ORIGINAL

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PPL Holtwood, LLC) **Project No. 1881-050**

PPL HOLTWOOD, LLC OFFER OF SETTLEMENT AND EXPLANATORY STATEMENT

Pursuant to Rule 602 of the Rules of Practice and Procedure of the Federal Energy Regulatory Commission ("FERC" or the "Commission"), 18 C.F.R. § 385.602 (2008), PPL Holtwood, LLC ("PPL") hereby files this Offer of Settlement and an accompanying Explanatory Statement relating to the redevelopment and expansion of the Holtwood Hydroelectric Project (the "Holtwood Project" or "Project"). This Offer of Settlement includes the Settlement Agreement Between Exelon Generation and PPL Holtwood, LLC Regarding the Expansion of the PPL Holtwood Hydroelectric Project, executed on May 5, 2008 (the "Settlement Agreement"). The Settlement Agreement serves as Exhibit A of this Offer of Settlement.

By its terms, the Settlement Agreement resolves between PPL and Exelon Generation Company, LLC ("Exelon") issues associated with the Holtwood Project expansion, and, as regards to those issues, the Offer of Settlement constitutes each party's complete recommendations, terms, conditions relating to the corresponding amendment of the Holtwood Project license under the Federal Power Act ("FPA"). Accordingly, PPL requests that the Commission: (1) approve the Offer of Settlement to the limited extent that it relates to jurisdictional issues under the FPA in the context of the contemplated Holtwood Project expansion; and (2) incorporate its terms relating to the operation of the Holtwood Project impoundment, Lake Aldred, and water releases from the project, into the amendments to the project license associated with the expansion.

As set forth in Rule 602(f), comments on the Offer of Settlement must be filed on or before November 12, 2008. Reply comments must be filed on or before November 22, 2008.

I. OFFER OF SETTLEMENT

A. Background

On December 20, 2007, PPL submitted an application to amend its license for the Holtwood Project, which is located on the Susquehanna River, in Lancaster and York Counties, Pennsylvania. PPL's proposed amendment would increase the installed capacity at the Project by constructing a new powerhouse with two turbine generator units; installing new two generating units in the existing powerhouse; and refurbishing four generating units in the existing powerhouse (Units 1, 2, 4 and 7). The total installed capacity of the Project would increase from approximately 107 MW to 195.5 MW and the total hydraulic capacity of the Project would increase from 31,500 cfs to approximately 61,500 cfs. PPL also proposed to construct a new skimmer wall upstream of the powerhouses and perform excavation in the forebay to replace deteriorating infrastructure, as well as to enable flows to enter the new generating units.

In order to improve fish passage at the Holtwood Project, PPL proposed to: (1) modify the existing fish lift; (2) reroute the discharge of Unit 1 in the existing powerhouse; and (3) excavate in the project tailrace and spillway. PPL also proposed to implement additional measures to enhance migratory fish passage, provide for minimum flows, and perform studies and evaluations. PPL's new construction will result in a reconfiguration of the Holtwood Project in a manner that is designed to accomplish very specific and ambitious goals for upstream fish passage. Prior to submitting its application, PPL entered into a Consent Order Agreement with the Pennsylvania Department of Environmental Protection ("PDEP"), which specified the minimum flow and fish passage provisions that were proposed to be inserted into PDEP's water quality certification

("WQC") of the Project redevelopment under Section 401 of the Clean Water Act ("CWA"). PPL requested the modification of those license articles related to these design changes. PPL also requested that FERC extend the term of the current license for the Holtwood Project from September 1, 2014 to August 31, 2030, which would result in a 50-year license term for the existing license.

On February 21, 2008, the Commission issued a notice accepting PPL's application for filing, soliciting motions to intervene and protests, indicating that the application was ready for environmental analysis, and soliciting comments, recommendations, terms and conditions, and fishway prescriptions. On April 4, 2008, Exelon's parent company, Exelon Corporation, filed a motion to intervene in the relicensing proceeding. Exelon is the owner of the Conowingo Hydroelectric Project ("Conowingo") and the Muddy Run Pumped Storage Project ("Muddy Run"), and has an ownership interest in the Peach Bottom Atomic Power Station ("Peach Bottom") – all of which are located downstream of the Holtwood Project on the Susquehanna River.[1] Conowingo Dam is located approximately 15 miles downstream of Holtwood Dam. Muddy Run, located in Lancaster County, Pennsylvania, is approximately two miles downstream of Holtwood Dam. Peach Bottom is located in York County, Pennsylvania, approximately six miles downstream of Holtwood Dam.

Like the Holtwood Project, Conowingo and Muddy Run are operated to meet peak electrical demand. Exelon Corporation stated in its motion to intervene that, because the Susquehanna River is a shared resource, expansion and consequent operational changes at PPL's upstream Holtwood project could adversely affect the operations of Exelon's downstream projects.

[1] Exelon is the licensee of Muddy Run, FERC Project No. 2355. Susquehanna Power Company and PECO Energy Power Company, also subsidiaries of Exelon Corporation, are the joint licensees of Conowingo, FERC Project No. 405. Exelon is the operator of Peach Bottom.

On May 14, 2008, Exelon Corporation and PPL submitted a joint notification that the parties had negotiated and subsequently executed a settlement agreement on May 5, 2008 (the "Settlement Agreement"), stating that the agreement fully resolves the respective concerns of both Exelon Corporation, as licensee of the Muddy Run and Conowingo Projects, and PPL as regards to PPL's proposed expansion of the Holtwood Project.

II. EXPLANATORY STATEMENT

lf accepted by the Commission, the Settlement Agreement represents a complete settlement of the issues and concerns of Exelon relating to the proposed Holtwood Project expansion, and thus a partial settlement of issues arising out of PPL's proposed license amendment for that purpose. Although most of the terms of the Settlement Agreement do not implicate the Commission's jurisdiction under Part l of the FPA, the provisions relating to minimum fiows and operation of Lake Aldred are jurisdictioual. Accordingly, the Settlement Agreement is being submitted to the Commission for approval of its jurisdictional elements. Although this Explanatory Statement provides an overview of the various commitments of the parties in the Settlement Agreement, only the provisions concerning minimum flows and the corresponding operation of Lake Aldred will result in license articles that should ultimately be incorporated into the amended license.

A. Licensing Commitments Subject to FERC Jurisdiction

Under Section Vl of the Settlement Agreement, PPL would provide: (1) a 24-hour continuous minimum flow of 800 cfs ("Continuous Minimum Flows"); and (2) a daily volumetric fiow equivalent to 98.7% of the Conowingo minimum continuous flow requirements aggregated over a 24-hour period ("Daily Minimum Flows"). Both the Continuous Minimum Flows and the

Daily Minimum Flows would be the lesser of the above amounts or net inflow to Lake Aldred and would include leakage at the Holtwood Project. If the Conowingo minimum continuous flow requirements are ever modified: (1) PPL's Continuous Minimum Flows will be similarly adjusted by an equivalent percentage; and (2) PPL's Daily Minimum Flows will be calculated based on the modified flows established by Conowingo's license.

With limited exception, the Continuous Minimum Flows and Daily Minimum Flows would commence on the effective date of the Commission's order approving the Holtwood Project license amendment and would continue for the term of PPL's existing license. Generally, however, in no event will the provision of the Continuous Minimum Flows be delayed beyond three years after the date of the Commission's final order approving the Holtwood Project license amendment. PPL would seek Exelon's consent for temporary variances from its obligation to provide Continuous Minimum Flows and Daily Minimum Flows for short-term construction activities, and the latter may not unreasonably withhold such consent. In the event of an emergency, where necessary to prevent unavoidable loss of life, personal injury, or severe property damage, and where there is no feasible alternative, PPL will not be required to meet the minimum stream flow provisions of the Settlement Agreement.

Scheduling, monitoring, verification, and reporting of minimum flows would occur in accordance with the Draft Minimum Stream Flow Operations Procedures Manual ("MSFOP"), which was developed to implement the requirements under the Settlement Agreement and all anticipated regulatory requirements. The Draft MSFOP serves as Appendix E to the Settlement Agreement. As provided in the Settlement Agreement, the Parties believe that the Draft MSFOP accurately reflects the requirements under the Settlement Agreement; however, to the extent that there are any inconsistencies between the Draft MSFOP and the Settlement Agreement regarding

the description of the Parties' respective obligations set forth in the latter, Section VI shall be controlling. PPL would consult with Exelon regarding any future changes in the Draft MSFOP that would affect Exelon's rights under the Settlement Agreement.

The Parties acknowledge in the Settlement Agreement the following: (1) discretionary operations of the Holtwood Project would not excuse PPL from fulfilling any of its minimum flow obligations under the Settlement Agreement; (2) the Settlement Agreement imposes no obligations on PPL to use water stored in Lake Aldred to satisfy the minimum flow obligations set forth in the Settlement Agreement; and (3) in the event of conflicting obligations under federal or state law or regulations and/or the Settlement Agreement, including but not limited to the Holtwood Project FERC license and the Section 401 WQC issued by PDEP, PPL shall consult with the appropriate resource agencies and FERC, and such agencies shall establish any necessary hierarchal order of compliance.

Section XXV of the Settlement Agreement provides that, within 30 days of the issuance of the Section 401 WQC by the PDEP, the parties will negotiate and jointly file a proposed license article with the Commission reflecting the minimum flow provisions of Section VI of the Settlement Agreement. This joint filing will include a description of the evidentiary basis necessary to support inclusion of the proposed license article in the amended license for the Holtwood Project. As such, PPL requests that the Commission approve Section VI of the Settlement Agreement without modification in order to permit the resulting license article to be incorporated into the Holtwood Project's amended license.

In addition, as noted more specifically below, the Settlement Agreement contains non-jurisdictional provisions relating to cooperation regarding fish study efforts, cooperation and communication procedures during construction, and tailwater encroachment issues.

Finally, it should also be noted that the Settlement Agreement also contemplates certain project boundary changes in Section III that will be the subject of future filings by the parties in this proceeding. In particular, Section 3.1 provides as follows:

> Each Party shall file with FERC on or before August 31, 2008, or other mutually agreeable date, applications to amend the existing licenses for Conowingo and the Holtwood Project to eliminate the existing overlapping project boundaries associated with these two projects. The proposed new project boundary for each project shall be generally consistent with the project boundary map sketch attached as Appendix A, to be finalized by appropriate field survey and joint agreement with the Parties. Each Party shall file an intervention and comments in the appropriate FERC docket supporting the other Party's proposed project boundary revisions.

The parties have committed to submit to FERC the necessary applications in accordance with these provisions of the Settlement Agreement, and therefore any transfers of lands and changes in project boundaries will the subject of a separate, later filing with the Commission.

B. Proposed License Terms and Conditions Will Serve the Public Interest

The commitments concerning minimum flows set forth in the Settlement Agreement establish measures that will address the impacts to resources that are directly or indirectly related to Holtwood Project operations. These measures, which also reflect negotiations with the PDEP in connection with certification of the project expansion under Section 401 of the CWA, are designed to provide operational flexibility for Exelon's downstream operations at Conowingo and Muddy Run, as well as provide water in sufficient quantities and at times to meet the needs of aquatic life in the Susquehanna River, particularly migrating fish. As such, these provisions are consistent with the requirements of the FPA.

Collectively, the measures in the Settlement Agreement addressing minimum flows provide for substantial environmental enhancements in the Holtwood Project area. Accordingly, the public

interest would be well-served by the Commission's approval of the Settlement Agreement in the manner requested herein.

C. Settlement Provisions Outside the Scope of FERC's Jurisdiction

In addition to the provisions in the Settlement Agreement addressing minimum flows and consequent operation of Lake Aldred, numerous other provisions in the Settlement Agreement are outside the scope of the Commission's jurisdiction because they do not address Holtwood Project impacts or other obligations under the FPA. Instead, they reflect the private commitments made between the parties that do not involve jurisdictional project operations. However, the private commitments contained in the Settlement Agreement are contingent upon the Commission's acceptance – without expansion or modification – of the Settlement Agreement provisions concerning minimum flows.

The primary non-jurisdictional Settlement Agreement commitments include the following:

- *Debris Management* (Section IV): In connection with the addition of a skimmer wall with vehicular access and a turn-around area at the Holtwood Project, PPL would use reasonable efforts to remove all debris that enters the forebay of the Holtwood Project and to remove reasonably accessible debris on the skimmer wall. However, PPL would not be required to engage in any debris removal operations that are inconsistent with applicable safety requirements.

- *Construction Activities* (Section V): PPL would take the following measures, among other things, in order to mitigate any adverse effects of construction of the Holtwood Project expansion on Exelon's facilities: (1) establish a Holtwood Project Redevelopment Construction Advisory Committee comprised of Exelon and other interested entities and persons; (2) undertake measures determined to be necessary by state or federal agencies to address the impacts of the Holtwood Project on endangered species; (3) make reasonable efforts to minimize the impact to Exelon resulting from changes in flow patterns during redevelopment construction activities; (4) prepare an Erosion and Sediment Control Plan that shall establish protocols for sediment control during construction; and (5) provide Exelon with prior notice of any material changes or revisions to its proposed blasting plans and specifications and update its reports on blasting impacts accordingly.

- *PIT Tagging and Telemetry Studies* (Section VII): Exelon would agree to install a Passive Integrated Transponder ("PIT") tag reader at the Conowingo hydroelectric

generating station in accordance with the plans to be developed by the parties and approved by the appropriate resource agencies.

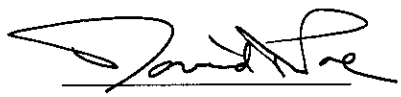
- *Tailwater Agreement* (Section IX): PPL and Exelon would amend the backwater agreement providing for the payment of compensation by Exelon to PPL.

III. CONCLUSION

The Offer of Settlement represents the successful culmination of the negotiations between PPL and Exelon to resolve the latter's concerns about the expansion of the Holtwood Project in a manner that is mutually satisfactory to both parties. Moreover, the settlement provisions and PPL's proposed expansion of the Holtwood Project would provide significant environmental benefits to the Holtwood Project area. Implementation of these measures will clearly be in the public interest. As explained above, the parties' settlement commitments are contingent upon the Commission's acceptance of those terms that are within the scope of the Commission's jurisdiction because they address minimum flows of the Holtwood Project. Accordingly, PPL respectfully requests that the Commission approve this Offer of Settlement to the limited extent it relates to the FERC-jurisdictional provisions of the Settlement Agreement, in order to give full force and effect to the negotiated agreement.

WHEREFORE, for the foregoing reasons, PPL respectfully requests that the Commission approve this Offer of Settlement, including the provisions of the Settlement Agreement addressing minimum flows of the Holtwood Project.

Respectfully submitted,



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Dated: October 23, 2008

SETTLEMENT AGREEMENT BETWEEN EXELON GENERATION AND PPL HOLTWOOD, LLC

REGARDING THE EXPANSION OF THE PPL HOLTWOOD HYDROELECTRIC PROJECT

May 5, 2008

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APPENDICES

SETTLEMENT AGREEMENT BETWEEN EXELON GENERATION COMPANY, LLC AND PPL HOLTWOOD, LLC REGARDING THE EXPANSION OF THE HOLTWOOD HYDROELECTRIC PROJECT

THIS AGREEMENT, including its appendices ("Agreement"), is made and entered into this 5th day of May, 2008, by and between Exelon Generation Company, LLC ("Exelon Generation") and PPL Holtwood, LLC ("PPL") (each Exelon Generation and PPL, a "Party," and collectively, the "Parties").

WITNESSETH:

WHEREAS, PPL has filed a license amendment with the Federal Energy Regulatory Commission ("FERC" or "Commission") to expand the hydraulic capacity of the PPL Holtwood hydroelectric project ("Holtwood Project") located on the Susquehanna River in York County and Lancaster County, Pennsylvania;

WHEREAS, PPL has conducted public outreach meetings with stakeholders to discuss the proposed Holtwood Project redevelopment, identify and study associated issues, and develop appropriate protection, mitigation, and enhancement ("PM&E") measures;

WHEREAS, Exelon Generation manages the Conowingo Pond, owns the Muddy Run Pumped Storage ("Muddy Run") and Conowingo hydroelectric projects, and has an ownership interest in the Peach Bottom Atomic Power Station ("Peach Bottom"), all immediately downstream of the Holtwood Project on the Susquehanna River ("Exelon Facilities");

WHEREAS, Exelon Generation, through written correspondence, participation in public outreach meetings, and other informal communications has identified to PPL a number of potential issues associated with the Holtwood Project redevelopment that may affect the Exelon Facilities;

WHEREAS, the Parties have engaged in settlement negotiations to address concerns raised by Exelon Generation regarding the Holtwood Project redevelopment and have resolved the issues identified herein to the mutual satisfaction of both Parties; and

NOW, THEREFORE, for and in consideration of the mutual rights contained herein, and other good and valuable consideration, the receipt of which is hereby acknowledged, the Parties hereby agree as follows:

SECTION I
EFFECTIVE DATE AND TERM OF AGREEMENT

This Agreement shall become effective upon its execution by both Parties and shall remain in effect for the term of the Holtwood Project's existing license, as amended by FERC, and during the term of any annual licenses issued thereafter ("Term"). This Agreement shall be binding and inure to the benefit of the Parties and their successors and assigns, unless otherwise specified herein.

SECTION II
COMMITMENTS OF THE PARTIES AND TERMINATION

Each Party shall comply with, execute, and implement all of the commitments specifically described herein throughout the Term of this Agreement, provided that FERC's final order amending the Holtwood Project license is not inconsistent with the terms of this Agreement. If FERC's order amending the Holtwood Project license affects the ability of either Party to perform its obligations under this Agreement: (1) each Party will file a request for rehearing of the license amendment order; and (2) to the extent necessary, the Parties shall engage in good-faith negotiations, for a period of sixty (60) days ("Renegotiation Period") following the issuance of any FERC order on rehearing, to amend the Agreement to the mutual satisfaction of both Parties. The Parties may, by mutual agreement, extend the Renegotiation Period. If the Agreement is not amended to the mutual satisfaction of both Parties within the Renegotiation Period as it may be extended, this Agreement shall terminate at the end of the Renegotiation Period. Neither Party shall advance any position nor make any argument in the context of PPL's license amendment proceeding that is inconsistent with this Agreement.

Either Party may opt to terminate this Agreement (i) within 30 days of any withdrawal for any reason of PPL's application to amend the Holtwood Project license, or (ii) for any other reason as permitted under this Agreement. If this Agreement is terminated at the option of either Party, then any obligation to act according to the terms of the Agreement will thereafter cease to be effective. Notwithstanding any of the foregoing if, after FERC has acted to amend the project license to permit the project redevelopment, PPL determines that it will not proceed with such redevelopment of the Holtwood Project during the term of the existing project license, then this Agreement will automatically terminate on the date of any FERC order or other issuance acquiescing in such PPL determination.

Notwithstanding any other provision, this Agreement shall terminate if FERC rejects, or otherwise does not approve, PPL's proposed license amendment concerning Holtwood Project Redevelopment.

SECTION III
PROJECT BOUNDARY AND LAND MANAGEMENT

3.1 *Changes to Project Boundaries*

Each Party shall file with FERC, on or before August 31, 2008, or other mutually agreeable date, applications to amend the existing licenses for Conowingo and the Holtwood Project to eliminate the existing overlapping project boundaries associated with these two projects. The proposed new project boundary for each project shall be generally consistent with the project boundary map sketch attached as Appendix A, to be finalized by appropriate field survey and joint agreement of the Parties. Each Party shall file an intervention and comments in the appropriate FERC docket supporting the other Party's proposed project boundary revisions.

3.2 *Brushy and Cannon Islands*

Within sixty days after FERC's approval of the Parties' proposed license revisions to eliminate the existing overlapping boundaries associated with the Conowingo and Holtwood Projects, Exelon Generation shall transfer ownership of Brushy and Cannon Islands to a mutually agreed upon governmental or non-governmental organization. Brushy and Cannon Islands are the parcels of land identified on the map attached as Appendix B.

3.3 *York County Parcel (Lock 12)*

Within sixty days after FERC's approval of the Parties' proposed license revisions to eliminate the existing overlapping boundaries associated with the Conowingo and Holtwood Projects, the Parties shall each extinguish their existing half-interest in the York County parcel, and transfer ownership interests such that: (1) PPL shall have an undivided ownership interest in the section of Lock 12 north of the Norman Wood Bridge; and (2) Exelon Generation shall have an undivided ownership interest in the section of Lock 12 south of the Norman Wood Bridge. The York County parcel is identified on the map attached as Appendix C.

SECTION IV
DEBRIS MANAGEMENT

The redevelopment of the Holtwood Project shall include the addition of a skimmer wall with vehicular access and a turn-around area. PPL commits to use reasonable efforts to remove all debris that makes its way into the forebay of the Holtwood Project and to remove reasonably accessible debris on the skimmer wall; *provided, however*, that PPL shall not be required to engage in any debris removal operations that are inconsistent with applicable safety requirements.

SECTION V
PPL CONSTRUCTION ACTIVITIES

PPL shall use reasonable efforts to mitigate any adverse effects of such construction on Exelon Facilities by doing the following:

5.1 *Coordination During Construction Activities*

5.1.1 ***PPL/Exelon Meetings.*** At least 90 days prior to the initiation of construction to expand the hydraulic capacity of the Holtwood project, the Parties shall consult to establish a mutually agreeable meeting schedule for the purpose of discussing any impact(s) of such construction on the Exelon Facilities and coordination as required as a result of such impact(s). These meetings shall occur until such time as PPL's construction activities are completed unless otherwise mutually agreed upon by the Parties.

5.1.2 ***Construction Advisory Committee.*** Within thirty (30) days after FERC issues a final order approving PPL's proposed license amendment, PPL shall establish a Holtwood Project Redevelopment Construction Advisory Committee ("CAC") comprised of Exelon Generation and other interested entities or persons. PPL will consult with the members of the CAC on PPL's proposed construction schedule and planned construction activities for the Holtwood Project redevelopment. The CAC shall meet no less than once quarterly.

5.1.3 ***Construction Schedules.*** PPL shall provide to Exelon Generation schedules of its proposed construction activities for the Holtwood Project redevelopment as they become available that are of sufficient detail to permit Exelon to assess whether any potential or unanticipated adverse impacts on the Exelon Facilities may occur as a result of those construction activities, and shall thereafter advise Exelon Generation on a timely basis of any changes, revisions, modifications, or additions to such schedules.

5.2 *Endangered Species*

The plant species White Doll's Daisy and Sticky Goldenrod, listed as endangered by the Commonwealth of Pennsylvania, are located in an area downstream of the Norman Wood Bridge within the Conowingo project boundary. The Parties recognize that PPL's construction activities and changes in Holtwood Project operations may adversely affect these endangered plant species and, therefore, upon the receipt of all necessary regulatory approvals, PPL shall undertake any PM&E measures that state or federal agencies may determine are necessary to address the Holtwood Project's impacts on White Doll's Daisy and Sticky Goldenrod, notwithstanding the fact that such impacts may occur within the Conowingo project boundary. Any costs associated with the obligations assumed in this Section 5.2 shall be borne exclusively by PPL.

5.3 *Potential Impact of Construction Activities on Resource Studies*

PPL's construction activities will overlap with the study phase of FERC's relicensing processes for Exelon Generation's Muddy Run and Conowingo hydroelectric projects. To minimize any adverse impact of PPL's construction activities, PPL shall: (a) coordinate its activities in accordance with Sections 5.1.1 and 5.1.2 of this Agreement; and (b) make reasonable efforts to cooperate with and to accommodate Exelon Generation's reasonable execution of its relicensing studies. The Parties also shall, from time to time, consult in good faith on matters of shared interest related to the public processes associated with the Holtwood Project redevelopment and Exelon's relicensings, including, but not limited to, the design and implementation of resource studies and PM&E measures, agency requests, and potential cost-sharing mechanisms associated with such activities.

5.4 *Impacts to Flow During Construction Activities*

As described in this Section 5.4, PPL shall make a reasonable effort to minimize any adverse impacts to Exelon Generation that could result from changes in flow patterns during PPL's Holtwood Project redevelopment construction activities. PPL shall provide Exelon Generation with: (a) reasonable prior notice of any potential changes in flows due to such construction activities; (b) an estimate of the duration of time during which flows could be curtailed as a result of such construction activities; and (c) the hours of the day in which flows could be curtailed as a result of such construction activities. PPL also shall immediately notify Exelon Generation of any material change to flow information previously provided to Exelon Generation. Any disputes regarding such disruption of flows during construction activities shall be resolved in accordance with Section X of this Agreement.

5.5 *Emergency Communications*

During the course of PPL's construction activities for the Holtwood Project redevelopment, PPL commits to 24X7 staffing of the control room at Holtwood and will provide emergency communications according to existing emergency protocols for the Holtwood Project.

5.6 *Contact Information*

Except as otherwise provided for in Section 10.1, PPL shall direct all communications and notices required pursuant to this Agreement to the following:

Conowingo Control Room
(410) 457-2422
(410) 457-2423 or
(410) 457-2511 (facsimile).

5.7 *Sediment Impacts to Peach Bottom Operations*

To minimize the potential for sediment to obstruct screens associated with Peach Bottom's circulating water systems as a result of PPL's construction activities, PPL shall prepare an Erosion and Sediment Control Plan ("Sediment Control Plan") that shall establish protocols for sediment control during the construction phase of the Holtwood Project redevelopment. PPL shall provide Exelon Generation with a draft of the Sediment Control Plan, and Exelon Generation shall have thirty (30) days in which to provide written comments to PPL on the Sediment Control Plan. PPL shall either: (1) incorporate Exelon Generation's comments into the final Sediment Control Plan; or (2) provide a written response explaining why Exelon Generation's comments were not incorporated into the final Sediment Control Plan. The Sediment Control Plan shall require PPL to use Best Management Practices to avoid sustained releases of high levels of sediment during construction. Best Management Practices shall mean activities, prohibitions of practices, maintenance procedures, and other management practices generally accepted in the electric utility industry to prevent or reduce sediment releases and erosion. Any disputes regarding sediment impacts during Holtwood Project redevelopment shall be resolved in accordance with Section X of this Agreement.

5.8 *Blasting Impacts and Seismic Monitoring*

The following provisions of Section 5.8 shall govern coordination and communication between the Parties with regard to blasting activities during Holtwood Project redevelopment:

5.8.1 ***Review of Draft Blasting Plans and Draft Specifications.*** PPL has provided Exelon Generation with copies of: (1) a draft *Report on Impacts of Blasting for Holtwood Hydroelectric Power Station Expansion Project on Exelon Power Generating Facilities* ("Report on Blasting Impacts"); and (2) a draft controlled blasting specifications plan associated with the Holtwood Project redevelopment (together attached as Appendix D). Exelon Generation shall retain expert consultants to review the draft documents and provide comments to PPL, as necessary, within 60 days of execution of this Agreement. PPL shall make a reasonable effort to resolve any issues identified by Exelon Generation with regard to its review of such documents. Any disputes regarding such blasting issues shall be resolved in accordance with Section X of this Agreement.

5.8.2 ***Proposed Material Changes or Revisions to Blasting Plan.*** PPL agrees to provide Exelon Generation with prior notice of any material changes or revisions to its proposed blasting plans and specifications, and shall update its Report on Blasting Impacts to account for any such material changes or revisions. Exelon Generation shall have at least two (2) weeks in which to review and comment on any proposed material changes or revisions to PPL's proposed blasting plans and specifications for the purpose of identifying any concerns regarding the potential effect of blasting on Muddy Run and Peach Bottom. PPL shall make a reasonable effort to address any concerns identified by Exelon Generation prior to implementing the revised blasting plan unless there is a disagreement between the Parties as to the potential impact of the revised blasting plan.

Such disagreements shall be resolved in accordance with the dispute resolution provisions set forth in Section X of this Agreement.

5.8.3 ***Prior Notification of Blasting Activity.*** During the blasting phase of PPL's construction activities, PPL shall provide to Exelon Generation, in writing, by facsimile or e-mail, a schedule of blasting activities ("Blasting Schedule") for the following week. The Blasting Schedule must be forwarded by Wednesday, 5 p.m. EST, of the week immediately preceding the proposed blasting activities and must clearly identify the hours of the day in which the blasting activities shall occur. PPL shall provide Exelon Generation with at least twenty-four (24) hours' prior notice of any deviations from the proposed Blasting Schedule; such notice shall be provided in writing by e-mail or facsimile. In circumstances in which it is not reasonably feasible to provide written notice of deviations to the Blasting Schedule, PPL shall telephone the Conowingo Control Room and orally communicate any deviations to the Blasting Schedule prior to commencing the blasting activities.

