UNITED STATES OF AMERICA

BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

DRAFT APPLICATION FOR NEW LICENSE FOR MAJOR PROJECT – EXISTING DAM

BLENHEIM-GILBOA PUMPED STORAGE POWER PROJECT

FERC PROJECT NO. 2685

EXHIBIT B
PROJECT OPERATION AND RESOURCE UTILIZATION

December 2016

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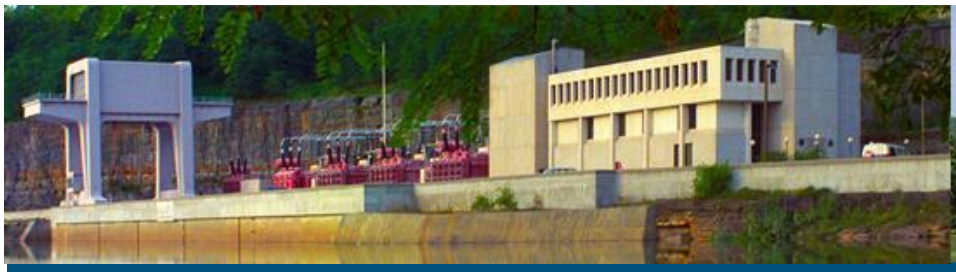

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1 Introduction

Named for the two towns within which it is located, the Blenheim-Gilboa Pumped Storage Power Project (B-G Project) is located on Schoharie Creek, a tributary of the Mohawk River, about 40 miles southwest of Albany, New York, in the northern Catskill Mountains. The B-G Project is owned and operated by The Power Authority of the State of New York (Power Authority).

This exhibit is required according to regulations established by the Federal Energy Regulatory Commission (FERC), which can be found in 18 Code of Federal Regulations (CFR) Section 4.51(c). The information provided herein covers the specifics prescribed for Exhibit B and serves the purpose of providing a statement of operation and resource utilization.

2 Project Operation (18 CFR Section 4.51(c)(1))

2.1 Operational Control

The B-G Project is currently manually operated by on-site Power Authority staff. The on-site operators are responsible for pumping and generating operations between the Upper Reservoir and the Lower Reservoir and for managing downstream releases from the Project's Lower Dam to Schoharie Creek.

2.2 Annual Plant Factor

The average annual plant factor is determined using the following equation:

$$\frac{\text{Average Annual Output}}{\text{Nameplate Capacity x 8,760 hrs/yr}} = \text{Avg. Annual Plant Factor}$$

The B-G Project currently has a gross average annual energy production of approximately 453,407 megawatt-hours (MWh) per year (2006-2014 Table 3-1) and an annual plant factor of approximately 4.5% based on its current FERC-authorized capacity of 1,160 MW.

2.3 Existing and Proposed Power Plant Operations

The B-G Project helps meet New York's peak power needs by cycling water between two reservoirs, one at the top of Brown Mountain (Upper Reservoir) and one at the base of Brown Mountain (Lower Reservoir). The water that flows through the powerhouse is supplied from the Upper Reservoir, which serves as a giant energy storage device. During periods of low demand for electricity and lower electricity prices, typically at nights and on weekends, water is pumped from the Lower Reservoir to the Upper Reservoir through the B-G Project's four pump-turbine units (Figure 2.3.1). During periods of peak demand for electricity, typically during the day, the motorized pumps are reversed to become turbine-generators (Figure 2.3.2). Water released from the Upper Reservoir spins the turbine generators to produce up to 1,160 MW of electricity before entering the Lower Reservoir.

