Attachment B

Minimum Stream Flow Operational Plan

("MSFOP")

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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NUMBER 405

MINIMUM STREAM FLOW OPERATION PLAN

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Constellation.

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March 2022

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LIST OF ABBREVIATIONS

cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
Constellation	Constellation Energy Generation, LLC (formerly known as Exelon Generation Company, LLC)
CRO	control room operator
DCS	Distributed Control System
EFL	East Fish Lift
FERC	Federal Energy Regulatory Commission
FWS	United States Fish and Wildlife Service
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MW	megawatt
NGVD 29	National Geodetic Vertical Datum of 1929
PADEP	Pennsylvania Department of Environmental Protection
PFBC	Pennsylvania Fish and Boat Commission
PJM	Pennsylvania Jersey Maryland Interconnection
Port Ops	Constellation's Portfolio Operations Group
Project	Conowingo Hydroelectric Project
RM	River Mile
RTO	regional transmission organization
SRBC	Susquehanna River Basin Commission
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey

1 INTRODUCTION

The Conowingo Hydroelectric Project (Project) is a 570.15 megawatt (MW) hydroelectric project located at the Conowingo Dam on the Susquehanna River in Harford and Cecil counties, Maryland. The Project is owned and operated by Constellation Energy Generation, LLC (formerly known as Exelon Generation Company, LLC (Constellation)).

A new Federal Energy Regulatory Commission (FERC or Commission) license for the Project was issued on March 19, 2021, with a term of 50 years and an effective date of March 1, 2021 (FERC, 2019). Under Article 408 of the new FERC License, Constellation is required to develop a Minimum Stream Flow Operation Plan.

Specifically, Article 408 of the License states:

> *Within one year of license issuance, the licensee must file with the Commission for approval, a minimum stream flow operation plan that describes how the licensee will document compliance with the minimum flow releases required by this license, to be initiated beginning 4 years from the date of license issuance. The plan must include the following:*
>
> *a) A detailed description of how the project will comply with the minimum flow, ramping rate, and maximum flow requirements of the license as well as Conowingo reservoir level restrictions specified in Article 406, including procedures for sequencing turbine start-up and operation for seasonal and daily operation;*
>
> *b) A description of the mechanisms and structures (i.e., type and exact locations of all flow and reservoir elevation monitoring equipment and gates) to be used for maintaining compliance with operational requirements, and procedures for maintaining and calibrating monitoring equipment;*
>
> *c) Standard operating procedures to be implemented during routine maintenance, including a schedule of routine maintenance, and procedures to be implemented during conditions outside of normal operation, including during emergency conditions such as unscheduled facility shutdowns and maintenance;*
>
> *d) A provision to file with the Commission, after consultation with MDE, a minimum flow and operation compliance report by March 1, annually, detailing implementation of the plan, including any deviations in minimum flows (planned and unplanned deviations, including those authorized pursuant to paragraphs c-f of Article 407) ramping rates, maximum flows, and pond levels that occurred during the previous calendar year; and*
>
> *e) An implementation schedule.*
>
> *The plan must be developed after consultation with MDE. The licensee must include with the plan documentation of consultation, copies of recommendations on the completed plan after it has been prepared and provided to MDE, and specific descriptions of how MDE's comments are accommodated by the plan. The licensee must provide a minimum of 30 days for MDE to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a*

> *recommendation, the filing must include the licensee's reasons, based on project-specific information.*
>
> *The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.*

This plan addresses near-term filing requirements to comply with the minimum flow, ramping rate, and maximum flow requirements of the license as well as Conowingo reservoir level restrictions specified in Articles 406 and 407. Per Article 409 of the License, Constellation is also currently conducting a study, in consultation with MDE, regarding the feasibility of redesigning, installing, and maintaining best available real-time flow telemetry at the USGS flow gage in the Project tailrace. This tailrace gage feasibility study is interrelated with many of the monitoring provisions contained in this plan, particularly as it relates to methods to monitor minimum flow releases and ramping rates at the Project. Given this, Constellation will review this plan at the conclusion of the tailrace gage feasibility study (March 2023) and update this plan as needed to reflect any proposed changes to the operation compliance monitoring program that result.

2 PROJECT DESCRIPTION

2.1 Susquehanna River Basin

The Project is located at River Mile (RM) 10 on the Susquehanna River. The Susquehanna River is the largest tributary to the Chesapeake Bay at approximately 444 miles long. It begins near Cooperstown, New York at Otsego Lake and flows into the Chesapeake Bay at Havre de Grace, Maryland. The Susquehanna River basin, which drains approximately 27,510 square miles in New York, Pennsylvania, and Maryland, encompasses 43% of the Chesapeake Bay's drainage area and provides approximately 50% of the total freshwater inflow to the bay. Major tributaries of the Susquehanna River include the Juniata River, Conodoguinet Creek, Conewago Creek, the Conestoga River, and Swatara Creek. The Susquehanna River becomes tidally influenced approximately 3.5 miles downstream of Conowingo Dam.

There are five hydroelectric projects on the lower Susquehanna River. The most upstream of these projects is the York Haven Hydroelectric Project (FERC Project No. 1888) at RM 55, followed by the Safe Harbor Hydroelectric Project (FERC Project No. 1025) at RM 33, the Holtwood Hydroelectric Project (FERC Project No. 1881) at RM 25, and the Muddy Run Pumped Storage Project (FERC Project No. 2355) at RM 22. The Conowingo Hydroelectric Project is the most downstream project.

