WASHINGTON DREISSENID MUSSEL RAPID RESPONSE PLAN

Version 2.0

WASHINGTON STATE
RECREATION AND CONSERVATION OFFICE
Washington Invasive
Species Council

Washington
Department of
FISH and
WILDLIFE

WASHINGTON DREISSENID MUSSEL RAPID RESPONSE PLAN

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INTRODUCTION

In 2007, both zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformis bugensis*) were found to have established populations west of the Rocky Mountains, and in 2016, the perimeter of the Pacific Northwest was breached when dreissenid veligers were detected in two Montana reservoirs.

The risk posed to the Pacific Northwest by the proximity of these new infestations is significant. This plan was developed in response to the increasing likelihood of the successful transport and introduction of these species into the State of Washington and Pacific Northwest. Although prevention remains the most cost-effective means of addressing potential infestations of aquatic invasive species, if prevention efforts fail, the State of Washington must be prepared to respond rapidly and effectively to minimize environmental and economic impacts and reduce the risk of spread.

The purpose of this plan is to identify prevention and contingency efforts to protect Washington's waters, aquatic resources, and facilities from the deleterious effects of dreissenid mussel establishment. This plan serves as a guidance document for natural resource managers to plan for and provide a rapid response effort to a dreissenid mussel infestation in Washington waters. This plan is intended to complement the *Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other Dreissena Species* drafted by the Columbia River Basin 100th Meridian Team as well as provide stand-alone guidance should mussels be found in Washington, but outside of the Columbia River Basin. This plan applies to all dreissenid mussels, although the current focus is on zebra and quagga mussels. Many of the strategies listed herein can be applied to rapid response efforts for other aquatic invasive species (AIS) of concern.[1]

[1] Although devised specifically to respond to dreissenid mussels, this plan should be useful for responding to any invasive freshwater animal. Freshwater plants fall under the purview of the Washington Department of Ecology (Aquatic Weeds Program) and are governed by different rules and regulations regarding response. Marine plants and animals will require unique considerations not included in this plan.

OBJECTIVES

This plan is designed to align with a comprehensive regional effort to protect aquatic resources in the Pacific Northwest by preventing the introduction of AIS, including dreissenid mussels, and employing detection strategies to discover incipient infestations early enough to facilitate successful eradication or control efforts.

Although eradication should always be the foremost goal of any rapid response plan, eradication may not always be feasible, especially in aquatic systems where removal and/or treatment can be challenging, if not impossible. In these cases, responders must determine which goals are attainable and cost-effective. The final response may have one of several possible goals, such as containing the invasion to a given area, suppressing population densities to reduce the rate of spread, prohibiting high-risk transport vectors, or in the worst-case scenario, developing adaptive strategies to co-exist with the invader.

There is a limited window of opportunity to respond once an introduction is suspected, or a population identified, thus it is imperative that the State of Washington have a plan outlining tasks, actions and responsibilities to increase response effectiveness. Such a plan is considered a "working" document, updated and/or revised to reflect new information and emerging technologies. The foundation for the response plan is the Incident Command System (ICS), a standardized protocol for cooperation and coordination among state and federal agencies as well as industry and others (visit the FEMA website to access the latest ICS forms: https://www.fema.gov/media-library/assets/documents/33584). It addresses:

- Responsibilities and authorities for rapid response beginning with the discovery of an introduction and continuing through containment and response.
- Long-term monitoring and control of infestations should eradication be deemed unfeasible.

Objectives include responding to and minimizing impacts of infestations of dreissenid mussels; providing timely and accurate information to managers, stakeholders and the general public; and providing for the safety of the public as well as all personnel involved at any stage of a response.

The response plan is divided into the following functional sections: pre-planning, initial response (incident action plan), and extended response.

BACKGROUND

Developing a state response to an AIS introduction, such as dreissenid mussels, requires an understanding of the threat, the existing AIS response framework, and the management and response capacity of the state. Although eradication should always be the foremost goal of any AIS rapid response plan, eradication is not always feasible, especially in aquatic systems in which removal and/or treatment can be challenging, if not impossible. In these cases, responders must identify attainable and cost-effective goals. The final response may have one of several possible outcomes, such as containing the invasion to a given area, suppressing population densities to reduce the rate of spread, prohibiting high-risk transport vectors, or in the least desirable scenario, developing adaptive strategies to co-exist with the invader.

In addition to the numerous options that can be considered as part of any rapid response, there are key steps integral to any such effort, including: (1) responding to and minimizing impacts of infestations; (2) providing timely and accurate information to managers, stakeholders and the general public; (3) providing for the safety of the public as well as all personnel involved at any stage of a response; and (4) coordinating with neighboring and regional jurisdictions on immediate response and long-term management, as appropriate. Developing a shared understanding of these important steps prior to a response is critical to effective prevention efforts, and greatly enhances the ability of jurisdictions to coordinate and cooperate.

Time is of the essence once a dreissenid introduction is suspected, or a population identified, thus it is imperative that Oregon have a plan outlining tasks, actions and responsibilities to increase response effectiveness. Such a plan is considered a "working" document, updated and/or revised routinely to reflect new information and emerging technologies.

The foundation for the response plan is based on the Incident Command System (ICS), a standardized protocol for cooperation and coordination among federal, state, and local governments, and other entities.

THE THREAT[2]

Zebra and quagga mussels are closely related filter-feeding freshwater mussels in the genus *Dreissena*. These bivalves produce free-swimming planktonic larvae that eventually settle out of the water column and attach to hard surfaces using byssal threads. First discovered in Lake Erie in 1988, dreissenid mussels have spread rapidly throughout North America and are found in all of the Great Lakes and many drainages in the Midwest, North Atlantic and Southwestern United States.

Dreissenid mussels are introduced into new water bodies through both natural and human-mediated transport. Natural dispersal occurs through larval drift, or by the transport of adults attached to floating objects. Human-mediated dispersal occurs through the movement of larvae in the ballast water tanks of vessels, via internal water stored in engine compartments of trailered boats, or via the movement of adults attached to the hulls of conveyances. Also, mussels may be introduced to new water bodies in contaminated bait livewells and fishery stocking programs.[3, 4]

Adult mussels may survive out of water up to five days in dry environments and for several weeks in wet areas and compartments of boats, motors, trailers, and other conveyances, making overland transport by recreational boaters a high-risk pathway for the introduction of zebra and quagga mussels into Washington waters.[5, 6] The chance of establishment of aquatic invasive species by overland transport increases by a factor of the square of the distance from existing populations.[7]

Many factors contribute to the risk of dreissenid introduction and establishment, including environmental parameters (e.g., dissolved calcium, pH), and the extent and types of public usage (e.g., total day use, presence of boat ramps and marinas, proximity to transportation corridors, motorized boating, fishing). Boat transport from contaminated waters is the most likely pathway of introduction

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[2] Excerpted and revised from the OISC Zebra Quagga Mussel Risk Assessment http://www.oregon.gov/OISC/calendar_may10.shtml

[3] Johnson L.E, A. Ricciardi, and J.T. Carlton. 2001. Overland dispersal of aquatic invasive species: a risk assessment of transient recreational boating. *Ecological Applications* **11**(6):1789–1799.

[4] Karatayev, A. Y., D.K. Padilla, D. Minchin, D. Boltovskoy, and L.E. Burlakova. 2007. Changes in global economies and trade: the potential spread of exotic freshwater bivalves. *Biological Invasions* **9**:161–180.

[5] Johnson L.E, A. Ricciardi, and J.T. Carlton. 2001. Overland dispersal of aquatic invasive species: a risk assessment of transient recreational boating. *Ecological Applications* **11**(6): 1789–1799.

[6] Timar, L., and D.J. Phaneuf, 2009. Modeling the human-induced spread of an aquatic invasive: The case of the zebra mussel. *Ecological Economics* **68**(12):3060–3071.

[7] Leung, B., J.M. Bossenbroek, and D.M. Lodge. 2004. Boats, Pathways, and Aquatic Biological Invasions: Estimating Dispersal Potential with Gravity Models. *Biological Invasions* **8**(2): 241–254.

to new water bodies in Washington.[8, 9, 10, 11] Once introduced, pH and calcium concentrations are likely to determine the success of the introduction. These factors are considered critical environmental parameters for dreissenid mussel survival and growth.[12, 13]

Once established, dreissenid mussels can dramatically alter the ecology of a water body and associated fish and wildlife populations. As filter feeders, they remove phytoplankton and other particles from the water column, reducing the availability of important food resources to other species.[14] Native mussels are significantly threatened by the presence of invasive mussels. By attaching themselves to the surfaces of other bivalves, dreissenid mussels can starve freshwater mussels and drive indigenous populations to local extinction. Dreissenid mussels can also reduce dissolved oxygen through respiration[15]—which affects the ability of other species to survive in those water bodies—and dissolved calcium carbonate concentrations through shell building[16]—which causes a water body to become more alkaline, stressing aquatic organisms who require a certain pH range for optimal growth and survival.[17]

Dreissenid mussels can cause substantial economic damage by infesting municipal, industrial, and agricultural water systems and attaching themselves to the hard substrates of pipes, dams, and diversion pathways. This restricts the flow of water through the systems impacting component service life, system performance, and maintenance activities. The annual cost to power plants and municipal

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[8] Lucy, A., J. Buchan, and D.K. Padilla, 1999. Estimating the Probability of Long Distance Overland Dispersal of Invading Aquatic Species. *Ecological Applications* **9**(1):254–265.

[9] Frischer, M.E., B.R. McGrath, A.S. Hansen, P.A. Vescio, J.A. Wyllie, J. Wimbush and S.A. Nierzwicki-Bauer, 2005. Introduction Pathways, Differential Survival of Adult and Larval Zebra Mussels (*Dreissena polymorpha*), and Possible Management Strategies, in an Adirondack Lake, Lake George, NY. *Lake and Reservoir Management* **21**(4):391–402.

[10] Johnson L.E, A. Ricciardi, and J.T. Carlton. 2001. Overland dispersal of aquatic invasive species: a risk assessment of transient recreational boating. *Ecological Applications* **11**(6): 1789–1799.

[11] Karatayev, A. Y., D.K. Padilla, D. Minchin, D. Boltovskoy, and L.E. Burlakova. 2007. Changes in global economies and trade: the potential spread of exotic freshwater bivalves. *Biological Invasions* **9:**161–180.

[12] Hincks, S.S. and G.L. Mackie. 1997. Effects of pH, calcium, alkalinity, hardness, and chlorophyll on the survival, growth, and reproductive success of zebra mussel (*Dreissena polymorpha*) in Ontario lakes. *Can. J. Fish. Aquat. Sci.* **54:**2049–2057.

[13] McMahon, R.F., 1996. The Physiological Ecology of the Zebra Mussel, *Dreissena polymorpha*, In *North America and Europe. Amer. Zool.* **36:**339–363.

[14] Sousa, R., J.L. Gutiérrez, and D.C. Aldridge, 2009. Non-indigenous invasive bivalves as ecosystem engineers. *Biological Invasions* **11**(10):2367–2385.

[15] Strayer, D.L., 2009. Twenty years of zebra mussels: lessons from the mollusk that made headlines. *Front Ecol. Environ.* **7**(3): 135–141.

[16] Ibid.

[17] http://www.uri.edu/ce/wq/ww/Publications/pH&alkalinity.pdf

drinking water systems in North America has been estimated between $267 million and $1 billion dollars.[18, 19]

Establishment of dreissenid mussels in the Columbia River Basin (CRB) would be expensive, requiring extensive maintenance to the nuclear power plant and hydroelectric dams, fish ladders, fish bypass facilities, navigation locks, and irrigation pumping. In an economic impact report prepared for Bonneville Power Administration, the one-time cost to install mussel treatment systems was estimated at more than $23 million dollars and annual costs were estimated at $1.5 million.[20] Because of the high value of fishery and aquatic resources in the CRB, and because no controls exist for mussels in open natural systems, the ecological costs of a CRB invasion could be much larger than other costs.[21]

[18] Connelly N., C.R. O'Neill, B.A. Knuth, and T.L. Brown. 2007. Economic Impacts of Zebra Mussels on Drinking Water Treatment and Electric Power Generation Facilities. *Environmental Management* **40**(1): 105–112.

[19] Pimentel, D., 2005. Aquatic Nuisance Species in the New York State Canal and Hudson River Systems and the Great Lakes Basin: An Economic and Environmental Assessment. *Environmental Management* **35**(5):692–701.

[20] Independent Economic Analysis Board. 2010. Economic Risk Associated with the Potential Establishment of Zebra and Quagga Mussels in the Columbia River Basin. Task Number 159. Document IEAB 2010-1. 79pp. (See next citation, also).

[21] Independent Economic Analysis Board. 2013. Invasive Mussels Update: Economic Risk of Zebra and Quagga Mussels in the Columbia River Basin. Task Number 201. Document IEAB 2013-2. 42pp.

THE COLUMBIA RIVER BASIN INTERAGENCY INVASIVE SPECIES RESPONSE PLAN

In 2008, the 100th Meridian Initiative's Columbia River Basin Team drafted a *Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other Dreissenid Species* (CRB RRP).[22] The purpose of the CRB RRP is to coordinate a rapid, effective, and efficient interagency response to delineate, contain, and when feasible, eradicate zebra, quagga, and other dreissenid mussel populations if they are introduced into CRB waters. The plan is updated on a continual basis to ensure the information, particularly notification lists, is current.

The CRB RRP includes 10 response objectives to delineate and control zebra, quagga, and other dreissenid mussel populations if detected in the CRB.

Rapid Response Objectives:

1. Make initial notifications (Appendix C of the CRB RRP)—Priority 1 contacts are notified when a report is received of live *dreissenids* within the CRB.
2. Activate appropriate organizational elements of the CRB RRP
3. Verify reported introduction
4. Define extent of colonization
5. Establish external communications system
6. Obtain and organize resources
7. Prevent further spread via quarantine and pathway management
8. Initiate available/relevant control actions
9. Institute long-term monitoring
10. Evaluate the response and the plan

Of the 10 objectives presented, six of them rely on action or planning and response by the state invasive species coordinator or the lead agency with response authority as determined by the location of the infestation.

[22] http://100thmeridian.org/ActionTeams/Columbia/CRB%20Dreissenid%20Rapid%20Response%20Plan%20OCTOBER%201%202008.pdf

AQUATIC INVASIVE SPECIES REGULATIONS IN WASHINGTON

In 2002, the Washington State Legislature began addressing the issue of interstate travel of aquatic invasive species (AIS)-contaminated watercraft by passing Engrossed Substitute Senate Bill (ESSB) 6553. The legislation in ESSB 6553 required WDFW and the Washington State Patrol (WSP) to develop a cooperative plan for inspecting watercraft entering the state in an effort to interdict AIS. This resulted in the development of a "Cooperative Boat Inspection Plan" which began to provide a framework for the effort of interdicting AIS entering Washington State.

In 2005, the AIS Prevention and Enforcement Programs were established by the Washington Legislature. The program, co-managed by WDFW and WSP and funded through dedicated fees on residential watercraft (ESSB 5699), has produced many outcomes since 2005, including outreach and education, watercraft inspection stations, monitoring for the presence of dreissenids, and response to incidents of watercraft entering the state. However, the program has also faced significant challenges, including budget reductions and the jurisdictional uncertainty associated with regulation of invasive species as a result of the numerous scattered state laws throughout Title 77 RCW.

In 2014, legislation (Appendix I) passed that amends existing regulations, adds new authorities, and prescribes penalties associated with the management of invasive species. Much of this legislation helps to address the challenges faced by the AIS Prevention and Enforcement Programs since their inception. Specifically, the law:

- Creates a unified single invasive species chapter and fill management authority gaps;
- Provides greater authority to implement the invasive species program through rules;
- Clarifies WDFW's role and responsibilities in providing a rapid response to infestations by animal invasive species;
- Allows WDFW to close or limit activities on infested waters; and
- Provides WDFW with clear authority to decontaminate, seize, or quarantine watercraft or other property suspected of containing invasive species.

In the 2014 legislation, the State of Washington established a new AIS classification system framework (interim classifications listed below exist until new rules are adopted by WDFW):

- *Prohibited Species.* Prohibited species are a priority for prevention and management actions. There are three categories of prohibited species: level 1 species pose a high invasive risk and are a priority for prevention and rapid response actions; level 2 species pose a high invasive risk and are a priority for infested site management; and level 3 species pose a moderate to high invasive risk and may be appropriate for prevention or management action; and

- *Regulated Species.* There are three classifications for regulated species. Type A species pose a low to moderate invasive risk and have a beneficial use; type B species pose a low or unknown risk and are used for personal or commercial uses, such as aquariums; and type C species pose a low or unknown risk and do not qualify as a type B species.

WASHINGTON AIS MANAGEMENT AND RESPONSE

AUTHORITY, LEADERSHIP AND ORGANIZATION

Agencies and entities authorized to respond to a discovery of dreissenid mussels will largely depend on the location of the initial discovery. The six state natural resource agencies with key WA RRP roles and responsibilities are noted below. Other local, state, tribal, and federal entities and agencies that may have WA RRP roles and responsibilities, though not intended to be a full representation, are listed in Table 1.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE (WDFW)

Charged with managing wildlife by preventing the depletion of indigenous species while providing optimum recreational benefits, WDFW is the lead state agency tasked with managing invasive species, excluding pests, domesticated animals, livestock managed by the Department of Agriculture, forest invasive insect and disease species managed by the Department of Natural Resources, and mosquito and algae control and shellfish sanitation managed by the Department of Health. Primary lead agency responsibilities include developing and implementing invasive species programs, establishing and maintaining outreach and education programs, managing invasive species, providing technical assistance, and researching and developing management tools and standards to decontaminate aquatic conveyances and controlling or eradicating invasive species. WDFW classifies prohibited species according to three levels:

- Level 1: High invasive risk and a priority for prevention and expedited rapid response management actions.
- Level 2: High invasive risk and a priority for long-term infested site management actions.
- Level 3: Moderate to high invasive risk and may be appropriate for prevention, rapid response, or other prohibited species management plan actions.

Dreissenids are classified as a prohibited Level 1 species in the State of Washington. These species may not be possessed, introduced on or into a water body or property, or trafficked, without WDFW authorization, a permit, or as otherwise provided by rule.

WASHINGTON STATE PATROL (WSP)

The Washington State Patrol, through its enforcement liaison in the Commercial Vehicles Division, co-manages the Aquatic Invasive Species Prevention and Enforcement Programs in Washington. Agency staff is trained to inspect commercially-hauled conveyances at state Port of Entry weigh stations.

WASHINGTON DEPARTMENT OF ECOLOGY (ECOLOGY)

The Washington Department of Ecology (Ecology) is the delegated authority for National Pollutant Discharge Elimination System (NPDES) permitting in Washington, which provides for the use of physical and chemical treatments in managing aquatic invasive species. The Department also manages the states' Aquatic Weeds Program, surveying Washington lakes annually to document density and species of aquatic plants in each water body and disbursing grants to state and local governments and technical support to address freshwater invasive plants statewide.