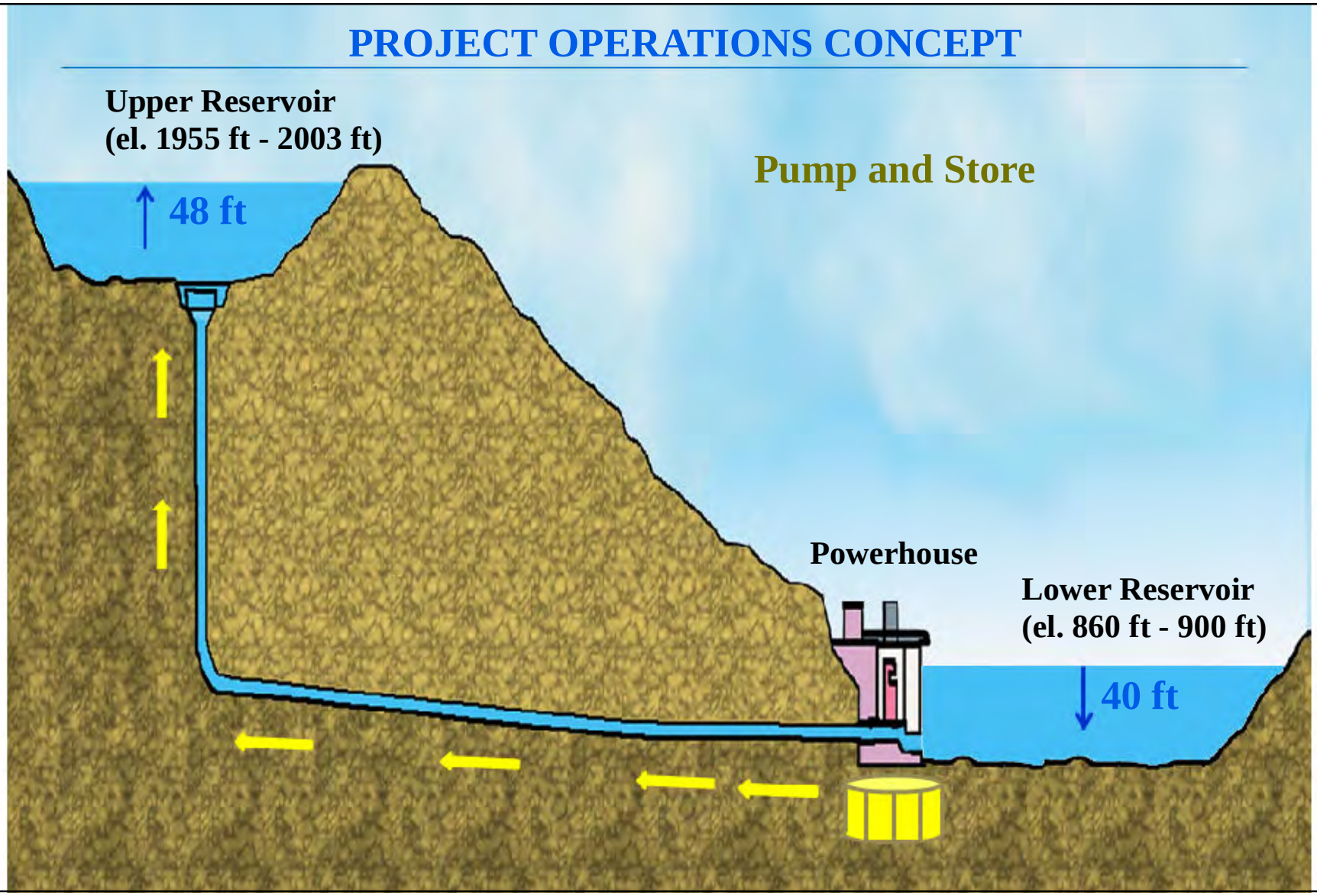

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Figure 2.3-1:
Project Operations - Pump & Store

