

July 8, 2022

VIA E-FILING

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

Subject: Proposed Studies Plan Document and Joint Meeting Notification
Robert C. Byrd Locks and Dam Hydroelectric Project (FERC No. P-15094)

Dear Secretary Bose:

Ohio Power and Light, LLC. (Licensee or Applicant), is submitting the attached Proposed Studies Plan Document (PSP) for Robert. C. Byrd Hydroelectric Project (RC Byrd Project, or Project) in advance of the proposed Joint Meeting (Meeting) on July 26, 2022, in Gallipolis Ohio. The Project is located at the U.S. Army Corps of Engineers (USACE) Robert C. Byrd Locks and Dam (R.C. Byrd L&D). The Project will require the construction of a new intake, powerhouse, tailrace, transmission utilidor, and appurtenant facility structures. The Applicant is pursuing a license from the Federal Energy Regulatory Commission (FERC or Commission) to develop the Project and gain additional required USACE, West Virginia, and Ohio approvals.

The Commission issued the existing Preliminary Permits for the Project, effective March 17, 2021, for the RC Byrd Project. The Applicant submitted the Pre-Application Document (PAD) on April 22, 2022, for the Project. On June 16, 2022, the Commission approved the use of the Traditional Licensing Process (TLP) for the RC Byrd Project. Accordingly, the applicant is pursuing a new license for the Project pursuant to the Commission's TLP, as described at 18 Code of Federal Regulations (CFR) Part 4.

Proposed Joint Meeting

The purpose of this Meeting is to provide an opportunity for project participation for all pertinent agencies, Indian tribes, and members of the public. In advance of that Meeting, the Applicant is providing the PSP to the distribution list provided in the attached Stakeholder Distribution List to facilitate discussion and to ensure all environmental concerns and impacts are adequately addressed in the study plan. The Applicant will present a detailed overview of our new hydropower proposal, their potential environmental impact and discuss the ecological data available and studies to be conducted.

As part of the FERC licensing process, the Applicant previously solicited comments from resource agencies and stakeholders to prepare a PAD. The Applicant utilized these comments, past completed studies at the Robert C Byrd site used in a previous FERC License, and the study requests and

comments in developing the scope of studies that we respectfully suggest, to be conducted in support of licensing. In accordance with 18 CFR §4.38 (b)(3)(ii) of the Commission's regulations, Ohio Power intends to hold an initial Meeting to describe the Project background, concepts, and study methods described in the PSP. Pursuant to 18 CFR §4.38(b)(5), a public site visit of the Project is planned to begin at 10:00 on the West Virginia side of the Ohio River near the USACE Robert C Byrd access gate at the public parking and fishing access location off Robert Byrd Rd in the town of Gallipolis Ferry, Mason County. The site visit will proceed to the Ohio side of the Robert C. Byrd L&D at the parking lot off State Route 7, in the Town of Gallipolis in Gallia County Ohio. The afternoon Meeting is scheduled for 1:30 pm at the Dr. Samuel L. Bossard Memorial Library at 7 Spruce Street, Gallipolis, Ohio. During the afternoon meeting Ohio Power staff will present information regarding the Commission's TLP, project concepts, and specifics regarding the study process. Final details for the Meeting will be listed at <https://currenthydro.com/calendar>

The Applicant distributed the Meeting Notification with this PSP on July 8, 2022. The Applicant requests that stakeholders provide any additional comments on the proposed studies by July 24, 2022, for inclusion in the Meeting discussion or pursuant to 18 CFR §4.38(b)(4), no later than (NLT) 60 days after the Meeting. Please provide written comments NLT September 24, 2022, pursuant to 18 CFR §4.38(b)(5), so that the Applicant may schedule an additional in-person meeting to address all project impact concerns adequately.

Proposed Study Plan

The Applicant evaluated all the study requests submitted to date by the stakeholders, focusing on the requests that specifically addressed the criteria outlined in §4.38 (b) of the Commission's TLP regulations, as discussed above. This PSP also provides FERC, regulatory agencies, Indian Tribes, and other stakeholders with the methodology and details of Ohio Power's proposed studies. At this time, the Applicant is proposing to conduct the following studies as described in detail in the PSP:

1. Project Hydraulics Study;
2. Fish Assemblage Surveys;
3. Fisheries and Fish Entrainment and Impingement Studies;
4. Freshwater Mussel Surveys;
5. Water Quality Study;
6. Aquatic Habitat Study;
7. Terrestrial Habitat and RTE Species Study;
8. Wetlands and Waters Delineation;
9. Recreational Resources; and
10. Cultural Resources.

DOCUMENT DISTRIBUTION

In accordance with 18 CFR §4.38 (b) of the Commission's regulations, we are transmitting this letter to relevant and known resource agencies, Tribes, non-governmental organizations, and stakeholders that we believe may be interested in the Project (see attached Distribution List). The Applicant is filing the PSP with the Commission electronically and is distributing this letter to the

parties outlined on the attached distribution list. For parties listed on the attached distribution list who have provided an email address, this notification and PSP is distributing this letter via email; otherwise, Ohio Power is delivering this letter via U.S. mail. All parties interested in the relicensing process may obtain a copy of the PSP electronically through FERC's eLibrary system at <https://elibrary.ferc.gov/idmws/search/fercgensearch.asp> under docket number P-15094, or on the Applicant's website at <https://www.currenthydro.com/RobertCByrd>.

Comments on the PSP, including any additional or revised study requests, must be filed within 60 days of the Meeting, no later than September 25, 2022. Any proposed modifications to this PSP must address the Commission's criteria as presented in 18 CFR §4.38 (b)(5). As necessary, after the comment period closes, the Applicant will prepare a Revised Study Plan (RSP) that will address interested parties' comments to the extent practicable.

To assist with meeting planning and logistics, Ohio Power respectfully requests that individuals or organizations who plan to attend the in-person site visit and Meeting to RSVP by sending an email to roy@currenthydro.com on or before July 24, 2022. An online virtual meeting invitation will be sent to all listed stakeholders to access to Meeting discussion remotely.

If there are any questions regarding the PSP or the Meeting, please do not hesitate to contact Roy Powers at (914) 805-2522 or at roy@currenthydro.com.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Roy Powers', with a long horizontal flourish extending to the right.

Roy Powers
Chief Operations Officer
Ohio Power and Light, LLC.


ATTACHMENT A

CERTIFICATE OF SERVICE AND DISTRIBUTION LIST

CERTIFICATE OF SERVICE

I hereby certify that Ohio Power and Light, LLC. has distributed notice of the Joint Meeting and Proposed Study Plan for the proposed Robert C Byrd project to all parties on the attached Distribution List on or about July 8, 2022.

By:



Joel Herm, CEO

Ohio Power and Light LLC.

STAKEHOLDER DISTRIBUTION LIST

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Proposed Study Plan

Issued July 8, 2022

Robert C Byrd Hydroelectric Project, FERC P-15094

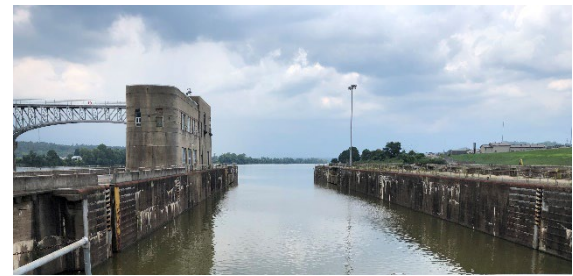
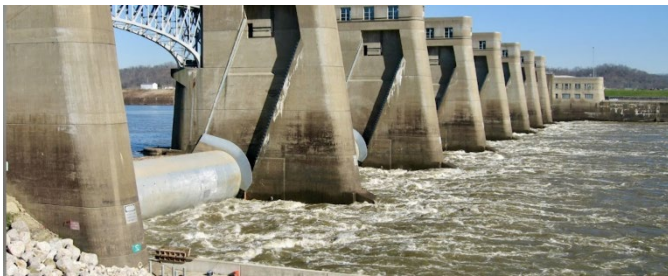


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Introduction and Background

1.1 Project Background

Ohio Power and Light, LLC. (Applicant) (the Applicant), is submitting the Proposed Studies Plan (PSP) for Robert C. Byrd Hydroelectric Project (RC Byrd Project, or Project) with the Federal Energy Regulatory Commission (FERC or Commission) Project No. 15094. This project is located on the Ohio River at river mile (RM) 279.2, at the U.S. Army Corps of Engineers (USACE), R.C. Byrd L&D near the Town of Gallipolis, in Gallia County, Ohio and Town of Gallipolis Ferry, Mason County, West Virginia.

The Commission issued the existing Preliminary Permit for the Project, with an effective date of March 17, 2021, for RC Byrd Project. The Applicant submitted Pre-Application Documents (PAD) on 22 April, 2022, for the Project. On June 16, 2022, the Applicant was granted Commission approval of the use of the Traditional Licensing Process (TLP). The Applicant is pursuing a new license for the Project pursuant to the Commission's TLP, as described at 18 Code of Federal Regulations (CFR) Part 4.

The Project will require the construction of new intakes, powerhouses, tailraces, transmission utilidors, and appurtenant recreational and other facility structures. The Applicant is pursuing a license from FERC to develop the Project and seek other required approvals, including permits from the USACE and the States of West Virginia and Ohio.

1.2 Study Plan Overview

The goal of this PSP is to advise all stakeholders of the studies that the Applicant proposes to conduct in connection with the licensing of this Project and to afford an additional opportunity for further discussion if these study plans differ from stakeholders' expectations or requirements. This PSP is being distributed to stakeholders concurrent FERC filing and incorporates additional studies and revised methodologies that were developed in response to stakeholder comments on the Applicant's PAD, in its previous Agency Consultation, and in other discussions with stakeholders, as further described herein.

The Applicant is distributing this PSP to resource agencies and stakeholders to provide: (i) a summary of comments and study requests made by various interested stakeholders and (ii) to introduce plans for the studies to be conducted before the Project's License Application submittals, including the rationale for and the methods and scope of each study. The Applicant distributed the Joint Meeting (Meeting) Notification with this PSP on July 8, 2022. The Applicant requests that stakeholders provide any additional comments on the proposed studies by July 24, 2022, for inclusion in the meeting discussion or pursuant to 18 CFR §4.38(b)(5), no later than (NLT) 60 days after the Meeting. Please provide written comments NLT September 24, 2022, so

that the Applicant may schedule an additional in-person meeting to address all project impact concerns adequately.

1.3 Agency Consultation

Table 1-2 Study Requests and Comments

Date	Agency / Stakeholder	Agency/ Stakeholder Participant	Other participants	Type of Consultation	Summary of Consultation
6/29/2021	Edge Engineering & Science	Casey Swecker		Informal Phone Call	Mr. Swecker is USFWS Qualified Freshwater Mussel Surveyor. Since 6/29/21: Discussion of a practicable approach to a Mussel Survey and Aquatic Habitat Study in the vicinity of the Projects.
6/25/2021	Bureau of Indian Affairs	Eastern Regional Office	Jan Borchert	Email Outreach	Informal request for support in identifying Tribal Nations affected by the Projects.
7/20/2021	USFWS	Richard McCorkle	Jan Borchert	Informal Phone Call	10-minute discussion of permitting plan and proposed use of TLP
10/26/2021	USACE			Agreement	Non-Disclosure Agreement signed with USACE and Ohio Power and Light
1/12/2022	USACE	Major Kelley and Belinda Weikle	Joel Herm, Norm Biship, Simon Strauss, Paul McMenemy	Site Visit at Robert C. Byrd	Initial site visit
1/13/2022	FERC	John Smith and Janet Hutzel	Current Hydro	Informal Virtual Meeting	The applicant and FERC have been discussing coordination within FERC to manage New Cumberland, Pike Island and Robert C Byrd Projects.
2/23/2022	USACE	Major Kelley,	Joel Herm	Teams Meeting	Discussion to encourage open communication and early engagement.

		Belinda Weikle, Matt Coakly and Rachel Phillips	and Roy Powers		Permitting update, NDA status, modeling, access MOA, timelines of meeting requests, update on engineering status, partnering program and minimum list of 404 and 408 requirements.
3/2/2022	Ohio River Valley Water Sanitation Commission (ORSANCO)	Jason Heath, Ryan Argo, Sam Dinkins	Current Hydro and Edge ES	Informal Virtual Meeting	Introduced Projects to ORSANCO. Discussed existing physical and biological datasets repositied by ORSANCO in vicinity of New Cumberland, Pike Island and Robert C Byrd. Sought guidance on Project-specific studies.
3/9/2022	USFWS	Rick McCorkle	Roy Powers	Email	Joint meeting notification and response. USFWS appreciates the collaborative approach.
3/24/2022	Stakeholder, Tribes and Public	Jacob Harrell, Rick McCorkle, Janet Norman, and others.	Current Hydro, Edge Engineering, and Alden Labs	In-person and virtual Joint Meeting	Presented Primarily Pike Island and New Cumberland Projects and Proposed Study Plan. RC Byrd Project was discussed during formal site visit and during meeting. Feedback from Pike and New Cumberland PSP would be used to develop the RC Byrd PSP.
4/19/2022	USACE	10 attendees	Roy Powers	GoToMeeting	Monthly meeting to continue open communication and early engagement. Update on permitting, regulatory guidance for water monitoring deployment, mussel study data 2021, access MOA example, site visit approval timeline, USACE/FERC MOU, study plan, and partnering program.
5/11/2022	USACE	16 attendees	Joel Herm and Roy Powers	GoToMeeting	Monthly meeting to continue open communication and early engagement. Update on permitting, PAD comments, transmission line proposal, follow on electrical meeting, water quality permitting, follow on meeting with USACE archeologist, access MOU in progress, and modeling.

5/11/2022	USFWS and WVDNR	Rick McCorkle and Jacob Harrell	Steve Amaral, Mithcell Kreige, Joel Herm and Roy Powers	Teams	Discussion to get feedback on proposed study plan. Discussed the Pike Island and New Cumberland PSP will be used to draft RC Byrd Project's PSP. Early discussion on the PSP.
6/8/2022	USACE	10 attendees	Roy Powers	GoToMeeting	Monthly meeting to continue open communication and early engagement. Update on permitting and TLP approval, engineering update, interconnection update, USACE electrical engineer comments, cultural data, follow on meeting with USACE archologist and joint meeting coordination.
6/22/2022	USACE	Major Kelley, Belinda Weikle, Rachel Phillips and Annette Erickson	Mitchell Kriege, Kristi Soltysaik, and Roy Powers	GoToMeeting	Meeting to discuss and begin an early engagement on historical and archaeological consideration. Ohio Power will submit a scope of work to WV and OH SHPO. Cultural and archaeological studies need to be completed on the decommissioned lock. Will keep USACE appraised of all cultural studies developments.

Comments received included study requests, comments on the PAD's content, past study result information, and requests for specific protection, mitigation, and enhancement measures.

In keeping with the intent of this document, the Applicant focused primarily on the study request comments; however, all comments were reviewed to ensure that the scope of the Project engineering adequately address all issues, and that the Applicant is a good environmental partner with the USACE, all agencies, the public and Indian Tribes. The Applicant addressed all comments thus far and welcomes additional discussion to improve proposed studies to further support a high-quality FERC License Application and protect our valuable resources.

1.4 Studies Proposed to be completed prior to Filing of FERC License Applications

Based upon comments received, the Applicant will conduct the following ten (10) studies that will be used in its License Application to assess Project effects:

-
- Project Hydraulics Study
 - Fish Assemblage Surveys
 - Fisheries and Fish Entrainment and Impingement Studies
 - Freshwater Mussel Surveys
 - Water Quality Study
 - Aquatic Habitat Study
 - Terrestrial Habitat and RTE Species Study
 - Wetlands and Waters Delineation
 - Recreational Resources
 - Cultural Resources

At this stage in the FERC licensing process, studies are conducted to gather data to assess Project effects addressed later in the Draft License Application (DLA) portion of the process. In addition to the Project effects assessments, any proposed protection, mitigation, and enhancement measures determined to be necessary will be addressed in the DLA. Some studies will commence as part of the DLA but may not be completed and assessed until later in the process or even after FERC license issuance.

It should be further noted that the RC Byrd Project proposed by the Applicant has a much lower environmental impact than the Previously issued FERC Licensed to the City of Wadsworth Ohio. The prior Robert C Byrd FERC Project Number P-12796 License was issued on August 30, 2017, for 50 years and kept active until The City of Wadsworth Surrendered the license on 3 December 2017.

The Applicant is developing the hydropower Project with the philosophy and intention of causing minimal impact to hydraulic, ecological, and recreational resources both at the powerhouse and downstream. This is the motivation for designing a powerhouse that uses maximum flows of 90% flow exceedance at these locations and with a powerhouse hydraulic capacity of 13,280 cubic feet per second (cfs) (see appendix A for annual and monthly flow duration curves [FDCs]). Thus, it is expected and intended that the Project will have minimal effects on Project-area resources and will protect existing uses of the Project-area waters. There may be localized changes in flow velocity and direction due to small proportions of water released from the powerhouse, rather than exclusively over the dam or via spillway gates and lockage operations. These changes will be analyzed in the Project Hydraulics Study and Water Quality Study, but lower hydraulic flow capacity diversion is an important factor when analyzing many other proposed studies described herein.

