

FEDERAL ENERGY REGULATORY COMMISSION  
WASHINGTON, DC 20426  
July 16, 2021

OFFICE OF ENERGY PROJECTS

Project No. 553-235 – Washington  
Skagit River Hydroelectric Project  
Seattle City Light

VIA FERC SERVICE

Chris Townsend  
Seattle City Light  
700 5th Avenue, Suite 3341  
Seattle, Washington 98104

**Reference: Study Plan Determination for the Skagit River Hydroelectric Project**

Dear Mr. Townsend:

Pursuant to 18 C.F.R. § 5.13(c) of the Commission's regulations, this letter contains the study plan determination for the Skagit River Hydroelectric Project No. 553 (project), located on the Skagit River near the town of Newhalem in Whatcom, Skagit, and Snohomish Counties, Washington. The determination is based on the study criteria set forth in section 5.9(b) of the Commission's regulations, applicable law, Commission policy and practice, and the record of information.

Background

On December 8, 2020, Seattle City Light (City Light) filed its proposed study plan (PSP) in support of its intent to relicense the project. The PSP covers 28 studies related to erosion, water quality, fisheries, terrestrial, recreation, and cultural resources.

City Light held four days of meetings to discuss the PSP (January 6, 12, 13, 14, 2021). In addition, City Light hosted ten topic-based meetings in late January through February 2021 to resolve outstanding differences between City Light's PSP and stakeholders' study requests.

Comments on the PSP were filed by the U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), National Park Service (NPS), U.S. Forest Service (Forest Service), Washington Department of Fish and Wildlife (Washington DFW), Washington Department of Ecology (Ecology), Sauk-Suiattle Indian Tribe (Sauk-Suiattle), Swinomish Indian Tribe (Swinomish), Upper Skagit Indian Tribe (Upper Skagit), Stillaguamish Tribe of Indians (Stillaguamish), Nlaka'pamux Nation Tribal Council (Nlaka'pamux Council), Skagit County Board of Commissioners (Skagit

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County), Skagit County Drainage and Irrigation District Consortium and Skagit County Dike and Drainage District Flood Control Partnership, (Drainage Districts), North Cascades Conservation Council (North Cascades Council), North Cascades Institute, American Rivers and Trout Unlimited (Conservation Groups), and American Whitewater.

City Light filed a revised study plan (RSP) on April 7, 2021, that included the 28 studies from the PSP, and five additional studies on aquatic habitat, fisheries, and recreation. Comments on the RSP were filed by the NPS, Forest Service, NMFS, FWS, Washington DFW, Ecology, Sauk-Suiattle, Swinomish, Upper Skagit, Nlaka'pamux Council, Nlaka'pamux Nation Bands Coalition (Nlaka'pamux Coalition), Skagit County, Drainage Districts, Conservation Groups, American Whitewater, Skagit Fisheries Enhancement Group, North Cascades Council, and North Cascades Institute.

Following the filing of its RSP, City Light continued to meet with licensing participants to resolve disagreements. On June 10, 2021, City Light filed an updated RSP that reflects certain agreements on studies it has reached with the Swinomish, Upper Skagit, NMFS, NPS, FWS, Ecology, and Washington DFW. In the filing City Light requests that the Commission approve the portions of the agreed upon studies as described in the updated RSP and resolve the remaining disagreements in the study plan determination. On June 14, 2021, the ILP process plan was modified to allow all interested parties to comment on the updated RSP. The Swinomish filed comments on the updated RSP.

### General Comments

This determination only addresses comments filed on the RSP that we consider to be unresolved based on our interpretation of the comments and City Light's updated RSP. Some comments do not directly address study plans. For example, some comments concern the ILP in general, provide additional information, discuss procedures for holding workshops and reaching consensus among stakeholders, discuss the funding of cultural resource studies, or recommend protection, mitigation, and enhancement (PME) measures. This determination does not address such comments, but only addresses comments specific to the merits of the proposed studies submitted pursuant to section 5.13 of the Commission's regulations and received thereon.

### Study Plan Determination

Of the 33 studies proposed by City Light, 20 are approved as proposed by City Light, 12 are approved with staff recommended modifications, and 1 is not required (Appendix A). Eight additional studies requested by stakeholders are not required. The specific modifications to the study plan and the bases for modifying City Light's study plan are discussed in Appendix B. Commission staff reviewed all comments and considered all study plan criteria in section 5.9 of the Commission's regulations.

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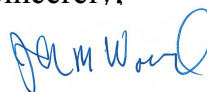
However, only the specific study criteria particularly relevant to the determination are referenced in Appendix B.

Studies for which no issues were raised in comments on the RSP are not discussed in this determination. Unless otherwise indicated, all components of the approved studies not modified in this determination must be completed as described in City Light's updated RSP. Pursuant to section 5.15(c)(1) of the Commission's regulations, the initial study report for all studies in the approved study plan must be filed by March 7, 2022.

Nothing in this study plan determination is intended, in any way, to limit any agency's proper exercise of its independent statutory authority to require additional studies. City Light may choose to conduct any study not specifically required herein that it feels would add pertinent information to the record of this proceeding.

If you have any questions, please contact Matt Cutlip at (503) 552-2762 or email at [matt.cutlip@ferc.gov](mailto:matt.cutlip@ferc.gov).

Sincerely,



for

Terry L. Turpin

Director

Office of Energy Projects

Enclosures: Appendix A – Summary of Determinations on Proposed and Requested Studies  
Appendix B – Staff Recommendations on Proposed and Requested Studies

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**APPENDIX A****SUMMARY OF DETERMINATIONS ON PROPOSED AND REQUESTED STUDIES**

<b>Study</b>	<b>Proposed or Requested By</b>	<b>Approved</b>	<b>Approved with Modifications</b>	<b>Not Required</b>
1. Reservoir Shoreline Erosion Study (GE-01)	City Light		X	
2. Erosion and Geologic Hazards at Project Facilities and Transmission Line Right-of-Way Study (GE-02)	City Light	X		
3. Sediment Deposition in Reservoirs Affecting Resource Areas of Concern Study (GE-03)	City Light	X		
4. Skagit River Geomorphology Between Gorge Dam and the Sauk River Study (GE-04)	City Light		X	
5. Operations Model Study (OM-01)	City Light		X	
6. Water Quality Monitoring Study (FA-01)	City Light		X	
7. Instream Flow Model Development Study (FA-02)	City Light	X		
8. Reservoir Fish Stranding and Trapping Risk Assessment (FA-03)	City Light		X	
9. Fish Passage Technical Studies Program (FA-04)	City Light		X	

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Study	Proposed or Requested By	Approved	Approved with Modifications	Not Required
10. Skagit River Gorge Bypass Reach Hydraulic and Instream Flow Model Development Study (FA-05)	City Light	X		
11. Reservoir Native Fish Genetics Baseline Study (FA-06)	City Light			X
12. Reservoir Tributary Habitat Assessment (FA-07)	City Light		X	
13. Fish Entrainment Study (FA-08)	City Light		X	
14. Recreation Use and Facility Assessment (RA-01)	City Light		X	
15. Gorge Bypass Reach Safety and Whitewater Boating Study (RA-02)	City Light	X		
16. Project Facility Lighting Inventory (RA-03)	City Light	X		
17. Project Sound Assessment (RA-04)	City Light		X	
18. Lower Skagit River Recreation Flow Study (RA-05)	City Light	X		
19. Vegetation Mapping Study (TR-01)	City Light	X		
20. Wetland Assessment (TR-02)	City Light	X		
21. Rare, Threatened, and Endangered Plants Study (TR-03)	City Light	X		
22. Invasive Plants Study (TR-04)	City Light	X		

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<b>Study</b>	<b>Proposed or Requested By</b>	<b>Approved</b>	<b>Approved with Modifications</b>	<b>Not Required</b>
23. Marbled Murrelet Study (TR-05)	City Light	X		
24. Golden Eagle Habitat Analysis (TR-06)	City Light	X		
25. Northern Goshawk Habitat Analysis (TR-07)	City Light	X		
26. Special-status Amphibian Study (TR-08)	City Light	X		
27. Beaver Habitat Assessment (TR-09)	City Light	X		
28. Northern Spotted Owl Habitat Analysis (TR-10)	City Light	X		
29. Cultural Resources Data Synthesis (CR-01)	City Light	X		
30. Cultural Resources Survey (CR-02)	City Light		X	
31. Gorge Bypass Cultural Resources Survey (CR-03)	City Light	X		
32. Inventory of Historic Properties with Traditional Cultural Significance Study (CR-04)	City Light		X	
33. Synthesis and Integration of Available Information on Resources in the Lower Skagit River (SY-01)	City Light	X		
34. Gorge Dam Removal Assessment Study	Upper Skagit			X

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<b>Study</b>	<b>Proposed or Requested By</b>	<b>Approved</b>	<b>Approved with Modifications</b>	<b>Not Required</b>
35. Reservoir Littoral and Riparian Habitat	NPS, FWS, Washington DFW, Upper Skagit,			X
36. Aquatic and Riparian Productivity	NMFS, NPS, FWS, Washington DFW, Upper Skagit			X
37. Reservoir Fish Populations	NPS, FWS			X
38. Angler Creel Surveys	NPS, FWS, Washington DFW			X
39. Mitigation Lands Cost/Benefit Analysis	Skagit County			X
40. Mitigation Lands Access, Stewardship, and Habitat Assessment	Skagit County			X
41. Terrestrial Wildlife Habitat Connectivity	FWS, Washington DFW, Upper Skagit, Swinomish			X

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## **APPENDIX B**

### **STAFF RECOMMENDATIONS ON PROPOSED AND REQUESTED STUDIES**

The following discussion includes staff's recommendations on studies proposed by Seattle City Light (City Light), requests for study modifications, and requests for additional studies. We base our recommendations on the study criteria located in the Commission's regulations at 18 C.F.R. § 5.9(b)(1)-(7). Except as explained below, the revised study plan (RSP) filed on April 7, 2021, and amended by the updated RSP filed on June 10, 2021, adequately addresses all study needs at this time.

#### **I. Required Studies**

##### **Study GE-01. Reservoir Shoreline Erosion**

###### Applicant's Proposed Study

Water level fluctuations and drawing down of Ross Lake during winter expose reservoir banks to erosion. City Light proposes to characterize areas of erosion along the project reservoir shoreline, identify project-related factors that may be causing erosion, estimate erosion rates to the extent possible, and evaluate the effectiveness of its existing shoreline control measures. The study would include an analysis of existing information, one season of field work to inventory existing areas of shoreline erosion, and analysis and report writing. City Light completed an inventory of erosion areas along the shorelines of Ross, Diablo, and Gorge Lakes in the late 1980s (Riedel, 1990), and erosion control measures and shoreline erosion monitoring at selected sites have taken place annually since 1995. The field inventory would identify the current status of the known erosion areas and identify any new erosion sites. Erosion locations would be mapped on recent aerial photograph base maps.

At each location, relevant erosion characteristics, including eroding length and bank height, would be collected; evidence of total erosion or bank retreat since project operations began would be estimated if possible from either aerial photographs and LiDAR data or on-site observations; erosion processes would be identified; and a photograph would be taken. City Light proposes to conduct the field survey between June and August 2021, when Ross Lake will be at or near its normal maximum water surface elevation.

###### Comments on the Study

FWS states that City Light's proposed erosion assessment is inadequate because it would only be conducted during the summer when Ross Lake is at or near the normal highwater elevation. Therefore, FWS requests that City Light expand the study to also include identifying and assessing areas of shoreline erosion during drawdown periods and to collect data over an



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entire year of operation to capture the effects across a range of elevations levels and during flow and storm events.

### Discussion and Staff Recommendations

In 1990, City Light (Reidel, 1990) inventoried the shoreline of all three reservoirs and identified 1,143; 78; and 17 erosion sites at Ross, Diablo, and Gorge Lakes, respectively. Five of the sites on Ross Lake included measurements of the depth of erosion within the Ross Lake drawdown zone at 10 Mile Island, Lightning Creek, Big Beaver, Rowland Creek, and Arctic Creek. City Light proposes to compare current erosion site characteristics with those identified from the 1990 survey to evaluate erosion rates and effectiveness of its mitigation measures. In order to achieve this objective, City Light would need to evaluate erosion characteristics within the Ross fluctuation zone for at least these five previously identified sites to provide an accurate comparison. It may not be logistically possible to survey the reservoir at the same elevations during which the 1990 study was conducted. However, conducting another inventory of these five sites in February or March when Ross Lake is likely at its lowest elevation would provide a reasonable comparison to the results of the original study, provide an opportunity to collect erosional data at more than one elevation level and under different operating conditions, help determine whether erosion patterns have changed over the course of the last license, and estimate erosion over the course of any new license. We estimate that the anticipated level of effort to conduct one additional survey would be \$1,200 (section 5.9(b)(7)) and conclude that the additional information is worth the added cost. Therefore, we recommend that City Light complete a field inventory and erosion assessment at 10 Mile Island, Lightning Creek, Big Beaver, Rowland Creek, and Arctic Creek in February or March 2022 when Ross Lake is likely at its lowest elevation.

### **Study GE-02. Erosion and Geologic Hazards at Project Facilities and Transmission Line Right-of-Way**

#### Applicant's Proposed Study

City Light proposes to determine: (1) where project operation and maintenance (O&M) activities are affecting erosion, mass wasting, and runoff that could affect natural resources; and (2) where existing erosion, mass wasting, and channel migration/bank erosion have the potential to affect project facilities. Specifically, City Light proposes to: (1) identify, map, inventory, and characterize areas of erosion, runoff, mass wasting, and culvert conditions that are affected by

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project facilities, townsites, transmission towers, and study roads;<sup>1,2</sup> (2) identify where project maintenance activities (e.g., road grading, ditch maintenance, vegetation management, streambank protection) along the transmission line right-of-way (ROW) and study roads have the potential to cause erosion or sedimentation or alter hydrologic connectivity to water bodies; (3) identify the current instream and riparian habitat conditions immediately upstream and downstream of transmission line stream crossings where channel migration, bank erosion, or mass wasting are affected by project operations; (4) identify mass wasting and channel erosion hazards (e.g., channel migration, bank erosion) that could affect project facilities, transmission towers, or study roads; and (5) characterize study road-stream crossing structures so that hydraulic capacity, erosion, and biological effects (e.g., fish passage) can be assessed.

The study area includes land within the project boundary from Ross Dam to the Bothell substation near Everett, Washington. This area includes the project dams and powerhouses, project townsites, transmission line ROW, and fish and wildlife mitigation lands.

*Transmission Tower Relocation Feasibility*

In the RSP, City Light acknowledges that routine maintenance such as vegetation clearing and road maintenance within the transmission line ROW has the potential to affect riparian vegetation and streambank stability. City Light proposes to compile a list of maintenance procedures used near each transmission-line stream crossing to help identify the potential for resource affects. Locations where bank armoring has been installed at transmission line crossings/tower locations would also be identified. Work products include: (1) describing the maintenance procedures used near transmission-line stream crossings, and (2) developing a GIS-based map showing affected stream crossing locations. In addition, information on aquatic habitat, bank conditions, and riparian habitat would be collected at locations within streams where channel migration could affect the transmission towers or at the transmission-line stream crossings where maintenance procedures affect aquatic and riparian resources. The collected data would be used during license application development to assist in the analysis and development of management plans.

Comments on the Study

In its comments on the RSP, the Sauk-Suiattle Tribe states that City Light has incorporated most of the elements of its study request to evaluate the effects of transmission line operation and maintenance on aquatic and riparian habitat except for exploring tower relocation

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<sup>1</sup> The study area for GE-02 excludes the reservoir shorelines, which will be studied as part of the Reservoir Shoreline Erosion Study (GE-01).

<sup>2</sup> City Light defines “study roads” as private roads that are owned and/or maintained by City Light to access project facilities; the study does not include roads maintained by Washington Department of Transportation because they are not project-related roads.

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alternatives. In its original study request, the tribe argues that City Light has armored the banks at stream crossings where transmission towers are threatened by bank erosion and avulsion, which reduces the habitat quality for salmonids. To identify potential protection, mitigation, and enhancement measures, the tribe recommends in its comments on the RSP that City Light identify those towers that are located in the channel migration zone of stream crossings and evaluate alternatives for relocating the towers to reduce effects on salmonid habitat.

In the updated RSP, City Light states that the existing geographic scope of the study is adequate to determine the effects of the towers on geomorphic processes on the “reach scale,” but that it would consider conducting smaller-scale assessments of individual tower effects on geomorphic processes (e.g., channel changes and sediment delivery) in consultation with stakeholders with the intent of developing plans to improve aquatic habitat at certain tower locations, if needed. However, City Light does not propose to evaluate alternatives for relocating any existing towers.

### Discussion and Staff Recommendations

City Light’s study proposal already includes steps to identify those towers that might be at risk from bank erosion or avulsion, where riparian and aquatic habitat might be affected by bank armoring and maintenance operations, and the source of those effects. This information should be sufficient to assess project effects (section 5.9(b)(4)). The need for tower relocations would be determined during application development and evaluation of proposed measures. Therefore, we do not recommend modifying the study to include an evaluation of tower replacements.

## **Study GE-04. Skagit River Geomorphology Between Gorge Dam and the Sauk River**

### Applicant’s Proposed Study

In the RSP, City Light proposes to characterize the current condition of aquatic habitat in the reach between Gorge Dam and the Sauk River and to characterize how project-related changes in peak flows affect geomorphic processes, which will be used to evaluate the project’s contribution to cumulative effects in the reach. Specifically, City Light proposes to: (1) collect and synthesize existing geomorphology and aquatic habitat studies, reports, and data; (2) analyze geomorphic change using channel migration and channel incision as metrics; (3) inventory the status of substrate in the Skagit River, side channels, tributary junctions, and unvegetated bars; (4) inventory the status of large wood in the Skagit River and at tributary mouths; (5) investigate process flows for various geomorphic and habitat changes; (6) develop a 1-D sediment transport model; (7) develop a 2-D sediment transport model of select focus areas in the Skagit River; (8) conduct an Indicators of Hydrologic Alteration (IHA) analysis to investigate the timing and duration of different types of high flow events under unmanaged conditions to inform the development of potential process flow scenarios; and (9) monitor movement of gravel deposits, cobble deposits, and added large wood.

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In the update to the RSP, City Light proposes to expand the geographic scope of some of the study components to include the Skagit River downstream of the Sauk River confluence to the estuary. City Light does not specify how exactly it will expand the study but indicates that it will convene workshops to address technical issues such as channel migration, large woody debris, suspended sediment transport, and off-channel habitat. City Light states that it will collaborate with stakeholders to look for opportunities to incorporate sediment modeling in reference reaches below the Sauk River confluence to the estuary.

*Side and Off-Channel Habitat*

City Light proposes to develop an initial map of side-channel and off-channel habitat based on a combination of georeferenced aerial photographs from 2019 and green LiDAR data in coordination with a NPS mapping project currently underway as well as the wetland assessment study (TR-02). Side channels will be digitized from this information to obtain a GIS layer and a Relative Elevation Map will be used to help delineate side-channel and off-channel habitats.

Comments on the Study

NMFS states that “side channels and off-channel habitats should be captured as discrete cells in the landform data set, especially as field work and LiDAR are proposed for extensive use among model development tools”.

Discussion and Staff Recommendations

Our interpretation of this comment is that it is NMFS’s desire to be able to isolate these habitats from other landforms in the GIS data gathered by City Light. As described above, City Light already proposes to identify these habitats as discrete features within the GIS landform data sets. Therefore, no modifications to the study plan are recommended.

*Reservoir Sediment Quantification*

In the RSP, City Light did not propose to quantify the amount of sediment transported into Ross Reservoir on an annual basis. However, to resolve disagreements on the study plan, City Light proposes in the update to the RSP to quantify these volumes “by using the existing DHSVM model<sup>3</sup> and historical contour and bathymetry information.”

Comments on the Study

In their comments on the RSP, the Sauk-Suiattle, Swinomish, Upper Skagit, and NMFS state that City Light should quantify sediment supply into Ross Lake as an annual rate (in cubic yards per year) so that the amount of sediment sequestered in the project reservoirs can be used to determine the amount of sediment lost to downstream habitats. NMFS and the tribes state that

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<sup>3</sup> Distributed Hydrology Soil Vegetation Model

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this information is needed in order to determine project effects on aquatic habitat downstream of the project.

### Discussion and Staff Recommendations

City Light is proposing numerous study methods as part of Study GE-04 and Study FA-02 (instream flow) to assess the project's effects on sediment and aquatic habitat in the river downstream of the project. Specific examples include: (1) developing 1-D and 2-D sediment transport models; (2) inventorying substrate in the main channel, side channels, tributary deltas, and unvegetated bars; (3) developing a 2-D instream flow model and conducting an IHA analysis to evaluate flows needed to maintain aquatic habitat and geomorphic processes; and (4) monitoring the movement of gravel deposits and cobble deposits. Together, these study components should provide sufficient information to inform staff's analysis of project effects on sediment and aquatic habitat in the river downstream of the project and develop license conditions if justified (section 5.9(b)(4)). We do not need to know the amount of sediment that is transported into Ross Reservoir on an annual basis to inform our analysis of project effects in the Skagit River downstream of the three project reservoirs. Therefore, we do not recommend that the study plan require City Light to quantify the amount of sediment transported into Ross Reservoir on an annual basis.

### *Vegetative Modeling*

Although City Light proposes to map vegetation downstream of the project, it does not propose to specifically study the influence of vegetation growth on sediment transport and the effects of fine sediment capture by vegetated floodplain surfaces.

### Comments on the Study

Upper Skagit states that the "2-D sediment transport model in focus areas has a chance of simulating sediment deposition on bars." However, to consider the dynamic balance between floodplain formation on bars and destruction at eroding banks and avulsions, Upper Skagit states that an "empirical model should be developed to assess the influence of vegetation growth and to incorporate the effects of fine sediment capture by vegetated floodplain surfaces."

### Discussion and Staff Recommendations

Upper Skagit does not specify the methods for its requested empirical model so we have no way to evaluate the information to be gained by the model or the level of effort and cost to complete the modeling effort. Nonetheless, both the HEC-RAS 1-D and 2-D platforms can incorporate the effect of varying vegetation cover through its incorporation of the land classification feature (USACE Hydrologic Engineering Center, 2021a and 2021b). Our understanding of how City Light intends to develop its 1-D and 2-D models would capture this information. Therefore, City Light's proposed methods follow accepted practices and should provide the information necessary to evaluate the impact of vegetation type and growth on

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sediment capture in the reach of interest (section 5.9(b)(6)). Therefore, no modifications to the study plan are recommended.

## **Study OM-01. Operations Model**

### Applicant's Proposed Study

City Light proposes to develop an Operations Model that describes existing project operation, and that can be used to simulate the effect of potential future operations on reservoir elevation, headlosses, net head, turbine discharge and spill, and power generation under a variety of operating scenarios. Specifically, City Light proposes to: (1) compile historical operational data; (2) assemble information pertaining to the physical and operational characteristics of the Ross, Diablo, and Gorge Developments; (3) develop a representative inflow dataset for purposes of model development; (4) develop an initial operations model utilizing the Computer Hydro Electric Operations and Planning Software (CHEOPS); and (5) validate the initial operations model under the "Base Case" scenario, or project operation as specified under the current project license.

City Light proposes to validate the model in two steps. First, the Operations Model will be evaluated by comparing various model outputs, including mean daily flows, reservoir elevations or storage, and generation, to the historical project record over an appropriate representative period of recent operations. City Light proposes to establish this period with input from stakeholders, but also refers to information in the PAD as having relevant flow information from 1990 to the present for developing the model. Then, City Light would verify that the model accurately represents the project's operating "rules," or the current physical, regulatory, and contractual constraints on operation by running the model and comparing the results with actual project data.

Once the model has been validated, City Light proposes to invite stakeholders to develop and submit different operating scenarios to be evaluated by the model. City Light will maintain a record of the operational scenarios evaluated as well as model output. City Light proposes to hold four separate workshops with stakeholders to ensure stakeholders understand how the model was developed and validated, how to develop scenario requests, and how to operate the model.

### *Flows for Development and Validation*

In the RSP, City Light states that the model will encompass an inflow data set, including stream flows into Ross, Diablo, and Gorge Lakes, as well as incremental flows to nodes along the Skagit River downstream of the Gorge Development. City Light does not specify the range of conditions (e.g., years of data, specific high and low water years) that will be included in the inflow data set, but states that this information will be compiled during model development. Specifically, City Light states that some of the data useful for model development is summarized in section 3.5 of the PAD, and that additional data searches and literature reviews will be completed to identify and evaluate available and relevant hydrologic data and other information

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related to historical and projected water quantity within the project's watershed and affected downstream reaches. As part of this data compilation, City Light will request input from stakeholders to make sure relevant hydrologic information is considered.

Comments on the Study

The Drainage Districts state that City Light should develop the model using as wide a range of inflow conditions as possible, and that using data from 1990 to present misses some extreme Pacific Decadal Oscillation periods, such as a persistent cool-wet period in the late 1960s and early 1970s. The Drainage Districts assert that the inflow hydrology data sets should reflect trends in increased early season rain-on-snow events as well as the effects of glacial recession. The Drainage Districts state that reservoir inflows should be validated using site-specific information and account for the hydrologic diversity unique to the project watershed, such as elevation, rain shadow effects, and glaciers.