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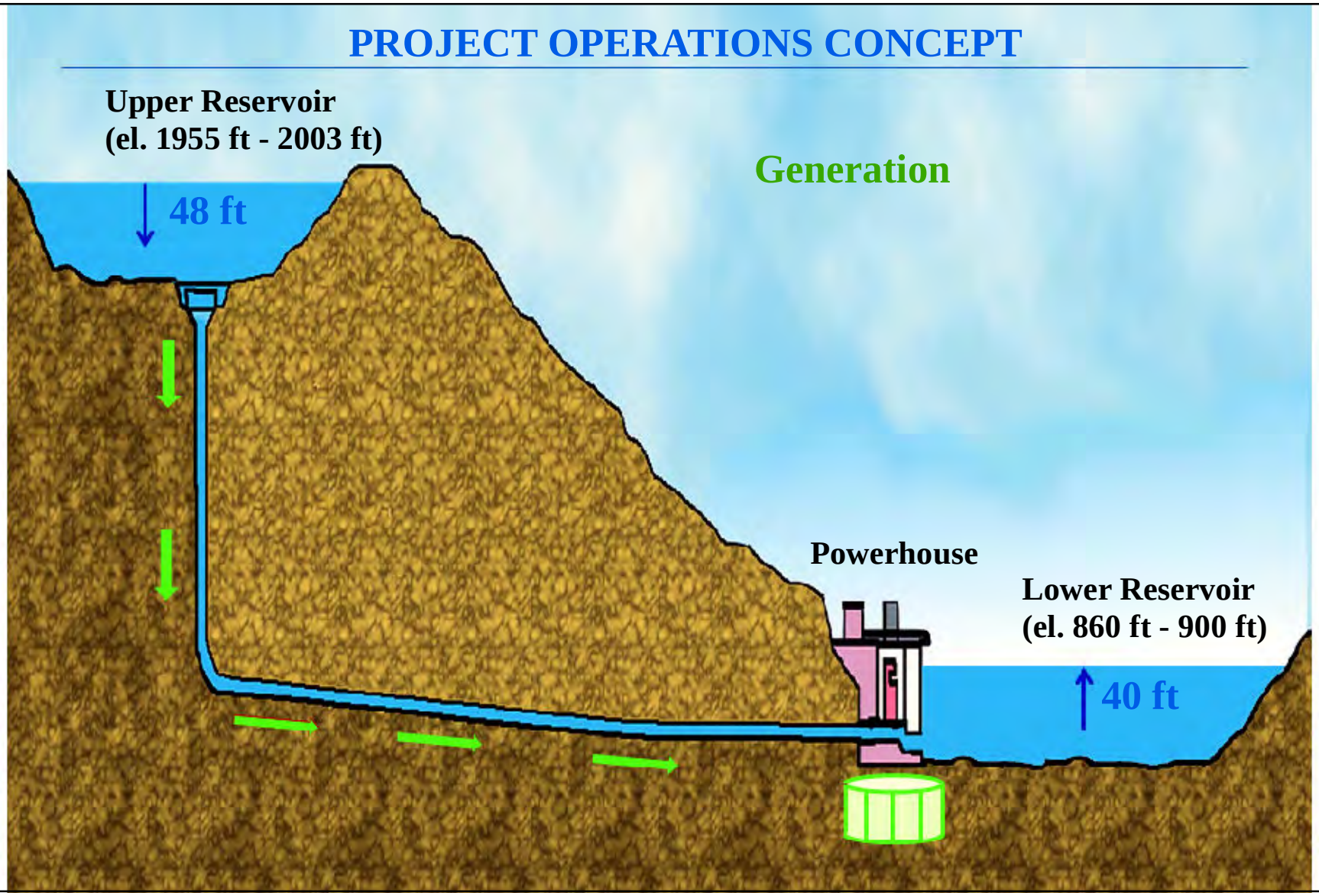

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Figure 2.3-2:
Project Operations - Generation

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The B-G Project is operated as a closed-cycle system because water is recycled between the two reservoirs during operation. No additional water is required on a continual basis, except for small amounts needed to replenish water depleted from the system by means of evaporation, minor seepage losses, or operating releases.

The Power Authority proposes to continue operating the project in the same manner as under the current license.

2.3.1 Operation during Adverse, Mean, and High Water Years

Inflow to the B-G Project includes spillage from the New York City Department of Environmental Protection's (NYCDEP's) Schoharie Reservoir through the Gilboa Dam approximately 5 miles upstream of the Lower Reservoir and runoff from about 40 square miles of the Schoharie watershed.

Discharges from the Lower Reservoir are typically made to equal Schoharie Creek inflow. Project inflow and outflow is monitored by Power Authority staff using four USGS gages described in Section 3.3. Between the low level outlet and Tainter gates, the Project has the ability to release water at the Lower Dam into Schoharie Creek.

The Operating Plan for Water Management as approved by the Federal Power Commission (FPC), FERC's predecessor agency, in 1975 states that the B-G Project be operated:

1. to prevent floods downstream from the Lower Reservoir Dam from being more severe than they would be without the Project;
2. to maintain low flows as nearly as practicable to what they would be without the Project; and
3. to keep fluctuations in downstream flow from being more severe than they be without the Project.

