BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

APPLICATION FOR NEW LICENSE FOR MAJOR WATER POWER PROJECT-EXISTING DAM

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NUMBER 405

Exelon Generation

Volume 1 of 4

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August 2012

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
INITIAL STATEMENT

INITIAL STATEMENT PER 18 CFR § 4.51

Application for New License Major Water Power Project - Existing Dam

(1) Exelon Generation Company ("Exelon" or "Applicant") applies to the Federal Energy Regulatory Commission ("Commission" or "FERC") for a new license for the existing Conowingo Hydroelectric Project ("the Project"), FERC Project Number 405, as described in the attached Exhibits. The current license for the Conowingo Hydroelectric Project was issued on August 14, 1980 and expires on September 1, 2014.

(2) The location of the Project is:

The Project is located on the Susquehanna River in Harford and Cecil Counties, Maryland, and York and Lancaster Counties, Pennsylvania.

(3) The exact name, address, and telephone number of the Applicant are:

Exelon Generation Company, LLC
300 Exelon Way
Kennett Square, PA 19348
Tel: (610) 765-5959

The exact name, address, and telephone number of each person authorized to act as agent for the Applicant in this application are:

Colleen E. Hicks
Manager Regulatory and Licensing, Hydro
Exelon Power
300 Exelon Way
Kennett Square, PA 19348
Tel: (610) 765-6791
Colleen.hicks@exeloncorp.com

Kathleen Barrón
Vice President
Federal Regulatory Affairs and Wholesale Market Policy
Exelon Corporation
101 Constitution Ave.
Washington, DC 20001
Tel: (202) 347-7500
Kathleen.Barron2@exeloncorp.com

(4) The Applicant is a domestic corporation and is not claiming preference under section 7(a) of the Federal Power Act, 16 U.S.C. 796.

(5) (i) The statutory or regulatory requirements of the State of Maryland which affect the Project as it exists with respect to bed and banks and the appropriation, diversion, and use of water for power

purposes, and with respect to the right to engage in the business of developing, transmitting, and distributing power and in any other business necessary to accomplish the purpose of the license under the Federal Power Act, are:

- Applicant is subject to Water Quality Certification from the Maryland Department of Environment and Section 401 (a)(1) of the Clean Water Act.

(5) (ii) The steps which the Applicant has taken or plans to take to comply with the regulations cited above are:

- The Applicant will submit a request for Water Quality Certification from the Maryland Department of Environment . Since this is an application for a new license for an existing waterpower project, the Applicant expects to continue to operate the facility pursuant to approvals, licenses, permits, and exemptions already in effect.

(6) Exelon owns the existing Project facilities; there are no Federally owned or operated facilities associated with the Project.

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
ADDITIONAL INFORMATION REQUIRED

ADDITIONAL INFORMATION REQUIRED BY 18 C.F.R. § 5.18(A)

(1) Identify every person, citizen, association of citizens, domestic corporation, municipality, or state that has or intends to obtain and will maintain any proprietary right necessary to construct, operate or maintain the project:

Exelon Generation Company, LLC, a Pennsylvania limited liability company currently owns and will continue to maintain all proprietary rights necessary to construct, operate and maintain the Project.

(2) Identify (providing names and mailing addresses):

(i) Every county in which any part of the project and any Federal facilities that would be used by the project would be located;

York County
100 W. Market Street
York, PA 17401

Cecil County
107 North Street
Elkton, MD 21921

Lancaster County
50 North Duke Street
Lancaster, PA. 17608

Harford County
212 South Bond Street
Bel Air, MD 21014

(ii) Every city, town, or similar local political subdivision:

i. In which any part of the Project, and any Federal facility that would be used by the project, would be located; or

Lower Chanceford Township
4120 Delta Road
Airville, PA 17302

Drumore Township
1675 Furniss Road
Drumore, PA 17518-9768

Peach Bottom Township
545 Broad Street, Extended
Delta, PA 17314

Fulton Township
777 Nottingham Road
Peach Bottom, PA 17563

Martic Township
370 Steinman Farm Road
Pequea, PA 17565

City of Havre de Grace
711 Pennington Avenue
Havre de Grace, MD 21078

ii. **That has a population of 5,000 or more people and is located within 15 miles of the project dam.**

Martic Township
370 Steinman Farm Road
Pequea, PA 17565

Oxford Borough
401 Market Street
Oxford PA 19363

East Nottingham Township
158 Election Road
Oxford, PA 19363

Providence Township
200 Mt. Airy Road
New Providence, PA 17560

Fulton Township 777 Nottingham Rd Peach Bottom, PA 17563	City of Havre de Grace 711 Pennington Avenue Havre de Grace, MD 21078
New London Township 902 State Road New London, PA 19360	Town of Bel Air 39 Hickory Avenue Bel Air, MD 21014
Lower Oxford Township 220 Township Road Oxford, PA 19363	City of Aberdeen 60 North Parke Street Aberdeen, MD 2100

(iii) Every irrigation district, drainage district or similar special purpose political subdivision (A) in which any part of the project is located, and any Federal facility that is or is proposed to be used by the project is located, or (B) that owns, operates, maintains, or uses any project facility or any Federal facility that is or is proposed to e used by the project:

There is no irrigation district, drainage district, or similar special purpose political subdivision in which any part of the Project is located or that owns, operates, maintains, or uses any Project facility. The Project uses no Federal facilities and occupies no Federal lands.

(iv) Every other political subdivision in the general area of the Project that there is reason to believe would likely be interested in, or affected by, the application.

There are no other political subdivisions in the general area of the Project that would likely be interested in, or affected by, the notification.

(v) All Indian tribes that may be affected by the Project.

Delaware Nation
P.O. Box 825
Anadarko, OK 73005

(3)

(i) The Applicant has made a good faith effort to give notification by certified mail of the filing of the application to:

(A) Every property owner of record of any interest in the property within the bounds of the Project, or in the case of the Project without a specific boundary, each such owner of property which would underlie or be adjacent to any Project works, including any impoundments; and

(B) The entities identified in paragraph (2) above, as well as any other federal, state, municipal or other local government agencies that there is reason to believe would likely be interested in or affected by the application.

<u>PURPA Benefits</u>

Exelon is not seeking any PURPA benefits in association with the relicensing of the Project.

3. VERIFICATION STATEMENT

This application is executed in the

STATE OF: Maryland

COUNTY OF: Harford

By: Colleen Hicks, being duly sworn, deposes and says that the contents of this application are true to the best of her knowledge or belief. The undersigned applicant has signed this application this 9th day of August, 2012.

Colleen Hicks

Colleen Hicks
Manager Regulatory and Licensing, Hydro
Exelon Power
300 Exelon Way
Kennett Square, PA 19348

Subscribed and sworn to before me, a Notary Public of the State of Maryland, this 9th day of August, 2012.

Catherine M Salamone

Notary Public

My commission expires:
7/8/2013

CATHERINE M. SALAMONE
NOTARY PUBLIC
HARFORD CO. MD.

ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
ADAAG	Accessibility Guidelines for Buildings and Facilities
AOI	Areas of Interest
APE	Area of Potential Effect
BEMP	Bald Eagle Management Plan
BMP	Best Management Practice
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CPUE	Catch Per Unit Effort
CU	Consumptive Use
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dBA	Decibel
°C	Degrees Centigrade
°F	Degrees Fahrenheit
DO	Dissolved Oxygen
DLA	Draft License Application
DPS	Distinct Population Segment
EA	Environmental Assessment
EAV	Emergent Aquatic Vegetation
EFL	Eastern Fish Lift
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
ETM	Estuarine Turbidity Maximum
Exelon	Exelon Generation Company, LLC
FERC	Federal Energy Regulatory Commission
FLA	Final License Application

ACRONYMS AND ABBREVIATIONS

FPA	Federal Power Act
FPC	Federal Power Commission
fps	Feet Per Second
ft	Feet
HPMP	Historic Properties Management Plan
IBA	Important Bird Area
IFIM	Instream Flow Incremental Methodology
ILP	Integrated Licensing Process
kg	Kilogram
kV	Kilovolts
kVA	Kilovolt-Ampere
LSHG	Lower Susquehanna Heritage Greenway
MAAC	Mid-Atlantic Area Council
MDNR	Maryland Department of Natural Resources
MGD	Millions Gallons per Day
MGS	Million Gallons per Second
mg/L	Milligrams Per Liter
MHT	Maryland Historical Trust
MW	Megawatt
MWh	Megawatt-Hour
MSA	Metropolitan Statistical Area
NAI	Natural Areas Inventory
NEPA	National Environmental Policy Act of 1969
NERC	North American Electric Reliability Council
NGVD 1929	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NGO	Non-Governmental Organization
NID	National Inventory of Dams
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places

NOI	Notice of Intent
NTU	Nephelometric Turbidity Unit
NWI	National Wetland Inventory
PAD	Pre-Application Document
PADEP	Pennsylvania Department of Environmental Protection
PADCNR	Pennsylvania Department of Conservation and Natural Resources
PBAPS	Peach Bottom Atomic Power Station
PECO	PECO Energy Company
PennDOT	Pennsylvania Department of Transportation
PEPCo	PECO Energy Power Company
PFBC	Pennsylvania Fish and Boat Commission
PGC	Pennsylvania Game Commission
PGS	Pennsylvania Geological Survey
pH	The measure of the acidity or alkalinity of a substance or liquid
PHMC	Pennsylvania Historical and Museum Commission
PJM	Pennsylvania, New Jersey, Maryland Interconnection
PM&E	Protection, Mitigation and Enhancement
PSP	Proposed Study Plan
REA	Ready for Environmental Analysis
RM	River Mile
RMP	Recreation Management Plan
ROW	Right of Way
RTE	Rare, Threatened or Endangered
RSP	Revised Study Plan
SAV	Submerged Aquatic Vegetation
SD1	FERC Scoping Document 1
SD2	FERC Scoping Document 2
SHPO	Pennsylvania State Historic Preservation Officer
SMP	Shoreline Management Plan
SRAFRC	Susquehanna River Anadromous Fish Restoration Committee
SRBC	Susquehanna River Basin Commission
SSURGO	Soil Survey Geographic Database
TL	Total Length

TMDL	Total Maximum Daily Loads
TSF	Trout Stocking
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WFL	Western Fish Lift
WMA	Wildlife Management Area
WQMAR	2010 Pennsylvania Integrated Water Quality Monitoring and Assessment Report
WWF	Warm Water Fishes
WY	Water Year

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)

APPLICATION FOR NEW LICENSE

EXHIBIT A-PROJECT DESCRIPTION

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
EXHIBIT A-PROJECT DESCRIPTION

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EXHIBIT A – PROJECT DESCRIPTION

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 4.51(b) describes the required content of this Exhibit.

Exhibit A is a description of the project. This exhibit need not include information on project works maintained and operated by the U.S. Army Corps of Engineers, the Bureau of Reclamation, or any other department or agency of the United States, except for any project works that are proposed to be altered or modified. If the project includes more than one dam with associated facilities, each dam and the associated component parts must be described together as a discrete development. The description for each development must contain:

(1*) The physical composition, dimensions, and general configuration of any dams, spillways, penstocks, powerhouses, tailraces, or other structures, whether existing or proposed, to be included as part of the project;*

(2) The normal maximum surface area and normal maximum surface elevation (mean sea level), gross storage capacity, and usable storage capacity of any impoundments to be included as part of the project;

(3*) The number, type, and rated capacity of any turbines or generators, whether existing or proposed, to be included as part of the project;*

(4) The number, length, voltage, and interconnections of any primary transmission lines, whether existing or proposed, to be included as part of the project (see 16 U.S.C. 796(11));

(5) The specifications of any additional mechanical, electrical, and transmission equipment appurtenant to the project; and

(6*) All lands of the United States that are enclosed within the project boundary described under paragraph (h) of this section (Exhibit G), identified and tabulated by legal subdivisions of a public land survey of the affected area or, in the absence of a public land survey, by the best available legal description. The tabulation must show the total acreage of the lands of the United States within the project boundary.)*

SECTION 1.0 PROJECT STRUCTURES

The Conowingo Hydroelectric Project (Figure 1-1) is located on the Susquehanna River (at river mile 10) in Pennsylvania and Maryland, which has a total drainage area of 27,100 square miles. Conowingo Dam is located 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 located in Pennsylvania, within York and Lancaster counties. The Project consists of: 1) a main dam, 2) a spillway, 3) a reservoir (Conowingo Pond), 4) an intake and powerhouse, and 5) two fish lifts.

1.1. Conowingo Dam

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 feet; 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 99.2 feet; an intake-powerhouse section which is 946 feet long; and a 127-foot long abutment section. The tailrace and spillway sections of the dam are separated by a dividing wall extending 300 feet downstream of the powerhouse. The dam and powerhouse also support US Highway Route No. 1, which passes over the top of Conowingo Dam.

During the original construction, the entire dam was erected upon a solid rock formation of granite and diorite. In 1978, to increase the dam's passage capacity and upgrade the structure to meet stability requirements, the dam was anchored into the bedrock foundation rock by a post-tensioned anchorage system consisting of stranded wire tendons installed in holes drilled through the structure and continuing into the foundation rock. A total of 537 tendons were installed across the non-overflow, spillway and powerhouse intake monoliths.

1.2. Spillway

The gated spillway at Conowingo Dam is ogee shaped, 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 99.2 feet. Flow over the ogee spillway sections is controlled by 50 stony-type crest gates with crest elevations of 86.7 feet and two regulating gates with crest elevations of 99.2 feet. Each of the crest gates is 22.5 feet high by 38 feet wide and have a collective discharge capacity of approximately 16,000 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 4,000 cfs per gate at a reservoir elevation of 109.2 feet. A spillway rating curve is shown in Figure 1.2-1. The Dam's tailwater elevation, which varies with discharge, is at an approximate elevation of 20.5 feet with all units operating with no spillway discharge (i.e. 86,000 cfs).

Three 90-ton gantry cranes are used to perform gate operations. Normally only two of the three gantry cranes are active. All three gantry cranes can be powered from the 440-volt bus on the headworks. Each gantry crane contains diesel generators for emergency backup power. The cranes are mounted on tracks that traverse the powerhouse intake structure and spillway sections of the dam.

1.3. Conowingo Pond

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 Conowingo Pond serves many diverse uses including hydropower generation, water supply, industrial cooling water, recreational activities and various environmental resources. Relative to hydropower generation, the Conowingo Pond serves as the lower reservoir for the 800-MW[1] Muddy Run Pumped Storage Project (Muddy Run Project), located 12 miles upstream of the Conowingo Dam. It also serves as the source of the cooling water for the 2,186 MW Peach Bottom Atomic Power Station (PBAPS), located approximately seven miles upstream of the Conowingo Dam. The 1,100 MW York Energy Center (formally referred to as the Delta Power Project) withdraws cooling water approximately seven miles upstream of Conowingo Dam as well. The Muddy Run Project has a maximum pumping capacity of 28,000 cfs, while PBAPS has a maximum withdrawal capacity of 3,450 cfs (2,230 MGD). The York Haven Energy Center is permitted to withdraw up to 20 cfs (13 MGD) for cooling water.

Conowingo Pond is used as a public water supply source, with the City of Baltimore and Chester Water Authority (CWA) having permitted withdrawals of 387 cfs (250 MGD) and 46 cfs (30 MGD), respectively.

[1] The rated generation capacity for the Muddy Run Powerhouse is 800 MW, which is based on the nameplate capacity of the 8 turbine/generator units combined. However, actual generation capacity can vary based upon hydraulic head and turbine/generator efficiency. The Project can achieve 1070 MW under ideal operating conditions, which also represents the Project's Installed Capacity (ICAP) based on the PJM ICAP definition.

1.4. Intakes and Powerhouse

The 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) (Table 1.4-1). The top two racks are constructed of wood due to frazzle ice accumulations on the steel sections. The racks were previously cleaned by a stationary crane. However, a multi-purpose gantry crane was installed in 2007 and is now used as a trash rake.

The first seven turbine/generating units (1-7) are completely enclosed within the powerhouse, while the last four units (8-11) are an outdoor type of construction thereby eliminating a superstructure in this area.

For Units 1-7, a 27-foot diameter butterfly valve is installed at the entrance to the scroll case. These valves are operated by oil pressure cylinders which are opened from a central oil pressure system, but are rarely used. Dewatering is performed by placement of headgates and stoplogs.

The main power station superstructure enclosing Units 1-7 includes the generator room and the electrical bay. The electrical bay is located between the generator room and the powerhouse headworks and consists of the 13.8-kilovolt (kV) bus and switching equipment. Compartments for step-up transformers are located on the roof of the electrical bay, together with the station service control room and the main control room, from which windows afford a direct view of the generator room.

Units 8-11 are of an outdoor type of construction. There are no valves within the intake; unit dewatering is performed by placement of headgates and stoplogs. Generator circuit breakers and electrical equipment are located in a two-story structure between the generator area and the headworks. The main step-up transformers are located on the roof of this structure.

1.5. Fish Passage Facilities

The Project currently operates two fish lifts. The West Fish Lift, adjacent to the dam's right abutment, is currently operated under an agreement with the United States Fish and Wildlife Service (USFWS) for American shad egg production and other research purposes. The newer East Fish Lift, which uses the regulating gate bays for attraction flow, is used primarily to pass American shad, river herring and other migratory fishes during the April-June migration season.

1.6. Tailrace

The tailrace is approximately 2,800 feet in length, extending from the powerhouse to the downstream end of Rowland Island. The tailrace width ranges from approximately 900 feet near the powerhouse to 1,500 feet near Rowland Island.

SECTION 2.0 SURFACE AREA, ELEVATION AND STORAGE CAPACITY

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 design volume of 310,000 acre-feet at that elevation. The effective storage between Conowingo Pond's licensed minimum and maximum elevations of 101.2 feet and 110.2 feet is 75,287 acre-feet. Storage and surface area curves for the Conowingo Pond are shown in Table 2-1 and are plotted in Figure 2-1.

2.1. Turbines and Generators

Conowingo Dam contains eleven main turbines, as well as two house turbines. The main turbines consist of seven Francis-type turbines and four Kaplan-type mixed flow turbines.

The current hydraulic equipment (Table 3-1) for units 1,3,4,6 and 7 consist of Francis-type single runner hydraulic turbines, operating at 81.8 revolutions per minute (RPM) and are designed to develop 64,500 horsepower (hp) each at a point of best efficiency, under a normal head of 89 feet. Units 2 and 5 consist of 54,000 hp Francis-type turbines with single runners, operating at 81.8 rpm at a point of best efficiency under a normal head of 89 feet.

The electric generating equipment (Table 3-2) for units 1 and 3 are Asea Brown Boveri, Inc. (ABB) 50,000 kilovolt-amperes (kVA) and 53,000 kVA, respectively, at 0.9 power factor, 60 hertz (Hz), 13,800 volt, three-phase vertical shaft water wheel type generators. Units 2, 4, 6 and 7 are Voith Siemens 53,000 kVA at 0.9 power factor, 60 Hz, 13,800 volt, three-phase vertical shaft water wheel type generators. Unit 5 is an ABB 40,000 kVA at 0.9 power factor, 60 Hz, 13,800 volt, three-phase vertical shaft water wheel type generator. Each generator is equipped with a static excitation system supplied with power from the main generator terminal. Switching and control equipment is provided to connect each pair of generators through individual 13.8 kV circuit breakers to a 13.8/220 kV transformer.

The hydraulic equipment (Table 3-1) for Units 8-11 consists of Voith-Siemens mixed flow turbines. Each of these turbines operates at 120 rpm and is designed to develop not less than 85,000 hp each under a normal head of 86 feet.

The electric generating equipment (Table 3-2) for Unit 8 is a Voith-Siemens with a 75,000 kVA at 0.95 power factor, 60 Hz, 13,000 volt, three-phase vertical shaft water wheel type generator. The electric generating equipment for Units 9, 10 and 11 are Voith with a 75,000 kVA at 0.95 power factor, 60 Hz, 13,000 volt, three-phase vertical shaft water wheel type generator.

Each generator is equipped with a static excitation system supplied with power from the main generator terminal. Switching and control equipment is provided to connect each pair of the four generators through individual 13.8 kV circuit breakers to a 13.8/220 kV transformer.

Additionally, two house turbines manufactured by S. Morgan-Smith, Inc. have been installed with a full gate capacity of 1,900 hp each when operating under a normal net head of 89 feet. The generators for these units are of Westinghouse manufacture and are rated at 1,600 kVA at 0.9 power factor each. These units provide station service.

2.2. Transmission Lines

There are no transmission lines within the Conowingo Project Boundary, as specified in the current FERC license.

2.3. Additional Equipment

The Conowingo Project also includes various turbine governors, generator exciters, batteries, control panels, and circuit breakers.

2.4. Lands of the United States

No lands of the United States are enclosed within the Project Boundary.

TABLE 1.4-1: TURBINE INTAKE STRUCTURE CHARACTERISTICS.

Site Characteristic		Units 1-11 (Francis and Kaplan Units)	2 House Units
Intake Elevations	Top (ft)	69.2	41.5
	CL (ft)	46.8	33.6
	Bottom (ft)	11.2	25.7
Unit Intake Width (ft)		23 per bay, 2 bays per unit	23
Unit Intake Area (sq ft)		1334 per bay, 2 bays per unit	361 1 bay for both units
Trash Rack Bars	Thickness (in)	0.625	0.5
	Height (in)	24	24
	Clear Spacing (in)	5.375	1.5

TABLE 2-1: CONOWINGO POND STAGE-STORAGE[2] AND STAGE-SURFACE AREA CALCULATIONS.

Pond Elevation (ft)	Surface Area (acres)	Usable Storage (acre-ft)
110.2	8,650	75,287
109.2	8,605	66,660
108.2	8,567	58,074
107.2	8,526	49,527
106.2	8,466	41,031
105.2	8,374	32,611
104.2	8,273	24,288
103.2	8,144	16,080
102.2	8,038	7,989
101.2	7,940	0

[2] Conowingo Pond storage was calculated relative to the minimum pond elevation allowed in Conowingo's current FERC license, which is elevation 101.2 ft, such that storage at elevation 101.2 ft is zero.

TABLE 3-1: SUMMARY OF TURBINE CHARACTERISTICS

Unit	Type	Manufacturer	Rated Head (ft)	Runner Speed (rpm)	Rated Output (hp)	Approx. Rated Discharge (cfs)
1	Francis	Voith-Siemens	89	81.8	64,500	6,749
2	Francis	Voith-Siemens	89	81.8	54,000	6,320
3	Francis	Voith-Siemens	89	81.8	64,500	6,749
4	Francis	Voith-Siemens	89	81.8	64,500	6,749
5	Francis	Voith-Siemens	89	81.8	54,000	6,320
6	Francis	Voith-Siemens	89	81.8	64,500	6,749
7	Francis	Voith-Siemens	89	81.8	64,500	6,749
8	Mixed-Flow Kaplan	Voith-Siemens	86	120	85,000	9,352
9	Mixed-Flow Kaplan	Voith-Siemens	86	120	85,000	9,727
10	Mixed-Flow Kaplan	Voith-Siemens	86	120	85,000	9,727
11	Mixed-Flow Kaplan	Voith-Siemens	86	120	85,000	9,727
House #1	Francis	S. Morgan-Smith	89	360	1,900	247
House #2	Francis	S. Morgan-Smith	89	360	1,900	247

TABLE 3-2: SUMMARY OF ELECTRIC GENERATOR CHARACTERISTICS

Unit	Manufacturer	Capacity (kVA)	Power Factor	Frequency (Hz)	Voltage (Volts)	Phases
1	Asea Brown Boveri, Inc.	50,000	0.9	60	13,800	3
2	Voith-Siemens	53,000	0.9	60	13,800	3
3	Asea Brown Boveri, Inc.	53,000	0.9	60	13,800	3
4	Voith-Siemens	53,000	0.9	60	13,800	3
5	Asea Brown Boveri, Inc.	40,000	0.9	60	13,800	3
6	Voith-Siemens	53,000	0.9	60	13,800	3
7	Voith-Siemens	53,000	0.9	60	13,800	3
8	Voith-Siemens	75,000	0.95	60	13,000	3
9	Voith	75,000	0.95	60	13,000	3
10	Voith	75,000	0.95	60	13,000	3
11	Voith	75,000	0.95	60	13,000	3
House #1	Westinghouse Electric	1,600	0.9	60	13,800	3
House #2	Westinghouse Electric	1,600	0.9	60	13,800	3

EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

Figure 1-1: Conowingo Dam Project Structures

N

0 0.075 0.15 0.3 0.45 Miles

1 inch = 0.15 miles

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\Exhib A Dam Map.mxd

FIGURE 1.2-1: CONOWINGO DAM SPILLWAY RATING CURVE

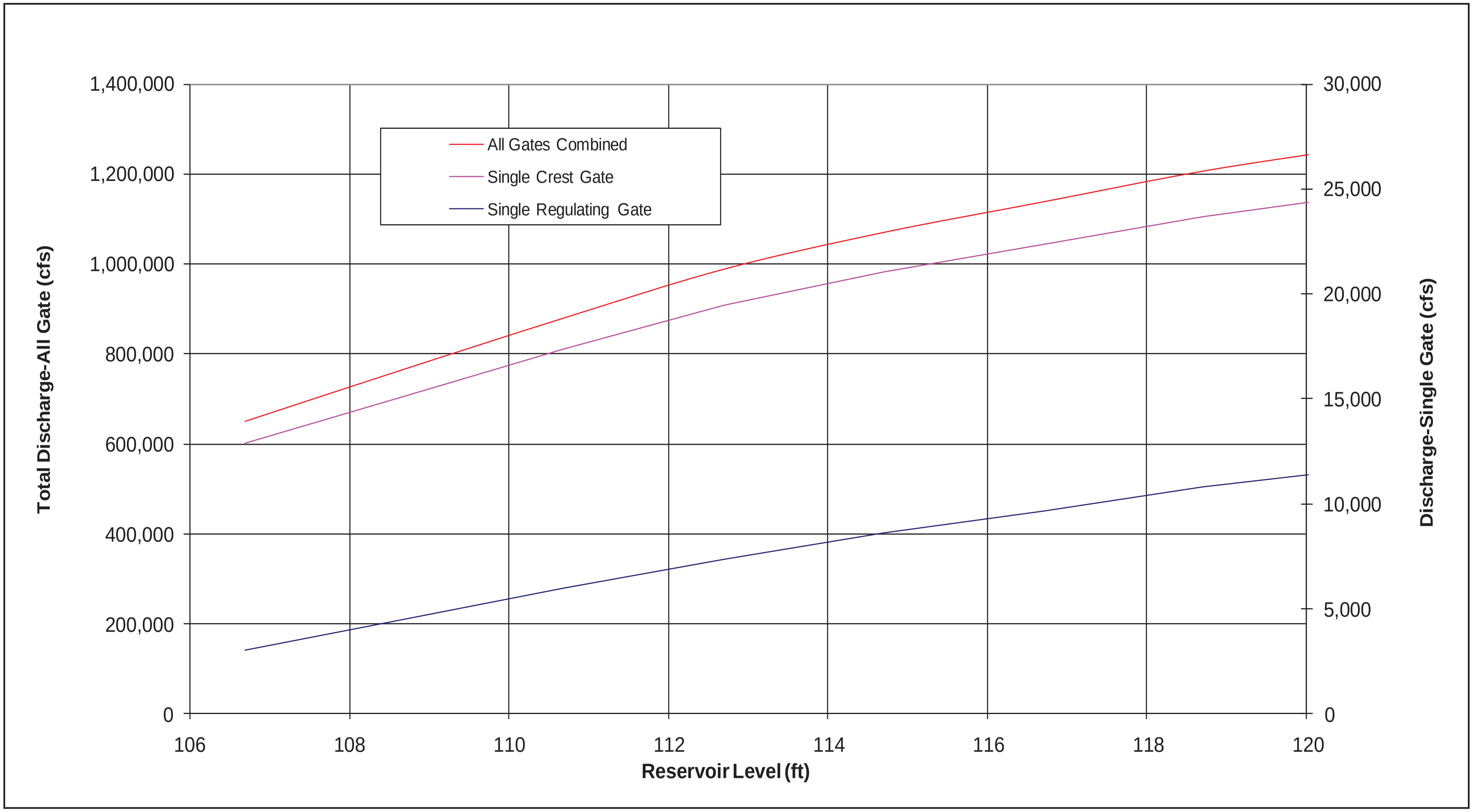
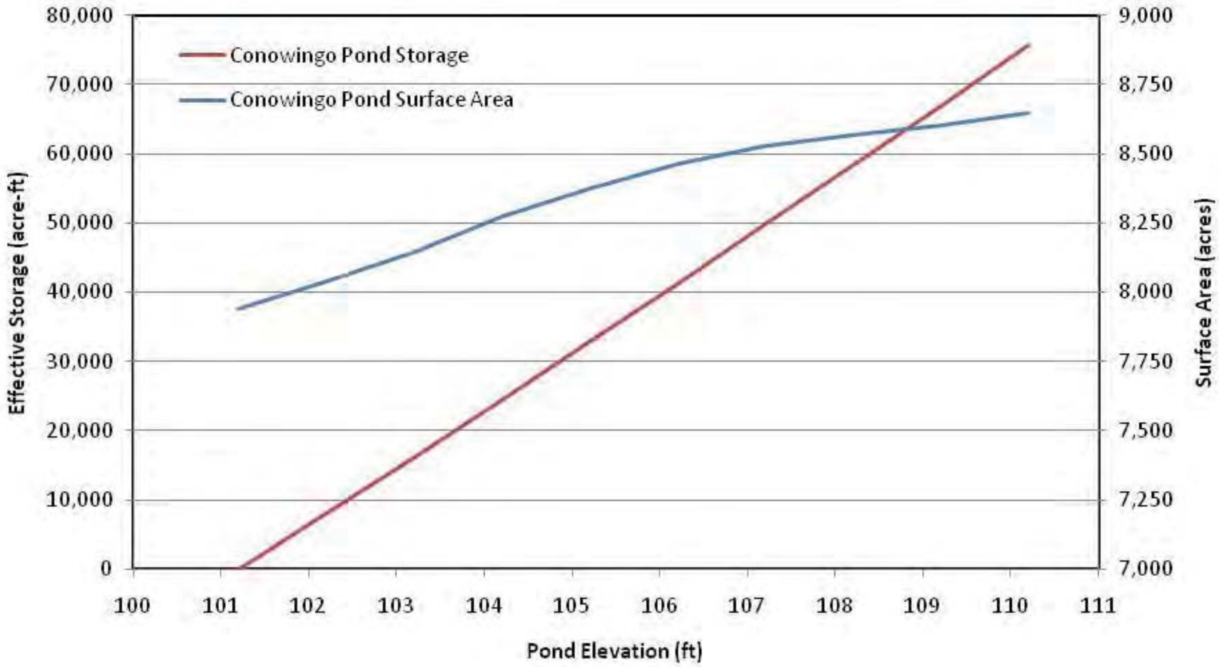


FIGURE 2-1: CONOWINGO POND STAGE-STORAGE AND STAGE-SURFACE AREA CURVES



CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)

APPLICATION FOR NEW LICENSE

EXHIBIT B-PROJECT OPERATION AND RESOURCE UTILIZATION

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EXHIBIT B – PROJECT OPERATION AND RESOURCE UTILIZATION

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 4.51 (c) describes the required content of this Exhibit.

Exhibit B is a statement of project operation and resource utilization. If the project includes more than one dam with associated facilities, the information must be provided separately for each such discrete development. The exhibit must contain:

(1) A statement whether operation of the powerplant will be manual or automatic, an estimate of the annual plant factor, and a statement of how the project will be operated during adverse, mean, and high water years;

(2) An estimate of the dependable capacity and average annual energy production in kilowatt hours (or a mechanical equivalent), supported by the following data:

> *(i) The minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the powerplant intake or point of diversion, with a specification of any adjustments made for evaporation, leakage, minimum flow releases (including duration of releases), or other reductions in available flow; monthly flow duration curves indicating the period of record and the gauging stations used in deriving the curves; and a specification of the period of critical streamflow used to determine the dependable capacity;*
>
> *(ii) An area-capacity curve showing the gross storage capacity and usable storage capacity of the impoundment, with a rule curve showing the proposed operation of the impoundment and how the usable storage capacity is to be utilized;*
>
> *(iii) The estimated hydraulic capacity of the powerplant (minimum and maximum flow through the powerplant) in cubic feet per second;*
>
> *(iv) A tailwater rating curve; and*
>
> *(v) A curve showing powerplant capability versus head and specifying maximum, normal, and minimum heads;*

(3) A statement, with load curves and tabular data, if necessary, of the manner in which the power generated at the project is to be utilized, including the amount of power to be used on-site, if any, the amount of power to be sold, and the identity of any proposed purchasers; and

(4) A statement of the applicant's plans, if any, for future development of the project or of any other existing or proposed water power project on the stream or other body of water, indicating the approximate location and estimated installed capacity of the proposed developments.

SECTION 1.0 PROJECT OPERATION

1.1 Existing Project Operation

The Conowingo Project is a peaking hydroelectric facility that 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 MW) is programmed into the control system; however, turbines are brought on-line 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. The Conowingo Project license allows for the Conowingo Pond to fluctuate between elevation 101.2 feet and 110.2 feet, NGVD 1929.

The following factors also influence the management of water levels within the Conowingo Pond:

- The Conowingo Pond must be maintained at elevation of 107.2 feet on weekends between Memorial Day and Labor Day to meet recreational needs;
- The Muddy Run Project cannot operate its pumps below elevation 104.7 feet due to cavitation;
- PBAPS begins experiencing cooling problems when the elevation of the pool drops to 104.2 feet;
- The Chester Water Authority cannot withdraw water below elevation 100.5 feet;
- The PBAPS Nuclear Regulatory Commission license requires PBAPS to shut down completely if Conowingo pond is at or below 99.2 feet;
- The York Energy Center (Calpine Energy) cannot withdraw water below elevation 98.0 feet; and
- The City of Baltimore cannot withdraw water below elevation 91.5 feet.

The current flow regime below Conowingo Dam was formally established with the signing of a settlement agreement in 1989 between the Project owners and several Federal and state resource agencies (FERC 1989). The flow regime was determined through negotiations and based on several studies, including a habitat-based instream flow study conducted by the Susquehanna River Basin Commission (SRBC). In addition, studies were subsequently completed by MDNR that examined benthic macroinvertebrate populations. These study results were used to establish the flow regime below Conowingo Dam as follows:

March 1 – March 31 3,500 cfs or natural inflow, whichever is less

April 1 – April 30 10,000 cfs or natural inflow, whichever is less

May 1 – May 31 7,500 cfs or natural inflow, whichever is less

June 1 – September 14 5,000 cfs or natural inflow, whichever is less

September 15 – November 30 3,500 cfs or natural inflow, whichever is less

December 1 – February 28 3,500 cfs intermittent (maximum six hours off followed by equal amount on)

The downstream discharge must equal these values or the discharge measured at the Susquehanna River at the Marietta United States Geological Survey (USGS) gage (No. 01576000), whichever is less. The Marietta USGS gage is located approximately 35 miles upstream of Conowingo Dam above the Safe Harbor Dam. The drainage area at the Marietta gage is 25,990 mi^2. Marietta is generally considered reflective of the lower Susquehanna River's natural flow regime. The Conowingo, MD USGS Gage No. 01578310 is located on the downstream face of Conowingo Dam (RM 10), and has a drainage area of 27,100 mi^2

During periods of regional drought and low river flow, Exelon has requested and received FERC approval for a temporary variance in the required minimum flow release from the Conowingo Project. Specifically, Exelon has sought approval to count the leakage from the Conowingo Project (approximately 800 cfs)[3] as part of the minimum flow discharge, as it typically does not count toward the minimum flow discharge. This temporary variance is typically approved by resource agencies (i.e., SRBC, MDNR, PFBC, and USFWS) as well. Table 1.1-1 shows a summary of instances over the past license term when this temporary variance was requested, and the time period over which the variance was in effect.

[3] As a result of a recent agreement with resource agencies, beginning in 2012 the minimum flow variance, when in effect, will count approximately 580 cfs as part of the minimum flow discharge at the Conowingo Project. The remaining portion of the Project leakage (approximately 220 cfs) will be credited to the PBAPS facility, as part of its consumptive use agreement.

When implemented, the temporary variance allows Exelon to maintain an adequate pond level elevation and storage capacity throughout a low-flow period. Maintaining water storage volume is critical under low-flow conditions, not only for electric generating capacity, but also to ensure an adequate water supply is available for recreational interests and consumptive water usage on Conowingo Pond.

1.2 Proposed Project Operation

Exelon is not proposing any changes to Project operations.

1.3 Annual Plant Factor

The average annual plant factor is determined using the following equation:

Average Annual Output/Nameplate Capacity x 8,760 hrs per yr= Avg. Annual Plant Factor

The Project has an average annual energy production of approximately 1,823,193 MWh per year for the period 1996 to 2010, and an annual plant factor of approximately 36.3% based on its current nameplate capacity of 573 MW[4].

1.4 Operation During Adverse, Mean and High Water Years

1.4.1 Adverse Water Years

The Project is operated within the licensed water level fluctuation range, as well as inflow and outflow constraints, to meet peak power demand. The Conowingo Pond has limitations on the maximum and minimum pond elevations. In addition to its FERC licensed range of water level fluctuation, Exelon is required to maintain a minimum Conowingo Pond elevation of 107.2 feet NGVD 1929, during the summer recreation season, which is defined as weekends from Memorial Day to Labor Day. Functionally, the Conowingo Pond is maintained above elevation 104.2 feet NGVD 1929 to facilitate operation of the Peach Bottom Atomic Power Station (PBAPS). During non-peak periods of electrical demand, some combination of turbine units is used to provide the minimum flow requirements at the Project. These minimum flow levels are on an "or-inflow" basis, based on streamflow levels at the Marietta USGS gage located approximately 35 miles upstream. When inflows are below the minimum turbine capacity, any additional water needed to meet minimum flow requirements would be taken from storage.

[4] This figure represents Conowingo's Installed Capacity (ICAP) (Winter/Summer) based on the following PJM ICAP definition: Value based on the summer net dependable rating of the unit as determined in accordance with PJM's Rules and Procedures of the Determination of Generating Capacity (Manual 21).

As mentioned previously, during periods of low river flow, Exelon has sought approval from FERC to count the leakage from the Conowingo Project (approximately 800 cfs) as part of the minimum flow discharge. The temporary variance allows Exelon to maintain an adequate pond level elevation and storage capacity throughout a low-flow period, not only for electric generating capacity, but also to ensure an adequate water supply is available for recreational interests and consumptive water usage on Conowingo Pond.

1.4.2 Mean Water Years

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 demands 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 high electrical demand periods with low inflow Exelon uses water from the available Conowingo Pond storage (within its FERC license constraints) to meet this demand. During any low electrical demand periods, Exelon typically uses some combination of turbine units to provide the minimum flow requirements at the Project.

1.4.3 High Water Years

Usually, all units are operating at maximum wicket gate opening and crest gate operation is used to pass the remainder of the streamflow. Typically, Conowingo Pond is kept near 109.2 feet NGVD 1929 to prevent splashing of water onto the US Route 1 roadways and debris from "floating over" the closed crest crests. There is a skimmer beam, bottom elevation 109.2 feet NGVD, that provides protection to motorists and floating debris from going over the closed crest gates, whose top elevation is 110.2 feet NGVD 1929.

1.5 OASIS Operations Model

Exelon developed an operations model to better understand how operational changes at the lower Susquehanna River’s four hydroelectric facilities (Safe Harbor, Holtwood, Muddy Run, and Conowingo) affect the timing of river flows and energy generation. The model takes into account each Project’s engineering data and operational constraints, such as Conowingo’s minimum flow requirements. The model outputs include hourly flow, pond elevations, generation and revenue from the lower Susquehanna River’s four hydroelectric projects.

The model calibration procedure involved adjusting several model parameters and constraints to match historic (2004-2007) Project data (flow, stage, generation), and then using the parameters and constraints from the final calibrated model to predict Project operations over a longer-term period (1930-2007) to establish a "Baseline" model. The Baseline production run was simulated using hydrologic data from Jan 1930 through Dec 2007[5].

The Baseline model results showed that from calendar year 1930 through 2007 the average annual generation at Conowingo was 1,669,000 MWh.

Some sections of this license application, including Exhibit D and Exhibit E-Developmental Analysis, utilize the Baseline model outputs. Sections using model outputs will explicitly state when model results (as opposed to actual data) are presented.

[5] The Baseline production run contains information to run from Jan 1930 through March 2008, but in order to prevent partial-year records from skewing any month-by-month analyses, analyses are limited to Jan 1930 – Dec 2007.

SECTION 2.0 DEPENDABLE CAPACITY AND AVERAGE ANNUAL GENERATION

2.1 Estimate of Dependable Capacity and Average Annual Generation

The net dependable capacity of the Conowingo Project is 573 MW.

Average annual net generation at the Project for the 1996-2010 period was 1,823,193 MWh. The monthly and annual net generation at the Project for the 1996-2010 period is provided in Table 2.1-1.

2.2 Streamflow

The Conowingo USGS gage (Station 01578310), located on the downstream face of Conowingo Dam in the Susquehanna River, measures the discharge from Conowingo Dam. Conowingo Dam outflows reflects the combined influences of the Conowingo Hydroelectric Project, Muddy Run, Holtwood Hydroelectric Project, Safe Harbor Hydroelectric Project and all other upstream water users along the Susquehanna River.

The Susquehanna River at the Conowingo gage drains a 27,100 mi^2 watershed. Between water year[6] 1968 and 2009 Conowingo had an annual average flow of 41,026 cfs. Monthly average and median flows are greatest in March and April and lowest in August and September (Table 2.2-1). Table 2.2-2 shows annual and monthly flow duration curves calculated from daily average flow data, respectively. Figures 2.2-1 thru 2.2-12 show monthly flow duration curves developed from daily average flow data.

2.3 Area-Capacity Curve

Storage and surface area curves for the Conowingo Pond are shown in Table 2.3-1. The storage and surface area curves for Conowingo Pond are also plotted on Figure 2.3-1. Conowingo Pond's licensed operating range is between 101.2 ft and 110.2 ft, which provides a total usable storage of 75,287 acre-feet.

2.4 Hydraulic Capacity

The Project's maximum hydraulic capacity is approximately 86,000 cfs through the powerhouse. Flows over 86,000 cfs are passed through the dam's 50 crest gates. Table 2.4-1 depicts the minimum and maximum hydraulic capacity of each turbine unit at the Conowingo Project.

[6] Water years refer to a year that begins in October and ends in September. For example, water year 1968 begins on 10/1/1967 and ends on 9/30/1968.

2.5 Tailwater Rating Curve

Conowingo Dam's tailwater is driven by Conowingo Dam discharge. A USGS gage (No. 01578310) is located on the downstream face of the dam, which measures Conowingo Dam's tailwater elevation and discharge. Table 2.5-1 shows the USGS gage's flow vs. tailwater elevation relationship, while Figure 2.5-1 shows the gage's rating curve.

2.6 Powerplant Capability versus Head Curve

A curve illustrating the maximum generating capacity available at a given gross head (headwater elevation minus tailwater elevation) is provided in Figure 2.6-1. The maximum and minimum gross heads at the Project are 97.3 feet and 83.9 feet, respectively, under normal operating conditions.

SECTION 3.0 UTILIZATION OF PROJECT POWER

The primary purpose of the Project is to supply energy, capacity, regulation and other ancillary services to the PJM Interconnection, a regional transmission organization that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia.

SECTION 4.0 PLANS FOR FUTURE DEVELOPMENT

There are no plans for future development at the Conowingo Hydroelectric Project.

TABLE 1.1-1: SUMMARY OF TEMPORARY MINIMUM FLOW VARIANCES

Year	Date of Request to FERC	Date Agency Approved	Date FERC Approved	Time Period
2010	SRBC 7/12/10 PFBC 7/12/10 MDNR 7/12/10 USFWS 7/12/10	SRBC 8/3/10 PFBC 7/19/10 MDNR 7/19/10 USFWS 7/19/10	None[7]	None
2007	SRBC 7/10/07 PFBC 7/10/07 MDNR 7/10/07 USFWS 7/10/07	MDNR 7/16/07 PFBC 7/17/07 SRBC 7/19/07 USFWS 7/23/07	7/25/07	7/26/07 - 9/14/07
2005	SRBC 8/12/05 PFBC 8/12/05 MDNR 8/12/05 USFWS 8/12/05	MDNR 8/12/05 PFBC 8/12/05 SRBC 8/12/05 USFWS 8/12/05	8/16/05	8/16/05 -9/1/05
2002	SRBC 8/13/02 PFBC 8/13/02 MDNR 8/13/02 USFWS 8/19/02	MDNR 8/13/02 PFBC 8/15/02 SRBC 8/13/02 USFWS 8/19/02	8/15/02	8/15/02 -9/25/02
2001	SRBC 7/24/01 PFBC 7/24/01 MDNR 7/24/01 USFWS 7/24/01	MDNR 7/24/01 PFBC 7/24/01 SRBC 7/24/01 USFWS 7/24/01	7/27/01	7/27/01 -9/14/01
1999	SRBC 7/7/99 MDNR 7/7/99	MDNR 8/6/99 SRBC 8/6/99 & 9/16/99	8/6/99	8/6/99 -9/14/99 & 9/15/99 –12/1/99
1998	MDNR 8/7/98 SRBC 8/7/98	MDNR 8/7/98	8/10/98	8/10/98 -9/14/98
1995	Not Applicable; meeting of Susquehanna River Technical Committee (SRTC) that included resource agencies[8]	MDNR 9/21/95 & SRTC including FWS 2/28/95	10/16/95	10/1/95 -11/30/95

[7] Streamflow increased so the waiver was never implemented.
[8] Waiver was to allow for studies of downstream fish migration.

TABLE 2.1-1: MONTHLY AND ANNUAL GENERATION (MWH) FOR 1996-2010.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1996	151,326	213,083	286,439	276,379	271,704	130,862	129,311	76,897	172,406	182,791	218,840	293,074	2,403,112
1997	159,696	191,499	311,568	189,021	145,916	112,842	40,281	33,806	35,369	30,185	162,712	144,453	1,557,348
1998	255,415	230,684	303,511	309,578	253,762	123,398	106,071	33,078	18,615	34,368	18,461	27,483	1,714,424
1999	145,016	181,916	253,409	265,420	89,790	32,223	18,602	19,167	91,668	89,773	68,584	157,185	1,412,753
2000	113,236	148,678	310,981	310,183	228,057	189,101	72,574	65,397	44,949	53,974	49,495	127,166	1,713,791
2001	71,909	150,631	216,348	289,489	76,161	94,250	43,249	19,149	32,273	33,774	25,949	109,828	1,163,010
2002	67,109	162,970	158,844	198,041	285,302	184,817	44,710	18,542	18,988	116,854	174,760	207,812	1,638,749
2003	179,166	119,514	296,640	277,388	197,671	276,408	122,471	182,015	201,743	193,222	250,705	302,838	2,599,781
2004	201,261	122,076	294,234	296,600	266,556	132,778	129,884	201,881	196,474	146,450	147,408	286,909	2,422,511
2005	260,473	202,055	210,016	238,836	96,181	57,565	59,865	23,696	28,177	135,231	167,276	204,930	1,684,301
2006	327,129	217,652	135,949	147,974	127,193	154,695	177,811	71,501	149,499	155,866	261,472	159,450	2,086,191
2007	264,151	74,018	298,309	281,658	148,579	54,737	32,665	48,649	25,487	45,636	120,692	235,109	1,629,690
2008	220,717	285,138	310,672	245,901	220,173	68,864	56,708	39,849	38,907	39,952	67,255	249,826	1,843,962
2009	150,227	152,508	206,959	197,895	177,066	159,246	94,574	126,813	63,607	139,238	144,862	244,361	1,837,356
2010	188,245	130,734	267,515	186,997	151,986	76,505	43,120	40,283	28,736	165,870	134,303	210,823	1,640,914
Average	183,672	172,210	257,426	247,424	182,046	123,219	78,126	66,725	76,460	104,212	134,185	197,416	1,823,193

TABLE 2.2-1: CONOWINGO AVERAGE AND MEDIAN FLOW BY MONTH, COMPUTED FROM DAILY AVERAGE FLOW RECORDS (WY 1968-2009)

Month	Average Flow (cfs)	Median Flow (cfs)
January	45,340	30,250
February	50,783	36,800
March	73,846	58,900
April	76,957	61,800
May	47,092	39,400
June	34,894	24,500
July	20,001	15,700
August	14,917	10,650
September	19,109	10,400
October	23,755	13,800
November	36,037	28,700
December	50,533	40,300

TABLE 2.2-2: CONOWINGO ANNUAL AND MONTHLY DAILY AVERAGE FLOW EXCEEDENCE PERCENTILES, IN CFS (WY 1968-2009).

Exceedence Percentile	Annual	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
0	1,120,000	622,000	470,000	462,000	467,000	235,000	1,120,000	213,000	202,000	662,000	245,000	272,000	357,000
5	121,000	131,000	139,000	184,000	188,050	104,000	80,645	50,575	41,300	56,480	84,690	90,320	129,950
10	85,400	93,980	98,500	139,000	144,000	81,100	59,000	37,500	28,280	35,240	57,170	70,410	98,350
15	70,600	76,140	81,420	119,000	116,150	70,685	49,015	31,985	24,100	26,315	42,285	60,215	80,000
20	60,300	62,160	70,860	102,000	102,200	64,000	42,240	28,080	20,600	22,120	32,480	53,600	71,380
25	52,600	53,775	60,500	88,600	89,175	58,700	37,725	25,500	18,400	19,325	26,825	46,800	64,050
30	46,100	47,800	54,240	81,400	82,700	53,400	33,900	23,170	16,300	17,100	22,700	42,500	57,200
35	40,700	42,800	48,890	73,500	76,870	49,300	31,400	20,665	14,900	14,900	20,265	39,035	52,630
40	35,700	38,060	44,800	68,360	70,900	45,760	28,900	18,900	13,300	13,100	17,460	35,200	47,820
45	31,600	33,955	41,060	63,155	66,545	43,000	26,800	17,355	12,000	11,900	15,355	31,700	43,900
50	27,800	30,250	36,800	58,900	61,800	39,400	24,500	15,700	10,650	10,400	13,800	28,700	40,300
55	24,800	27,600	33,500	54,100	57,700	36,245	22,555	14,400	9,489	8,861	12,100	26,000	36,900
60	21,700	25,040	30,840	50,440	53,900	33,200	20,300	13,100	8,380	7,410	10,900	23,460	33,880
65	19,000	22,635	27,900	46,335	50,500	30,700	18,600	11,800	6,837	6,393	9,690	20,200	31,235
70	16,200	20,800	25,680	42,130	45,470	28,030	17,170	10,400	6,143	5,337	8,320	17,700	28,330
75	13,700	18,700	23,050	38,025	42,000	26,200	15,400	8,373	5,663	4,953	6,890	14,775	25,800
80	11,200	16,240	20,700	34,100	38,200	23,520	13,580	6,946	5,290	4,368	4,912	12,400	22,040
85	8,270	13,200	18,490	30,300	34,500	21,100	11,385	6,152	5,002	3,799	4,460	9,459	18,815
90	5,840	10,210	15,500	24,410	29,690	18,100	8,658	5,421	4,490	3,037	3,750	5,807	13,610
95	4,300	5,465	10,790	18,415	24,485	14,005	6,179	4,527	2,702	1,420	1,212	3,838	7,831
100	269	511	758	287	6,090	5,220	622	269	367	363	295	303	777

TABLE 2.3-1: CONOWINGO POND STORAGE AND SURFACE AREA VERSUS RESERVOIR ELEVATION

Reservoir Elevation (ft)	Surface Area (acres)	Usable Storage (acre-ft)
100.2	7,825	N/A
101.2	7,940	0
102.2	8,038	7,989
103.2	8,144	16,080
104.2	8,273	24,288
105.2	8,374	32,611
106.2	8,466	41,031
107.2	8,526	49,527
108.2	8,567	58,074
109.2	8,605	66,660
110.2	8,650	75,287

TABLE 2.4-1: TURBINE UNIT HYDRAULIC CAPACITIES

	Units 1,3,4,6,7	Units 2,5	Unit 8	Unit 9-11	House Units (2)
Hydraulic Capacity at Rated Output (cfs)	6,749	6,320	9,352	9,727	247
Minimum Hydraulic Capacity (cfs)	4,200	2,000	7,500	7,800	210

TABLE 2.5-1: CONOWINGO TAILWATER ELEVATION (NGVD 1929) VERSUS FLOW RELATIONSHIP, FROM USGS GAGE AT CONOWINGO DAM

Tailwater Elevation (ft NGVD 1929)	Flow (cfs)
11.10	0
12.70	2,000
14.05	5,000
14.55	7,000
15.20	10,000
16.12	15,000
16.85	20,000
17.92	30,000
18.80	40,000
19.60	50,000
20.32	60,000
21.02	70,000
21.73	80,000
22.10	86,000
22.30	90,000
22.70	100,000
26.70	240,000
33.70	500,000

FIGURE 2.2-1: JANUARY MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

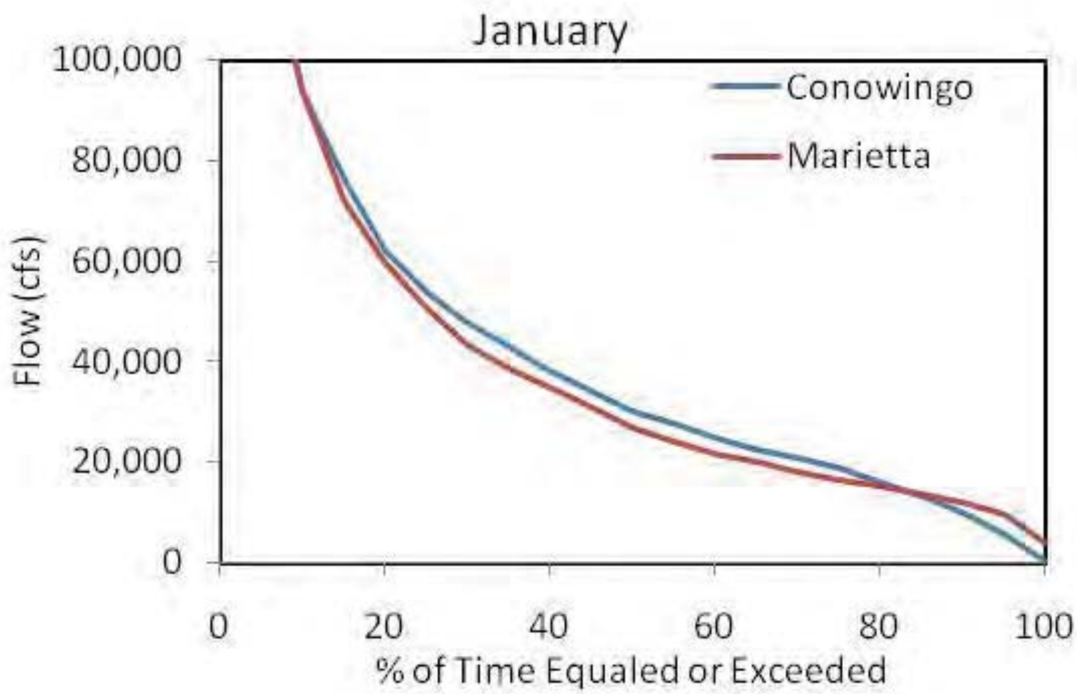


FIGURE 2.2-2: FEBRUARY MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

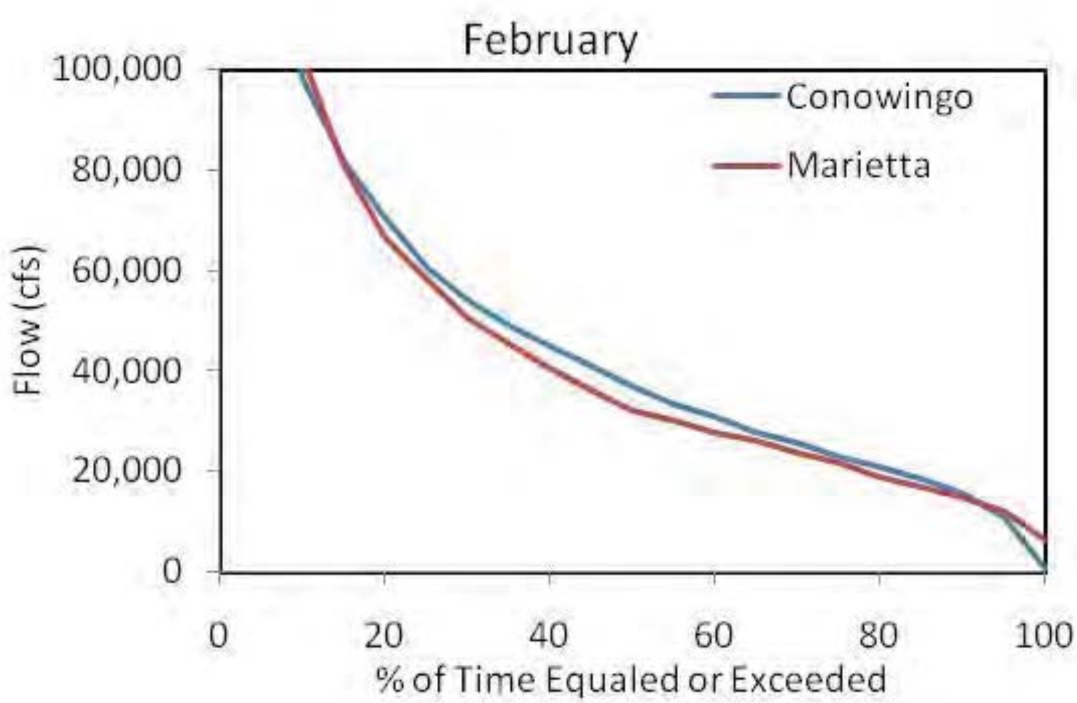


FIGURE 2.2-3: MARCH MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

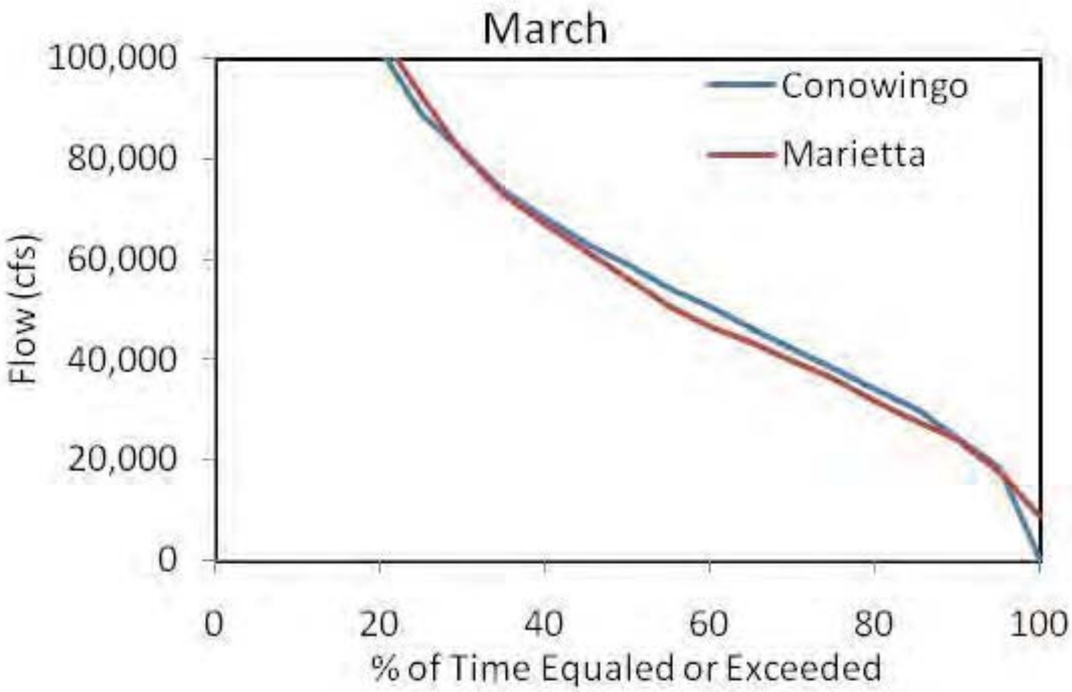


FIGURE 2.2-4: APRIL MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

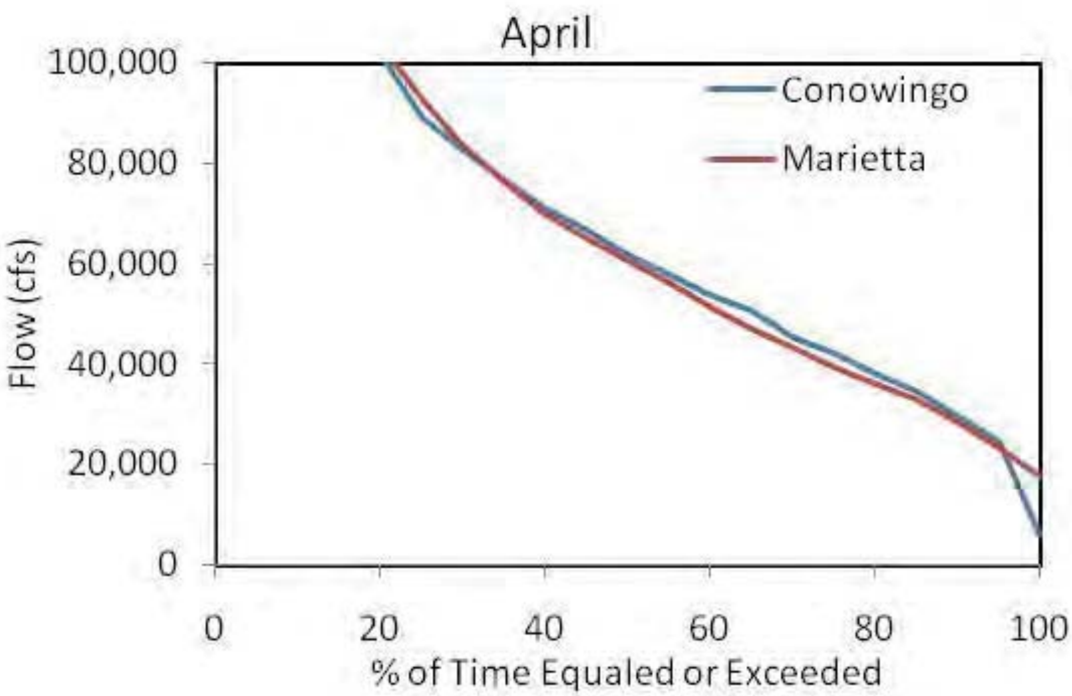


FIGURE 2.2-5: MAY MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

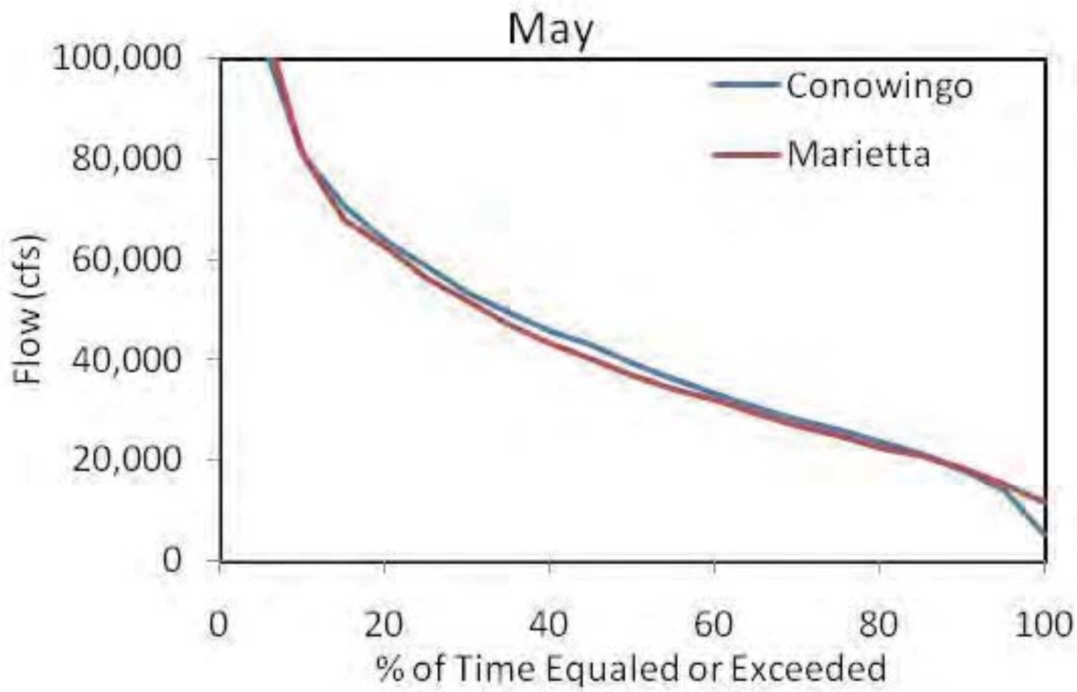


FIGURE 2.2-6: JUNE MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

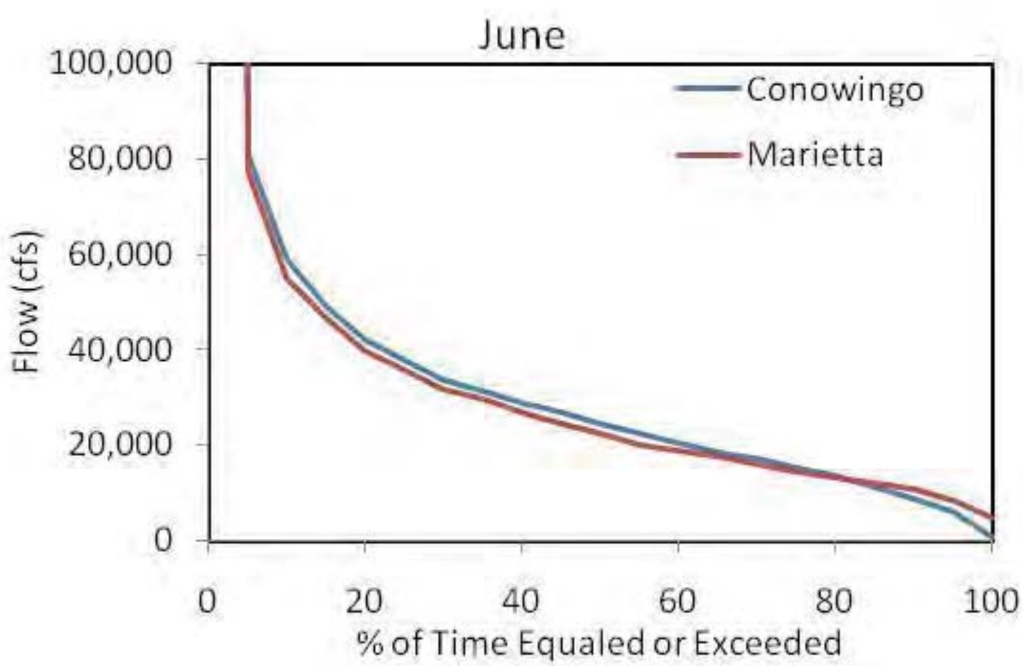


FIGURE 2.2-7: JULY MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

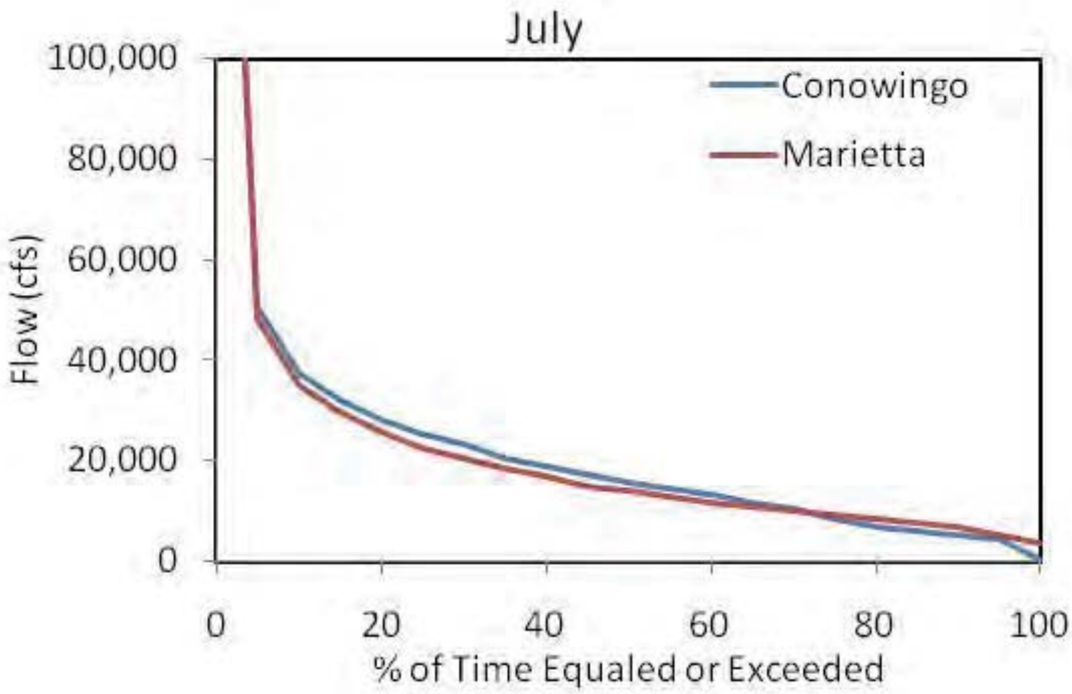


FIGURE 2.2-8: AUGUST MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

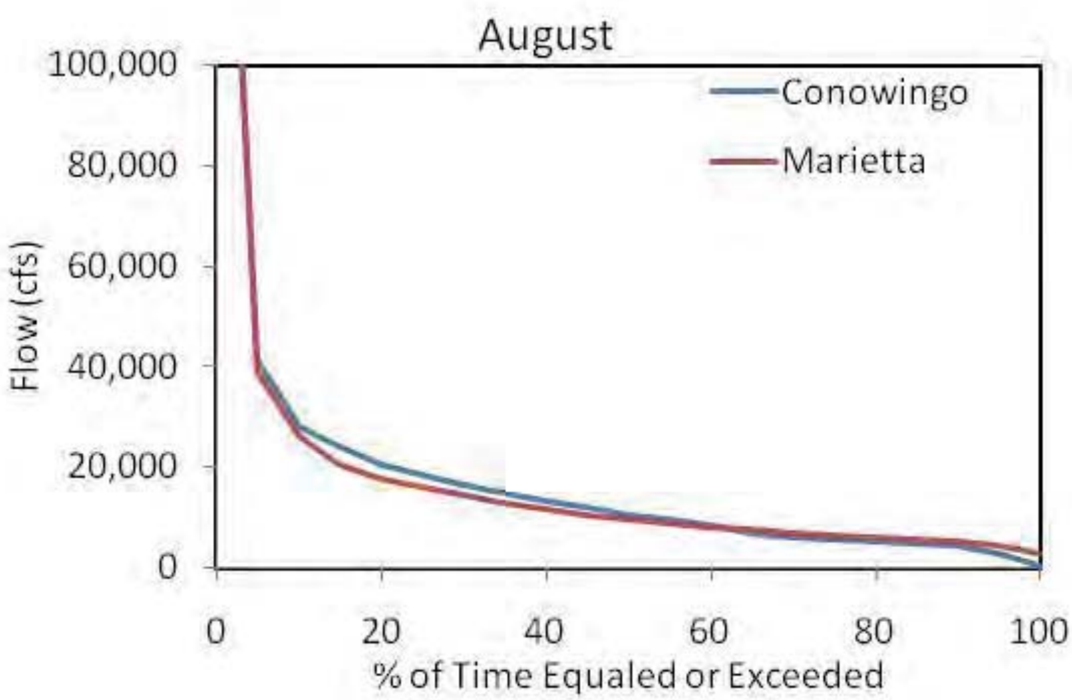


FIGURE 2.2-9: SEPTEMBER MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

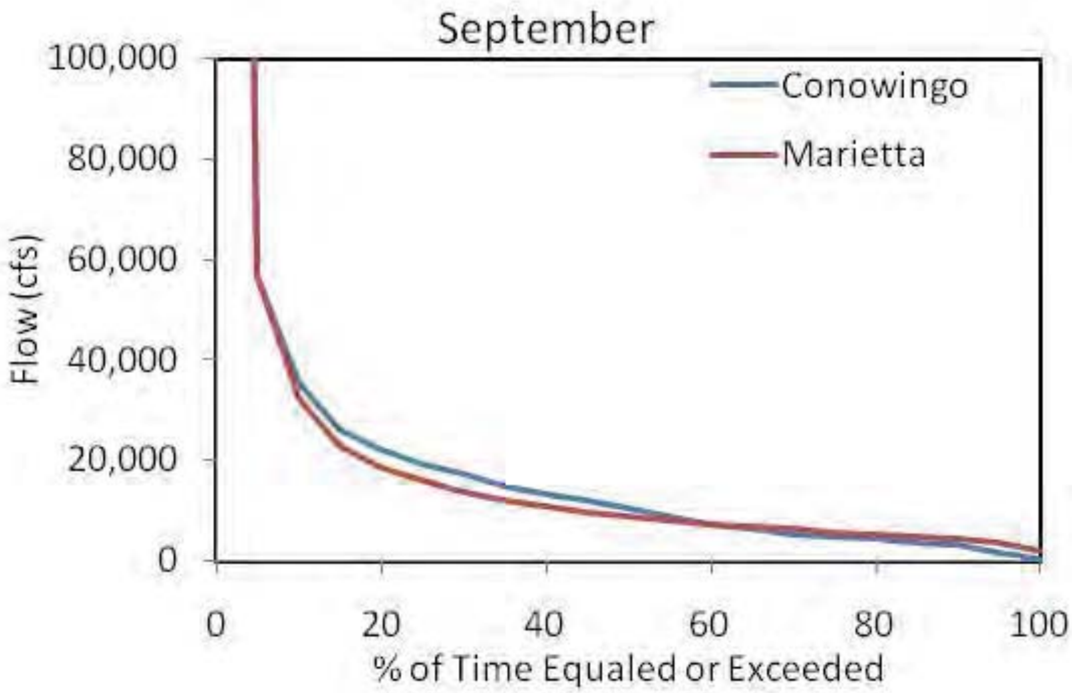


FIGURE 2.2-10: OCTOBER MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

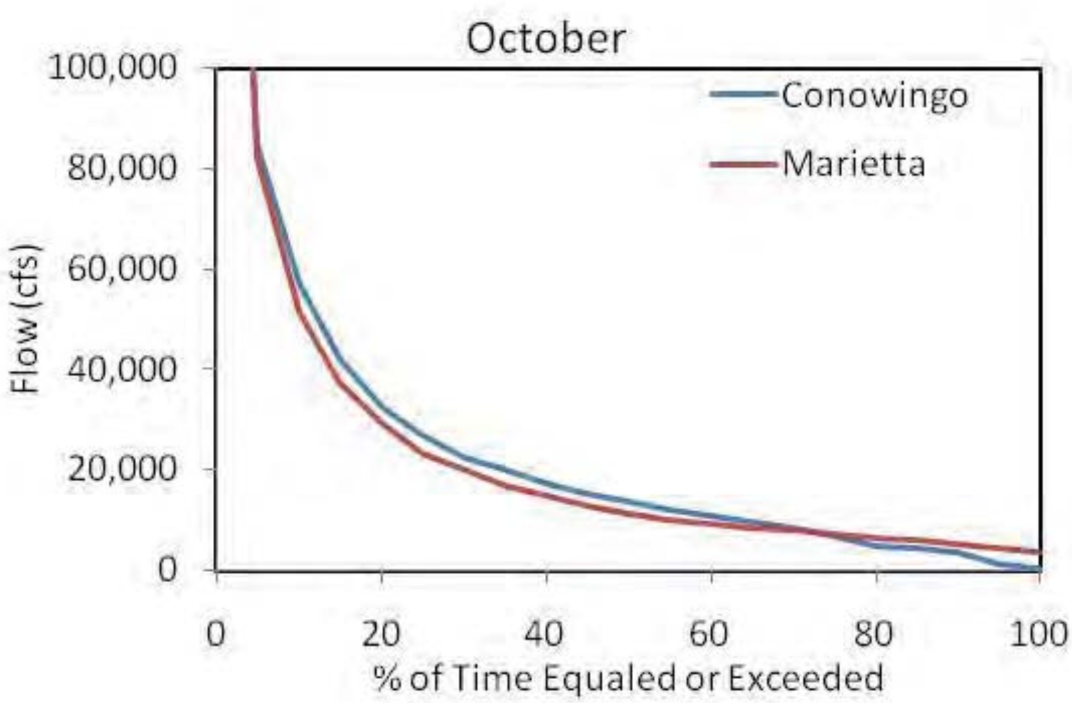


FIGURE 2.2-11: NOVEMBER MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

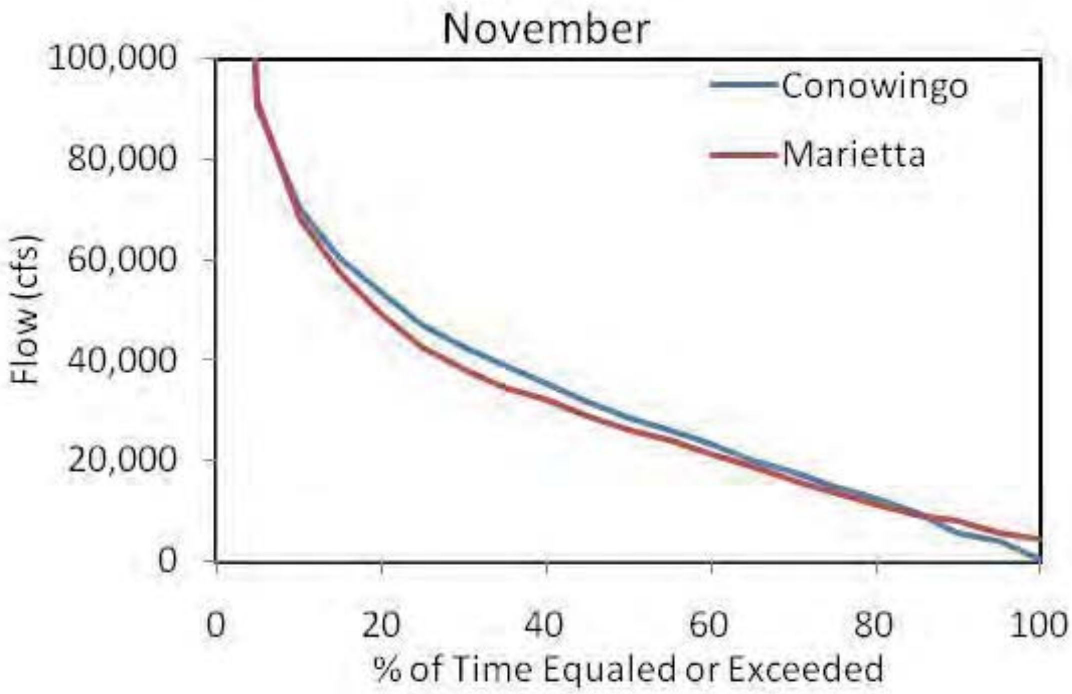


FIGURE 2.2-12: DECEMBER MONTHLY FLOW DURATION CURVE. SOURCE: WY 1968-2009 DAILY AVERAGE FLOW DATA.

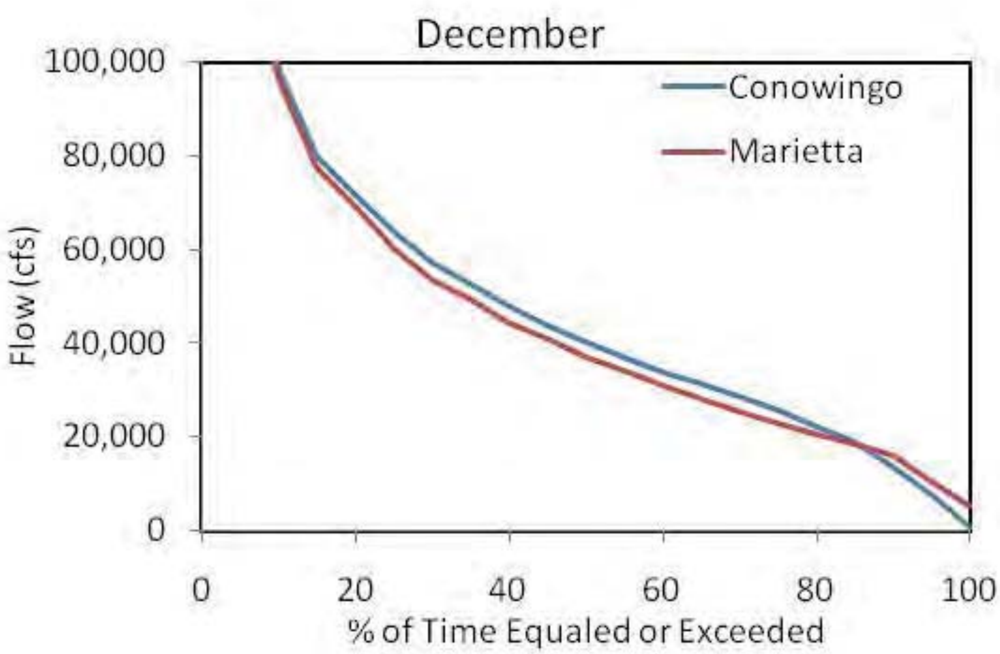


FIGURE 2.3-1: CONOWINGO POND STORAGE AND SURFACE AREA VERSUS ELEVATION CURVES. SOURCE: 2010 AND 2011 CONOWINGO POND BATHYMETRIC SURVEYS.