The proposed construction and operation described in the PAD has changed significantly from the information provided in the February 2021 Preliminary Permit submission which placed the powerhouse on the far western end of the USACE dam. The Applicant has since determined that utilizing the existing decommissioned USACE lock structures in the mid-channel of the Ohio River will be less disruptive to R.C. Byrd L&D USACE operations, reduce CAPEX, provide firm power, and possibly improve river flow and sediment management.

1.5 Study Requests

The Applicant worked with Interested Parties, Licensing Participants, and subject matter experts to identify areas of potential concern for Project effects to the human and natural environments. Partnering with Edge Engineering & Science and Alden Labs provides the Applicant with experiential guidance and standard methodology, included herein, to conduct appropriate and thorough investigations. Any resource agency, Indian Tribe, or members of the public may identify additional studies for consideration as specified by CFR 18, § 4.38 (b)(5); any study request must:

- Identify its determination of necessary studies to be performed or the information to be provided by the potential applicant;
- Identify the basis for its determination;
- Discuss its understanding of the resource issues and its goals and objectives for these resources;
- Explain why each study methodology recommended by it is more appropriate than any other available methodology alternatives, including those identified by the potential applicant pursuant to paragraph (b)(2)(vii) of CFR 18, § 4.38;
 - Detailed descriptions of any proposed studies and the proposed methodologies to be employed
- Document that the use of each study methodology recommended by it is a generally accepted practice; and
- Explain how the studies and information requested will be useful to the agency, Indian tribe, or member of the public in furthering its resource goals and objectives that are affected by the proposed project.

The Applicant addressed all comments thus far and welcomes additional discussion to further improve proposed studies and protect our valuable resources. Please provide written comments NLT September 25, 2022, so that the Applicant may schedule an additional in-person meeting to address all project impact concerns adequately. Email or mail completed study requests in MS Word or PDF format to:

Roy Powers
Roy@currenthydro.com
Ohio Power and Light, LLC.

Post Office Box 224
Rhinebeck NY, 12572

1.6 Studies and Resource Protection Plans Proposed to be Completed After Receipt of FERC License, but Prior to Construction

The Applicant intends to conduct various studies and prepare several resource protection plans after the FERC License is issued, but before the start of Project construction: each of these studies or plans are discussed below, along with the rationale for conducting them later in the Project development process.

The Applicant will propose that each of these studies and plans be required as a condition of its FERC License for the Project. The Applicant will request that FERC require that the plans for these studies be developed in consultation with agencies and stakeholders after issuance of the FERC License. Study results will be issued for agency and stakeholder review and comment before filing with FERC. FERC will require that the studies and or plans be completed before authorizing construction to begin. Further, if any of the studies indicate that resource protection or mitigation measures are necessary, such measures will be developed in consultation with affected resource agencies and stakeholders.

A brief description of each study or plan to be prepared after receiving the FERC License is provided below. Additional discussion will be included in the Applicant's DLA.

Invasive Species Survey and Invasive Species Management Plan

The Applicant will conduct an Invasive Species Survey in the area of the new powerhouse, transmission line, and substation. This study will be undertaken post-licensing, before commencing construction. The new survey will be followed by the development of an Invasive Species Management Plan that will apply to initial Project construction and future activities at the Project.

Avian Protection

The Applicant will develop an Avian Protection Plan for the Project. The Plan will be developed consistent with Avian Power Line Interaction Committee (APLIC) and the United States Fish and Wildlife Service (USFWS) guidelines and will identify protection measures that will be incorporated in the Project design. The Plan will also address measures that will be implemented in the future in association with transmission facility maintenance activities. This plan may need to be developed after the DLA but earlier in the process, as endangered species consultation will be necessary in order for FERC to make its effects determination during the National Environmental Policy Act (NEPA) review phase of licensing. A separate bald eagle (*Haliaeetus leucocephalus*) protection plan will be necessary after receipt of FERC license but prior to

construction. Prior to commencement of construction activities, surveys for active nest will be conducted and a plan developed, consistent with Service guidelines, to ensure that trees are not cleared within eagle nesting habitat and that nests are not disturbed by construction activities. This plan will be developed in consultation with the Service, to ensure it is consistent with national guidelines for protecting eagles.

Transmission Line Maintenance

The Applicant will develop a Transmission Line Corridor Management Plan. This plan will detail procedures to be implemented to control vegetation along any newly created transmission line corridors developed as part of the FERC-licensed Project. The proposed interconnection will follow existing utility easements and very little to no tree cutting is expected at this time.

Erosion and Sedimentation Control Plan

During construction, an Erosion and Sedimentation Control Plan will be required by the Commission, the USACE, and the States, under their respective regulatory approval processes. Prior to the start of construction, the Applicant will develop the plan in consultation with these agencies. The plan will address the relevant erosion and sedimentation control requirements of all agencies in one document. This plan will include all provisions to minimize erosion and sedimentation disturbance during Project construction and stabilize banks post-construction. In addition, a sediment testing and management plan will be included that is compliant with applicable State regulations.

Hazardous, Toxic and Radioactive Waste Plan

Hazardous, Toxic and Radioactive Waste (HTRW) study may be recommended and required by FERC, USFWS and WVDNR. According to the 1988 FEIS (FERC 1988). Applicant may complete a Phase 1 ESA and HTRW prior to construction-related activities commence and in consultation with WVDNR and USFWS to prevent contaminant-related impacts to fish and wildlife resources. Sediment samples will be analyzed for the full suite of contaminants that may be present. Sampling should focus on sediment layers where there is sediment staining or odor as this can be indicative of petroleum contamination. Sampling should also be focused on layers with fine grain material (e.g., silts) as these are the sediment materials to which contaminants would be bound. If there is no obvious staining or odor and the core appears to be fairly homogeneous, composite samples of top and bottom of the core should be sampled for chemical analysis. The requested study and resulting information will be used by the Service to determine whether any protection, mitigation or enhancement measures are needed to prevent impacts to fish and wildlife resources.

1.7 Area of Project Effect and Study Areas

The studies discussed herein will be conducted within the Area of Project Effect (APE). The APE includes an aquatic component and a terrestrial component.

The aquatic APE is the water area upstream and downstream of R.C. Byrd L&D that the new hydropower Project will potentially impact by changing hydraulic conditions (e.g., water elevations, flow velocities, or flow directions).

The terrestrial APE generally includes lands within the proposed Project Boundary, including transmission line corridors. The terrestrial APE also includes all lands that may be used for construction access, equipment storage areas, etc., and the new Recreational Fishing Access Park.

1.8 Study Reporting

Planned monthly meetings starting in the summer of 2022 will present the current findings and status of all studies. In general, we expect to issue final study reports concurrent with the DLA for the Project in September 2022. However, reports for some studies that require late summer, and all fieldwork may not be complete when the DLAs are issued. If necessary, the Applicant will issue supplements to the DLA for such studies and to report results. In any event, agencies will be provided drafts of all study reports for review and comment before the reports are finalized for submission to FERC with the Final License Application.

Proposed Studies

2.1 Project Hydraulics Study

Goals and Objectives

The Applicant is developing the Project at the R.C. Byrd L&D with the philosophy and intention of causing minimal impact to hydraulic, ecological, and recreational resources both at the powerhouse and downstream. This is the motivation for designing a powerhouse that uses maximum flows of 90% flow exceedance. The Project will operate according to USACE operational directives and will leave at least 60% of the Ohio River water going over the spillway for most of the year (see appendix A for annual and monthly FDCs). However, the redirection of even a small portion of water through the powerhouse could cause localized changes in velocity and direction of water flow. These changes can potentially alter aquatic habitat, water quality, sediment movement, and access to existing recreational facilities.

A Project Hydraulics Study will be performed to understand the effect powerhouse operations will have on the existing flow regime, study the potential for new sediment transport patterns and scouring, and facilitate the evaluation of the possibility that such alterations might have on habitat and recreation. The specific objectives of this study are to:

- Task 1 - Compile available hydrologic and bathymetric data and collect additional data if needed;
- Task 2 - Develop a two-dimensional hydraulic model of existing flow conditions upstream and downstream of the dam;
- Task 3 - Confirm the upstream and downstream boundaries of the APE;
- Task 4 - Model future flow conditions (velocity, direction, and depth) at high, average, and low flows in the APE using the two-dimensional model;
- Task 5 - Model changes in sediment movement and deposition in the APE using a two-dimensional model; and
- Task 6 - Model pool levels under future flow conditions at high, average, and low flows in the APE.

Data obtained through the initial phases of the modeling conducted under this study will be used as inputs to several other studies to assess resource effects. Specifically, the Project Hydraulic Study will provide the following data for the studies listed below:

- Fish Entrainment and Impingement Studies (Section 2.3) - Flow conditions upstream of the powerhouse.
- Water Quality Study (Section 2.5) - Flow conditions as related to spillway flow.
- Aquatic Habitat Study (Section 2.6) - Areas of changed sediment deposition and bed shear forces.

-
- Recreational Uses (Section 2.9) - Provide guidance as to the hydraulic conditions affecting the delineation of recreational use areas.

Resource Management Goals

USACE has authority over the hydraulic and physical operation of hydropower projects operated at USACE-owned facilities and requires them to conform to USACE policy regarding water management, which includes both water quality and water control. The Applicant's hydropower development at R.C. Byrd L&D and Dam must conform to USACE operational goals, which include ensuring that "all applicable state and federal water quality standards are met, water quality degradation of Corps resources is avoided or minimized, and project responsibilities are attained." (ER-1110-2-8154, Sec 2.1, 2018) The USACE dams in the upper Ohio River, including Robert C Byrd, are considered "efficient aerators," and reduced spillage over the dam spillway could result in the reduction of dissolved oxygen (DO) concentration which is critical to maintaining the overall health of the downstream reaches of the river. Likewise, the Corps is responsible for maintaining several water control functions on the Ohio River, including flow regulation, navigation, and recreational access.

Encompassed in the objectives of USACE are the goals of USFWS, Ohio DNR, and West Virginia DNR, as well as various recreation and conservation stakeholders that regulate, manage, and utilize the fisheries on the Ohio River. The Ohio River is home to a large number of fish and mussel species, some of which are federally listed as threatened or endangered. The protection of critical habitat for these species is of special concern for the Applicant and a responsibility that we take seriously.

Existing Information

There is a large amount of channel geometry data in existence collected for the purposes of academic studies, river navigation, and operational monitoring, which will be surveyed in advance of creating a specific data collection plan. Data sources may include U.S. Geological Survey (USGS), USACE, Pennsylvania Spatial Data Access, Ohio Geographically Referenced Information Program, and published studies and models. The existing available data will be compiled, and additional data needs evaluated in partnership with Alden Labs and Edge Engineering & Science. The Applicant is in the process of communicating with ORSANCO, USGS, USACE, and other hydropower providers to determine to what extent our efforts can be coordinated in terms of both data collection and modeling.

Methodology

Task 1 - Compile available hydrologic and bathymetric data; Estimate the Project APE and collect additional data if needed

Hydrologic data representative of Project area flows is available from USGS and USACE. The

Applicant will use existing data and analytical hydraulic principles with input from stakeholders, to estimate the APE for the Project. Considering the interests of the various stakeholders, the Applicant will choose the hydraulic study area appropriate for this Project, which will, at a minimum, include the estimated APE. This study area will extend at least 1600 meters below the tailrace, 1600 meters above the intake, and include any sensitive habitat areas identified at the time of study area selection.

Some bathymetric data is also available for the Project area from previous studies and operational needs. The existing data will be evaluated to determine if it is up to date and suitable for this study's objectives. If the study area is found to extend beyond the range of the existing, useable bathymetric data, the Applicant will conduct further field measurements to obtain additional bathymetric data and substrate characterization. ArcGIS spatial analysis extensions will be utilized to provide appropriate interpretation and mapping of bathymetric data.

Task 2 - Develop a two-dimensional hydraulic model of existing flow conditions upstream and downstream

Use dataset developed in Task 1 to create a two-dimensional, vertically averaged hydraulic model of the study area using software suitable to the application and accepted by stakeholders. The model will be developed with the following questions in mind and validated at high, average, and low flow conditions.

- How will powerhouse diversions change the major flowlines within navigational channels?
- How will flow velocities and lateral flow patterns change at the intake and tailrace areas of the powerhouse?
- Will water surface levels upstream and downstream of the dam be affected?
- Where do important areas of aquatic habitat coincide with predicted velocity or flow direction changes?
- What impact, if any, will powerhouse flows have on sediment transport in key areas within the study area?

Task 3 - Confirm the upstream and downstream boundaries of the APE;

Using the hydraulic model results, the boundaries of the APE will be confirmed based on hydraulic effect. If needed, the study area will be expanded to include all of the APE.

Task 4 - Model future flow conditions (velocity, direction, and depth) at high, average, and low flows in the APE using the hydraulic model.

The proposed hydraulic model will demonstrate flow conditions longitudinally, along the direction of flow, and laterally. Model inputs will be prepared from the best possible data and with study objectives in mind.

It is a design objective that hydropower operations at R.C. Byrd L&D have minimal effect on spillway flows, especially during critical flow periods. A primary modeling objective is to enumerate how spillway flows will be affected during low flow periods. Modeling results will assist in the design of state-of-the-art air injection systems proposed to be installed in the powerhouse to proactively mitigate any reduction in spillway flows and to support target DO levels during critical periods.

Task 5 - Model changes in sediment movement and deposition in the APE using the two-dimensional model.

Hydraulic modeling will be targeted both to overall changes in riverbed sedimentation, especially as it affects identified habitat areas or navigation and potential impacts to existing structures and riverbanks.

Task 6 - Model pool levels under future flow conditions at high, average, and low flows in the APE.

Pool levels are not expected to change under the proposed operating procedures of any of the three plants. The Applicant is aware that other hydropower projects on the Ohio River have had unexpected effects on pool levels in the vicinity of the Project. However, attention will be focused on steady-state pool levels and not on pulse flows because of the small quantity of water the powerhouse will be designed to pass. It is unlikely that hydropower operations will have an appreciable effect on pool levels at average or high flows. At low flows, steady-state pool levels will be examined for potential hazards should water levels change as a result of start-up or shut-down.

Level of Effort and Cost

A comprehensive hydraulics modeling requires a high level of effort by staff experienced in fluid mechanics and hydraulics with access to large amounts of empirical data. Uncertainty in available field data may increase the level of effort and cost considerably. The Applicant welcomes the opportunity to discuss further methodologies and the possibility of collaboration on more extensive basin-wide studies. Hydraulic modeling is scheduled to be begin in July 2022 and with initial report submitted as part of the DLA. Final modeling efforts will be completed as part of the USACE 408 process. The expected initial cost to conduct this study for the Project is \$50,000 to \$75,000.

2.2 Fish Assemblage Surveys

Goals and Objectives

This survey aims to provide a comprehensive assessment of fish populations and current information on the occurrence, abundance, and distribution of fish species in and around the

Project area; and provide quality data for use in a desktop fish entrainment analysis. Design of fisheries studies and analysis of corresponding data will pay particular attention to game species and state-protected benthic fishes.

Resource Management Goals

As the state resource agency, the West Virginia Division of Natural Resources (WVDNR) is charged with protecting and managing all wildlife within West Virginia, including the Ohio River fisheries. The Ohio Department of Natural Resources (ODNR) Division of Wildlife (DOW) aims to conserve and improve fish and wildlife resources and their habitats within the state of Ohio. Operations at the RC Byrd Project may impact Ohio River fish populations. An adequate fish survey would thus be necessary for making the most quality decisions about the fishery management within the Project area.

The ORSANCO is an interstate agency, composed of federal partners and eight member states bordering or within the Ohio River basin. ORSANCO was formed in 1948 and, commissioned to abate existing pollution and prevent future degradation of waters within the Ohio River basin. ORSANCO conducts water quality monitoring and assessments on behalf of Ohio River mainstem states, including West Virginia and Ohio. ORSANCO's biological program uses fish studies to establish biological criteria for the Ohio River to provide insight into the overall health of the river ecosystem, and assessment results are consequently utilized for regulatory, restorative, and protective efforts within the Ohio River basin.

Existing Information

Both ODNR and WVDNR have conducted numerous fish annual studies near the RC Byrd project. These studies, however, focus primarily on game fish species and utilize techniques that do not offer a full assessment of the total fish assemblages within the river reach. ORSANCO conducts fish assemblage assessments within discrete navigational pools of the Ohio River as part of their biological monitoring program on regular annual cycles. ORSANCO assessed the fish assemblages of Robert C Byrd Pool in 2008, 2013, and 2019. The Greenup Pool is located downstream of Robert C Byrd and was assessed in 2006, 2011 and 2016. Between 2006 and 2008, ORSANCO also collected benthic trawling data to supplement their nighttime electrofishing dataset.