Flows less than 700 cfs are discharged through the low level outlet located on the east spillway abutment and are free-flowing into the air. The outlet has four low-level discharge valves of 4, 6, 8, and 10 inches for releasing 5 to 25 cfs, as well as two hydraulically operated, 36-in diameter, Howell-Bunger valves that can discharge a combined flow of 25 to 700 cfs.

For flows greater than 700 cfs, the three spillway Tainter gates are used. Power to the three Tainter gates is supplied via a 7.2-kilovolt (kV) buried feed extending from the B-G Project powerhouse. Six alternate backup power sources for the Tainter gates are available that have both electrical power and mechanical modes (see Exhibit A for more details).

In order to account for evaporative losses and low flows (or no flows) from Schoharie Reservoir, the Power Authority releases water from storage from the Upper Reservoir to result in flows comparable to those that would have occurred if the B-G Project had not been built. When the inflow is less than 10 cfs, the Power Authority will maintain a minimum discharge of 10 cfs by tapping into the storage. The minimum discharge will be reduced to 7 cfs when a certain volume has been depleted. The result is that the flows downstream of the project during low inflow periods are improved over what occurred during the period after Gilboa Dam was built and before the BG project was built.

When outflow from the Project's Lower Dam exceeds 8,000 cfs or when flow or precipitation gages indicate it may exceed 10,000 cfs, the Project personnel monitor inflows and upstream flow gages, reservoir water level gages, and Tainter gate openings more frequently (at least every 20 minutes) than is done during

normal operations. This information is used to calculate the Project inflow and to determine how much to open or close the Tainter gates. Small, frequent changes in gate and valve settings are more likely to minimize flow fluctuations and ensure that the outflow will more closely match inflow. When these high flow operations are in effect, Power Authority staff communicate with the Schoharie County Sheriff's Department every 30 minutes.

3 Resource Utilization (18 CFR Section 4.51(c)(2))

3.1 Dependable Capacity

The dependable capacity is defined as the load carrying ability of a power plant under adverse load and flow conditions. The dependable capacity is 1,160 MW, the contracted capacity for the Project with NYISO, which assumes a full upper reservoir.

3.2 Average Annual Energy Generation

Table 3-1 lists the annual gross generated and pumped megawatt hours at the B-G Project for the past 10 years.

Table 3-1: Annual Gross Generated and Pumped Megawatt Hours[1]

Year	Generation (MWh)	Pumping (MWh)
2014	377,111	519,363
2013	260,031	380,468
2012	233,194	325,618
2011	189,549	277,938
2010	310,164	445,006
2009	241,617	339,811
2008	578,890	843,977
2007	780,327	1,152,329
2006	747,513	1,131,815
2005	815,673	1,232,612
Average	**453,407**	**664,894**

Table 3-2 lists the average monthly gross generation and pumping at the B-G Project for the 10-year period from 2005 through 2014.

[1] One of the pump-turbine generating units was out of service from 2006 through 2010 as part of the 2006 Life Extension and Modernization (LEM) license amendment.

Table 3-2: Average Monthly Gross Generation (2005 – 2014)

Month	Generation (MWh)	Pumping (MWh)
January	52,526	77,279
February	37,176	54,253
March	29,656	43,925
April	28,323	43,740
May	36,345	52,925
June	43,292	62,926
July	53,202	78,194
August	48,220	67,529
September	35,811	45,447
October	14,257	25,269
November	33,951	51,678
December	40,649	61,728

3.3 Project Hydrology

Water is provided to the Lower Reservoir from the Mine Kill (flows from the west), the Platter Kill (flows from the east), and Schoharie Creek upstream of the B-G Project. Spillage from NYCDEP's Schoharie Reservoir (Gilboa Dam) approximately 5 miles upstream of the Lower Reservoir also provide water to the B-G Project. Under normal conditions, however, there is little or no spill from NYCDEP's Schoharie Reservoir. Inflow to the B-G Project during normal conditions stems from the 40 square miles of the Schoharie Creek watershed between the Gilboa Dam and the Lower Reservoir.

The U.S. Geological Survey (USGS) operates several streamflow gaging stations in the vicinity of the B-G Project. Four USGS gages monitor inflow and outflow to and from the Lower Reservoir. Releases from Gilboa Dam are monitored using USGS Gage No. 01350101 and since no minimum flow is required, flows recorded are a function of leakage and spillage.

