

Attachment E

Conowingo Hydroelectric Project
(FERC Project No. 405)

Fishway Operations and Maintenance Plan
("FOMP")

CONOWINGO HYDROELECTRIC PROJECT FERC PROJECT NUMBER 405

FISHWAY OPERATION AND MAINTENANCE PLAN



Prepared for:



Prepared by:



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LIST OF ABBREVIATIONS

cfs	cubic feet per second
CDL	Commercial Driver's License
Conowingo Project	Conowingo Hydroelectric Project
Constellation	Constellation Energy Generation, LLC
CWECF	Conowingo West Eel Collection Facility
C	Celsius
DOT	Department of Transportation
EFL	East Fish Lift
EPAG	Eel Passage Advisory Group
FERC	Federal Energy Regulatory Commission
FOMP	Fishway Operation and Maintenance Plan
fps	feet per second
FWS	US Fish and Wildlife Service
gpm	gallons per minute
L	liter
LLC	Limited Liability Corporation
lpm	liters per minute
m	meter
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
mm	millimeter
NGVD	National Geodetic Vertical Datum
PADEP	Pennsylvania Department of Environmental Protection
PFBC	Pennsylvania Fish and Boat Commission
ppm	parts per million
SRBC	Susquehanna River Basin Commission
USFWS	United States Fish and Wildlife Service
WFL	West Fish Lift

1 INTRODUCTION

Constellation Energy Generation, LLC (Constellation) is the licensee for the 570.15-megawatt Conowingo Hydroelectric Project (Conowingo Project or Project). The Project is located on the Susquehanna River (at river mile 10) in Pennsylvania and Maryland. Conowingo Dam is in Maryland connecting Cecil and Harford counties, as is the lowermost six miles of the Project reservoir, Conowingo Pond. The remaining eight miles of Conowingo Pond are in Pennsylvania, within York and Lancaster counties.

A Project Fishway Operation and Maintenance Plan (FOMP) describing Constellation's fish passage operations and maintenance activities was previously filed with the Federal Energy Regulatory Commission (FERC) on February 2, 2021. A new 50-year license for the Project was issued to Constellation on March 19, 2021. Per Article 413 of the new license Constellation filed a revised FOMP on November 1, 2021, incorporating the terms of the new license. The most recent version of the FOMP describing Constellation's fish passage operations and maintenance activities for the 2022 fish passage season was previously filed with the Federal Energy Regulatory Commission (FERC) on January 24, 2022.

This version of the FOMP updates previous versions to describe Constellation's fish passage operations and maintenance activities to be instituted during the 2023 fish passage season. Major updates include the following.

- Constellation will continue sorting of all fish that enter the Conowingo East Fish Lift (EFL) and West Fish Lift (WFL).
- Constellation will monitor and alert the Resource Agencies if any of the following invasives are observed in the EFL or WFL during the 2023 fish passage season: Silver Carp (*Hypophthalmichthys molitrix*), Bighead Carp (*Hypophthalmichthys nobilis*) and Grass Carp (*Ctenopharyngodon idella*).
- For the 2023 fish passage season the Whooshh system will not be utilized, instead fish will be transported from the EFL holding tank area to the WFL area using a transport transfer tank and skid that will be hauled through the powerhouse ("turbine hall") by a forklift.
- Water temperatures and dissolved oxygen collected at Station 643 after May 1 will be included in the annual FOMP report in addition to the water temperatures and dissolved oxygen collected daily at the WFL during the fish passage season.
- Every 20th river herring of each species (Alewife and Blueback Herring) will be sacrificed with a maximum collection of 50 individuals per species from the Project. Additionally, any river herring mortalities resulting from lifting, sorting, handling, or transporting will be retained for analysis

The purpose of Constellation's 2023 fish passage operation and maintenance activities are to facilitate passage of American Shad (*Alosa sapidissima*) and river herring (Alewife, *Alosa pseudoharengus* and Blueback Herring, *Alosa aestivalis*) as well as discourage the passage of invasive aquatic species.

On August 10, 2022, Constellation met with the United States Fish and Wildlife Service (USFWS), Maryland Department of the Environment (MDE), and Maryland Department of Natural Resources (MDNR) regarding invasive species and to discuss the results of the 2022 fish passage season ([Appendix A](#)). At this meeting, the Resource Agencies and Constellation agreed that Constellation will continue to implement sorting of all fish that enter the Conowingo EFL and WFL. Constellation will also monitor and remove the following invasive species during the 2023 fish passage season: Northern Snakehead (*Channa argus*), Blue Catfish (*Ictalurus furcatus*), and Flathead Catfish (*Pylodictis olivaris*). These species will be managed in accordance with Article 419 of the new license, paragraphs (b), (c), and (d) specifically

collecting these species from both the EFL and WFL and placing them in totes and in a refrigeration unit that will be provided by MDNR. MDNR will remove the totes and beneficially reuse the aquatic invasive species. Constellation will also monitor and alert the Resource Agencies if any of the following invasives are observed in the EFL or WFL during the 2023 fish passage season: Silver Carp, Bighead Carp and Grass Carp. American Shad and river herring will be sorted at the EFL and WFL and transported upstream (“100% sorting”), and no volitional passage will take place. The Resource Agencies requested that Constellation operate in this manner for the following fish passage seasons: 2023, 2024, and 2025.

The upgrades planned to the EFL under FERC License, Appendix 1, Section 12.6.1 do not contemplate sorting of aquatic invasive species. Constellation believes that it can accommodate the 100% sorting request for the 2023 fish passage season through operational and logistical changes to the trap and transport program, however, consultation with the Resource Agencies will be required annually as the populations of aquatic invasive species may increase to the point where Constellation may not be able to accommodate this request safely through operational and logistical changes. The EFL volitional upgrades under FERC License, Appendix 1, Section 12.6.1 do not contain a mechanism to sort and remove aquatic invasive species.

In addition, the License requires a total of 80% of the migratory run, up to 100,000 American Shad and 100,000 river herring per year to be trapped and transported to the mainstem Susquehanna River upstream of York Haven. The remainder of the run is to pass volitionally at the EFL. As described above, in response to USFWS concerns with invasive species passing Conowingo Dam via volitional passage at the EFL, Constellation, USFWS, MDE, MDNR, Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Fish and Boat Commission (PFBC), and the Susquehanna River Basin Commission (SRBC) have agreed not to conduct volitional passage in 2023, 2024, or 2025.¹ The EFL and WFL will be operated for trap and transport using existing sorting and holding tank(s). In accordance with the License conditions, Constellation will trap and transport up to 80% of the American Shad and river herring run above York Haven Dam (RM 56.1). However, the remaining portion of the American Shad and river herring run will be transported and discharged upstream of the Safe Harbor Dam (RM 32.2), rather than pass volitionally. To accomplish this, Constellation will transport American Shad and river herring from every fifth transport (20%) above Safe Harbor Dam, and the remaining four transports (80%) will be made above York Haven Dam. As the season progresses, the transport targets will be assessed on a weekly basis, and transports will be adjusted as needed to achieve the 80%/20% proportion. Adjustments will be based on the total number of fish transported to each location, as it is likely that fish transport load size may vary throughout the season due to variances in daily catch numbers.

Article 401 requires Constellation to keep the FOMP revised and updated on an annual basis, as necessary, when new fish passage measures are implemented or planned for the next year. Filing of this FOMP with FERC addresses the Article 401 requirement to file annual FOMP updates by January 31, 2023.

¹ The EFL setup for volitional passage is not setup to accommodate 100% sorting. Previous efforts to remove invasive species in the upper exit trough required the shutdown of the EFL to dewater the exit trough to allow personnel to enter the exit trough and remove the invasive species. The EFL is shutdown during this period and due to safety requirements, such as Lock Out-Tag Out, could result in a shutdown of the EFL for up to five (5) hours. For this reason, Constellation is proposing to accomplish 100% sorting using the trap and transport setup at both fish lifts.

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This FOMP specifically includes the following.

- Protocols for the management of invasive fish species during fish lift operations.
- Details of how the Project will be operated during the migration season to provide for adequate fish passage conditions, including:
 - routine maintenance;
 - pre-season preparation and testing at the fish lift and eel passage facilities;
 - post-season maintenance, protection, and winterization of the fish lift and eel passage facilities;
 - sequence of turbine start-up and operation under various flow regimes to enhance fishway operation and effectiveness;
 - procedures for routing fishway operations, including seasonal and daily periods of operation;
 - debris management at the fishway entrance, guidance channels, and the exit; and
 - plant operations to provide near- and far-field attraction.
- Protocols for operation to help prevent the transmission of COVID-19 and ensure the safe and reliable operation of both Projects ([Appendix B](#)). COVID-19 protocols will be implemented as necessary based upon applicable federal and state guidelines in place at that time. Any changes in COVID-19 requirements will be communicated to FERC and the resource agencies through an informational filing to the extent the change in COVID-19 protocols impact fish passage.
- Standard operating procedures for monitoring and enumerating fish passage by species, including the American Eel (*Anguilla rostrata*) passage facilities.
- Standard operating procedures for collecting biological samples from target species to assess restoration efforts.
- Standard operating procedures for monitoring and reporting operations that affect fish passage.
- Standard operating procedures in case of emergencies and unit outages to first avoid, and second minimize, potential negative impacts on fishway operations and the effectiveness of upstream passage for target species.
- Trap and transport logistics plan for American Eel, as well as American Shad and river herring.
- Consultation records.

The development of this FOMP has included consultation with resource agencies and has specifically addressed consultation requirements described in Articles 401, 412, 414, 415, 416, 417, 418, and 419. This FOMP also references the articles listed in [Table 1-1](#).

Table 1-1. FERC License Articles Discussed within Fishway Operation and Maintenance Plan

Article	FOMP Section(s)
Article 401. Commission Approval, Reporting, and Filing of Amendments; Appendix 1, Section 12.4	All
Article 406. Conowingo Pond Level Management	Section 3.1
Article 407. Minimum flow requirements	Section 3.1
Article 412. Fish Lift Monitoring	Section 4.3.3.1 Appendix F
Article 413. Fishway Operation and Maintenance Plan	All
Article 414. Additions to American Eel Passage Prescription	Section 5.4
Article 415. American Eel Passage and Restoration Plan	Section 6.2

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Article	FOMP Section(s)
Article 416. American Eel Collection and Holding Tank Conditions	Section 5.3.3.1 Section 5.7
Article 417. Upstream American Eel Transport Criteria	Section 5.3.3 Section 6.2 Appendix F
Article 418. Sturgeon Reporting	Section 4.3.3.1
Article 419. Invasive species	Section 1 Section 4.3.1.1 Section 4.3.1.2 Section 7.1 Appendix A

2 PROJECT FACILITIES

2.1 Project Configuration

The Project consists of 1) a main dam, 2) a spillway, 3) a reservoir (Conowingo Pond), and 4) an intake and powerhouse.

The Conowingo Dam is a concrete gravity dam with a maximum height of approximately 94 feet and a total length of 4,648 feet. The dam consists of four distinct sections from east to west: a 1,190-foot long non-overflow gravity section with an elevation of 115.7 feet²; an ogee shaped spillway, the major portion of which is 2,250 feet long with a crest elevation of 86.7 feet, and the minor portion of which is 135 feet long with a crest elevation of 98.7 feet; an intake-powerhouse section which is 950 feet long; and a 100-foot long abutment section ([Figure 2.1-1](#)). The dam and powerhouse also support US Highway Route No. 1, which passes over the top of Conowingo Dam. The EFL and WFL are located at opposite ends of the powerhouse.

Flow over the Conowingo Main Dam spillway is controlled by 50 stony-type crest gates with crest elevations of 86.7 feet and two regulating gates with crest elevations of 98.7 feet. Each of the crest gates are 22.5 feet high by 38 feet wide and have a discharge capacity of approximately 16,000 cubic feet per second (cfs) at a reservoir elevation of 109.2 feet. The two regulating gates are 10 feet high by 38 feet wide and have a discharge capacity of approximately 5,000 cfs per gate at a reservoir elevation of 109.2 feet.

Conowingo Pond extends approximately 14 miles upstream from Conowingo Dam to the lower end of the Holtwood Project tailrace. The Conowingo Pond is generally maintained at an elevation of 109.2 feet, with a surface area of approximately 8,500 acres and a total impoundment design volume of 310,000 acre-feet at that elevation.

The Project powerhouse contains eleven main turbines, as well as two house turbines ([Table 2.1-1](#)). The house units are located on the far western end of the powerhouse, and discharge into the WFL, whereas the larger units are arranged in order such that Unit 1 discharges near the WFL, and Unit 11 discharges near the EFL ([Figure 2.1-2](#)). Units 2 and 5 are equipped with aerating runners, which serve to increase dissolved oxygen levels in the turbine discharge water. The Project intakes for each turbine are individually protected by seven trash racks; five are entirely steel (clear spacing of 5.375 inches) and two are steel framed with wood racks (clear spacing of 4.75 inches). The top two racks are constructed of wood due to frazzle ice accumulations on the steel sections.

2.2 Fish Passage Facilities

2.2.1 West Fish Lift

The WFL ([Figures 2.2.1-1](#) and [2.2.1-2](#)) is located at the west bank of the tailrace below Conowingo Dam and has been in operation since 1972. The WFL was designed to use the outflow from the two house units

² Unless noted otherwise elevations are in the National Geodetic Vertical Datum of 1929 (NGVD 1929), as opposed to Conowingo Datum. Conowingo Datum is 0.702 feet higher than NGVD 1929 Datum (i.e., El. 100.00 Conowingo Datum = 100.702 NGVD 1929 Datum).

as an attraction flow for the lift. Fish enter the WFL through one of two entrance gates. Entrance Gate 1 directs attraction water along the downstream face of the dam towards turbine Units 1 and 2. This gate is usually closed when Units 1 and 2 are operating to prevent overcrowding of the crowder channel by Gizzard Shad (*Dorosoma cepedianum*). Entrance Gate 2 directs water downstream along the east wall of the WFL. Entrance Gate 2 is operated when turbine Units 1 and 2 are operating, in conjunction with Entrance Gate 1, or by itself with turbine Units 1 and 2 on or off. Overall, Entrance Gate 2 is used most frequently. The WFL does not have the capability to pass fish into Conowingo Pond and was designed as a collection facility to allow for transport of pre-spawned American Shad to tributaries above the dam. The volume of the existing WFL hopper is approximately 900 gallons. The WFL is outfitted for trap and transport using the existing sorting and holding tank(s). A transport tank and skid will be used in 2023 similar to previous years. [Figure 2.2.1-3](#) illustrates the sorting and holding tank layout. Constellation has a total of four (4) transport tanks and skids to transport American Shad and river herring.

2.2.2 East Fish Lift

The EFL ([Figures 2.2.2-1](#) through [2.2.2-3](#)) is located at the east end of the powerhouse in the first spillway bay of the dam. It is used during the spring to lift fish over the Conowingo Dam directly into Conowingo Pond. Attraction water enters the EFL from one of two gates that replaced the original regulating gates previously in the spillway bay. Water also enters the EFL exit trough at the level of the spillway. Water flows through the exit trough and enters a bypass pipe that returns this water to the spillway creating a flow through the exit trough for the shad to swim upstream after being lifted and deposited into the exit trough from the hopper. Fish enter the hopper through one of three entrance gates; selection of the gate used is dependent on the turbines in use. The EFL has been in operation since 1991 and was operated as a trap and transport facility from 1991-1996. In 1997, the EFL began operation as a volitional-only facility. Due to Resource Agency concerns regarding the passage of aquatic invasive species, Constellation requested authorization from FERC to temporarily suspend upstream fish passage requirements. This request was approved by FERC, and the EFL has not operated in volitional passage mode since that time. The EFL was outfitted for trap and transport during the 2022 fish passage season, using the existing sorting and holding tank(s). Target species were transported from the EFL holding tank area to the WFL area for eventual transport upstream.³ For the 2023 fish passage season the Whooshh system will not be utilized, instead fish will be transported from the EFL holding tank area to the WFL area using a transfer tank that will be hauled through the powerhouse (“turbine hall”) by a forklift⁴.

The FERC License, Appendix 1, Section 12.6.1 requires EFL modifications identified as Initial Construction Items. Designs are currently under development in consultation with USFWS; no changes have yet been made.

³ Whooshh Innovations Inc. conducted a pilot study in October 2021 to determine if fish can be safely moved from the WFL to the EFL. The pilot study was successful and Constellation utilized the Whooshh system during the 2022 fish passage season to convey fish from the EFL area to the WFL holding area. Additional details on the system setup are provided in [Appendix B](#). The results of the pilot study and 2022 fish passage season are provided in the 2022 FOMP annual report.

⁴ Constellation is currently in the design phase for a railcar system to be deployed on the catwalk. Once design and construction are complete, this method for fish transport from the EFL holding tank area to the WFL area will be utilized in future years.

2.2.3 Conowingo West Eel Collection Facility

The Conowingo West Eel Collection Facility (CWECF) is located on the west bank of the Conowingo Dam tailrace ([Figures 2.2.3-1](#) and [2.2.3-2](#)). The facility was constructed in 2017 and consists of five main elements: (1) a water supply line; (2) a ramp; (3) a collection tank; (4) multiple holding tanks; and (5) an overflow tank. In September 2022, Constellation also installed an additional temporary ramp and collection tank at the site.

2.2.3.1 Water Supply Line and Attraction Flow

The facility uses up to 70 gallons-per-minute (gpm) of water to provide attraction flow to the eel ramp and for use within the collection and the holding tank(s). An eight-inch diameter gravity feed line supplies water for the CWECF. The water line forms a manifold at elevation 46 feet and contains four two-inch globe valves for the WFL and one three-inch gate valve for the CWECF. The main water line for the CWECF is three inches in diameter, but each fill line for each tank is two inches in diameter. Each tank's fill line has one two-inch gate valve and one two-inch angle valve along with an inline flow meter between these valves. A separate one-inch line with a ball valve continuously discharges water down the ramp and into the collection tank via a spray bar, keeping the substrate moist and creating a flow to attract juvenile eels. Climbing ramp flow is augmented by a one-inch diameter scent line from a tap and ball valve from the collection tank drain providing additional attraction flow via this gravity feed hose. The overflow tank collects the water from the collection tank and the holding tanks that are in service. Two three-inch diameter additional attraction flow pipes drain the overflow tank and are discharged near the entrance of the ramp. These additional flow pipes are discharged above the eel ramp's shade cloth allowing the water to disperse over a larger area and provide additional attraction. All water from the ramp and the additional attraction pipes provides the overall attraction flow down the shoreline riprap to the tailrace.

2.2.3.2 Collection Facility

The CWECF contains one collection tank, which is 40.2 inches wide with a length of 72.0 inches. The depth of the water in the collection tank is 27.0 inches, with a volume of approximately 336.6 gallons. The collection tank has eight inches of freeboard to keep eels from climbing out of the tank. The main flow into the collection tank is provided from the two-inch fill line with the terminus of the pipe about two inches above the waterline providing a constant flow of freshwater to the tank. Also, some water from the spray bar flow also enters the collection tank from the backside of the ramp. The bend of the ramp is custom fitted into the collection tank and ended about four inches above the high-water mark in the tank. The collection tank contains a drain comprised of a four-inch diameter PVC pipe with holes drilled through it and wrapped in 0.04-inch mesh to prevent juvenile eel escapement. The four-inch collection tank drain line contains a one--inch gravity drain line with a ball valve that is directed to the highest point possible (gravity feed) of the ramp, thus providing eel scent from the eels in the collection tank to the ramp. The collection tank also contains a three-inch drain line, positioned about three inches off the bottom. The drain line attaches to a gate valve that remains closed until eels are removed. The three-inch and four-inch flexible drain lines empty into the overflow tank. The collection tank was custom fitted with a lid made from 0.2-inch Lexan. In addition to the in-line flow meter, the collection tank contains a water temperature and dissolved oxygen probe.

The juvenile eel ramp is constructed of an aluminum cable tray. The cable tray contains landscape fabric climbing substrate (Enkamat 7010) attached to the tray bottom. This substrate consists of a dense three-

dimensional mesh of fused filaments, which provides a climbing surface for the juvenile eels. The ramp consists of an approximately 345 inches long by 18 inches wide cable tray positioned at a 42.5° angle, plus a continuous length of tray that is bent and shaped at a 90° angle over a one-inch radius at the top of the ramp to convey juvenile eels into the collection tank. The entrance of the ramp is at elevation 29 feet, which is above the normal high-water line, with a smooth transition to the existing rip-rap shoreline. The facility is designed so that eels ascend the riprap between the tailwater surface and the end of the ramp. This portion of the riprap is wetted from the attraction flow exiting the eel ramp and the overflow tank down to the tailwater level. Once eels ascend the rip-rap portion, they enter the eel ramp and can ascend to the collection tank. The ramp is held in place by six metal braces, evenly spread across the length of the ramp, and each brace is attached to a large substrate along the shoreline. The ramp is covered from the top down to near the entrance to protect juvenile eels when ascending. The large 70% shade cloth is installed below the entrance to help protect juvenile eels between the tailrace and the entrance of the ramp.

2.2.3.3 Holding Facility

The CWECF contains three holding tanks, with a total holding capacity of 51,660 juvenile eels. Each holding tank is 5.5 feet wide with a length of 5.5 feet. The depth of the water in each collection tank is 2.0 feet, providing approximately 455 gallons of water in each tank. A freeboard of eight inches is provided to prevent eels from climbing and escaping. The bottom of each holding tank is sloped to the center drain to help flush all water and eels from the tank. The top of the center drainpipe is fitted with an 18-inch square screen drain that has a height of eight inches. The screen drain is constructed of 0.04-inch mesh to prevent eels from escaping and allows consistent water exchange. This screened box is attached to a four-inch PVC pipe fitted into a four-inch bulkhead fitting that is removed to drain the tank completely. The bulkhead fitting is attached to a 90° PVC fitting and attached to a four-inch flexible hose by a cam fitting that drains into the overflow tank. The main flow into a holding tank is supplied by the two-inch fill line with the terminus of the pipe about two inches above the waterline, providing a constant flow of freshwater to the tank.

The overflow tank is a 150-gallon tank containing three three-inch bulkhead fittings. These bulkhead fittings are attached to a three-inch PVC solid wall pipe that is used to provide the additional attraction flow near the entrance of the ramp. The overflow tank is filled by the collection tank and all in-service holding tank drain lines. Prior to any tank being drained, a very fine mesh bag is hose clamped to the end of the drain hose to ensure that no eels are released into the overflow tank. The drain hose with the mesh bag attached is placed into the overflow, which acts as a water cushion for the eels being collected in the bag.

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Table 2.1-1: Conowingo Project Turbine Specifications

Unit	Type	Runner Speed (rpm)	Rated Output (hp)	Approx. Rated Discharge (cfs)
House #1	Francis	360	1,900	247
House #2	Francis	360	1,900	247
1	Francis	81.8	64,500	6,749
2	Francis	81.8	54,000	6,320
3	Francis	81.8	64,500	6,749
4	Francis	81.8	64,500	6,749
5	Francis	81.8	54,000	6,320
6	Francis	81.8	64,500	6,749
7	Francis	81.8	64,500	6,749
8	Mixed-Flow Kaplan	120	85,000	9,352
9	Mixed-Flow Kaplan	120	85,000	9,727
10	Mixed-Flow Kaplan	120	85,000	9,727
11	Mixed-Flow Kaplan	120	85,000	9,727



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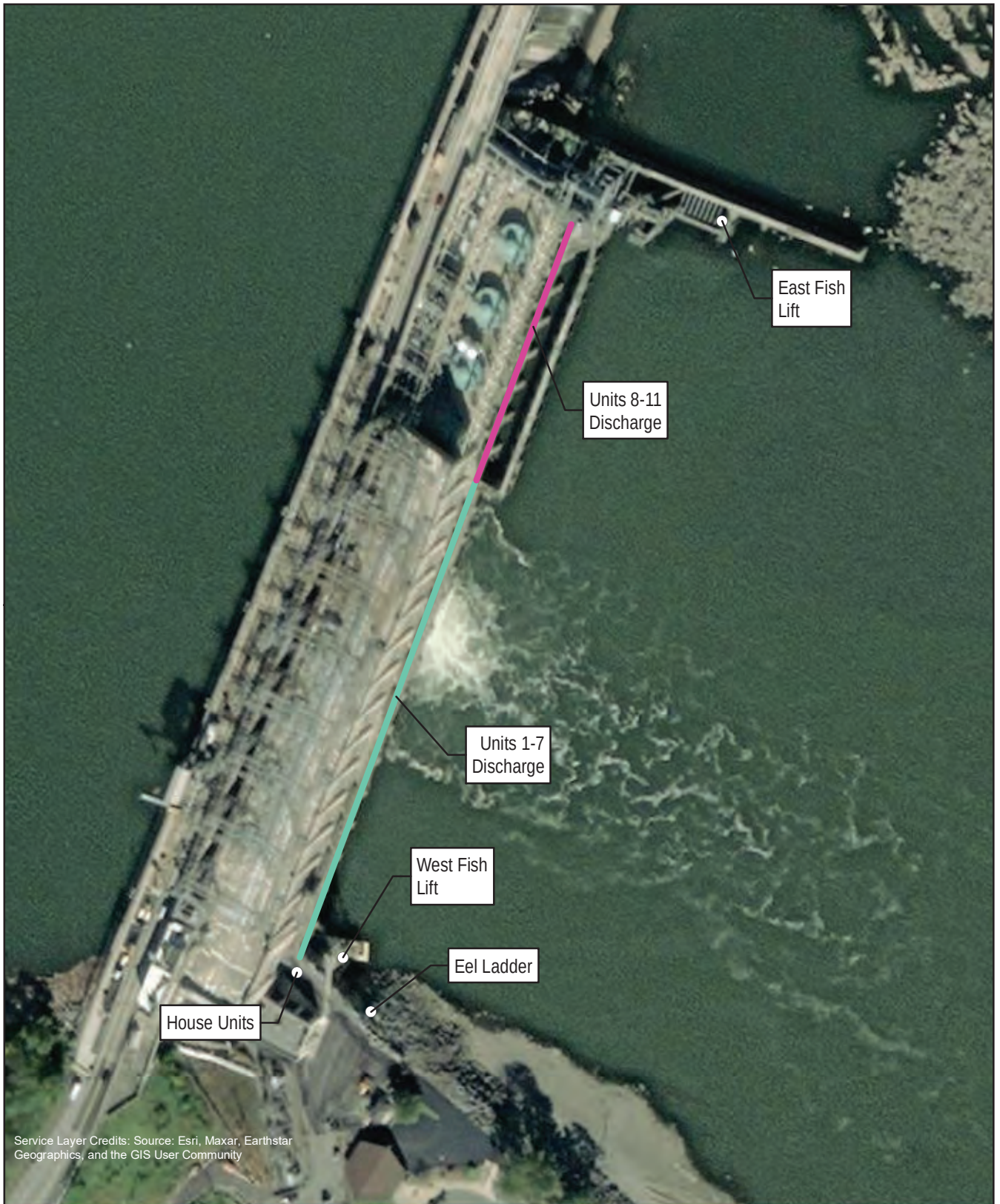
CONSTELLATION ENERGY GENERATION, LLC

CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

0 500 1,000 2,000
Feet

**Figure 2.1-1:
Project Overview**

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Geographics, and the GIS User Community



CONSTELLATION ENERGY GENERATION, LLC

CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

0 75 150 300
Feet

**Figure 2.1-2:
Project Facilities**

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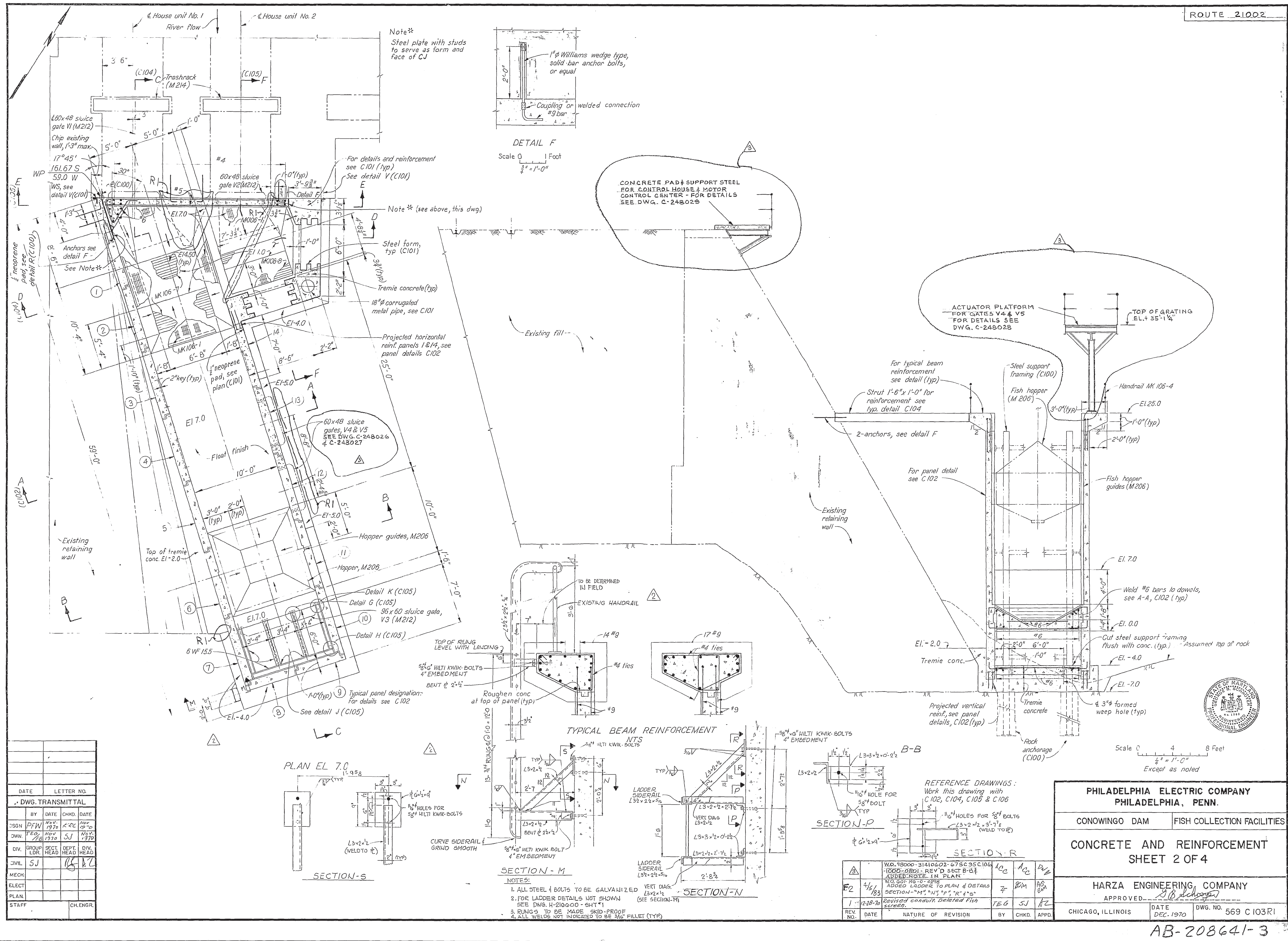
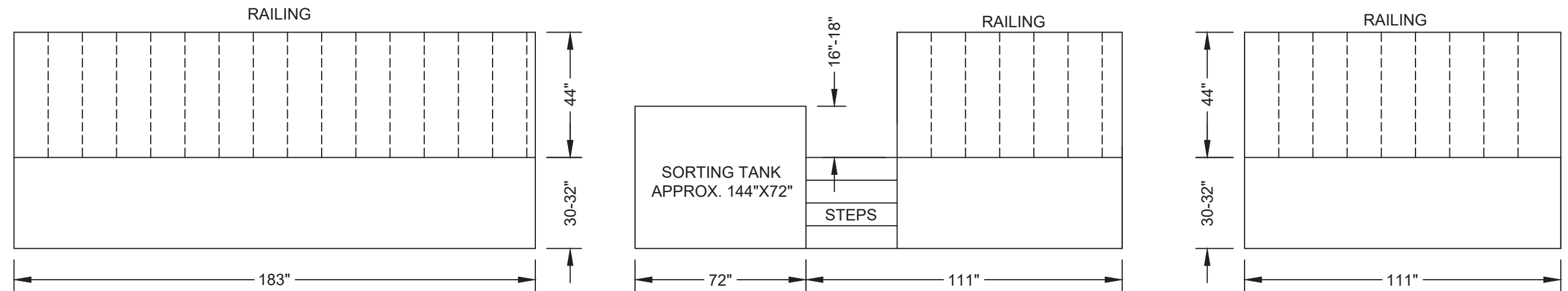


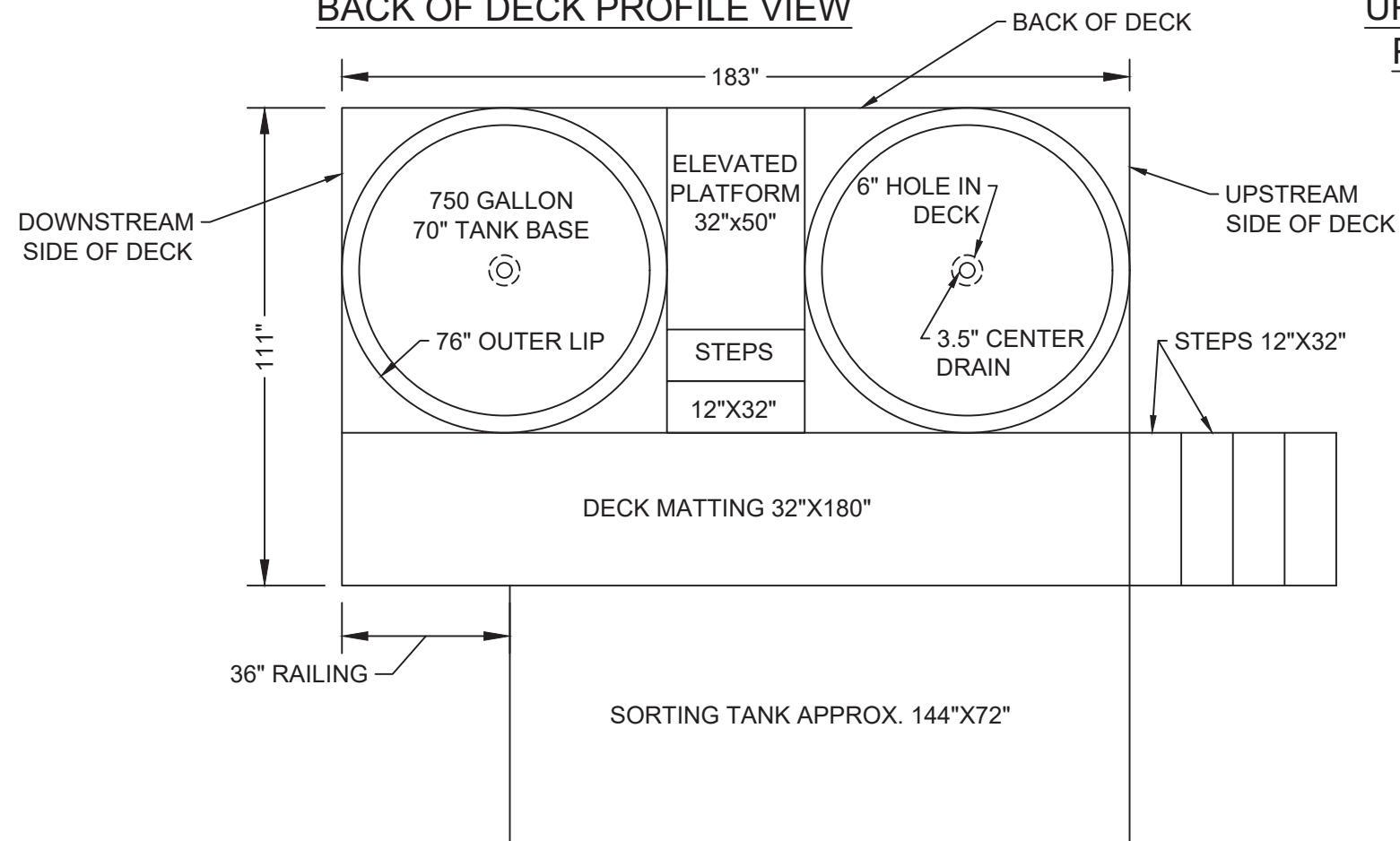
Figure 2.2.1-1: Plan View Layout of the WFL



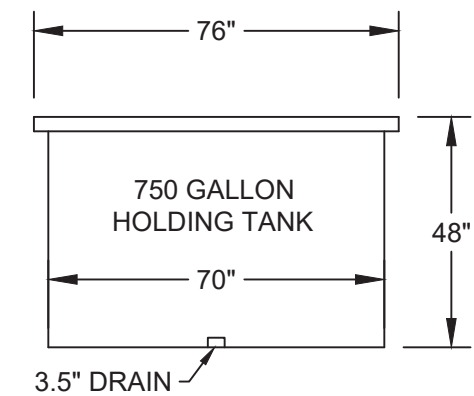
BACK OF DECK PROFILE VIEW

UPSTREAM DECK PROFILE VIEW

DOWNSTREAM DECK PROFILE VIEW



PLAN VIEW



TANK PROFILE VIEW



CONOWINGO HYDROELECTRIC PROJECT
INTERIM WEST FISH LIFT TRAP AND
TRANSPORT OPERATION



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Figure 2.2.1-3: WFL Sorting and Holding Tank Layout

DATE	#		BY	APP

DRAWN BY: JSC CHECKED BY:
APPROVED BY: GSE PROJECT NO.: 2144

SCALE:
DATE: 12/2/2020

DRAWING NO.: 1

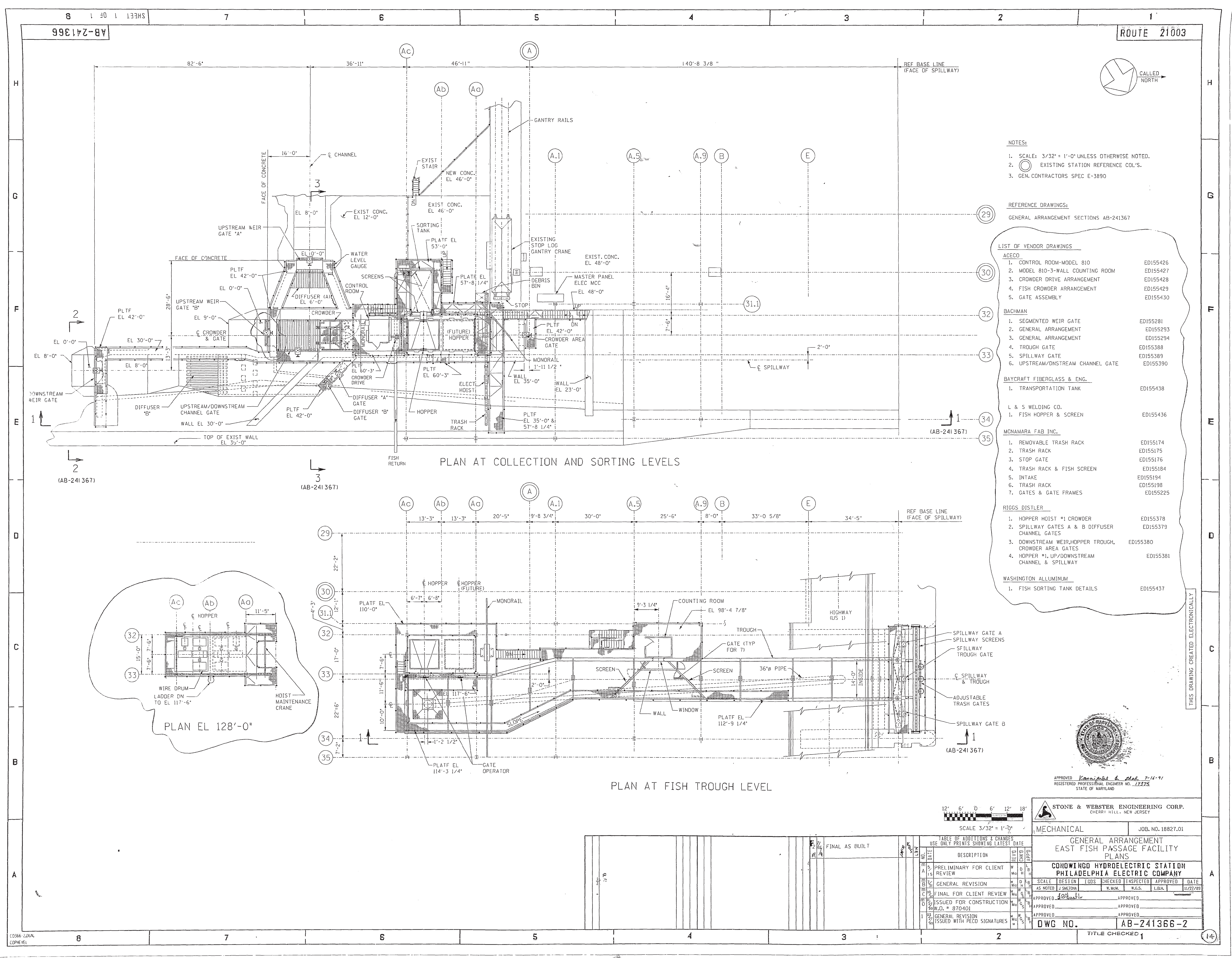


Figure 2.2.2-1: Plan View Layout of the EFL

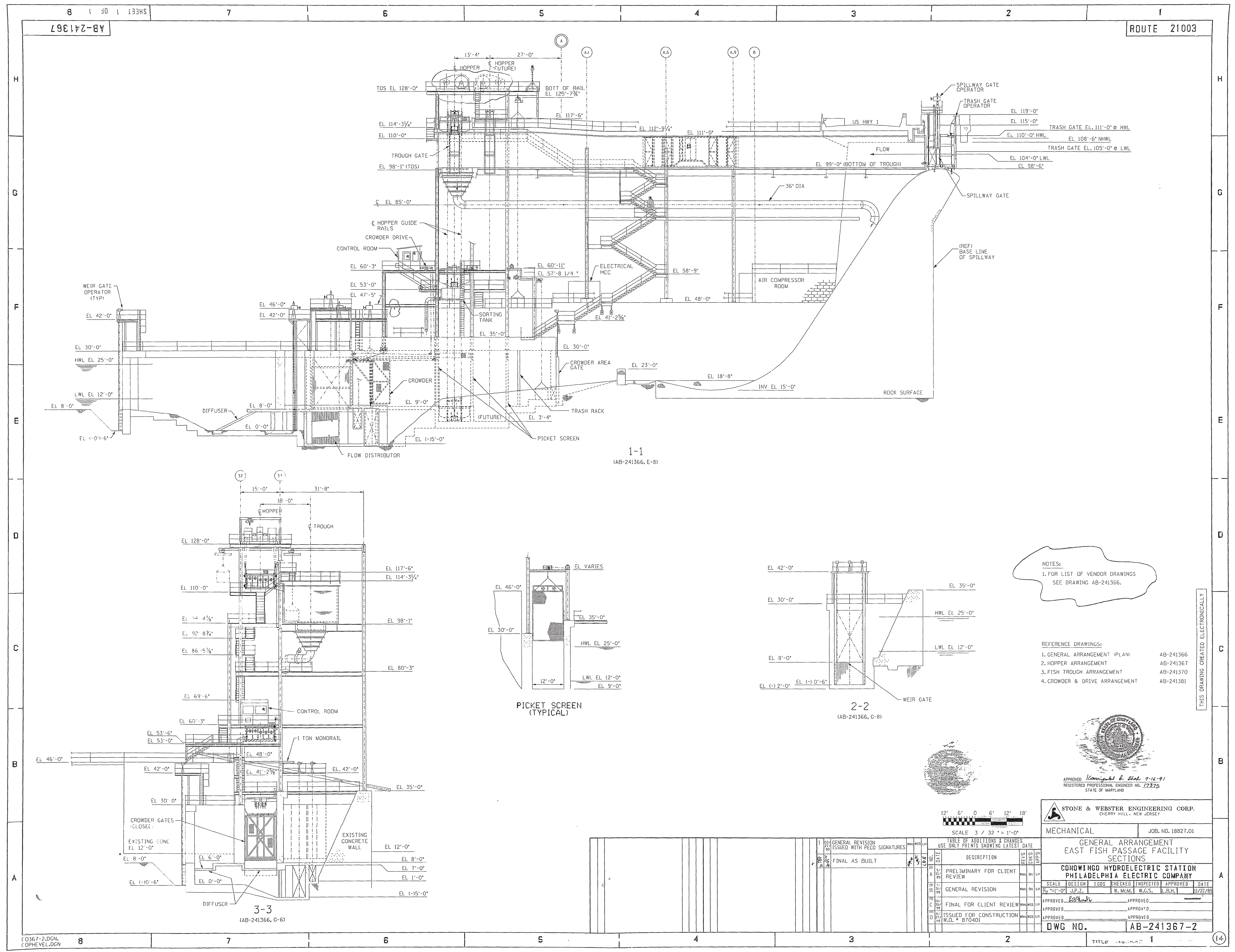
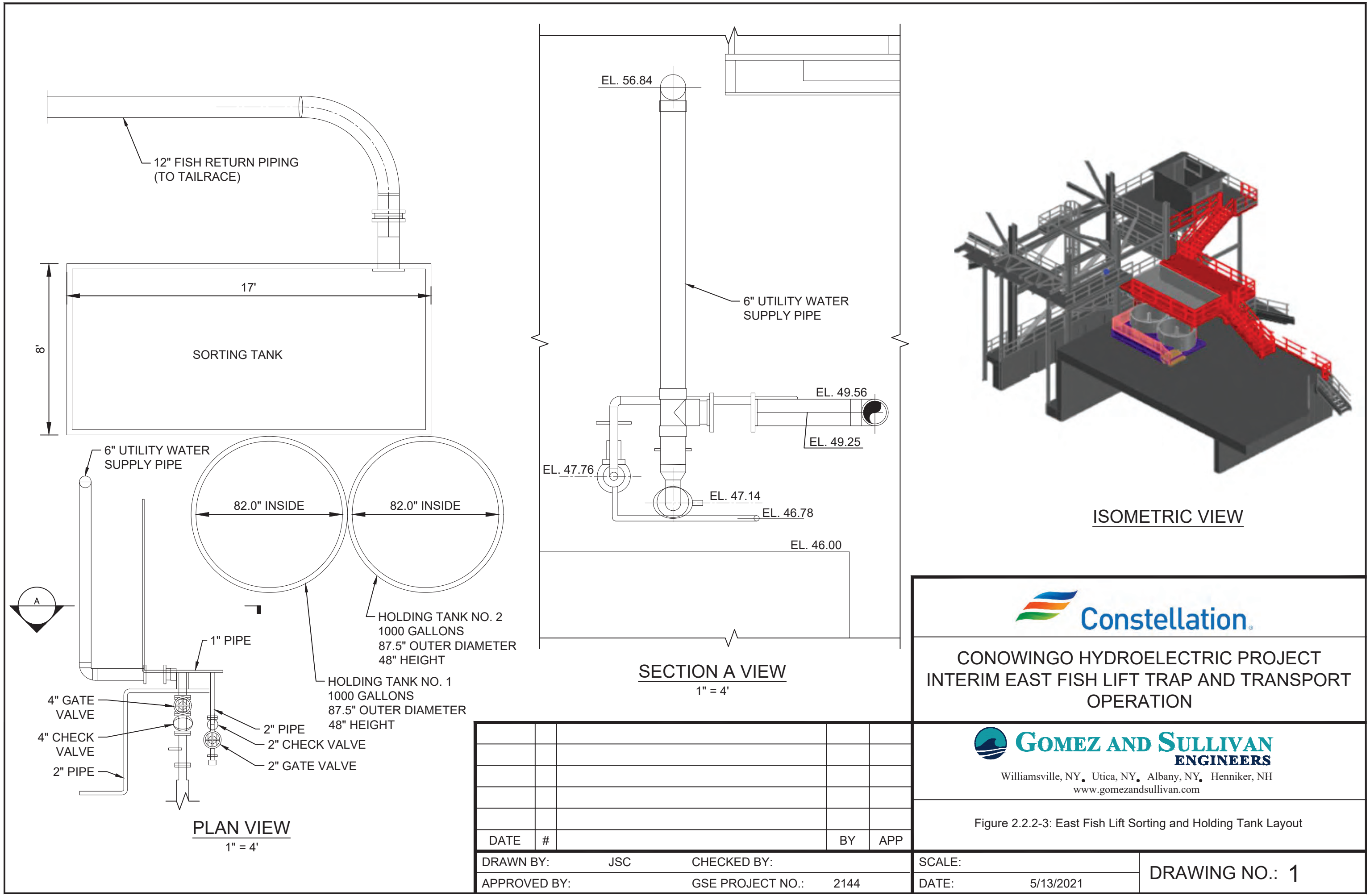
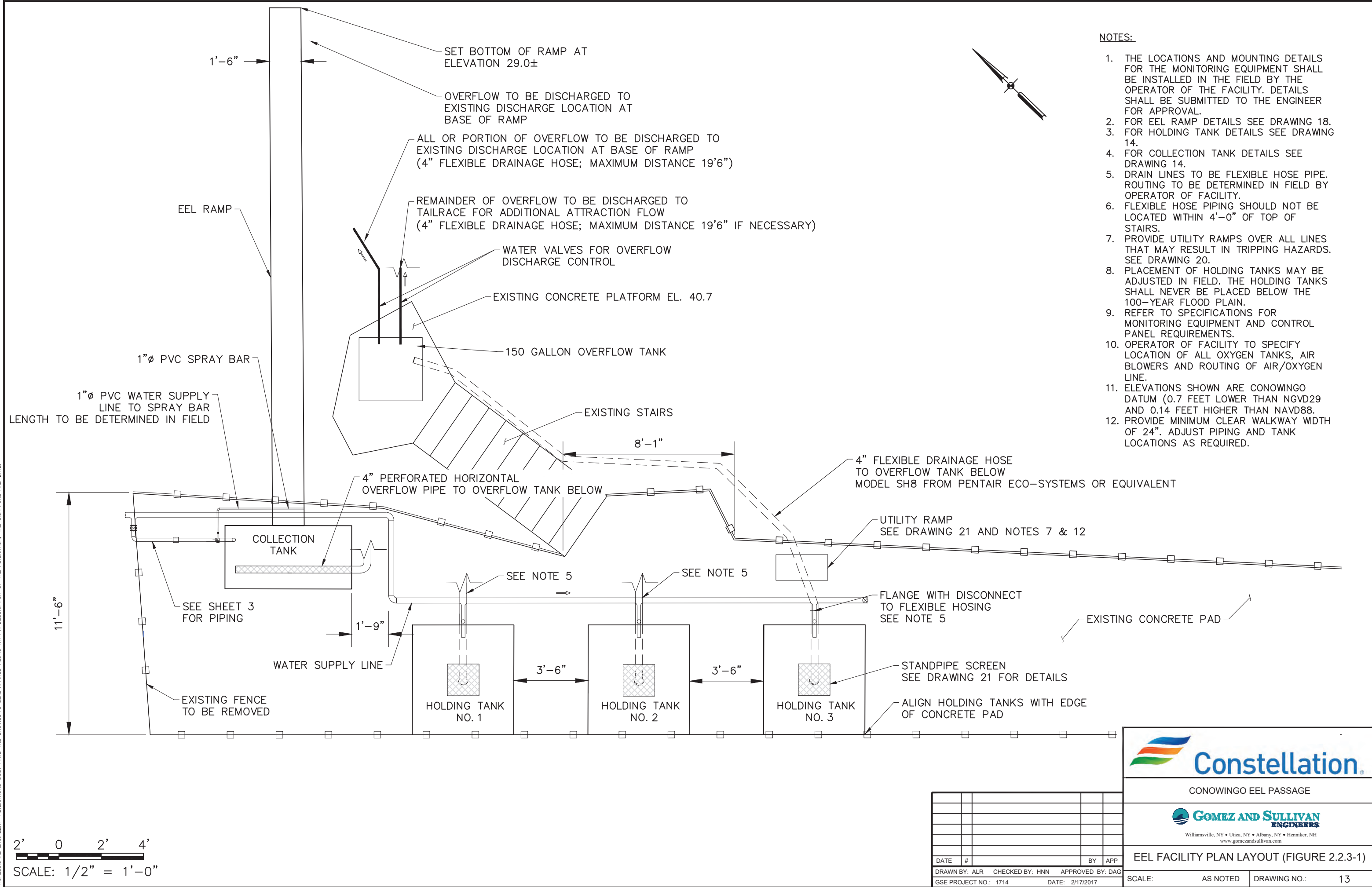


Figure 2.2.2-2: Side-View of the EFL



IT IS A VIOLATION OF THE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANYWAY UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. ALTERATIONS MUST HAVE THE ENGINEER'S SEAL AFFIXED ALONG WITH A DESCRIPTION OF THE ALTERATION, THE SIGNATURE AND DATE.



NOTES:

1. THE LOCATIONS AND MOUNTING DETAILS FOR THE MONITORING EQUIPMENT SHALL BE INSTALLED IN THE FIELD BY THE OPERATOR OF THE FACILITY. DETAILS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
2. FOR EEL RAMP DETAILS SEE DRAWING 18.
3. FOR HOLDING TANK DETAILS SEE DRAWING 14.
4. FOR COLLECTION TANK DETAILS SEE DRAWING 14.
5. DRAIN LINES TO BE FLEXIBLE HOSE PIPE. ROUTING TO BE DETERMINED IN FIELD BY OPERATOR OF FACILITY.
6. FLEXIBLE HOSE PIPING SHOULD NOT BE LOCATED WITHIN 4'-0" OF TOP OF STAIRS.
7. PROVIDE UTILITY RAMPS OVER ALL LINES THAT MAY RESULT IN TRIPPING HAZARDS. SEE DRAWING 20.
8. PLACEMENT OF HOLDING TANKS MAY BE ADJUSTED IN FIELD. THE HOLDING TANKS SHALL NEVER BE PLACED BELOW THE 100-YEAR FLOOD PLAIN.
9. REFER TO SPECIFICATIONS FOR MONITORING EQUIPMENT AND CONTROL PANEL REQUIREMENTS.
10. OPERATOR OF FACILITY TO SPECIFY LOCATION OF ALL OXYGEN TANKS, AIR BLOWERS AND ROUTING OF AIR/OXYGEN LINE.
11. ELEVATIONS SHOWN ARE CONOWINGO DATUM (0.7 FEET LOWER THAN NGVD29 AND 0.14 FEET HIGHER THAN NAVD88).
12. PROVIDE MINIMUM CLEAR WALKWAY WIDTH OF 24". ADJUST PIPING AND TANK LOCATIONS AS REQUIRED.

2' 0 2' 4'
SCALE: 1/2" = 1'-0"

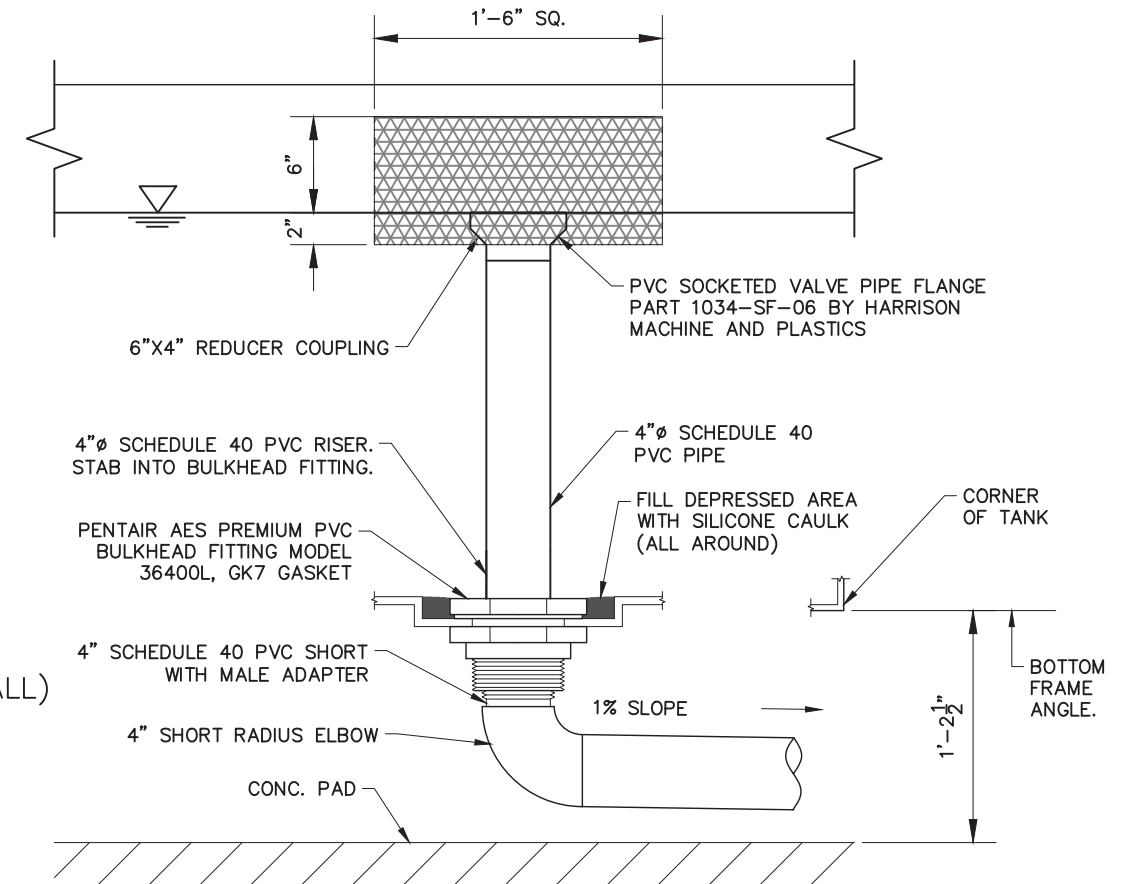
DATE	#		BY	APP	
DRAWN BY: ALR	CHECKED BY: HNN	APPROVED BY: DAG			
GSE PROJECT NO.: 1714		DATE: 2/17/2017			

**Constellation**
CONOWINGO EEL PASSAGE

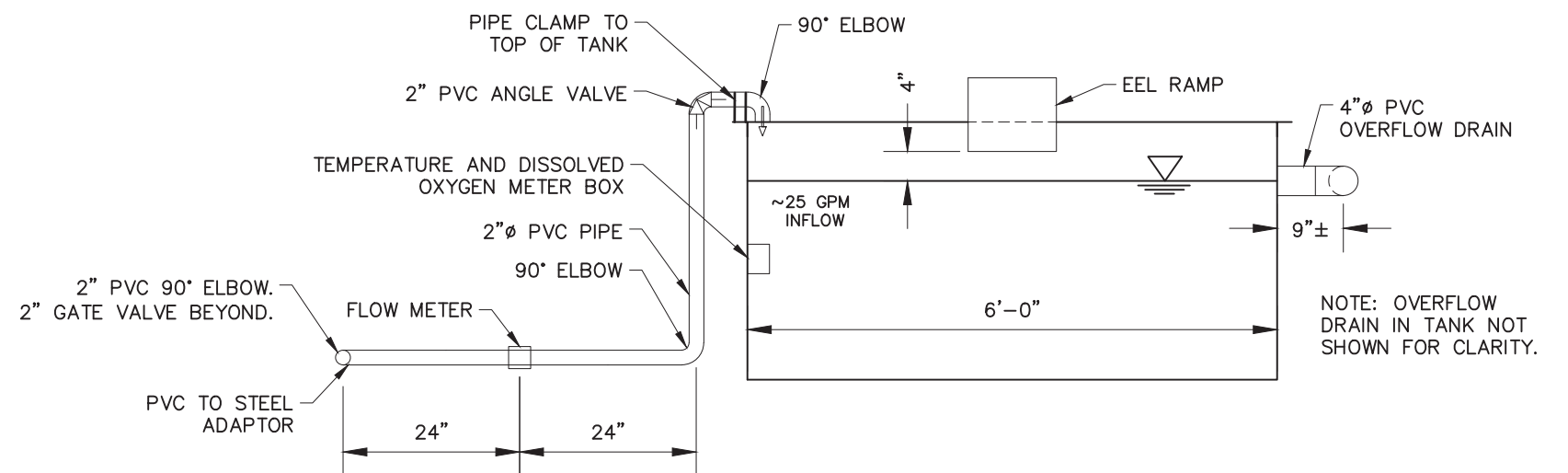
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EEL FACILITY PLAN LAYOUT (FIGURE 2.2.3-1)

SCALE:	AS NOTED	DRAWING NO.:	13



1 SECTION OF HOLDING TANK
14 1" = 1'-0" (APPROXIMATE TANK SIZE 5'6"X5'6"X2'8" TALL)

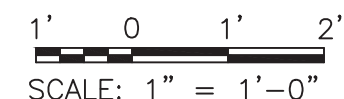


2 SECTION OF COLLECTION TANK
14 1" = 1'-0" (APPROXIMATE TANK SIZE 6'X3'4"X3'1" TALL)



3 SECTION OF OVERFLOW TANK
14 1" = 1'-0" (APPROXIMATE TANK SIZE 39"X58"X24" TALL)

1. REFER TO SPECIFICATIONS FOR MONITORING EQUIPMENT AND CONTROL PANEL REQUIREMENTS.
2. HOLES IN TANK COVERS FOR DISSOLVED OXYGEN AND AERATION LINES TO BE DRILLED IN FIELD.
3. OPERATOR OF FACILITY TO SPECIFY LOCATION OF ALL OXYGEN TANKS, AIR BLOWERS AND ROUTING OF AIR/OXYGEN LINE.
4. ELEVATIONS SHOWN ARE CONOWINGO DATUM (0.7 FEET LOWER THAN NAGVD 29 AND 0.14 FEET HIGHER THAN NAVD88).



DATE	#		BY	APP
DRAWN BY: ALR CHECKED BY: HNN APPROVED BY: DA				
GSE PROJECT NO.: 1714			DATE: 2/17/2017	



3 OPERATIONAL AND ATTRACTION FLOW REQUIREMENTS

3.1 Turbine Start-Up and Operation

The Conowingo Project utilizes a limited active storage reservoir to generate during peak electricity demand periods. The Project is typically operated semi-automatically as the generation setting (in megawatt) is programmed into the control system; however, turbines are brought online manually by an operator to ensure an efficient start-up until the generation setting is reached. At times, the Project is also operated in either full manual or automatic mode, and this type of operation is typically dictated by the prevailing river flow and system load conditions.

During the upstream American Shad migration season (no earlier than March 1 to no later than June 15) (see [Section 4.4](#)), the Project turbine units are preferentially loaded in the following order to provide conditions to optimize fish lift attraction capability during the migratory fish passage season. Generally, the WFL is more effective with Units 1 and 2 off and during periods of minimum flow discharge, having Units 5 and 7 on works well for both the EFL and WFL. [Table 3.1-1](#) below provides an operating order that accommodates both facilities when they are in operation. This schedule may be altered based on unit outages, operational requirements, etc. as necessary.

Table 3.1-1: Turbine Operating Order⁵

Order ON/OFF	Order in which Turbines are turned ON	Order in which Turbines are turned OFF
1 st	5	1
2 nd	7	2
3 rd	3	4
4 th	6	8
5 th	10	9
6 th	11	11
7 th	9	10
8 th	8	6
9 th	4	3
10 th	2	7
11 th	1	5

Article 406 allows for the Conowingo Pond to fluctuate between elevation 101.2 feet and 110.2 feet, except on weekends between Memorial Day and Labor Day when Constellation is required to maintain a minimum Conowingo Pond elevation of 107.2 feet. Conowingo Pond is typically maintained at approximately 109.2 feet and is typically at least above elevation 105.2 feet to facilitate operation of the Peach Bottom Atomic Power Station.

⁵ Columns show the order in which turbine units will be turned on and off. Example, if available flow dictates that four units much be turned on, then units 5,7,3 and 6 will be running. If flow increases and another unit must be turned on, then unit 10 will be started, while units 5,7,3 and 6 remain on.

The Conowingo Project has a maximum turbine discharge capacity of 86,000 cfs. When Project inflows exceed the maximum turbine capacity, all units are operated at maximum wicket gate opening and crest gate operation is used to pass the remainder of the river flow.

Usually, some combination of units are operated over a 24-hour period. The key variables are the number of units operating and the wicket gate settings during lower electrical demand hours versus in the higher electrical demand hours, when the other lower Susquehanna River hydroelectric dams are discharging their maximum flow during the peak electric loading periods. During any low-electrical demand periods, Constellation typically uses some combination of turbine units to provide the minimum flow requirements at the Project. Article 407 establishes the minimum flow regime currently required at Conowingo Dam as shown in [Table 3.1-2](#):

Table 3.1-2: Conowingo Dam Minimum Flow Regime⁶

Date	Minimum Flow
September 15 - March 31	3,500 cfs or natural inflow, whichever is less
April 1 - 30	10,000 cfs or natural inflow, whichever is less
May 1 - June 15	7,500 cfs or natural inflow, whichever is less
June 16 - September 14	5,000 cfs or natural inflow, whichever is less

Natural inflow is measured at the Marietta United States Geological Survey gage (No. 01576000). The downstream discharge must equal these values, or the discharge measured at the Susquehanna River at the Marietta United States Geological Survey gage (No. 01576000), whichever is less.

For unplanned deviations, Constellation must file a report with FERC as soon as possible, but no later than 14 days after the onset of the incident. Each report must describe the incident, including: (1) the cause, (2) the duration and magnitude, (3) any pertinent operational and/or monitoring data, (4) a timeline of the incident and the licensee's response, (5) any environmental effects, (6) documentation that MDE and USFWS were notified and any comments received, or affirmation that no comments were received, and (7) any measures to be implemented to prevent similar incidents in the future. Copies of any such reports will be provided to MDE.

3.2 Near-field and Far-field Attraction Flows

3.2.1 Near-field Attraction Flows

3.2.1.1 West Fish Lift

The WFL will be operated with an attraction flow ranging from approximately 175 to 272 cfs.

⁶ Note, the minimum flow requirements under License Article 407 as well as the monitoring method will be updated in future FOMP updates.

3.2.1.2 East Fish Lift

The EFL will be operated with an attraction flow around 300 cfs.⁷

3.2.2 *Far-field Attraction Flows*

As it relates to far-field attraction flows, Constellation will operate the Project according to the requirements described under [Section 3.1](#) of this document.

⁷ Modifications to the EFL to provide up to 900 cfs attraction flow will not be complete for the 2023 fish passage season.

4 WEST AND EAST FISH LIFT OPERATION

4.1 Staffing

During the 2023 fish passage facility operating season, trained and qualified individuals will be on site to operate the fish lifts. The fish lift operating crews will each include a supervising biologist, lift operator, and biological technicians. Constellation will maintain written documentation that all operational personnel have reviewed and understand this FOMP ([Appendix C](#)).

The supervising biologists and lift operators will be the individuals with primary responsibility to operate all mechanical and electrical equipment associated with the fish lifts. The lift operators will set the equipment as directed by the supervising biologist. The lift operators will adjust equipment settings throughout the course of each day as hydraulic conditions change so attraction flows from, and in, the fish lifts are optimized. Tailrace level, unit discharge, and the service unit determine the entrance gate position.

If volitional passage at the EFL were to be restarted in the future, a biological technician will identify, count, and record fish species as they pass the viewing window or are removed from the fish lift ([Appendix D, Species and Operation Sheet](#)). In addition, the biological technician will assist the supervising biologist with debris removal from screens, the trough, and other water supply areas on an as needed basis throughout the course of each day. The supervising biologists will provide supervision and technical guidance on all aspects of daily operation at the WFL and EFL and are responsible for fine tuning the operation to assure the best possible efficiency. In addition, the supervising biologist is responsible for establishing fishing time and/or lift frequency, and mobilizing transport units and personnel, which is based on fish abundance that can change throughout the day and the season. The supervising biologist will also oversee collection of all data on appropriate datasheets ([Appendix D](#)), ensure their accuracy, produce daily and weekly reports, and distribute reports to all pertinent Constellation and Resource Agency personnel.

4.2 Maintenance

Constellation's goal is to maximize fish passage facility equipment operating availability during any fish passage season. Achievement of this goal requires a comprehensive pre-season and post-season maintenance program designed to minimize in-season operational issues. Major maintenance will be completed following the spring fish passage season. Such maintenance will include correction and repair of items identified during the seasonal operation of the equipment that could affect equipment reliability. The intent is to correct such items so that pre-season activities can focus on equipment preparation, start-up and testing after equipment idle time over the winter months. In-season equipment problems will be addressed as they occur to restore operation expeditiously.

Constellation utilizes an electronic work management platform to manage maintenance tasks including tasks associated with the pre-season and post-season maintenance activities. Several tasks are set up in the work orders for pre- and post-season maintenance. Completion of activities is recorded in the work management system as well as any findings and follow-up required. Work orders are scheduled well in advance of the completion date to allow time for vendors to be on-site. Pre-season and post-season maintenance checklists from this work management platform will be submitted with the FOMP annual report described in [Section 7](#).

4.2.1 *Pre-Season Maintenance*

At least three weeks prior to start-up of each fish passage season, as river and weather conditions allow, the pre-season maintenance measures shown in [Appendix E](#) will be performed.

4.2.2 *Post-Season Maintenance*

Prior to the onset of winter conditions, the post-season maintenance measures shown in [Appendix E](#) will be performed.

4.3 **Operation**

4.3.1 *General*

4.3.1.1 *West Fish Lift*

Upon arrival at the Project, the WFL operating crew will notify pertinent Station personnel of their arrival, conduct a pre-job safety briefing and inform the Station that WFL operations will commence at the specified hour. The crew prepares the site for routine operations while the lift operator contacts the control room operator to adjust the house service units for the proper attraction flow and adjusts the entrance weir gate(s) based on current Project turbine operation and fully lowers the hopper. [Table 4.3.1-1](#) illustrates the current WFL operational matrix used to adjust the entrance weir gates.

The WFL 2023 interim trap and transport operation is scheduled to begin as early as March 1 and end no later than June 15 (see [Section 4.4](#)). If river flows are forecasted to reach 113,000 cfs, Station personnel will need to remove the crowder door and drive motors to prevent any damage to the motors during a high flow event. The motors will be reinstalled as soon as river flows recede to a safe level.

Attraction flow begins being released one hour prior to the start of daily lift operations. The hopper is lowered in position after the attraction flow begins. The WFL hopper door is located on the bottom of the hopper and is closed when the hopper is seated on the bottom of the channel. The hopper is lowered slowly when it touches the water's surface, so any fish that may be in the hopper pit can escape through the unlatched hopper door or swim around the sides of the hopper. The first lift at the WFL each day is a "clean out" lift to clear the crowder channel of any fish that may have accumulated over night in the crowder channel. Fish collected in the "clean out" lift will be identified, enumerated, and sorted. If a target species is identified and considered in good condition, they will be removed from the sorting tank and placed in a holding tank. Invasive species in the "clean out" lift, will be managed per Article 419 *Aquatic Invasive Species Management* ([Appendix A](#)). After completion of the "clean out" lift, the crowder doors are opened to the fishing or "V" position, which allows fish to enter the crowder channel and discourages them from leaving the crowder channel, the time recorded on appropriate datasheets ([Appendix D](#)), and fishing officially begins for the day. The "V" position is defined as the crowder doors being partially opened allowing fish to swim past the ends of the open crowder doors, and into the collection channel of the fish lift. During the daily operation of the WFL, the time will be recorded by the lift operator or supervising biologist whenever the crowder doors are opened or closed, and when the hopper is lifted ([Appendix D, Operator's Daily Log](#)). The hopper contents will be deposited into the sorting tank. Once the hopper is clear of the sorting tank, the crew of technicians start the sorting process, while the lift operator positions the

fishing equipment for another lift cycle. If target species or invasive species are present in the catch, they are placed in holding tanks or totes until a sufficient number are collected for transport or removed for invasive species management ([Appendix A](#)). After the target species are placed in holding tanks and all invasive species are removed and placed in totes, the remaining fish in the sorting tank are released back to the river (tailrace). If sufficient numbers of American Shad or river herring are collected prior to the scheduled end of daily operation, a transport unit will be prepped, loaded, and transported upriver to the designated stocking location.⁸ The WFL will be cycled throughout the day based on the presence of target species, invasive species, or Gizzard Shad in the catch. Each lift will be sorted, with the number of species and fish recorded per lift. A minimum of two lifts per hour will be conducted based on hopper load size and time required to sort the catch. The supervising biologist will track the number of target and invasive species throughout the day (Appendix D, [Species and Operation Sheet](#)). During the last lift of the day, the crowder doors are closed and the crowder moves to the “full crowd” position and the hopper is raised. The crowder returns to the fishing position with the crowder doors remaining closed in an effort to prevent fish from entering the WFL channel overnight. The WFL does not have a screen that prevents fish from accessing the area under the hopper, which is why the crowder doors remain closed. After depositing the fish in the sorting tank, the hopper is lowered down and seated on the bottom of the channel and kept there overnight. When the hopper is on the bottom of the channel overnight, it diminishes the possibility of debris in the hopper pit area. Also, the hopper is ready for the “clean out” lift the next morning.

At the end of daily operations, the crew will secure the WFL while the supervising biologist prepares and sends the daily email report to Constellation and Resource Agency personnel. The report will include information pertaining to the number of American Shad and river herring collected and transported, the number of invasive species collected, as well as the remaining capacity of the refrigerated unit for storage of invasive species specimens (Appendix D, [Daily and Weekly Fish Lift Email Template](#)). Prior to leaving the work site, the supervising biologist will inform the Station that operations have ended for the day and the facility is secure.

4.3.1.2 East Fish Lift

The EFL 2023 interim trap and transport is scheduled to begin as early as March 1 and end no later than June 15 (see [Section 4.4](#)). If river flows are forecasted to reach 113,000 cfs, the EFL may be temporarily shut down.

Upon arrival at the Project, the EFL operating crew notifies pertinent station personnel of their arrival, conducts a pre-job safety briefing, and informs the station that EFL operations will commence at the specified hour. The supervising biologist and technicians ready the computer for each individual lift, fish sorting, and data input and open the valve to the sorting tank while the lift operator adjusts the entrance, crowder area, diffuser gate, and attraction flow gates to their proper positions based on the current water levels and Project turbine operation. [Tables 4.3.1-2](#) and [4.3.1-3](#) illustrate the EFL operational matrix used when the EFL is in operation. During trap and transport operations, attraction flow begins being released one hour prior to the start of daily lift operations. During the previous day’s operations, a crowder hoist screen was lowered and stayed down to prevent fish from entering the hopper pit area overnight. The next

⁸ Fish may be held a maximum of two days prior to a transport during the early phase of the migration season when water temperatures are cooler. See [Section 4.3.4](#).

morning the hopper is lowered in position after the attraction flow begins. The crowder doors are opened to the fishing or “V” position, the time recorded, and fishing officially begins for the day. Prior to a lift, the crowder doors are closed, the crowder hoist screen is raised, and crowder travels forward. When the crowder is in the full crowded position, the crowder screen is lowered, and the hopper is raised. When the hopper is rising the crowder returns to the fishing position and crowder doors are opened to the fishing or “V” position. After fish and water have been deposited. The sequence is continued until the last lift of the day, when the crowder is returned to the fishing position, the doors remain closed, and the hopper remains out of the water near the operator booth level. Invasive species will be managed per Article 419 *Aquatic Invasive Species Management* ([Appendix A](#)).

During daily trap and transport operations at the EFL, the time will be recorded by the lift operator or supervising biologist whenever the crowder doors are opened or closed, and when the hopper is lifted (Appendix D, [Operator’s Daily Log](#)). The hopper contents will be deposited into the sorting tank during trap and transport operations. Once the hopper is clear of the sorting tank, the crew of technicians start the sorting process, while the lift operator positions the fishing equipment for another lift cycle. If target species or invasive species are present in the catch, they are placed in holding tanks ([Figure 2.2.2-3](#)) until a sufficient number are collected for transport or removed and placed in totes for invasive species management ([Appendix A](#)). Remaining fish are returned to the Susquehanna River.

Target species fish will be transferred in a transfer tank from holding tanks at the EFL area. Target species will be transferred to the transfer tank from the holding tanks via netting, as was done during previous trap and transport operations. Temporary stairs are on the concrete platform for the purpose of transferring the fish via the nets from the holding tanks into the transfer tank. If sufficient numbers of American Shad or river herring are collected prior to the scheduled end of daily operation, a transport unit will be prepped, loaded, and transported upriver to the designated stocking location (refer to [Section 4.3.5.1](#) Monitoring). Fish will be transported from the EFL holding tank area to the WFL area using a transfer tank that will be hauled through the powerhouse (“turbine hall”) by a forklift⁹.

The EFL will be cycled throughout the day based on the presence of target species, invasive species, or Gizzard Shad in the catch. A minimum of two lifts per hour will be conducted depending upon hopper load size and time required to sort through the catch to collect target species and cull out any invasive species. Although larger hoppers will be installed with the ability to cycle within a 15-minute time frame, as part of the EFL modifications, the number of lifts conducted each hour or throughout the day will still be dependent upon hopper load size and the time required to thoroughly sort through the catch. Each lift will be sorted, with the number of species and fish recorded per lift. The supervising biologist will track the number of target and invasive species throughout the day (Appendix D, [Species and Operation Sheet](#)). During the last lift of the day, the crowder doors are closed, the crowder screen is raised, and the crowder moves to the “full crowd” position, the crowder screen is lowered to prevent fish from escaping the hopper area, and the hopper is raised. The crowder returns to the fishing position with crowder doors closed and remains this way overnight.

⁹ Constellation is currently in the design phase for a railcar system to be deployed on the catwalk. Once design and construction are complete, this method for fish transport from the EFL holding tank area to the WFL area will be utilized in future years.

At the end of the day's operations, the supervising biologist prepares and sends the daily email report to Constellation and Resource Agency personnel (Appendix D, [Daily and Weekly Fish Lift Email Template](#)). The email report will include information pertaining to the number of American Shad and river herring collected and transported, the number of invasive species collected, as well as the remaining capacity of the refrigerated unit for storage of invasive species specimens.

Prior to leaving the work site, the supervising biologist will inform the Station that operations have ended for the day and the facility is secure.

4.3.2 Debris Management

4.3.2.1 West Fish Lift

Attraction water for the WFL is provided by the Project's house service units, and very little debris is encountered during WFL operations. Occasional cleaning of the picketed barrier (located in the crowder channel downstream of the hopper pit) occurs on an as needed basis to prevent disruption to the attraction water and maintain the velocity in the crowder channel. Debris is manually removed from the picketed barrier and lifted via 5-gal bucket(s) and disposed of in a dumpster on site.

4.3.2.2 East Fish Lift

Floating debris that enters/accumulates in the river level section of the EFL (generally upstream of the crowder), is sluiced through the crowder gates and exits the facility via Entrance Gate C. Sluicing debris from the EFL is conducted on an as-needed basis.

4.3.3 Fish Counts

4.3.3.1 West Fish Lift

The supervising biologist is responsible for recording the fish counts of each hopper load deposited in the sorting tank (unless fish numbers are low in a hopper, Gizzard Shad are estimated, and all other species counted) (Appendix D, [Species and Operation Sheet](#)). Per Article 412, during operation of the fish lift, the operating crew will visually quantify the fullness of each lift, for each hopper, and record it on the [Operator's Daily Log](#) (Appendix D). Hopper fullness will be quantified as 10, 25, 50, 75, or 100 percent full based on the following estimates of Gizzard Shad within each hopper:

- 10% full (1-100 Gizzard Shad)
- 25% full (101-250 Gizzard Shad)
- 50% full (251-500 Gizzard Shad)
- 75% full (501-750 Gizzard Shad)
- 100% full (751-1,000 Gizzard Shad)
- Over 100% full
 - Slight overcrowding: 1,001 – 1,200 Gizzard Shad
 - Moderate overcrowding: 1,201 - 1,499 Gizzard Shad

- Extreme overcrowding: more than 1,500 Gizzard Shad.¹⁰

The MDE Settlement Agreement, Section C.8, Commitments Related to Non-Licensing Issues, Hopper Fullness Measurements, also states, “If technology becomes available to do so, Constellation has agreed to implement technology to monitor the fullness of each fish lift hopper, subject to certain cost limitations.” The process for visual observations and indexing will be determined in consultation with MDE.¹¹ Records will be maintained and shared with FERC, MDE, and USFWS, when requested.

As the biological technicians sort through the contents of each lift at the WFL, the supervisor tracks the number of target species (American Shad, river herring) on the [Fish Lift Daily Count Worksheet](#) (Appendix D), placed in holding tanks or transport units or set aside for biological information collection, records any resident or invasive fish species identified by the technicians¹², estimates the number of Gizzard Shad, and estimates hopper fullness. Gizzard Shad are estimated since they are quite common and generally comprise more than 90% of the lift’s catch. Estimating Gizzard Shad also streamlines the sorting process as it would take too much time to individually count every Gizzard Shad. Other species such as White Perch (*Morone americana*) may be estimated if large numbers are collected in a lift. Once the supervisor has recorded all necessary information on datasheets ([Appendix D](#)) (see [Section 4.6](#) for biological parameters that will be collected) and the crew has sorted all target and invasive species, the remaining catch is sluiced back to the Susquehanna River downstream of Conowingo Dam. The requirements for management of invasive species are detailed in [Appendix A](#).

4.3.3.2 East Fish Lift

The supervising biologist is responsible for recording the fish counts of each hopper load deposited in the sorting tank (unless fish numbers are low in a hopper, Gizzard Shad are estimated, and all other species counted) (Appendix D, [Species and Operation Sheet](#)). Per Article 412, during operation of the fish lift, the operating crew will visually quantify the fullness of each lift, for each hopper and record on the [Operator’s Daily Log](#) (Appendix D). Hopper fullness will be quantified as 10, 25, 50, 75, or 100 percent full based on the following estimates of Gizzard Shad within each hopper:

- 10% full (1-361 Gizzard Shad)
- 25% full (361-900 Gizzard Shad)
- 50% full (901-1,800 Gizzard Shad)
- 75% full (1,801-2,700 Gizzard Shad)
- 100% full (2,701-3,600 Gizzard Shad)
- Over 100% full

¹⁰ The measure of “hopper fullness” is not an assessment of safe operating capacity of the WFL. The USFWS Fish Passage Engineering Design Criteria (2017) define safe passage as “the movement of fish through the zone of passage that does not result in unacceptable stress, incremental injury, or death of the fish (e.g., by turbine entrainment, impingement, and increased predation). The USFWS estimates that a maximum safe operating capacity would equate to 1,200 pounds of fish, translating into about 1,000 gizzard shad (personal communication, S. Eyler, USFWS, June 25, 2021, included in [Appendix H](#)).

¹¹ Consultation with MDE began April 15, 2021.

¹² FERC License Article 418 *Sturgeon Reporting* requires Constellation to report the number of Atlantic and Shortnose Sturgeon observed during the preceding calendar year. Sturgeon observed in the fish lifts or incidentally throughout the year will also be reported as part of the FOMP annual report.

- Slight overcrowding: 3,601 – 4,400 Gizzard Shad
- Moderate overcrowding: 4,401 – 5,199 Gizzard Shad
- Extreme overcrowding: more than 5,200 Gizzard Shad.

The MDE Settlement Agreement, Section C.8, Commitments Related to Non-Licensing Issues, Hopper Fullness Measurements, also states, “If technology becomes available to do so, Constellation has agreed to implement technology to monitor the fullness of each fish lift hopper, subject to certain cost limitations.” The process for visual observations and indexing will be determined in consultation with MDE.¹³ Records will be maintained and shared with FERC, MDE, and USFWS, when requested.

As the biological technicians sort through the contents of each lift at the EFL, the supervisor tracks the number of target species (American Shad, river herring) (Appendix D, [Fish Lift Daily Count Worksheet](#)), placed in holding tanks or transport units or set aside for biological information collection, records any resident or invasive fish species identified by the technicians, and estimates the number of Gizzard Shad, and estimates hopper fullness (per description in [Section 4.3.3.1](#)). Once the supervisor has recorded all necessary information on datasheets ([Appendix D](#)) (see [Section 4.6](#) for biological parameters that will be collected) and the crew has sorted all target and invasive species, the remaining catch is sluiced back to the Susquehanna River downstream of Conowingo Dam. The requirements for management of invasive species are detailed in [Appendix A](#).

4.3.4 Holding

For the purpose of this plan, “holding” refers to the retention of target species overnight in holding tanks at the fish lift facilities, prior to transport. The WFL holding facility contains three tanks (two 750-gallon tanks and one 1,000-gallon tank) and the EFL contains two tanks (EFL holding tanks are 1,000-gallon capacity). The number of tanks operating at any time will be determined by the number of target species being held at the facility. A total of 60 American Shad or 200 river herring are held in the 750-gallon holding tanks and 125 American Shad or up to 800 river herring can be held in the 1,000-gallon tanks. As water temperature approaches 21° Celsius (C) or 70° Fahrenheit (F) and above, fish numbers in the 750-gallon tanks are reduced to 50 American Shad and 150 river herring with fish numbers reduced to 100 American Shad and 600 river herring in the 1,000-gallon tank.

4.3.4.1 Monitoring

Proper operation of the WFL and EFL holding facilities will be ensured through manual monitoring of flow and water quality parameters at least three times each day between lifts and sorting activities during fish lift operations.

Water Exchange: The amount of water flowing into each operational holding tank will be checked at the start of the day and after a tank has been emptied of fish and refilled. If measured flows are not within the design parameters for flow velocity (less than or equal to 1 foot per second (fps) per tank in service), the flow will be adjusted accordingly. The water exchange rate (gallons per minute; gpm) is determined in the

¹³ Consultation with MDE began April 15, 2021.

field after properly setting the circulating flow velocity and cannot be measured until operations commence in spring 2023.

Temperature: Water temperature in each operational holding tank will be monitored throughout the day as time allows between sorting and transport activities (minimum of 3 times per day).

Dissolved Oxygen: Concentration of dissolved oxygen in each operational holding tank will be monitored throughout the day as time allows between sorting and transport activities (minimum of 3 times per day). If measured concentrations are not above 5 parts per million (ppm), the oxygen delivery system will be adjusted accordingly.

Results of any inspection items that require further action will be recorded on the [Anadromous Fish Holding or Transport Information Sheet](#) (Appendix D). If the flow through the holding tanks, water temperature, or dissolved oxygen is suspected of operating outside of design parameters, immediate action will be taken to correct the issue.

4.3.4.2 Maintenance

After each holding event, the holding tank(s) that were used will be scrubbed and rinsed with river water. Target species will be removed from the holding tanks prior to scrubbing, and cleaning will be coordinated with transport so that the tanks are cleaned after fish are removed for transport.

The holding tanks will be drained and cleaned after operations at the fish lifts have ceased and all target species have been transported.

4.3.5 Transport

For the purpose of this plan, “transport” refers to movement of target species from the sorting or holding tanks to transport tanks and transport to the upstream stocking location(s).

The transport truck will be a rental truck with the driver possessing a Commercial Driver’s License (CDL) license with tanker endorsement. A transport skid with a 1,300-gallon tank will be secured to the rental truck with chains and binders. The transport skid contains a pump to circulate the water in the tank. The tank contains an oxygen diffuser and an oxygen manifold connected to an oxygen bottle by a regulator. A monitor on the control panel attached to a water quality probe that displays water temperature and dissolved oxygen concentration continuously is installed in the tank. The water temperature and dissolved oxygen value is recorded every fifteen minutes during the transport trip. A generator powers the control panel and a light on the control panel informs the technician that the pump is running. No alarms are installed as the technician can clearly see the dissolved oxygen values and pump operation. An alarm for water temperature serves no purpose as water temperature cannot be controlled. The transport tanks are insulated to prevent extreme increases in temperature during transport trips.

4.3.5.1 Monitoring

Transport events will occur when the capacity of the holding tanks is approached. Fish will be transported at all water temperatures experienced during the migratory fish season. Standard operating protocol will be to conduct transport trips when 200 American Shad or 1,000 river herring have been collected. The

minimum number of fish to be transported per trip is 50 American Shad and/or 150 river herring. Fish may be held a maximum of two days prior to transport during the early phase of the migration season when water temperatures are cooler. Later in the season, as river temperature approaches 21° C (70° F) the number of fish transported will begin to be reduced to a range of 150-175 American Shad. If available, river herring numbers will be reduced accordingly. Each transport skid tank will be equipped with supplemental oxygen. The tank lid will be secured prior to transport. Monitoring data are recorded on the [Anadromous Fish Holding or Transport Information](#) form ([Appendix D](#)).

Temperature: Water temperature in the transport skid tank(s) will be monitored.

Dissolved Oxygen: Concentration of dissolved oxygen in the transport tank(s) will be monitored. If measured concentrations fall below 5 ppm, the transport crew will pull over at a safe location to quickly resolve the issue (adjust regulator and manifold pressure, hook up spare oxygen bottle, etc.).

4.3.5.2 Verification and Testing

Temperature and dissolved oxygen meters in the transport skid tanks will be tested once each week using an independent meter(s) to verify accuracy. The independent meter(s) will be calibrated according to manufacturer instructions and recommendations. If any continuous monitor provides measurements different than verification measurements, then it will be re-calibrated, repaired, or replaced.

4.3.5.3 Inspection

Prior to each trip, the transport truck and associated equipment will be inspected. The initial inspection will be done before any target species are transferred to a transport tank. The tank will then be filled approximately three-quarters full, immediately prior to inspection and subsequent transfer of target species to the transport tank. The tank and all drains will be secured and examined for leaks. Water quality parameters will be checked prior to target species being added to the tank. The supplemental oxygen system will be checked to verify that it is functioning properly. A final inspection will be conducted after the target species are transferred to the transport tank. Then the transport tank will be filled completely to prevent sloshing when driving. The tank and all drains will again be examined for leaks and water quality parameters will be recorded.

Water quality data will be recorded on the [Anadromous Fish Holding or Transport Information Sheet](#) ([Appendix D](#)) during each transport trip. The transport system must pass initial inspection before any target species are transferred to the transport tank and final inspection before transport begins. If the transport system does not pass inspection, it may not be used for transport until all issues are resolved and it passes a subsequent inspection.

4.3.5.4 Maintenance

Upon return to the facility, the transport skid tank will be opened to the air until the next transport. Before the next transport, the transport skid tank will be checked to ensure it is clean and ready to be used for transporting target species upriver.

4.4 Fishing Time and Hours of Operation

The fish lifts will begin operation when river temperature reaches 48° F¹⁴ for three consecutive days and no earlier than March 1¹⁵ and continue until river temperatures rise above 72° F for four consecutive days but ending no earlier than June 1 and no later than June 15.

The fish lifts will operate at the following times:

- 1) in March, from 7 a.m. to 7 p.m.
- 2) in April, from 6:30 a.m. to 7:30 p.m.; and
- 3) in May and June from 6:00 a.m. to 8:00 p.m.

Attraction flows will be released at least one hour prior to the start of daily lift operations.

4.5 Outage Prevention and Emergency Protocols

Daily management of fish lift operations by Constellation ensures that the lifts are operated efficiently to minimize downtime and maximize the catch. Any significant problems encountered will be reported, either in daily reports and/or in the annual report issued to the Resource Agencies. Should a problem and/or failure result in an unscheduled outage of the WFL or EFL during the fish migration season, Constellation shall notify Resource Agencies of the outage electronically. Notification will occur the day the outage occurred; however, depending upon the nature of the outage Constellation may require time to evaluate the outage and develop a repair plan. Constellation's evaluation and repair plan shall be coordinated with the Resource Agencies as soon as practical.

Fish lift operations may also be affected by high river flow conditions. When river flows are expected to exceed 113,000 cfs, Constellation will take steps to secure WFL equipment to prevent potential damage. This may include removing the WFL motors, which typically takes one day to complete. Once high flows have receded, another day is required to reinstall the WFL motors. The EFL may be shut down. Upon the cessation of high river flows, Constellation will notify the Resource Agencies as soon as feasible of any damage to either the WFL or EFL that would prevent return to operation and will take steps as necessary in consultation with the Resource Agencies to correct any damage due to high flows and restore equipment to operation.

4.5.1 Contacts

For emergency purposes, a contact list with multiple emergency contacts will be developed for the Conowingo Control Room. These individuals would be responsible for responding to and/or resolving

¹⁴ Water temperatures shall be monitored once daily at 11 a.m. at Monitoring Station 643 (Shures Landing) or some other location agreed upon by Constellation and USFWS. Monitoring will begin by March 1. Prior to the commencement of the fish passage season, Constellation will send daily emails to resource agencies providing the temperature reading for that day.

¹⁵ Because of factors outside of the Constellation's control, safety considerations may preclude Constellation's personnel from performing duties necessary to commence fish passage measures at Conowingo by the commencement date. When such conditions arise, Constellation shall notify the USFWS and the USFWS and Constellation shall consult regarding the anticipated schedule for commencing such measures.

emergency situations at the facilities if Station personnel cannot resolve the problem. The contact list will be updated prior to each migratory fish lift season, or if personnel changes occur during the migratory season.

During fish transport, there is not an alarm system because water temperature and dissolved oxygen are monitored and recorded every fifteen minutes. If a problem arises with dissolved oxygen or the water circulation system, the crew will pull off the road at the closest safe location, determine why the problem is occurring and resolve it. If a solution cannot be quickly accomplished, the crew will stock the fish at the closest safe location to the Susquehanna River.

If a holding event is required overnight, a holding sheet is filled out with the starting water temperature, dissolved oxygen, and the number of fish in the holding tank(s) ([Anadromous Fish Holding or Transport Information Sheet](#), [Appendix D](#)). The oxygen supply bottle is checked to ensure that enough oxygen is available to last the entire holding event (overnight). The bottle will be replaced if there is not enough oxygen to last overnight. The water circulation system is checked prior to the end of fish lift operations. The gravity feed water supply system helps ensure a constant supply of water is provided to the holding tanks when the crew is not on site. The following morning, the crew will check and record the water temperature and dissolved oxygen, drain the water down to a safe level to check for any fish mortalities, and record mortalities on the [Anadromous Fish Holding or Transport Information Sheet](#) ([Appendix D](#)). If there were enough fish held overnight to warrant a transport trip, a truck driver and technician will be scheduled to transport the fish upriver.

4.6 Monitoring

Constellation will monitor flows, water quality, project operations, fishway operations, and fish passage at the lifts and record information on datasheets included in [Appendix D](#). Data are recorded per lift during trap and transport operations. The data are entered into a laptop computer throughout the day, as time allows. At day's end, a computer program summarizes the data and produces the daily report. These data, along with the required station operation data will be entered into a database during the fish passage season, no later than one week after collection.¹⁶ The USFWS will have open access to that database. Other Resource Agencies will be given access, if specifically requested. Due to the short timeline for providing this information weekly, the database will be considered provisional until the final report is drafted, reviewed, and submitted. Recorded passage and operational data will include the following.

- Average daily flows at the Marietta gaging station.
- Daily water temperature and dissolved oxygen collection and reporting of readings¹⁷ at the WFL for each day (including non-operational days) of the fish passage season¹⁸. Water temperatures and

¹⁶ At the EFL after completion of the planned upgrades, this data will include thirty-minute recordings of: total flow discharging from behind the hopper; total flow discharging from the attraction water supply diffusers; water surface elevation immediately upstream from the entrance gates; and water surface elevation at the tailwater, elevation to the crest of the entrance weir gates.

¹⁷ Dissolved oxygen readings will be provided starting when the Project's National Pollutant Discharge Elimination System permit requires annual data collection through the end of the upstream migration period.

¹⁸ Daily water temperature will be collected at 1100 hours during the fish passage season outside of the WFL in the tailrace. A continuous water temperature and dissolved oxygen logger will be installed in the WFL near the

dissolved oxygen collected at Station 643 after May 1 will be included in the annual report in addition to the water temperatures and dissolved oxygen collected daily at the WFL during the fish passage season.

- Hourly individual turbine unit operations (on/off) and discharge.
- Hourly total discharge from the powerhouse, and through the spillway gates.
- Hourly¹⁹ counts of all captured species at the lift (this is by lift, not the hour during trap and transport)
- Number of fish by species trapped and transported, including date, time, and location of release.
- Weekly collection of a subsample of biological information from passing adult American Shad and river herring consisting of sex ratio, spawning condition, length, weight, and age.
- Biological information will be collected from every 50th American Shad captured at each fish lift for otolith analysis.
- Any American Shad mortalities resulting from lifting, sorting, handling, or transporting at either fish lift will be retained for analysis.
- Lengths (total and fork), weights, sex and scale samples will be taken and recorded for each American Shad collected as a sacrifice or retained as a mortality. Each fish will be individually bagged, labeled, and frozen on-site for later delivery to the PFBC.
- River herring will also be sacrificed for biological information. Every 20th river herring of each species (Alewife and Blueback Herring) will be sacrificed with a maximum collection of 50 individuals per species from the Project. River herring will be processed similar to American Shad. Additionally, any river herring mortalities resulting from lifting, sorting, handling, or transporting will be retained for analysis.
- Any Maryland Department of Natural Resources (MDNR)-tagged American Shad from 2023 tailrace tagging efforts that are collected in the WFL and EFL will be transported upstream after tag data is recorded.
- Any MDNR-tagged American Shad from previous year tailrace tagging efforts that are collected in the WFL and EFL will be sacrificed for PFBC and MDNR analysis.

picketed barrier. The logger will record water temperature and dissolved oxygen every thirty minutes to be compared with Station 643 at the end of the fish passage season.

¹⁹ During trap and transport operations, the counts will be recorded per each lift, not by the hour.

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Table 4.3.1-1: WFL Operational Matrix

Station Operation	Service Unit Gate Setting		Flows (cfs)	Weir Depth below Tailrace (ft.)	Attraction Velocity (ft./sec)	Holding Channel (ft./sec)
	No. 1	No. 2				
More than 4 Small Units	35%*	75%	265	6.9	6	1
1 to 4 Small Units	35%*	35%	150	5.1	6	1
No Generation **	35%	0%	75	3.1	6	1

* Considered House Load

** Condition no longer exists during fish passage season

Table 4.3.1-2: Recommended EFL Settings when Entrance Gate A is in Operation

Turbine Units in Operation		Upstream "A" Gate Setting (%)	Diffuser A (%)	Diffuser B (%)	Crowder Area Gate (%)	Spillway Gate (%)
Small	Large					
1	0	95-Bottom	5-10	0	15-20	14
2	0	85-95	5-10	0	15-25	14
3	0	78-85	5-15	0	20-30	14
4	0	74-82	10-20	0	20-40	14
5	0	69-75	10-20	0	25-35	14
6	0	65-70	10-20	0	30-40	14
4	1	68-75	10-20	0	40	14

*Upstream "A" Gate should only be used in the large units are off, unless they are shutting down soon.

*When using Upstream "A" Gate, Diffuser "B" MUST be closed.

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Table 4.3.1-3: Recommended EFL Settings when Entrance Gate C is in Operation

Turbine Units in Operation		Downstream “C” Gate Setting (%)	Diffuser A (%)	Diffuser B (%)	Crowder Area Gate (%)	Spillway Gate (%)
Small	Large					
3	1	75-80	0	40	40	14
4	0	72-78	0	40	25	14
4	1	65-74	0	20-55	25-40	14
4	2	50-55	0	40-75	25-40	14
4	3	45-50	0	35-80	30-45	14
4	4	40-50	0	40-70	25-50	14
6	1	55-60	0	30	25	14
6	2	52-57	0	45	40	14
6	3	45-50	0	50	35	14
6	4	42-47	0	50	25	14
7	3	37-47	0	50	30	14
7	4	30-40	0	50	50	14

*When using Downstream “C” Gate, Diffuser “A” should be closed, unless for additional attraction.

*When using Downstream “C” Gate, try to minimize the spill out of Downstream “B” Gate and keep flow under Upstream/Downstream Gate.

5 CONOWINGO WEST EEL COLLECTION FACILITY OPERATION

5.1 Staffing

During the eel passage facility operating season, trained and qualified individuals will operate the CWFECF located on the west bank of the Susquehanna River.^{20, 21} A supervising biologist will oversee operations and will be assisted by several biologists and/or biological technicians. Supervising biologists have a relevant bachelor's degree and/or a minimum of five-years' experience working at the Conowingo fish lift facilities. New technicians are first scheduled to work with experienced supervising biologist. The supervising biologist trains all biologists and biological technicians, and the FOMP requirements are included in this training. Biological technicians are always supervised.

Truck drivers have, at a minimum, Department of Transportation (DOT) driver's licenses.

Constellation also requires contractors to complete vendor safety training. Daily checks will be conducted by a crew of two trained personnel. Constellation will maintain written documentation that all operational personnel have reviewed and understand this FOMP ([Appendix C](#)).

5.2 Maintenance

5.2.1 Pre-Season Maintenance

Approximately two weeks prior to May 1, all eel passage facility components, including the eel ramp, collection, overflow, and holding tanks, as well as the associated water lines will be installed and tested ([Appendix E](#)). If any component is not in working order, appropriate action will be taken to resolve the problem.

5.2.2 Post-Season Maintenance

At the end of the eel passage season, all eel facility components will be dismantled, cleaned or stored appropriately ([Appendix E](#)). The collection, overflow, and holding tanks, as well as the water lines will be stored appropriately for the winter period.

5.3 Operation

Upon arrival at the Project, the eel passage facility operating crew notifies pertinent Station personnel of their arrival, conducts a pre-job safety briefing, informs the Station that eel passage operations will commence, and asks for a dissolved oxygen tailrace reading and if any issues have been recorded since completion of the last eel passage facility check.

²⁰ Operation of the CWFECF is also governed by the Muddy Run Pumped Storage Station Project FERC License Articles 414-417.

²¹ A temporary eel collection facility will be installed on the east side of the Susquehanna River within twelve months after the EFL modification are complete. No eel facility will be operated on the east side near Conowingo dam in 2023. Details of the east side facility will be included in updated versions of the FOMP.

