Black Canyon Hydroelectric Project
FERC Project No. P-14110
Proposed Hydropower Potential and Project Economics Study Plan
September 2012

Prepared for
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1 INTRODUCTION

Black Canyon Hydro, LLC, (BCH) ultimately plans to file an application for an original license for the Black Canyon Hydroelectric Project (Project), FERC Project Number P-14110, and associated facilities on the North Fork Snoqualmie River (North Fork), approximately 4 miles northeast of North Bend in King County, Washington. The Project has a proposed generation capacity of 25 megawatts (MW) and would be located entirely on private lands.

The Project would consist of the following new facilities: 1) a 8-foot-high, 162.4-foot-long inflatable rubber diversion with associated fish passage and intake structures; (2) a variable pooling area behind the diversion with a normal water surface elevation of 971 feet above mean sea level and a maximum pooling of 2.83 acres; (3) a power conduit tunnel consisting of an approximately 450-foot-deep vertical tunnel into an approximately 8,300-foot-long, 12-foot-diameter horizontal tunnel and penstock connecting to; (4) a 60-foot-long, 100-foot-wide metal powerhouse with two Francis turbine units, one rated at 16 MW and the other rated at 9 MW; (5) a 200-foot-long, 24-foot-wide tailrace; (6) a 4.2-mile-long, 115-kilovolt overhead transmission line that transmits project power to the regional grid (transmission line would be an overbuild of an existing transmission line with only approximately 0.65 miles of new transmission); (7) a 0.75-mile-long and a 0.5-mile-long extension of two existing logging roads that lead to the project facilities; and (8) appurtenant facilities (switchyard, maintenance building, etc.).

The project would operate in run-of-river mode. The combined maximum hydraulic capacity of the two project turbines would be 900 cubic feet per second (cfs). The project would divert water from a 2.6-mile-section of the North Fork Snoqualmie River.

BCH filed a Notice of Intent (NOI) and the associated Pre-Application Document (PAD) to commence the FERC Integrated Licensing Process on March 27, 2012. In response to the subsequent study requests filed by FERC staff and other stakeholders and as detailed in 18 CFR 5.11, BCH is required to submit relevant resource study plans. This includes a study of hydropower potential and economics which follows the requirements of 18 CFR 5.11(b)-(e).

2 STUDY DESCRIPTION AND OBJECTIVES

In accordance with 18 CFR §5.11(d)(1), this section describes the goals and objectives of

the study and the information to be obtained. The goal of this study is to evaluate project economics and the hydropower potential of the site. The specific objectives of the study are to:

- Determine whether the hydraulic capacity of the two proposed turbine generating units (or turbine generating units with a different hydraulic capacity) would best utilize the available river flow and any instream flow releases to the Project Reach; and
- Compare the cost of the proposed project (i.e., capital and annual operation and maintenance (O&M) costs) and the likely cost of alternative power in the region.

3 RESOURCE MANAGEMENT GOALS

In accordance with 18 CFR §5.11(d)(2), this section describes resources management goals of agencies or Indian tribes with jurisdiction over the resources to be studied. While BCH is unaware of any resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied, Section 4(e) and 10(a)) of the Federal Power Act (FPA) require that the Commission give equal consideration to all uses of the waterway on which a project is located. When reviewing a proposed action, the Commission must consider the environmental, recreational, fish and wildlife, and other non-developmental values of the project, as well as power and developmental values. Therefore, the Commission must have sufficient information describing project economics and the hydropower potential of the site to make a public interest determination.

4 EXISTING INFORMATION

In accordance with 18 CFR §5.11(d)(3), this section describes existing information related to the hydropower potential and project economics of the Project, and addresses the need for additional information.

