FINAL REVIEW OF APPLICATION FOR LIHI CERTIFICATION OF THE WILLOW ISLAND HYDROELECTRIC PROJECT

FERC Project No. 6902
Ohio River, Ohio/West Virginia

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This report provides findings and recommendations related to the application submitted to the Low Impact Hydropower Institute (LIHI) by American Municipal Power (AMP or Applicant) for Low Impact Hydropower Certification of the Willow Island Hydroelectric Project (the Project). The final application was filed on July 5, 2017 and supplemented with additional documentation during the application review. The application was held until the current time pending a Federal Energy Regulatory Commission (FERC) order amending the Project license which was issued on June 25, 2018 and subsequent studies conducted in 2019 and 2020. This report revises and updates the draft report prepared by a third-party LIHI reviewer in September 2017.

I. PROJECT LOCATION

The Willow Island Project (FERC # P-6902) is a 44-MW facility located in the Upper Ohio River Basin on the Ohio River at river mile (RM) 161.7 in Pleasants County, West Virginia and Washington County, Ohio. The powerhouse is located on the West Virginia side and the nearest towns are Waverly, Belmont, and St. Marys. The nearest towns in Ohio are Reno, Newport, and Marietta. The Project is located at the US Army Corps of Engineers (USACE) Willow Island Locks and Dam (Figures 1 and 2). A series of locks and dams all operated and maintained by the USACE regulates pool elevation on the Ohio River. These dams create 19 pools upstream of the Mississippi River confluence. Each has guaranteed, regulated minimum flows to assure commercial navigation at all times. The entire length of the Ohio River has been altered by channelization and the construction of over 60 locks and dams to accommodate ship traffic since the late 1800's.

The Willow Island Project is one of seven locks and dams located on this portion of the Ohio River (Figure 2) that flows generally in a southwesterly direction. The upstream dams include the Hannibal Locks and Dam (RM 126.4), Pike Island Locks and Dam (RM 84.2), and New Cumberland Locks and Dam (RM 54.3). The downstream dams include the Belleville Locks and Dam (RM 203.9), Racine Locks and Dam (RM 237.5), and Robert C. Byrd Locks and Dam (RM 279.2). The USACE owns and operates each of these facilities. Other than the Memorandum of Agreement (MOA) with USACE (see below and Appendix A documents), Willow Island has no operating agreements with any other upstream or downstream facilities. The Willow Island Project is bounded by the upstream Hannibal Locks and Dam which forms the 35.3-mile-long Willow Island Pool, and the downstream Belleville Locks and Dam which forms the 42.2-mile-long Belleville Pool. Both lock/dam projects include hydro facilities.

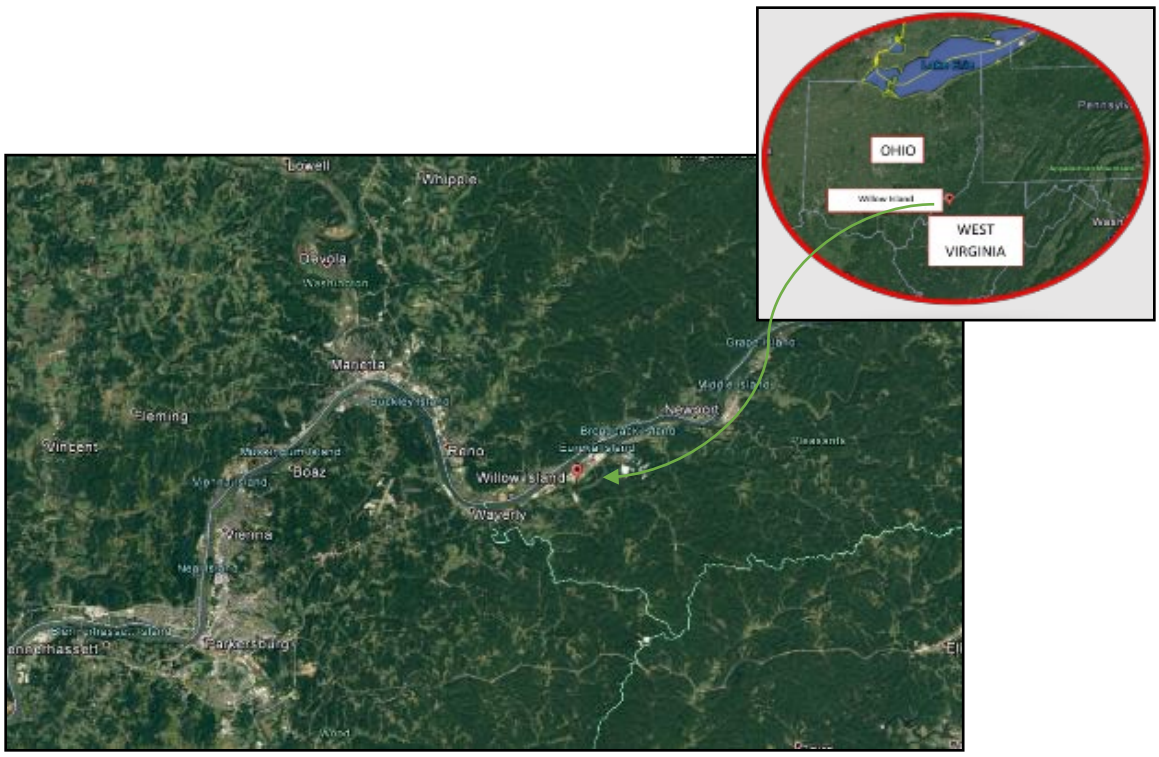

Figure 1 – Project Location Map.

Figure 2. Ohio River dams.

In addition to Willow Island, AMP holds the FERC licenses for four other projects on the Ohio River:

- Belleville Hydropower Project (P-6939),
- Cannelton Hydropower Project (P-10228),
- Meldahl Hydropower Project (P-12667), and
- Smithland Hydropower Project (P-6641)

The drainage area above the Project is approximately 26,930 square miles. The three upstream dams on the Ohio River affect Project inflows which typically range from approximately 20,000 cubic feet/second (cfs) in summer to approximately 50,000 cfs in in spring.

II. PROJECT AND SITE CHARACTERISTICS

FERC originally licensed the Project on September 27, 1989 to the City of New Martinsville, WV to construct and operate the Project at the existing USACE Willow Island Dam[1]. The 50-year license expires on September 1, 2039. On February 17, 2009[2], FERC approved the transfer of the license to American Municipal Power-Ohio, Inc. (AMP-Ohio). In January 2012, AMPO changed its name to American Municipal Power, Inc. (AMP).

An overhead view of the Project looking downstream is shown in Figure 3. The Project's powerhouse is located on the southeast (lefthand) side of the Willow Island Dam abutment. The USACE locks are located on the opposite side of the dam.

Figure 3. View of Project looking downstream.

[1] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01C4F58E-66E2-5005-8110-C31FAFC91712
[2] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01CD0909-66E2-5005-8110-C31FAFC91712

Original construction of the USACE locks and dam was completed in 1976. Excavation and cofferdam construction for the hydro facility started in June 2011 and powerhouse construction began in December 2012. The Project reached full commercial operation in February of 2016 and has a total capacity of 44 MW. Both units are very large horizontal-axis bulb-type turbine-generators (Figure 4). The major Project works consist of the existing dam and impoundment, a power canal, an intake structure, and a powerhouse. Specifically, the Project consists of:

- A high-lift, gated dam with a top length of 1,128 feet, including a 111-foot fixed weir with an 84-foot open crest. Eight Tainter gates with a clear span of 110 ft between piers, damming height of 26 feet above sills, clearance above maximum high water when fully raised approximately 5 feet;
- An impoundment with a normal upper pool elevation at 602 feet MSL, upper pool length of 35.3 miles to Hannibal Dam. The normal upper pool surface area is 6,400 acres. The normal lower pool elevation is 582 feet MSL, (upper pool of Belleville Dam) with a normal lift of 20 feet;
- An approach channel approximately 200 feet long with a wall on the river side;
- A concrete powerhouse structure approximately 260 feet long by 140 feet wide, containing two horizontal-axis bulb-type turbine-generator units with a total installed capacity of approximately 44 MW;
- A 700-foot-long by 200-foot wide tailrace channel that conducts the downstream discharge of the turbines back to the river at a point approximately 800 feet below the dam;
- Recreation facilities;
- Navigation control structures;
- A 138-kilovolt transmission line; and other appurtenant facilities.