Discussion and Staff Recommendations

Section 3.5 of the PAD summarizes available monthly and annual minimum, average, and maximum reservoir surface elevations for the three project reservoirs from 1991 through 2018. It also provides a summary of monthly minimum, average, and maximum reservoir outflows from 2014 to 2018. However, it does not summarize the available inflow data that can be used for model development. Elsewhere in the PAD, City Light indicates that there are current or historical streamflow records from gages on three Ross Lake tributaries (Big Beaver and Ruby Creeks and the upper Skagit River), one tributary to Diablo Lake (Thunder Creek), and one tributary to Gorge Lake (Stetattle Creek). Based on our review of the USGS web site for these gages, the three Ross Lake tributary gages were recently installed (2018), but the Stetattle gage has historical flow records from 1914 to 1983, while the Thunder Creek flow record extends from 1989 to present. Because the available inflow data for the project's reservoirs are relatively limited, we envision that City Light will need to develop synthetic flow records for some of the reservoir tributaries in order to develop its operations model. However, City Light has yet to specifically identify which reservoir tributaries or the period of record for each that it will use for the inflow data for model development. Therefore, there is no way to determine at this time whether the inflow data used to develop the model are sufficiently representative of the potential range of hydrologic conditions at the project. Nevertheless, City Light specifically proposes to select and develop the inflow data sets in consultation with stakeholders during the first study season. So that it is clear which inflow data sets City Light uses to develop the model, we recommend that City Light include in the ISR: (1) a specific description of the reservoir tributaries included in the inflow analysis, (2) the period of record used for each, and (3) the source of the flow data for each (e.g., USGS gage flow record or synthetic flow record). This would be a minor administrative requirement that stakeholders and staff can use to determine the adequacy of the inflow conditions at representing the range of potential hydrologic conditions that could occur at the project (section 5.9(b)(7)). There will be additional opportunities to comment on the adequacy of the inflow data sets after they are described in the ISR.

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### *Model Time Intervals*

In the RSP, City Light states that the proposed CHEOPS model will be able to predict reservoir elevation, head loss, net head, turbine discharge and spill, power generation, and other user-specified variables in hourly or higher-resolution (i.e., more-frequent) increments.

### Comments on the Study

The Drainage Districts state that the model should be validated at a time interval that is meaningful for the successful operation of the project prior to or during a flood event, as defined by the National Weather Service, and that the model should be capable of evaluating water surface elevations at a time interval appropriate for flood management.

### Discussion and Staff Recommendation

The Drainage Districts do not identify the time interval that they believe would be appropriate for flood management evaluation. Nonetheless, City Light states that the model will be capable of predicting reservoir elevations and other user-specified variables, such as generation and flows, on an hourly or more-frequent basis. This should be a sufficient time interval to assess the effects of project operation on environmental resources and flood management (section 5.9(b)(4)). Therefore, no modifications to the study plan are needed.

### *Stakeholder Engagement and Scenario Development*

City Light has developed a scenario request form that stakeholders can use to request alternative operating scenarios for evaluation by the model.

### Comments on the Study

The Drainage Districts state that the request form proposed by City Light is inappropriate because City Light is responsible for working cooperatively with stakeholders to develop operating scenarios for evaluation by the model.

### Discussion and Staff Recommendations

City Light's proposed scenario request form is a mechanism that could be used to solicit alternative operating scenarios from stakeholders. It's also unclear how this option would run counter to working cooperatively. Nonetheless, there will be additional opportunities after the filing of the ISR and USR for stakeholders to request alternative operating scenarios for Commission consideration should there be disagreements about which scenarios to model. Therefore, no modifications to the study plan are needed.

## **Study FA-01. Water Quality Monitoring**



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### Applicant's Proposed Study

City Light proposes to monitor water quality in the project reservoirs and the Skagit River downstream of the project. Specifically, City Light proposes to: (1) summarize existing relevant water quality data for the project vicinity; (2) characterize turbidity and total suspended solid (TSS) levels in the project reservoirs; (3) monitor temperature, dissolved oxygen, pH, turbidity, and TSS at one location in the Skagit River upstream of Ross Lake; (4) monitor turbidity and TSS at the mouths of select tributaries to Ross Lake (Big Beaver and Ruby Creeks) and Diablo Lake (Thunder Creek) to characterize turbidity levels during reservoir drawdowns; (5) monitor turbidity and TSS at transects parallel to the shoreline at three locations in Ross Lake to characterize conditions adjacent to areas of shoreline erosion during reservoir drawdown when erosional faces of the littoral fringe are exposed; (6) monitor fecal coliform levels at targeted locations in Ross and Diablo Lakes; (7) monitor temperature, dissolved oxygen, and pH in Diablo and Gorge Lakes; (8) continuously monitor total dissolved gas (TDG) in the Diablo Dam tailrace and Gorge Lake forebay; (9) continuously monitor temperature, dissolved oxygen, TDG, and turbidity at three locations in the Gorge bypassed reach; (10) continuously monitor temperature, dissolved oxygen, pH, TDG, and turbidity below Gorge Powerhouse; and sample TSS during periods when turbidity levels below Gorge Powerhouse are elevated; (11) continuously monitor temperature at six locations in the Skagit River between Gorge Powerhouse and just below the Baker River confluence; and (12) sample benthic macroinvertebrates in riffle habitat at six locations in the Skagit River between Gorge Powerhouse and a point just below the Baker River confluence.

In response to stakeholder comments on the RSP, City Light proposes in its update to the RSP to develop a hydrodynamic water quality model (CE-QUAL-W2) for the project's reservoirs to evaluate water temperatures, and specifically the effects of cold water releases from the reservoirs on water temperatures in the Skagit River downstream of Gorge Dam. After completion of the water temperature model, City Light states that it will develop a nutrient and productivity component for the water quality model.

City Light also proposes to expand the proposed sampling program specified in the RSP to include measuring biological productivity, including "primary producers", and conducting additional benthic macroinvertebrate sampling in the project reservoirs and at reference sites in the Skagit River from Gorge Powerhouse to the estuary. The expanded sampling program would be developed in collaboration with stakeholders and would be "informed" by the NPS's recommended sampling program included in Appendix A of NPS's comments on the RSP. However, the expanded sampling program would not necessarily include all of the sampling requested by NPS.

Lastly, City Light acknowledges in the RSP update that it may need to collect additional water quality data specifically to develop its proposed water quality model for temperature and nutrients. City Light states that the specific sampling program needed to develop the model is unknown at this time because it has yet to review all of the available water quality data for the project vicinity, much of which might be useful for model development and calibration.

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### *Ross Lake Water Temperature Sampling*

City Light does not propose to conduct water temperature sampling in Ross Lake to develop temperature profiles as part of the study.

#### Comments on the Study

Ecology states that the study should be expanded to include a water temperature sampling component for Ross Lake. Ecology states that this information is needed to determine the seasonal temperature profile and stratification of Ross Lake and to determine the potential temperature regime for instream flows should they be provided in the Gorge bypassed reach.

#### Discussion and Staff Recommendations

Section 2.3 of the RSP indicates that City Light has been collecting water temperature data at a variety of reservoir elevations at multiple sites in Ross Lake (e.g., Little Beaver, Skymo, Pumpkin Mountain, and the dam forebay) since 2015, with some data collection extending back to the early 2000s. However, very little of the available data are presented in the PAD. Therefore, there is no way to evaluate the data to determine whether they are sufficient to characterize water temperatures in Ross Lake. Nevertheless, City Light proposes to present the available data in the ISR, which can be evaluated at that time to determine whether the data are sufficient to describe water temperature conditions and develop the proposed water temperature model (section 5.9(b)(4)). Accordingly, it would be premature to require any additional water temperature monitoring in Ross Lake at this time. Therefore, no modifications to the study plan are needed.

### *Water Temperature Sampling Frequency*

City Light proposes to conduct water temperature sampling in Diablo and Gorge Lakes once per month from June 2021 to May 2023.

#### Comments on the Study

Ecology recommends increasing the frequency of water temperature sampling for developing vertical profiles in the reservoirs but does not specify the frequency. Ecology states that a sampling frequency of once per month may not provide sufficient data to evaluate project effects.

#### Discussion and Staff Recommendations

Collecting water temperature data to develop reservoir profiles on a monthly basis is an accepted practice for characterizing water temperature conditions in a reservoir environment (section 5.9(b)(6)). The monitoring data coupled with City Light's proposed water temperature

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model should provide sufficient information to assess project effects on water temperatures in the reservoirs (section 5.9(b)(4)). Therefore, no modifications to the study plan are recommended.

#### *Forebay Water Quality Monitoring Locations*

City Light does not specify the exact location within the reservoir forebays where it will collect water quality data for water temperatures, dissolved oxygen, or TDG.

#### Comments on the Study

Ecology states that temperature, dissolved oxygen, and TDG monitoring in the reservoir forebays should be conducted away from the face of the dam, which can affect the measurements, and therefore, lead to biased results (particularly for temperature) that are not representative of forebay water quality conditions as a whole.

#### Discussion and Staff Recommendations

Ecology does not provide any evidence to support its assertion that water temperatures, dissolved oxygen, or TDG would be affected by the presence of the dam, and we see no reason to believe that the dam would have a detectable influence on these water quality parameters measured in the forebay. While City Light does not specify the exact location of its proposed forebay sampling, it does indicate in the RSP that it has historically collected water temperature data in the reservoir forebays at the log booms, which are located some distance upstream of the dam. Either monitoring location (i.e., face of the dam or the log booms) would be sufficient to meet the study objectives of characterizing water temperature, dissolved oxygen, and TDG conditions in the forebay (section 5.9(b)(1)). Therefore, no modifications to the study plan are needed.

#### *TDG Monitoring*

City Light proposes to collect continuous measurements of TDG in the Diablo Dam tailrace, Gorge Dam forebay, at three locations within the Gorge bypassed reach (including the plunge pool at the base of the dam), and in the Skagit River immediately downstream of the Gorge Powerhouse. The monitoring will occur from June 2021 through May 2023.

#### Comments on the Study

Ecology states that TDG measurements should be collected in the spillway tailrace while the dam is spilling water. Ecology does not specify which dam it is referring to.

Ecology also requests that City Light collect TDG data in the Skagit River during typical operating conditions for Gorge powerhouse.

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Upper Skagit states that TDG sampling should extend much farther downstream than the one sampling location below Gorge Powerhouse that is proposed by City Light.

### Discussion and Staff Recommendations

As noted above, City Light is proposing to continuously monitor TDG in the Diablo and Gorge Dam tailraces as well as in the Skagit River below Gorge Powerhouse. The continuous TDG monitoring will allow it to collect data on TDG concentrations during periods of spill, as requested by Ecology.

According to the PAD, TDG was monitored near Gorge Powerhouse during spill events at Gorge Dam in 1997. The highest recorded measurement was 110.4 percent of saturation along one side of the river, which was slightly higher than the state TDG standard of a maximum concentration of 110 percent of saturation. However, a measurement on the opposite bank collected at the same time showed a TDG concentration of 107.4 percent of saturation. These data suggest that project operation does not cause significantly elevated TDG levels that would harm aquatic life in the Skagit River near the project. Because available information indicates that elevated TDG is not occurring near the project, there is no reason to believe that it would be a problem farther downstream (section 5.9(b)(4)). Nevertheless, City Light's proposal to continuously monitor TDG levels for 2 years near Gorge Powerhouse will provide additional information on TDG levels in the upper river near the project. If the results of the monitoring, as reported in the ISR and USR, indicate that the project is causing elevated TDG levels at Gorge Powerhouse, then the need for additional monitoring farther downstream can be considered in subsequent study seasons. Therefore, no modifications to the study plan are needed.

### *Water Temperature Monitoring*

In the RSP, City Light proposes to conduct continuous water temperature monitoring at six locations in the Skagit River between Gorge Powerhouse (RM 94.5) and at a location just downstream of the confluence of the Skagit River with the Baker River at about RM 54. In the update to the RSP, City Light proposes to develop a water quality model to aid in the assessment of project effects on water temperatures in the project reservoirs and Skagit River downstream. City Light also proposes to collaborate with stakeholders after model development to determine any remaining data gaps and potentially expand the water quality sampling program to include additional data collection farther downstream.

### Comments on the Study

Upper Skagit states that the sampling locations for temperature should extend much farther downstream than proposed by City Light. NMFS and NPS state that temperature sampling should extend to the Skagit estuary. Upper Skagit, NPS, and NMFS assert that the additional sampling is necessary because project flow releases contribute up to 50% of the total Skagit River flow in the lower river at the city of Mount Vernon located at about RM 10.

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In support of its recommendation, NMFS states that temperature modeling and empirical studies in the Willamette River Basin have clearly demonstrated that water releases from high head dams can influence downstream temperatures (Rounds, 2010; Rounds and Buccola, 2015; Steel et al., 2017). Specifically, NMFS states that water quality modeling on the Willamette River shows that there are temperature effects from dam operations that extend from about river mile 160 to river mile 27, which demonstrates that dam releases have significant effects on river temperatures over distances comparable to that from the Skagit Project to the Skagit estuary. NMFS asserts that both changes in temperature and flow have significant physiological effects on aquatic species, influencing basic metabolic functions, incubation, growth, and initiating upstream or downstream migration.

### Discussion and Staff Recommendations

The PAD includes water temperature data for the Skagit River at Newhalem (immediately below Gorge Powerhouse) and Marblemount (about 16 miles below Gorge) that were collected from 2009 to 2018. Monthly average temperatures at Newhalem ranged from a low of 4.2 degrees Celsius (°C) in the late winter to a high of 10.9°C in August. The maximum water temperature recorded during the sampling period was 15.4°C in August 2015. However, all other maximum water temperatures recorded in August during the sampling period did not exceed 12.2°C.

Farther downstream at Marblemount, monthly average water temperatures were slightly warmer, ranging from a low of 4.6°C in late winter to a high of 11.9°C in August.

These data show that water temperatures in the Skagit River below Gorge are generally cold and consistently meet state water temperature standards.<sup>4</sup> Therefore, there is no evidence that the project is causing significant adverse effects on water temperatures below the project, and NMFS, NPS, and Upper Skagit have not demonstrated that the project is adversely affecting water temperatures at sites farther downstream than City Light's proposed monitoring locations.<sup>5</sup> Further, the water quality data and modeling results from City Light's proposed study should be sufficient to assess the project's contribution to water temperature conditions in the lower river downstream of three major tributaries. If the monitoring results reported in the ISR and USR indicate that there are unforeseen effects on water temperatures at City Light's sampling sites at the lower end of the study area (e.g., below the Baker River confluence), then additional sampling can be considered in subsequent study seasons. Therefore, no modifications to the study plan are needed.

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<sup>4</sup> The Washington State temperature standard for the Skagit River during the summer specifies that the 7-day average daily maximum temperature should not exceed 16°C from June 15 to September 1.

<sup>5</sup> The proposed monitoring locations extend about 40 miles downstream and include sampling sites below three large tributaries to the Skagit River (i.e., Cascade, Sauk, and Baker Rivers).

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### *Turbidity and TSS Sampling*

City Light proposes to collect data from June 2021–May 2023 to establish baseline turbidity and TSS levels within Ross Lake. Sampling will be conducted once per month, at three sampling areas, one each in the upstream, middle, and downstream ends of the reservoir. The sampling approach is designed to measure turbidity during all times of year to characterize background conditions during minimum water surface elevation in winter, reservoir refill in spring, normal maximum water surface elevation during summer, and reservoir drawdown in fall. Turbidity will also be measured at the Big Beaver Creek confluence and the Ruby Creek confluence as well as in the Ruby Creek arm of the reservoir during fall, winter, and spring 2021–2023, to characterize turbidity conditions in these tributaries during reservoir drawdown. The exact timing of the sampling will be identified in consultation with stakeholders.

City Light will also measure turbidity conditions along three 100-m transects positioned parallel to the lakeshore (5 meters from the shoreline) in three areas where active shoreline erosion is occurring: Ross Lake Shoreline Erosional Area North, Ross Lake Shoreline Erosional Area Central, and Ross Lake Shoreline Erosional Area South. Measurements will be made at all three transects during fall, winter, and spring 2021–2023. During each sampling event, five equally spaced measurements will be made along each transect (i.e., one measurement will be made at each end and all measurements will be spaced 25 meters apart).

For Diablo Lake, City Light will sample turbidity at the upper end of Diablo Lake and in the Diablo Lake forebay. Turbidity will also be measured along a 100-m transect in the Thunder Creek Arm at the bridge near Colonial Creek Campground. Measurements will be made during fall, winter, and spring 2021–2023.

For Gorge Lake, turbidity will be measured at the upper end of Gorge Lake and in the Gorge Lake forebay.

TSS samples will be collected during all reservoir turbidity sampling events.

To evaluate turbidity conditions in the Skagit River downstream of Gorge Dam, City Light proposes to continuously monitor turbidity at three sites in the bypassed reach and one site in the Gorge Powerhouse tailrace from June 2021 to May 2023. At the powerhouse tailrace site, City Light would also collect TSS samples whenever turbidity levels are elevated.

### Comments on the Study

NPS states that City Light's proposed turbidity sampling program will be insufficient to evaluate turbidity conditions in the project reservoirs and the Skagit River downstream. Specifically, NPS states that elevated turbidity levels have been observed in Ross Lake and at tributary mouths, but City Light's proposed turbidity sampling program will be insufficient to evaluate "background/natural levels, the reservoir elevations, locations within the reservoirs,

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specific tributaries, ramping rates in the Skagit River downstream, or the environmental conditions (e.g. spring runoff, storm events) that generate the highest levels of turbidity and siltation rates in off-channel habitats in the Skagit River.” To address these issues, NPS requests that City Light expand the turbidity sampling program as specified in Appendix A of NPS’s comments on the RSP. Upper Skagit and FWS also support NPS’s recommended sampling program.

NPS, FWS, and Upper Skagit assert that elevated turbidity levels at tributary mouths due to sediment deposition and reservoir drawdowns are affecting fish migration into the reservoir tributaries. The agencies and Upper Skagit also assert that turbidity plumes along reservoir shoreline erosion sites are impairing fish movements within the reservoirs. The agencies and Upper Skagit are predominately concerned with turbidity effects in Ross Lake because it has large seasonal drawdowns and numerous fish bearing tributaries. As support for their concerns and the need for expanded turbidity sampling, NPS filed photographs showing substantial sediment deposits at Big Beaver Creek and Dry Creek within the Ross Lake drawdown zone. The Dry Creek photograph also showed a muddy creek flowing through the deposits. Upper Skagit provided a photograph of a turbidity plume in Ross Lake adjacent to a portion of the reservoir shoreline during drawdown.

NPS’s recommended sampling program in Appendix A of its comments on the RSP includes the following turbidity sampling: (1) twice per month for 2 years at 11 sites within the reservoirs (528 total samples); (2) twice per season at 18 reservoir tributary sites within the reservoir drawdown zone (144 total samples); and (3) twice per season at 12 reservoir tributary sites above the maximum elevation of the reservoirs (96 total samples).

For the Skagit River downstream of Gorge, the requested additional sampling would include expanding City Light’s proposed sampling at the Gorge Powerhouse tailrace site to include continuous turbidity monitoring and monthly TSS sampling at 3 additional off-channel Skagit River sites. It would also include expanding the sampling to include continuous turbidity monitoring and monthly TSS sampling at an additional 13 main channel and 11 off-channel Skagit River sites between Newhalem (RM 94) and Finney Creek (about RM 48).

### Discussion and Staff Recommendations

Other than reporting the results of a few secchi disk measurements taken in Ross Lake in the early 1970s, the PAD provides no information on turbidity in the project reservoirs. Therefore, there is little available information to characterize existing turbidity conditions, including at reservoir shoreline erosion sites and tributary mouths that are of concern to the agencies and Upper Skagit. Although there is little available information on turbidity conditions in the reservoirs, the photos provided by NPS and Upper Skagit suggest that project operation and drawdowns in Ross Lake may be causing elevated turbidity along reservoir shorelines and at tributary mouths.

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City Light's proposal to continuously monitor turbidity levels at multiple locations in the project reservoirs for 2 years should be sufficient to characterize turbidity conditions in the reservoirs (section 5.9(b)(1)). Additionally, City Light's proposal to monitor turbidity along transects adjacent to known areas of shoreline erosion in Ross Lake and Diablo Lake should provide sufficient information to determine if there is elevated turbidity due to shoreline erosion because these data can be compared to the reservoir turbidity data to evaluate the significance of any turbidity plumes from shoreline erosion sites (section 5.9(b)(4)).

Regarding the need to assess turbidity at reservoir tributary mouths, City Light's proposed turbidity sampling would not adequately characterize turbidity levels at the mouths of fish bearing streams to Ross Lake because it would only capture two (Big Beaver and Ruby Creek) of the numerous fish bearing tributaries that flow into Ross Lake. Therefore, we recommend that City Light collect one turbidity measurement at each tributary delta within the reservoir drawdown zone when it is surveying these sites for its ongoing spring and fall fish passage barrier assessments.<sup>6</sup> Because City Light will already be at the sites twice per year during the spring and fall for the fish barrier assessment, collecting data on turbidity levels would be a relatively low cost sampling effort (section 5.9(b)(7)) that would provide information needed to assess project effects on turbidity and fish passage into reservoir tributaries (section 5.9(b)(4)). For example, the data could be used to determine whether the elevated turbidity conditions shown in NPS's Dry Creek photograph are a persistent problem due to sediment deposits at the tributary mouth, or are a temporary condition related to seasonal high flows in the tributary. This additional Ross Lake tributary delta sampling coupled with City Light's proposed reservoir and shoreline turbidity sampling should be sufficient to assess project effects on turbidity conditions in the project reservoirs and tributary mouths and develop license conditions. Therefore, we do not recommend any other turbidity sampling in the project reservoirs or tributaries as recommended by NPS, FWS, and Upper Skagit.

Regarding the turbidity levels of the Skagit River below the project, the PAD provides monthly average turbidity data for the Skagit River at Marblemount (located about 16 miles downstream of Gorge Powerhouse at RM 78.5), collected by Ecology from 2009 to 2018. The data show that monthly average turbidity levels from January through October were very low, ranging from 0.8 to 2.6 Nephelometric Turbidity Units (NTU). During November and December, turbidity levels were higher (averaging 6.5 and 11.0 NTU, respectively); however, the elevated turbidity levels during these months were likely a result of seasonal high flow events associated with late fall and winter periods of high precipitation when turbidity levels are naturally elevated. Therefore, there is no evidence that the project is causing significant adverse effects on turbidity in the Skagit River downstream of the project, and the agencies and Upper Skagit have not demonstrated that the expanded turbidity sampling program is needed to assess the effects of the project or to develop license conditions. Consequently, there is no apparent relationship between project effects and the requested additional turbidity and TSS sampling in

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<sup>6</sup> City Light conducts spring and fall surveys at tributary mouths of fish bearing streams in Ross Lake to ensure that there are no impediments to fish passage from the reservoir into spawning tributaries.



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the river downstream of the Gorge Powerhouse (section 5.9(b)(5)). The results of City Light's proposed turbidity sampling in the project reservoirs and the Skagit River below Gorge Powerhouse should be sufficient to describe the existing environment and inform staff's analysis of project effects on turbidity levels in the Skagit River (section 5.9(b)(4)). If the sampling results as presented in the ISR or USR indicate that the project is causing elevated turbidity levels at the Gorge Powerhouse sampling site, then the need for additional sampling farther downstream can be considered in subsequent study seasons. Therefore, we do not recommend requiring City Light to expand the turbidity sampling program to include additional sampling downstream of the Gorge Powerhouse.

*Tributary Sampling*

City Light does not propose to collect water quality samples for all parameters in all reservoir tributaries.

Comments on the Study

Upper Skagit states that, in addition to sampling water quality in the project reservoirs and the Skagit River below Gorge Dam, it will be necessary to sample all water quality parameters within the reservoir tributaries to determine the influence of project operation on water quality. For example, Upper Skagit asserts that it will be important to measure suspended sediment concentrations in reservoir tributary inflows and the Skagit River to assess the amount and seasonal timing of fine sediment that is sequestered by the reservoirs.

Discussion and Staff Recommendations

The only identified project effect on water quality in reservoir tributaries is sediment deposition and elevated turbidity at tributary mouths in Ross Lake, which City Light will be evaluating as part of this study and study GE-03. There is no evidence that the project affects any other water quality parameters in reservoir tributaries. Therefore, there is no nexus between project effects and the sampling of all water quality parameters in reservoir tributaries (section 5.9(b)(5)).

Regarding the need to monitor suspended sediment concentrations in order to assess the amount and seasonal timing of fine sediment that is sequestered by the reservoirs and not transported to the Skagit River downstream, the effects of project operation on sediment in the Skagit River below Gorge Dam and whether the quantity of sediment in the river is sufficient to maintain aquatic habitat will be evaluated by Study GE-04 (section 5.9(b)(4)). Therefore, collecting data on suspended sediment concentrations in reservoir tributaries is not needed to evaluate the effects of the project or to develop license conditions. Accordingly, no modifications to the study plan are recommended.

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*Nutrients*

In the RSP, City Light did not propose to collect any nutrient samples in project waters.

In an attempt to resolve disagreements with stakeholders about the scope of the water quality study, City Light proposes in the updated RSP to conduct an assessment of nitrogen and phosphorous in the project reservoirs, representative major tributaries, and in the Skagit River below Gorge to the estuary through a sampling program that is developed in collaboration with stakeholders. City Light also proposes to develop a nutrient component for the CE-QUAL-W2 model at some point in the future after the completion of the water temperature component of the model.

Comments on the Study

Upper Skagit asserts that hydropower operations impact nutrient cycling dynamics and contribute to “cultural oligotrophication”<sup>7</sup> and even ultra-oligotrophication<sup>8</sup> of reservoirs and the river as well as estuaries downstream of impoundments (Stockner et al., 2000; Yamamoto, 2002; Stockner et al., 2005; Ahlgren et al., 2006; Matzinger et al., 2007; Bosch, 2008; Wang et al., 2018). Upper Skagit states that hydropower operations impact nutrient cycling through increased sediment retention (phosphorus-sink), losses from discharge (phosphorus-export), and loss of carbon production from lost littoral productivity due to drawdowns. Upper Skagit assert that the retention of nutrients in reservoir sediments have been noted to decrease reservoir primary productivity by approximately 30% and hydraulic modifications (e.g., water level fluctuations, leveling of seasonal outflow, and subsurface release of water) reduced primary productivity by up to 40% (Matzinger et al., 2007). Upper Skagit contends that, given the well documented ramifications of hydropower operations on nutrient sequestration, nutrient cycling, and nutrient delivery on a watershed scale, as well as the lack of existing nutrient data within the project boundary, City Light should conduct a complete nutrient analysis (i.e. sample a full suite of Nitrogen and Phosphorus compounds) for the project reservoirs and the Skagit River from Gorge Dam to the estuary (including off-channel habitats) for determination of project effects on “cultural oligotrophication” of the Skagit River.