The goal of the facility is to achieve maximum collections of eels while maintaining a minimum combined annual survival rate of 95% for juvenile eel during the trapping, collection, and holding processes. Additionally, the goal of the transport process is to achieve a minimum annual survival rate of 95%. Flow rates ([Table 5.3-1](#)) for the trapping, collecting, and holding processes will be the primary metric used to evaluate whether the facility is operating within design parameters. If flows are within the design parameters, then the facility would be operating properly. Additionally, continuous measurements of water temperature and dissolved oxygen as well as visual inspections during daily operation will determine that the facility is operating normally and that conditions are suitable for collecting and holding juvenile eels ([Table 5.3-2](#)). The continuous monitors are equipped with alarms that alert personnel when any of the measured parameters are not within design parameters. The proper operation of the continuous monitors and associated alarms will be verified regularly. Operation of the transport system will include continuous monitoring of water quality as shown in [Table 5.3-2](#). When daily eel sampling is complete, the eel passage facility operating crew notifies pertinent Station personnel of any major changes to the facility and that the crew is leaving the site.

5.3.1 Trapping and Collection

For the purposes of this plan, “trapping” includes the operation of a ramp-style trap and “collection” refers to operation of the collection tank where juvenile eels are temporarily held after ascending the ramp. The CWECF is a flow-through system, and no recirculation of any water is used except for attraction flow at the entrance of the ramp.

5.3.1.1 Monitoring

Proper operation of the components will be ensured either through the continuous monitoring of water flow supplied to the ramp and collection tank with an alarm system triggered by low flows or low dissolved oxygen conditions that are not within design parameters. The water flow and water quality parameters measured by the monitoring probes will be logged in the facility control panels where data are stored and available for download.

Water Exchange: The amount of water flowing into the collection tank will be monitored continuously. If measured flow is not within the design parameters flow (5 gpm to 25 gpm (19 to 95 lpm)), a sensor will trigger an alarm that will alert the Conowingo Control Room. Also, in the event of an alarm, a notification will be sent immediately to operational personnel.

Temperature: Water temperature in the collection tank will be monitored continuously.

Dissolved Oxygen: Concentration of dissolved oxygen in each operational holding tank will be monitored continuously. If measured concentrations are not above 5 ppm, a sensor will trigger an alarm that will alert the Conowingo Control Room. Also, in the event of an alarm, notification will be sent immediately to operational personnel.

During any instance when alarms indicate or daily inspections suggest that attraction or ramp flow is not within design parameters and cannot be adjusted to operate within these parameters within 24 hours, it will be considered an emergency, and operators must follow the Emergency Response Protocols outlined in [Section 5.6](#).

5.3.1.2 Verification and Testing

The main flow and spray bar flow will be independently measured once per week to verify that the flow meters are providing accurate measurements. If a flow meter provides measurements that differ from the design parameters, the main flow meter will be re-calibrated or replaced.

Similarly, the temperature and dissolved oxygen meter will be tested once each week using an independent meter(s) to verify that they are accurate. The independent meter(s) will be calibrated according to manufacturer instructions and recommendations. If any continuous monitor provides measurements different than verification measurements, or outside the designed parameters, then it will be re-calibrated, repaired, or replaced.

The alarm systems monitoring flow rates will be tested once per week. Monitors will be tested against deliberate deviations from the design range to ensure that these deviations trigger the alarms. The Conowingo Control Room will be contacted prior to any testing of the alarms.

5.3.1.3 Inspection

The ramp, cover, substrate, attraction flow, spray bar, and ramp flow will be visually inspected daily to ensure proper operation. If any component is not functioning properly, corrections and/or repairs will be made as soon as practicable. Results of any inspection items that require further action will be recorded on the [Conowingo West Eel Collection Facility Daily Field Sheet \(Appendix D\)](#).

If an inspection suggests that any structure or flow component is not performing properly and no alarm has been triggered, verification of this potential deviation will be performed as described above and corrective action will be taken as soon as possible. Upon a failed inspection, inspectors will refer to Failed Inspection protocols outlined in [Section 5.6](#).

5.3.1.4 Maintenance

The collection tank will also be drained daily to ensure all eels have been removed. Every day, after all eels have been removed, then the collection tank will be scrubbed.

Debris observed on the ramp and substrate during visual inspections will be removed at the time of the inspection. If the debris cannot be removed upon inspection for any reason, it will be removed as soon as practicable thereafter.

At the end of each sampling season, and if determined to be necessary during the season, the ramp will be cleaned. During this cleaning process the substrate will be inspected for any degradation or damage. Sections of the substrate will be replaced as necessary.

5.3.2 Holding

For the purpose of this plan, “holding” refers to the retention of eels in holding tanks at the eel-passage facility, prior to transport. The holding facility currently contains three tanks. The number of tanks operating at any time will be determined by the number of eels being held at the facility.

5.3.2.1 Monitoring

Proper operation of the holding facility will be ensured through the continuous monitoring of flow and water quality parameters by several probes and logged in the facility control panels where data are stored and available for download, weekly verification of monitors, and daily inspections. Monitoring will be recorded on the [Anadromous Fish Holding or Transport Information](#) data form ([Appendix D](#)). Monitoring devices will be equipped with alarms that sound in a daily staffed location if levels of any parameter are outside of established limits. Also, in the event of an alarm, notification will be sent immediately to operational personnel.

Water Exchange: The amount of water flowing into each operational holding tank will be monitored continuously. If measured flows are not within the design parameters flow (5 to 40 gpm (19 to 151 lpm) per tank in service), a sensor will trigger an alarm that will alert the Conowingo Control Room.

Temperature: Water temperature in each operational holding tank will be monitored continuously.

Dissolved Oxygen: Concentration of dissolved oxygen in each operational holding tank will be monitored continuously. If measured concentrations are not above 5 ppm, a sensor will trigger an alarm that will alert the Conowingo Control Room.

5.3.2.2 Verification and Testing

The flow into each holding tank will be measured once per week to verify that the flow meters are providing accurate flow measurements. If a flow meter provides measurements that differ from the design parameters, then the holding tank flow meter will be re-calibrated or replaced.

Similarly, the temperature and dissolved oxygen meters will be tested once each week using an independent meter(s) to verify that they are accurate. The independent meter(s) will be calibrated according to manufacturer instructions and recommendations. If any continuous monitor provides measurements different than verification measurements, or outside the designed parameters, then it will be re-calibrated, repaired, or replaced.

Alarm systems for holding tanks will be tested once per week. Monitors of flow, temperature, and dissolved oxygen will be tested against deliberate deviations from the design ranges to ensure that these deviations trigger the alarms. The Conowingo Control Room will be contacted prior to any testing of the alarms.

5.3.2.3 Inspection

The holding tanks in use will be inspected daily to ensure proper operation. Results of any inspection items that require further action will be recorded on the [Conowingo West Eel Collection Facility Daily Field Sheet](#) ([Appendix D](#)). If the flow through the holding tanks, water temperature, or dissolved oxygen is suspected of operating outside of design parameters, investigation of this suspected deviation will be performed via verification measuring, as described above, and, if found to be operating outside of design parameters, immediate action will be taken to find a solution.

5.3.2.4 Maintenance

Every week, the holding tank(s) that were used will be scrubbed and air dried, and this cleaning will be recorded on the associated [Conowingo West Eel Collection Facility Daily Field Sheet \(Appendix D\)](#). Eels will be removed from the holding tanks prior to scrubbing, and every effort will be made to coordinate cleaning with transport so that the tanks are cleaned after eels are removed for transport.

The holding tanks will be drained and cleaned at the end of the trapping season, after operations at the ramp have ceased and all juvenile eels have been transported.

5.3.3 Transport

For the purpose of this plan, “transport” refers to movement of eels from holding tanks to transport tanks and transport to the upstream stocking locations.

When fewer than 150 eels are collected during a sampling event, transport will occur using aerated 19-L buckets with lids, containing the maximum amount of water to prevent sloshing, with no more than 50 eels in each bucket. When counts of juvenile eels are greater than 150 but less than 2,500 individuals, a small, enclosed transport tank (250 L) with supplemental oxygen capability will be used to transport eels to designated locations. When large loads (more than 2,500) of American Eels are transported, a custom-made transport truck and tank unit will be used to deliver eels efficiently and safely to designated stocking locations. The large transport truck has continuous monitoring.

The transport truck is a non-CDL licensed, DOT truck with a 2,498 -L two-chambered transport tank (1,249 L = 12,490 eels per compartment) permanently centered on a flat bed. Each compartment contains a micro pore oxygen diffuser and an oxygen manifold connected to an oxygen bottle by a regulator. A monitor in the cab of the truck attached to a water quality probe that reads water temperature and dissolved oxygen concentration continuously are installed in each compartment. Each compartment has a 968 mm screen drain to release water prior to eels being released to check for any mortality. A 102 mm hose is connected to the 102 mm knife valve that is flush with the floor of the tank to ensure all eels and water are flushed from the tank.

5.3.3.1 Monitoring

Transport of juvenile eels will occur at least once per week. The frequency of transport will be increased if the capacity of the holding tanks is approached or if water temperatures are above 28° C. Standard operating protocol will be to conduct two transport trips per week beginning in mid-June, with additional trips made based on eel numbers and environmental conditions. The number of juvenile eels placed in the transport tank(s) will not exceed 10 juvenile eels per liter, and each transport tank will be equipped with supplemental oxygen/aeration.²² The tank will be fully enclosed during transport.

Temperature: Water temperature in the transport tank(s) will be monitored every fifteen minutes by reading a monitor in the cab of the truck that is attached to a water quality probe. When water temperatures begin

²² The maximum of 10 juvenile eels per liter as well as aeration to the collection tanks are in compliance with Article 416.

to increase in late spring/early summer or eel health issues are observed, the monitoring crews are trained to make the decision to conduct daily transports to minimize holding mortalities.

Dissolved Oxygen: Concentration of dissolved oxygen in the transport tank(s) will be monitored continuously by reading a monitor in the cab of the truck that is attached to a water quality probe. If measured concentrations fall below 5 ppm, the transport crew will pull over at a safe location to quickly resolve the issue by adjusting regulator pressure, or, if necessary, hooking up a spare oxygen bottle. If these steps do not resolve the problem, the eels will be transported to and stocked at the nearest practical location.

Monitoring data will be recorded on the [American Eel Transport Sheet \(Appendix D\)](#).

5.3.3.2 Verification and Testing

Temperature and dissolved oxygen meters in the transport tanks will be tested once each week using an independent meter(s) to verify that they are accurate. The independent meter(s) will be calibrated according to manufacturer instructions and recommendations. If any continuous monitor provides measurements different than verification measurements, then it will be re-calibrated, repaired, or replaced.

5.3.3.3 Inspection

Prior to each trip, the transport truck and associated equipment will be inspected. The initial inspection will be done before any eels are transferred to a transport tank. The tank will then be filled approximately three-quarters full, immediately prior to inspection and subsequent transfer of eels to the transport tank. All drains and tanks will be secured and examined for leaks. Water quality parameters will be recorded prior to eels being added to the tank. The supplemental oxygen system will be checked to verify that it is functioning properly. A final inspection will be conducted after the eels are transferred to the transport tank. The transport tank will be completely filled to prevent sloshing when driving. All drains and tanks will again be examined for leaks and water quality parameters will be recorded.

Water quality data will be recorded on the [American Eel Transport Sheet \(Appendix D\)](#). The transport system must pass initial inspection before any eels are transferred to the transport tank and final inspection before transport begins. If the transport system does not pass inspection, it may not be used for transport until all issues are resolved and it passes a subsequent inspection.

5.3.3.4 Maintenance

Upon return to the facility, the transport tank will be opened to the air until the next transport. Every week, any transport tank used since a previous cleaning will be scrubbed clean.

5.4 Fishing Time and Hours of Operation

The CWFECF will operate beginning May 1 and run continuously until the mean daily water temperature is 10° C or less for three (3) consecutive days, per Article 414. Water temperature will be determined by hourly readings at Constellation's monitoring station 643. This is a longer season than given in Appendix 1, which lists the season as May 1 to September 15.

5.5 Eel Counts

Juvenile eels will be counted during each daily check upon removal from the collection tank. When small numbers of eels (fewer than 1,000) are observed in the collection tank, actual counts will be performed. Large quantities of eels will be counted volumetrically. Volumetric estimates will be performed by placing 200 mL of water in a graduated container and then placing anesthetized juvenile eels in the graduated container and filling to the 400 mL mark. These juvenile eels will be counted after placing in the graduated container for a known number in the 200 mL displacement in the container. One gallon (four liters) of water will be added into a five-gallon (19-liter) graduated bucket, the remaining eels from the collection tank will be added to the five-gallon (19-liter) bucket, and the resulting displacement of water will indicate the number of eels.²³ This process will be repeated until all juvenile eels have been removed from the collection tank. Length measurements, weight, and condition factor will be taken from a maximum of 25 eels on a bi-weekly basis. Eels will be measured to the nearest mm and weighed to the nearest 0.1 grams after being anesthetized.

All data collected will be recorded on the [Conowingo West Eel Collection Facility Daily Field Sheet \(Appendix D\)](#). Any dead eels will be removed, enumerated, and recorded on the Daily Field Sheet. At the CWECF, the number of eels added to a given holding tank will be recorded, and at the other facilities, the number transferred to the holding tank(s) at the CWECF will be recorded.

5.6 Outage Prevention and Emergency Protocols

The goal of the restoration program is to achieve a minimum annual survival rate of 95% for juvenile eel during collection and holding processes. If these survival rates are not met each year, Constellation will, in consultation with the Eel Passage Advisory Group (EPAG), MDE, and USFWS review the reasons that the 95% survival rates were not achieved and, if necessary, develop modifications that will be implemented prior to the start of the eel-passage program in the following year.

5.6.1 Alarms and Contacts

For emergency purposes, a contact list with multiple emergency contacts will be developed for the Conowingo Control Room. These individuals would be responsible for responding to and/or resolving emergency situations at the facilities if Station personnel cannot resolve the problem. Alarm systems, where applicable by facility, for flows, and dissolved oxygen in the collection and holding facilities will be linked to the Conowingo Control Room for immediate alarm notification. Also, in the event of an alarm, a text message will be sent to operational personnel five minutes after the Conowingo Control Room has been notified. The operational personnel will contact the Conowingo Control Room and determine the appropriate action to be taken to correct the problem.

²³ For example, if 100 eels were counted in the displaced 0.05-gallon (200-mL) graduated container, the resulting ratio would be 500 eels per 0.26 gallon (one liter). If the displacement of water in the five-gallon (19-liter) bucket is one gallon (four liters), then 2,000 eels are in the five-gallon (19-liter) bucket.

5.6.2 *Failed Inspections*

As indicated in the previous sections, routine inspections will be performed at the facilities. Failed inspections will be followed immediately by corrective actions if possible. If there is the potential for increased eel mortality (e.g., low flow to collection or holding tanks, high ambient river water temperatures, low dissolved oxygen concentrations), all eels in the facility will be transported to the next scheduled stocking location as soon as possible and, if necessary, the facility temporarily shut down until the issue is resolved. If there is no potential for increased eel mortality (e.g., attraction flow is not operating within design parameters), then it may not be required to temporarily shut down or immediately transport eels.

If a transport tank fails the initial inspection, no eels will be transferred to it. If eels are transferred to a transport tank that fails the final inspection, all eels must be transferred back to a holding tank unless the cause of failure can be addressed immediately, or to another transport tank if one is immediately available that has already passed initial inspection.

5.7 **Reporting**

Throughout the collection facilities' operational season, Constellation will email daily summaries of American Eel collection, holding, transport, and stocking to representatives from the EPAG, MDE, USFWS and any other interested Resource Agencies ([Appendix D, Daily Conowingo West Eel Collection Facility Email Template](#)).

Table 5.3-1: Design Parameters for Flow at the Eel Trapping, Collecting, and Holding Facilities

	Operation	Minimum Flow	Maximum Flow
Total Attraction Flow	Trapping	5 gpm (18.9 lpm)	145 gpm (548.9 lpm)
Collection Tank Flow	Collection	5 gpm (18.9 lpm)	25 gpm (94.6 lpm)
Holding Tank(s) Flow	Holding	5 gpm (18.9 lpm)	40 gpm (151.4 lpm)

Table 5.3-2: Water Quality Ranges for Eel Collection, Holding, and Transport

	Temperature Range	Dissolved Oxygen Range
Collection Tank	10-32° C	5 -20 ppm
Holding Tanks	10-32° C	5 -20 ppm
Transport Tanks	10-32° C	5 -20 ppm

6 TRAP AND TRANSPORT PLANS

6.1 American Shad and River Herring

FERC License Appendix 1 Section 12.4 and Department of Interior Settlement Agreement Section 3.1 require Constellation to submit to USFWS a detailed logistics plan and operating protocol for trap and transport of American Shad and river herring from both the WFL and EFL. The operating protocols as well as the design plans for American Shad and river herring trap and transport from the EFL are in development and will be incorporated into a future iteration of the FOMP. For the 2023 upstream fish passage migration season, Constellation will trap and transport American Shad and river herring from the WFL and EFL. The logistics plan and operating protocol for American Shad and river herring trap and transport from the fish lifts is included as [Appendix F](#).

6.2 American Eel

The current FERC license for the Muddy Run Pumped Storage Project, which incorporates the terms and conditions of a water quality certification issued by PADEP, contains an American Eel Passage Plan for the CWECF. This plan, included in [Appendix G](#), describes the general operations for American Eel from the CWECF. In addition, [Section 5.3](#) provides a detailed description of the operational aspects of the trapping, collection, holding, and transport components of the CWECF. The EPAG, USFWS, and MDE will meet with Constellation monthly to discuss the on-going implementation of the eel trap and transport program described in [Appendix F](#).

In addition, Article 415 of the Conowingo Project License requires Constellation to develop and submit an American Eel Passage and Restoration Plan. Specifically, Article 415 states:

Within six months of license issuance, the licensee must file with the Commission for approval, an eel passage and restoration plan. The plan must include:

- a) detailed plans for modifications to the East Fish Lift to specifically accommodate a temporary eel trapping facility at a location within the East Fish Lift stilling basin in the vicinity of the foot of the spillway;*
- b) details regarding the annual operation and maintenance of all current and proposed eel fishways; and*
- c) proposed attraction flow velocity and volume, slopes of the ramps, matting, and methods to reduce predation.*

Within 30 days of license issuance, the licensee must submit the plan to the Maryland Department of the Environment (MDE), the Pennsylvania Department of Environmental Protection (Pennsylvania DEP), the Pennsylvania Fish and Boat Commission (Pennsylvania Fish and Boat), the Susquehanna River Basin Commission (SRBC), the U.S. Fish and Wildlife Service (FWS), and the Maryland Department of Natural Resources (Maryland DNR), for review. In the event that MDE, in consultation with the Pennsylvania DEP, the Pennsylvania Fish and Boat, SRBC, FWS, or the Maryland DNR, determines that additional information, revisions, modifications, or amendments are necessary to the eel

passage and restoration plan, then within 60 days of receipt of written notice, the licensee must submit such information, revisions or amendments to the above-listed agencies.

The licensee must include with the plan an implementation schedule, documentation of consultation, copies of recommendations on the completed plan after it has been prepared and provided to the entities above, and specific descriptions of how the entities' comments are accommodated by the plan. The licensee must provide a minimum of 30 days for the entities to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

The plan has been developed and was filed with FERC and submitted to USFWS, MDE, and EPAG on September 16, 2021. FERC approved the plan on March 28, 2022 ([Appendix H](#)).

7 ANNUAL REPORTING

By December 31 of each year, Constellation will submit an annual report to FERC, USFWS, National Marine Fisheries Service, MDE, MDNR, PFBC, PADEP, and SRBC detailing the implementation of the FOMP, including any deviations from the FOMP, and a process to prevent those deviations in the future; any proposed modifications to the FOMP, or in the case of emergencies or project outages, the steps taken by Constellation to minimize adverse effects on fisheries including any proposed modifications to those steps to further enhance their effectiveness in the future; and operational data for the WFL, EFL, CWEFC, and the Project. In December 2023, the annual report will include additional details on the interim trap and transport effort. The report will also include the data described below.²⁴

7.1 West Fish Lift and East Fish Lift

- 1) Description of routine maintenance as well as repairs made to the fishways or eel passage facilities during the previous fish passage season.
- 2) Average daily flows at the Marietta gaging station.
- 3) Hours of daily operation (including starting and end times).
- 4) Daily water temperature and dissolved oxygen collection and reporting of readings²⁵ at the WFL for each day (including non-operational days) of the fish passage season²⁶. Water temperatures and dissolved oxygen collected at Station 643 after May 1 will be included in the annual report in addition to the water temperatures and dissolved oxygen collected daily at the WFL during the fish passage season.
- 5) Hourly individual turbine unit operations (on/off) and discharge.
- 6) Hourly total discharge from the powerhouse, and through the spillway gates.
- 7) Hourly²⁷ counts of all fish species captured at the lift. (This is recorded by lift during trap and transport operations).
- 8) Number of fish by species trapped and transported, including date, time, and location of release.²⁸
- 9) Biological information from passing adult American Shad and river herring will be collected and recorded per [Section 4.6](#).
- 10) Invasive species data per Article 419 ([Appendix A](#))

²⁴ Article 411 requires Constellation to prepare a fish kill monitoring plan for any fish kills exceeding 50 fish in Conowingo Pond and/or the project tailrace. This plan will be developed after consultation with MDNR, USFWS, and PFBC and will be filed with FERC by March 18, 2022.

²⁵ Dissolved oxygen readings will be provided starting when the Project's National Pollutant Discharge Elimination System permit requires annual data collection through the end of the upstream migration period.

²⁶ Daily water temperature will be collected at 1100 hours during the fish passage season outside of the WFL in the tailrace. A continuous water temperature and dissolved oxygen logger will be installed in the WFL near the picketed barrier. The logger will record water temperature and dissolved oxygen every thirty minutes to be compared with Station 643 at the end of the fish passage season.

²⁷ During trap and transport operations, the counts will be recorded per each lift, not by the hour.

²⁸ Article 418 also requires Constellation to file a report with FERC, MDE, and MDNR giving the number of Atlantic and Shortnose Sturgeon observed at Conowingo Dam. This report must be filed by January 31 and include all relevant data from the previous calendar year.

7.2 Conowingo West Eel Collection Facility

- 1) The estimated number of juvenile eels captured each day (i.e., number of eels in collection tank).
- 2) The number of eels in the holding tanks each day.
- 3) The number of mortalities observed during collection and holding.
- 4) The number of eels transported to each stocking location
- 5) Statistics (average, maximum, minimum) showing operational parameters for the main components (i.e., attraction and tank flows, water temperatures, dissolved oxygen concentrations).
- 6) A description of any significant problem encountered with the trapping, collecting, and holding systems including results of weekly verification efforts and any repair/maintenance actions taken.

8 ANNUAL MEETING

Constellation will meet with the USFWS and the Susquehanna River Anadromous Fish Restoration Cooperative annually to discuss this FOMP. This meeting will occur no later than January 31 each year unless Constellation and the USFWS agree on a different date. The purpose of the meeting will be to discuss the fish passage results from the previous year, review regulatory requirements for fish lift and eel passage operations, consider invasive species management, and discuss any upcoming modification or testing Constellation proposes for the upcoming fish passage season. Following this meeting, a list of aquatic invasive species will be submitted to FERC prior to the start of the next passage season.

**APPENDIX A. FERC LICENSE ARTICLE 419. AQUATIC INVASIVE SPECIES
MANAGEMENT**

Appendix A Table of Contents

Article 419

Aquatic Invasive Species Consultation Record

Article 419

The Conowingo Hydroelectric Project No 405 Federal Energy Regulatory Commission License, issued March 19, 2021, includes the following Article regarding management of aquatic invasive species:

Article 419. Aquatic Invasive Species Management. Beginning 90 days after license issuance, the licensee must undertake the following measures for the management of aquatic invasive species:

- a) Consult annually with the Maryland Department of Natural Resources (Maryland DNR), Maryland Department of the Environment (MDE), the Pennsylvania Department of Environmental Protection (Pennsylvania DEP), Pennsylvania Fish and Boat Commission (Pennsylvania FBC), and the U.S. Fish and Wildlife Service (FWS) to identify a list of aquatic invasive species that must be monitored and file that list with the Commission prior to the start of the fish passage season.*
- b) Notify the Maryland DNR, Pennsylvania DEP, Pennsylvania FBC, and FWS within 24 hours if an aquatic invasive species is captured and removed in the West Fish Lift, captured and removed in the East Fish Lift, or passed from the East Fish Lift into Conowingo Pond. Notification must include: (i) the species name and number of specimens observed or collected; (ii) the disposition of the aquatic invasive species observed or collected; (iii) the approximate size of aquatic invasive species observed or collected; (iv) the date and time of passage; and (v) the estimated flow through the Conowingo Dam at time of passage.*
- c) During operation of the East Fish Lift, observe the fish lift hopper dumping into the fish exit trough. If an aquatic invasive species is viewed in the fish lift hopper or chute, the licensee must close the gate at the viewing window immediately, and institute a drawdown to remove the aquatic invasive species from the trough before releasing the remaining fish into Conowingo Pond. The licensee must also remove any aquatic invasive species that are observed while conducting fish tagging operations in the East Fish Lift trough.*
- d) Remove any invasive species that are collected during the operation of the West Fish Lift.*
- e) For all aquatic invasive species collected at the project, kill or dispatch the aquatic invasive species and as may be requested, place the specimen in a freezer for disposal by Maryland DNR or FWS. If freezer space at the Conowingo Project for storage of aquatic invasive species becomes limited, the licensee must notify Maryland DNR and MDE. If freezer space for storage of invasive species is not limited, the licensee, as may be requested by Maryland DNR, must send the frozen aquatic invasive species to a facility designated by Maryland DNR at the end of the fish passage season and notify*

the Maryland DNR and MDE as to the number and type of frozen aquatic invasive species sent to the designated facility.

- f) If, during any upstream migratory fish season, the licensee determines that compliance with the measures set forth in paragraph (c) and (d) of this license article will materially interfere with the licensee's fish passage obligations under this license and U.S. Department of the Interior's modified section 18 prescription (Appendix 1), notify FWS, MDE, Maryland DNR, Pennsylvania DEP, and Pennsylvania FBC via email of that determination. The licensee may suspend compliance with the measures set forth in paragraph (c) and (d) of this license article for the remainder of the upstream migratory fish season, unless MDE and FWS notify the licensee within 72 hours of the licensee's initial notification that they do not concur with the licensee's determination.*
- g) In any year where suspension under paragraph (f) of this license article occurs, convene a meeting no later than July 1 with MDE, Maryland DNR, FWS, Pennsylvania DEP, Pennsylvania FBC, and other state resource agencies as appropriate, to address invasive species issues for the subsequent year. The licensee, after said meeting or no later than August 31, and after consultation with said agencies, must file with the Commission, a report of proposed alternative measures for the management of invasive species, provided that said alternative measures do not significantly exceed the scope of the measures required in paragraphs (a) through (d) of this license article, and request Commission approval when necessary.*

Aquatic Invasive Species Consultation Record

CONSTELLATION ENERGY GENERATION, LLC
MUDDY RUN PUMPED STORAGE PROJECT (FERC NO. 2355)
CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
AQUATIC INVASIVE SPECIES & CONOWINGO EFL MEETING SUMMARY
AUGUST 10, 2022, 10:00 AM TO 12:00 PM EST
Call-in Number: Microsoft Teams Call-in 443-529-0267, passcode 3802853#

Attendee	Affiliation
Jay Campbell	Constellation
Andrea Danucalov	Constellation
Michael Utley	Constellation
Kirk Smith	Gomez and Sullivan Engineers
Matt Dunlap	Kleinschmidt Associates
Mike Hreban	Kleinschmidt Associates
Heather Nelson	Maryland Dept. of the Environment
Tony Prochaska	Maryland Dept. of Natural Resources
Bob Sadzinski	Maryland Dept. of Natural Resources
David Seaborn	Maryland Dept. of the Environment
Shawn Seaman	Maryland Dept. of Natural Resources
Steve Adams	Normandeau Associates, Inc.
Ray Bleistine	Normandeau Associates, Inc.
Mike Martinek	Normandeau Associates, Inc.
Kristen Rolison	Stantec
Clint Smith	Stantec
Heidi Wahto	Stantec
David Whitbeck	Stantec
Eleanor Wilson	Stantec
Sheila Eyler	US Fish and Wildlife Service

Introductions

Andrea Danucalov (Constellation) opened the meeting and welcomed everyone, and the meeting participants introduced themselves.

Meeting Purpose

The primary focus of this meeting was to give a brief update on the design and construction status of the West Fish Lift (WFL) and East Fish Lift (EFL) modifications. Additionally, the meeting aimed to discuss the planning and coordination activities for aquatic invasive species (AIS) management during the 2023 fish passage season.

Conowingo WFL and EFL Design and Construction Status

Bids from contractors are currently under evaluation for the WFL modifications. A contract award is expected by the end of August 2022, and construction is expected to begin in June 2023 after the fish passage season ends.

Design work related to the EFL internal modifications are currently at the 90% design phase. The EFL hopper/crowder upgrades are expected to be at the 30% design phase by March 2023. The EFL trap and transport design is expected to be at the 60% design phase by December 2023. For the zone of passage structures, the design is currently at the 60% design phase.

Aquatic Invasive Species Management

Tony Prochaska (MDNR) provided an update on recent resource agency initiatives for AIS. In late June, MDNR submitted a proposal to USFWS to receive funding to implement AIS preventive measures. Funding has been provided to Brett Towler (USGS) to conduct research at the Conte Lab to determine if aquatic stimuli can be used to deter AIS from entering fish passage facilities. The research is not specific to the Conowingo WFL and EFL but could possibly be applied to them, if the research indicates there is a viable method. MDNR is currently seeking funding to develop an AIS management plan; a decision on funding is expected in October 2022. MDNR is instituting a tagging program for AIS to encourage harvest and estimate movement of AIS. This program is expected to run from 2022-2024. The AIS removal work at Conowingo was conducted in 2022 and will continue in 2023. Sheila Eyler (USFWS) stated that USFWS is seeking general funding available through recently passed federal legislation. In addition, USFWS is developing a Northern Snakehead management plan for Chesapeake Bay, which is expected to be available in early 2023.

Andrea Danucalov reviewed Article 419 from the Conowingo license that details the AIS requirements. Andrea indicated that Constellation will soon be filing a letter detailing plans for 2023 AIS management activities at the WFL and EFL as required in Article 419. It was agreed at the meeting that Constellation will monitor and remove the following invasive species during the 2023 fish passage season: Northern Snakehead, Blue Catfish, Flathead Catfish, Silver Carp, Bighead Carp and Grass Carp.

Mike Utley (Constellation) gave a brief update on activities related to the Whooshh system, which is used to convey fish from the EFL to the west side of Conowingo as part of the trap and transport program. He said Whooshh is working on a design to implement the use of two tubes in 2023 to accommodate different sizes of American Shad. The design may incorporate a third smaller tube in the future to accommodate river herring, but Whooshh currently does not manufacture a tube of that size.

The group agreed to hold another meeting in the fall of 2022 to discuss potential longer-terms methodologies/solutions for managing AIS at the WFL and EFL.

The meeting was adjourned.

**APPENDIX B. CONSTELLATION PROTOCOLS FOR OPERATION TO HELP
PREVENT THE TRANSMISSION OF COVID-19**



COVID-19

Field Safety Awareness

2/23/2022 Revision 10

We are amid a global pandemic with the coronavirus disease (COVID-19). As the pandemic comes under control in the U.S. due to vaccinations Normandeau employees will follow all current CDC guidelines. Additionally, we intended to comply with all applicable guidelines or requirements of our clients. If CDC guidelines change all staff will be notified. Upon request by a client or partner this COVID-19 Field Safety Awareness Plan will be made available.

This virus is thought to spread mainly from person-to person:

- Between people who are in close contact with one another (within about 6 feet); or
- Through respiratory droplets produced when an infected person coughs or sneezes.
- May be spread by people that are not showing symptoms.
- Maintaining good social distance (about 6 feet) is very important in preventing the spread of COVID-19

Droplets infected with COVID-19 can be transferred to people who are nearby or through ingestion, absorption, or by inhalation into the lungs. Although individuals are thought to be most contagious when they are highly symptomatic (i.e., the sickest), some spread may be possible before people show symptoms; there have been reports of this occurring with this new coronavirus.

It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes. The virus that causes COVID-19 seems to be spread easily and sustainably in the community.

Purpose of Procedure:

Normandeau personnel working in the field on various environmental tasks studies in the United States will maintain a high standard of personal hygiene and social distancing when possible. All Normandeau field crews will follow NAI's COVID-19 Field Safety Awareness procedures, to prevent the spread of COVID-19.

Normandeau staff will follow all CDC guidelines. Staff with COVID-19 should isolate for 5 days and if they are asymptomatic or their symptoms are resolving (without fever for 24 hours), follow that by 5 days or wearing a mask when around others to minimize the risk of infecting people they encounter.

Individuals who have received their booster shots do not have to quarantine following exposure, but should wear a mask for 10 days after the exposure. For all those exposed, best practice would also include a test for SARS-CoV-2 at day 5 after exposure. If symptoms occur, staff should immediately quarantine until a negative test confirms symptom are not attributable to COVID-19.

Conowingo Hydroelectric Project
FERC Project Number 405
Fishway Operation and Maintenance Plan

All staff will follow client COVID policies. All staff will also follow CDC county community spread levels for face masks. The site is located here <https://www.cdc.gov/coronavirus/2019-ncov/your-health/covid-by-county.html>.

**APPENDIX C. CONSTELLATION OPERATIONAL PERSONNEL FISHWAY
OPERATIONS AND MAINTENANCE PLAN REVIEW AND UNDERSTANDING
SAMPLE LETTER**



Sample Letter

[Date]

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

**Re: Constellation Energy Generation, LLC (Constellation)
Conowingo Hydroelectric Project, FERC No. P-405
Fishway Operations Maintenance Plan Notice of Operational Personnel and Manager Review
and Understanding**

Dear Secretary Bose:

Constellation Energy Generation, LLC (Constellation) operates the Conowingo Hydroelectric Project (Federal Energy Regulatory Commission (the Commission) Project No. 405). As required by the Federal Energy Regulatory Commission license, Article 401 and Article 413 as well as Appendix 1, Section 12.4 Constellation maintains the Conowingo Fishway Operation and Maintenance Plan, which will be updated and filed with the Commission annually. The license requires Constellation to file written documentation with the Commission stating that all fishway operation personnel have reviewed and understand the latest Fishway Operation and Maintenance Plan.

This letter confirms that all fishway operation personnel have reviewed and understand the Conowingo Hydroelectric Project Fishway Operation and Maintenance Plan dated _____.

Please contact Andrea Danucalov at andrea.danucalov@constellation.com or 267-533-1125 with any questions.

Sincerely,

Dusty McKeown
Constellation Plant Manager

Cc: Sheila Eyler, US Fish and Wildlife Service
Richard McCorkle, US Fish and Wildlife Service
Heather Nelson, Maryland Department of the Environment
Shawn Seaman, Maryland Department of Natural Resources
Scott Williamson, Pennsylvania Department of the Environment
Jeremy Miller, Pennsylvania Department of the Environment
Josh Tryninewski, Pennsylvania Fish and Boat Commission
Aaron Henning, Susquehanna River Basin Commission

APPENDIX D. EXAMPLE DATASHEETS RELATED TO FISHWAY OPERATION

Operator's Daily Log

Location (circle) EFL WFL Sheet of
Recorded by _____ Date

[illegible]

Species and Operation Sheet

Sheet of Location (circle) EFL WFL

Date Air Temperature Water Temperature Recorded By

Operating	Lift No.										
	Set time										
	Lift time										
	WTH										
	# Sm turbines										
	# Lg turbines										
	Unit 1 on										
	Unit 2 on										
	# Spill gates										
	Hopper fullness										
Species	AMERICAN SHAD										
	ALEWIFE										
	BLUEBACK HERRING										
	GIZZARD SHAD										
	HICKORY SHAD										
	STRIPED BASS										
	WHITE PERCH										
	AMERICAN EEL										
	RAINBOW TROUT										
	BROWN TROUT										
	MUSKELLUNGE										
	CARP										
	QUILLBACK										
	WHITE SUCKER										
	S. REDHORSE										
	WHITE CATFISH										
	YELLOW BULLHEAD										
	BROWN BULLHEAD										
	CHANNEL CATFISH										
	ROCK BASS										
	REDBREAST SUNFISH										
	GREEN SUNFISH										
	PUMPKIN SEED										
	BLUEGILL										
	SMALLMOUTH BASS										
	LARGEMOUTH BASS										
	WHITE CRAPPIE										
	BLACK CRAPPIE										
	TESS. DARTER										
	YELLOW PERCH										
	WALLEYE										
	CHESAPEAKE LOGPERCH										
N. SNAKEHEAD											
FLATHEAD CATFISH											
BLUE CATFISH											

Fish Lift Daily Count Worksheet

Location (circle) EFL WFL Sheet of
 Date Subsample Size
 Recorded by Sex Ratio

Lift Number	Total Caught	Running Total	Recaptures	Lift Mortalities	Sacrificed	Released Not Recaptures	Into Tanks	Tank Mortalities	Released from Tank	Running Total Available for Transport

Anadromous Fish Holding or Transport Information

Origin Location (circle)	<u>EFL WFL</u>	Initials	<u> </u>	Sheet	<u>of</u>
Holding or Transport (circle)	<u>Holding Transport</u>	Date	<u> </u>		<u> </u>
Tank Clean (check)	<u> </u>		<u> </u>		
Origin	<u> </u>	Destination	<u> </u>		

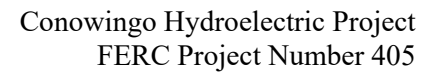
Beginning/Departure	Ending/Arrival
Time	Time
DO (tank)	DO (tank)
Water Temperature (tank)	Water Temperature (tank)

Species	Species
No. Placed in Holding/Truck Tank	No. Placed in Holding/Truck Tank
No. Died in Transit/Holding	No. Died in Transit/Holding
<i>Holding Only</i>	<i>Holding Only</i>
No. Released to Tailrace	No. Released to Tailrace
No. Transported	No. Transported
No. Remaining in Tank	No. Remaining in Tank

Species	Species
No. Placed in Holding/Truck Tank	No. Placed in Holding/Truck Tank
No. Died in Transit/Holding	No. Died in Transit/Holding
<i>Holding Only</i>	<i>Holding Only</i>
No. Released to Tailrace	No. Released to Tailrace
No. Transported	No. Transported
No. Remaining in Tank	No. Remaining in Tank

Transport Trip – 15 minute readings

Temperature and DO Minute Readings								
Time	Temp (C)	DO	Time	Temp	DO	Time	Temp (C)	DO
						River		

[illegible]

Daily and Weekly Fish Lift Email Template

PROVISIONAL DATA SUBJECT TO REVISION

The Conowingo [West/East] Fish Lift [Daily/Weekly] report is attached.

Collection

Today ____ American Shad were collected at the [West/East] Fish Lift. The season total is now ____.

Today ____ Alewife were collected at the [West/East] Fish Lift. The season total is now ____.

Today ____ Blueback Herring were collected at the [West/East] Fish Lift. The season total is now ____.

Transport

Today ____ American Shad were transported from the [West/East] Fish Lift to _____. The season total transported is now ____.

Holding

The following fish are in holding: _____

Invasive Species Information

Today ____ Northern Snakeheads were collected at the [West/East] Fish Lift. Approximate size range: _____.
Disposition: _____. The season total is now ____.

Today ____ Northern Snakeheads were passed at the [West/East] Fish Lift. Approximate time of passage: _____.
Approximate size range: _____. Disposition: _____. The season total is now ____.

Today ____ Flathead Catfish were collected at the [West/East] Fish Lift. Approximate size range: _____.
Disposition: _____. The season total is now ____.

Today ____ Flathead Catfish were passed at the [West/East] Fish Lift. Approximate time of passage: _____.
Approximate size range: _____. Disposition: _____. The season total is now ____.

Today ____ Blue Catfish were collected at the [West/East] Fish Lift. Approximate size range: _____.
Disposition: _____. The season total is now ____.

Today ____ Blue Catfish were passed at the [West/East] Fish Lift. Approximate time of passage: _____.
Approximate size range: _____. Disposition: _____. The season total is now ____.

Number of full bins in the refrigerated unit: _____. Number of unfilled bins in the refrigerated unit: _____.
Approximate time when most invasive species were collected (AM/PM): _____.

Approximate time when most invasive species were collected (AM/PM): _____.

Date and time of most recent invasive species collection by MDNR or agency partner: _____.

Other pertinent information that may have affected the day's operation (i.e. extreme weather conditions, exceptional equipment issues, etc.)

The next day of operations will be _____.

Note: Species and operation data collection on the [Species and Operations Data Sheet](#) will be attached to the daily emails as an Excel file. Each Saturday, the week's data will be attached to the daily email in an Excel file.

Conowingo West Eel Collection Facility Daily Field Sheet					
Project Number:		Crew:			
Collection Number:		Generation:			
Date:		Control Room DO reading:			
Weather:					
	Collection Tank	Holding Tank			Main Flow
		# 1	# 2	# 3	
Time:					
Flow Meter (gpm):					
Total Flow Volume:					
Temperature (°C):					
Dissolved Oxygen (mg/L):					
In Operation:					
Cleaned (check):					
Actual Counted # of Eels:		Volumetric Estimates			
Dead eels in collection tank #:		Actual # of eels in 200 mL:			
Sacrificed #:		# of eels in 1 Liter:			
Eels released into holding tank #:		Displacement of water (L):			
# Eels released into tank:		Estimated # of eels:			
Dead eels in tank #:		Total estimated:			
Total # of eels in tank: (not to exceed 17,000)		(total estimated equals number estimated plus eels in the 200 mL subsample)			
		Estimate Check (QA) (if necessary):			
		Actual:			
		Estimate:			
Holding Tank #:		Holding Tank #:			
Total alive:		Total alive:			
Dead #:		Dead #:			
New total:		New total:			
Comments:					

American Eel Transport Sheet

Facility (circle)	CWECF CEECF OECF	Transport Tank (circle)	Large Small

Prior to transport, while in holding (H1)		Prior to transport, while in holding	
Date	Time	Date	Time
DO	Temp	DO	Temp
No. eels being held		No. eels being held	
No. dead eels in holding prior to transport		No. dead eels in holding prior to transport	
No. eels being transported		No. eels being transported	

After eels have been loaded (in tank)		Prior to releasing eels (in tank)	
Date	Time	Date	Time
DO	Temp	DO	Temp
No. eels transported			
No. of eel dead during transport			
No. eels released			

Transport Trip – 15 minute readings

Time	Temp (C)	DO	Time	Temp	DO	Time	Temp (C)	DO
						River		

Release Location			
Date	Time	Creek DO	Creek Temp

Release Locations

A – Muddy Creek Forks (York County) B – Conowingo Creek, Aberdeen PA (Lancaster County) C – Beaver Creek, Hummelstown, PA Susquehanna River 1 – Conowingo Pond, Conowingo Creek (Cecil County) 2 – Lake Aldred (York/Lancaster County) 3 – Lake Clarke (Lancaster County) 4 – Etters Boat Ramp, Goldboro, PA 5 – West Fairview Access, Route 11/15 (Cumberland County)	Susquehanna River, continued 6 – For Hunter Access (Perry County) 7 – Shikellamy State Park (Northumberland County) 8 – Route 487 (Bloomsburg, PA (Columbia County) 9 – Route 29 Bridge (Luzerne County) 10 – Upstream of Hepburn Street Dam, Williamsport PA (Lycoming County) 11 – Upstream of Grant Street Dam (Clinton County) 12 – City Island (Dauphin County)

Comments:

Daily Conowingo West Eel Collection Facility Email Template

PROVISIONAL DATA SUBJECT TO REVISION

Collection

Today ____ American Eel were collected at the Conowingo West Eel Collection Facility. The season total is now ____.

New collection tank mortalities:

Transport

Today ____ American Eel were transported to _____. The season total transported is now ____.

New transport tank mortalities: ____.

Holding

____ American Eel are in holding.

New holding tank mortalities: ____.

**APPENDIX E. FISH LIFT AND EEL COLLECTION FACILITY PRE-SEASON AND
POST-SEASON MAINTENANCE MEASURES**

West Fish Lift Pre-Season Season Maintenance Measures

1. Inspect/repair three motors and gear boxes and prepare to install
2. Install motors and gear boxes, wire for operation
3. Install hoses for sorting tank
4. Inspect hopper drive motors and gear gases
5. Inspect electric winch used to raise down-river screen
6. Build new scaffolding for platform holding tanks
7. Set up deck and tanks needed for proper operations
8. Lubricate and test all components for proper operation
9. Install pump casing plugs and lubricate sorting tank pump
10. Open main supply valve and start-up sorting tank water supply
11. Test sprayers and install strainers for sorting tank
12. Wire WFL and invasive species trailer

West Fish Lift Post-Season Season Maintenance Measures

13. Remove three motors and gear boxes
14. Remove motors and gear boxes, wire for operation
15. Remove hoses for sorting tank
16. Remove deck and tanks needed for proper operations
17. Remove pump casing plugs and lubricate sorting tank pump
18. Shutdown sorting tank water supply
19. Remove strainers for sorting tank
20. Unwire WFL and invasive species trailer

East Fish Lift Pre-Season Maintenance Measures

1. Unwater fish trap for inspection and repair of all lower components
2. Powerwash EFL
3. Open main air supply valve and purge system
4. Inspect and repair spill gates A & B, and spill trough
5. Inspect and repair hopper through gate
6. Inspect and repair crowder and A diffuser gate
7. Check all air lines and connections
8. Lubricate all cables, sheaves and pulleys, wheels and all crowder moving parts and mating surface
9. Re-install crowder air cylinders and check operation
10. Operate and lubricate crowder doors and drive assembly check/adjust all limits and stops
11. Check/correct take-up on hose reels, lubricate as required
12. Inspect and repair B diffuser gate
13. Operate hopper dump doors and inspect for wear of seals, repair as needed
14. Lubricate all cables, sheaves, wheels and all hopper moving parts and mating surfaces
15. Check condition of hopper air hoses and connections
16. Raise hopper to sorting tank area, check all limits and stops, lubricate as needed
17. Inspect hopper check valves, grating and screening for water system
18. Re-install aluminum slide plates and hopper air cylinders
19. Check all settings on gates, racks, and screen limit and torque switches, adjust and record as found and as left settings
20. Inspect/repair all trash racks and screen doors
21. Exercise gates, screens, and racks, clean and lubricate stems and drive operations
22. Lubricate main hopper hoists, trash rack hoist, screen hoists and monorail hoists, have reading inspected
23. Exercise hand wheel operated trash racks at headworks trash gate $\frac{1}{4}$ open turn water supply valve
24. Install and test cameras
25. Reconnect water supply
26. Inspection of slope area outside of fish entrance gates for accumulation of sediment/rocks
27. Inspect Auxiliary Water System diffuser pits
28. Calibrate gate settings to match rating curves
29. Inspect/calibrate all recording instruments (e.g., water level loggers, temperature loggers, etc.)
30. Inspect and repair solenoid valves
31. Install hopper sheaves and cables
32. Inspect and repair gearbox diffuser A channel gate
33. Inspect/repair diffuser A gate
34. Inspect/repair A diffuser both gear boxes
35. Inspect/repair A spillway gate gear boxes, trans drives and auma drives
36. Inspect/repair C spillway gate gear boxes, trans drives and auma drives
37. Inspect/repair B diffuser gate
38. Inspect/repair of B diffuser both gear boxes
39. Inspect/repair of A diffuser auma drive box
40. Inspect/repair A spillway gate gear boxes, trans and auma drives
41. Inspect/repair C spillway gate gear boxes, trans and auma drives
42. Inspect/repair B diffuser auma drive box
43. Inspect/repair hopper trough inlet gate gear box
44. Inspect/repair both A diffuser gear boxes and apply new grease for operation
45. Inspect/repair both B diffuser gear boxes and apply new grease for operation
46. Inspect/repair A spillway gate trans drive, apply new grease for operation

47. Inspect/repair C spillway gate trans drive, apply new grease for operation
48. Reinstall C spillway gate gear boxes, trans drive and auma drive
49. Inspect/repair A diffuser gate auma drive
50. Inspect/repair A diffuser gate auma drive, apply new grease for operation
51. Inspect/repair B diffuser gate auma drive, apply new grease for operation
52. Inspect/repair hopper through inlet gear box, apply new grease for operation
53. Locate EFL trailer and wire-up

East Fish Lift Post-Season Maintenance Measures

1. Purge air system. Close main air valve and open all other air valves including drains
2. Lubricate all cables, sheaves, wheels and all mating surfaces
3. Check take-up on hose reels and lubricate as required
4. Inspect all air lines
5. Inspect/repair all electrical components
6. Remove crowder air cylinders
7. Lubricate all hopper cables, sheaves, wheels and all mating surfaces
8. Raise hopper to sorting tank area. Check all limits and stops
9. Operate hopper dump doors and inspect for seal wear. Replace as needed
10. Remove hopper air cylinders, aluminum slide plate and inspect hopper check valves, grating, and screening
11. Exercise gates, screens and trash rack. Clean and lubricate stems and drive operators
12. Dog trash racks and screens
13. Remove trough plugs
14. Lubricate main hopper hoist, screen hoists, trash rack hoist and monorail hoist
15. Visually inspect leakage at spillway gates and through exit gate, if excessive, install service gate and repair
16. Inspect splash guard at weir gates
17. Remove cameras and store

Conowingo West Eel Collection Facility Pre-season Set-up

1. Inspect and repair, (if necessary)
 - Ramp substrate
 - Ramp entrance for smooth transition
2. Install
 - Overflow tank
 - Additional attraction flow pipes from overflow tank
 - Shade cloth below entrance of ramp
 - Drain hoses (collection and holding)
 - Spray bar and spray bar line
 - Scent line
 - Overflow screened drain in collection tank
 - Collection tank overflow line
 - Center screened holding tank drains
 - Lexan covers on all tanks
 - Oxygen/temperature probes and associated wiring
 - Oxygen micro-pore diffusers and oxygen lines
 - Oxygen manifold and regulators
 - Oxygen bottles
 - Fine pore air stone and lines
 - Air blowers and boxes
 - Shade covering for eel facility

Other measures (Station support)

- Fill 8" supply pipe
- Open 3" water supply pipe for eel facility from 8" manifold
- Flush 3" eel facility pipe
- Bleed air from each of the tank fill lines
- Power up the control panels for monitoring
- Calibrate dissolved oxygen/temperature probes
- Calibrate flow meter monitors
- Turn on modems and webmaster
- Check alarms for each of the monitoring parameters

Conowingo West Eel Collection Facility Post-season Tear-down

1. Remove, clean, and store
 - Overflow tank
 - Additional attraction flow pipes from overflow tank
 - Shade cloth below entrance of ramp
 - Drain hoses (collection and holding)
 - Spray bar and spray bar line

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- Scent line
- Overflow screened drain in collection tank
- Collection tank overflow line
- Center screened holding tank drains
- Lexan covers on all tanks
- Oxygen/temperature probes and associated wiring
- Oxygen micro-pore diffusers and oxygen lines
- Oxygen manifold and regulators
- Oxygen bottles
- Fine pore air stone and lines
- Air blowers and boxes
- Shade covering for eel facility

Other measures (Station support)

- Drain 8" supply pipe
- Drain 3" water supply pipe for eel facility from 8" manifold
- Drain water from each of the tank fill lines
- Winterize the control panels
- Power down modems and webmaster
- Disable alarms

APPENDIX F. TRAP AND TRANSPORT LOGISTICS PLAN

Trap and Transport Logistics Plan for Adult American Shad and River Herring at Conowingo Dam (FERC Project No. 405)

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1.0 Introduction

On April 21, 2016, Constellation and the U.S. Department of the Interior (DOI), U.S. Fish and Wildlife Service (USFWS) reached an agreement (DOI Settlement Agreement; USFWS 2016) to improve efforts to restore American Shad and river herring to the Susquehanna River. This agreement included the Modified Prescription Fish Passage Requirements and Related Licensee Commitments as Attachment A. The Conowingo Hydroelectric Project Federal Energy Regulatory Commission (FERC) License issued March 19, 2021 (FERC, 2021) includes the Modified Prescription Fish Passage Requirements and Related Licensee Commitments as Appendix 1 (FERC License Appendix 1). Constellation will modify fish passage facilities at the Conowingo Hydroelectric Project (Project) to facilitate transport of up to 100,000 American Shad and 100,000 river herring annually to one or more locations upstream of York Haven Dam.

The number of American Shad and river herring transported annually will be approximately 80 percent of the number of each species captured in the Conowingo West Fish Lift (WFL) and East Fish Lift (EFL), up to a maximum of 100,000 of each species. Trap and transport operations will continue until Constellation can achieve a measured 85 percent upstream passage efficiency for American Shad at the Project without reliance on the trap and truck credit provided for in FERC License Appendix 1 Section 12.7.2.1.

This Logistics Plan addresses near-term operations to support the collection and transport of American Shad and river herring. Constellation will review this plan annually and update it as needed to reflect any agreed upon changes in the program. Initial construction items will begin within one year of issuance of the new FERC license. Initial construction items will require certain modifications to be able to sort and transport fish. A Fish Passage Design Team that includes Constellation and its consultants, USFWS, Maryland Department of Natural Resources (MDNR), Maryland Department of Environment (MDE), and Pennsylvania Fish and Boat Commission (PFBC) has been engaged in the design and approval of the modifications to the WFL and EFL. Construction item logistics will be like the process used successfully in the 1990s. Modifications to the fish lifts will facilitate the sorting of target species from other species, the holding of target species sorted for transport, and the loading of transport tanks. The initial modifications may not be sufficient to sort and transport 100,000 each of American Shad and river herring, but the populations are very low, and those numbers are not available for passage at this time. Following completion of initial construction items, additional modifications to the WFL, EFL, and Zone of Passage structures will be made to further improve the process of collecting, sorting, and transporting fish and to provide the capacity to transport up to 100,000 each of American Shad and river herring. (See Section 8 for additional information.)

Due to an increase in invasive fish species (Northern Snakehead, Blue Catfish, and Flathead Catfish) observed in the Conowingo tailrace and the passage of 21 Northern Snakeheads into Conowingo Pond during the abbreviated fish passage season in 2020 (due to COVID-19), the resource agencies and Constellation instituted an interim trap and transport program. This interim program includes the operation of the WFL and EFL to sort and transport American Shad and river herring as well as the management of invasive fish per Article 419.

2.0 Background

From 1980 – 1990, target species were sorted at the WFL and transported upstream. Upon completion of the Conowingo EFL in spring 1991, both the EFL and WFL were used to collect and transport American Shad and river herring to various locations upstream. Trap and transport operations occurred at both fish lifts through 1996, resulting in the transport of 168,989 American Shad with an overall mortality rate of 1.7% ([Table 2-1](#)). During this period (and through the next several years as the progeny of transported shad returned to Conowingo Dam), the annual returns of adult American Shad to Conowingo increased dramatically ([Figure 2-1](#)). The EFL switched to volitional fish passage in 1997 because of the completion of the fish passage facilities at Holtwood and Safe Harbor Dams. Within several years of volitional passage at the four dams, the annual returns of adult American Shad to Conowingo dropped dramatically ([Figure 2-2](#)). The return to a trap and transport program is intended to reverse the steep decline in the Susquehanna American Shad run.

Transport of fish from the EFL was accomplished using specialized 750-gallon circular tanks mounted on custom-made trailer units that could be transferred across the face of the dam via the catwalk ([Figure 2-3](#)). The customized trailer units were necessary because of the narrow width of the catwalk.

Larger circular transport tank units (approximately 1,000-gallon capacity) were utilized to transport anadromous fish species from the WFL because there was no constraint for getting a larger truck and tank to the WFL ([Figure 2-4](#)). Target species were either loaded from the WFL holding tanks or directly from the sorting tank into the transport unit prior to transport upriver to pre-determined stocking locations.

3.0 Initial Phase

3.1 Interim Trap and Transport

Trap and transport operations, which began in 2021, included only the use of the Conowingo WFL to sort and transport American Shad and river herring. A transport tank and skid was manufactured and used in 2021 for the transport of American Shad and river herring from the WFL. A temporary deck was built adjacent to the sorting tank to hold two of the three holding tanks that will be used to hold anadromous fish prior to transport ([Figure 3-1](#)).

At the WFL, each lift will be sorted by technicians who will place target species in the holding tanks or directly into the transport skid if warranted. Invasive fish will be managed per Article 419 requirements. The WFL lift cycle time will be determined by the number of fish observed in each lift. If only a small number of fish are observed, the cycle time will be shortened, whereas if several anadromous or invasive fish are observed, the cycle time will be increased to allow the technicians ample time to thoroughly sort through the catch.

TRAP AND TRANSPORT LOGISTICS PLAN FOR ADULT AMERICAN SHAD AND RIVER HERRING AT CONOWINGO DAM (FERC PROJECT NO. 405)

Hopper fullness will also be estimated for each lift per Article 412¹. Hopper fullness is estimated based on the approximate number of Gizzard Shad, the dominant species, in the WFL and EFL as follows²:

West Fish Lift

- 10% full (1-100 Gizzard Shad)
- 25% full (101-250 Gizzard Shad)
- 50% full (251-500 Gizzard Shad)
- 75% full (501-750 Gizzard Shad)
- 100% full (751-1,000 Gizzard Shad)
- Over 100% full
 - o Slight overcrowding: 1,001 – 1,200 Gizzard Shad
 - o Moderate overcrowding: 1,201-1,499 Gizzard Shad
 - o Extreme overcrowding: more than 1,500 Gizzard shad.

East Fish Lift

- 10% full (1-361 Gizzard Shad)
- 25% full (361-900 Gizzard Shad)
- 50% full (901-1,800 Gizzard Shad)
- 75% full (1,801-2,700 Gizzard Shad)
- 100% full (2,701-3,600 Gizzard Shad)
- Over 100% full
 - o Slight overcrowding: 3,601 – 4,400 Gizzard Shad
 - o Moderate overcrowding: 4,401 – 5,199 Gizzard Shad
 - o Extreme overcrowding: more than 5,200 Gizzard shad.

Hopper fullness will be recorded on the Operator's Daily Log (Appendix 1, Attachment II).

During trap and transport operations at the EFL, the existing configuration, (one 3,300-gallon hopper, one sorting tank, etc.) will be utilized prior to the modifications listed in the FERC License Appendix 1, Section 12.6.1 ([Figure 3-2](#)). No volitional passage will take place.

¹ The measure of "hopper fullness" is not an assessment of safe operating capacity of the WFL. The USFWS estimates that a maximum safe operating capacity would equate to 1,200 pounds of fish, translating into about 1,000 gizzard shad.

² Note, the ranges of fish associated with each hopper fullness estimate overlap as the Gizzard Shad can vary substantially in size.

TRAP AND TRANSPORT LOGISTICS PLAN FOR ADULT AMERICAN SHAD AND RIVER HERRING AT CONOWINGO DAM (FERC PROJECT NO. 405)

The catch data from the EFL and WFL will be reported by lift, and will include the following: time of lift, species and number of fish per species (including invasive species, per Article 419), and hopper fullness (per Article 412).

At day's end, the supervising biologist will email a daily summary report containing the following provisional information:

- Target species information
 - number of anadromous fish collected, transported, and in holding,
 - updated season total number of each target species,
- Invasive species information
 - number and type of invasive species name and number of specimens observed or collected,
 - disposition of invasive species observed or collected
 - approximate size of invasive species observed or collected
 - time of passage, if applicable
 - estimated flow-through the Conowingo Dam at time of passage
 - status of refrigerated storage unit
- and any other pertinent information.

Up to four trucks and transport skids will be used to transport fish upstream from the fish lifts. Each transport skid will include the following equipment: a transport tank (approximately 1,300-gallon capacity), an electric water circulation pump, a dissolved oxygen (DO) injection system, and a DO/temperature monitor ([Figure 3-3](#)).

During the future upgrade phase of trap and transport, new sorting and holding tanks along with the new platforms for fish loading, and appurtenant facilities will be designed, manufactured, and procured. Designs and specifications for all new trap and transport equipment will be developed in consultation with the USFWS and submitted to the USFWS and FERC for approval as stated in FERC License Appendix 1, Section 12.5.5.

4.0 WFL and EFL Operations

4.1 Lift Operation (date and times)

The fish lifts will begin operation when river temperature reaches 48° F³ for three consecutive days and no earlier than March 1⁴, until river temperatures rise above 72° F for four consecutive days, but ending no earlier than June 1 and no later than June 15.

The fish lifts will operate at the following times:

- 1) in March, from 7 a.m. to 7 p.m.;
- 2) in April, from 6:30 a.m. to 7:30 p.m.; and
- 3) in May and June from 6:00 a.m. to 8:00 p.m.

Attraction flows will be released at least one hour prior to the start of daily lift operations.

The last lift of the day will occur thirty minutes prior to the scheduled end time to better ensure that adequate daylight exists for safe and accurate sorting or loading of fish into transport units (if fish numbers warrant a late-night transport). Safe operations are the highest priority when conducting fish passage operations and will not be compromised at any time.

In the case of severe weather conditions, safety considerations may preclude Constellation's personnel from performing duties necessary to commence fish passage measures at Conowingo by the commencement date. When such conditions arise, the USFWS and MDE shall be notified, as well as other resource agencies, and the USFWS and Constellation shall consult regarding the anticipated/modified schedule for commencing fish passage operations.

4.2 Collection of Biological Information and Fish Counts

Per FERC License Appendix 1, Section 12.4, a weekly collection of biological information from a sample of American Shad and river herring will be completed. Data to be collected include the following: sex ratio (male: female), spawning condition (green/ripe), length and weight, and scale and otolith samples for age determination. The age structures, along with the corresponding length, weight, and sex data will be provided to the PFBC to assist them with meeting their annual obligations for the Atlantic States Marine Fisheries Commission.

Enumeration of fish by species will occur for each lift deposited in the sorting tank. When sorting, the Supervising Biologist will be responsible for recording and identifying the number of fish by species. Gizzard Shad numbers, unless observed in low numbers for a specific lift, will be estimated with most of the other species individually counted by the sorting technicians.

Every effort will be made to avoid trapping a population unrepresentative of the migrating population. Weekly assessment of sex ratio will assist those conducting the operation as to what portion of the

³ Water temperatures shall be monitored once daily at 11 a.m. at Monitoring Station 643 (Shures Landing) or some other location agreed upon by Constellation and USFWS.

⁴ Because of factors outside of the Constellation's control, safety considerations may preclude Constellation's personnel from performing duties necessary to commence fish passage measures at Conowingo by the commencement date. When such conditions arise, Constellation shall notify the USFWS and the USFWS and Constellation shall consult regarding the anticipated schedule for commencing such measures.

“run” is male versus female throughout the season. It is a common occurrence to have a higher proportion of males arrive early in the migration season, with a larger proportion of females arriving later.

4.3 Selection of Target Species for Transport

The sole purpose of the trap and transport program is to transport as many pre-spawned American Shad and river herring as possible upstream safely and expeditiously of the dams to facilitate ready access to suitable spawning habitat. This program is the best means to improve the Susquehanna River populations. In any given year, up to 100,000 shad and herring, if available, will be transported upriver.

When sorting fish, the technicians will conduct a quick visual screening to ascertain if each target fish collected is suitable for transport upriver. Fish that are in post-spawn condition (e.g., thin/emaciated, significant scale loss), or those with severe cuts or bruises will not be transported upriver but may be used for collection of biological information or returned to the Conowingo tailrace. Every effort will be made to transport as many healthy fish as possible upriver to meet the target numbers stated in the FERC License, Appendix 1.

5.0 Monitoring During Holding and Transport Operations

5.1 Holding Facility

The minimum number of fish to be transported per trip is 50 American Shad and/or 150 river herring. Until enough American Shad or river herring are collected on any given day to warrant a transport event, they will be held in circular holding tanks continually supplied with river water. An aeration system utilizing bottled oxygen will supplement ambient DO conditions as needed. Each holding tank will be fitted with a cover to prevent escape, reduce solar gain, and to reduce stress.

American Shad and river herring will be held a maximum of two days before a transport occurs. During a holding event, DO and water temperature will be routinely monitored and recorded to ensure suitable water quality throughout the day. At the end of the day if enough fish have not been collected to warrant transport, the fish will be held overnight. A full bottle of oxygen will be placed in service, the regulator adjusted for adequate oxygen disbursement, and a final DO and water temperature value recorded on the holding event data sheet prior to the end of operations. The circulating water velocity in the holding tanks will be checked on a regular basis throughout the season to assure that velocity is adequate for fish to orient into and to be sure that fish are not over exercised by high velocity. The holding tanks in use will be inspected throughout the day to ensure proper operation.

5.2 Transport Tank Skids

Prior to each trip, the transport truck and associated equipment will be inspected. The initial inspection will be done before any target species are transferred to a transport tank. Prior to fish being loaded from a holding or sorting tank into the transport tank, the transport tank will be filled with river water to a specified level. The tank and all drains will be secured and examined for leaks. Oxygen will also be supplied simultaneously to ensure that the amount of DO in the transport tank is at saturation. A final inspection will be conducted after the target species are transferred to the

transport tank. Then the transport tank will be filled to prevent sloshing when driving. The tank and all drains will again be examined for leaks and water quality parameters will be recorded. The tank lid will be closed and secured prior to transport.

Water temperature and DO values are monitored continuously and will be recorded every 15 minutes during the transport trip. The water temperature and DO reading will be collected and recorded at the fish release location prior to fish release. Appropriate flow is indicated by an indicator light on the control panel.

Prior to the start of transport operations, each transport unit will be filled to capacity with water, the water circulation pump turned on, and the entire unit checked for leaks, loose hose connections, etc. The velocity of the circulating water will be checked and adjusted to verify that the velocity is within the range of approximately 0.5 to 1.0 feet per second. Velocity measurements in each transport unit will be checked and recorded on a regular basis unless a unit has not been in service for several days or weeks. In that case, the transport unit will be checked prior to its initial transport after preseason calibration.

Transport events will occur when the capacity of the holding tanks is approached. Standard operating protocol will be to conduct transport trips when 200 American Shad or 1,000 river herring have been collected. The minimum number of fish to be transported per trip is 50 American Shad and/or 150 river herring. Fish may be held a maximum of two days prior to a transport during the early phase of the migration season when water temperatures are cooler. Later in the season, as river temperature approaches 21°C (70°F) the number of fish transported will begin to be reduced to a range of 150-175 American Shad. If available, river herring numbers will be reduced accordingly. Each transport skid tank will be equipped with supplemental oxygen/aeration. The tank lid will be secured prior to transport.

6.0 Data Collection/Reporting

Operational and environmental conditions and holding/transport numbers will be collected on a daily, weekly, and seasonal basis as appropriate.

Data to be recorded includes:

- Species counts per lift at each facility when the lift is operated in sorting mode.
- Number of American Shad and river herring collected, held, transported, sacrificed for biological information, or released back to river per day at each facility
- Biological information from a subsample of passing American shad and river herring, collected weekly and including sex ratio, spawning condition, length, weight, and age.
- Number of mortalities during holding events
- Number of mortalities during transport events
- Generation status of station turbines (on/off) and generation changes observed during fish lift operations

- Ambient river temperature and DO
- Qualitative description of weather conditions
- Equipment malfunctions or maintenance issues

All fish sorted or transported by each fish lift, including diadromous and resident species will be counted or estimated during the upstream anadromous fish passage season. A quality control check of data will be conducted each evening. After data verification is completed each day, a daily summary of fish lift operations per facility will be produced. The daily report will include the total number of migratory fish held overnight or transported upriver, hours of fishway operation, and documentation of any fish lift operation issues. Constellation will provide daily and weekly updates to the resource agencies that summarize fish lift operations. Constellation will also keep the resource agencies apprised of any modifications or interruptions to fish lift operations if they occur. A long-term data base will be created to incorporate Conowingo Station Data with fish lift data as specified in the FERC License Appendix 1, Section 12.4. USWFS and MDE will have full access to this database, as well as other resource agencies upon request.

Constellation shall provide the resource agencies with annual fish lift reports that will be part of the overall Fishway Operation and Maintenance Plan due by December 31 of each year. The annual report shall include summary information of the data listed above as well as the specific items listed in FERC License Appendix 1, Section 12.4.

7.0 Program Expansion Potential

For the 9-year period 2012 through 2020, the total number of American Shad collected or passed by both the EFL and WFL has ranged from 23,629 (in 2012) to 5,177 (in 2019) ([Table 7-1](#)). At the EFL in years 2012, 2013, and 2017, 1,000 or more shad were caught on four days of operation each season, dropping to three days of 1,000 or more shad in years 2014, 2015, and 2016. Based on these observations, Constellation will supply up to four transport units initially to transport the number of anadromous fish anticipated during the early stages of the trap and transport program for the EFL and WFL combined. If the population grows, the program will have the ability to expand simply by adding additional transport units. Annual internal reviews of the program will be conducted to improve overall success. Any modifications will be discussed with the resource agencies prior to, or during, the annual meeting to gain approval for the proposed adjustments to the program.

8.0 Initial Construction Items

The initial construction phase comprises primarily additional modifications to the facilities to better handle larger numbers of American Shad and river herring. Modifications will take place within three years of license issuance are described in the FERC License Appendix 1, Section 12.6.1 as follows:

12.6.1 Initial Construction Items

East Fish Lift Modifications

The Licensee shall modify the EFL facility to provide 900 cfs attraction flow to the EFL. Modifications to the EFL facility will include replacing spillway gates A & B, replacing the crowder system, addressing structural vibration issues, replacing diffuser gates A

and B, replacing the control system, and upgrading the electrical system to allow for a 15-minute lift cycle.

Replace the current 3,300-gallon hopper with two 6,500-gallon hoppers at the EFL

The Licensee shall remove the current hopper and install two 6,500-gallon hoppers within the existing superstructure of the EFL. One hopper will replace the current 3,300-gallon hopper and the second hopper will be located immediately upstream from the current location of the existing EFL hopper (see Figure 10). Access to both hoppers will be provided by the current entrance gates (A, B, and C) and the hoppers will share the same holding pool.

Trap and Transport Facilities at the EFL

The Licensee shall reduce cycle time at each hopper at the EFL to be able to lift fish four times per hour and complete modifications to the EFL structure to allow for trapping and sorting fish at the EFL facility and transporting them to the western side of the dam to a truck for transport upstream. Modifications to the EFL shall include two new sorting tanks; a loading tank; and a hy-rail truck and forklift, or functionally similar equipment, to facilitate movement of American shad from sorting tanks at the EFL to the west shore. These improvements shall be accomplished without losing a season of the passage provided by the EFL.

Trap and Transport Facilities at the WFL

WFL modifications shall be made to facilitate trap and transport including: decreasing lift cycle time by replacing the crowder linkage system and raising the elevation of the sorting tank(s), and providing a mechanism to allow for direct sluicing of fish into tanks mounted on the transport vehicle. These initial improvements shall be accomplished without losing a season of the passage provided by the EFL or trap and transport from the WFL.

Provide a Zone of Passage (ZOP) to the Fish Passage Facilities

The Licensee shall construct and maintain structures, to provide American shad and river herring a ZOP (i.e., route of passage) as described in this section.

In advance of any ZOP development and/or construction, the Service and Licensee will review CFD modeling results from the tailrace. The Licensee shall run the model under a predetermined number of structures arrangements (e.g., different angles, different spacing between the weirs, different weir slopes). In consultation with the Service, the Licensee shall choose to construct the configuration of structures that provides the most conducive hydraulic conditions for fish passage of river herring. The area to be considered for potential ZOP improvements includes approximately 2,500 feet on the west bank and 3,500 feet on the east side of Rowland Island. Based on CFD modeling results that analyze discharge velocities and turbulence, the Licensee shall provide stone weirs, and/or other suitable alternatives or measures that provide a contiguous zone of passage (ZOP) from the southern tip of Rowland Island to one or both of the lifts. The Licensee shall install up to ten stone weirs, with the option of considering other configurations for structures, so long as the total cost does not exceed the cost estimated for up to ten weirs. Model results will guide the placement and formation of these structures to provide for the hydraulic conditions necessary for the weakest

swimmers (river herring) to reach the lifts. Specifically, the ZOP must be designed to maintain instantaneous velocities below 3 feet per second, separated only by brief regions of higher velocity that river herring may traverse in seconds at burst speeds up to 6 feet per second, over the full range of operational flows for the EFL, and in all generation scenarios.

After ZOP construction is completed, the Licensee shall assess the ZOP for upstream migrating river herring under the full range of the current fish passage design flows (i.e., up to 113,000 cfs of river flow).

Five years after issuance of the FERC License, Constellation will be required to begin initial upstream passage efficiency tests⁵ per FERC License Appendix 1, Section 12.7.2. A post-modification efficiency test will begin in the first fish passage season immediately following any future required physical or operational modification implemented to approve attraction efficiency. A periodic efficiency test will be conducted every fifth year after a previous efficiency study determines that the adjusted efficiency of the project is achieving 85 percent passage efficiency for American Shad.⁶

In the fourth year after license issuance, Constellation will work with USFWS and other resource agencies to develop a one-year study to estimate the mortality of fish that are trapped and transported to areas upstream of York Haven Dam. This study will include assessment of immediate mortality (mortality occurring during transport) as well as delayed mortality (mortality occurring during some time period after release).

9.0 Trap and Transport Program Safety Protocols

All Constellation safety protocols will be followed during the construction phase that will modify both the EFL and WFL for conducting trap and transport activities. Procedures and guidelines for conducting all aspects of the program, (collection, holding, and transport of target fish species and invasive species) will be reviewed before and during facility operations to ensure that all work is being conducted as efficiently and safely (Appendices 1 and 2). Any issues that arise will be dealt with and resolved as soon as possible to minimize any delays or impacts to the trap and transport program.

10.0 Literature Cited

United States Fish and Wildlife Service. 2016. Decision Document and Modified Prescription for Fishways Pursuant to Section 18 of the Federal Power Act. United States Department of Interior. Federal Energy Regulatory Commission. 6/7/2016.

⁵ The Conowingo Fishway Effectiveness Monitoring Plan will provide details on efficiency testing and determining of mortality rates during trap and transport. This plan will be filed with FERC in September 2021.

⁶ Early Periodic Efficiency Tests may be delayed by up to two years to coincide with the schedule for tests at Muddy Run agreed upon in the 2015 Settlement Agreement between the Service and the Licensee.

Table 2-1: Conowingo Trap and Transport Mortality Rates (1991-1996)

Year	Conowingo WFL			Conowingo EFL			Mixed WFL & EFL			Overall Mortality
	# Transported	# Mortalities	% Mortality	# Transported	# Mortalities	% Mortality	# Transported	# Mortalities	% Mortality	Percentage
1991	10,183	117	1.1	9,738	335	3.4	3,861	172	4.4	2.6
1992	4,586	151	3.3	7,543	866	11.5	3,635	202	5.6	7.7
1993	3,973	112	2.8	6,983	518	7.4	215	13	6.0	5.8
1994	4,062	7	0.2	23,186	93	0.4	1,433	22	1.5	0.4
1995	12,212	53	0.4	37,648	137	0.4	5,906	33	0.6	0.4
1996	9,361	30	0.3	22,923	84	0.4	1,541	1	0	0.3
Total										1.79

Transport Mortality from EFL higher during the first three years due to design issues with customized trailer transport units.

During the “debugging process”, transport issues were addressed and resolved.

Information derived from SRAFRFC annual reports 1991-1996.

Table 7-1: Lift counts of American Shad and River Herring at the Conowingo EFL & WFL (2012-2020)

Year	Passed at Conowingo EFL		Collected at Conowingo WFL		Combined EFL and WFL	
	American Shad	River Herring	American Shad	River Herring	American Shad	River Herring
2012	22,143	52	1486	7	23,629	59
2013	12,733	7	2,030	2	14,763	9
2014	10,425	136	513	246	10,938	382
2015	8,341	13	875	46	9,216	59
2016	14,276	34	861	34	15,137	68
2017	16,265	65	736	5	17,001	70
2018	6,992	60	465	27	7,457	87
2019	4,787	15	390	13	5,177	28
2020	485	1	No Operation	0	485	1

Figure 2-1: American Shad Collections at Conowingo Dam, 1985 - 2001.

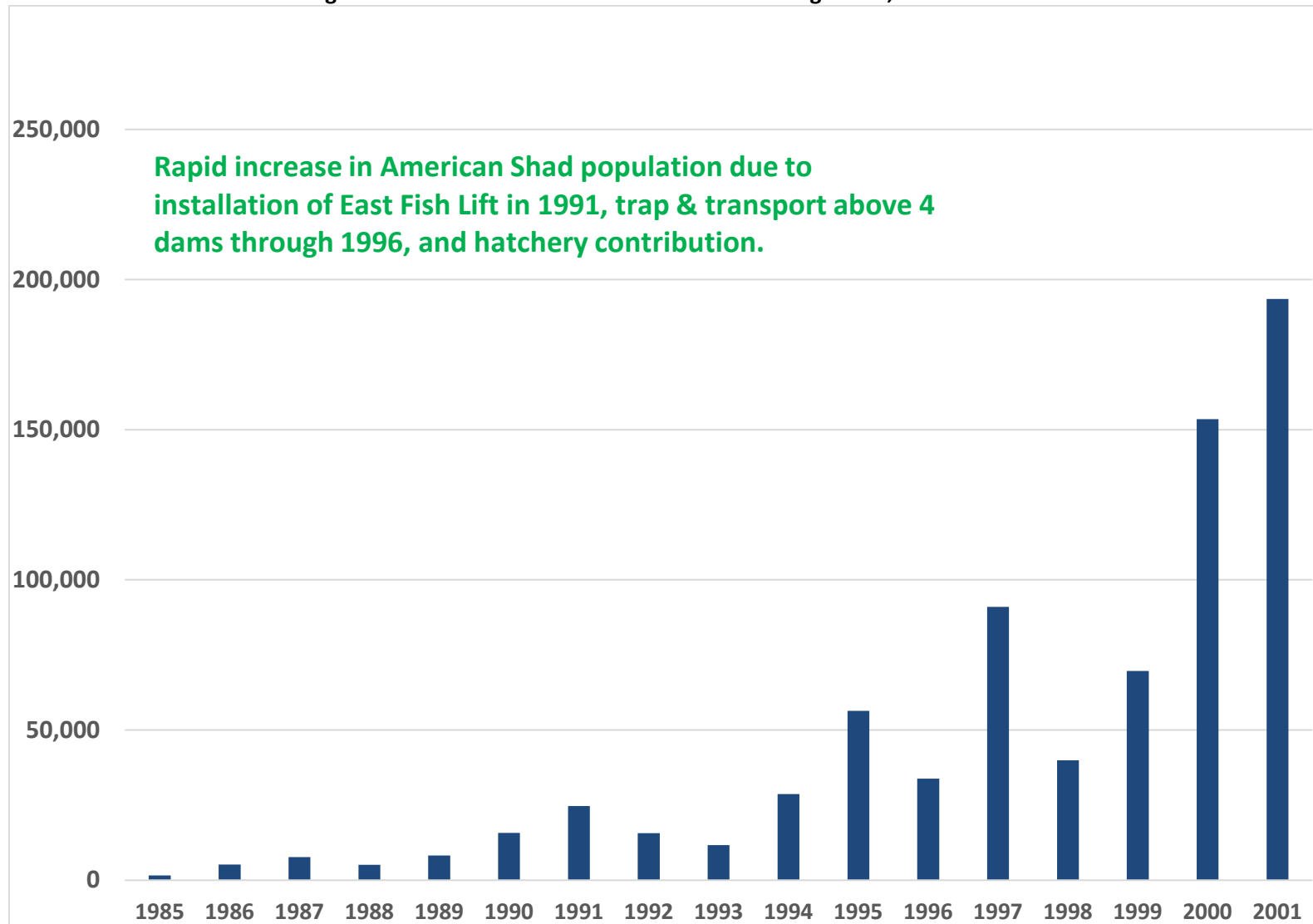


Figure 2-2. American Shad Collections at Conowingo Dam, 2002 - 2020.

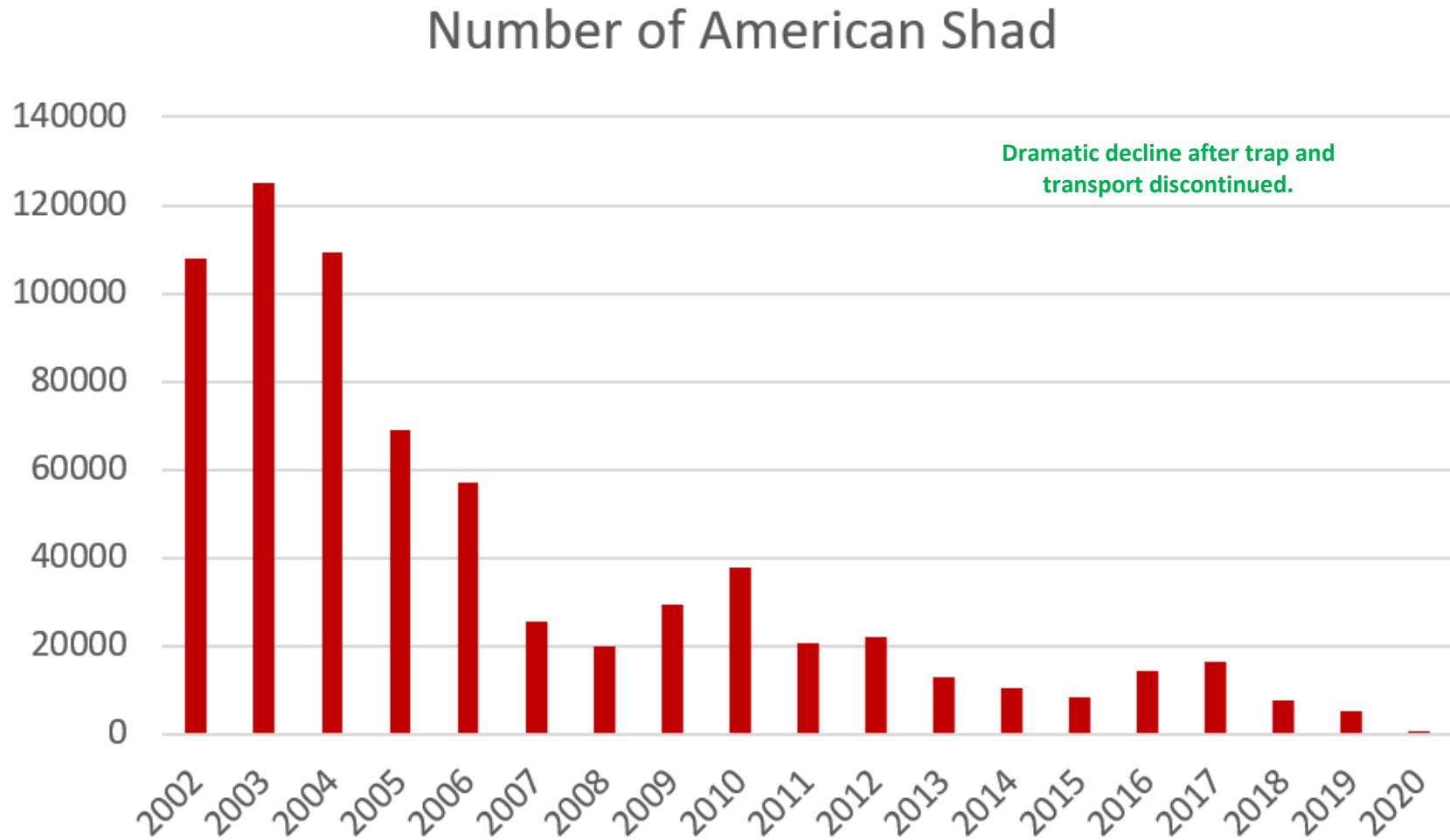
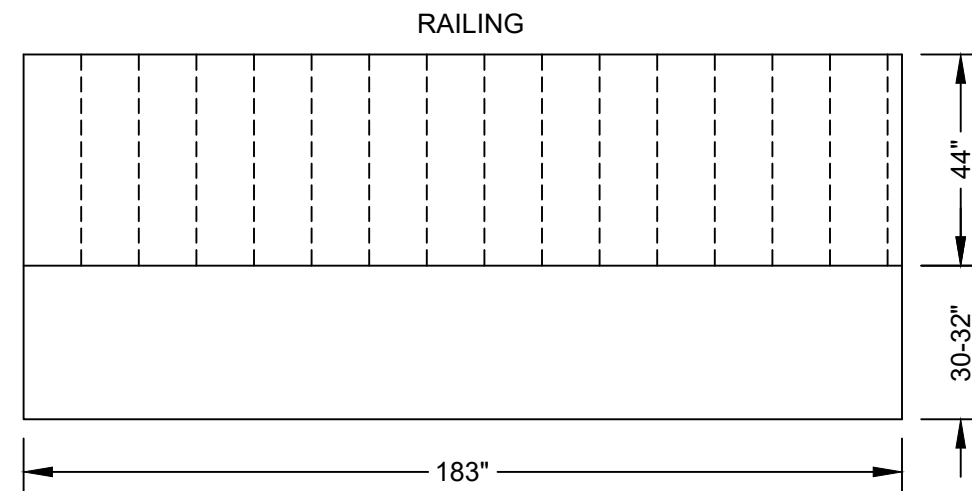


Figure 2-3: East Fish Lift Transport Unit, 1991-1996

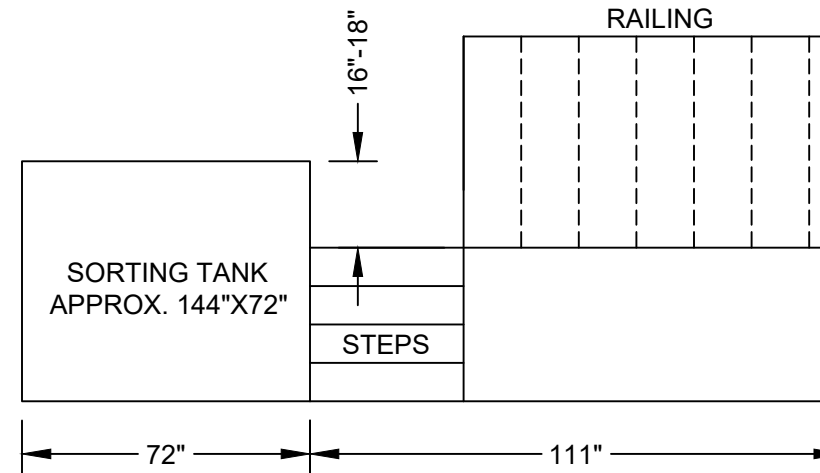


Figure 2-4: West Fish Lift Transport Unit, 1980-1999

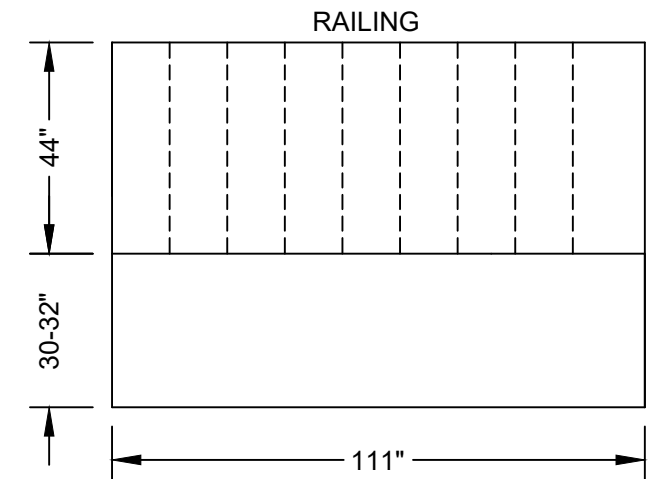




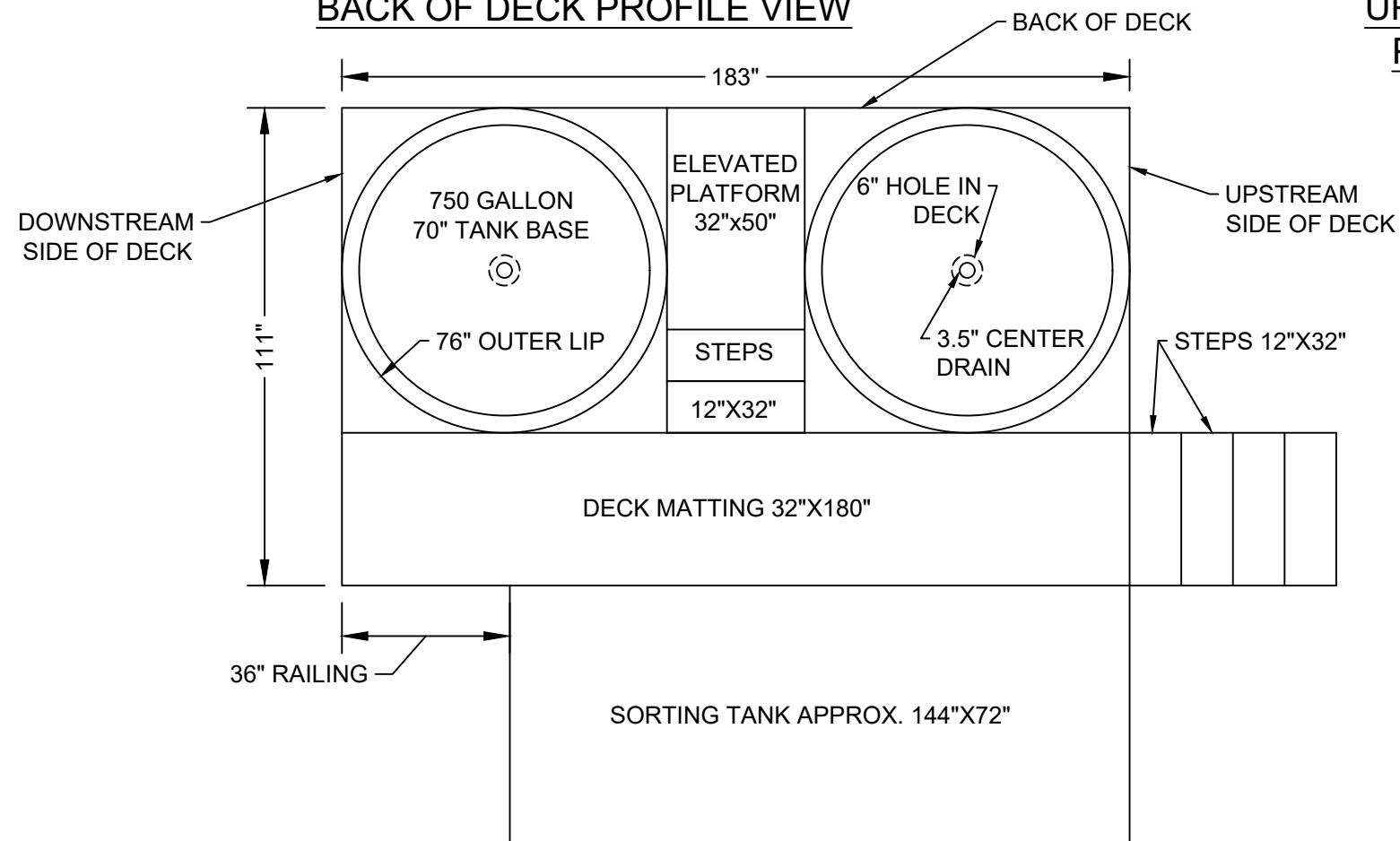
BACK OF DECK PROFILE VIEW



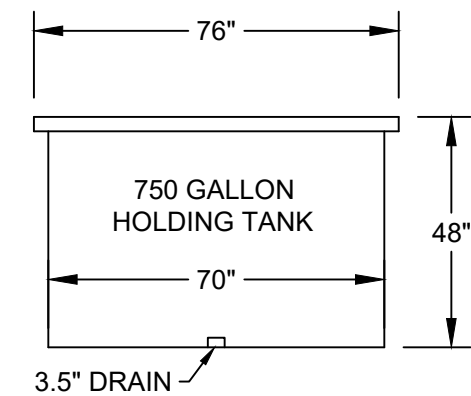
UPSTREAM DECK PROFILE VIEW



DOWNSTREAM DECK PROFILE VIEW



PLAN VIEW



TANK PROFILE VIEW



CONOWINGO HYDROELECTRIC PROJECT
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APPROVED BY: GSE PROJECT NO.: 2144

SCALE:
DATE: 12/2/2020

DRAWING NO.: 1

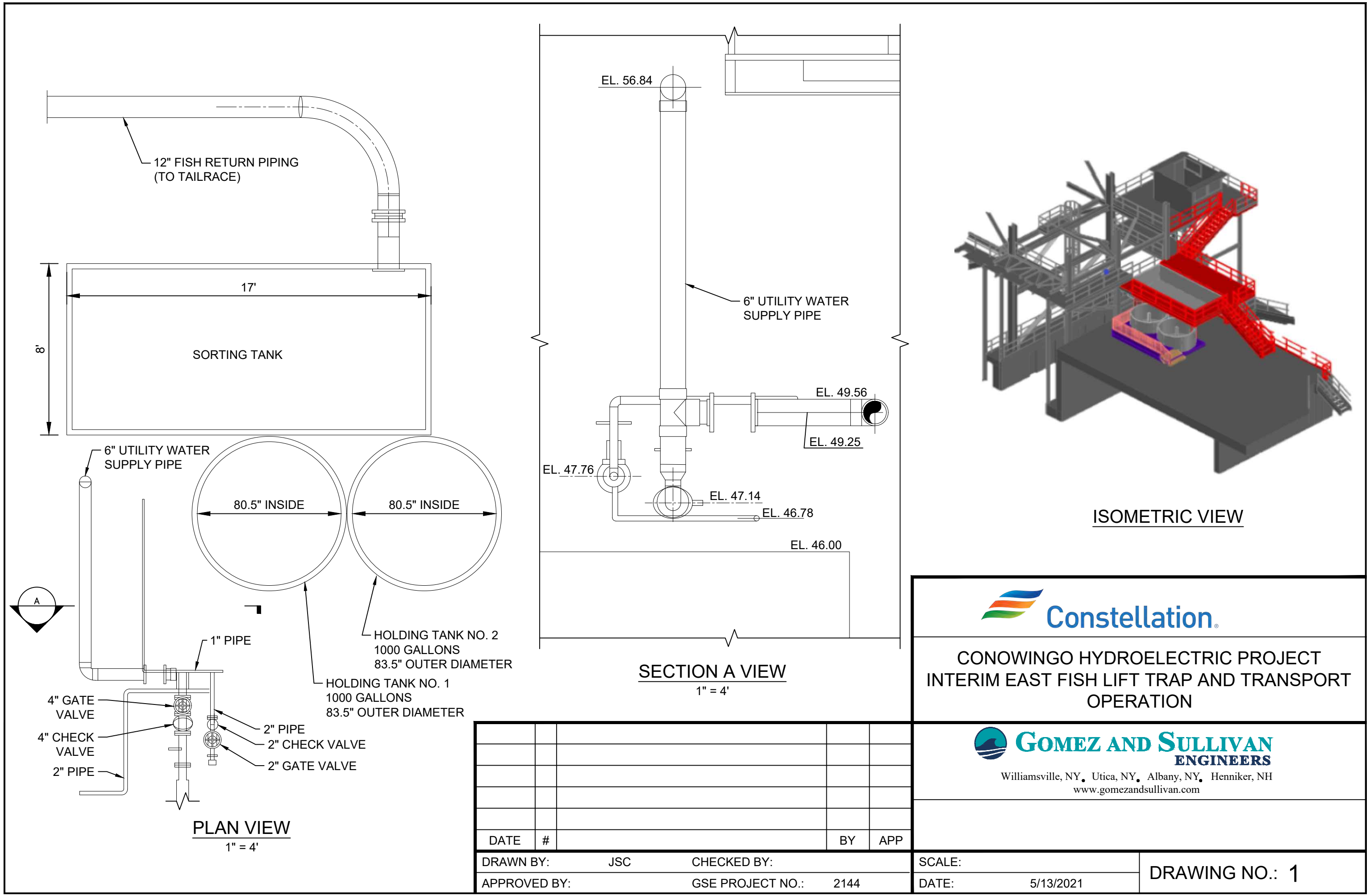


Figure 3-3: Transport Skid



Appendix 1: Guidelines for the Operation of the West Fish Lift Collection Facility, Conowingo Dam

GUIDELINES FOR THE OPERATION OF THE WEST FISH COLLECTION FACILITY, CONOWINGO DAM

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This guideline and all information contained herein is confidential proprietary information of Normandeau Associates, Inc. (Normandeau). The contents of this guideline shall not be disclosed outside of Constellation and shall not be duplicated, used or disclosed, in whole or in part, for any purpose other than to evaluate Normandeau's performance in the conduct of Constellation's Trap and Transport program at Conowingo Hydroelectric Project, as applicable to this guideline.

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1.0 Purpose

This document provides general guidelines for the operation of the West fish lift located at Conowingo Dam.

2.0 Scope

This guideline applies to personnel involved in the operation of the facility. This procedure specifies the correct methods necessary for safe, proficient operation of the facility.

3.0 References

3.1 Constellation Generation: Safety, Environmental, & Fundamentals Reference

4.0 Safety

4.1 Safety precautions and provided in reference 3.1 are to be observed at all times. Other applicable safety precautions, etc., as announced by Constellation shall be observed.

5.0 General Information

Upon arrival at the facility, notify the Control Room operator or designate and request appropriate service unit gate settings to correspond with turbine unit operation. The service units' discharge is routed into the facility and provides the facility's attraction water. Positioning of weir gates based on service unit gate settings as given in Attachment I provides a guideline to establish the desired attraction flow in the holding channel and at the entrances to the facility.

5.2 Depending on service unit availability, the largest volume of attraction water, based on the number of turbines units in operation (Attachment 1), should be utilized. During daily operation, each change (increase or decrease) in the number of turbine units operated requires that the weir gates be repositioned per Attachment I. In addition, should a change (increase or decrease) in the volume of attraction water discharged from the facility be required a request to change the service unit gate setting must be made through the Shift Manager and/or his designate.

5.3 Experimental operation has determined that the volume of attraction water discharged from the facility is a critical component of efficient facility operation. Based on service unit availability the facility can be operated at any level of discharge (within the range of its operational criteria; station discharges that range from 0 to 120,000 cfs). When the house unit is the only service unit operating set both weir gates 3.1 ft. below tailrace elevation or close either weir gate and open the other weir gate 6.2 ft. below tailrace elevation. Although the desired gate settings of both service units is 35% when one and/or a combination of 4 small turbine units are in operation, the facility can be operated by setting both weir gates 5.1 ft. below tailrace elevation at higher levels of station discharge. In addition, when five or more small turbines are in operation either weir gate may be closed and the other one set 10.2 ft. below tailrace elevation. Modified operation of the facility, one entrance open; occurs on an as

needed basis when large numbers of rough fishes (gizzard shad and/or carp) are attracted to the facility and decrease efficient collection of American shad.

In addition, although Attachment I lists the normal gate setting for the house service unit as 35%, at times, particularly early in the season when the station is at full generation it may be operated at a gate setting that ranges from 45 to 60%. When this occurs, an adjustment to the other house unit gate setting is made to ensure that the volume of attraction water discharged through facility equals the volumes prescribed in Attachment I. This ensures that the weir gate settings given in Attachment I provide the desired attraction flows at the entrances.

Once the service units have been adjusted per the request to Constellation and weir gates have been set in accordance with Sections 5.1 to 5.4, a clean out lift can be conducted (crowder doors not open) to remove fish that collected in the holding channel since the last day the facility was operated. After completion of the first lift (clean out lift) additional lifts are conducted at least twice per hour or on an as-needed basis based on visual observations indicating significantly large numbers of fish have collected in the holding/trapping area. Lifts are conducted throughout the day using the controls and indicators on the control panel as follows in Sections 6, 7, and 8.

6.0 Facility Operation Mode

6.1 The west fish lift has two equipment operation modes. The equipment is most often operated in the test mode to allow flexibility based on fishing conditions.

6.2 The equipment is also designed to operate in a run mode. In this mode only one function at a time is possible.

7.0 Standard Operations

7.1 Entrance Weirs

7.1.1 These weirs are operated by a manual control which will position the top of the weir to a selected depth.

7.1.2 Weir gate position is changed by depressing the corresponding pushbutton "raise", "stop", and "lower" on the control panel.

7.1.3 Weir gate position is determined by reading the individual counters mounted on the weir lifting drive shaft.

7.2 Crowder

7.2.1 Crowder operations begin with the hopper fully lowered. The crowder unit is positioned at the weir end of the structure with the crowder gates in the "intermediate close" position.

7.2.2 The crowder gates are closed by depressing the "close" pushbutton. A limit switch is activated stopping the motor when the crowder gates are fully closed.

7.2.3 The crowder assembly is moved towards the hopper end of the structure by depressing the "crowder forward" pushbutton. The crowder assembly moves at fast speed (20-25 feet per minute) until it is approximately 5 ft. from its maximum forward position where a speed adjustment switch changes the crowder to slow speed. The speed adjustment switch slows the crowder assembly's speed to 6-10ft per minute. A limit switch stops the crowder at the maximum forward position.

7.2.4 After the loaded hopper clears the channel (Section 7.3) the crowder assembly is moved back to the weir end of the channel. This is accomplished by depressing the crowder "reverse" pushbutton. The crowder assembly will move at slow speed until a speed adjustment switch changes the crowder to fast speed. The crowder will continue at fast speed until it reaches its fishing position where a limit switch stops crowder movement.

7.2.5 Once the crowder assembly comes to a stop the crowder gates are opened by depressing the crowder gate "open" pushbutton. The crowder gates are allowed to swing out until they are at least half way opened. At this point the gates are stopped by depressing the crowder gate "stop" pushbutton. The "intermediate close" pushbutton is depressed to return the crowder gates to the fishing position.

7.3 Hopper

7.3.1 When the crowder is fully forward the hopper "fast raise" pushbutton is depressed.

7.3.2 As the hopper nears the surface of the water in the channel the lift operator shall visually assess the number of fish in the hopper and the hopper fullness (i.e. 10, 25, 50, 75, 100, or over 100 percent full). If the number of fish exceeds hopper capacity {changes during season based on water temperature and DO) for one lift, a split lift is conducted (Section 8.1). If the number of fish present in the hopper is not excessive the lift proceeds as described below.

7.3.3 After clearing the channel the hopper continues to be raised until it approaches the swing arresting tracks mounted on the bottom of the hopper travel assembly. At this point the hopper is manually stopped by depressing the hopper lift "stop" pushbutton.

7.3.4 The lift operator shall observe the position of the hopper to be certain that it has come to a complete stop.

7.3.5 After the hopper is stopped the "slow raise" pushbutton is depressed. The hopper continues upward until the primary limit switch is engaged. The primary limit switch stops the hopper's movement in preparation for engagement of the hopper travel assembly. Should the primary limit switch fail, a secondary mechanical backup limit switch is engaged.