According to the most recent ORSANCO survey events within of RC Byrd and Greenup Pools, the biological health (assessed via the modified Ohio River Fish Index- *mORFIN*) is categorized as "Fair" and "Good," respectively. An assessed pool is deemed to be in full support of its aquatic life-use (ALU) designation (i.e., supporting intact biological communities) if both the *mORFIN* and Ohio River Macroinvertebrate Index (ORMI) result in biological ratings of "Fair," "Good," "Very Good," or "Excellent." The biological ratings for both navigational pools indicate full support of its ALU designation (ORSANCO 2017; ORSANCO 2018). ORSANCO's contemporary fish assessments and extensive historical database exhibit an adequate baseline characterization

of the fish assemblage in the vicinity of the RC Byrd Project.

Based on the current, best-available data (electrofishing, trawling, creel surveys), no federally endangered or threatened fish species are known to occur in this portion of the Ohio River. The Lake Sturgeon (*Acipenser fulvescens*) is petitioned for federal listing but has not been collected in the mid or upper Ohio River mainstem since 1971 and is generally considered extirpated from Ohio (Ohio River watershed only) and West Virginia (Rice and Zimmerman 2019; Center for Biological Diversity 2018). Thirty-one fish species are listed by the ODNR as endangered ($n=22$) or threatened ($n=11$), and a subset of these species are known or could potentially occur in the upper Ohio River mainstem.

Project Operation Potential Impact

The hydropower facility and associated USACE L&D structure create a partial physical barrier to fish species' upstream and downstream movement. During hydropower operation, river flow is partially directed through the powerhouse. Increased flow through the powerhouse is attractive to many fish moving downstream. Passing through the powerhouse poses inherent risks to fish. Fish may become entrained and may suffer turbine-induced injury and mortality, primarily due to blade strikes. In addition, alterations in flow patterns may alter fish behaviors and degrade suitable habitat downstream of the Project.

The Applicant is developing the hydropower Project at R.C. Byrd L&D with the philosophy and intention of causing minimal impact to hydraulic, ecological, and recreational resources both at the powerhouse and downstream. This is the motivation for designing a powerhouse that uses maximum flows of 90% flow exceedance at these locations and a powerhouse hydraulic capacity of 13,280 cfs (see appendix A for annual and monthly FDCs). Thus, it is expected and intended that the Project will have minimal effects on Project-area resources and will protect existing uses of the Project-area waters. There may be localized changes in flow velocity and direction due to small proportions of water to be released from the powerhouse rather than exclusively over the dam or via spillway gates and lockage operations. These changes will be analyzed in the Project Hydraulics Study and Water Quality Study, but lower hydraulic diversion is an important factor when analyzing effects on fish ecology. Lower volumes of water required for maximum powerhouse capacity equates to lower intake velocities and a higher percentage of spillage. Rated flow velocities at the Project will be about 2.0-2.5 feet per second (fps) at the trash racks and lower at the transect immediately upstream of the powerhouse intake piers, just upstream of the trash racks. All encountered fish from assemblage surveys and any other existing fisheries data will be modeled as part of entrainment and impingement studies outlined in section 2.3.

Study Methodology

Project-specific fisheries surveys are proposed and include night-time electrofishing and benthic trawling to complement the aggregation of existing fisheries data compiled from various survey techniques. Survey methodologies should target the complete array of fish species found at the

RC Byrd project, including a notable interest dedicated to American Eel (*Anguilla rostrata*) presence.

Under guidelines defined in Appendix A of ORSANCO's Biological Programs Standard Operating Procedures (SOP) (February 2020), fisheries assessments will occur in the vicinity of the R.C. Byrd L&D. The Applicant will conduct night-time boat electrofishing surveys at six, 0.5-kilometer-long sampling sites located upstream ($n=3$) and downstream ($n=3$) of R.C. Byrd L&D. Sites will be placed within approximately 1.6 kilometers upstream and downstream of the L&D. Four sites will be surveyed along the shorelines supporting the hydroelectric operations and two sites will be surveyed along the opposing shore (i.e., lock-chamber sides). A total of 12 electrofishing sites will be sampled. Electrofishing is performed at night to maximize gear efficiency and fish capture effectiveness resulting from increased foraging activity of predators that consequently increase prey movements along the littoral zone adjacent to the riverbank. One sampling event will be conducted per site in mid/late summer (July - September) during suitable survey conditions with regard (but not limited to) water transparency (i.e., Secchi depth), river flows, weather conditions, water temperatures, and safety (e.g., field staff, the general public). Fishes will be netted and placed in a live well for subsequent processing (e.g., identification, enumeration, size class lengths, physical condition), data recording, vouchering (photographic or preserved – as needed), and returned to the river. Characterization of instream habitats will occur using the "Copper-Pole Method" and following Appendix C of ORSANCO's SOP to assign a discrete habitat classification that ultimately accounts for each biotic index's scoring expectations.

Benthic trawling is a survey method used to target benthic fish species that boat electrofishing methods may underrepresent. Several benthic fishes listed in the state of Ohio as threatened (T), such as American Eel (T), River Darter (*Percina shumardi*) (T), Channel Darter (*Percina copelandi*) (T), may potentially occur in the vicinity of the locks and dam. No fish species listed as threatened or endangered by the USFWS are known to occur in this portion of the Ohio River. Benthic trawling will be performed at each of the electrofishing sites associated with the RC Byrd Project to supplement boat electrofishing survey data and existing datasets. Benthic trawling will occur within the 0.5-kilometer-long sampling sites using an eight-foot mini-Missouri trawl net for sampling small-bodied benthic fishes (Herzog et al. 2009) or equivalent netting. Diurnal sampling will involve twenty-four (24) trawls, each lasting approximately one minute as the boat travels in a downstream direction with the boat powered in reverse (i.e., bow upstream). Sampling will be conducted in mid/late summer (July - September) during suitable survey conditions with regard (but not limited to) water transparency (i.e., Secchi depth), river flows, weather conditions, water temperatures (above 65 degrees F), and safety (e.g., field staff, the general public). Fishes will be netted and placed in a live well for subsequent processing (e.g., identification, enumeration, size class lengths, physical condition), data recording, vouchering (photographic or preserved – as needed), and returned to the river.

Level of Effort and Cost

A qualitative and comprehensive study of the fishery would necessitate a high level of effort by staff experienced in fisheries and with a working knowledge Ohio River of fish identification. Conducting research targeting each trophic level and species in the Project area would be relatively costly compared to other recent electrofishing surveys in the area. However, such a comprehensive analysis of the fishery is necessary for proper management decisions and for the later determination of fish entrainment through the desktop entrainment analysis request in study 2.3. Additionally, the Applicant team welcomes the opportunity to further discuss methodologies and study plans with all stakeholders. The anticipated level of efforts and costs associated with fisheries studies are below:

Task	Hours	Anticipated Costs
Electrofishing	350	\$50,000
Benthic Trawling	100	\$15,000

2.3 Fisheries and Fish Entrainment and Impingement Studies

Goals and Objectives

The Applicant will conduct a desktop fish impingement and entrainment study. This study will describe the physical characteristics of the proposed Project that may influence fish impingement and entrainment rates, including the intake location and dimensions; the estimated velocity of flow approaching the intake structure; and the clear spacing between trash rack bars. Next, current and future routes for fish movement past the dam and the risks of injury or mortality for each will be identified, considering current and future flow management regimes (i.e., concerning flow allocations for spill and turbines based on river discharge). The analysis will identify individual species and guilds/groups for factors that may influence their vulnerability to entrainment and mortality. The assessment will include an evaluation of the potential for fish impingement and provide estimates of entrainment, turbine passage survival, total Project survival, and monthly and annual fish losses due to turbine entrainment.

Resource Management Goals

The WVDNR is charged with protecting and managing all wildlife within West Virginia, including within the section of the Ohio River that passes through its borders. WVDNR maintains the biological integrity of the State's fisheries and, when needed, ensures the ability of fish to move upstream or downstream in accordance with requirements governing Water Quality Standards, W.Va. C.S.R. §47-2-1, et seq. (26) and

antidegradation implementation procedures, W.Va. C.S.R. §60-5-1, et seq. (2008).

Existing Information

To the best of its knowledge, the Applicant is not aware of any entrainment studies that have been performed at the RC Byrd site, or at the very least, no recent entrainment studies (within the last five years) have been conducted. American Electric Power (AEP) completed a detailed entrainment study on the Racine Pool on September 8, 2021.

Project Operation Potential Impact

During the operation of the turbines at the Project, fish of a certain size will be able to pass through the trash racks and become entrained through the turbines. As the turbines operate, it is likely that some fish will suffer lethal injuries during passage, primarily from blade strikes. The likelihood of blade strike and turbine-induced mortality increases as the size of the fish increases, but they are also dependent on certain turbine design and operation parameters (e.g., runner rotational speed and diameter, blade spacing, blade leading edge thickness, and relative velocity of inflow to blades). Depending on entrainment and turbine survival rates, the loss of fish due to turbine entrainment can potentially impact fish populations in the vicinity of the Project.

Study Methodology

The Fish Impingement and Entrainment Study will utilize the existing fish community information, fisheries data collected upstream and downstream in the vicinity of the Project (i.e., Fish Assemblage Study), hydrological data, and design/operational characteristics of the Project to support the analysis of turbine entrainment and mortality for a select list of fish species (typically the most abundant and any considered to be important sportfish by the resource agencies). The Applicant will develop an initial target list of species from all available sources, including ORSANCO's pools survey and AEP's approved list of 82 species at the Racine Pool. The methodology employed will include standard and widely used desktop evaluation and modeling methods that have been accepted by state and federal agencies (including FERC) at projects throughout the U.S. The standard practice has been to utilize the Electric Power Research Institute (EPRI) turbine entrainment and survival database as a model in evaluating the potential for entrainment at a facility. Entrainment data (monthly and annual) will be provided for all target species and presented for up to three size groups (e.g., <250, 250-500, and >500 mm); turbine mortality will be estimated for 2-inch class sizes starting at a length of 2 inches.

For species and life stages that are expected to encounter the intake, impingement risk will be determined based on fish size and available swim speed data. The length at which each species will be too large to pass through the trash rack bar spacings will be determined using body depth and length ratios available in the literature, and the swim speed data will be used to

determine if fish that are physically excluded from entrainment can avoid impingement based on the estimated intake approach flow velocities.

Monthly and annual entrainment numbers will be estimated for abundant species and those specifically identified by the resource agencies for inclusion in the analysis. The estimation of entrainment will be conducted with data provided in the EPRI Turbine Entrainment and Survival Database for sites that are similar to the RC Byrd Project with respect to fish community composition, geographic proximity, reservoir size and volume, and turbine flow. Using the data selected from the EPRI database, entrainment rate estimates (i.e., number of fish entrained per a specified volume of generation flow) will be calculated by month for each species and specified size group. Monthly entrainment numbers will be summed to obtain an annual entrainment estimate.

Turbine survival will be calculated using a theoretical blade strike probability and mortality model that is similar to the one described by Franke et al. (1997). This model has been used to estimate turbine survival of fish entrained at more than 30 hydropower projects in the Midwest and Northeast, including three projects on the Upper Mississippi River in Minnesota and the Willow Island Project on the Ohio River. Using the turbine survival component of the EPRI database, the survival rates calculated with the theoretical model will be compared to data from field studies conducted at projects with similar turbine designs as the equipment proposed for the RC Byrd Project. Comparison of the theoretical results to field estimates allows for an assessment of consistency with the empirical data (i.e., a measure of model validity).

Based on consultation with the Service the Applicant will also utilize the Turbine Blade Strike Analysis (TBSA) model developed by USFWS fish passage engineers and utilize a turbine blade strike coefficient (Lambda) value of 0.40.

“TBSA models were created for all 74 turbine tests from 17 sites reported in Gomes and Larinier (2008). In each of these TBSA models, lambda was set so that model predictions matched the empirical results. In this way, each model’s lambda value was calibrated. The resulting mean lambda was 0.402, with a median value of 0.401. In summary, the Service’s fish passage engineering team’s analysis of Gomes and Larinier (2008) data suggest a great value of lambda is warranted, compared to the values recommended by Franke et al. (1997) for most other fish species, when modeling adult eel entrainment in Kaplan turbines” (McCorkle 2022).

For each selected species, the turbine survival rates will be applied to entrainment numbers to estimate the total number of fish killed during turbine passage on a monthly and annual basis. A total project survival rate will also be calculated using estimates of the proportion of fish that pass through each available route (e.g., turbines and spill gates) for the range of river flows that occur at the project (and the probability of flow occurrence) and route-specific survival rates (i.e., turbine survival estimates as described previously and literature-based spillway survival rates).

Level of Effort and Cost

The level of effort required to conduct a desktop impingement and entrainment analysis is relatively minor and several consulting firms are well equipped to perform such an analysis. Additionally, the cost of a desktop analysis is much more attainable when compared to the alternative of an in-field study. The desktop modeling methods are currently considered standard practice for estimating impingement, entrainment, and turbine and total project survival at hydropower project, and they have been accepted by numerous state and federal resource agencies and FERC. The expected cost to complete this study for the RC Byrd project is \$20,000 to \$30,000.

2.4 Freshwater Mussel Surveys

Goals and Objectives

Freshwater mussels (Unionidae) are among the most threatened group of aquatic organisms in the United States. The upper Ohio River system harbors a unique and diverse assemblage of freshwater mussels that may be impacted by Project activities. To alleviate freshwater mussel concerns, the Applicant will survey the Project APEs for populations of freshwater mussels. The goal of a mussel survey is to fully and completely assess the mussel populations; determine the presence of rare, threatened, and endangered species; provide information on the occurrence and distribution of mussels; and to establish current and baseline conditions of mussels within 1500 meters downstream of the Project. Anticipated upstream impacts will be limited to a short stretch of suboptimal habitat against the existing dam. Upstream freshwater mussel resources will not be assessed due to safety concerns.

Resource Management Goals

USFWS and WVDNR are charged with the protection and management of threatened and rare wildlife within West Virginia. This includes populations of sensitive freshwater mussels in the Ohio River. All native mussels are protected in the State of Ohio under Section 1533.324 of the Ohio Revised Code. However, the Ohio River mainstem is predominantly owned by the state of West Virginia; thus, ODNR defaults regulation of freshwater mussel consultation and management to WVNDNR. All mussels are protected in the State of West Virginia pursuant to West Virginia §20-2-4 and CSR 58-60-5.11. In addition, federally listed mussel species within the state are protected under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). The goal of this study, from a management perspective, is to determine what impacts, if any, the Projects' construction and operations may have on established mussel beds or suitable mussel habitat.

Existing Information

Throughout the 19th and 20th centuries, the upper Ohio River was heavily degraded by a wide array of pollutants from municipalities, the steel industry, chemical production, and mining. Freshwater mussel populations in the upper Ohio River suffered severe declines but have begun to recover over the last 30 years. R.C. Byrd L&D is within sections of the upper Ohio River mainstem that are known to support mussel populations, including sensitive federally protected species (WVDNR 2020).

The Huntington District has sponsored nine mussel surveys along the right descending bank downstream of R. C. Byrd L&D between 2001 – 2021. All of the mussel surveys show that a diverse mussel community exists along the right descending bank. These surveys have identified 27 live species in this reach of the Ohio River. One point of notable significance is the presence of the federally endangered Sheepnose (*Plethobasus cyphus*), which was encountered alive in 2009, 2011, 2016, 2017, and 2021 as well as a weathered dead relic shell in 2014. Based on this sampling effort, the mussel community has remained unchanged throughout the 21st century. The 2021 data show that the species collected, species diversity, and species evenness were similar to other years' surveys.

During the 2021 survey, a total of 812 live mussels from 20 unionid species were encountered (Lewis Envir. Consult. 2021). Live species encountered at the site included Ohio State Endangered Butterfly (*Ellipsaria lineolata*), Ebonyshell (*Reginaia ebenus*), Elephantear (*Elliptio crassidens*), Monkeyface (*Theliderma metanevra*), Ohio Pigtoe (*Pleurobema cordatum*), Pocketbook (*Lampsilis ovata*), Sheepnose and Ohio State Threatened Black Sandshell (*Ligumia recta*), and Threehorn Wartyback (*Obliquaria reflexa*). Collections included one live Sheepnose measuring 67 mm long, 47 mm high, 38 mm wide, weighing 100 g, and estimated to be eight years old.

Project Operation Potential Impact

Project operations have the potential to directly impact mussel communities by altering flow regimes, scouring potentially suitable habitat, redefining sediment transport downstream, disrupting preferred hydraulic conditions during crucial life stages, restricting movement of host fish species, and causing turbine mortality to host fish species (Haag 2012; Wegscheider et al. 2019). Unionid mussels are long-lived organisms that typically reproduce slowly and are sensitive to changes in environmental conditions. Changes in the flow dynamics from hydropower operation may produce significant impacts to unionid communities within close proximity to the powerhouse. Therefore, if unionids are encountered within the Project footprint, they will be relocated downstream to suitable habitat that will remain unimpacted by continued hydroelectric operation.