4.1 Updated Annual and Monthly Energy Production Estimates

The annual and monthly energy production estimates included within the Pre-Application Document were based on the streamflows measured upstream of the proposed intake site at USGS Stream Gage No. 12142000. This update (Table 1) uses flows adjusted to estimate flows near the actual intake site (for further explanation see “Hydrology Summary for the Black Canyon Hydroelectric Project” submitted concurrently with study plans). Importantly, these estimates do not include any loss of energy production to instream flow requirements. Estimating potential instream flow requirements prior to

undertaking studies is too speculative to be meaningful.

Table 1. Annual and Monthly Energy Production Estimates

Month	Monthly Total (MWh)
January	12,576
February	8,414
March	10,169
April	12,138
May	14,675
June	12, 676
July	4,951
August	1,081
September	2,202
October	7,756
November	11,457
December	10,758
Average Annual Generation	**108,852**

4.2 Instream Flow Requirement

Ultimately, the study analysis will account for lost generation associated with likely flow release alternatives. However, both the instream flow study, conducted for a past hydroelectric project proposed on the Black Canyon, and a minimum instream flow for the North Fork Snoqualmie River in the Washington Administrative Code suggest a potential range of instream flows from 50 to 300-cfs (instream flows related to recreational activities like fly fishing and kayaking are discussed in the "Recreation Resources Study Plan" and "Recreational Boating and River Access Study Plan").

4.2.1 Black Canyon/North Fork Snoqualmie River Instream Flow Study

The instream flow study was done to evaluate a nearly identical hydroelectric project proposed in the 1980s. The goal of the study was "to provide decision makers with a sound information base which can then be used in turn for the development of an instream flow agreement that best balances multiple water uses while avoiding unnecessary negative impact" (Beck and Associates 1985). While the instream flow study was focused on fishery resources, fishery resources remain a key resource in the North Fork Snoqualmie River. According to the study:

> Habitat maximums are reached at flows ranging from 170-185 cfs. When the resulting habitat from the three chosen flows are compared with existing conditions at the 50% flow exceedence level, there is a net increase

in habitat for most months with the exception of the 50-cfs scenario. Habitat available at the 50-cfs flow level exceeds habitat provided under existing conditions during May, June, November and December. Habitat available at the 100-cfs level exceeds existing habitat conditions in all months except August, September and October… Habitat available at the 200-cfs level exceeds existing habitat conditions in all months (Beck and Associates 1985).

4.2.2 Washington Administrative Code (Chapter 173-507)

Located within the Snohomish River Basin (Water Resource Inventory Area 7), the North Fork Snoqualmie River is a part of the Instream Resources Protection Program (Chapter 173-507 of the Washington Administrative Code). Under this program, minimum instream flows have been established for the North Fork and are measured at USGS Gage No. 12142000 located downstream of the Project's powerhouse. Depending on the time of the year, the WAC minimum instream flows range from 130-300 cfs.

5 NEXUS TO PROJECT

This section describes the nexus between Project operations and effects on the resource to be studied, and how the study results will inform the development of license requirements. In determining whether to issue a license for this project, the Commission considers a number of public interest factors, including project economics. The Commission must ensure that any license issued be best adapted to a comprehensive plan for improving or developing a waterway. Therefore, the Commission must have sufficient information on project costs and the hydropower potential of the site to evaluate the potential benefits of the project and develop any license requirements.

6 METHODS

In accordance with 18 CFR §5.11(d)(1) and §5.11(d)(5), this section provides a detailed description of the proposed study methodology, including data collection and analysis techniques, or objectively quantified information, sampling strategy, and a schedule including data collection and analysis techniques, or objectively quantified information, sampling strategy, and a schedule including appropriate field season(s) and the duration (see "Schedule" heading below for schedule).

The proposed study plan will utilize a proprietary feasibility model developed by BCH to evaluate hydroelectric projects. The model uses a range of data inputs including streamflow, derived statistical products, instream flow requirements and ramping rate

restrictions, facility parameters (including plant efficiencies and capacities), construction cost estimates, and power market trends. Inputs related to construction and operation/maintenance costs will be developed based on decades of BCH staff experience building and operating hydroelectric projects. The model outputs include daily generation, daily flows to the Project Reach, financial indicators, and the marginal cost of power required for project construction.