NPS states that the RSP does not meet the needs of NPS, FERC, or other stakeholders in the development of protection, mitigation, and enhancement measures or the forthcoming NEPA analysis because it fails to address effects of “cultural oligotrophication” and ultra-oligotrophication. Therefore, NPS requests that City Light conduct a detailed nutrient analysis according to the sampling program specified in Appendix A of NPS’s comments on the RSP. Specifically, NPS’s sampling program would include collecting nutrient samples and other indicators of productivity (e.g., periphyton and chlorophyll-a) at multiple locations and

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<sup>7</sup> Upper Skagit does not define the term “cultural oligotrophication”.

<sup>8</sup> Ultra-oligotrophic lakes are characterized by very low nutrient levels and very high water clarity.

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elevations within the project reservoirs, and in some reservoir tributaries. It would also include an extensive sampling program for nutrients in the Skagit River between Gorge Dam and Finney Creek, including numerous main-channel and off-channel sampling sites.

NMFS contends that nutrients in project reservoirs are limiting, and therefore, any retention of nutrients in the reservoirs is suppressing productivity in the Skagit River downstream. NMFS also recommends nutrient sampling, although it does not specify a level of sampling effort.

### Discussion and Staff Recommendation

The NPS and the Upper Skagit do not define the term “cultural oligotrophication” but based on our review of the citations provided by the Upper Skagit, they appear to be referring to the phenomena of the gradual reduction in nutrient concentrations within some reservoir systems over time. This process begins with the construction of a dam and initial flooding of a river valley, which typically causes a large release to the water column of dissolved particulate nutrients from riparian and upland habitats. This results in very high nutrient concentrations for a period within the reservoir before the ambient nutrient concentrations slowly decline due to a combination of factors such as flushing downstream and sequestration in reservoir sediments (Stockner et al., 2005). This type of boom and bust sequence is common in newly created riverine valley reservoirs, but the pattern of nutrient decline eventually reaches a stage of equilibrium with a new, more balanced nutrient input/output after about 20 to 30 years of operation (Stockner et al., 2005).

In the case of the Skagit Project, Gorge and Diablo Dams were constructed in the 1920s and 1930s and have been operating since that time. Ross Dam and Powerhouse were completed and have been operating since the early 1950s. Therefore, the project reservoirs are clearly beyond the initial boom and bust cycle for nutrients and available information indicates that the reservoir systems are currently oligotrophic.<sup>9</sup> For example, Washington State University and NPS conducted a water quality and aquatic productivity study within the North Cascades National Park Complex at Ross and Diablo Lakes and Lake Chelan in the late 1980s (Funk et al., 1987). The study concluded that “Diablo and Ross Lakes, and the head of Lake Chelan, are relatively cold, fully oxygenated, and with insignificant impairment by pollutants generated by humans. The waters for the most part are moderately soft with low nutrient content. Phosphorus and nitrogen are present in just enough quantities to support moderately low algal populations which in turn provide food for zooplankton characteristic of oligotrophic waters. Other bioreactive elements such as calcium, magnesium, silica, sodium, potassium, sulfur, and chlorine are present in quantities that are enough to support aquatic life but are not overly abundant. Nuisance algae such as the blue green species which lend very little to the aquatic food chain were very low in numbers and were not detected in many plankton samples. Carbon-14

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<sup>9</sup> Oligotrophic lakes are generally characterized as having low levels of nutrients and algae, good water clarity, and high levels of dissolved oxygen throughout the water column even when stratified.

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experiments and chlorophyll *a* measurements further indicate low productivity, characteristic of oligotrophic lakes.”

These data from the 1980s are consistent with the water temperature, nutrient, and zooplankton community data presented in the PAD, all of which indicate that the three project reservoirs are oligotrophic systems with generally cold water temperatures, low nutrient levels, and low levels of primary and secondary productivity. Therefore, there is sufficient existing information to characterize nutrient conditions and develop measures to enhance nutrient conditions in the project reservoirs and the Skagit River downstream, if desired (section 5.9(b)(4)). Accordingly, there is no need for a comprehensive nutrient analysis or nutrient model to further study what is already known.

For these reasons, we do not recommend requiring City Light to conduct a future nutrient sampling program and develop a nutrient model for the project reservoirs, major tributaries, and Skagit River from Gorge Dam to the Skagit estuary as it proposes. No other modifications to the study plan are recommended.

*Benthic Macroinvertebrate Sampling*

In the RSP, City Light proposes to sample benthic macroinvertebrates (BMI) at the six proposed temperature monitoring locations in the Skagit River from Gorge Dam to a point just downstream of the Baker River confluence at about RM 54. The sampling would occur in July and September for two years (i.e., four total sampling events per site).

In the updated RSP, City Light proposes to develop a sampling program to “evaluate measures of biological productivity including primary producers.” City Light states that this will include expanding the BMI sampling program proposed in the RSP “to include the project reservoirs, Skagit River downstream of the project to the estuary, varying seasons, varying habitat types, and invertebrate drift.” The sampling program will be developed in collaboration with the stakeholders and will be informed by NPS’s Appendix A to its comments on the RSP.

Comments on the Study

NPS notes that the RSP includes no BMI sampling in the project reservoirs or reservoir tributaries and very limited sampling (seasonally and spatially) in the Skagit River downstream of the project, with no sampling occurring in the Newhalem Reach immediately below Gorge Powerhouse. NPS and FWS assert that the proposed sample locations, number of samples, and frequency of sample collection in the RSP is inadequate and “will likely not account for natural variability and poses a high risk of a Type II statistical error (Flotemersch et al. 2011, Hughes et al. 2012).” Therefore, NPS and FWS assert that City Light should instead implement the sampling program included in Appendix A to NPS’s comments on the RSP which includes sampling BMI at multiple locations within the reservoirs, in tributary reaches within the reservoir drawdown zone, and in tributaries above the maximum reservoir elevation. It also includes seasonal sampling (i.e., 4 times per year) at multiple main-channel and off-channel sites in each

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of 10 sampling areas in the Skagit River between Gorge Dam and Finney Creek at about RM 48. Upper Skagit asserts that changes in BMI community richness has been noted throughout the United States due to river impoundment (Trottier et al. 2019) and also recommends the expanded sampling program described in NPS's Appendix A.

NMFS states that BMI surveys are a commonly used metric to measure habitat health and evaluate the effects of flow regimes. NMFS asserts that BMI species diversity provides a holistic long-term measure and provides a strong indicator of water quality and overall stream health (Karr and Kearns, 1991). Therefore, NMFS requests that City Light expand the BMI sampling program to include additional sampling sites downstream of the project, specifically in side-channel and off-channel habitat areas that are important habitats for juvenile salmonids and other fish, especially as thermal and flow refugia for fish that reside in freshwater for extended periods. NMFS states that the productivity of these areas is important to understand, especially in connection with other studies (i.e. operational or process flow studies) that assess the potential to create additional side-channel or off-channel habitat.

### Discussion and Staff Recommendations

The PAD provides limited BMI data collected by NPS in Stettatle Creek and its alluvial fan in Gorge Lake in 2014, as well as several tributaries to the Skagit River downstream of Gorge Dam that were sampled by Ecology in the 1990s and early 2000s. The PAD contains no BMI data for the Skagit River below Gorge Dam. Because there are no data available to characterize BMI in the Skagit River downstream of the project, City Light's proposal to collect BMI data at six sites between Gorge Powerhouse and a point just downstream of the Baker River confluence will provide information to describe existing conditions for macroinvertebrates in the Skagit River. It will also enable a comparison between sites closest to the project and farther downstream, to help determine whether the BMI communities change as the influence of the project attenuates farther downstream. Together, City Light's proposed BMI sampling, its proposed water temperature monitoring and model, and its proposed 2-D instream flow model should provide sufficient information to assess project effects on BMI in the Skagit River downstream of Gorge Dam and develop license conditions to enhance BMI communities, if desired (section 5.9(b)(4)). For example, the water temperature study results can be used to compare the temperature regime of the Skagit River to known temperature tolerances of macroinvertebrates to determine if there are opportunities to enhance macroinvertebrate production, while the 2-D flow model can be used to quantify the amount of wetted area of the main channel and off-channel habitats under alternative flow release scenarios. Therefore, because City Light's proposed studies will be sufficient to assess project effects on BMI, we see no reason to expand the sampling program to include additional sampling at numerous main-channel and off-channel sites between Gorge Dam and the Skagit River at Finney Creek.

We also see no reason to expand the program to include sampling in the reservoir tributaries or the reservoirs. The project does not affect macroinvertebrates occurring in reservoir tributaries (section 5.9(b)(5)). Regarding the reservoirs, our analysis of the effects of project operation on the BMI communities of the reservoirs will be informed by: (1) existing

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information on the effects of reservoir fluctuations and drawdowns on BMI (e.g., Carmignani and Roy, 2017), (2) other components of the water quality study (e.g., water temperature monitoring and model, dissolved oxygen monitoring), and (3) our recommendation that City Light quantify the acreages of the reservoir shorelines/beds that are within the fluctuation and drawdown zones (*see* our analysis and recommendations for Study FA-07). Therefore, sampling BMI communities in the reservoirs is not needed to evaluate project effects or develop license conditions (section 5.9(b)(4)).

For these reasons, we do not recommend City Light be required to expand the BMI sampling program to include an unspecified future sampling program that includes “the project reservoirs, Skagit River downstream of the project to the estuary, varying seasons, varying habitat types, and invertebrate drift” as proposed in the update to the RSP. No other modifications to the study plan are needed.

*Benthic Macroinvertebrate Sampling Protocol*

In the RSP, City Light proposes to collect and process BMI samples according to the procedures specified in Ecology’s document entitled “Standard Operating Procedure EAP073, Version 2.3, Minimum Requirements for the Collection of Freshwater Benthic Macroinvertebrates in Streams and Rivers.” At each sample location, BMI samples will be collected with a kicknet over a site length of 2 bankfull widths or more. Eight, 1-square-foot kicknet samples will be collected in multiple riffles at each location during a given sampling period to obtain a single 8-square-foot composite sample.

Comments on the Study

FWS and Upper Skagit state that City Light’s proposed BMI sampling methods are intended for wadable streams and not large rivers. Therefore, FWS and Upper Skagit request that macroinvertebrate sampling follow Ecology’s “wide protocol” instead of its “narrow protocol.”

Discussion and Staff Recommendations

Ecology’s EAP073 document includes procedures for collecting BMI according to three different protocols: (1) a “narrow protocol” that applies to wadeable streams and rivers with less than a 25-meter average bankfull width, (2) a “wide protocol” that applies to rivers larger than a 25-meter average bankfull width, and (3) a “targeted riffle sampling” protocol. Based on our review of City Light’s proposed study methods, it appears as though it is proposing to collect BMI samples according to the “targeted riffle sampling” protocol and not the “wide protocol” as the FWS and Upper Skagit suggest. Regardless, all three protocols are similar, with the major difference between the three being that the narrow and wide protocols cover a greater longitudinal distance at each sampling site (20 bankfull widths), when compared to the targeted riffle sampling protocol (2 bankfull widths). All three of the protocols are consistent with accepted practices for collecting BMI samples (section 5.9(b)(6)), and any of the three would be

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sufficient to meet the study objectives of characterizing BMI in the Skagit River below the project (section 5.9(b)(1)). Therefore, no modifications to the study plan are recommended.

### *Macroinvertebrate Taxonomic Identification*

As indicated above, City Light proposes to collect and process macroinvertebrate samples according to Ecology's EAP073 document.

### Comments on Study

Ecology requests that macroinvertebrate samples be identified to the lowest practical taxonomic level in order to utilize them in biotic index calculations.

### Discussion and Staff Recommendations

Section 4.2 of Ecology's EAP073 document specifies that sample collection under any of the three sampling protocols should be to the lowest practical level. Therefore, it is clear that City Light intends to identify macroinvertebrates to the lowest practical taxonomic level. Therefore, no modifications to the study plan are needed.

## **Study FA-02. Instream Flow Model**

City Light proposes to develop an instream flow model to evaluate flow and aquatic habitat relationships for the Skagit River in the approximately 29-mile study reach between Gorge Powerhouse to a point just downstream of the confluence with the Sauk River. The modeling platform will be the U.S. Army Corps of Engineers' (Corps) 2-dimensional HEC-RAS unsteady flow hydraulic model. Specific study tasks include: (1) developing topography and geometry data; (2) specifying boundary conditions; (3) collecting field data on river stage, mapping substrate and cover, and collecting depth, velocity, and discharge data at agreed-upon transects; (3) calibrating and validating the model; (4) developing habitat suitability criteria (HSC); and (5) conducting five consultation workshops with stakeholders during model development to solicit input and report results.

The focus of the hydraulic model will be on the in-channel portion of the mainstem Skagit River corridor and any side channels identified by the study team as having significant habitat value; however, to assess off-channel habitat and floodplain connectivity, the model will also include, in lesser detail, the overbank floodplain out to the valley side walls.

Results from the study will provide data to evaluate the relationships between flow releases at the Gorge Development and aquatic habitat in the study reach.

In the updated RSP, City Light proposes to develop a 1-D hydraulic model for areas below the Sauk River confluence to the estuary. City Light states that it will consult with stakeholders on model design and implementation.

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### *Field Data Collection for Model Calibration and Validation*

City Light began a field monitoring program in 2020 to acquire water level and discharge data throughout the study reach for use in the hydraulic model calibration and validation. Six automatic water level recorders were installed from June through November 2020 at key locations throughout the study reach to supplement stage data available from the three mainstem Skagit River USGS gages at Newhalem (RM 94), Marblemount (78), and Rockport (RM 68) as well as an additional mainstem stage gage located about 1 mile upstream from the Sauk River confluence (RM 67) that is operated by the Skagit River System Cooperative. The locations for the automatic water level recorders were selected based on hydraulic model requirements, locations of existing mainstem gages, locations of tributary inflows, local hydraulic conditions, and access.

In addition to continuous gaging, water surface profiles for the majority of the 29-mile reach were surveyed at discharges of 2,400; 4,200; and 6,700 cfs as measured at Newhalem. The surveys were conducted in August 2020, October 2020, and March 2021, respectively. Surveys were conducted using a boat-mounted echosounder continuously recording water surface elevation. Skagit River discharges were measured concurrent with the water surface profile surveys at multiple locations along the study reach. Discharges were determined as part of a more detailed transect monitoring program using an Acoustic Doppler Current Profiler mounted to a jet boat, augmented by a conventional current meter or handheld acoustic doppler velocimeter in areas too shallow for boat operation. Inflows at several ungaged tributaries (for example, Goodell, Diobsud, and Illabot Creeks) were also measured.

The goal of the monitoring program was to acquire model calibration data at three discharges covering the range of discharges and hydraulic conditions of primary interest for fisheries management. For planning purposes, target discharges were assumed to range from about 2,000 cfs to 6,000 cfs at Newhalem. Monitoring was also conducted for one high flow event. Given that high flow events are unpredictable, monitoring of the high flow event was conducted on an opportunistic basis. The high flow event for field data collection occurred in November 2020 and produced a peak flow of 12,200 cfs at Newhalem and 25,300 cfs at Marblemount.

### Comments on the Study

The Drainage Districts state that the 2-D instream flow model should be extended downstream to at least the town of Concrete to fully evaluate the effects of operational scenarios on flood management in the lower river. The Drainage Districts assert that extending the model to Concrete is critical as current project operation appears to exacerbate flood peaks. When extending the model to Concrete, the Drainage Districts also request that the model be validated



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for “a major flood event”<sup>10</sup> at the USGS Concrete gage to account for difference in the timing of input from tributaries such as the Cascade, Sauk, and Baker Rivers. The Drainage Districts state that City Light’s proposal to validate the instream flow model using a record that includes a high flow event in November 2020 that produced a peak flow of 12,200 cfs at Newhalem and 25,300 cfs at Marblemount is insufficient because that event had a discharge rate at Concrete of 57,700 cfs and a recorded stage of 27.26 feet, which is lower than the National Weather Service’s defined flood stage of 28.0 feet.

### Discussion and Staff Recommendations

The primary objective of the instream flow model is to evaluate flow and aquatic habitat relationships in the main channel of the Skagit River to develop license conditions to protect and enhance aquatic habitat and fish populations in the river downstream of Gorge Dam. It is not to evaluate flood risk (section 5.9(b)(1)). Accordingly, City Light targeted flow levels for the fish habitat evaluation between about 2,000 and 6,000 cfs as measured at Newhalem because City Light states that these are the flow levels that are typically provided to meet fisheries needs under existing project operation. For example, in 2018 the monthly average outflows from the Gorge Development ranged from a low of 3,210 in August to a high of 8,805 cfs in February.

Regardless, should stakeholders desire to evaluate higher flow scenarios that could contribute to increased flood risk downstream, there is sufficient existing historical streamflow data from the USGS gages on the Skagit, Sauk, Cascade, and Baker Rivers to determine the magnitude and timing of flows in each river when flooding conditions were observed at the town of Concrete (section 5.9(b)(4)). The instream flow model results (which specifically account for flows from the Skagit, Sauk, and Cascade Rivers) can be synthesized with these data to determine if alternative flow scenarios, including targeted high flow releases to enhance aquatic habitat, would contribute to a greater flood risk. Therefore, we do not recommend City Light be required to extend the 2-D hydraulic model downstream to the town of Concrete, or to validate the model under flow conditions that caused flooding at Concrete.

### **Study FA-03. Reservoir Fish Stranding and Trapping Risk Assessment**

#### Applicant’s Proposed Study

City Light proposes to assess the risk of stranding and trapping of native fish species (i.e., bull trout, dolly varden, and rainbow trout) along the exposed shorelines of the three project reservoirs due to water level fluctuations or Ross Lake winter drawdowns during normal project operating conditions. The study would not assess the potential for stranding and trapping due to extended drawdowns from infrequent maintenance activities. The study area includes Gorge Lake, Diablo Lake, and the portion of Ross Lake within the U.S.

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<sup>10</sup> The Districts do not specify the discharge level for “a major flood event” but do indicate that the National Weather Service defines these events as floods that occur when the Skagit River stage at Concrete is greater than 32.5 feet.

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Specific study tasks include: (1) conducting reconnaissance level field surveys of Ross Lake in 2020-2021 during the drawdown cycle, (2) collecting bathymetry data to fill existing gaps for Gorge and Diablo Lakes, (3) conducting a desktop analysis that includes: (a) developing digital elevation models to identify areas within the reservoirs that pose a higher risk for stranding and trapping, (b) analyzing reservoir drawdown rates, and (c) compiling information on native species and life stage periodicity within the reservoirs to determine which species and life stages are most susceptible to stranding risk; (4) conducting targeted field surveys within areas identified as having a high risk of stranding and trapping; and (5) completing post-fieldwork analyses and report preparation.

*Canadian Study Area*

In the RSP, City Light does not propose to collect any data in the Canadian portion of Ross Lake, but it indicates that it would evaluate the feasibility of expanding the Ross Lake study area into Canada if analysis of existing information and field data collected in the U.S. indicates that the information is needed to meet the study objectives.

In response to stakeholder comments on the RSP, City Light proposes in the updated RSP to review the 2021 sampling results from the U.S. to determine stranding risk and then use the data to “refine and inform the expansion to Canadian drawdown zone in 2022.”

Discussion and Staff Recommendations

While City Light could on its own initiative expand the study area to include the Canadian portion of Ross Lake, the Commission has no authority to require City Light to implement studies in Canada. Therefore, staff’s analysis of project effects on the potential for fish stranding and trapping in the Canadian portion of Ross Lake would be based on the study results obtained from the U.S. side of the border and other available existing information. Accordingly, we recommend removing the placeholder from the study plan requiring City Light to potentially expand the scope of study in 2022 to include field studies in the Canadian portion of Ross Lake.

**Study FA-04. Fish Passage Feasibility**Applicant’s Proposed Study

City Light proposes to investigate the benefits and feasibility of providing upstream and downstream fish passage at the three project dams. The study will include developing conceptual designs for upstream and downstream passage facilities at each dam, or a passage system designed for the project as a whole. Upstream and downstream passage concepts will be configured to accommodate the unique physical, operational, and site constraints at the project. The study will include developing cost estimates.

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City Light also proposes to conduct a field investigation to characterize and document the physical structure of two potential upstream passage barriers in the Gorge bypassed reach that were identified by a fish passage barrier evaluation completed in the 1980s (Envirosphere, 1989). The field investigation will also be used to collect additional data needed to develop a hydraulic model to assess the flow levels at which specific identified potential passage barriers in the bypassed reach could be passable by target species and life stages.

*Study Lead and Expert Panel*

City Light proposes, as part of the study, to form a three-member panel of independent fish passage experts (expert panel) to review reports and provide advisory opinions. The expert panel participants would be determined in collaboration with the licensing stakeholders, but City Light envisions that one member of the expert panel will be selected by stakeholders, a second by City Light, and a third selected by the other two expert panel members.

Comments on the Study

Skagit County states that City Light should not be the lead investigator in the fish passage study because it has spent many years and considerable resources undermining the idea that anadromous fish utilized the river upstream of the project's dams. Therefore, Skagit County asserts that "it defies reason to suggest that Seattle should now lead and control what is supposed to be an objective analysis of that very question." Accordingly, Skagit County requests that the Commission require the federal agencies and tribes to co-lead the study.

Discussion and Staff Recommendations

The ILP affords all licensing participants the opportunity to review and comment on the study results and recommend modifications to the studies. Therefore, no modifications to the study plan are needed.

Regarding City Light's proposal to convene an expert panel to review and evaluate study reports, there is no need for such a requirement. City Light's proposed fish passage study is consistent with accepted practices for evaluating fish passage feasibility and developing passage alternatives within the context of a hydroelectric licensing proceeding (section 5.9(b)(6)). Commission staff and stakeholders, including federal agencies and Indian tribes, will have the opportunity to review the study results and decide if it was completed as required by the study plan determination, and to determine whether it provides the information necessary to inform a licensing decision. Therefore, we do not recommend that City Light be required to convene an expert panel to review and provide opinions on the study results.

**Study FA-07. Reservoir Tributary Habitat**Applicant's Proposed Study

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As part of its overall assessment of the benefits of providing anadromous fish passage at the project, City Light proposes in the RSP to evaluate the productivity potential of the project's reservoirs and select tributaries for the following target species: Chinook, coho, and sockeye salmon, and steelhead trout. The study includes: (1) applying the NetMap Model to map and characterize the extent of potential spawning and rearing habitat for the target species within select reservoir tributaries; (2) using physical habitat variables to estimate juvenile rearing habitat capacity (i.e., productivity potential), for the target species within potentially suitable reaches identified by the NetMap Model; and (3) incorporating the results of the USGS's ongoing Food Web Study<sup>11</sup> into an overall juvenile production estimate for available habitat, including identifying constraints/limiting factors for productivity.

*Tributary Habitat Assessment*

In the RSP, City Light proposed a study area that encompassed the following tributaries to the project reservoirs: (1) Stetattle Creek (tributary to Gorge Lake); (2) Thunder Creek (tributary to Diablo Lake); and (3) nine tributaries to Ross Lake, including the Upper Skagit River, and Canyon, Little Beaver, Big Beaver, Hozomeen, McMillan, Devils, Granite, and Three Fools Creeks.

In response to stakeholder requests to expand the tributary assessment to include additional tributaries to Ross Lake, City Light proposes in the update to the RSP to expand the tributary assessment to include 17 additional tributary stream reaches that are located within the U.S. portion of the Skagit Basin and flow into Ross Lake, and 14 additional tributary stream reaches that are located in the Canadian portion of the Skagit Basin and flow into the Skagit River above Ross Lake.

Comments on the Requested Study

All disagreements on the scope of the tributary assessment were resolved by City Light's proposal in the updated RSP as explained above.

Discussion and Staff Recommendations

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<sup>11</sup> In 2018, City Light agreed to fund a comprehensive food web assessment in the project reservoirs to assess apparent recruitment limitations in the rainbow trout populations, thought to be related to the introduction of redbside shiners [bookmark55](#) (a non-native minnow species) to the project reservoirs. City Light states that the initial study results will be available in March 2022.

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With the exception of the issue of potential fish passage impediments at the mouths of tributaries,<sup>12</sup> there is no connection between the project and anadromous fish habitat upstream of the project reservoirs.

The suitability of upstream tributary habitat for anadromous salmonids, as it relates to recovery planning under NMFS guidelines, pertains to management decisions and actions that most appropriately fall under NMFS jurisdiction. While the results of the proposed study might be used to inform NMFS's decision on the need for anadromous fish passage into the Skagit River above the project's dams, the proposed study is not necessary for Commission staff to evaluate the potential effects of operation of the project on fisheries resources of the project area. Therefore, we do not recommend City Light be required to conduct any of the proposed studies to map and characterize tributary habitat and develop production estimates for anadromous salmon or any other fish species in tributaries to the project's reservoirs.

*Fall Spawning Salmon*

City Light does not propose to include in the study an evaluation of the effects of Ross Lake drawdown on fall spawning salmon.

Comments on the Study

The Sauk-Suiattle requests that the study evaluate the effects of Ross Lake drawdown on fall spawning salmon (e.g., are they likely to spawn in areas that will be subsequently dewatered or inundated due to reservoir fluctuations?).