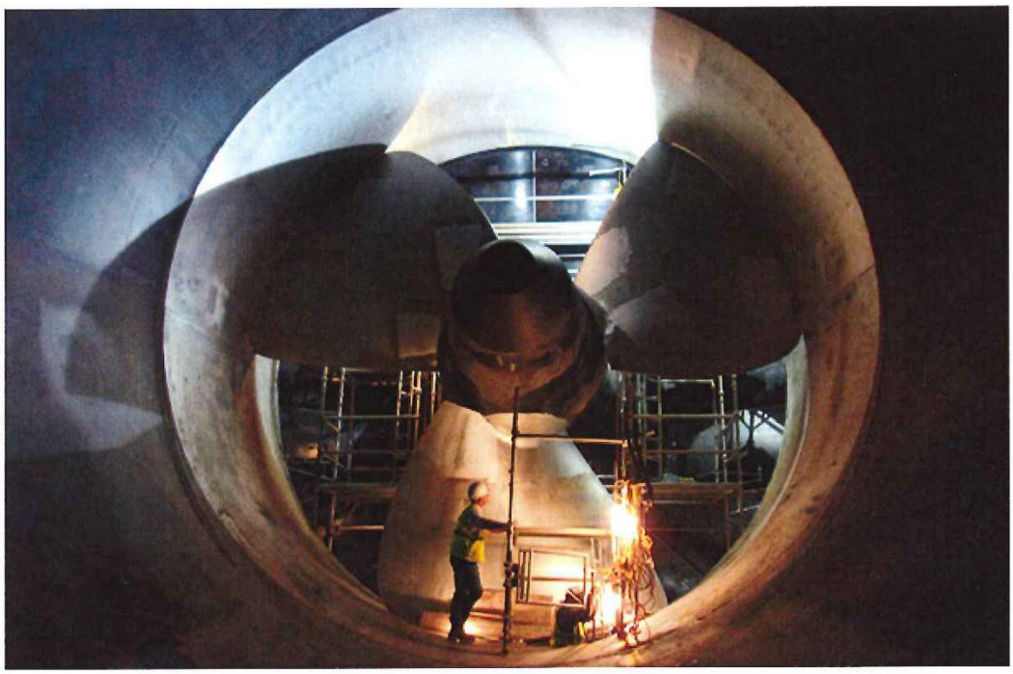

Figure 4. Horizontal Axis Bulb Turbine (note the person standing inside).

Mode of Operation

AMP operates the Project according to its FERC license and MOA (Appendix A) in which the USACE maintains the upper Willow Island Pool between elevation 602.00 feet Ohio River Datum (ORD) and elevation 603.00 feet ORD. AMP operates the Project in an instantaneous run-of-river (ROR) mode. The Project has no bypassed reach. When the Project is operating, total turbine flow is determined by the Lockmaster such that the upper impoundment (Willow Island) is maintained between 603.20 feet ORD and 601.80 feet ORD, depending on the total Ohio River flow and the lower impoundment (Belleville) at 582 feet. If the Ohio River flow exceeds 142,000 cfs or falls below 6,000 cfs, the Project shuts down and all flow passes through or over the dam outlet works, since the outlets are designed to be submerged during high flows. The USACE maintains the impoundment when discharging any flow through the dam. During low flow periods when the river is being regulated for protection of navigation or other federal interests, all discharges from the Project are controlled by the Lockmaster, who issues specific discharge instructions.

Zones of Effect

The Applicant identified one Zone of Effect (ZOE) for the Project stretching from the sidewall approach near the Project's powerhouse downstream approximately 10 miles to the confluence of the Muskingum River and the Ohio River main stem in Marietta, Ohio.
There is no bypassed reach. For purposes of this review however, the Project is being evaluated with two ZOEs – the impoundment extending about 4 miles upstream to the confluence with French Creek at Belmont, and the downstream reach extending 10 miles downstream (Figure 5) to the Muskingum River.

Figure 5. Zones of Effect.

The Applicant selected the following standards in ZOE 2, and the Reviewer agrees with the selected standards which also apply to ZOE 1, except as noted in the table below in **RED**.

Zone:		1: Impoundment	2. Downstream Reach
	River Mile at upper and lower extent of Zone:	165.7 - 161.7	161.7 – 151.7
Criterion		**Standard Selected**	
A	Ecological Flows	1	1
B	Water Quality	~~2,~~ **3**	~~2,~~ **3**
C	Upstream Fish Passage	1	1
D	Downstream Fish Passage	~~2,~~ **1**	~~2,~~ **1**
E	Shoreline and Watershed Protection	2	2
F	Threatened and Endangered Species	2	2
G	Cultural and Historic Resources	2	2
H	Recreational Resources	2	2

III. REGULATORY AND COMPLIANCE STATUS

AMP and the Huntington District of the USACE entered into a MOA on November 20, 2015 for Project operation with the primary purpose of navigation, as well as for water quality, recreation, and aquatic resources in the Ohio River (Appendix A). The MOA includes provisions for coordination and communication, regulation of discharge flows within certain stream gage ranges depending on total river flow; and continuous temperature and dissolved oxygen (DO) monitoring from May through October each year with annual reporting of water quality data to USACE and other relevant agencies.

The West Virginia Department of Environmental Protection, Division of Water and Waste Management (WVDEP) issued the Project's most recent Water Quality Certificate (WQC), on February 24, 2009[3] with conditions related to construction of the hydro facility, and which reiterated conditions in, and the validity of the original WQC issued in 1987[4], and subsequent amendments in 1990, and 1994. Collectively these WQCs required monitoring of DO and water temperature and adherence to state water quality standards.

The original FERC license issued in 1989 includes requirements for:

- maintaining instantaneous run-of-river (ROR) operations;
- providing minimum flow of 2,000 cfs when the project is not operating for recreational fishing and protection of aquatic habitat;
- monitoring water quality to ensure dissolved oxygen (DO) is maintained at the state standard of 5 mg/l or higher throughout the downstream Belleville impoundment;

[3] https://lowimpacthydro.org/wp-content/uploads/2021/10/2009-WQC.pdf

[4] FERC originally deemed the 1987 WQC waived since WVDNR had not acted on the application within 1 year. In its June 5, 1990 order on rehearing, FERC reversed its waiving and reinstated the WQC as part of the license.

- provision of temporary and permanent recreational facilities;
- monitoring of the federally endangered pink mucket pearlymussel (*Lampsilis orbiculate*);
- protection of visual resources;
- development of a cultural resources management plan; and
- mitigation of construction-related impacts.

Article 404 required the licensee, in conjunction with other licensees on the river, to conduct a fish entrainment/mortality study to support evaluation of cumulative effects of 16 hydro projects proposed at that time to be built at USACE dams on the Ohio River. All 16 projects were evaluated by FERC in a single comprehensive Final Environmental Impact Statement (FEIS) issued October 1, 1988. A compensatory mitigation provision was also included in Article 404 in the event that unavoidable project-induced fish mortality was documented. Subsequently, only two projects were built on the Ohio River – Willow Island and Belleville – and licenses for the other projects were either surrendered or terminated. AMP's predecessor filed the required study plan in 1994 which was approved by FERC in 1997. In 2018, FERC vacated license article 404 after previously vacating similar requirements in other projects on the Ohio River and after the Applicant's request to amend the Willow Island license for that purpose based on the City of Martinsville v. FERC appeals court decision in 1996.[5] The WQC retained a requirement to conduct a fish entrainment/impingement study. See Section V below for additional discussion on this issue.

IV. PUBLIC COMMENTS RECEIVED BY LIHI

The Willow Island LIHI application was posted for public comment on July 5, 2017 and on July 28, 2017, the original LIHI reviewer emailed individuals listed in the application's agency contact list for their input.

- On August 9, 2017, the original reviewer received communication from Susan Pierce, WV State Historic Preservation Office (SHPO) stating, "*… it is our opinion the LIHI review will have no effect on the Willow Island facility. No further consultation is necessary regarding cultural resources …*"

- On September 1, 2017, LIHI received an email from Richard C. McCorkle, Fish and Wildlife Biologist with the USFWS[6]. Mr. McCorkle believed LIHI Certification was premature given that post-construction monitoring of downstream mussel communities was ongoing at that time (see Section V.F below). In addition, the USFWS believed AMP's January 2017 FERC submittal proposing to delete the performance of a fish mortality study and the provision of mitigation compensation from Article 404 of the Project License was unwarranted (see Section V.D below).

[5] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01F710B3-66E2-5005-8110-C31FAFC91712
[6] https://lowimpacthydro.org/wp-content/uploads/2020/07/RMcCorkle-FWS-Comment-Email.pdf

- On September 6, 2017[7], the West Virginia Division of Natural Resources, Wildlife Resources Section (WVDNR) sent a letter to the original reviewer about the Willow Island LIHI application[8]. The WVDNR provided comments pertaining to each LIHI criterion. No concerns were raised relative to Criterion A, C, E, G and H. The WVDNR expressed concerns regarding water quality, downstream fish passage, and threatened and endangered species. These are discussed in Section V below.

A new public comment period was announced on August 19, 2021 when the Applicant provided supplemental information related to the recently completed studies. Resource agencies were notified of the application at that time and no comment letters were received during the 60-day comment period that ended on October 18, 2021.

The WV SHPO submitted a comment email on September 21, 2021 stating: "We have no issue with the proposed certification; therefore, a formal letter will not be provided unless requested".

V. LIHI CRITERIA REVIEW AND RECOMMENDATIONS

This section summarizes the review findings and conclusions for each of the eight LIHI criterion. A FERC e-library search was conducted to verify some claims in the application and additional research was conducted to locate relevant publicly available information. This review concentrates on the Project since being acquired by AMP in February of 2009 through October 15, 2021.

A. Ecological Flow Regimes

Goal: The flow regimes in riverine reaches that are affected by the facility support habitat and other conditions suitable for healthy fish and wildlife resources.

