LOW IMPACT HYDROPOWER INSTITUTE CERTIFICATION APPLICATION SUPPLEMENT

Molly's Falls Hydroelectric Project

Prepared for:

Green Mountain Power Corporation
163 Acorn Lane
Colchester, VT 05443

Prepared by:

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtGroup.com

March 2025

1.0 ADDITIONAL INFORMATION

This supplement to GMP's application for Low Impact Hydropower Institute (LIHI) Certification is being proved in response to LIHI's request for additional information based on Intake Review for the Molly's Falls Project.

1.1 Background Information Review

Please describe the current status of spillway and related construction and if not completed yet, the planned completion date.

The spillway and related construction activities were completed in 2023.

Please submit a signed Attestation and Waiver form using the current format found here (rather than the unsigned, older Sworn Statement form in the application).

Section 6.0 of the application has been updated to include the new signed Attestation and Waiver form.

1.2 Criteria Information Review

1.2.1 Ecological Flow Regime

The draft Flow Plan dated 09/28/2020 was provided along with VANR comments dated 01/27/2023. Please provide the final PUC and/or VANR-approved plan if available. If not yet approved, please indicate the expected approval date.

A final Flow and Water Level Management and Monitoring Plan was submitted to VANR in February 2024. On March 8, 2024, GMP received final comments from VANR on the plan and on March 28, 2024, GMP filed the final plans with the PUC[1]. Receiving final comments from VANR and filing with PUC completes the regulatory compliance requirements for this task. Please see Attachment A of this filing for consultation summary and Attachment B for the plan as submitted to the PUC.

[1] See Attachment A of this Supplement for GMP's transmittal (March 8, 2024 from SRH Law) of the Flow and Water Level Management and Monitoring Plan, Dissolved Oxygen Monitoring Plan, and Riparian Zone Management Plan to the PUC.

Please indicate if flow monitoring reports or data is required to be submitted to VANR or other regulatory bodies.

The Flow and Water Level Management and Monitoring Plan has no flow reporting or data sharing required. However, the Flow and Water Level Management and Monitoring Plan does require that GMP provide advance notice of any planned drawdown of Molly's Falls Reservoir for inspection, maintenance, or repairs to the Vermont Department of Forest, Parks and Recreation, and the Molly's Falls Pond State Park. Additionally, GMP shall provide VANR with a summary of any such drawdowns conducted during the prior 12-month period on or before February 15 of each year.

Please describe any reporting requirements in the event of non-compliance with the plan.

The final Flow and Water Level Management and Monitoring Plan was developed to keep the Project within compliance. There are no required flow or water level monitoring reports or data to be submitted to VANR or other regulatory bodies.

1.2.2 Water Quality Protection

The draft Dissolved Oxygen Plan dated 09/28/2020 was provided along with VANR comments dated 01/27/2023. Please provide the final PUC and/or VANR-approved plan if available. If not yet approved, please indicate the expected approval date.

A final Dissolved Oxygen Plan was submitted to VANR in February 2024. On March 8, 2024, GMP received final comments from VANR on the plan. On March 28, 2024, GMP filed the final plan with the PUC[1]. Receiving final comments from VANR and filing with PUC completes the regulatory compliance requirements for this task. Please see Attachment A of this filing for consultation summary and Attachment C for the plan as submitted to the PUC.

Please describe the aeration system, its components, and operations including triggers to its use, if not continuous.

GMP has completed both physical and operational changes at the Project to address Dissolved Oxygen issues. The new bypass flow system, which began operation in November 2021, releases additional water into Molly's Brook from the Molly's Falls Pond in order to meet conservation flows (8.5 cfs July through March, 12.0 cfs April through June, or inflow into the reservoir if less at any time). The intake is approximately 30 feet below the water surface and water released from the bypass pipe over rip-rap before reaching the Brook, which provides aeration via turbulence.

GMP also installed an aeration system at the powerhouse in February 2022 to add oxygen to water before it is released to the Winooski River. This aeration system consists of a valve installed in the penstock that enables flows to be ramped up and down at the beginning and end of generation cycles. The valve results in large quantities of air entrained in the water which is then released from the penstock into the Winooski River. Operation of the valve occurs automatically any time a generation cycle takes place. Additionally, GMP changed its generation operations pursuant to the MOU, so that the frequency and magnitude of generation cycles will be reduced, timing of generation will be changed to align more with natural higher-flow events, and generation flows will be gradually ramped-up and down. These flows are described in detail in the FWLMMP.

GMP is implementing the final Dissolved Oxygen Monitoring Plan filed with the PUC in March 2024. In the event that the dissolved oxygen monitoring indicates that dissolved oxygen levels do not comply with the VWQS Dissolved Oxygen criteria, GMP will make adjustments which may include increasing the aeration system capacity, and/or reducing the magnitude of generation flows, and continuing to monitor the dissolved oxygen until the results confirm the criteria are met. GMP recognizes meeting dissolved oxygen levels is required criteria for receiving the LIHI certification. Rather than delaying LIHI certification due to uncertainly around the efficacy of these systems, GMP would like to propose a condition be made within the LIHI certification that GMP and regulators would continue to work collaboratively to meet dissolved oxygen criteria.

Other

Though not included in LIHI's additional information request, GMP has also developed a Riparian Zone Restoration Plan (provided in Attachment D) pursuant to the MOU. Like the Flow Management Plan and Dissolved Oxygen Plan, the Riparian Zone Restoration Plan was submitted to VANR for review and comment, final comments were provided on March 8, 2024, and the plan was filed with the PUC.

1.2.3 Threatened and Endangered Species Protection

Please clarify that Indiana bats are not present (refer to top of application p. 65 which mentions the species).

Indiana bats are not present at the project. Page 65 of the application has been revised to remove the incorrect mention of the species.

Please conduct a data check for state-listed species and provide that information.

The state of Vermont completed a data check for state-listed species. This correspondence is provided as Attachment E.

1.2.4 Cultural and Historic Resource Protection

Please confirm that SHPO review was not required as part of the spillway work's Certificate of Public Use.

SHPO review was not required as part of the spillway work's Certificate of Public Use.

If available, please provide documentation of any prior SHPO reviews and determination of no effect.

Since SHPO review was not required for the spillway construction, documentation is not available or applicable.

1.2.5 Recreational Resources

Please confirm that there are no formal recreation areas owned by GMP.

There are no formal recreation areas owned by GMP at Molly's Falls.

Please describe the locations of any informal access to the river over lands owned by GMP.

There are no locations of any informal access to the river over lands owned by GMP at Molly's Falls.

ATTACHMENT A

CONSULTATION SUMMARY

VERMONT

Vermont Department of Environmental Conservation
Agency of Natural Resources
Watershed Management Division
1 National Life Drive, Davis 3 [phone] 802-490-6180
Montpelier, VT 05620-3522
www.watershedmanagement.vt.gov

DISTRIBUTED ELECTRONICALLY

January 27, 2023

Meddie Perry
Vanasse Hangen Brustlin, Inc.
40 IDX Drive, Building 100, Suite 200
South Burlington, VT 05403

RE: Molly's Falls Hydroelectric Project
Interim Comments on Draft Post Certificate of Public Good Plans

Dear Meddie:

The Agency of Natural Resources (Agency) has reviewed the draft post certificate of public good plans for the Mollys Falls Hydroelectric Project (Project). Specifically, these plans include a Flow and Water Level Management and Monitoring Plan, a Dissolved Oxygen Monitoring Plan, and a Winooski River Riparian Zone Restoration Plan. These plans were prepared by Vanasse Hangen Brustlin, Inc. on behalf of Green Mountain Power (GMP).

Below the Agency provides interim comments on the draft plans. The comments are provided in an interim format to allow the Agency and GMP to be able to discuss and inform revisions to the draft plans before they are finalized.

Background

The Public Utility Commission (PUC) issued a final order granting authorization improvements at the Molly's Falls Hydroelectric Project on March 27, 2020, which incorporated the terms and conditions of Memorandum of Understanding (MOU) between GMP and the Agency dated August 8, 2019. The relevant substantive sections pertaining to the specifics of the plans required by the MOU are identified below as a framework for review.

Flow and Water Level Management and Monitoring Plan

Section *III.H.* specifies 14 specific elements (parts *1.i* through *1.xiv*) to be included in the flow and water level management plan to assure compliance with the substantive flow and water level conditions established in the MOU.

Dissolved Oxygen Monitoring Plan

Sections *III.D. and III.F.* require GMP to prepare and implement a Dissolved Oxygen Monitoring Plan to confirm that the methods of releasing flow to Mollys Brook and the Winooski River comply with the Dissolved Oxygen criteria of the Vermont Water Quality Standards.

Winooski River Riparian Zone Restoration Plan

Section *III.G.* requires the development and implementation of a riparian zone restoration plan to close the temperature gap between generation flows released to the Winooski River and natural flows in the Winooski

River, to the extent reasonable and feasible, through extensive riparian buffer restoration along the Winooski River upstream of the powerhouse. The Restoration Plan shall identify reasonable and feasible opportunities for riparian zone restoration along the Winooski River, assess anticipated temperature impacts of implementing the feasible opportunities, and set forth a schedule for implementation. In addition, the Plan shall describe reasonable and feasible future monitoring and restoration efforts to be taken to close the temperature gap, if any are needed.

Agency Review and Comments

Flow and Water Level Management and Monitoring Plan

To better understand the draft Flow and Water Level Management and Monitoring Plan (FWLMMP) and inform development of final plans, the Agency posed an informal round of comments to GMP late in 2021 to which GMP provided substantive responses. The questions below aim to continue and build on that dialogue.

<u>Section III.A.1 Snow Water Content</u>

Comment ('Woods" Site): The prior round of comments and responses discussed the status of the proposed 'woods' site at Mollys Falls Reservoir and relocation to a new site. Please provide an update on a new location, if available.

Comment (Snow Core Sample): The Agency appreciates the additional detail provided on the equipment used for snow core sampling. Please add this detail to the revised plan.

Comment: The Agency does have concerns with the comparison of measured snow pack water content with the NOHRSC estimates based on remote sensing. Based on the comparison in Table 1, the NOHRSC remote sensing data consistently overestimates snow water content in comparison to the direct measurements of snow water content.

- GMP's response states "Higher snow-water content in the NOHRSC data is expected because it includes terrain at higher elevation than the on-site cores". While this is true and makes sense that terrain at a higher elevation may tend to have higher snow-water content, isn't the reverse also true, that the NOHRSC data includes terrain at a lower elevation that may tend to have lower snow water content? Additionally, given the elevation of where snow core measurements are obtained, at a relatively high elevation in the respective watersheds, shouldn't the measured snow cores be expected to be representative of higher terrain areas that would provide a margin of safety relative to watershed wide values?

<u>Section III.A.2 Hydrologic Forecasting</u>

Comment: GMP's response related to hydrologic forecasting states, "Use of the SWE analysis (NOHRSC data, to provide a watershed-wide amount, using on-site snow cores to provide data validation) for the long-term forecasting described above…"

- Based on the description provided, the Agency understands that the NOHRSC data is the primary snow water content input into the model. The on-site snow cores are a form of validation to the model. How does the data validation affect the model inputs? Is there currently any correction to the NOHRSC remote sensed estimates based on on-site snow cores? If not, based on the results in Table 1 (and data subsequently collected), could a correction factor be applied to address the consistent overestimation by the NOHRSC method while still maintaining an adequate margin of safety?

Comment: GMP's response subsequently states, "…the long-term forecasting described above was implemented for the 2019-20 and 2020-21 seasons, and has been reliable for forecasting volumes of springtime runoff for the reservoir drawdown and refill planning. No problems occurred such as overtopping spillways, releasing unsafe high flows, or failing to refill for spring/summer loon nesting and rec season, as illustrated in Figures 1 and 2:"

- The response subsequently provides figures for depicting water levels in Mollys Falls Reservoir. In contrast to the description for Mollys Falls, the Agency has heard from the residents of Peacham Pond over multiple seasons about issues with low water levels around the time of refill in the late spring / early summer. Please include similar figures for Peacham Pond to evaluate the Project as a whole. If there do appear to opportunities for refinement, this may underline our prior comment of using the validation snow water content data set to create an adjustment factor for the model inputs obtained from the NOHRSC remote sensing estimates.

Appendix 6: Reservoir Inflows and Winooski River Streamflow estimates
Comment: GMP's response states "Generation would not occur automatically merely because reservoir-level-rate-of-change indicates that Winooski River flows exceed 30 cfs. GMP would decide whether or not to generate when flows exceed the threshold, based on whether the apparent high-flow event is likely to persist and a reality check based on Pope Bk USGS gauge, weather at Peacham Pond/Mollys Falls Reservoir site; confirmation that Mollys Falls Reservoir Level (magnitude, regardless of rate-of-change) is high enough to support generation and meet the NOL requirements; weather forecast (i.e., are flows expected to persist or to rise further vs. decrease immediately)".

- At this stage, the Agency has concerns with using the water level in Mollys Falls Reservoir as a surrogate for flow in the Winooski River. However, the Agency remains open to alternatives to derive when streamflow in the Winooski River exceeds 30 cfs. The Agency appreciates the plethora of other considerations that would be weighed before generating, but is concerned such a complex framework can be implemented effectively. Would it be more practical to identify a better surrogate or perhaps a direct input? As a surrogate, Pope Brook may be more accurate than using water level in Mollys Falls Reservoir, but given the importance of determining 30 cfs as measured at the powerhouse for habitat conditions in the Winooski River, has GMP considered establishing the relationship between a transect where flow and water surface elevation is known (from the habitat study) and stage at a point where water level could be readily measured (e.g. a transducer by the powerhouse)? Such a solution would not need a complete rating curve, but rather only the stage equivalent to 30 cfs and would provide data that would feed directly into the PLC.

Dissolved Oxygen Monitoring Plan

Comment: Section 2.6.4 Reasonable Worst-Case Streamflow Conditions states, "For a reasonable worst-case flow condition, Winooski River flows should be no greater than 3 times the 7Q10 flow rate for at least ten days between June 1 and September 30. The ten days do not need to be consecutive. Winooski River streamflows at station W-1 immediately above the powerhouse will be determined following the protocols proposed in the Flow and Water Level Management and Monitoring Plan for the Facility (VHB, 2020). Based on the prior study, 7Q10 flow at the powerhouse is 4.2 cfs, therefore the low-flow goal is 12.6 cfs or less, for ten or more days."

- The streamflow condition of 3 times 7Q10 flow rate for at least ten days is not applicable in the case of the Mollys Falls Hydroelectric Project because the impact of operations is from the release of water from the Mollys Falls Reservoir that is low in dissolved oxygen into the Winooski River. Therefore, the primary focus of the dissolved oxygen monitoring should be on generation flows that occur at project under the operational changes agreed to in the 2019 MOU.

Comment: Section 4.1 Monitoring Schedule states, "In the event that flows do not meet the low-flow target, the data will be reviewed with the ANR to determine whether an additional second year of monitoring is appropriate."

- As stated above, the low-flow target is not applicable in the case of the impacts of Mollys Falls hydroelectric Project operations on dissolved oxygen levels in the Winooski River. A more appropriate target for critical is that generation occurs when the Mollys Falls Reservoir is stratified.

Winooski River Riparian Zone Restoration Plan

The Agency supports the plan in concept, as well generally the proposed means for implementation identified in the plan. However, the Agency does have concerns around the ability to make contact with landowners and possibly the appetite for participation in restoration efforts. The comments and question below focus on this concern.

Comment: Table 1 identifies ten ‘Target Restoration Areas’ for planting and subsequent monitoring. Please confirm that the plan would be to reach out to each respective landowner to gauge their willingness to participate in the program.

- Assuming that not all landowners may be able to be contacted or be willing to participate, is there a threshold that GMP would consider a minimal amount of target restoration areas or acreage to be planted and monitored for successful implementation?

Comment: The landowner outreach section states that “should landowners initially decline to participate, GMP proposes attempting to request their permission again at a later date after neighbors have joined the program, or after properties have changed ownership”.

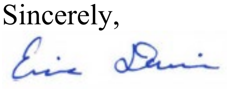
- While the Agency understands that there is a limit to what GMP can do entice landowners to participate, the Agency also appreciates the identification of the Conservation Reserve Enhancement Program as a potential partner and ‘new funding sources/grants’ in the ‘future efforts’ section. The Agency would encourage GMP to think creatively on options that may be available to incentivize participation, especially in the event initial outreach and participation is less than optimal.

Comment: Table 4 sets out the implementation schedule for the riparian zone restoration plan.

- Please update this schedule in the final plan to reflect the anticipated date of project completion and/or plan approval.

Thank you for the opportunity to continue discussion of the draft plans for the Mollys Falls Hydroelectric Project.

Sincerely,



Eric Davis
River Ecologist

c: Jason Lisai, Green Mountain Power
Andy Raubvogel, Esq., Dunkiel and Saunders
Kane Smart, Esq. Agency of Natural Resources
Jeff Crocker, Agency of Natural Resources

Memorandum

To:	GMP Molly's Falls Hydroelectric Station Project File	Date:	August 31, 2023
		Project #:	57646.30
From:	Meddie J. Perry	RE:	GMP Responses to ANR Interim Comments on Draft Post Certificate of Public Good Plans

GMP has received the Vermont Agency of Natural Resources' ("ANR") interim comments on the three draft post-Certificate of Public Good plans for the Mollys Falls Hydroelectric Project (Flow and Water Level Management and Monitoring Plan; Dissolved Oxygen Monitoring Plan; and Winooski River Riparian Zone Restoration Plan). GMP understands the ANR comments are provided in an interim format to allow the Agency and GMP to be able to discuss and inform revisions to the draft plans before they are finalized. GMP appreciates the Agency's interest in continuing and building-on the prior dialogue which included the Agency's informal round of comments to GMP late in 2021 to which GMP provided substantive responses (email with attachment from Jeff Crocker on 9/14/2021, remote video meeting on 9/21/2021, and email with attachment from Meddie Perry of VHB on 9/21/2021).

The ANR's interim comments, dated January 27, 2023, are copied below in *italics*, and GMP's responses follow.

Review and Comments

<u>Section III.A.1 Snow Water Content</u>

> *<u>Comment ('Woods" Site):</u> The prior round of comments and responses discussed the status of the proposed 'woods' site at Mollys Falls Reservoir and relocation to a new site. Please provide an update on a new location, if available.*
>
> <u>Response:</u>
> The Woods site has been moved to new location as of Feb 2022: "down below the new bypass valve at the dam in the woods between the bypass and stream." Section III.A & Figure 12 will be revised to show the new location which is as follows:

40 IDX Drive
Building 100, Suite 200
South Burlington, VT 05403
P 802.497.6100

Memorandum

Figure 12:
Molly's Falls Reservoir Snow Measurement Sites

<u>Comment (Snow Core Sample)</u>: *The Agency appreciates the additional detail provided on the equipment used for snow core sampling. Please add this detail to the revised plan.*

<u>Response:</u>

GMP will add the following information to Section III.A.1.:

> GMP uses a standard snow core sampler (aka "Federal Snow Sampler" consisting of a 1 5/8" (4.13 cm) interior-diameter aluminum snow tube and a sensitive spring scale. Weight of the snow-core is converted into snow-water equivalent.

Comment: The Agency does have concerns with the comparison of measured snow pack water content with the NOHRSC estimates based on remote sensing. Based on the comparison in Table 1, the NOHRSC remote sensing data consistently overestimates snow water content in comparison to the direct measurements of snow water content.

- *GMP's response states "Higher snow-water content in the NOHRSC data is expected because it includes terrain at higher elevation than the on-site cores". While this is true and makes sense that terrain at a higher elevation may tend to have higher snow-water content, isn't the reverse also true, that the NOHRSC data includes terrain at a lower elevation that may tend to have lower snow water content? Additionally, given the elevation of where snow core measurements are obtained, at a relatively high elevation in the respective watersheds, shouldn't the measured snow cores be expected to be representative of higher terrain areas that would provide a margin of safety relative to watershed wide values?*

Response:
The NOHRSC data in Table 1 from GMP's 9/21/2021 document (copied below for convenient reference) actually does not include terrain at a lower elevation than GMP's snow cores that would be likely to have a lower snow water content. The NOHRSC data in Table 1 represents the overall snow-water equivalent ("SWE") in the site-specific watersheds of Mollys Falls Reservoir and of Peacham Pond, i.e., VHB custom-analyzes the NOHRSC data exclusively within the local sub-watersheds of each reservoir. In contrast the GMP snow cores are obtained at or very near the lowest points of these local sub-watersheds as shown below in Figure A, where the lowest snow-water content within the sub-watershed is expected to be found.

Regarding the concept of a margin of safety, GMP believes that underestimating the amount of SWE poses the risk that actual inflows could result in excessively high water levels or unsafe operating conditions during spring snowmelt, and by estimating the watershed-wide SWE amounts GMP intends to make the most-accurate estimates feasible in order to reduce the chances of dams overtopping, or releasing excessively high flows that could cause erosive conditions downstream.

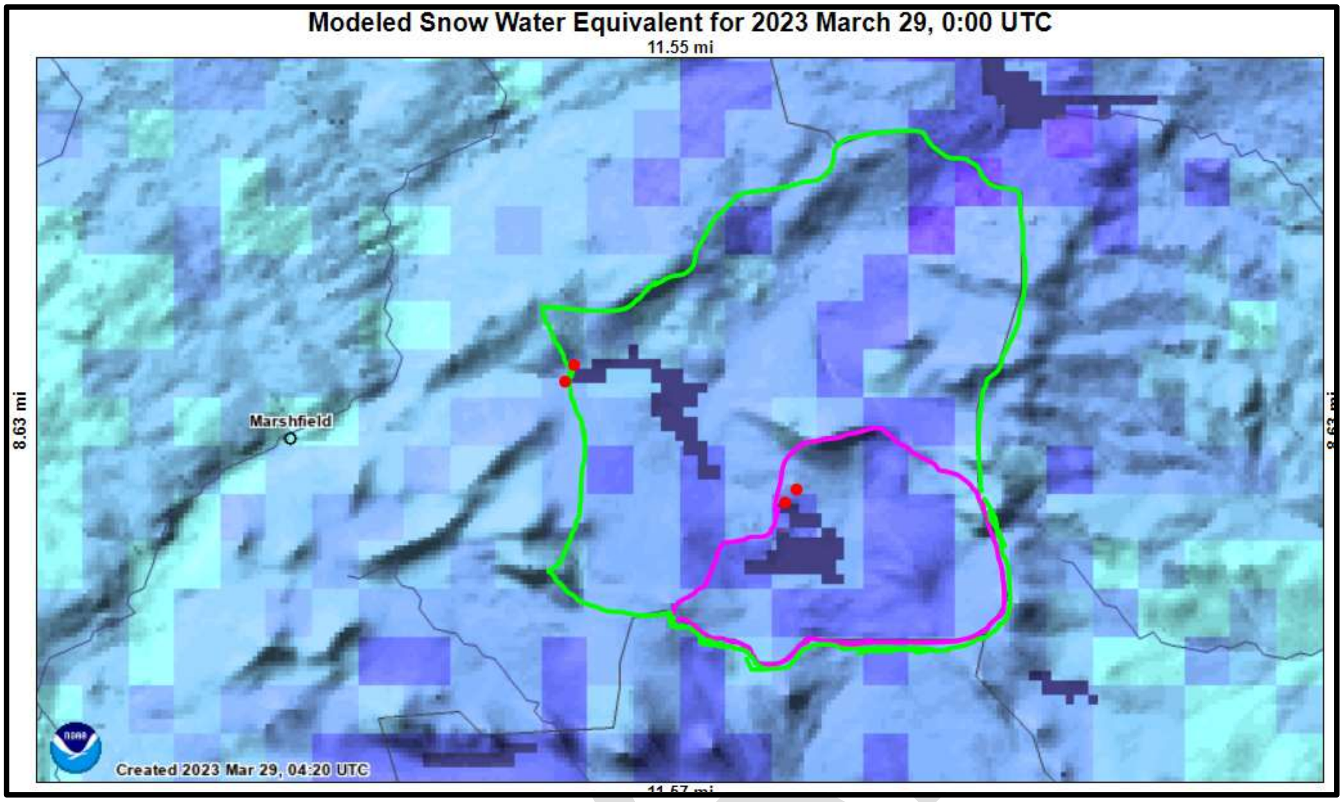


Figure A:
NOHRSC Data Map,
GMP Snow Core Sites (red dots),
Approximate Local Sub-Watersheds (Mollys Falls Reservoir = Green, Peacham Pond = Fuchsia)

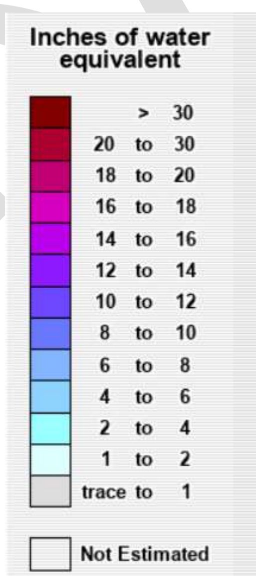


Figure B:
NOHRSC Legend

Table 1
Snowpack Comparison: On-Site Cores and NOHRSC Remote Sensing

Date	Snow-Water Content of Snowpack, Inches of Melted Water						Difference*	
	GMP Cores: Mollys Falls Reservoir		GMP Cores: Peacham Pond		NOHRSC			
	Woods	Field	Woods	Field	Mollys	Peacham	Mollys	Peacham
4/3/2019	4.7	3.0	7.3	5.0	6	8	-36%	-23%
2/19/2020	3.3	3.8	4.7	4.3	6	6	-42%	-25%
3/8/2020	3.0	3.3	3.0	3.5	6	7	-48%	-54%
3/26/2020	1.0	1.0	1.3	1.0	3.8	3.5	-73%	-68%
1/21/2021	1.0	2.7	1.3	2.0	3	3	-26%	-34%
2/19/2021	2.3	4.3	2.3	1.7	4	4	-18%	-50%
3/25/2021	trace	trace	trace	trace	2.2	2.7	-96%	-96%
4/1/2021	0.0	0.0	0.0	0.0	0.0	0.0	0%	0%

Notes:
* A positive difference indicates more snow-water content is indicated by on-site cores. A negative difference indicates more snow-water content is indicated by NOHRSC remote sensing data.

<u>*Section III.A.2 Hydrologic Forecasting*</u>

<u>Comment:</u> GMP's response related to hydrologic forecasting states, "Use of the SWE analysis (NOHRSC data, to provide a watershed-wide amount, using on-site snow cores to provide data validation) for the long-term forecasting described above…"

- *Based on the description provided, the Agency understands that the NOHRSC data is the primary snow water content input into the model. The on-site snow cores are a form of validation to the model. How does the data validation affect the model inputs? Is there currently any correction to the NOHRSC remote sensed estimates based on on-site snow cores? If not, based on the results in Table 1 (and data subsequently collected), could a correction factor be applied to address the consistent overestimation by the NOHRSC method while still maintaining an adequate margin of safety?*

<u>Response:</u>

A correction factor is not applied to the NOHRSC data. GMP's snow cores are reported to the National Oceanic and Atmospheric Administration ("NOAA"). GMP understands that the data from the cores are used by the federal government in developing the NOHRSC data. According to NOAA, "GMP's snow core data is very important and is used, along with a host of other cooperator snow survey data to help assess the current state of the snowpack across Vermont… NOHRSC takes all the cooperator survey data and ingests it into SNODAS, their snow data assimilation system to help calibrate their models." Therefore it is our understanding that the NOHRSC data are already calibrated, by NOAA, to the GMP snow core results.

GMP is open to further discussion. Please let us know if the Agency would like to discuss this topic via an in-person or remote meeting.

<u>Comment:</u> *GMP's response subsequently states, "…the long-term forecasting described above was implemented for the 2019-20 and 2020-21 seasons, and has been reliable for forecasting volumes of springtime runoff for the reservoir drawdown and refill planning. No problems occurred such as overtopping spillways, releasing unsafe high flows, or failing to refill for spring/summer loon nesting and rec season, as illustrated in Figures 1 and 2:"*

- *The response subsequently provides figures for depicting water levels in Mollys Falls Reservoir. In contrast to the description for Mollys Falls, the Agency has heard from the residents of Peacham Pond over multiple seasons about issues with low water levels around the time of refill in the late spring / early summer. Please include similar figures for Peacham Pond to evaluate the Project as a whole. If there do appear to opportunities for refinement, this may underline our prior comment of using the validation snow water content data set to create an adjustment factor for the model inputs obtained from the NOHRSC remote sensing estimates.*

<u>Response:</u>
Figures C through E below depict Peacham Pond water levels for winter drawdown and spring refill.

Memorandum

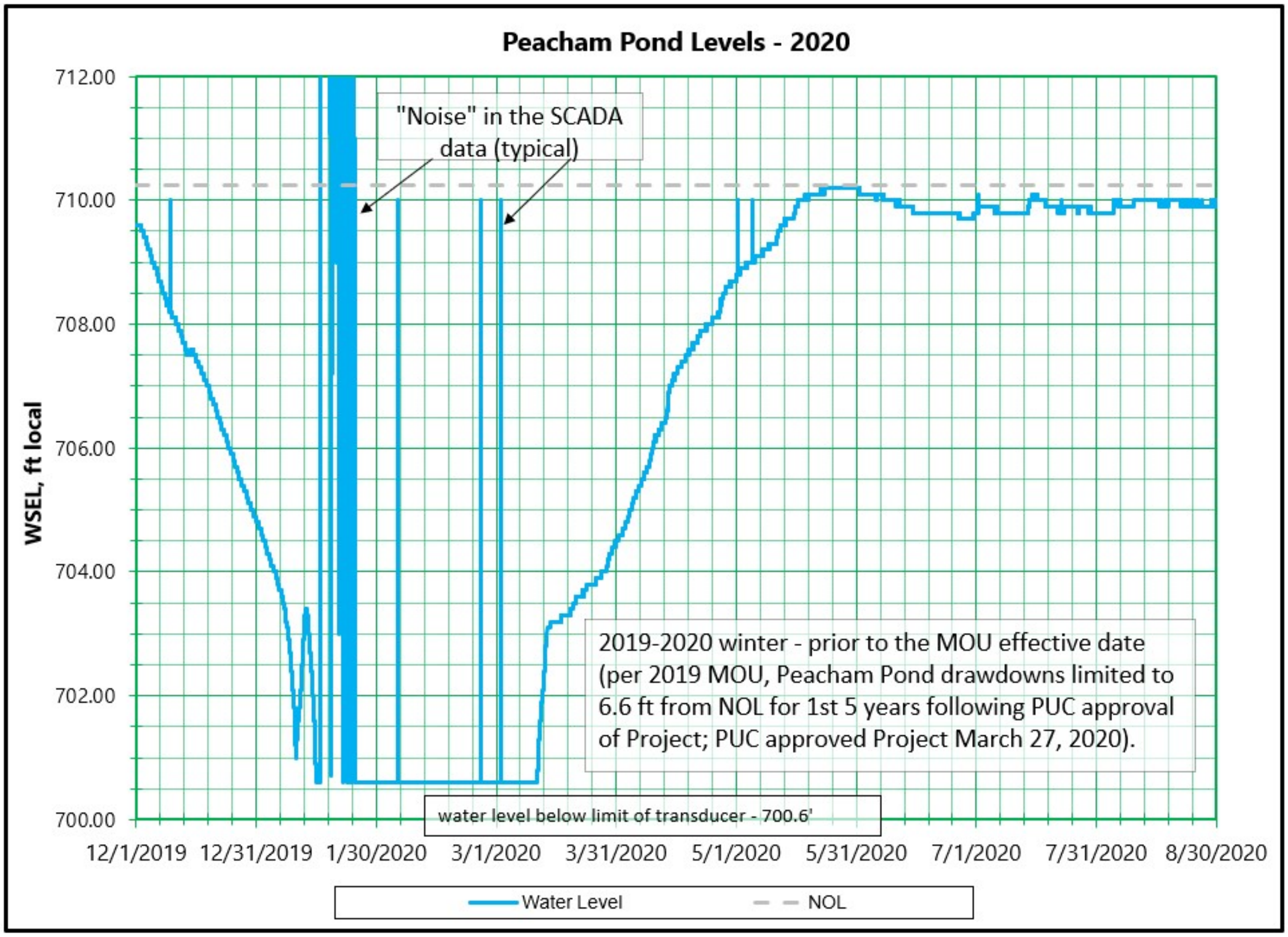


Figure C: Peacham Pond 2019-2020 Water Levels (Prior to MOU Implementation Date)

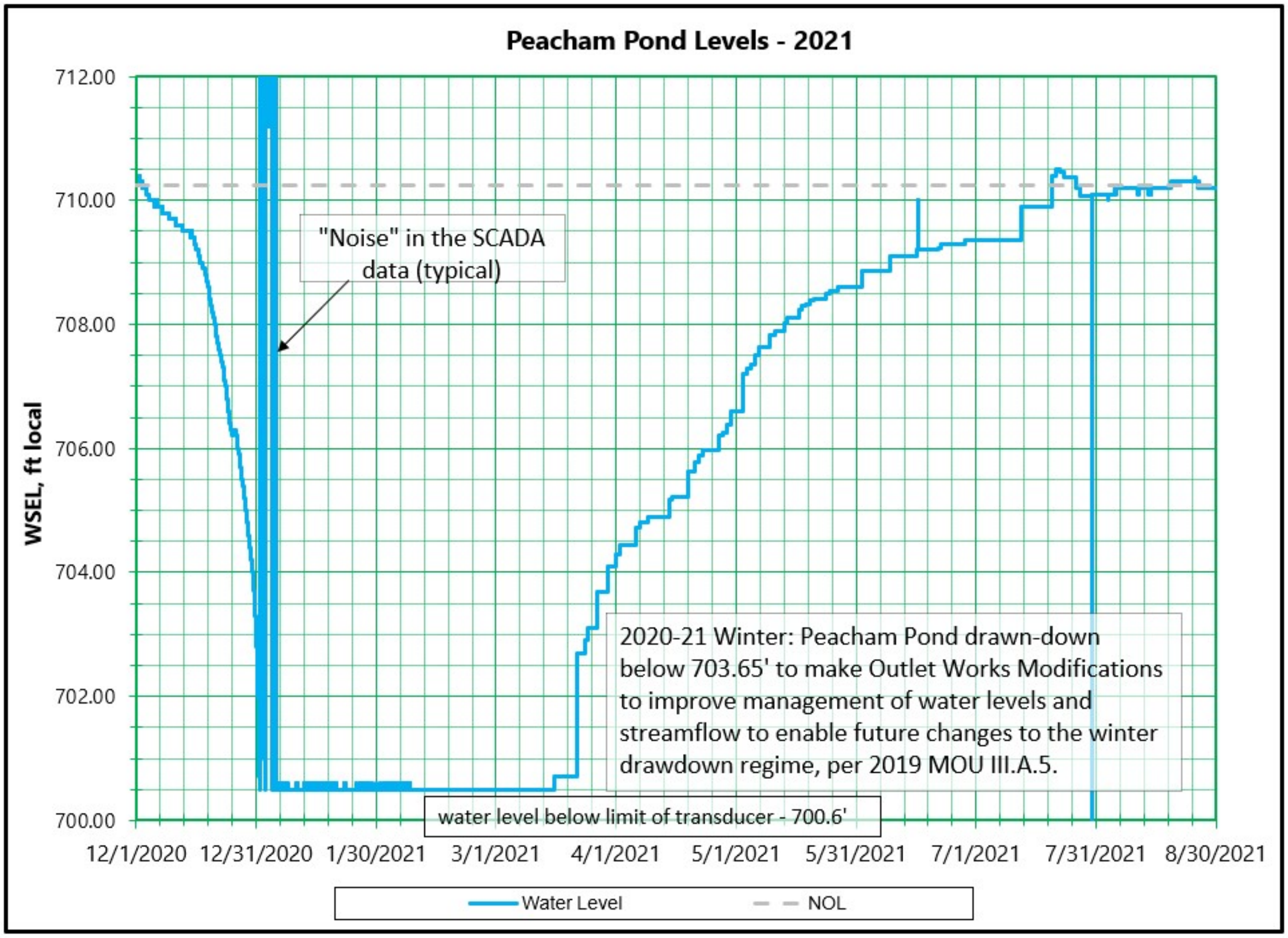


Figure D: Peacham Pond 2020-2021 Water Levels (Additional Drawdown Performed During Outlet Works Modifications)

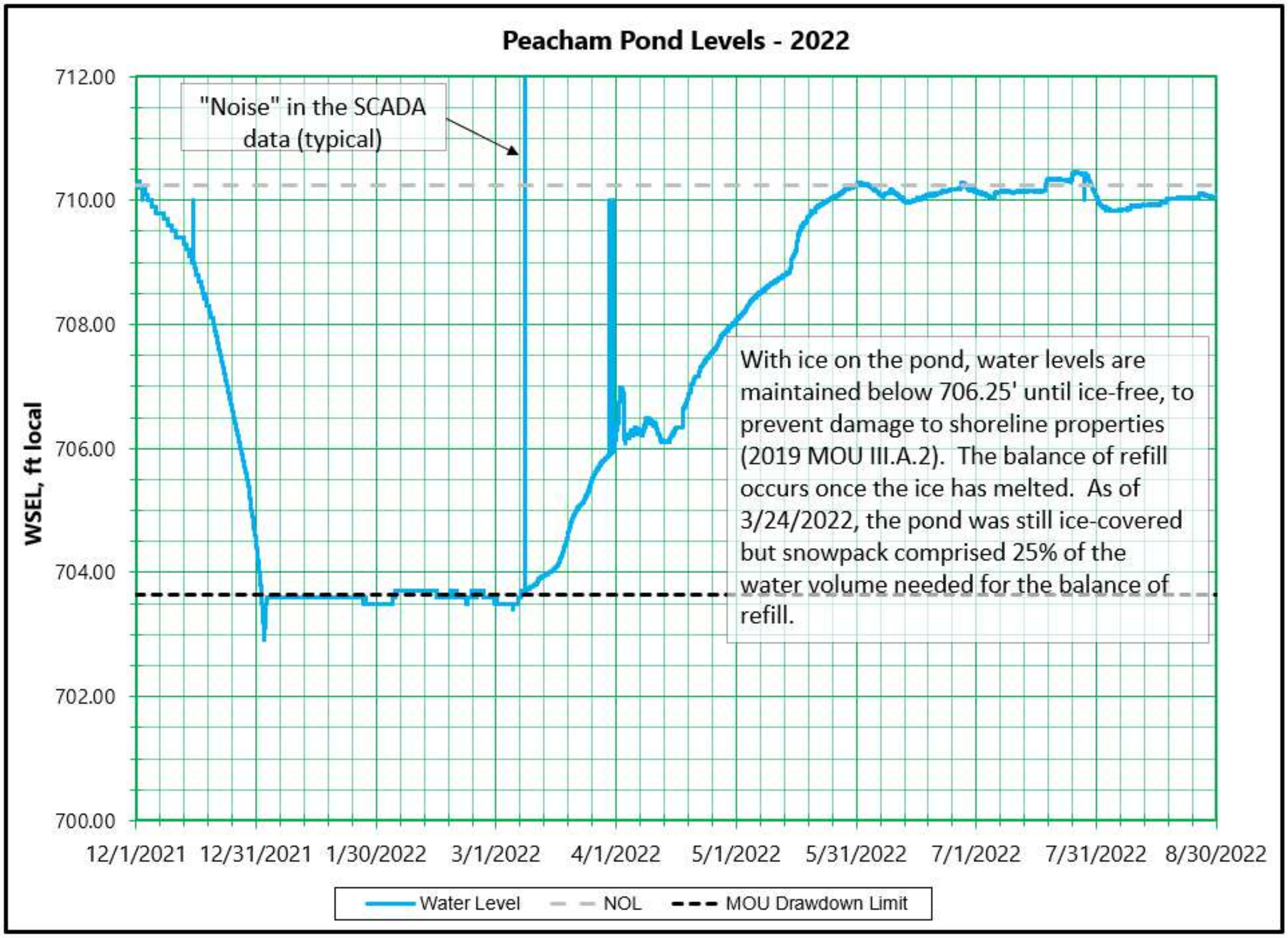


Figure E: Peacham Pond 2021-2022 Water Levels

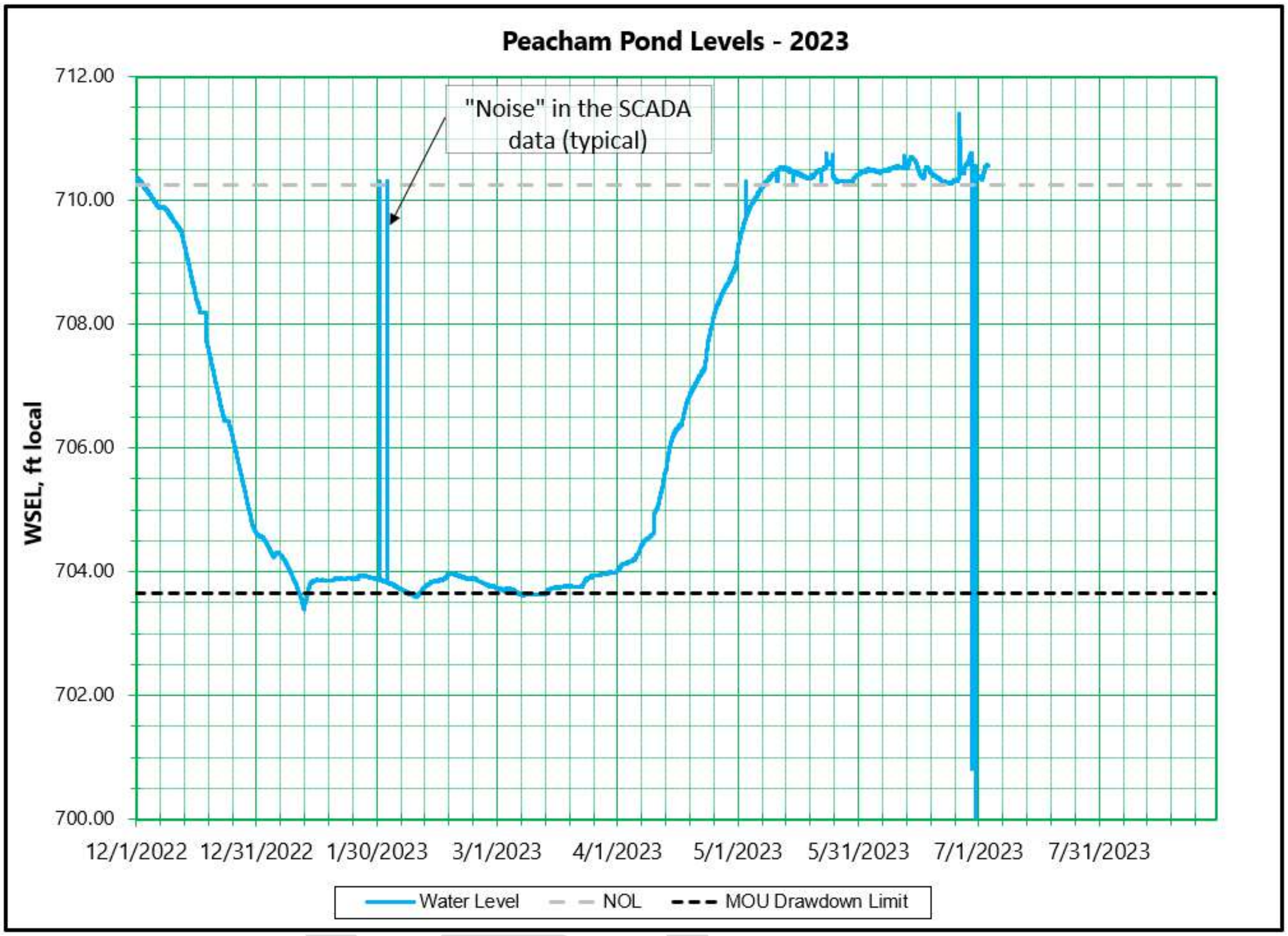


Figure F: Peacham Pond 2022-2023 Water Levels

Figure F shows a timely refill in May 2023. The information in figures C, D, and E shows Peacham Pond was refilled after May 1 for a variety of reasons including different operating procedures pre-MOU implementation, work on the outlet structure requiring additional drawdown, and ice on the pond resulting in delayed refill to prevent ice-damage to shoreline properties[1]. We do not believe the accuracy of the NOHRSC snow-water equivalent data is poor, due to the explanation from NOAA provided above. Another factor in the refill forecasting, as noted in the draft Plan, is long-range precipitation forecast data from NOAA which is used to estimate precipitation during the

[1] Per III.A.2 of the 2019 MOU and Section III of Attachment A, refill to the NOL shall be completed no later than May 1, unless at least one of the following criteria are met: a) If ice is present on reservoir surface, water level shall not rise higher than NOL minus 4 feet (Pond level shall be no higher than 706.25 feet local datum). The balance of refill shall commence once the surface is ice-free; or b) If snow-water content exceeds 6 inches after April 1, Peacham Pond refill shall be delayed until GMP determines that it is safe to allow water levels to rise without causing full gate operation or emergency spillway activation to be likely needed.

future refill period. This anticipated precipitation, in addition to the existing snowpack, is included in the forecasting. When actual precipitation is significantly less than the long-range forecast, a delayed refill may result[2]. We believe an opportunity for refinement exists with the potential to improve long-range precipitation forecasting.

Appendix 6: Reservoir Inflows and Winooski River Streamflow estimates

Comment: GMP's response states "Generation would not occur automatically merely because reservoir-level- rate-of-change indicates that Winooski River flows exceed 30 cfs. GMP would decide whether or not to generate when flows exceed the threshold, based on whether the apparent high-flow event is likely to persist and a reality check based on Pope Bk USGS gauge, weather at Peacham Pond/Mollys Falls Reservoir site; confirmation that Mollys Falls Reservoir Level (magnitude, regardless of rate-of-change) is high enough to support generation and meet the NOL requirements; weather forecast (i.e., are flows expected to persist or to rise further vs. decrease immediately)".

- *At this stage, the Agency has concerns with using the water level in Mollys Falls Reservoir as a surrogate for flow in the Winooski River. However, the Agency remains open to alternatives to derive when streamflow in the Winooski River exceeds 30 cfs. The Agency appreciates the plethora of other considerations that would be weighed before generating, but is concerned such a complex framework can be implemented effectively. Would it be more practical to identify a better surrogate or perhaps a direct input? As a surrogate, Pope Brook may be more accurate than using water level in Mollys Falls Reservoir, but given the importance of determining 30 cfs as measured at the powerhouse for habitat conditions in the Winooski River, has GMP considered establishing the relationship between a transect where flow and water surface elevation is known (from the habitat study) and stage at a point where water level could be readily measured (e.g. a transducer by the powerhouse)? Such a solution would not need a complete rating curve, but rather only the stage equivalent to 30 cfs and would provide data that would feed directly into the PLC.*

Response:
Since the methods for Reservoir Inflows and Winooski River Streamflow estimates were developed in the Plan and in GMP's 9/21/2021 response to Agency comments, GMP has improved the sensitivity of the transducer on site. The transducer can now report water levels with a nominal resolution of 0.01 feet in contrast to the resolution of 0.1 feet previously. However, the sensitivity of the transducer is limited to 0.06-foot increments. The somewhat improved transducer sensitivity results in less "noise" in the inflow estimates and some improvement in the accuracy.

---

[2] Between March 24 and May 1 during the 2021-22 refill, actual precipitation was 4.88" vs. 7.3" anticipated.

VHB analyzed the new transducer data for the period from April 1 through October 31, 2022. The April through October period is the interval in which the MOU specifies that generation may occur if Winooski River flows at the powerhouse exceed 30 cfs (with the potential to use the change in reservoir levels to indicate the streamflows). This interval from 2022 is the most-recent complete April-through-October period with new transducer data. During this period, estimated Winooski River flow at the Powerhouse, based on Mollys Falls Reservoir level changes, exceeded 30 cfs for a total duration of 1,312 hours. Based on the Pope Brook flows, it exceeded 30 cfs for a total duration of 1,284 hours during the same period.

Figures G and H below depict the Winooski River flows at the powerhouse, as estimated by both the reservoir-level change method, and the correlation with current USGS data from the Pope Brook gauge. Although there is frequent "noise" in the reservoir-level change data at lower flows, the timing and duration of events above the 30-cfs threshold is similar between the two methods.

GMP would be interested in discussing whether the current transducer on site is adequate for using the water level in Mollys Falls Reservoir as a surrogate for flow in the Winooski River.

Memorandum

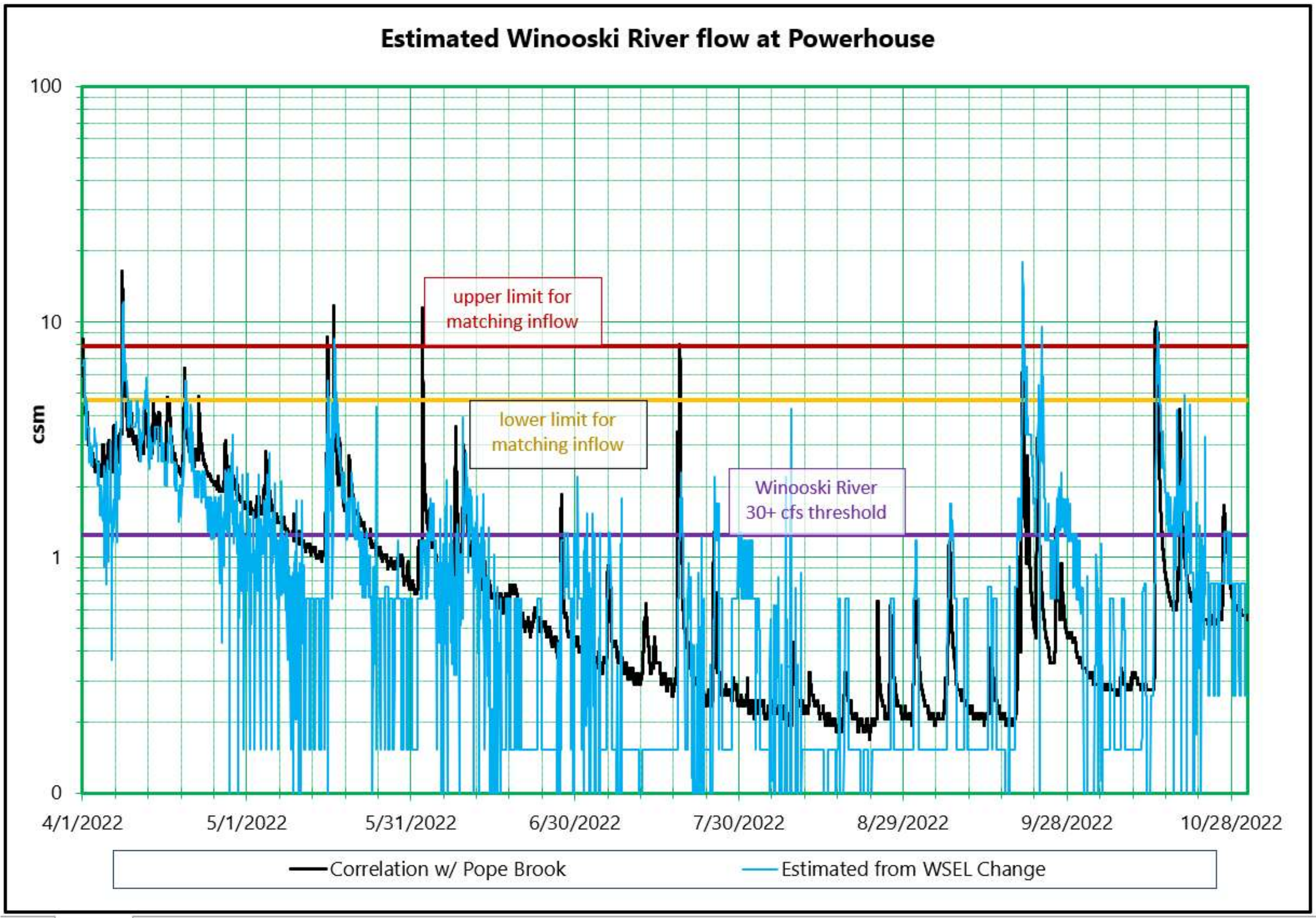


Figure G: Estimated Flows Based on Improved Transducer Resolution

Memorandum

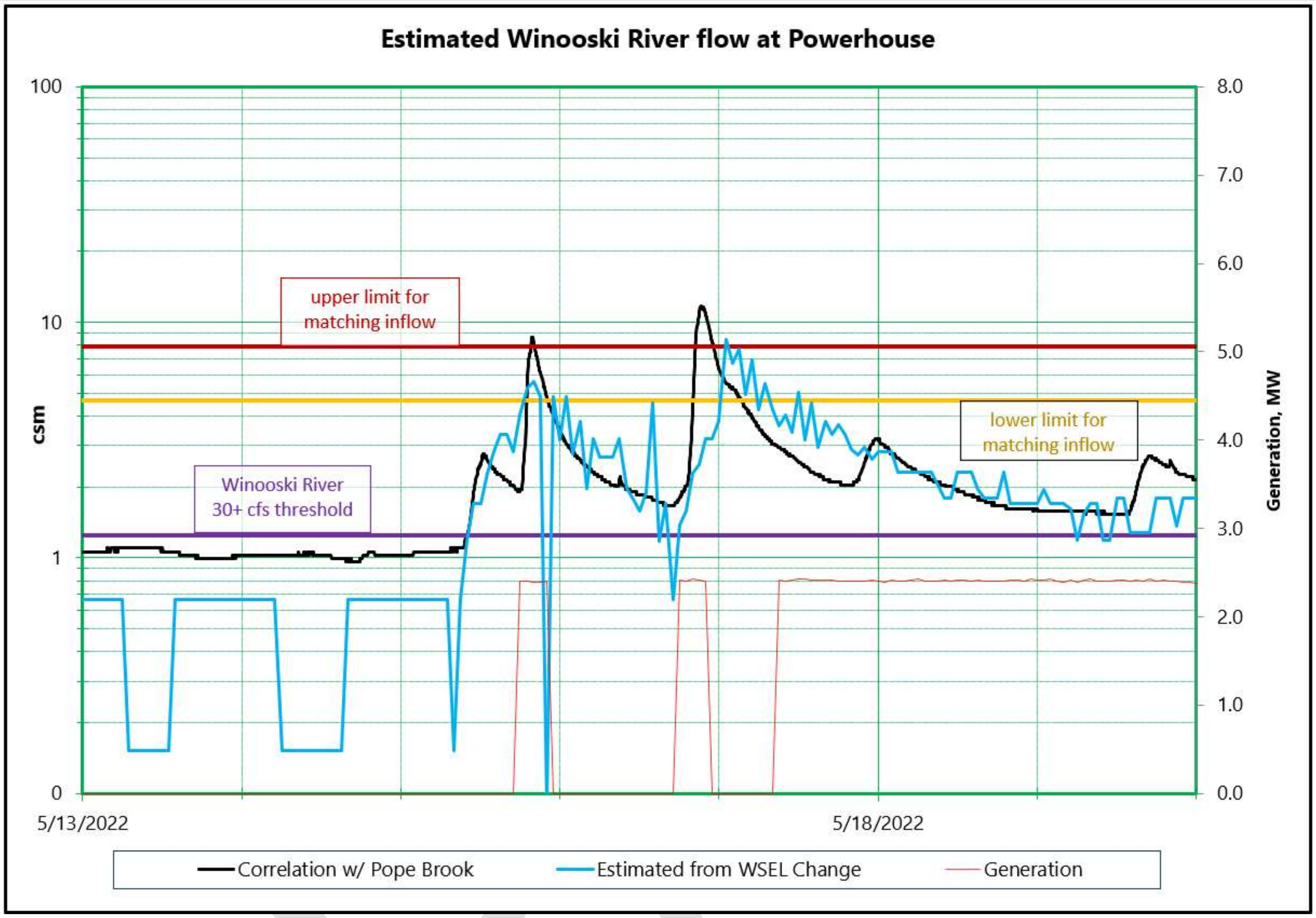


Figure H: Estimated Flows Based on Improved Transducer Resolution - Detail

Further upgrades in transducer equipment to achieve a true 0.01-foot sensitivity are theoretically possible, however wind and waves over the reservoir's surface area and long wind-fetch may limit the precision of such an instrument in actual practice.

Regarding the potential to install a transducer in the Winooski River at or near the powerhouse, to be used in conjunction with a stage:discharge relation to measure Winooski River flows directly, GMP is open to further investigation. Such a site would need to be upstream of the small riffle adjacent to the powerhouse, so it would not be affected by tailwater from generation (doesn't need to be above the rock falls further up). GMP will need to assess the feasibility of installing the needed equipment.

If the use of water level changes in Mollys Falls Reservoir as a surrogate for flow in the Winooski River is not desired, GMP's preferred alternative would be use of the Pope Brook USGS gauge data as a surrogate, because the USGS already maintains, calibrates, and operates the gauge, no new stream-channel disturbance or installation of equipment in the river is needed, and the Pope

Memorandum

Brook site has been found to correlate closely with the Winooski River immediately upstream of the powerhouse (r^2 = 0.8146 from the flow and habitat study[3]).

GMP is open to further discussion. Please let us know if the Agency would like to discuss this topic via an in-person or remote meeting.

Dissolved Oxygen Monitoring Plan

Comment: Section 2.6.4 Reasonable Worst-Case Streamflow Conditions states, "For a reasonable worst-case flow condition, Winooski River flows should be no greater than 3 times the 7Q10 flow rate for at least ten days between June 1 and September 30. The ten days do not need to be consecutive. Winooski River streamflows at station W-1 immediately above the powerhouse will be determined following the protocols proposed in the Flow and Water Level Management and Monitoring Plan for the Facility (VHB, 2020). Based on the prior study, 7Q10 flow at the powerhouse is 4.2 cfs, therefore the low-flow goal is 12.6 cfs or less, for ten or more days."

- *The streamflow condition of 3 times 7Q10 flow rate for at least ten days is not applicable in the case of the Mollys Falls Hydroelectric Project because the impact of operations is from the release of water from the Mollys Falls Reservoir that is low in dissolved oxygen into the Winooski River. Therefore, the primary focus of the dissolved oxygen monitoring should be on generation flows that occur at project under the operational changes agreed to in the 2019 MOU.*

Response:
Duly noted; the language regarding a low-flow target will be deleted. Note that due to the MOU requirements for conservation flow releases at the dam and limited reservoir water-level fluctuations, and because of the possibility of low summertime streamflows, generation during the summer when the reservoir is stratified may be infrequent, short-lived, or non-existent.

Is the Agency recommending that the Dissolved Oxygen Monitoring Plan include a statement along the lines of:

> "For a reasonable worst-case condition, generation cycles should occur on at least ten days between June 1 and September 30. The ten days do not need to be consecutive" ?

---

[3] The correlation coefficient exceeds the minimum of 0.8 specified in part B. of the Agency Procedure for Determining Acceptable Minimum Stream Flows (July 14, 1993).

Comment: Section 4.1 Monitoring Schedule states, "In the event that flows do not meet the low-flow target, the data will be reviewed with the ANR to determine whether an additional second year of monitoring is appropriate."

- *As stated above, the low-flow target is not applicable in the case of the impacts of Mollys Falls hydroelectric Project operations on dissolved oxygen levels in the Winooski River. A more appropriate target for critical is that generation occurs when the Mollys Falls Reservoir is stratified.*

Response:
Duly noted. Along with the above comment response, is the Agency recommending that the Dissolved Oxygen Monitoring Plan include an alternate statement in Section 4.1 along the lines of:

> "In the event that flows are too low to meet the generation target, the data will be reviewed with the ANR to determine whether an additional second year of monitoring is appropriate" ?

Winooski River Riparian Zone Restoration Plan

The Agency supports the plan in concept, as well generally the proposed means for implementation identified in the plan. However, the Agency does have concerns around the ability to make contact with landowners and possibly the appetite for participation in restoration efforts. The comments and question below focus on this concern.

Comment: Table 1 identifies ten 'Target Restoration Areas' for planting and subsequent monitoring. Please confirm that the plan would be to reach out to each respective landowner to gauge their willingness to participate in the program.

- *Assuming that not all landowners may be able to be contacted or be willing to participate, is there a threshold that GMP would consider a minimal amount of target restoration areas or acreage to be planted and monitored for successful implementation?*

Response:
Yes, the plan is to reach out to each owner of land within each of the ten Target Restoration Areas to encourage them to participate in the program.

GMP would restore as much acreage as it can obtain permission to do, i.e., there is no minimum amount that would result in cancellation of the restoration project if not met.

Comment: The landowner outreach section states that "should landowners initially decline to participate, GMP proposes attempting to request their permission again at a later date after neighbors have joined the program, or after properties have changed ownership".

- *While the Agency understands that there is a limit to what GMP can do entice landowners to participate, the Agency also appreciates the identification of the Conservation Reserve Enhancement Program as a potential partner and 'new funding sources/grants' in the 'future efforts' section. The Agency would encourage GMP to think creatively on options that may be available to incentivize participation, especially in the event initial outreach and participation is less than optimal.*

Response:
GMP agrees to think creatively throughout the process of implementing the Plan on options that may be available to incentivize participation, and will seek to identify any new funding sources, grants, and/or new potential partner organizations that may become available in the future.

Comment: Table 4 sets out the implementation schedule for the riparian zone restoration plan.

- *Please update this schedule in the final plan to reflect the anticipated date of project completion and/or plan approval.*

Response:
GMP agrees to update the schedule in the final plan for submittal to the PUC, to reflect the anticipated date of project completion and/or plan approval.

Meddie Perry

From: Davis, Eric <Eric.Davis@vermont.gov>
Sent: Friday, March 8, 2024 9:03 AM
To: Meddie Perry; Crocker, Jeff
Cc: Lisai, Jason; preston.gregory@greenmountainpower.com; Grace Grundhauser (Grace.Grundhauser@greenmountainpower.com)
Subject: [External] RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project

Good morning Meddie (and all),

Thank you for the revised plans for the Mollys Falls Hydroelectric Project. The Department has reviewed the revised plans and agrees that plans have been revised consistent with our ongoing dialogue. Thanks also for the updates that reflect the as-built specifications.

We appreciate the collaborative approach in finalizing these complex and technical plans and look forward to supporting the revised plans when they are submitted to the PUC.

Thanks,
Eric

VERMONT

Eric Davis | River Ecologist (he/him)
Vermont Agency of Natural Resources | Department of Environmental Conservation
Watershed Management Division | Rivers Program
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The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

VERMONT

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Vermont Agency of Natural Resources | Department of Environmental Conservation
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The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

From: Meddie Perry <MPerry@VHB.com>
Sent: Monday, February 26, 2024 1:04 PM
To: Davis, Eric <Eric.Davis@vermont.gov>; Crocker, Jeff <Jeff.Crocker@vermont.gov>
Cc: Lisai, Jason <jason.lisai@greenmountainpower.com>; preston.gregory@greenmountainpower.com; Grace Grundhauser (Grace.Grundhauser@greenmountainpower.com) <Grace.Grundhauser@greenmountainpower.com>
Subject: RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Eric & Jeff,

Thanks for the Agency's comments on the Mollys Falls Plans.

The three plans have all been revised in accordance with the Agency's comments and our various discussions. In addition to these changes, we have also made some further updates to reflect the fact that Project construction has been completed (in the prior drafts, phases of the construction were described as "proposed" or "planned" with anticipated completion dates). We've also added references to the additional MOU (12/2020) and PUC Orders (3/2020, 3/2021, 3/2022, and 12/2022) which were issued following the date of the draft plans. Also, the following specific updates have been made in the Flow and Water Level Management Plan to incorporate the actual "as-built" conditions of the completed new infrastructure:

- Section II.D: added explanation to relate spillway flow rates and gate operations, to the flooding/inundation flows noted in the Emergency Action Plan
- Section II.E.1.b: updated spillway operation procedures to harmonize with the current (2023) Emergency Action Plan
- Table 12: Peacham Pond Outlet Works flow rates have been updated for the as-built configuration of the outlet works
- Section III.F., table 18: Molly's Falls Reservoir outflows and Methods for Releasing Molly's Brook Bypass Flows have been added for the as-built configuration of the spillways and the new bypass flow system
- Section III.D: revised the Mollys Falls Reservoir Transducer Correction Factor, based on recent adjustments and PLC programming, so the correction is now internal to the PLC

Revised versions of the plans are too large for email, so they have been placed on this ShareSite where you may download them. Please let me know once you have downloaded all the documents. Feb 2024 Mollys Falls Plans

The VHB/GMP team believes the three plans have been revised consistent with the discussions with the Agency and with the Agency's prior response on November 17, 2023, and we have addressed the comments and reached consensus. Please let us know whether you agree.

Meddie Perry
Senior Hydrogeologist
Vermont Director of Water Resources

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From: Davis, Eric <Eric.Davis@vermont.gov>
Sent: Wednesday, December 27, 2023 11:05 AM
To: Meddie Perry <MPerry@VHB.com>; Crocker, Jeff <Jeff.Crocker@vermont.gov>
Cc: Lisai, Jason <jason.lisai@greenmountainpower.com>; preston.gregory@greenmountainpower.com; Grace Grundhauser (Grace.Grundhauser@greenmountainpower.com) <Grace.Grundhauser@greenmountainpower.com>
Subject: [External] RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project [Filed 22 Jan 2024 14:06]

Hi Meddie and all,

I Hope you area all enjoying the holidays! I just wanted to hopefully close the loop on our discussion here before the year is out. We appreciate the additional data and response regarding the 30 cfs trigger flow in the Winooski River. We believe it addresses our questions and an additional meeting is not necessary.

If the plans are revised consistent with this discussion and the prior response on November 17, 2023, it is my understanding that we will have addressed any outstanding comments and reached consensus. Could you please circulate final plans that incorporate these revisions when possible?

Thanks and Happy New Year,
Eric

VERMONT

Eric Davis | River Ecologist (he/him)
Vermont Agency of Natural Resources | Department of Environmental Conservation
Watershed Management Division | Rivers Program
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The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

From: Meddie Perry <MPerry@VHB.com>
Sent: Friday, December 15, 2023 8:15 AM
To: Davis, Eric <Eric.Davis@vermont.gov>; Crocker, Jeff <Jeff.Crocker@vermont.gov>
Cc: Lisai, Jason <jason.lisai@greenmountainpower.com>; preston.gregory@greenmountainpower.com; Grace Grundhauser (Grace.Grundhauser@greenmountainpower.com) <Grace.Grundhauser@greenmountainpower.com>
Subject: RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project

Eric,

Thanks for continuing the conversation about the Mollys Falls Plans.

Responses to your questions from your November 28, 2023 email are as follows:

- Q: It appears at flows are close to the threshold and where inflow is relatively static (for example 4/26 through 5/7) water level becomes less reliable as a surrogate. How would implementation (inputs and programming logic) attempt to deal with this?
    - A: When estimated Winooski River flow at the powerhouse are close to the 30-cfs threshold and reservoir inflow is relatively static, so that the estimated flow fluctuates frequently above/below the threshold, GMP would not activate generation. The 30-cfs flow threshold would not be used to trigger generation on an instantaneous basis; flows would need to be consistently above the threshold and show a stable or increasing trend (i.e., not trending towards becoming below the threshold) for at least 4 hours before generation would be activated [unless triggered by some other factor specified in the MOU such as emergencies or high water levels]. Additional information on protocols for activating generation based on the 30-cfs threshold are explained in our other responses below.

- Q: It appears that a period like early June (6/4-6/8), water level and Pope Brook would not indicate the threshold is met. Can you confirm that threshold is not met and if so after implementation under those conditions generation would not occur?
    - A: Correct, in the data set that VHB / GMP provided (spreadsheet "MF-Inflow-Estimates-2023-08-31.xlsx", emailed November 17, 2023), the data from June 4 through June 8, 2022 show that the 30-cfs threshold was not met by either the correlation with the Pope Brook USGS gauge, nor by the estimate based on reservoir level. Correct, under such conditions, generation would not occur [again, unless triggered by some other factor specified in the MOU such as emergencies or high water levels].
    - Note that during June 2022, the Emergency Spillway construction project was underway, and generation being used to manage reservoir levels per the Control of Water Plan that was in effect at that time, so the June 2022 generation operations were not typical of operating conditions under the MOU.

In a prior response to comments, GMP's response stated: "*Generation would not occur automatically merely because reservoir-level-rate-of-change indicates that Winooski River flows exceed 30 cfs. GMP would decide whether or not to generate when flows exceed the threshold, based on whether the apparent high-flow event is likely to persist and a reality check based on Pope Bk USGS gauge, weather at Peacham Pond/Mollys Falls Reservoir site; confirmation that Mollys Falls Reservoir Level (magnitude, regardless of rate-of-change) is high enough to support generation and meet the NOL requirements; weather forecast (i.e., are flows expected to persist or to rise further vs. decrease immediately)*".

- Q: Given the questions above and the data compiled from 2022, is it possible to revisit description and flesh out the specifics of how the factors would be considered? This may be particularly helpful as these considerations will have to be translated into either a procedure or logic to implement.
    - A: Generation will continue to be manually started and stopped by GMP's operators, normally remotely from the Control Center, or locally by the Mollys Falls Power Production Workers when needed. The PLC will not automatically start generation as a result of estimated Winooski River flow at the powerhouse exceeding 30 cfs, or any other factor.
    - The procedure is as follows:
    - In the Control Center and in the Mollys Falls Powerhouse, the Human-Machine Interface ("HMI") screens will display the reservoir water level, reservoir level setpoints, bypass valve position, generation rate, estimated reservoir inflow, and estimated Winooski River flow at the powerhouse.
    - During the April-October period when the 30-cfs flow threshold is applicable, GMP staff will view the current data and recent past trends on the HMI to confirm the following prior to starting generation:
        - estimated Winooski River flow at the powerhouse exceeds 30 cfs, and
        - reservoir water levels are sufficiently above the seasonally applicable minimum to remain in compliance with MOU requirements, and
        - the applicable seasonal conservation flows are being released into Mollys Brook, and
        - estimated Winooski River flow at the powerhouse is likely to exceed 30 cfs for at least 4 hours (i.e., the recent-past inflow data trend indicates a consistent trend of stable or increasing flow above 30 cfs, and inflows >30 cfs are not the result of an anomalous SCADA reading or "spike" in the transducer data).
        - A "reality-check" confirms the estimated Winooski River flow at the powerhouse in excess of 30 cfs is most likely accurate, based on the operators' judgment and in consideration of USGS pope Brook flows, and current & forecasted weather.
    - Ramping protocols are automatically implemented when generation starts and stops.

- While a generation cycle is underway, Winooski River flow at the powerhouse will continue to be estimated automatically by the PLC and displayed on the HMI. GMP operators will verify that flow remains 30 cfs or greater during generation.

Please let us know if this information addresses your questions, or if another discussion via MS Teams would be more helpful.

Meddie Perry
Senior Hydrogeologist
Vermont Director of Water Resources

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From: Davis, Eric <Eric.Davis@vermont.gov>
Sent: Tuesday, November 28, 2023 11:20 AM
To: Meddie Perry <MPerry@VHB.com>; Crocker, Jeff <Jeff.Crocker@vermont.gov>
Cc: Lisai, Jason <jason.lisai@greenmountainpower.com>; preston.gregory@greenmountainpower.com
Subject: [External] RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project

Good morning all,

I hope everyone had an enjoyable Thanksgiving and we appreciate the continued dialogue and data to finalize the Mollys Falls plans. Below, I'll address our review of the two items we discussed and I am also including an additional comment that I believe to be minor, but I missed addressing on our call.

Analysis of snow water content

The Department is amenable to the proposal to assess the methodology 5 years following the conclusion of the initial 3-year annual review period. Please revise the plan accordingly.

Reservoir level changes as a surrogate for flow

In general, it appears that reservoir water level is an acceptable surrogate for flow. Looking into the detail of the 2022 data, we do have a couple of questions regarding the details of implementing this approach.

- It appears at flows are close to the threshold and where inflow is relatively static (for example 4/26 through 5/7) water level becomes less reliable as a surrogate. How would implementation (inputs and programming logic) attempt to deal with this?
- It appears that a period like early June (6/4-6/8), water level and Pope Brook would not indicate the threshold is met. Can you confirm that threshold is not met and if so after implementation under those conditions generation would not occur?

In a prior response to comments, GMP's response stated: "*Generation would not occur automatically merely because reservoir-level-rate-of-change indicates that Winooski River flows exceed 30 cfs. GMP would decide whether or not to generate when flows exceed the threshold, based on whether the apparent high-flow event is likely to persist and a reality check based on Pope Bk USGS gauge, weather at Peacham Pond/Mollys Falls Reservoir site; confirmation that Mollys Falls Reservoir Level (magnitude, regardless of rate-of-change) is high enough to support generation and meet the NOL requirements; weather forecast (i.e., are flows expected to persist or to rise further vs. decrease immediately)*".

- Given the questions above and the data compiled from 2022, is it possible to revisit description and flesh out the specifics of how the factors would be considered? This may be particularly helpful as these considerations will have to be translated into either a procedure or logic to implement.

Dissolved oxygen plan comments

In its response to comments, GMP asked whether the Department was looking for specific language to be included in the plan. We don't believe it is necessary to include a specific number of events, as it will largely depend on conditions. However, the intent of our comments was to point that unlike in many instances where the critical conditions would occur at low flows and high temps, in this setting the critical conditions are likely to occur during generation events when the reservoir is likely to be stratified. If the plan were revised to generally describe these as the target conditions that would address the intent of our comments.

Thank you,
Eric

VERMONT

Eric Davis | River Ecologist (he/him)
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eric.davis@vermont.gov
dec.vermont.gov/watershed/rivers

The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

From: Meddie Perry <MPerry@VHB.com>
Sent: Friday, November 17, 2023 11:35 AM
To: Davis, Eric <Eric.Davis@vermont.gov>; Crocker, Jeff <Jeff.Crocker@vermont.gov>
Cc: Lisai, Jason <jason.lisai@greenmountainpower.com>; preston.gregory@greenmountainpower.com
Subject: RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.
Eric & Jeff,

Thanks again for the Teams Meeting this Tuesday and for the continued productive dialogue about the project.

Per your request during the meeting, attached please find a spreadsheet with the Marshfield Reservoir inflow data and graphs zoomed-in to 7-day periods enabling the inflow rates estimated from reservoir-level changes to be compared to those estimated via comparison to the Pope Brook USGS gauge, in terms of timing of flows exceeding the 30-cfs threshold.

Regarding analysis of the snow-water content data and the actual operations of the project with respect to winter drawdowns, spring refill, and snowmelt events, GMP's preference is to re-assess the need to refining the methodology 5 years following the 3-year period, i.e., in 2030. This time-frame would provide 8 years of operations data to evaluate.

Please let us know if you have any additional questions or would like to discuss further.

Meddie Perry
Senior Hydrogeologist
Vermont Director of Water Resources

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From: Davis, Eric <Eric.Davis@vermont.gov>
Sent: Wednesday, November 8, 2023 9:56 AM
To: Meddie Perry <MPerry@VHB.com>
Cc: Crocker, Jeff <Jeff.Crocker@vermont.gov>; preston.gregory@greenmountainpower.com; Lisai, Jason <jason.lisai@greenmountainpower.com>
Subject: [External] RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project

Good morning all,

Thanks for circling back with your availability. I have just sent out a Teams invite for the meeting.

Thank you,
Eric

VERMONT

Eric Davis | River Ecologist (he/him)
Vermont Agency of Natural Resources | Department of Environmental Conservation
Watershed Management Division | Rivers Program
Davis 3, 1 National Life Dr | Montpelier, VT 05620-3522
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eric.davis@vermont.gov
dec.vermont.gov/watershed/rivers

The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

From: Meddie Perry <MPerry@VHB.com>
Sent: Tuesday, November 7, 2023 12:10 PM
To: Davis, Eric <Eric.Davis@vermont.gov>
Cc: Crocker, Jeff <Jeff.Crocker@vermont.gov>; preston.gregory@greenmountainpower.com; Lisai, Jason <jason.lisai@greenmountainpower.com>
Subject: RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project

Eric,

Thanks for your email. We appreciate the opportunity to continue our discussions and ideally to find consensus. The GMP/VHB team can be available the following dates and times:

- Tuesday, November 14, 2–4pm
- Friday, November 17, 2–5pm

Please let us know which date/time you would prefer for a remote meeting.

Meddie Perry
Senior Hydrogeologist
Vermont Director of Water Resources

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From: Davis, Eric <Eric.Davis@vermont.gov>
Sent: Thursday, November 2, 2023 1:51 PM
To: Meddie Perry <MPerry@VHB.com>
Cc: Crocker, Jeff <Jeff.Crocker@vermont.gov>; preston.gregory@greenmountainpower.com; Lisai, Jason <jason.lisai@greenmountainpower.com>
Subject: [External] RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project

Good afternoon Meddie (and all),

Thank you for your response to our comments and thanks again for hosting us on site to view the completion of the project in person.

We had a chance to briefly discuss some of the comments and responses on site and in general I think we are moving towards finding mutual agreement, but what may make sense at this point is to set up a remote meeting to continue that discussion. Ideally, we could find consensus and no substantive comments would be needed when the plan is filed before the PUC.

Next week is challenging, but we have some availability the following week (the week of the 13th), particularly on the afternoon of the 13th, after 2 on the 14th, or the afternoon of the 17th. Does the GMP team agree on this approach and have availability on any of these dates or should we find alternatives?

Thanks!
Eric

VERMONT

Eric Davis | River Ecologist (he/him)
Vermont Agency of Natural Resources | Department of Environmental Conservation
Watershed Management Division | Rivers Program
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eric.davis@vermont.gov
dec.vermont.gov/watershed/rivers

The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

From: Meddie Perry <MPerry@VHB.com>
Sent: Thursday, August 31, 2023 4:05 PM
To: Davis, Eric <Eric.Davis@vermont.gov>
Cc: Crocker, Jeff <Jeff.Crocker@vermont.gov>; preston.gregory@greenmountainpower.com; Lisai, Jason <jason.lisai@greenmountainpower.com>
Subject: RE: Interim comments on draft plans for Mollys Falls Hydroelectric Project

Eric,

Thank you for the interim comments on the draft plans prepared for the Mollys Falls Hydroelectric Project. Our responses are provided in the attached document.

Note, there are a few items where we are open to further discussion; please let us know if the Agency would like to discuss via an in-person or remote meeting, and some dates that would work for you. Potentially we could discuss these items when we meet to review the status of operations (see separate email I just sent you and Jeff).

Meddie Perry
Senior Hydrogeologist
Vermont Director of Water Resources

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From: Davis, Eric <Eric.Davis@vermont.gov>
Sent: Friday, January 27, 2023 1:41 PM
To: Meddie Perry <MPerry@VHB.com>
Cc: Crocker, Jeff <Jeff.Crocker@vermont.gov>; Smart, Kane <Kane.Smart@vermont.gov>; Lisai, Jason <jason.lisai@greenmountainpower.com>; Andrew Raubvogel <araubvogel@dunkielsaunders.com>
Subject: [External] Interim comments on draft plans for Mollys Falls Hydroelectric Project

Good afternoon Meddie (and all),

Please find interim comments on the draft plans prepared for the Mollys Falls Hydroelectric Project attached. The Agency is categorizing these comments as interim to provide an opportunity to discuss before finalizing the plans.

Thank you,
Eric

VERMONT

Eric Davis | River Ecologist (he/him)
Vermont Agency of Natural Resources | Department of Environmental Conservation
Watershed Management Division | Rivers Program
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The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

SRH LAW
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March 28, 2024

Via ePUC

Holly Anderson, Clerk
Vermont Public Utility Commission
112 State Street
Montpelier, Vermont 05620-2701

Re: Case No. 18-2549-PET - Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 for authorization to make changes to the Molly's Falls Hydroelectric Facility in Cabot, Marshfield, and Peacham, Vermont

Dear Ms. Anderson:

Pursuant to the Commission's March 27, 2020 *Final Order Granting Chapter 43 Authorization* in the above captioned case, Green Mountain Power ("GMP") hereby files with the Commission the following plans required under ¶ 6 of that Order and under the 2019 Memorandum of Understanding reached between GMP and the Agency of Natural Resources ("ANR") ("2019 MOU") in that case:

- Dissolved Oxygen Monitoring Plan (2019 MOU, Sections III.D, III.F)
- Riparian Zone Restoration Plan (2019 MOU, Section III.G)
- Flow and Water Level Management and Monitoring Plan (2019 MOU, Section III.H)

In the subsequent proceeding involving Improvements to the Emergency Spillway at the Molly's Falls facility,[1] GMP and ANR entered into a MOU on December 23, 2020 ("2020 MOU"), which established deadlines for completing the above-referenced plans under the 2019 MOU. Pursuant to the 2020 MOU, GMP is required to file these plans with the Commission for approval by no later than 30 days after receiving comments on the draft plans from ANR. GMP provided draft plans to ANR for review and comment, and the plans have been revised in collaboration with the Agency consistent with their feedback. GMP received final comments from ANR on March 8, 2024.