WASHINGTON DEPARTMENT OF NATURAL RESOURCES (WDNR)

The Department of Natural Resources manages an Invasive Species Program to preserve and protect the value and ecological integrity of unaffected and minimally-affected state-owned aquatic lands by eliminating small noxious weed infestations, and eradicating or reducing large-scale infestations so that they no longer threaten native fish and wildlife and their habitats as well as industry and other public interests.

WASHINGTON INVASIVE SPECIES COUNCIL (WISC)

The Washington Invasive Species Council (WISC) provides policy-level direction, planning, and coordination for combating harmful invasive species throughout the state and preventing the introduction of others that may be potentially harmful. Members include representatives from federal, state, and local governments, one tribe, and one nonprofit organization.

WASHINGTON DEPARTMENT OF AGRICULTURE (WSDA)

The Washington Department of Agriculture (WSDA) participates in control and eradication of invasive aquatic plants (e.g., *Spartina*), conducts surveys and eradication programs, and is the lead authority for regulating pesticides in the State of Washington.

Table 1. Agencies and entities with AIS management and coordination responsibilities or interests in Washington and/or regionally (entities listed in bold have primary responsibility for dreissenid mussel management and response in Washington).

Bureau of Land Management (BLM)	Washington Invasive Species Council (WISC)
Bureau of Reclamation (BOR)	Washington State Parks and Recreation Commission
Bonneville Power Administration (BPA)	Washington Sea Grant (WSG)
City and County Governments	Washington State Patrol (WSP)
Columbia River Basin 100th Meridian Team	Pacific States Marine Fisheries Commission (PSMFC)
Columbia River Intertribal Fish Commission (CRITFC)	Ports
Individual Tribes in Washington	US Army Corps of Engineers (USACE)
National Park Service (NPS)	US Department of Agriculture (USDA)
NOAA Fisheries	US Environmental Protection Agency (EPA)
Northwest Power and Conservation Council (NWPCC)	US Fish and Wildlife Service (USFWS)
Washington Department of Agriculture (WSDA)	US Geological Survey (USGS)
Washington Department of Ecology (Ecology)	USDA Forest Service (USFS)
Washington Department of Fish and Wildlife (WDFW)	Western Regional Panel on Aquatic Nuisance Species (WRP)
Washington Department of Natural Resources (WDNR)	

INDIVIDUAL TRIBES IN WASHINGTON

Several Indian tribes in Washington hold Sovereign authority to govern their people and their resources. Certain tribes are authorized to develop regulations under the Clean Water Act and other federal statutes. The Columbia River Basin benefits from the existence of the Columbia River Inter-Tribal Fish Commission (CRITFC), which coordinates management policy and provides fisheries technical services for the Yakama Nation, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederation Tribes of the Umatilla Reservation, and Nez Perce tribe. The CRITFC Aquatic

Invasive Species Coordinator collaborates with federal, state, and local government partners on a variety of invasive species issues through forums, such as the Western Regional Panel, state invasive species councils, Pacific Northwest Economic Region, and the 100th Meridian Initiative CRB Team. Any introduction of dreissenids in the CRB on tribal land would launch the Quagga-Zebra Mussel Action Plan and the involvement of the CRITFC AIS Coordinator. On tribal lands within the State of Washington but outside the CRB, the CRITFC AIS Coordinator would play a liaison role with CRB partners and the affected sovereign Tribe.

Funding and Resources

ESSB 6040 establishes an aquatic invasive species management account and aquatic invasive species enforcement account within the Washington State Treasury, however the legislation passed without any funding mechanisms. The bill passed without any funding mechanism, creating a significant gap in the ability of the State of Washington to prepare for and rapidly response to a dreissenid introduction.

The CRB RRP charges that all signatories to the plan develop and maintain a list of resources in the event of a dreissenid introduction.

Quarantine Establishment and Enforcement

To prevent or slow the spread of dreissenid mussels, it may be necessary to mobilize a quarantine or emergency closure of the affected water body immediately upon the detection and verification of an introduction. This may be difficult, if not impossible, in large open water bodies, or flowing systems, such as rivers, and water bodies that span multiple jurisdictions. Various management actions may require quarantine authority to protect other areas from infestation or to slow spread in a regional context.

Although closure may be impractical for larger water bodies, there may be isolated water bodies or unique infestation scenarios that provide for the ability to quarantine an area. The ability to close or limit ingress and/or egress to all vehicles and equipment capable of carrying dreissenid mussels and to maintain closures or limited (controlled) access until an acceptable management plan has been developed and implemented is critically important.

The legislation that passed in 2014 includes Section 107, which provides authority to WDFW to declare a quarantine against a water body, property, or region within the state, and prohibit or condition the movement of aquatic conveyances and waters from such a quarantined place or area likely to contain a prohibited level 1 or level 2 species. If a dreissenid infestation is found in Washington and incident management capability or technical expertise to conduct quarantine and pathway management tasks

does not exist or is insufficient to address the situation, WDFW may formally delegate that responsibility to the CRB Interagency Rapid Response Team.[23]

Environmental Regulatory Compliance

The success of any eradication effort aimed at dreissenid mussels will depend on the availability of tools for rapid response. A combination of pre-planning efforts and adaptability to advances in control technology and efforts by other entities will be needed. Contingency planning exercises will allow managers to determine what tools will be appropriate to which areas, whether or not environmental compliance standards have been met (Appendix IV), and what regulatory compliance and permitting actions are required prior, during, and following control tactic operations.

If (in accordance with integrated pest management (IPM) principles) it is determined that pesticides will be required to meet the eradication or control objectives, then applications must comply with regulatory processes as outlined in Appendices III and IV. In particular, pesticide applications to waters of the state must meet the terms and timelines identified by both the state Clean Water Act (CWA)/National Pollutant Discharge Elimination System (NPDES) pesticide general permit (administered by Ecology), as well as product label directions and restrictions identified under the Federal Insecticide Fungicide Rodenticide Act (FIFRA) as administered by the Washington Department of Agriculture. For products not currently registered for aquatic use in Washington (or at application rates necessary for mussel eradication), emergency exemption FIFRA labels may be attained by requests made to WSDA.

If an infestation occurs in habitat that supports threatened and endangered species, NEPA and Endangered Species Act consultation will be required with appropriate state and federal agencies prior to implementing any control measures.

[23] http://www.100thmeridian.org/ActionTeams/Columbia/CRB_Dreissenid_Rapid_Response_Plan_September_19_2011.pdf

PRE-PLANNING

STREAMLINING A RESPONSE TO AN INTRODUCTION OF DREISSENIDS

Preparing for an eventual introduction of dreissenids is critical to ensuring the appropriate permits and protocols are in place to allow for rapid response actions. Ecology and WSDA are key agencies involved in the permitting and protocol processes. See Table IV1 in the Appendix for the *Pesticide Use Matrix For an Isolated Zebra Mussel Infestation in Washington's Columbia River Basin*. The table includes details on the State Environmental Policy Act (SEPA) and other regulatory regimes.

The following provides information about required permits and registration of pesticides likely to be used in a rapid response scenario for dreissenids, including a set of recommendations to best position the State of Washington for such an occurrence.

- Discharges of pesticides to waters of the states requires a National Pollution Discharge Elimination System (NPDES) permit. The Environmental Protection Agency (EPA) authorizes the State of Washington to administer NPDES permits through the Washington Department of Ecology (Ecology).
- If the State is the lead agency in a response and is operating under Washington's Pesticide General Permit (PGP), then all treatments throughout the State, including federal lands would be included within that permit.
- Applications made on Tribal sovereign nation lands would require an EPA Pesticide General Permit.

Options exist for how Columbia River Basin states could navigate through permitting requirements to respond to an introduction of invasive mussels, from the development of a Habitat Conservation Plan or programmatic Environment Impact Statement to using existing emergency procedures, such as a Section 18 (see below). The EPA registers all pesticides under the federal insecticide, fungicide, and rodenticide act of 1979 (FIFRA), which assures pesticides are properly labeled and will not cause harm to the environment if used in accordance with label.

- Section 3 FIFRA – EPA has reviewed and approved information and uses on product label.
- Section 24(c) FIFRA – allows states to grant registrations for additional uses of a product to meet local needs – for sites already listed on the label. Oregon and Washington do not have Section 3 registrations for the most commonly used pesticides that would be used to control invasive mussels.
- Section 18 – states, or the region, may petition EPA for section 18 emergency exemption from full section 3 registration – temporarily expands the terms of the pesticide label to include additional emergency uses – users must obtain directions from lead agency. A

Section 18 can be applied for regionally whereas Special Local Needs must be applied for on a state-by-state basis.

A joint programmatic opinion from NOAA and the USFWS is likely not the best approach for the region because of the potential number of locations where an introduction of dreissenids may occur and the complex issues associated with numerous sensitive, threatened, and endangered species that are known to exist in the State of Washington. To facilitate a more streamlined, realistic approach to working with key federal partners to address a dreissenid introduction, the Pacific States Marine Fisheries Commission, in concert with NOAA and the USFWS, is exploring other models that have similar elements to a mussel response, e.g., oil spill response, to identify best options for how CRB states could navigate through permitting requirements, especially those associated with threatened and endangered species (e.g., salmonids) to quickly respond to an introduction of invasive mussels. Likely options would require:

- Best management practices for the mainstem Columbia River and tributary watersheds.
- Inclusion of terrestrial species in terms of potential effects of a control action.
- Identification of pesticides that would most likely be used in a control action.
- Identification of sensitive, threatened, and endangered species in the control area (and downstream of the control area, if applicable).
- Addressing downstream habitats and how they might be affected by control actions.
- Setting goals and geographic scope to any likely control action.

Recommendations

- Pesticide Registration— To discharge a pesticide to waters of the state to control invasive mussels in Washington, the pesticide product must be registered by the state (WSDA), have a legal use in Washington, and be included in the states' NPDES General Permit. In addition, the applicator has to be covered under the NPDES permit.
    - WSDA staff have reviewed the list of products registered by WSDA, and should take steps to register new and emerging products (e.g. Zequanox®) designed to control invasive mussels with minimal impacts to non-target species.
    - As of April 2014, WDFW is now covered under Washington's NPDES permit and should take steps to ensure all aspects of the NPDES permit reflect control activities most likely to occur in the event of an introduction.
    - Washington should maintain an updated list of its impaired waterbodies (303d listings) and be aware of additional constraints on pesticide products that may be used if the waterbody being treated is on the list.
    - Washington has 21 products registered with Section 3 label registration for control of mussels (as well as supplemental distributor registrations). Although this list represents a list of products that could be used, Washington should refine and

maintain a list of Section 3 pesticides that would most likely be used to control an introduction of invasive mussels.

- At the time of this publication, registered Section 3 pesticides that would most likely be used to control an introduction of invasive mussels in the CRB include:
  - Copper-based algaecides
    - Copper sulfate; copper carbonate
  - Endothal
  - Potassium salts
  - Bacterial toxins
  - Pseudomonas fluorescens (Zequanox®)

- State and federal authorities have described critical habitat areas or times of the year when specific pesticides cannot be applied. For example, juvenile salmon and ESA-listed species must not be present at the time of treatment with Endothal is being applied. This list of recommended treatment windows should be maintained.

- PDMP—Ensure that Washington's Pesticide Discharge Management Plan is updated and includes the types of pesticides and control options that would likely occur upon an introduction of invasive mussels.

- Funding—It is imperative to identify sources of funding to initiate control and monitoring actions in advance of an introduction.

Early Detection and Rapid Response

Early detection is the key to successful rapid response. Early detection often provides the only chance at eradication, especially for aquatic invasive species, which are notoriously difficult to eradicate, successfully control or manage. The cost to respond to a population that was not detected during early stages of an invasion increases exponentially over time.

EARLY DETECTION EFFORTS

Early detection of dreissenid mussels relies upon the discovery of either veligers in the water column or juveniles and adults colonizing hard substrates. Washington has thousands of lakes—there are limited resources available for early detection. Efforts must be focused on high-risk water bodies—those with both high risk of introduction and risk of establishment should receive the highest monitoring priority.

HIGH RISK WATER BODIES[24]

Recreational boating is the primary vector for overland transport of mussels and increases the risk of inter-basin dreissenid introduction.[25, 26, 27] The ongoing discovery of recreational trailered-watercraft with attached mussels in the CRB, and throughout the western United States, corroborates the importance of this vector. Total day use of a water body, presence of boat ramps and marinas, water body size and access, and the presence of motorized boating and fishing activities, including angling tournaments that attract boats from outside the Pacific Northwest, are important risk determinants.

The risk of dreissenid establishment is also influenced by environmental parameters, such as dissolved calcium, pH, water temperature, salinity, dissolved oxygen, and substrate. Veliger survivorship increases from 3% at 12 mg Ca^{2+}/L to 20–25% at 47 mg Ca^{2+}/L.[28] North American dreissenid juveniles show initial growth at calcium concentrations between 8.5 and 11 mg Ca^{2+}/L[29, 30] and moderate shell growth between 25 and 26 mg Ca^{2+}/L.[31] In general, dreissenid adults inhabit waters with calcium concentrations greater than or equal to 15 mg Ca^{2+}/L, and populations become dense at concentrations greater than or equal to 21 mg Ca^{2+}/L.[32] Dissolved calcium concentrations and

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[24] Wells, S., T.D. Counihan, A. Puls, M. Sytsma and B. Adair. 2010. Prioritizing Zebra and Quagga Mussel Monitoring in the Columbia River Basin Prepared for Bonneville Power Administration and the Pacific States Marine Fisheries Commission BPA Contract Number: 00003373 TI Project Number: 152.

[25] Lucy, A., J. Buchan, and D.K. Padilla, 1999. Estimating the Probability of Long Distance Overland Dispersal of Invading Aquatic Species. *Ecological Applications* **9**(1):254–265.

[26] Johnson L.E, A. Ricciardi, and J.T. Carlton. 2001. Overland dispersal of aquatic invasive species: a risk assessment of transient recreational boating. *Ecological Applications* **11**(6): 1789–1799.

[27] Karatayev, A. Y., D.K. Padilla, D. Minchin, D. Boltovskoy, L.E. Burlakova. 2007. Changes in global economies and trade: the potential spread of exotic freshwater bivalves. *Biological Invasions* **9**:161–180.

[28] Sprung, M. 1987. Ecological requirements of developing *Dreissena polymorpha* eggs. *Archiv für Hydrobiologie Supplement* **79:**69–86.

[29] Hincks, S.S. and G.L. Mackie. 1997. Effects of pH, calcium, alkalinity, hardness, and chlorophyll on the survival, growth, and reproductive success of zebra mussel (*Dreissena polymorpha*) in Ontario lakes. *Can. J. Fish. Aquat. Sci.* **54:**2049–2057.

[30] McMahon, R.F., 1996. The Physiological Ecology of the Zebra Mussel, *Dreissena polymorpha*, in North America and Europe. *Amer. Zool.* **36**:339–363.

[31] Ibid.

[32] Ibid.

pH are likely the most limiting environmental parameters to dreissenid establishment in the CRB and greater Northwest.[33, 34] Water temperature is not expected to limit growth, as dreissenids inhabit a wide range of temperatures in North America. They are found in the Great Lakes at temperatures less than 5°C, and in the lower Mississippi where temperatures reach and exceed 30°C.[35]

Table 2 is a prioritized partial listing of water bodies for dreissenid monitoring in Washington (for complete table, see Appendix VI). The prioritization is based on an assessment of the relative risk of introduction and establishment of dreissenids into individual lakes, reservoirs, and rivers.

Dreissenid mussel surveys of water bodies with the greatest risk of introduction and establishment should employ standardized protocols for the examination of solid surfaces and sediment samples for adult mussel detection, plankton samples for veliger analysis, and shoreline walks to search for mussel shells, particularly in reservoirs that have been drawn down.

[33] Hincks, S.S. and G.L. Mackie. 1997. Effects of pH, calcium, alkalinity, hardness, and chlorophyll on the survival, growth, and reproductive success of zebra mussel (*Dreissena polymorpha*) in Ontario lakes. *Can. J. Fish. Aquat. Sci.* **54:**2049–2057.

[34] McMahon, R.F., 1996. The Physiological Ecology of the Zebra Mussel, *Dreissena polymorpha*, in North America and Europe. *Amer. Zool.* **36:**339–363.

[35] Ibid.

Table 2. Interim list of top 11 high-risk water bodies in Washington based solely on water chemistry and boat use data.[36] Detailed information about the top five water bodies can be found in Appendix VII.

Water Body Name	Ca++ mg/L	pH	Risk of Establishment	Risk of Introduction
Moses Lake	30.5	8.18	High	High
Potholes Reservoir outflow	28.3	8.14	High	High
Pend Oreille River	20.1	-	Medium	High
Lake Washington, inflow	18.8	7.77	Medium	High
Banks Lake	17.8	7.90	Medium	High
Columbia River, Lake Celilo	16.8	-	Medium	High
Columbia River, Lake Bonneville	16.5	8.11	Medium	High
Clear Lake	16.4	8.47	Medium	High
Williams Lake	20.5	7.39	Medium	Medium
Columbia River, Lake Wanapum	18.1	8.02	Medium	Medium
Lake Crescent	15.9	6.94	Medium	Medium

VERIFICATION AND INITIAL RESPONSE TO DREISSENIDS AND OTHER AIS REPORTS

Determining the credibility of any AIS report and further verifying an AIS or dreissenid mussel introduction can be difficult and time consuming. The initial response to an AIS report, including that of dreissenids, depends on protocols and steps established before any introduction. Clearly anticipating the nuances of any report can be difficult, and final determination of status/action is ultimately determined by the AIS Coordinators. Guidelines have been established for verifying a report, assigning a status to water bodies of concern, and addressing the tasks associated with each status level to facilitate the objectives of the CRB Plan as well as prepare for a complete response to a positive introduction. Steps are primarily focused on information gathering and preventing further spread while awaiting final confirmation of dreissenid or other AIS presence.

VERIFY REPORTED INTRODUCTION

Washington has an interim process relative to positive mussel identification (Table 3). The process assigns a status level to the water body in question and sets forth a list of corresponding actions to be

[36] Wells, S., T.D. Counihan, A. Puls, M. Sytsma and B. Adair. 2010. Prioritizing Zebra and Quagga Mussel Monitoring in the Columbia River Basin Prepared for Bonneville Power Administration and the Pacific States Marine Fisheries Commission BPA Contract Number: 00003373 TI Project Number: 152.

undertaken by the AIS coordinators as the verification proceeds. Figure 2 shows a mock timeline of how these actions might unfold along the report verification timeline.

The verification process is divided into categories based on life stage and identification technique involving an adult mussel or veliger discovered under cross-polarized light microscopy (XPLM), which is subdivided to allow for various levels of confidence within each type of sample/report.

After an initial detection report is received and evaluated by the AIS coordinators, the verification matrix is activated. In an ideal situation, no more than 7 business days elapse between the results of the initial notification and the verification step. In reality, times will likely vary divergently on a case-by-case basis.