The Applicant states that the Project satisfies this criterion by meeting Standard A-1, Not Applicable/De Minimis effect. The Project powerhouse is located directly adjacent to the Willow Island dam and the Project does not have a bypassed reach.

Discussion: License Article 401 requires the Project to operate as directed by the USACE. To the extent possible within the constraints established by the USACE, the Project operates in a run-of-river (ROR) mode. The ROR operation may be temporarily modified if required by operating emergencies or for short periods upon mutual agreement with AMP, USACE, WVDNR and the Ohio Department of Natural Resources (ODNR). In the event of water quality emergencies, the

[7] https://lowimpacthydro.org/wp-content/uploads/2020/07/WV-DNR-Willow-Island-LIHI-certification-comments-09-06-17.pdf
[8] https://lowimpacthydro.org/wp-content/uploads/2020/07/WV-DNR-Willow-Island-LIHI-certification-comments-09-06-17.pdf

Project, upon FERC approval, spills water as necessary for the protection of water quality in the Ohio River as directed by the USACE, WVDNR, Ohio Environmental Protection Agency (OEPA), or the Ohio River Valley Sanitation Commission (ORSANCO).

License Article 408 requires AMP to provide a minimum flow of 2,000 cfs within the tailrace during periods of Project shutdown as necessary to maintain recreational fishing activities and protection of aquatic habitat in the Project's tailrace. That flow level is based on the lowest daily river flow measured over a 26-year period prior to Project construction. The Project turbines have a minimum hydraulic capacity of 6,000 cfs so no generation occurs below that flow level. If the minimum flow falls below 2,000 cfs when inflow is higher than that, AMP must file a deviation report with FERC within 30 days of the incident.

License Article 410 required consultation with the USACE and the U.S. Geological Survey (USGS), to install streamflow gages in the Willow Island Lock and Dam reservoir and in the Ohio River to monitor ROR operation and minimum flow releases as stipulated by Articles 401 and 408, respectively. A minimum flow release plan[9] and a flow monitoring plan[10] were filed with FERC in August 2009.

The review found that since initial operation began in January of 2016, the Project has operated in a ROR mode, and in accordance with its FERC license and MOA monitoring requirements. No violations, deviations or excursions have occurred. Therefore, the Project satisfies the Ecological Flows Criterion.

B. Water Quality

Goal: Water quality is protected in waterbodies directly affected by the facility, including downstream reaches, bypassed reaches, and impoundments above dams and diversions.

The Applicant states that the Project satisfies this criterion by meeting Standard B-2, Agency Recommendation. This review finds that Standard B-3, Site Specific Studies is more applicable as discussed below.

Discussion: The WVDEP issued the Project's most recent WQC on February 24, 2009, more than 10 years ago. That WQC pertained primarily to the proposed construction of a new hydro plant at the dam. The 2009 WQC stated that the 401 certification and conditions dated April 10, 1987, and subsequently amended were still valid and in effect as of 2009. The original WQC included 13 conditions related to construction, recreation access, ROR operations, water quality monitoring, and fish impingement/entrainment. Post-construction provisions other than water quality are discussed under applicable criteria in this section. In the 1989 FERC license, FERC determined that WVDNR had waived certification having not acted in one year, meaning that

[9] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01548FA0-66E2-5005-8110-C31FAFC91712
[10] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01548F9E-66E2-5005-8110-C31FAFC91712

while the WQC is in effect it is not part of the FERC license.

Designated uses for the Ohio River include aquatic life, contact recreation, public water supply, and fish consumption. The most recent (2020) impaired waters list[11] indicates that the entire 981 miles of the Ohio River is designated as impaired for the fish consumption use, caused by PCBs and dioxin. While there have been instances of water quality criteria violations for total mercury and fish tissue criteria violations for methyl mercury, the consumption weighted pool averages were all below the fish tissue criterion, therefore no impairment is indicated for the fish consumption use based on mercury. Two-thirds of the river, or 639.7 miles, is designated as impaired for contact recreation caused by E. coli or fecal coliform bacteria, including some sections upstream and downstream of Willow Island, but not in the immediate vicinity. The entire river is fully supporting of aquatic life and public water supply uses. Since listed impairments are geographically extensive, they cannot be caused or exacerbated by the Project.

The USACE Draft Environmental Assessment issued in September 2010[12] stated that aeration at the Project was not expected to change with the implementation of the proposed project and the dam is not important for maintaining DO for fish and other aquatic organisms as discussed in the FERC License (Article 408). License Article 401 specifies that in the event of water quality emergencies, the Project, upon FERC approval, will spill water as necessary for the protection of water quality in the Ohio River as directed by the USACE and state resource agencies.

License Article 402 required the development of a Water Quality Monitoring Plan[13] to ensure dissolved oxygen levels at or above 5 milligrams per liter (mg/L) downstream throughout the Bellville impoundment for a period of five years post-construction. FERC approved a modified plan on July 29, 2015[14] requiring AMP to monitor real-time DO readings from May 1 to October 31, both upstream and downstream of the powerhouse, and provide access to this real-time information to the USACE and state agencies. In addition, the article requires that when requesting to continue operation during periods of low DO, the licensee must receive confirmation from all three agencies: the West Virginia Department of Natural Resources; U.S. Fish and Wildlife Service; and Ohio River Valley Water Sanitation District, in order to continue rather than curtail operations.

WVDNR's September 6, 2017 LIHI application comment letter was received before the 2017 (or later) data was available and referenced the 2016 monitoring results noting: *"There have been a number of instances in which the downstream DO concentration [in the 2016 monitoring season] was below what was present upstream of the facility … there were several days in which*

[11] https://www.orsanco.org/wp-content/uploads/2020/06/ORSANCO_2020_305b_Report.pdf
[12] https://lowimpacthydro.org/wp-content/uploads/2021/10/Willow-Island-2010-USACE-Draft-EA.pdf
[13] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01D20CCA-66E2-5005-8110-C31FAFC91712
[14] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01D57172-66E2-5005-8110-C31FAFC91712

the lower readings could not be explained away as errant readings. In particular, the month of September saw frequent situations in which the downstream DO concentration was lower than the upstream concentration. Some readings were more than two units lower than their upstream counterpart ... Having a lower DO concentration downstream of a project is unacceptable and the situation should be rectified". While differences between upstream and downstream DO readings occurred frequently, the 2016 report noted a single occurrence on August 8, 2016, where the upstream DO dropped below the state standard of 5 mg/L. However, since the downstream probe did not provide a similar DO reading, the report concluded that the probe was defective. A new probe was installed, and the DO reading returned to the same level as downstream.

Monitoring results from 2016 – 2020 were summarized in a 5-year report[15] which showed that DO met or exceeded the required downstream standard in all years, acknowledging some short term instances of monitoring probe failures that did not affect the overall data. In 2021, USACE and the Ohio River Sanitation Commission requested monitoring to continue for the license duration, which was already a requirement of the USACE Lakes and Rivers Division Operations Order 2012-075 (OPORD) that underlies and formed part of the basis for the MOA.[16]

The review found that since initial operation began in January of 2016, the Project has operated in accordance with its water quality monitoring requirements, FERC license and MOA monitoring requirements. Monitoring indicates that DO appears to meet water quality standards, and the ROR operation does not adversely impact water quality in the Ohio River. Therefore, the Project satisfies the Water Quality Criterion.

However, a condition is recommended for WQC Condition 10 which requires the Applicant to file for FERC approval a revised Exhibit E that includes impingement/entrainment and DO study conclusions, a summary of Project operations, and mitigative measures required by WVDNR.

C. Upstream Fish Passage

Goal: The facility allows for the safe, timely, and effective upstream passage of migratory fish. This criterion is intended to ensure that migratory species can successfully complete their life cycles and maintain healthy populations in areas affected by the facility.

The Applicant states that the Project satisfies this criterion by meeting Standard C-1, Not Applicable/ De Minimis Effect.

Discussion: The Morone family (potamodromous species), commonly known as white perch, white bass, yellow bass, striped bass, and hybrid striper are introduced migratory fish that have occurred historically at the Project, but do not depend on migration to complete their lifecycles.

[15] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020C73C5-66E2-5005-8110-C31FAFC91712
[16] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020D4591-66E2-5005-8110-C31FAFC91712

Currently, no migratory upstream fish passage is required since no upstream fish passage facility is installed at the downstream Belleville Project, nor at the Robert C. Byrd project located farther downstream. License Article 406 of the Willow Island license (and similar license articles at the Belleville and Byrd projects) reserves FERC authority to require the licensee to construct, operate, and maintain, or provide for the construction, operation, and maintenance of fish passage facilities as may be prescribed by the Secretary of the U.S. Department of Interior (USDOI). To date, the agency has not exercised its authority. At Willow Island, the reservation of authority also allows the USDOI inspection of Project records pertinent to fishways and requires the Applicant to investigate and prepare a report documenting the effectiveness of such fishways, if deemed necessary in the future.

