FINAL LICENSE APPLICATION
EXHIBIT E

APPENDIX Q

AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

AQUATIC INVASIVE SPECIES MANAGEMENT PLAN
DRAFT

SKAGIT RIVER HYDROELECTRIC PROJECT
FERC NO. 553

Seattle City Light

April 2023

TABLE OF CONTENTS

List of Figures

List of Tables

List of Acronyms and Abbreviations

AIS .....Aquatic Invasive Species
AISMP .....Aquatic Invasive Species Management Plan
AISU .....Aquatic Invasive Species Unit
B.C. .....British Columbia
BMP .....best management practice
City Light .....Seattle City Light
eDNA .....environmental DNA
EDRR .....early detection and rapid response
FERC .....Federal Energy Regulatory Commission
LP .....licensing participant
NISC .....National Invasive Species Council
NPS .....National Park Service
O&M .....operations and maintenance
Project .....Skagit River Hydroelectric Project
RCW .....Revised Code of Washington
SRCC .....Skagit Resource Coordinating Committee
USDA .....U.S. Department of Agriculture
USDOI .....U.S. Department of the Interior
USFS .....U.S. Forest Service
USFWS .....U.S. Fish and Wildlife Service
USGS .....U.S. Geological Survey
WDFW .....Washington Department of Fish and Wildlife
WISC .....Washington Invasive Species Council

1.0 INTRODUCTION

This document describes Seattle City Light's (City Light) proposed Aquatic Invasive Species Management Plan (AISMP) for the Skagit River Hydroelectric Project (Project or Skagit River Project), Federal Energy Regulatory Commission (FERC) No. 553. The intent of the AISMP is to implement an effective early detection and rapid response (EDRR) program to control non-native aquatic invasive species in Project waters to support and sustain healthy native aquatic species populations. Implementation of the AISMP can also support decision-making and management activities of agencies and organizations with responsibility for aquatic invasive species (AIS) management to ensure prevention, detection, and responses are maximized. The AISMP briefly summarizes relevant Project information, further details its purpose, identifies individual steps for implementation, and lays out the schedule and communication framework.

City Light will coordinate the efforts required under this AISMP with other license article obligations, including other Project resource management plans included in the new license.

2.0 PURPOSE AND SCOPE OF THE PLAN

The intent of the AISMP is to implement an effective EDRR program to control non-native aquatic invasive species in Project waters to support and sustain healthy native aquatic species populations. The Project Boundary includes three reservoirs (Ross, Diablo, and Gorge lakes) where the risks of AIS invasions and impacts are of greatest concern. Recreation access and activities, including fishing, boating, day-use, and camping are potential pathways through which AIS could be introduced to Project waters. Thus, recreation facilities in the Project Boundary (e.g., boat ramps, docks, campgrounds, beaches, and trailheads) represent point locations with the highest potential for AIS introductions, as well as the greatest potential for successfully implementing preventive measures.

Tributaries that enter Ross, Diablo, and Gorge lakes are another potential pathway for AIS introduction, although access is more dispersed (e.g., trailheads and hiking trails). Other activities in the Project Boundary that warrant consideration as potential AIS pathways include facility operations and maintenance (O&M), fire suppression, and monitoring and restoration efforts.

A unique characteristic of the Project that also has implications for the risk of AIS is that at full pool, the upper portion of Ross Lake is in Canada and is fed by the Canadian portion of the mainstem Skagit River. Similar types of recreation access and activities described above exist in this area and represent a potential AIS pathway beyond the Project Boundary and outside of the U.S.

2.1 Goals and Objectives

The goal of the AISMP is to prevent the introduction of AIS in Project reservoirs to promote a healthy aquatic ecosystem. Specific objectives of this management plan are as follows:

- Provide for AIS education and outreach activities within the Project area.
- Participate in regional and state efforts to prevent the introduction and spread of aquatic nuisance species at the Project and in the Skagit River Basin.
- Develop an Early Detection Plan that includes monitoring to identify AIS establishment.
- Develop a Rapid Response Plan to be implemented upon AIS detection.
- Integrate adaptive management principles to refine the plan based on new information.
- As feasible, ensure the AISMP is compatible with other AIS management activities in the Skagit River Basin.