2.2 Project Works

Conowingo Dam is a concrete gravity structure with a maximum height of approximately 94 feet and a total length of 4,648 feet. The dam consists of four distinct sections from east to west: (1) a 1,190-foot-long non-overflow gravity section with an elevation of 115.7 feet (east abutment); (2) an ogee shaped spillway, the major portion of which is 2,250 feet long, and the minor portion of which is 135 feet long; (3) an intake-powerhouse section which is 946 feet long; and (4) a 127-foot-long non-overflow gravity section (west abutment). The tailrace and spillway sections of the dam are separated by a dividing wall extending 300 feet downstream of the powerhouse. The dam and powerhouse support US Highway Route No. 1, which passes over the top of the Conowingo Dam. Flow over the spillway section is controlled by 50 Stoney-type crest gates and two regulating gates.

The Project has eleven (11) turbine-generator units and two (2) house (station service) units. Seven turbine-generator units (Units 1 through 7) and the two (2) house units are completely enclosed within the powerhouse, while the other four turbine-generator units (Units 8 through 11) are outside the powerhouse. Units 1 through 7 are Francis-type single runner hydraulic turbines and Units 8 through 11 are mixed-flow Kaplan-type hydraulic turbines. Table 2.2-1 includes a summary of turbine characteristics at the Project including rated head/capacity and hydraulic capacity in cubic feet per second (cfs).

2.3 Impoundment

Conowingo Dam impounds Conowingo Pond, an approximately 8,500-acre, 14-mile-long reservoir. Conowingo Pond has a gross storage capacity of 310,000 acre-feet at the normal full pool elevation of 109.2 feet National Geodetic Vertical Datum of 1929 (NGVD 29). The Project is operated as a peaking facility that uses reservoir storage to generate during periods of high electricity demand. Article 406 of the FERC License requires Constellation to maintain elevations between 101.2 feet NGVD 29 and 110.2 feet NGVD 29, with a minimum elevation of 107.2 feet NGVD 29 on weekends between Memorial Day and Labor Day, to meet recreational needs.

Table 2.2-1: Summary of Turbine Characteristics

Unit	Type	Rated Head (feet)	Rated Capacity (MW)	Max. Hydraulic Capacity (cfs)	Min. Hydraulic Capacity (cfs)
1	Francis	89	45.0	6,749	4,200
2	Francis	89	40.5	6,320	2,000
3	Francis	89	47.7	6,749	4,200
4	Francis	89	47.7	6,749	4,200
5	Francis	89	36.0	6,320	2,000
6	Francis	89	47.7	6,749	4,200
7	Francis	89	47.7	6,749	4,200
8	Mixed-Flow Kaplan	86	63.75	9,352	7,500
9	Mixed-Flow Kaplan	86	63.75	9,727	7,800
10	Mixed-Flow Kaplan	86	63.75	9,727	7,800
11	Mixed-Flow Kaplan	86	63.75	9,727	7,800
House #1	Francis	89	1.425	247	210
House #2	Francis	89	1.425	247	210

3 OPERATING REQUIREMENTS UNDER NEW LICENSE

The following articles describe the flow management conditions required by the FERC license.

Article 406 of the License states (FERC, 2019):

> *Upon license issuance, the licensee must operate the project with a normal range of operation for Conowingo Pond between elevations 101.2 feet National Geodetic Vertical Datum of 1929 (NGVD 29) and 110.2 feet NGVD 29, with a minimum elevation of 107.2 feet NGVD 29 on weekends between Memorial Day and Labor Day, to meet recreational needs.*
>
> *Conowingo Pond level may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods upon mutual agreement among the licensee, the Pennsylvania Department of Environmental Protection (Pennsylvania DEP), and the Maryland Department of the Environment (MDE). If pond levels are so modified, the licensee must notify the Commission, in writing, as soon as possible, but no later than 14 days after each such incident. In addition, the licensee must implement the following requirements with regard to planned and unplanned (emergency) changes in water surface elevation requirements of this article.*
>
> *Planned Deviations:*
>
> *Impoundment elevations may be temporarily modified if required by operating emergencies beyond the control of the licensee, or for short periods, up to three weeks, after mutual agreement among the licensee, Pennsylvania DEP, and the MDE. The licensee must file a report with the Commission as soon as possible, but no later than 14 calendar days after the onset of the planned deviation. Each report must include: (1) the reasons for the deviation and whether operations were modified; (2) the duration and magnitude of the deviation; (3) any environmental effects; and (4) documentation of consultation with Pennsylvania DEP and MDE. For planned deviations exceeding three weeks, the licensee must file an application for a temporary amendment of lake levels and receive Commission approval prior to implementation.*
>
> *Unplanned Deviation, more than three hours or resulting in environmental effects:*
>
> *If the licensee deviates from the impoundment elevation requirements, the licensee must file a report of each incident with the Commission. For any deviation that lasts longer than three hours or results in environmental effects, the licensee must file a report as soon as possible, but no later than 14 calendar days after each such incident. The report must include: (1) the cause of the event; (2) the duration and magnitude of the deviation; (3) any pertinent operational and/or monitoring data; (4) a timeline of the incident and the license's response; (5) any comments or correspondence received from Pennsylvania DEP and MDE, or confirmation that no comments were received from the consulted agencies; (6) documentation of any observed environmental effects; and (7) a description of measures implemented to prevent similar deviations in the future.*
>
> *Unplanned Deviations lasting three hours or less with no environmental effects:*
>
> *For deviations lasting three hours or less that do not result in environment effects, the licensee must file an annual report with the Commission, by March 1 of the year*

following the reporting year, describing each incident up to one month prior to the reporting date, including: (1) the cause of the event; (2) the duration and magnitude of the deviation; (3) any pertinent operational and/or monitoring data; (4) a timeline of the incident and the license's response; (5) any comments or correspondence received from Pennsylvania DEP and MDE, or confirmation that no comments were received from the listed agencies; and (6) a description of measures implemented to prevent similar deviations in the future.