Study Methodology

The WVDNR requires that any mussel survey be conducted in a manner consistent with the guidelines provided by the 2022 Protocol which can be found at <https://wvdnr.gov/plants-animals/freshwater-mussels/>. The selected contractor must employ a malacologist on the 2020 West Virginia Approved Freshwater Mussel Survey List for Group 4 stream consultation. The list is available through the WVDNR website at <https://wvdnr.gov/wp-content/uploads/2021/07/CertifiedMusselSurveyors.pdf>.

The Greenup Pool of the Ohio River is known to support populations of federally listed species; thus, prior to survey commencement, mussel survey plans and designs will be submitted to WVDNR and USFWS for approval. A state scientific collection permit and site-specific amendment will be obtained prior to conducting any survey work. Mussel work will be completed in coordination with WVDNR, USFWS, and ODNR during the approved mussel survey season (May 1 – October 1).

There is a plethora of existing mussel data available within the Project vicinity. Therefore, mussel survey efforts at the proposed Project will be completed as a Group 4 project with a site-specific survey design. Surveys will extend approximately 190 meters downstream from the Project footprint and follow Phase I and II survey methodology. The survey footprint assesses a flow refugia created by the historical lock chamber. Riverine substrates downstream of the lock chamber are assumed to be heavily scoured by navigational traffic and elevated flows created by the dam. Transects will be placed every 10 meters ($n=4$) within the direct Project footprint (i.e. lock chamber), and every 25 meters ($n=6$) throughout a 150-meter downstream buffer. During a second portion of the survey efforts, the applicant will forego continued surveys directly downstream of the powerhouse as the hydraulic footprint is expected to coincide with the navigational channel that supports marginal Unionid habitat. Instead, the applicant will work closely with WVDNR and USACE to further design a downstream survey that fills in data gaps of the rich mussel community in the upper Greenup Pool. The assumed Project APE conservatively includes a 1.6-kilometer downstream hydraulic mixing zone.

All collected mussels will be identified to species, measured, photographed for vouchers, and returned to the substrate. If initial survey efforts identify freshwater mussel resources within the Project footprint, they will be relocated downstream prior to construction.

Level of Effort and Cost

Conducting an adequate mussel survey in accordance with the West Virginia Mussel Survey Protocol requires an intensive surveyor certification process. Approved West Virginia mussel surveyors have a minimum of 3 years survey experience, are trained to assess and identify over 60 species of mussels and maintain the necessary expertise to properly implement the survey Protocol. This need for an experienced and knowledgeable surveyor increases the cost of a mussel survey. In addition, the Ohio River is a large, highly trafficked waterway. Mussel surveys

require SCUBA diving, communication with commercial traffic, and an understanding of dangerous riverine conditions. Large rivers pose unique mussel survey challenges, thus precluding many firms from performing a safe and successful survey. However, numerous mussel surveys have been conducted in large river settings throughout West Virginia and the United States. Experienced dive teams can conduct Ohio River surveys within a level of cost and effort that is both reasonable and prudent while still meeting the high level of effort required by the Protocol. The combined initial survey efforts are expected to require 750 hours with an approximate cost of \$60,000. If freshwater mussel populations are encountered, substantial additional costs may be associated with relocation efforts, USFWS formal consultation, or mitigation.

2.5 Water Quality Study

Goals and Objectives

The objectives of the water quality study are to ensure the Projects' compliance with state water quality standards, provide early detection for potential deviations in water quality measurements (i.e., DO levels approaching 5.0 milligrams per liter [mg/L]), and provide the mechanisms to correct these deviations. The Applicant's goal is to maintain DO levels downstream of the Project. Operational procedures will include alarm procedures below 6.5 mg/L followed by a combination of a powerhouse draft tube air injection system and flows through the Dam spillway gates to provide suitable DO concentrations downstream.

Resource Management Goals

Our consultations with ORSANCO and West Virginia resource agencies have shown that DO is the primary water quality parameter of concern with respect to the proposed Project. For the first three quarters of the 20th century, DO concentrations in the Ohio River were depressed because of the discharge of raw or inadequately treated sewage. Water Quality conditions began to improve following the promulgation in 1970 of ORSANCO's standard requiring secondary treatment for all sewage (Corps, 2006). DO is consistently less of a problem in the Ohio River as reported in 2020 ORSANCO 305 (b) Report Table 7.

The ORSANCO is an interstate commission that operates programs to improve water quality in the Ohio River basin. ORSANCO includes membership from eight states in the Ohio River Basin, as well as five federal agencies (National Oceanic and Atmospheric Administration [NOAA], USACE, United States Environmental Protection Agency [USEPA], USFWS, and USGS). Under the terms of an interstate agreement known as the Ohio River Valley Water Sanitation Compact, Article VII recognizes individual member states' authority to adopt water use designations and water quality standards that are no less stringent than the ORSANCO standards for the Ohio River mainstem. Within this portion of the Ohio River, ORSANCO, Ohio EPA, and WVDEP establish designated uses for the Ohio River and include fish and other aquatic life; contact recreation; public, agricultural, industrial, and wildlife water supply; water transport; cooling and

power; and fish consumption. ORSANCO issued a 2019 Revision of the Pollution Control Standards and established numerous water quality criteria that are identified and established to protect designated uses (ORSANCO 2019). The entire Ohio River is designated as impaired for fish consumption because of high levels of PCBs and dioxin (ORSANCO 2017).

In West Virginia, water quality criteria for the Ohio River are found in West Virginia’s Code of State Regulations (CSR §47-2, et seq. ([2016]) and in Ohio are found in the Ohio Administrative Code (OAC) 3745-1-32. Numeric water quality criteria exist for DO concentrations and are the same for ORSANCO, WVDEP, and Ohio EPA; however, the narratives associated with the reported DO criteria are slightly discrepant. The average DO concentrations for the protection of warm water aquatic life habitats shall be at least 5.0 mg/L for each calendar day; the minimum DO concentration shall not be less than 4.0 mg/L; and from April 15 to June 15, a minimum DO concentration of 5.0 mg/L shall be maintained at all times (ORSANCO 2021).

Water temperature criteria vary throughout the year and are based on daily maximum water temperature, period average, and instantaneous maximum temperatures. As of 2019, water temperature criteria for the Ohio River differ slightly for the ORSANCO, WVDEP, and Ohio EPA. Water temperature criteria are summarized in Table 1 and Table 2.

Table 1. ORSANCO’s Daily Maximum Water Temperature Criteria
Degrees Fahrenheit (°F) in the Ohio River between Ohio River Miles 0-341

ORSANCO	
Julian Day**	Daily Maximum Water Temperature
1-49	47.1 – 0.086 * Julian Day
50-166	26.6 + 0.328 * Julian Day
167-181	87
182-243	89
244-258	87
259-366	160.8 – 0.300 * Julian Day

**Julian Day is the number day of the year (1-366)

Table 2. Water Temperature Criteria (degrees Fahrenheit [°F]) in the Ohio River.

Month	Date Range	ORSANCO	Ohio EPA		WVDEP	
		Monthly Max Water Temperature	Period Average	Instantaneous Maximum	Period Average	Instantaneous Maximum
January	1-31	45.7	45.7	47.0	45	50

February	1-29	43.9	43.9	46.3	45	50
March	1-15	51.2	51.2	56.4	51	56
	16-31				54	59
April	1-15	61.2	61.2	66.3	58	64
	16-30				64	69
May	1-15	71.2	71.2	76.5	68	73
	16-31				75	80
June	1-15	78.8	78.8	81.0	80	85
	16-30	87.0	87.0	87.0	83	87
July	1-31	89.0	89.0	89.0	84	89
August	1-31	89.0	89.0	89.0	84	89
September	1-15	87.0	87.0	87.0	84	87
	16-30	81.0	81.0	83.1	82	86
October	1-15	74.1	74.1	78.3	77	82
	16-31				72	77
November	1-30	65.0	65.0	69.0	67	72
December	1-31	55.8	55.8	60.0	52	57

Existing Information

Historical and contemporary water quality information within the Projects’ vicinity was described in detail in Section 5.2.5 of the RC Byrd Project PAD. The Racine Hydropower facility at RM 238 and USGS gage at the Ironton (03216070) at RM 341, located approximately 41 upstream and 46 downstream respectively from the RC Byrd L&D, documents daily temperature and DO levels in the Ohio River. The available information suggests Ohio and West Virginia state water quality standards are rarely violated upstream or downstream pools. ORSANCO’s Water Quality Monitoring Program reports water quality information in their biennial 305(b) report. Additional data is available from ORSANCO’s historical and special-interest project (e.g., biological monitoring program, bimonthly clean metals monitoring) dataset at and near RC Byrd L&D. This data will be synthesized and analyzed as part of initial water quality study. Locally relevant water quality data will also be used in accordance with Project-generated data (from above and below the project) to assess Project impacts on water resources.

USACE and several hydroelectric project operators currently monitor DO at 13 Ohio River stations in hourly increments from May through October. ORSANCO compiled these DO data from 2006 through 2018 and found that overall, daily mean DO measurements were less than the daily mean standard (5.0 mg/L) in less than 1% of the sampling period in the RC Byrd Pool and in 21% of the sampling period in the Greenup Pool upstream of the Greenup Hydroelectric Project, FERC No. 2614 (FERC 2014).

Ohio River Dissolved Oxygen Values Below 5.0 mg/L Criteria

Ohio River Station	Mile Point	2014 % Days Below Criteria	2015 % Days Below Criteria	2016 % Days Below Criteria	2017 % Days Below Criteria	2018 % Days Below Criteria	2014-2018 % Days Below Criteria
Montgomery	31.7	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Hannibal	126.4	0.0%					0.0%
Willow Island	161.7						
US				0.0%	0.0%	0.0%	0.0%
DS				0.0%	0.0%	0.0%	0.0%
Racine	237.5	0.0%	0.0%	9.7%	0.0%	6.8%	3.1%
Ironton	325.0			0.0%	0.0%	0.0%	0.0%
Greenup	341.0						
US		14.0%	13.6%	0.0%		1.6%	8.7%
DS		2.0%	9.7%	4.4%	n/a	0.0%	4.0%
Meldahl	436.2						
US				0.0%	0.0%	2.4%	0.0%
DS				0.0%	0.0%	1.6%	0.0%
Markland	531.5						
US Hydro		4.0%	21.9%	11.1%	0.0%	2.4%	9.0%
DS Hydro		5.6%	12.8%	5.9%	6.7%	7.1%	6.9%
DS Lock		0.0%	5.9%				1.7%
US Lock		0.0%	1.8%				0.8%
McAlpine	606.8	4.6%	2.4%	19.8%	0.0%	6.6%	6.8%
Cannelton	720.7						
US				0.0%	0.0%	2.4%	0.0%
DS				3.0%	0.0%	0.0%	3.0%
John T. Myers	846.0	0.0%					0.0%
Smithland	919.0						
US		3.7%		0.0%	2.5%	7.1%	3.9%
DS				7.0%	0.0%	4.8%	7.0%

Olmsted	964.6	0.0%	8.4%	2.5%	0.0%		4.0%
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Project Operation Potential Impact

The Applicant is developing the Project at the R.C. Byrd L&D with the philosophy and intention of causing minimal impact to hydraulic, ecological, and recreational resources both at the powerhouse as well as downstream. This is the motivation for designing a powerhouse that limits maximum flows to 90% of flow exceedance at these locations and powerhouse hydraulic flow capacity of 13,280 cfs (see Appendix A for annual and monthly FDCs). In this section of the Ohio River the average flow is approximately 70,000 cfs. The previously City of Wadsworth FERC licensed project at R.C. Byrd L&D planned for powerhouse hydraulic flow capacity of 50,000 cfs. The new Applicant’s approach spills a much larger percentage of the available flow over spillways. Thus, it is expected and intended that the Project will have minimal effects on Project-area resources and will protect existing uses of the Project-area waters. There may be localized changes in flow velocity and direction due to small proportions of water to be released from the powerhouse, rather than exclusively over the dam or via spillway gates. These changes will be analyzed in the Project Hydraulics Study and Water Quality Study, but lower hydraulic diversion is an important factor when analyzing effects on water quality and most importantly DO.

The Applicant is committed to maintaining DO levels downstream and is actively investigating aeration alternatives when flows are within the operational range of the Project. Alternatives will include an air injection system in the powerhouse draft tubes and providing minimum flows over the dam spillway gates as ways improve DO concentrations below the Project to meet state water quality standards. The Applicant will monitor DO and install alarms that will draw operational attention to DO when saturation approaches 6.5 mg/L and will curtail power generation prior to downstream DO reaching 5.0 mg/L. The USACE maintains the pool elevation to allow for a depth suitable for navigation; the Applicant will not have the ability or authority to operate the powerhouse in anything but run-of- river mode. The USACE determines the total discharge flow from the dam, and the Applicant will use an allocated portion of that flow for power generation.

Study Methodology

Multiple water quality parameters could be assessed at R.C. Byrd L&D although water temperatures and DO concentrations will be the primary parameters of interest. Continuous monitoring of these two parameters will occur for two years prior to construction to establish baseline conditions and to generate background water quality data used to further document existing conditions. One water quality monitoring station will be placed above the dam and one below the dam. The APE precise locations of each monitoring station (within each of the general areas noted above) will be determined in coordination with USACE Huntington District. DO and temperature measurements will be recorded every 15 minutes and are accessible to ORSANCO and the public. Data loggers will be maintained and calibrated on a routine basis to address

potential fouling of data and other malfeasances with the probe's operation.

Monthly sampling of other parameters such as pH, turbidity, and conductivity may also be included before and during the construction period to track and manage turbidity, sedimentation, and other potential changes in water quality as outlined in FERC License conditions. DO and water temperature data will be collected from the Project intake and tailrace areas. Project operations information (e.g., production / output) will be compared to concurrent water quality data to identify influential trends within the Project area.

Level of Effort and Cost

The cost of conducting an ongoing and continual water quality monitoring program with a focus on two parameters (DO and temperature) is reasonable and attainable. An ongoing study would require approved scientific equipment (i.e., a water quality probe capable of recording readings at regular intervals and with a minimum of one month of data storage) and routine maintenance (calibration/maintenance of instruments and retrieval of data). Continual monitoring efforts of the requested parameters are being conducted at other facilities throughout the state of West Virginia and these can be used as estimates for total cost and effort. Total costs for water quality monitoring are not expected to exceed \$90,000.

2.6 Aquatic Habitat Study

Goals and Objectives

To ensure hydroelectric operations are consistent with the USACE prescribed water level management strategies for R.C. Byrd L&D, the applicant will delineate physical habitat characteristics throughout the downstream Project hydraulic footprint. A habitat field survey is proposed to delineate aquatic littoral and demersal habitat in terms of substrate and cover. Major habitat and shoreline types will be delineated with the data used to evaluate Project effects on aquatic resources in the area. Habitat suitability is defined primarily by substrate, cover, and depth, and will assist in characterizing the benthic community. Each of these habitat parameters will be assigned specific attributes to be used for field delineation. These will generally include:

- substrate: fines (sediment, organic detritus, mud etc.), sand, gravel, cobble, boulder, bedrock, anthropogenic rubble (concrete, rip-rap rock, etc.)
- cover type: object cover (i.e., boulder, woody debris, riprap, etc.), overhead cover (overhanging limbs, structures, etc.); vegetative cover (emergent, submergent)
- cover density: absent, low, moderate, high
- depth (at normal pool): surface to substrate (ft)

Resource Management Goals

The USACE is tasked with protecting the integrity of navigable waters throughout the US,

including the benthic zones. Identification of habitat types and features will provide a framework of locations within the Project footprints that may harbor sensitive aquatic fauna. The map of existing suitable habitats (i.e., instream cover features, heterogeneous substrates, etc.), combined with data from hydraulic modeling (sediment deposition and bed shear forces), will identify areas that may be negatively affected by altered flow dynamics. It is also important to understand habitat availability and alterations while interpreting fisheries data (e.g., habitat, trophic, and feeding guilds).

Any hydropower project developed by the Applicant will be required to conform to USACE operational goals, which include ensuring that “all applicable state and federal water quality standards are met, water quality degradation of Corps resources is avoided or minimized, and project responsibilities are attained.” (ER-1110-2-8154, Sec 2.1, 2018). Likewise, the Corps is responsible for maintaining a number of water control functions on the Ohio River, including flow regulation, navigation, and recreational access. The Ohio River is home to a large number of fish and mussel species, some of which are federally listed as threatened or endangered, and the management of the habitat of these species becomes the concern of the Applicant within the APE of the proposed hydroelectric Project.