5.8.4 ***Seismic Monitoring.*** PPL shall undertake seismic monitoring during blasting activities in a manner mutually agreed upon by the Parties to minimize the potential for blasting to adversely affect Exelon Facilities. When requested by Exelon Generation, seismic monitoring data collected by PPL shall be provided to Exelon Generation within one business day.

5.8.5 ***Security Issues.*** PPL shall promptly notify Exelon Generation of any theft of blasting materials.

5.9 ***Radioactivity Monitoring***

In accordance with applicable laws and regulations governing nuclear power plant operations, Peach Bottom monitors for, among other things, radioactive releases in the environment. Exelon Generation has informed PPL that Exelon Generation believes PPL's Holtwood Project redevelopment construction activities may release coal fine sediment containing traces of gamma radiation into the Susquehanna River that may potentially trigger certain Peach Bottom radiation monitors if released in significant quantities. If, during the course of Holtwood Project redevelopment construction activities, PPL reasonably believes that coal fine sediment may be released as a result of its construction activities, PPL shall provide prior written notice, by facsimile or e-mail, to Exelon Generation at least forty-eight (48) hours prior to commencing such activities. In the event PPL reasonably believes after the fact there may have been an unanticipated release or potential release of coal fine sediment, PPL shall immediately notify the Conowingo Control Room by telephone.

SECTION VI
MINIMUM FLOWS

PPL shall provide: (1) a twenty-four (24) hour continuous minimum flow of 800 cfs ("Continuous Minimum Flows"); and (2) a daily volumetric flow equivalent to 98.7% of the Conowingo minimum continuous flow requirements aggregated over a twenty-four

(24) hour period ("Daily Minimum Flows"). The Continuous Minimum Flows and the Daily Minimum Flows shall be the lesser of the above amounts or net inflow to Lake Aldred and shall include leakage at the Holtwood Project.

The current Conowingo project minimum continuous flow requirements, as reflected in Conowingo's existing license, are:

Time Interval	Conowingo Minimum Continuous Flow (cfs)
March 1 – March 31	3,500 or inflow as Measured at the Marietta USGS Gage, whichever is less.
April 1 – April 30	10,000 or inflow as Measured at the Marietta USGS Gage, whichever is less.
May 1 – May 31	7,500 or inflow as Measured at the Marietta USGS Gage, whichever is less.
June 1 – September 14	5,000 or inflow as Measured at the Marietta USGS Gage, whichever is less.
September 15 – November 30	3,500 or inflow as Measured at the Marietta USGS Gage, whichever is less.
December 1 – February 28	3,500 or inflow as Measured at the Marietta USGS Gage, whichever is less. This is an intermittent flow with a maximum of 6 hours off followed by an equal amount on.

If Conowingo's minimum continuous flow requirements are ever modified: (1) the Continuous Minimum Flows provided by PPL shall be similarly adjusted by an equivalent percentage;[1] and (2) the Daily Minimum Flows shall be calculated based on the modified flows established by Conowingo's license.

The Continuous Minimum Flows and the Daily Minimum Flows shall commence on the date FERC's order approving the Holtwood Project license amendment becomes final and shall continue for the Term of this Agreement; *provided, however*, PPL shall not be required to provide the Continuous Minimum Flows until: (1) the initial operation of unit 1 to Piney Channel; and (2) its refurbished exciter units are placed into service. Subject to Section XIX, in no event, however, shall the provision of the Continuous Minimum Flows be delayed beyond three years after the date of the FERC final order approving the Holtwood project license amendment.

PPL shall seek Exelon Generation's consent for temporary variances from its obligation to provide Continuous Minimum Flows and Daily Minimum Flows for short-term construction activities, such consent not to be unreasonably withheld by Exelon

[1] For example, the current FERC mandated minimum flow for the period June 1 - September 14 is 5,000 cfs. 800 cfs represents 16% of 5000 cfs. Should the Conowingo minimum flow for this period be increased to 6,000 cfs then Holtwood's Minimum Continuous Flows would increase to 16% of 6,000 cfs or 960 cfs.

Generation. In the event of an emergency, where necessary to prevent unavoidable loss of life, personal injury or severe property damage and where there is no feasible alternative, PPL shall not be required to meet the minimum stream flow provisions of this Agreement.

Scheduling, monitoring, verification, and reporting of minimum flows shall occur as prescribed in the Draft Minimum Stream Flow Operations Procedures Manual ("MSFOP"), which has been developed to implement the requirements under this Agreement and anticipated regulatory requirements and is attached hereto as Appendix E and made a part hereof. The Parties believe that the Draft MSFOP attached hereto accurately reflects the requirements under this Agreement. To the extent that there are any inconsistencies between the Draft MSFOP attached hereto and this Agreement regarding the description of the Parties' respective obligations set forth in this Section VI, the description of the Parties' respective obligations set forth in this Section VI shall be controlling.

In the event that future changes in the MSFOP become necessary that would affect Exelon Generation's rights under this Agreement, PPL shall consult with Exelon Generation regarding such changes. Subject to the provisions of the following paragraph, in the event that the Parties cannot agree regarding the changes, then any remaining dispute between the Parties shall be resolved according to the provisions of Section X hereof.

The Parties acknowledge that discretionary operations of the Holtwood facility shall not excuse PPL from fulfilling any of its minimum flow obligations under this Agreement. The Parties further acknowledge that this Agreement imposes no obligations on PPL to use water stored in Lake Aldred to satisfy the minimum flow obligations under this Agreement. However, the Parties also agree that in the event of conflicting obligations under federal or state law or regulations and/or this Agreement, including but not limited to the Holtwood Project FERC license and the Section 401 Certificate issued by the Pennsylvania Department of Environmental Project, PPL shall consult with the Resource Agencies and FERC who shall establish any necessary hierarchal order of compliance.

Set forth in Appendix G are some examples developed by the Parties in good faith to show how the Continuous Minimum Flows can be implemented. The examples are not intended to be all inclusive or to reflect how the Holtwood Project will actually be operated. The examples are intended only to confirm the Parties' understanding of the Agreement. To the extent that there are any inconsistencies between the examples attached hereto and this Agreement regarding the description of the Parties' respective obligations set forth in this Section VI, the description of the Parties' respective obligations set forth in this Section VI shall be controlling.

SECTION VII
PIT TAGGING AND TELEMETRY STUDIES

Exelon Generation agrees to install a Passive Integrated Transponder ("PIT") tag reader at the Conowingo hydroelectric generating station in accordance with the plans to

be mutually developed by the Parties and approved by the resource agencies. PPL agrees to assume the cost of such PIT tag reader, including the costs of design and installation. PPL shall also assume all costs associated with operations, maintenance, and monitoring of the above PIT tag reader unless or until Exelon separately becomes obligated upon renewal of its FERC license at Conowingo to assume these obligations. For any radio telemetry study undertaken by a Party or jointly by the Parties, each Party agrees to permit radio receivers to be deployed at its respective facilities if necessary to fulfill the objectives of a proposed study or studies; *provided, however*, that deployment of the radio receivers at the other Party's facilities shall be in accordance with a plan mutually developed by the Parties.

SECTION VIII
FURTHER COOPERATION OF THE PARTIES

Exelon Generation shall intervene in the Holtwood Project license amendment proceeding at FERC and file comments supporting PPL's proposed license amendment. The Parties shall endeavor to further cooperate as their respective interests may appear, especially with respect to fish passage issues. Subject to Section 10.2, both Parties further agree to oppose any PM&E measure, including any such measures that may be proposed in the Muddy Run and Conowingo Project relicensings, proposed by a third-party that adversely and materially affects any provision of this Agreement.

SECTION IX
TAILWATER AGREEMENT

PPL and Exelon Generation, through their affiliates as appropriate, are parties to a backwater agreement that provides for, among other things, the payment of compensation by Exelon Generation to PPL ("Backwater Agreement"). The Parties shall amend the Backwater Agreement to provide for the following: (1) a new expiration date of September 1, 2030; and (2) a waiver of any payments required under the Backwater Agreement by Exelon Generation to PPL, assuming no changes to the maximum Conowingo pond elevation of 109.5 as defined in the Supplemental Agreement Holtwood-Conowingo Backwater, dated August 20, 1981 (Supplemental Backwater Agreement"), for a period commencing on the date FERC issues its final order approving PPL's license amendment and terminating on September 1, 2030 ("Waiver Period").

At the end of the Waiver Period, Exelon Generation reserves its right to challenge whether there are backwater impacts to the Holtwood Project from Conowingo operations, and PPL reserves its ability to assert its right to be paid for backwater impacts from Conowingo operations. If any such challenge made by Exelon Generation is unsuccessful, the Parties agree that: (1) future calculation of net tailwater impacts, as defined by T minus T' in the Supplemental Backwater Agreement, shall never exceed the net tailwater impact calculated by using PPL drawing C-1837873 attached as Appendix F; and (2) the annual charge of $61,750 as defined in paragraph 6(b) of the Backwater Agreement shall be terminated. Except with respect to the term of the Backwater Agreement and the suspension of payments thereunder during the Waiver Period, nothing

in this Agreement shall be construed to in any way modify the respective rights or obligations of the Parties under the Backwater Agreement.

SECTION X
DISPUTE RESOLUTION AND RESERVATION OF RIGHTS

10.1 *Dispute Resolution*

Except for Emergency Circumstances, the Parties shall first attempt to resolve all disputes arising under, or in connection with, this Agreement informally through discussions among respective management personnel having responsibility for performance of this Agreement. In the event a Party has a dispute that arises out of, or in connection with, this Agreement, such Party (the "Disputing Party") shall provide written notice to the other Party of the dispute ("Notice of Dispute"). The Disputing Party shall forward the Notice of Dispute, by first-class mail, to senior representatives of each Party designated below for resolution on an informal basis within sixty (60) days of receipt of the Notice of Dispute. For the purposes of this section 10.1, the term "Emergency Circumstances" means circumstances in which a Party in good faith with the exercise of reasonable judgment determines that the use of the dispute resolution provisions of section 10.1 will prejudice its rights.

The designated senior representatives are:

For Exelon Generation:

Vice President - Operations
300 Exelon Way
Kennett Square, PA 19348
610-765-5550

For PPL:

Mr. Bradley J. Piatt
Manager - Peaking Power
PPL Generation, LLC
Two North Ninth Street (GENPL6)
Allentown, PA 18101
610-774-5664

10.2 *Reservation of Rights*

In the event that the Parties are unable to resolve a dispute arising under this Agreement in accordance with the provisions of Section 10.1, each Party reserves its right to pursue any and all available rights at law and in equity.

SECTION XI
HEADINGS

The descriptive headings of the various Sections of this Agreement have been inserted for convenience of reference only and shall in no way modify or restrict any of the terms and provisions of this Agreement.

SECTION XII
WAIVER

Except as otherwise provided for in this Agreement, any failure of a Party to comply with any material obligation, covenant, agreement, or condition herein may be waived by the Party entitled to the benefits thereof only by a written instrument signed by the Party granting such waiver, but any such waiver or failure to insist upon strict compliance with any such material obligation, covenant, agreement, or condition shall not operate as a waiver of, or estoppel with respect to, any subsequent or other failure.

SECTION XIII
COUNTERPARTS

This Agreement may be executed in one or more counterparts, all of which shall be considered one and the same Agreement, and each of which shall be deemed an original.

SECTION XIV
GOVERNING LAW

This Agreement and all rights, obligations, and performances of the Parties hereunder are subject to all applicable Federal and State laws and to all duly promulgated orders and other duly authorized action of any governmental authority. This Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Pennsylvania when not in conflict with or pre-empted by Federal law, without giving effect to the conflict of law principles thereof. Except for those matters covered in this Agreement and jurisdictional to FERC, any action arising out of or concerning this Agreement shall be brought exclusively in the Federal or State courts of the Commonwealth of Pennsylvania.

SECTION XV
SEVERABILITY

In the event that any of the provisions of this Agreement are held to be invalid, void or unenforceable by final order of any governmental authority, the Parties shall, to the extent possible, negotiate an equitable adjustment to the provisions of this Agreement, in order to effect the purposes of this Agreement, and the validity and enforceability of the remaining provisions hereof shall not be affected thereby.

SECTION XVI
ENTIRE AGREEMENT

This Agreement, and the Appendices attached hereto, constitute the entire understanding between the Parties with reference to the subject matter hereof, and supersedes any and all prior or contemporaneous communications, understandings,

representations or agreements, oral or written, which pertain to the subject matter contained herein.

SECTION XVII
CONSTRUCTION

Ambiguities or uncertainties in the wording of this Agreement shall not be construed for or against either Party, but shall be construed in the manner that most accurately reflects the Parties' intent as of the time they executed this Agreement. The Parties acknowledge that they have been represented by separate counsel in connection with the review and execution of this Agreement, and, accordingly, there shall be no presumption that this Agreement or any provision hereof be construed against the Party that drafted this Agreement or any portion hereof.

SECTION XVIII
NO THIRD-PARTY BENEFICIARIES

Nothing in this Agreement nor any action taken hereunder shall be construed to create any duty, liability or standard of care to any person not a party to this Agreement nor to create any rights or expectations in any such third party.

SECTION XIX
FORCE MAJEURE

An event of *Force Majeure* as used herein means any event beyond the reasonable control of and which occurs without the fault or negligence of the Party claiming *Force Majeure* or any entity controlled by the Party claiming *Force Majeure*, including its contractors and subcontractors (to the extent said contractor or subcontractor was acting under the control or direction of the Parties), which events shall include, without limitation, any directives or requirements of any RTO/ISO or reliability entity, any delay or failure to grant a permit or other regulatory authorization required by law to be granted by any Federal, State, multi-state, or local government authority, or any regulation, law, or prohibitory or mandatory action of any Federal, State, multi-state, or local governmental authority; acts of God; strikes, lockouts or other similar industrial disturbances; acts of the public enemy, including terrorist acts, wars, civil disturbances, blockades, military actions, insurrections or riots; landslides, floods, washouts, lightning, earthquakes, tornadoes, hurricanes, blizzards or other storms or storm warnings; ice conditions; explosions, fires, sabotage, or vandalism; breakage, defects, malfunctioning, or accident to machinery, equipment, materials, or lines of pipe or wires; freezing of machinery, equipment, materials or lines of pipe or wires; inability or delay in the obtaining of materials or equipment; inability to obtain or utilize any permit, approval, easement, license or right-of-way. The settlement of strikes, lockouts, or other similar such industrial disturbances shall be entirely within the discretion of the Party affected thereby. Nothing herein shall require of a Party claiming *Force Majeure* the settlement of strikes, lockouts or other similar such industrial disturbances when such course is, in the opinion of such Party, inadvisable.

SECTION XX
CONFIDENTIAL SETTLEMENT NEGOTIATIONS

The Parties have entered into the negotiations and discussions leading to this Agreement with the understanding that, to the fullest extent allowed by law, all discussions relating to this Agreement are privileged and confidential. In the event this Agreement is terminated, the Agreement, and all drafts, work papers, and notes related to its development, to the fullest extent allowed by law, shall be deemed settlement materials and shall not constitute a part of the record in any proceeding, nor be admissible into evidence in any proceeding related to the subject matter of this Agreement.

SECTION XXI
DEFAULT

The failure of a Party to perform or observe any material term or condition of this Agreement shall constitute a breach of this Agreement ("Breach"). Upon a Breach, the non-breaching Party shall give written notice ("Default Notice") of such Breach to the breaching Party. The breaching Party shall have thirty (30) days from receipt of the Default notice within which to cure such Breach; *provided, however*, if such Breach is not capable of cure within thirty (30) days, the breaching Party shall commence such cure within thirty (30) days after notice and continuously and diligently complete such cure within sixty (60) days from receipt of Default Notice; and if cured within such time, the Breach specified in such notice shall cease to exist. No Default shall exist where such failure to discharge an obligation is the result of *Force Majeure* as defined herein. If a Breach is not timely cured, or if a Breach is not capable of being cured within the period provided for herein, the non-breaching Party shall have the right to declare a Default, terminate this Agreement, be relieved of any further obligation hereunder, and pursue any of its available remedies provided for in law or equity.

SECTION XXII
REPRESENTATIONS AND APPROVALS

22.1 ***Exelon Generation's Representations and Warranties.***

As of the date hereof, Exelon Generation hereby makes the following representations and warranties to PPL:

22.1.1 ***Good Standing.*** Exelon Generation is a limited liability company duly organized, validly existing and in good standing under the laws of the Commonwealth of Pennsylvania.

22.1.2 ***Authority.*** Subject to Section 22.1.5, Exelon Generation has all requisite power and authority to conduct its business, to own its properties, and to execute, deliver and perform its obligations under this Agreement. This Agreement is a legal, valid and binding obligation of Exelon Generation, enforceable against Exelon Generation in accordance with its terms, except as the enforceability thereof may be limited by applicable bankruptcy, insolvency, reorganization or other similar laws affecting

creditors' rights generally and by general equitable principles (regardless of whether enforceability is sought in a proceeding in equity or at law).

22.1.3 ***No Conflict.*** The execution, delivery and performance by Exelon Generation of this Agreement have been duly authorized by all necessary action, and do not and shall not (i) require any approval or consent of any holder (or any trustee for any holder) of any indebtedness or other obligation of Exelon Generation or of any other person or entity, except approvals or consents that have been obtained, (ii) violate any provision of Exelon Generation's organizational documents, any indenture, contract or agreement to which it is a party or by which it or its properties may be bound, or any law, ordinance, rule, regulation, order, writ, judgment, injunction, decree, determination or award presently in effect, or (iii) result in a breach of or constitute a default under Exelon Generation's organizational documents or other material indentures, contracts or agreements to which it is a party or by which it or its properties may be bound.

22.1.4 ***No Pending Actions.*** There is no pending or, to its best knowledge, threatened action or proceeding against Exelon Generation before any court, governmental agency or arbitrator that could reasonably be expected to affect materially and adversely the financial condition or operations of Exelon Generation or the ability of Exelon Generation to perform its obligations under this Agreement, or that purports to affect the legality, validity or enforceability of this Agreement.

22.1.5 ***Consent and Approval.*** Exelon Generation has sought or obtained, or, in accordance with this Agreement, shall seek or obtain, each consent, approval, authorization, order or acceptance by any governmental authority required in connection with the execution, delivery and performance of this Agreement and it shall provide to any governmental authority any notices of actions under this Agreement that are required by applicable laws.

22.2 ***PPL's Representations and Warranties***

As of the date hereof, PPL hereby makes the following representations and warranties to Exelon Generation:

22.2.1 ***Good Standing.*** PPL is a limited liability company duly organized, validly existing and in good standing under the laws of Delaware.

22.2.2 ***Authority.*** Subject to Section 22.2.5, PPL has all requisite power and authority to conduct its business, to own its properties, and to execute, deliver and perform its obligations under this Agreement. This Agreement is a legal, valid and binding obligation of PPL, enforceable against PPL in accordance with its terms, except as the enforceability thereof may be limited by applicable bankruptcy, insolvency, reorganization or other similar laws affecting creditors' rights generally and by general equitable principles (regardless of whether enforceability is sought in a proceeding in equity or at law).

22.2.3 ***No Conflict.*** The execution, delivery and performance by PPL of this Agreement have been duly authorized by all necessary action, and do not and shall not (i)

require any approval or consent of any holder (or any trustee for any holder) of any indebtedness or other obligation of PPL or of any other person or entity, except approvals or consents that have been obtained, (ii) violate any provision of PPL's organizational documents, any indenture, contract or agreement to which it is a party or by which it or its properties may be bound, or any law, ordinance, rule, regulation, order, writ, judgment, injunction, decree, determination or award presently in effect, or (iii) result in a breach of or constitute a default under PPL's organizational documents or other material indentures, contracts or agreements to which it is a party or by which it or its properties may be bound.

22.2.4 ***No Pending Actions.*** There is no pending or, to its best knowledge, threatened action or proceeding against PPL before any court, governmental agency or arbitrator that could reasonably be expected to affect materially and adversely the financial condition or operations of PPL or the ability of PPL to perform its obligations under this Agreement, or that purports to affect the legality, validity or enforceability of this Agreement.

22.2.5 ***Consent and Approval.*** PPL has sought or obtained, or, in accordance with this Agreement, shall seek or obtain, each consent, approval, authorization, order or acceptance by any governmental authority required in connection with the execution, delivery and performance of this Agreement, and it shall provide to any governmental authority any notices of actions under this Agreement that are required by applicable laws.

SECTION XXIII
NO EFFECT ON LEGAL OBLIGATIONS

Nothing in this Agreement is intended to affect or limit the authority or obligation of either Party to comply with applicable statutory or regulatory requirements or judicial or administrative decisions or orders.

SECTION XXIV
AMENDMENT

The Parties may, by mutual agreement, amend this Agreement by a written instrument duly executed by each Party.

SECTION XXV
LICENSE AMENDMENT

Within 30 days of the issuance of the 401 certification by the Pennsylvania Department of Environmental Projection, the Parties will negotiate and jointly file a proposed license article with FERC reflecting the minimum flow provisions of Section VI of this Agreement. The Parties' joint filing will include a description of the evidentiary basis necessary to support inclusion of the proposed license article in the amended license for the Holtwood Project.

IN WITNESS THEREOF, Exelon Generation and PPL have caused this Agreement to be signed by their respective duly authorized officers.

Exelon Generation Company, LLC	PPL Holtwood, LLC
By: _____	By: _____
Name: Victoria Will	Name: Dennis J. Murphy
Title: Vice President	Title: Vice President & Chief Operating Officer

IN WITNESS THEREOF, Exelon Generation and PPL have caused this Agreement to be signed by their respective duly authorized officers.

Exelon Generation Company, LLC

By: _____

Name: Victoria Will

Title: Vice President

PPL Holtwood, LLC

By: Dennis J Murphy

Name: Dennis J. Murphy

Title: Vice President & Chief Operating Officer

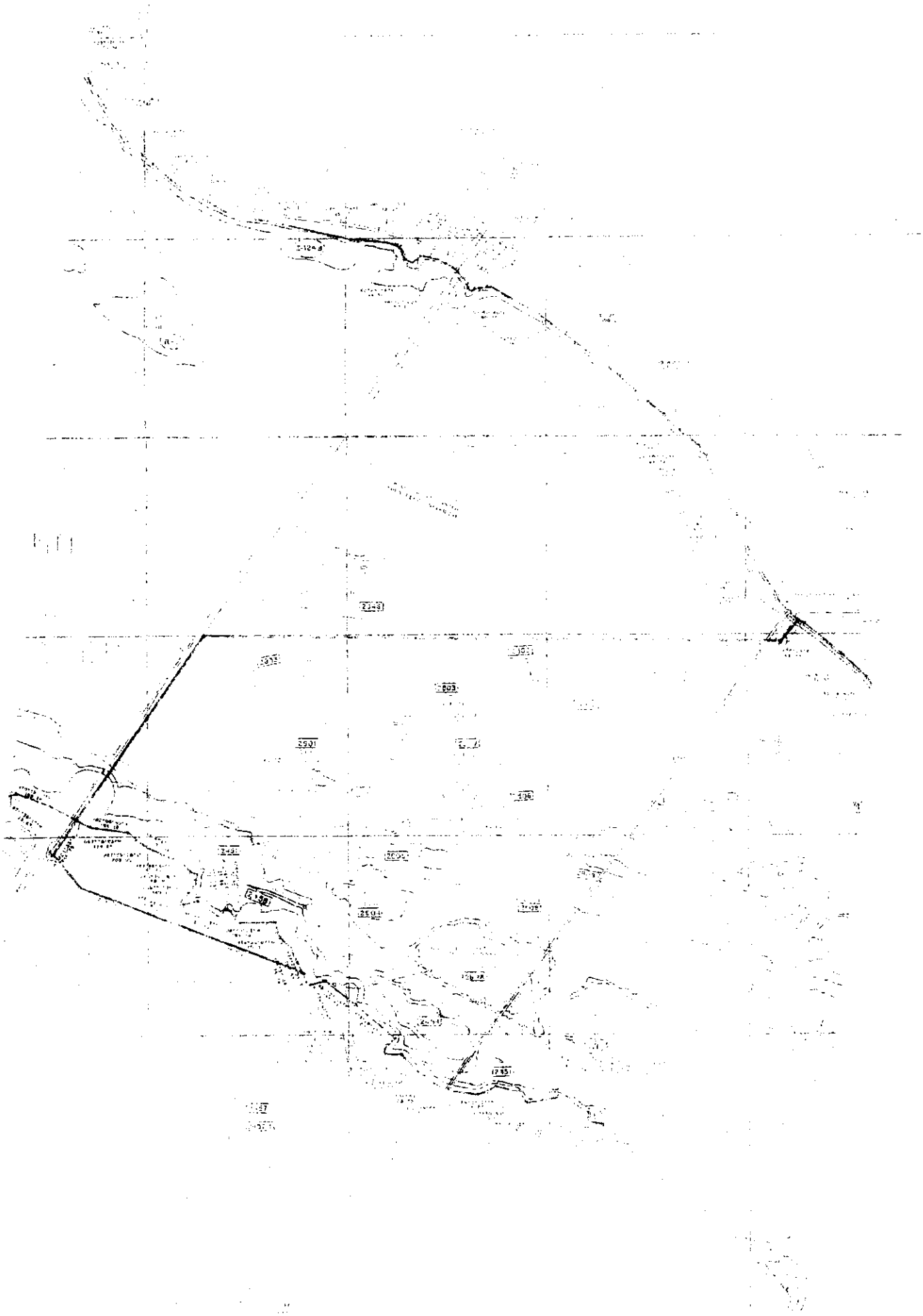
OFFICE OF GENERAL COUNSEL
BY TEC
DATE 5/5/08

IN WITNESS THEREOF, Exelon Generation and PPL have caused this Agreement to be signed by their respective duly authorized officers.

