drinking water agency. These adverse impacts include the obstruction of water intake structures like pipelines and screens, ultimately preventing the conveyance of water and disrupting operations at water diversion points and water treatment facilities.

Element 15.2: Prevention & Monitoring

With the presence of quagga mussels in the CRA since 2007, the Foothill Feeder's source water - Castaic Lake - since 2021, and the continued detections of golden mussels in the SWP, prevention of invasive mussels throughout SGVMWD's system is no longer feasible. Management options will be chosen with the intent of asset-based protection and long-term facility operations, limiting downstream spread by managing water and slowing the spread of the current populations as feasible.

Table 5: Invasive Mussel Sampling Locations

SGVMWD Delivery Point Procedures Summary Matrix

Connection Point	Delivery Phase	Procedure	Timeframe and Frequency	Location	Lead Agency
Azusa Flow Control Structure, North Azusa Connection	Pre Delivery	Surface survey of facilities. Verify sampling points. Inspect and secure diversion structures. Conduct plankton tow.	1 week prior to delivery.	Azusa Canyon Flow Control Structure Outlet	Watermaster
		Plankton tow sampling.	1 week prior to delivery.	San Gabriel River Receiving Waters	Watermaster
	Delivery	Basin operated to a maximum elevation of 650 feet mean sea level. Storage limited to 7,300 acre-feet.	Ongoing during delivery.	Azusa Canyon Flow Control Structure Outlet	LACPW
		Monitoring of flow rates, water levels, and capacity.	Ongoing during delivery.	Azusa Canyon Flow Control Structure Outlet	LACPW and San Gabriel District.
	Post Delivery	Surface survey of facilities.	1 month post delivery.	Azusa Canyon Flow Control Structure Outlet	Watermaster
		Plankton tow sampling.	1 month post delivery.	San Gabriel River Receiving Waters	Watermaster
	Ongoing	Artificial substrate monitoring.	Every 3 months.	Azusa Canyon Flow Control Structure Outlet	Watermaster
		Dive Inspections and Manual Removal	As Needed	Azusa Canyon Flow Control Structure Outlet	Watermaster

Element 15.3: Mechanical/Physical Methods

Mechanical/physical controls are practices that kill, damage, or directly remove mussels and/or their shells, physically block or prevent entry of mussel shells into managed areas, or make the environment unsuitable to support their growth. Mechanical/physical control tools used or considered for use by SGVMWD are described below:

Element 15.3.1: Anti-fouling Coatings:

Anti-fouling coatings may be used on trash racks and other infrastructure vulnerable to biofouling by mussels. The coatings either possess inert properties that reduce or prevent mussel attachment or contain biocides such as cuprous oxide (Cu_2O) that slowly release copper ions when in aquatic settings. These coatings can prolong the time between necessary surface cleanings by inhibiting mussel macrofouling. Drawbacks to coatings include limitations on durability and life-span, and copper-based coatings may not be effective on golden mussels, which have shown higher tolerance than quagga or zebra mussels.

Element 15.3.2: Filters

Physical filtration options include mesh, bag, cartridge, or media filters that block and/or trap veligers and adult mussels when passing through. Effective filter sizes to prevent downstream spread of veligers range from 25-microns to 40-microns and for practical implementation, generally require a series of progressively smaller filters to get to this small pore size. Installation of self-cleaning filters ahead of other control methods like UV light may increase efficacy.

Element 15.3.3: Manual removal

Manual removal of mussels from pump intake structures, grates and racks, and other accessible infrastructure may be done from land or in-water by divers. Tools used to manually remove mussels include paint scrapers, long-handled poles mounted with a scraping device, and similarly constructed items. These methods of manual removal may be possible at selected hot-spot locations with significant mussel populations. Frequent removal efforts may result in decreased mussel density and biomass on infrastructure but have limited duration of effect when implemented. Given this, manual removal may be time and cost-prohibitive on a large scale.

Element 15.3.4: Pigging

Pigging can be used to dislodge mussels settled within pipelines. Pigging is accomplished by sending a specialized scraping device into enclosed piping to dislodge mussel accumulation within a pipeline. This approach results in the quick removal of accumulated mussels in areas where a pig can be deployed. It is a method of reducing mussel density, and while effective immediately, pigged pipes are prone to reinfestation from upstream sources of mussels. This control method must be employed at regular intervals to prevent pipes from becoming too occluded by mussels. Limitations include concerns with pigs becoming stuck and blocking pipelines, small radius bends in pipes, and the lack of appropriate piping infrastructure to launch and recover pigs. This method requires specialized equipment and modifications to SGVMWD's existing infrastructure.