7.3.6 When the hopper's upward movement ceases the "hopper travel" (-) pushbutton is depressed. This starts the hopper travel assembly moving towards the sorting tank. The hopper travel "stop" pushbutton is depressed such that the hopper will be stopped directly over the sorting tank. In order to achieve this position a painted mark on the overhead support structure is matched with a similar mark on the hopper travel assembly.

7.3.7 As the hopper assembly approaches the sorting tank and deck area, the lift operator shall make sure that all personnel are cleared from the area. In addition, he shall ensure that a sufficient volume of water is in the sorting tank (a minimum of 12 inches).

7.3.8 The hopper "fast lower" pushbutton is depressed to begin the loaded hopper's descent. When the hopper is immediately (approximately 1 foot) above the sorting tank the hopper "stop" pushbutton is depressed. The hopper "slow lower" pushbutton is depressed right after the hopper "stop" pushbutton is depressed (before the hopper comes to a complete stop). As soon as the hopper door is tripped the hopper "stop" pushbutton is depressed. Immediately thereafter the hopper "fast raise" pushbutton is depressed.

7.3.9 The empty hopper is raised rapidly until it approaches the swing arrest tracks. At this point the hopper "stop" pushbutton is depressed. The hopper "slow raise" pushbutton is depressed to return the hopper to the fully raised position. The hopper is stopped at this position by the primary limit switch or by a secondary limit switch.

7.3.10 The hopper travel assembly is returned to the tailrace end of the hopper travel track by depressing the "hopper travel" (+) pushbutton. The hopper travel assembly is stopped by a limit switch when it reaches the point directly over channel.

7.3.11 The hopper "slow lower" pushbutton is depressed to lower the empty hopper down towards the channel. The hopper "stop" button is pushed when the hopper clears the swing arrest tracks. Depressing the hopper "fast lower" button resumes hopper movement towards the channel. When the hopper is submerged and comes to a rest on the channel floor a limit switch is activated to stop the release of the hopper cables. The lift operator shall carefully observe the cable motion and/or amount of slack to be certain that the hopper hoist motors have stopped.

7.3.12 The lift is shut down when the last lift of the day has been completed and all trash has been removed as described in Section 10.0. When the weir gates have been lowered to the lowest setting and the crowder doors have been closed, the lift operator shall double check all equipment before locking the control panel cabinet.

8.0 Special Operating Instructions to Maximize Collection of American Shad

8.1 Split Lift

8.1.1 If there are an excessive number of fish to be handled in a single lift as mentioned in Section 7.3.2, the hopper is returned to the bottom of the channel. This is accomplished by repeating the process given in Section 7.3.11.

8.1.2 The crowder assembly is moved back towards the weir end of the channel by depressing the crowder "reverse" pushbutton. When the crowder is approximately 5 ft. back from the maximum crowd position the assembly is stopped by depressing the crowder "stop" pushbutton. Note, in this position the crowder gates remain closed.

8.1.3 Once the crowder has been positioned the hopper is operated according to procedures in Sections 7.3.3 to 7.3.11 until the channel contains remaining fish that can be handled in one lift.

8.1.4 The final lift of a split lift is conducted by bringing the crowder assembly to the maximum crowd position as described in Section 7.2.3 and operating the hopper in a normal cycle. To avoid repeated split

lifts the operator must decrease fishing time (time crowder gate is open) on subsequent lifts (i.e., reduce fishing time from 30 min. to 20 min.).

8.2 Fast Fishing

8.2.1 Fast fishing is conducted on an as needed basis to increase efficiency of the facility by reducing mechanical delays associated with a normal lift cycle.

8.2.2 When fast fishing is conducted the crowder assembly remains stationary with the crowder gates in the intermediate close position. The hopper is run through a continuous normal cycle as described in Sections 7.3.3 to 7.3.11. This mode of operation is followed until the number of fish in a given lift is small enough to enable crowding.

8.2.3 If the number of fish being lifted in the fast fish mode exceeds the handling, holding and transportation capabilities of the sorting and transportation crew, the crowder gates must be closed.

9.0 Equipment Failure

9.1 If any mechanical and/or electrical failures occur during daily operations, contact an Constellation Representative concerning the continuation or termination of operations for the day.

10.0 Trash Removal

10.1 Trash accumulates on the picket barrier and on the crowder door screens. Thus, trash removal activities are to be conducted as needed or at the end of each day.

10.2 Following the last lift of each day the picket barrier is cleaned. In order to remove trash from the picket barrier, the picket barrier must be lifted out of the water. It is lifted by a chain hoist mounted on the superstructure directly above the barrier. The controls for hoist operation are mounted above the larger control box in the operator's booth and consist of two buttons. The upper button, when depressed, raises the picket barrier. It must remain depressed for the hoist to continue lifting. Properly attired crew (wearing life jackets) stationed on the fish lift deck, pick the trash off the barrier as it is raised in intervals. When all trash is removed and bagged for proper disposal, the "lower" barrier hoist control pushbutton is depressed until the barrier comes to a rest on the floor of the holding channel.

10.3 During the course of a season's operation at times a sufficiently large amount of debris can/will accumulate on the screens of the crowder doors preventing forward operation of the crowder assembly. At least weekly or on an as needed basis to remove trash from the crowder door screens the lift operator depresses the crowder swing "open" pushbutton. When the crowder doors are open and as to be parallel to the current in the channel, the crowder swing "stop" pushbutton is depressed. The crowder doors are left in this position as a trash removal crew deploys an air lance. The air lance is used to dislodge trash so that it will either be swept by the current through the opened doors or through the hinge crack which forms between the side screens and the door screens when the crowder doors are opened (Note: This procedure is conducted with one station service unit in operation at house load). Once the screens are cleaned normal operation of the facility is resumed and/or the doors are closed if the process is conducted at the end of daily operation.

11.0 Reporting

11.1 Complete a Conowingo Fish Collection Facility Operators Daily Log Sheet (Attachment II) and provide a copy of each sheet to Constellation at the end of season.

12.0 Attachments

- I. Matrix of service unit settings used to obtain desired attraction and holding channel velocities at the Conowingo West Fish Collection Facility.
- II. Conowingo Fish Collection Facility Operators Daily Log.
- III. Equipment settings during and at the conclusion of the fishing season.

Attachment I: Matrix of service unit settings used to obtain desired attraction and holding channel velocities at the Conowingo West Fish Collection Facility at various station operating conditions.

Station Operation	Service Unit Gate Setting		Flows (cfs)	Weir Depth below Tailrace (ft.)	Attraction Velocity	Holding Channel (ft./sec)
	No. 1	No. 2				
More than 4 Small Units	35%*	75%	265	6.9	6	1
1 to 4 Small Units	35%*	35%	150	5.1	6	1
No Generation **	35%	0%	75	3.1	6	1

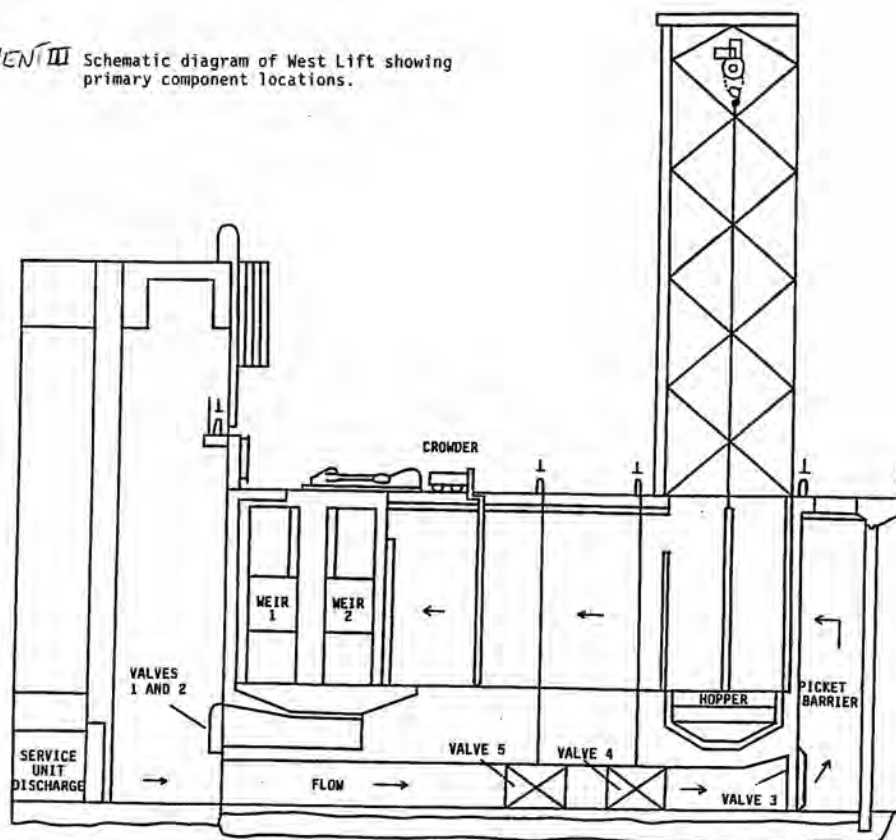
* Considered House Load

** Condition no longer exists during fish passage season

TRAP AND TRANSPORT LOGISTICS PLAN FOR ADULT AMERICAN SHAD AND RIVER HERRING AT CONOWINGO DAM (FERC PROJECT NO. 405)

Attachment III: Equipment settings during and at the conclusion of the fishing season.

ATTACHMENT III Schematic diagram of West Lift showing primary component locations.



Appendix 2: Guidelines for the Operation of the East Fish Lift Collection Facility, Conowingo Dam

GUIDELINES FOR THE OPERATION OF THE EAST FISH PASSAGE FACILITY, CONOWINGO DAM

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1.0 Purpose

This document provides a general guideline for the operation of the East Fish Passage Facility located at Conowingo Dam.

2.0 Scope

This guideline applies to personnel involved in the operation of the facility. Instructions contained in this procedure may be utilized to operate the facility in a trap and transport mode or enable direct passage of fish into Conowingo Pond.

3.0 References

3.1 Constellation (current revision) "Fundamentals, Safety & Environmental Handbook".

4.0 Safety

4.1 Safety precautions and guidelines provided in Reference 3.1 are to be observed at all times. Other applicable safety precautions, etc., as announced by Constellation shall be observed.

5.0 General Information/Instructions to Operate the Facility in Trap and Transport Mode

5.1 Upon arrival at the facility, notify the Control Room or designate. Also, make note of the station's prevailing generation status and which turbines are in operation. Obtain and record the existing tailrace and forebay (pond) elevation.

5.2 The operator shall refer to the applicable matrix table pertaining to the appropriate pond elevation to select the operating/fishing settings. In addition, the operator needs to make sure that when any or all mixed-flow turbines (Units 8, 9, 10 and 11) are in operation, upstream entrance A is usually closed. Under these conditions upstream entrance C can be utilized individually to attract fish into the facility. When Units 8, 9, 10, and 11 are off entrance A is utilized and entrance C is closed. The operator determines and selects what entrances are to be utilized based on the American shad catch and prior experience.

5.3 Based on the pond elevation, tailrace elevation, and turbine unit generation the operator will select the appropriate settings of the facility components to establish desired flow rates in and at the entrances to enable efficient operation. The settings for the following components are modified throughout the day to accommodate variations in pond and tailrace elevations and turbine unit generation:

- Upstream weir gate A
- Downstream weir gate C
- Diffuser A and B channel gates

- Crowder area gate
- Hopper stop position switch
- Spillway gates A and B

Note: Butterfly valve, spillway trough gate, and hopper trough gate need to be closed.

5.4 Prior to releasing attraction water into the facility (accomplished by the operation of spillway gates A and B), the operator determines the settings in 5.3 above and positions the gates and equipment using the controls and indicators of the control room panel. Once this is accomplished, the spillway regulating gates are set to the desired position. After the hydraulics in the facility reach equilibrium, daily trap and transport operations are ready to be conducted. If any mechanical and/or electrical failures occur during operations, contact a Constellation representative concerning the continuation or termination of operations for the day.

5.5 Spillway gates A and B, diffuser A and B channel gates, upstream weir gates A and B, crowder area gate, and downstream weir gate all have the following associated controls and indicators on the control panel.

5.5.1 Incremental position meter indicator (percentage open) according to a predetermined scale indicator.

5.5.2 Momentary open and close spring return to middle switches to adjust the equipment to the desired position.

5.5.3 A green indicator light which will be energized by a limit switch when the equipment reaches its fully closed position. This same limit switch will stop the equipment at the fully closed position.

5.5.4 A red indicator light which will be energized by a limit switch when the equipment reaches its fully opened position. This same limit switch will stop the equipment at the fully open position. NOTE: Both lights will be illuminated in intermediate position.

5.6 The upstream/downstream channel gate is no longer in service.

5.7 When all the above mentioned equipment is adjusted and the proper velocities have been achieved (velocities in the crowder channel from 0.5 to 1.5 fps, velocities in the vicinity of the upstream/downstream gate from 1.0 to 2.0 fps, and velocities at any entrance from 4.0 to 6.0 fps) a clean out lift can be initiated (crowder doors closed) to remove fish that may have entered the holding channel overnight (see Sections 5.7.1 to 5.7.18). During the fishing and lifting processes the lift operator will observe the pictures on the video monitors. These monitors (2) are located in the control booth to the right of the control panel. The pictures on the monitors are views as seen from two separate fixed cameras. One camera is mounted downstream and above the crowder channel. This camera provides a view of the channel, crowder unit and its operations. The other camera is mounted below the control booth and provides a limited view of the hopper as it moves up or down and may provide (at times based on lighting) a view of the fish being lifted. The lift operator will view the screen(s) when the hopper and crowder units are in motion to verify correct equipment position and functions. After satisfactory completion of the clean out lift additional lifts are conducted at least twice per hour or on an as needed basis. More frequent lifts may be made if significantly large numbers of fish (based on visual observation) have collected in the crowder area. Also, if the holding channel becomes overloaded with fish, "fast fishing" method may need to be utilized (Section 5.7.12). Lifts are conducted throughout the day using the controls and indicators of the control panel as follows:

5.7.1 Start with crowder screen lowered and hopper trough gate closed, crowder assembly in the fishing position, hopper in the lowered position, and crowder doors fully closed. If any or all of this equipment is not in position, make the necessary adjustments to set the equipment in this position before commencing lift operations (crowder doors, crowder, hopper hoist, hopper trough gate, and crowder screen green lights illuminated on the control panel).

CROWDER OPERATION

5.7.2 Depress the crowder screen "open" push button and the crowder screen will move to the fully raised position where a limit switch will stop the screen and energize a red light.

5.7.3 Depress crowder door "trap" push button and crowder doors will move to the trap position (doors open to 45 degree angle).

5.7.4 When enough fish have collected in the crowder section or a set fishing time has elapsed, depress the crowder door "close" push button, and crowder doors will move to the fully closed position, where a green light indicates "doors closed".

5.7.5 Following operator's visual confirmation of door position, move the crowder assembly from the fish position to the crowd position, depress the crowder "crowd" push button.

5.7.6 Once crowder "crowd" button is depressed, crowder will move at fast speed until it is approximately 6 ft from the maximum forward position where a limit switch reduces the crowder speed. The crowder will continue at slow speed until it reaches the maximum forward position where a limit switch stops the crowder and energizes a red light.

5.7.7 At this point the crowder screen shall be lowered. Depress the crowder screen "close" push button and the crowder screen will move to the fully lowered position where a limit switch will stop the screen and energize a green light.

5.7.8 After the crowder screen is fully lowered, the crowder assembly can be returned to the fishing position. The crowder should not be moved until the crowder screen is fully lowered and the crowder screen cannot be raised until the hopper returns to the fully lowered position.

5.7.9 To return the crowder assembly to the fishing position, depress the crowder "fish" push button. The crowder will move at slow speed until it is approximately 6 ft from the crowd position, where a limit switch increases the crowder speed. The crowder will continue at fast speed until it reaches the fish position, where a limit switch stops the crowder and energizes a green light.

5.7.10 At any time after the crowder switches to fast speed, it can be manually stopped using the "stop" push button.

5.7.11 Once the crowder assembly returns to the fishing position, depress the crowder door "trap" push button and crowder doors will move to the trap position (doors open to 45 degree angle).

5.7.12 Occasionally, large numbers of fish may enter the holding channel during the fishing time. When overloading is observed, conduct "Fast Fishing" as follows:

- Depress the crowder door "close" push button and the crowder doors will move to the fully closed position or operator may leave crowder doors in "trap" position.

- Depress the crowder screen "open" push button and it will move into the fully raised position. Immediately after the crowder screen is fully raised depress the crowder screen "close" push button and it will move into the fully lowered position.
- Use the hopper hoist controls to make the initial lift. (See Hopper Operation Section)
- Repeat the above procedure and continue to make as many lifts as necessary in order to thin out the fish in the holding channel.
- Close the crowder doors (if open during "Fast Fish" operations and depress the crowder "crowd" push button to move the crowder assembly forward and conduct the final lift.

HOPPER OPERATION

5.7.13 Start with the hopper door closed and the hopper fully lowered and the hopper hoist and hopper door green light illuminated on the control panel.

5.7.14 Depress hopper hoist "slow raise" push button and hopper will raise at slow speed to fully raised position. When the hopper reaches the discharge location at the fully raised position a limit switch stops the hopper and energizes a red light.

5.7.15 The fully raised position will be the sorting and trucking station which has been set using the hopper stop position switch on the control panel. An upper limit switch will provide a means of automatically stopping the hopper in the event that the fully raised limit is exceeded. When the hopper is fully raised to the sorting and trucking station, the hopper door can be opened. Before the hopper door is opened, the operator will shout "stand clear" to the sorting crew to ensure that it is secure and safe prior to opening the door.

5.7.16 When the hopper contents are completely discharged, the hopper can be returned to the fully lowered position using the hopper hoist "slow lower" or "fast lower" push buttons. Once the hopper reaches the water, it must be lowered in the slow lower mode so that the cables supporting the hopper do not become too slack. A limit switch will automatically stop the hopper and energize the green light when the fully lowered position is reached.

5.7.17 When the hopper is fully lowered, the hopper door can be closed. Depress the hopper door "close" push button. The hopper door will close and a green light will illuminate. (Note that the hopper door must be open when lowering the hopper into the water).

5.7.18 With the hopper fully lowered and the hopper door closed, the crowder screen can be raised as described in the crowder Section 5.7.8 and the fishing cycle can be repeated.

5.7.19 Repeat the above cycles as described for each lift until the last lift of the day is completed. Following the last lift, the crowder doors are to remain in the closed position until the start of the next day's operation.

5.7.20 At the end of daily operation and after trash has been removed (Section 7.0) position the equipment and gates as follows:

- Spillway gates A & B (closed)
- Downstream weir gate C (90% open)
- Diffuser A & B channel gates (open a minimum of 15%)
- Crowder area gate (open a minimum of 10%)

6.0 General Information and Instruction to Allow Passage of Fish Directly into Conowingo Pond

6.1 Prior to allowing any fish direct access into Conowingo Pond the hopper operation must be modified and the overhead trough must be opened.

6.2 To modify the hopper operation the following steps must be completed.

6.2.1 Raise the hopper up to sorting tank and empty the contents.

6.2.2 Change hopper stop position switch on the control panel from the sorting tank position to the spillway trough position. This will enable the hopper to be raised to the trough.

6.2.3 Raise hopper to control room level and install the plates over the drainage holes (up to 5 plates may need to be installed).

6.2.4 Lower the hopper to the level of concrete walkway.

6.2.5 Close the hopper door utilized during trap and transport operations. When closed, activate the air system for volitional passage enabling door on trough side of hopper to open.

6.2.6 Manually reverse plates in bottom of the hopper so they angle toward door on trough side of hopper. Open and close the hopper door a few times. This builds up air pressure in the line and assures that the door is working properly.

6.2.7 After the above steps are completed, open the hopper door and lower the hopper back into the fishing position.

6.3 To fill the trough, crack open the spillway trough gate slightly allowing the trough to fill gradually (butterfly valve closed; the butterfly valve is a manually operated valve that has visual indication of percent openings in 25% intervals). Once the water level in the trough equals the pond elevation, fully open the spillway trough gate.

6.4 After the trough is full, utilize a staff gauge located in the trough to obtain the pond elevation. Set the manually operated adjustable trash racks located at the pond entrance of the trough so a minimum of six inches of the racks are above the water level. This prevents large surface trash from entering the trough.

6.5 Based on pond and tailrace elevations and turbine unit operation, utilize the appropriate matrix table to position all equipment listed in Section 5.3, except spillway gates A and B. After all desired settings have been obtained, open spillway gates A and B to prescribed settings. Once the hydraulics in the facility have reached equilibrium, open the butterfly valve to 60%.

6.6 After completion of steps in Section 6.5 a clean out lift and subsequent lifts can be conducted following the steps outlined in Section 5.7 (exclude step 5.7.14). When the hopper is fully raised to the spillway trough, release the fish into the trough.

6.7 If trough operations are complete for a period of time, the trough will have to be dewatered. When the trough is dewatered it should be drained slowly and then stopped at a level which is low enough to enable personnel to enter the trough and allow remaining fish to be captured and removed. Fishes can either be stocked into Conowingo Pond or released into tailrace.

6.8 To resume trap and transport operations modify the hopper by reversing steps in Section 6.0. In addition, the hopper stop position switch **MUST** be set to the SORT position before normal fishing can be continued.

7.0 Removal of Trash from The Facility

7.1 During the daily operation of the lift in the trap and transport mode, debris enters the facility through spillway gates A and B and accumulates behind the trash racks. Trash rack A is located downstream of the crowder area gate. Trash rack B is located upstream of diffuser gates A and B. During the day, on an as needed basis (when flows in crowder area are affected), remove floating trash with a long-handled net from the upstream side of trash rack A.

7.2 After the final lift of the day and prior to setting all equipment in the proper position, close the crowder area gate and diffuser gates A and B and spill trash that accumulated in the stilling basin over the angled wall.

7.3 After the equipment has been positioned at the end of daily operation (Section 5.7.20), proceed to the area where the trash racks and hopper dividing screens are located.

7.3.1 Trash racks A and B and hopper dividing screens I and II are controlled by individual push button stations located at each piece of equipment which raise and lower the hoists as required.

7.3.2 Fully raise each trash rack and hopper dividing screen and remove any debris that has collected on them. Pick the trash that is within reach by hand and use a long-handled rake for more distant trash. Debris that accumulates in the channel as a result of hand cleaning the racks and screens needs to be removed by using a long-handled net. The collected trash must then be disposed of properly. A hoist is provided to lift trash from elevation 35 ft to elevation 45 ft.

7.4 If the facility has been operated in an upstream passage mode, trash is removed from the stilling basin and crowder channel following procedures outlined in Sections 7.2 and 7.3. Floating trash that accumulates in the downstream end of the trough is removed on an as needed basis during the day with a long-handled net to prevent damage to fish being sluiced into the trough from the hopper.

8.0 Reporting

8.1 Check and correct recorded data and produce the daily report. Record American Shad and River Herring numbers on Daily summary sheet

8.2 Send daily report via email to all pertinent Constellation and Resource Agency personnel.

**APPENDIX G. MUDDY RUN PUMPED STORAGE PROJECT AMERICAN EEL
PASSAGE PLAN**

PENNSYLVANIA WATER QUALITY CERTIFICATION EA 36-033

APPENDIX 1

**Exelon Generation
American Eel Passage Plan**

Muddy Run Pumped Storage Hydroelectric Project (P-2355-018)

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- IV. Upstream Passage (2031 - Term of New License)**

I. Introduction

Pursuant to the Federal Power Act, Exelon Generation (Exelon) filed new license applications with the Federal Energy Regulatory Commission (FERC) in August 2012 for the Muddy Run Pumped Storage Hydroelectric Facility (Muddy Run) and the Conowingo Hydroelectric Project (Conowingo). This American Eel Passage Plan (“Eel Plan”) is a condition of, and incorporated into, the Water Quality Certification for the Muddy Run Project. Under Section 401(d) of the Clean Water Act, the Eel Plan becomes a condition of the FERC license for the Muddy Run project.

II. Eel Passage Advisory Group

To inform implementation of the Eel Plan, Exelon will establish an Eel Passage Advisory Group (EPAG) by May 1, 2014. EPAG will be chaired by Exelon and composed of a representative from each of the following (collectively, the “Resource Agencies”): the Pennsylvania Department of Environmental Protection (PADEP), Pennsylvania Fish and Boat Commission (PAFBC), United States Fish and Wildlife Service (USFWS), the Maryland Department of Natural Resources (MDNR), Maryland Power Plant Research Project (PPRP) and the Susquehanna River Basin Commission (SRBC). Each designated representative shall be knowledgeable of American eel, the Susquehanna River, and ongoing fisheries and other related resource programs being implemented in the Lower Susquehanna River (*e.g.*, American shad restoration).

III. Upstream Passage for American Eel (2015-2030)

Consistent with the implementation plan set forth below, Exelon will trap, hold and transport American eels from the Conowingo Dam and transport them to designated points in the Susquehanna River watershed consistent with the level of effort established and described in this plan. Any trapping, holding, transportation or monitoring of eels or other eel related activities addressed in this plan that occurs in Maryland waters is expressly subject to any permits, licenses or authorizations that may be required by the State of Maryland related to such activities.

A. Trapping

Subject to required regulatory approvals, Exelon will design, install and operate an eel trapping facility along the western shore of the Conowingo Dam near the location of the current USFWS trapping location and facility, unless an alternate location is approved by the PADEP and MDNR in writing, according to the following schedule, unless an alternative schedule is approved by the PADEP in writing. In the event that the MDNR, USFWS or FERC determine that additional information, revisions, modifications, or amendments are necessary to the plans, specifications or construction activities, then within 60 days of receipt of written notice, Exelon shall submit to the Resource Agencies and FERC such information, revisions or amendments unless a longer period of time is approved by the requesting agency or FERC in writing.

1. Submit complete design plans and specifications for a trapping facility to the Resource Agencies and FERC by October 15, 2015;
2. Hold preconstruction meeting with MD and USFWS within 150 days of approval of the design plans and designs by FERC, MDNR and USFWS;
3. Begin construction within 180 days of receipt of approval of the design plans and specifications by the MDNR and USFWS;
4. Begin operation by May 1, 2017.

Beginning in 2014 and until Exelon's trapping facility along the western shore of the Conowingo Dam is completed, Exelon will work with the USFWS to trap eels using the USFWS trapping facility and will assist in the financial support of the USFWS trapping facility through a payment of \$20,000 per year to an entity approved by the PADEP with the capability of providing financial support to the USFWS Maryland Fisheries Resource Office for the eel trapping program. This payment will be made by May 1 of each year. In 2014, Exelon will participate in this effort using USFWS facilities, including the USFWS trapping facility, tanks and trucks. Beginning May 1, 2015, or such later date approved by the PADEP and MDNR, in writing, Exelon will use its own holding and transport facilities and continue working with the USFWS to trap eels using the USFWS trapping facility. Exelon will begin

operating the program independently, subject to USFWS supervision and input, using its own trapping facility when construction of that facility is completed.

Subject to required regulatory approvals, Exelon also will design, install and operate a temporary eel trapping facility on Octoraro Creek at a location approved by the PADEP in writing according to the following schedule, unless an alternative schedule is approved by the PADEP in writing. In the event that the MDNR, FERC, PADEP or the USFWS determine that additional information, revisions, modifications, or amendments are necessary to the plans, specifications or construction activities, then within 60 days of receipt of written notice, Exelon shall submit to the Resource Agencies and FERC such information, revisions or amendments unless a longer period of time is approved by the requesting agency or FERC in writing.

1. Conduct field evaluation using visual observation, electrofishing and other methods approved by the PADEP and USFWS, in writing, to evaluate and rank trapping locations on Octoraro Creek by September 15, 2014.
2. Submit complete design plans and specifications to the Resource Agencies by November 1, 2014;
3. Hold preconstruction meeting with PADEP and USFWS within 45 days of approval of the design plans and designs by FERC, PADEP and USFWS;
4. Begin construction within 90 days of receipt of approval of the design plans and specifications by PADEP and USFWS;
5. Begin operation by May 1, 2015.

If, after three years of operation, PADEP in consultation with EPAG determines the temporary eel trapping facility at Octoraro Creek is successful, Exelon will design, install, and operate a permanent eel trapping facility at this location in accordance with a schedule established by PADEP in consultation with the other Resource Agencies.

If, after three years of operation, PADEP in consultation with EPAG determines the temporary eel trapping facility at Octoraro Creek is unsuccessful, site-determination studies for an additional permanent trap will be performed beginning in 2017. Congregations of juvenile eels will be documented visually via bi-weekly nighttime surveys during the migration period; the locations surveyed will focus on the East Fish Lift area, the river banks and possibly lower-river tributaries, but will exclude the Conowingo Dam spillway. Based on the results of the site-determination studies, Exelon will design, install, and operate temporary mobile traps to inform the potential location of one additional permanent eel trapping facility. Temporary exploratory traps will be installed and operated at up to five locations determined by PADEP, MDNR and USFWS during 2018 and, if necessary, 2019, to assess the ability to collect sufficient numbers of juvenile eels for the eel passage program. Collection facilities for the temporary site determination study will be similar to those used in the 2011 and 2012 studies conducted by Exelon.

Based on the results of the site-determination studies, Exelon, in consultation with EPAG, will determine if and where an additional permanent eel trap is justified in support of the Eel Passage Program. If a decision is made in 2018 to install an eel trap at the selected location, unless a different date is established by the PADEP, MDNR and USFWS, that trap will be designed and constructed in 2019-2020, and operated beginning in 2021 subject to required regulatory approvals. If a second year of study is needed, the dates would advance by a year. Exelon will not be required to maintain and operate more than two permanent eel traps at any time during the term of the new license.

The collection device(s) for the two permanent eel trapping facilities will consist of a ramp-style trap leading to a collection tank at the top of the ramp. The collection device(s) shall have a capacity to pass 50,000 eels over a 24 hour period accommodating a minimum size of 3 inches. One or more pumping systems will provide attraction flow at the entrance of the ramp, flow in the troughs to allow eels to climb the ramp, and water to the collection and holding tanks. The lower section of the ramp will be designed to have removable covers or grating to allow eels to enter at differing water surface elevations. The ramp will contain two side-by-side troughs to provide redundancy and allow for the potential use of different climbing media in each trough. For the ramp on the western shore, the entrance to the ramp will be designed to accommodate the normal range of tailwater elevation (El. 12 – 25 ft). The additional permanent collection facility will contain elements of the facility on the western shore with the design modified to accommodate local conditions.

The trapping facilities will be operated continuously during the eel migration period from May 1 to September 15. Exelon will monitor and record days fished, hours fished and the weather. Daily counts of eels will be recorded. The method of counting under various capture scenarios will be developed in consultation with the EPAG. Temperature data will be obtained from Monitoring Station 643 (located approximately 0.6 miles below Conowingo Dam near the western shoreline) to examine river temperature in relation to catch rates of juvenile eels. Biweekly subsamples of collected eels will be examined for various life history parameters (e.g., length, weight, and condition factor). A portion of the subsampled eels will be sacrificed and examined for the presence of *Anguillicoloides crassus*.¹ Some of the sacrificed eels will have the otoliths removed and retained for age analysis. *Anguillicoloides crassus* infection rates (proportion of eels infected), the number of parasites per eel, along with associated age, length, and weight data will be reported. Additionally, Exelon will pay to have 60 elvers/year sent to the USFWS or such other entity that the PADEP may approve in writing, for wild fish health screening. The screening shall occur once per year and can occur anytime during the eel upstream passage season.

¹ This introduced parasite has been documented in juvenile eels collected at Conowingo Dam (Minkinen and Park 2012) and could affect the overall success of adult outmigration due to reduced swimming ability and potentially higher mortality of migrating silver eels (Szekely et al 2009).

B. Holding

Subject to required regulatory approvals, Exelon also will design, install and operate the holding facility for the west shore Conowingo Dam and the Octoraro Creek traps according to the following schedule, unless an alternative schedule is approved by the PADEP in writing. In the event that the MDNR, FERC, PADEP or the USFWS determine that additional information, revisions, modifications, or amendments are necessary to the plans, specifications or construction activities, then within 60 days of receipt of written notice, Exelon shall submit to the Resource Agencies and FERC such information, revisions or amendments unless a longer period of time is approved by the requesting agency or FERC in writing.

1. Submit complete design plans and specifications for holding facilities to the Resource Agencies by April 15, 2015;
2. Hold preconstruction meeting with PADEP and USFWS within 150 days of approval of the design plans and designs by FERC, PADEP and USFWS;
3. Begin construction within 180 days of receipt of approval of the design plans and specifications by PADEP and USFWS;
4. Begin operation by May 1, 2016.

Periodically, consistent with standards established by the PADEP, MDNR and USFWS, eels will be transferred from the collection tank to the holding tank(s) where they will be held prior to being transported upstream. The holding tanks will have an automatically engaging back up pump and an alarm that sounds in a daily staffed location if the primary pump malfunctions. The holding tank will have continuous temperature, dissolved oxygen and gallon/minute water exchange monitoring devices with alarms that sound in a daily staffed location if levels of any parameter are outside of established limits. Upon observation, dead eels will be removed, enumerated, and reported. The holding tank shall be designed and operated to hold eels at densities not exceeding 10 elvers per liter unless modified by PADEP in consultation with the other Resource Agencies. If necessary, aeration will be provided to the holding tanks.

C. Transport

Subject to required regulatory approvals, Exelon will design, construct and operate vehicle(s) to transport eels from the western shore and Octoraro facilities according to the following schedule, unless an alternative schedule is approved by the PADEP in writing. In the event that the FERC, MDNR, PADEP or the USFWS determine that additional information, revisions, modifications, or amendments are necessary to the plans, specifications or construction activities, then within 60 days of receipt of written notice, Exelon shall submit to the Resource Agencies and FERC such information, revisions or amendments unless a longer period of time is approved by the requesting agency or FERC in writing.

1. Submit complete design plans and specifications to the Resource Agencies and FERC by April 15, 2015;
2. Begin construction within 180 days of receipt of approval of the design plans and specifications by PADEP, MDNR and USFWS;
3. Begin operation by May 1, 2016.

Transport of juvenile eels will occur as necessary based on the capacity of holding tanks at the eel trapping facilities. All eels shall be moved within 1 week of capture. Eels from the holding tank(s) will be transferred to a transport vehicle equipped with an insulated transport container(s) that will be covered and aerated. The transport vehicle(s) will have an automatically engaging back up pump and an alarm that sounds in the cab of the vehicle(s). The transport vehicle taken will have continuous temperature and dissolved oxygen monitoring devices with alarms that sound in the vehicle(s) if levels of any parameter are outside of established limits. The transport vehicle(s) shall be designed and operated to hold eels at densities not exceeding 10 elvers per liter unless modified by PADEP in consultation with the other Resource Agencies. If necessary, aeration will be provided to the holding tanks on the transport vehicle(s). These eels will be trucked to appropriate release locations on the same day of removal from holding. Upon observation, dead eels will be removed, enumerated, and reported.

D. Release

Exelon will release eels at locations identified in Appendix A in amounts consistent with the release information provided to and approved by the PFBC in writing. Where feasible, eels will be released at public access locations. Unless otherwise directed by PFBC in consultation with EPAG, eels will be released: (1) at least one hour after sunset to promote eel dispersal and minimize predation; and (2) into at least three feet of water at multiple locations within designated release areas in order to avoid concentrations of eels that could become potential targets for increased predation. If necessary due to time limitations established by the Resource Agencies in writing, Exelon shall release eels at alternative locations to avoid mortality. The estimated number of eels released at each location will be documented in writing and on a GPS device capable of being mapped in a database as approved by the Resource Agencies. After release, any dead eels remaining in the transport vehicle or observed at the stocking locations will be removed, enumerated, and reported.

Modification of, or revisions to, the release locations in Appendix A shall occur after consultation with EPAG and consistent with the approval of the PFBC.

E. Quality Assurance/Quality Control

Exelon will develop a detailed quality assurance/quality control ("QA/QC") program according to the following schedule, unless an alternative schedule is approved by the PADEP in writing. In the event that the MDNR, PADEP or the USFWS determine that additional information, revisions, or amendments are necessary to the QA/QC program, then within 60 days of receipt of written notice Exelon shall submit to the Resource Agencies and such information, revisions or amendments unless a longer period of time is approved by the requesting agency in writing.

1. Submit a draft QA/QC program to the Resource Agencies for approval by April 15, 2014;
2. Implement the QA/QC program approved by the PADEP when trapping and transport begins.

Important parameters associated with trapping, collecting, holding, transport, release, and stocking will be recorded to assure and control the quality of various program elements. The collection of these data will assure that the program will be conducted according to design parameters, will adhere to sound scientific principles, and will allow for any necessary adjustments. The results of these quality assurance and quality control measures will be included in annual reports to the Resource Agencies and EPAG. Changes to the QA/QC procedures shall be submitted as requested by the PADEP, MDNR or USFWS in writing.

At a minimum, the QA/QC program shall provide:

- Detailed description of the eel trapping and holding process to achieve a minimum 95% survival rate.
- Detailed description of the eel transport process to achieve a minimum 95% survival rate.
- Collection facilities will be visually inspected daily to ensure proper operation.
- Design parameters for flows and key critical components (e.g. attraction flow, spray bar, collection tank) that will be measured weekly and qualitatively assessed daily to ensure that traps are operating within design parameters.
- Water temperature and dissolved oxygen and water exchange in the collection, holding, and transport tanks will be monitored continuously to ensure that water quality remains suitable for juvenile eels.
- Information on the periodic checks on the accuracy of the estimates of volumetric counts.

- Information on the cleaning and disinfection of the collecting, holding, and transportation tanks.
- Protocols for monitoring, removing, enumerating and reporting eel mortality.

F. Reporting, Monitoring, and Periodic Evaluation

1. *Reporting and EPAG Meetings*

During the eel passage season, Exelon shall provide a daily email to designated members of EPAG describing the status of trapping and trucking at each facility, the numbers of eels trapped and transported, any deviations from normal facility operations and the timing and substance of the resolution of any deviations.

On or before December 10 annually from 2015 through 2030, Exelon will submit a report to EPAG summarizing data from the trapping, collection, holding, transport, and stocking components of the Eel Plan for the calendar year. This report will provide program data to EPAG at the earliest practicable date, and provide EPAG with an opportunity to inform development of the Annual Report. On or before January 15 of the following year, Exelon will file an Annual Report with EPAG that analyzes annual data, including results from QA/QC.

Upon request, Exelon will meet with EPAG on or before February 15 of each year in which the Annual Report is filed.

2. *Periodic Evaluation*

Every three years, unless a different period is established by the PADEP in writing beginning in 2018 through 2030, Exelon will conduct stream segment evaluations through electrofishing or other method identified after consultation with EPAG. Representative stream segments will include tributaries and shorelines of the main-stem river. Exelon will propose locations and methods for this survey at least one year in advance to the Resource Agencies. Exelon shall implement the survey based on approval of the PADEP of the proposed locations and methods.

To implement the evaluations, eels will be captured by electrofishing, or other methods approved by the PADEP in consultation with the Resource Agencies. Sampling will be performed at block-netted transects along river shorelines and at block-netted segments of small tributaries using backpack electrofishing. The exact number, length, and location of transects sampled will be approved by the PADEP in consultation with EPAG.² Associated water quality parameters such as temperature and dissolved oxygen, as well as habitat characteristics, including mussel numbers observed, will be collected at each sampling location.

² It is anticipated that two weeks of electrofishing will be conducted during each third-year evaluation.

During sampling, the number of eels captured will be documented and data will be collected from a representative subsample of eels. A subsample of captured eels larger than 200 mm will be tagged with Passive Integrated Transponder (PIT) tags and released. Sampled eels will be scanned for PIT tags and data from recaptured eels will be recorded and included in the annual report. Data will include a variety of life history characteristics (e.g., length, weight, and condition factor) that can be assessed to determine how well stocked eels are utilizing the river and tributaries. A portion of the subsample will be sacrificed and examined for age (otolith analysis), gender, and level of *Anguillicoloides crassus* infection. Eels that are not sacrificed for further analysis will be measured, weighed, and released.

Results of stream segment evaluations will be included in the Annual Report and will document dispersal of the stocked eels, estimate the approximate density of stocked eels, and evaluate the growth, condition, age, gender and level of infestation with *Anguillicoloides crassus* of stocked eels.

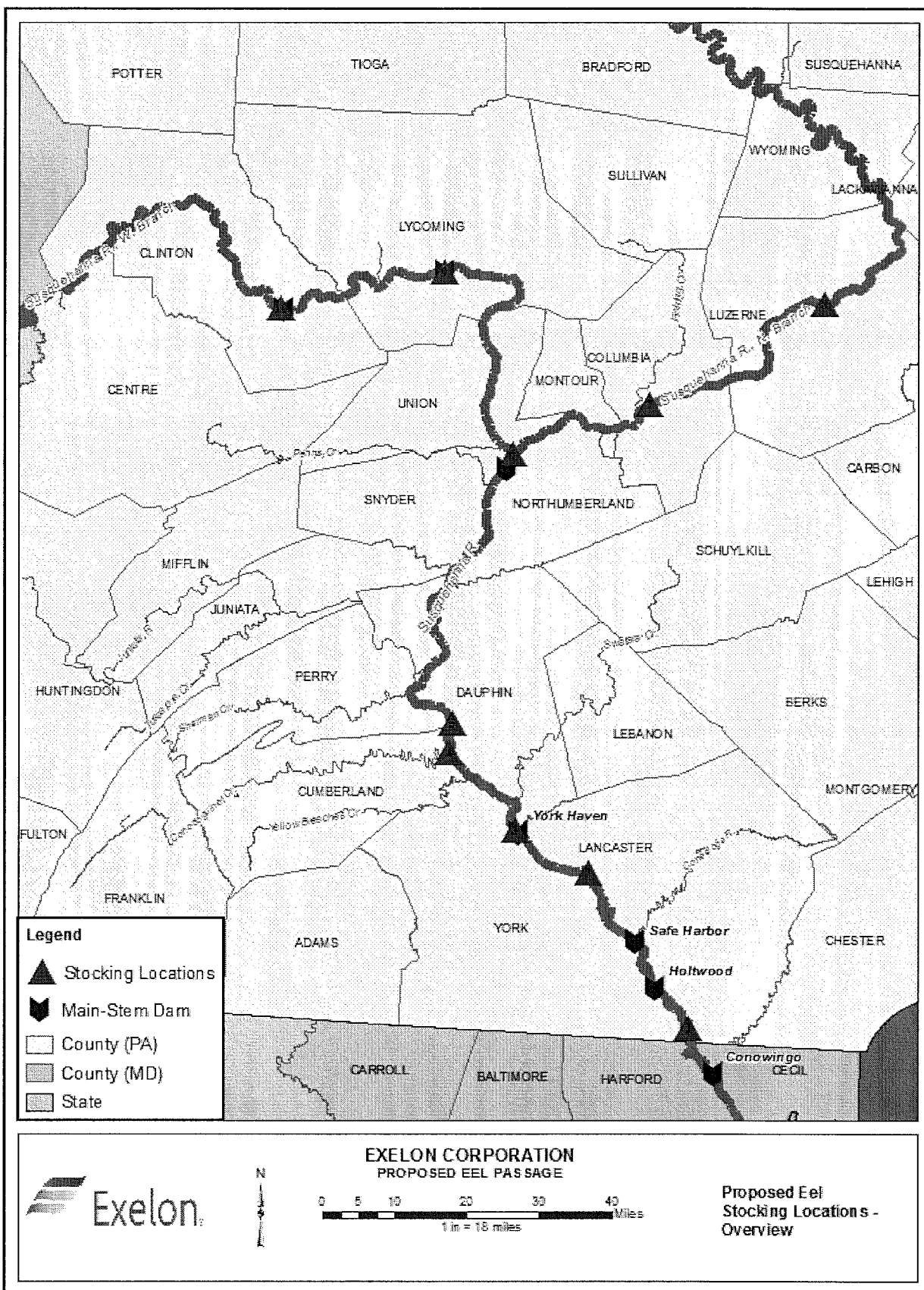
III. Upstream Passage (2031 - Term of New License)

If the upstream American eel passage trap and transport program terminates in 2030, Exelon will construct and operate a volitional upstream eel facility at Conowingo Dam through the term of the new license. Exelon will design and construct the volitional upstream eel facility, which will be operated in consultation with EPAG. In no event will Exelon be required to participate in the trap and transport program once the volitional upstream eel passage facility is operational.

If the upstream eel trap and transport and periodic evaluation program continues beyond 2030, Exelon will continue to provide access to the Conowingo eel collection facilities for as long as the program continues. Exelon, however, shall bear no cost responsibility for the trap and transport and periodic evaluation program until 2046, at which time cost responsibility shall be shared among all participants in the program.

APPENDIX A LOCATIONS OF EEL RELEASE

Site Number	Location	Water	County
1	Conowingo Pool	Susquehanna River	Lancaster
2	Between Holtwood and Safe Harbor	Susquehanna River	Lancaster/York
2	Between Safe Harbor and York Haven Dam	Susquehanna River	Lancaster
3	Upstream of York Haven Dam	Susquehanna River	Dauphin
4	West Fairview Access (Route 11/15)	Susquehanna River	Cumberland
5	Fort Hunter Access	Susquehanna River	Perry
6	Shikellamy State Park	Susquehanna River	Northumberland
7	Route 487 Bloomsburg	North Branch Susquehanna River	Columbia
8	Route 29 Bridge (Wilkes Barre)	North Branch Susquehanna River	Luzerne
9	Upstream of Hepburn Street Dam (Williamsport)	West Branch Susquehanna River	Lycoming
10	Upstream of Grant Street Dam	West Branch Susquehanna River	Clinton



Path: X:\GIS\Maps\Krazy\Eel Stocking\Eel Stocking Locations Updated 6-4.mxd

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- Minkinen, S. and I. Park. 2012. American eel sampling at Conowingo Dam, 2012. U.S. Fish and Wildlife Service – Maryland Fishery Resources Office.
- Székely, C., A. Palstra, K. Molnár, and G. van den Thillart. 2009. Impact of the swim-bladder parasite on the health and performance of European Eels, Chapter 9 in Spawning Migration of the European Eel, Fish & Fisheries Series, Volume 30, pages 201-226.

**APPENDIX H. CONOWINGO HYDROELECTRIC PROJECT AMERICAN EEL
PASSAGE AND RESTORATION PLAN**

**CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NUMBER 405**

AMERICAN EEL PASSAGE AND RESTORATION PLAN



Prepared for:



Prepared by:



and



September 2021

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Conowingo Hydroelectric Project
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LIST OF ABBREVIATIONS

CEECF	Conowingo East Eel Collection Facility
cfs	cubic feet per second
Conowingo Project or Project	Conowingo Hydroelectric Project
CWA	Chester Water Authority
CWECF	Conowingo West Eel Collection and Holding Facility
DO	dissolved oxygen
EFL	East Fish Lift
EPAG	Eel Passage Advisory Group
EPRP	American Eel Passage and Restoration Plan
Exelon	Exelon Generation Corporation, LLC
FERC or Commission	Federal Energy Regulatory Commission
hp	horsepower
L	Liter
MD	Maryland
MDE	Maryland Department of the Environment
MDE Settlement	Joint Offer of Settlement and Explanatory Statement of Exelon Generation Company, LLC and The Maryland Department of the Environment
m	meter
mL	milliliter
mm	millimeter
MRPSP	Muddy Run Pumped Storage Project
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
OECE	Octoraro Creek Eel Collection Facility
PA	Pennsylvania
ppm	parts per million
rpm	revolutions per minute
SRBC	Susquehanna River Basin Commission
USFWS	United States Fish and Wildlife Service
WQC	Water Quality Certificate

1 BACKGROUND

Exelon Generation Company, LLC (Exelon) is the licensee for the 570.15-megawatt Conowingo Hydroelectric Project (Conowingo Project or Project). The Project is located on the Susquehanna River (at river mile 10) in Pennsylvania and Maryland. Conowingo Dam is in Maryland, connecting Cecil and Harford counties, as are the lowermost six miles of the Project reservoir, Conowingo Pond. The remaining eight miles of Conowingo Pond are in Pennsylvania, within York and Lancaster counties.

The Conowingo Project Federal Energy Regulatory Commission (FERC or Commission) License requires Exelon to develop and submit an American Eel Passage and Restoration Plan (EPRP). Specifically, Article 415 states:

Within six months of license issuance, the licensee must file with the Commission for approval, an eel passage and restoration plan. The plan must include:

- a) detailed plans for modifications to the East Fish Lift to specifically accommodate a temporary eel trapping facility at a location within the East Fish Lift stilling basin in the vicinity of the foot of the spillway;*
- b) details regarding the annual operation and maintenance of all current and proposed eel fishways; and*
- c) proposed attraction flow velocity and volume, slopes of the ramps, matting, and methods to reduce predation.*

Within 30 days of license issuance, the licensee must submit the plan to the Maryland Department of the Environment (MDE), the Pennsylvania Department of Environmental Protection (Pennsylvania DEP), the Pennsylvania Fish and Boat Commission (Pennsylvania Fish and Boat), the Susquehanna River Basin Commission (SRBC), the U.S. Fish and Wildlife Service (FWS), and the Maryland Department of Natural Resources (Maryland DNR), for review. In the event that MDE, in consultation with the Pennsylvania DEP, the Pennsylvania Fish and Boat, SRBC, FWS, or the Maryland DNR, determines that additional information, revisions, modifications, or amendments are necessary to the eel passage and restoration plan, then within 60 days of receipt of written notice, the licensee must submit such information, revisions or amendments to the above-listed agencies.

The licensee must include with the plan an implementation schedule, documentation of consultation, copies of recommendations on the completed plan after it has been prepared and provided to the entities above, and specific descriptions of how the entities' comments are accommodated by the plan. The licensee must provide a minimum of 30 days for the entities to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Conowingo Hydroelectric Project
FERC Project Number 405
American Eel Passage and Restoration Plan

The Joint Offer of Settlement and Explanatory Statement of Exelon Generation Company, LLC and The Maryland Department Of The Environment (MDE Settlement) ([2019](#)) also requires the development of an Eel Passage and Restoration Plan that will:

(i) provide for modification of the EFL to accommodate a temporary eel trapping facility in the EFL stilling basin (the “Temporary Eel Trapping Facility”); (ii) contain details regarding the operation and maintenance of all existing and proposed eel fishways at the Project, including continued use of the EFL for eel passage after shad and herring season has ended; and (iii) establish attraction flow speed and volume, slopes of ramps, matting, and methods to reduce predation.

Exelon also operates the Muddy Run Pumped Storage Project (MRPSP) on the Susquehanna River in Pennsylvania (PA). The MRPSP FERC license includes an American Eel Passage Plan that requires Exelon to trap, transport, and stock eels in the Susquehanna River watershed from the Octoraro Eel Collection Facility (OECF) located at the Chester Water Authority (CWA) facility (located in Nottingham, PA) and the Conowingo West Eel Collection Facility (CWECEF) located on the west bank at Conowingo Dam. Under the MRPSP License, the eel collection season starts May 1 and ends September 15 at the OECF. The CWECEF will begin operation on May 1 and continue until the mean daily water temperature, as determined by hourly readings at Exelon’s monitoring station 643 (located 0.6 miles downstream of Conowingo Dam) or by manual readings taken at an alternative location within the Project tailrace, is 10 degrees Celsius or less for three consecutive days. The Conowingo East Eel Collection Facility (CEECEF)¹ will commence operation 10 days following the end of EFL operation and will continue to operate until the mean daily water temperature is 10 degrees Celsius or less for three consecutive days, as determined by hourly readings at Exelon’s monitoring station 643 (located 0.6 miles downstream of Conowingo Dam) or by manual readings taken at an alternative location within the Project tailrace.

¹ The temporary eel collection facility at the East Fish Lift stilling basin will be installed within twelve (12) months of completing the East Fish Lift modifications described in the FERC License, Appendix 1.

2 PROJECT CONFIGURATION

The Project consists of 1) a main dam, 2) a spillway, 3) a reservoir (Conowingo Pond), and 4) an intake and powerhouse.

The Conowingo Dam is a concrete gravity dam with a maximum height of approximately 94 feet and a total length of 4,648 feet. The dam consists of four distinct sections from east to west: a 1,190-foot long non-overflow gravity section with an elevation of 115.7 feet²; an ogee shaped spillway, the major portion of which is 2,250 feet long with a crest elevation of 86.7 feet, and the minor portion of which is 135 feet long with a crest elevation of 98.7 feet; an intake-powerhouse section which is 950 feet long; and a 100-foot long abutment section ([Figure 2.0-1](#)). The dam and powerhouse also support US Highway Route No. 1, which passes over the top of Conowingo Dam. The East and West Fish Lifts are located at opposite ends of the powerhouse.

Flow over the Conowingo Main Dam spillway is controlled by 50 stony-type crest gates with crest elevations of 86.7 feet and two regulating gates with crest elevations of 98.7 feet. Each of the crest gates are 22.5 feet high by 38 feet wide and have a discharge capacity of approximately 16,000 cubic feet per second (cfs) at a reservoir elevation of 109.2 feet. The two regulating gates are 10 feet high by 38 feet wide and have a discharge capacity of approximately 5,000 cfs per gate at a reservoir elevation of 109.2 feet.

Conowingo Pond extends approximately 14 miles upstream from Conowingo Dam to the lower end of the Holtwood Project tailrace. The Conowingo Pond is generally maintained at an elevation of 109.2 feet, with a surface area of approximately 8,500 acres and a total impoundment design volume of 310,000 acre-feet at that elevation.

The Project powerhouse contains eleven main turbines, as well as two house turbines ([Table 2.0-1](#)). The house units are located on the far western end of the powerhouse, whereas the larger units are arranged in order such that Unit 1 discharges near the western end of the dam, and Unit 11 discharges near the eastern end of the dam. Units 2 and 5 are equipped with aerating runners, which serve to increase dissolved oxygen (DO) levels in the turbine discharge water. The Project intakes for each turbine are individually protected by seven trash racks; five are entirely steel (clear spacing of 5.375 inches) and two are steel framed with wood racks (clear spacing of 4.75 inches). The top two racks are constructed of wood due to frazzle ice accumulations on the steel sections.

² Unless noted otherwise, elevations are in the National Geodetic Vertical Datum of 1929 (NGVD 1929), as opposed to Conowingo Datum. There is 0.702-foot difference between Conowingo Datum and NGVD 1929 Datum (i.e. El. 100.00 Conowingo Datum = 100.702 NGVD 1929 Datum).

Conowingo Hydroelectric Project
FERC Project Number 405
American Eel Passage and Restoration Plan

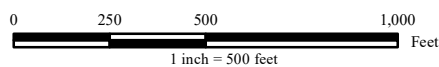
Table 2.0-1: Conowingo Project Turbine Specifications

Unit	Type	Runner Speed (rpm)	Rated Output (hp)	Approx. Rated Discharge (cfs)
House #1	Francis	360	1,900	247
House #2	Francis	360	1,900	247
1	Francis	81.8	64,500	6,749
2	Francis	81.8	54,000	6,320
3	Francis	81.8	64,500	6,749
4	Francis	81.8	64,500	6,749
5	Francis	81.8	54,000	6,320
6	Francis	81.8	64,500	6,749
7	Francis	81.8	64,500	6,749
8	Mixed-Flow Kaplan	120	85,000	9,352
9	Mixed-Flow Kaplan	120	85,000	9,727
10	Mixed-Flow Kaplan	120	85,000	9,727
11	Mixed-Flow Kaplan	120	85,000	9,727



**EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405
Eel Passage and Restoration Plan**

**Figure 2.0-1:
Project Configuration**



3 UPSTREAM TRAPPING, TRANSPORT, AND STOCKING FOR AMERICAN EEL

Exelon will trap and hold American Eels and then transport them to designated stocking locations in the Susquehanna River watershed in compliance with Article 414 and FERC License Appendix 1. Article 414 reads:

Upon license issuance, in addition to complying with U.S. Department of the Interior's section 18 prescription (Appendix 1), the licensee must:

- a) Operate all current and proposed eel fishways on the west side of the Conowingo Dam from May 1 until mean daily water temperature, as determined by hourly readings at Exelon's monitoring station 643 (located 0.6 mile downstream of Conowingo Dam), is 10 degrees Celsius or less for three consecutive days.*
- b) Operate all current and proposed eel fishways on the east side of Conowingo Dam from 10 days after the date that American shad operations cease at the East Fish Lift until mean daily water temperature, as determined by hourly readings at Exelon's monitoring station 643 (located 0.6 mile downstream of Conowingo Dam), is 10 degrees Celsius or less for three consecutive days³.*
- c) Maintain the upstream eel passage trap and transport program through 2035 .*
- d) During the 10 years of operating the East Fish Lift with the eel temporary modifications (12.6.1 of the section 18 prescription), if the number of eels exceeds the maximum capacity of eels per unit of ramp area, redesign and construct the East Fish Lift - Eel Temporary Modifications to reduce crowding.*
- e) If, after 10 years of operating the East Fish Lift with the eel temporary modifications (12.6.1 of the section 18 prescription), the 10-year average annual catch of the East Fish Lift is greater than or equal to 50% of the comparable 10-year average catch of eels at the eel trapping facility at the West Fish Lift, design, install, and operate a permanent eel trapping facility at the location of the East Fish Lift, in accordance with a schedule agreed upon by the Maryland Department of the Environment (MDE) and the U.S. Fish and Wildlife Service (FWS), and approved by the Commission. The 10-year average must be based on comparable dates of operation, as the East Fish Lift eel temporary modifications will operate a shorter period than the eel trapping facility at the West Fish Lift. The licensee must maintain and operate the eel trapping facility at the West Fish Lift for the term of the new license, but is not required to maintain and operate more than two permanent eel traps (e.g., the eel trapping facility at the West Fish Lift and either an eel trapping facility at the location of the East Fish Lift or Octoraro Creek, or comparable facility required under the Muddy Run Project License (FERC No. 2355) at any time, unless otherwise directed by the Commission.*

Unless otherwise directed by the Commission, the licensee must not make any modifications, undertake any construction, or make any changes to the operation of any eel fishway without the agreement of the MDE and FWS and approval from the Commission.

³ Station 643 will operate through October 31 each year. Beginning November 1, water temperature readings will be taken manually at the CWFECF.

The Commission reserves the right to require changes to any proposed modification. Modifications must not begin until the licensee is notified by the Commission that the modifications are approved. Upon Commission approval, the licensee must implement proposed modifications, including any changes required by the Commission.

All activities addressed in this EPRP that occur in Maryland waters are subject to any permits, licenses, or authorizations that may be required by the State of Maryland. All activities addressed in this EPRP that occur in Pennsylvania waters are subject to any permits, licenses, or authorizations that may be required by the Commonwealth of Pennsylvania.

3.1 Description of Facilities

Per MRPSP FERC license requirements, Exelon currently operates two American Eel collection facilities, the CWECF on the west shore of the Susquehanna River near Conowingo Dam and the OECF on Octoraro Creek below the Pine Grove Dam in Chester County, Pennsylvania. In addition to these two collection facilities, Exelon will design, construct, and operate a temporary eel collection facility in the vicinity of the Conowingo EFL, the CEECF. Features of each collection facility are detailed below.

3.1.1 Conowingo West Eel Collection Facility

The CWECF is located on the right (west) bank of the Conowingo Dam tailrace ([Figure 3.1.1-1](#)). Beginning in 2005, US Fish and Wildlife Service (USFWS) began collecting eels near the base of the Conowingo Dam at various locations. Information from these initial studies assisted in directing restoration efforts in the Susquehanna watershed above Conowingo Dam. During 2005 and 2006 exploratory efforts were conducted to determine the best placement and design of a temporary trapping facility. In 2007, elvers were observed climbing up the riprap where water was spilling over from pumps operated to supply water for the West Fish Lift operations. Since 2008, eels have been trapped and transported near this area on the west side of the Conowingo Dam in some capacity. From 2008 through 2016, excess water from the West Fish Lift operations was used as attraction flow over riprap. Elvers that found this attraction flow would crawl up the riprap to the trap and they were then transported and stocked in tributaries to the Susquehanna River and the Susquehanna River mainstem. In 2013, the USFWS increased the number of holding tanks and water supply and drainpipe sizes to improve holding capability. From 2005 to 2016, annual eel captures ranged from 19 to 293,141, with a total of 839,120 eel captures during the entire 2005-2016 period. The current facility was constructed in 2017 per USFWS design criteria and consists of four main elements: (1) a water supply line; (2) a ramp; (3) a collection tank; and (4) multiple holding tanks.

3.1.2 Octoraro Creek Eel Collection Facility⁴

The OECF is located on the left bank of Octoraro Creek immediately downstream of the CWA's Pine Grove Low-Head Dam ([Figure 3.1.2-1](#)). The facility was constructed in 2015 and consists of three main elements: (1) a water supply line and a submersible pump; (2) two ramps; and (3) a collection tank. Eels collected at the OECF are transported directly to, and held at, the CWECF at Conowingo Dam prior to transport upstream.

3.1.3 Conowingo East Eel Collection Facility

The CEECF will be located at the stilling basin dissipation wall within the EFL at Conowingo Dam, as called for in the MDE Settlement ([2019](#)) ([Figure 3.1.1-1](#)). The CEECF is an experimental facility that will operate for 10 years on a temporary basis to determine its suitability as a potential permanent location for the collection of eels. The location of the facility within the EFL was recommended by MDE to evaluate the feasibility of capturing eels on the easterly side of Conowingo Dam, as the American Eel Passage Plan

⁴ Details governing the Octoraro Creek Eel Collection Facility are contained in the MRPSP American Eel Passage Plan.

contained in the MRPSP FERC license as well as the Conowingo FERC license, Appendix 1 precludes the construction of any American Eel collection facilities below the Conowingo spillway. The facility will consist of three main elements: (1) a water supply line; (2) a ramp; and (3) a collection tank. Eels collected at the CEECF will be transported directly to, and held at, the CEECF prior to transport upstream. This facility will be installed and put in service 12 months after modifications related to upstream American Shad and river herring passage at the EFL are completed. Operation of the facility will start each season ten (10) days following the end of the operation of the East Fish Lift.⁵

3.2 Trapping and Collection

3.2.1 Design

For the purposes of this plan, “trapping” includes the operation of a ramp-style trap and “collection” refers to operation of the collection tank where juvenile eels are temporarily held after ascending the ramp. All facilities are a flow-through system and no recirculation of any water is used except for attraction flow.

Conowingo West Eel Collection Facility

This facility was put in service on May 1, 2017 upon approval by FERC and the Muddy Run Eel Passage Advisory Group (EPAG)⁶. Under Conowingo License Article 414, the CEECF will operate through 2035. The CEECF contains one collection tank, which is 1.02 meter (m) wide with a length of 1.83 m. The depth of the water in the collection tank is about 686 millimeters (mm), with a volume of approximately 1,274 liters (L). With a maximum density of 10 eels per L, the collection tank can hold up to 12,740 eels at once. The collection tank has 203 mm of freeboard to keep eels from climbing out of the tank. The main flow into the collection tank is provided from the 51-mm fill line with the terminus of the pipe about 51 mm above the waterline providing a constant flow of freshwater to the tank. Also, some water from the spray bar flow also enters the collection tank from the backside of the ramp. The upper end of the ramp is custom fitted into the collection tank and ends about 102 mm above the high-water mark in the tank. The collection tank contains a drain comprised of a 102-mm diameter PVC pipe with holes drilled through it and wrapped in 1-mm mesh to prevent juvenile eel escapement. The 102-mm collection tank drain line contains a 25-mm gravity drain line with a ball valve that is directed to the highest point possible (gravity feed) of the ramp, thus providing eel scent from the eels in the collection tank to the ramp. The collection tank also contains a 76-mm drain line, positioned about 76 mm off the bottom. The drain line attaches to a gate valve that remains closed until eels are removed. The 76 and 102-mm flexible drain lines empty into the overflow tank. The collection tank was custom fitted with a lid made from 6-mm polycarbonate sheet. In addition to the in-line flow meter, the collection tank contains a water temperature and DO probe.

The juvenile eel ramp is constructed of an aluminum cable tray. The cable tray contains landscape fabric climbing substrate (Enkamat 7010) attached to the tray bottom. This substrate consists of a dense three-dimensional mesh of fused filaments, which provides a climbing surface for the juvenile eels. The ramp consists of an approximately 8.75 m long by 457 mm wide cable tray positioned at a 42.5° angle, plus a continuous length of tray that is bent and shaped at a 90° angle over a 25 mm radius at the top of the ramp to convey juvenile eels into the collection tank. The entrance of the ramp is at elevation 29 feet, which is above the normal high-water line (elevation ±21 feet), with a smooth transition to the existing rip-rap shoreline. The facility is designed so that eels ascend the riprap between the tailwater surface and the entrance of the ramp. This portion of the riprap is wetted from the attraction flow exiting the eel ramp and the overflow tank down to the tailwater level. Once eels ascend the rip-rap portion, they enter the eel ramp

⁵ The East Fish Lift operation will operate until river temperatures rise above 72 degrees Fahrenheit for four consecutive days, but ending no earlier than June 1 and no later than June 15.

⁶ EPAG is a requirement under the MRPSP License and is chaired by Exelon with membership consisting of representatives of Pennsylvania Department of Environmental Protection, Pennsylvania Fish and Boat Commission, USFWS, the Maryland Department of Natural Resources, and the SRBC.

and can ascend to the collection tank. The ramp is held in place by six metal braces, evenly spread across the length of the ramp, and attached to large substrate along the shoreline. The ramp is covered from the top down to near the entrance to protect juvenile eels when ascending. The large 60% shade cloth⁷ is installed below the entrance to help protect juvenile eels between the tailrace and the entrance of the ramp.

The facility uses up to 265 L per minute of water to provide attraction flow to the eel ramp and for use within the collection tank. A 203-mm diameter gravity feed line supplies water for the CWEFCF. The water line forms a manifold at elevation 46 feet and contains four 51 mm globe valves for the Conowingo West Fish Lift and one 76 mm gate valve for the CWEFCF. The main water line for the CWEFCF is 76 mm in diameter, but each fill line for each tank is 51 mm in diameter. Each fill line has one 51 mm gate valve and one 51 mm angle valve along with an inline flow meter between these valves. A separate 25 mm line with a ball valve continuously discharges water down the ramp and into the collection tank via a spray bar, keeping the substrate moist and creating a flow to attract juvenile eels. Climbing ramp flow is augmented by a 25-mm diameter scent line from a tap and ball valve from the collection tank drain providing additional attraction flow via this gravity feed hose. The overflow tank collects the water from the collection tank and the holding tanks that are in service. Two 102-mm diameter additional attraction flow pipes drain the overflow tank and are discharged near the entrance of the ramp. These additional flow pipes are discharged above the shade cloth allowing the water to disperse over a larger area and provide additional attraction. All water from the ramp and the additional attraction pipes provides the overall attraction flow down the shoreline riprap to the tailrace. Engineering drawings for the facility are in [Appendix A](#).

Octoraro Creek Eel Collection Facility

The OECF collection tank is 660 mm wide with a length of 1,575 mm. The depth of the water in the collection tank is about 299 mm, with a volume of approximately 310.4 L. With a maximum density of 10 eels per L, the collection tank can hold up to 3,104 eels at once. The collection tank has 209 mm of freeboard to keep eels from climbing out of the tank. The collection tank is filled by allowing some of the spray bar flow to enter the collection tank, thus providing a constant flow of freshwater to the tank. The collection tank contains two drains that are comprised of a 76-mm PVC pipe with holes drilled through it and wrapped in 1-mm mesh to prevent juvenile eels from escaping. The drain line is directed to the highest point possible (gravity feed) to the cover of the ramp to add the scent of the eels into the ramp. The upper end of the ramp is custom fitted into the collection tank and ends about 50 mm above the high-water mark in the tank. The collection tank is custom fitted with a lid that is held down by clamps.

Each ramp consists of approximately 12.34 m x 305 mm wide cable trays positioned at approximately a 30° angle, plus a continuous length of tray that was bent and shaped at a 90° angle over a 25 mm radius at the top to convey juvenile eels into the collection tank. The entrance of each ramp is located underwater, during all tailwater elevations, with a smooth transition to the existing riverbed adjacent to a quiescent pool located in the creek. Ramps are held in place by a scaffold structure located approximately mid-length and four T-shaped solid metal braces, evenly spread across the length of the ramp and driven into the ground beneath the ramps. Ramps are covered from the top down to near the tailwater median flow height to protect juvenile eels when ascending. One cable tray contains a landscape fabric climbing substrate (Enkamat 7010) attached to the tray bottom. The other cable tray contains Milieu small substrate, with staggered vertical tubes.

Water flow to the ramps is supplied from a one horsepower (hp) submersible pump that is installed in a 114-L barrel in the forebay above CWA's Pine Grove Low-Head Dam. The barrel contains about 50, 38 mm holes that are covered with 1 mm mesh screen to prevent any material from entering the pump, lines

⁷ The percentage listed refers to the percentage of sunlight and corresponding UV rays that is blocked by the shade cloth.

and manifold that could cause clogging. The barrel is deployed in the forebay about 1.2 m below the water surface. The underground 51 mm water line is encased in 203-mm PVC, to protect the line. The 51 mm water line is attached to a 51 mm manifold with seven 25 mm ball valves that supply water to the spray bars and additional attraction flow lines. Water is continuously discharged down the ramp and into the collection tank via a spray bar, keeping the substrates moist and creating a flow to attract juvenile eels. Climbing ramp flow is augmented by additional attraction flow from the overflow of the collection tank via a gravity feed 25 mm scent line hose. Two additional 25 mm hoses are attached to the cover of each ramp near the water's edge to create splashing and additional attraction flow for the juvenile eels. The facility uses up to 265 L per minute of water to provide attraction flow to the eel ramp and for use within the collection tank. Each ramp has one spray bar and two attraction flow lines. Engineering drawings for the facility are in [Appendix B](#).

Conowingo East Eel Collection Facility⁸

The temporary CEECF will be installed each year ten (10) days after the completion of the upstream anadromous fish migration season, beginning the first eel season after the completion of the modifications to the EFL under the FERC License, Appendix 1, Section 12.6.1⁹, and will be located in the EFL stilling basin in the vicinity of the spillway.¹⁰ The temporary CEECF will be operated for ten (10) years, beginning after the EFL modifications are completed. If, after 10 years of operating the CEECF, the 10-year average annual catch of the CEECF is greater than or equal to 50% of the comparable 10-year average catch of eels at the CEECF, Exelon will design, install, and operate a permanent eel trapping facility at the location of the CEECF, in accordance with a schedule agreed upon by MDE and USFWS and approved by FERC. The 10-year average must be based on comparable dates of operation, as the CEECF will operate a shorter period than the CEECF. Exelon will maintain and operate the CEECF and either an eel trapping facility at the location of the CEECF or Octoraro Creek, or comparable facility required under the MRPSP FERC License at any time, unless otherwise directed by FERC. No modifications, construction, or other changes will be made to the operation of any eel fishway at the Conowingo Dam without the agreement of MDE and USFWS and approval of FERC.

The CEECF will contain one collection tank positioned on a platform, which is 660 mm wide with a length of 1,575 mm. The depth of the water in the collection tank is about 299 mm, with a volume of approximately 310.4 L. With a maximum density of 10 eels per L, the collection tank can hold up to 3,104 eels at once. The collection tank has 209 mm of freeboard to keep eels from climbing out of the tank. The collection tank is filled by a 25-mm fill line and also filled by allowing some of the spray bar flow to enter the collection tank, thus providing a constant flow of freshwater to the tank. The top end of the ramp is custom fitted into the collection tank and ends about 50 mm above the high-water mark in the tank. The 76-mm collection tank drain line contains a 25-mm gravity drain line with a ball valve that is directed to the highest

⁸ The attached drawings for the temporary eel facility at the EFL are based upon the most current EFL designs and will be resubmitted to the Resource Agencies and FERC for approval, if there are any changes to the EFL designs resulting from FERC License Appendix 1, Section 12.6.1. The Fishway Operations and Maintenance Plan will also be updated to reflect any changes in flows, unit operation, or other aspects with respect to eel collection facilities at Conowingo.

⁹ The construction schedule for the EFL modifications for river herring and American Shad has not been finalized. The CEECF will be installed after the EFL modifications are complete. Exelon will provide schedule updates at a minimum during the annual EPAG meetings and will also update this plan accordingly and submit it to the resource agencies for review and FERC for approval. Exelon also participates in monthly design-planning meetings with resource agencies, and schedule is discussed during these meetings.

¹⁰ Due to safety concerns, no equipment will be placed in the spillway. This is confirmed in the MDE Settlement, Draft Article XX. Eel Passage, i, "...in no case, shall any temporary or permanent eel ramps be required to be constructed in the Conowingo Dam spillway area. Additionally, the MRPSP FERC License requirements also exclude the spillway as a potential location for an eel facility due to safety concerns.

point possible (gravity feed) of the ramp, thus providing eel scent from the eels in the collection tank to the ramp. The collection tank also contains a 76-mm drain line, positioned near the bottom of the collection tank. The drain line attaches to a knife valve that remains closed until eels are removed. The collection tank is custom fitted with a lid that is held down by clamps. The EFL gravity-feed water supply, which withdraws water from approximately elevation 100.7 feet from Conowingo Pond, will provide water for the attraction flow for the CEECF. (Attraction flow will be approximately 265 L-per-minute). Proper operation of the components will be ensured through daily inspections and recording of water temperature and DO levels and weekly calibration of the water supply systems.

The juvenile eel ramp is constructed of an aluminum cable tray. The cable tray contains landscape fabric climbing substrate (Enkamat 7010) attached to the tray bottom. This substrate consists of a dense three-dimensional mesh of fused filaments, which provides a climbing surface for the juvenile eels. The ramp consists of an approximately 5 m long by 457 mm wide cable tray positioned at a 30° angle, plus a continuous length of tray that is bent and shaped at a 90° angle over a 25 mm radius at the top of the ramp to convey juvenile eels into the collection tank. The base of the ramp is at approximately elevation 17.8 feet, which is above the minimum tailwater line of approximately 12.9 feet (elevation at a flow of 4,000 cfs), with a smooth transition to the existing concrete stilling basin/east fish lift area floor. The facility is designed so that eels ascend the concrete floor between the tailwater surface and the end of the ramp. This portion of the concrete is wetted from the attraction flow exiting the eel ramp down to the tailwater level. Once eels ascend the concrete portion, they enter the eel ramp and can ascend to the collection tank. The ramp is held in place by metal braces, evenly spread across the length of the ramp, and attached to the existing concrete structures. The ramp is covered with a metal plate from the top down to near the normal high-water line (elevation ± 21 feet) to protect juvenile eels from avian predators when ascending. A large 60% shade cloth is installed below the entrance to help protect juvenile eels between the tailrace and the entrance of the ramp.

A gravity feed water line supplies at least 265 L per minute to the collection tank and ramp for eel attraction. A 51-mm diameter gravity feed line supplies water for the CEECF. The water line forms a manifold at elevation 48 feet and contains one 51-mm ball valve and two 25-mm ball valves for the CEECF (i.e., supply water to the spray bars and additional attraction flow lines). The main water line for the CEECF is 25 mm in diameter. The fill line has one 25-mm ball valve. A separate 25-mm line with a ball valve continuously discharges water down the ramp and into the collection tank via a spray bar, keeping the substrate moist and creating a flow to attract juvenile eels. Climbing ramp flow is augmented by additional attraction flow from the overflow of the collection tank via a gravity feed 25-mm scent line hose and 25 -mm ball valve. Two additional 25-mm hoses are attached to the cover of each ramp near the water's edge to create splashing and additional attraction flow for the juvenile eels. All water from the ramp and the additional attraction pipes provides the overall attraction flow down the concrete to the tailrace. Engineering drawings for the facility are in [Appendix C](#) and an annotated presentation of the drawings is included in [Appendix D](#).

During the 10 years of operation, if the number of American Eels attempting to migrate to the CEECF exceeds 90,000 eels per day, which is the maximum capacity of American Eels per unit of ramp area¹¹, or if densities in the collection tank exceed 10 eels per L, the facility will be modified, or operational protocols adjusted to reduce crowding, in consultation with MDE, USFWS, and EPAG.

¹¹ The maximum capacity of American Eels per unit of ramp area is based on the USFWS Fish Passage Engineering Design Criteria (USFWS, 2019), which gives a guideline of 5,000 eels per day per inch of ramp width, assuming that the mean eels are a size of 150 mm, total length.

3.2.2 Construction

Both the CWECF and OECF are constructed and have been in operation since 2017 and 2015, respectively. Modifications to the EFL to improve passage of American shad and river herring will be constructed as required by the Conowingo License, Appendix 1. The CEECF will be constructed, to be operational within 12 months of completion of construction of the EFL American shad and river herring improvements.

3.2.3 Operational Protocols

All trapping and collection facilities will be operated in accordance with the schedule outlined in [Section 5](#) and the following protocols.

The CEECF will be operated using the following gate position downstream of the facility inside the EFL¹².

- Downstream Weir Gate C: 100% open
- Downstream Weir Gate B: 0% open
- Upstream Weir Gate A: 0% open (to keep debris out of EFL)
- Diffuser Gate A: 100% open
- Diffuser Gate B: 100% open
- Crowder Area Gate: 100% open
- Crowder doors: fully open
- Crowder Screen Hoist: fully lowered (to keep debris out of hopper area)
- Crowder Dividing Screen: fully raised
- Crowder Channel Screen: fully raised
- Trash Rack A: fully raised
- Trash Rack B: raised a few feet (bottom of rack at full generation elevation)

Attraction flows for the CEECF will be from the gravity-fed water system from the headpond only. The Spillway Gates A and B along with the Spillway Trough Gate will be fully closed and locked out for safety measures prior to and during eel passage season at the CEECF.

The ramp will be removed when flows are forecast to exceed 113,000 cfs and will be reinstalled when flows have receded to a level that will allow for safe access.

Monitoring

At each facility, proper operation of the components will be ensured either through the continuous monitoring of water flow supplied to the ramp and collection tank with an alarm system triggered by low flows or low DO conditions that are not within design parameters (CWECF), or by daily inspections and continuous recording of water temperature and DO levels and weekly calibration of the water supply systems (OECF and CEECF). If an alarm at the CWECF is triggered by low DO or flow, an alarm sounds in the Station control room and a text message/email is sent to Exelon's contractor. If Exelon station personnel are unable to resolve the issue, the contractor will come to the site to troubleshoot and correct the issue. Daily Field Sheets are included in [Appendix E](#). The collection tanks hold American Eel at densities not exceeding 10 elvers per L unless otherwise agreed to by Exelon, MDE, and the USFWS. If deemed necessary by MDE, USFWS, or FERC, Exelon will provide aeration to the collection tanks.

During any instance when alarms indicate or daily inspections suggest that attraction or ramp flow is not within design parameters and cannot be adjusted to operate within these parameters within 24 hours, it will

¹² This section will be updated if there are any changes to the CEECF operation required by updated EFL designs per from Appendix 1 Section 12.6.1 of the Conowingo License. Any changes to operation protocols will be resubmitted to the Resource Agencies and FERC for approval.

be considered an emergency, and operators must follow the Emergency Response Protocols outlined in [Section 3.6](#).

Verification and Testing

The main flow and spray bar flow will be independently measured once per week to verify that the flow meters are providing accurate measurements. If a flow meter provides measurements that differ from the design parameters the main flow meter will be re-calibrated or replaced.

Similarly, the temperature and DO meter will be tested once each week using an independent meter(s) to verify that they are accurate. The independent meter(s) will be calibrated according to manufacturer instructions and recommendations. If any continuous monitor provides measurements different than verification measurements, or outside the designed parameters, then it will be re-calibrated, repaired, or replaced.

The alarm systems monitoring flow rates will be tested once per week. Monitors will be tested against deliberate deviations from the design range to ensure that these deviations trigger the alarms. The Conowingo Control Room will be contacted prior to any testing of the alarms.

Inspection

The ramp, cover, substrate, attraction flow, spray bar, and ramp flow will be visually inspected daily to ensure proper operation. If any component is not functioning properly, corrections and/or repairs will be made as soon as practicable. Results of any inspection items that require further action will be recorded on a Daily Field Sheet ([Appendix E](#)).

If an inspection suggests that any structure or flow component is not performing properly and no alarm has been triggered, verification of this potential deviation will be performed as described above and corrective action will be taken as soon as possible. If equipment function cannot be immediately repaired, inspectors will refer to Inspection Response Protocols outlined in [Section 3.6](#).

Maintenance

The collection tanks will be drained daily to ensure all eels have been removed. At least once per week, the collection tank(s) will be scrubbed. Scrubbing the tanks is performed with water, a brush, and scouring pad. No chemicals are used.

Debris that would block or hinder passage of eels that is observed on the ramp and substrate during visual inspections will be removed at the time of the inspection. If the debris cannot be removed upon inspection for any reason, it will be removed as soon as practicable thereafter.

At the end of each sampling season, and if determined to be necessary during the season, the ramp will be cleaned. During this cleaning process the substrate will be inspected for any degradation or damage. Sections of substrate will be replaced if necessary. Maintenance activities are recorded on a Daily Field Sheet ([Appendix E](#)).

American Eel Counting

Juvenile eels will be counted during each daily check upon removal from the collection tank. When small numbers of eels (fewer than 1,000) are observed in the collection tank, actual counts will be performed. Large quantities of eels will be counted volumetrically. Volumetric estimates will be performed by placing 200 mL of water in a graduated container and then placing anesthetized juvenile eels in the graduated container until it is filled to the 400 mL mark. These juvenile eels will be counted to determine the number of eels displaced by 200 mL of water. Four Ls of water will be added into a 20-L graduated bucket, the

remaining eels from the collection tank will be added to the 20-L bucket, and the resulting displacement of water will indicate the number of eels¹³. This process will be repeated until all juvenile eels have been removed from the collection tank. Length measurements, weight, and condition factor will be taken from a maximum of 25 eels on a bi-weekly basis. Eels will be measured to the nearest mm and weighed to the nearest 0.1 grams after being anesthetized.

All data collected will be recorded on the Daily Field Sheet ([Appendix E](#)). Any dead eels will be removed, enumerated, and recorded on the Daily Field Sheet. At the CWECF, the number of eels added to a given holding tank will be recorded, and at the other facilities, the number transferred to the holding tank(s) at the CWECF will be recorded.

3.3 Holding

For this plan, “holding” refers to the retention of eels in holding tanks after removal from the collection tank.

Conowingo West Eel Collection Facility

The only facility with holding capabilities other than in a collection tank is the CWECF. Eels from the OECF and CEECF are transported daily to the CWECF for holding. At the CWECF, there are three holding tanks positioned along a concrete pad. Juvenile eels captured in the collection tank(s) are counted and transferred to one of the three holding tanks. Eel that are transferred to holding tanks are recorded on the Daily Field Sheet ([Appendix E](#)).

3.3.1 Design

The CWECF contains three stainless steel holding tanks, with a total holding capacity of 51,660 juvenile eels at a maximum density of 10 eels per L of water. Each holding tank is 1.68 m wide and 1.68 m long. The depth of the water in each collection tank is 0.61 m, providing approximately 1,722 L of water in each tank. A freeboard of 203 mm is provided to prevent eels from climbing and escaping. The bottom of each holding tank is sloped to the center drain to help flush all water and eels from the tank. The top of the center drainpipe is fitted with a 457-mm square screen drain that has a height of 203 mm. The screen drain is constructed of 1-mm mesh to prevent eels from escaping and allows consistent water exchange. This screened box is attached to a 102-mm PVC pipe fitted into a 102-mm bulkhead fitting that is removed to drain the tank completely. The bulkhead fitting is attached to a 90° PVC fitting and attached to a 102-mm flexible hose by a cam fitting that drains into an overflow tank. The main flow into a holding tank is supplied by the 51-mm fill line with the terminus of the pipe about 51-mm above the waterline, providing a constant flow of freshwater to the tank.

An overflow tank holds the overflow water discharged from the holding tank system, where it is discharged to the bottom of the ramp to provide attraction flow and eel scent. The overflow tank is a 568-L tank containing three 76 mm bulkhead fittings. These bulkhead fittings are attached to 76-mm PVC solid wall pipe that is used to provide the additional attraction flow near the entrance of the ramp. The overflow tank is filled by the collection tank and all in-service holding tank drain lines. Prior to any tank being drained, a very fine mesh bag is hose clamped to the end of the drain hose to ensure that no eels are released into the overflow tank. The drain hose with the mesh bag attached is placed into the overflow, which acts as a water cushion for the eels being collected in the bag.

¹³ For example, if 100 eels were counted in the displaced 200 mL graduated container, the resulting ratio would be 500 eels per L. If the displacement of water in the 20-L bucket is four L, then 2,000 eels are in the 20-L bucket.

3.3.2 Operational Protocols

The number of holding tanks operating at any time will be determined by the number of eels being held at the CWECF. The number of juvenile eels in each holding tank will not exceed 17,222 eels, which is 10 juvenile eels per L. Juvenile eels may be held in holding tanks for a maximum of seven days prior to transport unless conditions (water temperature above 28.0°C or air temperature above 32.0°C on consecutive days) warrant transports to be conducted on multiple days throughout the week. Specifically, EPAG agreed that transports should occur at least twice per week starting in mid-June and continue through September 15. Additionally, daily transports are also conducted pre-emptively as water temperatures near 28°C or eels become crowded in the holding tanks. The CWECF is maintained daily and decisions to transport are made in real-time based on eel condition, environmental conditions, and the number of eels in holding. A transport vehicle is left on-site to facilitate the ability to conduct transports as needed.

Monitoring

Proper operation of the holding facility will be ensured through the continuous monitoring of flow and water quality parameters, weekly verification of monitors, and daily inspections.

Water Exchange: The amount of water flowing into each operational holding tank will be monitored continuously. If measured flows are not within the design parameters flow (19 to 151 L per minute per tank in service), a sensor will trigger an alarm that will alert the Conowingo Control Room. Also, in the event of an alarm, an e-mail notification will be sent immediately to operational personnel. Contact lists are updated regularly and will be distributed to resource agencies, Station staff, and contractors each season.

Temperature: Water temperature in each operational holding tank will be monitored continuously. If measured temperature is not within the design parameters (10-35° C), a sensor will trigger an alarm that will alert the Conowingo Control Room. Also, in the event of an alarm, an e-mail notification will be sent immediately to operational personnel.

Dissolved Oxygen: Concentration of DO in each operational holding tank will be monitored continuously. If measured concentrations are not within the design parameters (5-20 ppm), a sensor will trigger an alarm that will alert the Conowingo Control Room. Also, in the event of an alarm, an e-mail notification will be sent immediately to operational personnel.

Verification and Testing

The flow into each holding tank will be measured once per week to verify that the flow meters are providing accurate flow measurements. If a flow meter provides measurements that differ from the design parameters, then the holding tank flow meter will be re-calibrated or replaced.

Similarly, the temperature and DO meters will be tested once each week using an independent meter(s) to verify that they are accurate. The independent meter(s) will be calibrated according to manufacturer instructions and recommendations. If any continuous monitor provides measurements different than verification measurements, or outside the designed parameters, then it will be re-calibrated, repaired, or replaced.

Alarm systems for holding tanks will be tested once per week. Monitors of flow, temperature, and DO will be tested against deliberate deviations from the design ranges to ensure that these deviations trigger the alarms. The Conowingo Control Room will be contacted prior to any testing of the alarms.

Inspection

The holding tanks in use will be inspected daily to ensure proper operation. Results of any inspection items that require further action will be recorded on a Daily Field Sheet. If the flow through the holding tanks,

water temperature, or DO is suspected of operating outside of design parameters, investigation of this suspected deviation will be performed via verification measuring, as described above, and, if found to be operating outside of design parameters, immediate action will be taken to find a solution. Upon a failed inspection, inspectors will refer to Failed Inspection protocols outlined in [Section 3.6](#).

Maintenance

Every week, the holding tank(s) that were used will be scrubbed and air dried, and this cleaning will be recorded on the associated Daily Field Sheet. Eels will be removed from the holding tanks prior to scrubbing, and every effort will be made to coordinate cleaning with transport so that the tanks are cleaned after eels are removed for transport.

The holding tanks will be drained and cleaned at the end of the trapping season, after operations at the ramp have ceased and all juvenile eels have been transported.

American Eel Counting

During daily inspections of holding tanks, and immediately prior to transfer to transport tanks, any dead eels will be removed, enumerated, and recorded on the Daily Field Sheets.

3.4 Transport

For the purpose of this plan, “transport” refers to movement of eels from holding tanks to transport tanks and transport to the upstream stocking locations.

3.4.1 Design

Conowingo West Eel Collection Facility

When fewer than 150 eels are collected during a sampling event, transport will occur using aerated 19-L buckets with lids, containing the maximum amount of water to prevent sloshing, with no more than 50 eels in each bucket. When counts of juvenile eels are greater than 150 but less than 2,500 individuals, a small, enclosed transport tank (250 L) with supplemental oxygen capability will be used to transport eels to designated locations. When large loads (more than 2,500) of American Eels are transported, a custom-made transport truck and tank unit will be used to deliver eels efficiently and safely to designated stocking locations.

The transport truck is a non-CDL licensed, Department of Transportation truck with a 2,498-L two-chambered transport tank (1,249 L = 12,490 eels per compartment)¹⁴ permanently centered on a flat bed. Each compartment contains a micro pore oxygen diffuser and an oxygen manifold connected to an oxygen bottle by a regulator. A monitor in the cab of the truck attached to a water quality probe that reads water temperature and DO concentration continuously is installed in each compartment. Each compartment has a 968-mm screen drain to release water prior to eels being released to check for any mortality. A 102-mm hose is connected to the 102-mm knife valve that is flush with the floor of the tank to ensure all eels and water are flushed from the tank. Engineering drawings for the transport facility are in [Appendix F](#).

Octoraro Creek Eel Collection Facility

All juvenile eels that are captured at the OECF will be transported to the CWFECF at Conowingo Dam daily where they will be held before subsequent transport and release at designated locations in the Susquehanna River watershed. When less than 150 eels are collected at the OECF during a sampling event, the eels will be transported in aerated 19-L buckets with lids that contain the maximum amount of water to prevent sloshing, with up to 50 eels in each bucket. When counts of juvenile eels are greater than 150 individuals,

¹⁴ Transport tanks are designed to hold eels at densities less than 10 juvenile eels per liter.

a small, enclosed transport tank (250 L) filled completely to prevent sloshing and equipped with supplemental oxygen to maintain DO levels in the tank, will be used. When more eels are collected in a single day than the OECF collection tank or the transport tank can accommodate, multiple trips to transport eels from the OECF to the CWFECF holding tanks are made.

Conowingo East Eel Collection Facility

All juvenile eels that are captured at the CEECF will be transported to the CWFECF at Conowingo Dam daily where they will be held before subsequent transport and release at designated locations in the Susquehanna River watershed. Eels collected at the CEECF during a sampling event will be transported in aerated 19-L buckets with lids that contain the maximum amount of water to prevent sloshing, with no more than 50 eels in each bucket.

3.4.2 Operation Protocols

Monitoring

Transport of juvenile eels will occur at least once per week. Eels will be trucked to appropriate release locations on the same day of removal from holding. The frequency of transport will be increased if the capacity of the holding tanks is approached or if water temperatures are above 28°C. Specifically, EPAG agreed that transports should occur at least twice per week starting in mid-June and continue through September 15. Additionally, daily transports are also conducted pre-emptively as water temperatures near 28°C or eels become crowded in the holding tanks. Multiple daily transports could occur if holding capacity is expected to be exceeded at the CWFECF. The number of juvenile eels placed in the transport tank(s) will not exceed 10 juvenile eels per L, and each transport tank will be equipped with supplemental oxygen for aeration. The tank will be fully enclosed during transport.

Temperature: Water temperature in the transport tank(s) will be monitored with the same meter used to monitor DO; the probe measures both parameters.

Dissolved Oxygen: A continuous supply of DO is provided with an oxygen bottle, regulator, and diffuser. Concentration of DO in the transport tank(s) will be monitored. If measured concentrations fall below 5 ppm, the transport crew will pull over at a safe location to quickly resolve the issue (adjust regulator pressure, hook up spare oxygen bottle, etc.).

Verification and Testing

Temperature and DO meters in the transport tanks will be tested once each week using an independent meter(s) to verify that they are accurate. The independent meter(s) will be calibrated according to manufacturer instructions and recommendations. If any continuous monitor provides measurements different than verification measurements, then it will be re-calibrated, repaired, or replaced.

Inspection

Prior to each trip, the transport truck and associated equipment will be inspected to confirm that all equipment is operating as intended. The initial inspection will be done before any eels are transferred to a transport tank. Any necessary adjustments will be made, and the tank will then be filled approximately three-quarters full, immediately prior to inspection and subsequent transfer of eels to the transport tank. All drains and tanks will be secured and examined for leaks. Water quality parameters will be recorded prior to eels being added to the tank. The supplemental oxygen system will be checked to verify that it is functioning properly. A final inspection will be conducted after the eels are transferred to the transport tank. The transport tank will be completely filled to prevent sloshing when driving. All drains and tanks will again be examined for leaks again and water quality parameters will be recorded.

Water quality data during transports will be recorded. The transport system must pass initial inspection before any eels are transferred to the transport tank and final inspection before transport begins. If the transport system does not pass inspection, it may not be used for transport until all issues are resolved and it passes a subsequent inspection. These data are recorded on the Transport Data Sheet located in [Appendix E](#).

Maintenance

Upon return to the CWECF, the transport tank will be opened to the air until the next transport. Transport tanks will be cleaned weekly.

American Eel Counting

The number of eels transferred to the transport tank from holding tanks will be recorded on the Daily Field Sheets and will be recorded as the total number of live eels currently present in the holding tanks.

Transport mortality will be determined by visually inspecting the transport tanks prior to and after the eels are released. Additionally, release areas will be inspected prior to leaving the stocking site. The stocking location is monitored until the water returns to pre-stocking conditions (i.e. water and sediment have settled following stocking). Most eels will seek cover as soon as they are stocked. Eels that have died will be visible lying belly-up and motionless on the stream bottom. Dead eels are retrieved by the stocking crew when access allows. Any dead eels observed during transport and release will be considered transport mortality. Eel mortalities from collection, holding, and transport will be reported to MDE, USFWS, and EPAG in the final report.

3.5 Stocking

Proposed stocking locations are summarized on [Table 3.5-1](#) and shown in [Figure 3.5-1](#). Stocking locations will be finalized and the amount stocked at each location will be determined in consultation with MDE, USFWS, and EPAG by February 1 each year. Progress in stocking these locations will be reported to MDE and EPAG after each transport trip and will be summarized during the annual eel passage meeting, during which input will be received on future stocking locations.

In addition to these stocking locations, which are focused on stocking eels to areas upstream of the Conowingo Project in the Susquehanna River watershed, MDE, USFWS, and EPAG will consider requests for eels to support research or alternative stocking projects ([Appendix G](#)). All requests are subject to approval from Exelon, MDE, USFWS, and EPAG. Requests for research or alternate stocking projects within New York State are also subject to approval from the New York State Department of Conservation. No more than 20% of the average annual catch will be provided in a given year for research or alternate stocking projects and transport of eels will be provided by the entity requesting the eels.

Each year, prior to April 1, 60 juvenile eels will be sampled randomly from tributaries below Conowingo Dam and sent to the USFWS or another resource agency for wild fish health screening. Protocols for selecting, preserving, and handling these eels will be developed in consultation with the receiving entity. Results of the wild fish health screening will be shared with MDE, USFWS, and EPAG.

3.6 Emergency Response Protocols

The goal of the restoration program is to achieve a minimum annual survival rate of 95% for juvenile eel during collection and holding processes. If these survival rates are not met in a given year, Exelon will, in consultation with MDE, USFWS, and EPAG, review the reasons that the 95% survival rates were not achieved and, if necessary, develop modifications that will be implemented prior to the start of the eel passage program in the following year.

3.6.1 Alarms and Contacts

For emergency purposes, a contact list with multiple emergency contacts will be developed for the Conowingo Control Room. These individuals will be responsible for responding to and resolving emergency situations at the facilities if station personnel cannot resolve the problem. Alarm systems, where applicable by facility, for flows, and DO in the collection and holding facilities, will be linked to the Conowingo Control Room for immediate alarm notification. Also, in the event of an alarm, an e-mail notification or text message will be sent to operational personnel five minutes after the Control Room has been notified. The operational personnel will contact the Conowingo Control Room and determine the appropriate action to be taken to correct the problem.

3.6.2 Inspection Response Protocols

As indicated in the previous sections, routine inspections will be performed at the facilities. Equipment that is not functioning as intended will be repaired or corrected immediately, if possible. If a facility is not functioning as intended and there is the potential for increased eel mortality (e.g., low flow to collection or holding tanks, high ambient river water temperatures, low DO concentrations), all eels in the facility will be transported to the next scheduled stocking location as soon as possible and, if necessary, the facility temporarily shut down until the issue is resolved. If there is no potential for increased eel mortality (e.g., attraction flow is not operating within design parameters), then it may not be required to temporarily shut down or immediately transport eels.

If an initial inspection determines that a transport tank or associated equipment are not functioning as intended prior to having eels transferred to it, no eels will be transferred to it until repairs have been completed and the equipment has been tested for proper function. If eels are transferred to a transport tank that then fails the final inspection, all eels must be transferred back to a holding tank unless the cause of failure can be addressed immediately, or to another transport tank if one is immediately available that has already passed initial inspection. Inspection forms are included in [Appendix E](#).

3.7 Quality Assurance and Quality Control

As detailed in previous sections, important parameters associated with trapping, collecting, holding, transport, release, and stocking will be recorded to assure and control the quality of various program elements. The collection of these data will assure that the program will be conducted according to design parameters, will adhere to sound scientific principles, and will allow for any necessary adjustments. The results of these quality assurance and quality control measures will be included in annual reports to MDE, USFWS, and EPAG.

Various alarms and inspections, along with regular and seasonal maintenance, will ensure that the facilities are operating properly. All staff responsible for operating and maintaining trapping, holding, and transport components of the facilities will be trained and familiar with the specifications and operational parameters of applicable facilities/components. Supervising biologists will be responsible for training new staff members. Additionally, all operating personnel will be required to read and understand the Conowingo Fishway Operation and Maintenance Plan, as well as this Plan. Pertinent equipment and parts that are critical to operation of the facilities will be obtained and securely stored, to reduce the probability and extent of potential eel passage facility shutdowns.

Conowingo Hydroelectric Project
FERC Project Number 405
American Eel Passage and Restoration Plan

Table 3.5-1: Stocking Locations for Juvenile Eel in the Susquehanna River Watershed

Site Number	Location	Water Body	County	Driving Distance (Miles)	Minimum Transport Time (hr:min)¹⁵
1	Conowingo Pool	Susquehanna River	Lancaster	< 20	< 0:30
2	Between Holtwood and Safe Harbor	Susquehanna River	Lancaster/York	25	0:40
3	Between Safe Harbor and York Haven Dam	Susquehanna River	Lancaster	36	0:55
4	Upstream of York Haven Dam	Susquehanna River	Dauphin	55	1:20
5	West Fairview Access (Route 11/15)	Susquehanna River	Cumberland	72	1:30
6	Fort Hunter Access	Susquehanna River	Dauphin	75	1:30
7	Shikellamy State Park	Susquehanna River	Northumberland	125	2:25
8	Route 487 Bloomsburg	N. Br. Susquehanna River	Columbia	130	2:40
9	Route 29 Bridge (Wilkes Barre) Nesbitt Park, (Kingston)	N. Br. Susquehanna River	Luzerne	142	2:50
10	Upstream of Hepburn Street Dam (Williamsport)	W. Br. Susquehanna River	Lycoming	155	3:00
11	Upstream of Grant Street Dam	W. Br. Susquehanna River	Clinton	180	3:10
12	City Island	Susquehanna River	Dauphin	70	1:30

¹⁵ Actual transport times may be longer, due to slower driving with a loaded vehicle and multiple stocking locations per trip.



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PROJECT NO. 405
Eel Passage and Restoration Plan

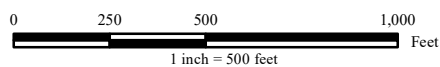
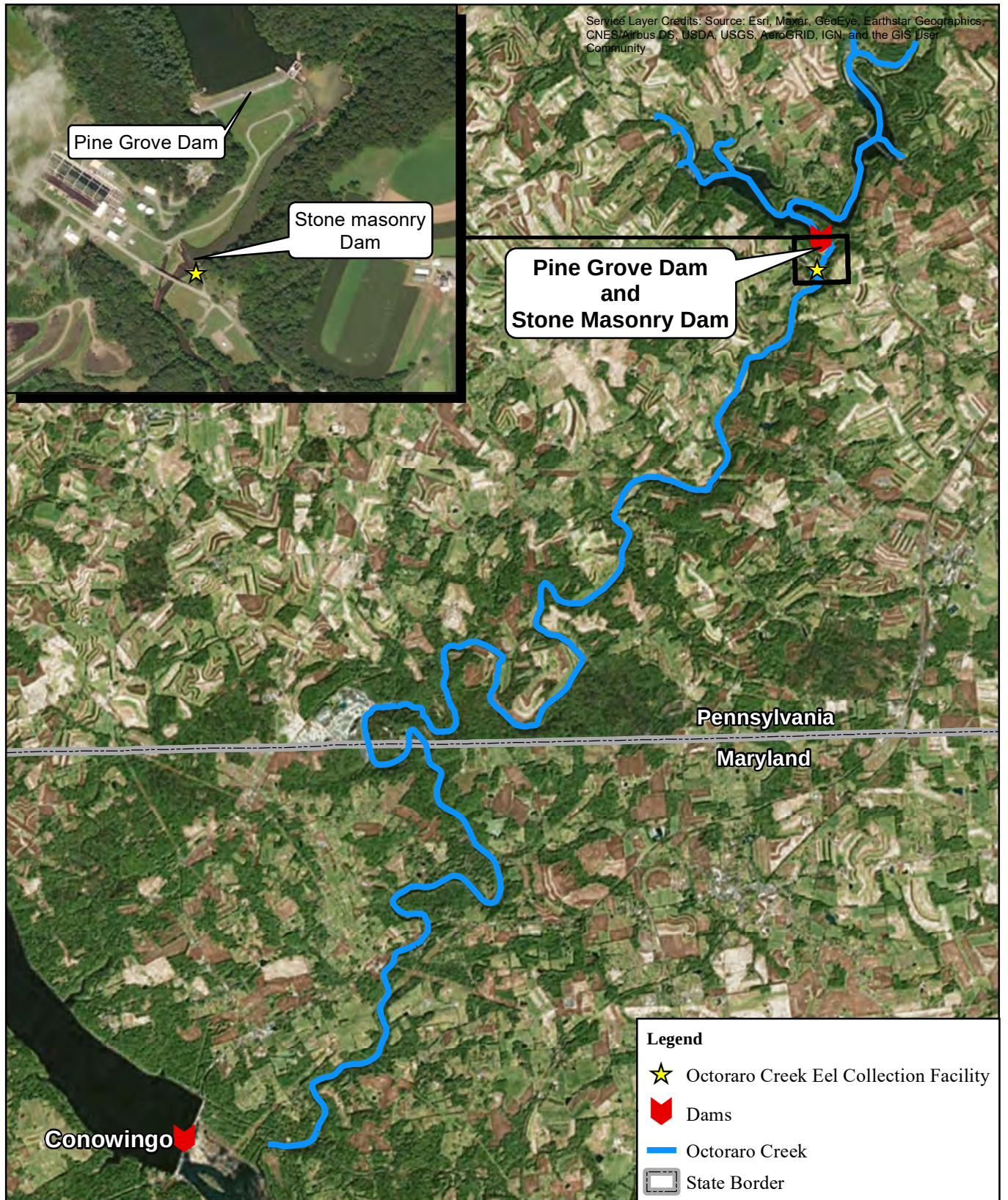


**Figure 3.1.1-1:
Locations of Conowingo West Eel
Collection and Holding Facility
and Conowingo East Eel
Collection Facility**



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PROJECT NO. 405
Eel Passage and Restoration Plan

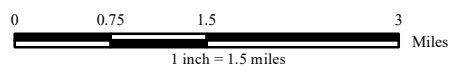


**Figure 3.1.2-1:
Location of Octoraro Creek
Eel Collection Facility**

4 IMPLEMENTATION SCHEDULE

This Eel Passage and Restoration Plan will be implemented following FERC approval. The CWECF operated has operated since 2017. It is anticipated that this plan will be approved prior to the 2022 eel passage season, and the CWECF will begin operation per this plan on May 1, 2022.