The hydropower potential and project economics study will include completing the following subtasks described below:

- Finalizing facility parameters
- Calculating construction capital costs and ongoing O&M costs
- Identifying likely instream flow requirements

6.1 Finalizing Facility Parameters

- At this stage in the FERC licensing process, a number of important facility parameters remain unknown. For example, the final siting of the Project's diversion and powerhouse will determine the gross and net project head. The installation of additional stream gages near the proposed intake site will also provide added certainty when calculating updated monthly flow duration curves. Expected flows and a final calculation of the Project's head will also determine the type and capacities of turbines.

6.2 Construction and O&M Cost Calculations

- The capital cost of constructing the diversion, intake, tunnel, penstock section, powerhouse, turbine generating units, tailrace, transmission line, appurtenant facilities, and extending existing logging roads will be calculated.
- Annual O&M costs of the Project facilities, including all proposed protection, mitigation, and enhancement (PME) measures will also be calculated.
- Each of these calculations will incorporate an appropriate discount rate (cost of money), depreciation, and annul fees and taxes.

6.3 Impact of Instream Flow Requirements

- Hydropower production and economic feasibility will ultimately depend upon factors such as ramping rates and instream flow requirements. The results of separate study plans, particularly those related to fisheries and recreation, will provide the data necessary to accurately estimate likely instream flow

requirements.

7 PROGRESS REPORTING

In accordance with 18 CFR §5.11(b)(3), this section describes provisions for periodic progress reports, including the manner and extent to which information will be shared; and the time allotted for technical review of the analysis and results.

Study reports will be submitted as required by the FERC Integrated Licensing Process (ILP). The most recent schedule, issued by FERC in Appendix B of Scoping Document 1, includes a number of opportunities for progress reports, exchange of analysis and results between stakeholders, and information sharing. After proposed study plans are filed with FERC there will be a study plan meeting and comment period before a revised study plan is filled and a comment period passes. Once studies begin, the ILP also has deadlines for an Initial Study Report to be submitted, an Initial Study Report Meeting, and an Initial Study Report Meeting Summary. However, this schedule is subject to change by FERC staff and should not necessarily be relied upon. It is BCH's understanding that any changes to the ILP plan and schedule will be noticed by FERC staff.

8 SCHEDULE

In accordance with 18 CFR §5.11(b)(2), the schedule for conducting the study is provided in Table 1 below.

Table 2. Hydropower Potential and Project Economics Study Plan Plan Schedule

Component	Completion Date*
Proposed Study Plan Meeting	October 4, 2012
Proposed Study Plan Comments Due	December 6, 2012
File Revised Study Plan	January 7, 2013
Revised Study Plan Comments Due	January 22, 2013
Finalizing Facility Parameters	2013
Construction and O&M Cost Calculations	2013
Instream Flow Estimates	2013
Initial Study Report filed with FERC	February 6, 2014
Initial Study Report Meeting	February 21, 2014
Initial Study Report Meeting Summary	March 10, 2014

*Dates based on schedule created and presented by FERC in Scoping Document 1 and subject to change.

9 LEVEL OF EFFORT AND COST

In accordance with 18 CFR §5.11(d)(6), the anticipated level of effort and cost are provided in Table 2 below.

The estimated cost of this work is approximately $10,000. While much of the data being used will be generated in other study plans, significant staff hours will be required.

Table 3. Level of Effort and Cost

Task	Labor and Expenses
Prepare Proposed Study Plan	$1,250
Prepare Revised Study Plan	$1,250
Construction and O&M Cost Calculations	$2,500
Study Report and Meeting	$5,000
Total	$10,000

10 REFERENCES

Beck and Associates, 1985. Black Canyon/North Fork Snoqualmie River Instream Flow Study: FERC Project No. 5387-000 for the Weyerhaeuser Company, pp. 27-28.