FINAL LICENSE APPLICATION
EXHIBIT E

APPENDIX L

RESERVOIR EROSION MANAGEMENT AND MONITORING PLAN

RESERVOIR EROSION MANAGEMENT AND MONITORING PLAN ANNOTATED OUTLINE

SKAGIT RIVER HYDROELECTRIC PROJECT FERC NO. 553

Seattle City Light

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List of Acronyms and Abbreviations

BMP .....Best Management Practice
City Light.....Seattle City Light
FERC.....Federal Energy Regulatory Commission
HPMP.....Historic Properties Management Plan
LiDAR.....Light Detection and Ranging
Project .....Skagit River Hydroelectric Project
SRCC .....Skagit Resource Coordinating Committee

1.0 INTRODUCTION

This document describes Seattle City Light's (City Light) proposed Reservoir Erosion Management and Monitoring Plan for the Skagit River Hydroelectric Project (Project or Skagit River Project), Federal Energy Regulatory Commission (FERC) No. 553. This Reservoir Erosion Management and Monitoring Plan describes the goals and recommendations for erosion control measures and erosion monitoring along Project reservoir shorelines and within the drawdown zones of the reservoirs. The goal of this Reservoir Erosion Management and Monitoring Plan is to minimize erosion along reservoir shorelines and drawdown zones that affect important natural, cultural, and recreational resources and provide a framework for monitoring erosion over the term of the new license.

City Light will coordinate the efforts required under this Reservoir Erosion Management and Monitoring Plan with other license article obligations, including other Project resource management plans included in the new license. Close coordination will take place between the efforts undertaken during planning and implementation of this Reservoir Erosion Monitoring and Management Plan and the Historic Properties Management Plan (HPMP; City Light 2023a) to ensure adequate protection and monitoring of erosion effects related to cultural and historic properties near and within Project reservoirs while maintaining confidentiality of sensitive resources.

2.0 PURPOSE AND SCOPE OF THE PLAN

City Light proposes this Reservoir Erosion Management and Monitoring Plan to provide best management practices (BMP) and procedures to guide City Light's actions related to minimizing potential effects of reservoir erosion to identified resources under the new license. Reservoir operations have the potential to exacerbate erosion along reservoir shorelines and within reservoir drawdown zones. Erosion has the potential to affect cultural and historical resource sites; recreation facilities at boat-in campsites, boat docks, and reservoir-adjacent trails; and terrestrial and aquatic habitat. This Reservoir Erosion Management and Monitoring Plan will be effective for the term of the new license and is subject to annual reporting and periodic five (5) year review and updates in consultation with the Skagit Resource Coordinating Committee (SRCC).[1]

2.1 Goals and Objectives

This section presents goals and objectives to reduce potential effects of reservoir erosion. The primary goals of this Reservoir Erosion Management and Monitoring Plan are as follows:

- Minimize the extent and rate of erosion along reservoir shorelines and within reservoir drawdown zones where erosion is affecting important cultural/historical resources, recreation sites, or terrestrial and aquatic habitat.
- Consider a range of erosion control measures, including vegetation and bioengineering techniques as appropriate, based on site and resource characteristics.
- Coordinate with the protocols and management measures in the HPMP to provide information needed for HPMP and National Historic Preservation Act compliance.
- Monitor reservoir erosion and erosion control measures:
    - Assess ongoing reservoir shoreline erosion rates and vegetation loss at shoreline monitoring sites.
    - Assess ongoing erosion within the drawdown zone (below the normal maximum water surface elevation) at stump monitoring sites within the Ross Lake drawdown zone.
    - Monitor erosion control structures and revegetation sites to assess effectiveness and update BMPs.
- Include adaptive management monitoring triggers and management actions.

2.2 Geographic Area

The geographic scope includes the three Project reservoirs: Ross Lake, Diablo Lake, and Gorge Lake.

[1] The Skagit Resource Coordinating Committee includes agency representatives that will collaborate regarding implementation and monitoring of this Reservoir Erosion Management and Monitoring Plan and contribute to adaptive management decisions.

3.0 PLAN IMPLEMENTATION

Upon approval by FERC, this Reservoir Erosion Management and Monitoring Plan will be implemented in consultation with the SRCC. This section will describe how the plan will be implemented, including potential erosion control treatments and identification, prioritization, and metrics/triggers for newly identified erosion control sites. Review of implementation effectiveness will be communicated annually and formal reports will be submitted to FERC every five (5) years. Implementation of this plan will include:

- Identify areas where shoreline or drawdown erosion intersect with important resource values.
- Prioritize areas by erodibility and magnitude of effects on identified resources.[2]
- Based on prioritization, areas will be identified for:
  - Implementation of erosion control measures;
  - Inclusion as a resource-specific monitoring site; or
  - Re-evaluation after ten (10) years of the general shoreline/drawdown monitoring program.
- Erosion affecting cultural/historic sites will be evaluated and included in the HPMP to maintain confidentiality of cultural/historic sites.[3]

3.1 Identification and Prioritization of Reservoir Erosion and Resource-Specific Affected Sites

This section will describe the prioritization process that will consider baseline data of reservoir erosion with known recreation, terrestrial, and aquatic resources (note that cultural/historic analysis will be documented in the HPMP). Sites will be prioritized for implementation of erosion control, monitoring, or re-evaluation. The prioritization will be based on factors such as resource(s) affected, location, extent, landform, geology and soils, slope conditions, and vegetation present. Prioritization of erosion treatment for culturally important plant species will be coordinated with Indian Tribes and Canadian First Nations and with the HPMP.