2.2 Geographic Scope

The geographic scope of the AISMP encompasses areas within the Project Boundary including Project reservoirs, shorelines, dams, and recreational facilities.

2.3 Applicable Laws and Regulations

Under the Revised Code of Washington (RCW 77.135.020), the Washington Department of Fish and Wildlife (WDFW) is the lead agency for managing AIS animal species in Washington State.

Within WDFW, the Aquatic Invasive Species Unit (AISU) is tasked with preventing the introduction of AIS and conducting early detection monitoring (WDFW 2022). The Washington Invasive Species Council (WISC) was created by the state legislature in 2006 and is comprised of federal, state, and local government, and Indian Tribe and non-governmental organization representatives. WISC provides policy-level direction, planning, and coordination to prevent and combat harmful invasive species throughout the state. Other state agencies with key AIS roles and responsibilities include the Washington State Patrol, the Washington State Department of Agriculture, the Washington State Department of Ecology, and the Washington Department of Natural Resources (DeBruyckere et al. 2014). Federal jurisdiction related to invasive species management is covered by a patchwork of legal authorities derived from various laws, regulations, policies, and programs (Reaser et al. 2020) that include the National Park Service (NPS), U.S. Forest Service (USFS), U.S. Department of Agriculture (USDA), U.S. Fish and Wildlife Service (USFWS), and U.S. Geological Survey (USGS) (WISC 2014).

3.0 PLAN IMPLEMENTATION

The two foundational components of this AISMP are a risk assessment model and EDRR principles which are both widely applied as best management practices (BMP) in invasive species management (Reaser et al. 2020; National Invasive Species Council [NISC] 2016; U.S. Department of Interior 2016; Mendoza et al. 2009). The AISMP is comprised of five discrete steps as described in the following sections: (1) risk assessment, (2) preventative measures, (3) early detection, (4) rapid response, and (5) adaptive management. These steps are iterative and are presented sequentially below. However, as discussed under Section 3.5 Adaptive Management, they collectively represent an ongoing process throughout AISMP implementation during the license term.

3.1 Risk Assessment

Assessing the risk of introduction for a given AIS is a critical first step that will be used to guide prevention and EDRR efforts. Overall risks can be considered in terms of both the potential ecological, economic, and social impacts of introduction, and the likelihood that introduction could occur based on the species' biological requirements, current distribution, and the number and scale of potential pathways for introduction (Mendoza et al. 2009). AIS representing the greatest risks are those that would cause severe impacts and have a high likelihood of introduction (Figure 3.1-1).

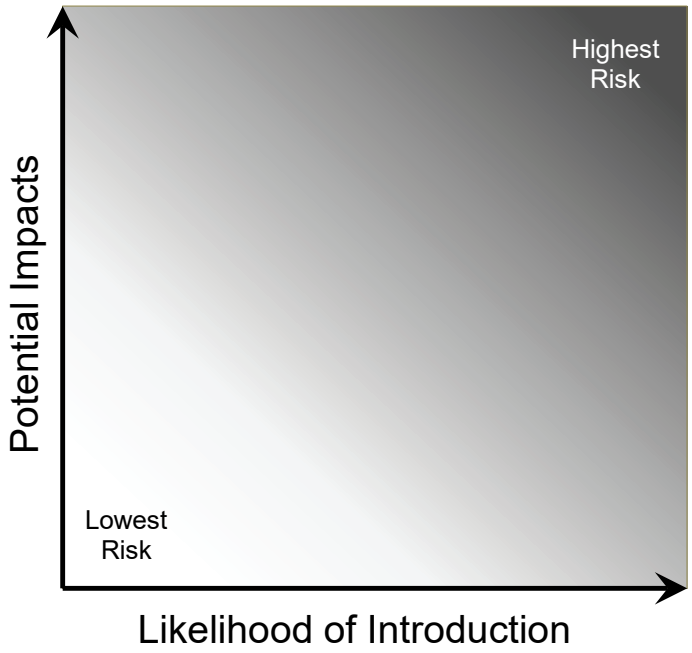

Figure 3.1-1. Conceptual diagram showing cumulative risk based on the severity of potential impacts from, and the likelihood of an invasive species introduction.