USFWS submitted a letter to FERC on October 3, 2017[17] which described the status of American eel (a state threatened species) in the Ohio River Basin and requested consideration of the species in FERC licensing of projects in the basin. To date, there have been only limited anecdotal observations of eels in the Ohio River, and no reports of the species in the vicinity of the Project in the most recent 2014 and 2016 surveys conducted downstream and upstream of the Project, respectively, by the Ohio River Valley Water Sanitation Commission (ORSANCO). The Racine Project, downstream of both Willow Island and Belleville, is currently in relicensing and fishery studies found no juvenile or adult eels, and the draft license application reported only one adult eel had been found in the prior 8 years by ORSANCO.[18]

Based on this review, the Project does not appear to create a barrier to upstream passage as fish can pass upstream through the lock facilities, and therefore satisfies the Upstream Fish Passage Criterion.

D. Downstream Fish Passage and Protection

Goal: The facility allows for the safe, timely, and effective downstream passage of migratory fish. For riverine (resident) fish, the facility minimizes loss of fish from reservoirs and upstream river reaches affected by facility operations. Migratory species can successfully complete their life cycles and maintain healthy populations in the areas affected by the facility.

The Applicant states that the Project satisfies this criterion by meeting Standard D-2, Agency Recommendation, however this review finds that Standard D-1, Not Applicable/ De Minimis Effect is more applicable.

Discussion: There is an extensive record of formal proceedings related to fish protection for Ohio River projects and for this Project. The 2009 WQC states that the Ohio River is a high-quality river with an excellent warm water fishery. There are no diadromous species in the

[17] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01EEE58A-66E2-5005-8110-C31FAFC91712
[18] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020DE8AD-66E2-5005-8110-C31FAFC91712

Project vicinity (except a potentially small number of American eels as noted above), but a variety of potamodromous and riverine species occur at the Project. Some state-listed species also occur (see Section V.F below). Fish survey information provided in the application from 2006 was updated in this review which found data collected ORSANCO in 2016[19] that characterized the Willow Island Pool as having healthy aquatic communities and meeting aquatic life use designations with a rating of "good" for fish and "very good" for macroinvertebrates. Fish surveys identified 49 species in Willow Island Pool including primarily shiners, minnows, sunfish, and suckers as well as smallmouth bass and gizzard shad. Willow Island Pool had the third highest fish diversity of all 19 Ohio River pools evaluated between 2011 and 2016 and the sixth highest numbers of all species observed. The second highest pool diversity with 52 species is the Belleville Pool just downstream of the Willow Island Project.

USACE reported in their 2010 Draft Environmental Assessment that impacts to the fish community would be insignificant under the license provisions. On the other hand, USFWS has repeatedly expressed concerns over entrainment and mortality of American eels in the Ohio River, suggesting that the population is larger than documented in ORSANCO studies which observed only a total of 315 eels in nearly 60 years of surveys.[20] However, USFWS currently acknowledges low abundance of eels in the river.[21]

USFWS commented on the LIHI application on September 1, 2017[22] with concerns similar to those in their FERC comments, and stated that LIHI Certification would be premature until "*it can be determined that the project is, indeed, a low impact project".* The WVNDR, in commenting on the LIHI application on September 6, 2017, also pointed out that entrainment/mortality studies at the Project had yet to be completed and consequently, LIHI Certification would be premature at that time.

The application and supplemental information described the existing fish protection measures at the Project including a fixed weir connected to the power plant that allows fish to pass over the weir structure during high flow periods, and two lock chambers that allow fish to move downstream as lock operations allow. To minimize impingement the Project trashracks have 8.25-inch spacing. While many fish could become entrained, the very large diameter Kaplan turbines (see Figure 4 above) with low rotational speed of 64 rpm, three large-diameter blades, wide gaps between blades, and relatively broad and smooth leading edges of blades also minimize blade strike and resulting mortality to entrained fish.

In accordance with condition 10 of the WQC, the Applicant conducted a desktop fish entrainment and survival study in 2020 which estimated average turbine survival from 79.6% for the very largest fish to 100% for very small fish, respectively. For American eel, turbine

[19] http://www.orsanco.org/wp-content/uploads/2016/11/2016-Combined-Pool-Report-Final.pdf
[20] ORSANCO data provided to LIHI by R. McCorkle, USFWS
[21] Email communication between M. Fischer, LIHI and R. McCorkle, USFWS October 19-20, 2021
[22] https://lowimpacthydro.org/wp-content/uploads/2020/07/RMcCorkle-FWS-Comment-Email.pdf

survival was estimated to be 97.5%. Overall project survival via all available passage routes was estimated to be 97.6% for all non-diadromous species and sizes, and 97.5% for American eel. The report concluded that any potential impacts of turbine entrainment on the fish community "are negligible and inconsequential". This was further corroborated by the primary study author who characterized the turbines "probably the fish-friendliest conventional design I have ever come across" given their large diameter, only three blades, and very low rotational speed "all of which contribute to low strike probabilities and mortality (even for large adult fish)". [23]

The report also noted that species such as gizzard shad, channel catfish, bluegill, emerald shiner, and sauger are resilient and fecund species whose populations are not expected to be negatively affected by Project operation.

However, USFWS suggested that eel survival is overestimated since the study did not account for delayed mortality due to injuries sustained during entrainment.[24] USFWS suggested an eel turbine survival rate of 90% based on a different methodology, and expressed concerns about sauger (Sander canadensis) a walleye relative, and the only known natural host for the federally listed endangered sheepnose mussel, which has been documented "immediately downstream of the Willow Island Project".[25] The application's USFWS IPaC report also lists sheepnose as potentially present within the project area; however, the species was collected only rarely in very small numbers over several years of surveys (see Section V.F below).

As noted in Section V.B above, the WQC Condition 10 also required AMP to file with FERC a revised Exhibit E once the impingement/entrainment and DO studies were completed. Specifically, the Exhibit E must include, among other things, study conclusions, a summary of project operation, and mitigative measures deemed necessary by WVDNR.

Based on this review, the Project does not appear to adversely affect downstream moving fish in more than a de minimis way given the high survival estimates, and therefore satisfies the Downstream Fish Passage and Protection Criterion. A condition is recommended to ensure that the revised Exhibit E, or equivalent is filed with FERC.

E. Shoreline and Watershed Protection

Goal: The facility has demonstrated that sufficient action has been taken to protect, mitigate or enhance the condition of soils, vegetation and ecosystem functions on shoreline and watershed lands associated with the facility.

The Applicant states that the Project satisfies this criterion by meeting Standard E-2, Agency Recommendation.

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[23] Email communication to M. Fischer, LIHI from S. Amaral, Alden Laboratory April 22, 2020
[24] Email communications between M. Fischer, LIHI and R. McCorkle, USFWS October 19-20, 2021
[25] Email communication to M. Fischer, LIHI from R. McCorkle, USFWS October 26, 2021

Discussion: License Article 416 required AMP to prepare and file a Sediment and Erosion Control Plan to control erosion/dust, and slope disposal areas/ and to minimize the quantity of sediment or other potential water pollutants resulting from construction of the Project. The plan was submitted to FERC on May 5, 2008.[26]

Lands within the Project boundary consist of approximately 24 acres on USACE-owned land and easements with private property owners for the transmission right-of-way. Land use in the immediate Project area on the south side of the river in West Virginia consists of industrial uses including a coal-fired power plant directly upstream. Other uses are primarily commercial, residential, and agricultural. There is less overall development on the north side of the river in Ohio but generally the same uses occur there. Near the end of the downstream reach are larger towns including Marietta, OH and Williamstown WV. Beyond the shoreline area, the surrounding lands are generally forested hills with numerous runoff streams. There are no lands of ecological significance and no critical habitats for listed species.

License Articles 413 and 417 required AMP to file a Visual Resources and Revegetation Plan. The plan minimizes disturbances to the quality of the existing visual resources of the Project area resulting from construction and operation of the Project. The plan also included provisions to revegetate all disturbed areas with plant species beneficial to wildlife and native to the Project area. The plan was submitted on April 2, 2008 and on January 22, 2010, FERC approved a modified version of it.[27] The revegetation plan was implemented beginning 2016, after construction was complete. The plan requires AMP to inspect revegetated sites and achieve at least 90 percent ground cover for legumes and grasses and a shrub and tree survival rate of no less than 75 percent. If these rates are not achieved, additional planting is proposed, and an annual monitoring report is required for 3 years after site revegetation.

On October 6, 2020, AMP filed the latest status update for these plans[28]. The report states and accompanying photographs confirm that the Project area was fully revegetated with native grasses, trees and shrubs and those areas have achieved a high rate of ground cover and high tree survival rates. Small areas of erosion have or are being addressed. The affected areas will continue to be monitored on a three-year basis for vegetation and annually for erosion.

Based on this review, the Project has no adverse effect on shoreline and watershed resources and has improved site conditions with tree planting and erosion control measures. Therefore, the Project satisfies the Shoreline and Watershed Protection Criterion.

[26] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01252FF8-66E2-5005-8110-C31FAFC91712
[27] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01CDB069-66E2-5005-8110-C31FAFC91712
[28] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020A3B37-66E2-5005-8110-C31FAFC91712

F. Threatened and Endangered Species Protection

Goal: The facility does not negatively impact federal, or state listed species.

The Applicant states that the Project satisfies this criterion by meeting Standard F-2, Finding of No Negative Effect.