Article 407 of the License states (FERC, 2019):

Upon license issuance, the licensee must operate the project in accordance with the following operational flow regime:

Date	***Minimum Flow***
September 15 – March 31	*3,500 cfs or natural inflow, whichever is less*
April 1 – 30	*10,000 cfs or natural inflow, whichever is less*
May 1 – June 15	*7,500 cfs or natural inflow, whichever is less*
June 16 – September 14	*5,000 cfs or natural inflow, whichever is less*

Beginning four years from the date of issuance of this license, the licensee must provide minimum flow and maximum flow releases and ramping rate limitations as described below:

Date	***Minimum Flow***	***Down-ramping Rate***	***Up-ramping Rate***	***Maximum Flow***
January 1–31	*4,000 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs*	*None*	*None*
February 1–28	*4,000 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs*	*None*	*None*
March 1–15	*13,100 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs*	*Up to 40,000 cfs/hour*	*None*
March 16–31	*18,200 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*Up to 40,000 cfs/hour*	*None*
April 1–30	*18,200 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*Up to 40,000 cfs/hour*	*None*
May 1–31	*18,200 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*Up to 40,000 cfs/hour*	*75,000 cfs*
June 1–15	*10,000 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*Up to 40,000 cfs/hour*	*75,000 cfs*

Date	*Minimum Flow*	*Down-ramping Rate*	*Up-ramping Rate*	*Maximum Flow*
June 16–30	*7,500 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*Up to 40,000 cfs/hour*	*75,000 cfs*
July 1–31	*5,500 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*Up to 40,000 cfs/hour*	*79,000 cfs*
August 1–31	*4,000 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*Up to 40,000 cfs/hour*	*79,000 cfs*
September 1–30	*4,000 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*Up to 40,000 cfs/hour*	*79,000 cfs*
October 1–31	*4,000 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*Up to 40,000 cfs/hour*	*None*
November 1–30	*4,000 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*None*	*None*
December 1–31	*4,000 cfs or natural inflow, whichever is less*	*Up to 12,000 cfs/hour if Conowingo discharge is less than 30,000 cfs.*	*None*	*None*

a) Natural inflow must be measured at the Marietta U.S. Geological Survey gage (No. 01576000).

b) Maximum flow restrictions must only apply when the natural flow is less than 86,000 cfs.

c) If compliance with the prescribed flows would cause the licensee to violate or breach any law, any applicable license, permit, approval, consent, exemption or authorization from a federal, state, or local governmental authority, including the Nuclear Regulatory Commission license for the Peach Bottom Atomic Power Station, the license for the Muddy Run Pumped Storage Project No. 2355 (Muddy Run Project), any agreement with the City of Baltimore or other governmental entity, or any tariff or other requirement of the PJM Interconnection Regional Transmission Organization or their assigns, the licensee may deviate from the prescribed flows to the least degree necessary in order to avoid such violation or breach.

d) If compliance with the prescribed flows would cause the licensee to violate any agreement in effect as of September 1, 2019, with the Chester Water Authority, Old Dominion Electric Cooperative, or the York Energy Center, the licensee may deviate from the prescribed flows to the least degree necessary in order to avoid such violation or breach.

e) If compliance with the prescribed flows would cause or exacerbate flooding or a similar public safety hazard, the licensee may deviate from the prescribed flows to the least degree necessary in order to avoid such flooding or public safety hazard.

f) Not including the authorized deviations in sections (c), (d), and (e) of this license article, the licensee shall have the flexibility to deviate from the up-ramping, down-ramping and maximum flow restrictions according to the following limits during each month:

- *January, February: 8 total permitted hours of deviation per month;*
- *March, April, May, and that portion of June during which the East Fish Lift (EFL) is in operation: no deviations allowed;*
- *June after EFL operation has ceased: 8 total permitted hours of deviation per month of which no more than 50% will be allocated to down-ramping and up-ramping;*
- *July, August: 26 total permitted hours of deviation per month of which no more than 50% will be allocated to down-ramping and up-ramping;*
- *September: 32 total permitted hours of deviation per month of which no more than 50% will be allocated to down-ramping and up-ramping;*
- *October: 14 total permitted hours of deviation per month; and*
- *November, December: 8 total permitted hours of deviation per month.*

When the licensee deviates from the down-ramping or up-ramping restrictions of the operational flow regime, the amount of time applied against the limits set forth above is two hours per event, regardless of the actual amount of time it takes the licensee to complete the down-ramping or up-ramping event. Minimum flow releases may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods upon mutual agreement among the licensee and the Maryland Department of the Environment. The licensee must maintain complete and accurate records of all deviations that occur pursuant to this section.