As part of their state-wide efforts, WISC evaluated over 700 different invasive species deemed to pose the greatest threat to Washington State, including plants, animals, insects, algae, and pathogens (WISC 2022). Of these, WISC identified 50 taxonomic groups as having the highest

priority for near-term action. WISC evaluates AIS using an assessment tool to score species based on (1) current presence in or proximity to Washington, (2) ecological impacts, (3) economic impacts, (4) human health impacts, (5) invasive potential, (6) difficulty of control, and (7) feasibility of prevention and early action. The resulting scores are then plotted in an "invasive species management priorities grid" comprised of four categories based on potential impacts and the ability to take preventative or early action for a given species (Figure 3.1-2).

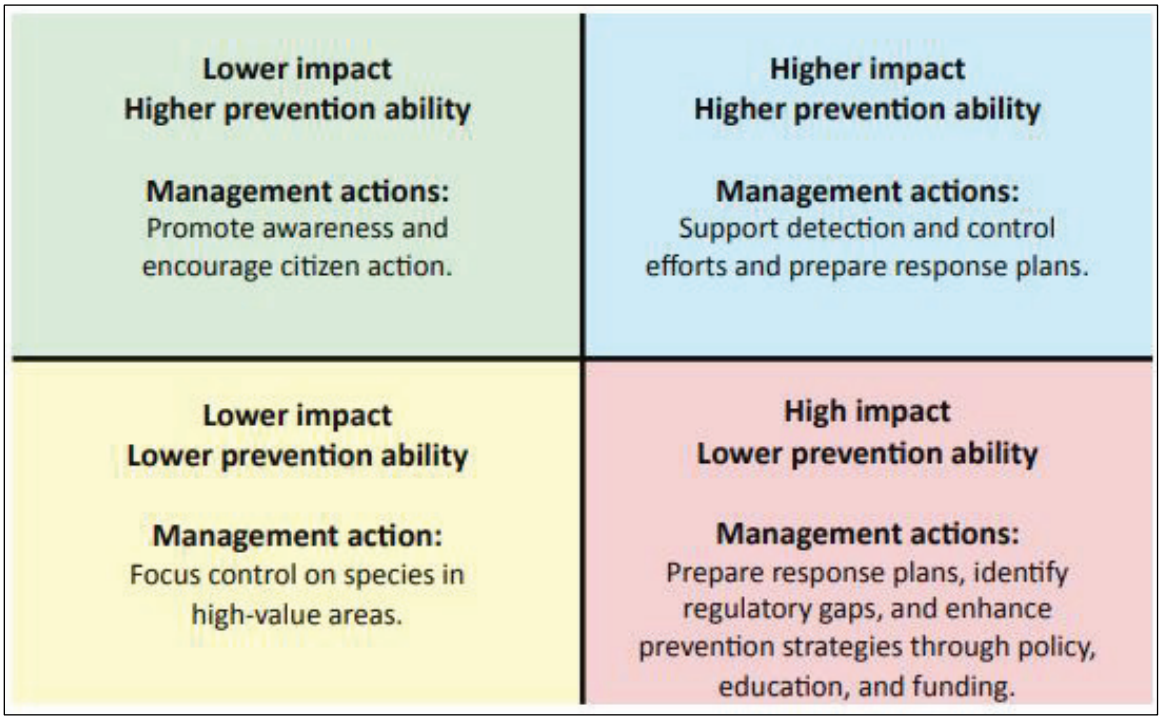

Figure 3.1-2. Invasive species management priorities grid developed by the Washington Invasive Species Council and used to guide council actions (Source: WISC 2022).

WISC's prioritization list is developed by invasive species professionals who review and reevaluate candidate species annually (WISC 2022). As an initial risk assessment step, this list will be used in implementing City Light's AISMP and reviewed annually to identify those species that fall under the scope of the AISMP (i.e., freshwater aquatic fauna).

Taxa currently prioritized by WISC that are within the scope of this AISMP are:

- Dreissenids: Zebra (*Dreissena polymorpha*) and quagga (*D. bugensis*) mussels;
- New Zealand mudsnail (*Potamopyrgus antipodarum*);
- Invasive crayfish, including virile (*Orconectes virilis*), rusty (*O. rusticus*), and red swamp (*Procambarus clarkii*) crayfish;
- Bullfrog (*Rana catesbeiana*) and African clawed frog (*Xenopus laevis*);[1] and

[1] City Light will coordinate any efforts or information collected related to amphibians with other license article obligations, including management plan activities focused on terrestrial resources.