[1] Case No. 20-2570-PET, *Petition of Green Mountain Power Corporation, under 10 V.S.A. Chapter 43 and pursuant to the March 27, 2020 Order in Case No. 18-2549-PET, for approval of improvements to the Emergency Spillway at the Marshfield #6 Dam in Cabot, Vermont, part of the Molly's Falls Hydroelectric Facility.*

Thank you, and if you have any questions, please feel free to contact me.

Sincerely,

Andrew N. Raubvogel, Esq.
Malachi Brennan, Esq.
SRH Law PLLC

cc: Service List (via ePUC)

ATTACHMENT B

FLOW WATER LEVEL MANAGEMENT AND MONITORING PLAN

GREEN MOUNTAIN POWER
MOLLY'S FALLS HYDROELECTRIC FACILITY

FLOW AND WATER LEVEL MANAGEMENT AND MONITORING PLAN

Prepared for **Green Mountain Power**
163 Acorn Lane
Colchester, Vermont 05446

Prepared by **VHB**
40 IDX Drive, Building 100, Suite 200
South Burlington, VT 05403

February, 2024

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GREEN MOUNTAIN POWER
MOLLY'S FALLS HYDROELECTRIC FACILITY
(Cabot, Marshfield, and Peacham, Vermont)

FLOW and WATER LEVEL MANAGEMENT and MONITORING PLAN

February, 2024

I. INTRODUCTION

This Plan specifies water levels, flows, and schedules that are required for the Molly's Falls Hydroelectric Facility following completion of construction of the physical improvements that the Vermont Public Utility Commission ("PUC") approved in its Orders dated March 27, 2020, March 23, 2021, March 30, 2022, and December 14, 2022 ("the Project"). The Molly's Falls Hydroelectric Facility involves Peacham Pond and its dam, Sucker Brook, Molly's Falls Reservoir and the Marshfield Dam, Molly's Brook, the powerhouse along the Winooski River, and a penstock from the Marshfield Dam to the powerhouse. The maps in Figures 1 and 2 below indicate the key Facility features (full-size versions are on pages 1-2 of Appendix 1).

I.A. About this Plan

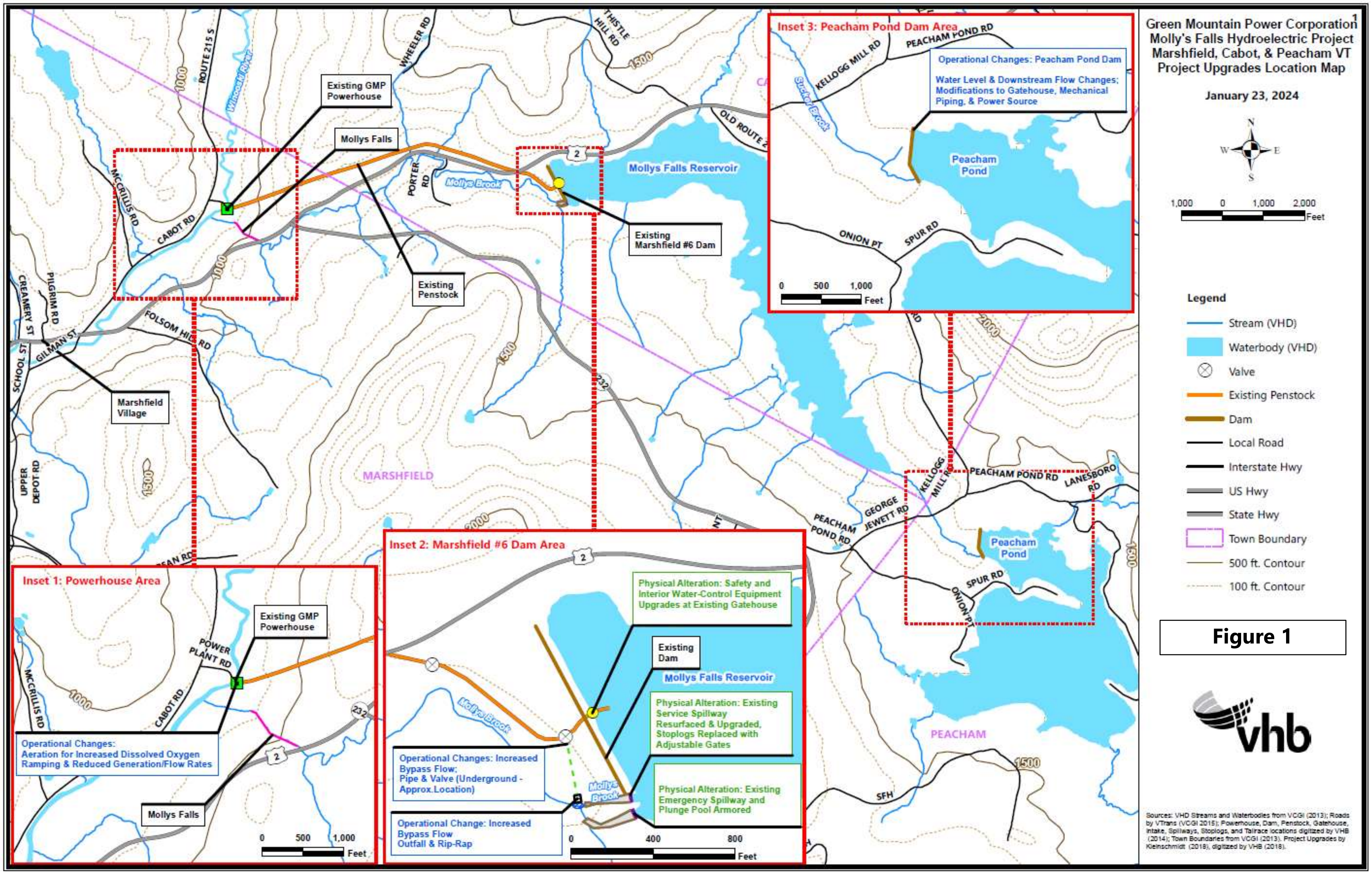
This is a plan for Green Mountain Power ("GMP") to rely upon to guide operations after Project construction has been completed. The PUC Order approving the Service Spillway improvements phase of the Project was issued on March 27, 2020 and authorized physical improvements and operational changes to the Molly's Falls Hydroelectric Facility. PUC Orders authorizing the Emergency Spillway improvements phase of the Project were issued on March 23, 2021, March 30, 2022, and December 14, 2022, and authorized additional physical improvements and set a schedule for implementing the previously-approved operational changes. Sections I.C. and I.D. below explain these operational changes and physical improvements, respectively, in detail. Construction of these physical improvements began in April of 2020 and was completed in the spring of 2023.

After the Project construction has been completed, and once the PUC has approved this Flow and Water Level Management and Monitoring Plan, the operational changes required by the March 2020 PUC Order and an August 23, 2019 Memorandum of Agreement ("MOU") with the Vermont Agency of Natural Resources ("ANR") will be implemented. In the interim prior to Plan approval, certain operational changes related to Peacham Pond and Molly's Falls Reservoir water levels, Molly's Brook bypass flows, generation rate caps, and generation-ramping have already been implemented pursuant to the March 2021 PUC Order and a December 23, 2020 MOU with the ANR. The PUC Orders and MOUs are in Appendix 2. This Plan supersedes GMP's procedures for normal Facility operations that were in effect prior to construction of the improvements, however GMP's Emergency Action Plan ("EAP," Kleinschmidt, 2023) for the Facility remains in effect for emergency situations. This Plan may be temporarily superseded by approved Control-of-Water Plans for construction of Facility improvements.

Section I of this Plan is the introduction, and includes a description of the Facility, specifications of key Facility components, descriptions of operations and regulatory compliance requirements, and a list of the construction work that has been completed.

Section II of this Plan describes the requirements and protocols for various situations and times of year, providing guidance on what reservoir levels, rates-of-change, generation operations, and flow-release rates are to be used and when. This is the "what to do" section.

Section III of this Plan includes details on how to implement the Section II requirements and goals. Methods of determining reservoir levels and storage-volumes, valve operations, flow-setting, and measurement, are explained. Detailed tables, graphs, and calculations are included for reference. This is the "how to do it" section.


Green Mountain Power Corporation
Molly's Falls Hydroelectric Project
Marshfield, Cabot, & Peacham VT
Project Upgrades Location Map
January 23, 2024
Legend
Stream (VHD)
Waterbody (VHD)
Valve
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Dam
Local Road
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US Hwy
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100 ft. Contour
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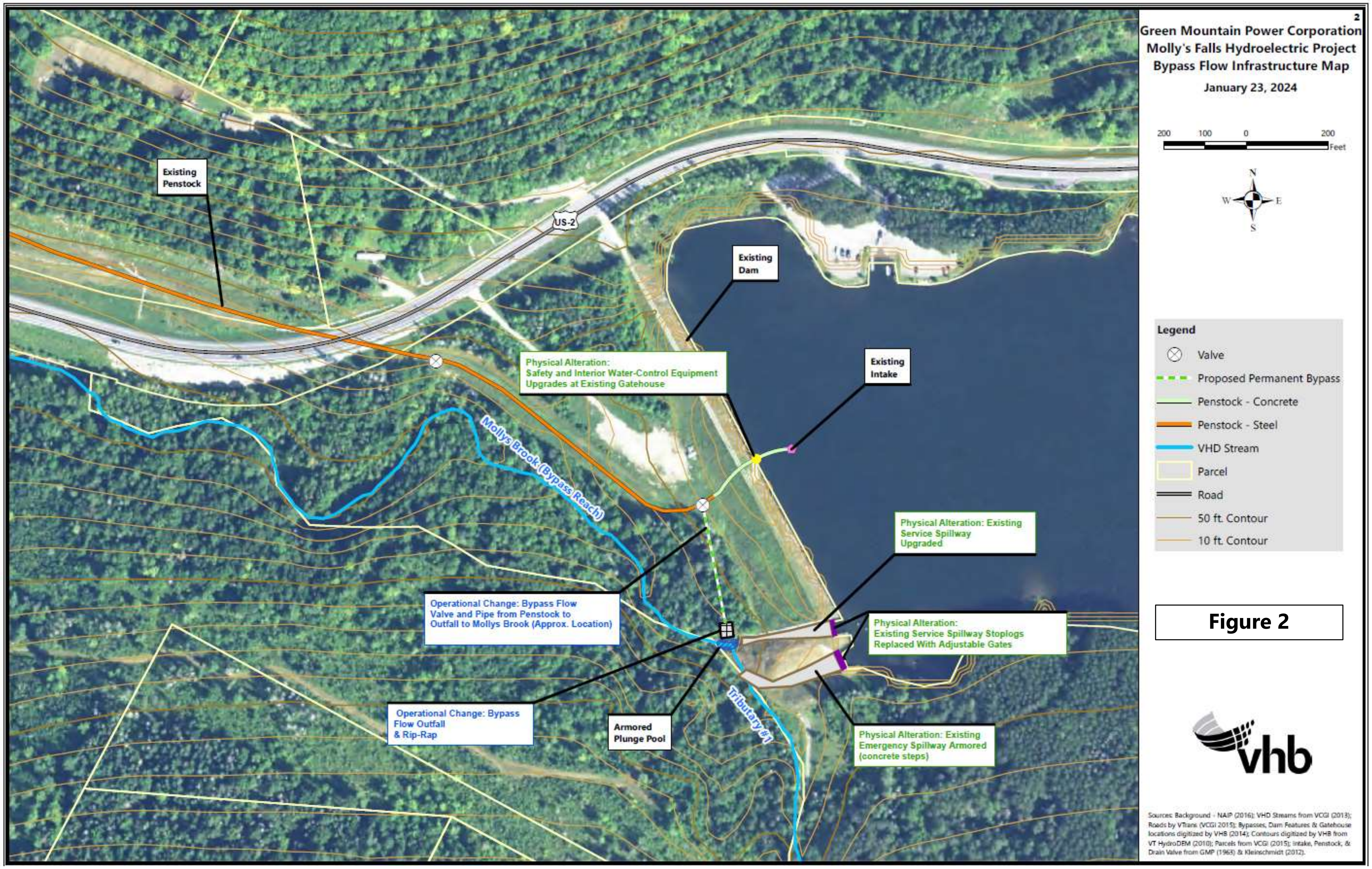
Mollys Falls
Existing Marshfield #6 Dam
Existing Penstock
Existing Dam
Marshfield Village
Mollys Falls Reservoir
Peacham Pond
MARSHFIELD
PEACHAM
Sources: VHD Streams and Waterbodies from VCGI (2013); Roads by VTrans (VCGI 2015); Powerhouse, Dam, Penstock, Gatehouse, Intake, Spillways, Stoplogs, and Tailrace locations digitized by VHB (2014); Town Boundaries from VCGI (2013). Project Upgrades by Kleinschmidt (2018), digitized by VHB (2018).



Green Mountain Power Corporation
Molly's Falls Hydroelectric Project
Bypass Flow Infrastructure Map
January 23, 2024
Existing Penstock
US-2
Existing Dam
Existing Intake
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Mollys Brook (Bypass Reach)
Physical Alteration: Existing Service Spillway Upgraded
Operational Change: Bypass Flow Valve and Pipe from Penstock to Outfall to Mollys Brook (Approx. Location)
Physical Alteration: Existing Service Spillway Stoplogs Replaced With Adjustable Gates
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Armored Plunge Pool
Tributary #1
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Legend
Valve
Proposed Permanent Bypass
Penstock - Concrete
Penstock - Steel
VHD Stream
Parcel
Road
50 ft. Contour
10 ft. Contour
Figure 2

I.B. Facility Description

The Facility is located in Peacham, Cabot, and Marshfield, VT, and includes the Peacham Pond reservoir and earthen dam in Peacham; the Molly's Falls Reservoir, dam, and gatehouse in Cabot; the powerhouse on Power Plant Road in Marshfield; and the approximately 1.6-mile long penstock from the dam to the powerhouse. Figures 1 and 2 above show the locations of the Facility features. Molly's Falls Reservoir was first filled in 1927 upon completion of the Marshfield #6 Dam, an 1,100-foot long rolled earthfill dam. The Facility has been used for renewable energy generation since then.

The Facility is exempt from Federal Energy Regulatory Commission ("FERC") license requirements, because it was constructed in 1927 prior to the enactment of licensing regulations.

GMP has historically used a local elevation datum at the Facility. New engineering plans for Molly's Falls Reservoir use NAVD 88 datum above mean sea level, and existing information for Peacham Pond uses NGVD 29 datum. Elevations are converted from local datum to feet above mean sea level ("msl"), as follows:

Table 1: Conversion Factors: to Convert from Local Elevation Datum, add the following

NGVD 29*	692.14 feet*
NAVD 88	692.00 feet

*Prior documents referenced a conversion of 691.65 feet. Recent benchmark surveying has determined that the correct conversion is actually 692.14 feet. All NGVD elevations in this Plan have been adjusted to use the correct conversion, including elevations specified in the 2019 MOU (e.g., the Peacham Pond Normal Operating Level is correctly 1,402.39' NGVD 29, equal to 710.25' local datum, which is unchanged from historic practices.

I.B.1. General Configuration

The Facility consists of water storage in Peacham Pond, which flows from the outlet works at the Peacham Pond dam through Sucker Brook into Molly's Falls Reservoir which provides additional storage. All flow from Peacham Pond passes through Sucker Brook which flows for 0.6 miles en route to Molly’s Falls Reservoir. Water used for generating renewable energy flows from Molly’s Falls Reservoir via a penstock to a powerhouse where the generating equipment is housed.

Water from Molly’s Falls Reservoir that is not used for generating renewable energy flows through the bypass flow system and the dam’s spillways into Molly’s Brook, a tributary of the Winooski River. Water is not normally released from the spillways, except that previously, approximately 1.6 cfs would leak through the current emergency spillway and former service spillway stoplogs. During high-inflow events the service spillway may release flow when the rate of inflow exceeds the generation rate and causes reservoir levels to rise. As part of the Project, the service spillway was reconfigured during 2020 and a new sliding gate was installed at the head of the spillway, replacing the former stoplog system to enable controlled releases of water. Unlike the former stoplogs that needed to be “tripped” all at once and that could not be re-installed until the reservoir drained down to the sill level, the new gate can be partially or fully re-closed at varying reservoir levels.

Molly’s Brook is termed the “bypass reach” at this Facility, because the portion of the water flowing through the penstock for generation bypasses an approximately 2-mile long reach of the brook between the Molly’s Falls Reservoir dam and its confluence with the Winooski River near the powerhouse. Approximately 2 mi^2 of watershed un-regulated by the Facility drains into the bypass reach. Molly’s Falls, a series of bedrock cascades and pools, is located along Molly’s Brook in a densely wooded area on GMP-owned property downstream from the Route 2 crossing, and is not visible from public areas or roads. The powerhouse is adjacent to the Winooski River, located a short distance upstream of its confluence with the bypassed reach of Molly’s Brook. At the powerhouse, the watershed of the Winooski River measures 24 mi^2. At the confluence of the Winooski River and the bypass reach, the watershed measures 49 mi^2. A new bypass flow system that was installed as part of the Project directs flow from the penstock to the head of Molly’s Brook to provide the conservation flows that are required by the 2019 MOU.

Table 2 below summarizes specifications, that are applicable to flow and water level management, of the two reservoirs and dams.

Table 2: Reservoir Summary		
Specification	**Peacham Pond**	**Molly's Falls Reservoir**
Watershed Area (mi^2)	5.8	22.2
Dam-Crest Elevation (ft)	717.70 (1,409.84 NGVD 29)	548.4 (1,240.4 NAVD 88)
Normal Operating Level ("NOL", ft) See note in Table 1 above	710.25 (1,402.39 NGVD 29)	531.7 (1,223.7 NAVD 88)
Surface Area at NOL (Acres)	382	377
Winter Drawdown* (ft below NOL)	6.6 (through 2024-25) 3.0 (2025-26 onward)	2.0
Winter Low Water Level* (ft)	703.65 (to 2024-25) 707.25 (2025-26 on)	529.7 (1,221.7 NAVD 88)
Useable Storage (Acre-Feet)**	2,056	740
Total Storage at NOL (Acre-Feet)	7,800	6,032
Outlet/Penstock Invert Elevation (ft)	691.6 (4 ft diam.) (1,383.74 NGVD 29)	498.86 (9.75 ft high) (1,190.86 NAVD 88)
Spillway Sill Elevation (ft)	711.7 (1,403.84 NGVD 29)	Service: 532.2 (1,224.2 NAVD 88)
Dam Hazard Classification	Significant	High
* Greater drawdowns (to lower levels) are allowed under specific circumstances, see Section II.A.2 (Peacham Pond) and II.C.2 (Molly's Falls Reservoir) below. ** Between NOL and normal winter low water level		

Appendix 3 contains detailed information on the reservoirs, including bathymetric maps, tables, and graphs relating water surface elevations to storage volumes and surface areas of Peacham Pond and Molly's Falls Reservoir.

I.B.2. Peacham Pond Outlet Works

The primary outlet from Peacham Pond is a concrete outlet structure that is accessed via a footbridge from the dam. A submerged intake with a steel grating is on the east face of the outlet structure. Inside the outlet structure, a submerged gate controls flow to a 48-inch diameter reinforced concrete pipe that flows to Sucker Brook. The gate opens vertically, and the height of the opening may be adjusted from 0.0 feet (fully closed) to 4.0 feet to adjust the rate of flow out of Peacham Pond. The gate may be operated via an electric actuator.

GMP installed a new weir in the outlet structure that allows the pond to function passively in run-of-river mode when filled to the Normal Operating Level ("NOL") or to the winter-drawdown level of 3.0 feet below the NOL. The weir is equipped with a vertically-adjustable gate; with the gate set for either the NOL or the minimum winter level, water would flow over the gate crest in the side of the outlet structure, and would fall into the outfall pipe.

Peacham Pond is equipped with a transducer at the outlet structure that communicates via GMP's System Command and Data Acquisition ("SCADA") system to enable remote water-level reading. The transducer can only read water levels as low as elevation 700.5 feet local datum. A staff gauge on the exterior of the outlet structure allows manual reading of the water level and can be used if water levels are too low for the transducer. The staff gauge reads in feet, local datum.

Figure 3:
Peacham Pond Outlet Works, viewed from the west
Weir visible on face of structure below bridge

Figure 4:
Peacham Pond Outlet Works, viewed from the north

A 90-foot wide overflow spillway in the earthen dam allows high flows to pass downstream when the pond water level exceeds the spillway crest elevation of 711.70 feet local datum. The spillway is maintained in an open configuration and is not equipped with stoplogs or other devices to impound water.

Figure 5:
Peacham Pond Spillway, viewed from the north

I.B.3. Molly’s Falls Reservoir Intake, Gatehouse, and Penstock

The primary outlet for water from Molly’s Falls Reservoir is the penstock that feeds the generating turbine. Water flows from a submerged intake, through a gatehouse, and through the penstock to the powerhouse. A tap in the penstock directs water through a flow-control valve to the bypass flow system that normally provides conservation flows to Molly’s Brook. Drain valves along the penstock also allow water to be released to Molly’s Brook using temporary hoses or overland flow, and may be used to provide bypass flow on an interim basis, with case-by-case approval from the ANR.

A single screened intake is submerged in the reservoir approximately 80 feet offshore from the gatehouse. The intake opening is rectangular and measures 12 feet wide by 13.8 feet long on the incline. The intake is oriented at an angle with a height of 9.75 feet above the invert, which is approximately 38 feet below the Normal Operating Level.

The gatehouse is a concrete and brick structure near the water’s edge in the reservoir, accessed via a new (2018) footbridge from the dam-crest. The gatehouse contains the headgate that can be closed manually or remotely to shut-off the flow of water into the penstock. This gate is either fully-open or fully-closed; it is not used to adjust the flow rate, and flow-control is performed by the generating unit and by the bypass flow system control valve. A water-level sensor inside the gatehouse provides GMP with remote reservoir-level monitoring, and a staff gauge to read water levels manually is affixed to the south side of the gatehouse exterior.

Figure 6:
Molly's Falls Reservoir Gatehouse, viewed from the south

The penstock is a 6-foot diameter, 8,700-foot long pipe from Molly's Falls Reservoir to the powerhouse. One surge tank is located along the penstock approximately 80-percent of the distance to the powerhouse. The penstock consists of concrete pipe from the intake to the gatehouse, continuing as concrete 340 feet through the dam to the base of the dam, and then consists of new steel, installed between 2007 and 2011, to the surge tank, while the original 1927-era riveted steel penstock remains in use from the surge tank to the powerhouse. Drain valves at locations along the penstock allow water to be drained from low points, and are normally closed except when penstock repair or inspections are underway. The tap to the Molly's Brook bypass flow system is located along the steel section of penstock. The bypass flow system is normally flowing to provide continuous conservation flows.

I.B.4. Powerhouse

The powerhouse contains a single Norcan vertical Francis turbine, with a rated hydraulic capacity of 200-210 cfs. The turbine's actual hydraulic capacity for safe operations is 103 cfs to 173 cfs, based on testing completed by the manufacturer (see Appendix 4). From November 1 through March 31, the normal flow rate for generation is 135 cfs, corresponding to 3.5 megawatts ("MW"). During the rest of the year, generation rates will normally be 103 cfs, corresponding to 2.4 MW. Higher generation rates will be allowed to match the rate of inflow to Molly's Falls Reservoir within the range for safe operation, and in defined emergencies and high-flow events (see Section II.E.1).

A valve and 24-inch bypass pipe at the powerhouse bypass the turbine and discharge into the tailrace beneath the building. The valve is a VAG Riker plunger valve with a Rotork electric actuator that is controlled by the SCADA system. This bypass valve and pipe are used automatically to release flows that are below the turbine's minimum capacity, for ramping flow-releases up at the start of generating cycles and down at the end of generating cycles.

Generation efficiency varies with the flow rate, and the combined turbine/generator efficiency is approximately 85 percent at the normal 173-cfs flow rate. Curves of efficiency as a function of flow and power are shown in Figure 7 and 8 respectively:

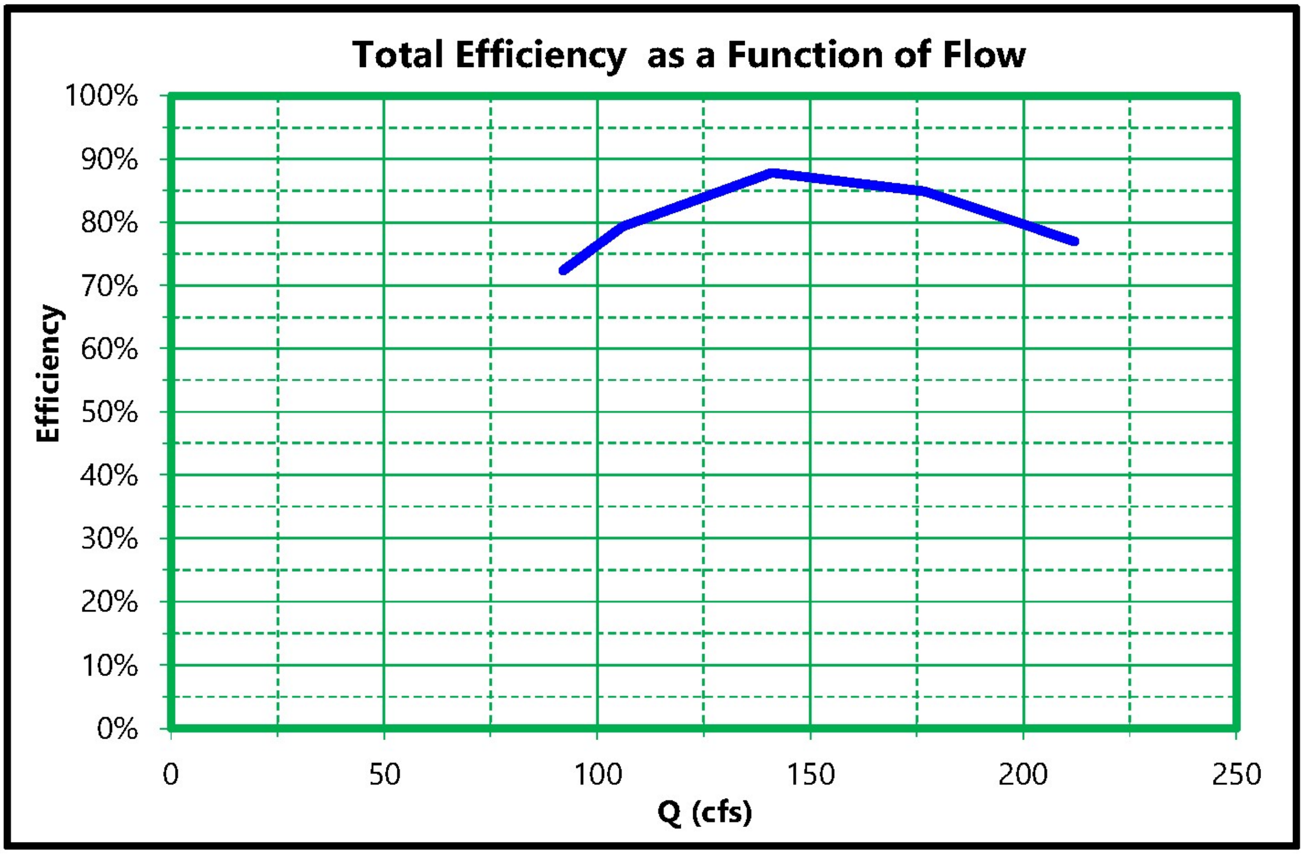

Figure 7:
Generation Efficiency as a Function of Penstock Flow Rate

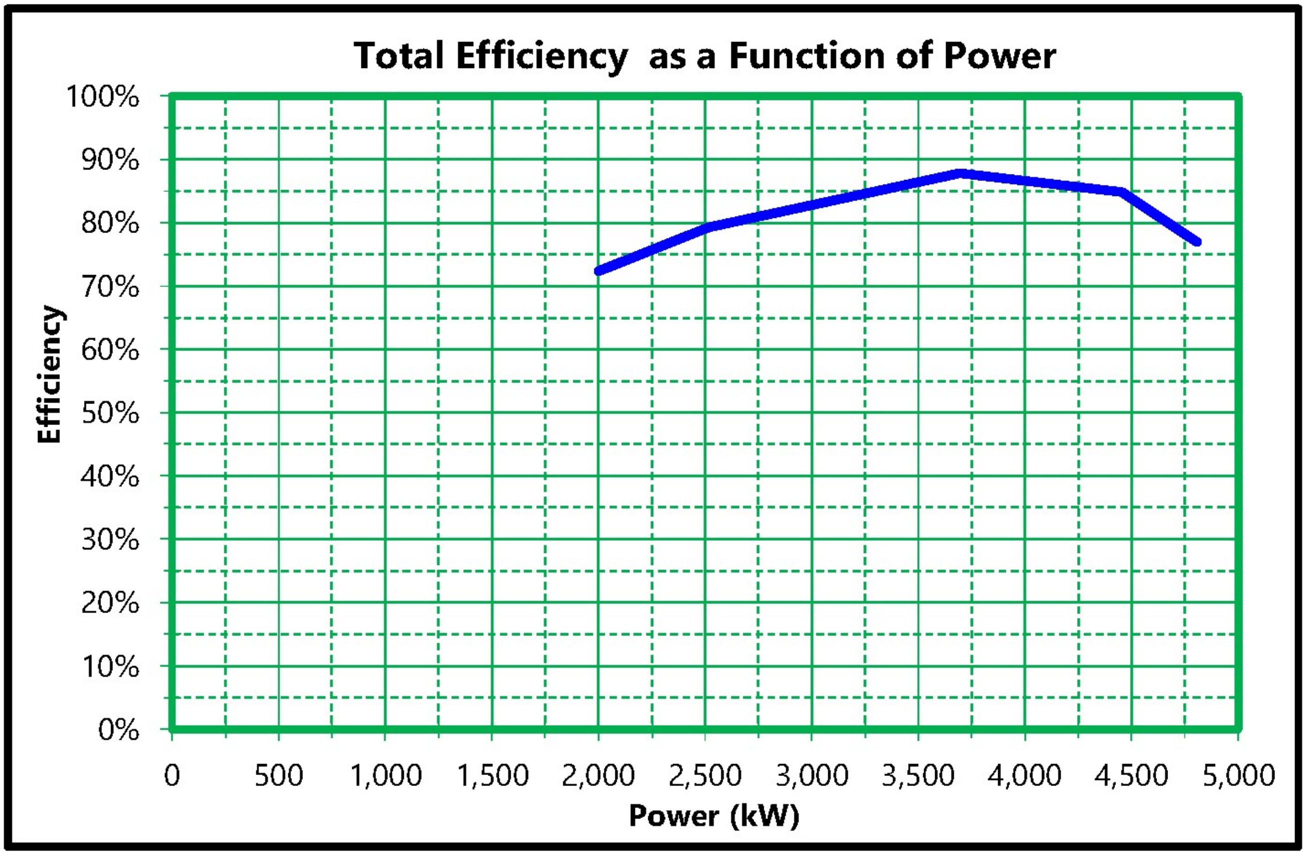

Figure 8:
Generation Efficiency as a Function of Power Production
With Molly's Falls Reservoir at Normal Operating Level

The tailrace discharges directly to the channel of the Winooski River from the base of the powerhouse building, where the elevation is approximately 158 feet local datum (850 feet NAVD 88). Upstream flows are not affected by this or other hydroelectric facilities because the dam and reservoirs are located on Molly's Brook, which joins the Winooski River downstream of the powerhouse.

Figure 9:
Molly's Falls Powerhouse, viewed from the west

Static head is approximately 374 feet with Molly's Falls Reservoir filled to the New Normal Operating Level, and the rated net head during generation is 346 feet, accounting for hydraulic head losses (approximately 28 feet at 173 cfs) within the penstock and surge tank.

I.B.5. Molly's Falls Reservoir Spillways

The Marshfield #6 dam has a service spillway and an emergency spillway. The spillways are not normally used to release water from the reservoir, because the penstock and bypass flow system are the primary means of releasing water and controlling water levels. The service spillway may be used when high inflows exceed the capacity of the penstock/turbine and reservoir water levels may be rising above the Normal Operating Level.

The service spillway is a 273-foot long concrete channel with sidewalls that discharges into a plunge pool at Molly's Brook. At the head of the service spillway, new construction in 2020 has replaced the former stoplogs with a pair of side-by-side slide gates that may be raised or lowered independently of each other to provide more precise control of flows through the service spillway. These gates can be operated remotely or manually, and can be quickly closed to restore the Normal Operating Level after a flood event. Each gate has a hydraulic width of 18 feet, 7 inches, a sill elevation of 532.2 feet, a top elevation of 538.7 feet when closed, and can be raised up to 548.3 feet when fully open (i.e., a 16.1-foot vertical opening), as summarized in Table 3 below.

Table 3: Molly's Falls Reservoir Service Spillway – Key Dimensions		
Dimension	**Gate 1**	**Gate 2**
Hydraulic Width (Ft)	18.58 (18′ 7″)	18.58 (18′ 7″)
Sill Elevation (Ft)	532.2 (1,224.2 NAVD 88)	532.2 (1,224.2 NAVD 88)
Top Elevation: Gate Closed (Ft)	538.7 (1,230.7 NAVD 88)	538.7 (1,230.7 NAVD 88)
Bottom Elevation: Gate Fully Raised (Ft)	548.3 (1,240.3 NAVD 88)	548.3 (1,240.3 NAVD 88)
Height of Opening: Gate Fully Raised (Ft)	16.1 (16′ 1.2″)	16.1 (16′ 1.2″)

Figure 10:
Molly's Falls Reservoir Service Spillway, viewed from the west

The emergency spillway is a 370-foot long channel consisting of an upstream concrete structure with gates and a stepped concrete channel with sidewalls leading to the armored plunge pool in Molly's Brook. The spillway is stepped to dissipate energy during a high flow event, to reduce risk of scour or erosion at the toe. At the upstream end of the emergency spillway is a gate structure which retains water in the reservoir and can be operated to release water into the spillway. The gates consist of stanchion stoplogs, which are a system of vertical support members and horizontal stoplogs, that can be operated to release water through the spillway in order to lower water levels in the reservoir. There are two emergency spillway gates, each 23 feet wide and consisting of three bays of stoplogs and stanchions. The gates have a sill elevation of 531.6 feet (1,223.6 feet NAVD 88) and a top elevation of 543.2 feet (1,235.2 feet NAVD 88) when all stoplogs are in-place.

Figure 11:
Molly's Falls Reservoir Emergency Spillway (right), Service Spillway (left), and plunge pool (foreground)

I.C. General Operations

GMP maintains Peacham Pond at a Normal Operating Level ("NOL") of 710.25 feet local datum, with fluctuations of ± 1 foot due to variations in inflow, from no later than May 1 to November 30. Water levels may be drawn-down in winter by as much as 6.6 feet below the NOL (no more than 3 feet below the NOL beginning the winter of 2025-26), and refilled during spring. Except during the drawdown and refilling periods, the outflow from Peacham Pond through Sucker Brook is essentially run-of-river to maintain stable pond levels.

The GMP Molly's Falls Hydroelectric Facility normally generates renewable energy at all times of year. Pursuant to the 2019 MOU, it will operate in a limited seasonal peaking mode, with the ability from November 1 through March 31 to generate from storage at 135 cfs (3.5 MW), or at higher rates when matching reservoir inflow. From April 1 through October 31, GMP may generate at 103 cfs (2.4 MW) if the Winooski River flow is 30 cfs or greater at the powerhouse, or if needed to maintain the new NOL in the reservoir, otherwise generation may not occur except in emergencies. At any time of year, when Molly's Falls Reservoir inflow is within range of the turbine (approx. 103-173 cfs), GMP may generate to match inflow.

GMP operates Molly's Falls Reservoir on a year-long cycle of winter drawdown and spring refill. The reservoir water surface is gradually drawn-down, typically starting in early December and proceeding through March. Each year, GMP determines the depth to draw-down the reservoir based on measurements of snow-water content in the watershed. The maximum allowed drawdown is 2 feet below the New NOL, except greater drawdowns are allowed on case-by-case basis in event of flood risk (as determined by GMP based on snowpack and forecast precipitation and streamflows). The reservoir is refilled to the New NOL by May 1, or later based on ice on reservoir surface and/or snowpack in the watershed. Subsequently, GMP shall maintain the reservoir level at the New NOL (to the extent feasible and safe) from refill through July 31 (or the end of loon nesting season if earlier), and within 1 foot above/below the New NOL from August 1 through November 30.

The Facility's production capacity is rated for 5,000 kilowatts ("kW") of electrical power, however actual power production is currently limited to approximately 4,400 kW due to limitations of the existing turbine and draft tubes. Under the new operating procedures specified herein, monthly long-term average gross energy generation is expected to range from 120 ± megawatt-hours ("MWh") in September to 1,170 ± MWh in April. On an annual basis, gross energy generation is expected to average approximately 6,355 MWh.

I.D. Physical Improvements

As of the writing of this Plan, GMP has completed the following physical improvements to the Facility associated with the Project:

- Gatehouse improvements including headgate refurbishment, walkway installation, and replacement of actuator and electronic and mechanical equipment with improved equipment enabling remote gate operation
- Service spillway concrete resurfacing

- Replacing the service spillway gates with vertical steel slide gates and a steel support structure that can be operated remotely or locally, including a walkway/operating platform
- Installing personnel and public safety features
- Installing an emergency generator to provide backup power for the operation of the new vertical slide gates and the existing headgate
- Increasing the height of the service spillway walls to a minimum of two feet above the water surface to provide adequate freeboard (elevation difference between the new top of the side wall and the expected maximum water level) during the probable maximum flood conditions
- Installing a bypass flow system to release flows into Molly's Brook
- Installing an aeration system at the powerhouse to increase Dissolved Oxygen levels
- Implementation of flow-ramping at the powerhouse using the existing turbine, bypass-pipe, and valve
- Peacham Pond Outlet Works upgrades to accommodate reductions in winter drawdowns
- Installation of power, new valve, and actuator to enable remote operation of the Peacham Pond outlet gate
- Installation of weir to enable passive run-of-river operation and maintenance of NOL and winter-drawdown level at Peacham Pond
- Armoring the emergency spillway channel and plunge pool to prevent erosion

I.E. Regulatory Compliance Requirements

This Plan was written to comply with the applicable sections of the March 2020 PUC Order and the August 2019 MOU with the ANR. Section III.H(4) of 2019 MOU states "*GMP shall implement the Flow and Water Level Management and Monitoring Plan upon completion of construction of the Revised Project or upon Plan approval by the Commission, whichever is later.*" As modified by the December 23, 2020 MOU with the ANR, certain operational changes related to Peacham Pond and Molly's Falls Reservoir water levels, Molly's Brook bypass flows, generation rate caps, and generation-ramping have been implemented already. Therefore the remaining flow and water-level requirements will take effect once this Flow and Water Level Management and Monitoring Plan has been approved.

Also, if GMP conducts drawdowns of Molly's Falls Reservoir to perform planned or required inspections, maintenance, or repairs on the Facility's infrastructure, GMP shall provide advance notice to the Vermont Department of Forests, Parks and Recreation and the Molly's Falls Pond State Park. On or before February 15 of each year, GMP shall provide ANR with a summary of any such drawdowns conducted during the prior 12-month period.

I.E.1. MOU Requirements

Section III.H.1. of the 2019 MOU specifies a list of components that shall be included in the Flow and Water Level Management and Monitoring Plan. The list is presented as follows, along with notes indicating where in this document the information corresponding to each required component is found:

> i. information on how the Facility will be managed to avoid non-compliance events with the conservation and maximum flow requirements for Sucker Brook, as described in Section III.B; [see Sections II.B.1 and III.C of this Plan]
>
> ii. information on how the Facility will be managed to avoid non-compliance events with the conservation flow requirements for Molly's Brook, as described in Section III.D; [see Sections II.D and III.F of this Plan]
>
> iii. information on how the Facility will be managed to avoid non-compliance events with the generation flow requirements for the Winooski River, as described in Section III.E; [see Sections II.E, III.E, and III.G of this Plan]
>
> iv. a detailed protocol for how the Facility will be operated to achieve ROR conditions in Sucker Brook, as described in Section III.B(2); [see Sections II.B.1 and III.C of this Plan]
>
> v. a detailed ramping protocol for how the Facility will be operated to transition between drawdown, refill, and ROR periods at Sucker Brook and Peacham Pond, as described in Section III.B(3); [see Sections II.B.2 and III.C of this Plan]
>
> vi. a detailed protocol for ramping up and ramping down the flows released to the Winooski River from the powerhouse during generation, as described in Section III.E(1); [see Sections II.E and III.G.1 of this Plan]
>
> vii. a description of the protocol for operating the proposed penstock tap valve (conservation flow device) and spillway slide gates under varying flow conditions at Molly's Falls Reservoir; [see Sections II.D and III.F of this Plan]

viii. information on how the Facility will be managed to avoid non-compliance events with the requirements for the NOL and the winter drawdowns at Peacham Pond, as described in Section III.A; [see Sections II.A and III.B of this Plan]

ix. a detailed protocol for deciding when and how the Facility will be managed in the event of winter drawdowns exceeding 6.6 feet (or 3 feet, as applicable) at Peacham Pond, as described in Section III.A(5); [see Sections II.A.2 and III.B of this Plan]

x. determination of the specific New NOL in Molly's Falls Reservoir and information on how the Facility will be managed to avoid non-compliance events with the requirements for the New NOL and the winter drawdowns at Molly's Falls Reservoir, as described in Section III.C; [see Sections II.C.1, II.C.2, and III.D of this Plan]

xi. a detailed protocol for deciding when and how the Facility will be managed in the event of winter drawdowns exceeding 2 feet (or 5.8 feet, as applicable) at Molly's Falls Reservoir, as described in Section III.C(4); [see Sections II.C.1, II.C.2, and III.D of this Plan]

xii. a mutually agreeable water-level trigger for releasing generation flows to the Winooski River, as described in Sections III.E(3)(ii) and III.H(3)(ii); [see proposed water-level trigger in Section II.E and Table 7 of this Plan]

xiii. information on how the Facility will be managed to avoid non-compliance events with the requirements for temperature and dissolved oxygen in the Winooski River, as described in Sections III.F and III.G; [see Section II.F of this Plan]

xiv. the testing results verifying the range of the turbine's hydraulic capacity for safe operations (the "Permitted Operating Zone"), as described in Section III.E(4)(i). [see Appendix 4].

II. PROJECT OPERATIONS

This Section of this Flow and Water Level Management and Monitoring Plan sets forth requirements and protocols for various situations and times of year. Refer to this Section for guidance on what reservoir levels, rates-of-change, and release rates are to be used at certain times of year. Refer to Section III below for details on how to implement the Section II requirements and goals.

Operations are intended to comply with the MOUs and PUC Orders, protect water quality, generate renewable energy, manage water levels in Peacham Pond and Molly's Falls Reservoir safely, and manage flows for safety of downstream communities. Winter drawdowns of Peacham Pond and Molly's Falls Reservoir are used to reduce peak downstream flows and improve safety.

II.A. Peacham Pond Water Levels

Water levels in Peacham Pond are normally maintained at the NOL from May 1 to November 30. GMP draws-down the water level beginning December 1 at the earliest, and completes the drawdown by December 31. Water levels may remain at the drawdown level until refill begins, typically in early March, but may rise above the drawdown level temporarily due to snowmelt and high inflow events. Refill is normally completed by May 1, with exceptions for defined criteria related to snow-water content in the watershed and ice thickness on the pond.

As noted above in Section I.B.2, Peacham Pond water levels may be measured remotely, down to 700.5 feet local datum, and via a staff gauge at the outlet structure.

II.A.1. Peacham Pond Normal Operating Level

The Peacham Pond NOL is 710.25 feet local datum (1,402.39 feet NGVD 29). The NOL is the same as it has been historically.

Normally, Peacham Pond is maintained at the NOL from May 1 to November 30, with fluctuations above/below the NOL as follows:

- From May 1 (or full refill if later, see criteria in Section II.A.3) until loon nesting begins (see Section II.A.4 below): <u>**NOL ± 0.5 feet**</u>
- During Loon Nesting season: <u>**manage pond levels as stable as is feasible and safe**</u>
- From August 1 (or end of loon nesting, whichever is earlier, see Section II.A.4 below) until November 30: <u>**NOL ± 1 foot**</u>
- At any time of year, higher fluctuations above the NOL may occur due to storms and

heavy snowmelt/rainfall, and GMP shall manage flow releases as best as possible to minimize high water levels

Exceptions from this normal schedule for water levels depending on weather and safety are described in Sections II.A.2.b, II.A.2.c., II.A.2.d, and II.A.3 below.

II.A.2. Peacham Pond Winter Drawdown

For five years beginning the winter of 2020-21, drawdown can be no more than 6.6 feet below the NOL (to elevation 703.65 feet local datum, equal to 1,395.79 feet NGVD 29), unless criteria (see Section II.A.2.b) for snow-water content, forecasted rainfall, hydrologic forecasting, or maintenance/repair at Molly's Falls Reservoir are met to allow a deeper drawdown.

Beginning the winter of 2025-26, drawdown can be no more than 3 feet below the NOL (to elevation 707.25 feet local datum, equal to 1,399.39 feet NGVD 29), unless criteria (see Section II.A.2.b) for snow-water content, forecasted rainfall, hydrologic forecasting, or maintenance/repair at Molly's Falls Reservoir are met to allow a deeper drawdown.

In an effort to achieve a timely refill, GMP may draw-down Peacham Pond by less than 6.6 feet (or less than 3 feet from 2025-26 onward) if snow-water content is low (see Section III.A below for snow-water content measurement and analysis procedures).

II.A.2.a. Timing

Drawdown shall start December 1 or later.

GMP shall limit the rate of drawdown to no more than 6 to 12 inches per week prior to December 15 of each year, subject to the criteria specified in Section II.A.2.c.

Winter drawdown should be completed by December 31 each year. The start date of refill each year should be determined based on the depth of drawdown, snow-water content in the watershed, and forecasted precipitation with the goal of completing refill normally by May 1 (see Section III.A below for snow-water content measurement and analysis procedures). Refill may be postponed due to defined criteria (see Section II.A.3) related to snow-water content and ice thickness on the pond.

II.A.2.b. Criteria for Additional Drawdown Beyond 6.6 Feet

Applicable for operations beginning the winter of 2020-21 through the winter of 2024-25, GMP will draw down Peacham Pond more than 6.6 feet below the NOL (i.e., lower than 703.65 feet local datum, equal to 1,395.79 feet NGVD 29), if any one or more of the following criteria are met:

1) Molly's Falls Reservoir cannot be drawn-down normally or other maintenance/repair work is taking place, or
2) Snow-Water Content exceeds 10 inches at any time, or
3) Snow-Water Content exceeds 6 inches after April 1, or
4) Forecast indicates over 3 inches of rain is likely within 24 hours, or
5) Forecast indicates over 4 inches of rain is likely within 48 hours, or
6) Forecast indicates over 5 inches of rain is likely within 72 hours, or
7) Hydrologic forecasting[1] indicates full gate operation or emergency spillway activation is likely to be needed.

The depth of drawdown will be determined by the hydrologic forecasting as the depth that is needed to manage water levels and downstream flows safely. Water levels will be drawn-down in accordance with the procedures for timing (per Section II.A.2.a. of this Plan) and for downstream flows in Sucker Brook (per Section II.B. of this Plan). Once the conditions that initiated the additional drawdown have passed, GMP will return the pond level to the normal seasonal level by implementing the conservation flow and outflow requirements for a refill (see Section II.A.3. of this Plan).

GMP shall monitor and record all applicable data.

II.A.2.c. Criteria for Additional Drawdown Beyond 3 Feet

Applicable for operations beginning the winter of 2025-26 and onward, GMP will draw down Peacham Pond more than 3 feet below the NOL (i.e., lower than 707.25 feet local datum, equal to 1,399.39 feet NGVD 29), if any one or more of the following criteria are met:

▼

[1] Hydrologic forecasting refers to event-specific analysis using GMP's Hydro Forecasting Tool and/or new tools that may be developed. See Section III.A.2 for more information.

1) Molly's Falls Reservoir cannot be drawn-down normally or other maintenance/repair work is taking place, or
2) Snow-Water Content exceeds 7 inches at any time, or
3) Snow-Water Content exceeds 4.5 inches after April 1, or
4) Forecast indicates over 2.5 inches of rain is likely within 24 hours, or
5) Forecast indicates over 3 inches of rain is likely within 48 hours, or
6) Forecast indicates over 3.75 inches of rain is likely within 72 hours, or
7) Hydrologic forecasting[2] indicates full gate operation or emergency spillway activation is likely to be needed.

Similar to protocols for drawdowns of more than 6.6 feet, the depth of drawdown will be determined by the hydrologic forecasting as the depth that is needed to manage water levels and downstream flows safely. Water levels will be drawn-down in accordance with the procedures for timing (per Section II.A.2.a. of this Plan) and for downstream flows in Sucker Brook (per Section II.B. of this Plan). Once the conditions that initiated the additional drawdown have passed, GMP will return the pond level to the normal seasonal level by implementing the conservation flow and outflow requirements for a refill (see Section II.A.3. of this Plan).

GMP shall monitor and record all applicable data.

II.A.2.d. Criteria to Waive the 6" – 12" per Week Drawdown Limit

For exemptions from the requirement to stage Peacham Pond drawdowns to no more than 6 to 12 inches per week prior to December 15, any one or more of the following criteria must be met:

1) Molly's Falls Reservoir cannot be drawn-down normally, or other maintenance/repair work is taking place, or
2) Snow-Water Content exceeds 7 inches at any time, or
3) Forecast indicates over 2.5 inches of rain is likely within 24 hours, or
4) Forecast indicates over 3 inches of rain is likely within 48 hours, or

[2] Hydrologic forecasting refers to event-specific analysis using GMP's Hydro Forecasting Tool and/or new tools that may be developed. See Section III.A.2 for more information.

5) Forecast indicates over 3.75 inches of rain is likely within 72 hours, or
6) Hydrologic forecasting[3] indicates full gate operation or emergency spillway activation is likely to be needed

Note: GMP shall monitor and record all applicable data.

II.A.3. Peacham Pond Spring Refill

As noted above, refill begins typically in early March, but the start date each year should be determined based on the depth of drawdown, snow-water content in the watershed, and forecasted precipitation with the goal of completing refill normally by May 1 (see Section III.A below for snow-water content measurement and analysis procedures). Refill to the NOL shall be completed no later than May 1, unless at least one of the following criteria for snow-water content in the watershed and ice thickness on the pond are met:

a) If ice is present on reservoir surface, water level shall not rise higher than NOL minus 4 feet (or the lowest allowed winter drawdown, if a higher water elevation). This requirement means the Pond level shall be no higher than 706.25 feet local datum, equal to 1,398.39 feet NGVD 29 when ice is present (except in years when a 3-foot maximum drawdown limit applies in which case the Pond level shall be no higher than 709.25 feet local datum, equal to 1,399.39 feet NGVD 29). The balance of refill shall commence once the surface is ice-free; or

b) If snow-water content exceeds 6 inches after April 1, Peacham Pond refill shall be delayed until GMP determines that it is safe to allow water levels to rise without causing full gate operation or emergency spillway activation to be likely needed.

[3] Hydrologic forecasting refers to event-specific analysis using GMP's Hydro Forecasting Tool and/or new tools that may be developed. See Section III.A.2 for more information.

II.A.4. Peacham Pond Loon Nesting Season

Between May 1 (or the date of refill to the Peacham Pond NOL, if later per Section II.A.3), and July 31 (or the date that the ANR determines that loon nesting is completed at Peacham Pond, whichever is earlier), GMP shall maintain water levels of Peacham Pond in accordance with the following loon protocols:

1. Prior to loon nesting season, GMP manages pond levels as close to the NOL as is feasible and safe, in anticipation of loon nesting season. Maintaining water levels as close to NOL as is feasible and safe, means maintaining water levels within 0.5 ft above or below the NOL, due to effects of changing flows, wind, waves, sensor accuracy, and sensitivity of level-controls.

2. Loon nesting season will commence when either the local Loon volunteer or VT Center for Ecostudies (currently: Eric Hanson) notify the GMP Control Center or local GMP field personnel (Power Production Workers or "PPW") that loons are on their nest, or when GMP PPW observe loons on their nest and notify the GMP Control Center.

3. Upon confirmation that loons are nesting, PPW site visit frequency shall increase to adjust water level/valve more frequently to manage pond levels as stable as is feasible and safe during loon nesting period.

4. Pending water level/flow status, slight to moderate storm events may raise pond levels, so in anticipation of a weather event, the valve shall be adjusted to manage water to the best of GMP's ability.

Between August 1 (or the date that the ANR determines that loon nesting is complete at Peacham Pond, whichever is earlier) and November 30, GMP shall maintain water levels of Peacham Pond within 1 foot above or below the Peacham Pond NOL.

II.B. Sucker Brook Flows

Conservation flows applicable to Sucker Brook vary seasonally. From May 1 (or Peacham Pond refill if later) to November 30, Sucker Brook is operated in run-of-river ("ROR") mode. Between December 1 and May 1 (or the date Peacham Pond is refilled to the NOL, if later), Peacham Pond may be drawn-down for winter and a maximum "cap" on the outflow applies. Also, during the December 1 to May 1 period (or until Peacham Pond is refilled to the NOL, if later), a minimum conservation flow requirement is in effect, applicable to spring refilling. Ramping requirements apply to the transitions between ROR, pond-drawdown, and pond-refill modes.

II.B.1 Peacham Pond Outflow Limitations

Between May 1 (or from the date of refill to the Peacham Pond NOL, whichever is later) and November 30, GMP shall manually implement ROR operations in Sucker Brook so that outflow to Sucker Brook equals the net of inflow to Peacham Pond minus evaporation from the surface of Peacham Pond. This ROR mode requires maintaining a steady water level (with fluctuations as specified in Section II.A. above) so that outflow will be approximately equal to inflow because water is not being detained or released from storage.

As noted in the 2019 MOU, levels may fluctuate within the tolerances noted in Section II.A. above, may temporarily rise above the NOL during high inflow events, and GMP would use gate operations to restore NOL while managing flow releases to reduce excessive downstream flows.

When Peacham Pond is being drawn-down, outflow is limited to a maximum of 25 cfs or inflow to Peacham Pond if greater. Generally, the 25-cfs cap would apply at most times during drawdown, unless pond levels are rising while 25 cfs (or more) are being released; the rising pond level would indicate that inflows exceed the outflow rate, and the outflow rate could be increased to match inflow so that pond levels stabilize. When the pond level subsequently drops, outflow must be decreased until either 25 cfs is released, or the pond level stabilizes, whichever occurs first. Inflows may also be estimated based on the rate-of-change of the pond level (see Section III.B and III.C below for detailed flow measurement and operating procedures).

When Peacham Pond is being refilled, a minimum of 6.7 cfs or inflow to Peacham Pond if less shall be released. Generally, the 6.7-cfs minimum would apply at most times during refill, unless pond levels are falling while 6.7 cfs (or less) are being released; the falling pond level would indicate that inflows are less than the outflow rate, and the outflow rate could be decreased to match inflow so that pond levels stabilize. When the pond level subsequently rises, outflow must be increased until either 6.7 cfs is released, or the pond level stabilizes, whichever occurs first. Inflows may also be estimated based on the rate-of-change of the pond level (see Section III.B and III.C below for detailed flow measurement and operating procedures).

II.B.2 Peacham Pond Outflow Ramping

Ramping is required for transitions between drawdown, refill, and ROR periods at Peacham Pond and Sucker Brook.

For the transition from ROR to drawdown, which occurs in early December when GMP begins drawing-down Peacham Pond, outflows shall not be immediately increased to 25 cfs unless inflows are already 20 cfs or more. Flow shall be ramped-up from the ROR rate to 25 cfs at a maximum rate-of-change of 1 cubic feet per second per square mile ("csm") per hour. Based on the 5.8-square mile watershed of Peacham Pond, the following ramping rates are specified:

Table 4:
Peacham Pond Outflows – Up-Ramping Limits

Starting Outflow Rate (cfs)	Next Outflow Rate (1 Hour Interval) (cfs)
0.2	6.0
3.0	8.8
6.0	11.8
9.0	14.8
11.8	17.6
15.0	20.8
17.6	23.4
21.0	25
23.4	25
Maximum hourly rate of change = 5.8 cfs increase	

For the transition from drawdown to maintaining the pond drawn-down (essentially ROR), outflow shall be ramped-down from the drawdown rate (no more than 25 cfs or inflow) at a maximum rate-of-change of 0.5 csm per hour. Based on the 5.8-square mile watershed of Peacham Pond, the following ramping rates are specified:

Table 5: Peacham Pond Outflows – Down-Ramping Limits	
Starting Outflow Rate (cfs)	**Next Outflow Rate (1 Hour Interval) (cfs)**
25	22
22	19
19	16
16	13
13	10
10	7
7	6.7 (conservation flow)
7	4 (if equal to inflow)
4	1 (if equal to inflow)
Maximum hourly rate of change = 3 cfs decrease	

Once the outflow has been ramped-down to match inflow (pond levels stabilized at the winter-low elevation), the winter orifice may be opened to maintain Pond water levels and release ROR flows passively (see Section III.B and III.C below for detailed flow measurement and operating procedures).

For the transition to refill, outflow shall be ramped-down from the drawdown-maintenance rate at a maximum rate-of-change of 0.5 csm per hour. Based on the 5.8-square mile watershed of Peacham Pond, the ramping rates in Table 5 above are specified. When the pond has been refilled to the NOL, outflow shall be gradually adjusted to match inflow following the up-ramping rates specified in Table 4 above. Once the outflow has been ramped-up to match inflow (pond levels stabilized at the NOL), the NOL orifice may be opened to maintain Pond water levels and release ROR flows passively (see Section III.B and III.C below for detailed flow measurement and operating procedures).

II.C. Molly's Falls Reservoir Water Levels

Water levels in Molly's Falls Reservoir are maintained at the NOL from May 1 to November 30. GMP draws-down the water level beginning December 1 at the earliest, and completes the drawdown prior to in mid-March. Refill begins after maximum drawdown has been reached, and is normally completed by May 1, with exceptions for defined criteria related to snow-water content in the watershed.

As noted above in Section I.B.3, Molly's Falls Reservoir water levels may be measured remotely, and via a staff gauge at the outlet structure.

II.C.1. Molly's Falls Reservoir Normal Operating Level

The new Molly's Falls Reservoir NOL is 531.7 feet local datum (1,223.7 feet NAVD 88). This level is intended to be slightly below the sill of the Service Spillway (532.2 feet local datum) to reduce risk of ice formation on the spillway and gates, especially during subfreezing weather and windy/wave-forming conditions prior to December 1 when the reservoir must be at the NOL. Ice formation on the spillway and gates can impede gate operation and present safety hazards.

Normally, Molly's Falls Reservoir is maintained at the NOL from May 1 to November 30, with allowed fluctuations above/below the NOL as follows:

- From May 1 (or full refill if later, see criteria in Section II.C.3) until Loon Nesting begins (see Section II.C.4 below): **NOL ± 0.5 feet**
- During Loon Nesting season: **manage pond levels as stable as is feasible and safe**
- From August 1 (or end of loon nesting, whichever is earlier, see Section II.C.4 below) until November 30: **NOL ± 1 foot**
- At any time of year, higher fluctuations above the NOL may occur due to storms and heavy snowmelt/rainfall, and GMP shall manage flow releases as best as possible to minimize high water levels

Exceptions from this normal schedule for water levels depending on weather and safety are described in Sections II.C.2.b and II.C.5 below.

II.C.2. Molly's Falls Reservoir Winter Drawdown

Under normal circumstances, the maximum winter drawdown depth is 2.0 feet below the new NOL. This means draw-down the reservoir to a water surface elevation of no lower than 529.70 feet local datum, equal to 1,221.70 feet NAVD. Greater drawdowns may be appropriate if unusually high amounts of snow-water equivalent or precipitation are forecasted, in order to manage downstream flows safely (see Sections II.C.2.b and II.C.2.c for details).

Within the allowed drawdown limits, GMP should use the following depth-of-drawdown protocols: specific depth-of-drawdown should be determined during each winter by GMP in consultation with hydrologic forecasting (currently performed by VHB), based on snow-water content in the watershed and anticipated precipitation during the winter and spring period. See Section III.A for these procedures.

II.C.2.a. Timing

Drawdown shall start December 1 or later.

GMP shall limit the rate of drawdown to no more than 6 to 12 inches per week prior to December 15 of each year, subject to the criteria specified in Section II.C.2.d.

Winter drawdown should be completed no later than mid-March each year. Once maximum drawdown has been reached, GMP should maintain water levels until spring snowmelt and then begin refilling Molly's Falls reservoir. The start date of refill each year should be determined based on the depth of drawdown, snow-water content in the watershed, volume of water stored in Peacham Pond, and forecasted precipitation with the goal of completing refill normally by May 1 (see Section II.C.3 below for snow-water content measurement and analysis procedures). Refill may be postponed due to defined criteria (see Section II.C.3) related to snow-water content.

It is not necessary for the refill to be steady or continuous (GMP may pause refill or draw-down again if needed to manage snow-water content or rain events).

II.C.2.b. Criteria for Additional Drawdown: 2.0 to 5.8 Feet

GMP will draw down Molly's Falls Reservoir more than 2.0 feet but not more than 5.8 feet below the new NOL (i.e., 529.7 to 525.9 feet local datum), if any one or more of the following criteria are met:

1) Generating unit is expected to be out-of-service for extended time or other maintenance/ repair work is taking place, or
2) Any one or more of the following critical components of the Facility requires planned or emergency maintenance: intake, gatehouse, penstock, surge tank, primary spillway, emergency spillway, and any/all areas of the dam, or
3) Peacham Pond cannot be drawn-down normally, or
4) Snow-Water Content exceeds 6 inches at any time, or
5) Snow-Water Content exceeds 4.5 inches after April 1, or

6) Forecast indicates over 2.5 inches of rain is likely within 24 hours, or
7) Forecast indicates over 3 inches of rain is likely within 48 hours, or
8) Forecast indicates over 3.75 inches of rain is likely within 72 hours, or
9) Hydrologic forecasting[4] indicates full gate operation or emergency spillway activation is likely to be needed.

The depth of drawdown will be determined by the hydrologic forecasting as the depth that is needed to manage water levels and downstream flows safely. Water levels will be drawn-down in accordance with the procedures for timing (per Section II.C.2.a. of this Plan) and for generation flows released to the Winooski River (per Section II.E. of this Plan). Once the conditions that initiated the additional drawdown have passed, GMP will return the reservoir to the normal seasonal level by reducing generation while implementing the conservation flow requirements for Molly's Brook (see Section II.D. of this Plan).

GMP shall monitor and record all applicable data.

II.C.2.c. Criteria for Additional Drawdown: Beyond 5.8 Feet

GMP will draw down Molly's Falls Reservoir more than 5.8 feet below the new NOL (i.e., lower than 525.9 feet local datum, equal to 1217.9 feet NAVD), if any one or more of the following criteria are met:

1) Generating unit is expected to be out-of-service for extended time or other maintenance/ repair work is taking place, or
2) Any one or more of the following critical components of the Facility requires planned or emergency maintenance: intake, gatehouse, penstock, surge tank, primary spillway, emergency spillway, and any/all areas of the dam, or
3) Peacham Pond cannot be drawn-down normally, or
4) Snow-Water Content exceeds 10 inches at any time, or
5) Snow-Water Content exceeds 5 inches after April 1, or
6) Forecast indicates over 3 inches of rain is likely within 24 hours, or
7) Forecast indicates over 4 inches of rain is likely within 48 hours, or

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[4] Hydrologic forecasting refers to event-specific analysis using GMP's Hydro Forecasting Tool and/or new tools that may be developed. See Section III.A.2 for more information.

8) Forecast indicates over 5 inches of rain is likely within 72 hours, or
9) Hydrologic forecasting[5] indicates full gate operation or emergency spillway activation is likely to be needed.

Note: GMP shall monitor and record all applicable data.

II.C.2.d. Criteria to Waive the 6" – 12" per Week Drawdown Limit

For exemptions from requirement to stage Molly's Falls Reservoir drawdowns to no more than 6 to 12 inches per week prior to December 15, any one or more of the following criteria must be met:

1) Generating unit is expected to be out-of-service for extended time, or other maintenance/repair work is in progress, or
2) Any one or more of the following critical components of the Facility requires planned or emergency maintenance: intake, gatehouse, penstock, surge tank, primary spillway, emergency spillway, and any/all areas of the dam, or
3) Peacham Pond cannot be drawn-down normally, or
4) Snow-Water Content exceeds 6 inches at any time, or
5) Forecast indicates over 2.5 inches of rain is likely within 24 hours, or
6) Forecast indicates over 3 inches of rain is likely within 48 hours, or
7) Forecast indicates over 3.75 inches of rain is likely within 72 hours, or
8) Hydrologic forecasting[6] indicates full gate operation or emergency spillway activation is likely to be needed

Note: GMP shall monitor and record all applicable data.

[5] Hydrologic forecasting refers to event-specific analysis using GMP's Hydro Forecasting Tool and/or new tools that may be developed. See Section III.A.2 for more information.
[6] Hydrologic forecasting refers to event-specific analysis using GMP's Hydro Forecasting Tool and/or new tools that may be developed. See Section III.A.2 for more information.

II.C.3. Molly's Falls Reservoir Spring Refill

As noted above, refill generally starts after spring runoff, and the specific refill-start-date each year should be determined based on the depth of drawdown, snow-water content in the watershed, and forecasted precipitation with the goal of completing refill normally by May 1 (see Section III.A below for snow-water content measurement and analysis procedures). Refill to the new NOL shall be completed no later than May 1, unless the following criterion for snow-water content in the watershed is met:

> a) If snow-water content exceeds 5 inches after April 1, Molly's Falls Reservoir refill shall be delayed to provide additional volume to store inflowing snowmelt and runoff. The date of full refill shall be delayed to the extent needed to control spillage and manage downstream flows safely by avoiding full-gate operation at the Marshfield Dam service spillway or activation of the emergency spillway.

II.C.4. Molly's Falls Reservoir Loon Nesting Season

Between May 1 (or the date of refill to the Molly's Falls Reservoir NOL, if later per Section II.C.3), and July 31 (or the date that the ANR determines that loon nesting is completed at Molly's Falls Reservoir, whichever is earlier), GMP shall maintain water levels of Molly's Falls Reservoir in accordance with the following loon protocols:

1. Prior to loon nesting season, GMP manages pond levels as close to the NOL as is feasible and safe, in anticipation of loon nesting season. Maintaining water levels as close to NOL as is feasible and safe, means maintaining water levels within 0.5 ft above or below the NOL, due to effects of changing flows, wind, waves, sensor accuracy, and sensitivity of level-controls.

2. Loon nesting season will commence when either local Loon volunteer or VT Center for Ecostudies (currently, Eric Hanson) notify GMP Control Center or local GMP field PPW that loons are on their nest, or when GMP PPW observe loons on their nest and notify GMP Control Center.

3. Upon confirmation that loons are nesting, PPW site visit frequency shall increase to adjust water level/valve more frequently to manage pond levels as stable as is feasible and safe during loon nesting period.

4. Pending water level/flow status, slight to moderate storm events may raise pond levels, so in anticipation of a weather event, flow-releases from the reservoir shall be adjusted to manage water to the best of GMP's ability.

Between August 1 (or the date that the ANR determines that loon nesting is complete at Molly's Falls Reservoir, whichever is earlier) and November 30, GMP shall maintain water levels of Molly's Falls Reservoir within 1 foot above or below the NOL.

II.C.5. Molly's Falls Reservoir Maintenance-Drawdowns

Pursuant to section III.C.6 of the 2019 MOU, at any time during the year, with notice to the ANR's Department of Forests, Parks and Recreation and the Molly's Falls Pond State Park, GMP may conduct drawdowns of Molly's Falls Reservoir as needed to perform planned or required inspections, maintenance, or repairs on the Facility's infrastructure. On or before February 15 of each year, GMP shall provide the ANR with a summary of any such drawdowns conducted during the prior 12-month period.

GMP is required to implement ramping of generation flows at the powerhouse when releasing water to the Winooski River in order to draw-down the water level of Molly's Falls Reservoir to perform planned or required inspections, maintenance, or repairs to the Facility's infrastructure. Ramping protocols are provided in Section II.E.2 of this Plan.

II.D. Molly's Brook Flows

Conservation flows applicable to Molly's Brook vary seasonally. From July through March, conservation flows of no less than 8.5 cfs must be released. From April through June, conservation flows of no less than 12.0 cfs must be released. Conservation flows may be provided by the bypass pipe and/or the service spillway slide gates.

Conservation flows are preferably released via the bypass flow system, which provides cool water from approximately 28 feet deep in the reservoir (intake centerline at elevation 503.7 feet local datum); the cool water supports higher-quality habitat for fish in the brook compared to warmer water from the near-surface release at the spillway gates. During winter, use of the slide gates to release conservation flows is discouraged due to risk of ice formation which can impede gate operation and present safety hazards. Flows from either source are aerated and likely to support adequate dissolved oxygen concentrations (see Section II.F of this Plan for dissolved oxygen and temperature protocols).

Specific procedures for operating the bypass pipe and spillway gates to provide the conservation flows are detailed below in Section III.F. of this Plan.

Per the EAP (2023), 600 cfs is the amount of spillway discharge that begins to inundate the roads and residences between the dam and the main stem of the Winooski River at Marshfield. A release of 600 cfs is equivalent to approximately 1 fully-open Service Spillway gate with the Marshfield Reservoir water surface at 537 feet local datum, or 2 fully-open Service Spillway gates with the Marshfield Reservoir water surface at 535 feet local datum.

II.E. Winooski River Generation Flows

Pursuant to the 2019 MOU, generation flows released from the powerhouse must be regulated based on the time of year, natural streamflows, and water levels in Molly's Falls Reservoir.

Under normal circumstances, the generating turbine shall operate at a flow rate of no less than 103 cfs (35% Wicket Gate) and no more than 173 cfs (62% Wicket Gate). The maximum flow rate corresponds to 4.4 MW when Molly's Falls Reservoir is at the New NOL. Higher flow rates may only be used when required by the Emergency Action Plan in order to manage reservoir water levels safely due to high inflow events. Table 6 summarizes minimum and maximum turbine flows, wicket gate openings, and corresponding power production rates.

Table 6:
Turbine Limits for Safe Operation [1]

Turbine Limit	Flow Rate (cfs)	Wicket Gate Opening [2]	Power Production (MW) [2]
Minimum	103	35%	2.4
Maximum	173	62%	4.4

[1] Source: "Marshfield No. 6 – Performance Testing – REVB Report" by NORCAN Hydraulic Turbine, Inc. January 22, 2018. This Report is contained in Appendix 4.

[2] With reservoir at New NOL

The following limits in Table 7 apply to generation flows:

Table 7:
Generation Flow Limits per MOU

Time of Year	Trigger	Maximum Generation Flow (cfs)	Corresponding Power at New NOL (MW)
November 1 to March 31	At GMP's discretion	135	3.5
	If Molly's Falls Reservoir inflow is within range of turbine (approx. 103-173 cfs)	Match inflow	2.4 – 4.4
	Emergency*	212	4.8
	Forecasted high-flow weather events†	212	4.8
April 1 to October 31	If Winooski River flow is 30 cfs or greater at powerhouse**	103	2.4
	If needed to maintain NOL in reservoir††	103	2.4
	If Molly's Falls Reservoir inflow is within range of turbine (approx. 103-173 cfs)	Match inflow	2.4 – 4.4
	Emergency*	212	4.8
	Forecasted high-flow weather events†	212	4.8

*Emergencies are generally defined as emergency shutdowns, plant trips, grid outages, grid emergency or capacity scarcity events, & high reservoir water levels. See Section II.E.1 for more detailed information.

†When responding to forecasted high-flow weather events described in Section II of Attachment C of the 2019 MOU, GMP may generate power and release generation flows of any magnitude to the Winooski River. See Section II.E.1 for a complete definition.

** Rate of reservoir level change may be used as a surrogate for Winooski River flow (see Section III.G. below for Winooski River flow determination methods). Refer to Appendix 6 for specific procedures.

†† Per Section III.H(3)(ii) of the 2019 MOU, unless GMP and ANR agree otherwise [during the review of drafts of this Plan], the water-level trigger shall be

(a) 1 foot above the New NOL between August 1 (or the date loon nesting is complete at Molly's Falls Reservoir, whichever is earlier) and April 30, and

(b) 0.5 feet above the New NOL between May 1 (or when Molly's Falls Reservoir is refilled to the New NOL if later), and July 31 (or the date loon nesting is complete at Molly's Falls Reservoir, whichever is earlier).

II.E.1 Emergencies and High Flow Weather Events

II.E.1.a Emergencies

Energy grid emergencies and capacity scarcity events in the regional (ISO-NE) or Local Grids are defined in Attachment C of the 2019 MOU as follows:

A. Local Grid is specific to the VELCO Hardwick, Morrisville, and Marshfield circuits.

B. Abnormal condition on local transmission lines or injection points (power in/out). Examples of this condition are unstable system, transmission or local system in weakened state that impacts Hardwick, Morrisville Water and Light, or GMP system in this region. GMP's Local Control Center (Colchester) will call on the Molly's Falls Facility to run for voltage control to stabilize the local grid. This occurs 1-2 times a year, duration could be 2-4 hours or up to 24 hours.

C. Similar to the 1998 Ice Storm or 2011 Tropical Storm Irene-type events, situations during which the regional transmission grid is cut off from the Marshfield area: once circuits are sectionalized the Molly's Falls Facility can provide localized power to the immediate area for emergency services, comparable to a microgrid system. In anticipation of these extended and catastrophic events, local hydro (and battery storage) sites such as the Molly's Falls Facility will become more critical for GMP to serve our customers and the local communities impacted.

II.E.1.b High Flow Weather Events

When responding to forecasted high-flow weather events described in Section II of Attachment C of the 2019 MOU, GMP may generate power and release generation flows of any magnitude to the Winooski River. Ramping is not required when releasing generation flows to the Winooski River in response to weather-related high-flow events. These events are defined as follows:

A. Preventative reservoir water level management for forecasted high-flow events, which are defined by the same criteria for additional drawdown described in Sections II.C.2.b. and II.C.2.c. of this Plan.

1) Example of a situation when preventative water level management would be needed: the day before TS Irene, estimated daily mean incoming Winooski River flow was approximately 6.5 cfs at station W-1 (upstream of the powerhouse). The next day it was approximately 378 cfs and the reservoir was 3 feet over the top of the service spillway stoplogs.

B. High reservoir water levels (generation and water passage needed to prevent service or emergency spillway activation)

1) If water levels in Molly's Falls Reservoir are expected to rise above 536.50 ft local datum, GMP shall generate at full capacity.

2) Per the EAP (2023), GMP shall:

a) fully open the Service Spillway gates if water level ≥538.06 ft local datum

b) Trip the North side of the Emergency Spillway if the Service Spillway is open and the water level ≥538.56 ft local datum

c) Trip the remaining Emergency Spillway bays if the North side has been tripped and the water level ≥538.56 ft local datum and still rising

C. Reservoir level in Peacham Pond or Molly's Falls Reservoir may temporarily exceed 1 foot above the NOL during high inflow events; in such circumstances, GMP would use generation and/or gate operations to restore NOL while managing flow releases to reduce excessive downstream flows.

Refer to Section III. of this Plan for procedures to be used in High Flow Weather Events.

II.E.2 Ramping

GMP shall continue to implement ramping for transitioning to and from generation flows, except in emergencies (including emergency shutdowns, plant trips i.e., unit trips off-line to protect mechanical/electrical equipment, grid outages, grid emergencies, or capacity scarcity events as defined in Section II.E.1 above), when Winooski River flow is 85 cfs or greater at the powerhouse, and during High Flow Weather Events as defined in Section II.E.1 above.

Ramping shall continue to utilize the existing infrastructure consisting of the bypass valve and pipe described in Section I.B.4 above, and shall be controlled automatically using the motor-actuator to adjust the valve. Ramping shall be performed as follows:

- Up-Ramping:
    - 0 to 103 cfs in 30 minutes
    - April-October: 60 cfs/hr for 103 cfs and above
    - Nov-March: 103 cfs to 135 cfs in 30 minutes
- Down-Ramping:
    - Generation rate to 103 cfs in 120 minutes
    - 103 to 0 cfs in 30 minutes

Detailed ramping procedures are specified in Section III.G.1. of this Plan below.

II.F Dissolved Oxygen & Water-Temperature

GMP installed an aeration system within the powerhouse to increase the dissolved oxygen content of the water released during ramping and generation. Separately from this Plan, GMP has prepared and submitted a Dissolved Oxygen Monitoring Plan to the VT ANR for review and comment (VHB, 2020a). The purpose of the Dissolved Oxygen Monitoring Plan is to confirm that the generation flows released to the Winooski River comply with the Dissolved Oxygen criteria of the Vermont Water Quality Standards ("VWQS," 2022). After ANR review, the Dissolved Oxygen Monitoring Plan will be revised and submitted to the Vermont PUC for review and approval. GMP shall implement the Dissolved Oxygen Monitoring Plan once the Project construction has been completed (including installation of the aeration system), and once the PUC has approved the Dissolved Oxygen Monitoring Plan.

In the event that the dissolved oxygen monitoring indicates that the generation flows released to the Winooski River do not comply with the VWQS Dissolved Oxygen criteria despite operation of the aeration system within the powerhouse, GMP will make adjustments which may include increasing the aeration system capacity, and/or reducing the magnitude of generation flows, and continuing to monitor the dissolved oxygen until the results confirm the criteria are met.

Regarding water temperature, GMP has developed and submitted a Riparian Zone Restoration Plan to the VT ANR for review and comment (GMP, 2020b). The purpose of the Riparian Zone Restoration Plan is to close the temperature gap between generation flows released to the Winooski River and natural flows in the Winooski River, to the extent reasonable and feasible, through extensive riparian buffer restoration along the Winooski River upstream of the powerhouse. After ANR review, the Riparian Zone Restoration Plan will be revised and submitted to the Vermont PUC for review and approval. GMP shall implement the Riparian Zone Restoration Plan once the PUC has approved it.

To avoid non-compliance events with the requirements for temperature in the Winooski River, as described in Section III.G of the 2019 MOU, GMP will implement the monitoring and reporting provisions of the Riparian Zone Restoration Plan and if needed would implement the future efforts described in the plan as contingencies if initial efforts are not successful.

III. WATER CONTROL AND MEASUREMENT

Section III of this Flow and Water Level Management Plan provides procedures for managing pond/reservoir water levels to meet the targets set forth in Section II; operating the outlet works, valves, and gates that release water from Peacham Pond and Molly's Falls Reservoir; measuring reservoir flow-releases; measuring, ramping, and adjusting generation flow rates that are released to the Winooski River; and for measuring and documenting operations. This Section also includes procedures for analyzing snowpack and forecasts to plan water level management and flow-releases.

III.A. Hydrologic Analysis

Hydrologic analysis provides the information that is relied upon for managing reservoir drawdowns (Sections II.A.2 and II.C.2), and planning Spring Refill (Sections II.A.3 and II.C.3). Hydrologic analysis performed at Peacham Pond and Molly's Falls Reservoir includes the following:

- snowpack measurements to plan how far reservoirs are drawn down each winter,
- long-term forecast analysis to schedule reservoir refilling in an effort to complete refill to the NOL by the specified dates, and
- short-term forecast analysis which is used in conjunction with snowpack measurements to determine when delayed reservoir refill or greater than normal drawdowns are needed to manage water levels and downstream flows safely.

Snow-water content analysis is performed to estimate the volume of water that will be released by future snowmelt. This information is used to plan the winter drawdown and springtime reservoir refilling (long-term forecasting), rather than being directly factored into storm-event forecasts (short-term forecasting). The snow-water content analysis is used to plan the depth of winter drawdown and timing of spring refill, with the goals of refilling the reservoirs to the NOL on-time for loon nesting and summer recreation levels, while mitigating risk of high water levels or excessive outflows and spillage during spring runoff (see Section III.A.2.a. below). GMP has not used the snow-water content analysis for short-term forecasting of the magnitude of inflows during specific storm events.

III.A.1 Snow-Water Content

GMP measures snow-water content on-site using a standard snow core sampler (aka "Federal Snow Sampler" consisting of a 1 5/8" (4.13 cm) interior-diameter aluminum snow tube and a sensitive spring scale. Weight of the snow-core is converted into snow-water equivalent ("SWE").

GMP should collect snow measurements every-other week generally beginning in mid-January (earlier or later if snow depth is heavy or light) and continuing until snow is gone.

GMP should measure snow at 2 locations in the Peacham Pond watershed and 2 locations in the Molly's Falls Reservoir watershed: 1 woods and 1 field location each (see maps, Figures 12 and 13 below). To perform the measurement, PPW should measure depth-of-snow on ground, collect snow-core samples, and melt the water to determine the water content in inches. The measurements are recorded on the form provided in Appendix 5, page 1.