Preliminary drawings for the CEECF have been developed ([Appendix C](#)). Design, including all reviews, will be further developed as the EFL modification designs are completed and approved. Permitting and other consultations will begin when the design is at least 60% finalized. Installation and operation of the temporary eel collection tank and eel ramp will occur no later than twelve (12) months following the completion of the EFL modifications.

5 ANNUAL SCHEDULES AND DURATION OF OPERATIONS

Each facility will operate annually in accordance with the schedule outlined below. During periods of operation, the facilities will each be operated 24 hours per day, seven days per week.

Facility	Start	End*
CWECF	May 1	Mean Daily Water Temperature < 10°C for three (3) consecutive days in the fall
CEECF	No more than ten (10) days after ceasing EFL shad passage operations	Mean Daily Water Temperature < 10°C for three (3) consecutive days in the fall
OECF	May 1	September 15

*Water temperatures will be monitored hourly at Station 643, approximately 0.6 miles downstream of Conowingo Dam, or by manual readings taken at an alternative location within the Project tailrace unless MDE, USFWS, EPAG, and FERC require a different location.

The operational schedule of the facilities may also be temporarily modified due to extreme hydrological conditions, as defined below, or by agreement between Exelon, MDE, USFWS, and EPAG. "Extreme Hydrologic Conditions" means the occurrence of events beyond Exelon's control that may potentially damage the facility(s) such as, but not limited to, abnormal precipitation, extreme runoff, flood conditions, or other hydrologic conditions such that the operation of the eel facilities is impractical or is inconsistent with the safe operation of the Project.

The trap and transport program will continue through the year 2035 at the Conowingo Project, at a minimum, prior to development of volitional passage structures. However, trapping operations at these specific facilities could change. Exelon is required to maintain and operate the CWECF for the term of the new license but is not required to maintain and operate more than two permanent eel traps (this includes the CWECF and either the CEECF or OECF (or comparable facility required under the MRPSP License) at any time and, in no case, shall any temporary or permanent eel ramps be required to be constructed in the Conowingo Dam spillway area. The OECF is required to be run through 2030 consistent with the MRPSP FERC License.

6 REPORTING AND MEETINGS

6.1.1 Daily Operation Summaries

Throughout the collection facilities' operational season, Exelon will email daily summaries of American Eel collection, holding, transport, and stocking to representatives from MDE, USFWS, and EPAG and any other interested resource agencies. Daily reports will include:

- The estimated number of juvenile eel captured (i.e., number of eels in collection tank).
- The estimated number of eels in the holding tanks.
- The number of eels transported or moved.
- The disposition (location and status) of any transported eels, and
- The count of any mortalities encountered at the CWECF and during transport.

6.1.2 Annual Reports

Due to different season requirements and different reporting requirements between the Conowingo and Muddy Run License requirements, annual reports will include, but not be limited to, the following information:

- The estimated number of juvenile eel captured each day (i.e., number of eels in collection tank).
- The estimated number of eels in the holding tanks.
- The number and dates of eels transported to each stocking location or moved.
- The number of mortalities observed during collection, holding, and transport.
- Statistics (average, maximum, minimum) showing operational parameters for the main components (i.e., flows, temperatures, DO concentrations).
- A description of any significant problem encountered with the trapping, collecting, and holding systems including results of weekly verification efforts and any repair/maintenance actions taken.

Draft annual reports will be submitted to MDE, USFWS, and EPAG by December 1 each year. The draft reports will detail eel collection, holding, and transport from May 1 through September 15 of each year. For the CWECF and the CEECF, eel collection, holding, and transport counts from September 16 through the close of the season will be added to this report as an addendum, and a draft updated report will be submitted to MDE, USFWS, and EPAG for review and comment by December 31¹⁶. Following review by MDE, USFWS, and EPAG, the final OECF report will be submitted to MDE, USFWS, and EPAG as well as filed with FERC by January 15 of the following year. The final CWECF and CEECF reports will be submitted to MDE, USFWS, and EPAG as well as filed with FERC by February 15 of the following year.

Report	Draft Report Submission Date	Final Report Filing Date
CWECF and CEECF annual reports (May 1 to Sept 15 period)	December 1	February 15
CWECF and the CEECF annual report addendum (Sept 16 to end of season period)	December 31	February 15
OECF annual report (May 1 to Sept 15 period)	December 1	January 15
Fishway Operation and Maintenance Plan annual report	---	December 31

¹⁶ The Fishway Operation and Maintenance Plan annual report will be filed on December 31 and will include daily counts of American eel collected at each facility.

6.1.3 Teleconferences and Remote Meetings

Monthly remote meetings with MDE, USFWS, and EPAG will include discussions of each operating eel passage facility, and also be used to administer implementation of this EPRP.

6.1.4 Meetings

Exelon will meet with MDE, USFWS, and EPAG annually to discuss this EPRP. This meeting will occur no later than January 31 each year unless Exelon and MDE, USFWS, and EPAG agree on a different date. The purpose of the meeting will be to discuss the eel passage results from the previous year and discuss any modifications for the upcoming eel passage season.

7 VOLITIONAL UPSTREAM PASSAGE FOR AMERICAN EEL

License Article 414 requires Exelon to maintain the upstream eel passage trap and transport program for American Eels through 2035.¹⁷ Exelon will work with the Resource Agencies to resolve the timing issues between the two licenses related to volitional and/or trap and transport of American eels.

¹⁷ This date differs from the Offer of Settlement and Explanatory Statement between Exelon and the US Department of Interior (2016), which states, “The Licensee shall conduct trap and transport of American eels until 2030, and will implement volitional American eel passage starting in the 2031 season,” and, “Consistent with the Eel Passage Plan established by the Muddy Run license, construction of the volitional passage facility will eliminate the Licensee’s obligation to participate in the trap and transport program once the volitional upstream eel passage facility is operational. However, if the upstream eel trap and transport and periodic evaluation program continues beyond 2030, the Licensee will continue to provide access to the Conowingo eel collection facilities for as long as the program continues. The Licensee, however, shall bear no cost responsibility for the trap and transport and periodic evaluation program until 2046, at which time cost responsibility shall be shared among all participants in the program.”

8 REFERENCES

- Exelon Generation Company, LLC. (2016). *Conowingo Hydropower Project Settlement Agreement Between Exelon Generation Company, LLC and the United States Department of the Interior Fish & Wildlife Service*.
- Exelon Generation Company, LLC and the Maryland Department of the Environment. (2019). *Joint Offer of Settlement and Explanatory Statement Of Exelon Generation Company, LLC and the Maryland Department of the Environment*.
- Federal Energy Regulatory Commission. (2015). *Final Multi-Project Environmental Impact Statement For Hydropower Licenses*. Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing. Washington, DC: Federal Energy Regulatory Commission.
- USFWS. (2019). *Fish Passage Engineering Design Criteria*. Fish and Aquatic Conservation, Fish Passage Engineering Ecological Services, Conservation Planning Assistance. Northeast Region: USFWS. Retrieved from <https://www.fws.gov/northeast/fisheries/pdf/USFWS-R5-2019-Fish-Passage-Engineering-Design-Criteria-190622.pdf>

**APPENDIX A. CONOWINGO WEST EEL COLLECTION FACILITY
DRAWINGS**

PROJECT OWNER:



CONOWINGO
HYDROELECTRIC PROJECT
FERC NO. 405

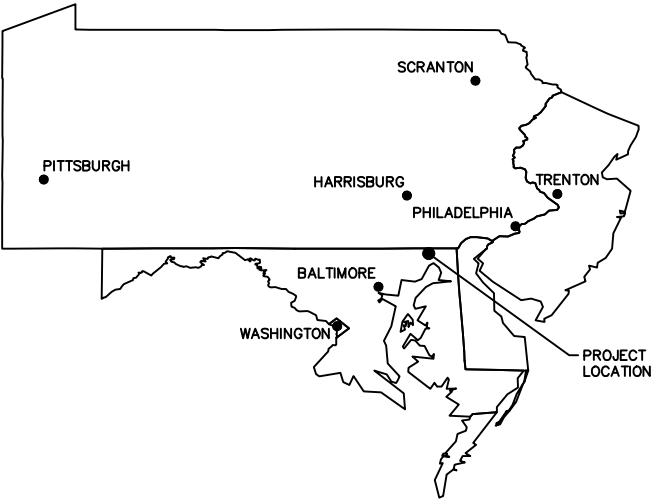
PROJECT TITLE:

CONOWINGO EEL PASSAGE

PROJECT ENGINEER:



DRAWING INDEX	
DRAWING NO.	DRAWING TITLE
CS	COVER SHEET AND LOCATION PLAN
1	GENERAL NOTES
GP-1	SITE ACCESS PLAN
2	PROPOSED PIPE LAYOUT
3	EEL FACILITY PIPING CONFIGURATION
4	8" PIPELINE 3D PROFILE (INSIDE)
5	8" AND 3" PIPELINES 3D PROFILE (OUTSIDE)
6	EEL FACILITY PIPELINE 3D PROFILE
7	DETAILED PIPE LAYOUT PLANS, SHEET 1
8	DETAILED PIPE LAYOUT PLANS, SHEET 2
9	SECTIONS AND DETAILS
10	EXCAVATION AND CONCRETE ENCASEMENT PLAN
11	EXCAVATION, CONCRETE ENCASEMENT, AND ROAD SECTIONS
12	PIPE SUPPORTS
13	EEL FACILITY PLAN LAYOUT
14	TYPICAL TANK SECTIONS
15	HOLDING TANK PLAN AND SECTIONS
16	HOLDING TANK SECTIONS AND DETAILS
17	COLLECTION TANK PLAN AND SECTIONS
18	EEL RAMP SECTIONS AND DETAILS
19	EEL RAMP ELEVATION AND PIPE SUPPORT DETAILS
20	SITE AND SEDIMENT AND EROSION CONTROL PLAN AND DETAILS
21	MISCELLANEOUS DETAILS



1 LOCUS PLAN
CS NOT TO SCALE



2 LOCATION PLAN
CS NOT TO SCALE

DATE	#			BY	APP
DRAWN BY: ALR		CHECKED BY: HNN		APPROVED BY: DAG	
GSE PROJECT NO.: 1714		DATE: 2/17/2017			


EXELON GENERATION COMPANY, LLC

CONOWINGO EEL PASSAGE


GOMEZ AND SULLIVAN ENGINEERS
Williamsville, NY • Utica, NY • Albany, NY • Henniker, NH
www.gomezandsullivan.com

COVER SHEET AND LOCATION PLAN

SCALE: AS NOTED DRAWING NO.: CS

IT IS A VIOLATION OF THE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANYWAY UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. ALTERATIONS MUST HAVE THE ENGINEER'S SEAL AFFIXED ALONG WITH A DESCRIPTION OF THE ALTERATION, THE SIGNATURE AND DATE.

IT IS A VIOLATION OF THE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANYWAY UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. ALTERATIONS MUST HAVE THE ENGINEER'S SEAL AFFIXED ALONG WITH A DESCRIPTION OF THE ALTERATION, THE SIGNATURE AND DATE.

STRUCTURAL DESIGN DATA NOTES

1. DESIGN REFERENCES
AMERICAN SOCIETY OF CIVIL ENGINEERS 7-10
UNITED STATES GEOLOGICAL SURVEY EARTHQUAKE HAZARDS PROGRAM 2014 MAPPING
AMERICAN SOCIETY OF CIVIL ENGINEERS MANUAL 79
AMERICAN IRON AND STEEL INSTITUTE WELDED STEEL PIPE
AMERICAN WATER WORKS ASSOCIATION C208-12
AMERICAN WATER WORKS ASSOCIATION M11
AMERICAN SOCIETY OF MECHANICAL ENGINEERS B16.9
AMERICAN SOCIETY OF MECHANICAL ENGINEERS PRESSURE VESSEL CODE
US BUREAU OF RECLAMATION WELDED STEEL PENSTOCKS MONOGRAPH NO.3
AMERICAN CONCRETE INSTITUTE 318
AMERICAN WELDING SOCIETY D.1.1
AMERICAN INSTITUTE OF STEEL CONSTRUCTION STEEL CODE
2. RISK CATEGORY: III
3. TERRAIN/EXPOSURE CATEGORY: D
4. DEAD LOAD
UNIT WEIGHT OF CONCRETE: 150PCF
UNIT WEIGHT OF STEEL: 490PCF
UNIT WEIGHT OF WATER: 62.4PCF
5. WIND LOADS
BASIC WIND SPEED (3 SECOND GUST): 120 MPH
DIRECTIONALITY FACTOR (Kd): 0.95
TOPOGRAPHIC FACTOR (Kzt): 1.0
HEIGHT OF STRUCTURE: 0-15' ABOVE FIN. GRADE
DESIGN WIND PRESSURE: 37 PSF
6. HYDROSTATIC
NORMAL POOL: EL. 108.5
MAX POOL (IDF): EL. 116.5
WATER HAMMER: 140% STATIC HEAD
STATIC HEAD: ±71.1 FT
ASSUMED TRANSIENT/SURGE PRESSURE: 52 PSI
DESIGN PRESSURE: 150 PSI
7. HYDRODYNAMIC
TOTAL FLOW IN SYSTEM = 1400 GPM (3.08 CFS)
DESIGN FLOW TO EEL FACILITY = 145 GPM (0.319 CFS)
ADDITIONAL FLOW CAPACITY (FOR WEST FISH LIFT & FUTURE USE) = 1255 GPM (2.76 CFS)
8. THERMAL
ΔTmax = 48° F (BETWEEN INSTALLATION AND EXTREME ANNUAL AIR/WATER TEMPERATURES)
9. DAM HAZARD CLASSIFICATION: HIGH

EROSION AND SEDIMENT CONTROL NOTES:

1. THE LIMIT OF DISTURBANCE SHALL BE CLEARLY DELINEATED IN THE FIELD PRIOR TO THE PRE-CONSTRUCTION MEETING AND ANY GRADING ACTIVITIES TO ENSURE COMPLIANCE WITH THE APPROVED PLAN.
2. THE APPROVED EROSION AND SEDIMENT CONTROL PLAN MUST BE KEPT AT THE PROJECT SITE.
3. THE SOIL CONSERVATION DISTRICT (SCD) RESERVES THE RIGHT TO MODIFY THE EROSION AND SEDIMENT CONTROL PLANS.
4. THE SCD MAY REVOKE THE APPROVAL OF THE EROSION AND SEDIMENT CONTROL PLAN IF WORK PERFORMED AT THE PROJECT SITE DOES NOT CONFORM TO THE PROVISIONS OF THE GRADING PERMIT, TO THE APPROVED PLAN OR TO ANY WRITTEN INSTRUCTIONS FROM MDE, COUNTY DPW OR THE SCD.
5. THE CONTRACTOR SHALL CONSTRUCT ALL EROSION AND SEDIMENT CONTROL MEASURES PER THE APPROVED PLAN AND CONSTRUCTION SEQUENCE AND SHALL HAVE THEM INSPECTED AND APPROVED BY THE SEDIMENT CONTROL INSPECTOR PRIOR TO BEGINNING ANY OTHER LAND DISTURBANCES.
6. THE CONTRACTOR SHALL ENSURE THAT ALL RUNOFF FROM DISTURBED AREAS IS DIRECTED TO THE SEDIMENT CONTROL DEVICES AND SHALL NOT REMOVE ANY EROSION OR SEDIMENT CONTROL MEASURE WITHOUT PRIOR PERMISSION FROM THE SEDIMENT CONTROL INSPECTOR.
7. THE FOLLOWING MINOR PLAN MODIFICATIONS MAY BE APPROVED BY THE SEDIMENT CONTROL INSPECTOR IN THE FIELD:
A. SEDIMENT CONTROL STRUCTURES (EXCEPT BASINS AND TRAPS) MAY BE MOVED TO MEET THE EXISTING CONTOURS AND FIELD CONDITIONS, WHEN MOVING THESE STRUCTURES WOULD HAVE NO IMPACT ON THEIR FUNCTION OR DESIGN CRITERIA.
B. SUBSTITUTION OF PERIMETER CONTROL MEASURES MAY BE MADE PROVIDED THE MEASURE SUBSTITUTED IS EQUIVALENT (I.E., SILT FENCE FOR STRAW BALES) OR IS AN UPGRADE OF THE ORIGINAL MEASURE (I.E., SILT FENCE TO A PERIMETER BERM WITH PROPERLY SIZED OUTLET).
C. ADDITION AND EXTENSION OF PERIMETER CONTROLS (INCLUDING STONE CONSTRUCTION ENTRANCES) MAY BE MADE TO MEET FIELD CONDITIONS.
8. THE CONTRACTOR SHALL PROTECT ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS TO PREVENT THE DEPOSITION OF MATERIALS ONTO PUBLIC ROADS. ALL MATERIALS DEPOSITED ONTO PUBLIC ROADS SHALL BE REMOVED IMMEDIATELY.
9. ON-SITE TEMPORARY STOCKPILE AREAS MUST BE PLACED AS SHOWN ON THE APPROVED PLAN. IF THE CONSTRUCTION SCHEDULE IS TO EXCEED 3 DAYS, THE STOCKPILE AREAS MUST BE STABILIZED. STOCKPILE AREAS SHOULD NOT EXCEED FIFTEEN FEET IN HEIGHT. IF A STOCKPILE IS TO EXCEED FIFTEEN FEET IN HEIGHT, IT MUST BE SHOWN ON THE PLAN TO BE TERRACED WITH PIPE SLOPE DRAINS INSTALLED AND APPROVED BY SCD. UPON THE COMPLETION OF THE USE OF THE STOCKPILE AREA, EXISTING GROUND SURFACES SHALL BE RESTORED TO THEIR ORIGINAL CONDITIONS AND PERMANENTLY STABILIZED.

EROSION AND SEDIMENT CONTROL NOTES CONTINUED:

10. VARIOUS STEPS IN THE SEQUENCE OF CONSTRUCTION MAY REQUIRE THE CONTRACTOR TO REMOVE EXCESS EXCAVATED MATERIAL TO AN APPROVED LOCATION OR TO IMPORT MATERIAL FROM AN APPROVED LOCATION. FOR PURPOSES OF THIS PLAN, AN APPROVED LOCATION SHALL BE ONE WHICH IS OPERATING UNDER AN APPROVED EROSION AND SEDIMENT CONTROL PLAN AND AN ACTIVE GRADING PERMIT AT THE TIME OF CONSTRUCTION.
11. THE CONTRACTOR SHALL INSPECT DAILY AND MAINTAIN CONTINUOUSLY IN AN EFFECTIVE OPERATING CONDITION ALL EROSION AND SEDIMENT CONTROL MEASURES UNTIL SUCH TIME AS THEY ARE REMOVED WITH PRIOR PERMISSION FROM THE SEDIMENT CONTROL INSPECTOR.
12. FOLLOWING INITIAL SOIL DISTURBANCE OR RE-DISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN:
A. THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES EQUAL TO OR GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1), AND
B. SEVEN (7) DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE.
THE ABOVE REQUIREMENTS DO NOT APPLY TO THOSE AREAS WHICH ARE SHOWN ON THE PLAN AND ARE CURRENTLY BEING USED FOR MATERIAL STORAGE OR FOR THOSE AREAS ON WHICH ACTUAL CONSTRUCTION ACTIVITIES ARE CURRENTLY BEING PERFORMED OR TO INTERIOR AREAS OF A SURFACE MINE SITE WHERE THE STABILIZATION MATERIAL WOULD CONTAMINATE THE RECOVERABLE RESOURCE.
MAINTENANCE SHALL BE PERFORMED AS NECESSARY TO ENSURE THAT THE STABILIZED AREAS CONTINUOUSLY MEET THE APPROPRIATE REQUIREMENTS OF THE MOST CURRENT MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL.
13. SEDIMENT CONTROL PRACTICES WILL BE MAINTAINED UNTIL THE ENTIRE CONTRIBUTING AREA TO THE PRACTICE HAS BEEN PERMANENTLY STABILIZED AND MEETS THE SATISFACTION OF THE SEDIMENT CONTROL INSPECTOR. SEDIMENT CONTROLS MAY ONLY BE REMOVED WITH THE AUTHORIZATION OF THE SEDIMENT CONTROL INSPECTOR.
14. ALL AREAS DISTURBED BY THE REMOVAL OF SEDIMENT CONTROL DEVICES MUST BE IMMEDIATELY STABILIZED.
15. SURFACE DRAINAGE FLOWS OVER UNSTABILIZED CUT AND FILL SLOPES SHALL BE CONTROLLED BY EITHER PREVENTING DRAINAGE FLOWS FROM TRAVERSING THE SLOPES OR BY INSTALLING PROTECTIVE DEVICES TO CONVEY THE WATER DOWNSLOPE WITHOUT CAUSING EROSION. DIKES SHALL BE INSTALLED AND MAINTAINED AT THE TOP OF CUT OR FILL SLOPES UNTIL THE SLOPE AND DRAINAGE AREA TO IT ARE FULLY STABILIZED, AT WHICH TIME THE DIKES MUST BE REMOVED AND FINAL GRADING DONE TO PROMOTE SHEET FLOW DRAINAGE. EROSION CONTROL MEASURES MUST BE IMPLEMENTED AT POINTS OF CONCENTRATED FLOW WHERE EROSION IS LIKELY TO OCCUR.
16. SEDIMENT REMOVED SHALL BE PLACED AND STABILIZED IN APPROVED AREAS, BUT NOT WITHIN A FLOODPLAIN, WETLAND OR FOREST RETENTION AREA. WHEN PUMPING SEDIMENT LADEN WATER, THE DISCHARGE MUST BE DIRECTED TO A SEDIMENT TRAPPING DEVICE PRIOR TO RELEASE FROM THE SITE.
17. FOR APPROVED DEWATERING STRATEGIES FOR TRAPS AND BASINS, SEE SECTION F OF THE 2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL. PUMPING SEDIMENT LADEN WATER INTO THE WATERS OF THE STATE WITHOUT FILTRATION IS STRICTLY FORBIDDEN.
18. THE DEVELOPER IS RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS PRIOR TO ANY CONSTRUCTION ACTIVITIES. FURTHER, THE ISSUANCE OF A GRADING PERMIT DOES NOT RELIEVE THE DEVELOPER OF THE RESPONSIBILITY TO OBTAIN ANY ADDITIONAL LOCAL, STATE OR FEDERAL PERMITS.

GENERAL NOTES:

1. THESE DRAWINGS DO NOT INCLUDE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR CONSTRUCTION SAFETY AND FOR COMPLIANCE WITH ALL OSHA REGULATIONS DURING CONSTRUCTION.
2. CONTRACTOR SHALL DETERMINE LOCATION OF EXISTING UTILITIES BEFORE COMMENCING WORK. CONTRACTOR AGREES TO BE FULLY RESPONSIBLE FOR DAMAGES WHICH MAY OCCUR BY FAILURE TO LOCATE AND PRESERVE EXISTING UTILITIES.
3. CONTRACTOR SHALL CONTACT THE LOCAL CALL BEFORE YOU DIG CENTER TWO FULL WORKING DAYS IN ADVANCE OF DIGGING. THE CONTACT NUMBER FOR MARYLAND IS 811.
4. THE LOCATIONS AND INFORMATION ABOUT UNDERGROUND PIPES, UTILITIES OR OTHER STRUCTURES ARE COMPILED FROM AVAILABLE RECORD DATA AND VISIBLE FIELD OBSERVATIONS AND ARE NOT REPRESENTED AS BEING EXACT OR COMPLETE.
5. THE CONTRACTOR SHALL RECORD TIE MEASUREMENTS, DEPTHS, DIMENSIONS, MATERIALS, FIELD CONDITIONS AND OTHER PERTINENT DATA ABOUT ALL UNDERGROUND PIPES, UTILITIES AND STRUCTURES ENCOUNTERED DURING THE WORK, BOTH EXISTING AND CONSTRUCTED. CONTRACTOR SHALL SUBMIT RECORD DRAWINGS WITH THIS INFORMATION TO THE CONSTRUCTION MANAGER WHO WILL SUBMIT TO THE ENGINEER, UPON COMPLETION OF THE WORK.
6. THE CONTRACTOR SHALL TAKE PRECAUTIONS TO PROTECT AND PREVENT DAMAGE TO ELECTRICAL AND MECHANICAL EQUIPMENT, CONTROLS, AND OTHER EXISTING STRUCTURES FROM CONSTRUCTION ACTIVITIES.
7. DIMENSIONS AND EXISTING CONDITIONS SHALL BE VERIFIED IN FIELD BY CONTRACTOR.
8. DO NOT SCALE DRAWINGS. CONTRACTOR SHALL NOTIFY CONSTRUCTION MANAGER WHO SHALL NOTIFY ENGINEER OF ANY DISCREPANCIES IN THE DRAWINGS.
9. DO NOT CHANGE SIZE OR SPACING OF STRUCTURAL ELEMENTS WITHOUT PRIOR APPROVAL FROM ENGINEER.
10. DETAILS SHOWN ARE TYPICAL; SIMILAR DETAILS APPLY TO SIMILAR CONDITIONS UNLESS OTHERWISE INDICATED.
11. THE CONTRACTOR SHALL PROVIDE AND DESIGN TEMPORARY BRACING/SHORING OF STRUCTURES AND EQUIPMENT DURING CONSTRUCTION AS REQUIRED UNTIL FINAL STRUCTURAL ELEMENTS NEEDED FOR STABILITY ARE INSTALLED..
12. CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER WHO SHALL NOTIFY THE ENGINEER IN WRITING OF PROPOSED DEVIATIONS OR SUBSTITUTIONS OF DIMENSIONS, MATERIALS, OR EQUIPMENT SHOWN ON THE DRAWINGS AND MAKE ONLY THOSE DEVIATIONS OR SUBSTITUTIONS ACCEPTED BY ENGINEER.
13. IF CONTRACTOR OBSERVES FIELD CONDITIONS WHICH VARY SIGNIFICANTLY FROM WHAT IS SHOWN ON THESE PLANS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE CONSTRUCTION MANAGER WHO SHALL NOTIFY THE ENGINEER FOR RESOLUTION OF THE CONFLICTING INFORMATION.
14. THE CONTRACTOR SHALL NOT BEGIN DEMOLITION UNTIL AFTER RECEIVING WRITTEN AUTHORIZATION FROM THE OWNER TO BEGIN DEMOLITION.
15. THE OWNER SHALL BE RESPONSIBLE FOR HAZARDOUS MATERIAL ABATEMENT AND PROTECTION OF WORKERS. MEASURES SHALL BE TAKEN, AS REQUIRED, PRIOR TO AND DURING CONSTRUCTION TO IDENTIFY, EVALUATE, AND REMOVE ANY ENCOUNTERED HAZARDOUS MATERIALS.
16. ALL ELECTRICAL WORK TO BE DESIGNED AND CONSTRUCTED BY OTHERS.
17. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH THE OWNER AND OTHER CONTRACTORS (AS NECESSARY) FOR ISOLATION AND DRAINAGE OF THE EXISTING HEADER PIPE.
18. PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION, EXELON SHALL CONSULT AND COOPERATE WITH THE STATE HISTORIC PRESERVATION OFFICER (SHPO) TO DETERMINE THE NEED FOR, AND EXTENT OF ANY ARCHEOLOGICAL OR HISTORIC SURVEYS, AND MITIGATION MEASURES THAT MAY BE NECESSARY. IF ANY PREVIOUSLY UNRECORDED ARCHAEOLOGICAL OR HISTORIC SITES ARE DISCOVERED DURING THE COURSE OF CONSTRUCTION, CONSTRUCTION ACTIVITY IN THE VICINITY SHALL BE HALTED, AND A QUALIFIED ARCHEOLOGIST SHALL BE CONSULTED TO DETERMINE THE SIGNIFICANCE OF THE SITES.

SURVEY NOTES

1. EXISTING PROJECT DRAWINGS AND FIELD MEASUREMENTS WERE USED TO DEVELOP THIS DRAWING SET.
2. HORIZONTAL DATUM IS NAD83 MARYLAND STATE PLANE US FEET.
3. THE VERTICAL DATUM IS CONOWINGO DATUM (0.7 FEET LOWER THAN NGVD29 AND .14 FEET HIGHER THAN NAVD88).

GENERAL CONCRETE NOTES:

1. THE FOLLOWING STANDARDS SHALL BE USED
 - CONCRETE DESIGN STANDARD: ACI 318;
 - CONCRETE DETAILING STANDARD: ACI 315;
 - CONCRETE SPECIFICATION STANDARD: ACI 301;
 - CONCRETE FIELD REFERENCE MANUAL: ACI MNL-15
2. ALL CORNERS, INTERSECTIONS, AND ENDS IN CONCRETE STRUCTURES SHALL BE REINFORCED WITH ADDITIONAL BARS. REFER TO SECTIONS AND DETAILS ON SHEET 11.
3. REINFORCEMENT STEEL SHALL EXTEND THROUGH CONCRETE CONSTRUCTION JOINTS AT LEAST A FULL DEVELOPMENT LENGTH ON EITHER SIDE OF JOINT.
4. ALL REINFORCING STEEL SHALL CONFORM WITH ASTM A615, GRADE 60 UNLESS GRADE 75 IS SPECIFIED. ALL REINFORCING SHALL BE PLAIN DEFORMED BARS.
5. PROTECT CONCRETE FROM PREMATURE DRYING IMMEDIATELY AFTER PLACEMENT. CURING OF CONCRETE SHALL START WITHIN TWO HOURS AFTER FINISHING OPERATIONS ARE COMPLETE. REFER TO THE PROJECT SPECIFICATIONS FOR ADDITIONAL CURING, THERMAL, AND MOISTURE RETENTION REQUIREMENTS.
6. CONCRETE FINISHES SHALL BE AS REQUIRED BY ACI 301, UNLESS OTHERWISE NOTED. ALL CONCRETE REMAINING EXPOSED TO VIEW AT THE COMPLETION OF CONSTRUCTION SHALL RECEIVE A BROOM FINISH. THE FINISH SHALL BE INSTALLED IMMEDIATELY UPON FORM REMOVAL.
7. THE CONTRACTOR SHALL COORDINATE THE SIZE OF ALL OPENINGS, PENETRATIONS, JOINTS AND UTILITIES WITH THE OWNER. THE FINAL SIZE AND LOCATION OF ALL ITEMS AFFECTING THE CONCRETE WORK SHALL BE INDICATED ON THE CONCRETE REINFORCING DRAWINGS AT THE TIME OF SUBMISSION TO THE ENGINEER FOR REVIEW. IF ADDITIONAL OPENINGS ARE REQUIRED THAT ARE NOT SHOWN, CONTRACTOR SHALL IDENTIFY SUCH OPENINGS TO THE OWNER'S PROJECT MANAGER WHO SHALL NOTIFY THE ENGINEER.
8. ALL EXPOSED EDGES SHALL HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.
9. CONCRETE COVER SHALL BE AS FOLLOWS:

COVER	DESCRIPTION
3"	CONCRETE IN CONTACT WITH THE GROUND.
2"	CONCRETE GREATER THAN 12" THICK OR EXPOSED TO WEATHER.
*	CONCRETE LESS THAN OR EQUAL TO 12" THICK SHALL USE COVER REQUIREMENTS IN ACI 318.
10. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4500PSI AT 28 DAYS.

GENERAL EARTHWORK NOTES:

1. PLACE FOUNDATIONS ON COMPETENT BEDROCK OR ON A SUITABLE SUBGRADE UNLESS OTHERWISE APPROVED. IF PLACED ON BEDROCK, REMOVE ORGANICS, DEBRIS, AND LOOSE SOIL/ROCK AND PRESSURE WASH PRIOR TO PLACING CONCRETE. IF ON SOIL: OVER EXCAVATE ±1FT AND REPLACE WITH COMPACTED STRUCTURAL FILL.
2. NO BORINGS ARE AVAILABLE.
3. PROVIDE BACKFILL WITH POSITIVE DRAINAGE AWAY FROM STRUCTURES.

GENERAL STEEL NOTES:

1. STRUCTURAL STEEL:
 - STEEL PLATE, SHAPES, AND BARS – ASTM A36
 - STAINLESS STEEL PLATE AND SHAPES – ASTM A276, TYPE 304
 - STEEL PIPE – ASTM A106, GRADE B (Fy=35KSI, Fu=50KSI)
 - STEEL FITTINGS – ASTM A105 (Fy=36KSI, Fu=70KSI)
2. DESIGN, FABRICATION, AND ERECTION SHALL BE AS PER SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS (AISC 360-10).
3. WHERE STEEL MEMBERS ARE WELDED AND NO SIZE IS SPECIFIED, PROVIDE FULL LENGTH FILLET WELDS BOTH SIDES OF MEMBER. WELD SIZES SHALL BE AS FOLLOWS UNLESS NOTED OTHERWISE:

MEMBER THICKNESS	WELD SIZE
3/16"	3/16"
1/4"	3/16"
5/16"	3/16"
3/8"	1/4"
7/16"	1/4"
1/2"	5/16"
9/16"	3/8"
5/8"	7/16"
4. SPLICING OF STRUCTURAL STEEL MEMBERS IS PROHIBITED WITHOUT PRIOR APPROVAL OF THE ENGINEER AS TO LOCATION AND TYPE OF SPLICE TO BE MADE. ANY MEMBER HAVING A SPLICE NOT SHOWN AND DETAILED ON SHOP DRAWINGS WILL BE REJECTED.
5. ALL WELDING SHALL CONFORM TO THE AMERICAN WELDING SOCIETY CODE. USE E70 SERIES ELECTRODES FOR ALL STRUCTURAL STEEL WELDS.
6. UNLESS OTHERWISE SPECIFIED, ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION, INCLUDING BOLTS, WASHERS, AND SHIMS.
7. ULTRASONIC INSPECTION OR OTHER APPROVED METHOD, BY THE TESTING LABORATORY SHALL BE PROVIDED FOR ALL WELDS CALLED FOR ON THE STRUCTURAL DRAWINGS OR SHOP DRAWINGS AS FULL PENETRATION OR COMPLETE JOINT PENETRATION WELDS.
8. ALL BOLTED CONNECTIONS SHALL CONFORM TO ASTM F3125, GRADE A325, UNLESS NOTED OTHERWISE.
9. REFER TO THE CONSTRUCTION SPECIFICATIONS FOR PIPE COATING REQUIREMENTS.
10. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO ENGINEER FOR APPROVAL PRIOR TO STARTING FABRICATION

DATE	#		BY	APP
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CONOWINGO EEL PASSAGE

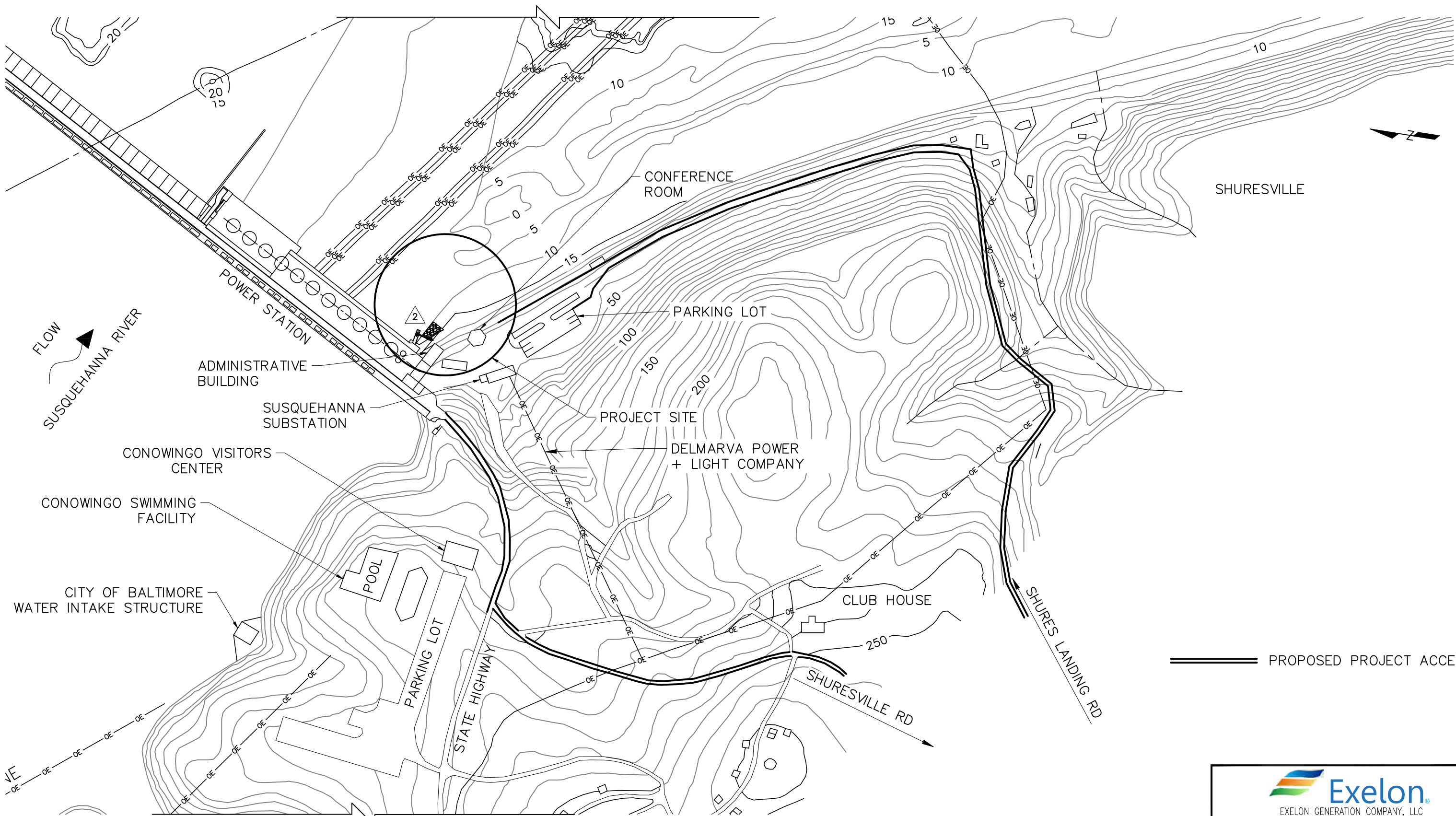


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GENERAL NOTES

SCALE: AS NOTED

DRAWING NO.: 1



NOTE: THIS DRAWING REFERENCES CONOWINGO DATUM, IN CONTRAST TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29). CONOWINGO ELEVATIONS ARE 0.7 FT LOWER THAN NGVD 29 ELEVATIONS SUCH THAT 108.5 FT CONOWINGO DATUM EQUALS ELEVATION 109.2 FT NGVD 29. CONOWINGO DATUM IS 0.14 FT HIGHER THAN NAVD 88.

2000' 0 2000' 4000'
SCALE: 1" = 2000'-0"

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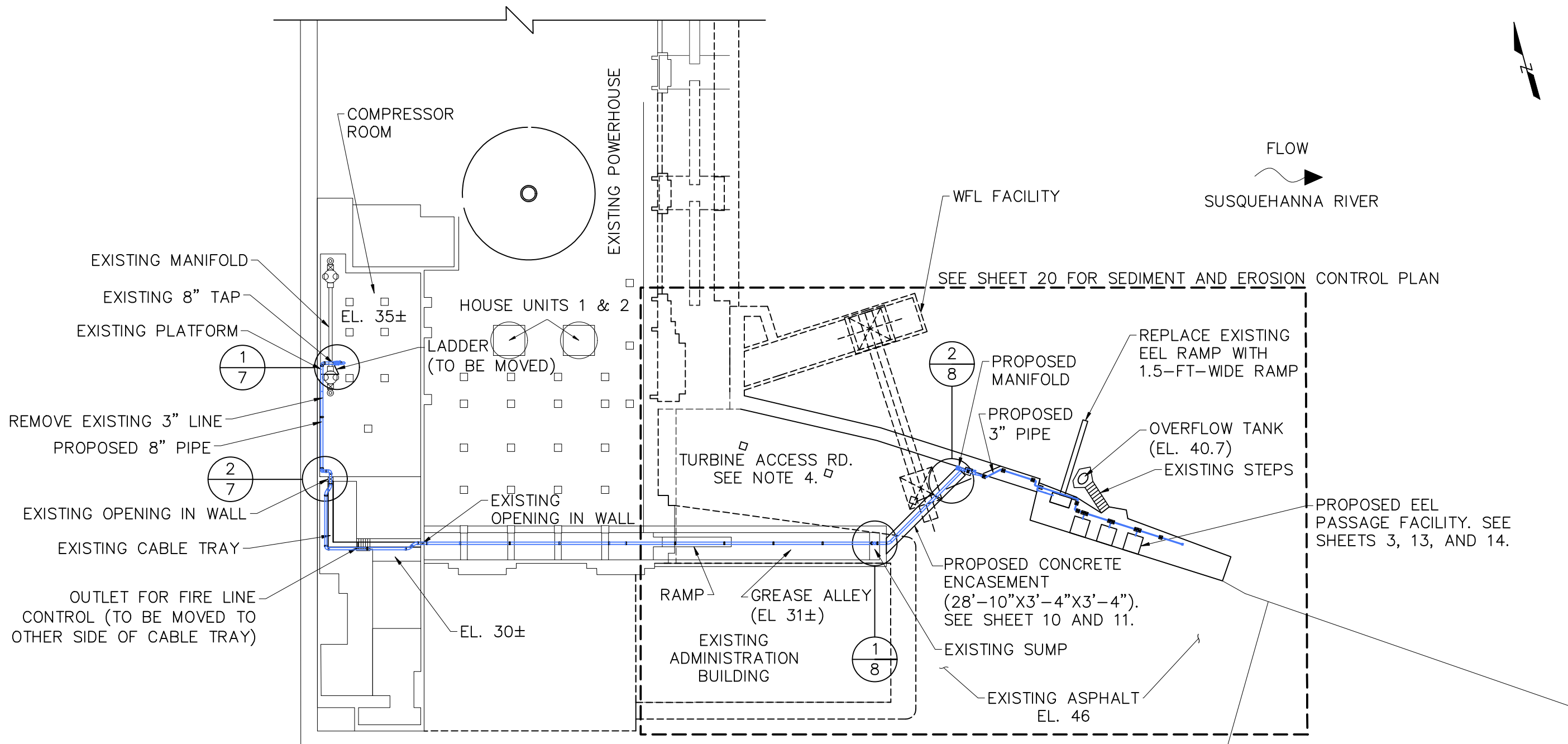
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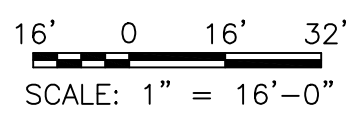
SCALE: AS NOTED DRAWING NO.: GP-1

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NOTES

1. ELEVATIONS SHOWN ARE CONOWINGO DAM DATUM (0.7 FEET LOWER THAN NGVD 29 AND 0.14 FEET HIGHER THAN NAVD88)
2. MAXIMUM SUPPORT SPACING SHALL BE 18 FEET FOR 8" PIPE AND 12 FEET FOR 3" PIPE. WHERE POSSIBLE THERE SHALL BE A SUPPORT AT EACH END OF AN ELBOW/BEND. ALL VERTICAL SUPPORTS SHALL BE SADDLE-SHAPED AND SHALL HAVE A MINIMUM CAPACITY OF 1500 LB. SEE SHEET 12 FOR TYPICAL SUPPORT DETAILS.
3. CONTRACTOR SHALL REMOVE EXISTING 3" PIPE THAT EXISTS ALONG THE ALIGNMENT OF THE PROPOSED 8" PIPE. AVOID OR MOVE OTHER PIPES UPON EXELON'S APPROVAL.
4. LOCATE AND PROTECT EXISTING BURIED DRAINS BENEATH TURBINE ACCESS ROAD (SEE EXISTING P.E. CO. DRAWING H-80531). RAILROAD TIES AND TRACKS MAY ALSO BE BURIED UNDER TURBINE ACCESS ROAD. IF ENCOUNTERED, AND PENDING SHPO CONSULTATION, THE RAILS AND TIES SHALL BE PRESERVED IN PLACE.



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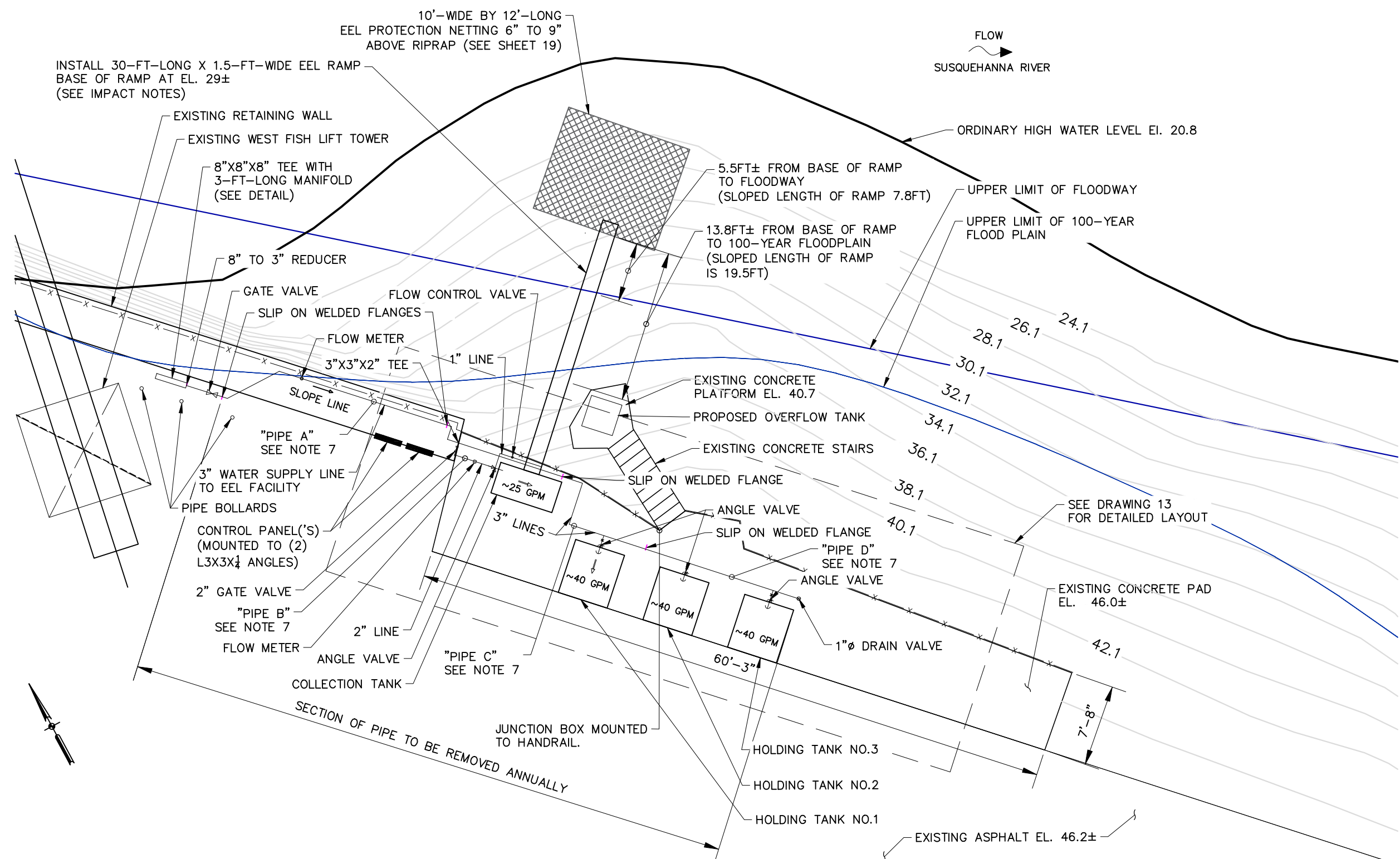
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PROPOSED PIPE LAYOUT

SCALE: AS NOTED	DRAWING NO.: 2

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- ### IMPACTS TO FLOODPLAIN
1. LINEAR FEET OF EEL RAMP WITHIN 100-YEAR FLOODPLAIN IS 13.8 FT.
 2. AREA OF EEL RAMP WITHIN 100-YEAR FLOOD PLAIN IS 20.7 FT².
 3. AREA OF EEL RAMP PIPE SUPPORT IS 2 FT².
 4. AREA OF TWO FLEXIBLE DRAINAGE HOSES IS 9.2 FT².
 5. AREA OF ANTI-PREDATOR NETTING IS 120 FT².

- ### NOTES
1. ELEVATIONS SHOWN ARE IN CONOWINGO DATUM.
 2. CONTOUR DATA WAS OBTAINED FROM THE HARFORD COUNTY GIS AND RECORDS MANAGEMENT. CONTOURS WERE DEVELOPED FROM LIDAR DATA COLLECTED ON 3/9/2013 AND 4/6/2013 WITH VERTICAL ACCURACY OF 0.223 FEET.
 3. FLOODWAY AND 100-YEAR FLOODPLAIN LINES WERE OBTAINED FROM FEMA'S NATIONAL FLOOD HAZARD LAYER.
 4. SEE DRAWING 6 FOR ADDITIONAL PIPING INFORMATION.
 5. SEE DRAWING 13 FOR DETAILED LAYOUT.
 6. SEE DRAWING 14 FOR TYPICAL TANK SECTIONS.
 7. PIPES SHALL BE CLEARLY MARKED AND LABELED WITH 1" HIGH LETTERS.

5' 0 5' 10'
SCALE: 1" = 5'-0"

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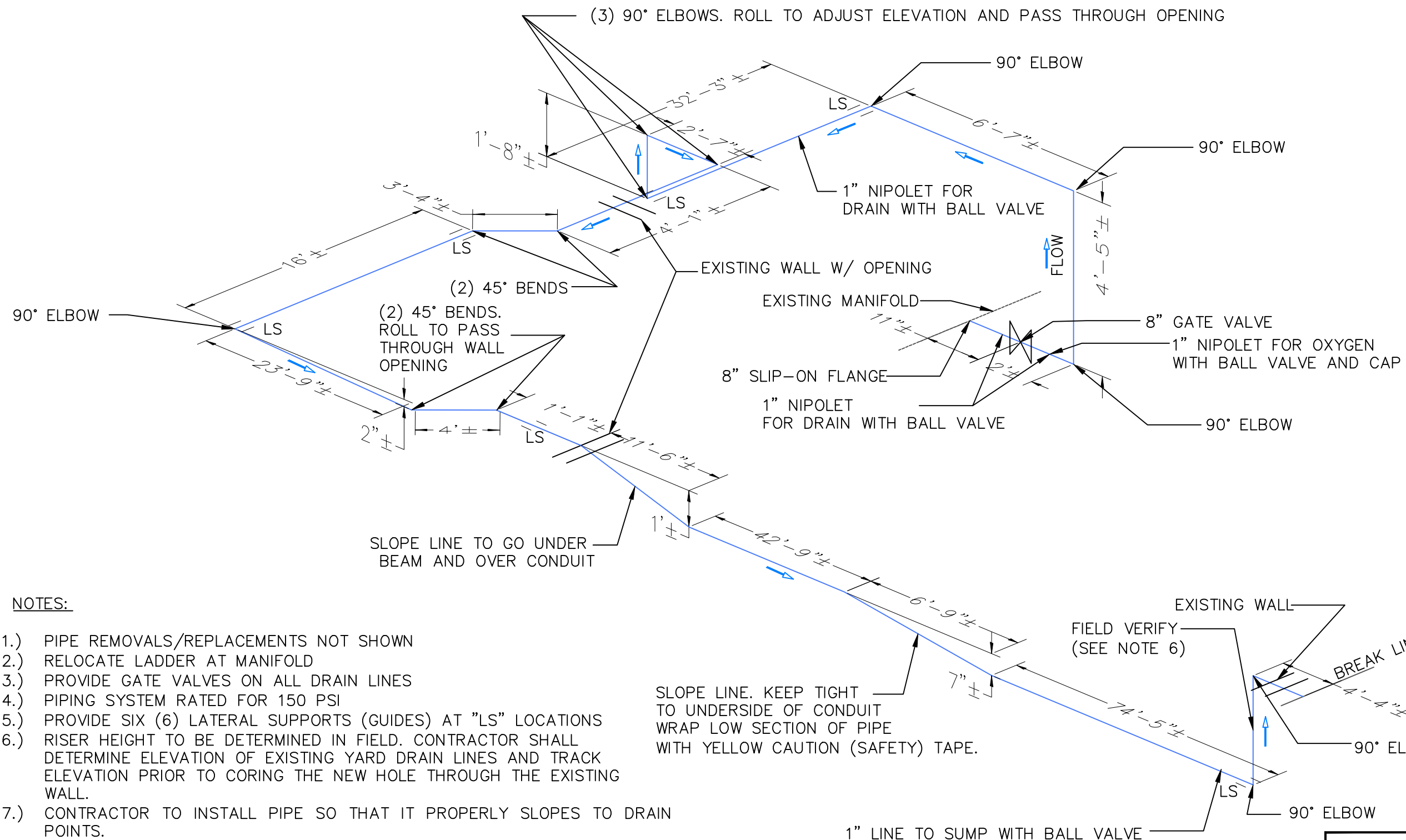


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EEL FACILITY PIPING CONFIGURATION

SCALE: AS NOTED

DRAWING NO.: 3



NOTES:

- 1.) PIPE REMOVALS/REPLACEMENTS NOT SHOWN
- 2.) RELOCATE LADDER AT MANIFOLD
- 3.) PROVIDE GATE VALVES ON ALL DRAIN LINES
- 4.) PIPING SYSTEM RATED FOR 150 PSI
- 5.) PROVIDE SIX (6) LATERAL SUPPORTS (GUIDES) AT "LS" LOCATIONS
- 6.) RISER HEIGHT TO BE DETERMINED IN FIELD. CONTRACTOR SHALL DETERMINE ELEVATION OF EXISTING YARD DRAIN LINES AND TRACK ELEVATION PRIOR TO CORING THE NEW HOLE THROUGH THE EXISTING WALL.
- 7.) CONTRACTOR TO INSTALL PIPE SO THAT IT PROPERLY SLOPES TO DRAIN POINTS.
- 8.) FIELD VERIFY ALL DIMENSIONS PRIOR TO PIPE FABRICATION.
- 9.) REFER TO NOTES 4 & 5 ON DRAWING 7 REGARDING ISOLATION OF THE PRESSURIZED MANIFOLD.

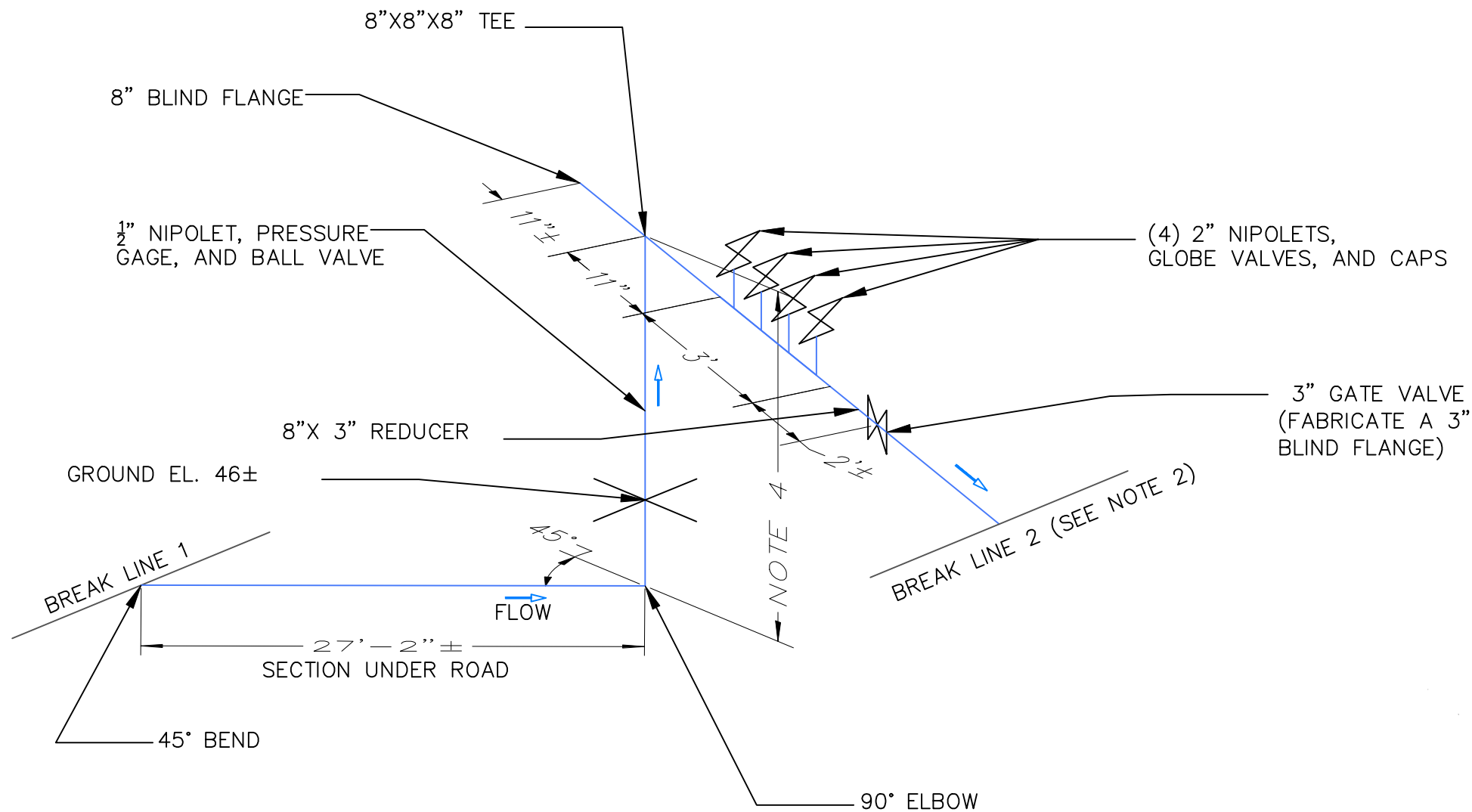
SLOPE LINE. KEEP TIGHT TO UNDERSIDE OF CONDUIT
WRAP LOW SECTION OF PIPE WITH YELLOW CAUTION (SAFETY) TAPE.

1" LINE TO SUMP WITH BALL VALVE

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	8" PIPELINE 3D PROFILE (INSIDE)	
SCALE:	AS NOTED	DRAWING NO.: 4

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NOTES:

- 1.) PIPING SYSTEM RATED FOR 150 PSI
- 2.) SEE ATTACHED SHEET 6 FOR CONTINUED PIPE PROFILE TO EEL PASSAGE STORAGE TANKS
- 3.) PIPING UNDER ROAD TO BE ENCASED IN CONCRETE.
- 4.) RISER HEIGHT TO BE DETERMINED IN FIELD. CONTRACTOR SHALL DETERMINE ELEVATION OF EXISTING YARD DRAIN LINES AND TRACK ELEVATION. CENTERLINE OF MANIFOLD SHALL BE AT ELEVATION 48±.
- 5.) 3-INCH SCHEDULE 40 STEEL CONDUIT (ELECTRICAL) TO BE INSTALLED ABOVE PIPE. SEE DRAWING 11.
- 6.) LENGTH OF PIPING IN BILL OF MATERIALS ASSUMES 10% CONTINGENCY. ALL LENGTHS OF PIPE TO BE FIELD VERIFIED PRIOR TO FABRICATION.
- 7.) BILL OF MATERIALS DOES NOT INCLUDE VALVES AND PIPING ATTACHED TO OR DOWNSTREAM OF THE EEL FACILITY TANKS. REFER TO SHEET 18 FOR EEL FACILITY SUPPLIES.

BILL OF MATERIALS, CONT'D	
Pipe Supports	
# of Item	Item Description
5	2-inch Pipe Stand
15	3-inch Pipe Stand
5	Type A Lateral Support
1	Type B Lateral Support
4	Type C Lateral Support
3	Type A Vertical Hanger Support
14	Type B Vertical Hanger Support
2	Type C Vertical Hanger Support

BILL OF MATERIALS	
Piping	
Item Description	Total Length
8-inch Schedule 40 Steel Pipe	±282 ft.
3-inch Schedule 40 Steel Pipe	±110 ft.
2-inch Schedule 40 PVC Pipe	±19 ft.
1-inch Schedule 40 Steel Pipe	±2 ft.

Valves	
# of Item	Item Description
1	8-inch Steel Gate Valve
6	1-inch Steel Ball Valve
1	1/2-inch Steel Ball Valve
4	2-inch Steel Globe Valve
1	3-inch Steel Gate Valve
4	2-inch PVC Gate Valve
4	2-inch PVC Angle Valve

Fittings	
# of Item	Item Description
3	8-inch Class D Slip-on Steel Flange
6	1-inch Steel Nipolet
6	1-inch Steel Threaded Cap
10	8-inch, 90-degree, Short Radius, Steel Elbow
5	8-inch, 45-degree Steel Bend
1	1/2-inch Steel Nipolet
1	1/2-inch Steel Threaded Cap
1	8"x8"x8" Steel Tee
1	8-inch Steel Blind Flange
4	2-inch Steel Nipolet
4	2-inch Steel Threaded Cap
1	8"x3" Steel Reducer (2' Long)
4	3-inch Slip-on Steel Flange
2	3-inch, 45-degree Steel Bend
4	3-inch, 90-degree, Short Radius Steel Elbow
4	3"x3"x2" Steel Tee
2	3-inch Steel Blind Flange
9	2-inch, 90-degree, PVC Elbow
4	Steel to PVC Adaptor
2	3-inch Steel Threaded Cap

Instruments	
# of Item	Item Description
1	1/2-inch Pressure Gage
1	3-inch Flow Meter
4	2-inch Flow Meter

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8" & 3" PIPELINES 3D PROFILE (OUTSIDE)

SCALE: AS NOTED

DRAWING NO.: 5

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NOTES:

- 1.) PIPING SYSTEM RATED FOR 150 PSI.
- 2.) A VERTICAL 2-INCH PIPE STAND SHALL BE PROVIDED AT THE BOTTOM OF EACH 2-INCH RISER.
- 3.) SLOPE PIPE TO DRAIN WITH DOWNSTREAM END 6" ABOVE GRADE.
- 4.) PROVIDE VERTICAL PIPE STANDS AT "LS" LOCATIONS SHOWN ON DRAWING.
- 5.) MAXIMUM SPACING OF PIPE STANDS SHALL BE 12 FEET FOR 3-INCH PIPING.
- 6.) PROVIDE LATERAL SUPPORT, TYPE C AT THE TOP OF EACH 2-INCH RISER.
- 7.) LABEL PIPE SEGMENTS AS SPECIFIED ON DRAWING 3.
- 8.) FIELD VERIFY ALL DIMENSIONS PRIOR TO FABRICATION.

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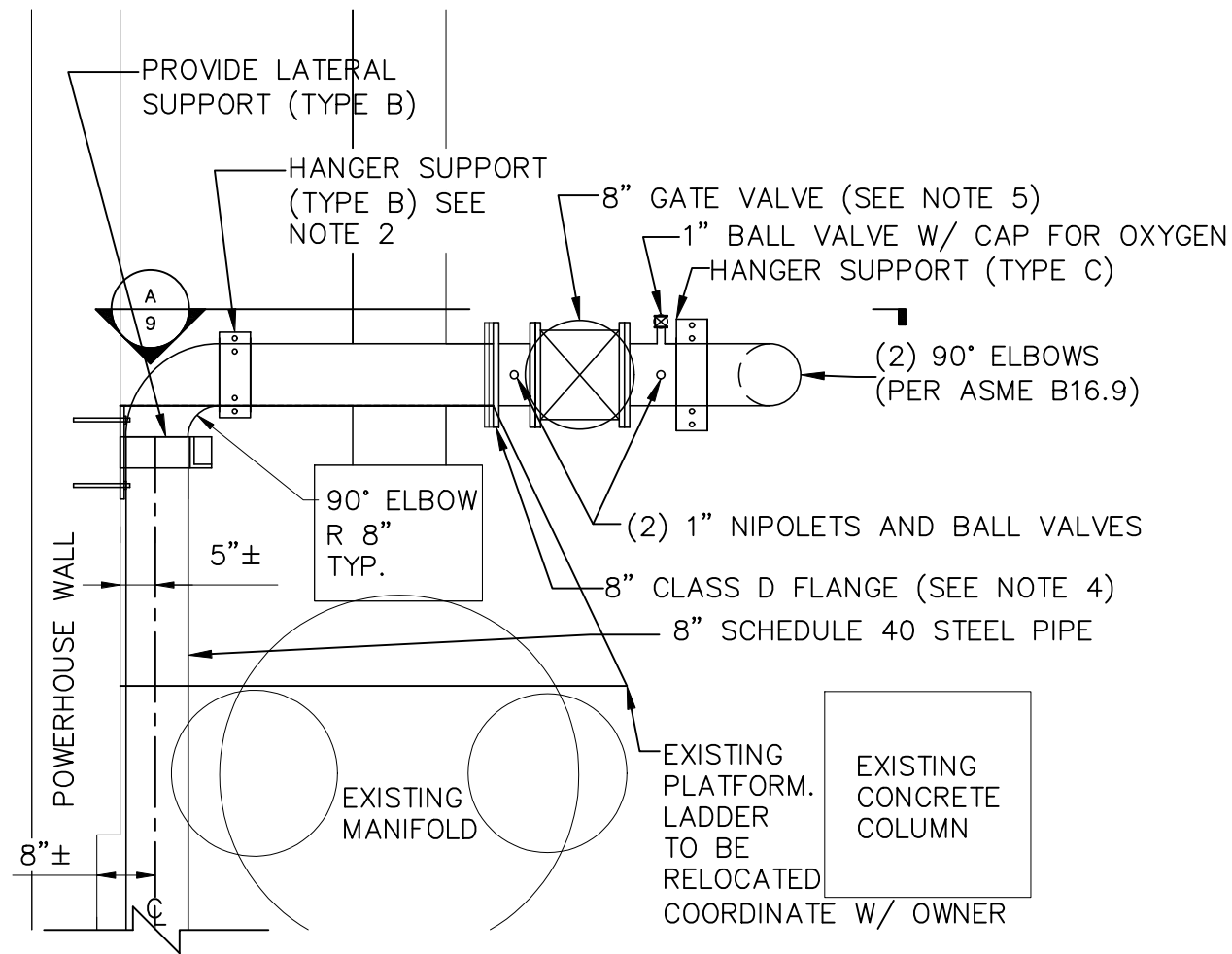


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EEL FACILITY PIPELINE 3D PROFILE

SCALE:	AS NOTED	DRAWING NO.:	6

IT IS A VIOLATION OF THE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANYWAY UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. ALTERATIONS MUST HAVE THE ENGINEER'S SEAL AFFIXED ALONG WITH A DESCRIPTION OF THE ALTERATION, THE SIGNATURE AND DATE.

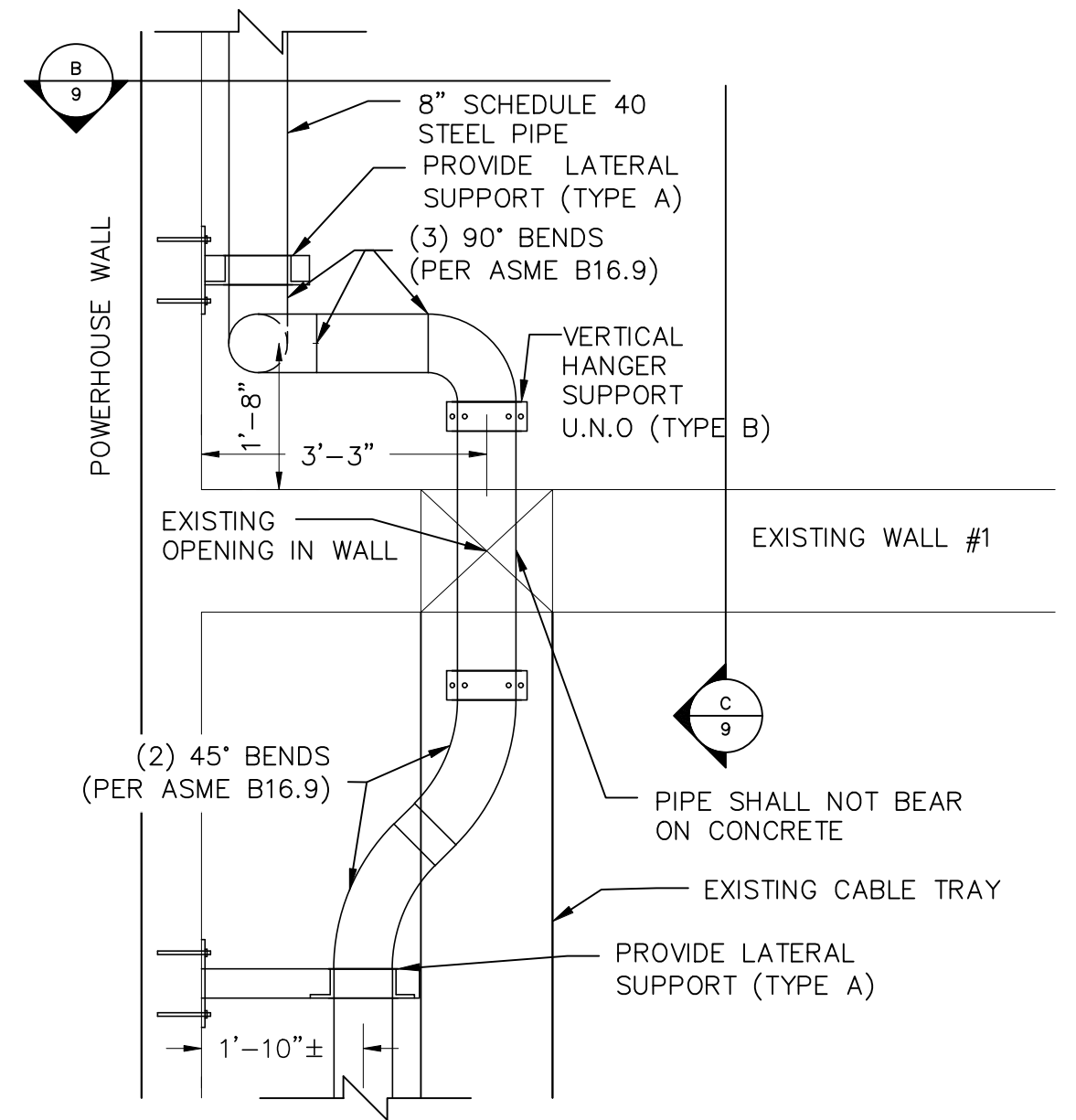


1 PLAN OF PIPE AT EXISTING MANIFOLD
7 Scale: 1"=1'

NOTES

1. ELEVATIONS SHOWN ARE CONOWINGO DAM DATUM (0.7 FEET LOWER THAN NGVD 29)
2. MAXIMUM SUPPORT SPACING SHALL BE 18 FEET FOR 8" PIPE AND 12 FEET FOR 3" PIPE. WHERE POSSIBLE THERE SHALL BE A SUPPORT AT EACH END OF AN ELBOW/BEND. ALL VERTICAL SUPPORTS SHALL BE SADDLE-SHAPED AND SHALL HAVE A MINIMUM CAPACITY OF 1500 LB. SEE SHEET 12 FOR TYPICAL SUPPORT DETAILS.
3. CONTRACTOR SHALL REMOVE EXISTING 3" PIPE THAT EXISTS ALONG THE ALIGNMENT OF THE PROPOSED 8" PIPE. AVOID OR MOVE OTHER PIPES UPON EXELON'S APPROVAL.
4. EXISTING MANIFOLD IS UNDER PRESSURE AND MUST BE ISOLATED (DOUBLE ISOLATED PREFERRED) PRIOR TO COMMENCING ANY WORK. BLIND FLANGE IS TO BE CAREFULLY REMOVED IN SUCH A MANNER TO CHECK LINE IS NOT PRESSURIZED.
5. THE NEW GATE VALVE IS TO BE INSTALLED AND CLOSED WITHIN 2 HOURS OF THE REMOVAL OF THE EXISTING BLIND FLANGE. TEMPORARILY SUPPORT THE VALVE UNTIL NEW SUPPORTS ARE INSTALLED.

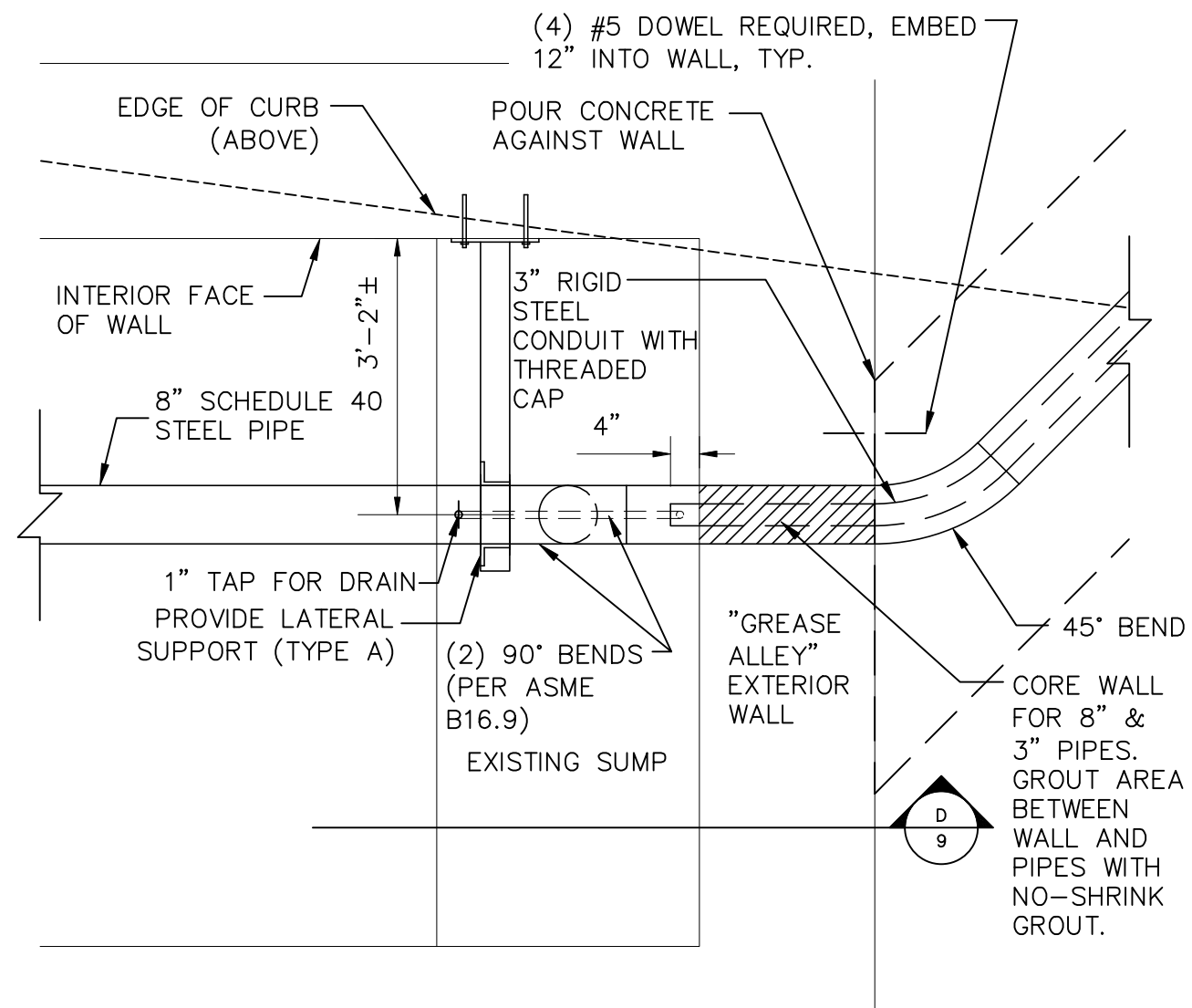
1' 0 1' 2'
SCALE: 1" = 1'-0"



2 PLAN OF PIPE THROUGH WALL #1
7 Scale: 1"=1'

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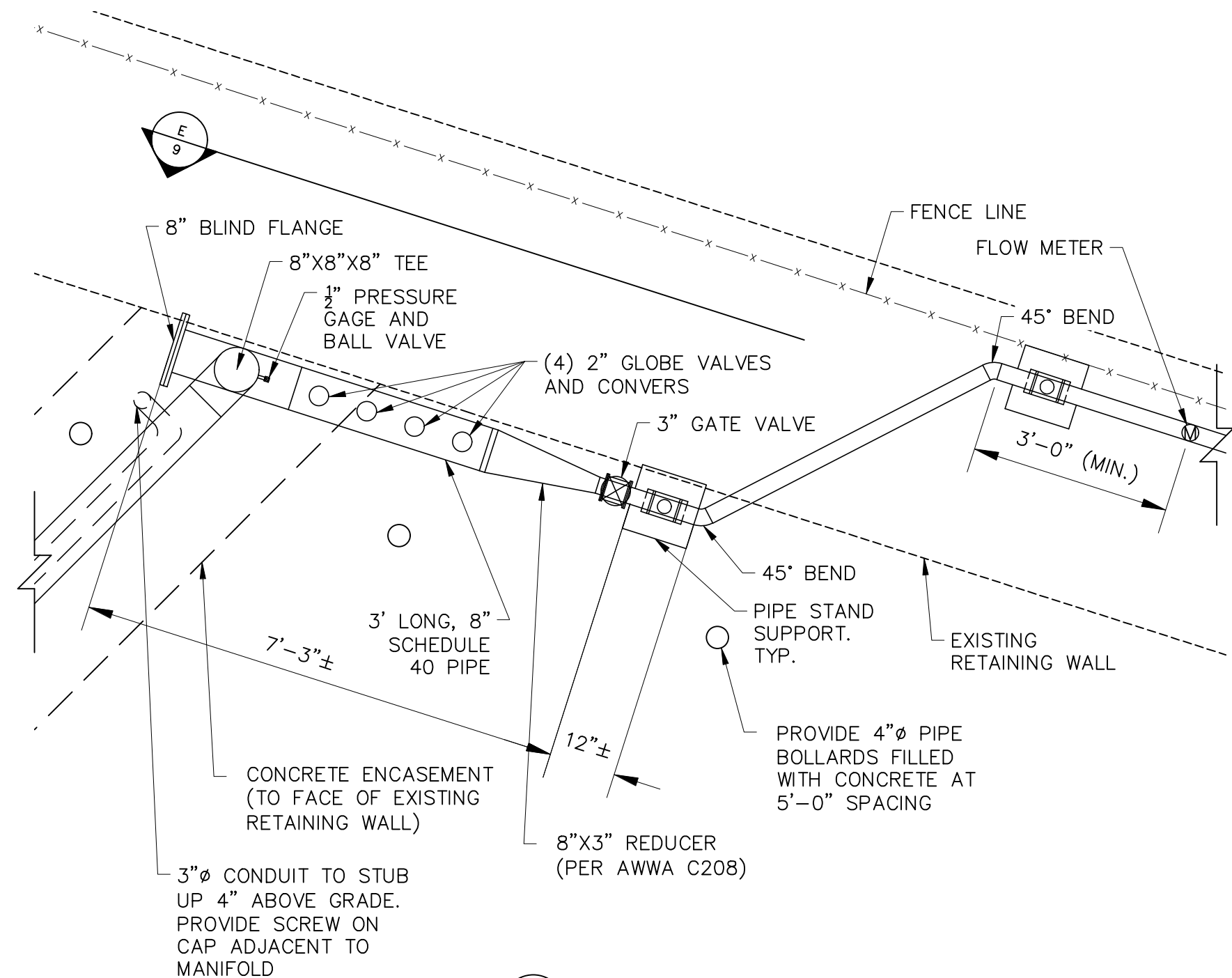
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DETAILED PIPE LAYOUT PLANS, SHEET 1		
SCALE:	AS NOTED	DRAWING NO.: 7



1 PLAN OF PIPE AT END OF ALLEY
8 Scale: 1"=1'

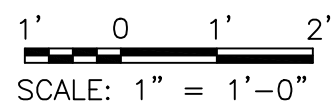
NOTES

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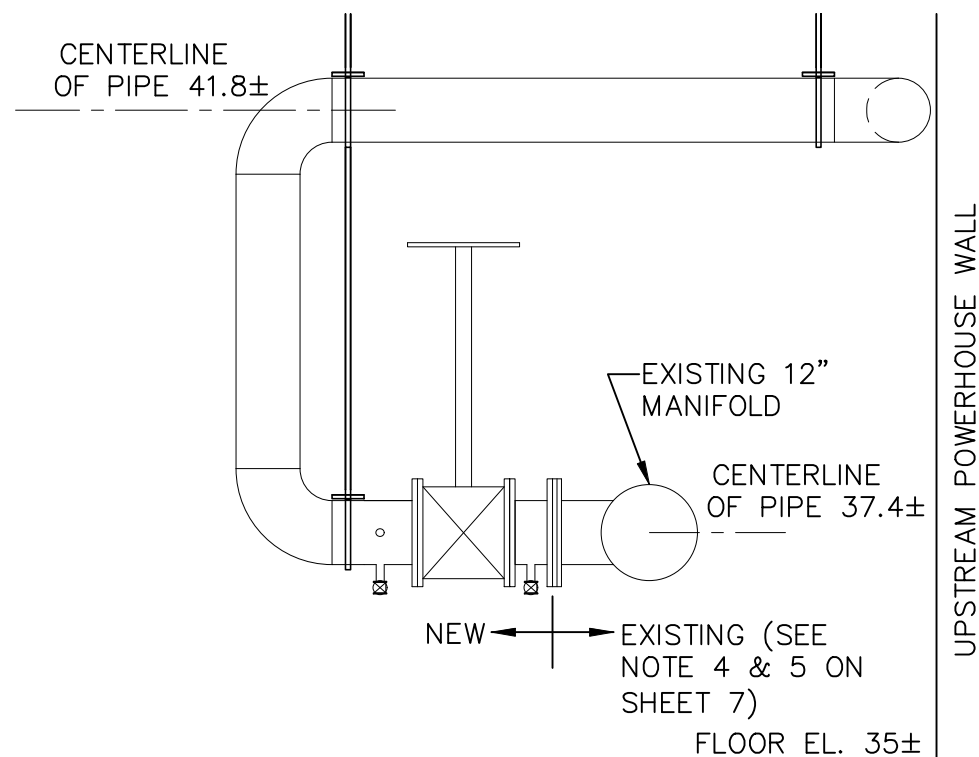
2 PLAN OF PROPOSED MANIFOLD
8 Scale: 1"=1'

NOTE: 3" RIGID STEEL CONDUIT TO STUB UP 4" ABOVE
FINISH GRADE. PLACE 12" AWAY FROM MANIFOLD.

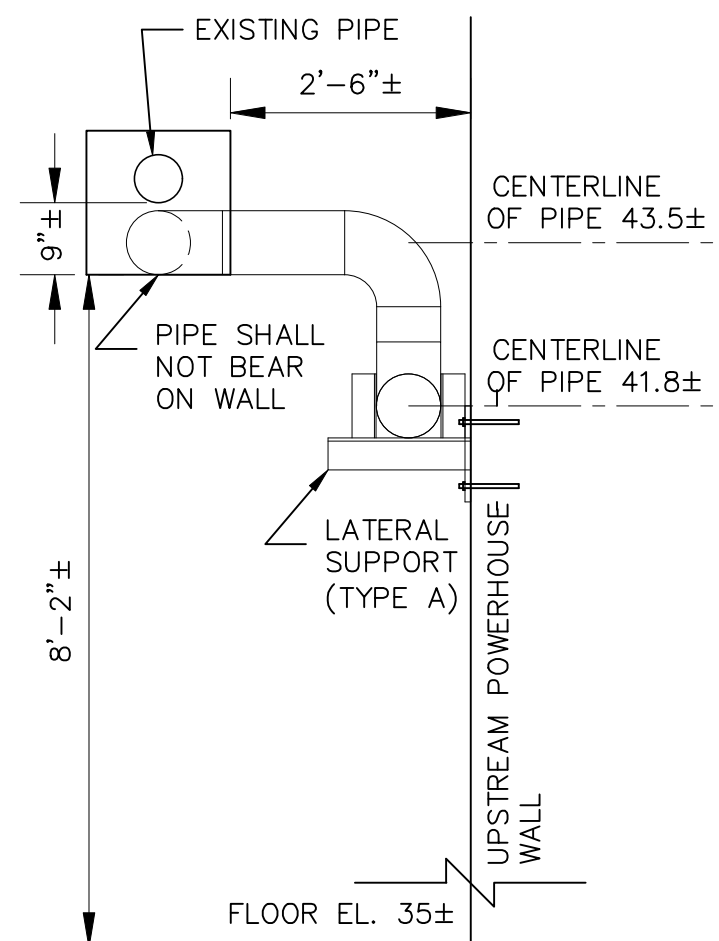


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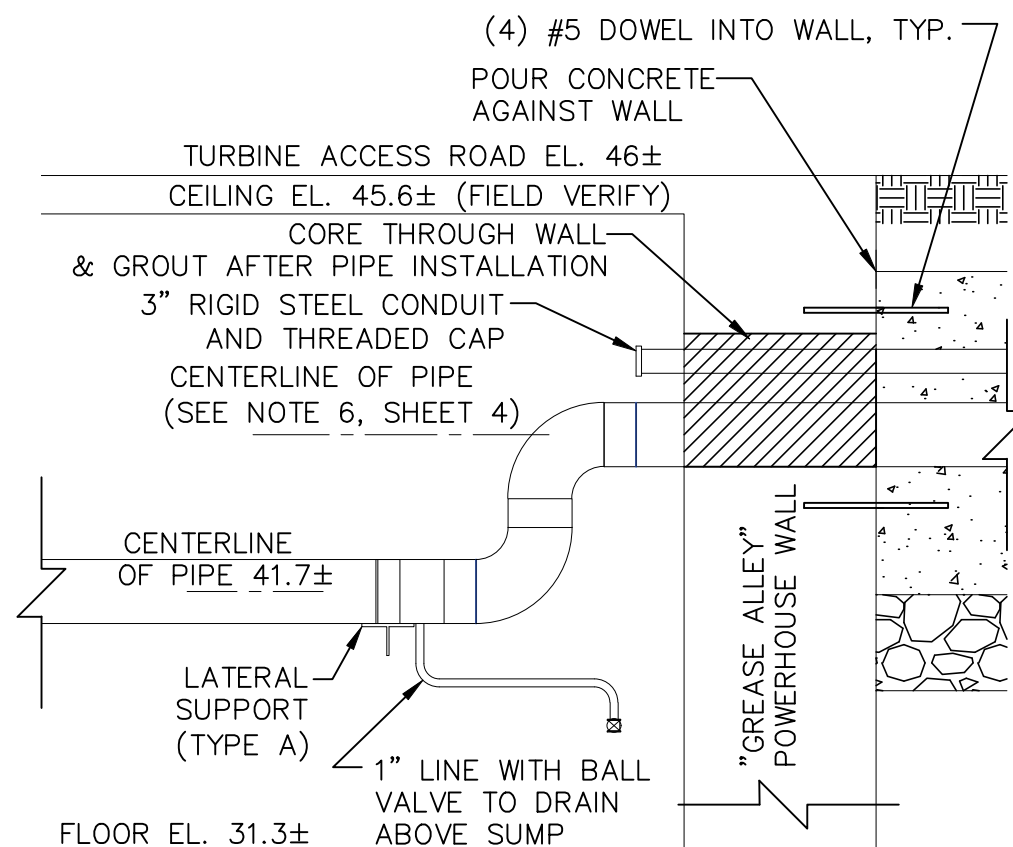
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 GOMEZ AND SULLIVAN ENGINEERS Williamsville, NY • Utica, NY • Albany, NY • Henniker, NH www.gomezandsullivan.com	DETAILED PIPE LAYOUT PLANS, SHEET 2
SCALE:	AS NOTED DRAWING NO.: 8



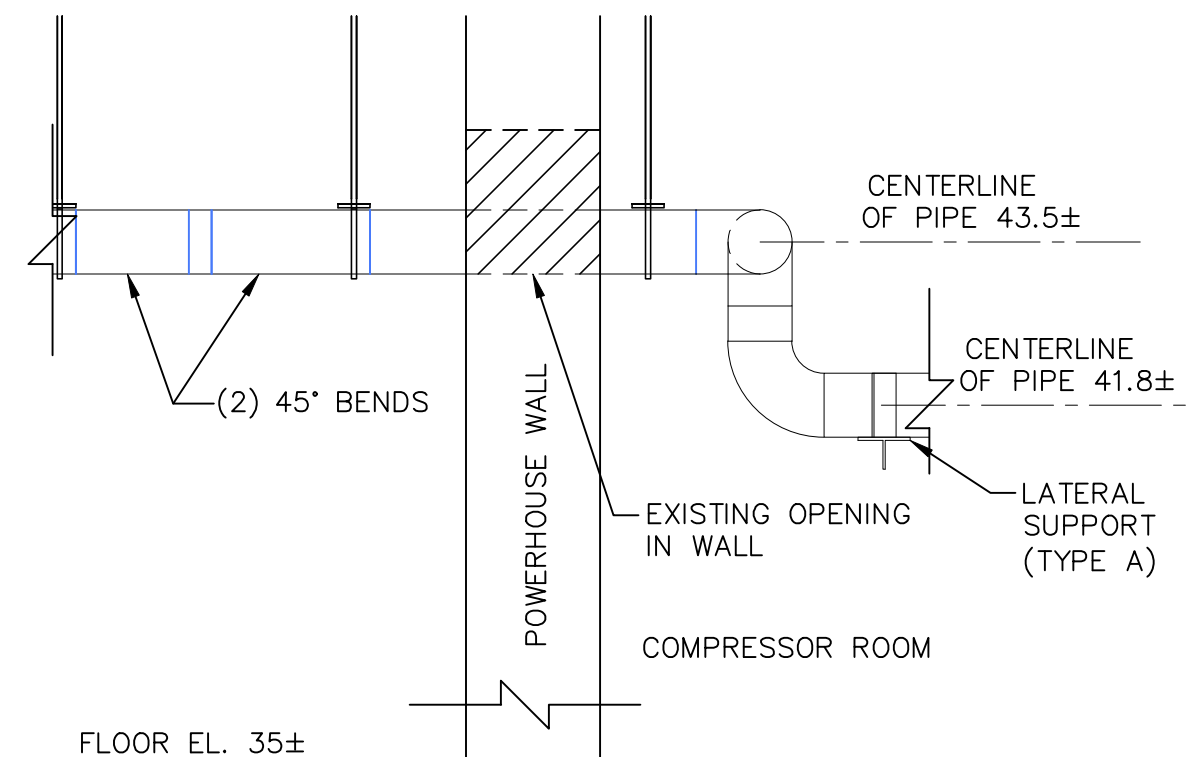
(A) ELEVATION AT EXISTING MANIFOLD
9 Scale: 1"=1'



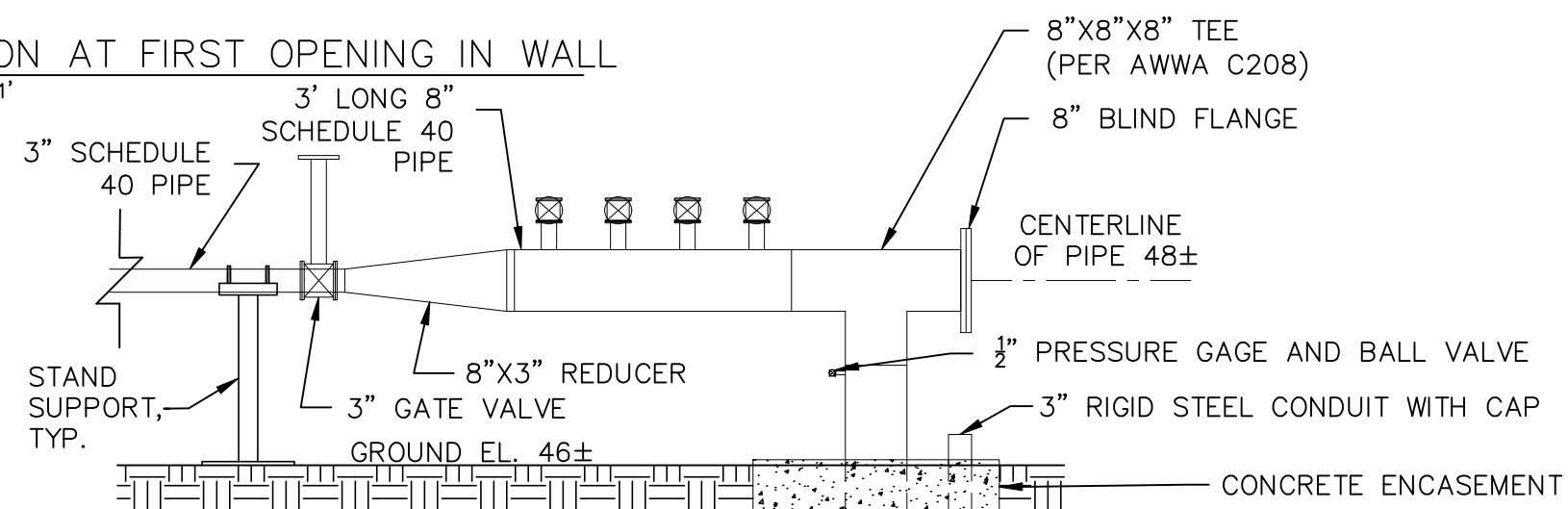
SECTION AT FIRST OPENING IN WALL
Scale: 1"=1' 3' LONG 8"



(D) ELEVATION AT END OF "GREASE ALLEY"
9 Scale: 1"=1'



C ELEVATION AT FIRST OPENING IN WALL
9 Scale: 1"=1'



MANIFOLD DETAIL ELEVATION
Scale: 1"=2'

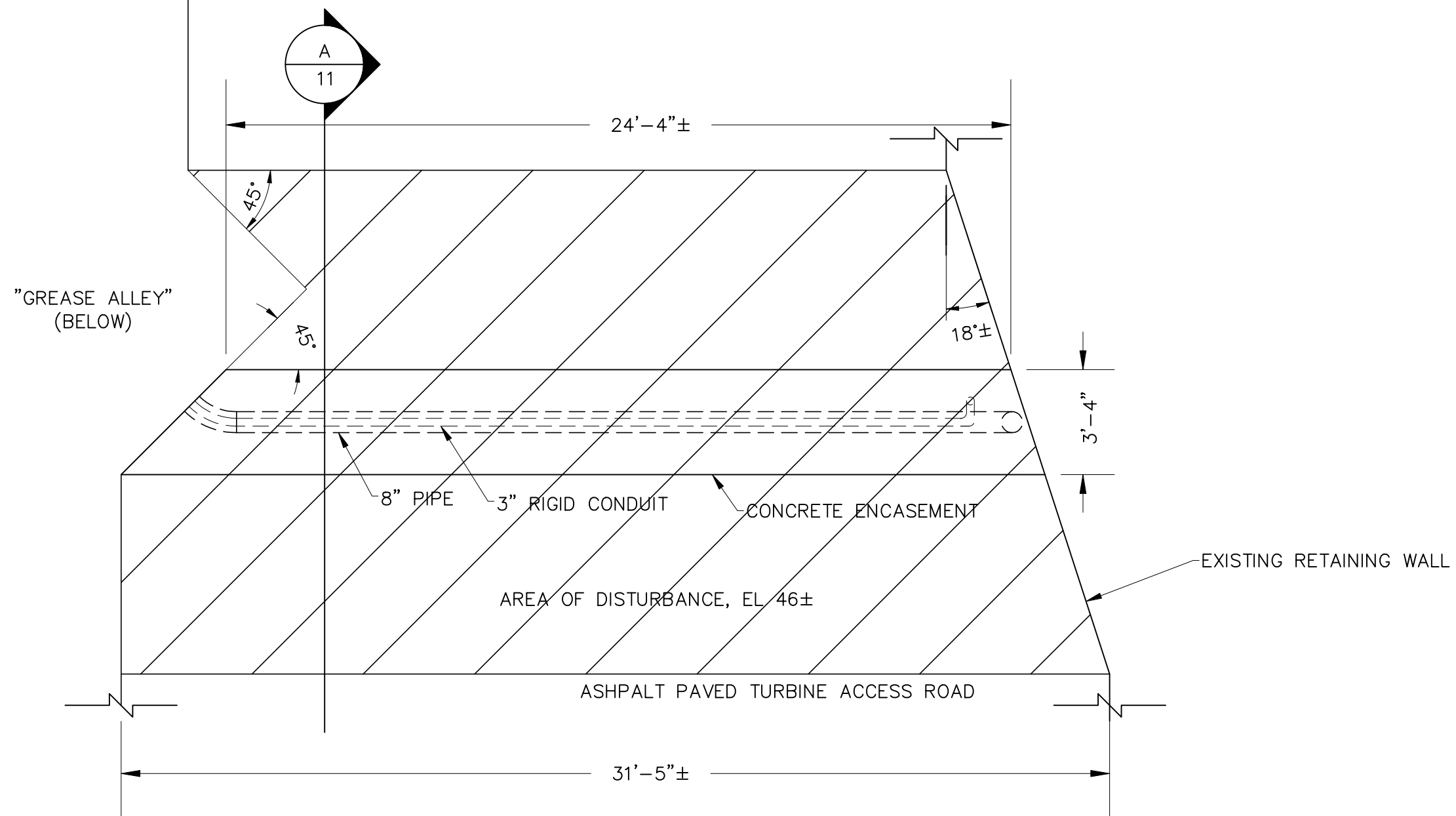
NOTES

1. ELEVATIONS SHOWN ARE CONOWINGO DAM DATUM (0.7 FEET LOWER THAN NGVD 29)

DATE	#		BY	AP
DRAWN BY: ALR CHECKED BY: HNN APPROVED BY: D				
GSE PROJECT NO.: 1714			DATE: 2/17/2017	

	 Exelon® EXELON GENERATION COMPANY, LLC	
	CONOWINGO EEL PASSAGE	
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	SECTIONS AND DETAILS	
SCALE:	AS NOTED	DRAWING NO.: 9

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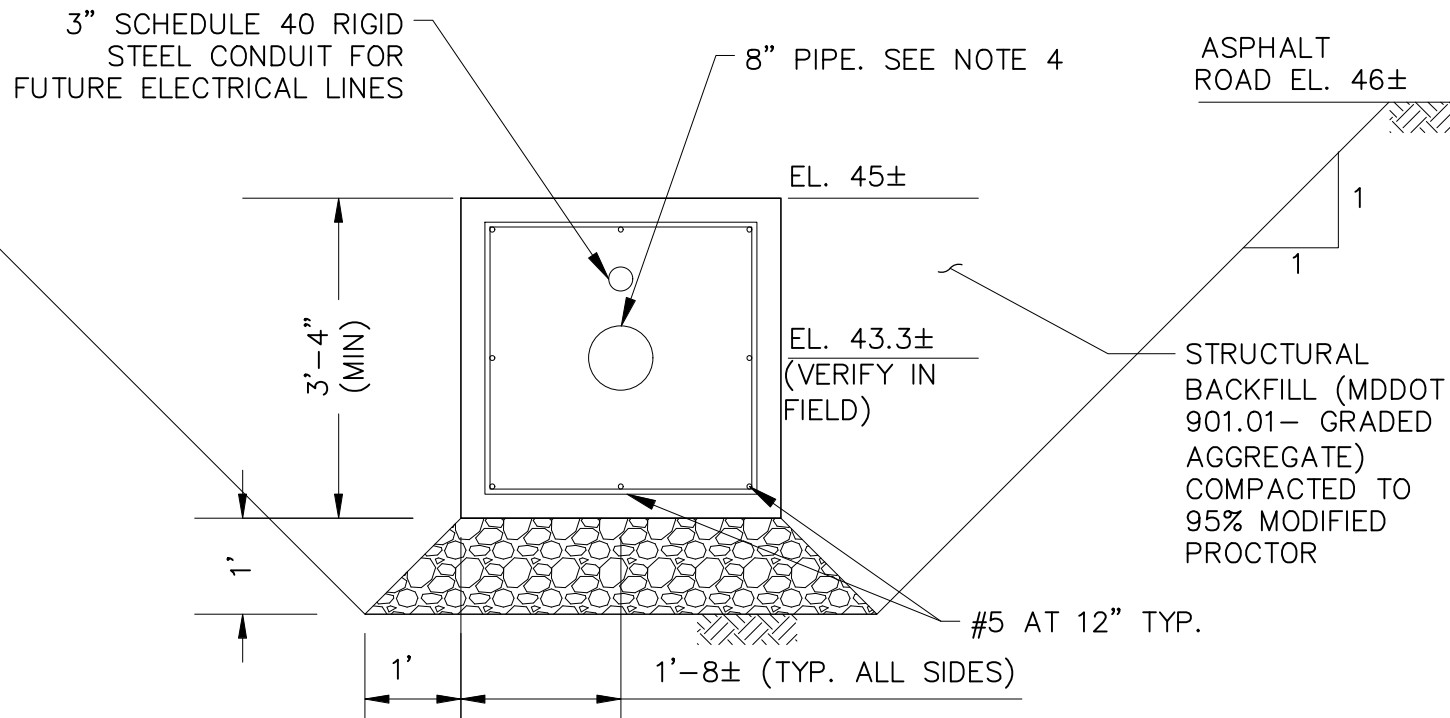
NOTES:

1. THE 8" PIPE SHALL RUN UNDER THE EXISTING YARD DRAINAGE LINES. EXCAVATE BY HAND TO LOCATE DRAIN LINES AND TO ENSURE LINES ARE NOT DAMAGED OR DISTURBED DURING INSTALLATION OF NEW PIPE. ELEVATION ACROSS DRIVEWAY WILL BE DEPENDENT ON LOCATION OF DRAIN LINES AND RAILROAD TRACKS.
2. MAXIMUM AREA OF DISTURBANCE EQUAL TO 507 SQ. FT.