Project Operation Potential Impacts

The initial operation of the powerhouse will cause localized changes in riverine flow dynamics. Changes in hydraulic conditions may cause scour or deposition of downstream benthic habitats, thus impacting the resident aquatic community. However, over time, downstream habitats will shift and adjust to the altered flow regime, forming new areas of suitable benthic habitats. The overall velocity and flow volume coming through the R.C. Byrd L&D facilities will remain unchanged. The absence of Project-related alterations to water depth and velocity over time will lead to near-constant quantities of available habitat.

Methodology

Downstream depths and velocities will be mapped during hydraulic modeling and physical habitat characteristics will be delineated via SCUBA diving during mussel survey efforts. Divers will record substrate sizes / categories (Wentworth 1922), depth, and type and amount of cover. Habitat will be recorded along survey transects spaced 100 meters apart (perpendicular to stream flow) and extending 1,600 meters downstream from the proposed Project’s tailrace. Instream littoral habitats will also be assessed during fisheries studies using the “Copper-Pole Method” as described in Appendix C of ORSANCO’s SOP.

Habitat surveys and delineations will occur during summer months with base riverine flows to provide adequate underwater visibility, observations of cover under consistent conditions, and accurate measurements of depth relative to substrate. Additionally, by mid-summer, annual aquatic vegetation beds have reached their peak yearly growth limits. Reporting of the habitat characteristics and potential influence of modified flow dynamics will include consideration of

sensitive aquatic species within the tailraces and expected impacts to their habitats. Reports will be augmented with detailed maps from hydraulic modeling efforts that depict areas where increased velocities may be expected to scour suitable benthic habitats.

Level of Effort and Cost

Habitat mapping will be performed concurrently with freshwater mussel survey efforts and fisheries studies. Performing the aquatic habitat assessment during mussel survey efforts will provide cost savings with a minimal increase in the time commitment. Collection of habitat data and preparation of detailed maps and reports is expected to require approximately 85 hours and cost \$12,000.

2.7 Terrestrial Habitat and RTE Species Study

Goals and Objectives

A terrestrial field study within the APE will be conducted to describe and document general wildlife habitat types and conditions, rare and invasive plant species, and habitat for federally protected bats. The primary goals of terrestrial studies include establishment of baseline conditions and identification of sensitive or ecologically valuable habitat types (i.e., old growth forest). A comprehensive understanding of baseline conditions will maximize the effectiveness of restoration efforts and species-specific mitigation measures (i.e., bat boxes) following ground disturbance.

Resource Management Goals

All wildlife within the state of Ohio is owned by the state under the Ohio Revised Code 1531.02. The ODNR's mission is to conserve and improve fish and wildlife resources and their habitats for sustainable use and appreciation by all. Terrestrial habitats impacted by the RC Byrd Project construction footprint are within the known range of rare and threatened wildlife (i.e., bats) within the state of Ohio. All species classified as state "threatened" or "endangered" are protected by ODNR under the Ohio Revised Code 1531.25.

West Virginia does not recognize state listings of rare or threatened species; however, all wildlife within the state of West Virginia is owned by the state under Code § 20-2-3. The mission of the WVDNR is to provide and administer a long-range comprehensive program for the exploration, conservation, development, protection, enjoyment and use of the natural resources of the State of West Virginia. Thus, the terrestrial footprint of the RC Byrd Project must be constructed in a manner consistent with all environmental preservation and development standards set by WVDNR.

Additionally, the project is within the range of federally protected and/or candidate bat species, protection of said bats and their habitats falls within the jurisdiction of USFWS under the

Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). The goal of this study from a resource management perspective is to ensure Project activities fall within the guidelines of all applicable state and federal regulations and do not harm sensitive or rare terrestrial species and their associated habitats.

Project Operation Potential Impacts

Following completion of Project infrastructure, terrestrial habitats will remain relatively uninfluenced by Project operations. A small portion (<1.5 acres) of the landscape at the Project site will be permanently appropriated for the powerhouse and substation footprints. Transmission lines will require periodic clearing that may impact ground nesting birds and pollinators and encourage colonization of invasive plant species. However, transmission lines are known to create useful edge habitats for foraging bats and state protected Timber Rattlesnakes (*Crotalus horridus*).

Study Methodology

Both Project locations lie within the known range of the federally protected Indiana Bat (*Myotis sodalis*) and the proposed Northern Long-Eared Bat (*Myotis septentrionalis*; NLEB). Project within range of the Indiana bat and NLEB must initiate formal consultation with USFWS by requesting information regarding known records of state and federally listed bats in the vicinity of the proposed Project (i.e., identify known occupied habitat). Following results of the formal consultation process terrestrial site assessments may/can occur. This includes coordination with USFWS, ODNR, and WVDNR to ensure bat roosting trees and/or maternity roosts are not adversely impacted by a Project from loss of summer habitat (e.g., forests) or winter hibernacula (e.g., caves, mines) due to construction or operation.

If the Project occur outside of known, listed bat capture buffers, an area-based presence and absence survey using mist nets (i.e., 9 net-nights) may be necessary to proceed with tree felling during time of year restrictions. Indiana bats and NLEB live in trees during the summer and live underground in winter. Determining the presence of portals to underground voids (such as caves or mines) is necessary to properly complete ESA compliance for federally listed bats.

The Project encompasses a relatively small footprint, all other terrestrial habitat delineations (i.e., rare and invasive plants surveys) will be performed by qualitatively assessing the entire Project footprint. Surveyors will use submeter Global Positioning System (GPS) units to accurately mark all species or areas of interest.

Level of Effort and Cost

Costs for bat and general habitat assessments, surveys of rare and invasive plants, and underground portal searches will include two days of field efforts, study plan preparation and coordination with the appropriate agencies, and report generation. The total time commitment

is expected to require 80-100 hours with a cost range of \$10,000 to \$14,000.

If the Project a) lies within an Indiana Bat or state-listed (i.e., Ohio) bat capture buffer or b) tree clearing is scheduled in the off-season (if feasible), the Applicant may forego summer mist netting surveys. Costs will increase significantly if mist netting surveys are required to determine presence/ probable absence of listed bats.

2.8 Wetlands and Waters Delineation

Goals and Objectives

Sensitive wetland features may exist within the proposed powerhouse footprints or associated construction staging yards. The Applicant proposes to conduct a desktop review and field study to document the location and extent of jurisdictional wetlands/waters of the U.S. (WOTUS) within the Project study areas including all areas that may be temporarily or permanently displaced during construction and/or operation in the APE. Completion of wetland surveys would aid the Applicant in designing Project features that would minimize impacts on jurisdictional wetlands/waters of the US and inform the design of appropriate mitigation if necessary. The study will also seek to advance the gathering of information needed to support the USACE Section 404 process.

Resource Management Goals

All jurisdictional wetlands within the United States are regulated by USACE (Section 404 of the CWA), USEPA (Section 401), and state agencies (i.e., Ohio EPA or WVDEP). State agencies coordinate with the USACE and issue of a Water Quality Certification (as needed) that ensures compliance with applicable state laws and water quality standards. Wetland and stream delineations are performed to comply with all temporary and permanent infrastructure associated with the Project in support of avoiding and minimizing impacts to these resources if determined to be present.

Project Operation Potential Impacts

Construction of the Project powerhouses is expected to permanently impact a small footprint (<0.6 acre) in an area that have likely already experienced disturbance during construction of the L&D structures. Temporary impacts can be expected within the temporary construction lot footprint. The continual Project operation is not expected to impact WOTUS not already impounded for USACE operations.

Methodology

Qualified wetland delineators based within the region will conduct wetland delineations in

accordance with the procedures set forth in the USACE 1987 Wetland Delineation Manual, applicable Regional Supplement, and any applicable District-specific, EPA, or state designated requirements. Prior to conducting the field surveys, the team will obtain and review available aerial photography, Natural Resource Conservation Service (NRCS) soil surveys, USFWS National Wetland Indicator (NWI) maps, and county hydric soils lists to identify the number, type, size, and location of potential wetlands and waterbodies within the Project area. Following initial desktop review, wetland delineators will conduct field surveys to ensure any changes to previously documented resources as well as any new resources within the APE are recorded. Documented waterbody boundaries will be recorded with submeter GPS technology, following standardized survey protocols and collecting all applicable data and forms.

Level of Effort and Cost

Desktop and on-site delineations of all wetland resources will be performed by qualified wetland scientists based in the upper Ohio River valley and expected to require two days of field day of work. The small Project footprints and close proximity to qualified delineators will keep costs for wetland assessment low. Costs for desktop review, site visits by a certified wetland delineator and their technician, and reporting are expected to require approximately 130 hours and cost less than \$10,000. If construction staging is performed within existing industrial spaces, costs will be greatly reduced.

2.9 Recreational Uses

Goals and Objectives

The Applicant proposes to conduct a desktop review to document the location and extent of recreation within the Project study areas including recreation activities that may be impacted during construction and/or operation. Given the construction of the facility structures (e.g., a new intake, powerhouse, tailrace, transmission) will occur exclusively in the restricted zone of the USACE lands, that are not permitted recreation sites, impacts on recreationalists in the Study Area will be generally short-term, associated with construction related noise and increased traffic. The Applicant will consult with state and local governments and appropriate interests to better ascertain recreational conditions, future plans, and potential Project impacts as well as opportunities to facilitate recreation in the Project Areas. The Applicant will consult throughout the licensing process regarding recreation needs as well as appropriate measures for protection and/or mitigation of identified recreational resources.

Resource Management Goals

A variety of recreational opportunities occur within the Project study areas and are managed by federal and state agencies including USACE, USFWS, ODNR, and WVDNR. These agencies are

tasked with management and protection of the natural environment (e.g., waters, fisheries) and its use and enjoyment.

Project Operation Potential Impacts

The RC Byrd powerhouse and associated transmission infrastructure lies within restricted private property owned primarily by the utility and USACE. Riverine access to the proposed powerhouse outfall is restricted by USACE. Continued operation is not expected to impact the general public accessing the Ohio River at the designated locations on the Ohio or the West Virginia side of Robert C Byrd L&D.

Methodology

The Applicant will initiate a desktop review of available USACE, ODNR, and WVDNR data (i.e., creel surveys, public stakeholder comments, etc.). If existing data and survey information is unavailable or insufficient to properly characterize recreation use, the Applicant will initiate field studies. The field studies will include public survey forms available on the Applicant's website with notifications in and around the Robert C Byrd Quick Response (QR) scan codes and website signage. Comments from survey forms and Meeting will be documented within the recreational use report.

Level of Effort and Cost

Costs for development of a recreation use report will include a desktop analysis based on publicly available data, study plan preparation and coordination with the appropriate agencies, and report generation. The total time commitment is expected to require no more than 70 hours at a maximum cost of \$11,000.

2.10 Cultural Resources

Cultural resources are defined as physical evidence or place of past human activity: site, object, landscape, structure; or a site, structure, landscape, object or natural feature of significance to a group of people traditionally associated with it. A historic property is any cultural resource that is either listed on or considered eligible for listing on the National Register of Historic Places (NRHP). For this Project, it is anticipated that archaeological sites and historic buildings and structures are the resource types considered most relevant and are therefore the focus of the goals and objectives described below.

Goals and Objectives

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, requires federal agencies to take into account the effects of their undertakings on properties listed in, or eligible for listing in, the NRHP, and to afford the Advisory Council on Historic Preservation

(ACHP) an opportunity to comment on the undertaking. Ohio Power, as the Applicant and non-federal party, will assist FERC in meeting its obligations under Section 106, and the implementing regulations, by preparing the necessary information, analyses, and recommendations, as authorized by 36 CFR 800.2(a)(3).

Therefore, the objective of the cultural resources work will be to identify and assess the potential effects of Project construction and operation (if any) on historic properties, including archaeological sites and historic architectural buildings and structures. To do so, a definition of the APE (direct and indirect) must be proposed by the Applicant in consultation with the FERC, USACE, Ohio Historic Preservation Office (OHPO) and West Virginia State Historic Preservation Office (WVSHPO), collectively referred to as the SHPOs, federally recognized Tribes with historic cultural ties to the Project area, and other Project stakeholders, as appropriate. Upon establishment of direct and indirect APEs, qualified cultural resources consultants will work to develop a scope of work to investigate the Project potential to affect archaeological and historic architectural resources. Throughout the licensing process, the Applicant will consult with the FERC, USACE, SHPOs, Tribes, and any other appropriate stakeholders invited to participate in the Section 106 consultation process will be consulted to develop approved scopes of work for inventory-level investigations (i.e., Phase I surveys) including the identification of previously undocumented resources as well as appropriate measures for protection and/or mitigation of identified resources considered to be historic properties.

Resource Management Goals

It is not always possible for the FERC (and the other Section 106 consulting or contributing parties) to determine all of the potential effects that may occur over the course of a license. Therefore, the FERC typically requires that a Historic Preservation Management Plan (HPMP) be developed and maintained for the term of the license. The purpose of the HPMP is to require the licensee to consider the appropriate management of effects on historic properties throughout the term of the license and ensures that the FERC meets the requirements of Section 106 for its undertakings.

Project Operation Potential Impacts

At this time, it is unknown whether the operation of the proposed Project would have impacts on cultural resources. However, following the desktop and required field studies, if it is determined that historic properties may be affected, the Applicant will work with the FERC, SHPOs, Tribes, and other appropriate stakeholders to develop a Project-specific HPMP.

Archaeological Methodology

In advance of completing any archaeological fieldwork within the direct APE, a desktop archival review will be used to collect data on known cultural resources within a 1-mile radius. The data collected will be limited to that on file at the respective state SHPO office. This will provide

information on all previous archaeological, architectural, and National Register-listed properties including previously conducted cultural resources investigations in Ohio and West Virginia.

In general, much of the direct APE has been altered by construction the Robert C. Byrd dam structures. Few greenfield or undisturbed areas will be affected by construction or operation of the Project. However, based on proposed plans, it is likely that initial agency consultations will result in a determination that a Phase I archaeological survey is needed. Any required work will be completed in accordance with regulations implementing the Section 106 review process (36 CFR 800), Section 101(b)(4) of the National Environmental Policy Act of 1969, the ACHP's Section 106 Archeology Guidelines, the Archaeological Resources Protection Act (ARPA) of 1979 which applies to projects on federal or tribal land, and if applicable, 43 CFR Part 10 of the Native American Graves and Repatriation Act (NAGPRA), which applies to human remains, sacred objects, and items of cultural patrimony (described as "cultural items" in the statute) located on Federal or Tribal lands or in the possession and control of Federal agencies or certain museums.

If required, all fieldwork including site delineation and recordation, shall conform to guidelines for conducting archaeological surveys and investigations in Ohio as established by the OHPO and in West Virginia as established by the WVSHPO. In general, the Phase I archaeological survey would follow standardized methodology for areas located on landforms with less than 20% slope and with less than 50% surface visibility and includes the excavation of shovel tests at 15-meter intervals along systematically spaced transects. A maximum of one transect of shovel tests will be placed in each workspace to ensure that information concerning the subsurface conditions is recorded for each location. All shovel tests will be refilled immediately, and no test pits will remain open overnight. Shovel test locations will be plotted with an iPad using the Collector application and a submeter GPS receiver. Shovel tests will be approximately 50 by 50 centimeters in size. Ground surface inspection will be conducted in those areas where surface visibility exceeds 50 percent, there is visible ground disturbance, and/or slope is greater than 20 percent. Data will be consolidated into a letter report.

The need for archaeological field investigations beyond Phase I survey will be determined following the completion of an initial approved scope of work and in consultation with the FERC, USACE, SHPOs, Tribes, and other stakeholders participating in the Section 106 consultation process.

Historic Architectural Methodology

The results of the desktop archival review (described above) will be used to develop a proposed scope of work for field investigations. It is already known that the Robert C. Byrd L&D structures are considered NRHP-eligible. As required following initial agency and stakeholder consultations, the Applicant will carry out an approved scope of work to identify historic architectural resources within the Project's indirect APE to evaluate the NRHP eligibility of historic buildings and structures within the Project's APE pursuant to both SHPO's state guidelines and requirements. This will also include a formal reassessment of the NRHP eligibility

of the Robert C. Byrd L&D structures. The Applicant will conduct additional property-specific research on historic buildings and structures within the indirect APE and complete the requisite state inventory forms for newly identified properties (if any) and provide information to each SHPO sufficient to determine the NRHP eligibility.

Reporting

In compliance with Section 106 and state reporting requirements, the Applicant will draft cultural resources study reports for both Ohio and West Virginia that present the results of the archaeological and architectural surveys. The draft reports will incorporate the results of the background research and archival review, including a cultural history of the research area and a description of previous work in and around the APEs. The reports will describe the approved methodologies, results, and recommendations regarding the need for additional fieldwork, for regarding investigations (e.g., archaeological site evaluations) and/or management measures. As appendices to the reports, the Applicant will also prepare a record of consultation/correspondence with the FERC, SHPOs, USACE, Tribes, and other parties (as appropriate). For review and comment, the draft reports will be submitted to the consulted parties described above. Following review, all received comments will be considered and incorporated into the final reports to be submitted and archived with each SHPO.