If the verification results are contradictory or vague, the status of the water body will remain "Inconclusive" until further verification results are available. The status remains "Inconclusive" until a rationale is provided and accepted. This may require additional sampling the following season or reevaluating archived samples from the water body. This will be undertaken on a case-by-case basis by an advisory team assembled by the Washington AIS coordinator.

If further verification efforts fail to confirm the initial detection, the Washington AIS coordinator may evaluate the situation and determine if down-grading the status of the water body or further research/exploration is warranted and in accordance with the de-listing protocols below.

It should be noted that verified reports for the presence of dreissenid veligers or a single adult mussel does not indicate that a water body is "positive" for a mussel infestation or "infested" i.e. supports a reproducing mussel population (see definitions below).

Current definitions for water body status categories and requirements for delisting are as follows:

Definitions:

- **Verification** – the scientifically-based process to confirm the presence of Aquatic Invasive Species (AIS).
- **Detect or detected** – the verified presence of AIS.

Water body definitions:

- **Status Unknown** – Waters that have not been monitored.
- **Undetected/Negative** - sampling/testing is ongoing and nothing has been detected, or nothing has been detected within the time frames for de-listing.
- **Inconclusive** (temporary status) – Water body has not met the minimum criteria for detection, but has had one positive test result.

Management Trigger →

- **Suspect** – Water body that has met the minimum criteria for detection.
- **Positive** – Multiple (2 or more) subsequent sampling events that meet the minimum criteria for detection.

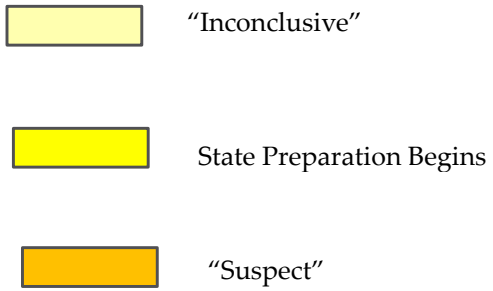
- **Infested** – A water body that has an established population (reproducing population with both juveniles and adults) of AIS.

De-listing a Water Body for Dreissenids:

- **Inconclusive** – 1 year of negative testing including at least one sample taken in the same month of subsequent year as the positive sample (accounting for seasonal environment variability) to get to undetected/negative.
- **Suspect** – 3 years of negative testing to become undetected/negative.
- **Positive** – 5 years of negative testing to become undetected/negative.
- **Infested** – Following a successful eradication or extirpation event including a minimum of 5 years post-event testing/monitoring with negative results.

Table 3. Interim protocols for verifying adult and veliger stages of dreissenids, with corresponding water body determinations.[37]

Adult		**Veliger/Microscopy (XPLM)** (Veliger sample preservation/handling to meet minimum PCR requirements (e.g., 70% buffered EtOH, cold storage, isopropyl alcohol)		
Visual ID of settled adult by expert	Plausible report, no shell/specimen available, survey water body	Strong positive visual ID [multiple larval states, high quality sample]	Positive visual ID [lacking "strong" criteria]	Weak visual ID [suspect bivalve, poor quality sample]
Confirmation of visual ID by additional expert [photo okay]		Independent expert confirmation of Dreissenid veliger [photo okay] – must be confirmed by at least 2 independent experts	Same as "strong"	[Evaluate other samples if avail.]
Confirmation of ID and determination of species		Microscopy by independent lab and/or PCR by independent lab	Same as "strong"	PCR confirmation X 2 and gene sequence match



[37] Unusual or contradictory results to be evaluated on a case-by-case basis by committee. Microscopy refers to cross-polarized light microscopy or XPLM. Protocols for scanning electron microscopy or SEM have not yet been developed.

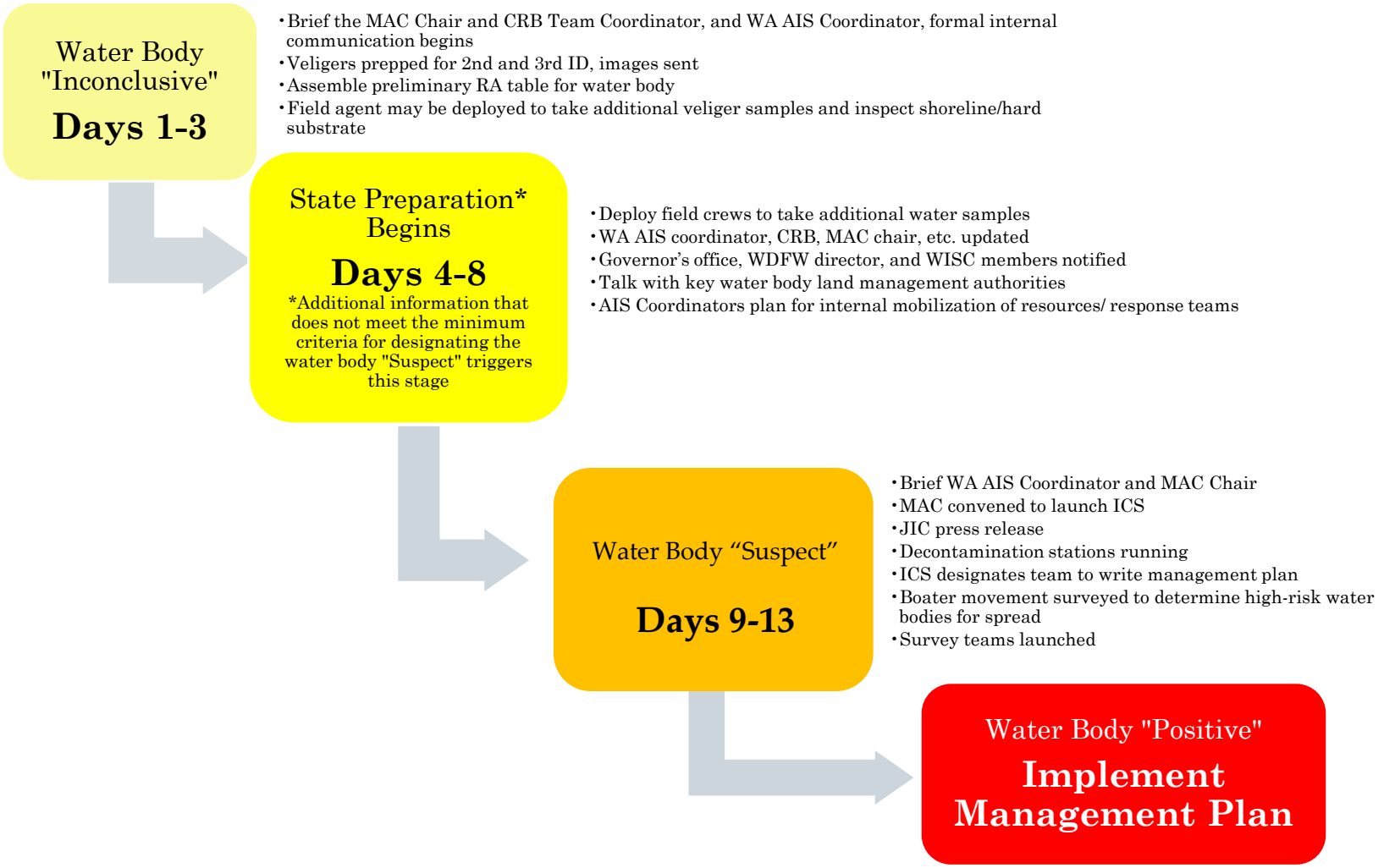


Figure 2. Mock timeline (in days) showing verification of identification, accompanying tasks and water body status following preliminary identification/reporting of dreissenid mussel veligers.

STATUS LEVELS AND CORRESPONDING ACTIONS

Water Body Status: INCONCLUSIVE

- Brief the MAC Chair and CRB Team Coordinator, and WA AIS Coordinator, formal internal communication begins
- Veligers prepped for 2nd and 3rd ID, images sent
- Assemble preliminary RA table for water body
- Field agent may be deployed to take additional veliger samples and inspect shoreline/hard substrate

State Preparation Begins

- Deploy field crews to take additional water samples
- WA AIS coordinator, CRB, MAC chair, etc. updated
- Governor's office, WDFW director, and WISC members notified
- Talk with key water body land management authorities
- AIS Coordinators plan for internal mobilization of resources/ response teams

Water Body Status: SUSPECT

- Brief WA AIS Coordinator and MAC Chair
- MAC convened to launch ICS
- Joint Information Center press release
- Decontamination stations running
- ICS designates team to write management plan
- Boater movement surveyed to determine high-risk water bodies for spread
- Survey teams launched:
    - Veliger samples taken (re-sample at 2 week intervals minimum in spawning season)
    - Additional WQ sampling as needed
    - Shoreline and fixed/temporary hard substrate surveys for adults (including any Portland Samplers, or exposed infrastructure - stakeholders)
    - Benthic sampling and or diver/snorkeler surveys of hard substrate
    - Survey moored boats/moorages/marinas if any for potential "carriers"

INITIAL RESPONSE

REPORTING

In Washington, there are two key recommended venues for reporting sightings of aquatic invasive species:

- The Washington AIS Program has a telephone number, 1-888-WDFW-AIS, to report an AIS sighting or to obtain information.
- WISC staffs an online reporting form and smartphone app ('WA Invasives') to report suspected sightings of invasive species.

Section 108 of Senate Bill 6040 (passed during the 2014 legislative session) provides authority to the WDFW to implement rapid response management actions where a prohibited Level 1 species, such as a zebra or quagga mussel, is detected in or on a water body or property. These actions may include, "expedited actions to contain, control, or eradicate the prohibited species; and, if applicable, be implemented in conjunction with a quarantine declaration." Section 108 notes that if a rapid response management action exceeds seven days, the WDFW may implement an incident command system for rapid response, including scope, duration, and types of actions to support mutual assistance and cooperation between WDFW and other affected state and federal agencies, tribal sovereign nations, local governments, and private water body or property owners. The legislation notes that WDFW may engage in cooperative agreements with partner entities to establish incident command structures, among other actions.

The first participating agency to discover or receive a report of a potential dreissenid [or other AIS infestation] will notify the WDFW Invasive Species Coordinator. The initial recipient should collect:

- Date and time of the report.
- Name and contact information of the report recipient
- Name and type of organism (e.g. zebra mussel, seaweed, etc.)
- Date and time of the sighting(s).
- Name, agency and contact information for the person making the report.
- Name, agency/entity and contact information of identifying biologist (if any)
- Details of the location of the infestation
    - Name of the affected water body,
    - Landmarks, highway mile, and other identifying details
    - GPS (if possible)

    - Description of surface attached to (if fouling organism) or substrate found on/in if appropriate
    - Other relevant conditions (draw down, low tide, etc.)
- An estimate of the number, density, and extent of the introduction
- Digital or other photographs (with scale indicator), ideally images shot from multiple angles
- If no photograph possible, obtain a detailed description of organism (size, coloration, flowering, etc.). Ensure reporter is looking at actual specimen not at an ID card/wanted poster.
- A sample of the organism (inform caller of proper storage/handling if necessary)
- Comments: These might include notes about the condition the specimen was in when found, how reporter came across organism, had they seen it before, access limitation to site, etc.

Notification of positive results from veliger monitoring (either through cross-polarized light microscopy or PCR) should be sent directly to the State Aquatic Invasive Species Coordinator(s) along with all supporting documents and the sample collection information (Appendix VIII describes documentation requested for veliger analysis).

NOTIFICATION

The following information pertains to a report and incident response on state-owned land. Responses on federal or tribal-owned land will not trigger state involvement unless invited by the landowner. A Washington ICS should be augmented with resources (staff and equipment) from the landowner in keeping with the "whole of government" approach embodied in this plan.

Washington AIS Incident Command System (ICS)

The coordinating structure of Washington AIS ICS (Figure 3) is designed to comply with the requirements of a National Incident Management System (NIMS) and describes the composition of the Washington AIS ICS, which focuses on interagency decision making and communication.

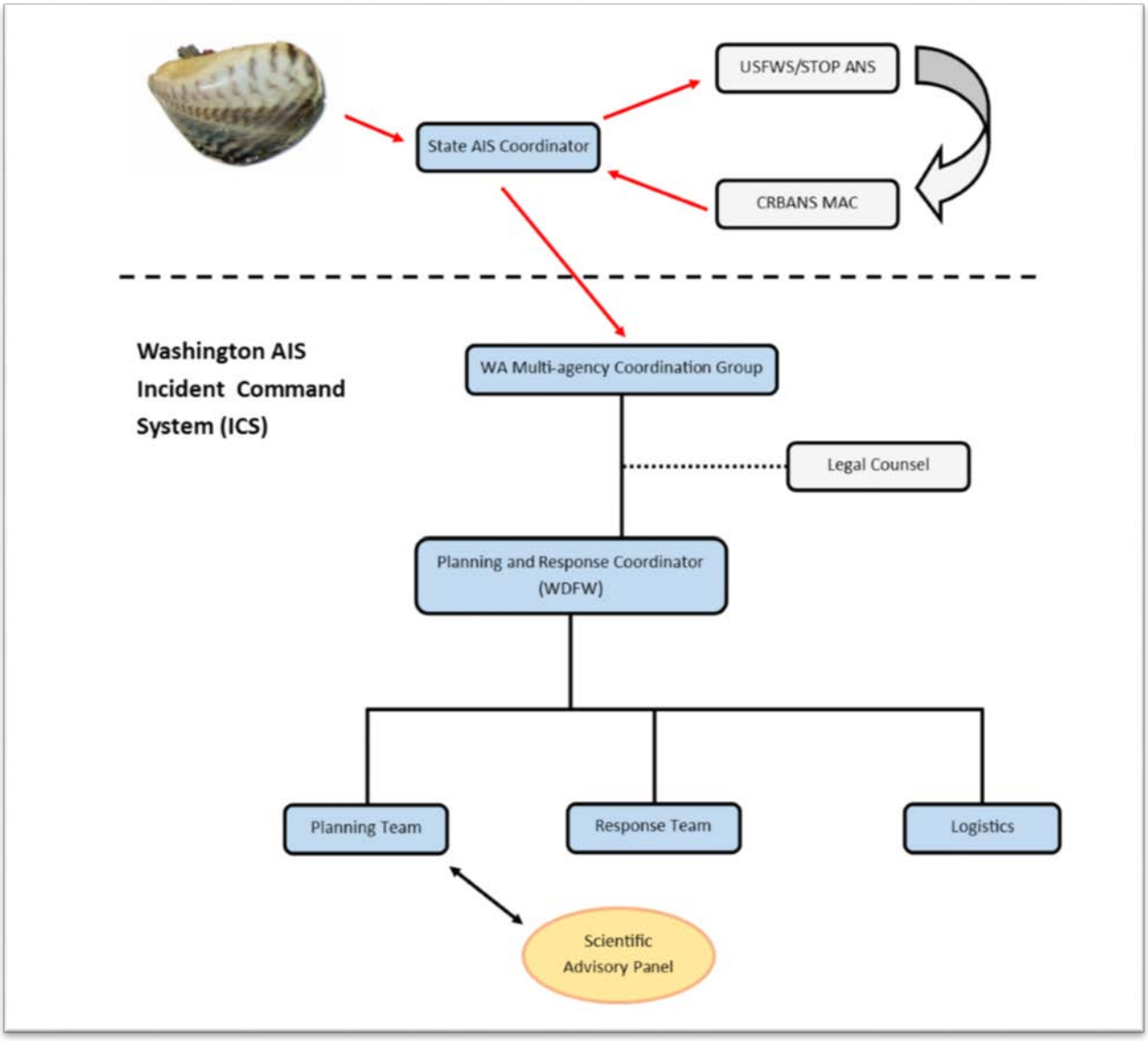


Figure 3. Example Washington AIS ICS.

WASHINGTON MULTI-AGENCY COORDINATION GROUP (WA MAC)

The Washington Multi-Agency Coordination Group (WA MAC) should be led by WDFW and include USFWS, Ecology, WDA, the Chair of the WISC, a representative of the Governor's office and others as determined by the incident (e.g., USFS, BLM, WDNR, Ecology, etc.) and the incident location.

Reporting directly to the WA MAC is the Planning and Response Coordinator. This will be staffed by WDFW. The Planning and Response Coordinator will oversee the Planning Team, the Response Team and any logistics staff.

The composition of the Planning Team, similar to the MAC, will be dependent on the location of the incident, but will include all the state AIS leads and major stakeholders.

The Joint Information Center will be a shared position staffed by WDFW, including Public Information Officers.

The Scientific Advisory Panel membership will include academia, AIS responders with experience in dreissenid infested waters and others who can provide planning advice and review response plans.

In the case of a mussel report, the Washington AIS Coordinator will alert other state AIS coordinators and the Regional USFWS AIS coordinator. Should the Columbia River Basin Rapid Response Plan (CRBRRP) be deemed by the Multi-Agency Coordination Group (CRB MAC) to not be the appropriate response structure to respond to the introduction,[38] the Washington AIS ICS will be used. The Washington AIS ICS structure has also been created to fit into the CRBRRP incident command structure to implement those objectives that are delegated to the state or responsible agency.

The objective of notification is to ensure that all parties that have jurisdiction over response decisions are engaged quickly and at the appropriate stage of any response. Table 2 of this document lists the agencies and entities with AIS management and coordination responsibilities or interests in Washington. Additional stakeholders may need to be notified in the course of a response, including, but not limited to, tribal sovereign nations, public utility districts, irrigation districts, municipal water users, marinas, and boat ramp operators.

[38] This may happen for one of several reasons: the infestation may be located outside of the Columbia River Basin (e.g., the Skagit River); the CRB MAC deems a situation to be better situated to a single state response; the plan is used for a non-dreissenid AIS response; etc.

Although the lead entity for undertaking initial notifications at the alert and suspect levels is WDFW, it may be appropriate for other agencies to take the lead in notifying their existing partners.

Appendix IX provides the contact information for individuals that should be notified when water bodies are determined to be inconclusive and suspect.

Inconclusive notification:

- WDFW
- Ecology, WSP, WDNR, WISC Coordinator
- USFWS RO, CRB MAC chair
- State/Federal AIS Coordinators as appropriate if shared waters

Suspect Notification (in addition to the above)

- Washington ISC, CRB MAC
- Primary stakeholders
- Governor's Office/ Governor's Natural Resource Cabinet
- Initial Press Release and briefing
- Notification of affected user groups
- Communicating with stakeholders and other agencies

Generic language for this initial release of information about the initial infestation is as follows:

> *We are currently investigating reports of* [name of invasive species] *in the vicinity of* [general location]. *Experts from the* [Columbia River Basin Interagency Team or WA AIS Coordinator] *and local agencies are responding, and we will have additional information available as we are able to confirm it. We will hold a briefing at* [location] *and will notify the press at least ½ hour prior to the briefing. At this time, the briefing is the only place where officials are authorized to speak about the incident and confirmed information will be available. Thank you for your assistance.*

A sample press release for a Suspect water body is provided in Appendix X.