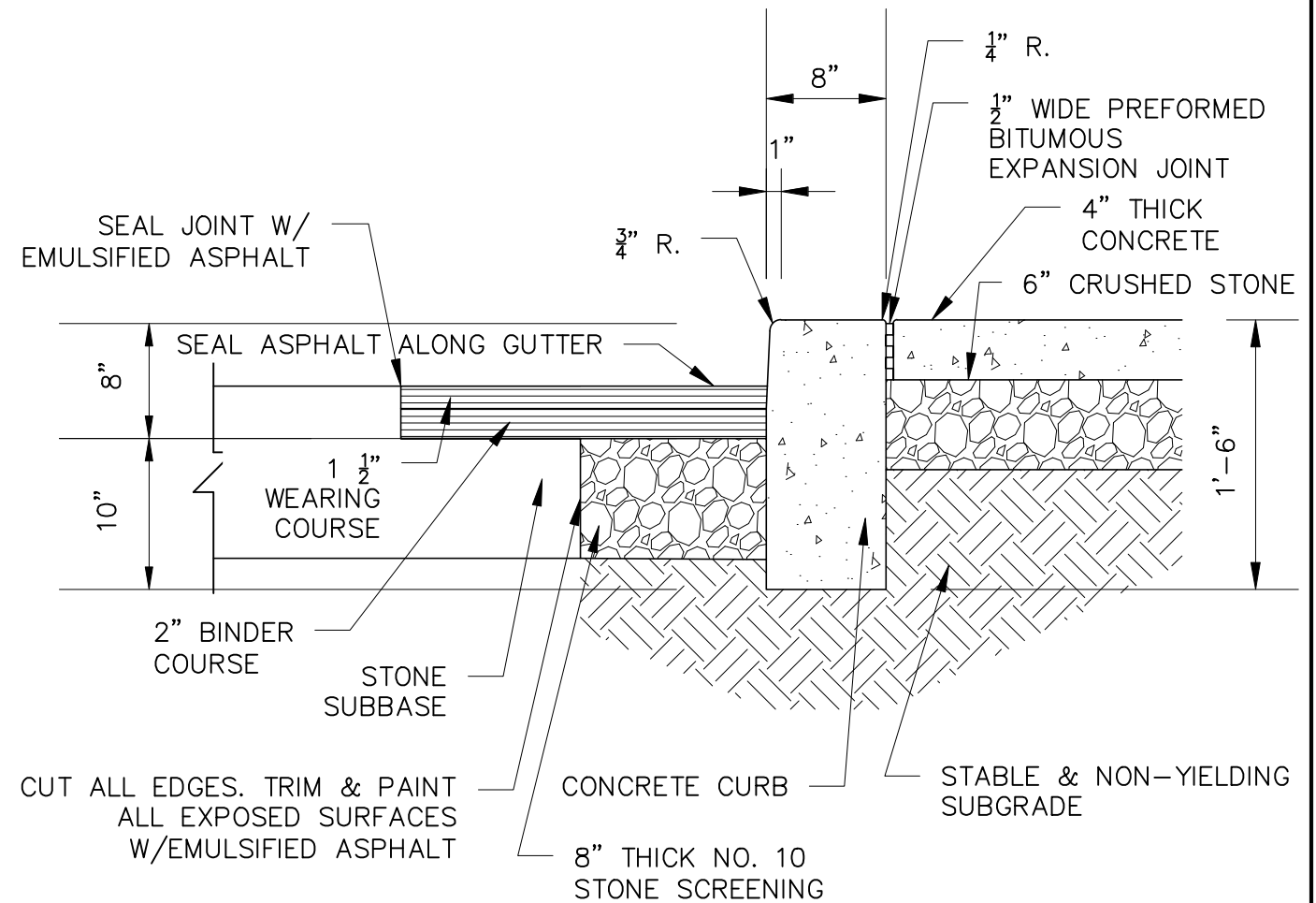
2' 0 2' 4'
SCALE: 1" = 2'-0"

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DRAWN BY: ALR		CHECKED BY: HNN		APPROVED BY: DAG
GSE PROJECT NO.: 1714		DATE: 2/17/2017		

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EXCAVATION AND CONCRETE ENCASEMENT PLAN	
SCALE: AS NOTED	DRAWING NO.: 10



A CONCRETE ENCASEMENT SECTION AND EXCAVATION DETAIL
Scale: 1"=1'



B ROAD BASE DETAIL TYP.
Scale: 1"=6"

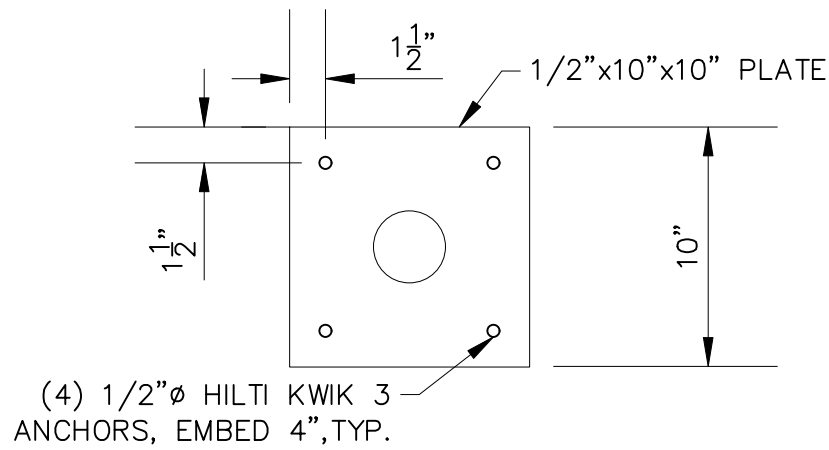
NOTES

- ELEVATIONS SHOWN ARE CONOWINGO DAM DATUM (0.7 FEET LOWER THAN NGVD 29)
- A BUOYANT FORCE OF 950 LB MUST BE RESISTED DURING POUR AND CURING OF CONCRETE
- GROUND SHALL BE COMPACTED TO ASTM D 1557 (95% MODIFIED PROCTOR).
- THE 8" PIPE SHALL RUN UNDER THE EXISTING YARD DRAINAGE LINES. EXCAVATE BY HAND TO LOCATE DRAIN LINES, TO LOCATE POSSIBLE RAILROAD TRACKS, AND TO ENSURE LINES ARE NOT DAMAGED OR DISTURBED DURING INSTALLATION OF NEW PIPE.
- ASPHALT ROAD TO BE REPLACED PER SECTION B.
- EROSION AND SEDIMENT CONTROL REQUIREMENTS ARE SHOWN ON DRAWING 20.

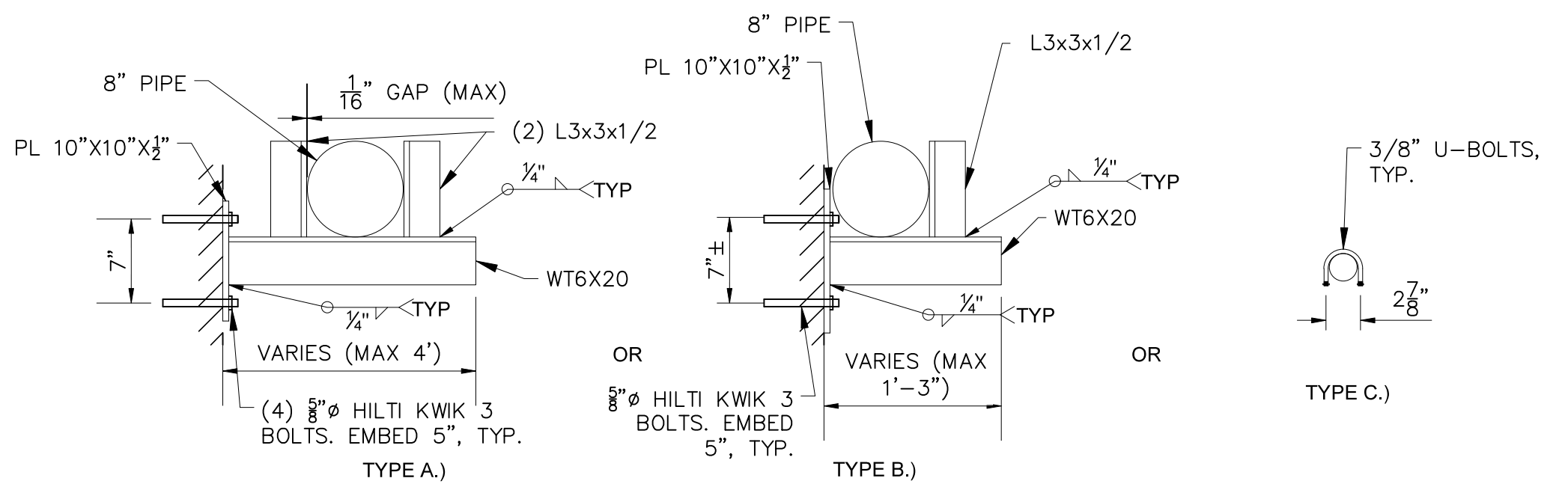
DATE	#	BY	APP
DRAWN BY: ALR	CHECKED BY: HNN	APPROVED BY: DAG	
GSE PROJECT NO.: 1714	DATE: 2/17/2017		

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CONOWINGO EEL PASSAGE	
 GOMEZ AND SULLIVAN ENGINEERS	
EXCAVATION, CONCRETE ENCASEMENT AND ROAD SECTIONS	
SCALE: AS NOTED	DRAWING NO.: 11

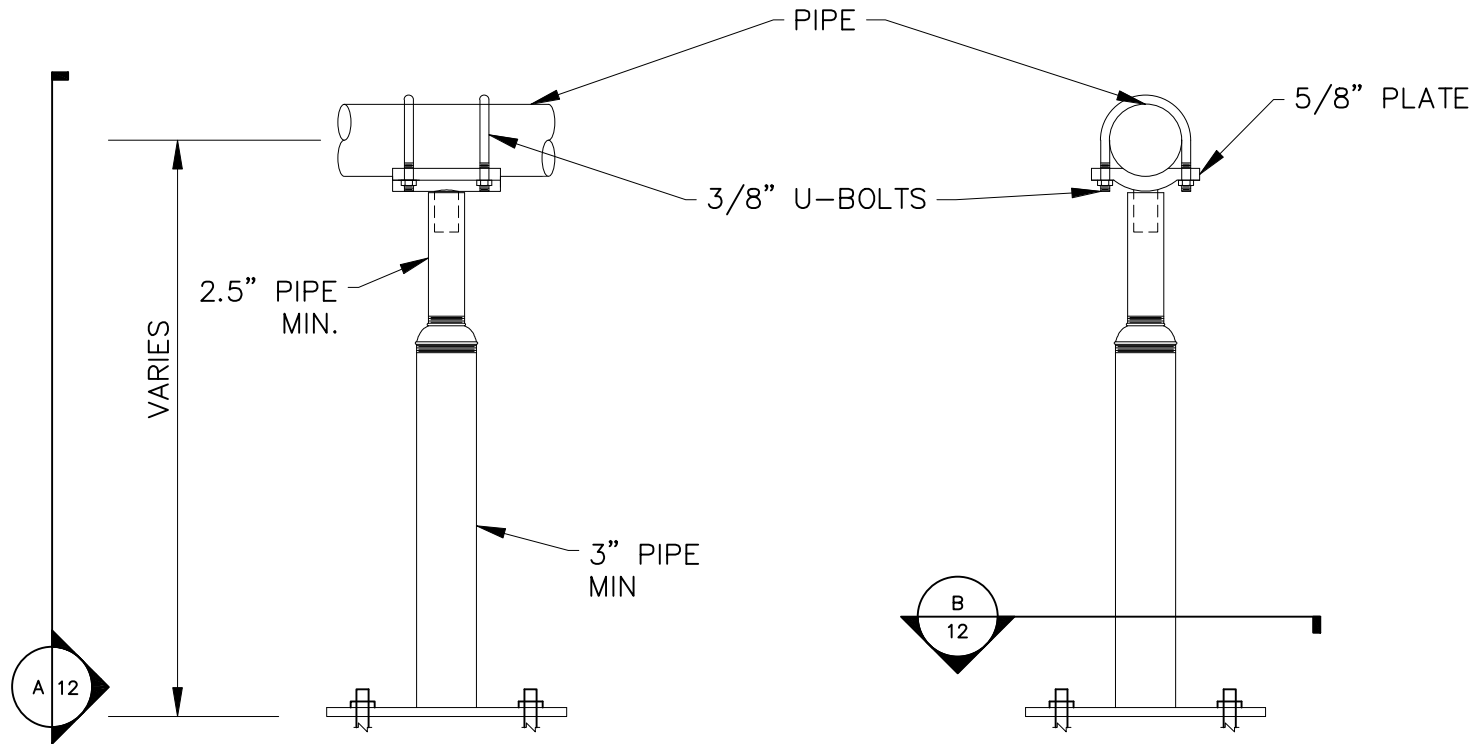
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B STAND PIPE SUPPORT BASE (TYP.)
12 Scale: 3"=1'

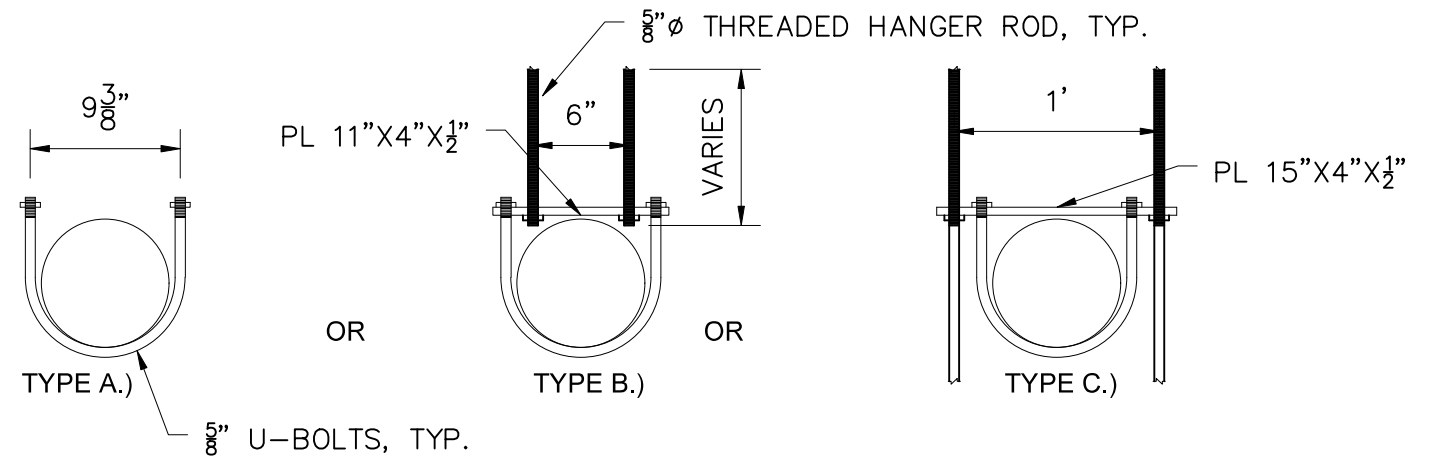


2 8" LATERAL PIPE SUPPORT (TYP.)
12 Scale: 2"=1'



1 ADJUSTABLE STAND
12 VERTICAL PIPE SUPPORT (TYP.)
Scale: 3"=1'

A ELEVATION STAND PIPE SUPPORT
12 Scale: 3"=1'



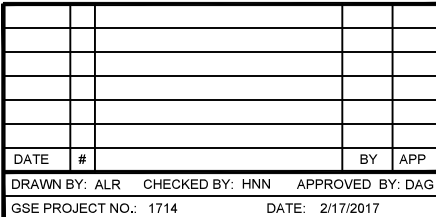
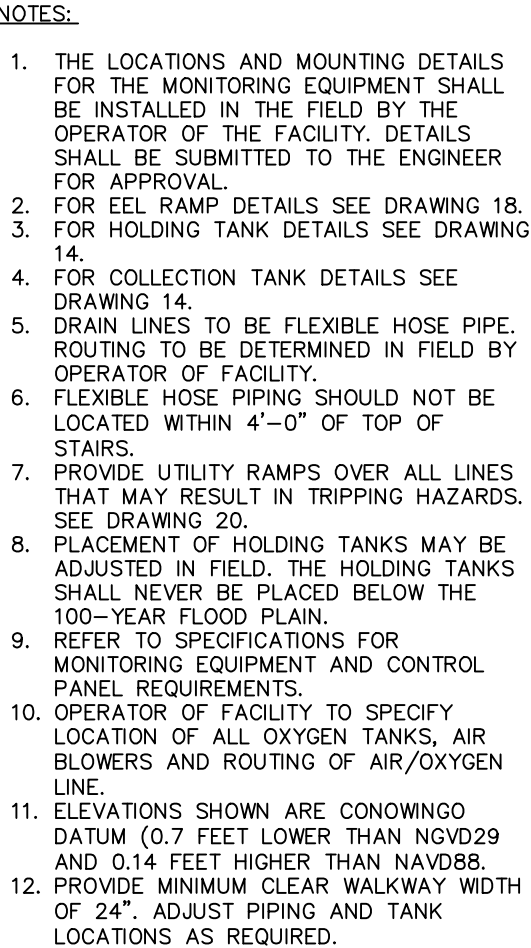
3 8" HANGER (VERTICAL) PIPE SUPPORTS (TYP.)
12 Scale: 2"=1'

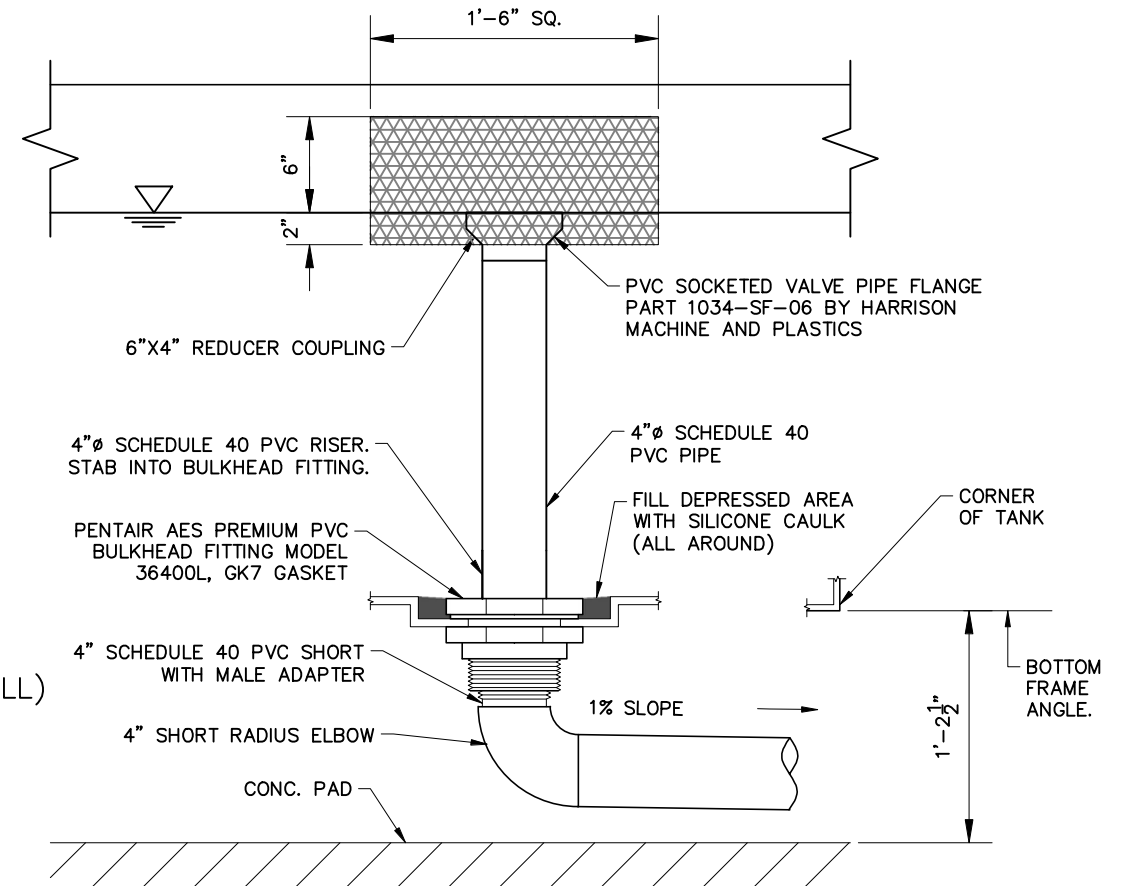
NOTES

1. MAXIMUM SUPPORT SPACING SHALL BE 18 FEET FOR 8" PIPE AND 12 FEET FOR 3" PIPE. WHERE POSSIBLE THERE SHALL BE A SUPPORT AT EACH END OF AN ELBOW/BEND. ALL VERTICAL SUPPORTS SHALL BE SADDLE-SHAPED AND SHALL HAVE A MINIMUM CAPACITY OF 1500 LB.
2. LATERAL SUPPORTS MUST BE CAPABLE OF SUPPORTING 1000 LB HORIZONTAL LOAD AND 1500 POUND VERTICAL LOAD.

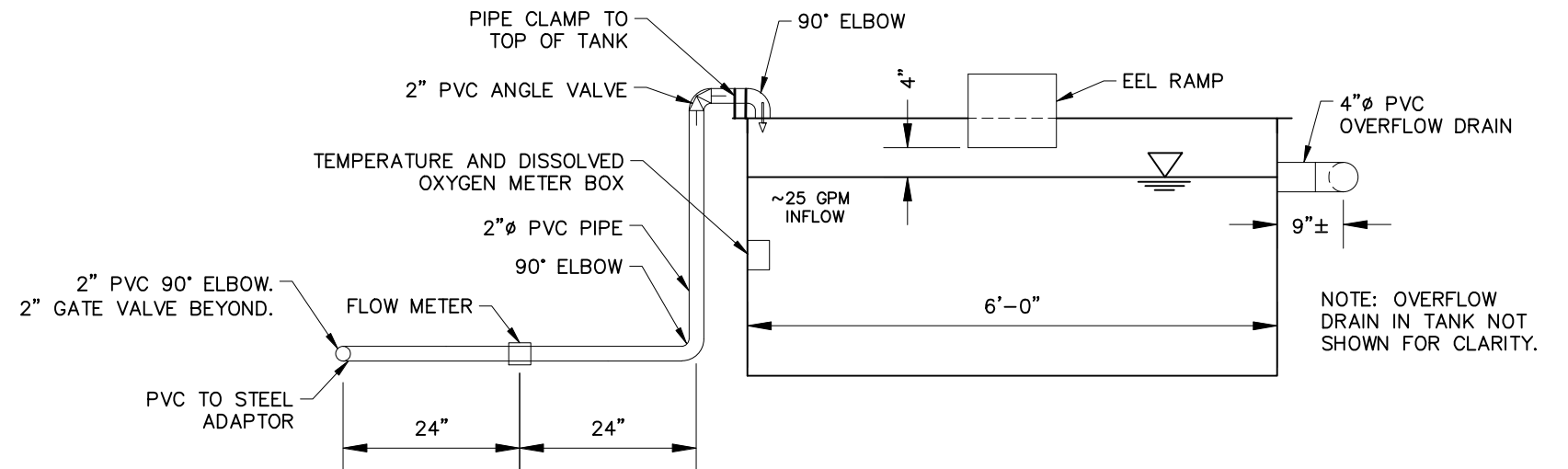
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PIPE SUPPORTS		
SCALE:	AS NOTED	DRAWING NO.: 12





1 SECTION OF HOLDING TANK
14 1" = 1'-0" (APPROXIMATE TANK SIZE 5'6"X5'6"X2'8" TALL)



2 STANDPIPE DETAIL – HOLDING TANK
Scale: 1" = 1'-0"

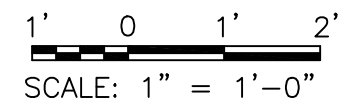
SECTION OF COLLECTION TANK

1" = 1'-0" (APPROXIMATE TANK SIZE 6'X3'4"X3'1" TALL)

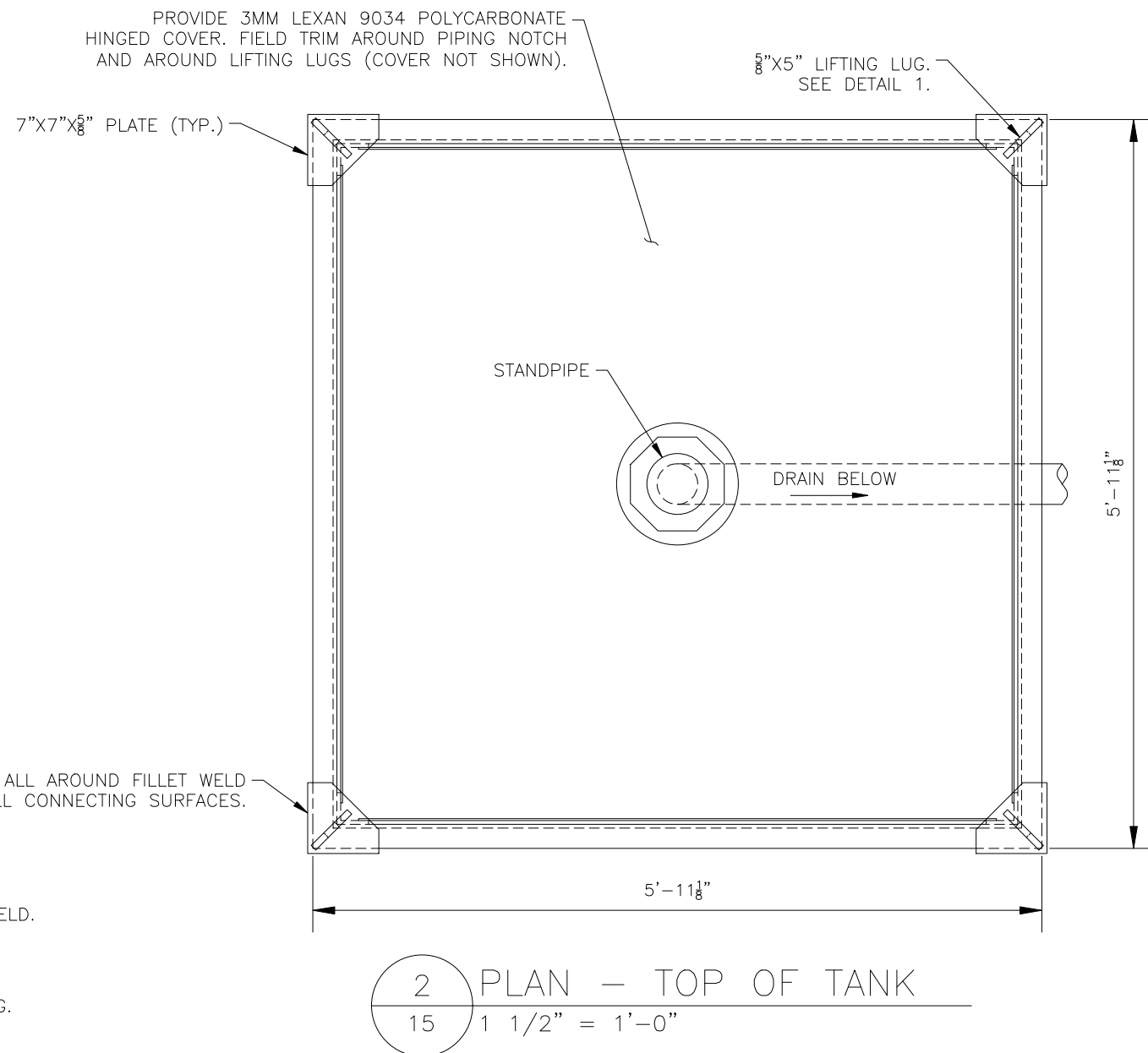
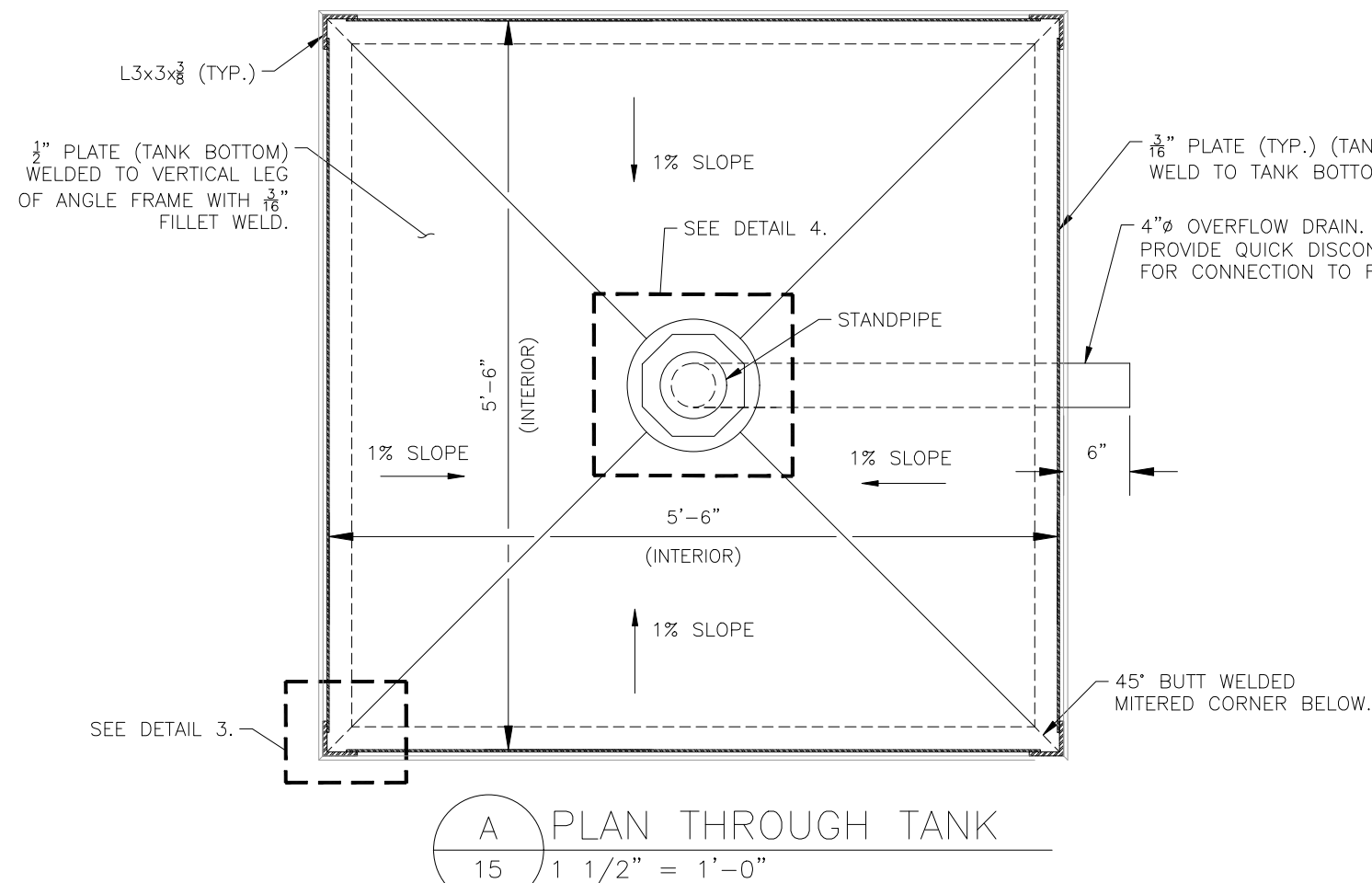
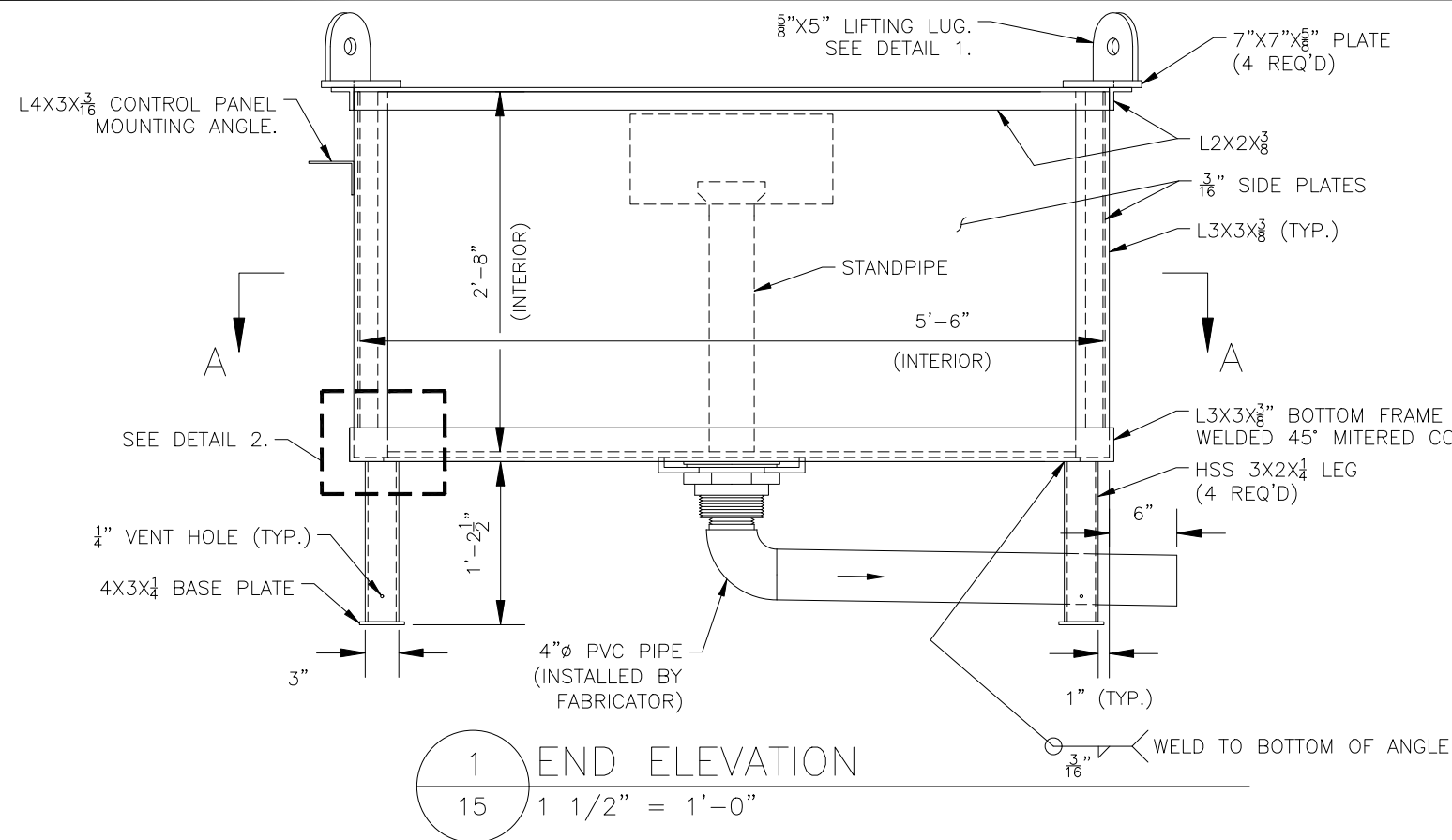


3 SECTION OF OVERFLOW TANK
14 1" = 1'-0" (APPROXIMATE TANK SIZE 39"X58"X24" TALL)

1. REFER TO SPECIFICATIONS FOR MONITORING EQUIPMENT AND CONTROL PANEL REQUIREMENTS.
2. HOLES IN TANK COVERS FOR DISSOLVED OXYGEN AND AERATION LINES TO BE DRILLED IN FIELD.
3. OPERATOR OF FACILITY TO SPECIFY LOCATION OF ALL OXYGEN TANKS, AIR BLOWERS AND ROUTING OF AIR/OXYGEN LINE.
4. ELEVATIONS SHOWN ARE CONOWINGO DATUM (0.7 FEET LOWER THAN NAGVD 29 AND 0.14 FEET HIGHER THAN NAVD88).

[illegible]

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NOTES:

1. USE STAINLESS STEEL ELECTRODES.
2. UNLESS OTHERWISE SPECIFIED, ALL WELDS TO BE CONTINUOUS.
3. UNLESS OTHERWISE SPECIFIED, ALL WELDS TO BE 3/16" FILLET WELDS.
4. ALL OVERLAPPING SURFACES TO BE FULLY WELDED WITH 3/16" FILLET WELDS.
5. LIFTING LUGS ARE DESIGNED TO LIFT TANK ASSUMING TANK IS COMPLETELY DRAINED.
6. SUBMIT SHOP DRAWINGS TO ENGINEER FOR APPROVAL.
7. TANK FABRICATOR SHALL DRILL/CUT HOLES IN TANK SIDES FOR MONITORING EQUIPMENT (TEMPERATURE AND OXYGEN METERS). LOCATIONS AND SIZES TO BE DETERMINED DURING MEETING WITH OWNER'S REPRESENTATIVE(S) AND ENGINEER.
8. LOCATION OF CONTROL PANEL MOUNTING ANGLE TO BE DETERMINED DURING THE SITE MEETING WITH OWNER, OWNER'S REPRESENTATIVE, AND ENGINEER.
9. FITTINGS ATTACHED TO TANKS TO BE SUPPLIED AND INSTALLED BY TANK MANUFACTURER.

8" 0 8" 16"
SCALE: 1 1/2" = 1'-0"

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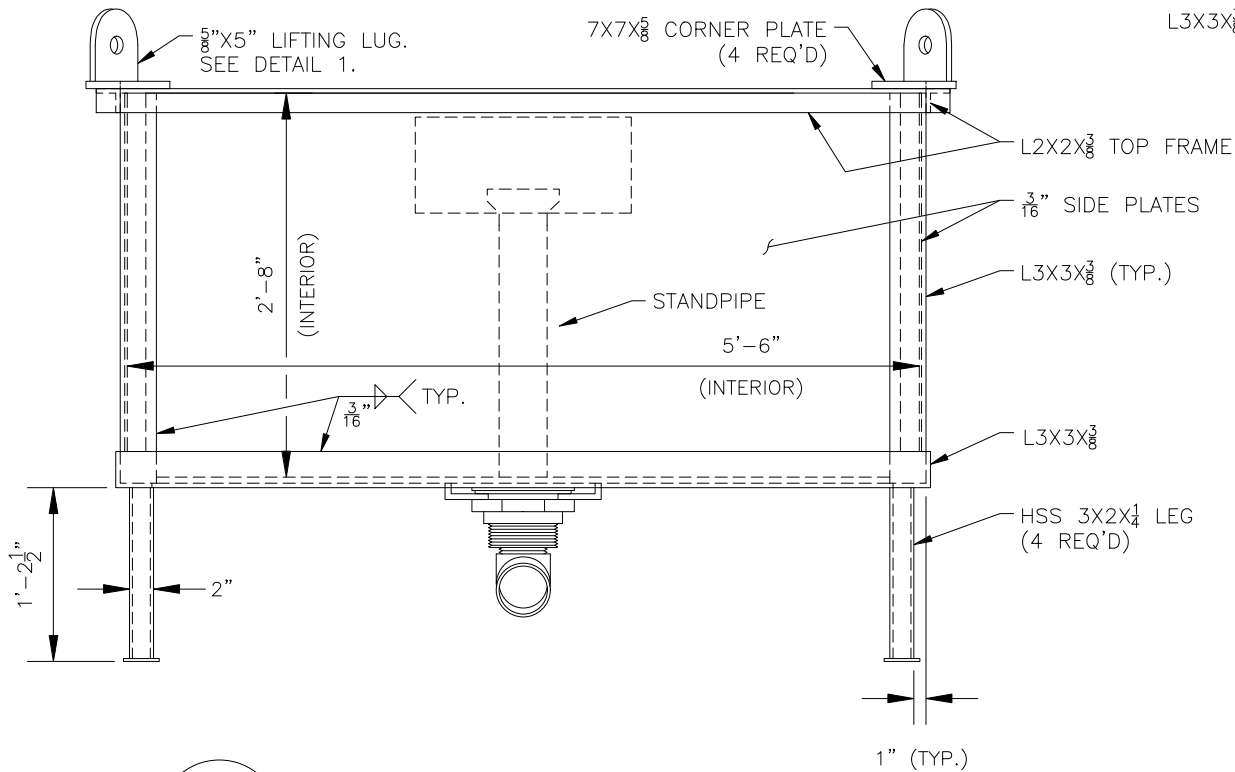


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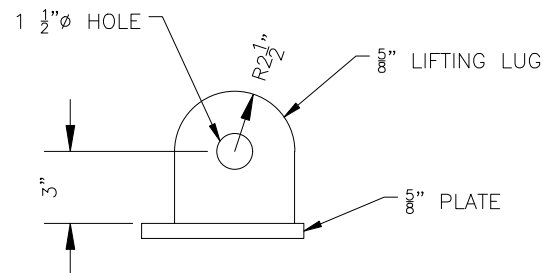
HOLDING TANK PLAN AND SECTIONS

SCALE:	AS NOTED	DRAWING NO.:	15

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1 SIDE ELEVATION
16 3/4" = 1'-0"

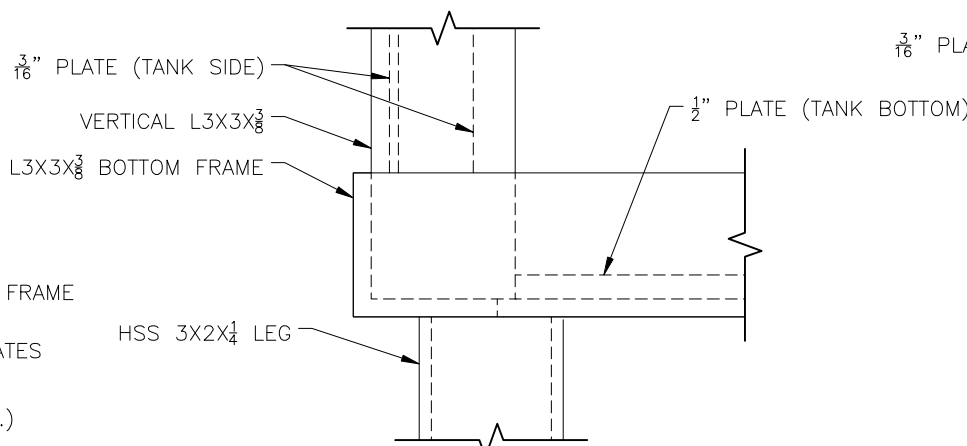


1 DETAIL
Scale: 3" = 1'-0" (SEE NOTE 8)

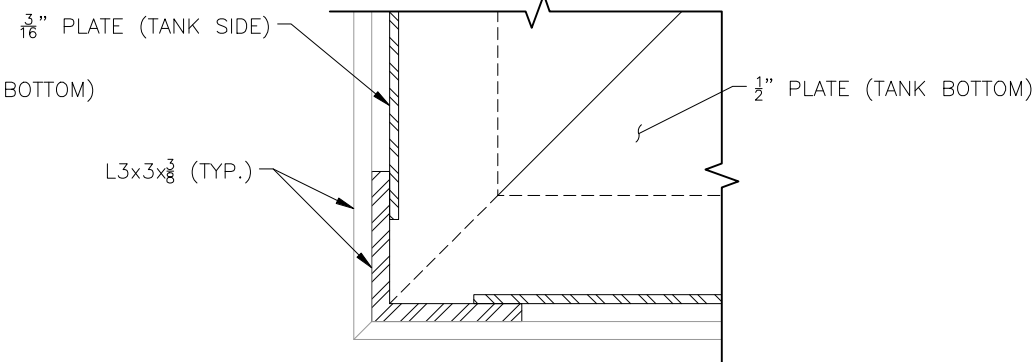
NOTES:

1. USE STAINLESS STEEL ELECTRODES.
2. UNLESS OTHERWISE SPECIFIED, ALL WELDS TO BE CONTINUOUS.
3. UNLESS OTHERWISE SPECIFIED, ALL WELDS TO BE 3/16" FILLET WELDS.
4. ALL OVERLAPPING SURFACES TO BE FULLY WELDED WITH 3/16" FILLET WELDS.
5. SUBMIT SHOP DRAWINGS TO ENGINEER FOR APPROVAL.
6. BULKHEAD FITTINGS TO BE PROVIDED AND INSTALLED BY THE FABRICATOR AT THE FABRICATION PLANT.
7. TANK FABRICATOR SHALL DRILL/CUT HOLES IN TANK SIDES FOR MONITORING EQUIPMENT (TEMPERATURE AND OXYGEN METERS). LOCATIONS AND SIZES TO BE DETERMINED DURING MEETING WITH OWNER'S REPRESENTATIVE AND ENGINEER.
8. LIFTING LUGS ARE DESIGNED TO LIFT TANK ASSUMING TANK IS COMPLETELY DRAINED.

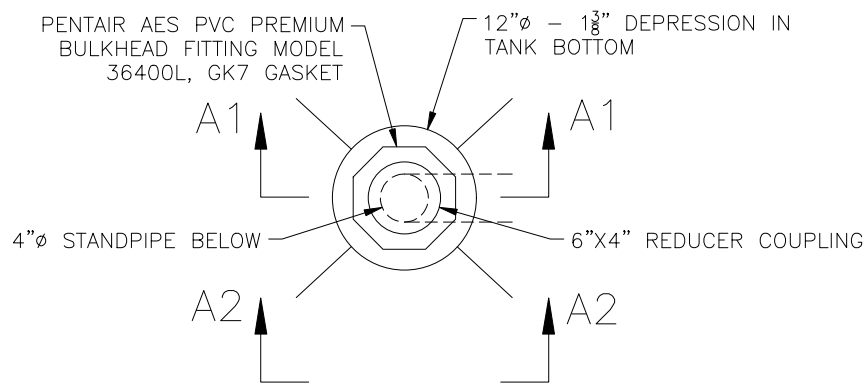
4" 0 4" 8"
SCALE: 3" = 1'-0"



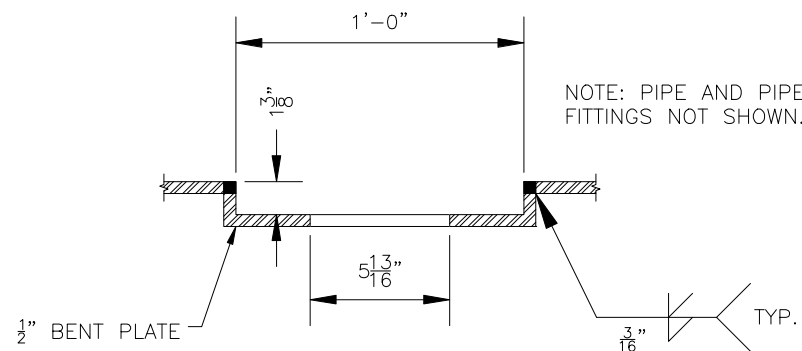
2 DETAIL
Scale: 6" = 1'-0"



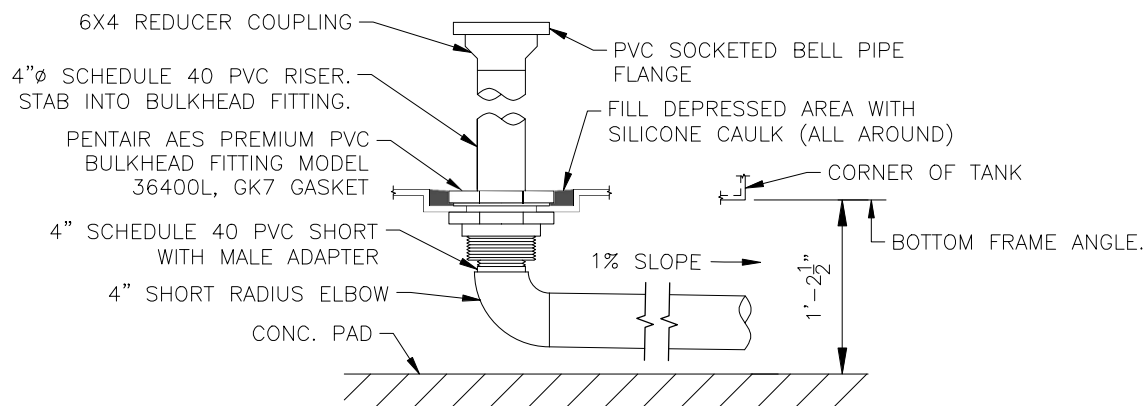
3 DETAIL
Scale: 6" = 1'-0"



4 DETAIL
Scale: 1 1/2" = 1'-0"



A1 SECTION THROUGH TANK BOTTOM
16 3" = 1'-0"

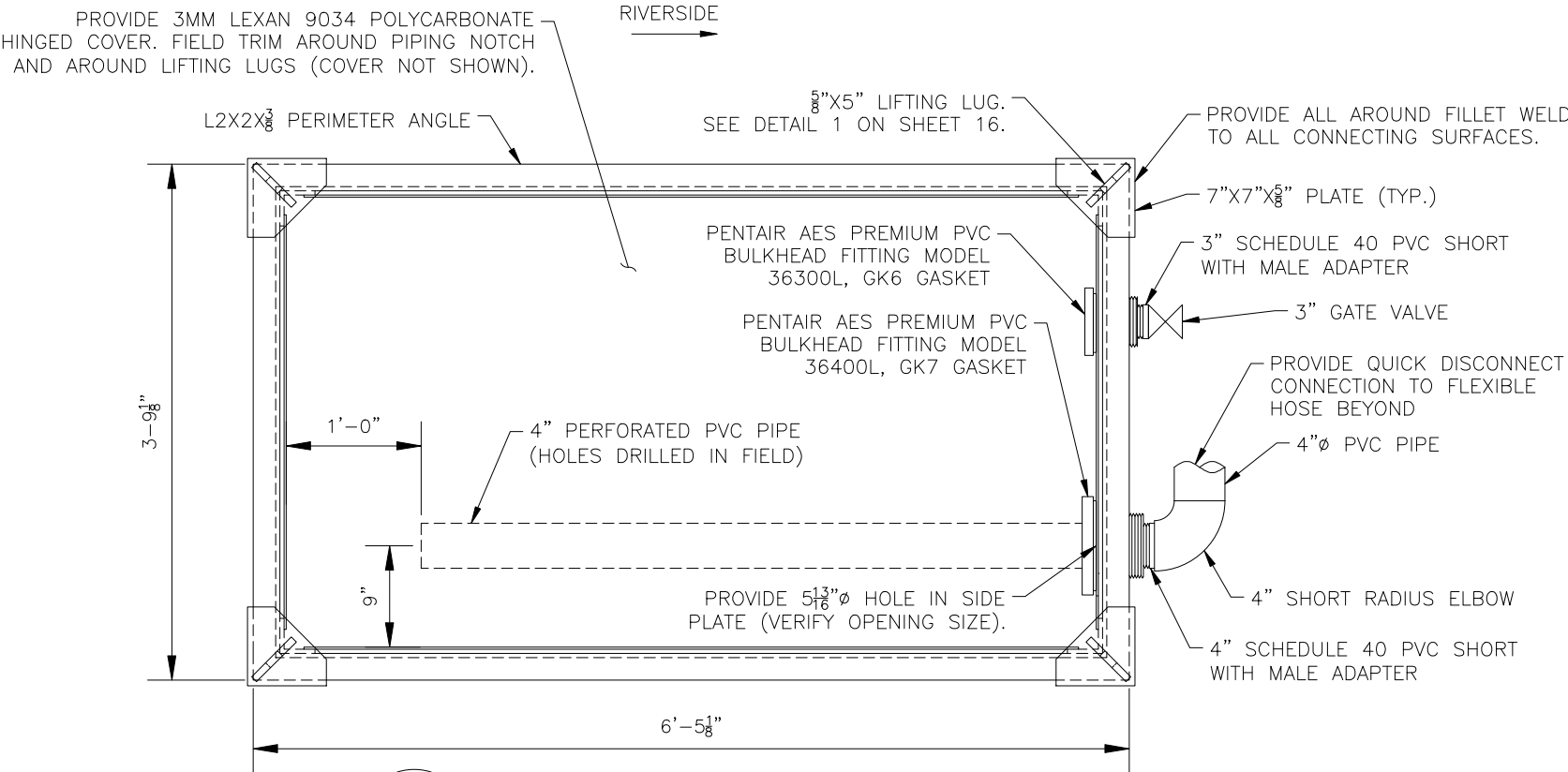


A2 SECTION OF TANK BOTTOM
16 1 1/2" = 1'-0"

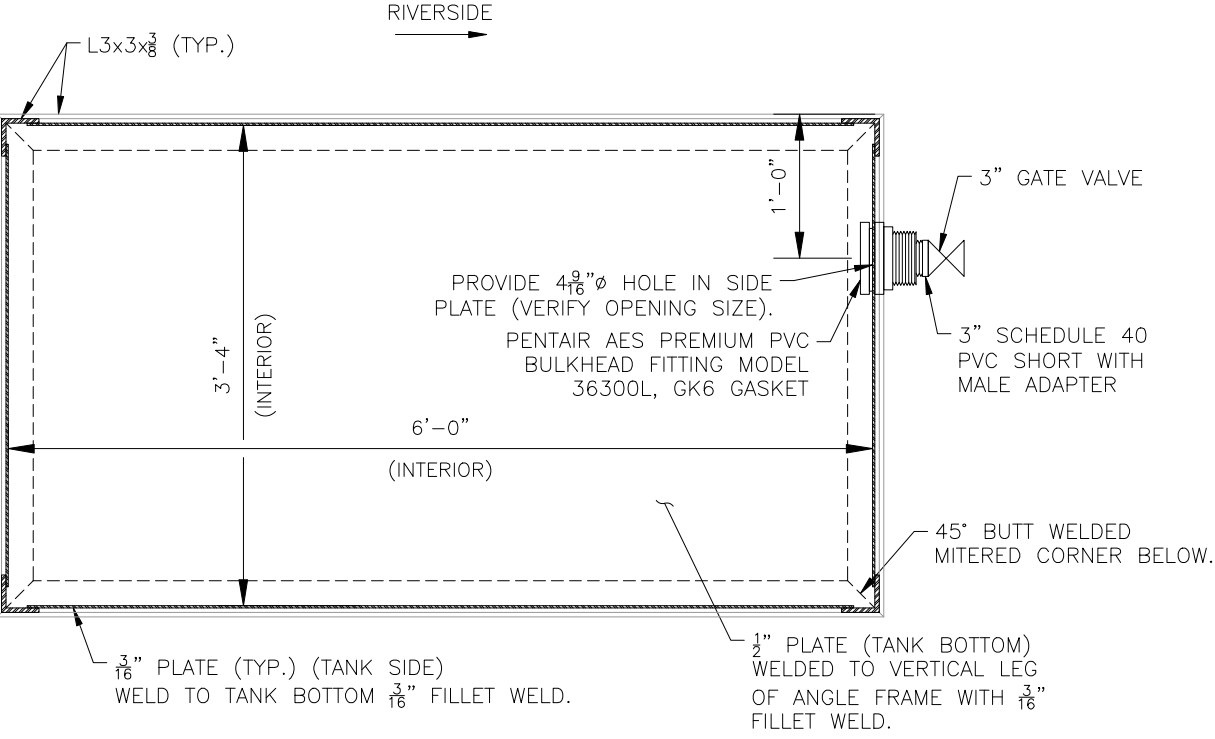
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GSE PROJECT NO.: 1714 DATE: 2/17/2017					

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HOLDING TANK SECTIONS AND DETAILS
SCALE: AS NOTED DRAWING NO.: 16

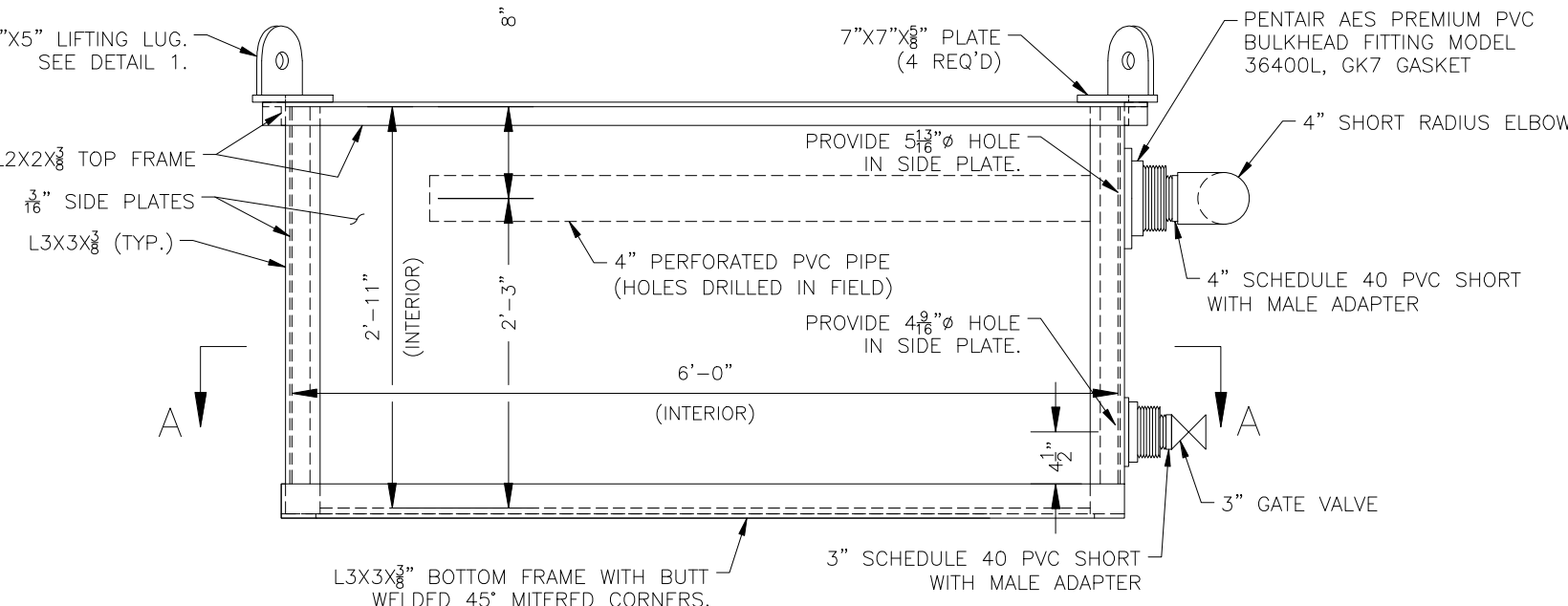
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1 PLAN — TOP OF TANK
17 1 1/2" = 1'-0"



A PLAN THROUGH TANK
17 1 1/2" = 1'-0"



2 SIDE ELEVATION
17 1 1/2" = 1'-0"

8" 0 8" 16"
SCALE: 1 1/2" = 1'-0"

- NOTES:
1. USE STAINLESS STEEL ELECTRODES.
 2. UNLESS OTHERWISE SPECIFIED, ALL WELDS TO BE CONTINUOUS.
 3. UNLESS OTHERWISE SPECIFIED, ALL WELDS TO BE 3/16" FILLET WELDS.
 4. ALL OVERLAPPING SURFACES TO BE FULLY WELDED WITH 3/8" FILLET WELDS.
 5. SUBMIT SHOP DRAWINGS TO ENGINEER FOR APPROVAL.
 6. FABRICATION DETAILS SHALL BE SIMILAR TO THOSE SHOWN FOR THE FABRICATION TANK.
 7. TANK FABRICATOR SHALL DRILL/CUT HOLES IN TANK SIDES FOR MONITORING EQUIPMENT (TEMPERATURE AND OXYGEN METERS). LOCATIONS AND SIZES TO BE DETERMINED DURING MEETING WITH OWNER'S REPRESENTATIVE AND ENGINEER.
 8. LIFTING LUGS ARE DESIGNED TO LIFT TANK ASSUMING TANK IS COMPLETELY DRAINED.
 9. FITTINGS ATTACHED TO TANKS TO BE SUPPLIED AND INSTALLED BY TANK MANUFACTURER.

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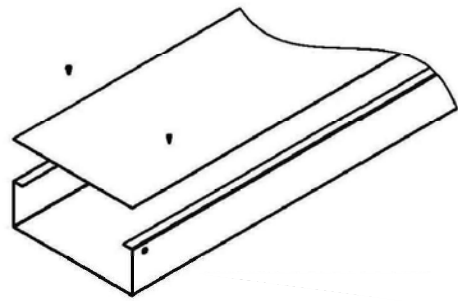


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COLLECTION TANK PLAN AND SECTIONS

SCALE: AS NOTED

DRAWING NO.: 17

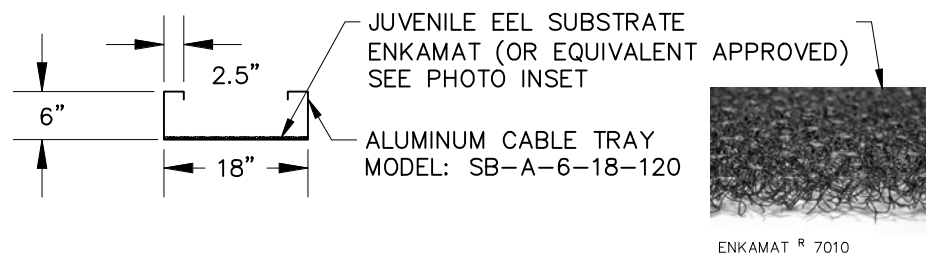


NOTES

1. PROVIDE COVER WITH (10) #8 SELF DRILLING TEK SCREWS FOR MOUNTING. RECOMMENDED ATTACHMENT LOCATIONS: 3/8" FROM EDGES WIDTH WISE AND 1" FROM END LENGTH WISE, FOLLOWED BY 29-1/2" O.C.

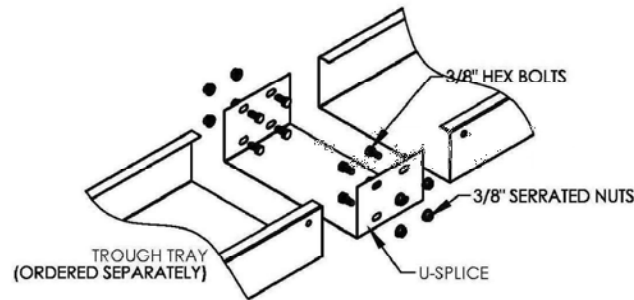
1 COVER DETAIL

18 NOT TO SCALE



2 EEL RAMP ELEVATION

18 Scale: 1"=1'

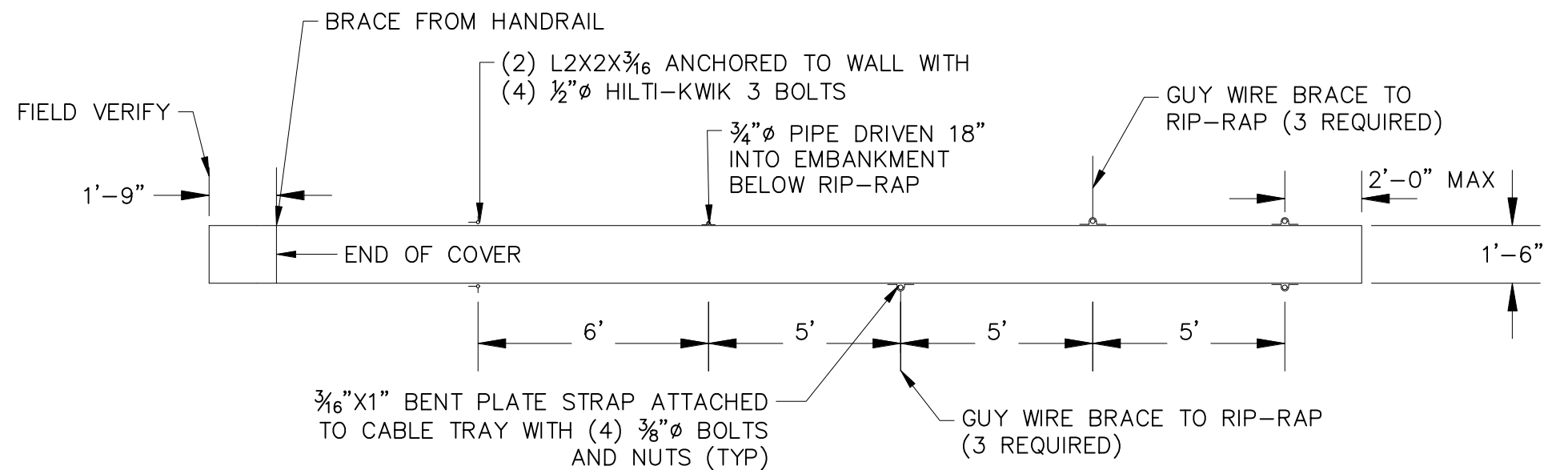


NOTES:

1. USE TO JUNCTION TRAY SECTIONS TOGETHER.
2. FEED PROVIDED 3/8"X3/4" HEX HEAD BOLT THRU TRAY AND U-SPLICE AND ATTACH 3/8" SERRATED NUTS ON OUTSIDE OF U-SPLICE.
3. RECOMMENDED TORQUE:
FOR 3/8" FASTENERS: 25-35 FT-LBS.
4. IF DESIRED, ADDITIONAL HOLES MAY BE FIELD DRILLED IN THE BOTTOM OF THE TRAY THRU THE C-SPLICE AND ADDITIONAL HARDWARE (BY OTHERS) ATTACHED.

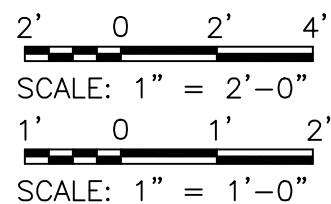
4 U-SPLICE DETAIL

18 NOT TO SCALE



3 EEL RAMP PLAN

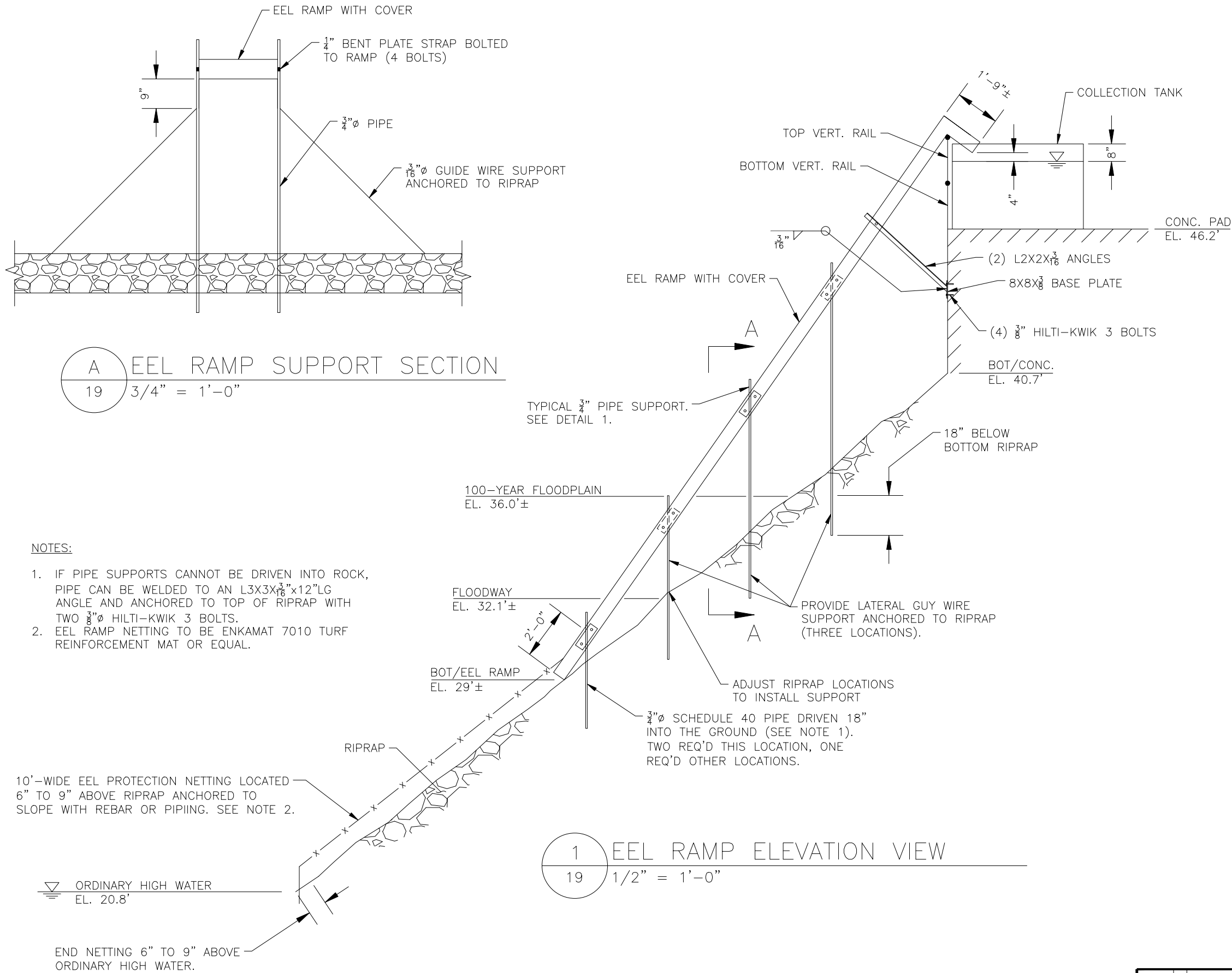
18 Scale: 1"=2'



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EEL RAMP SECTIONS AND DETAILS	
SCALE: AS NOTED	DRAWING NO.: 18

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- NOTES:
- IF PIPE SUPPORTS CANNOT BE DRIVEN INTO ROCK, PIPE CAN BE WELDED TO AN L3X3X $\frac{3}{16}$ "x12"LG ANGLE AND ANCHORED TO TOP OF RIPRAP WITH TWO $\frac{3}{8}$ " HILTI-KWIK 3 BOLTS.
 - EEL RAMP NETTING TO BE ENKAMAT 7010 TURF REINFORCEMENT MAT OR EQUAL.

10'-WIDE EEL PROTECTION NETTING LOCATED 6" TO 9" ABOVE RIPRAP ANCHORED TO SLOPE WITH REBAR OR PIPING. SEE NOTE 2.

ORDINARY HIGH WATER
EL. 20.8'

END NETTING 6" TO 9" ABOVE
ORDINARY HIGH WATER.

2' 0 2' 4'
SCALE: 1/2" = 1'-0"

EEL FACILITY EQUIPMENT LIST		
QUANTITY	ITEM DESCRIPTION	MANUFACTURER
60 feet	Eel Ramp cable tray	Monosystems
1	200-foot roll of Enkamat 7010 Substrate	
1	Overflow tank	Plastic Mart
150 sq-ft	Lexan for tank covers	
4	Dock Ramp	
8	Dock ramp panels	
TANK DRAINAGE		
4	PVC socketed valve pipe flange	Pentair Ecosystems
6	6" X 4" Reducer Coupling	Pentair Ecosystems
30 feet	4" Schedule 40 PVC pipe	Pentair Ecosystems
6	4" Schedule 40 PVC short radius elbow	Pentair Ecosystems
6	4" diameter aluminum quick disconnect fitting	Pentair Ecosystems
6	4" schedule 40 PVC short with male adapter	Pentair Ecosystems
2	3" PVC Bulkhead fitting	Pentair Ecosystems
2	3" PVC gate valve	Pentair Ecosystems
60 feet	4-inch Schedule 40 PVC Pipe	Pentair Ecosystems
10 feet	1-inch Schedule 40 PVC Pipe	Pentair Ecosystems
300 feet	4" Suction Discharge Hose (Model SH8)	Pentair Ecosystems
OXYGEN/AIR DIFFUSER PIPING		
3	linear piston air pump (SL44B)	Pentair Ecosystems
200 feet	3/4" Vinyl clear tubing for air lines	Pentair Ecosystems
200 feet	1/4" vinyl clear tubing for air lines	Pentair Ecosystems
250 feet	1/4" thick walled rubber tubing for O2	Pentair Ecosystems
50	3/4" polyethylene tubing for airlines	Pentair Ecosystems
200	3/4" hose clamps	Pentair Ecosystems
100	1/4" hose clamps	Pentair Ecosystems
4	O2 bottle regulators	Pentair Ecosystems
4	Reducer from 3/4" to 1/4", prior to splitter	Pentair Ecosystems
3	three way splitters for air lines (needle valves)	Pentair Ecosystems
3	O2 flow meter manifold	Pentair Ecosystems
2	Pump blower boxes with louvers	Pentair Ecosystems
12	Fine pore diffusers (AS300)	Pentair Ecosystems
SPRAY BAR AND OVERFLOW PIPE		
10 feet	1" PVC solid wall pipe (spray bar)	Pentair Ecosystems
10	1" PVC cap, adapter, ball valve	Pentair Ecosystems
5	3" PVC bulkhead fitting for overflow tank drains	Pentair Ecosystems
SHADING/EEL PROTECTION		
2	12' X 10' shade cloth (SC70) for eel protection	Pentair Ecosystems
1,250 sq-ft	60% black UV shade cloth over eel facility	GreenhouseMegastore
MONITORING EQUIPMENT		
2	3" flow meter	PDIR
6	2" flow meter	PDIR
5	Temperature/DO sensor	PDIR
1	cellular modem	PDIR
2	controller	PDIR
ADDITIONAL SUPPLIES FOR EEL PROCESSING		
2	Fish measuring board (FMB2)	Pentair Ecosystems
1	Dissecting microscope	Pentair Ecosystems
2	Dissection kit	Pentair Ecosystems
	Digital scale	Pentair Ecosystems
	zip ties	
100	spat bags	Pentair Ecosystems
	Nets of various sizes, small to large	Pentair Ecosystems
2	1,000 ml graduated container	Pentair Ecosystems
2	2,000 ml graduated container	Pentair Ecosystems
5	brushes, bottle, hose, pipe, long handle	Pentair Ecosystems


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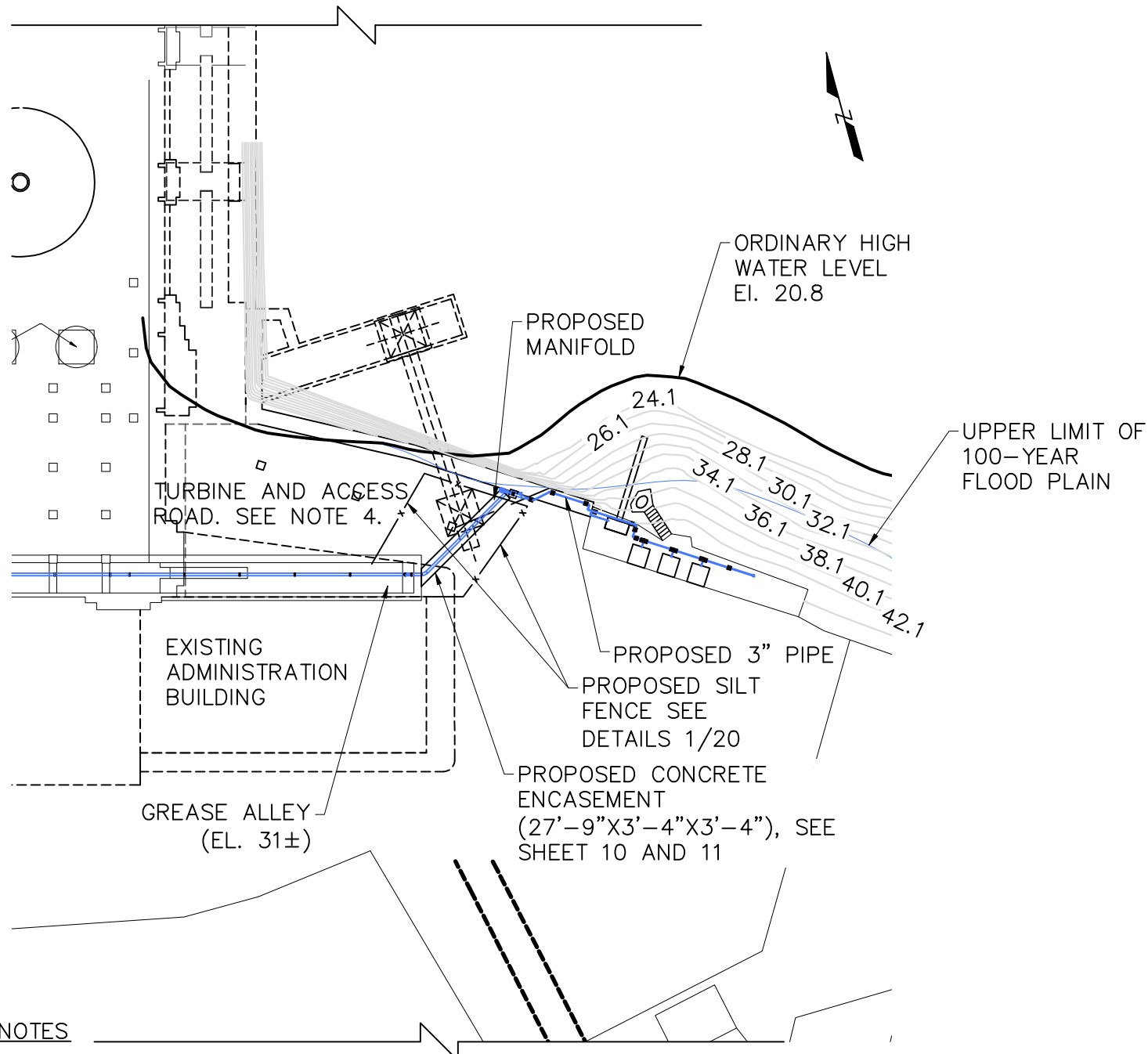
CONOWINGO EEL PASSAGE


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EEL RAMP ELEVATION AND PIPE SUPPORT
DETAILS

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DRAWN BY: ALR	CHECKED BY: HNN	APPROVED BY: DAG	
GSE PROJECT NO.: 1714	DATE: 2/17/2017		

SCALE: AS NOTED DRAWING NO.: 19

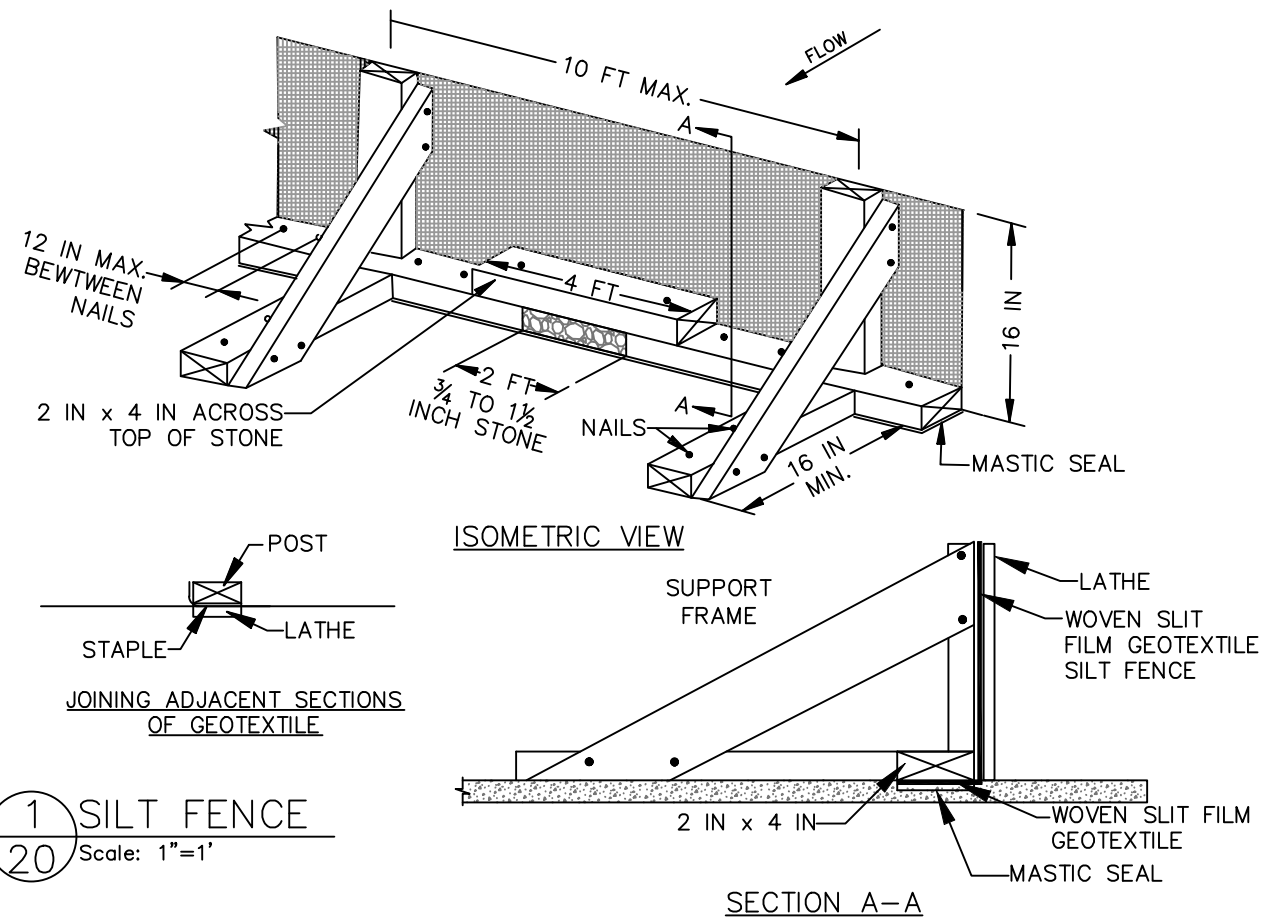


NOTES

- ELEVATIONS SHOWN ARE CONOWINGO DAM DATUM (0.7 FEET LOWER THAN NGVD 29 AND 0.14 FEET HIGHER THAN NAVD 88)
- MAXIMUM SUPPORT SPACING SHALL BE 18 FEET FOR 8" PIPE AND 12 FEET FOR 3" PIPE. WHERE POSSIBLE THERE SHALL BE A SUPPORT AT EACH END OF AN ELBOW/BEND. ALL VERTICAL SUPPORTS SHALL BE SADDLE-SHAPED AND SHALL HAVE A MINIMUM CAPACITY OF 1500 LB. SEE SHEET 12 FOR TYPICAL SUPPORT DETAILS.
- CONTRACTOR SHALL REMOVE EXISTING 3" PIPE THAT EXISTS ALONG THE ALIGNMENT OF THE PROPOSED 8" PIPE. AVOID OR MOVE OTHER PIPES UPON EXELON'S APPROVAL.
- LOCATE AND PROTECT EXISTING BURIED DRAINS BENEATH TURBINE ACCESS ROAD (SEE EXISTING P.E. CO. DRAWING H-80531). RAILROAD TIES AND TRACKS MAY ALSO BE BURIED UNDER TURBINE ACCESS ROAD. IF ENCOUNTERED, AND PENDING SHPO CONSULTATION, THE RAILS AND TIES SHALL BE PRESERVED IN PLACE.

20' 0 20' 40'

SCALE: 1" = 20'-0"



CONSTRUCTION SPECIFICATIONS

- USE NOMINAL 2 INCH X 4 INCH LUMBER.
- USE WOVEN SLIT FILM GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS.
- PROVIDE MANUFACTURER CERTIFICATION TO THE AUTHORIZED REPRESENTATIVE OF THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT THE GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
- SPACE UPRIGHT SUPPORTS NO MORE THAN 10 FEET APART.
- PROVIDE A TWO FOOT OPENING BETWEEN EVERY SET OF SUPPORTS AND PLACE STONE IN THE OPENING OVER GEOTEXTILE.
- KEEP SILT FENCE TAUT AND SECURELY STAPLE TO THE UPSLOPE SIDE OF UPRIGHT SUPPORTS. EXTEND GEOTEXTILE UNDER 2x4.
- WHERE TWO SECTIONS OF GEOTEXTILE ADJOIN: OVERLAP, FOLD, AND STAPLE TO POST IN ACCORDANCE WITH THIS DETAIL. ATTACH LATHE.
- PROVIDE A MASTIC SEAL BETWEEN PAVEMENT, GEOTEXTILE, AND 2x4 TO PREVENT SEDIMENT-LADEN WATER FROM ESCAPING BENEATH SILT FENCE INSTALLATION.
- SECURE BOARDS TO PAVEMENT WITH 40D 5 INCH MINIMUM LENGTH NAILS.
- REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN SILT FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. MAINTAIN WATER TIGHT SEAL ALONG BOTTOM. REPLACE STONE IF DISPLACED.

Exelon
EXELON GENERATION COMPANY, LLC

CONOWINGO EEL PASSAGE

GOMEZ AND SULLIVAN
ENGINEERS

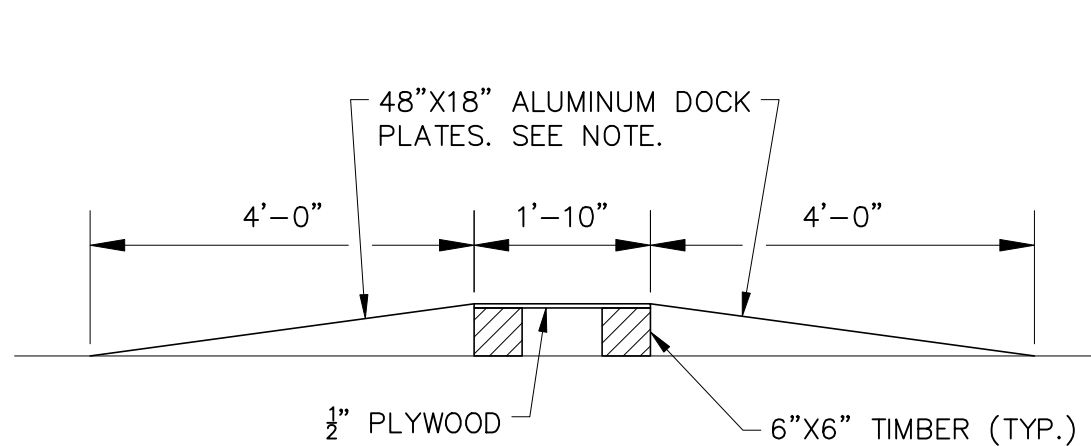
Williamsville, NY • Utica, NY • Albany, NY • Henniker, NH
www.gomezandsullivan.com

SITE AND SEDIMENT AND EROSION
CONTROL PLAN AND DETAILS

DATE	#	BY	APP
DRAWN BY: ALR	CHECKED BY: HNN	APPROVED BY: DAG	
GSE PROJECT NO.: 1714	DATE: 2/17/2017		

SCALE: AS NOTED DRAWING NO.: 20

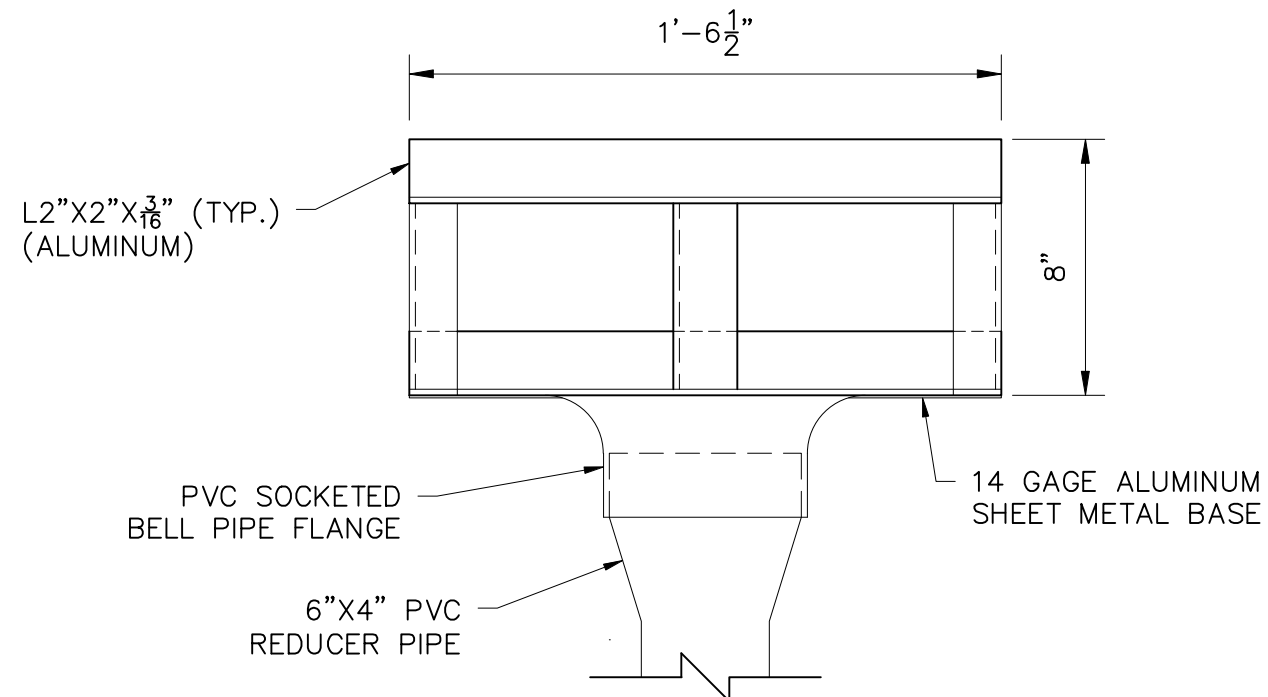
IT IS A VIOLATION OF THE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANYWAY UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. ALTERATIONS MUST HAVE THE ENGINEER'S SEAL AFFIXED ALONG WITH A DESCRIPTION OF THE ALTERATION, THE SIGNATURE AND DATE.



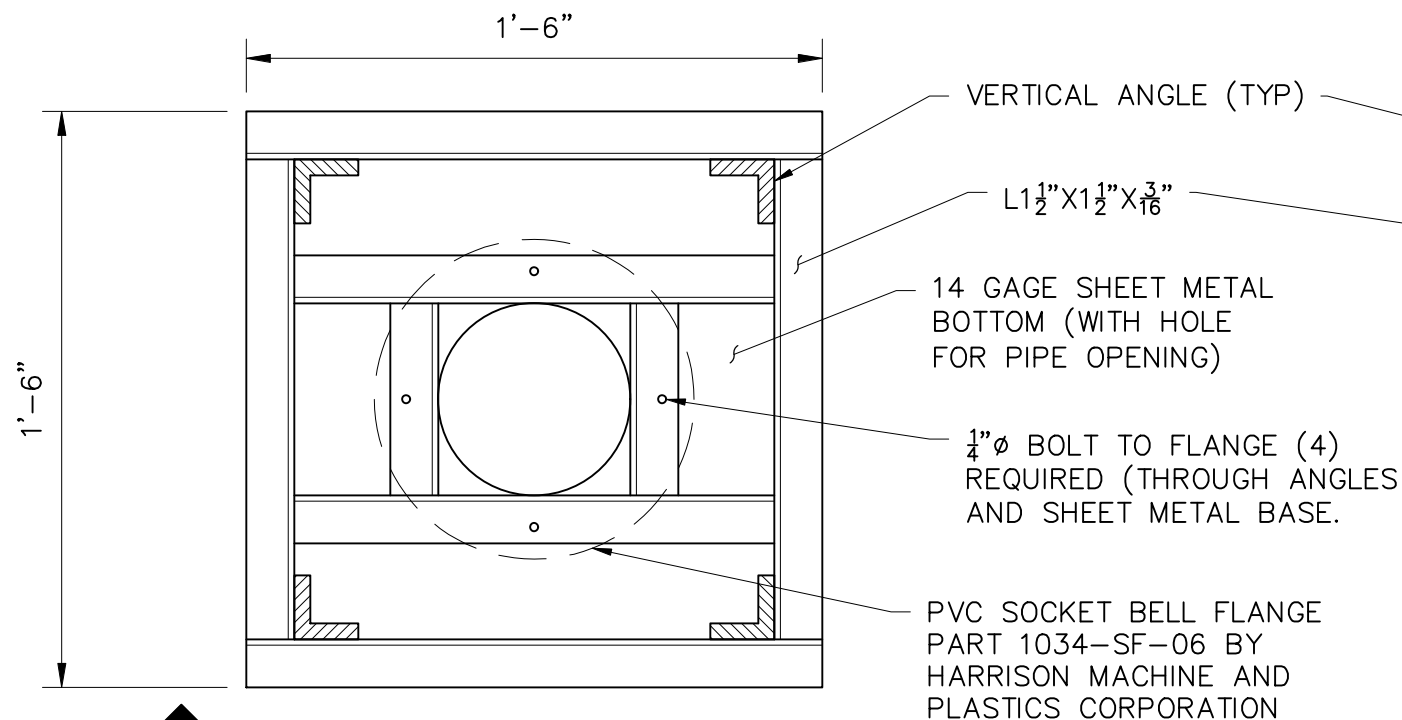
NOTE: PROVIDE 48"x18"x7" ALUMINUM HAND TRUCK DOCK PLATE RATED 500 LBS BY GLOBAL INDUSTRIES OR OR EQUAL. ANCHOR TO 6X6 TIMBERS WITH (4) 1/4"Ø ROUND HEADED LAG SCREEN. (PROVIDE 4 RAMPS - 8 PANELS.)

1 DETAIL
21 Scale: 1" = 1'-0"

1' 0 1' 2'
SCALE: 1" = 1'-0"

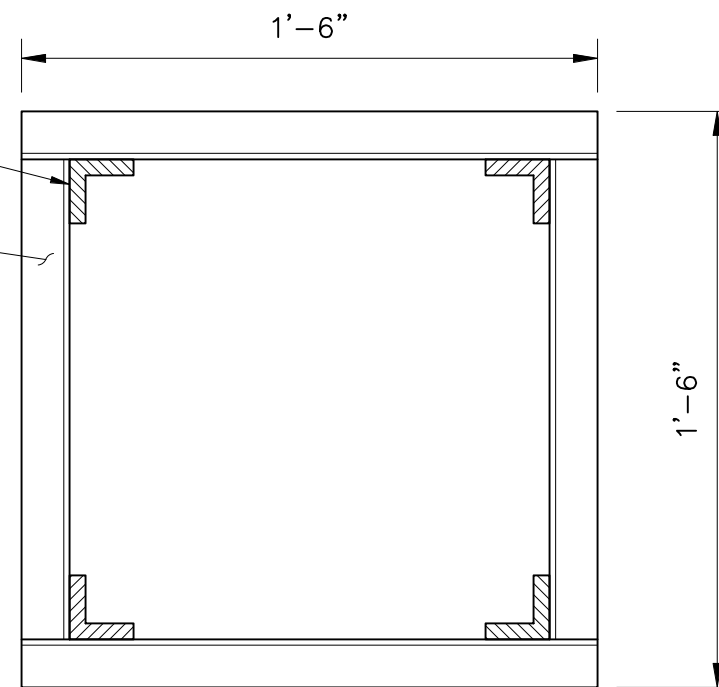


4 HOLDING TANK FILTER ELEVATION VIEW
21 Scale: 4" = 1'-0"



2 HOLDING TANK FILTER LOWER FRAMING PLAN
21 Scale: 4" = 1'-0"

3' 0 3' 6'
SCALE: 4" = 1'-0"



3 HOLDING TANK FILTER UPPER FRAMING PLAN
21 Scale: 4" = 1'-0"

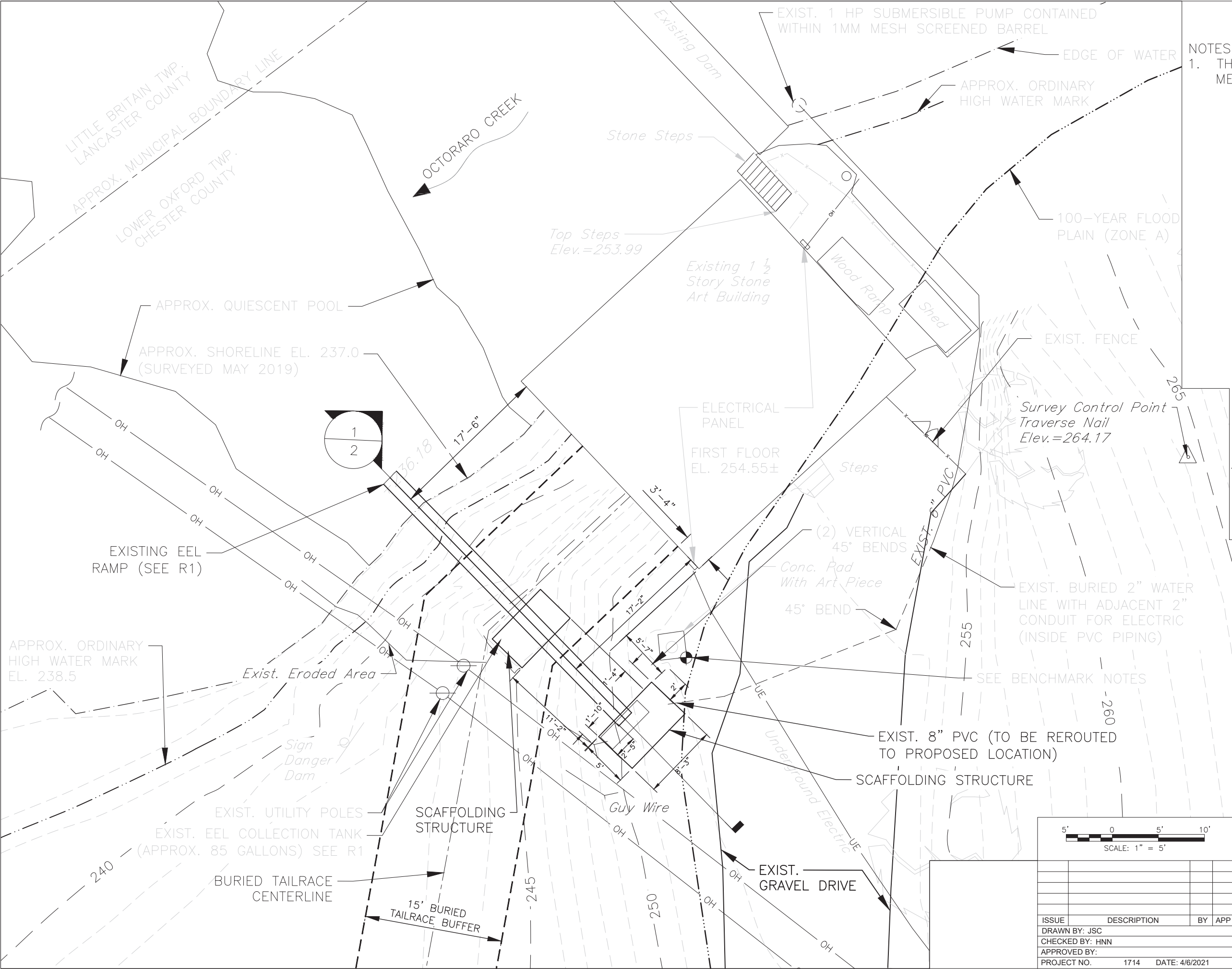
- NOTES:
- 1MM FILTER SCREEN TO BE WRAPPED AROUND AND FASTENED TO THE FILTER FRAME.
 - DO NOT LIFT OR PRY FRAME FROM EXTERIOR EDGES. LIFT FROM SOCKETED BELL PIPE FLANGE.
 - PROVIDE (4) FRAME STRUCTURES.

DATE	#		BY	APP	
DRAWN BY: ALR	CHECKED BY: HNN	APPROVED BY: DAG			
GSE PROJECT NO.: 1714		DATE: 2/17/2017			

 EXELON GENERATION COMPANY, LLC		
CONOWINGO EEL PASSAGE		
 GOMEZ AND SULLIVAN ENGINEERS Williamsville, NY • Utica, NY • Albany, NY • Henniker, NH www.gomezandsullivan.com		
MISCELLANEOUS DETAILS		
SCALE:	AS NOTED	DRAWING NO.: 21

APPENDIX B. OCTORARO CREEK EEL COLLECTION FACILITY DRAWINGS

IT IS A VIOLATION OF THE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANYWAY UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. ALTERATIONS MUST HAVE THE ENGINEER'S SEAL AFFIXED ALONG WITH A DESCRIPTION OF THE ALTERATION, THE SIGNATURE AND DATE.



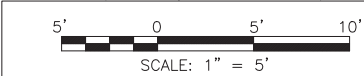
NOTES:
1. THE DIMENSIONS NOTED ARE AS MEASURED IN THE FIELD.