The gages at Mine Kill (No. 01350140) and Platter Kill (No. 01350120) monitor inflow into the B-G Project's Lower Reservoir from the west and east, respectively. A fourth gage on Schoharie Creek at North Blenheim (No. 01350180), below the Lower Dam, measures outflow from the B-G Project. Table 3-3 lists the gages in the vicinity of the B-G Project and Figure 3.3-1 shows the location of the gages.

Table 3-3: USGS Gages in the Vicinity of the Project

No.	Name	Drainage Area	Comments
01350101	Schoharie Creek at Gilboa, NY	316 mi^2	0.4 mile downstream from Gilboa Dam (Schoharie Reservoir); entire flow (runoff from 316 square miles), except for periods of spill, is diverted from Schoharie Reservoir to supply water to New York City; discharge less than 10 cfs not determined at this station.
01350120	Platter Kill at Gilboa, NY	10.9 mi^2	0.3 mile upstream from mouth
01350140	Mine Kill near N. Blenheim, NY	16.2 mi^2	0.6 mile upstream from mouth
01350180	Schoharie Creek at N. Blenheim, NY	358 mi^2	Power Authority regulates flow from the Blenheim-Gilboa Pumped Storage Power Project immediately upstream from gage.

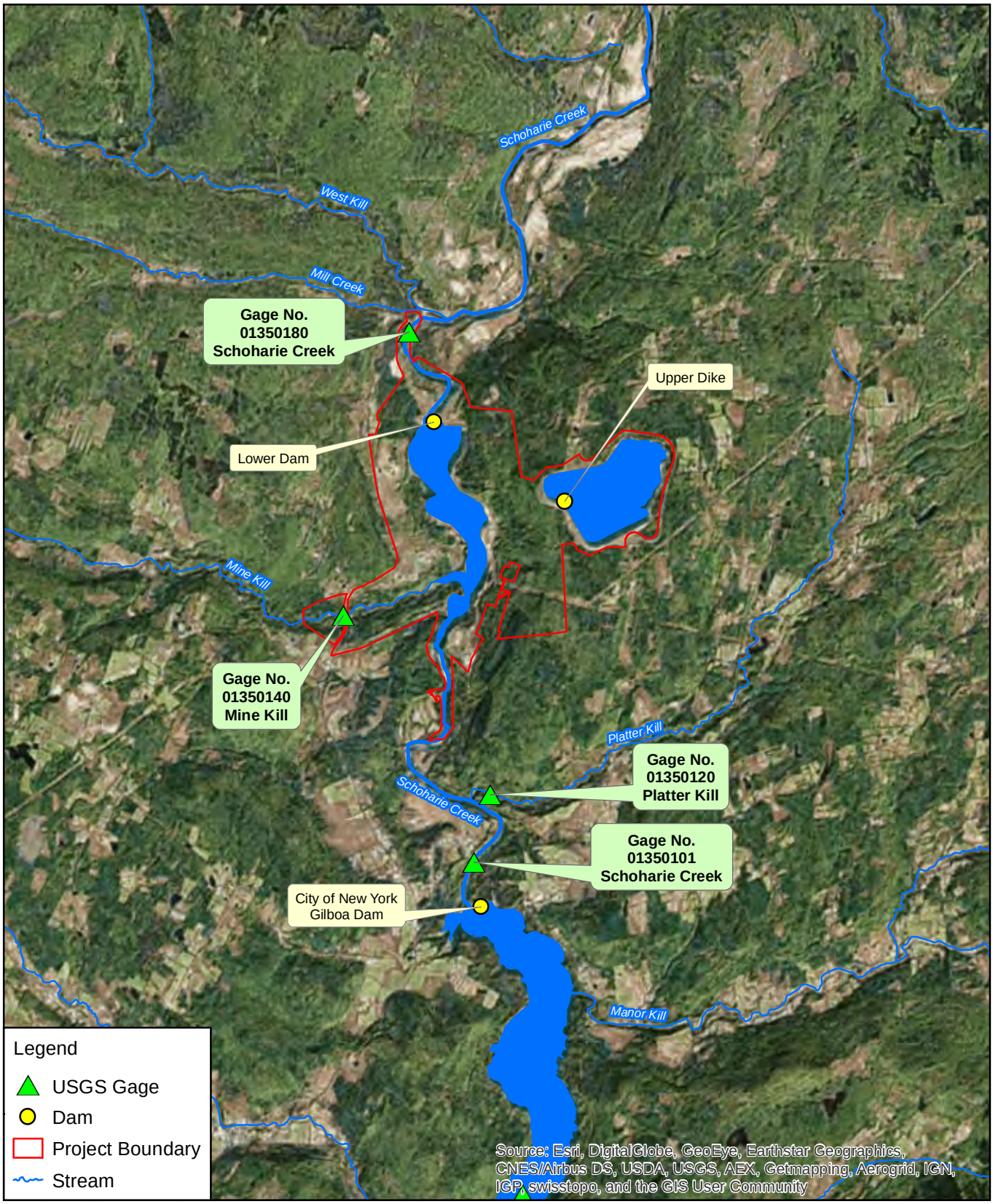

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Figure 3.3-1:
USGS Stream Gages
in the Vicinity
of the Project

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Table 3-4 lists monthly minimum, median, mean, and maximum flow statistics for water years 1971-2015 for USGS Gage No. 01350180 below the B-G Project's Lower Dam.[2] The lowest recorded daily flow below the Lower Dam for this period of record is less than 1 cfs and the highest recorded daily flow is 46,600 cfs.

Table 3-4: Monthly Flow Statistics below Lower Dam, Water Years 1971- 2015

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
min	3	7	8	9	5	<1	<1	<1	<1	<1	<1	2
max	29,900	8,200	18,000	21,600	9,700	15,700	4,490	46,600	15,500	14,800	11,700	11,500