Figure 12:
Molly's Falls Reservoir Snow Measurement Sites

Figure 13:
Peacham Pond Snow Measurement Sites

VHB should also use remote-sensing data, e.g., the National Operational Hydrologic Remote Sensing Center's ("NOHRSC") Interactive Snow Information on-line at: https://www.nohrsc.noaa.gov/interactive/html/map.html) to supplement the on-site snow measurements. The remote-sensing data are less precise than the on-site measurements but have the advantages of analyzing the entire watershed (local sub-watersheds for each dam) rather than just specific points, and of providing data on any date when on-site measurements are not available. The NOHRSC data is expected to yield higher snow-water content than GMP's on-site cores because the NOHRSC data includes terrain at higher elevation than GMP's on-site cores, and thus are more representative of the SWE within the overall watershed of the Peacham Pond and Molly's Falls dams.

A correction factor is not applied to the NOHRSC data. GMP's snow cores are reported to the National Oceanic and Atmospheric Administration ("NOAA"). GMP understands that the data from the cores are used by the federal government in developing the NOHRSC data. According to NOAA, "GMP's snow core data is very important and is used, along with a host of other cooperator snow survey data to help assess the current state of the snowpack across Vermont… NOHRSC takes all the cooperator survey data and ingests it into SNODAS, their snow data assimilation system to help calibrate their models." In other words, the NOHRSC data are already calibrated, by NOAA, to the GMP snow core results.

The NOHRSC data are analyzed to determine the overall SWE in the site-specific watersheds of Mollys Falls Reservoir and of Peacham Pond, i.e., custom GIS analysis is used to quantify the NOHRSC data exclusively within the local sub-watersheds of each reservoir. In contrast the GMP snow cores are obtained at or very near the lowest points of these local sub-watersheds as shown below in Figure 14, where the lowest snow-water content within the sub-watershed is expected to be found.

Underestimating the amount of SWE poses the risk that actual inflows could result in excessively high water levels or unsafe operating conditions during spring snowmelt, and by estimating the watershed-wide SWE amounts GMP intends to make the most-accurate estimates feasible in order to reduce the chances of dams overtopping, or releasing excessively high flows that could cause erosive conditions downstream.

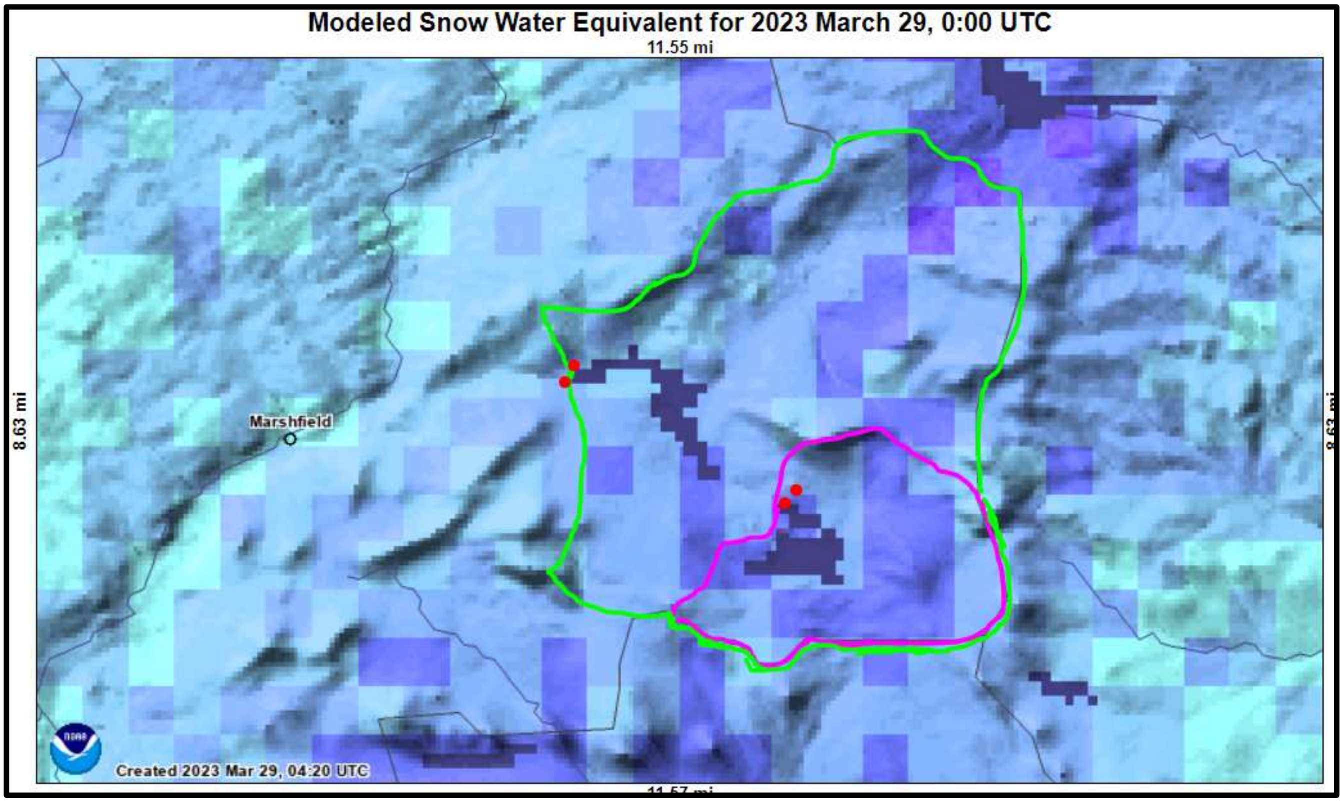

Figure 14:

NOHRSC Data Map,

GMP Snow Core Sites (red dots),

Approximate Local Sub-Watersheds (Mollys Falls Reservoir = Green, Peacham Pond = Fuchsia)

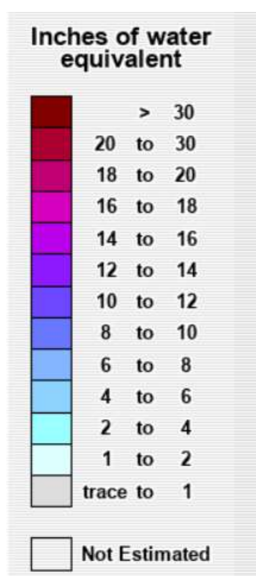

Figure 15:

NOHRSC Legend

III.A.1.a. Snow-Water Analysis Refinement

GMP will assess the need for refining the snow-water content analysis methodology in 2030. The assessment will involve comparison of the snow-water content data and the actual operations of the project with respect to winter drawdowns, spring refill, and snowmelt events. This time-frame would provide 8 years of operations data to evaluate. If the assessment indicates that the current methodology has been effective at ensuring timely spring refills and mitigating high water conditions after snowmelt events, it may be deemed that no refinement or adjustments are needed. However, if the current methodology has not adequately predicted the volume of snow-water content (i.e., late spring refills, excessive water levels following melt events), refinements would be made.

III.A.2. Hydrologic Forecasting

Currently, GMP performs daily short-term hydrologic forecasting for Peacham Pond and Molly's Falls Reservoir using the Hydro Forecast Tool, and VHB currently assists GMP with long-term forecasting for springtime reservoir refilling and with short-term forecasting for storms and expected high-flow events as requested.

III.A.2.a. Refill Forecasting

Beginning in mid-February, VHB performs weekly refill forecasting to determine the refill start-date, based on analysis of snow-water content, current water level, long-range precipitation and temperature forecast, and required conservation flows.

A sample forecasting calculation brief is provided on Appendix 5, pages 2 to 3, to illustrate. In this illustration, Peacham Pond refill could begin on March 18 to be completed by the required May 1 refill date, and excess water would be available to be released downstream above the minimum conservation flow during the refill. Also in this illustration, Molly's Falls Reservoir refill could begin on March 18 to be completed by the required May 1 refill date, while generating at the allowed 135-cfs rate (through March 31, and generating to match inflow during April) for an average of 8 hours every day until refill was completed.

III.A.2.b. Storm-Event Forecasting

Short-term forecasting (Hydro Forecast Tool) determines likely rates of inflow, reservoir levels, outflow, generation, and gate/spillway operation on an hourly basis for the next two to four days, based on inputs consisting of National Weather Service ("NWS") forecast data, United States Geological Survey ("USGS") and GMP-SCADA data, and the configuration and hydraulic properties of the facility. Significant storm events are analyzed by assessing the "more likely" and "maximum flow" scenarios identified in the NWS ensemble forecasts, which are based on numerous different models. The forecast results for reservoir levels and outflow will indicate whether full gate operation or emergency spillway activation is likely to be needed at a particular time.

A sample forecasting calculation brief is provided on Appendix 5, pages 4 to 11, to illustrate. In this illustration of Tropical Storm Isaias, Peacham Pond water levels are within 1 foot of the NOL prior to the start of the storm, and would not refill to a level that would result in spillage or full-gate operation in either the more likely or maximum flow scenario. Also in this illustration, Molly's Falls Reservoir water levels are about one foot above the New NOL, and constant generation would be needed to avoid spillway activation or full-gate operation, with no spillage expected for the more likely or maximum flow scenario. Water levels in Molly's Falls Reservoir are not expected to rise above 536.50 ft local datum in either scenario. This analysis is used to determine the need for preventative reservoir water level management for forecasted high-flow events pursuant to Section II.E.1.b of this Plan. The same analysis would be performed during winter to determine if additional drawdown of Peacham Pond and/or Molly's Falls Reservoir would be needed pursuant to Sections II.A.2. and II.C.2. of this Plan.

Accuracy of the forecasts is dependent on underlying NWS forecast accuracy, therefore GMP should observe real-time conditions and use judgment to react to changing conditions to operate the facility safely.

III.B. Peacham Pond Levels

As noted above in Section I.B.2, Peacham Pond water levels are read remotely with a transducer at the outlet structure that communicates via GMP's SCADA system. The transducer can only read water levels as low as elevation 700.5 feet local datum (1,392.64 feet NGVD 29). A staff gauge on the exterior of the outlet structure allows manual reading of the water level and can be used if water levels are too low for the transducer. The staff gauge reads in feet, local datum.

To keep Peacham Pond water levels at the NOL, under most conditions the main outlet valve can remain closed and Peacham Pond will passively maintain water levels at the NOL as water flows through the new weir in the outlet structure with the adjustable gate set for the NOL. When high inflows occur due to rain and/or snowmelt, when the pond is being drawn-down, and when the pond is being refilled, it will be necessary to operate the main outlet valve to regulate water levels.

Likewise, under most conditions, once the pond level has reached the winter-drawdown level of 3.0 feet below NOL, the main outlet valve can remain closed and Peacham Pond will passively maintain water levels at this winter-drawdown level as water flows through the weir in the outlet structure with the adjustable gate set for the winter-drawdown level, once the pond level has first been gradually lowered to the winter-drawdown level and outflows have been ramped to match inflow by adjusting the main valve. Very high inflows in excess of the weir capacity may require operation of the main outlet valve to maintain winter-drawdown levels and operate in run-of-river mode. The adjustable gate at the weir should be closed for spring refill to begin, and flows during refill should be regulated using the main valve.

When high inflows occur due to rain and/or snowmelt, when the pond is being drawn-down, and when the pond is being refilled, it is necessary to operate the main outlet valve to regulate water levels. The main outlet valve is operated by controlling the motor-actuator, or manually by turning the wheel to move the gate-valve to the desired opening as follows:

- The gate moves 1 inch for every 12.5 revolutions of the valve stem
- From the fully-closed position, the gate-valve must be opened 1.5 inches for the gate to travel past the overlap and reach 0.00 inches of opening.

Appendix 3 contains detailed information on the reservoirs, including bathymetric maps, tables, and graphs relating water surface elevations to storage volumes and surface areas of Peacham Pond and Molly's Falls Reservoir.

Tables 8 through 11 provide general guidance on how to manage Peacham Pond water levels at different times of year and in various non-emergency circumstances. Also refer to Section III.C. below for rates of flow-release into Sucker Brook.

Table 8: Peacham Pond – Summer/Fall Operations (August 1* to November 30) For Normal Operations Only – Refer to EAP for Emergencies			
If water level is in this range	**And is doing this**	**Do this**	**To make this happen**
NOL + 1′ or more	Rising	Open valve more	Make level drop back towards NOL
	Stable		
	Falling	Leave valve as-is	
NOL + 1′ or less	Rising	Open Valve slightly	Keep level within NOL ± 1′
	Stable	Leave valve as-is (rely on NOL orifice)	
	Falling		
NOL - 1′ or less	Rising	Leave valve as-is (rely on NOL orifice)	Keep level within NOL ± 1′
	Stable		
	Falling	Close Valve slightly	
NOL - 1′ or more	Rising	Leave valve as-is	Make level rise back towards NOL
	Stable	Close valve more	
	Falling		
*Or end of loon nesting season, whichever is earlier			

<table>
<tr><th colspan="4">Table 9:
Peacham Pond – Winter Operations (December 1 to Start of Spring Refill*)
For Normal Operations Only – Refer to EAP for Emergencies</th></tr>
<tr><th>When</th><th>If water level is doing this</th><th>Do this</th><th>To make this happen</th></tr>
<tr><td rowspan="3">December 1 to 15 & pond is above drawdown-level**</td><td>Rising</td><td rowspan="2">Open valve more</td><td rowspan="3">Draw-down pond no faster than 6” to 12” per week† and keep outflow ≤ 25 cfs (or = inflow if more)</td></tr>
<tr><td>Stable</td></tr>
<tr><td>Falling</td><td>Leave valve as-is or close slightly</td></tr>
<tr><td rowspan="3">December 16-31 & pond is above drawdown-level**</td><td>Rising</td><td rowspan="2">Open valve more</td><td rowspan="3">Draw-down pond to winter drawdown-level** and keep outflow ≤ 25 cfs (or = inflow if more)</td></tr>
<tr><td>Stable</td></tr>
<tr><td>Falling</td><td>Leave valve as-is</td></tr>
<tr><td rowspan="3">Pond is at drawdown-level**</td><td>Rising</td><td>Open valve more</td><td rowspan="3">Maintain Pond at drawdown-level</td></tr>
<tr><td>Stable</td><td>Leave valve as-is (rely on winter orifice)</td></tr>
<tr><td>Falling</td><td>Close valve more</td></tr>
<tr><td rowspan="3">Pond is below drawdown-level**</td><td>Rising</td><td>Leave valve as-is</td><td rowspan="3">Return Pond to drawdown-level and keep outflow ≥6.7 cfs (or = inflow if less)</td></tr>
<tr><td>Stable</td><td rowspan="2">Close valve more</td></tr>
<tr><td>Falling</td></tr>
<tr><td colspan="4">*Refill start-date is typically early March, actual date is to be determined annually (see Sections II.A.3. and III.A.2.a.)

** Through winter 2024-25, drawdown-level is normally 6.6’ below NOL (drawdown = 703.65’ local datum), except if greater drawdowns are allowed due to expected storm/high water event or maintenance (see Section II.A.2.b.)
** Beginning winter 2025-26, drawdown-level is normally 3’ below NOL (drawdown = 707.25’ local datum), except if greater drawdowns are allowed due to expected storm/high water event or maintenance (see Section II.A.2.b.)

† Faster drawdowns are allowed under conditions listed in Section II.A.2.c.</td></tr>
</table>

Table 10:
Peacham Pond – Spring Refill (Through May 1*)
For Normal Operations Only – Refer to EAP for Emergencies

If water level is in this range	And is doing this	Do this	To make this happen
NOL + 1′ or more	Rising	Open valve more	Make level drop back towards NOL
	Stable		
	Falling	Leave valve as-is	
NOL + 1′ or less	Rising	Open Valve slightly	Keep level within NOL ± 1′
	Stable	Leave valve as-is (rely on NOL orifice)	
	Falling		
Below NOL	Rising	Leave valve as-is	Refill pond
	Stable	Close valve more	
	Falling		

*Refill date is normally May 1, actual date may be later if conditions specified in Section II.A.3. are met.

Table 11:
Peacham Pond – Once Refilled Through Loon Nesting Season (August 1*)
For Normal Operations Only – Refer to EAP for Emergencies

When	If water level is doing this	Do this	To make this happen
Once refilled, to start of Loon Nesting	NOL + 0.5 ft or more	Open valve more	Keep level within NOL ± 0.5′
	At NOL ± 0.5 ft	Leave valve as-is (rely on NOL orifice)	
	NOL – 0.5 ft or more	Close valve	
During Loon Nesting Season	Above NOL	rely on NOL orifice (unless inflows high: open main valve)	Keep level at NOL (as close as feasible & safe)
	At NOL	rely on NOL orifice	
	Below NOL	Close valve	

*Or end of loon nesting season, whichever is earlier

See Section II.A.4. to determine Loon Nesting Season start and end

III.C. Peacham Pond Outflows (Sucker Brook Flows)

Flows into Sucker Brook are controlled by the Peacham Pond outlet works. When the pond is at or above the NOL and the main gate-valve is closed, outflows passively match inflows (minus any evaporation) when the weir in the outlet structure has the adjustable gate set at the NOL, allowing the inflow to overflow into the Brook (except during high flow events that exceed the orifice capacity). Likewise, when the pond is at the winter-drawdown level of 3 feet below the NOL and the weir in the outlet structure has the adjustable gate set at this winter-drawdown level, outflows will passively match inflows (minus any evaporation). Very high inflows in excess of the orifice capacity may require operation of the main outlet valve to maintain NOL and operate in run-of-river mode.

When high inflows occur due to rain and/or snowmelt, when the pond is being drawn-down, and when the pond is being refilled, it is necessary to operate the main outlet valve to release the required flow rates. During drawdown to the winter low level and during spring refill, the adjustable gate should be set at the NOL position and the main outlet valve should be used for all flow control. See Section III.B. above for details of valve operation.

Once the required outflow rate has been determined (pursuant to Section II.B. of this Plan), the following flow rating (Table 12) can be used to determine the valve position needed to release the correct flow. Table 12 accounts for the combined flows into Sucker Brook from the weir, main gate-valve, and spillway. When pond levels are above the sill of the weir (adjustable gate set at NOL), the overflow rate will correspond to the pond level, based on the depth of the overflowing stream of water.

Table 12: Peacham Pond Outlet Works (adjustable gate set at NOL) Flows (cfs) for Various Pond Levels and Main Gate-Valve Openings									
Valve Opening / Pond Level	**0 in**	**2 in**	**4 in**	**6 in**	**8 in**	**10 in**	**12 in**	**14 in**	**16 in**
715.00	1,825	1,787	1,795	1,804	1,814	1,826	1,838	1,852	1,865
714.00	1,076	1,044	1,051	1,060	1,070	1,082	1,094	1,107	1,120
713.00	472	447	454	462	473	484	495	508	521
712.00	68	53	60	68	78	89	100	113	125
711.70 (Spillway)	15	4	10	19	29	39	51	63	76
711.25	9.2	3.7	10	19	28	39	50	62	75
710.25 (NOL)	0.8	3.6	10.1	18	28	38	49	61	73
709.25	0.0	3.5	9.8	18	27	37	48	59	71
708.25	0.0	3.4	9.5	17	26	36	46	57	69
707.25 (3.0 Ft Drawdown)	0.0	3.3	9.2	17	25	35	45	55	66
706.25	0.0	3.2	8.9	16	24	33	43	54	64
705.25	0.0	3.1	8.6	16	24	32	42	52	62
704.25	0.0	3.0	8.3	15	23	31	40	50	59
703.65 (6.6 Ft Drawdown)	0.0	2.9	8.1	15	22	30	39	48	58
702.00	0.0	2.7	7.5	13.5	20	28	36	45	54
700.00	0.0	2.4	6.7	12.1	18	25	32	40	48
697.00	0.0	1.9	5.4	9.6	14	20	25	31	37

Table 12, continued for 18” to 34” valve openings: Peacham Pond Outlet Works (adjustable gate set at NOL) Flows (cfs) for Various Pond Levels and Main Gate-Valve Openings									
Valve Opening / **Pond Level**	**18 in**	**20 in**	**22 in**	**24 in**	**26 in**	**28 in**	**30 in**	**32 in**	**34 in**
715.00	1,921	1,894	1,908	1,923	1,937	1,951	1,965	1,979	1,992
714.00	1,169	1,148	1,162	1,176	1,190	1,204	1,218	1,231	1,244
713.00	563	548	562	576	589	603	616	629	642
712.00	157	152	165	179	192	205	218	231	243
711.70 (Spillway)	103	102	115	128	142	155	168	180	192
711.25	97	101	114	127	140	153	166	178	190
710.25 (NOL)	86	98	111	123	136	149	161	173	185
709.25	83	95	108	120	132	145	157	168	179
708.25	80	92	104	116	128	140	152	163	174
707.25 (3.0 Ft Drawdown)	78	89	101	113	124	136	147	158	168
706.25	75	86	97	109	120	131	142	152	162
705.25	72	83	94	105	115	126	136	146	156
704.25	69	80	90	100	111	121	131	140	149
703.65 (6.6 Ft Drawdown)	68	78	88	98	108	117	127	136	145
702.00	63	72	81	90	99	108	117	125	133
700.00	56	64	72	80	88	96	103	111	118
697.00	43	50	56	62	68	73	79	84	89

Table 12, continued for 36” to 48” (fully-open) valve openings: Peacham Pond Outlet Works (adjustable gate set at NOL) Flows (cfs) for Various Pond Levels and Main Gate-Valve Openings							
Valve Opening / Pond Level	36 in	38 in	40 in	42 in	44 in	46 in	48 in
715.00	2,046	2,017	2,028	2,037	2,046	2,052	2,055
714.00	1,292	1,268	1,278	1,288	1,296	1,302	1,306
713.00	683	665	675	685	693	699	702
712.00	273	266	276	285	292	298	301
711.70 (Spillway)	219	215	225	234	241	247	250
711.25	211	212	222	231	238	244	247
710.25 (NOL)	197	206	216	224	232	237	240
709.25	190	200	209	218	225	230	233
708.25	184	194	203	211	217	222	225
707.25 (3.0 Ft Drawdown)	178	187	196	203	210	215	217
706.25	172	180	189	196	202	207	209
705.25	165	173	181	188	194	199	201
704.25	158	166	173	180	186	190	192
703.65 (6.6 Ft Drawdown)	154	161	169	175	180	184	186
702.00	141	148	155	160	165	169	170
700.00	124	130	136	141	145	148	149
697.00	93	98	101	104	107	108	108

III.C.1 Peacham Pond Inflow Estimation

Inflow to Peacham Pond may be used to determine the appropriate flow to release into Sucker Brook when the run-of-river weir is not in use, as described above in Section II.B of this Plan. Inflow to Peacham Pond may be estimated based on the rate of change in the pond level and the rate of outflow as measured following the procedures described above. The following sequence of calculations may be used:

1) Determine Peacham Pond Volume:

Eq. 1 If $H < 1393$, $V = (4.0389\,(H) - 606.93) * 43560$

If $H \geq 1393$, $V = (315.55197\,(H) - 434618.0913) * 43560$

where,

V = volume (cubic feet)

H = reservoir water surface elevation (ft NGVD 1929); Reservoir water surface elevation is measured by GMP's SCADA system in feet (local datum); the conversion is:

Eq. 2 local datum + 692.14' = ft NGVD 1929

Detailed bathymetry maps and tables showing the relation between reservoir level, surface area, and volume are in Appendix 3.

2) Estimate Peacham Pond Inflow:

Eq. 3 QInflow = [(Vnow – V18hrs) / 720 minutes / 60 seconds] + Qoutflow18hrs

where,

QInflow = Peacham Pond inflow (cfs)

Vnow = Pond volume, cubic feet (most recent reading)

V18hrs = Pond volume, cubic feet (reading from 18 hours prior)

Qoutflow18hrs = total outflow (cfs) averaged over prior 18 hours

III.D. Molly's Falls Reservoir Water Levels

As noted above in Section I.B.3, Molly's Falls Reservoir water levels are read remotely with a transducer in the gatehouse that communicates via GMP's SCADA system. The transducer reads water levels accurately when there is no flow through the penstock. When there is flow through the penstock, the transducer is affected by drawdown and the readings are internally corrected as follows:

Corrected water level (feet) = transducer reading (feet)+ Correction Factor (feet)

where:

Correction Factor (feet) = if MW>0 then CF = 0.2878*MW - 0.3739 else CF = 0

The correction is performed automatically by the Programmable Logic Control ("PLC") and the corrected water level readings are displayed at the site and remotely. A staff gauge to read water levels manually is affixed to the south side of the gatehouse exterior. The staff gauge reads in feet, local datum and is not affected by drawdown from flow in the penstock.

Under most conditions, the new service spillway gates can remain closed because Molly's Falls Reservoir water levels are managed primarily by generation. Depending on inflows, the generating unit can be operated at up to normal full capacity (173 cfs producing 4.4 MW at NOL), and the frequency and duration of generation cycles can be adjusted to manage reservoir water levels. The new service spillway gates may be opened during large storm events, particularly when the reservoir is not already drawn-down, to release additional water beyond the capacity of the generating turbine. The gates may be opened gradually in this situation in order to spread-out the release of water, to help prevent sudden or catastrophic releases.

When storm and snowmelt events are expected or occurring, the timing and duration of generation cycles and use of the Service Spillway gates are to be determined based on forecasting. GMP's goal is to maintain reservoir water levels primarily via generation. GMP will allow controlled releases from the Service Spillway as needed to maintain water levels within acceptable ranges to avoid full-gate operation at the service spillway, or emergency spillway activation. GMP intends to maintain the service spillway gates in the open position during the winter to avoid impounding water above the service spillway crest elevation, to reduce risk of ice forming on the gates and preventing their operation.

Appendix 3 contains detailed information on the reservoirs, including bathymetric maps, tables, and graphs relating water surface elevations to storage volumes and surface areas of Peacham Pond and Molly's Falls Reservoir.

Tables 13 through 17 provide general guidance on how to manage Molly's Falls Reservoir water levels at different times of year and in various non-emergency circumstances. Also refer to Section III.E. below for rates of flow-release into Molly's Brook.

Table 13:
Molly's Falls Reservoir – Summer/Fall Operations (August 1* to November 30)
For Normal Operations Only – Refer to EAP for Emergencies

If water level is in this range	And is doing this	Do this	To make this happen
any	Emergency† or Forecasted high-flow weather event††	Generate as needed, return water level to NOL following storm; if necessary open Service Spillway gate(s); follow EAP procedures	Manage water levels for safety and to prevent high reservoir levels (>536.50′ local datum)
NOL + 1′ or more	Rising	Generate (103 cfs or inflow if more), if necessary open Service Spillway gate(s)	Make level drop back towards NOL
	Stable		
	Falling	Generate (103 cfs or inflow if more), if necessary stage closing of Service Spillway gate(s)	
NOL + 1′ or less	Rising	Generate (103 cfs or match inflow if more) if inflow or Winooski River Flow criteria are met); if necessary open Service Spillway gate(s)	Keep level within NOL ± 1′
	Stable	Continue existing operations	
	Falling		
NOL - 1′ or less	Rising	Continue existing operations	Keep level within NOL ± 1′
	Stable		
	Falling	Stop generating; if necessary close Service Spillway gates. If inflow < 8.5 cfs reduce bypass flow to match inflow	
NOL - 1′ or more	Rising	Continue existing operations**	Make level rise back towards NOL**
	Stable	Stop generating; if necessary close Service Spillway gates. If inflow < 8.5 cfs reduce bypass flow to match inflow	
	Falling		

*Or end of loon nesting season, whichever is earlier

** Exception is if reservoir is being drawn-down due to forecast high flow event or maintenance (per Section II.C.5. or II.E.1.b of this Plan), then adjust generation and/or Service Spillway gates to reach intended water level.

†Emergencies are generally defined as emergency shutdowns, plant trips, grid outages, grid emergency or capacity scarcity events, & high reservoir water levels. See Section II.E.1 for more detailed information.

††When responding to forecasted high-flow weather events described in Section II of Attachment C of the 2019 MOU, GMP may generate power and release generation flows of any magnitude to the Winooski River. See Section II.E.1 for a complete definition.

Table 14:
Molly's Falls Reservoir – Winter Operations (December 1 to Start of Spring Refill*)
For Normal Operations Only – Refer to EAP for Emergencies

When	If water level is	Do this	To make this happen
Emergency† or Forecasted high-flow weather event††	any	Generate as needed, return water level to NOL following storm; if necessary open Service Spillway gate(s); follow EAP procedures	Manage water levels for safety and to prevent high reservoir levels (>536.50' local datum)
any	Above NOL + 1'	Generate (135 cfs or inflow if more)	Make level drop back towards NOL
December 1 to 15 & reservoir is above drawdown-level**	Rising	Generate at 135 cfs or match inflow if more, if necessary open Service Spillway gate(s)	Draw-down reservoir no faster than 6" to 12" per week*†
	Stable		
	Falling	Continue existing operations	
After December 16 & reservoir is above drawdown-level**	Rising	Generate at 135 cfs or match inflow if more, if necessary open Service Spillway gate(s)	Draw-down reservoir**
	Stable		
	Falling	Continue existing operations	
Reservoir is at drawdown-level**	Rising	Continue existing operations	Stop drawdown
	Stable		
	Falling	Stop generating, if necessary stage closing of Service Spillway gates. If inflow < 8.5 cfs reduce bypass flow to match inflow	
Reservoir is below drawdown-level**	Rising	Continue existing operations	Return Reservoir to drawdown-level
	Stable	Stop generating, if necessary stage closing of Service Spillway gates. If inflow < 8.5 cfs reduce bypass flow to match inflow	
	Falling		

*Refill start-date is typically mid-March, actual date is to be determined annually (see Sections II.C.3. and III.A.2.a.)

**Maximum drawdown-level is 2' below NOL (drawdown = 529.7' local datum), unless greater drawdowns are allowed based on snowpack and expected rainfall/runoff (see Section II.C.2)

†Emergencies are generally defined as emergency shutdowns, plant trips, grid outages, grid emergency or capacity scarcity events, & high reservoir water levels. See Section II.E.1 for more detailed information.

††When responding to forecasted high-flow weather events described in Section II of Attachment C of the 2019 MOU, GMP may generate power and release generation flows of any magnitude to the Winooski River. See Section II.E.1 for a complete definition.

*† Faster drawdowns are allowed under conditions listed in Section II.C.2.d.

Table 15: Molly's Falls Reservoir – Spring Refill (Through March 31) For Normal Operations Only – Refer to EAP for Emergencies			
If water level is in this range	**And is doing this**	**Do this**	**To make this happen**
any	Emergency† or Forecasted high-flow weather event††	Generate as needed, return water level to NOL following storm; if necessary open Service Spillway gate(s); follow EAP procedures	Manage water levels for safety and to prevent high reservoir levels (>536.50' local)
NOL + 1' or more	Rising	Generate (135 cfs or inflow if more), if necessary open Service Spillway gate(s)	Make level drop back towards NOL
	Stable		
	Falling	Generate (135 cfs or inflow if more), if necessary stage closing of Service Spillway gate(s)	
NOL + 1' or less	Rising	Generate 135 cfs or match inflow if more. If necessary open Service Spillway gate(s)	Keep level within NOL ± 1'
	Stable	Continue existing operations	
	Falling		
Below NOL	Rising	Continue existing operations	Refill reservoir
	Stable	Reduce/stop generation, if necessary close Service Spillway gates. If inflow < 8.5 cfs reduce bypass flow to match inflow	
	Falling		

†Emergencies are generally defined as emergency shutdowns, plant trips, grid outages, grid emergency or capacity scarcity events, & high reservoir water levels. See Section II.E.1 for more detailed information.

††When responding to forecasted high-flow weather events described in Section II of Attachment C of the 2019 MOU, GMP may generate power and release generation flows of any magnitude to the Winooski River. See Section II.E.1 for a complete definition.

Table 16:
Molly's Falls Reservoir – Late Spring Refill (April 1 Through May 1*)
For Normal Operations Only – Refer to EAP for Emergencies

If water level is in this range	And is doing this	Do this	To make this happen
any	Emergency† or Forecasted high-flow weather event††	Generate as needed, return water level to NOL following storm; if necessary open Service Spillway gate(s); follow EAP procedures	Manage water levels for safety and to prevent high reservoir levels (>536.50' local)
NOL + 1' or more	Rising	Generate (103 cfs, or inflow if more), if necessary open Service Spillway gate(s)	Make level drop back towards NOL
	Stable		
	Falling	Generate (103 cfs, or inflow if more), if necessary stage closing of Service Spillway gate(s)	
NOL + 1' or less	Rising	Generate 103 cfs or match inflow if more, if inflow or Winooski River Flow criteria are met. If necessary open Service Spillway gate(s)	Keep level within NOL ± 1'
	Stable	Continue existing operations	
	Falling		
Below NOL	Rising	Continue existing operations	Refill reservoir
	Stable	Reduce/stop generation, if necessary close Service Spillway gates. If inflow < 12 cfs reduce bypass flow to match inflow	
	Falling		

*Refill date is normally May 1, actual date may be later if conditions specified in Section II.C.3. are met.

†Emergencies are generally defined as emergency shutdowns, plant trips, grid outages, grid emergency or capacity scarcity events, & high reservoir water levels. See Section II.E.1 for more detailed information.

††When responding to forecasted high-flow weather events described in Section II of Attachment C of the 2019 MOU, GMP may generate power and release generation flows of any magnitude to the Winooski River. See Section II.E.1 for a complete definition.

Table 17:
Molly's Falls Reservoir – Once Refilled Through Loon Nesting Season (July 31*)
For Normal Operations Only – Refer to EAP for Emergencies

When	If water level is	Do this	To make this happen
Emergency† or Forecasted high-flow weather event††	Any	Generate as needed, return water level to NOL following storm; if necessary open Service Spillway gate(s); follow EAP procedures	Manage water levels for safety and to prevent high reservoir levels (>536.50′ local)
Once refilled, to start of Loon Nesting	NOL + 0.5 ft or more	Generate (103 cfs, or inflow if more), if necessary open Service Spillway gate(s)	Keep level within NOL ± 0.5′
	At NOL ± 0.5 ft	Continue existing operations	
	NOL – 0.5 ft or more	Reduce generation (stop generating if inflow and Winooski River Flow criteria are both not met), if necessary close Service Spillway gates	
During Loon Nesting Season	NOL + 0.5 ft or more	Generate (103 cfs, or inflow if more), if necessary open Service Spillway gate(s)	Keep level at NOL (as close as feasible & safe)
	Between NOL and 0.5 ft above NOL	Generate (103 cfs, or inflow if more, if inflow or Winooski River Flow criteria are met), if necessary open Service Spillway gate(s)	
	At NOL	Continue existing operations	
	Below NOL	Reduce generation, if necessary close Service Spillway gates	

*Or end of loon nesting season, whichever is earlier. See Section II.C.4. to determine Loon Nesting Season start and end.

†Emergencies are generally defined as emergency shutdowns, plant trips, grid outages, grid emergency or capacity scarcity events, & high reservoir water levels. See Section II.E.1 for more detailed information.

††When responding to forecasted high-flow weather events described in Section II of Attachment C of the 2019 MOU, GMP may generate power and release generation flows of any magnitude to the Winooski River. See Section II.E.1 for a complete definition.

III.E. Molly's Falls Reservoir Inflows and Winooski River Flows

Inflow to Molly's Falls Reservoir will be determined by the SCADA system based on the rate of change in the reservoir level plus the outflows that are measured at the spillways, bypass pipe, and generation as described above. GMP proposes to use reservoir level/inflow as a surrogate for Winooski River flows at the powerhouse, pursuant to Section III.H.3.i. of the 2019 MOU.

III.E.1 Molly's Falls Reservoir Inflows

Appendix 6 includes a technical memorandum describing the specific data and calculations used to determine Molly's Falls Reservoir Inflows based on the rate of change in the reservoir level plus the outflows that are measured at the spillways, bypass pipe, and generation as described above. The data collection and calculations will be performed by GMP's SCADA system, providing "real-time" data.

III.E.2 Winooski River Flows

The technical memorandum in Appendix 6 describes the specific data and calculations proposed to determine Winooski River flows at the powerhouse based on the rate of change in the water level of Molly's Falls Reservoir. The method involves determining the Molly's Falls Reservoir Inflows as noted above, and then estimating the Winooski River flows based on the relative sizes of the watersheds (22 square miles for Molly's Falls Reservoir and 24 square miles for the Winooski River at the powerhouse). The data collection and calculations will be performed by GMP's SCADA system, providing "real-time" data.

A proposed alternate surrogate for the magnitude of flows in the Winooski River is real-time flow data from USGS gauge #01135150 (Pope Brook near North Danville, VT). Appendix 6 provides the correlation equation to adjust for the previously-measured relation between Pope Brook and the Winooski River. The Pope Brook USGS gauge was found to have the best correlation, of any USGS-gauged stream, to the Winooski River flows upstream of the powerhouse as gauged by the ANR during the 2015 study (VHB, 2016).

If a surrogate for the magnitude of flows in the Winooski River is not used, GMP may establish a flow gauging station immediately upstream of the powerhouse, where flows are not affected by generation, and develop a rating curve via streamflow gauging at a range of at least 5 flows and water levels, including at least one gauging measurement at approximately 30 cfs (+/- 10%). This flow gauging station, if needed, would communicate with GMP's SCADA system to provide real-time data and would be operated and maintained by GMP.

III.F. Molly's Falls Reservoir Outflows (Molly's Brook Flows)

Flows into Molly's Brook are controlled by the Service Spillway, Emergency Spillway, and bypass pipe. Primarily, water from Molly's Falls Reservoir is released into the Brook via the bypass pipe, which releases the required seasonal conservation flow (or inflow if less) and is the only release of flow from the reservoir into the Brook except when spillway gates are opened and reservoir water-levels are above the spillway sill. Along the 2-mile length of the brook, additional flow accumulates from tributaries and groundwater discharge.

The bypass flow system is equipped with an adjustable valve to allow GMP to regulate the flow rate to the appropriate conservation flow of 8.5 cfs (July through March) or 12.0 cfs (April through June), or inflow into the reservoir if less at any time. Inflow determination methods are specified in Section III.E. above. Flow calibration gauging performed by VHB in November 2021 and April 2022 verified the valve-openings required to pass the two seasonal bypass flows, as summarized in Table 18 below.

The Service Spillway gates are operated by electric motors that control the movement of each gate independently, and may be operated locally or remotely via GMP's SCADA system. Gate openings can be adjusted in approximately 0.1-foot increments. When the bypass flow system is not in service (i.e., when headgate is closed for penstock repair or inspections), bypass flows may be provided by allowing the reservoir water-level to rise within the allowed seasonal fluctuation (0.5 or 1 ft above the NOL) and opening the gate so water spills through the Service Spillway.

Table 18:
Methods for Releasing Molly's Brook Bypass Flows

Bypass Flow Requirement	via Bypass Flow System	via Service Spillway
8.5 cfs (July through March)	Valve open 8 turns	Reservoir water level of 532.6' (both gates open)
12.0 cfs (April through June)	Valve open 10 turns	Reservoir water level of 532.65' (both gates open)

The emergency spillway gates are normally closed. They would only be opened following the emergency procedures specified in the Emergency Action Plan (2023, see Section II.E.1 of this

Plan). Opening the emergency spillway involves tripping first one, then the other gate (each consisting of 3 bays of stoplogs), causing a sudden release of a large flow of water. The flow of water through the emergency spillway cannot be stopped until reservoir levels have dropped to the sill of the spillway and new stoplogs can be re-installed.

The following flow rating (Tables 19 and 20) indicate flows into Molly's Brook from the Service and Emergency Spillways for a variety of reservoir water levels and gate positions. The Service and Emergency Spillways can operate independently of one another, therefore separate tables for each spillway are provided.

Table 19:
Molly's Falls Reservoir Service Spillway
Flows (cfs per Gate) for Various Reservoir Levels and Gate-Settings

Gate Opening / Reservoir Level	0 ft	0.5 ft	1.0 ft	1.5 ft	2.0 ft	3.0 ft	4.0 ft	5.0 ft	6.0 ft	7.0 ft
548.3 (Max Gate)	0	209	418	627	836	1,261	1,692	2,128	2,535	2,557
547	0	200	400	600	803	1,210	1,625	2,043	2,222	2,255
546	0	193	387	582	775	1,171	1,572	1,980	2,029	2,076
545	0	186	373	559	746	1,126	1,514	1,882	1,844	1,903
544	0	179	357	536	716	1,087	1,462	1,629	1,662	1,744
543	0	171	341	513	687	1,042	1,398	1,457	1,498	1,572
542	0	163	326	490	654	992	1,242	1,287	1,339	1,403
541	0	155	310	464	621	944	1,104	1,132	1,184	1,239
540	0	145	292	439	585	892	938	977	1,022	1,085
539	0	136	272	411	550	737	786	832	877	995
538	0	125	250	379	511	628	658	687	790	812
537	0	114	229	347	467	488	520	606	621	621
536	0	101	204	309	356	369	437	444	444	444
535	0	87	175	235	242	276	276	276	276	276
534	0	70	124	136	144	144	144	144	144	144
533	0	30	40	40	40	40	40	40	40	40
532.2	0	0	0	0	0	0	0	0	0	0
Data source: Kleinschmidt, 2020, based on HEC-RAS model of new Spillway Gates										

Table 19, continued for 8′ to 16.1′ gate openings: Molly’s Falls Reservoir Service Spillway Flows (cfs per Gate) for Various Reservoir Levels and Gate-Settings										
Gate Opening / Reservoir Level	**8 ft**	**9 ft**	**10 ft**	**11 ft**	**12 ft**	**13 ft**	**14 ft**	**15 ft**	**16 ft**	**16.1 ft (Max Gate)**
548.3 (Max Gate)	2,580	2,679	2,751	2,833	2,905	2,946	3,031	3,184	3,379	3,400
547	2,403	2,425	2,490	2,567	2,610	2,692	2,837	3,036	3,252	3,257
546	2,166	2,236	2,296	2,365	2,420	2,560	2,739	2,954	2,969	2,969
545	1,989	2,053	2,108	2,157	2,280	2,473	2,635	2,640	2,640	2,640
544	1,808	1,866	1,915	2,025	2,182	2,343	2,343	2,343	2,343	2,343
543	1,630	1,664	1,766	1,923	2,094	2,072	2,072	2,072	2,072	2,072
542	1,440	1,528	1,680	1,788	1,788	1,788	1,788	1,788	1,788	1,788
541	1,302	1,438	1,535	1,535	1,535	1,535	1,535	1,535	1,535	1,535
540	1,211	1,275	1,275	1,275	1,275	1,275	1,275	1,275	1,275	1,275
539	1,034	1,034	1,034	1,034	1,034	1,034	1,034	1,034	1,034	1,034
538	812	812	812	812	812	812	812	812	812	812
537	621	621	621	621	621	621	621	621	621	621
536	444	444	444	444	444	444	444	444	444	444
535	276	276	276	276	276	276	276	276	276	276
534	144	144	144	144	144	144	144	144	144	144
533	40	40	40	40	40	40	40	40	40	0
532.2	0	0	0	0	0	0	0	0	0	0
Data source: Kleinschmidt, 2020, based on HEC-RAS model of new Spillway Gates										

Table 20: Molly's Falls Reservoir Emergency Spillway Flows (cfs) for Various Reservoir Levels and Gate-Settings		
# Bays Open / Reservoir Level	1 Gate (3 Bays)	2 Gates (6 Bays)
548.3	5,013	10,026
547	4,402	8,804
546	3,978	7,957
545	3,568	7,137
544	3,183	6,367
543	2,575	5,150
542	2,253	4,505
541	1,916	3,831
540	1,613	3,227
539	1,328	2,656
538	1,059	2,119
537	809	1,617
536	536	1,071
535	321	643
534	147	294
533	41	82
532	17	34
531.6	0	0
Data source: Kleinschmidt, 2020, based on HEC-RAS model of Spillways		

III.G. Flow Through Turbine (Generation)

Flows through the penstock and turbine enter the Winooski River at the powerhouse. The flow rate is not directly measured, but may be determined and controlled based on the rate of power generation. Flow is controlled by adjusting the percent-opening of the wicket gates that regulate flow into the generating turbine.

The following flow rating tables indicate flows through the turbine based on the rate of power generation, which can be measured directly and read via SCADA.

As noted in Section II.E. above, the generating turbine should normally operate at a flow rate of no less than 103 cfs (35% Wicket Gate) and no more than 173 cfs (62% Wicket Gate). Table 21 indicates generation rates (MW) that correspond to various turbine flows and reservoir levels.

Table 21:
Generator Power (MW)
as a Function of Turbine Flow and Reservoir Level

Reservoir Level / Flow (cfs)	522.0	525.9	529.7 (2-Ft Winter Drawdown)	531.7 (New NOL)	535.0	540.0
0	0.0	0.0	0.0	0.0	0.0	0.0
103 (Min)	2.3	2.4	2.4	2.4	2.4	2.5
110	2.6	2.6	2.7	2.7	2.7	2.7
120	2.9	3.0	3.0	3.0	3.0	3.1
130	3.3	3.3	3.3	3.3	3.4	3.4
135 (Normal Nov-March Cap)	3.4	3.4	3.5	3.5	3.5	3.6
140	3.5	3.6	3.6	3.6	3.7	3.7
150	3.8	3.8	3.9	3.9	3.9	4.0
160	4.0	4.1	4.1	4.1	4.2	4.2
173 (Normal Max)	4.3	4.3	4.4	4.4	4.4	4.5
180	4.4	4.4	4.5	4.5	4.5	4.6
190	4.5	4.5	4.6	4.6	4.7	4.7
200	4.6	4.6	4.7	4.7	4.7	4.8
212 (Emergency-Max)	4.7	4.7	4.8	4.8	4.8	4.9

III.G.1 Generation Ramping Procedures

When ramping is required per Section II.E.2 of this plan, the following protocols will be used:

A. Flow releases would ramp-up from 0 cfs to 103 cfs (minimum for generation) within 30 minutes and would be controlled by the SCADA system, as follows:

1) The existing turbine-bypass-pipe valve (“valve”) would ramp-up from 0 cfs to 40 cfs over 28 minutes.

2) Valve up-ramping would be comprised of 28 steps in which the flow would increase by approximately 1.4 cfs over a 2-second pulse of bypass valve motor-actuator, occurring every 1 minute.

3) the generator will be synchronized (10% +/- wicket gate), which may take 1 to 10 minutes, then the breaker will be tripped.

4) Flow would be transitioned from the 40-cfs maximum valve flow to the 103-cfs turbine minimum capacity in two minutes, with the valve being closed simultaneously with the turbine flow being brought up to 103 cfs, this method will ensure flow releases continuously are at least 40 cfs but not above 103 cfs.

B. Once the turbine is generating at 103 cfs, it would either ramp-up to the maximum allowed seasonal capacity, or remain at 103 cfs depending on the time of year, inflow, etc. (refer to Section II.E. of this Plan above). Ramping above 103 cfs would be as follows:

1) April-October: 103 cfs to match inflow (up to max 173 cfs capacity) at a rate of 60 cfs per hour rate of increase

2) November-March: 103 cfs to 135 cfs (or to match inflow if higher) within 30 minutes

C. Down-ramping: At the end of a generation cycle, if the turbine is generating at more than 103 cfs, it would ramp-down to 103 cfs within 120 minutes. Once at 103 cfs, flow would then be transitioned to 40 cfs being released via the bypass valve within 2 minutes, and the valve would be down-ramped to 0 cfs over 28 minutes in the reverse sequence as at startup.

References

Kleinschmidt, 2016. Third Safety Inspection Report: Peacham Dam, Vermont Dam No. 00050. Prepared for GMP. January 2016.

Kleinschmidt, 2020. Dive and Conduit Inspection Report: Peacham Dam, Vermont Dam No. 00050. Prepared for GMP. April 2020.

Kleinschmidt, 2023. Emergency Action Plan: Marshfield No. 6 Dam, Mollys Falls Reservoir, National Inventory of Dams No. VT 00046. Prepared for GMP. Updated December 2023.

Norcan, 2018. Marshfield No. 6 Performance Testing Report. Norcan Hydraulic Turbine Inc., January 22, 2018.

Vermont Agency of Natural Resources, Department of Environmental Conservation, 2022. Vermont Water Quality Standards, Environmental Protection Rule Chapter 29A. Effective November 15, 2022.

Vermont Agency of Natural Resources and Green Mountain Power, 2019. Memorandum of Understanding Between Green Mountain Power Corporation and the Vermont Agency of Natural Resources. Application of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 for authorization to make changes to the Molly's Falls Hydroelectric Facility in Cabot, Marshfield, and Peacham, Vermont, Case No. 18-2549-PET. August 8, 2019.

Vermont Agency of Natural Resources and Green Mountain Power, 2020. Memorandum of Understanding Between Green Mountain Power Corporation and the Vermont Agency of Natural Resources. Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 and pursuant to the March 27, 2020 Order in Case No. 18-2549-PET for approval of improvements to the Emergency Spillway at the Marshfield #6 Dam in Cabot, Vermont, part of the Molly's Falls Hydroelectric Facility ("ES Project"), Case No. 20-2570-PET. December 23, 2020.

Vermont Public Utility Commission, 2020. Final Order Granting 10 V.S.A. Chapter 43 Authorization for Improvements at the Molly's Falls Hydroelectric Facility. Case No. 18-2549-PET, Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 for authorization to make changes to the Molly's Falls Hydroelectric Facility in Cabot, Marshfield, and Peacham, Vermont. Order entered 03/27/2020.

Vermont Public Utility Commission, 2021. Final Order Granting 10 V.S.A. Chapter 43 Authorization for Improvements at the Molly's Falls Hydroelectric Facility. Case No. 20-2570-PET. Petition of Green Mountain Power Corporation, under 10 V.S.A. Chapter 43 and pursuant to the March 27, 2020 Order in

Case No. 18-2549-PET, for approval of improvements to the Emergency Spillway at the Marshfield #6 Dam in Cabot, Vermont, part of the Molly's Falls Hydroelectric Facility. Order entered 03/23/2021.

Vermont Public Utility Commission, 2022. Order Approving Changes to Molly's Falls Dam Emergency Spillway Project. Case No. 22-0231-PET. Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 and pursuant to the March 27, 2020 Order in Case No. 18-2549-PET for approval of improvements to the Emergency Spillway at the Marshfield #6 Dam in Cabot, Vermont, part of the Molly's Falls Hydroelectric Facility. Order entered 03/30/2022.

Vermont Public Utility Commission, 2022. Order Approving Changes to Molly's Falls Dam Emergency Spillway Project. Case No. 22-3438-PET. Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43, and pursuant to the March 27, 2020, Order in Case No. 18-2549-PET, the March 23, 2021, Order in Case No. 20-2570-PET, and the March 30, 2022, Order in Case No. 22-0231-PET, for approval of improvements to the emergency spillway at the Marshfield #6 Dam in Cabot, Vermont, part of the Molly's Falls Hydroelectric Facility. Order entered 12/14/2022.

VHB, 2016. Study Report: Green Mountain Power, Mollys Falls Hydroelectric Project. March 1, 2016.

VHB, 2018. Revised Winter Drawdown Assessment: Mollys Falls Reservoir and Peacham Pond. January 26, 2018.

VHB, 2024a. GMP Mollys Falls - Dissolved Oxygen Monitoring Plan. February 2024.

VHB, 2024b. Green Mountain Power: Molly's Falls Hydroelectric Facility Winooski River Riparian Zone Restoration Plan. February 2024.

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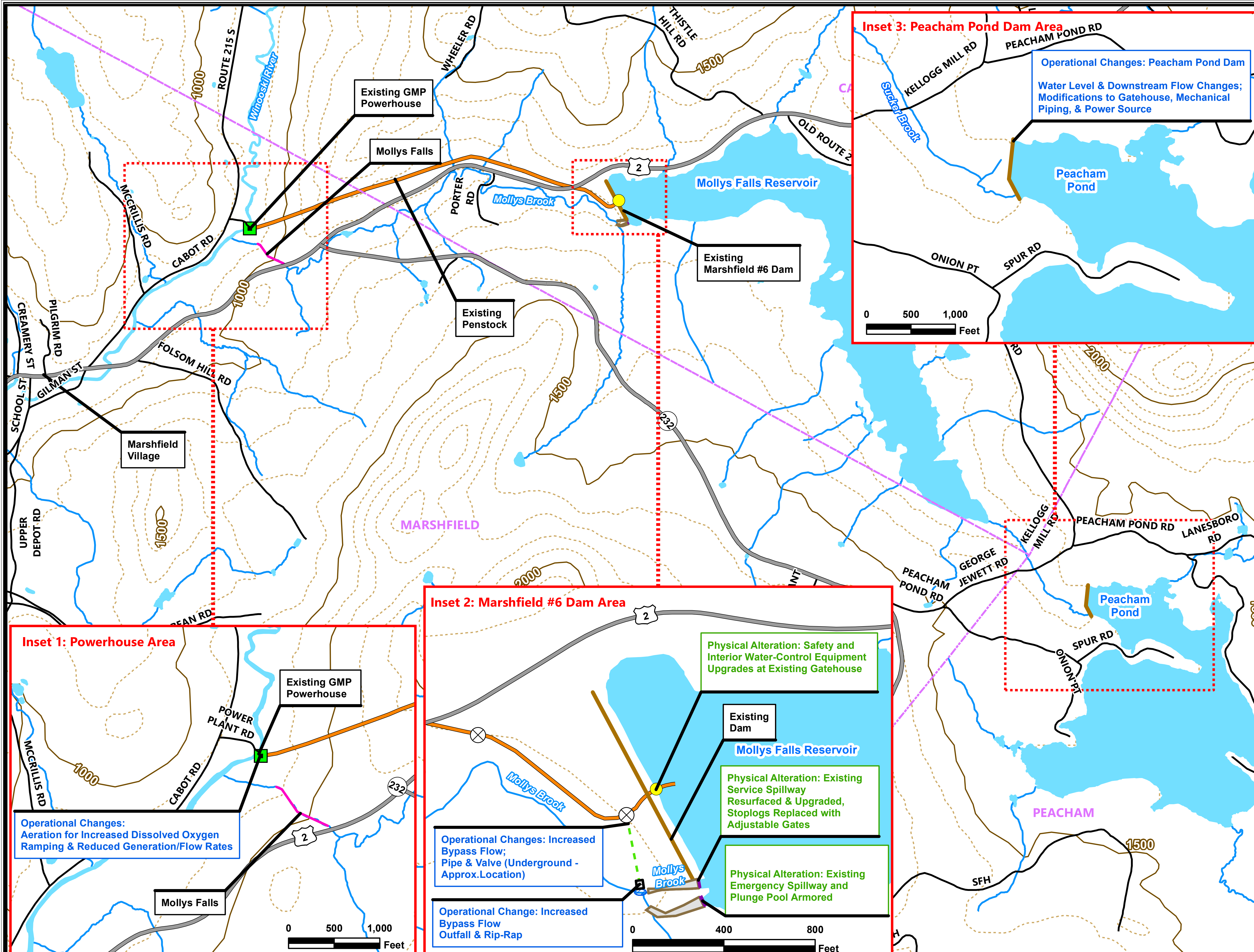
APPENDIX 1



Green Mountain Power Corporation Molly's Falls Hydroelectric Project Marshfield, Cabot, & Peacham VT Project Upgrades Location Map

January 23, 2024

1,000 0 1,000 2,000 Feet

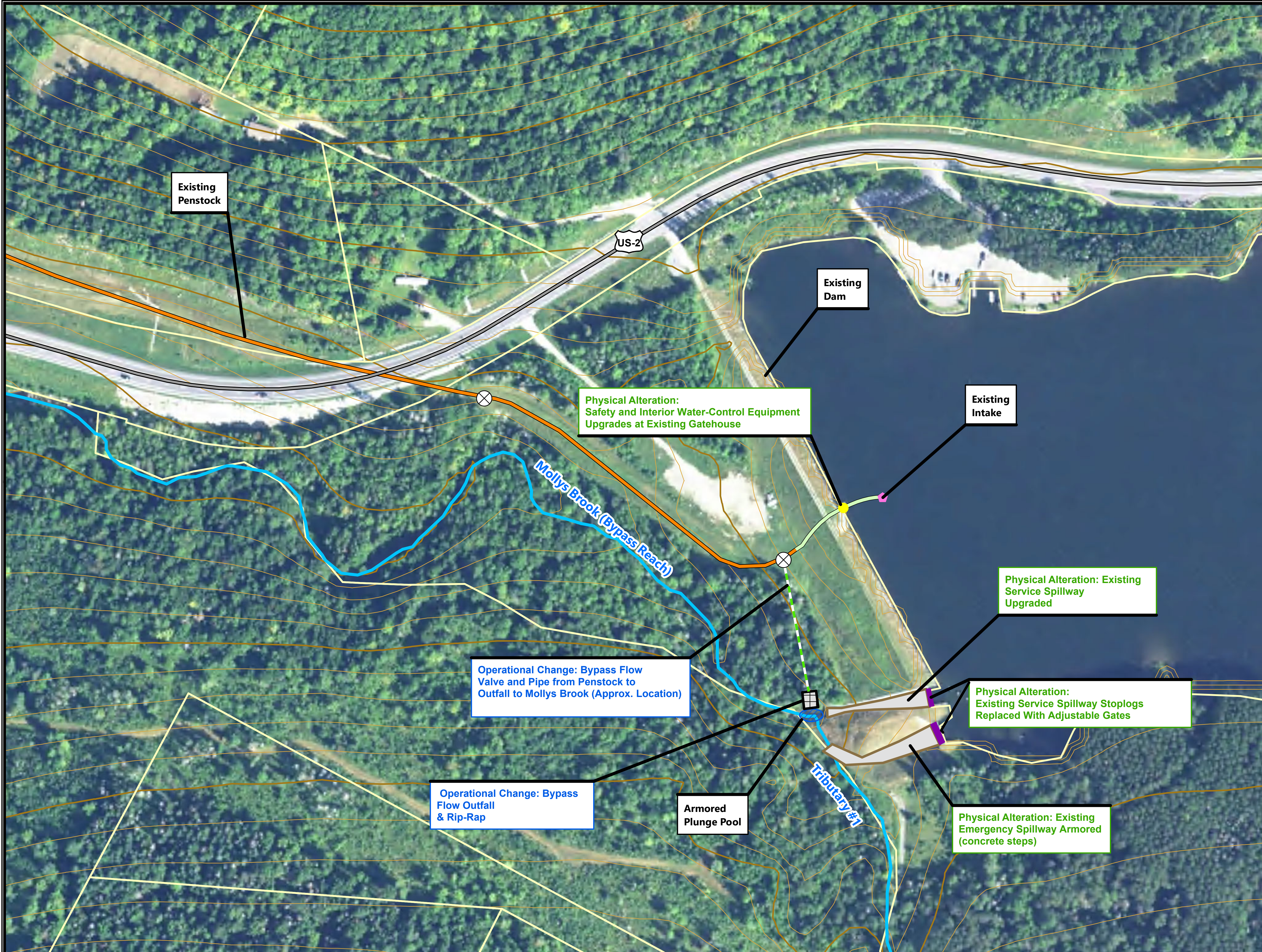
Legend

- Stream (VHD)
- Waterbody (VHD)
- Valve
- Existing Penstock
- Dam
- Local Road
- Interstate Hwy
- US Hwy
- State Hwy
- Town Boundary
- 500 ft. Contour
- 100 ft. Contour

Sources: VHD Streams and Waterbodies from VCGI (2013); Roads by VTrans (VCGI 2015); Powerhouse, Dam, Penstock, Gatehouse, Intake, Spillways, Stoplogs, and Tailrace locations digitized by VHB (2014); Town Boundaries from VCGI (2013). Project Upgrades by Kleinschmidt (2018), digitized by VHB (2018).

Green Mountain Power Corporation
Molly's Falls Hydroelectric Project
Bypass Flow Infrastructure Map

January 23, 2024



200 100 0 200 Feet

N W E S

Legend

- Valve
- Proposed Permanent Bypass
- Penstock - Concrete
- Penstock - Steel
- VHD Stream
- Parcel
- Road
- 50 ft. Contour
- 10 ft. Contour

Sources: Background - NAIP (2016); VHD Streams from VCGI (2013); Roads by VTrans (VCGI 2015); Bypasses, Dam Features & Gatehouse locations digitized by VHB (2014); Contours digitized by VHB from VT HydroDEM (2010); Parcels from VCGI (2015); Intake, Penstock, & Drain Valve from GMP (1963) & Kleinschmidt (2012).

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APPENDIX 2

STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 18-2549-PET

Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 for authorization to make changes to the Molly's Falls Hydroelectric Facility in Cabot, Marshfield, and Peacham, Vermont	

Order entered: 03/27/2020

FINAL ORDER GRANTING 10 V.S.A. CHAPTER 43 AUTHORIZATION FOR IMPROVEMENTS AT THE MOLLY'S FALLS HYDROELECTRIC FACILITY

In this Order, the Vermont Public Utility Commission adopts the following revised proposal for decision.

PROPOSAL FOR DECISION

I. INTRODUCTION

This case concerns a petition filed with the Vermont Public Utility Commission ("Commission") by Green Mountain Power Corporation ("GMP") under 10 V.S.A. Chapter 43 for authorization to make physical and operational changes to the Molly's Falls hydroelectric facility ("Molly's Falls Facility") in Cabot, Marshfield, and Peacham, Vermont (the "Petition"). Based on the findings below, I recommend that the Commission conclude that GMP's proposed modification of the service spillway at the Molly's Falls Facility will serve the public good and recommend that the Commission approve the changes.

II. PROCEDURAL HISTORY

On March 8, 2018, the Commission opened Case No. 18-0537-INV to address safety concerns raised by the Town of Plainfield regarding GMP's Marshfield #6 Dam on Molly's Brook in Cabot, Vermont and asked GMP to respond to Plainfield's concerns.

On March 29, 2018, GMP filed a response and explained that it would be filing a petition under Chapter 43 of Title 10 for modifications of the Molly's Falls Facility, which includes the Marshfield #6 Dam that would address some of the concerns raised by Plainfield, including modifications to the service spillway that GMP began discussing with the Vermont Agency of Natural Resources ("ANR") in 2012.

On June 29, 2018, GMP submitted its Petition requesting approval to make changes to the Molly's Falls Facility in Cabot, Marshfield, and Peacham, Vermont.

On August 27, 2018, the hearing officer held a prehearing conference in this proceeding.

On September 4, 2018, the hearing officer issued an order granting motions to intervene filed by the Towns of Marshfield and Plainfield.

On September 25, 2018, the hearing officer issued an order granting motions to intervene filed by the City of Montpelier, Town of Cabot, and Vermont Natural Resources Council ("VNRC"). In addition, the hearing officer directed ANR and GMP to respond to questions regarding the scope of the proceeding with respect to the proposed improvements to the emergency spillway and the upcoming Seventh Dam Safety Inspection Report (the "2018 Inspection Report").

On October 4, 2018, the Commission issued a request for proposals for an independent engineer to evaluate the Project as required by 10 V.S.A. § 1087.

On October 8, 2018, GMP and ANR responded to the Commission's order requesting clarification on the scope of the proceedings. ANR moved to stay the proceeding until GMP submitted final service spillway and emergency spillway design plans.

On October 16, 2018, Plainfield filed comments on the scope of the proceeding.

On October 22, 2018, GMP responded to ANR's motion to stay and Plainfield's comments. Also on October 22, 2018, ANR responded to GMP's October 8 filing.

On October 23, 2018, Plainfield responded to ANR's motion to stay.

On October 29, 2018, the hearing officer issued an order: (i) establishing the remaining schedule for the proceeding, (ii) denying ANR's motion to stay the proceeding, and (iii) clarifying the scope of public safety issues as those that are relevant to the Petition under 10 V.S.A. § 1086(a)(13) and explaining that public safety issues that are not relevant to the Petition were to be addressed in Case No. 18-0537-INV.

On November 14, 2018, GMP filed supplemental prefiled testimony and exhibits concerning the conceptual designs for improvements to the emergency spillway.

On December 14, 2018, the Commission issued an order granting the MadDog Chapter of Vermont Trout Unlimited's motion to intervene.

On February 27, 2019, Plainfield filed a motion to compel GMP to respond to certain of Plainfield's discovery requests and for a ruling regarding the scope of public safety issues in the proceeding.

On April 1, 2019, the hearing officer denied Plainfield's motion to compel discovery. The hearing officer also clarified that the scope of the proceeding was limited to issues related to the statutory criteria of 10 V.S.A. § 1086 and the modifications proposed in the Petition.

On May 16, 2019, the Commission notified the parties that it had retained GZA GeoEnvironmental, Inc. ("GZA") to assist the Commission in connection with dam safety issues in Cases 18-2549-PET and 18-0537-INV, with a start date of May 1, 2019.

On June 25, 2019, GMP informed the Commission that it had reached an agreement with ANR concerning the Petition, to be memorialized in a memorandum of understanding (the "2019 ANR MOU") to be filed with the Commission.

On August 1, 2019, a site visit was conducted for the purpose of allowing GZA to inspect the Facility.

On August 9, 2019, GMP submitted supplemental prefiled testimony and exhibits, including the executed 2019 ANR MOU.[1]

On August 19, 2019, ANR submitted the Commissioner of the Department of Fish & Wildlife's Final Certification Under 10 V.S.A. § 1084.

On August 19, 2019, the hearing officer held a status conference to discuss a schedule for further proceedings in this matter.

On August 26, 2019, GMP filed a letter addressing issues raised at the status conference including: (i) confirming that the 2019 ANR MOU did not require any changes to the design of the Project's Proposed Physical Improvements; (ii) recommending documents for GZA's review; and (iii) providing a proposed schedule for the remainder of the proceeding.

On September 6, 2019, the Plainfield filed a list recommending documents for GZA's review.

[1] The 2019 ANR MOU is included in the evidentiary record as Exhibit GMP-8.

On September 30, 2019, the hearing officer issued an order regarding the schedule for the remainder of the proceeding.

On October 15, 2019, the hearing officer forwarded GZA's Questions for Clarification with Respect to Petition Review (the "GZA Questions") to the parties.

On October 29, 2019, GMP filed responses to the GZA Questions.

On November 12, 2019, the hearing officer issued GZA's Petition Review Report (the "GZA Report").

On November 22, 2019, GMP filed a response to the GZA Report.

On December 6, 2019, the hearing officer held an evidentiary hearing in Montpelier, Vermont. The prefiled testimony and exhibits of the parties were admitted into the evidentiary record without objection as Commission Exhibit 1.

On December 23, 2019, the parties filed their post-hearing briefs and proposed findings.

On January 2, 2020, I granted Plainfield's request for additional time to file a revised post-hearing brief due to a delay in Plainfield receiving the transcript of the evidentiary hearing.

On January 17, 2020, Plainfield filed a revised post-hearing brief.

On February 10, 2020, I circulated a proposal for decision to the parties.

On February 24, 2020, the parties submitted comments and proposed revisions on the proposal for decision.

On March 9, 2019, this revised proposal for decision was recirculated to the parties incorporating changes proposed in the comments filed by ANR on the February 10, 2020, proposal for decision, which were also supported by GMP and the Department.

On March 13, 2020, GMP filed comments stating that it supported the revised proposal for decision.

No other comments were received.

III. LEGAL STANDARD

Section 1082 of Title 10 of the Vermont Statutes Annotated requires State authorization to "construct, enlarge, raise, lower, remodel, reconstruct, or otherwise alter any nonfederal dam, pond, or impoundment or other structure that is or will be capable of impounding more than 500,000 cubic feet of water." Applications under Section 1082 must describe:

(1) the location; the height, length, and other dimensions; and any proposed changes to any existing dam;

(2) the approximate area to be overflowed and the approximate number of or any change in the number of cubic feet of water to be impounded;

(3) the plans and specifications to be followed in the construction, remodeling, reconstruction, altering, lowering, raising, removal, breaching, or adding to;

(4) any change in operation and maintenance procedures; and

(5) other information that the State agency having jurisdiction considers necessary to review the application.[2]

Pursuant to 10 V.S.A. § 1086, when considering a request to modify a dam under the Commission's jurisdiction, the Commission must determine whether the proposed modification will serve the public good giving due consideration to 13 factors, including:

(1) the quantity, kind, and extent of cultivated agricultural land that may be rendered unfit for use by or enhanced by the project, including both the immediate and long-range agricultural land use impacts;

(2) scenic and recreational values;

(3) fish and wildlife;

(4) forests and forest programs;

(5) the need for a minimum water discharge flow rate schedule to protect the natural rate of flow and the water quality of the affected waters;

(6) the existing uses of the waters by the public for boating, fishing, swimming, and other recreational uses;

(7) the creation of any hazard to navigation, fishing, swimming, or other public uses;

(8) the need for cutting clean and removal of all timber or tree growth from all or part of the flowage area;

(9) the creation of any public benefits;

(10) the classification, if any, of the affected waters under chapter 47 of this title;

(11) any applicable State, regional, or municipal plans;

(12) municipal grand lists and revenues;

(13) public safety; and

(14) in the case of the proposed removal of a dam that formerly related to or was incident to the generation of electric energy, but that was not subject to a

[2] 10 V.S.A. § 1083(a).

> memorandum of understanding dated prior to January 1, 2006 relating to its removal, the potential for and value of future power production.

If the Commission determines that a proposed project will serve the public good after considering the above factors, the Commission's order approving the project must include "conditions for minimum stream flow to protect fish and instream aquatic life as determined by the Agency of Natural Resources" and any other conditions that it considers necessary to protect the public good.[3]

IV. FINDINGS

Pursuant to 30 V.S.A. § 8(c), and based on the record and evidence before me, I present the following proposed findings of fact to the Commission.

A. Description of the Molly's Falls Facility

1. The Molly's Falls Facility is an earth-fill dam that was filled in 1927. Prefiled Testimony of Jason Lisai and John Greenan ("GMP Witnesses") at 4; exh. Plainfield-1 at 13; exh. GMP-MP-3 at 10.

2. The Molly's Falls Facility includes infrastructure that spans approximately 4.5 miles in multiple towns, including Cabot, Marshfield, and Peacham, Vermont. Its primary components include: the Peacham Pond Dam and gatehouse in Peacham; the Marshfield #6 Dam in Cabot, which consists of a gatehouse, service spillway, and emergency spillway; the penstock and surge tank; and the powerhouse and substation on the Winooski River in Marshfield. GMP Witnesses pf. at 3-4; exh. GMP-MP-22.

3. The Molly's Falls Facility impounds approximately 354,883,320 cubic feet of water in the Molly's Falls Reservoir and 339,811,560 cubic feet of water in Peacham Pond at normal full pool levels. Petition at 3.

4. Pursuant to Commission Rule 4.500, the Marshfield #6 Dam is classified as a high hazard dam, which means a potential for loss of life of "more than a few" and an "excessive (extensive community, industry, or agriculture)" potential for economic loss in the event of a dam failure. Exh. Plainfield 1 at 15.

[3] 10 V.S.A. § 1086(b) (2017).

5. The penstock at the Marshfield #6 Dam is a six-foot diameter, 8,700-foot-long pipe that runs adjacent to Route 2 from Cabot to Marshfield. GMP uses the penstock as the primary means for regulating the water level in Molly's Falls Reservoir. GMP Witnesses pf. at 4-5.

6. Two spillways at the Marshfield #6 Dam provide GMP with additional ways to regulate water levels in the reservoir. The primary spillway (also known as the service spillway) is a 260-foot-long concrete channel that discharges into Molly's Brook. The emergency spillway is a 370-foot-long channel consisting of an upstream concrete structure with gates and an earthen channel. GMP Witnesses pf. at 4-5.

7. Gate structures at the reservoir end of each spillway can be manually operated to release water through the spillways to lower water levels in the reservoir. The gates consist of stanchion stoplogs, which are a system of vertical supports and horizontal wooden stoplogs. Wooden flashboards are mounted on top of the service spillway stanchion stoplogs and can be removed independently of the stanchions to release water through the spillway. GMP Witnesses pf. at 5; exh. Plainfield-1 at 37, Appendix D photographs 10, 18, Appendix E at 11.

8. To open the gates, two field workers must manually remove the flashboards and actuate each vertical support member. The stoplogs are an "all or nothing system" and do not allow for control or adjustment of the flows through the spillways once opened. Once opened, the stoplogs also cannot be replaced until the reservoir level has receded below the crest of the service spillway. GMP Witnesses pf. at 10; Haskell pf. at 8; exh. Plainfield-1 at 14.

9. GMP resurfaced the existing service spillway in 2018 to replace deteriorating concrete. GMP Witnesses at 23; exh. Plainfield-1 at 17, 40, Appendix D photographs 11-13.

B. <u>Proposed Modifications of the Molly's Falls Facility</u>

10. The 2018 Inspection Report for the Marshfield #6 Dam identified several priority safety issues to be addressed, including reconfiguration of the emergency spillway to mitigate the potential for erosion of the spillway chute and replacement of the service spillway stop logs with modernized and automated mechanical gates. Exh. Plainfield-1 at 5-6.

11. The proposed modifications to the Molly's Falls Facility in the Petition include the following work on the service spillway ("Service Spillway Modifications"):

- replacing the service spillway gates with vertical steel slide gates and a steel support structure that can be operated remotely or locally, including a walkway/operating platform;
- installing handrails, fall protection, restraints, and a walkway/operating platform at the service spillway modified to accommodate the new gates;
- installing an emergency generator to provide backup power for the operation of the new vertical slide gates and the existing head gate; and
- increasing the height of the service spillway walls to a minimum of two feet above the water surface to provide adequate freeboard (elevation difference between the new top of the side wall and the expected maximum water level) during the probable maximum flood conditions.

GMP Witnesses pf. at 8-9; Prefiled testimony of Adam Haskell ("Haskell") at 2, 8-9; exhs. GMP-AH-3, 4; 2019-10-29 GMP's Responses to GZA Questions ("GMP 10/29/19 Response").

12. The proposed modifications to the Molly's Falls Facility in the Petition include the following work on the emergency spillway ("Emergency Spillway Modifications"):

- armoring the emergency spillway's earthen channel to prevent erosion; and
- potential modifications to the gate system.

GMP Witnesses pf. at 9; Haskell pf. at 3, 9-10; Haskell pf. supp. (11/14/18) at 1; exh. GMP-AH-7.

13. The proposed modification of the emergency spillway is based on a preliminary hydraulic analysis that determined that the earthen spillway channel would likely be subject to significant flow velocities that could erode the channel in the event the emergency stoplogs are removed. Haskell pf. at 9.

14. The Emergency Spillway Modifications are still in the conceptual stage. Although the need for armoring is certain, GMP is still evaluating options for the type of armoring and for improving the existing gate system. Haskell pf. at 9; Haskell pf. supp. (11/14/18) at 1; exh. GMP-AH-7.

15. Other proposed modifications include installing a minimum-flow bypass structure and pipe system in connection with operational changes agreed to in the MOU with ANR. The final construction design for the minimum bypass pipe has not yet been completed. Haskell pf. at 10; GMP 10/29/19 Response at 5; exh. GMP-MP-22.

16. The proposed modification of the gate systems on the spillways is designed to improve dam safety and allow GMP to better manage water levels with much greater precision and improved response time, both locally and remotely. GMP Witnesses pf. at 6.

17. The proposed increase in height of the service spillway walls will provide adequate freeboard during a probable maximum flood condition and reduce the possibility of water overtopping the service spillway and affecting the integrity of the dam. GMP Witnesses pf. at 10-11; Haskell pf. at 3, 8-9.

18. The proposed minimum-flow bypass structure will be utilized to provide the necessary conservation flows in Molly's Brook as required by the 2019 ANR MOU. Haskell pf. at 10; exh. GMP-8, Section III(D).

19. GMP has proposed to complete work on the service spillway in 2020 and the emergency spillway in 2021. Haskell pf. supp. (8/9/19) at 3.

C. Operational Changes at the Molly's Falls Facility

20. The operational changes required by the 2019 ANR MOU include modifications of the water level and flow management protocols at Peacham Pond, Sucker Brook, Molly's Falls, Molly's Brook, and the Winooski River, as well as dissolved oxygen and temperature fluctuation management on the Winooski River. GMP Witnesses pf. supp. (8/9/19) at 4; exh. GMP-8, Section III.

21. The operational changes required by the 2019 ANR MOU:

- restrict the amounts of water level drawdown in the reservoirs;
- ensure that the timing of water level management is compatible with loon nesting;
- require higher minimum-flow rates in Sucker Brook, Molly's Brook, and the Winooski River;
- restrict peaking flow rates from the Peacham Pond dam and the Facility's powerhouse;
- reduce the frequency of generation cycles;
- align generation with high natural flows;
- smooth flow-rate transitions between drawdown, refill, and run-of-river operations in Sucker Brook; and
- smooth flow-rate transitions between generation-start, generation-end, and non-generation periods in the Winooski River.

Perry pf. supp. at 10-11; exh. GMP-8, Section III.

22. The 2019 ANR MOU requires certain operational, management, and monitoring plans to be prepared and submitted to ANR for review and to the Commission for approval, including:

- Flow and Water Level Management and Monitoring Plan for achieving compliance with water level and flow requirements to be prepared within six months of Commission approval of the proposed modification and submitted to the Commission for approval after ANR review and comment (2019 ANR MOU, Section III.H);
- Control of Water Plan for water management and safety during construction to be prepared within six months of Commission approval of the proposed modification and submitted to the Commission for approval after ANR review and comment (2019 ANR MOU, Section III.J); and
- Dissolved Oxygen Monitoring Plan for the Molly's Brook and Winooski River inflows to confirm compliance with Vermont Water Quality Standards to be prepared within six months of Commission approval of the proposed modification and submitted to the Commission for approval after ANR review and comment (2019 ANR MOU, Section III.D).

D. <u>Engineering Review of Proposed Modifications</u>

23. Pursuant to 10 V.S.A. § 1087, the Commission retained GZA Environmental, Inc., to review the proposed modifications and prepare a report addressing public safety issues. Memorandum re: Notification of retention of consultant issued 5/16/19; GZA Report.

24. The GZA Report concluded that the Service Spillway Modifications are reasonable and prudent and would improve dam safety. The GZA Report also found that the plans and drawings for the Service Spillway Modifications submitted by GMP were professionally prepared and provide appropriate information regarding the proposed structure and features. GZA Report at 4, 10.

25. The GZA Report agreed that improvements to the Emergency Spillway Modifications were reasonable and prudent even though the activation of the emergency spillway was a "relatively low-probability event." The GZA Report concluded that it lacked sufficient information to fully evaluate the Emergency Spillway Modifications due to the conceptual nature of the plans and recommended that the proposal be reevaluated by the Commission when the design had been more fully developed. GZA Report at 7-8.

26. The GZA Report recommended that the final minimum-flow bypass structure and pipe system construction plans be reviewed by a design engineer for seepage potential and embankment stability if significant excavation is required. GZA Report at 9.

27. The GZA Report agreed that the schedule proposed by GMP for dam rehabilitation activities, including completing the Service Spillway Modifications by November of 2020 and completing the Emergency Spillway Modifications by October of 2021, was "reasonable and appropriate." GZA Report at 9-10.

28. The GZA Report concluded that GMP's proposed method of using a contractor-designed cofferdam that can be removed in the event of a major flood is an "appropriate and typical approach to construction-phase water control" and recommended that the temporary water control designs and plans, and part of the construction-phase water management plan be prepared by a registered professional engineer. GZA Report at 4.

29. The GZA Report notes that, in addition to the benefits to the reservoir and wildlife, the operational changes described in the 2019 ANR MOU will provide public safety benefits because of the reduced normal pool level in the reservoir. GZA Report at 4-5.

30. In response to the GZA Report, GMP stated that it would:[4]

- Design the cofferdam and temporary water control systems to meet the industry-standard factors of safety for similar structures in cooperation with GMP's contractors and a registered professional engineer. The design will include provisions for the contractor to complete a timely removal of the system should the pond elevation or the weather forecast warrant such an action;
- Perform additional sensitivity analyses on the calibration of the probable maximum flood model that uses a different gage (such as the Dog River gage) to determine if its calibration factors are still appropriate. Verification of the pond response will be completed using historical water surface elevations from specific storm events. If results of the analysis indicate that the calibration should be changed, the probable maximum flood analysis will be revised. A supplemental report will be developed summarizing the analysis, findings, and resulting probable maximum flood;

[4] I have only listed items relevant to the modifications proposed in this proceeding. The GZA Report and GMP's responses address issues, such as other safety improvements identified in the 2018 Inspection Report and changes to the Emergency Action Plan for the Molly's Falls Facility, which are beyond the scope of a proceeding under 10 V.S.A. Chapter 43.

- Design emergency spillway modifications based on the latest probable maximum flood analysis, including any revisions due to GMP's additional sensitivity analyses;
- Review existing available subsurface information to determine the scope of subsurface investigation required for the emergency spillway design;
- Incorporate the details of energy dissipation and end discharge area protection features identified as priorities in the 2018 Inspection Report in the final design of the emergency spillway;
- Incorporate the details of the final design of the emergency spillway, including drawings, specifications, and pertinent information, into supporting technical information documents and provide those documents to the Commission; and
- Review seepage potential, embankment stability, and impacts to the dam when developing design and location for the minimum bypass flow pipe and take steps to minimize potential stability impacts during construction.

2019-11-22 GMP Responses to GZA R2 Qs and GZA Report ("GMP 11/22/19 Response") at 7-10.