BENCHMARK NOTES:
SOUTHEAST CORNER OF
CONCRETE PAD
ELEV. = 252.64 FT
NORTHING = 172329.0 FT
EASTING = 2447865.2 FT
VERTICAL DATUM: NAVD88
HORIZONTAL DATUM: NAD83
PA SOUTH ZONE

LEGEND

- MINOR CONTOUR
- MAJOR CONTOUR
- EDGE OF WATER
- ORDINARY HIGH WATER MARK
- FEMA 100-YEAR FLOODPLAIN
- OVERHEAD ELECTRIC LINE
- UNDERGROUND ELECTRIC LINE
- FENCE
- SURVEY CONTROL POINT
- UTILITY POLE
- BENCHMARK

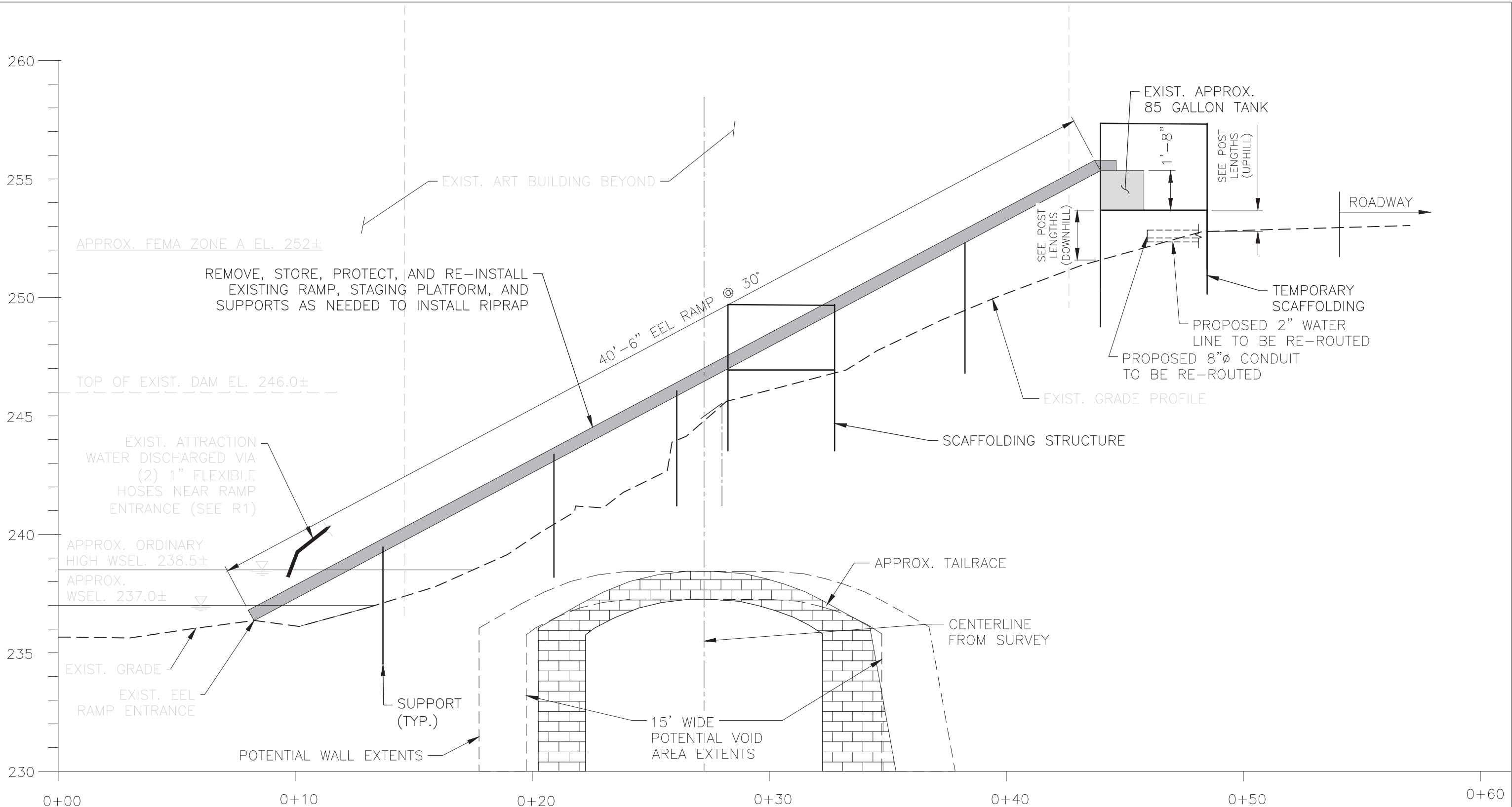
**OCTORARO CREEK EEL
COLLECTION FACILITY
TEMPORARY FACILITY
PLAN**



ISSUE	DESCRIPTION	BY	APP
DRAWN BY:	JSC		
CHECKED BY:	HNN		
APPROVED BY:			
PROJECT NO.	1714	DATE:	4/6/2021

Exelon Generation Company, LLC 300 Exelon Way Kennett Square, PA 19348	Gomez and Sullivan Engineers, D.P.C. 288 Genesee Street Utica, NY 13502
SCALE: 1" = 5' (34"x22")	DRAWING: OCTORARO 1 OF 2

IT IS A VIOLATION OF THE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANYWAY UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. ALTERATIONS MUST HAVE THE ENGINEER'S SEAL AFFIXED ALONG WITH A DESCRIPTION OF THE ALTERATION, THE SIGNATURE AND DATE.



NOTES:
1. THE DIMENSIONS NOTED ARE AS MEASURED IN THE FIELD.

SCAFFOLDING POST LENGTHS:
1. UPSTREAM DOWNHILL = 1'-4"
2. DOWNSTREAM DOWNHILL = 3'-6"
3. UPSTREAM UPHILL = 2'-3"
4. DOWNSTREAM UPHILL = 11"

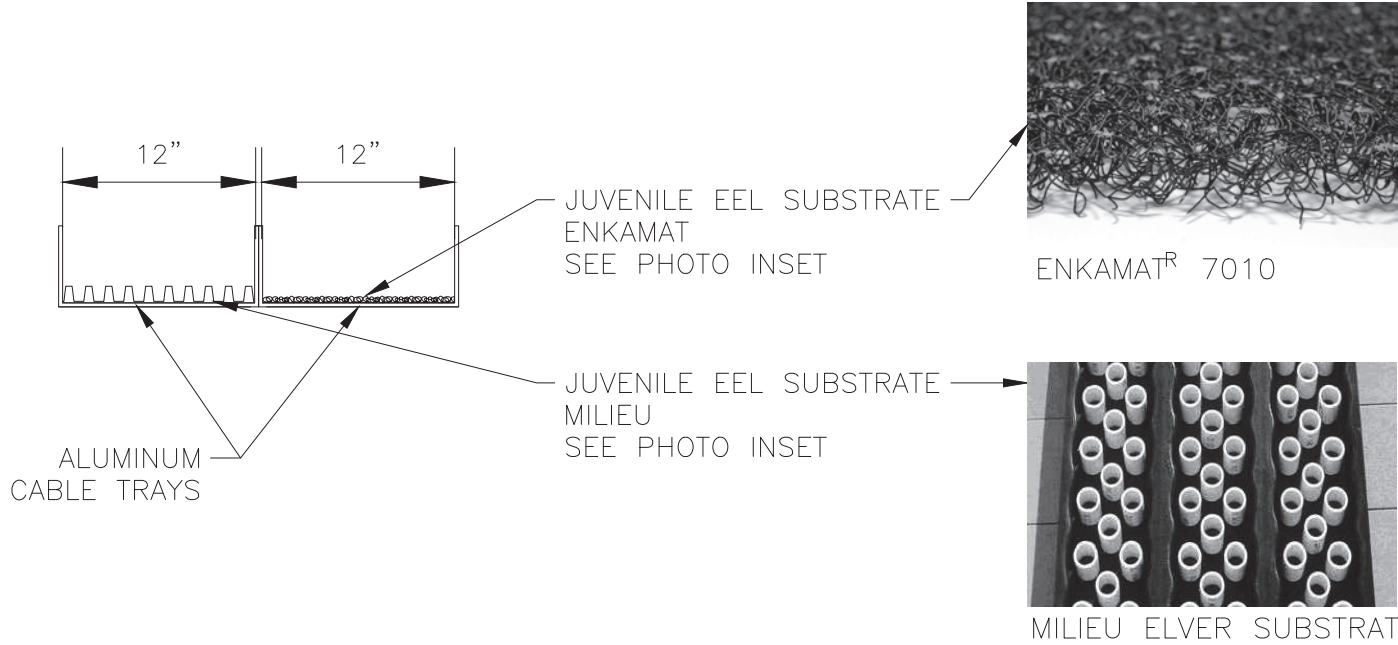
1 PROFILE
2 Scale: 1" = 2'-0"



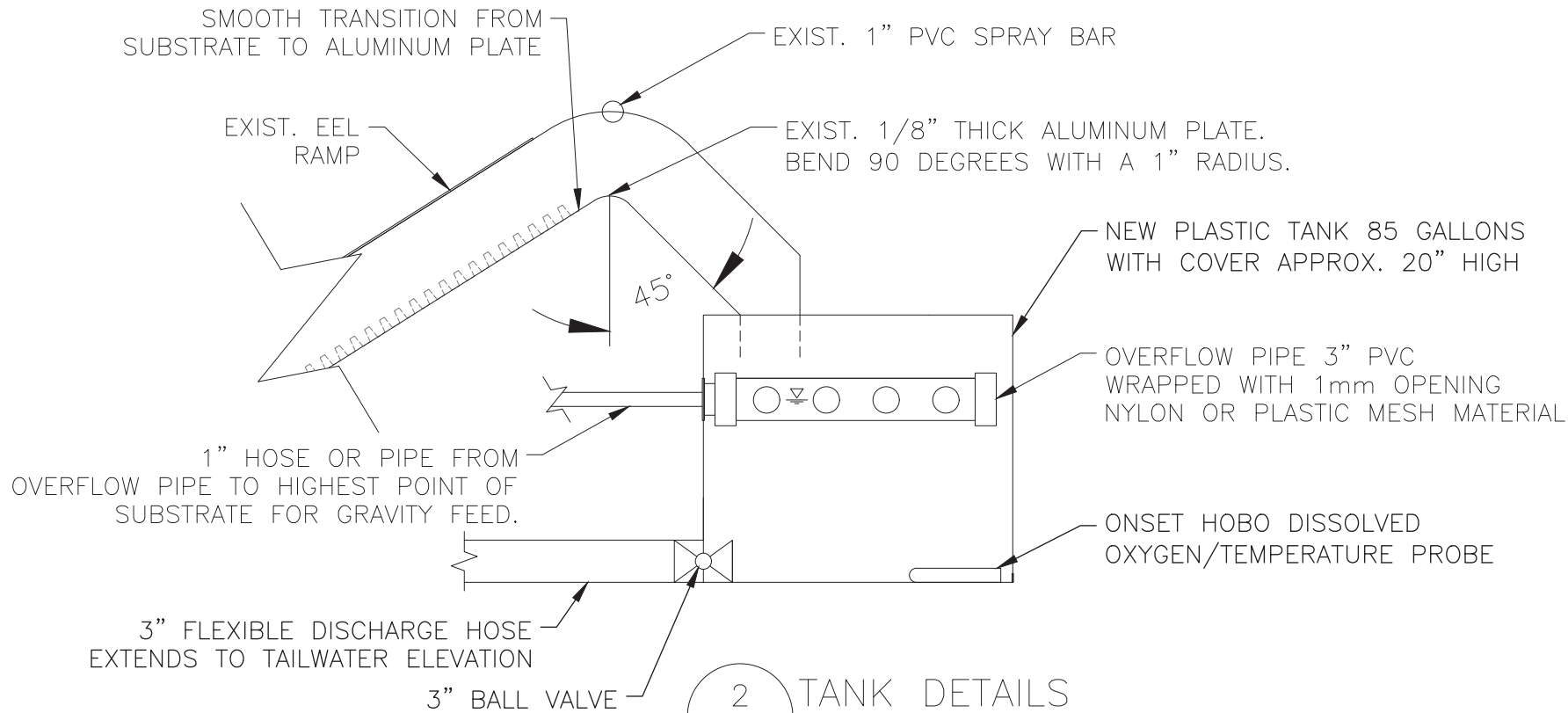
ISSUE	DESCRIPTION	BY	APP	
DRAWN BY: JSC				
CHECKED BY: HNN				
APPROVED BY:				
PROJECT NO.	1714	DATE:	4/6/2021	

OCTORARO CREEK EEL COLLECTION FACILITY			
TEMPORARY FACILITY PROPOSED PROFILE			
Exelon Generation Company, LLC 300 Exelon Way Kennett Square, PA 19348		Gomez and Sullivan Engineers, D.P.C. 288 Genesee Street Utica, NY 13502	
SCALE: 1" = 2' (34"x22")		DRAWING: OCTORARO	2 OF 2

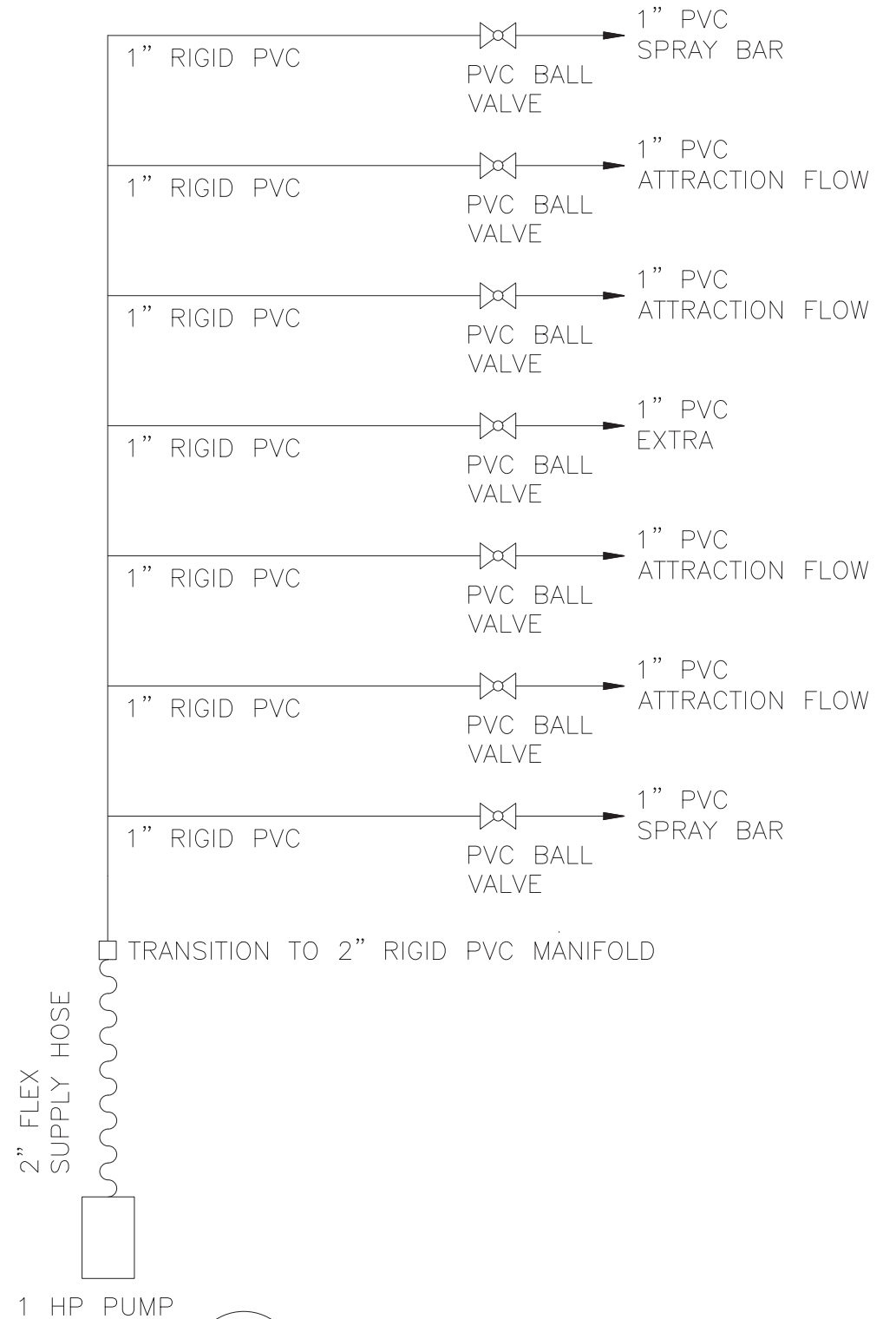
IT IS A VIOLATION OF THE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANYWAY UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER. ALTERATIONS MUST HAVE THE ENGINEER'S SEAL AFFIXED ALONG WITH A DESCRIPTION OF THE ALTERATION, THE SIGNATURE AND DATE.



1 EEL RAMP SECTION (TYPICAL)
R1 Scale: 1" = 1'-0"



2 TANK DETAILS
R1 Scale: 1" = 1'-0"



3 PIPING SCHEMATIC
R1 Scale: NTS

2' 0 1' 2'
SCALE: 1" = 1'

OCTORARO CREEK EEL
COLLECTION FACILITY

TYPICAL EEL LADDER
SECTION AND DETAILS (DONE
BY OTHERS)

ISSUE	DESCRIPTION	BY	APP
DRAWN BY:	JSC		
CHECKED BY:	HNN		
APPROVED BY:			
PROJECT NO.	1714	DATE:	4/6/2021

Exelon Generation Company, LLC
300 Exelon Way
Kennett Square, PA 19348

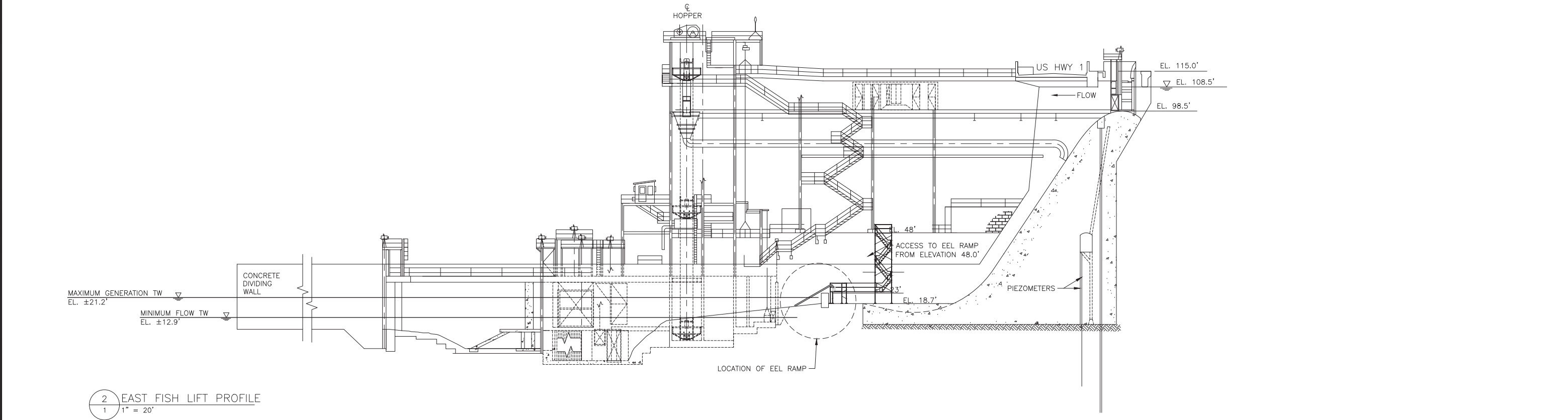
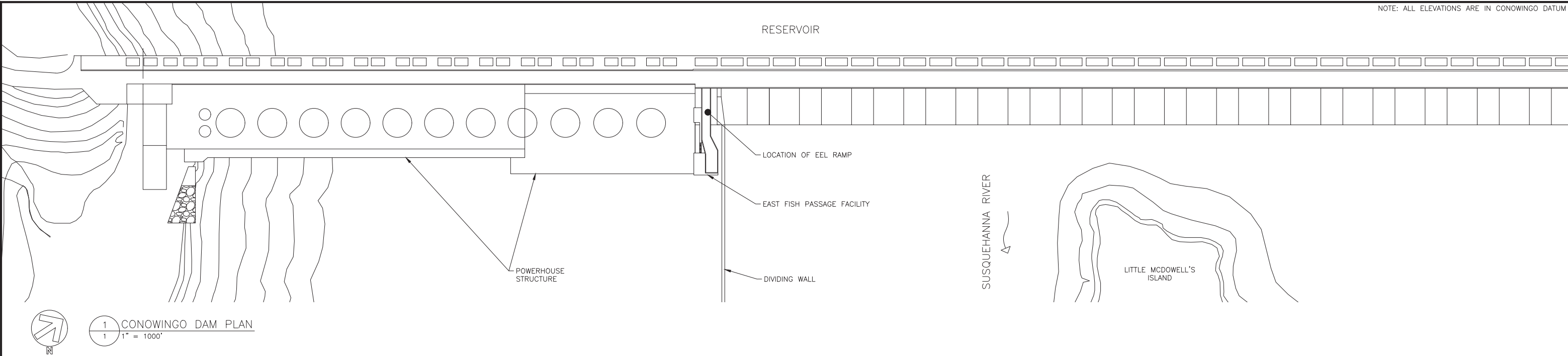
Gomez and Sullivan Engineers, D.P.C.
288 Genesee Street
Utica, NY 13502

SCALE: AS SHOWN (34"x22")

DRAWING: OCTORARO

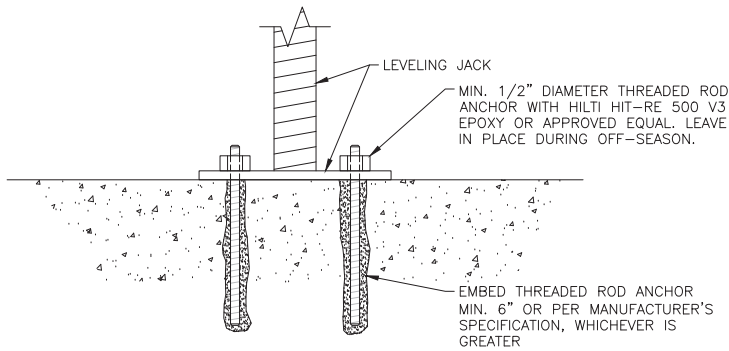
R1

APPENDIX C. CONOWINGO EAST EEL COLLECTION FACILITY DRAWINGS

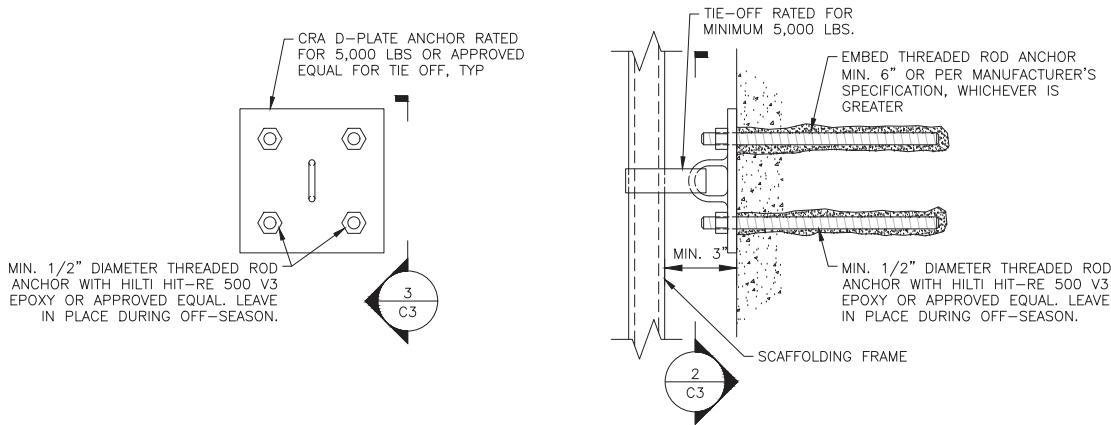


PRELIMINARY DRAWINGS
TO BE REVISED PENDING FINALIZATION OF
EAST FISH LIFT MODIFICATIONS' FOOTPRINT

												FOR: 		DESIGNED BY: BAS	CONOWINGO EAST EEL COLLECTION FACILITY			
												BY: 		DRAWN BY: BAS	PROPOSED EEL RAMP LOCATION AND PROFILE			
												1 5/22/20 CONCEPTUAL CONOWINGO EFL EEL FACILITIES BAS -		CHECKED BY: HNN				
												DATE: 4/15/2021		APPROVED BY: -	SCALE: AS NOTED			
												PROJECT NO.: 2132		DATE: 4/15/2021	DRAWING NO.: 1			
NO.	DATE	DESCRIPTION	BY	APP	NO.	DATE	DESCRIPTION	BY	APP	NO.	DATE	DESCRIPTION	BY	APP				

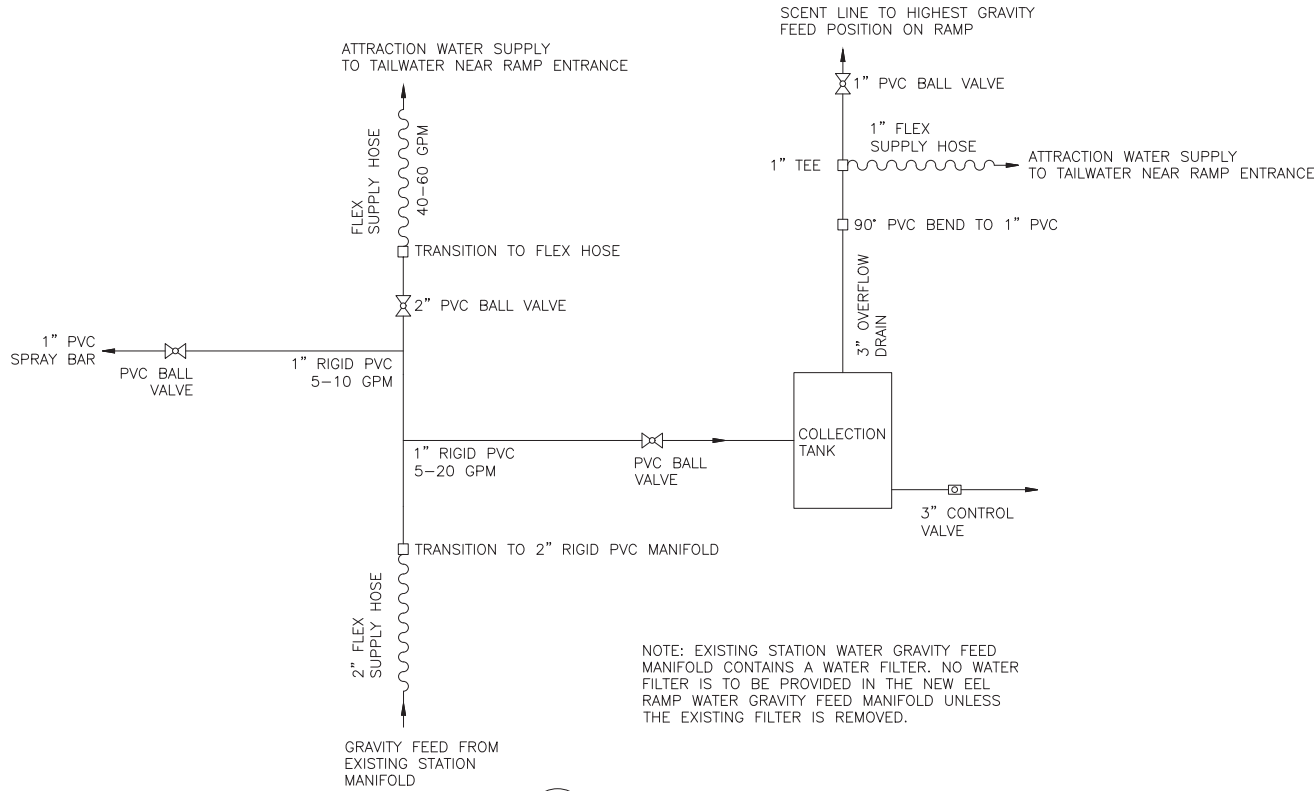


1 LEVELING JACK ANCHORS
C3 NOT TO SCALE



2 D-PLATE ANCHOR ELEVATION
C3 NOT TO SCALE

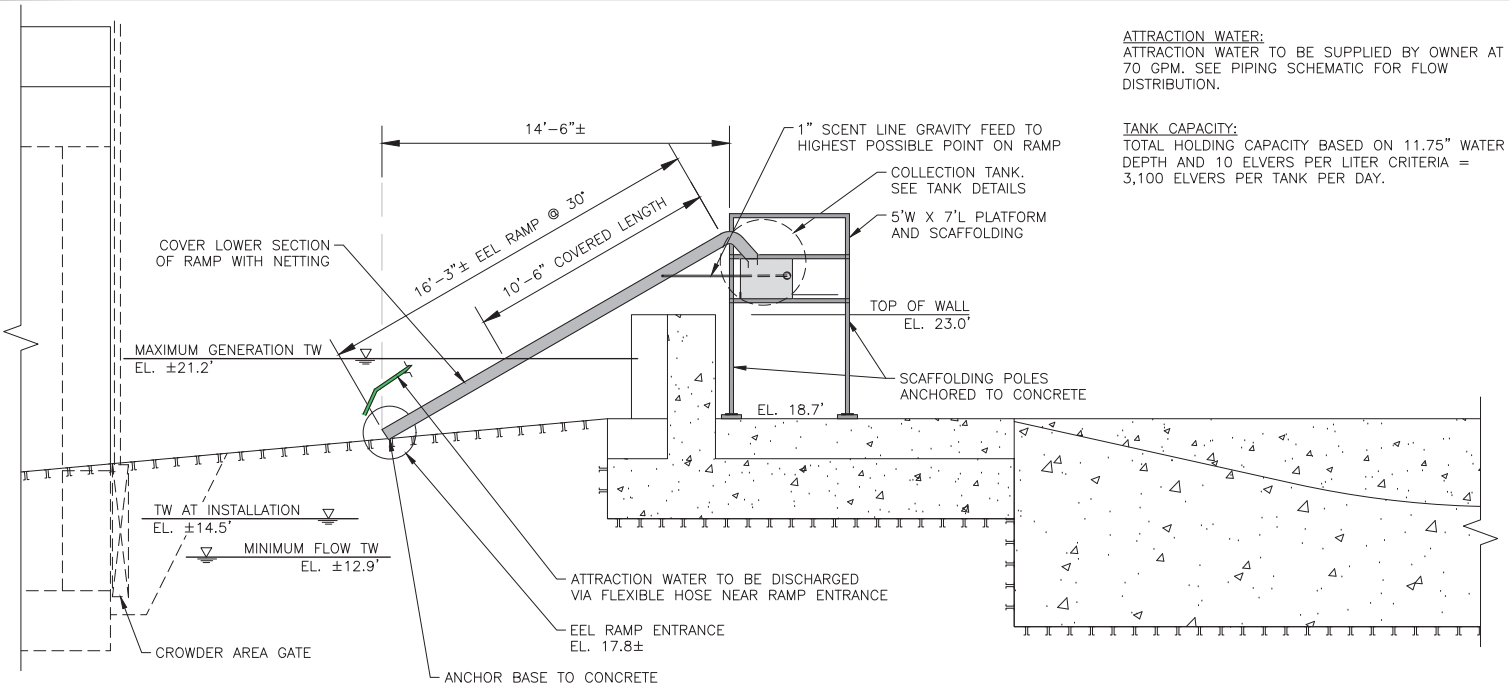
NOTE: PROVIDE SIMILAR ANCHOR POINT FOR GUY WIRES



4 PIPING SCHEMATIC
C3 NO SCALE

NOTE: EXISTING STATION WATER GRAVITY FEED MANIFOLD CONTAINS A WATER FILTER. NO WATER FILTER IS TO BE PROVIDED IN THE NEW EEL RAMP WATER GRAVITY FEED MANIFOLD UNLESS THE EXISTING FILTER IS REMOVED.

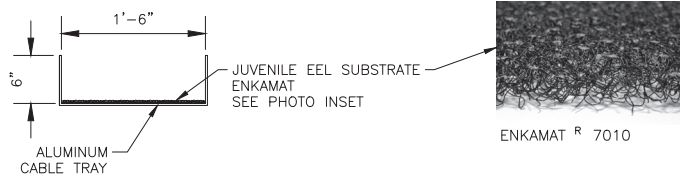
PRELIMINARY DRAWINGS
TO BE REVISED PENDING FINALIZATION OF
EAST FISH LIFT MODIFICATIONS' FOOTPRINT



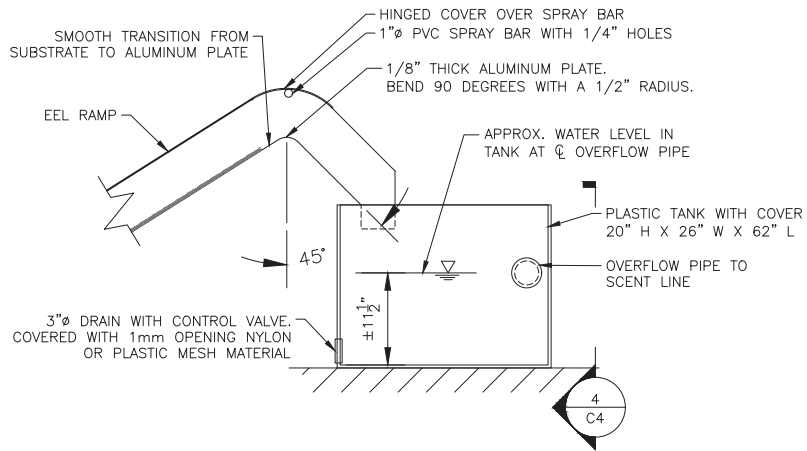
ATTRACTION WATER:
ATTRACTION WATER TO BE SUPPLIED BY OWNER AT 70 GPM. SEE PIPING SCHEMATIC FOR FLOW DISTRIBUTION.

TANK CAPACITY:
TOTAL HOLDING CAPACITY BASED ON 11.75" WATER DEPTH AND 10 ELVERS PER LITER CRITERIA = 3,100 ELVERS PER TANK PER DAY.

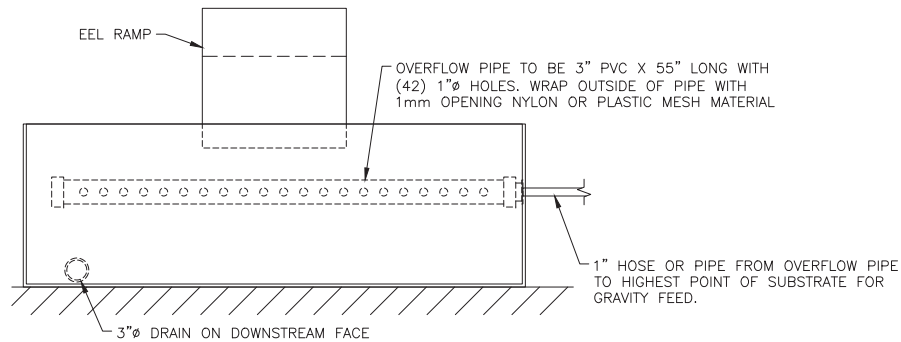
1 EEL RAMP PROFILE
C4 1/4" = 1'-0"



2 EEL RAMP SECTION
C4 1" = 1'-0"



3 COLLECTION TANK DETAILS
C4 1" = 1'-0"



4 COLLECTION TANK SECTION
C4 1" = 1'-0"

PRELIMINARY DRAWINGS
TO BE REVISED PENDING FINALIZATION OF EAST FISH LIFT MODIFICATIONS' FOOTPRINT

												FOR: 	DESIGNED BY: BAS	CONOWINGO EAST EEL COLLECTION FACILITY	
												EXELON GENERATION COMPANY, LLC	DRAWN BY: BAS		
												BY: 	CHECKED BY: HNN	EEL RAMP DETAILS	
												PROJECT NO.: 2132	APPROVED BY: -		
												DATE: 4/15/2021	DATE: 4/15/2021	SCALE: AS NOTED	DRAWING NO.: 4
NO.	DATE	DESCRIPTION	BY	APP	NO.	DATE	DESCRIPTION	BY	APP	NO.	DATE	DESCRIPTION	BY	APP	

**APPENDIX D. ANNOTATED CONOWINGO EAST EEL COLLECTION
FACILITY DESIGN PRESENTATION**

Conowingo Hydroelectric Facility and Muddy Run Pumped Storage Project

FERC Project Nos. 405 and 2355

Eel Passage Advisory Group (EPAG) Teleconference

Remote Meeting
October 15, 2020, 2:00 pm to 3:30 pm



Exelon Generation®

Agenda

- Review East Fish Lift (EFL) Temporary Eel Facility Design
- Review EFL Temporary Eel Facility Drawings and photos of existing structure
- Questions and 3D model presentation



Source: NYSDEC Wiki Commons

EFL Eel Facility Design

Water Levels (Conowingo Datum)

- Based on 5% and 95% exceedance flows during passage season (June 1 – November 30)
- Minimum Tailwater (95% exceedance) = El. 12.79'
- Maximum Tailwater (5% exceedance) = El. 21.17'

Eel Ramp

- 18-inches wide, 30° slope, approx. 16'-3" length
- Enkamat substrate, throughout ramp and along concrete to low water level
- Solid cover above max. water level and netting along the remainder
- Ramp entrance elevation = El. 17.8' +/-

EFL Eel Facility Design (cont.)

Collection Tank

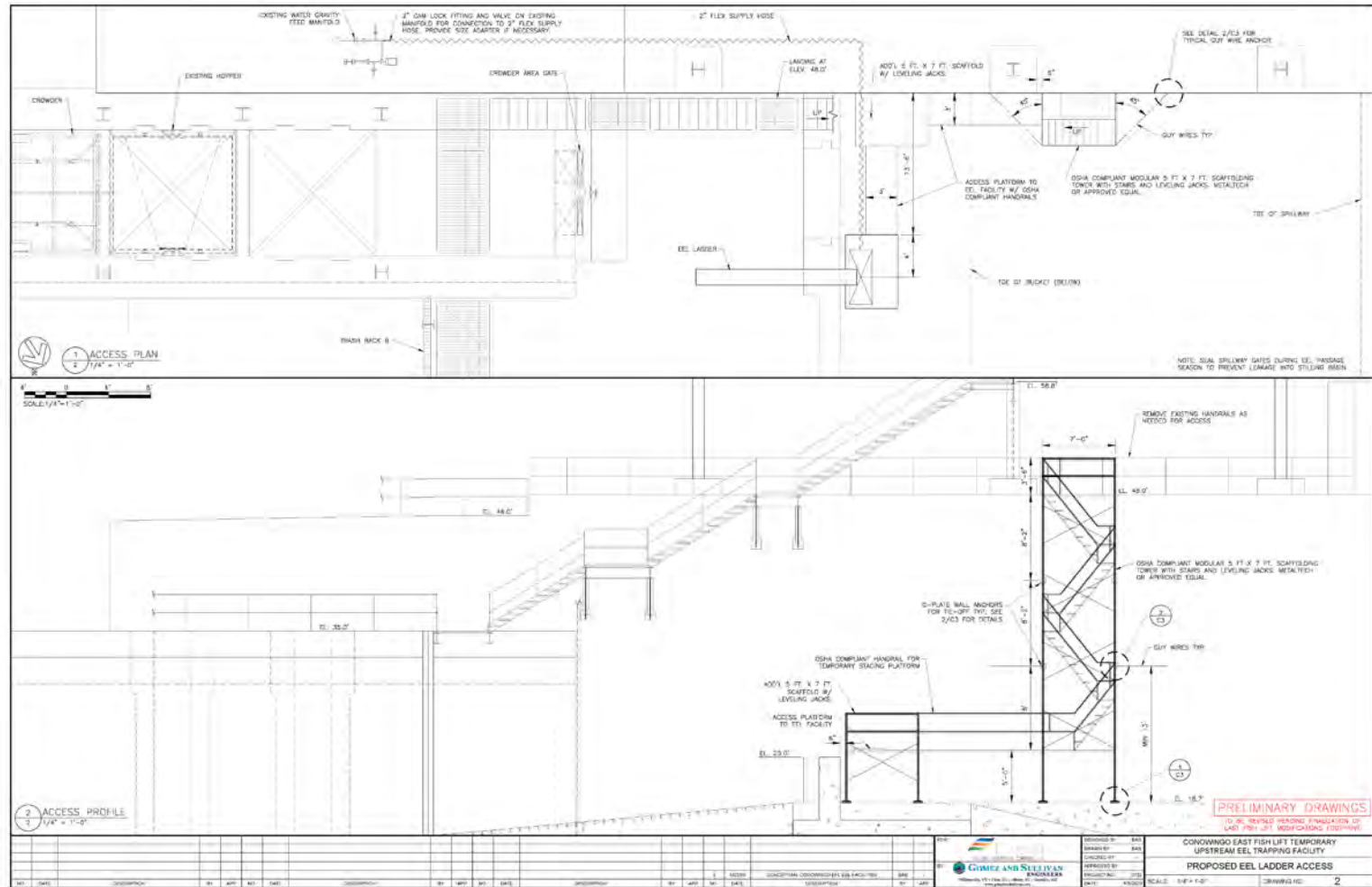
- Approximately 80-gallon capacity (3100 eels @ 10 eels per liter)
- 11.75-inch +/- water depth

Water Supply

- 1-inch PVC spray bar
- Scent line from tank to highest gravity fed position on ramp
- Overflow line from tank to base of ramp.

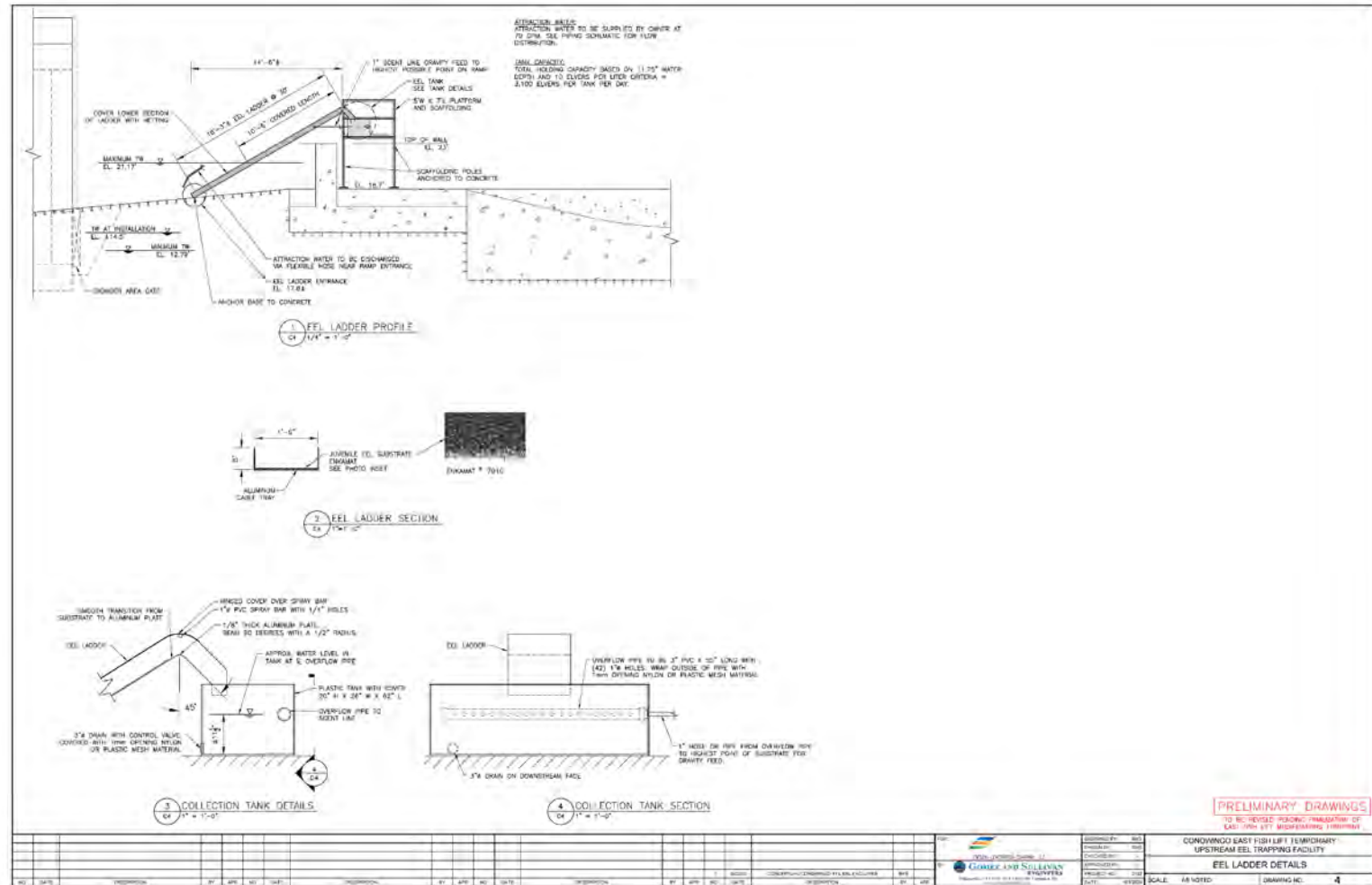
5

EFL Eel Facility Drawings (pg. 2)

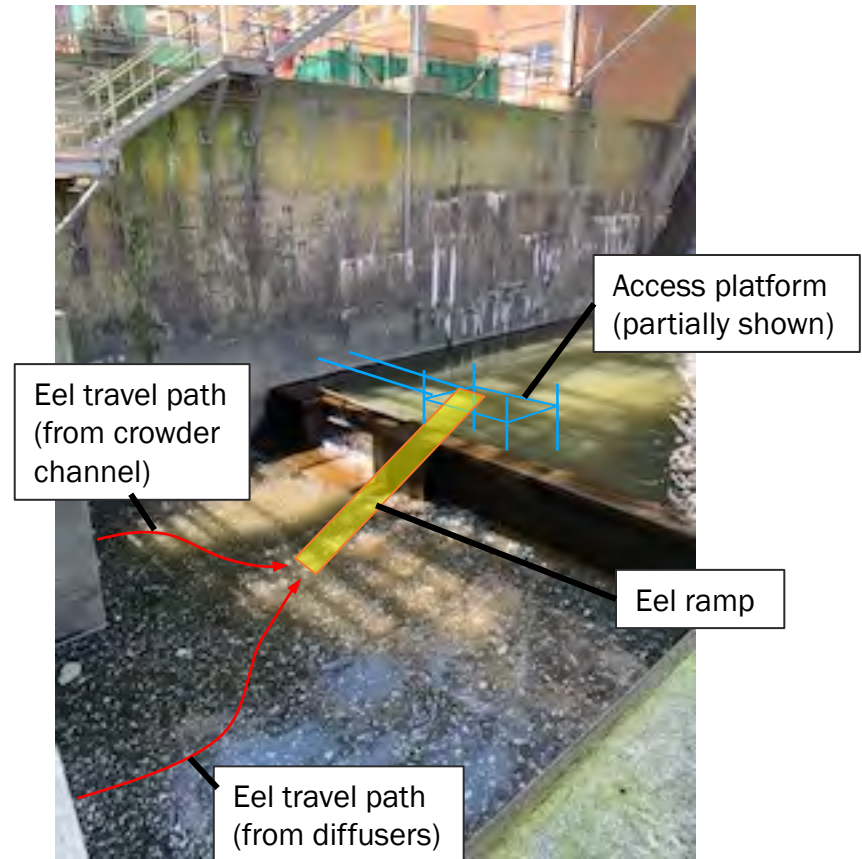
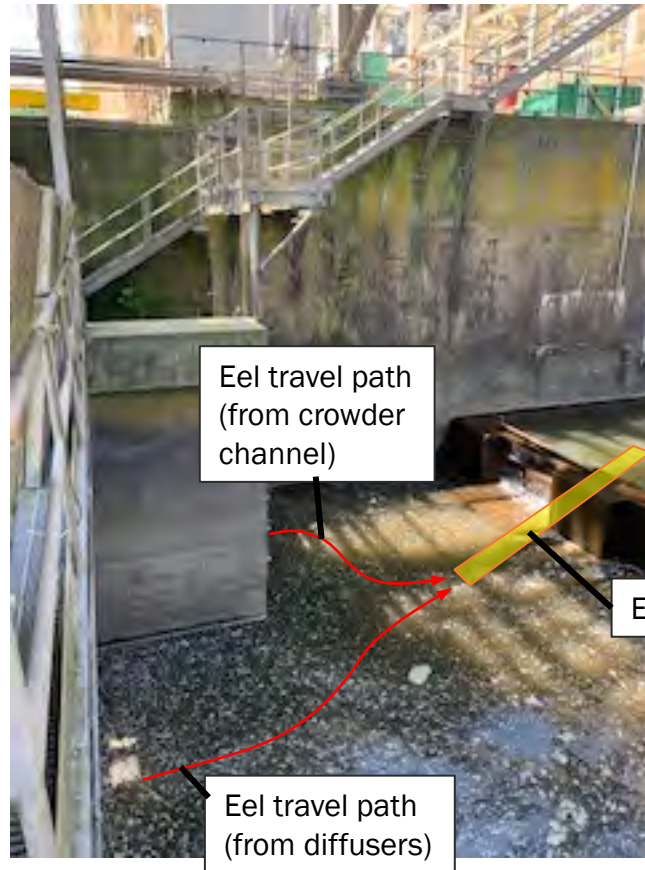


7

EFL Eel Facility Drawings (pg. 4)



East Fish Lift Photos



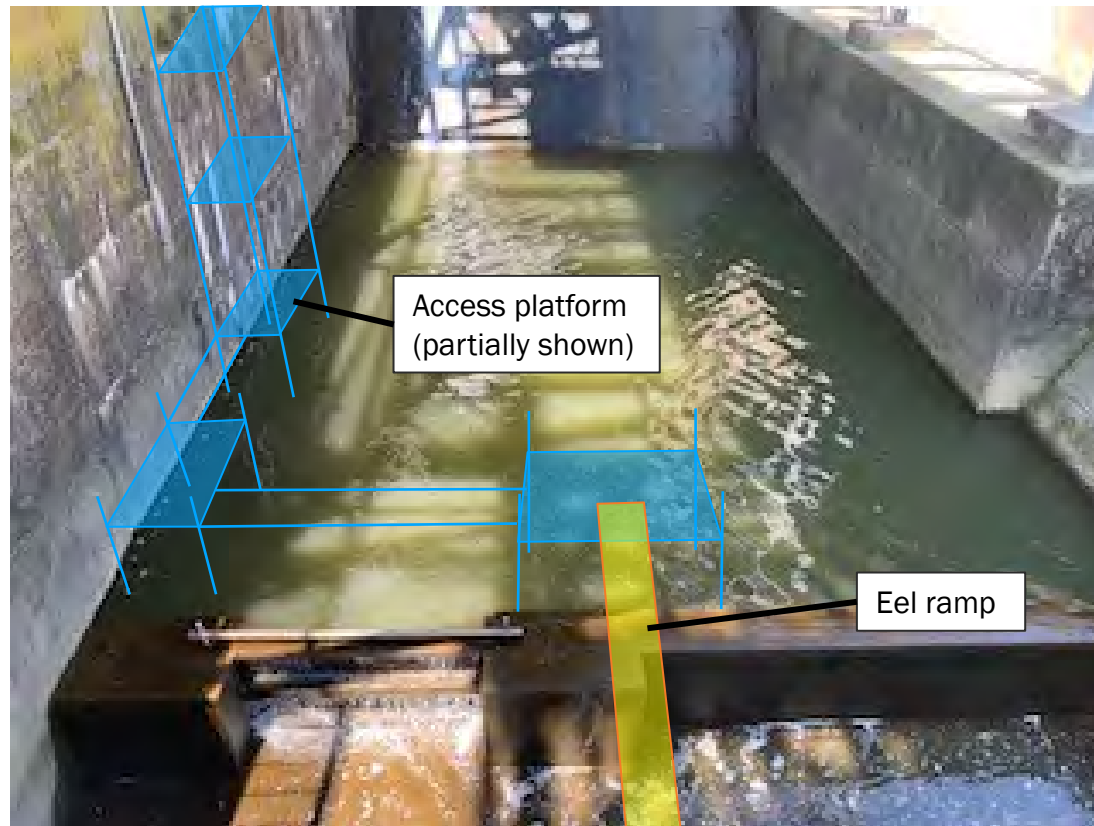
Dissipation Wall

East Fish Lift Photos



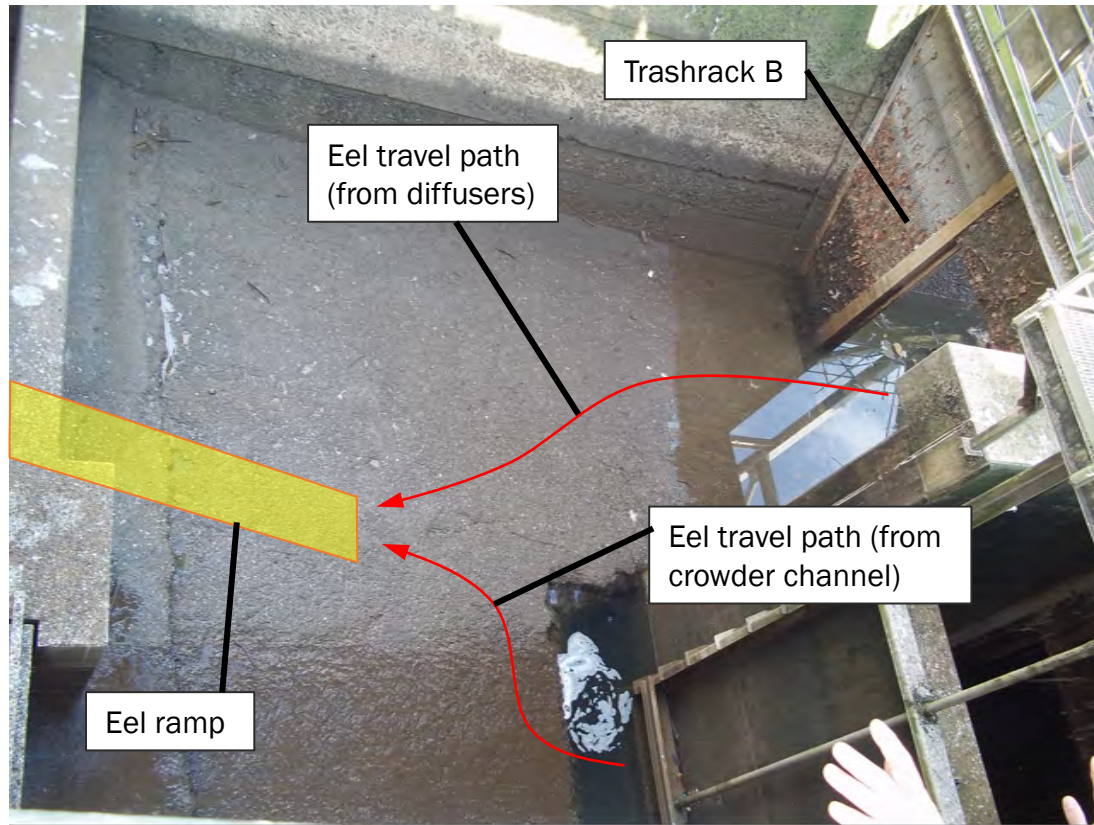
Trashrack B from Crowder Area Gate

East Fish Lift Photos



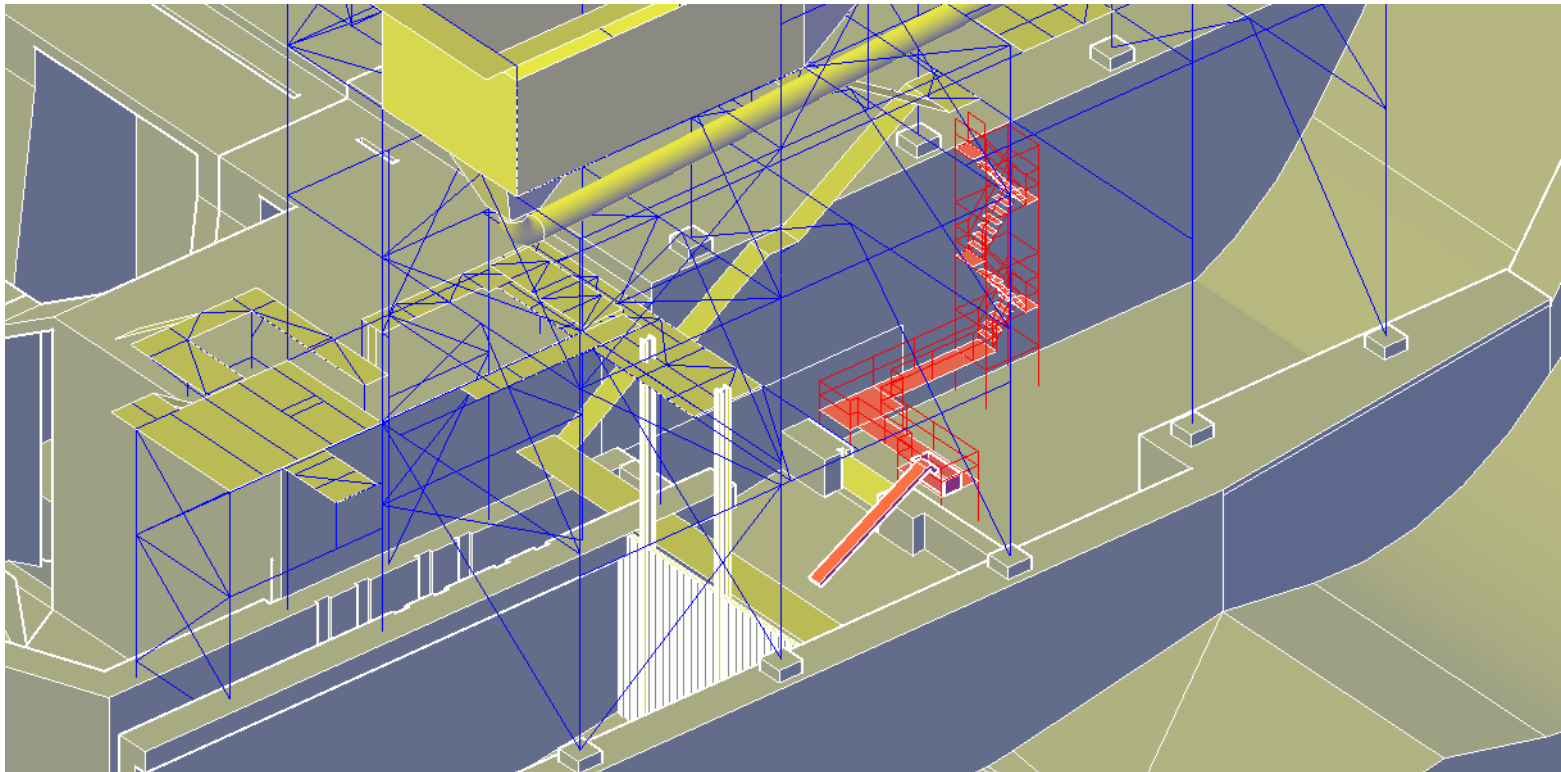
Upper Basin from Crowder Area Gate

East Fish Lift Photos



Stilling Basin Wall to Trashrack B and Crowder Area Gate

3D Model



3D model of EFL with proposed Eel Facilities shown in red

APPENDIX E. DAILY AND WEEKLY DATA SHEETS



Conowingo West Eel Collection Facility Daily Field Sheet	
Project Number:	Crew:
Collection Number:	Generation:
Date:	<i>Control Room DO reading:</i>
Weather:	

	Collection Tank	Holding Tank			Main Flow
		# 1	# 2	# 3	
Time:					
Flow Meter (gpm):					
Total Flow Volume:					
Temperature (°C):					
Dissolved Oxygen (mg/L):					
In Operation:					

Actual Counted # of Eels:	Volumetric Estimates
Dead eels in collection tank #:	Actual # of eels in 200 mL:
Sacrificed #:	# of eels in 1 Liter:
Eels released into holding tank #:	Displacement of water (L):
# Eels released into tank:	Estimated # of eels:
Dead eels in tank #:	Total estimated: (total estimated equals number estimated plus eels in the 200 mL subsample)
Total # of eels in tank: (not to exceed 17,000)	
	Estimate Check (QA) (if necessary):
	Actual:
	Estimate:
Holding Tank #:	Holding Tank #:
Total alive:	Total alive:
Dead #:	Dead #:
New total:	New total:

Comments:



Biological Data, Monday and Thursday (sheet 2)
Calibration, Wednesday

[illegible]

[illegible]



American Eel Transport Sheet

Facility (circle)	CWECF CEECF OECF	Transport Tank (circle)	Large Small

Prior to transport, while in holding (H1)		Prior to transport, while in holding	
Date	Time	Date	Time
DO	Temp	DO	Temp
No. eels being held		No. eels being held	
No. dead eels in holding prior to transport		No. dead eels in holding prior to transport	
No. eels being transported		No. eels being transported	

After eels have been loaded (in tank)		Prior to releasing eels (in tank)	
Date	Time	Date	Time
DO	Temp	DO	Temp
No. eels transported			
No. of eel dead during transport			
No. eels released			

Release Location			
Date	Time	Creek DO	Creek Temp

Release Locations

- A – Muddy Creek Forks (York County)
- B – Conewago Creek, Aberdeen PA (Lancaster County)
- C – Beaver Creek, Hummelstown, PA

Susquehanna River

- 1 – Conowingo Pond, Conowingo Creek (Cecil County)
- 2 – Lake Aldred (York/Lancaster County)
- 3 – Lake Clarke (Lancaster County)
- 4 – Etters Boat Ramp, Goldboro, PA
- 5 – West Fairview Access, Route 11/15 (Cumberland County)
- 6 – For Hunter Access (Perry County)
- 7 – Shikellamy State Park (Northumberland County)
- 8 – Route 487 (Bloomsburg, PA (Columbia County)
- 9 – Route 29 Bridge (Luzerne County)
- 10 – Upstream of Hepburn Street Dam, Williamsport PA (Lycoming County)
- 11 – Upstream of Grant Street Dam (Clinton County)
- 12 – City Island (Dauphin County)



Daily Conowingo West Eel Collection Facility Email Template

PROVISIONAL DATA SUBJECT TO REVISION

Collection

Today ____ American Eel were collected at the Conowingo West Eel Collection Facility. The season total is now ____.

New collection tank mortalities:

Transport

Today ____ American Eel were transported to _____. The season total transported is now ____.

New transport tank mortalities: ____.

Holding

____ American Eel are in holding.

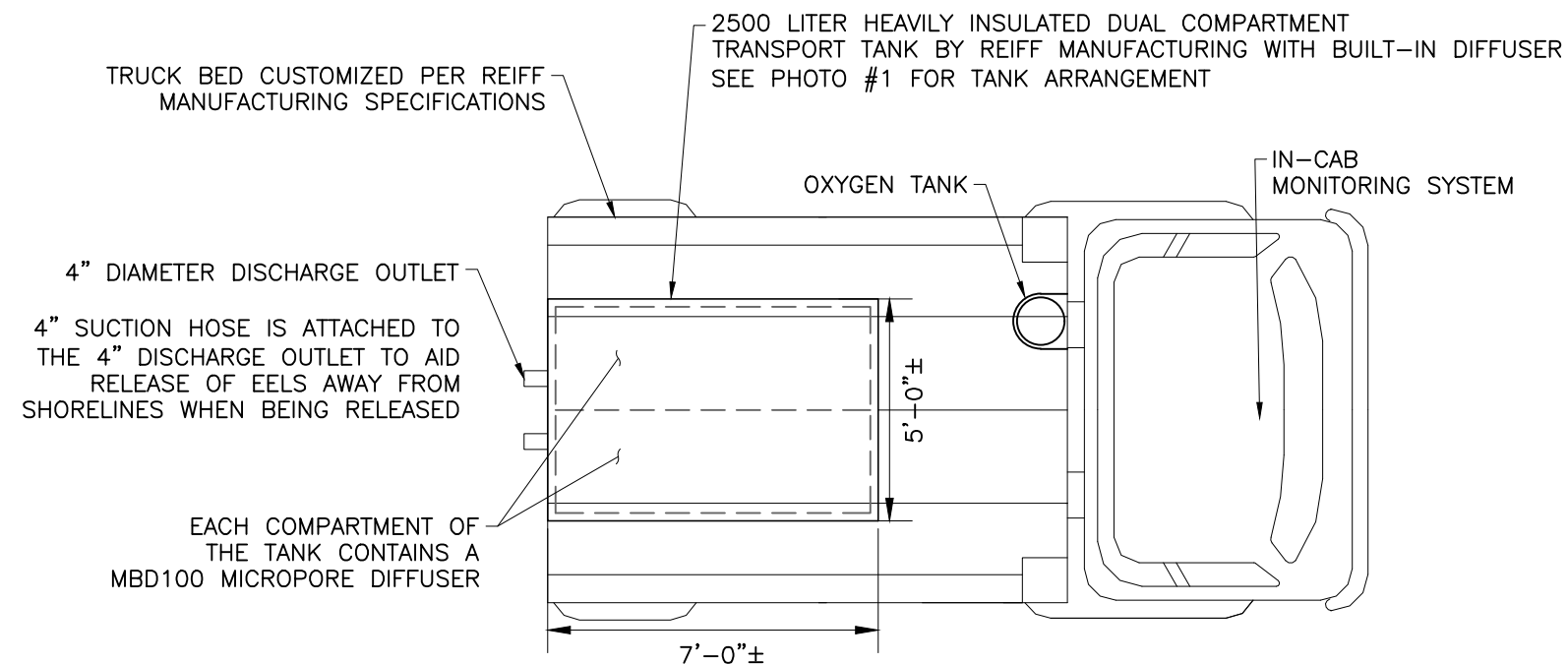
New holding tank mortalities: ____.



Meter and Probe Maintenance

[illegible]

APPENDIX F. CONOWINGO TRANSPORT FACILITY DRAWINGS



TRANSPORT TRUCK PLAN
SCALE: 1/4" = 1'

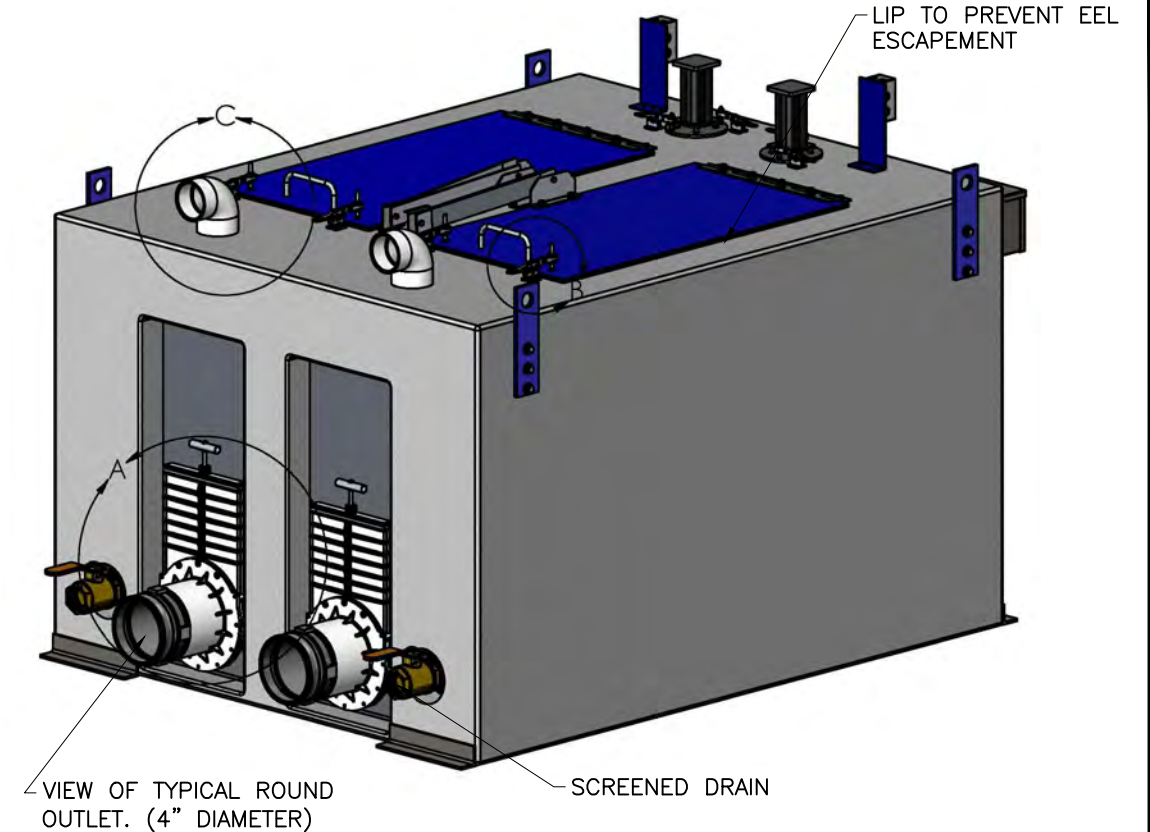


PHOTO 1: ISOMETRIC VIEW OF REIFF MANUFACTURING TRANSPORT TANK

REIFF MANUFACTURING TRANSPORT TANK ARRANGEMENT

NOTES:

TRANSPORT TRUCK AND MONITORING

1. TRANSPORT TRUCK HAS CAPACITY TO TRANSPORT 25,000 EELS (2,500 LITERS) IN ONE TRIP.
2. TRANSPORT TRUCK INCLUDES CONTINUOUS IN-CAB MONITORING SYSTEM FOR INSUFFICIENT WATER TEMPERATURE AND DISSOLVED OXYGEN PARAMETERS. NO BACK-UP PUMP AND NO ALARMS (FLOW IS NOT NEEDED FOR EELS AND THE TECHNICIAN MONITORS THE IN-CAB MONITORING SYSTEM).

TRANSPORT TANK

1. TANK HAS CAPACITY TO HOLD 25,000 EELS (2,500 LITERS) WITH 4" OF FREEBOARD.
2. TANK INCLUDES LIP TO PREVENT EEL ESCAPEMENT.
3. TANK MANUFACTURED BY REIFF MANUFACTURING.
4. EELS WILL BE EMPTIED DIRECTLY FROM TANK VIA 4" SUCTION HOSE ATTACHED TO THE 4" DRAIN (KNIFE VALVE) TO AID RELEASE OF EELS AWAY FROM SHORELINES AT DESIRED STOCKING LOCATIONS.
5. TANK INCLUDES 1½" SCREENED DRAIN TO LOWER WATER LEVELS AS NEEDED.
6. OTHER DETAILS OF THE TANK CAN BE FOUND ON THE REIFF MANUFACTURING DRAWINGS.

FINAL

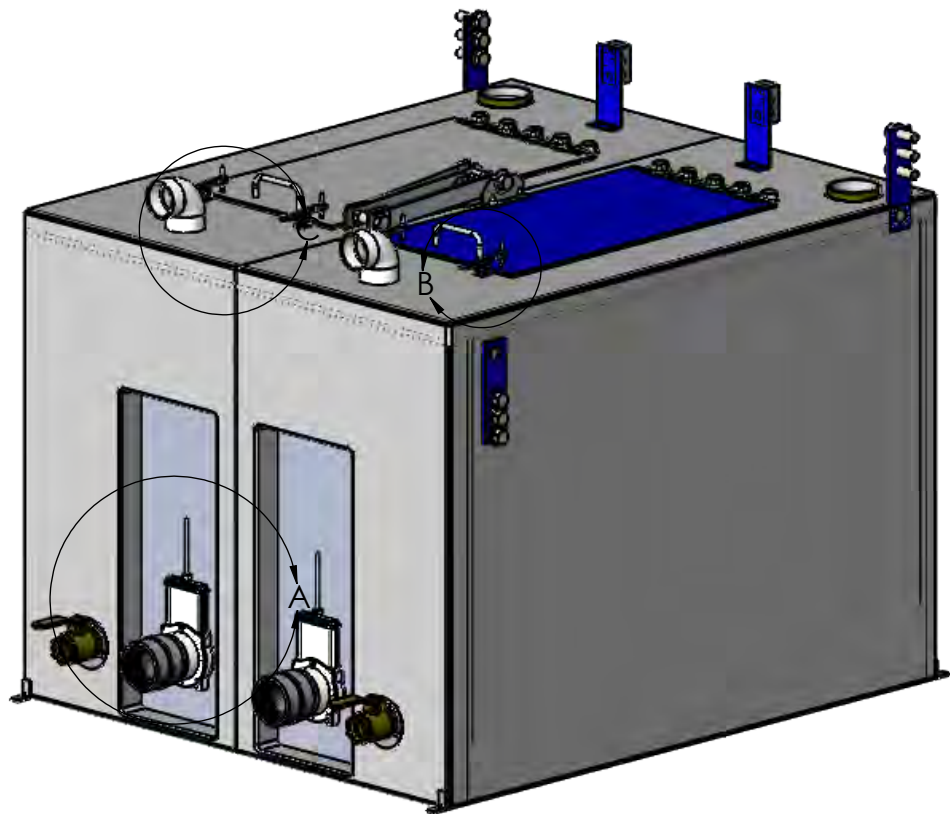
					FOR:	 EXELON GENERATION COMPANY, LLC	DESIGNED BY:	CRS	CONOWINGO AMERICAN EEL TRANSPORT FACILITY	
							DRAWN BY:	CRS		
					BY:	 GOMEZ AND SULLIVAN ENGINEERS	CHECKED BY:	-	PLAN, SECTION, DETAILS - EEL TRANSPORT	
						Williamsville, NY • Utica, NY • Albany, NY • Henniker, NH www.gomezandsullivan.com	APPROVED BY:	-		
0	4/15/19	CONOWINGO EEL TRANSPORT FACILITIES	KBS	-			PROJECT NO.:	1385	SCALE: SHEET 1 of 4	
NO.	DATE	DESCRIPTION	BY	APP			DATE:			

Tank Notes:

- Inner Tank structure to be built out of 0.19" thick 5025-H32 Aluminum 2 Tank Insulation 2lb. density EI Foam P200 or equal (7.9 Rs per in.).
- External Tank to be made of 0.125" thick FRP with additional in corners and bottom for reinforcement.
- Urethane clear coat over outer gelcoat layer for durability and ease of cleaning.
- [2] 4" Round outlet with external mount Valterra 4" Knife gates. (1) per compartment. Gates are mounted to Tank with machined Alum plate.
- (2) - 24 Point Four Systems microbubble diffuser. (1) per compartment.
 - Each diffuser stone is countersunk in tank bottom.
 - Stones have removable alum covers for maintenance and repair.
 - Countersunk pockets have drainline for water drainage of pockets.
 - (2) Oxygen Flowmeter, (1) per stone.
 - (1) Oxygen Regulator.
- (2) Ventilation scoop. SCH 40 PVC elbow with Alum perforated screening. (1) per compartment mounted on access hatch doors.
- (2) Access hatch 18" x 36" with 21" x 39" single hinge doors. (1) per compartment.
 - Each door has heavy duty Stainless Steel piano style hinge.
 - (1) Alum fabricated jack knife door lock hinge. Hinge holds door in open position to keep accidental closure from occurring.
- Details NOT shown in Submittal drawings include: Point Four oxygen stones and internal oxygen lines. (placement pocket and flush mount cover is shown.

External Valterra Gate Notes

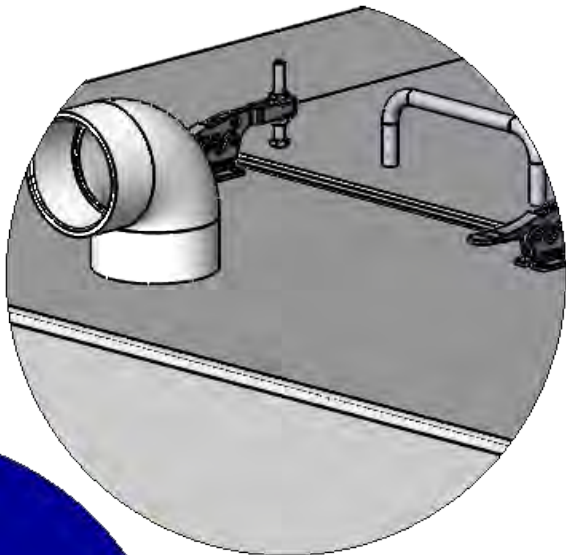
- Gate is double sealed with easily replacable seals.
- Gate is double flanged with full gate able to be removed easily for maintenance or repair.
- Gate seal when gate is closed to be drip tight, and leak proof, when properly adjusted.
- Bolts for mounting of flanges to allow for seal tension adjustment.
- Outer removable flange has threaded pipe stub in slip flange for mounting threaded 4". Female thread to Male camlock quick coupler.



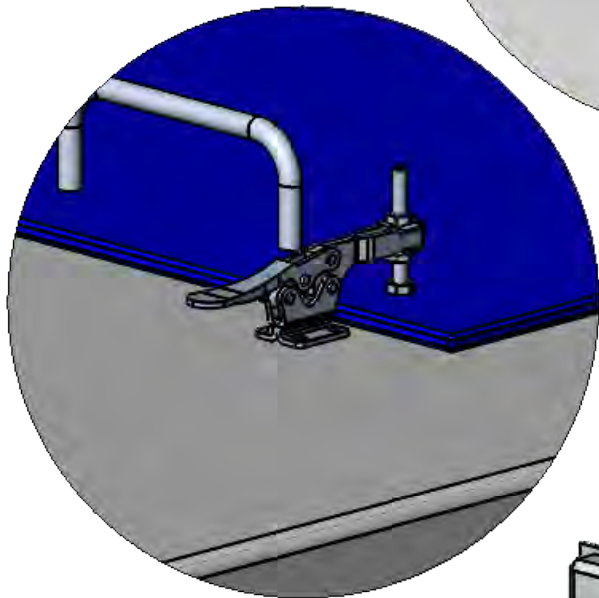
SCREENED TEMPERING VALVE
DETAIL
SCALE 1:8



DETAIL C
SCALE 1 : 6



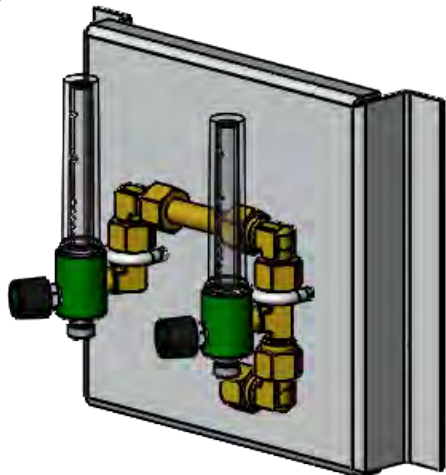
DETAIL B
SCALE 1 : 4



DETAIL A
SCALE 1 : 8



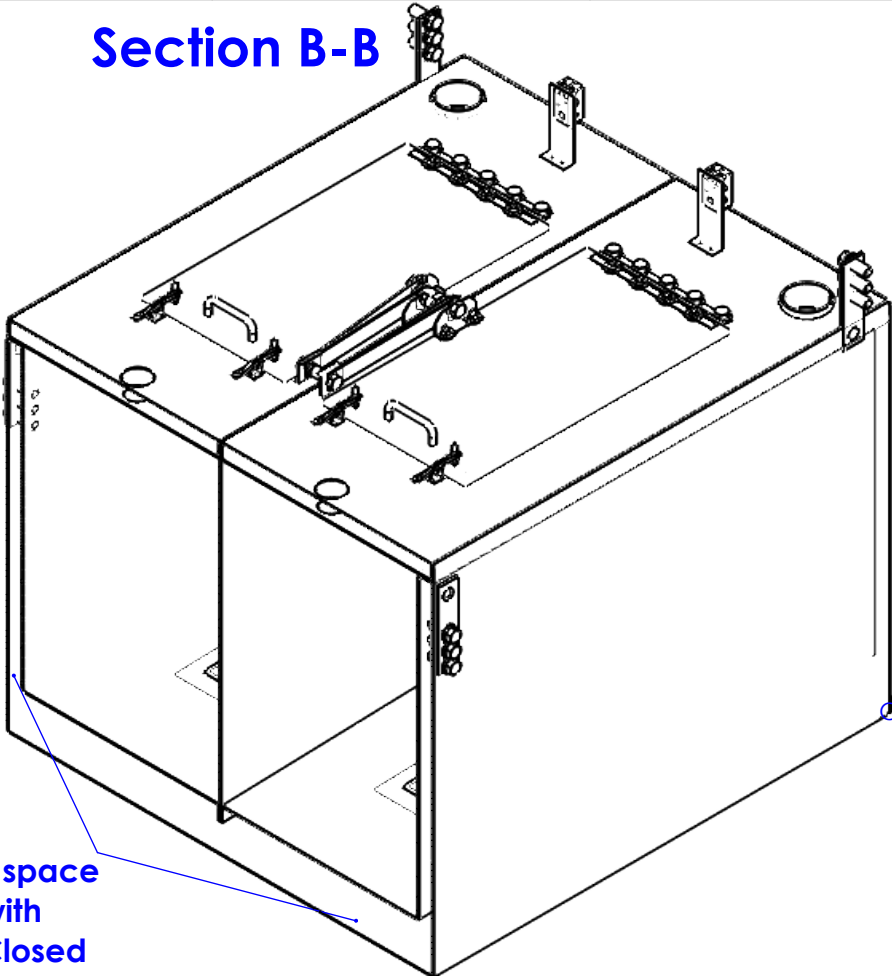
FLOWMETER DETAIL
SCALE 1:4



FINAL

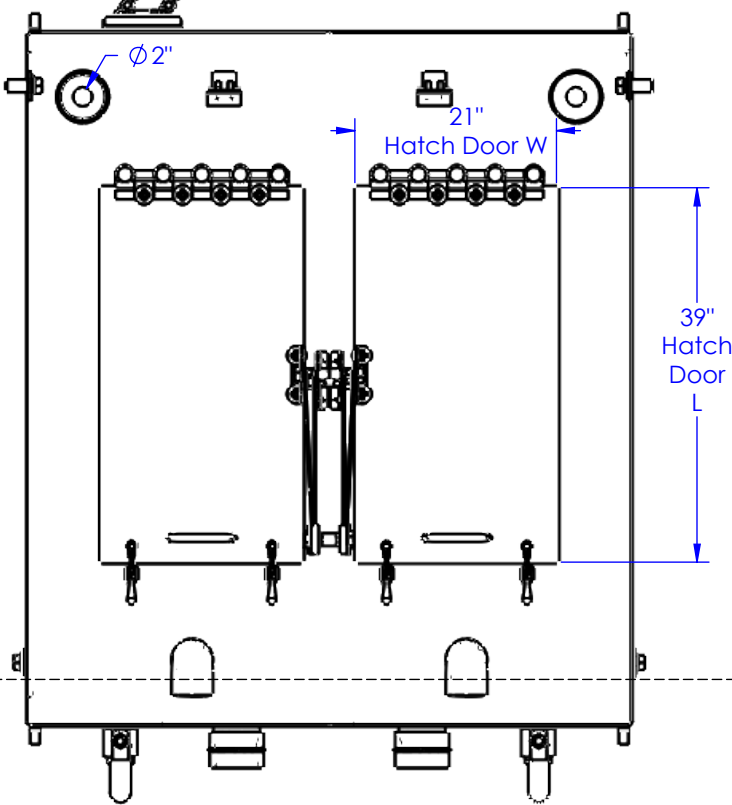
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF REIFF MANUFACTURING COMPANY. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF REIFF MANUFACTURING COMPANY IS PROHIBITED.	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± 1/32" ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± 0.01 THREE PLACE DECIMAL ± REIFF Mfg. ACCURACY TOLERANCE (Job Specific): ±		NAME	DATE	CUSTOMER: Normandeau - PA			
			DRAWN	CA			3/23/2016	
			CHECKED			TITLE: 660gal 2 comp fish trans		
								
CUSTOMER SUBMITTAL APPROVAL Signature or Initial: (upon approval)	MATERIAL		 CITY/COUNTY AIRPORT 670 B Street WALLA WALLA, WA.99362 PHONE: 509-525-1081			SIZE B	JOB. NO. 650gal 2 Comp	REV 1
Date Signed: (MM/DD/YYYY)	FINISH							
	DO NOT SCALE DRAWING					SCALE: 1:20 WEIGHT:		SHEET 2 OF 4

Section B-B

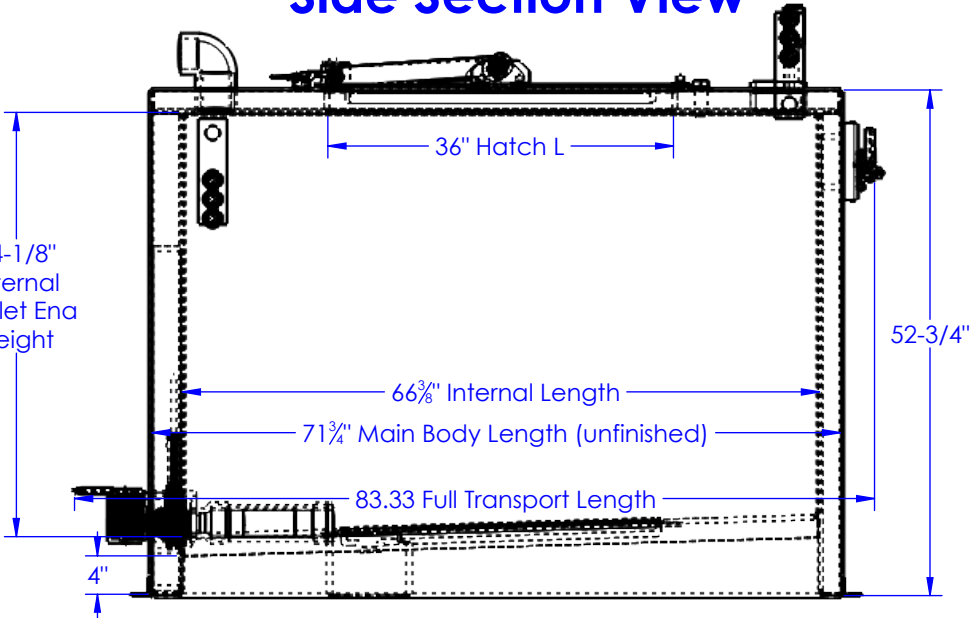


Empty space filled with P200 Closed Cell Foam

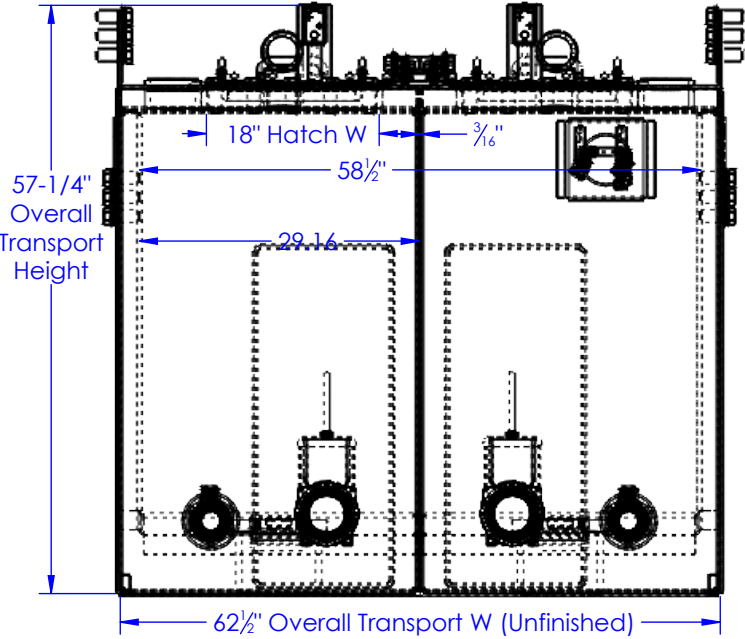
Top Section View



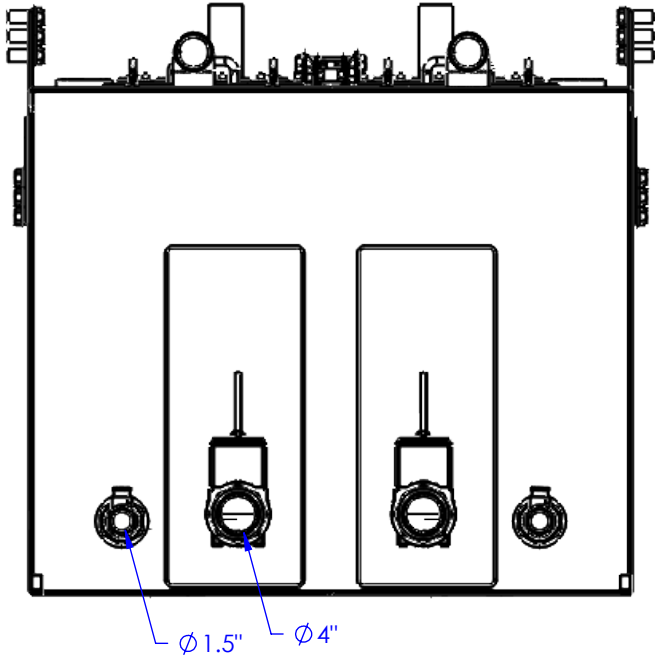
Side Section View



Cab End Section View



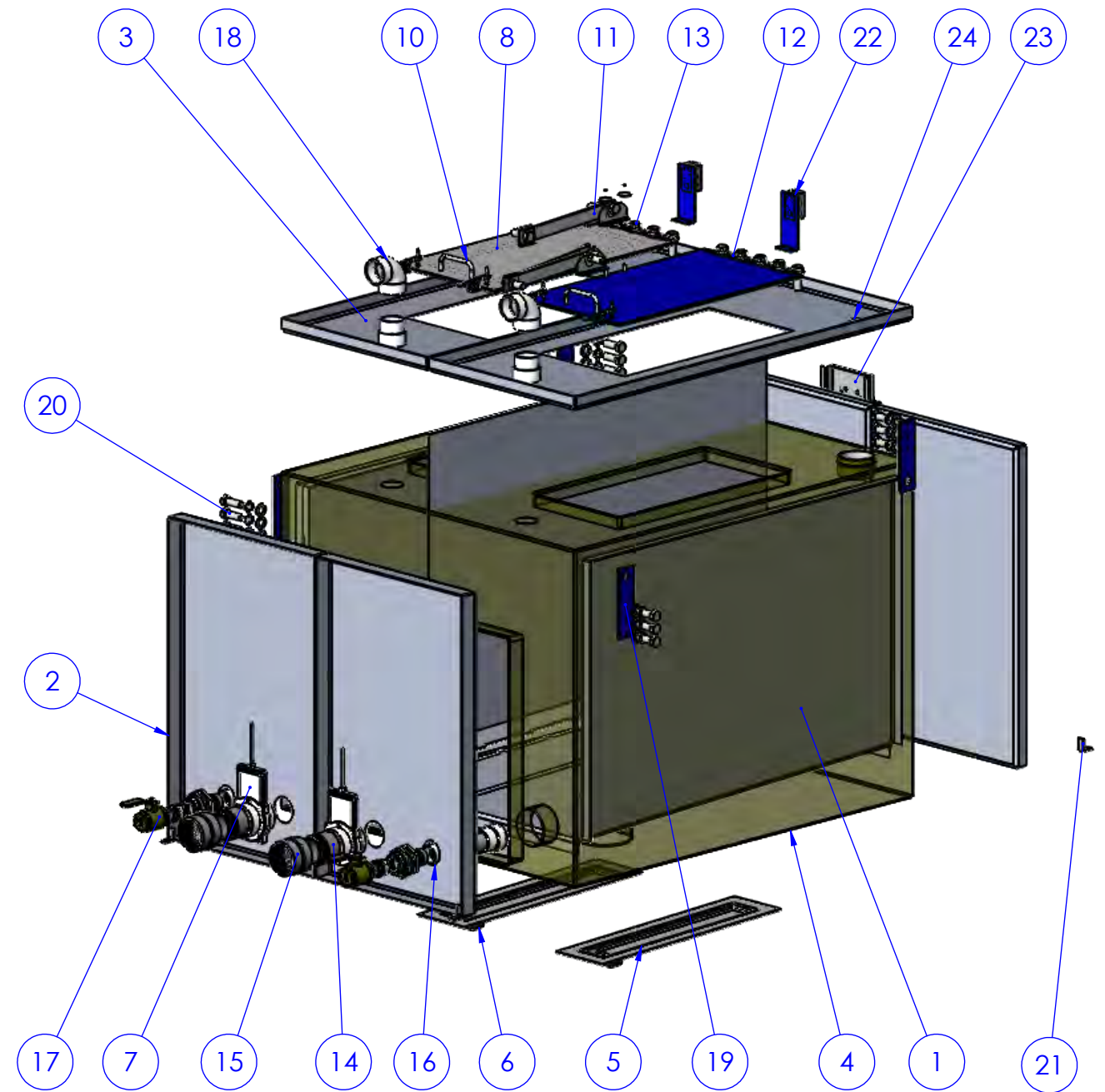
Outlet End Section View



FINAL

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CUSTOMER SUBMITTAL APPROVAL Signature or Initial: (upon approval)		MATERIAL		DRAWN	CA	3/23/2016	TITLE: 660gal 2 comp fish trans		
				CHECKED					
									
Date Signed: (MM/DD/YYYY)		FINISH		Reiff MFG. CITY/COUNTY AIRPORT 670 B Street WALLA WALLA, WA. 99362 PHONE: 509-525-1081			SIZE	JOB. NO.	REV
							B	650gal 2 Comp	1
							SCALE: 1:20 WEIGHT:		SHEET 3 OF 4
		DO NOT SCALE DRAWING							

NOTE #	PART	QTY.	DESCRIPTION
1	660 gal Alum Interior Body Piece	2	Tank Body made from 0.19" thick 5052-H32 fabricated Alum Sheet.
2	660 gal Alum Interior Ends	4	Tank Body made from 0.19" thick 5052-H32 fabricated Alum Sheet.
3	660 gal Alum Interior Top	2	Tank Body made from 0.19" thick 5052-H32 fabricated Alum Sheet.
4	Fiberglass Outer Shell	1	White and Clear gel coated, Chop Applicated 0.15" FRP Outer Shell.
5	Point Four System's 24" O2 diffuser stone FRP pockets	2	Pockets are recess mounted to allow flush mounting of O2 stone cover.
6	0.125" 5052-H32 flush mount O2 stone covers	2	Flush Alum covers secured with removable hardware for servicing of O2 stones.
7	4" Valterra External Mount ABS Plastic KnifeGate	2	Valterra 4" ABS Plastic, Alum plate flange mounted exterior fish release knife gate valve.
8	15" x 32" un-insulated 0.25" thick Alum hatchway access door	2	Alum Angle reinforced large access top door for loading fish into transport tank.
9	USS DeStaCo 225 horizontal toggle clamps	4	Toggle clamps for securing top hatch door and applying gasket seal pressure. 500 lbs. pressure per clamp.
10	Alum 6" access door handle	2	
11	Reiff Jack-Knife Door Hinge	2	Hinge that is installed to hold door in open position and prevent injury due to accidental closing.
12	18" L Heavy Duty 3" stainless steel hinge	2	18" length Heavy Duty 3" Stainless Stell Piano Style Hinge for Hatch Door.
13	0.25" Bolt hardware		Used to mount hatch door, toogle clamps, other non-load bearing items.
14	4" Male NPT PVC Pipe Stub	2	4" Male NPT PVC pipe stub for attaching camlock fitting to 4" gate valve flange.
15	4" Female NPT to Male Camlock quick connector	2	Female NPT end is threaded onto male pipe stub for attachment of hose with camlock fitting.
16	1.5" PVC screened bulkhead fitting	2	PVC tank wall threaded bulkhead fitting for mounting tempering valve, screened internally.
17	1.5" Tempering and Dewatering ball valve	2	Threaded manual operated ball valve mounted to bulkhead.
18	3" SCH40 90 Elbow Vent	2	Screened Vent elbow for air circulation and keep tank from over pressurization.
19	0.375" thick powder coated Alloy Steel Tank lifting Bracket	4	Lifting brackets that can be used for lifting tank WHILE EMPTY.
20	0.375" Stainless Steel lifting eye Hardware	12	Hardware for securing lifting eye to backing on tank (3 per lifting eye).
21	3" x 3" x 0.25" Alum Angle	4	Alum Angle for bolting or mounting Transport to bed of truck
22	0.125" thick Alum Outlet Box Bracket Mount and Electric J Box	4	1 Bracket per Aerator with mounted Aerator plug in electrical J box.
23	Oxygen Flow Meters and Mount	2	(1) Alum mounting bracket, (2) O2 flow meter, Brass fittings connected to green O2 lines.
24	2" Bulkhead	2	
Extra	Hardware not shown on tank		El Foam Insulation, Diffuser Stone (MBD100), O2 regulator, Plumbing for O2 delivery, and internal wire routing



FINAL

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CUSTOMER SUBMITTAL APPROVAL Signature or Initial: (upon approval)		MATERIAL		CHECKED			TITLE: 660gal 2 comp fish trans	
Date Signed: (MM/DD/YYYY)		FINISH		DO NOT SCALE DRAWING		SIZE B	JOB. NO. 650gal 2 Comp	REV 1
						SCALE: 1:24WEIGHT: SHEET 4 OF 4		

Reiff MFG.
CITY/COUNTY AIRPORT
670 B Street
WALLA WALLA, WA. 99362
PHONE: 509-525-1081

Conowingo Hydroelectric Project
FERC Project Number 405
American Eel Passage and Restoration Plan

Conowingo 250-L Transport Tank



Conowingo Hydroelectric Project
FERC Project Number 405
American Eel Passage and Restoration Plan

Conowingo 19-L Transport Buckets



**APPENDIX G. SUSQUEHANNA RIVER AMERICAN EEL ELVER REQUEST
FORM**

Susquehanna River American Eel Elver Request Form

Submit requests to Aaron Henning of the Susquehanna River Basin Commission (ahenning@srbc.net) by November 15 to be considered for eel distribution the following calendar year. Approval of this request is not a binding contract for the agencies or Exelon to provide eels.

Principal Investigator: _____

Organization Affiliation: _____

Email Address: _____ **Phone Number:** _____

Project Title: _____

Brief Project Description (a project proposal can be attached to this form): _____

Total # Eels requested (by calendar year): _____

Estimated Duration of Holding: _____

Ultimate Disposition of Eels (released or other): _____

Proposed release location, including waterbody, county, municipality, and state: _____

An 8.5"x11" map of the stocking location should be attached to this request

Project Start and End Dates: _____

Have scientific collection and/or stocking permits been secured?: _____

Is this a new or ongoing request?: _____

Has sufficient funding been secured to implement the project?: _____

Has a transport mechanism been approved by the agencies?: _____

Additional Information:

For projects requesting large numbers of eels (i.e. >500/yr), the agencies may require the requestor to give a presentation of the proposed study plan at the annual SRAFR/ Hydro Meeting in December or at another time agreed to by the Resource Agencies.

Annual study reports must be filed with the Resource Agencies each year prior to November 15. Study reports should include the number of eels received by date, the disposition of eels (stocked, retained, died in transport, etc.), the conditions monitored during transport, latitude, longitude, and number of elvers released at each stocking event, and any available information related to the project results. Future eel requests may be denied if annual study reports are not filed in a timely manner.

All requests are subject to approval from the following agencies: Susquehanna River Basin Commission, U.S. Fish and Wildlife Service, Pennsylvania Fish and Boat Commission, Pennsylvania Department of Environmental Protection, New York State Department of Environmental Conservation, and Maryland Department of Natural Resources. No more than 20% of the average annual catch will be provided in a given year for research or alternate stocking projects.

All proposed transport procedures will need to be submitted to the agencies for approval no later than April 1. Procedures need to include details on vehicle, transport tank size, mechanism to continuously monitor temperature and dissolved oxygen during transport, and ability to provide supplemental oxygen during transport. Water quality measurements for transport will need to be reported in the annual report along with number of eels transported and number of mortalities during transport. An inspection of the transport vehicle and water quality monitoring mechanisms may be required by a resource agency staff or Exelon representative prior to approving transport procedures.

All parties receiving eels must comply with Exelon's standard operating procedures for eel transfer and also complete a Chain of Custody form (attached).

Standard Operating Procedures for American Eel Transfer from Exelon

The purpose of this protocol is to ensure the health of the eels removed from and transported to locations as designated by the eel request form. Exelon's ability to hold eels for longer than 24-hours may be limited during the summer due to the increased stress and mortality related to high water temperatures.

A minimum notice of 24 hours is required for an anticipated pickup. No pickups will be facilitated by Exelon on weekends or holidays.

Pickup personnel should be limited to 1-2 people and the names of those individuals must be provided to Exelon prior to arrival, ideally when the pickup is scheduled. For anyone arriving on

station, proper PPE must be worn including closed toe shoes, long pants, and short sleeve shirts. Hard hats and safety glasses will need to be worn on site, but can be provided temporarily by Exelon if notified prior to arrival on station.

Planned pickup time should be around 7:30 a.m. No transfers will occur after 5:00 pm.

Exelon reserves the right to deny transfer of eels if they believe the transport vehicle and supporting equipment could jeopardize safety and survival of eels.

Exelon will notify resource agency staff if the requested eels are (or anticipated to be) available. Agency staff will approve transfer and coordinate with the requestor and Exelon to arrange pickup details for the next day.

ATTACH CHAIN OF CUSTODY FORM



**CHAIN OF CUSTODY SHEET: JUVENILE EELS PROVIDED TO RESOURCE AGENCY
PERSONNEL FROM THE CONOWINGO EEL COLLECTION FACILITY**

Date: _____

Time: _____

NUMBER OF EELS PROVIDED:

CECF Collection Tank: _____

Holding Tank # 1: _____

Holding Tank # 2: _____

Holding Tank # 3: _____

Total number of eels provided for Transport: _____

WATER TEMPERATURE:

Collection/Holding Tank: _____

Transport Truck: _____

SIGNATURES:

Normandeau/Exelon Representative: _____

Agency Representative: _____

Agency Rep. Printed Name and Agency: _____

**APPENDIX H. FINAL STUDY REPORT: BIOLOGICAL AND ENGINEERING
STUDIES OF AMERICAN EEL AT CONOWINGO PROJECT
2011 EEL SAMPLING BELOW CONOWINGO DAM**

**FINAL STUDY REPORT
BIOLOGICAL AND ENGINEERING STUDIES OF AMERICAN
EEL AT CONOWINGO PROJECT
2011 Eel Sampling below Conowingo Dam**

RSP 3.3

CONOWINGO HYDROELECTRIC PROJECT

FERC PROJECT NUMBER 405



Prepared for:



Prepared by:

Normandeau Associates, Inc.

