Brookfield



Bear Swamp Project (FERC No. 2669)

Flow Regime Working Group Meeting

July 28, 2017

Brookfield Renewable A Leader in Renewable Power Generation

Brookfield Renewable Health, Safety, Security and the Environment Policy:

We continuously strive to achieve excellence in safety performance and to be recognized as industry leaders in accident prevention.

- In case of emergency, we will dial 911
- Emergency exits and rally point outside
- Locations of emergency fire pulls
- Restrooms

Introductions



Flow Regime Working Group Meeting Overview and Agenda

Meeting Agenda

Friday, July 28, 2017	
9:00 AM – 9:15 AM	Welcome and Introduction
9:15 AM – 10:30 AM	Discussion of Modeled Scenarios
10:30 AM – 10:45 AM	Break
10:45 AM – 12:00 PM	Results of Operations Modeling
12:00 PM – 12:45 PM	Lunch
12:45 PM – 1:30 PM	Discussion of Model Results and Scenarios
1:30 PM – 1:45 PM	Break
1:45 PM – 2:30 PM	Discussion of Model Results and Scenarios (continued)
2:30 PM – 3:00 PM	FRWG Next Steps

Overview

Bear Swamp Power Company, LLC (BSPC) is pursuing a new license for the Bear Swamp Project (FERC No. 2669) (Project) from the Federal Energy Regulatory Commission (FERC or Commission) in accordance with FERC's Integrated Licensing Process (ILP) at 18 C.F.R. Part 5.

- FERC's October 30, 2015 Study Plan Determination (SPD) directed BSPC to conduct 19 studies in support of preparing an application for a new license for the Project, including an Operations Model.
- The approved Operations Model study plan establishes a Flow Regime Working Group (FRWG) to serve as a forum to discuss model scenario development, findings, on-going efforts by BSPC, and to examine the feasibility of potential operational modifications that can benefit or support interests of relicensing participants and BSPC.
- BSPC held an initial FRWG Meeting on February 24, 2016. At that time, FRWG participants
 agreed to postpone FRWG Meetings until the Operations Model was fully developed and other
 studies were more fully developed.
- In the October 31, 2016 Initial Study Report and the February 28, 2017 Study Progress Report, BSPC indicated that coordination with the FRWG to resume FRWG Meetings would take place in Quarter 1 of 2017.
- A FRWG Meeting was held on April 12, 2017 at the Berkshire East Mountain Resort.

Operations Model Goals and Objectives

Pursuant to the Commission's SPD, the goals and objectives of the Operations Model are:

- Demonstrate the operations (and limits) of the Bear Swamp Pumped Storage Development (PSD) and Fife Brook Development within the context of inflow as provided by the Deerfield River Project's (FERC No. 2323) (DRP) Station No. 5 development and outflow as constrained and required by the Settlement Agreement;
- Examine the extent to which today's management of the Fife Brook impoundment can be potentially modified (i.e. managing a disconnect different from today's incoming 73 cfs minimum flow and the outgoing 125 cfs minimum flow) so long as and assuming replenishing water is made available from the DRP (conversely, volume deficit or how much more is needed);
- Examine the extent (desktop feasibility) to which BSPC can influence change on or improve upon the timing and magnitude of Fife Brook outflow (e.g. relative to timing/magnitude of whitewater releases, timing/magnitude of minimum flow releases, alternate ramping, effects at the upstream end of the Fife Brook impoundment), and associated effects on, or relation to, aspects such as water availability, adverse impacts to the Bear Swamp PSD and effects on public safety; and
- In accordance with the approved Operations Model study plan, the FRWG is intended to serve as a collaborative forum by which BSPC and relicensing participants can exchange ideas and examine potential improvements (feasibility) in relation to operation of the Project.

Operations Model Reporting

Pursuant to the Commission's SPD BSPC expects to compile and summarize the results of all model scenarios in the Operations Model Study Report.

• The Commission's revised Process Plan and Schedule for the Project directs BSPC to file the Operations Model Study Report on or before September 30, 2017.

Purpose of this Meeting

The purpose of this meeting is to:

- Present the results of the scenarios modeled to-date, including certain scenarios identified in the approved Operations Model study plan, the Commission's SPD, and scenarios selected by the FRWG at the April 12, 2017 FRWG Meeting; and
- Identify any additional and reasonable scenarios to be modeled prior to the filing of the Operations Model Study Report.

This FRWG Meeting is not a settlement negotiation meeting or a forum to negotiate protection, mitigation, or enhancement (PM&E) measures. None of the scenarios modeled by BSPC for this study should be construed as proposals.





Modeled Scenarios

Operations Modeling

As provided in the approved study plan and described during the previous FRWG Meetings, modeling was conducted using HDR's CHEOPS[™] model (Computer Hydro Electric Operations and Planning Software).

- CHEOPS is an operations model/software tool for evaluating a wide range of physical and operational constraints on a hydroelectric facility.
- CHEOPS is typically used to compare:
 - Effects of potential changes to operation
 - Physical modifications
 - Equipment modifications
- For this model, HDR used a 9 year period of record (POR).