<u>Unplanned Deviations</u>

For unplanned deviations, the licensee must file a report with the Commission as soon as possible, but no later than 14 days after the onset of the incident. Each report must describe the incident, including: (1) the cause, (2) the duration and magnitude,(3) any pertinent operational and/or monitoring data, (4) a timeline of the incident and the licensee's response, (5) any environmental effects, (6) documentation that MDE and FWS were notified and any comments received, or, affirmation that no comments were received, and (7) any measures to be implemented to prevent similar incidents in the future.

4 OPERATIONS MONITORING PLAN

Conowingo Station is managed according to a set of operating guidelines, which are maintained and periodically updated by Constellation. The operating guidelines include extensive, and sensitive, details regarding communication protocols, responsibilities, action levels, unit operations, and gate operations. The management of pond levels, downstream discharge, emergency conditions (including unit trips and ice jams), and maintenance activities are all covered by these operating guidelines. The following sections summarize the items covered by the operating guidelines.

4.1 Operations Management Overview

The Project will operate in a peaking mode, as scheduled through coordination between PJM Interconnection, LLC (PJM)[1] and Constellation's Portfolio Operations Group (Port Ops)[2] considering river flows, peak demand hours, Muddy Run Pumped Storage Project operations, and other parameters. Schedules are typically issued daily before 10 AM with a four-day outlook. However, the schedules are revised multiple times throughout the day to accommodate changing river and market conditions. The schedule consists of a generation setpoint for the Project and is manually dispatched by phone call from Port Ops to the control room operator (CRO) at the Project. The CRO determines how many units to put into or remove from service to match the generation setpoint, ensuring that all impoundment level, downstream flow, and any other requirements will be met as part of the change. If the CRO identifies an issue with meeting any requirements[3], the CRO and Port Ops will coordinate to resolve the issue. Once all issues are resolved, the CRO fills out a sheet documenting the current and proposed unit settings and gets approval from the control room shift manager prior to making any changes to the number of units started or stopped. The CRO then manually starts or stops the required units to meet the generation setpoint, ensuring that all required public safety measures (e.g., sirens, beacons, visually verifying tailrace conditions) are followed. During normal operations, the units are in Gate Control mode with a wicket gate setpoint of 80%. However, the CRO may select a different wicket gate setpoint if needed to meet minimum flow requirements, increase flow due to imminent spill conditions, address mechanical issues with a unit, or resolve other situations. Throughout unit operation, the CRO monitors water levels, flows, and other metrics to ensure compliance with all Project requirements.

Under normal operations, the Project first utilizes four of the small units (Units 1 through 7), then the four large units (Units 8 through 11), before using the remaining three small units (Units 1 through 7). During high flow conditions, crest gates are utilized once all units are operating to pass flow downstream for the purpose of water level management. These gates cannot be throttled and are thus either opened or closed. There is no set order for the use of crest gates, as the order is rotated to ensure continued operability of all gates. PJM, Port Ops, and the Project are staffed 24 hours a day, 7 days a week to ensure operational changes deviate from License requirements to the least degree necessary due to emergency conditions, including unscheduled facility shutdowns and maintenance.

[1] PJM is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia.
[2] Port Ops is the group within Constellation that markets and sells power.
[3] PJM and Port Ops are expected to create schedules that comply with all FERC License requirements, but it is ultimately the responsibility of the CRO to ensure compliance.

4.2 Operations Monitoring Equipment and Methods

A Distributed Control System (DCS) is used by the CRO to monitor and adjust Project operations. The DCS monitors instantaneous headwater and tailwater levels, generation for each unit, regulating and crest gate openings, wicket gate setting, unit and gate discharge, and other ancillary Project operating data. Data is not archived on a set interval, but rather a new archive value is recorded for a given parameter when the difference between the current archive value the current actual value meets or exceeds a pre-defined percent change in magnitude[4]. When the DCS generates a report at a specified interval, the reported values are linearly interpolated between the archived data points.

Impoundment water levels are monitored by two separate pressure sensors located in a single stilling well on the headworks near Unit 1. The average reading from these two sensors is recorded as the headwater level for the Project. Tailrace water levels are monitored by two separate pressure sensors in stilling wells near Unit 1 and Unit 8[5]. The average reading from these two sensors is recorded as the tailwater level for the Project. The difference between the headwater and tailwater levels is recorded as the net head for the Project. Each unit is equipped with a MW transducer to monitor its generation output.

Flow through each unit, including the House Units, is computed by the DCS using the net head and that unit's current generation output as inputs to a polynomial equation based on the turbine performance curves for that unit. Tables of flow through each unit for a given net head and MW output are provided in Appendix A. The CRO manually sets the regulating and crest gates as either opened or closed in the DCS, once station personnel have reported a gate change. The flow through each open gate is computed by the DCS based on the impoundment water level and a discharge rating curve. Gate discharge rating curves are provided in Appendix A. Total Project discharge is then calculated by adding flow from all units and gates[6].

4.3 Operations Monitoring Compliance

4.3.1 Impoundments Levels

Constellation will utilize the pressure sensors located on the headworks and described in Section 4.2 to monitor and record real-time impoundment levels, which will be recorded electronically by the DCS system and archived and output at a 15-minute time interval for Constellation's record of compliance with the requirements of the FERC license.