- Invasive aquatic plants, including (but not limited to) Eurasian milfoil (*Myriophyllum spicatum*);

WISC scoring categorizes zebra and quagga mussel as "higher impact, higher prevention ability," recommending management actions that support detection and control efforts and development of a response plan (Figure 3-2). New Zealand mudsnail and invasive crayfish and frog species are categorized as "higher impact, lower prevention ability," with recommended management actions that develop response plans, identify regulatory gaps, and enhance prevention strategies through policy, education, and funding.

The second step in risk assessment will focus on identifying and evaluating pathways of introduction to Project waters for a given AIS. Potential AIS pathways include:

- Boats and fishing gear
- Downstream dispersal
- Aquaria specimens
- Live bait releases
- Biological supply houses
- Construction activities/heavy equipment
- Scuba/ROVs
- Aquatic monitoring/sampling gear
- Firefighting activities
- Restoration activities
- Intentional releases

For each species, relevant pathways will be identified and evaluated in terms of their scale/magnitude, proximity to Project waters, and probability/frequency of pathway occurrence. The above list of pathways is neither exhaustive nor fixed; new pathways may develop, or existing pathways may become obsolete as activities, facilities, or regulations change over time. Thus, an important step in implementing the AISMP will be to routinely review potential pathways.

The risk assessment steps outlined above will identify priority AIS for which feasible introduction pathways exist in the vicinity of Project waters. The following implementation steps (prevention, early detection, rapid response, and adaptive management) will be geared toward these species.

3.2 Prevention

Prevention will rely on a layered approach involving both active and passive measures that target specific pathways, including education, watercraft inspections, and regional coordination. Preventive measures will initially focus on those species identified through the risk assessment steps (i.e., invasive Dreissenids, crayfish, and frog species). However, measures may be refined through adaptive management should new or additional species become prioritized or additional pathways are identified.

3.2.1 Information and Education Outreach

City Light will develop and make available an informational brochure describing the risks and costs associated with AIS introductions, the importance of preventing introductions, recommended practices for their prevention, and steps for reporting observations. The brochure will be geared toward recreational user groups representing specific pathways (e.g., anglers, boaters, campers, etc.) and made available for distribution at Project recreation points of access and facilities.

City Light will also place signage relaying similar information in an abbreviated format at locations throughout the Project that represent the most likely points of introduction. These include docks, angler access locations, beaches, campgrounds, and all boat ramps or launch facilities.

Annually, City Light will provide training for Project staff and contractors relating to BMPs for preventing the introduction of AIS. This training will be focused on activities related to Project O&M and facilities where introduction pathways exist, such as heavy equipment operation, facility maintenance, boat usage, and any habitat restoration actions or environmental research and monitoring efforts. Specific protocols will be adapted from the latest Invasive Species Management Protocols developed by WDFW (2022).

3.2.2 Watercraft Inspection and Cleaning

Watercraft inspections are an integral component of AIS prevention. City Light will continue implementing watercraft inspections and best management practices for AIS consistent with activities under the current license. Within three (3) years of license issuance, City Light, in consultation with the Skagit Resource Coordinating Committee (SRCC), will develop an updated AIS watercraft inspection and operations program to continue addressing AIS introduction risk from recreational, research or operations-related watercraft use on Project reservoirs. As part of an updated watercraft inspection program, City Light will construct and operate a watercraft inspection, decontamination, and cleaning station in Newhalem. City Light staff and contractors will use this facility to conduct inspections and decontamination of any of their watercraft used in waters outside the Project Boundary prior to Project use. Additionally, City Light will cooperate with relevant authorities to make the facility available to the public during the recreation season to support regional AIS inspection and decontamination efforts.

3.2.3 Regional Coordination

City Light will coordinate directly with the WDFW, AISU, and WISC regarding information-sharing, planning, activities, and rapid response actions related to AIS. In addition, City Light staff will engage with regional AIS coordinators including partners in neighboring states and provinces. Such regional coordination will be integral to ongoing understanding of new AIS species, risks, pathways, and monitoring and mitigation approaches.

