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December 10, 2013

FERC Project No. 1864-164

Ms. Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Dear Secretary Bose:
Supplement to Request for Amendment: Docket P-1984-164

In the March 16, 2012 USDA-Forest Service Comments, the March 14, 2012 Michigan Department of Natural Resources Comments, and the April 9, 2012 Wisconsin Department of Natural Resources Comments, several members of the Bond Falls Implementation Team indicated being receptive to exploring alternatives that meet the intent of the Settlement Agreement.

In the November 7, 2012 joint Michigan Department of Natural Resources, Wisconsin Department of Natural Resources, U.S. Fish and Wildlife Service, and Michigan Hydro Relicensing Coalition comments indicate they are still willing to discuss options to meet the intent of the 75-foot fixed crest weir.

In the November 8, 2012 USDA-Forest Service Comments, the USDA-Forest Service requested the Commission to Direct UPPCO to initiate the dispute resolution process. Although not specifically stated, UPPCO interprets this recommendation based upon previous comments to require UPPCO to initiate the dispute resolution process to develop a feasible alternative that would meet the intent of the Settlement Agreement language and associated downstream concerns.

On December 4, 2012, UPPCO submitted a letter to the Commission agreeing to enter into a good faith negotiation period regarding the dispute.

On April 11, 2013, UPPCO submitted an update of the good faith negotiation period extending the good faith negotiation period to July 31, 2013.

On August 15, 2013, UPPCO provided an update to the Commission indicating it was collecting additional information to help evaluate if a new design which meets the requirements of Section 3.1.4.3 of the Settlement Agreement is acceptable. UPPCO also outlined its intentions with the process moving forward.

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As part of the "Good Faith Negotiations," and dispute resolution process, several items were accomplished and are as follows:

**Clarification of the Purposes of the Fixed Crest Weir**

Since there is a dispute on the language included in Section 3.1.4.3 of the Settlement Agreement, UPPCO met with other interested members of the Bond Falls Implementation Team to come to agreement and clarify many items of disagreement, including the purpose(s) of the fixed crest weir.

As a result, on January 8, 2013, the members of the BFIT held their first "Good Faith Negotiation" Meeting. During the meeting, the members of the BFIT indicated the purposes of the fixed crest weir were to:

(1) To more closely mimic a run of river flow and to thus provide a means for "naturalizing" the hydrograph. During relicensing negotiations a design for a 75 foot long fixed crest weir was referenced because the design would provide for downstream flow, or outflow from the reservoir an estimated 97% of the time. Outflows would be attenuated in such a way that there would be fewer and smaller peaks in flow when compared to current operation of the dam.

(2) Create a more passive operation.

Representatives of the Cisco Chain Riparian Owners Association were also present at the January 8, 2013 meeting. They requested that any structure be designed for a maximum water level of 1683.9 feet with an average time to return to 1683.4 feet within 4.5 days.

The minutes of the January 8, 2013 meeting were provided to the Commission in the April 11, 2013 filing and are also included as **Appendix 1** of this filing.

**Development of a Conceptual Design by the USDA-Forest Service**

During discussions at the January 8, 2013 meeting, the USDA- Forest Service believed they could develop a conceptual design for a fixed-crest weir that could be constructed within UPPCO's financial commitment as outlined in the Settlement Agreement. As a result, the USDA-Forest Service provided a conceptual design for a fixed-crest weir. That conceptual design was provided to the Commission in the April 11, 2013 filing and is also included in **Appendix 2** of this filing.

**Hydrologic Analysis of the USDA-Forest Service Conceptual Design**

As a result of the January 8, 2013 meeting, the USDA- Forest Service completed an internal routing study of their Conceptual Design and provided it to the Bond Falls Implementation Team on March 29, 2013. The Routing Study Results are included in **Appendix 2** of this document.

**Development of a Cost Estimate for the USDA-Forest Service Conceptual Design**

As a result of the January 8, 2013, UPPCO provided a cost-estimate for the construction of a fixed-crest weir according to the USDA-Forest Service Conceptual Design. The estimated cost of the project according to the conceptual design is approximately $700,000 in 2014 dollars. The cost estimate was provided to the members of the BFIT on April 29, 2013. The cost estimate was provided to the Commission as Appendix 1 of UPPCO's submittal dated April 29, 2013.

**Development of Alternative Design by UPPCO (UPPCO Design)**

As a result of the January 8, 2013 meeting, UPPCO agreed to develop an alternative design for operation much like a fixed-crest weir. UPPCO presented their design which consists of setting the existing boards

in the existing dam at an elevation of 1683.0 feet MSL and allowing the dam to passively act like a fixed-crest weir until action is required for "very high-flow periods" to increase flows by lifting the boards when the current license requirements and approved Cisco Dam Operation Plan requires action (**See Appendix 3**). UPPCO initially provided the UPPCO Design to the BFIT on April 29, 2013.

**Hydrologic Analysis of UPPCO Design**

In an email from Norm Nass of the USDA-Forest Service dated July 31, 2013, the USDA-Forest Service recommended that UPPCO provide a hydrologic analysis of its design. A copy of the email was provided to the Commission in Appendix A of the August 15, 2013 filing. To complete the hydrologic analysis, UPPCO retained Ellen Faulkner of Ayres Associates to develop a routing study. The analysis report is enclosed in **Appendix 4** of this filing.

**Comparison of Hydrologic Parameters of USDA-Forest Service Design and UPPCO Design**

As part of the hydrologic analysis, Ayres Associates reviewed the USDA-Forest Service Analysis, corrected the errors in the analysis, and compared the results for the USDA-Forest Service Conceptual Design with two sensitivities of the routing study for the UPPCO Proposal. One of the main points of the analysis indicates both the USDA-Forest Service and the UPPCO Proposal are quite comparable from a lake elevation and outflow standpoint. The complete comparison of the results are also discussed and included in **Appendix 4** of this filing.

**Refinement of UPPCO Design**

Due to the results of additional hydrologic analysis, UPPCO has refined its design, provided it to the Bond Falls Implementation Team for comment on October 16, 2013, and addressed their comments received on November 18, 2013 (See **Appendix 5** for the comment letter and UPPCO responses to comments).

**Consensus on Future Use of Third Party Arbitrator/Facilitator**

As part of the consultation provided to the Commission in Appendix A of the August 15, 2013 filing, consensus to not use a third party arbitrator/facilitator on this dispute was reached among members of the BFIT. UPPCO also agreed, based upon the USDA-Forest Service recommendation to gather additional hydrologic information on the UPPCO Design.

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UPPCO has demonstrated the UPPCO proposal presented in **Appendix 3** is a feasible alternative that would meet the intent of Section 3.1.4.3 of the Settlement Agreement language and associated downstream concerns.

The above statement is supported by the following points:

1) The 75-foot fixed crest weir is no longer feasible.
   As stated in UPPCO's application for license amendment dated June 14, 2012, the 75-foot fixed crest weir cannot be completed with only the required money contribution of UPPCO (UPPCO's financial obligation for a fixed-crest weir is limited by the Settlement Agreement to $75,000 in December 1998 dollars adjusted for CPI-0.5%). The 75-foot fixed crest weir with a small adjustable spill area as originally envisioned as part of the Settlement Agreement (14 foot wide adjustable spill area where boards are removed at an elevation of 1683.90 feet and replaced at

an elevation of 1683.85 feet) cannot be constructed. The remaining members of the Bond Falls Implementation Team have not provided any firm sources for the additional funding to construct it.

In addition to the financial reasons stated above, layout of the dam area has changed significantly. The county bridge spanning the dam has been re-constructed and it was not designed for the addition of a 75-foot fixed crest spillway.

The lack of feasibility for the 75-foot fixed crest spillway was recognized by the Bond Falls Implementation Team and served as a reason for the dispute resolution to develop an alternative that meets the intent of the Settlement Agreement.

2) <u>The funds are not available to construct the USDA Forest Service Proposal.</u>
The conceptual design presented by the USDA Forest Service is estimated to cost approximately $700,000 to construct. UPPCO's financial obligation for a fixed-crest weir is limited by the Settlement Agreement to $75,000 in December 1998 dollars adjusted for CPI-0.5% and the members of the BFIT have not provided any firm sources for the additional funding to construct the USDA-Forest Service's Conceptual Design (See Appendix 2 for the USDA-Forest Service Proposal).

3) <u>The funding is available to implement the UPPCO Proposal .</u>
UPPCO completed work on the dam when the county rebuilt the bridge. A portion of that work resulted in being able to lift the board section as one unit using hoist device and removal of individual boards is no longer necessary. As a result, the cost associated with the UPPCO proposal to set the upper level of the boards at an elevation of 1683.0 feet MSL is minimal. UPPCO can complete the task prior to removal of the facility from the project license. The new owner can operate the dam with less of a need for active adjustments and can make any necessary adjustments with greater ease.

4) <u>The UPPCO Proposal naturalizes the hydrograph during low flows compared to current operation.</u>
As demonstrated in the report contained in **Appendix 4** of this filing, the UPPCO proposal provides for downstream flows at all times except for 20 days over a twenty-year period. Based upon a 20-year record of inflows beginning in 1993 and ending in 2013, all of the days with zero outflow under the UPPCO proposal occur in August and September of 2007 (a severe drought period). In summary, downstream flows are provided over 99% of the time based upon the 20-year record of flows.

5) <u>The UPPCO Proposal creates a more-passive operation compared to the current operation.</u>
Since the UPPCO Proposal fixes the top of the boards at an elevation of 1683.0 feet MSL, action is only required when inflow increases to a point where there is a threat of the reservoir rising above the maximum license elevation of 1683.9 feet MSL (when the reservoir rises to an elevation of 1683.9 feet MSL, release is approximately 34 cfs). Therefore, during most instances of normal inflow increases, actions such as the lifting of boards to increase outflows will not occur unless the reservoir elevation is trending to rise above 1683.9 feet MSL. These statements are supported in the report contained in **Appendix 4** of this filing and estimates the number of operational actions required over the 20-year record. Under the UPPCO proposal, operation

actions are expected to take place less than 10.7 percent of the days (less than one day per week). Under the current operation, UPPCO estimates that operational actions occur considerably more than 10.7 percent of the days because currently every time a flow release needs to be changed (even when the outflows are less than 34 cfs) an operational action is necessary. Some level of active operation contributes to the safety of the facility. Therefore, active intervention by the operator at least once per week is a best practice anyway.

6) <u>The UPPCO Proposal meets and exceeds the intent of the fixed-crest weir.</u>
The BFIT members agreed upon in the January 8, 2013 meeting the purposes for the fixed-crest weir. Those purposes are as follows: (1) To more closely mimic a run of river flow and to thus provide a means for "naturalizing" the hydrograph. During relicensing negotiations a design for a 75 foot long fixed crest weir was referenced because the design would provide for downstream flow, or outflow from the reservoir an estimated 97% of the time. Outflows would be attenuated in such a way that there would be fewer and smaller peaks in flow when compared to current operation of the dam[1]. (2) Create a more passive operation.

The UPPCO Proposal provides a downstream flow, or outflow from the reservoir an estimated maximum of all but 20 days in the last 20 years or over 99.7% of the time. This exceeds the original intent as agreed upon with the Bond Falls Implementation Team in the January 8, 2013 meeting (See Part 5)(1) above).

7) <u>The UPPCO Proposal maintains the current level of safety.</u>
The UPPCO Proposal has been reviewed by UPPCO's Director of Dam Safety and there were no obvious concerns for dam safety with the proposal because it requires very little structural modification and required a regular visit to the dam.