4.3.2 Minimum and Maximum Flows

Minimum and maximum flow requirements vary depending on the natural inflow, which is to be measured at the Marietta USGS gage (Gage No. 01576000). Constellation will monitor the natural inflow and generation at the Project continuously via the DCS. Turbine outflow will be calculated automatically from the generation output readings (MW) and the net head (difference between impoundment and tailrace water level transducer readings) as described in Section 4.2 and using the turbine performance curves for each unit (Appendix A). Flow through the other Project components including over the spillway will be determined by reading and recording gate settings and pond level and calculating flow based on the engineering curves for each component (Appendix A). The calculated turbine and spillway outflows will

[4] The percent change applied to the headwater gages equates to approximately 0.46 feet, while the percent change applied to the generating units varies between approximately 70 cfs and 110 cfs, depending on the unit.
[5] The sensor near Unit 8 shares a stilling well with the United States Geological Survey (USGS) pressure sensor associated with Gage Number 01578310 (Susquehanna River at Conowingo, MD).
[6] The DCS does not currently track flows through Regulating Gate 1, as this gate is throttled (i.e., not just open or closed) to supply controlled flows for East Fish Lift (EFL) operations.

be recorded electronically by the DCS system and archived and output at a 15-minute time interval for Constellation's record of compliance with the minimum and maximum flow requirements of the FERC license.

4.3.3 Ramping Rates

Compliance with up and down ramping requirements will be monitored continuously via the DCS using the turbine outflow calculations as described Section 4.3.2. The calculated turbine outflows will be recorded electronically by the DCS system and archived and output at a 15-minute time interval to determine Constellation's record of compliance with the up and down ramping requirements of the FERC license.

4.4 Procedures for Monitoring Equipment Maintenance and Calibration

During each quarter of the year, the headwater and tailwater pressure sensor readings are compared against a visual reading of the staff gage located in the Project's forebay and tailrace, and, if necessary, these water level recorders are calibrated. During each unit outage, the wicket gate position transmitters and MW transducers are inspected, and, if necessary, these measurement devices are calibrated. As previously stated, there is no set order for the use of crest gates, as the order is rotated to ensure continued operability of all gates. All crest and regulating gates are operated annually.

4.5 Routine Maintenance

Periodic turbine shutdowns will occur as necessary to perform maintenance activities. Under these circumstances, Constellation will maintain the impoundment levels, minimum flows, maximum flows, and ramping rates as described in Section 4.3 through the remaining operable turbine units and/or over the spillway as available or appropriate, in accordance with the operating guidelines.

During planned maintenance activities or other conditions where temporary changes to the required impoundment levels, minimum and maximum flows, or ramping rates are necessary, Constellation will consult with the Susquehanna River Basin Commission (SRBC), Maryland Department of Environment (MDE), Maryland Department of Natural Resources (MDNR), Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Fish and Boat Commission (PFBC), and U.S. Fish and Wildlife Service (USFWS).

4.6 Unscheduled Facility Shutdowns and Maintenance

The minimum and maximum flows as well as ramping rates can be maintained by several different combinations of the seven small units (Units 1 through 7), or the four large units (Units 8 through 11). The generating unit(s) may occasionally trip unexpectedly (i.e., line fault, equipment failure, etc.). Under these circumstances, Constellation will maintain the impoundment levels, minimum and maximum flows, and ramping rates through the remaining unit(s) or over the spillway as available or appropriate, in accordance with the operating guidelines.

5 REPORTING AND NOTIFICATION OF DEVIATIONS

The procedures, outlined in Section 4.0 of this document, are designed to allow the Project to operate such that it would not deviate from the water level and flow constraints described in the Project's FERC License Articles 406 and 407, respectively. However, these articles allow for different authorized deviations in water level and flow requirements, as well as limited discretionary deviations in flow requirements. Alarms are programmed in the DCS to notify the CRO should a deviation occur. The CRO will be responsible for maintaining a log of all deviations. The CRO will first categorize the deviation, as this will determine the reporting requirements associated with the deviation. Table 5-1 outlines the deviation types and associated required report type(s), while Table 5-2 outlines the minimum data log requirements for each deviation type.

5.1.1 Operation Compliance Annual Report

Annual reports will be drafted by January 15th following each calendar year of operation describing all deviation events occurring the previous calendar year. These drafts will be provided to MDE for a 30-day consultation period, after which the reports will be finalized and filed with the Commission by March 1st.

5.1.2 Operation Compliance Event Reports

Planned Deviations:

As required by Article 406 of the License, Constellation will consult with PADEP and the MDE in advance of a planned deviation from impoundment elevation requirements due to operating emergencies beyond the control of the licensee, or for short periods, up to three weeks. After concurrence from these resource agencies, Constellation will file a report with the Commission as soon as possible, but no later than 14 calendar days after the onset of the planned deviation. Each report must include: (1) the reasons for the deviation and whether operations were modified; (2) the duration and magnitude of the deviation; (3) any environmental effects; and (4) documentation of consultation with Pennsylvania DEP and MDE. For planned deviations exceeding three weeks, the licensee must file an application for a temporary amendment of lake levels and receive Commission approval prior to implementation.