Level of Effort and Cost

The level of effort and cost associated with cultural resource studies is highly dependent on the quality and quantity of undisturbed land within the Project footprints. If the initial desktop review indicates that the Project footprints fall entirely within land disturbed by L&D construction or previous industrial sites, cultural resource studies (i.e., archaeology and architectural history) including consultation with the SHPOs and Tribes will require a commitment of approximately 30-40 hours and an estimated \$10,000. However, depending on the results of the desktop review and Project plans, if the Project site require full Phase I archeology and architectural history field surveys and reporting efforts, the commitment may include an estimated 150 – 200 hours, or approximately \$70,000.

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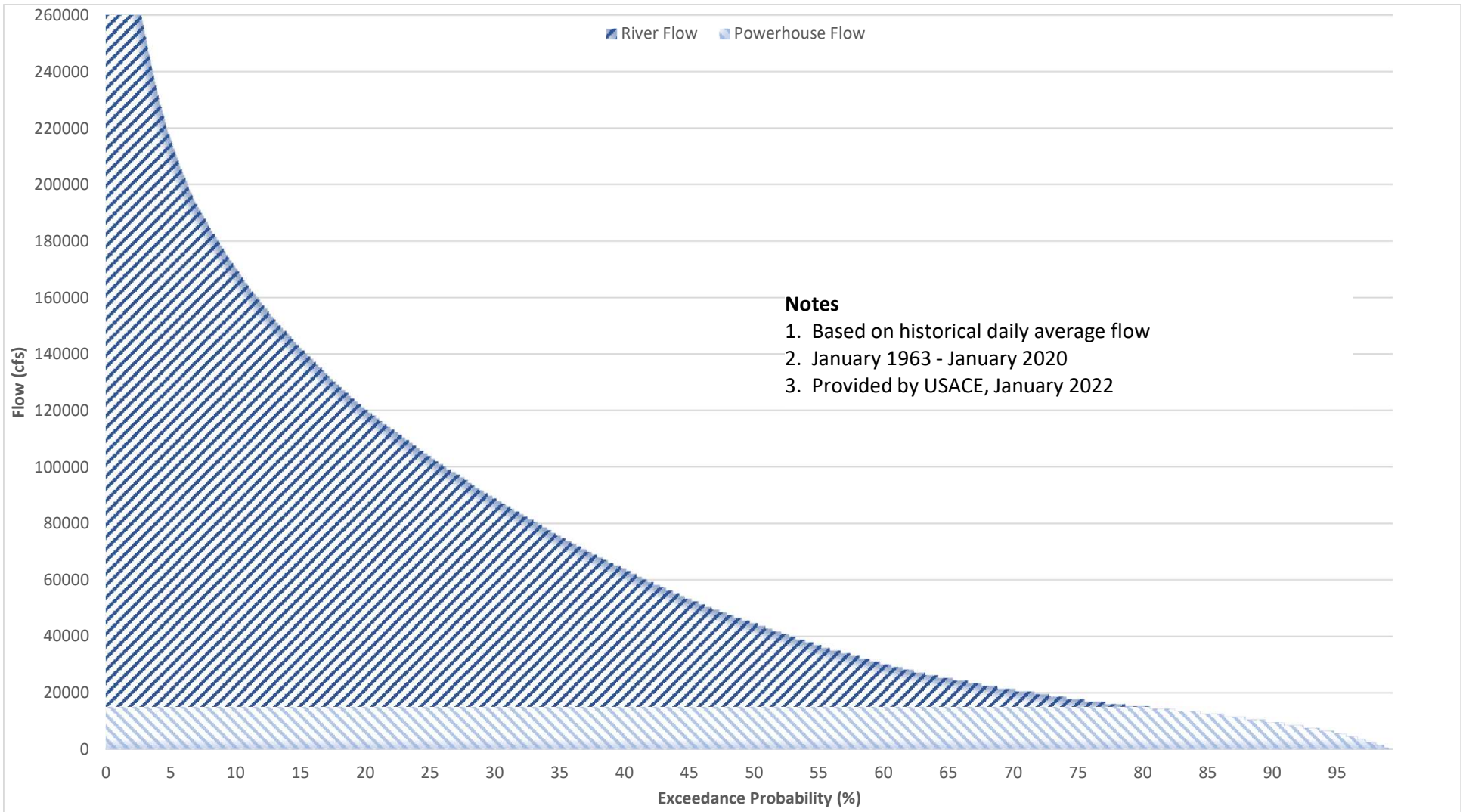
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Appendix A: Flow Duration Curves

Appendix A includes Flow Duration Curves for the RC Byrd Project and are based on a 10-year average.



Robert C Byrd Locks and Dam

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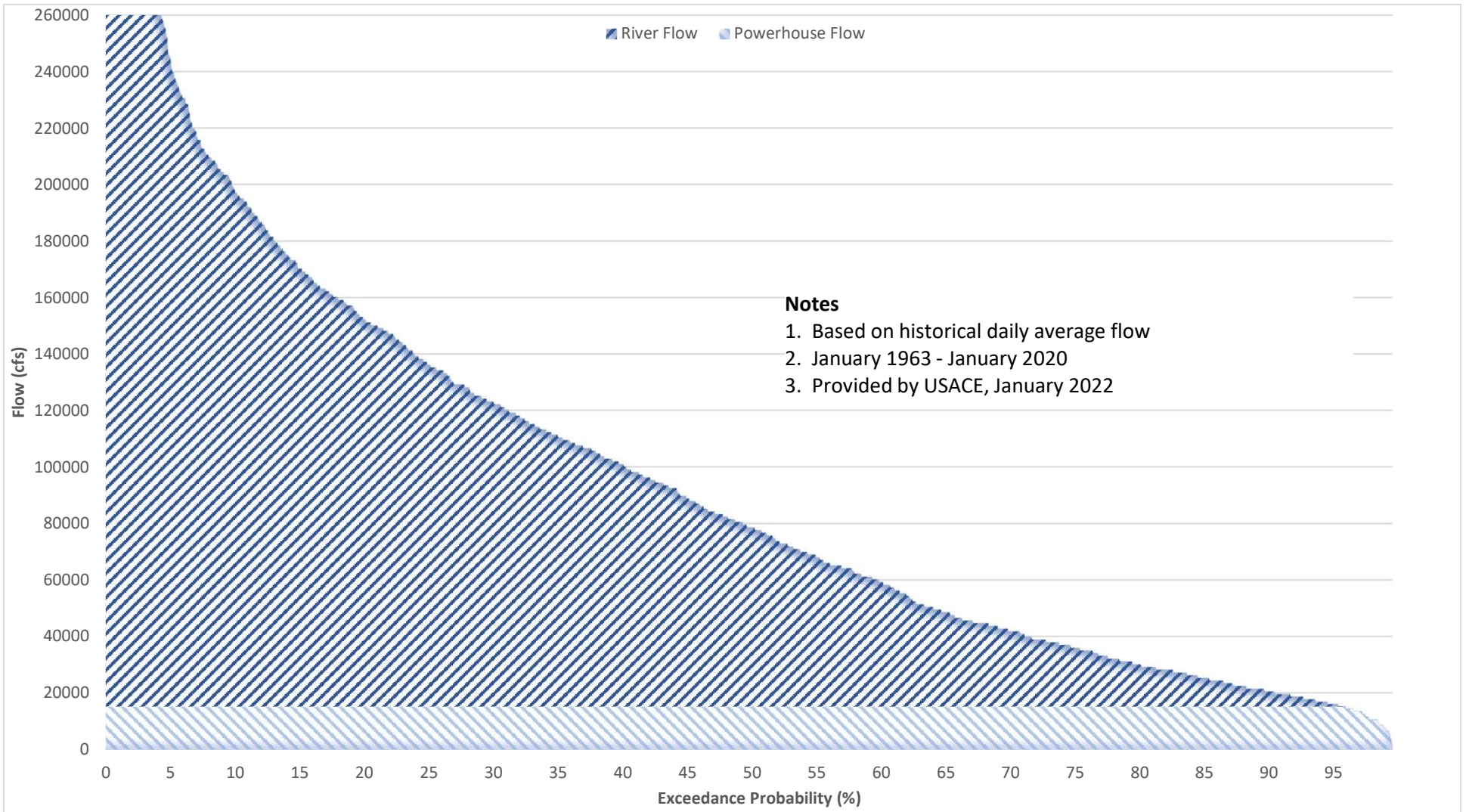


CURRENT HYDRO

Figure 2: Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



Robert C Byrd Locks and Dam

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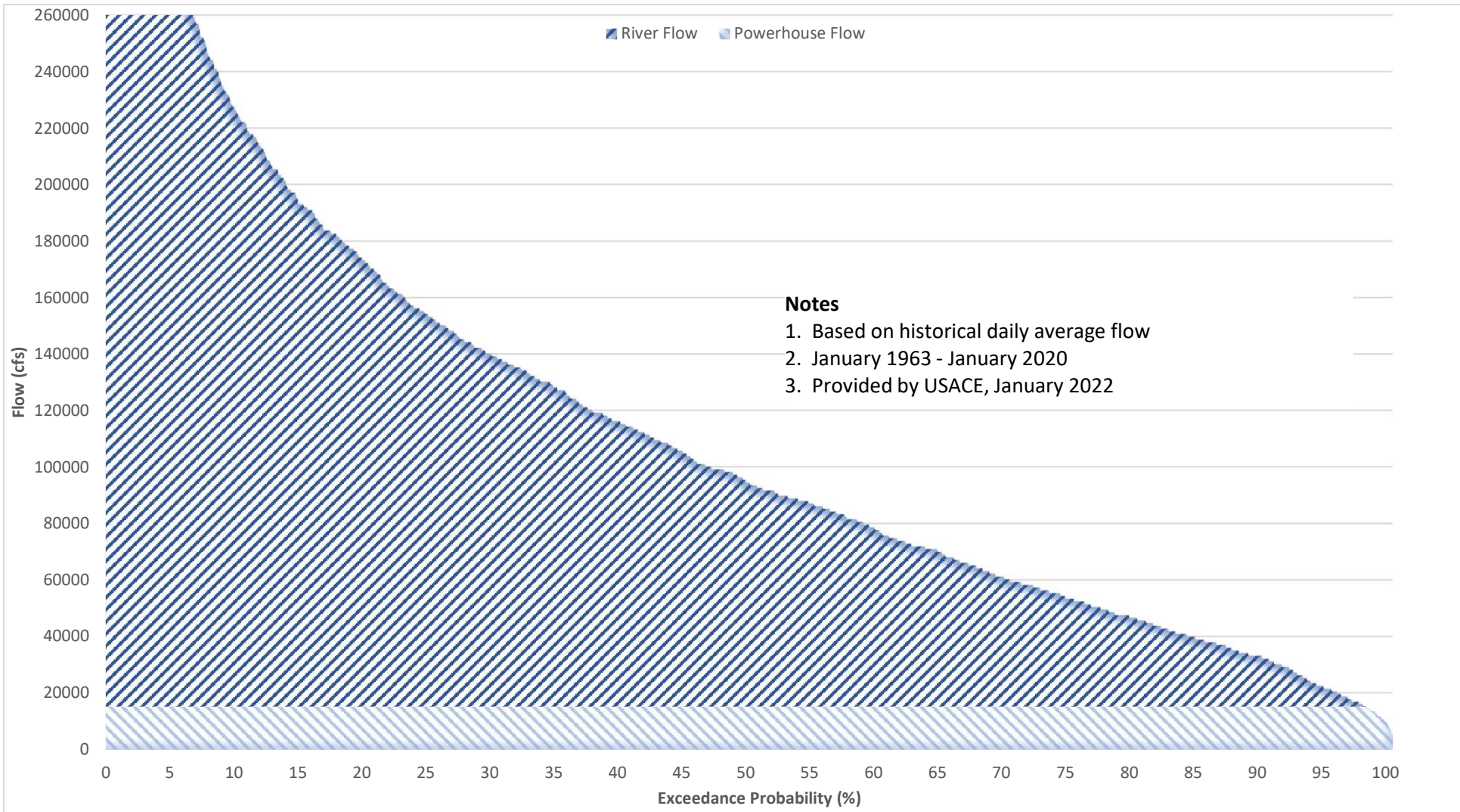


CURRENT HYDRO

Figure 3: January Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



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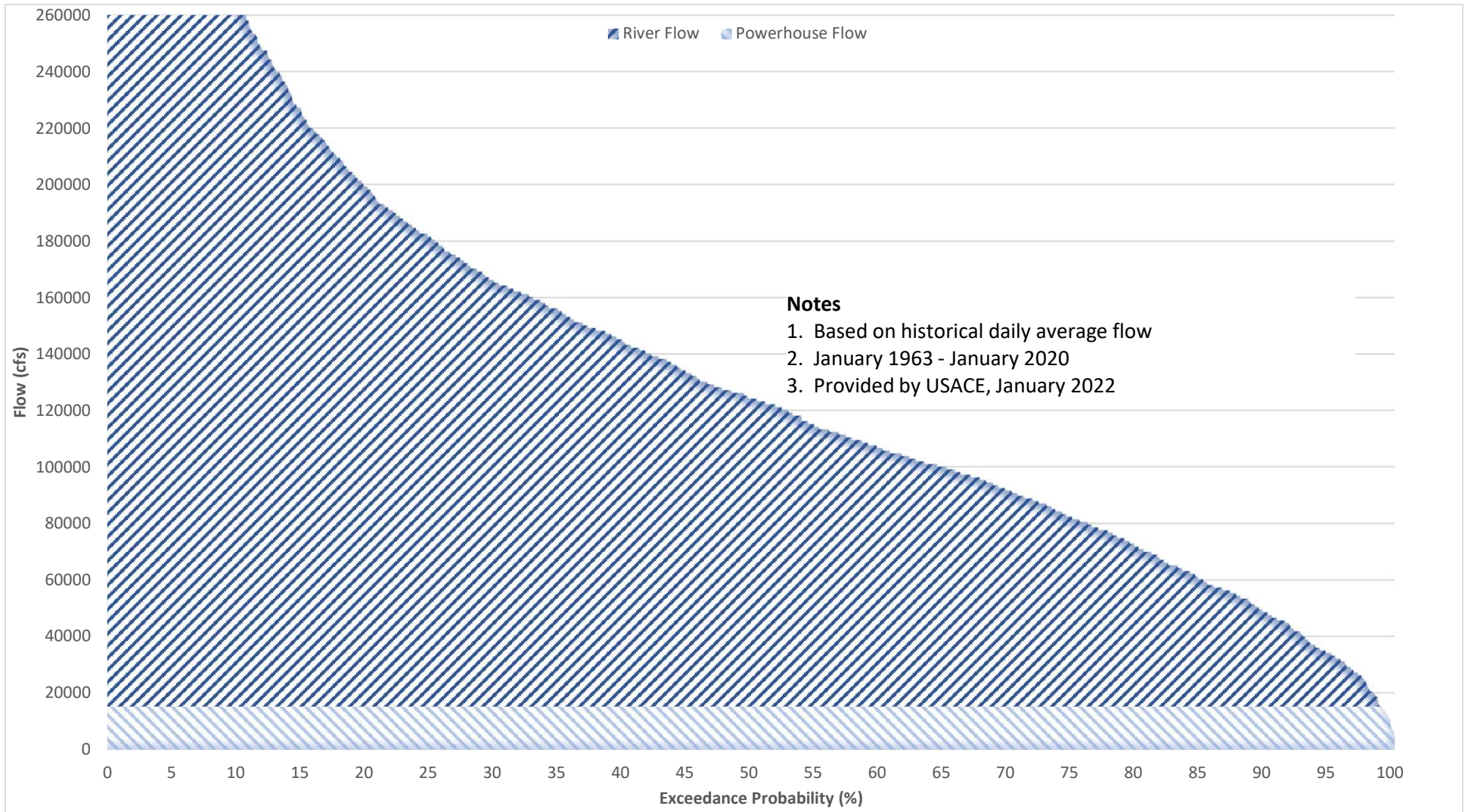