Discussion

Because of the conceptual nature of the Emergency Spillway Modifications and the conclusion of the GZA Report that more information is required to assess the proposal, I recommend that the Commission defer consideration of the Emergency Spillway Modifications until final plans have been developed and submitted to the Commission for review. Without a final design plan, evaluation of the proposal under the criteria of 10 V.S.A. § 1086, and in particular the public safety criterion, will be incomplete. Requiring more information on the design is also consistent with 10 V.S.A. § 1083, which requires applications under Section 1082 to include plans and specifications describing the proposed work. I recommend that the Commission require GMP to file a final design for the emergency spillway modifications by September 1, 2020, with work to be completed during the 2021 construction season.

I further recommend that the Commission incorporate GMP's responses to the GZA report as conditions of any order that issues approving work requested in GMP's Petition. These conditions include:[5]

- Installing a filter berm (GMP 11/22/19 Response I.1);

[5] GMP has prepared a Dam Safety Surveillance Monitoring Plan (DSSMP) as stated in Response I.3. GMP filed the DSSMP with the Commission on January 6, 2010, in Case No. 20A-0026.

- Preparing Supporting Technical Information Documents for the Molly's Falls Facility by March 2020 (GMP 11/22/19 Response I.2);
- Working with GMP contractors and a registered professional engineer on cofferdam design and removal procedures during construction (GMP 11/22/19 Response II);
- Preparing a report on the results of additional sensitivity analysis on the probable maximum flood model using a different gage and verifying the pond response using data from specific storm events, including data from the May 26-27, 2011, storm event (GMP 11/22/19 Response III, Tr. (12/6/19) at 132:12-16);
- Incorporating results of probable maximum flood report and geotechnical subsurface investigation into final emergency spillway design and updating supporting technical information documents with final emergency spillway design (GMP 11/22/19 Response IV); and
- Developing a design and location for the minimum bypass flow pipe that considers seepage potential, embankment stability, and dam impacts and minimizes stability impacts to the embankment toe (GMP 11/22/19 Response V).

E. <u>Section 1086 Review of the Service Spillway Modifications</u>

In light of the recommendations above, I have limited the proposed findings on the Section 1086 criteria to the Service Spillway Modifications and, where relevant, the changed operating conditions contained in the 2019 ANR MOU.

<u>Effect on Cultivated Agricultural Land</u>

[10 V.S.A. § 1086(a)(1)]

31. The proposed operational changes and Service Spillway Modifications will not render any cultivated agricultural lands unfit for use or enhance any cultivated agricultural lands beyond the existing conditions. Perry pf. at 8, 12.

32. No agricultural land is present or adjacent to where the dam structure Service Spillway Modifications will occur. Perry pf. at 12.

33. The Molly's Falls Facility mitigates downstream flows during some high flow and flood events, which may benefit some agricultural lands. No change to this existing operation will occur due to the proposed operational changes and Service Spillway Modifications. Perry pf. at 8.

<u>Scenic and Recreational Values & Existing Uses of the Waters</u>

[10 V.S.A. § 1086(a)(2) and (a)(6)]

34. The proposed operational changes and Service Spillway Modifications will not affect scenic and recreational values in the surrounding area because the changes will be limited to upgrades of existing infrastructure. Perry pf. at 12; Perry pf. supp. at 8-9, 12-13.

35. The Service Spillway Modifications will not enlarge the dam and will be located at least 500 feet from public highways and fishing access areas. Perry pf. at 13.

36. Waters associated with the Molly's Falls Facility include the Molly's Falls reservoir, Peacham Pond, and the Winooski river. These waters are used by the public for boating, fishing, swimming, and other recreation. State park land on the shore of Molly's Falls Reservoir is accessible for hiking, picnicking, and camping. Boat ramps at the Molly's Falls Reservoir and Peacham Pond are open to the public. Summer homes and camps are also located on Peacham Pond. Perry pf. at 27.

37. Although the operating changes in the 2019 ANR MOU will lower the current normal water level, the new water level will not affect scenic values and will continue to support the existing uses of the waters by the public. Perry pf. at 15; Perry pf. supp. at 8-9, 12-13.

<u>Fish and Wildlife</u>

[10 V.S.A. § 1086(a)(3)]

38. The Department of Fish and Wildlife issued a certification under 10 V.S.A. § 1084 stating that it does not anticipate adverse effects on fish or wildlife habitats from the proposed physical modifications to the Molly's Falls Facility as long as standard construction precautions are followed. Exh. ANR-1.

39. The proposed minimum-flow bypass structure will provide necessary conservation flows in Molly's Brook. Haskell pf. at 10; exh. GMP-8, Section III(D).

40. The certification states that the operating procedures agreed to in the 2019 ANR MOU will result in a rapid and measurable improvement to stream, pond, and reservoir habitats and associated animal and plant communities. Exh. ANR-1.

Forests and Forest Programs

[10 V.S.A. § 1086(a)(4)]

41. The Service Spillway Modifications will not affect forests and forest programs, because they involve modifications of dam structures that already exist. Perry pf. at 14.

42. The operational changes required by the 2019 ANR MOU are related to flows and water levels within reservoirs, streams, and rivers and will not affect forests or forest programs. Perry pf. supp. at 11.

Minimum Stream Flow & Water Quality

[10 V.S.A. § 1086(a)(5)]

43. The Service Spillway Modifications and operational changes will not have an undue adverse effect on minimum stream flow, because the Project's water discharge flow rate schedules protect the natural rate of flow and the water quality of the affected waters. Perry pf. at 14; Perry pf. supp. at 12.

44. The 2019 ANR MOU specifies operational changes that include changes to water level and flow management for Peacham Pond, Sucker Brook, Molly's Falls Reservoir, Molly's Brook, and the Winooski River, and requires GMP to implement monitoring plans for flow and water levels and dissolved oxygen. Exh. GMP-8, Section III; Perry pf. supp. at 9-12.

45. The aeration of generation flows within the powerhouse are expected to meet the dissolved oxygen criteria of the Vermont Water Quality Standards and will be verified with the monitoring plans required by the 2019 ANR MOU. Perry pf. supp. at 10; exh. GMP-8, Section III.

46. The Molly's Brook minimum flows, in conjunction with the unregulated flows in the main stem of the Winooski River that are not affected by the Molly's Falls Facility, will provide the necessary minimum stream flows in the Winooski River below the Molly's Falls Facility powerhouse. Perry pf. supp. at 12.

Creation of Hazards to Public Uses

[10 V.S.A. § 1086(a)(7)]

47. The proposed modifications will not create any hazard to navigation, fishing, swimming, or other public uses of the Molly's Falls Facility. The proposed modifications will

improve GMP's ability to control reservoir levels and water releases, and ensure the continued integrity of the spillways. Perry pf. at 15, 27-28; Perry pf. supp. at 13.

<u>Need for Cutting and Removal of Timber or Tree Growth</u>

[10 V.S.A. § 1086(a)(8)]

48. The proposed modifications will be limited to the gatehouse and spillway areas and, other than routine vegetation management, will not involve any cutting or removal of timber or tree growth from flowage areas. Perry pf. at 15; Perry pf. supp. at 14.

<u>Public Benefits</u>

[10 V.S.A. § 1086(a)(9)]

49. The proposed modifications will provide public benefits that include improved public safety through downstream flood protection, continued recreational use, and continued generation of in-state renewable energy. GMP Witnesses pf. at 11-12; Perry pf. supp. at 14-15.

50. The Department analyzed the economic benefits of upgrading the Molly's Falls Facility and concluded that the proposed modifications are prudent and beneficial because the levelized value of continued generation will exceed the levelized value of costs. Wheeler pf. (2/20/19) at 2-3.

<u>Classification of Affected Waters</u>

[10 V.S.A. § 1086(a)(10)]

51. The Service Spillway Modifications and proposed operational changes will have no effect on the classification of the waters. The waters in the vicinity of the Molly's Falls Facility are all classified as B(2) Waters for all uses pursuant to Appendix F of the 2017 Vermont Water Quality Standards and will remain classified as B(2) Waters. Perry pf. supp. at 15.

<u>State, Regional, or Municipal Plans</u>

[10 V.S.A. § 1086(a)(11)]

52. The Service Spillway Modifications will have no effect on any applicable state, regional or municipal plans and will instead improve public safety by increasing the height of the service spillway walls, providing GMP with additional control over service spillway outflows,

and adding an emergency generator backup for power outages. GMP Witnesses pf. at 12-13; exh. GMP-5; GMP Witnesses pf. supp. at 7-8; Perry pf. supp. at 16-17.

Municipal Grand Lists and Revenues

[10 V.S.A. § 1086(a)(12)]

53. The operating conditions contained in the 2019 ANR MOU will reduce the assessed value of the Molly's Falls Facility because the operating conditions will reduce generation by approximately 22%. This will result in a reduction of the tax revenues paid annually to Marshfield, Cabot, and Peacham by the Molly's Falls Facility by $6,631, $6,673, and $922, respectively. GMP Witnesses pf. supp. at 8-9.

Discussion

Although the new operating conditions in the 2019 ANR MOU will reduce the tax revenues paid by the Molly's Falls Facility to the host towns, I recommend that the Commission conclude that the impact is not undue because amounts of the revenue reductions are small and the conditions are required to protect fish and instream aquatic life pursuant to 10 V.S.A. § 1086(b).

Public Safety

[10 V.S.A. § 1086(a)(13)]

54. The proposed modifications will improve worker and public safety at the Marshfield #6 Dam and in the downstream communities. Rehabilitating and increasing the height of the existing service spillway will improve the performance and response of the dam during flood events and allow for controlled releases during high-water events. The new spillway gates will improve worker safety by limiting the exposure of field personnel to potentially unsafe water conditions, including operation at night or during significant weather events. Haskell pf. at 10; GMP Witnesses pf. at 11, 14; exh. GMP-AH-4.

55. Components used in the Service Spillway Modifications will meet current dam safety standards and design requirements based on recent hydraulic analyses, Occupational Safety and Health Administration requirements for worker safety, and water quality standards. Haskell pf. at 10-11.

56. The new gates will be electronically operated with primary power supplied by the electric grid, backup emergency power supplied by an on-site generator, and handwheels for manual operation, if necessary. The new gates allow for more precise flow control, can be operated remotely or manually, and can be closed to restore pond levels after a flood event. GMP Response to GZA Questions (10/29/19) at 8; GMP Witnesses pf. at 14; Haskell pf. at 4.

57. The new gates will include a local notification system with alarms, including audio and visual alarms that activate upon opening, closing, or other significant changes. The emergency notification system and communication methods will be supported by a back-up generator, which will reduce the potential for downstream environmental or recreational user impacts. GMP Witnesses pf. at 15; tr. (12/06/19) at 86-88 (Lisai).

58. During construction of the Service Spillway Modifications, a contractor-designed cofferdam will be used to protect workers, equipment, and infrastructure from water impounded by the dam. Tr. (12/06/19) at 66.

59. If a high-water event occurs during construction, GMP will remove the cofferdam and use the service spillway rather than using the emergency spillway. Tr. (12/06/19) at 52, 71, 94-95 (Lisai); 55 (Greenan).

60. Before construction on the service spillway, GMP will create a Temporary Construction Emergency Action Plan ("TCEAP") in accordance with Federal Energy Regulatory Commission ("FERC") guidelines. The TCEAP will incorporate the existing Emergency Action Plan for the Molly's Falls Facility. The TCEAP will include instructions on the removal of construction-related equipment, including the cofferdam, in anticipation of a high water event. Tr. (12/06/19) at 37, 39, 40-41 (Greenan).

61. The construction work for the Service Spillway Modifications will be coordinated with weather forecasts. Construction plans and emergency responses will be determined with models prepared by engineers and other consultants. Tr. (12/06/19) at 69, 72 (Greenan); 96-97 (Lisai).

62. During the construction period, GMP will maintain Molly's Falls Reservoir at a level below current summer operating levels. If a storm is predicted to exceed the flow capacity of the penstock, construction equipment and portions of the cofferdam would be removed to be

able to pass flows through the service spillway. GMP will also perform preemptive reservoir drawdowns as needed. GMP Response to GZA Questions (10/29/19) at 6-7.

Discussion

Plainfield asks the Commission to require GMP to complete the design and work required for the Emergency Spillway Modifications before beginning the Service Spillway Modifications and to complete both projects during the 2020 construction season. According to Plainfield, removing the service spillway from operation without first repairing the emergency spillway will result in a public safety risk because the emergency spillway cannot be safely used in its current condition if there is a high-water event during construction.

GMP disagrees with Plainfield's assertion that public safety requires the emergency spillway to be repaired before the service spillway. GMP states that the Service Spillway Modifications, once completed, will allow the service spillway to contain probable maximum flood conditions without needing to activate the emergency spillway. GMP explains that completing the Service Spillway Modifications first allows GMP to have two reliable sources available to manage pond levels and flow events—the service spillway and the penstock—during repairs to the emergency spillway. According to GMP, completing the Service Spillway Modifications first results in less overall risk to the public.

GMP has stated that it cannot complete the Service Spillway Modifications and the Emergency Spillway Modifications in the same construction season and that completing the Service Spillway Modifications now will pose less risk to the public. The GZA Report concluded that the use of a cofferdam that can be removed in the event of a major flood was "an appropriate and typical approach to construction phase water control," that the proposed schedule was "reasonable and appropriate," and that the activation of the emergency spillway was a "low-probability event."[6] The GZA Report also noted that the final design for the Emergency Spillway Modifications may be affected by the Service Spillway Modifications, which is another reason to follow GMP's proposed schedule. Requiring GMP to complete the emergency spillway design and repairs before the Service Spillway Modifications would also likely delay the entire project, including additional delays of the Service Spillway Modifications.

[6] Findings 24-28.

That risk is avoided if GMP is permitted to complete the Service Spillway Modifications as proposed. For these reasons, I recommend that the Commission conclude that completing the Service Spillway Modifications before repairing the emergency spillway is an acceptable approach to the repairs required at the Molly's Falls Facility and will not create an unacceptable risk to public safety.

Potential for Future Power Production for Proposed Removal of Dam

[10 V.S.A. § 1086(a)(14)]

63. This criterion does not apply because the proposed modifications do not involve the removal of a dam. GMP Witnesses pf. at 15.

V. Discussion and Conclusion

Plainfield has raised a number of issues throughout this proceeding related to safety at the Molly's Falls Facility. Many of these issues relate to items identified in safety inspection reports for the Molly's Falls Facility, such as seepage at the toe of the dam, emergency spillway repairs, and the ability of the existing spillways to handle probable maximum flood conditions. Other issues raised by Plainfield relate to GMP's Emergency Action Plan for the Molly's Falls Facility, which Plainfield views as inadequate, and a lack of any requirement for insurance coverage for loss of life, injury, or damage caused by a dam release.

GMP maintains that many of the issues raised by Plainfield are general safety concerns that are not related to the modifications proposed in its Chapter 43 Petition and are more appropriately addressed in the investigation proceeding.[7] GMP also notes that it is continuing to work on the issues raised in the 2018 Safety Report and previous reports and is filing quarterly updates on its progress in Case No. 18A-1359. GMP asks that this proceeding remain focused on the improvements proposed by GMP in its Chapter 43 Petition that require the Commission's approval under 10 V.S.A. § 1082.

Consistent with the proposed findings above, I recommend that the Commission limit its order in this case to those issues relevant to the issues that require the Commission's approval under 10 V.S.A. Chapter 43 and those additional issues that GMP has addressed in its response

[7] Case No. 18-0537-INV.

to the GZA Report. These issues include the Service Spillway Modifications, the Emergency Spillway, and the minimum-flow bypass structure and pipe system. As explained in previous hearing officer orders regarding the scope of this proceeding, issues not related to the modifications requiring approval under 10 V.S.A. § 1082 can be addressed in Case No. 18-0537-INV.[8]

VI. Conclusion

Based upon all of the above evidence and provided that the conditions set forth in section III of the 2019 ANR MOU and GMP's representations in its response to the GZA Report are incorporated into any order issued by the Commission in this case, I recommend that the Commission conclude that the operating conditions in the 2019 ANR MOU, the Service Spillway Modifications, and the proposed minimum-flow bypass structure and pipe system will not have an undue adverse effect on:

- the quantity, kind, and extent of cultivated agricultural land that may be rendered unfit for use by or enhanced by the project, including both the immediate and long-range agricultural land use impacts (10 V.S.A. § 1086(a)(1));
- scenic and recreational values (10 V.S.A. § 1086(a)(2));
- fish and wildlife (10 V.S.A. § 1086(a)(3));
- forests and forest programs (10 V.S.A. § 1086(a)(4));
- •the need for a minimum water discharge flow rate schedule to protect the natural rate of flow and the water quality of the affected waters (10 V.S.A. § 1086(a)(5));
- the existing uses of the waters by the public for boating, fishing, swimming, and other recreational uses (10 V.S.A. § 1086(a)(6));
- the creation of any hazard to navigation, fishing, swimming, or other public uses (10 V.S.A. § 1086(a)(7));
- the need for cutting clean and removal of all timber or tree growth from all or part of the flowage area (10 V.S.A. § 1086(a)(8));
- the creation of any public benefits (10 V.S.A. § 1086(a)(9));
- the classification, if any, of the affected waters under chapter 47 of this title (10 V.S.A. § 1086(a)(10));
- any applicable state, regional or municipal plans (10 V.S.A. § 1086(a)(11));

[8] *See* Order of 4/1/19 at 3-4.

- municipal grand lists and revenues (10 V.S.A. § 1086(a)(12)); and
- public safety (10 V.S.A. § 1086(a)(13)).

I further recommend that any order entered by the Commission in this case require that the construction, alteration, and action authorized be supervised by a registered engineer employed by GMP pursuant to 10 V.S.A. § 1090 and that, upon completion of the work, the engineer certify to the Commission that the work has been completed in conformance with the approved plans and specifications.

This revised proposal for decision has been corrected to incorporate changes proposed by ANR in its comments on the February 10, 2020, proposal for decision. In its comments, ANR noted that the current version of Chapter 43 of Title 10 of the Vermont Statutes went into effect on July 1, 2018,[9] and that GMP filed its petition two days earlier on June 29, 2018. I agree that the prior version of Chapter 43 and the criteria in 10 V.S.A. § 1086 apply to GMP's petition. While the statutory changes do not change the recommendations to the Commission in the original proposal for decision, I have revised the discussion and proposed findings to conform to the version of Chapter 43 in effect when GMP filed its petition.

I have not incorporated the changes proposed by Plainfield to finding 56 (now finding 60) regarding GMP's Temporary Construction Emergency Action Plan into this revised proposal for decision because GMP's TCEAP will comply with current FERC guidelines.

This revised proposal for decision has been served on all parties to this proceeding in accordance with 3 V.S.A. § 811.

Dated at Montpelier, Vermont, this March 9, 2020.

Micah Howe
Hearing Officer

[9] Public Act No. 161 (2018 Vt., Adj. Sess.).

VII. Commission Discussion

Finding 53 states that the operating conditions required by the 2019 ANR MOU will reduce power generation at the Molly's Falls Facility by 22% and, as a result, reduce the tax revenues paid by GMP to the Towns of Marshfield, Cabot, and Peacham. In addition to the loss of tax revenues, we also note that the reduction in generation due to the operating conditions required by the 2019 ANR MOU will have a negative impact on the public benefit criterion of 10 V.S.A. § 1086(a)(9). Although the reduced power generation at the Molly's Falls Facility allows for the improved streamflow conditions required by ANR, the reduced generation will also affect GMP's compliance with other State environmental programs and, ultimately, GMP's ratepayers.

GMP will need to replace the lost generation from the Molly's Falls Facility with energy and capacity from another source, which will increase costs for GMP ratepayers. GMP also relies on the Molly's Falls Facility to meet its total renewable energy obligations under the Vermont Renewable Energy Standard ("RES"). According to GMP, the 22% reduction in power generation from the Molly's Falls Facility corresponds to 1,377 tons of additional CO_2 emissions per year if GMP replaces the lost power with system power from the regional transmission system.[10] For continued compliance with the RES, GMP will either need to replace the lost generation with another renewable energy source or pay alternative compliance payments, resulting in additional potential costs to GMP ratepayers.[11]

While this does not change our ultimate conclusion that the approved modifications to the Molly's Falls Facility will serve the public good, the consequences of reduced generation discussed above are relevant to our consideration of the public benefit criterion.

ANR, GMP, the Department, and the Town of Plainfield filed comments on the original proposal for decision. Based on those comments, the hearing officer issued a revised proposal for decision that corrected the factors of 10 V.S.A. § 1086 applicable to this proceeding. The hearing officer did not adopt proposed amendments raised in the Town of Plainfield's comments.

[10] GMP Witnesses pf. supp. at 5-6.

[11] GMP Witnesses pf. at 20. *See also* 30 V.S.A. § 8005(a)(1) (discussing the total renewable energy requirements of the RES).

Plainfield asks the Commission to modify finding 56, which has been renumbered as finding 60 in the revised proposal for decision, to read as follows (underlining is proposed by Plainfield):

> 60. Before construction on the service spillway, GMP will create a Temporary Construction Emergency Action Plan ("TCEAP") in accordance with Federal Energy Regulatory Commission ("FERC") guidelines. The TCEAP will incorporate the existing Emergency Action Plan for the Molly's Falls Facility. The TCEAP will include instructions on the removal of construction-related equipment, including the cofferdam, in anticipation of a high water event. <u>And that the TCEAP contain clear instructions about alternate routes for its own personnel to reach key sites; that traffic routing be planned which can bypass Route 2 and the needed personnel to accomplish that be noted; that all households in the possible evacuation zones be individually identified so local responders can review the scope of a possible evacuation; and that all downstream localities receive a draft of the TCEAP in advance of publication and adoption, with the goal of incorporating municipal suggestions for revision and inclusion.</u>

The guidelines provided by the Federal Energy Regulatory Commission on TCEAPs explain that "[a] Temporary Construction Emergency Action Plan (TCEAP) is required where construction workers or the public would be endangered from failure of the temporary construction work."[12] Pursuant to the FERC guidelines, a TCEAP should include:

> 1. A notification list of emergency response authorities.
>
> 2. A plan drawing showing the proposed arrangement of the structure.
>
> 3. The location of safety devices and escape routes.
>
> 4. Action levels (based on the Construction PFMA, if applicable), when the plan will be activated and when evacuation will occur.
>
> 5. A brief description of testing procedures for the plan.[13]

At the evidentiary hearing, GMP explained that, under the FERC guidelines, TCEAPs work in conjunction with existing EAPs for hydroelectric facilities in emergency situations and are focused on the new potential hazards resulting from construction activities.[14]

[12] Engineering Guidelines for the Evaluation of Hydropower Projects, Chapter 6, Section 6-9 (available at https://www.ferc.gov/industries/hydropower/safety/guidelines/eng-guide/chap6.PDF).
[13] *Id. See also* 18 C.F.R. § 12.23(a)(2).
[14] Tr. (12/6/19) at 104-105 (Greenan).

GMP has stated that it will prepare a TCEAP for the Spillway Modifications in compliance with FERC guidelines. We have required compliance with the FERC guidelines as a condition of our Order.[15] We have not adopted Plainfield's proposed amendment because those requirements go beyond the FERC guidelines for TCEAPs or are addressed in the existing emergency action plan ("EAP") for the Molly's Falls Facility.

We note that some of the issues raised in Plainfield's proposed amendment have been addressed by GMP even though not required for the TCEAP. For example, independent engineer GZA specifically asked GMP about the accessibility of the Molly's Falls Facility in light of difficulties that occurred during the May 2011 high-water event noted in the Molly's Falls EAP.[16] GMP explained that, in response to the event, GMP had increased personnel assigned to the Molly's Falls Facility, including field personnel that reside near the facility. GMP also explained that some of the additional personnel are stationed in Montpelier and in a new St. Johnsbury service center, which allows GMP personnel to access the Molly's Falls Facility from multiple directions. According to GMP, its workers are aware of alternate routes to the site in the event of washouts. GMP has also stated that it would rely on subject-matter experts to prepare the plan and would share the plan with the surrounding municipalities, including Plainfield.[17]

VIII. ORDER

IT IS HEREBY ORDERED, ADJUDGED, AND DECREED by the Public Utility Commission ("Commission") of the State of Vermont that:

1. The findings, conclusions, and recommendations of the hearing officer are adopted. All other findings proposed by parties, to the extent that they are inconsistent with this Order, were considered and not adopted.

2. In consideration of the criteria set forth in 10 V.S.A. § 1086 and in accordance with the plans and evidence presented in this proceeding, the following proposed modifications of the Molly's Falls hydroelectric facility in Cabot, Marshfield, and Peacham, Vermont, will serve the public good of the State of Vermont and will adequately protect the public safety, provided that

[15] Finding 60.
[16] 2019-11-22 GMP Responses to GZA R2 Qs and GZA Report ("GMP 11/22/19 Response") at 1-2.
[17] Tr. (12/6/19) at 41-42 (Greenan)

Green Mountain Power Corporation ("GMP") complies with this Order and the conditions of the memorandum of understanding between GMP and the Vermont Agency of Natural Resources ("ANR"):

Service Spillway

- replacing the service spillway gates with vertical steel slide gates and a steel support;
- installing handrails, fall protection, restraints, and a walkway/operating platform at the service spillway modified to accommodate the new gates;
- installing an emergency generator to provide backup power for the operation of the new vertical slide gates and the existing head gate;
- increasing the height of the service spillway walls to a minimum of two feet above the water surface to provide adequate freeboard during probable maximum flood conditions; and

Bypass Structure

- installing a minimum-flow bypass structure and pipe system.

3. GMP shall file a new Chapter 43 petition for a final design proposal for the emergency spillway conceptual design described in this case with the Commission by September 1, 2020. This petition shall be filed as a new case.

4. The representations in Green Mountain Power's Summary Responses to Independent Engineer GZA's Report Dated November 12, 2019, filed by GMP on November 22, 2019, are incorporated as conditions of the Commission's approval in this order, including:

- Installing a filter berm (Section I.1);
- Preparing supporting technical information documents for the Molly's Falls Facility by March 2020 (Section I.2);
- Working with GMP contractors and a registered professional engineer on cofferdam design and removal procedures during construction (Section II);
- Preparing a report on the results additional sensitivity analysis on the probable maximum flood model using a different gage and verifying the pond response using data from specific storm events, including data from the May 26-27, 2011, storm event (Section III, Tr. (12/6/19) at 132:12-16);
- Incorporating results of a probable maximum flood report and geotechnical subsurface investigation into final emergency spillway design and updating supporting technical information documents with final emergency spillway design (Section IV); and

- Developing a design and location for the minimum bypass flow pipe that consider seepage potential, embankment stability, and dam impacts and minimize stability impacts to the embankment toe (Section V).

5. The memorandum of understanding filed with the Commission on August 15, 2019, between GMP and ANR ("2019 ANR MOU") is approved, and the terms of the 2019 ANR MOU, which is attached to this Order as Appendix A and admitted into the evidentiary record as Exhibit GMP-8, are incorporated as terms of this Order.

6. As required by the 2019 ANR MOU, GMP shall within six months of this Order prepare the following plans for ANR's review and comment:

- Dissolved Oxygen Monitoring Plan (2019 ANR MOU, Sections III.D, III.F);
- Riparian Zone Restoration Plan (2019 ANR MOU, Section III.G);
- Flow and Water Level Management and Monitoring Plan (2019 ANR MOU, Section III.H); and
- Control of Water Plan (2019 ANR MOU, Section III.J).

Following ANR's review and comment, GMP shall file the plans with the Commission for approval. The plans shall be filed in the compliance portion of this case.

7. As required by 10 V.S.A. § 1090, the construction, alteration, and action authorized by this Order under 10 V.S.A. § 1086 shall be supervised by a registered engineer employed by GMP and, upon completion of the project, the engineer shall certify to the Commission that the project has been completed in conformance with the approved plans and specifications. The certification shall be filed in the compliance portion of this case.

8. Site preparation, construction, operation, and maintenance of the project shall be in accordance with the plans and evidence as submitted in these proceedings. Any material deviation from these plans must be approved by the Commission.

9. GMP shall prepare a Temporary Construction Emergency Action Plan for the project that complies with the guidelines provided by the Federal Energy Regulatory Commission.

Dated at Montpelier, Vermont, this 27th day of March, 2020.

Anthony Z. Roisman	)	PUBLIC UTILITY
Margaret Cheney	)	COMMISSION
Sarah Hofmann	)	OF VERMONT

OFFICE OF THE CLERK

Filed: March 27, 2020

Attest: Judith C. Whitney
Clerk of the Commission

Notice to Readers: This decision is subject to revision of technical errors. Readers are requested to notify the Clerk of the Commission (by e-mail, telephone, or in writing) of any apparent errors, in order that any necessary corrections may be made. (E-mail address: puc.clerk@vermont.gov)

Appeal of this decision to the Supreme Court of Vermont must be filed with the Clerk of the Commission within 30 days. Appeal will not stay the effect of this Order, absent further order by this Commission or appropriate action by the Supreme Court of Vermont. Motions for reconsideration or stay, if any, must be filed with the Clerk of the Commission within 28 days of the date of this decision and Order.

PUC Case No. 18-2549-PET - SERVICE LIST

Parties:

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STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Application of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 for authorization to make changes to the Molly's Falls Hydroelectric Facility in Cabot, Marshfield, and Peacham, Vermont	)))))	Case No. 18-2549-PET

MEMORANDUM OF UNDERSTANDING BETWEEN GREEN MOUNTAIN POWER CORPORATION AND THE VERMONT AGENCY OF NATURAL RESOURCES

With respect to the above-referenced application, Green Mountain Power Corporation ("GMP" or "Applicant"), and the Vermont Agency of Natural Resources ("ANR" or "the Agency") (collectively the "Parties") hereby agree and stipulate in this Memorandum of Understanding ("MOU") as follows:

WHEREAS, on June 29, 2018, GMP filed an application with the Public Utility Commission ("PUC" or "Commission") under 10 V.S.A. Chapter 43 to make certain "Proposed Physical Changes" and "Proposed Operational Changes" (collectively, the "Project") to the Molly's Falls Hydroelectric Facility (the "Facility"); and

WHEREAS, on July 23, 2018, ANR entered an appearance in this matter; and

WHEREAS, on February 20, 2019, ANR submitted testimony and exhibits recommending alternative operational changes to the Facility; and

WHEREAS, on May 3, 2019, GMP submitted rebuttal testimony and exhibits responding to ANR's recommended alternative operational changes; and

WHEREAS, on May 31, 2019, the Agency served discovery on GMP's rebuttal testimony and exhibits; and

WHEREAS, the schedule in this proceeding required that GMP respond to discovery by June 28, 2019, and that the Agency file surrebuttal testimony by August 9, 2019; and

WHEREAS, the Parties, having had an opportunity to review and assess the application materials, prefiled testimonies, and discovery questions and responses, have agreed that neither discovery responses nor Agency surrebuttal testimony are necessary because the Parties have resolved all outstanding issues between them related to the Project, and have agreed that in order for the intent of the parties as expressed in this MOU to be realized, the conditions set forth herein must be included in any Certificate of Public Good ("CPG") issued by the Commission.

THEREFORE, in consideration of the above and the undertakings and covenants set forth below, the Parties hereby agree as follows:

I. GMP shall submit to the Commission supplemental prefiled testimony and exhibits that describe and depict the changes to the Project agreed to by ANR and GMP (the "Revised Project"), as reflected in the proposed conditions for Commission approval specified in Section III of this MOU, and to conform the Project to those conditions.

II. The Agency's Department of Fish and Wildlife shall file with the Commission the certified results of its investigation into the Revised Project's potential effects on fish and wildlife habitats, pursuant to 10 V.S.A. § 1084.

III. GMP and ANR agree that the following conditions must be included in any Certificate of Public Good issued by the Commission in this matter, and that the terms and conditions of this MOU shall supersede any inconsistent prefiled testimony and exhibits:

A. <u>Peacham Pond Water Level Management:</u>

1. The Normal Operating Level ("NOL") of Peacham Pond shall remain at 1,401.9 feet above mean sea level (NGVD29).

2. GMP shall ensure that the water level of Peacham Pond equals the Peacham Pond NOL no later than May 1 unless the criteria for delayed refill timing set forth in Section III of Attachment A are met.

3. Between May 1 (or the date of refill to the Peacham Pond NOL, whichever is later), and July 31 (or the date that the Agency determines that loon nesting is completed at Peacham Pond, whichever is earlier), GMP shall maintain water levels of Peacham Pond in accordance with the loon protocols presented in Section IV of Attachment A.

4. Between August 1 (or the date that the Agency determines that loon nesting is complete at Peacham Pond, whichever is earlier) and November 30, GMP shall maintain water levels of Peacham Pond within 1 foot above or below the Peacham Pond NOL.

5. GMP shall complete an assessment of outlet works modifications ("OWM") for Peacham Pond to improve management of water levels and streamflow to enable changes to the winter drawdown regime. Within two (2) years following Commission approval of the Revised Project, GMP shall design the OWM and shall apply for permits and approvals needed for OWM construction.

6. In order to implement operational or other modifications to the outlet of Peacham Pond, between December 1 and April 30, for the first five years following Commission approval of the Revised Project, GMP may conduct winter drawdowns of Peacham Pond, subject to the conditions herein and Attachment A. Winter drawdown of Peacham Pond shall not exceed 6.6 feet from the Peacham Pond NOL, except that GMP may conduct drawdowns exceeding 6.6 feet under the conditions and criteria defined in Section II of Attachment A.

7. Within five (5) years following Commission approval of the Revised Project, GMP shall construct the OWM, subject to necessary permits and other regulatory requirements. Thereafter, between December 1 and April 30 of each subsequent year, GMP may conduct winter drawdowns of Peacham Pond subject to the conditions herein and Attachment A. Winter drawdown of Peacham Pond shall not exceed 3 feet from the Peacham Pond NOL, except that GMP may conduct drawdowns exceeding 3 feet under the conditions and criteria defined in Section I and Section II of Attachment A.

8. GMP shall stage winter water-level drawdowns of Peacham Pond to no more than 6 to 12 inches per week prior to December 15 of each year, subject to the conditions herein and Section I of Attachment A.

B. <u>Sucker Brook Flow Management</u>

1. Between December 1 and May 1 (or to the date of refill to the Peacham Pond NOL, whichever is later), GMP shall release to Sucker Brook a minimum conservation flow of 6.7 cubic feet per second ("cfs") (or the magnitude of inflow to Peacham Pond, if less), and a maximum flow of 25 cfs (or the magnitude of inflow to Peacham Pond, if greater). GMP shall implement these flow-management protocols upon implementation of the Flow and Water Level Management and Monitoring Plan pursuant to the schedule in Section III.H(4).

2. Between May 1 (or from the date of refill to the Peacham Pond NOL, whichever is later) and November 30, GMP shall manually implement run-of-river ("ROR") operations in Sucker Brook so that outflow to Sucker Brook equals the net of inflow to Peacham Pond minus evaporation from the surface of Peacham Pond. GMP shall implement these flow management protocols upon implementation of the Flow and Water Level Management and Monitoring Plan pursuant to the schedule in Section

III.H(4).

3. GMP shall develop and implement a ramping plan for transitions between drawdown, refill, and ROR periods at Peacham Pond and Sucker Brook. This plan shall be a part of the Flow and Water Level Management and Monitoring Plan that GMP shall develop and implement pursuant to Section III.H. GMP shall implement the ramping plan upon completion of construction of the Revised Project or upon Plan approval by the Commission, whichever is later.

C. <u>Molly's Falls Reservoir Water Level Management</u>

1. The NOL for Molly's Falls Reservoir shall be set approximately 4.2 feet lower than the current NOL of 1,228.2 feet above mean sea level (NGVD29), or approximately 1,224.0 feet (the "New NOL"). GMP shall determine the precise New NOL in developing the Flow and Water Level Management and Monitoring Plan, as described in Section III.H. GMP shall implement the New NOL upon implementation of the Flow and Water Level Management and Monitoring Plan pursuant to the schedule in Section III.H(4).

2. Between May 1 (or the date of refill to the Mollys Falls Reservoir New NOL, whichever is later) and July 31 (or the date that the Agency determines that loon nesting is completed at Mollys Falls Reservoir, whichever is earlier), GMP shall maintain water levels in Mollys Falls Reservoir in accordance with the loon protocols presented in Section IV of Attachment A.

3. Between August 1 (or the date that the Agency determines that loon nesting is complete at Mollys Falls Reservoir, whichever is earlier), and November 30, GMP shall maintain water levels of Mollys Falls Reservoir within 1 foot above or below the New NOL.

4. Between December 1 and April 30, GMP may perform winter drawdowns of Mollys Falls Reservoir, subject to the conditions herein and in Sections I and II of Attachment A. Winter drawdown of Mollys Falls Reservoir shall not exceed 2 feet from the New NOL (i.e., to approximately 1,222.0 feet NGVD29), except that GMP may conduct drawdowns to 5.8 feet from the New NOL, (i.e., to approximately 1,218.2 feet NGVD29) or more if needed, under the conditions and criteria defined in Sections I and II of Attachment A. GMP shall implement the drawdown protocols upon implementation of the Flow and Water Level Management and Monitoring Plan pursuant to the schedule in Section III.H(4).

5. GMP shall stage winter water-level drawdowns of Mollys Falls Reservoir to no more than 6 to 12 inches per week prior to December 15 of each year, subject to the conditions herein and Section I of Attachment A.

6. At any time during the year, with notice to the Agency's Department of Forests, Parks and Recreation and the Mollys Falls Pond State Park, GMP may conduct drawdowns of Mollys Falls Reservoir as needed to perform planned or required inspections, maintenance, or repairs on the Facility's infrastructure. On or before February 15 of each year, GMP shall provide ANR with a summary of any such drawdowns conducted during the prior 12-month period. GMP shall implement ramping pursuant to Section III.E(1) when releasing flows to the Winooski River in order to drawdown the water level of Mollys Falls Reservoir to perform planned or required inspections, maintenance, or repairs to the Facility's infrastructure.

D. <u>Mollys Brook Conservation Flow</u>

1. Between July 1 and March 31, GMP shall release to Mollys Brook a minimum conservation flow of the lesser of 8.5 cfs or the net of inflow to Mollys Falls Reservoir minus evaporation from the surface of Mollys Falls Reservoir. GMP shall implement the conservation flow upon implementation of the Flow and Water Level Management and Monitoring Plan pursuant to the schedule in Section III.H(4).

2. Between April 1 and June 30, GMP shall release to Mollys Brook a minimum conservation flow of the lesser of 12 cfs or the net of inflow to Mollys Falls Reservoir minus evaporation from the surface of Mollys Falls Reservoir. GMP shall implement the conservation flow upon implementation of the Flow and Water Level Management and Monitoring Plan pursuant to the schedule in Section III.H(4).

3. GMP shall prepare and implement a Dissolved Oxygen Monitoring Plan to confirm that the methods of releasing and aerating the conservation flows in Mollys Brook comply with the Dissolved Oxygen criteria of the Vermont Water Quality Standards. Within 6 months following Commission approval of the Revised Project, GMP shall submit the Dissolved Oxygen Monitoring Plan to ANR for comment, and thereafter to the Commission for review and approval. GMP shall implement the Dissolved Oxygen Monitoring Plan upon completion of construction of the Revised Project, or upon Plan approval by the Commission, whichever is later.

E. <u>Winooski River Generation Flows</u>

1. GMP shall use existing infrastructure to ramp up and ramp down flows released to the Winooski River from the powerhouse during generation in accordance with the conditions herein and Attachment B. GMP shall develop and implement a ramping plan for transitioning to and from generation flows. This plan shall be a part of the Flow and Water Level Management and Monitoring Plan that GMP shall develop and implement pursuant to Section III.H. GMP shall implement the ramping plan upon completion of construction of the Revised Project or upon Plan approval by the

Commission, whichever is later.

2. Between November 1 and March 31, subject to ramping, water level, and conservation flow conditions, GMP may generate power and release generation flows to the Winooski River at its sole discretion. During this period, the magnitude of generation flow shall not exceed 135 cfs (or the magnitude of inflow to Mollys Falls Reservoir, as provided for in Section III.E(4)(i), whichever is greater).

3. Between April 1 and October 31, subject to ramping, water level, and conservation flow conditions, GMP may generate power and release generation flows to the Winooski River under the circumstances described in (i) and (ii) below:

    i. When flow in the unregulated Winooski River exceeds 30 cfs as measured at the powerhouse. As described in Section III.H(3)(i), ANR and GMP may agree to use the rate of water level change in Mollys Falls Reservoir as a surrogate metric for the magnitude of flows in the Winooski River. If ANR and GMP agree on the use of a surrogate, the terms and conditions of agreement shall be included in the Flow and Water Level Management and Monitoring Plan and any releases of generation flows tied to this surrogate shall be subject to ramping, water level, and conservation flow conditions.

    ii. When the water level of Mollys Falls Reservoir reaches a mutually agreeable water level, irrespective of the magnitude of flows in the Winooski River or inflow rates to Mollys Falls Reservoir. Once ANR and GMP determine a mutually agreeable water-level trigger, as provided for in Sections III.H(1)(xii) and III.H(3)(ii), the terms and conditions of agreement shall be included in the Flow and Water Level Management and Monitoring Plan.

    iii. Irrespective of the specific trigger used for releasing generation flows during this period, the magnitude of generation flows shall not exceed 103 cfs (or the magnitude of inflow to Mollys Falls Reservoir, as provided for in Section III.E(4)(i), whichever is greater). As provided for in Section III.H(1)(xiv), GMP shall verify that 103 cfs is within the turbine's hydraulic capacity for safe operations (referred to in GMP's Ch. 43 Petition as the "Permitted Operating Zone"). In the event testing determines that 103 cfs is outside the Permitted Operating Zone, the magnitude of allowable generation flows between April 1 and October 31 and the associated ramping requirements in Attachment B shall be adjusted by mutual agreement through the Flow and Water Level Management and Monitoring Plan. Any disputes over necessary modifications to operating conditions shall be resolved by the Commission.

4. Notwithstanding the above, at any time during the year:

i. GMP may generate power and release generation flows to the Winooski River when inflow to Molly's Falls Reservoir is within the existing turbine's hydraulic capacity for safe operations as determined by the manufacturer (referred to in GMP's Petition as the "Permitted Operating Zone"), subject to ramping, water level, and conservation flow conditions. The magnitude of generation flows released to the Winooski River shall match the magnitude of inflow to Molly's Falls Reservoir.

ii. When responding to forecasted high-flow weather events described in Section II of Attachment C, GMP may generate power and release generation flows of any magnitude to the Winooski River. Ramping is not required when releasing generation flows to the Winooski River in response to weather-related high-flow events.

iii. GMP may generate power and release generation flows of any magnitude to the Winooski River for emergency purposes in order to participate in capacity markets and when responding to energy grid emergencies or capacity scarcity events in the regional (ISO-NE) and local grids (as defined in Section I of Attachment C). Ramping is not required when releasing generation flows to the Winooski River for emergency purposes.

5. GMP shall implement Section III.E upon implementation of the Flow and Water Level Management and Monitoring Plan pursuant to the schedule in Section III.H(4).

F. <u>Winooski River Generation: Dissolved Oxygen Fluctuations</u>

1. GMP shall install an aeration system within the powerhouse and shall prepare and implement a Dissolved Oxygen Monitoring Plan to confirm that the generation flows released to the Winooski River are complying with the Dissolved Oxygen criteria of the Vermont Water Quality Standards.

2. Within 6 months of Commission approval of the Revised Project, GMP shall submit the Dissolved Oxygen Monitoring Plan to ANR for comments, and thereafter to the Commission for review and approval. GMP shall implement the Dissolved Oxygen Monitoring Plan upon completion of construction of the Revised Project or upon Plan approval by the Commission, whichever is later.

G. <u>Winooski River Generation: Temperature Fluctuations</u>

1. GMP shall develop and implement a riparian zone restoration plan to close the temperature gap between generation flows released to the Winooski River and natural flows in the Winooski River, to the extent reasonable and feasible, through extensive riparian buffer restoration along the Winooski River upstream of the powerhouse. The Restoration Plan shall identify reasonable and feasible opportunities for riparian

zone restoration along the Winooski River, assess anticipated temperature impacts of implementing the feasible opportunities, and set forth a schedule for implementation. In addition, the Plan shall describe reasonable and feasible future monitoring and restoration efforts to be taken to close the temperature gap, if any are needed.

2. Within 6 months of Commission approval of the Revised Project, GMP shall submit the Restoration Plan to ANR for comment, and thereafter to the Commission for review and approval. After Commission approval, GMP shall implement the Restoration Plan in accordance with the schedule therein.

H. <u>Flow and Water Level Management and Monitoring Plan</u>

1. GMP shall develop and implement a Flow and Water Level Management and Monitoring Plan which shall include the following components:
    i. information on how the Facility will be managed to avoid non-compliance events with the conservation and maximum flow requirements for Sucker Brook, as described in Section III.B;
    ii. information on how the Facility will be managed to avoid non-compliance events with the conservation flow requirements for Mollys Brook, as described in Section III.D;
    iii. information on how the Facility will be managed to avoid non-compliance events with the generation flow requirements for the Winooski River, as described in Section III.E;
    iv. a detailed protocol for how the Facility will be operated to achieve ROR conditions in Sucker Brook, as described in Section III.B(2);
    v. a detailed ramping protocol for how the Facility will be operated to transition between drawdown, refill, and ROR periods at Sucker Brook and Peacham Pond, as described in Section III.B(3);
    vi. a detailed protocol for ramping up and ramping down the flows released to the Winooski River from the powerhouse during generation, as described in Section III.E(1);
    vii. a description of the protocol for operating the proposed penstock tap valve (conservation flow device) and spillway slide gates under varying flow conditions at Mollys Falls Reservoir;
    viii. information on how the Facility will be managed to avoid non-compliance events with the requirements for the NOL and the winter drawdowns at Peacham Pond, as described in Section III.A;
    ix. a detailed protocol for deciding when and how the Facility will be managed in the event of winter drawdowns exceeding 6.6 feet (or 3 feet, as applicable) at Peacham Pond, as described in Section III.A(5);
    x. determination of the specific New NOL in Molly's Falls Reservoir and information on how the Facility will be managed to avoid non-compliance

events with the requirements for the New NOL and the winter drawdowns at Molly's Falls Reservoir, as described in Section III.C;

xi. a detailed protocol for deciding when and how the Facility will be managed in the event of winter drawdowns exceeding 2 feet (or 5.8 feet, as applicable) at Molly's Falls Reservoir, as described in Section III.C(4);

xii. a mutually agreeable water-level trigger for releasing generation flows to the Winooski River, as described in Sections III.E(3)(ii) and III.H(3)(ii);

xiii. information on how the Facility will be managed to avoid non-compliance events with the requirements for temperature and dissolved oxygen in the Winooski River, as described in Sections III.F and III.G; and

xiv. the testing results verifying the range of the turbine's hydraulic capacity for safe operations (the "Permitted Operating Zone"), as described in Section III.E(4)(i).

2. No later than October of each of the first three (3) years following completion of construction of the Revised Project, GMP and ANR shall meet and confer to review the status of operations at the Facility, to discuss challenges and successes in implementing the operating protocols and conditions described herein and in the Flow and Water Level Management and Monitoring Plan, and to identify opportunities for improvement.

3. In the development of the Flow and Water Level Management and Monitoring Plan, GMP and ANR may agree on additional circumstances and conditions under which GMP may generate power and release generation flows to the Winooski River between April 1 and October 31, as referenced in Section III.E(3).

   i. GMP and ANR may agree that the rate of change in the water level of Molly's Falls Reservoir is a reasonable and appropriate surrogate for the magnitude of flows in the Winooski River measured from the powerhouse. GMP and ANR will work to understand the relationship between water levels in Mollys Falls Reservoir, generation flows, and generation run-time. In the event that GMP and ANR agree on a surrogate for the magnitude of flows in the Winooski River, the Flow and Water Level Management and Monitoring Plan shall detail the specific approach and the calculations that support the use of the surrogate. In the event that GMP and ANR do not agree on a surrogate, none shall be described in the Flow and Water Level Management and Monitoring Plan.

   ii. GMP and ANR agree that the water level of Mollys Falls Reservoir represents a reasonable and appropriate trigger for GMP to generate power and release generation flows to the Winooski River, irrespective of flows in the Winooski River or inflow rates to Mollys Falls Reservoir. Once GMP and ANR agree on a water-level trigger, the Flow and Water Level Management and Monitoring Plan shall detail the specific approach and the calculations that support the use of the mutually agreeable water-level trigger. Unless GMP and ANR agree otherwise, the water-level trigger shall be (a) 1 foot above the New NOL between August 1 (or the date that the Agency determines that loon nesting is complete at Mollys Falls Reservoir, whichever is earlier) and April 30, and (b) 0.5 feet above the NOL between May 1 (or the date of refill to the Mollys Falls Reservoir New NOL, whichever is later), and July 31 (or the date that the Agency determines that loon nesting is completed at Mollys Falls Reservoir, whichever is earlier).

4. Within 6 months after the Commission approves the Revised Project, GMP shall submit the Flow and Water Level Management and Monitoring Plan to the ANR for comment, and thereafter to the Commission for review and approval. GMP shall implement the Flow and Water Level Management and Monitoring Plan upon completion of construction of the Revised Project or upon Plan approval by the Commission, whichever is later.

I. <u>Operations and Maintenance Plan</u>

1. GMP shall develop and implement an Operations and Maintenance Plan ("O&M Plan"), which will be prepared and maintained by GMP to detail information on the operational plans for the Facility's components including:
   i. operation of the spillways during a flood or high water event;
   ii. the surveillance and monitoring plan for the Facility; and
   iii. the plan for routine Facility maintenance.

2. The existing Marshfield Emergency Action Plan ("EAP", December 2018) information will be updated to reflect the Revised Project including the service spillway vertical slide gates, penstock bypass valve, and any operational changes that relate to operations during an emergency event.

3. Any Critical Energy Infrastructure Information ("CEII") contained in the O&M Plan shall be handled by GMP in accordance with applicable federal or state requirements. The parties will identify and implement a procedure and schedule by which ANR may review the O&M Plan or portions thereof that contain CEII.

J. <u>Control of Water Plan</u>

1. GMP shall develop and implement a water management and safety plan for the construction of the Revised Project. The Control of Water Plan will protect the contractor and work area during construction and provide GMP the flexibility to pass

flows if necessary during the construction phase.

2. Within 6 months after the Commission approves the Revised Project, GMP shall submit the Control of Water Plan to ANR for comment, and thereafter to the Commission for review and approval.

IV. The Parties agree that, subject to the Commission including the conditions of Section III in its approval of the Revised Project, the Revised Project will serve the public good, and will have no undue adverse effect to scenic and recreational values; fish and wildlife; forests and forest programs; existing uses of the waters by the public for boating, fishing, swimming, and other recreational uses; the creation of any hazard to navigation, fishing, swimming, or other public uses; the creation of any public benefits; the classification, if any, of the affected waters under 10 V.S.A. Chapter 47; and compliance with applicable State, regional, or municipal plans; pursuant to 10 V.S.A. § 1086.

V. The Parties agree that the Commission may approve the Revised Project and issue an Order and CPG in this matter in accordance with the plans and specifications submitted with the Application, as modified by the supplemental prefiled testimony and exhibits that are specified in this MOU, and including the terms and conditions of this MOU. The Parties agree that to the extent any testimony or evidence submitted in this proceeding differs from the provisions of this MOU, the provisions of the MOU shall control.

VI. This MOU may be modified only upon mutual written agreement by the Parties and is subject to any necessary Commission approvals.

VII. The Parties agree that this MOU shall not be construed by any party or tribunal as having precedential impact on any future proceeding involving the Parties, except as necessary to implement this MOU or to enforce an order of the Commission resulting from this MOU.

VIII. Nothing in this MOU shall bind the Parties to take or refrain from taking any position on any issue not addressed herein, including any issue raised by any other party to this docket, or in any future docket.

IX. This MOU is expressly conditioned upon the Commission's acceptance of all of its provisions, without material change or condition. The Parties agree that, should the Commission fail to approve this MOU in all material aspects, the Parties' agreements set forth herein shall terminate, this MOU shall not constitute any part of the record in this proceeding, and this MOU shall not be used for any other purpose. The Parties' agreements in this MOU shall not be construed by any party or tribunal as having precedential impact on any testimony or positions that may be advanced in these proceedings. Each Party shall be placed in the position that it enjoyed in this proceeding before entering into the MOU and shall have the right to submit filings in this docket, including testimony.

X. Any disputes arising under this MOU shall be resolved by the Commission under Vermont law.

XI. Provided that the Proposal for Decision is consistent in all material respects with this MOU and contains conditions substantially similar to those set forth in this MOU, the Parties hereby waive their rights under 3 V.S.A. § 811 to review and comment upon a Proposal for Decision with respect to the issues addressed herein. Notwithstanding the above, ANR or GMP may submit comments in response to any comments submitted by other parties in the proceeding, provided such comments are consistent with the intent and terms of this MOU.

[*Signatures pages follow*.]

Dated at Burlington, Vermont, this 8th day of August, 2019.

GREEN MOUNTAIN POWER CORPORATION

By: ______________________

Andrew N. Raubvogel, Esq.
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Dated at Montpelier, Vermont, this 8th day of August, 2019.

VERMONT AGENCY OF NATURAL RESOURCES

By: ______________________

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Attachment A: Reservoir Drawdown & Refill Criteria

I. Criteria for Drawdown below 1,398.9′ (Peacham Pond) or 1,222.0′ (Mollys Falls Reservoir)

A. The following criteria and conditions shall apply in the following circumstances:

1. **When drawing down Peacham Pond 3.0′ to 6.6′ below NOL (i.e., 1,398.9′ to 1,395.3′ NGVD29 based on a NOL of 1,401.9′),**
2. **For exemptions from requirement to stage Peacham Pond or Mollys Falls Reservoir drawdowns to no more than 6 to 12 inches per week prior to December 15, and**
3. **For drawing down Mollys Falls Reservoir 2′ to 5.8′ below *the new* NOL (i.e., approximately 1,222.0′ to 1218.2′ NGVD29 based on a new NOL of approximately 1,224.0).**

B. GMP will conduct drawdowns subject to these criteria and conditions (see also Notes 1 and 2 below):

1. **Mollys Falls Reservoir:**

    1) Generating unit is expected to be out-of-service for extended time or other maintenance/repair work, or
    2) Any one or more of the following critical components of the Facility requires planned or emergency maintenance: intake, gatehouse, penstock, surge tank, primary spillway, emergency spillway, and any/all areas of the dam, or
    3) Peacham Pond cannot be drawn-down normally, or
    4) Snow-Water Content exceeds 6 inches at any time, or
    5) Snow-Water Content exceeds 4.5 inches after April 1, or
    6) Forecast indicates over 2.5 inches of rain is likely within 24 hours, or
    7) Forecast indicates over 3 inches of rain is likely within 48 hours, or
    8) Forecast indicates over 3.75 inches of rain is likely within 72 hours, or
    9) Hydrologic forecasting indicates full gate operation or emergency spillway activation is likely to be needed

2. **Peacham Pond:**

    1) Mollys Falls Reservoir cannot be drawn-down normally or other maintenance/repair work, or
    2) Snow-Water Content exceeds 7 inches at any time, or
    3) Snow-Water Content exceeds 4.5 inches after April 1, or
    4) Forecast indicates over 2.5 inches of rain is likely within 24 hours, or
    5) Forecast indicates over 3 inches of rain is likely within 48 hours, or
    6) Forecast indicates over 3.75 inches of rain is likely within 72 hours, or
    7) Hydrologic forecasting indicates full gate operation or emergency spillway activation is likely to be needed

Notes:

1) Reservoir level may temporarily rise above the NOL during high inflow events and GMP would use generation and/or gate operations to restore NOL while managing flow releases to reduce excessive downstream flows.

2) Pre-approval by ANR is not required for GMP to conduct drawdowns below 1,398.9′ (Peacham Pond) or 1,222.0′ (Mollys Falls Reservoir). GMP will monitor and record all applicable data.

II. Criteria for Additional Drawdown below 1,395.3′ (Peacham Pond) or 1,218.2′ (Mollys Falls Reservoir)

A. The following criteria and conditions shall apply in the following circumstances:

1. **for drawing down Peacham Pond more than 6.6′ below NOL (i.e., lower than 1,395.3′ NGVD29 based on a NOL of 1,401.9′), and**
2. **for drawing down Mollys Falls Reservoir more than 5.8′ below *the new* NOL′ (i.e., lower than approximately 1,218.2′ NGVD29 based on a *new* NOL of approximately 1,224.0). This is equivalent to a drawdown of more than 6.6′ in Peacham Pond, and more than 10′ below *the historic (current)* NOL in Mollys Falls Reservoir.**

B. GMP will conduct drawdowns subject to these criteria and conditions (see also Notes 1 and 2 below):

1. **Mollys Falls Reservoir:**

1) Generating unit is expected to be out-of-service for extended time or other maintenance/repair work, or
2) Any one or more of the following critical components of the Facility requires planned or emergency maintenance: intake, gatehouse, penstock, surge tank, primary spillway, emergency spillway and any/all areas of the dam, or
3) Peacham Pond cannot be drawn-down normally, or
4) Snow-Water Content exceeds 10 inches at any time, or
5) Snow-Water Content exceeds 5 inches after April 1, or
6) Forecast indicates over 3 inches of rain is likely within 24 hours, or
7) Forecast indicates over 4 inches of rain is likely within 48 hours, or
8) Forecast indicates over 5 inches of rain is likely within 72 hours, or
9) Hydrologic forecasting indicates full gate operation or emergency spillway activation is likely to be needed

Peacham Pond:

1) Mollys Falls Reservoir cannot be drawn-down normally or other maintenance/repair work, or
2) Snow-Water Content exceeds 10 inches at any time, or
3) Snow-Water Content exceeds 6 inches after April 1, or
4) Forecast indicates over 3 inches of rain is likely within 24 hours, or
5) Forecast indicates over 4 inches of rain is likely within 48 hours, or
6) Forecast indicates over 5 inches of rain is likely within 72 hours, or
7) Hydrologic forecasting indicates full gate operation or emergency spillway activation is likely to be needed

Notes:

1) Reservoir level may temporarily rise above the NOL during high inflow events and GMP would use generation and/or gate operations to restore NOL while managing flow releases to reduce excessive downstream flows.

2) Pre-approval by ANR is not required for GMP to conduct drawdowns below 1,395.3 (Peacham Pond) or 1,218.2′ (Mollys Falls Reservoir). GMP will monitor and record all applicable data.

III. Refill Timing: Both Reservoirs

1. Complete refill by May 1 each year, or sooner/later as feasible based on actual conditions. Criteria for delaying Reservoir Refill Completion past May 1:
    1) Mollys Falls Reservoir
        a) Snow-Water Content exceeds 5 inches after April 1
    2) Peacham Pond
        a) If ice is present on reservoir surface, water level shall not rise higher than normal full level minus 4 feet (balance of refill to commence once surface is ice-free); or
        b) Snow-Water Content exceeds 6 inches after April 1

IV. Existing Loon Protocols: Both Reservoirs

1. Prior to loon nesting season, GMP manages pond levels as close to normal operating levels (NOL) as is feasible and safe, in anticipation of loon nesting season. Maintaining water levels as close to NOL as is feasible and safe, means maintaining water levels within 0.5 ft above or below the NOL, due to effects of changing flows, wind, waves, sensor accuracy, and sensitivity of level-controls.
2. Loon nesting season will commence when either local Loon volunteer or VT Center for Ecostudies (Eric Hanson) notify GMP Control Center or local GMP field personnel (Power Production Workers or "PPW") that loons are on their nest, or GMP PPW observe loons on their nest and notify GMP Control Center.
3. Upon confirmation that loons are nesting, PPW site visit frequency shall increase to adjust water level/valve more frequently to manage pond levels as stable as is feasible and safe during loon nesting period.
4. Pending water level/flow status, slight to moderate storm events may raise pond levels, so in anticipation of a weather event, the valve shall be adjusted to manage water to the best of GMP's ability.

Attachment B: Ramping Criteria

I. Criteria for Ramping Generating Flows Up and Down Using Existing Infrastructure:

A. Flow releases would ramp-up from 0 cfs to 103 cfs (minimum for generation) within 30 minutes as follows:

1) The existing turbine-bypass-pipe valve (“valve”) would ramp-up from 0 cfs to 40 cfs over 28 minutes.

2) Valve up-ramping would be comprised of 28 steps in which the flow would increase by approximately 1.4 cfs over a 2-second pulse, occurring every 1 minute.

3) Flow would be transitioned from the 40-cfs maximum valve capacity to the 103-cfs turbine minimum capacity in two minutes, with the valve being closed simultaneously with the turbine starting flow, this method will ensure flow releases continuously are at least 40 cfs but not above 103 cfs.

B. Once the turbine is generating at 103 cfs, it would either ramp-up to the maximum allowed seasonal capacity, or remain at 103 cfs depending on the time of year, inflow, etc. (refer to Attachment C for Generation Flow-Triggers). Ramping above 103 cfs would be as follows:

1) April-October: 103 cfs to match inflow (up to max 173 cfs capacity) – 60 cfs per hour rate of increase

2) November-March: 103 cfs to 135 cfs (or to match inflow if higher) within 30 minutes

C. Down-ramping: At the end of a generation cycle, the turbine would ramp-down to 103 cfs within 120 minutes, if needed. Once at 103 cfs, flow would then be transitioned to 40 cfs being released via the bypass valve within 2 minutes, and the valve would be down-ramped to 0 cfs over 28 minutes in the reverse sequence as at startup.

D. Ramping would not be required in the following circumstances:

1) Emergency shutdowns, plant trips (unit trips off-line to protect mechanical/electrical equipment)

2) Grid outages

3) Grid emergency or capacity scarcity events (ISO or local grid) as described in Section I of Attachment C

4) High natural flows: Mainstem Winooski River flow > 85 cfs at Powerhouse

5) Forecasted High flow weather events as described in Section II of Attachment C

Attachment C: Generation Flow-Trigger Criteria

I. Energy-related Emergencies under Section III.E.4.iii:

Energy grid emergencies and capacity scarcity events in the regional (ISO-NE) or Local Grids are described as follows:

A. Local Grid is specific to the VELCO Hardwick, Morrisville, and Marshfield circuits

B. Abnormal condition on local transmission lines or injection points (power in/out). Examples of this condition are unstable system, transmission or local system in weakened state that impacts Hardwick, Morrisville Water and Light, or GMP system in this region. GMP's Local Control Center (Colchester) will call on the Molly's Falls Facility to run for voltage control to stabilize the local grid. This occurs 1-2 times a year, duration could be 2-4 hours or up to 24 hours.

C. Similar to the 1998 Ice Storm or 2011 Tropical Storm Irene-type events, situations during which the regional transmission grid is cut off from the Marshfield area: once circuits are sectionalized the Molly's Falls Facility can provide localized power to the immediate area for emergency services, comparable to a microgrid system. In anticipation of these extended and catastrophic events, local hydro (and battery storage) sites such as the Molly's Falls Facility will become more critical for GMP to serve our customers and the local communities impacted.

II. Forecasted high-flow weather events under Sections III.A., III.C, and III.E.4.ii

A. Preventative reservoir water level management for forecasted high-flow events, which are defined by the same criteria for additional drawdown described in Sections I and II of Attachment A)

   1) Example of situation when preventative water level management would be needed: the day before TS Irene, estimated daily mean incoming Winooski River flow was 6.5 cfs at station W-1. The next day it was 378 cfs and the reservoir was 3 feet over the top of the service spillway stoplogs.

B. High reservoir water levels (generation and water passage needed to prevent service or emergency spillway activation)

   1) Pursuant to the Emergency Action Plan for the Facility, if water levels in Mollys Falls Reservoir are expected to rise above 1,228.64 ft NGVD29 (536.50 ft local), GMP shall generate at full capacity.

C. Reservoir level in Peacham Pond or Mollys Falls Reservoir may temporarily exceed 1 foot above the NOL during high inflow events; in such circumstances, GMP would use generation and/or gate operations to restore NOL while managing flow releases to reduce excessive downstream flows.

STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 20-2570-PET

Petition of Green Mountain Power Corporation, under 10 V.S.A. Chapter 43 and pursuant to the March 27, 2020 Order in Case No. 18-2549-PET, for approval of improvements to the Emergency Spillway at the Marshfield #6 Dam in Cabot, Vermont, part of the Molly's Falls Hydroelectric Facility	

Order entered: 03/23/2021

FINAL ORDER GRANTING 10 V.S.A. CHAPTER 43 AUTHORIZATION FOR IMPROVEMENTS AT THE MOLLY'S FALLS HYDROELECTRIC FACILITY

In this Order, the Vermont Public Utility Commission adopts the following proposal for decision.

PROPOSAL FOR DECISION

I. INTRODUCTION

This case involves a petition filed with the Vermont Public Utility Commission ("Commission") by Green Mountain Power Corporation ("GMP") for approval of improvements to the emergency spillway at the Marshfield #6 Dam in Cabot, Vermont ("Molly's Falls Dam") under Chapter 43 of Title 10 of the Vermont Statutes Annotated. Based on the findings below, I recommend that the Commission conclude that GMP's proposed modification of the emergency spillway at the Molly's Falls Dam will serve the public good and approve the proposed changes.

II. PROCEDURAL HISTORY

On March 27, 2020, the Commission issued an order in Case No. 18-2549-PET granting GMP's request for authorization to upgrade the service spillway and install a bypass flow pipe at the Molly's Falls Dam (the "18-2549-PET Final Order"). The Commission did not grant GMP's request to upgrade the emergency spillway, but instead required GMP to file a new petition for the emergency spillway upgrades after GMP had prepared a final design plan.

On September 9, 2020, GMP filed its petition for approval of improvements to the emergency spillway at the Molly's Falls Dam.

On October 15, 2020, I held a prehearing conference via videoconference and adopted GMP's proposed schedule.

On October 23, 2020, the Commission provided notice of this Petition to the selectboards of the towns of Marshfield, Cabot, and Peacham.

On December 1, 2020, the Commission retained GZA GeoEnvironmental, Inc. ("GZA") as a dam safety consultant on the issues raised in GMP's petition.

On December 28, 2020, GMP filed a memorandum of understanding between GMP and the Vermont Agency of Natural Resources ("ANR") (the "2020 ANR MOU") and supplemental testimony. The Vermont Department of Public Service ("Department") also filed supplemental testimony supporting the 2020 ANR MOU.

On January 7, 2021, ANR filed the Commissioner of Fish and Wildlife Certification under 10 V.S.A. § 1084.

On January 12, 2021, I issued a memorandum requesting responses to comments and questions submitted by GZA.

On January 21, 2021, GMP filed responsive documents to GZA's comments and questions.

On January 29, 2021, GZA submitted its Emergency Spillway Review Report to the Commission, and I provided it to the parties on February 2, 2021.

On February 5, 2021, I held a remote evidentiary hearing via the online software application GoToMeeting. At the hearing, I admitted the testimony and exhibits contained in a jointly filed exhibit list as Commission Exhibit 1.

On February 19, 2021, GMP submitted a proposed final order. On the same date, the Department submitted comments stating that it did not oppose the findings and conclusions in GMP's proposed order.

III. LEGAL STANDARD

Section 1082 of Title 10 of the Vermont Statutes Annotated requires State authorization to "construct, enlarge, raise, lower, remodel, reconstruct, or otherwise alter any nonfederal dam, pond, or impoundment or other structure that is or will be capable of impounding more than 500,000 cubic feet of water."

Pursuant to 10 V.S.A. § 1086, when considering a request to modify a dam under the Commission's jurisdiction, the Commission must determine whether the proposed modification will serve the public good giving due consideration to 13 factors, including:

(1) the quantity, kind, and extent of cultivated agricultural land that may be rendered unfit for use by or enhanced by the project, including both the immediate and long-range agricultural land use impacts;

(2) scenic and recreational values;

(3) fish and wildlife;

(4) forests and forest programs;

(6) the existing uses of the waters by the public for boating, fishing, swimming, and other recreational uses;

(7) the creation of any hazard to navigation, fishing, swimming, or other public uses;

(8) the need for cutting clean and removal of all timber or tree growth from all or part of the flowage area;

(9) the creation of any public benefits;

(10) attainment of the Vermont water quality standards;

(11) any applicable State, regional, or municipal plans;

(12) municipal grand lists and revenues;

(13) public safety; and

(14) in the case of the proposed removal of a dam that formerly related to or was incident to the generation of electric energy, but that was not subject to a memorandum of understanding dated prior to January 1, 2006 relating to its removal, the potential for and value of future power production.

If the Commission determines that a proposed project will serve the public good after considering the above factors, the Commission's order approving the project must include "conditions for attainment of water quality standards, as determined by the Agency of Natural Resources" and any other conditions that it considers necessary to protect the public good.

IV. FINDINGS

Pursuant to 30 V.S.A. § 8(c), and based on the record and evidence before me, I present the following proposed findings of fact to the Commission.

A. Description of the Molly's Falls Hydroelectric Facility

1. The Molly's Falls Hydroelectric Facility ("Molly's Falls Facility") includes infrastructure that spans approximately 4.5 miles in multiple towns, including Cabot, Marshfield, and Peacham, Vermont. Its primary components include: the Peacham Pond Dam and gatehouse in Peacham; the Molly's Falls Dam in Cabot, which includes a gatehouse, service spillway, and emergency spillway; the penstock and surge tank; and the powerhouse and substation on the Winooski River in Marshfield. Prefiled testimony of Jason Lisai and John Greenan, GMP ("GMP Panel pf.") at 4-5; exh. GMP-Panel-2.

2. GMP installed the emergency spillway in the early 1990s to improve the discharge capacity of the Molly's Falls Dam. GMP Panel pf. at 6.

3. GMP completed improvements to the Service Spillway, including replacing the gate system, in October 2020, pursuant to the 18-2549-PET Final Order. Exh. GMP-GZA-1.

4. The Commission authorized the installation of a minimum-flow bypass structure and pipe system in Case No. 18-2549-PET, but GMP has not completed the project. GMP Panel pf. supp. at 3-4; exh. GMP-Panel-7.

5. The Emergency Spillway consists of an approximately 70-foot channel of reinforced concrete followed by an approximately 370-foot excavated earthen channel with riprap armoring placed at a downstream bend in the channel. Two sets of stoplogs approximately 10 feet high function as a gate that can be operated to release water through the emergency spillway if necessary to lower water levels in the reservoir. GMP Panel pf. at 6; exh. GMP-Panel-5.

6. The emergency spillway was built as a backup if the main service spillway is unable to convey the needed flows from the reservoir during a flood or other highwater event. The emergency spillway is not designed for routine use and has not been activated in its full capacity since it was constructed. GMP Panel pf. at 7-8.

B. Proposed Modifications to the Emergency Spillway

7. The earthen design of the emergency spillway and its steep gradient make it susceptible to erosion if exposed to high water velocities. GMP Panel pf. at 8; prefiled testimony of Adam Haskell, GMP ("Haskell pf.") at 6-7.

8. The 2018 Safety Inspection Report for the Marshfield Dam recommended the following improvements to the emergency spillway:

- The emergency spillway should be reconfigured to mitigate the potential for head cutting and erosion of the spillway chute for flows up to and including the Probable Maximum Flood.
- The toe area of the emergency spillway should be configured to dissipate flow energy and/or be remediated to prevent undercutting/headcutting of the spillway chute.
- Security should be implemented to prevent gate opening by unauthorized personnel.
- The operation of the stanchion gates should be thoroughly reviewed for controlling sudden releases that could result in significant downstream incremental impacts.

Haskell pf. at 6-7; exh. GMP-Panel-4 at 5-6.

9. Based on the recommendations in the 2018 Safety Inspection Report, GMP proposes the following modifications to the emergency spillway ("Emergency Spillway Modifications"):

- construct a new concrete chute spillway with an underdrain system;
- remove and replace the wing walls downstream of the emergency spillway gate;
- replace existing temporary extensions to the abutment walls with reinforced concrete extensions;
- install of a cutoff wall;
- armor the existing plunge pool; and
- add security and personnel safety improvements.

Haskell pf. at 3; exh. GMP-AH-3.

10. GMP's initial construction schedule proposed to complete work on the emergency spillway by November of 2021. Haskell pf. at 13.

11. GMP has concluded that the Emergency Spillway Modifications will require two construction seasons due to the complexity of the work. Tr. 2/5/21 at 30, 40-42 (Lisai).

12. The Emergency Spillway Modifications and the minimum-flow bypass structure and pipe system authorized in Case No. 18-2549-PET cannot be performed concurrently because the temporary construction access road to the emergency spillway will interfere with the construction of the bypass pipe. Additionally, the penstock and generating unit must be available to control water levels during the Emergency Spillway Modifications, and the bypass pipe and flow system installation will require the penstock to be dewatered. Haskell pf. supp. at 2.

13. Dividing the Emergency Spillway Modifications into two construction phases over two construction seasons will ensure the project can be completed in a safe manner consistent with the proposed design plans. Tr. 2/5/21 at 40-41 (Lisai).

14. GMP has proposed the following revised construction schedule:

- Spring 2021: mobilization and site preparation.
- Summer/Fall 2021: Installation of the penstock bypass flow system; installation of emergency spillway construction access road, spillway toe cut-off wall, and portions of plunge pool armoring.
- Spring 2022: Mobilization and site preparation for the remainder of work on the emergency spillway.
- Spring/Summer 2022: Demolition work on existing emergency spillway structure.
- Summer/Fall 2022: Installation of new concrete emergency spillway structure; completion of project and demobilization.

C. The 2020 ANR MOU

15. On December 23, 2020, GMP and ANR entered into the 2020 ANR MOU, which includes a schedule for completing certain conditions of the memorandum of understanding entered into between GMP and ANR in Case No. 18-2549-PET (the "2019 ANR MOU"). The Commission approved the 2019 ANR MOU in the 18-2549-PET Final Order. GMP Panel pf. supp. at 1; exh. GMP-Panel-7; supplemental prefiled testimony of Meddie Perry ("Perry pf. supp.") at 2.

16. Under the terms of the 2020 ANR MOU, GMP will install the bypass pipe and flow system and implement the Flow and Water Level Management and Monitoring Plan ("FWLMMP"), the Dissolved Oxygen Monitoring Plan, and the Control of Water Plan requirements of the 2019 ANR MOU in 2021. GMP Panel pf. supp. at 3; Haskell pf. supp. at 2.

17. ANR and GMP agree that, subject to the conditions contained in the 2020 ANR MOU, the Emergency Spillway Modifications will serve the public good, with due consideration given to the impact on scenic and recreational values, fish and wildlife, forests and forest programs, existing uses of the waters by the public for boating, fishing, swimming, or other public uses, the creation of public benefits, attainment of the Vermont Water Quality Standards, and applicable State, regional, or municipal plans. Exh. GMP-Panel-7 at II.

D. <u>Engineering Review of the Proposed Modifications</u>

18. Pursuant to 10 V.S.A. § 1087, the Commission retained GZA Environmental, Inc., to review the proposed modifications and prepare a report addressing public safety issues. Memorandum re: Notice of Intent to Retain Consultant issued 11/10/2020; GZA Emergency Spillway Review Report.

19. GZA concluded that the completion of the proposed improvements to the Emergency Spillway will improve public safety. GZA Emergency Spillway Review Report at 6.

20. GZA identified several areas for further consideration by GMP during the final design of the Emergency Spillway Modifications, including:

- Lessons learned from recent dam safety events, and reference to federal-issued Best Practices in Dam and Levee Safety Risk Analysis.
- Further consideration of the structural fill material and filter options.
- Verifying and augmenting positive seepage cutoff.
- Assessing seepage gradients during elevated water surface levels.
- Examining measures that will also disrupt direct seepage paths along the soil sides of the new training walls near the top of the chute.
- Examining the details of the underdrainage system.
- Assessing the upstream extent of the plunge pool riprap.

GZA Emergency Spillway Review Report at 4-6.

21. GZA noted that deferring the Emergency Spillway Modifications until 2022 resulted in a marginal increase in risk from a dam safety standpoint but that the annual likelihood that the emergency spillway would be activated was low. To mitigate the risk, GMP recommended that GMP develop appropriate construction-phase water control and emergency

action plans to reduce the potential for spillway activation and potential damage during construction. GZA Emergency Spillway Review Report at 6.

22. GMP has agreed to implement GZA's recommendations. Tr. 2/5/21 at 34 (Haskell).

E. Section 1086 Review of the Emergency Spillway Modifications

Effect on Cultivated Agricultural Land
[10 V.S.A. § 1086(a)(1)]

23. The proposed Emergency Spillway Modifications will not render any cultivated agricultural lands unfit for use or enhance any cultivated agricultural lands beyond the existing conditions. Perry pf. at 7.

24. No cultivated agricultural land is present on or adjacent to where the Emergency Spillway Modifications will occur. Perry pf. at 7.

Scenic and Recreational Values & Existing Uses of the Waters
[10 V.S.A. § 1086(a)(2) and (a)(6)]

25. The proposed Emergency Spillway Modifications will not affect scenic and recreational values in the surrounding area because the changes will be limited to modifications of existing infrastructure. Perry pf. at 8.

26. The Emergency Spillway Modifications will be located on the downstream side of the Molly's Falls Dam, at least 900 feet from public highways and fishing access areas, and will not be visible from boats on the reservoir or other public vantage points. Perry pf. at 8; exh. GMP-Panel-3; exh. GMP-Panel-5.

27. The Emergency Spillway Modifications will not enlarge the Molly's Falls Dam and will not change operations, water levels, or flows. Perry pf. at 8.

Fish and Wildlife
[10 V.S.A. § 1086(a)(3)]

28. The Emergency Spillway Modifications will not affect flows or water levels in any aquatic habitat, will not change the operation of the Molly's Falls Dam, and will not have any adverse effect on fish and wildlife habitats. Perry pf. at 8-9.

29. The construction activities for the Emergency Spillway Modifications will be limited to the area of the existing emergency spillway. Perry pf. at 8.

30. Pursuant to the 2020 ANR MOU, GMP will not perform site preparation or construction activity within a nearby mapped deer wintering area or its 300-foot buffer during the deer wintering period from December 15 to April 15 unless given specific prior written authorization by the Vermont Fish & Wildlife Department of ANR. Exh. GMP-Panel-7.

31. The Department of Fish and Wildlife issued a certification under 10 V.S.A. § 1084 stating that it does not anticipate adverse effects on fish or wildlife habitats from the Emergency Spillway Modifications as long as standard construction precautions are followed. The Department of Fish and Wildlife also states that it expects implementing the terms and conditions of the 2020 ANR MOU to result in "relatively rapid and measurable improvement to both stream and pond/reservoir habitats and associated animal and plant communities." Exh. ANR-1.

32. Prior to site preparation or construction, GMP will obtain all applicable permits. Construction will be completed in accordance with all applicable permits and best management practices. Perry pf. at 12; Perry pf. supp. at 9; exh. GMP-Panel-7.

Forests and Forest Programs
[10 V.S.A. § 1086(a)(4)]

33. The Emergency Spillway Modifications will not affect forests or forest programs because the proposed work is located on an existing dam structure that is not forested. Perry pf. at 10.

Creation of Hazards to Public Uses
[10 V.S.A. § 1086(a)(7)]

34. The Emergency Spillway Modifications will not involve the placement or construction of hazards to boating, navigation, fishing, swimming, or other public uses in the vicinity of the Molly's Falls Dam, because construction will occur on the downstream side. The Emergency Spillway Modifications will not change the operation of the Molly's Falls Dam. Perry pf. at 12.

Need for Cutting and Removal of Timber or Tree Growth
[10 V.S.A. § 1086(a)(8)]

35. The Emergency Spillway Modifications are limited to the area of the existing emergency spillway. The only removal of tree growth associated with the Emergency Spillway

Modifications will be the routine maintenance and cutting of trees that emerge in the area of the Molly's Falls Dam, which is part of the routine vegetation management required for dam safety. Perry pf. at 12.

<u>Public Benefits</u>
[10 V.S.A. § 1086(a)(9)]

36. The Emergency Spillway Modifications will improve regional safety by reducing flood and erosion risks to public resources and public safety downstream. The Emergency Spillway Modifications will improve the performance, durability, and response of the Molly's Falls Dam during high-water events and will allow for the continued safe and reliable operation of the Molly's Falls Hydroelectric Facility. GMP Panel pf. at 9, 11.

37. The Department analyzed the economic benefits of upgrading the Molly's Falls Dam and concluded that the proposed modifications are prudent and beneficial because the levelized value of continued generation at the Molly's Falls Dam will exceed the levelized value of costs of operation. Prefiled testimony of Scott Wheeler, DPS ("Wheeler pf.") at 2-3.

<u>Attainment of Vermont Water Quality Standards</u>
[10 V.S.A. § 1086(a)(10)]

38. The Emergency Spillway Modifications will not affect the attainment of the Vermont water quality standards. Perry pf. at 12.

39. Construction related to the Emergency Spillway Modifications will be limited to the area of the existing Emergency Spillway and will be completed in accordance with all required permits and applicable best management practices. Perry pf. at 12-13.