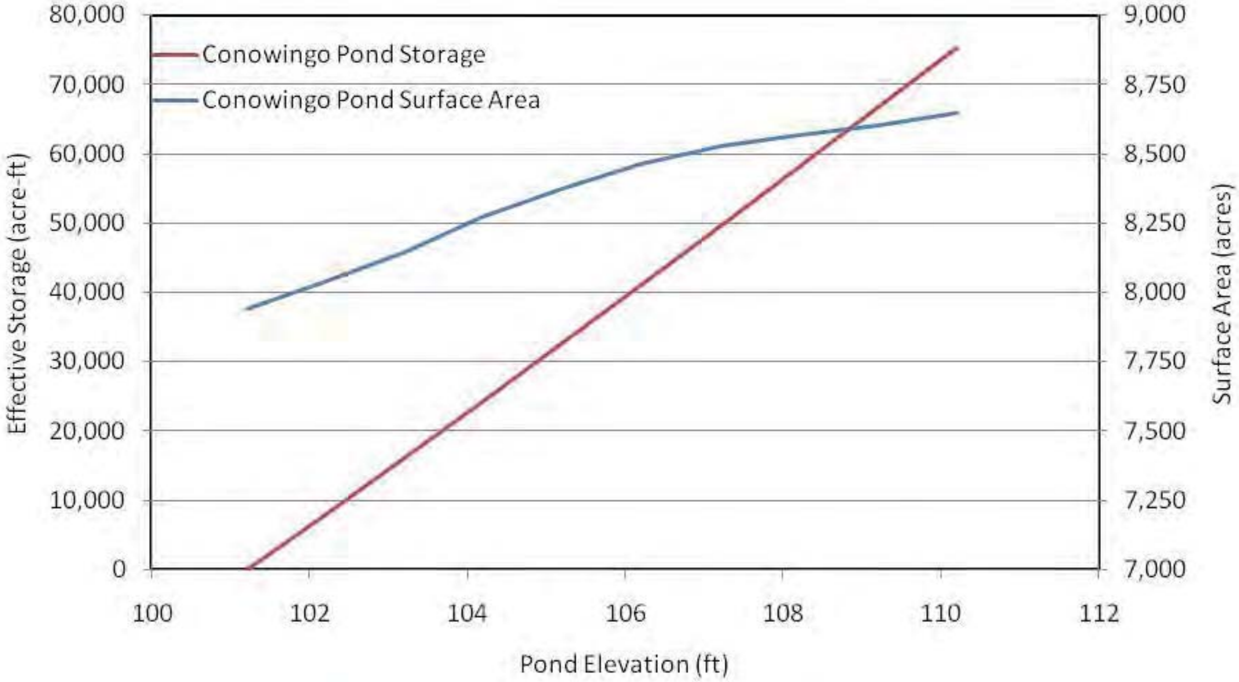


FIGURE 2.5-1: TAILWATER RATING CURVE

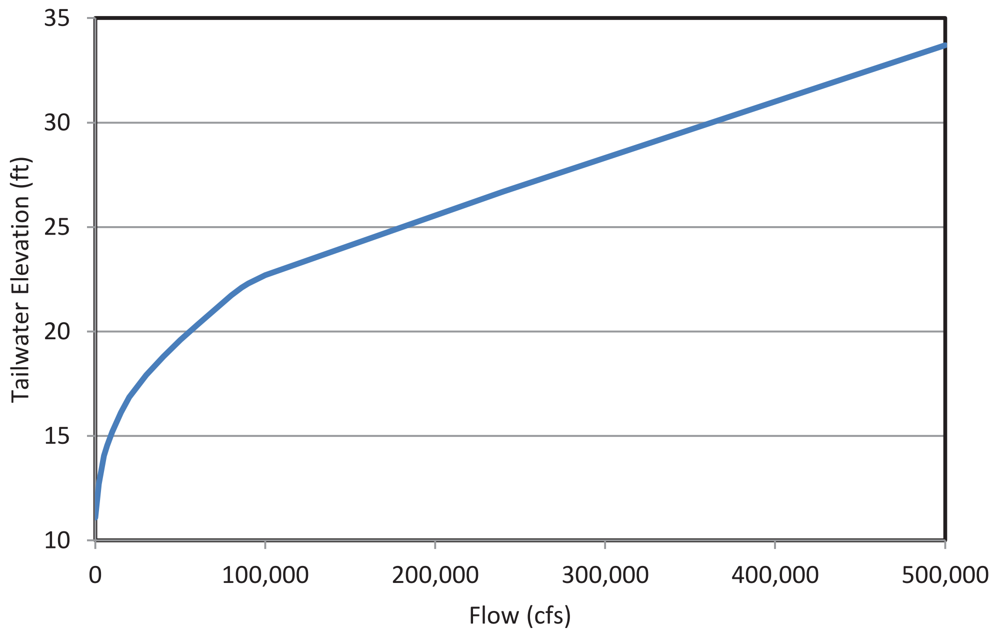
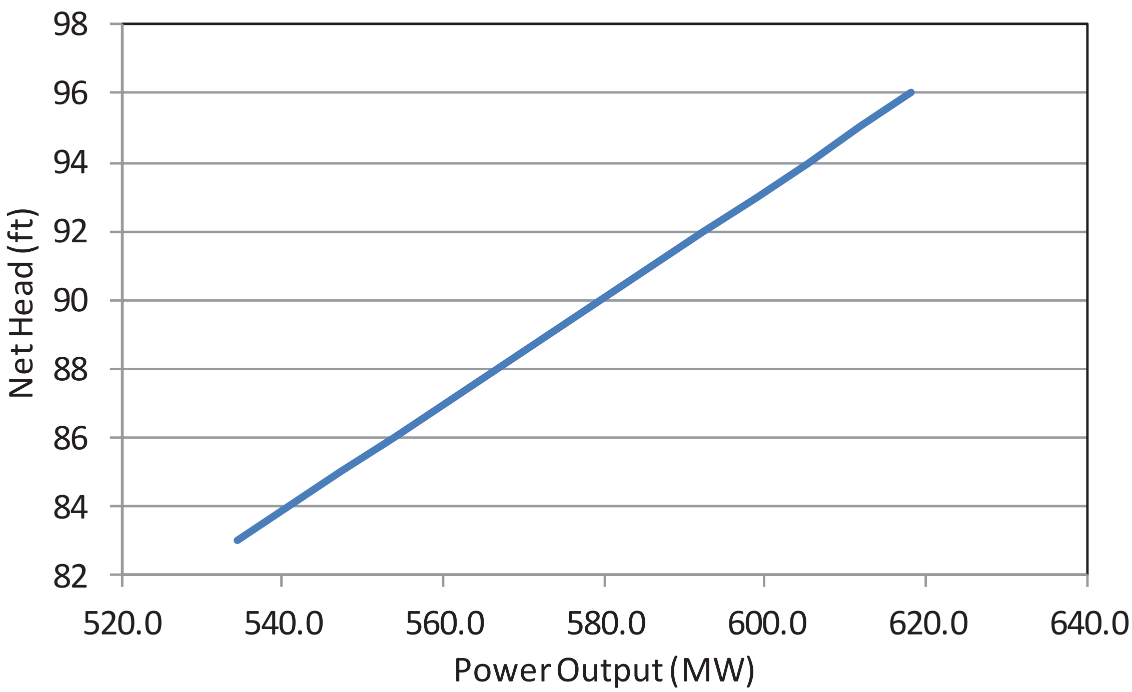


FIGURE 2.6-1: GROSS HEAD VS. UNIT OUTPUT



CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)

APPLICATION FOR NEW LICENSE

EXHIBIT C-CONSTRUCTION HISTORY AND PROPOSED CONSTRUCTION

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EXHIBIT C – CONSTRUCTION HISTORY AND PROPOSED CONSTRUCTION

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 4.51 (d) describes the required content of this Exhibit.

(d) Exhibit C is a construction history and proposed construction schedule for the project. The construction history and schedules must contain:

(1) If the application is for an initial license, a tabulated chronology of construction for the existing projects structures and facilities described under paragraph (b) of this section (Exhibit A), specifying for each structure or facility, to the extent possible, the actual or approximate dates (approximate dates must be identified as such) of:

(i) Commencement and completion of construction or installation;
(ii) Commencement of commercial operation; and
(iii) Any additions or modifications other than routine maintenance; and

(2) If any new development is proposed, a proposed schedule describing the necessary work and specifying the intervals following issuance of a license when the work would be commenced and completed.

SECTION 1.0 PROJECT HISTORY

FERC regulations require a construction history only for applications for an initial license. Therefore, a construction history is not required for this relicensing application for the Conowingo Hydroelectric Project. However, a brief Project timeline is included to provide general Project background.

In 1926, the Federal Power Commission issued a license to the Susquehanna Power Company and the Philadelphia Electric Company to begin construction of the Project. Commercial operation at Conowingo began in 1928, when seven 36-MW Francis turbines were commissioned and operated (Units 1-7). When the dam was built, room for four additional turbines (Units 8-11) was created but no units were initially installed. In 1965, four additional Kaplan-type units were added and began commercial operation.

The Conowingo Project is maintained through regularly scheduled maintenance inspections and replacement of deficient equipment as necessary. In addition to the routine maintenance, various areas of the Project have been refurbished. Major maintenance items have been completed during the life of the Project as follows:

1926	Federal Power Commission issues license to the Susquehanna Power Company and Philadelphia Electric Company to construct the Project
1928	The Conowingo Project began operation with seven 36-MW Francis-type units
1965	Four additional Kaplan-type units added, bringing total station capacity to 514.4 MW (including 2.4 MW from two house units)
1972	First operation of the West Fish Lift.
1976-1978	Tendon anchors installed through the dam into bedrock to strengthen the dam to withstand overtopping from high river flows
1980	Conowingo obtains new license from FERC through 2014.
1989	Settlement Agreement signed between Project owners and resource agencies established water quality standards, minimum flows and fish restoration programs
1990-1991	Construction and start-up of the East Fish Lift
1996	Unit 8 runner replaced
1997	Units 10 and 11 runner replacements. Units 1 and 2 13.8-200 single phase transformer replacement
1998	Unit 9 runner replacement and relay installation
1999	Units 3 and 4 13.8-200 single phase transformer replacement
2001-2003	Units 1 and 3 stator and runner replacement, increasing units’ capacities from 36 MW to 47.7 MW each. Total station capacity increased from 514.4 MW to 537.8 MW.
2004	Completion of Unit 4 end-of-life stator and runner replacement, increasing unit capacity from 36 MW to 47.7 MW. Total station capacity increased from 537.8 MW to 549.5 MW.

2005	Completion of Unit 5 end-of-life runner replacement. No increase in Unit 5 or total station capacity.
2006	Completion of Unit 6 end-of-life runner replacement. Unit 6 capacity increased from 36 MW to 47.7 MW. Total station capacity increased from 549.5 MW to 561.2 MW.
2007	Completion of Unit 7 end-of-life runner replacement. Unit 7 capacity increased from 36 MW to 47.7 MW. Total station capacity increased from 561.2 MW to 572.9 (573) MW.
2008	Completion of Unit 2 end-of-life runner and generator replacement. No increase in Unit 2 or total station capacity.
2009-2011	Unit 8, 10, 11 generator replacement.
2012	Unit 9 generator replacement.

SECTION 2.0 SCHEDULE FOR PROPOSED PROJECT DEVELOPMENT

Exelon is not proposing any new development at the Conowingo Hydroelectric Project.

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)

APPLICATION FOR NEW LICENSE

EXHIBIT D-STATEMENT OF COSTS AND FINANCING

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EXHIBIT D – STATEMENT OF COSTS AND FINANCING

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 4.51 (e) describes the required content of this Exhibit.

(e) Exhibit D is a statement of costs and financing. The statement must contain:

(1) If the application is for an initial license, a tabulated statement providing the actual or approximate original cost (approximate costs must be identified as such) of:

(i) Any land or water right necessary to the existing project; and

(ii) Each existing structure and facility described under paragraph(b) of this section (Exhibit A).

(2) If the applicant is a licensee applying for a new license, and is not a municipality or a state, an estimate of the amount which would be payable if the project were to be taken over pursuant to section 14 of the Federal Power Act upon expiration of the license in effect [see 16 U.S.C. 807], including:

(i) Fair value;

(ii) Net investment; and

(iii) Severance damages.

(3) If the application includes proposals for any new development, a statement of estimated costs, including:

(i) The cost of any land or water rights necessary to the new development; and

(ii) The cost of the new development work, with a specification of:

(A) Total cost of each major item;

(B) Indirect construction costs such as costs of construction equipment, camps, and commissaries;

(C) Interest during construction; and

(D) Overhead, construction, legal expenses, taxes, administrative and general expenses, and contingencies.

(4) A statement of the estimated average annual cost of the total project as proposed specifying any projected changes in the costs (life-cycle costs) over the estimated financing or licensing period if the applicant takes such changes into account, including:

(i) Cost of capital (equity and debt);

(ii) Local, state, and Federal taxes;

(iii) Depreciation and amortization;

(iv) Operation and maintenance expenses, including interim replacements, insurance, administrative and general expenses, and contingencies; and

(v) The estimated capital cost and estimated annual operation and maintenance expense of each proposed environmental measure.

(5) A statement of the estimated annual value of project power, based on a showing of the contract price for sale of power or the estimated average annual cost of obtaining an equivalent amount of power (capacity and energy) from the lowest cost alternative source, specifying any projected changes in the cost of power from that source over the estimated financing or licensing period if the applicant takes such changes into account.

(6) A statement specifying the sources and extent of financing and annual revenues available to the applicant to meet the costs identified in paragraphs (e) (3) and (4) of this section.

(7) An estimate of the cost to develop the license application;

(8) The on-peak and off-peak values of project power, and the basis for estimating the values, for projects which are proposed to operate in a mode other than run-of-river; and

(9) The estimated average annual increase or decrease in project generation, and the estimated average annual increase or decrease of the value of project power, due to a change in project operations (i.e., minimum bypass flows; limits on reservoir fluctuations).

SECTION 1.0 ORIGINAL COST OF DEVELOPMENT

This application is for a new license, not an initial license; the Conowingo Project was originally licensed in 1926. Accordingly, the Commission’s regulations do not require Exelon to include a statement of costs of lands, water rights, structures or facilities. 18 C.F.R. § 4.51(e)(1).

SECTION 2.0 AMOUNT PAYABLE IN THE EVENT OF PROJECT TAKEOVER

To date, no agency or interested party has recommended a Federal takeover of the Project pursuant to Section 14 of the Federal Power Act. If such a takeover were to occur, Exelon would have to be reimbursed for the net investment, not to exceed the fair value of the property taken, plus severance damages, if any, to property of the licensee valuable, serviceable, and dependent for its usefulness on the continuance of the license, but not taken. (Section 14, Federal Power Act).

2.1. Fair Value

The term “fair value” is not defined in FPA Section 14. Exelon believes the best approximation of fair value is the cost to construct and operate a comparable power generating facility. Because of the high capital costs involved with constructing new facilities and the increase in fuel costs (assuming a fossil fueled replacement), the fair value would be considerably higher than the net investment (see Section 2.2). If a takeover were proposed, Exelon would calculate fair value based on then-current conditions.

2.2. Net Investment

The Federal Power Act defines “net investment” as the original cost, plus additions, minus the sum of the following items (to the extent that such items have been accumulated during the period of the license from earnings in excess of a fair return on such investment): (a) unappropriated surplus; (b) aggregate credit balances of current depreciated accounts; and (c) aggregate appropriations of surplus or income held in amortization, sinking fund, or similar reserves.

The Project’s net investment is $263,430,000. This should not be interpreted as the fair market value of the Project.

2.3. Severance Damages

Severance damages are determined either by the cost of replacing (retiring) equipment that is “dependent for its usefulness upon the continuance of the License” but not taken (Section 14, Federal Power Act).

SECTION 3.0 CAPITAL COST OF PROPOSED DEVELOPMENT

Exelon does not propose to add any additional power generation facilities to the Project.

SECTION 4.0 ESTIMATE AVERAGE ANNUAL COST OF PROJECT

The average annual cost of the Project includes capital costs, taxes, depreciation, as well as operations and maintenance costs. The average annual costs also include any costs associated with the proposed PM&E measures.

4.1. Capital Costs

The estimated average annual capital costs for the Project are $15,974,000. These costs include life cycle costs such as runner replacements, generator rewinds, and oil circuit breaker replacements and routine replacement of vehicles and tools. Additional capital costs related to the implementation of PM&E measures will add to the annual capital expense. These costs are detailed in the Section 4.5.

4.2. Taxes

The estimated annual property taxes are approximately $3,843,000. Exelon estimates paying approximately $36,788,000 in Project-related Federal income taxes and approximately $6,561,000 in Project-related state income taxes annually.

4.3. Depreciation and Amortization

The estimated annual deprecation and amortization costs associated with the Project are $6,101,000.

4.4. Operation and Maintenance Expenses

Annual operations and maintenance (O&M) expenses include interim replacements, insurance, and administrative and general costs associated with the operation of the Project. The estimated O&M costs for the Project are approximately $15,985,000 per year.

Additional O&M expenses related to the implementation of PM&E measures will add to the annual O&M expense. These costs are detailed in the Section 4.5.

4.5. Costs of Environmental Measures

Exelon proposes several environmental measures for inclusion in the new license for the Project. The measures would add capital costs, and increase annual operations and maintenance costs for the Project.

Exelon estimates that the capital cost associated with Project PM&E measures will be approximately $5,413,000 (nominal 2014 dollars). PM&E costs will increase O&M costs by approximately $54,955,000 (nominal 2014 dollars).

Table 4.5-1 presents the itemized preliminary costs associated with these PM&E measures.

TABLE 4.5-1: PRELIMINARY COST ESTIMATE OF PROPOSED ENVIRONMENTAL MEASURES

PME Measure	Total Capital Cost over 46 Years (2014 dollars)	Total O&M Cost over 46 Years (2014 dollars)	Average Annual Cost over 46 Years (2014 dollars)
Fish Lift Maintenance Plan	$0	$9,200,000	$200,000
Upstream American Eel Passage	$718,000	$28,954,000	$645,000
Downstream American Eel Passage	$227,000	$13,165,000	$291,000
Bald Eagle Management	$0	$123,000	$3,000
Historic Properties Management	$95,000	$973,000	$23,000
Recreation Management	$4,373,000	$2,102,000	$141,000
Shoreline Management	TBD	TBD	TBD
Sediment Management Plan[9]	$0	$438,000	$10,000
Total	**$5,413,000**	**$54,955,000**	**$1,313,000**

SECTION 5.0 ESTIMATED ANNUAL VALUE OF PROJECT POWER

If all Project generation was sold into the market, it would be priced at the Day Ahead and Real Time Locational Marginal Prices that clear for each generator. For 2011, the Project had a realized energy value of $43.73 per MWh (this is a realized value calculated as revenue divided by generation).

[9] Cost for sediment removal activites related to Project recreation facilities to be determined.

The economic analysis of the Project also recognizes that the PJM market values the installed capacity and ancillary services provided by generation facilities. Installed Capacity (ICAP) is required by PJM to ensure the reliability of the electric system. ICAP is compensated in terms of Unforced Capacity (UCAP) within PJM where UCAP =ICAP*(1-EFORd[10]). UCAP price is established by PJM through an RPM (Reliability Pricing Model) auction process. For 2011, the calendar average RPM clearing price is $136.6/MW-day. The Project's UCAP value is 566.1 MW. Thus, the capacity value of the Project for 2011 is approximately $28.2 million (566.1 MW * $136.6/MW-day * 365days/yr.).

In addition to energy and capacity, the Project produces ancillary services that provide spinning reserve and black start capability to the PJM market. For 2011, the ancillary services revenue has been calculated as $115,000 per year.

Table 5-1 below shows the total valuation of the power based on the product components identified above. This assumes an average net generation, based on the Exelon operations model, of 1,669,000 MWh annually. The annual market value of the energy, capacity and ancillary services is approximately $101,327,000 per year, which equates to $60.71 per MWh.

TABLE 5-1: VALUATION OF THE ANNUAL OUTPUT OF THE CONOWINGO PROJECT

Revenue Source	Value
Energy at $43.73 (for 1,669,000 MWh)	$72,985,000
UCAP at $136.60 per MW-day (566.14 MW)	$28,227,000
Ancillary Services	$115,000
Total Value (Energy + Ancillary Services +UCAP)	$101,327,000
Total value per MWh	$60.71

SECTION 6.0 SOURCES AND EXTENT OF FINANCING

Exelon finances capital projects using a combination of debt obligations and internal funding sources. Based on the value of Project power (Section 5.0), the Project has adequate financial resources for the operation of the Project for the term of a new license (Section 4.0).

[10] EFORd = Equivalent Forced Outage Rate.

SECTION 7.0 ESTIMATE OF COST TO DEVELOP LICENSE APPLICATION

The cost to develop the information necessary to complete the Conowingo Project license application is estimated to be $14,989,000. This estimate includes all study costs, ILP costs, and personnel and administrative costs associated with processing.

SECTION 8.0 ON-PEAK AND OFF-PEAK VALUES OF PROJECT POWER

The Conowingo Project operates within the Pennsylvania-New Jersey-Maryland (PJM) Interconnection, whose geographic area includes that of the Mid-Atlantic Area Council (MAAC) region.

Exelon has provided the historical 2011 Real Time On-Peak and Off-Peak prices for the Conowingo generation node[11].

On Peak Price	$53.61/MWh
Off-Peak Price	$37.39/MWh

SECTION 9.0 ESTIMATED AVERAGE ANNUAL INCREASE OR DECREASE IN PROJECT GENERATION

No changes in operations of the Project are proposed, and therefore no increases or decreases in Project generation are expected.

[11] The electricity values were internally generated from an Exelon software application. This application software retrieves PJM data such as LMP electricity prices directly from the PJM database. Exelon's program retrieves data every hour and also on a daily and monthly basis. The data referenced were the historical Real Time LMP values for Conowingo for 2011. The Conowingo Pricing node (Pnode) ID is #37401237. For reference, the URL for PJM data is http://www.pjm.com/pub/account/lmp/20120801.csv (data for August 1st 2012).

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)

APPLICATION FOR NEW LICENSE

EXHIBIT E-ENVIRONMENTAL REPORT

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EXHIBIT E – ENVIRONMENTAL REPORT

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 5.18(b) describes the required content of this Exhibit.

Exhibit E—Environmental Exhibit. The specifications for Exhibit E in §§4.41, 4.51, or 4.61 of this chapter shall not apply to applications filed under this part. The Exhibit E included in any license application filed under this part must address the resources listed in the Pre-Application Document provided for in §5.6; follow the Commission's "Preparing Environmental Assessments: Guidelines for Applicants, Contractors, and Staff," as they may be updated from time-to-time; and meet the following format and content requirements:

(1) General description of the river basin. Describe the river system, including relevant tributaries; give measurements of the area of the basin and length of stream; identify the project's river mile designation or other reference point; describe the topography and climate; and discuss major land uses and economic activities.

(2) Cumulative effects. List cumulatively affected resources based on the Commission's Scoping Document, consultation, and study results. Discuss the geographic and temporal scope of analysis for those resources. Describe how resources are cumulatively affected and explain the choice of the geographic scope of analysis. Include a brief discussion of past, present, and future actions, and their effects on resources based on the new license term (30–50 years). Highlight the effect on the cumulatively affected resources from reasonably foreseeable future actions. Discuss past actions' effects on the resource in the Affected Environment Section.

(3) Applicable laws. Include a discussion of the status of compliance with or consultation under the following laws, if applicable:

(i) Section 401 of the Clean Water Act. The applicant must file a request for a water quality certification (WQC), as required by Section 401 of the Clean Water Act no later than the deadline specified in §5.23(b). Potential applicants are encouraged to consult with the certifying agency or tribe concerning information requirements as early as possible.

(ii) Endangered Species Act (ESA). Briefly describe the process used to address project effects on Federally listed or proposed species in the project vicinity. Summarize any anticipated environmental effects on these species and provide the status of the consultation process. If the applicant is the Commission's non-Federal designee for informal consultation under the ESA, the applicant's draft biological assessment must be included.

(iii) Magnuson-Stevens Fishery Conservation and Management Act. Document from the National Marine Fisheries Service (NMFS) and/or the appropriate Regional Fishery Management Council any essential fish habitat (EFH) that may be affected by the project. Briefly discuss each managed species and life stage for which EFH was designated. Include, as appropriate, the abundance, distribution, available habitat, and habitat use by the managed species. If the project may affect EFH, prepare a draft "EFH Assessment" of the impacts of the project. The draft EFH Assessment should contain the information outlined in 50 CFR 600.920(e).

(iv) Coastal Zone Management Act (CZMA). Section 307(c)(3) of the CZMA requires that all Federally licensed and permitted activities be consistent with approved state Coastal Zone Management Programs. If the project is located within a coastal zone boundary or if a project affects a resource located in the boundaries of the designated coastal zone, the applicant must certify that the project is consistent with the state Coastal Zone Management Program. If the project is within or affects a resource within the coastal zone, provide the date the applicant sent the consistency certification information to the state agency, the date the state agency received the certification, and the date and action taken by the state agency (for example, the agency will either agree or disagree

with the consistency statement, waive it, or ask for additional information). Describe any conditions placed on the state agency's concurrence and assess the conditions in the appropriate section of the license application. If the project is not in or would not affect the coastal zone, state so and cite the coastal zone program office's concurrence.

(v) National Historic Preservation Act (NHPA). Section 106 of NHPA requires the Commission to take into account the effect of licensing a hydropower project on any historic properties, and allow the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment on the proposed action. "Historic Properties" are defined as any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places (NRHP). If there would be an adverse effect on historic properties, the applicant may include a Historic Properties Management Plan (HPMP) to avoid or mitigate the effects. The applicant must include documentation of consultation with the Advisory Council, the State Historic Preservation Officer, Tribal Historic Preservation Officer, National Park Service, members of the public, and affected Indian tribes, where applicable.

(vi) Pacific Northwest Power Planning and Conservation Act (Act). If the project is not within the Columbia River Basin, this section shall not be included. The Columbia River Basin Fish and Wildlife Program (Program) developed under the Act directs agencies to consult with Federal and state fish and wildlife agencies, appropriate Indian tribes, and the Northwest Power Planning Council (Council) during the study, design, construction, and operation of any hydroelectric development in the basin. Section 12.1A of the Program outlines conditions that should be provided for in any original or new license. The program also designates certain river reaches as protected from development. The applicant must document consultation with the Council, describe how the act applies to the project, and how the proposal would or would not be consistent with the program.

(vii) Wild and Scenic Rivers and Wilderness Acts. Include a description of any areas within or in the vicinity of the proposed project boundary that are included in, or have been designated for study for inclusion in, the National Wild and Scenic Rivers System, or that have been designated as wilderness area, recommended for such designation, or designated as a wilderness study area under the Wilderness Act.

(4) Project facilities and operation. Provide a description of the project to include:

(i) Maps showing existing and proposed project facilities, lands, and waters within the project boundary;

(ii) The configuration of any dams, spillways, penstocks, canals, powerhouses, tailraces, and other structures;

(iii) The normal maximum water surface area and normal maximum water surface elevation (mean sea level), gross storage capacity of any impoundments;

(iv) The number, type, and minimum and maximum hydraulic capacity and installed (rated) capacity of existing and proposed turbines or generators to be included as part of the project;

(v) An estimate of the dependable capacity, and average annual energy production in kilowatt hours (or mechanical equivalent);

(vi) A description of the current (if applicable) and proposed operation of the project, including any daily or seasonal ramping rates, flushing flows, reservoir operations, and flood control operations.

(5) Proposed action and action alternatives.

(i) The environmental document must explain the effects of the applicant's proposal on resources. For each resource area addressed include:

(A) A discussion of the affected environment;

(B) A detailed analysis of the effects of the applicant's licensing proposal and, if reasonably possible, any preliminary terms and conditions filed with the Commission; and

(C) Any unavoidable adverse impacts.

(ii) The environmental document must contain, with respect to the resources listed in the Pre-Application Document provided for in §5.6, and any other resources identified in the Commission's scoping document prepared pursuant to the National Environmental Policy Act and §5.8, the following information, commensurate with the scope of the project:

(A) Affected environment. The applicant must provide a detailed description of the affected environment or area(s) to be affected by the proposed project by each resource area. This description must include the information on the affected environment filed in the Pre-Application Document provided for in §5.6, developed under the applicant's approved study plan, and otherwise developed or obtained by the applicant. This section must include a general description of socio-economic conditions in the vicinity of the project including general land use patterns (e.g., urban, agricultural, forested), population patterns, and sources of employment in the project vicinity.

(B) Environmental analysis. The applicant must present the results of its studies conducted under the approved study plan by resource area and use the data generated by the studies to evaluate the beneficial and adverse environmental effects of its proposed project. This section must also include, if applicable, a description of any anticipated continuing environmental impacts of continued operation of the project, and the incremental impact of proposed new development of project works or changes in project operation. This analysis must be based on the information filed in the Pre-Application Document provided for in §5.6, developed under the applicant's approved study plan, and other appropriate information, and otherwise developed or obtained by the Applicant.

(C) Proposed environmental measures. The applicant must provide, by resource area, any proposed new environmental measures, including, but not limited to, changes in the project design or operations, to address the environmental effects identified above and its basis for proposing the measures. The applicant must describe how each proposed measure would protect or enhance the existing environment, including, where possible, a non-monetary quantification of the anticipated environmental benefits of the measure. This section must also include a statement of existing measures to be continued for the purpose of protecting and improving the environment and any proposed preliminary environmental measures received from the consulted resource agencies, Indian tribes, or the public. If an applicant does not adopt a preliminary environmental measure proposed by a resource agency, Indian tribe, or member of the public, it must include its reasons, based on project specific information.

(D) Unavoidable adverse impacts. Based on the environmental analysis, discuss any adverse impacts that would occur despite the recommended environmental measures. Discuss whether any such impacts are short- or long-term, minor or major, cumulative or site-specific.

(E) Economic analysis. The economic analysis must include annualized, current cost-based information. For a new or subsequent license, the applicant must include the cost of operating and maintaining the project under the existing license. For an original license, the applicant must estimate the cost of constructing, operating, and maintaining the proposed project. For either type of license, the applicant should estimate the cost of each proposed resource protection, mitigation, or enhancement measure and any specific measure filed with the Commission by agencies, Indian tribes, or members of the public when the application is filed. For an existing license, the applicant's economic analysis must estimate the value of developmental resources associated with the project under the current license and the applicant's proposal. For an original license, the applicant must estimate the value of the developmental resources for the proposed project. As applicable, these developmental resources may include power generation, water supply, irrigation, navigation, and flood control. Where possible, the value of developmental resources must be based on market prices. If a protection, mitigation, or

enhancement measure reduces the amount or value of the project's developmental resources, the applicant must estimate the reduction.

(F) Consistency with comprehensive plans. Identify relevant comprehensive plans and explain how and why the proposed project would, would not, or should not comply with such plans and a description of any relevant resource agency or Indian tribe determination regarding the consistency of the project with any such comprehensive plan.

(G) Consultation Documentation. Include a list containing the name, and address of every Federal, state, and interstate resource agency, Indian tribe, or member of the public with which the applicant consulted in preparation of the Environmental Document.

H) Literature cited. Cite all materials referenced including final study reports, journal articles, other books, agency plans, and local government plans.

(6) The applicant must also provide in the Environmental Document:

(A) Functional design drawings of any fish passage and collection facilities or any other facilities necessary for implementation of environmental measures, indicating whether the facilities depicted are existing or proposed (these drawings must conform to the specifications of §4.39 of this chapter regarding dimensions of full-sized prints, scale, and legibility);

(B) A description of operation and maintenance procedures for any existing or proposed measures or facilities;

(C) An implementation or construction schedule for any proposed measures or facilities, showing the intervals following issuance of a license when implementation of the measures or construction of the facilities would be commenced and completed;

(D) An estimate of the costs of construction, operation, and maintenance, of any proposed facilities, and of implementation of any proposed environmental measures.

(E) A map or drawing that conforms to the size, scale, and legibility requirements of §4.39 of this chapter showing by the use of shading, cross-hatching, or other symbols the identity and location of any measures or facilities, and indicating whether each measure or facility is existing or proposed (the map or drawings in this exhibit may be consolidated).

SECTION 1.0 INTRODUCTION

1.1 Exelon's Application for a New License

Exelon Generation Company LLC (Exelon or Licensee), in accordance with Sections (§§) 5.17 and 5.18 of Title 18 of the Code of Federal Regulations (CFR), is filing with the Federal Energy Regulatory Commission (FERC or Commission) an Application for a New License for Major Project – Existing Dam - for Exelon's 573 megawatt (MW) Conowingo Hydroelectric Project, FERC Project No. 405 (Project). The existing license for the Project was issued by FERC to Susquehanna Power Company and Philadelphia Electric Power Company. The license was issued on August 14, 1980, for a term ending August 31, 2014.

Project facilities and features of the existing FERC license for the Project include the Conowingo Dam which creates the Project reservoir, known as Conowingo Pond. The reservoir extends approximately 14 miles upstream from Conowingo Dam to the lower end of the Holtwood Project tailrace. Conowingo Pond is generally maintained at an elevation of 109.2 feet (National Geodetic Vertical Datum of 1929 [NGVD 1929]), with a surface area of 8,500 acres and a design storage capacity of 310,000 acre-feet. The effective storage between Conowingo Pond's licensed minimum and maximum elevations of 101.2 feet and 110.2 feet is 75,287 acre-feet.

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 feet; 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 99.2 feet; an intake-powerhouse section which is 946 feet long; and a 127-foot-long abutment section. The tailrace and spillway sections of the dam are separated by a dividing wall extending 300 feet downstream of the powerhouse. The dam and powerhouse also support U.S. Highway Route No. 1, which passes over the top of Conowingo Dam.

Flow over the ogee spillway sections is controlled by 50 stony-type crest gates with crest elevations of 86.7 feet and two regulating gates with crest elevations of 99.2 feet. Each of the crest gates are 22.5 feet high by 38 feet wide and have a discharge capacity of 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 4,000 cfs per gate at a reservoir elevation of 109.2 feet.

The first seven turbine/generating units (1-7) are completely enclosed within the powerhouse, while the last four units (8-11) are an outdoor type of construction thereby eliminating a superstructure in this area. The Project currently operates two fish lifts. The west lift, adjacent to the right abutment, is currently operated under an agreement with the United States Fish and Wildlife Service (USFWS) for American shad egg production and other research purposes. The newer east lift, which uses regulating gate bays for attraction flow, is used primarily to pass American shad and other migratory fishes during the April – June migration season.

Exelon intends to continue to operate the Project as it has operated historically. Exelon proposes to amend the Project boundary to eliminate certain lands along Broad Creek and lands downstream from the Conowingo Dam. The lands downstream of the dam were included in the original 1928 license because they encompassed the railroad line necessary to construct the Project. The railroad was abandoned several decades ago and the lands proposed to be excluded serve no Project purpose. Exelon is proposing the implementation of several resource management plans and a comprehensive management and upgrade proposal for the recreational facilities at the Conowingo Project.

1.2 Purpose for Action and Need for Power

1.2.1 Purpose of Action

FERC must decide whether to issue a new hydropower license to Exelon for the Conowingo Project and what conditions should be placed on any license issued. In deciding whether and under what conditions to issue a license for a hydroelectric project, pursuant to Section 10(a)(1) of the Federal Power Act (FPA), FERC must determine that the Project will be best adapted to a comprehensive plan for improving or developing the waterway. In addition to the power and developmental purposes for which licenses are issued, FERC is required under Section 4 (e) of the FPA to give equal consideration (but not equal treatment) to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.

Issuing a new license for the Project would allow Exelon to continue to generate and transmit electricity at the Project for the term of the new license, making electric power from a renewable resource available to serve regional demand.

Exhibit E of this license application has been prepared in accordance with 18 CFR § 5.18(b) and in general conformance with the Commission's Preparing Environmental Assessments: Guidelines for Applicants, Contractors and Staff (FERC 2008). This Exhibit E is designed to support FERC's required analysis under the National Environmental Policy Act of 1969 (NEPA), as amended. The Exhibit analyzes the environmental and economic effects associated with the continued operation of the Conowingo Project, as proposed by Exelon. This Exhibit includes measures proposed by Exelon for the PM&E of resources that would potentially be affected by Exelon's proposed Project. The effects of a no-action alternative are also considered.

1.2.2 Need for Power

The Conowingo Project is located within the PJM Regional Transmission Organization (PJM) which is responsible for the movement of wholesale power in thirteen eastern states and the District of Columbia. PJM prepares a 15-year load projection in energy demand, which it utilizes to plan improvements to the existing transmission system. PJM currently predicts that in the Mid-Atlantic region, peak summer energy usage demand for the 15-year period from 2010 through 2024 will increase annually by 1.5 percent. Over the term of the new license, the Conowingo Project will provide power and ancillary services to help meet this growing demand.

The Conowingo Project is operated as a base load, voltage control, and reserve capacity facility within the regional electrical system. The Project is also capable of providing "black start" service. Black start is the procedure used to recover from a total or partial loss of the transmission system by starting individual stations independently of the grid and gradually reenergizing the interconnected system. In the event that the regional grid loses all power, Exelon can bring the Conowingo Project online using installed station batteries to begin the process of returning power to the grid.

1.3 Applicable Statutory and Regulatory Requirements

Issuance of a new license for the Project is subject to numerous requirements under the FPA and other applicable statutes. The major acts and related requirements are described below. Actions undertaken by Exelon or the agency with jurisdiction related to each requirement are also described.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA, 16 U.S.C. § 811, states that FERC shall require construction, maintenance, and operation by a licensee of such fishways as the Secretaries of the Department of Commerce and the Department of the Interior (USDOI) may prescribe. Exelon has consulted with the USFWS and National Marine Fisheries Service (NMFS) during implementation of the Integrated Licensing Process (ILP), including study plan development.

1.3.1.2 Section 10(j) Recommendations

Under the provisions of Section 10(j) of the FPA, each hydroelectric license issued by FERC is required to include conditions based on recommendations of Federal and state fish and wildlife agencies for the protection, mitigation or enhancement of fish and wildlife resources affected by the Project, unless FERC determines they are inconsistent with the purposes and requirements of the FPA or other applicable law. During the relicensing, Exelon consulted with the Maryland Department of the Environment (MDE), Maryland Department of Natural Resources (MDNR), Pennsylvania Department of Environmental Protection (PADEP), the Pennsylvania Fish and Boat Commission (PFBC), Susquehanna River Basin Commission (SRBC), NMFS and the USFWS.

1.3.2 Clean Water Act

Section 401 of the Clean Water Act (CWA) requires Exelon to obtain certification from the state in which the Project discharges water of the Project's compliance with applicable provisions of the CWA, or a waiver of certification from the appropriate state agency. FERC regulations require that a request for CWA Section 401 certification be filed within 60 days of FERC's issuance of a notice of acceptance and ready for environmental analysis (REA). During the relicensing, Exelon consulted with the Maryland Department of Environment Wetland and Waterway Program and the PADEP. Exelon is prepared to file its application for CWA Section 401 certification with the MDE in a timely manner.

In Maryland, water quality standards for Conowingo Project waters are established by the MDE Water Quality Standards Section. All Maryland water quality standards, including those applicable to the Project, are codified in Maryland State statutes.

1.3.3 Endangered Species Act

The ESA of 1973, as amended, (16 USC § 1531 et seq.) was enacted to protect and conserve endangered and threatened species and the ecosystems upon which they depend. The ESA defines an "endangered" species in part as a "species which is in danger of extinction throughout all or a significant portion of its range" and a "threatened" species as one, "which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." (16 USC § 1532(6)). A species may be officially proposed for listing under the ESA as endangered or threatened. The ESA is administered by the Secretary of the Interior through USFWS for most species, and by the Secretary of Commerce through NMFS for marine and anadromous species.

Section 7 of the ESA requires Federal agencies to consult with the USFWS and NMFS to ensure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of critical habitat for these listed species. Section 7 consultation with the USFWS and NMFS is ongoing.

1.3.4 National Historic Preservation Act

As the lead Federal agency for hydropower relicensing, FERC is responsible for satisfying Section 106 consultation requirements under the National Historic Preservation Act (NHPA). Implementation regulations for Section 106 have been published by the Secretary of the Interior in 36 CFR 800. FERC must consult with interested parties, including the Pennsylvania Historical and Museum Commission, Bureau for Historic Preservation (PHMC), Maryland Historical Trust (MHC), and all Indian Tribes which may have used the area in the past on Project effects on historic properties eligible for protection under the NHPA. This consultation must document that FERC has considered the effects of the undertaking (the issuance of a new Federal operating license) on historic properties eligible for listing on the National Register of Historic Places (NRHP) and allow the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on its conclusions. FERC typically satisfies Section 106 requirements by delegating day-to-day consultation to the License applicant. FERC designated Exelon as its non-Federal representative for prefiling consultation under Section 106 by notice issued May 11, 2009.

Exelon developed a study plan to identify and assess, in consultation with the Pennsylvania Historical and Museum Commission (PHMC), Maryland Historical Trust (MHT), and potentially affected Indian tribes, any adverse effects on historic properties resulting from continued operation of the Project, as required under 36 CFR § 800.5. Exelon will develop a Historic Properties Management Plan (HPMP) in consultation PHMC, MHC, and any other interested parties.

1.3.5 Coastal Zone Management Act of 1972

Under § 307(c)(3)(A) of the Coastal Zone Management Act of 1972, as amended, (CZMA), (16 U.S.C. § 1456(3)(A)), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program. The agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The Project is not located within the Pennsylvania coastal zone boundary, which is located along a portion of Lake Erie and the Delaware River basin. Continued operation of the Project would not affect resources located within the boundary of a coastal zone. Therefore, the Project is not subject to Pennsylvania coastal zone program review. In correspondence dated June 24, 2009, the Pennsylvania Coastal Zone Management Program has confirmed that no consistency certification is needed.

In Maryland, both Harford and Cecil counties are located within the Coastal Zone. Electric generation and transmission are both permissible coastal uses within Maryland. Exelon certifies that the proposed relicensing of the Conowingo Project complies with the enforceable policies of the Maryland Coastal Zone Management Program (CZMP) and will be conducted in a manner consistent with the CZMP. Exelon is providing the Maryland Department of Environment-Wetlands and Waterways Program with a consistency certification concurrent with the filing of this license application.

1.3.6 Energy Policy Act of 2005

The Energy Policy Act of 2005, as amended (P.L. 109-58) provides parties to a licensing proceeding the opportunity to propose alternatives to preliminary conditions and to request trial-type hearings regarding issues of material fact that support the preliminary conditions developed under FPA §§ 4 and 18.

1.4 Public Review and Consultation

The Commission's regulations (18 CFR § 5.1(d)) require an applicant to consult with appropriate Federal and state agencies, Indian tribes, and members of the public that may be interested in the proceeding before filing an application for a license. This consultation is the first step in complying with the FPA, ESA, NHPA, and other Federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations. Confirmation of Exelon's prefiling consultation is included in Exhibit E, Section 7 of the license application.

1.4.1 Scoping

Issuance of a license requires preparation of either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS), in accordance with NEPA. The preparation of an EA or EIS is supported by a scoping process to ensure the identification and analysis of all pertinent issues.

On May 11, 2009, the Commission issued a notice of commencement of proceeding stating FERC intended to prepare an EA for the Project but noting there was a possibility that an EIS would be required. At the same time, the Commission issued Scoping Document 1 (SD1). SD1 provided Relicensing Participants with FERC's preliminary list of issues and alternatives to be addressed in an EA, or EIS, for the Project relicensing and enabled Relicensing Participants to more effectively participate in and contribute to the scoping process.

The Commission held two public scoping meetings in Darlington, Maryland, on June 11 and 12, 2009, and conducted a site visit on June 11, 2009. The scoping meetings and site visit were noticed in a local newspaper and the Federal Register. The meetings were recorded and the transcript posted by the Commission on its Internet E-Library.

The Commission requested that written comments on SD1 and Exelon's Pre-Application Document (PAD) be provided to the Commission no later than July 10, 2009. In addition to the oral comments received during the scoping meetings, the Commission received 14 comment letters by the July 10 deadline[12]. Thirteen of the letters provided comments on SD1 and 6 of the letters comment on the PAD. Table 1.4.1-1 lists Relicensing Participants that filed comments on SD1 and the PAD.

Based on the Commission's review of oral comments during the June 10 and 11 scoping meetings and written comments on SD1 and the PAD, on August 24, 2009, the Commission issued Scoping Document 2 (SD2), which replaced SD1.

[12] The Mason-Dixon Trail System submitted comments on July 13, 2009, however this comment letter is included as being considered submitted by the comment period deadline.

1.4.2 Interventions

At this time, the Commission has not acted on motions to intervene.

1.4.3 Relicensing Studies

1.4.3.1 FERC's Determination on Revised Study Plan

Pursuant to 18 C.F.R. § 5.11 of the Commission's regulations, Exelon filed its Proposed Study Plan (PSP) on August 24, 2009, and distributed the PSP to interested resource agencies and stakeholders for review and comment. In addition, pursuant to 18 C.F.R. § 5.11(e), Exelon held an initial meeting on the PSP at the Darlington Volunteer Fire Department in Darlington, MD on September 22 and 23, 2009.

On November 22, 2009, several resource agencies and stakeholders provided comments on Exelon's PSP, pursuant to 18 C.F.R. § 5.12 of the Commission's regulations, including Commission staff, the MDNR, the NMFS, the Nature Conservancy, the PFBC, the Pennsylvania Game Commission (PGC), the SRBC, and the USFWS. Exelon filed its Revised Study Plan with FERC on December 22, 2009. Table 1.4.3-1 lists the 32 studies included in Exelon's Revised Study Plan.

On February 4, 2010, FERC issued a Study Plan Determination for Exelon's Conowingo Project. The Determination approved without modification 15 of the 32 studies in Exelon's Revised Study Plan, approved with modifications 15 of the studies, eliminated two studies and did not add any studies.

1.4.3.2 FERC's Determination Regarding Study Disputes

Two agencies (SRBC and MDNR) filed with FERC a formal dispute with FERC's February 4, 2010, Study Determination. Collectively, the agencies' disputes focused on four studies (3.1, 3.2, 3.11, and 3.18).

On May 10, 2010, FERC issued an Order Denying Rehearing to the SRBC, indicating that this agency does not have mandatory conditioning authority under Sections 4(e) or 18 of the Federal Power Act.

On September 30, 2010, Maryland's Department of Natural Resources, Power Plant Research Program and Department of the Environment (Maryland agencies) filed a notice of settlement and request to withdraw study dispute. Specifically, the Maryland agencies withdrew a February 24, 2010 notice of study dispute filed on four studies concerning the relicensing of Exelon Generation Company, LLC's (Exelon) Conowingo Hydroelectric Project No. 405. Exelon agreed to conduct a field-based study of turbine passage survival for American shad. The Maryland agencies indicated that the specific methodologies of the agreed-upon study will be included in a revised study plan to be filed with the Commission at a later date. As a result of the withdrawal filing, FERC did not issue a study dispute determination for the Conowingo Project.

1.4.3.3 FERC's Determination on Initial Study Report

Exelon filed with FERC an Initial Study Report on February 22, 2011, held an Initial Study Report meeting on March 9-11, 2011, and filed with FERC an Initial Study Report meeting summary on March 28, 2011. Ten stakeholders filed letters regarding Exelon's Initial Study Report with FERC. On June 24, 2011, the Commission issued a Determination that ordered refinements to five studies[13]; no new study plans were required to address these modifications.

1.4.3.4 FERC's Determination on Updated Study Report

Exelon filed with FERC an Updated Study Report on January 23, 2012, and held an Updated Study Report meeting on February 1-2, 2012. Exelon filed an Updated Study Report meeting summary on February 17, 2012. On May 21, 2012, the Commission issued a Determination that ordered refinements to one study.[14]

1.4.3.5 Study Status

Thirty of the 32 FERC-approved studies have been completed. The remaining studies in progress involved field sampling which was completed in the spring and summer of 2012. The remaining studies include RSP 3.5-2012 American shad telemetry study and RSP 3.21-Ichthyoplankton Sampling. Exelon anticipates filing these study report on or before September 30, 2012.

[13] Studies modified include RSP 3.11 Hydrologic Study, RSP 3.15 Sediment Introduction Study, RSP 3.19 Freshwater Mussel Study, RSP 3.29 Downstream Flooding Study, and RSP 3.32 Closing of the Catwalk Evaluation Study.

[14] Studies modified include RSP 3.19 Freshwater Mussel Study. On June 20, 2012, MDNR and MDE filed a Request for Rehearing of FERC's May 21 Study Determination letter. On July 18, 2012, FERC rejected this Request for Rehearing. On August 3, 2012, MDNR and MDE filed a Request for Rehearing of FERC's July 18, 2012 rejection of Maryland's initial Request for Rehearing. At the time of the filing of the FLA, FERC has not responded to Maryland's August 3rd Request for Rehearing.

1.4.4 Comments on the Draft License Application

On April 3, 2012, Exelon filed with FERC and made available to Relicensing Participants a Draft License Application (DLA).

Twelve letters regarding Exelon's DLA were filed with FERC within the 90-day comment period, which ended on July 9, 2012. Table 1.4.4-1 lists the commenters and the date of their letter.

Exelon has addressed the various comment letters that were received on the DLA, consistent with the regulatory requirements of 18 CFR § 5 and the related FERC guidance. Refer to Appendix A of this Exhibit E for a reply to comments requesting additional studies of clarification of material in the DLA. Proposals regarding PM&E measures and studies that were not adopted by Exelon, and the reason Exelon did not adopt them, are discussed in Exelon's response to comments on the DLA provided in Appendix A of this Exhibit E.

1.4.5 Comments on the Final License Application

Upon filing, FERC will solicit and compile comments on the final license application. Within 14 days of filing, FERC will issue a public Tendering Notice for the application which includes a schedule for processing of the application. When FERC determines that the application is complete, it will then issue a Notice of Acceptance of the application and a Notice of Ready for Environmental Analysis (REA).. Comments on this REA notice, intervention requests, and preliminary terms and conditions must be filed with FERC no more than 60 days after the REA notice has been issued. The licensee must also file a Water Quality Certificate application within 60 days from the issuance of the REA notice. At this time, FERC will consider comments received and begin its processing of the NEPA document required for the licensing action. Once this process has been completed and a Water Quality Certificate has been issued, FERC will then issue a new license for the Project.

1.4.6 Comments on the Draft Environmental Assessment

FERC will solicit, compile and respond to comments received on the draft EA, or draft EIS if FERC chooses to prepare an EIS instead of an EA, in the final environmental document.

TABLE 1.4.1-1: SCOPING COMMENT SUMMARY

Relicensing Participant	Date of Letter	Document on Which Comments Were Filed	
		FERC's Scoping Document 1	Exelon's Pre-Application Document
Town of Port Deposit	June 11, 2009	X	--
Alex Balboa	June 17, 2009	--	--
Ronald Steelman	June 25, 2009	X	--
PFBC	July 9, 2009	X	X
USFWS	July 10, 2009	X	X
Susquehanna River Basin Commission	July 10, 2009	X	X
PADEP	July 10, 2009	X	--
Nature Conservancy	July 10, 2009	X	--
NMFS	July 10, 2009	X	X
MDNR	July 10, 2009	X	X
Lower Susquehanna Riverkeeper	July 10, 2009	X	X
Lancaster County Planning Commission	July 10, 2009	X	--
FERC	July 10, 2009	X	X
American Rivers	July 10, 2009	X	--
Mason-Dixon Trail System	July 13, 2009	X	--

TABLE 1.4.3-1: STUDY DETERMINATION SUMMARY

Study Number	Study Description	Studies Proposed by Exelon in Exelon's December 22, 2009 Revised Study Plan	Studies Approved or Modified by FERC in FERC's February 4, 2010 Determination	
			Approved	Modified
3.1	Seasonal and Diurnal Water Quality in Conowingo Pond and below Conowingo Dam	X	X	X
3.2	Downstream Fish Passage Effectiveness Study	X	X	(Not required[15])

[15] Field based entrainment and mortality study.

Study Number	Study Description	Studies Proposed by Exelon in Exelon's December 22, 2009 Revised Study Plan	Studies Approved or Modified by FERC in FERC's February 4, 2010 Determination	
			Approved	Modified
3.3	Biological and Engineering Studies of American Eel at the Conowingo Project	X	X	X
3.4	American Shad Passage Study	X		(Not required)
3.5	Upstream Fish Passage Effectiveness Study	X	X	X
3.6	Conowingo East Fish Lift Attraction Flows	X	X	X
3.7	Fish Passage Impediments Study below Conowingo Dam	X	X	
3.8	Downstream Flow Ramping and Fish Stranding Study	X	X	X
3.9	Biological and Engineering Studies of the East and West Fish Lifts	X	X	
3.10	Maryland Darter Surveys	X	X	
3.11	Hydrologic Study of the Lower Susquehanna River	X	X	X
3.12	Water Level Management	X	X	X
3.13	Study to Assess Tributary Access in Conowingo Pond	X	X	
3.14	Debris Management Study	X	X	
3.15	Sediment Introduction and Transport	X	X	X
3.16	Instream Flow Habitat Assessment below Conowingo Dam	X	X	
3.17	Downstream EAV/SAV Study	X	X	
3.18	Characterization of Downstream Aquatic Communities	X	X	
3.19	Freshwater Mussel Characterization Study below Conowingo Dam	X	X	X
3.20	Salinity and Salt Wedge Encroachment	X	X	X
3.21	Impact of Plant Operations on Migratory Fish Reproduction	X	X	X
3.22	Shortnose and Atlantic Sturgeon Life History Studies	X	X	X
3.23	Study to Identify Habitat Use Areas	X	X	

Study Number	Study Description	Studies Proposed by Exelon in Exelon's December 22, 2009 Revised Study Plan	Studies Approved or Modified by FERC in FERC's February 4, 2010 Determination	
			Approved	Modified
	for Bald Eagle			
3.24	Zebra Mussel Monitoring Study	X	X	X
3.25	Creel Survey of Conowingo Pond and the Susquehanna River below Conowingo Dam	X	X	X
3.26	Recreational Inventory and Needs Assessment	X	X	X
3.27	Shoreline Management Plan	X	X	X
3.28	Archaeological and Historic Cultural Resource Review and Assessment	X	X	
3.29	Effect of Project Operations on Downstream Flooding	X	X	
3.30	Osprey Nesting Survey	X	X	
3.31	Black-crowned Night Heron Nesting Survey	X	X	
3.32	Re-evaluate the Closing of the Catwalk to Recreational Fishing	X	X	

TABLE 1.4.4-1. LIST OF COMMENT LETTERS FILED WITH FERC ON EXELON'S DRAFT LICENSE APPLICATION.

Commenter	Date of Letter
Mason-Dixon Trail	February 10, 2012
Rawlinsville Fire Department	May 13, 2012
FERC	July 2, 2012
PADEP	July 2, 2012
USFWS	July 5, 2012
Susquehanna Riverkeeper	July 8, 2012
MDNR	July 9, 2012
TNC	July 9, 2012
NMFS	July 9, 2012
NPS	July 6, 2012
PFBC	July 9, 2012
SRBC	July 9, 2012

SECTION 2.0 PROPOSED ACTION AND ALTERNATIVES

This section describes the existing Project (i.e., the No-Action Alternative) and Exelon's proposed changes to the existing Project (i.e., proposed Project). Specifically, Section 2.1 describes the No-Action Alternative, the baseline from which to compare all action alternatives. Section 2.2 describes Exelon's proposed Project. Section 2.3 describes any other action alternatives proposed at this time. Section 2.4 describes alternatives considered but not analyzed in detail in this document.

2.1 No Action Alternative

Under the No-Action Alternative, the Project would continue to operate into the future as it has operated and no new environmental PM&E measures would be implemented. Provided below is a description of: 1) existing Project facilities (Section 2.1.1); 2) existing Project Boundary (Section 2.1.2); 3) Project safety (Section 2.1.3); 4) current Project operations (Section 2.1.4); and 5) conditions in the existing FERC license and other agreements and contracts that affect existing Project operations (Section 2.1.5).

2.1.1 Existing Project Facilities

The existing Project facilities consist of: 1) a main dam, 2) a spillway, 3) a reservoir (Conowingo Pond), 4) an intake and powerhouse, and 5) two fish lifts. The Project also includes public recreation facilities and use areas. The location of major Project facilities is shown in Figure 2.1.1-1. Detailed descriptions of these facilities are provided in Exhibit A of this application. The principal Project facilities as currently licensed are summarized below.

- The Conowingo Main 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 feet; 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 99.2 feet; an intake-powerhouse section which is 946 feet long; and a 127-foot long abutment section. The dam and powerhouse also support US Highway Route No. 1, which passes over the top of Conowingo Dam.

- 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 99.2 feet. Each of the crest gates are 22.5 feet high by 38 feet wide and have a discharge capacity of approximately

16,000 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 4,000 cfs per gate at a reservoir elevation of 109.2 feet. Three 90-ton gantry cranes are used to perform gate operations.

- The Project Reservoir, 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 design volume of 310,000 acre-feet at that elevation.

The Conowingo Pond serves as the lower reservoir for the 800-MW Muddy Run Pumped Storage Project (Muddy Run Project), located 12 miles upstream of the Conowingo Dam. It also serves as the source of the cooling water for the 2,186 MW Peach Bottom Atomic Power Station (PBAPS), located approximately seven miles upstream of the Conowingo Dam and the York Energy Center, a 1,100 MW electric generation facility, also located approximately 7 miles upstream of Conowingo Dam. Conowingo Pond is used as a public water supply source, with the City of Baltimore and Chester Water Authority having permitted withdrawals of 387 cfs (250 million gallons per day (MGD)) and 46 cfs (30 MGD), respectively.

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.

The Project powerhouse contains eleven main turbines, as well as two house turbines. Units 1, 3, 4, 6 and 7 consist of Francis-type single runner hydraulic turbines, designed to develop 64,500 horsepower each, under a normal head of 89 feet. Units 2 and 5 consist of 54,000 horsepower Francis-type turbines with single aerating runners under a normal head of 89 feet. Units 8-11 consists of Voith-Siemens mixed flow turbines. Each of these turbines is designed to develop not less than 85,000 horsepower each under a normal head of 86 feet.

The electric generating equipment for units 1 and 3 are Asea Brown Boveri, Inc. 50,000 kilovolt-amperes (kVA) and 53,000 kVA, respectively, generators. Units 2, 4, 6 and 7 are Voith Siemens 53,000 kVA generators. Unit 5 is an ABB 40,000 kVA generator. The electric generating equipment for Units 8 (Voith-Siemens), 9, (Voith), 10 (Voith), and 11 (Voith) are 75,000 kVA generators.

The two house turbines manufactured by S. Morgan-Smith, Inc. have a capacity of 1,900 horsepower each under a normal net head of 89 feet. The generators for these units are of Westinghouse Electric manufacture and are rated at 1,600 kVA each.

The Project currently operates two fish lifts. The West Fish Lift, adjacent to the dam's right abutment, is currently operated under an agreement with the USFWS for American shad egg production and other research purposes. The East Fish Lift, located near the mid-point of the dam, is used primarily to pass American shad, river herring and other migratory fishes during the April-June migration season.

2.1.2 Existing Project Boundary

The existing Conowingo Project Boundary contains 11,721 acres of land: 9,951 acres of flowed land and 1,770 acres above the normal high water elevation (Figure 2.1.2-1). These lands are located in Lancaster and York counties in Pennsylvania and Harford and Cecil counties in Maryland. There are approximately 43 miles of shoreline within the Project boundary: 40 miles associated with Conowingo Pond and three miles associated with the area downstream of Conowingo Dam.

2.1.3 Existing Project Safety

The Project has been operating for more than 30 years under the existing license and during this time FERC staff has conducted operational inspections focusing on the continued safety of the structure, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, the Project has been inspected and evaluated every 5 years by an independent consultant and a consultant's safety report has been submitted for FERC's review.

2.1.4 Existing Project Operations

The Conowingo Project is a peaking hydroelectric facility that utilizes a limited active storage reservoir to generate during peak electricity demand periods. The Conowingo Project license allows for the Conowingo Pond to normally fluctuate between elevation 101.2 feet and 110.2 feet, NGVD 1929.

The following factors also influence the management of water levels within the Conowingo Pond:

- The Conowingo Pond must be maintained at elevation of 107.2 feet on weekends between Memorial Day and Labor Day to meet recreational needs;
- The Muddy Run Project cannot operate its pumps below elevation 104.7 feet due to cavitation;

- PBAPS begins experiencing cooling problems when the elevation of the pool drops to 104.2 feet;
- The Chester Water Authority cannot withdraw water below elevation 100.5 feet;
- The PBAPS Nuclear Regulatory Commission license requires PBAPS to shut down completely if Conowingo pond is at or below 99.2 feet;
- The York Energy Center cannot withdraw water below elevation 98.0 feet; and
- The City of Baltimore cannot withdraw water below elevation 91.5 feet.

The current minimum flow regime below Conowingo Dam is the following:

March 1 – March 31	3,500 cfs or natural inflow, whichever is less
April 1 – April 30	10,000 cfs or natural inflow, whichever is less
May 1 – May 31	7,500 cfs or natural inflow, whichever is less
June 1 – September 14	5,000 cfs or natural inflow, whichever is less
September 15 – November 30	3,500 cfs or natural inflow, whichever is less
December 1 – February 28	3,500 cfs intermittent (maximum six hours off followed by equal amount on)

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

2.1.5 Existing Environmental Measures

Water Level and Flow Management

- The water level management regime described above in Section 2.1.4 provides for protection and enhancement of wetland, littoral, and riparian habitat within Conowingo Pond.

- The minimum flow regime described above in Section 2.1.4 provides for protection and enhancement of aquatic resources downstream of the Project.

Dissolved Oxygen Monitoring

- Exelon currently aerates the Project discharge through a turbine venting system at Units 1-7, to enhance Dissolved Oxygen (DO) levels downstream of Conowingo Dam. In addition, Units 2 and 5 have aerating runners, which also increase DO levels in the Project discharge.

- Exelon continuously monitors DO levels from May 1 through October 1 at the Station 643 location approximately 0.6 miles downstream of Conowingo Dam.

Upstream Fish Passage

- The East Fish Lift is used to pass American shad, river herring, and other migratory fishes. Exelon operates the West Fish Lift, adjacent to the dam's right abutment, for American shad egg production and other research purposes.

Debris Management

- Exelon employs a substantial debris management program which includes clamming (with three gantry cranes with grapple attachments) to remove submerged debris from the area upstream of the powerhouse intakes as well as floating surficial debris in front of the dam powerhouse intakes. In addition, Exelon sponsors community-based clean-ups in the pond and downstream of the dam.

Recreation Facilities

- Exelon currently maintains several public recreation facilities within the Project Boundary. The facilities are described in detail in Section 3.3.6.

2.1.6 Measures in Current FERC License

The existing FERC license includes 46 articles. Articles 29, 33, 34, 40, 41, 42, 43, 44, 45, and 46 may be considered "expired" or "out of date" since each pertains to a construction activity that has been completed, a filing related to a construction activity that has been completed, or another activity that has been completed. As a result, the existing license contains 37 "active" articles. Of these, Articles 1 through 28 are the Federal Power Commission's (FPC) "standard" articles included in most licenses for a major constructed project issued in the 1980s, and Articles 30, 31, 32, 34, 35, 36, 37, 38 and 39 can be considered "Project specific" articles. The latter articles most relevant to relicensing issues are Articles 32 and 37. Each of these is provided below as it appears in the existing FERC license.

Article 32. The Licensee shall operate the Conowingo Reservoir between minimum elevation 100.5 feet and normal maximum elevation 109.5 feet, shall permit the Licensee of Muddy Run Project, FERC No. 2355, to utilize a maximum of 35,500 acre-feet of pondage weekly from Conowingo Reservoir, and shall coordinate the operation of the Conowingo Project with the Muddy Run Project in such a manner as to maximize total power benefits from both projects.

Article 37. Prior to the commencement of any construction or development of any Project works or other facilities at the Project, the Licensee shall consult and cooperate with the State Historic Preservation Officer (SHPO) to determine the need for, and extent of, any archeological or historic resource surveys and any mitigative measures that may be necessary. The Licensee shall provide funds in a reasonable amount for such activity. If any previously unrecorded archeological or historic sites are discovered during the course of construction, construction activity in the vicinity shall be halted, a qualified archeologist shall be consulted to determine the significance of the sites, and the Licensee shall consult with the SHPO to develop a mitigation plan for the protection of significant archeological or historic resources. If the Licensee and the SHPO cannot agree on the amount of money to be expended on archeological or historic work related to the Project, the Commission reserves the right to require the Licensee to conduct, at its own expense, any such work found necessary.

Pursuant to a settlement agreement on water quality and fish passage approved by the Commission on January 24, 1989, Exelon operates the East and West Fish lifts at the Conowingo Project and operates in accordance with an agreed upon minimum flow regime. Exelon maintains the following minimum flow requirements pursuant to this settlement: 3,500 cfs or inflow from March 1 to March 31; 10,000 cfs or inflow from April 1 to April 30; 7,500 cfs or inflow from May 1 to May 31; 5,000 cfs or inflow from June 1 to September 14; 3,500 cfs or inflow from September 15 to November 30; and 3,500 cfs or inflow from December 1 to February 28, consisting of six hours off followed by six hours on.

2.2 Exelon's Proposal

2.2.1 Proposed Project Facilities

2.2.1.1 Generation Facilities

Exelon does not propose any changes to existing developmental (i.e., generation) facilities.

2.2.1.2 Non-Generation Facilities

Exelon is proposing trap and transport facilities to provide upstream and downstream passage measures for American eel.

Exelon has also proposed the following capital improvements to recreation facilities at the Conowingo Project.

Lock 13. Enhancements at Lock 13 include installation of a trailhead directional sign at the Lock 12 parking area and clearing the vegetation from within the lock to provide an unobstructed view of the structure. Light fencing will be constructed along each side of the lock structure to protect visitors.

Lock 15. Access at Lock 15 will be improved by designating two American with Disability Act (ADA) compliant parking spaces in the existing parking area and installing a dock on the shoreline near the picnic area to allow boaters to access the site. A concrete pad for portable restroom placement will be constructed. The open shoreline area near the parking area will be stabilized to prevent erosion.

Muddy Creek Boat Launch. Two boat trailer spaces and one vehicle space will be designated for ADA parking in the existing parking lot. Areas adjacent to the southwest corner and southerly side of the parking area will be stabilized to improve drainage and redirect flow away from the parking area and the river. A sign providing information on the Conowingo Dam canoe portage and the location of the portage take-out will be erected on site.

Cold Cabin. Access to the site will be improved by designating a one-way directional traffic pattern through the site and constructing parking for 11 vehicles (five boat trailer and six vehicle spaces), including two ADA spaces. The existing boat ramp will be reinforced to prevent undermining of the ramp and a boat dock will be installed. A sign providing information on the Conowingo Dam canoe portage and the location of the portage take-out will be erected. Two ADA picnic tables will be provided to replace the existing tables. A concrete pad for the placement of two portable restrooms (1 ADA, 1 standard), will be constructed.

Dorsey Park. Both boat ramps at Dorsey Park will be rebuilt. One ADA boat trailer space and one ADA vehicle space will be designated in the existing lot. A concrete pad for three portable restrooms (1 ADA, 2 standard), will be constructed. A sign providing information on the Conowingo Dam canoe portage and the location of the portage take-out will be erected.

Conowingo Creek Boat Launch. One ADA parking space will be designated in the existing parking area. A roadside ditch along Mt. Zoar Road will be stabilized and a stone line drainage ditch will be constructed along the south side of the parking lot to redirect runoff from the parking lot and boat ramp area. A sign will be erected providing information on the Conowingo Dam canoe portage and the location of the portage take-out.

Glen Cove Marina. Parking at the marina will be improved and expanded with seven additional boat trailer spaces (one ADA) and 11 vehicle (two ADA) spaces. The marina's bulkhead wall will also be repaired.

Funks Pond. One ADA parking space will be designated in the existing parking area.

Line Bridge. Shoreline erosion control and stabilization work will be performed at this unimproved carry-in boat access area.

Conowingo Swimming Pool. An ADA access facility will be installed at the swimming pool and an ADA compliant access ramp will be installed at the wading pool.

Conowingo Dam Overlook. This facility will be reopened. Three ADA vehicle spaces will be designated in the existing parking lot. The existing pavilion will be demolished and replaced with a new 24' by 24' wood pavilion. Pavement will be removed from the easterly corner of the existing paved parking area, loamed and seeded, and three ADA pathways and picnic tables will be installed. Security fencing will be installed around the site to restrict access to Conowingo Dam while allowing unobstructed views from the pavilion and picnic area.

Fisherman's Park/Shures Landing. The access road leading to the facility will be widened three to five feet in order to construct 12-foot wide lanes. A retaining wall will be constructed along the easterly 250 feet of existing parking along the access road due to widening. Five additional ADA parking spaces will be designated in the existing parking lot. The access road leading to Shures Landing will be widened four feet along the eastbound lane for 320 feet, and the access road from the trailhead parking northerly to the retaining wall will be widened two feet. An additional 13 space parking area will be constructed near the Lower Susquehanna Heritage Greenway trailhead at the southerly end of Fisherman's Park. The existing access at Shures Landing will be closed. The existing hard surface boat launch and asphalt access will be demolished. Stone fill will be placed next to the existing wall down to existing grade along the shore. A new 20-foot wide hard surface carry-in boat launch with a floating dock and breakwater will be constructed at Shure's Landing to replace the existing launch area.

Peach Bottom Access Development. A small (approximately four vehicle) road-side parking area will be constructed near the existing informal boat launch area south of Peters Creek. A sign will be erected providing information on the Conowingo Dam canoe portage and the location of the portage take-out.

2.2.2 Proposed Project Boundary

Exelon is proposing to modify the Project boundary in the vicinity of upper Broad Creek and downstream of the Conowingo Dam. This modification to the Project is reflected in Figure 2.2.2-1. This modification will remove lands from the upper Broad Creek as well as downstream of Rowland Island that were originally included for construction of the Project. The proposed Project boundary would contain 9,919 acres of land: 8,850 acres of Project waters and 1,069 acres above the normal high water elevation in Lancaster and York counties in Pennsylvania and Harford and Cecil counties in Maryland. The lands contained within the proposed Project boundary are those lands necessary for Project purposes. Exelon is commited to negotiating leases with existing recreation facility operators for the continued operation of those facilities located on lands owned by Exelon but no longer within the Project Boundary. Exelon will also commit to negotiate a new lease with the Maryland Department of Natural Resources for the continued protection and use of the collocated Lower Susquehanna Greenway Trail and Mason Dixon Trail on Exelon owned lands outside of the Project Boundary. The existing lease expires in August 2014.

2.2.3 Proposed Project Safety

Exelon anticipates that, as part of the relicensing process, FERC staff will evaluate the continued safety of the proposed Project facilities under the new license. Exelon anticipates FERC will continue to inspect the Project during the new license term to assure continued adherence to FERC-approved plans and specifications, any special license articles pertaining to construction, operations and maintenance, and accepted engineering practices and procedures.

2.2.4 Proposed Project Operations

Exelon is not currently proposing any changes to the existing Project operations.

2.2.5 Proposed Environmental Measures

Exelon proposes to continue the existing recreation improvements described in Section 2.1.5. In addition, Exelon proposes additional measures to protect and enhance environmental resources in the Project Boundary during the term of the next license. The proposed measures are summarized below.

East Fish Lift. Exelon is proposing the implementation of a preventative maintenance program for the East Fish Lift. The purpose of the program will be to extend the useful life of the facility over the next license term. Specific measures are contained in Appendix B of Exhibit E.

Upstream and Downstream Passage of American Eel. Exelon is proposing to construct a permanent trap and transport facility, consisting of an eel ramp and collection facility on the west bank of the Conowingo tailrace. This facility would allow for upstream passage via trap and transport of American eel.

In addition, Exelon is proposing to develop a downstream trap and transport program for outmigrating American eel. The specifics of the program have not been worked out as of the date of the draft license application. However, Exelon has assumed the program will start in two small tributaries (~50 feet wide) upstream of York Haven Dam that have been previously stocked by the USFWS. Exelon anticipates that the cost of the upstream and downstream trap and transport program would be shared among the licensees of the four dams the eels would be required to pass.

Shoreline Management Plan. Exelon proposes to implement a Shoreline Management Plan (SMP) consistent with Guidance for Shoreline Management Planning at Hydropower Projects (FERC 2001). The SMP includes specific measures and policies related to shoreline vegetation management and erosion control, woody debris management, game species management, sensitive natural resource protection, recreation use, and use of Project lands. The SMP is being filed in Volume 3 of this final license application.

Bald Eagle Management Plan. Bald eagles use Project lands and waters for nesting, roosting and foraging. Exelon has prepared a Bald Eagle Management Plan (BEMP) in consultation with the USFWS and MDNR.

The BEMP provides for the management of bald eagle habitat on Exelon lands in accordance with recommendations from the National Bald Eagle Management Guidelines and state agency guidance. Bald eagle habitat, including nest sites, forage sites, and communal roost sites on Exelon lands will be managed through a range of measures. The range of measures is tailored to types of activities with potential to impact eagles and will include, but not be limited to, seasonal restrictions, distance buffers, and landscape buffers. The BEMP is being filed with FERC, USFWS, MDNR, and PGC in conjunction with this final license application.

Historic Properties Management Plan. Exelon proposes to implement a Historic Property Management Plan (HPMP) for the management of archaeological and historic resources throughout the term of the new license. The HPMP will be prepared in consultation with the Pennsylvania and Maryland SHPOs, and other stakeholders and in accordance with the Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects.

The HPMP will address, among other things, a schedule and methodology for completing any additional recommended studies and implementing monitoring measures; management measures for identified historic properties including the Conowingo Dam and powerhouse; protection of any historic properties threatened by Project-related activities, including Project operations, shoreline and aquatic recreation, shoreline development, routine Project maintenance, and other Project activities or operations; and public outreach, education, and signage for the purpose of reducing looting and vandalism of sites. A HPMP is being filed with the final license application.

Recreation Management Plan. Exelon proposes to implement a Recreation Management Plan (RMP). The RMP will guide the operation and maintenance of Exelon's recreation facilities, and also include proposals for recreation facility enhancements as outlined in Sections 2.2.1 and 3.3.6. The RMP is being filed in Volume 3 of this final license application.

Sediment Introduction and Transport. As part of the proposed SMP described above, Exelon proposes to adopt best management practices for controlling sediment introduction from lands within the Project boundary. In addition, Exelon proposes to conduct a bathymetry survey of Conowingo Pond every five (5) years to monitor sediment transport and deposition patterns within the Pond. Exelon also developed a sediment management plan to identify benchmarks and thresholds for action to address sediment issues that may effect Project operations. Specific measures are contained in Appendix C of Exhibit E.

2.3 Alternatives Considered But Eliminated From Further Analysis

Exelon considered but eliminated from further analysis the following alternatives:

- Retire the Project
- Issue a Non-Power License
- Federal Agency Takeover of the Project

Each of these alternatives and the consideration of factors through which the alternative was eliminated from further analysis are described below.

2.3.1 Retire the Project

Project retirement could be accomplished with or without removal of the Project dam. No relicensing participant has suggested that removal of the Project dam would be appropriate in this case; therefore, there is no basis for recommending it. Thus, dam removal is not a reasonably foreseeable alternative to relicensing the Project with appropriate resource management measures.

The second Project retirement alternative would involve retaining the Project dam and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic, consumptive, environmental and recreational water management, or other purposes. This would require that a government agency with authority to assume regulatory control and supervision of the remaining facilities be identified. No relicensing participant has advocated this alternative. Therefore, there is no basis for recommending it. Because the power supplied by the Project is needed, a source of replacement power would have to be identified. In these circumstances, removal of the electric generating equipment is not a reasonably foreseeable alternative.

FERC's statement from SD2 regarding a project decommissioning license analysis follows:

> Decommissioning of the Project could be accomplished with or without dam removal. Either alternative would require denying the relicense application and surrender or termination of the existing license with appropriate conditions. There would be significant costs involved with decommissioning the Project and/or removing any Project facilities. The Project provides a viable, safe, and clean renewable source of power to the region. With decommissioning, the Project would no longer be authorized to generate power.
>
> No party has suggested Project decommissioning would be appropriate in this case, and we have no basis for recommending it. Thus, we do not consider Project decommissioning a reasonable alternative to relicensing the Project with appropriate environmental enhancement measures.

2.3.2 Issue a Non-Power License

A non-power license is a temporary license that FERC issues when it determines that a project should no longer be used for power purposes. Such licenses are designed as an interim measure until a separate state, municipal, interstate, or Federal agency assumes regulatory supervision over the lands and facilities involved. FERC's statement from SD2 regarding a non-power license analysis follows:

"A non-power license is a temporary license which the Commission would terminate whenever it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license.

Hence, issuing a non-power license for the Project would not provide a long-term solution to the issues presented. To date, no party has sought a non-power license, and we have no basis for concluding that the Project should no longer be used to produce power. Thus, we do not consider a non-power license to be a reasonable alternative to some form of new license with enhancement measures."

Because the Project power is needed and Exelon believes that a new license can be issued that will satisfy the FPA's public interest/comprehensive development standard, Exelon believes there is no basis for the Commission to conclude that the Conowingo Project should no longer be used for power generation. Thus, issuance of a non-power license is not a reasonable alternative to issuance of a new license with appropriate PM&E measures.

2.3.3 Federal Agency Takeover of the Project

Federal takeover of the Project is not a reasonably foreseeable alternative. Federal takeover and operation of the Project would require Federal Congressional approval. While that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that Federal takeover should be recommended to Congress. No relicensing participant or other party has suggested Federal takeover would be appropriate, and no Federal agency has expressed an interest in operating the Project.

FERC's statement from SD2 regarding a Federal government takeover license analysis follows:
"In accordance with § 16.14 of the Commission's regulations, a Federal department or agency may file a recommendation that the United States exercise its right to take over a hydroelectric power project with a license that is subject to sections 14 and 15 of the FPA (16 U.S.C. §§ 791(a)-825(r). We do not consider Federal takeover to be a reasonable alternative. Federal takeover of the Project would require congressional approval. While that fact alone would not preclude further consideration of this alternative, there is currently no evidence showing that Federal takeover should be recommended to Congress. No party has suggested that Federal takeover would be appropriate and no Federal agency has expressed interest in operating either of the projects."
Federal takeover of the Project is not a reasonably foreseeable alternative.

EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

N

1 inch = 700 feet

0 350 700 1,400 Feet

Figure 2.1.1-1:
Conowingo Hydroelectric Project
Major Project Facilities

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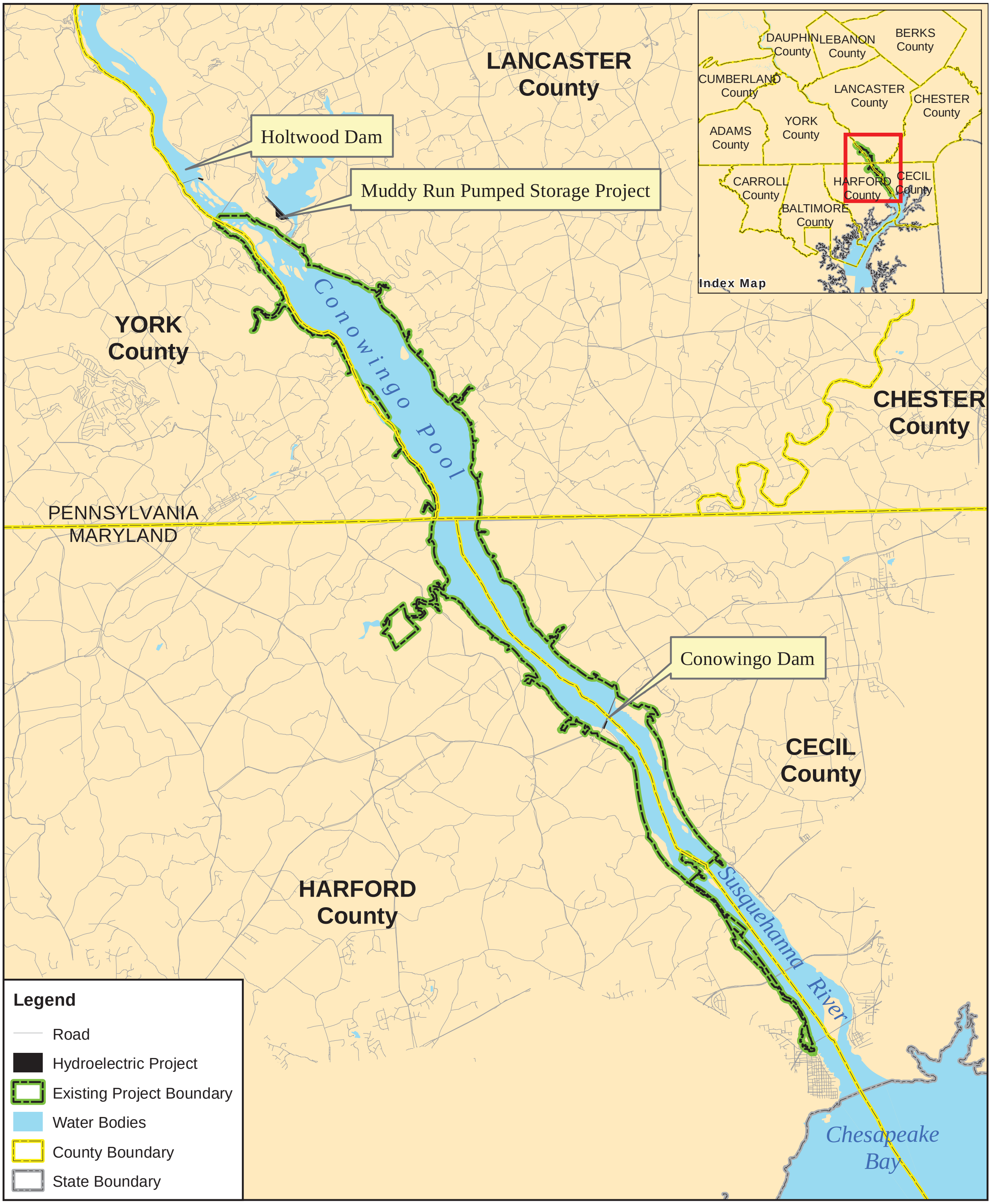

EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

Figure 2.1.2-1:
Conowingo Hydroelectric Project
Existing Project Boundary

N

1 inch = 3 miles

0 1.5 3 6 Miles

Data Source: ESRI; Exelon; PA Chesapeake Bay Program; PA State University - Environmental Resources Research Institute; USGS National Hydrography Dataset.