An external communications system will be established and activated consistent with the guidance for a CRB RRP. The WDFW Public Information officers would be responsible for the coordinated formulation and release of information about the infestation to the news media, the public, and other agencies. The Public Information Officers are also responsible for

disseminating summary information on the project if and when the Washington AIS ICS is disbanded.

Lead Agency: WDFW Public Information Officers

Defining the Extent of Colonization

To inform policy and tactical response to the infestation, survey crews (formed based on location of potentially infested water body) will establish the physical range of infestation and identify the life-cycle phase(s)/age of infestation of mussels present. These demographics will guide subsequent management decisions, including survey design. Investigation of the geographic extent of infestation will require surveying upstream and downstream areas and any connected water bodies.

Lead entity: WDFW, lead agency where incident occurs, CLR

Tasks:

1. Survey nearby water bodies with vulnerability to the same vectors (using information from boater surveys, where available, to determine high traffic areas). Potential methodologies include:

    - Sampling fixed and temporary hard substrates
    - Shoreline surveys
    - SCUBA and snorkel surveys
    - Plankton sampling. Plankton sampling may be analyzed microscopically or via Polymerase Chain Reaction (PCR) genetic analysis. Plankton samples should involve sufficient water volume to detect low veliger concentrations via either of those methods. These efforts should follow existing regional or national protocols.

2. Assess maturity and spawning condition of mussels at the infestation site(s).

3. Determine likely water flow dispersal of mussel veligers. Potential methodologies include:

    - Dye studies
    - Other hydrographic research techniques
    - Interviewing field personnel

4. Identify facilities (e.g., hydropower, fish hatcheries, irrigation systems, etc.) that could be affected.

5. Ensure that surveys are completed and that results are reported

PREVENTING FURTHER SPREAD

Preventing spread of an original introduction is crucial to the success of a rapid response plan. The use of a quarantine or temporary closure will likely be necessary until prevention techniques can be implemented to manage the pathways that spread dreissenid mussels. The duration of the emergency closure will last until a prevention plan is implemented for the water body. If closure is untenable, Watercraft Inspection Teams (WIT) must be on hand for decontamination.

Lead entity: WDFW

Tasks:

1. Identify dispersal vectors (including movement by humans, fish and wildlife, water traffic, water flow, and other processes). Assume measures are needed to prevent release of veligers as well as movement of adult mussels.

- Assess the likely movement of boats that recently used the infested water body to identify inspection needs in other water bodies.

2. Establish public outreach efforts, including:

- Ensure that zebra/quagga mussel —alert signs are adequately deployed.
- Alert prior users of these waters of the risks their boats and equipment create for other water bodies.
- Design and implement educational outreach programs using print, electronic media and other avenues, with an emphasis on raw water users.

3. Restrict dispersal pathways, where feasible, including:

- If feasible, identify and eliminate the likely source of mussel inoculation (e.g., infested boat).
- Quarantine any hatcheries or aquaculture operations that are likely to spread mussels or their larvae via transfers outside the affected watershed(s).

- Quarantine infested water bodies as needed to prevent spread by watercraft.
- Consider and implement any needed prevention of overland veliger or adult mussel transport to other water bodies.
- Develop and implement Hazard Analysis and Critical Control Point (HACCP) plans to ensure that response personnel do not further spread the original introduction.
- Stop or slow water release to potentially uninfested sites.
- Draw water from below thermocline.
- Install physical barriers.
- Consider special management measures for operations of locks and commercial vessel traffic.

4. Establish wash and inspection requirements on boats and equipment, and provide for associated logistical support (e.g., disinfection kits).

- Begin a post haul-out inspection of boats and equipment in the areas where mussels were found.
- Begin a pre-launch inspection program for all boats and equipment in places where boats and equipment from a contaminated area are likely to be launched next.

A template that includes information that should be included in a management plan is described in Appendix XI.

Initiating Available/relevant Control Actions

Evaluate management options and proceed either with eradication efforts or containment/mitigation activities. Convene scientific advisory team to consult (Appendix V).

Lead entity: WDFW

Tasks:

1. Decide if eradication is possible based on rapid analysis of population dynamics and pathways of spread. Consider the following:

- Cost versus benefit of treatment options.
- Type of water body (e.g., contained lake, mainstem reservoir, tributary reservoir, small stream, large river, estuary, or water diversion facility).

- Type of substrate (e.g., rocks that allow mussel attachment on their undersides where chemicals may not reach them).
- Extent of population distribution (isolated vs. widespread coupled with a priori assumptions about the spread of mussels before detection).
- Life stage(s) present (default assumption is both veligers and adults).
- Time of year in relation to spawning season.
- Is spawning occurring now or possible based on current water temperature (e.g., 12 °C or greater)?
- When is the likely spawning season based on predicted temperature conditions?
- How do mean monthly temperature patterns for the water body relate to mussel spawning requirements?
- Amount of water in reservoir or waterway.
- Does the reservoir need to be drawn down before treatment?
- How much can the reservoir be drawn down?
- Is river flow low enough for effective treatment?
- Circulation patterns in water body.
- Spreading pattern of population within the water body.
- Inflow rates and sources.
- If drawdown needs to occur, what is the feasibility given input source(s)?
- Rate of outflow and distance of veliger dispersal.
- Do flow patterns help or hinder eradication options?
- Presence of state or federally listed threatened or endangered species.
- Special status of water body, including:
    - Water use designation (e.g., drinking water).
    - Wild and scenic designation.
    - Wilderness area.
    - Potential impact to cultural resources.
    - Department of Defense or other restricted access areas.
    - Tribal lands.
    - Endangered Species Act critical habitat.
    - Presence of marine mammals covered by Marine Mammal Protection Act.
    - Clean Water Act 303(d) listing.
    - Beneficial uses of water bodies.
    - Use of area by threatened and endangered species.

2. If eradication is attempted, select appropriate method(s).

3. If eradication is not possible or fails, develop control objectives and select/design appropriate control measures.

4. Obtain relevant permits and regulatory agency concurrence (see Appendices IV, V).

5. Implement eradication or control strategies.

EXTENDED RESPONSE

LONG-TERM MONITORING

This objective provides data for adaptive management and long-term evaluation of management and control efforts, and will be included in the management plan for each water body.

Lead entity: The responsible agency where the infestation of mussels is found.

Tasks:

1. Continue control strategy developed during Initial Response phase.

2. Develop long-term control objectives

3. Design a monitoring program to evaluate the status of the zebra/quagga mussel populations, emphasizing veliger sampling. Monitoring activities should be implemented in coordination with other field operations, such as environmental monitoring requirements associated with control action regulatory compliance (e.g., National Pollutant Elimination Discharge System [NPDES] permits).

4. Disseminate findings through an easily-accessible, consolidated, coordinated real-time database and listserv.

5. Evaluate control strategy against results of monitoring program and revise strategy as needed to meet long-term control objectives.

OTHER AQUATIC INVASIVE SPECIES

In addition to this plan, the State of Washington published the "Washington State Aquatic Nuisance Species Management Plan," in 2001. The plan described coordination of aquatic invasive species management actions in existence, and identified additional needed management actions, all of which were intended to focus on feasible, cost-effective, collaborative management practices.

In 2005, the Aquatic Invasive Species Prevention and Enforcement Program, co-managed by the Fish and Enforcement Divisions of the Washington Department of Fish and Wildlife, was established. The program addresses a wide variety of priority aquatic invasive species, including dreissenids. For example:

- In 2008, 3.5% of the watercraft inspected at mandatory check stations were infested with aquatic invasive species.
- Since 2009, a multi-stakeholder work group has been formed to replace prohibited crayfish with native crayfish for use in schools.
- The program has worked with the shellfish aquaculture industry by providing guidance on how to minimize risk of infestations to culture facilities and prevent the spread of invasives during shellfish transport.

In its 2012 report to the Legislature, the Washington Invasive Species Council and Washington Department of Fish and Wildlife staff documented challenges to implementing its statutory authority associated with aquatic invasive species, including scattered statutes that create jurisdictional uncertainties and budget reductions that have affected programs involving tunicates, ballast water, Atlantic salmon, green crab monitoring, and enforcement. Senate Bill 6040, which was passed during the 2014 legislative session, helped to consolidate state invasive species laws and provide certainty for those agencies authorized to regulate invasive species. However, the legislation passed without funding—the challenges associated with implementing a comprehensive aquatic invasive species program in Washington remain until those budget gaps can be addressed.

In 2012, the Washington Department of Fish and Wildlife published version 2.0, "Invasive Species Management Protocols," a document that provides protocols for work in terrestrial and aquatic ecosystems as well as other "special" situations, such as working with fish tankers, and diving equipment. The protocols document, in combination with this rapid response plan and other species-specific plans, such as the 2007–2009 Tunicate Management Plan, if funded, create

a suite of policy guidance documents that will efficiently allow the state to prevent and manage invasive species.

APPENDICES

Appendix I.	Engrossed Substitute Senate Bill 6040 - 2014 Regular Session - 63rd Legislature.
Appendix II.	List of State Resources for *Dreissena* Response.
Appendix III.	Quarantine Authority.
Appendix IV.	Washington Environmental Regulatory Compliance Framework.
Appendix V.	Flow Chart of Permitting Alternatives and Associated Contacts.
Appendix VI.	Interim List of At-Risk Water Bodies in Washington.
Appendix VII.	Details for Top Five Interim High-Risk Water Bodies in Washington.
Appendix VIII.	Veliger Analysis Documentation.
Appendix IX.	Interim Notification List for Reports of Dreissenids in Washington.
Appendix X.	Sample Press Release.
Appendix XI.	Outline for Draft Management Plan.
Appendix XII.	Example of FIFRA Section 18 Emergency Exemption Application.

APPENDIX I. ENGROSSED SUBSTITUTE SENATE BILL 6040 - 2014 REGULAR SESSION - 63RD LEGISLATURE

Senate Bill 6040 was signed by the Washington Governor Jay Inslee in March of 2014. The following are key sections of the bill:

Background: Classification and Regulation of Aquatic Animal Species. The Fish and Wildlife Commission (Commission) has the authority to classify species as a prohibited aquatic animal species or regulated aquatic animal species, depending on the risk level and any beneficial use of the species. Unless authorized by the Department of Fish and Wildlife (DFW), it is generally illegal to possess, transport, propagate, buy, sell, or release a prohibited or regulated aquatic animal species. The release of a regulated aquatic animal species or a species that has not yet been classified is also illegal. In general these offenses are punishable as gross misdemeanors.

When the Commission identifies a prohibited aquatic animal species infestation, DFW must develop a rapid response plan to address potential actions such as eradication, containment, enforcement, and public education. DFW and other agencies may post signs at an infestation site to identify the infestation and notify the public of potential penalties for possessing and transporting these species.

Aquatic Invasive Species (AIS) Enforcement. In general anyone that has used a commercial or recreational watercraft outside of the state must have documentation that the watercraft is free of AIS. A violation of this requirement is an infraction. DFW must adopt rules to implement the documentation requirement, including identifying the types of allowable documentation.

Specifically, DFW may require anyone transporting a watercraft to stop at a check station and failure to do so is a gross misdemeanor. Check stations must be plainly marked and operated by at least one DFW Officer. A person with a watercraft that is contaminated with AIS must bear the expense for any necessary impoundment, transportation, or decontamination.

However, a person who stops at a check station and complies with DFW directives is exempt from AIS-related criminal penalties and forfeiture.

Summary: Specifies General Invasive Species Authority. DFW is designated as the state's lead agency for managing many types of invasive species, both aquatic and terrestrial. Subject to the availability of funding, DFW may conduct activities to include the following:

monitoring and rapid response actions; conducting education and outreach; aligning standards, classifications, and enforcement provisions with regional, national, and international provisions; and providing technical assistance or other support to government entities and private groups.

AIS Classification System. A new AIS classification system framework is established, similar to the existing classification system but with more potential classification options. DFW must adopt species classifications in consultation with the Invasive Species Council (Council). The framework is as follows:

Prohibited Species. Prohibited species are a priority for prevention and management actions. There are three categories of prohibited species: level 1 species pose a high invasive risk and are a priority for prevention and rapid response actions; level 2 species pose a high invasive risk and are a priority for infested site management; and level 3 species pose a moderate to high invasive risk and may be appropriate for prevention or management action;

Regulated Species. There are three classifications for regulated species. Type A species pose a low to moderate invasive risk and have a beneficial use; type B species pose a low or unknown risk and are used for personal or commercial uses, such as aquariums; and type C species pose a low or unknown risk and do not qualify as a type B species; and

Interim classifications are provided until new rules are adopted by DFW.

Rapid Response, Infested Site Management, and Quarantine Authorities. When a prohibited level 1 species is detected, DFW may implement rapid response management actions to contain, control, or eradicate the species. DFW may utilize an incident command system if the action exceeds seven days, and may cooperate with other agencies, specified entities, and private landowners. In implementing a rapid response management action, DFW may enter onto property when authorized by a warrant supported by reasonable cause.

Infested site management actions are authorized when a prohibited level 2 species is detected, and may include long-term actions to contain, control, or eradicate the species. DFW must consult with other agencies, specified entities, and private landowners. In implementing an infested site management action, DFW may enter onto property when authorized by a warrant supported by reasonable cause.

DFW may issue a quarantine declaration due to threats posed by a prohibited level 1 or 2 species. The declaration may include a prohibition or limitation on the movement of

conveyances or water from an area. DFW may use this authority separately or in conjunction with a rapid response or infested site management action.

Additionally, DFW may, in consultation with the Council, request that the Governor order emergency measures in circumstances where prohibited level 1 or 2 species pose an imminent environmental, economic, or human health danger. DFW may implement measures approved by the Governor, which may include the use of pesticides after consultation with other agencies and landowners and evaluation of alternative measures.

Notification, consultation, and appeals procedures are established for the exercise of these AIS management authorities, as well as a requirement that DFW publicly list infested water bodies. In exercising these authorities, DFW must endeavor to contain, control, and eradicate AIS while protecting human safety and minimizing impacts to the environment and landowners.

AIS Inspections and Decontamination. The scope of vehicles and equipment that must comply with AIS documentation requirements is expanded to any aquatic conveyance entering the state, which includes transportable personal property such as watercraft, watercraft-related equipment, float planes, fish tanker trucks, irrigation equipment, and fishing gear. DFW must implement this requirement by rule, including identifying allowable certificate of inspection forms and the type of conveyances to which the requirement applies.

Anyone using an aquatic conveyance must clean and drain the conveyance after use on a water body or property. This includes removal of visible aquatic plants, animals, other organisms, and water from the water body. DFW may begin enforcing clean and drain provisions on watercraft and seaplanes transporting aquatic plants, but must adopt rules before enforcing the requirement more broadly.

As under current law, DFW may establish mandatory check stations for the inspection of watercraft. DFW may adopt rules covering other types of aquatic conveyances that must stop at check stations. At least one DFW officer, ex-officio officer, or agency representative must be present during check station operation. A person stopped at a check station must allow inspection for AIS and clean and drain requirements, and follow any clean and drain or decontamination orders given.

When encountering an aquatic conveyance with AIS, a DFW officer or ex-officio officer may require decontamination on site, prohibit launch into a water body until decontamination, require immediate transport to a decontamination station, or seize and transport the conveyance to a decontamination station. The specific order depends on the risk and

availability of resources, and compliance must occur at the expense of the person in possession of the conveyance.

DFW may operate inspection and decontamination stations, which can be either part of or separate from inspection stations. Authorized representatives with sufficient training may operate inspection, decontamination, and check stations. These stations must be operated consistent with rules established by DFW. Within two years, DFW must submit a recommended fee schedule that DFW-authorized representatives may charge for inspection and decontamination services.

AIS Inspection and Enforcement. DFW officers and ex-officio officers are provided the authority to: temporarily stop persons to inspect aquatic conveyances for AIS or compliance with clean and drain requirements based on reasonable cause; and execute a search or arrest warrant issued by a court based on probable cause that a violation of an invasive species law has occurred.

DFW staff may take samples of invasive species or inspect property or a water body under a warrant issued by a court based on probable cause that an invasive species is present and after seeking the owner's permission for the inspection.

The following acts are established as gross misdemeanors:

- failure to allow inspection while stopped at a check station;
- failure to comply with a decontamination order;
- possession of a prohibited level 1 or 2 species without DFW authorization;
- possession of, introduction of, or trafficking in a prohibited level 3 species without DFW authorization;
- introduction of a regulated type A, B, or C species without DFW authorization;
- failure to clearly identify by species or subspecies name a regulated type B species used for commercial purposes; and
- a knowing violation of a quarantine declaration.

Interfering with DFW personnel authorized by a warrant to conduct a rapid response or infested site management action is included within the existing crime of unlawful interfering in department operations, which is punishable as a gross misdemeanor. A class C felony is established for trafficking or introducing a prohibited level 1 or 2 species without DFW authorization, or if a person commits a second invasive species related act punishable as a gross misdemeanor within five years.

A new infraction is established for failure to follow clean and drain requirements or a clean and drain order.

In addition to criminal penalties, violators are subject to any costs incurred in managing the invasive species and its progeny. Certain exemptions apply to AIS offenses, including those in compliance with directives at a check station, acting in a manner authorized by DFW, or returning AIS caught while fishing into the water.