40. The 2020 ANR MOU establishes deadlines for implementing the operational changes set forth in the 2019 ANR MOU, including the FWLMMP, the Dissolved Oxygen Monitoring Plan, and the Control of Water Plan, as well as the water management requirements for the interim period prior to full implementation of the FWLMMP, all of which are protective of water quality and aquatic habitat in the reservoirs and downstream waters. Perry pf. at 12- 13; Perry pf. supp. at 2-4; exh. GMP-Panel-7.

State, Regional, or Municipal Plans
[10 V.S.A. § 1086(a)(11)]

41. The Emergency Spillway Modifications are consistent with the applicable State and regional plans and the municipal plans from the communities in which the Molly's Falls Facility is located, including the 2016 Vermont Comprehensive Energy Plan, the 2012 Winooski River Basin Water Quality Management Plan, the 2018 Winooski River Tactical Basin Plan, the 2016 Central Vermont Regional Plan, the 2017 Cabot Town Plan, and the 2012 Cabot Local Hazard Mitigation Plan. GMP Panel pf. at 9-10; exh. GMP-Panel-6.

Municipal Grand Lists and Revenues
[10 V.S.A. § 1086(a)(12)]

42. The Emergency Spillway Modifications will not affect the municipal grand lists and revenues of the Towns of Cabot and Marshfield. The assessed value of the Molly's Falls Facility is based on annual power generation, which will not change as a result of the Emergency Spillway Modifications. GMP Panel pf. at 10.

Public Safety
[10 V.S.A. § 1086(a)(13)]

43. The Emergency Spillway Modifications will improve public safety at the Molly's Falls Dam and in the downstream communities by rehabilitating the existing emergency spillway, improving the performance, durability, and response of the Facility during flood events, and ensuring continued safe and reliable operation of the Molly's Falls Facility. GMP Panel pf. at 11; Haskell pf. at 14-15.

44. Safety improvements will be incorporated into the Emergency Spillway Modifications, including improvements to access, fall protection, site security, lighting, and signage. GMP Panel pf. at 11.

45. The emergency spillway was designed to be used for the discharge of flows exceeding a 500-year flood event, which has an annual likelihood of 0.2 percent. GZA Emergency Spillway Review Report at 6; GMP Panel pf. at 7-8.

46. The additional control over water management due to the operational and physical changes made to the Facility in 2020 will provide additional risk-mitigation capabilities during

the Emergency Spillway Modifications construction period. GMP Panel pf. at 11; GZA Emergency Spillway Review Report at 6.

47. A temporary construction emergency action plan ("TCEAP") will be prepared and implemented prior to the start of construction. The TCEAP will meet the Federal Energy Regulatory Commission's requirements for TCEAPs and will incorporate GMP's current Emergency Action Plan. GMP Panel pf. at 12; Haskell pf. at 14-15.

48. A construction water management plan also will be developed for the Emergency Spillway Modifications construction period. The document will provide GMP's plan for water and flow management during construction and provide additional procedures during construction for the contractors and GMP during a flood event. Haskell pf. at 15.

49. The pond level during construction of the Emergency Spillway Modifications will be lowered below 1223.6 feet to reduce risk to contractors from leakage and seepage in the work area and to provide GMP with more storage capacity during a high-water event to reduce the likelihood of emergency spillway activation. GMP Panel pf. at 11; Haskell pf. at 14.

Discussion

GMP originally proposed to complete the Emergency Spillway Modifications during the 2021 construction season, but now proposes to begin the emergency spillway work during the 2021 construction season and install the minimum-flow bypass structure and pipe system and complete the Emergency Spillway Modifications in 2022. GMP explains that additional time is needed because the complexity of the work was more than GMP had originally anticipated. To ensure that GMP was able to complete the Emergency Spillway Modifications as proposed, GMP divided the project into two phases.

Although extending the Emergency Spillway Modifications until 2022 also extends the current condition of the emergency spillway, GMP can mitigate any risks during high-water events by using the improved service spillway infrastructure to control water levels and by having appropriate safety plans in place. To ensure that GMP has adequate time to complete the project and to adjust for any complications that may arise without compromising quality and the safety of GMP's workers and the public, I recommend that the Commission allow GMP to extend the schedule for completing the Emergency Spillway Modifications over a two-year period.

Potential for Future Power Production for Proposed Removal of Dam
[10 V.S.A. § 1086(a)(14)]

50. This criterion does not apply because the proposed modifications do not involve the removal of a dam. GMP Panel pf. at 12.

V. CONCLUSION

Based upon all of the above and provided that the conditions set forth in the 2020 ANR MOU are incorporated into any order issued by the Commission in this case, I recommend that the Commission conclude that the Emergency Spillway Modifications will not have an undue adverse effect on:

- the quantity, kind, and extent of cultivated agricultural land that may be rendered unfit for use by or enhanced by the project, including both the immediate and long-range agricultural land use impacts (10 V.S.A. § 1086(a)(1));
- scenic and recreational values (10 V.S.A. § 1086(a)(2));
- fish and wildlife (10 V.S.A. § 1086(a)(3));
- forests and forest programs (10 V.S.A. § 1086(a)(4));
- the existing uses of the waters by the public for boating, fishing, swimming, and other recreational uses (10 V.S.A. § 1086(a)(6));
- the creation of any hazard to navigation, fishing, swimming, or other public uses (10 V.S.A. § 1086(a)(7));
- the need for cutting clean and removal of all timber or tree growth from all or part of the flowage area (10 V.S.A. § 1086(a)(8));
- the creation of any public benefits (10 V.S.A. § 1086(a)(9));
- the attainment of Vermont water quality standards (10 V.S.A. § 1086(a)(10));
- any applicable state, regional or municipal plans (10 V.S.A. § 1086(a)(11));
- municipal grand lists and revenues (10 V.S.A. § 1086(a)(12)); and
- public safety (10 V.S.A. § 1086(a)(13)).

This Proposal for Decision has not been circulated to the parties pursuant to 3 V.S.A. § 811 because it is not adverse to any party.

Micah Howe
Hearing Officer

VI. ORDER

IT IS HEREBY ORDERED, ADJUDGED, AND DECREED by the Public Utility Commission ("Commission") of the State of Vermont that:

1. The findings, conclusions, and recommendations of the hearing officer are adopted. All other findings proposed by parties, to the extent that they are inconsistent with this Order, were considered and not adopted.

2. In consideration of the criteria set forth in 10 V.S.A. § 1086 and in accordance with the plans and evidence presented in this proceeding, the proposed modifications to the emergency spillway at the Molly's Falls hydroelectric facility in Cabot, Marshfield, and Peacham, Vermont, will serve the public good of the State of Vermont and will adequately protect the public safety, provided that Green Mountain Power Corporation ("GMP") complies with this Order and the conditions of the memorandum of understanding between GMP and the Vermont Agency of Natural Resources ("ANR") dated December 23, 2020.

3. Site preparation, construction, operation, and maintenance of the project shall be in accordance with the plans and evidence as submitted in these proceedings. Any material deviation from these plans must be approved by the Commission.

Dated at Montpelier, Vermont, this 23rd day of March, 2021.

______________________________	)	
Anthony Z. Roisman	)	PUBLIC UTILITY
	)	
	)	
______________________________	)	COMMISSION
Margaret Cheney	)	
	)	
	)	OF VERMONT
______________________________	)	
Sarah Hofmann	)	

OFFICE OF THE CLERK

Filed: March 23, 2021

Attest: ____
Clerk of the Commission

Notice to Readers: This decision is subject to revision of technical errors. Readers are requested to notify the Clerk of the Commission (by e-mail, telephone, or in writing) of any apparent errors, in order that any necessary corrections may be made. (E-mail address: puc.clerk@vermont.gov)

Appeal of this decision to the Supreme Court of Vermont must be filed with the Clerk of the Commission within 30 days. Appeal will not stay the effect of this Order, absent further order by this Commission or appropriate action by the Supreme Court of Vermont. Motions for reconsideration or stay, if any, must be filed with the Clerk of the Commission within 28 days of the date of this decision and Order.

PUC Case No. 20-2570-PET - SERVICE LIST

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STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 and pursuant to the March 27, 2020 Order in Case No. 18-2549-PET for approval of improvements to the Emergency Spillway at the Marshfield #6 Dam in Cabot, Vermont, part of the Molly's Falls Hydroelectric Facility ("ES Project")	))))))))	Case No. 20-2570-PET

MEMORANDUM OF UNDERSTANDING BETWEEN GREEN MOUNTAIN POWER CORPORATION AND THE VERMONT AGENCY OF NATURAL RESOURCES

With respect to the above referenced Petition, Green Mountain Power Corporation ("GMP" or "Petitioner"), and the Vermont Agency of Natural Resources ("ANR") (collectively the "Parties") hereby agree and stipulate in this Memorandum of Understanding ("2020 MOU") as follows:

WHEREAS, on March 27, 2020, the Public Utility Commission ("PUC" or "Commission") issued an Order in Case No. 18-2549-PET that authorized GMP to make certain modifications to the Molly's Falls Hydroelectric Facility (the "Facility");

WHEREAS, the Order authorized GMP to replace the service spillway gates, to install an emergency generator, to increase the height of the service spillway walls, and to install a minimum flow bypass structure and pipe system (the "Service Spillway Project");

WHEREAS, the Order did not authorize GMP to perform work on the Facility's emergency spillway, for which GMP had sought conceptual approval, but instead required GMP to file a "new Chapter 43 petition for a final design proposal for the emergency spillway conceptual design described in this case" (the "Emergency Spillway Project");

WHEREAS, the Order expressly incorporates as a condition a Memorandum of Understanding between the Parties dated August 8, 2019 (the "2019 MOU");

WHEREAS, among other requirements, the 2019 MOU requires that GMP implement at the Facility a Flow and Water Level Management and Monitoring Plan and a Dissolved Oxygen Monitoring Plan upon completion of the "Revised Project" (as that term is used in the 2019 MOU) or upon Plan approval by the Commission, whichever is later;

WHEREAS, the parties to this MOU disagree on the meaning of the "Revised Project" in the 2019 MOU and the implementation deadline for the Flow and Water Level Management and Monitoring Plan and a Dissolved Oxygen Monitoring Plan, but are nonetheless entering into this 2020 MOU in the spirit of compromise and to address and clarify when the conditions of the 2019 MOU will be implemented;

WHEREAS, GMP intends to complete construction of both the Service Spillway Project and the Emergency Spillway Project by December 2022;

WHEREAS, on September 9, 2020, GMP filed a petition with the Commission, assigned Case No. 20-2570-PET, seeking approval of the Emergency Spillway Project, which includes (1) construction of a new concrete chute spillway structure with an underdrain system; (2) removal and replacement of the wing walls downstream of the emergency spillway gate; (3) replacement of the temporary extensions to the abutment walls with reinforced concrete wall extensions; (4) installation of a cutoff wall; (5) armoring of the existing plunge pool; and (6) additional security and personnel safety improvements;

WHEREAS, the Parties, having had an opportunity to review and assess the application materials, prefiled testimonies, and discovery questions and responses, have resolved all outstanding issues between them related to the Emergency Spillway Project, and have agreed that in order for the intent of the Parties as expressed in this 2020 MOU to be realized, the conditions set forth herein must be included in any Order or Certificate of Public Good ("CPG") issued by the Commission.

THEREFORE, in consideration of the above and the undertakings and covenants set forth below, the Parties hereby agree as follows:

I. GMP and ANR agree that the following conditions must be included in any CPG or Order issued by the Commission in this matter, and that the terms and conditions of this 2020 MOU shall supersede any inconsistent prefiled testimony and exhibits:

A. GMP shall file with the Commission the Flow and Water Level Management and Monitoring Plan ("FWLMMP") described in Section III.H of the 2019 MOU, no later than 30 days after receiving comments from ANR on the FWLMMP.

B. GMP shall file with the Commission the Dissolved Oxygen Monitoring Plan described in Sections III.D(3) and III.F of the 2019 MOU, no later than one month after receiving comments from ANR on the plan, to confirm that the methods of releasing and aerating the conservation flows in Mollys Brook and that the generation flows released to the Winooski River are complying with the Dissolved Oxygen criteria of the Vermont Water Quality Standards.

C. No later than December 31, 2021, or upon Commission approval of the FWLMMP if issued after that date, GMP shall implement the FWLMMP in its entirety and as it relates to all waters affected by the Facility.

D. During construction of the Emergency Spillway Project, GMP shall manage water in accordance with a Control of Water Plan ("ES-COWP") to be reviewed by the Agency and approved by the Commission. The Control of Water Plan shall be filed with the Commission no later than October 31, 2021, and no earlier than 30 days after its receipt by the Agency. If GMP does not obtain Agency approval of the Control of Water Plan in advance of filing with the Commission, the Agency shall have at least 14 days to file with the Commission any arguments or comments or written prefiled testimony that explains the basis for its position.

E. In the interim period before the FWLMMP is implemented, the following provisions shall govern water management at the Facility:

1. Molly's Falls Reservoir
    i. No later than September 1, 2021, the level of Molly's Falls Reservoir shall be set at the New NOL established in the FWLMMP (except for construction periods during which the ES-COWP would apply).

2. Mollys Brook
    i. Beginning August 1, 2021, or as soon as practicable if extenuating circumstances beyond GMP's reasonable control such as unforeseeable delays in the delivery of equipment or construction work prevent GMP from meeting this deadline, GMP shall release to Mollys Brook a minimum conservation flow of the lesser of 8.5 cfs or the net of inflow to Molly's Falls Reservoir minus evaporation from the surface of Molly's Falls Reservoir.

    ii. GMP shall implement the Dissolved Oxygen Monitoring Plan as it relates to aerating the conservation flows in Mollys Brook after: (1) Commission approval of the plan; and (2) completion of the plunge pool and bypass pipe construction and implementation of the Mollys Brook conservation flows specified in E.2.i. above.

3. <u>Winooski River</u>
    i. Beginning September 1, 2021, or as soon as practicable if extenuating circumstances beyond GMP's reasonable control such as unforeseeable delays in the delivery of equipment or construction work prevent GMP from meeting this deadline, GMP shall ramp up and ramp down flows released to the Winooski River in accordance with Attachment B of the 2019 MOU.

    ii. Between April 1 and October 31, 2021, the magnitude of generation flows shall be limited to 103 cfs, or inflow if greater.

    iii. Between November 1 and December 31, 2021, the magnitude of generation flows shall be limited to 135 cfs, or inflow if greater.

    iv. At any time when responding to forecasted high-flow weather events, GMP may generate power and release generation flows of any magnitude to the

Winooski River as described in Section II of Attachment C of the 2019 MOU. Ramping is not required when releasing generation flows to the Winooski River in response to weather-related high-flow events.

v. Beginning June 1, 2022, GMP shall implement the Dissolved Oxygen Monitoring Plan approved by the Commission, as it relates to aerating the generation flows to the Winooski River.

F. GMP shall not perform site preparation or construction activity within the mapped deer wintering area or its 300-foot buffer during the deer wintering period from December 15 to April 15, unless given specific prior written authorization by the Vermont Fish & Wildlife Department of ANR.

G. Prior to site preparation or construction of the Emergency Spillway Project, GMP shall obtain from the Agency of Natural Resources all permits and approvals required to relocate the stream in the lower section of the Emergency Spillway, including, as applicable and without limitation, a Flood Hazard Area and River Corridor Permit, a Section 404 Permit from the US Army Corps of Engineers, and a Stream Alteration Permit. GMP shall comply with all terms and conditions of such permits and approvals. GMP shall file administratively complete applications for all required permits no later than February 15, 2021, or as soon as practicable if unforeseeable extenuating circumstances beyond GMP's reasonable control prevent it from meeting that deadline.

H. Prior to site preparation or construction of the Emergency Spillway Project, GMP shall obtain from the Agency of Natural Resources a Stormwater Construction General Permit, a Shoreland Protection Permit, and a Wetlands Permit, as applicable, that authorize that work to be conducted. GMP shall comply with all terms and conditions of such permits and approvals. GMP shall file administratively complete applications for all required permits no later than February 15, 2021, or as soon as practicable if unforeseeable extenuating circumstances beyond GMP's reasonable control prevent it from meeting that deadline.

I. GMP shall perform site preparation, construction, operation, and maintenance of the Emergency Spillway Project in accordance with the plans and evidence submitted in this proceeding. Any material deviation from these plans or a substantial change to the Emergency Spillway Project must be approved by the Commission. Failure to obtain advance approval from the Commission for a material deviation from the approved plans or a substantial change to the Emergency Spillway Project may result in the assessment of a penalty pursuant to 30 V.S.A. §§ 30 and 247.

II. The Parties agree that, subject to compliance with the above conditions, the Emergency Spillway Project will serve the public good, with due consideration having been given to its effect on: scenic and recreational values; fish and wildlife; forests and forest programs; existing uses of the waters by the public for boating, fishing, swimming, and other recreational uses; the creation of any hazard to navigation, fishing, swimming, or other public uses; the creation of any public benefits; attainment of the Vermont water quality standards; and applicable State, regional, or municipal plans, pursuant to 10 V.S.A. § 1086.

III. The Parties agree that the testimony and exhibits filed by the Parties to date should be admitted into evidence in this case. The Parties agree that this 2020 MOU is based on the Emergency Spillway Project described and detailed in the plans, specifications, and testimony in the record to date, and as further described in any discovery responses provided to date. Any material deviation from these plans and specifications must be approved by the Parties in advance of any filing with the Commission. Failure to obtain advance approval for a material deviation from the evidence in the record or discovery responses to date shall void the 2020 MOU and terminate the Parties' agreements set forth herein. Each Party shall be placed in the position that it enjoyed before entering into the 2020 MOU and shall have all rights otherwise available under law and equity.

IV. The Parties agree that the Commission may approve the Emergency Spillway Project and issue an Order and CPG or other approval in this matter in accordance with the plans, specifications, and testimony in the record, and the terms and conditions of this 2020 MOU. The Parties agree that to the extent any testimony or evidence submitted in this proceeding differs from the provisions of this 2020 MOU, the provisions of the 2020 MOU shall control.

V. This 2020 MOU may be modified only upon mutual written agreement by the Parties and is subject to any necessary Commission approvals.

VI. The Parties agree that this 2020 MOU shall not be construed by any party or tribunal as having precedential impact on any future proceeding involving the Parties, except as necessary to implement this MOU or to enforce an order of the Commission resulting from this 2020 MOU.

VII. Nothing in this 2020 MOU shall bind the Parties to take or refrain from taking any position on any issue not addressed herein, including any issue raised by any other party to this case, or in any future case. Nor shall it bind the Parties to any positions to be taken in Case No. 18-2549-PET or any future investigatory cases associated therewith.

VIII. This 2020 MOU is expressly conditioned upon the Commission's acceptance of all of its provisions, without material change or condition. The Parties agree that, should the Commission fail to approve this 2020 MOU in all material aspects, the Parties' agreements set forth herein shall terminate, this 2020 MOU shall not constitute any part of the record in this proceeding, and this 2020 MOU shall not be used for any other purpose. The Parties' agreements in this 2020 MOU shall not be construed by any party or tribunal as having precedential impact on any testimony or positions that may be advanced in these proceedings. Each Party shall be placed in the position that it enjoyed in this proceeding before entering into the 2020 MOU and shall have the right to submit filings in this case, including testimony.

IX. Any disputes arising under this 2020 MOU shall be resolved by the Commission under Vermont law.

X. The Parties hereby waive their rights under 3 V.S.A. § 811 to file exceptions and present briefs and oral arguments with respect to a Proposal for Decision to be issued in this case, provided that the Proposal for Decision is consistent in all material respects with this 2020 MOU and contains conditions materially similar to those set forth in this 2020 MOU. Notwithstanding the above, ANR or GMP may submit comments in response to any comments submitted by other parties in the proceeding, provided such comments are consistent with the intent and terms of this 2020 MOU.

[*Signature pages follow.*]

Dated at Montpelier, Vermont, this 23rd day of December, 2020.

GREEN MOUNTAIN POWER CORPORATION

By: ______________________

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Dated at South Burlington, Vermont, this 23rd day of December, 2020.

VERMONT AGENCY OF NATURAL RESOURCES

By: ______________________

Kane Smart, Esq.
Enforcement & Litigation Attorney
Vermont Agency of Natural Resources
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STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 22-0231-PET

Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 and pursuant to the March 27, 2020 Order in Case No. 18-2549-PET for approval of improvements to the EmergencySpillway at the Marshfield #6 Dam in Cabot, Vermont, part of the Molly's Falls HydroelectricFacility	

Order entered: 03/30/2022

ORDER APPROVING CHANGES TO MOLLY'S FALLS DAM EMERGENCY SPILLWAY PROJECT

In this Order, the Vermont Public Utility Commission adopts the following proposal for decision.

PROPOSAL FOR DECISION

I. INTRODUCTION

This case involves a petition filed with the Vermont Public Utility Commission ("Commission") by Green Mountain Power Corporation ("GMP") for approval of changes to the emergency spillway project ("ES Project") at the Marshfield #6 Dam in Cabot, Vermont ("Molly's Falls Dam"). Based on the findings below, I recommend that the Commission conclude that GMP's proposed changes to the ES Project will serve the public good and approve the proposed changes.

II. PROCEDURAL HISTORY

On March 23, 2021, the Commission issued its Final Order in Case No. 20-2570-PET approving the ES Project at the Molly's Falls Dam.

On May 21, 2021, GMP notified the Commission of a potential violation of the Commission's Final Order involving tree clearing in a deer-wintering area.

On July 13, 2021, the Commission opened an investigation into the proceeding in Case No. 21-2501-INV.

On October 7, 2021, the Commission issued an order in Case No. 21-2501-INV approving a memorandum of understanding between the Vermont Agency of Natural Resources

("ANR") and GMP and assessing a $15,000 penalty on GMP for the unauthorized tree clearing. The Commission also directed GMP to file a written report evaluating the cause of the violation and describing the steps that GMP would take to prevent future violations, and to file a revised site plan.

On December 6, 2021, GMP filed its report on the violation and the future preventative measures that GMP would implement.

On January 24, 2022, GMP filed a petition requesting approval of changes to the ES Project in this case.

On February 15, 2022, ANR filed comments on the petition and requested that any approval of the proposed modifications also require GMP to amend its wetlands permit for any unpermitted earth disturbance or construction activities.

On February 23, 2022, the Vermont Department of Public Service ("Department") filed comments recommending that the Commission approve the petition without further hearings or investigation.

No other comments on the application were received by the Commission.

No party has requested an evidentiary hearing or objected to the prefiled testimony and exhibits. Accordingly, the following materials are admitted as if presented at a hearing: the petition; and attachments A-E.

III. Findings

GMP asks the Commission to approve its issued-for-bid ("IFB") construction plans for the ES Project. The changes include the tree clearing addressed by the Commission in Case No. 21-2501-INV, design modifications to incorporate the recommendations of the Commission's dam safety consultant, GZA GeoEnvironmental, Inc. ("GZA"), and other changes to improve access and safety during the construction period.

Pursuant to 30 V.S.A. § 8(c), and based on the record and evidence before me, I present the following proposed findings of fact to the Commission.

1. GMP has modified the footprint of the construction laydown area for the ES Project to avoid a Class II wetland area. Petition at 3-4; attachment A.

2. GMP will widen sections of the access road from 10 feet to 14 feet and build a pull-off area to allow for the safe travel of construction vehicles during the construction period. Petition at 4-5; attachment A.

3. Modifying the laydown area and widening the access road requires clearing approximately 2.5 acres of trees. Petition at 3; attachment A.

4. The cleared acreage includes the approximately two acres that GMP already cleared in the deer wintering area that were the subject of the investigation and penalty in Case No. 21-2501-INV. An additional 0.49 acre will be cleared in 2022. Petition at 3; attachment A.

5. All tree clearing will be performed in accordance with the conditions required by the memorandum of understanding between GMP and ANR in the investigation in Case No. 21-2501-INV ("Tree Clearing MOU"). Petition at 2-3; attachment D at 4.

6. The additional tree clearing will not have an undue adverse effect on the natural environment subject to the conditions in the Tree Clearing MOU. Tree Clearing MOU at 3.

7. GMP will improve the access road entrance by paving an unpaved section of the landowner's driveway to reduce dust. Petition at 5; exh. A; attachment B.

8. GMP has updated the spillway design to incorporate the results of a revised analysis of the probable maximum flood conditions as recommended by GZA. Petition at 5-6; attachment B; attachment E at 3.

9. The impact of the changes under the criteria of 10 V.S.A. § 1086(a) is not undue and the ES Project will still serve the public good. Attachment D; ANR Comments.

10. The proposed changes to the ES Project will not affect current electric rates. Department Comments.

IV. DISCUSSION

The Commission based its approval of the ES Project in Case No. 20-2570 on its consideration of the effect the project would have under the criteria provided in 10 V.S.A. § 1086. Those criteria include:

(1) the quantity, kind, and extent of cultivated agricultural land that may be rendered unfit for use by or enhanced by the project, including both the immediate and long-range agricultural land use impacts;

(2) scenic and recreational values;

(3) fish and wildlife;

(4) forests and forest programs;

(6) the existing uses of the waters by the public for boating, fishing, swimming, and other recreational uses;

(7) the creation of any hazard to navigation, fishing, swimming, or other public uses;

(8) the need for cutting clean and removal of all timber or tree growth from all or part of the flowage area;

(9) the creation of any public benefits;

(10) attainment of the Vermont water quality standards;

(11) any applicable State, regional, or municipal plans;

(12) municipal grand lists and revenues;

(13) public safety; and

(14) in the case of the proposed removal of a dam that formerly related to or was incident to the generation of electric energy, but that was not subject to a memorandum of understanding dated prior to January 1, 2006 relating to its removal, the potential for and value of future power production.

GMP's proposed changes to the ES Project will have a limited impact on the Commission's analysis of the Section 1086 criteria in Case No. 20-2570-PET. The changes to the spillway design reflect refinements and construction-level details necessary to complete the ES Project, which will provide a public safety benefit during flood events. The improvement of the access road will also provide a public safety benefit during construction. The clearing of trees associated with the access road improvements and relocated construction laydown area does affect the Commission's previous analysis under criterion 8 (need for cutting or removal of timber or tree growth), but will not have an adverse impact provided that GMP complies with all existing conditions established in previous cases and in the Tree Clearing MOU and also amends its wetlands permit for any unpermitted earth disturbance or construction activities.[1]

Based on the findings and recommendations above, I recommend that the Commission conclude that the modifications to the ES Project will not have an undue adverse effect on the

[1] ANR Comments at 1-2.

public good criteria of 10 V.S.A. § 1086, and approve the proposed changes to the ES Project subject to the conditions proposed by ANR.

This Proposal for Decision has not been circulated to the parties pursuant to 3 V.S.A. § 811 because it is not adverse to any party.

Micah Howe
Hearing Officer

V. ORDER

IT IS HEREBY ORDERED, ADJUDGED, AND DECREED by the Public Utility Commission ("Commission") of the State of Vermont that:

1. The findings, conclusions, and recommendations of the Hearing Officer are adopted. All other findings proposed by parties, to the extent that they are inconsistent with this Order, were considered and not adopted.

2. In consideration of the criteria set forth in 10 V.S.A. § 1086, the changes proposed by Green Mountain Power Corporation ("GMP") to the emergency spillway project approved by the Commission in Case No. 20-2570-PET will serve the public good.

3. Before beginning any unpermitted earth disturbance or construction activities related to the modified project, Green Mountain Power Corporation ("GMP") shall obtain an amendment to Wetlands Permit No. 2018-513.03 (the "Amended Wetlands Permit"). GMP shall comply with all provisions of the Amended Wetlands Permit for any activity that is not an Allowed Use designated in Section 6 of the Vermont Wetland Rules (2020) before impacting or disturbing earth in Class II wetlands or wetland buffer zones.

4. All conditions of any Orders in Case Nos. 20-2570-PET, 21-2501-INV, and 18-2549-PET remain in full force and effect.

5. Site preparation, construction, operation, and maintenance of the project shall be in accordance with the plans and evidence as submitted in these proceedings. Any material deviation from these plans must be approved in advance by the Commission.

Dated at Montpelier, Vermont, this 30th day of March, 2022.

Anthony Z. Roisman	)	PUBLIC UTILITY
Margaret Cheney	)	COMMISSION
J. Riley Allen	)	OF VERMONT

OFFICE OF THE CLERK

Filed: March 30, 2022

Attest: ______________________________
Clerk of the Commission

Notice to Readers: This decision is subject to revision of technical errors. Readers are requested to notify the Clerk of the Commission (by e-mail, telephone, or in writing) of any apparent errors, in order that any necessary corrections may be made. (E-mail address: puc.clerk@vermont.gov)

Appeal of this decision to the Supreme Court of Vermont must be filed with the Clerk of the Commission within 30 days. Appeal will not stay the effect of this Order, absent further order by this Commission or appropriate action by the Supreme Court of Vermont. Motions for reconsideration or stay, if any, must be filed with the Clerk of the Commission within 28 days of the date of this decision and Order.

PUC Case No. 22-0231-PET - SERVICE LIST

Parties:

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STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Case No. 22-3438-PET

Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43, and pursuant to the March 27, 2020, Order in Case No. 18-2549-PET, the March 23, 2021, Order in Case No. 20-2570-PET, and the March 30, 2022, Order in Case No. 22-0231-PET, for approval of improvements to the emergency spillway at the Marshfield #6 Dam in Cabot, Vermont, part of the Molly's Falls Hydroelectric Facility	

Order entered: 12/14/2022

ORDER APPROVING CHANGES TO MOLLY'S FALLS DAM EMERGENCY SPILLWAY PROJECT

In this Order, the Vermont Public Utility Commission ("Commission") adopts the following Proposal for Decision.

PROPOSAL FOR DECISION

This case involves a petition filed with the Commission by Green Mountain Power Corporation ("GMP") requesting approval of changes to the emergency spillway improvement project at the Marshfield #6 Dam in Cabot, Vermont (the "ES Project"). The ES Project was approved by the Commission in Case Nos. 20-2570-PET and 22-0231-PET. In this case, GMP asks the Commission to approve a second modification to the ES Project to allow GMP to use a culvert instead of the rock-armored swale that was approved in Case No. 20-2570-PET for the relocation of an intermittent stream adjacent to the emergency spillway wall.

I. PROCEDURAL HISTORY

On August 19, 2022, GMP filed its petition.

On September 14, 2022, the Vermont Agency of Natural Resources ("ANR") filed comments on GMP's petition. ANR requested that the Commission require GMP to supplement its filing with sworn testimony from qualified witnesses containing additional information that GMP provided to ANR during the comment period about the proposed changes and the circumstances necessitating the proposed changes.

On September 15, 2022, GMP filed comments stating that it would provide supplemental documentation on the proposed changes as requested by ANR.

On September 29, 2022, GMP submitted additional documentation consisting of affidavits from Adam Haskell, Jason Lisai, and Meddie Perry.

On October 20, 2022, the Vermont Department of Public Service filed comments stating that it does not oppose GMP's petition.

No other comments were received.

No party has requested an evidentiary hearing or objected to the materials filed. Accordingly, the following materials are admitted as if presented at a hearing: Affidavit of Adam Haskell, GMP (9/30/22) ("Haskell Affidavit"); Affidavit of Jason Lisai, GMP (8/22/22) ("Lisai Affidavit (8/22/22)"); Second Affidavit of Jason Lisai, GMP (9/30/22) ("Lisai Affidavit (9/30/22)"); Affidavit of Meddie Perry, GMP (9/30/22) ("Perry Affidavit"); Memorandum from Meddie Perry to Jason Lisai, dated August 19, 2022 ("Perry Memo"); and ANR 9/14/22 Comments.

II. FINDINGS

Pursuant to 30 V.S.A. § 8(c), and based on the record and evidence before me, I present the following proposed findings of fact to the Commission.

1. GMP proposes to use a culvert to relocate approximately 140 feet of an intermittent stream that will run parallel to the outer wall of the emergency spillway. The culvert will replace the open, rock-armored swale that was approved in the original design plans. Haskell Affidavit at 1; Lisai Affidavit (9/30/22) at 1-2, Attachment A; Perry Affidavit at 3; Perry Memo at 2-3.

2. The proposed culvert will be a three-foot diameter, dual wall, high-density polyethylene pipe with a smooth interior. Haskell Affidavit at 2, Attachment A.

3. The culvert will be installed in accordance with the latest version of ASTM D2321 ("Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications"). Haskell Affidavit at 3, Attachment A.

4. The proposed culvert will be the primary passage for flows in the intermittent stream and surface runoff adjacent to the emergency spillway. The culvert has been sized to

handle the full flow of potential flood events, including flows above the 500-year recurrence event. Haskell Affidavit at 4.

5. Using a culvert rather than the approved rock-armored swale for the intermittent stream relocation will reduce the risk of potential failure that could result from slope instability due to wet soils in the area of the relocated stream channel. Lisai Affidavit (8/22/22) at 2.

6. In addition to the culvert, GMP has also proposed to include a smaller secondary rock-armored swale adjacent to the culvert. The secondary swale will help manage any surface waters present along the wall of the emergency spillway and prevent erosion if the proposed culvert is blocked. Haskell Affidavit at 4.

7. The design plans for the ES Project that GMP submitted with its petitions in Case Nos. 20-2570-PET and 22-0231-PET were based on the structural, geotechnical, and hydraulic information that was available to GMP at the time. Haskell Affidavit at 5-6.

8. During the installation of the approved swale, GMP discovered that the soils in the area of the swale were potentially too wet to support the grade of the swale during long-term operation. The subsurface conditions where the swale is located differed from the subsurface conditions in the emergency spillway channel, which GMP evaluated when developing the design plan for the ES Project. GMP was not able to evaluate subsurface conditions in the swale area before construction began due to the steep slope of the area. Haskell Affidavit at 7-8.

9. The installation of the approved swale was completed in September 2022 as an interim measure. Additional modifications would be required to ensure long-term stability if the previously approved swale were to remain permanently. Haskell Affidavit at 5-6; Lisai Affidavit (9/30/22) at 2, Attachment A.

10. If GMP's proposed changes are approved, the swale will be replaced by the proposed culvert and secondary rock-armored swale. Lisai Affidavit (9/30/22) at 2.

11. The proposed changes do not affect GMP's ability to complete the improvements to the emergency spillway, which are expected to be substantially complete by December 15, 2022. If approved, GMP will complete the proposed culvert in 2023 during dry conditions. Lisai Affidavit (9/30/22) at 2, 3-4; Perry Affidavit at 3.

12. The proposed change does not affect GMP's implementation of the 2019 and 2020 memorandums of understanding ("MOU") between GMP and ANR entered into in Case Nos. 18-2549-PET and 20-2570-PET. Lisai Affidavit (9/30/22) at 4; Perry Affidavit at 3-4.

13. The proposed culvert will not provide a habitat for invertebrates, but the interstitial spaces in the rock armoring in the proposed secondary swale adjacent to the culvert may provide potential invertebrate habitat due to groundwater seepage from the wet soils in the area, precipitation, and runoff. Perry Affidavit at 2-3; ANR 9/14/22 Comments at 2 n.1.

14. The proposed change will not have an undue adverse impact on fish and wildlife. Perry Affidavit at 3.

15. The proposed culvert will provide an improved public safety benefit due to the culvert's higher stability. Lisai Affidavit (8/22/22) at 2.

16. The proposed change does not affect the conclusions reached by the Commission in Case Nos. 20-2570-PET and 22-0231-PET regarding the criteria of 10 V.S.A. § 1086. Perry Affidavit at 4; Lisai Affidavit (8/22/22) at 2; Perry Memo at 3-6.

III. Discussion

The Commission approved the ES Project in Case No. 20-2570-PET after considering the effect the Project would have on the criteria provided in 10 V.S.A. § 1086. Those criteria include:

(1) the quantity, kind, and extent of cultivated agricultural land that may be rendered unfit for use by or enhanced by the project, including both the immediate and long-range agricultural land use impacts;

(2) scenic and recreational values;

(3) fish and wildlife;

(4) forests and forest programs;

(6) the existing uses of the waters by the public for boating, fishing, swimming, and other recreational uses;

(7) the creation of any hazard to navigation, fishing, swimming, or other public uses;

(8) the need for cutting clean and removal of all timber or tree growth from all or part of the flowage area;

(9) the creation of any public benefits;

(10) attainment of the Vermont water quality standards;

(11) any applicable State, regional, or municipal plans;

(12) municipal grand lists and revenues;

(13) public safety; and

(14) in the case of the proposed removal of a dam that formerly related to or was incident to the generation of electric energy, but that was not subject to a memorandum of understanding dated prior to January 1, 2006, relating to its removal, the potential for and value of future power production.

GMP's proposed changes to the ES Project will have a minor impact on the Commission's analysis of the Section 1086 criteria in Case No. 20-2570-PET. Replacing the armored swale with a culvert for the intermittent stream relocation along the emergency spillway wall is necessary due to the wet soils discovered during construction and will lower the risk to public safety by reducing the potential for erosion in the wet subgrade soils along the spillway wall. As ANR explains, however, the proposed culvert and secondary swale will provide less potential habitat for invertebrates than the approved swale. Although ANR notes that the proposed change offers less potential habitat, ANR has not objected to the proposed change as having an undue adverse effect under the fish and wildlife criterion.[1]

GMP's witnesses also explain that the proposed change will not affect the implementation of the requirements of the MOUs that GMP entered into with ANR in Case Nos. 18-2549-PET and 20-2570-PET, many of which have already been implemented.[2] GMP notes, however, that there are remaining conditions to be implemented, including the implementation of the Flow and Water Level Management and Monitoring Plan and the Dissolved Oxygen Monitoring Plan, both of which require Commission approval.[3] I recommend that the Commission require GMP to provide a status update on the anticipated filing date of these plans with the Commission.

Based on the findings and discussion above, I recommend that the Commission conclude that GMP's proposed modification of the ES Project to replace the approved rock-armored swale

[1] ANR 9/14/22 Comments at 2 n.1.

[2] Lisai Affidavit (9/30/22) at 2, 4; Perry Affidavit at 3.

[3] Perry Affidavit at 3. *See also Petition of Green Mountain Power Corp. under 10 V.S.A. Ch. 43*, Case No. 20-2570-PET, Exh. GMP-Panel-7 (2020 GMP-ANR MOU) at I.A, B; *Application of Green Mountain Power Corp. under 10 V.S.A. Ch. 43*, Case No. 18-2549-PET, Exh. GMP-8 (2019 GMP-ANR MOU) at III.F, H.

with a culvert and adjacent swale will not have an undue adverse effect on the public good criteria of 10 V.S.A. § 1086, and approve the proposed changes.

This Proposal for Decision has not been circulated to the parties pursuant to 3 V.S.A. § 811 because it is not adverse to any party.

Micah Howe
Hearing Officer

IV. ORDER

IT IS HEREBY ORDERED, ADJUDGED, AND DECREED by the Public Utility Commission ("Commission") of the State of Vermont that:

1. The findings, conclusions, and recommendations of the Hearing Officer are adopted. All other findings proposed by parties, to the extent that they are inconsistent with this Order, were considered and not adopted.

2. In consideration of the criteria set forth in 10 V.S.A. § 1086, the changes proposed by Green Mountain Power Corporation ("GMP") to the emergency spillway project approved by the Commission in Case No. 20-2570-PET will serve the public good.

3. All conditions of any Orders in Case Nos. 22-0231-PET, 21-2501-INV, 20-2549-PET, and 18-2549-PET remain in full force and effect.

4. Site preparation, construction, operation, and maintenance of the project shall be in accordance with the plans and evidence as submitted in these proceedings. Any material deviation from these plans must be approved by the Commission.

5. GMP shall file a status update with the Commission regarding the Flow and Water Level Management and Monitoring Plan and Dissolved Oxygen Monitoring Plan required by the memorandums of understanding with the Vermont Agency of Natural Resources in Case Nos. 18-2549-PET and 20-2570-PET within 30 days of the date of this Order. The status update shall be filed in the compliance subcase of Case No. 18-2549-PET.

Dated at Montpelier, Vermont, this 14th day of December, 2022.

Anthony Z. Roisman	)	PUBLIC UTILITY
	)	
Margaret Cheney	)	COMMISSION
	)	
J. Riley Allen	)	OF VERMONT

OFFICE OF THE CLERK

Filed: December 14, 2022

Attest: ______________________________
Clerk of the Commission

Notice to Readers: This decision is subject to revision of technical errors. Readers are requested to notify the Clerk of the Commission (by e-mail, telephone, or in writing) of any apparent errors, in order that any necessary corrections may be made. (E-mail address: puc.clerk@vermont.gov)

Appeal of this decision to the Supreme Court of Vermont must be filed with the Clerk of the Commission within 30 days. Appeal will not stay the effect of this Order, absent further order by this Commission or appropriate action by the Supreme Court of Vermont. Motions for reconsideration or stay, if any, must be filed with the Clerk of the Commission within 28 days of the date of this decision and Order.

PUC Case No. 22-3438-PET - SERVICE LIST

Parties:

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Vermont Agency of Natural Resources
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kane.smart@vermont.gov

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Jamesjamele@charter.net
Selectboard11@gmail.com

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clerk@town.marshfield.vt.us

VNRC
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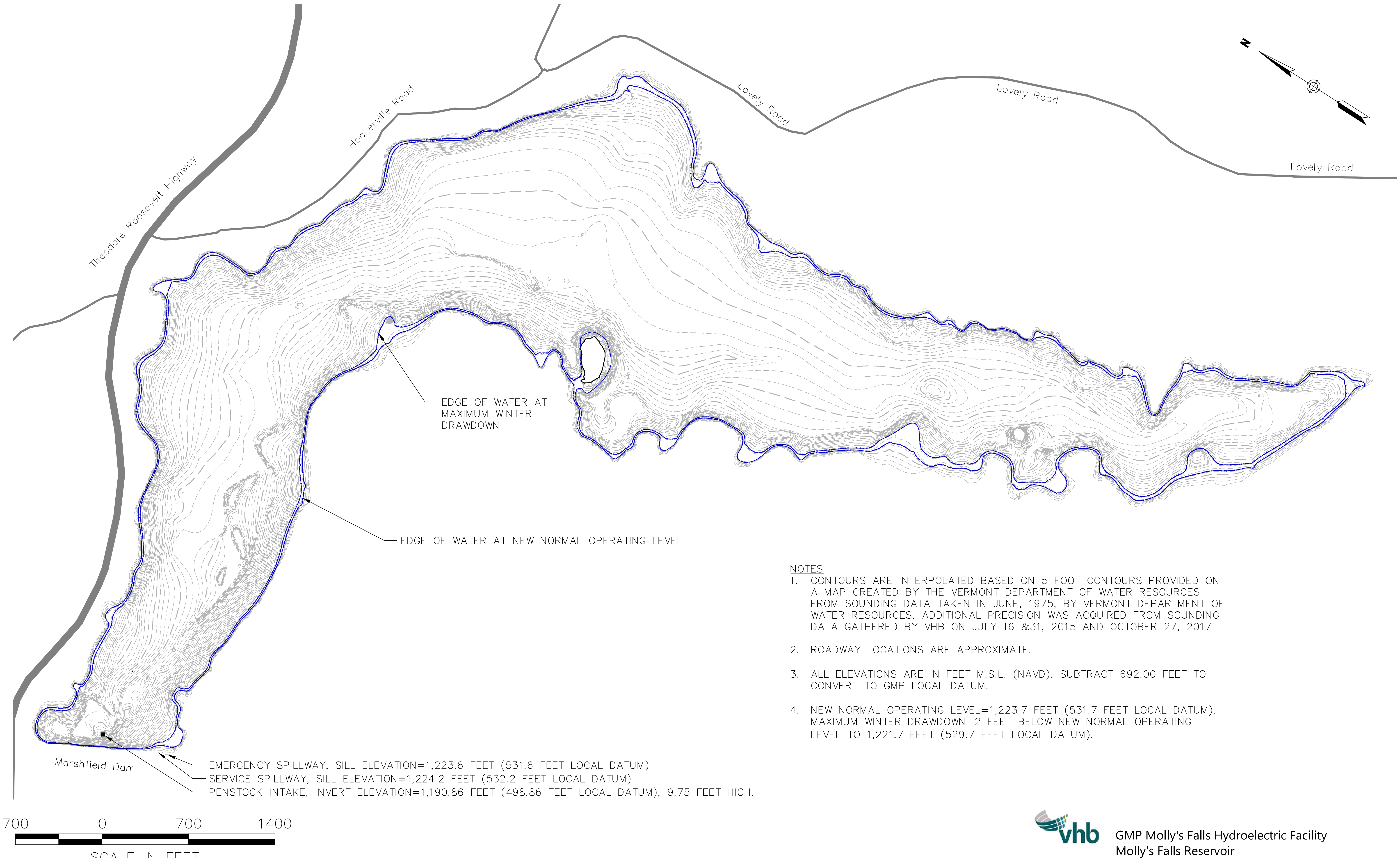
jmclean@firmspf.com

Town of Cabot
mtarrant@tarrantgillies.com

MadDog Chapter of Vermont Trout Unlimited
rjaredcarpenter@gmail.com

APPENDIX 3



NOTES

1. CONTOURS ARE INTERPOLATED BASED ON 5 FOOT CONTOURS PROVIDED ON A MAP CREATED BY THE VERMONT DEPARTMENT OF WATER RESOURCES FROM SOUNDING DATA TAKEN IN JUNE, 1975, BY VERMONT DEPARTMENT OF WATER RESOURCES. ADDITIONAL PRECISION WAS ACQUIRED FROM SOUNDING DATA GATHERED BY VHB ON JULY 16 &31, 2015 AND OCTOBER 27, 2017

2. ROADWAY LOCATIONS ARE APPROXIMATE.

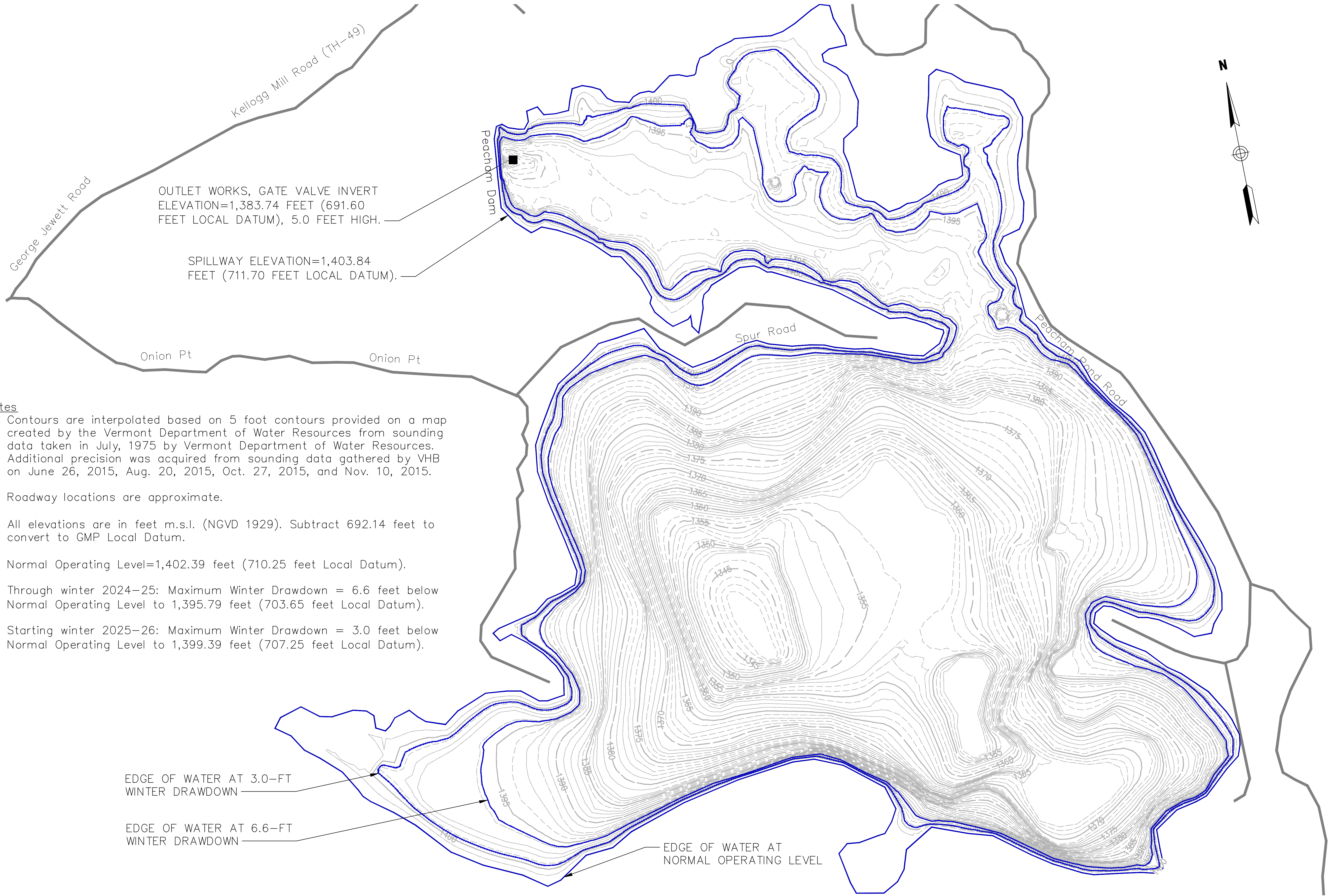
3. ALL ELEVATIONS ARE IN FEET M.S.L. (NAVD). SUBTRACT 692.00 FEET TO CONVERT TO GMP LOCAL DATUM.

4. NEW NORMAL OPERATING LEVEL=1,223.7 FEET (531.7 FEET LOCAL DATUM). MAXIMUM WINTER DRAWDOWN=2 FEET BELOW NEW NORMAL OPERATING LEVEL TO 1,221.7 FEET (529.7 FEET LOCAL DATUM).

vhb

GMP Molly's Falls Hydroelectric Facility
Molly's Falls Reservoir
Bathymetry Plan

Date: Sept. 23, 2020



Notes

1. Contours are interpolated based on 5 foot contours provided on a map created by the Vermont Department of Water Resources from sounding data taken in July, 1975 by Vermont Department of Water Resources. Additional precision was acquired from sounding data gathered by VHB on June 26, 2015, Aug. 20, 2015, Oct. 27, 2015, and Nov. 10, 2015.
2. Roadway locations are approximate.
3. All elevations are in feet m.s.l. (NGVD 1929). Subtract 692.14 feet to convert to GMP Local Datum.
4. Normal Operating Level=1,402.39 feet (710.25 feet Local Datum).
5. Through winter 2024-25: Maximum Winter Drawdown = 6.6 feet below Normal Operating Level to 1,395.79 feet (703.65 feet Local Datum).
6. Starting winter 2025-26: Maximum Winter Drawdown = 3.0 feet below Normal Operating Level to 1,399.39 feet (707.25 feet Local Datum).

600 0 600 1200

SCALE IN FEET

vhb

GMP Molly's Falls Hydroelectric Facility
Peacham Pond
Bathymetry Plan

Date: Sept. 23, 2020

GMP Marshfield - Mollys Falls Hydroelectric Facility

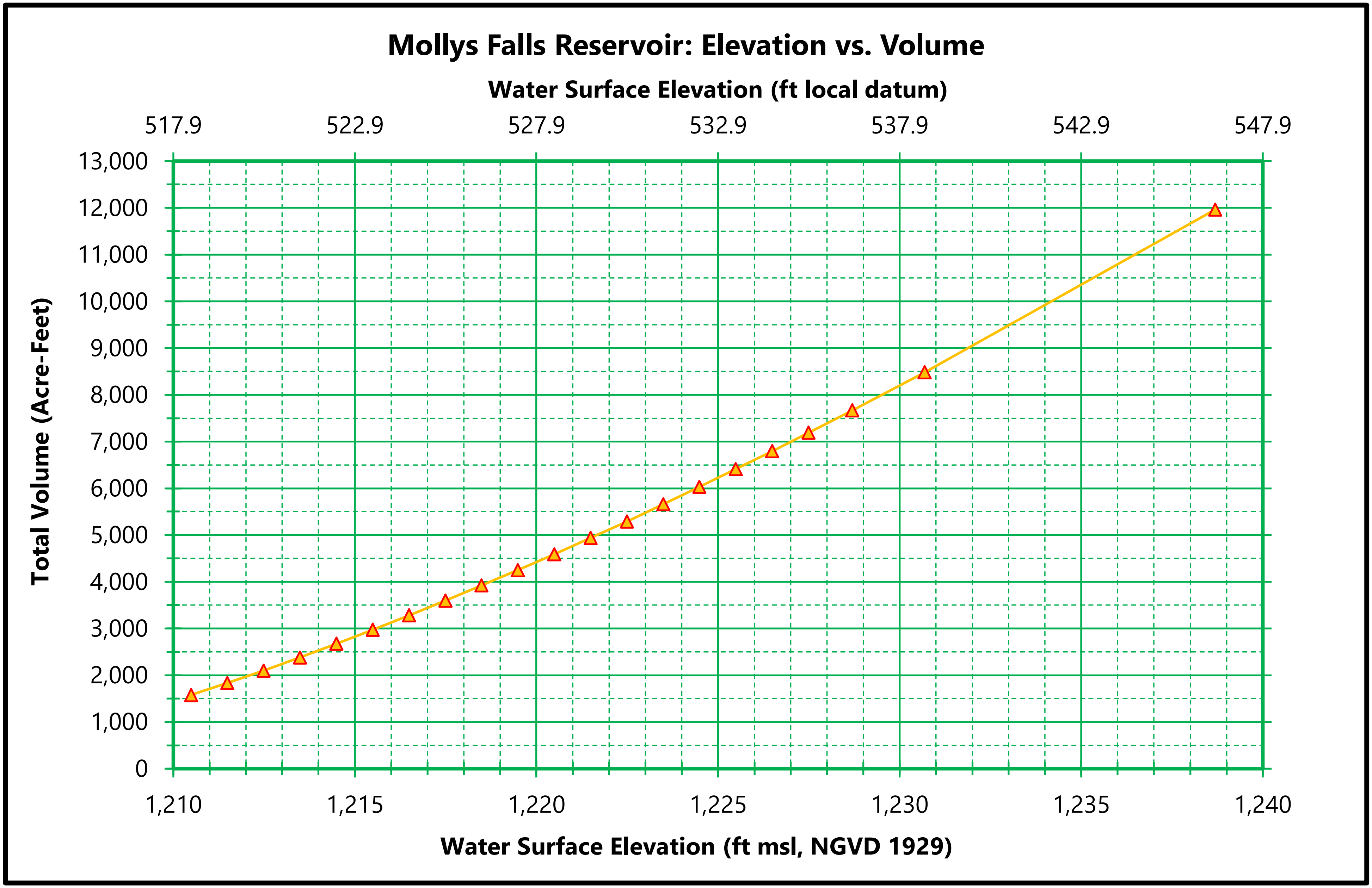
Mollys Falls Reservoir Volume and Area Data

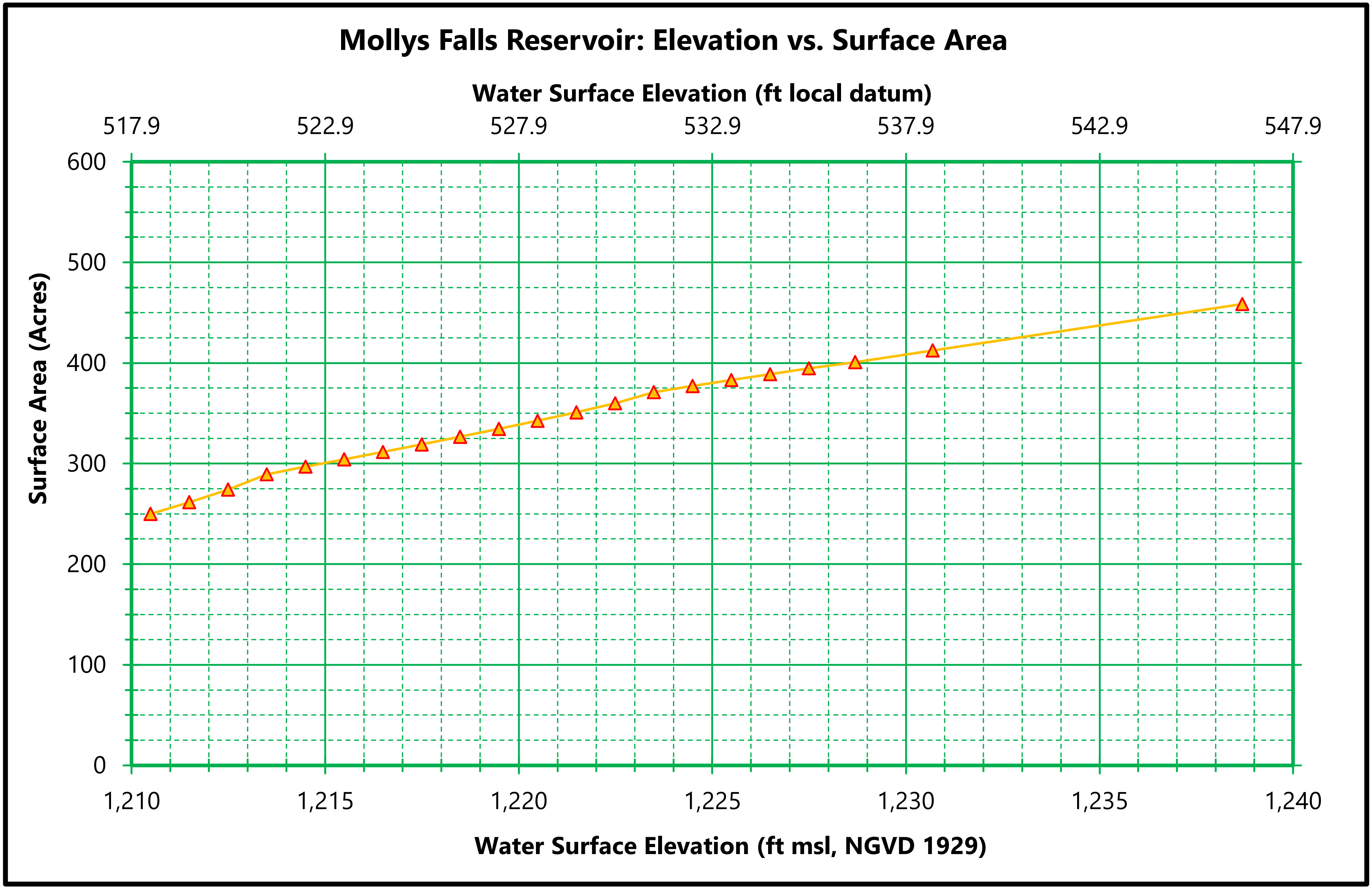
Revised: January 18, 2018 using additional bathymetry data from October 2017

Note	Water Level			Reservoir Volume		Water Surface Area			
	Water Surface Elevation (ft local datum)	Water Surface Elevation (ft msl, NGVD 1929)	Depth Below Normal Full Pond Level (ft)	Cumulative (Ac-Ft)	Delta (Ac-Ft)	Total (Acres)	Delta (Acres)	Exposed (Acres)*	% Exposed*
	501.4	1,193.5	35.2	0	--	1.8	--	399	100%
	502.4	1,194.5	34.2	2.4	2.4	3.0	1.2	398	99%
Intake Centerline Elevation = 503.66'	503.4	1,195.5	33.2	5.9	3.5	4.0	1.0	397	99%
	504.4	1,196.5	32.2	10.6	4.7	5.4	1.4	395	99%
	505.4	1,197.5	31.2	17	6	7	1.4	394	98%
	506.4	1,198.5	30.2	31	14	21	15	379	95%
	507.4	1,199.5	29.2	58	27	32	11	368	92%
	508.4	1,200.5	28.2	95	38	43	11	358	89%
	509.4	1,201.5	27.2	144	49	54	11	347	86%
	510.4	1,202.5	26.2	204	60	65	11	335	84%
	511.4	1,203.5	25.2	286	82	98	33	303	76%
	512.4	1,204.5	24.2	397	111	124	26	277	69%
	513.4	1,205.5	23.2	533	136	149	25	252	63%
	514.4	1,206.5	22.2	695	162	174	25	226	56%
	515.4	1,207.5	21.2	883	189	203	28	198	49%
	516.4	1,208.5	20.2	1,098	215	228	25	173	43%
	517.4	1,209.5	19.2	1,332	233	239	11	162	40%
	518.4	1,210.5	18.2	1,576	244	250	11	151	38%
	519.4	1,211.5	17.2	1,832	256	262	12	139	35%
	520.4	1,212.5	16.2	2,100	268	274	13	127	32%
	521.4	1,213.5	15.2	2,381	282	289	15	112	28%
	522.4	1,214.5	14.2	2,674	293	297	7.6	104	26%
	523.4	1,215.5	13.2	2,975	301	304	7.3	97	24%
	524.4	1,216.5	12.2	3,283	308	312	7.4	89	22%
	525.4	1,217.5	11.2	3,598	315	319	7.5	82	20%
5.8-Ft Winter Drawdown = 525.9'	526.4	1,218.5	10.2	3,921	323	327	8	74	19%
	527.4	1,219.5	9.2	4,252	331	334	7.8	66	17%
	528.4	1,220.5	8.2	4,590	339	343	8.1	58	15%
	529.4	1,221.5	7.2	4,937	347	351	8.4	50	12%
Default Winter Drawdown = 529.7' (2.0 ft)	530.4	1,222.5	6.2	5,292	355	360	8.9	41	10%
	531.4	1,223.5	5.2	5,658	365	371	11.2	30	7%
New NOL = 531.7' Spillway Sill = 532.2'	532.4	1,224.5	4.2	6,032	374	377	6.1	24	6%
	533.4	1,225.5	3.2	6,412	380	383	5.8	18	4%
	534.4	1,226.5	2.2	6,798	386	389	5.8	12	3%
	535.4	1,227.5	1.2	7,190	392	395	5.8	6	2%
	536.6	1,228.7	0.0	7,667	477	401	6.3	0	0%
	538.6	1,230.7	-2.0	8,480	813	412	12	--	--
1.8 Ft Freeboard (crest el = 548.4')	546.6	1,238.7	-10.0	11,964	3,484	459	46	--	--

* "Exposed" refers to the area of the reservoir bottom that is normally below the full pool level, that is exposed during drawdown.

Conversion from local datum to NGVD = 621.14 ft


Mollys Falls Reservoir: Elevation vs. Volume
Water Surface Elevation (ft local datum)
517.9
522.9
527.9
532.9
537.9
542.9
547.9
Total Volume (Acre-Feet)
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1,210
1,215
1,220
1,225
1,230
1,235
1,240
Water Surface Elevation (ft msl, NGVD 1929)



Mollys Falls Reservoir: Elevation vs. Surface Area
Water Surface Elevation (ft local datum)
517.9
522.9
527.9
532.9
537.9
542.9
547.9
Surface Area (Acres)
600
500
400
300
200
100
0
1,210
1,215
1,220
1,225
1,230
1,235
1,240
Water Surface Elevation (ft msl, NGVD 1929)

GMP Marshfield - Mollys Falls Hydroelectric Facility

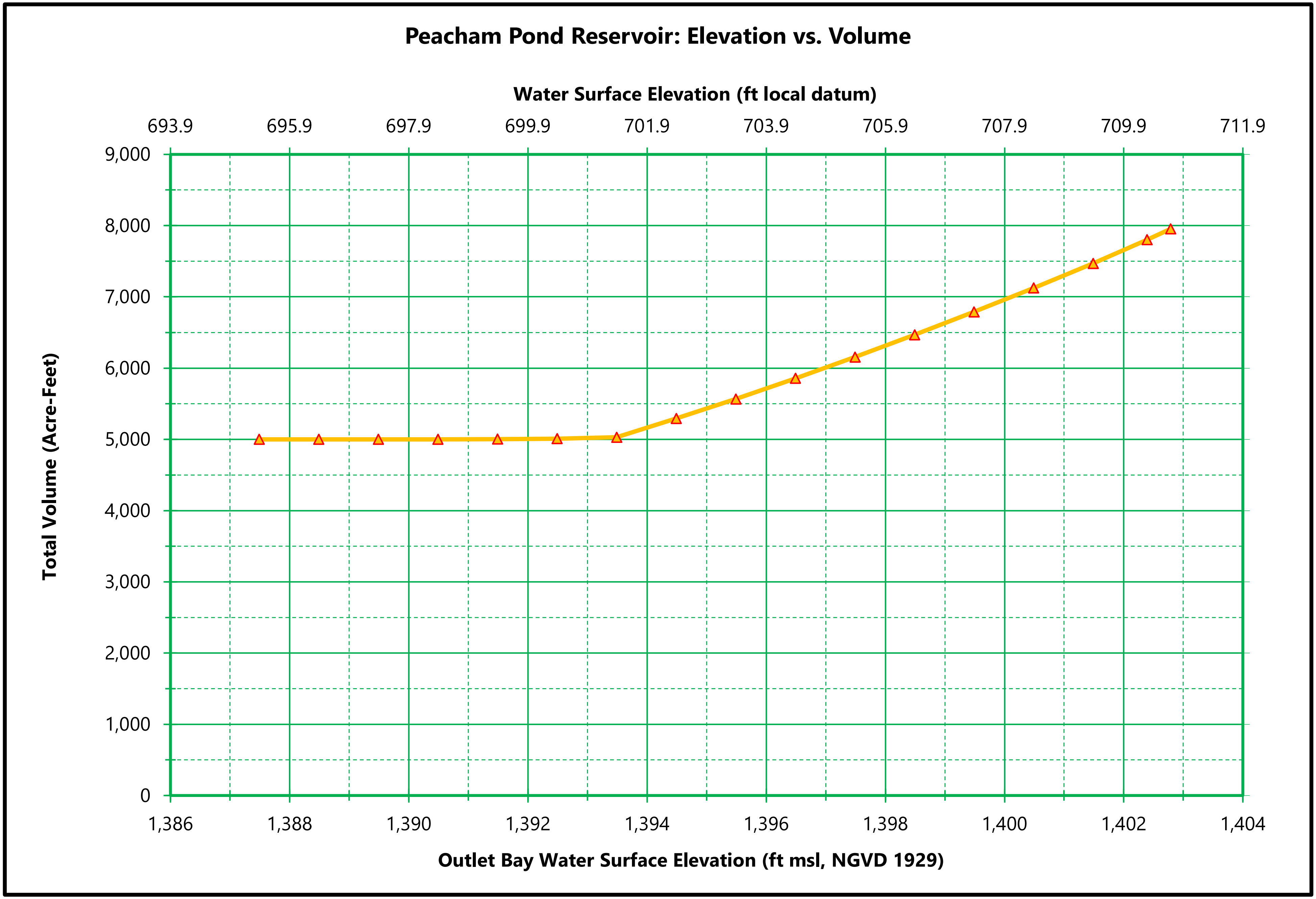
Peacham Pond Reservoir Volume and Area Data

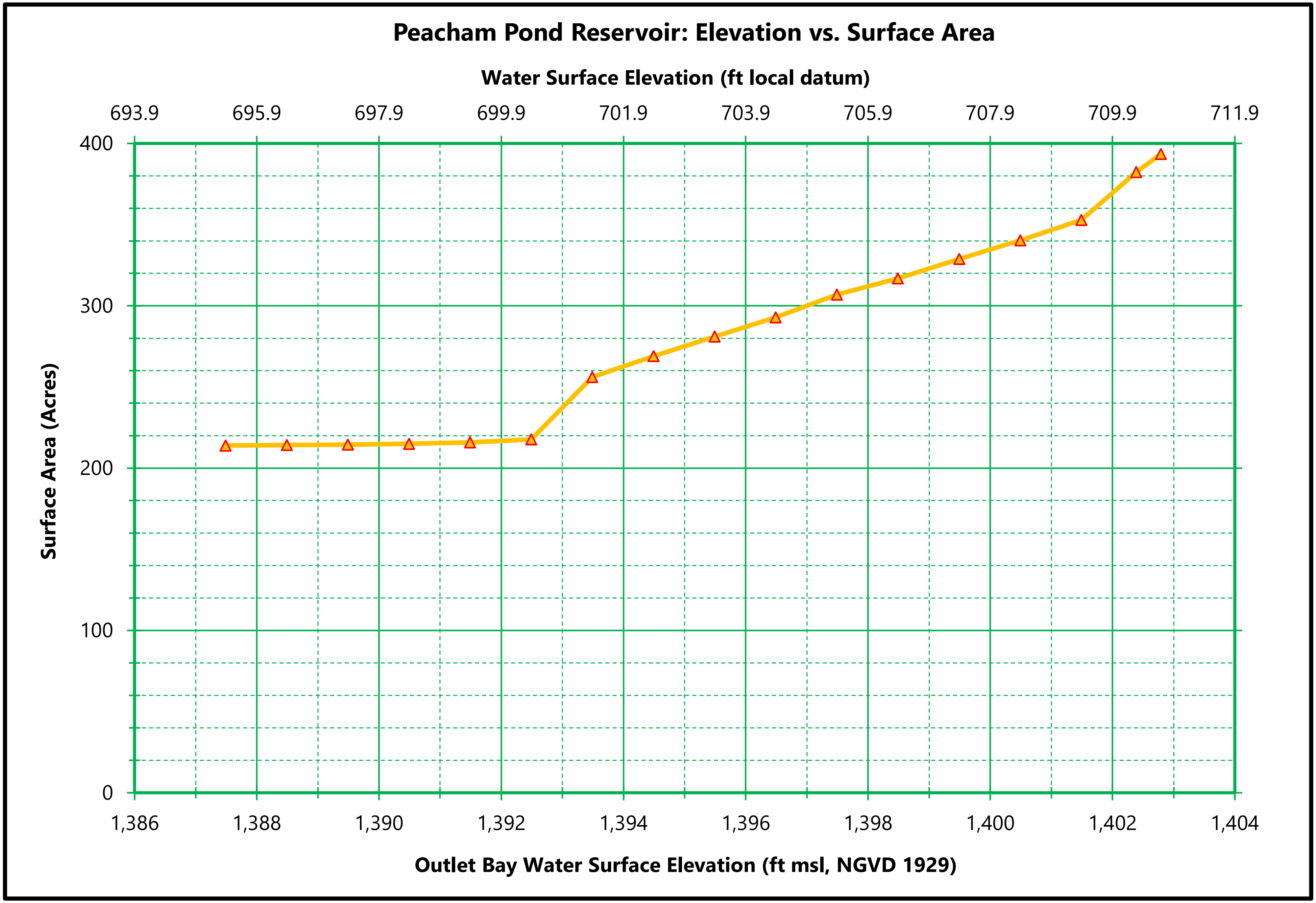
Note	Water Level in Outlet Bay*			Reservoir Volume		Water Surface Area			
	Water Surface Elevation (ft local)	Water Surface Elevation (ft msl, NGVD 1929)	Depth Below Normal Full Pond Level (ft)	Cumulative (Ac-Ft)	Delta (Ac-Ft)	Total (Acres)	Delta (Acres)	Exposed (Acres)†	% Exposed†
	695.4	1,387.5	14.9	5,001	0.1	213.9	0.00	168	44%
	696.4	1,388.5	13.9	5,001	0.3	214.1	0.19	168	44%
	697.4	1,389.5	12.9	5,001	0.4	214.4	0.32	168	44%
	698.4	1,390.5	11.9	5,002	0.7	214.9	0.51	167	44%
	699.4	1,391.5	10.9	5,003	1.4	215.8	0.84	166	44%
	700.4	1,392.5	9.9	5,011	8.1	217.8	2.0	165	43%
	701.4	1,393.5	8.9	5,031	19	256.0	38	126	33%
	702.4	1,394.5	7.9	5,293	262	268.9	13	113	30%
Max Drawdown = 6.6' (703.65')	703.4	1,395.5	6.9	5,568	275	281.0	12	101	26%
	704.4	1,396.5	5.9	5,855	287	292.7	12	90	23%
	705.4	1,397.5	4.9	6,155	300	306.9	14	75	20%
	706.4	1,398.5	3.9	6,466	312	316.7	9.8	66	17%
Max Drawdown = 3' (707.25')	707.4	1,399.5	2.9	6,789	323	328.7	12	54	14%
	708.4	1,400.5	1.9	7,124	334	340.2	11	42	11%
	709.4	1,401.5	0.9	7,470	346	352.8	13	29	8%
Normal Full Pool = 710.25'	710.3	1,402.4	0.0	7,801	331	382.3	54	0	0%
Dam Spillway = 711.7'	710.7	1,402.8	-0.4	7,956	155	393.4	41	--	--

* GMP measures Peacham Pond water levels in the outlet bay. The shoals at the mouth of the outlet bay prevent water levels in the main lake from being drawn-down below 1,393 feet, regardless of water levels at the outlet.

Conversion to local datum is 692.14'

† "Exposed" refers to the area of the reservoir bottom that is normally below the full pool level, that is exposed during drawdown.


Peacham Pond Reservoir: Elevation vs. Volume
Water Surface Elevation (ft local datum)
693.9
695.9
697.9
699.9
701.9
703.9
705.9
707.9
709.9
711.9
Total Volume (Acre-Feet)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1,386
1,388
1,390
1,392
1,394
1,396
1,398
1,400
1,402
1,404
Outlet Bay Water Surface Elevation (ft msl, NGVD 1929)



Peacham Pond Reservoir: Elevation vs. Surface Area
Water Surface Elevation (ft local datum)
693.9
695.9
697.9
699.9
701.9
703.9
705.9
707.9
709.9
711.9
Surface Area (Acres)
400
300
200
100
0
1,386
1,388
1,390
1,392
1,394
1,396
1,398
1,400
1,402
1,404
Outlet Bay Water Surface Elevation (ft msl, NGVD 1929)

APPENDIX 4

NORCAN
HYDRAULIC TURBINE INC.

50 Bruce Crescent, Carleton Place, ON Canada K7C 3V6 **T** (613) 257-4755 **F** (613) 257-4215 **E** nht@norcanhydro.com **www.norcanhydro.com**

January 22, 2018

Marshfield No. 6
– Performance Testing -
REVB
Report

Green Mountain Power Inc.

Rod Foster
Operations Manager
Norcan Hydraulic Turbine Inc.
T 613-257-4755 ext 17
F 613-257-4215
C 613-883-3503

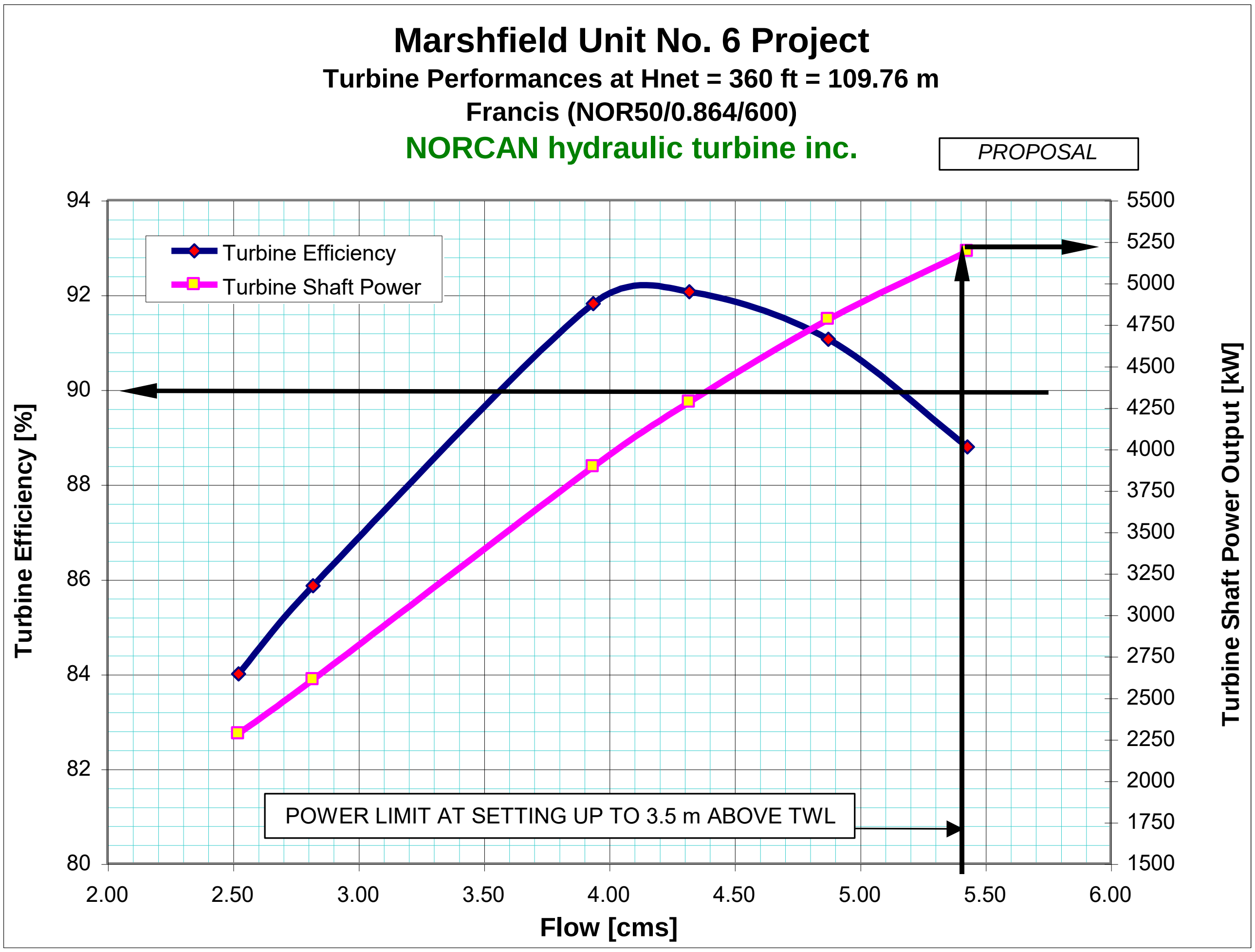
NORCAN
HYDRAULIC TURBINE INC.

Table of contents

Preamble

This project was undertaken on a request from Green Mountain Power Inc. to analyze the operation of the existing 2004 installed Francis Turbine outside of the originally designed parameters.

Original 2004 Performance Curve



Performance Test description

Index test at 5% incremental increased Wicket Gate set point monitoring and recording the following:

- Flow using portable ultra-sonic flow equipment
- Pressure Gauge at entrance to Spiral Case
- Power (kW) from HMI
- Vibration (IPS) from HMI
- Intake behavior (observation)
- Tailrace behavior (observation/audible noise)

0% Wicket Gate

- Flow= N/A
- Pressure Gauge = 156psi
- kW= 0.0
- Turbine Vibration=0.0ips
- Generator Vibration=0.0ips
- Intake behavior=static
- Tailrace behavior=static

1-3% Wicket Gate

- Flow= N/A
- Pressure Gauge = 158psi
- kW= N/A synchronization
- Turbine Vibration=.03ips
- Generator Vibration=.11ips
- Intake behavior=static
- Tailrace behavior=Small amounts of air bubbles witnessed in discharge

5% Wicket Gate

- Flow= .4cms/14cfs
- Pressure Gauge = 158psi
- kW= ~100kw
- Turbine Vibration=.03ips
- Generator Vibration=.11ips
- Intake behavior=static
- Tailrace behavior=Small amounts of air bubbles witnessed in discharge, small vortices forming around perimeter of Draft Tube

10% Wicket Gate

- Flow= .81cms/29cfs
- Pressure Gauge = 157-158psi
- kW= ~300kw
- Turbine Vibration=.03ips
- Generator Vibration=.11ips
- Intake behavior=static
- Tailrace behavior=Increased air bubbles witnessed in discharge, increased small vortices forming around perimeter of Draft Tube

15% Wicket Gate

- Flow= 1.1cms/39cfs
- Pressure Gauge = 157psi
- kW= ~720kw
- Turbine Vibration=.04ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior=Increased air bubbles with foam witnessed in discharge, increased small vortices forming around perimeter of Draft Tube

20% Wicket Gate

- Flow= 1.75cms/62cfs
- Pressure Gauge = 156psi
- kW= ~1110kw
- Turbine Vibration=.04ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= Audible cavitation from Discharge Cone hatch door. Increased air bubbles with foam witnessed in discharge, increased small vortices forming around perimeter of Draft Tube

25% Wicket Gate

- Flow= 1.94cms/69cfs
- Pressure Gauge = 156psi
- kW= ~1575kw
- Turbine Vibration=.04ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= Increased steady audible cavitation from Discharge Cone hatch door. Increased air bubbles with foam witnessed in discharge, increased small vortices forming around perimeter of Draft Tube

30% Wicket Gate

- Flow= 2.35cms/83cfs
- Pressure Gauge = 155psi
- kW= ~2075kw
- Turbine Vibration=.04ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= Audible cavitation from Discharge Cone hatch door <u>decreased</u>. Steady discharge air bubbles are plentiful. Vortices around perimeter are no longer visible

35% Wicket Gate

- Flow= 2.91cms/103cfs
- Pressure Gauge = 154-155psi
- kW= ~2545kw
- Turbine Vibration=.04ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= Audible cavitation from Discharge Cone hatch door <u>no longer present</u>. Steady discharge air bubbles are plentiful. Vortices around perimeter are not visible

40% Wicket Gate

- Flow= 3.3cms/117cfs
- Pressure Gauge = 153psi
- kW= ~3000kw
- Turbine Vibration=.04ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= No audible cavitation from Discharge Cone hatch door.. Steady discharge air bubbles are plentiful.