Unplanned Deviations:

As required by Article 406 of the License, for any unplanned deviation from impoundment level requirements that lasts longer than 3 hours or results in visible environmental effects, Constellation will notify FERC as soon as possible, but no later than 14 days of any such deviations from impoundment elevation requirements. The report will contain, to the extent possible, (1) the cause of the event; (2) the duration and magnitude of the deviation; (3) any pertinent operational and/or monitoring data; (4) a timeline of the incident and the license's response; (5) any comments or correspondence received from PADEP and MDE, or confirmation that no comments were received from the consulted agencies; (6) documentation of any observed environmental effects; and (7) a description of measures implemented to prevent similar deviations in the future.

As required by Article 406 of the License, for unplanned deviations lasting 3 hours or less that do not result in visible environmental effects, Constellation will file an annual report to the Commission, by March 1, describing each incident up to one month prior to the reporting date, including: (1) the cause of the event; (2) the duration and magnitude of the deviation; (3) any pertinent operational and/or monitoring data; (4) a timeline of the incident and the license's response; (5) any comments or correspondence received from

Pennsylvania DEP and MDE, or confirmation that no comments were received from the listed agencies; and (6) a description of measures implemented to prevent similar deviations in the future.

As required by Article 407 of the License, for unplanned deviations from minimum flows, Constellation will file a report with the Commission as soon as possible, but no later than 14 days after the onset of the incident. Each report must describe the incident, including: (1) the cause, (2) the duration and magnitude,(3) any pertinent operational and/or monitoring data, (4) a timeline of the incident and the licensee's response, (5) any environmental effects, (6) documentation that MDE and USFWS were notified and any comments received, or, affirmation that no comments were received, and (7) any measures to be implemented to prevent similar incidents in the future.

Table 5-1: Summary of Deviation and Report Types

Deviation Type	Deviation Description	Reporting Type	
		Event Report	Annual Report
406-A	Planned Deviations pursuant to Article 406	X	X
406-B	Unplanned Deviations lasting more than three hours or resulting in environmental effects pursuant to Article 406	X	X
406-C	Unplanned Deviations lasting less than three hours with no environmental effects pursuant to Article 406		X
407-A	Unplanned Deviations pursuant to Article 407 sections (c), (d), and (e)	X	X
407-B	Planned Deviations pursuant to Article 407 section (f)		X

Table 5-2: Summary of Minimum Data Log Requirements

Deviation Reporting Information	Deviation Type				
	406-A	406-B	406-C	407-A	407-B
Cause	X	X	X	X	
Duration	X	X	X	X	X[4]
Magnitude	X	X	X	X	X
Environmental Effects	X	X		X	
Agency Correspondence	X[1]	X[2]	X[2]	X[3]	X[5]
Pertinent Operational/Monitoring Data		X	X	X	X
Timeline and Response		X	X	X	
Changes to Prevent Future Deviations		X	X	X	

Notes:
1. Pennsylvania DEP and MDE approval required in advance of implementing all planned water level deviations. FERC approval must be obtained prior to implementing water level deviations planned to last longer than three weeks.
2. Comments/correspondence, or confirmation that no comments were received, from Pennsylvania DEP and MDE must be included.
3. Documentation of MDE and FWS notification and either comments received or affirmation that no comments were received must be included.
4. The duration applied to deviations from down-ramping and up-ramping restrictions will be two hours per event, regardless of the actual amount of time it takes the licensee to complete the down-ramping or up-ramping event.
5. Temporary modifications to minimum flow requirements due to operating emergencies require prior approval from MDE.

6 AGENCY CONSULTATION

A draft of this plan was provided to MDE on February 14, 2022. MDE responded on March 16, 2022 that they had no comments on the draft Minimum Stream Flow Operation Plan. Appendix B includes, a copy of the draft plan transmittal letter, and a copy of the response from MDE.

7 REFERENCES

FERC. (2019, March 19). *Order Issuing New License re Exelon Generation Company, LLC under P-405.* Retrieved from Federal Energy Regulatory Commision eLibrary: https://elibrary.ferc.gov/eLibrary/search

APPENDIX A. UNIT AND GATE DISCHARGE RATING CURVES

Table A-1: Unit Discharge Rating Curves for 75 feet of Net Head

Generation (MW)	Discharge (cfs) under 75 feet of Net Head										
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11
0	1,821	1,759	1,801	1,801	1,759	1,821	1,801	2,686	2,692	2,692	2,692
5	1,870	1,759	1,843	1,843	1,759	1,870	1,843	3,142	3,160	3,160	3,160
10	2,558	2,290	2,590	2,590	2,290	2,558	2,590	3,751	3,785	3,785	3,785
15	3,189	2,895	3,256	3,256	2,895	3,189	3,256	4,360	4,409	4,409	4,409
20	3,878	3,526	3,976	3,976	3,526	3,878	3,976	4,970	5,033	5,033	5,033
25	4,598	4,279	4,713	4,713	4,279	4,598	4,713	5,579	5,658	5,658	5,658
30	5,279	5,048	5,386	5,386	5,048	5,279	5,386	6,188	6,282	6,282	6,282
35	5,923	6,629	6,300	6,300	6,629	5,923	6,300	6,797	6,907	6,907	6,907
40	7,115	6,629	7,146	7,146	6,629	7,115	7,146	7,406	7,531	7,531	7,531
45	7,407	6,629	7,146	7,146	6,629	7,407	7,146	8,014	8,137	8,137	8,137
50	7,407	6,629	7,146	7,146	6,629	7,407	7,146	8,599	8,691	8,691	8,691
55								10,163	9,903	9,903	9,903
60								10,163	9,903	9,903	9,903
65								10,163	9,903	9,903	9,903
70								10,163	9,903	9,903	9,903
75								10,163	9,903	9,903	9,903