Exelon Generation Company, LLC	PPL Holtwood, LLC
By: Victoria Will	By: _____
Name: Victoria Will	Name: Dennis J. Murphy
Title: Vice President	Title: Vice President & Chief Operating Officer

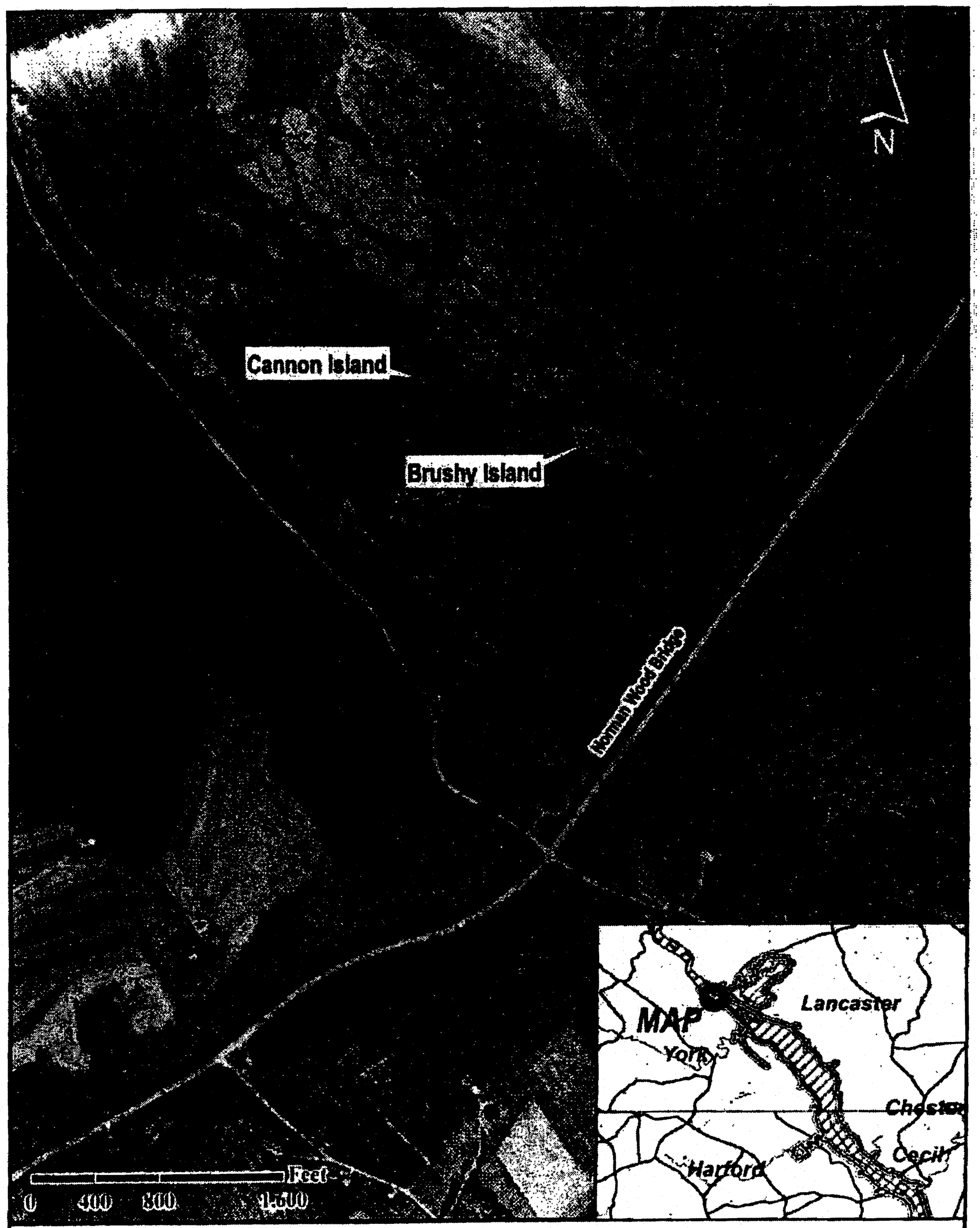
APPENDIX A:

PROPOSED PROJECT BOUNDARY REVISIONS SKETCH



APPENDIX B:

LOCATION OF BRUSHY AND CANNON ISLANDS

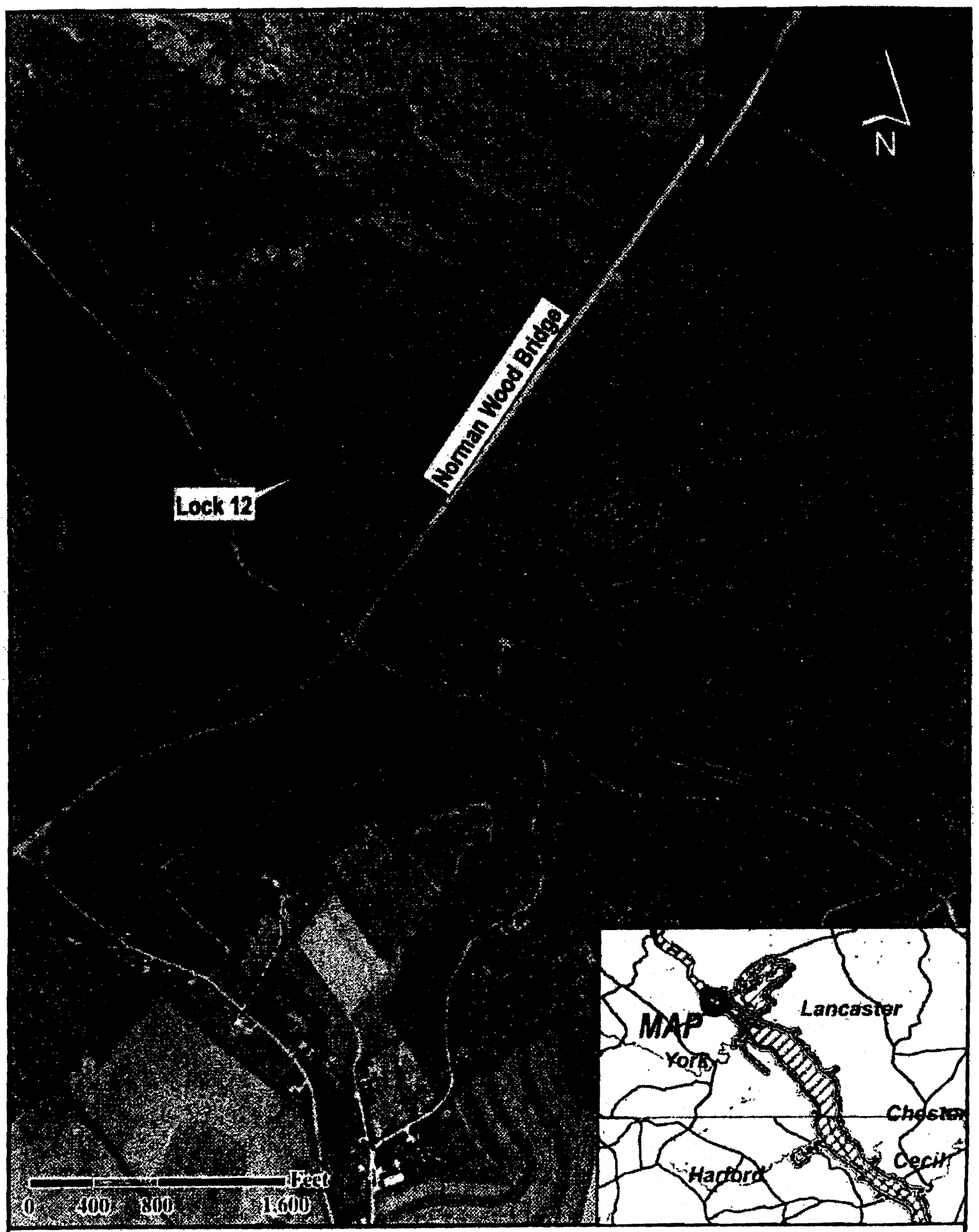


EXPANSION OF THE PPL HOLTWOOD HYDROELECTRIC PROJECT
LOCATION OF BRUSHY & CANNON ISLANDS

Map Document: (X:\GIS\maps\Liana\Brushy&Cannon.mxd)
11/28/2007 – 2:25:46 PM

APPENDIX C:

LOCATION OF YORK COUNTY PARCEL



EXPANSION OF THE PPL HOLTWOOD HYDROELECTRIC PROJECT
York County Parcel (Lock 12)

Map Document: (X:\GIS\maps\Lan\York Parcel.mxd)
10/28/2007 – 2:06:41 PM

APPENDIX D:

DRAFT BLASTING REPORT AND SPECIFICATIONS

Haley & Aldrich, Inc.
465 Medford St.
Suite 2200
Boston, MA 02129-1400

Tel: 617.886.7400
Fax: 617.886.7600
HaleyAldrich.com

HALEY&
ALDRICH

28 November 2007
File No. 32943-008

SITE-Blauvelt/TRC Engineers, Inc.
1600 Commerce Parkway, Suite B
Mount Laurel, New Jersey 08054

Attention: Frederick A. Brinker, P.E.

Subject: Report on Impacts of Blasting for
Holtwood Hydroelectric Power Station Expansion Project
On Exelon Power Generating Facilities

Ladies and Gentlemen:

This letter presents the preliminary results of our evaluation of impacts of blasting required to construct the subject project on two Exelon power generation facilities located downstream (to the southeast) of the proposed Holtwood project. The two existing Exelon facilities, both located on or near the Susquehanna River, are the Muddy Run Pump Storage Project located about 11,000 ft southeast of the new Power Station for the Holtwood project, and the Peachbottom Nuclear Power Plant located about 27,000 ft south southeast of the new Power Station for the Holtwood project. Drill and blast rock excavation will be required to construct the proposed new Power Station. Figure 1 shows the location of the proposed new Power Station for the Holtwood project as well as the Muddy Run and Peach Bottom Facilities. Also shown on Figure 1 is the location of the Route 372 Bridge over the Susquehanna River. Some small charge blasting will also he required in the river below the bridge, so the potential impacts of that blasting was also assessed.

The purpose of our work was to assess potential impacts of the blast-induced ground vibrations and air blast overpressures on the two facilities, and if necessary to provide recommendations for steps to reduce the impact of the drilling and blasting on the two facilities.

BACKGROUND

The most significant rock cuts which will be required for the project--and therefore the largest explosive charge weights--will be for the new Power Station, which is located approximately 80 ft away from the existing power station at its closest and approximately 350 ft away at its farthest point. The new Power Station will require rock cuts up to about 130 ft deep. Based on blast hole deviation requirements and rock excavation support requirements, it is anticipated that the maximum lift height utilized for the power station blasting will not exceed 50 ft.

Rock cuts up to 18 ft will also be required within the river below the Route 372 bridge to deepen the downstream channel under the bridge. Although rock cut depths--and therefore charge weights--will be much less than for the new Power Station, the bridge is closer to the power generation facilities than the proposed new Power Station and is approximately

7,000 ft from the Muddy Run Pump Storage Facility and 23,000 ft from the Peachbottom Nuclear Power Plant.

ANTICIPATED BLASTING PROCEDURES AND RESULTING VIBRATIONS

Anticipated Blasting Procedures

As noted above, we anticipate the blasting for the new Power Station to be conducted in maximum 50-ft lifts, so blast holes would be about 52 ft deep maximum. Vibrations will have to be controlled at the existing power station during this blasting to less than 2.0 inches per second (in./sec). When blasting at the closest point to the existing power station, at a closest distance of about 80 ft, small charge weights will have to be utilized to maintain the 2-in./sec maximum allowable level. However, when blasting at the other end of the proposed new Power Station, at approximately 350 ft away from the existing power station, much larger charge weights will be able to be used. We have estimated that for 4-inch-diameter, 52-ft-deep blast holes with 7 ft of stemming, the blast hole loading, utilizing 2-in.-diameter cartridged explosive with a loading density of 2.5 pounds per foot, would be about 112 lbs. We have further estimated that two to three holes per delay could be utilized (approximately 224 to 336 lbs per delay) and still keep the vibrations at the 2 in./sec limit at the existing power station. To be conservative, we have used a maximum charge weight per delay for the project of 336 pounds to estimate the vibrations and airblast at the Exelon power generation facilities from blasting at the proposed new Power Station.

At the Route 372 bridge area, rock cuts up to 18 ft will be required. We estimate that a 4-ft by 4-ft to a 5-ft by 5-ft blast hole pattern will be used, loaded with 2-in.-diameter cartridged explosive having a loading density of about 1.1 lb per foot. Therefore, for 20-ft-deep blast holes with 6 ft of stemming, the loading of each hole would be approximately 16.5 lbs. We have further estimated that two holes per delay, or 33 lbs, could be detonated at a distance of approximately 120 ft from the closest bridge pier and still maintain the maximum PPV of 2 in./sec at the bridge. Therefore, we have used a maximum charge weight per delay of 33 lbs to estimate the vibrations and airblast at the Exelon power generation facilities from blasting at the Route 372 bridge.

Predicted Blast Vibrations at Exelon Power Generation Facilities

A. Ground Vibration (Peak Particle Velocity)

To predict blast induced ground vibrations at Exelon power generation facilities, we have used commonly-used scaled distance relationships based on the International Society of Explosives Engineers Blasters Handbook. Scaled distance is defined as the distance from a blast to a structure (R, in feet), divided by the square root of the maximum charge weight per delay (W, in pounds). Based on work by Lewis Oriard, the Blaster's handbook recommends empirical relationships between charge weight, distance, and peak particle velocity based on the following formulas:

Best Estimate of Peak Particle Velocity: $PPV\ (in/sec) = 160\ (R/W^{1/2})^{1.6}$.

Maximum Estimated Peak Particle Velocity: $PPV\ (in/sec) = 242\ (R/W^{1/2})^{1.6}$.

For vibrations from blasting at the new Power Station, we have conservatively estimated the maximum charge weight per delay which might be used to be approximately 336 lbs. The distance from the new Power Station to the Muddy Run Pump Storage Facility is about 11,000 ft, so the scaled distance ($R/W^{1/2}$) would be about 600, and the best estimate of the Peak Particle Velocity (PPV) would be about 0.006 in./sec. The maximum estimated PPV at the Muddy Run Pump Storage Facility from blasting at the new Power Station would be about 0.009 in./sec.

The distance from the new Power Station to the Peachbottom Nuclear Power Station is about 27,000 ft, so the scaled distance ($R/W^{1/2}$) would be about 1470, and the best estimate of the Peak Particle Velocity (PPV) would be about 0.001 in./sec. The maximum estimated PPV at the Peachbottom Nuclear Power Station from blasting at the new Power Station would be about 0.002 in./sec.

For blasting below the Rte 372 bridge piers, we have estimated the maximum charge weight per delay which might he used to be approximately 33 lbs. The distance from the new Power Station to the Muddy Run Pump Storage Project is about 7,000 ft, so the scaled distance ($R/W^{1/2}$) would be about 1218, and the best estimate of the Peak Particle Velocity (PPV) would be about 0.002 in./sec. The maximum estimated PPV at the Muddy Run Pump Storage Project from blasting below the Rte 372 bridge would be about 0.003 in./sec.

The distance from the new Power Station to the Peachbottom Nuclear Power Station is about 23,000 ft, so the scaled distance ($R/W^{1/2}$) would be about 4,000, and the best estimate and maximum estimated Peak Particle Velocity (PPV) would both be well below 0.001 in./sec.

B. Airblast Overpressure

It is also possible to estimate airblast overpressure from blasting based on scaled distance relationships. Oriard recommends using cube root scaling, and the equation for estimation of airblast overpressure (P) is based on the degree of confinement of the explosive charge in the blast hole as follows:

Confined for Airblast Suppression: $P = 0.1\ (R/W^{1/3})^{-1.1}$

Average Burial: $P = 0.1\ (R/W^{1/3})^{-1.1}$

For airblast overpressure from blasting at the new Power Station, we have conservatively estimated the maximum charge weight per delay which might be used to be approximately 336 lbs. The distance from the new Power Station to the Muddy Run Pump Storage Project is about 11,000 ft, so the cube root scaled distance ($R/W^{1/3}$) would be about 1580, and the estimated airblast overpressure, with average burial of charges, would be 0.0003 pounds per square inch (psi). For burial confined for airblast suppression the estimated airblast overpressure would be 0.00003 psi. These are very low airblast overpressures, and the airblast overpressures from blasting at the Rte 372 bridge would be even lower.

Allowable Blast Vibrations at Power Generation Facilities

For the Holtwood project, Peak Particle Limits at the existing Holtwood Power Station, which will remain in service, vary based on the distance of the blasting from the facility: from 5 in./sec for blasting within 25 ft to 2 in./sec when blasting more than 75 ft from the facility. For off-site residences, ground vibration limits were set at the safe limits recommended by the U.S. Bureau of Mines (USBM RI 8507, 1980), which are provided on Figure 2. These limits, which vary from 0.50 to 2.0 in./sec, are based on the frequency of the vibrations and are aimed at preventing cosmetic damage to residential type structures (i.e., cracking of plaster walls and ceilings). We have not done a survey of the Exelon Power Generation facilities, but based on our experience with similar facilities we would consider a PPV limit of 2.0 in./sec to be reasonable and conservative at those facilities. It can be seen that the highest estimated maximum PPV at the Muddy Run Pump Storage Facility from blasting at the new Power Station would be about 0.009 in./sec, which is less than 0.5 percent of the recommended safe limit for protecting the facility from damage. The maximum estimated PPV at the Peachbottom Nuclear Power Station would be about 0.002 in./sec, or about 0.I percent of the recommended safe limit. It should be noted that these levels of PPV are below the perceptible range of humans of about 0.02 in./sec.

The U.S. Bureau of Mines (USBM RI 8485, 1980) also provides safe limits of airblast overpressure for residential structures aimed at reducing annoyance due to rattling of walls and windows, as well as preventing damage to windows. The recommended safe limit is 133 db (peak), or 0.014 psi for the conventional seismograph recording systems generally used today. General window breakage would not be expected until airblast overpressures reached about 1 psi, and damage to concrete or masonry structures, such as at power generation facilities, would not be expected until airblast overpressures reached much higher levels. It can be seen that the highest estimated airblast overpressure at the Muddy Run Pump Storage Facility from blasting at the new Power Station would be about 0.0003 psi, which is about 2 percent of the recommended safe limit for preventing annoyance and window breakage at residential structures. This maximum airblast overpressure could be equated to the pressure exerted by wind with a velocity of about 4 mph. The maximum estimated airblast overpressure at the Peachbottom Nuclear Power Station would be significantly less than at the Muddy Run Pump Storage Project.

CONCLUSIONS REGARDING BLASTING IMPACTS

In summary, it is our opinion that ground vibrations or airblast overpressures from blasting at the Holtwood Hydroelectric Power Station Expansion Project will have no adverse impacts on the Muddy Run Pump Storage Facility or the Peachbottom Nuclear Power Station. These conclusions are based on the following:

1. Maximum PPV of ground vibrations at the closest facility, the Muddy Run Pump Storage Facility, are predicted to be less than 0.01 in./sec, which is about 0.5 percent of the conservative safe limit for the facility; maximum vibrations will he even less at the Peachhottom Nuclear Power Station. These levels are below the level of human perception of vibrations of about 0.02 in./sec.

2. Maximum airhlast overpressures at the closest facility, the Muddy River Pump Storage Facility, are predicted to be about 0.0003 psi, which is about 2 percent of the

recommended safe limit for preventing annoyance and window breakage at residential structures. This maximum airblast overpressnre could be equated to the pressure exerted by wind with a velocity of about 4 mph.

It should be noted that airblast overpressures, especially at great distances from the source, can be affected by atmospheric conditions and wind direction, so it is possible that personnel at one or both of the Exelon facilities may sometimes hear a blast, especially on overcast days with the wind blowing from the northwest, even thougb the airblast overpressure is well below safe levels.

Please call if you have any questions concerning our assessments and conclusions.

Sincerely yours,
HALEY & ALDRICH, INC.

Andrew F. McKown, P.E.
Vice President

Attachments:
Figure 1 - Site and Surrounding Facility Location Plan
Figure 2 - Blasting Limit Criteria

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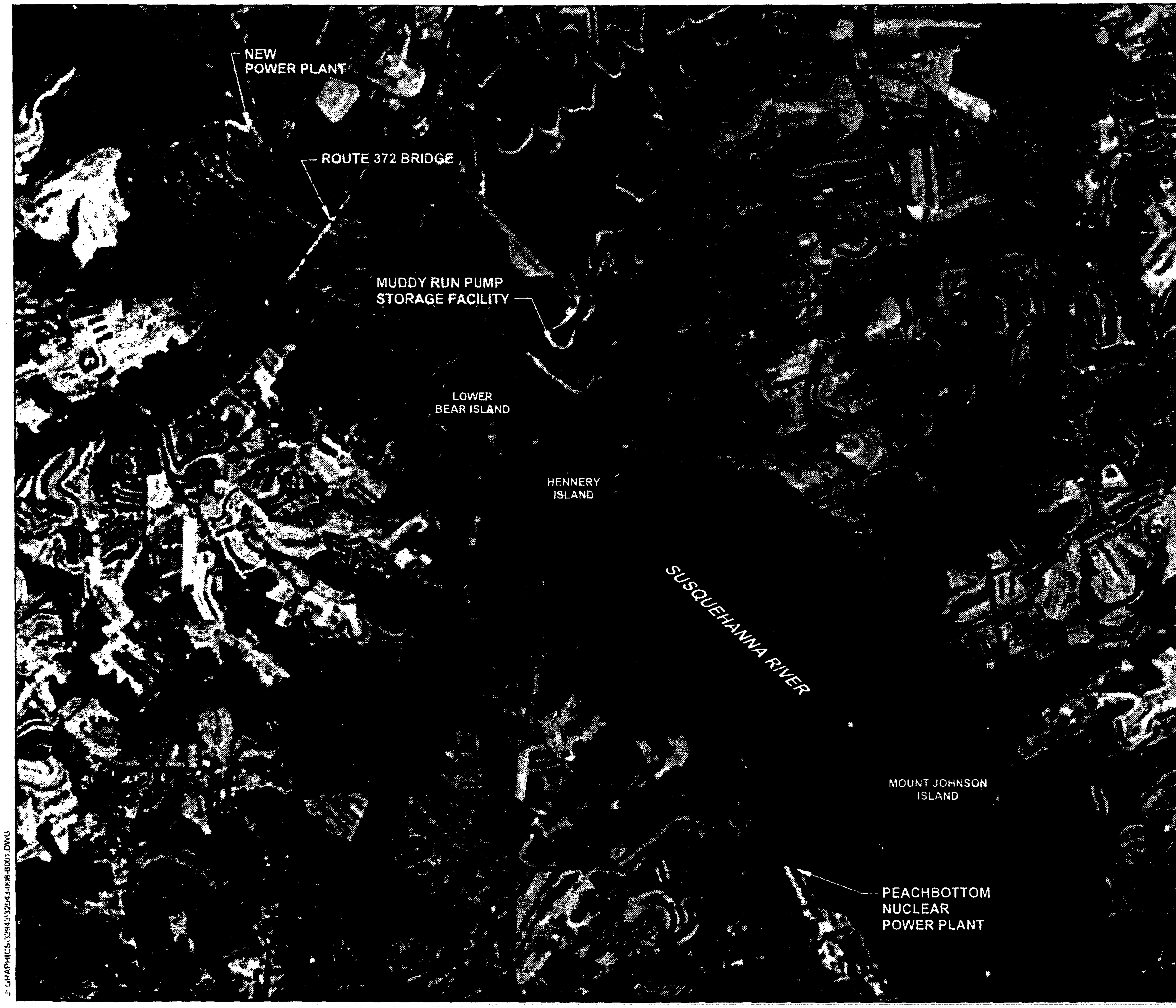

NOTE:

BASE PLAN TAKEN ELECTRONICALLY FROM GOOGLE EARTH PRO SOFTWARE

0 3000 6000

APPROXIMATE SCALE IN FEET

HALEY& ALDRICH

HOLTWOOD HYDROELECTRIC POWER STATION
EXPANSION PROJECT
HOLTWOOD, PENNSYLVANIA

SITE AND SURROUNDING
FACILITY LOCATION PLAN

SCALE: AS SHOWN
AUGUST 2007

FIGURE 1

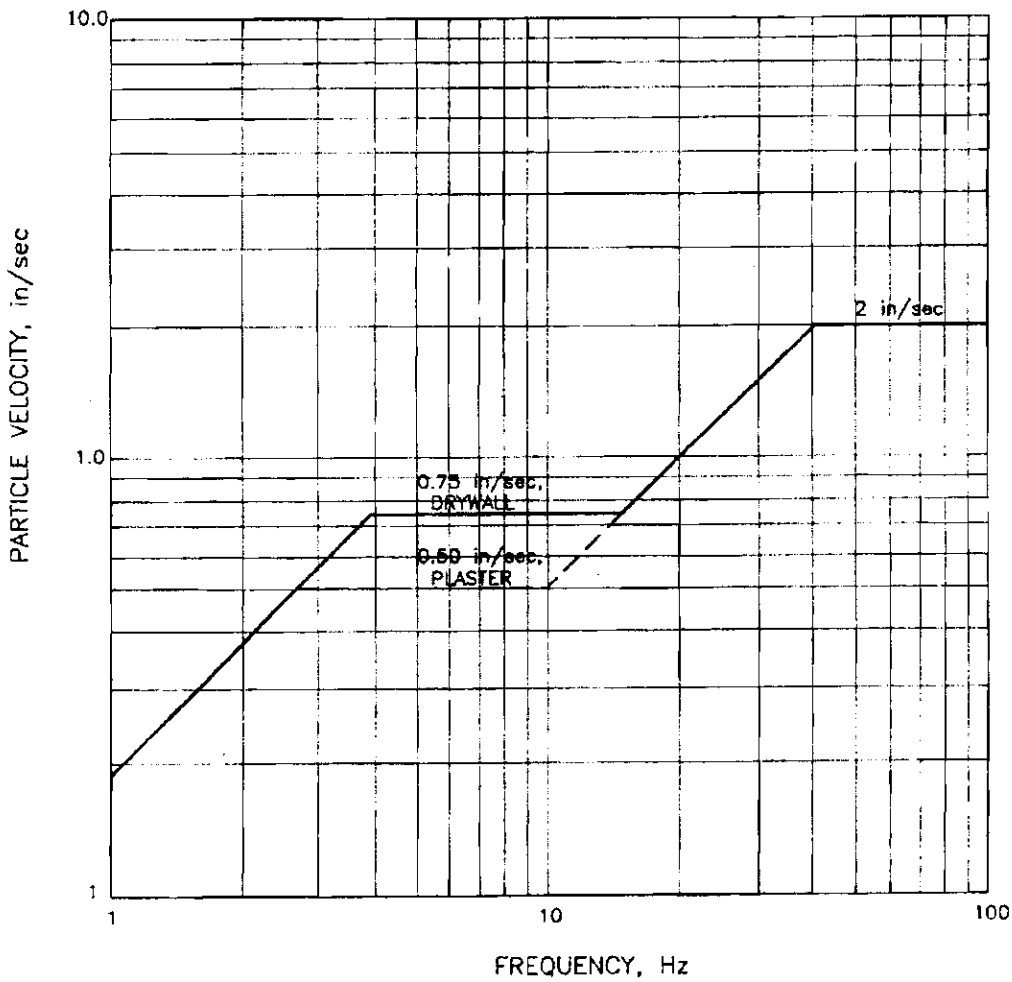

Figure 2 - Blasting Limit Criteria

SECTION 31 23 01 KA

CONTROLLED BLASTING

PART 1 GENERAL

1.0 RELATED DOCUMENTS

See Project Plans, Schedule, Haley & Aldrich Geotechnical Design Memorandum, TRC Geotechnical Data Report, Soil Erosion Plan, and other specifications for applicable related documents.

1.1 DEFINITIONS

A. *Controlled Blasting.* Controlled Blasting is excavation in rock in which the various elements of the blast (hole size, depth, spacing, burden, charge size, distribution, delay sequence) are carefully designed and controlled to provide a distribution of charge that will fracture the rock to the required lines and to minimize overbreak, flyrock, stressing and fracturing of the rock beyond the contour lines.

B. *Perimeter Control Blasting.* The use of specialized techniques to control blasting at the excavation limits, condition of the rock face after the blast, and condition of the remaining rock. Perimeter control blasting includes the designed use of drill holes, charge type, loading details, blasting sequence, and delays.

C. *Pre-splitting.* Pre-splitting refers to a perimeter control blasting technique involving a single row of closely spaced holes drilled along the excavation line which are loaded and fired before any adjoining excavation area is blasted.

D. *Cushion Blasting.* Cushion Blasting is a perimeter control blasting technique involving the drilling of a single row of closely spaced holes along the excavation line which are loaded with light, well-distributed charges and are fired either after the main excavation is removed or in the last delay(s) of a single blast.

E. *Line Drilling.* Line Drilling is a perimeter control blasting technique involving the drilling of a single row of very closely spaced holes along the excavation line. Line Drilling holes are not charged during the blast.

F. *Smooth Wall Blasting.* Smooth Wall Blasting is a technique similar to Cushion Blasting used in tunnel blasting. Smooth Wall Blasting techniques involve perimeter holes drilled along the excavation limits which are lightly loaded to remove the final burden, and are fired on the last delay of the detonation sequence. The objective is to obtain smooth walls with minimum overbreak and minimal damage to the rock outside the excavation limits.

G. *Perimeter Hole.* A perimeter hole is any hole, loaded or not, at or near the excavation surface used to break rock to the excavation surface.

H. *Half-Cast.* The portion of a drill hole remaining at the blast limit or final excavation surface after a blast.

I. *Half-Cast Factor.* The total length of half casts visible on the excavation perimeter after a blast round divided by the total length of perimeter holes drilled for the blast round. Half cast factors give an indication of the effectiveness of the perimeter control blasting and the condition of the remaining rock.

J. *Trial Blast.* A Trial Blast is a blast or series of blasts designed to assist in determining the combination of blast parameters which is most appropriate to achieve the desired result as described in this special provision.

K. *Seismograph:* An instrument used to record the amplitude and frequency of ground vibrations sensed by a geophone and airblast overpressure sensed by an omnidirection transducer.

L. *Airblast overpressure:* The air pressure over and above atmospheric pressure resulting from blasting, measured in dB Peak, pounds per square inch (psi) or dB(Peak).

M. *Maximum Peak particle velocity (PPV):* The maximum of any one of the three mutually perpendicular ground motion velocity components of a vibration measured in directions vertical, radial, and perpendicular to the vibration source, measured in inches per second (in/sec).

N. *Flyrock:* Rock propelled through the air beyond the blaster designated "safe zone" as a result of blasting.

O. *Rock:* Rock is defined as naturally-occurring, intact material which cannot be broken and removed by large power excavation equipment and requires use of hoe rams, systematic drilling and blasting, or other mechanical means to fracture and remove. Boulders over two cubic yards in volume located within soil in open excavation or in trenches, requiring the use of hoe rams, drills, or explosives for removal are also defined as rock excavation. Rock does not include boulders less than two cubic yards in volume, or loose, weathered, or fragmented rock which can be excavated with a large backhoe.

P. *Overbreak:* The excess amount of rock removed by and/or resulting from blasting which falls outside (beyond) the excavation line specified or indicated on the Plans, or below design excavation grades. Overbreak is considered non-paid excavation. Excessive overbreak is considered to start 12 inches outside the excavation line.