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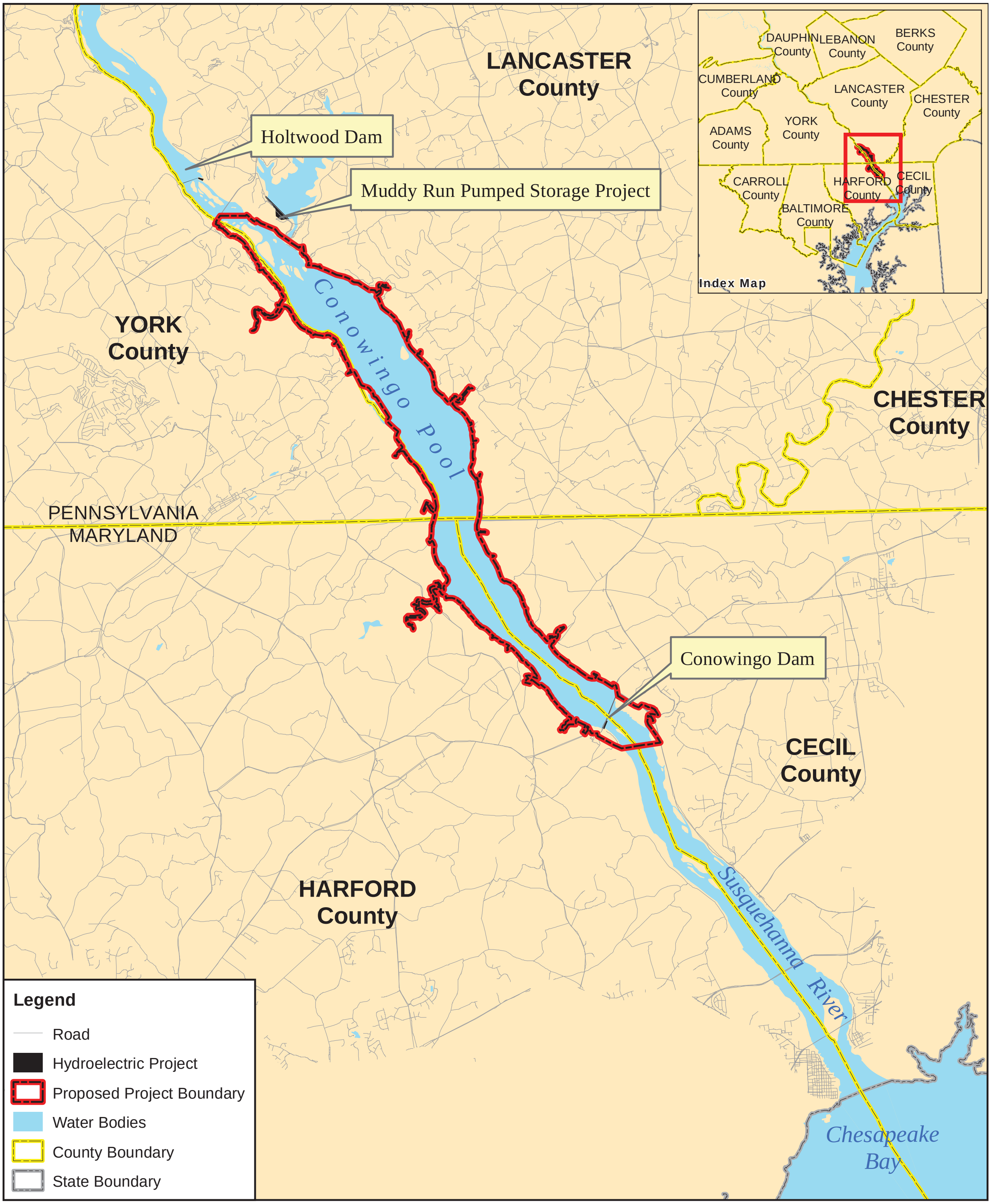

EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

N

1 inch = 3 miles

0 1.5 3 6 Miles

Figure 2.2.2-1:
Conowingo Hydroelectric Project
Proposed Project Boundary

Data Source: ESRI; Exelon; PA Chesapeake Bay Program; PA State University - Environmental Resources Research Institute; USGS National Hydrography Dataset.

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SECTION 3.0 ENVIRONMENTAL ANALYSIS

3.1 General Description of River Basin

The Susquehanna River originates near Cooperstown, New York at Otsego Lake and flows for about 444 miles to the Chesapeake Bay at Havre de Grace, Maryland (SRBC 2008a) (Figure 3.1-1). The drainage area of the Susquehanna River encompasses portions of New York, Pennsylvania and Maryland and covers 27,510 square miles. The Susquehanna River Basin can be divided into six major subbasins: the Upper Susquehanna, Chemung, West Branch Susquehanna, Middle Susquehanna, Juniata, and Lower Susquehanna.

The Conowingo Project is located on the main stem of the Susquehanna River, within the Lower Susquehanna subbasin, at River Mile (RM) 10 in Maryland. The impoundment formed upstream of the Conowingo Project extends approximately 14 miles. Table 3.1-1 illustrates the drainage area and population within each subbasin.

3.1.1 Topography

The Conowingo Project is located in the Piedmont Upland Section of the Piedmont Physiographic Province of Pennsylvania and Maryland. The region is characterized by a rolling upland with broad hills and some steep-sided valleys (Risser and Siwiec 1996). The Susquehanna River valley narrows and deepens abruptly to a steep-walled gorge (the Holtwood Gorge) nearly 600 feet deep flanked by gently-rolling upland with under 100 feet of local relief as the river enters the Upland Section (Pazzaglia and Gardner 1993). Upland elevations of the Project area decrease downstream, from generally 200 to 300 feet to less than 100 feet National Geodetic Vertical Datum (NGVD) of 1929.

The distinctive topography and landforms characterizing the Project area developed from the weathering and erosion of underlying geologic units.

3.1.2 Climate

Climatic conditions vary within the Lower Susquehanna River subbasin. The Ridge and Valley physiographic province in the northwest experiences a humid continental climate with large seasonal temperature variations, which contrasts with the more coastal-type climate experienced in the Piedmont physiographic province in the southeastern part of the subbasin where temperatures are more moderate and precipitation is slightly greater (Risser and Siwiec 1996).

Average annual precipitation is distributed fairly evenly throughout the year; however, long-term records indicate wet and dry periods (Risser and Siwiec 1996). Droughts have been fairly common, at times threatening groundwater supplies (SRBC 2005). During the 1990s through the mid-2000s droughts have occurred in 1991, 1995, 1997, 1998, 1999, 2000, 2002 and 2006 (SRBC 2007b).

3.1.3 Land and Water Use

3.1.3.1 Major Land Uses

The Lower Susquehanna subbasin drains 5,809 square miles from Sunbury, Pennsylvania to Havre de Grace, Maryland (SRBC 2008b). Two-hundred eighty square miles are in Maryland. It is the most developed of the six subbasins. Some of the most productive agricultural lands and largest population centers of the Susquehanna River Basin are located in the Lower Susquehanna subbasin as well. Major population centers include Harrisburg (47,196), Lancaster (54,672), and York (40,226), Pennsylvania (2007 population estimates; U.S. Census Bureau 2010).

The Chesapeake Bay Watershed Land Cover Data Series (USGS 2006) indicates land cover of the Lower Susquehanna subbasin consists of forested areas (43.6 percent), pasture/hay (13.8 percent), cultivated crops (27.8 percent), developed (11.0 percent), open water and wetlands (2.8 percent), herbaceous grassland (0.5 percent) and barren land (0.4 percent). The land uses currently found near the Conowingo Project are largely related to electric power production facilities and various recreation amenities.

3.1.3.2 Major Water Uses

Power generation (12 major power plants[16]) accounts for the greatest water use in the Lower Susquehanna River subbasin (89%) (SRBC 2008b). Other uses include industrial (4.8 percent), municipal (4.2 percent), agricultural (1.2 percent), and domestic (0.8 percent). The power producers use surface water while non-power users also rely on groundwater (Risser and Siwiec 1996; Lindsey, et al. 1998). Seventy-eight percent of the approved consumptive water use in the entire basin (about 441 million gallons per day (mgd)) is from the Lower Susquehanna subbasin (SRBC 2008c)[17].

In its analysis of power plant water use in the entire basin, SRBC reports only 4 percent (168 mgd) of the water withdrawn from the basin by the fossil (8) and nuclear (3) power plants in Pennsylvania (4,217

[16] Five fossil, five hydro, and two nuclear (SRBC 2008d)
[17] 2005 data

mgd) is consumptively used (SRBC 2008d). Most of the consumptive use (CU) of water in the entire basin is due to facilities located in the lower subbasin - City of Baltimore and Chester Water Authority diversions (321 MGD /100 percent CU) and two nuclear power plants (74 MGD)(SRBC 2008c). SRBC also estimates that 785 agricultural operations consumptively use more than 20,000 gallons per day each across the entire basin (SRBC 2007a). Hydroelectric power generation is an in-stream non-consumptive use of water while thermoelectric power generation is a consumptive off-stream water use (Ludlow and Gast 2000).

The Conowingo Project creates the Conowingo Pond, a 14-mile-long 9,000-acre pond, extending into Pennsylvania, with 43 miles of shoreline, a width varying from 0.5 to 1.3 miles, and a maximum depth of about 98 feet. The Conowingo Pond is currently a source of water for the:

- Conowingo Project, located in Cecil and Harford Counties, Maryland;
- Muddy Run Project, Lancaster County, Pennsylvania;
- PBAPS, York County, Pennsylvania;
- York Energy Center, York County, Pennsylvania;[18]
- City of Baltimore, Maryland, municipal water supply;
- Harford County, Maryland, public water supply (provided by Baltimore's system);
- Chester Water Authority water supply utility, serving areas of southeast Pennsylvania and northern Delaware;
- Recreational uses, including boating and fishing; and
- Sustained stream flows downstream of the dam.

3.1.3.3 Basin Dams and other Energy Producers

Five projects cross the main stem of the Susquehanna River in the lower subbasin. These consist of four hydroelectric dams (Conowingo, Holtwood, Safe Harbor, and York Haven) and the Adam T. Bower Memorial Dam (the Sunbury fabridam). On Muddy Run, a tributary to the Lower Susquehanna River, there are four dams associated with the Muddy Run Project: the Main Dam, East Dike, Intake Channel Dam, and Recreation Dam. Nearly 300 smaller dams are also distributed throughout the subbasin (Howard Weinberger, Chesapeake Bay Program, personal communication, 2012) (Figure 3.1.3.3-1).

Ten dam structures related to hydropower production are located within the lower subbasin (Table 3.1.3.3-1). Three of these dams (Conowingo Dam, Holtwood Dam, and Safe Harbor Dam) form a

[18] Commercial operation began March 2011.

reservoir system (Conowingo Pond, Lake Aldred, and Lake Clarke, respectively). Upstream of these reservoirs are the York Haven dams. The Muddy Run Project Main Dam crosses the Muddy Run ravine a few miles below Holtwood. The Muddy Run Project pumps water from a lower reservoir (Conowingo Pond) to an upper reservoir (Muddy Run Reservoir) formed by the Main Dam.

3.1.3.4 Tributary Streams

There are 21 major tributaries to the Susquehanna River (each with a drainage area of greater than 100 square miles) in the lower subbasin (Risser and Siwiec 1996). These tributaries are listed in Table 3.1.3.4-1 and depicted in Figure 3.1.3.4-1.

Muddy Creek is a major tributary to the Conowingo Pond. Smaller named tributaries to the Conowingo Pond include Conowingo Creek, Broad Creek, Hanes Branch, Michaels Run, Peters Creek, Barnes Run, Fishing Creek, Wissler Run, and Muddy Run. Numerous unnamed tributaries also discharge to Conowingo Pond. The major tributaries of the Conowingo Project below the Conowingo Dam are Octoraro Creek and Deer Creek.

TABLE 3.1-1: CHARACTERISTICS OF THE SUSQUEHANNA RIVER SUBBASINS

Subbasin	Drainage Area (square miles)	Population
Upper Susquehanna	4,944	488,800
Chemung	2,595	225,350
West Branch Susquehanna	6,978	475,350
Middle Susquehanna	3,771	696,800
Juniata	3,404	312,750
Lower Susquehanna	5,809	1,761,500

TABLE 3.1.3.3-1: HYDROPOWER IN THE LOWER SUSQUEHANNA RIVER SUBBASIN

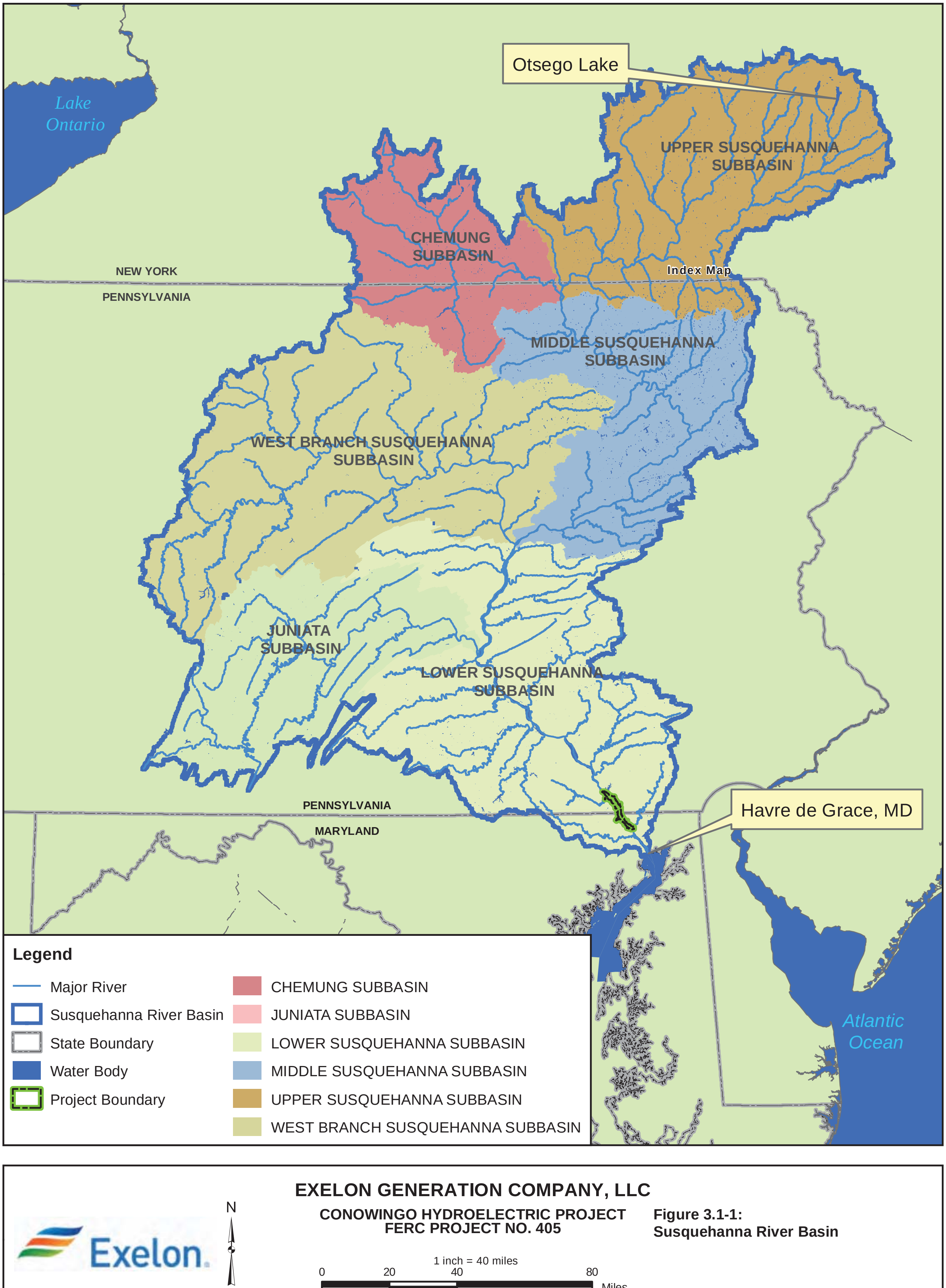
Project Dams	River (River Mile) [1]	NID ID	NID Height (feet) [2]	NID Length (feet) [2]	NID Storage (acre-feet) [2]	Nameplate Capacity (megawatts) [1]
Conowingo	Susquehanna (10)	MD00097	94	4,648	310,000	573
Muddy Run Main Dam	Muddy Run(22)	PA00266	260	4,800	56,731	800
Muddy Run Intake Channel Dam (Canal Dam)	Muddy Run (NA)	PA83008	35	2,300	56,731	NA
Muddy Run Recreation Dam	Muddy Run (NA)	PA83009	90	750	709	NA
Muddy Run East Dike	Muddy Run (NA)	PA83010	12	800	56,731	NA
Holtwood	Susquehanna (24.6)	PA00854	55	3,075	19,000	196
Safe Harbor	Susquehanna (32.2)	PA00855	75	4,869	144,000	417
York Haven Main Dam	Susquehanna (56.1)	PA00515	23	7,970	13,300	19
York Haven East Channel Dam	Susquehanna (NA)	PA83001	10	935	13,300	NA

[1] FERC (2004)
[2] USACE (2005)

TABLE 3.1.3.4-1: MAJOR TRIBUTARIES TO THE LOWER SUSQUEHANNA RIVER

TRIBUTARY	DRAINAGE AREA (SQUARE MILES)	STATE	PHYSIOGRAPHIC PROVINCE
Shamokin Creek	137	PA	Ridge and Valley
Middle Creek	175	PA	Ridge and Valley
Penns Creek	533	PA	Ridge and Valley
Mahanoy Creek	157	PA	Ridge and Valley
Mahantango Creek	164	PA	Ridge and Valley
Wiconisco Creek	116	PA	Ridge and Valley
Sherman Creek	244	PA	Ridge and Valley
Conodoguinet Creek	506	PA	Ridge and Valley
Yellow Breeches Creek	219	PA	Ridge and Valley
Swatara Creek	571	PA	Ridge and Valley
Bermudian Creek	110	PA	Piedmont
Conewago Creek	515	PA	Piedmont
South Branch Codorus Creek	117	PA	Piedmont
Codorus Creek	278	PA	Piedmont
Chickies Creek	126	PA	Piedmont
Cocalico Creek	140	PA	Piedmont
Conestoga River	277	PA	Piedmont
Pequea Creek	154	PA	Piedmont
Muddy Creek	139	PA	Piedmont
Octoraro Creek	210	MD & PA	Piedmont
Deer Creek	170	MD & PA	Piedmont

(Source: Risser and Siwiec 1996)



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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

Figure 3.1-1:
Susquehanna River Basin

Data Source: ESRI; Susquehanna River Basin Commission; USGS National Hydrography Dataset.

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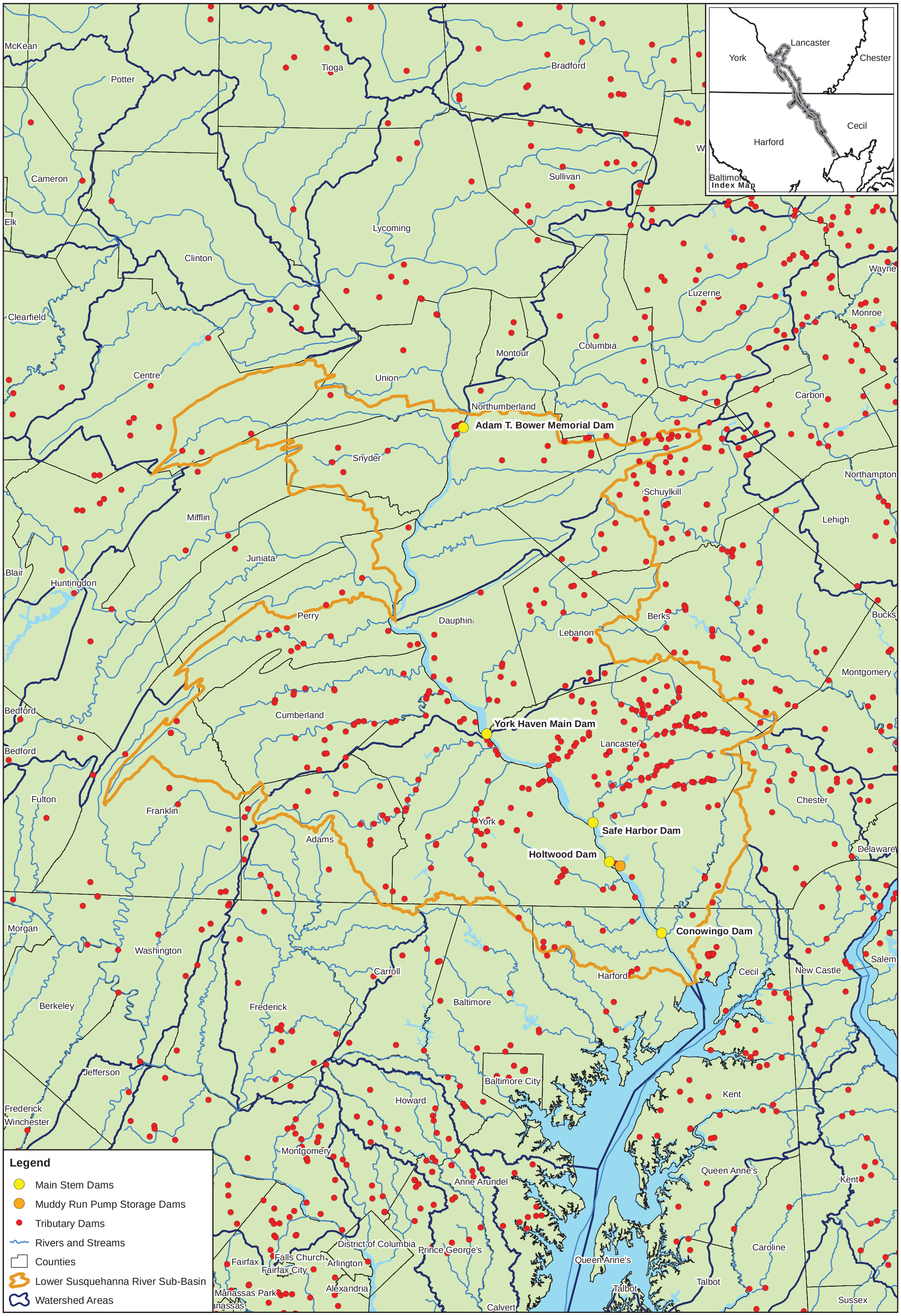

EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

1 inch = 15 miles

0 7.5 15 30 Miles

N

Exelon.

Figure 3.1.3.3-1:
Dams in the Lower Susquehanna River Sub-Basin

Source: ESRI Data and Maps DVD 2007, Susquehanna River Basin Commission, Chesapeake Bay Program, National Hydrography Dataset, USACE National Inventory of Dams

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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

N

1 inch = 15 miles
0 7.5 15 30 Miles

Figure 3.1.4-1:
Major Tributaries to the Susquehanna River in the Lower Susquehanna River Sub-Basin

Source: ESRI Data and Maps DVD 2007, Susquehanna River Basin Commission, National Hydrography Dataset

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3.2 Cumulative Effects

3.2.1 Cumulatively Affected Resources

According to § 1508.7 of the Council on Environmental Quality's regulations for implementing NEPA, an action may cause cumulative impacts on the environment if its impacts overlap in space and time with the impacts of other past, present and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

This Exhibit E addresses four resource areas that have a potential to be cumulatively affected by the continued operation of the Project in combination with other activities:

- Geology and Soils
- Water Quantity and Quality
- Aquatic Resources
- Threatened and Endangered Species

Provided below is the geographic and temporal scope of the cumulative affects analysis for these resources, and past, present and reasonably foreseeable future actions considered in the analysis.

3.2.2 Geographic Scope of Analysis for Cumulatively Affected Resources

The geographic scope of the cumulative effects analysis defines the physical limits or boundaries of the proposed action's effect on the resources. Because the proposed action would affect the resources differently, the geographic scope for each resource may vary. FERC's SD2 described the geographic scope for cumulative effects as follows:

> "Based on information in the Conowingo and Muddy Run PADs and preliminary staff analysis, we have identified water quality and quantity, resident and diadromous fish, and Chesapeake Bay habitats as resources that may be cumulatively affected by the proposed operation of the projects in combination with other developmental activities in the Susquehanna River Basin."

Exelon has included this geographic area in the cumulative effects analysis for the resources identified by FERC.

3.2.3 Temporal Scope of Analysis for Cumulatively Affected Resources

The temporal scope of the cumulative effects analysis addresses past, present, and future actions and their effects on each affected resource. Based on the expected term of a new license, the temporal scope of analysis addresses reasonably foreseeable actions for 30-50 years into the future.

3.2.4 Past, Present and Reasonably Foreseeable Future Actions

The cumulative effects of past and present actions on water quantity and aquatic resources are incorporated into the description of the existing resources in Sections 5.2 and 5.3, Affected Environment, of this Exhibit E.

3.3 Proposed Action and Action Alternative

3.3.1 Geology and Soils

3.3.1.1 <u>Affected Environment</u>

3.3.1.1.1 *Geology*

The Conowingo Project is located in the Piedmont Upland Section of the Piedmont Physiographic Province of Pennsylvania and Maryland. The Piedmont Upland Section contains crystalline bedrock (low-grade metamorphic rocks and metamorphosed igneous rocks) with a mantle of unconsolidated *in situ* or transported surficial material. The underlying geologic structure is the result of multiple episodes of metamorphism and deformation. The Pennsylvania Geological Survey (PGS), Maryland Geological Survey (MGS), and USGS each use different rock unit terms to represent different levels of detail of geologic mapping in different regions. The bedrock geology described in this section is based on a digital map compiled by the Susquehanna River Basin Commission (SRBC 2006b) by merging the digitally updated 1980 Geologic Map of Pennsylvania (PGS 2001) and a USGS modification of the 1968 Geologic Map of Maryland.

Outcropping bedrock islands in the Susquehanna River from below Holtwood Dam to Mt. Johnson Island, collectively called the Conowingo Islands, are recognized as an outstanding geologic feature of Pennsylvania (Geyer and Bolles 1979). Most of the islands are concentrated between Holtwood Dam and Muddy Creek. This area of the Susquehanna River is also known as the Holtwood Gorge. The potholes and cliffs of the gorge area are regarded by the Pennsylvania Department of Conservation and Natural Resources (PADCNR) as heritage geology sites called Erosional Remnants. The gorge contains three distinct bedrock terraces representing episodes of rapid downcutting that took place about 13,000 to 35,000 years ago (Reusser et al. 2004).

3.3.1.1.2 *Bedrock Geology*

The bedrock geology of the Project area is illustrated in Figure 3.3.1.1.2-1 and described in Tables 3.3.1.1-1 and 3.3.1.1-2.

In Pennsylvania, the Project area is mostly underlain with the Octoraro Formation (*Xo*) and Peters Creek Schist (*Xpc*). The Peach Bottom Slate and Cardiff Conglomerate (undivided) (*Xpb*) crosses the Project area near PBAPS and Peters Creek. Ultamafic rocks consisting primarily of serpentinite (*Xu*) are present near Peters Creek. Metabasalt is also present immediately below the Holtwood Dam and near the shore above Fishing Creek. The Sams Creek Metabasalt (*Xsc*) is located within the Project boundary just above Fishing Creek. Two episodes of diabase dike intrusion are present in the region, including at the edges of the Project area. The ages of the dikes are Jurassic (Jd) and likely Triassic (Tr(?)d).

In Maryland, the major bedrock units are the Metagraywacke Member of the Wissahickon Formation (*wmg*), Boulder Gneiss Member of the Wissahickon Formation (*wbg*), Ultramafic Rock (*um*), Baltimore Gabbro Complex (*bgb*), Gabbro and Quartz Diorite Gneiss (*Pzgd*), Wissahickon Formation (undivided) (*wu*), Port Deposit Gneiss (*Pzpd*), Metagabbro and Amphibolite (*mgb*), and Volcanic Complex of Cecil County (*vc*). The Ultramfic Rock unit is primarily serpentinite.

3.3.1.1.3 *Surficial Geology*

Surficial geologic units overlap with the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soils described in the next section. Descriptions of surficial geologic units provide information not available in USDA/NRCS soil descriptions.

Surficial geologic units within the Project area in Pennsylvania form a discontinuous mantle of unconsolidated in situ material (weathered bedrock) and transported material (alluvium and colluvium) (Sevon 1996). Weathered bedrock consists of all *in situ* rock between the surface and unweathered rock at depth that is broken or breaks readily with minimal force. Alluvium is material transported and deposited by running water. Colluvium is material mass transported by gravity.

Some of this material is deposited on lower terraces located within about 150 feet above the present channel along the margins of the Conowingo Pond and Susquehanna River, at major tributary mouths throughout the Project area, and on upland terraces located about 260 and 460 feet above the present channel (Pazzaglia and Gardner 1993).

The different surficial units mapped in the Project area in Pennsylvania by Sevon (1996) are described in Table 3.3.1.1-3. Similar mapping of the Maryland portion of the Project area is not available. However, Pazzaglia and Gardner (1993) identified the presence of lower terrace deposits at the mouths of Broad and Deer creeks and immediately above the Conowingo Dam.

Other surficial geologic features of the Project area are the exposed bedrock islands, large rounded boulders scattered on the islands, and very deep potholes in Holtwood Gorge (Thompson 1990). Along the eastern wall of the gorge, unconnected and elongated, spoon-shaped "deeps" over 3,000 feet in length, about 300 feet across, and up to 115 feet deep occur (Pazzaglia and Gardner 1993).

3.3.1.1.4 *Soils*

The most up-to-date soils mapping and map unit descriptions available were accessed from the Soil Survey Geographic database (SSURGO) (Figures 3.1.1.4-1, 3.3.1.1.4-2, 3.3.1.1.4-3 and 3.3.1.1.4-4). SSURGO map units consist of individual soil series. Only soil series within the Project boundary are referenced in the figures and described in the tables.

Pennsylvania

The Project area in Pennsylvania is covered primarily with Manor and Mt. Airy soils that developed from weathered bedrock on steep slopes. Soils associated with flowing water also occur. Hydric soils form under conditions that promote the development of wetlands. Each of these soil map units is dominantly non-hydric. However, the Cm, Ff, and Ud map units may contain inclusions of hydric soils. The soil map units within the Project area in Pennsylvania are described in Table 3.3.1.1.4-1.

Maryland

The most prevalent soil map units within the Project area in Maryland are stony to very stony soils associated with the steep uplands bordering both sides of the river (LbE, MdE, St) and the Comus silt loam floodplain soils (Cp) below the dam extending from Octoraro Creek to Sterrett Island along the Cecil County bank. Most of the units within the Project area are non-hydric and some may contain inclusions of hydric soils. Av, BaB, Hb. Sw, Tm, WaB (Harford) and WcB (Harford) are entirely hydric. The soils map units within the Project area in Maryland are described in Table 3.3.1.1.4-2.

3.3.1.1.5 *Shoreline Characteristics*

Shoreline Types. The shorelines of Conowingo Pond consist of a discontinuous distribution of the following types:

- Bedrock outcrops;
- Weathered bedrock (fractured and fragmented);
- Alluvium (material transported and deposited by running water);
- Colluvium (material mass transported by gravity); and
- Disturbed/Artificial

Bedrock outcrops occur as exposures along the river and island shorelines as well as mid-stream (inundated or exposed). Bedrock may be bare, covered with alluvium, and/or colluvium at the toe-of-slope. Weathered bedrock consists of fragmented rock of varying sizes (boulders to gravel). Vegetation may be present and rooted in rock fractures or unconsolidated sediment. Distinguishing properties such as stratification in alluvium, bank failure by mass wasting (e.g., slumps, fallen trees due to undercutting), and soil profile development are evident. Disturbed/artificial shorelines consist of retaining walls, docks, armored shores (e.g., riprap, gabions), canal towpath berm, rail embankment fill, laid rock (purpose unknown), industrial structures (e.g., Peach Bottom Atomic Power Station and the Muddy Run Project), and manicured lawns to the water's edge.

Erosion Features. Evidence of shoreline erosion is present along unconsolidated shorelines. Typical features are bank undercutting, fallen trees, mass wasting, terraces, and scarps. In general, two zones of erosion (not always present at a single location) are recognizable in Conowingo Pond. A lower zone was visible within 1 to 3 feet of the water elevation at the time of the survey (within the range of Project water level fluctuation in the pool) and a higher zone extended 10 to 15 feet above the water elevation at the time of the survey (above the range of pool fluctuation).

The Norfolk Southern railroad embankment dominates the eastern shoreline of Conowingo Pond. Exposed vertical banks reached about 20 feet above the water level at the time of survey. The abandoned and collapsing Susquehanna and Tidewater Canal towpath berm dominates the western shoreline below the PFBC boat launch opposite the Muddy Run powerhouse. For the most part, the erosion consists of nominal undercutting, but greater erosion (5 to 6 feet vertical bank) was noted below the PBAPS. In summary, erosion is ongoing along 'soft' shorelines that consist predominantly of unconsolidated sediment. Where shorelines are 'hard' (e.g., predominantly bedrock, retaining wall, rip-rap) there is little to no erosion.

3.3.1.1.6 *Shoreline Erosion Inventory*

Shorelines are categorized and mapped by the predominance of erosion properties as follows:

- Low to Moderate Erosion: Predominantly unconsolidated material; includes natural shoreline (alluvium or colluvium) or disturbed/artificial shoreline (e.g., canal towpath berm, rail embankment); resource not adversely affected.

- Residential: Predominantly disturbed/artificial shoreline clearly associated with residential use and includes hard and soft shorelines.

- Minimum to None: Predominantly bedrock outcrops or non-residential disturbed/artificial hard shorelines. Bedrock may be bare, covered with alluvium, and/or with colluvium at toe-of-slope; bedrock may be weathered. Non-residential hard shorelines include industrial and engineered structures not clearly associated with residential use.

The shoreline erosion inventory of Conowingo Pond is illustrated in Figure 3.1.1.6-1. The degree of erosion observed in the pond is variable and generally falls within the low to moderate range. Instances of high erosion do not encroach on infrastructure, therefore, severe erosion was not a ranking category identified in the erosion inventory. Shoreline erosion in tributaries is also ranked low to moderate.

3.3.1.1.7 *Depositional Features*

Some shorelines are not erosional but are actively accreting, that is, gradually extending into the pond by sedimentation. Sediment originating outside of the Conowingo Project system, as well as some of the sediment eroding from Project area banks, is transported and deposited as alluvium elsewhere in the system. Large expanses of alluvium are deposited as accretionary features at or near the downstream ends of existing islands and at or near tributary mouths.

Accretionary features are stabilized by vegetation when optimal conditions of inundation and sediment stability are reached. Once established, the vegetation initiates a cycle of sediment trapping, stabilization and accretion. Different degrees of stabilization and vertical accretion have been reached in Conowingo Pond, ranging from littoral areas with or without submerged aquatic vegetation to wetlands with emergent vegetation. This process is particularly prominent at Mt. Johnson Island, Peters Creek, and Fishing Creek.

Another example of an accretionary shoreline is seen in Peters Creek several hundred feet upstream of the mouth. A laterally and vertically accreting point bar has developed on the inside bend of the channel opposite Peach Bottom Marina. A prominent wetland has become established on this point bar deposit.

The depositional nature of other shorelines along the pond is manifested by gently sloping deposits at the water's edge. These deposits include sediment at the mouths of minor streams entering the river (e.g., Muddy Run), sediment associated with stormwater runoff that drains riparian areas, and sediment deposited by receding floodwaters.

3.3.1.1.8 *Sediment Loading*

The Conowingo Dam currently traps sediment and associated nutrients generated by erosion and upstream land uses. Previous studies have suggested that the water quality of Chesapeake Bay may be adversely impacted by the release of sediment behind the dam as a result of a scour event associated with a major storm, or from the loss of sediment trapping capability when Conowingo Pond reaches its sediment storage capacity. Because sediment deposition and transport is a basin-wide, multi-dimensional issue, the goal of Exelon's Sediment Introduction and Transport study (RSP 3.15) was to provide data for the future development of an overall sediment management strategy for the lower Susquehanna River and Chesapeake Bay by others.

This study involved three tasks: a review and compilation of existing information; a quantitative assessment of sediment-related impacts of the Project on downstream habitat; and an evaluation of options to manage sediment at the Project. The following assumptions underlying previous studies relating to the Project's potential effects were tested: 1) 400,000 cubic feet per second (cfs) is the trigger flood event for scour; 2) the two upstream reservoirs—Lake Clarke and Lake Aldred—are at steady-state equilibrium with respect to sediment trapping; and 3) Tropical Storm Agnes (1972) was associated with a major scour event in Conowingo Pond.

Existing literature and data examined involved both regional and local published scientific investigations and Project-specific field studies. The following were specifically reviewed: the sedimentary context of the Project area; previous studies of the Project area; relicensing field studies, which included a characterization of bank stability, shoreline erosion, and nearshore sedimentation; and additional relevant information, such as local bed level control by bedrock and tributary input. A key finding of this review was that prior to the construction of Conowingo Dam, the river in the Project area was likely very similar to the condition of the river today downstream of the dam. A natural barrier existed at the site of the dam, and flow was strong enough to inhibit sediment deposition until near the mouth of the river.

Three quantitative assessments to examine localized sediment-related impacts of the Project on downstream habitat were performed. The first analysis calculated sediment entrainment potential ratios for different Project release scenarios by comparing bottom shear stresses to the critical shear stresses required to initialize and sustain mobility of substrates supporting persistent habitats for immobile life stages of biota. The second analysis tested hypotheses of earlier studies of potential scour in Conowingo Pond during major storm events. This was accomplished by using the HEC-6 model previously developed by the U.S. Geological Survey (USGS) for the lower Susquehanna River reservoir system. The third analysis used a regression equation developed by the USGS relating discharges at Conowingo Dam to quantities of bottom sediment scour in Conowingo Pond to compare with the HEC-6 results[19].

The HEC-6 results:

- Do not seem to support the conclusion that the catastrophic impact to the Chesapeake Bay from Tropical Storm Agnes was due to scour from Conowingo Pond.
- Suggest Lake Clarke is not in equilibrium and is, in fact, trapping sediment.
- Contradict the net scour regression model which is predicated on a 400,000 cfs scour threshold[20].

Building on these results, watershed-based sediment and nutrient management practices currently in place were evaluated, including the Environmental Protection Agency's Chesapeake Bay Total Maximum Daily Load (TMDL) Program, which indicate that Best Management Practices (BMPs) from all sediment/nutrient source sectors are effective in reducing sediment and nutrient loads to Conowingo Pond. Exelon conducted a bathymetric survey in 2011 following Tropical Storm Lee (GSE 2012c). When compared to 2008 bathymetric data (Langland 2009), the analysis showed that the 2008-2011 period experienced net deposition. Exelon also examined traditional methods of preserving reservoir storage capacity and developed potential components of a proposed Sediment Management Plan for the Project. BMPs on Project lands that may be incorporated into a proposed SMP are:

- Stream restoration and stabilization to reduce erosion and provide habitat;

[19] The 1995 HEC-6 report (Hainley et al 1995) concluded that the model simulated trapping efficiencies that were greater than measured data showed. They stated that the model was most inaccurate during flooding events like Hurricane Agnes. The authors hypothesized that the model's algorithms were the primary cause of the model inaccuracies.

[20] The Lower Susquehanna River Watershed Assessment Sediment Task Force is currently undertaking a study to re-evaluate how sediment transport is assessed in the river's lower three impoundments (Lake Clarke, Lake Aldred and Conowingo Pond), the reach downstream of Conowingo Dam and the Susquehanna Flats. The previously-estimated 400,000 cfs scour threshold is being assessed as part of this work.

- Stream bank/channel stability assessment;
- Riparian buffers; and
- Natural/constructed wetlands.

Finally, a cumulative impacts analysis of Project relicensing on the lower Susquehanna River Basin and Chesapeake Bay was conducted. With or without a Sediment Management Plan, the cumulative impact of the Project will be to continue to reduce sediment and nutrient loads to the Chesapeake Bay until sediment storage capacity in Conowingo Pond is reached.

3.3.1.2 Environmental Effects

FERC's SD2 identified shoreline erosion as the only potential geology and soils Project-related issue. Areas of potential Project-related erosion are located along the Conowingo Pond shoreline (including the mouths of tributaries) and the Conowingo tailrace shoreline. Erosion may occur due to water level fluctuations in the pond and dam releases, respectively. Though pond elevation changes by Project operations do cause erosion of the shoreline, the majority of the observed erosion along Conowingo Pond is predominantly due to natural processes - wind generated waves, river flow, surface runoff, and mass wasting. As storms in 2010 and 2011 illustrate, river flow is greatly affected by significant watershed rain and snow events, which can promote shoreline erosion as well as shore sediment deposition. Boat wakes and ice are likely other contributing factors to shoreline erosion. Considering these processes act concurrently and that Conowingo Pond is a flowing waterbody experiencing strong currents at times, effects of Project operations, if any, are not discernible from the non-Project related influences. Similarly, below the dam, the effects of Project operations on shoreline erosion are not discernible from natural processes.

Minor shoreline erosion, which is typical for hydropower reservoirs, and some deposition of this shoreline sediment in the Project reservoir are expected to continue with the proposed Project, but these effects are minimal. As there are currently no proposed changes to operations, the minimal nature of the Project effects on shoreline erosion are not expected to increase.

3.3.1.3 Cumulative Effects

Council of Environmental Quality (CEQ) regulations define 'cumulative effects' as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40CFR§1508.7).

For this analysis, the action is the relicensing and continued operation of the Conowingo Project. The cumulatively affected resource is the Lower Susquehanna River Basin and the Chesapeake Bay. The geographic scope of this analysis is defined by the scope of EPA's Bay Total Maximum Daily Load (TMDL), which covers a 64,000-square-mile area across seven jurisdictions. The temporal scope of this analysis includes a discussion of the past, present, and reasonably foreseeable future actions, and their effects on the resource 50 years into the future.

The impact of the Project has been to alter the sediment budget of the Lower Susquehanna River which had already been altered by Holtwood Dam (built 1910) when the Project was initially constructed in 1928. The Project has been, and currently is, interrupting downstream sediment transport by trapping sediment behind Conowingo Dam. This is due to the sediment storage capacity created by the Project. In effect, the Project added to sediment storage capacity created by the Holtwood and Safe Harbor projects. The cumulative impact of the Project to the system is to provide the last site of sediment storage along the Susquehanna River before sediment reaches Chesapeake Bay. This has benefited Chesapeake Bay by providing a means by which the quantity of fine-grained sediment and associated nutrients, sources of water quality impairment, reaching the Bay are reduced.

At the same time, Project trapping reduces the supply of coarse sediment reaching the Upper Bay. The Project's impact on coarse sediment transport (sand and gravel) is exerted on a sediment supply already similarly affected by the Holtwood and Safe Harbor Dams. The paucity of sand and gravel substrates below the Project has been confirmed in ILP studies. However, coarse sediment likely was not deposited immediately downstream of the Conowingo Dam location prior to its construction. Past and ongoing interruption of its supply downstream, episodically replenished by the action of major storms, may have led to a reduction in coarse substrate habitat close to the river mouth.

The cumulative impact of the Project on the affected resource occurs within the context of watershed activities that directly control sediment reaching the Project. Regulations and voluntary incentives implemented to date by Federal, state and local governments; non-governmental organizations; and stakeholders in the agricultural, storm water, and wastewater sectors of the watershed have reduced sediment/nutrient loads reaching the reservoirs, including the Project, but not enough to prevent Chesapeake Bay and its tidal tributaries from becoming impaired waterbodies unable to meet water quality criteria. Within this context, the Project has reduced sediment/nutrient loadings to the Bay from these watershed sources by trapping sediment.

Operational capacity will not be added and physical modification will not be made under the proposed action. The cumulative impacts of the action are evaluated within the context of the EPA Chesapeake Bay TMDL process and planned expansion program of the Holtwood Dam Project under possible future scenarios – with and without the Project reaching steady-state within the new license term.

The long-term average trapping efficiency of the Project is 55 percent, without accounting for large scour events or improvements in ongoing watershed Best Management Practices (BMP) reductions. At this rate, USGS predicts the Project will reach its sediment storage capacity in the 2023 to 2028 time period. A reduction in sediment yield of 20 percent extends this another 5 to 10 years, and the passage of major storm producing large amount of scour will extend this more. It is important to note that the Bay TMDL assumes this 55 percent trapping efficiency through 2025.

With or without the proposed Sediment Management Plan the Project will continue trapping sediment as long as steady-state conditions are not reached. With successful implementation of the Environmental Protection Agency's (EPA) Chesapeake Bay TMDL program, sediment loads to the Project will be reduced and the time to Project sediment-storage capacity will be prolonged. The cumulative impact of the Project will be to continue to reduce sediment and nutrient loads to Chesapeake Bay until sediment-storage capacity is reached.

If the Project reaches its sediment-storage capacity, the ability of the Project to trap sediment will be lost. The EPA has stated changes in Project sediment-trapping capacity are not expected to change the amount of sediment the Bay can assimilate. Interruption of a continuous supply of sand and gravel to the lower reaches of the river below the Project will continue regardless of the state of sediment trapping in the Project. The character of sediment transport during major flood events is unclear.

In summary, the impact of the Project on sediment, when added to other past, present, and reasonably foreseeable future actions, is beneficial or small. When the Project reaches steady state, these benefits will be reduced.

3.3.1.4 Proposed Environmental Measures

Exelon proposes to conduct a bathymetry survey of Conowingo Pond every five (5) years to monitor sediment transport and deposition patterns within the Pond. Exelon also developed a sediment management plan to identify benchmarks and thresholds for action to address sediment issues that may effect Project operations. Specific measures are contained in Appendix C of Exhibit E.

3.3.1.5 Unavoidable Adverse Impacts

Fluctuation of reservoir and tailwater levels will result in unavoidable bank erosion and mobilization of bed substrate. A shoreline management plan is proposed to address the issue of shoreline erosion.

TABLE 3.3.1.1-1: BEDROCK GEOLOGIC UNITS OF THE PROJECT AREA IN PENNSYLVANIA

Unit	Map Symbol	Age	Description
Octoraro Formation	*Xo*	Probably lower Paleozoic	Albite-chlorite schist with phyllite, hornblend gneiss, and granitized members
Peters Creek Schist	*pc*	Probably lower Paleozoic	Chlorite-sericite schist with interbedded quartzite
Peach Bottom slate and Cardiff Conglomerate (undivided)	*Xpb*	Probably lower Paleozoic	Bluish-black slate and quartz conglomerate having matrix of sericite and chlorite
Ultramafic rocks	*Xu*	Probably lower Paleozoic	Serpentinite with pyroxenite and steatite
Sams Creek Metabasalt	*Xsc*	Probably lower Paleozoic	Green, altered basaltic flows; schistose
Metabasalt	*mb*	Precambrian	Metabasalt
Diabase dike	*Jd*	Jurassic	Medium- to coarse grained, quartz tholeiite
Quarryville Diabase	*Tr(?)d*	Triassic (?)	Very dark gray, medium- to coarse-grained olivine tholeiite

(Source: PGS 2001)

TABLE 3.3.1.1-2: BEDROCK GEOLOGIC UNITS OF THE PROJECT AREA IN MARYLAND

Unit	Map Symbol	Description
Metagraywacke Member of the Wissahickon Formation	wmg	Schist
Boulder Gneiss Member of the Wissahickon Formation	wbg	Gneiss with schist
Ultramafic rock	um	Massive
Baltimore Gabbro Complex	bgb	Mixed gabbro; massive
Gabbro and Quartz Diorite Gneiss	Pzgd	Quartz gabbro with quartz gneiss; massive
Wissahickon Formation (undivided)	wu	Schist
Port Deposit Gneiss	Pzpd	Gneiss with diorite; massive
Metagabbro and Amphibolite	mgb	Metagabbro with amphibolite
Volcanic Complex of Cecil County	vc	Metaigneous with metavolvanics (locally)

(Source: SRBC 2006b)

TABLE 3.3.1.1-3: SURFICIAL GEOLOGIC UNITS OF THE PROJECT AREA IN PENNSYLVANIA

Unit	Description
Rock and alluvium undivided	Flat to vertical surfaces of schist bedrock either bare or covered with alluvium. Exposed areas in bed of Susquehanna River.
Schist bedrock and colluvium undivided	Surfaces with low to steep slopes underlain by unweathered or weathered schist bedrock and thin (< 6 feet), discontinuous deposits of colluvium.
Rock	Surfaces with steep to very steep slopes underlain by unweathered or weathered rock that is at or very close to the surface. Some colluvium may occur at the base of the slope.
Alluvium	Material underlies narrow to broad, flat-surfaced floodplains of perennial streams. Comprises stratified sand, silt and clay in upper part; same plus gravel in lower part. Generally less than 10 feet thick.
Alluvium and colluvium undivided	Alluvium and colluvium are mapped together where the valley in which they occur is too narrow to map the units separately at 1:24,000 scale.
Colluvium	Colluvium is unsorted and unstratified to crudely stratified debris derived from underlying bedrock. Comprised of fragments set in finer-grained matrix. Platy fragments in schist bedrock areas. Mapped where greater than 6 feet thick.

(Source: Sevon 1996)

TABLE 3.1.1.4-1: SOIL UNITS OF PROJECT AREA IN PENNSYLVANIA

Map Unit	Map Symbol	Description
Chagrin silt loam	*Cd*	Chagrin soils make up 85 percent of this map unit. Deep and well drained; potentially highly erodible; forms in recent alluvial material on floodplains. Other minor soils make up the remainder of the map unit.
Comus silt loam	*Cm*	Comus soils make up 90 percent of this map unit. Deep and well drained; potentially highly erodible; forms in micaceous alluvial material on floodplains. Other minor soils make up the remainder of the map unit.
Fluvaquents and Udifluvents, loamy	*Ff*	Fluvaquents soils make up 60 percent of this map unit and Udufluvents soils make up 25 percent. Silty sediment frequently flooded and reworked by rivers. Occur mainly in areas with low flow velocities.
Glenelg silt loam 8 to 15 percent slopes	*GbC*	Glenelg soils make up 85 percent of this map unit. Very deep and well drained; highly erodible; forms in weathered micaceous schist and gneiss. Other minor soils make up the remainder of the map unit.
Manor very stony silt loam, 8 to 25 percent slopes	*MbD*	Manor soils make up 90 percent of this map unit. Very deep and well drained to somewhat excessively drained; highly erodible; forms in weathered micaceous schist. Other minor soils make up the remainder of the map unit.
Manor very stony silt loam, 25 to 60 percent slopes	*MbF*	Manor soils make up 90 percent of this map unit. Very deep and well drained to somewhat excessively drained; highly erodible; forms in weathered micaceous schist. Other minor soils make up the remainder of the map unit.
Mt. Airy and Manor soils, 8 to 15 percent slopes	*MOC*	Mt. Airy soils make up 55 percent of this map unit and Manor soils make up 25 percent. Moderately deep to very deep and well drained to somewhat excessively drained; potentially highly erodible; forms in weathered micaceous crystalline rock. Other minor soils make up the remainder of the map unit.
Mt. Airy and Manor soils, 15 to 25 percent slopes	*MOD*	Mt. Airy soils make up 60 percent of this map unit and Manor soils make up 20 percent. Moderately deep to deep and well drained to somewhat excessively drained; potentially highly erodible; forms on weathered micaceous crystalline rock. Other minor soils make up the remainder of the map unit.

Map Unit	Map Symbol	Description
Mt. Airy and Manor soils, 8 to 25 percent slopes, very stony	*MPD*	Mt. Airy soils make up 55 percent of this map unit and Manor soils make up 25 percent. Moderately deep to very deep and well drained to somewhat excessively drained; potentially highly erodible; forms in weathered micaceous crystalline rock. Other minor soils make up the remainder of the map unit.
Mt. Airy and Manor soils, 25 to 60 percent slopes, extremely stony	*MRF*	Mt. Airy soils make up 60 percent of this map unit and Manor soils make up 20 percent. Moderately deep to very deep and well drained to somewhat excessively drained; potentially highly erodible; forms in weathered micaceous crystalline rock. Other minor soils make up the remainder of the map unit.
Rock outcrop	*Rc*	Bedrock exposures on surface.
Udorthents, loamy	*Ud*	Udorthents soils make up 90 percent of this map unit. Well drained; potentially highly erodible; typically high in rock fragments. Other minor soils make up the remainder of the map unit.

(Source: SSURGO)

TABLE 3.1.1.4-2: SOIL UNITS OF PROJECT AREA IN MARYLAND

Map Unit	Map Symbol	Description
Aldino silt loam, 3 to 8 percent slopes	*AdB*	Aldino series consists of deep, moderately well drained upland soils. Forms in weathered serpentine and overlain by a silty mantle.
Alluvial land	*Av*	Soil material washed from uplands and recently deposited on floodplains. Material consists of sands and sandy loams.
Balle silt loam, 3 to 8 percent slopes	*BaB*	Baile series consists of very deep, poorly drained soils in upland depressions and footslopes. Formed in local alluvium and underlying material, weathered from micaceous schist.
Beaches	*Bc*	Consists of sandy areas typically in long narrow strips between open water and tidal marshes, uplands, or small escarpments.
Beltsville silt loam, 2 to 5 percent slopes	*BeB*	Beltsville series consists of deep, moderately well-drained soils on uplands formed in coastal plain sediments.
Brinklow-Blocktown complex, 25 to 65 percent slopes	*BnF*	Brinklow component is found on hillslopes, piedmonts. The parent material consists of gravelly residuum weathered from phyllite and/or schist. The Blocktown component is found on hillslopes, piedmonts. The parent material consists of gravelly residuum weathered from phyllite and/or schist.
Brandywine gravelly loam, 8 to 15 percent slopes, moderately eroded	*BrC2*	Brandywine series consists of very deep, somewhat excessively to excessively drained soils on uplands formed in material weathered from gneiss.
Brandywine gravelly loam, 15 to 25 percent slopes, severely eroded	*BrD3*	Brandywine series consists of very deep, somewhat excessively to excessively drained soils on uplands formed in material weathered from gneiss.
Brinklow channery loam, 25 to 65 percent slopes, very stony	*BrvF*	Brinklow component is found on hillslopes, piedmonts. The parent material consists of gravelly residuum weathered from phyllite and/or schist.
Chester silt loam, 3 to 8 percent slopes, moderately eroded	*CcB2*	Chester series consists of very deep, well drained soils on uplands formed in material weathered from micaceous schist.
Codorus silt loam, 0 to 3 percent slopes, occasionally flooded	*Ch*	Codorus series is found on uplands, floodplains. The parent material consists of miceous alluvium derived from igneous and metamorphic rock.
Comus silt loam, 0 to 3 percent slopes, occasionally flooded	*Cp*	Comus series is found on floodplains, uplands. The parent material consists of alluvium derived from mica schist.

Map Unit	Map Symbol	Description
Conowingo-Watchung complex, 0 to 8 percent slopes, very stony	*CrB*	Conowingo component is found on hills and uplands. The parent material consists of residuum weathered from serpentinite. The Watchung component is found on depressions, swales, and piedmonts. The parent material consists of clayey residuum weathered from gabbro or other mafic rocks.
Chrome channery silty clay loam, 15 to 45 percent slopes	*CrE*	Chrome series consists of moderately deep, well drained upland soils formed in materials weathered from serpentine or other high magnesium content rock.
Codorus silt loam	*Cu*	Codorus series consists of very deep moderately well drained and somewhat poorly drained soils on floodplains generally formed in recently deposited micaceous sediments washed from uplands.
Comus silt loam	*Cv*	Comus series consists of deep, well drained soils on floodplains formed in micaceous alluvial material washed from uplands.
Cut and fill land	*Cx*	Cut and fill consists of areas where soils have been graded for land leveling or areas that have been filled with soil and other materials. Depth is generally multiple feet and soil material is variable.
Delanco-Codorus-Hatboro complex, 0 to 8 percent slopes, flooded	*DcB*	Delanco component is found on stream terraces on piedmonts. The parent material consists of alluvium derived from igneous and metamorphic rocks. The codorus component is occasionally flooded and found on uplands, floodplains. The parent material consists of alluvium derived from gneiss and/or mica schist. The hatboro component is frequently flooded on floodplains, river valleys. The parent material consists of loamy alluvium derived from greenstone, quartzite, phyllite, schist, and/or diabase
Elsinboro silt loam, 3 to 8 percent slopes	*EnB*	Elsinboro component is found on stream terraces on piedmonts. The parent material consists of mixed alluvium.
Elsinboro-Delanco-Urban land complex, 0 to 8 percent slopes	*ErB*	Elsinboro component is found on stream terraces on piedmonts. The parent material consists of mixed alluvium. The Delanco component is found on stream terraces on piedmonts. The parent material consists of alluvium derived from igneous and metamorphic rocks.
Elsinboro loam, 0 to 2 percent slopes	*EsA*	Elsinboro series consists of deep, well drained soils on stream terraces. Formed in old alluvium washed from areas of micaceous crystalline rock.

Map Unit	Map Symbol	Description
Elsinboro loam, 2 to 5 percent slopes moderately eroded	*EsB2*	Elsinboro series consists of deep, well drained soils on stream terraces. Formed in old alluvium washed from areas of micaceous crystalline rock.
Gaila loam, 25 to 45 percent slopes	*GaE*	Gaila component is found on hillslopes, piedmonts, and ridges. The parent material consists of residuum weathered from quartz, muscovite schist, and gneiss
Glenelg loam, 8 to 15 percent slopes moderately eroded	*GcC2*	Glenelg series consists of very deep, well drained soils on uplands, formed in micaceous material weathered mainly from schist and gneiss.
Glenelg loam, 8 to 15 percent slopes	*GeC*	Glenelg component is found on hillslopes, piedmonts. The parent material consists of loamy residuum weathered from schist and phyllite.
Glenelg gravely loam, 3 to 8 percent slopes, moderately eroded	*GgB2*	Glenelg series consists of very deep, well drained soils on uplands, formed in micaceous material weathered mainly from schist and gneiss.
Glenelg gravely loam, 8 to 15 percent slopes, moderately eroded	*GgC2*	Glenelg series consists of very deep, well drained soils on uplands, formed in micaceous material weathered mainly from schist and gneiss.
Glenville silt loam, 3 to 8 percent slopes	*GnB*	Glenville series consists of very deep, moderately well to somewhat poorly drained soils on uplands.
Hatboro silt loam	*Hb*	Hatboro series consists of deep, poorly drained soils on floodplains formed in recently deposited micaceous sediments washed from uplands.
Hatboro silt loam, 0 to 3 percent slopes, frequently flooded	*Ht*	Hatboro component is found on floodplains, river valleys. The parent material consists of loamy alluvium derived from greenstone, quartzite, phyllite, schist, and/or diabase.
Hatboro-Codorus complex, 0 to 3 percent slopes, flooded	*Hw*	Hatboro component is found on floodplains, river valleys. The parent material consists of loamy alluvium derived from greenstone, quartzite, phyllite, schist, and/or diabase. Codorus component is occasionally flooded and found on uplands, floodplains. The parent material consists of alluvium derived from gneiss and/or mica schist.
Kelly very stony silt loam, 3 to 25 percent slopes	*KfD*	Kelly soils consist of moderately well drained to somewhat poorly drained on uplands and formed partly in periglacial and partly in residuum weathered from hornfel and granulite
Legore silt loam, 15 to 45 percent slopes, very stony	*LbE*	Legore component is found on hills, uplands. The parent material consists of residuum weathered from diabase and/or residuum weathered from anorthosite.
Legore silt loam, 15 to 25 percent slopes, moderately eroded	*LeD2*	Legore series consists of very deep, well drained upland soils formed in material weathered from diabase, diorite and related rocks.

Map Unit	Map Symbol	Description
Legore silt loam, 25 to 45 percent slopes	*LeE*	Legore series consists of very deep, well drained upland soils formed in material weathered from diabase, diorite and related rocks.
Legore very stony silt loam, 0 to 15 percent slopes	*LfC*	Legore series consists of very deep, well drained upland soils formed in material weathered from diabase, diorite and related rocks.
Legore very stony silt loam, 25 to 45 percent slopes	*LfE*	Legore series consists of very deep, well drained upland soils formed in material weathered from diabase, diorite and related rocks.
Manor loam, 8 to 15 percent slopes	*MaC*	Manor component is found on hillslopes, piedmonts, and ridges. The parent material consists of loamy residuum weathered from phyllite and schist.
Manor loam, 15 to 25 percent slopes	*MaD*	Manor component is found on hillslopes, piedmonts, and ridges. The parent material consists of loamy residuum weathered from phyllite and schist.
Manor loam, 25 to 45 percent slopes	*MaE*	Manor component is found on hillslopes, piedmonts, and ridges. The parent material consists of loamy residuum weathered from phyllite and schist.
Manor loam, 3 to 8 percent slopes, moderately eroded	*MbB2*	Manor series consists of very deep, well drained to somewhat excessively drained upland soils formed in material weathered mainly from micaceous schist.
Manor channery loam, 3 to 8 percent slopes, moderately eroded	*McB2*	Manor series consists of very deep, well drained to somewhat excessively drained upland soils formed in material weathered mainly from micaceous schist.
Manor channery loam, 8 to 15 percent slopes, moderately eroded	*McC2*	Manor series consists of very deep, well drained to somewhat excessively drained upland soils formed in material weathered mainly from micaceous schist.
Manor channery loam, 15 to 25 percent slopes, moderately eroded	*McD2*	Manor series consists of very deep, well drained to somewhat excessively drained upland soils formed in material weathered mainly from micaceous schist.
Manor very stony loam, 25 to 45 percent slopes	*MdE*	Manor series consists of very deep, well drained to somewhat excessively drained upland soils formed in material weathered mainly from micaceous schist.
Manor soils, 25 to 45 percent slopes	*MfE*	Manor series consists of very deep, well drained to somewhat excessively drained upland soils formed in material weathered mainly from micaceous schist.
Manor and Glenelg very stony loams, 3 to 15 percent slopes	*MgC*	Manor series consists of very deep, well drained to somewhat excessively drained upland soils formed in material weathered mainly from micaceous schist. Glenelg series consists of very deep, well drained upland soils formed in micaceous material weathered from schist and gneiss.

Map Unit	Map Symbol	Description
Manor and Glenelg very stony loams, 15 to 25 percent slopes	*MgD*	Manor series consists of very deep, well drained to somewhat excessively drained upland soils formed in material weathered mainly from micaceous schist. Glenelg series consists of very deep, well drained upland soils formed in micaceous material weathered from schist and gneiss.
Matapeake silt loam, 2 to 5 percent slopes	*MkB*	Matapeake series consists of very deep, well drained soils on coastal plain uplands formed in a silty mantle and underlying silty sediments.
Mattapex silt loam, 0 to 2 percent slope	*MlA*	Mattapex series consists of very deep, moderately well drained soils formed in silty sediments overlying coarser sediments of marine or alluvial origin.
Montalto silty clay loam, 15 to 25 percent slopes	*MyD*	The Montalto component is found on piedmonts, hillslopes. The parent material consists of clayey residuum weathered from diabase.
Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded	*NeB2*	Neshaminy series consists of deep and very deep well drained upland soils formed in material weathered from mixed basic and acidic rocks.
Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded	*NeC2*	Neshaminy series consists of deep and very deep well drained upland soils formed in material weathered from mixed basic and acidic rocks.
Neshaminy and Montalto very stony silt loams, 0 to 15 percent slopes	*NsC*	Neshaminy series consists of deep and very deep well drained upland soils formed in material weathered from mixed basic and acidic rocks. Montalto series consists of very deep, well drained upland soils formed in material weathered from basic igneous rocks
Neshaminy and Montalto very stony silt loam, 15 to 25 percent slopes	*NsD*	Neshaminy series consists of deep and very deep well drained upland soils formed in material weathered from mixed basic and acidic rocks. Montalto series consists of very deep, well drained upland soils formed in material weathered from basic igneous rocks
Neshaminy and Montalto very stony silt loam, 25 to 45 percent slopes	*NsE*	Neshaminy series consists of deep and very deep well drained upland soils formed in material weathered from mixed basic and acidic rocks. Montalto series consists of very deep, well drained upland soils formed in material weathered from basic igneous rocks
Quarries	*Qu*	Area where rock is being excavated exposing rock layers
Sand and gravel pits	*Sa*	Open excavations from which soil and gravel have been removed, exposing the gravelly material.
Stony land, steep	*St*	Consists of very deep, well drained to somewhat excessively drained upland soils formed in material weathered mainly from micaceous schist.

Map Unit	Map Symbol	Description
Swamp	*Sw*	Consists of very deep, very poorly drained soils formed in organic deposits over sand and gravel. Typically consist of a black surface and subsurface layer of highly decomposed organic material.
Tidal marsh	*Tm*	Tidal marsh consists of poorly drained organic soils with sulfidic material formed in stratified highly decomposed herbaceous plant remains and fluvial sediments inundated daily by brackish waters.
Udorthents, bedrock substratum, 0 to 8 percent slopes	*UaB*	Udorthents component is found on ridges, uplands. The parent material consists of graded areas of schist and/or gneiss.
Udorthents, bedrock substratum, 8 to 15 percent slopes	*UaC*	Udorthents component is found on ridges, uplands. The parent material consists of graded areas of schist and/or gneiss.
Urban land, bedrock substratum	*Uy*	Miscellaneous area
Water	*W*	Open water including streams, lakes, ponds, and estuaries covered with water throughout the year.
Watchung silt loam, 3 to 8 percent slopes	*WaB*	Watchung series consists of very deep, poorly drained soils on upland flats and in depressions. They formed in material weathered from basic rocks.
Watchung very stony silt loam, 0 to 8 percent slopes	*WcB*	Watchung series consists of very deep, poorly drained soils on upland flats and in depressions. They formed in material weathered from basic rocks.

Source: SSURGO

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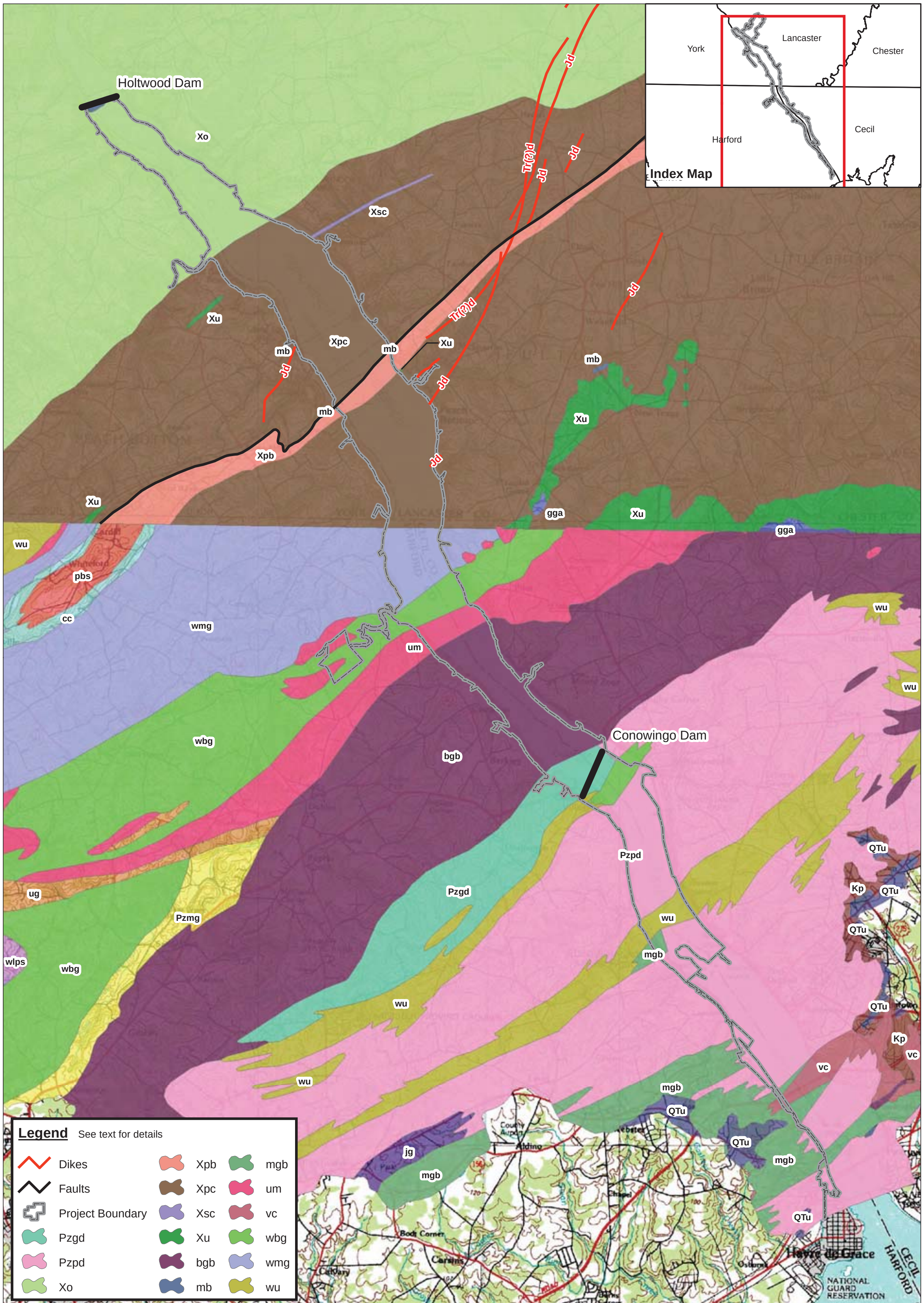


Exelon.

MN

11.5°

True North at 76 ° 20' west long.

EXELON POWER CORPORATION

CONOWINGO HYDROELECTRIC PROJECT

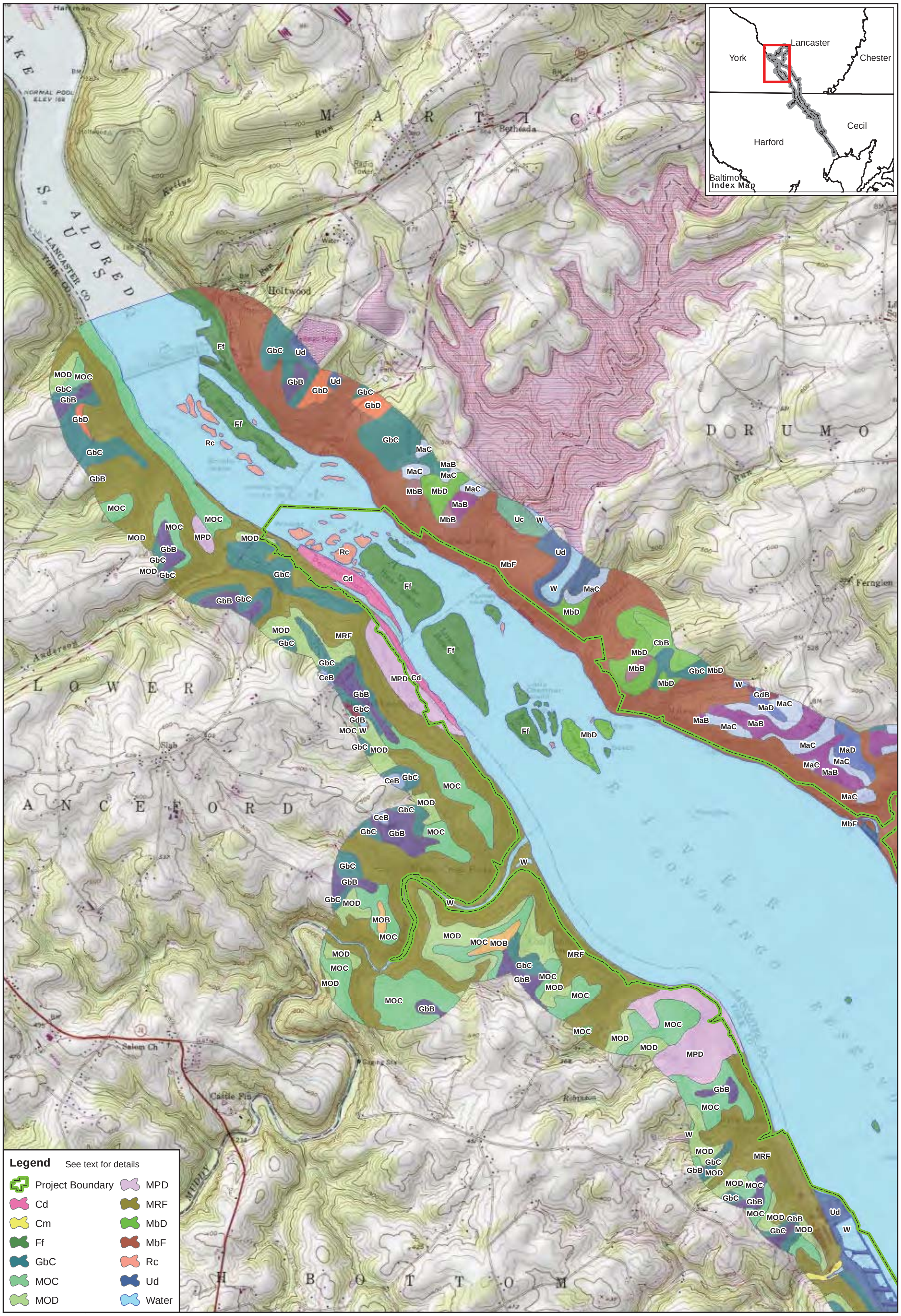
PROJECT NO. 405

1:100,000

0 0.5 1 2 3 Miles

Figure 3.3.1.1.2-1
Bedrock Geology
Conowingo Hydroelectric Project

Source: Susquehanna River Basin Commission
Bedrock Geology of MD 1968 (modified)
Bedrock Geology of Pennsylvania v.1.0
PGS (Pennsylvania Geological Survey), 2001.



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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

1 inch = 0.5 miles

0 0.25 0.5 1 Miles

Figure 3.3.1.1.4-1:
Pennsylvania
Soils within 2000 feet of Project Boundary Extent 1

Source: ESRI Data & Maps CD; USGS 7.5 Topo Holtwood Quad; USDA SSURGO Database

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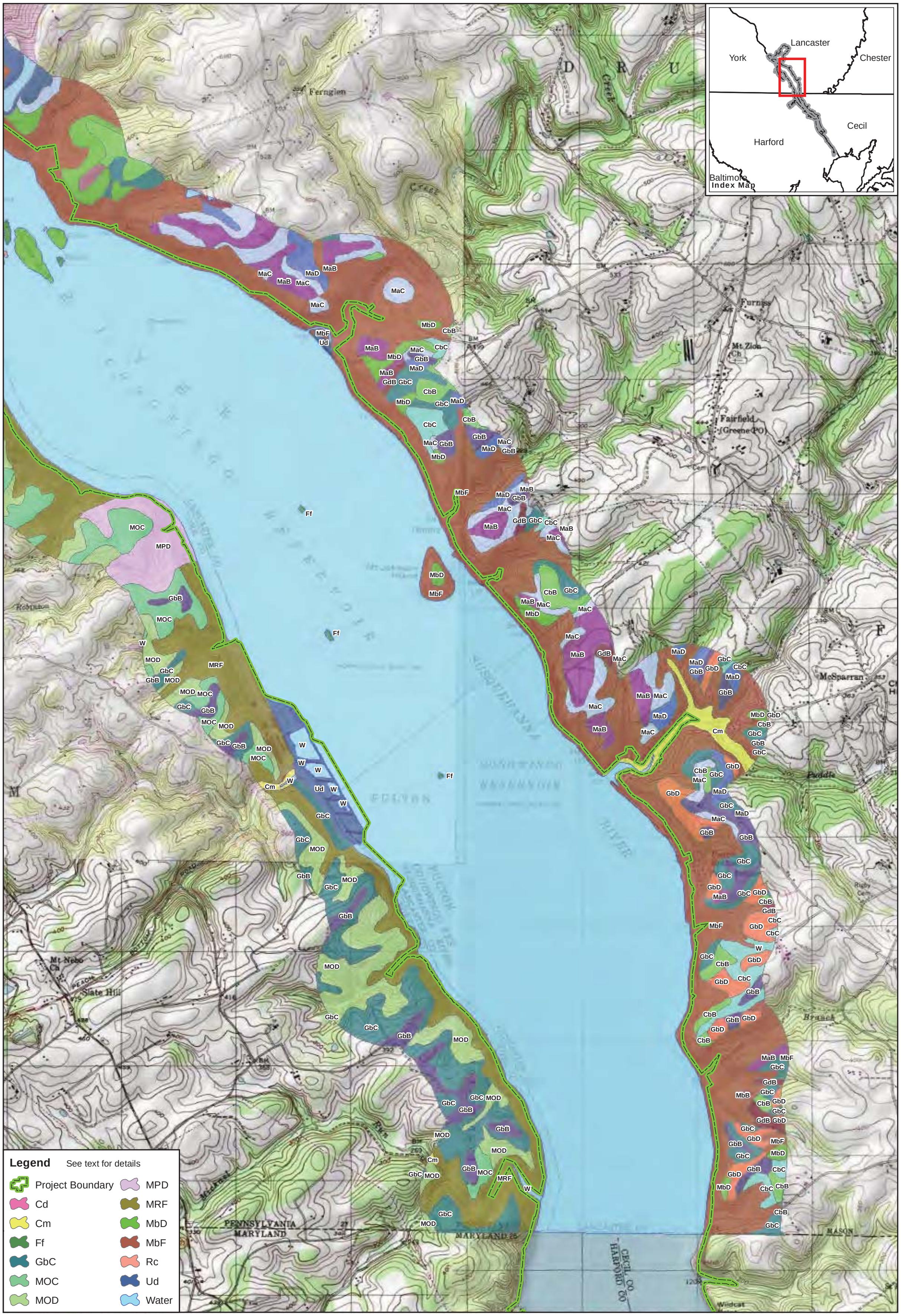

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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

Exelon.

N

1 inch = 0.5 miles

0 0.25 0.5 1 Miles

Figure 3.3.1.1.4-2:
Pennsylvania
Soils within 2000 feet of Project Boundary Extent 2

Source: ESRI Data & Maps CD; USGS 7.5 Minute topo Wakefield, Holtwood, Delta, & Conowingo Dam Quad; USDA SSURGO Database

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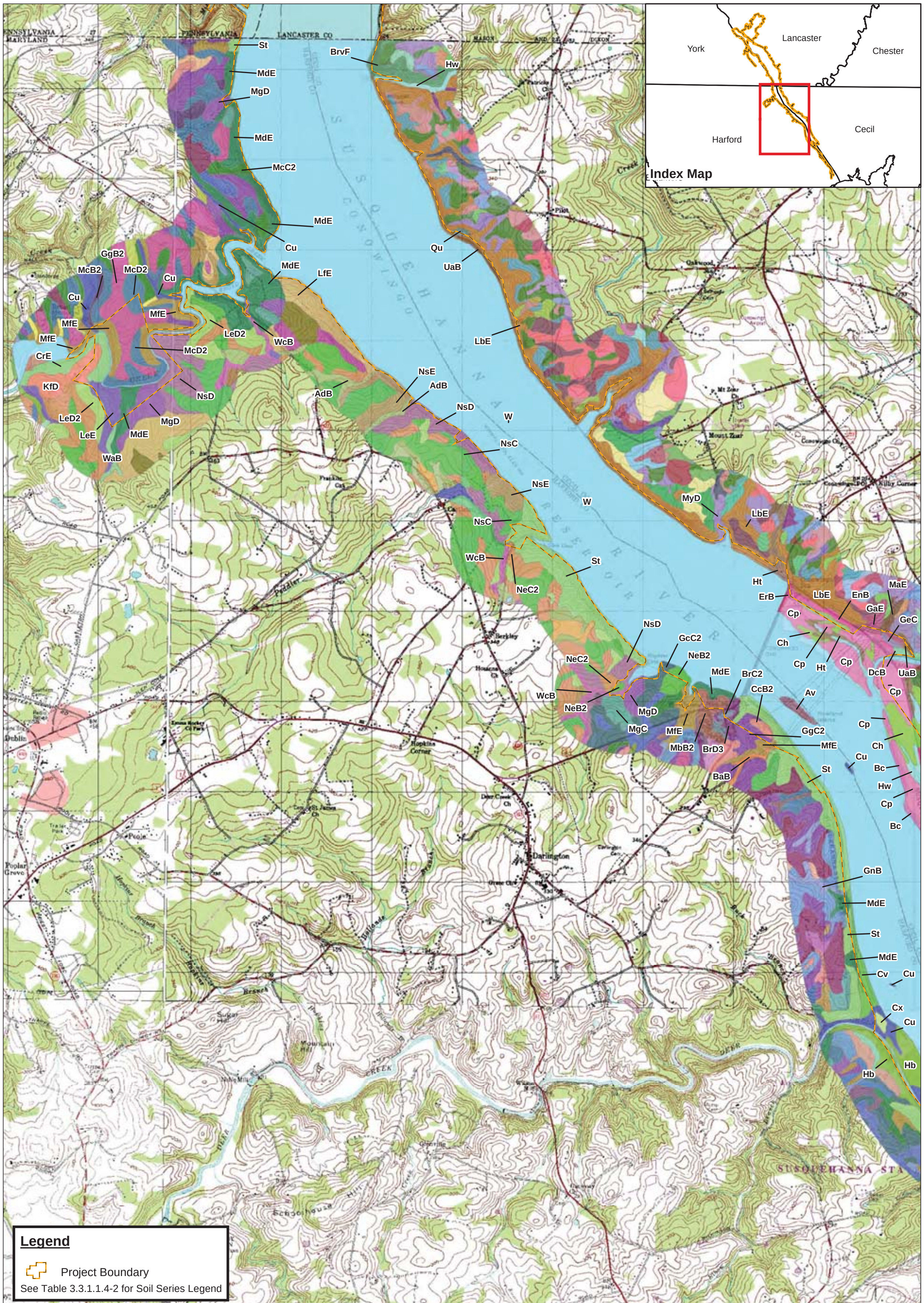


MN

11.5°

True North at 76° 20' west long.

Exelon.

