FILED ELECTRONICALLY

December 16, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

SUBJECT: Braddock Locks and Dam Hydroelectric Project (FERC No. 13739-002)
Response to the Army Corps of Engineers' Pittsburgh District
Request for Additional Studies

Dear Secretary Bose:

In response to the Federal Energy Regulatory Commission's (Commission) September 28, 2012 *Notice of Application Tendered for Filing with the Commission and Soliciting Additional Study Requests*, the U.S. Army Corps of Engineers' Pittsburgh District (USACE) submitted study requests based on the Application for Original License filed by Lock+™ Hydro Friends Fund XLII, LLC (Hydro Friends Fund) on September 17, 2012. This filing is in response to the USACE Pittsburgh District's request for additional studies.

Hydro Friends Fund appreciates the opportunity to comment on the study requests of USACE and looks forward to the Commission's efforts to continue to review the Braddock Locks & Dam Project in a thoughtful and timely manner.

Please contact me by phone at (877) 556-6566 ext. 711 or email at mark@hgenergy.com if additional information is needed, or if there are any questions or concerns.

Sincerely,

Mark R. Stover
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Enclosure

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Introduction

Lock+™ Hydro Friends Fund XLII, LLC (Hydro Friends Fund) is in receipt of the additional study requests that were filed with the Commission by the Pittsburgh District of the U.S. Army Corps of Engineers ("USACE" or "District") on November 16, 2012. Consistent with the conversations with representatives from the District during the December 5, 2012 project scoping meeting in Pittsburgh, Pennsylvania, as well as previous conversations with the District and the Commission, Hydro Friends Fund filed the results of the 2012 water quality monitoring study with the Commission on December 7, 2012. In addition, Hydro Friends Fund distributed copies of the Water Quality Study Report with applicable agencies including the District, via mail on December 7th. The District confirmed receipt of the report on December 10, 2012. This extensive, seasonal water quality study was performed as a result of a request made by the Pittsburgh District following the Joint Agency Public Meetings that were held on March 7, 2012 in Pittsburgh, PA.

The Water Quality Study Report is a compilation of the continuous and discrete water quality monitoring that was conducted during 2012, as well as the results of the water quality modeling effort and the evaluation of the historical data performed by Hydro Friends Fund. Given that data was collected until September 27, 2012 (in order to capture the specific period of interest expressed by the District), as well and the large volume of data associated with the field effort and the associated analysis, December 7, 2012 was the earliest that the report could be finalized and distributed. Now that the report has been made available, Hydro Friends Fund believes that the report, in conjunction with the extensive information presented in the September 17, 2012 FERC License Application, will address the Pittsburgh District's additional study requests and allow the Commission to move forward with its required environmental review of the project.

As specified in the license application, the proposed Project would operate in run-of-release mode, and would not impound additional water, result in additional storage capacity, or affect USACE operations. As indicated by the results of the Water Quality Study, which included the use of an Acoustic Doppler Current Profiler (ADCP) to measure flow velocities and directions under both the baseline and proposed operating conditions, the proposed project will result in

very limited changes to flow distribution within the immediate tailrace of the Project, but will have no negative impact on water quality, including downstream dissolved oxygen (DO) levels, or aquatic habitat.

Regarding DO levels, as presented in the study reports and the license application, DO levels both upstream and downstream of the Project have been historically well above the minimum state standards. Similar results were found during the continuous and discrete water monitoring conducted in 2012. In fact, most DO concentrations measured during 2012 were well above 7 mg/L. Furthermore, as presented in the study report, given the high level of percent saturation of water both upstream and downstream of the project, there is no indication that proposed project operations will have any environmental or ecological impact to the aquatic environment associated with the project area or any area downstream of the project.

Within the District's request for additional studies, the "Lower Mon Project" is referenced a number of times. Regarding this project and the pending removal of Monongahela Lock and Dam No. 3 at Elizabeth, PA and the modifications that are planned for Monongahela Lock and Dam No. 4 as part of the project, Hydro Friends Fund provides the following.