• To examine the effects or constraints of each scenario, the model maintains Bear Swamp PSD operations and associated reservoir storage in a manner consistent with historical operations.



Modeled Scenarios

To-date, BSPC has modeled existing conditions and the certain model scenarios identified in the approved Operations Model study plan and the Commission's SPD. The scenarios modeled in these series demonstrate the physical limits of the Project. Scenarios modeled to-date include:

- Series 1: Alternative minimum flows from the Fife Brook Dam, ranging from 125 cubic feet-persecond (cfs) to 275 cfs in increments of 50 cfs;
- Series 2: Alternative whitewater flows ranging from 800 cfs to 1,400 cfs in increments of 100 cfs; and
- Series 3: Alternative minimum flows from the Fife Brook Dam, ranging from 125 cfs to 275 cfs in increments of 50 cfs combined with alternative whitewater flows ranging from 800 cfs to 1,400 cfs in increments of 100 cfs (combination of Series 1 and Series 2).



Modeled Scenarios

BSPC also modeled a series identified by the FRWG at the April 12, 2017 FRWG Meeting:

- Series 4: 120 whitewater releases annually (increase of 14 from existing conditions), with the additional releases occurring in July August. For this series, flows of 800 cfs, 900 cfs, and 1100 cfs were modeled, and whitewater flows from Fife Brook Dam were scheduled to occur concurrent with the 32 Monroe Bridge whitewater releases. The Bear Swamp Lower Reservoir was held at an elevation at or below 835 feet to expose the Showtime whitewater feature for each of the scenarios modeled in this series.
 - This series is consistent with the Commission's SPD which directed BSPC to "model a scenario where scheduled whitewater releases from Fife Brook Dam and a drawdown of the Fife Brook impoundment are coordinated with the 32 scheduled whitewater releases from Deerfield No. 5."





Results of Operations Modeling

Operations Modeling Results

The results are based on the specific criteria for each modeled scenario and are expressed in the following metrics:

- **Total volumetric shortfall for POR :** The additional volume of water (in acre-feet) that would be necessary over the POR to meet the model criteria (e.g., to meet the minimum flow requirements and scheduled whitewater releases) for each scenario.
- **Difference in total generation from base case for POR:** The difference in generation in megawatt hours (MWh) between the existing (base case) scenario and the modeled scenario over the POR.
- Number of days where minimum instantaneous flows not met: The total number of days over the POR that insufficient water is available for a period of time to meet the instantaneous minimum flow requirements from Fife Brook Dam.
- Number of days where recreation flows not met: The total number of days over the POR that insufficient water is available for a period of time to meet the scheduled whitewater flow releases from Fife Brook Dam.
- **Count of days with no generation:** Days over the POR in which the Bear Swamp PSD is restricted from operating for to accomplish the specific requirement of exposing the Showtime whitewater feature during Monroe Bridge recreation flow releases.



Series 1: Alternative Minimum Flows



Series 2: Alternative Recreation Flows



Series 3: Alternative Minimum Flows and Recreation Flows





Series 4: Alternative Recreation Flows and Impoundment Drawdown



Summary of All Scenarios Modeled To-date

325 Number of Days Where Minimum -458,055 -460,674 -469,053 -209,403 190,528 Instantaneous Flows Not Met 7.199 1,493 -198,324 300 532 Number of Days Where Recreation Flows -185,814 Not Met 5 519 275 Count of Days with No Generation -177,408 154.702 250 -168,255 Total Volumetric Shortfall for POR (acre-feet) 8 117 -160,470 130,094 225 Difference in Generation from Base Case for POR -155,682 116,014 (MWh) 200 -147,627 -138,249 175 98,908 Days -130,599 87,665 150 -121,644 49 -113,688 -105,714 125 58.761 -98,406 49,309 -91,728 100 -82,170 14 675 -74,943 75 -67,887 -59,148 28 -40,221 50 -52,776 -32,328 -46,674 -21,879 -16,020 -10,161 463 25 4,671 2.319 40 0 RatRect_NoGen_BORTS FERC. Recipio Mult FERC RECOOL MIRLES FERC. Recipio Minute Feet Pectago Municip FERC. Pectoo Min215 FRC Reci300 Min215 FERC Rectard Min215 Rathect, Nocen 20045 HERC RECOOL MINITS FERC Reci300 Minutes FERC Mininstals FERC. Rectago Minute FERC. Rection Minute FERC. Rection Minute FERC Rectard INITIZE FERC RECOOL MIRE FERC. Recipio Minutes FERC Recipo Mult RatiRect Mogen 110005 FERC RECOOD MINIS FERC Pection Minutes FERC Record FERC Recipop FERC Recition FERC Reci200 FERC Mininstit FERC Mininstits Basel Scenario

Contact Information

Stakeholders are encouraged to contact Brookfield directly at any time with any questions about the Project:

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