EXELON POWER CORPORATION

CONOWINGO HYDROELECTRIC PROJECT

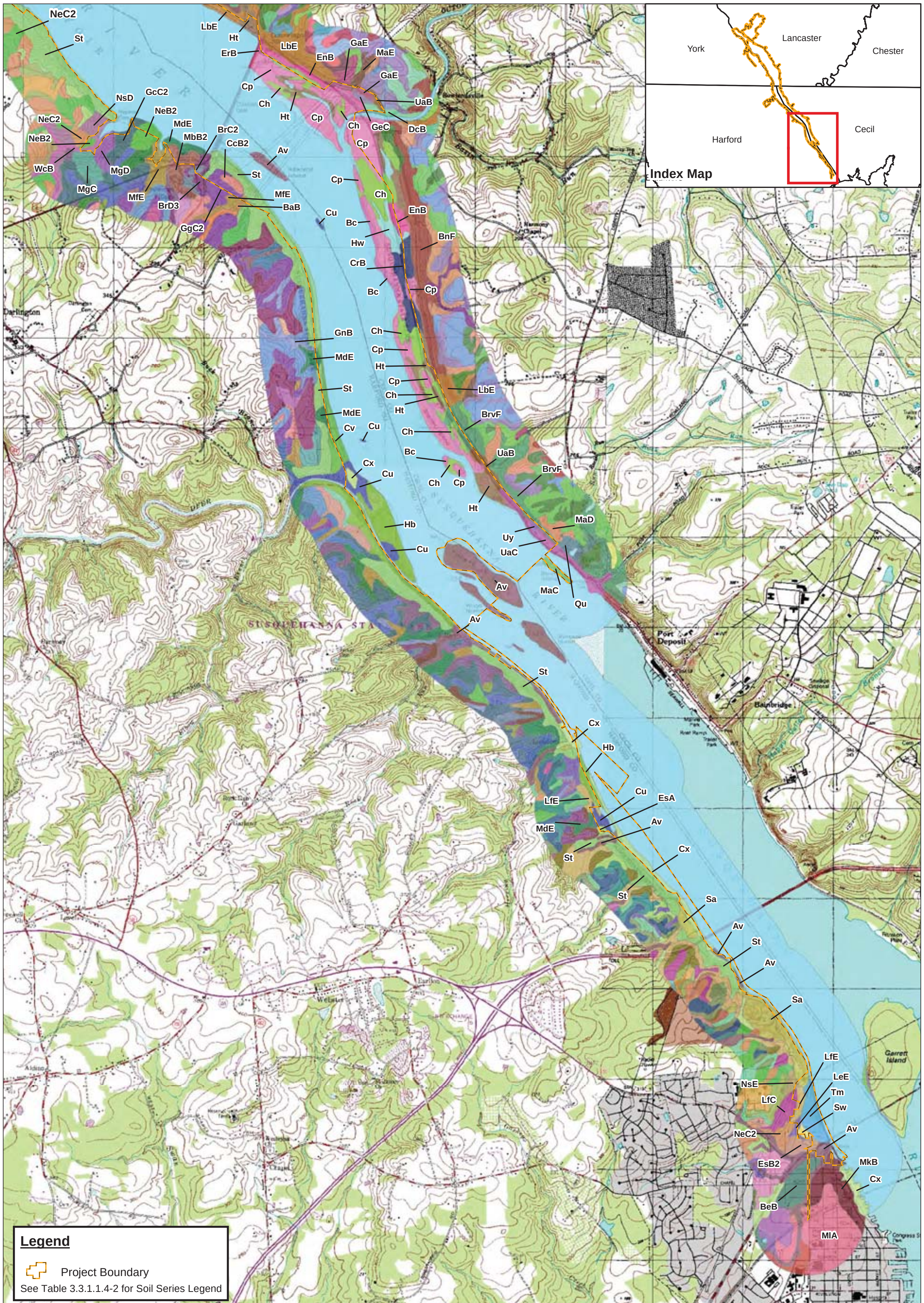
PROJECT NO. 405

1:40,000

0 0.25 0.5 1 1.5 Miles

Figure 3.3.1.1.4-3 (Maryland) Soils within 2000 feet of Project Boundary - Northern Extent

Source: Susquehanna River Basin Commission
USDA SSURGO Soil Database
USGS 24K Quadrangle Maps:
Aberdeen, Bel Air, Conowingo Dam, & Delta



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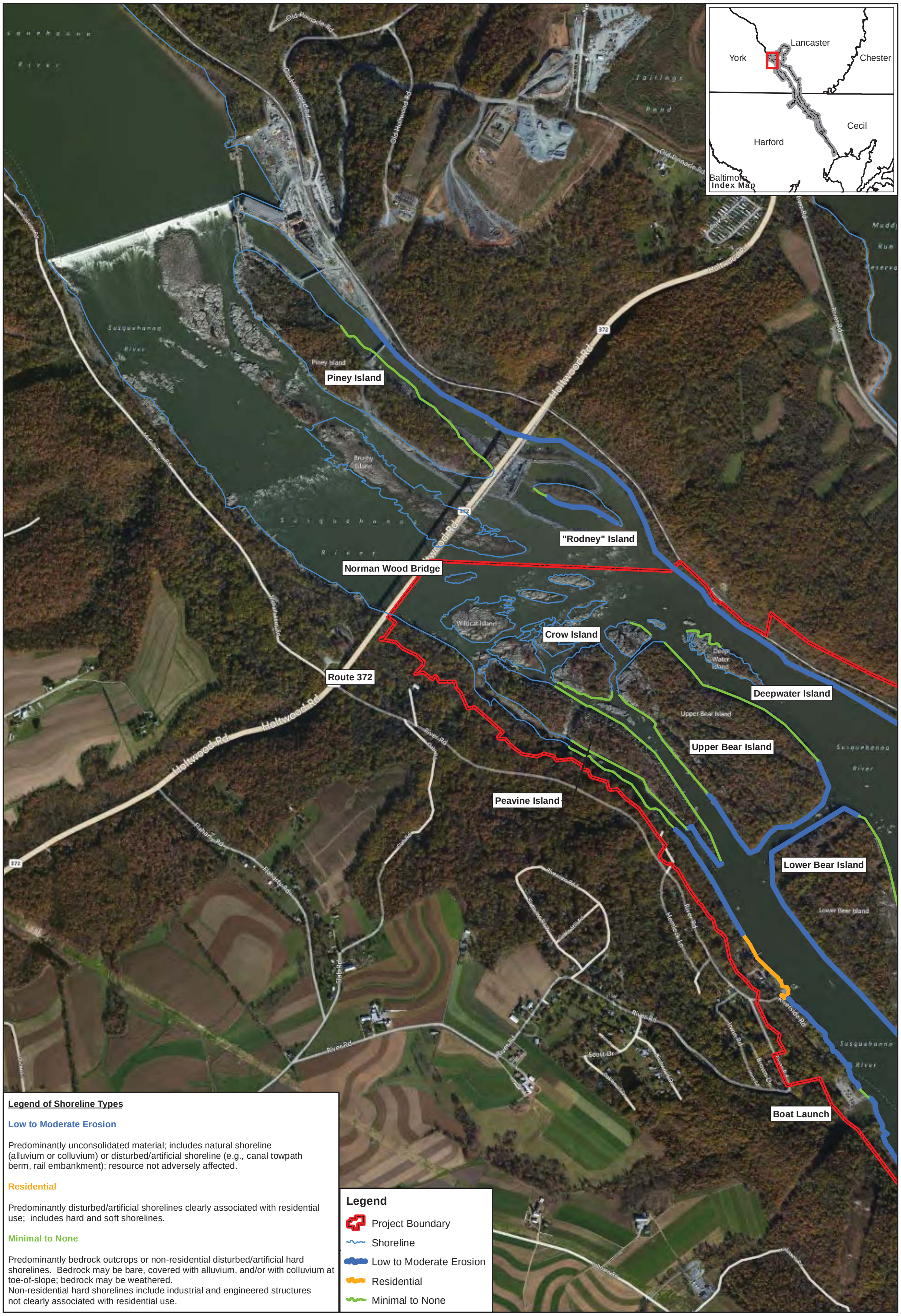
PROJECT NO. 405

1:40,000

Figure 3.3.1.1.4-4 (Maryland) Soils within 2000 feet of Project Boundary - Southern Extent

Source: Susquehanna River Basin Commission
USDA SSURGO Soil Database
USGS 24K Quadrangle Maps:
Aberdeen, Conowingo Dam,
Havre De Grace, & Rising Sun



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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

1 inch = 1,100 feet
0 550 1,100 2,200 Feet

N

Figure 3.3.1.1.6-1:
Pennsylvania
Shoreline Erosion Inventory
Extent 1

Source: ESRI Data & Maps CD, USDA NAIP 2005 Lancaster Imagery, URS Shoreline Study Data

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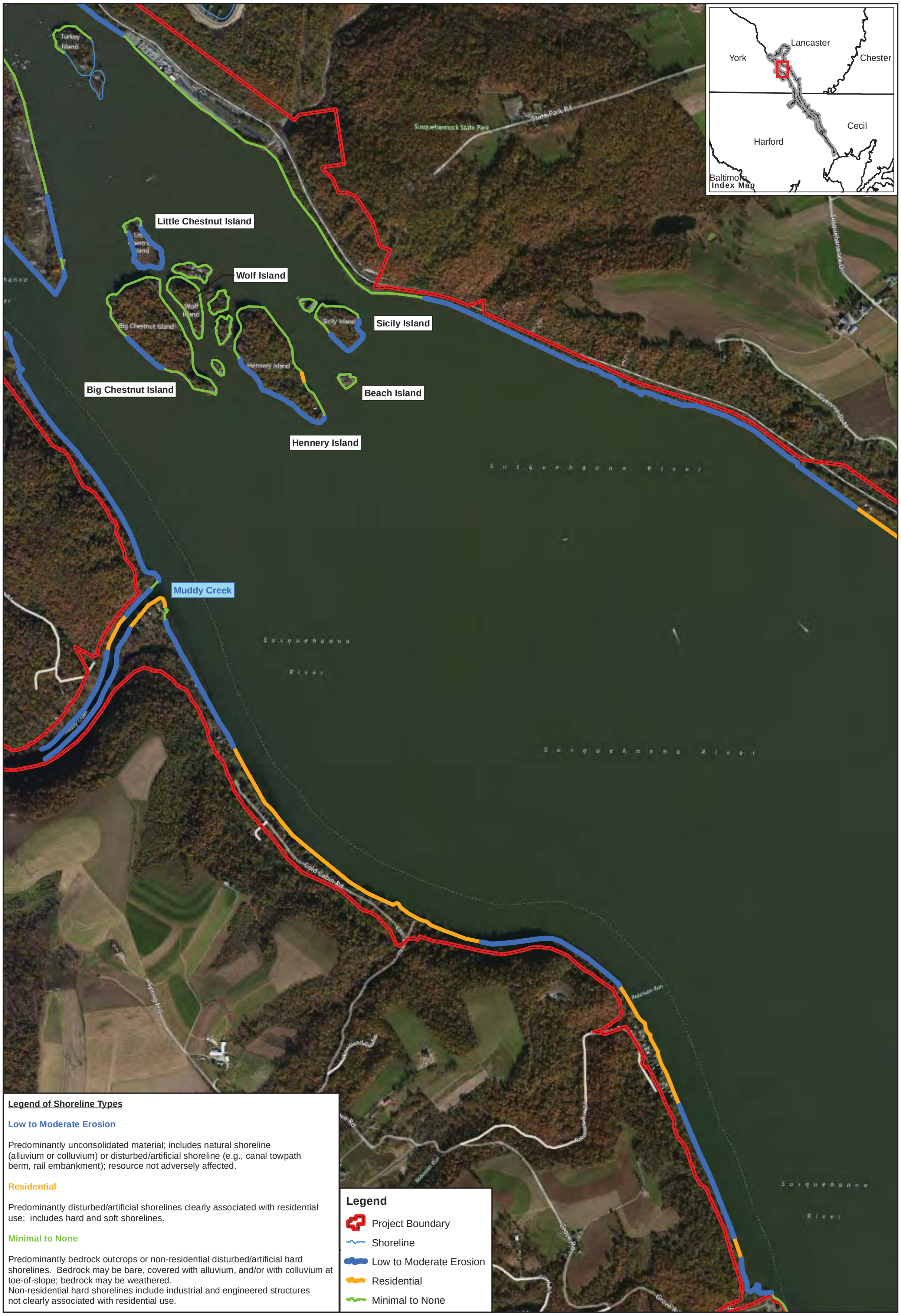

Legend of Shoreline Types

Low to Moderate Erosion

Predominantly unconsolidated material; includes natural shoreline (alluvium or colluvium) or disturbed/artificial shoreline (e.g., canal towpath berm, rail embankment); resource not adversely affected.

Residential

Predominantly disturbed/artificial shorelines clearly associated with residential use; includes hard and soft shorelines.

Minimal to None

Predominantly bedrock outcrops or non-residential disturbed/artificial hard shorelines. Bedrock may be bare, covered with alluvium, and/or with colluvium at toe-of-slope; bedrock may be weathered.
Non-residential hard shorelines include industrial and engineered structures not clearly associated with residential use.

Legend

- Project Boundary
- Shoreline
- Low to Moderate Erosion
- Residential
- Minimal to None

Exelon.

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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

1 inch = 1,100 feet

0 550 1,100 2,200 Feet

Figure 3.3.1.1.6-1:
Pennsylvania
Shoreline Erosion Study
Extent 2

Source: ESRI Data & Maps CD, USDA NAIP 2005 Lancaster Imagery, URS Shoreline Study Data

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EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

N

1 inch = 1,100 feet

0 550 1,100 2,200 Feet

Figure 3.3.1.1.6-1:
Pennsylvania
Shoreline Erosion Study
Extent 3

Source: ESRI Data & Maps CD, USDA NAIP 2005 Lancaster Imagery, URS Shoreline Study Data

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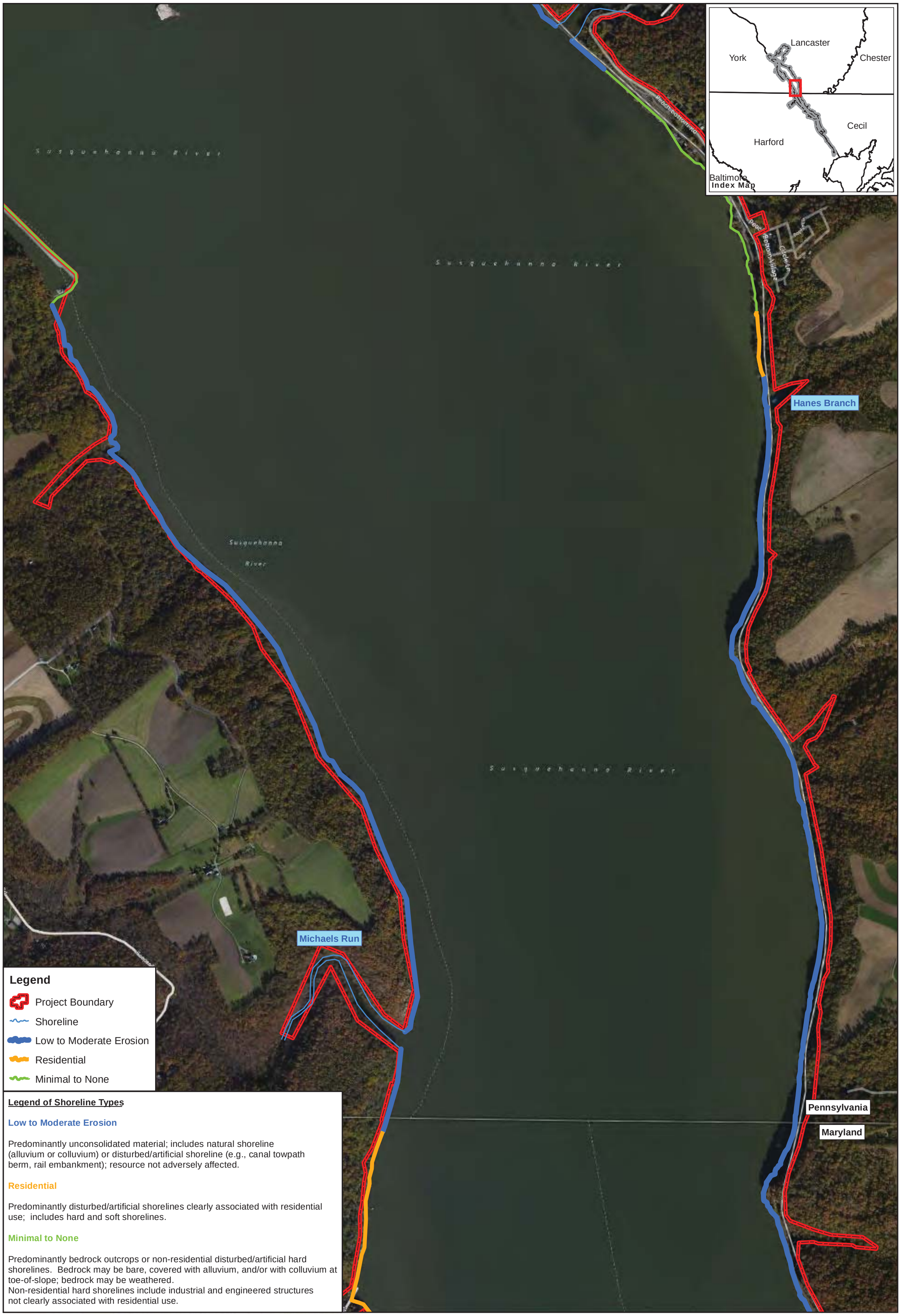


EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

N

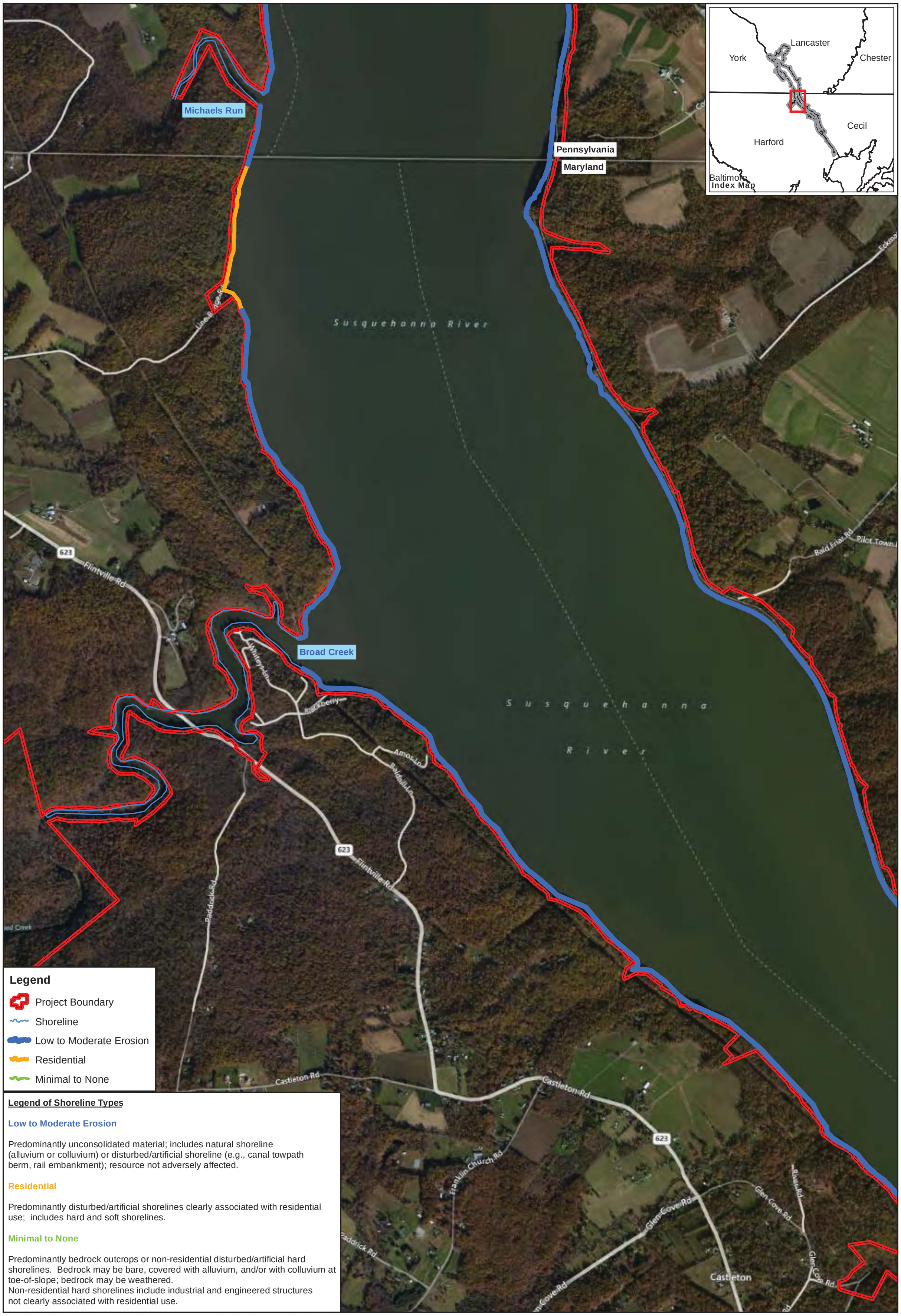
1 inch = 1,100 feet

0 550 1,100 2,200 Feet

Figure 3.3.1.1.6-1:
Pennsylvania
Shoreline Erosion Study
Extent 4

Source: ESRI Data & Maps CD, USDA NAIP 2005 Lancaster Imagery, URS Shoreline Study Data

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_shoreline_erosion_extent_4.mxd



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CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

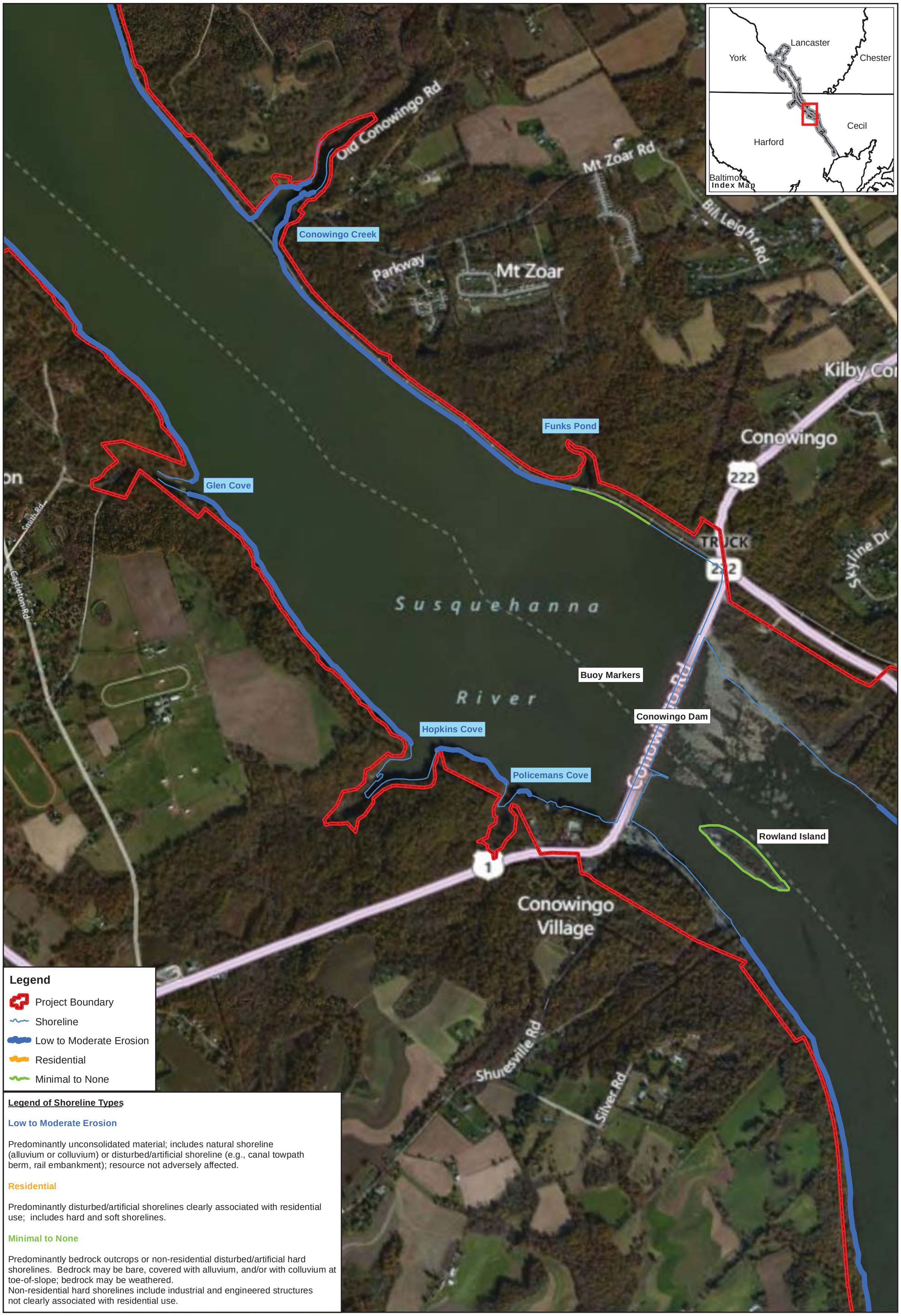
1 inch = 1,500 feet
0 750 1,500 3,000 Feet

N

Figure 3.3.1.1.6-1:
Maryland
Shoreline Erosion Study
Extent 5

Source: ESRI Data & Maps CD, USDA NAIP 2005 Lancaster Imagery, URS Shoreline Study Data

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_shoreline_erosion_extent_5.mxd



EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

1 inch = 1,500 feet

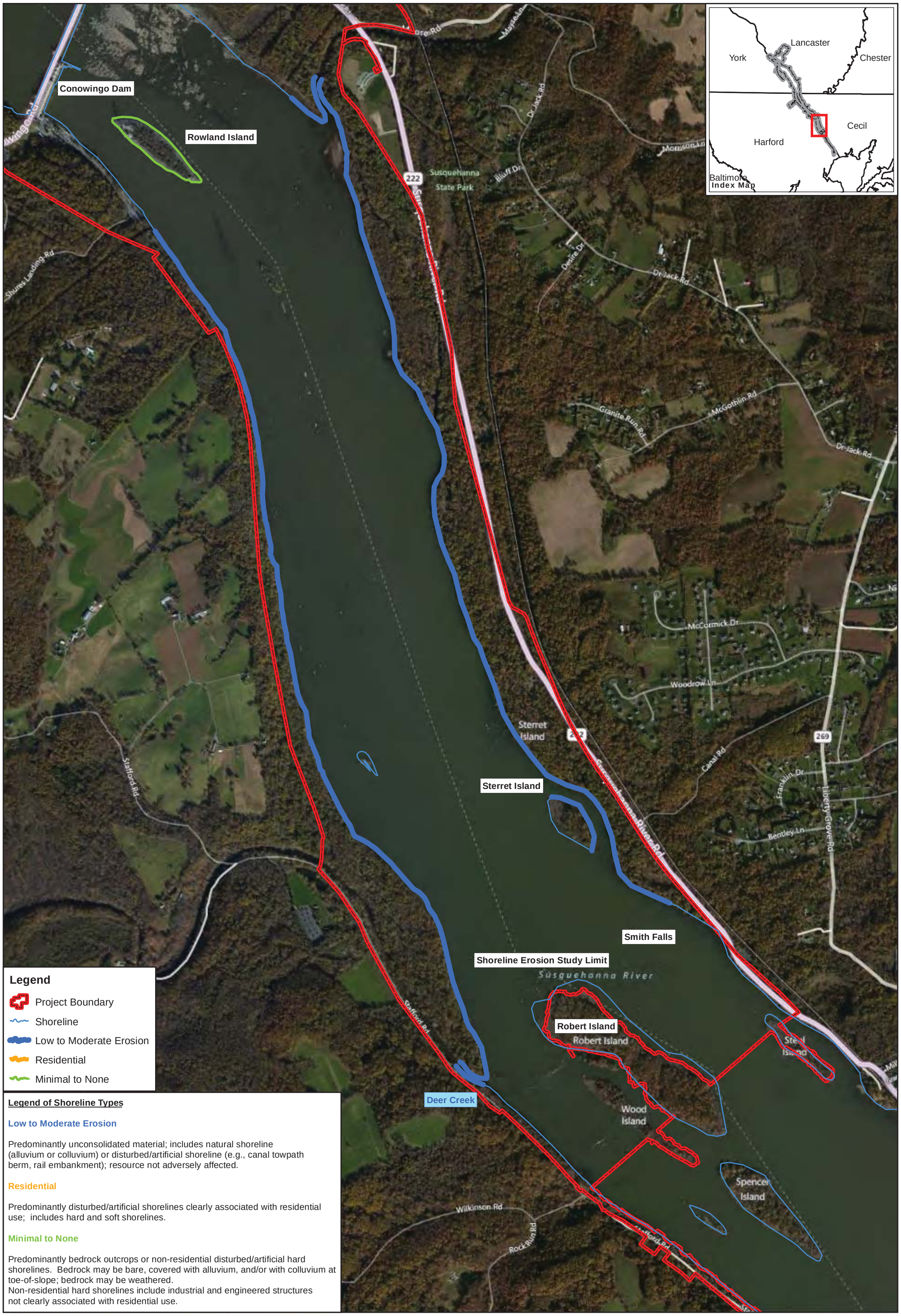
0 750 1,500 3,000 Feet

N

Figure 3.3.1.1.6-1:
Maryland
Shoreline Erosion Study
Extent 6

Source: ESRI Data & Maps CD, USDA NAIP 2005 Lancaster Imagery, URS Shoreline Study Data

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_shoreline_erosion_extent_6.mxd



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CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

1 inch = 1,500 feet

0 750 1,500 3,000 Feet

N

Figure 3.3.1.1.6-1:
Maryland
Shoreline Erosion Study
Extent 7

Source: ESRI Data & Maps CD, USDA NAIP 2005 Lancaster Imagery, URS Shoreline Study Data

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_shoreline_erosion_extent_7.mxd

3.3.2 Water Resources

3.3.2.1 Affected Environment

3.3.2.1.1 *Water Quantity*

The Susquehanna River has a total drainage area of 27,510 square miles, of which 6,270 square miles are in south-central New York, 20,950 square miles are in central Pennsylvania, and 280 square miles are in northeastern Maryland. Of this total drainage area, approximately 27,100 square miles are located above Conowingo Dam.

The lower Susquehanna has several hydroelectric projects that collectively influence the river's flow characteristics. In the approximately 45 river miles between the Marietta, PA USGS gage (No. 01576000) and the mouth of the Susquehanna at Chesapeake Bay, there are three main channel dams and one pumped storage facility, all constructed for the purpose of hydroelectric energy generation. In addition to the hydroelectric energy generation, there are several other withdrawals for various uses, including power generation cooling water as well as drinking water withdrawals.

Hydrology and Streamflow

There are two USGS flow gages located on the lower Susquehanna River. The Marietta, PA USGS Gage is located on the upper end of the lower Susquehanna River at RM 45, just upstream of the Safe Harbor Dam impoundment. The drainage area at this gage is 25,990 mi^2. Marietta is generally considered reflective of the lower Susquehanna River's natural flow regime. The Conowingo, MD USGS Gage No. 01578310 is located on the downstream face of Conowingo Dam (RM 10), and has a drainage area of 27,100 mi^2. The Conowingo gage directly reflects Project operations and the influences of the other lower Susquehanna water users.

Exelon conducted a statistical analysis of lower Susquehanna River flows (Gomez and Sullivan 2011k). The results are presented in this section.

Daily Average Flow Statistics

The average annual flows between water year (WY[21]) 1968 and 2009 measured at the Marietta and Conowingo USGS gages were 39,686 and 41,026 cfs, respectively. Monthly average and median flows

[21] Water year refers to a year that begins on October 1 and ends September 30. For example, WY 1968 begins October 1, 1967 and ends September 30, 1968.

are compared in Table 3.3.2.1.1-1, showing that Conowingo flows are typically 900 to 2,100 cfs greater than Marietta flows. Flows are greatest in March and April, and lowest in August.

Annual and monthly flow exceedances were calculated for daily average flow data. Daily average annual flow exceedance plots showed that Conowingo and Marietta typically experience similar flow distributions, with Conowingo experiencing slightly more days in the 20,000 cfs to 60,000 cfs range (Figure 3.3.2.1.1-1). Slightly higher flows at Conowingo are expected, as Conowingo drains an additional 1,010 mi^2 compared to Marietta. Monthly daily average flow exceedances were similar, showing that Conowingo flow exceedances (Table 3.3.2.1.1-2) were generally greater than Marietta flow exceedances (Table 3.3.2.1.1-3). One notable exception was the monthly minimum observed daily average flows (0^{th} percentile) were always lower at Conowingo than at Marietta, and were often below 1,000 cfs though the minimum daily average flow observed at Marietta was 2,150 cfs. This reflects the period prior to the 1989 settlement agreement, under which Conowingo and the other upstream hydroelectric projects did not have minimum flow requirements.

Sub-Daily Flow Statistics

Time series plots reveal that the sub-daily flows do not match between Marietta and Conowingo as well as the daily flow data (Figure 3.3.2.1.1-2). Annual and monthly flow exceedances were calculated for sub-daily flows using 30-min instantaneous flow data. While the Conowingo and Marietta median flows are very similar (25,200 cfs and 27,000 cfs, respectively), sub-daily annual flow exceedance curves (Figure 3.3.2.1.1-3) show that Conowingo experiences more frequent low (< 10,000 cfs) and high (> 60,000 cfs) flows. Monthly sub-daily flow exceedances showed a similar pattern (Table 3.3.2.1.1-4 and Table 3.3.2.1.1-5), though the flow magnitudes were different depending on the time of year.

Major Water Withdrawals and Use

There are eight main water users along the lower Susquehanna downstream of the Marietta, PA USGS gage, which is at (RM 45 (Figure 3.3.2.1.1-4). The eight water users, in upstream to downstream order, are:

- Safe Harbor Hydroelectric Project - The farthest upstream water user, located at RM 31. Safe Harbor is a peaking project, with an installed generation capacity of 417.5 MW and an estimated hydraulic capacity of 110,000 cfs.

- Holtwood Hydroelectric Project - Located at RM 24, Holtwood Dam has a powerhouse with a total hydraulic capacity of approximately 31,500 cfs and an installed generation capacity of 107 MW. FERC recently issued PPL a License Amendment to expand the capacity at the Holtwood Project. Construction began in 2010, and when completed will result in a total generation capacity of 196 MW and total hydraulic capacity of 62,000 cfs.

- Muddy Run Pumped Storage Project - Located at RM 22, Muddy Run uses Conowingo Pond as a lower storage reservoir. The powerhouse turbines have a total discharge capacity from the powerhouse of 32,000 cfs. The total powerhouse pumping capability is 28,000 cfs.

- Peach Bottom Atomic Power Station - PBAPS withdraws cooling water from Conowingo Pond, and is located at approximately RM 17. PBAPS has two units, with a total generating capacity of 2,186 MW. A total of approximately 2,230 MGD (3,450 cfs) is drawn at full power operation

- The York Energy Center - This facility has a 1,100 MW electric generation facility that withdraws cooling water approximately 8 miles upstream of Conowingo Dam, at RM 18. The facility has a permitted is allowance of 12.62 MGD (19.5 cfs)from Conowingo Pond.

- The City of Baltimore - Currently, the City of Baltimore is approved by the SRBC to withdraw a maximum of 250 MGD (387 cfs) from the Conowingo Pond, but is currently limited by its pumping capacity to a withdrawal of approximately 137 MGD (212 cfs). During low flow periods[22] on the Susquehanna River, the maximum 30-day average withdrawal is reduced to 64 MGD (99 cfs). The Conowingo Pond withdrawal is principally used during major drought periods or under emergency operating conditions.

- Chester Water Authority - The SRBC has permitted Chester Water Authority to withdraw up to 30 MGD (46 cfs) of water from Conowingo Pond.

- Conowingo Hydroelectric Project - The Conowingo Project has an nameplate capacity of 573 MW and a hydraulic capacity of 86,000 cfs.

Surface Water Discharges

[22] Baltimore's low flow withdrawal restriction refers to when Marietta flow is below Conowingo's seasonal minimum flow (QFERC).

Discharges to the Susquehanna River include point and nonpoint sources. Point source discharges typically include manufacturing plants and municipal wastewater treatment plants. Nonpoint sources consist of those not traceable to a pipe. Control of pollution from point source discharges is managed through the National Pollution Discharge Elimination System (NPDES) permit program. As shown in Table 3.3.2.1.1-6, the Conowingo Pond segment of the Susquehanna River receives discharges from a total of 13 NPDES registered facilities (USEPA 2006).

Downstream Flooding

Exelon conducted an analysis to determine potential Project impacts on downstream flooding (Gomez and Sullivan 2011c). The Project's current FERC license permits water levels in Conowingo Pond to range from 101.2 to 110.2 ft NGVD 1929. However, Conowingo Pond water surface is typically maintained between an elevation of 109.2 ft, which is considered normal pond, and 105.2 ft. At normal pond (109.2 ft), Conowingo Pond contains an effective storage capacity of approximately 34,049 acre-ft, relative to elevation 105.2 ft.

A HEC-RAS model was used to evaluate the Project's actual and potential influence on downstream flooding at Port Deposit during several flood events (10, 50, 100 and 500-year floods). Three alternative operating scenarios were investigated for their potential to reduce downstream flooding. The first alternative simulated drawing down Conowingo Pond prior to high-flow events arriving. The second alternative simulated the impact of targeting lower pond levels during the storm. The third alternative analyzed using the reservoir storage during the storm peak to reduce downstream flows. Additionally, a no-dam scenario was included, which simulated Port Deposit stage time series to estimate what conditions would be like if Conowingo Dam did not exist.

The study results indicated that none of the considered alternative operating scenarios substantially reduced downstream flooding. The first alternative was found to have no effect on downstream flooding magnitude and only a slight reduction in flooding duration. The second alternative had no considerable impact on flooding magnitude or duration (< 15 min). The third alternative negligibly reduced flooding magnitudes (< 0.02 ft) and duration (< 15 min). The no-dam scenario had slightly increased (0.00 to 0.08 ft) flooding magnitudes and slightly decreased flooding durations, relative to existing conditions.

3.3.2.1.2 *Water Quality*

Water Quality Standards and Classifications

The following sub-sections discuss Pennsylvania and Maryland water quality standards that are applicable to Project operations.

Pennsylvania

The Pennsylvania Code (Title 25, Chapter 93) establishes narrative and numeric water quality criteria needed to support a variety of protected water uses (Table 3.3.2.1.2-1). All surface waters in Pennsylvania are protected for aquatic life, water supply (potable, industrial, livestock, wildlife and irrigation) and recreation (boating, fishing, water contact sports and aesthetics). The segment of the Susquehanna River between the confluence with the Juniata River and the Pennsylvania-Maryland border where the Project is located has a warm water fishes (WWF) designated water use. In addition to general/narrative standards that are applicable to all surface waters, specific water quality criteria for parameters such as pH, alkalinity, bacteria, color, DO, temperature and certain ions, metals and nutrients are established for critical use (i.e., the most sensitive designated or existing use designated for protection).

For WWF waters, the Pennsylvania DO standard is a minimum daily average of 5.0 milligrams per liter (mg/L) with an instantaneous minimum of 4.0 mg/L. The standard recognizes the natural process of stratification in lakes, ponds and impoundments and applies to flowing water and the epilimnion of a naturally stratified lake, pond or impoundment and throughout the water column for non-stratified bodies of water.

Maximum temperature limits vary with the time of year. The maximum temperature criteria for WWF are summarized in Table 3.3.2.1.2-2. These temperature standards apply only to water affected by heated discharges. In addition to these temperature criteria, heated waste sources may not result in a change of temperature in receiving water of more than 2°F during a one-hour period.

Maryland

Maryland's surface water quality standards (Code of Maryland Regulations Title 26, Subtitle 08, Chapter 2) segment the state's surface waters into eight designated uses (Table 3.3.2.1.2-3) based on existing conditions and potential uses which may be achieved through anticipated water quality improvements. All Maryland surface waters must be protected to support water contact recreation, fishing, aquatic life, wildlife and water supply (agricultural, industrial). In addition, each major stream segment within the state has been assigned to one of the eight designated use categories with associated minimum water quality criteria.

Numeric water quality criteria for various water quality parameters (e.g., bacteria, DO, temperature, pH, turbidity, color, toxic substances, etc.) are specified for each designated use. Maryland's water quality standards state the maximum temperature outside of a mixing zone (i.e., an area where an effluent mixes with surface waters) may not exceed 90°F (32°C) or the ambient temperature of the surface water, whichever is greater. In addition, the standards state that a thermal barrier that adversely affects aquatic life may not be established.

The reach of the Susquehanna River from the north side of the Conowingo Dam to the Maryland/Pennsylvania border (i.e., Conowingo Pond) is designated as Use I-P (Water Contact Recreation, Protection of Aquatic Life and Public Water Supply). The DO criterion is that DO may not be less than 5 mg/L at any time. The Susquehanna River mainstem from Conowingo Dam downstream to the confluence with the Chesapeake Bay is designated as Use II (Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting – includes applicable Use I-P categories). Water quality standards for the Chesapeake Bay and tidal tributaries (e.g., Susquehanna River downstream of Conowingo Dam) are further assessed on a Bay Segment scale for four segments with "Migratory Spawning and Nursery Use" and "Open Water Fish and Shellfish Use" sub-category designations during specified periods of time.

Based on the criteria for Use II and sub-category designations, the current DO standard applicable to discharges from Conowingo is summarized below:

- February 1 through May 31: DO ≥ 6 ml/L for a 7-day averaging period

- June 1 to January 31: DO ≥ 5.5 mg/L for a 30-day averaging period; 4.0 mg/L for a 7-day average; 3.2 mg/L as an instantaneous minimum year-round; and for protection of endangered shortnose sturgeon, 4.3 mg/L as an instantaneous minimum at water column temperatures 77°F (25°C).

Historical Water Chemistry

The following sections describe the water quality conditions within Conowingo Pond and the lower Susquehanna River based on information from historical studies and surveys (1959-2007).

Conowingo Pond

Water Temperature

Long-term Conowingo Pond monitoring studies indicate that water temperature generally follows a sinusoidal pattern typical of temperate waters (Figure 3.3.2.1.2-1). Water temperatures are lowest in the winter (typically 32°F-40°F), increase in spring (45°F-65°F) to seasonal highs in summer (at or near 80°F-86°F) and then decline in the fall (40°F-70°F). Temperatures throughout the water column in the upper, shallower areas of the Pond remain relatively well mixed throughout the year; surface to bottom temperature differences are usually less than 1°F (Whaley 1960; Normandeau 1998-2000). Long-term monitoring of water temperature at the MD-PA state line relative to PBAPS's heated water effluent showed that the respective water temperature standards were met.

Although the Pond does not develop a classic thermal stratification during the summer, surface waters often exceed bottom temperatures by several degrees in the lower third of the Pond's deeper waters. This phenomenon is particularly apparent on sunny, calm days.

Dissolved Oxygen

Although substantial year-to-year variation exists, surface DO levels are typically highest in the winter (12-15 mg/L), decline through the spring, are lowest in the summer (5-7 mg/L) and then increase through the fall (Figure 3.3.2.1.2-2).

DO levels in the water column remain relatively well mixed throughout most of the year. Depth variations, however, do occur in summer, particularly in the lower Pond's deeper waters near Conowingo Dam. When stratification occurs, surface to bottom DO differences of up to 9 mg/L may occur. Significant DO stratification rarely occurs during other months or in the Pond's shallower locations (Normandeau 1998-2000).

The time of initial development, strength, duration and stability of DO stratification depend primarily on river flows, water temperatures and weather conditions (recent rainstorms, wind conditions). Stratification tends to occur when river flows are less than 20,000 cfs and water temperatures are greater than 70°F. Typically the stratification process begins in late June or early July, with low DO levels (<5 mg/L) occurring by mid to late July. DO values less than 5 mg/L are common at depths greater than 30 ft. Additionally, the deepest portions of the Pond may approach or become hypoxic (DO <2 mg/L) under certain conditions. Low DO conditions in bottom waters usually occur on or after mid-July and can persist for up to 60 days depending on river flows, decomposition of materials in Conowingo Pond, wind/storm events and photorespiration (Mathur et al. 1988).

An investigation into the effects of variable discharges from the Conowingo Project on summer DO concentrations revealed that Conowingo Pond DO concentrations are predominantly controlled by meteorological factors that are independent of Project operations. DO stratification in the lower third of the Pond can be temporarily destroyed by strong winds and/or a rapid increase in incoming river flows. However, Conowingo Project discharges, regardless of magnitude, have little effect on DO stratification upstream of the dam (Mathur et al. 1988, RMC Environmental Services 1985a, 1985b).

Conowingo Pond DO varies diurnally during the summer, with fluctuations primarily limited to surface and near-surface waters. The magnitude of diurnal variations is up to 5 mg/L in surface waters. Little to no diurnal variation occurs in waters greater than 20 ft deep. On sunny days, daily maximum DO values occur in mid to late afternoon and minimum values occur just before or after sunrise. Diurnal variations occur due to photosynthetic organisms' net oxygen production during the daytime and net respiratory oxygen consumption during the nighttime. Wind, rainstorms and prolonged cloud cover can also affect the magnitude of diurnal DO variations (RMC Environmental Services 1985a).

Conowingo Tailrace

Seasonal and diurnal variations in water temperature downstream of Conowingo Dam parallel those observed in Conowingo Pond waters. Seasonally, water temperatures are highest in the summer and lowest in the winter. Tailrace water temperatures usually are highest in the mid to late afternoon and lowest at night, with only a few degrees of difference between the highest and lowest temperatures (Figure 3.3.2.1.2-3). Station 643, located along the Susquehanna River's west shore 0.6 miles downstream of the dam, is designated as the primary Maryland State standard compliance monitoring location.

Seasonal DO variations downstream of Conowingo Dam (Figure 3.3.2.1.2-4) parallel those seen in Conowingo Pond (Figure 3.3.2.1.2-2). In studies prior to 1989, when turbine aeration began, summer tailrace DO levels ranged from 2 mg/L to 6 mg/L (RMC Environmental Services 1985a, 1985b). These values were highly dependent on the average Conowingo Pond DO at depths from 40 to 70 ft (Mathur et al. 1988). To enhance DO levels in the tailrace, a venting system was installed in all of the Francis Units in 1991.

Since the initial installation in 1991, the turbine venting system has been used to meet the Maryland DO standards. Table 3.3.2.1.2-4 compares hourly summertime DO levels for pre-venting (1982-1988) and post-venting (1989-2007). With no venting from 1982-1988, hourly DO values were less than 5 mg/L 20.3% of the time with 8.6% of the values less than 4.0 mg/L, and some years had DO levels below 5 mg/L nearly 40% of the time. In contrast, 1989-2007 hourly DO values less than 5 mg/L occurred only 0.03% (11 hours) of the time, and no readings were less than 4.3 mg/L. In addition, Exelon installed aerating turbine runners in two Francis units in 2005 and 2008, providing additional measures to increase DO concentrations in Project discharges.

Information pertaining to other water quality parameters is collected above the head of tide to enable a causal relationship to be established with upstream influences (USGS 2004a). The principal water quality monitoring station for the lower Susquehanna River (USGS Gage No. 01578310) is located on the discharge boil for Unit #8 at the Project. Discrete water quality samples are collected monthly or bi-monthly under baseflow conditions and during storm events (USGS 2004a). Results of water quality measurements collected at this site are summarized in Table 3.3.2.1.2-5.

Existing Water Chemistry

Exelon conducted a water quality study (Normandeau and GSE 2012a) in 2010 to better understand water temperature, DO and other water quality parameters upstream and downstream of the Project.

Conowingo Pond

Exelon established water quality sampling locations for DO, water temperature, pH, turbidity, and fecal coliform in Conowingo Pond from April through October 2010. Figure 3.3.2.1.2-5 shows the Conowingo Pond sampling locations and transects.

Water Temperature

Conowingo Pond sampling in 2010 indicated that the Pond did not experience a classic thermal stratification (decrease of 1 °C per 1 m increase in depth) in 2010, even during the summer months when flows were lower than average. Small (<4°F or < 2.2 °C) top to bottom temperature differences were measured in Transects 2 through 4 in summer months. Surface heating of the water in these locations was limited to the top 15 ft. of the water column, and was likely an effect of the PBAPS thermal discharge. Lack of thermal stratification in Conowingo Pond is consistent with historic conditions observed over the past 30 years.

Dissolved Oxygen

DO in Conowingo Pond was generally good in the spring and fall months. However, some low DO observations (<5 mg/L) occurred during the summer months (July and August). In some instances, DO below 4.0 mg/L was observed (<4.0 mg/L). Often, the low DO readings were in the bottom of the water column, due to DO stratification. There were also, however, several low DO readings observed in un-stratified conditions, or where the entire water column contained DO below 5.0 mg/L (and 4.0 mg/L in some instances).

DO stratification began to appear in late May and was consistently evident into July (Figure 3.3.2.1.2-6 and Figure 3.3.2.1.2-7). DO stratification decreased through most of August and September. In some instances in mid-summer, DO approached hypoxic (< 2.0 mg/L) levels at depth greater than 30-35 meters, such as in station 301, 304, 404, 502 and 503. By early October, DO values had increased significantly and there was little DO stratification observed (Figure 3.3.2.1.2-8).

In more than one instance, some instantaneous DO profiles near Conowingo Dam showed DO levels less than 4.0 mg/L throughout the entire water column. This phenomenon was only observed in transect 5 (Station 501, 502 and 503) during low flow periods. In some instances (Aug 2, Aug 10) the DO was stratified in the upstream transects (Transects, 2, 3 and 4), but it appears the stratification was broken up between transect 4 and transect 5, resulting in DO below 4.0 mg/L being distributed throughout the water column in much of the Pond close to Conowingo Dam. In other instances (June 8), the DO was not stratified upstream, and it decreased closer to Conowingo Dam.

pH, Turbidity

pH and turbidity values were measured at mid-point stations in Conowingo Pond in 2010. The minimum and maximum pH values in Conowingo Pond were 7.0 and 8.9, respectively. Although variations between dates were evident, little difference occurred between locations on a given sampling date. The minimum and maximum turbidity values recorded in Conowingo Pond during the 2010 sampling period were 1.2 and 146.5 Nephelometric Turbidity Units (NTU).

Fecal Coliform

Fecal coliform values were recorded at each of the 2010 Conowingo Pond stations. Generally, fecal coliform values were low throughout Conowingo Pond during the 2010 sampling season. In the Pond, higher coliform values were recorded at two stations on May 4, and at all stations on October 5, following a period of high river flows. In total, 5 fecal coliform samples collected from Conowingo Pond in 2010 were greater than 200 per 100 ml,[23] one of which was collected during the swimming season (May through September).

Conowingo Dam Tailrace

Exelon monitored water temperature and DO using three methods in 2010. First, water quality sampling locations for DO and water temperature were established in the Conowingo tailrace from April through October 2010. Secondly, water temperature and DO were also recorded continuously at Station 643 from May 1 through October 31, 2010. Thirdly, discharge boils samples of operating turbines were collected on 20 dates between July and August, for a total of 635 samples. Figure 3.3.2.1.2-9 shows the Conowingo Pond sampling locations and transects and Station 643.

Water Temperature

Water temperatures downstream of the dam reflected historic patterns. Water temperatures increased from April through early and mid-summer to a seasonal high of about 80°F in late July, and then declined from mid-August through October. The highest water temperatures were recorded in July and August. Conowingo tailrace water temperatures closely mirrored water temperatures observed in Conowingo Pond. Temperatures showed little variation with depth, indicating waters are well-mixed downstream of the dam.

Water temperatures throughout the river were compared to those measured at Station 643. The comparison showed that Station 643 generally represented overall river temperatures well.

In July, turbine boil discharge temperatures ranged from a low of about 83 °F (28.4 °C) to a high near 90 °F (32.2 °C), with most values measured during the month between 84-86 °F (28.9-30.0 °C). Across turbines, differences in water temperature were small, generally less than 2 °F or approximately 1 °C, and overall, the discharge boils were thermally homogeneous. Differences between hourly temperature measurements within a turbine discharge boil on a given date were also small (up to 2 °F or

[23] The Pennsylvania Department of Environmental Protection (PADEP, 1999, p.16) fecal coliform standard for bathing (full body contact) is 200 and the U.S. Environmental Protection Agency (USEPA) have the same set of criteria for fecal coliform levels, on the basis of water use. For bathing (full body contact) in recreational freshwater, on the basis of a statistically sufficient number of samples (generally not less than five samples equally spaced over a 30-day period), the geometric mean of the indicated bacterial densities of fecal coliform should not exceed 200 colonies/100 ml during the swimming season (May 1 through September 30) and should not exceed 2,000 colonies/100 ml for the remainder of the year.

approximately 1 °C). In early August, turbine boil temperatures were generally higher than in July, but still very homogenous between turbines and over a sampling day. By late August, water temperatures had cooled and during the August 25-28 sampling event water temperatures were lower, in the 80-85 °F (26.7-29.5 °C) range.

Dissolved Oxygen

DO concentrations measured throughout the river were similar, indicating good mixing throughout the tailwater area. At station 643, virtually all hourly DO values were greater than 6 mg/L and no DO value less than 5 mg/L was recorded throughout 2010. Diurnal DO variations were generally within 1.3 mg/L, and may have been influenced by the operation of the unaerated Kaplan turbines on some days.

Station 643 DO values were also compared to DO levels throughout the river to determine how well Station 643 values represented overall river DO levels. Generally, Station 643 DO levels were similar to DO levels throughout the river, though some differences with Transect 6 were identified beginning in July. Beginning in July, on several days, DO concentrations measured at Station 643 were noticeably higher than those measured along Transect 6. The greatest difference was measured on July 19, when Station 643 DO was approximately 1 mg/L greater than the highest value measured at Transect 6. Later in the summer and into the fall, the DO concentrations measured at Station 643 were again similar to those measured at Transect 6, as was the case in spring and early summer.

A high percentage of the hourly turbine discharge boil DO values exceeded 5 mg/L (622 of 635 or 97.8%). The cause of the low DO (mostly between 4.4 and 4.9 mg/L; 8 in Units 8-11, 5 in Unit 6, and 1 in Unit 4) in discharge boils is unclear, although two explanations seem likely. First, some low DO values might reflect sampling that occurred during or immediately following turbine start up, resulting in the sample reflecting stagnant turbine runner and/or penstock water. Second, in the case of the larger Kaplan units (Units 8-11), which do not have aeration capability, lower DO values recorded in these discharge boils may simply be more reflective of the DO concentrations being drawn into the unit from the headpond. Because the low DO boil readings are instantaneous periodic samples, and are not part of a continuous dataset, the duration of these low DO samples cannot be reliably assessed.

In general, there was more variability in turbine boil DO averages between turbines than there was for water temperature. For example, On July 15, turbine boil DO averages ranged from a high of 7.7 mg/L (Unit 2) to a low of 4.8 mg/L (Unit 11). On other days, the DO values recorded during a given sampling day were similar for all the operating turbines. Over the course of the sampling season, some general patterns seemed apparent. First, among all the turbines the DO averages were generally higher in the discharge boils of the Francis turbines (Units 1 to 7) that have aeration capabilities, than in the discharge boils of the Kaplan turbines (Units 8 to 11) which do not have aeration. Among the smaller Francis units (Units 1-7), the average DO in the discharge boils of Units 2 and 5 was consistently slightly higher than the DO measured at Units 1, 3, 4, 6 and 7. The observed differences in DO among Francis turbines may be due to different aeration capabilities and efficiencies, as well as the prevailing hydrological-meteorological conditions. Among the larger Kaplan turbines (Units 8-11), there were no consistent patterns of differences in DO averages measured in the discharge boils on any given day. In mid-July (July 14-15), the DO average for Unit 11 tended to be lower than the DO average measured on the same day in the discharge boils of Units 8 and 9. This was again observed on August 14. However, Unit 11 was not measured frequently enough to suggest any consistent pattern.

Representativeness of Station 643 for DO Monitoring

The representativeness of Station 643 as a monitoring location was assessed by calculating differences in DO between discharge boil(s) and those recorded at Station 643 approximately 1 hour later. The one hour difference was used to account for water travel time from the powerhouse to the monitoring location[24]. The calculated differences in DO between the two locations provide the frequency and magnitude of DO differences between the two locations and a further means to assess the representativeness of the present location of Station 643 for compliance monitoring.

Figure 3.3.2.1.2-9 shows the frequency (number of hours) of DO differences between Station 643 and discharge boils in intervals of 0.5 mg/L. Negative differences shown on the chart represent observations when DO measured at Station 643 was greater than that measured in a turbine boil. Positive numbers reflect observations when DO measured at Station 643 was less than that measured in the DO boil. The greatest number of observations were made when there was less than a 0.25 mg/L observed difference between the turbine boil DO and the Station 643. Additionally, the distribution of values around zero is relatively even between observations where Station 643 over or under recorded the DO measured in the turbine boils. The average difference in DO between Station 643 and the discharge boils was -0.32 mg/L, such that Station 643 tended to read 0.32 mg/L higher than the boil DO, on average.

[24] While the 1-hour lag time may overestimate the actual lag time at higher flows, any concerns with DO readings are typically concerned with low-flow periods, not high-flow periods.

Debris Management

At present, Exelon employs three gantry cranes with grapple attachments to remove submerged debris from the intakes as well as floating surficial debris in front of the dam. In addition, Exelon acquired a new skimmer in 2011; when set-up is complete, it will also be used to remove debris in front of the dam. Debris management activities do not take place during high river flows due to safety concerns.

The varying hydraulic capacities of upstream facilities and varying contributing watershed areas to Conowingo Dam under different river flow conditions combine to influence the amount of debris that reaches Conowingo Dam such that there is no direct relationship between river flow and the quantity of debris removed.

Exelon sponsors community-based clean-ups in the pond and downstream of the dam, such as the Exelon Cleanup Day, clean-up of the Conowingo Creek launch, and the Lower Susquehanna Heritage Greenway River Sweep. Debris is hauled off-site by a commercial waste disposal company.

Debris management practices at the York Haven, Safe Harbor, and Holtwood Projects are similar to those employed at the Conowingo Project. These efforts focus on clearing trash racks that protect the intakes and generating units and clearing the forebay to maintain unrestricted flow to turbine units.

Salinity and Salt Wedge Encroachment in the Lower Susquehanna River

Exelon conducted a study to analyze Project impacts on salinity levels downstream of Conowingo Dam (Gomez and Sullivan 2011t). Salinity levels in the lower Susquehanna rise during periods of low flow and high tidal elevations. Observed salinity values were compared to Conowingo and Marietta streamflow, tidal elevation, and wind speed and direction data to determine what most influenced salinity levels and whether Conowingo Dam operations impact downstream salinity levels.

Salinity levels linearly correlated best with 30 to 60-day average Conowingo USGS gage flows. In addition, tidal influences were evident during higher salinity periods. Wind speed and direction did not appear to impact salinity levels. A least-squares regression found that 30-day average flows best predicted 15-min salinity levels (R^2 = 0.758). Streamflow comparisons showed that Conowingo Dam operations only slightly impacted flows on a daily average time step and minimally influenced weekly and longer flows up to 30 days.

There appears to be unique phenomenon influencing salinity levels during the high salinity periods. While overall comparisons showed that long-term river flows generally correlate well with salinity observations, a comparison of 2007 and 2008 salinity observations versus river flow during high salinity periods shows that salinity levels vary somewhat independently of long-term and instantaneous flows at the Marietta and Conowingo USGS gages. During high salinity events, tidal influences clearly influenced salinity levels, which contradicts what the composite data analysis showed. The apparent change in controlling phenomena during high salinity events is likely due to the Chesapeake Bay salt wedge encroaching on the monitoring station. During extended low flow periods, the salt wedge travels progressively farther upstream over time. Conversely, the salt wedge is pushed downstream during higher flow periods. Additionally, the salt wedge is pushed upstream and downstream in the river as the tide rises and falls. Once the salt wedge reaches the monitoring station, salinity levels vary rapidly, explaining why tidal influences only appear to be important during high salinity periods.

3.3.2.2 Environmental Effects

3.3.2.2.1 *Water Quantity*

The following subsections address the expected water quantity effects of Exelon's proposed operations.

Hydrology and Streamflow

Conowingo Project peaking operations, under Exelon's proposed action, would continue to alter flow on an intra-daily timeframe in the approximately 4 mile non-tidal reach below Conowingo Dam.

Sub-daily comparisons between the Marietta and Conowingo USGS gages show a noticeable difference in flow distribution (Figure 3.3.2.1.1-3). Since no USGS flow gages exist between the Marietta and Conowingo USGS gages, it is not possible to directly assess Conowingo's specific influence on Susquehanna River flows relative to the upstream hydroelectric projects. That is, differences between the Marietta and Conowingo USGS gages are due to the cumulative effects of all four hydroelectric projects, since Conowingo's operations depend greatly on water availability. Thus, while the Project's peaking operations do alter the flows in the Susquehanna River downstream of Conowingo Dam, the magnitude of the Project's overall hydrologic impacts (relative to the other upstream peaking hydroelectric projects) is not fully quantifiable based on the streamflow gage information.

Effects of Project Operations on Flooding

Under the proposed action, the Conowingo Project would have a little or no impact on downstream flooding. The limited storage available in Conowingo Pond (2.0 hours at 250,000 cfs) indicates that the dam cannot substantially change flooding durations that are days long and that managing the pond to do so would be ineffective. The pond's actively used storage is small relative to the flows experienced in the river. The three alternatives investigated in Exelon's study represented a wide range of operational changes that could be made to Conowingo Dam, but it appears that none of the investigated operational alternatives would substantially reduce flooding in Port Deposit if implemented.

Effects on DO stratification in Conowingo Pond

Under Exelon's proposed action, during low flow periods (<15,000 cfs), the waters in Conowingo Pond may stratify and result in a vertically-varying DO profile in deeper parts of the pond. When flows are <10,000 cfs, the stratification can occasionally result in certain parts of the Pond experiencing or approaching hypoxic conditions (DO < 2 mg/L). The stratification impacts are expected to be short-term and moderate, occurring during periods of low flow (< 15,000 cfs). Conowingo daily average flows exceed 15,000 cfs 42.4% of the time during the July-October period.

The occasionally low DO water in Conowingo Pond is not expected to impact waters downstream of the dam, as the combination of turbine venting and use of aerated runners in two turbines have proven effective at raising downstream DO levels.

State Water Quality Standards

In Pennsylvania, water quality standards for Conowingo Project waters are established by the Bureau of Water Standards and Facility Regulation, Water Quality Standards Division, of the PADEP. The water quality standards applicable to the Project are contained in the 2010 Pennsylvania Integrated Water Quality Monitoring and Assessment Report (WQMAR). Under Exelon's proposed action, it is anticipated that the Project will continue to meet current Maryland water quality standards. The 2010 water quality study (Normandeau and GSE 2012a) demonstrated that:

- The operation of the Conowingo Project has no effect on the distribution of temperature and DO conditions in Conowingo Pond;
- Water temperature in the Conowingo Project discharge is similar to pond water temperatures and is unaffected by Project operations;
- DO and temperature measured at Station 643 are very similar to the DO and temperature conditions measured in the turbine discharge boils and along the downstream transects. Thus,

Station 643, is a good, representative location for monitoring compliance with state standards; and

- State DO standards in the Conowingo tailrace were met or exceeded 100% of the time during the period May 1 through October 31, 2010 as measured at Station 643.

Effects on the Suspension of Toxic Compounds and Algae Growth

Under Exelon's proposed action, effects on DO in Conowingo Pond and below the dam will not create conditions leading to algal blooms. Additionally, Conowingo Project peaking operations, under Exelon's proposed action, will not affect any potentially toxic compounds in suspension from upstream sources nor cause the resuspension of any compounds present in surficial bottom sediment also delivered from the upstream watershed.

Salinity and Salt Wedge Encroachment in the Lower Susquehanna River

Under Exelon's proposed action, Project impacts on the encroachment of the saline water in the tidal portion of the Susquehanna River are expected to be low. Exelon's environmental analysis (Gomez and Sullivan 2011t) indicates that the Conowingo Project does not influence salinity levels in the lower Susquehanna River. Elevated salinity appears to be related to prolonged drought and low river flow conditions.

3.3.2.3 Cumulative Effects

CEQ regulations define 'cumulative effects' as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR §1508.7).

For this analysis, the action is the relicensing and continued operation of the Conowingo Project. The cumulatively affected resource is the Lower Susquehanna River Basin and the Chesapeake Bay. The geographic scope of this analysis is defined by the scope of EPA's Bay TMDL, which covers a 64,000-square-mile area across seven jurisdictions. The temporal scope of this analysis includes a discussion of the past, present, and reasonably foreseeable future actions, and their effects on the resource 50 years into the future.

The potential impact of the Project is associated with whether the continued operation of the Conowingo Project affects water quantity and quality of the Lower Susquehanna River, which had already been altered by construction of the Holtwood Dam (built 1910) when the Project was initially constructed in 1928.

3.3.2.3.1 *Water Availability in Conowingo Pond*

The cumulative impact of the Project on the affected resource occurs within the context of the presence of a series of hydroelectric facilities that directly control the hydrologic regime of the Susquehanna River. Operational capacity will not be added and physical modification will not be made under the proposed action. The Project contributes to the alteration of the lower Susquehanna River's hydrology, particularly in terms of water levels and flow regime. The Project directly influences Conowingo Pond water levels and streamflow in the approximately 4 mile non-tidal reach below Conowingo Dam. However, other than evaporative losses, which are small compared to other consumptive uses on the Pond (drinking water, industrial cooling water, etc.), the Conowingo Project does not result in any net water loss to the Susquehanna River Basin. While flow releases (generation and spill) reduce the water available to Conowingo Pond, flows do not leave or bypass any portion of the Susquehanna River. Under drought conditions, Conowingo Pond and Conowingo Dam releases are carefully monitored to maintain pond levels so that all water needs are adequately met. It is difficult to quantify specific Project impacts, because Conowingo Pond's inflows are highly regulated by the upstream lower Susquehanna River hydroelectric projects (Safe Harbor and Holtwood). While Conowingo's license permits water levels to range between 101.2 ft and 110.2 ft, in practice Exelon maintains water levels high enough to accommodate Muddy Run Project and PBAPS withdrawals. Since the Project effectively does not draw water levels below 105.2 ft, it is not expected to have any adverse effects on other Conowingo Pond water withdrawals for public water supply or cooling water purposes.

The Project does not directly alter the water quantity of the Lower Susquehanna River on a long-term basis and, therefore, does not impact water quantities within the Chesapeake Bay. The Proposed Actions of the Project, in combination with other activities within the watershed, will not alter this condition for the reasonably foreseeable future.

3.3.2.3.2 *Water Quality*

The cumulative impact of the Project on the affected resource occurs within the context of the presence of a series of hydroelectric facilities that have the potential to collectively affect the water quality of the Susquehanna River. Operational capacity will not be added and physical modifications will not be made under the proposed action. The Project does not appear to have appreciable impacts on several water quality parameters, such as dissolved oxygen, water temperature, pH and specific conductivity, as levels in the tailrace meet applicable state water quality standards. The Project does not result in local impacts to the water quality of the Lower Susquehanna River and, therefore, does not impact the Susquehanna River Basin downstream of the Project or the Chesapeake Bay. The Proposed Actions of the Project, in combination with other activities within the watershed, will not alter this condition for the reasonably foreseeable future.

3.3.2.4 Proposed Environmental Measures

Exelon's environmental analysis indicates that Project operations alter streamflow on an intra-daily basis. Exelon is not proposing any flow-related environmental measures at this time.

In addition, Exelon's environmental analysis indicated that Project impacts related to 1) water withdrawals from Conowingo Pond, 2) downstream flooding, 3) DO stratification in Conowingo Pond, 4) maintenance of state water quality standards, and 5) suspension of toxic compounds and algae growth are minor; therefore Exelon is not proposing any environmental measures at this time.

3.3.2.5 Unavoidable Adverse Impacts

Conowingo Project peaking operations, under Exelon's proposed action, would continue to alter flow on an intra-daily timeframe in the approximately 4 mile non-tidal reach below Dam.

TABLE 3.3.2.1.1-1: CONOWINGO AND MARIETTA MEAN AND MEDIAN FLOW BY MONTH, COMPUTED FROM DAILY AVERAGE FLOW RECORDS (WY 1968-2009)

Month	Average		Median	
	Marietta Flow (cfs)	Conowingo Flow (cfs)	Marietta Flow (cfs)	Conowingo Flow (cfs)
January	43,253	45,340	27,000	30,250
February	48,958	50,783	32,200	36,800
March	73,258	73,846	56,200	58,900
April	76,024	76,957	60,700	61,800
May	46,122	47,092	37,000	39,400
June	33,310	34,894	22,450	24,500
July	19,022	20,001	13,900	15,700
August	14,015	14,917	9,570	10,650
September	17,669	19,109	8,655	10,400
October	22,479	23,755	11,200	13,800
November	34,512	36,037	26,250	28,700
December	48,522	50,533	37,000	40,300
Annual	39,686	41,026	25,700	27,800

TABLE 3.3.2.1.1-2: CONOWINGO ANNUAL AND MONTHLY DAILY AVERAGE FLOW EXCEEDANCE PERCENTILES, IN CFS (WY 1968-2009)

Exceedance Percentile	Annual	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	1,120,000	622,000	470,000	462,000	467,000	235,000	1,120,000	213,000	202,000	662,000	245,000	272,000	357,000
5	121,000	131,000	139,000	184,000	188,050	104,000	80,645	50,575	41,300	56,480	84,690	90,320	129,950
10	85,400	93,980	98,500	139,000	144,000	81,100	59,000	37,500	28,280	35,240	57,170	70,410	98,350
15	70,600	76,140	81,420	119,000	116,150	70,685	49,015	31,985	24,100	26,315	42,285	60,215	80,000
20	60,300	62,160	70,860	102,000	102,200	64,000	42,240	28,080	20,600	22,120	32,480	53,600	71,380
25	52,600	53,775	60,500	88,600	89,175	58,700	37,725	25,500	18,400	19,325	26,825	46,800	64,050
30	46,100	47,800	54,240	81,400	82,700	53,400	33,900	23,170	16,300	17,100	22,700	42,500	57,200
35	40,700	42,800	48,890	73,500	76,870	49,300	31,400	20,665	14,900	14,900	20,265	39,035	52,630
40	35,700	38,060	44,800	68,360	70,900	45,760	28,900	18,900	13,300	13,100	17,460	35,200	47,820
45	31,600	33,955	41,060	63,155	66,545	43,000	26,800	17,355	12,000	11,900	15,355	31,700	43,900
50	27,800	30,250	36,800	58,900	61,800	39,400	24,500	15,700	10,650	10,400	13,800	28,700	40,300
55	24,800	27,600	33,500	54,100	57,700	36,245	22,555	14,400	9,489	8,861	12,100	26,000	36,900
60	21,700	25,040	30,840	50,440	53,900	33,200	20,300	13,100	8,380	7,410	10,900	23,460	33,880
65	19,000	22,635	27,900	46,335	50,500	30,700	18,600	11,800	6,837	6,393	9,690	20,200	31,235
70	16,200	20,800	25,680	42,130	45,470	28,030	17,170	10,400	6,143	5,337	8,320	17,700	28,330
75	13,700	18,700	23,050	38,025	42,000	26,200	15,400	8,373	5,663	4,953	6,890	14,775	25,800
80	11,200	16,240	20,700	34,100	38,200	23,520	13,580	6,946	5,290	4,368	4,912	12,400	22,040
85	8,270	13,200	18,490	30,300	34,500	21,100	11,385	6,152	5,002	3,799	4,460	9,459	18,815
90	5,840	10,210	15,500	24,410	29,690	18,100	8,658	5,421	4,490	3,037	3,750	5,807	13,610
95	4,300	5,465	10,790	18,415	24,485	14,005	6,179	4,527	2,702	1,420	1,212	3,838	7,831
100	269	511	758	287	6,090	5,220	622	269	367	363	295	303	777

TABLE 3.3.2.1.1-3: MARIETTA ANNUAL AND MONTHLY DAILY AVERAGE FLOW EXCEEDANCE PERCENTILES, IN CFS (WY 1968-2009).

Exceedance Percentile	Annual	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	1,040,000	556,000	446,000	444,000	431,000	223,000	1,040,000	223,000	199,000	545,000	246,000	265,000	348,000
5	123,000	130,000	139,700	185,900	182,000	109,000	76,930	48,390	38,775	56,770	81,990	91,615	125,950
10	86,500	93,990	103,000	140,000	146,100	80,980	55,110	35,080	26,000	32,010	51,460	68,450	96,000
15	68,400	72,055	80,730	120,000	120,000	67,985	46,415	29,700	20,385	23,100	37,485	57,575	77,670
20	58,000	59,800	66,680	105,000	104,000	62,480	39,900	25,800	17,600	18,600	29,180	49,120	68,900
25	49,300	50,675	58,100	92,475	92,700	56,300	35,700	22,700	16,075	16,100	23,250	42,450	60,075
30	42,800	43,370	50,520	81,240	83,590	51,870	31,930	20,300	14,600	13,830	20,100	38,000	53,400
35	37,400	38,500	45,280	72,665	76,170	47,100	29,535	18,600	12,965	12,200	17,000	34,435	49,400
40	33,000	35,000	40,560	67,100	70,040	43,360	26,900	16,760	11,500	10,900	14,900	32,000	44,360
45	29,100	30,855	36,030	61,500	65,100	40,255	24,390	15,000	10,400	9,489	12,800	28,745	40,800
50	25,700	27,000	32,200	56,200	60,700	37,000	22,450	13,900	9,570	8,655	11,200	26,250	37,000
55	22,600	24,300	30,000	50,645	56,055	34,000	20,255	12,745	8,809	7,960	10,245	24,100	34,200
60	19,800	21,840	27,700	46,700	51,420	32,000	18,760	11,800	8,062	7,426	9,310	21,360	31,100
65	17,300	19,900	26,000	43,200	47,100	29,270	17,600	10,900	7,520	6,900	8,574	18,800	28,235
70	15,000	18,000	23,800	39,830	43,300	26,800	16,100	9,986	6,989	6,277	7,913	16,270	25,400
75	12,700	16,600	21,600	36,300	39,500	24,825	14,400	9,273	6,493	5,790	7,090	13,600	22,800
80	10,700	15,420	19,000	31,800	35,980	22,420	13,100	8,446	5,892	5,390	6,514	11,400	20,600
85	8,720	13,800	17,000	27,900	33,000	20,900	12,100	7,618	5,530	4,870	5,940	9,434	18,600
90	7,050	12,110	15,000	24,210	28,370	18,600	11,000	6,721	5,091	4,429	5,360	7,935	16,110
95	5,530	9,600	12,030	17,805	23,500	15,205	8,577	5,401	4,361	3,800	4,453	5,809	10,400
100	2,150	4,200	6,600	9,000	17,500	11,500	4,830	3,710	2,630	2,150	3,570	4,490	5,110

TABLE 3.3.2.1.1-4: CONOWINGO ANNUAL AND MONTHLY SUB-DAILY (30-MINUTE) FLOW EXCEEDANCE PERCENTILES, IN CFS (WY 1989-1990, 1992-1993, 1995-2009)

Exceedance Percentile	Annual	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	909,000	909,000	264,000	416,000	500,000	278,000	459,000	235,000	179,000	446,000	233,000	302,000	295,000
5	122,000	176,000	126,000	173,000	189,000	123,000	86,400	70,230	59,100	74,500	81,100	95,900	138,000
10	85,600	133,000	89,200	132,000	128,000	87,200	72,500	57,800	45,100	58,100	68,100	80,700	97,800
15	79,000	99,000	81,600	106,000	104,000	81,700	65,000	47,745	32,400	45,900	52,000	74,900	82,700
20	73,000	84,000	78,100	87,500	88,200	76,200	58,000	38,200	22,800	32,900	41,100	67,200	79,800
25	67,000	80,200	74,900	82,900	83,800	69,100	50,600	30,400	11,600	23,600	32,800	60,500	75,500
30	60,800	77,700	71,600	79,320	80,700	65,500	42,700	22,200	6,820	10,500	25,900	53,000	70,400
35	51,200	73,000	68,300	76,300	77,700	60,500	36,600	10,800	6,550	6,450	21,900	44,700	66,300
40	41,400	68,300	64,300	73,500	74,400	54,400	29,900	7,460	6,400	6,070	11,600	36,500	61,200
45	33,000	62,500	59,500	71,100	71,800	46,500	23,900	6,800	6,250	5,790	5,930	30,700	52,800
50	25,200	56,300	48,300	68,600	69,400	39,400	17,600	6,550	6,070	5,340	4,910	24,100	43,900
55	17,100	45,900	38,600	64,700	65,900	34,200	8,850	6,350	5,930	4,950	4,680	13,600	34,400
60	9,650	34,800	30,200	59,100	62,500	27,100	7,280	6,220	5,790	4,630	4,590	6,250	26,600
65	6,800	26,400	23,300	48,000	55,000	23,200	6,650	6,060	5,690	4,410	4,510	5,010	19,500
70	6,150	17,600	13,200	38,400	44,680	12,800	6,300	5,880	5,500	4,280	4,420	4,680	7,780
75	5,690	6,750	6,550	29,800	33,700	10,400	6,070	5,790	5,390	4,040	4,320	4,540	4,500
80	5,100	4,410	4,410	23,000	24,900	9,640	5,920	5,650	5,190	3,800	4,210	4,450	3,510
85	4,550	1,870	1,710	7,250	13,700	9,320	5,830	5,550	4,950	3,650	3,840	4,280	1,450
90	4,120	1,160	1,140	5,100	12,500	9,110	5,650	5,290	4,680	3,470	3,730	3,960	1,020
95	3,280	959	950	4,460	11,900	8,800	5,390	4,950	3,760	3,050	3,620	3,620	879
100	257	297	261	1,380	10,000	6,200	4,410	3,070	2,200	1,700	959	756	257

TABLE 3.3.2.1.1-5: MARIETTA ANNUAL AND MONTHLY SUB-DAILY (30-MINUTE) FLOW EXCEEDANCE PERCENTILES, IN CFS (WY 1989-1990, 1992-1993, 1995-2009)

Exceedance Percentile	Annual	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	588,000	588,000	244,000	352,000	448,000	230,000	421,000	249,000	126,000	390,000	198,000	277,000	272,000
5	119,000	176,000	121,000	172,000	179,000	129,000	84,500	48,000	44,900	73,600	65,800	89,600	127,000
10	85,800	122,800	98,100	134,000	131,000	82,500	55,100	37,200	26,400	41,900	42,900	68,300	90,800
15	69,000	98,900	77,200	110,000	107,000	68,700	46,408	31,300	21,700	28,700	33,800	56,600	76,700
20	58,800	85,200	65,500	94,300	95,200	63,100	39,700	28,400	18,939	22,500	28,600	50,300	67,000
25	51,000	72,300	58,800	83,000	85,800	56,900	36,300	25,000	16,700	18,300	25,200	42,400	57,826
30	44,300	63,100	53,500	74,600	77,200	52,900	32,800	21,800	14,400	15,700	22,400	38,200	52,500
35	38,800	57,000	49,200	68,900	71,600	48,100	30,100	19,200	12,300	13,400	20,100	35,400	47,300
40	34,200	50,500	45,000	63,900	67,100	43,600	28,300	17,200	11,100	11,600	17,900	32,500	42,100
45	30,200	44,700	41,200	58,700	62,800	40,100	25,000	14,900	9,630	9,895	15,256	29,000	37,800
50	27,000	40,600	37,700	52,300	58,500	35,801	22,400	13,400	8,680	8,380	12,800	26,300	34,500
55	24,000	36,600	32,900	47,400	54,700	33,400	20,000	12,000	7,960	7,320	10,649	24,360	30,700
60	21,100	31,500	29,900	44,700	50,500	30,800	18,300	11,100	7,340	6,620	9,290	21,500	28,200
65	18,200	27,500	27,600	41,081	46,800	27,900	16,600	10,300	6,560	6,040	8,243	17,700	25,700
70	15,600	23,600	25,900	37,800	43,600	25,690	14,900	9,440	6,040	5,590	7,370	14,100	23,600
75	12,900	21,300	24,100	34,900	39,500	23,700	13,600	8,750	5,630	5,190	6,823	11,000	21,300
80	10,500	19,600	21,200	31,700	35,700	21,800	12,700	7,740	5,350	4,820	6,307	9,330	19,000
85	8,130	17,633	18,400	28,800	32,448	19,300	11,900	7,010	5,000	4,400	5,960	7,810	16,800
90	6,270	15,900	16,691	25,400	27,900	16,700	10,900	6,130	4,400	3,890	5,330	5,920	14,200
95	5,180	13,900	14,700	23,200	23,400	14,600	8,150	5,270	3,530	3,010	4,500	5,350	8,130
100	2,130	7,920	8,930	15,100	17,900	10,900	4,580	3,470	2,600	2,130	3,070	4,220	4,700

TABLE 3.3.2.1.1-6: SUMMARY OF NPDES DISCHARGES ALONG THE CONOWINGO POND SEGMENT OF THE SUSQUEHANNA RIVER.

NPDES ID	Facility Name	Average Design Flow (MGD)	Receiving Waters	Location
PA0009741	Muddy Run Pumped Storage Project	2.64	Susquehanna River	Drumore, PA
PA0246948	Donald Eckman	--	Watershed 7-K	Peach Bottom, PA
PA0088889	Graywood Farms, LLC	--	Watershed 7-K	Peach Bottom, PA
PA0247031	Red Knob Farm	--	Watershed 7-K	Peach Bottom, PA
PA0246417	State Line Sales Inc.	--	Conowingo Creek	Peach Bottom, PA
PA0085332	Delta Borough WWTP	0.24	Scott Creek	Delta, PA
PA0009733	Peach Bottom Atomic Power Station	0.048	Susquehanna River	Delta, PA
PA0081833	Peach Bottom Inn	0.013	Scott Creek	Delta, PA
MD0053139	Camp Shadowbrook WWTP	0.004	Susquehanna River	Conowingo, MD
MDG766829	Indian Lake Christian Service Camp	--	Susquehanna River	Darlington, MD
MD0002518	Conowingo Hydroelectric Station	47.74	Susquehanna River	Darlington, MD

Source: USEPA 2006.