Q. *Tights or underbreak:* Rock that remains inside of the excavation line or specified limits after initial perimeter control blasting is completed. Tights shall be removed. No additional payment will be made for required removal of tights.

1.2 DESCRIPTION OF WORK

A. The work to be done under this Section includes furnishing all labor, equipment, materials and services, and performing operations required to excavate rock to the excavation limits, specified in the Plans. The Contractor shall utilize controlled blasting techniques, such that damage is prevented to adjacent structures, property and work, and such that flyrock is prevented and resulting airblast overpressures and particle velocities are consistently maintained below the maximum levels specified in this Section.

1.3 SPECIAL CONSIDERATIONS

A. The Contractor shall protect new construction, adjacent property, workers, owner's personnel, and the general public from damage or injury from improper handling of explosives, flyrock, excessive ground vibrations, and/or excessive airblast overpressure levels. Any damages resulting from the Contractor's controlled blasting operations shall be repaired by the Contractor at no additional cost to the Owner.

B. Contractor shall engage a qualified independent firm, qualified by training and experience to conduct a pre-blast condition survey of all structures, buildings, and facilities within 2,000 feet of the area requiring blasting and any other structures indicated by the Owner. Such inspection shall be documented with recorded or written notations, photographs, or other method, and shall be conducted in the presence of the owner of the inspected property or his designated agent. A copy of a report prepared from the inspection shall be provided to Owner, the Contractor, and the Property Owner (if requested by the property owner) prior to commencement of any blasting, and the report shall be maintained in the permanent file for the project.

C. The Contractor will engage a qualified independent firm to perform a representative pre-blast survey of water quality and quantity for drinking water wells within 2000 feet of the area requiring blasting.

D. Owner will engage the Geotechnical Engineer, or another independent, qualified professional engineer or seismologist, trained in the use of seismographic equipment to monitor blast-induced vibrations, air blast overpressure, underwater hydrostatic pressures, and crack gages at the site, as specified herein. In addition, the Contractor may provide independent monitoring as he deems necessary, at no additional cost to the Owner.

E. The Contractor will engage a qualified registered professional surveyor to perform precision level surveys of bridge pier foundations and top of rock outside the excavations between bridge piers at the Route 372 bridge, and at other locations in the powerhouse, spillway, and dam locations where blasting will be performed within 40 ft of those structures

F. The Contractor will engage a qualified engineer or consultant, experienced in underwater blasting effects on fish, to prepare, with Owner representatives, a fish protection plan which will set kill radius limits for various types and sizes of fish based on underwater pressure and impulse, and provide for techniques to identify and scare fish from the fish kill radius, and check for dead fish after each underwater blast.

G. The handling, storage, and use of explosives will be governed by applicable codes including state, county, and municipal laws, codes and regulations. Licenses for the transportation, storage and use of explosive are the responsibility of the Contractor.

H. Storage of explosives shall be in a secure facility meeting all legal requirements and under the strict supervision of the Contractor, and in a safe location relative to the project construction.

I. All blasting and excavation under and within 60 ft upstream and downstream of the Route 372 bridge shall be performed according to the following requirements:

1. The work shall be done in the dry with this portion of the main channel dewatered.

2. After this portion of the channel is dewatered, the pier, pier foundation, and the general dewatered area to be blasted shall be inspected by Owner, with PENN DOT also provided the opportunity to inspect. This inspection shall include a photographic pre-blast survey of the dewatered area and baseline heave/settlement measurements of the rock adjacent to the pier foundations, and the piers themselves.

3. All blasting and excavation shall not be closer to the existing bridge piers than shown on the drawings without written Owner permission.

4. All excavation limits shall be line drilled or trim blasted prior to blasting.

5. Presplitting shall not be used.

6. All exposed rock surfaces to be blasted shall be covered with rubber blasting mats of sufficient quantity and size to prevent flyrock.

7. Seismographs shall be placed to monitor and record any vibration at the two bridge pier foundations closest on each side of the blast, and on the deck above the same two piers.

8. After each blast the undisturbed rock near the pier shall be resurveyed to look for any signs of ground rupture or heave outside the limits of the blast round. Also the two bridge piers closest on each side of the blast shall be inspected and resurveyed after each blast.

9. If any heave is noticed the Owner shall be informed before any subsequent work is performed. If no movement is detected then these measurements will become the baseline for the next blast.

J. Eagle Nest Blast Noise Study

The Contractor shall perform an eagle nest blast noise study and the results shall be approved by the Owner prior to any production blasting at the site. The test program shall start with small blasts and incrementally work up to production blast rounds. Initial test blasts shall be at a location at least 1,000 ft from the nearest eagle nest, using a scaled distance no less than 500 ft/lb 1/3. Incremental tests shall be a site specific distance relationships and charged weights per delay adjusted as needed for locations closer to the nests.

The testing shall include noise measurements and visual observation of the eagles at the nest(s). The noise levels shall not exceed the limits specified in the Specification Section 01 14 01 KA Paragraph 1.3.3, and also not disturb any eagles in the nest.

The results of this study that are approved by the Owner shall be used as the maximum production blasts.

1.4 SUBMITTALS

A. Preliminary Submittals. The following shall be submitted by the Contractor to Owner, Design Engineer, and Geotechnical Engineer in accordance with Section 01340, no later than three weeks prior to beginning any work involving excavation or explosives.

1. *Qualifications and Resumes of Personnel and firms involved with blasting and blast monitoring.*

2. *General Excavation Plan.* This submittal shall be a general narrative containing at least the following information for all blasts including blasts for both underground work (tunnels) and exterior work (slopes and cuts):

a. A list of equipment, which will be available on the site for performing the blasting work.

b. A description of the heavy equipment, which will be available on site to clear the road and bench of debris generated by the Contractor's blasting operations.

c. A listing of the blasting materials which the Contractor will have available on site to perform blasting work. The list shall include the types, sizes and strengths of explosives proposed for the work, a description of the types of detonation systems to be employed.

d. Manufacturers' data sheets for all explosives, primers and initiators to be employed.

e. A description of the preblast warning system to be used.

f. Intended sequence and direction across the site of blasting and rock excavation work.

g. Methods of protecting or stabilizing adjacent roadway structures, waterways, and vegetation.

h. Proposed method of controlling flyrock.

i. Schedule for the blasting and rock excavation work.

j. Expected production rates.

k. Monitoring Plan with locations, equipment, and schedule.

l. Warning Sign locations and sign design with text.

3. *Standard Blast Plan.* This shall be a brief description and plan of the planned blast and shall be submitted by the Contractor to Owner, Design Engineer, and Geotechnical Engineer no later than 3 weeks prior to drilling for that blast. Submit a Standard Blast Plan for each blast type to be used throughout the project. Submit Individual Blast Plans if blasting deviates from the Standard Blast Plan submittal. Standard Blast Plans for each type of blasting, for both underground and exterior work and for initial and trial blasts for each type of blasting. All blast designs shall include the following:

a. Indicate proposed method of blasting, delay pattern, explosive types, type of blasting mat or cover, and intended rock excavation method.

b. Plan and section views to scale of proposed drilling pattern, including diameters, spacing, depth and orientation of drill holes, free faces, burden and sub-drilling.

c. Identification of perimeter control blasting and smooth wall blast areas and techniques including presplitting, line drilling, Cushion Blasting, and smooth-wall blasting.

d. Types and quantities of explosives proposed for use in each hole and for each total blast.

e. Blast type designation (for example, tunnel production, exterior pre-split, exterior production, etc.)

f. Distribution of the charge in the holes, priming of each hole and stemming of holes.

g. Type sequence and number of delays, delay pattern, diagram for blast and type and capacity of initiation devices.

h. Intended direction of movement (throw direction) of fragmented rock.

i. Signature of blasting supervisor.

j. Type of detonators.

4. *Qualifications.* The Contractor shall submit name and qualifications of person who will be directly responsible for planning, supervising, loading, and firing of blasts to Owner including the following:

a. Names and Experience of Blasting Supervisors. Blasting supervisors shall have a minimum of two years experience in supervising the loading and firing of charges of rock excavation and shall have all necessary licenses and permits required by the governmental agencies having jurisdiction.

b. Name and experience record of the Contractor's blasting engineer or consultant retained to develop all controlled blasting designs and details.

c. Name and experience record of the Contractor's engineer or consultant retained for preblast surveys, and name and qualifications of personnel who will conduct independent blast vibration monitoring, if elected by the Contractor.

d. Name and qualifications of Contractor's engineer or consultant retained to assist in preparing a fish protection plan to protect fish during underwater blasting.

e. Name and qualifications of Contractor's registered professional surveyor retained to conduct precisionlevel surveys of heave at the Route 372 bridge area and other areas.

B. Construction Submittals. The following shall be submitted to Owner and the Geotechnical Engineer as noted herein:

1. *Blast Report.* The Contractor shall furnish an as-built plan of each blast no later than 24 hours after the shot is fired. This shall be a complete description of the blast and shall include as a minimum the following information:

a. Type of blast.

b. Date, precise time of initiation and location of the blast, including station limits.

c. A sketch plan of the blast which clearly indicates the locations of the drill holes, the depth of round pulled, the location, placement and quantity of all explosive charges used. Diagram shall note any changes or deviations from the submitted blast plan.

d. Number of blastholes loaded and fired, diameter, depth, spacing, and burden of blast holes, subdrill depth, loading of each hole and total amounts of each explosive used.

e. The name and signature of the person responsible for designing, loading and firing of the shot. The signature of the blasting supervisor.

f. A description of any unusual occurrences including unanticipated rock fall, misfires, remaining unstable ground, equipment malfunctions and any other unusual occurrences.

g. Powder factor, i.e., the weight of explosives per cubic meter of rock in place as determined from the blast pattern.

h. Total number of delays used, number of holes for each delay period, maximum charge per delay and type of detonators.

i. An evaluation of the blast indicating areas of significant overbreak and planned adjustments to the blast design for the next blast.

2. *Blast Monitoring Report.* Within 24 hours following each blast, the independent Engineer contracted by Owner will prepare a Blast Monitoring Report. Each Blast Monitoring Report shall include all of the following applicable items. If any vibrations or displacements exceed the threshold or limiting criteria described herein, the Contractor will be immediately notified so that revisions to procedures can be undertaken prior to the next blast:

a. Blast round data, as indicated in paragraph B.1.a and b. above.

b. Blast Monitoring Location Plan, indicating the location from the blast to the monitoring locations.

c. Vibration, airblast overpressure, and elastic displacement data from each seismograph, including a copy of the strip chart (or other permanent record of velocity/time waveform) with calibration and monitoring record marked with the date, time and location of the blast.

d. Water pressure data at closest underwater structures from underwater blasting, and at other locations as required.

e. Crack gage data from crack gage readings at various locations within the powerstation, dam, and other locations.

f. Heave monitoring data (from Contractor engaged surveyor)

3. Complaints

All blasting complaints addressed to the Contractor shall be logged on a blasting complaint form developed by the Contractor prior to any blasting work and approved by the Owner. These shall be chronologically numbered and a copy of each complaint given to the Owner before the next blast and no later than 24 hours after receipt.

C. Review by the Owner, Design Engineer, Geotechnical Engineer of the blast designs and techniques shall not relieve the Contractor of responsibility for the accuracy, adequacy and safety of the blasting, exercising proper supervision and field judgment, and producing the results within the blasting limits required by these Specifications.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. All blasting shall be conducted by persons qualified and experienced in drilling and controlled blasting procedures for open-cut and underground rock excavation. Persons responsible for blasting shall be licensed blasters in the Commonwealth of Pennsylvania and shall have had acceptable experience in similar excavations in rock and controlled blasting techniques. Drillers shall demonstrate to Owner proficiency in collaring and drilling holes precisely.

2. The Contractor shall engage the services of a qualified, independent professional engineer, to conduct a pre-blast condition survey of adjacent structures.

3. Blast monitoring shall be conducted by an independent, qualified professional engineer or seismologist engaged by Owner, trained in the use of a seismograph, and records shall be analyzed and results reported by persons familiar with analyzing and reporting the frequency content of a seismograph record.

B. Codes, Permits and Regulations:

1. The Contractor shall comply with all applicable laws, rules, ordinances and regulations of the federal government the Commonwealth of Pennsylvania, or local jurisdiction governing the transportation, storage, handling and use of

explosives. All labor, materials, equipment and services necessary to make the blasting operations comply with such requirements shall be provided without additional cost to the Owner.

2. The Contractor shall obtain and pay for all permits and licenses required to complete the work of this Section.

3. In case of conflict between regulations or between regulations and Specifications, the Contractor shall comply with the strictest applicable codes, regulations or Specifications.

C. Blasting Limit Criteria:

1. Airblast Overpressure Limit: Air blast overpressures shall not exceed 130 dB (peak), or 0.013 psi, at the closest off site above ground structure from the blasting site.

2. Peak Particle Velocity and Elastic Displacement Limits: The Contractor shall conduct all blasting activity in such a manner that the maximum peak particle velocity (PPV) and the maximum elastic displacement does not exceed the following:

At Powerhouse and other on site concrete structures

Distance from Blast to Structure	Max PPV (in/sec) Threshold	Limiting	Max. Elastic Displacement (in)
0 to 25 ft	4.0	5.0	0.010
25 to 50 ft	3.0	4.0	0.010
50 to 75 ft	2.0	3.0	0.008
over 75 ft	1.5	2.0	0.008

3. Ground vibration shall not exceed the U.S. Bureau of Mines Safe Limits (Figure 1 attached) at the ground surface outside any building or structure located off site

4. Ground vibration at the piers of the Rte 372 bridge shall not exceed the following limits:

Distance from Blast to Structure	Max PPV (in/sec) Threshold	Limiting	Max. Elastic Displacement (in)
0 to 30 ft	No Blasting		
35 to 50 ft	2.0	2.5	0.008
Over 50 ft	1.5	2.0	0.008

5. Blasting in the vicinity of curing concrete shall be limited to the following Peak Particle Velocity (PPV) limits to prevent damage to concrete

Maximum Allowable PPV (in/sec) at closest Curing Concrete

Type of Blast Concrete from Concrete	Distance	Concrete Age <2 days	2 to 7 days	>7 days
Type 1	< 100 ft	1.0	1.5	2.0
	> 100 ft	0.5	1.0	1.5
Type 2	< 100 ft	1.5	2.0	2.5
	> 100 ft	1.0	1.5	2.0

Type 1 concrete is capable of undergoing bending, such as formed walls.
Type 2 concrete is mass concrete which cannot undergo bending, such as footings.

6. Crack Gage Movement Limits: Crack gage movements as a result of blasting shall be limited to the following:

Type of Gage	Maximum Crack Opening (in.) Threshold Value	Limit Value
Type 1	0.03	0.04
Type 2	0.04	0.06

Type 1 crack gages shall be installed and monitored in areas of structural distress within the powerhouse or dam, or on cracks in structural elements where additional movements could result in structural distress. Type 2 crack gages shall be installed in representative cracks in non critical areas, such as cosmetic cracks in non load bearing walls or slabs.

These maximum values may be adjusted by Owner based on interpretations of actual readings obtained, with respect to normal temperature related expansion and contraction of structures. It will be important to observe trends of increasing opening of cracks, or sudden larger than normal increases in opening of cracks beyond normal temperature related movements.

7. Heave/Settlement Limits: Heave/Settlement measurements will be taken with precision level equipment capable of measuring heave/settlement of 0.06 in. Heave/settlement as a result of blasting shall be limited to the following:

Location	Maximum Heave/Settlement (in.) Threshold Value	Limit Value
Rte 372 Bridge Piers	0.12	0.18
Rock Outside excavation Near Rte 372 Bridge Excav.	0.25	0.37
Powerhouse, Dam, Spillway	0.18	0.25

8. Water Pressure Limits: Hydrostatic pressure at underwater structures shall be limited to the following:

Structure	Distance	Max. Water Pressure (psi)	
	Threshold	Limit	Value
Power Station, Gatehouse:	<75 ft	15	20
	>75 ft	12	15
Skimmer piers, other structures:	<75 ft	20	25
	>75 ft	15	20

It will be important to have adequate confinement of explosives placed for underwater blasting, so that excessive water pressure and impulse are not generated, especially in areas near sensitive underwater structures and where fish may be present in the area. Bubble curtains may be required to minimize water pressures at sensitive underwater facilities, such as at the powerhouse intake area.

9. Actions if threshold or limiting values are exceeded:

   a. If threshold limits of vibration or movement are exceeded, the Contractor shall submit to Owner and the Geotechnical Engineer, within 24 hours of notification of the exceedance, a submittal indicating the reason for the exceedance, and the steps the Contractor has taken and will take to prevent further exceedances.

   b. If limiting values of vibration or movement are exceeded, all work by the Contractor in the vicinity of the exceeded values shall stop until a meeting takes place between the Contractor, the Geotechnical Engineer, and Owner to assess the cause of the exceeded values. A submittal shall be prepared and submitted to Owner and the Geotechnical Engineer indicating the reason for the exceedance and what steps the Contractor will take to prevent further exceedances of the limits. No work in the vicinity of the exceedance shall be restarted until the submittal is reviewed and approved by Owner.

D. Blast Monitoring: Blast monitoring shall be conducted by the Geotechnical Engineer, or another independent, qualified professional engineer or seismologist, trained in the use of seismographic equipment to monitor blast-induced vibrations, air blast overpressure, underwater hydrostatic pressures, and crack gages, in accordance with the following criteria:

1. The Geotechnical Engineer will monitor peak particle velocity and airblast overpressure levels resulting from all blast rounds fired for the project. Monitoring shall be conducted at the nearest structure to the blast and at other critical locations as directed by the Owner, Design Engineer, and Geotechnical Engineer. It is anticipated that a minimum of five engineering seismographs will be utilized for each blast, to monitor vibrations at the existing dam, the existing powerhouse, diversion wall, fish passage elevator, nearby residences along the railroad, and at the Rte 372 Bridge, at various times during construction depending on the excavation activities.

2. The Contractor shall cooperate with the Owner, Design Engineer and the Geotechnical Engineer in permitting observation of the Contractor's drilling and loading procedures, as well as in providing detailed information on blasting operations.

3. The Contractor shall be completely responsible for all damages resulting from the blasting operations and shall minimize damage to rock left in place. Modifications to blasting and excavation methods required to meet these requirements shall be undertaken at no additional cost to Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.0 INSPECTION

A. The Contractor shall evaluate site conditions and note irregularities affecting blasting work.

3.1 STORAGE

A. Explosives shall be stored, handled and employed in accordance with Federal, state and local regulations.

B. The explosives expert shall bring, or have brought to him, sufficient explosives for each day of activity at the beginning of the day, and remove excess at the day's end. No explosives or explosive agents shall remain on the site between sunset and the next day's sunrise or during non-working hours, unless permission is granted by Owner to do so, and approved magazines are utilized.

C. The explosive storage facility or facilities shall be located on the surface, in the areas in accordance with all Federal, state, and local laws and regulations, and as approved by Owner, and the Geotechnical Engineer, and shall be not more than six feet in largest internal dimension. They shall meet the applicable requirements of Class A magazines including being bullet proof, protected from the weather, and having adequate ventilation and

shall be isolated from other worksite activities. The contractor will not be provided with an off site storage area by Owner.

D. Explosives shall be removed from the worksite at the beginning of weekend and holiday shutdowns and at the end of the last shift when operations are on a less than 24 hours per day basis. However the contractor will be required to provide magazines for storage and obtain permits for storage.

E. The Contractor shall maintain on the site detailed records of explosives in storage and explosives use, for review by Owner if desired. Inventories shall be conducted and reported daily to the appropriate permitting authority. In addition to submittals to Owner, the Contractor shall maintain blasting reports for each blast.

3.2 SAFETY

A. The Contractor shall be responsible for determining any other safety requirements unique to blasting operations on this particular site so as not to endanger life, property, utility services, or any existing or new construction, or any property adjacent to the site.

3.3 TRIAL BLAST

A. The first blasts for the open-cut excavation and tunnel shall be Trial Blasts. If the Trial Blast is successful and approved by the Owner, Design Engineer, and Geotechnical Engineer, the following blasts increase in size incrementally until the approved production blast size is reached. If Owner, Design Engineer, and Geotechnical Engineer do not approve the Trial Blast, another Trial Blast shall be made, changing one or more blast parameters. This process shall be repeated at no additional cost to Owner, until Owner, Design Engineer, and Geotechnical Engineer approve of the Trial Blast.

3.4 GENERAL BLASTING REQUIREMENTS

A. All handling, loading, detonation and the effectiveness evaluation shall be conducted by or in the presence of a licensed explosive expert. The explosives expert's license number shall appear on all correspondence, reports, or other documentary memoranda regarding the blasting activities.

B. No blasting shall take place on Sunday, statutory holidays, or outside 0600 to 2200 hours for tunnel blasting, and 0800 to 2000 hours for surface blasting.

C. Controlled blasting techniques shall be used for all blasting on this project.

D. The explosive charges, whether contained in drilled holes or not, shall have a detonation sequence which provides the greatest degree of relief to the final excavation surface, unless otherwise directed by the Owner.

E. ANFO (Ammonium Nitrate/Fuel Oil) shall not be used on the project. Certain pumped emulsion explosives may be allowed, based on the technical properties of the explosive and the experience of the contractor in their use. Otherwise, all explosives shall be in cartridges or other semi-rigid containers. The explosives used in Perimeter Holes shall have a detonation velocity of not less than 15,000 ft/sec.

F. The Contractor shall use blasting mats or some other positive means of controlling flyrock.

G. Blasts shall be designed so as not to exceed the peak particle velocity, elastic displacement, air-blast, overpressure, water pressure, heave, and crack gage opening limits specified herein.

H. Pre-split, cushion blast, line-drill, and smooth wall blast holes shall not deviate from the excavation line by more than 6 inches unless directed by the Owner.

3.5 OPEN-CUT ROCK CUT EXCAVATION

A. When excavating the cuts along the power house walls Contractor shall comply with the following:

1. Damage to rock outside the excavation limits shall be limited to maintain the integrity and stability of the rock mass. The integrity and stability of the rock mass will be evaluated based on an evaluation of the half-cast factor, degree of blast induced fracturing, loosening of and opening of preexisting rock joints, and stability of the rock mass including blocks and wedges within the rock mass. The Contractor shall use Perimeter Control blasting techniques to create a stable excavated rock surface and to maintain the integrity and stability of the rock mass.

2. The presence of perimeter Half-Casts will be used to judge the effectiveness of the perimeter control blasting procedures specified below. The Contractor shall conduct perimeter control blasting operations to maintain a half-cast factor greater than 75 percent. If, in the judgment of the Owner, Design Engineer, and Geotechnical Engineer, the Contractor's smooth wall blasting procedures are causing or resulting in a half-cast factor below 75 percent, the geometry (diameter, spacing), stemming and loading of perimeter holes and adjacent production holes shall be adjusted until results acceptable to the Owner, Design Engineer, Geotechnical Engineer are obtained.

3. All drilling equipment used to drill perimeter and production holes shall have an inclinometer device affixed to the drill mast in order to accurately determine the angle of the drill rods. The device shall have a remote electronic readout mounted at the rig control console, and be capable of reading angles parallel and perpendicular to the line of excavation limits, over a range of +35 degrees to -35 degrees from vertical, with an accuracy of 0.50 degrees over the entire range.

4. For boreholes over 40', a borehole deviation survey shall be completed for every fourth perimeter hole, and every fourth first row in from the perimeter hole. The borehole deviation survey system shall be capable of measuring deviation along two axes: one parallel to the excavation limits, one perpendicular to the excavation limits. It should be able to survey a 2-in. to 4 -in. diameter hole, up to 90 feet deep, to approximately 30 degrees, at an accuracy of 0.10 degrees. One acceptable system would be the "Boretrak" borehole deviation survey system. Perimeter and first row in production holes shall not deviate by more than one percent of the hole depth from the correct alignment.

5. Excavation shall be staged to allow rock reinforcement, where required, to be installed as the cut is brought down. Drilling of the next lift will not be permitted until all of the required rock reinforcement for the preceding lift is installed.

B. SPECIAL PERIMETER CONTROL BLASTING PROCEDURES FOR OPEN-CUT EXCAVATION

1. Pre-Splitting:

a. Pre-split blast holes shall be loaded and fired separately before the main round to create a fracture plane along the perimeter of the excavation.

b. Pre-split holes shall be string-loaded or space-loaded with light, distributed charges and shall be thoroughly stemmed for the full length of hole with sand. The top of the hole, for a minimum of 18 inches, shall be unloaded and stemmed with crushed stone stemming.

c. Spacing, burden, hole diameter and loading shall be maintained within the guidelines listed in the following table unless deviation from the guidelines is approved by Owner, Design Engineer, and Geotechnical Engineer based on observed field performance.

Pre-Splitting Guidelines

Hole Diameter (in.)	Hole Spacing (ft)	Column Load Charge Concentrations (lb/ft)
1.5 to 2.5	1.0 to 1.5	0.06 to 0.15
3.0 to 4.0	1.5 to 2.0	0.10 to 0.20

d. Use of one or more strands of 400 grain/ft PRIMA-CORD, such as manufactured by the Ensign-Bickford Company, or equivalent, as a string-loaded column charge, will meet the required low level of column charge concentrations for pre-split holes.

e. The bottom charge concentration within the bottom 1 to 3 feet of hole shall be approximately two (2) times the column charge concentration.

f. Pre-split holes shall be fired simultaneously if particle velocity and air blast considerations will permit. Otherwise, groups of pre-split holes in segments along the pre-split line shall be systematically fired with millisecond (MS) delays.

g. Pre-split holes shall not deviate more than 6 inches out of alignment over the full maximum vertical lift height.

h. Loading of the first-row-in of production holes shall be approximately 50 percent of normal production hole loading.

i. The first row of production holes in from the perimeter holes shall be angled at the same slope as the adjacent perimeter holes.

2. Cushion Blasting:

a. If used, cushion blast holes shall be loaded and fired separately after the main round to ensure a free face and equal burden.

b. Cushion blast holes shall be string-loaded or space-loaded with light charges, and shall be thoroughly stemmed with a minimum of 18 inches of crushed stone stemming, or other material capable of maintaining explosive gas pressures. Spacing, burden, blast hole diameter and loading shall be maintained within the guidelines listed in the following table.

Cushion Blasting Guidelines

Hole Diameter (in.)	Hole Spacing (ft)	Burden (ft)	Column Load Charge Concentrations (lb/ft)
1.5 - 2.0	1.0 - 1.5	2.5 - 3.0	0.06 - 0.15
2.5 - 4.0	1.5 - 2.0	3.0 - 3.5	0.10 - 0.25

NOTE: Small diameter, unloaded guide holes shall be used if required for satisfactory results, located midway between each cushion blast hole.

c. The first row of drill holes in from the perimeter row shall be loaded with not more than four times the charge weight indicated in the above table. Spacing and burden of first row-in holes shall be decreased sufficiently from those of other production holes to

ensure that the perimeter holes have a free face and equal burden for the full depth of the round.

d. The first row of production holes in from the perimeter holes shall be angled at the same slope as the adjacent perimeter holes.

e. Use of one or more strands of 400 grain/ft PRIMA-CORD, such as manufactured by the Ensign-Bickford Company, or equivalent, as a string-loaded column charge, will meet the required low level of column charge concentrations for cushion blast holes.

3. Line Drilling

a. Line Drilling shall consist of a minimum of 3-in diameter holes evenly spaced at a center to center spacing of 2 times the drill hole diameter. Drill holes shall not deviate more than 3-in from their required plane over the entire length of the hole. The line drilled holes are to be left unloaded. As the perimeter is approached with the primary (production) blasting, the distance between the line drilled holes and the adjacent row should be about 50 percent of the normal hole spacing. The spacing of production holes in the row adjacent to the perimeter holes (first row in holes) should also be about 50 to 75 percent of the normal hole spacing. The loading of the holes in the adjacent row should be about 50 percent of the loading used in the primary holes.

3.6 UNDERGROUND BLASTING REQUIREMENTS

A. Before drilling each round, the blast pattern shall be painted on the face indicating the holes to be drilled, delay interval and relationship of the blast pattern to each excavation line.

B. Vertical holes are not required.

C. Blasts for the proposed diversion tunnel shall be designed so as not to exceed a maximum elastic displacement of 0.010 in. at the fish elevator, as measured by an engineering seismograph capable of monitoring at a frequency range up to at least 200 Hz.

D. Excavation to final rock surfaces shall be carried out using Smooth Wall Blasting techniques. If a blast or blasts show damage along final rock surfaces unacceptable to Owner, Owner may require restrictions in addition to those specified herein.