Discussion and Staff Recommendation

Sauk-Suiattle does not recommend a specific methodology for how the requested evaluation should be completed. The need to conduct such an evaluation would be based on several factors, including which species of fall spawning salmon are passed upstream of the dams. At this point, it would be premature to require such an evaluation until City Light has completed its fish passage feasibility study (FA-05) to determine the feasibility of passing salmon and steelhead upstream of the project's dams (section 5.9(b)(4)). Should the results of the evaluation indicate that it is feasible to pass fall spawning salmon upstream, then the potential for project effects on spawning habitat in the reservoir fluctuation zone could be evaluated at that time. If needed, that evaluation could be completed using existing information such as GIS tools to quantify the length of exposed tributaries that would be available for spawning based on typical reservoir elevations in the fall. Therefore, we do not recommend that City Light be required to evaluate the effects of reservoir drawdown on fall spawning salmon at this time.

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<sup>12</sup> Information to assess the effects of project operation on the creation of fish passage impediments within tributary deltas (e.g., physical blockages or turbidity plumes that could impede passage) is being collected through study GE-03 (reservoir sediment deposition) and study FA-01 (water quality monitoring).

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### *Reservoir Littoral Zone Evaluation*

In response to stakeholder requests to conduct studies of reservoir littoral zone habitat in the drawdown and fluctuation zones of the reservoirs, City Light proposes as part of Study FA-07 to “conduct a GIS assessment of habitat in the reservoir littoral and varial zones in 2021 and evaluate and determine parameters and metrics for representative field sample frames if warranted to evaluate habitat quality in a workshop with LPs [licensing participants].”

### Comments on the Study

No entities filed comments on City Light’s proposal in the updated RSP to conduct a littoral zone evaluation as part of Study FA-07.

### Discussion and Staff Recommendations

It is unclear how City Light proposes to “conduct a GIS assessment of habitat in the reservoir littoral and varial zones in 2021 and evaluate and determine parameters and metrics for representative field sample frames if warranted to evaluate habitat quality in a workshop with LPs.” However, as explained in our analysis and recommendations for the stakeholder requested *Reservoir Littoral and Riparian Habitat* studies in section II, *Studies Not Required*, of this determination, we will need to know the affected area of the reservoir shorelines and beds that are subject to large seasonal drawdowns in Ross Lake and smaller daily fluctuations in Gorge and Diablo Lakes.

Therefore, we recommend requiring City Light to quantify the acreages of reservoir shoreline/bed that are subject to frequent fluctuations (i.e., Gorge and Diablo Lakes) or extended drawdowns (i.e., Ross Lake) under normal operating conditions. This is a desktop exercise that could be completed using GIS tools and would enable staff to quantify the affected area of the reservoirs beds and shorelines that are dewatered during project operation (section 5.9(b)(4)).

## **Study FA-08. Fish Entrainment**

### Applicant’s Proposed Study

In the RSP, City Light proposes to conduct a desktop evaluation of potential fish entrainment and impingement at the Ross, Diablo, and Gorge Developments. The study will also evaluate injury and mortality through the powerhouses and spillways.

Specifically City Light would: (1) describe the physical characteristics of the project powerhouses and intake structures; (2) summarize water quality conditions in the vicinity of the intake structures; (3) estimate intake velocities at each of the powerhouse intake structures; (4) describe the fish community and compile a target species list for entrainment and impingement analyses; (5) characterize the risk of impingement to target species based on intake velocities,

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trash rack bar spacing, and target species life history information and estimated swim speeds; (6) characterize the risk of turbine and non-turbine (e.g., spillway) entrainment to target species based on body size, life stage, periodicity, habitat requirements, and passage route; (7) conduct a literature review and desktop analysis of historical turbine entrainment and entrainment survival studies to estimate turbine entrainment and entrainment survival at each of the developments; (8) estimate probability of passage and survival for target species using site-specific physical and operational parameters and the FWS's Turbine Blade Strike Analysis Model; and (9) provide an overall qualitative summary of entrainment and impingement potential for target species.

City Light estimates that the cost of the desktop study would be about \$85,000.

*Entrainment Field Studies*

In response to stakeholder comments on the RSP, City Light proposes in the updated RSP to complete the desktop study during the first study season, and then use the results to evaluate the need for field-based entrainment studies during the second study season.

Comments on the Study

Upper Skagit states that the desktop analysis will not be able to predict the unique character and operations of the Skagit Project and accurately estimate the direct and delayed mortality of fish. Therefore, Upper Skagit recommends that City Light conduct a mark/recapture field study using Passive Integrated Transponder (PIT) tags and tailrace netting as originally requested in their October 2020 study requests. The PIT tag studies would be conducted in Diablo and Gorge Lakes and include tagging a representative sample of life histories of all native and "exotic" species in each reservoir, establishing an antenna monitoring system at all entrainment points in each dam structure, and calibrating detection rates over a range of conditions to accurately estimate entrainment rates by species and life histories. Upper Skagit asserts that it is critical to sample over multiple seasons to "capture fish behavior under various environmental conditions and as life history changes".

NPS and FWS state that an entrainment study should, at the very least, consist of a phased approach where field studies would be conducted if desktop analysis warrants it (similar to the approved study plan for the Jackson Hydroelectric Project, FERC P-2157). NPS and FWS state that City Light's basis for not conducting detailed entrainment studies is that most of the reservoir fish species exhibit a resident life history strategy and are not inclined to migrate; however, this would not be the case with anadromous fish species if they are passed upstream of the project. Although they do not explain how, NPS, FWS, and Upper Skagit assert that providing minimum flows in the bypassed reach could increase the entrainment risk at Gorge Dam. For these reasons, NPS and FWS continue to request a mark/recapture field study and tailrace netting as outlined in their October 2020 study requests. The study would be similar to the Upper Skagit's requested study described above, except that it would include all three project reservoirs and include tagging a representative sample of all size classes of all reservoir fish species.

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The Swinomish Tribe filed comments on the RSP stating that it supports NPS's requested mark/recapture study request.

In their study requests, Upper Skagit, NPS, and FWS estimate that their recommended mark/recapture studies would take about 3 to 5 years and cost about \$400,000.

#### Discussion and Staff Recommendations

City Light is currently conducting a bull trout acoustic-tag tracking program to track bull trout movements through the project reservoirs and assess the potential for turbine entrainment and spillway passage at the three developments. The study began in 2013 and is ongoing. According to City Light's 2019 Bull Trout Incidental Take Report, City Light generally attempts to maintain 10 active acoustic tags in bull trout greater than 400 millimeters in length in each reservoir each year (30 total tagged bull trout). Tagged bull trout are continually tracked with a large array of receivers installed in the reservoirs, including the forebay of each development. City Light is continually tagging additional bull trout because the battery life of the acoustic tags is about 3 to 4 years. Between the years 2013 and 2018, a total of 2 tagged bull trout were entrained into the Diablo intakes and both fish survived passage. No tagged bull trout were entrained into the intakes at Ross or Gorge.

City Light also calculates bull trout spillway passage and mortality rates annually as part of its ongoing bull trout monitoring program. The calculation is based on: (1) the annual spill duration at each dam; (2) the time that tagged bull trout spend near the spillways at each dam; (3) the assumed adult bull trout population abundance in each reservoir; and (4) spillway mortality rates of 10 percent at Ross Dam, 55 percent at Diablo Dam, and 10 percent at Gorge Dam. For the period of 2013-2018, City Light estimates that bull trout mortality from spillway passage each year averages less than 1 fish at Ross Dam, about 24 fish at Diablo Dam, and about 4 fish at Gorge Dam.

These data suggest that turbine entrainment and spillway passage rates for adult bull trout at each of the project's developments is generally low. However, the ongoing studies are specific to large bull trout greater than 400 millimeters and do not account for the smaller life stages of bull trout or other fish species in the reservoirs. City Light's proposed desktop study would supplement the existing site-specific data on turbine entrainment and spillway passage for adult bull trout, and estimate the entrainment and mortality rates for smaller bull trout as well as multiple life stages of the other target species (section 5.9(b)(4)).

Expanding the proposed entrainment study to include mark-recapture studies using PIT tags and tailrace netting for all native and "exotic" reservoir fish species could potentially provide more detailed information on the rates of entrainment and injury or mortality sources during turbine passage. However, a field study using the methods recommended by the agencies



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and Upper Skagit would be very difficult and costly to implement for the reasons discussed below.

First, City Light would need to collect and tag a minimum of several hundred individuals of each life stage of each target species in the project reservoirs in order to ensure that some of the tagged fish pass downstream through the dams, especially considering that many of these fish species (e.g., dolly varden, rainbow trout, brook trout, cutthroat trout) would likely exhibit a resident life history type and not be inclined to migrate downstream in large numbers. Second, City Light would need to shut down the turbines and dewater the project's 12 penstocks in order to safely access the penstocks to install a PIT-tag antenna array in each to determine the entrainment rates of tagged fish. Lastly, because PIT tags are "passive" tags that do not transmit a signal that can be tracked using aerial or boat surveys to determine if tagged fish are still moving after dam passage (i.e., survived passage), City Light would need to isolate the tailraces and physically collect and inspect fish passing downstream to assess injury and mortality rates. Installing block nets and attempting to recapture live, injured, or dead fish to assess injury and mortality rates in the powerhouse tailraces would be exceedingly difficult if not impossible. At a minimum, the nets would need to span the width and depth of each powerhouse tailrace. Each of the project's tailraces appear to be at least 100 to 200 feet wide,<sup>13</sup> and would require nets be placed both downstream and upstream of the powerhouse to prevent fish from migrating upstream or downstream. Even if nets are installed, it is unclear how fish that are dead or alive could be effectively recaptured within the area isolated by the nets given the large sampling area, high volume of water that would be discharged during turbine operation (i.e., maximum hydraulic capacities of about 7,000 cfs at Gorge and Diablo and 16,000 cfs at Ross), and small size of some of the size classes of fish (e.g., juvenile) that the agencies and Upper Skagit desire to include in the study.

Given these challenges, we estimate that the agencies' and Upper Skagit's estimated study costs of \$400,000 are likely far too low. The cost would likely be considerably more to develop any reliable field-based estimates of entrainment and injury and mortality rates.

Overall, using existing data to perform a desktop analysis of entrainment is consistent with generally accepted practices and is similar to a number of entrainment studies performed in support of other hydroelectric licensing proceedings (section 5.9(b)(6)). The results of the proposed desktop study coupled with City Light's ongoing acoustic tagging and tracking study would provide the necessary information to conduct staff's analysis of fish entrainment and spillway passage at the project (section 5.9(b)(4)), at a lower cost than the study recommended by NPS, FWS, and Upper Skagit (section 5.9(b)(7)). Therefore, we do not recommend that City Light be required to conduct field-based entrainment studies during the second study season.

### **Study SY-01. Synthesis and Integration of Available Information on Resources in the Lower Skagit River**

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<sup>13</sup> The PAD does not describe the dimensions of the powerhouse tailraces so we estimated the widths of the tailraces using aerial images.

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### Applicant's Proposed Study

City Light proposes a desktop study to develop a comprehensive data set of existing information on the Skagit River between the Sauk River confluence and the estuary. Specifically this will: (1) compile, analyze, and summarize relevant available information about the primary factors affecting life stages of anadromous fish resources; (2) identify the project's potential contribution to those factors affecting life stages of anadromous fish resources and identify data gaps related to the evaluation of the project's effects; and (3) develop proposals for studies to be conducted during the second year of the ILP study period to fill those data gaps, if necessary.

### Comments on the Study

NPS, FWS, NMFS, Swinomish, Upper Skagit state that City Light should have already completed a data synthesis of existing information on environmental resources downstream of the Sauk River confluence with the Skagit River during development of the PAD as required by 18 CFR section 5.6(b). The agencies and tribes assert that City Light is essentially relying on a single year of data compilation rather than empirical studies to assess project effects downstream of the Sauk River confluence, and the effort is unlikely to produce any new conclusions or consensus on the appropriate study scope for field data collection needs in the lower Skagit River.

The agencies and tribes indicate that they have already provided evidence in prior comment letters and study requests that project effects extend below the Sauk River confluence, and provide the following examples: (1) the exceedance probability at the Concrete gage shows a substantial change in the spring flood magnitude and duration, (2) project flows contribute over 50% of Skagit River flow at Mt. Vernon, and (3) other studies of large gravel bed rivers have documented impacts in excess of 100 km below dams (Grant et al., 2012).

Therefore, the agencies and tribes request that City Light extend the instream flow modeling study (FA-02), geomorphology study (including the IHA analysis) (GE-04), and water quality study (FA-01) downstream to the estuary.

### Discussion and Staff Recommendations

Although the agencies and tribes submitted these comments on City Light's proposed lower river data synthesis study, the comments are actually requests to extend the geographic scope of other studies, which we address in the analysis and recommendations for each of the relevant studies elsewhere in this determination (to the extent that there are still disagreements over the downstream scope of each of the studies after the filing of the update to the RSP).

## **Study RA-01. Recreation Use and Facility Assessment**

### Applicant's Proposed Study

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City Light proposes to inventory and evaluate project and non-project recreation facilities to determine their condition and accessibility for the disabled, identify recreation uses and visitor preferences, and estimate current recreation use and demand. The study area includes the lands and waters within and adjacent to the project boundary at Ross Lake, Diablo Lake, and Gorge Lake, the towns of Newhalem and Diablo, and the Skagit River from the town of Newhalem downstream to Marblemount. Recreation sites within the Ross Lake National Recreation Area (RLNRA), and within the Mount Baker Snoqualmie and Okanogan-Wenatchee National Forests are included within the study area. Specifically, City Light proposes to:

- (1) Inventory recreation facilities and amenities (tables, restrooms, trails, etc.), assess the condition of each amenity at each recreation facility, assess accessibility for the disabled at select sites, and assess recreation access and use impacts at all project recreation facilities and select non-project recreation facilities (June-October 2021);
- (2) Determine the usable periods of the project's Gorge Lake Boat Launch (June-October 2021);
- (3) Identify recreation use and visitor attitudes, beliefs, and preferences via field observation counts (i.e., spot counts) and visitor surveys (May-October 2022);
- (4) Estimate current recreational use in the study area, including the amount and timing of use, activity types, barriers and safety issues, and occupancy and capacity of recreation facilities; and
- (5) Identify future use and demand opportunities.

City Light estimates the cost of conducting this study to be \$1,150,000.

*Inventory and Condition Assessments*

City Light proposes to inventory 43 recreation facilities located on Ross, Diablo, and Gorge Lakes, in the project town of Newhalem,<sup>14</sup> and on the Skagit River. The specific types of evaluation vary for each facility. The assessment, in part, includes evaluating conditions of eight trails—two project trails (Ladder Creek Falls Trail and Trail of the Cedars) and six non-project trails (Hozomeen Lake Trail, Ross Dam Trail, East Bank Trail, Happy Panther Trail, Thunder Knob Trail, Thunder Creek Trail, Stetattle Creek Trail, and Diablo Dam Trail)—where additional information is needed to understand the potential to provide enhanced accessible access for the disabled. As such, City Light proposes to qualitatively assess the developed recreation trails to characterize the general opportunities and constraints to making future accessibility

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<sup>14</sup> Newhalem is a company town owned by Seattle City Light in Whatcom County that is part of the Skagit River Project and located along the Skagit River just downstream of the Gorge Powerhouse. The town was originally constructed to house project workers during the construction of the project but continues to provide housing for some full-time project operations personnel or contractors. The town includes the Gorge switchyard, project maintenance and administrative buildings, shops, dining facilities, a firehouse, wastewater treatment plant, a general store and a variety of recreational amenities and interpretive facilities open to the public.

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improvements. That qualitative evaluation would generally assess the running slope, cross slope, tread obstacles (e.g., rocks, roots), trail width, trail surface material and compaction, sign condition, and connection to parking and trailhead facilities, among others. City Light proposes to limit trail assessments to trailheads only. City Light states that the assessment is intended to provide a summary of the overall constraints and barriers for each trail, including photographs of representative conditions and notable constraints or barriers during the field assessments; it is not meant as an engineering or universal trail accessibility assessment. Based on the NPS and Forest Service's request, one of the trails City Light intends to assess for improvements for the disabled is the 1.0-mile-long non-project Ross Dam Trail. The Ross Dam Trail starts at Ross Dam Trailhead along State Route 20 and leads to the Ross Dam area, Ross Lake Resort dock, and the Happy Panther Trail.

Comments on the Study

In their comments on the RSP, the NPS and Forest Service state that they are "in alignment with SCL's RSP on the sites and methods to complete the: facility condition assessment, facility inventory, and impact assessments." However, they later state that in addition to identifying barriers to accessibility on the trails (i.e., surface, current barriers, width, length, slope) as proposed by City Light, the assessment should also include an assessment of existing signage to determine if it provides the information needed by users to determine the trail conditions and ability level needed for the trail. The agencies also recommend that, instead of evaluating the accessibility of Ross Dam Trail, City Light evaluate the accessibility for the portage route to Ross Lake. The agencies reason that because the Ross Dam Trail is steep, modifying it to improve accessibility would likely be more expensive than modifying the portage route to be more accessible to those with disabilities. The agencies state that assessing the accessibility of the portage route would help identify what facilities need to be added, improved, or modified to improve access to Ross Lake. The agencies point out that because City Light already proposes to conduct accessibility assessments on most portions of the portage, completing an assessment of the entire portage route would not be difficult as City Light would only need to add the haul road connecting the East Landing with the Ross Lake Dock and the Ross Lake Dock to the assessment.

Discussion and Staff Recommendations

Visitors can access Ross Lake by the Diablo Ferry or private boat from Diablo Lake, or by hiking in off Route 20. Boaters or those arriving by the Diablo Ferry, once they reach the base of Ross Dam, can either take a shuttle service that picks them up at this location and takes them around the dam on a gravel haul road to a dock on the east side of Ross Lake, or they can hike along the haul road to the dock. Because City Light already plans to assess the accessibility of most of the portage route between Diablo Lake and Ross Lake, assessing the remaining portion of the route (the haul road and Ross Lake Dock) would provide a more complete assessment of accessibility needs along the route and inform licensing decisions (section 5.9(b)(5)). Sufficient information exists to determine that the Ross Dam Trail, leading from Route 20 to Ross Lake, is inaccessible and would be costly and difficult to make accessible to the public (section

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5.9(b)(4)). Therefore, we recommend that City Light conduct an accessibility assessment of the entire Diablo to Ross Lake portage route in lieu of assessing the accessibility of Ross Dam Trail given its greater potential for accessibility improvements.

City Light's proposed assessment methods include an assessment of the condition of signs (signs of weathering, legibility of text) but does not explicitly state that the assessment will identify a sign's ability to effectively communicate trail conditions to the public. It is our understanding that none of the trails that would be evaluated except possibly the trail at the Gorge Overlook is accessible to the disabled; therefore, it is unlikely that there is any signage as to a trail's difficulty. Nonetheless, it would be easy to also document such information for any existing signage when conducting the proposed field assessments (section 5.9(b)(6) and (7)). Therefore, we recommend City Light also examine the ability of signs to effectively communicate trail conditions (e.g., level of difficulty) to the public and note in the study report where no such signage exists.

#### *Study Sites for Visitor Surveys and Observation Counts*

To gather information about recreation use and visitor preferences, City Light proposes to conduct observation counts (i.e., use spot counts) at 22 locations and on-site visitor surveys at 22 locations, some of which are different than the on-site visitor survey locations, on Ross, Diablo, and Gorge reservoirs, in the town of Newhalem, and along the Skagit River. City Light would conduct the observation counts and visitor surveys where visitors are observed (i.e., parking areas, picnic areas, fishing piers, boat launch ramps, docks, shoreline access areas, etc.). City Light would also conduct visitor surveys and observation counts where City Light observes overflow use and use in areas immediately adjacent (i.e., within approximately 200 yards) to the formal study sites if City Light is not able to correlate the use area/uses to an adjacent non-study site facility or use (i.e., neighboring trailhead, parking area, campground, residence, etc.).

City Light proposes to conduct observation counts (i.e., use spot counts) at the following project and non-project recreation facilities: (1) Hozomeen Boat Launch, Winnebago Flats Boat Launch, Ross Dam trailhead, and East Bank trailhead on Ross Lake; (2) the Skagit Tour Dock parking area, the West Ferry Landing parking area, the Environmental Learning Center/Diablo Trailhead, the roadside Diablo parking area, the Diablo Dam trailhead, Colonial Creek boat launch, Diablo Overlook, Thunder Knob trailhead, and Thunder Creek trailhead on Diablo Lake; (3) Ross Lodge Picnic Shelter, Gorge Lake boat launch, Gorge Overlook, and Sourdough Mountain trailhead on Gorge Lake; (4) parking areas and picnic sites in the town of Newhalem; and (5) the Gorge Powerhouse parking lot, Goodell Creek boat launch, and Marblemount boat launch on the Skagit River.

City Light proposes to conduct visitor surveys at the following project and non-project recreation facilities: (1) Hozomeen Campground, Hozomeen Boat Launch, Winnebago Flats Campground, Winnebago Flats Boat Launch, Ross Lake Boat-in sites, Ross Dam Trailhead, and East Bank Trailhead on Ross Lake; (2) Ferry Landings, North Cascades Environmental Learning Center/Diablo Lake Trailhead, Diablo Dam parking area, Diablo Overlook, Colonial Creek

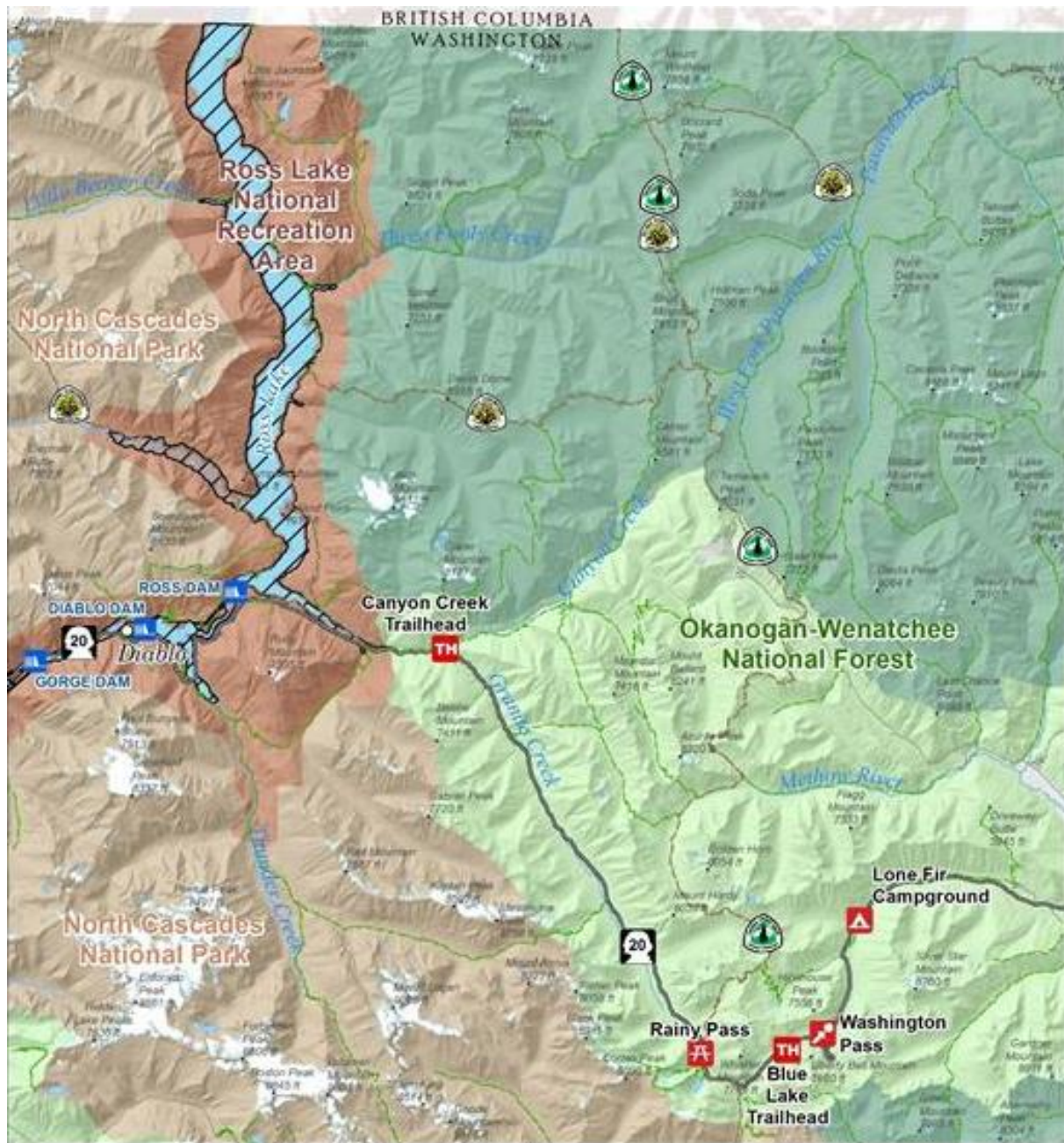
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Campground, Colonial Creek Boat Launch and Fishing Pier, and Skagit Tour Dock on Diablo Lake; (3) Gorge Lake Campground, Gorge Overlook, Gorge Lake Boat Launch, Gorge powerhouse and Newhalem parking area at Gorge Lake; and Goodell Creek Campground, Goodell Creek Boat Launch, and Marblemount Boar Launch on the Skagit River downstream of the Gorge powerhouse.