In consideration of flow dispersal pathways, and because the Skagit River Basin includes 381 square miles upstream of Ross Lake in British Columbia (B.C.), City Light will also engage with Canadian partners. This will occur either directly with the Invasive Species Council of B.C. or via international fora such as the Invasive Species Working Group of the Pacific Northwest Economic Region, a statutory public/private non-profit created by northwestern states and provinces.

As invasion pathways are identified and evaluated during AISMP implementation, City Light may form partnerships with other stakeholders or user-groups to facilitate further educational, monitoring, or response activities.

3.3 Early Detection

The early detection of AIS following an initial invasion is a critical component of invasive species management because it increases the likelihood that eradication measures can be successfully implemented before the founding population becomes established or spreads (USDOI 2016). Early detection concepts are typically paired with a rapid response plan as part of a coordinated EDRR framework (although early detection and rapid response steps are listed separately here, this AISMP follows such a framework). Early detection efforts will be comprised of three measures: (1) support and supplementation of AISU's ongoing monitoring efforts; (2) deployment and monitoring of artificial substrates and shoreline surveys; and (3) facilitating incidental observations.

3.3.1 AISU Support

The foundation of City Light's early detection efforts will be coordination with and support of AISU's ongoing efforts in the Project Boundary through supplemental sampling. In developing the current sampling program, AISU chose the number of monitoring sites and the sampling frequency based on a risk assessment of each water body using over 17 different variables (e.g., access, calcium concentrations, land use, etc.) (City Light 2020). As described above and based on the resulting "low-risk" rating, the current monitoring program involves sampling at one site in Gorge Lake and two sites in Ross Lake on an annual basis. City Light will provide funds or in-kind support to increase the sampling frequency at existing sites. City Light may also support monitoring at additional sites as warranted based on annual risk assessment. The actual number of sampling sites and sampling frequency will be determined annually based on the prevailing understanding of invasion pathways and priority species for monitoring in consultation with AISU.

The monitoring methods used to date by AISU in lentic waterbodies include plankton net tows, Ponar grabs, deployment and monitoring of artificial substrates for AIS colonization, visual shoreline inspections, water quality sampling (including dissolved calcium concentration), and collection of eDNA samples (Schultz 2019). Appropriate monitoring method(s) will be dependent on the prevailing understanding of invasion pathways and priority species for monitoring. Because monitoring priorities may change over time, and AIS monitoring techniques and technologies are rapidly evolving (Larson et al. 2020), the monitoring approach will be selected in consultation with AISU and reviewed with the SRCC, annually. As an example, if water quality parameters in Project reservoirs were deemed to be limiting for colonization by zebra/quagga mussels, sampling for mussel veligers with plankton net tows may be ruled out in favor of methods that target AIS having a higher risk profile.

3.3.2 Artificial Substrate Monitoring and Shoreline Surveys

To further increase early detection capabilities for zebra/quagga mussels, and separate from support of other AISU efforts, within one (1) year of license issuance, City Light will deploy artificial substrates at each development (i.e., at Ross, Diablo, and Gorge dams), in coordination with AISU or as part of supporting AISU efforts (Section 3.3.1), and inspect them for colonization on no less than a quarterly basis. In addition, City Light will conduct shoreline surveys in Ross

Lake annually after the seasonal drawdown is complete. Specific methods for both efforts will be adapted from the Zebra and Quagga Mussel Field Sampling and Monitoring Protocol developed by the Western Regional Panel on Aquatic Nuisance Species (WRP 2020).

3.3.3 Incidental Observations

In addition to the targeted monitoring described above, City Light will facilitate the reporting of any AIS incidentally observed in the Project Boundary through the following mechanisms:

- *Other monitoring activities*: Activities associated with other resource measures/management plans at the Project (e.g., sampling or surveys) that have the potential to encounter AIS. City Light will establish protocols for coordination, documentation, retention of specimen vouchers, and reporting of any AIS observed as part of these activities.
- *City Light staff and contractors*: AIS training described in Section 3.2.1 will include guidance on priority AIS, their identification, documentation, and reporting protocols for personnel routinely working at the Project.
- *Members of the public*: Signage and brochures described in Section 3.2.1 will include guidance on identifying priority AIS and provide contact information in the event of observation.