E. The perimeter holes for Smooth Wall Blasting shall conform to the following requirements:

Smoothwall Blasting Guidelines

Hole Diameter (in.)	Hole Spacing (ft)	Burden (ft)	Column Load Charge Concentrations (lb/ft)
1.5 to 1.75	1.5 to 2	2 to 3	0.08 to 0.20
1.75 to 2.25	2 to 2.5	3 to 3.5	0.15 to 0.30

F. The lookout (flare off of excavation line) of perimeter holes along the Excavation Line shall not exceed ¼ inch per lineal foot of hole drilled.

G. Smooth wall holes shall be string-loaded or space-loaded with light, well-distributed charges. The collar of the hole, for a minimum of 24 inches, shall be unloaded and stemmed with tamped sandbags, water bags, or other suitable inert stemming.

H. The presence of perimeter Half-Casts will be used to judge the effectiveness of the smooth wall blasting procedures. The Contractor shall conduct smooth-wall blasting operations to maintain a half-cast factor greater than 75 percent. If, in the judgment of the Owner, Design Engineer, and Geotechnical Engineer, the Contractor's smooth wall blasting procedures are causing or resulting in a half-cast factor below 75 percent, the geometry (diameter, spacing), stemming and loading of perimeter holes and adjacent production holes shall be adjusted until results acceptable to the Owner, Design Engineer, Geotechnical Engineer are obtained.

I. Blasts shall be conducted in conformance with the above limitations. These limitations shall remain in effect unless it is demonstrated through Trial Blasts that the desired results can be achieved when said limitations are exceeded.

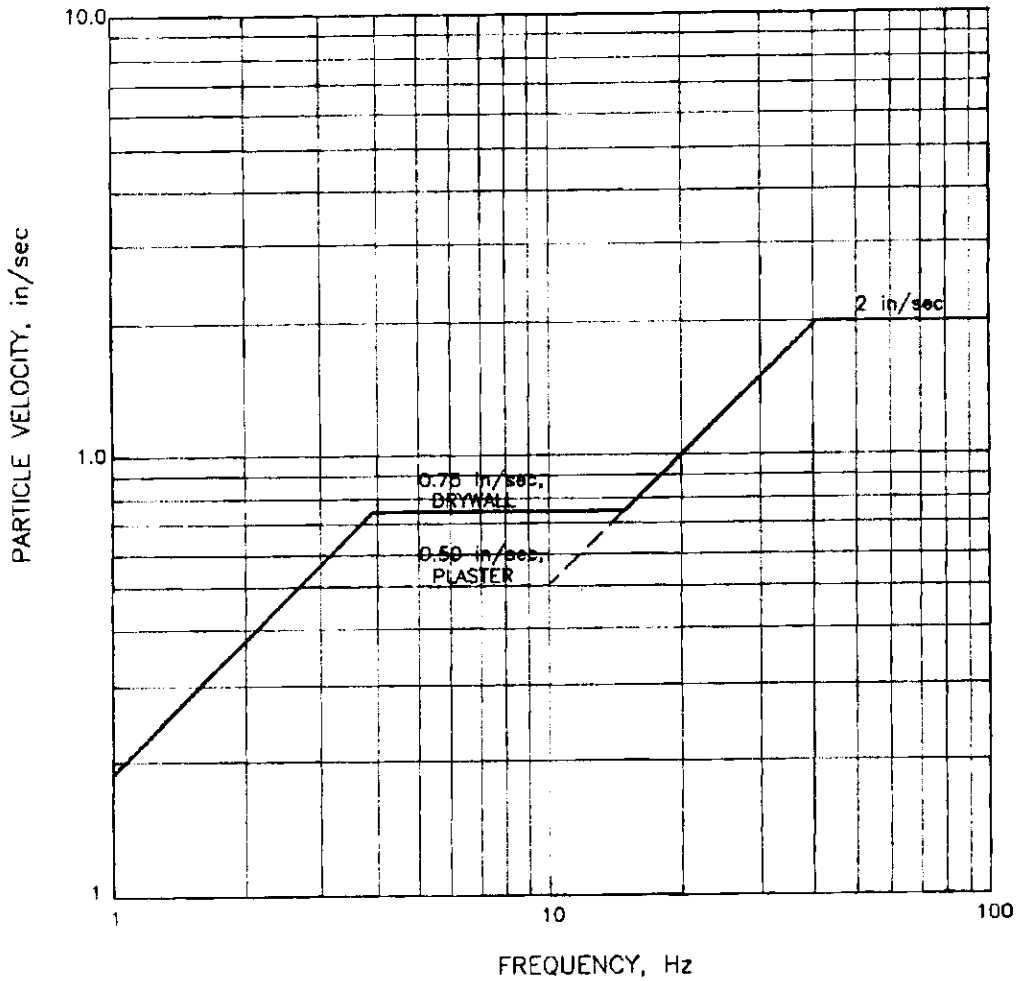

Figure 1 - Blasting Limit Criteria

-- End of Section --

APPENDIX E:

DRAFT MINIMUM STREAMFLOW OPERATIONS PROCEDURES MANUAL

PPL Holtwood, LLC

HOLTWOOD HYDROELECTRIC PROJECT

Minimum Stream Flow Operations Procedures Manual

DRAFT (May 5, 2008)

CONTENTS

DEFINITIONS

Continuous Minimum Conservation Flow(s) means flow(s) in cubic feet per second (cfs) released to the Piney Channel, Tailrace, or Spillway Area below the Holtwood dam as prescribed in the amended license for the Project for the purpose of in-stream resource protection.

Continuous Minimum Flow(s) – means flow(s) in cfs released from the Holtwood project to satisfy the continuous flow provisions of the PPL/Exelon Settlement Agreement dated May 5, 2008 ("PPL-Exelon Agreement"). These flows include all releases of water from the Holtwood project without respect to the source of water including but not limited to project leakage, unit flows, fish lift flows, spills, and the Continuous Minimum Conservation Flow(s). For practical purposes the Continuous Minimum Flow requirements of the PPL/Exelon Settlement Agreement are interpreted herein in terms of hourly volumetric average requirements.

Daily Minimum Flow(s) – means the minimum daily volumetric flow(s) released from the Holtwood project as prescribed in the amended license for the project and the PPL-Exelon Agreement.

Piney Channel – means the river channel immediately west of and along Piney Island in the river area immediately below the Holtwood Dam.

Tailrace – means the river channel located east of Piney Island and situated between Piney Island and the Lancaster County shoreline immediately below the Holtwood Project powerhouse.

Spillway Area – means the river area located to the west of Piney Channel and situated between the Piney Channel and the York County shoreline immediately below the Holtwood Dam.

DRAFT (May 5, 2008)

Holtwood Hydroelectric Project
Minimum Stream Flow Operation Procedures Manual

I. Purpose of Manual

This Minimum Stream Flow Operations Procedures ("MSFOP") Manual has been prepared pursuant to and in satisfaction of the conditions expected to be contained in the section 401 water quality certification to be issued by the Commonwealth of Pennsylvania, Department of Environmental Protection ("401 Certification"). The 401 Certification is expected to establish certain minimum outflow ("stream flow") requirements for the Holtwood Project, both during construction as approved redevelopment components are brought on line and after construction of the redevelopment is complete. *[This procedure will be revised as necessary when the 401Certification is issued].*

In addition, PPL Holtwood, LLC (PPL) and Exelon Generation, the operator of the Muddy Run and Conowingo projects, have reached agreement[1] on certain outflows to be maintained at Holtwood. This MSFOP Manual also has been prepared in consideration of the provisions of the PPL-Exelon Agreement.

This MSFOP Manual is intended (a) to guide PPL personnel in implementing the minimum stream flow requirements that are expected to be contained in the 401 Certification and that are contained in the PPL-Exelon Agreement and (b) to establish documentation and reporting to permit verification by other parties [PADEP, Exelon, SRBC, FERC] that the requirements have been met. PPL will begin implementation of this MSFOP Manual on the date upon which the FERC order approving the project's license amendment becomes final. Specific minimum stream flow requirements will become effective as stated in Section II.

[1] *Settlement Agreement between Exelon Generation and PPL Holtwood, LLC regarding the expansion of the PPL Holtwood Hydroelectric Project*, May 5, 2008. *[The agreement is tentative as of the date of this draft.]*

II. Minimum Stream Flow Requirements

Under the [*expected*] terms of the 401 Certification the minimum stream flow requirements at the project may be subject to change. Should changes occur this MSFOP Manual will be accordingly modified.

The following minimum stream flow requirements apply:

- A Continuous Minimum Conservation Flow to the Spillway Area during periods when spill is not present over the dam equal to normal leakage through the dam flashboards plus unobstructed flow through the 10-inch diameter pipe in the main dam, or other flow as prescribed in the 401 certification.

- A Continuous Minimum Conservation Flow in the Piney Channel equal to 200 cfs, or other flow as prescribed in the 401 Certification, to become effective upon the routing of unit 1 discharge to the Piney Channel.

- A Continuous Minimum Conservation Flow in the tailrace as may be specified in the future by the resource agencies under the provisions of the 401 Certification.

- A Daily Minimum Flow from the project equal to either (a) 98.7 percent of the required minimum flow at Conowingo Dam as described in Section VIII[2] or (b) net inflow to Lake Aldred, whichever is less, to become effective on the date upon which the FERC order approving the project's license amendment becomes final.

A Continuous Minimum Flow from the project equal to either (a) 800 cfs[3] or (b) net inflow to Lake Aldred, whichever is less, to become effective on the date upon the latter of initiation of unit 1 discharge to Piney Channel or initial operation of the planned exciter replacement units in the existing powerhouse. For practical purposes the Continuous Minimum Flow requirement is interpreted herein in terms of an hourly volumetric average requirement.

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[2] If the minimum flow at Conowingo Dam changes in the future, the Daily Minimum Flow from the Holtwood Project will be adjusted accordingly.

[3] If Conowingo's minimum flow requirements are ever modified then the 800 cfs Continuous Minimum Flow shall be adjusted by an equivalent percentage per Section VI of the PPL-Exelon Agreement.

The above requirements do not apply in the event of an emergency. Procedures in the event of an emergency are provided in Section XIV.

If error adjustments hereunder or regulatory requirements create a conflict with the protocols under this MSFOP, then PPL shall consult with FERC and the resource agencies to modify this MSFOP to resolve the conflict.

The implementation and verification of the above minimum stream flow requirements are discussed in the ensuing sections of this MSFOP. Specifically, this MSFOP requires that the components and the total of the flows in the Tailrace, the Piney Channel and the Spillway Area be determined, recorded and reported on an hourly basis as specified in Section X below. How the components will be determined and which data will be recorded and reported is described in the respective appendices.

III. Net Inflow to Lake Aldred

Net inflow ($\mathbf{Q_{NI}}$) to Lake Aldred has the following components, a technical discussion of each of which is presented in the appendices of this MSFOP:

- Discharge from Safe Harbor ($\mathbf{Q_{SH}}$) (APPENDIX I) where $\mathbf{Q_{SH}}$ includes generating flow, leakage and trash sluicing flow
- Local inflow from the 686-square-mile drainage area between Safe Harbor Dam and Holtwood Dam ($\mathbf{Q_{LI}}$) (APPENDIX J)
- Net lake evaporation (difference between evaporation and direct precipitation) ($\mathbf{Q_E}$) (APPENDIX K)

Total net inflow is determined by the following:

$$\mathbf{Q_{NI} = Q_{SH} + Q_{LI} - Q_E}$$

PPL expects to know the anticipated hourly generating schedule of the Safe Harbor generating units on a 24-hour advance basis. At the end of each hour, PPL expects to know the actual hourly volumetric average discharge by the Safe Harbor generating units for the hour just ended.

IV. Holtwood Outflow (Q_H)

Holtwood outflow (Q_H) is the sum of the flows to the Tailrace (Q_T), to the Piney Channel (Q_{PC}) and to the Spillway Area (Q_{SA}).

Total Holtwood outflow is determined by the following:

$$Q_H = Q_T + Q_{PC} + Q_{SA}$$

Q_T, Q_{PC} and Q_{SA} and the corresponding minimum flow requirements are described in the following sections.

V. Tailrace Flow (Q_T)

The present source(s) of flow to the Tailrace are the discharges from Units 1-10 (Q_1, Q_2, etc) (APPENDIX A), and discharges from fish lift entrances A (Q_{FLA}) and B (Q_{FLB}) (APPENDIX C). When the units are idle (if not dewatered) flows from the units will be leakage (APPENDIX B).

Total tailrace flow under present conditions is determined by the following:

$$Q_T \text{ (present)} = Q_1 + Q_2 + \ldots + Q_9 + Q_{10} + Q_{FLA} + Q_{FLB}$$

Upon redevelopment, the new units (Units 11, 13, 18 and 19) will discharge to the Tailrace (Q_{11}, Q_{13}, Q_{18}, Q_{19}) and Unit 1 (Q_{1R}) will no longer discharge to the Tailrace (APPENDIX A). When the units are idle (if not dewatered) these flows will be leakage (APPENDIX B).

Total tailrace flow under redeveloped conditions is determined by the following:

$$Q_T \text{ (redeveloped)} = Q_2 + Q_3 + \ldots + Q_9 + Q_{10} + Q_{11} + Q_{13} + Q_{18} + Q_{19} + Q_{FLA} + Q_{FLB}$$

A Continuous Minimum Conservation Flow requirement for the Tailrace has not been imposed but may be required in the future. Nevertheless, this MSFOP requires the recording and reporting of the individual components and the total of the hourly flow in the Tailrace as this flow is a component of the Daily Minimum Flow requirement and the Continuous Minimum Flow requirement.

VI. Piney Channel Flow (Q_{PC})

The present sources of flow to the Piney Channel (Q_{PC}) are:

- Flow from the fish lift Entrance C ($\mathbf{Q_{FLC}}$) (APPENDIX C)
- Flow from the trash sluice ($\mathbf{Q_{TS}}$) (APPENDIX D)
- Spill when the forebay elevation exceeds Elev. 169.75 (APPENDIX H)
    - over spillway Sections 2 and 3 ($\mathbf{Q_{S2}}$, $\mathbf{Q_{S3}}$)
    - over the eastern one-third of the rubber dam/spillway Section 4 ($\mathbf{Q_{S4E}}$)

Total Piney Channel flow under present conditions is determined by the following:

$$\mathbf{Q_{PC}\ (present) = Q_{FLC} + Q_{TS} + Q_{S2} + Q_{S3} + Q_{S4E}}$$

Note: At high forebay elevations including elevations that would cause spill over the present rubber dam at spillway Section 1 (Elevation 175 ft), implementation of this MSFOP is unnecessary and impracticable.

Upon project redevelopment, flow to the Piney Channel will include:

- Flow from the fish lift Entrance C ($\mathbf{Q_{FLC}}$) (APPENDIX C)
- Flow from the trash sluice ($\mathbf{Q_{TS}}$) (APPENDIX D)
- Flow from Unit 1 as redeveloped by extension of the draft tube ($\mathbf{Q_{1R}}$) (APPENDIX A); when Unit 1 is idle (if not dewatered), the flow will be leakage (APPENDIX B) and
- Flow over the Obermeyer gates to be installed atop the dam at Sections 1, 2 and 3 ($\mathbf{Q_{OG}}$) (APPENDIX E).
- Spill when the forebay elevation exceeds Elev. 169.75 over the eastern 33 percent of the rubber dam/spillway Section 4 ($\mathbf{Q_{S4E}}$) (APPENDIX H).

Total Piney Channel flow under redeveloped conditions is determined by the following:

$$\mathbf{Q_{PC}\ (redeveloped) = Q_{FLC} + Q_{TS} + Q_{1R} + Q_{OG} + Q_{S4E}}$$

Upon redevelopment of the project, the required Continuous Minimum Conservation Flow in Piney Channel will be 200 cfs, or other flow as prescribed in the 401 Certification.

When the forebay is Elevation 169.75 or lower, the required Continuous Minimum Conservation Flow in Piney Channel will normally be provided by either operation of unit 1 ($\mathbf{Q_{1R}}$), operation of fish lift Entrance C ($\mathbf{Q_{FLC}}$), operation of the Obermeyer gates ($\mathbf{Q_{OG}}$), or via a combination of these sources.

VII. Spillway Area Flow (Q_{SA})

The sources of flow to the Spillway Area below the dam ($\mathbf{Q_{SA}}$) are:

- Flow through the 10-inch pipe through the dam ($\mathbf{Q_P}$) (APPENDIX F)
- Leakage from the wooden flashboards ($\mathbf{Q_{WFL}}$) (APPENDIX G)
- Spill when the forebay elevation exceeds Elev. 169.75 (APPENDIX H)
  - over the western two-thirds of the rubber dam/spillway Section 4 ($\mathbf{Q_{S4W}}$)
  - over the wooden flashboards (Q_{SWF})
  - over the dam crest (Elev. 165.0 ft) where/if wooden flashboards have failed ($\mathbf{Q_{SDC}}$)

Total Spillway flow is determined by the following:

$$\mathbf{Q_{SA} = Q_P + Q_{WFL} + Q_{S4W} + Q_{SWF} + Q_{SDC}}$$

For purposes of this operating procedure, documentation of the required Continuous Minimum Conservation Flow to the Spillway Area will not be required during periods of spill.

Total Spillway flow during non-spill periods will therefore be determined as follows:

$$\mathbf{Q_{SA} = Q_P + Q_{WFL}}$$

In the future, if the required Continuous Minimum Conservation Flow to the Spillway Area exceeds the flow from the 10-inch pipe ($\mathbf{Q_P}$) and leakage from the wooden flashboards ($\mathbf{Q_{WFL}}$), PPL will develop a means of providing supplemental flow to the Spillway Area, and this procedure will be revised accordingly.

VIII. Daily Minimum Flow Operations

The Daily Minimum Flow requirement at Holtwood is either (a) 98.7 percent of the minimum flow requirement at Conowingo or (b) daily net inflow to Lake Aldred, whichever is less. In turn, the minimum flow requirement at Conowingo is either (a) the flow at the USGS Marietta gage (No. 01576000) or (b) the so-called "QFERC" as tabulated below, whichever is less:

	QFERC (cfs)
March	3,500
April	10,000
May	7,500
June 1-September 14	5,000
September 15-November 30	3,500
December-February	1,750 daily average

For practical purposes, the Marietta flow to be considered on any day shall be the prior day's average flow (provisional data as reported). The average Marietta flow for the prior day is obtained by selecting "Table" and inserting the prior day date as the Begin/End Date in the box at the following USGS web page:

http://waterdata.usgs.gov/nwis/dv/?site_no=01576000&referred_module=sw

For purposes of the MSFOP, the operating day shall be defined as the period from 3 a.m. to 3 a.m. (0300-0300 hours). During low flow periods, Safe Harbor is rarely generating during the hours from midnight to 6 a.m., and lake level is relatively stable. Selection of a 3 a.m.-to-3 a.m. operating day maximizes PPL's ability to make corrective releases if needed to meet the Daily Minimum Flow requirement. The "prior day's average flow" at the Marietta gage shall be the average flow during the 24-hour period ending at midnight preceding the beginning of the respective daily operating period.

PPL will determine whether the total outflow ($\mathbf{Q_{II}}$) satisfies the Daily Minimum Flow requirement by the general procedure described below. The procedure includes provision for a daily correction ("volume deficit") in the event of over- or under-release on the prior day; provision for a daily

correction is necessary due to: (a) inability to accurately predict Safe Harbor operations; and (b) unavoidable error in the estimates of all flow and volume components. Notwithstanding the procedure for daily correction, PPL will use its best efforts to satisfy the Daily Minimum Flow requirement each day. The specific water accounting procedure is included in the data entry form in APPENDIX L and is as follows:

1. Determine the minimum flow requirement at Conowingo (lesser of prior day's Marietta flow and QFERC)
2. Determine 98.7 percent of [1] expressed in cfs-hrs for the day
3. Estimate the net inflow to Lake Aldred ($\mathbf{Q_{NI} = Q_{SH} + Q_{LI} - Q_E}$) expressed in cfs-hrs for the day
4. If [2] is less than [3], the Daily Minimum Flow requirement at Holtwood will be [2]. The requirement will be met if Holtwood outflow (cfs-hrs) during the operating day equals or exceeds 98.7 percent of the Conowingo minimum flow requirement (cfs-hrs). If insufficient water has been released during the operating day, a "volume deficit" will be added to the requirement for the next operating day.
5. If [3] is less than [2], the daily minimum flow requirement at Holtwood will be $\mathbf{Q_{NI}}$ (cfs-hrs). The requirement will be met if the end-of-day lake level is not higher than the beginning-of-day lake level. If the end-of-day lake level is higher than the beginning-of-day level, then insufficient water has been released, and a "volume deficit" will be determined according to the lake level change and added to the requirement for the next operating day. Conversely, if the end-of-day lake level is lower than the beginning-of-day lake level, then excess flow has been released and a negative "volume deficit" will be added to the requirement for the next operating day. The target lake level at the end of each operating day shall be the lake level at the beginning of that operating day adjusted for any "volume deficit" from the prior operating day. Lake levels will be read and recorded to 0.01 ft. Reasonable efforts shall be undertaken to ensure that the end-of-day lake levels are within 0.05 feet of the respective target lake levels in order to minimize day-to-day adjustments.[4] This procedure will eliminate cumulative error during periods when [3] is less than [2].

[4] Lake levels are read to 0.01 ft but this accuracy is questionable. It can be assumed that the lake level readings are accurate at least to the nearest 0.1 ft. The maximum error in a lake level reading thus is 0.05 ft. An error of 0.05 ft equates to an average flow of approximately 65 cfs for a 24-hour period. As noted, the procedure will ensure that the error is not cumulative from day to day.

For daily minimum flow operation, PPL will initially schedule its daily operations on a day-ahead basis to meet the Daily Minimum Flow requirement assuming that the Safe Harbor generating units will operate according to the anticipated hourly schedule and that local inflow and evaporation will remain constant over the day. Local inflow will be estimated on a day-ahead basis. During the operating day PPL will then track hourly local inflow and after-the-fact hourly discharges from Safe Harbor and will adjust the Holtwood operating schedule as necessary to attempt to minimize error in daily release volumes. At the end of the operating day, if the Holtwood daily release exceeded 98.7 percent of the Conowingo minimum flow requirement, then no correction is needed. If the Holtwood daily release did not exceed 98.7 percent of the Conowingo minimum flow requirement, then correction by means of a volume deficit (which may be negative) applied to the next day's operation may be needed as described in this Section.

To summarize: If actual daily net inflow ($\mathbf{Q_{NI}}$ expressed in cfs-hrs for the day) is less than 98.7 percent of the Conowingo minimum flow requirement (expressed in cfs-hrs for the day), then Holtwood must release daily net inflow and lake level is not allowed to rise. If actual daily net inflow ($\mathbf{Q_{NI}}$ expressed in cfs-hrs for the day) exceeds 98.7 percent of the Conowingo minimum flow requirement (expressed in cfs-hrs for the day), then Holtwood must release 98.7 percent of the Conowingo minimum flow requirement. Thus, Holtwood's obligation (with appropriate allowance for error) is to either (a) release 98.7 percent of the Conowingo flow requirement during the operating day or (b) ensure that the lake level at the end of the operating day is not higher than the lake level at the beginning of the operating day.

IX. Continuous Minimum Flow Operations

The PPL-Exelon Agreement specifies a Continuous Minimum Flow requirement at Holtwood equal to (a) 800 cfs or (b) the net inflow to Lake Aldred ($\mathbf{Q_{NI}}$), whichever is less, which for practical purposes is interpreted herein in terms of an hourly volumetric average flow.

On an hourly basis PPL will determine whether the total outflow ($\mathbf{Q_{II}}$) satisfies the Continuous Minimum Flow requirement by the general procedure described below. The procedure includes provisions for the use of hourly volumetric inflow data and for an hour-to-hour correction

("volume deficit") in the event of over- or under-release in prior hours; provision for an hourly correction is necessary due to: (a) inability to accurately predict Safe Harbor operations; (b) unavoidable error in the estimates of all flow and volume components, and (c) the inability of the Holtwood plant to instantaneously respond to changed inflow conditions. Notwithstanding the procedure for hour-to-hour correction, PPL will use its best efforts to satisfy the Continuous Minimum Flow requirement.

PPL will schedule and determine the required discharge from Holtwood by the general procedure presented below. The specific water accounting procedure is included in the suggested data entry form in APPENDIX L.

PPL will initially schedule its hourly operations to meet the Continuous Minimum Flow requirement on a day-ahead basis assuming that the Safe Harbor generating units will operate according to the anticipated hourly schedule and that local inflow and evaporation will remain constant over the scheduling period. When $\mathbf{Q_{NI}}$ is greater than 800 cfs on an hourly volumetric average basis, the objective each hour is that total Holtwood outflow $\mathbf{Q_H}$ be not less than 800 cfs on an hourly volumetric average basis. When $\mathbf{Q_{NI}}$ is less than 800 cfs on an hourly volumetric average basis, the objective each hour is that total Holtwood outflow $\mathbf{Q_H}$ equals net inflow $\mathbf{Q_{NI}}$. $\mathbf{Q_{NI}}$ will likely never be less than 800 cfs on an hourly volumetric average basis when Safe Harbor generates during the hour.

PPL will then track hourly local inflow and changes in Safe Harbor scheduling to determine on a 24-hour forward looking basis whether any scheduling adjustments are needed in order to attempt to minimize error in hourly release volumes.

1. On an hour-to-hour basis deviations from scheduled releases will be determined as follows:

    a. At the beginning of each hour PPL will compile inflow data from the prior hour ($\mathbf{Q_{NI}} = \mathbf{Q_{SH}} + \mathbf{Q_{LI}} - \mathbf{Q_E}$) where:

Q_{SH} is the actual hourly volumetric average discharge from Safe Harbor for the prior hour based on real-time Safe Harbor discharge data available to PPL[5] (see APPENDIX I);
Q_{LI} is the estimated local average inflow for the prior hour determined as described in APPENDIX J; and
Q_E is a calculated allowance for net lake evaporation determined as described in APPENDIX K.

b. If Q_{NI} is less than 800 cfs and Q_H for the prior hour differs from Q_{NI} for the prior hour PPL will schedule a flow correction as soon as is reasonably practical but not later than one hour from the time of the hourly data compilation.[6] The flow correction will be determined as follows:

Flow Correction (Q_{FC}) =
Q_{NI} - (Q_H or 800 cfs, whichever is less)

This correction may be positive or negative and will be added to the scheduled Q_H within one hour as discussed above.

Note: If a Flow Correction from a previous hour (Q_{FCprev}) was to have been applied, then the new Flow Correction determined above would be:

Q_{FC} = (Q_{NI} + Q_{FCprev}) - (Q_H or 800 cfs, whichever is less)

c. When Q_{NI} for the prior hour is equal to or greater than 800 cfs and Q_H for the prior hour is less than 800 cfs the flow correction will be determined as follows:

Flow Correction (Q_{FC}) = 800 cfs - Q_H

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[5] Data communication upgrades between PPL and Safe Harbor are currently planned separate from the redevelopment project that will make real-time Safe Harbor discharge data available to PPL. PPL anticipates that these upgrades will be complete prior to initiation of the minimum stream flow obligations of this MSFOP. In the event that this project is delayed beyond the date when the minimum stream flows will commence, or data is otherwise not available to PPL, PPL will consult with affected parties to determine either temporary or alternative methods, and will accordingly modify this MSFOP.

[6] Example: At 1600 hours PPL determines Q_{NI} for the 1500 to 1600 hour (say 500 cfs) and determines that Q_H during the prior hour was 50 cfs- less than Q_{NI}. PPL will then schedule an additional 50 cfs release. The release will be scheduled as soon as practical but no later than the hour commencing at 1700 hours (one hour after data is compiled).

This correction may only be positive and will be added to the scheduled Q_H within one hour as discussed above.

Note: If a Flow Correction from a previous hour (Q_{FCprev}) was to have been applied, then the new Flow Correction determined above would be:

$$Q_{FC} = (800 \text{ cfs} + Q_{FCprev}) - Q_H$$

To summarize: For hourly minimum flow operation PPL will schedule Holtwood hourly operations to satisfy the Continuous Minimum Flow requirement based on the best available estimate of net inflow, and will modify this schedule hourly as a result of schedule changes or additional information. On an hour-to-hour basis PPL will compile data for the past hour to determine any deviations due to recorded hourly volumetric average net inflow conditions and will schedule corrections as needed as soon as reasonably practical but not later than one hour from the time of the hourly data compilation.. The corrections may be positive or negative, except when hourly volumetric average net inflow is in excess of 800 cfs in which case corrections may only be positive.