The USDA-Forest Service Proposal has also been reviewed by UPPCO's Director of Dam Safety. UPPCO's Director of Dam Safety provided several comments related to dam safety and constructability which are summarized as follows:

[1] It should be noted, although the majority of members of the BFIT at the January 8, 2013 meeting indicated the primary purpose of the fixed-crest weir was to naturalize flows, the FERC in the Environmental Assessment dated June 27, 2002 indicates the following on page 186:"UPPCO proposes to operate the Cisco dam to mimic ROR conditions using the existing structure. GLIFWC and RCB express concern over the effects of fluctuating flows, including periods of no flow below the Cisco dam, on recreational resources, and recommend that UPPCO install a fixed crest weir on the current dam to allow more natural releases to the Cisco Branch for recreational resources (see section 4.1.3). We agree that providing continuous flows below the dam would enhance the recreation potential of the Cisco Branch. However, after weighing the enhanced recreational opportunity downstream of the dam against the possible reduction in opportunities upstream of the project (if drawdowns are required to maintain minimum flows), we conclude that maintaining reservoir levels should take priority over downstream flows for recreational opportunities. The number of recreational users would be much greater on the Cisco Chain of Lakes than those potentially using the Cisco Branch." including periods of no flow below the Cisco dam, on recreational resources, and recommend that UPPCO install a fixed crest weir on the current dam to allow more natural releases to the Cisco Branch for recreational resources (see section 4.1.3). We agree that providing continuous flows below the dam would enhance the recreation potential of the Cisco Branch. However, after weighing the enhanced recreational opportunity downstream of the dam against the possible reduction in opportunities upstream of the project (if drawdowns are required to maintain minimum flows), we conclude that maintaining reservoir levels should take priority over downstream flows for recreational opportunities. The number of recreational users would be much greater on the Cisco Chain of Lakes than those potentially using the Cisco Branch."

1) Underpinning the bridge foundation as called for in the design is very unusual and modifications to the bridge or abutments must be approved by the County, their engineering consultant, and possibly the MDOT.
2) Bridge abutments are pile supported and not designed to act as retaining walls as required by the design.
3) Frost depth of approximately 4' to 6' under the bridge abutment must be maintained and the proposed design provides only roughly 1.5 feet of frost depth.
4) The design would only allow for debris passage at high flows. Debris would accumulate at lower flows upstream of the weir. This accumulation could lead to plugging of the weir and restrict outflow as the reservoir rises.
5) The design does not allow for drawdown for floods or maintenance work.

8) <u>The UPPCO Proposal incorporates a small adjustable spill area, but acquires abrupt changes to operate within the requirements of the Operating Plan.</u>
Section 3.1.4.3 of the Settlement Agreement states "operation as established in the Operating Plan" is a necessary component to be addressed in a fixed-crest weir. However, "naturalizing the hydrograph" as agreed upon in the January 8, 2013 meeting is not mentioned in the Settlement Agreement.

The current USDA-Forest Service Proposal does put a priority on operating within the existing Operating Plan, but chooses to focus more on "naturalizing" the outflows. Unfortunately, those two factors contradict one another.

The USDA-Forest Service Proposal does not effectively reduce the average duration of the exceedances of the upper lake elevations required under the Operating Plan (average duration of the USDA-Forest Proposal is 12.6 days where the average duration of the UPPCO proposal is between 3.6 and 7.3 days).

The USDA-FS Proposal approach is also not consistent with the balance of uses identified in the Environmental Assessment dated June 27, 2002 as described in footnote 1 regarding the appropriate balance of uses of the resource.

An action to reduce the average duration requires an adjustable spill area and increases the number of days with zero outflow. It also causes the figure in Exhibit 2(b) of **Appendix 4** to show "relative abrupt reductions in outflow" as described in Comment 1 of the Resource Agency Comment letter dated November 18, 2013 contained in **Appendix 5**[2].

9) <u>The UPPCO proposal has been provided to the Bond Falls Implementation Team for Comment.</u>
The comment letter dated November 8, 2013, makes two main comments on UPPCO's engineering design for a fixed crest weir and two additional comments on the request for amendment to remove the Cisco Development from the hydroelectric Project. The comment letter and UPPCO's full responses to the comments can be found in **Appendix 5**.

[2] It should be noted that the "relative abrupt outflows" as defined by the resource agencies in their November 18, 2013 comment letter (**Appendix 5**) are simplifications of the day-by-day, case-by-case decision process of the operators and were addressed in bullet point 3 of Page 6 of the Hydrologic Analysis contained in **Appendix 4** of this submittal.

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UPPCO has attempted to negotiate in "Good Faith" for at least 90 days, and has demonstrated that a third party arbitrator/facilitator cannot be successful (See August 15, 2013 filing with the Commission). Therefore, under the terms of the Settlement Agreement (Section 9.3.2), UPPCO is referring this dispute to FERC for resolution.

UPPCO is requesting the Commission to resolve the dispute between UPPCO and the Wisconsin Department of Natural Resources, the Michigan Department of Natural Resources, the U.S. Fish and Wildlife Service, the USDA-Forest Service, and the Michigan Hydro Relicensing Coalition on a feasible alternative that would meet the intent of the Settlement Agreement language and associated downstream concerns.

UPPCO is amending its Request for Amendment-Removal of the Cisco Dam from the Bond Falls Hydroelectric Project dated June 14, 2012 supplemented on April 2, 2013, to include an action where the boards will be set at a crest elevation of 1683.0 feet MSL prior to the removal of the Cisco Dam from the Bond Falls Hydroelectric Project. This action is the UPPCO proposal presented in **Appendix 3** of this filing and is believed to be the only feasible alternative that can be funded under the requirements of Section 3.1.4.3 of the Settlement Agreement.

If you should have any questions relative to this material, please contact Shawn Puzen at (920) 433-1094 at your earliest convenience.

Sincerely,

Terry P. Jensky
Vice President - Generation Assets for
Wisconsin Public Service Corporation

Enc.

cc:
Mr. Gil Snyder, WPS
Mr. Virgil Schlorke, UPPCO
Mr. Keith Moyle, UPPCO
Mr. James Schramm, MHRC
Mr. John Myers, IBS
Mr. Greg Egtvedt, IBS
Mr. Jim Melchiori, UPPCO
Ms. Patricia Grant, FERC - CRO
Mr. Gene Mensch, KBIC
Mr. John Zygaj, FERC-CRO
Mr. Norm Nass, USDA-FS
Mr. Kyle Kruger, MDNR
Mr. Burr Fisher, FWS
Mr. Stephen Gilbert, WDNR

APPENDIX 1

January 8, 2013 Meeting Minutes as Provided by the USDA-Forest Service

The electronic file with the email containing the document as it was received has been e-filed as a separate file to allow verification of what was received by UPPCO.

APPENDIX 2

USDA-Forest Service Routing Study for the USDA-Forest Service Proposal

Please note: The electronic file with the email containing the document has been e-filed as a separate file to allow verification of what was received by UPPCO.

# Appendix 3

# UPPCO Proposal

# Bond Falls Hydroelectric Project
# (FERC No. 01864)

# Upper Peninsula Power Company
# Alternative Design Proposal

**Cisco Development License Operating Requirements:**
The licensee shall operate Cisco Dam to maintain Cisco Lake at or above elevation 1,683.0 feet MSL, with a target elevation between 1,683.4 to 1,683.9 feet MSL as required by Article 401.

**Settlement Agreement Section 3.1.4.3 Language:**
UPPCO will attempt, with the Team's support, to find a new owner for Cisco Dam in order to allow it to be removed from the Bond Falls Project license. Any new owner shall be required to operate the dam according to the Operation Plan developed by the Team. If Cisco Dam is removed from the license and operated by a new owner, UPPCO shall install and finance up to $75,000 (in December 1998 dollars adjusted for CPI - 0.5%) for a 75-foot-long, fixed-crest spillway structure with a small adjustable spill area or another acceptable engineering design for very high-flow periods to allow dam operation as established in the Operating Plan.

**Objective:**
Develop another acceptable engineering design for very high-flow periods to allow dam operations as established in the operating plan.

1) Primary Reason: To more closely mimic a run of river flow and to thus provide a means for "naturalizing" the hydrograph. Outflows would be attenuated in such a way that there would be fewer and smaller peaks in flow when compared to current operation of the dam[3].
2) Secondary Reason: Create a more passive operation.

**Constraints:**

- Allow for operations as established in the operating plan.
- Maintain Cisco Lake at or above elevation 1,683.0 feet MSL, with a target elevation between 1,683.4 to 1,683.9 feet MSL.
- CCROA requested that any new structure be designed for a maximum water level of 1683.9 feet with an average time to return to 1683.4 feet within 4.5 days.

**Proposed Structure Modifications:**

- **Modify the dam structure such that small flow adjustments can be made**.

  The past practice was to make adjustments by removing one board at a time. Each board height was 8". Therefore, adjustments were made in 8" increments per each bay.
  This modification has already been made. All boards have been fastened into one piece and water releases require the lifting of the entire board section for each bay with a hoist. The water is then released from the bottom of the board section in each bay. This allows for infinitely small flow adjustments.

- **Set the elevation of the top of the boards in each bay at 1683.0 feet MSL.**

[3] The Primary Reason and the Secondary Reason were developed during the January 8, 2013 "Good Faith" negotiation meeting.

Set the elevation at the top of the boards of each bay (by replacing the top board) at elevation 1683.0.

**Operation of the Dam:**

To minimize flow and level fluctuations, removal or installation of planks will be completed at a rate of 8 inches (equal to one plank) per ten-minute interval. In the event that the reservoir is rising at a rate faster than 0.1 foot per day from an increased flow event, the rate of removal or opening shall be 8 inches per two-minute interval.

**Conclusions:**

The changes in the structure also retain the possibility for necessary intervention from the operator in the case where inflow conditions deviate from the normal distribution of flows.

The dam will still need to be visited on a regular basis to assure debris has not accumulated such that downstream flows are restricted and to assure the facility is operating correctly.

The proposed changes can be accomplished within the finance and installation requirements outlined in Section 3.1.4.3 of the Settlement Agreement.

# Appendix 4

# Hydrologic or Routing Study of the UPPCO Proposal

October 2, 2013

Mr. Shawn Puzen
Integrys Business Support
700 North Adams St
Green Bay, WI 54301

Re: Routing Analyses for Cisco Chain of Lakes Dam Outlet Alternatives

Dear Mr. Puzen:

Ayres Associates has completed a reservoir routing analysis to compare two proposed outlet configurations and operating strategies for the Cisco Chain of Lakes near Watersmeet, Michigan. According to materials you provided to us, the lake owners' association has expressed a desire to maintain lake levels between 1683.4 and 1683.9 feet MSL, with as rapid a return as possible to this range when high flow events necessitate a surcharge above elevation 1683.9. Furthermore, the local fire protection service requires a minimum lake elevation of 1683.0 feet for operation of a boat used in fire fighting.

The objective of our analysis was to determine the frequency distributions of lake levels and outflows for each proposed configuration, assuming a daily inflow series matching the last 20 years of record at the site (February 1993 – February 2013).

*Note:* The MSL vertical datum is mentioned in the summary of the lake property owners' objectives. However, the USGS level gage on the lake uses the NGVD29 vertical datum, so we have assumed that the desired lake elevations are intended to reference NGVD29 as well.

***Summary of Proposed Outlet Alternatives***

The two proposed alternatives are as follows:

"Forest Service Alternative." This alternative consists of a 49-foot-long fixed crest weir with crest elevation 1683.1 and three 36-inch diameter culvert pipes for passing high flows. The structure would be entirely passive. In our analysis we used the discharge rating curve developed for this structure by the Forest Service. The rating curve indicates a discharge of approximately 25 cubic feet per second (cfs) at elevation 1683.4 and 122 cfs at elevation 1683.9. A discharge of 260 cfs – similar to large floods that occurred in April, 2002 and May, 2003 – would be passed at an elevation of approximately 1684.4 feet.