mean	444	350	938	1,309	595	330	90	94	157	255	331	466
median	109	98	415	866	331	23	9	8	7	9	34	73

Source: USGS Gage No. 1350180 Schoharie Creek at North Blenheim

The mean annual regulated flow below the Lower Dam for this period of record is approximately 444 cfs. Average monthly mean flows are highest from December through May and lowest from June through November. Monthly and annual flow duration curves for water years 1971 through 2015 were calculated using mean daily flows from this gage (see Exhibit E).

3.4 Area Capacity Curve and Rule Curve

The normal operating range of Upper Reservoir is between El. 1955 and El. 2003 feet. At the normal maximum operating level of El. 2003 feet, the B-G Project's Upper Reservoir has a total storage capacity of 18,791 acre-feet and a useable storage capacity of 15,085 acre-feet with 3,706 acre-feet of dead storage below elevation 1,955 feet.

The Lower Reservoir operates between normal maximum and minimum levels of 900 ft and 860 ft, respectively. The Lower Reservoir has a total storage capacity of 16,167 acre-feet and a useable storage capacity of 12,422 acre-feet at El. 900 ft with 3,745 acre-feet of dead (i.e. unusable) storage below elevation 860 feet.

For a traditional hydroelectric project, a rule curve summarizes seasonal reservoir storage targets to meet reservoir objectives. In a pumped storage project, however, reservoir storages are dictated by pumping and generating operations, rather than seasonal targets. Therefore a rule curve is not applicable to a pumped storage project. Figures 3.4-1 and 3.4-2 are the area-capacity curves for the Upper Reservoir and Lower Reservoir, respectively.

[2] A water year is defined as the 12-month period from October 1 of any given year through September 30 of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the 12-month period ending on September 30th, 2015 is called water year 2015.