This section will also include a schedule for implementation of erosion control measures at identified sites.

3.2 Erosion Control Treatments

This section will describe potential erosion control treatments at different types of erosion sites. Potential treatments may include:

[2] Prioritization of areas may use baseline data established during City Light's relicensing studies, as described in GE-01 Reservoir Shoreline Erosion Study Report (City Light 2023b) and GE-03 Sediment Deposition in Reservoirs affecting Resource Areas of Concern Study Report (City Light 2023c).

[3] Monitoring sites may be identified in this Reservoir Erosion Management and Monitoring Plan that will provide data to the HPMP, but evaluation will take place as identified in the HPMP (City Light 2023a).

- Use bioengineering approaches as part of erosion control structures, where appropriate for the site and compatible with recreation objectives and public safety.
- Incorporate revegetation with native plant species at sites to minimize erosion and restore lost vegetation where possible. Continue plant propagation, seed collecting, and outplanting at erosion control sites based on site-specific vegetation targets. To the extent possible, plantings should use climate-suitable species of appropriate provenance based on anticipated climatic conditions in the new license period.
- Evaluate Project reservoir operation scenarios to examine the feasibility of increasing water surface elevation variability at Ross Lake during the growing season to promote native riparian vegetation just below the normal maximum water surface elevation to reduce erosion and, if feasible, conduct trial to assess effects on vegetation and shoreline stability at select sites.
- Evaluate various bioengineering treatment approaches to dissipate wave energy and create greater edge habitat complexity at selected sites. City Light will collect large logs and root wads for use in the shoreline protection pilot project and will consider Project operational safety, recreation, cultural, historical, and natural resources.

3.2.1 Cultural/Historic Resource Erosion Control Sites

This section will describe how erosion control treatments at cultural/historic resource sites will be included in the HPMP to protect confidentiality of these resources.

3.2.2 Recreation Facility Erosion Control Sites

This section will describe erosion control measures at recreation facility sites, including the 37 sites under the current license.

- Develop and implement an erosion management implementation, maintenance and monitoring plan that includes site-specific treatments for the 37 recreation facility sites identified in the current license and new locations of Project-related erosion identified at recreation facility sites during the GE-01 Reservoir Shoreline Erosion Study (City Light 2023b).

If new recreational resources are added to the reservoirs under the new license, then erosion management treatments will be designed and implemented to protect these resources if Project operations affect them.

3.2.3 Terrestrial or Aquatic Resource Erosion Control Sites

This section will discuss erosion control measures for any terrestrial or aquatic resource sites identified using the results of GE-01 Reservoir Shoreline Erosion Study (City Light 2023b) inventory combined with other resource studies.

3.2.4 Identification and Prioritization of New Erosion Control Sites

This section will discuss methods to identify and prioritize any new erosion control sites that are identified through the monitoring program (see Section 4). It will include metrics/triggers that will determine if erosion control measures are necessary at a site. City Light will appropriately monitor and then manage any new erosion sites related to the protection of cultural, recreation, and terrestrial and aquatic resources, including those that results from any changes in normal maximum

water surface elevation levels under the new license. This may also trigger the need to rehabilitate old sites if reservoir water surface level management is altered.

3.2.4.1 Triggering Metrics

This section will include a description of how the monitoring program data (Section 4) will be used to re-evaluate existing and newly identified erosion/resource overlap sites for treatment or monitoring. Potential triggering metrics include a measure of:

- Need for maintenance of erosion control functionality at each treatment site;
- Quantify bare ground and native vegetative cover on treated sites; and
- Measure bank retreat rate and quantification of tree loss at selected/representative active erosion monitoring locations.

4.0 MONITORING, REPORTING, AND COMMUNICATIONS

This section will describe the monitoring efforts that will be performed to document the progress of meeting the Reservoir Erosion Management and Monitoring Plan goals and objectives. Monitoring will be an extension of protection and enhancement implementation, using baseline information determined through City Light study efforts.

4.1 Monitoring Plan

This section will describe the Reservoir Erosion Monitoring Plan, including methods and metrics. The goals of monitoring are to inform the effectiveness of existing erosion control measures, monitor erosion rates, and to identify any new locations where erosion is affecting important cultural/historic, recreation, terrestrial, or aquatic resources.

4.1.1 Erosion Control Measures

This section will describe monitoring methods and schedules for erosion control measures that have been implemented.

- Monitor condition and efficacy of existing and new erosion control treatments every two (2) years and conduct maintenance/modification as needed on structures and revegetation; and
- Develop monitoring endpoints for compliance and performance evaluation, for example:
  - Measure of revegetation success in monitoring protocol.