45% Wicket Gate

- Flow= 3.7cms/131cfs
- Pressure Gauge = 152psi
- kW= ~3410kw
- Turbine Vibration=.05ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= No audible cavitation from Discharge Cone hatch door. Steady discharge air bubbles are plentiful.

50% Wicket Gate

- Flow= 4.0cms/141cfs
- Pressure Gauge = 151psi
- kW= ~3810kw
- Turbine Vibration=.04ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= Hissing sound from Discharge Cone hatch door. Steady discharge air bubbles are plentiful.

55% Wicket Gate

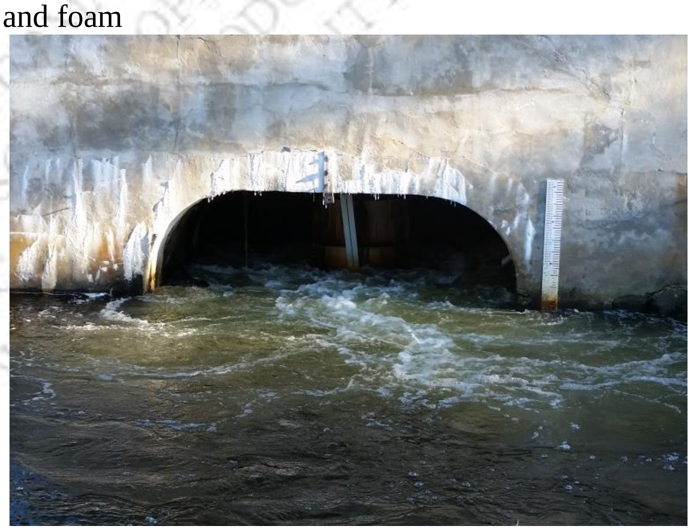
- Flow= 4.35cms/154cfs
- Pressure Gauge = 150psi
- kW= ~4150kw
- Turbine Vibration=.03ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= Hissing sound from Discharge Cone hatch door. Erratic discharge increased air bubbles and foam.

60% Wicket Gate

- Flow= 4.7cms/166cfs
- Pressure Gauge = 149psi
- kW= ~4420kw
- Turbine Vibration=.03ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= <u>Minor audible</u> cavitation from Discharge Cone hatch door. <u>Erratic</u> discharge increased air bubbles and foam.

62% Wicket Gate

- Flow= 4.9cms/173cfs
- Pressure Gauge = 148psi
- kW= ~4500kw
- Turbine Vibration=.04ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= <u>Intermittent audible</u> cavitation from Discharge Cone hatch door. <u>Erratic</u> discharge increased air bubbles and foam



65% Wicket Gate

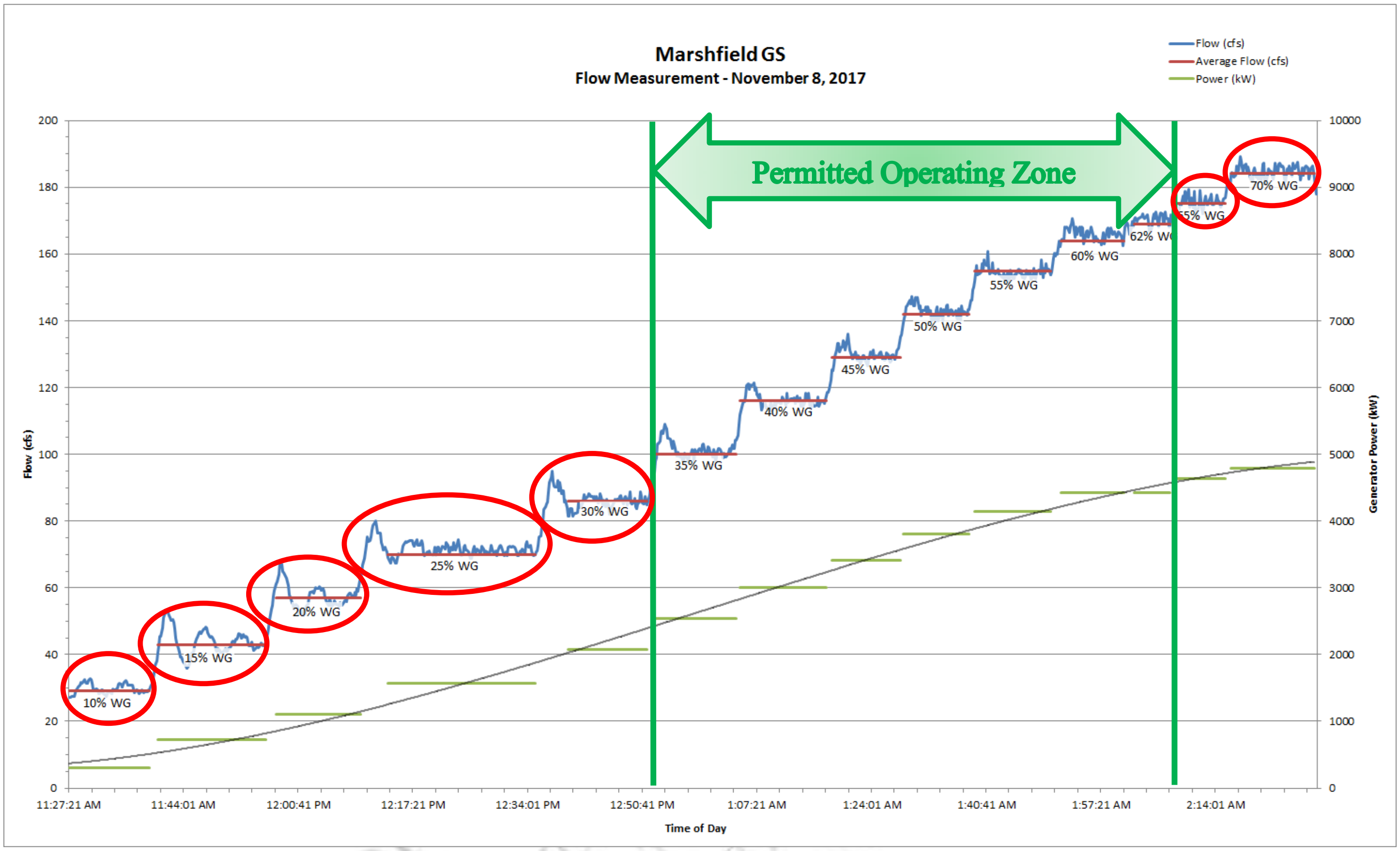
- Flow= 4.97cms/176cfs
- Pressure Gauge = 148psi
- kW= ~4630kw
- Turbine Vibration=.04ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= Steady audible cavitation from Discharge Cone hatch door. Erratic discharge increased air bubbles and foam

70% Wicket Gate

- Flow= 5.2cms/184cfs
- Pressure Gauge = 147psi
- kW= ~4785kw
- Turbine Vibration=.03ips
- Generator Vibration=.12ips
- Intake behavior=static
- Tailrace behavior= Steady increased audible cavitation from Discharge Cone hatch door. Erratic discharge increased air bubbles and foam

Observations and conclusions

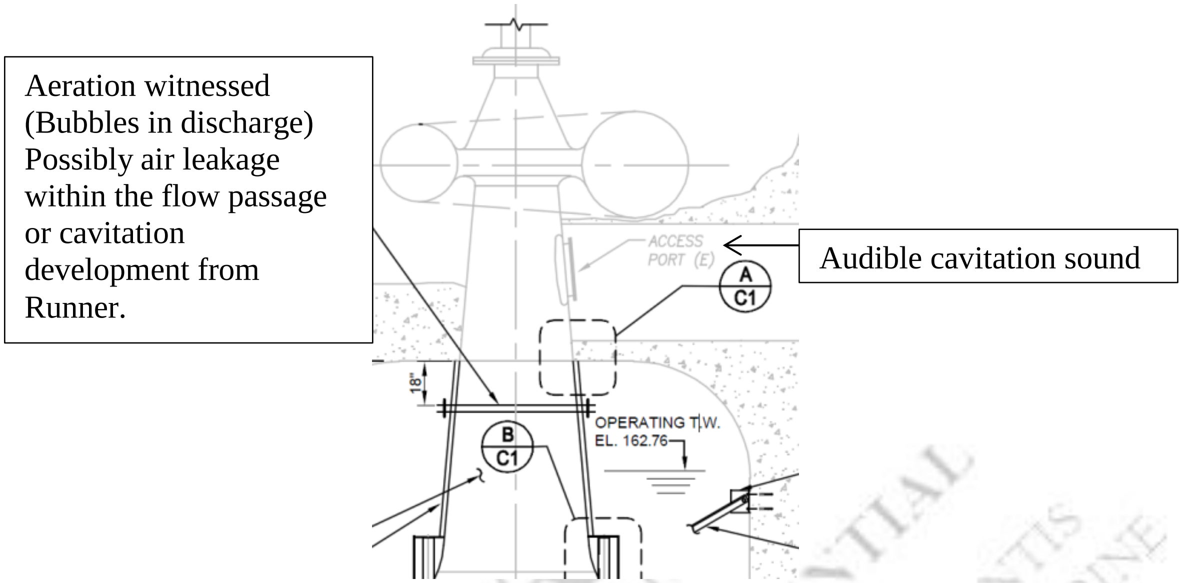
Testing has confirmed that operation outside of the original 2004 design parameters is not to be permitted. Top end operation over 4.9cms/173cfs shall no longer be permitted due to the evident cavitation/aeration and instability witnessed. Air bubbles were visible within the discharge of the Turbine throughout the complete testing range. The volume of air increases with Wicket Gate opening both in and outside of the highlighted cavitation zones. No vortices were witnessed at the Head pond Intake which rules out this area as a possible aeration path.



Cavitation-audible

Audible cavitation was observed from the Discharge Cone inspection hatch door in flow ranges below 2.91cms/103cfs and above 4.9cms/173cfs.

Cavitation occurs when the static pressure of the liquid falls below its vapor pressure. Cavitation is most likely to occur near the fast moving blades of the turbines and in the exit region of the turbines. The formation and collapse of vapor bubbles generates pressure waves, which can be of very high frequencies, causing damage to the machinery. The bubbles collapsing near the machine surface are more damaging and cause erosion on the surfaces called cavitation erosion. Through testing, the "Permitted Operating Zone" is defined by the limits of onset cavitation, and therefore not recommended to be operated outside of the permitted zone.



Possible excessive losses in the new penstock

Pressure readings at the entrance to the Spiral Case decreased from 158psi-147psi throughout the range of testing (0-70%WG). This is equivalent to ~25ft Head loss.

*Note-Tail water elevation increased 16`` from 0.0cms/cfs-5.2cms/184cfs

Recommendations

Operation of Turbine limited between 2.91cms/103cfs (35%WG) – 4.9cms-173cfs (62%WG). Inspection of Runner and Discharge Cone for increased cavitation damage. Locally repair damaged areas with Belzona 1311, 1341 top coat with 2141. Ramping up to 35% WG shall be limited to <2 minutes for safe operation of the turbine and to limit mechanical failure due to unstable operation.

APPENDIX 5

SNOW MEASUREMENTS

			MARSHFIELD RESERVOIR				PEACHAM POND			
			WOODS		FIELD		WOODS		FIELD	
YEAR	MONTH	DAY	Snow Depth (Inches)	Water Content (Inches)	Snow Depth (Inches)	Water Content (Inches)	Snow Depth (Inches)	Water Content (Inches)	Snow Depth (Inches)	Water Content (Inches)
	Nov.									
	Nov.									
	Dec.									
	Dec.									
	Jan.									
	Jan.									
	Feb.									
	Feb.									
	Mar.									
	Mar.									
	Apr.									
	Apr.									
	Nov.									
	Nov.									
	Dec.									
	Dec.									
	Jan.									
	Jan.									
	Feb.									
	Feb.									
	Mar.									
	Mar.									
	Apr.									
	Apr.									

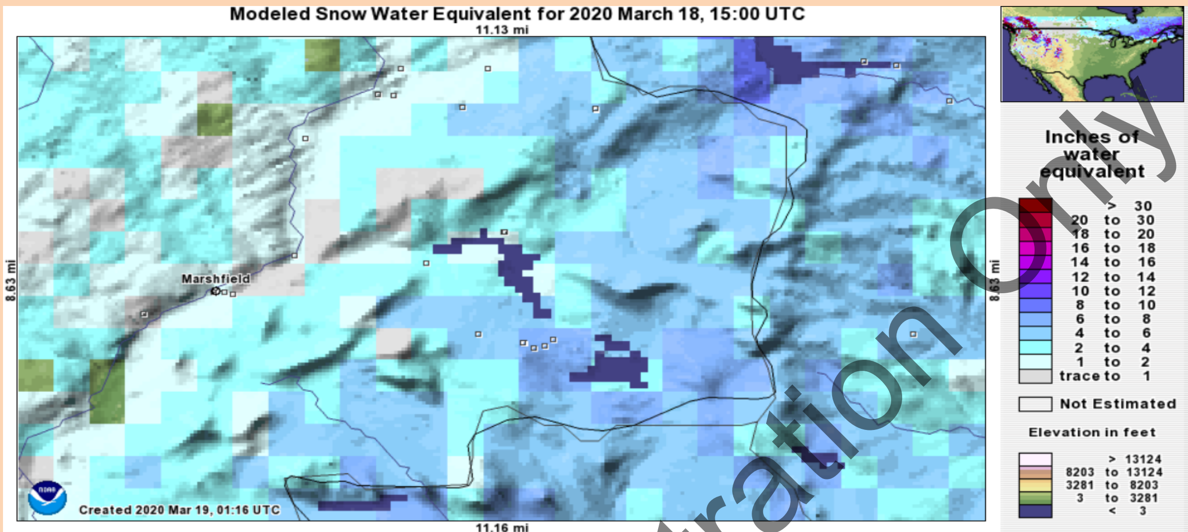
Green Mountain Power - Mollys Falls Hydroelectric Facility

Snowpack & Reservoir Volume Calculations

Peacham Pond **Scenario:** MOU Operating Conditions

1) Snow-Water Content

Sample data from: https://www.nohrsc.noaa.gov/interactive/html/map.html



Peacham watershed ave. =	**2.5**	**in. snow-water equivalent, remote sensing data as of:**	03/18/2020
Watershed area =	5.8	square miles @ Peacham Pond dam	
Snowpack volume =	33,686,400	cubic feet of water equivalent	
or,	**770**	**acre-feet of water equivalent**	

2) Reservoir Volumes

	ft local	**ft msl (NGVD 1929)**		
Normal Operating Level =	710.25	1,402.39	(Normal Operating Level = "NOL")	
current water level =	707.25	1,399.39	per GMP SCADA / manual, last reading:	03/18/2020 10:20
depth below full =	**3.0**	**feet**		
Volume at NOL =	7,909	acre-feet		
current volume =	6,962	acre-feet		
delta volume =	**900**	**acre-feet**		

3) Flows

Minimum Downstream Q =	6.7	cfs (conservation flow requirement, unless inflow is less)
Today's date =	18-Mar	Refill target: 1-May Days to refill = 43.6
Minimum Outflow vol =	579	acre-feet, from now until Refill Due Date
Volume Needed to Refill =	**1,500**	**acre-feet (delta volume plus minimum outflow volume)**
Typical precip =	4.3	inches now to May 1 (NWS St. Johnsbury station ave for 1990-2019)
Long-Range Forecast =	100%	of normal precip (NWS Climate Prediction Center)
Equivalent runoff =	1,330	acre-feet from new precipitation
Total Runoff =	**2,100**	**acre-feet from new precipitation + snowmelt**
Excess Runoff vol =	600	acre-feet (Total Runoff volume minus Volume Needed to Refill)
Average Outflow rate =	13.6	cfs, from now to refill target date: 1-May

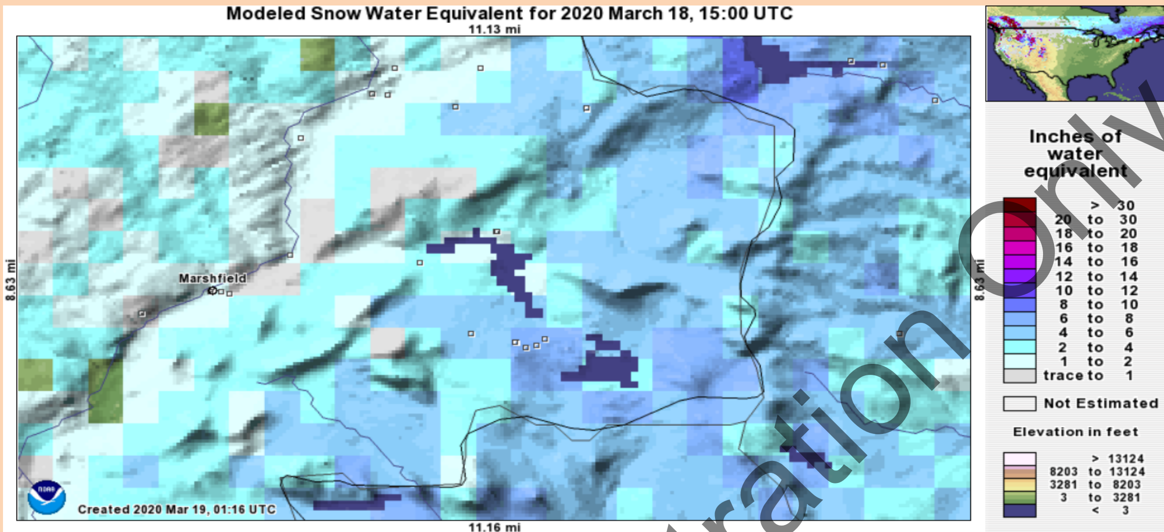
Green Mountain Power - Mollys Falls Hydroelectric Facility

Snowpack & Reservoir Volume Calculations

Mollys Falls Reservoir **Scenario:** MOU Operating Conditions

1) Snow-Water Content

Sample data from: https://www.nohrsc.noaa.gov/interactive/html/map.html



Mollys watershed ave. =	**2.3**	**in. snow-water equivalent, remote sensing data as of:**	03/18/2020
Watershed area =	22.2	square miles @ Mollys Falls Reservoir dam	
Snowpack volume =	118,622,592	cubic feet of water equivalent	
or,	**2,700**	**acre-feet of water equivalent**	

2) Reservoir Volumes

2) Reservoir Volumes	**ft local**	**ft msl (NAVD88)**		
Gate Crest =	538.70	1,230.70	(top of slidegate when closed)	
current water level =	529.70	1,221.70	per GMP SCADA / manual, last reading:	03/18/2020 10:20
New NOL =	531.70	1,223.70	(GMP Proposal Sept 2020)	
depth below new NOL =	**2.0**	**feet**		
Volume at new NOL =	5,941	acre-feet		
current volume =	5,196	acre-feet		
delta volume =	**700**	**acre-feet**		

3) Flows

Minimum Downstream Q =	8.5	cfs (conservation flow requirement, unless inflow is less) July-March	
Minimum Downstream Q =	12.0	cfs (conservation flow requirement, unless inflow is less) April-June	
Today's date =	18-Mar	Refill target: 1-May	Days to refill = 43.6
Minimum Outflow vol =	943	acre-feet, from now until refill due date	
Volume Needed to Refill =	**2,500**	**acre-feet (Peacham & MFR delta volumes, plus minimum outflow volume)**	
Typical precip =	4.3	inches now to May 1 (NWS St. Johnsbury station ave for 1990-2019)	
Long-Range Forecast =	100%	of normal precip (NWS Climate Prediction Center)	
Equivalent runoff =	5,100	acre-feet from new precipitation	
Total Runoff =	**7,800**	**acre-feet from new precipitation + snowmelt**	
Excess Runoff vol =	5,300	acre-feet (Total Runoff volume minus Volume Needed to Refill)	
Average Outflow rate =	70	cfs, from now to refill target date: 1-May	
Available Generation =	475	Hours (equivalent Excess Runoff volume at 135 cfs generation flow)	
Available Generation =	10.9	hrs/day, on average	

Marshfield Forecast Summary Information

Date of Forecast	Item	More Likely Scenario	Max Flow Scenario	MOU (2018) & EAP (2021) Guidance
8/4/2020	48-hr rainfall (inches)	2.0	4.0	>2.5”= generate @ Max Q
	72-hr rainfall (inches)	2.25	4.0	>3” = generate @ Max Q
	Peak MFR Inflow (cfs)	580	1,300	> 536.5′ =generate@Max Q
	When Peak MFR Inflow	Weds 8/5, morning	Weds 8/5, early morning	--
	Current MFR Level (ft)	532.80	532.80	New NOL = 531.70′
	Peak MFR Level (ft)	533.26* *assumes constant generation beginning Tues 8/4 HE 16:00	535.95* *assumes constant generation beginning Tues 8/4 HE 10:00 am	Spillway Sill = 532.20′ Gate Top (Closed) = 538.70′ Gate (Open) = 548.30′ Em. Spillway crest = 543.20′
	When Peak MFR Level	Weds 8/5, afternoon	Weds 8/5, afternoon	--
	MFR Service Spillway ?	No spillage or full-gate operation if generate as recommended	No spillage or full-gate operation if generate as recommended	Fully open slide gates if water level ≥ 538.06′
	MFR Emergency Spillway ?	No spillage or tripping if generate as recommended	No spillage or tripping if generate as recommended	Trip if svc. open, WSEL rising, and ≥ 538.56′
	Current Peacham Level (ft)	709.80	709.80	Normal Pool Level = 710.25′
	Peak Peacham Level (ft)	710.25	711.44	Spillway crest = 711.70′
	When Peak Peacham Level	Thursday 8/6 afternoon	Thursday 8/6 morning	--
	Recommendation:	• Peacham valve @ 3” • Generate constantly beginning Tues HE 16:00	• Peacham valve @ 4” • Generate constantly beginning Tues HE 10:00 am	Generate at 200 cfs when over 536.50′

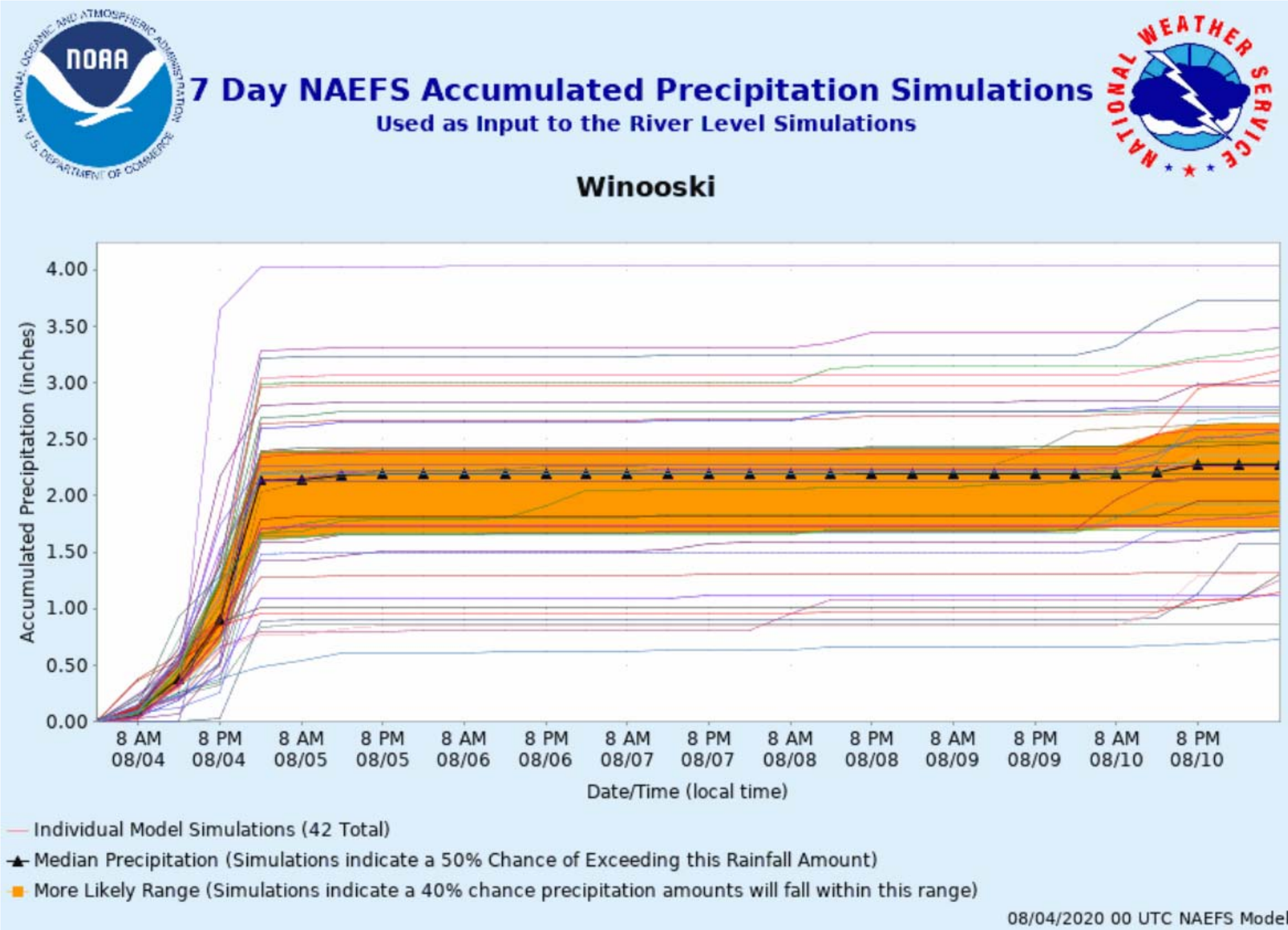
These scenarios were developed with the Winooski Watershed Hydro Forecasting Tool based on different simulations from the National Weather Service’s 10-Day HEFS and 7-Day NAEFS Ensemble River Forecasts.

1) The “more likely” range is near the median of the NWS ensemble models.

2) The "maximum flow" is based on the single highest amount of flow from any 1 of the NWS ensemble models. (This is not the standard "wet" mode in the Forecast Tool – this is a wetter scenario that was done by manually entering the worst-case flows from the NWS ensemble forecast).

All elevations are in local datum. Add 692.00′ to convert to msl NAVD 88.

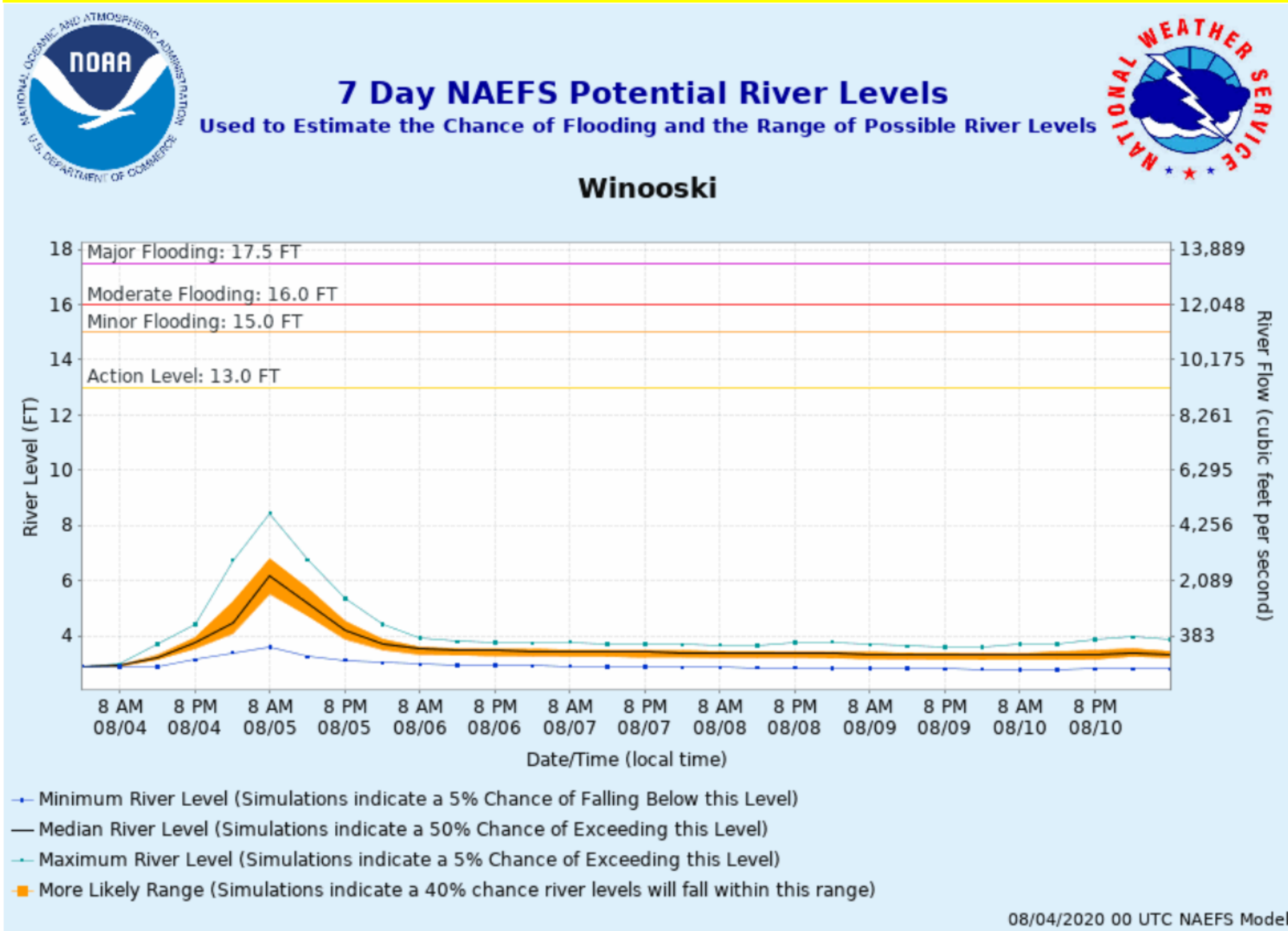
Rainfall in the upper Winooski basin is expected to occur between Tuesday morning and early morning Wednesday. Precipitation is forecast at approximately 2.25 inches in the more likely scenario, and up to approximately 4.0 inches in the maximum flow scenario.



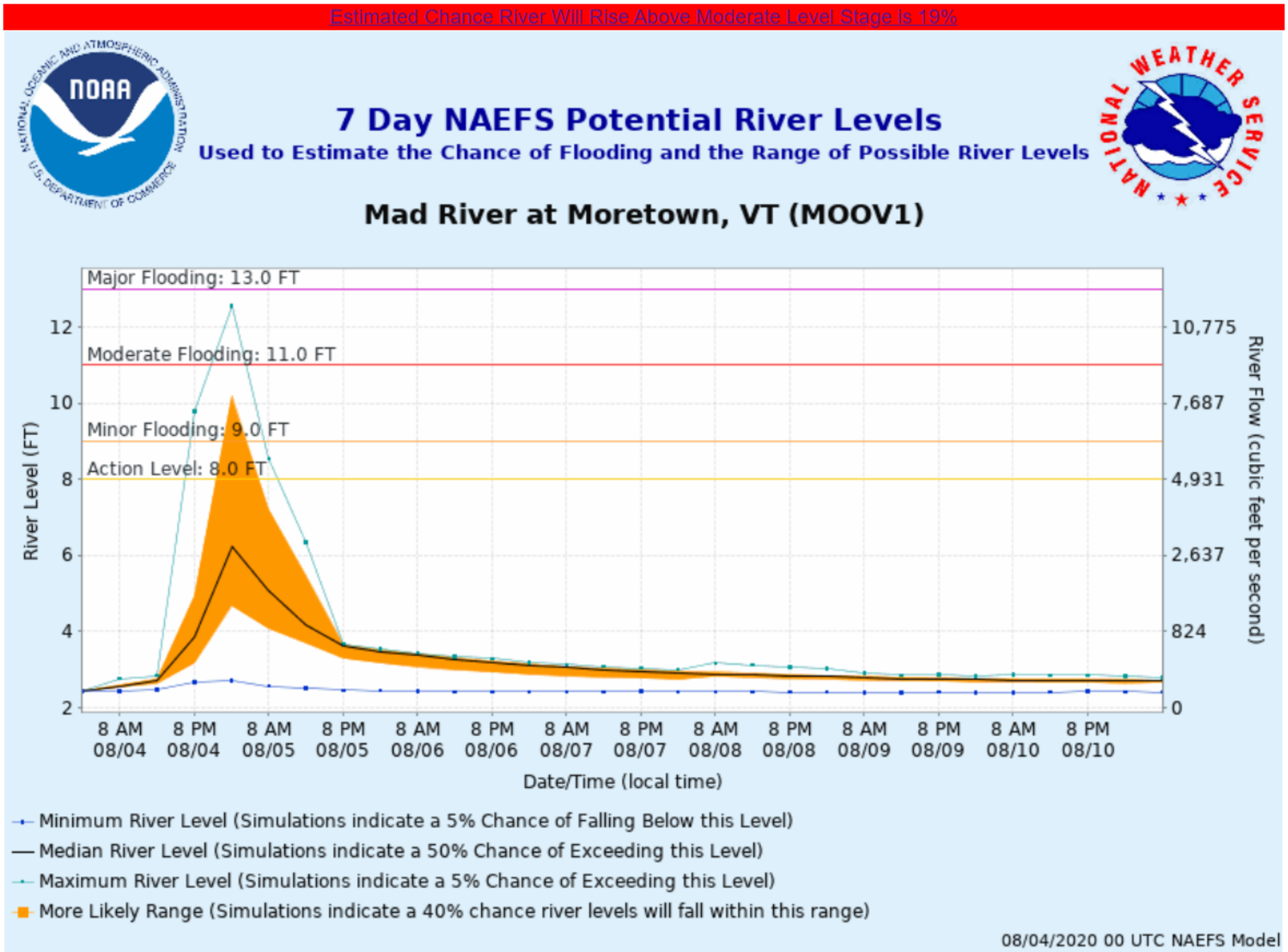
River flows in the Winooski River at Montpelier are forecast to peak around Wednesday 8/5 morning, and drop through Thursday 8/6.

At Montpelier, the river is not expected to rise to flood stage or action level. The official likely scenario indicates flows of approximately 2,600 cfs (compared to ~9,200 cfs at action level), and the highest-predicting model indicates a peak of about 4,300 cfs, below the action level.

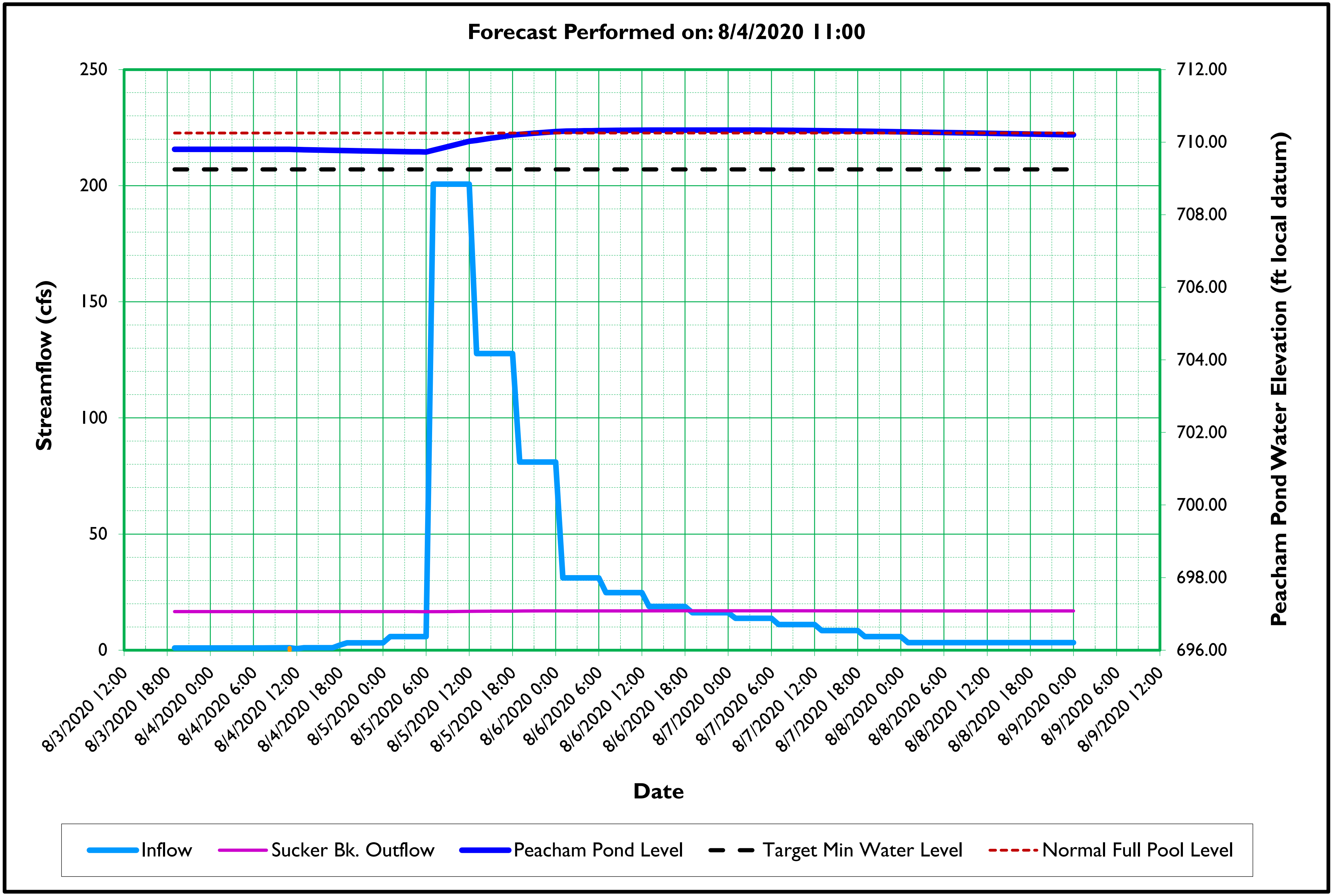
Estimated Chance River Will Rise Above Action Level is less than 10%



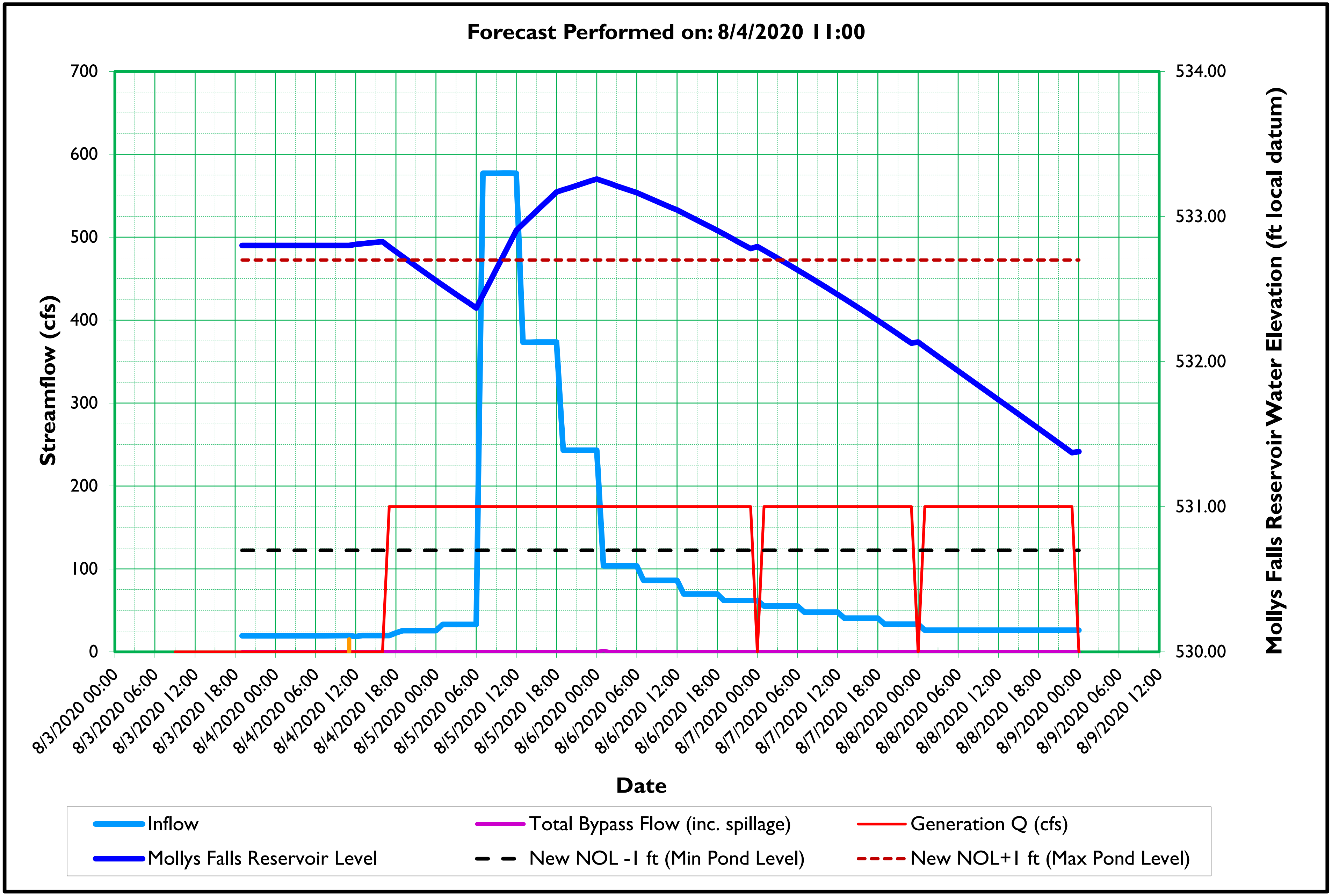
At the Mad River near Moretown USGS gauge, the official likely flow scenario predicted by the NWS models indicates peak flows are expected around Wednesday early morning. The official likely peak in the Mad River is approximately 4,810 cfs (near the action level of 4,900 cfs) while the maximum scenario is approximately 11,000 cfs (moderate flooding).



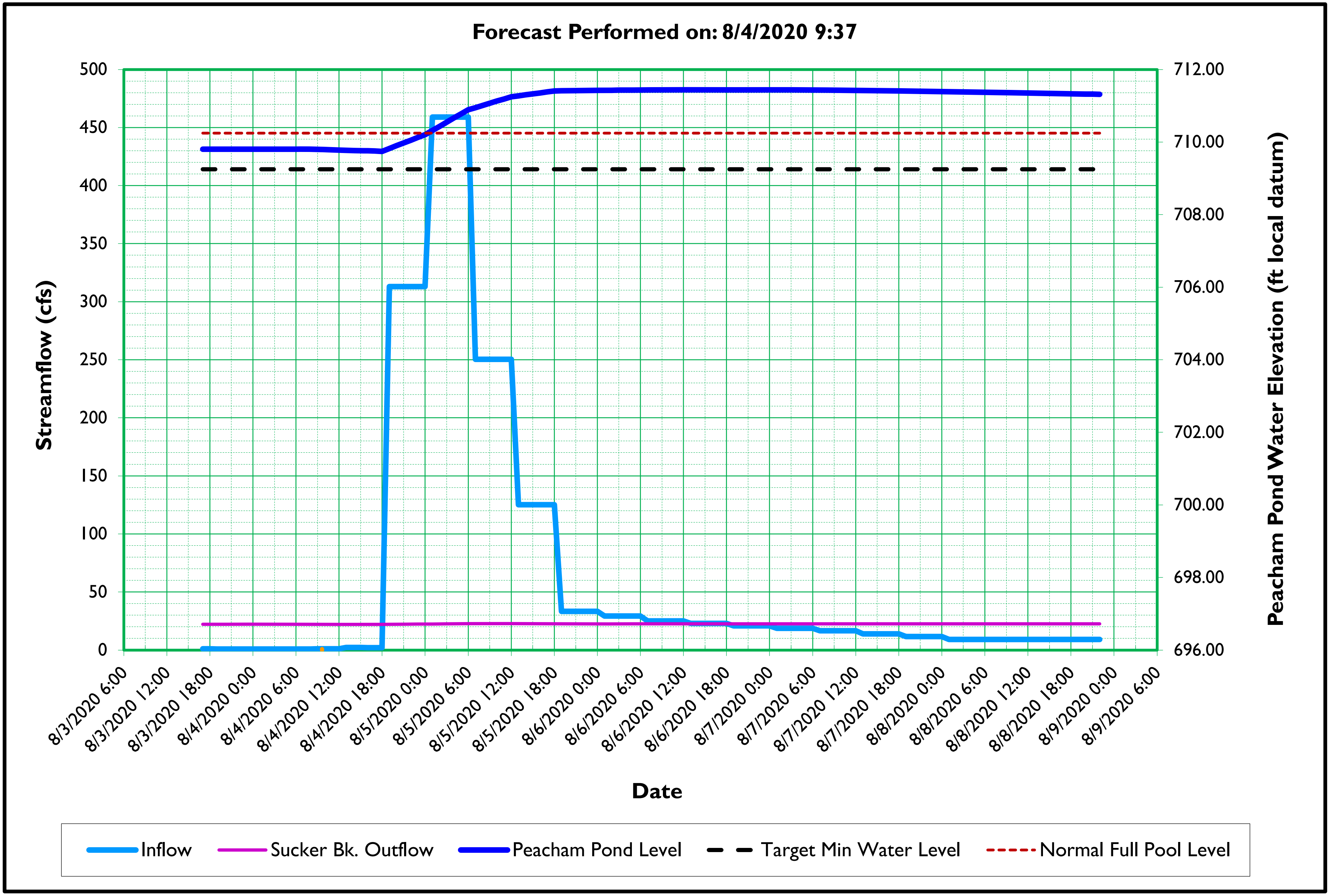
GMP - Peacham Pond More Likely Scenario



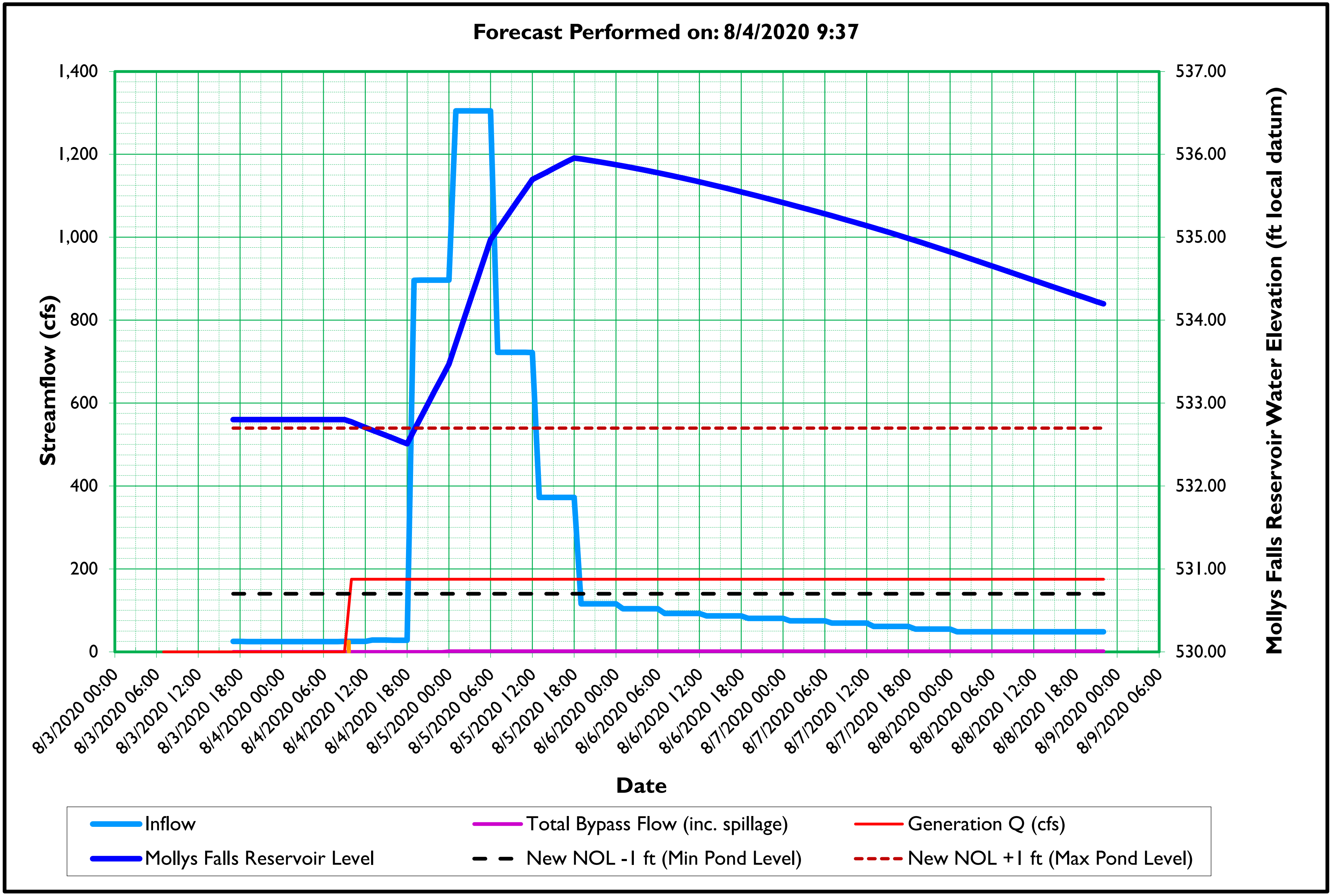
GMP - Mollys Falls Reservoir Results
More Likely Scenario



GMP - Peacham Pond
Maximum Flow Scenario



GMP - Mollys Falls Reservoir Results
Maximum Flow Scenario



APPENDIX 6

vhb

Memorandum

To:	GMP Mollys Falls Hydroelectric Station Project File	Date:	January 24, 2024
		Project #:	57646.30
From:	Meddie J. Perry	RE:	Calculation Methods: Molly's Falls Reservoir Inflow and Winooski River Flow at Powerhouse

This memorandum presents GMP's proposed methods for Molly's Falls Reservoir Inflow, and for relying on the rate of change in the water level of Molly's Falls Reservoir as a surrogate for flows in the Winooski River at the powerhouse. These methods are being proposed pursuant to the Memorandum of Understanding ("MOU") between GMP and the ANR dated August 8, 2019. The previous methodology has been updated based on ANR comments during the review of GMP's Molly's Falls Hydroelectric Facility Flow and Water Level Management and Monitoring Plan that is required by the MOU.

Specifically, section III.E of the MOU ("Winooski River Generation Flows") states "3. *Between April 1 and October 31, subject to ramping, water level, and conservation flow conditions, GMP may generate power and release generation flows to the Winooski River… i. When flow in the unregulated Winooski River exceeds 30 cfs as measured at the powerhouse. As described in Section III.H(3)(i), ANR and GMP may agree to use the rate of water level change in Mollys Falls Reservoir as a surrogate metric for the magnitude of flows in the Winooski River"*

Section III.H ("Flow and Water Level Management and Monitoring Plan") states under part 3.i *"GMP and ANR will work to understand the relationship between water levels in Mollys Falls Reservoir, generation flows, and generation run-time. In the event that GMP and ANR agree on a surrogate for the magnitude of flows in the Winooski River, the Flow and Water Level Management and Monitoring Plan shall detail the specific approach and the calculations that support the use of the surrogate."*

To develop these revised methods, GMP monitored and analyzed Mollys Falls Reservoir water levels, generation flows, and generation run-time during for the period from April 1 through October 31, 2022. The April through October period is the interval in which the MOU specifies that generation may occur if Winooski River flows at the powerhouse exceed 30 cfs (with the potential to use the change in reservoir levels to indicate the streamflows). During this evaluation, generation was used to manage water levels in the reservoir as would normally occur. The observations and the methods developed from this evaluation are discussed below.

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Building 100, Suite 200
South Burlington, VT 05403
P 802.497.6100

I. Relationship Between Water Levels, Generation Flows, and Generation Run-Time

GMP's System Command and Data Acquisition ("SCADA") computer system measures and controls generation flows and run-time. Other flows out of the reservoir, aside from generation, include leakage, spillway releases, and releases via the new bypass flow system that provides conservation flows in Mollys Brook. Flows at the spillways are calculated based on the measured reservoir water levels and standard hydraulic computations based on the geometry and elevations of the spillways. Approximately 0.8 cfs leaks through the emergency spillway when reservoir levels are above the spillway sill.

GMP's SCADA system monitors water levels in Mollys Falls Reservoir via a transducer in the gatehouse. GMP improved the sensitivity of the transducer on site during the 2021-22 winter. The transducer can now report water levels with a nominal resolution of 0.01 feet in contrast to the resolution of 0.1 feet previously. However, the sensitivity of the transducer is limited to 0.06-foot increments. The somewhat improved transducer sensitivity results in less "noise" in the inflow estimates and some improvement in the accuracy. Further upgrades in transducer equipment to achieve a true 0.01-foot sensitivity are theoretically possible, however wind and waves over the reservoir's surface area and long wind-fetch may limit the precision of such an instrument in actual practice.

The bathymetry of Mollys Falls Reservoir has been measured via depth soundings, mapped, and analyzed to determine the storage volume that corresponds with any water surface elevation. This information is presented in detail below.

With a water surface area of 377 acres at the Normal Operating Level of 531.7 feet local datum, and a watershed area of 22 square miles, slight changes in the water level of Mollys Falls Reservoir correspond to significant changes in the net volume flowing in or out. GMP's transducer reports water levels in 0.06-foot increments. During dry-weather conditions when generation is not occurring, the reservoir surface as measured by the transducer can appear constant for many hours at a time, so that no inflow (net of evaporation) is apparent. When the reservoir level eventually rises enough for the transducer to register a 0.06-foot change, the instantaneous inflow rate that is calculated based on the rate of water level change appears very large (approximately 280 cfs if no outflows are occurring at the time, with an hourly measurement interval).

Due to these sensitivity limitations of the transducer, it is necessary to analyze the change in reservoir water levels over a sufficient period of time for the changes to be measurable. Several hours at a steady water-level, followed by a 0.06-foot rise, realistically indicates a gradual and steady inflow when analyzed over an adequately-long time-period. Based on experimentation, a variable time-period of 4 to 16 hours is used for measuring the reservoir-volume changes and outflow volumes used for estimating inflow. A 4-hour period is used when inflow is above 150 cfs, an 8-hour period is used when inflow is between 75 and 150 cfs, and a 16-hour period is used when inflow is 75 cfs or less. The inflow-dependent variable time-step allows more accurate measurements of both short-duration peak flows when inflow is high and volume changes are more readily measured, and of base flow rates when the water elevation changes more gradually. This method provides realistic inflow estimates that are comparable to nearby USGS streamflow data and that are not prone to unrealistic high inflow values when a stable reservoir level occasionally rises by the minimum sensitivity of the transducer.

Evaporation from the 377-acre reservoir surface is not measured, but may be a significant component of the water balance during warm and dry weather. Estimated evaporation rates reach 2 cfs, approximately equal to 0.1 csm which is a typical 7Q10 drought flow rate in Vermont; in other words, evaporation could theoretically consume all the raw inflow to the reservoir during warm, dry weather. It is not necessary to measure evaporation because the intent is to assess run-of-river operation in which a steady reservoir level achieves an outflow that is equal to inflow minus evaporation (without knowing either the raw inflow nor the evaporation independently). All inflow rates presented in this memorandum are "net of evaporation" because they are determined based on the reservoir water levels without being parsed separately into raw inflow and evaporation.

II. Calculation Method

GMP's proposed sequence of calculations for estimating the rate of inflow to Mollys Falls Reservoir, and the unregulated Winooski River flow at the powerhouse, is outlined below.

1) Determine Molly's Falls Reservoir Volume:

Eq. 1 $$V = (372.5806787 (H) - 450038.33) * 43560$$

where,

V = volume (cubic feet)

H = reservoir water surface elevation (ft NGVD 1929); Reservoir water surface elevation is measured by GMP's SCADA system in feet (local datum); the conversion is:

Eq. 2 $$\text{local datum} + 692.14' = \text{ft NGVD 1929}$$

Detailed bathymetry maps and tables showing the relation between reservoir level, surface area, and volume are attached. Figure 1 below presents the relation between reservoir level and volume graphically.

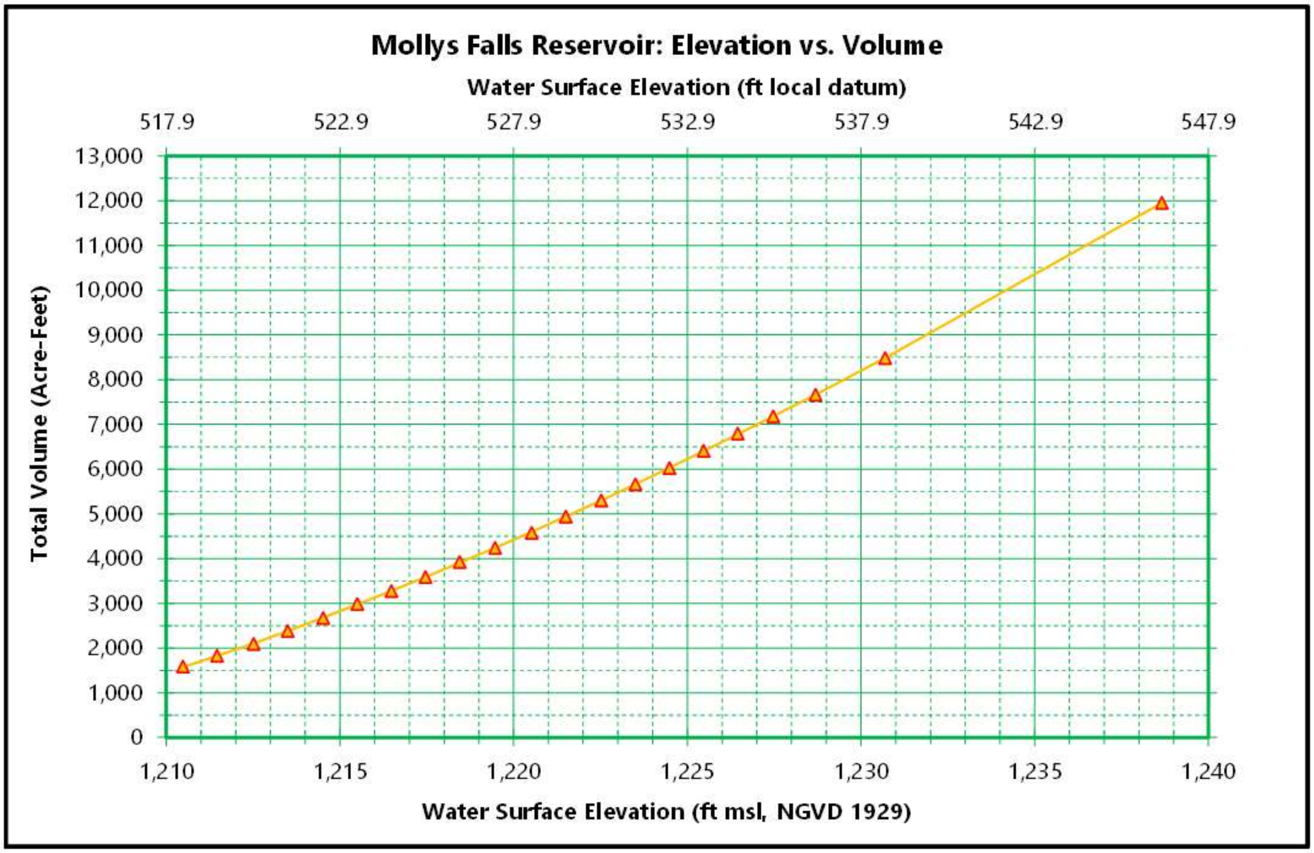


Figure 1: Mollys Falls Reservoir Elevation:Volume Curve

2) Determine Molly's Falls Reservoir Outflow:

Eq. 3 Qoutflow = Qgeneration + Qleakage + Qbypass + Qsvc_spillway + Qem_spillway

where,

Qoutflow = Mollys Falls Reservoir total outflow (cfs)
Qgeneration = flow through generating turbine (cfs)
Qleakage = emergency spillway leakage (0.8 cfs if reservoir level > 1,223.6')
Qbypass = flow through bypass flow system (cfs)
Qsvc_spillway = flow through service spillway (cfs), calculated by SCADA based on reservoir level and gate-opening position

Qem_spillway = flow through emergency spillway (cfs), calculated by SCADA based on reservoir level and stoplog position

3) Estimate Molly's Falls Reservoir Inflow:

Eq. 4 $QInflow = [(Vnow – V_t) / t * 60 \text{ minutes} * 60 \text{ seconds}] + Qoutflow_t$

where,

QInflow = Mollys Falls Reservoir total inflow (cfs)
Vnow = Reservoir volume, cubic feet (most recent reading)
t = time (hours), where
if Qinflow > 150 cfs then t = 4
if Qinflow > 75 cfs ≤150 cfs then t = 8
if Qinflow ≤ 75 cfs then t = 16
V_t = Reservoir volume, cubic feet (reading from t hours prior)
$Qoutflow_t$ = total outflow (cfs) averaged over prior t hours

4) Estimate Unregulated Winooski River Flow at the Powerhouse:

Eq. 5 QWinooski = (Qinflow) (24 sq mi) / 22 sq mi

where,

QWinooski = Winooski River flow at Powerhouse (cfs) [24 sq mi watershed]
QInflow = Mollys Falls Reservoir total inflow (cfs) [22 sq mi watershed]

III. Validation

To help assess the accuracy of the flow estimation method, USGS-gauged streamflows at the nearby USGS gauge #01135150 (Pope Brook Near North Danville, VT) were compared against the estimated inflows. Previously, the Pope Brook USGS gauge was found to have the best correlation, of any USGS-gauged stream, to the Winooski River flows upstream of the powerhouse as gauged by the ANR[1]. Figure 2 shows the correlation analysis.

[1] Source: VHB, 2016. Study Report: Green Mountain Power, Mollys Falls Hydroelectric Project. March 1, 2016.

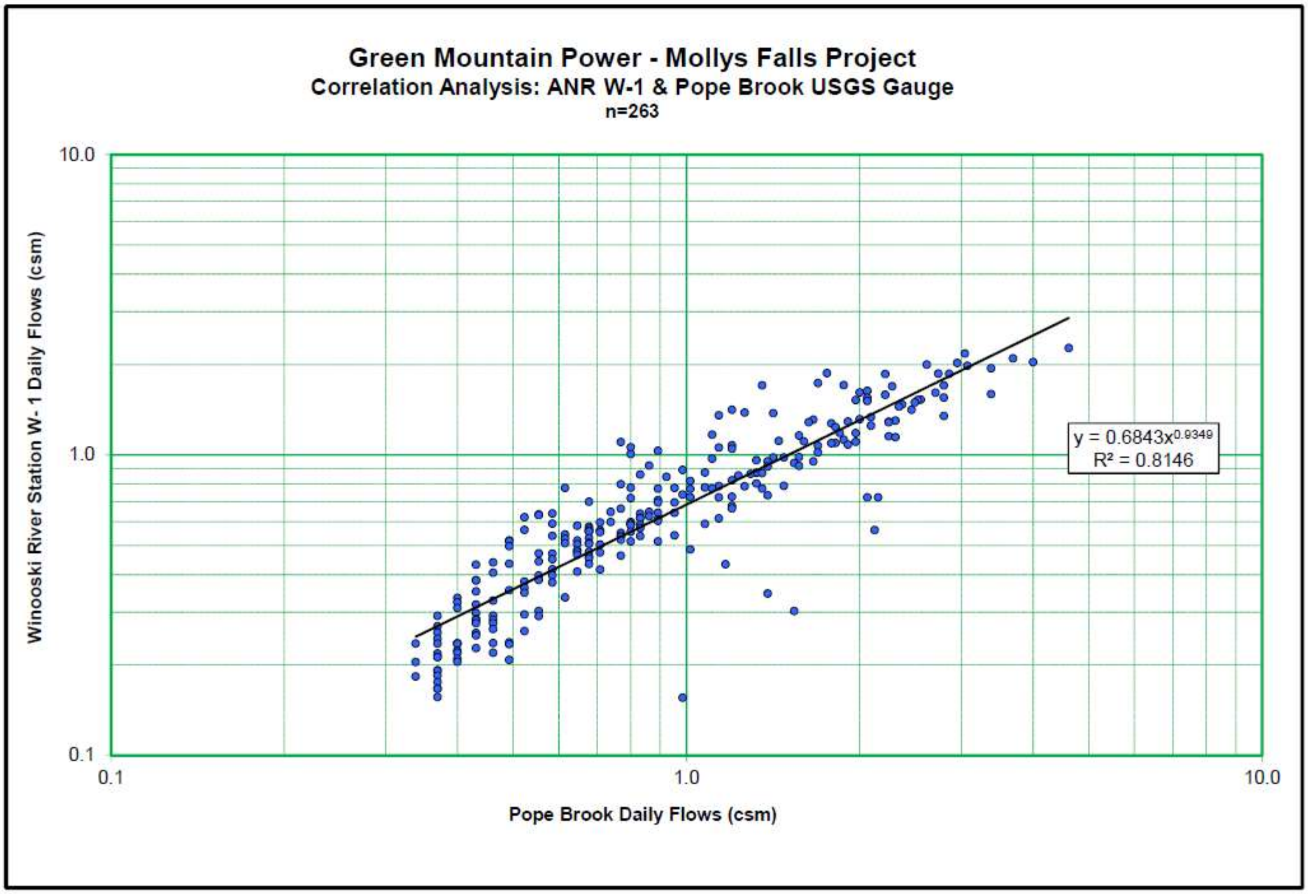


Figure 2: Correlation of Flows at Pope Brook and Winooski River at Powerhouse

The inflow-estimate-validation was performed using the previously-determined relationship between the USGS Pope Brook and Winooski River flows, as follows:

Eq. 6 $QUWinooski = (0.6843)\ (QUPope)^{0.9349}$

where,

QUWinooski = Unitized Winooski River flow at Powerhouse (csm) [24 sq mi watershed]
QUPope = Unitized Pope Brook flow (csm) [3.25 sq mi watershed]

Figures 3 and 4 below depict the Winooski River flows at the powerhouse, as estimated by both the reservoir-level change method, and the correlation with current USGS data from the Pope Brook gauge. Although there is frequent "noise" in the reservoir-level change data at lower flows, the timing and duration of events above the 30-cfs threshold is similar between the two methods.

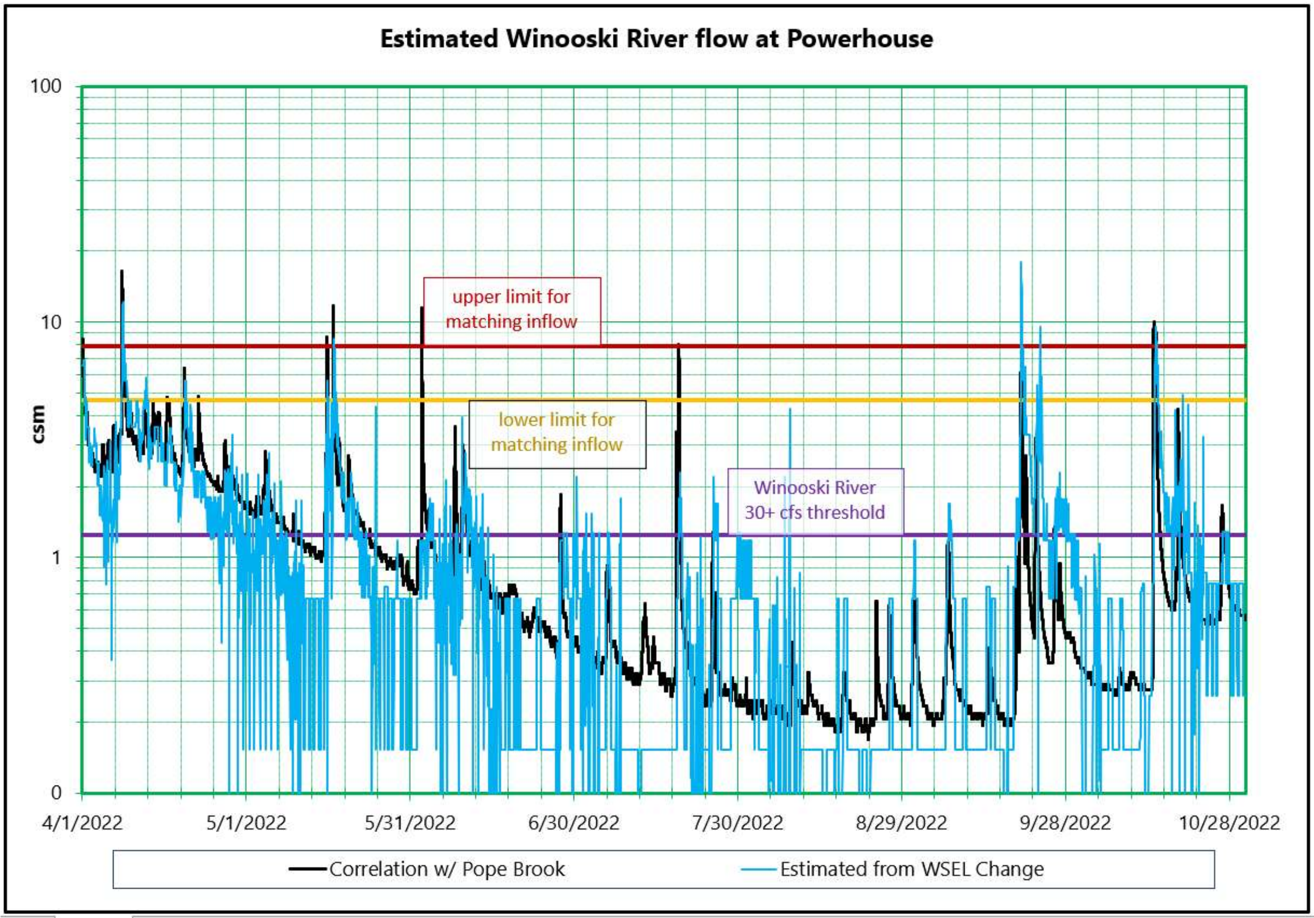


Figure 3: Hydrograph of Estimated Winooski River flow at Powerhouse Based on Molly's Falls Reservoir Water Level Change, and on Pope Brook Correlation

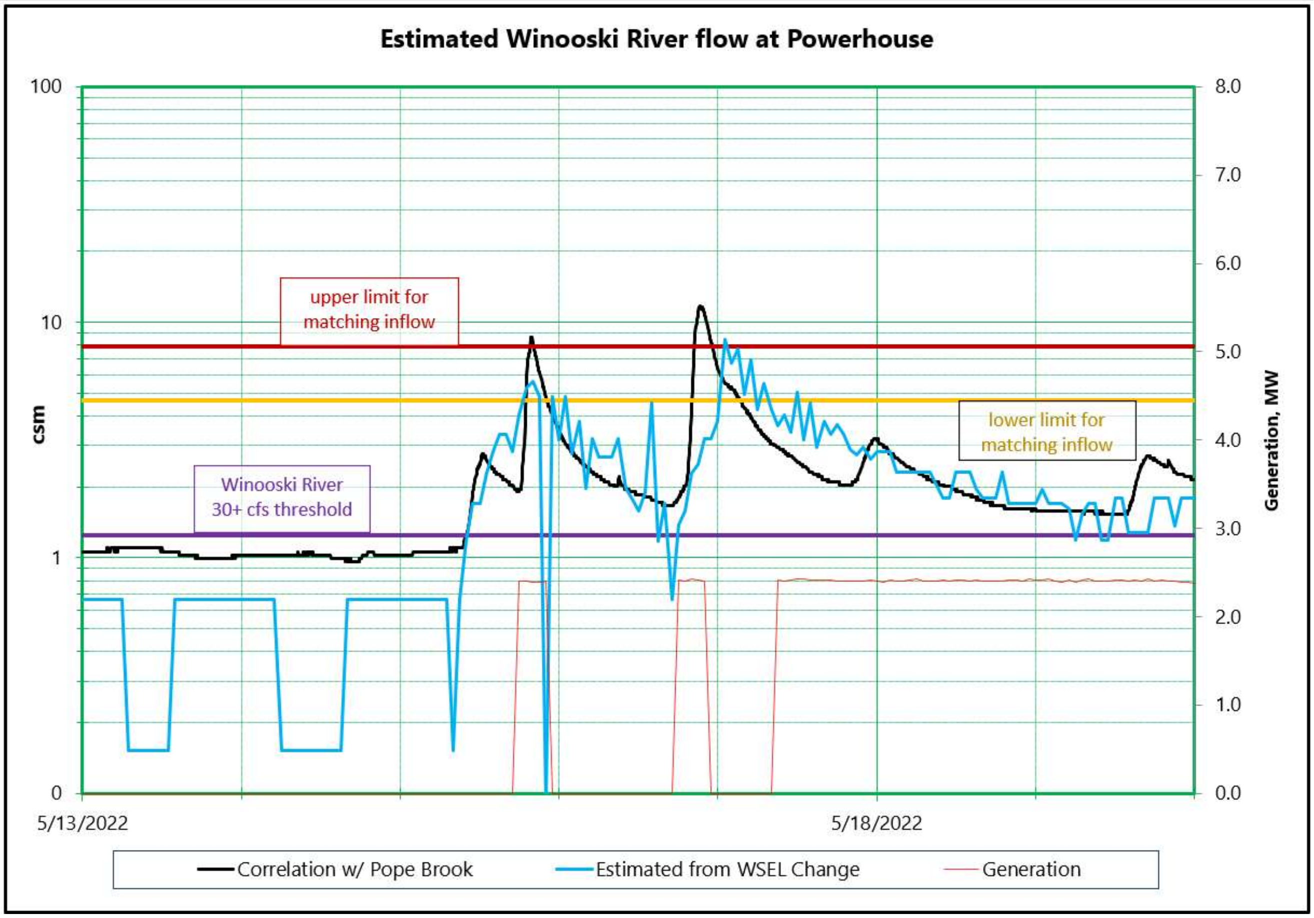


Figure 4: Estimated Flows Based on Improved Transducer Resolution - Detail

Figure 3 shows the Unitized Winooski River flow at the Powerhouse, estimated based on the rate of change of the Molly's Falls Reservoir level and measured outflows, as a light blue line. The Figure also shows the Unitized Winooski River flow at the Powerhouse, estimated based on the USGS Pope Brook flows (Eq. 6), as a black line. Figure 4 depicts a one-week portion of this data for clarity, focusing on a period of low flows followed by flows exceeding the 30-cfs threshold and then receding. The similarity in timing and magnitude of peak flow events shown by these two lines indicates the inflow estimate method is reasonably accurate. Although several lower-magnitude "spikes" are seen in the Estimated Inflow hydrograph due to the transducer periodically registering a 0.06-foot water level rise, these events do not exceed the 30-cfs threshold for allowing generation and therefore would not affect facility operations. Some other differences among the hydrographs may be due to localized storms in one watershed or the other, as is common during summer.

During this period, estimated Winooski River flow at the Powerhouse, based on Mollys Falls Reservoir level changes, exceeded 30 cfs for a total duration of 1,312 hours. Based on the Pope Brook flows, it exceeded 30 cfs for a total duration of 1,284 hours during the same period.

An alternate method of estimating Winooski River flows at the powerhouse is to use the Pope Brook USGS gauge as a surrogate, using the equation that was derived from the ANR's streamflow gauging to adjust for the relation between Pope Brook and the Winooski River:

Eq. 7 $QUWinooski = (0.6843)\,(QUPope)^{0.9349}$

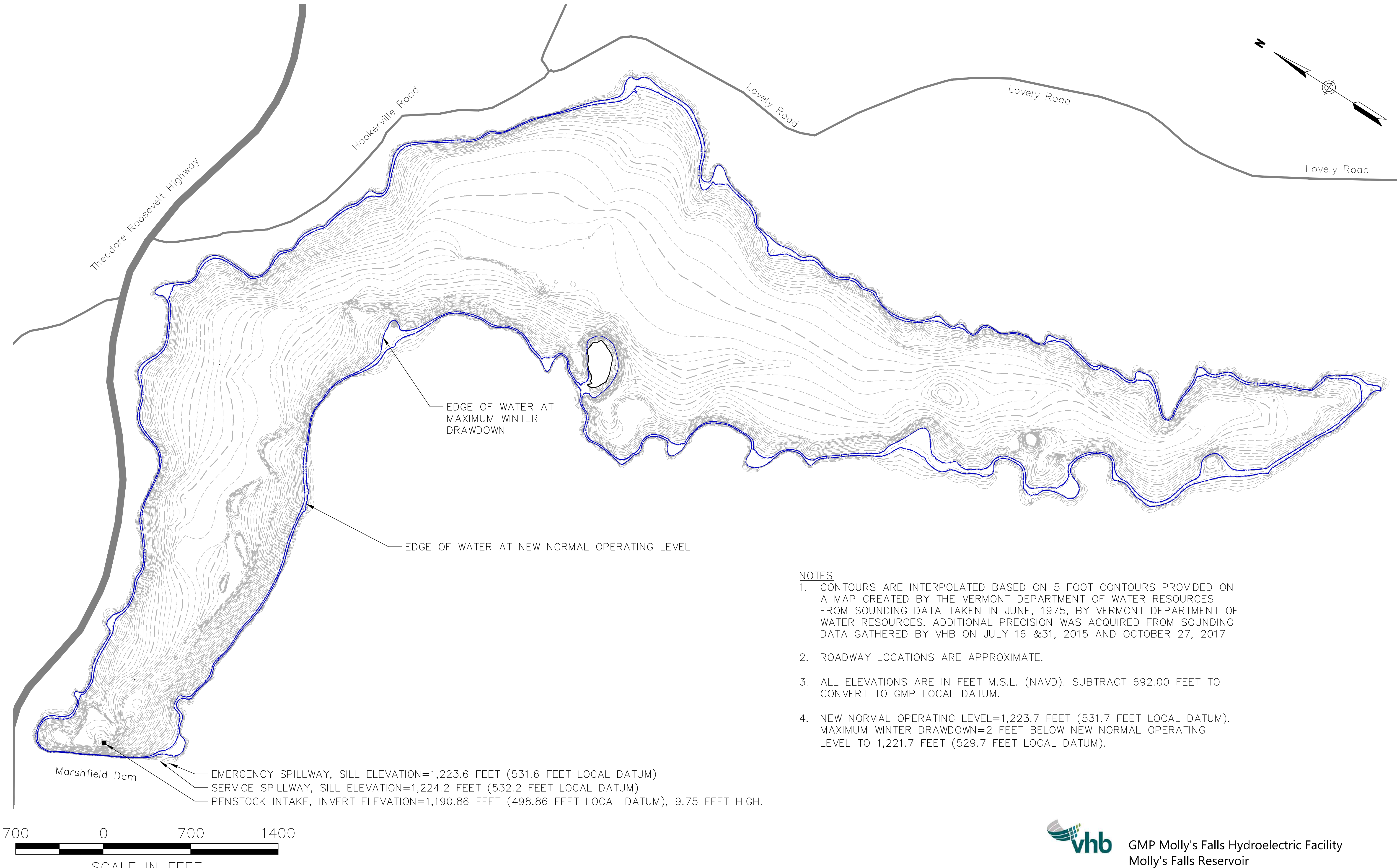
IV. Implementation Procedure

Generation at the Marshfield powerhouse will continue to be manually started and stopped by GMP's operators, normally remotely from the Control Center, or locally by the Molly's Falls Power Production Workers when needed. The SCADA system or Programmable Logic Control ("PLC") will not automatically start generation as a result of estimated Winooski River flow at the powerhouse exceeding 30 cfs, or any other factor. To determine whether to generate, GMP would consider the estimates of the unregulated Winooski River flow rates at the powerhouse in its decision-making as follows:

- In the Control Center and in the Mollys Falls Powerhouse, the Human-Machine Interface ("HMI") screens will display the reservoir water level, reservoir level setpoints, bypass valve position, generation rate, estimated reservoir inflow, and estimated Winooski River flow at the powerhouse.
- During the April-October period when the 30-cfs flow threshold is applicable, GMP staff will view the current data and recent past trends on the HMI to confirm the following prior to starting generation:
  - estimated Winooski River flow at the powerhouse exceeds 30 cfs, and
  - reservoir water levels are sufficiently above the seasonally applicable minimum to remain in compliance with MOU requirements, and
  - the applicable seasonal conservation flows are being released into Mollys Brook, and
  - estimated Winooski River flow at the powerhouse is likely to exceed 30 cfs for at least 4 hours (i.e., the recent-past inflow data trend indicates a consistent trend of stable or increasing flow above 30 cfs, and inflows >30 cfs are not the result of an anomalous SCADA reading or "spike" in the transducer data).
  - A "reality-check" confirms the estimated Winooski River flow at the powerhouse in excess of 30 cfs is most likely accurate, based on the operators' judgment and in consideration of USGS pope Brook flows, and current & forecasted weather.
- Ramping protocols are automatically implemented when generation starts and stops.