TABLE 3.3.2.1.2-1: SUMMARY OF PENNSYLVANIA PROTECTED WATER USE CATEGORIES

Protected Use	Description
Aquatic Life	
CWF	*Cold Water Fishes* – Maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat.
WWF	*Warm Water Fishes* – Maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.
MF	*Migratory Fishes* – Passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which ascend to flowing waters to complete their life cycle.
TSF	*Trout Stocking* – Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.
Water Supply	
PWS	*Potable Water Supply* – Used by the public as defined by the Federal Safe Drinking Water Act, 42 U.S.C.A. § 300F, or by other water users that require a permit from the Department under the Pennsylvania Safe Drinking Water Act (35 P. S. § § 721.1-721.18), or the act of June 24, 1939 (P. L. 842, No. 365) (32 P. S. § § 631-641), after conventional treatment, for drinking, culinary and other domestic purposes, such as inclusion into foods, either directly or indirectly.
IWS	*Industrial Water Supply* – Use by industry for inclusion into non-food products, processing and cooling.
LWS	*Livestock Water Supply* – Use by livestock and poultry for drinking and cleansing.
AWS	*Wildlife Water Supply* – Use for waterfowl habitat and for drinking and cleansing by wildlife.
IRS	*Irrigation* – Used to supplement precipitation for growing crops.
Recreation and Fish Consumption	
B	*Boating* – Use of the water for power boating, sail boating, canoeing and rowing for recreational purposes when surface water flow or impoundment conditions allow.
F	*Fishing* – Use of the water for the legal taking of fish. For recreation or consumption.
WC	*Water Contact Sports* – Use of the water for swimming and related activities.
E	*Esthetics* – Use of the water as an esthetic setting to recreational pursuits.
Special Protection	
HQ	High Quality Waters
EV	Exceptional Value Waters
Other	
N	*Navigation* – Use of the water for the commercial transfer and transport of persons, animals and goods.

TABLE 3.3.2.1.2-2: PENNSYLVANIA'S MAXIMUM WATER TEMPERATURE CRITERIA SPECIFIED FOR WARM WATER FISHERIES

Critical Use Period	Maximum Temperature Criteria (°F)
January 1-31	40
February 1-29	40
March 1-31	46
April 1-15	52
April 16-30	58
May 1-15	64
May 16-31	72
June 1-15	80
June 16-30	84
July 1-31	87
August 1-15	87
August 16-30	87
September 1-15	84
September 16-30	78
October 1-15	72
October 16-31	66
November 1-15	58
November 16-30	50
December 1-31	42

TABLE 3.3.2.1.2-3: SUMMARY OF MARYLAND'S DESIGNATED USE CATEGORIES

Designated Use	Description
Use I	Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life
Use I-P	Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply
Use II	Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting Shellfish Harvesting Subcategory Seasonal Migratory Fish Spawning and Nursery Subcategory (Chesapeake Bay only) Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory (Chesapeake Bay only) Open-Water Fish and Shellfish Subcategory (Chesapeake Bay only) Seasonal Deep-Water Fish and Shellfish Subcategory (Chesapeake Bay only) Seasonal Deep-Channel Refuge Use (Chesapeake Bay only)
Use II-P	Tidal Fresh Water Estuary – includes applicable Use II and Public Water Supply
Use III	Nontidal Cold Water
Use III-P	Nontidal Cold Water and Public Water Supply
Use IV	Recreational Trout Waters
Use IV-P	Recreational Trout Waters and Public Water Supply

TABLE 3.3.2.1.2-4: COMPARISON OF HOURLY CONOWINGO TAILRACE (STATION 643) DO MEASUREMENTS

Year	< 3.0 mg/l		3.0-3.9 mg/l		4.0-4.9 mg/l		> 5.0 mg/l		Total	River Flow (cfs)
	N	%	N	%	N	%	N	%	N	(Jul-Sep)
Francis Turbines Not Vented										
1982	73	2.7	339	12.7	616	23.1	1,635	61.4	2,663	11,600
1983	246	9.0	389	14.2	458	16.8	1,638	60.0	2,731	9,477
1984	0	0.0	0	0.0	42	1.8	2,327	98.2	2,369	24,557
1985	47	1.8	354	13.4	301	22.8	1,632	62.0	2,634	9,027
1986	0	0.0	18	0.6	235	8.4	2,555	91.0	2,808	14,527
1987	17	0.6	165	6.1	547	20.3	1,961	72.9	2,690	18,690
1988	2	0.1	2	0.1	103	3.6	2,772	96.3	2,879	9,937
1982-1988	**385**	**1.9**	**1267**	**6.7**	**2302**	**12.3**	**14,520**	**77.3**	**18,774**	
Some or All Francis Turbines Vented										
1989	0	-	0	-	0	-	2,873	100.0	2,873	22,013
1990	0	-	0	-	0	-	2,890	100.0	2,890	21,457
1991	0	-	0	-	10	0.3	2,848	99.65	2,858	5,323
1992	0	-	0	-	0	-	2,900	100.0	2,900	21,070
1993		DO Compliance Data Not Readily Available								7,757
1994		DO Compliance Data Not Readily Available								30,363
1995		DO Compliance Data Not Readily Available								8,333
1996		DO Compliance Data Not Readily Available								27,373
1997	0	-	0	-	0	-	2,928	100.0	2,928	8,100
1998		DO Compliance Data Not Readily Available								11,347
1999		DO Compliance Data Not Readily Available								10,007
2000	0	-	0	-	0	-	2,916	100.0	2,916	13,243
2001	0	-	0	-	1	0.03	2,924	99.97	2,925	7,633
2002	0	-	0	-	0		2,928	100.0	2,928	6,454
2003	0	-	0	-	0	-	2,925	100.0	2,925	39,679
2004*	0	-	0	-	0	-	596	100.0	596	64,561
2005	**Data for 1 Jun-13 Jul Not Readily Available**					**-**	**1,884**	**100.0**	**1,884**	7,771
2006	0	-	0	-	0	-	2,928	100.0	2,928	34,192
2007	0	-	0	-	0	-	2,928	100.0	2,928	7,098
1989-2007	**0**		**0**		**11**	**0.03**	**34,468**	**99.97**	**34,479**	

N=The Number Of Hourly Measurements
*DO was monitored hourly through 16 June. Thereafter and per MDNR approval, DO in the discharge boil of all operating turbines was monitored twice daily (AM and PM) due to Colonial Pipeline's construction activities to repair a damaged line in the tailrace.

TABLE 3.3.2.1.2-5: SELECT WATER QUALITY PARAMETERS COLLECTED BY USGS FOR THE SUSQUEHANNA RIVER AT THE CONOWINGO DAM, JANUARY 1978-JUNE 2000

Parameter	Units	N *	Min	Mean	Max	Median	Std Dev
Water Temperature	^{O}C	701	0.0	13.4	31.0	11.6	8.7
Water Temperature	^{O}F	701	32.0	56.2	87.8	52.9	15.7
Instantaneous Discharge	cfs	913	844	110,399	623,000	78,100	99,650
Turbidity	NTU	171	0	13	410	4	38
Specific Conductivity	uS/cm @ 25C	784	110	218	420	209	70
Dissolved Oxygen	mg/LL	609	1.4	10.4	17.8	11.4	3.5
DO Saturation	%	453	18	95	143	101	19
pH-Field	su	697	6.0	7.5	8.8	7.5	.4
Alkalinity, dissolved	mg/L CaCO3	541	8	40	82	38	14
Bicarbonate, dissolved	mg/L HCO3	175	15	48	101	44	19
Total Residue	mg/L	185	61	142	254	135	47
Total Dissolved Solids	mg/L	291	53	120	246	110	45
TDS Loading	tons/day	292	490	29,332	99,500	22,900	21,259
Total Suspended Solids	mg/L	786	1	45	1200	18	88
TSS Loading	tons/day	782	12	32,230	2,020,000	3,790	122,540
Total Nitrogen	mg/L N	751	0.4	1.8	6.6	1.7	0.5
Dissolved Nitrogen	mg/L N	604	0.8	1.7	5.7	1.6	0.5
Nitrate Nitrogen	mg/L N	512	0.33	1.23	4.73	1.19	0.42
Total Nitrite + Nitrate	mg/L N	749	0	1	5	1	0
Total Phosphorus	mg/L P	764	0.010	0.072	1.500	0.050	0.077
Dissolved Phosphorus	mg/L P	725	0.000	0.021	0.158	0.018	0.016
Ortho Phosphorus	mg/L P	638	0.000	0.012	0.137	0.008	0.013
Total Organic Carbon	mg/L C	716	1.1	3.8	26.0	3.3	2.1
Dissolved Organic Carbon	mg/L C	105	1.0	3.1	16.0	2.7	1.9
Total Hardness	mg/L CaCO3	305	30	80	160	74	32

Parameter	Units	N *	Min	Mean	Max	Median	Std Dev
Noncarbonate Hardness	mg/L CaCO3	116	13	44	94	41	18
Calcium, dissolved	mg/L Ca	305	9	22	42	20	8
Magnesium, dissolved	mg/L Mg	305	0.7	6.2	14.0	5.6	2.9
Sodium, dissolved	mg/L Na	305	2.9	8.2	29.0	7.3	4.2
Potassium, dissolved	mg/L K	308	0.4	1.9	23.0	1.6	1.3
Choloride, dissolved	mg/L CL	308	3	13	32	11	6
Sulfate, dissolved	mg/L SO4	307	13	37	98	32	17
Fluoride, dissolved	mg/L F	159	<0.1	0.1	0.6	0.1	0.1
Silica, reactive	mg/L SiO2	582	<0.1	3.7	13.0	4.1	1.6
Aluminum, total	ug/l Al	127	80	1,088	1,200	600	1,692
Aluminum, dissolved	ug/l Al	457	<1	62	600	30	77
Arsenic, dissolved	ug/l As	35	<1	1	2	1	1
Arsenic, total	ug/l As	42	<1	1	6	1	1
Barium, total	ug/l Ba	14	<1	93	100	100	27
Cadmium, total	ug/l Cd	49	<1	1	20	0	3
Chromium, total	ug/l Cr	122	<1	6	30	3	6
Cobalt, total	ug/l Co	14	<1	1	6	1	2
Copper, total	ug/l Cu	157	<1	4	23	4	3
Iron, total	ug/l Fe	191	20	1,895	1,500	920	2,341
Iron, dissolved	ug/l Fe	262	<1	71	810	50	95
Lead, total	ug/l Pb	152	<1	18	1,800	3	146
Manganese, total	ug/l Mn	149	25	274	4,700	180	412
Manganese, dissolved	ug/l Mn	228	<1	124	670	100	117
Mercury, dissolved	ug/l Hg	18	<0.10	0.19	0.50	0.20	0.11
Nickel, total	ug/l Ni	147	2	8	49	7	7
Silver, total	ug/l Ag	31	<1	<1	7	<1	1
Selenium, total	ug/l Se	9	<1	<1	1	<1	<1

*N = number of samples

FIGURE 3.3.2.1.1-1: CONOWINGO AND MARIETTA DAILY AVERAGE FLOW EXCEEDANCE CURVES (WY 1968-2009)

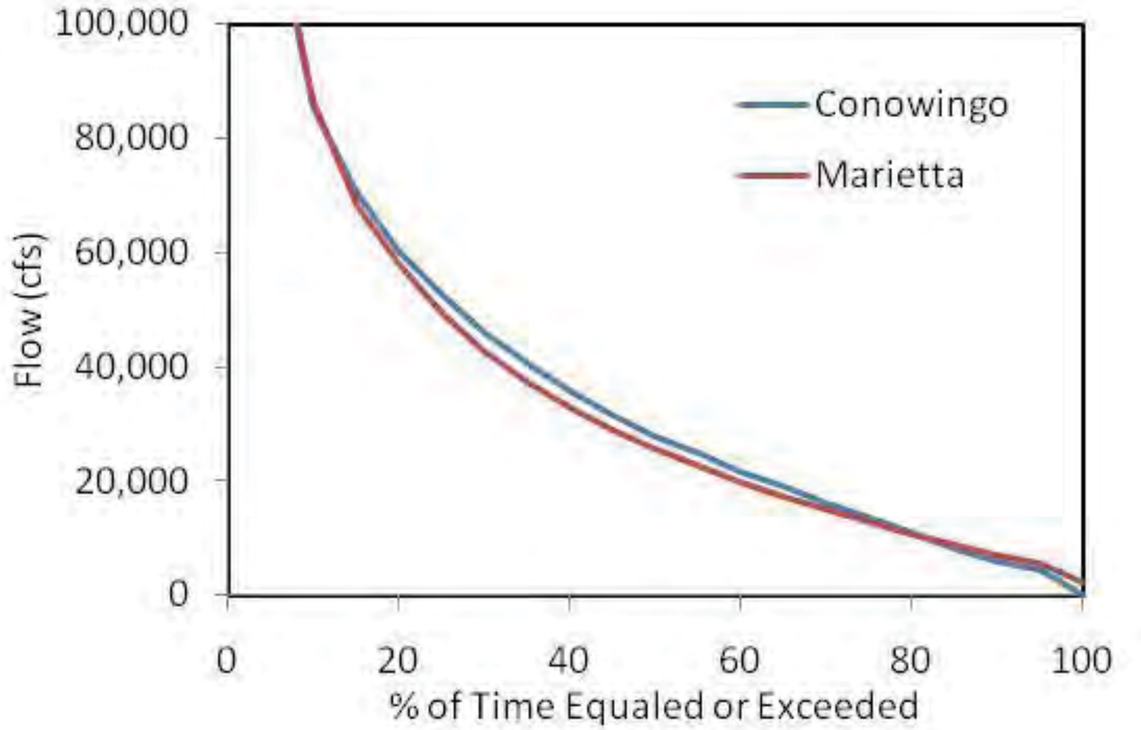


FIGURE 3.3.2.1.1-2: COMPARISON OF MARIETTA AND CONOWINGO 30-MINUTE AND DAILY AVERAGE FLOW DATA

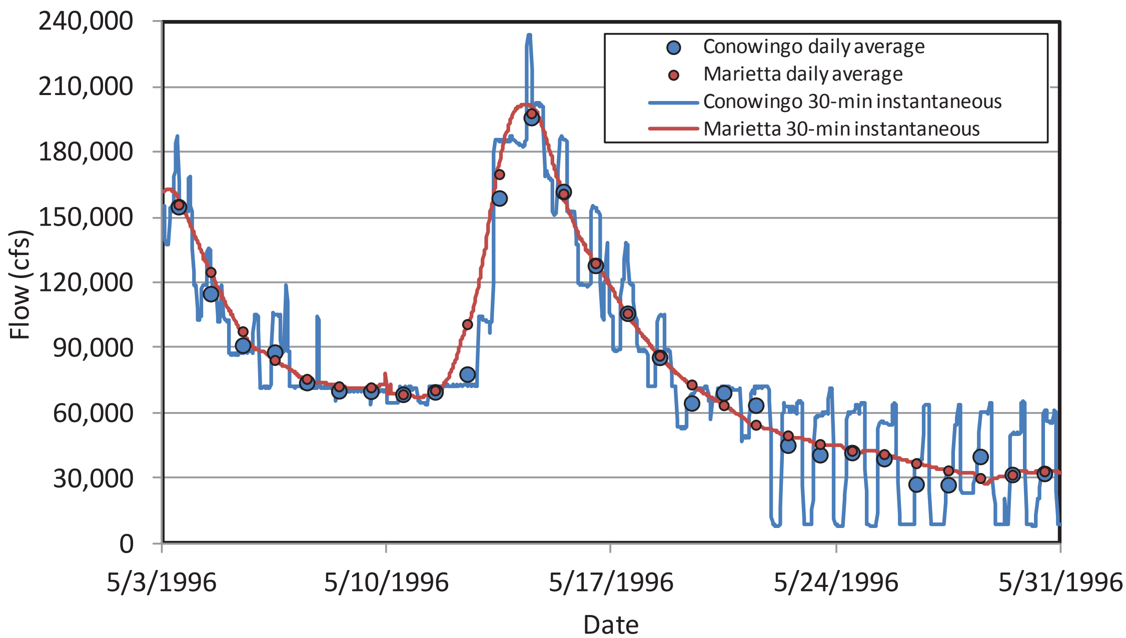
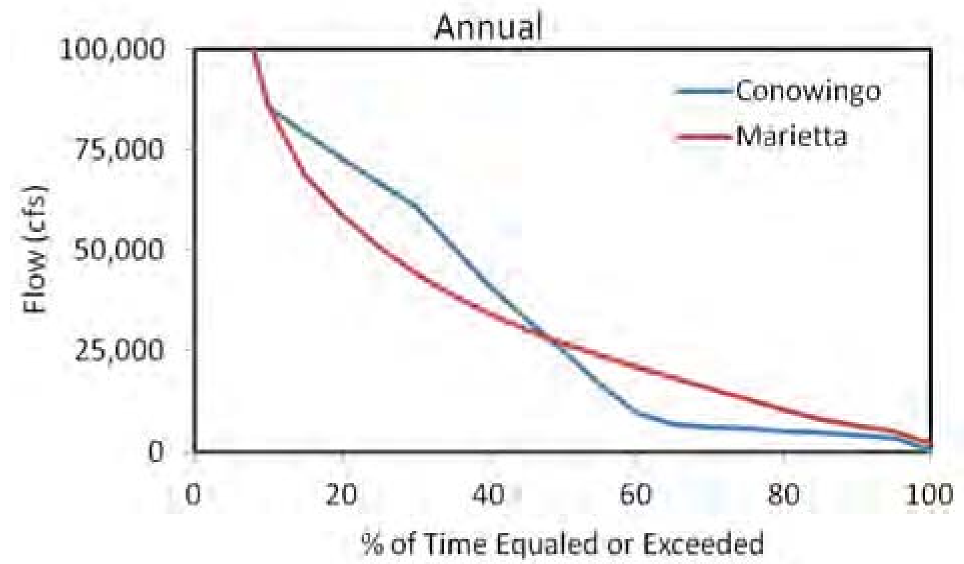
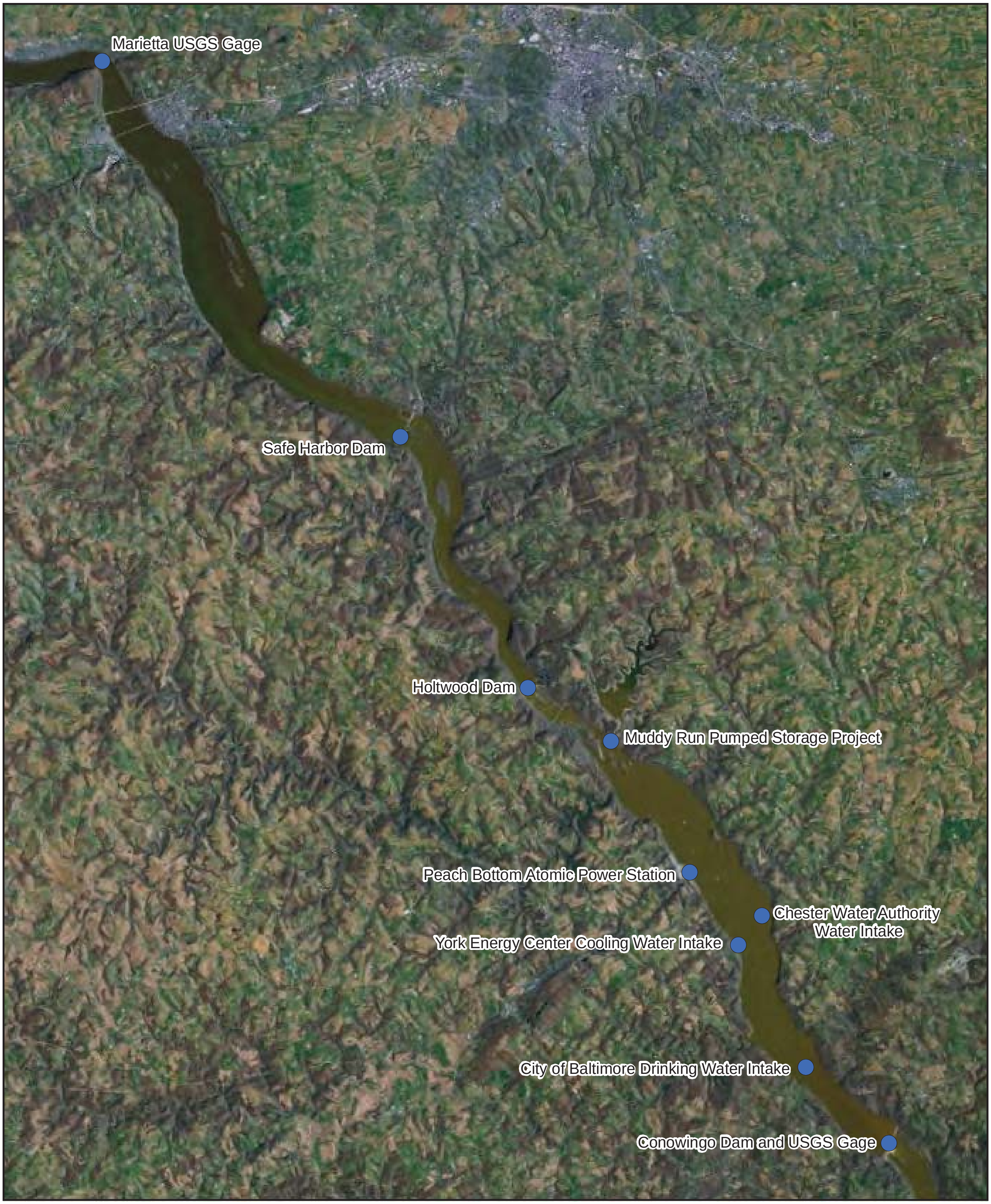


FIGURE 3.3.2.1.1-3: CONOWINGO AND MARIETTA ANNUAL SUB-DAILY FLOW EXCEEDANCE CURVES (WY 1989-1990, 1992-1993, 1995-2009)





EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

N

1 inch = 3.5 miles

0 1.75 3.5 7 Miles

Figure 3.3.2.1.1-4:
Lower Susquehanna River
Water Use Facilities

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_water_use_facilities.mxd

FIGURE 3.3.2.1.2-1: SUMMARY OF MONTHLY AVERAGE MINIMUM, MEAN AND MAXIMUM DAILY WATER TEMPERATURES AT HOLTWOOD DAM.

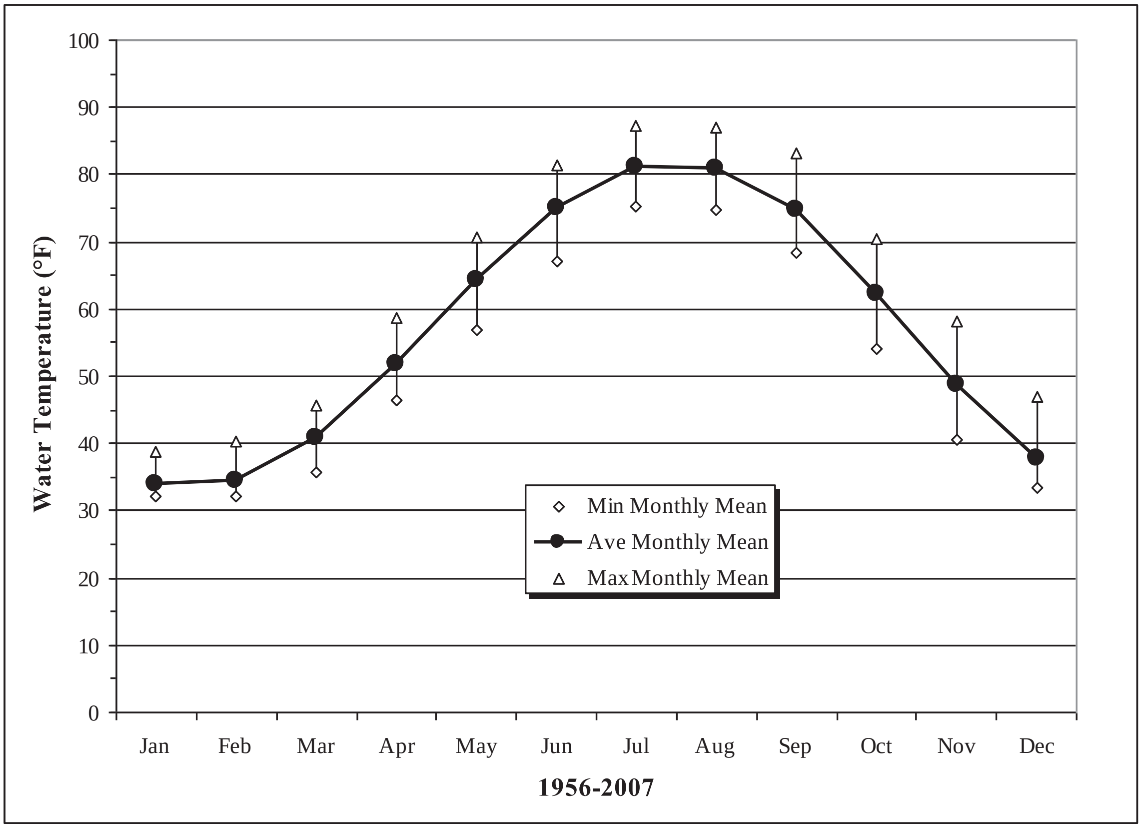


FIGURE 3.3.2.1.2-2: SUMMARY OF MONTHLY AVERAGE MINIMUM, MEAN AND MAXIMUM SURFACE DO LEVELS IN CONOWINGO POND FROM 1971-1983 AND 1996-1999.

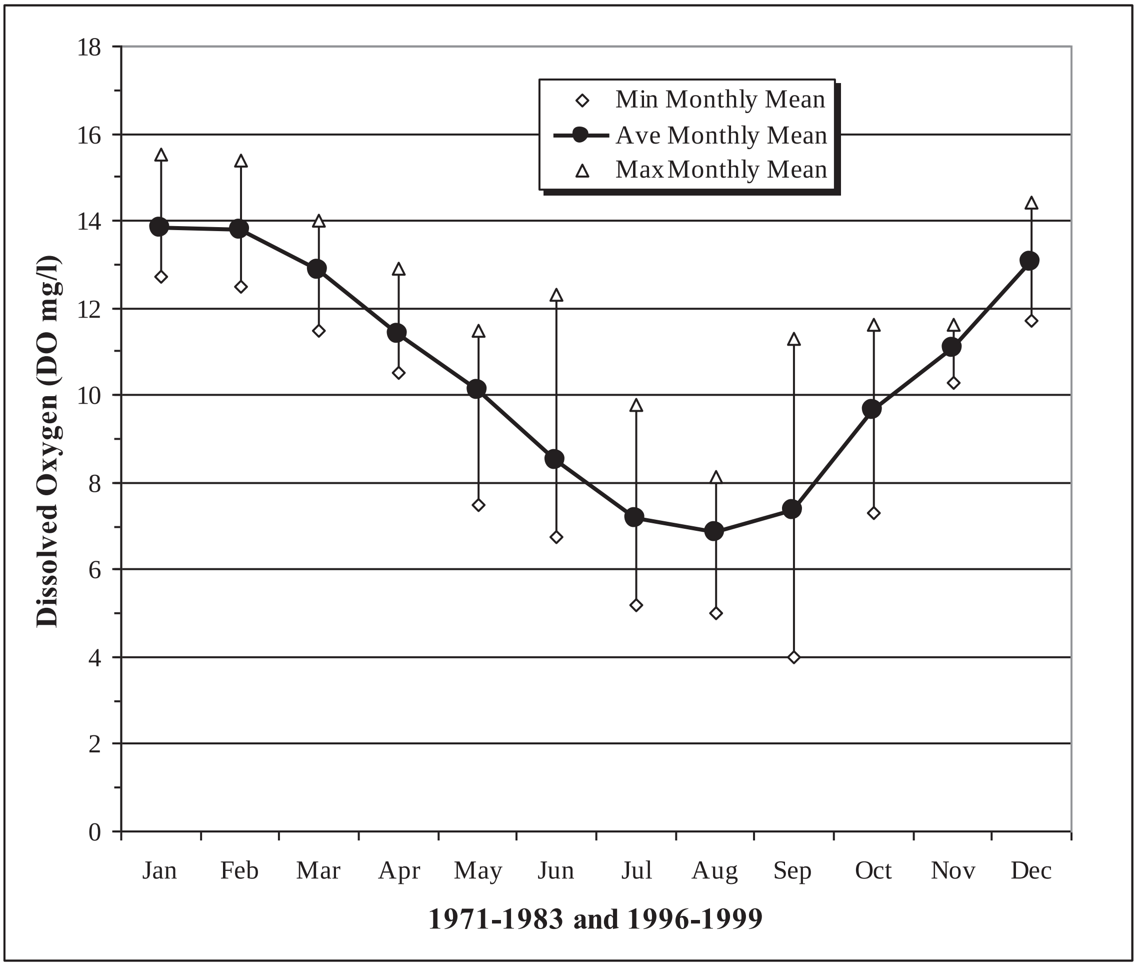


FIGURE 3.3.2.1.2-3: EXAMPLE OF DO AND WATER TEMPERATURE DIURNAL VARIATIONS IN THE CONOWINGO DAM TAILRACE (STATION 643).

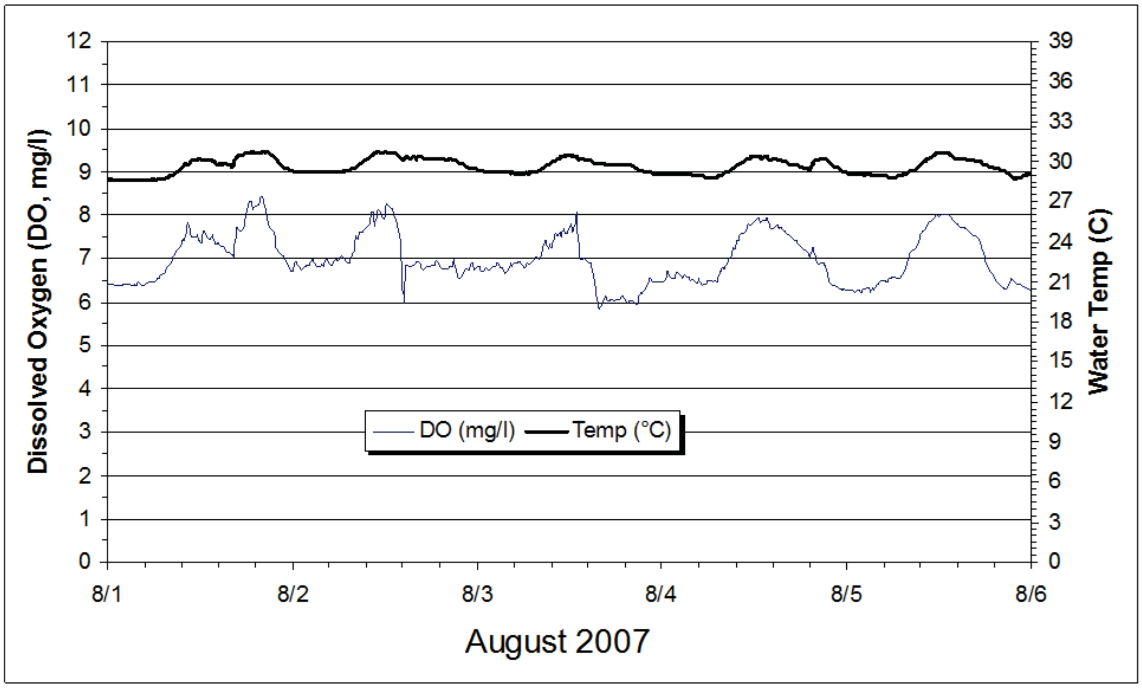
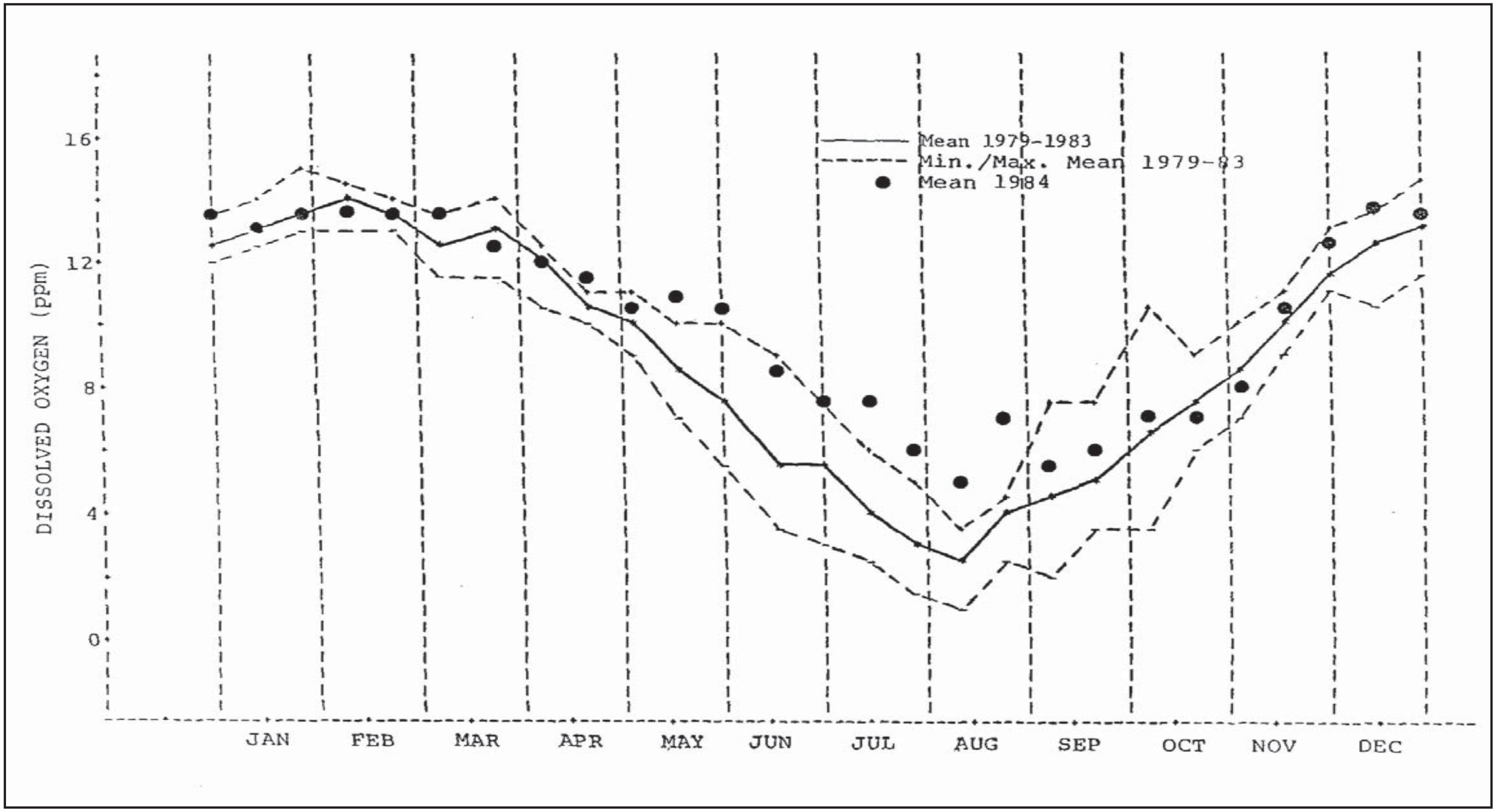
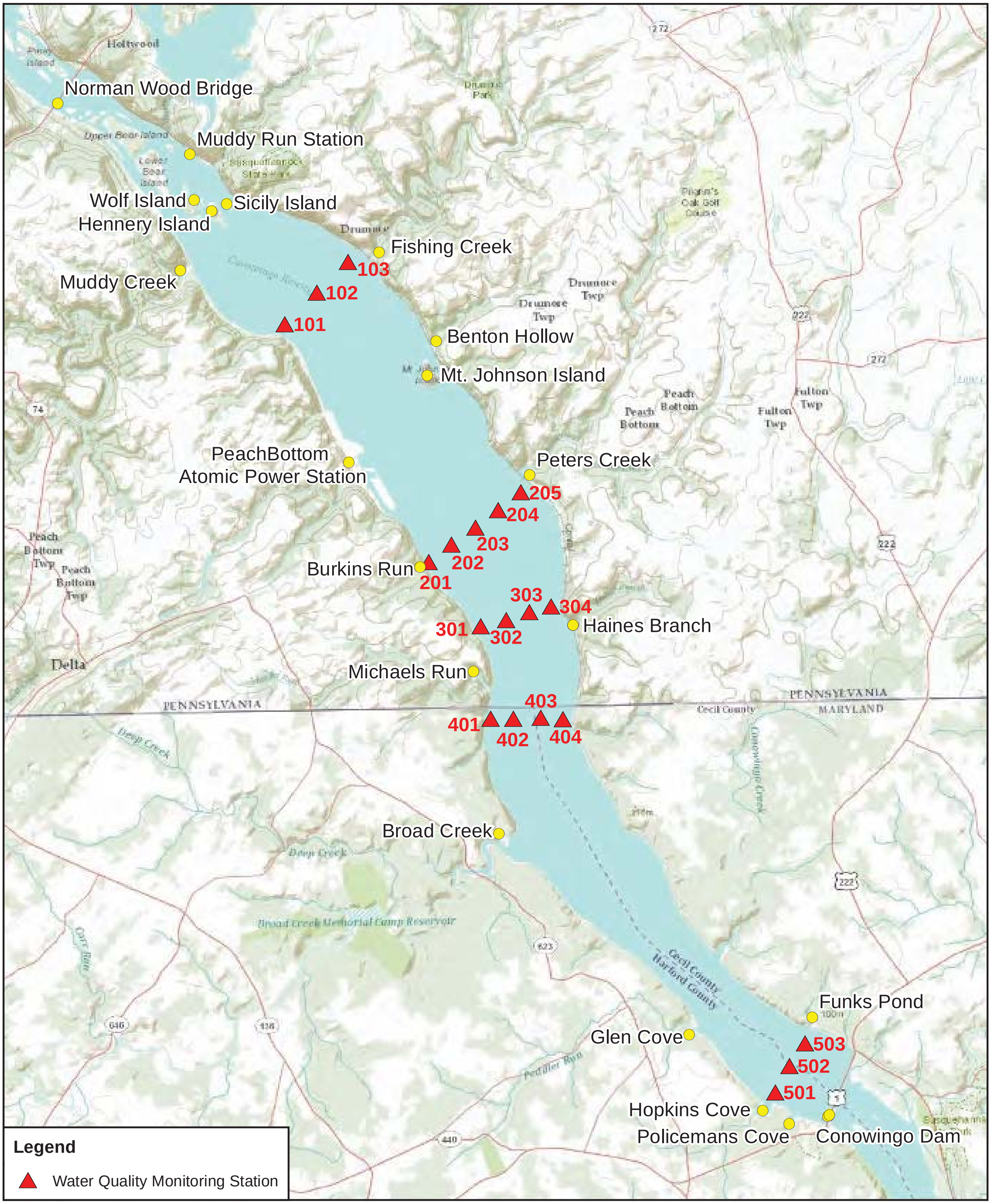


FIGURE 3.3.2.1.2-4: SEASONAL DO PATTERNS IN THE CONOWINGO DAM TAILRACE.





EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

N

1 inch = 1.5 miles
0 0.75 1.5 3 Miles

Figure 3.3.2.1.2-5:
Water Quality Sampling Transects in Conowingo Pond
April - October 2010

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_wq_sampling_transects.mxd

FIGURE 3.3.2.1.2-6: STATION 502 VERTICAL DO PROFILES IN APRIL THROUGH JUNE 2010.

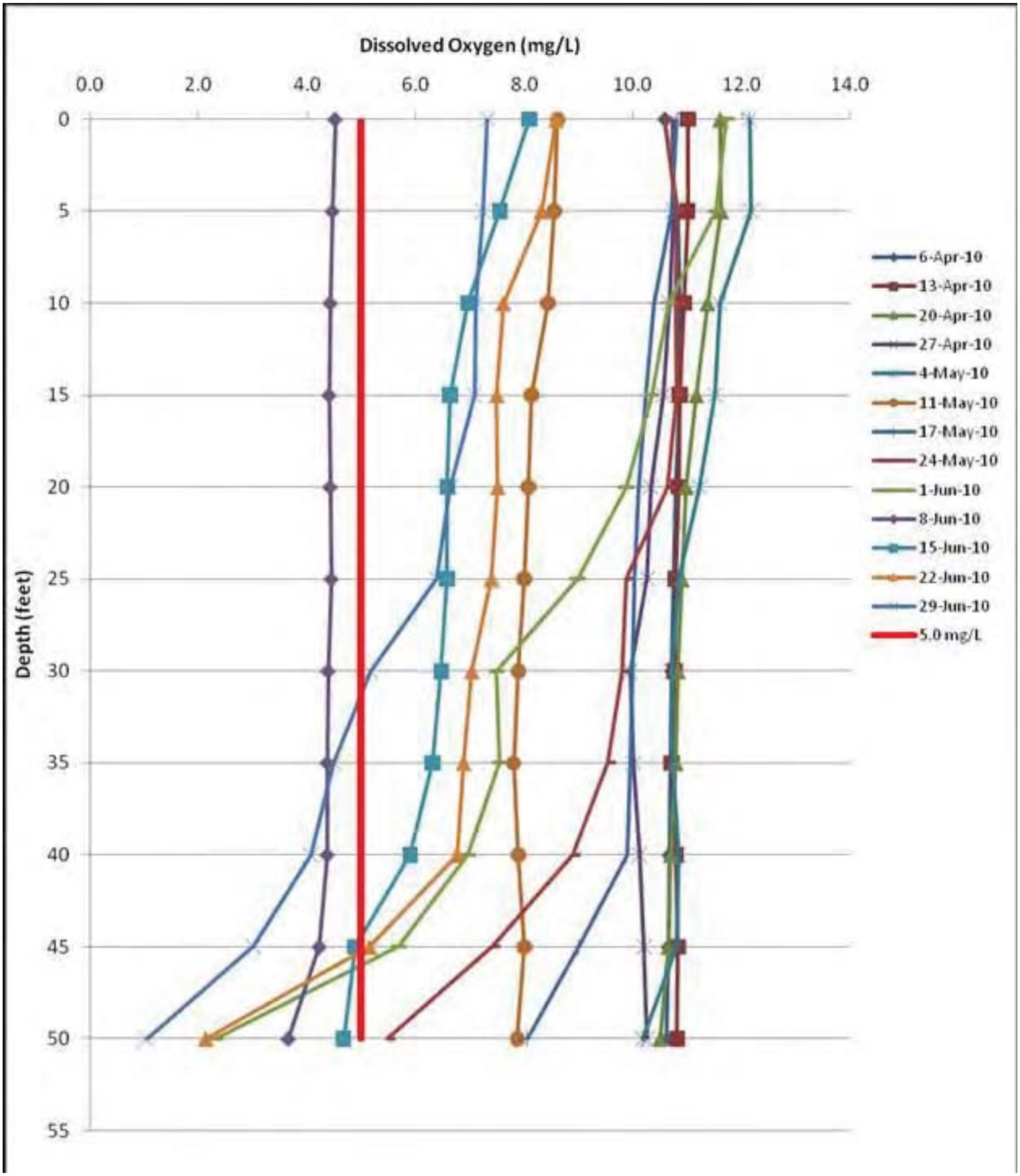


FIGURE 3.3.2.1.2-7: STATION 502 VERTICAL DO PROFILES IN JULY THROUGH SEPTEMBER 2010.

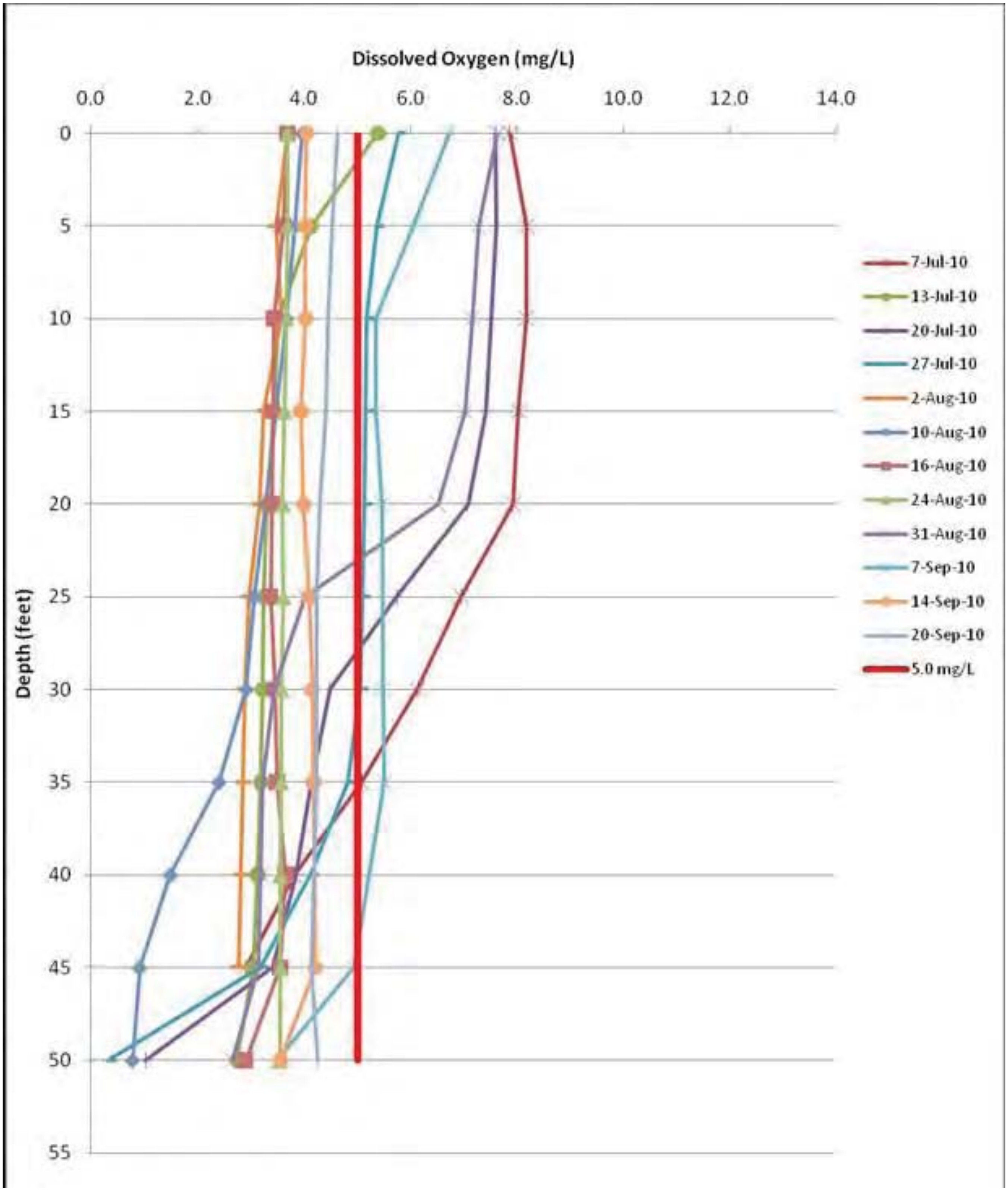


FIGURE 3.3.2.1.2-8: STATION 502 VERTICAL DO PROFILES IN OCTOBER 2010.

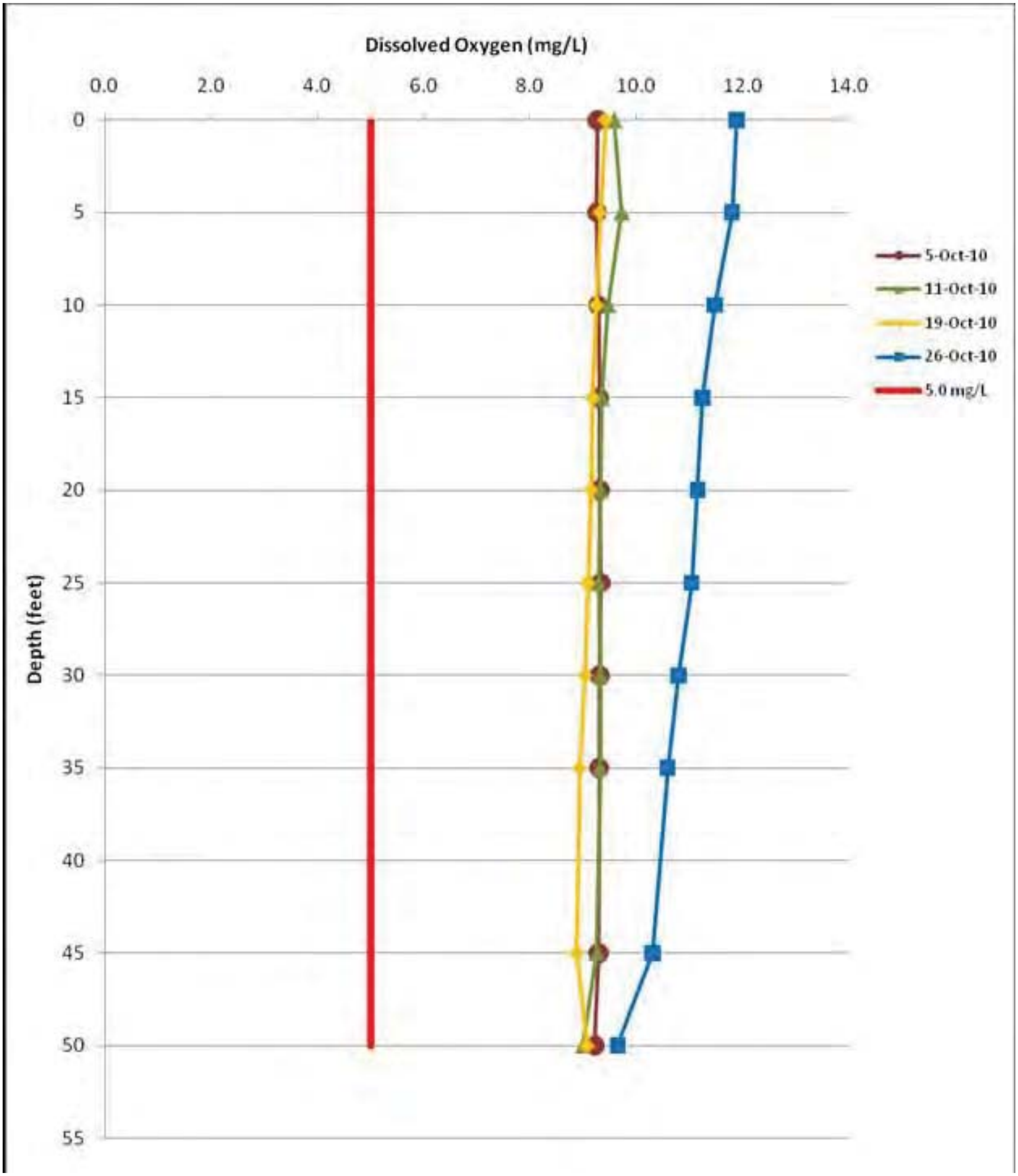
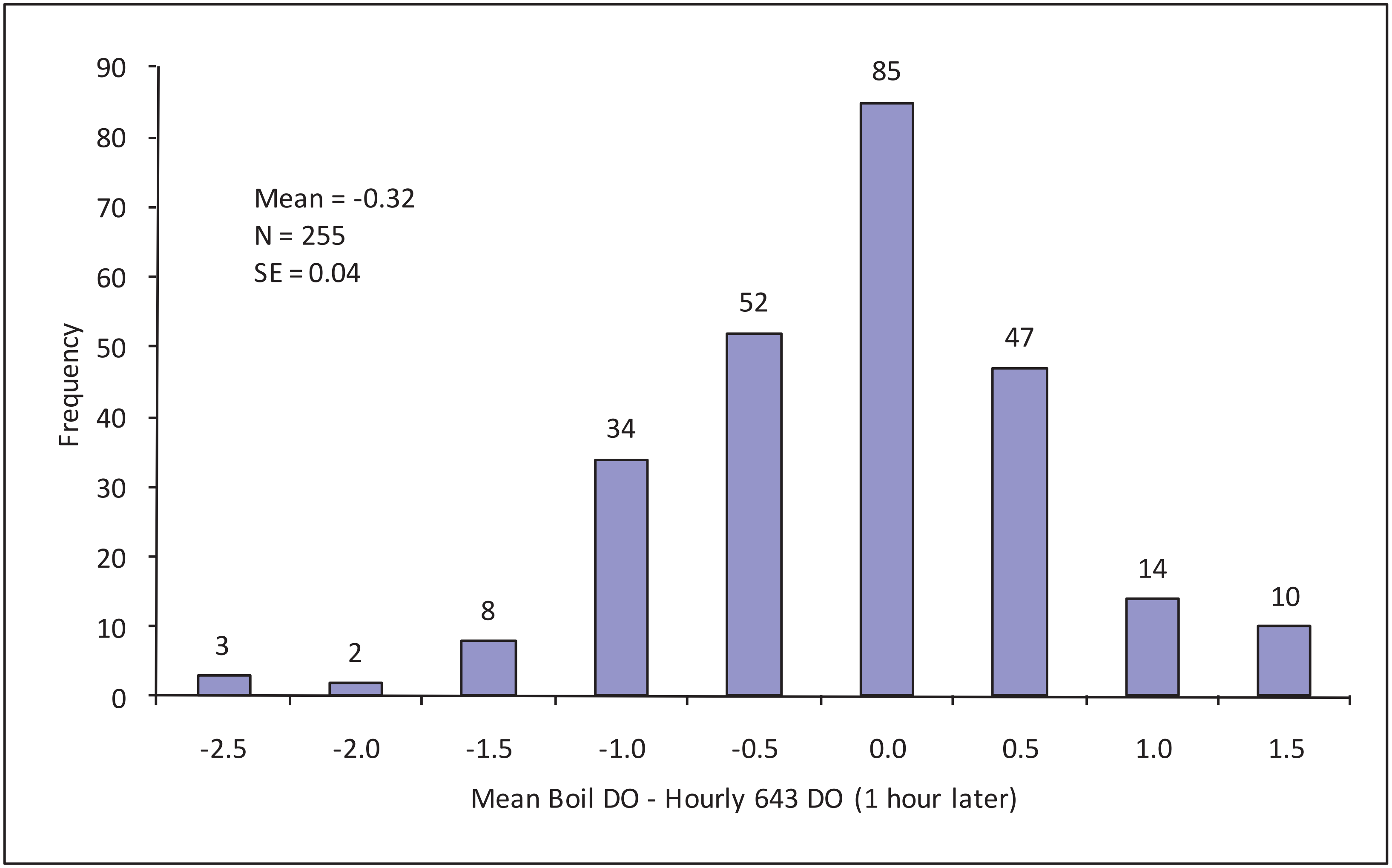


FIGURE:3.3.2.1.2-9: FREQUENCY DISTRIBUTION OF AVERAGE HOURLY DO AND AVERAGE BOIL DO DIFFERENCES AT CONOWINGO DAM, JULY-AUGUST 2010.



3.3.3 Aquatic Resources

3.3.3.1 Affected Environment

3.3.3.1.1 *Fish Species*

Multiple aquatic ecological studies have been conducted since 1966 in Conowingo Pond and in the vicinity of Conowingo Dam, primarily on the resident and anadromous fishes that utilize these portions of the river for feeding, spawning, rearing, migration, or other life requisite behavior. A total of 80 fish species, listed in Table 3.3.3.1.1-1, have been identified in the Project waters. (Exelon 2009). Both the Conowingo Pond and the non-tidal portion of the Susquehanna River below Conowingo Dam support numerous resident game and forage fish species as well as anadromous and catadromous fishes during their migration, as described below.

Conowingo Pond

The fish community of Conowingo Pond is a complex and dynamic ecological system. In addition to natural reproduction, fish are recruited to the system from downstream of Conowingo Dam (via the East Fish Lift), from the Muddy Run Project in generating mode, and from upstream impoundments and Conowingo Pond tributaries. Egress of fishes occurs via the Holtwood Fish Lift, the Muddy Run Project in pumping mode, and Conowingo Dam (Normandeau Associates and GSE 2012b).

The resident fishes of Conowingo Pond include common warm-water species that are found in lakes, ponds, and reservoirs from the southeastern US to Canada. The resident fish community also reflects intentional and unintentional fish introductions over the last several decades. Unintentional introductions include the planktivorous gizzard shad (*Dorosoma cepedianum*) in 1972 and, more recently (2002), the predatory flathead catfish (*Pylodictis olivaris*). Intentional introductions include the stocking of hybrid fishes for recreational angling (*e.g.,* striped bass *x* white bass and tiger muskellunge); neither hybrid is currently stocked in Conowingo Pond, but tiger musky are recruited from upriver stocking. American eel (*Anguilla rostrata*) was stocked above Conowingo Dam for years until 1980, and individuals were commonly taken in Conowingo Pond until recently, but few, if any, individuals are likely currently present in Conowingo Pond. Other introductions have occurred via volitional passage of resident and migratory fishes into Conowingo Pond each spring since 1997. As a result, white perch (*Morone americana*) and an apparently residualized population of alewife (*Alosa pseudoharengus*), likely a result of escape from Raystown Lake on Juniata River, PA are now occasionally caught by various gear types.

Historically, abundance, species composition, and life-history parameters have been monitored to document the resident fish community of Conowingo Pond relative to the Muddy Run Project and/or

PBAPS operations since 1966. Juvenile and adult fishes have been sampled principally by seine, bottom trawl, and trap net at selected locations throughout Conowingo Pond. Until 1979, sampling was continuous on a bi-weekly basis. Beginning in 1980, when PBAPS was relieved of sampling requirements by the Nuclear Regulatory Commission (NRC) (RMC 1980), and throughout most of the following decade, the number of sampling stations and the sampling frequency were reduced (to monthly or less) to reflect a maintenance-level program. Renewed systematic sampling relative to proposed changes in PBAPS operations (reduced cooling tower use) occurred from 1996 through 1999, focusing on monthly sampling during June to October in the vicinity of PBAPS.

Based on historical fishery studies in Conowingo Pond, the principal game fish species include: walleye (*Sander vitreus*), black bass (smallmouth bass (*Micropterus dolomieu*) and largemouth bass (*Micropterus salmoides*), combined), and channel catfish (*Ictalurus punctatus*). Green sunfish (*Lepomis cyanellus*), pumpkinseed (*Lepomis gibbosus*), bluegill (*Lepomis macrochirus*), and white crappie (*Pomoxis annularis*) were important pan fishes. Forage species include gizzard shad, spottail shiner (*Notropis hudsonius*), spotfin shiner (*Cyprinella spilopterus*), bluntnose minnow (*Pimephales notatus*), and tessellated darter (*Etheostoma olmstedi*). Gizzard shad, one of the most common species found, may be out-competing other species (e.g., white crappie) for food (Normandeau Associates 2000). In 2005, more than 305,000 gizzard shad (81% of the total catch) passed into Conowingo Pond via the Eastern Fish Lift (EFL) (SRAFRC 2006). In some years, the number of gizzard shad passed into Conowingo Pond approaches one million fish.

A new 5-year sampling program was initiated in 2010 relative to proposed operational changes at PBAPS. Monthly fisheries sampling was planned for April through October from 2010-2014 utilizing three gear types: electrofishing, seine net, and bottom trawl. The study plan also includes two winter sample events by electrofishing only. Start-up delays meant that April-June 2010 fisheries data were not collected; however sampling occurred as planned in July-October 2010. In 2011, fisheries data were collected in February (electrofishing only) and from April through October.

A summary of the fish species composition for these more recent samplings is shown in Table 3.3.3.1.1-2. In 2010 (July – October), a total of 34 species occurred in a total catch of 12,455 fish. In 2011 (April – October), a total of 41 species occurred in a total catch of 25,690 fish. As typical of results from earlier years, gizzard shad, channel catfish, spotfin shiner, comely shiner, and bluegill dominated the overall species composition. Green sunfish, spottail shiner, bluntnose minnow, smallmouth bass, and rock bass were also caught in numbers greater than one percent. All other species comprised about 5% of the catch.

Flathead catfish known to occur in the lower Susquehanna River drainage since 2002 represented a new species addition within a formal sampling program.

Susquehanna River below Conowingo Dam

Characterization of year-to-year and long-term fluctuations of key resident and migratory species in the Lower Susquehanna River fish assemblage has been facilitated by several major past studies. Annual collections at the West Fish Lift (WFL) and EFL were analyzed over a period of 38 and 19 years, respectively, between 1972 and 2009. Fish distribution and abundance surveys conducted by Exelon during previous relicensing studies between 1982 and 1987 included electrofishing, gill netting, and ichthyoplankton sampling efforts from Conowingo Dam downstream to the tidal waters at Havre de Grace, Maryland. These data augment the fish lift collections by providing a more spatially and temporally diverse characterization of the downstream fish populations in regards to species assemblage, condition, food habits, and habitat use. Data collected during the 2010 fish stranding summer surveys in the spillway reach below Conowingo Dam supplement the fish lift catches with data from a season not typically represented by fish lift sampling (Normandeau Associates and GSE 2012m).

The dominant species documented by the fish community studies in the Susquehanna River downstream of Conowingo Dam to the tidal zone are summarized in Table 3.3.3.1.1-3. Primary resident species include gizzard shad, white perch, common carp, quillback, comely shiner, channel catfish, walleye, and black bass, along with seasonal migrants like American shad, blueback herring, alewife, sea lamprey, striped bass, and hickory shad. Condition factor and length-weight relationships of representative common fish species are comparable to those from other populations, and are indicative of relatively favorable conditions and habitats in the lower Susquehanna River (Normandeau Associates and GSE 2012m).

Several changes to the fish species assemblage were evident over the period studied—most notably with regard to clupeids. Gizzard shad have become the increasingly dominant species over time, river herring have decreased proportionally, and American shad have generally increased proportionally. Since 1972, the population of gizzard shad has increased exponentially. Catches of white crappie at the WFL have declined substantially since the mid-1970s, in part due to the competition for zooplankton with juvenile gizzard shad (Normandeau Associates 1994, 2000).

From 1991 to 2009, blueback herring[25] comprised 4% of the overall catch per unit effort (CPUE) at the EFL. In 1997, 1999, and 2001, significant catches of blueback herring were made. As recently as 2001, 510 herring per lift were collected—the highest number in any year and the second-most proportionally abundant species that year after gizzard shad. Since 2002, however, very few blueback herring have been passed. This decline may reflect recent coast-wide population decreases due to various potential causes such as habitat loss, targeted or bycatch in commercial fisheries, and increased numbers of striped bass and other predators (ASMFC 2009).

In the 1970s and 1980s, the proportion of American shad in the fish lift catch was very low, but as a result of restoration measures, American shad numbers increased through the 1990s. Since the mid-1990s, American shad have been one of the five most abundant fish in annual fish lift counts, and are usually second-most abundant in the EFL.

Ichthyoplankton

Exelon conducted sampling in the spring of 2012 to gather additional information on the occurrence of ichthyoplankton in the Susquehanna River downstream of Conowingo Dam. Systematic weekly sampling was completed in the river reach between Conowingo Dam downstream to the I-95 Bridge. A study report detailing the results will be filed with FERC on or before September 30, 2012.

3.3.3.1.2 *Recreational Fishery*

Conowingo Pond

The recreational fishery of the Conowingo Pond was assessed by a creel survey conducted by Exelon from March 1, 2010 through February 28, 2011 (Normandeau Associates and GSE 2012q). Surveys (aerial and land-based) conducted during the spring, summer, and fall (March 1 through November 30, 2010) provided the most useful information. Count efforts during 42 scheduled weekly aerial flights recorded 497 actively fishing boats and 189 shore anglers. Additionally, boat and shore anglers were interviewed at 13 access points ranging from the Norman Wood Bridge (PA Rt. 372) just below

[25] Alewife and blueback herring (collectively referred to as river herring) are currently in status review under the the Federal Endangered Species Act (ESA), On November 2, 2011, National Marine Fisheries Service (NMFS) published its Notice of 90-day Finding on a Petition to List Alewife and Blueback Herring as Threatened under the Endangered Species Act (ESA) (76 Federal Register 67652), finding that the action may be warranted, based primarily on dramatic range-wide population declines. The publication of their 90-day finding initiated a 12-month status review that is ongoing at this time (Summer 2012).

Holtwood Dam to the Conowingo Dam. A total of 646 boat anglers representing 365 parties, as well as 152 shore anglers representing 71 parties were interviewed.

Although "casual" anglers not seeking a particular species accounted for 80% of all shore anglers interviewed, boat fishing pressure was largely directed toward black bass. Over half of the boat anglers interviewed during the summer and fall were seeking black bass, with weekend fishing pressure dominating.

Of the estimated 18,466 black bass caught (41% of all fish caught), only 79 were estimated to have been harvested. Instead, catfish (flathead and channel) were more likely to be harvested, with an estimated 2,147 of 12,428 catfish caught being harvested (80% of all fish harvested). None of the estimated 11,000 sunfish and crappie species caught were reported to have been harvested. The retention rate of the total 44,526 fish caught by boat (5.3%) and shore (8.9%) anglers was 6.0% combined. Table 3.3.3.1.2-1 shows a breakdown of species caught and harvested by boat and shore anglers combined on Conowingo Pond in the spring, summer, and fall of 2010.

The winter portion of the Conowingo Pond creel survey (December 1, 2010 through February 28, 2011) found relatively little angling. Winter count efforts during 13 aerial flights recorded only six actively fishing boats and two shore anglers. A total of 22 boat anglers representing 13 parties were interviewed. Six fish species or species groups were sought, with the largest proportion of anglers (36.4%) seeking largemouth bass.

The primary purposes of the winter study were to estimate angling pressure at PBAPS warm-water discharge and determine the opportunity to ice fish in the tributaries like Broad Creek and Funk's Run. All boat anglers reported to be fishing the thermal discharge. Although the winter of 2010-2011 produced ice on Conowingo Pond, it may have been too thin for many shore anglers to utilize, while still creating an obstacle for boat anglers trying to launch and navigate to the PBAPS discharge. Ice started in the tributaries and coves in early December, and the PBAPS boat launch at Dorsey Park was iced in by mid-December. In January, ice fishing holes were observed at Funk's Run and Broad Creek. By mid-February, the Conowingo Pond was free of ice except for a small portion of Funk's Run Pond.

Susquehanna River below Conowingo Dam

During the spring, summer, and fall (March 1 through November 30) of 2010 a creel survey was conducted by Exelon in the Lower Susquehanna River to describe the recreational fishery in this portion of the river (Normandeau Associates and GSE 2012r). Results of this study can be used to describe the recreational fishery in the Lower Susquehanna River.

Count efforts during the same 42 scheduled weekly aerial flights that flew over Conowingo Pond recorded 853 actively fishing boats and 1,741 shore anglers in the Lower Susquehanna River. Boat and shore anglers were interviewed at 13 access points, ranging from the west shoreline below the Conowingo Dam tailrace downstream to the Amtrak Bridge in Havre de Grace, MD near the mouth of the Susquehanna River. A total of 797 boat anglers representing 383 parties, as well as 1,120 shore anglers representing 664 parties were interviewed.

The largest proportion of anglers (35%) sought “anything.” However, among anglers fishing for a particular species, striped bass (*Morone saxatilis*) were most frequently sought (16%). Striped bass are mainly sought downstream of Lapidum in the catch-and-release section of the river, as well as in the upper bay and tributaries used as spawning areas in March and April. Other migratory species such as shad (hickory shad and American shad) and white perch were highly sought in the spring. During this season, shore anglers seek hickory shad near the mouths of Octoraro and Deer Creeks, which are used as spawning tributaries, and American shad in the tailrace of the Conowingo Dam among other locations along the lower river. Blue crabs (*Callinectes sapidus*) were highly sought in the fall, particularly by boat anglers.

Overall, Lower Susquehanna River anglers caught an estimated 264,429 fish and 60,874 blue crabs. White perch dominated the estimated catch (37%) and harvest (54%) of any fish, with the highest pressure concentrated in the spring and, to a lesser extent, the summer. Summer and fall fishing pressure primarily targeted catfish species (mainly channel catfish) and striped bass, with similar catch (28%) and harvest (37% and 30%, respectively) proportions of the totals for those two seasons. The retention rate of all fish by boat and shore anglers combined was 14%. Nearly all (99%) of the blue crabs caught were harvested.

Table 3.3.3.1.2-2 shows a breakdown of species caught and harvested by boat and shore anglers combined on the Lower Susquehanna River in the spring, summer, and fall of 2010.

3.3.3.1.3 *Entrainment, Impingement, and Mortality*

In 2010, Exelon investigated the potential for fish to be entrained at Conowingo powerhouse intakes (Normandeau Associates and GSE 2012b). The objectives of the study were to: 1) evaluate the potential for entrainment and impingement of six resident fish species and two diadromous fish species at the

Conowingo Project, and 2) evaluate survival probabilities of the eight fish species (target species) at the Project, taking into account site specific data such as turbine type, rotational speed (rpm), and size of entrained fish.

The goal of the study was to determine the likelihood of entrainment into Project intakes and if so, whether it is likely that entrainment would have a significant effect on fish populations. To achieve this goal, a fish entrainment evaluation was conducted utilizing historic data from Conowingo Pond, existing literature, life history information, and data on fish entrainment at other hydroelectric projects for the eight species of interest at the Conowingo Project. The fish species considered in the evaluation were those identified by Exelon and Project stakeholders as important management species and included both resident fish: gizzard shad, bluegill, channel catfish, largemouth bass, smallmouth bass, and walleye; and diadromous fish: American eel and American shad.

The evaluation also considered the potential for fish survival in the event of entrainment into and through the Project turbines. The survival assessment was based on an extensive review of literature and existing data and considered the important physical characteristics of the units, as well as the biological characteristics of the target fish species. Some of the important factors considered in this portion of the assessment included turbine type, turbine runner rotational speed and intake characteristics. The results of Exelon's study are summarized below.

Resident Species

Conowingo Pond supports a diverse assemblage of fishes and a healthy multi-species sport fishery supported by natural reproduction. Based on entrainment potential, passage survival, and impingement potential (discussed below), the overall entrainment and impingement impacts on resident fishes is expected to be moderate for gizzard shad and low for bluegill, channel catfish, largemouth bass, smallmouth bass, and walleye.

Entrainment potential is low for bluegill, channel catfish, largemouth bass, smallmouth bass, and walleye due to characteristics of the Project, combined with habit preferences and life history traits of the fish. The Project intake bays for the primary Francis (Nos. 1-7) and Kaplan (Nos. 8-11) units are deep (intake ceiling is 40 feet below normal full pond) and intake flow velocities calculated at the intake structure are moderate, ranging from 2.4 to 3.7 fps. Entrainment through the two (2) house units is expected to be lower than through the primary Francis (Nos. 1-7) and Kaplan (Nos. 8-11) units because of their low hydraulic capacity, very deep intake (67.7 feet below normal full pond) and intake flow velocity of 1.4 fps. The deep intakes are remote to the shallow water areas where the littoral species (e.g., bluegill, largemouth bass and smallmouth bass) are found, and large juvenile and adult life stages of channel catfish and walleye have burst swim speeds greater than intake flow velocities. Small juveniles that are not strong swimmers are more susceptible to entrainment, as are walleye or other piscivorous species chasing prey, such as gizzard shad, close to the intake structure.

A qualitative assessment of overall survival potential for target species passing the units at the Conowingo Project was developed from data in the Electric Power Research Instituts (EPRI) database, results from additional survival studies, and survival estimates calculated using the Franke *et al.* (1997) model. Quantitative data from the three data sets were converted to a qualitative ranking system where:

High (H)	= 100-95%
Moderate-High (MH)	= 95-90%
Moderate (M)	= 90-85%
Low-Moderate (LM)	= 85-80%
Low (L)	= <80%

An overall rating of survival potential for each species and turbine type at the Conowingo Project was assigned based on qualitative summary of the datasets relative to life stage size for each target species. Fish size was the ranking variable as size has been found to be more important than species *per se* when assessing fish survival potential (Franke *et al.* 1997; Winchell *et al.* 2000).

Passage survival through the Francis units 1-7 is High for juvenile bluegill; High to Moderate-High for juvenile channel catfish and smallmouth bass; High to Moderate for juvenile gizzard shad, largemouth bass and walleye. Adult bluegill and smallmouth bass survival is Moderate-High to Low-Moderate; adult channel catfish, gizzard shad, and largemouth bass survival is Moderate-High to Low; and adult walleye survival is Moderate to Low.

Passage survival of juvenile fish passing the Kaplan units 8-11 is High for bluegill, channel catfish, and smallmouth bass; High to Moderate for juvenile gizzard shad, largemouth bass; and walleye. Survival for adult life stages is High to Moderate for bluegill and smallmouth bass, High to Low for channel catfish; Moderate-High to Low-Moderate for gizzard shad and largemouth bass; and Moderate-High to Low for walleye, the largest of the adult life stages.

Passage survival through the two (2) house turbines is Moderate-High for bluegill, Moderate-High to Low-Moderate for channel catfish and smallmouth bass, and Moderate-High to Low for gizzard shad, largemouth bass, and walleye. For the adult life stage, bluegill and channel catfish have the highest survival potential at Moderate-High to Low, smallmouth bass survival is Moderate to Low and the remainder (gizzard shad, largemouth bass, and walleye) have a survival potential rating of Low.

Impingement on the bar racks is an unlikely event at units 1-11 based upon the relationship of fish length to body width for resident species. Only large (30 inch) channel catfish had calculated body widths (6.1 inches) wider than the 5.375 inch trash rack spacing at units 1-11. Except for large adult channel catfish, target fish species unable to escape the flow field of the intake structure could pass through the rack spaces rather than become impinged on the racks or support structures.

Bar rack spacing (1.5 inches) on the house units is smaller than at the primary units; however flow velocity is low, 1.4 fps. Fry and most small juvenile bluegill that lack the swimming ability to avoid intake flows would be small enough to pass through the racks. Juvenile and adult stages of the remaining target species have burst swim speeds sufficient to overcome intake flow velocities at these units. Some fish may be unable to react normally to a flow field if injured or lethargic due to loss or reduction of swimming ability, such as can occur in cold water.

Migratory Species

The two species considered in the evaluation were American eel and American shad, which are migratory species that pass downstream past Conowingo Dam during their life cycle.

<u>Adult American Eel</u>

Adult or silver American eel migrate downstream through Conowingo Pond primarily in the fall (October-November), although few eels are currently found above Conowingo Dam. Based on studies at other hydroelectric projects and calculated survival rates, passage survival through the Francis (1-7) and Kaplan (8-11) units are Moderate-High to Low for adult American eel.

In addition, site specific data t on adult American eel survival at Conowingo are available. USFWS (2012) analyzed silver eel migrations past Conowingo dam in 2011. Based on 88 tagged silver eels released in upper Conowingo Pond above the Muddy Run Pumped Storage Project, 79 eels (89.8%) were detected at receivers downstream of Conowingo Dam. As these eels were detected 14 km below the Dam, USFWS concluded that these 79 eels successfully migrated past the Dam and out of the Susquehanna River. Since spillage occurred for a number of days during which eels were outmigrating, it was not possible to determine whether eels passed the Dam through spillage or turbine passage. The remaining nine eels were not detected below the Dam so it is not known if they remained in the Pond, migrated after the end of the monitoring (late December), did not survive passage through the turbines or over the spillway, or the tags or tag battery failed, or the tags were damaged in turbine or spillway passage.

Juvenile American Eel

Yellow or juvenile eels may find suitable habitat and reside in Conowingo Pond until making their downstream migration as an adult. Yellow eel have a limited home range, suggesting that only those yellow eel residing in the vicinity of the intake structure are susceptible to entrainment. Exelon's study concluded that the entrainment potential for juvenile American eel in Conowingo Pond was considered to be Moderate-High for yellow eels in the near vicinity of the intake structure, and Low for juvenile eels in other areas of the Conowingo Pond (Normandeau Associates and GSE 2012b). Currently, few juvenile eels are present in Conowingo Pond.

Survival of entrained individuals will depend on size. Survival of smaller individuals is expected to be high. As size increases, survival decreases such that larger individuals are expected to have a lower survival rate.

Adult American Shad

Adult American shad migrate downstream through Conowingo Pond for a short period of time in the spring (April-June). Exelon conducted site-specific studies to determine passage survival through the Francis and Kaplan units at the Project. Adult American shad passing through a Francis and Kaplan unit have a survival rate of 93.0% and 86.3%, respectively (Normandeau Associates and GSE 2012d).

Juvenile American Shad

Juvenile American shad migrate downstream through Conowingo Pond for a short period in the fall (October-November). Exelon conducted site-specific studies to determine passage survival through the Francis and Kaplan units at the Project. Juvenile American shad passing through a Francis unit have a survival rate of 89.9% (Normandeau Associates and GSE 2012c). An earlier study conducted by Exelon indicates that passage survival through a Kaplan unit is 94.9% (RMC 1994).

Alewife and Blueback Herring

Alewife and blueback herring were not identified as target species for the study, but the effects likely would be similar to American shad based on similar migratory behaviors. This is especially applicable in assessing juvenile survival. However, using those larger species as a proxy for adult alewife and blueback herring survival should provide a conservative estimate.

Juvenile alewife and blueback herring turbine passage survival is expected to be high. The passage survival of juvenile American shad through a Kaplan unit was estimated at 94.9% (RMC 1994). Turbine passage survival through a Francis unit was estimated at 89.9%.

Adult American shad survival after passage through an aerated Francis unit and Kaplan unit were evaluated. For the Francis unit, the survival reate was 93.0%. . The survival rate for adult American shad passed through the Kaplan unit was estimated at 86.3%. Downstream passage survival of adult alewife and river herring was not assessed, however it is assumed that the adult American shad survival rates serve as a conservative estimate.

3.3.3.1.4 *Macroinvertebrates*

Conowingo Pond

Benthic invertebrate samples obtained from various locations in Conowingo Pond between 1967 and 1984 yielded 61 taxa (Normandeau Associates 2006a). Primary components of the benthic community were oligochaetes and chironomids, with the tubificid worm *Limnodrilus hoffmeisteri*, the midge *Procladius* sp., the phantom midge *Chaoborus punctipennis*, the midge *Chironomus attenuatus*, the midge *Coelotanypus consinnus*, and the tubificid worm *Ilyiodrilus templetoni* comprising 94-98 percent of the total abundance in various years. The generally sparse invertebrate community in the lower two-thirds of the Conowingo Pond may be due to unfavorable substrate conditions (sand-coal fines and silt) (Normandeau 2001). Burrowing mayflies such as *Hexagenia limbata* in this reach provide a significant food resource for species such as smallmouth bass, white crappie, and channel catfish (RMC 1979).

Susquehanna River below Conowingo Dam

From 1980 through 1991, a series of quantitative benthic studies were conducted in the non-tidal area of the Lower Susquehanna River below the Conowingo Dam to determine a minimum flow release schedule sufficient to maintain healthy fish and macroinvertebrate communities. A total of 71 macroinvertebrate taxa were collected and were identified to the genus level. These studies were used as a basis to characterize the invertebrate community as moderately rich and moderately dense. The community was generally comprised of facultative or tolerant warm-water genera. Most abundant were: Chironomidae in the genera *Cricotopus*, *Dicrotendipes*, and *Polypedilum*; caddisflies in the genera *Cheumatopsyche* and *Hydroptila*; Asiatic clams in the genus *Corbicula*; flatworms in the genus *Dugesia*; a crustacean in the genus *Gammarus*; a snail in the genus *Goniobasis*; and aquatic worms in the genera *Manayunkia* and

Nais. The most important food items in the stomach contents of eight fish species examined were Chironomidae, *Cheumatopsyche*, and *Gammarus* (Normandeau Associates and GSE 2012m).

Most of the genera identified from the studies possess some adaptation to water level fluctuation and low dissolved oxygen concentrations, which are typically associated with a corresponding tolerance index. Although tolerance indices are assigned to invertebrate taxa according to more of their ability to adapt to chemical degradation than to habitat instability caused by changes in water levels, taxa resistant to reductions in water quality also tend to be resistant to habitat alteration. Review of tolerance indices showed only 8 of 71 genera are considered sensitive/intolerant (tolerance index of 3 or less). Twenty-eight genera were found to be facultative (tolerance index of 4-6) and the remaining 35 genera were tolerant (tolerance index of 7-10).

Invertebrate data collected during the later years of tailrace studies showed observable increases in community density, after the current minimum flow release schedule was implemented and dissolved oxygen conditions (≥5 mg/L) had consistently improved.

3.3.3.1.5 *Mussels*

Conowingo Pond

An assessment of the mussel community conducted below Holtwood Dam in September 2005 revealed little available mussel habitat in the spill pool and tailrace areas below the Dam. A total of six live mussels (five eastern elliptio and one yellow lampmussel) were identified downstream of the Holtwood Dam from a single sheltered location of the shoreline adjacent to the tailrace (Normandeau 2006b). Data for other portions of Conowingo Pond relative to mussel occurrence are limited.

Susquehanna River below Conowingo Dam

Exelon conducted semi-quantitative and quantitative mussel surveys in the Susquehanna River below Conowingo Dam to determine species composition, distribution, density, and abundance 2010 (Normandeau Associates and GSE 2012n) and 2012 (Biodrawversity and GSE 2012). Fieldwork included semi-quantitative (i.e., timed searches) surveys conducted by wading, snorkeling, or SCUBA diving at 128 stations distributed throughout the study reach, as well as quantitative (i.e., quadrat) surveys at six locations.