Discussion: The Applicant provided an updated USWFS IPaC report in June 2021 which identified the following federally threatened and endangered species within the Project reaches, but there are no critical habitats for any species in the Project area:

- Indiana bat (endangered)
- Northern long-eared bat (threatened)
- Seven species of mussels and clams (all endangered, see below)

Several migratory bird species may occur in the project area including bald eagle. None of those bird species are state-listed in Ohio although several are considered species of concern. West Virginia does not maintain a state list for any species and relies on the federal listings but does maintain a list of at-risk species.

An Indiana bat habitat evaluation was conducted prior to Project construction and indicated that potential summer roosting habitat exists along portions of the transmission line. Total potential Indiana bat habitat removed for the proposed transmission line was about 13.2 acres. The USACE determined that effects on potential bat habitat were mitigated by winter tree clearing and therefore no adverse effect to the Indiana bat would occur. Northern long-eared bat was listed (and is also state-listed) after the evaluation, but it is likely similar to Indiana bat with no effect.

The ODNR current list of plants in Washington County[29] includes 12 threatened or endangered species. Given the previously developed nature of lands within the Project boundary it is unlikely that the Project would adversely affect those species.

The ODNR current state listed wildlife species for Washington County[30] includes the following endangered fish species:

- Western banded killfish
- Goldeye
- Ohio lamprey
- Northern madtom

[29] https://ohiodnr.gov/static/documents/wildlife/state-listed-species/washingtonp.pdf
[30] https://ohiodnr.gov/static/documents/wildlife/state-listed-species/washington.pdf

- Pugnose minnow

And the following threatened fish species:

- American eel
- Blue sucker
- Tippecanoe darter
- Mountain madtom
- Channel darter
- River darter
- Paddlefish

Of those listed species, a 2016 ORSANCO study of the Willow Island Pool and a 2014 study of the Belleville Pool[31] found a single Ohio lamprey specimen and two channel darters. As discussed in Section V.D above, the Project is unlikely to adversely affect these species.

Ten mussel species in the county are state-endangered (three are also federally endangered) and another three are state-threatened species. Another four species are federally endangered but not state listed in the county. As noted above there are no critical habitats for federally-listed mussels in the project area.

Species	Scientific Name	Ohio Status	Federal Status
Clubshell	Pleurobema clava	n/a	Endangered
Northern Riffleshell	Epioblasma torulosa rangiana	n/a	Endangered
Pink Mucket	Lampsilis abrupta	n/a	Endangered
Purple Cat's Paw	Epioblasma obliquata	n/a	Endangered
Fanshell	Cyprogenia stegaria	Endangered	Endangered
Sheepnose	Plethobasus cyphyus	Endangered	Endangered
Snuffbox	Epioblasma triquetra	Endangered	Endangered
Butterfly	Ellipsaria lineolata	Endangered	n/a
Longsolid	Fusconaia subrotunda	Endangered	n/a
Monkeyface	Theliderma metanevra	Endangered	n/a
Ohio Pigtoe	Pleurobema cordatum	Endangered	n/a
Pocketbook	Lampsilis ovata	Endangered	n/a
Pyramid Pigtoe	Pleurobema rubrum	Endangered	n/a
Washboard	Megalonaias nervosa	Endangered	n/a
Black Sandshell	Ligumia recta	Threatened	n/a
Fawnsfoot	Truncilla donaciformis	Threatened	n/a
Threehorn Wartyback	Obliquaria reflexa	Threatened	n/a

[31] http://www.orsanco.org/wp-content/uploads/2016/11/2016-Combined-Pool-Report-Final.pdf

As part of license article 412, AMP implemented an approved Mussel Monitoring Plan. The plan required mussel sampling, substrate and habitat assessment and characterization, and water quality assessment to be performed at the Project prior to, during, and post-construction. Pre-construction surveys found no federally-listed species and the USACE's review in consultation with the USFWS, determined there would be no adverse effects to listed mussel species with implementation of the proposed hydro development.

The 2016 mussel survey represented the first year of post-construction or operational monitoring for the Project. Twenty-three mussel species were collected in the reach below the Project. During the survey, seven state-listed mussel species were collected. The federally endangered fanshell (cyprogenia stegaria), also a state protected species, was also collected. The fanshell specimen was collected along the right descending shoreline over one mile downstream of the Project's tailrace. Based on the condition and location of the specimen it is outside the range of any potential project-related impacts. Fanshell was only collected in 2016, sheepnose mussel was only collected in the pre-construction baseline survey and in 2014 (2 specimens), and pink mucket was not collected in any surveys including the baseline survey.

In WVDNR's September 6, 2017 LIHI application comment letter, they noted no significant change in mussel numbers from the 2012 pre-construction survey to the 2016 post-construction survey. The agency stated, *"Populations for some of these species [federally listed and state listed imperiled species] improved in the 2016 study while other species saw a decline in their population…It is simply too soon to notice trend lines in populations. Essentially, the 2016 data that is available is only reflective of the changes to the population over the period of construction and not over the period of operation … The WVDNR has also recently re-established two federally listed mussel species (northern riffleshell and clubshell) to a portion of the Ohio River approximately seven miles downstream of the Willow Island Project which has yet to fully be studied with relation to this project".*

Two additional years of post-construction mussel study were required, in 2018 and 2020, and the Applicant filed those reports with FERC. On April 29, 2021, the Applicant filed a mussel study compendium report[32] that summarized all the data collected. Only one or a few specimens of some listed species were collected in one or more surveys between 2007 and 2020. The compendium report noted that overall mussel density was higher on the Ohio side than on the West Virginia side of the river. It also reported inter-year variability in river flows and natural fluctuation in substrate composition and variability in mussel densities over different survey years, and that most pre- and post-construction surveys showed similar or greater densities than the pre-construction baseline survey.

Results of the multiple mussel surveys indicate that operations of the hydro project have no demonstrable effect on freshwater mussels. As discussed above, it is also unlikely that the

[32] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020D0503-66E2-5005-8110-C31FAFC91712

Project has adverse effects on other listed species. Therefore, this review finds that the Project satisfies the Threatened and Endangered Species Criterion.

G. Cultural and Historic Resources Protection

Goal: The facility does not unnecessarily impact cultural or historic resources that are associated with the facility's lands and waters, including resources important to local indigenous populations, such as Native Americans.

The Applicant states that the Project satisfies this criterion by meeting Standard G-2, Agency Recommendation.

Discussion: In the 1989 FERC license, the State Historic Preservation Office (SHPO) determined that the Project should have no effect upon known archaeological and historical resources. In addition, on January 4, 2011, AMP filed a Cultural Resources Management Plan (CRMP) for the Project pursuant to license Article 414 and FERC approved the plan on February 10, 2011[33]. Cultural resource investigations identified historic properties for evaluation. The CRMP details each discovered property, describes the potential effect on each discovered property, and proposes measures for avoiding or mitigating effects.

USACE conducted investigations in 2008 which identified five sites within the then-proposed Project area, including three prehistoric archaeological sites, a historic dwelling, and the Willow Island Locks and Dam. USACE determined that part of one archaeological site would be adversely impacted and required AMP to develop a data recovery plan in accordance with an MOA executed among USACE, AMP, and the WV SHPO.

The CRMP includes documentation of consultation and the 2010 MOA with the USACE, which addresses and mitigates impacts on cultural resources based on construction of the Project pursuant to Section 106 of the National Historic Preservation Act. As stated in the CRMP, in August 11, 2010 and October 28, 2010 letters, the SHPO concurred with the stipulations in the MOA with the USACE's assessment that the proposed construction will have no adverse effect on the historic integrity of the Willow Island dam.

This review finds the Project complies with all requirements regarding cultural resource protection, mitigation, or enhancement; and therefore, the Project satisfies the Cultural and Historic Resources Criterion.

[33] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01CE4D6A-66E2-5005-8110-C31FAFC91712

H. Recreation Resources

Goal: The facility accommodates recreation activities on lands and waters controlled by the facility and provides recreational access to its associated lands and waters without fee or charge.

The Applicant states that the Project satisfies this criterion by meeting Standard H-2, Agency Recommendation.

Discussion: License Article 407 required development of plans for development of Project recreational resources. On August 26, 2009, AMP filed a revised recreation plan (RRP)[34]. AMP filed a supplement to the plan on January 7, 2011 and FERC issued an order amending the plan on February 7, 2011 requiring further agency consultation pertaining to fishing concerns. On October 25, 2013, AMP filed supplemental information to FERC[35], stating that AMP and WVDNR agreed that no fishing platform would be attached to the downstream side of the Willow Island powerhouse due to security concerns. Instead, a grouted riprap walkway in the tailrace, which originally was proposed to terminate 150 feet downstream of the powerhouse, would be extended upstream by 75 feet. There would be no recreational access allowed at the powerhouse.

Final recreational amenities include a tailrace fishing pier, a downstream fishing pier with fish attractants, a parking area, picnic and play area with a picnic shelter and toilet, and the walkway. Additional non-Project recreation facilities include two upstream boat launches, a group picnic shelter and two USACE operated recreation areas.