3.4 Rapid Response

After early detection, a rapid response is equally essential to maximizing the likelihood that prospective mitigation measures will be successful in preventing or limiting colonization. WISC (2020) identifies several key elements of best management practices for EDRR. Specific to rapid response planning, these include (1) clear interagency and public communication, (2) access to necessary resources, (3) secure funding, (4) predetermined protocols, and (5) a level of detail balanced against the need for species-specific flexibility. WISC also identified activation of the Incident Command System, used widely in emergency response, as a valuable component for many rapid response efforts.

Washington State's Aquatic Nuisance Species Management Plan (WDFW 2001) provides a broad framework to guide the state's management of AIS by coordinating ongoing actions and identifying new strategies. However, for select high-priority AIS, WDFW has also developed species-specific rapid response plans. Notable is the Washington Dreissenid Mussel Rapid Response Plan (WDFW 2014), which identifies the following response steps:

(1) *Verification of Reported Introduction*: Evaluate details of initial detection to determine waterbody status.

   (a) Inconclusive – One positive test result, but has not met minimum criteria for detection (temporary status).

   (b) Suspect – Meets minimum criteria for detection (management trigger).

   (c) Positive – Multiple subsequent sampling events that meet minimum criteria for detection.

   (d) Infested – Established reproducing population (both juveniles and adults).

(2) *Initial Response*: Specific procedures will depend on waterbody status but will entail the following actions.

(a) Reporting

(b) Notification

(c) Defining extent of colonization

(d) Preventing further spread

(e) Initiating control actions

(3) *Extended response and long-term monitoring*

(a) Continue control strategy of Initial Response phase

(b) Develop long-term control objectives

(c) Design monitoring program

(d) Communicate findings

(e) Evaluate and revise control strategy as needed

Within one (1) year of license issuance, City Light, in consultation with the SRCC, will develop a Project Rapid Response Plan in the event of a potential AIS observation that is generally consistent with the steps described above. City Light's primary role in the implementation of rapid response measures will be to immediately notify appropriate agencies of any suspected AIS observed by Project staff, by contractors, or through implementation of the prevention/detection measures described above. In such an event, City Light will strive to contact WDFW in its role as the lead agency (via an established AISU contact) and WISC (via the online/mobile reporting system) within 24 hours. As feasible, a voucher specimen will be retained for transport to WDFW for verification and the time and precise location at which the observation occurred will be reported.

City Light will also strive to notify SRCC members within 72 hours of suspected AIS detection. In addition, City Light will actively participate in regional response coordination efforts at a level commensurate with the magnitude of the risk and its nexus to Project facilities, operations, or programs.

3.5 Adaptive Management

AIS management is a rapidly evolving field, partly because of the nature of invasion biology, but also because of evolving responsibilities and responses (e.g., regulations, legislation, monitoring techniques, and control tools). As such, adaptive management principles will be applied throughout implementation of the AISMP. Where practicable, implementing adaptive management will incorporate the testing of hypotheses that specific measures representing best practices (Walters 1986). Specific components of the plan for which routine review and refinement are particularly important are as follows:

- New or obsolete AIS species risks and prioritization;
- New or obsolete invasion pathways;

- Efficacy of information and education outreach;
- Watercraft inspection;
- Detection monitoring techniques and technologies;
- Sampling frequencies;
- Number of monitoring sites; and
- Communication protocols and coordination efforts.

The mechanism for adaptively managing the AISMP will be through an annual meeting with licensing participants (LP) to review management plan implementation.

4.0 MONITORING, REPORTING, AND COMMUNICATIONS

4.1 Implementation and Monitoring Schedule

Implementation of the AISMP will begin upon license issuance and continue through the license term. The schedule for specific measures is shown in Table 4.1-1.

Table 4.1-1. Implementation schedule for AISMP measures.