"UPPCO Alternative." The alternative under consideration by the Upper Peninsula Power Company (UPPCO) involves modifying the existing two-gated structure. With gates closed, water would flow over the top of the gates, which would form a 13.4-foot-long fixed crest weir with crest elevation 1683.0. The proposed operating plan would follow the requirements outlined in Article 401 of the Order Approving Settlement and Issuing License dated August 20, 2003 as amended by Orders dated August 26, 2008 and August 18, 2011. The proposed plan

would allow flow over the top of the closed boards until action is required (a lifting of the boards or gates) to maintain the reservoir elevation above 1683.0 feet MSL at all times and target the lake elevation between 1683.4 feet MSL and 1683.9 feet MSL.

To analyze the UPPCO alternative, the operation is simplified by running two possible sensitivities or model scenarios.

The first scenario allows flow over the top of the boards until the lake level reaches 1683.7 feet MSL, at which point the gates could be lifted to any opening height and left open until the lake level draws down to elevation 1683.6 feet. Under this proposal, the outflow over the top of the closed gates at elevation 1683.7 (just before the gates are opened) is 23 cfs. The concrete sill of the open gates is at elevation 1680.7. The maximum outflow at elevation 1683.7, assuming both gates are lifted clear of the water, is 216 cfs. A flow of 238 cfs could be passed at elevation 1683.9.

The second UPPCO scenario allows flow over the top of the boards until the lake level reaches 1683.9 feet MSL, at which point the gates could be lifted to any opening height and left open until the lake level draws down to elevation 1683.7. Under this proposal, the outflow over the top of the closed gates at elevation 1683.9 (just before the gates are opened) is 34 cfs. The concrete sill of the open gates is at elevation 1680.7. The maximum outflow at elevation 1683.9, assuming both gates are lifted clear of the water, is 238 cfs. A flow of 260 cfs could be passed at elevation 1684.1.

Both scenarios are probable scenarios to correctly explain the two "bookends" of operation according to the requirements outlined in the license. The midpoint of the target elevations is 1683.65 feet MSL. To operate consistently with the license requirements, operation action to increase flows would take place once the reservoir rises past the midpoint of the target elevations. In practice the soonest this would take place would likely be at an approximate elevation of 1683.7 feet MSL. The latest or the highest trigger elevation that operation action to increase flows could take place consistent with the license requirements is 1683.9 feet MSL (the upper license elevation).

***Inflow Series Analysis***

A USGS lake level gage (no. 04037400) is located on the Cisco Chain near the existing outlet structure. A USGS streamflow gage (no. 04037500) is located just downstream of the outlet. Both gages have periods of record extending back to the 1940s. In order to provide a parallel analysis to one already conducted by the Forest Service, we performed routing analyses on lake levels and discharges using the daily period of record February 21, 1993 – February 20, 2013. Some missing daily data in the lake level records were filled by interpolation.

In their analysis, Forest Service engineers used the daily streamflow values from the downstream gage to represent inflows to the lakes. A more accurate representation is to "backroute" these flows, adjusting each daily outflow value by the change in lake storage on the same day. This procedure accounts for the fact that if the lake level rises or falls over a given day, the outflow is not the same as the inflow. The backrouting analysis was accomplished using an MS Excel spreadsheet, the USGS daily flow and lake stage records, and the elevation-storage relationship provided with the Forest Service analyses.

Backrouting is subject to a certain amount of numerical instability because when the lake area is large relative to the volume of water passing through it, very small measured changes in lake level produce large and sudden changes in calculated inflow. Furthermore, the backrouting

procedure can – and did - result in a few negative computed inflows. Some of these are simply due to the numerical sensitivity to small changes in elevation. However, several instances of multi-day negative computed inflows do appear during July, August, and September, suggesting that there are probably days in the late summer when the net inflow to the lake, after accounting for evaporation, actually is negative.

To test the sensitivity of our routing model results to these instabilities and negative inflows, we ran two different inflow series for each alternative. The first inflow series used the "unsmoothed" daily backrouted values, including negative inflows whenever they appeared. In the second inflow series – denoted "smoothed" – the daily backrouted flows were converted to three-day running averages, and all negatives inflows were reset to zero. As will be seen below, the use of "smoothed" versus "unsmoothed" inflow data did not substantially affect the routing results.

Cumulative daily inflow frequency curves for the "unsmoothed" and "smoothed" inflow series are attached as Exhibit 1.

***Modeling Methods***

The Forest Service alternative involves a single-valued discharge rating curve (i.e. each lake level is associated with exactly one discharge value). The single-valued curve is easy to model in HEC-HMS, the software used by the Forest Service in its analysis. Therefore HEC-HMS was retained for analysis of the Forest Service alternative. However, UPPCO's proposal involves a more complex rating curve. For instance, in the first UPPCO operating scenario any discharge up to 216 cfs may be passed once the trigger point to manipulate the gates (elevation 1683.7) has been passed. To accommodate the operating rules included in UPPCO's proposed alternative, an MS Excel spreadsheet was developed.

In our opinion the use of two different modeling tools does not present an "apples and oranges" problem in comparing results. Both HEC-HMS and the MS Excel spreadsheet analysis used a one-day time step and simple storage-elevation-discharge routing routines. The only actual difference between the two analysis procedures was that in the MS-Excel spreadsheet for the UPPCO proposed alternative, the process of choosing a flow release was more complex than the decision process in HEC-HMS. (A possible exception to this statement occurs when a near-zero outflow is computed, as discussed below.)

Forest Service Model. The HEC-HMS model developed for the Forest Service alternative included the two daily inflow series (smoothed and unsmoothed), as well as storage-discharge and storage-elevation tables taken directly from the Forest Service materials provided to us. The storage-discharge table reflects the Forest Service's computed rating curve for the fixed-crest spillway and high flow culverts.

The HEC-HMS output series included daily values of inflow, outflow, lake stage, and lake storage.

UPPCO Model. The MS-Excel spreadsheet for the UPPCO-proposed alternative used a sharp-crested weir equation for flow over the two closed gates whenever the lake level was below the trigger elevations outlined in the sensitivities or model scenarios (1683.7 feet and 1683.9 feet for rising stages; 1683.6 feet and 1683.7 feet for falling stages). At each daily time step the model determined whether the gates should be opened or closed (opened if the lake level rose above elevation 1683.7 in the first scenario and 1683.9 in the second scenario, and subsequently closed if it dropped below 1683.6 in the first scenario and 1683.7 in the second scenario).

On days when the decision had been made to open the gates, the modeled release was the lesser of either the full capacity of the opened gates or the daily discharge amount needed to drop the lake down to the specified closure elevation. This is a simplification, as operators might choose to open the gates incrementally, and only release enough to stay at or just below the target maximum elevation, especially if further high inflows were not expected. However, the model is consistent with the proposed operating rules and, for cases where the lake actually has exceeded the desired range, does represent the operation that would bring the level back down within as few days as possible. Had the lake storage been smaller, this simplification might have caused problems with the lake level "bouncing" as the gates cycled through open and closed positions. However, the Cisco Chain storage is large enough that a 24-hour period of full-open gate outflows corresponds to a lake level drop of just 0.1 foot, even if there is no inflow. Therefore there is no overcorrection related to the simplified operating assumptions.

**Results**

Plotted frequency distributions for the two outlet alternatives, two UPPCO operating scenarios, and the two types of inflow series are attached as Exhibit 2. Results from both inflow series are plotted to demonstrate that the overall conclusions are not very sensitive by the decision to smooth or eliminate negative inflows in the inflow series.

Table 1 summarizes some key points of the results, using the unsmoothed inflow series results. All of the listed statistics refer to the entire 20 year period analyzed.

| Table 1: Results of Analysis for 20 Year Period February 1993 – February 2013 ("Unsmoothed" inflow series) | | | |
|---|---|---|---|
| | **Forest Service Alternative** | **UPPCO Alternative Operating Scenario 1: open boards at 1683.7 ft; close boards at 1683.6 ft** | **UPPCO Alternative Operating Scenario 2: open boards at 1683.9 ft; close boards at 1683.6 ft** |
| Median Stage (ft) | 1683.47 | 1683.61 | 1683.74 |
| Median Outflow (cfs) | 34.1 | 19.2 | 25.8 |
| 20% - 80% Stage Range (ft) | 1683.40 – 1683.58 | 1683.54 – 1683.67 | 1683.61 – 1683.82 |
| 20% - 80% Outflow Range (cfs) | 25.7 – 54.0 | 15.7 – 22.3 | 19.1 – 30.5 |
| 20% - 80% Inflow Range (cfs) | 3 – 62 | 3 - 62 | 3-62 |
| Maximum Lake Elevation (ft) | 1684.43 | 1684.24 | 1684.36 |
| Minimum Lake Elevation (ft) | 1683.22 | 1682.93 | 1682.96 |
| Maximum Outflow (cfs) | 277 | 276 | 291 |
| Minimum Outflow (cfs) | 3.0 | 0 | 0.0 |
| Number of Days with Zero Outflow | 0 | 20 | 11 |
| Number of Exceedances of Elevation 1683.95 ft.* | 8 | 4 | 23 |
| Number of Days Above Elevation 1683.95 feet | 101 | 29 | 83 |
| Average Length of Exceedance of Elevation 1683.95 feet (Days) | 12.6 | 7.3 | 3.6 |
| Percent of days requiring gate operation | NA | 10.7 | 7.8 |
| Number of events (including multi-day events) requiring gate operation | NA | 286 | 117 |
| Number of Days with Lake elev. below 1683.0 | 0 | 18 | 5 |
| Number of Events with Lake elevation below 1683.0 | 0 | 3 | 2 |
| Average number of days per event with lake elevation below 1683.0 | 0 | 6 | 2.5 |
| **Consecutive days count as one exceedance. This entry uses a threshold of 1683.95 feet to avoid counting every day when the lake elevation rises just enough to trigger UPPCO's gate opening.* | | | |

## Discussion

Both alternatives with sensitivities result in a lake elevation range of 0.1 to 0.2 foot over the middle 60 percent of days. Notable differences between the two alternatives include the following:

- Because the UPPCO alternative has just a 13.4-foot weir length and the Forest Service alternative has a 49-foot weir length, stages are generally lower for the Forest Service alternative except on days when the UPPCO structure's gates are open.

- The mid-range of outflows is higher for the Forest Service structure. The UPPCO strategy (as modeled) releases higher flows once the decision has been made to open the gates, but these occasions are a minority of days and tend to more quickly return the lake levels to a point where outflows are less than they would be under the Forest Service alternative.

- In the UPPCO outflow series, there are only a few days where the outflow is more than 23 or 34 cfs (the flow over the closed gates just before they are opened, depending on the operating scenario) and less than 216 or 238 cfs (the flow through the open gates just before they are closed). This can be seen in the near-vertical segment of the outflow frequency curve in Exhibit 2. As noted above, this is a simplification of the day-by-day, case-by-case decision process of the operators and is not necessarily how the gates have to be operated. It is, however, consistent with UPPCO's proposal and is the most rapid way to return the lake level to the middle of the desired range.

- With the UPPCO alternative, the number of separate exceedances of the maximum desired level is sensitive to the action levels chosen (Scenario 1 vs Scenario 2). Using the higher UPPCO action level, lake levels exceed the desired maximum on more separate occasions than with the Forest Service alternative. However, for both UPPCO operating scenarios, the length of the exceedance is much less than in the Forest Service alternative because of the capability to rapidly release stored water via the gates.

- With the UPPCO alternative and an operating scenario using a lower (1683.7) action level, the lake level exceeds the maximum desired level on fewer separate occasions than with the Forest Service alternative.