CURRENT HYDRO

Figure 4: February Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



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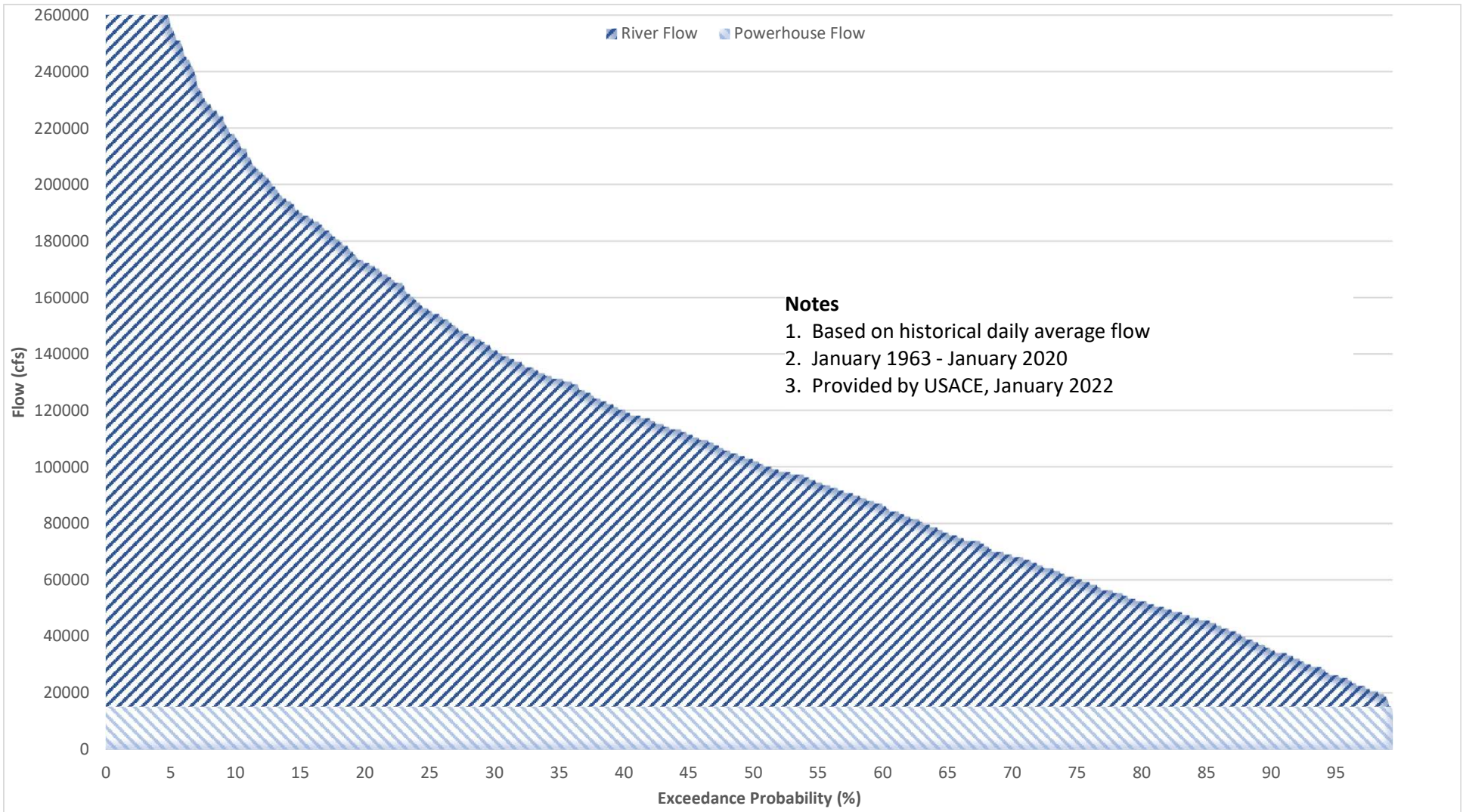


CURRENT HYDRO

Figure 5: March Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



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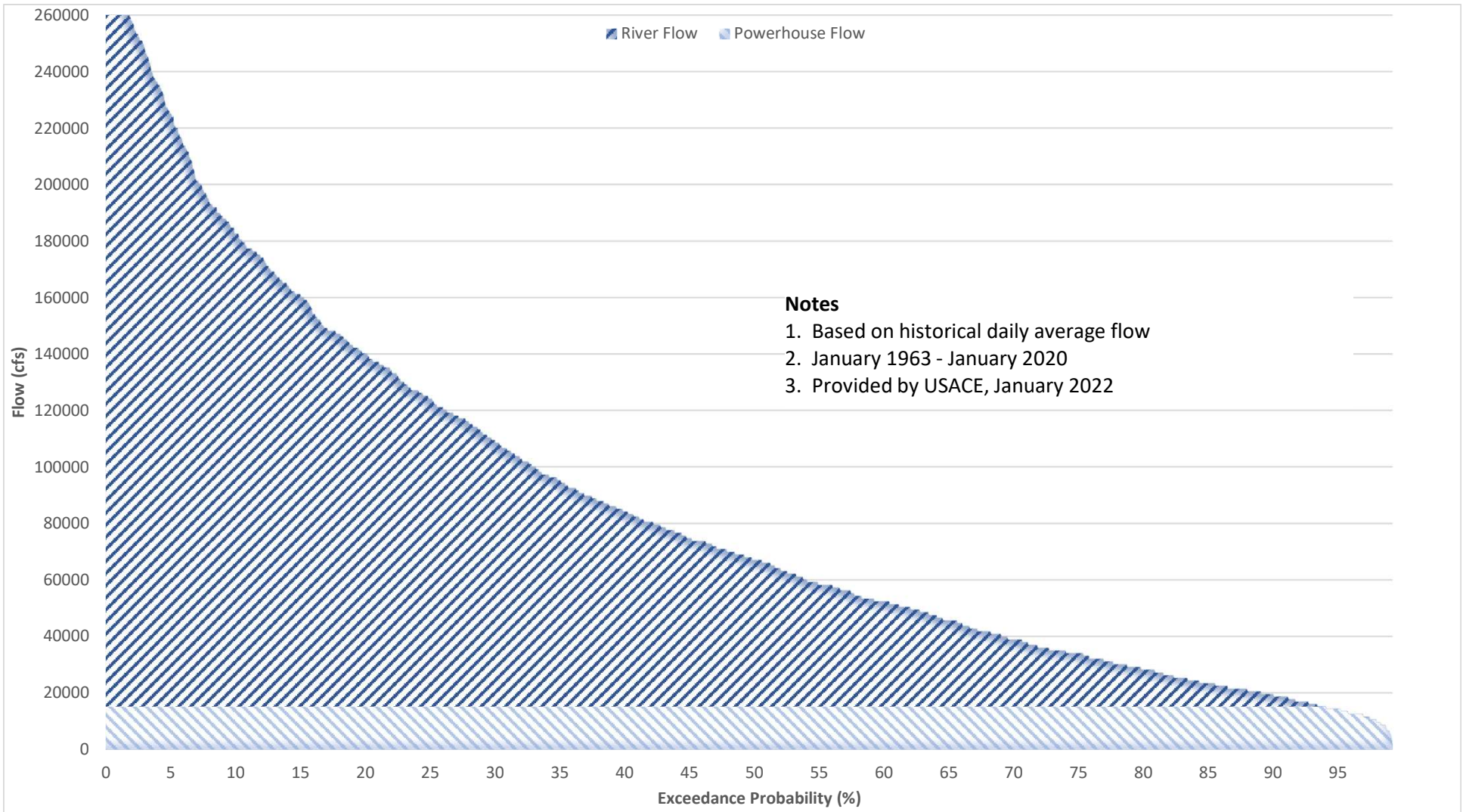


CURRENT HYDRO

Figure 6: April Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



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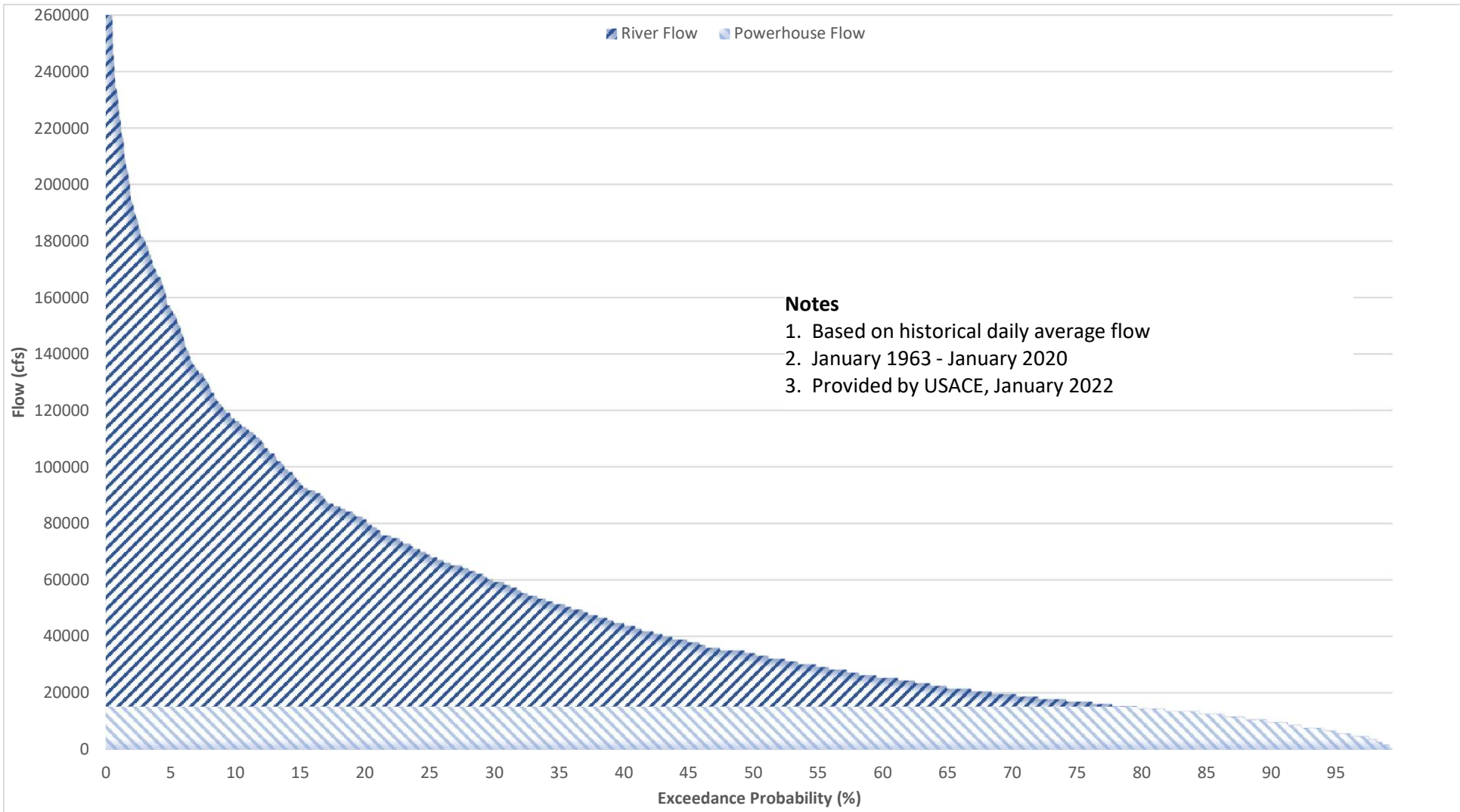


CURRENT HYDRO

Figure 7: May Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



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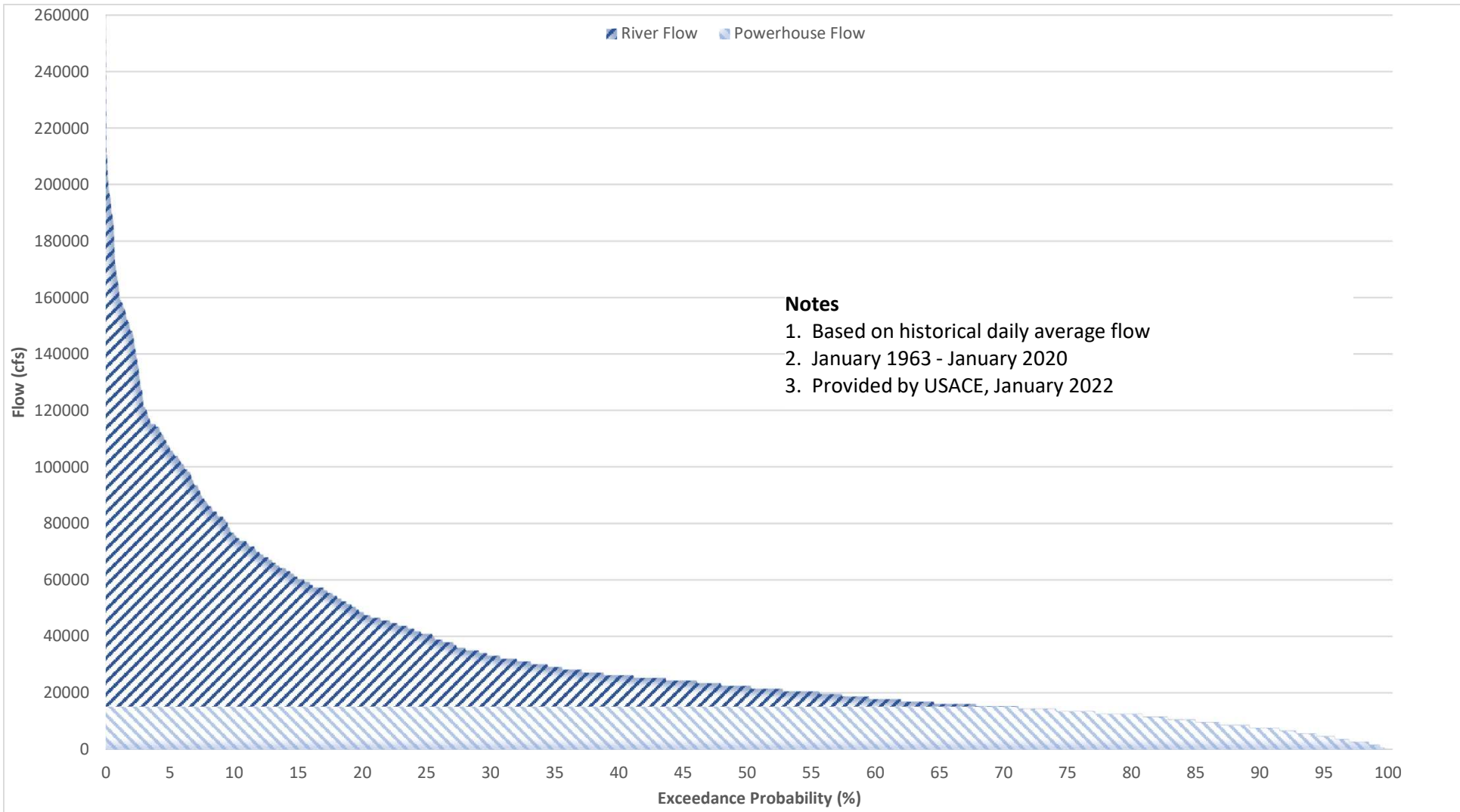


CURRENT HYDRO

Figure 8: June Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



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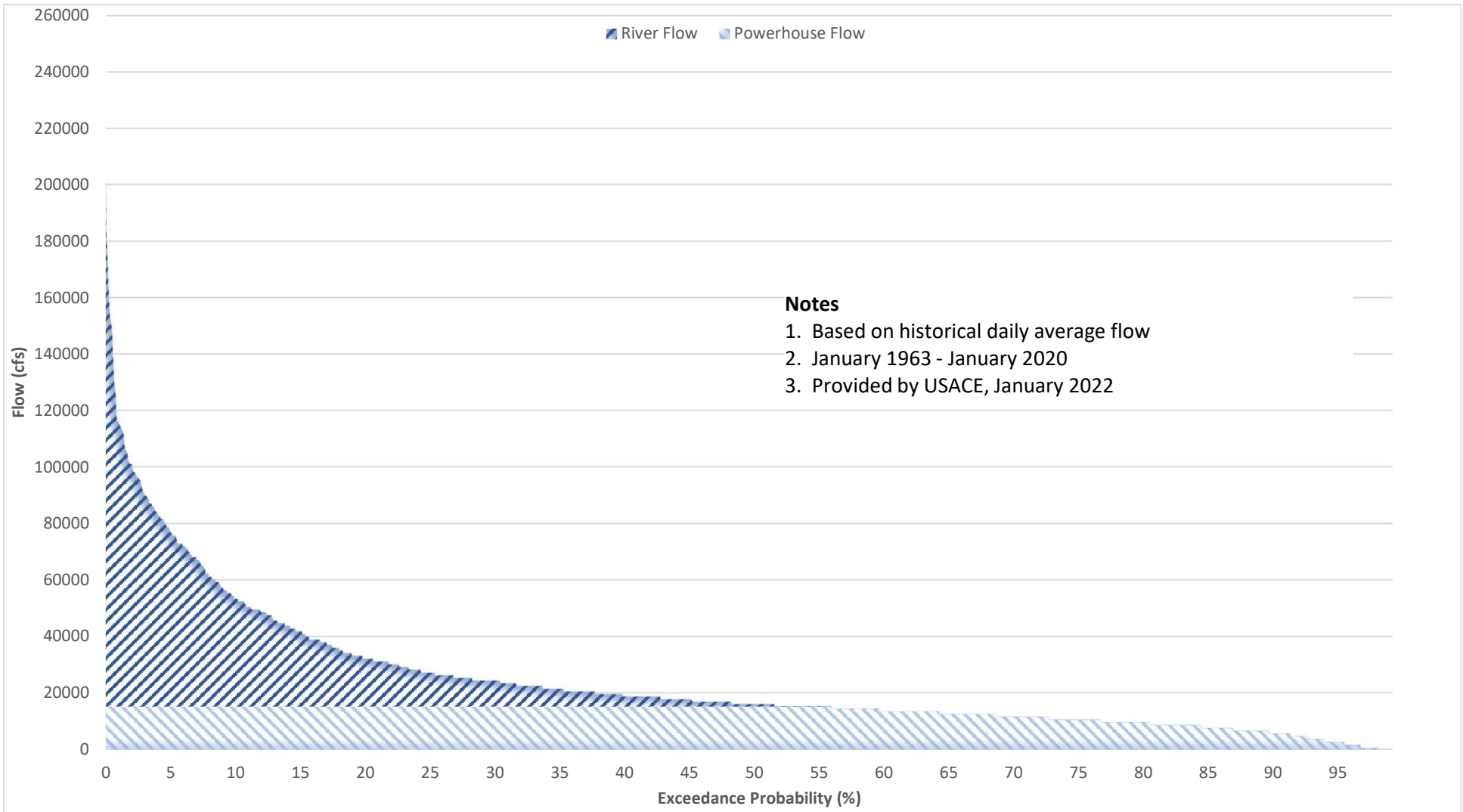