Gomez and Sullivan Engineers, P.C.

August 2012

EXECUTIVE SUMMARY

Exelon Generation Company, LLC (Exelon) has initiated with the Federal Energy Regulatory Commission (FERC) the process of relicensing the 573-megawatt Conowingo Hydroelectric Project (Conowingo Project). The current license for the Conowingo Project was issued on August 14, 1980 and expires on September 1, 2014. FERC issued the final study plan determination for the Conowingo Project on February 4, 2010, approving the revised study plan with certain modifications.

The final study plan determination required Exelon to conduct biological and engineering studies of American eel (*Anguilla rostrata*). The objectives of the study are to: 1) summarize available scientific and commercial information regarding the American eel; 2) identify suspected factors affecting American eel abundance; 3) describe the spatial distribution and size characteristics of American eels in the Conowingo tailrace; 4) examine the engineering feasibility and costs of upstream and downstream passage options, including consideration of potential fallback of eels after exiting an upstream passage device; (5) examine the potential impact of upstream and downstream passage of American eels on the Susquehanna River; (6) assess the cumulative impacts to the biodiversity of the Susquehanna River ecosystem of upstream and downstream passage of American eel; and (7) if deemed beneficial to American eel abundance, identify potential locations for an upstream eel passage facility at Conowingo Dam.

An initial study report (ISR) was filed on February 22, 2011 that covered study objective 3, containing Exelon's 2010 study findings. An initial study report meeting was held on March 9, 10 and 11, 2011 with resource agencies and interested members of the public. Formal comments on the ISR including requested study plan modifications were filed with FERC on April 27, 2011 by Commission Staff, several resource agencies and interested members of the public. Exelon filed responses to the ISR comments with FERC on May 27, 2011. On June 24, 2011, FERC issued a study plan modification determination order. The order specified what, if any, modifications to the ISRs should be made. For this study, FERC's June 24, 2011 order required no modifications to the original study plan. An updated study report (USR) describing the results of the 2011 biological sampling at the spillway side of the dam was filed on January 23, 2012. This final study report detailing the 2011 sampling is being filed with the Final License Application for the Project. A separate report was developed to address the remaining study objectives 1, 2, and 4 thru 7.

The 2011 study began June 24, 2011 and ended on September 5, 2011. Heavy rainfall in the spring of 2011 delayed implementation of the study. Construction and deployment of the spillway elver ramps could not be completed until spillway water levels stabilized to safely allow work crews access to the

spillway. During the May 2011 relicensing meeting, the potential impacts of a delayed study start were discussed and it was felt that the heavy rainfall and high river flows probably hindered the upstream elver migration, thus indicating that a late start may not significantly impact the 2011 study results. The USFWS sampling area, (West bank), is accessible at higher river flows which allowed them to start on May 20, 2011 as planned. The spillway area sampled by Normandeau Associates is not accessible during spill conditions, which delayed the set-up and start of sampling. Heavy rainfall associated with Hurricane Irene and Tropical Storm Lee forced both studies, (USFWS and Normandeau), to conclude early.

Two capture methods were deployed for eels. Elver ramps and associated collection facilities were placed on the west and east sides of the spillway below Conowingo Dam. In 2011, two ramps per sample location, each with a different substrate, were deployed. Additional attraction water was provided to each set of ramps which appeared to attract more elvers to the ramp locations and improved upon the elver catch observed in 2010. On the west side a submersible pump provided water which drained down the East Lift wing wall creating water movement at the base of the ramps. The east side ramps were placed downstream of a creek which provided natural water movement and potential attractant. In addition, both sample areas had PVC pipes placed between the dual ramps, which were fed with water provided from a gravity-flow system within Conowingo Dam creating more attraction flow than previously used in 2010.

In concert with the substrate utilized in the 2010 study, (Enkamat®), a second substrate (AkwaDrain™) was placed in a separate parallel ramp. Two different mesh-sized baited eel pots that targeted larger yellow eels were situated adjacent to the two ramps. Both gear types (excluding the new AkwaDrain™ ramp) were consistent with those used in 2010 and previous years by USFWS to enhance data comparability between the two sampling areas.

Elvers and yellow eels were sampled between June 24 and September 5, 2011. A total of 1,159 eels were collected. Of these, 1,100 were elvers collected from the ramps. The east ramps collected 539 elvers, with 133 harvested in the Enkamat® substrate and 406 captured from the AkwaDrain™ substrate. The west ramps collected 561 elvers, with 405 harvested in the Enkamat® substrate and 156 collected in the AkwaDrain™ substrate. Elver lengths ranged from 87 to 188 mm total length (TL), with an average size of 124.9 mm. Yellow eels harvested from the eel pots totaled 59; all yellow eels were collected from the west side. The length range of eels collected in pots ranged from 300 to 689 mm TL, with an average length of 515.4 mm.

Hourly water temperatures were recorded throughout the study period. Water temperatures typically rose and fell three to four degrees Fahrenheit (°F) every day. The water temperature in the Conowingo

spillway ranged from a low of 73.7° F on September 3 to a high of 90.8° F on July 24. A comparison of water temperatures to elver catch at the ramps revealed no apparent relationship.

The study period encompassed three new moon periods and two full moon periods. A possible, but weak and limited relationship between the number of elvers collected and moon periods was observed during part of the study period.

Normandeau Associates also conducted three nighttime surveys to document areas of elver congregation in the spillway. During these surveys, elvers were only observed in abundance below crest gate #30.

Seventy-seven eels were preserved for otolith ageing. A total of 73 of the 77 otoliths preserved were aged successfully. The majority of elvers were split at age I or II, and III to V years of age, at 30% for each group. A large gap in age at years VI to VIII is apparent due to a lack of specimens in the 189 to 299 mm size range. Larger eels were aged IX to XVII, plus one at age XIX.

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**APPENDIX B- USFWS 2011 EEL COLLECTION REPORT, CONOWINGO DAM
TAILRACE**

LIST OF ABBREVIATIONS

Exelon	Exelon Generation Company, LLC
F	Fahrenheit
FERC	Federal Energy Regulatory Commission
ft	feet
h	hour
in	inch
ISR	Initial Study Report
L	liter
min	minute
mm	millimeter
MW	megawatt
PIT	Passive Integrated Transponder
RSP	Revised Study Plan
TL	total length
USFWS	United States Fish and Wildlife Service
USR	Updated Study Report

1.0 INTRODUCTION

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2.0 METHODS

The 2011 study objectives were to acquire; 1) eel spatial distribution data in the tailrace and spillway pool, and 2) collect associated biological and physical data (Appendix A). In order to maximize elver and yellow eel catch, (the life stages targeted by this study), we utilized two capture methods. Elver ramps and associated collection facilities were placed on the west and east sides of the spillway below Conowingo Dam ([Figure 2-1](#)). Baited eel pots that targeted larger yellow eels were fished adjacent to these two ramp locations.

During the 2010 study, we had utilized one elver ramp per site containing Enkamat® substrate. In 2011, two ramps per site, each with different substrates ([Figure 2-2](#)) were deployed. In addition to the Enkamat® substrate utilized in 2010, a second substrate, AkwaDrain™, was placed in a separate ramp adjacent to the Enkamat® ramp.

The west ramps were constructed and placed parallel to the wing wall near the East Fish Lift on June 23, 2011 ([Figures 2-3](#) and [2-4](#)), with additional water cascading down from the top of the wing wall to create disturbance and additional flow for attraction purposes. The west spillway ramps operated for nearly two weeks prior to the installation of the east spillway ramps.

The east side spillway sampling location used in 2010 was structurally damaged by heavy spring rainfall. Therefore, on July 1, 2011, the east spillway ramps ([Figure 2-5](#)) were deployed at a location adjacent to the location used in 2010. The east ramps were constructed on scaffolding located near the mouth of a small intermittent stream entering the Susquehanna River near the base of the dam ([Figure 2-6](#)). This provided natural water flow patterns that may have attracted elvers to the ramp.

The ramps were constructed with galvanized ductwork, and Enkamat® or AkwaDrain™ substrate was attached to the tray bottom with industrial grade adhesive ([Figure 2-7](#)). These substrates allowed elvers to climb the ascending section of the ramps. As advised by USFWS personnel, the substrate did not extend to the top of the ramp so the climbing elvers were forced to swim the final section of the ascending ramp; this configuration prevented them from using the substrate to pull themselves back up the descending section of the ramp to avoid capture. Each ramp unit was supported by scaffolding, which provided a sturdy base. The angle of each ramp was measured, the east ramp angle was 40°, and the west ramp angle was 35°. Each ramp consisted of approximately 20 ft. of cable tray, 12 in. wide, plus tray and sheet metal curved at the top to convey elvers into secure mesh bags which were housed in holding containers which were medium sized plastic trash cans. All ramps were fastened to scaffolding and located at or near spillway drainage or overflow.

Water flow to each ramp was supplied from a gravity-flow system within Conowingo Dam ([Figure 2-8](#)). Water was continuously released down the ramp via a spray bar to provide even sheet flow across the entire width of the ascending and descending sections of the ramps ([Figure 2-9](#)), keeping the substrate moist and creating a small amount of flow to attract elvers. The spray bars also directed water into each holding container and played a role in keeping the collected elvers aerated and alive.

Climbing ramp flow was augmented by an additional attraction flow directed to the bottom of the ramp and released between the ramps at each location ([Figure 2-9](#)). This attraction water was provided to each set of ramps which appeared to attract more elvers to the ramp locations and improved upon the elver catch observed in 2010.

On the west side a submersible pump provided water which drained down the East Lift wing wall creating water movement at the base of the ramps. The east side ramps were placed downstream of a creek which provided natural water movement and potential attractant.

In addition, both sample areas had PVC pipes placed between the dual ramps which were fed with water from a gravity-flow system within Conowingo Dam providing more attraction flow. Attraction flow volumes from the PVC pipes on both sets of ramps were measured. The west ramp was nearly 57 L/min (15 gpm), while the estimated attraction flow volume on the east ramps was 45 L/min (12 gpm). These volumes were a slight increase to the amounts used in 2010, due in part to the distance of the ramps from the water source. In addition to added attraction flow, water was siphoned from the holding containers where elvers were collected and redirected down each ramp to provide a scent trail to potentially attract elvers to the ramps.

Holding containers were checked for elvers on Mondays, Wednesdays and Fridays during the entire 2011 study with exceptions on holidays, (July 4, Labor Day), when the holding containers were checked the following day. Wednesday and Friday samples represented a 48 h fishing effort while Monday samples included the weekend days and represented a 72 h effort.

Yellow eels were collected with two different size mesh eel pots. The mesh of the pots was 0.25 in. (modified pot) and 0.5 in. (cloth pot). ([Figure 2-10](#)). These two sized mesh pots were fished adjacent to each set of elver ramps. Two pots at each end of the spillway were baited and fished for a 48-h period every other week.

Once captured, eels were sedated with MS-222, counted and measured ([Figure 2-11](#)). All captured eels were scanned for PIT tags previously inserted by USFWS ([Figure 2-12](#)). At the request of USFWS

personnel, PIT tags were implanted into yellow eels captured during the 2011 study period. These tags were provided by USFWS, and the corresponding PIT tag numbers were recorded. After PIT tagging, yellow eels were released back into the Susquehanna River at the point of capture. A subsample of captured elvers and yellow eels was frozen for otolith analysis. All remaining elvers were placed in the USFWS tank located near the West Fish Lift facility for upstream transport.

Water temperature was determined by an ONSET Water Temp Pro2 recording device which was located in the Conowingo spillway at the west ramp. ([Figure 2-13](#)). This device measured water temperature on an hourly basis throughout the entire study. Data were retrieved monthly. Data on daily rainfall (measured at Conowingo Dam) and percent lunar fractions at Havre de Grace, MD (www.usno.navy.mil/USNO/astronomical-applications/data-services/lunar-ecl-us) were also collected throughout the study period.

A representative sample of elvers and yellow eels were frozen for otolith removal and aging. Otoliths were removed from the eels, embedded in clear epoxy, and dried for 12 hours. Utilizing a double-bladed, slow speed saw, a 0.2-mm thick transverse section was cut through the nucleus perpendicular to the sulcus. Adhesive was applied to the cut otolith which was then placed on a glass slide. The sample was polished using a series of fine grade lapping films, which were periodically inspected to insure no damage to the polished otolith. After polishing, Toluidine Blue stain was applied to the sample to assist readers when counting the annular rings. All otolith samples were read by two readers. If the two readers agreed on the analysis, the age estimate was accepted. If readers of the slides weren't in agreement on an age, that slide was re-analyzed. If no consensus was met, the otolith was rejected. The age reported herein is the freshwater age (*i.e.*, the numbers of annuli outside the transition mark - the end of larval growth in salt water).

During the 2011 study period, three nighttime surveys were conducted below the Conowingo spillway area to examine potential evening movements of elvers. Correlating with full and new moon periods, two boat crews utilizing headlamps, and LED marine rechargeable spotlights with night vision covers, (red lenses), traversed the spillway area looking for elver abundance. A fourth survey was scheduled but was cancelled due to heavy rains that created unsafe conditions in the spillway area.

3.0 RESULTS

Elvers and yellow eels were sampled between June 24 and September 5, 2011. Heavy rains from Hurricane Irene and Tropical Storm Lee forced the early termination of this year's study. A major spill event at Conowingo Dam was imminent so all equipment was removed on 6 September.

A total of 1,159 eels were collected from the Conowingo Dam spillway in 2011 ([Table 3-1](#)). Of these, 1,100 were elvers collected from all elver ramps combined. This represents a substantial increase in the number collected in 2010, when the east elver ramp collected 158 elvers and the west elver ramp collected 8. In 2011, the east elver ramps collected 539 elvers, with 133 harvested in the Enkamat® substrate and 406 captured from the AkwaDrain™ substrate ([Table 3-1](#)). Generally, the east ramps collected elvers evenly throughout the study period. However, on July 11, the AkwaDrain™ substrate collected 239 elvers, with none collected in the adjacent Enkamat® ramp. The west elver ramps collected 561 elvers, with 405 harvested in the Enkamat® substrate and 156 collected in the AkwaDrain™ substrate ([Figure 3-1](#)). Overall, the majority of elvers were collected in the Enkamat® substrate on the west side (405), and the AkwaDrain™ substrate (406) on the east side. Both of these ramps were located adjacent to walls suggesting that elvers may utilize structures to help orientate them upstream. Elver lengths ranged from 87 to 188 mm TL, with an average size of 124.9 mm ([Figure 3-2](#)).

A subsample of elvers (N = 46) and yellow eels (N = 31) caught was frozen for ageing by otolith analysis. All remaining elvers not used for otolith research (1,007) were placed in the USFWS tank located near the West Fish Lift facility for upstream transport ([Table 3-2](#)). Yellow eels harvested from the eel pots totaled 59, all of which were collected on the west side. The size of eels collected in the pots ranged from 300 to 689 mm TL, with an average length of 515.4 mm ([Figure 3-3](#)). Twenty-seven of the 59 yellow eels were PIT tagged and released back at the point of capture. No recaptures were encountered during the study period.

Water temperature was recorded on an hourly basis throughout the study period. Water temperatures typically rose and fell three to four degrees Fahrenheit each day at all ramps. The water temperature in the Conowingo spillway ranged from a low of 73.7° F on September 3 to a high of 90.8° F on July 24 ([Table 3-3](#)). A comparison of water temperature to elver catch revealed no apparent relationships ([Figure 3-4](#)).

The 2011 study period encompassed three new moon periods (0% lunar phase) and two full moon periods (100% lunar phase). Eels have been observed to move in abundance during new moon periods or periods of little illumination. During the 2010 survey, a correlation between full moon periods and elver collection was observed. The 2011 survey had little data to support any association with movement and

lunar illumination. However, when moon phase is plotted against the number of elvers collected; a slight positive relationship was observed on July 11. ([Figure 3-4](#)). July 11 was also the largest single day collection of elvers during 2011.

Three nighttime surveys were conducted in the Conowingo spillway to document locations of elver congregation ([Figure 3-5](#)). Elvers were only observed in abundance below crest gate #30 ([Figures 2-1](#) and [3-6](#)). Located immediately downstream of crest gate #30 is a plateau of concrete or macadam. Elvers were observed at this location during all three nighttime surveys. Elvers were also observed, (although not in abundance) near seeps, or areas where water trickled over the spillway sill , and when water cascaded down bedrocks associated near these seeps. In these areas where elvers were observed, predatory fish such as channel catfish, and striped bass also were observed.

Rainfall occurred on 25 of the 74 days during the 2011 elver study. Daily rainfall at Conowingo Dam plotted against the number of elvers collected does not show any relationship between rainfall events and elver movement ([Figure 3-7](#)).

Seventy-seven eels were preserved for otolith research. A sample from each size range was collected in the 2011 study. Four otoliths were deemed unreadable. Seventy-three eels were aged successfully. The dominate age group collected (I to V years of age) comprised 60% of the otoliths examined. A large gap in age at years VI to VIII is apparent due to lack of specimens in the 189 to 299 mm size range. Larger eels were aged IX to XVII, plus one eel aged at XIX years ([Table 3-4](#)).

The 2011 study ended abruptly due to heavy rainfall from Hurricane Irene and Tropical Storm Lee that forced Conowingo Dam to spill water through forty-three of its fifty crest gates ([Figure 3-8](#)).

4.0 DISCUSSION

The low elver catch in 2010 and agency comments provided on that study report prompted some changes for the 2011 study. An additional ramp with a different substrate was added to each spillway sampling location. Additional attraction flow was also provided for both sets of ramps. The west side ramps were located in the same general position as in the 2010 study, but were oriented parallel to the river in 2011 rather than perpendicular in 2010. The east side ramps were relocated due to structural damage at the 2010 sampling location from heavy spring rains. The new location was constructed close to the 2010 placement.

Although the 2011 study period was bookended by heavy rains that attributed to a late start and early finish, the overall elver catch was significantly higher in 2011 (1,159), than in 2010 (258) . Once the study was underway, the elver ramps collected eels for 74 days as compared to 106 days in 2010. Collection of elvers and yellow eels was consistent throughout the entire study period with a few exceptions. The east spillway facility collected 239 elvers from a single ramp on July 11, 2011.

Predation from both land-based animals and birds was not directly observed but may have occurred at the east side. On several collection days, animal tracks were present in the muddy areas near the ramps. This same area exhibited an abundance of avian fecal matter and feathers littered on and around the ramp platform. Predation may have been an issue, but evidence does not exist to quantify. The 2011 catch of elvers was much higher than the total collected in 2010. An increase in elver catch during the 2011 study period may be attributed to additional ramps, (four in 2011, as opposed to two in 2010), additional attraction water and the addition of scent attraction.

In contrast to 2010, both sides of the spillway captured nearly equal numbers of elvers, with the west side collecting slightly more than the east. The absence of eels from ~189 to 299 mm is generally similar to previous year's collections by Normandeau Associates and USFWS. Attempts to collect this size range of yellow eels with smaller-mesh pots (.25 inch) failed. Enkamat® is reportedly size-selective for eels less than 260 mm (Soloman and Beach 2004), but neither Enkamat® nor either type of pot deployed was successful catching eels in the 189 to 299 mm size range.

Elvers were observed during the 3 night surveys below crest gate #30 near the macadam plateau. The macadam and the water cascading over it is an attractant to elvers migrating upstream. Water trapped in the spillway sill after the cessation of full generating conditions, and water seeping from the crest gate provided this attraction flow. Without these two water sources, particularly the leakage from crest gate

#30, water would not flow over the macadam plateau and would likely not attract large numbers of elvers to this particular location.

5.0 2011 USFWS SAMPLING RESULTS

The 2011 USFWS report on elver sampling on the West bank of the Conowingo tailrace is contained in [Appendix B](#). During the 2011 sampling season, USFWS reported that approximately 85,000 elvers were collected from their West side facility and some 62,000 elvers were transported to upstream tributaries of the Susquehanna River in Pennsylvania.

REFERENCES

Soloman, D.J. and M.H. Beach. 2004. Manual for provision of upstream migration facilities for eel and elver. Science Report SC020075/SR2. Environment Agency, Bristol, UK.

TABLE 3-1: DAILY COLLECTION OF YELLOW EELS AND ELVERS FROM EAST AND WEST SPILLWAY AREAS IN 2011.

Date	E. Ramp Enka Mat	E. Ramp Akwa Drain	E. Ramp Cloth Pot	E. Ramp Modified Pot	W. Ramp Enka Mat	W. Ramp Akwa Drain	W. Ramp Cloth Pot	W. Ramp Modified Pot	Lunar %	Rain
6/24	-	-	-	-	-	-	-	-	39	0
6/25	-	-	-	-	-	-	-	-	30	0
6/26	-	-	-	-	-	-	-	-	21	0
6/27	-	-	-	-	0	0	0	0	14	0.01
6/28	-	-	-	-	-	-	-	-	8	0
6/29	-	-	-	-	7	1	5	0	3	0
6/30	-	-	-	-	-	-	-	-	1	0
7/1	-	-	-	-	15	16	0	0	0	0
7/2	-	-	-	-	-	-	-	-	2	0
7/3	-	-	-	-	-	-	-	-	6	0.05
7/4	-	-	-	-	-	-	-	-	13	0
7/5	0	2	0	0	0	0	0	0	22	0
7/6	-	-	-	-	-	-	-	-	32	0
7/7	-	-	-	-	-	-	-	-	43	0
7/8	0	2	0	0	58	2	14	5	50	0.05
7/9	-	-	-	-	-	-	-	-	66	0.8
7/10	-	-	-	-	-	-	-	-	76	0
7/11	0	239	0	0	18	21	0	0	85	0
7/12	-	-	-	-	-	-	-	-	92	0.82
7/13	2	11	0	0	3	17	6	0	97	0
7/14	-	-	-	-	-	-	-	-	100	0
7/15	2	1	0	0	59	18	0	0	100	0
7/16	-	-	-	-	-	-	-	-	98	0
7/17	-	-	-	-	-	-	-	-	94	0
7/18	3	2	0	0	3	13	0	0	88	0
7/19	-	-	-	-	-	-	-	-	81	0
7/20	3	8	0	0	12	7	8	1	73	0.02
7/21	-	-	-	-	-	-	-	-	64	0
7/22	36	11	0	0	5	11	0	0	55	0
7/23	-	-	-	-	-	-	-	-	45	0
7/24	-	-	-	-	-	-	-	-	36	0.04
7/25	3	13	0	0	15	13	0	0	27	0
7/26	-	-	-	-	-	-	-	-	19	0.99
7/27	21	0	0	0	0	0	0	0	11	0
7/28	-	-	-	-	-	-	-	-	5	0
7/29	10	22	0	0	6	2	0	0	2	0.03
7/30	-	-	-	-	-	-	-	-	0	0.02
Totals	80	311	0	0	201	121	33	6	1598	2.83

TABLE 3-1: CONTINUED.

Date	E. Ramp Enka Mat	E. Ramp Akwa Drain	E. Ramp Cloth Pot	E. Ramp Modified Pot	W. Ramp Enka Mat	W. Ramp Akwa Drain	W. Ramp Cloth Pot	W. Ramp Modified Pot	Lunar %	Rain
7/31	-	-	-	-	-	-	-	-	1	0
8/1	2	0	0	0	6	0	0	0	5	0
8/2	-	-	-	-	-	-	-	-	11	0.04
8/3	0	5	0	0	6	3	2	0	20	0
8/4	-	-	-	-	-	-	-	-	30	0.12
8/5	1	0	0	0	9	3	0	0	41	0
8/6	-	-	-	-	-	-	-	-	50	0
8/7	-	-	-	-	-	-	-	-	63	0.37
8/8	2	3	0	0	0	0	0	0	74	1.8
8/9	-	-	-	-	-	-	-	-	83	0
8/10	0	0	0	0	5	0	5	5	90	0.33
8/11	-	-	-	-	-	-	-	-	95	0
8/12	4	0	0	0	3	6	0	0	99	0
8/13	-	-	-	-	-	-	-	-	100	0
8/14	-	-	-	-	-	-	-	-	99	1.05
8/15	5	4	0	0	3	3	0	0	96	1.83
8/16	-	-	-	-	-	-	-	-	92	0.07
8/17	3	0	0	0	28	7	5	1	86	0
8/18	-	-	-	-	-	-	-	-	79	0.13
8/19	10	18	0	0	5	1	0	0	71	0.32
8/20	-	-	-	-	-	-	-	-	62	0
8/21	-	-	-	-	-	-	-	-	50	0
8/22	3	7	0	0	47	7	0	0	43	0.22
8/23	-	-	-	-	-	-	-	-	33	0
8/24	2	4	0	0	12	2	2	0	24	0
8/25	-	-	-	-	-	-	-	-	15	0
8/26	9	6	0	0	28	0	0	0	8	0.47
8/27	-	-	-	-	-	-	-	-	3	0
8/28	-	-	-	-	-	-	-	-	0	4.8
8/29	5	36	0	0	13	2	0	0	1	0.014
8/30	-	-	-	-	-	-	-	-	4	0
8/31	5	3	0	0	5	1	0	0	9	0
9/1	-	-	-	-	-	-	-	-	18	0
9/2	2	4	0	0	31	0	0	0	27	0
9/3	-	-	-	-	-	-	-	-	38	0
9/4	-	-	-	-	-	-	-	-	50	0
9/5	0	4	0	0	3	0	0	0	60	0.7
Totals	53	94	0	0	204	35	14	6	1730	12.26

TABLE 3-2: NUMBER OF ELVERS PROVIDED TO USFWS FOR UPSTREAM TRANSPORTATION IN 2011.

Date	No. of Elvers
5-Jul-11	16
8-Jul-11	74
11-Jul-11	268
13-Jul-11	29
15-Jul-11	81
22-Jul-11	63
25-Jul-11	47
27-Jul-11	21
29-Jul-11	45
1-Aug-11	7
3-Aug-11	14
5-Aug-11	13
8-Aug-11	19
10-Aug-11	5
12-Aug-11	13
15-Aug-11	15
17-Aug-11	39
19-Aug-11	17
22-Aug-11	62
24-Aug-11	20
26-Aug-11	43
29-Aug-11	39
31-Aug-11	14
2-Sep-11	35
6-Sep-11	8
Total	1007

**TABLE 3-3: MEAN DAILY WATER TEMPERATURES RECORDED AT THE SPILLWAY
ELVER RAMPS, 2011.**

Date	Water Temp.	Date	Water Temp.
24-Jun-11	80.5	31-Jul-11	88.2
25-Jun-11	81.1	1-Aug-11	88.6
26-Jun-11	80.8	2-Aug-11	88.1
27-Jun-11	80.6	3-Aug-11	86.5
28-Jun-11	80.5	4-Aug-11	85.2
29-Jun-11	81.2	5-Aug-11	85.9
30-Jun-11	81.2	6-Aug-11	85.4
1-Jul-11	80.9	7-Aug-11	85.6
2-Jul-11	81.3	8-Aug-11	86.1
3-Jul-11	81.3	9-Aug-11	86
4-Jul-11	82.1	10-Aug-11	85.5
5-Jul-11	83.1	11-Aug-11	84.8
6-Jul-11	83.2	12-Aug-11	84.1
7-Jul-11	83.6	13-Aug-11	83.2
8-Jul-11	83.7	14-Aug-11	82.2
9-Jul-11	83.8	15-Aug-11	82.4
10-Jul-11	84.2	16-Aug-11	81.8
11-Jul-11	84.5	17-Aug-11	82.2
12-Jul-11	85.5	18-Aug-11	81.9
13-Jul-11	85.7	19-Aug-11	82.1
14-Jul-11	84.4	20-Aug-11	82.2
15-Jul-11	84.3	21-Aug-11	81.9
16-Jul-11	84.2	22-Aug-11	81.7
17-Jul-11	84.4	23-Aug-11	80.8
18-Jul-11	84.9	24-Aug-11	81.2
19-Jul-11	86.1	25-Aug-11	80.9
20-Jul-11	87	26-Aug-11	81.2
21-Jul-11	87.9	27-Aug-11	81.1
22-Jul-11	89.1	28-Aug-11	79.5
23-Jul-11	89.8	29-Aug-11	78.3
24-Jul-11	90.8	30-Aug-11	76.6
25-Jul-11	89.7	31-Aug-11	75.3
26-Jul-11	88.8	1-Sep-11	74.6
27-Jul-11	88	2-Sep-11	73.9
28-Jul-11	87.1	3-Sep-11	73.7
29-Jul-11	87.9	4-Sep-11	74.2
30-Jul-11	88.6	5-Sep-11	74.8

TABLE 3-4: AGES OF 73 AMERICAN EELS COLLECTED IN THE CONOWINGO DAM SPILLWAY BY SIZE GROUP.

Elver Size Range (mm)										Elver Totals		
75-99		100-124		125-149		150-174		175-274				
Age	No.	Age	No.	Age	No.	Age	No.	Age	No.	Age	No.	Percent
I	9	I	2	—	—	—	—	—	—	I	11	25.0
II	1	II	7	II	3	—	—	—	—	II	11	25.0
—	—	—	—	III	5	III	2	—	—	III	7	15.9
—	—	—	—	IV	1	IV	7	IV	6	IV	14	31.8
—	—	—	—	—	—	V	1	—	—	V	1	0.2
											44	

Yellow Eel Size Range (mm)										Yellow Eel Totals		
275-349		350-449		450-549		550-649		650+				
Age	No.	Age	No.	Age	No.	Age	No.	Age	No.	Age	No.	Percent
IX	1	—	—	—	—	—	—	—	—	IX	1	3.4
X	1	X	3	—	—	—	—	—	—	X	4	13.7
—	—	XI	1	XI	1	—	—	—	—	XI	2	6.8
—	—	XII	1	XII	4	XII	1	—	—	XII	6	20.7
—	—	—	—	XIII	2	XIII	2	—	—	XIII	4	13.7
—	—	—	—	XIV	2	XIV	2	—	—	XIV	4	13.7
—	—	—	—	XV	1	XV	1	—	—	XV	2	6.8
—	—	—	—	—	—	XVI	2	XVI	1	XVI	3	10.3
—	—	—	—	—	—	XVII	1	XVII	1	XVII	2	6.8
—	—	—	—	—	—	—	—	XVIII	—	XVIII	—	0.0
—	—	—	—	—	—	—	—	XIX	1	XIX	1	3.4
											29	

FIGURE 2-1: LOCATION OF ELVER RAMPS, AND EELS POTS FISHED IN SPILLWAY REACH BELOW CONOWINGO DAM.

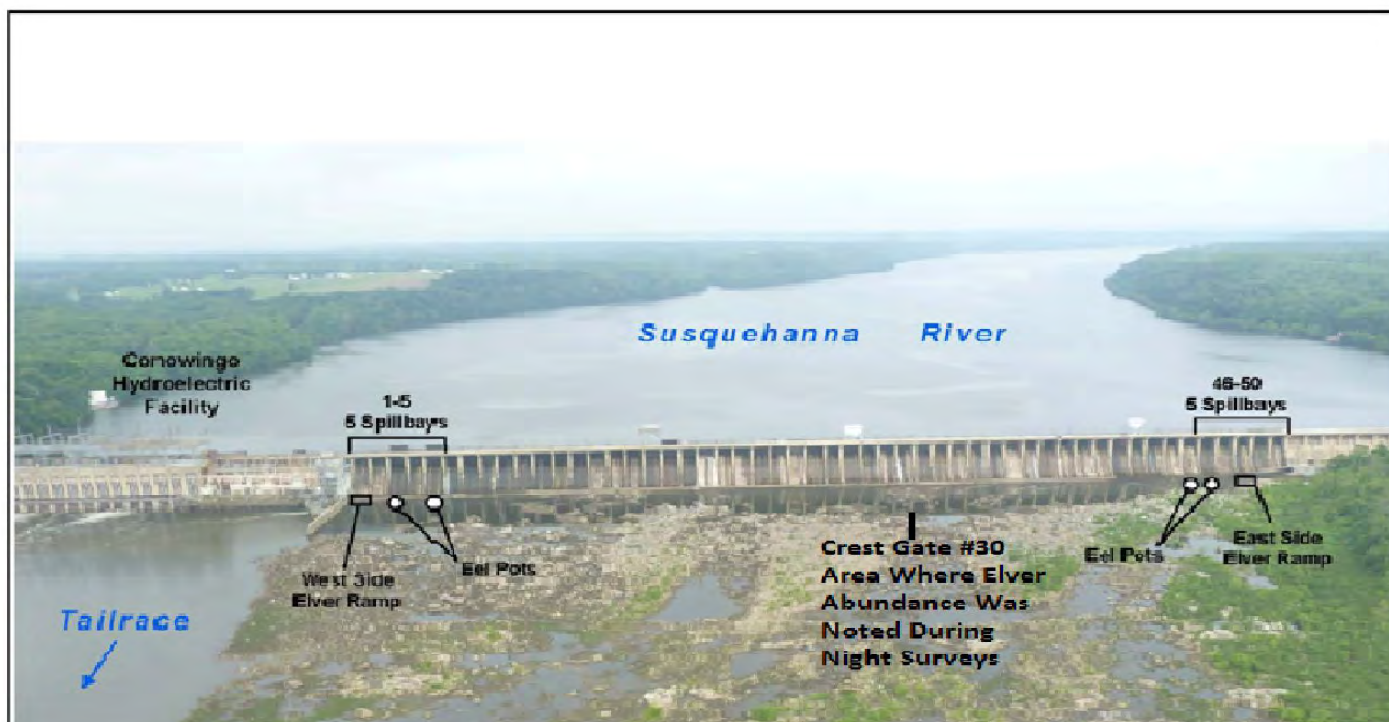


FIGURE 2-2: ENKAMAT® AND AKWADRAIN™ SUBSTRATE.



FIGURE 2-3: WEST SIDE ELVER RAMPS WITH ADDITIONAL ATTRACTION WATER.



FIGURE 2-4: COMPARISON AND SAMPLING LOCATIONS OF 2010 AND 2011 WEST SPILLWAY RAMP LOCATION.

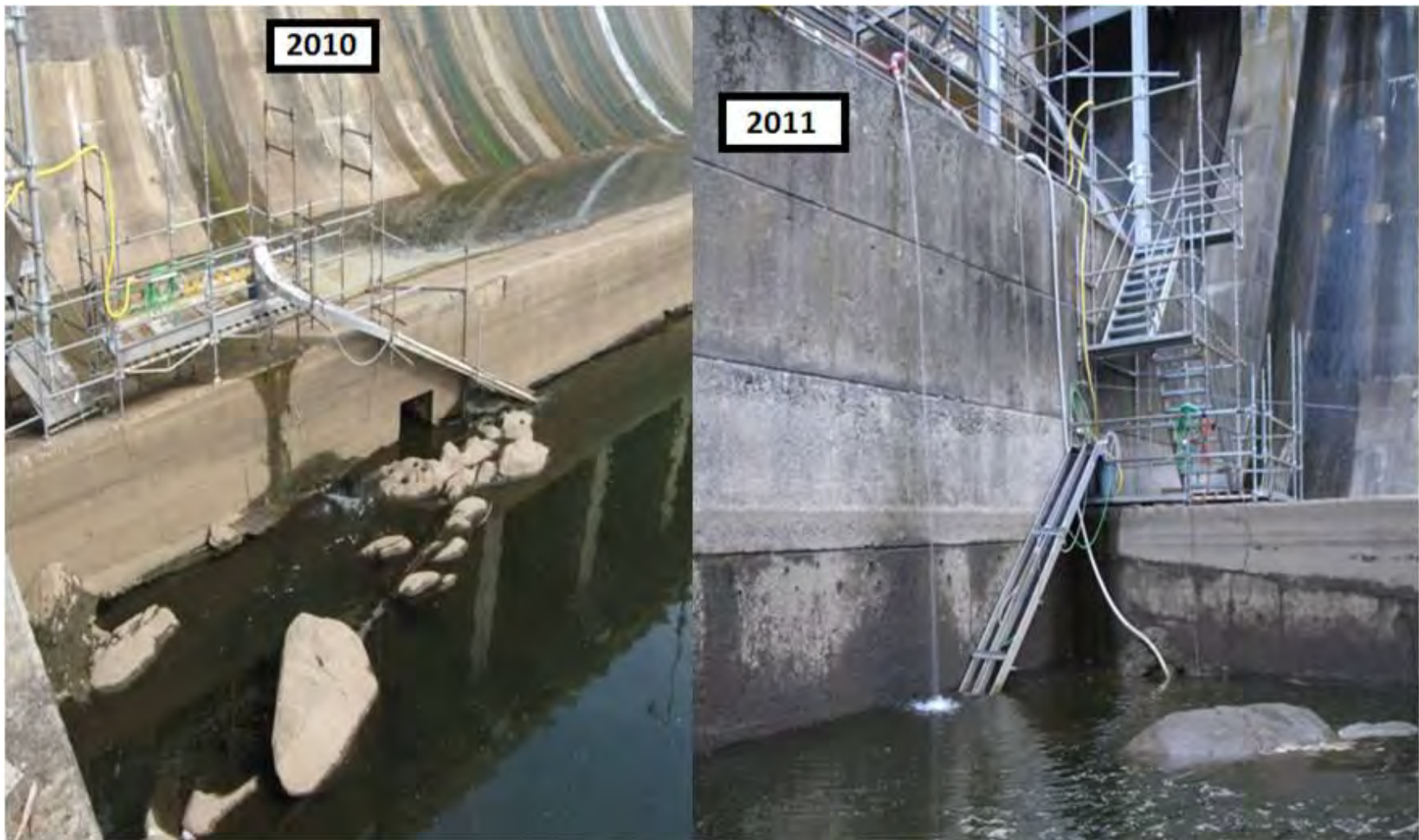


FIGURE 2-5: LOCATION AND CONFIGURATION OF EAST SIDE ELVER RAMPS IN 2010 AND 2011.



FIGURE 2-6: EAST RAMP WITH NATURAL ATTRACTION FLOW FROM INTERMITTENT STREAM.



FIGURE 2-7: CONSTRUCTION OF ELVER RAMPS USING TWO DIFFERENT SUBSTRATES.



FIGURE 2-8: WATER SUPPLY MANIFOLD, SPRAY BARS, AND HOLDING CONTAINERS.



FIGURE 2-9: PHOTO OF SPRAY BAR AND ADDITIONAL FLOW.



FIGURE 2-10: BAITING AND SETTING EEL POTS.



FIGURE 2-11: PROCESSING OF COLLECTED SPECIMENS.



FIGURE 2-12: COLLECTION OF YELLOW EELS AND PITT TAG SCANS.



FIGURE 2-13: WATER QUALITY MEASURING DEVICE, HOBO.



FIGURE 3-1: COMPARISON OF ELVER CATCH TO ENKAMAT® AND AKWADRAIN™ SUBSTRATES.

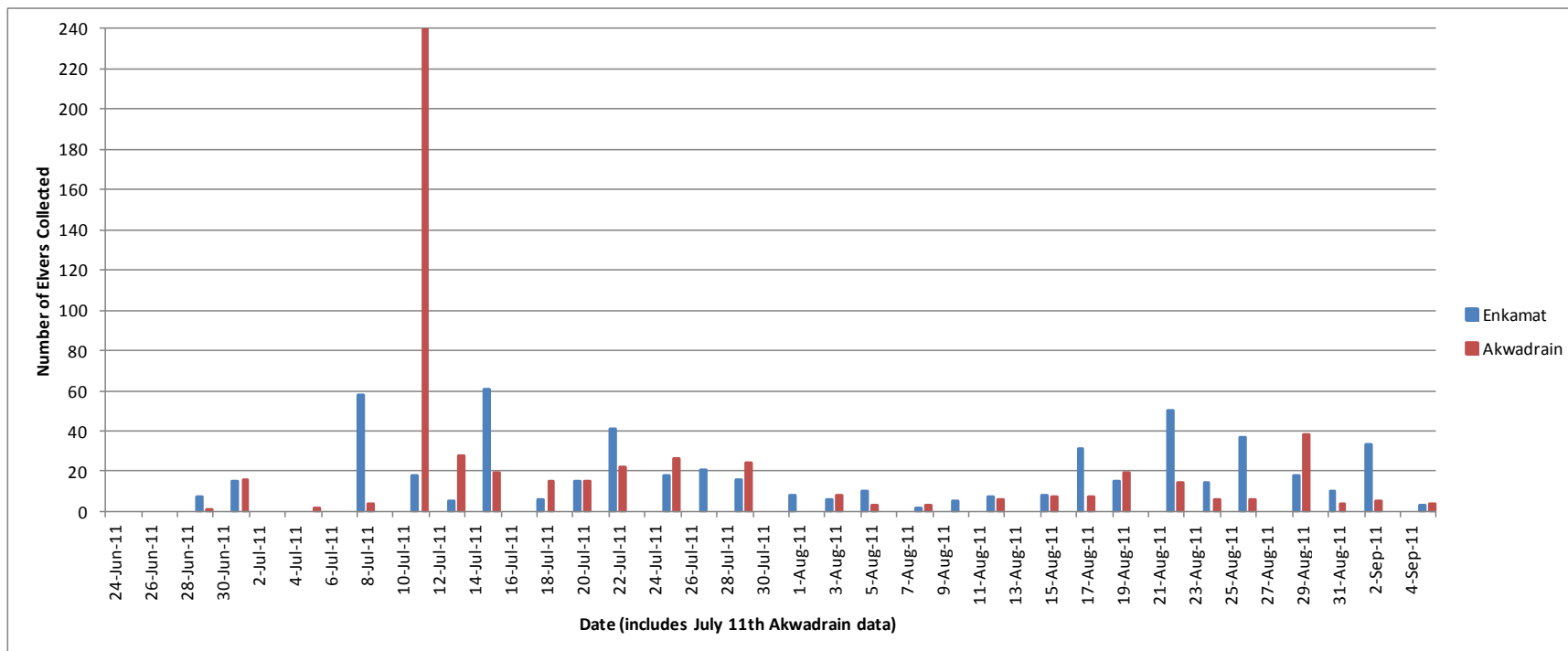


FIGURE 3-1: CONTINUED.

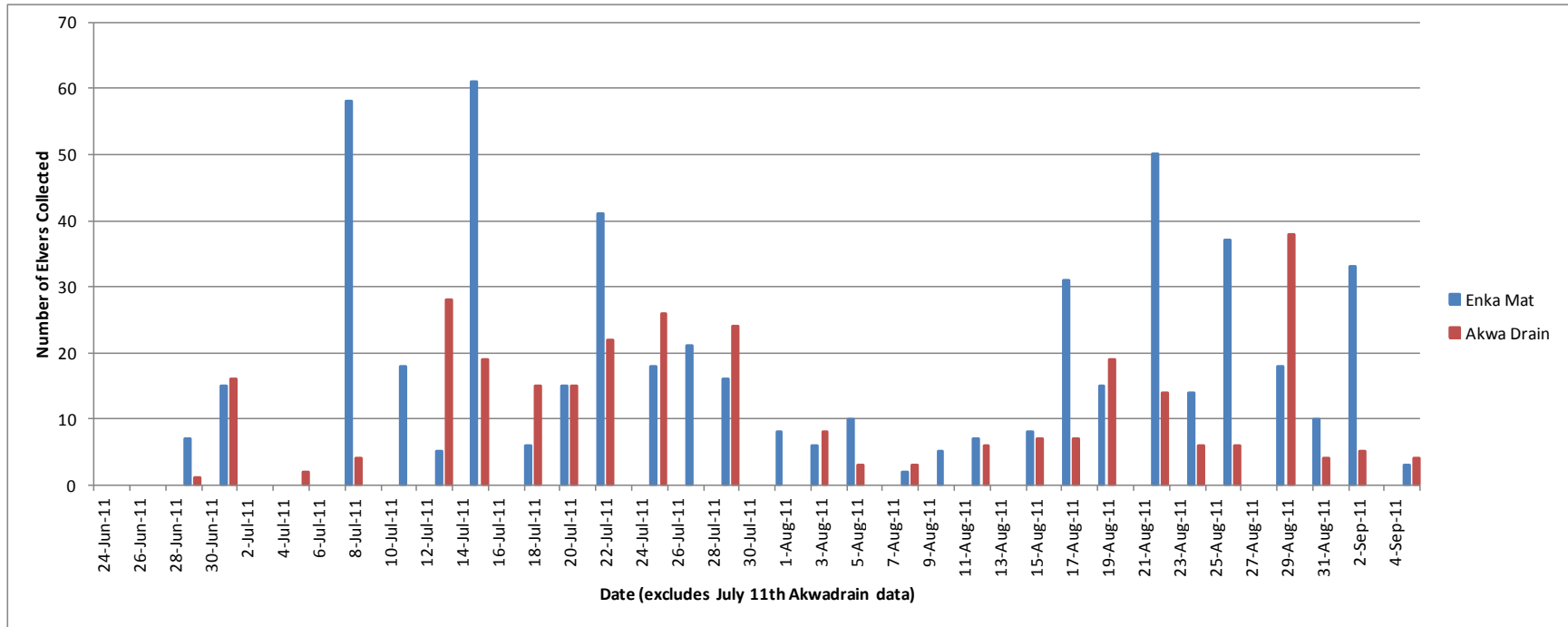


FIGURE 3-2: SIZE RANGE OF ELVERS CAUGHT IN SPILLWAY RAMPS.

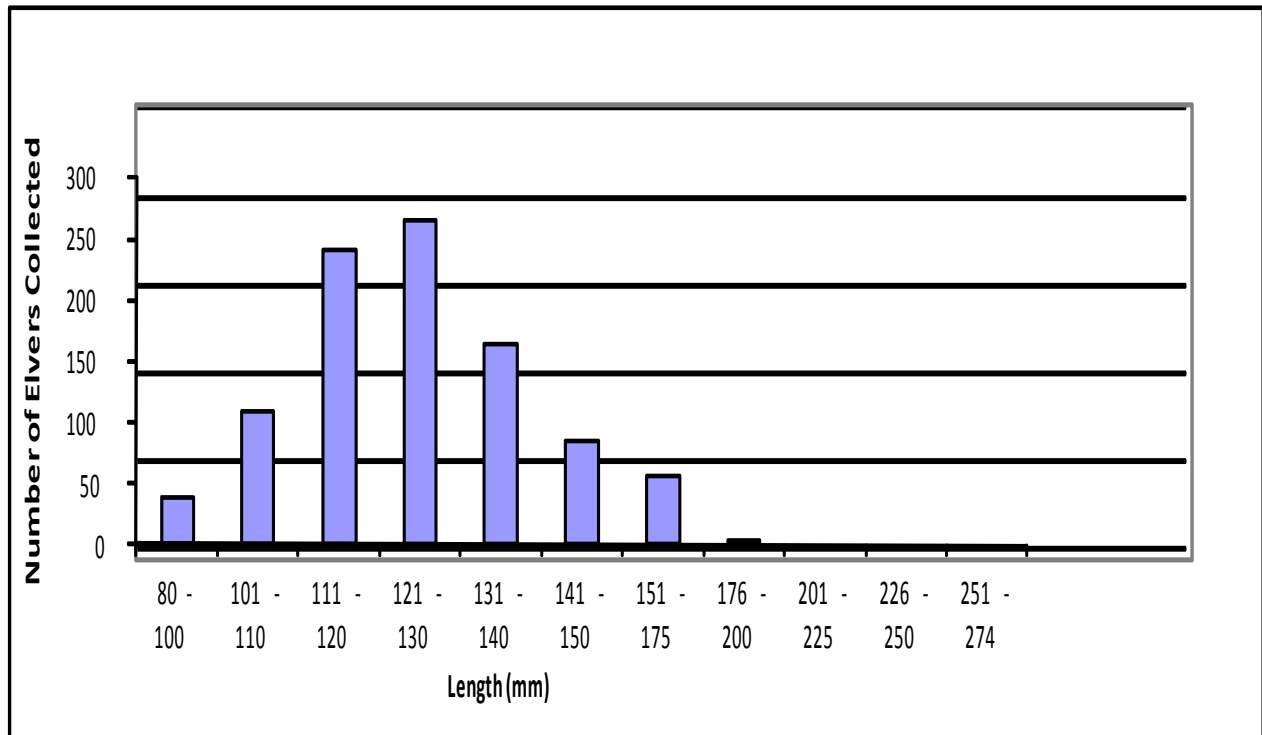


FIGURE 3-3: SIZE RANGE OF YELLOW EELS CAUGHT IN SPILLWAY POTS.

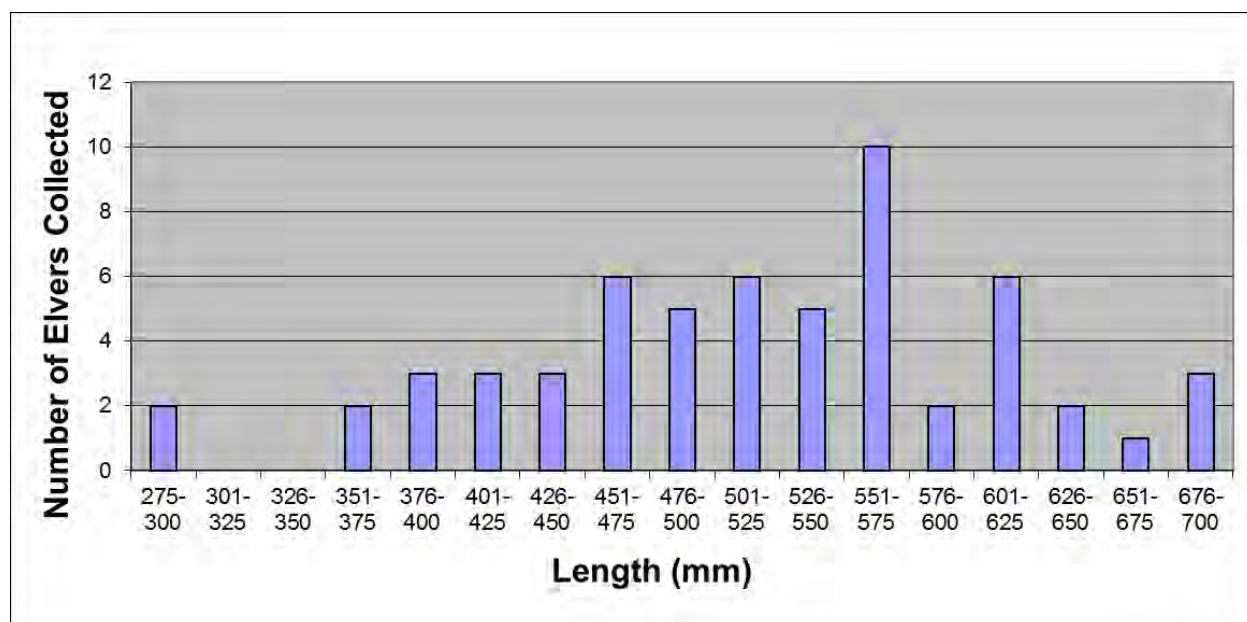


FIGURE 3-4: ELVERS COLLECTED IN RELATION TO WATER TEMPERATURE (°F) AND LUNAR CYLCE IN THE CONOWINGO SPILLWAY.

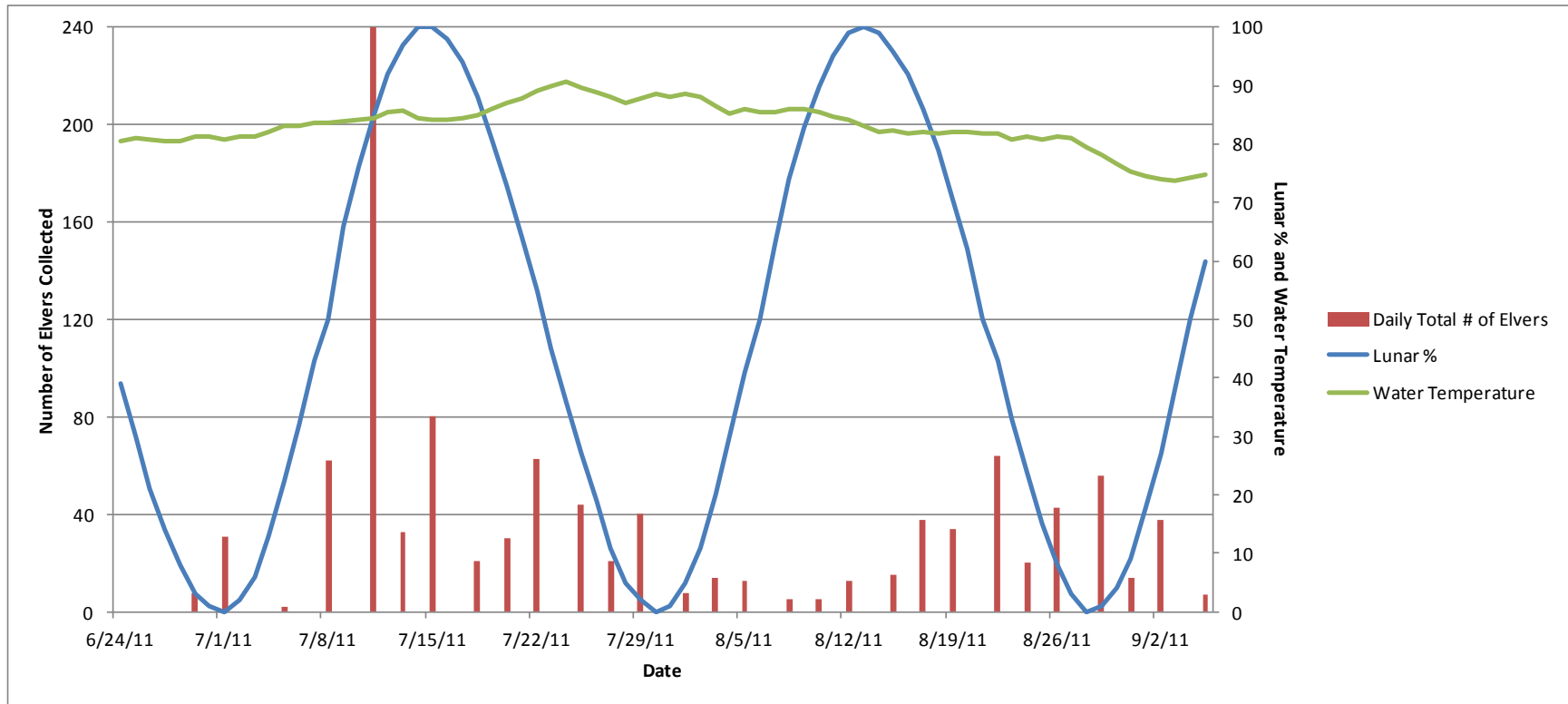


FIGURE 3-5: EVENING ASSESSMENT OF ELVER MOVEMENT.

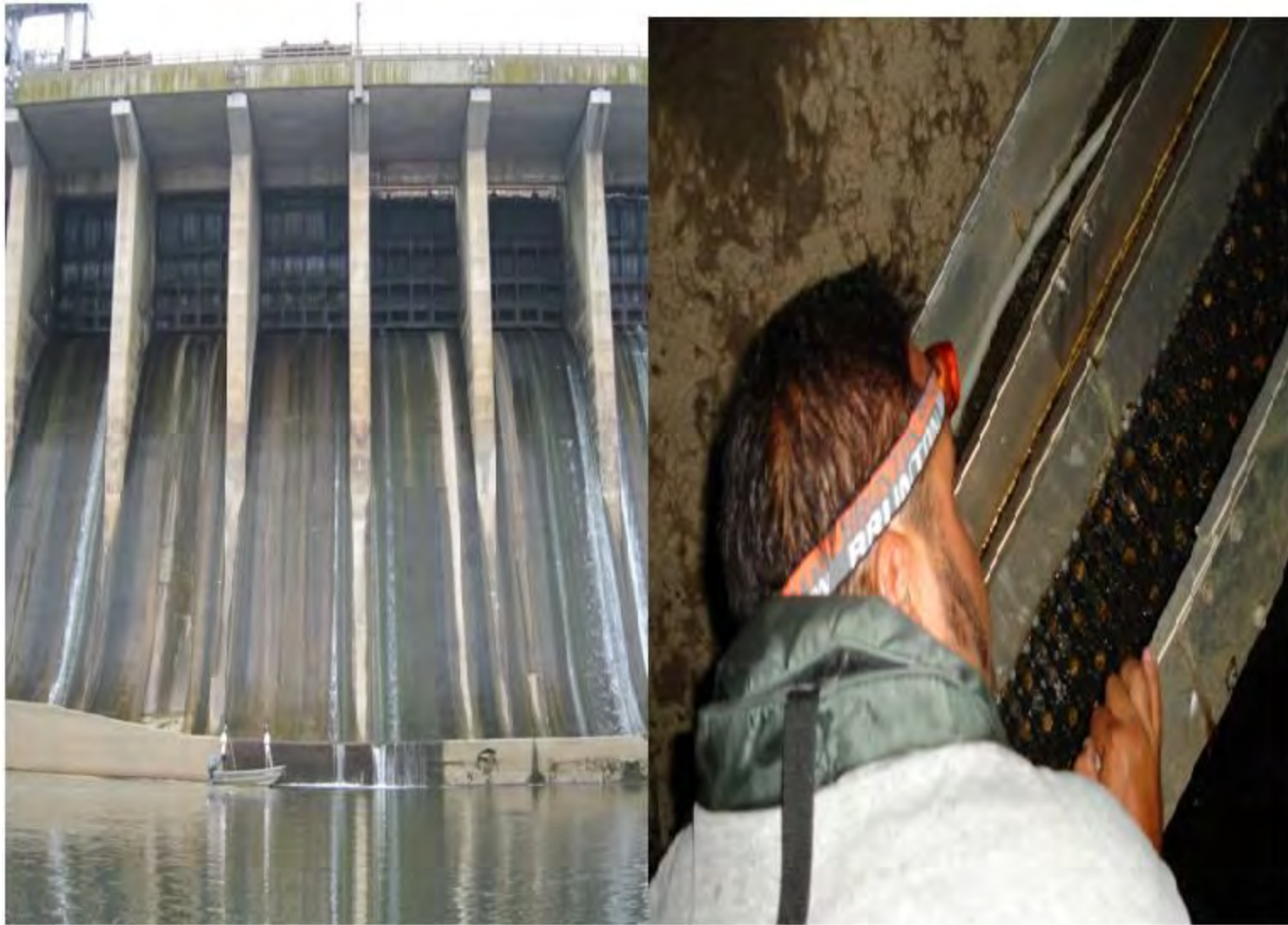


FIGURE 3-6: AREA IN FRONT OF SPILLBAY 30 WHERE ELVERS WERE OBSERVED.



FIGURE 3-7: NUMBER OF ELVERS COLLECTED IN SPILLWAY RAMPS IN RELATION TO RAINFALL (INCHES) AT CONOWINGO DAM. EXCLUDES DAYS OF NO RECORDED RAINFALL.

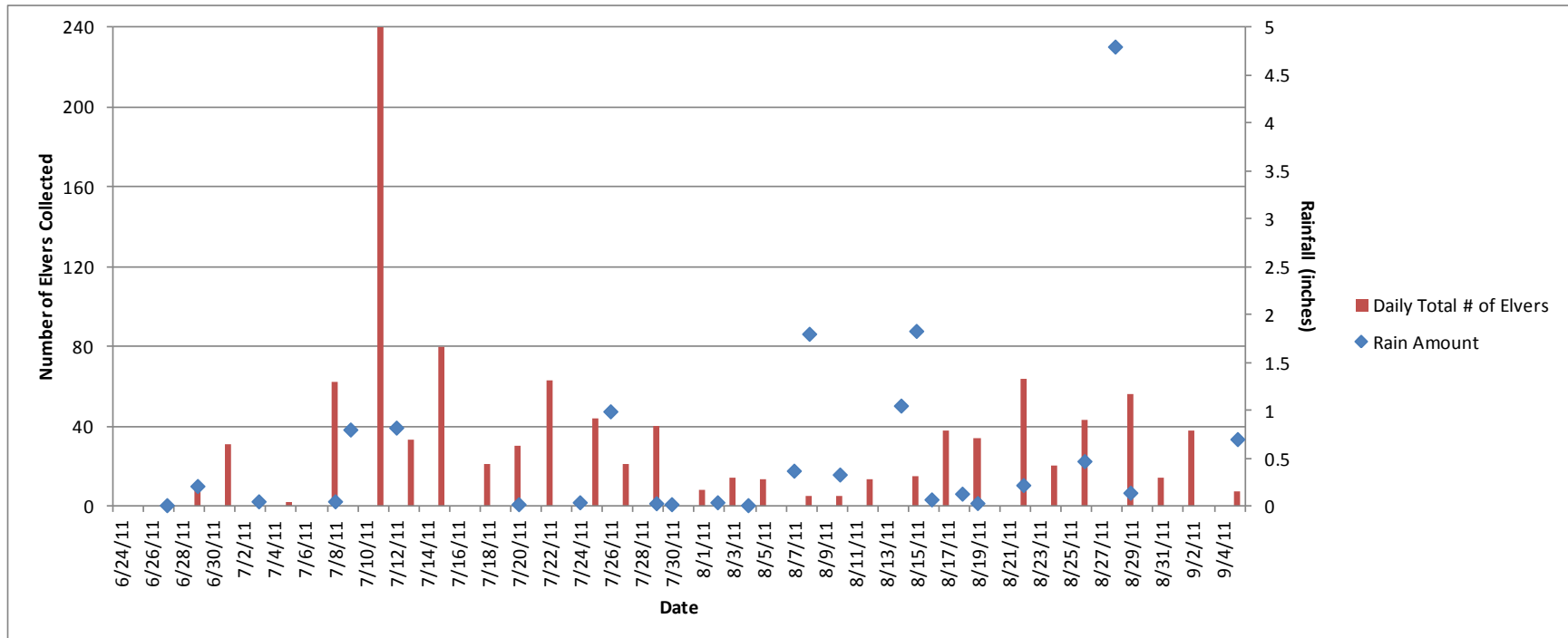


FIGURE 3-8: HURRICANE IRENE AND TROPICAL STORM LEE ENDED THE 2011 SEASON.



APPENDIX A -2011 STUDY PLAN

2011 STUDY WORK PLAN
CONOWINGO HYDROELECTRIC PROJECT

May 13, 2011

3.3 Biological and Engineering Studies of American Eel at the Conowingo Project

3.3.1 Study Request

The FERC, Lower Susquehanna Riverkeeper, MDNR, PaDEP, PFBC, SRBC, and USFWS have requested engineering and biological studies to assess the passage of American eel over the Conowingo Dam. The study requests generally recommend the following elements: (1) assessment of the optimal location for an upstream American eel passage facility; (2) an assessment of the rate of drop-back of migrating American eels; and (3) documentation of seasonal eel abundance and size/age distribution below the Conowingo Dam. Exelon does not plan to address Study Request Component 2 (drop-back study) during the field studies that gather siting and biological data, per the recommendation by MDNR to defer this aspect in their study request letter. Rather, this field study would be more appropriate pre-construction during evaluations of potential design and exit location for an upstream eel passage facility.

In section 5.0 of the Conowingo PAD, Exelon proposed to complete a literature based study on American eel to: (1) summarize available scientific and commercial information; (2) identify suspected factors affecting the American eel population; (3) examine the engineering feasibility of upstream and downstream passage options for American eel; and (4) examine the potential impact of upstream and downstream passage of American eels in the Susquehanna River on the American eel population.

3.3.2 Existing Information (18 CFR § 5.11(d)(3))

Results of 2010 elver and yellow eel biological studies performed in the tailrace (by USFWS) and spillway (by Exelon) below Conowingo Dam were submitted to FERC and participating agencies for review on February 22, 2011. Elvers and yellow eels were sampled between June 14 and September 30, 2010. A total of 258 eels were collected on the spillway side of Conowingo Dam. Of these, 166 were elvers collected from the elver ramps. The east elver ramp collected 158 elvers, while the west elver ramp collected eight. Elver lengths ranged from 92 to 154 mm TL. Baited eel pots yielded 91 yellow eels and one elver. The east-side eel pots collected one yellow eel, while the west-side pots collected 90 yellow eels. The length range of yellow eels collected in pots ranged from 301 to 640 mm TL. Seven yellow eels were fin-clipped recaptures from the location where tagged.

Otoliths from 65 eels were aged. Most elvers were age I or II, although 15% had spent four years in fresh water. Most yellow eels were aged VII, VIII, or IX. However, ages IV through VI were likely under sampled by the gears utilized since no eels were collected between 155-300 mm.

The findings in 2010 suggested that the comparatively low numbers of elvers collected in the spillway (relative to 24,000 elvers collected by USFWS in the tailrace) may have resulted from a delayed start, or possibly from additional factors including attraction flow volume, ramp substrate material, and/or ramp location. Consequently, Exelon plans to repeat the spillway study in 2011 to acquire additional information while adjusting for, to the extent feasible, any effects of those factors identified above. For example, different substrate material may allow collection of small yellow eels between 150-300 mm that eluded capture in 2010. Section 3.3.6 below presents plans to collect additional biological information in the spillway area in 2011.

3.3.2 Resource Management Goals (18 CFR § 5.11(d)(2))

The SRAFRRC Alosid Management and Restoration Plan for the Susquehanna River Basin was completed November 15, 2010 and provides for restoration of American eels to their historical habitats above dams. ASMFC's eel management plan calls for provision of upstream eel passage facilities at dams throughout the Atlantic coast of the United States.

3.3.3 Purpose (18 CFR § 5.11(d)(1))

The purpose of the 2011 study is to: 1) describe the spatial distribution and size characteristics of American eels in the Conowingo tailrace; 2) identify potential locations for an upstream eel passage facility at Conowingo Dam. Thus, the goals are to refine and improve upon the information learned during the 2010 study.

3.3.4 Project Nexus (18 CFR § 5.11(d)(4))

Conowingo Dam is an impediment to upstream passage of American eel.

3.3.5 Investigation Area

The study area for the desktop portion of this study plan includes the lower Susquehanna River from Conowingo Dam upstream to above the York Haven Dam. The field biological studies will occur in the Conowingo tailrace and below the spillway.

3.3.6 Methodology (18 CFR § 5.11(b)(1), (d)(5)-(6))

Task 1: Field Studies in 2011

Task 1A—Collect Eel Spatial distribution data in the tailrace and spillway pool

Spatial distribution and abundance data will be collected from the tailrace and from below the spillway. Recent USFWS methodology in the tailrace has utilized separate gear types to capture elver-stage eels and larger yellow eels. Exelon will utilize both elver ramps and baited eel pots to collect a broad range of eel sizes within the spillway pool.

Elvers in the tailrace will be collected using the USFWS ascent ramp(s) and collection facility on the west bank. The USFWS west bank facility is typically deployed in May and will be sampled regularly (2-3 times per week) through late summer. This is already a known location where elvers congregate in sizeable numbers. Seasonal abundance and biological data may be obtained from this location.

Historical observations of elver use of the spillway pool exist from the 1960s to the 1980s. Elvers in the spillway pool will be collected by a system of self-contained devices consisting of elver ascent ramps and collection buckets. One station will be located on the spillway lip, adjacent to the east fish lift, and a second station located on the spillway lip adjacent to the eastern river shore. Similar systems have been used below the Roanoke Rapids (NC) Project and others to collect eels in a spillway area. Exelon safety standards will be followed for these locations. The spillway pool collection ramps will be fished from late May through October 2011. This study period is contingent upon the termination of spill conditions at the Project. Upon start-up of ramp and attraction flows, elver ramps will fish continuously and be visited each Monday-Wednesday-Friday each sampling week. If elver numbers dictate, more frequent visits to tend collection tanks or larger collection tanks will be utilized as necessary. This component will determine seasonal use of the spillway pool by elvers as well as contrast spatial abundance with the tailrace.

In 2010, Enkamat substrate was used in the elver ramps, conforming by study design to techniques used over several years in the tailrace ramps utilized by the USFWS. In March 2011, Normandeau biologists attended an eel symposium in Gloucester, MA and intend to incorporate ideas gleaned from the meeting into the design of the elver ramps for the 2011 study. Alternate substrate materials will be examined and one selected for use in combination with Enkamat. For example, an alternate substrate such as Akwadrain or equivalent will be fitted to an elver ramp used in tandem with a ramp with Enkamat to compare efficacy. Moreover, such a substrate ideally would pass elvers as well as yellow eels. For this study, attraction flow will be provided simultaneously to both ramps, if the water source is able to provide sufficient flow volume. Substrate coverage will be refined to better lead eels to the collection facilities, as will ramp flow through the substrate.

Among other potential modifications to increase the efficacy of the ramps, further research prior to 2011 start-up will examine appropriate ramp angles for the length of ramp used and the amount of attraction flow. Attraction flow is important and the volume achieved in 2010 may have been too little to attract elvers, given the volume and number of spillway lip overflows available. Attraction flow will be increased as feasible given the in-house supply capability. Periodic review of catch results and ramp performance may also lead to changes to ramp structure throughout the study period. Periodic nighttime observations of the study equipment and surrounding spillway area may be necessary to help ascertain best placement of the catch-gear in the spillway area. Such observations may lead to mid-season relocation of ramp entrances if feasible. Exelon will conduct up to four night surveys of the spillway lip/pool area, timed to match high/peak catch rates of elvers in the spillway and the USFWS WFL facility (June/July 2011). Exelon is currently establishing safety protocols for field crews when conducting these nighttime surveys.

Yellow eels in the tailrace and spillway pool will be collected with baited eel pots. Spillway pool eel pots will be fished at intervals along the spillway lip where lock-out and safety protocol permits. Typically, about 0.5 pound of bait is adequate for a 48-h set. Eel pots will be modified to catch a broader range of size classes. The eel pots will be fished bi-weekly from May through October or as tailrace and spillway pool conditions permit.

Task 1B—Collect Biological and Physical Data

Captured eels will be counted, measured, and scanned for PIT tags. Large counts of elvers may be estimated volumetrically. Yellow eels from both locations will be measured. The first ten specimens from six representative size ranges will be sacrificed for age analysis via otoliths. All remaining yellow eels will have pectoral fins clipped; right pectoral fin for eels captured in east spillway pots, left pectoral for west, then provided to the USFWS for insertion of PIT tags (personal communication with Steve Minkinen (USFWS)). Representative samples of tailrace and spillway pool elvers will be measured. A representative sample from a variety of predetermined size classes will be sacrificed for otolith analysis, including those in the 151 to 300 mm size range that have been uncommon in sampling to date. All other elvers will be placed into the USFWS west bank facility for transport if desired.

Daily and weekly catch data will describe temporal occurrence in relation to several physical variables. Physical data recorded for each sample will include: water temperature, rainfall during the sample period, and percent lunar fraction. Tailrace water temperatures will be obtained from the Exelon tailrace continuous monitor (Station 643). Spillway pool temperatures will be monitored with two ONSET temperature loggers, one at each end of the spillway pool. Percent lunar fraction for a nearby location will be obtained from the Naval Observatory website.

Size structure from each gear type will be determined, including how size structure changes during the sampling season. Size structure informs the choice of substrate material for any upstream passage device.

Task 2: Develop Study Report

Study results will be summarized in a report that will include the study methodology, results of the desktop and field studies, and conclusions. The report will be distributed to interested stakeholders and submitted to the FERC.

3.3.7 Level of Effort and Cost (18 CFR § 5.11(d)(6))

Exelon believes that the proposed level of effort is adequate to analyze this issue. The estimated total cost for the field study outlined in this plan is approximately \$100,000.

3.3.8 Study Reporting and Schedule

In accordance with 18 CFR § 5.15(c)(1), a Study Report will be prepared and submitted to FERC and resource agencies by January 21, 2012.

APPENDIX B - USFWS 2011 EEL COLLECTION REPORT, CONOWINGO DAM TAILRACE

American Eel sampling at Conowingo Dam 2011

Steve Minkkinen, Ian Park, Maryland Fishery Resources Office, 1/25/2012

Background

Eels are a catadromous species that ascend freshwater environments as juveniles then reside in riverine habitats until reaching maturity at which time they migrate to the Sargasso Sea where they spawn once and die. Larval eels are transported by ocean currents to rivers along the eastern seaboard of the continent. Unlike anadromous shad and herring, they have no particular homing instinct. Historically, American eels were abundant in East Coast streams, comprising more than 25 percent of the total fish biomass in many locations. However, Atlantic coast commercial landings have been declining since the 1970's.

The Atlantic States Marine Fishery Commission Fishery Management Plan for American Eel lists access to freshwater habitat as a priority for protecting the population. Although the Chesapeake Bay and tributaries support a large portion of the coastal eel population, eels have been essentially extirpated from the largest Chesapeake tributary, the Susquehanna River. The Susquehanna River basin comprises 43% of the Chesapeake Bay watershed. Construction of Conowingo Dam in 1928 effectively closed the river to upstream migration of elvers at river mile ten (Figure 1).

Mainstem Susquehanna fish passage facilities (lifts and ladder) were designed and sized to pass adult shad and herring and are not effective (due to attraction flow velocities and operating schedules) in passing juvenile eels (elvers) upriver. Specialized passages designed to accommodate elvers are needed to allow them access to the watershed above dams.

Survey methods and Equipment Placement

To determine the best method to reintroduce eels into the Susquehanna River above Conowingo Dam, we have collected baseline information on eel abundance, migration timing, catch efficiency, and attraction parameters at the base of the Conowingo Dam since the spring of 2005. Information from the study will assist in determining the potential for reintroducing eels into the Susquehanna watershed above Conowingo Dam.

The 2011 American eel sampling below Conowingo took place on the west side of the dam adjacent to the West Fish Lift. This sampling served as an attempt to further survey the population of juvenile eels (elvers) at the base of Conowingo Dam. In 2007, elvers were observed climbing up the rip rap where water was spilling over from pumps operated to supply water for the West fish lift operations. From 2008 through 2011 we used this excess water as attraction flow for our elver trap, constructed from industrial cable tray with landscape fabric attached to the bottom (Figure 2). Elvers that found this attraction flow would crawl up the rip rap to the trap and then climb into the trap. The top of the cable tray emptied into a fine mesh collection bag placed in collection tanks (Figure 3). Aerated water was supplied to the collection and holding tanks using a 1/8 HP Sweetwater™ Blower. In 2009 and 2010 we made an attempt

to attract elvers directly from the Susquehanna River at the base of the riprap as well. In 2011 we discontinued the experimental trap going down to the river's edge. Elvers were sedated with, Finquel Tricane Methanesulfonate (MS-222), measured for total length (TL), and individually counted. Large numbers of eels were counted volumetrically. The collection of substantial numbers of eels allowed for the experimental stocking of elvers into Buffalo Creek, Pine Creek and Conowingo Creek. Stocking in Buffalo Creek and Pine Creek is part of a compensatory mitigation for the Sunbury Riverfront Stabilization Project for the City of Sunbury (DA Permit Application Number: NAB 2005-02860-PO5) (attachment 1).

All of the elvers stocked were marked with a 6 hour immersion in buffered oxytetracycline (OTC) at a concentration of 550 ppm prior to release. A subsample of elvers captured was also sent to the Lamar Fish Health Center (Lamar, PA) for disease testing before any stocking occurred.

In previous years, eel pots with a 6 mm square mesh were set around the base of the West Fish Lift to catch larger eels. In 2011, we changed our collection device from a cylindrical eel pot to a double throated rectangular trap with a 25 mm by 13 mm mesh that is more consistent with local commercial gear. Yellow eels captured in eel pots were sedated with a concentrated solution of MS-222 (450g/L), measured, fin clipped, and had a Passive Integrated Transponder (PIT) tag inserted in the dorsal musculature and released.

In 2011, young-of-year (glass eels) were collected by Maryland Department of Natural Resources (Maryland DNR) in Turville Creek, MD. These eels were then transported to the United State Geological Survey lab in Wellsboro, Pennsylvania. The glass eels were held in the lab until June, and then released in Buffalo and Pine Creek (Table 1).

Results

Eels were sampled between 23 May and 8 September 2011 and elvers were collected throughout the sampling timeframe (Table 2). A total of 85,000 elvers were collected during 2011 with the majority collected in two pulses. The first wave occurred in the month of July and the second wave occurred at the end of August through the beginning of September during high flows associated with hurricane Irene and tropical storm Lee. Sampling ended abruptly due to flooding subsequently caused by tropical storm Lee. The seasonal pattern of migration in 2011 was similar to that observed in 2008 when a majority of the eel collection occurred in the end of June through the end of July. During 2009 the migration was later and more protracted with the majority of elvers being collected in the end of July through August. In 2008, 2010 and 2011 we saw multiple waves of elvers throughout our sampling efforts; where as in 2009 there did not appear to be spikes in collections, but more of a steady level of migration through the sampling period (Figure 4).

Juvenile eel lengths ranged from 84 to 225 mm TL (Figure 5), slightly larger than previous years sampling. In 2011, 75% of elvers measured were between 110 and 149 mm, and from 2005-2009 56% of elvers measured were between 110 and 149 mm.

Yellow and silver eel collections in eel pots have taken place from 2007 - 2011. In 2011, we caught 224 yellow and silver eels that ranged from 333 to 659 mm TL. Of the 224 captures, 127 eels had new PIT tags inserted, 55 were recaptures from tagging done in 2011 or in previous year, and the rest were released without being tagged. This year we caught significantly more yellow and silver eels than in previous years. The largest number of yellow and silver eels previously caught was in 2009, when we had 68 new captures (Table 3). The addition of the 127 new captures brings the total number of PIT-tagged yellow eels in the study to 289. We are tracking annual growth rates of the 31 PIT tagged eels that have been recaptured after at least one year after tagging (Table 4).

A total of ten stockings from elvers captured at Conowingo Dam were conducted, with an estimated total of 62,000 elvers being stocked in Buffalo, Pine and Conowingo Creek (Table 1).

To evaluate stocking success at Buffalo and Pine Creek, we conducted electrofishing surveys using 3 backpack shockers and a barge shocker in August 2011. We duplicated methods used by the Maryland Biological Stream Survey (2007) to quantify the catch per unit effort (CPUE) and the biomass of eels. Two sites, bracketing the eel release sites, in each creek were surveyed (Table 1). At each site, 75 meters of stream were blocked off using ¼" mesh block net. In order to quantify the fauna in the stream, two passes with the electrofishing units were conducted and all species of fish collected were enumerated. Captured eels were measured to assess growth and a subsample of the eels collected was brought back to confirm previous marking of otoliths by OTC. In August of 2011, 441 elvers were recaptured in Buffalo Creek. All but 9 of these were recaptured at the Strawbridge Rd site. An attempt was made to sample at the foot bridge on Rte. 1003 but high flows prevented a depletion study from being conducted. The average TL of stocked elvers from Conowingo was 127 mm, and the average TL of glass eels stocked was 80mm, while the average TL of recaptured eels in Buffalo Creek was 137 mm (Figure 6). Sampling Pine Creek in 2011 provided 20 recaptured elvers, 12 of which were recaptured at the Darling Run site, and the rest were caught at the Ansonia Bridge site. The average TL of recaptured eels in Pine Creek was 143 mm. In addition to eels, 4,854 individuals of 30 fish species were collected in Buffalo Creek and 3,663 individuals of 23 fish species were collected in Pine Creek during electrofishing surveys. (Minkinen et al. 2011)

Maryland DNR conducts an American eel young of year (glass eel) survey to characterize trends in American eel recruitment over time (ASMFC 2000). Sampling takes place at Turville Creek, MD using a modified Irish elver ramp. We compared estimated recruitment of glass eels from Turville Creek to captures of elvers below Conowingo dam one year later. Based on four years of data it appears that the glass eel recruitment index at Turville Creek does predict elver abundance the following year at Conowingo Dam (Figure 7).

A subsample of elvers was sacrificed to evaluate the presence of the parasite *Anguillicola crassus*. A total of 46 eels were euthanized using MS-222, then examined for the presence of *Anguillicola crassus* in the swim bladder. The samples were collected in 2010 and 2011, with 19 samples from 2010 and 27 samples from 2011. *Anguillicola crassus* was found in 22 of the samples, with the highest infection rate of 6 being found in one eel. There does not appear to be any relation between the length of an eel and the infection rate (Figure 8) or an increase in infection rate from one year to the next.

Discussion

Throughout the project we have compared elver captures to several environmental factors. This year we increased the environmental factors analyzed. The factors we looked at were lunar fraction, river flow in Havre De Grace MD, barometric pressure, air temperature, daily precipitation levels, and the average daily values of dissolved oxygen, salinity, water temperature, pH, turbidity, and chlorophyll. In years past we have not been able to determine what environmental factors control the timing of the elver migration below Conowingo Dam. Typically elvers reach the dam between the first week of May through the end of June and peak captures usually occur in June and July. Using Pearson correlation it appears that turbidity, river flow and precipitation have the largest correlation value and these three values are directly related to one another (Table 5). With an increase of rain, for example the tropical storm that was observed this year, there was an increase in elver collection.

Interruptions in power supply to our pumps have impacted elver catch on several occasions. We have implemented several sampling design changes in an attempt to ensure that we would have an uninterrupted supply of water throughout the sample period. We have also increased the size of our collection and holding tanks in an effort to increase survival and decrease stress while holding the elvers for stocking. These measures have improved our ability to capture and hold larger numbers of elvers for stocking above the dam.

In 2012 we will attempt to release an additional 36,000 elvers in Pine Creek. We also will attempt to release elvers into Conowingo Creek in Maryland and Buffalo Creek in Pennsylvania. Elvers will be marked with OTC before being released. The Maryland Biological Stream Survey plans on conducting surveys in Conowingo Creek to evaluate the stocking effort. The Maryland Fishery Resources Office will survey elvers released in Buffalo Creek and Pine Creek using methods identical to those used in 2010 and 2011.

Figure 1. Map of the Maryland Biological Stream Survey (MBSS) sampling sites of tributaries to the Susquehanna River in Maryland. The numbers in boxes indicates eel counts at each sampling site. Note the difference in densities of eels in tributaries below Conowingo Dam compared to above the Dam.

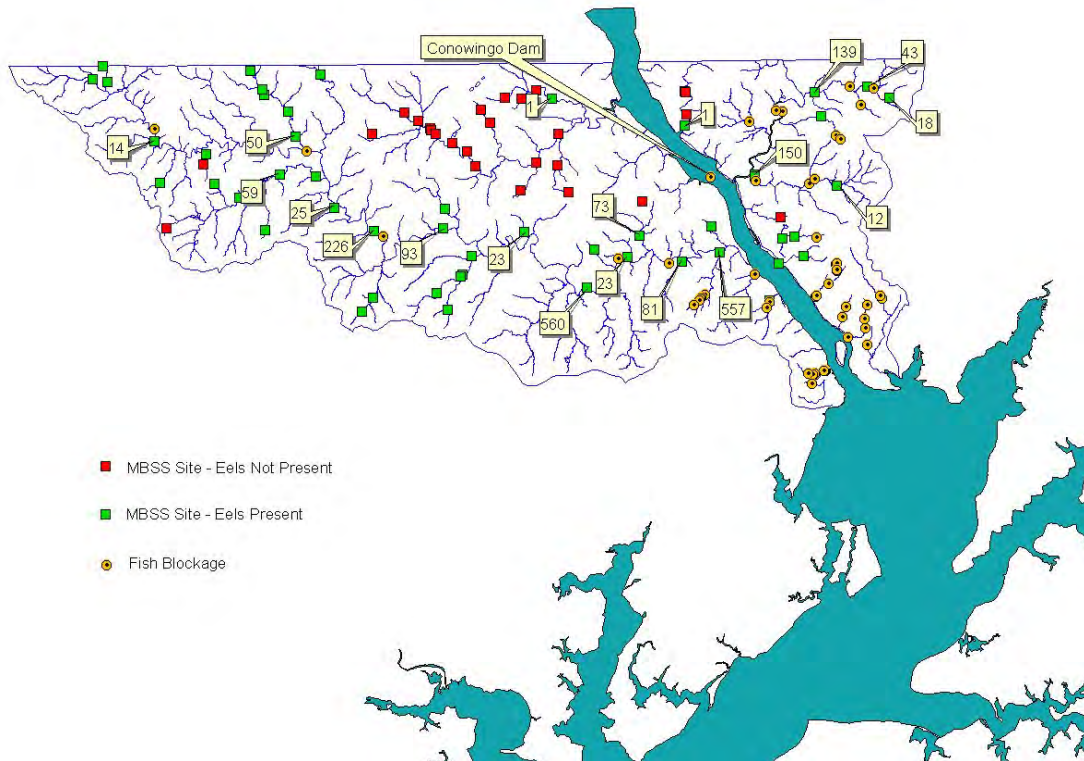


Figure 2. Eel trap constructed of industrial cable tray and landscape fabric.



Figure 3. The cable tray emptying into a collection bag in a holding tank.



Figure 4 Elver capture in relation to date for 2008 – 2011.

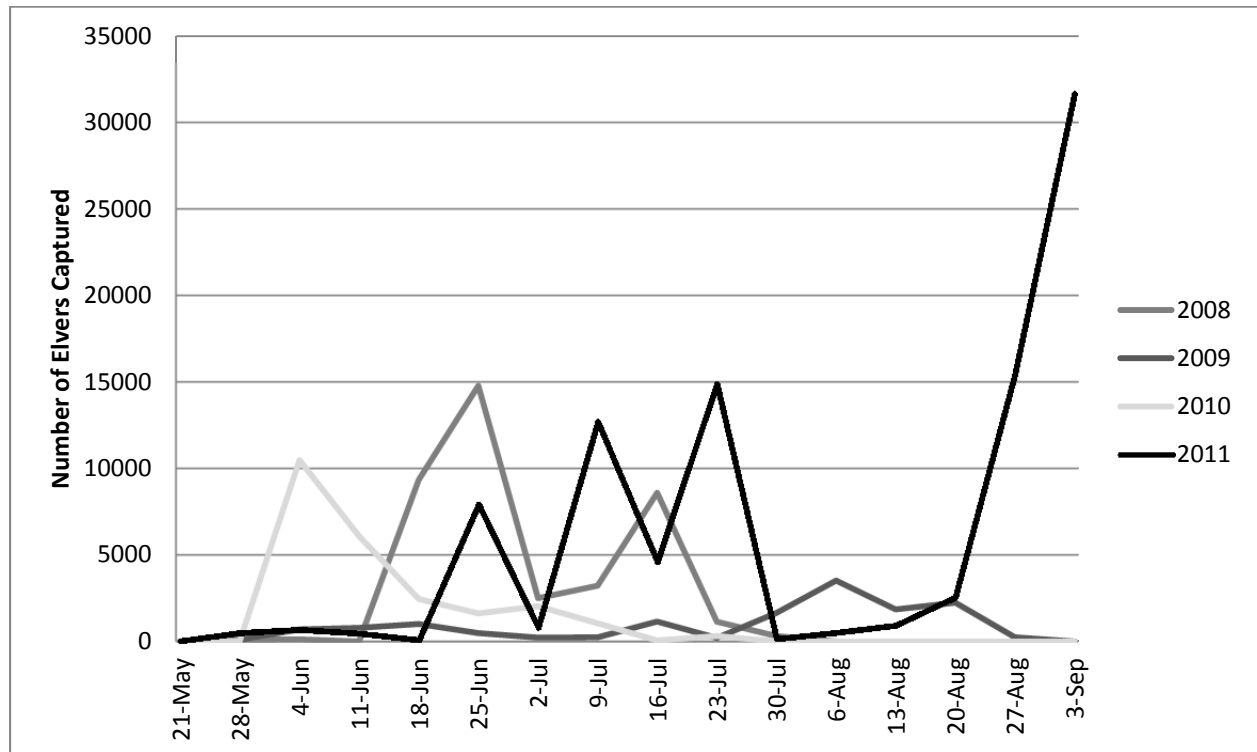


Figure 5 Length frequency of elvers captured below Conowingo Dam 2005-2011.

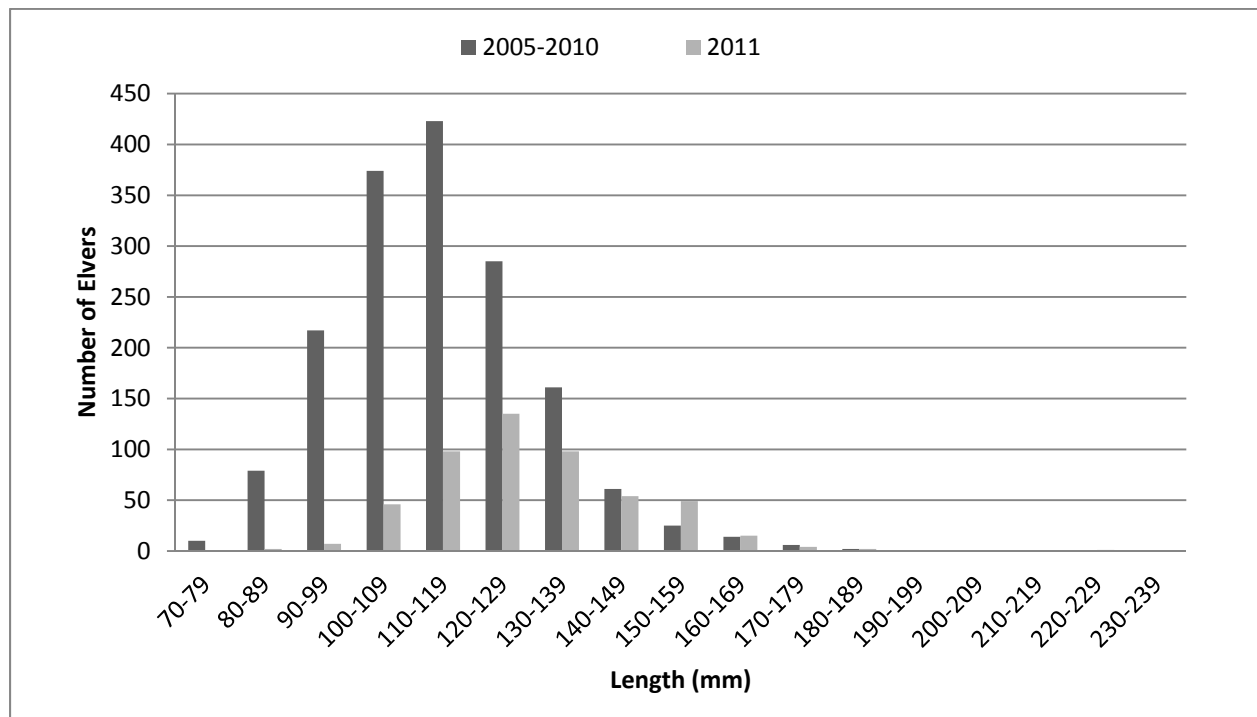


Figure 6 Length frequency of elvers recaptured in Buffalo Creek 2011

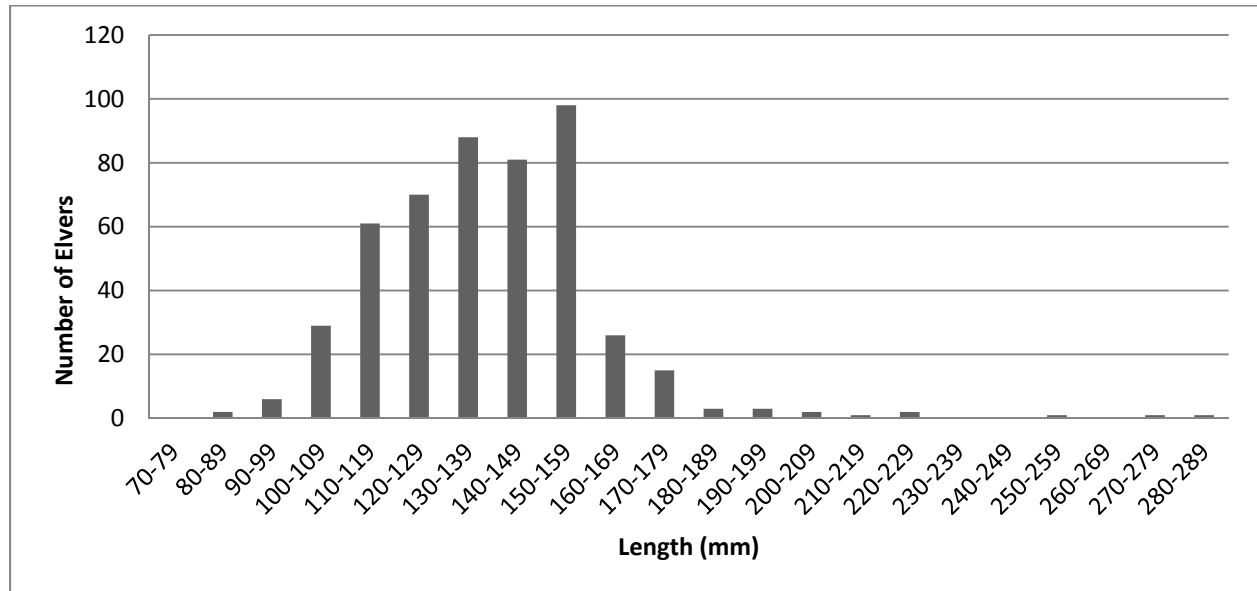


Figure 7 Yearly catch rates of glass eels from Turville Creek and elvers from Conowingo Dam

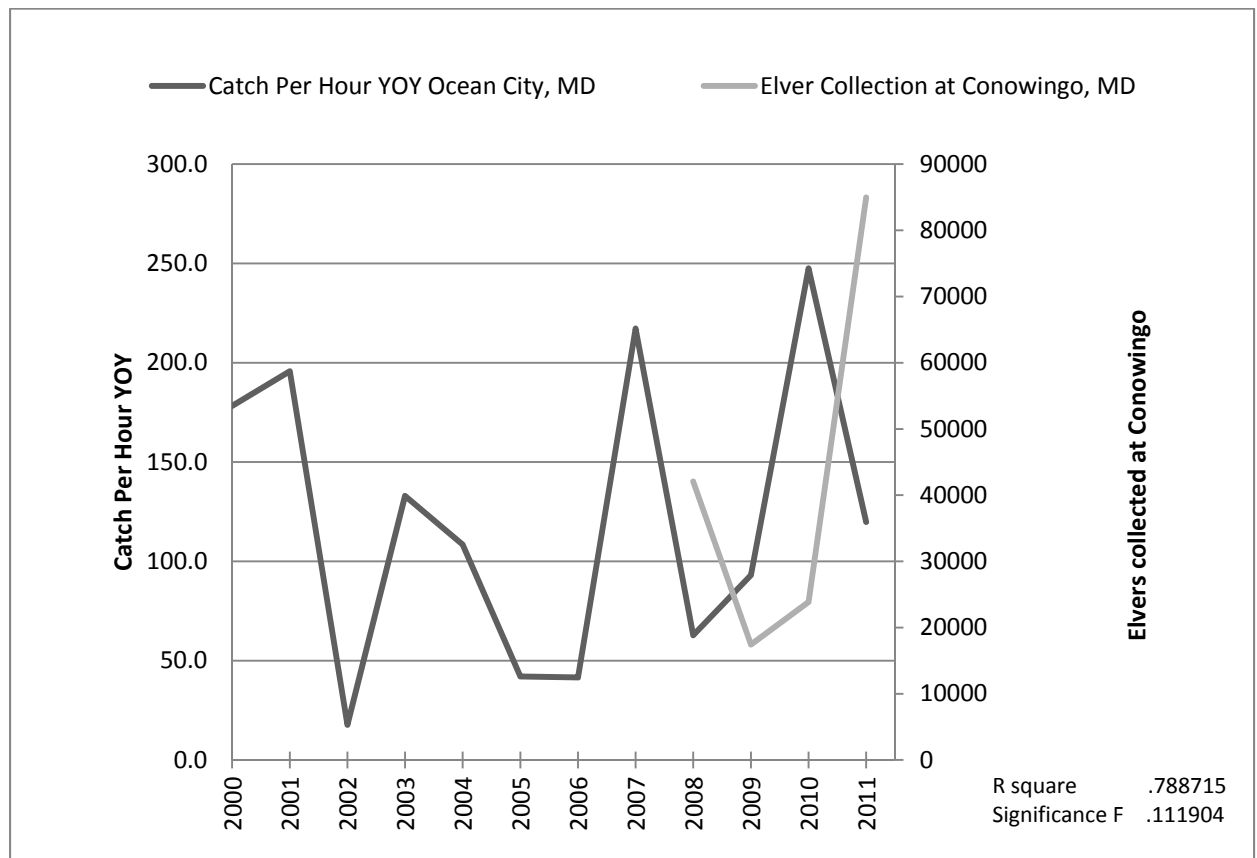


Figure 8 The number of *Anguillicola crassus* present in different lengths of elvers.

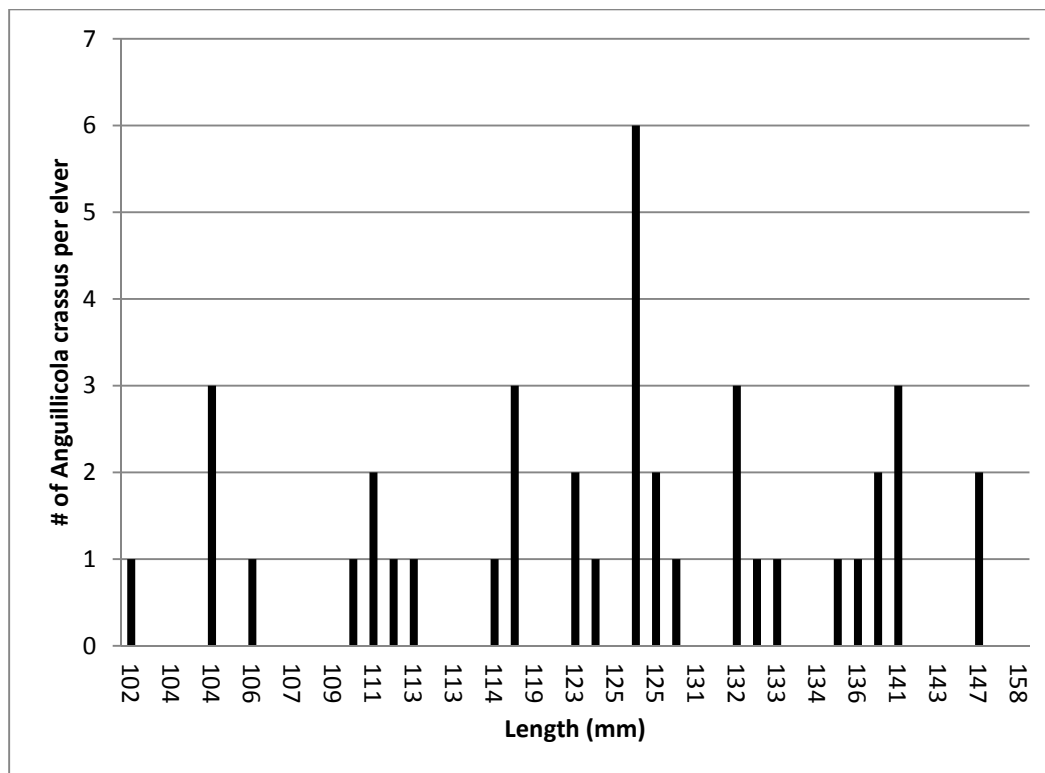


Table 1. Date, location, and number of elvers collected and stocked in 2011

STOCKING DATE	TOTAL ELVERS	STOCKING SITE	Latitude	Longitude	Origin
6/21/2011	16110	Buffalo Creek	40 58.864' N	76.57.081' W	Turville Creek
6/21/2011	16109	Buffalo Creek	40 59.139' N	76 55.930' W	Turville Creek
6/22/2011	10666	Pine Creek	41 44.633' N	77 26.031' W	Turville Creek
6/22/2011	10666	Pine Creek	41 16.285' N	77 19.894' W	Turville Creek
6/22/2011	10666	Pine Creek	41 44.203' N	77 25.822' W	Turville Creek
6/22/2011	1797	Conowingo Creek	39 43.852' N	76 10.701' W	Conowingo Dam
6/30/2011	7222	Pine Creek	41 44.633' N	77 26.031' W	Conowingo Dam
7/14/2011	6326	Buffalo Creek	40 59.139' N	76 55.930' W	Conowingo Dam
7/18/2011	4390	Buffalo Creek	40 59.139' N	76 55.930' W	Conowingo Dam
7/28/2011	3603	Buffalo Creek	40 59.139' N	76 55.930' W	Conowingo Dam
8/22/2011	1528	Pine Creek	41 44.633' N	77 26.031' W	Conowingo Dam
8/31/2011	8940	Pine Creek	41 44.633' N	77 26.031' W	Conowingo Dam
9/2/2011	8084	Pine Creek	41 44.633' N	77 26.031' W	Conowingo Dam
9/7/2011	12205	Pine Creek	41 44.633' N	77 26.031' W	Conowingo Dam
9/8/2011	7844	Conowingo Creek	39 43.852' N	76 10.701' W	Conowingo Dam

Table 2. Number of eels caught at the base of Conowingo Dam on the West side of the dam during 2011.

Date	# of Elvers		Date	# of Elvers
5/23/2011	34		7/20/2011	282
5/25/2011	8		7/22/2011	1380
5/27/2011	1		7/25/2011	2013
5/31/2011	41		7/27/2011	3603
6/3/2011	476		7/29/2011	34
6/6/2011	511		8/1/2011	87
6/8/2011	70		8/2/2011	16
6/10/2011	121		8/5/2011	58
6/13/2011	382		8/8/2011	250
6/15/2011	79		8/10/2011	126
6/17/2011	21		8/12/2011	149
6/20/2011	71		8/15/2011	257
6/22/2011	6		8/17/2011	184
6/24/2011	21		8/19/2011	506
6/27/2011	1217		8/22/2011	928
6/29/2011	4467		8/24/2011	850
6/30/2011	1817		8/26/2011	797
7/1/2011	439		8/29/2011	1344
7/3/2011	378		8/30/2011	2648
7/5/2011	162		8/31/2011	3358
7/7/2011	288		9/1/2011	3548
7/11/2011	1132		9/2/2011	4573
7/12/2011	5514		9/3/2011	3880
7/13/2011	1660		9/4/2011	7250
7/14/2011	2074		9/6/2011	6275
7/15/2011	2340		9/7/2011	6424
7/16/2011	2187		9/8/2011	7844
7/18/2011	780			

Table 3. Number of Passive Integrated Transponder Tags (PIT) applied to yellow eels by year.

Year	# of Tags Applied
2007	51
2008	32
2009	68
2010	11
2011	127

Table 4. Growth of yellow eels caught and recaptured in pots at the base of Conowingo dam by year.