Comments on the Study

City Light explains in the RSP that it did not include Newhalem Campground, Marble Creek Campground, Canyon Creek Trailhead, Rainy Lake Picnic Area, Blue Lake Trailhead, Washington Pass Overlook, and Lone Fir Campground, as recommended by the NPS and Forest Service, because they are too far from the project to experience a project-induced recreation effect (figure 1 and 2). City Light also states that its proposed visitor survey instrument includes a question designed to collect information on what areas respondents are visiting during their trips, which would cover these more distant recreation sites. City Light also states that adding these sites would increase the number of surveys to be administered, which would tax logistic resources and potentially compromise study success.

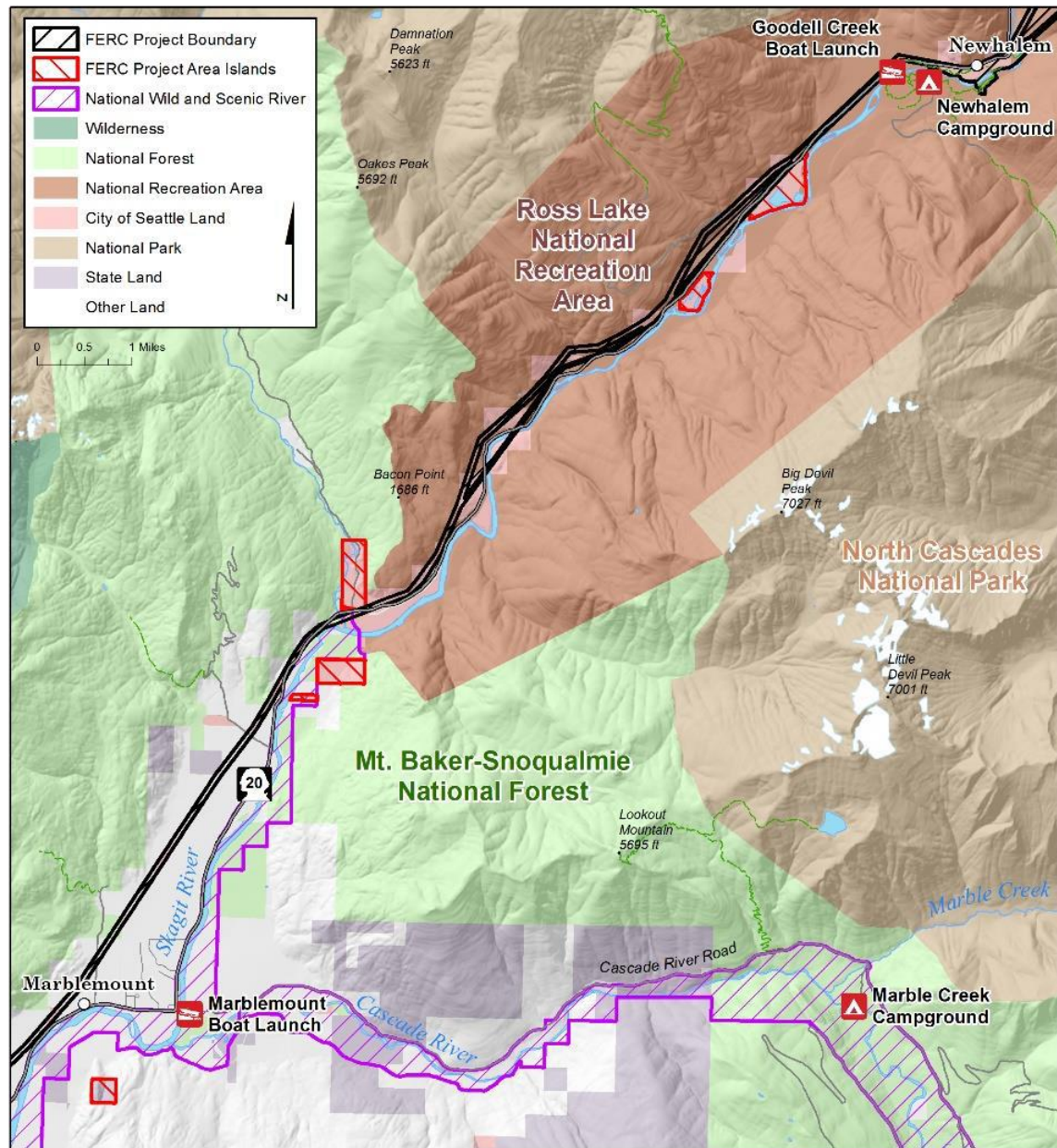
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**Figure 1.** Recreation sites east of Skagit Project Boundary, along Highway 20 (source: NPS).



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**Figure 2. Recreation Sites within the Skagit River Study Area (source: NPS).**

In their comments on the RSP, the NPS and Forest Service again recommend that City Light add the Newhalem Campground, Marble Creek Campground, Canyon Creek Trailhead, Rainy Lake Picnic Area, Blue Lake Trailhead, Washington Pass Overlook, and Lone Fir Campground to the recreation study. Specifically, the agencies recommend that City Light: (1) conduct on-site visitor surveys at all seven sites, (2) conduct observation counts at Rainy Lake Picnic Area; and (3) do not conduct observational use counts or visitor surveys at the proposed Newhalem picnic site and Skagit Tour dock because visitor use and preference can be gathered from visitors using other Newhalem town sites and checking in at the Environmental Learning Center.



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In support of their recommendation, the agencies again argue that the Newhalem Campground, which is located adjacent to the town of Newhalem, receives higher use because it serves as an overflow campground when reservoir campsites are full and the visitors to the campground visit other project facilities. The agencies state that a 2007 recreation survey of the Ross Lake National Recreation Area (Swanson and Johnson, 2007) found that 87 percent of visitors surveyed at the Newhalem Campground said visiting the Ross Lake National Recreation Area was one of the primary reasons for their trip, while 64 percent said that lake viewing was part of their visit. Similarly, the agencies state that Marble Creek Campground not only serves as an overflow facility when reservoir campgrounds are full, but it is also used by those who access the Skagit River via the Marblemount Boat Launch, which City Light proposes to include in the recreation study, to take advantage of late-season project-induced whitewater flows. The agencies state that the Marble Creek Campground, located 8.7 miles away from the Marblemount Boat Launch, is the closest campground to the boat launch and that City Light advertises the campground on the project's website as a place to stay when visiting the Skagit River and the Marblemount Boat Launch.

The agencies argue that the Canyon Creek trailhead, located 1.7 miles east of the project boundary along Highway 20 and a 15-minute drive east of Colonial Creek Boat Launch on Diablo Lake, should be included in the study because Ross Lake is the primary destination of this trail which connects with the Devils' Dome Trail to provide direct access to Ross Lake. The agencies state that the Rainy Lake Picnic Area, Blue Lake Trailhead, Washington Pass Overlook, and Lone Fir Campground should be included in the study because they are all located within a 35 to 45 minute drive along Highway 20 from the project site and, according to the Swanson and Johnson (2007) survey, are used by Ross Lake visitors on extended trips. The agencies point out that the Lone Fir Campground serves as an overflow facility when campgrounds closer to the project are full and offers a drier weather alternative to camping for those who want to camp outside of the rain shadow where the project lakes are located. Further, the Forest Service notes that City Light, as part of the 1993 settlement agreement, annually funds the Forest Service for its management of the Canyon Creek Trailhead, Rainey Lake Picnic Area, Blue Lake Trailhead, Washington Pass Overlook, and Lone Fir campground.

To reduce the costs of adding these seven sites to the study, the agencies recommend that City Light use existing NPS use data at the Newhalem Campground rather than conduct new counts there and eliminate the observation counts at the Skagit Tour Dock because the number of visitors using the dock can be captured when they check-in at the Environmental Learning Center. However, the agencies still recommend conducting visitor surveys at the Newhalem and Marble Creek Campgrounds. To further reduce costs, the agencies recommend eliminating observational counts at the Newhalem Picnic sites, East Bank Trailhead, and Diablo Overlook. The agencies state that Diablo Overlook use information can be obtained via existing NPS traffic count data and that taking observational counts at the Newhalem picnic sites is not necessary because this use can be captured at other Newhalem town sites. Other than an effort to reduce the costs of the study, the NPS does not explain why it no longer needs observational counts at Marble Creek Campground and East Bank Trailhead.

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### Discussion and Staff Recommendations

While those staying at the Newhalem and Marble Creek Campgrounds visit the nearby national recreation area and fish, hunt and hike on the surrounding national forest lands, available information suggests that these campgrounds are also used by those who visit the project, including project lakes and facilities, such as the Gorge powerhouse visitor gallery, Gorge Inn museum, Newhalem picnic sites, etc., or boating flows in the Skagit River below the Gorge powerhouse. Adding these two recreation sites would provide information on current use patterns and identify the need for additional recreational facilities at the project; thereby meeting study goals and informing license recommendations (section 5.9(b)(1), (4), and (5)). Conducting visitor surveys at these two sites would cost about \$40,000. The additional information obtained from these sites would be worth the added cost. Therefore, we recommend City Light conduct visitor surveys at both Newhalem and Marble Creek Campgrounds.

Similarly, Canyon Creek Trailhead is also reasonably close and therefore is likely affected by project-related recreation. While one branch of the trail leads away from the project, another branch (Jackita Ridge Trail) provides direct access to Ross Lake via Devil's Ridge Trail which is part of the Devil's Dome Loop, a popular hike which starts at the Canyon Creek Trailhead and loops around to the East Bank Trailhead on Highway 20 (Forest Service, 2021; Washington Trails Association, 2021). Devil's Ridge Trail also leads directly to the Devil's Creek Campground and the Devil's Junction Campground on Ross Lake, just beyond its juncture with the East Bank Trail. Conducting on-site visitor surveys at Canyon Creek Trailhead would provide information on existing use patterns; thereby meeting study goals and informing license recommendations (section 5.9(b)(1), (4), and (5)). Conducting visitor surveys at Canyon Creek Trailhead would cost about \$20,000. The additional information obtained from these sites would be worth the added cost. Therefore, we recommend City Light conduct visitor surveys at Canyon Creek Trailhead.

Because existing information is sufficient to describe recreation use at Diablo Overlook and the Newhalem Picnic sites, use counts at these sites are not needed to establish baseline conditions (section 5.9(b)(5)). Therefore, we recommend modifying the study to eliminate use counts at these two recreation sites, but visitor surveys should still be conducted at Diablo Overlook as proposed.

As discussed further below, a trail counter would be installed at the East Bank Trailhead that would generate enough data to characterize recreational use of this trail (section 5.9(b)(4)); therefore, we recommend modifying the study to remove observation counts at the East Bank Trailhead.

Rainy Lake Picnic Area, Blue Lake Trailhead, Washington Pass Overlook Trailhead, and Lone Fir Campground are located 30 to 45 miles away from the project by vehicle. The location of these sites indicates that while some users may visit the project while staying at or visiting these recreation sites, their primary use is likely for purposes other than project recreation such as

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accessing National Forest hiking trails leading to nearby lakes or mountain views (Washington Trails Association, 2021). We therefore do not recommend modifying the study to include observation counts and visitor surveys at Rainy Lake Picnic Area, Blue Lake Trailhead, Washington Pass Overlook Trailhead, and Lone Fir Campground.

*Trail-Specific Use Counts and Calibrating Trail Counters*

City Light proposes to conduct use counts via a single trail counter at the following project and non-project trails: (1) Ross Dam Trail, East Bank Trail, Lightning Creek Trail, Desolation Peak Trail, Little Beaver Trail, and Big Beaver Trail at Ross Lake; (2) Thunder Knob Trail, Thunder Creek Trail, Sourdough Mountain Trail, Diablo Lake Trail, and Diablo Dam Trail at Diablo Lake; (3) and Ladder Creek Falls Trail and Trail of the Cedars in Newhalem. City Light would locate the counters in the vicinity of the trailhead or trail intersection near the project reservoirs. The exact location would be determined during the installation of each trail counter.

Comments on the Study

City Light explains in the RSP that it did not include the Blue Lake Trailhead, Canyon Creek Trailhead, Washington Pass Overlook Trailhead, Panther Creek Trail, Hozomeen Viewpoint Trail, Pacific Northwest Trail, River Loop Trail, and the informal user trail connecting the Goodell Creek Campground to the Town of Newhalem as recommended by the NPS and Forest Service because they are too far removed from the project, making any connection to project recreation tenuous.

In its comments on the RSP, NPS and Forest Service state that, in an effort to reduce the cost of adding the seven additional recreation sites for visitor surveys and use counts discussed above, that it was no longer requesting trail counts at Panther Creek Trail, Hozomeen Viewpoint Trail, Pacific Northwest Trail, River Loop Trail, and the informal user trail connecting the Goodell Creek Campground to the Town of Newhalem. The agencies also recommend that City Light calibrate its trail counters through direct observation of actual trail use. The agencies recommend that a minimum of five hours of direct observation be collected at each counter over a study season (one hour of observation at five different times spread out over the study season between Memorial Day and Labor Day).

In their comments on the RSP, the Nlaka'pamux Council and the Nlaka'Pamux Coalition, however, do not agree that the Hozomeen Viewpoint Trail should be excluded from the study. Specifically, the Nlaka'pamux Council recommends that City Light conduct trail counts on Lightning Creek Trail, East Bank Trail, and Hozomeen Viewpoint Trail because these trails are within a known traditional travel corridor of the Nlaka'pamux Nation, high pedestrian traffic on these trails threaten areas of cultural importance to the Nlaka'pamux Nation, and the information that would be obtained would inform Traditional Cultural Properties study (CR-04) evaluations. The Nlaka'pamux Council also recommends installing a counter on the East Bank Trail at Roland Point because it is an area of high use with several campgrounds nearby.

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### Discussion and Staff Recommendations

Based on an examination of trail maps of this area, Hozomeen Viewpoint Trail is a 0.2-mile-long trail that originates off Silver Skagit Road that leads from Canada along the northeast shore of Ross Lake. We are not aware of any cultural sites located along this trail. Rather, the cultural sites of concern to the Nlaka'pamux Nation appear to be associated with Hozomeen Lake, which is a high mountain lake east of Ross Lake and accessed via 0.8-mile-long trail that connects to the East Bank Trail. Given its distance from project recreation activities, installing a trail counter on Hozomeen Viewpoint Trail would not provide information related to project effects on cultural resources as suggested by Nlaka'pamux Nation Council and Nlaka'pamux Nation Coalition. Therefore, we do not recommend installing a trail counter on Hozomeen Viewpoint Trail.

City Light already proposes to install trail counters at the East Bank Trailhead at Highway 20 and at the Lightning Creek Trailhead where the East Bank Trail joins the Lightning Creek Trail. Because the East Bank Lake Trail is 31 miles long and parallels much of the east bank of Ross Lake, we recommend installing a counter at the trailhead on Highway 20 and at its terminus near Hozomeen Campground. A counter at the East Bank Trailhead near the Hozomeen Campground would provide information on the level of use originating at the campground that could be accessing Hozomeen Lake as a day hike from the campground. Further, installing a counter on the East Bank Trail near Roland Point would capture the level of use originating from the three boat-in campgrounds located on Roland Point and near cultural resources of importance to the Nlaka'pamux Nation. Placing a trail counter on the East Bank Trail at Roland Point and at the Hozomeen Campground Trailhead would cost about \$20,000 and would be worth the additional expense to more thoroughly capture project trail use patterns along the eastern shore of Ross Lake and determine potential effects on cultural resources (section 5.9(b)(4) and (5)). As City Light states, the exact location of trail counters would be determined at the time of installation. To ensure that an appropriate location is selected that would capture trail use in the vicinity of culturally sensitive areas, we recommend that City Light consult with the Nlaka'pamux Council, the Nlaka'pamux Coalition, and other interested licensing parties prior to installing the counter.

Trail counters should be regularly calibrated to ensure that the use recorded by the counters reflects actual use. While City Light proposes to calibrate its trail counters, it does not describe how it would do so. The NPS and Forest Service-recommended methods are consistent with acceptable practices and would yield sufficient information to determine whether recorded use matches actual use so that correction factors could be applied to obtain an accurate estimate of existing use of trails in the study area (section 5.9(b)(5) and (6)). Therefore, we recommend that City Light calibrate the counters by directly observing use at each counter during five 1-hour periods between Memorial Day and Labor Day.

### *Survey Methods for Observational Counts and Visitor Surveys*

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To collect usage data at each study site, City Light proposes to conduct two point-in-time observations/spot counts during each visit to a study site – one count upon arrival and one count prior to departing the site. To collect information on perceptions, attitudes, and satisfaction with resource conditions, City Light surveyors also would seek out visitors and secure responses to visitor surveys during the time between the spot counts during each visit. City Light proposes to conduct a roving use survey using a stratified two-stage (geographic and temporal) probability sampling approach (Malvestuto 1996; Pollock et al. 1994). Using this approach, City Light would stratify observational counts during its administration of visitor surveys at each survey site across an 8- to 10-hour sampling day over the entire survey season by visiting each site at different times of the day. By visiting each study site at different times on each successive survey day, it would provide a range of spot count times over the entire survey period, which would allow City Light to summarize uses at different times of the day (i.e., morning, midday, and afternoon). City Light states that it will use multiple survey teams to conduct these surveys and counts on each day but that the final survey team approach will be determined based on field testing of the survey and logistics.

City Light would administer the visitor surveys during each visit to a study site on each survey day where recreation visitors are readily visible and willing to participate. When visitors are not readily visible (i.e., where vehicles are parked and visitors cannot be located), City Light would contact visitors via a mail-back windshield survey. City Light states it would prioritize securing on-site visitor surveys whenever possible but may need to employ mail-back windshield surveys when use patterns at study sites necessitate their use to get enough responses.

The sampling frequency for the observation and visitor surveys would be divided into two categories – peak and off-peak seasons. The peak season would be from July 1 through Labor Day. The off-peak season includes the shoulder seasons of spring (May and June) and fall (Tuesday after Labor Day through October). Closure of SR 20 from November through April limits visitor access to the area and associated recreation use during the winter months; therefore, no winter surveys are proposed. Overall, City Light would conduct a total 35 days of surveying including 18 days during the peak season and 17 days during the off-peak season at each of its proposed recreation sites. City Light's surveyors would conduct the surveys on each survey day in a linear visitation pattern, whereby, the surveyors would start each day at the next study site upstream or downstream in a linear visitation pattern. This approach would vary the times each study site is visited to ensure a range of visitation times and potential user groups over the course of the survey period. City Light does not define how many teams or the number of surveyors within each team would be required.

### Comments on the Study

In the RSP, City Light argues that the NPS' and the Forest Service's requested observation counts in 15-minute time blocks each hour throughout the survey day would overtax City Light time and resources and would not be necessary to provide the resolution of data needed to meet study objectives. City Light states that its approach to take a single spot count at the beginning and end of each sampling day, and stratify the times for surveys to be conducted,

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would account for hourly variation in use over the course of a day and provide a robust enough data set to identify where potential use levels are approaching capacity and other visitor management issues.

In their comments on the RSP, the agencies argue that City Light's proposed sampling approach using single spot counts to generalize daily recreation use at a site is flawed because the approach fails to adequately capture daily variability and would be subject to sampling bias. In addition, the agencies state that the use of windshield surveys is flawed because it would not generate a random sample and therefore would not be able to account for non-response bias. The agencies further point out that a windshield survey makes it impossible to send follow-up requests to respondents as is standard practice with mail-in surveys.

To reduce study costs and still obtain a reasonably robust data set, the agencies recommend that City Light revise the sampling frequency for its surveys and observation counts during the peak recreation season (July 1 – Labor Day) by reducing the number of sampling days from 18 to 14; modify the number of sites at which counts would be collected (discussed later); and collect spot counts of visitors at the site once every 15 minutes over a 4-hour period on a given day, either from 8:00 AM to 12:00 pm or from 12:00 pm to 4:00 pm (instead of over 8 hours as it originally recommended). The NPS and Service do not recommend any revisions to City Light's off-peak sampling frequency (17 days). Like City Light, the agencies recommend distributing the visitor surveys on each sampling day, with sampling distributed by weekday, weekend day, and holiday and across the peak season (July 1 to Labor Day) and off-peak seasons (spring—May and June; fall—Tuesday after Labor Day through October). No surveys would be left on windshields. The agencies argue that given the high volume of use in the national recreation area (over an estimated 750,000 visitors annually), obtaining a sufficient number of responses should not be a problem.

With their proposed modifications to the number of study areas and study sites and frequency of sampling during the peak season, the agencies state that their recommended methodology involves less field time and would be less costly to implement, requiring only 15 to 30 sampling days depending on the number of survey teams employed to implement the study as opposed to the 35 or more sampling days that would be required by City Light's methodology.

The agencies do not define how many survey teams or the number of people comprising the team or the basis of their costs, but state that they estimate that City Light could implement its recommended study (including all of its proposed modifications for sampling study areas and sites) for \$525,000<sup>15</sup> compared to City Light's estimated \$1,150,000. The agencies assert that its recommended methods and costs have been developed by experts that conducted similar studies at Yellowstone and Arches National Parks.

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<sup>15</sup> The NPS and Forest Service estimate that a sample size of about 2,000 survey respondents administered in a national park setting can be completed at an approximated cost of \$200,000 and a study to capture detailed data of visitor use levels and movements can be completed at a cost of approximately \$350,000.

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### Discussion and Staff Recommendations

Both City Light's and the agencies' recommended study methods follow accepted practices (section 5.9(b)(6)). City Light's methods have been used at other hydroelectric projects to provide sufficient data for the Commission's analysis (Green Mountain Power, 2020; Merced Irrigation District, 2009). The agencies' proposed methods have been used at national parks. We could not reproduce the costs of either City Light's proposed methods or the agencies with the information provided. Therefore, in deciding which survey methods to recommend, we considered the level of effort and the quality of the data that would be obtained using both methods (section 5.9(b)(7)) based on staff's estimated labor costs. To estimate labor costs, we assumed that both methods would use 3 teams of 3 people (i.e., one team for each of the three study areas discussed below) and a salary of \$50 per hour and observation counts would be collected at the 21 sites recommended by staff for the reasons discussed above.

The agencies' proposed methods would require a total of 30 sampling days, and a dedicated surveyor to take observational counts at 15-minute intervals while the remaining team administered the visitor surveys. A total of 10,080 observations would be collected, providing estimates of hourly and seasonal variation in use. We estimate the labor costs for this effort would be \$13,500.

City Light's proposed methods would require 35 sampling days and would generate 1,470 observations spread out over the recreation season and throughout the day. City Light's methods would not require a dedicated surveyor, which could increase the number of administered visitor surveys during a site visit. However, City Light's methods would not capture as much of the hourly and daily variation compared to the agencies' methods. The estimated labor costs would be \$15,750.

The difference in the level of effort is not great and a more robust data set would be obtained following the agencies' recommended block sampling protocol. However, taking counts in 15-minute intervals is excessive and unnecessary to get an accurate characterization of how use varies during the day. Therefore, we recommend that City Light follow the block sampling protocol and sampling frequencies as recommended by the agencies, but instead conduct a spot count every hour over a 4-hour period on any given survey day (either from 8 AM to 12 PM or 12 PM to 4 PM). This would provide sufficient information to adequately characterize hourly and seasonal use variations and would free up time for the person conducting the counts to help with conducting visitor surveys; thereby likely increasing the number of returned surveys.

While the windshield surveys may have an inherent non-response bias and may be difficult to follow-up on, they have been successfully used at other hydropower projects and by the NPS. Further, City Light does not intend to rely on these surveys as the primary data collection methodology, but rather as a supplement. Windshield surveys would enable City Light to capture use data from users that are not present during the survey time, which could aid

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in informing recreational use patterns and needs. Therefore, we do not recommend modifying the study to remove the windshield surveys as suggested by the agencies.

*Sample Size and Number of Study Areas*

City Light proposes to divide the overall recreation study area into two sampling areas: (1) Ross Lake and (2) the SR-20 corridor which would include Diablo and Gorge Lakes and the Skagit River downstream of the Gorge powerhouse that is affected by project-modified flows. City Light states that this grouping of sites for analysis is reasonable because the study sites within each group share similar characteristics: the Ross Lake recreation sites share a remote, boat-in/hike-in backcountry experience and the SR-20 corridor sites share a more developed recreation experience that is easily accessible by a major highway.

City Light established the target number of visitor surveys for each survey area based on the estimated recreation use. Because exact recreation use estimates for the specific survey areas do not exist, City Light assumed the visitation to either survey area is at least 200,000 visitors. Using a 95 percent confidence interval with a sampling error no more than +/-5 percent, City Light determined that the target number of surveys for each survey area is 384 surveys, at a minimum, or 768 surveys in total (Salant and Dillman 1994). City Light states that it will continuously monitor survey returns to ensure the target number of surveys is being met during the study year and will adjust the sampling frequency or methodology (discussed further below) as needed. City Light would continue to survey throughout the established survey season, even if targets have already been met before the end of the season.

Comments on the Study

To better differentiate project-induced use by region, the NPS and Forest Service recommend that City Light divide the recreation study area into 4 distinct sampling areas: (1) the Ross Lake area, (2) the Diablo and Gorge Reservoir Area, (3) the Skagit River and Newhalem, and (4) the Highway 20 corridor east of the project. The agencies also recommend that City Light collect 384 responses in each sampling area, thus increasing target total sample size for the on-site visitor surveys from 768 to 1,536. The agencies also recommend that the 384 total survey responses collected in each sampling area be further broken down to target 192 survey responses collected during peak and off-peak recreation seasons.

Discussion and Staff Recommendations

Two study areas are not enough to capture the variety of recreation experiences and opportunities provided by the project and may obscure the amount of use, types of activities, visitors' preferences, and barriers to use in these areas. Grouping Diablo and Gorge Lakes together with the Skagit River reach downstream of the Gorge powerhouse will not capture the distinctions between visitor needs and preferences associated with reservoir recreation experiences and those seeking downstream river recreation experiences (e.g., whitewater boating). As noted by the NPS, Forest Service and City Light, the Ross Lake backcountry also



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offers distinctly unique recreation opportunities with different visitor preferences and needs. However, except for Canyon Creek Trailhead, the recreation sites east of Highway 20 do not have a sufficient connection to project recreation (for the reasons discussed earlier) to warrant sampling in this study area.