- While a generation cycle is underway, Winooski River flow at the powerhouse will continue to be estimated automatically by the PLC and displayed on the HMI. GMP operators will verify that flow remains 30 cfs or greater during generation.

ATTACHMENT



NOTES

1. CONTOURS ARE INTERPOLATED BASED ON 5 FOOT CONTOURS PROVIDED ON A MAP CREATED BY THE VERMONT DEPARTMENT OF WATER RESOURCES FROM SOUNDING DATA TAKEN IN JUNE, 1975, BY VERMONT DEPARTMENT OF WATER RESOURCES. ADDITIONAL PRECISION WAS ACQUIRED FROM SOUNDING DATA GATHERED BY VHB ON JULY 16 &31, 2015 AND OCTOBER 27, 2017

2. ROADWAY LOCATIONS ARE APPROXIMATE.

3. ALL ELEVATIONS ARE IN FEET M.S.L. (NAVD). SUBTRACT 692.00 FEET TO CONVERT TO GMP LOCAL DATUM.

4. NEW NORMAL OPERATING LEVEL=1,223.7 FEET (531.7 FEET LOCAL DATUM). MAXIMUM WINTER DRAWDOWN=2 FEET BELOW NEW NORMAL OPERATING LEVEL TO 1,221.7 FEET (529.7 FEET LOCAL DATUM).

vhb

GMP Molly's Falls Hydroelectric Facility
Molly's Falls Reservoir
Bathymetry Plan

Date: Sept. 23, 2020

GMP Marshfield - Mollys Falls Hydroelectric Facility

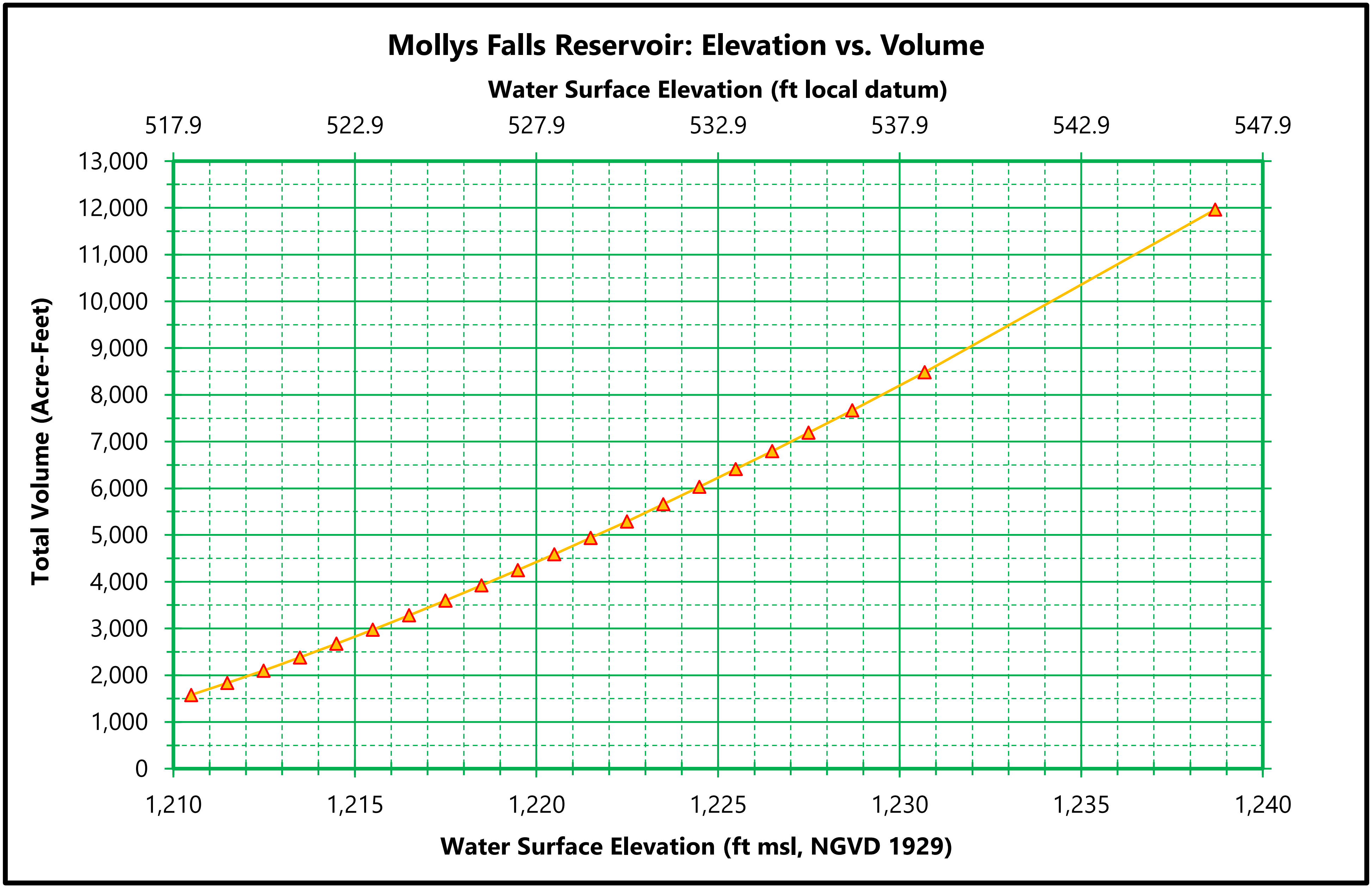
Mollys Falls Reservoir Volume and Area Data

Revised: January 18, 2018 using additional bathymetry data from October 2017

Note	Water Level			Reservoir Volume		Water Surface Area			
	Water Surface Elevation (ft local datum)	Water Surface Elevation (ft msl, NGVD 1929)	Depth Below Normal Full Pond Level (ft)	Cumulative (Ac-Ft)	Delta (Ac-Ft)	Total (Acres)	Delta (Acres)	Exposed (Acres)*	% Exposed*
	501.4	1,193.5	35.2	0	--	1.8	--	399	100%
	502.4	1,194.5	34.2	2.4	2.4	3.0	1.2	398	99%
Intake Centerline Elevation = 503.66'	503.4	1,195.5	33.2	5.9	3.5	4.0	1.0	397	99%
	504.4	1,196.5	32.2	10.6	4.7	5.4	1.4	395	99%
	505.4	1,197.5	31.2	17	6	7	1.4	394	98%
	506.4	1,198.5	30.2	31	14	21	15	379	95%
	507.4	1,199.5	29.2	58	27	32	11	368	92%
	508.4	1,200.5	28.2	95	38	43	11	358	89%
	509.4	1,201.5	27.2	144	49	54	11	347	86%
	510.4	1,202.5	26.2	204	60	65	11	335	84%
	511.4	1,203.5	25.2	286	82	98	33	303	76%
	512.4	1,204.5	24.2	397	111	124	26	277	69%
	513.4	1,205.5	23.2	533	136	149	25	252	63%
	514.4	1,206.5	22.2	695	162	174	25	226	56%
	515.4	1,207.5	21.2	883	189	203	28	198	49%
	516.4	1,208.5	20.2	1,098	215	228	25	173	43%
	517.4	1,209.5	19.2	1,332	233	239	11	162	40%
	518.4	1,210.5	18.2	1,576	244	250	11	151	38%
	519.4	1,211.5	17.2	1,832	256	262	12	139	35%
	520.4	1,212.5	16.2	2,100	268	274	13	127	32%
	521.4	1,213.5	15.2	2,381	282	289	15	112	28%
	522.4	1,214.5	14.2	2,674	293	297	7.6	104	26%
	523.4	1,215.5	13.2	2,975	301	304	7.3	97	24%
	524.4	1,216.5	12.2	3,283	308	312	7.4	89	22%
	525.4	1,217.5	11.2	3,598	315	319	7.5	82	20%
5.8-Ft Winter Drawdown = 525.9'	526.4	1,218.5	10.2	3,921	323	327	8	74	19%
	527.4	1,219.5	9.2	4,252	331	334	7.8	66	17%
	528.4	1,220.5	8.2	4,590	339	343	8.1	58	15%
	529.4	1,221.5	7.2	4,937	347	351	8.4	50	12%
Default Winter Drawdown = 529.7' (2.0 ft)	530.4	1,222.5	6.2	5,292	355	360	8.9	41	10%
	531.4	1,223.5	5.2	5,658	365	371	11.2	30	7%
New NOL = 531.7' Spillway Sill = 532.2'	532.4	1,224.5	4.2	6,032	374	377	6.1	24	6%
	533.4	1,225.5	3.2	6,412	380	383	5.8	18	4%
	534.4	1,226.5	2.2	6,798	386	389	5.8	12	3%
	535.4	1,227.5	1.2	7,190	392	395	5.8	6	2%
	536.6	1,228.7	0.0	7,667	477	401	6.3	0	0%
	538.6	1,230.7	-2.0	8,480	813	412	12	--	--
1.8 Ft Freeboard (crest el = 548.4')	546.6	1,238.7	-10.0	11,964	3,484	459	46	--	--

* "Exposed" refers to the area of the reservoir bottom that is normally below the full pool level, that is exposed during drawdown.

Conversion from local datum to NGVD = 621.14 ft


Mollys Falls Reservoir: Elevation vs. Volume
Water Surface Elevation (ft local datum)
517.9
522.9
527.9
532.9
537.9
542.9
547.9
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Total Volume (Acre-Feet)
1,210
1,215
1,220
1,225
1,230
1,235
1,240
Water Surface Elevation (ft msl, NGVD 1929)

ATTACHMENT C

DISSOLVED OXYGEN MONITORING PLAN

GMP Molly's Falls Hydroelectric Facility- Dissolved Oxygen Monitoring Plan

PREPARED FOR

Green Mountain Power
163 Acorn Lane
Colchester, VT 05446

PREPARED BY

vhb

40 IDX Drive, Building 100, Suite 200
South Burlington, VT 05403

February 2024

Table of Contents

List of Tables

1

Introduction

On behalf of Green Mountain Power Corporation ("GMP"), Vanasse Hangen Brustlin ("VHB") has prepared this Dissolved Oxygen ("DO") Monitoring Plan pursuant to the Public Utility Commission ("PUC") Final Order Granting 10 V.S.A. Chapter 43 Authorization for Improvements at the Molly's Falls Hydroelectric Facility ("Order") dated March 27, 2020, and pursuant to the Memorandum of Understanding Between Green Mountain Power Corporation and the Vermont Agency of Natural Resources dated August 8, 2019 ("MOU").

The Molly's Falls Hydroelectric Facility ("Facility") impounds water in Peacham Pond, which flows through Sucker Brook into Molly's Falls Reservoir, where flow is also impounded. From Molly's Falls Reservoir, a portion of the stored water flows intermittently through a penstock to the powerhouse on Power Plant Road where it is discharged into the Winooski River during periods of renewable energy generation. A bypass flow system has been constructed to release conservation flows from Molly's Falls Reservoir into Molly's Brook. Additionally, water from Molly's Falls Reservoir may be released at times through the service and emergency spillways that lead to Molly's Brook. The DO Study Site Location Map on page 1 of the Appendix shows the locations of the project components and associated waters.

VHB previously studied the effects that the Facility had on DO in Molly's Brook, Sucker Brook, and the Winooski River in 2015. The study (VHB, 2016) concluded that DO in the Winooski River downstream of the Facility dropped at times below the water quality criteria that were established at the time by the Vermont Water Quality Standards ("VWQS", 2014). Additionally, DO in a portion of Molly's Brook dropped at times below the VWQS criteria, but it was determined that the decrease in DO was likely caused by beaver activity and not the Facility because DO in Molly's Brook met the VWQS criteria at the two monitoring stations directly downstream of the reservoir whereas the low-DO reach was further downstream, below a beaver dam complex.

GMP has completed both physical and operational changes at the Facility that are expected to affect DO concentrations in Molly's Brook and the Winooski River. The new bypass flow system, which began operation in November 2021, releases additional water into Molly's Brook from the reservoir in order to meet new conservation flow requirements (8.5 cfs July through March, 12.0 cfs April through June, or inflow into the reservoir if less at any time). Potentially, water in the bypass pipe will have low DO concentrations because the intake is approximately 30 feet below the water surface, where low-DO water accumulates when the reservoir stratifies during summer. However, water released from the bypass pipe will be aerated by turbulent flow over rip-rap before reaching the Brook.

GMP also installed an aeration system at the powerhouse in February 2022 to add oxygen to water from the turbine before it is released to the Winooski River. GMP is changing its generation operations pursuant to the MOU, so that the frequency and magnitude of generation cycles will be reduced, timing of generation will be changed to align more with natural higher-flow events, and generation flows will be gradually ramped-up and down.

This monitoring plan is being proposed to confirm that DO conforms with the current VWQS (2022) criteria after the physical and operational changes described above have been implemented.

The Winooski River and Molly's Brook are classified by the state of Vermont as Class B2 for all designated uses and are classified as cold water fish habitat. For cold water fish habitat, Section 29A-302(5)(A) of the VWQS establishes the DO criteria as the following instantaneous minimum values:

i. In waters that the Secretary determines are salmonid spawning or nursery areas important to the establishment or maintenance of the fishery resource, not less than 7 milligrams per liter (mg/l) and 75% saturation at all times, nor less than 95% saturation during late egg maturation and larval development of salmonids.

ii. All Other Waters. Not less than 6 mg/l and 70% saturation at all times.

2

Methodology

2.1 Parameters and Locations

Monitoring for DO will occur in the Winooski River, Molly's Brook, and Molly's Falls Reservoir. Water temperature will also be measured to determine the percent DO saturation. For consistency, proposed monitoring locations will match the applicable stations previously studied during the 2015 VHB DO study. These locations are described in more detail in Section 3.1 below. Depth-profiles for DO and water temperature will be collected in Molly's Falls Reservoir. Additionally, streamflow in the Winooski River will be determined for station W-1 immediately above the powerhouse, generation flows will be recorded, and bypass flow rates into Molly's Brook will be documented.

2.2 Equipment Specifications

DO and water temperature depth-profiles in Molly's Falls Reservoir will be performed using a handheld YSI 550A DO and temperature probe suspended on cables that are demarked in feet and tenths (refer to Table 1 for instrument specifications). Profiles will be performed from a boat.

DO and temperature data at the proposed monitoring stations in Molly's Brook and the Winooski River will be measured by computerized HOBO® Dissolved Oxygen Loggers (refer to Table 2 for instrument specifications). The dataloggers measure DO in milligrams per liter ("mg/L") and temperature in degrees Celsius. DO percent saturation will be computed based on the DO and water temperature readings. These devices are intended for in-situ installation in streams and rivers, and are able to collect accurate data over the duration of the monitoring.

2.3 Equipment Setup and Installation

All dataloggers will be secured inside perforated PVC sounding tubes to protect the dataloggers while allowing water to flow past them. All locations are wadeable, so the sounding tubes will be attached to temporary anchors to be placed on the river bed. Prior to installation, dataloggers will be calibrated to 100% saturation and 0% saturation as described in the User Manual included on pages 2 to 7 of the Appendix.

The handheld YSI 550A will be rented from Geotech Environmental Equipment, Inc. ("Geotech"), or similar environmental equipment provider, for use during field visits. This equipment will be pre-calibration by Geotech prior to use.

2.4 Download and Recording Frequency

DO and water temperature measurements will be recorded at all Molly's Brook and Winooski River monitoring locations by dataloggers at a frequency of 15-minute intervals. Datalogger data will be downloaded by GMP on a bi-weekly basis throughout the monitoring period to confirm proper functioning of the dataloggers.

Vertical DO and temperature profiles within Molly's Falls Reservoir will be measured each time that the dataloggers will be downloaded (bi-weekly).

2.5 Data Analysis

The DO and water temperature datalogger data will be analyzed to evaluate the Facility's impacts to DO concentrations and percent saturation in Molly's Brook and the Winooski River, and to determine whether the DO conditions comply with the VWQS (2022) criteria. Graphical comparisons of data at all stations compared to the applicable criteria of the VWQS will be used to present data and to determine compliance with the VWQS. Additionally, generation data from the Facility will be graphed to determine any effects that releasing water to the Winooski River may have on DO concentrations and percent saturation.

2.6 Quality Assurance and Quality Control Procedures

2.6.1 Instrument/Equipment Calibration

Professional scientific-grade DO and temperature dataloggers will be used for collecting field measurements during the monitoring. Calibration of the meters used for field measurements will be performed in accordance with manufacturer's specifications as presented in the operations manual for the instrument and documented in the field notes. The dataloggers will be calibrated to 100% saturation and 0% saturation prior to installation, and the handheld probes will be calibrated to 100% saturation and 0% saturation prior to each day of use. To calibrate to 100% saturation, the sensor will be placed in the included calibration boot with a wet sponge for 15 to 30 minutes until reaching temperature equilibrium. To calibrate to 0% saturation, the sensor will be placed in a sodium sulfite solution for 15 to 30 minutes until reaching temperature equilibrium. The DO sensors for the dataloggers will be replaced and recalibrated every 6 months, if deployed for that length of time.

2.6.2 Data Management

Field notes will be digitally scanned from the field notebook(s) and stored in the electronic project file after the completion of each site visit. Monitoring data will be collected by computerized dataloggers. All monitoring data will be entered into a spreadsheet maintained for the Project. The data within the spreadsheet will be checked against original field data to ensure accuracy by a person uninvolved in the sampling and data entry.

2.6.3 Data Validation and Usability

Upon inspection of the field-collected data, the data will be accepted unless there is a noted occurrence of field instrumentation malfunction. These conditions will be clearly noted within the field data collection notes.

To assure that accurate data are presented and analyzed, independent staff who were not involved in the data collection or analysis will cross-check all data, graphs, and calculations, and a senior scientist will review a draft report.

All data that are validated using the methods described above will be considered to be suitable for use in meeting the objectives of this monitoring program.

2.6.4 Representative Conditions

For Molly's Brook, a low-streamflow goal is not applicable because the bypass pipe is expected to be releasing the required bypass flows of 12.0 cfs during June, and 8.5 cfs from July through September, or inflow if less, during the study.

For the Winooski River, the impact of operations is from the release of water from the Molly's Falls Reservoir that is low in dissolved oxygen into the Winooski River. Therefore, the focus of the dissolved oxygen monitoring will be on generation flows that occur at the Facility under the operational changes agreed to in the 2019 MOU. Critical conditions are likely to occur during generation events when the reservoir is stratified. As noted above, depth-profiles for DO and water temperature will be collected in Molly's Falls Reservoir bi-weekly (each time that the stream/river dataloggers will be downloaded).

3

Monitoring Locations

Monitoring stations are shown on the DO Study Site Location Map on page 1 of the Appendix and are described below in Sections 3.1, 3.2, and 3.3.

3.1 Winooski River Monitoring Locations

The dataloggers will be installed at two stations in the Winooski River. The first station, designated W-1, will be located upstream of the GMP powerhouse that is located on Power Plant Road. The second station, designated W-2, will be located across from McCrillis Road, which is downstream of the GMP powerhouse and downstream of the confluence with Molly's Brook. These locations will be the same as the W-1 and W-2 stations monitored during the 2015 study.

3.2 Molly's Brook Monitoring Locations

The dataloggers will be installed at two stations in Molly's Brook. The first station, designated MB-1, will be located immediately downstream of the spillway and bypass pipe from Molly's Falls Reservoir. The second station, designated MB-2, will be located further downstream, near the Porter Road culvert. These locations will be the same as the MB-1 and MB-2 stations monitored during the 2015 study.

3.3 Molly's Falls Reservoir Monitoring Location

Depth-profiles in Molly's Falls Reservoir will be measured from the water surface down to the depth of the intake, which will be the source of water released at the powerhouse to the Winooski River and from the bypass pipe to Molly's Brook. A boat will be used to reach the monitoring location and a portable GPS unit will be used to navigate to the location of the intake. The reservoir bottom is approximately 33 feet below the elevation of the spillway sills at this location, and the depth to the reservoir bottom will be checked to confirm that the depth-profile is being taken in the location that is representative of water entering the intake.

4

Schedule

4.1 Monitoring Schedule

Monitoring is proposed to occur during summer, to measure conditions for DO and water temperature when flows are typically lowest and water temperatures are warmest, and when the reservoir is most likely to be stratified, for conservative conditions.

Monitoring would take place during the first summer that occurs following 1) PUC approval of this DO Monitoring Plan and 2) completion of Project construction, including the bypass pipe and powerhouse aeration system. Project construction was completed during 2023, and GMP anticipates PUC approval of this Plan in early 2024; therefore monitoring is expected to begin during the summer of 2024. Water quality monitoring will occur from no later than June 1 through at least September 30. Depending on river flows, equipment may be installed several weeks prior to June 1 in order to complete installation when flows are low enough, to ensure that possible high flows close to June 1 do not prevent timely installation.

No further monitoring is proposed unless the monitoring results show that water quality does not meet the VWQS due to Facility operations. If that is the case, then GMP would make additional improvements and would monitor the locations that did not meet the VWQS, during the following summer(s) until the VWQS are met.

4.2 Reporting Schedule

GMP will produce a report detailing the findings of the water quality monitoring, by December 31 of the year the monitoring is conducted,. This report will be submitted to the Vermont Agency of Natural Resources ("ANR") and the PUC.

5

Reporting

A Monitoring Report will be produced which will present the data and analyses from the monitoring and will evaluate Facility compliance with the VWQS criteria for DO. The report will assess whether the Winooski River and Molly's Brook DO conforms with the VWQS downstream of the powerhouse and bypass pipe after the proposed physical and operational changes to the Facility are in effect. The report will present the DO measurements, generation rates, bypass flow rates, and estimated Winooski River Flows at the powerhouse. At a minimum, data will be presented in tabular and graphical formats as follows:

- Tabulated depth-profile results from Molly's Falls Reservoir, for each date of measurement.
- Graphical depth-profile results from Molly's Falls Reservoir, depicting each date of measurement.
- Time-series tabulations of all 15-minute increment measurements at each monitoring station (DO as mg/L and percent saturation; and estimated Winooski River flow and Facility generation rates, or bypass flow rates for Winooski River or Molly's Brook stations, respectively);
- Tabulated daily minimum, mean, and maximum values at each monitoring station (DO as mg/L and percent saturation; estimated Winooski River flow; Facility generation rates; and bypass flow rates);
- One graph for each Winooski River monitoring station of all measurements of DO (mg/L), estimated Winooski River flow (cfs), and Facility generation rates; indicating the VWQS DO criteria;
- One graph for each Molly's Brook monitoring station of all measurements of DO (mg/L) and bypass flow rates (cfs); indicating the VWQS DO criteria;
- One graph comparing DO across all Winooski River monitoring stations as mg/L, indicating the VWQS DO criteria and depicting estimated Winooski River flow; and Facility generation rates;
- One graph comparing DO across all Winooski River monitoring stations as percent saturation, indicating the VWQS DO criteria and depicting estimated Winooski River flow; and Facility generation rates;
- One graph comparing DO across all Molly's Brook monitoring stations as mg/L, indicating the VWQS DO criteria and depicting bypass flow rates;
- One graph comparing DO across all Molly's Brook monitoring stations as percent saturation, indicating the VWQS DO criteria and depicting bypass flow rates;

- One summary table comparing the minimum, mean, and maximum DO (mg/L), DO (percent saturation), across all locations, with comparison to the VWQS criteria;
- Tabulated 15-minute increment data to be provided to ANR in Excel format.

9 Reporting

Table 1 YSI 550A Handheld Dissolved Oxygen Meter Equipment Specifications

Parameter	Range	Accuracy	Resolution
Dissolved Oxygen	› 0 to 50 mg/L	0-20 mg/L: ± 0.3 mg/L 20-50 mg/L: 6% of reading	0.01 mg/L
Temperature	› -5 to 45 °C	± 0.3 °C	0.1 °C

Table 2 HOBO U26 Dissolved Oxygen Datalogger Equipment Specifications

Parameter	Range	Accuracy	Resolution
Dissolved Oxygen	› 0 to 30 mg/L	0-8 mg/L: ± 0.2 mg/L 8-30 mg/L: ± 0.5 mg/L	0.02 mg/L
Temperature	› -5 to 40 °C	± 0.2 °C	0.02 °C

10 Reporting

References

Vermont Agency of Natural Resources, Department of Environmental Conservation, 2014. Vermont Water Quality Standards, Environmental Protection Rule Chapter 29A. Effective October 30, 2014.

Vermont Agency of Natural Resources, Department of Environmental Conservation, 2022. Vermont Water Quality Standards, Environmental Protection Rule Chapter 29A. Effective November 15, 2022.

Vermont Agency of Natural Resources and Green Mountain Power, 2019. Memorandum of Understanding Between Green Mountain Power Corporation and the Vermont Agency of Natural Resources. Application of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 for authorization to make changes to the Molly's Falls Hydroelectric Facility in Cabot, Marshfield, and Peacham, Vermont, Case No. 18-2549-PET. August 8, 2019.

Vermont Public Utility Commission, 2020. Final Order Granting 10 V.S.A. Chapter 43 Authorization for Improvements at the Molly's Falls Hydroelectric Facility. Case No. 18-2549-PET, Petition of Green Mountain Power Corporation under 10 V.S.A. Chapter 43 for authorization to make changes to the Molly's Falls Hydroelectric Facility in Cabot, Marshfield, and Peacham, Vermont. Order entered 03/27/2020.

VHB, 2016. Study Report: Green Mountain Power, Mollys Falls Hydroelectric Project. March 1, 2016.

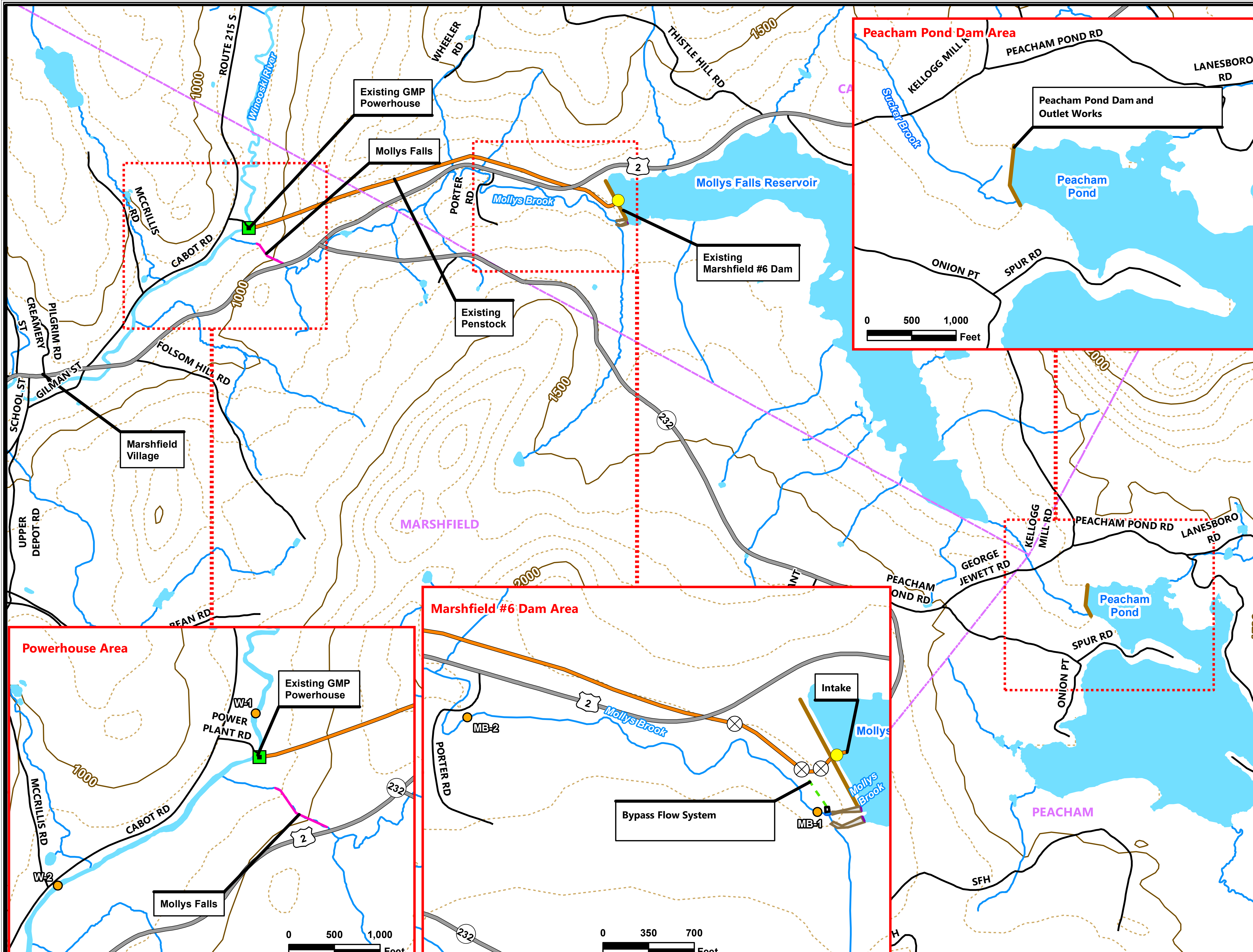
VHB, 2024. Green Mountain Power, Molly's Falls Hydroelectric Facility: Flow and Water Level Management and Monitoring Plan. February 2024.

Appendix

1

Green Mountain Power Corporation
Molly's Falls Hydroelectric Facility
Marshfield, Cabot, & Peacham VT
DO Study Site Location Map

January 31, 2024



N
W E
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1,000 0 1,000 2,000 Feet

Legend

- DO Monitoring Station
- Stream (VHD)
- Waterbody (VHD)
- Valve
- Existing Penstock
- Dam
- Local Road
- Interstate Hwy
- US Hwy
- State Hwy
- Town Boundary
- 500 ft. Contour
- 100 ft. Contour

vhb

Sources: VHD Streams and Waterbodies from VCGI (2013); Roads by VTrans (VCGI 2015); Powerhouse, Dam, Penstock, Gatehouse, Intake, Spillways, Stoplogs, and Tailrace locations digitized by VHB (2014); Town Boundaries from VCGI (2013). Project Upgrades by Kleinschmidt (2018), digitized by VHB (2018).

\\vhb\gis\proj\SBurlington\57646.30 GMP Mollys Falls Hydro\gis\Project\DO_Study_Location_Map.mxd Exported on 9/22/2020

HOBO® Dissolved Oxygen Logger (U26-001) Manual

HOBO Dissolved Oxygen Logger with Included Calibration Boot and Sponge (Shown Wet in Photo)

HOBO Dissolved Oxygen Logger

U26-001

Included Items:

- Dissolved Oxygen Sensor Cap
- Protective Guard
- Calibration Boot and Sponge

Required Items:

- Coupler (COUPLER-2-C) with USB Optic Base Station (BASE-U-4) *or* HOBO Waterproof Shuttle (U-DTW-1)
- HOBOware Pro 3.3.1 or later

Accessories:

- Replacement Dissolved Oxygen Sensor Cap (U26-RDOB-1)
- Anti-Fouling Guard (U26-GUARD-2)
- Sodium Sulfite (U26-CAL-SOL)

You May Also Need:

- For salt water, salinity or conductivity measurements are required; HOBO Conductivity/Salinity Logger (U24-002-C) recommended
- For percent saturation, barometric pressure is required; HOBO Water Level Logger (U20-001-0x or U20L-0x) recommended

The HOBO Dissolved Oxygen logger is a standalone logger that uses RDO® Basic Technology to measure dissolved oxygen (DO). The logger has an optical sensor that provides 0.2 mg/L accuracy. The logger also features an easily replaceable sensor cap and an integrated temperature sensor. Using HOBOware® software for logger setup and a HOBO Waterproof Shuttle for quick data offload, this logger is easy to deploy in both freshwater and saltwater environments making it an ideal tool for environmental impact studies as well as ecological and oceanographic research. Using the data offloaded from the logger, the HOBOware Dissolved Oxygen Assistant can calculate percent saturation and salinity-adjusted DO concentration as well as correct for measurement drift from fouling (additional meter or logger measurements required).

Specifications

Dissolved Oxygen

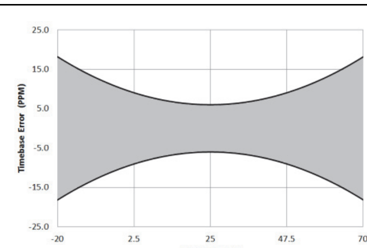
Sensor Type	Optical (dynamic luminescence quenching)
Measurement Range	0 to 30 mg/L
Calibrated Range	0 to 20 mg/L; 0 to 35°C (32 to 95°F)
Accuracy	±0.2 mg/L up to 8 mg/L; ±0.5 mg/L from 8 to 20 mg/L
Resolution	0.02 mg/L
Response Time	To 90% in less than 2 minutes
DO Sensor Cap Life	6 months (cap expires 7 months after initialization)

Temperature

Temperature Measurement/ Operating Range	-5 to 40°C (23 to 104°F), non-freezing
Temperature Accuracy	0.2°C (0.36°F)
Temperature Resolution	0.02°C (0.04°F)
Response Time	To 90% in less than 30 minutes

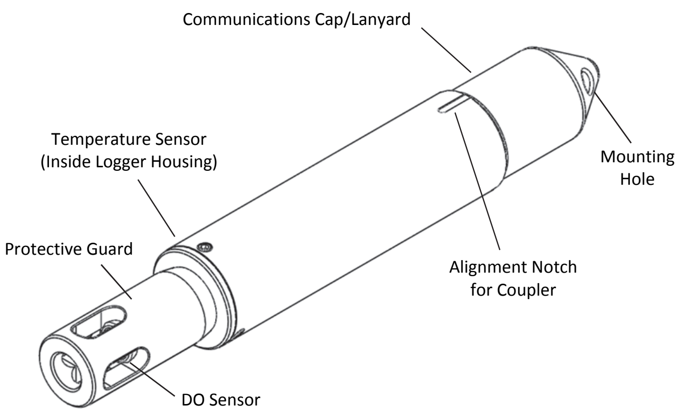
Logger

Memory	21,700 sets of DO and temperature measurements (64 KB total memory); logging stops when memory fills
Logging Rate	1 minute to 18 hours
Time Accuracy	±1 minute per month at 0 to 50°C (32 to 122°F) (see Plot A)
Battery	3.6 V lithium battery; factory replaceable
Battery Life	3 years (at 5 minute logging)
Download Type	Optical
Depth Rating	100 m (328 ft)
Buoyancy	Salt water: 178 g (6.27 oz) negative Fresh water: 185 g (6.52 oz) negative
Wetted Materials	Black Delrin®, PVC, EPDM o-rings, silicon bronze screws; rated for saltwater use
Size	39.6 mm diameter x 266.7 mm length (1.56 x 10.5 inches); mounting hole 7.88 mm (0.31 inches)
Weight	464 g (16.37 oz)
Environmental Rating	IP68
CE	The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).



Plot A: Time Accuracy

Logger Components and Operation



Communications Cap/Lanyard. This removable cap protects the optical communications window. An LED in the communications window of the logger confirms logger operation. When the logger is logging, the LED blinks once every four seconds. The LED also blinks when the logger is recording a sample. When the logger is awaiting a start because it is configured to start "At Interval," "On Date/Time," or "Using Coupler," the LED blinks once every eight seconds until logging begins. See *Connecting the Logger to a Computer or Waterproof Shuttle* for details on using the communications window.

Mounting Hole. Use the hole on the communications cap to mount the logger. See *Deploying the Logger* for more information.

Alignment Notch for Coupler. Use this notch to align the coupler when communicating with the logger. See *Connecting the Logger to a Computer or Waterproof Shuttle* for more information.

DO Sensor. This optical sensor measures dissolved oxygen using RDO® Basic Technology. It is shipped with a red dust cap that must be replaced with a green sensor cap that lasts for six months plus a one-month grace period. See *Installing the Sensor Cap* for more details.

Protective Guard. This removable guard protects the DO sensor. Unscrew it to install or replace the sensor cap as needed. See *Installing the Sensor Cap* for more details.

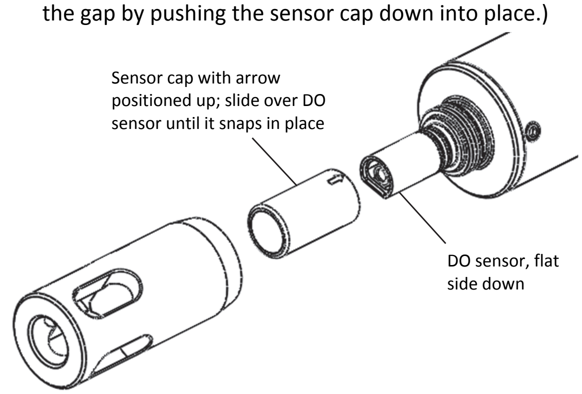
Temperature Sensor. This built-in sensor (not visible in diagram) measures temperature.

> ⚠ **WARNING:** This logger can be damaged by mechanical shock. Always handle the logger with care. The logger may be damaged if it is dropped. Use proper packaging when transporting or shipping the logger.
>
> Do not attempt to open the logger case or sensor housing. Disassembling of the logger case or sensor housing will cause serious damage to the sensor and logger electronics. There are no user-serviceable parts inside the case. Contact Onset Technical Support at 1-800-LOGGERS (1-800-564-4377) or an authorized Onset dealer if your logger requires servicing.

Installing the Sensor Cap

The logger ships with a replaceable sensor cap that provides six months of continuous use. Once the cap is initialized, an internal clock within the logger will count down until the sensor cap expiration date. When the sensor cap expires, you will need to replace it with a new cap (U26-RDOB-1). The sensor cap is intended for six months of actual deployment, but the expiration date is seven months from the date the cap was initialized. This allows for any time needed between launching the logger and physically deploying as well as extra time in case you are not able to get the logger after exactly six months of deployment. To install the sensor cap:

1. Unscrew the protective guard covering the DO sensor (see diagram at left).
2. Remove the red dust cap that protects the sensor during shipping.
3. Take the green sensor cap out of the canister.
4. With the flat part of the DO sensor pointing down and the green sensor cap oriented with the arrow up, slide the sensor cap over the sensor until it snaps in place. The cap should be snug against the logger housing without any gaps. (If you see a gap, the protective guard installed in the next step will close the gap by pushing the sensor cap down into place.)



5. Screw the external protective guard back on until tight.

> **IMPORTANT:** The sensor cap expires 7 months (to the day) after it has been initialized. The logger will record a value of -888 mg/L at each logging interval after the cap has expired. Initialization occurs automatically when the cap is installed while the logger is logging. You can also initialize it from the Status window in HOBOware or when using the Lab Calibration tool. To see when the sensor cap expires after being initialized, check the Status in HOBOware for the expiration date. The cap also has a shelf life; check the "Install By" date printed on the canister.

Connecting the Logger to a Computer or Waterproof Shuttle

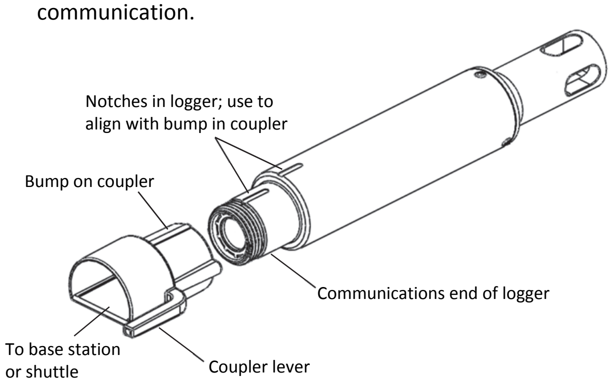
To connect the logger to a computer, use either the Optic USB Base Station (BASE-U-4) or HOBO Waterproof Shuttle (U-DTW-1) with a coupler (COUPLER2-C). To launch and read out the logger in the field, use one of these three methods:

- Laptop computer with Optic USB Base Station (BASE-U-4) and coupler (COUPLER2-C)
- HOBO Waterproof Shuttle (U-DTW-1, Firmware Version 3.2.0 or later) and coupler (COUPLER2-C)

- HOBO U-Shuttle (U-DT-1, Firmware Version 1.16 or later) with Optic USB Base Station and coupler (COUPLER2-C)

IMPORTANT: USB 2.0 specifications do not guarantee operation outside the range of 0°C (32°F) to 50°C (122°F).

1. Follow the instructions that came with your base station or Waterproof Shuttle to attach it to a USB port on the computer.
2. Unscrew the pointed cap on the communications end of the logger.
3. Attach the coupler to the base station or shuttle.
4. Insert the logger into the coupler, aligning the bump/arrow on the coupler with the notches on the logger. Be sure that it is properly seated in the coupler. If the logger has never been connected to the computer before, it may take a few seconds for the new hardware to be detected by the computer. **Note**: If you are using the HOBO Waterproof Shuttle as a base station with a computer, briefly press the coupler lever to put the shuttle into base station mode. A green LED on the shuttle or base station indicates good communication.



5. After logger communications are complete, remove the logger from the coupler. Make sure the o-ring is still in the groove inside the cap and then reinstall the communications cap.

IMPORTANT: When connected to a coupler, the logger is "awake" and consumes significantly more power than when it is disconnected and considered "asleep." The logger will automatically "go to sleep" after being left in the coupler for 30 minutes. It will no longer appear as a USB device connected to the computer. If this occurs, remove it from the coupler and start the instructions to connect the logger to a computer or waterproof shuttle over again.

Calibrating the Logger with the Lab Calibration Tool

Use the Lab Calibration tool in HOBOware when you need to calibrate the logger before deploying it or after replacing an expired sensor cap. The tool sets the gain and offset adjustment values for the logger by:

- Restoring logger calibration values to the factory defaults,
- Using your own gain and offset adjustment values, or
- Calculating the values with a 3-step calibration procedure.

In the three-step procedure, the logger is first calibrated to 100% saturation by placing it in water-saturated air. Then, you can calibrate the logger to 0% saturation by placing it in sodium sulfite or another 0% oxygen environment (recommended if the logger will be deployed in water with DO levels of 4 mg/L or less).

IMPORTANT: Lab calibration only affects future launches; any data saved in the logger will be based on the previous calibration values. If the sensor cap is installed and it has not yet been initialized, you will be prompted to do so. Follow the instructions on the screen.

To complete these steps, you will need fresh water, the calibration boot and sponge supplied with the logger, and a source for current barometric pressure at your current location. You will also need sodium sulfite solution and a 7.6 cm (3 inch) beaker if you will be calibrating to 0% saturation.

The fresh water, logger, and sodium sulfite (if applicable) should be left out in the lab where the calibration is being done long enough so that they are at room temperature. If the logger was deployed previously, make sure the sensor is clean and dry (see *Maintenance* for more details). To use the Lab Calibration tool:

1. Connect the logger to the computer as described in the previous section. Stop the logger if it is currently logging or awaiting a coupler or delayed start.
2. From the Device menu, click Lab Calibration.
3. The current gain and offset adjustments are displayed in the top pane of the Lab Calibration window along with the date and time the last lab calibration was completed (if applicable). Completing Steps 1 through 3 in the Lab Calibration tool will result in new gain and offset adjustment values based on the current logger conditions. Continue to the next section for details on how to complete these steps.

   If you already know what the gain and offset values should be (for example, the values from a previous calibration that you want to use again) or want to return to the default factory values, click the "I know my values, skip to Finish" button. This will automatically move you to "Step 3: Finish" in the Lab Calibration window. Either click the "Reset to Factory Defaults" button or type in the desired gain adjustment and offset adjustment values and click the "Send Calibration to the Logger" button. **Note:** If you decide you do not need to change the calibration, click Close to cancel the calibration and revert back to the last saved logger values.

Step 1: 100% Saturation

1. In "Step 1: 100% Saturation" in the Lab Calibration window, enter the barometric pressure for your current location. If the barometric pressure reading has been adjusted for sea level (such as a reading taken from the National Weather Service weather station), select the "If using sea level barometric pressure, enter elevation" checkbox and enter your elevation in either meters or feet.
2. Make sure the logger either has the protective guard or the anti-fouling guard installed (whichever guard you plan to use in the deployment) so that the sensor is covered.

3. Wet the small sponge with fresh water. Squeeze out any excess water.
4. Place the sponge in the end of the calibration boot.
5. Insert the logger in the calibration boot so that there is approximately a 1 cm (0.5 inch) overlap between the end of the boot and the body of the logger. This will ensure there is enough space between the end of the logger and the sponge (the logger should not be pressed up tightly against the sponge).
6. Wait for approximately 15 minutes until the logger reaches temperature equilibrium (and less than 30 minutes so the logger does not go to sleep).
7. Click the “Get DO value from the logger” button to display the 100% saturation results. You can click this button as often as needed. The results are updated each time you click the button. To check for equilibrium, click the “Get DO value from the logger” button several times in a row to check the current “DO Conc from logger at 100% Saturation” value. If the value remains the same or varies very little with each button click, then temperature equilibrium has likely been reached.
8. When you are satisfied with the results displaying in the “Step 1: 100% Saturation” tab, click the Next button to proceed to “Step 2: 0% Saturation.”

Step 2: 0% Saturation (optional)

If the logger will be deployed in water with DO levels greater than 4 mg/L, click the “Skip this Step” button. Otherwise, continue with the following procedure.

1. Make sure the logger either has the protective guard or the anti-fouling guard installed (whichever guard you plan to use in the deployment) so that the sensor is covered.
2. Pour the sodium sulfite into the beaker so that it is about two-thirds full.
3. Place the sensor end of the logger into the solution so that the entire protective guard or anti-fouling guard and at least 2.5 cm (1 inch) of the logger body are submerged in the beaker. Allow it to rest on the bottom of the beaker.
4. Wait for approximately 15 minutes until the logger reaches temperature equilibrium (and less than 30 minutes so the logger does not go to sleep).
5. Click the “Get DO value from the logger” button to display the 0% saturation results. As with the 100% calibration, you can click this button as often as needed. The results are automatically updated each time you click the button. If the value remains the same or varies very little with each button click, then temperature equilibrium has likely been reached.
6. When you are satisfied with the results displaying in the “Step 2: 0% Saturation” tab, click the Next button to proceed to “Step 3: Finish.”

Step 3: Finish

The results from the first two steps are displayed as well as the overall calibration results and the new gain and offset adjustment values. If you are satisfied with the results, click the “Send Calibration to Logger” button. The logger will then be calibrated based on the new values. These values will not take effect until the logger is launched. If you do not want to save these values, click Close to cancel the calibration and revert back to the last saved logger values. Or, click “Reset to Factory Defaults” to return to the original values. If you performed Step 2, then remove the logger from the solution and thoroughly rinse it with fresh water to remove any excess sodium sulfite. See *Maintenance* for additional details on cleaning the logger.

Launching the Logger

After calibrating the logger, it needs to be launched to configure it before taking it to the field for deployment. Once launched, the logger will record two types of data: samples and events. Samples are the sensor measurements recorded at each logging interval. Events are independent occurrences triggered by a logger activity, such as Bad Battery or Host Connected. Events help you determine what was happening while the logger was logging. To launch the logger:

1. With the logger connected to the computer, open HOBOware. From the Device menu, select Launch.
2. Select both the DO and Temperature channels to log. **Note:** HOBOware provides the option of recording the current battery voltage at each logging interval, which is disabled by default. Recording battery life at each logging interval takes up memory and therefore reduces logging duration. It is recommended that you only record battery voltage for diagnostic purposes. Even with the channel disabled, a bad battery event will still be recorded.
3. Select a logging interval.
4. Choose when to start logging and click the Start button.
5. Remove the logger from the coupler and screw the communications cap back on the logger.

IMPORTANT: If this is the first launch with a new sensor cap, the sensor cap will expire six months (plus a one-month grace period) from the time of the first sensor reading. Two caps per year are required for year-round deployment.

Deploying the Logger

The logger is designed to be easy to deploy in many environments. Follow these guidelines when deploying it:

- Remove the calibration boot before deploying the logger.
- Make sure the logger is located where it will receive an unrestricted flow of the water being monitored to the sensor.
- Make sure the logger is fully submerged and not in direct sunlight to minimize temperature changes that are unrelated to water temperature.
- When deploying the logger in rivers, streams, and ponds, insert the logger in a PVC or ABS pipe for protection from debris (if possible). The pipe should have enough holes to ensure good circulation of water to the sensor.
- If possible, position the logger so the sensor face is oriented vertically. After deploying in the water, move the logger around slightly to eliminate any bubbles that may have formed.

- Do not deploy the logger in freezing water with moving ice where the logger could be crushed.
- Use the optional anti-fouling guard to protect against fouling. Unscrew the protective guard and replace it with the anti-fouling guard.
- If fouling is expected during deployment, use field calibration readings from both the beginning and end of the deployment as described in the next section. These readings can then be entered into the HOBOware Dissolved Oxygen Assistant to compensate for any measurement drift due to fouling. Scrub fouling off the logger with a plastic bristle brush.
- When deploying the logger in salt water with small changes in salinity, you will need a conductivity or salinity value from either a conductivity meter or salinometer to enter in the Dissolved Oxygen Assistant to adjust the data from the logger for salinity. A single meter reading will add less than 1.1% DO error (assuming the conductivity changes are within ±3,000 µS/cm from the calibration point).

  If the conductivity changes, then you will need a data file with salinity or specific conductivity readings for the entire deployment. Consider deploying a HOBO Conductivity logger (U24-002-C) next to this DO logger to use the resulting data file for salinity data. For U24-002-C conductivity readings within a ±30,000 µS/cm range, there will be less than 4% error added to the DO measurements, and for readings over a narrower range, the accuracy will be even better. Refer to the *HOBO Conductivity Logger (U24-002-C) Manual* for more details. For applications that require higher accuracy conductivity data than the U24-002-C can provide, use a third-party conductivity logger.
- To generate a percent saturation series, you will need to deploy a barometric pressure logger (such as a HOBO Water Level Logger, U20-001-0x or U20L-0x) or have access to a nearby weather station to gather barometric pressure data. This data is necessary for the Dissolved Oxygen Assistant to calculate percent saturation.

Taking Field Calibration Readings

If fouling is expected during the deployment, you can take calibration readings at the beginning and end of the deployment to enter in the Dissolved Oxygen Assistant. This will adjust the data from the logger to compensate for any measurement drift due to fouling. There are two methods for taking field calibration readings: the first method involves taking readings using a dissolved oxygen meter or titration while the second method involves calibrating the logger in 100% water-saturated air. The first method is recommended because it is quicker to get the necessary calibration readings; the second method can take 40 minutes or more to achieve equilibrium with temperature extremes.

To Take Calibration Readings Using a DO Meter or Titration:

1. The logger must be logging. Take a DO measurement of the water where the logger is being deployed using either a DO meter or by titration. If using a meter, make sure it is calibrated and allow time for the meter probe to stabilize (this will occur when three meter measurements taken in a row are within your accuracy tolerance).

   If the logger is being deployed in salt water, adjust the meter measurements for salinity using a meter with both conductivity and DO probes. If the salt water has a constant salinity, you can use a DO meter where you can enter that salinity value to adjust the readings. If the salinity and/or DO are changing rapidly, then you will need to get a sample of the water in a container large enough for both the logger and meter probe to be completely submerged. Place both devices in the water long enough for them to stabilize and then for the DO logger to log at least two values, and take a concurrent meter reading.
2. Record the reading, date, and time of the measurement in a field notebook.
3. At the end of the deployment, repeat steps 1 and 2.

To Take Calibration Readings Using 100% Water-Saturated Air:

1. The logger must be logging. You will need fresh water, the included calibration boot and sponge, and the current barometric pressure from a HOBO U20 or U20L Water Level logger, a barometer, or a nearby weather station.
2. If the logger has been in salt water, clean the logger body and sensor cap as described in the *Maintenance* section. Make sure the sensor cap is dry before continuing.
3. Make sure the protective guard or anti-fouling guard is installed on the logger.
4. Wet the small sponge with fresh water. Squeeze out any excess water.
5. Place the sponge in the end of the calibration boot.
6. Insert the logger in the calibration boot so that there is approximately a 1 cm (0.5 inch) overlap between the end of the boot and the body of the logger. This will ensure there is enough space between the end of the logger and the sponge (the logger should not be pressed up tightly against the sponge).
7. Allow at least 40 minutes for the logger to reach temperature equilibrium, and then write down the date and time in a field notebook.
8. Write down the barometric pressure at that time (note the elevation if the barometric reading has been adjusted for sea level).
9. Repeat these steps at the end of the deployment.

Reading Out the Logger and Redeploying

Your readout and maintenance schedule will be determined by the amount of fouling at the site. To read out the logger in the field:

1. Take a field calibration reading as described in the *Taking Field Calibration Readings* section.
2. If the logger was in salt water and you did not deploy a HOBO Conductivity Logger, then use a conductivity meter or salinometer to take a conductivity reading. Write down the reading and the date and time.

3. Remove the logger from the water and read out the data from the logger using a shuttle or computer with a base station.
4. If you are deploying it again, clean the sensor (see *Maintenanc*e for details).
5. Check the expiration date for your cap and make sure it will not expire before the end of your deployment. Replace it if needed.
6. Relaunch the logger if it is not already logging.
7. Take another field calibration reading after the logger is cleaned.
8. Redeploy the logger.

Using the HOBOware Dissolved Oxygen Assistant

Use the Dissolved Oxygen Assistant to obtain accurate Dissolved Oxygen readings if the logger was deployed in a saltwater environment or if percent saturation is required. Also use this assistant if you took field calibration readings. The Dissolved Oxygen Assistant is only available in HOBOware from the Plot Setup window when you open a file from this logger. To use the assistant:

1. Offload the most recent data files from the shuttle or logger to your computer.
2. Open a data file in HOBOware.
3. In the Plot Setup window, select the Dissolved Oxygen Assistant and click Process.
4. In the Dissolved Oxygen Assistant window, enter the salinity, barometric pressure, and field calibration information as needed. Click the Help button in the Dissolved Oxygen Assistant for more details and to learn about the ranges of input data allowed.
5. Plot the data and save it as a project file.

Maintenance

To clean the sensor cap:

1. Remove the protective guard or anti-fouling guard, but leave the sensor cap on the sensor.
2. Rinse the logger with clean water from a squirt bottle or spray bottle.
3. Gently wipe the cap with a soft-bristled brush (such as a toothbrush) or soft cloth if biofouling is present. Use Alconox® to remove grease.
4. If extensive debris or mineral build-up is present, soak the cap end in vinegar for 15 minutes, then soak it in deionized (DI) water for another 15 minutes.
5. If the logger is being immediately redeployed with the same sensor cap, a field calibration is adequate. If a new sensor cap is being installed, a lab calibration with HOBOware is recommended. When storing the logger between deployments, keep it in the calibration boot (wet the small sponge with fresh water, place the sponge in the end of the calibration boot, and then insert the logger in the boot.)

WARNING: Do not use organic solvents; they will damage the sensor. Do not remove the sensor cap from the sensor prior to cleaning with a brush. Only clean the sensor when you replace the sensor cap. See the full instructions that ship with the replacement sensor cap. Do not wet the sensor optical lens area with water or any solution. Remove the cap and gently wipe the window with a soft cloth.

To clean the logger body:

1. Make sure the sensor cap is installed on the logger.
2. Gently scrub the logger body with a plastic bristle brush or nylon dish scrubber.
3. Use Alconox® to remove grease.
4. Soak in vinegar to remove mineral deposits.
5. Rinse the logger with deionized (DI) water.

Battery Guidelines

The battery life of the logger should be three years or more. Actual battery life is a function of the number of deployments, logging interval, and operation/storage temperature of the logger. Frequent deployments with fast logging intervals, continuous storage/operation at temperatures above 35°C (95°), and keeping the logger connected to the coupler will result in significantly lower battery life. For example, the battery may last less than a year with a 1-minute logging interval. To obtain a three-year battery life, a logging interval of five minutes or greater should be used and the logger should be operated and stored at temperatures between 0° and 25°C (32° and 77°F).

The logger can report and log its battery voltage. If the battery falls below 3.2 V, the logger will record a “bad battery” event in the datafile. The logger will record a second “bad battery” event and stop logging when the battery falls below 3.1 V. If the datafile contains “bad battery” events, the logger should be returned to Onset for battery replacement. Note the logger does not have to be recording the battery channel for it to detect bad battery events. The logger will record these events regardless of what channels are logged. To have your logger’s battery replaced, contact Onset or your place of purchase for return arrangements. Do not attempt to replace the battery yourself. Severe damage to the logger will result if the case is opened without special tools, and the warranty will be voided.

WARNING: Do not cut open, incinerate, heat above 100°C (212°F), or recharge the lithium battery. The battery may explode if the logger is exposed to extreme heat or conditions that could damage or destroy the battery case. Do not dispose of the logger or battery in fire. Do not expose the contents of the battery to water. Dispose of the battery according to local regulations for lithium batteries.

ATTACHMENT D

WINOOSKI RIVER RIPARIAN ZONE RESTORATION PLAN

Memorandum

To:	GMP Mollys Falls Project File	Date:	February 2024
From:	Ryan T. Colarusso, Environmental Scientist & Meddie J. Perry, Senior Hydrogeologist	Project #:	57646.30
		RE:	Green Mountain Power: Molly's Falls Hydroelectric Facility Winooski River Riparian Zone Restoration Plan

INTRODUCTION AND BACKGROUND

On behalf of Green Mountain Power Corporation ("GMP"), Vanasse Hangen Brustlin, Inc. ("VHB") is presenting this plan for riparian zone restoration (the "Restoration Project") along an approximately 3.15-mile reach of the Winooski River in Cabot and Marshfield, Vermont. The Restoration Project area is depicted on the set of maps in Attachment 1.

GMP owns a powerhouse located directly south of the Restoration Project that generates power from water diverted from Molly's Falls Reservoir. Prior studies have found that generation flows released from the powerhouse during the warmer months have historically been a consistent, low temperature whereas the receiving portion of the Winooski River has historically had significant daily temperature fluctuations (VHB, 2016). The variability in temperature seen in the Winooski River is due to degraded riparian habitat along the Winooski River upstream of the powerhouse including within the Restoration Project area. The Restoration Project area consists mostly of agricultural land with little to no buffer between agricultural fields and the existing river channel. On a majority of the properties within the Restoration Project area, vegetation is cut directly to the edge of the riverbank. The lack of shade-bearing vegetation causes water temperatures to rise rapidly during the day and to decrease sharply at night, leading to large temperature fluctuations in the river that are detrimental to aquatic life. Additionally, the absence of soil stabilizing vegetation has caused bank instability and erosion along the reach of the river upstream of the powerhouse. Although GMP's facilities and operations do not cause or contribute to the temperature fluctuations, riverbank erosion, and lack of shade upstream of the powerhouse, GMP has nonetheless agreed to develop and implement a riparian zone restoration in this area with the intent of improving water quality.

In its March 27, 2020 Final Order Granting 10 V.S.A. Chapter 43 Authorization for Improvements at the Molly's Falls Hydroelectric Facility, the Vermont Public Utilities Commission ("PUC") required GMP to develop and implement a riparian restoration plan in accordance with the Memorandum of Understanding ("MOU") dated August 8, 2019 between GMP and the Vermont Agency of Natural Resources ("ANR"). According to the MOU, the plan "shall identify reasonable and feasible opportunities for riparian zone restoration along the Winooski River, assess anticipated temperature impacts of implementing the feasible opportunities, and set forth a schedule for implementation" (ANR, 2019). The purpose of the Restoration

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Project is to implement a riparian restoration plan that will improve shading of the river channel and reduce the peak water temperatures and daily water-temperature fluctuations in the Winooski River.

RESTORATION PROJECT DEVELOPMENT

Initially, VHB identified a Study Area extending from the powerhouse upstream along the Winooski River as far as Cabot Village, as shown on the maps in Attachment 1. Cabot Village is a logical upstream endpoint for the riparian zone restoration because it is the upstream-most end of the river reach with the most degraded riparian zone.

On May 29, 2020, VHB assessed the condition of riparian habitat within the Study Area in order to determine Target Restoration Areas ("TRA's"). This assessment involved two staff paddling the Winooski River throughout the Study Area by canoe to observe and photograph soil and erosion conditions, existing vegetation types and distribution, and development and land uses. Geographic Position System ("GPS") equipment was used to determine specific locations of observed features.

TRA's were defined as land within the riparian zone that lacked sufficient shade-bearing vegetation and/or exhibited signs of bank instability and erosion, and where restoration appeared feasible based on existing land uses and development (see Photography Log presented in Attachment 2). The proposed TRA's were chosen based on their potential to have the greatest beneficial impact on water temperature in the river following implementation of the Restoration Project and establishment of riparian vegetation. In accordance with the ANR's Riparian Buffer Guidance (ANR, 2005), VHB established a 100-foot buffer from the top of the riverbank for all TRA's (see maps in Attachment 1).

PROJECT DESCRIPTION

Target Restoration Areas

Table 1 lists the proposed TRA's. The TRA's are shown on the maps in Attachment 1, along with Vermont Significant Wetland Inventory ("VSWI") wetlands, property parcels, soils as mapped by the Natural

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Resources Conservation Service ("NRCS"), roads, a recent (2018) aerial photo base, ANR river corridors, streams, and waterbodies[1]. Photographs of current conditions in the TRA's are provided in Attachment 2.

Table 1: Target Restoration Areas	
TRA #	**Description**
1	Right bank of river from VT Rte 215 to farm; agricultural land with lack of soil stabilizing or shade-bearing vegetation
2	Right bank of river from farm to Jug Brook, includes VSWI wetlands; erosion from farm, evidence of cow crossing; apparent previous restoration effort
3	Left bank of river from VT Rte 215 to existing wooded area with established riparian zone; agricultural land with lack of soil stabilizing or shade-bearing vegetation
4	Right bank of river between two areas with wooded riparian zones; lack of soil stabilizing or shade-bearing vegetation; apparent previous restoration effort
5	Left bank of river between two areas with wooded riparian zones; agricultural land devoid of shade-bearing vegetation; erosion of steep banks due to lack of soil stabilizing vegetation
6-Upland	Upland floodplain terrace along right bank of river between two areas with wooded riparian zones, with upland soils; agricultural land devoid shade-bearing vegetation; erosion of steep banks due to lack of soil stabilizing vegetation
6-Hydric	Right bank of river between two areas with wooded riparian zones, with hydric soils; agricultural land devoid of shade-bearing vegetation; erosion of steep banks due to lack of soil stabilizing vegetation
7	Right bank of river between two areas with wooded riparian zones, ending near powerhouse; lack of soil stabilizing or shade-bearing vegetation

[1] The TRA's shown on these maps align with the current extent of the river as shown in the aerial photography. The ANR streams and waterbodies GIS layers do not always align with the river, because the river has meandered and adjusted its course since the GIS layers were created.

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Table 1: Target Restoration Areas	
TRA #	**Description**
8-Upland	Upland floodplain terrace along left bank of river between two areas with wooded riparian zones, with upland soils; agricultural land and maintained lawn with evidence of erosion; lack of shade-bearing vegetation
8-Hydric	Left bank of river between two areas with wooded riparian zones, with hydric soils; agricultural land and maintained lawn with evidence of erosion; lack of shade-bearing vegetation
Note: the intent is to reach out to each owner of land within each of the above Target Restoration Areas to encourage them to participate in the program. GMP would restore as much acreage as it can obtain permission to do, i.e., there is no minimum amount that would result in cancellation of the restoration project if not met.	

Proposed Plantings

VHB developed a list of native plant species observed during the May 29, 2020 site investigation, as well as plants VHB believes to be suitable shade-providing species for the TRA's. A list of species with technical details and habitat suitability is provided on page 1 of Attachment 3, and a simplified version is provided as Table 2 below.

Table 2: Summary of Proposed Riparian Buffer Planting Species	
Common Name	**Latin Name**
Black Willow	*Salix nigra*
Silver Maple	*Acer saccharinum*
Bebb's Willow	*Salix bebbiana*
Speckled Alder	*Alnus incana ssp. rugosa*
Tamarack	*Larix laricina*
Pussy Willow	*Salix discolor*
Balsam Poplar	*Populus balsamifera*

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Table 2: Summary of Proposed Riparian Buffer Planting Species	
Common Name	**Latin Name**
Red Osier Dogwood	*Cornus sericea*
Balsam Fir	*Abies balsamea*
Box Elder	*Acer negundo*
Gray Birch	*Betula populifolia*
Red Maple	*Acer rubrum*
Red Elderberry	*Sambucus racemosa*
Quaking Aspen	*Populus tremuloides*
White Pine	*Pinus strobus*

The species listed in Table 2 represent all the potential species that are being proposed to be planted in the various TRA's. Proposed plantings specific to each TRA are provided in the TRA-Specific Planting Plans on pages 2 through 11 of Attachment 3. Species were selected based on a variety of data and regulatory guidance, as follows. Plant characteristics were considered, including wetland indicator status, wetness coefficient value, and knowledge of appropriate species for the various environmental settings. Physical characteristics of the proposed TRA's also affected species selections, including mapped soil types, mapped river corridors, wetlands, and existing vegetation conditions. Early-successional species such as Box Elder and Balsam Poplar are included because they are hardy and typically grow rapidly, but are short-lived so that they tend to enable later-successional species to become established. VHB also relied on regulatory guidance regarding establishing woody vegetation in riparian buffers to steer species choices, including the "Specification Guide Sheet for Riparian Forest Buffers (391)" (USDA, 2009), as well as the "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers" (DEC, 1994).

The proposed planting plans contained in Attachment 3 were developed to be implemented on a "per unit" (e.g. per acre) basis, within each TRA, and are not specific to individual property parcels. While implementation of the restoration plantings is dependent on agreement with individual landowners, all property parcels within any given TRA would be subject to the same plans for species and density of plants to be planted.

Restoration and Planting Methods

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The following methods are proposed for acquiring and planting the vegetation that would be planted for the Restoration Project.

- Planting materials will be commercially available native plant materials.
- Actual species to be planted are subject to source and season; stem quantity and density may vary according to available stock size and site conditions.
- Planting should occur in either the spring or fall depending on landowner agreement; spring or fall typically yield more favorable soil moisture conditions for planting and establishment, and can therefore minimize transplant shock.
- The planting areas should not be subject to vegetation maintenance other that what is necessary to protect property or infrastructure in the immediate area.
- Plantings will be installed using a recommended 10-foot spacing between stems, resulting in an approximate 400 stems/ acre starting density, recommended for a shrub-dominated community.
- The plant materials will be planted by hand, with no fill placed in wetlands, other than what is needed to install native plantings best. Shrubs should be planted in same-species groups of 3 to 5 stems.
- Following planting, the area surrounding the base should be mulched to prevent drying (e.g., with weed-free straw or wood chips).

Monitoring

The final stem density goal for the mature restoration planting areas is between 200 and 400 stems/ acre, which is recommended by the USDA for forested or shrub-dominated riparian communities, respectively. The Project anticipates this density goal will be met through plantings as well as through the natural growth of stems that are not planted ("volunteers"), which are already present in a number of the TRA's. In order to ensure this density goal is met, the following monitoring actions are proposed:

- Areas that have been planted will be monitored annually during the growing season for a period of up to three (3) years following the completion of planting within each TRA or property.
- Monitoring should occur in late-spring to early-summer (ideally early to mid-June) in order to record growing season conditions as well as to allow time for implementing corrective measures that may be recommended.
- Monitoring will include quantifying the stem densities within the planted areas. The purpose of the stem-density monitoring will be to ensure stem density goal is being met, and to ensure no corrective action or supplemental recommendations are needed.

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- Monitoring will also include establishing permanent photograph locations, which will be documented via GPS-location, throughout the planting areas to record and monitor on-site conditions visually.
- Monitoring for tree and shrub stem density will occur by establishing 5-meter diameter plots (evenly distributed throughout the planting areas to capture representative conditions) in which each stem (both planted and natural "volunteer") will be tallied and extrapolated to provide an average stem density across the entire subject TRA or parcel.
- Corrective actions would be proposed if it appears the overall stem density goal is not being met within each planting area. If during annual monitoring it appears stem densities will not meet either 200 stems/ acre for tree dominated communities, or 400 stems/ acre for shrub dominated communities, GMP will work with the partner organizations and landowners to determine if corrective actions (e.g., supplemental plantings of the same species, plantings of different species, and/or applying biodegradable weed-control mats to plantings) would be appropriate.
- At the completion of monitoring, GMP will prepare and submit a monitoring report to the ANR and PUC (by December 31st of the final monitoring year). The monitoring report will include the following information:
    - a brief summary of the project background;
    - a summary of the plantings that have been conducted in the subject TRA's;
    - mapping showing the Restoration Project area and indicating the locations of the subject TRA's, completed plantings, and monitoring locations;
    - a description of any corrective actions that were undertaken during the monitoring period;
    - tabulated stem monitoring results;
    - photographic monitoring results;
    - any recommendations for future corrective actions.

PROJECT IMPLEMENTATION

GMP will implement the Restoration Project, following approval of this plan, with the cooperation of landowners and partner organizations. Because GMP does not own land within the Study Area where the riparian zone is degraded, for any restoration work to take place within the TRA's, owners of land within the TRA's will need to be contacted and will need to grant permission for the proposed restoration work. A proposed plan for landowner outreach and engagement is outlined in the Landowner Outreach Section below, and is proposed to be implemented in collaboration with partner organizations, following plan approval.

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Restoration plantings will take place during the spring and fall seasons once landowner approval has been granted. Monitoring will take place following the plantings. Individual properties will be planted as permission allows; all properties within the Restoration Project area may not necessarily all be planted in one year.

Potential Partner Organizations

There are a number of organizations that would benefit the Project and increase the likelihood of successful landowner participation and implementation of the Restoration Project. A list of these potential partner organizations and their roles in the Project is provided as Table 3; more detailed contact information is provided as Attachment 4. Potential partner organizations could benefit the Project by providing technical guidance, assisting with landowner outreach, providing incentives to landowners who allow GMP to perform restoration work, providing and coordinating field crews for plan implementation including plantings and monitoring.

Table 3:
Potential Partner Organizations

Organization	Interest ?	Role
U.S. Fish and Wildlife Service	Yes	Technical support for developing restoration plan; field coordination
Friends of the Winooski River	Yes	Outreach to landowners
Trout Unlimited - MadDog Chapter	Yes	Volunteer field crew
Cabot Conservation Committee	TBD	Outreach to landowners
Marshfield Conservation Commission	TBD	Outreach to landowners
Winooski Natural Resources Conservation District	TBD	Field crew coordination; outreach
Conservation Reserve Enhancement Program	TBD	Financial support to landowners
Seventh Generation	Yes	Volunteer field crew

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Table 3:
Potential Partner Organizations

Organization	Interest ?	Role
Cabot Creamery	TBD	Volunteer field crew with prior experience
SunCommon	TBD	Volunteer field crew with prior experience

GMP will reach out to potential partner organizations to request their participation following plan approval (see Schedule for Implementation Section below). To-date, GMP has been in contact with the Friends of the Winooski River organization, Trout Unlimited, the US Fish and Wildlife Service, and Seventh Generation all of whom have expressed interest in helping in the Restoration Project.

Landowner Outreach

GMP proposes to work with partner organizations for landowner outreach, with the expectation that local organizations such as the Cabot Conservation Committee and Marshfield Conservation Commission will have the best rapport with landowners; as well as with nonprofits such as Friends of the Winooski River. Landowners would be encouraged to participate in the Restoration Project because it will benefit water quality in their community, reduce soil erosion on their lands, and will be performed at no cost to them. Landowners who agree to participate in the Restoration Project will be asked to sign a permission form and to agree not to mow or cut vegetation in the restoration areas, and to allow access for plantings and monitoring.

Should landowners initially decline to participate, GMP proposes attempting to request their permission again at a later date after neighbors have joined the program, or after properties have changed ownership. GMP will think creatively throughout the process of implementing the Plan on options that may be available to incentivize participation, and will seek to identify any new funding sources, grants, and/or new potential partner organizations that may become available in the future.

Anticipated Water-Temperature Impacts

VHB has conducted extensive research into the impacts of riparian zone restoration on water temperatures, as described in detail in the memorandum presented in Attachment 5. Based on this literature research,

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Memorandum

VHB expects this Restoration Project will improve water quality by lowering peak temperatures during daytime in the warmer months, and by reducing water-temperature fluctuations compared to current conditions. The temperature impacts will be manifested gradually over a number of years, as the restoration plantings grow and mature to the extent that they will provide substantial amounts of shade. A precise quantification of the temperature impacts is not considered feasible, due to the numerous variables in Vermont's changing climate including changing streamflows and temperatures, due to the changing morphology and active meandering of the subject reach of the Winooski River, and because the restoration plantings are expected to be planted at staggered times and are expected to grow gradually over many years. Nonetheless, as explained in Attachment 5, a decrease in peak daytime temperatures between 0.55 degrees C (1.0 degrees F) and 4.0 degrees C (7.2 degrees F) is possible during the warm months. Temperature impacts are expected to increase during the first 25 years following planting.

Future Efforts

If needed, additional efforts during the monitoring period would include supplemental plantings of new species if the monitoring finds that the original plantings are not viable (pending landowner approval), supplemental plantings of more individuals of the same species if viable (pending landowner approval), applying biodegradable weed-control mats to the base of the plantings to protect them from becoming overwhelmed by surrounding vegetation, and/or repeat attempts to gain landowner permission if changes occur that suggest improved participation is likely (e.g., change of property ownership, successful neighboring participation, new funding source/grants).

Schedule for Implementation

GMP proposes the following schedule for implementation of the Riparian Zone Restoration Plan:

Table 4:
Implementation Schedule

Activity	Start Date*	End Date*	Note
GMP provides Draft Plan to ANR for comment	3/27/2020	9/28/2020	Per MOU: "Within 6 months of Commission approval [3/27/2020] of the Revised Project, GMP shall submit the Restoration Plan to ANR for comment, and thereafter to the Commission for review and approval."

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Memorandum

**Table 4:
Implementation Schedule**

Activity	Start Date*	End Date*	Note
GMP provides Revised Plan to PUC for review and approval	Upon receipt of ANR comments (anticipated April 1, 2024)	Within 60 days of receipt of ANR comments (anticipated May 30, 2024)	Additional time may be required if ANR comments require extensive revisions or coordination
GMP contacts Potential Partner Organizations to initiate collaboration and landowner outreach	Upon PUC approval of Revised Plan (anticipated May 30, 2024)	Within 6 months of PUC approval of Revised Plan (anticipated Nov 29, 2024)	GMP has already contacted some Potential Partner Organizations as noted above. Further collaboration is planned to start implementing the Restoration Plan.
Landowner outreach by GMP and/or Partner Organizations	Within 6 months of PUC approval of Revised Plan (anticipated Nov 29, 2024)	Within 6 months of outreach start date (anticipated May 29, 2025)	Initial outreach. Follow-up outreach for properties that do not provide permission may be conducted during following 5 years if changes occur (e.g., change of property ownership, successful neighboring participation, new funding source/grants).
Plantings	First spring or fall season following landowner permission (anticipated 2025)	Within 5 years of planting start date (anticipated 2030)	Plantings to be conducted over period of up to 5 years, as additional landowner permission becomes available.
Monitoring	Year 1 following first planting (anticipated 2026)	Year 3 following last planting (anticipated 2033)	Annual monitoring during growing season, as described above. Reporting as described above.

*All time-frames and end-dates are subject to change if affected by the COVID pandemic and related restrictions on activities, travel, and interpersonal contact.

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Memorandum

REFERENCES AND RESOURCES

Green Mountain Power and Vermont Agency of Natural Resources, 2019. Memorandum of Understanding between Green Mountain Power Corporation and the Vermont Agency of Natural Resources. Dated August 8, 2019.

USDA Natural Resources Conservation Service ("NRCS"), 2009. "Specification Guide Sheet for Riparian Forest Buffers (391)". Available Online: https://efotg.sc.egov.usda.gov/api/CPSFile/22122/391_VT_PS_Riparian_Forest_Buffer_2009

Vermont Agency of Natural Resources, Department of Environmental Conservation ("DEC"), 1994 "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers."

Vermont Agency of Natural Resources, 2005. "Guidance for Agency Act 250 and Section 248 Comments Regarding Riparian Buffers". Adopted December 6, 2005.

Vermont Public Utilities Commission, 2020. Final Order Granting 10 V.S.A. Chapter 43 Authorization for Improvements at the Molly's Falls Hydroelectric Facility. Issued March 27, 2020.