- Based on consultation with the District, it appears that this project may not be completed until 2030.
- Based on Railsback, S. F. et al. (1990)[1], due to the geometry and limited plunge depth of water passing over the spillway associated with Monongahela Lock and Dam No. 3, the spillway structure provides very limited DO enhancement. Based on this evaluation performed by the Oak Ridge National Laboratory, the same is true for the former Monongahela Locks and Dam No. 2 spillway structure. In particular, Railsback concluded that "…Monongahela 3 and 2 are fixed-crest dams where we observed that air

[1] Railsback, S. F. et al. (1990). Aeration at Ohio River Basin Navigation Dams. *Journal of Environmental Engineering* , 361-375.

gets entrained as water crests the dam, but the structures prevent the flow from plunging very far beneath the surface of the downstream pool. This design feature appears to prevent the entrained air from dissolving in significant quantities." Therefore, Hydro Friends Fund requests that the greatly limited ability of the Monongahela Lock and Dam No. 3 and the former Monongahela Locks and Dam No. 2 spillway structures be fully considered when discussing the potential water quality impacts associated with the Lower Mon Project. Based on consultation with staff of the Planning and Environmental Branch of the Pittsburgh District, staff was not aware of this evaluation or publication. Hydro Friends Fund has since provided the District with a copy of the publication.

- The Braddock Locks and Dam pool is currently being maintained at the "interim" elevation of 721.8 feet msl, as compared to the previous pool elevation of 718.7 feet msl. Therefore, the eventual raise (potentially by 2030) of the Braddock pool to 723.7 feet msl will result in a raise of 1.9 feet, as compared to the full 5.0 feet that District staff has mentioned of numerous occasions. Data shows that the pool raise that has already occurred has not produced negative impacts to water quality, so it is difficult to image the additional pool raise (which will be lesser in scope than the previous pool raise) introducing significant new impacts, as District staff has contended.
- As noted in the License Application, the Youghiogheny River and Turtle Creek discharge into the Monongahela River downstream of the current Monongahela Lock and Dam No. 3, and upstream of the Braddock Locks and Dam. In addition, the Alleghany River converges with the Monongahela River downstream of the Braddock Locks and Dam and upstream of the Emsworth Locks and Dam to form the Ohio River. These relations will continue to exist following the completion of the Lower Mon Project in 2030. Hydro Friends Fund contends that the volume of water provided by these two rivers, in conjunction with the percent saturation associated with the water upstream of the Braddock Locks and Dam has a much greater influence on potential water quality than the proposed Lower Mon Project.
- Based on consultation with the Planning and Environmental Branch of the Pittsburgh District, no modeling data or design goals/criteria exist for Gate No. 1. Therefore, the District is not aware of the aeration limits of the gate or the flows at which maximum

aeration is achieved. For example, the gate may maximize its benefit to the system with 1,000 cfs flowing through the gate as with any greater flow. Based on the results of the Water Quality Study, the aeration benefits of Gate 1 were very limited and local (approximately 0.1 mg/L), and usually temporary in nature due to the existing higher percent saturation levels. Monitoring indicates that due to these upstream and downstream levels, water DO levels quickly equilibrate with atmospheric conditions as the flow leaves Gate No. 1 and travels downstream. District staff contends that the environmental benefits of Gate are realized far downstream and into the Ohio River. This claim is proven incorrect with gathered data.

Regarding the NEPA process initiated by the Commission, given the small footprint and low-impact nature of the proposed project, Hydro Friends Fund is surprised by the District's decision not to act as a cooperating agency in this licensing process. Although within the discretion of the District to pursue a separate NEPA process, given the March 2011 hydropower licensing Memorandum of Understanding (MOU) between the USACE and FERC, which was touted by high-level USACE staff and officials, as well as associated conversations with USACE personnel in Washington, D.C., this decision is inconsistent with the USACE's desire to help improve and streamline the licensing and permitting processes[2].

Regarding the District's request for additional study activities to assess the potential for cumulative impacts associated with "stacked hydro," Hydro Friends Fund does not understand the reason for the request and is firmly opposed to such as request. For one, there are no hydroelectric facilities upstream of the Braddock Locks and Dam on the Monongahela River. In addition, there are no hydroelectric facilities associated with the four downstream Ohio River lock and dams. Hydro Friends Fund believes that it would be wholly inappropriate and a highly inefficient use of resources to try to analyze the potential impacts associated with hypothetical facilities to try to estimate the potential impacts when there are no existing FERC-issued licenses for any such facilities

[2] "The MOU Signatories anticipate that the Corps will act as a cooperating agency in most circumstances." March 2011 USACE-FERC Non-Federal Hydropower MOU.

Hydro Friends fund would also note that the District's estimated costs for performing the proposed modeling, monitoring, and IFIM studies is significantly low and would place a substantial financial burden on Hydro Green Energy and introduce significantly negative impacts to existing project economics

Water Quality Model

USACE District staff states that the model developed by Hydro Friends Fund was inadequate and have recommended that a predictive water quality model study using the USACE's CE-Qual-R2 model, more extensive continuous water quality calibration data, and extending the area of coverage from Dam 3 downstream to the entire Emsworth Pool is needed. We present the following discussion in support of the predictive model used for this analysis with support from an extensive historical and newly collected continuous and discrete water quality data set. Our analysis demonstrates that the existing information is more than sufficient to conclude that the proposed Project will not affect overall water quality in the Monongahela River.