Therefore, we recommend that City Light divide the study area into three sampling areas – Ross Lake (including Canyon Creek Trailhead), Diablo and Gorge Lakes, and the Skagit River downstream of Gorge Powerhouse. Data generated from studying these three areas should be sufficient to meet study goals and understand recreational use and needs in the project area (section 5.9(b)(1) and (4)). Accordingly, we also recommend that City Light target a total of 384 responses in each of the three sampling areas, for a total of 1,152 responses, with at least 192 survey responses from the peak and off-peak seasons to ensure that each recreation season is adequately represented. Conducting the study in this manner is in keeping with accepted practices (Salant and Dillman, 1994; Dillman, 2000; Watson et al. 2000) (section 5.9(b)(6)) and will yield meaningful results to inform the development of license requirements (section 5.9(b)(5)).

*Survey Instrument*

City Light included in the RSP a questionnaire and mail-back windshield survey to collect visitor perceptions on current resource conditions (e.g., recreation facilities, recreation use levels, and users' feedback on lake elevations relative to their recreation experience), visitors' zip codes, user characteristics, recreation activities, management concerns, and overall recreation experiences.

Comments on the Study

In the RSP, City Light states that providing a map would be unwieldy in the field and would not provide sufficient detail given the large study area to be of use to the respondents.

In their comments on the RSP, the NPS and the Forest Service again recommend that City Light's survey instrument include a map to orient respondents to where they received the survey and to areas they visited or planned to visit. The agencies also recommended modifying some of the open-ended questions to provide more consistent responses to reduce subjectivity in interpreting responses, and that additional questions be added to ascertain visitor motivations or behavior in their recreation choices. The agencies provided a revised survey instrument which they state is "contract ready" and would obtain consistent, unbiased information that could be more easily analyzed. The survey instrument includes a map of the recreation sites in the project area.

Discussion and Staff Recommendations

City Light's survey instrument is very similar to the agencies' recommended instrument, except it does not include a map that would orient visitors, includes a few open-ended questions

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that would be hard to interpret, and does not include questions that are specific enough to understand respondents' motivations for visiting certain recreation sites. For example, City Light's proposed question number 2 asks the respondent to identify general areas (e.g., North Cascades National Park, Mount Baker-Snoqualmie National Forest, Ross Lake, etc.) where they visited or plan to visit rather than specific recreation sites. The agencies' survey instrument is more specific. For example, the agencies' proposed question 6, similar to City Light's question 5, asks the respondent to select the top three reasons for their trip; but unlike City Light's question which asks respondents to write in their response, the agencies' question provides a selection of responses to eliminate the open-ended nature of the question. The agencies' proposed questions 4, 11, and 12 would solicit information on visitor motivations for visiting certain campgrounds or reservoirs, on crowding effects on their decisions, and on what they would do if unable to visit their preferred facility. City Light's questions would not obtain these data. The map provided by the agencies is readable, easily reproducible, and would help to provide more reliable data on locations visited by respondents. Using the survey instrument provided by the agencies would not increase the cost in preparing or implementing the survey and would provide more precise responses (section 5.9(b)(4) and (5)). For these reasons, we recommended that City Light use the survey instrument provided by the agencies with one minor modification to Question 4, which in part asks respondents to identify whether one or more campgrounds they are staying at are their preferred campground. We recommend modifying Question 4 to have the respondent identify the preferred campgrounds, regardless if the campground they are staying at is a preferred campground.

*Future Recreation Use and Demand Assessment Modifications*

City Light proposes to identify the future recreation use and demand opportunities from three perspectives: (1) assessing the existing unmet demand; (2) assessing future recreation demand; and (3) assessing the regional recreational uniqueness and significance of the project. To assess existing unmet demand, City Light would summarize relevant existing information (Washington Recreation and Conservation Office 2017, NPS 2012, and NPS 2001); collect visitor perceptions of unmet recreation demand during the visitor surveys; and identify potential activities with high unmet demand within and adjacent to the project boundary based on the review of unmet demand information derived from the NPS, the visitor survey, monitoring data, and any other regional unmet demand sources. City Light proposes to estimate project recreation use and facility utilization over the term of the new license based on historical trends, future growth projections, and likely foreseeable events in the Skagit River watershed. To do so, it would utilize available data on current and future population rates from state of Washington Office of Financial Management website for counties where most project area visitors originate. City Light's population projections would consider demographics such as age and race. City Light states that the focus of the unmet demand assessment would be to identify possible recreation activities with substantial unmet demand with a qualitative discussion of participation constraints and whether these constraints are likely affected by project operations.

Comments on the Study

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In their comments on the RSP, NPS and Forest Service state that recreation use has grown three-fold since the current license was issued and that the populations of the two metropolitan areas within driving distance of the project—Seattle and Vancouver, Canada—have also grown considerably in the last decade. Consequently, the agencies recommend that as part of the unmet demand assessment, City Light “evaluate the changing demographics in the communities from which the project is drawing; identify what changes to the facilities may be needed due to cultural changes; and define other potential barriers to visitor use that could be addressed in license implementation.” The agencies state that while City Light’s “proposal will look at future use and may generally address demographics, the FS/NPS request that special attention to underserved communities be considered in this analysis by looking at the change in demographics and identifying what potential changes to facilities and information sharing might facilitate participation by these groups.” The agencies also recommend that the future use assessment not only look at barriers that result from project operations, but effects of project-induced recreation.

### Discussion and Staff Recommendations

City Light is already proposing to evaluate visitor characteristics, demand, and changing demographics of the communities the project serves. City Light also recognizes in the RSP that existing recreation use does not always represent the total existing recreation demand because there may be constraints that limit participation, such as lack of free time, cost, geographic distance, lack of skills or equipment, and site-specific management (e.g., limited access to lands or water, use limits or full occupancies at facilities, project operations that eliminate or diminish the quality of experiences and opportunities, or the lack of information about available recreation opportunities). Because City Light already proposes to consider these constraints in its analysis of visitor perceptions and desires, we have no basis to recommend modifying the study plan.

In regard to considering the needs of “underserved communities,” the agencies do not define these communities or explain how City Light should identify and evaluate their needs. City Light already proposes to consider available information from the state outdoor recreation plan and the NPS management plans (RCO 2017, NPS 2012, and NPS 2001). We expect City Light to consider this information to the extent that it sheds any light on defining underserved communities and their needs. Assessing visitor characteristics and localities from the visitor surveys should also help define these communities and any barriers to information needs. City Light’s methods to assess future recreation demand follows accepted practices and should be sufficient for the Commission’s analysis (section 5.9(b)(4)). Therefore, we do not recommend any modifications to the proposed study to address assessing future recreation demands.

## **Study RA-04. Project Sound Assessment**

### Applicant’s Proposed Study

Project generating facilities are located within a remote area with a natural soundscape and may emit some noise. City Light proposes to characterize the existing outdoor soundscape

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near project facilities and define the extent of noise emitting from project facilities, equipment, or activities within the project boundary. This information would be used to assess how project-related noise may affect other resources (e.g., wildlife, cultural resources, recreation resources). To develop this information, City Light proposes to:

- (1) Inventory and assess noise-emitting facilities and activities during the spring and summer;
- (2) Identify areas where project-related noise may have a potential adverse effect on these non-project land use resources;
- (3) Select study sites and perform spring and summer 7-day ambient field noise measurements and short-term project-related noise measurements (June-September 2021, May-June 2022);
- (4) Process and analyze the 7-day noise measurement results to characterize the hourly ambient noise; and
- (5) Model noise using GIS, Cadna-A (3D noise modeling software) and CF18X (a BPA corona noise model) to evaluate transmission line noise (corona noise) and noise from other project features and activities.

City Light estimates that the study would cost \$475,000.

*Study Area*

The study area includes an area covering 0.6 mile from noise-generating facilities, activities, and ongoing/known maintenance and construction projects within the project boundary, and a 500-foot buffer on either side of project transmission lines for the corona noise assessment. This area includes Ross Dam and Powerhouse, Diablo Dam and Powerhouse, Gorge Dam and Powerhouse, and the project transmission line. City Light does not propose to study noise from boats on the project reservoirs because it contends that “noise from recreational boating is assumed to be a component of the soundscape that will be measured and recorded during the long-term 7-day unattended noise measurements.”

Comments on the Study

In its comments on the RSP, NPS asserts that the project induces boating recreation, and therefore, the study should be expanded to capture sound effects from recreational boating. The NPS states that the proposed study area was drawn to address the operational sound effects near project facilities; therefore, it only includes Diablo Lake and small section of Ross Lake near the dam. To capture sound effects from recreational boating, the NPS recommends that the study area be expanded to include all of Gorge and Ross lakes.

Discussion and Staff Recommendations

City Light’s proposed study area includes the entirety of Diablo Lake, a portion of Ross Lake near the dam and powerhouse, and the portion of Gorge Lake near the dam. As NPS acknowledges, these areas focus on noise generated by project operation—areas where City

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Light has some control to minimize noise levels. However, City Light's proposed study will also capture some of the recreational boating occurring on the reservoirs near the project facilities. These areas likely represent where the greatest amount of noise is generated and has the greatest potential to detract from the solitude and recreation experience. Further the project existed prior to the designation of the NRA, so it was part of the baseline conditions when the NRA and its management objectives went into effect. The record does not indicate that noise from recreational boating is adversely affecting those choosing to recreate on the project reservoirs, nor does the NPS indicate how it would use the noise data to develop license conditions to address noise for boating (section 5.9(b)(5)). Therefore, we do not recommend requiring City Light to modify the study to include the entirety of Gorge and Ross lakes.

*Sampling Period and Locations*

City Light proposes to collect continuous 7-day unattended outdoor noise measurements at 3 to 6 locations during the spring and summer to establish ambient noise levels and collect additional short-term attended measurements of noise from select project-related activities and equipment (e.g., corona noise emitted from transmission lines, chainsaws, etc.) where existing data are insufficient to simulate project-related noise emissions in the noise modeling task. For each hour's worth of 7-day noise measurement, City Light would determine minimum noise level (Lmin); maximum noise level (Lmax), energy-equivalent noise level (Leq), mean average noise level, and statistical descriptors (ln) that characterize noise levels exceeded n percent of the hour (i.e., L10, L33, L50 and L90).

City Light states that the unattended 7-day noise measurement is based on American National Standards Institute (ANSI) ANSI-ASA\_S3-SC1.100\_S12.100-2014, and that its proposed 7-day monitoring period during the spring and summer is commensurate with the scope of the magnitude of potential impacts associated with the project on other resources.

Comments on the Study

NPS recommends the following modifications to the sound assessment:

- (1) Measure sound over a 25-day period per the standard protocol developed by NPS for noise audibility and sound levels in National Parks outlined in Lynch, et al. (2011);
- (2) Calculate L<sub>Anat</sub> (hourly sound source audibility) – the percentile of sound level that corresponds to the percentage of an hour where noise occurred – in addition to the calculation L<sub>A50</sub>; and
- (3) Clarify whether City Light proposes to monitor 3 to 6 sites during each season, or as a total and include a 25-day sampling period during springtime in the Gorge reach and at Diablo Dam and during the summertime in the area of Thunder Arm/Environmental Learning Center and lower Ross Lake.

In support, NPS states that the Lynch et al. (2011) protocol and the longer monitoring time is needed to capture the full range of uses and impacts City Light has on the acoustic

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environment. NPS adds that because “a national park is not a quiet residential area...a longer monitoring period is warranted” and that the “staff at North Cascades sets up equipment for 25 days that requires no maintenance for the time period.” NPS states that “including hourly sound source audibility in the analysis will clarify the likely sources (including those that are loud, but also encompassing those that may be less loud but are nevertheless persistently audible) of sound measured during the study period.”

### Discussion and Staff Recommendations

Lynch et al. (2011) found that monitoring ambient sound levels for a continuous 25-day period reduces any uncertainty in the data to less than 3 A-weighted decibels (dBA) (the lowest level at which sound is detected by the human ear). However, monitoring sound levels for a continuous 7-day period, or even lesser periods of time, has been an accepted methodology used in approved sound studies at other FERC projects (Alaska Energy Authority, 2012, PacifiCorp Energy, 2013). While both methodologies are valid, we do not need the level of precision that would be obtained by monitoring sound for a 25-day period to characterize ambient sound levels in the project area (section 5.9(b)(4)) and it would not justify the estimated additional \$100,000 cost of analyzing over three times the amount of data that a 25-day monitoring period would generate (section 5.9(b)(7)). We therefore do not recommend the study be modified to include a 25-day monitoring period.

City Light does not explain which sites would be monitored or how it would determine the number of sites to be monitored. However, City Light does state that it will review and assess available noise-sensitive land uses (areas or specific locations) within 0.6-mile of each project dam and powerhouse, the townsite of Newhalem, one additional site on Diablo Lake, and within 500 feet of the project transmission line and that these areas would inform the noise measurement site selection process. We interpret this to mean that City Light would collect ambient sound levels from each of the areas for a total of six sites during the spring and summer. We recommend that City Light work out the exact monitoring sites in consultation with the NPS and other interested licensing participants.

Each of the areas that the NPS recommends City Light monitor for 25 days (Gorge reach near the dam, Diablo Dam, the Thunderarm/Environmental Learning Center, and lower Ross Lake) are located within a 0.6-mile radius of the project facilities identified by City Light. Therefore, no modifications to the study plan are required to include these areas. For the reasons discussed above, we do not recommend requiring City Light to measure noise levels for a 25-day sampling period in the springtime in the Gorge reach and at Diablo Dam and in the summertime in the area of Thunder Arm/Environmental Learning Center and lower Ross Lake.

### *Noise Statistics*

For each hour's worth of a 7-day noise measurement, City Light proposes to determine the minimum noise level (Lmin); the maximum noise level (Lmax), the energy-equivalent noise

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level (Leq), a mean average noise level, and statistical descriptors (Ln) that characterize noise levels exceeded n percent of the hour (i.e., L10, L33, L50 and L90).

### Comments on the Study

In its comments on the RSP, NPS recommends that City Light calculate L<sub>Anat</sub> in addition to the calculation L<sub>A50</sub>.

City Light states in the RSP that it does not propose to determine L<sub>Anat</sub>.

### Discussion and Staff Recommendations

The status of the acoustical environment can be characterized by sound level (L<sub>A50</sub>, L<sub>Anat</sub>, L<sub>A90</sub>, L<sub>A10</sub>, L<sub>Aeq</sub>) and frequency content. NPS uses two fundamental descriptors to describe the soundscape: existing ambient (L<sub>A50</sub>) and natural ambient (L<sub>Anat</sub>) sound levels. Both are examples of percentile levels, where each L<sub>x</sub> value refers to the sound level that is exceeded x% of the time. The L<sub>A50</sub> represents the median sound level and is drawn from a full dataset (removing data with wind speed > 5m/s to eliminate error from microphone distortion). The L<sub>A50</sub> is the preferred metric to represent prevailing acoustic conditions (Lynch et al. 2011). The natural ambient (L<sub>Anat</sub>) is an estimate of what the sound levels for a site would be if all human-caused noise sources were removed. L<sub>Anat</sub> is the preferred metric to represent baseline or reference conditions (Lynch et al. 2011). For a given hour (or other specified time period), L<sub>Anat</sub> is calculated to be the sound level exceeded x percent of the time, where x is defined as  $x = (100 - PH/2) + PH$  and PH is the percentage of the hour that contained noise. For example, if human caused sounds are present 30 % of the hour,  $x = 65$ , and the L<sub>Anat</sub> is equal to the L<sub>65</sub>, or the level exceeded 65% of the time (Lynch et al. 2011).

City Light's proposed sound descriptors would describe the median average (L<sub>50</sub>) as well as other descriptors to evaluate the amount of variation in sound levels during an hour under existing conditions. Nonetheless, describing the amount of time that no sound is recorded should be a relatively simple task using the data City Light is going to collect. It would also help determine the frequency in which all audible project-generated noise occurs. Therefore, we recommend modifying the study to include the L<sub>Anat</sub> values for each study site.

## **Study CR-02. Cultural Resources Survey**

### Applicant's Proposed Study

City Light proposes to identify archaeological and historic properties and assess potential project-related effects to historic properties within the area of potential effects (APE). Key components for identifying priority areas for the cultural resources survey will be derived both from cultural resources' potential on the landscape and the scope of potential project operations and activities that could affect historic properties, pursuant to 36 CFR § 800.4(a). To achieve this goal, City Light proposes to:

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- (1) Develop a research design and define the specific survey areas within the APE that will be surveyed in consultation with the Cultural Resource Working Group;
- (2) Review and synthesize existing archaeological, historic, and ethnographic data within 1.0 mile of the APE;
- (3) Conduct field surveys over two seasons to identify and record archaeological and historic built environment resources;
- (4) Complete an initial evaluation for eligibility for listing on the National Register of Historic Places;
- (5) Evaluate potential effects on National Register-eligible resources and summarize results to inform the development of the license application and management plans; and
- (6) Make recommendations for additional work, if needed, to evaluate eligibility and effects.

*Schedule and Consulting Parties*

City Light proposes to develop the research design and establish the survey areas in consultation with those entities in the Cultural Resources Working Group, which includes Section 106 consulting parties and others with interests in cultural resources, during the winter and spring of 2021 and conduct two years of field work. The first year of field work would be conducted between June and October of 2021 and the second between March and September 2022. City Light states that to date, Section 106 consulting parties identified for the project relicensing include: the Washington SHPO, NPS, FERC, the Upper Skagit, the Sauk-Suiattle, the Swinomish, Nlaka'pamux Council, and City Light. City Light states that it expects to include others such as the Advisory Council on Historic Preservation, Bureau of Indian Affairs, Forest Service, Washington Department of Natural Resources, Snohomish County, Stó:lō Nation, Confederated Tribes of the Colville Reservation, Lummi Nation, Muckleshoot Indian Tribe, Nooksack Indian Tribe, Samish Indian Nation, Snoqualmie Indian Tribe, Stillaguamish Tribe of Indians, Suquamish Indian Tribe, and Tulalip Tribes of Washington, as well as other potential parties to be identified during Section 106 consultation process.

Comments on the Study

In its comments on the RSP, the Nlaka'pamux Council requests that City Light develop a specific schedule for research and field work. The Nlaka'pamux Council states that because the proposed research questions would influence collection strategies, types of samples collected, and other elements of field methodology, the research design questions should be more clearly defined before fieldwork begins.

The Nlaka'pamux Coalition states that it has not been represented in the relicensing proceeding and that as the Nlaka'pamux Coalition represents member Bands of the Nlaka'pamux, City Light must include the Nlaka'pamux Coalition as a Section 106 consulting party in all studies which affect Nlaka'pamux Nation interests.

Discussion and Staff Recommendations



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Finalizing the research design is necessary before conducting any field work as it will, in part, determine the survey areas. City Light identifies this as its first step in the proposed study plan. City Light is in the process of developing this design and has provided its draft research strategy to the Cultural Resources Working Group and all interested Native American tribes and Canada First Nations for comment and review (section 5.9(b)(1)). Therefore, there is no need to modify the study to require finalizing the research design before beginning field work.

Because the Nlaka’pamux Coalition has an interest in the project, City Light should include the Nlaka’pamux Coalition as an additional consultation party for Study CR-02.

*Research Design Questions*

City Light included a draft research design in the RSP that it intends to finalize in consultation with the cultural resources group. The draft research design describes the types of information it would gather and questions it would consider in prioritizing survey efforts, methods for conducting a pedestrian survey and subsequent subsurface surveys, procedures for collection, recordation and curation of identified artifacts consistent with federal and state laws, and steps for conducting post-field documentation, analysis, and evaluation of NRHP eligibility. Because the study area overlaps a broad geographic area that was important to people throughout the precontact and historic periods, City Light included a number of general research questions to focus its efforts on identifying where significant locations of human activity occurred that intersect with current or anticipated project activities. These questions included: are there specific areas where evidence of precontact and historic use is visible?; what are common landform types or conditions where archaeological signatures are typically found in the APE?; where are specific project activities or places where project operations are most likely to put archaeological resources at risk?; and where are naturally-caused or human-caused activities that do not stem from the project operations or activities most likely to trigger a change in operation or maintenance of the project?

Comments on the Study

In its comments on the RSP, the Nlaka’pamux Council states that the draft research design questions generally focus on the characterization of the project’s effects on archaeology, rather than an exploration of past peoples through a study of the archaeological record. The Nlaka’pamux Council recommends that the questions for the research design be better defined to more clearly direct the survey effort and should be based on the region’s archaeological, ethnographic, and historic context and the interests of the license participants as determined through Cultural Resources Working Group meetings. The Nlaka’pamux Council states that it would like to discuss research topics and questions at an upcoming cultural resources workgroup meeting.

Discussion and Staff Recommendations

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The research questions suggested in the draft design directly relate to identifying areas where the project has the potential to adversely affect archaeological and historic resources (section 5.9(b)(5)). City Light also intends to review the historical record to identify areas likely to contain cultural resources and to interview people with relevant cultural resources knowledge of the APE. Consequently, City Light's proposed methods should already consider the archaeological, ethnographic, and historic interests of the tribes and First Nations. Regardless, City Light proposes to continue to discuss these questions and other issues with the Cultural Resources Working Group as suggested by the Nlaka'pamux Council. Therefore, we have no basis for requiring City Light to modify the research questions as recommended by the Nlaka'pamux Council.

*Collection and Preservation of Artifacts*

In its draft research design, City Light states that no artifacts will be collected as part of the inventory unless authorized by appropriate permits from the NPS, Forest Service, and/or the Washington Department of Archaeology and Historic Preservation (Washington DAHP). City Light states that its NPS permit includes a limited collection of artifacts that are uncovered during excavation and those that are at risk of being illegally collected. Any collected artifacts would be curated in accordance with federal and state laws, as applicable. All identified artifacts would be recorded and photographed in the field. If diagnostic artifacts are identified in a shovel probe, the artifact(s) would be bagged, tagged, and collected in accordance with the archaeological permit stipulations and authorized by the permitting agency. Non-diagnostic artifacts, if encountered, would be analyzed in the field and reburied in the respective shovel probe.

Comments on the Study

The Nlaka'pamux Council states that it "appreciates the focus on low-collection strategy and preservation in place of artifacts when in a secure location." However, the Nlaka'pamux Council recommends that

"artifacts to be recovered should specifically include formal or expedient tools, diagnostic artifacts, artifacts which may provide opportunities for additional analysis (e.g., XRF; residue analysis), and all surface artifacts at risk from proposed development, erosion, or unauthorized collection. Furthermore, artifacts left in the field should be described, assigned basic analysis, and photographed. Photographs should be of a sufficient quality to confirm an artifact's cultural origin. Photos must be date-stamped. If the site consists of non-diagnostic debitage, a selection of artifacts should be photographed as evidence of cultural modification prior to reburial. When artifacts are reburied, the field paperwork should clearly state that this occurred and the shovel test pit (STP) records (via GPS or maps on paperwork) should be of sufficient quality to relocate the STP if needed. If artifacts not recovered from STPs are reburied, fieldnotes should explain clearly when, where, and why this was done."

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### Discussion and Staff Recommendations

The recordation procedures recommended by the Nlaka'pamux Council are consistent with accepted practices and would better preserve the data record than what is broadly described in City Light's draft research design (section 5.9(b)(6)). Therefore, we recommend that City Light incorporate these measures into the study methods.

#### *Training of Field Personnel*

In its response to concerns that implementing proposed studies may pose an immediate threat to cultural resources, City Light states that "all personnel who will be conducting field studies will take cultural resources training provided by City Light and its consultants."

### Comments on the Study

The Nlaka'pamux Council states that "Indian tribes and First Nation [license participants] LPs should have a direct role in how cultural resource training is prepared and delivered to personnel and consultants and that the study plan and research design must directly incorporate this requirement." The Nlaka'pamux Council adds that "personnel and consultants who may be in contact with Nlaka'pamux cultural resources must be adequately trained to understand the specific Nlaka'pamux protocols which will apply to ensure those resources are not threatened or disturbed." The Nlaka'pamux Council further states that City Light "must provide sufficient capacity funding and opportunity to the Coalition to be able to develop and deliver specific cultural resource training to personnel and consultants who may be in contact with Nlaka'pamux cultural resources."

### Discussion and Staff Recommendations

Training of project personnel is not a specific task identified in of City Light's proposed studies. Rather, it appears as a commitment in its response to comments. However, City Light does not describe who will conduct this training or when, only that it would be provided to all its consultants performing studies.

Because the various cultural resource study plans were developed and would be overseen by a professional archaeologist who meets the Secretary of Interior (SOI) Professional Qualifications Standards for Archaeology and by an architectural historian who meets the SOI Professional Qualifications Standards for Architectural History, City Light has access to professionals that can provide adequate training. It is also our understanding that City Light has trained cultural resource personnel on staff that can perform the training. We expect City Light to use these resources for the training. The Commission does not have the authority to require a licensee to fund a particular entity to develop or conduct such training. Therefore, no further modifications to the study are needed to address cultural resources training.