WVDNR reported in the 2017 LIHI application comment letter that: *"In 2015, AMP completed implementation and construction of conditions within a Recreation Management Plan created in consultation with WVDNR. This plan included the construction of fish attractants, a fishing pier, and a grouted angler access. The WRS considers AMP to have met the requirements of standard H-2 of this criterion (Agency Recommendations)".*

License article 409 required recreational monitoring and annual agency meetings about recreation, along with 5-year reports to FERC. The article was amended in 1997 to allow for 6-year filings on the same schedule as FERC Form 80 recreation reports starting on April 1, 2003[36]. No Form 80 submittals were found in the FERC eLibrary, but a 2014 FERC letter to the Applicant reiterated the requirement to file Form 80 by April 1, 2015 and noted that no Form 80 had been filed in 2009[37]. It is important to note that construction of the hydroelectric facility had not been completed until 2016 and only temporary recreation facilities were in place prior to construction of the final recreation facilities.

[34] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01543643-66E2-5005-8110-C31FAFC91712
[35] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01B88295-66E2-5005-8110-C31FAFC91712
[36] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=00151546-66E2-5005-8110-C31FAFC91712
[37] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01BBD7E1-66E2-5005-8110-C31FAFC91712

In 2018, FERC amended its regulations and rescinded the Form 80 requirement for all projects except those that otherwise require it due to specific license articles, as is the case for this Project under article 409. The Applicant recently reported that with the elimination of the general Form 80 requirements, they believed recreational use monitoring is no longer required.

This is a common misperception, yet FERC stated in the regulation amendment: "*unless recreation use reporting is required by a license condition — including any approved recreation plan or report or mandatory agency condition — licensees will no longer have any specific recreation use reporting obligation once the Form 80 is eliminated*"[38].

This review finds that the Project provides recreation access free of charge in accordance with the approved recreation plan; and therefore, satisfies Recreation Resources Criterion. However, since article 409 requires ongoing monitoring and reporting of recreation use, a condition is recommended. The first post-construction 6-year recreation report would have been due April 1, 2021 covering the 2020 monitoring year. It is likely that the Covid pandemic would have precluded accurate monitoring in 2020, but the requirement appears to still be in effect.

VI. CERTIFICATION RECOMMENDATION

Based on the review of the application, supplemental documentation, and a thorough review of available public documents available for the Project, I recommend that the Project be granted LIHI Certification for a term of five (5) years with the following conditions:

Condition 1: The facility Owner shall consult with WVDNR staff to clarify compliance with WQC Condition 10, and if required, shall prepare and submit the revised Exhibit E to WVDNR and to FERC for approval, with a copy to LIHI within 90 days of the submittal.

Condition 2: The facility Owner shall consult with FERC staff to clarify compliance with recreation monitoring and reporting requirements under license article 409. The Owner shall provide a status update and copies of all relevant documents in annual compliance statements.

[38] https://www.federalregister.gov/documents/2018/12/28/2018-28250/elimination-of-form-80-and-revision-of-regulations-on-recreational-opportunities-and-development-at

APPENDIX A – USACE MOA DOCUMENTS

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
502 EIGHTH STREET
HUNTINGTON, WV 25701-2070

May 17, 2021

Program and Project Management

Mrs. Lisa McAlister
American Municipal Power
General Counsel for Regulatory Affairs
1111 Schrock Road
Columbus, Ohio 43229

Dear American Municipal Power:

On November 20, 2015, the US Army Corps of Engineers (USACE), Huntington District, and the Federal Energy Regulatory Commission (FERC) Licensee, American Municipal Power (AMP), signed a Memorandum of Operating Agreement (MOA) to cooperate in the coordinated operation of the Willow Island Locks and Dam and the Hydropower Project (Project No. 6902-003) to protect Federal interests. The MOA includes language from the USACE Lakes and Rivers Division Operations Order 2012-075 (OPORD) establishing water quality monitoring and reporting requirements for non-federal hydropower projects on the Ohio River. Although a five year, post-construction water quality monitoring strategy was agreed to in the MOA, this OPORD remains in effect, requiring all non-federal hydropower projects on the Ohio River, including the Willow Island Hydropower Project, to continue to monitor and report water quality data throughout the license term.

In order to standardize water quality management and reporting for the Ohio River, the USACE Lakes and Rivers Division (LRD) issued the OPORD (Regional Strategy for Improved Water Quality Monitoring on the Ohio River). This OPORD directs how all non-federal hydropower generating facilities, co-located with USACE Navigation projects along the Ohio River, monitor and report real-time water temperature and dissolved oxygen (DO) levels (i.e. water quality data). The prescribed monitoring and reporting details were included in the MOA.

The MOA, Sections B (11, 12) state that:

> *From 1 May through 31 October each year, the Licensee will continuously measure and record in real time the water temperature and dissolved oxygen*

(DO) concentration both upstream and downstream of the dam, at locations approved by the District and other appropriate water resources agencies throughout the license term, or until the Licensee is able to demonstrate following at least 5 years of monitoring that the hydroelectric project does not adversely affect water temperature and DO and both parties agree to discontinue monitoring, or the Licensee ceases to operate the hydroelectric project. Should the licensee and the Corps fail to reach an agreement, the matter will be referred to the Director, Office of Energy Projects for resolution.

Once operations begin, the Licensee will provide to the District, on an electronic and continuous basis (e.g. internet website) real-time, continuously recorded DO and water temperature data upstream and downstream of the hydroelectric facility from 1 May through 31 October of each year, as per LRD OPERATIONAL ORDER 2012-075. Additionally, an Annual Report summarizing the data will be submitted to the District and Division by December 1 of each year. The data provided does not relieve Licensee from their obligation to monitor closely and adjust operations in order to meet state minimum WQ criteria, nor does it absolve the Licensee from reporting/distributing data to appropriate state water quality agencies as required by other existing agreements.

As intended by the OPORD, the collection and reporting of this data has continued to be valuable. Since the 2016 initiation of commercial power generation at the Willow Island Hydropower Project, USACE has received annual reporting of the water quality data required by the MOA. In addition, USACE has been provided access to real-time data via the WQDatalive website. The Ohio River Sanitation Commission (ORSANCO) has utilized this real-time data for their weekly and monthly river condition reports. AMP has used the data to ensure that the FERC Order Issuing License and state water quality criteria have been satisfied during power generation.

On November 8, 2015, ORSANCO provided a letter of support for USACE's OPORD stating*:*

Continuous DO monitoring and real-time tracking are critical to ensure hydropower operations are managed so as to maximize dam aeration potential during critical periods of low dissolved oxygen. LRD's OPORD is consistent and complementary to ORSANCO's hydropower policy in requiring all Ohio River hydropower facilities to collect and make electronically available continuous DO data from locations upstream and downstream of the hydropower installations.

On July 8, 2020, ORSANCO renewed its support of USACE's OPORD stating:

ORSANCO does continue to value monitoring data for dissolved oxygen and water temperature at USACE Ohio River Hydropower facilities to help assure that aquatic life is being protected downstream from hydropower sites.

In order to ensure our environmental responsibilities are efficiently met, USACE will require AMP to continue to monitor and report the Willow Island Hydropower Project's water quality data as directed in the OPORD throughout the license term.

If you have any questions or concerns, please contact the undersigned at Patrick.J.Kelley@usace.army.mil or (606)-585-4022.

Sincerely,

Patrick J. Kelley
Major, Corps of Engineers
Huntington District
Non-Federal Hydro Power
Program Manager

2 Enclosures

1. Memorandum of Operating Agreement, USACE Huntington District and American Municipal Power, November 20, 2015
2. USACE Lakes and Rivers Division Operations Order 2012-075 (Regional Strategy for Improved Water Quality Monitoring on the Ohio River)
3. ORSANCO letter to Erich Emery, USACE Lakes and Rivers Division dated November 8, 2015

cc:
Patrick Kelly, FERC-NY
Scott Barta, AMP Assistant Vice President of Hydroelectric Operations

Copy ____ of ____ Copies
Great Lakes & Ohio River Division
550 Main Street
Cincinnati, Ohio

LRD OPERATION ORDER 2012-075 (Regional Strategy for Improved Water Quality Monitoring on the Ohio River) (U)

(U) References: NA

(U) Time Zone Used Throughout the Operation: ROMEO (Eastern Daylight Time)

1. (U) Situation. Hydropower units are in place or planned at fourteen Ohio River lock and dam projects and the potential exists to develop this technology at many of the remaining lock and dam projects as well. As required by FERC licensing agreements, hydro facilities collect water quality data, but the parameters are usually limited to temperature and dissolved oxygen and instrumentation and reporting can vary greatly from operator to operator. There are operating hydropower units in place at six Ohio River lock and dam projects. If the water quality data generated by the hydro facilities were collected in a consistent fashion, this data set would be particularly useful to the Corps in its efforts to meet the objectives of the LRD I-Plan and ER 1110-2-8154 as well as Executive Order 12088, which requires that federal facilities comply with appropriate pollution control standards. Establishing a consistent, regional approach will help ensure that our environmental responsibilities are efficiently met and that the data gathered provides the Corps and our partners/stakeholders with an appropriate level of situational awareness.

2. (U) Mission. LRD establishes a regional systematic approach to managing water quality at/below non-federal hydropower installations associated with USACE dams on the Ohio River no later than 1 May, 2013 in order to ensure our environmental responsibilities are efficiently met.

3. (U) Execution.

a. (U) Commander's Intent.