- The analysis indicates that with the UPPCO alternative, the lake is at or below the spillway crest, resulting in a zero outflow, for eleven days over the 20-year period for the 1683.9 action level and twenty days over the 20-year period for the 1683.7 action level. All of the days for both action levels occur in August and September 2007. This does not occur with the Forest Service alternative. The reason for this difference is not apparent but it may have to do with the HMS routine for computing outflow as the lake elevation drops very close to the zero-outflow point. However, if zero outflows actually occur and are determined to be unacceptable, it is important to note that the UPPCO structure offers a means to release flows when the lake drops below elevation 1683.1, while the Forest Service structure does not.

Some of the differences noted above and visible in Exhibit 2 are a result of the difference between a passive, fixed-crest structure and a gated structure. For example, the UPPCO structure's capability to rapidly return the lake to the desired elevation range after a high flow event arises from the assumed operation of the gates. Other differences result more from the selection of specific crest elevation and gate opening trigger elevations. To address the sensitivity of the simulation results to the selected trigger elevations under the UPPCO proposal, two of the most-likely trigger elevation scenarios within the license requirements have been analyzed to show how the results respond.

We appreciated the opportunity to complete these analyses and would be pleased to provide further analyses or discussion. Please contact us if you have further questions or concerns.

Sincerely,

AYRES ASSOCIATES

Ellen Faulkner, P.E
715-831-7631 (o)
715-559-0779 (m)
FaulknerE@AyresAssociates.com

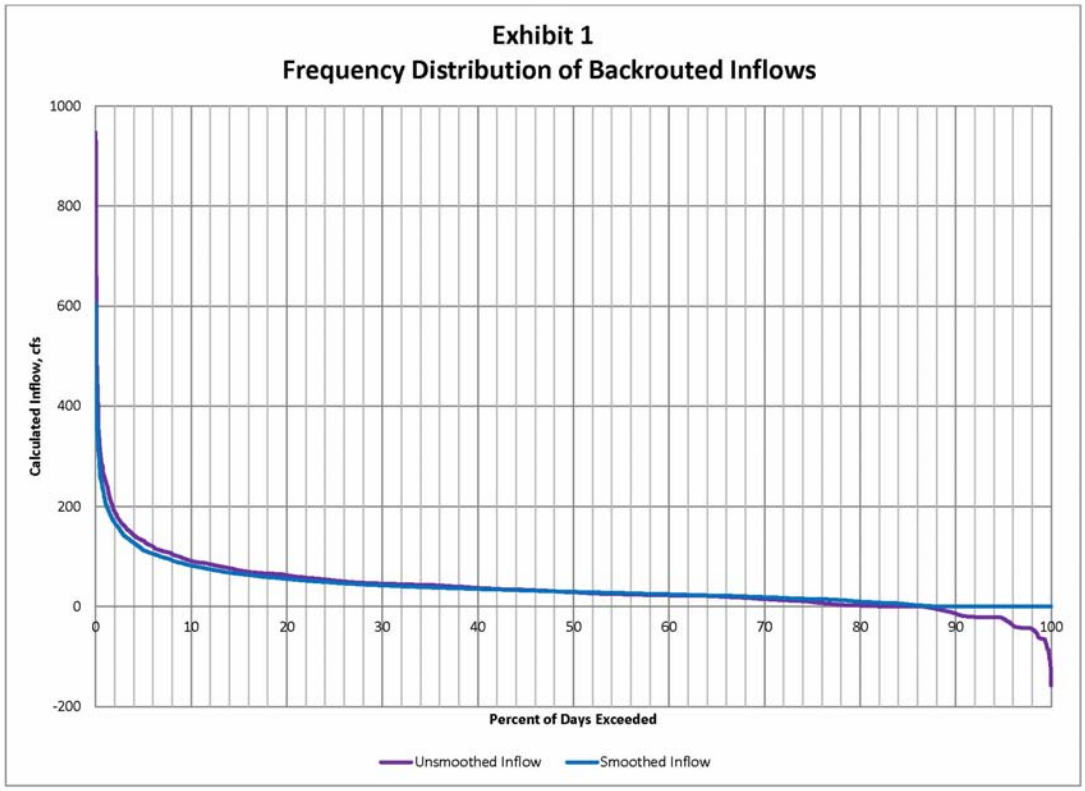
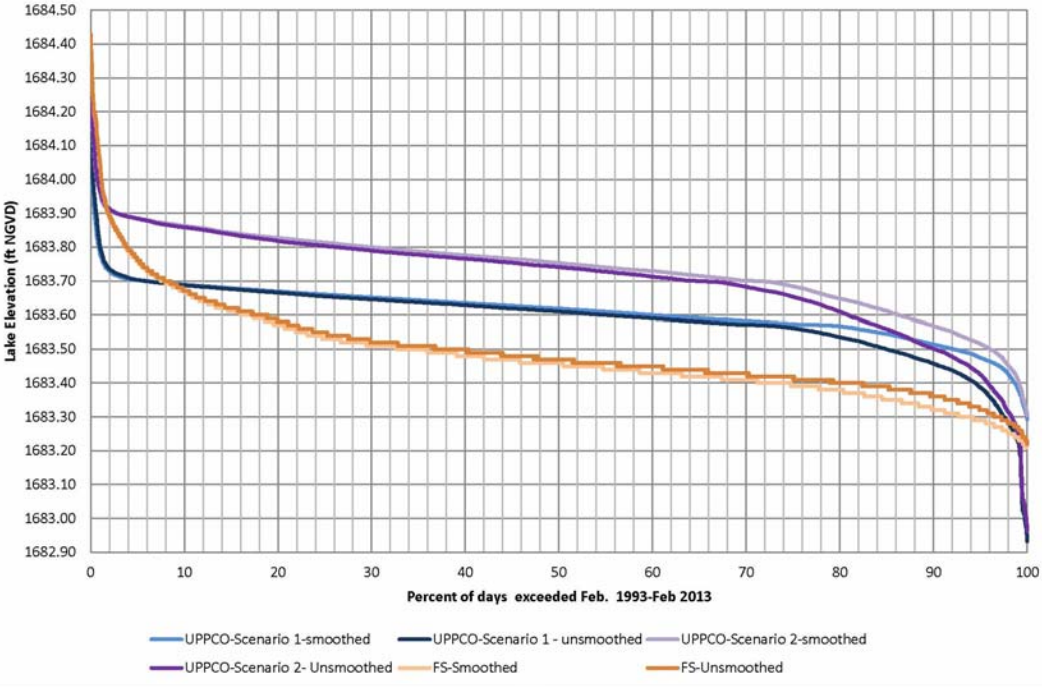


Exhibit 1
Frequency Distribution of Backrouted Inflows
Calculated Inflow, cfs
1000
800
600
400
200
0
-200
0
10
20
30
40
50
60
70
80
90
100
Percent of Days Exceeded
Unsmoothed Inflow
Smoothed Inflow

## Exhibit 2 (a)
## Cisco Lake Chain - Temporal Distribution of Lake Elevations



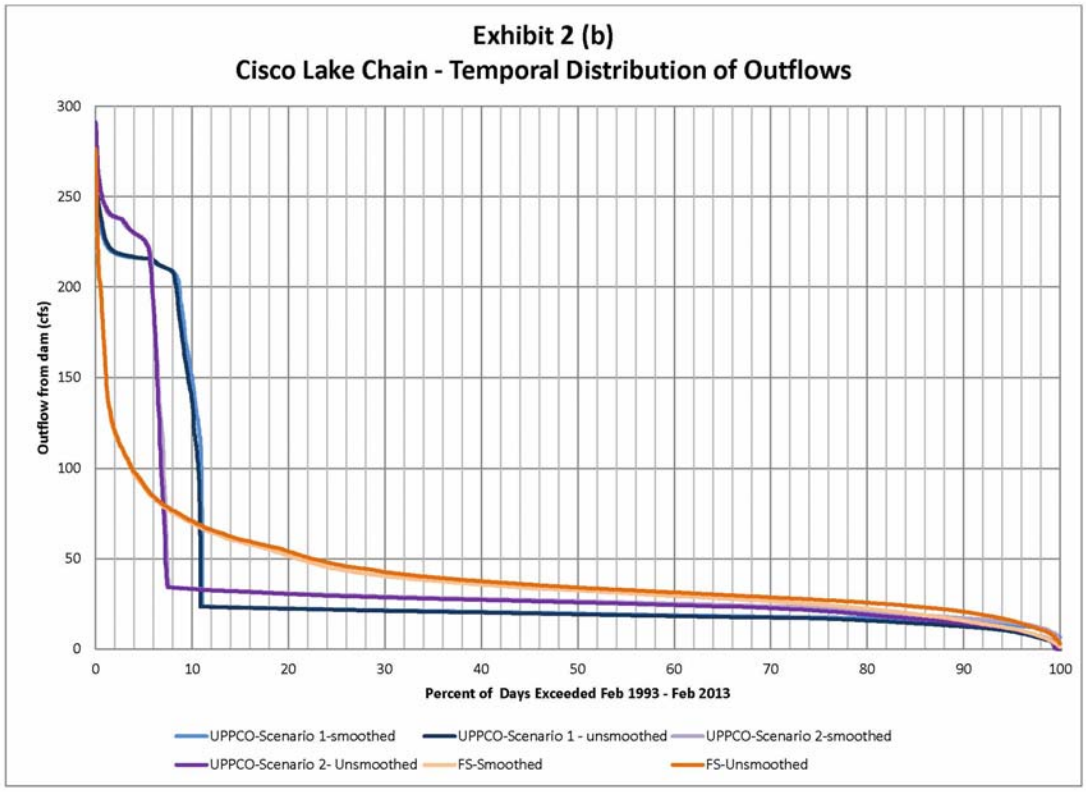


Exhibit 2 (b)
Cisco Lake Chain - Temporal Distribution of Outflows
Outflow from dam (cfs)
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Days Exceeded Feb 1993 - Feb 2013
UPPCO-Scenario 1-smoothed
UPPCO-Scenario 1 - unsmoothed
UPPCO-Scenario 2-smoothed
UPPCO-Scenario 2- Unsmoothed
FS-Smoothed
FS-Unsmoothed

# Appendix 5

# Comment Letter and Responses to Comments

Comment:
The alternative design does not appear to meet the intent of the Settlement Agreement. As stated in your October 16, 2013 letter, the Resource Agencies and UPPCO agreed that the intent of the Settlement Agreement for a fixed crest spillway structure is to more closely mimic a run of river flow thus "naturalizing" the hydrograph. Comparing the frequency distribution of backrouted inflows in Exhibit 1 with the Exhibit 2(b) – Temporal Distribution of Outflows in the document submitted by Ayres Associates to UPPCO, it is seen that outflows in UPPCOs alternative design include relative abrupt reductions in outflow whereas rates of change in the Forest Service design more closely mimics inflows.

Response:
Reason for the Fixed Crest Weir
The following is the exact statement that was agreed upon in the January 8, 2013 meeting as the purpose of the fixed crest spillway taken from the meeting notes provided by the USDA-Forest Service:

*Primary Reason: To more closely mimic a run of river flow and to thus provide a means for "naturalizing" the hydrograph. During relicensing negotiations a design for a 75 foot long fixed crest weir was referenced because the design would provide for downstream flow, or outflow from the reservoir an estimated 97% of the time. Outflows would be attenuated in such a way that there would be fewer and smaller peaks in flow when compared to current operation of the dam.*

Naturalizing the Hydrograph
The comment above focuses on the "relative abrupt reductions" and completely disregards the UPPCO design's ability to provide "for downstream flow, or outflow from the reservoir" over 99% of the time as demonstrated in the hydrologic analysis or routing study of the UPPCO Proposal.