APPENDIX II. LIST OF STATE RESOURCES FOR *DREISSENA* RESPONSE

WIT 1 Level Trained Personnel

NAME		AGENCY	DIVISION
LAST	**First**		
ALEXANDER	Brian	WDFW	Enforcement
ANDERSON	Chris	WDFW	Enforcement
ANDERSON	Eric	WDFW	Enforcement
ANDERSON	Patrick	WDFW	Enforcement
ANDERSON	Dan	WDFW	Enforcement
APPLE	Mike	WDFW	Enforcement
BALAZS	Ken	WDFW	Enforcement
BEAUCHENE	JoLynn	WDFW	Enforcement
BRINSON	Dan	WDFW	Enforcement
BUSCHING	Chris	WDFW	Enforcement
CAPELLI	Jason	WDFW	Enforcement
CATON	Michael	WDFW	Enforcement
CENCI	Mike	WDFW	Enforcement
CHADWICK	Dan	WDFW	Enforcement
CHAMBERLIN	Brandon	WDFW	Enforcement
CHANDLER	Kim	WDFW	Enforcement
CHRISTENSEN	Dan	WDFW	Enforcement
CILK	Harry	WDFW	Enforcement
CLEMENTSON	Chris	WDFW	Enforcement
COOK	Julie	WDFW	Enforcement
CROWN	Steve	WDFW	Enforcement
CZEBOTAR	Jason	WDFW	Enforcement
DAVIDSON	Bryan	WDFW	Enforcement
DAY	Jason	WDFW	Enforcement
DO	Loc	WDFW	Enforcement
DOWNES	Ralph	WDFW	Enforcement
ERHARDT	Chris	WDFW	Enforcement
ERICKSON	Severin	WDFW	Enforcement
FAIRBANKS	Brian	WDFW	Enforcement
FLOWERS	Dennis	WDFW	Enforcement
FULTON	Brian	WDFW	Enforcement
GASTON	Zach	WDFW	Enforcement
GRANT	Graham	WDFW	Enforcement
GRANT	Morgan	WDFW	Enforcement
GRESHOCK	Jacob	WDFW	Enforcement

HAHN	Lenny	WDFW	Enforcement
HAW	Greg	WDFW	Enforcement
HILLMAN	Mark	WDFW	Enforcement
HJELMSTAD	Jesse	WDFW	Enforcement
HOBBS	Michael	WDFW	Enforcement
HOPKINS	Bret	WDFW	Enforcement
HORN	Jonathan	WDFW	Enforcement
HUGHES	David	WDFW	Enforcement
JACKSON	Ted	WDFW	Enforcement
JACOBSON	Paul	WDFW	Enforcement
JAMES	Mark	WDFW	Enforcement
JAROS	Tony	WDFW	Enforcement
JEWELL	Mike	WDFW	Enforcement
JEWETT	Matt	WDFW	Enforcement
JOHN	Ryan	WDFW	Enforcement
JOHNSON	Phillip	WDFW	Enforcement
JONES	David	WDFW	Enforcement
JORG	Nicholas	WDFW	Enforcement
KIM	Hwa	WDFW	Enforcement
KING	Doug	WDFW	Enforcement
KIRSCH	Keith	WDFW	Enforcement
KLEIN	Carl	WDFW	Enforcement
KLUMP	Danyl	WDFW	Enforcement
KOONTZ	Joshua	WDFW	Enforcement
LANGBEHN	Jason	WDFW	Enforcement
LANTIEGNE	Bill	WDFW	Enforcement
LEE	Jeff	WDFW	Enforcement
LEONETTI	Tony	WDFW	Enforcement
LUDWIG	John	WDFW	Enforcement
MANN	Richard	WDFW	Enforcement
MARTHALLER	Aaron	WDFW	Enforcement
MARTIN	Lance	WDFW	Enforcement
MASCHHOFF	Justin	WDFW	Enforcement
MAURSTAD	Jennifer	WDFW	Enforcement
MCCORMICK	Troy	WDFW	Enforcement
MCGARY	Chad	WDFW	Enforcement
MCLERRAN	Kerry	WDFW	Enforcement
MCQUARY	Robert	WDFW	Enforcement
MCQUOID	Mike	WDFW	Enforcement
MOATS	Thomas	WDFW	Enforcement
MOSMAN	Paul	WDFW	Enforcement

MOSZETER,	Chris	WDFW	Enforcement
MULLINS	Russ	WDFW	Enforcement
MYERS	Shawn	WDFW	Enforcement
MYERS	Alan	WDFW	Enforcement
NELSON	Jim	WDFW	Enforcement
NICKS	Dennis	WDFW	Enforcement
NIXON	Matt	WDFW	Enforcement
O'HAGAN	Dan	WDFW	Enforcement
OLSON	Erik	WDFW	Enforcement
ORR	Gary	WDFW	Enforcement
OSWALD	Eric	WDFW	Enforcement
PACE	Carlo	WDFW	Enforcement
PARKERT	Nick	WDFW	Enforcement
PETERS	Carly	WDFW	Enforcement
PETERSON	Cory	WDFW	Enforcement
PHILLIPS	Rich	WDFW	Enforcement
PRATER	Dustin	WDFW	Enforcement
RAHN	Dan	WDFW	Enforcement
RICHARDS	Bruce	WDFW	Enforcement
ROSENBERGER	Kit	WDFW	Enforcement
SCHERZINGER	Brent	WDFW	Enforcement
SCHLENKER	Murray	WDFW	Enforcement
SCHROEDER	Scott	WDFW	Enforcement
SMITH	Chris	WDFW	Enforcement
SMITH	William	WDFW	Enforcement
SNYDER	Jason	WDFW	Enforcement
SPRECHER	Mike	WDFW	Enforcement
SPURBECK	David	WDFW	Enforcement
STEFFLER	Glenn	WDFW	Enforcement
STEPHENSON	Tylar	WDFW	Enforcement
STEVENS	Lance	WDFW	Enforcement
SUMMIT	Jeff	WDFW	Enforcement
TAYLOR	Pam	WDFW	Enforcement
THOMPSON	Katie	WDFW	Enforcement
TRESER	Calvin	WDFW	Enforcement
VALENTINE	Ryan	WDFW	Enforcement
VAN VLADRICKEN	Isabel	WDFW	Enforcement
VANCE	Brendan	WDFW	Enforcement
VARYVODA	Roman	WDFW	Enforcement
VOROUS	Natalie	WDFW	Enforcement
WATTS	Cody	WDFW	Enforcement

WEAVER	Bob	WDFW	Enforcement
WENDT	Lauren	WDFW	Enforcement
WICKERSHAM	Jeffrey	WDFW	Enforcement
WILLETTE	Wendy	WDFW	Enforcement
WOOD	Curt	WDFW	Enforcement
ZUCHLEWSKI	Christopher	WDFW	Enforcement

WIT 1 Level Trained Personnel

Name		Agency	Division
Last	**First**		
ANDERSON	Eric	WDFW	Enforcement
CORRADO	Greg	Washington Sea Plane Pilots Association	N/A
JOHNSON	Phil	WDFW	Enforcement
KLEIN	Carl	WDFW	Enforcement
SCHULTZ	Jesse	WDFW	Fish Management
WILKINSON	Michael	WDFW	Fish Management

APPENDIX III. QUARANTINE AUTHORITY

Excerpted from Z-0454.4/Engrossed Senate Bill 6040

Section 107.
If the department determines it is necessary to protect the environmental, economic, or human health interests of the state from the threat of a prohibited Level 1 or Level 2 species, the department may declare a quarantine against a water body, property, or region within the state. The department may prohibit or condition the movement of aquatic conveyances and waters from such a quarantined place or area that are likely to contain a prohibited species.

A quarantine declaration under this section may be implemented separately or in conjunction with rapid response management actions under section 108 of this act and infested site management actions under section 109 of this act in a manner and for a duration necessary to protect the interests of the state from the threat of a prohibited Level 1 or Level 2 species. A quarantine declaration must include:

(a) The reasons for the action including the prohibited Level 1 or Level 2 species triggering the quarantine;

(b) The boundaries of the area affected;

(c) The action timeline;

(d) Types of aquatic conveyances and waters affected by the quarantine and any prohibition or conditions on the movement of those aquatic conveyances and waters from the quarantine area; and

(e) Inspection and decontamination requirements for aquatic conveyances.

APPENDIX IV. WASHINGTON ENVIRONMENTAL REGULATORY COMPLIANCE FRAMEWORK

Of particular relevance to the application of pesticides to state waters is the recently revised status of Clean Water Act NPDES permitting requirements. Prior to 2009, the Environmental Protection Agency (EPA) ruled that a CWA NPDES permit was not required when legally registered pesticides are applied for pest control purposes (Federal Register Vol. 71, No. 227, November 27, 2006). In response to legal challenges in 2009, however, the sixth circuit federal court determined that EPA must issue NPDES permits for all chemical pesticide applications that leave a residue or excess pesticide in water (as well as biological pesticide applications). In response, EPA issued a Pesticide General Permit in October 2011 to cover discharges in areas under their permitting authority, which included six states, most tribal lands, and federal facilities in four additional states (including Washington). States with EPA delegated authority to issue NPDES permits (e.g., Montana, Oregon, and Washington) have developed state-specific permitting approaches that may be similar or more stringent than the federally issued Pesticide General Permit.

Fact Sheet:

http://www.deq.state.or.us/wq/pubs/factsheets/permits/2300APesticides.pdf

Pesticide General Permit (2300A)

PESTICIDE APPLICATIONS COVERED UNDER THE PERMIT

"Nuisance animal control for invasive or other nuisance animals and pathogens in water and at the water's edge. Coverage extends to but is not limited to, control of fish, mollusks, fungi and bacteria. The term "in water" includes, but is not limited to applications made to creeks, rivers, lakes, riparian areas, wetlands, and other seasonally wet areas when water is present. The term "water's edge" means within 3 feet of waters of the state and conveyances with a hydrologic surface connection to waters of the state at the time of pesticide application. The 3 feet is measured horizontally from the water's edge and conveyance."

TABLE IV1. PESTICIDE USE MATRIX FOR AN ISOLATED ZEBRA MUSSEL INFESTATION IN WASHINGTON'S COLUMBIA RIVER BASIN

REGULATORY REGIME	REGULATORY APPROVAL PROVISIONS	EMERGENCY PROVISIONS
Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)—administered by US EPA. Pesticide licensing and application authority delegated to Washington State Dept. of Agriculture (WSDA). Implemented under the **Washington Pesticide Control Act (RCW 15.58) and the Pesticide Application Act (RCW 17.21)**	▪ Pesticides approved for aquatic application by the WSDA must also be covered under a general NPDES permit or a State Waste Permit issued by the Dept. of Ecology (see below). ▪ For commercial pesticides not currently approved by WSDA, a formal Section 3 application process is required. The requesting body would submit an application through the WSDA. ▪ For an emergency situation, FIFRA provides for exemptions under Sections 18 and 24. See next column.	▪ Section 18 of FIFRA allows for an emergency use exemption for a pesticide that is not already approved for a specific use. The request is processed through the WSDA[i], who evaluates the request and forwards it to the EPA. The EPA then has 50 days to conduct a risk assessment. The total process has to be completed in 120 days if it is a new request, or 80 days if is a repeat request. If approved, the approval has a one-year duration. ▪ Section 18 also allows for a crisis exemption that would allow unregistered use for 15 days. The requesting entity has to justify the crisis to WSDA, who then notifies the EPA. The EPA conducts a cursory review, confers with the state, and gives a crisis exemption. Use beyond the 15 days requires an emergency exemption. Section 24 (c) allows the states to register an additional use of a federally registered pesticide, or a new use, if there is a "special local need" and a current tolerance for the use approved by EPA. The request is processed through the WSDA for review and approval, and is then submitted to the EPA for review.
Endangered Species Act (ESA)—The ESA is administered jointly by the US Fish and Wildlife Service (USFWS) for freshwater and terrestrial species, and NOAA Fisheries for anadromous and marine species. Washington Dept. of Fish and Wildlife(WDFW) maintains a **state species**	▪ Pesticide-related response actions undertaken in the CRB could affect species or critical habitat listed under the ESA. In those cases, if the action is being taken by a federal agency, or is being funded by a federal agency, an ESA Section 7 consultation needs to occur. See next column for Section 7 consultation emergency provisions. ▪ For state-only actions, ESA consultation is not required.	▪ Federal agency requests to the EPA for FIFRA Section 18 or Section 24 approval to use pesticides for emergency response actions that may affect a listed species or critical habitat would trigger the requirement for an ESA Section 7 consultation between EPA and NOAA Fisheries and/or the FWS depending on the species and critical habitat affected. ▪ Under emergency circumstances, such consultation would be conducted informally during the emergency. Formal consultation would be initiated, as appropriate, as soon as practicable after the emergency is under control. ▪ If formal consultation is required, the FWS and/or NOAA Fisheries provide an after-the-fact biological

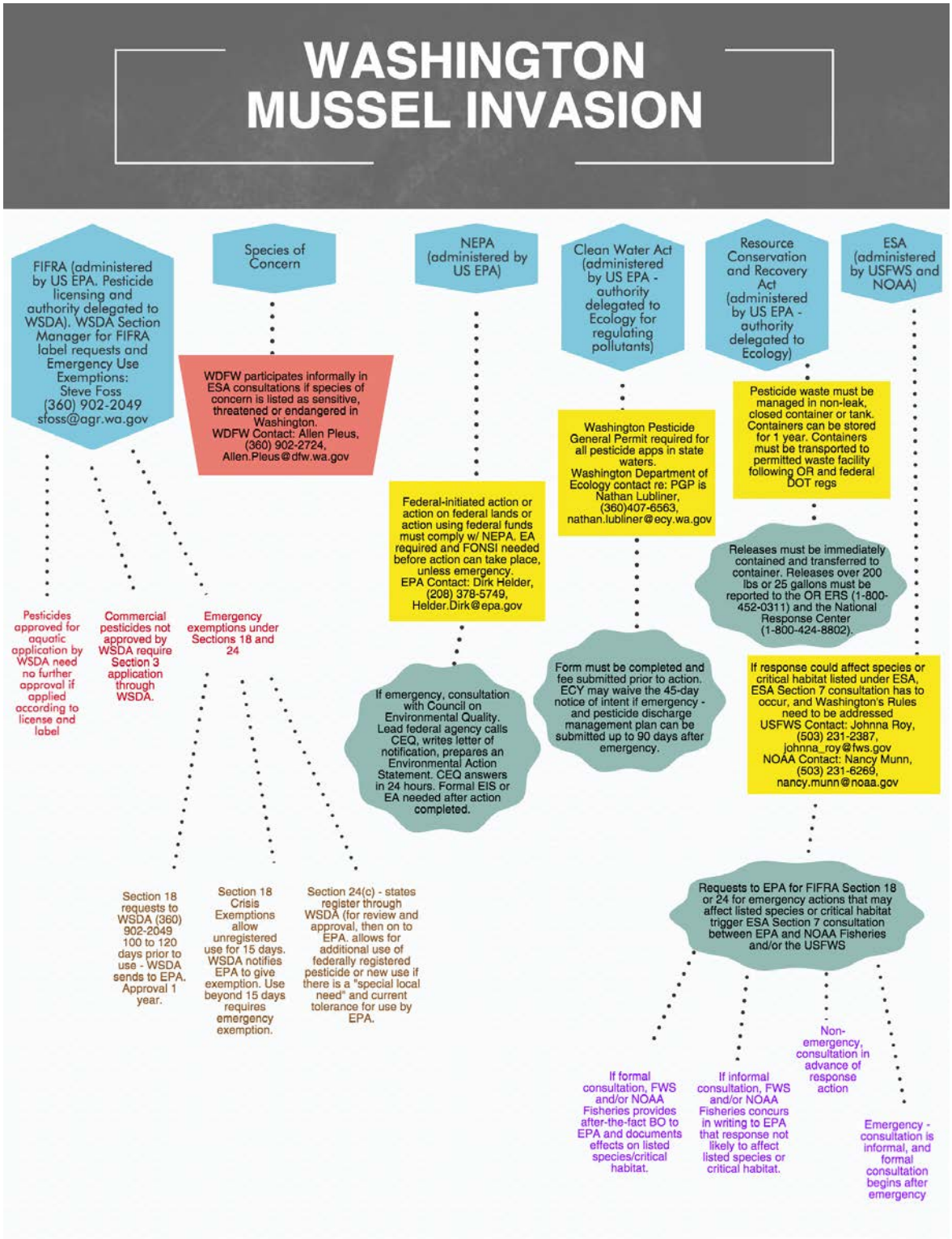
REGULATORY REGIME	REGULATORY APPROVAL PROVISIONS	EMERGENCY PROVISIONS
of concern list (WAC 232-12-297)	• To protect salmon, steelhead and bull trout, WDFW fish timing windows are incorporated into the NPDES Aquatic Invasive Species General Permit issued by Ecology.	opinion to the EPA that documents the effects of the emergency response action on listed species and/or critical habitat. ▪ If informal consultation is appropriate, the FWS and/or NOAA Fisheries provide written concurrence to the EPA that the response action is not likely to adversely affect listed species or critical habitat. ▪ Under non-emergency circumstances, the same response action would be the subject of a completed consultation in advance of the response action being implemented. WDFW would have to be consulted if a state species of concern was at risk.
National Environmental Policy Act (NEPA)— administered by US EPA. **State Environmental Policy Act (SEPA)—** administered by WA Dept. of Ecology**. (RCW 43.21)**	▪ Any federally initiated action, or action on federal lands, or action that uses federal funds, must also comply with the provisions of NEPA. An Environmental Assessment (EA) would be required, and a finding of no significant impact needed before the action could take place. For an emergency situation, see next column. ▪ SEPA provides a statewide process for identifying and evaluating the potential adverse environmental impacts of a proposal. SEPA requirements are addressed in the Ecology permit process described in the next section below. ▪ During development of the Aquatic Invasive Species General Permit (see next section below), a non-project EIS was developed to satisfy state SEPA requirements.	▪ NEPA provides for an emergency action through consultation with the Council on Environmental Quality. The lead federal action agency would call CEQ, write a letter of notification, and prepare an environmental action statement. CEQ would respond in 24 hours. After the action is complete, a formal EIS or EA would have to be prepared.
Clean Water Act (CWA)—administered by US EPA with authority delegated to the WA Dept. of Ecology (Ecology) for regulating pollutants in state waters. Implemented	▪ The Aquatic Invasive Species NPDES and State Waste Discharge General Permit (see notes below) has been developed by Ecology to allow for the treatment of aquatic invasive species. ▪ As part of applying for coverage under the permit, the Permittee must complete a SEPA checklist. The checklist is an addendum to the EIS Ecology	▪ Sections 18 and 24 of FIFRA allow for emergency or crisis exemptions from normal pesticide labeling requirements. Water pollution control laws do not have provisions that exempt emergency situations from requiring a permit. Applying a pesticide under Section 18 or 24 of FIFRA still requires a water quality permit.

REGULATORY REGIME	REGULATORY APPROVAL PROVISIONS	EMERGENCY PROVISIONS
under the **Washington Water Pollution Control Law (RCW 90.48)**	developed (see previous section). After permit coverage is issued, allowed chemicals could be used immediately, provided that appropriate FIFRA labels or exemptions have been obtained. Permittees covered under the NPDES permit for invasive species must complete an adaptive management plan. If treatment will occur before the plan is completed, the Permittee may complete it within the 18 months following treatment.	
Resource Conservation and Recovery Act— administered by US EPA with authority delegated to the Washington Dept. of Ecology **Dangerous Waste Regulations (WAC 173-303)**	▪ Pesticide waste must be managed in a non- leak, closed container or tank that is appropriately labeled. ▪ Properly managed containers may be stored for up to one year. ▪ Containers must be transported to permitted hazardous waste facility following Washington and Federal Dept. of Transportation regulations.	▪ Releases must be immediately contained and transferred to appropriate container. Releases over 200 #s or 25 gallons must be reported to the National Response Center 1 (800) 424-8802 and to the Washington Emergency Management Division 1 (800) 258-5990 and the appropriate Ecology regional office.

NOTES:

1. WSDA provides guides on line for requesting Section 18 and Section 24 exemptions. Requests are made through the Special Pesticide Registration Program Coordinator in the Pesticide Management Division of WSDA in Olympia. The contact number is 1 (360) 902-2030 or 2078.
2. Ecology has issued an NPDES/State Waste General Permit for aquatic invasive species control. http://www.ecy.wa.gov/programs/wq/pesticides/invasive.html
3. The SEPA program can be contacted at (360) 407-6922.