During semi-quantitative surveys, a total of 6,301 mussels were counted and five species were observed. Mussels were detected at 121 of 128 stations (94.5 percent), and a mean of 1.8 species (range = 0-5) were found per station. Species included eastern elliptio (*Elliptio complanata*; 6,069 individuals found at 120 stations), alewife floater (*Anodonta implicata*; 133 individuals found at 46 stations), eastern floater (*Pyganodon cataracta*; 67 individuals found at 29 stations), tidewater mucket (*Leptodea ochracea*; 25 individuals found at 22 stations), and eastern lampmussel (*Lampsilis radiata*; seven individuals found at seven stations). For all species combined, catch-per-unit-effort (CPUE) ranged from 0-612 mussels/hour (mean = 64.1 mussels/hour, standard deviation = 94.5) among the stations. In addition to the five native mussel species, the non-native zebra mussel (*Dreissena polymorpha*) was detected at nine stations and the Asian clam (*Corbicula fluminea*) was detected at nearly every station. Table 3.3.3.1.5-1 provides a comparison of the species caught during recent surveys by Exelon (2010 and 2012), MDNR (2009 and 2010), and Marshall University (2008). In addition, Tables 3.3.3.1.5-2 and 3.3.3.1.5-3 depict historic records of mussel collections in the Susquehanna River below Conowingo Dam.

The predominant habitat features of the study reach were the boulder and bedrock formations, shallow depth, and moderate to strong flow velocities. Although these features are not generally ideal for mussels, there was significant fine-scale habitat heterogeneity, including patches of habitat that mussels prefer such as hydraulic refugia behind boulders, bedrock outcrops, and islands; and interstitial sand and gravel. Mussel densities in these small patches often exceeded 10-20 per square meter. Mussel CPUE was nearly three times higher in tidal areas than non-tidal areas (115.1 vs. 38.3 mussels/hour), and both alewife floater and tidewater mucket were nearly five times more abundant in tidal areas. Within non-tidal areas, mussel CPUE was typically highest in pools and side channels, and lowest in shallow runs and riffles.

Mussel literature has indicated that shear stress is useful in evaluating the suitability of mussel habitat (Layzer and Madison 1995). Information was collected as part of the instream flow study (GSE and Normandeau Associates 2012b) to calculate shear stress, and the results were used to predict mussel habitat suitability. There was a strong inverse relationship between mussel CPUE and Low Flow Shear Stress (LFSS), and a weaker inverse relationship between mussel CPUE and High Flow Shear Stress (HFSS). There was a significant trend of increasing mussel CPUE, as well as increasing variability in CPUE, with distance from the dam.

Population (all species) estimates for the quantitative survey plots ranged from 50 mussels (90% Confidence Interval (CI) = -32-132 mussels) to 1,920 mussels (90% CI = 623-3,217 mussels). Highest population estimates were for two sites in the secondary channel of McGibney Island. A total of 117 mussels were observed during quantitative surveys, including 111 eastern elliptio (95.7 percent), and three individuals of both alewife floater and eastern floater. Mussels were generally associated with quadrats where relatively fine materials (silt, sand, and gravel) accounted for between 30-80 percent of total substrate.

There was a distinct lack of juveniles and young mussels for all species, particularly for alewife floater, tidewater mucket, eastern floater, and eastern lampmussel. Eastern elliptio exhibited a broad range of sizes – from 11.8 to 170.0 mm, but only eight (1.1 percent of the 691 measured) were smaller than 40.0 mm in length.

Dreissenid Mussel Monitoring

The detection and subsequent monitoring for Dreissenid mussels by Exelon at Conowingo Dam has occurred since 1991 and continued annually through 2008. With a one-year lapse, the monitoring program at Conowingo Dam was conducted again in the spring of 2010 (Normandeau Associates and GSE 2012p).

The investigation area for this study included Conowingo Dam and surrounding Project waters. Veliger net sampling was conducted at Conowingo Dam. Artificial substrate inspections occurred at both the WFL (immediate tailrace) and in Conowingo Pond (six tube samplers). Natural substrate inspections were conducted at Shure's Landing Area (west shoreline 0.5 miles downstream of Conowingo Dam) for settled juveniles and adults.

Overall, no Dreissenid mussel veligers or settled juveniles were found in any of the net or substrate samples collected during the 2010 monitoring period at Conowingo Dam. Sampling frequency increased to weekly at Conowingo Dam in July after Dreissenid mussel veligers were observed in samples from the PBAPS intake area, located approximately six miles upstream of Conowingo Dam. A few adult zebra mussels were collected downstream of Conowingo Dam by MDNR biologists conducting a darter survey. In addition, during its 2010 and 2012 mussel surveys of the downstream reach below Conowingo Dam Exelon collected zebra mussels. This suggeststhat a widely distributed, low-density population of adult zebra mussels is present in close proximity and downstream of Conowingo Dam. It is unclear whether this represents the start of a population explosion or the extent of the ability of zebra mussels to colonize this portion of the Susquehanna River below Conowingo Dam. Although zebra mussels were not collected at Conowingo Dam, the Asiatic clam (*Corbicula fluminea*), another bio-fouling organism, was routinely observed in samples taken at Conowingo Dam in June through November 2010, as well as downstream of the Conowingo Dam during Exelon's 2012 mussel survey.

3.3.3.1.6 *Phytoplankton and Zooplankton*

Conowingo Pond

The Conowingo Pond plankton community was characterized during ecological studies conducted at various locations in the Pond from 1966 through 1978 (RMC 1979). A total of 44 genera of algae were identified in Conowingo Pond in the vicinity of the Muddy Run Project, including the most common genera observed: *Pandorina, Pleodorina, Pediastrum* (green algae), *Melosira* (diatom), and *Anacystis*, *Gomphosphaeria*, and *Anabaena* (blue-green algae). Diatoms comprised 50 percent of the phytoplankton population in Conowingo Pond. Green algae were common in August and September, brown algae in October, diatoms in June and July, and blue-green algae in September.

The zooplankton community in Conowingo Pond was evaluated in studies conducted between 1966 and 1978 (RMC 1979). The community was comprised of 53 species, and was numerically dominated by six taxa: the water fleas *Diaphanosoma leuchtenbergianum, Daphnia spp.,* and *Bosmina longirostris*, the cyclopoid copepod *Cyclops vernalis*, *cyclopoid copepodids*, and general *copepod nauplii*. The mean monthly density of these dominant taxa was greatest between the months of June and September, with densities exceeding 100 individuals/L (RMC 1979). Densities averaged less than three individuals/L from November through May.

Susquehanna River below Conowingo Dam

Drift net sampling conducted from 1982 to 1984 showed densities varied from month to month between 91 individuals per cubic meter in July to 10 per cubic meter in September. The collection effort produced a total of 20 taxa (all stations/dates combined). However, only four taxa were numerous enough to represent at least 5% of the total during at least one of the months sampled; these taxa were *Leptodora* (70.6%), Chironimidae (15.8%), *Hydroptila* (2.8%), and *Cheumatopsyphe* (1.6%).

Leptodora kindti is a limnetic crustacean (found in the water column) was particularly abundant in the July collections (76 per cubic meter; 82.6% of the total). A zooplankter adapted to lakes and ponds, it represents a Conowingo Pond out-migrant that serves as a transported food item. They are large for a planktonic organism (attaining a length of nearly 1 milimeter when fully mature), are predatory, and are attracted to aquatic vegetation. Stomach content analysis showed that *L. kindti* were preyed upon in large numbers by white perch.

The phantom midge (*Chaoborus punctipennis*) is another drift organism that was not as abundant and was found in the diet of white perch and bluegill. *Chaoborus* are a limnetic form present in large numbers in Conowingo Pond. Predatory, they are mobile swimmers that migrate vertically into the water column after dark, becoming subject to passage downstream during generation. Their presence, along with *L. kindti* illustrates the contribution that organisms in flow releases from Conowingo Pond make to the forage base available to the fish found below the dam.

Detailed stomach analyses of individuals of three common fish (white perch, channel catfish, and yellow perch) taken by electrofishing in the tailrace below Conowingo Dam in July through December of 1982 and 1983 were reported by Weisberg and Janicki (1985). Small zooplankters were abundant in white perch stomachs, but caddisfly larva (*Cheumatopsyche*) and chironomid larva were more important on a frequency basis, with caddisfly larvae most important based on percent of the biomass eaten. Chironomids were most important to channel catfish numerically and on a frequency of occurrence basis. However, similar to white perch, caddis larva formed most of the diet biomass. The amphipod *Gammarus* was the most important food of yellow perch (Normandeau Associates and GSE 2012m).

The fishes examined appeared to utilize both autochthonous food resources (primarily benthic taxa) and allochthonous food resources (organisms originating and transported from areas other than the sampling location, likely from above Conowingo Dam and available in the drift). Major drift taxa from Conowingo Pond, as reported by Weisberg and Janicki (1985), were the large zooplankters *Leptodora* and *Chaoborus*, similar to those found by RMC in 1982 (RMC 1985a). However, the food habit studies concluded that benthic taxa originating from below Conowingo Dam (chironomids and *Cheumatopsyche*) were more important to these three species.

Zooplankton Prey for Alewife and Blueback Herring

Potential effects of dams on river herring species include impacts to prey resources or access to prey. Conowingo Dam, however, does not appear to negatively impact zooplankton prey. In Conowingo pond the zooplankton community was composed of 53 species, and was numerically dominated by six taxa: the water fleas *Diaphanosoma leuchtenbergianum*, *Daphnia spp.*, and *Bosmina longirostris*, the cyclopoid copepod *Cyclops vernalis*, *cyclopoid copepodids*, and general *copepod nauplii* (RMC 1979). These taxa represent favorable prey for all life stages of river herring. The mean monthly density of these dominant taxa was greatest between the months of June and September, with densities exceeding 100 individuals/L (RMC 1979).

3.3.3.1.7 *Habitat*

Physical habitat affected by the Conowingo Project extends from the Holtwood Dam tailrace in Pennsylvania (RM 24 to the tidal confluence at the downstream end of Spencer Island (RM 6). Figures 3.3.3.1.7-1 and 3.3.3.1.7-2 show the major islands and tributaries in this region of the Susquehanna River above and below Conowingo Dam, respectively. Aquatic habitat was described in several licensing studies, including RSP 3.12 – Water Level Management Study (URS Corporation and Gomez and Sullivan 2012a); RSP 3.13 – Tributary Access in Conowingo Pond (Normandeau Associates and GSE 2012l), and RSP 3.16 – Instream Flow Habitat Assessment below Conowingo Dam (GSE and Normandeau Associates 2012b). Aquatic species' physical habitat and expected habitat utilization is described in the following sections.

Conowingo Pond Habitat

Conowingo Pond is often characterized in terms of a lower and upper section. The upper Pond (RM 24 to RM 21) is characterized by potholes, deep channels carved into the bedrock and rugged island rock formations. Alluvial tails are present immediately downstream of the islands where the river has deposited sediment. The majority of the upper reach is relatively shallow (6.5 to 20 ft), and the river bed just below the Holtwood Dam is often exposed. However, a few potholes with approximately 100 foot depths occur along the upper Pond's eastern shoreline. For the lower pond (RM 21 to RM 10), the river channel below Hennery Island broadens significantly into a lentic environment with greater average depths and lower water velocities. Only one bedrock island, Mount Johnson Island, is found above-water in the lower Pond. Muddy Run and Holtwood Dam operations are the primary hydraulic influences in the upper Pond; Project operations have limited effect on upper Pond water levels. Conversely, Project operations are the primary hydraulic influence in the lower Pond.

Given the Project's limited influence on upper Pond hydraulics, the effect of Project operations on Conowingo Pond extends from Hennery Island (RM 21) downstream to Conowingo Dam (RM 10). A habitat assessment and water level analysis was conducted along this reach in 2010 (URS Corporation and GSE 2012a). This study involved collecting bathymetric and substrate information as well as existing submerged aquatic vegetation (SAV) and emergent aquatic vegetation (EAV) data. This information was combined with historic water level fluctuation data to assess the Project's effects on SAV and EAV growth and aquatic species' use of Conowingo Pond's littoral zone. Potential SAV and EAV growth and distribution effects are discussed in Section 3.3.4.1.4. Potential effects on habitat utilization by aquatic species are discussed here.

Principal Conowingo Pond resident species for which habitat was assessed include gizzard shad, largemouth bass, smallmouth bass, walleye, channel catfish, and several minnow species, including spotfin shiner, spottail shiner, and bluntnose minnow.

Table 3.3.3.1.7-1 presents each resident species/life stages' habitat preferences. Most species' spawning habitat occurs over shallow vegetated and unvegetated gravel substrates. Gizzard shad and channel catfish will also spawn over shallow sandy habitat. Shallow unvegetated gravel substrates and shallow vegetated sand substrates are most adult life stages' preferred environments. Adult gizzard shad, largemouth bass, channel catfish, and minnows also prefer shallow silt substrates containing vegetation.

Littoral substrate varied within the lower Pond area from alluvial fine grained sand and silt deposits (including fine coal particles) to bedrock and boulder dominated shorelines. The total area of dominant substrate was grouped in broad categories from field observations made using the modified Wentworth classification system. Figure 3.3.3.1.7-3 presents a study area extent map showing the dominant substrate types recorded during the August 2010 habitat survey.

The eastern shoreline in the upper portion of the lower Pond contains large alluvial deposits of sand and silt. Within this area are several "coves" where the river widens and the littoral zone bathymetry is flat, permitting the accumulation of fine-grained sediment. However, along the Pond shorelines and the majority of the Mt. Johnson Island perimeter (i.e., at and directly adjacent to the 110.2 foot water elevation), the substrate is composed primarily of larger diameter gravel (primarily cobble).

An area of accretion was detected northwest of Mt. Johnson Island. The substrate in this shallow offshore area consisted predominately of sand. A similar offshore depositional band of sand-dominated substrate is present south of Mt. Johnson Island and east of the PBAPS thermal discharge canal. Along the lower portion of the eastern shore (below the PA/MD state line), littoral substrate transitions to cobble- and boulder-dominated, steeply sloping shorelines, and a general absence of aquatic vegetation. Shallow littoral substrate generally consists of boulder, while deeper littoral substrate is dominated by cobble. Substrate found within the littoral zone of Conowingo Creek is mainly limited to fine grained deposits along bedrock-dominated shorelines. Dominant substrate at the mouth of the Conowingo Creek includes silt and very fine sand.

The western shoreline contains a variable littoral substrate composition within the upper portion of the lower Pond. The majority of the littoral shoreline is composed of gravel or bedrock. In some areas, silt is present in deeper water adjacent to the shallow gravel dominated zone. A large portion of anthropogenically altered shoreline is present within the upper portion of the western shoreline of the lower Pond, including wooden bulkhead walls along residential communities and rip-rap fill material along the shoreline abutting the PBAPS. Along the lower portion of the western shoreline (below PA/MD state line), littoral substrate consists largely of bedrock formed by steep bedrock outcrops that extend below the water surface. Littoral substrate within Broad Creek was similar to Pond substrates along the lower reach of the western shoreline. Bedrock dominated much of the shoreline extending upstream from the mouth approximately 2,700 feet. Vertical bedrock cliffs were present along the lower shoreline of Broad Creek, where the thalweg elevation averaged approximately 90 feet. Within this transition area of Broad Creek, deep littoral substrate is dominated by silt, while shallow littoral substrate is comprised mainly of bedrock, and secondarily by silt.

In general, few EAV areas were identified in the study area during the August 2010 habitat survey. SAV communities were more extensive in the study area. Figure 3.3.3.1.7-4 presents a study area extent map indicating locations of littoral zone SAV beds. Generally, these SAV beds were co-located with unconsolidated alluvial deposits in the upper portion of the lower Pond. Dense beds were observed to be most prevalent in the littoral zone of the eastern shoreline, particularly in the upper portion of the lower Pond. The heaviest concentrations of SAV were present in the “coves” associated with the confluences of Fishing Creek and Peters Creek. In addition, a large SAV bed was observed growing within the accretionary expanse below Mt. Johnson Island.

In contrast with the Pond’s eastern shoreline, the spatial coverage and density of the western shoreline SAV community is significantly less. The lower areal coverage of SAV along the western portion of the Pond can be attributed to the sharply sloping shorelines and bedrock-dominated substrates.

Submerged vegetation was present along the eastern shoreline of Conowingo Creek and directly above its confluence with Conowingo Pond. These areas are characterized by minimal SAV growth. Growth of SAV (mainly hydrilla) in Broad Creek was restricted to a small area along the southern shoreline of the creek below the Route 623 (Flintville Road) bridge. The relatively steep shorelines and deep water depths likely limit the growth of SAV in the surveyed area of Broad Creek.

Littoral Zone Habitat

Water elevation data collected at half-hourly intervals for Conowingo Pond from January 2004 to September 2010 revealed that water levels were maintained between elevation 109.5 and 106.2 feet 90% of the time based on monthly averages. Maximum and minimum observed water levels from the entire data set of 30-minute water elevations were 110.1 feet and 104.7 feet, respectively.

Substrate composition was variable throughout the Conowingo Pond's littoral zone, particularly in the upper portion where depositional areas and fine-grained sediments were more prominent. The aerial coverage of the littoral zone's various substrate types is presented graphically in Figure 3.3.3.1.7-5. As evidenced from the figure, bedrock and gravel (primarily boulder) dominate the littoral habitat in the Pond's upper fluctuation range (110.2 feet to 106 feet). Within the permitted fluctuation range in the study area, however, this elevation range comprises only 73.7 acres (16.2%) of the total littoral habitat (453.48 acres). The relative proportions of sand and silt increase substantially over the lower (106 feet to 101.2 feet) elevation fluctuation range, which comprises 379.8 acres, or 83.8% of the total littoral habitat. The greatest amount of available habitat (98.3 acres) is in the 104-105 foot elevation range. Approximately 60% of the littoral habitat within the 104-105 foot interval is composed of sand. Bedrock habitat was generally consistent in extent throughout the the licensed fluctuation range (110.2 feet to 101.2 feet), comprising between 0.5 and 5.0 acres.

The extent and coverage of SAV within the study area was broad, particularly in areas of unconsolidated substrates in the study area's upper portion (e.g., near Fishing Creek and Peters Creek, and below Mt. Johnson Island) (Figure 3.3.3.1.7-4). The five most common SAV species observed within the study area of the Pond covered 320.8 total acres, with hydrilla identified as the dominant species in 292.0 acres of the total SAV cover (91%).

Figure 3.3.3.1.7-6 depicts the relationship between water level and total area of SAV. The extent of SAV decreases very little between elevation 110.2 and 106 feet. More consistant declines in SAV extent occur at a water surface elevation of approximately 106 feet. The loss of SAV cover continues to elevation 102, with a less pronounced rate of decrease to elevation 101.2. Coverage of SAV is greatest at Pond elevations between 104 feet and 105 feet, with total coverage of approximately 86 acres of the 98 total acres of littoral habitat available in this interval.

SAV growth within specific substrate categories throughout the fluctuation range preferred sand, as evidenced in Table 3.3.3.1.7-2. Gravel and silt also provided substantive habitat for SAV growth, but to a lesser degree than sand. Between water surface elevation 110.2 feet and 105 feet, sand accounts for 46-50% of the substrate type containing SAV growth. Reductions in water level below these elevations reduce the amount of SAV in sand, from 18-32%. Between elevations 110.2 feet and 104 feet, SAV coverage at each water elevation is highly consistent (26-30%). Growth of SAV in silt is also consistent across surface water elevations between 110.2 feet and 105 feet (21-28%). At lower elevations, silt is the primary substrate for SAV growth (e.g., 77% of SAV growth in the study area at elevation 102 feet was in silt).

Tributary Habitat and Access

Exelon assessed tributary access in Conowingo Pond (Normandeau Associates and GSE 2012l). Two Conowingo Pond tributary access surveys for recreational boaters and fishes were conducted between June 29 and July 30, 2010; one at a pool elevation of 109.2 ft and the other at a minimum recreational pool elevation (107.2 ft). Additional data were as recorded on September 18, 2010 when a pool level of about 106.2 ft was maintained for several hours due to an unrelated study. A total of 18 tributaries were surveyed (nine backwater and nine shoreline). Backwater tributaries are characterized by a broad mouth at their point of confluence with Conowingo Pond. Shoreline tributaries are narrower and end abruptly at their point of confluence with the Pond.

The majority of Conowingo Pond's resident fish are warm water species that prefer the conditions found in the Pond's open waters. A few resident fish such as white suckers (*Catostomus commersoni*) may seek out some of the larger tributaries in early spring when tributary temperatures rise above river temperature, but the majority of Conowingo Pond's resident fishes do not require tributary access to spawn or feed. The shallow shoreline areas of Conowingo Pond's backwater tributaries and coves provide spawning habitat for most members of the sunfish (Centrachidae) and catfish (Ictaluridae) families, and also provide nursery areas for a multitude of species. During the summer months, large schools of young gizzard shad (*Dorosoma cepedianum*) are often observed near the water surface in these backwater tributaries.

A 3.4-foot pond fluctuation during the present study did not reveal any migration barriers that were not apparent at full pool elevation (109.2 ft). A 6- to 10-foot-high waterfall 0.6 mi above the Fishing Creek mouth forms a natural barrier to fish movement from the Pond. Steep cascades in Peters Creek (1.3 miles upstream of mouth), Conowingo Creek (0.5 miles upstream of mouth), and Muddy Creek (1.5 miles above mouth) are natural obstacles to migrating adult fish.

Habitat Downstream of Conowingo Dam

The description of the affected environment downstream of Conowingo Dam includes the reach of the Susquehanna River from Conowingo Dam (RM 10) to the downstream end of Spencer Island, a length of approximately 4.5 miles (Figure 3.3.3.1.7-2). Major tributaries to this reach include Octoraro (RM 9) and Deer Creeks (RM 6). The lower end of the affected reach, from the upstream end of Robert Island (RM 6) to the downstream end of Spencer Island experiences some tidal influence, while the Susquehanna River downstream of Spencer Island is primarily tidally influenced. The general habitat features in the reach from Rowland Island (RM 9) downstream to McGibney Island (RM 6) is shown in Figure 3.3.3.1.7-7 with an area of detail shown in the vicinity of Octoraro Creek in Figure 3.3.3.1.7-8.

The reach from Conowingo Dam to the downstream end of Spencer Island was the subject of RSP 3.16 – Instream Flow Habitat Assessment below Conowingo Dam (GSE and Normandeau Associates 2012b). The study determined the relationship between flow and aquatic habitat conditions below Conowingo Dam. Species evaluated in the study, along with their expected periodicity, are listed in Table 3.3.3.1.7-3. This analysis considered several "species of special concern," which were analyzed separately as opposed to in habitat guilds (which were also analyzed). An analysis of the relationship between flow and habitat for fish and invertebrates was carried out using a calibrated, two dimensional hydraulic model (River2D) and habitat suitability information (i.e. species preferences for depth, velocity and substrate) developed in consultation with the licensing stakeholders. In addition, a separate analysis was conducted using the hydraulic model output to assess habitat for mussel species.

The relationship between flow and aquatic habitat in the Conowingo Dam to Spencer Island reach is illustrated in Table 3.3.3.1.7-4 and graphically for each month of the year in Figures 3.3.3.1.7-9 through 3.3.3.1.7-20. Table 3.3.3.1.7-4 illustrates the flow for each lifestage at which overall habitat is maximized as well as the range of flows that provide 60, 70, 80, and 90 percent of the overall maximum habitat value. Figures 3.3.3.1.7-9 through 3.3.3.1.7-20 provide similar information but also provide the context of expected unregulated flows at Conowingo Dam.

The current flow regime below Conowingo Dam was formally established with the signing of a settlement agreement in 1989 between the Project owners and several Federal and state resource agencies. The existing minimum flows, based on the referenced agreement, are as follows:

- **Mar 1- Mar 31:** 3,500 cfs or natural inflow,[26] whichever is less
- **Apr 1 – Apr 30:** 10,000 cfs or natural inflow, whichever is less
- **May 1 – May 31:** 7,500 cfs or natural inflow, whichever is less
- **Jun 1 – Sep 14:** 5,000 cfs or natural inflow, whichever is less
- **Sep 15 – Nov 30:** 3,500 cfs or natural inflow, whichever is less
- **Dec 1 – Feb 28:** 3,500 cfs intermittent (maximum six hours off followed by equal amount on)

During periods of regional drought and low river flow, Exelon has requested and received FERC approval for a temporary variance in the required minimum flow release from Conowingo Pond. Specifically, this variance, which was requested six times over the period 1999 – 2011, allows Exelon to include leakage (approximately 800 cfs) as part of the minimum flow discharge. Table 3.3.3.1.7-5 quantifies the habitat

[26] As measured at the Susquehanna River at Marietta, USGS Gage No. 0157600

available for the various species and life stages at the current minimum flows as a percentage of the maximum potential habitat at any flow.

The overall habitat analysis has value in understanding the habitat vs. flow relationship. However, it does not provide insight into the overall habitat quality or how the habitat location and quality may shift with flow. Appendix E of the RSP 3.16 report includes habitat maps that show habitat quality and location over a wide range of flows.

Steady-State Habitat Analyses

The amount of aquatic habitat for a given species/life stage of fish was calculated using the River 2D program described in RSP 3.16 – Instream Flow Habitat Assessment below Conowingo Dam (GSE and Normandeau Associates 2012b). Habitat was quantified spatially throughout the study reach at 14 steady-state flows (2,000 cfs, 3,500 cfs, 5,000 cfs, 7,500 cfs, 10,000 cfs, 15,000 cfs, 20,000 cfs, 30,000 cfs, 40,000 cfs, 50,000 cfs, 60,000 cfs, 70,000 cfs, 80,000 cfs, 86,000 cfs) which encompassed Conowingo's normal operating flow range. The following sub-sections describe select species/life stages' habitat throughout the study reach at several flows. The flows described include each minimum flow the species/life stage experiences (e.g., American shad spawning/incubation experiences 10,000 cfs in April, 7,500 cfs in May and 5,000 cfs in June) as well as the powerhouse's maximum flow (86,000 cfs).

American Shad

Figure 3.3.3.1.7.21 illustrates American shad spawning habitat location and quality at river flows of 10,000 cfs (April), 7,500 cfs (May), 5,000 cfs (June), and 86,000 cfs (plant design flow). High quality (combined suitability greater than 0.75) American shad spawning habitat between 5,000 cfs and 10,000 cfs is limited to an isolated area southwest of Bird Island. At 86,000 cfs, however, the area southwest of Bird Island is low quality (combined suitability less than 0.5) habitat. High quality habitat areas at 86,000 cfs are present downstream of Rowland Island, near the mouth of Octoraro Creek and between Robert, Wood and Spencer Islands.

Figure 3.3.3.1.7.22 illustrates American shad fry habitat location and quality at river flows of 7,500 cfs (May), 5,000 cfs (June) and 86,000 cfs (plant design flow). High quality American shad fry habitat between 5,000 cfs and 7,500 cfs is found in a small area southwest of Bird Island, near the mouth of Octoraro Creek, downstream of Robert Island and downstream of Snake Island. At 86,000 cfs, high quality habitat areas are present near the mouth of Octoraro Creek, between Robert, Wood and Spencer Islands and downstream of Steel Island. A moderate quality (combined suitability between 0.5 and 0.75) habitat area is also located downstream of Rowland Island at 86,000 cfs.

Figure 3.3.3.1.7.23 illustrates American shad juvenile habitat location and quality at river flows of 5,000 cfs (June-September 14), 3,500 cfs (September 15-November) and 86,000 cfs (plant design flow). High quality American shad juvenile habitat between 3,500 cfs and 5,000 cfs is found downstream of Rowland Island, in a small area southwest of Bird Island, near the mouth of Octoraro Creek, downstream of Robert Island and downstream of Snake Island. At 86,000 cfs, high quality habitat areas are present near the mouth of Octoraro Creek, between Robert, Wood and Spencer Islands, and downstream of Steel Island.

Figure 3.3.3.1.7.24 illustrates American shad adult habitat location and quality at river flows of 10,000 cfs (April), 7,500 cfs (May), 5,000 cfs (June and July), and 86,000 cfs (plant design flow). High quality American shad adult habitat between 5,000 cfs and 10,000 cfs is limited to a small area southwest of Bird Island and near the mouth of Octoraro Creek. Moderate quality American shad adult habitat between 5,000 cfs and 10,000 cfs is found between Robert, Wood, and Spencer Islands and downstream of Snake Island. At 86,000 cfs, high quality habitat areas are present near the mouth of Octoraro Creek, downstream of Rowland Island and between Robert, Wood and Spencer Islands, and downstream of Steel Island.

Shortnose Sturgeon

Figure 3.3.3.1.7.25 illustrates shortnose sturgeon spawning habitat location and quality at river flows of 10,000 cfs (April), 7,500 cfs (May), and 86,000 cfs (plant design flow). High quality shortnose sturgeon spawning habitat between 7,500 cfs and 10,000 cfs is limited to an isolated area southwest of Bird Island. At 86,000 cfs, however, the area of high quality habitat southwest of Bird Island is reduced in size. Moderate habitat between 7,500 cfs and 10,000 cfs also exists downstream of Rowland Island and near the mouth of Octoraro Creek. High quality habitat areas at 86,000 cfs are present downstream of Rowland Island, near the mouth of Octoraro Creek and between Robert, Wood, and Spencer Islands.

Figure 3.3.3.1.7.26 illustrates shortnose sturgeon fry habitat location and quality at river flows of 7,500 cfs (May), 5,000 cfs (June - July) and 86,000 cfs (plant design flow). High quality shortnose sturgeon fry habitat between 5,000 cfs and 7,500 cfs is not found anywhere in the study area. Some poor-to-moderate quality habitat between 5,000 cfs and 7,500 cfs is found downstream of Rowland Island, southwest of Bird Island, downstream of Robert Island and downstream of Snake Island. At 86,000 cfs, there are no high-quality habitat areas, but some moderate habitat areas are present near the mouth of Octoraro Creek, and between Robert, Wood, and Spencer Islands.

Figure 3.3.3.1.7.27 illustrates shortnose sturgeon juvenile and adult habitat location and quality at river flows of 10,000 cfs (April), 7,500 cfs (May), 5,000 cfs (June-September 14), 3,500 cfs (September 15-

November, March) and 86,000 cfs (plant design flow). High quality shortnose sturgeon juvenile and adult habitat between 3,500 cfs and 10,000 cfs is found downstream of Robert Island and downstream of Snake Island. Moderate habitat between 3,500 cfs and 10,000 cfs is found near the mouth of Octoraro Creek and southwest of Bird Island. At 86,000 cfs, high quality habitat areas are present near the mouth of Octoraro Creek, between Robert, Wood, and Spencer Islands, and downstream of Steel Island.

Striped Bass

Figure 3.3.3.1.7.28 illustrates striped bass spawning habitat location and quality at river flows of 10,000 cfs (April), 7,500 cfs (May), 5,000 cfs (June), and 86,000 cfs (plant design flow). High quality striped bass spawning habitat between 5,000 cfs and 10,000 cfs is found in a 1-mile stretch of the main river channel from the upstream end of Rowland Island to about a quarter-mile downstream of Bird Island. Other isolated high-quality habitat patches are also scattered along the river's East bank. At 86,000 cfs, the river's high quality habitat areas are present throughout most of the river, excluding the stretch of river that was high quality habitat at low flows.

Figure 3.3.3.1.7.29 illustrates striped bass fry habitat location and quality at river flows of 10,000 cfs (April), 7,500 cfs (May), 5,000 cfs (June-July), and 86,000 cfs (plant design flow). High quality striped bass fry habitat between 5,000 cfs and 10,000 cfs is found in a 1-mile stretch of the main river channel from the upstream end of Rowland Island to about a quarter-mile downstream of Bird Island. Other isolated high-quality habitat areas are also scattered along the river's left (East) bank. At 86,000 cfs, the river's high quality habitat areas are present throughout most of the river, excluding the stretch of river that was high quality habitat at low flows.

Figure 3.3.3.1.7.30 illustrates striped bass juvenile habitat location and quality at river flows of 5,000 cfs (June-September 14), 3,500 cfs (September 15-November), and 86,000 cfs (plant design flow). High quality striped bass juvenile habitat between 3,500 cfs and 5,000 cfs is found in an isolated patch southwest of Bird Island. The small area southwest of Bird Island is low quality habitat at 86,000 cfs. At 86,000 cfs, high quality habitat areas are present downstream of Rowland Island, near the mouth of Octoraro Creek, between Robert, Wood, and Spencer Islands, and downstream of Steel Island.

Figure 3.3.3.1.7.31 illustrates striped bass adult habitat location and quality at river flows of 10,000 cfs (April), 7,500 cfs (May), 5,000 cfs (June-September 14), 3,500 cfs (September 15-November, March), and 86,000 cfs (plant design flow). High quality striped bass adult habitat between 3,500 cfs and 10,000 cfs is found in a 1-mile stretch of the main river channel from the upstream end of Rowland Island to about a quarter-mile downstream of Bird Island. Other isolated high-quality habitat areas are also scattered along the river's East bank and in the tidal reach, particularly at 7,500 cfs and 10,000 cfs. At 86,000 cfs, high quality habitat areas are present throughout the entire study reach, except for the Conowingo Dam tailrace and the east channel that was high quality habitat at low flows.

Smallmouth Bass

Figure 3.3.3.1.7.32 illustrates smallmouth bass spawning habitat location and quality at river flows of 7,500 cfs (May), 5,000 cfs (June) and 86,000 cfs (plant design flow). High quality smallmouth bass spawning habitat between 5,000 cfs and 10,000 cfs is isolated to an area on the downstream tip of Robert Island, with a poor-to-moderate habitat area located just below Rowland Island. At 86,000 cfs, there was little to no high or moderate quality habitat in the entire study area.

Figure 3.3.3.1.7.33 illustrates smallmouth bass fry habitat location and quality at river flows of 5,000 cfs (June-July), and 86,000 cfs (plant design flow). There is little to no high or moderate quality smallmouth bass fry habitat at 5,000 cfs or 86,000 cfs.

Figure 3.3.3.1.7.34 illustrates smallmouth bass juvenile habitat location and quality at river flows of 5,000 cfs (June-September 14), 3,500 cfs (September 15-November), and 86,000 cfs (plant design flow). High quality smallmouth bass juvenile habitat between 3,500 cfs and 5,000 cfs is found downstream of Rowland Island, near the mouth of Octoraro Creek and between Robert and Wood Islands. At 86,000 cfs, there are little to no high quality habitat areas, though the Conowingo Dam spillway and shallower areas near Robert, Wood and Spencer Islands provide some moderate quality habitat.

Figure 3.3.3.1.7.35 illustrates smallmouth bass adult habitat location and quality at river flows of 10,000 cfs (April), 7,500 cfs (May), 5,000 cfs (June-September 14), 3,500 cfs (September 15-November, March), and 86,000 cfs (plant design flow). High quality smallmouth bass adult habitat between 3,500 cfs and 10,000 cfs is found near the mouth of Octoraro Creek, near the mouth of Deer Creek, and near the upstream end of Sterret Island. Moderate quality habitat is found in large areas throughout the study area at lower flows. At 86,000 cfs, high quality habitat is limited to the area between Robert and Wood Island, as well as a small area near the mouth of Deer Creek. Moderate quality habitat is also found in the Conowingo Dam spillway area at 86,000 cfs.

Macroinvertebrates

Figure 3.3.3.1.7-36 illustrates stonefly (plecoptera) habitat location and quality at river flows of 3,500 cfs (March, September 15-November), 10,000 cfs (April), 7,500 cfs (May), and 5,000 cfs (June-September 14). High quality stonefly habitat between 3,500 cfs and 10,000 cfs is found downstream of Rowland

Island and near the mouth of Octoraro Creek. Moderate quality habitat is found near the mouth of Deer Creek at 3,500 cfs and 5,000 cfs, but it decreases in quality at higher flows. Almost no high or moderate quality habitat is found in the study reach at 86,000 cfs.

Figure 3.3.3.1.7-37 illustrates mayfly (ephemeroptera) habitat location and quality at river flows of 3,500 cfs (March, September 15-November), 10,000 cfs (April), 7,500 cfs (May), and 5,000 cfs (June-September 14). High quality mayfly habitat between 3,500 cfs and 10,000 cfs is found downstream of Rowland Island and near the mouth of Octoraro Creek. Moderate quality habitat is found near the mouth of Deer Creek and near the upstream end of Sterret Island at 3,500 cfs and 5,000 cfs. Almost no high or moderate quality habitat is found in the study reach at 86,000 cfs.

Figure 3.3.3.1.7-38 illustrates caddisfly (trichoptera) habitat location and quality at river flows of 3,500 cfs (March, September 15-November), 10,000 cfs (April), 7,500 cfs (May), and 5,000 cfs (June-September 14). High quality caddisfly habitat between 3,500 cfs and 10,000 cfs is found downstream of Rowland Island, near the mouths of Octoraro and Deer Creeks, southwest of Bird Island, half a mile downstream of Mud Island, near the upstream end of Sterret Island, along the eastern edge of Robert Island and downstream of Snake Island. At 86,000 cfs, high quality habitat is found near the mouth of Octoraro Creek and between Robert, Wood, and Spencer Islands, with some moderate habitat downstream of Rowland Island, near the mouth of Deer Creek and near the upstream end of Wood Island.

Alewife and Blueback Herring

Alewife and blueback herring were not target species, but were included in the Deep-Slow and Shallow-Slow guilds in the Instream Flow Habitat Assessment, depending on species, life stage and seaonality (see Table 3.3.3.1.7-3). Where the species are sympatric, alewife and blueback herring may use separate spawning sites to reduce competition (Loesch 1987). Alewife spawning habitat is often in slow-moving water in streams, coastal ponds and lakes. Blueback herring tend to select the swifter main stream flow, and gravel and clean sand substrates for spawning (Loesch and Lund 1977, Loesch 1987, Klauda et al. 1991b, Greene et al. 2009).

The relationship between flow and aquatic habitat in the Conowingo Dam to Spencer Island reach for the period that river herring are present (April – October) is illustrated graphically for each month of the year in Figures 3.3.3.1.7-12 through 3.3.3.1.7-18. Little spawning habitat appears to exist during the spawning season, but the proportion of available rearing habitat tends to increase seasonally as natural river flows diminish. Despite the modeled habitat availability, however, river herring (not identified to species) were collected in relatively high densities in 1980's ichthyoplankton surveys (RMC 1985a,b,c), contributing

24% of the total ichthyoplankton collected. Eggs and larval life stages were collected throughout the upper and lower riverine reaches as well as the upper tidal reach. The greatest density of eggs was collected in the upper riverine section and the greatest density of postlarvae was collected in the upper tidal reach, suggesting that young river herring were transported down river to more extensive rearing habitat. More recently there is little information due to declining stocks of river herring; however those declines are likely attributable to sources unrelated to Conowingo Project operations. Populations of blueback herring have been declining in the northeast due to a number of potential causes including habitat loss, targeted catch or bycatch at sea via commercial fishing, and increased numbers of striped bass and other types of predators (ASMFC 2009).

Conowingo Spillway Habitat

The spillway reach below Conowingo Dam is an off-channel habitat that contains areas with both low-relief substrate and areas with extremely rugged, high-relief substrate. Substrate in low-relief areas is a mix of gravel, cobbles, and small boulders (Figure 3.3.3.1.7-39). The more rugged areas feature very large boulders and/or bedrock outcrops (Figure 3.3.3.1.7-40). At prevailing minimum flows, the low-relief areas retain pools of various size that are generally shallow and wadeable, whereas the high-relief areas retain pools also variable in size but which can be deep and not wadeable.

The spillway reach is watered by daily generation to a level that depends on natural river inflow, operations of upstream hydroeletric dams, and electricity load demand. When station load is reduced (down-ramping) and river stage declines, the spillway reach begins to drain downstream (longitudinally) and laterally towards the tailrace. The most conspicuous drainage occurs as a large pooled area immediately below the spillway structure flows rapidly toward the tailrace past the concrete wing wall adjacent to the EFL. Drainage laterally toward and into the tailrace also occurs at several locations approximately 1,200-2,400 feet below Conowingo Dam. Spillway-reach stage generally declines most rapidly in the first hour following station load reduction, although the rate of decline varies with the number of generating units taken off line.

3.3.3.2 Environmental Effects

3.3.3.2.1 *Entrainment, Impingement, and Mortality*

Resident Fish

For Exelon's proposed alternative, the overall entrainment and impingement impacts on resident fishes is expected to be moderate for gizzard shad and low for all other target species (bluegill, channel catfish, largemouth bass, smallmouth bass, and walleye). Entrainment potential is low for bluegill, channel catfish, largemouth bass, smallmouth bass, and walleye due to characteristics of the Project (deep intakes and intake flow velocity), combined with habitat preferences (littoral zone species) and life history traits (*e.g.*, burst swim speeds) of the fish.

Fish impingement would be unlikely for most target species during generation given the wide bar rack spacing and relatively deep intake. Fish lacking the swimming ability to avoid the intakes would be expected to pass through the bar racks and not be impinged upon them.

Under Exelon's proposed alternative, passage survival through the Francis units 1-7 is expected to be High (100-95%) for juvenile bluegill; High to Moderate-High (100-90%) for juvenile channel catfish and smallmouth bass; High to Moderate (100-85%) for juvenile gizzard shad, largemouth bass and walleye. Adult bluegill and smallmouth bass survival is expected to be Moderate-High to Low-Moderate (95-80%); adult channel catfish, gizzard shad, and largemouth bass were rated Moderate-High to Low (95-<80%); and adult walleye were rated Moderate to Low (90-<80%).

Passage survival of juvenile fish passing the Kaplan units 8-11 is expected to be High (100-95%) for bluegill, channel catfish, and smallmouth bass; High to Moderate (95-90%) for juvenile gizzard shad, largemouth bass; and walleye. Survival for adult life stages is expected to be High to Moderate (95-90%) for bluegill and smallmouth bass, High to Low (100-<80%) for channel catfish; Moderate-High to Low-Moderate (95-80%) for gizzard shad and largemouth bass; and Moderate-High to Low (95-<80%) for walleye, the largest of the adult life stages.

Passage survival through the two (2) house turbines is anticipated to be Moderate-High (95-90%) for bluegill, Moderate-High to Low-Moderate (95-80%) for channel catfish and smallmouth bass, and Moderate-High to Low (95-<80%) for gizzard shad, largemouth bass, and walleye. For the adult life stage, bluegill and channel catfish are expected to have the highest survival potential at Moderate-High to Low (95-<80%), smallmouth bass rated Moderate to Low (90-<80%) and the remainder (gizzard shad, largemouth bass, and walleye) received a survival potential rating of Low (<80%).

3.3.3.2.2 *Fish Passage for Migratory Species*

Upstream Fish Passage

<u>In-River Fish Passage Impediments (Velocity Barriers)</u>

Hydraulic model outputs for Project discharges of 10,000 and 40,000 cfs, indicate that there are relatively few areas within the approximately 4 mile non-tidal river reach where velocities were greater than the burst speeds of American shad and river herring (Normandeau Associates and GSE 2012h). American shad and river herrings exhibit burst swim speeds of at least, if not greater than, six fps. There were also significant areas of passage where the velocity was below burst speed and in the range of sustained or prolonged swim speeds.

At the maximum Project generation discharge of 86,000 cfs, hydraulic modeling did indicate several areas of higher velocities approaching as high as seven to nine fps. These highest velocities were concentrated primarily in the tailrace and both sides of Rowland Island, and could impede upstream migration based on a comparison to burst swim speeds. However, radio telemetry data indicate that regardless of Project discharge, tagged adult American shad migrated upstream with little observable difficulty. Overall, 130 separate upstream forays were completed by 68 individual radio tagged American shad during the spring of 2010. These forays were accomplished during Conowingo Dam discharges ranging between 8,618 and 82,085 cfs. There was no clear indication that migratory behavior or movement to the immediate vicinity of Conowingo Dam and Powerhouse was adversely influenced by operations of Conowingo Dam in the approximate 4-mile river reach below the tailrace. Variations in migration times did occur among upstream forays but these did not positively correlate to Conowingo Dam discharge.

Exelon conducted additional radio telemetry data collection in the spring of 2012, which will provide additional insights on the velocity barrier issue. A study report analyzing this information is expected to be completed by September 30, 2012.

East Fish Lift

Operation of the EFL as an upstream volitional passage facility for adult American shad, as well as other resident and migratory species, will continue under Exelon's proposed alternative. The EFL has been in operation since 1991. Remaining life expectancy on the EFL will be up to 25 – 30 years (from present) with the implementation of the proposed preventive maintenance plan. Details of the maintenance plan are described in Appendix B of Exhibit E.

Exelon's proposal may directly or indirectly influence the effectiveness of the EFL in providing upstream volitional passage for adult American shad, as well as other resident and migratory species. Radio telemetry data collected in 2010 indicates that (65 of 89) 73% of adult American shad that migrated to the Project tailrace entered into the EFL. However, (40 of 89) 45% of those adult American shad that migrated to the Project tailrace successfully completed passage through the EFL (Normandeau and GSE 2011).

Statistical analysis of hourly American shad passage data and station generation scenarios for the 2001 through 2010 migration seasons did not reveal a meaningful overall relationship between the two parameters (Normandeau and GSE 2012s).

A detailed review of the 2010 radio-telemetry data (Normandeau and GSE 2012t) indicated that a higher percentage of shad successfully entered and/or passed through the EFL (in 2010) at turbine discharges less than 36,000 cfs. However, natural river flows, inflows to Conowingo Pond, and power demand determine to what extent the Project can discharge a specific amount of water over a certain period of time. Therefore, an attempt was made to identify specific turbine combinations with higher discharges that result in adequate shad passage as well as improve passage conditions within the EFL.

The analysis of the 2010 radio-telemetry data suggests that further study of at least 2 turbine scenarios (4 Francis + 1 Kaplan and 6 Francis + 3 Kaplan) is warranted to investigate potential improvements to EFL passage . Although EFL operators dislike the flow pattern observed in the tailrace during the operation of 4 Francis units in conjunction with Kaplan unit 8 or 9, as this combination typically results in the formation of a large eddy that pushes attraction water from entrance gate C into the spillway immediately downstream of the wing wall. Eleven forays (4 successful, 7 unsuccessful) into the EFL occurred during this scenario in 2010. Generally, Kaplan units 8 and/or 9 were used more often, as Kaplan units 10 and 11 experienced mechanical problems in 2010.

Seven forays, 5 that were successful, occurred during the operation of 6 Francis and 3 Kaplan units. On May 7, EFL operations started with the turbine scenario of 4 Francis units and 1 Kaplan unit operating, resulting in the passage of 383 American shad, (2 were radio-tagged), in 6 hours. At approximately 1400 hrs, generation was switched to 6 Francis units and 3 Kaplan units, resulting in the passage of 1,960 American shad, (5 were radio-tagged) over the remaining 6 hours of operation. It is difficult to ascertain if the turbine scenario was solely responsible for the catch, but it may warrant further review. Also, on May 3, EFL operations started with only 2 Francis turbines in operation and resulted in the passage of 482 American shad in 5 hours, (2 were radio-tagged). At 1215 hrs, generation switched to the operation of all 7 Francis turbines plus 3 Kaplan turbines, resulting in the passage of 518 American shad over the remaining 6 hours of operation. During that time Kaplan unit 11 was operating at a 70% setting instead of the normal operational setting due to a mechanical issue. If one or 2 Kaplan turbines are able to operate at some type of reduced setting without damaging the turbine, it may be another option to consider in order to improve shad passage during periods of higher river flow when Kaplan turbine operation is necessary.

Exelon conducted an additional site-specific telemetry study in the spring of 2012 to provide more information on the effectiveness and efficiency of the EFL operation. Analysis of this information is expected to be completed by September 30, 2012. The 2012 telemetry data will also be used to analyze the relationship between station generation scenarios and fish passage success. This additional data will inform consideration of changes to EFL operations that may help to increase upstream shad passage at the Project.

West Fish Lift

Under Exelon's proposed alternative, the WFL would continue to operate in its current condition as a fish trapping, sorting, and egg production facility for American shad. The eggs are transferred to a hatchery in Pennsylvania where they are hatched and then stocked into the Susquehanna River basin in the early summer.

The WFL has been in operation since 1972 with no substantial upgrades or changes to its structure or operation. Remaining life expectancy on the WFL will be up to 15 years. According to the PFBC, the WFL is currently adequate to provide enough fish for spawning American shad at the site, and supporting the hatchery and stocking program (GSE and Normandeau Associates 2012a).

American Eel Passage

At Conowingo Dam, studies have been conducted by the USFWS from 2005 to 2011, utilizing a ramp facility located near the WFL to collect American eel. The annual catch at this facility ranged from 19 to 85,000 elvers. The larger catches occurred over the period 2008-2011. The number of yellow eels caught over this period ranged from 25 to 224. The size range of elvers and yellow eels caught from 2005 to 2011 was 76-225 mm and 256-770 mm, respectively.

Exelon collected eels at two locations in the spillway in 2010 and 2011. Of these locations, the location known as spillway 50 (extreme eastern side of the spillway) captured slightly more elvers (697) than the EFL spillway ramps (569). The overall size range of the elvers caught by Exelon was 92-188 mm; while the overall size range of yellow eels caught was 300-689 mm (Normandeau Associates and GSE 2012e).

Exelon proposes to construct an upstream trap and transport facility consisting of an eel ramp and collection facility on the west bank of the Conowingo tailrace, where catch rates have been higher than the two locations in the spillway. This facility would allow for upstream passage above York Haven Dam with transported eels released in small tributaries (approximately 50 feet wide) upstream of York Haven Dam that were previously stocked by the USFWS. Exelon anticipates that the cost of the upstream trap and transport program would be shared among the licensees of the four dams the eels would be required to pass. If this program proves successful, it could be expanded to other locations within the Lower Susquehanna River. Additional details related to the program would be developed in consultation with stakeholders.

Based on an estimated overall upstream passage efficiency calculated at a similar sized project (defined as the proportion of tagged eels released in the tailrace that later ascend the passage facility/ladder), the upstream passage efficiency of the trap-and-transport program from Conowingo Dam to upstream of York Haven would be expected to be between 36 and 43 percent. With an expected very low mortality associated with transport, the cumulative efficiency of transported fish upstream of York Haven (or any reasonable distance of transport) would remain constant between 36 and 43 percent (Normandeau Associates and GSE 2012e).

Alewife and Blueback Herring

Upstream passage effectiveness for river herring has not been assessed at Conowingo Dam. Telemetry data obtained for American shad is not considered to be a suitable proxy for river herring in estimating fish passage effectiveness as it appears that runs of river herring are more episodic in nature and generally of shorter duration (SRAFRC Reports, 1997-2003 and Table 1). Based on annual passage counts, the EFL is capable of passing more than 200,000 river herring in a single day of operation (SRAFRC Report 2001, May 4). Personal observations by EFL operating crews note that if herring are present in the Conowingo tailrace, the bulk of the run occurs during a very short period of time, (3 to 7 days), or on a single day.

As discussed above, hydraulic model outputs indicate that there are relatively few areas in the non-tidal river reach where water velocities were greater than the burst speeds of river herring (> 6 fps) resulting from discharges of 10,000 and 40,000 cfs (Normandeau Associates and GSE 2012h). Additionally there were significant areas of passage where the velocity was below burst speed and in the range of sustained or prolonged swim speeds. At the maximum Project generation discharge of 86,000 cfs, hydraulic modeling did indicate several areas of higher velocities approaching as high as seven to nine fps. These highest velocities were concentrated primarily in the tailrace and both sides of Rowland Island.

Downstream Fish Passage

Juvenile and Adult American Shad

Under Exelon's proposed alternative, downstream passage of juvenile and post-spawned adult American shad (and other herring species) would occur via the Conowingo Project turbines during the October-

November and June timeframes, respectively. Both site-specific survival and literature based studies indicate a relatively high survival rate for juvenile and adult American shad passing through the turbines.

Site-specific studies at Conowingo indicate a relatively high survival rate for juvenile American shad (~90% for passage through Francis units and ~95% for passage through the Kaplan units) passing through the turbines.

Based on studies at other hydroelectric projects and calculated survival rates, passage survival through the Francis and Kaplan units is expected to be Moderate-High to Low (95% to <80%) for adult American shad. Site-specific studies at Conowingo indicate a relatively high survival rate for adult American shad (~93% for passage through Francis units and ~86% for passage through the Kaplan units) passing through the turbines.

Adult American Eel

Adult American eel must move past the Project to complete their emigration to the sea in the fall and are, therefore, subject to entrainment. Based on studies at other hydroelectric projects and calculated survival rates, passage survival through the Francis and Kaplan units is expected to be Moderate-High to Low (95% to <80%) for adult American eel. In addition, site specific data (USFWS 2012) indicate that adult American eel survival at Conowingo ranges between 89.8% and 100%.

Exelon proposes to develop a downstream trap and transport program for outmigrating American eel. The specifics of the program have not been worked out as of the date of the draft license application. However, Exelon has assumed the program will start in two small tributaries (about 50 feet wide) upstream of York Haven Dam that were previously stocked by the USFWS. The downstream trap and transport measure would allow passage of trapped eels past multiple dams (York Haven, Safe Harbor, Holtwood, and Conowingo Dams and the Muddy Run Pumped Storage Project). Finally, while trapping efficiency is unknown, it is known that there is extremely high transport survival for adult eels and that large eels tend to resume migration after release. Therefore, the proposed alternative is anticipated to alleviate impacts related to downstream passage and survival of American eel. Exelon anticipates that the cost of the downstream trap and transport program would be shared among the licensees of the four dams the eels would be required to pass. Additional background and research information will need to be gathered to further refine aspects of the downstream trap and transport program before its implementation.

Juvenile and Adult Alewife and Blueback Herring

Downstream passage of juvenile and post-spawned adult river herring species would occur via the Conowingo Project turbines during the October-November and June time frames, respectively. Both site-specific survival and literature based studies indicate a relatively high survival rate for juvenile and adult American shad passing through the turbines. Juvenile American shad are considered to be a proxy for juvenile river herring, and adult American shad a conservative proxy given the differences in body size between adult American shad and adult river herring.

Site-specific studies at Conowingo indicate a relatively high survival rate for juvenile American shad (~90% for passage through Francis units and ~95% for passage through the Kaplan units) passing through the turbines. Site-specific studies at Conowingo indicate a relatively high survival rate for adult American shad (~93% for passage through Francis units and ~86% for passage through the Kaplan units) passing through the turbines.

3.3.3.2.3 *Effect of Reservoir Fluctuations on Aquatic Habitat*

Water level fluctuations in Conowingo Pond resulting from peaking operation of the Conowingo Project would continue under Exelon's proposed alternative. Shallow littoral zone and SAV habitat within the lower portion of Conowingo Pond would be most affected by drawdown below an elevation of 106 feet. Most shallow littoral habitat available for SAV growth is found below the elevation of 106 feet, and fluctuations below this level begin to decrease available habitat. Sand substrate, which is conducive for SAV growth, also begins to decline below elevation 106 feet, and is approximately halved with each successive one-foot water surface drawdown.

Although the current license conditions allow water levels to fluctuate between 101.2 feet and 110.2 feet (NGVD 1929), analyses conducted on historic Conowingo Pond water level elevation data indicate that water level fluctuations are primarily confined to water elevations between 107 feet and 109 feet, and do not typically fall below 106 feet during the growing season. Water level elevations below 106 feet typically occur over brief periods that typically do not overlap with the optimal timing for SAV growth (summer). During the summer months of June, July, and August, weekly average fluctuations are highly limited, with water elevations between 108.8 feet and 107.5 feet. This is likely due, in part, to the current license requirement to maintain a minimum summertime weekend surface water level elevation of 107.2 feet to satisfy recreational needs. As such, the potential for dewatering SAV-vegetated habitat in Conowingo Pond's littoral zone to the point where adverse effects could occur is considered minimal.

3.3.3.2.4 *Downstream Flow Regime and Peaking Flows*

Conowingo Project peaking operations, under Exelon's proposed alternative, would continue to alter flow on an intra-daily timeframe in the approximately four mile non-tidal reach below the Dam. Exelon's environmental analysis indicated that the minimum and generation flow combinations contained in the proposed alternative provided modest amounts of habitat for several of the immobile life stages of fish and macroinvertebrates evaluated in the study.

The relative amount of area suitable for mussel development appeared to be related to shear stress. Shear stress thresholds predicted that significant portions of the study area are not suitable for mussel development at high flows. This reach of the Susquehanna River experiences both natural high flow events (e.g., spring runoff freshet) and daily peaking flows. The shear stress analysis does not address which of these event types govern mussel presence or habitat, nor does it address the frequency, timing or duration of shear stress effects.

Most of these areas of fish and macroinvertebrate habitat and mussel occurrence were located downstream of Rowland Island, near the mouths of Octoraro and Deer Creeks, an area southwest of Bird Island, downstream of Snake Island and in-between Robert, Wood and Spencer Islands. These areas often provided unique combinations of depth, velocity and substrate, providing refugia for species and life stages that are not well suited for the conditions found in the river's main channel. Other than for striped bass, these areas often proved to be the highest quality habitat found in the river for the target species.

In addition, under Exelon's proposed alternative the current peaking operations of the Project would continue to have impacts relative to fish stranding in the Conowingo Dam spillway. Project operations result in a decrease in water level following peaking generation, when flow releases are reduced from generation flows to the minimum flow. Exelon conducted an analysis (Normandeau Associates and GSE 2012i) to determine fish stranding potential in the spillway reach below Conowingo Dam. During the three-season (spring, summer, and fall) survey, most stranded fish were noted during the summer (10,308) in the spillway study reach. Fewer stranded fish occurred in spring surveys (5,030) and in fall surveys (1,779). The numbers of dead fish documented were highest in spring (18% of the total) and less than 4% of the total in other seasons. Dead fish found in all seasons were primarily gizzard shad.

Stranded fish in spring were more common in the west side of the tailrace and were mostly adult-sized. Stranded fish, mostly small or juveniles, were documented primarily in east-side pools in summer and fall. Any larger individuals stranded in fall occurred mostly in west-side pools near the tailrace.

Resident fish species such as gizzard shad and common carp formed 90% or more of stranded fish. Low numbers of anadromous fish species such as American shad, river herring, and white perch were documented, and only in spring and early summer.

Young of many species, particularly of gizzard shad (57% of the total), accounted for the high fish abundance in the summer surveys. The spillway reach appears to represent an important habitat area used by numerous resident fish species in summer and into fall for rearing and growth.

Predation by several bird species on many fish species occurred each season. However, the risk of larger stranded fish dying due to predation in the fall is higher due to abundant birds, particularly bald eagles.

3.3.3.2.5 *Effects on Invasive Zebra Mussels and Other Exotics*

Under Exelon's proposed alternative, zebra mussel settlement within Conowingo Pond could potentially continue from veligers spawned in upstream impoundments/areas of the river.

3.3.3.2.6 *Effects on the Recruitment, Population Dynamics, and Habitat needs of Resident and Migratory Fishes*

Both historic and current fish population data collected within Conowingo Pond and in the Susquehanna River below Conowingo Dam indicate a healthy and robust fishery exists. In addition, data from creel surveys of Conowingo Pond and the Lower Susquehanna River show that a healthy year-round sport fishery is present.

Exelon's environmental analysis indicates that long-term (1972-2009) fish collections at the EFL and WFL are dominated by gizzard shad, channel catfish, common carp, and white perch, and are similar to those observed in electrofishing, gill net, and ichthyoplankton sampling conducted below Conowingo Dam during the 1980's.

Changes to the fish species assemblage are evident over the period studied (1972-2009). As gizzard shad have trended upward in abundance, some other species have declined. White crappie catches at the WFL have declined substantially since the mid 1970's, and it has been noted that one of the primary mechanisms of low recruitment of white crappie is the competition for zooplankton with juvenile gizzard shad (Normandeau Associates 1994).

In 1997, 1999, and 2001 significant catches of blueback herring were made. As recently as 2001, 510 herring per lift were collected, the highest amount in any year and the second most proportionally abundant species that year after gizzard shad. Since 2002; however, very few blueback herring have been passed. This decline might reflect recent population declines coast-wide due to a number of potential causes including habitat loss, targeted or bycatch in commercial fisheries, and increased numbers of striped bass and other predators (ASMFC 2009). In the 1970's and 1980's the proportion of American shad in the fish lift catch was very low, but as the result of restoration measures, American shad have increased through the 1990's. Since the mid 1990's American shad has been one of the five most abundant fish in annual fish lift counts, and is usually second most abundant in the EFL.

The fish species assemblage has remained diverse below Conowingo Dam with the same core group of species as was observed in the 1980's. The fish lift catches have ranged from 30 to 49 taxa annually at the WFL and 25 to 45 taxa annually at the EFL.

Condition factor of seven species collected at the WFL in 2010 were within the normal range of means presented from various reference populations of the same species in Carlander (1969, 1977, and 1997). The length weight relationship expressed by the slope of the regression equation based on data collected in 2010 indicates that lengths and weights of selected species collected at the WFL were similar to those collected from 1982 to 1987. Both the 1980's fish and those collected in 2010 were within the reference length weight relationship ranges presented. Condition factor and length weight relationships of representative common fish species downstream of Conowingo Dam are comparable to those from other normal, natural populations and are indicative of relatively favorable conditions and habitats in the lower Susquehanna River.

3.3.3.2.7 *Effect of Sediment Deposition and Storage in Conowingo Pond on Aquatic Habitat Downstream of Conowingo Dam*

Exelon's environmental analysis indicates that the substrate below Conowingo Dam is mainly bedrock with some areas of finer sediments (GSE and Normandeau Associates 2012b). The prevalence of coarser sediment suggests that the flow regime is too swift to allow for the deposition of fine material.

Finer-grained substrates are limited downstream of the dam, and where present, boulder and cobble are most prevalent. Trapping of coarse sediment behind Conowingo Dam limits the supply downstream. Additionally, flow conditions in the river are naturally turbulent, inhibiting deposition until the change in gradient near the Deer Creek area. Between Rowland and Roberts Islands, the river bottom would be essentially bedrock without the Project, much as it is today, except where there is a discrete sediment supply. The sediment from major tributaries, Octoraro Creek and Deer Creek, is the source for sediment deposited in areas of locally dissipated flow.

The paucity of non-bedrock substrate downstream of the dam increases the value of the few habitats that exist. These habitats are located downstream of Rowland Island, near the mouths of Octoraro and Deer Creeks, an area southwest of Bird Island, downstream of Snake Island and in-between Robert, Wood and Spencer Islands. These areas often provided unique combinations of depth, velocity and substrate, providing areas of refugia for species and life stages that are not well suited for the conditions found in the river's main channel.

3.3.3.2.8 *Effects on the American Eel Population and Distribution of the Eastern Elliptio Mussel*

Sampling efforts conducted by Exelon and the USFWS indicate that American eel occur below Conowingo Dam (Normandeau Associates and GSE 2012e). However, occurrence in the Susquehanna River above Conowingo Dam is very limited due to the lack of eel passage at the four dams on the lower Susquehanna. Eastern elliptio use several fish species as hosts, including white perch, yellow perch, American eel, alewife, blueback herring, three-spine stickleback, banded killifish, white sucker, pumpkinseed sunfish, redbreast sunfish, black crappie, largemouth bass, smallmouth bass, brook trout, lake trout and mottled sculpin (Wiles 1975, Watters 1994, Lellis et al. 2001, and Kneeland and Rhymer 2008, as cited in Nedeau 2008).

During semi-quantitative surveys below Conowingo Dam during 2010 and 2012, 6,069 eastern elliptio were found at 120 out of 128 stations. Generally, it was absent at stations closer to Conowingo Dam. It was the most common species observed during the surveys. A total of 117 mussels were observed during quantitative surveys, including 111 eastern elliptio (95.7 percent). Eastern elliptio exhibited a broad range of sizes – from 11.8 to 170.0 mm, but only eight (1.1 percent of the 691 measured) were smaller than 40.0 mm in length, suggesting that recruitment appears low.

Minkkinen and Park (2007) report that American eels may have a unique role as a host species for the mussel eastern elliptio (*Elliptio complanata*) and cite work conducted by the USGS Northern Appalachian Research Laboratory.

Attempts to obtain and review the documentation of the original USGS research establishing the American eel-eastern elliptio link were made. On March 12, 2012, Exelon received information from USGS in response to a FOIA request regarding mussels in the Susquehanna River. The cover letter indicated that the package contained information on eastern elliptio in New Jersey, New York along with manuscripts, emails and abstracts of posters and oral presentations. Two abstracts included with this information are of relevance to the Susquehanna River. The abstracts of interest are titled: Host Identification for *Elliptio complanta* (Bivalvia: Unionidae) from the upper Susquehanna River Basin, Pennsylvania and Assessing the Importance of American Eel (*Anguilla rostrata*) to Freshwater Mussel Populations in the Susquehanna River.

The first abstract[27] described a laboratory experiment where multiple fish species were exposed to infestation by freshly-released glochidia of eastern elliptio. The results of the experiment showed metamorphosed individuals on American eel, brook trout, lake trout and mottled sculpin. Juvenile mussels were recovered from 18 to 48 days. No metamorphosed individuals were observed on American toad tadpoles, Atlantic sturgeon, blacknose dace, bluntnose minnow, central stoneroller, common shiner, cutlips minnow, fallfish, longnose dace, margined madtom, red-spotted newt, river chub, rock bass, shield darter, smallmouth bass, spottail shiner, tessellated darter or white sucker.

The second abstract[28] linked the low number of eastern elliptio in the Susquehanna River to the lack of upstream eel passage at hydropower dams. The abstract suggests that large populations of eastern elliptio in neighboring rivers and streams results from their their larger eel populations compared to low elliptio and eel numbers in the Susquehanna River. The abstract indicates that host fish studies showed that American eels were likely the primary host for eastern elliptio prior to dam construction. The study used qualitative and quantitative surveys above and below the Conowingo Dam to compare eastern elliptio recruitment. The results presented showed that population estimates in high density areas in the Susquehanna River were much lower than high density areas in the Delaware River. Other results presented showed that the eastern elliptio below Conowingo Dam are smaller than those at the six sites sampled above the dam. The conclusion presented in the abstract is that this indicates limited recruitment, presumably above the dam.

The remaining information supplied is various email correspondence concerning eastern elliptio. The correspondence identifies American eel and lake trout as the best hosts for eastern elliptio and mottled and slimy sculpin as minor hosts. The correspondence also identifies many other unsuccessful host species not listed in the abstract above. The correspondence mentions the incongruity of these results to results of other published studies as well as the common knowledge about eastern elliptio. Unfortunately,

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[27] Host Identification for *Elliptio Complanata* (Vivalvia: Unionidate) from the upper Susquehanna River Basin, Pennsylvania . W.A. Lellis, E.S. Gray, J.C. Cole, B.S. White and J.S. Hotter. U.S. Geological Survey, Northern Appalachian Research Laboratory.

[28] Assessing the Importance of American Eel (*Anguilla Rostrata*) to Freshweater Mussels Populations in the Susquehanna River. Julie Devers, Jeffrey Cole, Barbara St. John White, Steve Minkkinen (Maryland Fishery Resource Office, USFWS), and William Lellis (Northern Appalachian Research Laboratory, USGS)..

the information presented in the FOIA concerning the relationship between American eel and eastern elliptio was limited, with very little supporting data or technical reports.

Exelon proposes to construct a permanent trap and transport facility, consisting of an eel ramp and collection facility on the west bank of the Conowingo tailrace. This facility would allow for upstream passage of American eel above York Haven Dam. Transported eels would be released in small tributaries (~50 feet wide) upstream of York Haven Dam that have been previously stocked by the USFWS. The transport of American eel into the Susquehanna River above York Haven would also benefit the distribution of eastern elliptio, to the extent that this species successfully utilizes American eel as a host species.

3.3.3.3 Cumulative Effects

CEQ regulations define ‘cumulative effects’ as “the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40CFR§1508.7).

For this analysis, the action is the relicensing and continued operation of the Conowingo Project. The cumulatively affected resource is fish / aquatic resources. The geographic scope of this analysis is defined as the Lower Susquehanna River and Chesapeake Bay. The temporal scope of this analysis includes a discussion of the past, present, and reasonably foreseeable future actions, and their effects on the resource 50 years into the future.

The potential impact of the Project is associated with whether the continued operation of the Conowingo Project affects resident and migratory fish populations and associated habitat of the Lower Susquehanna River, which had already been altered by Holtwood Dam (built 1910) when the Project was initially constructed in 1928.

Effect on Entrainment and Impingement on Resident and Migratory Fish Populations

Since Project operation began in 1928, direct impacts related to entrainment and mortality of resident fish populations within Conowingo Pond have resulted. However, both historic and current fish population data collected within Conowingo Pond indicate a healthy and robust fishery exists. In addition, data from historic and current creel surveys of Conowingo Pond and the Lower Susquehanna River show that a healthy year-round sport fishery is present. Exelon’s analysis of current and future impacts indicate that entrainment impacts related to Project operations are expected to be low-moderate during generation. In addition, survival potential for entrained resident fish is expected to range from 80-100% depending on the particular life stage and species.

Exelon's analysis indicates that the estimated survival rate at the Project ranges from approximately 90% to 95% for downstream migrating juvenile shad and river herring. Other non-Project factors that may affect American shad and river herring populations in the watershed include upstream and downstream passage efficiency at the Holtwood, Safe Harbor, and York Haven Dams. In addition, predation, by-catch, and competition are possible factors impacting the American shad and river herring population. In the ocean, American shad and river herring are likely preyed upon by many species of fish, marine mammals, and seabirds. Inshore, it has been suggested that striped bass (*Morone saxatilis*) predation may limit the American shad population. Bycatch in commercial fisheries is a threat of significant concern for American shad and river herring populations. Significant bycatch primarily occurs in coastal ocean trawl fisheries for Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scomber scombrus*) and squids. Competition with other aquatic species for food resources could impact American shad abundances. For example, gizzard shad populations increased dramatically in the mid-20th century as broad based ecological changes provided a potential increase in suitable habitats.

Construction of Conowingo Dam in 1928 effectively closed the Susquehanna River to upstream migration of eels at RM 10. Remnants of a stocking program in Pennsylvania that ended decades ago are occasionally taken. Elver stocking above Conowingo Dam was resumed in 2008 by USFWS. Exelon's proposed upstream and downstream trap and transport program for American eel passage between Conowingo and York Haven Dams will likely mitigate for impacts from Conowingo Project operations on American eel in the future.

Effect on Zone of Passage and Attraction Flow at Fish Passage Facility Entrances

Since Project operation began in 1928, Conowingo Dam has created a barrier to the upstream movement of migratory fishes. With the commencement of operation of the WFL (1972) and the EFL (1991), either trap-and-transport or volitional passage for migratory fish has been provided at the Project.

Radio telemetry data collected in 2010 indicates that 73% of adult American shad that migrated to the Project tailrace entered into the EFL, but not all successfully passed upstream. Only 45% of those adult American shad that migrated to the Project tailrace successfully completed passage through the EFL. In addition, statistical analysis of hourly American shad passage data and station generation scenarios for the 2001 through 2010 migration seasons did not reveal a meaningful overall relationship between the two parameters.

The additional site-specific telemetry study completed in the spring of 2012 will provide more data; to inform the development of fish passage improvements at the Project.

Passage effectiveness of the fish lifts has not been evaluated for river herring. Large Alewife runs have never been recorded, probably reflective of the species habitat preferences. Annual blueback herring passage was highly variable, but as recently as 2001 contributed significant proprotions of the anadromous fish passage in some years.

Effect on the Recruitment, Population Dynamics, and Habitat Needs of Resident and Migratory Fishes

Since 1928, Project operations have altered the flow regime below Conowingo Dam. However, both historic and current fish population data collected within Conowingo Pond and the Susquehanna River below Conowingo Dam indicate a healthy and robust fishery exists. In addition, data from creel surveys of Conowingo Pond and the Lower Susquehanna River show that a healthy year-round sport fishery is present. Exelon’s analysis indicates that the fish species assemblage has remained diverse below Conowingo Dam with the same core group of species as was observed in the 1980’s. The fish lift catches have ranged from 30 to 49 taxa annually at the WFL and 25 to 45 taxa annually at the EFL. This period of data collection included the advent of the current minimum flow regime in 1989.

However, gizzard shad have become more abundant over time. White crappie catches at the WFL have declined substantially since the mid-1970s, and one of the primary mechanisms of low recruitment of white crappie is competition with juvenile gizzard shad.

Recently, very few blueback herring have been passed at Conowingo Dam. This decline may reflect recent population declines coast-wide due to a number of potential causes including habitat loss, targeted or bycatch in commercial fisheries, and increased numbers of striped bass and other of predators.

Effect on the American Eel Population and Distribution of the Eastern Elliptio Mussel

Since Project operation began in 1928, the Project dam has created a barrier to the upstream movement of American eel. Other upstream barriers are also created by the York Haven, Holtwood, and Safe Harbor Dams. American eels are one of a number of species of fish that serve as a host species for the larval stage (known as glochidia) of freshwater mussels. Mussel species depend on their hosts for dispersal, which completes a mussel’s life cycle.

Over its range (Georgia to the St. Lawrence River and west to Lake Superior and Hudson Bay), eastern elliptio use several fish species as hosts, including white perch, yellow perch, American eel, alewife, blueback herring, three-spine stickleback, banded killifish, white sucker, pumpkinseed sunfish, redbreast sunfish, black crappie, largemouth bass, smallmouth bass, brook trout, lake trout, and mottled sculpin (Wiles 1975, Watters 1994, Lellis et al. 2001, Kneeland and Rhymer 2008, as cited in Nedeau 2008).

Providing an upstream and downstream trap and transport program for American eel passage between Conowingo and York Haven Dams will return American eel to the lower Susquehanna River and its tributaries in the future. The return of eels to the river above Conowingo Dam would provide for the return of eastern elliptio to this portion of the river. Therefore, the cumulative impact of the Project on eastern elliptio distribution, when added to other past, present, and reasonably foreseeable future actions, is positive.

3.3.3.4 Proposed Environmental Measures

3.3.3.4.1 *Entrainment, Impingement, and Mortality – Resident Fish Species*

Exelon's environmental analysis indicated that entrainment, impingement, and mortality resulting from Project operations have relatively minor impacts on resident fish species; therefore, Exelon is not proposing any environmental measures at this time.

3.3.3.4.2 *Fish Passage for Migratory Species*

Upstream Fish Passage

In-River Fish Passage Impediments

Exelon's environmental analysis indicated that at the maximum Project generation flow (~86,000 cfs), there were isolated areas near the Project tailrace that could impede upstream migration based on a comparison to burst swim speeds. However, radio telemetry data from 2010 indicated that American shad migration occurred during Conowingo Dam discharges ranging between 8,618 and 82,085 cfs. Exelon conducted additional radio telemetry data collection in the spring of 2012, and analysis of this data is expected to be complete by September 30, 2012. Exelon is not proposing any environmental measures at this time.

East Fish Lift

Exelon's environmental analysis indicated that the Project may directly or indirectly influence the effectiveness of the EFL in providing upstream volitional passage for adult American shad. Exelon conducted additional radio telemetry data collection in the spring of 2012, and analysis of this data is expected to be complete by September 30, 2012 At this time, Exelon is proposing to continue existing operations of the facility, along with the implementation of a preventive maintenance program to extend the life of the facility. Details of the preventive maintenance plan are described in Appendix B of Exhibit E.

West Fish Lift

Exelon's environmental analysis indicated that the WFL is currently adequate to provide sufficient spawning American shad to support PFBCs annual stocking efforts in the basin. Exelon is proposing to continue existing operations of the facility,.

American Eel

Exelon's environmental analysis identified potential Project impacts related to upstream passage of American eel. Exelon is proposing trap and transport facilities to provide upstream passage measures for this species. Exelon anticipates that the cost of the trap and transport program would be shared among the licensees of the four dams the eels would be required to pass.

Downstream Fish Passage

American Shad

Exelon is proposing to continue to provide downstream passage via the Project turbines for juvenile and adult American shad. Exelon's environmental analysis indicated that survival rates for these species would be sufficiently high so as to not require additional mitigation measures.

Alewife and River Herring

Exelon is proposing to continue to provide downstream passage via the Project turbines for juvenile and adult river herring. Exelon's environmental analysis indicates that survival rates for these species would be sufficiently high so as to not require additional mitigation measures.

American Eel

Exelon's environmental analysis identified potential Project impacts related to downstream passage of American eel. Exelon is proposing a trap and transport program to provide downstream passage measures for this species. Exelon anticipates that the cost of the downstream trap and transport program would be shared among the licensees of the four dams the eels would be required to pass. This program will mitigate potential effects of the Project on downstream migrating eels.

3.3.3.4.3 *Aquatic Habitat*

Conowingo Pond

Littoral Zone Habitat

Exelon's proposal will have no significant adverse effects to aquatic habitat within Conowingo Pond. Exelon proposes no environmental measures related to littoral zone habitat at this time.

Tributary Access

Exelon's proposal will have no significant adverse effects to tributary access within Conowingo Pond. Exelon proposes no environmental measures related to tributary access at this time.

Susquehanna River below Conowingo Dam

At this time, Exelon proposes to continue the existing flow regime below Conowingo Dam to provide habitat for resident and migratory fish, mussels, and macroinvertebrates.

3.3.3.4.4 *Effects on Invasive Zebra Mussels and Other Exotics*

Exelon's environmental analysis indicated that the Project does not directly influence the spread of the invasive zebra mussel and other exotic mollusks. Exelon proposes no environmental measures related to this issue at this time.

3.3.3.4.5 *Effects on the Recruitment, Population Dynamics, and Habitat Needs of Resident and Migratory Fishes*

The Project does not significantly affect the recruitment and population dynamics of resident and migratory fishes within Conowingo Pond or the Susquehanna River below Conowingo Dam. Exelon proposes to continue the existing flow regime below Conowingo Dam to provide habitat for fish species in this river reach.

3.3.3.4.6 *Effect of Sediment Deposition and Storage in Conowingo Pond on Aquatic Habitat Downstream of Conowingo Dam*

Exelon's environmental analysis indicated that the lack of non-bedrock substrate downstream of the dam limits aquatic habitat for certain immobile life stages of aquatic biota. The lack of appropriate substrate is due to several factors, including natural geomorphic conditions as well as Project impacts. At this time, Exelon proposes to continue the existing generation and minimum flow regime below Conowingo Dam.

3.3.3.5 Unavoidable Adverse Impacts

The continued operation of the Project will have a unavoidable impact to aquatic resources below the Conowingo dam due to flow alteration.

TABLE 3.3.3.1.1-1: FISH SPECIES WITHIN THE CONOWINGO PROJECT WATERS

Common	Scientific
Anadromous Species	
Alewife	*Alosa*
American	*Alosa*
Blueback	*Alosa aestivalis*
Hickory	*Alosa mediocris*
Sea	*Petromyzon*
Striped bass	*Morone*
White	*Morone*
Catadromous Species	
American	*Anguilla*
Resident Species	
Banded	*Etheostoma*
Banded	*Fundulus*
Black	*Pomoxis*
Blacknose	*Rhinichthys*
Bluegill	*Lepomis*
Bluespotted	*Enneacanthus*
Bluntnose	*Pimephales*
Bowfin	*Amia calva*
Brook trout	*Salvelinus*
Brown	*Ameiurus*
Brown trout	*Salmo trutta*
Central	*Campostoma*
Chain	*Esox niger*
Channel	*Ictalurus*
Comely	*Notropis*
Common	*Cyprinus carpio*
Common	*Luxilus*
Creek chub	*Semotilus*
Creek	*Erimyzon*
Cutlips	*Exoglossom*
Fallfish	*Semotilus*
Fathead	*Pimephales*
Flathead	*Pylodictis*
Gizzard	*Dorosoma*
Golden	*Notemigonus*
Green	*Lepomis*
Greenside	*Etheostoma*
Hybrid	*Morone*
Largemouth	*Micropterus*
Chesapeake	*Percina*
Longnose	*Rhinichthys*
Margined	*Noturus*

Common	Scientific Name
Resident Species *(continued)*	
Mimic shiner	*Notropis volucellus*
Mummichog	*Fundulus*
Muskellunge	*Esox masquinongy*
Northern	*Hypentelium*
Northern	*Esox lucius*
Pumpkinseed	*Lepomis gibbosus*
Quillback	*Carpiodes cyprinus*
Rainbow	*Oncorhynchus*
Redbreast	*Lepomis auritus*
River chub	*Nocomis*
Rock bass	*Ambloplites*
Rosyside	*Clinostomus*
Satinfin	*Cyprinella*
Shield darter	*Percina peltata*
Shorthead	*Moxostoma*
Silverjaw	*Notropis buccatus*
Smallmouth	*Micropterus*
Splake	*Salvelinus fontinalis*
Spotfin	*Cyprinella*
Spottail	*Notropis hudsonius*
Swallowtail	*Notropis procne*
Tadpole	*Noturus gyrinus*
Tessellated	*Etheostoma*
Tiger	*Esox lucius x E.*
Walleye	*Sander vitreus*
White catfish	*Ameiurus catus*
White	*Pomoxis annularis*
White sucker	*Catostomus*
Yellow	*Ameiurus natalis*
Yellow	*Perca flavescens*
Estuarine/Marine Species	
Atlantic	*Brevoortia tyrannus*
Atlantic	*Strongylura marina*
Hogchoker	*Trinectes maculatus*
Spot	*Leiostomus*
Striped	*Mugil cephalus*
Accidental Species	
Bigmouth	*Ictiobus cyprinellus*
Blue tilapia	*Oreochromis aureus*
Goldfish	*Carassius auratus*
Lake herring	*Coregonus artedi*
Rainbow	*Osmerus mordax*

[1]Considered "semi-anadromous" based on migration from brackish water to tidal-freshwater to spawn.

Sources: Susquehanna River Anadromous Fish Restoration Committee (2006), PPL and Kleinschmidt (2006), Normandeau (2001), Normandeau (2000), ERM (1981), RMC.