The hydrologic analysis or routing study also explains the magnification of the "relative abrupt reductions" in bullet point 3 of page 6 of the report as a simplification of the day-by-day and case-by-case decision process. In reality, the flow changes are only abrupt on a day to day basis and are made subject to the same restrictions currently outlined in the Operating Plan.

The "relative abrupt reductions" are also a function of the adjustable spill area that reduces the amount of time the reservoir is required to be above the maximum elevation as required in the Operating Plan (a requirement under Section 3.1.4.3 of the Settlement Agreement).

The comment compares the UPPCO proposal to the current USDA-Forest Service proposal that does not include the adjustable spill area. If the USDA-Forest Service Proposal incorporated an adjustable spill area, it too would show "relative abrupt reductions" in its routing study.

Reason for a Small Adjustable Spill Area in the Settlement Agreement
On September 28, 2013, UPPCO provided the Commission with a copy of the 1997 USDA-Forest Service Fixed Crest Weir Study. The study is often referenced in these proceedings. Therefore, the Commission requested a copy. In the 1997 study, which precedes the Settlement Agreement, the USDA-Forest Service recommended alternative labeled "75 max" includes an adjustable spill area 14 feet wide where boards are removed at an elevation of 1683.90 feet and replaced at an elevation of 1683.85 feet.

The USDA-Forest Service completed a routing study for its most recent proposal. The email providing the routing study and the evaluation is **Appendix 2** of this submittal. In the text of the email, the USDA-Forest Service admits that a small adjustable spill section is needed to meet the conditions of the Operating Plan as required by Section 3.1.4.3 of the Settlement Agreement by stating the following: "*I am confident enough to suggest that the lowing (sic) the water level to normal conditions within a 4 ½ days as preferred by the riparian owners would most likely be unachievable without the aid of a manual or automated large release apparatus.*"

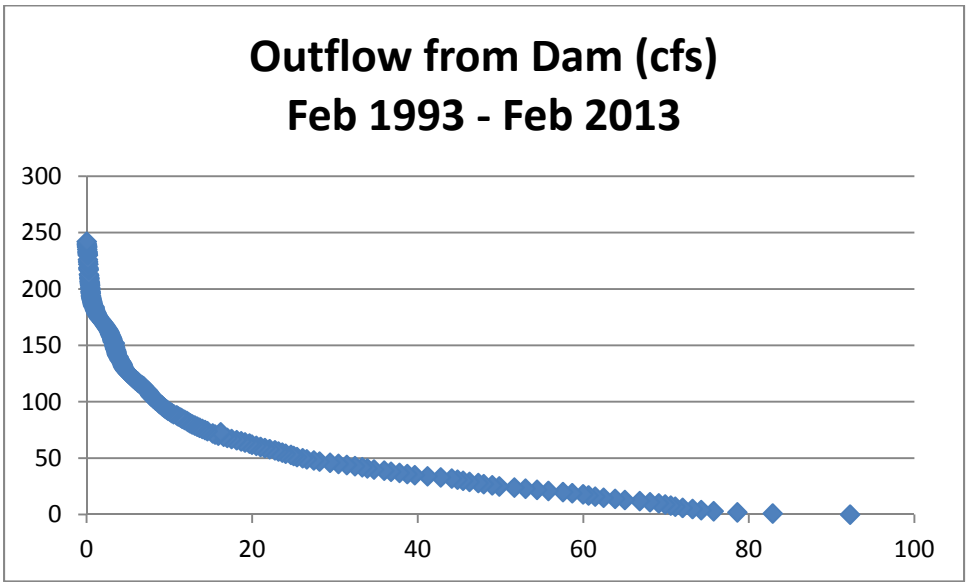
Un-Addressed Financial Obligations

It has been previously demonstrated the current USDA-Forest Service Proposal cannot be accomplished through UPPCO's financial obligations that are specifically outlined in Section 3.1.4.3 of the Settlement Agreement. The members of the Bond Falls Implementation Team that are in support of the current USDA-Forest Service Proposal have also not provided any means to meet the required financial obligations that are outside of the UPPCO responsibility.

UPPCO Proposal Compared to the Current Operation of the Dam

As the notes from the January 18, 2013 meeting indicate under the first or primary reason for a fixed crest weir, the UPPCO proposal needs to be compared to the "current operation of the dam," not the USDA-Forest Service Proposal.

The following Temporal Distribution Outflow Exhibit has been generated by UPPCO using flow releases measured by the Cisco Lake Outflow USGS Gage 04037500 for the period Feb 1993 to Feb 2013. This represents the current operation of the dam:




The current operation of the dam releases 0 cfs approximately 8% of the time over the 20-year record, while the UPPCO Proposal releases 0 cfs less than 1% of the time based upon the data.

Generally, aquatic environments or associated downstream concerns as stated by the USDA-Forest Service as a goal in their November 8, 2012 letter are sensitive to the lower flow ranges due to potential dewatering. The UPPCO proposal provides benefits to the aquatic environment above what is provided by the current operation of the dam.

Comment:

Manual operation of a gated spillway does not meet the intent of creating a more passive operation. Frequent adjustments of the spillway, opening and closing of the gate, will be needed in response to storm events and subsequent changes in lake levels. This will result in greater fluctuations in both lake elevation levels and outflows when compared to a fixed crest spillway. As lake levels increase too rapidly or to too high of an elevation, manual operation of the spillway would result in sudden, rapid increases in downstream flows. The fixed crest spillway designed and presented by the Forest Service would result in a completely passive operation.

Response:

The UPPCO Proposal operation is more passive than the current operation. Under the UPPCO proposal, operation actions are expected to take place less than 10.7 percent of the days (less than one visit per week). Under the current operation, UPPCO makes at least four visits to the dam per week. The four visits per week do not include visits to make adjustments at times other than normal working hours.

Comment:
Monitoring and verification of the operation of the dam in accordance with current license requirements would require maintenance of the existing lake level and stream flow gauges. Cost for the maintenance of these gauges would presumably fall to the new owners of the dam.

Response:
In the January 8, 2013 meeting minutes (See Appendix 5) the gauges were discussed. The minutes state the following:

*There is no need for a stream flow gauge if a fixed crest weir is installed. However, the lake level gauge will need to be maintained as long as the current dam is in place. It was noted that there may be a need to maintain a gauge of an agreed-upon type for a few years to determine actual performance of a newly installed weir. An agreement on stream flow and lake level measuring protocols would be needed.*

According to the current license conditions (The Approved Cisco Operation Plan dated July 9, 2004), there is currently a staff gage located for public viewing and maintained by UPPCO. This staff gage would have to be maintained by the new owner. The only operating license requirements that require verification is headwater elevation. A regular reading of the staff gage and the ability of the public to view the staff gage reading is sufficient to demonstrate headwater compliance. There are no license requirements that need monitoring for outflows to verify compliance. There is also no need to fund the USGS gages for lake elevation and outflows to monitor and verify compliance.

Comment:

We would also like to note that the Resource Agencies and UPPCO previously agreed to the need for a deed covenant requiring that the new dam owner comply with all applicable requirements of the current FERC license. The Resource Agencies are concerned that there is no mechanism in place to monitor and assure compliance with the current license requirements for the operations that would be needed for this gated spillway design. Transfer of the dam would need to include enforceable requirements for validation monitoring and compliance reporting to the State of Michigan.

Response:
UPPCO already addressed this comment on Page 8 of its original application for license amendment dated June 14, 2012. Nothing has been changed in the application applying to the original UPPCO commitment.

Comment:
We appreciate the close communication between the Resource Agencies and UPPCO during these Good Faith Negotiations. We look forward to continued communication regarding these negotiations and encourage you continue discussions with us about these concerns.

Response:

Under the recent comment letter dated November 18, 2013, the signatories do not agree with the UPPCO proposal, but do not present any option that meets all of the requirements outlined in the Settlement Agreement. The option they continue to support cannot be accomplished through UPPCO's financial obligations that are specifically outlined in Section 3.1.4.3 of the Settlement Agreement and does not include the required adjustable spill area.

Continued discussion between UPPCO and the resource agencies on this topic is no longer productive.

Michigan Hydro
Relicensing Coalition

November 18, 2013

Shawn Puzen
Upper Peninsula Power Company
700 North Adams Street
P.O. Box 19001
Green Bay, WI 54307-9001

RE: Resource Agency Comments – Good Faith Negotiations – Cisco Dam Transfer (FERC Project Number 1864), "**Another Acceptable Engineering Design**"

Dear Mr. Puzen:

Please find enclosed combined comments from the Michigan Department of Natural Resources, Wisconsin Department of Natural Resources, Ottawa National Forest, U.S. Fish and Wildlife Service and the Michigan Hydro Relicensing Coalition (collectively referred to as "Resource Agencies") on the alternative engineering design developed by UPPCO for the Cisco Dam. The Resource Agencies and UPPCO agreed to look at this alternative design as another possibility for the future operation of the Cisco Dam in accordance with the Settlement Agreement's provision that states: " . . . a 75-foot long, fixed crest spillway structure with a small adjustable spill area or other acceptable engineering design for very high flow periods . . .".

Reviewing UPPCOs alternative design proposal, the Resource Agencies have agreed to the following comments:

1. The alternative design does not appear to meet the intent of the Settlement Agreement. As stated in your October 16, 2013 letter, the Resource Agencies and UPPCO agreed that the intent of the Settlement Agreement for a fixed crest spillway structure is to more closely mimic a run of river flow thus "naturalizing" the hydrograph. Comparing the frequency distribution of backrouted inflows in Exhibit 1 with the Exhibit 2(b) – Temporal Distribution of Outflows in the document submitted by Ayres Associates to UPPCO, it is seen that outflows in UPPCOs alternative design include relative abrupt reductions in outflow whereas rates of change in the Forest Service design more closely mimics inflows.

2. Manual operation of a gated spillway does not meet the intent of creating a more passive operation. Frequent adjustments of the spillway, opening and closing of the gate, will be needed in response to storm events and subsequent changes in lake levels. This will result in greater fluctuations in both lake elevation levels and outflows when compared to a fixed crest spillway. As lake levels increase too rapidly or to too high of an elevation, manual operation of the spillway would result in sudden, rapid increases in downstream flows. The fixed crest spillway designed and presented by the Forest Service would result in a completely passive operation.
3. Monitoring and verification of the operation of the dam in accordance with current license requirements would require maintenance of the existing lake level and stream flow gauges. Cost for the maintenance of these gauges would presumably fall to the new owners of the dam.

We would also like to note that the Resource Agencies and UPPCO previously agreed to the need for a deed covenant requiring that the new dam owner comply with all applicable requirements of the current FERC license. The Resource Agencies are concerned that there is no mechanism in place to monitor and assure compliance with the current license requirements for the operations that would be needed for this gated spillway design. Transfer of the dam would need to include enforceable requirements for validation monitoring and compliance reporting to the State of Michigan.

We appreciate the close communication between the Resource Agencies and UPPCO during these Good Faith Negotiations. We look forward to continued communication regarding these negotiations and encourage you continue discussions with us about these concerns.

Sincerely,

William L. Deephouse

William L. Deephouse
Michigan Hydro Relicensing Coalition

BURR FISHER
Fish and Wildlife Biologist
Upper Peninsula Sub-Office
U.S. Fish and Wildlife Service

KYLE KRUGER
Michigan Department of Natural Resources

NORMAN E. NASS
District Ranger
Ottawa National Forest

STEPHEN GILBERT
Fisheries Biologist
Bureau of Fisheries Management
Wisconsin Department of Natural Resources.