X. Data Records and Reporting

A data entry form ("Minimum Flow Log Sheet") for recording the necessary hourly flow components is provided in APPENDIX L. The daily data entry record shall be kept for the life of the facility and may be kept in electronic format. The date of each operating day shall be the date on which the operating day begins.

The daily data entry record shall be available to the resource agencies on request provided that records that are less than 30 days old will only be released to resource agencies that have provisions for maintaining the confidentiality of confidential business information, and the requesting agency implements those procedures with respect to such records. The daily data entry record shall be available to Exelon on request 30-days following the entry for a day.

A summary data reporting form "Daily Minimum Flow Report" is provided in APPENDIX M. The Daily Minimum Flow Report shall be provided to

Exelon in accordance with a mutually agreeable schedule, provided that such Daily Minimum Flow Report will be provided to Exelon no earlier than 3:00 p.m (1500 hours) on the day following the date of the operating day covered by such summary report. The Daily Minimum Flow report, or other desired summary report shall be provided to the PADEP, SRBC and FERC in accordance with the requirements of the 401 Certification, SRBC approval and FERC licensing order respectively.

XI. Installation, Maintenance, Inspection and Repair of Equipment

A tailwater gage is already installed in the tailrace. A lake level gage is also installed at the project. Valve position within the fishlift is also presently monitored through the fish lift programmable logic controller (PLC). PPL intends to install monitoring equipment to record the position of the Obermeyer gates to be installed on the dam, and intends to install a new tailwater gage in the Piney Channel below the unit 1 discharge. An enhanced data communication link with Safe Harbor is also planned separate from the redevelopment project.

PPL will maintain all equipment and facilities critical to this MSFOP in good working order in accordance with manufacturer's recommendations. In the event any equipment or component becomes inoperative that could jeopardize compliance with the minimum flow requirements of this MSFOP, PPL will notify the Contact Personnel listed in Section XIII by telephone or e-mail within five working days and in writing within ten working days. At the time written notice is provided, PPL will provide a plan for either the repair or replacement of said equipment and will propose interim procedures to fulfill its obligations under this MSFOP to the fullest extent practicable.

XII. Periodic Review of MSFOP

PPL proposes to meet annually with the Contact Personnel listed in Section XIII to discuss and, if appropriate and mutually acceptable, to modify this MSFOP. When mutually agreed to by PPL and PADEP, in consultation with the other resource agencies, meetings may be held less frequently. However, if proposed changes are made to any water conveyance structure at Holtwood that would impact the respective outflow rating curve, then all

parties should be notified of these changes at least three months in advance and, if needed, a meeting shall be held.

XIII. Communications and Contact Personnel

The following are the duly authorized representatives of the involved parties to whom communications concerning this MSFOP Manual should be addressed. All parties' representatives are to be notified in writing upon a change in representative.

[List names, mailing addresses, phone, FAX, e-mail of each individual]

Party/Agency	Representative
PPL	N. Christian Porse PPL Holtwood, LLC 482 Old Holtwood Road Holtwood, PA 17532-9720 Phone – 717-284-6257 FAX – 717-284-6234 e-mail: ncporse@pplweb.com
DEP	
PFBC	
SRBC	
Exelon	Exelon needs to specifiy

XIV. Emergency Conditions

Should any emergency[7] conditions occur at the project that would prevent PPL from fulfilling the minimum stream flow obligations PPL shall notify DEP within 24 hours and provide a report to DEP within 15 days from the date of the emergency. PPL shall also notify the Contact Personnel in Section XIII above, and shall act to restore minimum flows as soon as possible.

[7] The provisions of the final 401 Certification shall govern with respect to the definition of emergency.

APPENDIX A – HOLTWOOD UNIT PERFORMANCE

Holtwood has ten existing units (Units 1-10). Units 1-7 are vertical, double-Francis-runner units. Units 8-10 are vertical, single-Francis-runner units. The runners of Units 3, 5, 6, 8, 9 and 10 have been replaced beginning in 1987; replacement runners for Units 1, 2, 4 and 7 are planned for 2009-2012. The single-runner units (Units 8-10) are the most efficient units.

Holtwood flow (cfs) is a function of output (MW) and gross head (ft) for each existing unit. Flow tables are provided in EXHIBIT AI. The tables were originally developed in the 1930s and grouped Units 1-5, Units 6-7, Unit 8, and Units 9-10. The tables were updated in the 1950s and again in the 1990s. The current tables for Units 3, 6, 8 and 9 are based on model tests run in the mid-1980s at the time the replacement runners were purchased. No model tests have been run on either Unit 5 or Unit 10. New tables for Units 1, 2, 4 and 7 will be prepared when those units are upgraded.

The heads in the tables range up to 65.0 ft for Units 3, 6 and 8 and up to 62.0 ft for the remaining units. These heads are gross heads determined as the difference between the level measured by a gage located at the ramp at the northern end of the forebay and a tailrace gage. The forebay level drops by about 1 foot from Unit 1 to Unit 10. That same differential also exists in the tailrace so that the effective gross heads across all units are about equal. The tailrace gauge is located in the center of the powerhouse and consequently indicates an average tailrace level for all units. The gross head determined by the difference between the forebay level gage and the tailrace gage thus indicates a nominal effective gross head for each unit.

Tables similar to the tables in EXHIBIT AI will be developed by the turbine manufacturers for new Units 11, 13, 18 and 19 before those units become operable.

As part of the redevelopment, Unit 1 draft tube will be extended so that Unit 1 will discharge into Piney Channel. Coincident with this construction PPL is planning to replace the unit 1 runners which will alter the unit's performance characteristics. Following initial operation and testing of the rerouted unit 1, manufacturer's performance curves for the modified unit will be incorporated in this procedure.

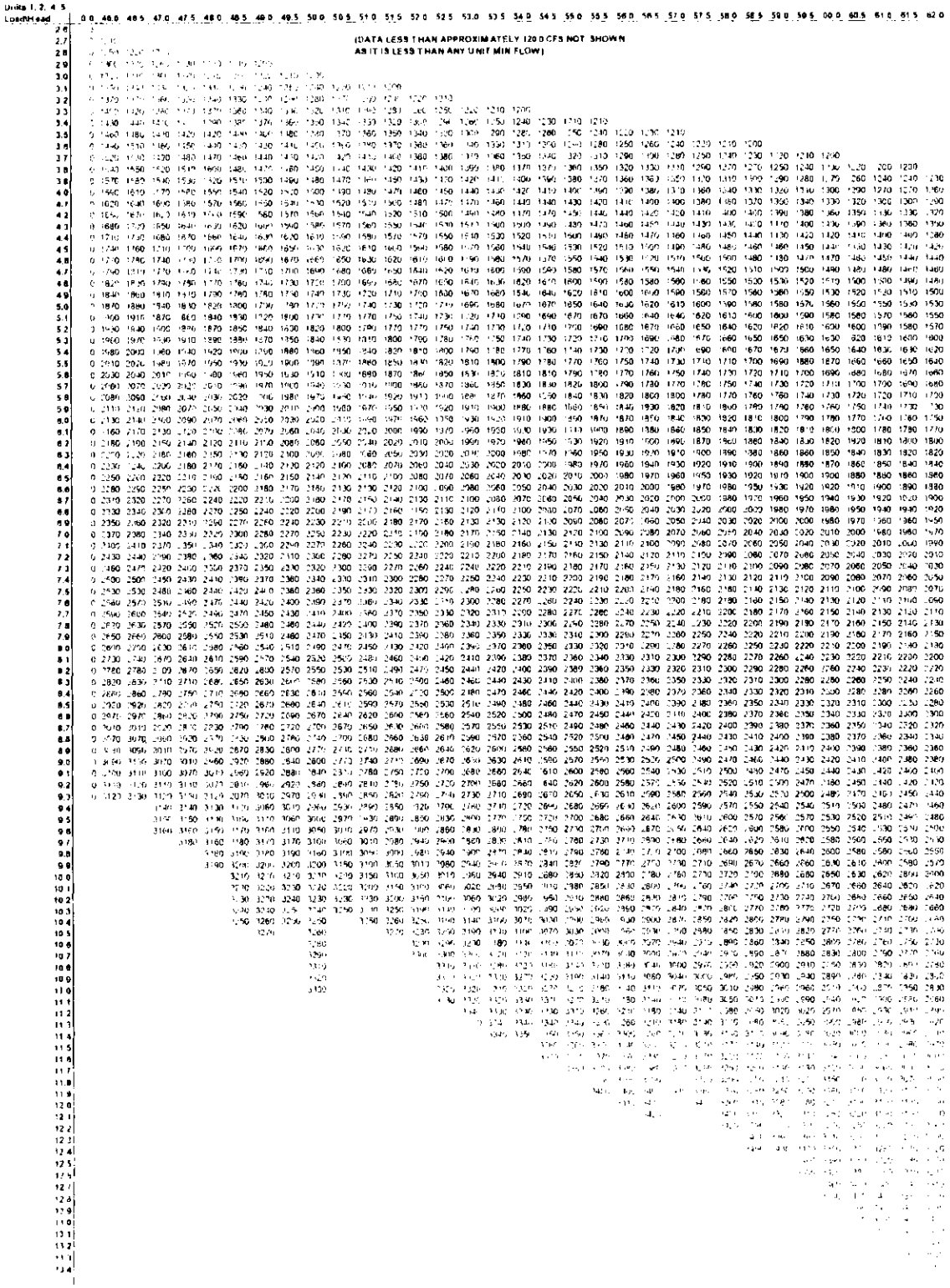
The practical flow ranges for the existing units are:

Unit(s)	Min flow (cfs)	Max flow (cfs)
1, 2	2,568 (each)	3,210 (each)
3, 6	1,250 (each)	2,750 (each)
4	2,240	2,800
5	2,044	3,212
7	1,995	2,850
8	1,210	2,662
9	1,420	3,156
10	1,560	3,468

The expected practical flow ranges for the new units and renovated Unit 1 are:

Unit(s)	Min flow (cfs)	Max flow (cfs)
11, 13	125 (each)	300 (each)
18, 19	3,000 (each)	15,000 (each)
1(renovated)	TBD(approx 1200)	TBD(approx 3150)

EXHIBIT A1 Unit Performance Tables (Sample data for units 1,2,4,5, Similar tables are available for all units, and will be developed for new units)



APPENDIX B – HOLTWOOD UNIT LEAKAGE

Leakage tests on the Holtwood units were last conducted in 1991-92. Prior to 1991-92, leakage tests had been conducted in 1985. The test data through the years suggest total plant leakage on the order of 200 cfs at a gross head of 61.0 ft. The test results also indicate significantly lower leakage rates at the single-runner units (Units 8, 9 and 10). See EXHIBIT B1.

Based on the more recent test data, it appears that the combined leakage from all units is approximately 200 cfs. (In the analyses of project redevelopment, the total plant leakage has been assumed to be 210 cfs, as indicated by the 1985 estimate.)

Four units (3, 6, 8 and 9) were upgraded between the 1985 and 1991-92 tests. The 1991-92 tests did not indicate that the combined leakage of these four units lessened as a result of the upgrades.

Pending further testing, for purposes of this MSFOP, the leakage rates for idle units will be assumed as shown in Table B-1, without adjustment for plant gross head:

Table B-1 Assumed Holtwood existing unit leakage rates for purposes of MSFOP

Units	Unit leakage (cfs)	Combined leakage (cfs)
double-runner units (1-7)	25	175
single-runner units (8-10)	10	30
Total existing units		205

PPL will conduct new leakage tests on all existing units after completion of the upgrading of all existing units, expected not later than 2012. Table B-1 will be revised upon completion of these leakage tests.

When the new units 18 and 19 are installed, PPL will conduct leakage tests of those units or will include leakage tests as a condition of unit acceptance from the manufacturer. Leakage from the small new units 11 and 13 is expected to be small and is assumed to be 0 for the purposes of this MSFOP.

EXHIBIT B1

HOLTWOOD HYDRO WICKET GATE LEAKAGE
UNITS 1 THRU 10
R. E. Moyer 6/23/92

Wicket gate leakage tests were conducted on Hydro Units 1 thru 10 on the dates indicated in the summary of results table listed below. Units 1 and 6 were not done on 11/5/91 because of outage work. They had to be postponed until 6/22/92 due to high river flows. The results of the previous leakage tests performed in 1985 are listed for comparison.

Unit No.	Gate Leakage	Test Date	1985 Leakage
1	31 cfs	6/22/92	33 cfs
2	14 cfs	11/05/91	14 cfs
3	7 cfs	11/05/91	29 cfs
4	17 cfs	11/05/91	19 cfs
5	19 cfs	11/05/91	46 cfs
6	45 cfs	06/22/92	19 cfs
7	24 cfs	11/05/91	25 cfs
8	2 cfs	11/05/91	10 cfs
9	7 cfs	11/05/91	7 cfs
10	19 cfs	11/05/91	8 cfs
Total Station	186 cfs		210 cfs
Avg./Unit	19 cfs		21 cfs
Avg./Double Runner Unit	23 cfs		26 cfs
Avg./Single Runner Unit	9 cfs		8 cfs

The historical average for total station leakage at Holtwood since 1938 is 228 cfs. Based on the current hydro energy rate and the running five-year average Capacity Factor of 65%, each recoverable cfs is worth $570/yr. The results for Units 1, 6, 7 and 10 indicate a need for improvement. The Unit 6 Renovation Project will take care of its need. The other units should be checked during upcoming overhauls.

The Holtwood Hydro Wicket Gate Leakage Test Procedure documented in Station Service Memorandum RM-36 was used to conduct these tests. The data sheets taken during the tests are attached for additional information.

R. E. Moyer

REM/ks

Attachments

b:\rem64

HOLTWOOD HES
WICKET GATE LEAKAGE TESTS
LEAKAGE IN CFS

(CORRECTED TO 51.0 FT. HEAD)

YEAR TESTED	UNIT #											REMARKS
	1	2	3	4	5	6	7	8	9	10	TOTAL	
1938	33	38	33	47	22	40	36	14	4	6	273	
1939	28	31	36	43	31	35	27	19	5	7	262	FROM
1940	26	33	28	50	28	32	27	8	3	7	242	
1941	32	35	26	46	28	30	27	9	5	8	246	
1942	35	33	29	46	25	35	29	8	4	8	252	
1943	30	34	31	40	29	30	29	7	7	11	248	OLD
1944	37	40	38	53	30	29	29	6	4	9	274	
1945	40	14	21	35	22	31	27	7	2	-	208*	
1946	39	14	20	32	26	39	29	5	3	-	216*	
1947	38	12	17	30	21	34	33	6	3	12	206	PWP
1948	26	11	17	24	21	34	26	9	5	18	191	
1949	32	12	18	28	18	32	28	9	2	11	190	
1950	32	12	44	33	20	20	-	9	9	22	229*	
1951	-	13	44	30	20	32	15	10	8	24	228*	FILES
1952	31	13	43	-	20	35	18	11	8	24	233*	
1953	28	13	41	30	20	30	18	10	8	-	222*	
1954 & 1968	25	12	31	29	21	27	21	10	9	10	195	
& 1982	23	13	26	26	24	22	17	7	5	9	172	B. GOODLEY LETTER (1982)
1983	20	-	30	28	58	26	29	-	10	13	234*	HOERNER
1988	33	15	29	27	41	25	29	10	16	15	241	
1993	33	14	29	19	45	19	25	10	7	8	210	TROMBETTA
1997	31	14	7	17	19	45	24	2	7	19	185	MOYER

*NOTE. Data from preceding year used to fill in missing information (in arriving at total)

APPENDIX C – HOLTWOOD FISH LIFT FLOWS

The fish lift has three entrances, which can be operated singly or in any combination. Entrances A and B discharge into the Holtwood tailrace. Entrance C discharges into the Piney Channel

The lift has seven motor-operated butterfly valves to provide flow at the fish lift entrances as follows:

Operating Entrance(s)	Nominal target flow at normal tailwater (cfs)	Operating Valves: MOV-						
		1	2	3	4	5	6	7
A	300	√	√		√			√
B	300	√		√	√			√
C	200	√				√	√	√
A and B	600	√	√	√	√			√
A and C	500	√	√		√	√	√	√
B and C	500	√		√	√	√	√	√
A, B and C	800*	√	√	√	√	√	√	√

* Not achievable at some heads

The fish lift designer prepared tables of required valve opening (percent) and resulting valve discharge to achieve the entrance target flows for combinations of widely-ranging forebay and tailrace elevations. These tables are presented in EXHIBIT C1 to illustrate the data available at the present time. However, the fish lift operators, through experience, open the requisite valves as required to maintain acceptable flow conditions to attract fish over the entrance weirs. The target flows are not considered and the tables in EXHIBIT C1 are not used for setting the valves during operation. Further analysis would be needed in order to determine fish lift flows at valve openings other than as shown on the tables of EXHIBIT C1.

As a component of the redevelopment, the attraction water inlet piping will be modified. Upon modification, PPL will conduct appropriate flow measurements or hydraulic analyses, or both, as required to recalibrate valve

flows and settings, and thereafter will revise or replace the tables in EXHIBIT C1 as necessary.

Whenever the fish lift is operated to provide minimum flow, PPL proposes to operate the fish lift in accordance with the tables in EXHIBIT C1.

EXHIBIT C1 Fish Lift Operating Tables (Sample Data)

Rev 0
11/25/97

HOLTWOOD FISH LIFT
OPERATION GUIDELINES
ENTRANCE A

A. **Initiate Fish Lift Operation from "Park"**

- Preparing for filling upper Trough
- From local controls, set/verify following positions

• Gate 8 (Trough isolation gate)	-	FULL UP
• Gate 7 (Debris gate)	-	FULL DOWN
• Trash Scrn 1	-	FULL DOWN
• Trash Rack	-	REMOTE
• Gate 11 (Counting Room)	-	OPEN
• Gate 6 (Downstream gate)	-	FULL UP
• Gate 10 (Flood gate)	-	FULL UP
• Valve 9 (Upper Trough drain)	-	FULL CLOSED

- From control panel, (or PLC), set/verify following positions.

• Gate 4	-	FULL RAISED
• Gate 5	-	FULL RAISED
• TRAK1	-	AUTOSET
• HAF1 (Upper Trough)	-	FULL CLOSED
• HAF7 (Main attr Water)	-	FULL CLOSE

- From local control, set following:

• Gate 9	-	"NORMAL FULL UP"

- From control panel (or PLC), set/verify following:

• Gate 1 (Entrance A)	-	FULL DOWN
• Gate 2 (Entrance B)	-	FULL UP
• Gate 3 (Entrance C)	-	FULL DOWN

B **For Fishing from Entrance A**

1 Setup Screen

- Select Desired Entrances

  Entrance A to "ON" position
  Entrance B to "OFF" position
  Entrance C to "OFF" position
  Tunnel Lights to "ON" position

- Water Elevation Input

  Select "AUTO"

- Water Elevation Auto Update

  Select Timer setting 15 minutes
  Delta Water Elevation 12 inches

2. Gate Control Screen:

- Gates 1 to "AUTOSET"
- Gates 2 to "FULL RAISE"
- Gates 3 to "FULL LOWER"
- Gates 4 to "AUTOSET"
- Gates 5 to "FULL RAISE"
- Trak 1 to "AUTOSET"

3 Valve Control Screen

The valves are to be opened in the following sequence. Verify each step is completed prior to the next step being initiated

Step 1
- HAF 5 to "FULL CLOSE"
- HAF 6 to "FULL CLOSE"
- HAF 3 to "FULL CLOSE"

Step 2
- HAF 2 to "AUTOSET"
- HAF 4 to "AUTOSET"

Step 3
- HAF 1 to "AUTOSET"

Step 4 • HAF 7 to "AUTOSET"

4 Crowder Hopper Control Screen (Tailrace)

- Set Fish Timer at 10 Minutes
- Start Auto Cycle

C **From Fishing Setup to Overnight Setup**

1 Crowder Hopper Control Screen

- Stop Auto Cycle (Hopper/Crowder)

2. Valve Control Screen

The valves are to be closed in the following sequence. Verify each step is completed prior to initiating next step.

Step 1 • Set HAF 7 to "FULL CLOSE"

Step 2 • Set HAF 1 to "FULL CLOSE"

Step 3 • Set HAF 2 to "FULL CLOSE"
• Set HAF 4 to "AUTOSET"

Step 4 • Set HAF 1 to "AUTOSET"

3 Gate Control Screen

- Set Gates 1 to "AUTOSET"
- Set Gates 2 to "AUTOSET"
- Set Gates 3 to "AUTOSET"

- Set Gates 4 to "FULL RAISE"
- Set Gates 5 to "FULL RAISE"

- Set Trak 1 to "AUTOSET"

4. Setup Screen

- Set Entrance A to "ON"
- Set Entrance B to "ON"
- Set Entrance C to "ON"
- Tunnel Lights to "OFF"

D. From Fishing Setup to Shutting Down Fishing Operation

1. Crowder Hopper Control Screen (Tailrace and Spillway)

- Stop Auto Cycle (Hopper/Crowder)

2. From Local Control, Set Following:

- Gate 9 - FULL DOWN
- Trash SCRN 1 - FULL UP
  (Note: To remove floating trash in upper trough, open Gate 6)
  Once upper trough is drained
- Gate 8 - FULL DOWN

3. Valve Control Screen

The valves are to be closed in the following sequence. Verify each step is completed prior to initiating next step

Step 1
- Set HAF 5 to "FULL CLOSE"
- Set HAF 6 to "FULL CLOSE"

Step 2
- Set HAF 7 to "FULL CLOSE"
- Set HAF 1 to "FULL CLOSE"

Step 3
- Set HAF 4 to "FULL CLOSE"
- Set HAF 2 to "FULL CLOSE"
- Set HAF 3 to "FULL CLOSE"

4 Gate Control Screen

- Set Gates 1 to "FULL LOWER"
- Set Gates 2 to "FULL LOWER"
- Set Gates 3 to "FULL LOWER"

- Set Gates 4 to "FULL RAISE"
- Set Gates 5 to "FULL RAISE"
- Set TRAK 1 to "FULL RAISE"

5. Setup Screen

- Set Entrance A to "OFF"
- Set Entrance B to "OFF"
- Set Entrance C to "OFF"
- Tunnel Lights to "OFF"

6. From Local Control, Set Following:

- Gate 10 to "FULL DOWN"

TABLE E-1

MOV SETTINGS FOR VARIOUS WATER ELEVATIONS

MOV NO 1
CONFIGURATION ENTRANCE A

VALVE SETTING % OPEN

TAILRACE ELEVATION FT	FOREBAY ELEVATION (FT)									
	174	173	172	171	170	169	168	167	166	165
122	57	55	52	50	50	45	45	40	40	40
120	57	55	52	50	49	45	45	40	38	38
118	57	55	50	50	49	45	45	40	38	36
116	57	55	50	50	49	45	42	40	38	36
114	57	55	50	50	48	45	42	40	37	36
112	57	55	50	49	48	45	40	38	37	35
110	57	55	50	49	48	45	40	38	36	35
108	57	55	51	49	47	45	40	38	36	32
106	57	55	51	49	47	43	40	38	36	32
104	57	55	51	49	47	43	40	38	35	32

TABLE E-2

MOV SETTINGS FOR VARIOUS WATER ELEVATIONS

MOV NO. 2
CONFIGERATION ENTRANCE A

VALVE SETTING % OPEN

TAILRACE ELEVATION FT	FOREBAY ELEVATION (FT)									
	174	173	172	171	170	169	168	167	166	165
122	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0
118	0	0	0	0	0	0	0	0	0	0
116	0	0	0	0	0	0	0	0	0	0
114	44	44	44	44	44	45	46	46	47	47
112	45	45	45	45	45	46	47	47	48	48
110	46	46	46	46	46	47	47	48	49	49
108	47	47	47	47	47	47	47	49	50	50
106	48	48	81	89	87	49	49	50	51	51
104	49	49	49	49	50	50	50	51	52	52

TABLE E-3

MOV SETTINGS FOR VARIOUS WATER ELEVATIONS

MOV NO 4
CONFIGURATION ENTRANCE A

VALVE SETTING % OPEN

TAILRACE ELEVATION FT	FOREBAY ELEVATION (FT)									
	174	173	172	171	170	169	168	167	166	165
122	79	79	79	79	79	80	80	80	80	80
120	64	64	64	64	64	64	67	67	67	67
118	58	58	58	58	58	58	60	60	60	60
116	54	54	54	54	54	54	54	56	56	56
114	50	50	50	50	50	52	52	52	52	52
112	46	46	46	46	46	48	48	48	48	48
110	42	42	42	42	44	44	44	44	44	44
108	38	38	38	38	40	40	40	40	40	40
106	30	30	30	30	30	31	31	31	31	31
104	22	22	22	22	22	22	22	22	22	22

NOTE Valve may cavitate in zones below thick line.

TABLE E-4

MOV SETTINGS FOR VARIOUS WATER ELEVATIONS

MOV NO 7
CONFIGURATION ENTRANCE A

VALVE SETTING % OPEN

SPILLWAY ELEVATION FT	FOREBAY ELEVATION (FT)									
	174	173	172	171	170	169	168	167	166	165
122	50	50	50	50	50	50	50	50	50	50
120	48	48	48	48	48	48	48	48	48	48
118	46	46	46	46	46	46	46	46	46	46
116	44	44	44	44	44	44	44	44	44	44
114	42	42	42	42	42	42	42	42	42	42
112	40	40	40	40	40	40	40	40	40	40
110	37	37	37	37	37	37	37	37	37	37
108	35	35	35	35	35	35	35	35	35	35
106	33	33	33	33	33	33	33	33	33	33
104	30	30	30	30	30	30	30	30	30	30

TABLE E-1

DISCHARGE FOR VARIOUS WATER ELEVATIONS

MOV NO 1
CONFIGURATION ENTRANCE A

DISCHARGE (CFS)

TAILRACE ELEVATION FT	FOREBAY ELEVATION (FT)									
	174	173	172	171	170	169	168	167	166	165
122	196	182	168	154	140	126	112	98	84	70
120	196	182	168	154	140	126	112	98	84	70
118	196	182	168	154	140	126	112	98	84	70
116	196	182	168	154	140	126	112	98	84	70
114	196	182	168	154	140	126	112	98	84	70
112	196	182	168	154	140	126	112	98	84	70
110	196	182	168	154	140	126	112	98	84	70
108	196	182	168	154	140	126	112	98	84	70
106	196	182	168	154	140	126	112	98	84	70
104	196	182	168	154	140	126	112	98	84	70

TABLE E-2

DISCHARGE FOR VARIOUS WATER ELEVATIONS

MOV. NO 2
CONFIGURATION ENTRANCE A

DISCHARGE (CFS)

TAILRACE ELEVATION FT	FOREBAY ELEVATION (FT)									
	174	173	172	171	170	169	168	167	166	165
122	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0
118	0	0	0	0	0	0	0	0	0	0
116	0	0	0	0	0	0	0	0	0	0
114	132	132	132	132	132	132	132	132	132	132
112	156	156	156	156	156	156	156	156	156	156
110	180	180	180	180	180	180	180	180	180	180
108	204	204	204	204	204	204	204	204	204	204
106	228	228	228	228	228	228	228	228	228	228
104	228	228	228	228	228	228	228	228	228	228

TABLE E-3

DISCHARGE FOR VARIOUS WATER ELEVATIONS

MOV. NO 4
CONFIGURATION ENTRANCE A

DISCHARGE (CFS)

TAILRACE ELEVATION FT	FOREBAY ELEVATION (FT)									
	174	173	172	171	170	169	168	167	166	165
122	300	300	300	300	300	300	300	300	300	300
120	300	300	300	300	300	300	300	300	300	300
118	300	300	300	300	300	300	300	300	300	300
116	300	300	300	300	300	300	300	300	300	300
114	168	168	168	168	168	168	168	168	168	168
112	144	144	144	144	144	144	144	144	144	144
110	120	120	120	120	120	120	120	120	120	120
108	96	96	96	96	96	96	96	96	96	96
106	72	72	72	72	72	72	72	72	72	72
104	72	72	72	72	72	72	72	72	72	72

NOTE Valve may cavitate in zones below thick line

TABLE E-4

DISCHARGE FOR VARIOUS WATER ELEVATIONS

MOV NO 7
CONFIGURATION: ENTRANCE A

DISCHARGE (CFS)

TAILRACE ELEVATION FT	FOREBAY ELEVATION (FT)									
	174	173	172	171	170	169	168	167	166	165
122	104	118	132	116	160	174	188	202	216	230
120	104	118	132	116	160	174	188	202	216	230
118	104	118	132	116	160	174	188	202	216	230
116	104	118	132	116	160	174	188	202	216	230
114	104	118	132	116	160	174	188	202	216	230-
112	104	118	132	116	160	174	188	202	216	230
110	104	118	132	116	160	174	188	202	216	230
108	104	118	132	116	160	174	188	202	216	230
106	104	118	132	116	160	174	188	202	216	230
104	104	118	132	116	160	174	188	202	216	230

APPENDIX D - HOLTWOOD TRASH SLUICE FLOW

The trash sluice has an exit width (**W**) of 14 ft and an exit sill at El. 159.0. Flow from the trash sluice is controlled by a lift gate that replaced the original stoplog system and is normally lifted clear of the water surface when the trash sluice is operating. The curve "Discharge Through Log Chute – All Stoplog Sections Out" shown on PPL drawing LE-131133 (EXHIBIT D1) depicts the applicable relationship between plant forebay elevation and trash sluice flow. The curve is a standard weir flow curve allowing for end contraction proportional to the head, with variable "C" values determined from model tests.