#### *Unanticipated Discovery of Archaeological Materials and Human Remains*

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City Light included in its RSP a plan for reporting the discovery of archaeological materials and potential human remains found during its studies. If on-site personnel find remains but cannot determine whether they are of animal or human origin, photographs of the find would be sent to City Light's Senior Archaeologist and/or consultant Senior Archaeologist for confirmation and identification. Photographs would not be shared by others unless directed. If a human origin cannot be ruled out, a site visit by City Light's Senior Archaeologist and/or consultant Senior Archaeologist would follow to observe the find and the Washington DAHP Physical Anthropologist would be contacted for confirmation. Photographs of the find may be provided to the Washington DAHP Physical Anthropologist to aid in identification. If the Washington DAHP evaluation indicates that the remains are human, City Light would immediately report the find to law enforcement and to the state medical examiner to determine whether the remains are forensic or not. If found to be non-forensic, the state medical examiner would report the finding to the Washington DAHP, where the State Physical Anthropologist would make an initial determination of whether the remains are Native American or non-Native American to the extent possible within two business days of notification. If the remains are determined to be Native American, the Washington DAHP would notify all affected tribes via certified mail to the head of the appropriate tribal government within two business days and contact the appropriate tribal cultural resources staff. The affected tribes would then have five business days to respond via telephone or writing to the Washington DAHP as to their interest in the remains. The Washington DAHP would handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains. City Light and its consultants would only resume study activities in the area of the discovery upon receiving written authorization from either the medical examiner or the Washington DAHP, whoever has jurisdiction under state law.

Comments on the Study

The Nlaka'pamux Council requests that interested tribes and First Nations be given the option to be notified as soon as potential human remains are found rather than after the State Physical Anthropologist determines the remains are human, as proposed by City Light. The Nlaka'pamux Council asks that such notification occur at the time when the coordinators of the Cultural Resources Working Group begin planning a site visit to confirm or exclude the possibility that human remains have been found and give the tribes and First Nations the option to participate in that site visit. In the event that human remains are found, the Nlaka'pamux Council requests that the heads of local tribes and First Nations be immediately notified by phone and email (or at least within two business days) in addition to receiving a formal certified letter as per City Light's proposed protocol. The Nlaka'pamux Council requests that City Light's Cultural Resources Working Group meet in the future to finalize the plan and work out details on the preferred contact schedule for all licensing participants and the proper handling and disposition of photographs of human remains.

Discussion and Staff Recommendations

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City Light's proposal for reporting the discovery of human remains is consistent with state protocol which gives the Washington DAHP the authority to determine whether non-forensic human remains are Native American or non-Native American and notify and consult with tribes in the handling of Native American human remains. Any requests by a tribe or First Nation to be immediately notified by phone and email in the event that human remains are determined to be Native American by the State Anthropologist would have to be made to the Washington DAHP, since City Light would have no authority to make such a decision. Therefore, we do not recommend modifying the notification procedures.

#### **Study CR-04. Inventory of Historical Properties with Traditional Cultural Significance**

##### Applicant's Proposed Study

City Light proposes to identify historic properties with traditional cultural significance within the study area, and preliminarily assess potential project-related adverse effects on them. To accomplish this goal City Light would:

- (1) select ethnographers (January-February 2021);
- (2) conduct outreach with Indian tribes and First Nations to identify participants and develop a research design in coordination with the participating Indian tribes and First Nations (April – June 2021);
- (3) gather ethnohistorical and ethnographic data from participating Indian tribes and First Nations (May 2021 – May 2022);
- (4) evaluate and document properties with traditional cultural significance that are eligible for inclusion on the National Register of Historic Places (National Register) (December 2021 – June 2022); and
- (5) assess potential project-related adverse effects on historic properties with traditional cultural significance (April – August 2022).

The study area will include the APE. On June 9, 2021, City Light filed a copy of a letter to the Washington SHPO seeking concurrence on a revised APE that reflect comments from the tribes regarding direct and indirect effects. The revised APE includes all lands within the project boundary as well as lands outside the project boundary where project operations or project-related recreation activities may cause changes in the character or use of historic properties, if they exist.

##### Comments on the Study

The Nlaka'pamux Council recommends that if the Commission determines that if there are effects from project recreation outside of the current APE, City Light must consider impacts of those activities on cultural resources.

The Nlaka'pamux Council also recommends that the Commission include appropriate determinations for funding the study. As an example, the Nlaka'pamux Council suggests that the

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Commission require City Light to consult with it on the budget for the portion of CR-04 incorporating Nlaka'pamux Council study requests before making a decision on funding.

### Discussion and Staff Recommendations

The study plan already states that City Light would expand the APE to include project recreation effects on historic resources, as recommended by the Nlaka'pamux Council. Therefore, no modifications to the study plan are needed.

Commission staff does not establish funding requirements for proposed studies. Rather, if it finds that the information is needed to conduct its environmental analysis, it requires a license applicant to conduct the study as specified in the study determination. Commission staff considers the level of effort and cost of any required or proposed study in making that determination (section 5.9(b)(7)). Therefore, no modifications to the study plan are needed to address funding as recommended by the Nlaka'pamux Council.

While the study plan states that it will reach out to First Nations, the study plan does not specifically identify the Bands of the Nlaka'pamux Coalition as potentially interested participants in the ethnographic study. The Nlaka'pamux Coalition have recently indicated they have an interest in this proceeding and the resources around Ross Lake and that they are not being adequately represented by the Nlaka'pamux Council. Therefore, we recommend modifying the study to specifically include Nlaka'pamux Coalition as a First Nation that should be consulted during the study.

### **Study TR-08. Special-Status Amphibians**

#### Applicant's Proposed Study

City Light proposes to collect information on special-status amphibians, with an emphasis on the federally threatened Oregon spotted frog and the Washington DFW candidate species Columbia spotted frog, in areas potentially affected by project activities. The goals of the study are to: (1) identify areas of potentially suitable breeding habitat for the two spotted frog species within the study area; (2) assess the likelihood that the species occur in areas where there is activity related to project O&M; (3) document incidentally observed occurrences of another Washington DFW candidate species, western toad, and the locations and types of habitats it used around the project reservoirs; and (4) collect relevant information on populations where the spotted frogs are found, including numbers, life stages, habitat, and locations.

The study area would include land and waters within the project boundary with emphasis on locations where suitable habitat and potential project effects may intersect. This would include areas on the fringes of the reservoirs (including depressions in drawdown zones and littoral zones), recreation facilities, areas adjacent to project facilities and roads, within the transmission line ROW, wetlands affected by project operation, and wetlands hydrologically connected to the Skagit River between Gorge Powerhouse and the Sauk River confluence. The

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study area would not include the fish and wildlife mitigation lands because no project effects occur in these areas, and 2011-2012 wetland surveys on the mitigation lands found only northern red-legged frogs. Field reconnaissance and survey locations would be determined based on the occurrence of suitable habitat, intersection with potential project effects, and logistical constraints (e.g., safely accessible and permitted by the landowner, if located on private lands).

The initial cost estimate of the special-status amphibian survey is \$125,000, but the final cost would depend on the number of sites surveyed.

Comments on the Study

In its comments on the RSP, Washington DFW repeats verbatim its prior request that City Light include in the study area Big Beaver Creek, its surrounding valley, and associated wetlands, because these areas support populations of Oregon spotted frog and possibly Columbia spotted frog. Washington DFW asserts that reed canarygrass, an invasive wetland plant that degrades amphibian habitat, has spread into the Big Beaver Valley from Ross Lake. In addition, Washington DFW states that “the operation of the reservoir also affects the interaction of the frogs with reservoir bull and rainbow trout that have now become larger in size due to the explosion of the Ross Reservoir redbreasted sunfish population.” Washington DFW adds that “the increase in water elevation during the summer allows [these larger fish] access over a fish passage barrier to Beaver Creek and any hydraulically connected wetlands.” Washington DFW states that “access by larger reservoir fish increase the chances for predation, not only frog juveniles, but possibly adults due to the larger size of the reservoir fish, something that has only happened in the last 20 years.” Washington DFW states that “the survey and mapping of the location of the special-status frog population [within the Big Beaver Valley] could help inform management of reed canarygrass, operation of the reservoir between the levels that affect fish passage, and possible future disturbances by project-related recreation.”

In the RSP, City Light objects to adding Big Beaver Valley to the study area. City Light states that, contrary to Washington DFW’s assertion, the range of the Oregon spotted frog does not appear to include Big Beaver Valley (Hallock, 2013). In support, City Lights states that tissue samples collected in 1997 from frogs in Big Beaver Valley were DNA typed and determined to be Columbian spotted frog (Holmes and Glesne, 1999) and that additional genetic samples from frogs captured in 1998 at McMillan Creek (a main tributary of Big Beaver Creek) beaver ponds were also shown to be Columbian spotted frog (City Light, 2000).

City Light states that it has not seen any evidence that project operations cause the spread of reed canarygrass to wetlands upstream of the project in Big Beaver Valley or that Columbia spotted frog or other amphibians are being adversely affected at specific locations. City Light states that the widespread nature of reed canarygrass in the Pacific Northwest, including isolated wetlands, demonstrates that infestations may arise from distant source populations and by multiple vectors. City Light states that it currently supports efforts to control, manage, or eliminate reed canarygrass infestations at the project, and currently conducts reed canarygrass management with the NPS in the Big Beaver wetland, using spot applications of herbicides

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approved for aquatic environments. City Light believes these weed control efforts are best addressed over a new license term in a separate management plan, to be developed in consultation with interested LPs.

City Light also disagrees with Washington DFW's conclusions about the effects of predatory fish on frogs in the Big Beaver Valley, and in particular that "(1) fish are more widely distributed or larger than they were in 1996 when Holmes and Glesne surveyed amphibians in the valley; or (2) that fish are having a greater effect on frog populations than previously." City Light points out that Holmes and Glesne found Columbia spotted frog at beaver-dammed wetlands in Big Beaver Valley, including sites with fish, decades after the creation of Ross Lake. City Light also states that it is not aware of evidence that the distribution of fish in Big Beaver Valley has changed to the detriment of frog populations. City Light states that population declines of spotted frog species are generally associated with the introduction of non-native fishes, whereas frog populations can coexist with native fishes where dense vegetation and shallow edges provide hiding cover and habitat separation from fish.

#### Discussion and Staff Recommendations

About 8 miles of the lower Big Beaver Valley, creek, and associated wetlands are located within the project boundary. The reservoir, however, extends only 3-4 miles upstream when Ross Lake is at the normal maximum elevation of 1,602.5 feet. Most of the wetlands of interest here are located 10 to 15 feet above the normal maximum water surface elevation of Ross Lake. Therefore, current project operation has no effect on the hydrology of those wetlands above the project fluctuation zone. Washington DFW offers no evidence that bull trout and rainbow trout are more widely distributed in Ross Lake tributaries due to the project or that these fish are adversely affecting amphibians. Additionally, as City Light points out, reed canarygrass is a wide-spread invasive species and can be spread by a variety of vectors; therefore, its introduction and spread within Beaver Creek cannot be conclusively attributed to the project, and there is no evidence that the project is causing the spread of this species. Consequently, there is no apparent relationship between project effects and the need to study fish predation on amphibians in wetlands that are located outside of the influence of project operation (section 5.9(b)(5)).

Therefore, we do not recommend expanding the study to include the Big Beaver Valley as requested by Washington DFW.

#### **Study TR-09. Beaver Habitat Assessment**

##### Applicant's Proposed Study

Beaver utilize and modify habitat within and adjacent to the project boundary. Beaver dams constructed near the outlets and other areas of six project, off-channel Chum salmon



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spawning channels<sup>16</sup> have sometimes significantly impeded fish access for spawning. City Light proposes to: (1) summarize the hydrologic and geomorphologic conditions at the chum spawning channels and the ongoing beaver conflicts; (2) identify beaver habitat and active beaver territories throughout the study area using existing information and incidental field observations made during relicensing studies; and (3) use the Beaver Intrinsic Potential (BIP) model to assess ongoing project effects and inform potential PME measures such as beaver relocation. The study area would include the area within a 2-mile buffer of: (1) the project boundary, including the fish and wildlife mitigation lands and transmission line ROW, and (2) the Skagit River between Gorge Dam and the Sauk River. The beaver habitat assessment would cost an estimated \$70,000.

### Comments on the Study

Upper Skagit recommends that City Light include “the feasibility and engineering study plan component to assess relocation program alternative for potential PM&Es.”

### Discussion and Staff Recommendation

It is not clear exactly how Upper Skagit wants the study to be revised. We interpret their comment to mean that it is still advocating for City Light to evaluate where the use of beaver exclusionary measures might be used effectively. Because the need for environmental measures will depend on information gathered during the study and other considerations determined through the Commission’s environmental analysis, there is no need to modify the study to addresses Upper Skagit’s concerns. Therefore, we do not recommend any modifications to Study TR-09.

## **II. Studies Not Required**

### **Gorge Dam Removal Assessment Study**

#### Study Request

The Upper Skagit request that City Light examine the ongoing impacts of Gorge Dam on anadromous salmonid habitat productivity, and viable salmon populations by exploring the possible ecological and “social economic” effects of Gorge Dam removal. The Upper Skagit assert that the presence of Gorge Dam has caused the loss of access to historical fishing encampments and fishing due to the depressed nature of Skagit salmon stocks. The Upper Skagit cites a number of observations that it believes demonstrates that Gorge Dam contributes to the current low abundance of salmon stocks, including desiccated Chinook and chum salmon redds, and stranded juvenile steelhead trout, pink, and coho salmon in isolated pools. The Tribe states

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<sup>16</sup> The Chum salmon spawning channels are located in the Skagit River between Gorge Powerhouse and the Sauk River confluence.

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that Gorge Dam prevents access to 2.9 miles of Essential Fish Habitat, 158 miles of suitable salmon habitat, and 40% of the entire watershed for anadromous fish.

Therefore, the Upper Skagit recommends that City Light: (1) assemble existing data and collect supplemental baseline data of the bypass reach, Gorge Reservoir, and the contributing watershed, including LiDAR, reservoir bathymetry, amount and character of sediment currently stored in the reservoir, annual sediment and wood load delivered to the reservoir, suspended sediment concentration and suspended sediment load downstream of Gorge Dam, historic fish use and habitat conditions and presence of bank armoring and fill associated with existing infrastructure; (2) develop 2-D hydraulic, sediment transport, and wood transport models for the river reach currently occupied by Gorge Reservoir, and “modify the proposed CHEOPS model to provide upstream boundary conditions”; (3) predict the effects of potential dam removal approaches and sediment management plans on anadromous salmonids and evaluate the need for downstream biological mitigation measures; (4) assess the ability of Diablo Dam to provide instream flows using the CHEOPS model; (5) determine the potential approaches and timeline for terrestrial and fluvial restoration of Gorge Lake; (6) predict habitat conditions and capacity for anadromous salmon and steelhead trout between Diablo Dam and Newhalem after accumulated reservoir sediments have been mobilized; and (7) identify potential options for dam removal, including engineering feasibility and cost estimates.

### Comments on the Study

In the RSP, City Light states that the request constitutes a study of a specific mitigation measure, dam removal, which has not been shown to be necessary or warranted, and that the development of proposals for mitigation measures necessarily must occur after appropriate studies of potential project effects have undergone rigorous scientific investigation. City Light adds that while the Upper Skagit’s study request identifies possible resource concerns, the requested study does not demonstrate that there are significant resource impacts that cannot be addressed by other measures, nor does it demonstrate that these impacts are occurring.

City Light also states that the extent to which a serious resource impact should be clearly demonstrated may be proportional to the overall benefits and importance of the Gorge Development to the project, which currently provides 40 percent of the project’s energy production, ancillary services to the electrical grid which brings stability and reliability to the grid, and control of downstream flows and associated river stage to benefit and enhance fish spawning and egg incubation and flood control.

Lastly, City Light states the request does not meet the Commission’s study criteria because it does not provide clear goals and objectives, does not demonstrate a nexus between project operations and the resource to be studied, and does not conform with generally accepted

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practice. City Light also states that most of the study request consists of study components that are already included in other proposed studies.

In its comments on the RSP, the Upper Skagit reiterate its concerns and request that the study should be conducted to evaluate the benefits of removing Gorge Dam on salmon and steelhead populations. The Upper Skagit adds that contrary to City Light's claim, only one of its seven objectives, the collection of baseline data, has been addressed by other studies proposed by City Light.

In its comments on the RSP, American Whitewater states that while it is not actively advocating for Gorge Dam removal, it is interested in better understanding this alternative and supports the Upper Skagit's study request. American Whitewater asserts that City Light's argument that the study request constitutes a specific mitigation measure that has not been shown to be necessary or warranted is circular because a determination on whether a mitigation measure is warranted can only be made if adequate information is collected during the study process.

### Discussion and Staff Recommendations

As the Commission has previously held, and as explained in SD2, decommissioning is not a reasonable alternative to relicensing in most cases.<sup>17</sup> Decommissioning can be accomplished in different ways depending on the project, its environment, and the particular resource needs.<sup>18</sup> For these reasons, the Commission does not speculate about possible decommissioning measures at the time of relicensing, but waits until an applicant actually proposes to decommission a project, or a participant in a relicensing proceeding demonstrates that there are serious resource concerns that cannot be addressed with appropriate license measures and that make

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<sup>17</sup> See, e.g., *Eagle Crest Energy Co.*, 153 FERC ¶ 61,058, at P 67 (2015); *Public Utility District No. 1 of Pend Oreille County*, 112 FERC ¶ 61,055, at P 82 (2005); *Midwest Hydro, Inc.*, 111 FERC ¶ 61,327, at PP 35-38 (2005).

<sup>18</sup> In the unlikely event that the Commission denies relicensing a project or a licensee decides to surrender an existing project, the Commission must approve a surrender "upon such conditions with respect to the disposition of such works as may be determined by the Commission." 18 C.F.R. § 6.2. This can include simply shutting down the power operations, removing all or parts of the project (including the dam), or restoring the site to its pre-project condition.

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decommissioning a reasonable alternative and proposes a substantive, detailed decommissioning proposal that can be studied.<sup>19</sup>

Here, the Gorge Development generates approximately 998 gigawatt hours per year, which accounts for 40 percent of the Skagit Project's overall generation. In turn, the Skagit Project supplies approximately 20 percent of the City of Seattle's overall generation needs. Additionally, flow regulation at Gorge Dam is used for flood control and to maintain the flows and river stages necessary to meet fisheries needs downstream. City Light does not propose decommissioning, nor does the project record demonstrate that there are serious resource concerns that cannot be mitigated if the project, including the Gorge development, is relicensed with appropriate salmonid protection measures, and no detailed decommissioning proposal has been proposed. Information from other studies (GE-04 Skagit River Geomorphology, FA-01 Water Quality Monitoring Study, FA-02 Instream Flow Model Development, FA-03 Fish Passage Technical Studies, and FA-05 Skagit River Gorge Bypass Reach Hydraulic Flow Model Development) should provide the information needed to identify potential passage improvements and flow releases that would improve aquatic habitat conditions below Gorge Dam. Therefore, there is no justification for recommending a study of decommissioning the Gorge Development at this time.

## Aquatic and Riparian Productivity

### Study Requests

NMFS, NPS, FWS, and Upper Skagit request studies to assess the effects of project operation on aquatic and riparian productivity. The agencies and Upper Skagit assert that project operation (e.g., reservoir stratification and cold-water releases from the deep power intakes, and the regulated flow regime downstream of Gorge Powerhouse) is suppressing primary and secondary productivity in the reservoirs and in the Skagit River downstream of the project, which in turn is affecting the productivity of salmonid populations.

The primary objectives of the requested studies are to: (1) quantify invertebrate prey resource availability in the project reservoirs (e.g., benthic, littoral, and pelagic macroinvertebrates); (2) determine which elements of project operation are having the greatest adverse effect on macroinvertebrate and zooplankton production in the project reservoirs; and (3) quantify invertebrate prey resources and assess how project operation affects aquatic (primary

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<sup>19</sup> See generally *Project Decommissioning at Relicensing; Policy Statement*, FERC Stats. & Regs., Regulations Preambles (1991-1996), ¶ 31,011 (1994); see also *City of Tacoma, Washington*, 110 FERC ¶ 61,140 (2005) (finding that unless and until the Commission has a specific decommissioning proposal, any further environmental analysis of the effects of project decommissioning would be both premature and speculative).

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producers, invertebrates, and fish) and riparian productivity in the Skagit River from Gorge Dam to Puget Sound (a distance of 97 river miles).

The specific study elements include: (1) sampling benthic, littoral, and pelagic macroinvertebrates in the reservoirs; (2) sampling periphyton, macrophytes, and benthic macroinvertebrates in the river downstream of the project; (3) measuring fish productivity by developing abundance estimates, assessing juvenile salmon growth rates, and developing bioenergetics models; (4) assessing riparian productivity by measuring vegetation establishment on gravel bars; (5) measuring aquatic-terrestrial linkages by studying the interface between the wetted channel and vegetated banks and gravel bars; and (6) quantifying how much of the floodplain is inundated by high flows.

Comments on the Studies

In the RSP, City Light states that the study requests are extensive baseline data gathering efforts that do not provide evidence of an adverse project effect on nutrients and productivity and do not explain how the results would be used to develop license requirements. City Light asserts that the project reservoirs constitute an oligotrophic system, and previous measurements of nutrients in Ross Lake reveal very low concentrations of nutrients. Moreover, tributary inflows to the reservoirs are nutrient poor, which is a characteristic of ambient conditions and not project effects. City Light states that the USGS is periodically collecting nutrient data in the Skagit River Basin at the U.S.-Canada border and it is City Light's intent to summarize these data in the study report for the water quality monitoring study (FA-01).

City Light indicates that the USGS's ongoing Food Web Study in the project reservoirs would address some of the elements of the study requests in the project reservoirs (e.g., trophic relationships, bioenergetics). City Light also indicates that it is proposing to collect benthic macroinvertebrates at several locations downstream of Gorge Powerhouse as part of the water quality study that would provide an index of productivity at multiple locations downstream of the project and data on any longitudinal trends in productivity extending downstream of the dam. City Light states that it also has zooplankton abundance and taxonomic composition data for Ross Lake, which it believes adequately characterize existing conditions.

In their comments on the RSP, NMFS and the Upper Skagit request that City Light conduct the study and assert that studies of reservoir productivity are also needed to determine the rearing potential of the project reservoirs for anadromous salmonids should they be passed upstream of the project dams.

Discussion and Staff Recommendation

As discussed in our analysis and recommendations for the water quality study (FA-01), there is sufficient existing information to describe the existing environment for nutrient

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conditions and primary productivity in the project reservoirs and in the Skagit River downstream, and to identify any measures that would enhance nutrient conditions (section 5.9(b)(4)). This existing information coupled with City Light's proposed water quality monitoring and water temperature model study should provide sufficient information to assess project effects on water quality in the project reservoirs and the Skagit River downstream. These data can be compared to the known water quality (e.g., temperature) tolerances of macroinvertebrates and salmonids to assess project effects and develop any license conditions that would enhance aquatic and salmonid productivity (section 5.9(b)(4)). In addition, City Light is proposing numerous other studies and models (e.g., instream flow (FA-02), vegetation mapping (TR-01), and geomorphology (GE-04)) that can be used to assess project effects on various life stages of salmonids and to develop any license conditions that would enhance salmonid productivity (such as measures to enhance inundation of off-channel, vegetated, and floodplain habitats). Consequently, there is no need for additional, extensive data gathering studies to attempt to quantify invertebrate prey resources for salmonids in the project reservoirs; or primary, secondary, and fish productivity in the Skagit River downstream of Gorge Powerhouse to the estuary. Therefore, we do not recommend requiring City Light to conduct the aquatic and riparian productivity study requested by the agencies and Upper Skagit.

**Reservoir Littoral and Riparian Habitat**Requested Studies

The NPS, FWS, Washington DFW, and the Upper Skagit request studies to evaluate and map nearshore and riparian physical habitat conditions along the shoreline of the project's three reservoirs. The primary study objectives of the requested studies include: (1) survey shorelines to assess and quantify physical habitat structure and evaluate the effects of erosion, sediment deposition, fluctuating water levels, and large woody debris management; (2) quantify the conditions and amount of woody debris that is providing habitat for fish, amphibians, and invertebrates; (3) identify areas of high quality habitat for fish and amphibians; and (4) identify restoration opportunities (including retaining large woody debris in the reservoirs) to enhance habitat for native fish, amphibians, and wildlife.

The agencies and Upper Skagit state that City Light's proposed reservoir shoreline studies are specifically lacking in data collection needed to assess how project impacts such as water level fluctuations prevent the establishment of quality habitat (e.g., the establishment of littoral vegetation). The agencies and Upper Skagit assert that the studies are needed to develop meaningful license conditions (e.g., changes in drawdown regimes and enhancement measures such as floating wetlands) to mitigate project effects by enhancing aquatic productivity.

Comments on Requested Studies

In the RSP, City Light acknowledges that reservoir water surface elevations fluctuate due to project operation, but states that the existing information on reservoir fish populations and habitat does not identify any specific adverse effects of the fluctuations. City Light asserts that

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much of the information sought by the requested studies is already available or will be available as the result of studies proposed by City Light. City Light states that its proposed GE-01, *Reservoir Shoreline Erosion Study*, includes objectives to: (1) identify ongoing areas of erosion along the reservoirs' shorelines; (2) assess the contribution of project and non-project related factors to areas of erosion; (3) estimate shoreline erosion rates at representative unmonitored sites; (4) correlate existing erosion rates with erosion site characteristics (e.g., underlying geology, slope, aspect, shoreline height) to help estimate ongoing erosion rates; and (5) evaluate the condition and effectiveness of existing shoreline erosion control measures.

City Light indicates that it currently estimates the volume of woody debris entering Ross Lake and transports large wood downstream for release into the Skagit River below Gorge Powerhouse to benefit downstream aquatic habitat. The future monitoring and management of large wood, including decisions on whether to continue to transport wood to the lower river or use it to enhance shoreline habitat in the project reservoirs, will be a topic of discussion during the collaborative identification of PMEs for the next license term.

Although City Light does not propose to conduct these studies, it does indicate in the update to the RSP for Study FA-07 that it would conduct "a GIS assessment of habitat in the reservoir littoral and varial zones in 2021 and evaluate and determine parameters and metrics for representative field sample frames if warranted to evaluate habitat quality in a workshop with LPs [licensing participants]." The workshop would be held during the 3<sup>rd</sup> quarter of 2021.