Upper Peninsula Power Company

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October 16, 2013

FERC Project No. 1864-164

Bond Falls Implementation Team

Dear Team Member:

Request for Comments on "Another Acceptable Engineering Design for Very High-Flow Periods to Allow Dam Operation as Established in the Operating Plan"-Section 3.1.4.3 of the Settlement Agreement.

On December 4, 2012, UPPCO submitted a letter to the Commission agreeing to again enter into a good faith negotiation period regarding a dispute on what constitutes "another acceptable engineering design for very high-flow periods to allow dam operation as established in the Operating Plan" as required in Section 3.1.4.3 of the Settlement Agreement.

On April 11, 2013, UPPCO submitted an update of the good faith negotiation period extending the good faith negotiation period to July 31, 2013.

On August 15, 2013, UPPCO provided an update to the Commission indicating it was collecting additional information to help evaluate if a new proposal for another engineering design which meets the requirements of Section 3.1.4.3 of the Settlement Agreement is acceptable. UPPCO also outlined its intentions with the process moving forward.

As part of the "Good Faith Negotiations," several items were accomplished and are as follows:

**Clarification of the Purposes of the Fixed Crest Weir**

On January 8, 2013, the members of the BFIT held their first "Good Faith Negotiation" Meeting. During the meeting, the members of the BFIT indicated the purposes of the fixed crest weir were to (1) To more closely mimic a run of river flow and to thus provide a means for "naturalizing" the hydrograph. During relicensing negotiations a design for a 75 foot long fixed crest weir was referenced because the design would provide for downstream flow, or outflow from the reservoir an estimated 97% of the time. Outflows would be attenuated in such a way that there would be fewer and smaller peaks in flow when compared to current operation of the dam. (2) Create a more passive operation. The minutes of the January 8, 2013 meeting were provided to the Commission in the April 11, 2013 filing.

**Development of a Conceptual Design by the USDA-Forest Service**

The USDA-Forest Service provided a conceptual design for a fixed-crest weir. That conceptual design was provided to the Commission in the April 11, 2013 filing.

**Hydrologic Analysis of the USDA-Forest Service Conceptual Design**

The USDA- Forest Service completed an internal routing study of their Conceptual Design and provided it to the Bond Falls Implementation Team on March 29, 2013. The Routing Study Results are included in Appendix A of this document.

**Development of a Cost Estimate for the USDA-Forest Service Conceptual Design**

At the request of the BFIT, UPPCO provided a cost-estimate for the construction of a fixed-crest weir according to the USDA-Forest Service Conceptual Design. The estimated cost of the project according to the conceptual design is approximately $700,000 in 2014 dollars. The cost estimate was provided to the members of the BFIT on April 29, 2013. To date, the cost estimate has not been provided to the Commission.

**Development of Another Acceptable Engineering Design by UPPCO (UPPCO Design)**

As a result of the January 8, 2013 meeting of the BFIT, UPPCO agreed to develop an alternative design for operation much like a fixed-crest weir. UPPCO presented their design which consists of setting the existing boards in the existing dam at an elevation of 1683.0 feet MSL and allowing the dam to passively act like a fixed-crest weir until action is required to increase flows by lifting the boards when the current license requirements and approved Cisco Dam Operation Plan requires action. UPPCO initially provided the UPPCO Design to the BFIT on April 29, 2013. Due to the results of additional hydrologic analysis, UPPCO has refined its design and has provided a revised UPPCO Design in Appendix B of this submittal.

**Hydrologic Analysis of UPPCO Design**

In an email from Norm Nass of the USDA-Forest Service dated July 31, 2013, the USDA-Forest Service recommended that UPPCO provide a hydrologic analysis of its design. A copy of the email was provided to the Commission in Appendix A of the August 15, 2013 filing. To complete the hydrologic analysis, UPPCO retained Ellen Faulkner of Ayres Associates to develop a routing study. The analysis report is enclosed in Appendix C of this filing.

**Comparison of Hydrologic Parameters of USDA-Forest Service Design and UPPCO Design**

As part of the hydrologic analysis, Ayres Associates reviewed the USDA-Forest Service Analysis, corrected the errors in the analysis, and compared the results for the USDA-Forest Service Conceptual Design with two sensitivities of the routing study for the UPPCO Proposal. One of the main points of the analysis indicates both the USDA-Forest Service and the UPPCO Proposal are quite comparable from a lake elevation and outflow standpoint. The complete comparison of the results are also discussed and included in Appendix C of this filing.

**Consensus on Future Use of Third Party Arbitrator/Facilitator**

As part of the consultation provided to the Commission in Appendix A of the August 15, 2013 filing, consensus on the use of a third party arbitrator/facilitator was reached among members of the BFIT. UPPCO agreed, based upon the USDA-Forest Service recommendation to gather additional hydrologic information on the UPPCO Design.

UPPCO believes the UPPCO proposal presented in Appendix B meets or exceeds the needs of "another acceptable engineering design for very high-flow periods to allow dam operation as established in the Operating Plan" as required in Section 3.1.4.3 of the Settlement Agreement.

The above statement is supported by the following points:

1) The funds are not available to construct a 75-foot long fixed crest weir.
   The conceptual design presented by the USDA Forest Service is estimated to cost approximately $700,000 to construct. UPPCO's financial obligation for a fixed-crest weir is limited by the Settlement Agreement to $75,000 in December 1998 dollars adjusted for CPI-0.5% and the members of the BFIT have not provided any firm sources for the additional funding to construct the USDA-Forest Service's Conceptual Design.

2) The funding is available to implement the UPPCO Proposal .
   The cost associated with the UPPCO proposal is to set the upper level of the boards at an elevation of 1683.0 feet MSL. The cost to complete the task is minimal. UPPCO can complete the task prior to removal of the facility from the project license and the new owner can operate the dam with less of a need for active adjustments.

3) The UPPCO Proposal naturalizes the hydrograph.
   As demonstrated in the report contained in Appendix C of this filing, the UPPCO proposal provides for downstream flows at all times except for 20 days over a twenty-year period. Based upon a 20-year record of inflows beginning in 1993 and ending in 2013, all of the days with zero outflow under the UPPCO proposal occur in August and September of 2007 (a severe drought period).

4) The UPPCO Proposal creates a more-passive operation.
   Since the UPPCO Proposal fixes the top of the boards at an elevation of 1683.0 feet MSL, action is only required when there is a threat of the reservoir rising above the maximum license elevation of 1683.9 feet MSL. Therefore, during most instances of normal inflow increases, actions such as the lifting of boards to increase outflows will not occur unless the reservoir elevation rises above the midpoint of the license range. These statements are supported in the report contained in Appendix C of this filing and estimates the number of operational actions required over the 20-year record.

5) The UPPCO Proposal meets and exceeds the intent of the fixed-crest weir.
   The BFIT members agreed upon in the January 8, 2013 meeting the purposes for the fixed-crest weir. Those purposes are as follows: (1) To more closely mimic a run of river flow and to thus provide a means for "naturalizing" the hydrograph. During relicensing negotiations a design for a 75 foot long fixed crest weir was referenced because the design would provide for downstream flow, or outflow from the reservoir an estimated 97% of the time. Outflows would be attenuated in such a way that there would be fewer and smaller peaks in flow when compared to current operation of the dam[1]. (2) Create a more passive operation. As

[1] It should be noted, although the majority of members of the BFIT at the January 8, 2013 meeting indicated the primary purpose of the fixed-crest weir was to naturalize flows, the FERC in the Environmental Assessment dated June 27, 2002 indicates the following on page 186:"UPPCO proposes to operate the Cisco dam to mimic ROR conditions using the existing structure. GLIFWC and RCB express concern over the effects of fluctuating flows, including periods of no flow below the Cisco dam, on recreational resources, and recommend that UPPCO install a fixed crest weir on the current dam to allow more natural releases to the Cisco Branch for recreational resources (see section 4.1.3). We agree that providing continuous flows below the dam would enhance the recreation potential of the Cisco Branch. However, after weighing the enhanced recreational opportunity downstream of the dam against the possible reduction in opportunities upstream of the project (if drawdowns are required to maintain minimum flows), we conclude that maintaining reservoir levels should take priority over downstream flows for recreational opportunities. The number of recreational users would be much greater on the Cisco Chain of Lakes than those potentially using the Cisco Branch."

demonstrated by the two previous points, the UPPCO Proposal meets and exceeds the intent of a fixed-crest weir.

6) The UPPCO Proposal maintains the current level of safety.
The UPPCO Proposal allows for flexibility of releases that do not modify the current capacity of the dam structure to pass high flows and no structural modifications to the earthen embankments are required (i.e. installation of over flow culverts) which could compromise the safety of the Cisco Dam.

UPPCO is proposing to amend its Request for Amendment-Removal of the Cisco Dam from the Bond Falls Hydroelectric Project dated June 14, 2012 supplemented on April 2, 2013, to include an action where the boards will be set at a crest elevation of 1683.0 feet MSL prior to the removal of the Cisco Dam from the Bond Falls Hydroelectric Project.

Please provide your comments on the above proposal within 30 days. If this proposal is not acceptable to the Bond Falls Implementation Team, UPPCO will notify the Commission the dispute has not been resolved and ask the Commission to resolve it based upon this proposal meeting the definition of "another acceptable engineering design for very high-flow periods to allow dam operation as established in the Operating Plan" as required in Section 3.1.4.3 of the Settlement Agreement.

If you should have any questions relative to this information, please do not hesitate to contact me at (920) 433-1094.

Sincerely,

Shawn C. Puzen
Environmental Consultant
for Upper Peninsula Power Company

cc:

| | | |
|---|---|---|
| Mr. Gil Snyder, WPS | Mr. Greg Egtvedt, IBS | Mr. Norm Nass, USDA-FS |
| Mr. Virgil Schlorke, UPPCO | Mr. Jim Melchiori, UPPCO | Mr. Kyle Kruger, MDNR |
| Mr. Keith Moyle, UPPCO | Ms. Patricia Grant, FERC - CRO | Mr. Burr Fisher, FWS |
| Mr. James Schramm, MHRC | Mr. Gene Mensch, KBIC | Mr. Stephen Gilbert, WDNR |

# APPENDIX A

**Puzen, Shawn C**

**From:** Nass, Norman -FS [nnass@fs.fed.us]
**Sent:** Friday, March 29, 2013 12:23 AM
**To:** Puzen, Shawn C; Gilbert, Stephen J - DNR (Stephen.Gilbert@Wisconsin.gov); 'Laatsch, Cheryl - DNR' (Cheryl.Laatsch@Wisconsin.gov); 'Kruger, Kyle (DNR)' (KRUGERK@michigan.gov); Egtvedt, Gregory W; Fedora, Mark -FS; jdschramm@oceana.net; tnkkraut3649@gmail.com; 'Burr_Fisher@fws.gov'; Bill Deephouse <troutkpr@up.net> (troutkpr@up.net); Gene Mensch (gmensch@kbic-nsn.gov)
**Cc:** Kiaer, Gregory J -FS; Bigelow, Michael J -FS
**Subject:** Cisco Fixed Crest Weir - Alternative Conceptal Design
**Attachments:** Norman Nass.vcf; Details.pdf; HEC-HMS_outputAnalysis.xlsx; HecHms_Output.pdf

Hi all, attached is the alternative conceptual design for a fixed crest weir that could be used to replace the Cisco Dam. Following are notes from Greg Kiaer, Civil Engineer, describing the design and his analysis findings:

Attached for your review are plan and elevation details that show a concept of a weir spanning the existing bridge abutments as we discussed . Also included are the results of the hydrologic analysis in support of the concept. In summary the details propose the existing control structure is to be demolished and fixed sharped-crested weir to be constructed between the existing bridge abutments spanning approximately 49 ft. The fixed weir will not require any manual adjustments to the structure, nor will lake level have to be lowered to accommodate spring runoff as it was often practiced by the Cisco riparian owners. An emergency overflow consisting of three 36" diameter pipes sized to pass a 100-year flood event is provided for extreme events.