The flow from the trash sluice ($\mathbf{Q_{TS}}$) when operating may be represented by the following relationship between flow and forebay elevation:

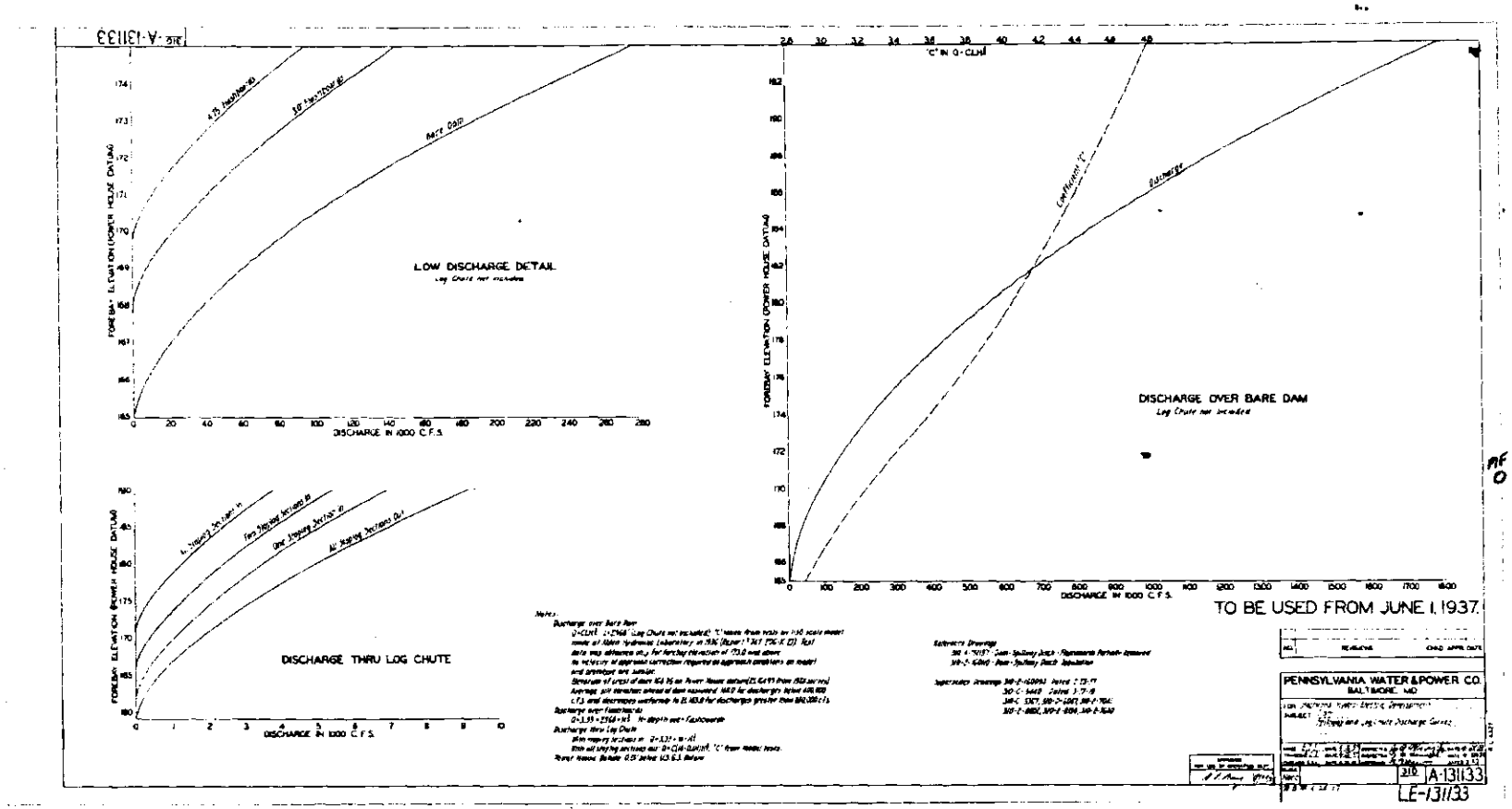
$$\mathbf{Q_{TS} = C \times (W - 0.1H) \times H^{1.5}}$$

Where **W** = 14 and **H** = Forebay Elev. (ft) – 159.0. Representative values determined from EXHIBIT D1 are tabulated in Table D-1:

Forebay El. (ft)	**H** (ft)	Effective width **W**	Apparent C	$\mathbf{Q_{TS}}$ (cfs)
173.00	14.00	12.60	4.00	2,640
172.00	13.00	12.70	3.93	2,340
171.00	12.00	12.80	3.85	2,050
170.00	11.00	12.90	3.77	1,770
169.75	10.75	12.92	3.75	1,710
169.00	10.00	13.00	3.67	1,510
168.00	9.00	13.10	3.57	1,260
167.50	8.50	13.15	3.53	1,150
167.00	8.00	13.20	3.47	1,040
166.00	7.00	13.30	3.37	830
165.00	6.00	13.40	3.26	640
164.00	5.00	13.50	3.13	470
163.50	4.50	13.55	3.07	400

The minimum flow log sheet in Appendix L will automatically compute hourly $\mathbf{Q_{TS}}$ from entered forebay elevations.

EXHIBIT D-1



APPENDIX E – OBERMEYER GATE FLOWS

The spillway sections on the dam which had originally been fitted with wooden flashboards replaced in the 1990s with rubber dams are designated from east to west as:

- Section 1: 40 ft long, adjacent to the fish lift exit
- Section 2: 300 ft long
- Section 3 and Section 4, each 387 ft long

The rubber dams at Sections 2 and 3 have been damaged beyond repair and temporarily replaced by wooden flashboards. The rubber dams at Sections 1 and 4 remain in place but are considered inoperable for flow control. The rubber dam at Section 1 is 10 ft high (to Elevation 175.0 ft in order to prevent spill near fish lift entrance C). The replacement wooden flashboards at Sections 2 and 3, and the remaining rubber dam at Section 4, are 4.75 ft high (to Elevation 169.75 ft, the normal maximum pond level).

Currently, for purposes of this MSFOP, no flow is considered to be provided from Sections 1-4 when the forebay elevation is 169.75 ft or less.

As part of the redevelopment, controllable Obermeyer gates will be installed atop the spillway crest in Sections 1, 2 and 3 [*pending agency approval*]. The gates can be operated to provide flow to Piney Channel if necessary. The number of individual gates within Sections 1, 2 and 3 will be determined in final designs. For purposes of this MSFOP, flows over the Obermeyer gates are represented by $\mathbf{Q_{OG1}}$, $\mathbf{Q_{OG2}}$ and $\mathbf{Q_{OG3}}$ as if all gates in each section are at the same position *[This will be adjusted later based on the final design configuration selected]*.

Flow in each Obermeyer gated section will be computed as simple weir flow:

$$\mathbf{Q\ (cfs) = C\ (weir\ coefficient) \times L\ (total\ length,\ ft) \times H\ (head,\ ft)^{1.5}}$$

Where:

C will be determined based on manufacture literature and the final design configuration.

L is the total effective length of the gate within each section and

H is the difference (ft) between the elevation of the crest of a gate and the plant forebay elevation

The Minimum Flow Log Sheet for the redeveloped project in APPENDIX L represents the gates in each section as single gates. *[The final design may provide for multiple gates in any section, but all gates in each section will normally operate as a single gate.]* The log sheet will automatically compute the total hourly $\mathbf{Q_{OG}}$ from the entered forebay elevations and the individual gate positions (gate crest elevations).

APPENDIX F – 10-INCH PIPE FLOW

An uncontrolled nominal 10-inch-diameter pipe through the dam discharges into the Spillway Area. [8] The elevation of the centerline of the upstream opening of the pipe is approximately 164.0 ft.

Kleinschmidt has estimated the flow through the pipe to vary from zero cfs when the lake level is Elevation 164.0 (or lower) up to approximately 6.5 cfs with the lake level at Elevation 169.75 ft. Kleinschmidt assumed orifice flow with a coefficient of 0.6 and an effective opening of 0.55 square feet. The resulting equation is:

$$\mathbf{Q_P\,(cfs) = C\ (orifice\ coefficient)\ x\ A\ (effective\ opening\ square\ ft)\ x\ (\ 2\ x\ g\ x\ H\ (head,\ ft)\ )^{0.5}}$$

Where:

C was assumed to be 0.6
A is 0.55 square ft (effective area)
g is the gravitational acceleration constant (approx. 32.2 ft/sec^2)
H is the depth (ft) from the plant forebay elevation (ft) to the centerline of the pipe opening (assumed Elevation 164.0 ft).

Representative flow rates are tabulated in Table F-1:

Table F-1. Flow from 10-inch Pipe

Forebay Elev. (ft)	Q_P (cfs)
172.0	8
171.0	7
170.0	6
169.75	6
169.0	6
168.0	5
167.5	5
167.0	5
166.0	4

[8] A portion of this small flow may find its way into Piney Channel. PPL will investigate this further to determine whether any change to this MSFOP is merited.

165.0	3
164.0	0

The Minimum Flow Log Sheet will automatically calculate hourly $\mathbf{Q_P}$ from the entered forebay elevations.

APPENDIX G – LEAKAGE FROM WOODEN FLASHBOARDS

Leakage from the wooden flashboards (west end of dam) provides flow to the Spillway Area.

Kleinschmidt has estimated the rate of leakage through the Holtwood Dam wooden flashboards with the pond at Elevation 169.75. Kleinschmidt analyzed the leakage as flow through the vertical joints between flashboard sections, as both weir and orifice flow alternatives. The results were very close; averaging the two resulted in an estimate of 40 cfs for 1,226 linear feet of wooden flashboards, or 0.033 cfs per foot of flashboard length.

Not included in this estimated flow is leakage under the flashboards, i.e., between the boards and the crest of the dam. This leakage may be a significant quantity. The crest of the dam is irregular, due to erosion of the concrete, so that a tight joint between the flashboards and the crest of the dam cannot be achieved. As a result, leakage computations as defined below are viewed as conservative.

[PPL expects to reconsider the computation/measurement of flashboard leakage in consultation with other parties prior to finalizing this MSFOP.]

At pond levels less than 169.75, the calculated leakage through the vertical joints would vary approximately in proportion to the three-halves power of the head above the spillway crest elevation (165.0 ft). Computed as simple weir flow, the leakage at any forebay elevation between Elevation 165 ft and Elevation 169.75 ft may be calculated as:

Q_{WF} (cfs) = C (weir coefficient) x L (total length, ft) x H (head, ft)$^{1.5}$

Where:

C may be assumed as 2.8 for purposes of this MSFOP
L is the assumed effective total width of vertical joints = 1.28 ft and
H is the difference (ft) between the elevation of the dam crest (Elevation 165 ft) and the plant forebay elevation.

The Minimum Flow Log Sheet (APPENDIX L) will automatically calculate hourly Q_{WF} from the entered forebay elevations.

Representative leakage rates are tabulated in Table G-1:

Table G-1. Flow to Spillway Area from Flashboard Leakage [1]		
Pond Level (ft)	Leakage Rate (cfs per 1,226 feet)	Leakage Rate (cfs per foot)
172.0	66	0.054
171.0	53	0.043
170.0	40	0.033
169.75 (full)	37	0.030
169.0	31	0.025
168.0	20	0.016
167.5	15	0.012
167.0	11	0.009
166.0	4	0.003
165.0	0	0.000

[1] Does not include allowance for flow through the joint between flashboards and dam crest.

APPENDIX H – HOLTWOOD SPILLS

Uncontrolled spill at the existing project occurs whenever the lake level (forebay) exceeds Elevation 169.75 ft. Sections 2, 3 and 4 of the spillway and the wooden flashboards are overtopped. Section 1 of the spillway would not be overtopped until the lake level reaches Elevation 175.0 ft.

Spill over Sections 2 and 3 enter Piney Channel. Spill over Section 4 is estimated to split 33 percent to Piney Channel and 67 percent to the Spillway Area. Spill over the wooden flashboards enters the Spillway Area.

The wooden flashboards are designed to fail at lake level Elevation 174.2 ft. Where flashboards have failed, flow in the failed sections is uncontrolled spill over the dam at concrete crest Elevation 165.0 ft. This spill enters the Spillway Area.

For the redeveloped project, spillway Sections 1, 2 and 3 will have Obermeyer gates *[pending agency approval]*. The hydraulic calculation of spill over these gates is considered the same irrespective of the gate position. APPENDIX E presents the calculation of flow over the gates.

Uncontrolled spills at Holtwood would not normally be a consideration with regard to minimum flows as they occur at high river flow. However, periods of spill may occur during low flow periods due to flashboard failure, sudden loss of unit generation, and/or due to excess Safe Harbor releases and inadequate lake storage. Under these circumstances uncontrolled spill may be a component of the minimum flow calculation,

The several spill components are calculated as simple weir flow as follows:

- Spill over existing Sections 2, 3 and 4 ($\mathbf{Q_{S2}}$, $\mathbf{Q_{S3}}$, Q_{S4}) and over the wooden flashboards in place ($\mathbf{Q_{SWF}}$):

$$Q_{SWF} = C \text{ (weir coefficient)} \times L \text{ (total length, ft)} \times H \text{ (head, ft)}^{1.5}$$

Where:

C for the wooden flashboards = 3.33; C for the planned Obermeyer gates will be derived from manufacturer supplied performance data

L is the total effective length of each section (L2 = 300 ft, L3 and L4 = 387 ft, L of the flashboards = 1,226 ft) and

H is the difference (ft) between Elevation 169.75 ft and the plant forebay elevation

- Spill over the dam crest where/if wooden flashboards have failed (Q_{SDC}):

Where:

C varies from approximately 2.9 to 3.6 within the range of forebay elevations from 165 ft to 174 ft in accordance with PPL drawing LE-131133 (EXHIBIT D1)

L is the total length (ft) of failed flashboards and

H is the difference (ft) between Elevation 165.0 ft and the plant forebay elevation

APPENDIX I – SAFE HARBOR DISCHARGE

Discharge from Safe Harbor (Q_{SH}) is normally the principal component of net inflow (Q_{NI}). Each day, Holtwood receives from Safe Harbor Water Power Corporation (SHWPC) the anticipated hourly schedule of the Safe Harbor generating units for the next day. Holtwood will request SHWPC to continue to provide this information.

PPL is also in the process of upgrading a data communications link between the Holtwood plant and Safe Harbor that will make available to Holtwood real-time Safe Harbor unit discharge data, excluding leakage.

Leakage rates from the Safe Harbor powerhouse and spillway gates are presently unknown. For purposes of initial minimum flow operations according to this MSFOP, it will be assumed that Safe Harbor leakage is equal to 210 cfs, the estimated leakage for the existing Holtwood powerhouse (APPENDIX B), and that the Safe Harbor leakage is a constant component of net inflow (Q_{NI}). If experience in implementing this MSFOP indicates the need for better estimates of leakage rates from Safe Harbor, PPL will seek to have leakage tests performed of the Safe Harbor units or will conduct appropriate studies to estimate leakage from the Safe Harbor units.

APPENDIX J – LOCAL INFLOW TO LAKE ALDRED

The USGS gage for the Conestoga River at Conestoga will be the primary reference gage for purposes of estimating local inflow to Lake Aldred from the 686-square-mile drainage area between Safe Harbor and Holtwood dams. The USGS gage for the Conestoga River at Lancaster will be the backup gage. Current flows for both gages are normally available via the Internet. PPL intends to obtain hourly data from the primary gage (or the backup gage whenever the primary gage is unavailable).

Flows at both gages are affected by City of Lancaster water supply operations. The City withdraws a portion of its demand from the Susquehanna River above Safe Harbor Dam. The City also withdraws a portion of its demand from the Conestoga River above the Lancaster gage. These flows are assumed to be returned to the Conestoga River at the City's wastewater treatment plant below the Lancaster gage and above the Conestoga gage. Adjustments to reflect the City's water supply operations are necessary in using the gaged flows to estimate local inflow to Lake Aldred.

The SRBC suggests nominal average withdrawal rates by the City of 10 MGD (15 cfs) from the Susquehanna River ("W_S") and 10 MGD (15 cfs) from the Conestoga River ("W_C"). To use the gaged flows at Conestoga to represent the per-square-mile rate of runoff into Lake Aldred from the 686-square-mile drainage area: (1) W_S must be subtracted from the gaged flows before prorating the gaged flow according to the ratio of the total drainage area to the gage drainage area; then (2) W_S must be added back to represent the total inflow to Lake Aldred. To use the gaged flows at Lancaster to represent the per-square-mile rate of runoff into Lake Aldred from the 686-square-mile drainage area: (1) W_C must be added to the gaged flows before prorating the gaged flow according to the ratio of the total drainage area to the gage drainage area; then (2) W_S must be added to represent the total inflow to Lake Aldred.

Information about the respective gages and details of the computations to estimate $\mathbf{Q_{LI}}$ are presented below.

Primary Gage for MSFOP:

> **STATION.**--01576754 CONESTOGA RIVER AT CONESTOGA, PA
> **LOCATION.**--Lat 39°56'47", long 76°22'05", Lancaster County, Hydrologic Unit 02050306, on left bank on SR 3030, 1,500 ft downstream

from Little Conestoga Creek, 1.0 mi west of Conestoga, and 2.6 mi upstream from mouth.
DRAINAGE AREA.--470 mi^2.
PERIOD OF RECORD.--October 1984 to current year.
GAGE.--Water-stage recorder. Datum of gage is 180.45 ft above sea level.

Internet access for real-time flows
(http://waterdata.usgs.gov/nwis/uv?01576754)
Phone access? _____

Estimated local inflow to Lake Aldred (cfs) based on Conestoga gage
Drainage area ratio = 686/470 = 1.46
Estimated local inflow = 1.46 x (gage cfs – W_S cfs) + W_S cfs
= (1.46 x gage cfs)- 7 cfs
Where W_S = 15 cfs is the nominal average flow diverted by the City of Lancaster from above Safe Harbor Dam and discharged to the Conestoga River above the gage

Backup Gage for MSFOP:

STATION.--01576500 CONESTOGA RIVER AT LANCASTER, PA
LOCATION.--Lat 40°03'00", long 76°16'39", Lancaster County, Hydrologic Unit 02050306, on left bank at Penn Central Railroad bridge, 50 ft downstream from small right-bank tributary, 500 ft downstream from diversion dam at city water plant, and 0.7 mi east of Lancaster.
DRAINAGE AREA.--324 mi2.
PERIOD OF RECORD.--October 1928 to March 1932; August, September 1932; April 1933 to current year. Prior to October 1973, published as Conestoga Creek at Lancaster.
GAGE.--Water-stage recorder and concrete control. Datum of gage is 245.63 ft above sea level. Prior to May 1, 1933, at site 600 ft upstream at different datum, excluding small tributary.

Internet access for real-time flows
(http://waterdata.usgs.gov/nwis/uv?01576500)
Phone access? _____

Estimated local inflow to Lake Aldred (cfs) based on Lancaster gage
Drainage area ratio = 686/324 =2.12
Estimated local inflow = 2.12 x (gage cfs + W_C cfs) + W_S cfs
= (2.12 x gage cfs) + 47 cfs

Where W_C = 15 cfs is the nominal average flow diverted by the City of Lancaster from above the gage and discharged to the Conestoga River below the gage and W_S = 15 cfs is the nominal average flow diverted by the City of Lancaster from above Safe Harbor Dam and discharged to the Conestoga River below the gage.

The selected gage (Conestoga when available) will be indicated on the Minimum Flow Log Sheet (APPENDIX L). Hourly gage readings will be entered, and the hourly local inflows ($\mathbf{Q_{LI}}$) will be calculated automatically from the gage readings.

APPENDIX K – NET LAKE EVAPORATION

The surface area of Lake Aldred varies with lake level approximately as shown in Table K-1.

Table K-1 Approximate Lake Aldred Surface Area

Lake Level	Area (acres)
169.75	2,650
169.00	2,600
168.00	2,550
167.00	2,450
166.00	2,400
165.00	2,300
164.00	2,150
163.50	2,000

Within the range of precision appropriate for estimating the water lost to net evaporation, the MSFOP assumes a constant lake surface area of 2,600 acres.

SRBC Evaporation

The SRBC has developed a regionalized guidance estimate for pond evaporations in the Susquehanna River Basin for use in calculating pond evaporation under the SRBC's consumptive use regulation. (EXHIBIT K1) Applying the monthly amounts of pond evaporation (net of direct precipitation) as proposed by SRBC and assuming an effective lake area of 2,600 acres would result in the nominal equivalent monthly losses at Holtwood shown in Table K-2:

Table K-2 Nominal Monthly Net Evaporation from Lake Aldred

Month	SRBC-proposed Evaporation (inches)	Lake Aldred Net Evaporation (cfs or cfs-hrs per hour)
January	0	0
February	0	0
March	0	0
April	3.0	11
May	4.9	15
June	5.4	16
July	5.8	17
August	4.9	15
September	3.6	13
October	2.4	9
November	0	0
December	0	0

For purposes of this MSFOP the allowance for net evaporation from Lake Aldred ($\mathbf{Q_E}$) will be as follows:

- zero from November through March
- 15 cfs from April through October.

Net evaporation from Lake Aldred will be considered to be constant every hour of each month.

Reference Evaporation Determined from Weather Data

The Northeast Regional Climate Center (Cornell) calculated monthly Class A pan evaporation rates from weather data at the meteorological stations at Harrisburg (Middletown), Lancaster, York and Baltimore (BWI). These data are summarized below, as averages by month, and presented here only for reference. *To derive corresponding estimates of net lake evaporation would require application of a standard pan coefficient (lake evaporation = 0.7 x pan evaporation) and consideration of direct precipitation.*

	Calculated Average Monthly Pan Evaporation (inches)			
	Harrisburg	Lancaster	York	Baltimore
	Sep 1991-2007	Aug 1996-2007	Sep 1997-2007	1950-2007
January	1.01	0.97	0.96	1.27
February	1.55	1.53	1.52	1.76
March	2.82	2.84	2.84	3.15
April	4.28	4.28	4.32	4.50
May	5.81	5.91	5.93	5.82
June	6.35	6.45	6.57	6.60
July	6.76	7.06	7.14	6.86
August	5.92	6.06	6.21	6.02
September	4.29	4.21	4.30	4.55
October	2.89	2.76	2.72	3.22
November	1.53	1.50	1.55	1.82
December	1.02	0.97	0.99	1.21

EXHIBIT K1 SRBC Pond Evaporation Reference Document

POND EVAPORATION

These values are to be used to calculate pond evaporation for the Susquehanna River Basin Commission's Consumptive Use Regulation.

Month	Inches of Evaporation*
January	0
February	0
March	0
April	3.0
May	4.9
June	5.4
July	5.8
August	4.9
September	3.6
October	2.4
November	0
December	0

***Inches of Evaporation** are averages for the Susquehanna River basin and account for rainfall for each month. These averages are based on pan evaporation at various climatological stations. Penn State University then converted the numbers to reflect Lake Evaporation.

The following is a sample calculation of daily average pond evaporation for a 2.5-acre pond for the month of July. Please note that the size of your particular irrigation pond(s) and the month will directly affect your calculations. This calculation should be completed for each month and each pond.

EXAMPLE:

Pond Size = 2.5 acres
Inches of Evaporation for July = 5.8 inches

$$5.8 \text{ in.} \times \frac{1 \text{ ft.}}{12 \text{ in.}} \times 2.5 \text{ ac.} \times \frac{43{,}560 \text{ sq. ft.}}{\text{ac.}} \times \frac{7.48 \text{ gal.}}{\text{cu. ft.}} = \frac{393{,}709.75 \text{ gal.}}{\text{month of July}}$$

$$\frac{393{,}709.75 \text{ gal.}}{31 \text{ days}} = \frac{\mathbf{12{,}700 \text{ gal.}}}{\mathbf{day}}$$

This is the daily average of pond evaporation from a 2.5 acre pond for the month of July. This number should be recorded daily and included in your total consumptive water use calculations. The appropriate daily value should be calculated and recorded for each month.

APPENDIX L – DATA ENTRY (MINIMUM FLOW LOG SHEET)

This appendix provides two versions of a proposed daily data entry form or log sheet, the first for the existing project and the second for the redeveloped project. In either case, the data entry form would be an electronic spreadsheet that would include all the computations and data manipulations necessary to determine and verify the required minimum flows. Entries would be hourly entries. [*The data entry forms included in this appendix need to be tested to ensure compatibility with this MSFOP and consequently may require further revision.]*

Completion of the forms will be suspended whenever the lake level (forebay) exceeds Elevation 171.0 ft. With current flashboards in place, the spill at this elevation would be in excess of 10,000 cfs (see Exhibit D1).

For convenience of presentation in this manual, the daily data entry forms are separated into multiple pages.