VHB, 2016. "Green Mountain Power Corporation: Mollys Falls Facility Study Report." March 1, 2016

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Memorandum

ATTACHMENTS

Attachment 1: Riparian Restoration Planning Map Set
Attachment 2: Photography Log
Attachment 3: Plant Species Summary Table and TRA Planting Tables
Attachment 4: Potential Partner Organizations
Attachment 5: Temperature Impacts Assessment

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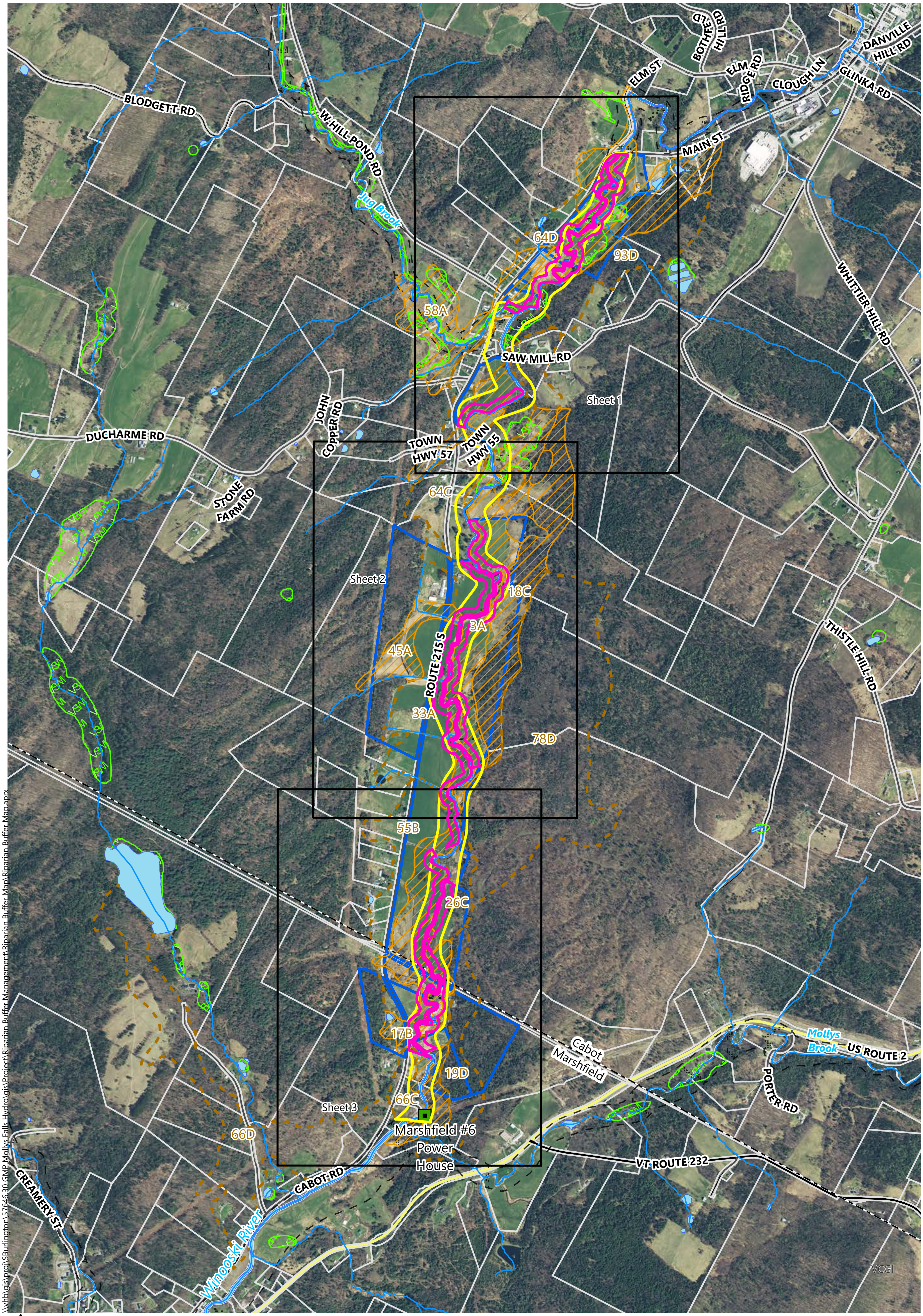
ATTACHMENT 1

vhb September 18, 2020



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GMP Riparian Buffer Management | Cabot/Marshfield, VT

- Study Area (VHB)
- Proposed Riparian Buffer - 100 FT (VHB)
- Index Map (VHB)
- GMP Power House (VHB)
- Stream (ANR)
- Waterbody (ANR)
- VSWI Advisory Wetland (ANR)
- VSWI (ANR)
- Soils (NRCS)
  - Non Hydric Soils
  - Hydric Soils
- River Corridors (ANR)
  - River Corridors (Aug 27, 2019)
  - Town Boundary (VCGI)
  - Target Parcels (VCGI)
- Parcel Boundary (VCGI)
- Interstate Highway
- US Highway
- State Highway
- Local Road
- Other Road
- Private Road

Sources:
ANR - Vermont Agency of Natural Resources Web Map Service
VCGI - Vermont Center for Geographic Information Web Map Service
VTrans - Vermont Agency of Transportation Web Map Service
Background Image by VCGI (2018)
VHB - (2020)

River Buffer Restoration Index

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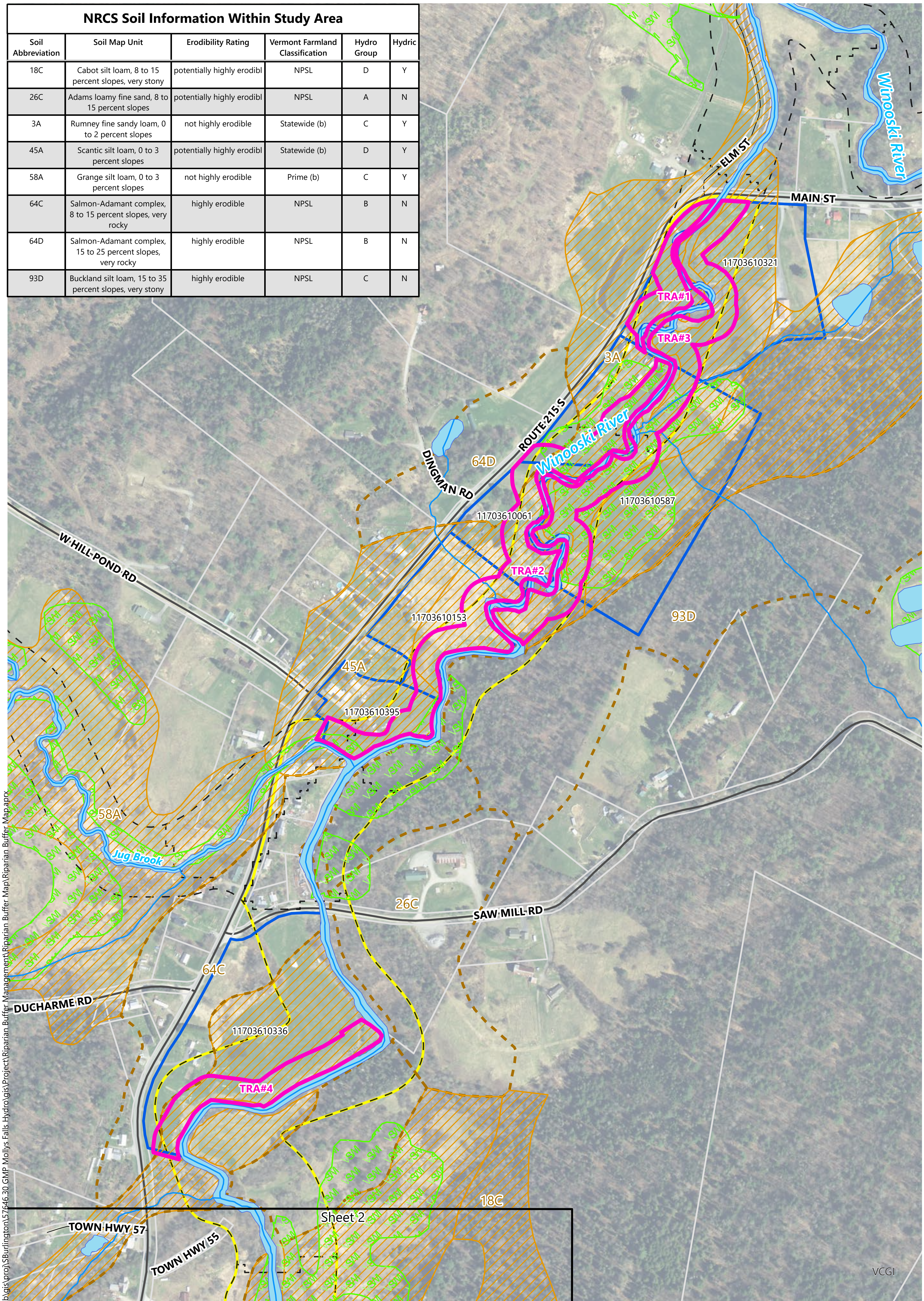
NRCS Soil Information Within Study Area

Soil Abbreviation	Soil Map Unit	Erodibility Rating	Vermont Farmland Classification	Hydro Group	Hydric
18C	Cabot silt loam, 8 to 15 percent slopes, very stony	potentially highly erodibl	NPSL	D	Y
26C	Adams loamy fine sand, 8 to 15 percent slopes	potentially highly erodibl	NPSL	A	N
3A	Rumney fine sandy loam, 0 to 2 percent slopes	not highly erodible	Statewide (b)	C	Y
45A	Scantic silt loam, 0 to 3 percent slopes	potentially highly erodibl	Statewide (b)	D	Y
58A	Grange silt loam, 0 to 3 percent slopes	not highly erodible	Prime (b)	C	Y
64C	Salmon-Adamant complex, 8 to 15 percent slopes, very rocky	highly erodible	NPSL	B	N
64D	Salmon-Adamant complex, 15 to 25 percent slopes, very rocky	highly erodible	NPSL	B	N
93D	Buckland silt loam, 15 to 35 percent slopes, very stony	highly erodible	NPSL	C	N



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GMP Riparian Buffer Management | Cabot, VT

Study Area (VHB)
Target Restoration Areas (VHB)
River Corridors (ANR)
River Corridors (Aug 27, 2019)
Stream (ANR)
Waterbody (ANR)
VSWI (ANR)
Target Parcels (VCGI)
Parcel Boundary (VCGI)
Soils (NRCS)
Non Hydric Soils
Hydric Soils
Index Map (VHB)
Town Boundary (VCGI)
Roads (VTrans)
Local Road
Other Road
Private Road

River Buffer Restoration Planning Map

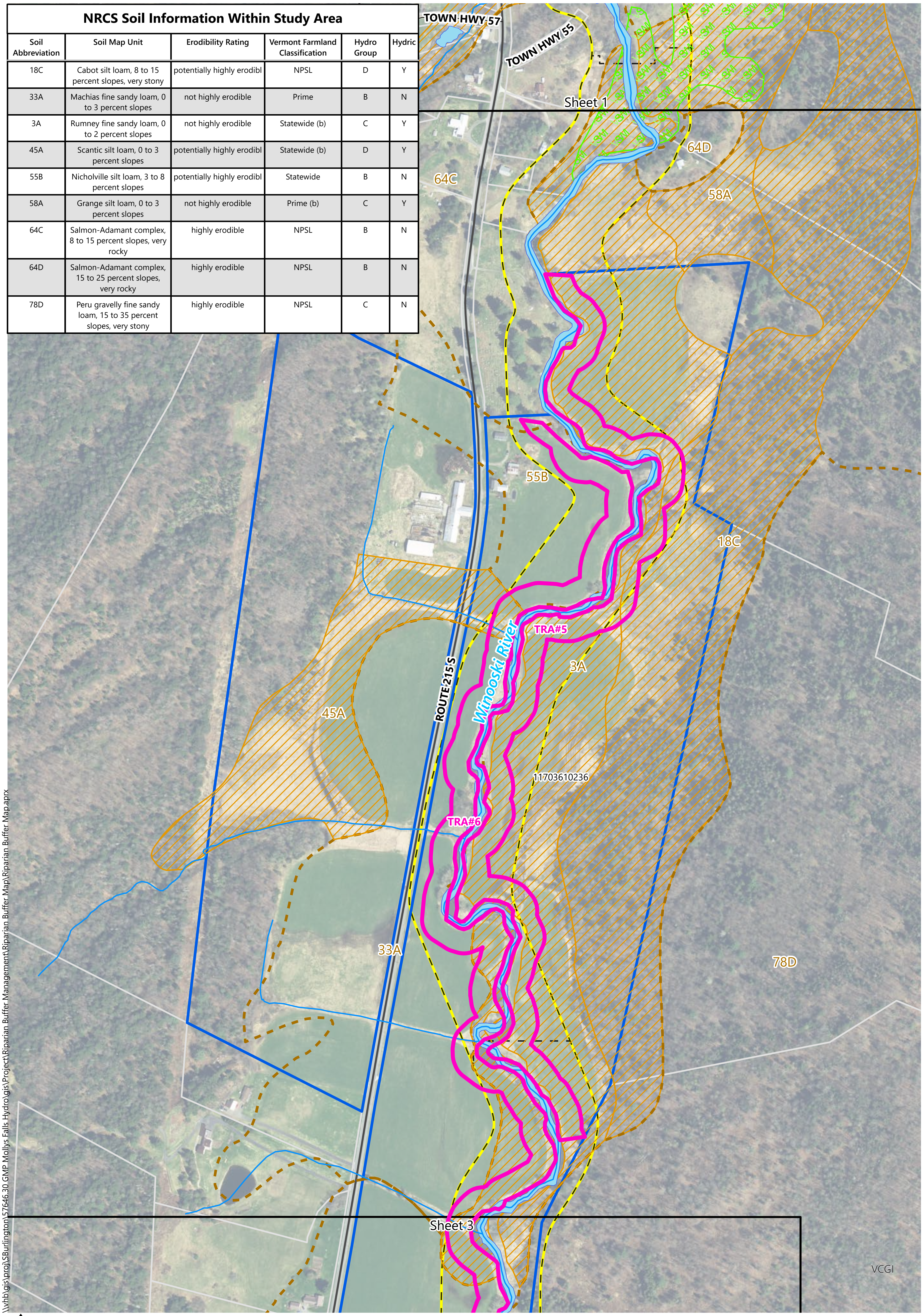
Sheet 1 of 3

Sources:
ANR - Vermont Agency of Natural Resources Web Map Service
VCGI - Vermont Center for Geographic Information Web Map Service
VTrans - Vermont Agency of Transportation Web Map Service
Background Image by VCGI (2018)
VHB - (2020)

September 18, 2020

NRCS Soil Information Within Study Area

Soil Abbreviation	Soil Map Unit	Erodibility Rating	Vermont Farmland Classification	Hydro Group	Hydric
18C	Cabot silt loam, 8 to 15 percent slopes, very stony	potentially highly erodibl	NPSL	D	Y
33A	Machias fine sandy loam, 0 to 3 percent slopes	not highly erodible	Prime	B	N
3A	Rumney fine sandy loam, 0 to 2 percent slopes	not highly erodible	Statewide (b)	C	Y
45A	Scantic silt loam, 0 to 3 percent slopes	potentially highly erodibl	Statewide (b)	D	Y
55B	Nicholville silt loam, 3 to 8 percent slopes	potentially highly erodibl	Statewide	B	N
58A	Grange silt loam, 0 to 3 percent slopes	not highly erodible	Prime (b)	C	Y
64C	Salmon-Adamant complex, 8 to 15 percent slopes, very rocky	highly erodible	NPSL	B	N
64D	Salmon-Adamant complex, 15 to 25 percent slopes, very rocky	highly erodible	NPSL	B	N
78D	Peru gravelly fine sandy loam, 15 to 35 percent slopes, very stony	highly erodible	NPSL	C	N



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GMP Riparian Buffer Management | Cabot, VT

River Buffer Restoration Planning Map

Study Area (VHB)
Target Restoration Areas (VHB)
River Corridors (ANR)
River Corridors (Aug 27, 2019)
Stream (ANR)
Waterbody (ANR)
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Non Hydric Soils
Hydric Soils
Index Map (VHB)
Town Boundary (VCGI)
Roads (VTrans)
Local Road
Other Road
Private Road

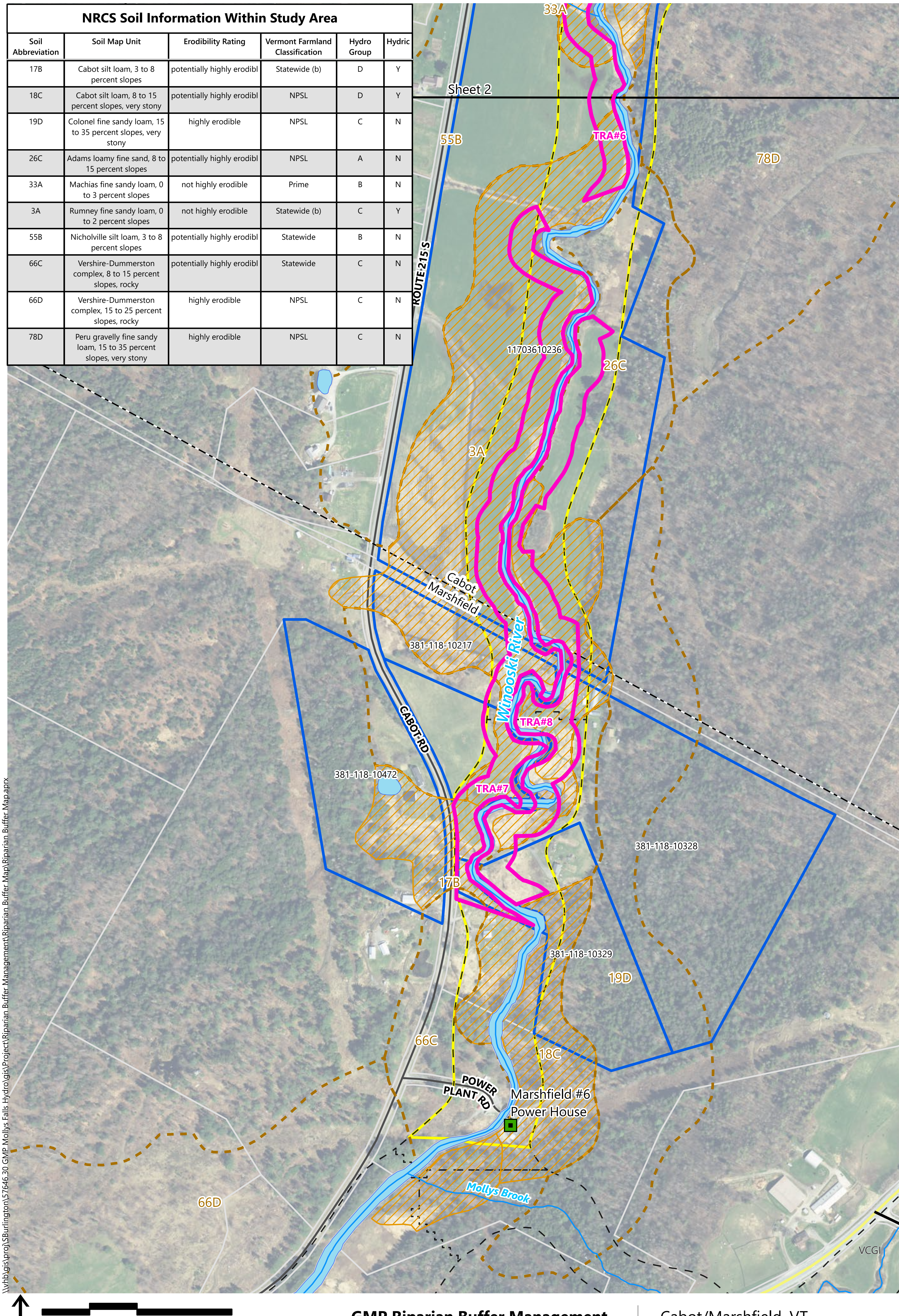
Sheet 2 of 3

Sources:
ANR - Vermont Agency of Natural Resources Web Map Service
VCGI - Vermont Center for Geographic Information Web Map Service
VTrans - Vermont Agency of Transportation Web Map Service
Background Image by VCGI (2018)
VHB - (2020)

vhb September 18, 2020

NRCS Soil Information Within Study Area

Soil Abbreviation	Soil Map Unit	Erodibility Rating	Vermont Farmland Classification	Hydro Group	Hydric
17B	Cabot silt loam, 3 to 8 percent slopes	potentially highly erodibl	Statewide (b)	D	Y
18C	Cabot silt loam, 8 to 15 percent slopes, very stony	potentially highly erodibl	NPSL	D	Y
19D	Colonel fine sandy loam, 15 to 35 percent slopes, very stony	highly erodible	NPSL	C	N
26C	Adams loamy fine sand, 8 to 15 percent slopes	potentially highly erodibl	NPSL	A	N
33A	Machias fine sandy loam, 0 to 3 percent slopes	not highly erodible	Prime	B	N
3A	Rumney fine sandy loam, 0 to 2 percent slopes	not highly erodible	Statewide (b)	C	Y
55B	Nicholville silt loam, 3 to 8 percent slopes	potentially highly erodibl	Statewide	B	N
66C	Vershire-Dummerston complex, 8 to 15 percent slopes, rocky	potentially highly erodibl	Statewide	C	N
66D	Vershire-Dummerston complex, 15 to 25 percent slopes, rocky	highly erodible	NPSL	C	N
78D	Peru gravelly fine sandy loam, 15 to 35 percent slopes, very stony	highly erodible	NPSL	C	N



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GMP Riparian Buffer Management | Cabot/Marshfield, VT

River Buffer Restoration Planning Map

Study Area (VHB)
Target Restoration Areas (VHB)
River Corridors (ANR)
River Corridors (Aug 27, 2019)
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Hydric Soils
Index Map (VHB)
Town Boundary (VCGI)
Roads (VTrans)
US Highway
State Highway
Local Road

Sheet 3 of 3

Sources:
ANR - Vermont Agency of Natural Resources Web Map Service
VCGI - Vermont Center for Geographic Information Web Map Service
VTrans - Vermont Agency of Transportation Web Map Service
Background Image by VCGI (2018)
VHB - (2020)

ATTACHMENT 2

Green Mountain Power: Molly's Falls Hydroelectric Facility
Winooski River Riparian Zone Restoration Plan

NO. 1 / 5.29.2020 9:51 AM

DESCRIPTION

TRA#1, looking west, bank instability.

NO. 2 / 5.29.2020 10:04 AM

DESCRIPTION

TRA#2, looking south, erosion.

Green Mountain Power: Molly's Falls Hydroelectric Facility
Winooski River Riparian Zone Restoration Plan

NO. 3 / 5.29.2020 10:22 AM

DESCRIPTION

TRA#2, looking northwest, previous restoration effort.

NO. 4 / 5.29.2020 10:40 AM

DESCRIPTION

TRA#2, looking south, lack of vegetation and bank instability.

Green Mountain Power: Molly's Falls Hydroelectric Facility
Winooski River Riparian Zone Restoration Plan

NO. 5 / 5.29.2020 9:48 AM

DESCRIPTION

TRA#3, looking north, lack of vegetation and bank instability.

NO. 6 / 5.29.2020 11:14 AM

DESCRIPTION

TRA#4, looking west, bank instability.

Green Mountain Power: Molly's Falls Hydroelectric Facility
Winooski River Riparian Zone Restoration Plan

NO. 7 / 5.29.2020 11:38 AM

DESCRIPTION

TRA#5, looking east, bank instability.

NO. 8 / 5.29.2020 12:07 PM

DESCRIPTION

TRA#6, looking southwest, bank instability.

Green Mountain Power: Molly's Falls Hydroelectric Facility
Winooski River Riparian Zone Restoration Plan

NO. 9 / 5.29.2020 12:03 PM

DESCRIPTION

TRAs #5 and #6, looking south.

NO. 10 / 5.29.2020 12:16 PM

DESCRIPTION

TRA#7, looking south, bank instability.

Green Mountain Power: Molly's Falls Hydroelectric Facility
Winooski River Riparian Zone Restoration Plan

NO. 11 / 5.29.2020 12:29 PM

DESCRIPTION

TRA#7, looking west, lack of vegetation and bank instability.

NO. 12 / 5.29.2020 12:25 PM

DESCRIPTION

TRA#8, looking southeast, bank instability

ATTACHMENT 3

Green Mountain Power: Molly's Falls Hydroelectric Facility
Winooski River Riparian Zone Restoration Plan
Riparian Plant Species

Plant Species Summary				
The following species were either observed within the Target Restoration Areas (TRA's), or are expected to be suitable shade-providing species for the sites.				
Common Name	**Latin Name**	**Wetness Coefficient***	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**
Black Willow	*Salix nigra*	5	R	Tree
Silver Maple	*Acer saccharinum*	3	R	Tree
Bebb's Willow	*Salix bebbiana*	3	R	Shrub
Speckled Alder	*Alnus incana ssp. rugosa*	3	R	Shrub
Tamarack	*Larix laricina*	3	R ††	Tree
Pussy Willow	*Salix discolor*	3	R	Shrub
Balsam Poplar†	*Populus balsamifera*	3	B	Tree
Red Osier Dogwood†	*Cornus sericea*	3	R	Shrub
Balsam Fir	*Abies balsamea*	0	B	Tree
Box Elder	*Acer negundo*	0	R	Tree
Gray Birch†	*Betula populifolia*	0	B	Tree
Red Maple†	*Acer rubrum*	0	B	Tree
Red Elderberry	*Sambucus racemosa*	-3	B	Shrub
Quaking Aspen†	*Populus tremuloides*	-3	U	Tree
White Pine	*Pinus strobus*	-3	U	Tree

* The wetness coefficient corresponds to wetland indicator status where 5 is obligate and -5 is upland

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

† Not observed on site, but ecologically and hydrologically fitting

†† Not ranked by the VT DEC, VHB estimate.

Green Mountain Power: Molly's Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Target Restoration Areas (TRA) Specific Planting Plans

TRA 1					
TRA Dominant Soil Type(s)	**Hydric Soil?**	**TRA Subunit Size**	**Stems/Acre***	**Total Stems**	
Rumney Fine Sandy Loam	Yes	1.26	400	504	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Black Willow	*Salix nigra*	5	R	Tree	42
Bebb's Willow	*Salix bebbiana*	3	R	Shrub	42
Speckled Alder	*Alnus incana ssp. rugosa*	3	R	Shrub	42
Pussy Willow	*Salix discolor*	3	R	Shrub	42
Red Osier Dogwood	*Cornus sericea*	3	R	Shrub	42
Silver Maple	*Acer saccharinum*	3	R	Tree	42
Tamarack	*Larix laricina*	3	R	Tree	42
Balsam Poplar	*Populus balsamifera*	3	B	Tree	42
Balsam Fir	*Abies balsamea*	0	B	Tree	42
Box Elder	*Acer negundo*	0	R	Tree	42
Gray Birch	*Betula populifolia*	0	B	Tree	42
Red Maple	*Acer rubrum*	0	B	Tree	42

Notes:

*From VT DEC Guidance "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers," 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

This TRA is mapped as entirely hydric soils. Given the mapped hydric soil of the TRA, species with wetness coefficients of -3 or -5, or VT DEC planting locations of U, are not proposed. 75% of species recommended are trees (per DEC Guidance of at least 50%).

Green Mountain Power: Molly's Falls Hydroelectric Facility
Winooski River Riparian Zone Restoration Plan
Target Restoration Areas (TRA) Specific Planting Plans

TRA 2					
TRA Dominant Soil Type(s)	**Hydric Soil?**	**TRA Subunit Size**	**Stems/Acre***	**Total Stems**	
Rumney Fine Sandy Loam and Scantic silt	Yes	6.07	400	2,428	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Black Willow	*Salix nigra*	5	R	Tree	202
Bebb's Willow	*Salix bebbiana*	3	R	Shrub	202
Speckled Alder	*Alnus incana ssp. rugosa*	3	R	Shrub	202
Pussy Willow	*Salix discolor*	3	R	Shrub	202
Red Osier Dogwood	*Cornus sericea*	3	R	Shrub	202
Silver Maple	*Acer saccharinum*	3	R	Tree	202
Tamarack	*Larix laricina*	3	R	Tree	202
Balsam Poplar	*Populus balsamifera*	3	B	Tree	202
Balsam Fir	*Abies balsamea*	0	B	Tree	202
Box Elder	*Acer negundo*	0	R	Tree	202
Gray Birch	*Betula populifolia*	0	B	Tree	202
Red Maple	*Acer rubrum*	0	B	Tree	202

Notes:

*From VT DEC Guidance "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers," 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

This TRA had three mapped soils, two of which were hydric and one of which was not, but which only comprised approximately 7% of the TRA area. Given the mapped hydric soil of the TRA, species with wetness coefficients of -3 or -5, or VT DEC planting locations of U, are not proposed. 75% of species recommended are trees (per DEC Guidance of at least 50%).

Green Mountain Power: Molly's Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Target Restoration Areas (TRA) Specific Planting Plans

TRA 3					
TRA Dominant Soil Type(s)	**Hydric Soil?**	**TRA Subunit Size**	**Stems/Acre***	**Total Stems**	
Rumney Fine Sandy Loam	Yes	5.51	400	2,204	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Black Willow	*Salix nigra*	5	R	Tree	184
Bebb's Willow	*Salix bebbiana*	3	R	Shrub	184
Speckled Alder	*Alnus incana ssp. rugosa*	3	R	Shrub	184
Pussy Willow	*Salix discolor*	3	R	Shrub	184
Red Osier Dogwood	*Cornus sericea*	3	R	Shrub	184
Silver Maple	*Acer saccharinum*	3	R	Tree	184
Tamarack	*Larix laricina*	3	R	Tree	184
Balsam Poplar	*Populus balsamifera*	3	B	Tree	184
Balsam Fir	*Abies balsamea*	0	B	Tree	184
Box Elder	*Acer negundo*	0	R	Tree	184
Gray Birch	*Betula populifolia*	0	B	Tree	184
Red Maple	*Acer rubrum*	0	B	Tree	184

Notes:

*From VT DEC Guidance "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers," 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

TRA 3 is mapped as 98% hydric soils. Given the mapped hydric soil of the TRA, species with wetness coefficients of -3 or -5, or VT DEC planting locations of U, are not proposed. 75% of species recommended are trees (per DEC Guidance of at least 50%).

Green Mountain Power: Molly's Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Target Restoration Areas (TRA) Specific Planting Plans

TRA 4					
TRA Dominant Soil Type(s)	**Hydric Soil?**	**TRA Subunit Size**	**Stems/Acre***	**Total Stems**	
Rumney Fine Sandy Loam	Yes	2.55	400	1,020	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Black Willow	*Salix nigra*	5	R	Tree	85
Bebb's Willow	*Salix bebbiana*	3	R	Shrub	85
Speckled Alder	*Alnus incana ssp. rugosa*	3	R	Shrub	85
Pussy Willow	*Salix discolor*	3	R	Shrub	85
Red Osier Dogwood	*Cornus sericea*	3	R	Shrub	85
Silver Maple	*Acer saccharinum*	3	R	Tree	85
Tamarack	*Larix laricina*	3	R	Tree	85
Balsam Poplar	*Populus balsamifera*	3	B	Tree	85
Balsam Fir	*Abies balsamea*	0	B	Tree	85
Box Elder	*Acer negundo*	0	R	Tree	85
Gray Birch	*Betula populifolia*	0	B	Tree	85
Red Maple	*Acer rubrum*	0	B	Tree	85

Notes:

*From VT DEC Guidance "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers," 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

TRA 4 is mapped as approximately 97% hydric soils. Given the mapped hydric soil of the TRA, species with wetness coefficients of -3 or -5, or VT DEC planting locations of U, are not proposed. 75% of species recommended are trees (per DEC Guidance of at least 50%).

Green Mountain Power: Molly's Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Target Restoration Areas (TRA) Specific Planting Plans

TRA 5					
TRA Dominant Soil Type(s)	**Hydric Soil?**	**TRA Subunit Size**	**Stems/Acre***	**Total Stems**	
Rumney Fine Sandy Loam	Yes	9.5	400	3,800	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Black Willow	*Salix nigra*	5	R	Tree	317
Bebb's Willow	*Salix bebbiana*	3	R	Shrub	317
Speckled Alder	*Alnus incana ssp. rugosa*	3	R	Shrub	317
Pussy Willow	*Salix discolor*	3	R	Shrub	317
Red Osier Dogwood	*Cornus sericea*	3	R	Shrub	317
Silver Maple	*Acer saccharinum*	3	R	Tree	317
Tamarack	*Larix laricina*	3	R	Tree	317
Balsam Poplar	*Populus balsamifera*	3	B	Tree	317
Balsam Fir	*Abies balsamea*	0	B	Tree	317
Box Elder	*Acer negundo*	0	R	Tree	317
Gray Birch	*Betula populifolia*	0	B	Tree	317
Red Maple	*Acer rubrum*	0	B	Tree	317

Notes:

*From VT DEC Guidance "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers," 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

TRA 5 is mapped as approximately 99% hydric soils. Given the mapped hydric soil of the TRA, species with wetness coefficients of -3 or -5, or VT DEC planting locations of U, are not proposed. 75% of species recommended are trees (per DEC Guidance of at least 50%).

Green Mountain Power: Molly's Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Target Restoration Areas (TRA) Specific Planting Plans

TRA 6 U (Upland)					
TRA Dominant Soil Type(s)	**Hydric Soil?**	**TRA Subunit Size**	**Stems/Acre***	**Total Stems**	
Nicholville Silt and Machias fine sandy loam	No	7.53	400	3,012	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Balsam Fir	*Abies balsamea*	0	B	Tree	431
Box Elder	*Acer negundo*	0	R	Tree	431
Gray Birch	*Betula populifolia*	0	B	Tree	431
Red Maple	*Acer rubrum*	0	B	Tree	431
Red Elderberry	*Sambucus racemosa*	-3	B	Shrub	431
Quaking Aspen	*Populus tremuloides*	-3	U	Tree	431
White Pine	*Pinus strobus*	-3	U	Tree	431

Notes:

*From VT DEC Guidance "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers," 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

TRA 6 is approximately 60% mapped non-hydric soil and 40% hydric soils; thus the TRA has been split into subunits 6U (upland) & 6H (hydric).

Subunit 6U of TRA 6 is an upland floodplain terrace, thus species that are either obligate or facultative wetland have been excluded from the recommended plants. Box elder, which is recommended for Riparian placement by the DEC, is recommended because it is a fast-growing, hardy species that would thrive in the well-drained soils. Approximately 85% of recommended species are trees.

Green Mountain Power: Molly's Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Target Restoration Areas (TRA) Specific Planting Plans

TRA 6 H (Hydric)					
TRA Dominant Soil Type(s)	**Hydric Soil?**	**TRA Subunit Size**	**Stems/Acre***	**Total Stems**	
Rumney Fine Sandy Loam	Yes	4.9	400	1,960	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Black Willow	*Salix nigra*	5	R	Tree	164
Bebb's Willow	*Salix bebbiana*	3	R	Shrub	164
Speckled Alder	*Alnus incana ssp. rugosa*	3	R	Shrub	164
Pussy Willow	*Salix discolor*	3	R	Shrub	164
Red Osier Dogwood	*Cornus sericea*	3	R	Shrub	164
Silver Maple	*Acer saccharinum*	3	R	Tree	164
Tamarack	*Larix laricina*	3	R	Tree	164
Balsam Poplar	*Populus balsamifera*	3	B	Tree	164
Balsam Fir	*Abies balsamea*	0	B	Tree	164
Box Elder	*Acer negundo*	0	R	Tree	164
Gray Birch	*Betula populifolia*	0	B	Tree	164
Red Maple	*Acer rubrum*	0	B	Tree	164

Notes:

*From VT DEC Guidance "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers," 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

TRA 6 is approximately 60% mapped non-hydric soil and 40% hydric soils; thus the TRA has been split into subunits 6U (upland) & 6H (hydric).

Given the mapped hydric soils within TRA 6H, species with wetness coefficients of -3 or -5, or VT DEC planting locations of U, are not proposed. 75% of species recommended are trees (per DEC Guidance of at least 50%).

Green Mountain Power: Molly’s Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Target Restoration Areas (TRA) Specific Planting Plans

TRA 7					
TRA Dominant Soil Type(s)	**Hydric Soil?**	**TRA Subunit Size**	**Stems/Acre***	**Total Stems**	
Rumney Fine Sandy Loam	Yes	8.3	400	3,320	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Black Willow	*Salix nigra*	5	R	Tree	277
Bebb's Willow	*Salix bebbiana*	3	R	Shrub	277
Speckled Alder	*Alnus incana ssp. rugosa*	3	R	Shrub	277
Pussy Willow	*Salix discolor*	3	R	Shrub	277
Red Osier Dogwood	*Cornus sericea*	3	R	Shrub	277
Silver Maple	*Acer saccharinum*	3	R	Tree	277
Tamarack	*Larix laricina*	3	R	Tree	277
Balsam Poplar	*Populus balsamifera*	3	B	Tree	277
Balsam Fir	*Abies balsamea*	0	B	Tree	277
Box Elder	*Acer negundo*	0	R	Tree	277
Gray Birch	*Betula populifolia*	0	B	Tree	277
Red Maple	*Acer rubrum*	0	B	Tree	277

Notes:

*From VT DEC Guidance “Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers,” 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

TRA 7 is mapped as 94% hydric soils. Given the mapped hydric soil of the TRA, species with wetness coefficients of -3 or -5, or VT DEC planting locations of U, are not proposed. 75% of species recommended are trees (per DEC Guidance of at least 50%).

Green Mountain Power: Molly's Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Target Restoration Areas (TRA) Specific Planting Plans

TRA 8U (Upland)					
TRA Dominant Soil Type(s)	**TRA Subunit Size**	**Hydric Soil?**	**Stems/Acre***	**Total Stems**	
Adams Loamy Fine Sand	2.6	No	400	1,040	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Balsam Fir	*Abies balsamea*	0	B	Tree	149
Box Elder	*Acer negundo*	0	R	Tree	149
Gray Birch	*Betula populifolia*	0	B	Tree	149
Red Maple	*Acer rubrum*	0	B	Tree	149
Red Elderberry	*Sambucus racemosa*	-3	B	Shrub	149
Quaking Aspen	*Populus tremuloides*	-3	U	Tree	149
White Pine	*Pinus strobus*	-3	U	Tree	149

Notes:

*From VT DEC Guidance "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers," 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

TRA 8 is mapped as 43% non-hydric soil and 57% hydric soil; thus, TRA 8 has been split into 8U (upland) and 8H (Hydric) subunits.

Subunit 8U of TRA 8 is an upland floodplain terrace, thus species that are either obligate or facultative wetland have not been recommended. Box elder, which is recommended for Riparian placement by the DEC, is recommended because it is a fast-growing, hardy species that would thrive in the well-drained soils. Approximately 85% of recommended species are trees.

Given the mapped hydric soils within TRA 8H, species with wetness coefficients of -3 or -5, or VT DEC planting locations of U, are not proposed. 75% of species recommended are trees (per DEC Guidance of at least 50%).

Green Mountain Power: Molly's Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Target Restoration Areas (TRA) Specific Planting Plans

TRA 8H (Hydric)					
TRA Dominant Soil Type(s)	**TRA Subunit Size**	**Hydric Soil?**	**Stems/Acre***	**Total Stems**	
Rumney Fine Sandy Loam	3.46	Yes	400	1,384	
Proposed Species					
Common Name	**Latin Name**	**Wetness Coefficient**	**VT DEC Planting Location Recommendation****	**Shrub or Tree?**	**Stems Recommended**
Black Willow	*Salix nigra*	5	R	Tree	116
Bebb's Willow	*Salix bebbiana*	3	R	Shrub	116
Speckled Alder	*Alnus incana ssp. rugosa*	3	R	Shrub	116
Pussy Willow	*Salix discolor*	3	R	Shrub	116
Red Osier Dogwood	*Cornus sericea*	3	R	Shrub	116
Silver Maple	*Acer saccharinum*	3	R	Tree	116
Tamarack	*Larix laricina*	3	R	Tree	116
Balsam Poplar	*Populus balsamifera*	3	B	Tree	116
Balsam Fir	*Abies balsamea*	0	B	Tree	116
Box Elder	*Acer negundo*	0	R	Tree	116
Gray Birch	*Betula populifolia*	0	B	Tree	116
Red Maple	*Acer rubrum*	0	B	Tree	116

Notes:

*From VT DEC Guidance "Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers," 1994.

** **R**=Riparian floodplain (hydric soils and periodic inundation); **U**=Upland (Drier upland side slopes and terraces); **B**=Both

TRA 8 is mapped as 43% non-hydric soil and 57% hydric soil; thus, TRA 8 has been split into 8U (upland) and 8H (Hydric) subunits.

Given the mapped hydric soils within TRA 8H, species with wetness coefficients of -3 or -5, or VT DEC planting locations of U, are not proposed. 75% of species recommended are trees (per DEC Guidance of at least 50%).

ATTACHMENT 4

Green Mountain Power: Molly's Falls Hydroelectric Facility

Winooski River Riparian Zone Restoration Plan

Potential Partner Organization Details

Organization	Mailing Address	Primary Contact	Phone Number	Email	Initial Contact Date	Interested ?	Role
U.S. Fish and Wildlife Service	11 Lincoln St., Essex Junction, VT 05452	Katie Kain	(802) 238-3316	katherine_kain@fws.gov	6/9/2020	Yes	Technical support for developing restoration plan; field coordination
Friends of the Winooski River	P.O. Box 777, Montpelier, VT 05601	Michele Braun; Shawn White	(802) 279-3771	Michele@winooskiriver.org; Shawn@winooskiriver.org	9/2/2020	Yes	Outreach to landowners
Trout Unlimited - MadDog Chapter	P.O. Box 793, Montpelier, VT 05601	Jared Carpenter	--	rjaredcarpenter@gmail.com	9/2/2020	Yes	Volunteer field crew
Cabot Conservation Committee	P.O. Box 36, 3084 Main St., Cabot, VT 05647	Gary Gulka, Chair	(802) 563-2279	tcocabot@gmail.com	--	TBD	Outreach to landowners
Marshfield Conservation Commission	122 School St., Marshfield, VT 05658	Anne Reed, Chair; Steve Fiske	(802) 426-3305	clerk@town.marshfield.vt.us	--	TBD	Outreach to landowners
Winooski Natural Resources Conservation District	617 Comstock Rd., Suite 1, Berlin, VT 05602	Gianna Petito	(802) 778-3178	gianna@winooskinrcd.org	--	TBD	Field crew coordination; outreach
Conservation Reserve Enhancement Program	Vermont State Farm Service Agency, 356 Mountain View Drive, Suite 104, Colchester, VT 05446	Ben Gabos	--	Ben.Gabos@vermont.gov	--	TBD	Financial support to landowners
Seventh Generation	60 Lake St., Burlington, VT 05401	Melissa Mills	--	melissa.mills@seventhgeneration.com	7/1/2020	Yes	Volunteer field crew
Cabot Creamery	193 Home Farm Way, Waitsfield, VT 05673	--	--	--	--	TBD	Volunteer field crew with prior experience
SunCommon	442 US-2, Waterbury, VT 05676	--	--	--	--	TBD	Volunteer field crew with prior experience

APPENDIX 5

Memorandum

To: GMP Mollys Falls Project File

Date: September 28, 2020

Project #: 57646.30

From: Levi Keszey, Ecologist

RE: Green Mountain Power: Molly's Falls Hydroelectric Facility
Winooski River Riparian Zone Restoration Plan,
Anticipated Impacts on Stream Temperature

INTRODUCTION

This memorandum assesses the anticipated temperature impacts of implementing the Winooski River Riparian Zone Restoration Project in the approximately 3.15-mile reach of river in Cabot and Marshfield, Vermont, upstream of GMP's Molly's Falls Hydroelectric Facility powerhouse. The Restoration Project is described in detail in VHB's Winooski River Riparian Zone Restoration Plan (VHB, 2020). Based on a literature review conducted by VHB, water temperature in streams and rivers is impacted by three main factors: 1) advected heat from upstream, 2) heat exchange at the air-water column interface, and 3) groundwater inflows (Garner et al. 2017). These broad factors are determined by numerous complex variables having to do with climate, landscape, geology and hydrology, all of which are dynamic and unique to the body of water. These factors, plus the complicated and unpredictable impacts of climate change make predictions of stream temperatures complex.

Due to the nature of the Restoration Project, the assessment presented in this memorandum focuses on the second factor mentioned above, and specifically, the role in which shading due to riparian vegetation plays in stream temperatures. Various peer-reviewed sources were evaluated in order to understand how riparian shading impacts stream temperatures, and to estimate how stream temperatures would change following the restoration of riparian vegetation for shading along the approximately 3.15-mile reach of the Winooski River that is the subject of the Restoration Project.

IMPACT OF RIPARIAN VEGETATION ON STREAM WATER TEMPERATURES

General

VHB reviewed various scientific literature articles regarding riparian vegetation, shading, and instream water temperatures which are listed in the References and Resources section below.

In summary, the scientific literature indicates that riparian vegetation decreases peak and average water temperature during the hottest months of the year and reduces the extent of water-temperature fluctuations. Shading of a stream due to riparian vegetation decreases the air temperatures, thus

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South Burlington, VT 05403-7771
P 802.497.6100

decreasing heat exchange to the water at the air-water column interface (Hannah et al., 2008; Hrachowitz et al., 2010; Roth et al., 2010; among others). The temperature impacts of riparian vegetation are most significant during the warmer months because that period coincides with the growing season when leaves are present on deciduous trees and shrubs. Further, this is when the potential temperature difference between air and water temperatures is at its greatest, creating high potential for heat transfer from the air to water.

Direct solar radiation on the water surface is only one shade-related cause of temperature fluctuations in streams. Additionally, riparian vegetation can create microclimates by altering wind, relative humidity and air temperatures (Hannah et al., 2008; Garner et al. 2015). Streams that lack the cooler microclimate created by riparian vegetation are susceptible to higher daily and seasonal temperature fluctuations (Dugdale et al., 2018; Garner et al. 2017; Rutherford et al. 1997). Streams that have undergone riparian vegetation removal have shown increases in water temperature maximums and fluctuations (Garner et al. 2017; Brown, 1969; Leblanc and Brown, 2000) and conversely, streams that have undergone riparian revegetation, either through restoration or recruitment, have shown decreases in water temperature maximums and fluctuations (Bond et al.. 2015; Garner et al. 2017). Garner et al. (2017) found that simulated temperature decreased as canopy density decreased and documented that even intermediate canopy densities had the potential to significantly lower maximum and mean stream temperatures.

Bowler et. Al. (2012) reviewed numerous water temperature studies (approximately 20 stream temperature datasets) from streams with and without riparian buffers and identified two key trends: 1) mean water temperatures were 0.39°C cooler in shaded streams than in non-shaded streams, on average; 2) peak water temperatures were 3.16°C cooler in shaded streams than in non-shaded streams, on average. The study also documented higher differences in stream temperature between forested and non-forested landscapes, but these figures are less pertinent as this project is aiming to restore a riparian buffer, not to reforest the entire landscape within the watershed.

Based on the findings of the reviewed literature, it is expected that an increase in shade along the banks of the Winooski River in the Restoration Project area, especially dense vegetation with the potential for tall growth, would contribute to a decrease in the peak and average water temperatures in the Winooski River where it meets GMP's Mollys Falls powerhouse.

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Quantitative

Based on the literature review, quantifying instream water temperatures accurately requires consideration of numerous factors and is still somewhat unreliable. Whereas the link between riparian shade and stream temperature is widely accepted, the ability to predict temperature changes accurately in response to changes in riparian vegetation is still very imprecise and nuanced depending on many characteristics of the stream and watershed in question. Rutherford et al. (1997) found that shade along streams can be highly variable, difficult to measure, and prone to change with the seasons. Abiotic factors such as direction of flow, sinuosity, elevation, bank height, adjacent topography (hills and mountains), and depth of water are significant variables in modeling stream shading (Rutherford et al. 1997; Garner et al. 2017). At the Restoration Project area in particular, the Winooski River has shown significant changes in sinuosity, bank height, and direction of flow as the river has been recently adjusting its course and meandering (VHB, 2020), thus confounding attempts to isolate riparian vegetation as a factor in quantifying water-temperature impacts.

In addition, biotic factors such as riparian vegetation species, age structure, density and riparian corridor width, affect stream temperatures (Leblanc and Brown, 2000). These variables, along with considerable precipitation and air temperature variations from year to year, land-use changes to riparian areas along tributaries, legacy and new wetland impacts, and climate change, among others, contribute to the uncertainty of quantifying future water temperatures in a stream.

Brown (1969, 1970) developed the exposed surface model which uses changes in exposed water surface (due to changes in riparian vegetation shading), insolation (solar radiation amount) and streamflow to predict changes in water temperatures:

$$\Delta T = \frac{AN}{Q} * .000167$$

This simplified model calculates water temperature change (ΔT, °C) as a function of new stream surface area (A, m^2), insolation (N, cal/cm^2-min) and stream flow (Q, m^3/s). VHB used a GIS model to determine the values of A and N that would correspond to complete implementation of the proposed riparian revegetation in the Restoration Project Area. For this analysis, VHB used ArcPro GIS to generate a raster that is representative of tree growth 25 years after Project implementation per the findings of Justice et al. (2017) that the most rapid water temperature benefits occur in the first 25 years after revegetation. Random

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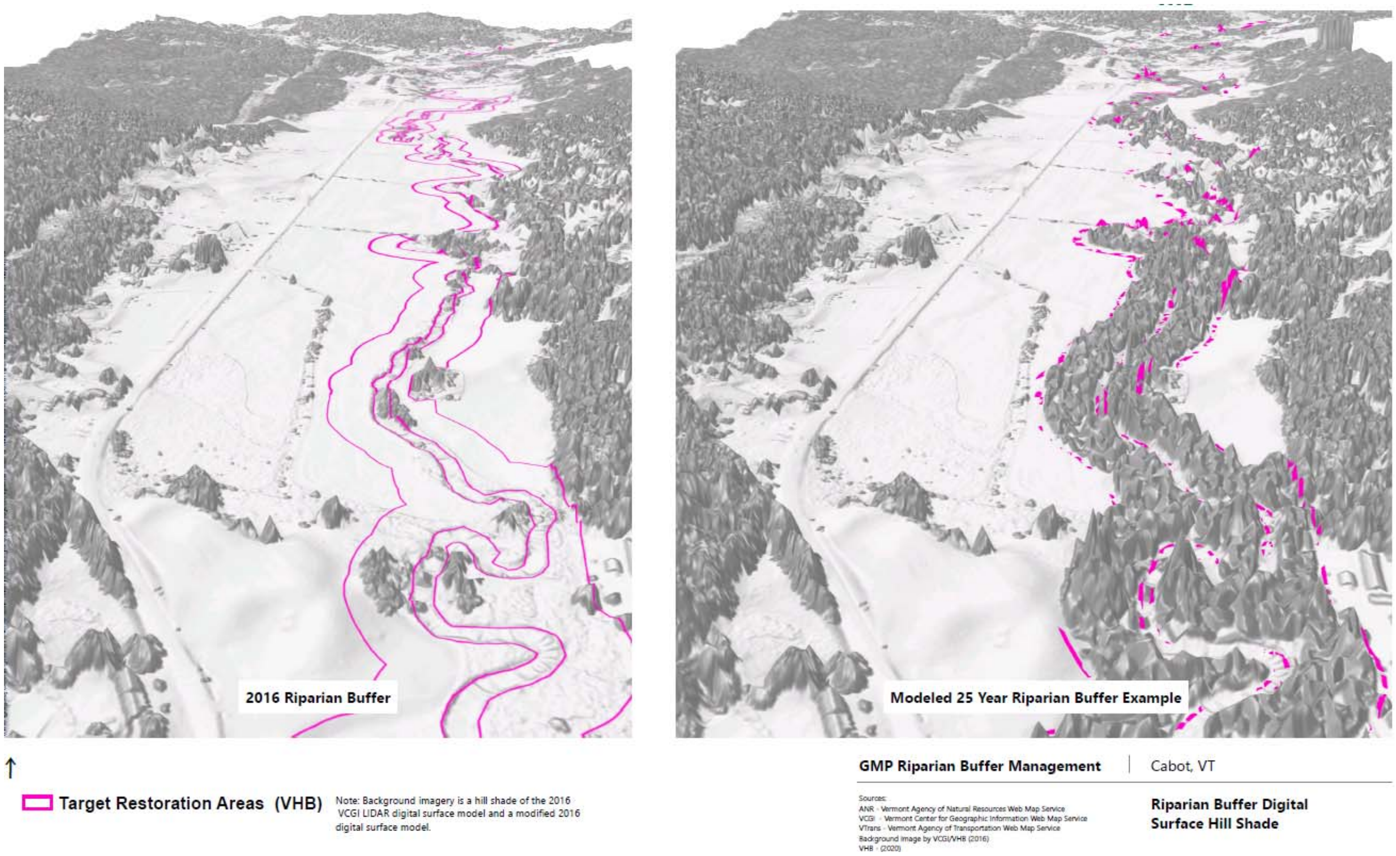
point elevations with elevations from 15 to 60 feet were generated at a density of 200 points per acres to represent mature tree heights based on the growth rate of proposed species over 25 years. A raster was generated from the points and appended to the 2017 Processed LIDAR Digital Surface Model ("DSM"). Figure 1 below depicts the GIS model with current buffer vegetation shown on the left (before proposed restoration) and anticipated riparian buffer 25 years following revegetation on the right.

Figure 1 – GIS Shading Model: Current and Full Restoration Conditions



The Area Solar Radiation (Spatial Analyst) tool was used to calculate the possible solar radiation change of the river surface using the unedited 2017 DSM to represent current conditions, and using the DSM with the appended tree-canopy raster, to represent conditions at full riparian revegetation in the Restoration Project Area. The Area Solar Radiation tool was used to estimate canopy shade. Figure 2 below depicts the Area Solar Radiation results based upon the current (2016) and modeled (25 years following revegetation) riparian buffers shown above.

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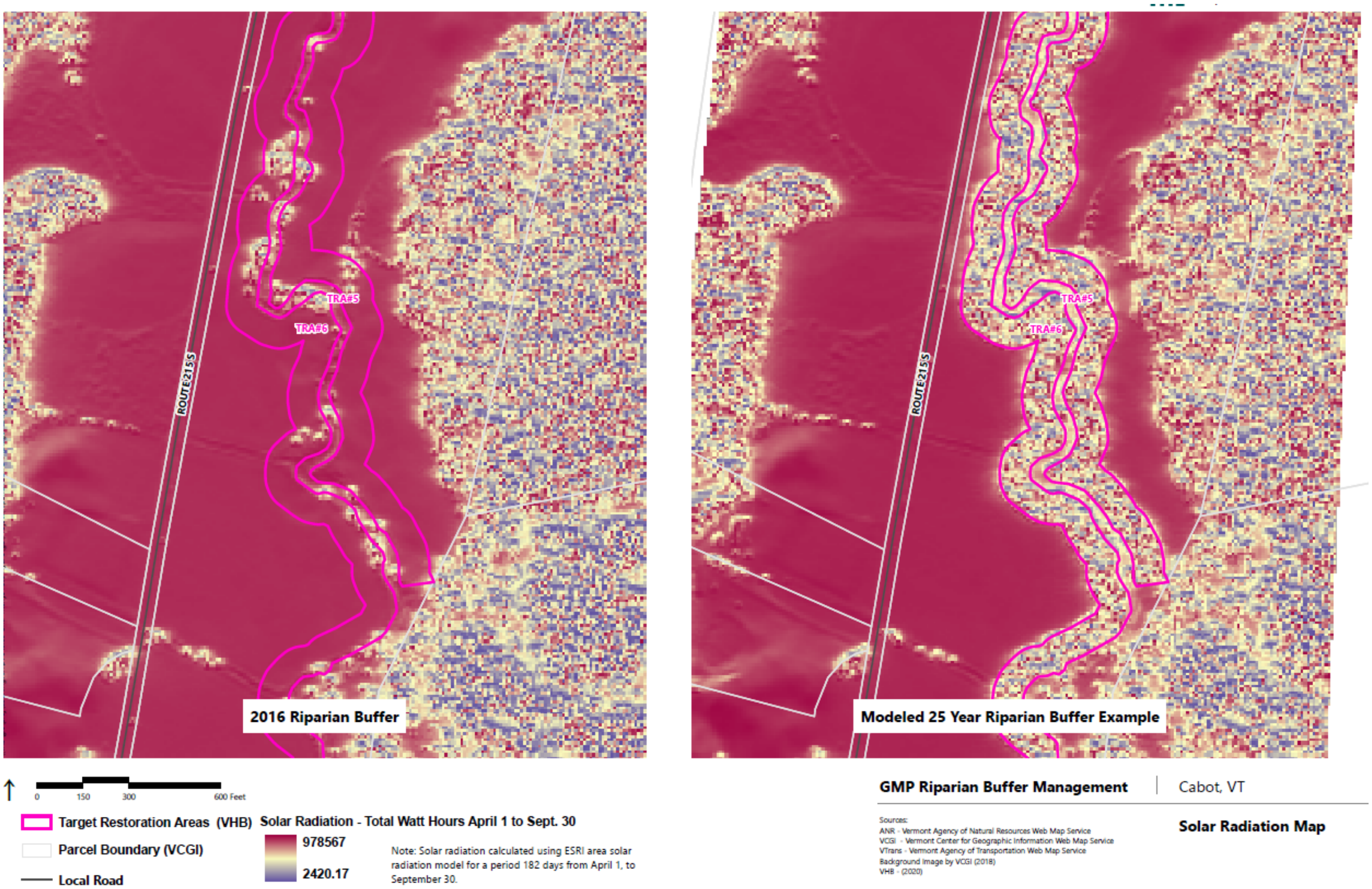
Figure 2 – Area Solar Radiation Results



Using the insolation (N) and exposed surface area (A) values generated by this GIS analysis, VHB ran the Brown (1969, 1970) model to predict potential stream temperature changes 25 years following proposed revegetation. For full restoration of the riparian zone in the approximately 3.15-mile reach of river at the Restoration Project, this analysis predicted a change in water temperature of 1.7° C at August Median streamflow (7.5 cfs) and 3.0° C at 7Q10 streamflow (4.2 cfs).

The advantage to this simplified model is that the required inputs are feasible to determine with reasonable accuracy, based on available data. In comparing models to field measurements, McGurk (1989) found that the Brown model predicted stream temperatures relative to the standards of error associated with the data

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upon which the calculations were made. In other words, quantifying stream temperatures based on field measurements has its limitations associated with the ability of the point-collected field data to represent conditions across the watershed. Further, simplified models do not account for some of the variables discussed above and thus may not provide a comprehensive heat budget of the watershed.

More recent stream temperature model development has relied more heavily on remote sensing and computer modeling to incorporate additional variables in temperature prediction, such as stream morphology and landcover classes. Bond et al. (2015) found that partial reforestation of riparian vegetation lowered peak stream temperatures 0.11° to 0.12 °C per km for partial and 0.26° to 0.27° C per km for full reforestation of riparian vegetation. The proposed Target Restoration Areas for the Restoration Project total approximately 5 km which, when the above estimates are applied, indicates that partial restoration of the riparian buffer in the Restoration Project area could cool the peak water temperatures by 0.55° to 0.60° C and eventual total riparian buffer restoration could cool the peak water temperatures by 1.3° to 1.35°C.

Abbott (2012), in modeling and measuring water temperatures of the Shasta River, found that maximum vegetation impact on average daily temperatures would be approximately 4°C. Further, Abbott's findings suggest that revegetation efforts should be focused on areas of shallow flows, which VHB has found to be representative of the reach of the Winooski in question.

La Marche et Al. (1997) used a model called STRTEMP, with GIS-derived inputs to analyze the potential effects of riparian buffer removal on stream temperatures along the Deschutes River and found that total riparian vegetation removal could lead to a daily peak temperature increase of as much as 3°C.

Boyd and Casper (2003) developed a more comprehensive analytical method called Heat Source that is used by the Oregon Department of Environmental Quality. This model employs a robust set of variables and geospatial modeling, but the authors caution that individual streams and rivers are "thermally unique" and "inherently complex". Heat Source employs Excel and ArcGIS tools, comes with a 200+ page user manual, and is the most comprehensive tool VHB has found to answer this question; however, the Heat Source manual explicitly warns that when possible, parties should not seek to predict stream temperatures when they can be measured.

Justice et al. (2016) used Heat Source to model basin-wide restoration of both channel width and riparian vegetation along two rivers in Oregon. The study found these actions could potentially reduce peak water temperatures by approximately 3.5° C in the large Upper Grande Ronde basin and 1.8° C in the smaller

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Catherine Creek basin. The study also found that the simulated water temperatures tracked closely with measured stream temperatures, giving more credence to the Heat Source model. As previously mentioned, the model predicted the most rapid temperature reductions to occur during the first 25 years, in this case up to 2.2° C. It is expected that temperature impacts in the Winooski River would also be most significant in the first 25 years.

The Heat Source analytical model is a potential tool for predicting the benefits of land-use changes within a basin on stream temperatures, but would likely not be able to quantify temperature impacts for this Restoration Project accurately for a few reasons:

1) Intensive data input requirements: As mentioned above, Heat Source's strength is in its comprehensive analysis of the watershed, but this requires significant remote and in-field data collection including precise channel dimensions, bed substrates, flow and wind measurements and landcover data. This data is currently unavailable, resource and time-intensive to gather, and is subject to change over time, irrespective of the Riparian Restoration Project.

2) Issues of scale: The Heat Source model works best when analyzing entire larger basins as opposed to a middle watershed segment of a stream.

CONCLUSIONS

VHB has conducted extensive research into the effects of riparian zone restoration and shading on stream water temperatures. Based on the literature, VHB expects this Restoration Project will improve water quality by lowering average annual peak temperatures and by reducing daily water-temperature fluctuations compared to current conditions. The temperature impacts will be manifested gradually, as the restoration plantings grow and mature to the extent that they will provide substantial amounts of shade. A precise quantification of the temperature impacts is not considered feasible, due to the numerous variables in Vermont's changing climate including changing streamflows and temperatures, due to the changing morphology and active meandering of the subject reach of the Winooski River, and because the restoration plantings are expected to be planted at staggered times and are expected to grow into a mature forested riparian buffer. Nonetheless, due to the Restoration Project peak daytime water temperatures could be reduced by 0.55° to 1.35° C based on Bond et al. (2015), or 1.7° to 3.0 ° C depending on streamflow based on Brown (1970), and potentially could be reduced by as much as 4° C based on the findings of Abbott

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(2012) and La Marche, et. al. (1997). Temperature impacts are expected to increase during the first 25 years following planting. GMP and VHB look forward to monitoring the outcome of the Restoration Project and contributing new data to the evolving science of stream restoration in Vermont.

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REFERENCES AND RESOURCES

Abbott, Alida G.P. 2002. The effect of riparian vegetation on stream temperature in the Shasta River. Masters Thesis.

Bond, R. M., A.P. Stubblefield, R. W. Van Kirk. 2015. Sensitivity of summer stream temperatures to climate variability and riparian reforestation strategies. Journal of Hydrology, 4. Pgs. 267-279.

Bowler, D.E., R. Mant, H. Orr, D. M. Hannah and A.S. Pullin. 2012. What are the effects of wooded riparian zones on stream temperatures? Environmental Evidence.

Boyd, M., and Kasper, B. 2003. Analytical methods for dynamic open channel heat and mass transfer: Methodology for heat source model Version 7.0.

Brown, George W. 1969. Predicting temperatures of small streams. Water Resources Research 5:1.

Brown, George W. 1970. Predicting the effect of clearcutting on stream temperature. Journal of Soil and Water Conservation 25(1):11-13.

Dugdale, S.J., I.A. Malcom, K. Kantola, D. M. Hannah. 2018. Stream temperature under contrasting riparian forest cover: Understanding thermal dynamic and heat exchange processes. Science of the Total Environment 610-611 pgs. 1375-1389.

Garner, G., Malcolm, I.A., Sadler, J.P., Millar, C.P., Hannah, D.M., 2015. Inter-annual variability in the effects of riparian woodland on micro-climate, energy exchanges and water temperature of an upland Scottish stream. Hydrol. Process. 29 (6), 1080–1095. http://dx.doi.org/10.1002/hp.10.223.

Garner, G., I.A. Malcolm, J.P. Sadler, D. M. Hannah. 2017. The role of riparian vegetation density, channel orientation and water velocity in determining river temperature dynamics. Journal of Hydrology 533. Pgs. 471-485.

Hannah, D.M., Malcolm, I.A., Soulsby, C., Youngson, A.F., 2008. A comparison of forest and moorland stream microclimate, heat exchanges and thermal dynamics. Hydrol. Process. 22 (7), 919–940. http://dx.doi.org/10.1002/hyp.7003.

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Hrachowitz, M., Soulsby, C., Imholt, C., Malcolm, I.A., Tetzlaff, D., 2010. Thermal regimes in a large upland salmon river: a simple model to identify the influence of landscape controls and climate change on maximum temperatures. Hydrol. Process. 24 (23), 3374–3391. http://dx.doi.org/10.1002/hyp.7756.

Justice, C., S.M. White, D. A. McCullough, D.S. Graves, M. R. Blanchard. 2016. Can stream and riparian restoration offset climate change impacts to salmon populations? Journal of Environmental Management: 188, pgs. 212-227

La Marche, J. L., Dubin, A. & Lettenmair, D.P. 1997. A two-layer energy balance model for the prediction of stream temperature. Fall AGU.

Leblanc, R. T. and R.D. Brown. 2000. The use of riparian vegetation in stream-temperature modification. Water and Environment Journal 14:4.

McGurk, Bruce J. 1989. Predicting stream temperatures after riparian vegetation removal. U.S. Forest Service General Technical Report PSW-110.

Roth, T.R., Westhoff, M.C., Huwald, H., Huff, J.A., Rubin, J.F., Barrenetxea, G., Vettereli, M., Parriaux, A., Selker, J.S., Parlange, M.B., 2010. Stream temperature response to three riparian vegetation scenarios by use of a distributed temperature validated model. Environ. Sci. Technol. 44 (6), 2072–2078. http://dx.doi.org/10.1021/es902654f.

Rutherford, C.J., S. Blackett, C. Blackett, L. Saito, R.J. Davies-Colley. 1997. Predicting the effects of shade on water temperature in small streams. New Zealand Journal of Marine and Freshwater Research, Vol 31. Pgs. 701-721.

Schloss, A.J. 1985. A predictive model for estimating maximum summer stream temperatures in western Oregon. Technical Note 370, Denver, CO: Bureau of Land Management Service Center, U.S. Department of Interior; BLM/4A/PT

VHB, 2020. "Green Mountain Power: Molly's Falls Hydroelectric Facility Winooski River Riparian Zone Restoration Plan." September 28, 2020.

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ATTACHMENT E

IPAC CONSULTATION AND STATE RTE LIST

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: 03/20/2025 18:24:17 UTC
Project Code: 2025-0071959
Project Name: Marshfield - Molly's Falls LIHI

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

Updated 4/12/2023 **-** *Please review this letter each time you request an Official Species List, we will continue to update it with additional information and links to websites may change.*

About Official Species Lists

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested by returning to an existing project's page in IPaC.

Endangered Species Act Project Review

Please visit the "**New England Field Office Endangered Species Project Review and Consultation**" website for step-by-step instructions on how to consider effects on listed species and prepare and submit a project review package if necessary:

https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review

NOTE Please do not use the **Consultation Package Builder** tool in IPaC except in specific situations following coordination with our office. Please follow the project review guidance on our website instead and reference your **Project Code** in all correspondence.

Northern Long-eared Bat - (**Updated 4/12/2023**) The Service published a final rule to reclassify the northern long-eared bat (NLEB) as endangered on November 30, 2022. The final rule went into effect on March 31, 2023. You may utilize the **Northern Long-eared Bat Rangewide Determination Key** available in IPaC. More information about this Determination Key and the Interim Consultation Framework are available on the northern long-eared bat species page:

https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis

For projects that previously utilized the 4(d) Determination Key, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective. If your project was not completed by March 31, 2023, and may result in incidental take of NLEB, please reach out to our office at newengland@fws.gov to see if reinitiation is necessary.

Additional Info About Section 7 of the Act
Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/service/section-7-consultations

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Please contact NEFO if you would like more information.

Candidate species that appear on the enclosed species list have no current protections under the ESA. The species' occurrence on an official species list does not convey a requirement to consider impacts to this species as you would a proposed, threatened, or endangered species. The ESA does not provide for interagency consultations on candidate species under section 7, however, the Service recommends that all project proponents incorporate measures into projects to benefit candidate species and their habitats wherever possible.

Migratory Birds

In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see:

https://www.fws.gov/program/migratory-bird-permit

https://www.fws.gov/library/collections/bald-and-golden-eagle-management

Please feel free to contact us at **newengland@fws.gov** with your **Project Code** in the subject line if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat.

Attachment(s): Official Species List

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

PROJECT SUMMARY

Project Code: 2025-0071959
Project Name: Marshfield - Molly's Falls LIHI
Project Type: Power Gen - Hydropower - Non-FERC
Project Description: LIHI app
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@44.345142300000006,-72.27823539959624,14z

Counties: Caledonia and Washington counties, Vermont

ENDANGERED SPECIES ACT SPECIES

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency: Kleinschmidt Associates
Name: Karen Bishop
Address: 35 Pratt Street Suite 201
City: Essex
State: CT
Zip: 06246
Email karen.bishop@kleinschmidtgroup.com
Phone: 8605815877

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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In Reply Refer To: 03/20/2025 18:29:29 UTC
Project code: 2025-0071959
Project Name: Marshfield - Molly's Falls LIHI

Federal Nexus: no
Federal Action Agency (if applicable):

Subject: Record of project representative’s no effect determination for 'Marshfield - Molly's Falls LIHI'

Dear Karen Bishop:

This letter records your determination using the Information for Planning and Consultation (IPaC) system provided to the U.S. Fish and Wildlife Service (Service) on March 20, 2025, for 'Marshfield - Molly's Falls LIHI' (here forward, Project). This project has been assigned Project Code 2025-0071959 and all future correspondence should clearly reference this number. **Please carefully review this letter.**

Ensuring Accurate Determinations When Using IPaC

The Service developed the IPaC system and associated species’ determination keys in accordance with the Endangered Species Act of 1973 (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and based on a standing analysis. All information submitted by the Project proponent into IPaC must accurately represent the full scope and details of the Project.

Failure to accurately represent or implement the Project as detailed in IPaC or the **Northern Long-eared Bat and Tricolored Bat Range-wide Determination Key (Dkey)**, invalidates this letter. ***Answers to certain questions in the DKey commit the project proponent to implementation of conservation measures that must be followed for the ESA determination to remain valid.***

Determination for the Northern Long-Eared Bat and/or Tricolored Bat

Based upon your IPaC submission and a standing analysis, your project has reached the following effect determinations:

Species	Listing Status	Determination
Northern Long-eared Bat (*Myotis septentrionalis*)	Endangered	No effect

To make a no effect determination, the full scope of the proposed project implementation (action) should not have any effects (either positive or negative), to a federally listed species or designated critical habitat. Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See § 402.17).

Under Section 7 of the ESA, if a federal action agency makes a no effect determination, no consultation with the Service is required (ESA §7). If a proposed Federal action may affect a listed species or designated critical habitat, formal consultation is required except when the Service concurs, in writing, that a proposed action "is not likely to adversely affect" listed species or designated critical habitat [50 CFR §402.02, 50 CFR§402.13].

Other Species and Critical Habitat that May be Present in the Action Area

The IPaC-assisted determination key for the northern long-eared bat and tricolored bat does not apply to the following ESA-protected species and/or critical habitat that also may occur in your Action area:

- Monarch Butterfly *Danaus plexippus* Proposed Threatened

You may coordinate with our Office to determine whether the Action may affect the animal species listed above and, if so, how they may be affected.

Next Steps

If there are no updates on listed species, no further consultation/coordination for this project is required with respect to the species covered by this key. However, the Service recommends that project proponents re-evaluate the Project in IPaC if: 1) the scope, timing, duration, or location of the Project changes (includes any project changes or amendments); 2) new information reveals the Project may impact (positively or negatively) federally listed species or designated critical habitat; or 3) a new species is listed, or critical habitat designated. If any of the above conditions occurs, additional coordination with the Service should take place to ensure compliance with the Act.

If you have any questions regarding this letter or need further assistance, please contact the New England Ecological Services Field Office and reference Project Code 2025-0071959 associated with this Project.

Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name

Marshfield - Molly's Falls LIHI

2. Description

The following description was provided for the project 'Marshfield - Molly's Falls LIHI':

> LIHI app

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@44.345142300000006,-72.27823539959624,14z

DETERMINATION KEY RESULT

Based on the information you provided, you have determined that the Proposed Action will have no effect on the species covered by this determination key. Therefore, no consultation with the U.S. Fish and Wildlife Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat. 884, as amended 16 U.S.C. 1531 *et seq.*) is required for those species.

QUALIFICATION INTERVIEW

1. Does the proposed project include, or is it reasonably certain to cause, intentional take of listed bats or any other listed species?

   Note: Intentional take is defined as take that is the intended result of a project. Intentional take could refer to research, direct species management, surveys, and/or studies that include intentional handling/encountering, harassment, collection, or capturing of any individual of a federally listed threatened, endangered or proposed species?

   No
2. Is the action area wholly within Zone 2 of the year-round active area for northern long-eared bat and/or tricolored bat?

   Automatically answered
   No
3. Does the action area intersect Zone 1 of the year-round active area for northern long-eared bat and/or tricolored bat?

   Automatically answered
   No
4. Does any component of the action involve leasing, construction or operation of wind turbines? Answer 'yes' if the activities considered are conducted with the intention of gathering survey information to inform the leasing, construction, or operation of wind turbines.

   Note: For federal actions, answer ‘yes’ if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

   No
5. Is the proposed action authorized, permitted, licensed, funded, or being carried out by a Federal agency in whole or in part?

   No
6. [Semantic] Is the action area located within 0.5 miles of a known bat hibernaculum?

   Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your State wildlife agency.

   Automatically answered
   No

7. Does the action area contain any winter roosts or caves (or associated sinkholes, fissures, or other karst features), mines, rocky outcroppings, or tunnels that could provide habitat for hibernating bats?

   No

8. Does the action area contain (1) talus or (2) anthropogenic or naturally formed rock shelters or crevices in rocky outcrops, rock faces or cliffs?

   No

9. Will the action cause effects to a covered bridge?

   No

10. Are trees present within 1000 feet of the action area?

    Note: If there are trees within the action area that are of a sufficient size to be potential roosts for bats answer "Yes". If unsure, additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    Yes

11. Does the action include the intentional exclusion of bats from a building or structure?

    Note: Exclusion is conducted to deny bats' entry or reentry into a building. To be effective and to avoid harming bats, it should be done according to established standards. If your action includes bat exclusion and you are unsure whether northern long-eared bats or tricolored bats are present, answer "Yes." Answer "No" if there are no signs of bat use in the building/structure. If unsure, contact your local Ecological Services Field Office to help assess whether northern long-eared bats or tricolored bats may be present. Contact a Nuisance Wildlife Control Operator (NWCO) for help in how to exclude bats from a structure safely without causing harm to the bats (to find a NWCO certified in bat standards, search the Internet using the search term "National Wildlife Control Operators Association bats"). Also see the White-Nose Syndrome Response Team's guide for bat control in structures.

    No

12. Does the action involve removal, modification, or maintenance of a human-made structure (barn, house, or other building) **known or suspected to contain roosting bats?**

    No

13. Will the action cause construction of one or more new roads open to the public?

    For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

14. Will the action include or cause any construction or other activity that is reasonably certain to increase average daily traffic permanently or temporarily on one or more existing roads?

    Note: For federal actions, answer ‘yes’ when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.). .

    No

15. Will the action include or cause any construction or other activity that is reasonably certain to increase the number of travel lanes on an existing thoroughfare?

    For federal actions, answer ‘yes’ when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

16. Will the proposed Action involve the creation of a new water-borne contaminant source (e.g., leachate pond, pits containing chemicals that are not NSF/ANSI 60 compliant)?

    Note: For information regarding NSF/ANSI 60 please visit https://www.nsf.org/knowledge-library/nsf-ansi-standard-60-drinking-water-treatment-chemicals-health-effects

    No

17. Will the proposed action involve the creation of a new point source discharge from a facility other than a water treatment plant or storm water system?

    No

18. Will the action include drilling or blasting?

    No

19. Will the action involve military training (e.g., smoke operations, obscurant operations, exploding munitions, artillery fire, range use, helicopter or fixed wing aircraft use)?

    No

20. Will the proposed action involve the use of herbicides or other pesticides other than herbicides (e.g., fungicides, insecticides, or rodenticides)?

    No

21. Will the action include or cause activities that are reasonably certain to cause chronic or intense nighttime noise (above current levels of ambient noise in the area) in suitable summer habitat for the northern long-eared bat or tricolored bat during the active season?

    Chronic noise is noise that is continuous or occurs repeatedly again and again for a long time. Sources of chronic or intense noise that could cause adverse effects to bats may include, but are not limited to: road traffic; trains; aircraft; industrial activities; gas compressor stations; loud music; crowds; oil and gas extraction; construction; and mining.

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: [https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.](https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines)

    No

22. Does the action include, or is it reasonably certain to cause, the use of permanent or temporary artificial lighting within 1000 feet of suitable northern long-eared bat or tricolored bat roosting habitat?

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: [https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.](https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines)

    No

23. Will the action include tree cutting or other means of knocking down or bringing down trees, tree topping, or tree trimming?

    No

24. Will the proposed action result in the use of prescribed fire?

    Note: If the prescribed fire action includes other activities than application of fire (e.g., tree cutting, fire line preparation) please consider impacts from those activities within the previous representative questions in the key. This set of questions only considers impacts from flame and smoke.

    No

25. Does the action area intersect the northern long-eared bat species list area?

    Automatically answered
    Yes

26. [Semantic] Is the action area located within 0.25 miles of a culvert that is known to be occupied by northern long-eared or tricolored bats?

    Automatically answered
    No

27. [Semantic] Is the action area located within 150 feet of a documented northern long-eared bat roost site?

    Note: The map queried for this question contains proprietary information and cannot be displayed. If you need additional information, please contact your State wildlife agency.

    Automatically answered
    No

28. Is suitable summer habitat for the northern long-eared bat present within 1000 feet of project activities?
    If unsure, answer "Yes."

    Note: Additional information defining suitable summer habitat for the northern long-eared bat and tricolored bat can be found in Appendix A of the USFWS' Range-wide Indiana Bat and Northern long-eared bat Survey Guidelines at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines.

    Yes

29. Has a presence/probable absence summer bat survey targeting the northern long-eared bat following the Service's Range-wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines been conducted within the project area?

    No

30. Do you have any documents that you want to include with this submission?

    No

PROJECT QUESTIONNAIRE

IPAC USER CONTACT INFORMATION

Agency: Kleinschmidt Associates
Name: Karen Bishop
Address: 35 Pratt Street Suite 201
City: Essex
State: CT
Zip: 06246
Email karen.bishop@kleinschmidtgroup.com
Phone: 8605815877

Outlook

RE: RTE Species Check for Molly's Falls Hydroelectric Project Low Impact Hydropower Institute Application

From Wood, Andrew <Andrew.Wood@vermont.gov>
Date Fri 6/28/2024 10:51 AM
To Jessica Antonez <Jessica.Antonez@Kleinschmidtgroup.com>
Cc Ferguson, Mark <Mark.Ferguson@vermont.gov>; Groff, Luke <Luke.Groff@vermont.gov>; Glynn, Grace <Grace.Glynn@vermont.gov>; Murphy, Margaret <Margaret.Murphy@vermont.gov>; Marshall, Everett <Everett.Marshall@vermont.gov>

MAY CONTAIN SENSITIVE INFORMATION. NOT FOR DISTRIBUTION OR PUBLIC DISPLAY.

Greetings Jessica,

Thank you for your patience. I have reviewed this LIHI application request to "*confirm what the species are that are present in the area and confirm that the normal operation of the project would not impact those species present.*"

The following information is provided below, subject to the Vermont Fish and Wildlife Department's Data Sharing Guidelines. To our knowledge the species mapped in the Natural Heritage Database/ANR Atlas are presumed present, and the normal operation of the project likely would not impact those species present. However, note that the Department reserves the right to evaluate impacts to fish, wildlife, plants, and their habitats on a case-by-case basis, including but not limited to: FERC or other hydropower relicensing process; state permits (i.e., Act 250, Section 248, Threatened & Endangered Species Takings Permit; and any other regulatory proceeding the Department is party to.

If you have further questions about data sharing permissions, contact Everett.Marshall@Vermont.gov.

Element Occurrence ID: 33937
Eleocharis diandra
Type Code: Plant
State Protection: N
Federal Protection: N

Element Occurrence ID: 5168
Malaxis unifolia
Type Code: Plant
State Protection: N
Federal Protection: N

Element Occurrence ID: 5331
Huperzia selago
Type Code: Plant
State Protection: N
Federal Protection: N

Element Occurrence ID: 7005
redacted species name
(Note: This information may not be included in public-facing documents due

to the highly sensitive nature of this species)
Type Code: Animal
State Protection: N
Federal Protection: N

Element Occurrence ID: 10840 (presumed a typo. EO ID 10848 is the following species:
Margaritifera margaritifera
Type Code: Animal
State Protection: Y
Federal Protection: N

Element Occurrence ID: 9031
Carex foena
Type Code: Plant
State Protection: Y
Federal Protection: N

Element Occurrence ID: 9102
Ophioglossum pusillum
Type Code: Plant
State Protection: N
Federal Protection: N

Andy Wood (he/him) | Habitat Protection Scientist
Department of Fish & Wildlife | Wildlife Division, Lands & Habitat Program
802-461-5118 cell | Andrew.Wood@vermont.gov

From: Jessica Antonez <Jessica.Antonez@Kleinschmidtgroup.com>
Sent: Monday, June 10, 2024 8:00 AM
To: Wood, Andrew <Andrew.Wood@vermont.gov>
Subject: Re: RTE Species Check for Molly's Falls Hydroelectric Project Low Impact Hydropower Institute Application

Hi Andrew,

I apologize, I think that it was an error with the photograph on my end because my computer was also having issues with it. I went back into the Natural Resources Atlas and have included an updated screenshot with a fairly general outline of the project area and the highlighted RTE species that occur. Since I have sent you the first one, there are now seven results that come up.

Element Occurrence ID: 33937
Type Code: Plant
State Protection: N
Federal Protection: N

Element Occurrence ID: 5168
Type Code: Plant
State Protection: N

Federal Protection: N

Element Occurrence ID: 5331
Type Code: Plant
State Protection: N
Federal Protection: N

Element Occurrence ID: 7005
Type Code: Animal
State Protection: N
Federal Protection: N

Element Occurrence ID: 10840
Type Code: Animal
State Protection: Y
Federal Protection: N

Element Occurrence ID: 9031
Type Code: Plant
State Protection: Y
Federal Protection: N

Element Occurrence ID: 9102
Type Code: Plant
State Protection: N
Federal Protection: N

Please let me know if you need anything else from me. Thanks for your help!

Jessica

From: Wood, Andrew <Andrew.Wood@vermont.gov>
Sent: Friday, June 7, 2024 1:00 PM
To: Jessica Antonez <Jessica.Antonez@Kleinschmidtgroup.com>
Subject: RE: RTE Species Check for Molly's Falls Hydroelectric Project Low Impact Hydropower Institute Application

You don't often get email from andrew.wood@vermont.gov. Learn why this is important

Jessica,

Apologies for the delay. Could you please re-send the image, perhaps as an attachment? My PC is having trouble viewing the photo.

Thanks,

Andy Wood (he/him) | Habitat Protection Scientist
Department of Fish & Wildlife | Wildlife Division, Lands & Habitat Program
802-461-5118 cell | Andrew.Wood@vermont.gov

From: Wood, Andrew
Sent: Wednesday, May 15, 2024 1:09 PM
To: Jessica Antonez <Jessica.Antonez@Kleinschmidtgroup.com>

Subject: RE: RTE Species Check for Molly's Falls Hydroelectric Project Low Impact Hydropower Institute Application

Hi Jessica,

Thanks for reaching out. I will put this in my review queue and be in touch.

Thanks,
Andy

Andy Wood (he/him) | Habitat Protection Scientist
Department of Fish & Wildlife | Wildlife Division, Lands & Habitat Program
802-461-5118 cell | Andrew.Wood@vermont.gov

From: Jessica Antonez <Jessica.Antonez@Kleinschmidtgroup.com>
Sent: Friday, May 10, 2024 10:09 AM
To: Wood, Andrew <Andrew.Wood@vermont.gov>
Subject: RTE Species Check for Molly's Falls Hydroelectric Project Low Impact Hydropower Institute Application

Hi Andrew,

On behalf of Green Mountain Power, I am working on an application for the Low Impact Hydropower Institute for the Molly's Falls Hydroelectric Project in Peacham and Marshfield. Part of the application process requires a state data check for rare, threatened, and endangered species that could be present in the project vicinity. There are no proposed changes to current operations and no proposed construction activities. I used the Vermont Natural Resource Atlas to perform a preliminary datacheck in the project vicinity, and got results for five species.

Element Occurrence ID: 2617
Element Occurrence ID: 5168
Element Occurrence ID: 5331
Element Occurrence ID: 7980
Element Occurrence ID: 7005

I have also included a picture below of the map with the general project area marked and the results of the RTE species included. I am looking to confirm what the species are that are present in the area and confirm that the normal operation of the project would not impact those species present. Please let me know if you need any further information, and I will be happy to provide it to you.

Thanks so much!
Jessica

Jessica Antonez

Regulatory Consultant

Office: 207-416-1214

www.KleinschmidtGroup.com