

Relicensing Study 3.8.1

EVALUATE THE IMPACT OF CURRENT AND PROPOSED FUTURE MODES OF OPERATION ON FLOW, WATER ELEVATION AND HYDROPOWER GENERATION

Updated Study Report Summary

**Northfield Mountain Pumped Storage Project (No. 2485)
and Turners Falls Hydroelectric Project (No. 1889)**

Prepared for:



Prepared by:



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1.1 Study Summary

Study No. 3.8.1 *Evaluate the Impacts of Current and Potential Future Modes of Operation on Flow, Water Elevation and Hydropower Generation* includes the development of an operations model of the Connecticut River from TransCanada’s Wilder Dam to the Holyoke Gas and Electric’s Holyoke Dam. The purpose for developing the operations model is to evaluate the impacts of alternative modes of operation on water elevations, flows and hydropower generation.

1.2 Study Progress Summary

Task 1. Modify Model

FirstLight has modified the HEC-ResSim simulation model provided by the United States Corps of Engineers (USACOE) via The Nature Conservancy (TNC) to reflect the following:

- Converted the daily time step model to an hourly time step model. Currently the model’s period of record extends from 1960-2003; however, the United States Geological Survey (USGS) via TNC has updated the hydrologic data to include the period 2004 to 2012. The updated hydrologic data has been provided to FirstLight. FirstLight has incorporated the inflows from tributaries between TransCanada’s Wilder Dam down to Holyoke Dam.
- The model provided to FirstLight by the USACOE was also modified by FirstLight to better simulate
 - the Northfield Mountain Project pumping and generating cycles;
 - water level fluctuations observed in the Turners Falls Impoundment and Upper Reservoir; and
 - the timing and magnitude of fish ladder flows, attraction flows and bypass flows

Task 2. Calibration

The modified HEC-ResSim model was calibrated to annual generation at the FirstLight projects and three TransCanada projects (Wilder, Bellows Falls and Vernon) for the year 2000. Since 2000 there have been some changes to the electrical capacities. The 2004-2012 hydrologic data has been added to the HEC-ResSim model; however, the calibrated model has not been verified using the most up-to-date station electrical and hydraulic capacities. For the year 2000 calibration, the annual energy calibration was within 10% of observed annual generation at the facilities.

For the year 2000, the model was also calibrated to mean daily flows at two USGS gages on the Connecticut River including the North Walpole, NH gage (Gage No. 01154500) located above Bellows Falls Dam and the Montague, MA gage (Gage No. 01170500) located below Cabot Station and the Deerfield River.

Task 3. Establish Baseline Model

The calibrated model, based on 2002 equipment, was subsequently updated to reflect today’s equipment and operating conditions- this model is referred to as the baseline model. The baseline model serves as the point of comparison to alternative operating scenarios (termed “production runs”). All production runs will subsequently be compared to the baseline model results relative to water elevations, flows and generation.

Task 4. Production Runs

FirstLight has used the model internally to evaluate the impact on generation, impoundment elevations and flows from various modes of operation. Because not all of the study results are complete, the range of production runs has not been finalized. Those studies that evaluate flow regimes in the bypass reach and below Cabot Station, and the water level fluctuation in the Turners Falls Impoundment will inform various production runs. The studies that will inform the flow regime include the following:

- Study No. 3.3.1 *Instream Flow Studies in Bypass Channel and below Cabot.*
- Study No. 3.6.3 *Whitewater Boating Evaluation*

There are several studies that relate to water level studies including the following:

- Study No. 3.1.2 *Northfield Mountain/Turners Falls Operation Impact on Existing Erosion and Potential Bank Instability*
- Study No. 3.3.6 *Impact of Project Operation on Shad Spawning, Spawning Habitat and egg Deposition in the Area of the Northfield Mountain and Turners Falls Projects*
- Study No. 3.3.10 *Assess Operational Impacts on Emergence of State-Listed Odonates*
- Study No. 3.3.13 *Impact of the Turners Falls Project and Northfield Mountain Project on Littoral Zone Habitat and Spawning Habitat*
- Study No. 3.3.15 *Assessment of Adult Sea Lamprey Spawning within Turners Falls Project and Northfield Mountain Project Areas*
- Study No. 3.3.17 *Assess the Impact of Project Operations of the Turners Falls Project and Northfield Mountain Project on Tributary and Backwater Area Access and Habitat*

Once the above studies are complete, FirstLight will use the model to simulate alternative operating conditions.

Task 5. Use of Model Output for other Uses

The HEC-ResSim model will be used to inform other studies such as the instream flow study. The instream flow study will develop habitat versus flow relationships for various species and life stages of fish. The habitat versus flow relationship can be married with the operations modeling hourly discharge data – such as below Cabot Station—to develop habitat versus time graphs.

Task 6. Report

A final report will be completed in the 1st quarter of 2017, after all field studies are completed so that various alternative operating scenarios can be evaluated.

1.3 Variances from Study Plan and Schedule

To date, there are no variances from the study plan or schedule.

1.4 Remaining Activities

- Validate the model using the more recent hydrologic period of record 2004-2012.

- Simulate various production runs.
- Complete a final report.