MINIIMUM FLOW LOG SHEET- **EXISTING PROJECT**: __month/day/year__ Sheet 1 of 8

Initial data:

[A] Marietta gage flow (prior day): _____ cfs
[B] QFERC: _____ cfs
[C] 98.7 percent Conowingo required flow: _____cfs-hrs = 24 x 0.987 x lesser of [A], [B]
[D] Carry-over daily volume deficit from prior day: _____ cfs-hours = [P] or [S] from prior day (may be negative)
[E] Equivalent lake level excess from prior day: _____ ft = [D] / 31,200 (may be negative)
[F] Carry-over six-hour running average deficit from prior day: _____ cfs = [T] from prior day (may be negative)
[G] Allowance for net lake evaporation: _____ cfs
[H] Estimated percent of wooden flashboards in place: ___ % (100 to 0)
[I] Holtwood forebay elevation at 0300 hrs of prior day: ____ ft
[J] Holtwood tailrace elevation at 0300 hrs of prior day: ____ ft

Results (calculated automatically):

[K] Net inflow (Q_{NI}) : _____ cfs-hrs = total of Column G of log sheet for 0400 through 0300 hours
[L] Holtwood flow = _____ cfs-hrs = total of Column BE of log sheet for 0400 through 0300 hours

Average Holtwood flow (Q_H) = ___ cfs = [L] / 24

Average Holtwood units' leakage = ____ cfs = average of Column AP of log sheet for 0400 through 0300 hours

[M] Holtwood forebay elevation at end of day = ___ ft = entry in Column H of log sheet at 0300 hours
[N] Holtwood tailrace elevation at end of day = ____ ft = entry in Column J of log sheet at 0300 hours

If [K] is greater than or equal to [C]

[O] Holtwood daily minimum flow requirement = _____ cfs-hrs = [C] + [D]
[P] Carry-over daily volume deficit to next day = _____ cfs-hrs = [O] – [L], zero if [O] – [L] is negative

If [K] is less than [C]

[Q] Holtwood end-day lake level requirement = ____ ft = [I] – [E]
[R] Lake level excess for day = ____ ft = [M] – [Q] (may be negative)
[S] Carry-over daily volume deficit to next day = _____ cfs-hrs = 31,200 x [R] (may be negative)

[T] Carry-over six-hour running average deficit: ___ cfs = Column BL of log sheet at 0300 hours (may be negative)

MINIIMUM FLOW LOG SHEET- **EXISTING PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	A	B_1	B_2	B_3	C	D [1]	E [1]	F [2]	G
Hour ending	Scheduled SH gen flow	Actual SH gen flow	SH leakage (assumed)	SH trash sluice flow	Total SH flow (A or B_1) + B_2 + B_3 Q_{SH}	Flow at reference gage [3]	Local inflow Q_{LI} [4]	Evaporation allowance Q_E [4]	Expected or actual net inflow Q_{NI} C + E - F [4]
0400			210						
0500			210						
0600			210						
0700			210						
0800			210						
0900			210						
1000			210						
1100			210						
1200			210						
1300			210						
1400			210						
1500			210						
1600			210						
1700			210						
1800			210						
1900			210						
2000			210						
2100			210						
2200			210						
2300			210						
2400			210						
0100			210						
0200			210						
0300			210						

[1] Entries in these columns are constant for the day unless Column C can be entered automatically [2] Entries in this column are constant for the day

[3] Reference gage check one: Conestoga River at Conestoga __; Conestoga River at Lancaster (backup) ___

[4] Entered automatically by spreadsheet for current day

MINIIMUM FLOW LOG SHEET- **EXISTING PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Powerhouse water levels			
	H	I	J	K
Hour ending	forebay elev end hr (ft)	forebay elev average (ft) [4]	tailrace elev end hr (ft)	tailrace elev average (ft) [4]
0400				
0500				
0600				
0700				
0800				
0900				
1000				
1100				
1200				
1300				
1400				
1500				
1600				
1700				
1800				
1900				
2000				
2100				
2200				
2300				
2400				
0100				
0200				
0300				

[4] Entered automatically by spreadsheet for current day

MINIIMUM FLOW LOG SHEET- **EXISTING PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

		Flow to Tailrace (continued next sheet)											
		Unit 1		Unit 2		Unit 3		Unit 4		Unit 5		Units 1-5	
	L	M	N	O	P	Q	R	S	T	U	V	W	X
Hour ending	avg head I – K (ft) [4]	gen flow Q_1	leakage Q_{1L} [6]	gen flow Q_2	leakage Q_{2L} [6]	gen flow Q_3	leakage Q_{3L} [6]	gen flow Q_4	leakage Q_{4L} [6]	gen flow Q_5	leakage Q_{5L} [6]	gen flow M+O+Q +S+U [4]	leakage N+P+R+T+V [4]
0400													
0500													
0600													
0700													
0800													
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2200													
2300													
2400													
0100													
0200													
0300													

[4] Entered automatically by spreadsheet for current day

Note: Footnote [5] is omitted from this draft

[6] If gen flow = 0, enter leakage flow

MINIIMUM FLOW LOG SHEET- **EXISTING PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

		Flow to Tailrace (continued from prior sheet)											
		Unit 6		Unit 7		Unit 8		Unit 9		Unit 10		Units 6-10	
	L (repeated)	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
Hour ending	avg head I - K (ft) [4]	gen flow Q_6	leakage Q_{6L} [6]	gen flow Q_7	leakage Q_{7L} [6]	gen flow Q_8	leakage Q_{8L} [6]	gen flow Q_9	leakage Q_{9L} [6]	gen flow Q_{10}	leakage Q_{10L} [6]	gen flow Y+AA+AC +AE+AG [4]	leakage Z+AB +AD+AF +AH [4]
0400													
0500													
0600													
0700													
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[4] Entered automatically by spreadsheet for current day

[6] If gen flow = 0, enter leakage flow

APPENDIX L (continued)

MINIIMUM FLOW LOG SHEET- **EXISTING PROJECT**: __month/day/year__ Sheet 6 of 8

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Fish Lift				Powerhouse			Flows to Piney Channel excluding Fish Lift						Piney Channel
	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX
Hour ending	entrnce A Q_{FLA}	entrnce B Q_{FLB}	entrnce C Q_{FLC}	total Q_{FL} AK+AL+ AM [4]	total gen flow W + AI [4]	total leakage X + AJ [4]	total tailrace flow Q_T AK+AL +AO+AP [4]	Trash sluice operating ? Y/N	Trash sluice flow Q_{TS} [4]	Spill over Section 1 Q_{S1} [4]	Spill over Section 2 Q_{S2} [4]	Spill over Section 3 Q_{S3} [4]	Spill over Section 4 (partial) Q_{S4E} [4]	total flow Q_{PC} AM + AS + AT + AU + AV + AW [4]
0400														
0500														
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0800														
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[4] Entered automatically by spreadsheet for current day

MINIMUM FLOW LOG SHEET- **EXISTING PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Flow to Spillway Area					
	AY	AZ	BA	BB	BC	BD
Hour ending	10-in pipe flow Q_P [4]	Wooden flashboard leakage Q_{WFL} [4]	Spill over wooden flashboards Q_{SWF} [4]	Spill over dam crest Q_{SDC} [4]	Spill over Section 4 (partial) Q_{S4W} [4]	Spillway Area flow Q_{SA} AY + AZ + BA + BB + BC [4]
0400						
0500						
0600						
0700						
0800						
0900						
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0300						

[4] Entered automatically by spreadsheet for current day

MINIIMUM FLOW LOG SHEET- **EXISTING PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

						deficit if BG = 800	deficit if BG < 800	deficit	
		BE	BF	BG	BH	BI	BJ	BK	BL
	Hour ending	Hltwd flow Q_H = Q_T + Q_{PC} + Q_{SA} AQ + AX + BD [4]	carryover deficit (+) or credit (-) BL from prior hour [4]	Lesser of G and 800 [4]	Target Flow Q_{TF} BF + BG [4]	BH - BE (enter "X" if negative) [4]	BH- BE (may be negative) [4]	BI or BJ (may be negative) [4]	6-hr running average of BK [4]
Prior Operating Day	2300								
	2400								
	0100								
	0200								
	0300								
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	0200								
	0300								

[4] Entered automatically by spreadsheet for current day

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: __month/day/year__ Sheet 1 of 11

Initial data:

[A] Marietta gage flow (prior day): _____ cfs

[B] QFERC: _____ cfs

[C] 98.7 percent Conowingo required flow: _____cfs-hrs = 24 x 0.987 x lesser of [A], [B]

[D] Carry-over daily volume deficit from prior day: _____ cfs-hours = [P] or [S] from prior day (may be negative)

[E] Equivalent lake level excess from prior day: _____ ft = [D] / 31,200 (may be negative)

[F] Carry-over six-hour running average deficit from prior day: _____ cfs = [T] from prior day (may be negative)

[G] Allowance for net lake evaporation: _____ cfs

[H] Estimated percent of wooden flashboards in place: ___ % (100 to 0)

[I] Holtwood forebay elevations at 0300 hrs of prior day:

[I-E] Existing powerhouse: ____ ft

[I-N] New powerhouse: ____ ft

[J] Holtwood tailwater elevations at 0300 hrs of prior day:

Existing powerhouse: ____ ft

New powerhouse: ____ ft

Unit 1/Fish lift: ____ ft

Results (calculated automatically, continued on next sheet):

[K] Net inflow (Q_{NI}): _____ cfs-hrs = total of Column G of log sheet for 0400 through 0300 hours

[L] Holtwood flow = _____ cfs-hrs = total of Column CF of log sheet for 0400 through 0300 hours

Average Holtwood flow (Q_H) = ___ cfs = [L] / 24

Average Holtwood leakage from units = ___ cfs = average of sum of Columns AR + AZ + BN of log sheet for 0400 through 0300 hours

Average Tailrace flow (Q_T) = ____ cfs = average of Column BJ of log sheet

Average Piney Channel flow (Q_{PC}) = ____ cfs = average of Column BY of log sheet

Average Spillway Area flow (Q) = ___ cfs = average of Column CE of log sheet

[M] Holtwood forebay elevations at end of day

Existing Powerhouse = ___ ft = entry in Column H of log sheet at 0300 hours

New Powerhouse = ____ ft = entry in Column L of log sheet at 0300 hours

[N] Holtwood tailwater elevations at end of day

Existing Powerhouse = ____ ft = entry in Column J of log sheet at 0300 hours

New Powerhouse = ___ ft = entry in Column N of log sheet at 0300 hours

Unit 1/Fish lift = ____ ft = entry in Column P of log sheet at 0300 hours

(continued on next sheet)

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: __month/day/year__ Sheet 2 of 11

Results (calculated automatically, continued from prior sheet):

If [K] is greater than or equal to [C]

[O] Holtwood daily minimum flow requirement = _____ cfs-hrs = [C] + [D]

[P] Carry-over daily volume deficit to next day = _____ cfs-hrs = [O] – [L], zero if [O] – [L] is negative

If [K] is less than [C]

[Q] Holtwood end-day lake level requirement = ____ ft = [I-E] – [E]

[R] Lake level excess for day = ____ ft = [M] – [Q] (may be negative)

[S] Carry-over daily volume deficit to next day = _____ cfs-hrs = 31,200 x [R] (may be negative)

[T] Carry-over six-hour running average deficit: ___ cfs = Column CM of log sheet at 0300 hours (may be negative)

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: __month/day/year__ Sheet 3 of 11

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	A	B_1	B_2	B_3	C	D [1]	E [1]	F [2]	G
Hour ending	Scheduled SH gen flow	Actual SH gen flow	SH leakage (assumed)	SH trash sluice flow	Total SH flow (A or B_1) + B_2 + B_3 Q_{SH}	Flow at reference gage [3]	Local inflow Q_{LI} [4]	Evaporation allowance Q_E [4]	Expected or actual net inflow Q_{NI} C + E - F [4]
0400			210						
0500			210						
0600			210						
0700			210						
0800			210						
0900			210						
1000			210						
1100			210						
1200			210						
1300			210						
1400			210						
1500			210						
1600			210						
1700			210						
1800			210						
1900			210						
2000			210						
2100			210						
2200			210						
2300			210						
2400			210						
0100			210						
0200			210						
0300			210						

[1] Entries in these columns are constant for the day unless Column C can be entered automatically [2] Entries in this column are constant for the day

[3] Reference gage check one: Conestoga River at Conestoga __; Conestoga River at Lancaster (backup) ___

[4] Entered automatically by spreadsheet for current day

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: __month/day/year__

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Existing Powerhouse				New Powerhouse				Unit 1 & Fish Lift	
	H	I	J	K	L	M	N	O	P	Q
Hour ending	forebay elev end hr (ft)	forebay elev average (ft) [4]	tailwater elev end hr (ft)	tailwater elev average (ft) [4]	forebay elev end hr (ft)	forebay elev average (ft) [4]	tailwater elev end hr (ft)	tailwater elev average (ft) [4]	tailwater elev end hr (ft)	tailwater elev average (ft) [4]
0400										
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0300										

[4] Entered automatically by spreadsheet for current day

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Existing Powerhouse	Flow to Tailrace from Existing Powerhouse (continued next sheet)											
		Unit 2		Unit 3		Unit 4		Unit 5		Unit 6		Units 2-6	
	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
Hour ending	avg head I – K (ft) [4]	gen flow Q_2	leakage Q_{2L} [6]	gen flow Q_3	leakage Q_{3L} [6]	gen flow Q_4	Leakage Q_{4L} [6]	gen flow Q_5	leakage Q_{5L} [6]	gen flow Q_6	leakage Q_{6L} [6]	gen flow S+U+W +Y+AA [4]	leakage T+V+X +Z+AB [4]
0400													
0500													
0600													
0700													
0800													
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2400													
0100													
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0300													

[4] Entered automatically by spreadsheet for current day

Note: Footnote [5] is omitted in this draft

[6] If gen flow = 0, enter leakage flow

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Existing Powerhouse	Flow to Tailrace from Existing Powerhouse (continued from prior sheet)											
		Unit 7		Unit 8		Unit 9		Unit 10		Unit 11	Unit 13	Units 7-10, 11, 13	
	R (repeated)	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP
Hour ending	avg head I – K (ft) [4]	gen flow Q_7	leakage Q_{7L} [6]	gen flow Q_8	leakage Q_{8L} [6]	gen flow Q_9	leakage Q_{9L} [6]	gen flow Q_{10}	leakage Q_{10L} [6]	gen flow Q_{11}	gen flow Q_{13}	gen flow AE+AG+AI +AK+AM+AN [4]	leakage AF+AH +AJ+AL [4]
0400													
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0300													

[4] Entered automatically by spreadsheet for current day

[6] If gen flow = 0, enter leakage flow

MINIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Existing Powerhouse (excluding Unit 1)			New Powerhouse								Fish Lift flows			
					Unit 18		Unit 19		Units 18, 19						
	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE
hour ending	gen flow AC + AO [4]	leakage AD + AP [4]	total flow AQ + AR [4]	average head M − O (ft) [4]	gen flow Q_{18}	leakage Q_{18L} [6]	gen flow Q_{19}	leakage Q_{19L} [6]	gen flow AU + AW [4]	leakage AV + AX [4]	total AY + AZ [4]	entrance A Q_{FLA}	entrance B Q_{FLB}	entrance C Q_{FLC}	total Q_{FL} BB+BC +BD [4]
0400															
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0300															

[4] Entered automatically by spreadsheet for current day

[6] If gen flow = 0, enter leakage flow

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Tailrace Flow					
	BF	BG	BH	BI	BJ	BK
Hour ending	gen flow AQ + AY [4]	leakage AR + AZ [4]	total both powerhouses BF + BG [4]	Fish Lift flow BB + BC [4]	Total Q_T BH + BI [4]	Total w/o leakage BJ – BG [4]
0400						
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[4] Entered automatically by spreadsheet for current day

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: __month/day/year__

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Unit 1 (redeveloped)				Miscellaneous flows to Piney Channel									Piney Channel
	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY
Hour ending	avg head I – Q (ft) [4]	gen flow Q_{1R}	leakage Q_{1RL} [6]	total flow BM+BN [4]	Trash sluice operating? Y/N	Trash sluice flow Q_{TS} [4]	elev Sect 1 (ft)	flow over Sect 1 Q_{OG1} [4]	elev Sect 2 (ft)	flow over Sect 2 Q_{OG2} [4]	elev Sect 3 (ft)	flow over Sect 3 Q_{OG3} [4]	spill over Sect 4 (partial) Q_{S4E}[4]	Q_{PC} BD+BO+BQ+BS +BU+BW+BX [4]
0400														
0500														
0600														
0700														
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0300														

[4] Entered automatically by spreadsheet for current day

[6] If gen flow = 0, enter leakage flow

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: __month/day/year__ Sheet 10 of 11

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

	Flow to Spillway Area					
	BZ	CA	CB	CC	CD	CE
Hour ending	10-in pipe flow Q_P [4]	Wooden flashboard leakage Q_{WFL} [4]	Spill over wooden flashboards Q_{SWF} [4]	Spill over dam crest Q_{SDC} [4]	Spill over Section 4 (partial) Q_{S4W} [4]	Spillway Area flow Q_{SA} BZ + CA + CB + CC + CD [4]
0400						
0500						
0600						
0700						
0800						
0900						
1000						
1100						
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1300						
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2200						
2300						
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0100						
0200						
0300						

[4] Entered automatically by spreadsheet for current day

MINIIMUM FLOW LOG SHEET- **REDEVELOPED PROJECT**: month/day/year

ALL ENTRIES ARE CFS UNLESS OTHERWISE NOTED

						deficit if CH = 800	deficit if CH < 800	deficit	
		CF	CG	CH	CI	CJ	CK	CL	CM
	Hour ending	Hltwd flow Q_H = Q_T + Q_{PC} + Q_{SA} BJ + BY + CE [4]	carryover deficit (+) or credit (-) CM from prior hour [4]	Lesser of G and 800 [4]	Target Flow Q_{TF} CG + CH [4]	CI – CF (enter "X" if negative) [4]	CI - CF (may be negative) [4]	CJ or CK (may be negative) [4]	6-hr running average of CL [4]
Prior Operating Day	2300								
	2400								
	0100								
	0200								
	0300								
	0400								
	0500								
	0600								
	0700								
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[4] Entered automatically by spreadsheet for current day

APPENDIX M – DAILY MINIMUM FLOW REPORT

This appendix provides an Exelon and Agency data reporting form for providing information to the Agencies and Exelon concerning daily minimum flows at the Holtwood Project.

Holtwood Hydroelectric Project – FERC Project No. 1881-PA						
Daily Minimum Flow Report						
Date (mm/dd/yyyy): / /				Reference gage: Conestoga Lancaster		
Prior day daily release deficit (cfs-hrs):				Net lake evaporation (cfs):		
Hour Ending	Local Inflow (Q_{LI}) cfs	Net Inflow (Q_{NI}) cfs	Spillway Area Flow (Q_{SA}) cfs	Piney Ch. Flow (Q_{PC}) cfs	Tailrace Flow (Q_T) cfs	Total Flow (Q_H) cfs
0400						
0500						
0600						
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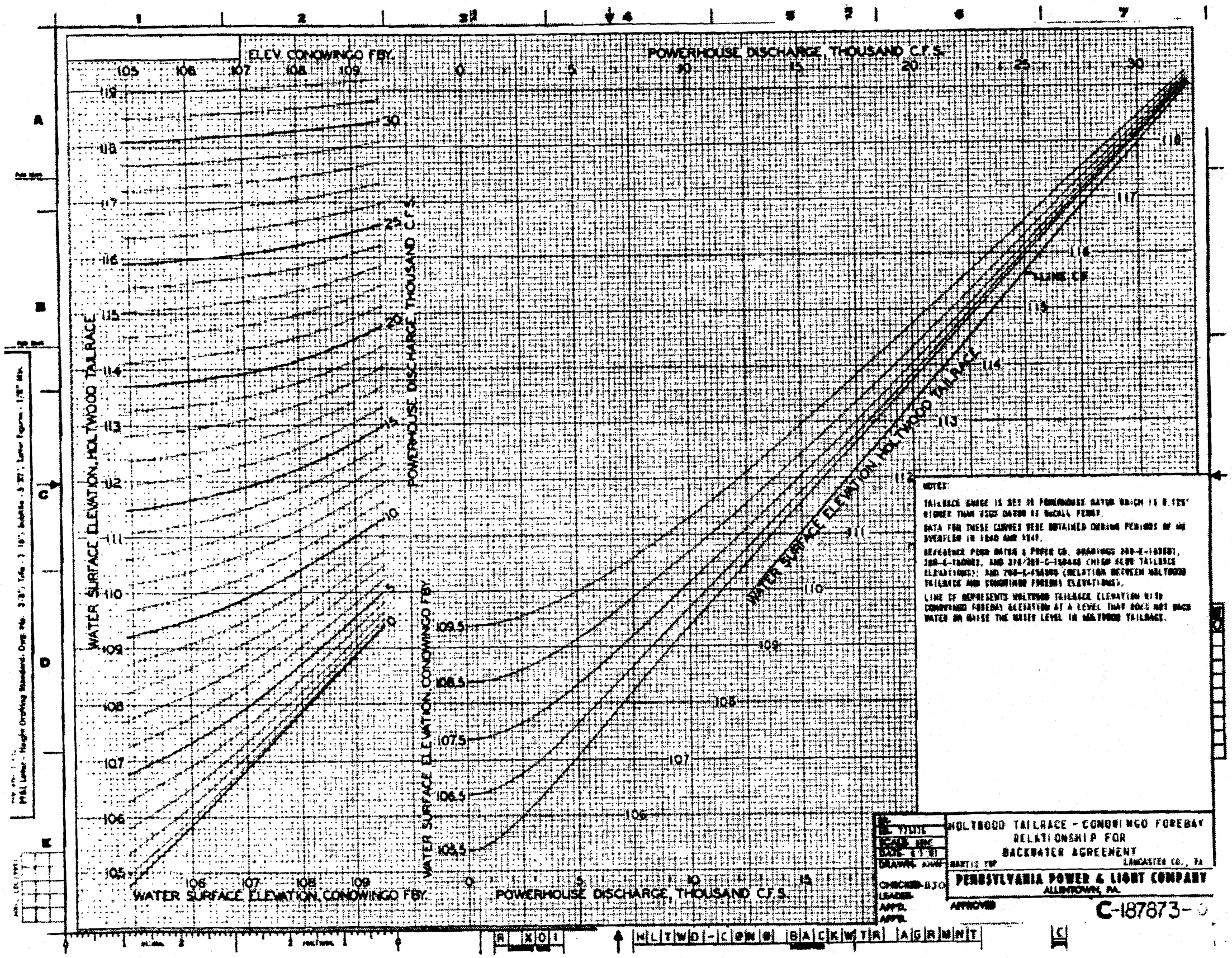
2400						
0100						
0200						
0300						
Total (cfs-hrs)						
Daily deficit (cfs-hrs)						

APPENDIX F:

PPL DRAWING C-187873



APPENDIX G:

EXAMPLES OF SOME CONTINUOUS MINIMUM FLOW SCENARIOS

Assumptions

Variable	Definition	Constant or Variable
Q_{LI}	Local Inflow between SH and Holtwood	Variable
Q_E	Reservoir Evaporation	Constant, 15 cfs
Q_{PC}	Piney Channel Flow	Constant, 200 cfs from storage, if needed
Q_P	10" pipe flow	Constant, 5 cfs
Q_{WF}	Flashboard Leakage	Constant, 15 cfs
Q_T	Holtwood Turbine Leakage	Constant, 205 cfs, when not operating
Q_{NI}	Net Inflow between SH and Holtwood	
$Q_{SHleakage}$	Safe Harbor Leakage	Constant, 210 cfs
$Q_{SHscheduled}$	Safe Harbor scheduled release	
$Q_{SHactual}$	Safe Habor actual release	
$Q_{Hscheduled}$	Holtwood scheduled release	
Q_{FC}	Holtwood flow correction rate	
$Q_{Hcorrected}$	Holtwood corrected release	

Scenario 1. Safe Harbor scheduled on 1-5 pm but is off (unscheduled) 3-4 pm. Holtwood release exceeds objective 3-4 pm.

Hour	$Q_{SHscheduled}$	$Q_{SHactual}$	Q_{LI}	Q_E	Q_{NI} =($Q_{SHactual}$ +Q_{LI}-Q_E)	Holtwood minimum flow objective (uncorrected)	Correction from 1st or 2nd prior hour	Corrected Holtwood minimum flow objective	Q_H Holtwood release	Correction if Q_{NI}<800 = corrected Holtwood objective - (Q_H or 800 cfs, whichever is less)	Correction if Q_{NI}>=800 = corrected Holtwood objective - Q_H [can't be negative]	Correction	Comments
1:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
2:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
3:00 PM	55000	210	310	15	505	505	0	505	5000	-295		-295	Holtwood release exceeds objective; schedule correction in second hour
4:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
5:00 PM	210	210	310	15	505	505	-295	210	420	-210		-210	The most PPL can reduce the net inflow
6:00 PM	210	210	310	15	505	505	-210	295	420	-125		-125	of 505 cfs is 85 cfs because the min
7:00 PM	210	210	310	15	505	505	-125	380	420	-40		-40	flow below Holtwood will always be 420
8:00 PM	210	210	310	15	505	505	-40	465	465	0		0	cfs.
9:00 PM	210	210	310	15	505	505	0	505	505	0		0	
10:00 PM	210	210	310	15	505	505	0	505	505	0		0	

Scenario 2. Safe Harbor scheduled on 1-10 pm but is off (unscheduled) 2-3 pm and 5-6 pm. Holtwood release exceeds objective 2-3 and 5-6 pm.

Hour	$Q_{SHscheduled}$	$Q_{SHactual}$	Q_{LI}	Q_E	Q_{NI} =($Q_{SHactual}$ +Q_{LI}-Q_E)	Holtwood minimum flow objective (uncorrected)	Correction from 1st or 2nd prior hour	Corrected Holtwood minimum flow objective	Q_H Holtwood release	Correction if Q_{NI}<800 = corrected Holtwood objective - (Q_H or 800 cfs, whichever is less)	Correction if Q_{NI}>=800 = corrected Holtwood objective - Q_H [can't be negative]	Correction	Comments
1:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
2:00 PM	55000	210	310	15	505	505	0	505	5000	-295		-295	Holtwood release exceeds objective; schedule correction in second hour
3:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
4:00 PM	55000	55000	310	15	55295	800	-295	505	5000		0	0	
5:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
6:00 PM	55000	210	310	15	505	505	0	505	5000	-295		-295	Holtwood release exceeds objective, schedule correction in second hour
7:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
8:00 PM	55000	55000	310	15	55295	800	-295	505	5000		0	0	
9:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
10:00 PM	210	210	310	15	505	505	0	505	505	0		0	

Scenario 3. Safe Harbor scheduled on/off operation 1-10 pm but is on continuously (unscheduled) 1-10 pm. Holtwood release is short of objective 2-3 and 6-7 pm.

Hour	$Q_{Srscheduled}$	$Q_{SHactual}$	Q_{LI}	Q_E	Q_{NI} =($Q_{SHactual}$ +Q_{LI}-Q_E)	Holtwood minimum flow objective (uncorrected)	Correction from 1st or 2nd prior hour	Corrected Holtwood minimum flow objective	Q_H Holtwood release	Correction if Q_{NI}<800 = corrected Holtwood objective - (Q_H or 800 cfs, whichever is less)	Correction if Q_{NI}>=800 = corrected Holtwood objective - Q_H [can't be negative]	Correction	Comments
1:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
2:00 PM	210	55000	310	15	55295	800	0	800	505		295	295	Holtwood release is less than objective; schedule correction in second hour
3:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
4:00 PM	55000	55000	310	15	55295	800	295	1095	5000		0	0	Holtwood release exceeds corrected objective
5:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
6:00 PM	210	55000	310	15	55295	800	0	800	505		295	295	Holtwood release is less than objective; schedule correction in second hour
7:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
8:00 PM	55000	55000	310	15	55295	800	295	1095	5000		0	0	Holtwood release exceeds corrected objective
9:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
10:00 PM	210	210	310	15	505	505	0	505	505	0		0	
11:00 PM	210	210	310	15	505	505	0	505	505	0		0	

Scenario 4. Safe Harbor scheduled on/off operation 1-10 pm but is on continuously (unscheduled) 1-8 pm. Holtwood release is short of objective 2-3 and 6-7 pm.

Hour	$Q_{SHscheduled}$	$Q_{SHactual}$	Q_{LI}	Q_E	Q_{NI} =($Q_{SHactual}$ +Q_{LI}-Q_{EI})	Holtwood minimum flow objective (uncorrected)	Correction from 1st or 2nd prior hour	Corrected Holtwood minimum flow objective	Q_H Holtwood release	Correction if Q_{NI}<800 = corrected Holtwood objective - (Q_H or 800 cfs, whichever is less)	Correction if Q_{NI}>=800 = corrected Holtwood objective - Q_H [can't be negative]	Correction	Comments
1:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
2:00 PM	210	55000	310	15	55295	800	0	800	505		295	295	Holtwood release is less than objective; schedule correction in second hour
3:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
4:00 PM	55000	55000	310	15	55295	800	295	1095	5000		0	0	Holtwood release exceeds corrected objective
5:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
6:00 PM	210	55000	310	15	55295	800	0	800	505		295	295	Holtwood release is less than objective; schedule correction in second hour
7:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
8:00 PM	210	210	310	15	505	505	295	800	800	0		0	Holtwood releases 800 to meet corrected objective
9:00 PM	55000	55000	310	15	55295	800	0	800	5000		0	0	
10:00 PM	210	210	310	15	505	505	0	505	505	0		0	
11:00 PM	210	210	310	15	505	505	0	505	505	0		0	

Scenario 5. Safe Harbor releases from 1:00 to 1:15 pm. Holtwood release meets objective based on volumetric average Q_{NI} for the hour.

Note: This example is presented in 15-minute intervals to illustrate part-hour SH operation. However, Holtwood will log and report data in one-hour intervals only.

Hour	$Q_{SHscheduled}$	$Q_{SHactual}$	Q_{LI}	Q_E	Q_{NI} =($Q_{SHactual}$+ Q_{LI}-Q_E)	Volumetric average Q_{NI}	Holtwood minimum flow objective (uncorrected)	Correction from 1st or 2nd prior hour	Corrected Holtwood minimum flow objective	Q_H Holtwood release	Correction if Q_{NI}<800: = corrected Holtwood objective - (Q_H or 800 cfs, whichever is less)	Correction if Q_{NI}>=800: = corrected Holtwood objective - Q_H [can't be negative]	Correction	Comments
1:00 PM	55000	55000	310	15	55295									At 1:15 pm, SH discharge is reduced to leakage. Holtwood must meet hourly release of 800 cfs because volumetric average net inflow is equal to or greater
1:15 PM	210	210	310	15	505									
1:30 PM	210	210	310	15	505									
1:45 PM	210	210	310	15	505	14203	800	0	800	800		0	0	
2:00 PM	210	210	310	15	505		505	0	505	505	0		0	
3:00 PM	210	210	310	15	505		505	0	505	505	0		0	

CERTIFICATE OF SERVICE

Pursuant to Rule 2010 of the Commission's Rules of Practice and Procedure, I hereby certify that I have on this day caused the foregoing "PPL Holtwood, LLC Offer of Settlement and Explanatory Statement" to be served upon each person designated on the official service list compiled by the Secretary in Project No. 1881.

Dated at Washington, DC this 23rd day of October, 2008.

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