CURRENT HYDRO

Figure 9: July Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



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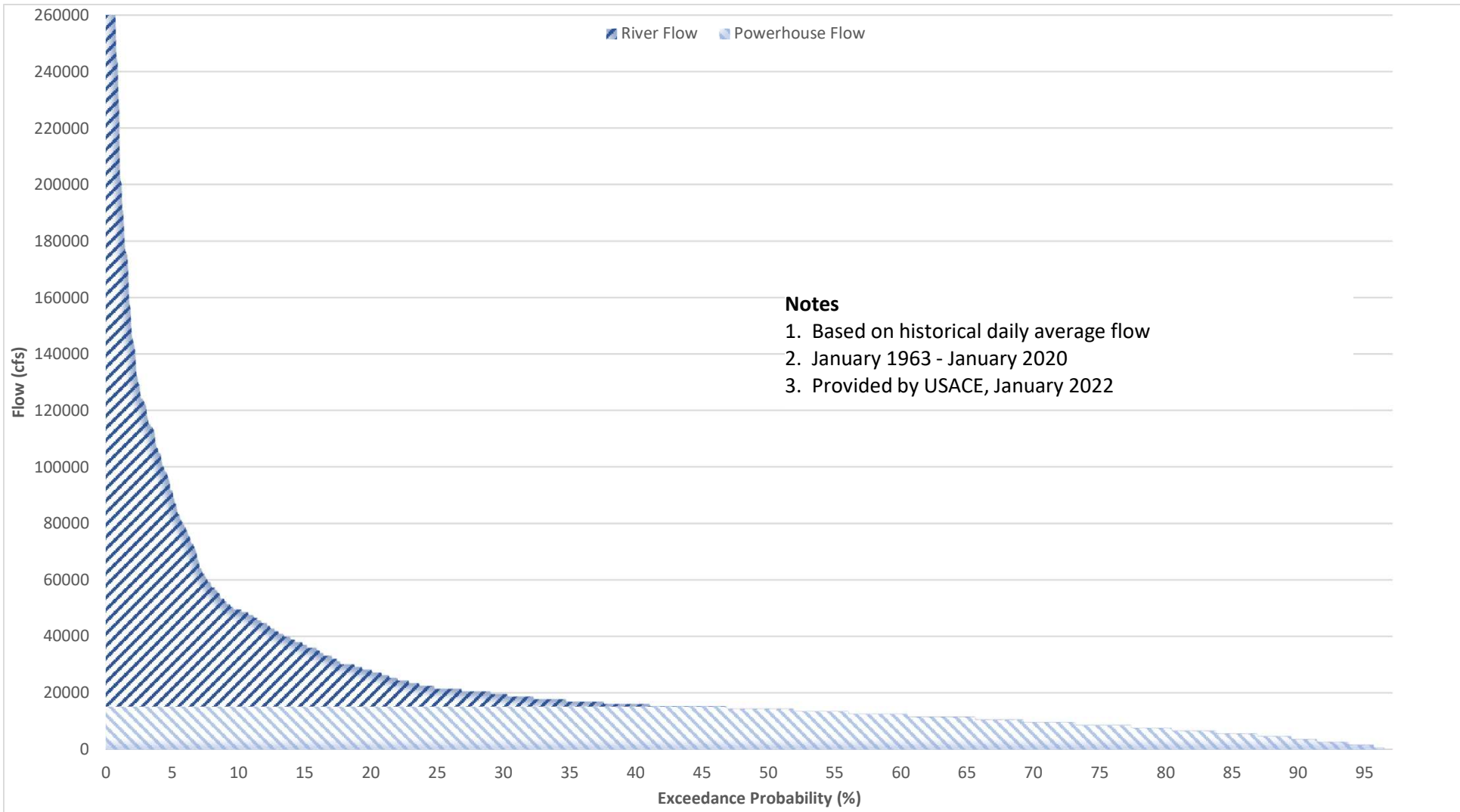


CURRENT HYDRO

Figure 10: August Flow Duration Curve

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Prepared by: LMGonzalez



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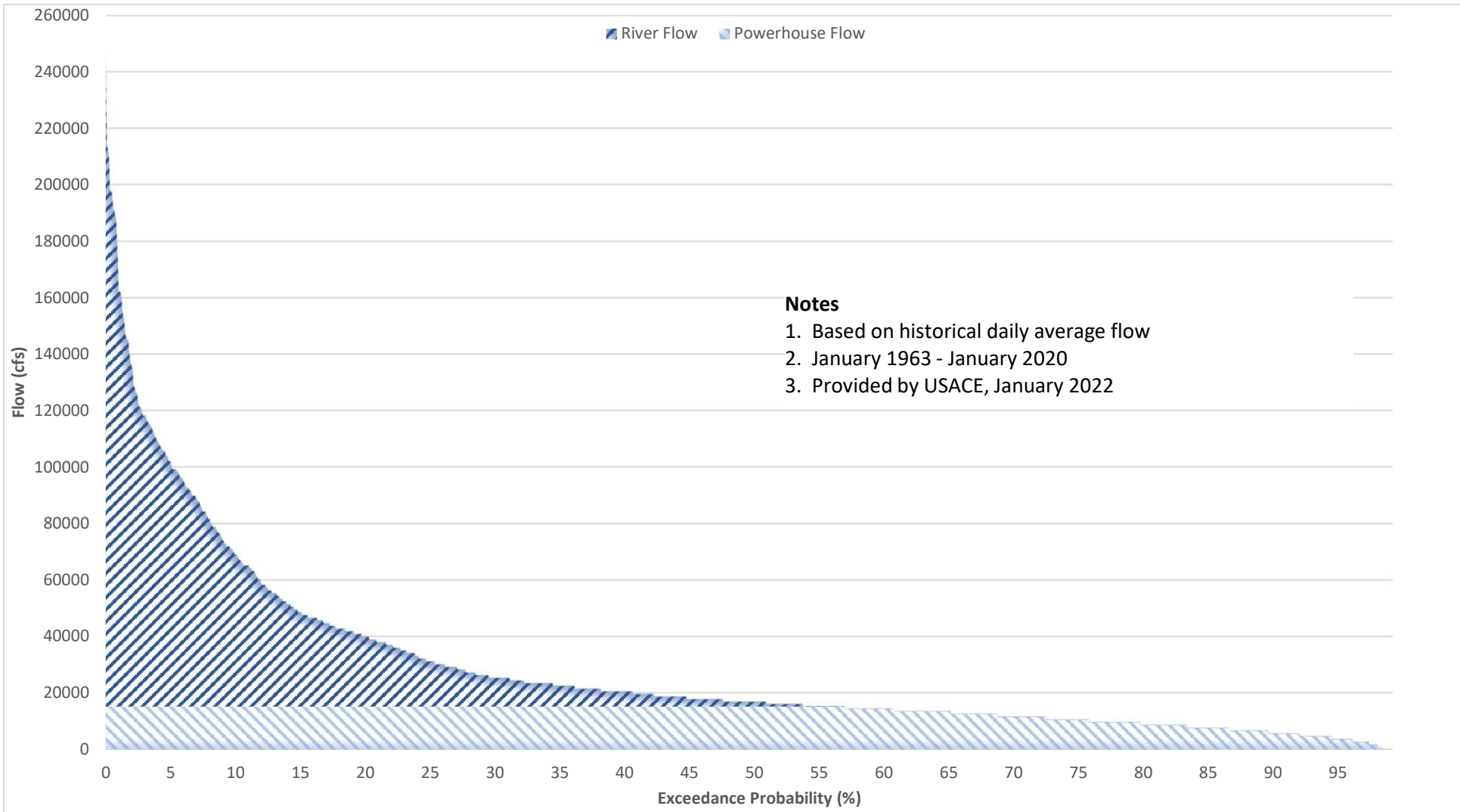


CURRENT HYDRO

Figure 11: September Flow Duration Curve

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Prepared by: LMGonzalez



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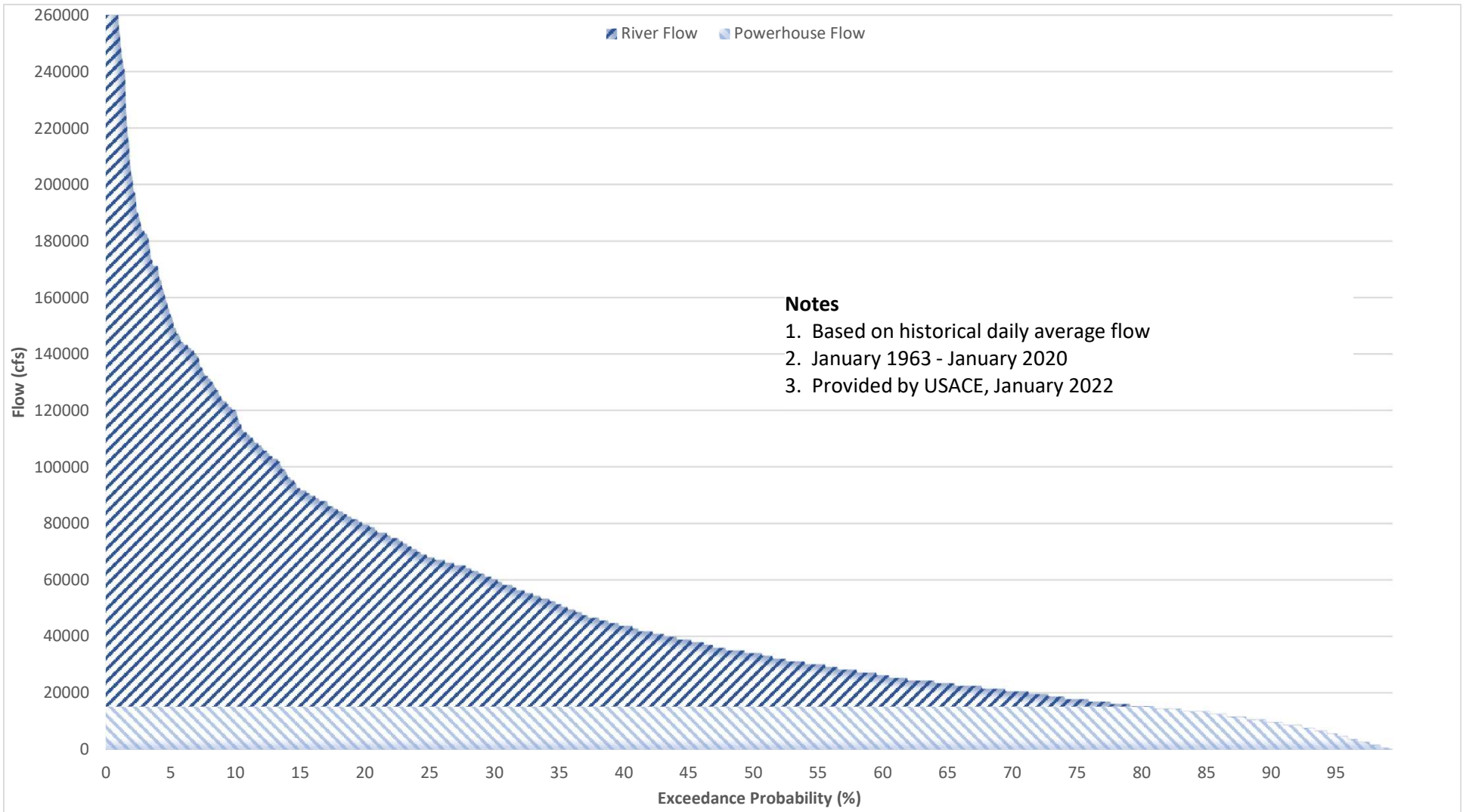


CURRENT HYDRO

Figure 12: October Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



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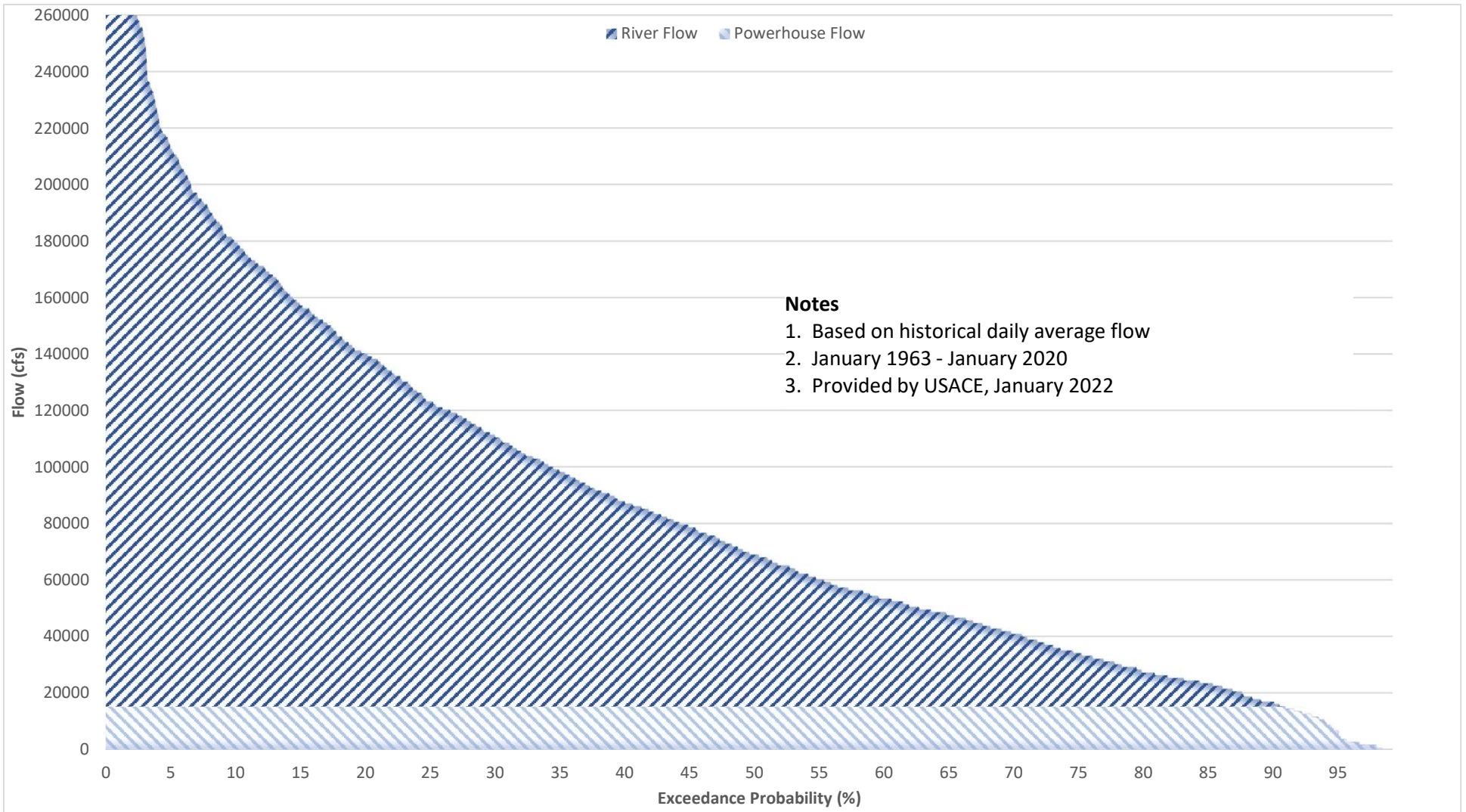


CURRENT HYDRO

Figure 13: November Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez



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CURRENT HYDRO

Figure 14: December Flow Duration Curve

Date: February 10, 2022

Prepared by: LMGonzalez