Element 15.3.5: Hot Water Injection

The injection of hot water is currently being evaluated as a potential treatment option for the control of freshwater mussel infestations. Mussel mortality can occur quickly or slowly, depending on the temperature of injected water and contact time with targeted mussels. Experimental results show that temperatures effective to kill quagga and zebra mussels will be effective on golden mussels. When considering injection into full pipes, mussel mortality can be unpredictable as it is difficult to maintain consistent high temperatures through long pipelines, where thermal losses occur due to the pipeline material and the ambient water's heat capacity. Treatment often requires pipeline sections to be isolated, which is unfeasible for much of SGVMWD's water conveyance system.

Element 15.3.6: UV Radiation Exposure

A recent approach to preventing veliger settlement is the use of UV radiation. Exposure to UV-C radiation from medium-density UV bulbs has been demonstrated to result in mortality of mussels in the veliger life stage. UV units are typically installed to protect small (e.g., less than 14 inch) diameter piping as their effectiveness is limited by flow rate and pipe diameter, making them impractical for larger flow rates or large diameter pipes. To be effective, filters are installed upstream of UV units to remove any adults or translocating mussels and are connected to flow and ultraviolet light transmittance meters to ensure the appropriate dose is delivered to control veligers. Limitations in the implementation of this approach include fitting the unit and filters into existing plant infrastructure, providing sufficient power to run the units, and some on-going maintenance time and costs to clean filters and swap bulbs.

Element 15.3.7: Emerging Technologies

Electric Currents/Fields

The application of electric fields or currents in flowing water may be used with the intention of preventing mussel settlement or killing veligers that move through them. Results are reported to depend on water flow rate, voltage, and type of current used, with higher voltages correlating with higher veliger mortality. In larger water flows, the energy demands and high costs associated with effective mortality are often cost prohibitive and impractical. This approach has not been demonstrated to have consistent results; SGVMWD may consider this in the future if additional research shows some utility and relevance to its system.

Plasma Pulse Technology

Plasma sparkers have been developed and examined as a method to control mussels in pipelines. When activated, the device releases stored electrical energy between two electrodes (Miller 2000). A plasma channel is formed, which simultaneously creates a strong shockwave, steam bubble, and ultraviolet light in the surrounding water. The theory is that the plasma pulses may deter mussel settlement and kill veligers traveling between the electrodes. This technology has not been adopted at many locations, and its effect appears to be limited to pipelines and smaller confined waterbodies like sumps. Implementation of this technology is not anticipated to be effective or relevant to much of SGVMWD’s water conveyance system and is therefore not being considered.

Acoustic Energy and Vibration

The use of acoustic energy and vibration is an emerging control method that may be used to prevent mussel biofouling, and in some cases cause mortality after extended exposure. This technique is largely experimental to date and will require further studies on actual efficacy to prevent settlement before it can be applied to larger systems effectively.

Element 15.4: Cultural Methods

Cultural controls can generally be described as preventative measures that discourage mussel populations from developing by reducing the mussel’s ability to establish, reproduce, disperse, and survive. Cultural control tools used or considered for use by SGVMWD are described below.

Element 15.4.1: Desiccation

Facility outages that result in pipelines with mussel infestations being drained may allow for the desiccation and control of mussel populations over an extended period of time in dry conditions. While this approach has been largely successful in the CRA during its three-to-four-week annual maintenance shutdown, desiccation is unfeasible as a management option for delivery infrastructure such as the DCAP due to the physically isolated and enclosed environment provided by the pipeline itself. Additionally, golden mussels have exhibited a higher tolerance to desiccation compared to other invasive mussels and may require a drying-out period of 4 weeks for successful control. Even after an extended outage, enclosed pipelines may provide mussels with enough moisture to survive due to their high humidity level. This challenge further positions the use of copper treatment as a primary candidate for the incorporation of invasive mussel treatment into SGVMWD operations.

Element 15.5: Biological Control Agents

Biological control is the use of natural enemies or other species to manage pests, typically in an effort to restore, enhance, or mimic naturally occurring conditions. To date, there are no existing biological control agents that could be feasibly used by SGVMWD to control invasive mussels within its infrastructure.

Element 15.6: Molluscicides

SGVMWD has determined that a feasible option for the successful management of invasive freshwater mussels includes the use of chemical molluscicides. SGVMWD is considering the use of molluscicides containing the active ingredients copper sulfate pentahydrate in the aquatic pesticide known as "EarthTec QZ" that is registered for use by DPR and allowed by the Permit to control mussels.

Molluscicide formulations containing copper have proven to be effective at controlling invasive zebra and quagga mussel infestations throughout the United States. Investigation and testing on golden mussels in California have demonstrated efficacy, albeit at higher concentrations and longer exposure times than dreissenid mussels. The dosing of copper-based molluscicides can be effective when the concentration and exposure time (CET) is properly calibrated to expose the target mussels to a sufficient concentration of the cupric ion of copper, resulting in toxicity and eventual death. Generally, lower concentrations of copper molluscicide require longer exposure durations; a continuous injection of low-dose copper molluscicide into flowing water is typically necessary to meet the CET required to achieve the desired level of copper in the treatment area. Although copper is an essential trace nutrient that is required in small amounts by most living organisms, it can be toxic to non-target organisms at higher concentrations.