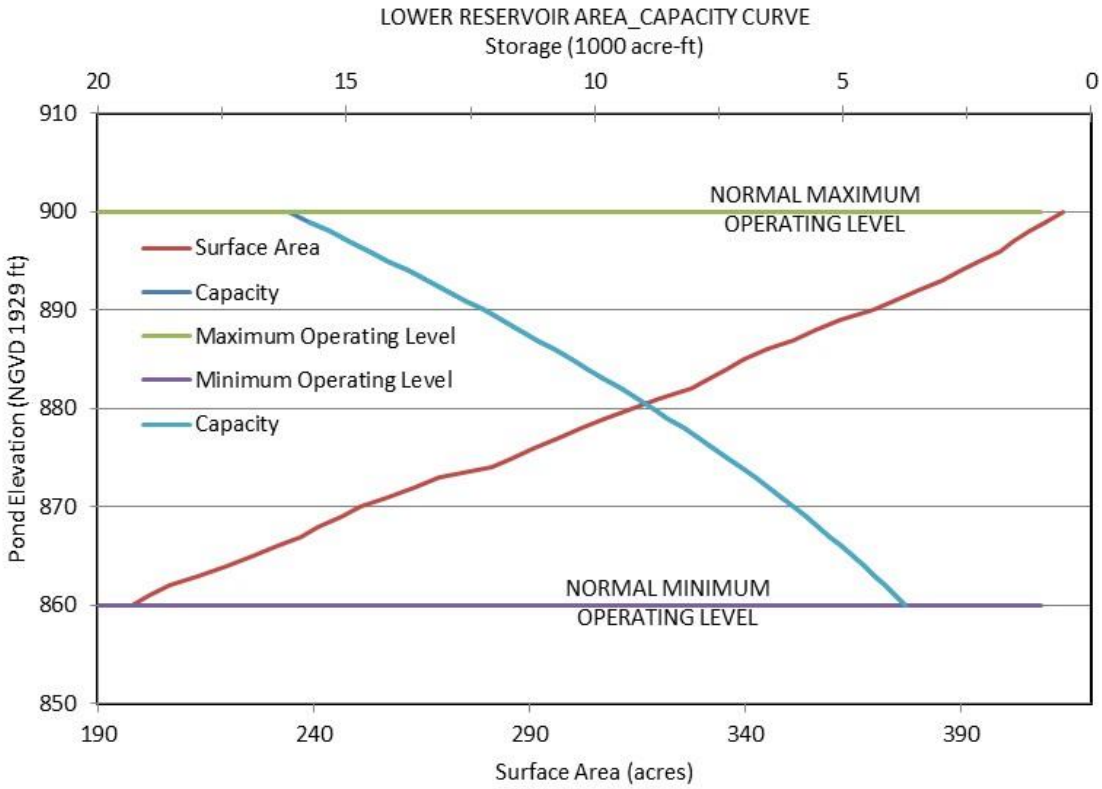

Figure 3.4-1: Upper Reservoir Area Capacity Curve

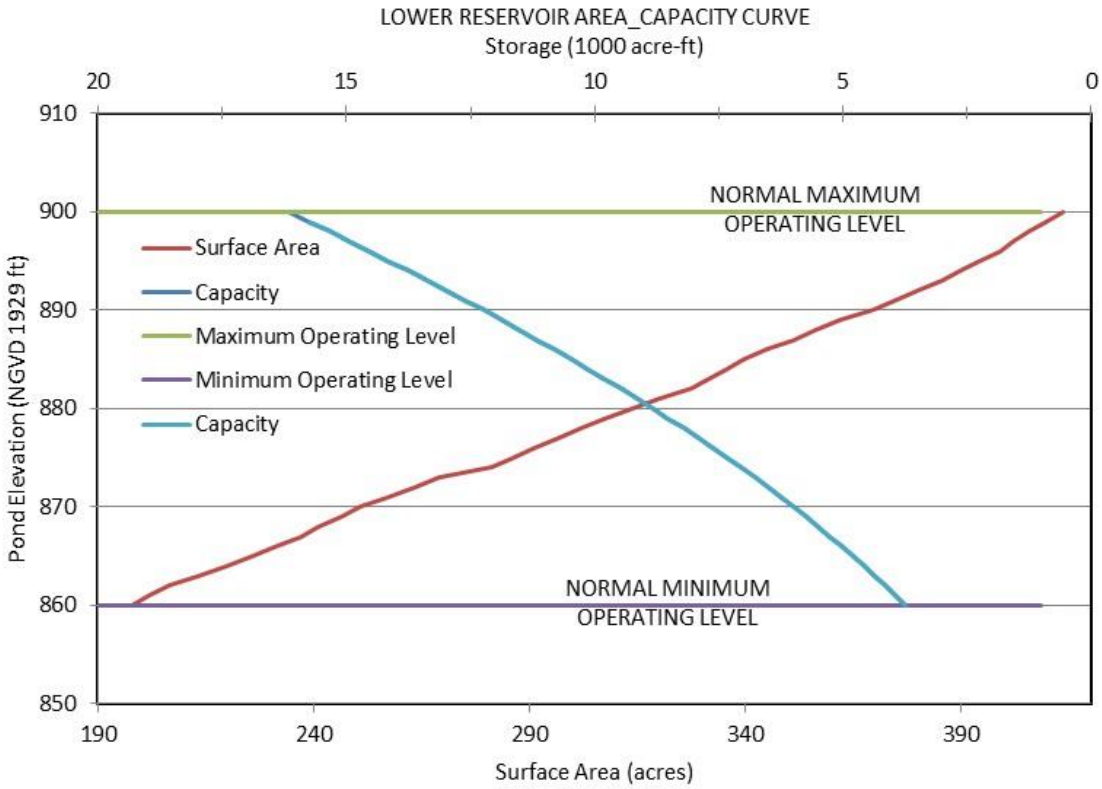

Figure 3.4-2: Lower Reservoir Area Capacity Curve

3.5 Hydraulic Capacity

The maximum pumping hydraulic capacity of each unit is 2,550 cfs. The total maximum pumping hydraulic capacity of all units is 10,200 cfs.

The maximum and minimum generating hydraulic capacity of each unit is 3,200 cfs and 1900 cfs respectively. The total maximum generating hydraulic capacity of all units is 12,800 cfs.

3.6 Tailwater Rating Curves

Tailwater rating curves are not applicable to the B-G Project because the pump turbines discharge water directly to either the Upper Reservoir or Lower Reservoir.

4 Utilization of Project Power (18 CFR Section 4.51(c)(3))

The primary purpose of the Project is to supply energy, capacity, regulation and other ancillary services to the New York Independent System Operator (NYISO), a regional transmission organization that coordinates the generation and transmission of wholesale electricity within the state of New York. The B-G Project plays an important role in New York's renewable energy portfolio because it provides low-cost energy and stores water for power production during periods of peak demand for energy. The B-G Project is typically operated to serve two purposes: to provide power at times of high consumer use, and to be available in a reserve mode to respond to an unanticipated loss of elements of the electric system. That is, if a generating plant suddenly and unexpectedly experiences an equipment failure and stops generating, the B-G Project is capable of starting up quickly and generating sufficient power to support the grid.

The B-G Project has "black start" capability, and is a cornerstone of the NYISO reliability plan for the grid, along with the St. Lawrence and Niagara Projects. When needed, "black start" capabilities allow the B-G Project to restart other Power Authority facilities and, eventually, the statewide energy grid. The B-G Project can generate power within several minutes when other facilities within the NYISO are shut down. The B-G Project also provides the ancillary services of regulation reserve and voltage support to the state power system.