Measure	Timing	Frequency
Risk Assessment	Annual meeting (date TBD)	Annually
Prevention		
Information and Education Outreach	Beginning within one (1) year of license issuance	Content reviewed annually for accuracy and relevance
Develop an updated AIS watercraft inspection and operations program	Beginning within three (3) years of license issuance	Annually
Construct Watercraft Inspection and Decontamination Facility at Newhalem	Construction will commence within ten (10) years of license issuance	Once constructed, operated annually for remainder of the license
Regional Coordination	Annual meeting (date TBD)	Annually
Early Detection Monitoring		
AISU Support	TBD in consultation with AISU	TBD in consultation with AISU, but greater than once annually
Artificial Substrate Monitoring	Continual deployment beginning within one (1) year of license issuance	Inspection of substrates to occur at minimum, once quarterly
Shoreline Inspections	To be conducted following fall drawdown	Once annually
Rapid Response	Completion within one (1) year of license issuance	As warranted
Adaptive Management	Annual meeting (date TBD)	Annually and as warranted

4.2 Reporting Schedule

City Light will provide a draft annual report summarizing AISMP efforts and results during the preceding year and any recommended changes to the SRCC allowing a minimum of 30 days for review and comment. When filing this annual report with FERC, City Light shall include documentation of consultation, copies of comments and recommendations, and specific descriptions of how comments and recommendations from the SRCC were accommodated. If City Light does not adopt a recommendation, the filing shall include the reasons based on project-specific information.

4.3 Communications

As described above, information regarding discrete AIS detections will be shared with SRCC members. Programmatic discussions regarding implementation, refinement, and findings of the AISMP will occur annually during the annual reporting consultation meeting.

5.0 REFERENCES

DeBruyckere, L.A., W. Brown, and B. Tweit. 2014. Washington *Dreissenid* mussel rapid response plan. Washington Invasive Species Council (WISC) and Washington Department of Fish and Wildlife (WDFW).

Larson, E.R., B.M Graham, R. Achury, J.J. Coon, M.K. Daniels, D.K. Gambrell, K.L. Jonasen, G.D. King, N. LaRacuente, T.I. Perrin-Stowe, and E.M. Reed. 2020. From eDNA to citizen science: emerging tools for the early detection of invasive species. Frontiers in Ecology and the Environment, 18(4), pp.194-202.

Mendoza, R.E, B. Cudmore, R. Orr, J.P. Fisher, S. Contreras, W. Courtenay, P. Koleff, N. Mandrak, P. Álvarez, and M. Arroyo. 2009. Trinational Risk Assessment Guidelines for Aquatic Alien Invasive Species. Test Cases for the Snakeheads (*Channidae*) and Armored Catfishes (*Loricariidae*) in North American Inland Waters. Commission for Environmental Cooperation Montreal. Quebec.

National Invasive Species Council (NISC). 2016. NISC Management Plan: 2016-2018. Washington, D.C.

Reaser, J.K., S.W. Burgiel, J. Kirkey, K.A. Brantley, S.D. Veatch, and J. Burgos-Rodríguez. 2020. The Early Detection of and Rapid Response (EDRR) to Invasive Species: A Conceptual Framework and Federal Capacities Assessment. Biological Invasions 22 (1): 1–19.

Schultz, J. 2019. Washington Department of Fish and Wildlife Zebra/Quagga Mussel Risk Assessment Presentation.

Seattle City Light (City Light). 2020. Pre-Application Document for the Skagit River Hydroelectric Project, FERC No. 553. January 2020.

U.S. Department of the Interior (USDOI). 2016. Safeguarding America's Lands and Waters from Invasive Species: A National Framework for Early Detection and Rapid Response. Washington D.C.

Walters, C.J.. 1986. Adaptive management of renewable resources. Macmillan Publishers Ltd.

Washington Department of Fish and Wildlife (WDFW). 2001. Washington State Aquatic Nuisance Species Management Plan. Coordinated by P. Meacham of the WDFW Fish Program for the Washington Aquatic Nuisance Species Committee. October 2001.

_____. 2022. Invasive Species Management Protocols, Version 4. Aquatic Invasive Species Unit, Fish Program. September 2022.

Washington Invasive Species Council (WISC). 2014. A baseline assessment of priority invasive species in the Puget Sound Basin: Phase II. Conducted by ESA, Hook Knauer, SpatialDev, and Sarah Reichard. January 2014.

_____. 2020. Early detection and rapid response best practices. Approved June 2020 by the Washington Invasive Species Council, Washington State Recreation and Conservation Office.

Western Regional Panel on Aquatic Nuisance Species (WRP). 2020. Zebra and quagga mussel field sampling and monitoring protocol. [Online] URL: https://westernregionalpanel.org/key-documents/.