Hydro Friends Fund used the hydrodynamic model ECOM and water quality model RCA to assess the potential changes in reaeration associated with flows passing through the turbines rather than through the USACE reaeration Gate 1. The ECOM/RCA model framework is capable of representing the transport, physical, chemical and biological processes that occur in the water. The water quality model for this analysis has been specifically designed to simulate mechanisms that impact DO in the water column. In addition, this modeling framework allows calculations in 3 dimensions (vertical, lateral, and longitudinal). This provides a substantial advantage over the CE-QUAL-R2 model, which only possesses a 2-dimensional framework.

As explained in the Water Quality Study Report, the model was calibrated based on an extensive seasonal data set and was used to evaluate worst case scenarios. The calibration data set covered the period from 2004 to 2012, representing the current Braddock Dam location as of 2004 (consistent with USACE requests to use no data prior to 2004). Since this data set represents conditions covering the full nine years that the dam has been at its current location, and covers a very wide range of seasonal flows and conditions inclusive of when the turbines would be operating, it can be considered to be reasonably representative of hydrologic and seasonal conditions. Results from the modeling indicated that there would be little difference in average DO concentrations downstream of the Braddock Locks and Dam associated with operation of the proposed Project, even during summer low flow conditions, which are the conditions of most concern to USACE staff. In fact, the modeling results indicate that the DO gain resulting from

Gate 1 flow releases is very limited (approximately 0.1 mg/L) and is usually temporary because DO concentrations are already above the saturation limit and quickly equilibrate with atmospheric conditions as flows travel downstream. As a result, it is expected that DO concentrations will continue to easily meet state minimum criteria under the proposed Project operations and will not comprise the function of the reaeration Gate 1.

The goal of the modeling analysis was to assess impacts of the proposed Project on downstream DO concentrations, rather than to predict future system-wide water quality conditions. As presented in the Water Quality Report, the analysis was done using worst case conditions. To this end, an appropriate area of interest above and below the Braddock Locks and Dam was selected. Model results indicate that local minor effects on DO concentrations occur immediately downstream of the dam and cumulative impacts are essentially non existent by the downstream model boundary. Thus the model conditions and extent are sufficient to address impacts.

Considering the USACE's request to model the area extending from the Dam 3 Pool through to the Emsworth Pools of the Monongahela River and on the Ohio River, we anticipate that the requested modeling effort would take up to a year to complete and would likely cost between $150K and $200K, placing a financial burden on Hydro Green Energy. The USACE states that water quality *may* be degraded with removal of Lock and Dam No. 3, which may not occur until 2030. However, no supporting analysis has been provided by USACE staff for its determination that water quality may be degraded by its dam removal actions. Given that the water quality model utilized representative data, and worst case conditions, a full system wide water quality analysis is not warranted for the relatively small change in flow distribution that would result from the proposed Project.

Real-time, Continuous Water Quality Monitoring

The District describes the relevant resource management goal as "to document baseline conditions, for model development, and for water quality control….Additionally, to assure compliance with Federal laws and regulations as they pertain to the Corps' water management / water quality and resource management missions." The USACE states the existing information is inadequate and that real-time continuous water quality data representative of season and hydrologic variation is required. The USACE further states that Gate 1 was added to the Braddock Locks and Dam to mitigate upstream DO losses by increasing aeration of the discharge. They further state that as a result of the new gate installation, tailwater DO concentrations are higher than historical levels and close to 100% saturation even during warm, low flow periods. The USACE makes the assertions that diverting flow from Gate 1 will significantly reduce DO concentrations in the river downstream all the way to the Ohio River. Absolutely no scientific justification or empirical data is presented supporting the effectiveness of Gate 1 or to support the statement that the project will significantly reduce DO concentrations. We present the following discussion to address USACE's concerns.

Hydro Friends Fund has been diligently consulting and working with the USACE and other applicable parties to secure the level of water quality data needed to characterize baseline conditions and to evaluate potential effects to downstream water quality associated with the proposed Project.