Table A-2: Unit Discharge Rating Curves for 80 feet of Net Head

Generation (MW)	Discharge (cfs) under 80 feet of Net Head										
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11
0	1,838	1,772	1,863	1,863	1,772	1,838	1,863	2,686	2,692	2,692	2,692
5	1,879	1,772	1,872	1,872	1,772	1,879	1,872	3,142	3,160	3,160	3,160
10	2,536	2,261	2,488	2,488	2,261	2,536	2,488	3,751	3,785	3,785	3,785
15	3,158	2,873	3,126	3,126	2,873	3,158	3,126	4,360	4,409	4,409	4,409
20	3,832	3,489	3,761	3,761	3,489	3,832	3,761	4,970	5,033	5,033	5,033
25	4,541	4,213	4,467	4,467	4,213	4,541	4,467	5,579	5,658	5,658	5,658
30	5,214	4,966	5,143	5,143	4,966	5,214	5,143	6,188	6,282	6,282	6,282
35	5,851	6,324	5,807	5,807	6,324	5,851	5,807	6,797	6,907	6,907	6,907
40	6,951	6,676	6,903	6,903	6,676	6,951	6,903	7,406	7,531	7,531	7,531
45	7,365	6,676	7,340	7,340	6,676	7,365	7,340	8,014	8,137	8,137	8,137
50	7,459	6,676	7,340	7,340	6,676	7,459	7,340	8,599	8,691	8,691	8,691
55								10,163	9,903	9,903	9,903
60								10,163	9,903	9,903	9,903
65								10,163	9,903	9,903	9,903
70								10,163	9,903	9,903	9,903
75								10,163	9,903	9,903	9,903

Table A-3: Unit Discharge Rating Curves for 85 feet of Net Head

Generation (MW)	Discharge (cfs) under 85 feet of Net Head										
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11
0	1,906	1,828	1,927	1,927	1,828	1,906	1,927	2,703	2,709	2,709	2,709
5	1,916	1,828	1,927	1,927	1,828	1,916	1,927	3,134	3,143	3,143	3,143
10	2,451	2,155	2,389	2,389	2,155	2,451	2,389	3,708	3,721	3,721	3,721
15	3,034	2,769	3,008	3,008	2,769	3,034	3,008	4,282	4,299	4,299	4,299
20	3,646	3,368	3,590	3,590	3,368	3,646	3,590	4,856	4,877	4,877	4,877
25	4,314	3,982	4,241	4,241	3,982	4,314	4,241	5,430	5,455	5,455	5,455
30	4,957	4,681	4,898	4,898	4,681	4,957	4,898	6,004	6,033	6,033	6,033
35	5,565	5,488	5,480	5,480	5,488	5,565	5,480	6,578	6,611	6,611	6,611
40	6,293	6,862	6,264	6,264	6,862	6,293	6,264	7,152	7,189	7,189	7,189
45	7,197	6,862	7,515	7,515	6,862	7,197	7,515	7,725	7,764	7,764	7,764
50	7,668	6,862	7,542	7,542	6,862	7,668	7,542	8,288	8,323	8,323	8,323
55								8,843	8,985	8,985	8,985
60								10,316	9,882	9,882	9,882
65								10,316	10,064	10,064	10,064
70								10,316	10,064	10,064	10,064
75								10,316	10,064	10,064	10,064

Table A-4: Unit Discharge Rating Curves for 90 feet of Net Head

Generation (MW)	Discharge (cfs) under 90 feet of Net Head										
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11
0	1,974	1,890	1,983	1,983	1,890	1,974	1,983	2,720	2,689	2,689	2,689
5	1,974	1,890	1,983	1,983	1,890	1,974	1,983	3,120	3,094	3,094	3,094
10	2,367	2,063	2,306	2,306	2,063	2,367	2,306	3,653	3,634	3,634	3,634
15	2,929	2,667	2,918	2,918	2,667	2,929	2,918	4,186	4,174	4,174	4,174
20	3,487	3,256	3,478	3,478	3,256	3,487	3,478	4,719	4,714	4,714	4,714
25	4,121	3,833	4,056	4,056	3,833	4,121	4,056	5,252	5,254	5,254	5,254
30	4,731	4,442	4,656	4,656	4,442	4,731	4,656	5,785	5,794	5,794	5,794
35	5,303	5,095	5,242	5,242	5,095	5,303	5,242	6,318	6,333	6,333	6,333
40	5,877	6,206	5,795	5,795	6,206	5,877	5,795	6,852	6,874	6,874	6,874
45	6,658	7,040	6,854	6,854	7,040	6,658	6,854	7,385	7,414	7,414	7,414
50	7,838	7,040	7,741	7,741	7,838	7,741	7,915	7,954	7,954	7,954	7,954
55								8,431	8,475	8,475	8,475
60								8,965	8,993	8,993	8,993
65								10,498	10,232	10,232	10,232
70								10,498	10,232	10,232	10,232
75								10,498	10,232	10,232	10,232