The molluscicide containing the active ingredient *Pseudomonas fluorescens* is also being considered by SGVMWD. Mussels ingest the material via filter feeding and the active ingredient destroys the epithelial cells in the digestive gland to kill the mussel. The active ingredient is quickly broken down in the environment and has no degradation byproducts. However, it may be cost-prohibitive for large scale treatments and it is not currently NSF/ANSI Standard 60 certified for use in drinking water systems.

SGVMWD will continue to review additional molluscicide options as products become available. Although not currently registered for use as a molluscicide in California, and therefore not permissible for use under the Permit, carbon dioxide (CO_2) and potassium chloride (KCl) have recently gained attention as promising treatment methods for the control of invasive mussels. Several advantages set CO_2 apart from existing treatment methods, including its lack of persistence in the environment, ability to be readily off-gassed or neutralized at the end of a treatment, and lower toxicity compared to several current-use molluscicides. In closed water delivery lines, infusion of low dose CO_2 can prevent veliger settlement, while higher concentrations can cause adult mussel detachment. KCl is a naturally occurring biocide that inhibits the sodium-potassium pump in mussels, ultimately leading to a fatal disruption in gas exchange and feeding abilities. KCl has demonstrated safety for special status fish, such as salmonids, and is non-toxic to non-mussel aquatic invertebrates and fish.

Element 16: Correct Use of Molluscicides

All treatments will be conducted by and/or under the direct supervision of the DPR-licensed Qualified Applicator License (QAL) or Qualified Applicator Certificate (QAC). The licensed application staff are knowledgeable and trained in the safe handling, proper use, label restrictions and precautions, storage, and application of molluscicide products, as well as their associated regulatory requirements. Treatments will follow the site-specific treatment plan and PCR prepared by a PCA.

SGVMWD uses qualified staff to conduct treatment monitoring to document water quality and mussel conditions before, during, and after application. Dose rates may be checked with field tests and/or analytical laboratory testing throughout the treatment area, or at select locations during treatment to ensure target concentrations are being met and maintained. Efficacy of treatments and the ability to meet treatment objectives will be evaluated after treatments are completed.

Element 17: Public Notice

Every calendar year, prior to the first application of molluscicides, SGVMWD will notify potentially affected water agencies, government agencies, and downstream water users. This notice will be sent via mail and/or posted on SGVMWD's website to advise potentially affected water users that they may be impacted by molluscicide treatments. It is not anticipated that there will be any water use restrictions following treatment based on the materials SGVMWD is considering using to manage invasive mussels.

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Limitations

The services used to prepare this document were performed consistent with the agreement with San Gabriel Valley Municipal Water District and were rendered in a manner consistent with generally accepted professional consulting principles and practices using the level of care and skill ordinarily exercised by other professional consultants under similar circumstances at the same time the services were performed. No warranty, express or implied, is included. This document is solely for the use of San Gabriel Valley Municipal Water District unless otherwise noted. **Any use or reliance on this document by a third party is at such party's sole risk.**

Appendix A

Molluscicide Application Monitoring/Sampling Forms

Molluscicide Application Monitoring/Sampling Form

Date: ______________________ Time Onsite: ________ to ________

Site Owner:

Owner Contact Phone:

Conditions Onsite
Temp: ______________
Wind: ______________
Weather: ______________

Point of Application

Name/Designation of Flow Infrastructure: ______________________________

Condition of Application Components/Hardware: ______________________________

____

Operational Status Upon Arrival

Flowing: ☐ Not Flowing: ☐

Most Recent Startup Date: ______________ Locked Out/Tagged Out? Yes ☐ No ☐

If Yes, Date on LO/TO: __________

Molluscicide Application

Application Product Description/Concentration: ______________________________

Dosage: ______________ Units: ______________

Current Reading on Metering Pump: ______________ Units: ______________

Current Remaining Level of Molluscicide Product: ______________ Units: ______________

Visual Confirmation of Product Application: ☐ Comments: ______________________________

____

____

Water Body Information:

Name: ______________________

Location on Owner's Property:

____

____

Type of Water Body/Conveyance:
Unlined Stream/River ☐
Engineered/Lined Channel ☐
Basin or Lake ☐
Other ☐ ______________

Water Quality Characteristics:

Temperature:	________	Units:	________
pH:	________		________
Turbidity:	________		________
Dissolved Oxygen:	________		________
Electrical Conductivity:	________		________

Agency/Entity Responsible for Application: ______________________________

I certify that the information enttered on this form are true, correct, and accurate to the best of my ability, and that all activities and operations performed onsite by by me conform to the descriptions, specifications and requirements set forth in the Aquatic Pesticide Application Plan by San Gabriel Valley Municipal Water District:

Applicator: ______________________

Date: ______________________