APPENDIX V. FLOW CHART OF PERMITTING ALTERNATIVES AND ASSOCIATED CONTACTS



APPENDIX VI. INTERIM LIST OF INTERIM AT-RISK WATER BODIES IN WASHINGTON

Table 19. Interim list of water bodies in Washington that have a high to medium relative risk of dreissenid mussel establishment and/or introduction. Risk categories were formulated using best professional judgment. The amount of data used to assign risk categories varied for each water body. Data is summarized in Appendix 1 and II, and risk categories based on one or two data points are flagged with an asterisk. Dreissenids can establish in areas identified with low to very low risk of establishment.

Water Body Name	Ca++ mg/L	pH	Risk of Establishment	Risk of Introduction
Moses Lake	**30.5**	**8.18**	**High**	**High**
Potholes Reservoir Outflow	**28.3**	**8.14**	**High**	**High**
Pend Oreille River	**20.1**	**-**	**Medium**	**High**
Lake Washington Inflow	**18.8**	**7.77**	**Medium**	**High**
Banks Lake	**17.8**	**7.90**	**Medium**	**High**
Columbia River, Lake Celilo	**16.8**	**-**	**Medium**	**High**
Columbia River, Lake Bonneville	**16.5**	**8.11**	**Medium**	**High**
Clear Lake	**16.4**	**8.47**	**Medium**	**High**
Williams Lake	**20.5**	**7.39**	**Medium**	**Medium**
Columbia River, Lake Wanapum	**18.1**	**8.02**	**Medium**	**Medium**
Lake Crescent	**15.9**	**6.94**	**Medium**	**Medium**
Nooksack River	**12.0**	**7.57**	**Low**	**Medium**
Silver Lake	**10.4**	**7.49**	**Very Low**	**High**
Deer Lake	**9.3**	**7.50**	**Very Low**	**High**
Cowlitz River	**8.1**	**7.47**	**Very Low**	**High**
Lake Cushman	**11.6**	**7.55**	**Very Low**	**Medium**
Diamond Lake	**7.5**	**7.90**	**Very Low**	**Medium**
Mineral Lake Outflow	**5.8**	**7.64**	**Very Low**	**Medium**
Alder Lake	**5.1**	**7.45**	**Very Low**	**Medium**
Cle Elum Reservoir	**4.7**	**7.08**	**Very Low**	**Medium**
Bumping Reservoir	**3.8**	**7.55**	**Very Low**	**Medium**

Source: Wells, S., T.D. Counihan, A. Puls, M. Sytsma, and B. Adair. 2011. Prioritizing Zebra and Quagga Mussel Monitoring in the Columbia River Basin. Center for Lakes and Reservoirs Publications. Paper 10. http://pdxscholar.library.pdx.edu/centerforlakes_pub/10

APPENDIX VII. DETAILS FOR TOP FIVE HIGH-RISK WATER BODIES IN WASHINGTON

	Moses Lake	Potholes Reservoir	Pend Oreille River	Lake Washington	Banks Lake
Waterbody Type	Reservoir	Reservoir	River	Natural Lake	Reservoir
Location					
Latitude	47. 04' 06.23"N	46. 58' 54.24" N		47.37'0"N	47.37'12''N
Longitude	119. 19' 55.51"W	119. 15'53.70"W		122.15'53"W	119.18'27''W
County	Grant	Grant	Pend Oreille	King	Grant
Drainage	Columbia Basin	Columbia Basin	Columbia Basin		Columbia Basin
Inflow	Crab Creek	Moses lake	Priest River/Lake Pend Oreille	Sammamish and Cedar Rivers	Lake Roosevelt
Outflow	Potholes Reservoir	Crab Creek	Columbia River	Lake Washington Ship Canal	
Statistics					
Surface Elevation (ft)	1,050	1,046		16	1,571
Basin Area (mi^2)	3,080	3,920	25,792	315,000	
Surface Area (ac)	6,728	27,800		21,000	26,886
Volume (ac ft)	131,000	332,800		2,400,000	1,237,000
Max. Depth (ft)	38	142		214	177
Mean Depth (ft)	19	18		108	46
Shoreline length (mi)					135
Trophic state	eutrophic	eutrophic		mesotrophic	
Water quality/monitoring					
pH	8.18	8.14	7.92	7.77	7.9
Ca++	30.5	28.3	20.1	18.8	17.8
Secchi		8.8			
The Center for Lakes and Reservoirs at Portland State University maintains a searchable database of water bodies in the United States that are sampled for dreissenids and *Corbicula*. Results are reported as "non-detect," "unknown," and "results pending," and identify substrate type (e.g., natural, artificial, plankton, SCUBA, ROV, other, and unspecified). For additional information, or updated information not yet loaded into the database, contact: Mark Sytsma, Ph. (503)725-2213, Fx. (503)725-3834, Email. sww@pdx.edusytsmam@pdx.edu Mailing: Portland State University, PO BOX 751-ESM, Portland OR 97207-0751 Physical: Portland State University, 1719 SW 10th Ave, SRTC Rm 218, Portland OR 97201					
Information					
Dam	Moses Lake	O'Sullivan		None	

Owned/ Administered by:	Bureau of Reclamation/ Moses Lake Irrigation and Rehabilitation District	Bureau of Reclamation		King County Water and Land Resources Division	
URL				KingCounty.gov	
Contact Info					
Dam type	earthfill	earthfill		None	
Draw down y/n	Y	Y		N	
Irrigation y/n	Y	Y		N	
Irrigation District	Moses Lake Irrigation and Rehabilitation District	East and South Columbia Basin Irrigation Districts			
WDFW Contact	TeamEphrata@dfw.wa.gov	Greg Fitzgerald, colbaswa@dfw.wa.gov			Greg Fitzgerald, colbaswa@dfw.wa.gov
Adjacent land managers/owners					
WDFW Contact	TeamEphrata@dfw.wa.gov	Greg Fitzgerald, colbaswa@dfw.wa.gov			Greg Fitzgerald, colbaswa@dfw.wa.gov
Access					
Public ramps?	Y http://wdfw.wa.gov/fishing/washington/388/	Y http://wdfw.wa.gov/lands/wildlife_areas/columbia_basin/access_sites.php#banks		Y	Y http://wdfw.wa.gov/lands/wildlife_areas/columbia_basin/access_sites.php#banks
Private ramps?	N	N		N	
Moorages?	N	N			

APPENDIX VIII. VELIGER ANALYSIS DOCUMENTATION

Sample information:

Name

Date

Location

Preservation Technique

Handling: (OR Veliger sample preservation/handling to meet minimum PCR requirements (e.g. 70% EtOH, cold storage, isopropyl alcohol)

APPENDIX IX. NOTIFICATION LIST FOR REPORTS OF DREISSENIDS IN WASHINGTON. NAMES LISTED ARE CONTACTED WHEN WATER BODIES ARE DETERMINED TO BE INCONCLUSIVE.

AGENCY	NAME	PHONE	MOBILE	FAX	EMAIL
Washington Department of Fish and Wildlife	Allen Pleus, AIS Coordinator	(360) 902-2724	(360) 918-3868		allen.pleus@dfw.wa.gov
Washington Department of Fish and Wildlife	Sgt. Justin Maschhoff, AIS Enforcement Coordinator	(360) 902-2936	(253)381-7387		justin.maschhoff@dfw.wa.gov
Washington Department of Fish and Wildlife	Bill Tweit, Special Assistant to Director	(360) 902-2723	(360) 489-2644		william.tweit@dfw.wa.gov
Pacific States Marine Fisheries Commission	Stephen Phillips	(503) 595-3100			stephen_phillips@psmfc.org
U.S. Fish and Wildlife Service	Linda Beck, Region 1 AIS Coordinator	(503) 736-4722			linda_beck@fws.gov
Portland State University	Mark Sytsma, Director for the Center for Lakes and Reservoirs	(503) 725-2213	(502) 307-6131	(503) 725-3834	sytsmam@pdx.edu
Oregon State University	Sam Chan, Assistant Professor	(503) 679-4828		(541) 737-3039	samuel.chan@oregonstate.edu

APPENDIX X. SAMPLE PRESS RELEASE

Contact: Allen Pleus, WDFW Aquatic Invasive Species Coordinator, (360) 902-2724, Allen.Pleus@dfw.wa.gov

The Washington Department of Fish and Wildlife (WDFW) has declared _____-_____ a "suspect location" for infestation of invasive quagga mussels. This report has been initially verified by [agency/recognized expert], and efforts are underway to [describe what's next, if anything, to confirm identification].

This discovery is a serious environmental and economic concern for the Pacific Northwest. Invasive quagga and zebra mussels are small nonnative freshwater mollusks that have caused major problems in the United States after their introduction in the 1980s.

Officials have not yet determined how these mussels entered _____. Recreational boats are known to be a major source of invasive mussel spread in the United States, and there are a number of past incidents where boats fouled by live invasive mussels have been intercepted prior to launching in Northwest waters.

In preparation for an introduction of invasive mussels in Washington, officials developed a rapid response plan outlining a set of actions to address the initial finding and monitor the situation long term.

Until additional surveys are conducted, the extent of the infestation is unknown. During this phase of rapid response, the _____ (agency) has _____ (restricted access) to _____ (infected location) to help prevent further potential dispersal of the invasive mussels. The public can help by avoiding the ____ (infected area) and following some good general guidelines. They should clean all boats, trailers, and other equipment after leaving a lake or stream and never release any live organisms into the wild.

Allen Pleus, WDFW Aquatic Invasive Species Coordinator, emphasized the importance of inspecting boats. "We recognize the inconvenience to boaters and understand the need for additional sampling and identification to determine if this water body is positive for quagga mussels," Pleus said. "Our staff will ensure that boats will go through the inspection process as efficiently as possible."

Boaters can assist with the process by arriving at _____ with a clean, drained and dry vessel.

For more information, visit WDFW's website at http://wdfw.wa.gov/ais/

APPENDIX XI. OUTLINE FOR DRAFT MANAGEMENT PLAN

Upon discovery of a suspected infestation, the State of Washington implements a Dreissenid Rapid Response Plan, which includes:

a. Detection activities—define the extent of the mussel infestation, its distribution and maturity.
b. Coordination activities—define the lead agency, coordinate collaboration among agencies, and allocate resources for a response and coordinate communication.
c. Mitigation and control strategies—to avoid further spread of the infestation, control[39] and reduce the size of the infestation and establish a monitoring plan to assess control effectiveness.

Upon confirmation of an infestation (i.e., a water body is determined to be positive for invasive mussels), the State will develop a management plan for that water body. The plan will include the following elements:

- **Identify objectives, priorities, and timeframes.**

  - **Objective: Determine extent of infestation**
    - Establish training and assessment protocols
    - Conduct surveys
    - Compile findings and distribute online
    - Collect additional samples
    - Identify at-risk infrastructure and coordinate with local infrastructure authorities

  - **Objective: Contain infestation**
    - **Coordinate with land management authority to implement mandatory inspection and decontamination of boats upon entry and exit of water body**
    - **Ensure decontamination units are available at water body**
    - **Communications**

[39] Details on potential treatment methods can be found in Appendix D1 of the *Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other* Dreissenid *Species*.

- **Management Authority-specific**
    - Develop and distribute survey decontamination protocols
    - Train individuals in mussel detection and communication with the public (draft key messages)
    - **Establish and maintain internal communication** protocols with partner agencies.
    - **Establish and maintain communications** with other geographic response organizations.
    - **Develop briefing statements** to inform senior management within the partner agencies.
    - **Establish an interagency public affairs team** to promote coordinated public outreach effort.
    - **Continue to participate in efforts to address quagga/zebra mussels** via 100th meridian, Western Regional Panel, Pacific Northwest Economic Region, and others.
- **External**
    - **Raise public awareness** via media outlets by issuing news releases, sponsoring a media day event.
    - Post signs at water body and throughout local community.
    - Promote Clean, Drain, Dry

- **Objective: Investigate treatment options**
    - Determine most appropriate option to control or eradication mussels (Review Appendix D1 of the *Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other Dreissenid Species* to explore treatment options)
    - Explore and implement permitting requirements needed to effect management actions (Refer to Table IV1. Pesticide Use Matrix For An Isolated Zebra Mussel Infestation In Washington's Columbia River Basin as well as appendices of *Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other Dreissenid Species*).
    - Coordinate with water body land management authority (ies) to manage use of the lake and control implementation actions.

- **Objective: Identify actions needed to meet statutory responsibility of management agencies**

- **Identify Members of the Scientific Advisory Panel**, composed of both subject matter experts on *Dreissena* spp. as well as limnologists and aquatic ecologists familiar with the watershed (academia, AIS responders with experience in dreissenid infested waters and others), who can provide planning advice and review response plans.

- **Economics**
  - **Accurately track costs and cost estimates** of the response and share with management authorities and the public. Provide justifications for expenditures.
  - Communicate financial responsibility to all incident responders

- **Identify ecological impacts**
  - Measure and track ecological changes, develop mitigation plans, and implement long-term mitigation actions (examples listed below).
    - Food chain
    - Water clarity
    - Bioaccumulation of pollutants and toxic metals
    - Alteration of waterfowl migration
    - Effects on sport fisheries
    - Effects on threatened and endangered species

APPENDIX XII. EXAMPLE OF FIFRA SECTION 18 EMERGENCY EXEMPTION APPLICATION

FIFRA SECTION 18 - EMERGENCY EXEMPTION - QUARANTINE REQUEST

FIFRA SECTION 18 - EMERGENCY EXEMPTION - QUARANTINE REQUEST

Dreissenid Mussel Treatment Plan using KCl for XXXX (Location), Oregon/Washington/Idaho/Montana

(§166.20 Application for a quarantine exemption.)

AGENCY CONTACT PERSON:

Name
Title
Division
Agency
Address
City, State, Zipcode
Email
Telephone

Qualified Experts:

Name
Title
Division
Agency
Address
City, State, Zipcode
Email
Telephone

Registrant (Supplier of product to be used):

Name
Title
Division
Agency
Address
City, State, Zipcode
Email
Telephone

PESTICIDE DESCRIPTION:

Potassium Chloride (KCl) is a metal halide salt also known as Muriate of Potash or Potash. This salt has an unclear mode of action but the potassium (K^+) is the lethal chemical for mussels. Evidence suggests it kills mussels by interfering with gill respiration (Aquatic Sciences Inc. 1997).

> *The application shall contain a description of the pesticide(s) proposed for use under the exemption:*
>
> *(i)* *For a federally registered pesticide product:* **Not applicable**
> *(ii)* *For any other pesticide products:* **KCl**
> i. *A confidential statement of formula*: **See Attachment 1**
> ii. *Complete labeling to be used with exemption:* **See Attachment 2 & 2.5**

DESCRIPTION OF THE PROPOSED USE:

Treatment Sites:

The proposed sites for use of KCl are (describe the body of water, its location, including county as well as nearest city and state and attach maps showing the body(ies) of water) (see Attachments 5&6). XXXXX has a surface area of XXXX acres and a maximum depth of XXX feet. The treatment area for the body of water is approximately xx,xxx square feet with an average depth of xx feet. The treatment area the water body is enclosed by a XX-foot tall floating curtain barrier, restricting flow and open water exchange. The barrier outlining the treatment area makes contact with the shoreline and (include any description of structures, such as boat ramp launches). The site is currently closed off from public use. The water body is not used for public drinking water. Overflow of the way body flows into XXXXX from XXX Creek.

Method of Application:

The KCl will be applied in liquid form (as a mixed slurry), similar to two treatment studies conducted in Millbrook Quarry, Virginia, USA (Fernald and Waterson, 2014), and Lake Winnipeg, Manitoba, Canada (DFO 2014), and Christmas Lake and Lake Independence in Minnesota (USA).

A pesticide applicator, licensed by the State Department of Agriculture, will be responsible for all applications of potash. Granular KCl will be mixed on board the applicators watercraft and agitated throughout the treatment. The pesticide will be applied to the surface water using a spray wand and allowed to mix with the water column.

Application Rate & Pesticide Quantities:

The potassium (K^+) concentration in potash required to kill dreissenids is 100 ppm. Fernald and Watson (2014) achieved 100% mortality between 98-115 ppm.

Following the initial dosing for each treatment area (estimated at 1700 lbs. of granular KCl), potassium (K^+) concentrations will be measured either in the field with a potassium ion electrode or analyzed by a certified lab. The pesticide applicator may also monitor for chloride concentrations in the field (as a surrogate for potassium (K^+)) as was the method in Sister Grove Creek in Texas (as per verbal conversation with the Texas Department of Parks and Wildlife). Follow-up applications(s) may be required to maintain 100 ppm potassium (K^+) for a sufficient duration which will be determined by dreissenid bioassays in lake (caged dreissenids within the treatment area monitored daily for mortality) and dreissenids in aquaria lab trials.

According to a report by ASI project E9015 (1997) potassium does not require continual addition to the water column, except to account for leakage. Efficacy will be monitored with dreissenid bioassays in lake (caged dreissenids within the treatment area monitored daily for mortality) and dreissenids in aquaria lab trials.

Total Amount of Pesticide Proposed for Treatments:

Total amount of pesticide proposed for each treatment area depends upon in-lake potassium (K^+) concentration achieved for up to two weeks after the initial dosing treatment. Additional application(s) of potash may be necessary to maintain 100 ppm potassium for up to two weeks. Initial dosing of KCl for each lake is calculated to be:

> 1700 lbs. dry weight of KCl (equates to 900 lbs. of potassium per treatment area)
>
> Note: the atomic mass percentage of KCl is 53% potassium and 47% chloride

Maximum Number of Applications:

The total number of applications in the initial two-week treatment period will depend on the dispersal and dissolve rates determined during and between applications as well as achieving 100% mortality in the dreissenid bioassays. Water samples will be collected at surface and near bottom (3–4 ft.) depths every 48–96 hours and analyzed at a professional lab. Because the area is enclosed, the State Department of XXXX does not anticipate potassium (K^+) concentrations to dissipate quickly. Dosing will be adjusted accordingly and upon achieving 100% dreissenid mortality the floating curtain will be removed from each lake, allowing the treated water to mix. One or more additional two–week treatment periods may be necessary within or outside the original treatment areas in Year, Year, and Year, depending on the results of mussel monitoring.

Total Acreage to be Treated:

The total acreage proposed is approximately XXX acres (XX,XXX square feet or XXX acres per lake). Depending upon dreissenid monitoring efforts in the near future, additional acreage may need treatment.

Total Lake Surface Area: XXXX Water Body - XXX acres

Applicable Restrictions and Requirements Concerning the Proposed Use Not on Label:

Although there are no immediate effects of KCl to human health and non-target species (Fernald and Watson, 2014), the Department of XXX will continue to monitor K concentrations (and other water quality parameters) in the water body upon barrier removal and achieved 100% dreissenid mortality. This monitoring will take place over the next consecutive years.

***Duration of Proposed Use*:**

The duration of the proposed use is for 3 years (Month Year – Month Year).