TABLE 3.3.3.1.1-2: FISH SPECIES COMPOSITION IN CONOWINGO POND, 2010-2011

Species	Percent of Catch
Gizzard shad	42.4%
Channel catfish	19.5%
Spotfin shiner	7.9%
Comely shiner	6.8%
Bluegill	6.6%
Green sunfish	4.0%
Spottail shiner	3.0%
Bluntnose minnow	1.8%
Smallmouth bass	1.4%
Rock bass	1.3%
Other species	*5.3%*

TABLE 3.3.3.1.1-3: SUMMARY OF FISH COMMUNITY AND DOMINANT SPECIES DOCUMENTED TO OCCUR DOWNSTREAM OF CONOWINGO DAM BASED ON HISTORICAL STUDIES (1972-2010)

	Data Source:	WFL	EFL	Ichthyo-plankton sampling	Electro-fishing	Gill Nets	Stranding Surveys
	Study Years:	1972-2009	1997-2009	1982-1984	1982-1987	1981-1984	2010
	Number of Taxa:	72	59	27	66	28	14
Dominant Species	*Gizzard shad*	75%	87%	3%	49%	22%	57%
	American eel				11%		
	American shad	<1%	8%				
	White perch	12%	<1%	72%	12%	23%	
	Blueback herring	4%	4%	24% (incl. alewife)			
	Channel catfish	3%			4%	42%	
	Banded killfish						23%
	Sunfish				7%		11%
	Largemouth bass						4%
	Yellow perch				6%		
	Other species	5% (67 taxa)	<1% (5 taxa)	1% (24 taxa)	11% (60 taxa)	13% (24 taxa)	5% (10 taxa)

TABLE 3.3.3.1.2-1: ESTIMATED CATCH AND HARVEST TOTALS ON CONOWINGO POND IN 2010

Species	Spring		Summer		Fall		TOTAL	
	Catch	*Harvest*	*Catch*	*Harvest*	*Catch*	*Harvest*	*Catch*	*Harvest*
Gizzard shad	12	0	—	—	—	—	12	0
Common carp	241	205	1428	166	264	0	1933	371
Catfish	836	0	361	0	—	—	1197	0
Channel catfish	1719	367	7239	1208	849	52	9807	1627
Flathead catfish	690	395	180	39	553	87	1424	520
Smallmouth bass	5082	0	4606	0	1759	35	11447	35
Largemouth bass	3197	0	3077	0	744	44	7019	44
Sunfish	404	0	605	0	277	0	1286	0
Bluegill	1787	0	6112	0	186	0	8085	0
Rock bass	587	0	848	0	43	0	1478	0
Green sunfish	—	—	13	0	—	—	13	0
Pumpkinseed	—	—	26	0	—	—	26	0
White crappie	—	—	13	0	—	—	13	0
Black crappie	54	0	—	—	—	—	54	0
Striped bass	66	0	—	—	27	27	93	27
White perch	—	—	90	0	—	—	90	0
Walleye	242	35	142	0	150	17	533	52
Striped bass hybrid	—	—	—	—	18	0	18	0
TOTAL	**14,917**	**1,001**	**24,740**	**1,413**	**4,869**	**262**	**44,526**	**2,676**

TABLE 3.3.3.1.2-2: ESTIMATED CATCH AND HARVEST TOTALS ON THE SUSQUEHANNA RIVER BELOW CONOWINGO DAM IN 2010

Species	Spring		Summer		Fall		TOTAL	
	Catch	*Harvest*	*Catch*	*Harvest*	*Catch*	*Harvest*	*Catch*	*Harvest*
American eel	33	0	—	—	44	0	77	0
Shad	796	0	—	—	—	—	796	0
American shad	14831	0	—	—	—	—	14831	0
Hickory shad	68731	0	—	—	—	—	68731	0
River herring	1756	200	—	—	—	—	1756	200
Gizzard shad	3406	66	—	—	385	79	3791	145
Rainbow trout	33	0	—	—	—	—	33	0
Common carp	483	143	145	107	162	162	790	412
Fallfish	—	—	—	—	197	0	197	0
Catfish	1265	22	1424	755	63	0	2752	777
Channel catfish	6113	1033	10692	3882	3483	1113	20288	6028
Flathead catfish	817	77	1686	829	625	333	3128	1239
Brown bullhead	100	0	—	—	—	—	100	0
Largemouth bass	1923	66	4074	35	1002	302	6999	403
Smallmouth bass	697	0	3385	35	838	0	4920	35
Striped bass	6630	67	9388	1943	8795	3800	24813	5810
White perch	82973	14938	13675	4580	1576	567	98224	20085
Sunfish	—	—	277	0	144	0	421	0
Bluegill	229	0	875	35	21	0	1125	35
Rock bass	133	33	41	0	—	—	174	33
Green sunfish	33	33	—	—	—	—	33	33
Walleye	612	88	56	35	639	258	1307	381
Yellow perch	8886	1740	219	35	—	—	9105	1775
Atlantic needlefish	—	—	38	0	—	—	38	0
TOTAL *(w/o crab)*	**200480**	**18505**	**45937**	**12271**	**17974**	**6614**	**264429**	**37391**
Blue crab	—	—	4153	3859	56721	56721	60874	60580

TABLE 3.3.3.1.5-1: COMPARISON OF MUSSEL SPECIES SAMPLED BY EXELON, MDNR, AND MARSHALL UNIVERSITY (2008-10)

Common Name	Latin Name	2008	2009	2010[29]	2012[30]
Alewife Floater	*Anodonta implicata*	x	x	x	x
Eastern Elliptio	*Elliptio complanata*	x	x	x	x
Yellow Lampmussel	*Lampsilis cariosa*	x (1)	x (1)	x (1)	
Eastern Lampmussel	*Lampsilis radiata*			x	x
Tidewater Mucket	*Leptodea ochracea*	x	x	x	x
Eastern Floater	*Pyganodon cataracta*	x	x	x	x
Creeper	*Strophitus undulatus*			x (2)	

1. Based on examination of voucher photos and shells, and consultation with regional experts, prior reports of yellow lampmussels have been changed to tidewater mucket.
2. Matt Ashton (MDNR) reported finding one shell.

TABLE 3.3.3.1.5-2: RESULTS OF MUSSEL COLLECTION SEARCH CANADIAN MUSEUM OF NATURE IN OTTAWA, CANADA

Common Name	Species	Locality	Collection Date	Notes
eastern elliptio	*Elliptio complanata*	Susquehanna River near mouth of Deer Creek	June 15, 1963	Acquisition No. 1968-141; Catalogue No. CMNML 046709
	Anodonta fluviatilis	Susquehanna River near mouth of Deer Creek	September 16, 1962	Acquisition No. 1968-073; Catalogue No. CMNML 058227
eastern elliptio	*Elliptio complanata*	Susquehanna River, Havre de Grace, near PA Railroad Bridge	October 18, 1958	Acquisition No. 1968-073; Catalogue No. CMNML 059547
eastern lampmussel	*Lampsilis r. radiata*	Susquehanna River, Havre de Grace, near PA Railroad Bridge	October 18, 1958	Acquisition No. 1968-073; Catalogue No. CMNML 059548

[29] Zebra mussel also observed.
[30] Zebra mussel and Asian clam also observed

TABLE 3.3.3.1.5-3: RESULTS OF MUSSEL COLLECTION SEARCH –NATIONAL MUSEUM OF NATURAL HISTORY IN WASHINGTON

Common Name	Species	Locality	Collection Date	Notes
tidewater mucket	*Leptodea ochracea*	3 miles southwest of Charlestown; shallow water at head of Chesapeake Bay	--	Catalogue No. 521838
eastern lampmussel	*Lampsilis r. radiata*	Chesapeake Bay, 5 miles southwest of Charlestown	--	Catalogue No. 521841
eastern lampmussel	*Lampsilis r. radiata*	Chesapeake Bay, 3 miles southwest of Charlestown	--	Catalogue No. 521879

TABLE 3.3.3.1.7-1: PRINCIPAL RESIDENT FISH SPECIES' OPTIMAL HABITAT UTILIZATION FOR ADULT AND SPAWNING LIFESTAGES

Species	Lifestage	Habitat Type													
		Shallow Bedrock	*Deep Bedrock*	*Shallow Gravel Unveg.*	*Shallow Gravel Veg.*	*Deep Gravel Unveg.*	*Deep Gravel Veg.*	*Shallow Sand Unveg.*	*Shallow Sand Veg.*	*Deep Sand Unveg.*	*Deep Sand Veg.*	*Shallow Silt Unveg.*	*Shallow Silt Veg.*	*Deep Silt Unveg.*	*Deep Silt Veg.*
Gizzard shad	*Spawning*			O	O			O	O						
	Adult							O	O	O	O	O	O	O	O
Largemouth Bass	*Spawning*			O	O	O	O								
	Adult								O				O		
Smallmouth Bass	*Spawning*			O											
	Adult			O		O									
Walleye	*Spawning*			O				O							
	Adult			O		O	O								
Channel Catfish	*Spawning*			O		O									
	Adult			O	O	O	O		O		O		O		O
Cyprinidae[1]	*Spawning*				O				O						
	Adult			O	O				O				O		

O – Represents optimal habitat for a specific lifestage.

[1] Includes spotfin shiner, spottail shiner, and bluntnose minnow.

Sources: Becker, G.C. 1983. Fishes of Wisconsin. The University of Wisconsin Press.
USGS. 2011. Habitat Suitability Index Models. http://www.nwrc.usgs.gov/wdb/pub/hsi/hsiindex.htm.

TABLE:3.3.3.1.7-2: CONOWINGO POND SAV GROWTH, BY SUBSTRATE TYPE

Water Elevation (ft) *(NGVD 1929)*	**Total Submerged Aquatic Vegetation (SAV acreage at each water elevation)**				
	Bedrock	*Gravel*	*Sand*	*Silt*	*Unidentified*
110.2	1.24	96.10	147.42	66.03	1.46
110	1.24	96.01	147.41	66.03	1.46
109	1.24	95.48	147.31	66.03	1.46
108	1.23	94.60	147.17	66.03	1.46
107	1.23	92.47	146.88	66.02	1.46
106	1.20	73.12	144.11	65.85	1.46
105	1.05	59.85	107.36	64.40	1.44
104	0.70	39.04	46.85	59.92	1.34
103	0.19	4.84	13.97	56.93	0.11
102	0.04	0.52	3.92	15.15	0.01
101.2	-	-	-	-	-

Note: Unidentified vegetative bed found during side scan sonar survey.

TABLE 3.3.3.1.7-3: SEASONAL PERIODICITY OF TARGET SPECIES' OCCURRENCE BELOW CONOWINGO DAM

Species	Lifestage	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
American shad	Spawning				■	■	■						
	Fry					■	■	■					
	Juveniles							■	■	■	■	■	
	Adults				■	■	■						
Hickory shad	Spawning *(Deep-Slow)*			■	■	■							
	Fry *(Shallow-Slow)*				■	■	■						
	Juveniles *(Deep-Slow)*						■						
	Adults *(Deep-Fast)*			■	■	■							
Blueback herring	Spawning *(Deep-Slow)*				■	■	■						
	Fry *(Shallow-Slow)*					■	■						
	Juveniles *(Shallow-Slow)*							■	■	■	■		
	Adults *(Deep-Slow)*				■	■	■						
Alewife	Spawning *(Deep-Slow)*			■	■	■							
	Fry *(Shallow-Slow)*			■	■	■							
	Juveniles *(Deep-Slow)*						■	■	■	■	■		
	Adults *(Shallow-Slow)*				■	■							
White perch	Spawning *(Shallow-Fast, Deep-Fast)*				■	■	■						
	Fry *(Shallow-Slow)*				■	■	■	■					
	Juveniles *(Shallow-Slow, Deep-Slow)*					■	■	■	■	■	■	■	■
	Adults *(Deep-Slow)*	■	■	■	■	■	■	■	■	■	■	■	■
Yellow perch	Spawning *(Deep-Slow)*			■	■								
	Fry *(Shallow-Slow)*				■	■							
	Juveniles *(Deep-Slow)*						■	■	■	■	■	■	■
	Adults *(Deep-Slow)*	■	■	■	■	■	■	■	■	■	■	■	■
Striped bass	Spawning				■	■	■						
	Fry				■	■	■	■					
	Juveniles						■	■	■	■	■	■	■
	Adults	■	■	■	■	■	■	■	■	■	■	■	■

Notes: Italicized life stages are considered immobile. Habitat guilds are shown in parentheses.

TABLE 3.3.3.1.7-3: SEASONAL PERIODICITY OF TARGET SPECIES' OCCURRENCE BELOW CONOWINGO DAM (CONT.)

Species	Lifestage	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Largemouth bass	Spawning *(Shallow-Slow, Deep-Slow)*					■	■						
	Fry *(Shallow-Slow, Deep-Slow)*						■	■					
	Juveniles *(Shallow-Slow, Deep-Slow)*								■	■	■	■	■
	Adults *(Deep-Slow)*	■	■	■	■	■	■	■	■	■	■	■	■
Smallmouth bass	Spawning			■	■								
	Fry				■	■	■						
	Juveniles						■	■	■	■	■	■	■
	Adults	■	■	■	■	■	■	■	■	■	■	■	■
Walleye	Spawning *(Deep-Fast)*				■	■							
	Fry *(Deep-Slow)*					■	■	■					
	Juveniles *(Deep-Slow)*							■	■	■	■	■	■
	Adults *(Deep-Slow)*	■	■	■	■	■	■	■	■	■	■	■	■
Shortnose sturgeon	Spawning				■	■							
	Fry					■	■	■					
	Juveniles/Adults	■	■	■	■	■	■	■	■	■	■	■	■
Atlantic sturgeon	Spawning *(Deep-Fast)*				■	■							
	Fry *(Deep-Slow, Deep-Fast)*					■	■	■					
	Juveniles/Adults *(Deep-Slow, Deep-Fast)*	■	■	■	■	■	■	■	■	■	■	■	■
American eel	Elver *(Shallow-Slow, Deep-Slow, Deep-Fast)*				■	■	■	■	■	■	■		
	Yellow *(Shallow-Slow, Deep-Slow, Deep-Fast)*	■	■	■	■	■	■	■	■	■	■	■	■
	Silver *(Deep-Slow)*									■	■	■	■
Alewife floater	Adults/juveniles	■	■	■	■	■	■	■	■	■	■	■	■
	Spawning										■	■	■
	Larvae			■	■	■							
Eastern elliptio	Adults/juveniles	■	■	■	■	■	■	■	■	■	■	■	■
	Spawning	■	■	■									
	Larvae				■	■	■	■	■				
Fingernail clams	Adults	■	■	■	■	■	■	■	■	■	■	■	■
	Spawning/larvae	■	■	■	■	■	■	■	■	■	■	■	■
Ephemeroptera-Plecoptera-Trichoptera (all life stages)		■	■	■	■	■	■	■	■	■	■	■	■

Notes: Italicized life stages are considered immobile. Habitat guilds are shown in parentheses.

TABLE 3.3.3.1.7-4: FLOWS PROVIDING VARIOUS PERCENTAGES OF SPECIES' MAXIMUM AVAILABLE HABITAT

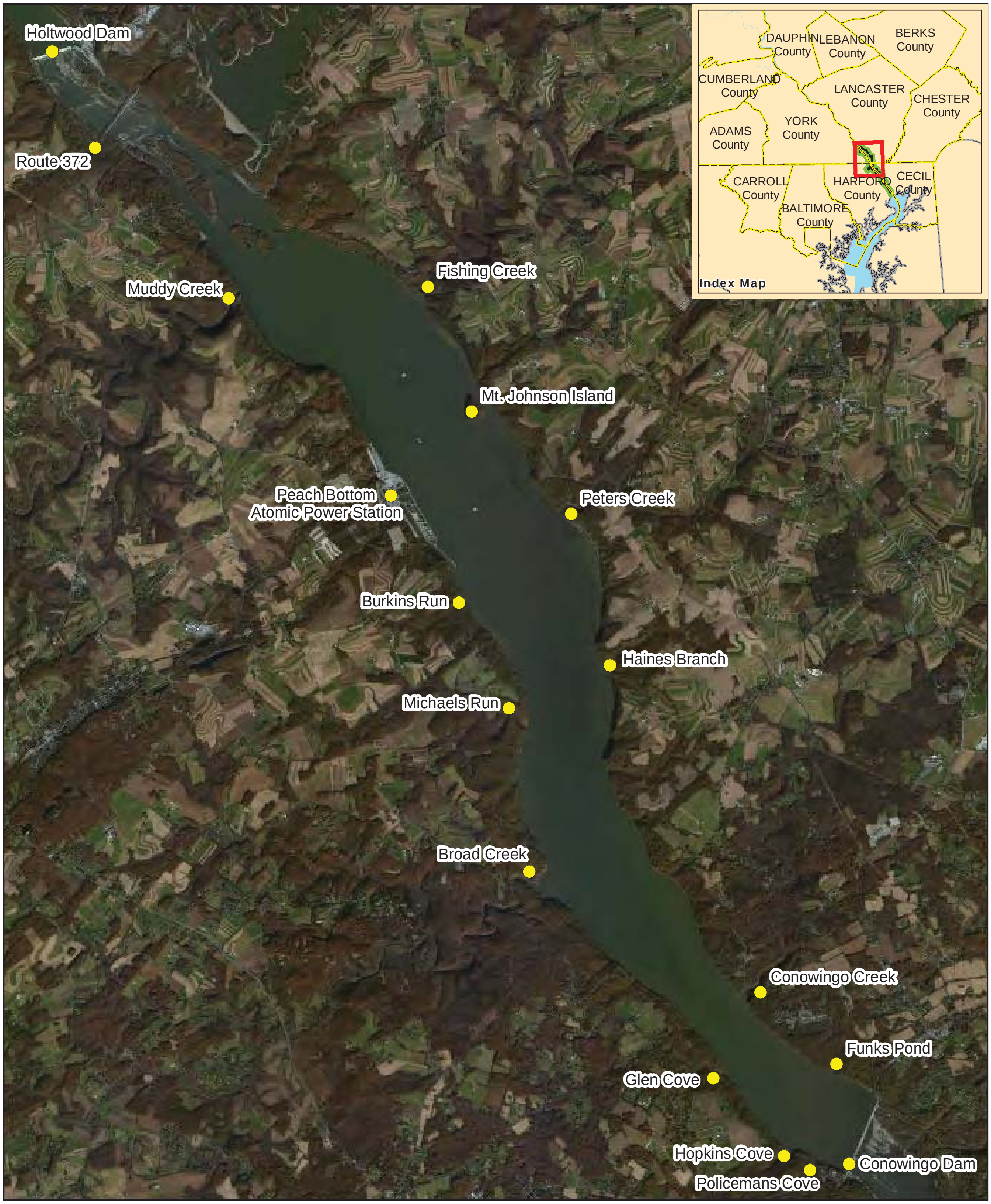
Species/Life Stage	Months Present	Flow at Maximum WUA (cfs)	Flow Range Providing 90% of Maximum WUA (cfs)	Flow Range Providing 80% of Maximum WUA (cfs)	Flow Range Providing 70% of Maximum WUA (cfs)	Flow Range Providing 60% of Maximum WUA (cfs)
American shad						
Spawning & Incubation	Apr-Jun	40,000	24,200 – 61,325	18,144 – 72,765	14,472 – 82,757	11,801 – 86,000*
Fry	May-Jul	30,000	14,716 – 43,771	10,703 – 55,000	7,744 – 67,028	5,513 – 80,335
Juvenile	Jul-Nov	10,000	4,011 – 29,062	2,670 – 42,383	2,000* – 52,641	2,000* – 65,469
Adult	Apr-Jun	40,000	25,090 – 69,495	18,332 – 84,715	13,861 – 86,000*	10,166 – 86,000*
Shortnose sturgeon						
Spawning & Incubation	Apr-May	50,000	24,234 – 86,000*	16,997 – 86,000*	13,008 – 86,000*	9,872 – 86,000*
Fry	May-Jul	30,000	16,917 – 62,164	11,835 – 79,017	8,546 – 86,000*	6,424 – 86,000*
Juvenile	All	30,000	14,068 – 54,906	9,240 – 77,199	6,228 – 86,000*	4,078 – 86,000*
Adult	All	30,000	14,068 – 54,906	9,240 – 77,199	6,228 – 86,000*	4,078 – 86,000*
Striped bass						
Spawning & Incubation	Apr-Jun	50,000	32,730 – 77,550	25,977 – 86,000*	20,450 – 86,000*	16,272 – 86,000*
Fry	Apr-Jul	50,000	34,705 – 76,746	27,846 – 86,000*	22,977 – 86,000*	18,547 – 86,000*
Juvenile	Jun-Dec	40,000	20,968 – 64,890	12,777 – 76,387	7,961 – 86,000*	5,290 – 86,000*
Adult	All	80,000	38,584 – 86,000*	28,570 – 86,000*	21,450 – 86,000*	16,057 – 86,000*
Smallmouth bass						
Spawning & Incubation	May-Jun	5,000	2,000* – 8,262	2,000* – 10,853	2,000* – 13,430	2,000* – 16,725
Fry	Jun-Jul	2,000*	2,000* – 2,556	2,000* – 3,111	2,000* – 3,778	2,000* – 4,703
Juvenile	Aug-Dec	5,000	2,000* – 10,552	2,000* – 14,474	2,000* – 18,051	2,000* – 21,757
Adult	All	15,000	6,737 – 24,531	4,623 – 33,522	3,127 – 44,491	2,000* – 58,145
Macroinvertebrates						
Ephemeroptera (mayfly)	All	5,000	3,190 – 7,823	2,469 – 9,340	2,000* – 11,168	2,000* – 13,235
Plecoptera (stonefly)	All	5,000	2,000* – 8,067	2,000* – 10,404	2,000* – 13,217	2,000* – 16,828
Trichoptera (caddisfly)	All	10,000	4,289 – 17,762	3,038 – 23,884	2,000* – 29,890	2,000* – 36,612
Habitat Guilds						
Shallow-Slow	All	2,000*	2,000* – 2,726	2,000* – 3,452	2,000* – 4,098	2,000* – 4,740
Shallow-Fast	Apr-Jun	2,000*	2,000* – 3,143	2,000* – 4,007	2,000* – 4,743	2,000* – 5,921
Deep-Slow	All	5,000	2,703 – 8,574	2,000* – 10,428	2,000* – 12,565	2,000* – 14,702
Deep-Fast	All	20,000	14,376 – 22,424	12,866 – 24,848	11,355 – 27,271	9,888 – 26,695

*Indicates that the flow range was limited by the lowest or highest production run flow, thus the true flow range providing this habitat falls outside of the modeled flows and is greater than shown.

TABLE 3.3.3.1.7-5: PERCENTAGE OF THE MAXIMUM WEIGHTED USABLE AREA HABITAT FOR VARIOUS FLOWS

Species / Life Stage	Months Present	Flow at Max WUA (cfs)	Maximum WUA (ft^2)	Percentage of Maximum WUA Habitat for Specified Flow (cfs)			
				3,500	5,000	7,500	10,000
American Shad							
Spawning & Inc.	Apr-Jun	40,000	24,052,704	17.2	26.3	40.8	53.3
Fry	May-Jul	30,000	17,990,453	48.9	57.6	69.1	78.2
Juvenile	Jul-Nov	10,000	21,651,763	87.8	94.2	98.4	100.0
Adult	Apr-Jun	40,000	26,204,622	35.2	41.4	51.1	59.6
Shortnose Sturgeon							
Spawning & Inc.	Apr-May	50,000	14,048,270	24.1	34.3	49.0	60.6
Fry	May-Jul	30,000	848,538	41.7	52.1	65.9	75.7
Juvenile	All	30,000	1,431,622	56.8	65.2	75.0	82.2
Adult	All	30,000	1,431,622	56.8	65.2	75.0	82.2
Striped Bass							
Spawning & Inc.	Apr-Jun	50,000	56,216,898	19.1	24.9	33.8	42.1
Fry	Apr-Jul	50,000	55,545,960	13.2	18.4	26.9	35.2
Juvenile	Jun-Dec	40,000	30,036,145	49.8	58.9	68.8	75.4
Adult	All	80,000	63,530,991	18.9	25.7	35.9	44.5
Smallmouth Bass							
Spawning & Inc.	May-Jun	5,000	1,141,787	98.4	100.0	92.9	83.3
Fry	Jun-Jul	2,000*	3,611,296	73.0	56.8	42.4	35.4
Juvenile	Aug-Dec	5,000	26,005,058	99.5	100.0	96.7	91.4
Adult	All	15,000	36,373,846	72.9	82.4	93.3	98.9
Macroinvertebrates							
Ephemeroptera	All	5,000	6,052,996	94.3	100.0	92.1	75.7
Plecoptera	All	5,000	4,432,285	99.4	100.0	92.5	81.4
Trichoptera	All	10,000	12,751,836	0.9	0.9	100.0	99.9
Habitat Guilds							
Shallow-Slow	All	2,000*	29,171,737	79.3	55.9	27.7	15.6
Shallow-Fast	Apr-Jun	2,000*	1,079,340	86.9	66.5	48.8	33.9
Deep-Slow	All	5,000	34,257,996	95.4	100.0	96.0	82.0
Deep-Fast	All	20,000	1,219,290	6.0	14.4	38.2	61.0

* Indicates that the flow range was limited by the lowest production run flow



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1 inch = 1.5 miles

0 0.75 1.5 3 Miles

Figure 3.3.3.1.7-1: Major Islands and Tributaries of Conowingo Pond

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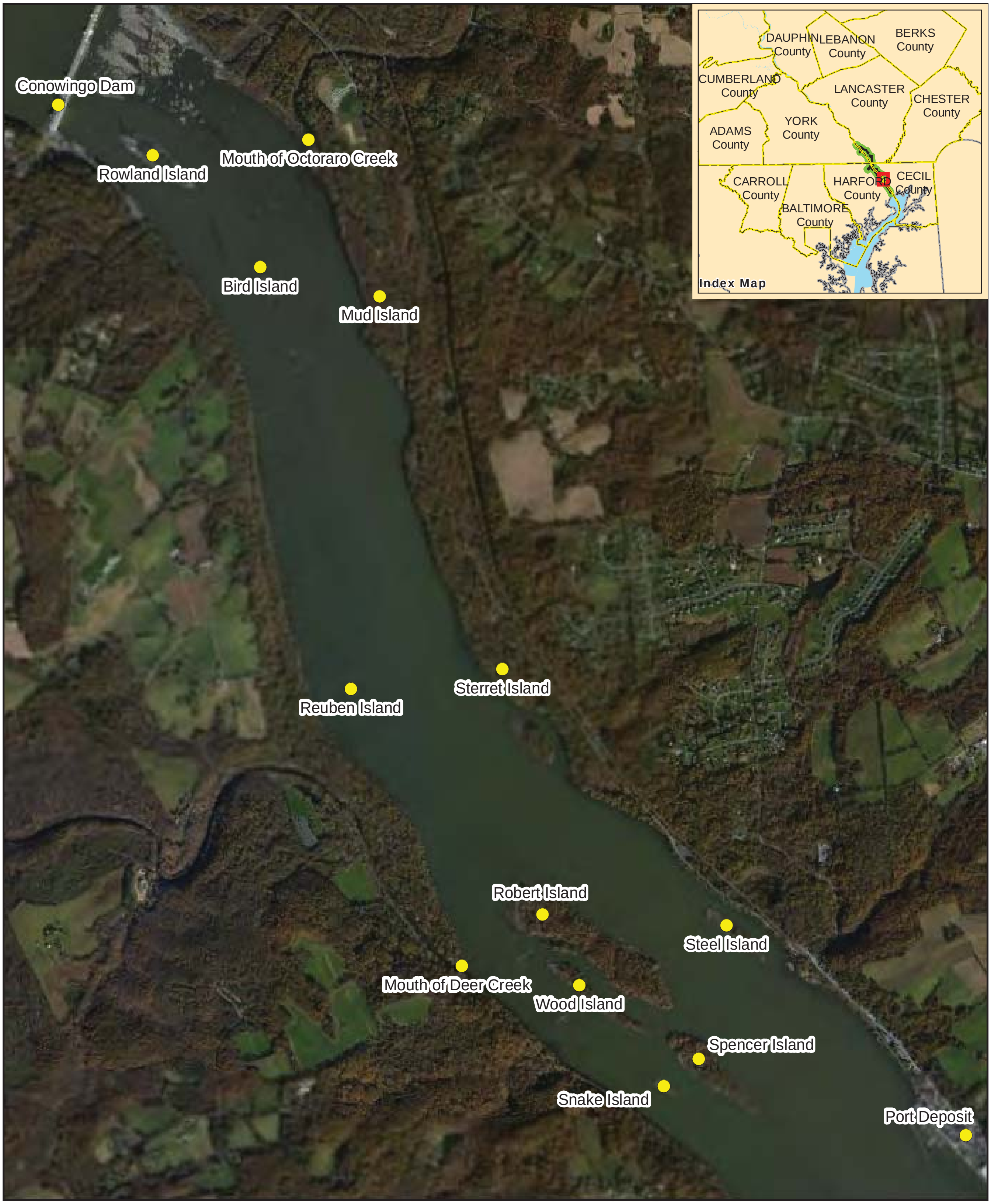

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N

1 inch = 0.5 miles
0 0.25 0.5 1 Miles

Figure 3.3.3.1.7-2:
Major Islands and Tributaries of the Non-Tidal Susquehanna River below Conowingo Dam

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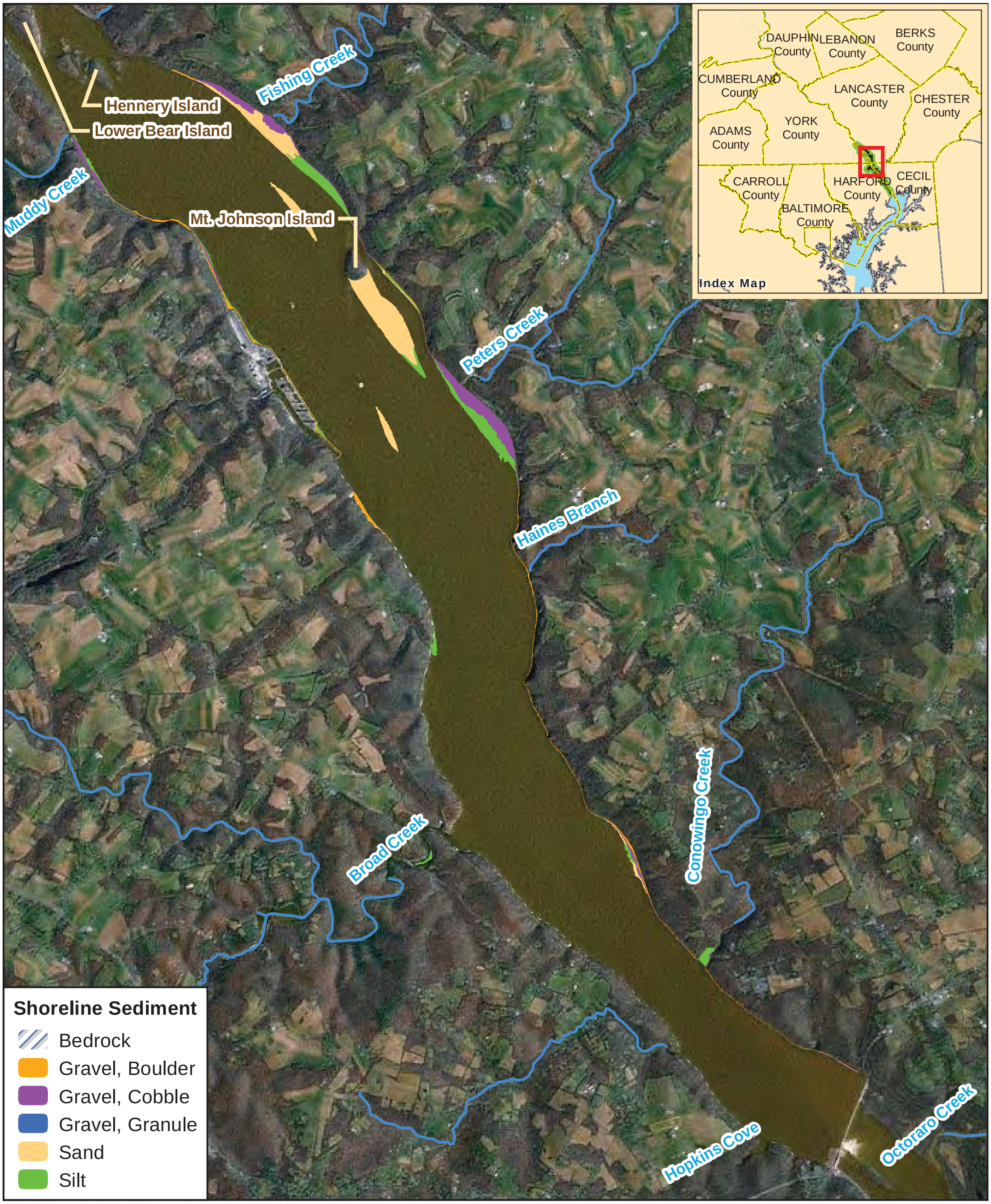

Exelon.

N

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1 inch = 1.25 miles
0 0.625 1.25 2.5 Miles

Figure 3.3.3.1.7-3:
Conowingo Pond Substrate Extent Map

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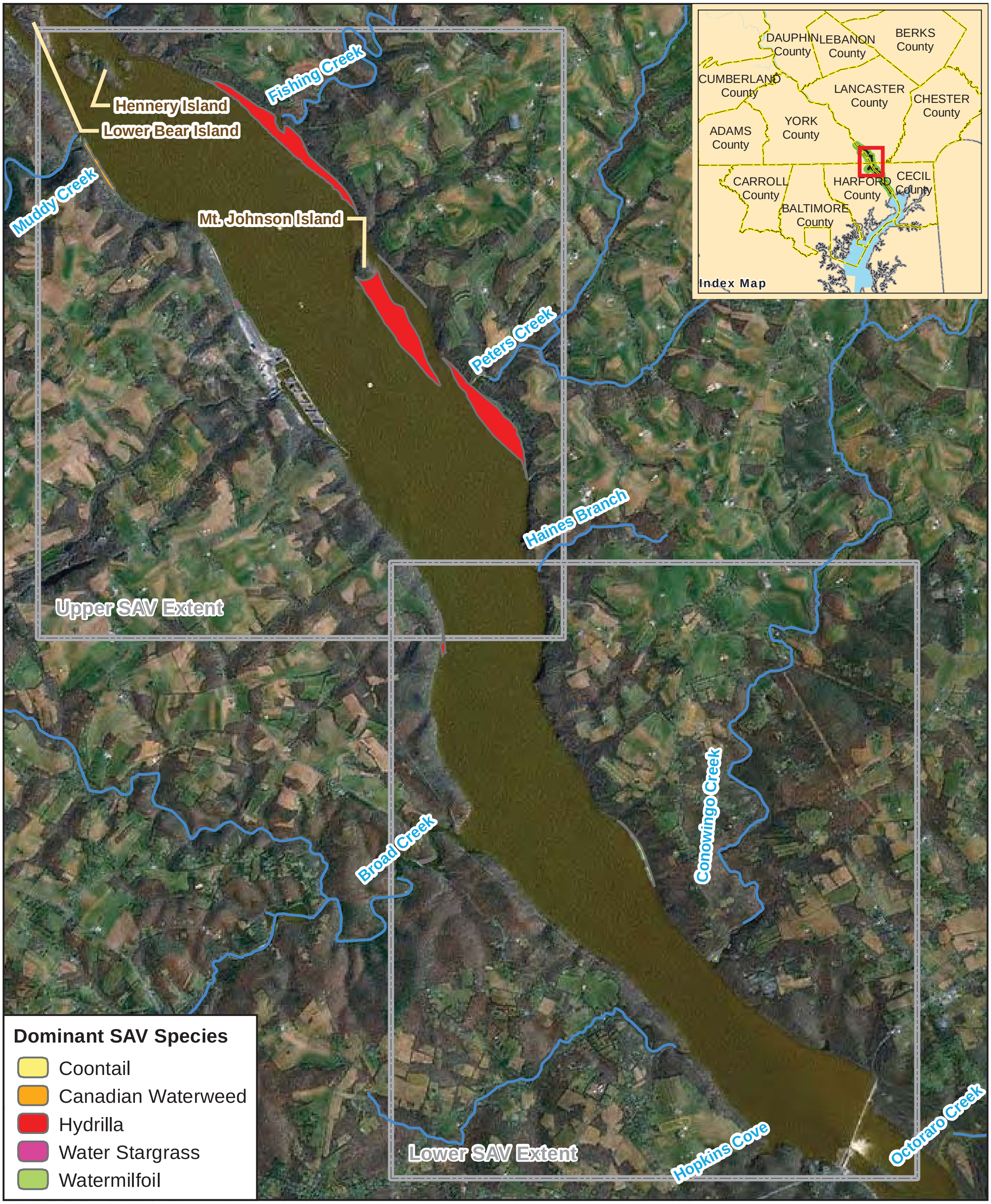

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Figure 3.3.3.1.7-4:
SAV Community Extent Map

N

1 inch = 1.25 miles
0 0.625 1.25 2.5 Miles

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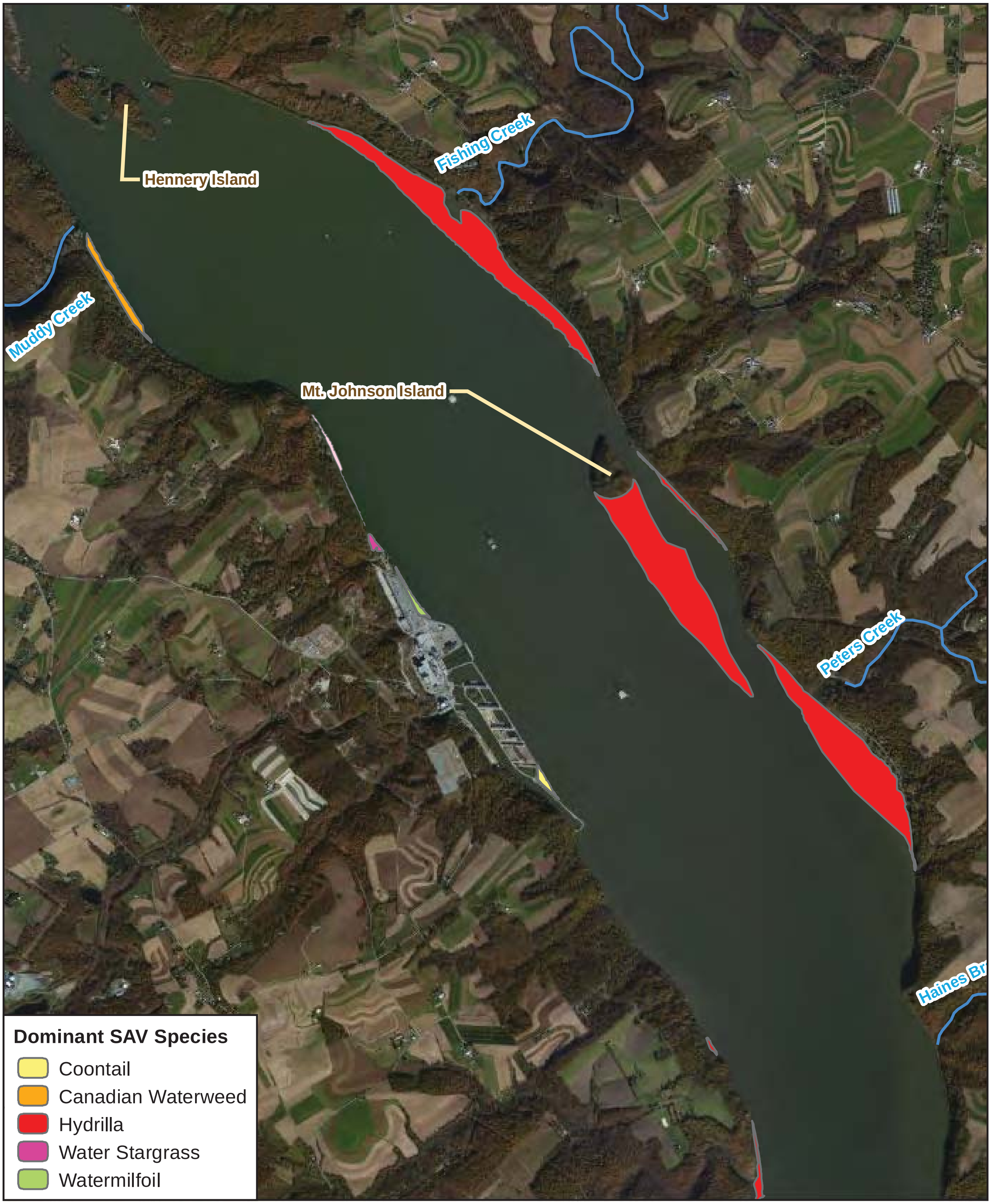

Exelon.

N

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0 0.25 0.5 1 Miles

Figure 3.3.3.1.7-4:
SAV Community Extent Map
Upper Extent

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Figure 3.3.3.1.7-4:
SAV Community Extent Map
Lower Extent

0 0.25 0.5 1 Miles

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_SAV_extent_map_lower_extent.mxd

FIGURE 3.3.3.1.7-5: SPATIAL COVERAGE OF SUBSTRATE TYPES IN EACH 1-FOOT CONTOUR INTERVAL

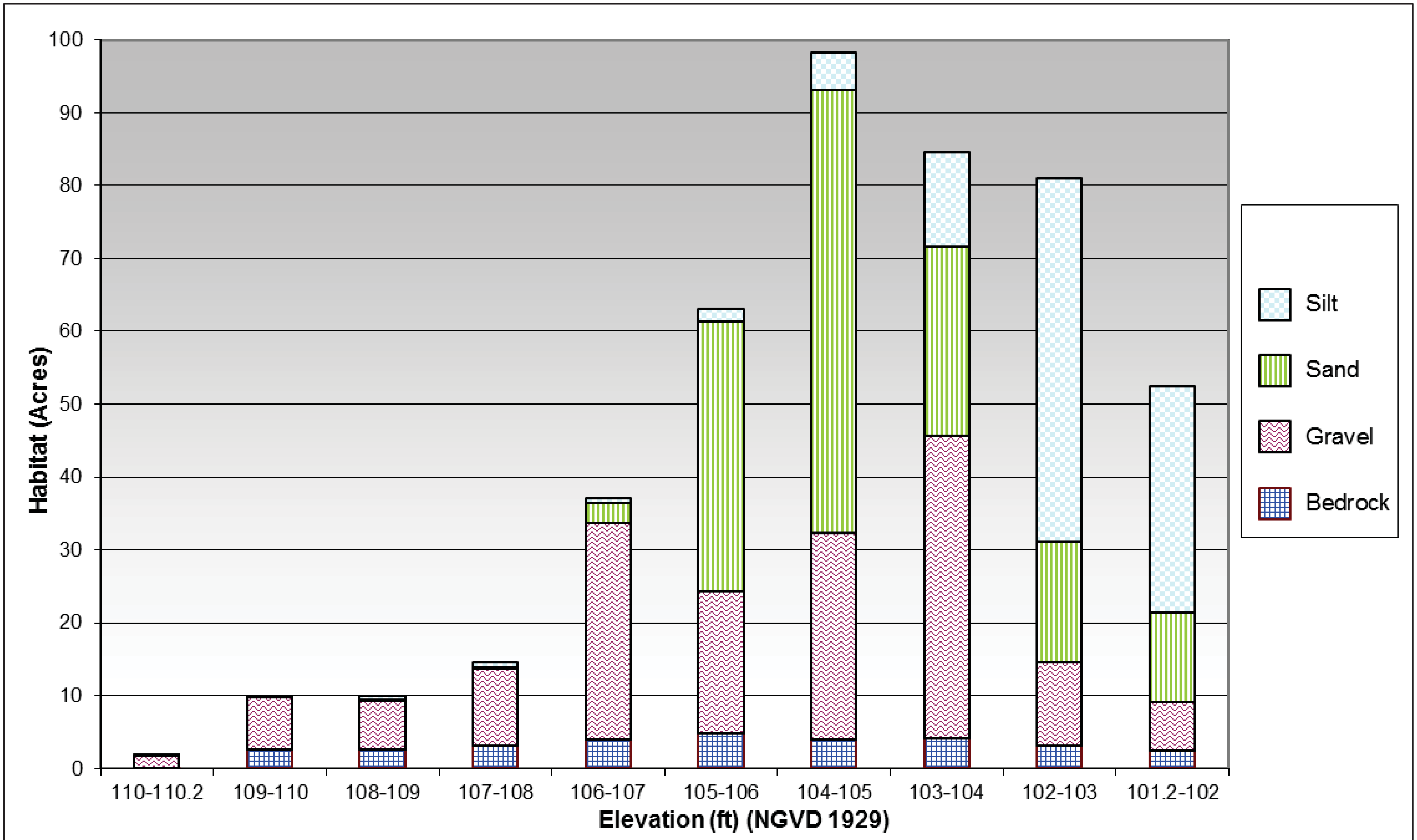
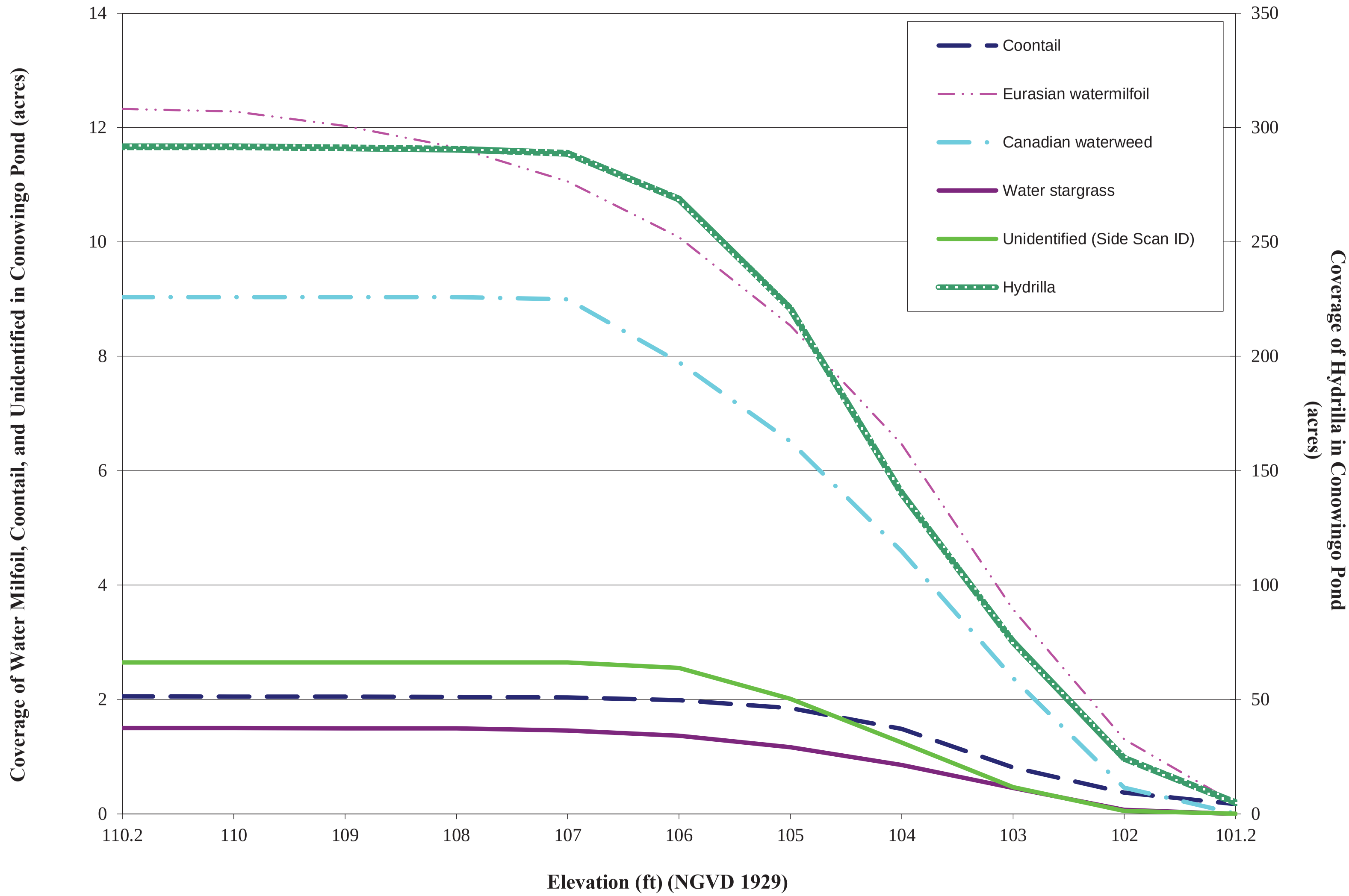
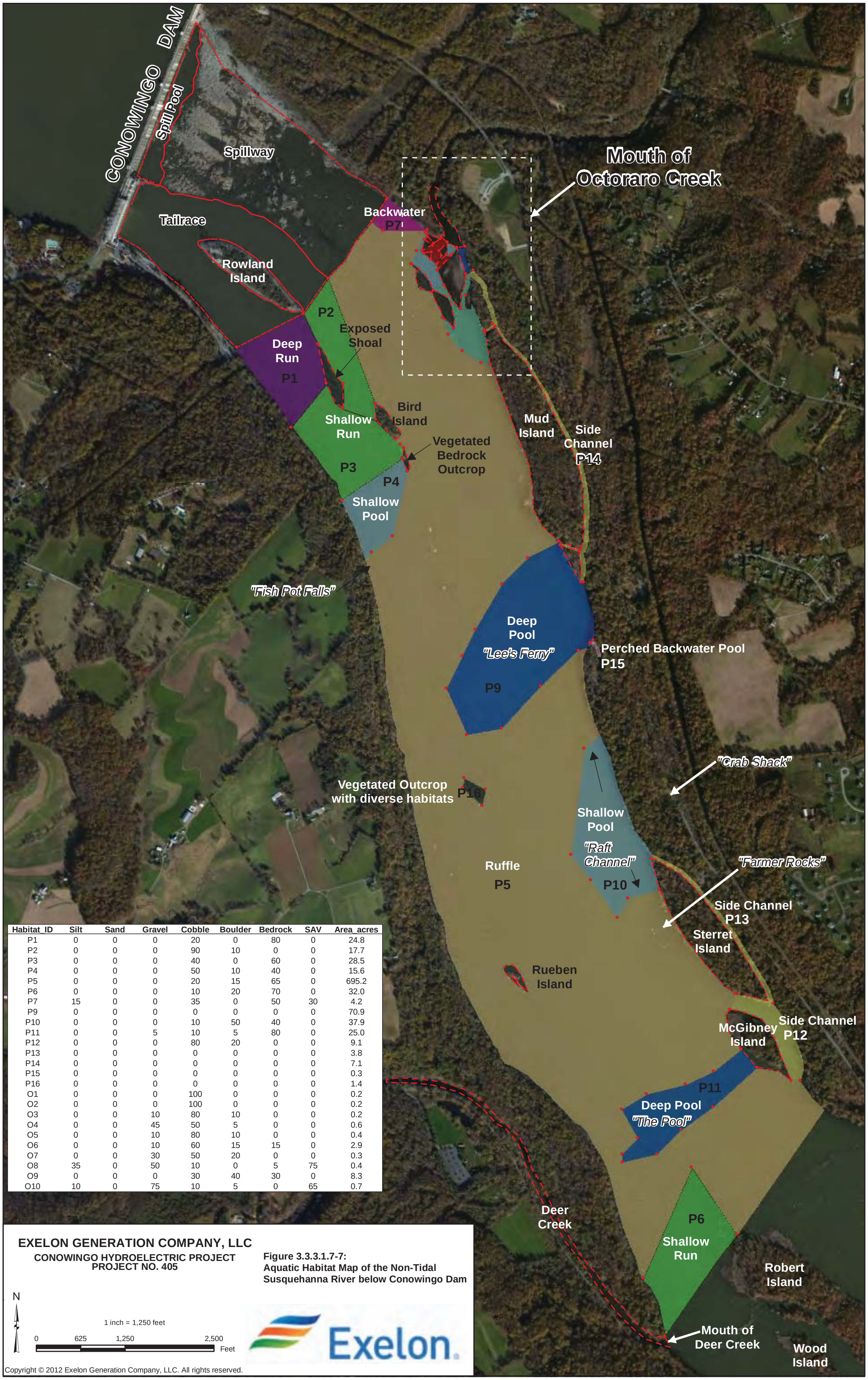


FIGURE 3.3.3.1.7-6: RELATIONSHIP BETWEEN WATER LEVELS AND SAV COVER





Habitat_ID	Silt	Sand	Gravel	Cobble	Boulder	Bedrock	SAV	Area_acres
P1	0	0	0	20	0	80	0	24.8
P2	0	0	0	90	10	0	0	17.7
P3	0	0	0	40	0	60	0	28.5
P4	0	0	0	50	10	40	0	15.6
P5	0	0	0	20	15	65	0	695.2
P6	0	0	0	10	20	70	0	32.0
P7	15	0	0	35	0	50	30	4.2
P9	0	0	0	0	0	0	0	70.9
P10	0	0	0	10	50	40	0	37.9
P11	0	0	5	10	5	80	0	25.0
P12	0	0	0	80	20	0	0	9.1
P13	0	0	0	0	0	0	0	3.8
P14	0	0	0	0	0	0	0	7.1
P15	0	0	0	0	0	0	0	0.3
P16	0	0	0	0	0	0	0	1.4
O1	0	0	0	100	0	0	0	0.2
O2	0	0	0	100	0	0	0	0.2
O3	0	0	10	80	10	0	0	0.2
O4	0	0	45	50	5	0	0	0.6
O5	0	0	10	80	10	0	0	0.4
O6	0	0	10	60	15	15	0	2.9
O7	0	0	30	50	20	0	0	0.3
O8	35	0	50	10	0	5	75	0.4
O9	0	0	0	30	40	30	0	8.3
O10	10	0	75	10	5	0	65	0.7

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Figure 3.3.3.1.7-7:
Aquatic Habitat Map of the Non-Tidal Susquehanna River below Conowingo Dam

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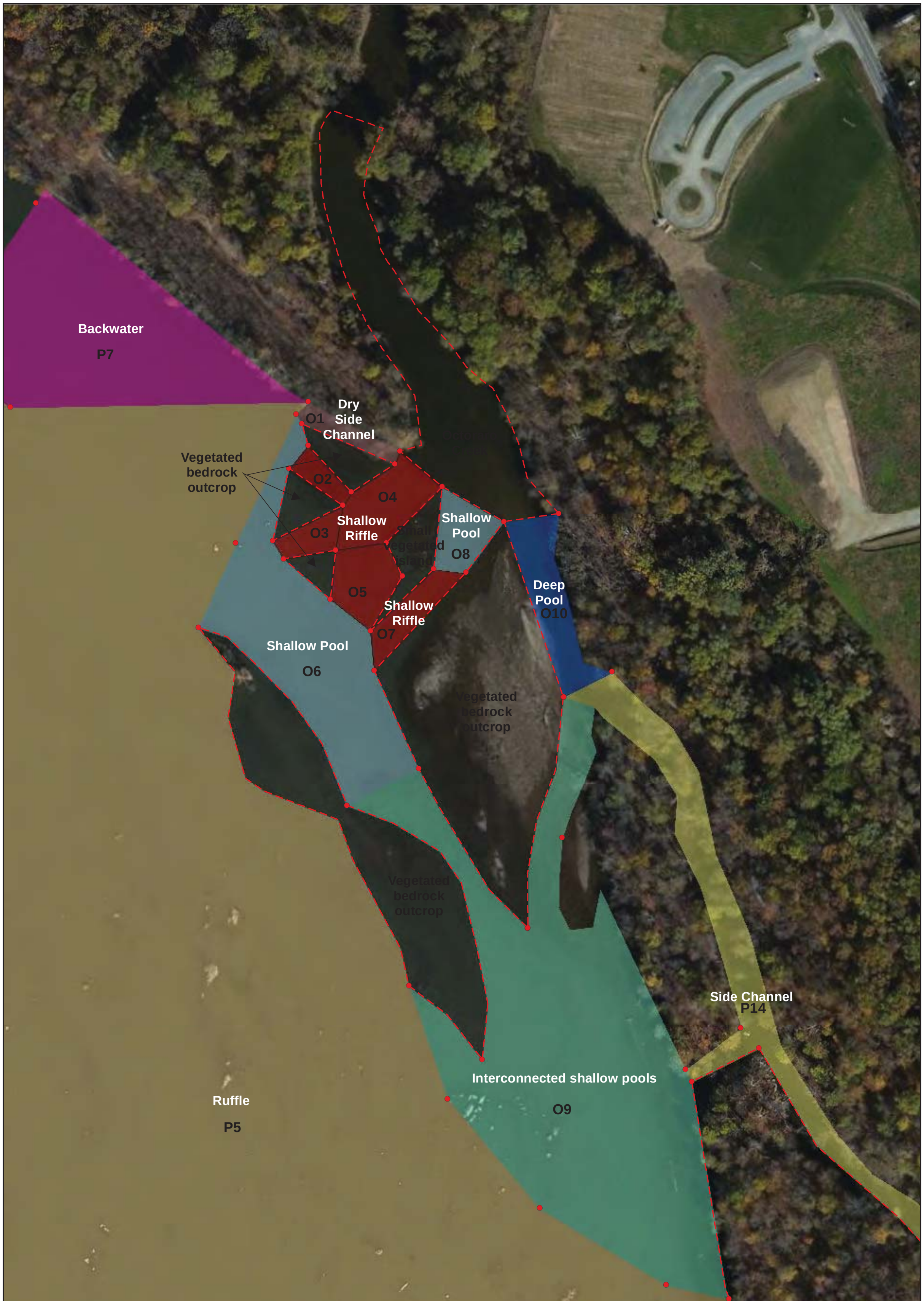

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Figure 3.3.3.1.7-8:
Aquatic Habitat Map of the Non-Tidal
Susquehanna River near Octoraro Creek

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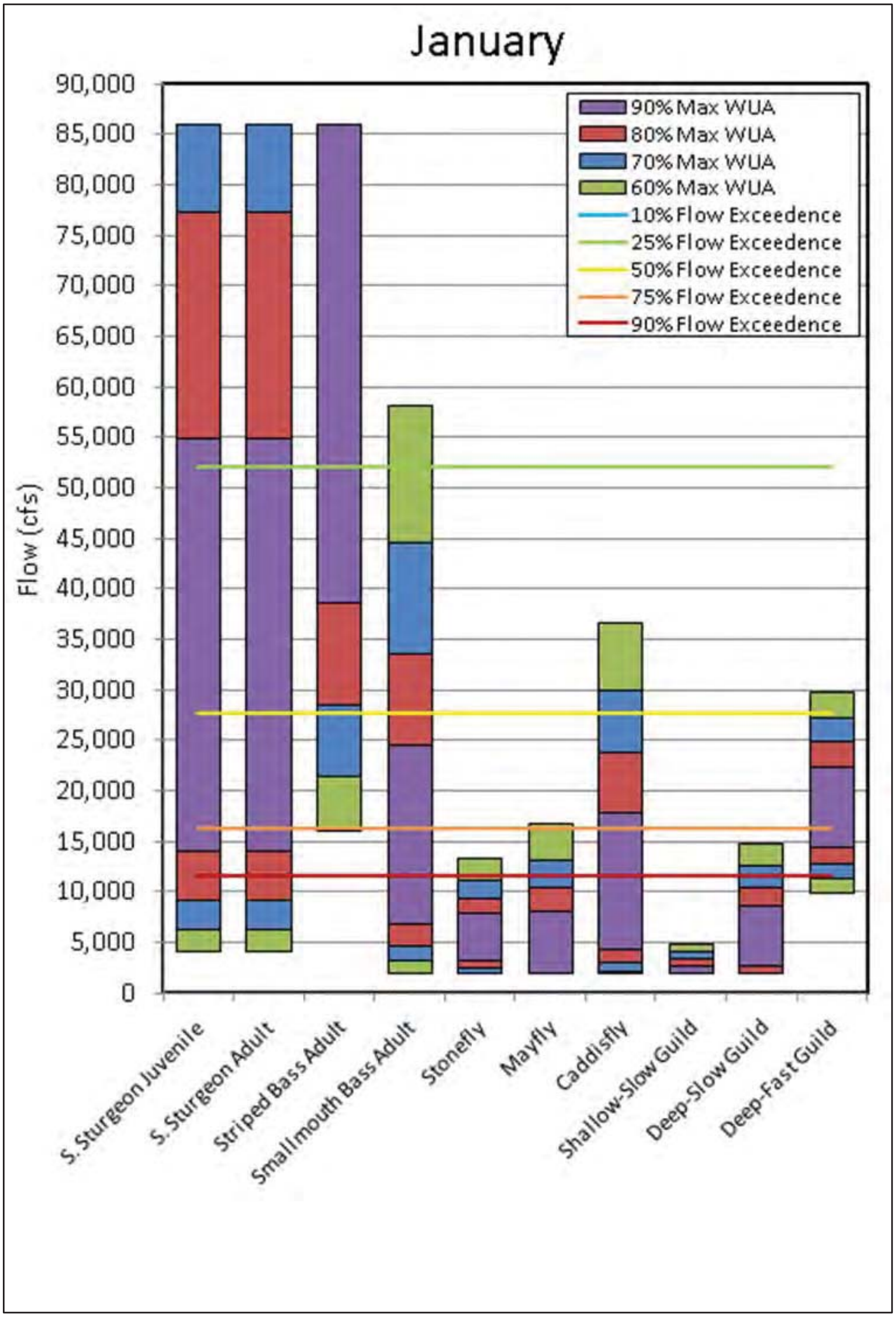
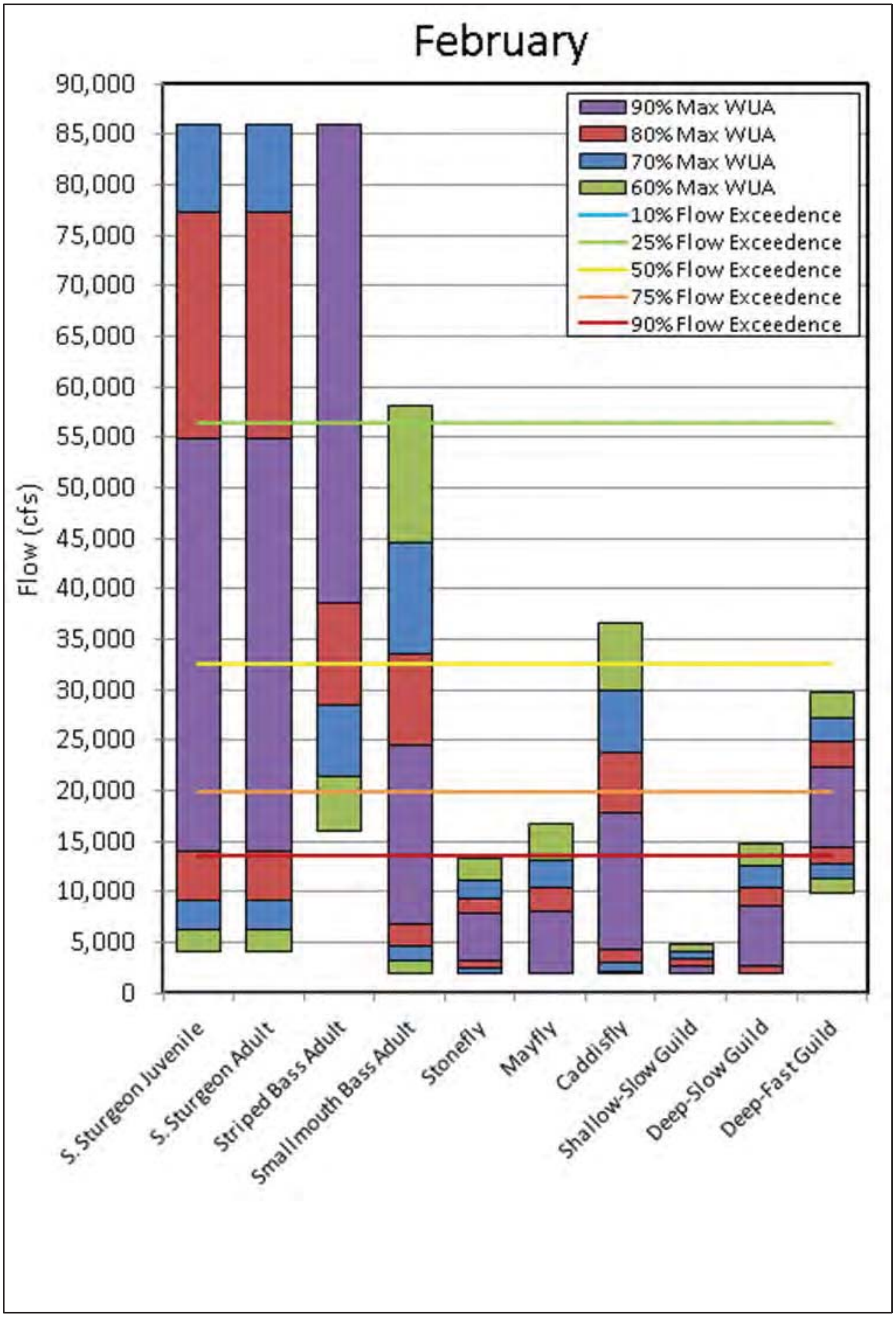
FIGURE 3.3.3.1.7-9: JANUARY FLOW VS. HABITAT COMPARISON



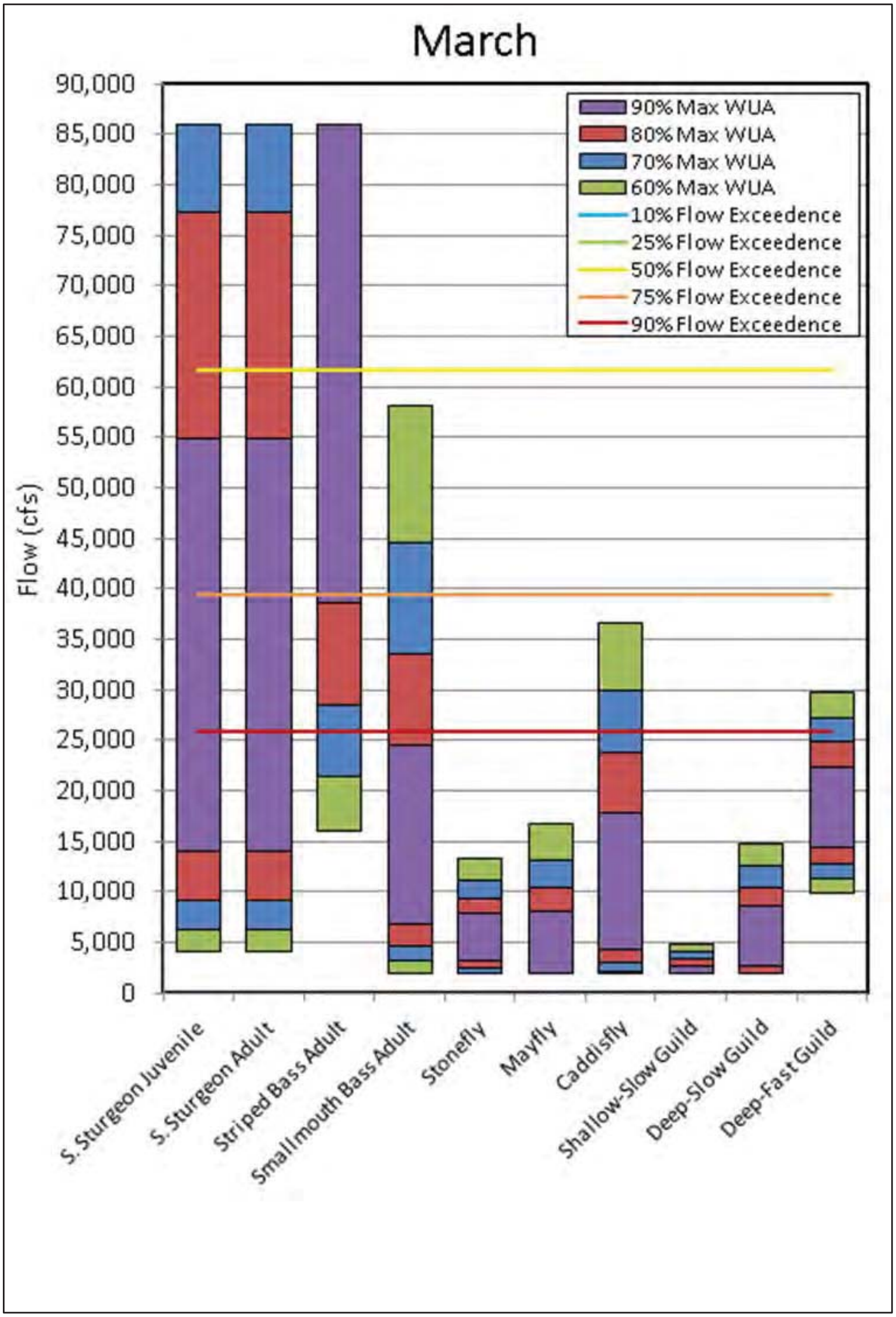
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-10: FEBRUARY FLOW VS. HABITAT COMPARISON



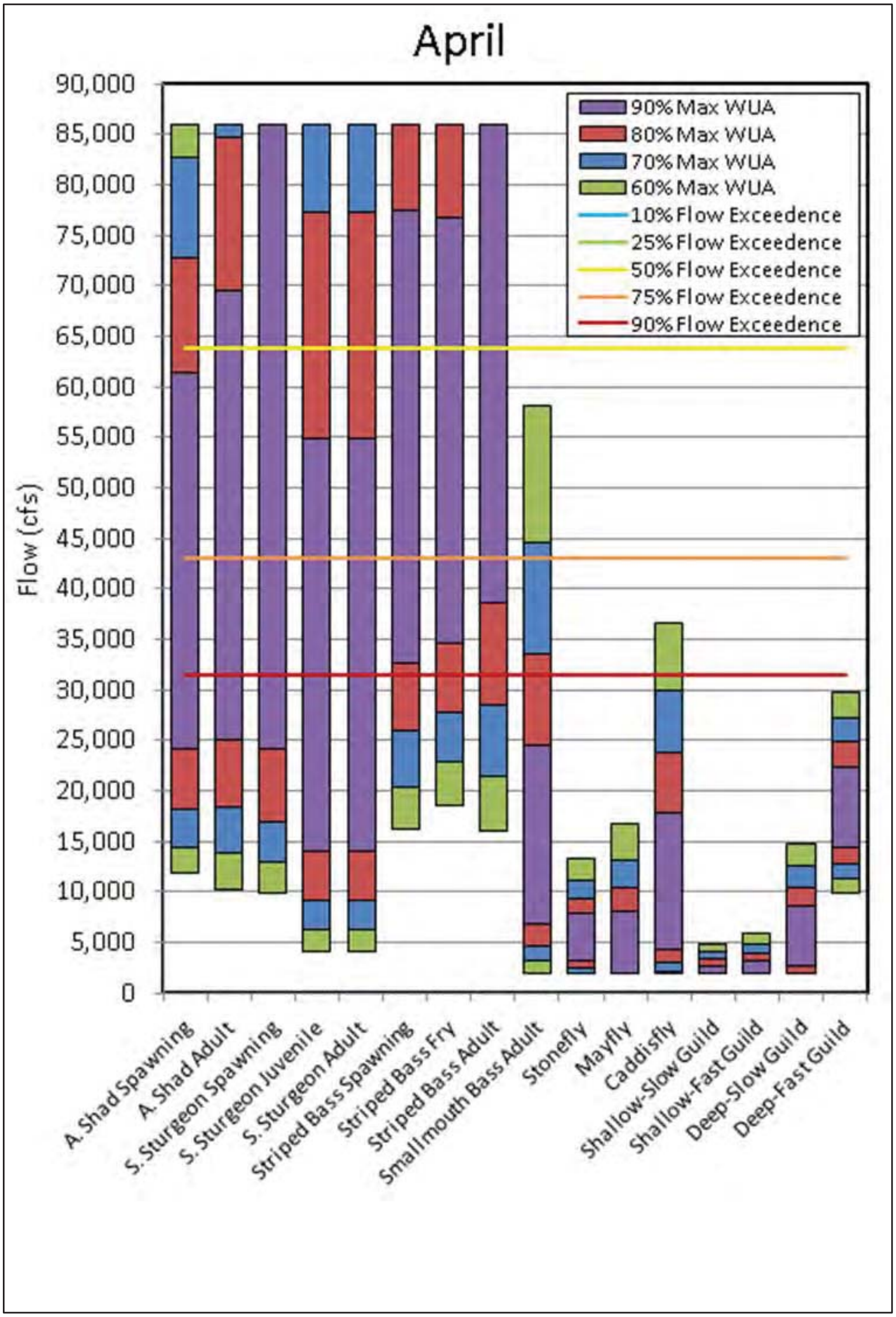
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-11: MARCH FLOW VS. HABITAT COMPARISON



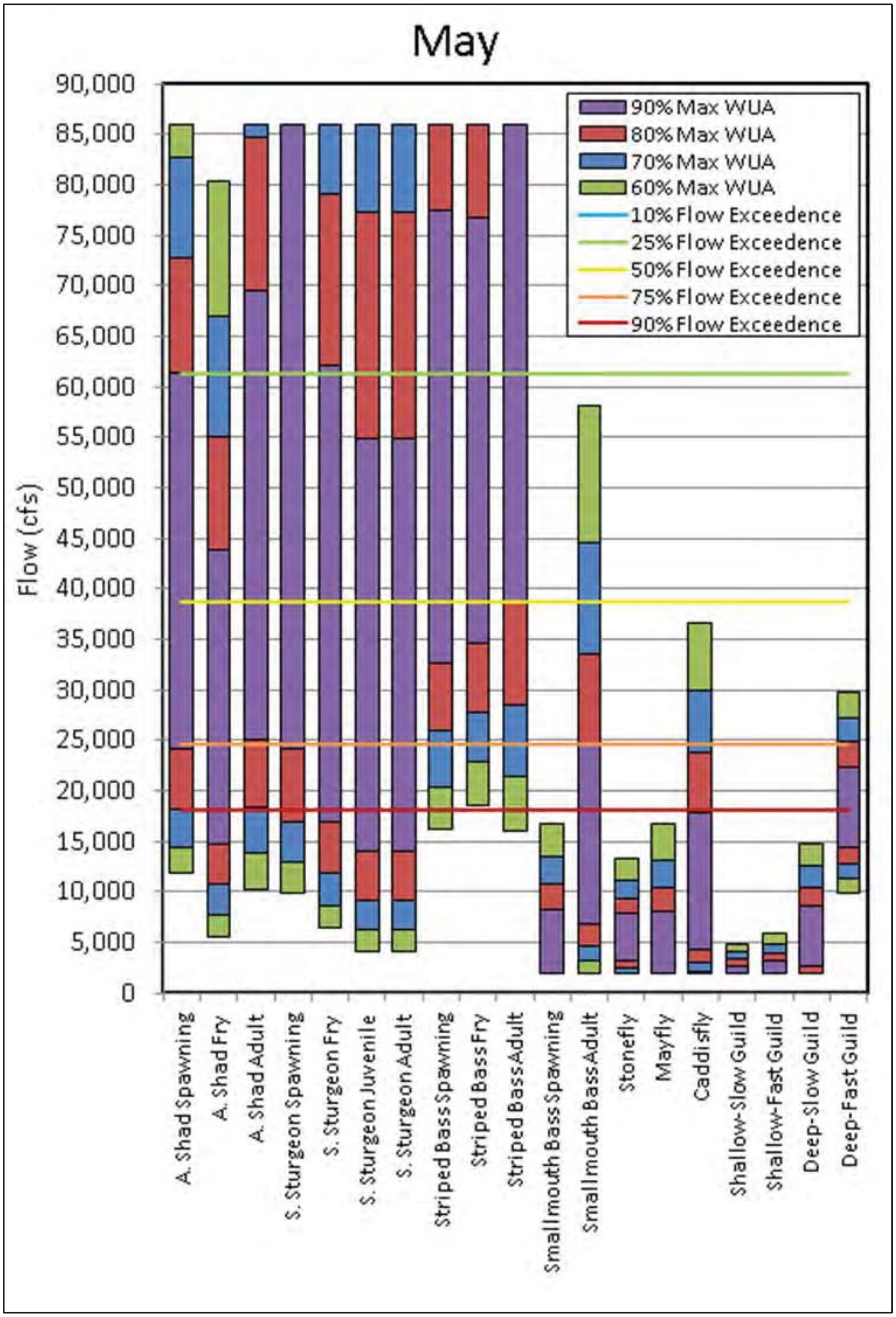
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-12: APRIL FLOW VS. HABITAT COMPARISON



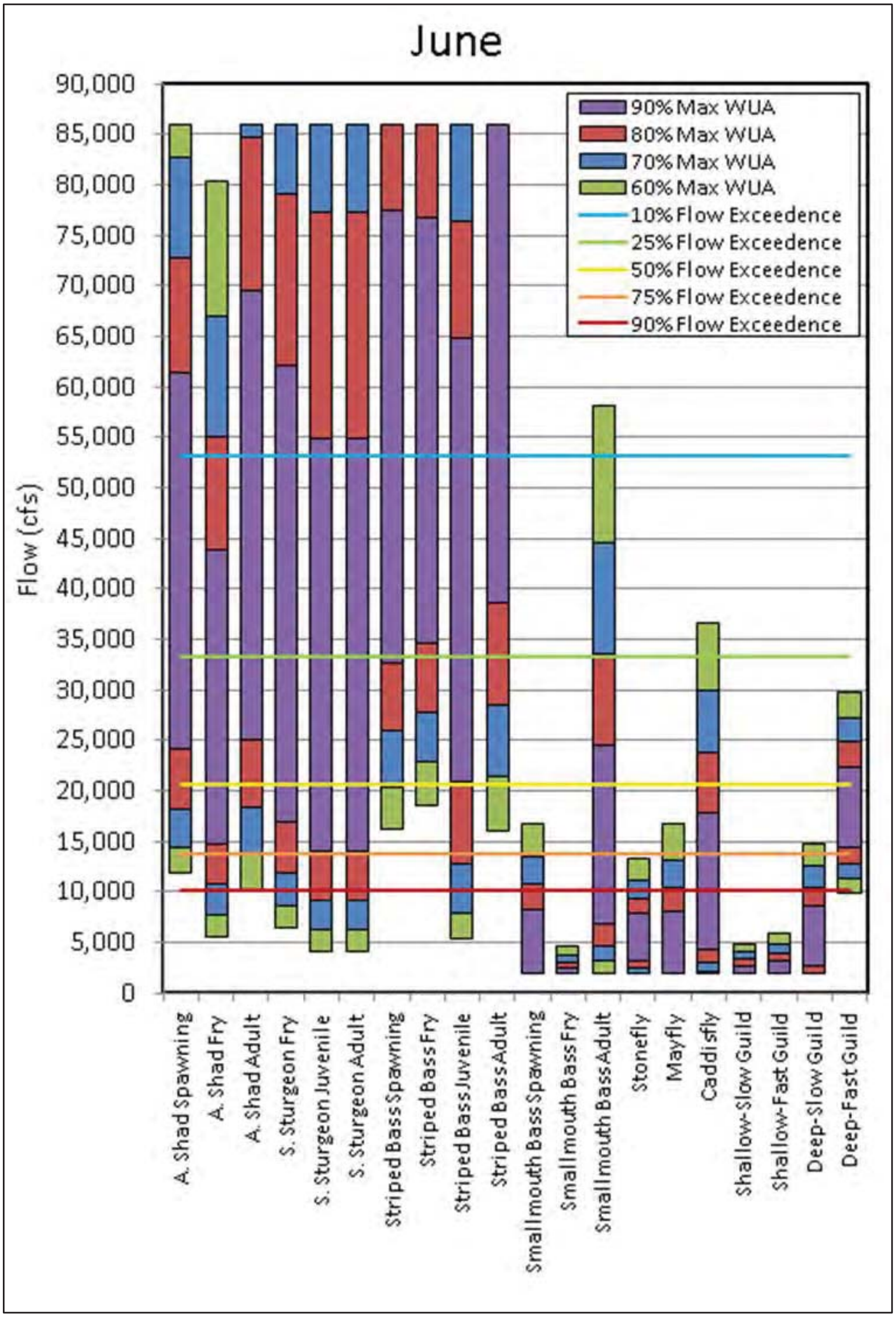
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-13: MAY FLOW VS. HABITAT COMPARISON



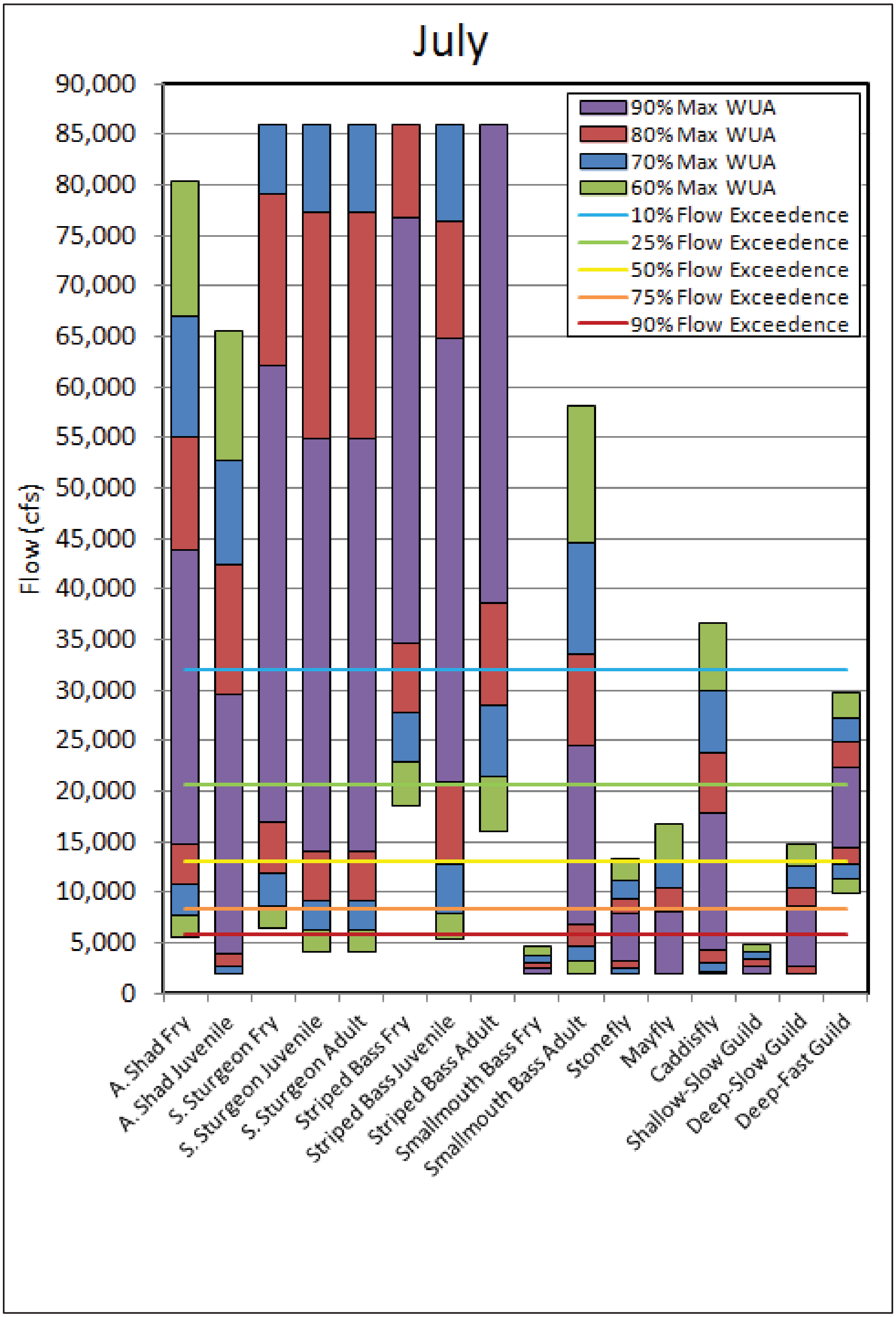
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-14: JUNE FLOW VS. HABITAT COMPARISON