Per request from the Pittsburgh District of the USACE, Hydro Friends Fund conducted a continuous and discrete water quality monitoring study during the summer of 2012, a period which typically represents worst case conditions. The USACE was consulted during development of the sampling program and the methods and placement of the water quality data sondes were adjusted to address comments and recommendations by the USACE. Continuous and discrete water quality data were collected upstream and downstream of the Braddock Locks and Dam from June 27 through September 27. Flow conditions on the Monongahela River during this period exhibited both periods of low, steady flows as well as higher flow conditions representative of rainfall runoff events in the watershed. Discrete water quality profile data was

collected in the forebay to evaluate stratification within the pool and assess potential project operations data during conditions when the forebay would be stratified (i.e. summer conditions). Winter conditions were not included in the study because the forebay upstream from the Braddock Dam is not stratified during the cooler months, and as a result, flow releases from the proposed Project would not have any significant effects on downstream DO concentrations. Furthermore, during summer conditions, the lowest DO concentrations measured in the forebay were typically in the bottom three feet (below the withdrawal zone of the proposed Project), and were still above state DO standards.

The results of the 2012 continuous water quality monitoring survey were consistent with historical data collected upstream and downstream of Braddock Locks and Dam and associated modeling activities. DO concentrations were well above the Pennsylvania DO standards of 4 mg/L instantaneous and 5 mg/L daily average. In fact, most DO concentrations measured both upstream and downstream of the dam were well above 7 mg/L.

To address the concern expressed by USACE that operation of the proposed project would negatively impact the reaeration currently provided by Gate 1, the 2012 water quality study included a discrete sampling period designed specifically to evaluate baseline operations (Gate 1 flow releases) and proposed (or modified) operations whereby Gate 4 releases were used to simulate operations of the proposed hydroelectric Project. Hydro Friends Fund coordinated with the District extensively on the appropriate gate settings for the testing setup and schedule so that USACE staff could be on site to collect concurrent water quality data for quality control. This discrete monitoring event was conducted under relatively stable, low-flow conditions. For normal operations (baseline conditions), regularly scheduled lock flows were not altered during the testing period and the remainder flow was released through Gate 1. For modified operations, regularly scheduled lock flows were not altered, approximately 1,000 cfs was released through Gate 1, and the remainder of the flow was released through Gate 4 (approximately 3,000 cfs). Since Gate 4 withdrawals from mid-depth in the forebay, it serves as an appropriate surrogate for the proposed withdrawal of the hydroelectric turbines. Proposed operations are such that when

total river flows are less than 1,000 cfs, all flow would pass entirely through Gate 1 (as is the current case), with no flow through the proposed turbines.

The discrete data collection effort included an evaluation of flow velocities and directions using an Acoustic Doppler Current Profiler (ADCP) along multiple river transects upstream and downstream of the Braddock Locks and Dam. Results demonstrated that water quality in the immediate vicinity of the Braddock Locks and Dam is driven by flow patterns but quickly becomes uniform across the river. Any affect of increased aeration downstream from Gate 1 is quickly lost as flow travels downstream and equilibrates with the atmosphere. During normal operations, flows released from Gate 1 (adjacent to the locks) create a single large eddy that stretches over to the opposite bank (i.e., in front of the overflow weir and Gate 4 on river left). During modified operations, two eddies are formed; one from Gate 1 stretching half-way over to Gate 4 and the other from Gate 4 half-way over to Gate 1. As a result, DO concentration patterns are spatially different between the normal and modified operations scenarios (a single uniform eddy associated with normal operations that spans from bank to bank as compared to two eddies that intersect under the modified scenario), but the average DO concentration across this area are similar (i.e., within 0.1 mg/L within the immediate tailwater area). Further, these spatial differences blend together as flow travels downstream and DO concentrations are almost uniform from bank-to-bank by the end of the lock wall (i.e., less than 0.5 mile downstream from the dam).

The recently collected 2012 water quality data is in agreement with the historical data set that was used to calibrate the ECOM/RCA model, further supporting the model analysis and results, which indicated that water quality in the Project area meets relevant state and federal criteria and the proposed operation of the Hydro Friends Fund Project would not affect water quality at the Project.

In summary, Hydro Friends Fund data collection efforts have provided all parties with ample information to assess the baseline water quality conditions and identify any potential impacts associated with the proposed Project. The historical data review, which encompasses multiple

years and seasons over a large spatial extent, the 2012 continuous and discrete data collected in the immediate project area, including a simulation of modified operations, and the predictive modeling effort comparing baseline and proposed project operations, are more than adequate to describe baseline conditions and to evaluate potential project effects. The continuous water quality data collected in 2012 targeted typical worst case conditions for water quality when the forebay could be stratified (i.e., summer, low flow, high temperature periods). There is no reason to believe that water quality during other times of year would be affected or of concern, especially given that available historical and current data indicate that water quality is good and meets applicable stated and federal standards.