The New York electric grid is expected to require greater flexibility in the future to operate reliably given the increasing variability and uncertainty associated with larger installations of wind and solar generation. Pumped storage facilities such as the B-G Project have the technical capabilities that closely match the power system's growing need for flexibility. The ability of pumped storage to accommodate a variable supply from renewable generators such as wind and solar, which generate intermittently depending upon when wind or sunshine is available, is another benefit. The B-G Project can be used effectively to serve some of the electricity storage needed to provide a consistent and reliable grid based increasingly on renewable sources.

Another significant contribution of the B-G Project is the ability to contribute to the more efficient use of the fossil-fueled and nuclear generation fleets. Traditional power plants such as coal-fired and nuclear plants operate more efficiently when they are maintained at a steady level of electrical output and are not subject to adjustments for constantly changing loads (i.e., cycling). Pumped storage facilities are capable of significant flexibility in operations, such that they can be used to increase load in the off-peak hours by drawing electricity for pumping water to the upper reservoir when thermal units might otherwise need to reduce generation or be shut off. Reducing the need for thermal plant cycling results in much more efficient operations, which lowers overall emissions from fuel consumption.

The B-G Project's capability to support grid flexibility in enabling intermittent resources combined with its contribution to greater operating efficiency of the New York power grid and the overall "greening" of the system provide significant value.

5 Plans for Future Development (18 CFR Section 4.51(c)(4))

In 2010, Power Authority completed the $135 million Life Extension and Modernization project where each of the four turbine generating units were increased from an original generating capacity of 250 MW to an upgraded generating capacity of 290 MW each. The Power Authority has no additional plans to construct new facilities or to alter operations of the B-G Project. The Power Authority seeks authorization to continue operating the B-G Project in its current configuration and as it is currently licensed to operate.