The system was analyzed replicating the same methodology as used in the original analysis. Twenty years of actual hydrologic data was obtained from a USGS gage immediately upstream of the dam that measures stages in the water surface in Cisco Lake and another USGS gage immediately downstream that measures discharge in the Cisco Branch of the Ontonagon River. Additional data from the date of the original to the present was included. This data was useful in the analysis since it did not require creating a hydrograph from actual or synthetic precipitation, plus the data represents discharge conditions that can be attributed to snow melt, evaporation, and seepage, which did not require input into the analysis.

The results of the analysis predict that flow over the weir will occur almost continuously ranging from 0 to 249 cfs with a mean discharge of 44 cfs. The results show 18 days of no flow or 0.25% within 7,309 days or 20 years. The range of water levels in Cisco lake are expected to range from an elevation of 1684.37 to 1683.02 with a mean of 1683.53. Please refer to the attached Excel Output Analysis for calculations.

I estimated the average number of days that it would take the lake to drain to normal conditions when the lake is at high water levels to be approximately 14 days. This was determined by applying the statistical 80/20 percentile rule due to the varying degree of elevation. Please refer to the Output Analysis in which, I compared the 80 percentile elevation of 1683.7 to the normal or mean elevation of 1683.53. Please note that the number of days that I am currently stating is more than 7 days I mentioned during our recent conference call. The modification is due to updating the analysis by an adjustment in the starting water surface elevation. I am confident enough to suggest that the lowing the water level to normal conditions within a 4 ½ days as preferred by the riparian owners would most likely be unachievable without the aid of a manual or automated large release apparatus.

Please note that the attached Hec-Hms Output Time-Series data is quite lengthy. Scroll down and you will eventually come to output graphs that show inflow, outflow, elevation, and storage.

Please let me know what additional information is needed.

Norman

**Norman Nass**
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# APPENDIX B

# Bond Falls Hydroelectric Project
# (FERC No. 01864)

# Upper Peninsula Power Company
# Alternative Design Proposal

**Cisco Development License Operating Requirements:**
The licensee shall operate Cisco Dam to maintain Cisco Lake at or above elevation 1,683.0 feet MSL, with a target elevation between 1,683.4 to 1,683.9 feet MSL as required by Article 401.

**Settlement Agreement Section 3.1.4.3 Language:**
UPPCO will attempt, with the Team's support, to find a new owner for Cisco Dam in order to allow it to be removed from the Bond Falls Project license. Any new owner shall be required to operate the dam according to the Operation Plan developed by the Team. If Cisco Dam is removed from the license and operated by a new owner, UPPCO shall install and finance up to $75,000 (in December 1998 dollars adjusted for CPI - 0.5%) for a 75-foot-long, fixed-crest spillway structure with a small adjustable spill area or another acceptable engineering design for very high-flow periods to allow dam operation as established in the Operating Plan.

**Objective:**
Develop another acceptable engineering design for very high-flow periods to allow dam operations as established in the operating plan.

1) Primary Reason: To more closely mimic a run of river flow and to thus provide a means for "naturalizing" the hydrograph. Outflows would be attenuated in such a way that there would be fewer and smaller peaks in flow when compared to current operation of the dam[2].
2) Secondary Reason: Create a more passive operation.

**Constraints:**

- Allow for operations as established in the operating plan.
- Maintain Cisco Lake at or above elevation 1,683.0 feet MSL, with a target elevation between 1,683.4 to 1,683.9 feet MSL.
- CCROA requested that any new structure be designed for a maximum water level of 1683.9 feet with an average time to return to 1683.4 feet within 4.5 days.

**Proposed Structure Modifications:**

- **Modify the dam structure such that small flow adjustments can be made.**

  The past practice was to make adjustments by removing one board at a time. Each board height was 8". Therefore, adjustments were made in 8" increments per each bay.
  This modification has already been made. All boards have been fastened into one piece and water releases require the lifting of the entire board section for each bay with a hoist. The water is then released from the bottom of the board section in each bay. This allows for infinitely small flow adjustments.
- **Set the elevation of the top of the boards in each bay at 1683.0 feet MSL.**

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[2] The Primary Reason and the Secondary Reason were developed during the January 8, 2013 "Good Faith" negotiation meeting.

Set the elevation at the top of the boards of each bay (by replacing the top board) at elevation 1683.0.

**Operation of the Dam:**
To minimize flow and level fluctuations, removal or installation of planks will be completed at a rate of one plank (8 inches) per ten-minute interval. In the event that the reservoir is rising at a rate faster than 0.1 foot per day from an increased flow event, the rate of removal or opening shall be one plank (8 inches) per two-minute interval.

**Conclusions:**
The changes in the structure also retain the possibility for necessary intervention from the operator in the case where inflow conditions deviate from the normal distribution of flows.
The dam will still need to be visited on a regular basis to assure debris has not accumulated such that downstream flows are restricted and to assure the facility is operating correctly.
The proposed changes can be accomplished within the finance and installation requirements outlined in Section 3.1.4.3 of the Settlement Agreement.

Appendix C

AYRES ASSOCIATES

October 2, 2013

Mr. Shawn Puzen
Integrys Business Support
700 North Adams St
Green Bay, WI 54301

Re: Routing Analyses for Cisco Chain of Lakes Dam Outlet Alternatives

Dear Mr. Puzen:

Ayres Associates has completed a reservoir routing analysis to compare two proposed outlet configurations and operating strategies for the Cisco Chain of Lakes near Watersmeet, Michigan. According to materials you provided to us, the lake owners' association has expressed a desire to maintain lake levels between 1683.4 and 1683.9 feet MSL, with as rapid a return as possible to this range when high flow events necessitate a surcharge above elevation 1683.9. Furthermore, the local fire protection service requires a minimum lake elevation of 1683.0 feet for operation of a boat used in fire fighting.

The objective of our analysis was to determine the frequency distributions of lake levels and outflows for each proposed configuration, assuming a daily inflow series matching the last 20 years of record at the site (February 1993 – February 2013).

*Note:* The MSL vertical datum is mentioned in the summary of the lake property owners' objectives. However, the USGS level gage on the lake uses the NGVD29 vertical datum, so we have assumed that the desired lake elevations are intended to reference NGVD29 as well.

***Summary of Proposed Outlet Alternatives***

The two proposed alternatives are as follows:

"Forest Service Alternative." This alternative consists of a 49-foot-long fixed crest weir with crest elevation 1683.1 and three 36-inch diameter culvert pipes for passing high flows. The structure would be entirely passive. In our analysis we used the discharge rating curve developed for this structure by the Forest Service. The rating curve indicates a discharge of approximately 25 cubic feet per second (cfs) at elevation 1683.4 and 122 cfs at elevation 1683.9. A discharge of 260 cfs – similar to large floods that occurred in April, 2002 and May, 2003 – would be passed at an elevation of approximately 1684.4 feet.

"UPPCO Alternative." The alternative under consideration by the Upper Peninsula Power Company (UPPCO) involves modifying the existing two-gated structure. With gates closed, water would flow over the top of the gates, which would form a 13.4-foot-long fixed crest weir with crest elevation 1683.0. The proposed operating plan would follow the requirements outlined in Article 401 of the Order Approving Settlement and Issuing License dated August 20, 2003 as amended by Orders dated August 26, 2008 and August 18, 2011. The proposed plan

would allow flow over the top of the closed boards until action is required (a lifting of the boards or gates) to maintain the reservoir elevation above 1683.0 feet MSL at all times and target the lake elevation between 1683.4 feet MSL and 1683.9 feet MSL.

To analyze the UPPCO alternative, the operation is simplified by running two possible sensitivities or model scenarios.

The first scenario allows flow over the top of the boards until the lake level reaches 1683.7 feet MSL, at which point the gates could be lifted to any opening height and left open until the lake level draws down to elevation 1683.6 feet. Under this proposal, the outflow over the top of the closed gates at elevation 1683.7 (just before the gates are opened) is 23 cfs. The concrete sill of the open gates is at elevation 1680.7. The maximum outflow at elevation 1683.7, assuming both gates are lifted clear of the water, is 216 cfs. A flow of 238 cfs could be passed at elevation 1683.9.

The second UPPCO scenario allows flow over the top of the boards until the lake level reaches 1683.9 feet MSL, at which point the gates could be lifted to any opening height and left open until the lake level draws down to elevation 1683.7. Under this proposal, the outflow over the top of the closed gates at elevation 1683.9 (just before the gates are opened) is 34 cfs. The concrete sill of the open gates is at elevation 1680.7. The maximum outflow at elevation 1683.9, assuming both gates are lifted clear of the water, is 238 cfs. A flow of 260 cfs could be passed at elevation 1684.1.

Both scenarios are probable scenarios to correctly explain the two "bookends" of operation according to the requirements outlined in the license. The midpoint of the target elevations is 1683.65 feet MSL. To operate consistently with the license requirements, operation action to increase flows would take place once the reservoir rises past the midpoint of the target elevations. In practice the soonest this would take place would likely be at an approximate elevation of 1683.7 feet MSL. The latest or the highest trigger elevation that operation action to increase flows could take place consistent with the license requirements is 1683.9 feet MSL (the upper license elevation).

***Inflow Series Analysis***

A USGS lake level gage (no. 04037400) is located on the Cisco Chain near the existing outlet structure. A USGS streamflow gage (no. 04037500) is located just downstream of the outlet. Both gages have periods of record extending back to the 1940s. In order to provide a parallel analysis to one already conducted by the Forest Service, we performed routing analyses on lake levels and discharges using the daily period of record February 21, 1993 – February 20, 2013. Some missing daily data in the lake level records were filled by interpolation.

In their analysis, Forest Service engineers used the daily streamflow values from the downstream gage to represent inflows to the lakes. A more accurate representation is to "backroute" these flows, adjusting each daily outflow value by the change in lake storage on the same day. This procedure accounts for the fact that if the lake level rises or falls over a given day, the outflow is not the same as the inflow. The backrouting analysis was accomplished using an MS Excel spreadsheet, the USGS daily flow and lake stage records, and the elevation-storage relationship provided with the Forest Service analyses.

Backrouting is subject to a certain amount of numerical instability because when the lake area is large relative to the volume of water passing through it, very small measured changes in lake level produce large and sudden changes in calculated inflow. Furthermore, the backrouting

procedure can – and did - result in a few negative computed inflows. Some of these are simply due to the numerical sensitivity to small changes in elevation. However, several instances of multi-day negative computed inflows do appear during July, August, and September, suggesting that there are probably days in the late summer when the net inflow to the lake, after accounting for evaporation, actually is negative.

To test the sensitivity of our routing model results to these instabilities and negative inflows, we ran two different inflow series for each alternative. The first inflow series used the "unsmoothed" daily backrouted values, including negative inflows whenever they appeared. In the second inflow series – denoted "smoothed" – the daily backrouted flows were converted to three-day running averages, and all negatives inflows were reset to zero. As will be seen below, the use of "smoothed" versus "unsmoothed" inflow data did not substantially affect the routing results.

Cumulative daily inflow frequency curves for the "unsmoothed" and "smoothed" inflow series are attached as Exhibit 1.

***Modeling Methods***

The Forest Service alternative involves a single-valued discharge rating curve (i.e. each lake level is associated with exactly one discharge value). The single-valued curve is easy to model in HEC-HMS, the software used by the Forest Service in its analysis. Therefore HEC-HMS was retained for analysis of the Forest Service alternative. However, UPPCO's proposal involves a more complex rating curve. For instance, in the first UPPCO operating scenario any discharge up to 216 cfs may be passed once the trigger point to manipulate the gates (elevation 1683.7) has been passed. To accommodate the operating rules included in UPPCO's proposed alternative, an MS Excel spreadsheet was developed.