#### Discussion and Staff Recommendation

The specific study methods recommended by the agencies and Upper Skagit are not entirely clear because they do not explicitly describe the study methodology and instead cite to several different sampling protocols from the literature.<sup>20</sup> However, based on our review of the citations, it appears that the agencies and Upper Skagit are requesting a detailed study of reservoir littoral and riparian habitat using methods such as those specified in the U.S. Environmental Protection Agency's 2017 National Lakes Assessment Field Operations Manual. The specific sampling protocols specified in the manual are as follows: (1) establish 10 physical sampling sites around the reservoir perimeter; (2) estimate substrate characteristics, aquatic macrophyte cover, fish habitat cover, and cover and type of riparian and drawdown zone vegetation at each of the sampling sites; and (3) sample benthic macroinvertebrates at each site.

City Light does not propose to collect the detailed information on reservoir littoral and riparian habitat requested by the agencies and the Upper Skagit, and we see no reason why this level of information is needed to evaluate the effects of project operation. Reservoirs such as Ross Lake that are subject to large winter drawdowns typically have reduced macrophyte density

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<sup>20</sup> The study requests cite to the following study reports from the literature: EPA (2017), Newbrey et al. (2005), and Kaufmann et al. (2014a; 2014b).

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in the drawdown exposure zone compared to areas that remain wetted year-round because, generally, macrophyte colonization and growth occurs in areas that remain wet year-round (Carmignani and Roy, 2017). Additionally, invertebrate densities either decrease or they are absent during winter drawdown in the exposed areas of the reservoir bed; however, by late summer, most invertebrates have fully recolonized the drawdown zone (Carmignani and Roy, 2017). We also expect that the areas of the reservoir shoreline in Gorge and Diablo Lakes that are subject to daily fluctuations of 4 to 5 feet per day would also have reduced macrophyte growth and macroinvertebrate abundance compared to the rest of the reservoirs that are not subject to these fluctuations. Because these effects are already known, there would be little benefit from additional field sampling.

Instead of collecting detailed site-specific data in the littoral zone, we are recommending (in our analysis and recommendations for Study FA-07) that City Light estimate the acreages of reservoir bed and shoreline that are subject to frequent fluctuations (e.g., Gorge and Diablo Lakes) or extended drawdowns (e.g., Ross Lake) under normal operating conditions. This is a desktop exercise that would enable staff to quantify the affected area of the reservoir beds and shorelines that are dewatered during project operation (section 5.9(b)(4)).

To assess riparian and amphibian habitat and inform the amount of LWD available for potential habitat restoration activities around the project's reservoirs, City Light's proposed vegetation mapping (TR-01), shoreline erosion (GE-01), reservoir LWD inventory (GE-04), and special-status amphibian studies (TR-08) should provide sufficient information to describe the existing environment for these resources, inform staff's analysis of project effects, and develop license conditions (section 5.9(b)(4)). For these reasons, we do not recommend requiring any additional studies of reservoir littoral or riparian habitat.

## **Reservoir Fish Populations**

### Requested Studies

NPS and FWS request that City Light assess the abundance, distribution, timing, and behavior of fish in the project reservoirs under project operation in order to inform potential operational modifications to protect and enhance native fish populations in the reservoirs.

Specific objectives of the requested studies include: (1) determine seasonal changes in the distribution, habitat use, and relative abundance of redbside shiner and salmonids in nearshore habitats, tributary deltas, and stream and river channels in the drawdown zone; (2) determine seasonal changes in the distribution and abundance of different size classes of fish in the reservoirs; (3) determine timing of spawning migrations, juvenile outmigration, and foraging movements in and out of tributaries of all salmonid species and at all life history stages; (4) evaluate the effects of project operation on an annual, seasonal, monthly, and hourly basis using radio telemetry studies; (5) estimate the mortality rate of salmonids when they enter the reservoirs using juvenile salmonid abundance in tributary streams as a baseline; (6) determine reservoir population abundances and habitat use using hydroacoustic assessments in pelagic



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waters and nearshore sampling (e.g. boat electrofishing, gillnets) techniques to determine juvenile/sub-adult abundances and habitat use of both pelagic and littoral habitats; (7) refine and expand on existing acoustic tagging studies to include all fish species occurring in the reservoirs to track movement, distribution, habitat use, and thermal experience; (8) determine the population structure of native fish that have been blocked by the presence of the three project dams; (9) facilitate management objectives, including fish passage around the project dams, that would preserve the reproductive potential for genetically unique bull trout and other fish populations in Skagit Basin above the Cascade River; and (10) provide a means to assess the health and viability of fish populations in each reservoir and predict long-term persistence in the face of changing flow and temperature regimes and project operations.

Comments on Requested Studies

In the RSP, City Light states that the requested studies of reservoir fish habitat use and population dynamics constitute significant baseline information requests that involve gathering data with the intent of identifying a project effect that has not been documented to exist. City Light asserts that existing information documented in the PAD together with ongoing data collection efforts under the existing license and proposed relicensing studies will provide sufficient information to assess project effects on reservoir fish communities and their habitat. Specifically, City Light indicates that Study FA-06, (fish genetics study), will provide additional data to expand upon the existing baseline genetics data for three native salmonid species in the project reservoirs. Study FA-03, (reservoir stranding and trapping study), will assess stranding and trapping risk for reservoir fish species during drawdowns, and Study FA-08 (fish entrainment study) will evaluate the potential for injury and mortality from fish entrainment into the project's turbines or spillway passage at each of the project's dams. City Light also points out that the ongoing USGS Food Web Study being conducted under the current license is intended to study food web relationships for the reservoir fish populations. Lastly, City Light states that its ongoing reservoir tributary barrier removal program implemented under the current license includes surveying reservoir tributaries to ensure that reservoir fish are not precluded from accessing tributaries at critical times during their life-histories.

In its comments on the RSP, Upper Skagit states that it supports the NPS and FWS's fish population study requests because City Light's proposed genetics study does not consider population abundance, habitat use, and migration timing of reservoir fish populations. The Upper Skagit asserts that, given its concerns that project operations are depressing reservoir productivity, it is possible that reservoir fish populations are expressing a reduced propensity for adfluvial migratory behavior. Therefore, Upper Skagit states that it is critical to fully evaluate reservoir fish population dynamics, habitat use, and migration timing to evaluate whether project operation is affecting the life history "expression" of the reservoir fish species. As an example, the Upper Skagit indicates that operations such as drawdowns can cause elevated turbidity levels due to shoreline erosion and sediment deposits that prevent fish movement and dispersal within the reservoir or into the tributaries, which they assert results in large fish kills.

Discussion and Staff Recommendation

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The requested fish population studies appear to be a large, general data gathering exercise on fish biology, habitat use, and population dynamics, rather than a specific study that would be used to assess a specific project effect and potentially develop license requirements (section 5.9(b)(5)).

City Light's proposed study on reservoir stranding and trapping (FA-03), study to assess sediment deposition in specific reservoir tributary mouths (GE-01), and ongoing annual surveys of passage barriers at tributary mouths, should provide sufficient information to assess the effects of reservoir fluctuations on reservoir fish populations. Additionally, City Light's proposed fish passage (FA-04), fish entrainment (FA-08), and ongoing acoustic tagging studies should provide enough information to assess the project's effects on fish passage between the three reservoirs. Lastly, City Light's proposed water quality monitoring study (FA-01) should provide additional water quality data for the project reservoirs, including specific targeted assessments of turbidity at erosion sites and at tributary mouths where sedimentation is occurring. These data can be used to evaluate the effects of reservoir stratification and turbidity on fish movements within the reservoirs and tributaries. Overall, these studies together with the information on the reservoir fish populations contained in the PAD should provide sufficient information to assess project effects on the reservoir fish populations (section 5.9(b)(4)). Therefore, we do not recommend requiring any additional fish population studies in the project reservoirs.

**FA-06. Reservoir Native Fish Genetics Study**Study Request

In their October 2020 study requests, NPS and FWS<sup>21</sup> requested that City Light develop a genetic baseline for the native fish species in the project reservoirs in order to inform management decisions that are beneficial to native fish at the project. Specifically, the agencies recommend that City Light conduct a study to: (1) determine the number of local populations in the project reservoirs, their spawning grounds, and how they relate to other local populations; (2) determine areas (e.g., tributaries, reaches, shorelines, and drawdown zones) where hybridization is occurring; and (3) determine to what degree each local population is affected by project operations such as migration barriers that are created by sediment deposition, turbidity, high temperatures in the epilimnion, or project dams. In addition to using the data for management purposes, the agencies assert that this information will aid in developing fish passage recommendations and prescriptions for resident fish and rates and timing of reservoir drawdown.

Applicant's Proposal

In the RSP, City Light agreed to include a genetic study aimed at refining baseline genetic information for bull trout, dolly varden, and rainbow trout within the project

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<sup>21</sup> The Upper Skagit stated their support for genetics study requests submitted by others.

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reservoirs, with the goal of refining the collective understanding of the genetic health and viability of the reservoir populations for the purpose of informing long-term fisheries management.

Specifically, City Light proposes to conduct a two-year study. Year 1 would involve compiling and analyzing existing target species genetic data with the goal of creating a standardized datafile for each species to calculate within- and among-population summary statistics, estimate relatedness, and estimate the power of genetic markers; and identifying the availability of additional genetic samples (either already existing or that could be opportunistically collected). Year 2 would involve additional data collection to address heterozygosity, within- and among-population variance, and relatedness for Dolly Varden; additionally, data would be gathered to estimate effective population size of each target species. City Light proposes that this work occur under the guidance of a Salmonid Genetics Expert Panel.

Comments on the Study

In its comments on the RSP, NPS states that the study should also evaluate hybridization among bull trout, dolly varden, and brook trout, and between rainbow and cutthroat trout.

In its comments on the RSP, Upper Skagit requests that the study be modified to include: (1) re-collection of all existing genetics samples that were not collected in a manner consistent with common practices “(i.e. juveniles on the spawning grounds)”; (2) careful evaluation of existing data (including metadata) for applicability; (3) re-processing of existing data to account for any misguided results; (4) expansion of sampling and analysis to include out of basin representative sampling for lineage comparisons as well as above and below reservoir sampling to discern how project infrastructure has affected Skagit River fish genetics at a watershed scale; (5) inclusion of a fisheries biologist/ecologist familiar with the Skagit River system on the expert panel; and (6) evaluation of reservoir fish abundance, habitat use, and migration timing.

The FWS and the Upper Skagit request that fish tissue samples be collected from juvenile bull trout within natal tributaries to obtain a clearer picture of distinct populations. They assert that collecting tissue samples from adult fish within the reservoir as proposed can obscure any information regarding distinct populations because adults mix within the reservoir and adults collected within the reservoir cannot be assigned to a natal geographic location.

The NPS, FWS, and the Upper Skagit request that the expert panel include a combination of field biologists familiar with the Skagit Basin and geneticists with experience working with salmonids. The NPS also requests that each of the following entities have a representative on the expert panel if they desire: NPS, NMFS, FWS, Washington DFW, the Upper Skagit, and Skagit River System Cooperative. FWS requests that it has a representative on the panel. NPS, FWS, and the Upper Skagit also request that all meetings of the expert panel be open to all stakeholders for transparency, and that a mutually agreed upon decision making structure be established prior to convening the first meeting.

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The NPS, FWS, and Upper Skagit request that the study results be used to compare genetic data between Upper Skagit populations and populations within neighboring basins across Puget Sound and Canada. For example, genetic data from Upper Skagit populations should be compared with, but not limited to, genetic data from the Fraser, Methow, Yakima, Chelan, and Olympic basins.

### Discussion and Staff Recommendation

While the genetic information that would be gathered from the proposed study may be useful for agency management purposes in determining the relatedness and population genetic structure within the project reservoirs over time, it is not needed for Commission staff to assess project effects or passage of these species at the project or to inform license conditions (section 5.9(b)(4)). The mechanisms that the agencies and Upper Skagit assert may be isolating these populations (passage barriers created by sediment deposition, turbidity, high temperatures in the epilimnion, or project dams) and leading to reduced genetic diversity and population viability, are the subject of other studies (*GE-03 Sediment Deposition in Reservoirs Affecting Resource Areas of Concern Study*, *FA-01 Water Quality Monitoring Study*, *FA-08 Fish Entrainment Study*, and *FA-04 Fish Passage Technical Studies*). Data collected from these studies should be sufficient to assess fish passage for these species within the reservoirs and inform whether changes in operation or other measures are needed (section 5.9(b)(4)). For these reasons, we do not recommend requiring City Light to conduct its proposed genetics study or the study modifications requested by the agencies or the Upper Skagit.

### **Angler Creel Surveys**

#### Study Request

NPS, FWS, and Washington DFW request that City Light conduct creel surveys in the project reservoirs. The agencies state that recreational fishing in the reservoirs is increasing and understanding the mortality rates of the different salmonid species will be necessary to understand their population dynamics as well as to evaluate the production potential for anadromous fish in the project reservoirs. The agencies also contend that creel surveys are important to assess impacts on bull trout from angling pressure. The agencies assert that angling pressure within the reservoirs is a project effect since the angling opportunity would not exist without the presence of project facilities. For example, the agencies contend that the project provides angling access via ferries, docks, and a pier.

The specific objectives of the survey include: (1) determine fishing effort, catch and harvest per unit effort, the number of species of fish that are harvested and released, and angler related mortality; (2) collect biological information related to species, size, and age of fish that are harvested as well as information related to parasite loads and disease; (3) determine the economic value of angling in each reservoir; (4) determine angler preferences, satisfaction, knowledge of fishing regulations, and understanding of catch-and-release practices; (5) evaluate

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impacts to ESA listed bull trout from angling; and (6) determine the effectiveness of fishing regulations at reducing effects on bull trout.

### Comments on Requested Studies

In the RSP, City Light states that the study objectives (i.e., fisheries management, enforcement, and regulation) relate to the responsibilities of resource management agencies and are not appropriate to study as part of relicensing because of the lack of project nexus and the information resulting from this study would not inform the development of license requirements.

City Light states that its proposed fish genetics study (FA-06), ongoing bull trout acoustic tagging and monitoring study in the project's reservoirs, and the USGS's ongoing food web study will provide a greater understanding of the reservoir fish populations than creel surveys.

### Discussion and Staff Recommendations

The overarching goals of the study are to assess harvest and corresponding mortality rates within the project reservoirs to provide data for resource agency fisheries management purposes and to determine the effectiveness of and compliance with fishing regulations. However, setting resource agency fisheries management goals and fishing regulations are not within the Commission's purview. For example, should the agencies decide that the results of the creel surveys indicate that angling pressure is adversely affecting bull trout, the Commission has no authority to modify state fishing regulations to reduce bull trout harvest. Therefore, while the creel surveys could be used to support the resource agencies' fisheries management goals, the study would not be needed to assess the effects of the project or to develop any license conditions (section 5.9(b)(4)). Therefore, we do not recommend requiring City Light to conduct the requested creel surveys.

## **Terrestrial Wildlife Habitat Connectivity Study**

### Study Request

FWS, Washington DFW, the Upper Skagit, and the Swinomish recommend a study of project effects on terrestrial wildlife habitat connectivity. FWS and Washington DFW state that degraded riparian habitat within the reservoir drawdown zones might lack sufficient vegetative cover to facilitate wildlife movement between the North Cascades National Park (North Cascades NP) and Ross Lake National Recreation Area (Ross Lake NRA) at low water levels. They state that at high water levels, the three reservoirs present a landscape barrier between the North Cascades NP and Ross Lake NRA. Washington DFW states that the cumulative impacts of the project reservoirs, recreation associated with the Ross Lake NRA, the project transmission line ROW, climate change, and concentrated project impacts along non-project Highway 20 may disrupt connectivity of wildlife populations, including culturally significant species.

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To achieve the study objectives, the agencies and tribes recommend that City Light: (1) review Washington Department of Transportation carcass removal records from Washington State Highway 20 between Rockport and Rainy Pass trailhead; (2) identify culverts, bridges, and other structures that may serve as underpasses for wildlife; (3) review the Washington Connected Landscapes Project<sup>22</sup> data for mountain goat, American pine marten, Canada lynx, and wolverine; (4) place camera traps at locations identified by the above objectives to investigate potential wildlife movement corridors; (5) conduct an aerial survey for mountain goat within the North Cascades NP, Ross Lake NRA, and the surrounding area to provide a baseline population estimate to determine potential cumulative impacts of the project on these populations; and (6) use Washington state connectivity mapping as a base to develop more local travel corridors between seasonal habitats. To quantify species presence and abundance, the four requesters also recommend that City Light conduct: (1) spotlight surveys for ungulates three to four times a year along a random sample of transects along transmission line corridors and ROWs, the project reservoirs, and access roads/highways; (2) conduct audio-visual bird presence and abundance surveys near the transmission line ROW three times a year; and (3) assess forage species energy and nutritional value, and roadside visual screening quality for wildlife. FWS states that the results of the requested study of current conditions would inform future licensing decisions.

### Comments on the Study

In the RSP, City Light states that there is no evidence that the project isolates wildlife populations or hinders the movement, to any significant degree, of mountain goat, marten, lynx, or wolverine; therefore, no nexus has been demonstrated between project operation and wildlife movements. City Light argues that mountain goat populations are suppressed throughout the North Cascades likely due to conditions unrelated to the project, such as low habitat quality, lack of natural salt licks, and lack of satisfactory winter habitat (Welch et al., 1997). City Light states that while some studies suggest that freeways, highways, water, agriculture, and urban landcover may limit gene flow in mountain goat populations in Washington and British Columbia (Parks et al., 2015), other studies, such as Shirk et al. (2010), suggest that patterns are poorly understood and that water bodies are not major impediments to gene flow because mountain goats are capable swimmers and have been observed crossing major lakes and rivers. Similarly, City Light cites to studies that indicate extensive wolverine movement east and north of Ross Lake and into British Columbia where core populations occur (Aubry et al., 2012), and no evidence of genetic structuring in black bear and marten populations in the vicinity of the project (Long et al., 2013). City Light points out that Washington State Highway 20 is not a project facility; therefore, it is not responsible for any effects on wildlife movement associated with Highway 20. City Light further argues that a regional study focusing on connectivity would require a multi-year regional effort and would have severe limitations in its ability to isolate the effects of the project from other factors influencing wildlife movement and connectivity.

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<sup>22</sup> The Washington Connected Landscapes Project is a broad-scale connectivity modeling analysis based on the attributes of representative wildlife species chosen to represent habitat types.

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In its comments on the RSP, FWS states that it continues to request this study for the reasons previously stated. FWS adds that while the project is not responsible for all terrestrial connectivity issues, project operations such as reservoir drawdowns and filling can alter migratory pathways (positively or negatively). FWS contends that understanding where wildlife migration occurs on the project landscape can inform project operation and the installation of recreational or other facilities over the next license term.

### Discussion and Staff Recommendation

Sufficient information exists to describe the current populations of mountain goats, marten, lynx, and wolverine at the project. While reservoir fluctuations can result in an area devoid of vegetation within the drawdown zone, there is no evidence to indicate that the fluctuations or the presence of the project is isolating or hindering movement of mountain goats, marten, lynx, or wolverine (section 5.9(b)(5)) for the reasons described above by City Light. Data to quantify the drawdown zone and the potential changes in vegetative cover that may result from changes in project operations will be gathered in TR-01, *Vegetation Mapping Study*, and TR-02, *Wetlands Assessment Study*, which should be sufficient to inform any license recommendations to benefit wildlife movement (section 5.9(b)(4)). Therefore, we do not recommend requiring City Light to evaluate wildlife connectivity at the project as requested by FWS, Washington DFW, the Upper Skagit, and the Swinomish.

### **Mitigation Lands—Cost/Benefits Analysis**

#### Study Request

Skagit County recommends that City Light conduct a cost/benefit analysis of City Light's mitigation land acquisition program to assess the merits of any future mitigation land acquisition pursuant to a new project license. Skagit County states that the study should include an assessment of "real estate acquisition costs; the effects of a shifted tax burden to Skagit County taxpayers; the costs of ongoing management and stewardship actions related to the acquisitions; and the broader socioeconomic impacts to the community arising from what amounts to the dismantling of our County's land/tax base by the City of Seattle as a substitute for providing fish passage." Skagit County argues that the land acquisition program and poor land stewardship has placed additional burdens on county services, such as its sheriff's office, while reducing the tax revenues needed to support those services. Skagit County asserts that the study seeks to analyze whether City Light's mitigation land acquisitions are generating the intended benefit to fisheries that would justify the other costs and burden to its community, with an eye toward informing any potential future acquisitions.

#### Comments on the Requested Study

In the RSP, City Light opposes the study because: (1) the study will not inform license conditions; (2) the Commission has no authority to award damages, including the assessment of payments in lieu of taxes, or to require the funding of local governmental functions; and (3)

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Skagit County's concerns regarding proliferation of illegal activities and impacts on local law enforcement are more properly attributed to "desired methods for selection and management of mitigation lands rather than a study request." City Light adds that it has acquired more than 10,300 acres of mitigation lands in Skagit County pursuant to the requirements of its current license and that these lands primarily address wildlife mitigation purposes, although many have a secondary direct or indirect benefit for salmonids.

Discussion and Staff Recommendation

While Commission staff could evaluate the effects of future land acquisition on the county's tax base and services, City Light is correct that the Commission does not have the authority to require City Light to make payments in lieu of taxes or to fund local government services.<sup>23</sup> Whether project land should be managed differently, will be considered during relicensing and will be informed by the information gathered from other studies. Therefore, we do not recommend requiring City Light to conduct Skagit County's requested cost/benefit analysis.

**Mitigation Lands— Land Access, Stewardship and Habitat Assessment**Study Request

FWS and the Swinomish request that City Light examine the impact that the current condition, configuration, and locations of mitigation lands have on wildlife abilities to live, migrate, and maintain healthy populations. To achieve this goal, FWS and the Swinomish recommend that City Light: (1) identify land-locked mitigation parcels, (2) evaluate how access and land use practices around mitigation lands have changed since acquisition and impacted fish and wildlife and tribal cultural practices, (3) assess the impacts of illegal activities on species of concern, (4) evaluate the conditions of the habitat and its potential as mitigation lands to support species of concern, and (5) identify potential fish and wildlife habitat corridors between mitigation lands and other conservation lands. The FWS and the Swinomish also request that City Light assess access to mitigation lands and evaluate the potential for these lands to support culturally significant and special-status species. The Swinomish states that over 5,900 acres of project mitigation lands may require third-party permission for tribes to exercise federally reserved hunting and gathering rights and cultural practices, and these changes impact the availability of culturally significant natural resources to tribes.

Comments on the Requested Study

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<sup>23</sup> *City of Tacoma*, 84 FERC ¶ 61,037 (1998), reh'g denied, 85 FERC ¶ 61,020 (1998) (municipal licensee of lands for wildlife mitigation. Not a matter for Commission where state law provided procedures for establishing payments in lieu of taxes.); *Holyoke Water Power Company*, 88 FERC ¶ 61,186 (1999) (FPA has no "no net loss" standard for affected resources and values, including tax revenues);



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In the RSP, City Light asserts that the requested study is not needed because the agencies and tribes have not demonstrated a nexus between project operations and effects on mitigation land habitat. City Light states that under the terms of the current license, its principal focus was acquiring wildlife mitigation lands, which were selected in consultation with and approved by all members of the Wildlife Management Review Committee which included the tribes, FWS, and Washington DFW. City Light explains that management of the mitigation lands has been passive under the current license, but for the new license it will develop specific management plans for each parcel that would be informed by its proposed relicensing studies (TR-01 *Vegetation Mapping Study*, TR-02 *Wetland Assessment*, TR-04 *Invasive Plants Study*, GE-02 *Erosion and Geologic Hazards at Project Facilities and Transmission Line Right-of-Way Study*, TR-05 *Marbled Murrelet Study*, TR-09 *Beaver Habitat Assessment*, and TR-10 *NSO Habitat Analysis*). City Light states that these studies will collect information on “habitat conditions of the mitigation lands, instances of illegal activity, access issues and land use changes near mitigation lands” for each parcel. Further, City Light states that the parcel assessment “will provide a basis for developing parcel-specific management objectives and actions and would be compiled into an updated management plan for mitigation lands.”

In its comments on the RSP, Swinomish states that City Light has proposed no studies addressing project impacts on terrestrial mammals. The Swinomish states that it has witnessed significant alterations to the Skagit watershed over the course of the current license as a result of the project and that climate change, sustained increase in project-induced recreation, and land-use changes necessitate a preemptive and adaptive approach to terrestrial resource management. The tribe acknowledges that City Light-funded wildlife research under the current license provides limited data, but states that those research projects lack specific objectives to investigate project impacts on terrestrial wildlife, and none of the funded wildlife research includes mitigation lands west of the project reservoirs. The Swinomish states that greater knowledge of wildlife abundance, movement corridors, seasonal movement patterns, and habitat needs from the Ross Lake NRA to mitigation lands west of the project reservoirs would enable management strategies ensuring that culturally significant and special-status species persist. Therefore, the Swinomish asserts that the data it requested is essential to inform the development of any management plan to ensure the long-term protection, mitigation, and enhancement of terrestrial resources within the Skagit watershed.

### Discussion and Staff Recommendation

While the specific effects noted by FWS and the Swinomish are not the result of project operation, management of project lands can affect whether project lands achieve specific management goals and project purposes (e.g., improve elk foraging habitat) (section 5.9(b)(2) and (5)). Here, specific land management objectives for project lands have not been established. City Light’s proposed relicensing studies should provide most of the information about site habitat conditions (e.g., vegetation mapping, occurrence of invasive species, available spotted owl habitat) needed to develop appropriate management objectives and actions to achieve those objectives, including whether the sites might support culturally significant and special-status

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species as requested by the Swinomish. Therefore, we do not recommend requiring City Light to conduct the study requested by FWS and the Swinomish.

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