ALTERNATIVE METHODS OF CONTROL:

> *The application shall contain: A detailed explanation of why the pesticide(s) currently registered for the particular use proposed in the application is not available in adequate supplies and/or effective to the degree needed to control the emergency. If the applicant states that an available registered pesticide is ineffective for the given situation, the statement must be supported by field data which demonstrate ineffectiveness of registered pesticides, or, if such data are unavailable, statements by qualified agricultural experts, extension personnel, university personnel or other persons similarly qualified in the field of pest control; and A detailed explanation of why alternative practices, if available, either would not provide adequate control or would not be economically or environmentally feasible.*

The following alternatives are considered less desirable because of environmental concerns, technical infeasibility, logistics, or expense. Below are the listed alternatives and a detailed explanation of why they would not be effective due to lack of 1) adequate control or 2) economic and environmental feasibility.

Chemical Control

Non-oxidizing molluscicides

There are several commercial products in this category, including Clam-trol®, BULAB 6002, Calgon H-130M and others. These are generally labelled for closed system use, such as cooling water treatments, water treatment systems and power plant water lines. Generally, they are

toxic to fish and require detoxification by use of some additional substance, such as bentonite clay, prior to discharge to open waters. Clam-trol® was examined for possible use in Iowa and was ruled out as a treatment option in Iowa Great Lakes due to, "… uncertainty of its effectiveness due to potential inadequate mixing in the water column, its short life span and the anticipated kill of most aquatic organisms in the quarry." Their restricted labelling and broader non-target toxicity makes them unsuitable for open water use such as needed in the water body described herein.

For more info see here:
http://www.iagreatlakes.com/ZQM_Eradication_Control_Options.pdf
http://www.epa.gov/pesticides/chem_search/ppls/003876-00149-20130709.pdf

Oxidizing molluscicides

Copper products, such as copper sulfate are pesticides used to control snails and swimmers itch in several Midwestern states. In addition, chelated copper products have been used to target dreissenids. However, attempts using copper in open water applications have shown inconsistent results, resulting in non-target impacts to outlet stream invertebrate fauna, "molluscan fauna eliminated, as well as amphipods, mayflies and stoneflies, with some species of caddis flies also showing impacts", while in Nebraska copper sulfate was unsuccessful in eradicating dreissenids in Base Lake, and also resulted in a large fish kill (Schainost 2010). Research conducted by the U.S. Army Corps of Engineers found that adult dreissenids require significantly higher levels of copper for mortality than veligers. Thus, high doses or repetitive copper treatments are needed, and may result in increased non-target impacts. In addition, recent treatments utilizing one copper based product (EarthTec QZ®, copper sulfate pentahydrate) have not produced the desired dreissenid mortality as it has proven difficult to maintain adequate copper levels in open-water applications.

For more info see here:
http://www.iagreatlakes.com/ZQM_Eradication_Control_Options.pdf
http://www.ianrpubs.unl.edu/epublic/live/g2173/build/#target5
http://www.omaha.com/outdoors/invasive-zebra-mussels-confirmed-at-offutt-lake/article_e5327a2a-1507-11e4-b44a-0017a43b2370.html

Bio-pesticides

Zequanox® is a highly selective biological molluscicide that has low toxicity and presents little to no risk towards non-target organisms. Water temperatures below those recommended for optimum efficacy of this control material significantly reduce the efficacy of this product. Once reproduction has occurred, veligers can move throughout the water column, rendering treatment of the area ineffective at eliminating the dreissenids from the water body. In addition, Zequanox® is cost prohibitive in terms of treating large, open waters compared to chemically based products (i.e. copper-based algaecides/molluscicides or KCl).

Physical/Mechanical Removal

It is unrealistic and unfeasible to remove dreissenids through physical or mechanical means. In addition, mechanical means could increase turbidity and a reduce water clarity by stirring up sediment in the cordoned off area. Additionally, if mechanical means were to stir up bottom materials, these could move from the area and potentially carry attached mussels to other areas of the lake.

EFFECTIVENESS OF PROPOSED USE:

> *The application shall contain data, a discussion of field trials, or other evidence that provide the basis for the conclusion that the proposed pesticide treatment will be effective in dealing with the emergency.*

To date there are few instances of open-water applications of potash (KCl) for dreissenid control in lakes and rivers, although the product has been used in closed systems for decades largely for non-pesticide industrial/municipal purposes. The few examples of open-water applications cited in the literature include lake treatments in Millbrook Quarry, Virginia, and Lake Winnipeg, Manitoba, and one stream treatment in Sister Grove Creek, Texas (see details below). The lake treatments were both successful at achieving mortality in the treatment areas, but the stream treatment was not. In addition, treatments of potash were attempted in late 2014 in two lakes in Minnesota.

Millbrook Quarry, Virginia

Zebra mussels were identified in 2002 in Millbrook Quarry, Virginia, by the Virginia Department of Game and Inland Fisheries (Fernald and Watson 2014). This was the first open-water infestation to be documented in the state of Virginia. Millbrook Quarry is 12 acres and has a depth of 93 feet. The quarry was opened in 1947 and has been inactive since 1963. The quarry has been used as a training and recreational dive site since 1970.

After the zebra mussel population delineation and assessment, the decision was made to attempt to eradicate the mussels via the application of potassium under a section 18 emergency exemption authorized by EPA. Treatment was conducted by a private contractor (Aquatic Sciences LP) during a three-week period in January-February 2006. The contractor injected a solution of 74,000 gallons of potassium chloride (muriate of potash) over the three-week period, aiming for a target concentration of 100 milligrams of KCl per liter of water or 100 ppm KCl. Weekly monitoring of potassium concentrations was conducted during and post-treatment, along with monitoring of adjacent waters. Detected concentrations ranged from 98-115 ppm of potassium within the quarry, and no leaks of potassium in to surrounding waters were detected. The Virginia Department of Fish and Game concluded that the treatment was successful, and that zebra mussel mortality was 100%. Zebra mussel mortality was assessed by four methods, including collection of over 1000 mussels from rocks at sites around the quarry

(no live mussels were collected), visual dive surveys of the quarry for live mussels, video surveys of the bottom via robotic camera, and bioassays of caged live zebra mussels exposed to the treated quarry water. No non-target impacts were observed on local aquatic wildlife (including crayfish, mollusks, turtles, and multiple fish species), and unrestricted use of the Quarry for diving was allowed starting on May 6, 2006.

Lake Winnipeg, Manitoba

Lake Winnipeg is a large (9,465 square miles) lake in the province of Manitoba, Canada. It has an average depth of 39 feet, and a maximum depth of 118 feet, and is used extensively for tourism/ recreation, commercial fishing, and in the generation of hydroelectric power. Zebra mussels were first identified in Lake Winnipeg in October 2013 on a private dock. Subsequent searches also identified a private individual who found five dead mussels on a piece of PVC pipe in 2011, but did not report the findings until late 2013.

The October 2013 zebra mussel finding prompted the Province of Manitoba to implement a rapid response protocol in an attempt to eradicate all known populations and suppress the spread of the existing population (Department of Fisheries and Oceans, 2014). As part of the rapid response protocol, a survey was conducted in October 2013 to determine the spatial extent and density of the zebra mussel population, and four harbors were identified as infested. Previously collected data from 2013 spiny waterflea (*Bythotrephes longimanus*) collections across the lake were also analyzed for zebra mussel veligers, and none were found in locations away from the infested harbors. Based on the successful use of liquid potash in Millbrook Quarry, the high toxicity of potash to zebra mussels and its low toxicity to most other aquatic biota, the Province of Manitoba selected potash to use for the treatment in Lake Winnipeg. In 2014, the four harbors were sealed off from the main lake for 60 days using non-permeable geotextile membranes, and treated by a private contractor (ASI Group Ltd-formerly Aquatic Sciences LP). In order to maintain KCl concentrations similar to those in Millbrook Quarry, Virginia (100 ppm), approximately 336 metric tons of 20% KCl solution was used to treat 356,000-427, 000 m^3 of water (Department of Fisheries and Oceans 2014). All four harbors were treated once within 28 working days. Daily water quality monitoring was conducted during the treatments, along with post-treatment monitoring to assess potassium levels. Zebra mussel mortality was assessed via bioassays of healthy adult zebra mussels exposed to treated harbor water, and via ongoing monitoring of the harbors. The Manitoba minister of Conservation and Water Stewardship described the treatments as 100% effective in the treated areas, but surveys are still taking place outside of the harbors to determine whether a zebra mussel population exists elsewhere in the lake.

Sister Grove Creek, Texas

Zebra mussels were first observed in Texas in 2009, in Lake Texoma. Zebra mussels then moved south, and in 2010 a small, low-density population was documented in a tributary of Lake Lavon, Sister Grove Creek. Lake Lavon is an important water supply source and recreation destination in north Texas, and so the Texas Commission on Environmental Quality and the Texas Parks and Wildlife Department submitted an application to treat 35 miles of Sister Grove Creek for zebra mussels. The treatment took place September-October 2010, and the entire stream length was treated using 35,000 pounds of potash under section 18 emergency exemption authorized by EPA. Conductivity was monitored during the treatments to assess whether target potassium concentrations had been achieved, and post-treatment evaluations examined zebra mussel survival in the upper and lower sections of the creek. While 100% zebra mussel mortality was achieved in the lower section of the creek, some live mussels were found even after a second application of potash in the upper creek. The lack of mortality was attributed to the low flow and low water volumes in the upper section of the creek during the treatment periods. Monitoring of the zebra mussel populations is continuing, since treatment efforts may have set back the zebra mussel population in Sister Grove Creek enough to slow their expansion or to limit their ability to develop a viable breeding population.

DISCUSSION OF RISK INFORMATION:

> *The application shall address the potential risks to human health, endangered or threatened species, beneficial organisms, and the environment expected to result from the proposed use, together with references to data and other supporting information.*

Human health

It is not expected that the application of potash to the proposed treatment area will have any potential risk to human health (see Attachment 3 - MSDS, Hazards Identification). The initial application(s) in 2014-2015 would occur during colder water temperatures, so any swimming or other related recreational use would not occur. For follow up treatments in the summer/late fall, no direct contact by humans would be expected. The small proposed treatment area will remain contained within the barrier until all treatments have been completed. Data from the Final Environmental Assessment from Virginia (2005) stated that toxicity levels for the potash that was applied to Millbrook Quarry were:

> Acute Oral Toxicity: (mouse, rat) LD50 = 1500 – 2600 mg/kg bw.

As these levels far exceed the proposed application rates (100 ppm) it is unlikely that incidental human contact with treated waters could cause any human health risk. Potassium chloride can be prescribed in pill form to treat low levels of potassium in the body. Thus, any exposure to water or biota from the treatment area would not likely have negative impacts on human health.

Endangered or threatened species

Describe the listed threatened/endangered species in the water body and downstream of the water body.

Non-target effects

Potash has been shown in previous uses to have an extremely high level of non-target organism safety (see MSDS; Toxicological Information and Ecological Information). Toxicity data indicates that the target concentration is not lethal to non-target organisms other than freshwater mollusks (e.g., the threshold effect concentration [TEC] for potassium is 272.6 ppm for *Ceriodaphnia* and 426.7 ppm for fathead minnows; Aquatic Sciences Inc. 1997, USFWS 2005). One major group that could be impacted by potash is molluscs, which include native unionids and gastropods as well as the target pest dreissenids. Surveys in the proposed treatment area have documented XXX native mussel individuals. Freshwater snails would also likely be impacted in the treatment – however, due to the small area of the treatment location, repopulation via existing snail populations within the lake and adjacent to the treatment area would likely be rapid.

COORDINATION WITH OTHER AFFECTED STATE OR FEDERAL AGENCIES:

> *If the proposed use of the pesticide is likely to be of concern to other Federal or State agencies, the application shall indicate that such agencies have been contacted prior to submission of the application, and any comments received from such agencies shall be submitted to EPA.*

The State Department of Agriculture and Department of Fish and Wildlife cooperated in the creation of this Section 18 Quarantine request and has provided the treatment plan as well as background information on KCl. These agencies fully support this request as a prudent control measure for localized dreissenid infestations in (name the state) waters. In addition, the agencies will be gathering valuable data in terms of dreissenid eradication strategies for future localized infestations.

The (state) Department of Environmental Quality (pollution control agency) was also contacted regarding this proposal and they submitted the following response:

> Department of XXXXX staff have reviewed this application and concluded that it poses no significant threat of water quality harm or ecological risk to the two lakes. We note that the chronic standard for chloride in these water bodies (and in most waters of the state) is XXX mg/L, whereas the proposed treatment concentration is less than XX% of

this standard (about 50 mg/L in terms of chloride). (initials of agency representatives and date)

ACKNOWLEDGMENT BY REGISTRANT:

The application shall contain a statement by the registrants of all pesticide products proposed for use acknowledging that a request has been made to the Agency for use of the pesticide under this section. This acknowledgment shall include a statement of support for the requested use, including the expected availability of adequate quantities of the requested product under the use scenario proposed by the applicant(s); and the status of the registration in regard to the requested use including appropriate petition numbers, or of the registrant's intentions regarding the registration of the use.

See Attachment 3

Description of Proposed Enforcement Program:

Prior to approval, the applicant shall provide an explanation of the authority of the applicant or related State or Federal agencies for ensuring that use of the pesticide under the proposed exemption would comply with any special requirements imposed by the Agency and a description of the program and procedures for assuring such compliance.

Treatment(s) will be permitted and supervised by the state Department of Agriculture. The state Department of Agriculture will take appropriate steps to ensure that the conditions of the exemption are met.

Information Required for a Quarantine Exemption:

An application for a quarantine exemption shall provide all of the following information concerning the nature of the emergency:

The scientific and common name of pest: ***Dreissena rostriformis bugensis*, quagga mussels**

The origin of pest and the means of its introduction or spread if known:

Dreissenids are a detrimental aquatic invasive species that have invaded North America.

Zebra mussels were first observed in Lake St. Clair in 1986 and spread through ballast waters discharged from commercial ships. They are now widespread in areas such as the Great Lakes, the Ohio and Mississippi River drainage and lakes from Wisconsin to New England. A key vector for spread is watercraft that move from water body to water body after remaining in an infested water body for a period of time (see an updated GIS map on zebra mussel distribution at http://nas2.er.usgs.gov/viewer/omap.aspx?SpeciesID=5).

The quagga mussel was first sighted in the **Great Lakes** in September 1989, when one was found near Port Colborne, Lake Erie, though the recognition of the quagga type as a distinct species was not until 1991. In August 1991, a mussel with a different genotype was found in a random zebra mussel sample from the Erie Canal near Palmyra, New York, and after confirmation that this mussel was not a variety of *Dreissena polymorpha*, the new species was named "quagga mussel" after the "quagga", an extinct African relative of the zebra. The quagga mussel has since been found in Lake Michigan, Lake Huron, Lake Erie, Lake Ontario, Lake St. Clair, Saginaw Bay, and throughout the St. Lawrence River north to Quebec City. The first sighting of quagga mussels outside the Great Lakes basin was made in the Mississippi River between St. Louis, **Missouri** and Alton, **Illinois** in 1995. In January 2007, populations of quagga mussels were discovered in Lake Mead near Boulder City, **Nevada**), and in Lake Havasu and Lake Mohave on the **California/Arizona** border. This was an extremely large leap in their range and cause for much concern to limited water supplies and endangered fishes in the southwestern US. Late in 2007 and early 2008, quagga mussels were discovered in 15 southern **California** reservoirs. Veligers were identified from six **Colorado** reservoirs. In **Utah**, only veligers were collected from Red Fleet Reservoir and just one adult from Sand Hollow Reservoir. They are not considered established in Utah. A reservoir in **New Mexico** tested positive for veliger DNA in 2011 (see an updated GIS map on quagga mussel distribution at http://nas2.er.usgs.gov/viewer/omap.aspx?SpeciesID=95).

The anticipated impact of not controlling the pest:

The dreissenids found represent an isolated population. The likelihood of eradication through chemical control is high. If no action were taken, it is likely that the dreissenids will establish a reproducing, self-sustaining population, which could then serve as another source population and possibly contribute to the infestation of water bodies free from dreissenids. Most importantly, taking no action would mean that agencies and partners would lose a valuable opportunity to learn whether dreissenid mussel eradication/control can be achieved. Information gathered from this study will be beneficial for resource agencies addressing dreissenid introductions in the future.

Dreissenid infestations in other water bodies in North America have caused human health concerns through cuts on recreationists' feet, as well as scrapes on hands and other areas. In Lake Pepin (Mississippi River) people have reported serious cuts to the paws of their dogs which have gone into the water in areas of heavy mussel densities. Reports from Lake Zumbro (southern Minnesota) have included emergency room visits to have stiches put in the feet of water skiers who have jumped from the ski boat onto lake areas with zebra mussels.

Dreissenids have been shown to have a variety of environmental, economic, and recreational impacts. Native mussels are infested by this bio-fouling invasive species and can be quickly killed. Areas of the Great Lakes showed massive declines in native mussel local populations after invasion and heavy infestation. Dreissenids have also been correlated with blooms of toxic

blue-green algae in bays within the Great Lakes. Their feeding targets green algae and they reject blue-green forms. This selective feeding removes competition in the algal community for nutrients, permitting potentially high densities of undesirable blue-green algae. Extensive filtering of suspended particulates in the lake by high densities of dreissenids can lead to increased macrophyte growth through increased water clarity. Some contaminants are bio-accumulated by the filter-feeding behavior, and can potentially be passed on to any predators (diving ducks, fish) that eat these mussels. In some areas of the Great Lakes, dreissenids have been implicated in a complex path that has led to large waterfowl die-offs (including loons and other important species) through botulism toxin. Researchers have also suggested that dense extensive populations of dreissenids may interfere with the base of the food chain in lakes, competing with zooplankton for the desirable component of the algal community.

Other issues include clogging of personal water intakes, used for lawn and garden watering, as well as heavy infestations on boats and other watercraft moored in infested waters. The potential for inadvertent spread via recreational gear moved from infested waters increases with new infestations, including but not limited to private sale of docks, lifts, rafts and other recreational gear. Reports from Great Lakes areas have included alteration of algal community to favor blue-green algae, in some cases creating conditions that favor blooms that can create toxins.

References:

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Waller, D.L., Rach, J.J., Cope, W.G., Marking, L.L., Fisher, S.W., and Dabrowka, H. 1993. Toxicity of candidate molluscicides to zebra mussels (*Dreissena polymorpha*) and selected target organisms. J. Great Lakes Res. 19: 695-702.