Both the modeling results and field data collection program indicate that the DO gain resulting from Gate 1 flow releases is very limited (approximately 0.1 mg/L) and temporary because DO concentrations are already above the saturation limit and quickly equilibrate with atmospheric conditions as flows travel downstream. This is described in greater detail in the Water Quality Study Report.

Therefore, additional real-time monitoring is not required to assess the baseline conditions of the river, but will be considered for future post-deployment monitoring, as appropriate. The historical water quality data for the lower Monongahela River, along with the 2012 Water Quality Study, demonstrates state DO standards are, and will continue to be met.

Aquatic Habitat Assessment and Incremental Flow In-stream Methodology (IFIM)

The USACE requested an Instream Flow Incremental Methodology (IFIM) study be conducted to determine an appropriate conservation flow (minimum release) from Gate 1 and appropriate flow and stream depths necessary to support the existing fishery. The District further states that a study is needed to assess water quality, aquatic life, and habitat impacts related to the location of the flow releases from the proposed turbines and the concern they may create backwater currents, in-river scour and/or erosion, or degrade shallow water habitat. The District suggested cross-sectional flow and river depth data under various release scenarios is needed throughout the Emsworth Pool to evaluate habitat changes. No other Federal or State agency has requested additional information or studies on the limited environmental impacts of the Project.

Hydro Friends Fund believes that sufficient data has already been collected to address the USACE's request. In addition to water quality data, Hydro Friends Fund collected flow and river depth data at multiple cross-sectional transects during in 2012 to assess mixing patterns under normal operating conditions and the proposed modified operating conditions. Data were collected immediately downstream of Braddock Dam and sufficiently far enough downstream to confirm the point at which river flow patterns normalized. The collected velocity data indicates that regardless of whether flows are released from Gate 1 only (normal operations), or Gates 1 and 4 (modified operations), the geometry of the downstream channel forces flows to the south bank of the river (river left overflow weir side). When these flows hit the south bank and reflect back towards the north bank (lock side), complete lateral mixing occurs and velocity patterns become similar across the channel from that point downstream (i.e., approximately 0.5 miles below the dam). Therefore, the physical habitat and/or aquatic organisms along the south bank of the river, or further downstream in the Emsworth Pool will not be differentially affected by the modified operations. In addition, depths will not change as a result of modified operations because the same volume of water is being discharged into the tailwaters regardless of normal or modified operations, and there are no shallow water habitats in the areas influenced (within 0.5 mile downstream of the gates) by these flow patterns. Based on ADCP depth and velocity profiles there is no difference in velocity patterns between normal and modified operations downstream from Transect E – the end of the lock wall.

As described previously and in greater detail in the Water Quality Study report, during normal operations, flows released from Gate 1 create a single large eddy that stretches over to the opposite bank (i.e., in front of the overflow weir and Gate 4 on river left). Maximum velocities downstream from Gate 1 under normal operations were approximately 3 ft/s, while the majority of the immediate tailwater area exhibited slack water or slow moving water in the upstream direction. During modified operations, two eddies form; one from Gate 1 stretching half-way over to Gate 4 and the other from Gate 4 half-way over to Gate 1. Higher velocities shift to the areas downstream from Gate 4, and actually extend deeper into the water column due to the deeper depths below Gate 4. Flowing habitats are still present below Gate 1, although the magnitudes are less due to the majority of water passing through Gate 4. Given the immediate downstream nature of the tailrace channel, it is expected that rocky habitats occur in this area and could be utilized by various fish species for cover, spawning, feeding, etc. There is no evidence to suggest that shifting significant portions of flow from one side of the river to the other will have a negative effect on substrate scour or aquatic habitat. It is likely that these areas have, and will continue to experience scour from the high flow/spill events at the Project. There is also no evidence to suggest that current normal operations provide better quality habitat for fish and other aquatic organisms. The modified operations, which release water from two different locations across the river provides for a greater diversity of tailwater habitats in terms of available flow patterns.

Because the hydroelectric project will be operated in a run-of-release fashion, there will be no "minimum flow" release, as the inflow to Braddock will continue to be released through normal lock operations, Gate 1, and the proposed hydroelectric Project. There will be no additional storage of water and if the turbines are not operating, flow will be re-routed through either the locks or Gate 1. Therefore, any effects on downstream aquatic communities already occurring from the existence of the Braddock Project will remain unchanged. As discussed, minimal effects will occur in the immediate tailwaters where the redistribution of flow patterns are expected to enhance available flowing habitats.