(1) Purpose: Develop a regional, systematic approach to managing Ohio River water quality.

(2) Key Tasks: Districts will revise water quality (WQ) clauses in their projects' operating Memorandum of Agreements (MOAs) in order to ensure WQ data generated by all Ohio river hydropower operators are consistent.

(3) Endstate: WQ data generated by all Ohio River locks and dams hydropower operators is consistent.

b. (U) Concept of Operations. LRD's Ohio River districts will develop new language for MOAs and ensure the following two clauses are included:

(1) From 1 May through 31 October of each year, the Licensee will continuously measure and record in real time the water temperature and dissolved oxygen (DO) concentration

both upstream and downstream of the dam, at locations approved by the District and other appropriate water resources agencies throughout the license term or until such time as the Licensee ceases to operate the hydroelectric project. The collected data will be reported to the District as provided in Paragraph 4.c.

(2) Beginning 1 May, 2013, the Licensee will provide to the District, on an electronic and continuous basis (e.g., Internet website) real-time, continuously recorded DO, and water temperature data upstream and downstream of the hydroelectric facility from 1 May through 31 October of each year. Additionally, an Annual Report summarizing the data will be submitted to the District and the Division by December 1 of each year. The data provided does not relieve licensees from their obligation to monitor closely and adjust operations in order to meet state minimum WQ criteria or other Memorandum of Agreement with the District, i.e. DO instantaneous or averages included in the license requirements; nor does it absolve the the licensee from reporting/distributing data to appropriate state water quality agencies as required by other existing agreements.

4. **(U)** Tasks to Subordinate - Units LRP, LRH, LRL.

a. Revise MOAs and include the two clauses outlined above. Work with hydropower developers to include the clauses in new and modified MOAs.

b. Ensure hydropower operators begin continuously generating water quality data and make it available in real-time via the web.

c. Ensure data (parameters, frequency, report format, timeframe and availability) generated by all Ohio River locks and dams hydropower operators is consistent, for example:

Timeframe: Annually; 1-May through 31-October
Availability: Continuous
Parameters: Location, Date/Time, Temperature and Dissolved Oxygen
Frequency: Real-Time (continuous recording)
Report Format: Internet – web based hypertext markup language format; display of graphs; data tables as shown below.

Lat/Long	Date	Time	D.O. mg/L	Temp °C

5. **(U) Sustainment.** NA

6. **(U) Command and Signal.**

a. (U) Command.

b. (U) Control.

(1) LRD Non-Federal Hydropower Coordinator-Robert Iseli, robert.w.iseli@usace.army.mil

(2) LRD Water Management-Erich Emery, erich.b.emery@usace.army.mil

c. (U) Signal. POC for this order is Robert Iseli, robert.w.iseli@usace.army.mil.

(1) This order and associated products are maintained by LRD EOC.

ACKNOWLEDGE: Via once per district EOC email to CELRD-EOC@usace.army.mil

BURCHAM
BRIGADIER GENERAL

FOR THE COMMANDER
OFFICIAL:

PETERSON
DEPUTY COMMANDER

OHIO RIVER VALLEY
WATER SANITATION COMMISSION
5735 KELLOGG AVENUE, CINCINNATI, OHIO 45228-1112 (513) 231-7719 FAX: (513) 231-7761

November 18, 2015

Erich Emery
Water Management Division
US Army Corps of Engineers, Great Lakes & Ohio River Division
5550 Main Street, Room 10-032
Cincinnati, OH 45202-3222

Dear Mr. Emery:

ORSANCO adopted a policy on dissolved oxygen (DO) monitoring requirements for Ohio River hydroelectric power plants in 1988 due to concerns regarding the potential impacts of hydropower development on DO levels in the Ohio River. Past modeling studies indicated that aeration at dams was an important source of oxygen to the Ohio River. Diversion of the river's flow through hydroelectric turbines rather than passing over the dam, however, eliminates the potential for aeration. So while a hydropower facility does not lower DO directly, it does prevent the river from receiving an input of oxygen. It is that oxygen input that must be preserved at critical periods (i.e. low flow, high temperature periods when DO is typically lowest).

The Commission's hydropower policy includes three provisions which should be contained in each operating license for Ohio River hydroelectric facilities. These include:

1. Adequate studies are conducted prior to facility operation to define aeration characteristics of the dam;
2. Continuous monitoring of dissolved oxygen is provided at representative locations above and below the facility as appropriate, with data available to ORSANCO through remote interrogations;
3. Provisions are made in the facility design and operation to allow maintenance of the full aeration potential of the dam during critical conditions.

These provisions were set in place to ensure hydroelectric power production does not negatively contribute to DO levels dropping below minimum water quality standards established for the protection of aquatic life or create conditions whereas oxygen-demanding wastes require advanced wastewater treatment.

The requirements of the USACE LRD Operation Order 2012-075 are in-line with ORSANCO's hydropower policy. More specifically, Provisions 3(1) and 3(2) in the Corps OPORDER call for continuous DO monitoring at locations upstream and downstream of the dam through the license period and that the data be a made available electronically in real-time. This is consistent with

Provision 2 of the ORSANCO policy (noted above) which requires continuous monitoring be conducted upstream and downstream of all Ohio River hydropower facilities and that ORSANCO have access to remotely interrogate (i.e. electronically) the monitoring data.

Continuous DO monitoring and real-time tracking are critical to ensure hydropower operations are managed so as to maximize dam aeration potential during critical periods of low dissolved oxygen. LRD's OPORDER is consistent and complementary to ORSANCO's hydropower policy in requiring all Ohio River hydropower facilities to collect and make electronically available continuous DO data from locations upstream and downstream of the hydropower installations.

Please feel free to contact either myself or Sam Dinkins with any questions or comments regarding the Commission's hydropower policy.

Sincerely,

Richard Harrison
Executive Director

MEMORANDUM OF OPERATING AGREEMENT
Between American Municipal Power, Inc. and
the Huntington District Engineer, United States Army Corps of Engineers
for the Willow Island Hydropower Plant

WHEREAS, American Municipal Power, Inc. (hereinafter "AMP" or "Licensee"), is licensed (FERC Project License 6902) to construct and operate the Willow Island Hydroelectric Plant (hereinafter "Hydropower Plant"), at the Willow Island Locks and Dam, a Federal Navigational Facility located at Ohio River Mile 161.7, and operated by the Huntington District, United States Army Corps of Engineers (hereinafter "Huntington District"), and

WHEREAS, Article 308 of said license requires the Licensee to enter into a Memorandum of Operating Agreement (hereinafter referred to as the "MOA") with the Huntington District Engineer, United States Army Corps of Engineers (hereinafter referred to as the "Parties"); and

WHEREAS, the Memorandum is to describe the detailed operation of the powerhouse acceptable to the United States Army Corps of Engineers and specify any restrictions needed to protect the Federal interests of the United States Army Corps of Engineers' project and to provide reasonable rules and regulations pertaining to operations.

NOW THEREFORE, the Parties hereby agree to the following:

ARTICLE 1. COOPERATION

The Huntington District and the Licensee agree to cooperate in the coordinated operation of the Willow Island Locks and Dam and the Hydropower Plant to protect Federal interests, including but not limited to the limitations on fluctuations of the Willow Island pool and the downstream Belleville pool, and to cooperate in the generation of electric energy at the Hydropower Plant, provided such generation is consistent with the protection of Federal interests and with the Huntington District's responsibilities for maintaining navigation. The Huntington District hereby agrees to the extent possible, to provide as much flow as possible to the Hydropower Plant without jeopardizing, or causing any impacts to navigation or other Federal interest, and to the greatest extent possible operate the Willow Island Locks and Dam to maximize the Willow Island pool level to elevation 602 feet Ohio River Datum (ORD). The Huntington District also agrees to assist in the flushing of debris, when possible, as requested by the Licensee.

ARTICLE 2. PHYSICAL LOCATION AND DESCRIPTION

The Hydropower Plant is located on the south-east side of the Willow Island dam abutment at the left descending bank. The top of the powerhouse roof is at elevation 614 feet ORD. 12 feet above the Willow Island normal operating pool and 7.8 feet below the 100-year flood level of elevation 621.8 feet ORD. The Hydropower Plant includes a concrete powerhouse structure, containing two turbine-generator units with a total installed capacity of approximately 35 megawatts (MW); an approach channel; a tailrace channel, a submerged navigation groin; a single-circuit, 138 kilovolt transmission line; a landside closure structure; a riverside closure structure and a J-wall on the right side of the approach channel; recreation facilities; and other appurtenant facilities. The powerhouse structure is approximately 260 feet long and 140 feet wide. The powerhouse structure is a watertight cast-in-place reinforced concrete enclosure housing two horizontal-axis bulb-type generating units, each with an approximate FERC Licensed capacity of 17.5 MW ratings. and the auxiliary equipment. A tailrace channel. approximately 700 feet long and 200 feet wide, will conduct the downstream discharge of the turbines back to the river at a point approximately 800 feet below the Willow Island Dam. Normal access to the powerhouse interior will be at elevation 625.5 feet ORD by means of an entrance building constructed of reinforced concrete.