4.1.2 Shoreline Erosion/Retreat Rates

This section will describe monitoring methods and schedules to monitor shoreline erosion/retreat rates.

- Use a combination of remote sensing (including drones), aerial or ground-based Light Detection and Ranging (LiDAR), and field measures to monitor erosion at selected representative segments of shorelines stratified by landform, aspect, and other attributes every two (2) years to estimate continuing erosion rates. This will continue the monitoring of all sites that are being monitored at Ross Lake under the current license, including the five reference locations above normal maximum water surface elevation and add any new shoreline retreat sites as identified in Section 3.
- At appropriate sites, shoreline erosion monitoring will document exposed tree roots and trees lost to erosion at monitoring sites by species and size class.

4.1.3 Erosion within the Ross Lake Drawdown Zone

This section will describe monitoring methods and schedules to monitor erosion within the Ross Lake drawdown zone using the stump transects established as part of the GE-01 Reservoir Shoreline Erosion Study Report Study (City Light 2023b).

- Conduct erosion monitoring at stump locations below the Ross Lake normal maximum water surface elevation at the five reference locations established under the current license and include resampling of stump locations in the entire drawdown zone monitoring transects on a five (5) year cycle (include contingency schedule to accommodate anticipated higher/lower reservoir drawdown levels).

4.1.4 Shoreline Erosion Re-inventory

This section will describe monitoring methods and schedules for conducting a re-inventory of shoreline erosion at all three reservoirs (Table 4.1-1).

- Conduct complete re-inventory of erosion sites every ten (10) years and collaborate with other resources to determine if identified erosion sites are affecting important cultural, recreation, terrestrial, or aquatic resources; and
- Large, unusual (to be defined) erosion events along the reservoirs will be documented and reported upon in timely manner.

Table 4.1-1. Timeline for reservoir erosion monitoring activities.

Timeline	Protection and Enhancement Monitoring Activity
Years 1-3 following license issuance	Baseline vegetation mapping and site inventory at Ross, Diablo, and Gorge lakes.
	Assess and prioritize erosion sites for treatment and monitoring.
	Assess erosion sites for natural system design and develop designs at each location.
Every two (2) years following license issuance	Monitor shoreline retreat rate sites.
	Monitor erosion control measures.
Every five (5) years following license issuance	Monitor Ross drawdown zone (stump) transects.[1]
Every ten (10) years following license issuance	Re-inventory shoreline erosion along entire shorelines of Ross, Diablo, and Gorge lakes.
	File report with FERC (following consultation with the SRCC) summarizing erosion measures and monitoring.

1 If there is a deep drawdown of Ross Lake that will allow monitoring of stumps that are not normally exposed, monitor just these stumps opportunistically.

4.2 Adaptive Management

This section will describe the application of adaptive management which is the iterative process by which City Light will gather information, synthesize new and existing information, and assess the need to update management decisions outlined in this Reservoir Erosion Management and Monitoring Plan. Adaptive management will be applied to each implementation activity through monitoring using information gathered during City Light's relicensing study data as baseline. At five (5) year intervals, City Light will collaborate with the SRCC to evaluate monitoring information to determine if new erosion control measures or erosion monitoring methods are warranted.

4.3 Reporting Schedule

This section will describe the schedule and method for regular communications with the SRCC and submittals to FERC. City Light will report every ten (10) years on the status of existing erosion control measures. Every ten (10) years, City Light will include information on reservoir erosion monitoring in the Project annual report filed with FERC, describing implementation and any proposed modifications to the Reservoir Erosion Management and Monitoring Plan based upon the results of monitoring and consultation with the SRCC.

4.4 Communications

This section will describe a process for making coordinated, timely, and informed decisions while implementing the Reservoir Erosion Management and Monitoring Plan, including how City Light will coordinate and communicate its Reservoir Erosion Management and Monitoring Plan implementation actions with the SRCC. Because of simultaneous implementation of multiple resource management plans (i.e., cultural, wildlife, fish, and aquatics, etc.), cross-resource communication will be necessary. An important goal of this communication will be to achieve a balanced integration of resource goals in the Project Boundary. Coordination processes may include:

- Clarifying resource goals, objectives, and priorities;
- Ongoing consultation with relevant resource groups and other entities;
- Sharing information used to make resource decisions; and
- Solving problems and resolving issues.

5.0 REFERENCES

Seattle City Light (City Light). 2023a. Draft Historic Properties and Management Plan for the Skagit River Hydroelectric Project, FERC Project No. 553. Prepared by HDR Engineering, Inc. April 2023.

_____. 2023b. GE-01 Reservoir Shoreline Erosion Study Report for Skagit River Hydroelectric Project, FERC Project No. 553. Prepared by Watershed GeoDynamics. March 2023.

_____. 2023c. GE-03 Sediment Deposition in Reservoirs affecting Resource Areas of Concern Study Report for Skagit River Hydroelectric Project, FERC Project No. 553. Prepared by Watershed GeoDynamics. March 2023.