In our opinion the use of two different modeling tools does not present an "apples and oranges" problem in comparing results. Both HEC-HMS and the MS Excel spreadsheet analysis used a one-day time step and simple storage-elevation-discharge routing routines. The only actual difference between the two analysis procedures was that in the MS-Excel spreadsheet for the UPPCO proposed alternative, the process of choosing a flow release was more complex than the decision process in HEC-HMS. (A possible exception to this statement occurs when a near-zero outflow is computed, as discussed below.)

Forest Service Model. The HEC-HMS model developed for the Forest Service alternative included the two daily inflow series (smoothed and unsmoothed), as well as storage-discharge and storage-elevation tables taken directly from the Forest Service materials provided to us. The storage-discharge table reflects the Forest Service's computed rating curve for the fixed-crest spillway and high flow culverts.

The HEC-HMS output series included daily values of inflow, outflow, lake stage, and lake storage.

UPPCO Model. The MS-Excel spreadsheet for the UPPCO-proposed alternative used a sharp-crested weir equation for flow over the two closed gates whenever the lake level was below the trigger elevations outlined in the sensitivities or model scenarios (1683.7 feet and 1683.9 feet for rising stages; 1683.6 feet and 1683.7 feet for falling stages). At each daily time step the model determined whether the gates should be opened or closed (opened if the lake level rose above elevation 1683.7 in the first scenario and 1683.9 in the second scenario, and subsequently closed if it dropped below 1683.6 in the first scenario and 1683.7 in the second scenario).

On days when the decision had been made to open the gates, the modeled release was the lesser of either the full capacity of the opened gates or the daily discharge amount needed to drop the lake down to the specified closure elevation. This is a simplification, as operators might choose to open the gates incrementally, and only release enough to stay at or just below the target maximum elevation, especially if further high inflows were not expected. However, the model is consistent with the proposed operating rules and, for cases where the lake actually has exceeded the desired range, does represent the operation that would bring the level back down within as few days as possible. Had the lake storage been smaller, this simplification might have caused problems with the lake level "bouncing" as the gates cycled through open and closed positions. However, the Cisco Chain storage is large enough that a 24-hour period of full-open gate outflows corresponds to a lake level drop of just 0.1 foot, even if there is no inflow. Therefore there is no overcorrection related to the simplified operating assumptions.

**Results**

Plotted frequency distributions for the two outlet alternatives, two UPPCO operating scenarios, and the two types of inflow series are attached as Exhibit 2. Results from both inflow series are plotted to demonstrate that the overall conclusions are not very sensitive by the decision to smooth or eliminate negative inflows in the inflow series.

Table 1 summarizes some key points of the results, using the unsmoothed inflow series results. All of the listed statistics refer to the entire 20 year period analyzed.

| Table 1: Results of Analysis for 20 Year Period February 1993 – February 2013 ("Unsmoothed" inflow series) | | | |
|---|---|---|---|
| | **Forest Service Alternative** | **UPPCO Alternative Operating Scenario 1: open boards at 1683.7 ft; close boards at 1683.6 ft** | **UPPCO Alternative Operating Scenario 2: open boards at 1683.9 ft; close boards at 1683.6 ft** |
| Median Stage (ft) | 1683.47 | 1683.61 | 1683.74 |
| Median Outflow (cfs) | 34.1 | 19.2 | 25.8 |
| 20% - 80% Stage Range (ft) | 1683.40 – 1683.58 | 1683.54 – 1683.67 | 1683.61 – 1683.82 |
| 20% - 80% Outflow Range (cfs) | 25.7 – 54.0 | 15.7 – 22.3 | 19.1 – 30.5 |
| 20% - 80% Inflow Range (cfs) | 3 – 62 | 3 - 62 | 3-62 |
| Maximum Lake Elevation (ft) | 1684.43 | 1684.24 | 1684.36 |
| Minimum Lake Elevation (ft) | 1683.22 | 1682.93 | 1682.96 |
| Maximum Outflow (cfs) | 277 | 276 | 291 |
| Minimum Outflow (cfs) | 3.0 | 0 | 0.0 |
| Number of Days with Zero Outflow | 0 | 20 | 11 |
| Number of Exceedances of Elevation 1683.95 ft.* | 8 | 4 | 23 |
| Number of Days Above Elevation 1683.95 feet | 101 | 29 | 83 |
| Average Length of Exceedance of Elevation 1683.95 feet (Days) | 12.6 | 7.3 | 3.6 |
| Percent of days requiring gate operation | NA | 10.7 | 7.8 |
| Number of events (including multi-day events) requiring gate operation | NA | 286 | 117 |
| Number of Days with Lake elev. below 1683.0 | 0 | 18 | 5 |
| Number of Events with Lake elevation below 1683.0 | 0 | 3 | 2 |
| Average number of days per event with lake elevation below 1683.0 | 0 | 6 | 2.5 |
| **Consecutive days count as one exceedance. This entry uses a threshold of 1683.95 feet to avoid counting every day when the lake elevation rises just enough to trigger UPPCO's gate opening.* | | | |

**Discussion**

Both alternatives with sensitivities result in a lake elevation range of 0.1 to 0.2 foot over the middle 60 percent of days. Notable differences between the two alternatives include the following:

- Because the UPPCO alternative has just a 13.4-foot weir length and the Forest Service alternative has a 49-foot weir length, stages are generally lower for the Forest Service alternative except on days when the UPPCO structure's gates are open.

- The mid-range of outflows is higher for the Forest Service structure. The UPPCO strategy (as modeled) releases higher flows once the decision has been made to open the gates, but these occasions are a minority of days and tend to more quickly return the lake levels to a point where outflows are less than they would be under the Forest Service alternative.

- In the UPPCO outflow series, there are only a few days where the outflow is more than 23 or 34 cfs (the flow over the closed gates just before they are opened, depending on the operating scenario) and less than 216 or 238 cfs (the flow through the open gates just before they are closed). This can be seen in the near-vertical segment of the outflow frequency curve in Exhibit 2. As noted above, this is a simplification of the day-by-day, case-by-case decision process of the operators and is not necessarily how the gates have to be operated. It is, however, consistent with UPPCO's proposal and is the most rapid way to return the lake level to the middle of the desired range.

- With the UPPCO alternative, the number of separate exceedances of the maximum desired level is sensitive to the action levels chosen (Scenario 1 vs Scenario 2). Using the higher UPPCO action level, lake levels exceed the desired maximum on more separate occasions than with the Forest Service alternative. However, for both UPPCO operating scenarios, the length of the exceedance is much less than in the Forest Service alternative because of the capability to rapidly release stored water via the gates.

- With the UPPCO alternative and an operating scenario using a lower (1683.7) action level, the lake level exceeds the maximum desired level on fewer separate occasions than with the Forest Service alternative.

- The analysis indicates that with the UPPCO alternative, the lake is at or below the spillway crest, resulting in a zero outflow, for eleven days over the 20-year period for the 1683.9 action level and twenty days over the 20-year period for the 1683.7 action level. All of the days for both action levels occur in August and September 2007. This does not occur with the Forest Service alternative. The reason for this difference is not apparent but it may have to do with the HMS routine for computing outflow as the lake elevation drops very close to the zero-outflow point. However, if zero outflows actually occur and are determined to be unacceptable, it is important to note that the UPPCO structure offers a means to release flows when the lake drops below elevation 1683.1, while the Forest Service structure does not.

Some of the differences noted above and visible in Exhibit 2 are a result of the difference between a passive, fixed-crest structure and a gated structure. For example, the UPPCO structure's capability to rapidly return the lake to the desired elevation range after a high flow event arises from the assumed operation of the gates. Other differences result more from the selection of specific crest elevation and gate opening trigger elevations. To address the sensitivity of the simulation results to the selected trigger elevations under the UPPCO proposal, two of the most-likely trigger elevation scenarios within the license requirements have been analyzed to show how the results respond.

We appreciated the opportunity to complete these analyses and would be pleased to provide further analyses or discussion. Please contact us if you have further questions or concerns.

Sincerely,

AYRES ASSOCIATES

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**Exhibit 1**
**Frequency Distribution of Backrouted Inflows**

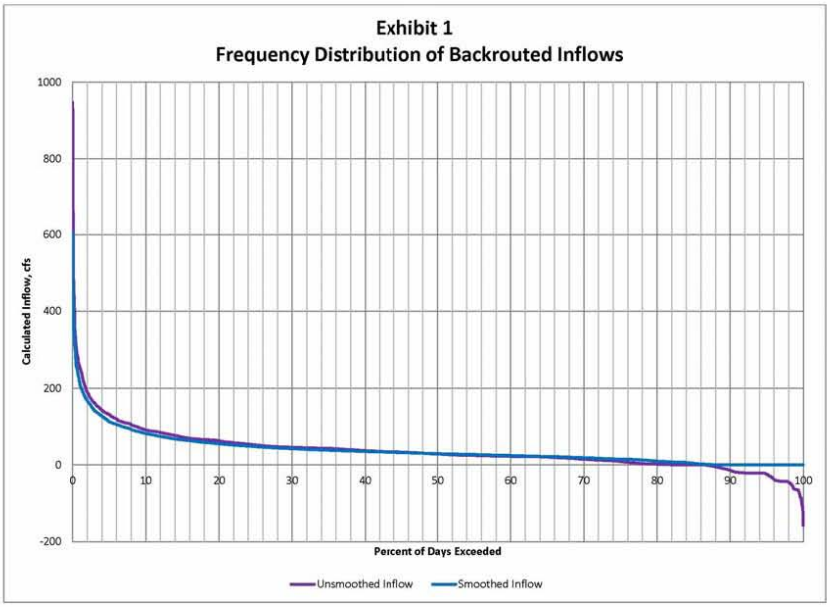

**Exhibit 2 (a)**

**Cisco Lake Chain - Temporal Distribution of Lake Elevations**

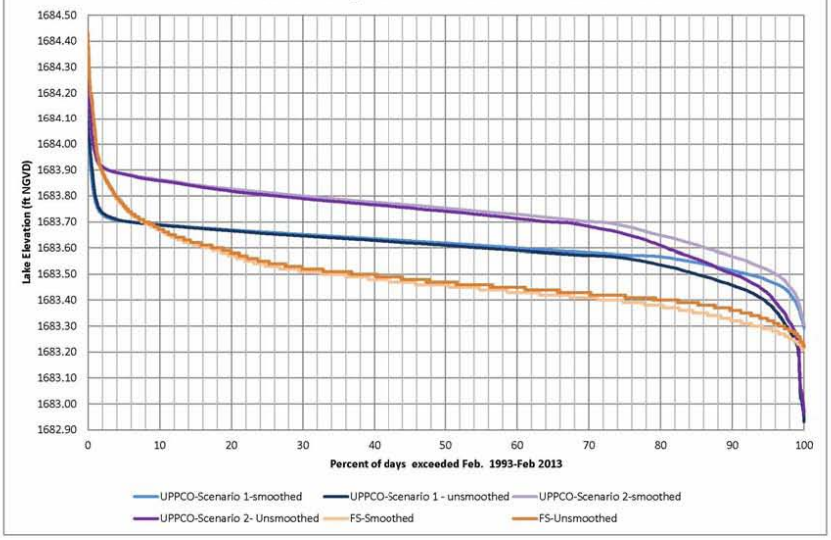

**Exhibit 2 (b)**
**Cisco Lake Chain - Temporal Distribution of Outflows**