Attachment 1: Confidential Statement of Chemical Formula

Mosaic

KCl Fine – Untreated

PARTICLE SIZE DISTRIBUTION — SGN = 30

Tyler Mesh	US Mesh	Opening (mm)	Typical (% Cum.)
20	20	0.841	0.2
28	30	0.600	1.8
35	40	0.420	16
65	70	0.210	72
100	100	0.149	93

PHYSICAL PROPERTIES	Typical
Bulk Density, loose	
- lb/cu foot	72
- kg/cu meter	1153
Angle of Repose (degrees)	26

CHEMICAL ANALYSIS

Component	Symbol	Typical %
Potassium Oxide Equivalent	K_2O	62.38
Potassium Chloride	KCl	98.74
Potassium	K	51.78
Sodium Chloride	NaCl	1.00
Moisture at 130° C	H_2O	0.070
Chloride	Cl	47.61
Sodium	Na	3935 PPM
Calcium	Ca	250 PPM
Magnesium	Mg	110 PPM
Bromide	Br	560 PPM
Sulfate	SO_4	450 PPM
Water Insoluble	—	100 PPM

Product analyses are typical as tested at minesite. Handling and transportation may affect the analysis of the delivered product.

Revised 11/05

Attachment 2: Muriate of Potash Label

MOP (Muriate of Potash)

For control of zebra mussels and quagga mussels in specific lakes in Minnesota
For use only by Minnesota Department of Natural Resources personnel and their designees
Section 18 Emergency Exemption
EPA File Symbol: XX-XX-XX

THIS IS AN UNREGISTERED PRODUCT AND MAY BE DISTRIBUTED AND USED ONLY IN MINNESOTA.

EFFECTIVE PERIOD: This exemption becomes effective on MM/DD/14 and expires on MM/DD/17.

ACTIVE INGREDIENT: potassium chloride….99%

OTHER INGREDIENTS: ……..…….1%

TOTAL: ……...…100.0% **NET CONTENTS:** 55 lbs.

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION. Harmful if swallowed. Harmful if absorbed through skin. Causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Harmful if inhaled. Avoid breathing dust or spray mist. Wash thoroughly with soap and water after handling and before eating, drinking,

chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing before reuse.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Wear long-sleeved shirt, long pants, socks, and shoes. Wear waterproof gloves. Wear protective eyewear.

FIRST AID

If swallowed:

– Call a poison control center or doctor immediately for treatment advice.

– Have person sip a glass of water if able to swallow.

– Do not induce vomiting unless told to by a poison control center or doctor.

– Do not give anything to an unconscious person.

If inhaled:

– Move person to fresh air.

– If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.

– Call a poison control center or doctor for further treatment advice.

If on skin:

– Take off contaminated clothing.

– Rinse skin immediately with plenty of water for 15-20 minutes.

– Call a poison control center or doctor for treatment advice.

If in eyes:

– Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.

– Call a poison control center or doctor for treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. For medical emergencies call your poison control center at 1-800-222-1222.

ENVIRONMENTAL HAZARDS

PHYSICAL OR CHEMICAL HAZARDS

When this material is subjected to high temperatures, it may release small amounts of chloride gas.

DIRECTIONS FOR USE

This use is in connection with an emergency exemption authorized under the provisions of section 18 of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended.

This label must be in the possession of the user at the time of application. It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Any adverse effects resulting from the use of MOP (Muriate of Potash) under this quarantine exemption must be immediately reported to the State Department of Agriculture (651-201-6292).

For use only by _____ (agency) personnel and their designees

- For use only in _____ (water body) and _____ county, state
- For use in control of zebra mussels and quagga mussels
- **Application rate:** 100 ppm potassium (K^+)
- **Method of application:** The KCl will be mixed with water at _____ (water body) and applied to the surface waters of the designated treatment areas. A pesticide applicator, licensed by the State Department of Agriculture, will be responsible for all applications of potash. Granular KCl will be mixed on board the applicators watercraft and agitated throughout the treatment. The pesticide will be applied to the surface water using a spray wand and allowed to mix with the water column.
- **Application frequency:** Following the initial dosing for each treatment area (estimated at 1700 lbs. of granular KCl), xxpotassium (K^+) concentrations will be measured either in the field with a potassium ion electrode or analyzed by a certified lab. The pesticide applicator may also monitor for chloride concentrations in the field (as a surrogate for potassium (K^+). Follow-up applications(s) may be required to maintain 100 ppm potassium (K^+) for a sufficient duration which will be determined by zebra mussel bioassays in lake (caged zebra mussels within the treatment area monitored daily for mortality) and zebra mussels in aquaria lab trials.
- For use only in localized areas.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

STORAGE: Keep container closed and away from food, feedstuffs, and domestic water supplies.

PESTICIDE DISPOSAL: Any unused, unregistered product must either be returned to the manufacturer or distributor (unopened containers) or disposed of in accordance with Resource Conservation and Recovery Act regulations following the expiration of the emergency exemption.

CONTAINER DISPOSAL: Nonrefillable container. Do not reuse or refill this container. Offer for recycling, if available. If not available, then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State or local authorities, by burning. If burned, stay out of smoke.

Manufactured by: Contact information for manufacturer

Distributed by: Contact information for distributor

Attachment 2.5: Muriate of Potash Batch Information/Quality Certificate

11835

Mosaic

SK, Belle Plaine - Mosaic
Kalium Road
Belle Plaine SK S0G 0G0
Telephone: 3063458400
Fax:

HAWKINS CHEMICAL INC.
3100 E HENNEPIN AVE
MINNEAPOLIS MN 55413
UNITED STATES OF AMERICA

FAX: 6126178578

Vehicle ID: **SY7410-MB**
Scale Ticket No: **BP60007983**
Deliveries: **1001800321**

Quality Certificate
Date
06/13/2014
Purchase order item/date
527149 / 05/15/2014
Delivery item/date
1001800321 000010 / 06/10/2014
Order item/date
1701420 000010 / 05/15/2014
Customer number
5007820

Material: Our / Your reference
102944 MOP, 62% WHITE FINE UNTR 55 LB BAGS /

Inspection lot 100000064998 from 06/10/2014

Characteristic	Value	Unit	Lower Limit	Upper Limit
Chemical Analysis				
NaCl	0.86	%		
KCl	98.98	%		
K2O	62.53	%		
SH2O	0.040	%		
Physical Analysis				
20 Mesh	1.00	%		
28 Mesh	3.64	%		
35 Mesh	28.71	%		
48 Mesh	64.49	%		
65 Mesh	84.07	%		
100 Mesh	94.39	%		
Lot Number 1 →	14.147			

Additional Vehicles in this shipment:
Additional Deliveries in this shipment:

Pat Mudry
Quality Control Lab Supervisor
Mosaic Potash,Belle Plaine,(306)345-8631

QA Approved
Kc 19 Jun 14

Attachment 3: Statement from Supplier

Attachment 4: Muriate of Potash MSDS

Mosaic

MATERIAL SAFETY DATA SHEET
Muriate of Potash

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name:	Muriate of Potash (MOP), all grades
Chemical Name:	Potassium Chloride
Chemical Family:	Inorganic Salt
Synonyms:	Potash; MOP; Potassium Chloride; Potassium Muriate; Potassium Monochloride
Chemical Formula:	KCl
Primary Use:	Crop nutrient; Industrial applications
Responsible Party:	Mosaic USA LLC 3033 Campus Drive Plymouth, MN 55441
Non-Emergency Technical Contact:	8:00 am - 4:00 pm Central Time, Mon - Fri: 800-323-5523

EMERGENCY OVERVIEW
24 Hour Emergency Telephone Number:
For Chemical Emergencies:
Spill, Leak, Fire or Accident
Call CHEMTREC
North America: (800) 424-9300
Others: (703) 527-3887 (collect)

Health Hazards:	Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. Potassium chloride is generally recognized as safe (GRAS) when used in accordance with good manufacturing practice.
Physical Hazards:	None expected
Physical Form:	Solid
Appearance:	White to reddish-brown, crystalline or granular
Odor:	None

NFPA HAZARD CLASS		HMIS HAZARD CLASS	
Health:	1 (Slight)	Health:	1 (Slight)
Flammability:	0 (Least)	Flammability:	0 (Least)
Instability:	0 (Least)	Physical Hazard:	0 (Least)
Special Hazard:	None		

Status: Revised MSDS
Revised Section: 1
Issue Date: December 1, 2006
MSDS Number: MOS002

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	% Weight	Exposure Guideline		
Potassium Chloride CAS No. 7447-40-7	95 - 99.5	NE	OSHA ACGIH	All All
Sodium Chloride CAS No. 7647-14-5	0.3 - 3.7	NE	OSHA ACGIH	All All
Calcium and Magnesium Chlorides and Sulfates CAS No. Various	0.2 - 1.3	NE	OSHA ACGIH	All All

NE = Not established, but the following particulate limits apply to all inert inorganic dusts.

Particulates Not Otherwise Classified (PNOC)	10 mg/m^3 3 mg/m^3	ACGIH	TWA - Inhalable TWA - Respirable
Particulates Not Otherwise Regulated (PNOR)	15 mg/m^3 5 mg/m^3	OSHA	TWA - Total Dust TWA - Respirable

Notes:
State, local or other agencies or advisory groups may have published more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

3. HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS	
Eye:	Contact may cause mild eye irritation including stinging, watering and redness.
Skin:	Contact may cause mild irritation including redness and a burning sensation. No information available on skin absorption.
Inhalation (Breathing):	No information available.
Signs and Symptoms:	Effects of overexposure may include irritation of the nose, throat and digestive tract, nausea, vomiting, diarrhea, abdominal cramping, irregular heartbeats (arrhythmias), dehydration, and hypertension. Repeated overexposure to dusts may result in irritation of the respiratory tract, coughing and shortness of breath.
Cancer:	Inadequate data available to evaluate the cancer hazard of this material.
Target Organs:	No data available.
Developmental:	Inadequate data available for this material.
Other Comments:	None.
Pre-Existing Medical Conditions:	Conditions aggravated by exposure may include kidney disorders and high blood pressure (hypertension).

4. FIRST AID MEASURES

Eye:	If irrigation or redness develops, move victim away from exposure and into fresh air. Flush eyes with clean water. If symptoms persist, seek medical attention.
Skin:	Cleanse affected area(s) thoroughly by washing with mild soap and water. If irritation or redness develops and persists, seek medical attention.
Inhalation (Breathing):	If respiratory symptoms develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.
Ingestion (Swallowing):	If large amounts are swallowed, seek emergency medical attention. If victim is drowsy or unconscious and vomiting, place on left side with the head down and do not give anything by mouth. If victim is conscious and alert and ingestion occurred within the last hour, vomiting should be induced for ingestion of large amounts (more than 5 ounces or a little more than 1/2 cup in an adult) preferably under direction from a physician or poison center. If possible, do not leave victim unattended and observe closely for adequacy of breathing.
Note to Physicians:	No information found.

5. FIRE FIGHTING MEASURES

Flammable Properties:	**This product is non-flammable.** Flash Point - Not applicable OSHA Flammability Class - Not applicable LEL/UEL - Not applicable Auto-ignition Temperature - Not applicable
Unusual Fire & Explosion Hazards:	No unusual fire or explosion hazards are expected. When this material is subjected to high temperatures, it may release small amounts of chloride gas.
Extinguishing Media:	Use extinguishing agent suitable for type of surrounding fire.
Fire Fighting Instructions:	Positive pressure, self contained breathing apparatus is required for all fire fighting activities involving hazardous materials. Full structural fire fighting (bunker) gear is the minimum acceptable attire. The need for proximity, entry, flashover and/or special chemical protective clothing (see Section 8) needs to be determined for each incident by a competent fire fighting safety professional. Water used for fire suppression and cooling may become contaminated. Discharge to sewer system(s) or the environment may be restricted, requiring containment and proper disposal of water (see Section 6).

6. ACCIDENTAL RELEASE MEASURES

Muriate of Potash is a crop nutrient and plant food however, large spills can harm or kill vegetation.

- Stay upwind and away from spill (dust hazard).
- Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).
- Prevent spilled material from entering sewers, storm drains, other unauthorized treatment drainage systems, and natural waterways.
- Notify appropriate federal, state, and local agencies as may be required (see Section 13).
- Minimize dust generation.
- Sweep up and package appropriately for disposal.

7. HANDLING AND STORAGE

Handling:	The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8). Wash thoroughly after handling. Wash contaminated clothing. Use good personal hygiene practice.
Storage:	Keep container(s) tightly closed. When possible use and store this material in cool, dry, well ventilated areas. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:	If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits (see Section 2), additional ventilation or exhaust systems may be required.

Personal Protective Equipment (PPE)	
Respiratory:	A NIOSH approved air purifying respirator with a type 95 (R or P) particulate filter may be used under conditions where airborne concentrations are expected to exceed exposure limits (see Section 2). Protection provided by air purifying respirators is limited (see manufacturer's respirator selection guide). Use a positive pressure air supplied respirator if there is potential for uncontrolled release, exposure levels are not known or any other circumstances where air purifying respirators may not provide adequate protection. A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed if workplace conditions warrant a respirator.
Skin:	The use of cloth or leather work gloves is advised to prevent skin contact, possible irritation and absorption (see glove manufacturer literature for information on permeability).
Eye/Face:	Approved eye protection to safeguard against potential eye contact, irritation, or injury is recommended. Depending on conditions of use, a face shield may be necessary.
Other PPE:	A source of clean water should be available in the work area for flushing eyes and skin. Impervious clothing should be worn as needed.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm)

Flash Point:	Not applicable
Flammable/ Explosive Limits (%)	LEL/UEL - Not applicable
Auto-ignition Temperature:	Not applicable
Appearance:	White to reddish-brown, crystalline or granular
Physical State:	Solid
Odor/Taste:	None/Strong saline
Molecular Weight of Pure Material:	KCl - 74.6; NaCl - 58.5
pH:	5.4 - 10.0 in a 5% solution
Vapor Pressure MM Hg):	Approximately zero
Vapor Density (air = 1):	2.57
Boiling Point:	Sublimes at 1,500°C (2,732°F)
Freezing/Melting Point:	772 to 776°C (1423 to 1428°F)
Solubility in Water:	99.5 - 99.999%; 34.2 g/100mL at 20°C
Specific Gravity:	1.986 - 1.990
Volatility:	No data available
Bulk Density:	Loose - 64 to 75 lbs/ft^3 (1025 to 1200 kg/m^3)

10. STABILITY AND REACTIVITY

Chemical Stability:	Stable under normal conditions of storage and handling. Material is hygroscopic (May absorb moisture from air when relative humidity >72%).
Conditions to Avoid:	None known
Incompatible Materials:	Avoid contact with hot nitric acid, may cause evolution of toxic nitrosyl chloride. Contact with other strong acids may produce irritating hydrogen chloride gas. KCl may react violently with bromine trifluoride and may explode if mixed with potassium permanganate and sulfuric acid. NaCl can react with most noble metals, such as iron or steel, building materials (such as cement), bromine, or trifluoride. A potentially explosive reaction may occur if NaCl is mixed with dichloromaleic anhydride and urea. Electrolysis of mixtures containing NaCl and nitrogen compounds may form explosive nitrogen trichloride.
Corrosivity:	Similar to salt. Mildly corrosive to metals in the presence of moisture.
Hazardous Decomposition Products:	None known
Hazardous Polymerization:	Will not occur

11. TOXICOLOGICAL INFORMATION

Potassium Chloride:	LD50 (rat, oral) = 2.6 g/kg LD50 (mouse, oral) = 1.5 g/kg LC50: no information available Eye (rabbit): 500 mg/24 H, mild irritant Inadequate carcinogenicity, mutagenicity, or developmental toxicity data located for potassium chloride. No target organ data located for potassium chloride.
Sodium Chloride:	LD50 (rat, oral) = 3 g/kg; LD50 (mouse, oral) = 4 g/kg LC50 (rat) >42 g/m3 / 1 hour Eye (rabbit): 100 mg/24 hour, moderate irritant Eye (rabbit): 500 mg/24 hour, mild irritant Inadequate carcinogenicity, mutagenicity, or developmental toxicity data located for sodium chloride. No target organ data located for sodium chloride.

12. ECOLOGICAL INFORMATION

Ecotoxicity:	Dissolution of large quantities of potassium chloride and sodium chloride in water may create an elevated level of salinity that may be harmful to fresh water aquatic species and to plants that are not salt-tolerant. **Potassium Chloride:** Lepomis macrochirus LC50 - 2010 mg/l Physa heterostrapha LC50 - 940 mg/l Scenedesmus subspicatus EC50 - 2500 mg/l **Sodium Chloride:** Ceriodaphania dubia LC50 - 280,000 - 3,540,000 ug/l Daphnia magnia LC50 - 3,144,000 - 10,000,000 ug/l Daphnia pulex EC50 - 56.40 mM Pimephales promelas LD50 - 6,020,000 - 10,000,000 ug/l
BOD AND COD:	No data found

13. DISPOSAL CONSIDERATIONS

This material, if discarded as produced, is not an RCRA "listed" or "characteristic" hazardous waste. Contamination may subject it to hazardous waste regulations. Properly characterize all waste materials. Consult state and local regulations regarding the proper disposal of this material.

Status: Revised MSDS	**Issue Date: December 1, 2006**
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MATERIAL SAFETY DATA SHEET
Muriate of Potash

14. TRANSPORT INFORMATION

Hazard Class or Division:	Not listed in the hazardous materials shipping regulation (49 CFR, Table 172.101) by the U.S. Department of Transportation, or in the Transport of Dangerous Goods (TDG) regulations in Canada.

15. REGULATORY INFORMATION

FDA:	1. Potassium Chloride used as a dietary supplement in food for human consumption is generally recognized as safe (GRAS) when used in accordance with good manufacturing practice [21 CFR 182.5622]. 2. Substance added directly to human food affirmed as GRAS [21 CFR 184.1622].
CERCLA:	Not listed
RCRA 261.33:	Not listed
SARA Title III:	**SARA 302:** RQ: No; TPQ: No
	SARA 311/312: Acute: No; Chronic: No; Fire: No; Pressure: No; Reactivity: No - Exemptions at 40 CFR, Part 370 may apply for agricultural use, or quantities of less than 10,000 pounds on site.
	SARA 313 List: No
TSCA:	8 (b) Chemical Inventory: Yes; TSCA 8 (d): No
Proposition 65: (CA Health and Safety Code Section 25249.5)	Warning: This product contains substances that are known to the State of California to cause cancer and/or reproductive harm.
NTP, IARC, OSHA:	This material has not been identified as a carcinogen by NTP, IARC, or OSHA.
Canada DSL:	Yes
Canada NDSL:	No
WHMIS:	Not controlled

16. OTHER INFORMATION

The information in this document is believed to be correct as of the date issued. Nothing herein contained shall be deemed to be a representation or warranty with respect to the product described herein. **NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THIS INFORMATION, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE, AND ALL SUCH REPRESENTATIONS AND WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED BY MOSAIC.** This information and product are furnished on the condition that the person receiving them shall make their own determination as to suitability of the product for their particular purpose and on the condition that they assume the risk of their use thereof. The conditions and use of this product are beyond the control of Mosaic, and Mosaic disclaims any liability for loss or damage incurred in connection with the use or misuse of this substance.

Status: Revised MSDS	**Issue Date: December 1, 2006**
Revised Section: 1	**MSDS Number: MOS002**

- **Attachment 5: Map of Proposed Treatment Area**