ARTICLE 3. OPERATIONAL REQUIREMENTS

Section A. GENERAL

1. The Licensee shall operate the Hydropower Plant in accordance with this Agreement and the License, and any amendments which shall become legally effective.

2. The Licensee shall operate the Hydropower Plant at all times in such manner as is necessary for the Huntington District to ensure that navigation will not be hindered. The Licensee recognizes that navigation is the primary purpose of the Willow Island Locks and Dam. If an emergency situation arises which threatens navigation or other Federal interests as determined in the sole discretion of the Huntington District, the Licensee agrees to cooperate with the Huntington District directives pertaining to the emergency.

3. The Project will be constructed and operated in a manner such that protects navigation, recreation, fish and wildlife, and other Federal interests that are within the purposes of the Corps.

Section B. SPECIFIC OPERATIONAL DETAILS

1. The Hydropower Plant shall be operated by AMP as a run-of-river plant. Under normal operation. the upper pool level shall be maintained at approximately elevation 602 feet ORD and the lower pool shall not fall below elevation 582 feet ORD on the lower gage due to the operation of the Hydropower Plant, unless otherwise directed

by the Huntington District. During low flow periods when the river is being regulated for protection of navigation, or other Federal Interests, all discharges for the Hydropower Plant will be will be controlled by the Lockmaster, or his designee who will issue specific discharge instructions.

2. When the Hydropower Project is discharging, the operators of the Hydropower Project shall maintain a watch of the Willow Island upper pool and regulate flows according to the direction of the Willow Island Locks and Dam Lockmaster such that the upper gauge readings shall stay between the limits of 13.2 and 11.8 depending on the total Ohio River flow as indicated in the table below:

Upper Gauge Limits Maximum / Minimum	Total River Flow (cfs)
13.2 12.8 Target 13.0	Less than 6,000
13.0 12.0 Target 12.5	6,000 to 36,000
12.2 11.8 Target 12.0	36,000 and greater

3. If the river flow exceeds approximately 142,000 cfs or if the river flow is less than 6,000 cfs (the minimum turbine discharge of 3,000 cfs plus lockage and leakage of approximately 3,000 cfs), the Hydropower Plant will be shut down and all flow passed through the Dam. The Huntington District will maintain the upper Willow Island pool when discharging any flow through the Dam. The sequence of gate openings shall ordinarily be in accordance with the Gate Operating Schedules, subject to revisions as operating experience is gained with the Hydropower Plant. The Belleville pool shall not be adversely affected by the operation of the Hydropower Plant.

4. In the event that the Licensee cannot meet its obligations imposed upon it by the terms of its License, the Huntington District agrees to operate the gates of the Dam in an effort to assist the Licensee to meet such obligation, provided such Dam gate operations can be made in accordance with the purposes of navigation or other Federal interests of the Huntington District.

5. The Licensee agrees to notify the Lockmaster, or his designee as far in advance as reasonably possible before the planned starting or stopping of a generating unit, and as soon as possible whenever a generating unit is subject to an unanticipated, forced outage. The Licensee agrees to keep the Lockmaster, or his designee advised of any change in generation that will affect the flow of water through the Hydropower Plant or cause significant fluctuations in the Willow Island and Belleville pools.

6. The Huntington District will make every reasonable effort to give advance notification to Licensee's control room personnel for any scheduled changes in discharge due to operation of the dam. Notification shall be made promptly after the fact for any unscheduled changes in the discharge or discharge capacity pertaining to the Willow Island Locks and Dam.

7. The Licensee recognizes that unusual and infrequent operations of Willow Island Locks and Dam may be required when any conditions develop on the Ohio River system that impact navigation or other Federal interests or life or property. When these conditions are determined to exist in the sole discretion of the Huntington District, control of the Hydropower Plant will be under the immediate direction of the Lockmaster, or his designee.

8. The Licensee shall have operating personnel on duty at the Hydropower Plant 24 hours each day. In the event remote operation of the Willow Island Hydropower facility is pursued in the future, revisions to the MOA and Operations Plan will be required to outline proper communication procedures.

9. When the Hydropower Plant is discharging, the operators of the Hydropower Plant shall maintain a watch of the Willow Island Locks upper gage and regulate flows according to the direction of the Lockmaster, or his designee, such that the upper gage readings will stay between the limits of 11.8 and 13.2, (601.8 feet ORD to 603.2 feet ORD) depending on the total river flow as indicated in Section 3.3 of the Regulating Plan.

   Even under the specified conditions, the Lockmaster, or his designee, may issue operating guidance if the Hydropower Plant operation is adversely impacting the navigation or other Federal interests, on the river system.

10. The Huntington District and Lockmaster, or his designee will maintain the upper Willow Island pool between elevation 602 feet ORD and elevation 603 feet ORD.

11. From 1 May through 31 October each year, the Licensee will continuously measure and record in real time the water temperature and dissolved oxygen (DO) concentration both upstream and downstream of the dam, at locations approved by the District and other appropriate water resources agencies throughout the license term, or until the Licensee is able to demonstrate following at least 5 years of monitoring that

the hydroelectric project does not adversely affect water temperature and DO and both parties agree to discontinue monitoring. or the Licensee ceases to operate the hydroelectric project. Should the licensee and the Corps fail to reach an agreement. the matter will be referred to the Director. Office of Energy Projects for resolution.

12. Once operations begin. the Licensee will provide to the District. on an electronic and continuous basis (e.g. internet website) real-time, continuously recorded DO and water temperature data upstream and downstream of the hydroelectric facility from 1 May through 31 October of each year, as per LRD OPERATIONAL ORDER 2012-075. Additionally. an Annual Report summarizing the data will be submitted to the District and Division by December 1 of each year. The data provided does not relieve Licensee from their obligation to monitor closely and adjust operations in order to meet state minimum WQ criteria. nor does it absolve the Licensee from reporting/distributing data to appropriate state water quality agencies as required by other existing agreements."

ARTICLE 4. INSPECTION

The Huntington District has the right to inspect the Hydropower Plant within a 48 hour notice period. This right of inspection is in addition to the Huntington District's authority under the Periodic Inspection and Continuing Evaluation of Completed Civil Works Structure Program. All inspection reports of the Hydropower Plant by FERC given to the Licensee shall be submitted to the Huntington District.

ARTICLE 5. COMMUNICATION NETWORK AND INFORMATION EXCHANGE

1. Both Parties agree to maintain communication between the Lockmaster, or his designee, at the Dam and the control room for the Hydropower Plant by means of a direct wire telephone circuit and/or by means of a two-way radio so as to coordinate the operation of the Hydropower Plant and the Dam, and to keep each other advised of any adverse river and weather conditions which may effect the elevation. flows and fluctuations in elevation of the river or of pending or threatened emergency affecting human life or property.

2. The Licensee shall provide to the Lockmaster, or his designee details of its turbine operations on a regular basis and any time the Licensees make a change in turbine operations. Licensee shall provide upper gage and lower gage information at the time of the change and the new total discharge flow in cfs. Information shall be upper gage and lower gage at the time of the change and the new total discharge flow in cfs.

3. The Lockmaster, or his designee at the Dam will provide the Licensee at its control room of the Hydropower Plant information on all gate operations at the Willow Island Locks and Dam as soon as possible before and after such gates have been operated.

4. The Licensee will comply with all relevant FERC orders regarding dissolved oxygen including but not limited to FERC's order 6902-018 issued on July 20, 2015.

5. The FERC Regional Director shall be invited to attend meetings regarding this MOA.

ARTICLE 6. MAINTENANCE OR CONSTRUCTION ACTIVITY BY HUNTINGTON DISTRICT

The Huntington District retains the authority to perform routine and recurring maintenance operations and to perform repair work, as well as new construction, on the Willow Island Locks and Dam. (Examples of routine maintenance include, but are not limited to greasing of trunnions, cycling of gates, drift passage through the Dam, and trash flushing of lock chambers and emergency gates). However, the Huntington District shall use good faith efforts to exercise such authority so as not to unreasonably hinder generation of electric energy by the Hydropower Plant. The Licensee agrees to cooperate with the Huntington District in such maintenance operations, repair work and new construction by allowing any necessary access to the exterior of the Hydropower Plant by Huntington District employees and, as authorized by the Huntington District Chief of Operations and Readiness Division or his designee, by Corps Contractors, actual or prospective, or their subcontractors. The MOA will specify any restrictions needed to protect the Federal interests of the United States Army Corps of Engineers' project and to provide reasonable rules and regulations pertaining to operations.

ARTICLE 7. RE-OPENER PROVISION

Both Parties recognize that this MOA is subject to review from time-to-time upon the request of either Party as operating experience is gained and conditions warrant.

ARTICLE 8. SAVING CLAUSE

Nothing in this MOA shall be deemed as a waiver of any requirement or obligation imposed upon the Licensee by the terms and conditions of the License or any amendments to the License issued by the Federal Energy Regulatory Commission, or its predecessor, the Federal Power Commission

WITNESSETH the following signatures and seals this 20th of November, 2015.

American Municipal Power, Inc.

By: _____

Mr. Marc S. Gerken. P.E.
President and CEO
American Municipal Power, Inc.

HUNTINGTON DISTRICT

By: _____

Mr. Philip M. Secrist III
Colonel, Corps of Engineers
Huntington District Engineer

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