Table A-5: Unit Discharge Rating Curves for 95 feet of Net Head

Generation (MW)	Discharge (cfs) under 95 feet of Net Head										
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11
0	2,012	1,948	2,035	2,035	1,948	2,012	2,035	2,708	2,692	2,692	2,692
5	2,012	1,948	2,035	2,035	1,948	2,012	2,035	3,083	3,072	3,072	3,072
10	2,321	2,007	2,231	2,231	2,007	2,321	2,231	3,582	3,577	3,577	3,577
15	2,879	2,571	2,828	2,828	2,571	2,879	2,828	4,081	4,083	4,083	4,083
20	3,419	3,147	3,379	3,379	3,147	3,419	3,379	4,580	4,588	4,588	4,588
25	4,016	3,694	3,919	3,919	3,694	4,016	3,919	5,080	5,094	5,094	5,094
30	4,613	4,252	4,472	4,472	4,252	4,613	4,472	5,579	5,600	5,600	5,600
35	5,178	4,841	5,026	5,026	4,841	5,178	5,026	6,078	6,105	6,105	6,105
40	5,732	5,625	5,556	5,556	5,625	5,732	5,556	6,577	6,611	6,611	6,611
45	6,376	6,827	6,262	6,262	6,827	6,376	6,262	7,077	7,116	7,116	7,116
50	7,532	7,212	7,474	7,474	7,212	7,532	7,474	7,576	7,622	7,622	7,622
55								8,075	8,128	8,128	8,128
60								8,564	8,618	8,618	8,618
65								9,220	9,245	9,245	9,245
70								10,678	10,395	10,395	10,395
75								10,678	10,395	10,395	10,395

Table A-6: Gate Discharge Rating Curves

Reservoir Level (ft, NGVD29)	Discharge (cfs)		
	Per Regulating Gate (n=2)	Per Crest Gate (n=50)	All Gates
101.0	275	7,354	368,260
101.5	408	7,787	390,181
102.0	561	8,232	412,699
102.5	735	8,687	435,813
103.0	928	9,146	459,164
103.5	1,138	9,611	482,823
104.0	1,367	10,086	507,019
104.5	1,612	10,570	531,747
105.0	1,870	11,061	556,791
105.5	2,144	11,558	582,197
106.0	2,435	12,065	608,108
106.5	2,745	12,581	634,524
107.0	3,063	13,107	661,475
107.5	3,391	13,643	688,952
108.0	3,734	14,189	716,930
108.5	4,091	14,745	745,410
109.0	4,455	15,298	773,831
109.5	4,823	15,853	802,318
110.0	5,508	16,417	831,849
110.5	5,741	16,988	860,884

APPENDIX B. AGENCY COMMENTS

From: David Seaborn -MDE- <david.seaborn@maryland.gov>
Sent: Wednesday, March 16, 2022 3:54 PM
To: Erin Redding <eredding@gomezandsullivan.com>
Cc: Denise Keehner, MDE <denise.keehner@maryland.gov>; Heather Nelson, MDE <hnelson@maryland.gov>; Danucalov, Andrea H:(Exelon Power) <Andrea.Danucalov@constellation.com>; Kirk Smith <ksmith@gomezandsullivan.com>; David Frazier <dfrazier@gomezandsullivan.com>
Subject: EXTERNAL EMAIL -Re: Constellation Conowingo Minimum Stream Flow Operation Plan

CAUTION: This email originated from outside of GSE. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Andrea and Kirk,

Maryland (MDE coordinating with MDNR) does not have any comments on the Constellation's draft Minimum Stream Flow Operation Plan.

Thank you,

David Seaborn

On Thu, Mar 10, 2022 at 12:28 PM Erin Redding <eredding@gomezandsullivan.com> wrote:

Hello,

Thank you to everyone who is reviewing Constellation's Minimum Stream Flow Operation Plan Draft sent on February 14. Please submit any comments to Andrea Danucalov and Kirk Smith by March 16, 2021.

Thank you,

Erin Redding (she/her)

Certified Senior Ecologist, ESA

Gomez and Sullivan Engineers, D.P.C.

1961 Wehrle Dr.

Suite 12

Williamsville, NY 14221
eredding@gomezandsullivan.com

Please note, I do not work on Wednesdays.

GOMEZ AND SULLIVAN ENGINEERS

From: Erin Redding
Sent: Monday, February 14, 2022 4:48 PM
To: David Seaborn, MDE <david.seaborn@maryland.gov>; Denise Keehner, MDE <denise.keehner@maryland.gov>; Heather Nelson, MDE <hnelson@maryland.gov>
Cc: Andrea Danucalov <andrea.danucalov@constellation.com>; Kirk Smith <ksmith@gomezandsullivan.com>; David Frazier <dfrazier@gomezandsullivan.com>
Subject: Constellation Conowingo Minimum Stream Flow Operation Plan

Hello,

Constellation has prepared the attached Minimum Stream Flow Operation Plan Draft in accordance with Conowingo Hydroelectric Project Federal Energy Commission License Article 408. Please review this plan and provide any comments to Andrea Danucalov and Kirk Smith by March 16, 2021.

Sincerely,

Erin Redding (she/her)

Certified Senior Ecologist, ESA

Gomez and Sullivan Engineers, D.P.C.

1961 Wehrle Dr.

Suite 12

Williamsville, NY 14221
eredding@gomezandsullivan.com

Please note, I do not work on Wednesdays.

GOMEZ AND SULLIVAN ENGINEERS

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