ID	Average Length (mm)					Average Annual Growth Increase (mm)
	2007	2008	2009	2010	2011	
257C63E092	594	617	*	*	*	23
257C6534CA	733	770	*	*	*	37
257C6526C0	463	474	*	*	*	11
257C65EB48	404	510	521	*	*	58.5
257C655F24	426	445	*	*	*	19
257C65F2F2	338	390	505	*	*	83.5
257C63E581	551	589	*	*	*	38
257C65F8B0	475	511	*	*	*	36
257C65E87B	405	471	510	*	*	55
257C65FBAB	377	405	440	*	*	31.5
257C652B3A	466	490	*	*	*	24
257C63C580	391	520	*	557	*	55.3
257C660193	386	428	*	*	*	21
257C63CE9A	458	*	565	*	*	53.5
257C63CF54	484	*	624	*	*	70
257C652735	457	*	590	*	*	66.5
257C6534A4	386	*	478	*	*	46
257C66192F	447	*	580	*	*	66.5
257C63D36E	*	419	433	*	*	14
257C652BF4	*	364	383	395	449	28.3
257C65342C	*	393	516	*	*	123
257C65B1E0	*	479	543	*	*	64
257C660279	*	497	575	*	*	78
257C65E54F	*	454	*	550	*	48
1C2D05239A	*	*	612	626	*	14
1C2D0529B9	*	*	495	578	*	83
257C63D39B	*	*	432	462	470	19
257C6553FB	*	335	*	*	446	37
257C655957	*	321	*	*	377	18.6
1C2D05286B	*	*	476	*	508	16
1C2D052453	*	*	368	*	465	48.5

Table 5 Pearson Correlation performed on number of elvers captured and environmental variables

	# eels	Lunar Fraction	Avg. Att Flow	Barrometric Pressure	Air Temp	Precipitation Sum	AVG of DO (conc.)	AVG of Salinity (ppt)	AVG of Temp (°C)	AVG of pH	AVG of Turbidity (NTU)	AVG of Chlorophyll a (µg/l)
# eels	1											
Lunar Fraction	0.0260	1										
AVG Flow	0.4241	0.0330	1									
Barrometric Pressure	0.1454	-0.2805	0.1595	1								
Air Temp	-0.2163	0.0302	-0.2621	-0.4116	1							
Precipitation	0.3088	0.0424	0.2415	0.0207	-0.3217	1						
AVG of DO	-0.0735	-0.1243	0.2647	0.2474	0.0248	-0.1219	1					
AVG of Salinity	-0.2894	-0.0734	-0.5819	-0.1535	0.1199	-0.1368	-0.5397	1				
AVG of Temp	-0.2502	0.0874	-0.6924	-0.2893	0.5639	-0.1738	-0.3882	0.6475	1			
AVG of pH	-0.5675	-0.1282	-0.3780	-0.0321	0.2888	-0.2476	0.6206	-0.0170	0.3254	1		
AVG of Turbidity	0.6111	0.1400	0.8525	0.0083	-0.1800	0.2524	0.0581	-0.4502	-0.4174	-0.4150	1	
AVG of Chlorophyll a	-0.1177	-0.4422	0.2031	0.1431	-0.0758	-0.0637	0.6783	-0.3313	-0.2645	0.6269	0.1055	1

REFERENCES

ASMFC (Atlantic States Marine Fisheries Commission). 2000. Standard procedures for American eel young of the year survey.

Maryland DNR. 2007. Maryland Biological Stream Survey: Sampling Manual Field Protocols. 65 pp.

Minkinen S.P., Devers J.L. & W.A. Lellis. 2011. Experimental Stocking of American Eels in the Susquehanna River Watershed. Report of U.S. Fish and Wildlife Service to City of Sunbury, Pennsylvania.

APPENDIX I. AGENCY CONSULTATION RECORDS

From: Danucalov, Andrea H;(Exelon Power) <Andrea.Danucalov@exeloncorp.com>
Sent: Friday, April 16, 2021 4:52 PM
To: denise.kehner@maryland.gov; Heather Nelson -MDE-; David Seaborn -MDE-; 'Eyler, Sheila'; 'McCorkle, Richard';
jesus_morales@fws.gov; 'Minkinen, Steve'; 'Henning, Aaron'; 'McCollum, Allyson'; 'Miller, Jeremy'; 'Williamson,
Scott'; Eberts, Ron; Tony Prochaska -DNR-; Brett Coakley -DNR-; 'Seaman, Shawn'; Bob Sadzinski - MD DNR;
'Steffy, Luanne'; 'Tryniewski, Joshua'
Cc: Bleistine, Ray; David Frazier; Ian Kiraly; Erin Redding; Kirk Smith; Martinek, Michael; 'Slowik, Adam'
Subject: Conowingo Eel Passage and Restoration Plan
Attachments: Conowingo_Eel_Passage_and_Restoration_Plan (MDE Version).pdf

All,

On March 19, 2021, the Federal Energy Regulatory Commission issued a new license for the Conowingo Hydroelectric Project (P-405) to Exelon Generation, LLC (Exelon). Article 415 of the license requires Exelon to develop an *American Eel Passage and Restoration Plan* and submit the Plan to the Maryland Department of the Environment (MDE), the Pennsylvania Department of Environmental Protection (PADEP), the Pennsylvania Fish and Boat Commission (PFBC), the Susquehanna River Basin Commission (SRBC), the U.S. Fish and Wildlife Service (USFWS), and the Maryland Department of Natural Resources (MDNR) within 30 days of license issuance (April 18, 2021). Accordingly, please find attached to this email a copy of the Plan for your review and comment.

Please send your comments to me at andrea.danucalov@exeloncorp.com by May 18, 2021.

The approval of the Plan by MDE will also be completed pursuant to Section 2.5(g), Procedure for Approval of Plans, of the Conowingo Dam Water Quality Settlement Agreement between MDE and Exelon, dated October 29, 2019. In addition, the document will be posted on our web portal on Monday, April 19, 2021. I will send the link separately.

Article 415 of the license also requires Exelon to file a final version of the Plan with FERC within 6 months of license issuance (September 19, 2021).

Please let me know if you have any questions, comments, or concerns.

Have a good weekend!

Andrea

Andrea Danucalov
FERC License Compliance Manager



Exelon Generation
Conowingo Hydroelectric Generating Station
2569 Shures Landing Road
Darlington, MD 21034
Skype: 267.533.1125
Cell: 610.301.1664
andrea.danucalov@exeloncorp.com

From: Eyler, Sheila <sheila_eyler@fws.gov>
Sent: Thursday, May 6, 2021 8:53 AM
To: Danucalov, Andrea; denise.keehner@maryland.gov; Heather Nelson -MDE-; David Seaborn -MDE-; McCorkle, Richard; Morales, Jesus J; Minkkinen, Steve; 'Henning, Aaron'; 'Miller, Jeremy'; Eberts, Ron; 'Seaman, Shawn'; Bob Sadzinski - MD DNR; 'Tryninewski, Joshua'
Cc: Bleistine, Ray; David Frazier; Ian Kiraly; Erin Redding; Kirk Smith; Martinek, Michael; 'Slowik, Adam'
Subject: Re: [EXTERNAL] Conowingo Eel Passage and Restoration Plan

Andrea,

FWS has reviewed the Conowingo Eel Passage and Restoration Plan. Generally, we have no significant concerns with the document. We recommend the following edits and additions be included in the final version of the Plan:

1. Background, Page 2: Exelon states that the Conowingo East Eel Collection Facility (CEECE) (the temporary eel facility to be placed in the vicinity of the stilling basin at the East Fish Lift (EFL) will begin operation on May 1. This is inconsistent with the license and EFL operations. According to the license, operation of the CEECE will not commence until 10 days following the end of the operation of the EFL, as correctly stated in section 3.1.3.
2. Reporting and Meetings, Page 23: Regarding eel transport in Sections 6.1.1 and 6.1.2, Exelon describes reporting on transport in the text but does not include the reporting on transport in the bulleted list of items to be included in the daily and annual reports. Transport information (i.e. number transported by date and location) should be included in bulleted lists for both sections.
3. Appendix D: Daily datasheets for transport efforts should be included in this section or added as a separate appendix item.

Thank you for the opportunity to review.

Sheila Eyler
U.S. Fish and Wildlife Service
Mid-Atlantic Fish & Wildlife Conservation Office
177 Admiral Cochrane Dr.
Annapolis, MD 21401
717-387-2117

From: Henning, Aaron <ahenning@srbc.net>
Sent: Friday, May 7, 2021 7:53 AM
To: Danucalov, Andrea; denise.keehner@maryland.gov; Heather Nelson -MDE-; David Seaborn -MDE-; 'Eyler, Sheila'; 'McCorkle, Richard'; jesus_morales@fws.gov; 'Minkkinen, Steve'; 'McCollum, Allyson'; 'Miller, Jeremy'; 'Williamson, Scott'; Eberts, Ron; Tony Prochaska -DNR-; Brett Coakley -DNR-; 'Seaman, Shawn'; Bob Sadzinski - MD DNR; Steffy, Luanne; 'Tryninewski, Joshua'
Cc: Bleistine, Ray; David Frazier; Ian Kiraly; Erin Redding; Kirk Smith; Martinek, Michael; 'Slowik, Adam'
Subject: RE: Conowingo Eel Passage and Restoration Plan

Andrea,

Thank you for the opportunity to comment on the eel plan. The Susquehanna River Basin Commission submits the following comments for consideration:

- In Table 3.5-1, Site 9 refers to rt. 29 bridge in Wilkes Barre. Rt. 29 crosses the Susquehanna River in Nanticoke and does not offer a safe offload point. Consider Nesbitt Park, Kingston PA for comparable alternative access (- 75.8851, 41.2513)
- In Table 6.1.1 Daily Operations Summary, in addition to the two listed items please include the following in daily reports: The number of eels transported or moved from the CECF (even if zero), disposition (location and status) of any eels transported from the CECF, any mortalities encountered at the CECF or during transport
- On page 10, paragraph two the document states: "During the 10 years of operation if the number of American Eels attempting to migrate to the CEECF exceeds the maximum capacity of American Eels per unit of ramp area, or if densities exceed 10 eels per L, the facility will be modified...." The "maximum capacity of American eels per unit of ramp area" needs a clear definition and determination on how this will be measured, by who and when.

Aaron Henning
Fisheries Biologist
Susquehanna River Basin Commission
4423 North Front St.
Harrisburg, PA 17110
Office: (717) 238-0423 ext.1184
Mobile: (717) 884-5937
ahenning@srbc.net



Maryland

Department of the Environment

Larry Hogan, Governor
Boyd K. Rutherford, Lt. Governor

Ben Crumbles, Secretary
Horacio Tablada, Deputy Secretary

May 14, 2021

Via electronic mail

Ms. Andrea Danucalov
FERC License Compliance Manager
Exelon Generation
Conowingo Dam
2569 Shures Landing Road
Darlington, MD 21034
Andrea.Danucalov@exeloncorp.com

Re: Conowingo Dam, Draft American Eel Passage and Restoration Plan

Dear Ms. Danucalov:

The Maryland Department of the Environment, Wetlands and Waterways Program, (MDE) has consulted with the Maryland Department of Natural Resources, Power Plant and Research Program, (MDNR) to review and comment on the Draft American Eel Passage and Restoration Plan (Plan) submitted by Exelon Generation Company, LLC (Exelon) on April 16, 2021 in accordance with the Federal Energy and Regulatory Commission (FERC) License, specifically License Article 415. A requirement of License Article 415 is that the Plan be submitted to MDE within 30 days of the FERC License issuance for the operation of the hydropower facility at the Conowingo Dam. Exelon has prepared the Plan and is seeking initial agency comments prior to a formal submission by a requisite due date per the FERC License. MDE and MDNR are offering the attached comments requesting additional information, revisions and modifications to the Plan. MDE and MDNR are not approving in whole or in part the Plan. Please see Attachment I for comments regarding the Plan.

If you would like to discuss these comments further, please contact David Seaborn, Deputy Program Manager, MDE, Wetlands and Waterways Program via email at david.seaborn@maryland.gov to arrange a time to discuss with the appropriate MDE and MDNR staff.

Sincerely,

Heather L. Nelson, Manager
Wetlands and Waterways Program
Water and Science Administration

Attachment

(Via electronic mail)

cc: Bob Sadzinski, MDNR
Shawn Seaman, MDNR
Sheila Eyler, USFWS

Attachment I

General Comments:

- 1) The history of the WFL eel ramp does not include the time when U.S. Fish and Wildlife Service (USFWS) setup the ramp and operated it. Please include the complete history of the ramp.
- 2) Regarding FERC Article 414: The trigger for the eel ramp to operate within the East Fish Lift (EFL) is based on the closing of the EFL after the shad season. The Plan should describe what happens if the EFL does not operate or operates intermittently. We anticipate the Conowingo East Eel Collection Facility (CEECECF) would operate during those extended periods when the EFL is not operating and after 1 May of any year.
- 3) The east side eel ramp is based on “modifications” of the new EFL. The Plan should include a construction timeline for the rebuilding of the EFL and any provisions to capture eels during this period. Interim eelway collections during construction or modifications to the eelway or EFL should not be considered as years to be compared between the CEECECF and the west side eelway.
- 4) Maryland recommends including an eelway shakedown period that does not affect the ten-year comparison clock for the ramp to become permanent.
- 5) Small “tweaks” (*e.g.*, flow changes, gate openings/closings, ramp substrate(s)) should not be considered as modifications and should be differentiated from modifications requiring approval from the FERC. This needs to be defined in the Plan.
- 6) The Plan should address how the parties resolve disagreements regarding modifications to the eel collection facilities. (see Page 90 of the FERC Order)
- 7) Significant numbers of eels were observed during nighttime observations below the spillway during an Exelon study conducted in 2011. These eels could be redirected to the new eel ramp if access including attraction water could be provided through the wing wall. Exelon should consider this option (or other alternatives) to provide passage to eels attracted to the spill gate area? Since the EFL is being redesigned, this may be a minor modification to significantly improve the catchability of eels on the east side of the river.
- 8) Studies to determine ramp efficiency should be implemented during the first full season of operation and any time the ramp substrate is changed, or ramp flows are significantly changed by using a known number of eels released at the base of the ramp versus the number captured in the holding tank. Identified problems with the ramp must be addressed immediately.

Specific Comments:

- 1) 3.2.1 Design Conowingo East Eel Collection Facility (CEECECF)
 - a. The Plan states that the CEECECF be supplied with at least 265 liters per minute (70 gal/min, 1.2 gal/sec) of water. This flow may be insufficient to attract eels past the diffuser’s flow and to the ramp. Additional attraction water may need to be provided such that it does not spill or sheet across the concrete pad creating false attraction when tailwater is low.

b. Nighttime observations should also be made of the concrete pad to ensure no eels are congregating toward this flow.

c. How does Exelon plan to determine if ramp density (overcrowding) is an issue?

2) 3.2.3 Operational Protocols

The plan states that:

- Weir gate C open 100% open.
- Weir gates B 0% open.
- Weir gates A 0% open
- Diffuser gates A 100% open
- Diffuser gates B 100% open

a. The plan should describe the amount of flow from diffusers. How will this configuration affect internal EFL flow patterns, and the amount of flow at Weir Gate C?

i. Exelon should also include diffuser Gate C into the operation plan along with options for the operation of entrance Gate A.

ii. Sufficient flow from the weir gate(s) is necessary to attract eels while maintaining velocities suitable for entry. The plan should also address the potential for attraction of eels into flow from the diffuser(s).

b. Prior to initial operation of the CEECF, operation flows should be observed and agreed to by agency representatives/personnel. Any subsequent modifications to flows or gate operations should also be observed and agreed to by agency representatives/personnel.

c. Entrance gates should be constructed with bar racks to reduce the number of predators accessing the EFL during the operation of the eel ramp.

d. Internal and zone-of-passage (ZOP) flow modeling should be conducted at the CEECF to ensure no velocity barriers exist for American Eels.

e. Monitoring- aeration of the collection tanks at the CEECF and CEECF should be performed unless DO is continuously monitored in those tanks.

3) 3.4 Transport, 3.4.1 Design

a. The plan should include density of eels in 19-liter buckets and 250-liter tank during transport to stocking locations.

b. If density is same as in large tanks (10 eels per liter) then continuous DO monitoring is needed.

EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
EEL PASSAGE AND RESTORATION PLAN REMOTE MEETING SUMMARY
JULY 9, 2021, 1:00 PM TO 2:30 PM EST
Call-in Number: Microsoft Teams Call-in 716-402-6612, passcode 20670122

Attendees

Attendee	Affiliation	Email
Andrea Danucalov	Exelon	andrea.danucalov@exeloncorp.com
Erin Redding	Gomez and Sullivan Engineers	eredding@gomezandsullivan.com
Ben Sawyer	Gomez and Sullivan Engineers	bsawyer@gomezandsullivan.com
Kirk Smith	Gomez and Sullivan Engineers	ksmith@gomezandsullivan.com
Heather Nelson	Maryland Department of the Environment	hnelson@maryland.gov
David Seaborn	Maryland Department of the Environment	David.seaborn@maryland.gov
Shawn Seaman	Maryland Dept. of Natural Resources	shawn.seaman@maryland.gov
Ray Bleistine	Normandeau Associates, Inc.	rbleistine@normandeau.com
Mike Martinek	Normandeau Associates, Inc.	mmartinek@normandeau.com
Jeremy Miller	PA Dept of Environmental Protection	jeremmille@pa.gov
Josh Tryninewski	PA Fish and Boat Commission	jtryninews@pa.gov
Aaron Henning	Susquehanna River Basin Commission	ahenning@srbc.net
Sheila Eyer	US Fish and Wildlife Service	sheila_eyer@fws.gov
Rick McCorkle	US Fish and Wildlife Service	richard_mccorkle@fws.gov
Jesus Morales	US Fish and Wildlife Service	jesus_morales@fws.gov
Don Pugh	Consultant for Maryland	don.pugh@outlook.com

Meeting Purpose

Andrea Danucalov began the meeting. The focus of this meeting will be to review the resource agencies' comments on Exelon's Draft Eel Passage and Restoration Plan (EPRP). Exelon would like to finalize the EPRP and submit it to FERC. Following this meeting, an updated draft EPRP will be distributed to resource agencies for a final review.

Conowingo East Eel Collection Facility Design and Planned Operation

Ben Sawyer shared a 3-D model of the Conowingo East Eel Collection Facility (CEECE) on his screen. Major features were highlighted to show how the facility will be laid out.

The CEECE is in the stilling basin. A scaffolding stairway leads down from the dam to a walkway that allows for access to the collection tank, positioned at the top of the ramp. The ramp runs from the stilling basin down over the dissipation wall.

Eels may access the ramp via multiple routes. Once they reach and ascend the ramp, they are collected from the tank and carried out of the facility in buckets. The EPRP discusses which gates will be open or closed.

Ben showed the model in low and in high water level conditions. The model can show approximate low and high water levels.

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Attraction flow for the CEECF is sourced from the dam. Water is supplied via the same pipe that feeds the stilling basin. The pipe is from the forebay located between Unit 11 and the EFL. Flow will be tapped off that pipe and sent to the CEECF via pipes or hoses. A manifold is located on top of the concrete at the powerhouse level. All the provided flow comes off the existing manifold, and all the flow will eventually come out the bottom of the ramp. The flow will then continue out the crowder channel or the diffuser channel.

There will be no water upstream of the dissipation wall where the scaffolding is placed. The scaffolding area will be dry, even during high water conditions.

The attraction flow will be 70 gallons per minute (0.16 cfs). Jesus Morales asked the manifold's flow capacity. Ben did not have this information available. Ray Bleistine said that the pipe that feeds the manifold is a six-inch pipe and previously provided water for the east lift. There is sufficient flow for the 70 gpm. Mike Martinek said that there is a two-inch hose called out for this facility, so flows will be very similar to flow at the Conowingo West Eel Collection Facility.

Jesus asked which gates will be open for eels to enter the East Fish Lift. He noted that most of the time, more water will be coming into the East Fish Lift than 70 gpm. He asked what the expectation is for how fish will find their way through the gates to the ramp. He also asked if the gates be completely open, screened, or covered. Gate C will be fully open. Mike said that there are no plans for screening the entrances to the channels; however, areas susceptible to avian predation will be screened. Jesus asked for confirmation that when the water level is dry, the attraction flow will be the only water coming down the concrete slab. Mike confirmed that this statement is correct.

Don Pugh asked how much flow will pass through the diffuser gates. Mike said that the attraction flow of 70 gpm will pass through the diffuser gates. Don expressed doubt that the eels would be able to locate the 70 gpm attraction flow where there would also be potentially thousands of gallons of flow coming downstream from the Conowingo operating units. Don thinks that the eels will instead be attracted to the flow from the dam. Jesus agreed and said that there would be more water going into Gate A than water coming out. Jesus said that he thinks some eels will eventually locate the ramp; however, he is wondering what will draw eels into the east fish lift to begin with. He acknowledged that they may follow the wall on that leads to Gate C and enter the fish lift there. Ray said that there are historic observations of eels in this area, before the east fish lift was built. Eels were observed coming through leakage from the regulating gate. An eel ramp at this location is in response to agency requests. The ramp cannot be put into the spillway due to safety and operation concerns. Ray said that there is no guarantee that there are eels here; this is an experiment. Benefits of the site include access and water availability.

Jesus agreed that this location is experimental and agreed that there are positive aspects of this location. He said he still wonders if something else could be done to improve the attraction flow for eels as the 70 gpm will be competing with the flow from the powerhouse. Ray said that the specifications for the CEECF are aligned with the CEECF as Exelon is required to compare the two facilities after ten years of operation. Ray said that he is concerned that having a different set up in the CEECF may bias the required comparisons. Don said the CEECF's purpose is to collect eels, not to replicate the CEECF for comparison. Conditions on the west side of the river are different; eels come up the edge of the river into an open area. This area is not open. Ray said that the eels could come up the wingwall. Don said that that the attraction flow is not sufficient to bring eels into the fish lift. They may wander into the fish lift, but could still miss the attraction flow due to water movement within the lift. Mike said that when the units are operating, flow from the dam will be too great for eels to swim up to the dam. The flow will push eels toward the wingwall where they will find Gate C. Don said that the eels will only be pushed to the wingwall

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and Gate C if units 10 and 11 are running. Otherwise they could swim up to Gate A, which will be closed. Mike said that if unit 5 is on, the eels will be throughout the tailrace. Don said that this makes his point that collecting on the west side does not collect all the eels in the river that are trying to pass upstream of Conowingo Dam. The locations of the eels in the river downstream of the dam are unknown as they are too small for tracking studies.

Regarding diffuser flows, Don asked if the water could go through the diffusers and down the channel. It can.

Don said that predators entering the east fish lift may also be an issue. He asked if there will be bar racks in front of the gate. Bar racks are not currently planned for in front of the gates. Ray said there is an eddy below the CWFECF where predatory fish rest; however, there is no evidence that it is impacting the CWFECF catch. Don said that it is not possible to know if predatory fish are impacting the CWFECF catch or not because no one knows how many eels are available. It is known that the species of predatory fish in the eddy do like to eat eel. Aaron Henning said that there were eels in the stomachs of some of the snakeheads caught this summer.

Conowingo Eel Passage and Restoration Plan – Agency Comments and Exelon’s Responses

A comments response matrix was shared on the meeting screen and Kirk Smith led the group through a discussion. For each comment, Kirk summarized Exelon’s response and solicited further comments or questions from the resource agencies. The matrix and meeting discussion begin on the next page.

Agency Comments and Draft Responsiveness Matrix Discussion

Comment		How Addressed
MDE & MDNR		
General Comments		
Meeting Discussion: Ray said that the C-channel will be narrowed with supports and steel plates, making it even more challenging to create a hole for attraction flow here.		
8	Studies to determine ramp efficiency should be implemented during the first full season of operation and any time the ramp substrate is changed, or ramp flows are significantly changed by using a known number of eels released at the base of the ramp versus the number captured in the holding tank. Identified problems with the ramp must be addressed immediately.	FERC License, Appendix 1, Section 12.7.3 requires that upstream American Eel effectiveness testing be completed in the year immediately following license issuance unless Exelon and the USFWS agree that effective technology is not available. Based on the available scientific literature, Exelon and USFWS agree that the appropriate, proven tagging technology does not currently exist to conduct ramp efficiency studies for the size range of eels currently collected at Conowingo Dam (mean length 125 mm). Per the FERC License, Appendix 1, Section 12.7.3, available technology will be reconsidered and the potential for tests of upstream passage efficiency will be discussed at annual meetings with USFWS. In addition, Section 12.7.3 requires that when technology is available and following any modifications to the operation or physical structure an upstream efficiency study will be conducted to evaluate the relative success of the modifications. This language has been added to the Eel Passage and Restoration Plan. Additionally, to perform a comparative analysis with the CEECF, substantial modifications such as changing ramp substrate or attraction flow should be avoided during the 10-year comparative period so as not bias results.
Meeting Discussion: Don said that Maryland is requesting a ramp efficiency study, rather than a passage efficiency study. The requested study would involve containing a fixed number of eels at the base of the eel ramp and then, over a set time-period, seeing what percentage of the eels reach the collection tank. Ray said that, at Conowingo, it would be a challenge to keep other eels from entering the ramp via the sides of the ramp, as the eels climb up the rip-rap. Ray also noted that closing off the ramp for a day to eels that are trying to move upstream could result in not passing thousands of eels. Don agreed that this type of study would be difficult at the CEECF, but it could be possible at the CEECF. Exelon now understands Don's request and will consider it further.		

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Comment	How Addressed
Specific Comments	
1 3.2.1 Design Conowingo East Eel Collection Facility (CEECF) a. The Plan states that the CEECF be supplied with at least 265 liters per minute (70 gal/min, 1.2 gal/sec) of water. This flow may be insufficient to attract eels past the diffuser's flow and to the ramp. Additional attraction water may need to be provided such that it does not spill or sheet across the concrete pad creating false attraction when tailwater is low. b. Nighttime observations should also be made of the concrete pad to ensure no eels are congregating toward this flow. c. How does Exelon plan to determine if ramp density (overcrowding) is an issue?	a. There will be no flow provided through the EFL diffusers. The weir and diffuser gates are open to allow eels the opportunity to enter the EFL via multiple locations, but there will be no flow provided through the gates via the conventional operation of the EFL. Attraction flow to the CEECF will be provided from a separate water source. This flow will consist of 70 gpm of water discharged through the ramps attraction flow system as described in Section 3.2.1. Therefore, there is no potential for the creation of false attraction by the EFL diffusers when the tailwater is low. b. Nighttime observations are not necessary, since the EFL will not be providing flow through diffusers; thus, eliminating the potential for false attraction. c. The proposed eel ramp is 18 inches wide. Using the USFWS Fish Passage Engineering Design Criteria (2019) of a maximum capacity of 5,000 eels/day per inch of ramp width, assuming a mean eel size of 150 mm total length, the proposed ramp will have a capacity of 90,000 eels/day. During the 10 years of operation, if the number of American Eels attempting to migrate through the CEECF exceeds 90,000 eels per day, based on volumetric estimates, or if densities in the collection tank exceed 10 eels per L, the facility will be modified, or operational protocols adjusted to reduce crowding, in consultation with MDE, USFWS, and EPAG, and following approval from FERC. This information has been added to page Error! Bookmark not defined.
Meeting Discussion: Don asked where the maximum ramp capacity metric comes from, other than the USFWS' guidelines. Jesus suggested that Alex Haro may know the source of this metric. Don said that he has asked Alex Haro, and Alex did not know either. (At the end of the meeting, Jesus typed in the chat that the maximum capacity metric was taken from the UK Environment Agency's eel manual.)	

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	Comment	How Addressed
2	3.2.3 Operational Protocols The plan states that: Weir gate C open 100% open. Weir gates B 0% open. Weir gates A 0% open Diffuser gates A 100% open Diffuser gates B 100% open	Appendix D has been added to provide additional information regarding operations.
	e. Monitoring- aeration of the collection tanks at the CEECF and CEECF should be performed unless DO is continuously monitored in those tanks.	Daily DO checks and weekly downloads of continuous monitoring data will be performed. Aeration will be provided if DO monitoring indicates that it is necessary. See Section 3.2.1 for details.
	Meeting Discussion: Don asked for confirmation that there will be a daily check as well as logged continuous monitoring. Ray confirmed that Normandeau will perform manual daily checks of water quality and a HOBO is also in place to collect continuous monitoring data. These data are downloaded on an established schedule. This approach is similar to how monitoring is completed at the Octoraro Creek Eel Collection Facility.	
3	3.4 Transport, 3.4.1 Design a. The plan should include density of eels in 19-liter buckets and 250-liter tank during transport to stocking locations. b. If density is same as in large tanks (10 eels per liter) then continuous DO monitoring is needed.	a. The density of eels in the transport buckets and transport tank are less than less than 10 juvenile eels per liter. Section 3.4 has been revised to clarify this. b. Eels are transported with continuous DO supply. This has been clarified in Section 3.4.2.
	Meeting Discussion: Don asked if Normandeau has ever transported eels in 5-gallon buckets. Mike said yes; this is done when eel numbers are low. No more than 50 eels are placed in a 5-gallon bucket. Normandeau puts a blower in the bucket during transport to ensure there is sufficient oxygen.	

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Agency Comments on April 16, 2021 Draft and Exelon Responses

Comment		How Addressed
MDE & MDNR		
General Comments		
1	The history of the WFL eel ramp does not include the time when U.S. Fish and Wildlife Service (USFWS) setup the ramp and operated it. Please include the complete history of the ramp.	A brief history of the WFL eel ramp has been incorporated into Section 3.1.1.
2	Regarding FERC Article 414: The trigger for the eel ramp to operate within the East Fish Lift (EFL) is based on the closing of the EFL after the shad season. The Plan should describe what happens if the EFL does not operate or operates intermittently. We anticipate the Conowingo East Eel Collection Facility (CEECE) would operate during those extended periods when the EFL is not operating and after 1 May of any year.	Exelon does not anticipate any periods when the EFL would not be operating in some capacity from May 1 to June 15. Exelon must operate the EFL, as required by the FERC license. Not operating the EFL or operating the EFL intermittently would require FERC to approve a variance request in advance of any changes to operation of the EFL. Also, per the MDE Settlement the temporary eel facility is to start operating twelve months after the EFL modifications required under Appendix 1 of the FERC license (i.e., the DOI Fishway Prescription) in order to allow for the construction of the upgrades required by the license to occur. Exelon does not anticipate a scenario where the EFL will not be operated in either trap and transport or volitional mode after the EFL initial modifications are complete. Given this, there does not appear to be any circumstance where the CEECE would operate prior to the closing of the typical American Shad passage season.
3	The east side eel ramp is based on “modifications” of the new EFL. The Plan should include a construction timeline for the rebuilding of the EFL and any provisions to capture eels during this period. Interim eelway collections during construction or modifications to the eelway or EFL should not be considered as years to be compared between the CEECE and the west side eelway.	Exelon is developing a schedule to complete the upgrades to the EFL. Per the MDE Settlement, Exelon and MDE agreed to initiate operation of the CEECE 12 months after completion of the EFL upgrades. Due to safety concerns and the required EFL upgrade requirement, collection of eels will not occur until completion of the EFL upgrades. There are no specific requirements in the MDE Settlement or FERC License to capture eels on the east side of the dam during the EFL construction period. However, operation of the CEECE and the

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		OECF will continue during the EFL construction period and will continue to provide a source of eels for upstream transport.
4	Maryland recommends including an eelway shakedown period that does not affect the ten-year comparison clock for the ramp to become permanent.	The current CEECF design follows USFWS's Fish Passage Engineering Design Criteria (2019) in relation to attraction flow, general design configuration, and substrate material. The design has also been discussed with EPAG, USFWS, and MDE. The CEECF and OECF did not require shakedown periods after their initial construction and have not required any substantive modifications since operation began. As part of the normal operating procedure before the start of the eel passage season, each ramp undergoes a series of pre-season checks as well. Exelon anticipates the same for the proposed CEECF and therefore is not proposing a shakedown period.
5	Small "tweaks" (e.g., flow changes, gate openings/closings, ramp substrate(s)) should not be considered as modifications and should be differentiated from modifications requiring approval from the FERC. This needs to be defined in the Plan.	Article 414 has been added to Section 3 for reference. The language of Article 414 does not suggest that small changes or "tweaks" to design or operation may be made without MDE, USFWS, and FERC approval; therefore, Exelon considers it appropriate to have all changes to the design or operation approved by FERC before they are implemented to ensure license compliance.
6	The Plan should address how the parties resolve disagreements regarding modifications to the eel collection facilities. (see Page 90 of the FERC Order)	Exelon maintains regular consultation with MDE, USFWS and EPAG through monthly virtual meetings, emails and phone calls, and annual meetings, and meeting records are maintained. Exelon will attempt to resolve any disagreements regarding modifications to the eel collection facilities through conversations held during these meetings, phone calls, and emails. In the case of unresolved disagreements between MDE, USFWS, and EPAG regarding modifications, FERC will maintain and exercise its decision authority based upon the consultation record.
7	Significant numbers of eels were observed during nighttime observations below the spillway during an Exelon study conducted in 2011. These eels could be redirected to the new eel ramp if access including attraction water could be provided through the wing wall. Exelon should consider this option (or other alternatives) to provide	Three nighttime surveys were conducted in 2011. Elvers were observed in the same area below Crest gate #30 during all three surveys, which is located approximately 1,200 feet away from the EFL.

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	passage to eels attracted to the spill gate area? Since the EFL is being redesigned, this may be a minor modification to significantly improve the catchability of eels on the east side of the river.	However, crest gate #30 was leaking a significant amount of water since it had been opened during high spring river flows that resulted in spill, and it had not been resealed prior to the survey. It was concluded that eels would not have been attracted to that location if the crest gate had not been leaking. A copy of the 2011 study is attached as Appendix H. Exelon is not proposing any modifications to the EFL wingwall as it serves to regulate the tailwater elevation in the vicinity of Gate C of the EFL as generation and spillway flows change. In addition, there is a channel at the terminus of the wingwall that maintains connectivity between the spillway and tailrace under nearly all flow conditions experienced at the Project.
8	Studies to determine ramp efficiency should be implemented during the first full season of operation and any time the ramp substrate is changed, or ramp flows are significantly changed by using a known number of eels released at the base of the ramp versus the number captured in the holding tank. Identified problems with the ramp must be addressed immediately.	FERC License, Appendix 1, Section 12.7.3 requires that upstream American Eel effectiveness testing be completed in the year immediately following license issuance unless Exelon and the USFWS agree that effective technology is not available. Based on the available scientific literature, proven tagging technology does not currently exist to conduct ramp efficiency studies for the size range of eels currently collected at Conowingo Dam (mean length 125 mm). Per the FERC License, Appendix 1, Section 12.7.3, available technology will be reconsidered and the potential for tests of upstream passage efficiency will be discussed at annual meetings with USFWS. In addition, Section 12.7.3 requires that when technology is available and following any modifications to the operation or physical structure an upstream efficiency study will be conducted to evaluate the relative success of the modifications. This language has been added to the Eel Passage and Restoration Plan. Testing of ramp efficiency by placing a known number of unmarked eels at the bottom of an eel ramp to determine the percentage of eels that successfully ascend the ramp has had mixed results. A method for marking juvenile eels (size range 70 to 130 mm) needs to be developed in

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	order to detect eels as they enter, ascend, and exit the eel ramp. This would allow testing to occur without shutting down the ramp for some length of time and eliminate concerns of eels not in the test group infiltrating the ramp and skewing the results. Until a marking technique is developed for small eels that provides reliable detectability to ensure accurate results, it is our consensus that this type of study be delayed. Exelon will continue to work with the resource agencies to address this issue.
Specific Comments	
1 3.2.1 Design Conowingo East Eel Collection Facility (CEECE) a. The Plan states that the CEECF be supplied with at least 265 liters per minute (70 gal/min, 1.2 gal/sec) of water. This flow may be insufficient to attract eels past the diffuser's flow and to the ramp. Additional attraction water may need to be provided such that it does not spill or sheet across the concrete pad creating false attraction when tailwater is low. b. Nighttime observations should also be made of the concrete pad to ensure no eels are congregating toward this flow. c. How does Exelon plan to determine if ramp density (overcrowding) is an issue?	a. There will be no flow provided through the EFL diffusers. The weir and diffuser gates are open to allow eels the opportunity to enter the EFL via multiple locations, but there will be no flow provided through the gates via the conventional operation of the EFL. Attraction flow to the CEECF will be provided from a separate water source. This flow will consist of 70 gpm of water discharged through the ramps attraction flow system as described in Section 3.2.1. Therefore, there is no potential for the creation of false attraction by the EFL diffusers when the tailwater is low. b. Nighttime observations are not necessary, since the EFL will not be providing flow through diffusers; thus, eliminating the potential for false attraction. c. The proposed eel ramp is 18 inches wide. Using the USFWS Fish Passage Engineering Design Criteria (2019) of a maximum capacity of 5,000 eels/day per inch of ramp width, assuming a mean eel size of 150 mm total length, the proposed ramp will have a capacity of 90,000 eels/day. During the 10 years of operation, if the number of American Eels attempting to migrate through the CEECF exceeds 90,000 eels per day, based on volumetric estimates, or if densities in the collection tank exceed 10 eels per L, the facility will be modified, or operational protocols adjusted to reduce crowding, in consultation with MDE, USFWS, and EPAG, and following approval from

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		FERC. This information has been added to page 11.
2	3.2.3 Operational Protocols The plan states that: Weir gate C open 100% open. Weir gates B 0% open. Weir gates A 0% open Diffuser gates A 100% open Diffuser gates B 100% open	Appendix D has been added to provide additional information regarding operations.
	a. The plan should describe the amount of flow from diffusers. How will this configuration affect internal EFL flow patterns, and the amount of flow at Weir Gate C? i. Exelon should also include diffuser Gate C into the operation plan along with options for the operation of entrance Gate A. ii. Sufficient flow from the weir gate(s) is necessary to attract eels while maintaining velocities suitable for entry. The plan should also address the potential for attraction of eels into flow from the diffuser(s).	The weir and diffuser gates are open to allow eels the opportunity to enter the EFL via multiple locations; however, there will be no flow provided through the EFL diffusers or through the gates via the conventional operation of the EFL. Attraction flow to the CEECF will be provided from a separate water source. This flow will consist of 70 gpm of water discharged through the ramps attraction flow system as described in Section 3.2.1. Note that items have been added to the Operational Protocols list on page 12. Exelon has attached a copy of the PowerPoint presented at the October 15, 2020 EPAG meeting, which provides additional information regarding the operation of the temporary eel facility at the EFL (Appendix D).
	b. Prior to initial operation of the CEECF, operation flows should be observed and agreed to by agency representatives/personnel. Any subsequent modifications to flows or gate operations should also be observed and agreed to by agency representatives/personnel.	As described above, there will be no attraction flow provided through conventional operation of the EFL. Therefore, observation of flows is not necessary, aside from regular inspections made by the ramp operating staff. The magnitude (70 gpm) of attraction flow water for the eel ramp itself is provided based on the USFWS Fish Passage Engineering Design Criteria (2019).
	c. Entrance gates should be constructed with bar racks to reduce the number of predators accessing the EFL during the operation of the eel ramp.	The proposed eel ramp design does not require bar racks on the EFL entrance gates. The only EFL entrance gate that will be open during operation of

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	d. Internal and zone-of-passage (ZOP) flow modeling should be conducted at the CEECF to ensure no velocity barriers exist for American Eels. e. Monitoring- aeration of the collection tanks at the CEECF and CEECF should be performed unless DO is continuously monitored in those tanks.	the eel ramp will be Gate C. There is no provision within the MDE Settlement to modify the current EFL entrance gates with bar racks. There will be no attraction flow provided through conventional operation of the EFL. The 70-gpm magnitude of attraction flow water for the eel ramp itself is provided based on the USFWS Fish Passage Engineering Design Criteria (2019). The 70-gpm (0.16 cfs) attraction flow is not expected to form any velocity barriers within the EFL, so flow modeling is unnecessary. Daily DO checks and weekly downloads of continuous monitoring data will be performed. Aeration will be provided if DO monitoring indicates that it is necessary. See Section 3.2.1 for details.
3	3.4 Transport, 3.4.1 Design a. The plan should include density of eels in 19-liter buckets and 250-liter tank during transport to stocking locations. b. If density is same as in large tanks (10 eels per liter) then continuous DO monitoring is needed.	a. The density of eels in the transport buckets and transport tank are less than less than 10 juvenile eels per liter. Section 3.4 has been revised to clarify this. b. Eels are transported with continuous DO supply. This has been clarified in Section 3.4.2.
PADEP		
1	Page 10, Paragraph 2: Please provide description of maximum capacity of American Eels per unit of ramp area for CEECF.	The proposed eel ramp is 18 inches wide. Using the USFWS Fish Passage Engineering Design Criteria (2019) of a maximum capacity of 5,000 eels/day per inch of ramp width, assuming a mean eel size of 150 mm total length, equates to a capacity of 90,000 eels/day. This information has been added to page 11.
2	Table 3.5-1 Stocking Locations for Juvenile Eel in the Susquehanna River Watershed: Site #6 Fort Hunter should be Dauphin County not Perry County.	The county has been corrected in the table.
SRBC		

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1	In Table 3.5-1 , Site 9 refers to Rt. 29 bridge in Wilkes Barre. Rt. 29 crosses the Susquehanna River in Nanticoke and does not offer a safe offload point. Consider Nesbitt Park, Kingston PA for comparable alternative access (-75.8851, 41.2513).	Comment noted. This alternative access point has been added to Table 3.5-1.
2	In Table 6.1.1 Daily Operations Summary , in addition to the two listed items please include the following in daily reports: The number of eels transported or moved from the CEECF (even if zero), disposition (location and status) of any eels transported from the CEECF, any mortalities encountered at the CEECF or during transport.	These items are now included in the list of items for daily reports. (Note, this comment refers to Section 6.1.1, not Table 6.1.1.)
3	On page 10, paragraph two the document states: “During the 10 years of operation if the number of American Eels attempting to migrate to the CEECF exceeds the maximum capacity of American Eels per unit of ramp area, or if densities exceed 10 eels per L, the facility will be modified...” The “maximum capacity of American eels per unit of ramp area” needs a clear definition and determination on how this will be measured, by who and when.	The proposed eel ramp is 18 inches wide. Using the USFWS Fish Passage Engineering Design Criteria (2019) of a maximum capacity of 5,000 eels/day per inch of ramp width, assuming a mean eel size of 150 mm total length, the proposed ramp will have a capacity of 90,000 eels/day. This information has been added to page 11. During the 10 years of operation, if the number of American Eels attempting to migrate through the CEECF exceeds 90,000 eels per day, based on volumetric estimates, or if densities in the collection tank exceed 10 eels per L, the facility will be modified, or operational protocols adjusted to reduce crowding, in consultation with MDE, USFWS, and EPAG, and following approval from FERC.
USFWS		
1	Background , Page 2: Exelon states that the Conowingo East Eel Collection Facility (CEECF) (the temporary eel facility to be placed in the vicinity of the stilling basin at the East Fish Lift (EFL) will begin operation on May 1. This is inconsistent with the license and EFL operations. According to the license, operation of the CEECF will not commence until 10 days following the end of the operation of the EFL, as correctly stated in section 3.1.3.	The text in the Section 1 . Background has been corrected.
2	Reporting and Meetings , Page 23: Regarding eel transport in Sections 6.1.1 and 6.1.2, Exelon describes reporting on transport in the text but does not include the reporting on transport in the bulleted list of items to be included in the daily and annual reports. Transport information (i.e. number transported by date and location) should be included in bulleted lists for both sections.	Transport information has been added to the list of items to be included in the daily and annual reports on page 25.
3	Appendix E: Daily datasheets for transport efforts should be included in this section or added as a separate appendix item.	Daily transport sheets have been added to what is now Appendix E.

From: Kirk Smith
Sent: Wednesday, August 18, 2021 10:33 AM
To: Erin Redding; Danucalov, Andrea; Bleistine, Ray; Brett Coakley; Mike.Cox@ERM.com; David Frazier; Eberts, Ron; 'Eyler, Sheila'; 'Henning, Aaron'; denise.kehner@maryland.gov; Ian Kiraly; jesus_morales@fws.gov; Martinek, Michael; 'McCollum, Allyson'; 'McCorkle, Richard'; 'Miller, Jeremy'; 'Minkkinen, Steve'; Heather Nelson -MDE-; Tony Prochaska; 'Sadzinski, Robert'; David Seaborn -MDE-; 'Seaman, Shawn'; 'Slowik, Adam'; Smith, Fred; 'Steffy, Luanne'; 'Tryniewski, Joshua'; 'Williamson, Scott'
Subject: Exelon EPAG July Meeting Summary and August Meeting Agenda
Attachments: EPAG_Meeting_Summary_20210715.pdf; EPAG_Meeting_Agenda_20210819.pdf; Conowingo_Eel_Passage_and_Restoration_Plan_2021.pdf

Hello,

Please see the attached Exelon EPAG July 2021 Meeting Summary and August 2021 Meeting Agenda.

Also attached is a revised version of the *American Eel Passage and Restoration Plan* required by Article 415 of the new license. The plan was previously distributed in April 2021 and has been revised based on resource agency comments.

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Maryland DNR / Power Plant Research Program
Comments, Questions and Recommendations
Exelon's Proposed American Eel Passage and Restoration Plan

9/1/21

Received 9/2/2021

Section 2 – Project Configuration:

- 2nd Paragraph: Be consistent with acronym definitions (i.e. define WFL. Use of both WFL and West Fish Lift is below).
- 2nd Paragraph: Figure 2.0-1 should depict all that is described in the text (i.e. spillway, abutment sections, etc.)

Section 3.2.1 - Conowingo West Eel Collection Facility

- 2nd Paragraph: Suggest including the elevation of the normal high-water line in the text.
- 3rd Paragraph: What is defined as 'large 60% shade cloth'. Additional clarification is needed.

Section 3.2.1 - Octoraro Creek Eel Collection Facility

- 2nd Paragraph: Add angle to 90-degrees.
- 3rd Paragraph: Define L as Liter and use consistently throughout.

Section 3.2.1 - Conowingo East Eel Collection Facility

- How was the location of the ramp determined?
- Does the attraction water come off the top of the pond?
- What is the general difference in water temperatures during the summer? Water temperatures in the tailrace compared to the CEECF attraction water should be recorded.
- The plan should describe how predators prevented from entering the EFL?
- Clarify the amount of attraction water coming out of the entrance gate C and how that will be a signal for eels to enter the EFL
- The plan should describe the flows when the eel ramp will be pulled.
- Provide an approximate year of project initiation/operation startup. We realize this is defined in the schedule section but mention of it here is recommended.
- 2nd Paragraph last sentence: Sentenced needs to be edited. Use of with versus will.
- 3rd Paragraph:
 - o Include elevation of normal high-water line.
 - o 7th sentence: is it 'tailwater level', or 'existing tailwater elevation'.

Section 3.2.2 – Construction

- Provide an estimated construction date.

Section 3.2.3 – Operational Protocols: Intro

- Re: Operation of CEECF - Diffuser gates A & B are to be open. With only 70 gal/min 'attraction flow' it might be better to close them off to get max guidance in the open channel for any eels that enter the EFL.

- Section 3.2.3 references a schedule outlined in Section 4. Section 4 needs more detailed information detailing actual operation and monitoring schedules at all three facilities.

Section 3.2.3 – Operational Protocols: Monitoring

- Are there specific monitoring forms? If so, please include in the plan
- Continuous monitoring / alarm systems at both the OECK and CEECF should be considered for replacement instead of daily inspections.

Section 3.2.3 – Operational Protocols: Inspection

- Page 12 states: *if an inspection suggests that any structure or flow component is not performing properly and no alarm has been triggered, verification of this potential deviation will be performed as described above and corrective action will be taken as soon as possible.* The plan should define this process.
- Alarms are mentioned but not discussed in enough detail.
- Please reference or clarify use, operation, etc. of alarms.
- What defines a failed inspection?

Section 3.2.3 – Operational Protocols: Maintenance

- Will the CEECF ramp be accessible for daily clearing obstructions?
- Is there a process or specific procedure for scrubbing the collection tank?
- What triggers a determination that the ramp needs to be cleaned?
- Are there specific maintenance logs/sheets?
- Are they provided in this plan and where will they be stored?
- Is anyone qualified to conduct the monitoring and maintenance activities or will this be a requirement?

Section 3.3 – Holding (Conowingo West Eel Collection Facility)

- Include a reference that all eels transferred to holding tanks will be recorded on the daily inspection sheet.
- Maryland is concerned that the plan continues to recommend holding eels for seven days until water temperatures exceed 28°C on consecutive days. Eels in crowded conditions can become stressed and develop fungus, as has been observed. Eels should be transported within 48 hours of capture. A recommended alternative would be the transportation and stocking to the Conowingo Pond and Lake Aldred eels that, held 48 hours, when the number held does not meet the threshold for stocking at upriver locations.

Section 3.3.2 – Operational Protocols

- What is the QA/QC process associated with the inspection sheets such that holding time and temperatures are met for transport?

Section 3.3.2 – Operational Protocols / Monitoring

- What defines continuous? Operation is noted later as 24 hours a day 7 days a week. This implies that monitoring will be conducted non-stop during the collection season/operation.
- 2nd Paragraph: Please reference and maintain/update a contact list including operational personnel in the plan.
- 4th Paragraph: Is there an elevated concentration that will trigger an alarm or just the minimum?

Section 3.3.2 – Operational Protocols / Inspection

- Once per day? Continuous measurements on other systems and only daily for holding tanks? Please clarify.

Section 3.4.1 – Design

Conowingo West Eel Collection Facility

- How often is the water quality probe calibrated and maintained?
- Where are the calibration and maintenance forms located in this plan?
GLOBAL note for calibration forms as it is discussed in other sections of the plan
- Appendix F references engineering drawings for transport facility. Are there drawings for the 19-L buckets and enclosed transport tank?

Octoraro Creek Eel Collection Facility

- the holding tank has a capacity of 3,140 eels. The transport truck for more than 150 eels is a 250 liter tank which can transport 2,500 eels. In 2021, more than 2,500 eels were collected on July 13 – 3,474, 14 – 4,738 and 15 – 6,168. The plan should describe operations when more eels are collected in a single day than the holding tank or the transport tank can accommodate.
- How are the 19-L buckets loaded and transported?

Conowingo East Eel Collection Facility

- How are 19-L buckets transported?
- What are the plans to transport eels from CEECF to CEECF if a significant number of eels are collected? All in the 19-L bucket?

Section 3.4.2 Operation Protocols Monitoring (1st Paragraph):

- Is there a maximum amount of trips that are prohibitive per week based on staff or equipment limitations?
- Will this be an area of concern if the capacity of the holding tanks are continuously met and/or water temperatures exceed 28-degrees C?
- How are oxygen levels monitored and maintained?
- What is the calibration program for monitoring these levels?

Section 3.4.2 Operation Protocols Temperature

- Please provide additional detail on how the temperature will be monitored.

Section 3.4.2 Operation Protocols Dissolved Oxygen

- Regarding prior note on calibration protocols – this should be addressed in the plan.

Section 3.4.2 Operation Protocols Inspection (1st Paragraph)

- Please reference and provide an inspection check list.

Section 3.4.2 Operation Protocols Inspection (2nd Paragraph)

- How and where is this data recorded - data logger or field form?
- Please define the criteria for passing inspection. This is a vague statement.

Section 3.4.2 Operation Protocols Maintenance

- What is defined as the facility? Conowingo?
- Clarify the meaning here. Are you saying all tanks will be cleaned weekly?

Section 3.4.2 Operation Protocols American Eel Counting (1st Paragraph)

- Is it determined or recorded?

Section 3.4.2 Operation Protocols American Eel Counting (2nd Paragraph)

- What does this evaluation consider?
- Will all deceased eels float to the top of the tank or remain in the tank after release?
- At the release site how long is the area inspected to evaluate for mortality?
- Is the mortality evaluation process defined or is it subjective depending on the transport staff?

Section 3.6 – Emergency Response Protocols

- Maryland advises that if 95% survival is not achieved then modifications are deemed necessary.

Section 3.6.1 – Alarms and Contacts

- The contact list should be maintained, updated and provided in this plan.
- Is temperature included in the alarm system process?

Section 3.6.2 – Failed Inspections (2nd Paragraph)

- All inspections, passed or failed will be recorded how?
- Where are the forms/sheets documenting the inspections?

Section 3.7 – Quality Assurance and Quality Control

- A QA/QC plan should be developed and included as an appendix.
- Please define training requirements and how training records will be maintained.
- Table 3.5-1: In support of stocking locations, consider adding written directions and/or maps from Conowingo Dam to each of the stocking locations. In the event a new driver is needed how will they locate the site?

Section 4 – Implementation Schedule

- We believe the second sentence should be both CWECE and CEECF.

Section 6 – Reporting and Meetings

- Plan should identify (and be updated) as to which emails and staff receive these reports.
- Daily reports should include alarms, maintenance and cleaning operations that occurred if any

Section 6.1.2 - Annual Reports

- Draft reports for the CWEFC and CEEFC are proposed to be submitted on December 1 (up to Sept 15) and December 31 (16th to end of season). Final report filing dates are February 15. While time may be short between the end of the eel passage season and December 1, it is much preferable that there be only one report for the season.

Appendix I - Agency Consultation Records

General Comments #4

The recommended shakedown period was not intended for ramp efficiency (efficiency test) but to see if eels were attracted into the EFL and then to the ramp location. With additional attraction flow (See comment 1a below) a shakedown period will still be necessary. Tweaks are standard practice as indicated by the many tweaks and upgrades at the CWEFC and the shakedown periods for the rebuilt east and west fish lifts. Maryland would again strongly recommend a period of time when tweaks and upgrades be made and this time period not counted towards a fully functioning CEEFC evaluation period.

General Comments #8

Maryland disagrees with Exelon in that ramp efficiency testing technology is not available. Determining the efficiency of an eel ramp is feasible and has been done at a number of other projects. As Exelon described, a ramp efficiency test is simple. Enclose a known number of eels at the bottom of the ramp, which has been cleared of eels, and count the number in the capture/holding tank at the top over a fixed period such as 6, 12, 18, 24, etc. hours.

Ramp efficiency has been evaluated on three ladders at the Woronoco project (FERC # 2631) on the Westfield River in Massachusetts (Woronoco 2010 & 2012), at the Lawrence dam (FERC # 2800) on the Merrimack River in Massachusetts (Normandeau 2015), and on the Messalonskee Stream in Maine (Hickey 2012). In all cases, eelway efficiency was determined. At Woronoco the results were 99% in 96 hours at the North Ladder, 93% at the Middle Ladder in 66 hours, and 100% at the South Ladder in 18 hours. At the Lawrence Dam results after 36 hours were 55% and 32%. At the Automatic project on the Messalonskee Stream 97% efficiency was reported on the Enkamat side and 90% efficiency on the Plinko side. No times were reported.

Exelon states that where ramp efficiency tests have been done the results are mixed. That is true in that in the above projects two had high efficiencies and one was poor. Exelon expressed concern that eels infiltrating the eelway might affect the result as happened at Lawrence. The report surmises that eels at Lawrence may have infiltrated the ramp due to gaps in the wooden channel where sections were joined or were not detected under the substrate which was not checked prior to the tests. Infiltration would not be an issue at the ramps at Conowingo as they

are aluminum trays with a climbing material where all eels in the ramp could be observed and removed prior to the test. Any concerns with shutting down the west ramp could be mitigated by installing a temporary ramp or scheduling the test when eels movement is expected to be low.

Specific Comments 1a

Maryland disagrees with the proposed attraction flow for the eel ramp (70 gpm) which results in 0.16 cfs. This ramp must attract eels away from the flow from the turbines and leakage from the spill and into the EFL; 70 gpm is virtually no attraction flow and therefore must be increased to a flow such that eels are attracted into the EFL.

Specific Comments 1b

Night time observations are reasonable as a means of observing eels in the EFL to note concentration locations and to compare observations with captures.

Specific Comments 2a

Closing diffusers would direct flow to the open channel providing a stronger signal in the open channel to guide eels to the ramp.

Specific Comments 2b

As noted above, 70 gal/min is insufficient to attract eels into the EFL. It is concerning that Exelon has proposed an eelway with no attraction flow beyond ramp and side splash flows.

Specific Comment 2c

That there is no provision in settlement to include bar racks is does not justify rejecting them.. Many modifications to both fishways have been included as designs are developed. Adding slots for bar racks is a less than minor modification to protect eels from snakeheads and other invasives lying in wait in the EFL.

References

Hickey, S.J. January 26, 2012. Letter to Mr. Steven Shepard, USFWS. Kennebec Water District Upstream and Downstream Proposal. Pg. 4.

Normandeau. 2015. Assessment of eel pass effectiveness at the Lawrence hydroelectric project (FERC No. 2800), Merrimack River, Lawrence, MA.

Woronoco Hydro. 2010. Report on the 2009 testing of the upstream passage for juvenile American eels phase i – passability testing and site observations. FERC # 2631. Accession No. 20110131-5111.

Woronoco Hydro. 2012. Report on the 2011 testing of the upstream passage of juvenile eels, Phase 1 Passability tests of all eel ladders and repeat of Phase II attractiveness testing and observations –article 404. FERC # 2631. Accession No. 20120229-5139.

From: Miller, Jeremy <jeremmille@pa.gov>

Sent: Friday, September 3, 2021 6:32 AM

To: Danucalov, Andrea H:(Exelon Power) <Andrea.Danucalov@exeloncorp.com>

Cc: Eberts, Ron <reberts@pa.gov>; Williamson, Scott <scwilliams@pa.gov>

Subject: RE: [External] American Eel Passage and Restoration Plan

Andrea,

DEP has reviewed the revised Conowingo American Eel Passage and Restoration Plan dated August 2021 and have no further comments or questions.

Thank you for the opportunity to review.

Jeremy

Jeremy Miller | Aquatic Biologist

Department of Environmental Protection | Clean Water Program

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DEP's 24-hour Emergency Response Number is 1.800.541.2050

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Agency Comments on August 18, 2021 Draft and Exelon Responses

Comment		How Addressed
MDE & MDNR, Received September 2, 2021		
Section 2 – Project Configuration		
1	2nd Paragraph: Be consistent with acronym definitions (i.e. define WFL. Use of both WFL and West Fish Lift is below).	WFL has been removed from the document.
2	2nd Paragraph: Figure 2.0-1 should depict all that is described in the text (i.e. spillway, abutment sections, etc.)	This figure has been updated.
Section 3.2.1 - Conowingo West Eel Collection Facility		
3	2nd Paragraph: Suggest including the elevation of the normal high-water line in the text.	The elevation of the normal high-water line has been added to the text.
4	3rd Paragraph: What is defined as ‘large 60% shade cloth’. Additional clarification is needed.	The percentage listed refers to the percentage of sunlight and corresponding UV rays that are blocked by the shade cloth. This explanation has been added as a footnote to the text.
Section 3.2.1 - Octoraro Creek Eel Collection Facility		
5	2nd Paragraph: Add angle to 90-degrees.	The word “angle” has been added to the text.
6	3rd Paragraph: Define L as Liter and use consistently throughout.	L is defined as liter in Section 3.2.1, the first paragraph under Conowingo West Eel Collection Facility. The document has been checked for consistency as liter has been replaced with L in one location within the document.
Section 3.2.1 - Conowingo East Eel Collection Facility		

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	Comment	How Addressed
7	How was the location of the ramp determined?	The MDE Settlement Joint Explanatory Statement, Section A.2.a.i says, “Exelon will develop an ‘Eel Passage and Restoration Plan’ that will (i) provide for modification of the EFL to accommodate a temporary eel trapping facility in the EFL stilling basin (the ‘Temporary Eel Trapping Facility’). The MDE Settlement Draft License Article Eel Passage says, “The Eel Passage and Restoration Plan shall include (i) detailed plans for modifications to the East Fish Lift to specifically accommodate a temporary eel trapping facility at a location within the East Fish Lift stilling basin in the vicinity of the foot of the spillway (‘EFL Eel Temporary Modifications’).” Due to the language of the MDE Settlement draft license article, Article 415 then specifically calls for a temporary eel trapping facility at a location within the East Fish stilling basin. The MDE Settlement is referenced in Section 3.1.3. The stilling basin location allows for a water source, power source, and safety from vandalism. No facility can be placed below the spillway itself due to safety concerns. The CEECF is considered experimental and temporary. The design for the CEECF is not finalized and will be developed further, as necessary, in consultation with the resource agencies, after the design of the EFL modifications for American Shad and river herring are complete.
8	Does the attraction water come off the top of the pond?	Attraction flow water to the CEECF comes from a 6-inch gravity feed water line from the headpond near elevation 100.7 feet (full pond elevation is 109.2 feet) to valve located near the EFL. Then the water line is reduced to a 2-inch line to feed the CEECF.

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	Comment	How Addressed
9	What is the general difference in water temperatures during the summer? Water temperatures in the tailrace compared to the CEECF attraction water should be recorded.	Available data from Exelon’s 2010 water quality study ¹⁸ conducted during relicensing indicates there is little to no thermal stratification during summer in Conowingo Pond at sampling locations near the dam. In addition, a comparison of water temperatures measured at monitoring locations throughout the water column just upstream of the dam indicated that temperatures were comparable to those measured in the tailrace at monitoring station 643. Water temperature from the continuous monitor located in the collection tank can be compared to temperature data recorded in the tailrace at monitoring station 643.
10	The plan should describe how predators prevented from entering the EFL?	Predators will not be excluded from the EFL but will be excluded from the diffuser pits and above the crowder screen hoist by grating with 7/8-inch opening. This grating opening may change depending on the final design of the EFL modifications.
11	Clarify the amount of attraction water coming out of the entrance gate C and how that will be a signal for eels to enter the EFL	The attraction flow out of entrance gate C will be 265 L-per-minute. This is the same amount of attraction flow used at the CEECF, which as of September 2021 had captured over 580,000 moving along the west side of the tailrace, along the margin of the main generation flow. The CEECF is intended to collect eels that may move along the east side of the tailrace to the EFL entrances along the margin of the main generation flow. The amount of attraction flow has been added to Section 3.2.1 .
12	The plan should describe the flows when the eel ramp will be pulled.	The ramp should be pulled when flows are forecasted to exceed 113,000 cfs. This has been added to Section 3.2.3 . The ramp will be redeployed once flows have receded to a level that allow for safe access.

¹⁸ Normandeau Associates, Inc. and Gomez and Sullivan Engineers, P.C., 2012. Seasonal and Diurnal Water Quality in Conowingo Pond and Below Conowingo Dam.

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Comment	How Addressed
13 Provide an approximate year of project initiation/operation startup. We realize this is defined in the schedule section but mention of it here is recommended.	The construction schedule for the EFL modifications for river herring and American Shad has not been finalized. The CEECF will be installed after the EFL modifications are complete. Exelon will provide schedule updates at a minimum during the annual EPAG meetings and will also update this plan accordingly and submit it to the resource agencies for review and FERC for approval. Exelon also participates in monthly design-planning meetings with resource agencies, and schedule is discussed during these meetings. This has been added to Section 3.2.1.
14 2nd Paragraph last sentence: Sentenced needs to be edited. Use of with versus will.	This sentence has been corrected.
15 3rd Paragraph: Include elevation of normal high-water line. 7th sentence: is it ‘tailwater level’, or ‘existing tailwater elevation’.	This sentence has been revised to reference the elevation of the base of the ramp (+/-17.8 ft) relative to the minimum tailwater elevation (+/-12.9 ft) expected to occur during the operational season for the CEECF (mid-June to early November).
Section 3.2.2 – Construction	
16 Provide an estimated construction date.	The construction schedule for the EFL modifications for river herring and American Shad has not been finalized. The CEECF will be installed after the EFL modifications are complete. Exelon will provide schedule updates at a minimum during the annual EPAG meetings and will also update this plan accordingly and submit it to the resource agencies for review and FERC for approval. Exelon also participates in monthly design-planning meetings with resource agencies, and schedule is discussed during these meetings.
Section 3.2.3 – Operational Protocols: Intro	

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Comment	How Addressed
17 Re: Operation of CEECF - Diffuser gates A & B are to be open. With only 70 gal/min 'attraction flow' it might be better to close them off to get max guidance in the open channel for any eels that enter the EFL.	If eels are near the bottom of the channel, having the Diffuser C open will help guide eels into the stilling basin, otherwise they could become trapped in this area and have no way out. The situation is similar at the Crowder Area Gate. Leaving Diffuser Gate A and B open along with Crowder Area Gate will allow eels to reach the CEECF, without becoming isolated and trapped in these passages.
18 Section 3.2.3 references a schedule outlined in Section 4. Section 4 needs more detailed information detailing actual operation and monitoring schedules at all three facilities.	Section 3.2.3 should refer to Section 5, which outlines the annual schedule and duration of operation at each of the facilities. The text has been revised to reflect this. Monitoring schedules are outlined in Section 3.2.3 under the monitoring subheading.
Section 3.2.3 – Operational Protocols: Monitoring	
19 Are there specific monitoring forms? If so, please include in the plan	The CWECF Daily Field Sheet is included in Appendix E .
20 Continuous monitoring / alarm systems at both the OECF and CEECF should be considered for replacement instead of daily inspections.	30-minute readings of temperature and DO will be recorded using an Onset HOB0 Probe in the collection tanks at both the CEECF and OECF. These data are downloaded and reviewed regularly to identify any water quality related issues with the operation of the facilities. Daily inspections by operation staff are an important component of maintaining the proper functioning of each facility, and Exelon does not believe discontinuing these procedures would be appropriate.
Section 3.2.3 – Operational Protocols: Inspection	
21 Page 12 states: if an inspection suggests that any structure or flow component is not performing properly and no alarm has been triggered, verification of this potential deviation will be performed as described above and corrective action will be taken as soon as possible. The plan should define this process.	Items such as faulty or incorrectly positioned attraction flow hoses or components such as a spray bar incorrectly spraying water due to blockages of the holes, etc. are examples of items included in the visual inspection. These items are not identifiable by the alarm system and must be covered during the daily inspections. Observed anomalies are recorded on the Daily Field Sheet. The CWECF Daily Field Sheet is included in Appendix E .

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Comment		How Addressed
22	Alarms are mentioned but not discussed in enough detail.	Text has been added to Section 3.2.3 (Monitoring).
23	Please reference or clarify use, operation, etc. of alarms.	Refer to text in Section 3.2.3 (Monitoring).
24	What defines a failed inspection?	The term failed inspection refers to when a facility is not operating as intended. This term and Section 3.6.2 have been revised for clarity.
Section 3.2.3 – Operational Protocols: Maintenance		
25	Will the CEECF ramp be accessible for daily clearing obstructions?	The ramp will be accessible; however, very few obstructions are anticipated to be found near the ramp area due to trash racks preventing debris from entering through the gravity feed line and no debris are expected to enter the stilling basin due to the elevation of the EFL walls that surround it.
26	Is there a process or specific procedure for scrubbing the collection tank?	Scrubbing the tanks is performed with water, a brush, and scouring pad. No chemicals are used.
27	What triggers a determination that the ramp needs to be cleaned?	The ramp will need to be cleaned if debris block or hinders passage of eels at the entrance or on the ramp.
28	Are there specific maintenance logs/sheets?	The Daily Field Sheet is used to record all information including any issues that might be observed. There is also a weekly calibration sheet that is used to verify that the eel ramp equipment is working properly.
29	Are they provided in this plan and where will they be stored?	Data sheets are in Appendix E . They are stored in files at Normandeau's office and data are digitized.
30	Is anyone qualified to conduct the monitoring and maintenance activities or will this be a requirement?	The eel ramps are checked daily by experienced personnel. If a new employee is used to assist with the ramp checks, that employee is always teamed and trained by an experienced member of the maintenance staff.
Section 3.3 – Holding (Conowingo West Eel Collection Facility)		
31	Include a reference that all eels transferred to holding tanks will be recorded on the daily inspection sheet.	This reference has been added.

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	Comment	How Addressed
32	Maryland is concerned that the plan continues to recommend holding eels for seven days until water temperatures exceed 28°C on consecutive days. Eels in crowded conditions can become stressed and develop fungus, as has been observed. Eels should be transported within 48 hours of capture. A recommended alternative would be the transportation and stocking to the Conowingo Pond and Lake Aldred eels that, held 48 hours, when the number held does not meet the threshold for stocking at upriver locations.	Health of eels in holding is a top priority. The Muddy Run Eel Passage Plan call for weekly transport, but EPAG agreed that transports should occur twice per week starting in mid-June and continue through September 15. Daily transports are conducted pre-emptively before water temperatures exceed 28°C or eels become crowded. SRBC has traditionally suggesting stocking locations and the locations are approved by EPAG. Alternative stocking approaches can be discussed during annual meetings with EPAG and MDE. Exelon would propose 100 eels in holding over a 48-hour period as a threshold to determine transport to Conowingo Pond and Lake Aldred versus locations further upstream.
	Section 3.3.2 – Operational Protocols	
33	What is the QA/QC process associated with the inspection sheets such that holding time and temperatures are met for transport?	The CWECF is maintained daily and decisions to transport are made in real-time based on eel condition, environmental conditions, and the number of eels in holding. A transport vehicle is on-site to facilitate the ability to conduct transports as needed.
	Section 3.3.2 – Operational Protocols / Monitoring	
34	What defines continuous? Operation is noted later as 24 hours a day 7 days a week. This implies that monitoring will be conducted non-stop during the collection season/operation.	Flow, DO, and temperature are monitored and recorded continuously at the CWECF holding tanks. These meters are in place throughout the entire collection season and operate 24/7.
35	2nd Paragraph: Please reference and maintain/update a contact list including operational personnel in the plan.	Contact lists are updated regularly and will be distributed to resource agencies, Station staff, and contractors each season.
36	4th Paragraph: Is there an elevated concentration that will trigger an alarm or just the minimum?	The upper DO threshold is 20 ppm. This has been added to the text.
37	Section 3.3.2 – Operational Protocols / Inspection Once per day? Continuous measurements on other systems and only daily for holding tanks? Please clarify.	Eel tanks are typically checked every morning. Continuous measurements of temperature, flow and DO are recorded for the holding tanks, as well as the collection tank.
	Section 3.4.1 – Design	

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Comment		How Addressed
Conowingo West Eel Collection Facility		
38	How often is the water quality probe calibrated and maintained?	Water quality data are downloaded weekly. The probe is checked weekly versus a calibrated meter, and then the probe is calibrated, as necessary.
39	Where are the calibration and maintenance forms located in this plan? <i>GLOBAL note for calibration forms as it is discussed in other sections of the plan</i>	This form has been added to Appendix E .
40	Appendix F references engineering drawings for transport facility. Are there drawings for the 19-L buckets and enclosed transport tank?	There are no engineering drawings for the 19-L buckets or the smaller enclosed transport tank. Pictures of these have been provided in Appendix E .
Octoraro Creek Eel Collection Facility		
41	The holding tank has a capacity of 3,140 eels. The transport truck for more than 150 eels is a 250 liter tank which can transport 2,500 eels. In 2021, more than 2,500 eels were collected on July 13 – 3,474, 14 – 4,738 and 15 – 6,168. The plan should describe operations when more eels are collected in a single day than the holding tank or the transport tank can accommodate.	Under these circumstances, multiple trips to transport eels from the OECF to the CWFECF holding tanks are made. This has description has been included in text in Section 3.4.1 .
42	How are the 19-L buckets loaded and transported?	The 19-L buckets are manually loaded into a custom-made bucket holder that keeps the buckets from tipping over during transport via a small cart.
Conowingo East Eel Collection Facility		
43	How are 19-L buckets transported?	A small cart will be used to transport buckets or the 250-L transport tank from the EFL area to the CWFECF holding tanks.
44	What are the plans to transport eels from CEECF to CWFECF if a significant number of eels are collected? All in the 19-L bucket?	All the eels will be transported in the 19-L buckets or the 250-L transport tank with supplied oxygen.
Section 3.4.2 Operation Protocols Monitoring (1st Paragraph):		
45	Will this be an area of concern if the capacity of the holding tanks are continuously met and/or water temperatures exceed 28-degrees C?	Daily transports will occur if water temperatures exceed 28°C, and multiple daily transports could occur if holding capacity is expected to be exceeded at the CWFECF.

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	Comment	How Addressed
46	How are oxygen levels monitored and maintained?	At the CWECF, oxygen levels are continuously monitored by a probe. The results are automatically sent to a control panel, which is connected to the Conowingo control room. At the OECF, oxygen levels and water temperature are monitored with an Onset HOBO Probe. Oxygen levels are maintained at the CWECF and will be maintained at the CEECF with an oxygen bottle, regulator, and micro-pore diffuser. Currently, there is no oxygen bottle at OCEF, but there are two battery-powered bubblers that provide DO augmentation to the collection tank. Oxygen levels in the transport tank are maintained with oxygen bottle, regulator, and diffuser.
47	What is the calibration program for monitoring these levels?	Probes (CWECF and transport tank) and Onset HOBO Probes (OECF) are checked and calibrated weekly, and data, where applicable, are downloaded weekly.
48	Section 3.4.2 Operation Protocols Temperature Please provide additional detail on how the temperature will be monitored.	During transport events, water temperature is monitored with the same meter used to monitor DO; the probe measures both parameters.
49	Section 3.4.2 Operation Protocols Dissolved Oxygen Regarding prior note on calibration protocols – this should be addressed in the plan.	See response to Comment # 47.
50	Section 3.4.2 Operation Protocols Inspection (1st Paragraph) Please reference and provide an inspection check list.	Refer to Transport Data Sheet in Appendix E .
	Section 3.4.2 Operation Protocols Inspection (2nd Paragraph)	
51	How and where is this data recorded - data logger or field form?	Refer to Transport Data Sheet in Appendix E .
52	Please define the criteria for passing inspection. This is a vague statement.	The first sentence under Inspection has been changed to read, “Prior to each trip, the transport truck and associated equipment will be inspected to confirm that all equipment is operating as intended.”
	Section 3.4.2 Operation Protocols Maintenance	
53	What is defined as the facility? Conowingo?	The term “facility” has been edited to “CWECF”.

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	Comment	How Addressed
54	Clarify the meaning here. Are you saying all tanks will be cleaned weekly?	All tanks that are in use will be cleaned at least weekly.
55	Section 3.4.2 Operation Protocols American Eel Counting (1st Paragraph)	The text has been revised to use the term “recorded.”
	Is it determined or recorded?	
	Section 3.4.2 Operation Protocols American Eel Counting (2nd Paragraph)	
56	What does this evaluation consider?	Mortality is not an evaluation but rather a determination. The term has been changed in the text.
57	Will all deceased eels float to the top of the tank or remain in the tank after release?	Freshly dead eels sink. They are removed by netting. Only when a small proportion of eels are left in the holding tank are they flushed. All eels are checked prior to loading into transport tank.
58	At the release site how long is the area inspected to evaluate for mortality?	The stocking location is monitored until the water returns to pre-stocking conditions (i.e. water and sediment have settled following stocking). Most eels will seek cover as soon as they are stocked. Eels that have died will be visible lying belly-up and motionless on the stream bottom. Dead eels are retrieved by the stocking crew when access allows.
59	Is the mortality evaluation process defined or is it subjective depending on the transport staff?	The word evaluated has been changed to “determined”. An eel is either “alive “or “dead”, hence there is no subjectivity.
60	Section 3.6 – Emergency Response Protocols	As stated in the plan, Exelon will meet with resource agencies to develop appropriate modifications for the facilities, if the survival goal is not met. In previous years of operation of the CWECF and OECF facilities, Exelon has met the 95% survival standard each year.
	Maryland advises that if 95% survival is not achieved then modifications are deemed necessary.	
	Section 3.6.1 – Alarms and Contacts	
61	The contact list should be maintained, updated and provided in this plan.	Contact lists are updated regularly and will be distributed to resource agencies, Station staff, and contractors each season.
62	Is temperature included in the alarm system process?	There is no temperature alarm, as temperature cannot be adjusted. However, temperature is monitored continuously and recorded. Eel condition and daily water temperature are used to inform the transport schedule.

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Comment		How Addressed
Section 3.6.2 – Failed Inspections (2nd Paragraph)		Section 3.6.2 has been renamed Inspection Response, which is more accurate than Failed Inspections Protocols.
63	All inspections, passed or failed will be recorded how?	Notes detailing the issue will be recorded in the Comments section of the Daily Field Sheet or the Transport Sheet.
64	Where are the forms/sheets documenting the inspections?	The forms are included in Appendix E .
Section 3.7 – Quality Assurance and Quality Control		
65	A QA/QC plan should be developed and included as an appendix.	The QA/QC measures related to the eel program are described throughout Section 3 of this document for each facility, and inspection forms and data sheets are included as Appendices.
66	Please define training requirements and how training records will be maintained.	Supervising biologist train new staff members, who are subject to internal review. Most of the training is hands-on. A new or inexperienced staff member never leads the daily crew. Additionally, all operating personnel are required to read and understand the Conowingo Fishway Operation and Maintenance Plan.
67	Table 3.5-1 : In support of stocking locations, consider adding written directions and/or maps from Conowingo Dam to each of the stocking locations. In the event a new driver is needed how will they locate the site?	All “drivers” are biologists with several seasons of experience. Maps are no longer required as most cell phones have apps for directions and rerouting capabilities when a specific road is closed due to accidents, etc.
68	Section 4 – Implementation Schedule We believe the second sentence should be both CWECE and CEECE.	This sentence has been revised for clarity. It is only referring to the CWECE. The CEECE will begin operation one year after the EFL modifications are complete.
Section 6 – Reporting and Meetings		
70	Plan should identify (and be updated) as to which emails and staff receive these reports.	Confidential contact lists including Exelon staff, consultants, and resource agencies, are kept separately from this publicly accessible report. Contact lists are updated regularly.

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Comment	How Addressed
71 Daily reports should include alarms, maintenance and cleaning operations that occurred if any	It is preferable to detail these issues if they occur in a section of the annual report. Exelon does notify the resource agencies when there is an issue with any of the eel ramps by email. The daily emails should be succinct and brief unless an unexpected situation arises.
72 Section 6.1.2 - Annual Reports Draft reports for the CWECE and CEECE are proposed to be submitted on December 1 (up to Sept 15) and December 31 (16th to end of season). Final report filing dates are February 15. While time may be short between the end of the eel passage season and December 1, it is much preferable that there be only one report for the season.	The Muddy Run Pumped Storage Project License Appendix A requires Exelon to submit draft annual reports to resource agencies for the CWECE and OECF summarizing eel facility data by December 10 each year and final reports to FERC by January 15. MDE, PADEP, SRBC, and USFWS were consulted regarding draft report submission during a meeting on October 1, 2020. Exelon stated at that time that providing a quality draft report by December 10 that covers the longer MDE-defined season at CWECE is not feasible and proposed submitting only one draft report at a later date. However, PADEP and USFWS agreed that a draft report must still be submitted by December 10 per the Muddy Run License. They acknowledged that including additional data from operations through mid-November was not feasible and it was agreed that additional September 16 through early November data should be added to the report later as an addendum. The addendum will not include additional biological data. MDE asked if the interim draft would be provided to them and Exelon agreed that all eel facility interim draft reports would be provided to all resource agencies.
Appendix I - Agency Consultation Records	

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	Comment	How Addressed
73	General Comments #4 The recommended shakedown period was not intended for ramp efficiency (efficiency test) but to see if eels were attracted into the EFL and then to the ramp location. With additional attraction flow (See comment 1a below) a shakedown period will still be necessary. Tweaks are standard practice as indicated by the many tweaks and upgrades at the CWEFC and the shakedown periods for the rebuilt east and west fish lifts. Maryland would again strongly recommend a period of time when tweaks and upgrades be made and this time period not counted towards a fully functioning CEEFC evaluation period.	The CEECF is an experimental ramp. Exelon is proposing to begin operation of the ramp as outlined in this Plan. Adjustments to the attraction flow and other operational parameters can be considered at annual EPAG meetings, as necessary, after the initial installation and operation of the CEECF is evaluated.
74	General Comments #8 Maryland disagrees with Exelon in that ramp efficiency testing technology is not available. Determining the efficiency of an eel ramp is feasible and has been done at a number of other projects. As Exelon described, a ramp efficiency test is simple. Enclose a known number of eels at the bottom of the ramp, which has been cleared of eels, and count the number in the capture/holding tank at the top over a fixed period such as 6, 12, 18, 24, etc. hours. Ramp efficiency has been evaluated on three ladders at the Woronoco project (FERC # 2631) on the Westfield River in Massachusetts (Woronoco 2010 & 2012), at the Lawrence dam (FERC # 2800) on the Merrimack River in Massachusetts (Normandeau 2015), and on the Messalonskee Stream in Maine (Hickey 2012). In all cases, eelway efficiency was determined. At Woronoco the results were 99% in 96 hours at the North Ladder, 93% at the Middle Ladder in 66 hours, and 100% at the South Ladder in 18 hours. At the Lawrence Dam results after 36 hours were 55% and 32%. At the Automatic project on the Messalonskee Stream 97% efficiency was reported on the Enkamat side and 90% efficiency on the Plinko side. No times were reported. Exelon states that where ramp efficiency tests have been done the results are mixed. That is true in that in the above projects two had high efficiencies and one was poor. Exelon expressed concern that eels infiltrating the eelway might affect the result as happened at Lawrence. The report surmises that eels at Lawrence may have infiltrated the ramp due to gaps in the wooden channel where sections were joined or were not detected under the substrate which was not checked prior to the tests. Infiltration would not be an issue at the ramps at Conowingo as they are aluminum trays with a climbing material where all eels in the ramp could be observed and removed prior to the test. Any concerns with shutting down the west ramp could be mitigated by installing a temporary ramp or scheduling the test when eels movement is expected to be low.	Exelon would prefer to complete attraction efficiency and ramp efficiency testing using a single, proven technology. Proven technology for attraction efficiency (such as appropriately sized tags) is not available. Discussion of technological developments will continue at annual EPAG meetings with resource agencies. Regarding ramp efficiency only, Exelon will draft a study plan for an efficiency test in 2022, as suggested by MDE. The draft study plan will be provided to EPAG members and USFWS and will be implemented following approval of this Plan.

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Comment		How Addressed
75	Specific Comments 1a Maryland disagrees with the proposed attraction flow for the eel ramp (70 gpm) which results in 0.16 cfs. This ramp must attract eels away from the flow from the turbines and leakage from the spill and into the EFL; 70 gpm is virtually no attraction flow and therefore must be increased to a flow such that eels are attracted into the EFL.	The CWECF currently operates with the same attraction flow as proposed for the CEECF. The CWECF must also attract eels away from turbines and up the riprap on the streambank. In 2021, over 580,000 eels (as of September) were captured at the CWECF. The CEECF is an experimental ramp. Exelon is proposing to begin operation of the ramp with the 265 L-per-minute (70-gpm) attraction flow. Adjustments to the attraction flow can be considered annually at EPAG meetings, as necessary, after the initial installation and operation of the CEECF is evaluated.
76	Specific Comments 1b Night time observations are reasonable as a means of observing eels in the EFL to note concentration locations and to compare observations with captures.	Exelon is proposing that the need for nighttime observations be discussed after initial installation and operation of the CEECF. The scope and level of effort for any nighttime observations can be discussed annually at EPAG meetings and implemented accordingly.
77	Specific Comments 2a Closing diffusers would direct flow to the open channel providing a stronger signal in the open channel to guide eels to the ramp.	Exelon is proposing to begin the initial operation of the CEECF with the diffusers opened. Alternative diffuser gate settings can be considered annually at EPAG meetings, as necessary, after the initial installation and operation of the CEECF is evaluated.
78	Specific Comments 2b As noted above, 70 gal/min is insufficient to attract eels into the EFL. It is concerning that Exelon has proposed an eelway with no attraction flow beyond ramp and side splash flows.	The CWECF currently operates with the same attraction flow as proposed for the CEECF. The CWECF must also attract eels away from turbines and up the riprap on the streambank. In 2021, over 580,000 eels were captured at the CWECF by early September. The CEECF is an experimental ramp. Exelon is proposing to begin operation of the ramp with the 265 L-per-minute (70-gpm) attraction flow. Adjustments to the attraction flow can be considered annually at EPAG meetings, as necessary, after the initial installation and operation of the CEECF is evaluated.

Conowingo Hydroelectric Project
FERC Project Number 405
American Eel Passage and Restoration Plan

Comment		How Addressed
79	Specific Comment 2c That there is no provision in settlement to include bar racks is does not justify rejecting them. Many modifications to both fishways have been included as designs are developed. Adding slots for bar racks is a less than minor modification to protect eels from snakeheads and other invasives lying in wait in the EFL.	Predators will be excluded from the diffuser pits and above the crowder screen hoist by grating with 7/8-inch opening. This grating opening may change depending on the final design of the EFL modifications. Exelon will consider the need for additional predator exclusion devices (i.e., bar racks on the C gate entrance) as part of the EFL modification design process for American Shad and river herring. Any design must consider worker safety and access constraints during installation and removal of the bar racks.

APPENDIX I. AGENCY COMMENTS AND RESPONSIVENESS SUMMARY

Appendix I Table of Contents

November 2022 Draft FOMP – Resource Agency Comment Responsiveness Summary

November 2022 Draft FOMP – Resource Agency Comment Letters

**Conowingo Hydroelectric Project
FERC Project Number 405
Fishway Operation and Maintenance Plan**

November 2022 Draft FOMP – Resource Agency Comment Responsiveness Summary

Comment	Response
MDE in coordination with MDNR, dated December 16, 2022,	
Appendices- Please update the appendices and only include what is needed for the revised plan (e.g., is the Whoosh System Information still valid in 2023?)	Appendix B (Whoosh System Information has been removed.
Introduction Paragraph 6 – Last Sentence· Is it assumed that reassessment will be based on an estimate of the actual fish count? Please clarify.	Reassessment will be based on the total number of those fish transported, not on the actual fish count since some fish are sacrificed for biological information and some fish die during holding events or during lift operations. Fish transport numbers will vary throughout the season due to variations in the daily fish catch at each fish lift.
Section 3.1: Turbine Start-Up and Operation· Please provide clarifying text (i.e. give an example) that defines/explains the sequence in relation to Unit No. On and Unit No. Off. Without this description/explanation, the reader is likely to get confused as to why in the 6th Sequence Unit No. 11 is both On and Off.	The text in Section 3.1 and Table 3.1-1 have been revised to clarify the turbine operation order.
Section 4.3.1.1 West Fish Lift Third Paragraph · Please clarify that the hopper isn't lowered into the hopper bay while fish are present in the bay. · Please rephrase/define the process (i.e. state that the crowder doors have remained closed overnight since the last lift (i.e. unlikely any fish will be in the hopper bay).	Text has been added to Section 4.3.1.1. Please note that the hopper may be lowered when fish are present in the hopper pit, but the hopper door, located on the bottom of the hopper is open as it is lowered slowly to the bottom and fish can and do escape through the open door or around the sides of the hopper during its descent. The WFL crowder doors do remain closed overnight, but our experience has shown that some fish are able to enter the crowder channel with the doors closed. Divers have inspected

**Conowingo Hydroelectric Project
FERC Project Number 405
Fishway Operation and Maintenance Plan**

	the WFL several times but have not been able to determine how fish bypass the crowder doors. We anticipate that the WFL modifications will alleviate this issue.
Section 4.3.1.2 East Fish Lift Second Paragraph · This version of the report can be edited as to not reflect volitional passage (i.e., for 2023) · Refer to similar note from Section 4.3.1.1 re: potential presence of fish in the hopper bay prior to lowering the hopper. · Please clarify if there is a 'clean out' lift for the EFL? If not, please define why for the WFL and not the EFL?	Text has been edited in Section 4.3.1.2. References to volitional passage has been removed. The EFL has a crowder hoist screen which is lowered prior to the hopper being raised out of the channel. The crowder hoist screen stays down to prevent fish from entering the hopper pit area until the hopper is placed back down in the hopper pit. The crowder hoist screen is then raised allowing fish to enter hopper area. There is no “clean out” lift for the EFL because of the crowder hoist screen prevents fish from entering hopper area overnight. The current WFL does not have a crowder hoist screen and some fish have been known to get passed the closed crowder doors at the WFL.
Section 4.3.2.1 West Fish Lift · Please define how debris is removed when ‘occasional cleaning is needed’?	Text has been added to Section 4.3.2.1 to define debris removal.
Section 4.5.1 First Paragraph · Please provide a time frame of when the contact list will be posted and how often it will be updated.	Text has been added to Section 4.5.1 to define time frame of the contact list and when it will be updated.
USFWS, dated December 16, 2022	
In the Introduction, it would be helpful to provide a brief bulleted list of items that have changed in this FOMP compared to the previous FOMP.	A list has been added in Section 1.0 describing major items that have changed with the annual revision of the FOMP.

**Conowingo Hydroelectric Project
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Section 4.3.1.1: Although it is assumed, it may be useful to new readers to indicate that all fish not removed for transport or for AIS disposal are returned to the tailrace.	Text has been added to Section 4.3.1.1.
Section 4.6: Bullet 2 – Daily water temperature and dissolved oxygen (DO, after May 1) data are to be collected daily at the fish lifts and in the tailwater area. Those data were not fully collected/reported in the 2022 FOMP Report. In 2023, daily water temperature collection and reporting should occur for each day (including nonoperational days) of the fish passage season. In addition, if water temperatures are collected at Station 643 after May 1, please include those data in the annual report in addition to temperatures collected daily at the WFL. Temperature data from Station 643 should not replace WFL temperature monitoring unless concurrent sampling at both stations can demonstrate that similar data are collected at both locations. In addition, tracking DO concentrations in water flowing from Conowingo Pond into the WFL is critical to ensuring that sufficient DO concentrations are present for fish entering the WFL during the latter (warmer) part of the season. The Service requests collection of DO data to occur daily at the WFL location during the entire fish passage season. Monitoring of DO at the WFL could be discontinued after May 1 if concurrent sampling between the WFL and Station 643 show similar data are being collected at both locations.	Text has been added to Section 4.6 Bullet 2. Daily water temperature will be collected at 1100 hours during the fish passage season outside of the WFL in the tailrace. A continuous water temperature and dissolved oxygen logger will be installed in the WFL near the picketed barrier. The logger will record water temperature and dissolved oxygen every thirty minutes to be compared with Station 643 at the end of the fish passage season.
Section 4.6: Last Bullet - Please replace the text to reflect this updated collection protocol for river herring: River herring will also be sacrificed for biological information. Every 20th river herring of each species (Alewife and Blueback Herring) will be sacrificed with a maximum collection of 50 individuals per species from the project. River herring will be processed similar to American Shad. Additionally, any river herring mortalities resulting from lifting, sorting, handling, or transporting will be retained for analysis.	The requested revisions to Section 4.6 , last bullet were made.

**Conowingo Hydroelectric Project
FERC Project Number 405
Fishway Operation and Maintenance Plan**

November 2022 Draft FOMP – Resource Agency Comment Letters

From: [David Seaborn -MDE-](#)
To: [Kendra Gorski](#)
Cc: [Kirk Smith](#); [Danucalov, Andrea H:\(Constellation Power\)](#); [Bleistine, Ray](#); [Mike.Cox@ERM.com](#); [David Frazier](#); [Eberts, Ron](#); [Eyler, Sheila](#); [Henning, Aaron](#); [jesus_morales@fws.gov](#); [Martinek, Michael](#); [McCorkle, Richard](#); [Miller, Jeremy](#); [Minkinen, Steve](#); [Sadzinski, Robert](#); [Seaman, Shawn](#); [Smith, Fred](#); ['Steffy, Luanne'](#); [Tryniewski, Joshua](#); [Williamson, Scott](#); [Heather Nelson -MDE-](#); [Tony Prochaska -DNR-](#); [Brett Coakley -DNR-](#); [Donald Pugh](#); [Matthew Jargowsky -DNR-](#); [emily.zollweg-horan@dec.ny.gov](#); [Joseph Petre](#)
Subject: EXTERNAL EMAIL -Re: Conowingo Fishway Operations and Maintenance Plan for the 2023 passage season
Date: Friday, December 16, 2022 10:43:01 AM
Attachments: [image002.png](#)

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Ms. Gorski,

Thank you for the opportunity to provide comments on the 2023 Draft Conowingo FOMP. Maryland (MDE in coordination with MDNR) has the following comments:

Appendices

- Please update the appendices and only include what is needed for the revised plan (*e.g.* is the Whoosh System Information still valid in 2023?)

Introduction Paragraph 6 – Last Sentence

- Is it assumed that reassessment will be based on an estimate of the actual fish count? Please clarify.

Section 3.1: Turbine Start-Up and Operation

- Please provide clarifying text (*i.e.* give an example) that defines/explains the sequence in relation to Unit No. On and Unit No. Off. Without this description/explanation, the reader is likely to get confused as to why in the 6th Sequence Unit No. 11 is both On and Off.

Section 4.3.1.1 West Fish Lift Third Paragraph

- Please clarify that the hopper isn't lowered into the hopper bay while fish are present in the bay.
- Please rephrase/define the process (*i.e.* state that the crowder doors have remained closed overnight since the last lift (*i.e.* unlikely any fish will be in the hopper bay)).

Section 4.3.1.2 East Fish Lift Second Paragraph

- This version of the report can be edited as to not reflect volitional passage (*i.e.* for 2023)
- Refer to similar note from Section 4.3.1.1 re: potential presence of fish in the hopper bay prior to lowering the hopper.
- Please clarify if there is a 'clean out' lift for the EFL? If not, please define why for the WFL and not the EFL?

Section 4.3.2.1 West Fish Lift

- Please define how debris is removed when 'occasional cleaning is needed'?

Section 4.5.1 First Paragraph

- Please provide a time frame of when the contact list will be posted and how often it will be updated.

On Fri, Nov 18, 2022 at 3:45 PM Kendra Gorski <kgorski@gomezandsullivan.com> wrote:

Hello,

Please see the attached the Constellation Conowingo Fishway Operations and Maintenance Plan for the 2023 passage season.

 [Conowingo_FOMP_2023.pdf](#)

Constellation is requesting that comments be provided to Andrea Danucalov by December 17, 2022 so that the final report can be filed with FERC.

Thank you,

Kendra



Kendra Gorski

Environmental Scientist

Gomez and Sullivan Engineers, D.P.C.

1961 Wehrle Drive, Suite 12

Williamsville, NY 14221

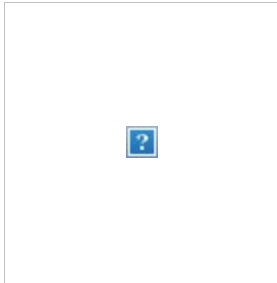
Direct: 716-402-6811

Office: 716-250-4960

kgorski@gomezandsullivan.com

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--



David Seaborn, Ph.D.

Deputy Program Manager, Wetlands and
Waterways Protection Program

Water and Science Administration

Maryland Department of the Environment

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443-621-1009 (C)

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From: [Eyler, Sheila](#)
To: [Kendra Gorski](#); [Kirk Smith](#); [Danucalov, Andrea H:\(Constellation Power\)](#); [Bleistine, Ray](#); [Mike.Cox@ERM.com](#); [David Frazier](#); [Eberts, Ron](#); ["Henning, Aaron"](#); [Morales, Jesus J](#); [Martinek, Michael](#); [McCorkle, Richard](#); ["Miller, Jeremy"](#); [Minkinen, Steve](#); ["Sadzinski, Robert"](#); ["Seaman, Shawn"](#); [Smith, Fred](#); [Isteffy@srbc.net](#); ["Tryninewski, Joshua"](#); ["Williamson, Scott"](#); [Heather Nelson -MDE](#); [tony.prochaska@maryland.gov](#); [Brett Coakley -DNR](#); [David Seaborn -MDE](#); [don.pugh](#); [Matthew Jargowsky -DNR](#); [emily.zollweg-horan@dec.ny.gov](#)
Cc: [Joseph Petre](#)
Subject: EXTERNAL EMAIL -Re: [EXTERNAL] Conowingo Fishway Operations and Maintenance Plan for the 2023 passage season
Date: Friday, December 16, 2022 10:12:42 AM
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Ms. Gorski,

Thank you for the opportunity to provide comments on the Draft Conowingo FOMP for 2023. The Service submits the following comments and recommended edits for your consideration:

- In the Introduction, it would be helpful to provide a brief bulleted list of items that have changed in this FOMP compared to the previous FOMP.
- Section 4.3.1.1: Although it is assumed, it may be useful to new readers to indicate that all fish not removed for transport or for AIS disposal are returned to the tailrace.
- Section 4.6:
 - Bullet 2 – Daily water temperature and dissolved oxygen (DO, after May 1) data are to be collected daily at the fish lifts and in the tailwater area. Those data were not fully collected/reported in the 2022 FOMP Report. In 2023, daily water temperature collection and reporting should occur for each day (including non-operational days) of the fish passage season. In addition, if water temperatures are collected at Station 643 after May 1, please include those data in the annual report in addition to temperatures collected daily at the WFL. Temperature data from Station 643 should not replace WFL temperature monitoring unless concurrent sampling at both stations can demonstrate that similar data are collected at both locations. In addition, tracking DO concentrations in water flowing from Conowingo Pond into the WFL is critical to ensuring that sufficient DO concentrations are present for fish entering the WFL during the latter (warmer) part of the season. The Service requests collection of DO data to occur daily at the WFL location during the entire fish passage season. Monitoring of DO at the WFL could be discontinued after May 1 if concurrent sampling between the WFL and Station 643 show similar data are being collected at both locations.
 - Last Bullet - Please replace the text to reflect this updated collection protocol for river herring: *River herring will also be sacrificed for biological information. Every 20th river herring of each species (Alewife and Blueback Herring) will be sacrificed with a maximum collection of 50 individuals per species from the project. River herring will be processed similar to American Shad. Additionally, any river herring mortalities resulting from lifting, sorting, handling, or transporting will be retained*

for analysis.

Let me know if you have any questions or would like a meeting to discuss these items further.

Sheila Eyler
U.S. Fish and Wildlife Service
Mid-Atlantic Fish & Wildlife Conservation Office
717-387-2117

From: Kendra Gorski <kgorski@gomezandsullivan.com>
Sent: Friday, November 18, 2022 3:45 PM
To: Kirk Smith <ksmith@gomezandsullivan.com>; Danucalov, Andrea H:(Constellation Power) <u000ahd@constellation.com>; Bleistine, Ray <rbleistine@normandeau.com>; Mike.Cox@ERM.com <Mike.Cox@ERM.com>; David Frazier <dfrazier@gomezandsullivan.com>; Eberts, Ron <reberts@pa.gov>; Eyler, Sheila <sheila_eyler@fws.gov>; 'Henning, Aaron' <ahenning@srbc.net>; Morales, Jesus J <jesus_morales@fws.gov>; Martinek, Michael <mmartinek@normandeau.com>; McCorkle, Richard <richard_mccorkle@fws.gov>; 'Miller, Jeremy' <jeremmille@pa.gov>; Minkkinen, Steve <steve_minkkinen@fws.gov>; 'Sadzinski, Robert' <bob.sadzinski@maryland.gov>; 'Seaman, Shawn' <shawn.seaman@maryland.gov>; Smith, Fred <fredp.smith@exeloncorp.com>; Isteffy@srbc.net <Isteffy@srbc.net>; 'Tryninewski, Joshua' <jtryninews@pa.gov>; 'Williamson, Scott' <scwilliams@pa.gov>; Heather Nelson -MDE- <hnelson@maryland.gov>; tony.prochaska@maryland.gov <tony.prochaska@maryland.gov>; Brett Coakley -DNR- <brett.coakley@maryland.gov>; David Seaborn -MDE- <david.seaborn@maryland.gov>; don.pugh <don.pugh@outlook.com>; Matthew Jargowsky -DNR- <matthew.jargowsky@maryland.gov>; emily.zollweg-horan@dec.ny.gov <emily.zollweg-horan@dec.ny.gov>
Cc: Joseph Petre <jpetre@gomezandsullivan.com>
Subject: [EXTERNAL] Conowingo Fishway Operations and Maintenance Plan for the 2023 passage season

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Hello,

Please see the attached the Constellation Conowingo Fishway Operations and Maintenance Plan for the 2023 passage season.

 [Conowingo_FOMP_2023.pdf](#)

Constellation is requesting that comments be provided to Andrea Danucalov by December 17, 2022 so that the final report can be filed with FERC.

Thank you,
Kendra



Kendra Gorski
Environmental Scientist
Gomez and Sullivan Engineers, D.P.C.
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Williamsville, NY 14221
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Office: 716-250-4960
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From: [Eberts, Ron](#)
To: [Danucalov, Andrea H:\(Constellation Power\)](#); [Kendra Gorski](#)
Cc: [Kirk Smith](#); [Danucalov, Andrea H:\(Constellation Power\)](#); [Bleistine, Ray](#); [Mike.Cox@ERM.com](#); [David Frazier](#); [Sheila Eyler](#); [Aaron Henning](#); [jesus_morales@fws.gov](#); [Martinek, Michael](#); [McCorkle, Richard](#); [Miller, Jeremy](#); [Minkkinen, Steve](#); [Sadzinski, Robert](#); [Seaman, Shawn](#); [Smith, Fred](#); [Steffy, Luanne](#); [Tryniewski, Joshua](#); [Williamson, Scott](#); [Heather Nelson -MDE-](#); [Tony Prochaska -DNR-](#); [Brett Coakley -DNR-](#); [Donald Pugh](#); [Matthew Jargowsky -DNR-](#); [emily.zollweg-horan@dec.ny.gov](#); [Joseph Petre](#)
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Andrea,

PA DEP has reviewed the 2023 Conowingo FOMP and does not have any suggested changes.

Thank you,

Ronald C. Eberts, Jr. | Environmental Protection Compliance Specialist
Department of Environmental Protection
Southcentral Regional Office
Waterways & Wetlands Program
909 Elmerton Avenue | Harrisburg, PA 17110
Phone: 717.705.4819 | Fax: 717.705.4760
THE SOUTHCENTRAL REGIONAL OFFICE AFTER HOURS REPORTING & 24 HOUR EMERGENCY
RESPONSE NUMBER: 1-800-541-2050.

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On Fri, Nov 18, 2022 at 3:45 PM Kendra Gorski <kgorski@gomezandsullivan.com> wrote:

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 [Conowingo_FOMP_2023.pdf](#)

Constellation is requesting that comments be provided to Andrea Danucalov by December 17, 2022 so that the final report can be filed with FERC.

Thank you,

Kendra



Kendra Gorski

Environmental Scientist

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--



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