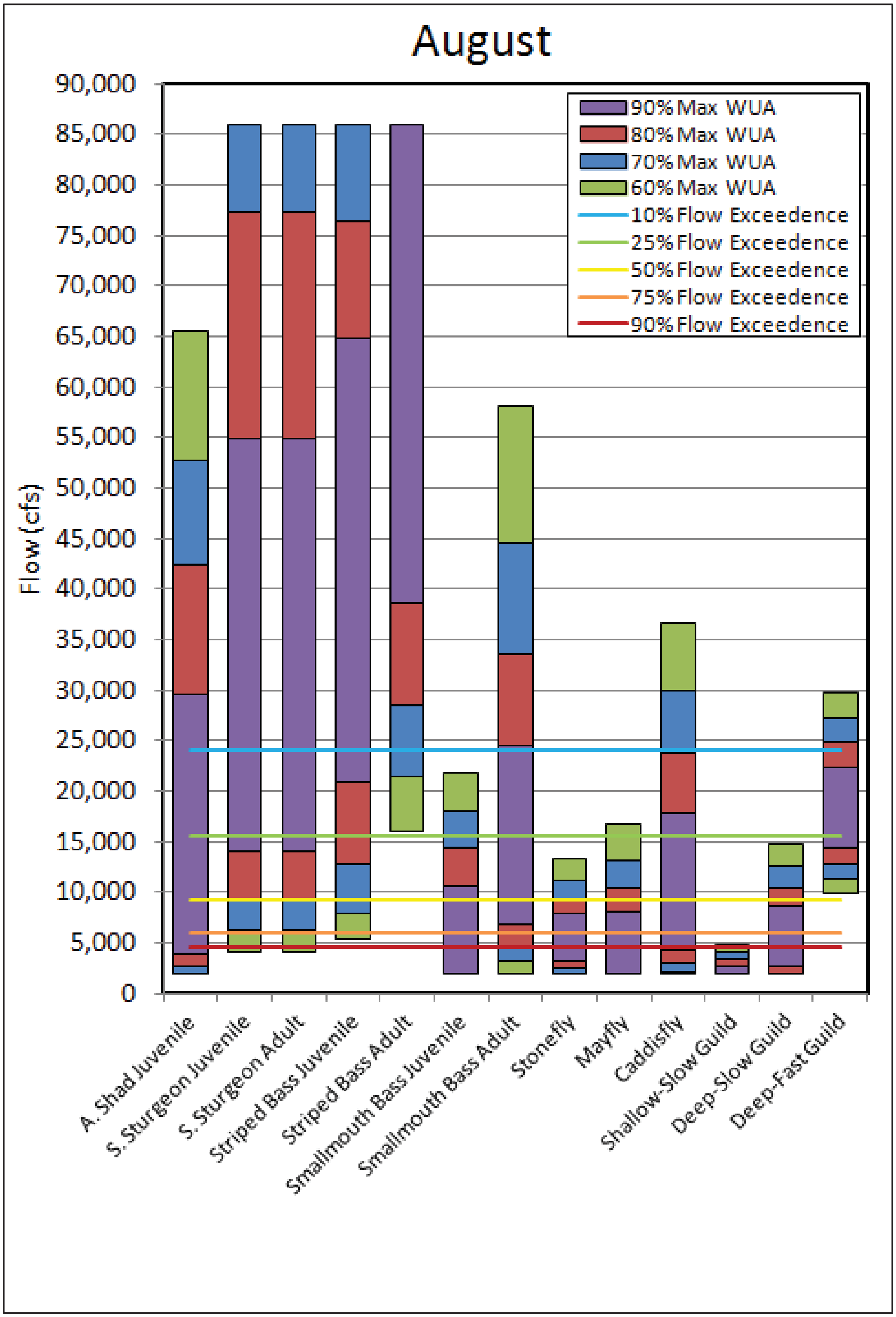
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-15: JULY FLOW VS. HABITAT COMPARISON



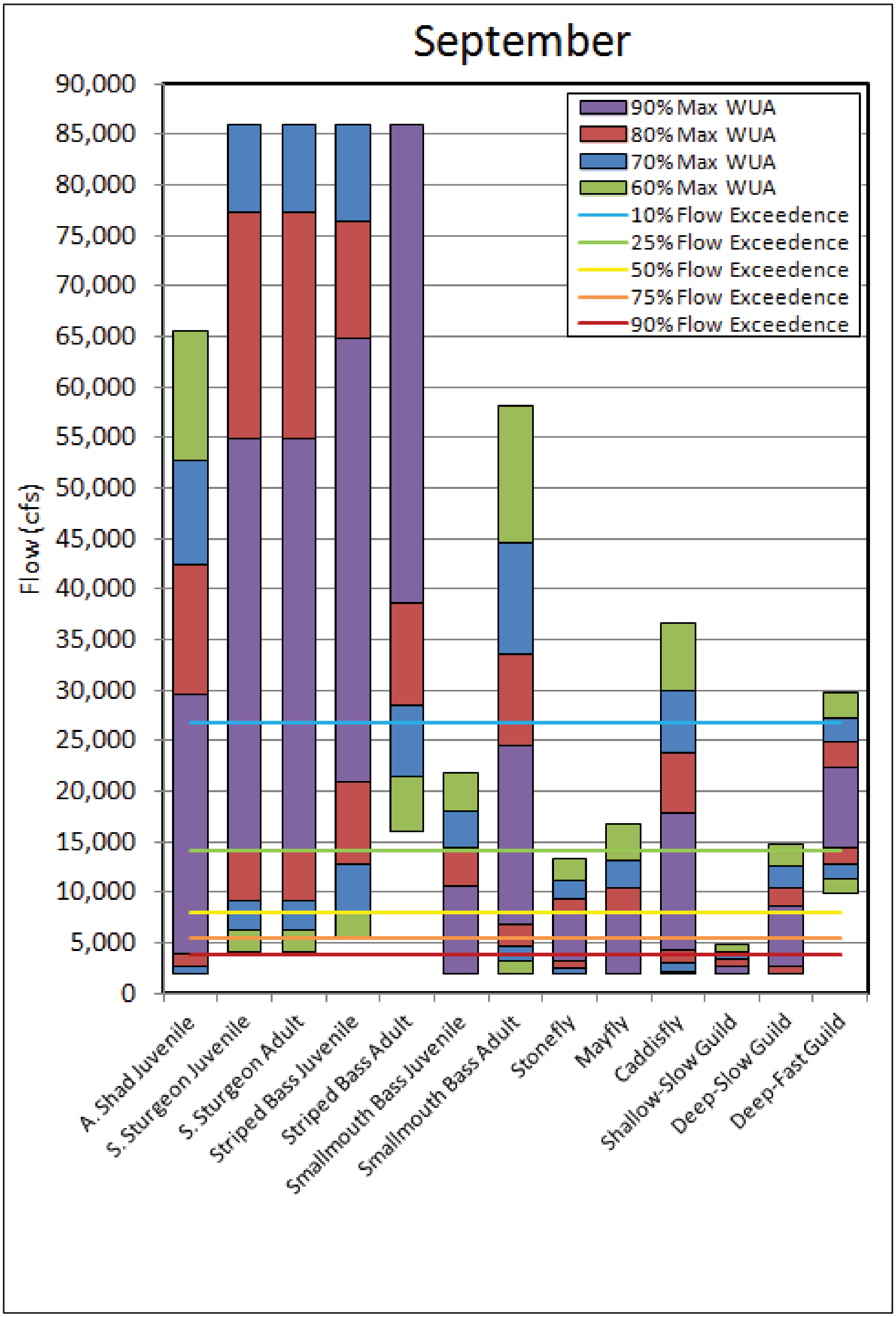
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-16: AUGUST FLOW VS. HABITAT COMPARISON



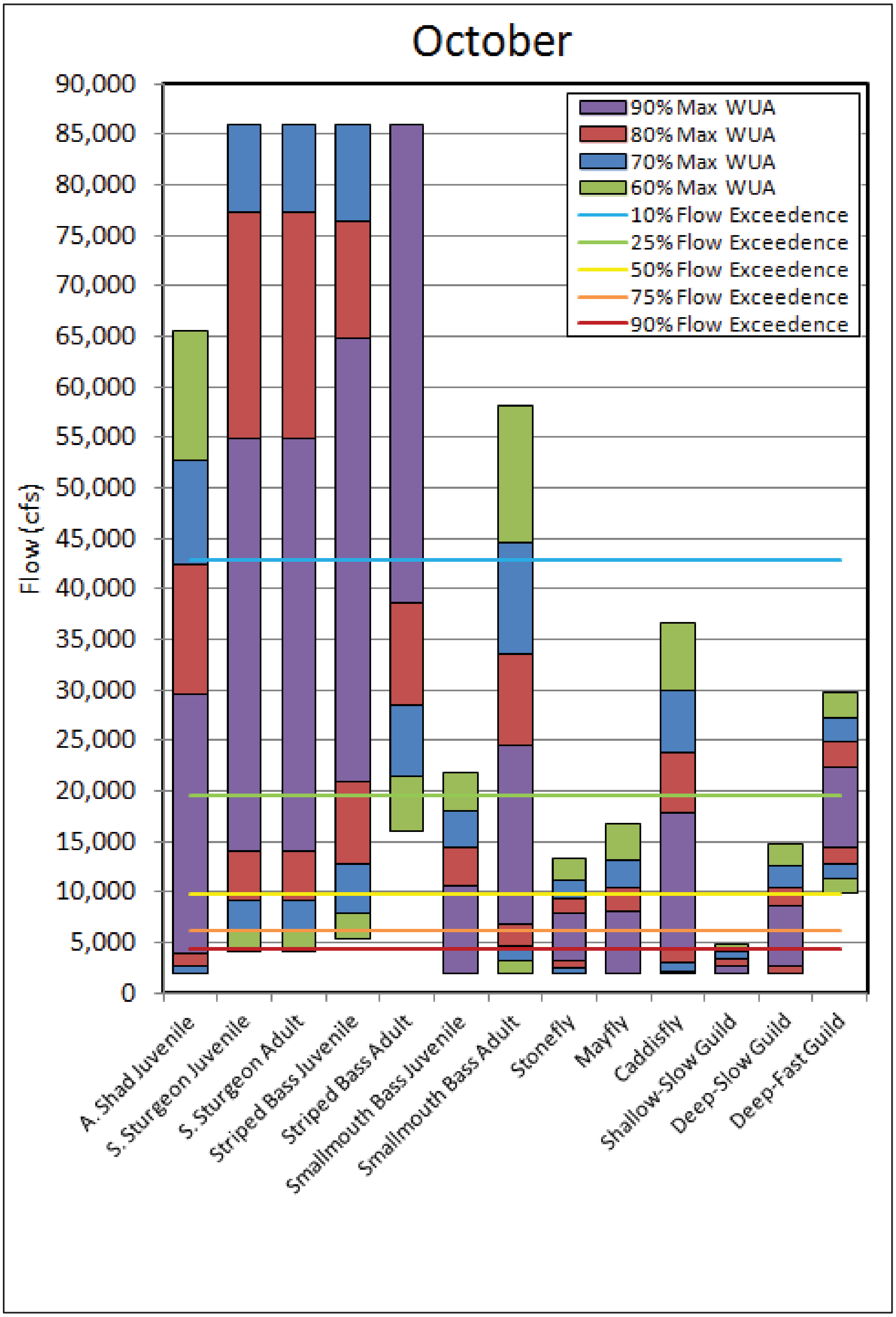
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-17: SEPTEMBER FLOW VS. HABITAT COMPARISON



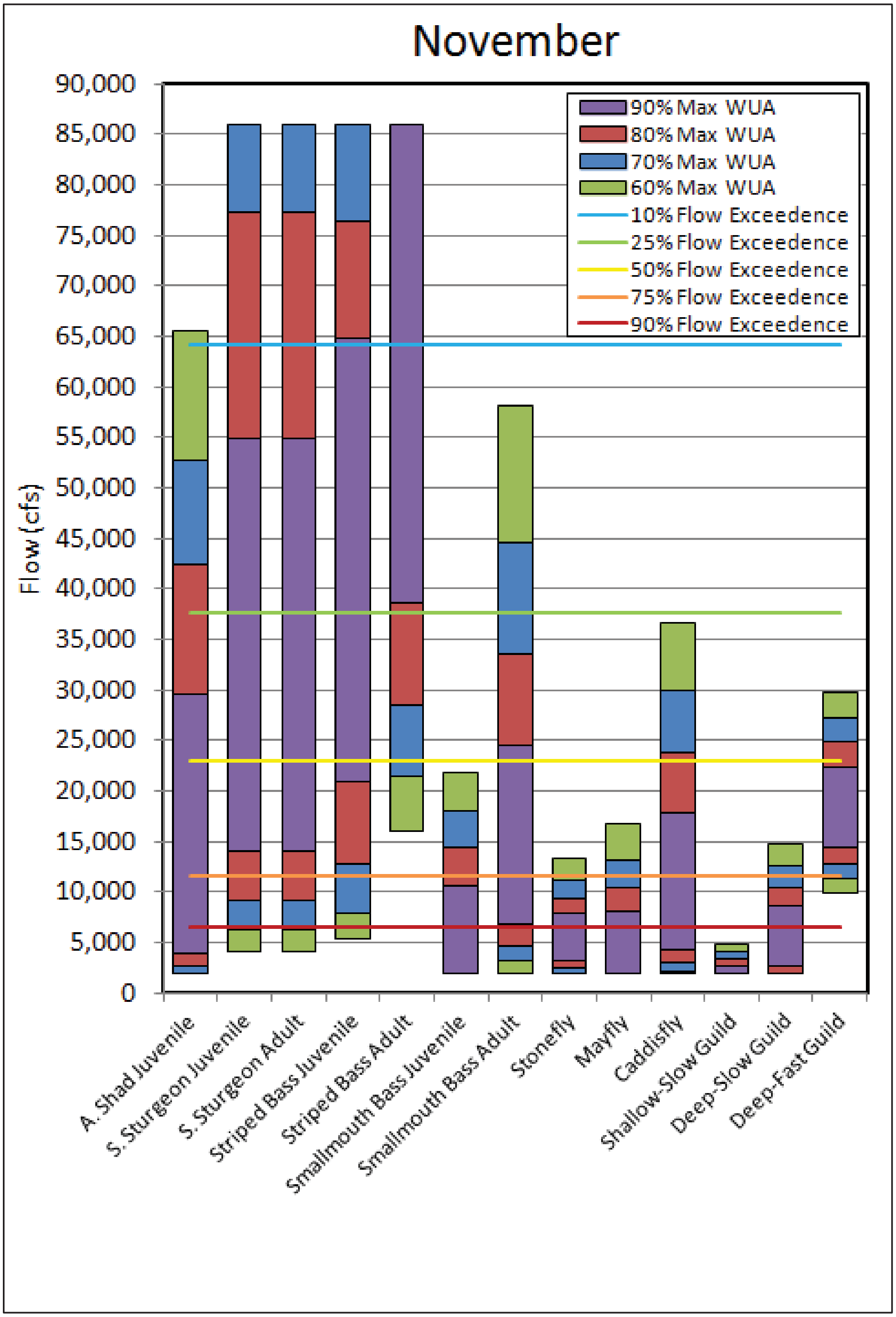
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-18: OCTOBER FLOW VS. HABITAT COMPARISON



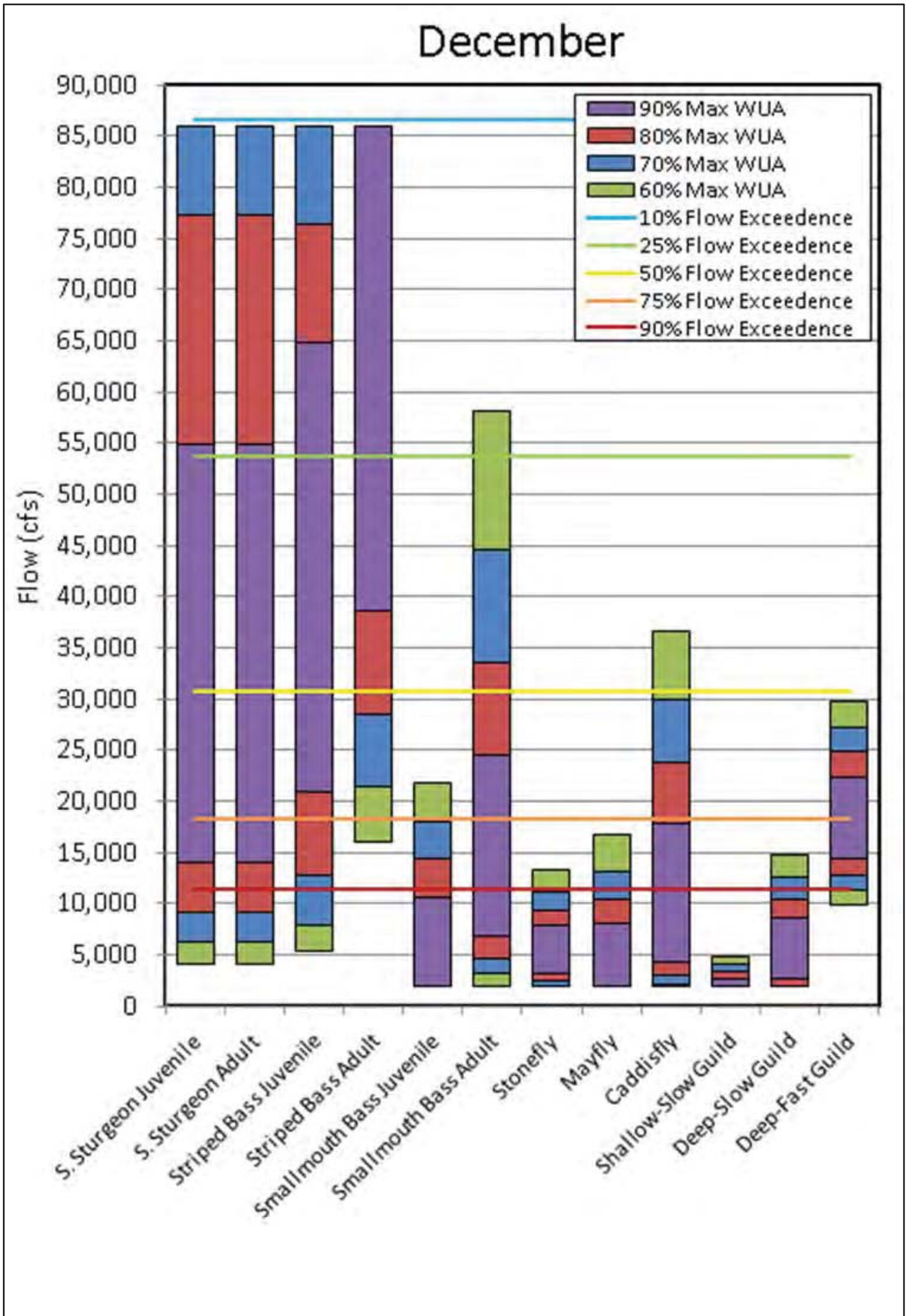
Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-19: NOVEMBER FLOW VS. HABITAT COMPARISON



Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-20: DECEMBER FLOW VS. HABITAT COMPARISON



Note: Flow exceedances are from Conowingo estimated unregulated flows, period of record WY 1934-2009.

FIGURE 3.3.3.1.7-21: SELECT AMERICAN SHAD SPAWNING HABITAT MAPS

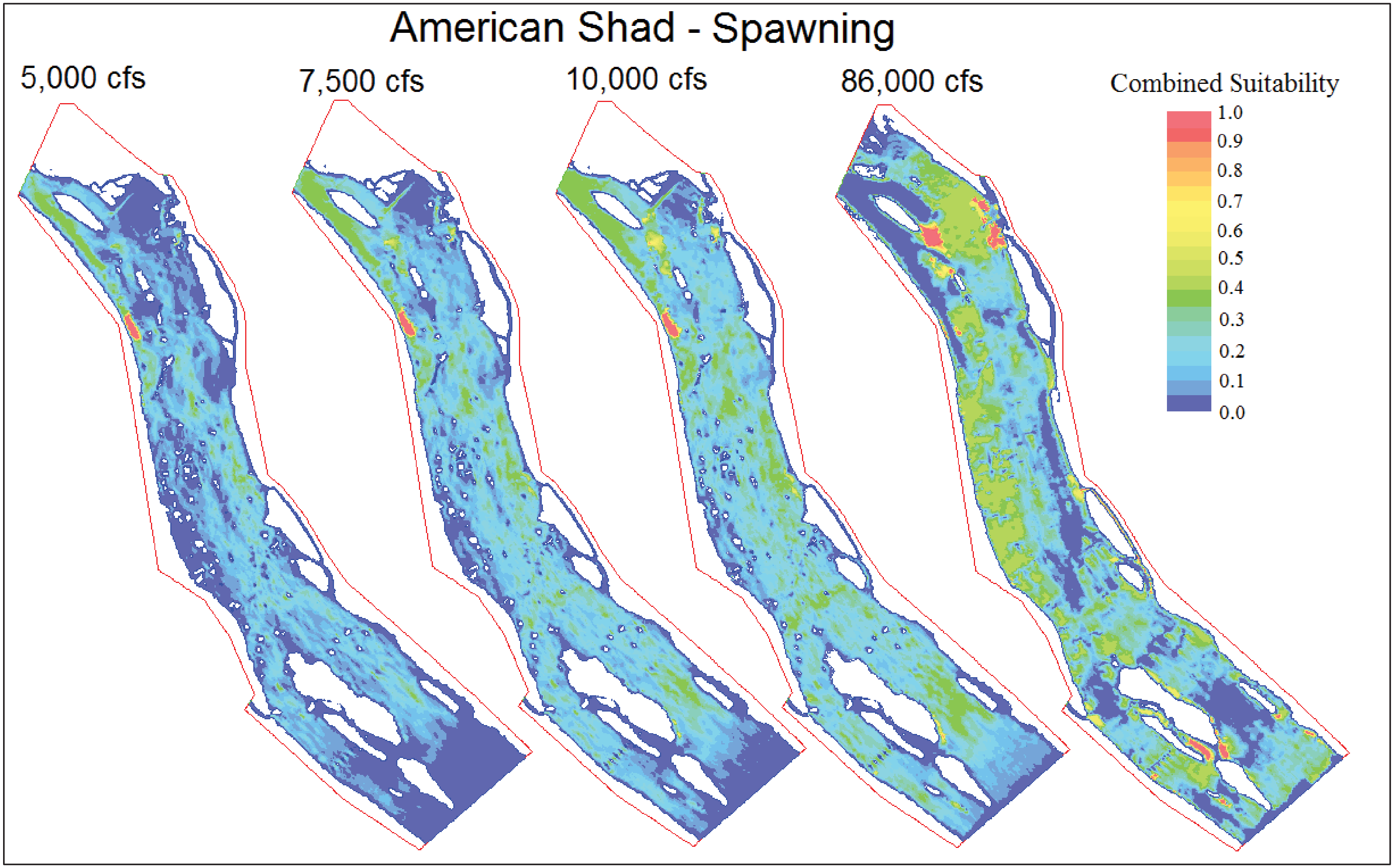


FIGURE 3.3.3.1.7-22: SELECT AMERICAN SHAD FRY HABITAT MAPS

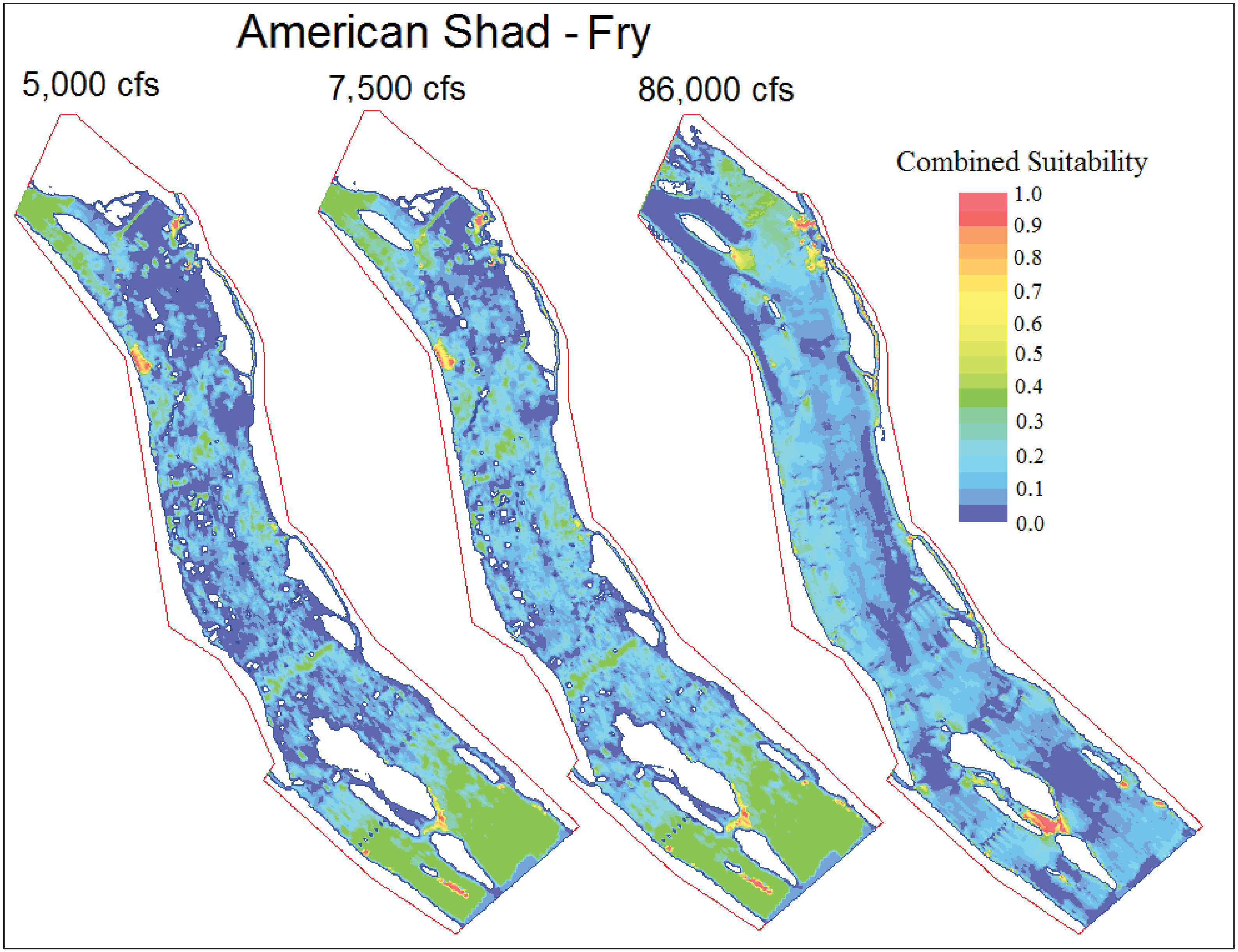


FIGURE 3.3.3.1.7-23: SELECT AMERICAN SHAD JUVENILE HABITAT MAPS

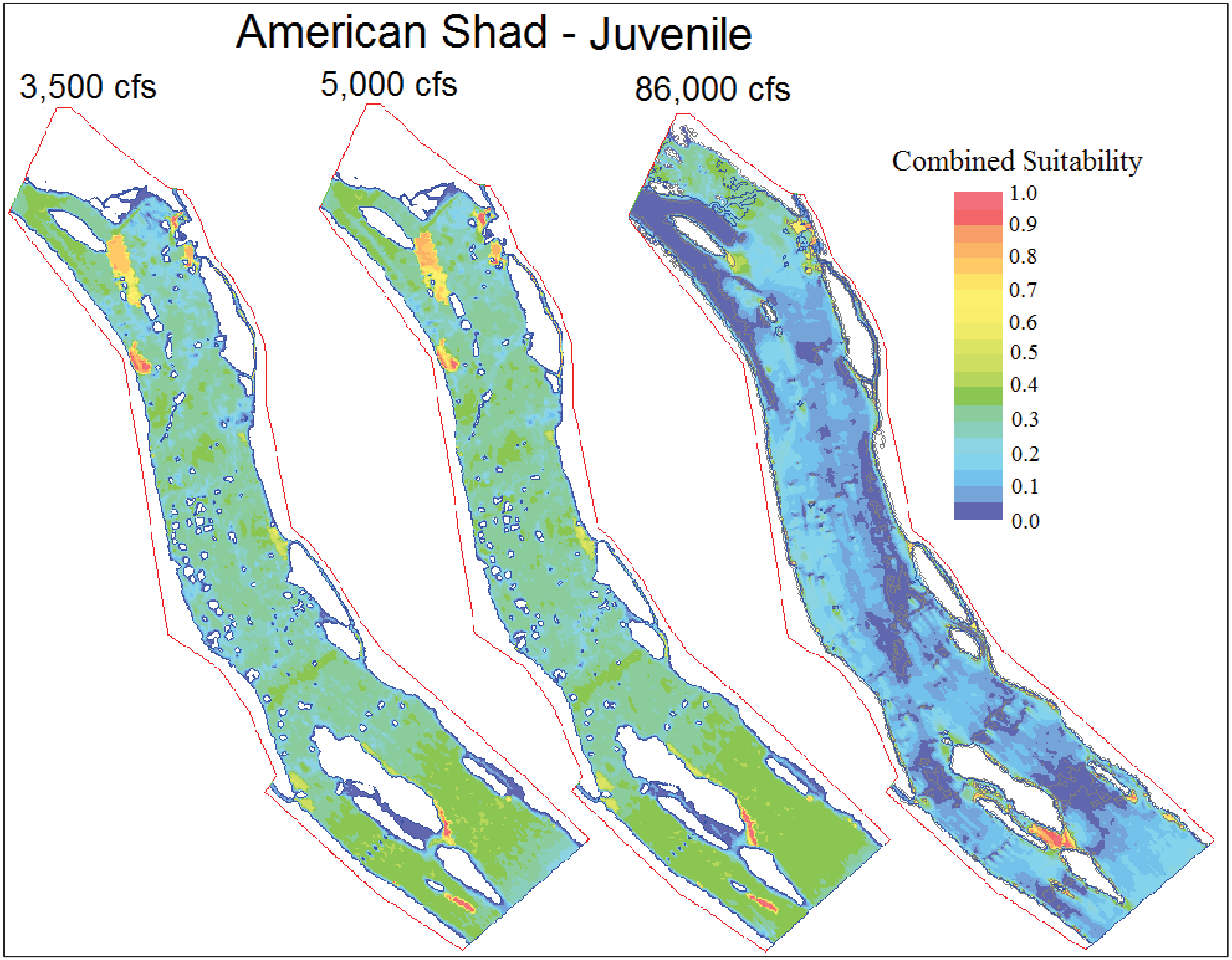


FIGURE 3.3.3.1.7-24: SELECT AMERICAN SHAD ADULT HABITAT MAPS

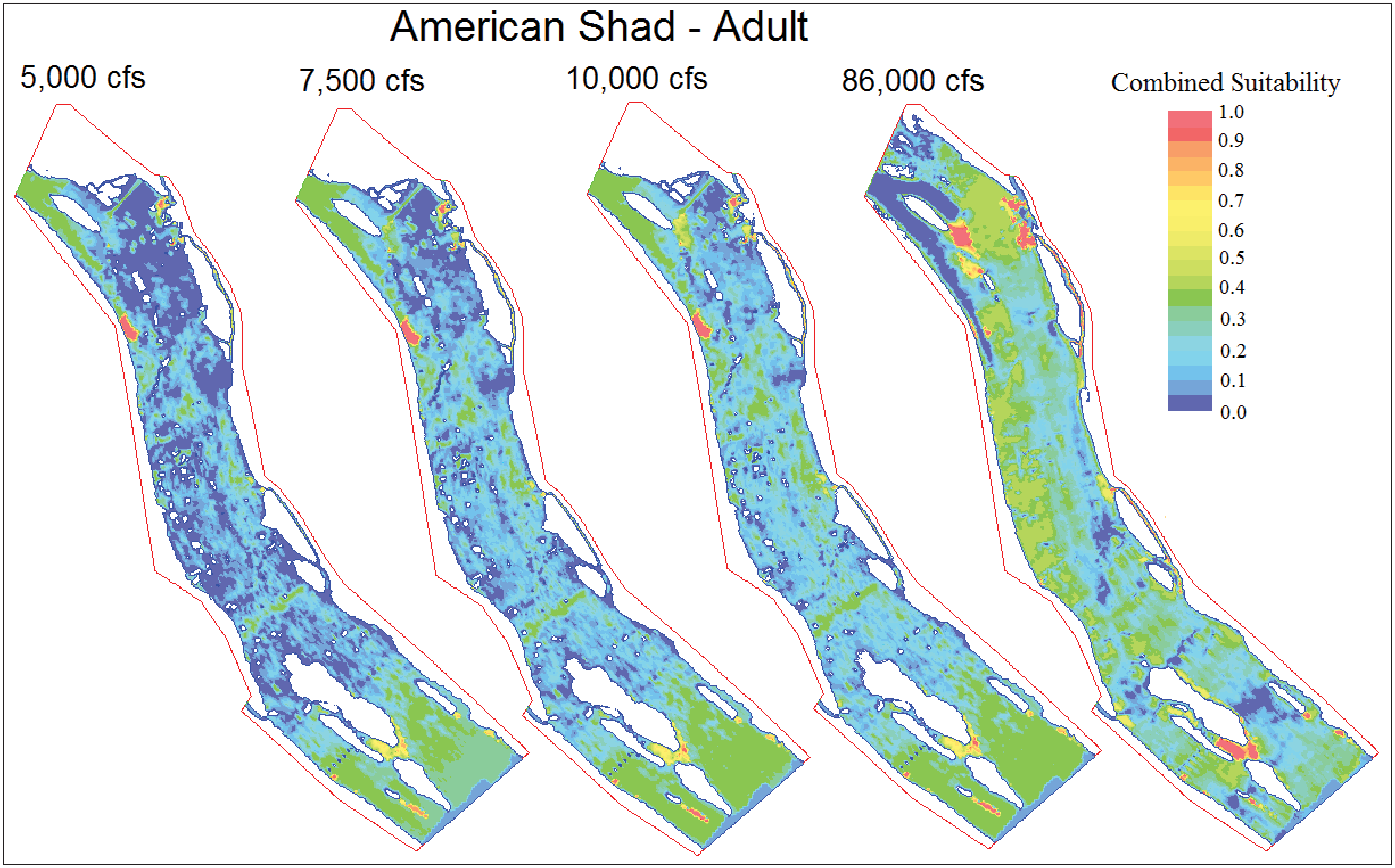

American Shad - Adult
5,000 cfs
7,500 cfs
10,000 cfs
86,000 cfs
Combined Suitability
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

FIGURE 3.3.3.1.7-25: SELECT SHORTNOSE STURGEON SPAWNING HABITAT MAPS

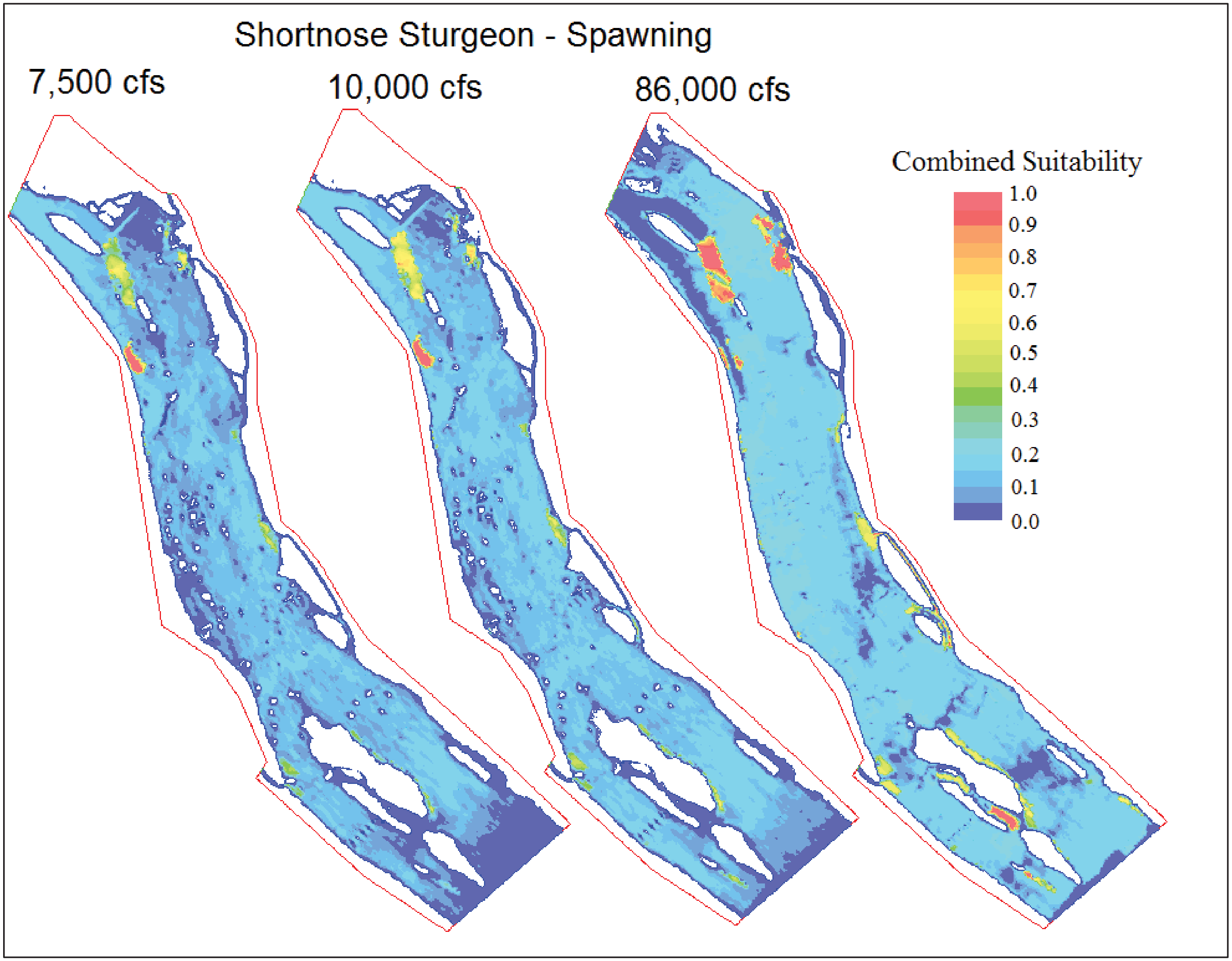


FIGURE 3.3.3.1.7-26: SELECT SHORTNOSE STURGEON FRY HABITAT MAPS

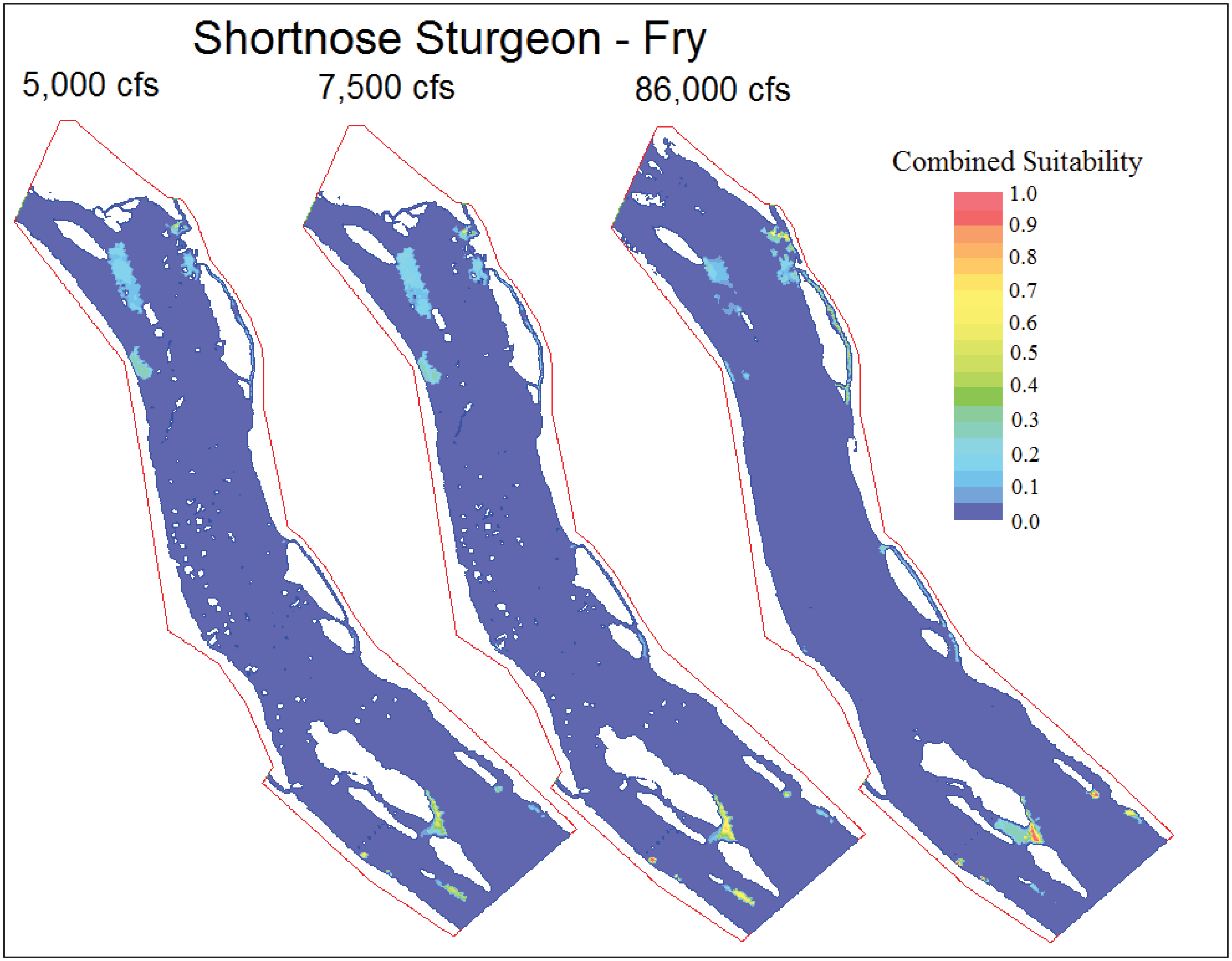


FIGURE 3.3.3.1.7-27: SELECT SHORTNOSE STURGEON JUVENILE AND ADULT HABITAT MAPS

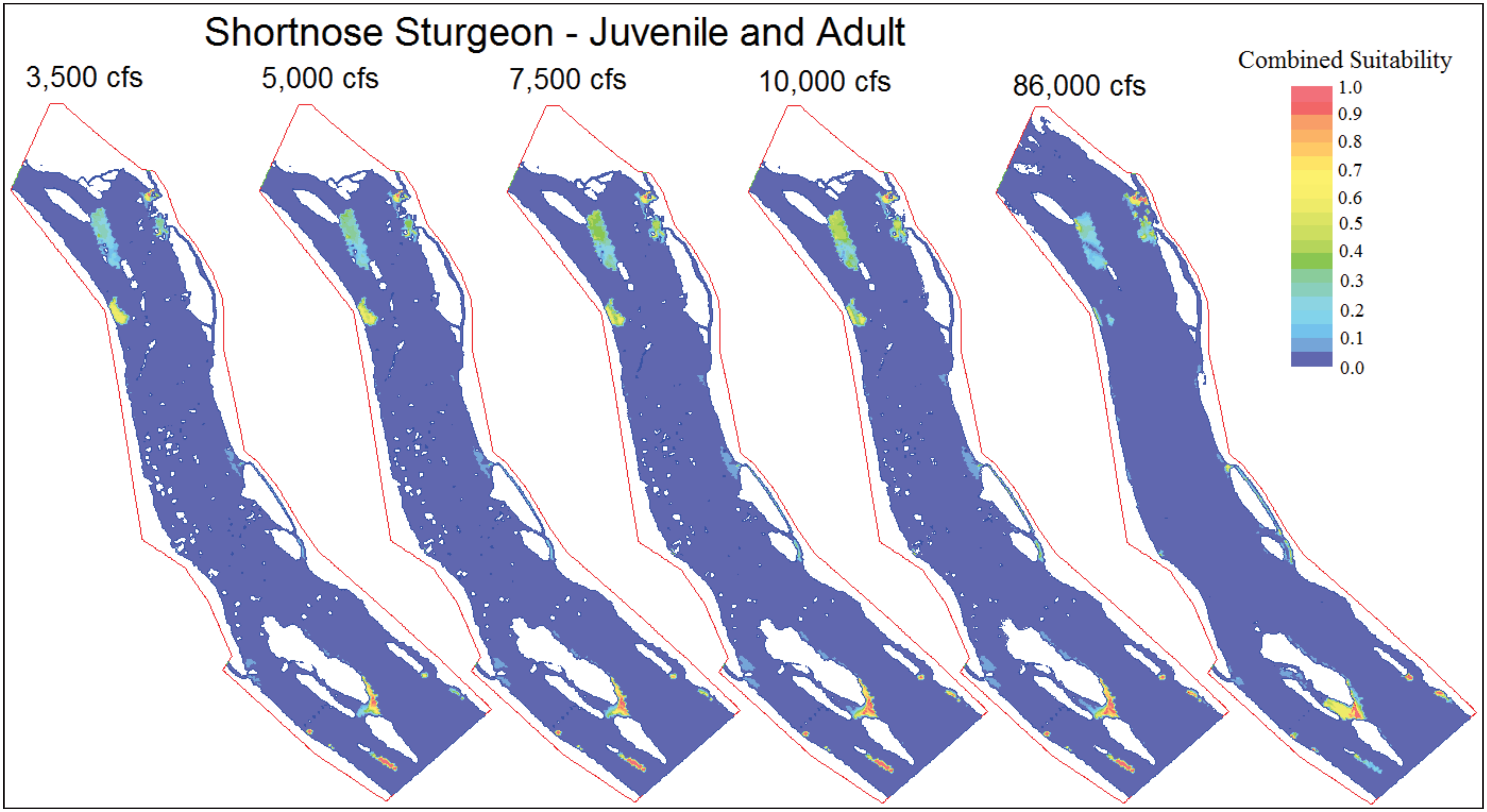


FIGURE 3.3.3.1.7-28: SELECT STRIPED BASS SPAWNING HABITAT MAPS

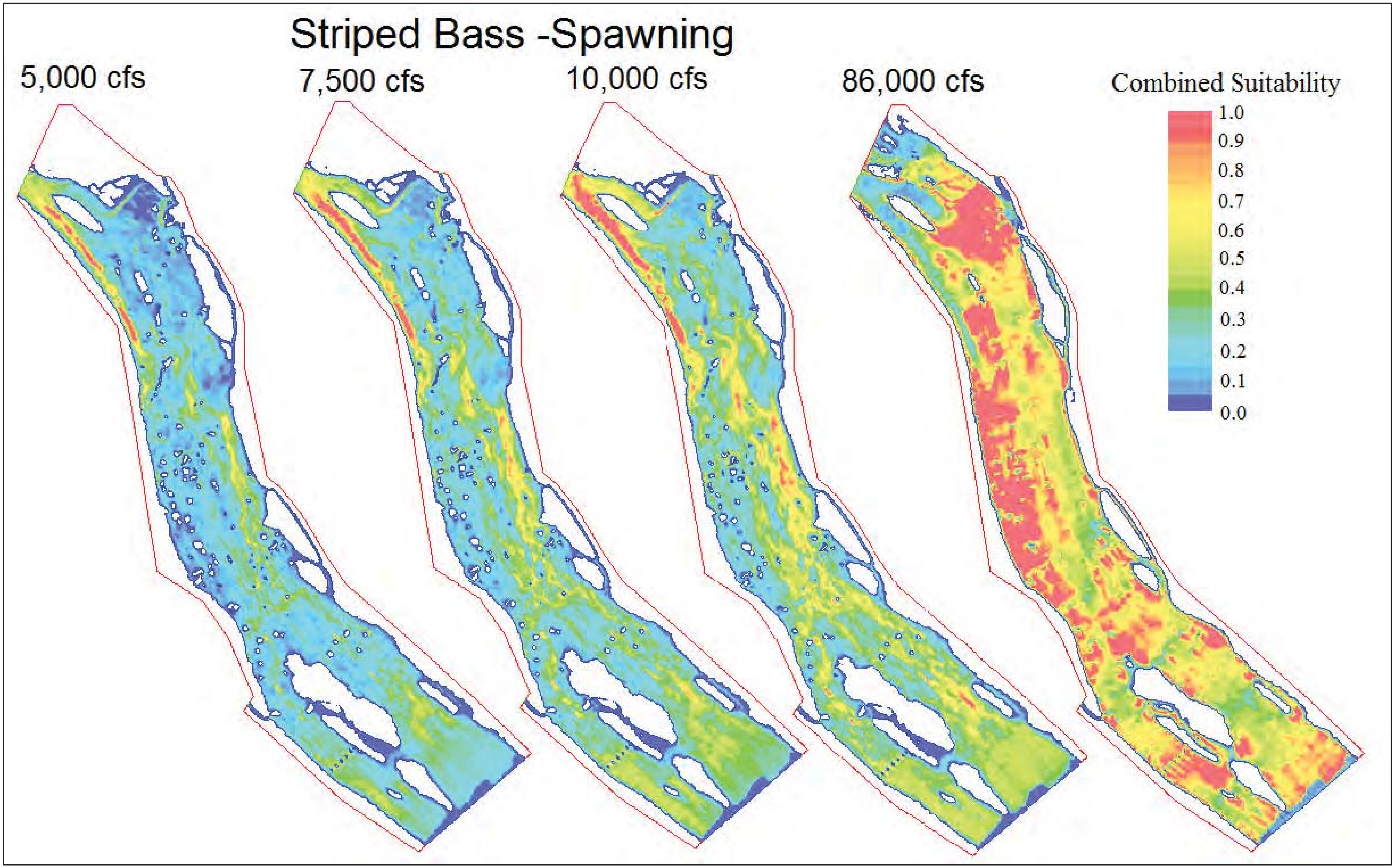


FIGURE 3.3.3.1.7-29: SELECT STRIPED BASS FRY HABITAT MAPS

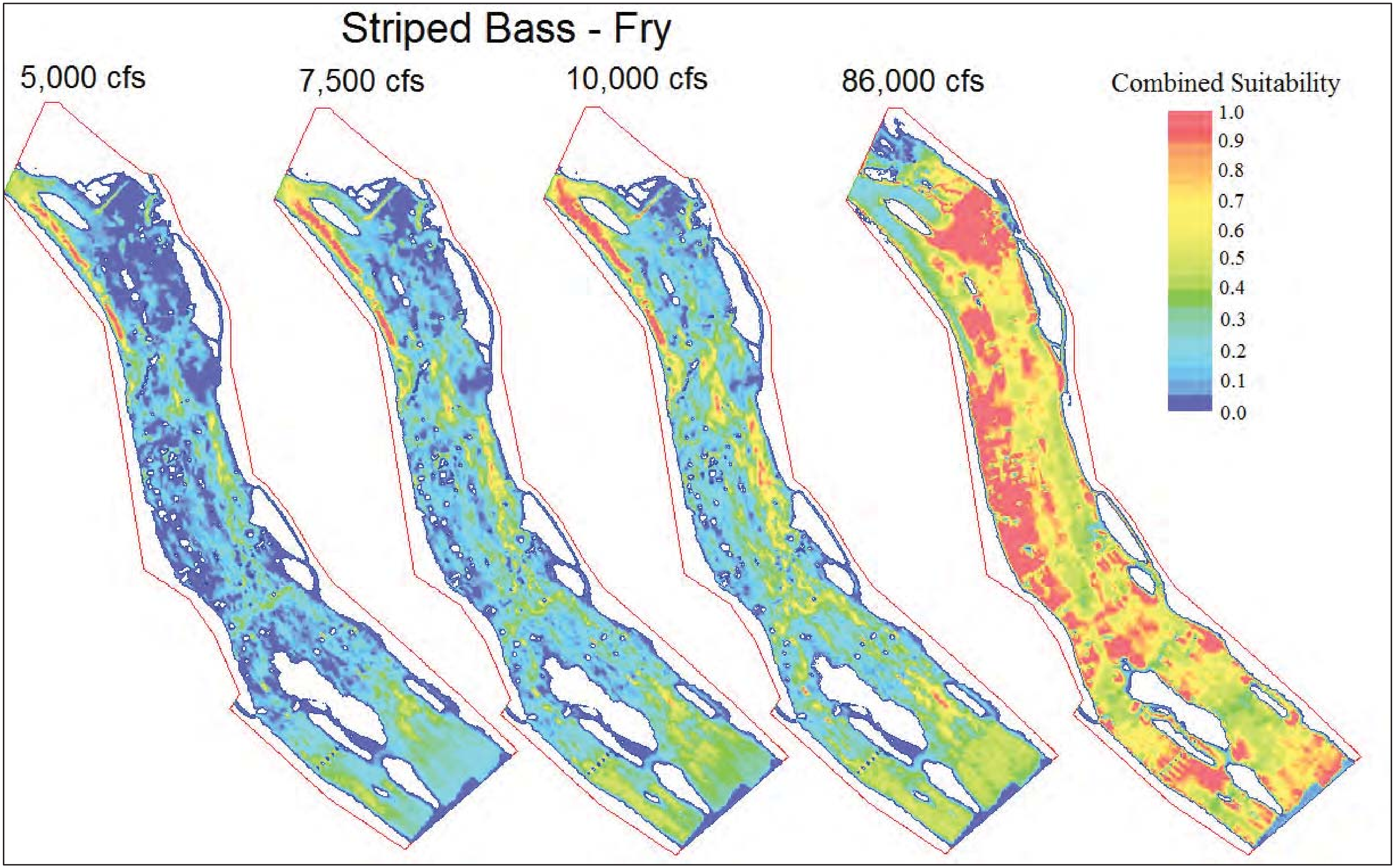


FIGURE 3.3.3.1.7-30: SELECT STRIPED BASS JUVENILE HABITAT MAPS

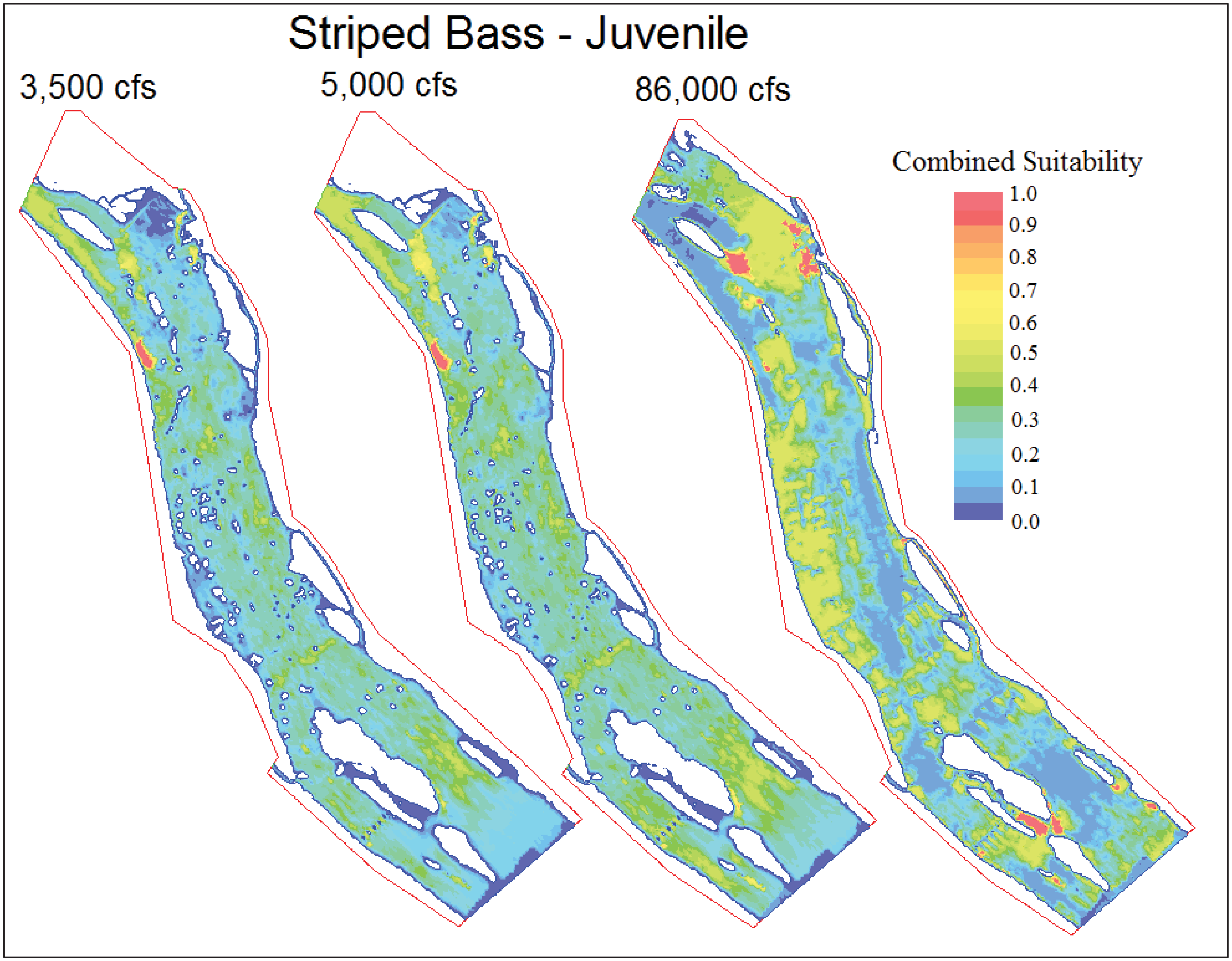


FIGURE 3.3.3.1.7-31: SELECT STRIPED BASS ADULT HABITAT MAPS

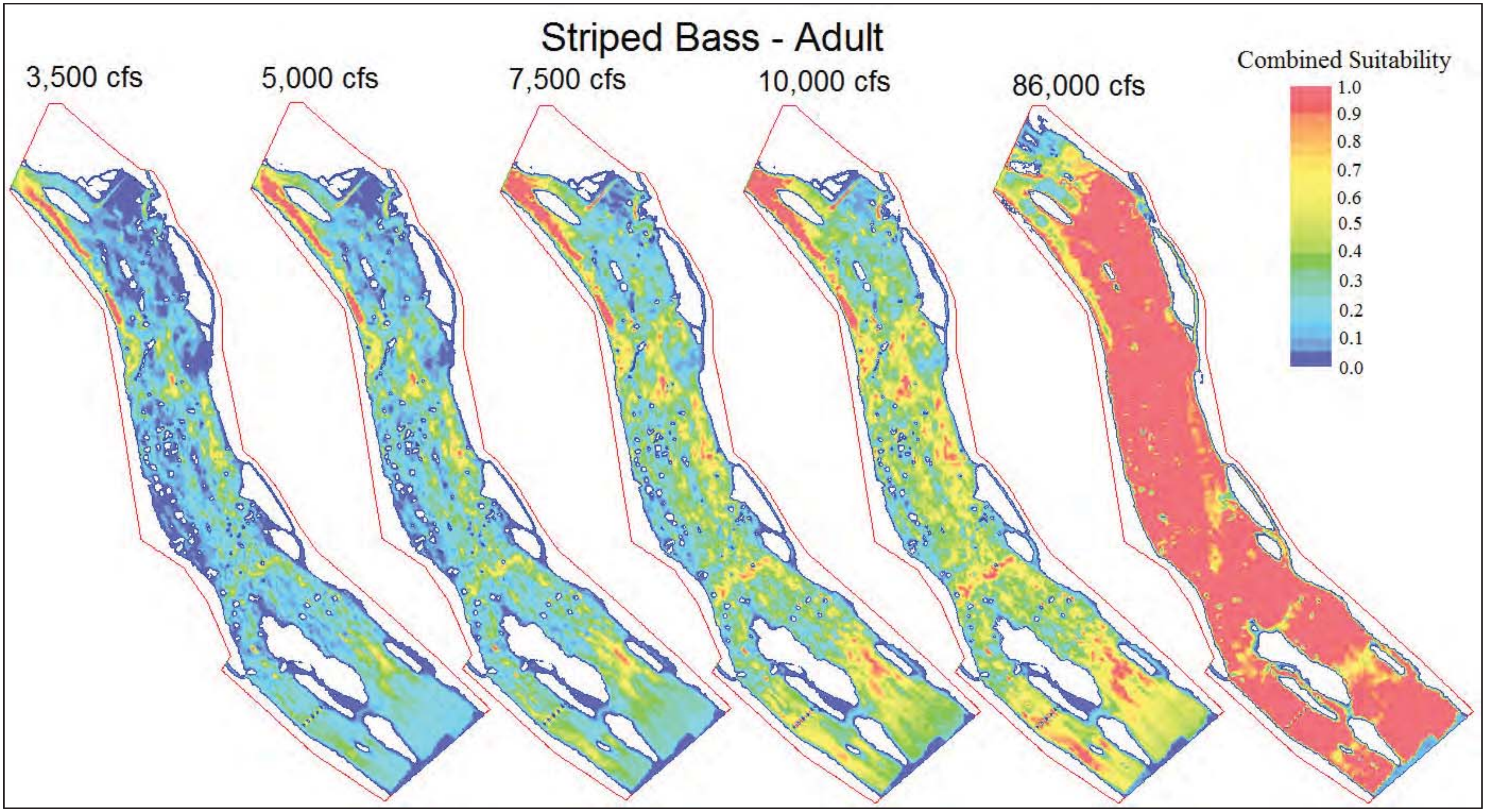


FIGURE 3.3.3.1.7-32: SELECT SMALLMOUTH BASS SPAWNING HABITAT MAPS

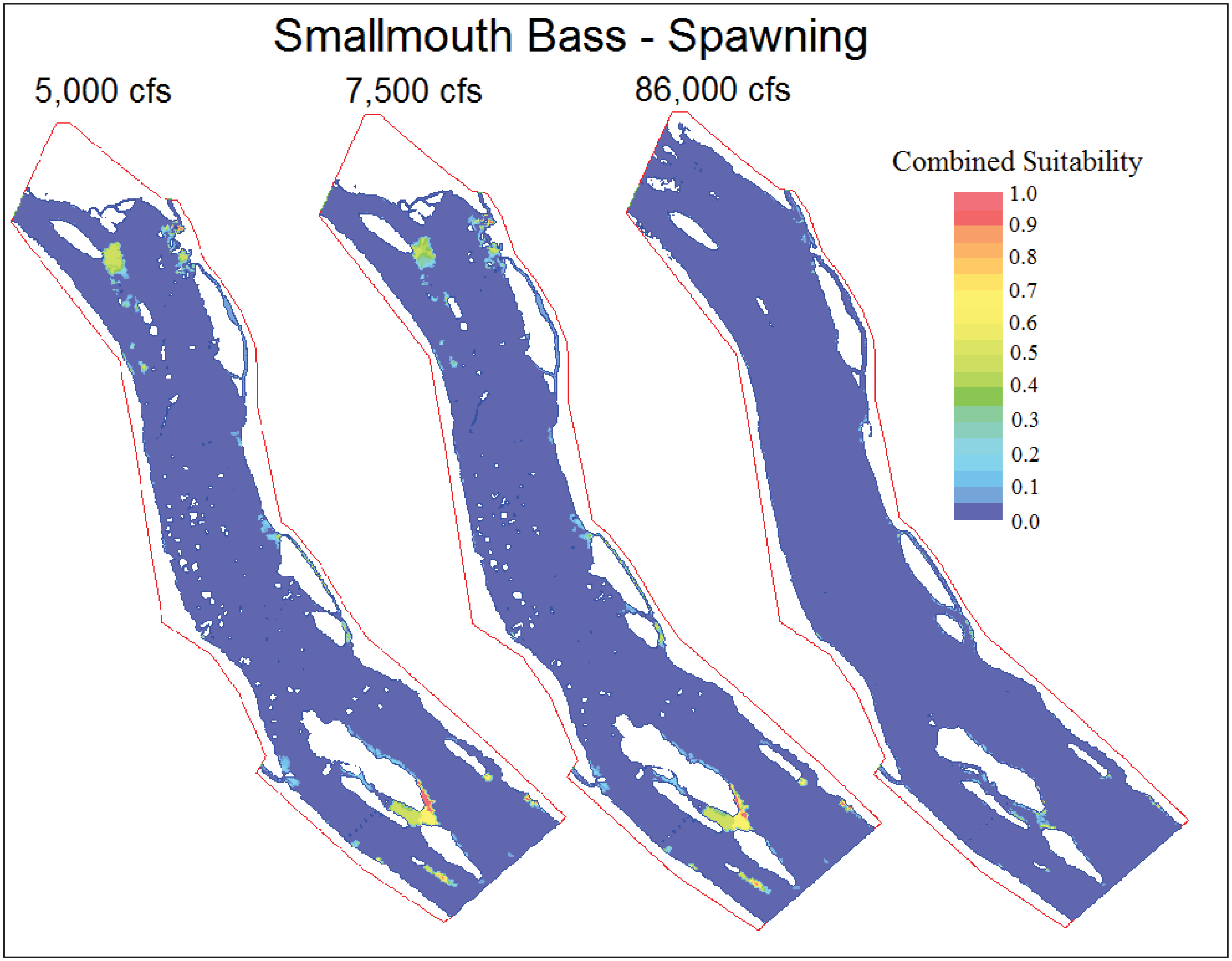


FIGURE 3.3.3.1.7-33: SELECT SMALLMOUTH BASS FRY HABITAT MAPS

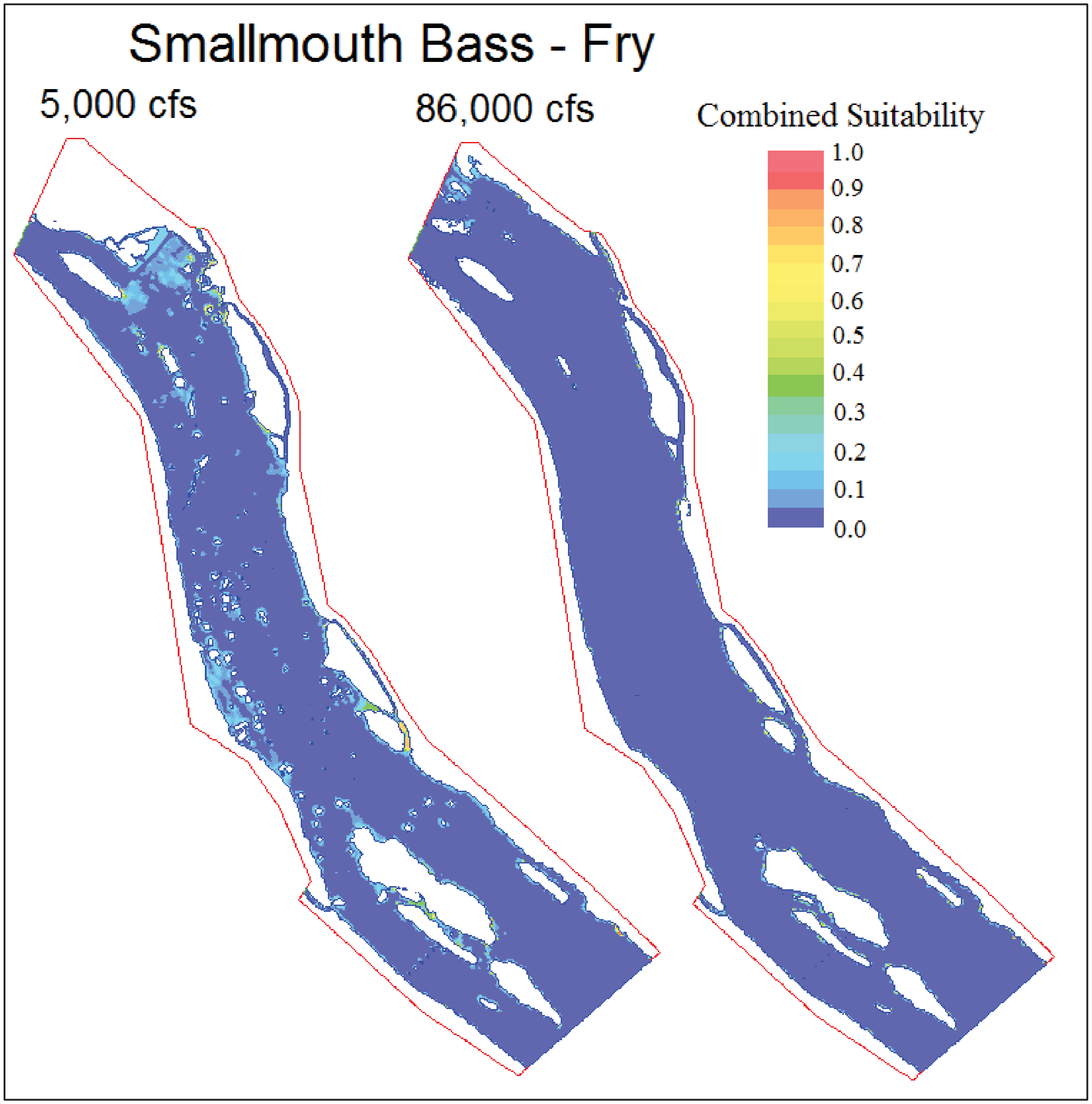


FIGURE 3.3.3.1.7-34: SELECT SMALLMOUTH BASS JUVENILE HABITAT MAPS

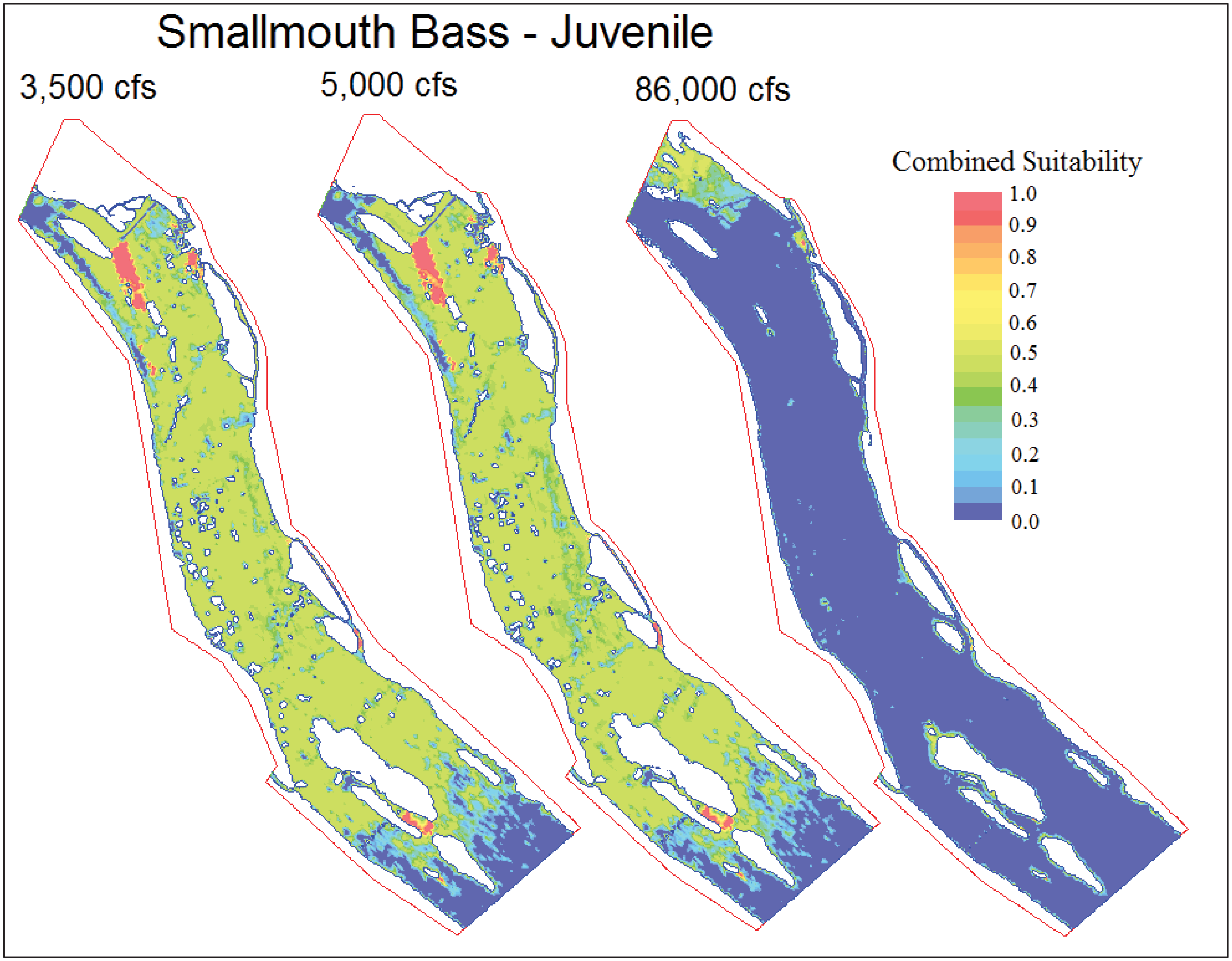


FIGURE 3.3.3.1.7-35: SELECT SMALLMOUTH BASS ADULT HABITAT MAPS

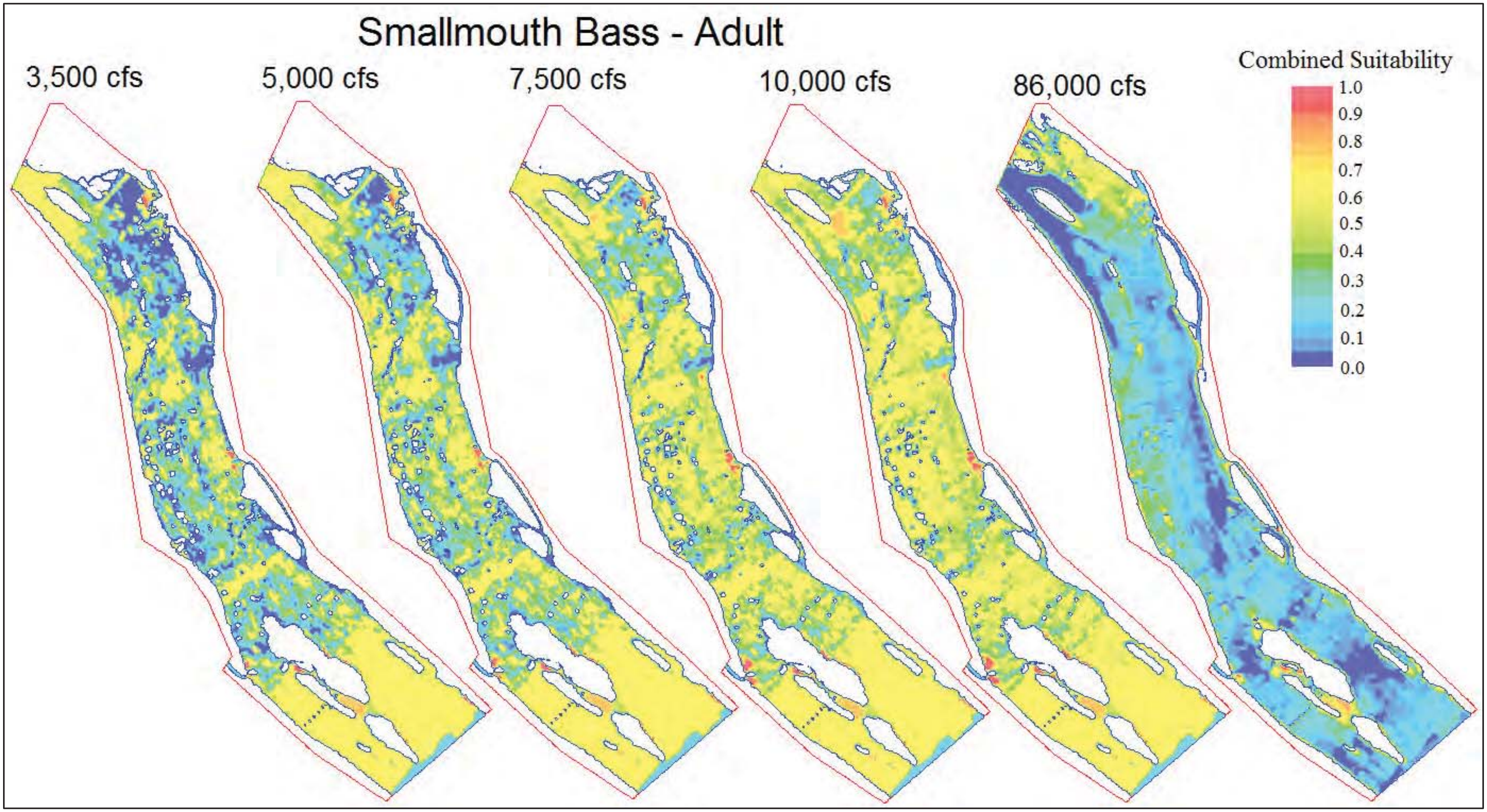


FIGURE 3.3.3.1.7-36: SELECT STONEFLY (PLECOPTERA) HABITAT MAPS

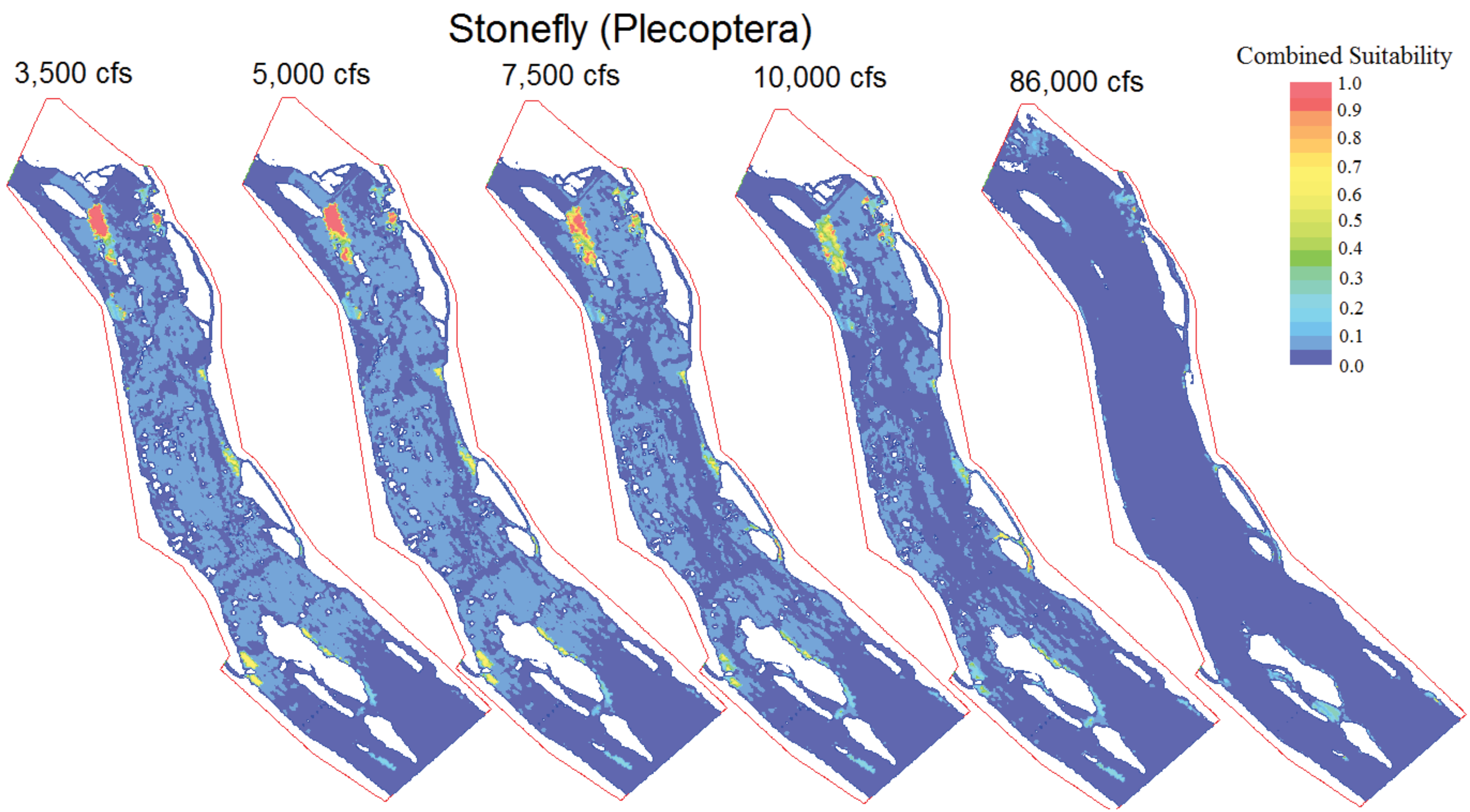


FIGURE 3.3.3.1.5-37: SELECT MAYFLY (PLECOPTERA) HABITAT MAPS

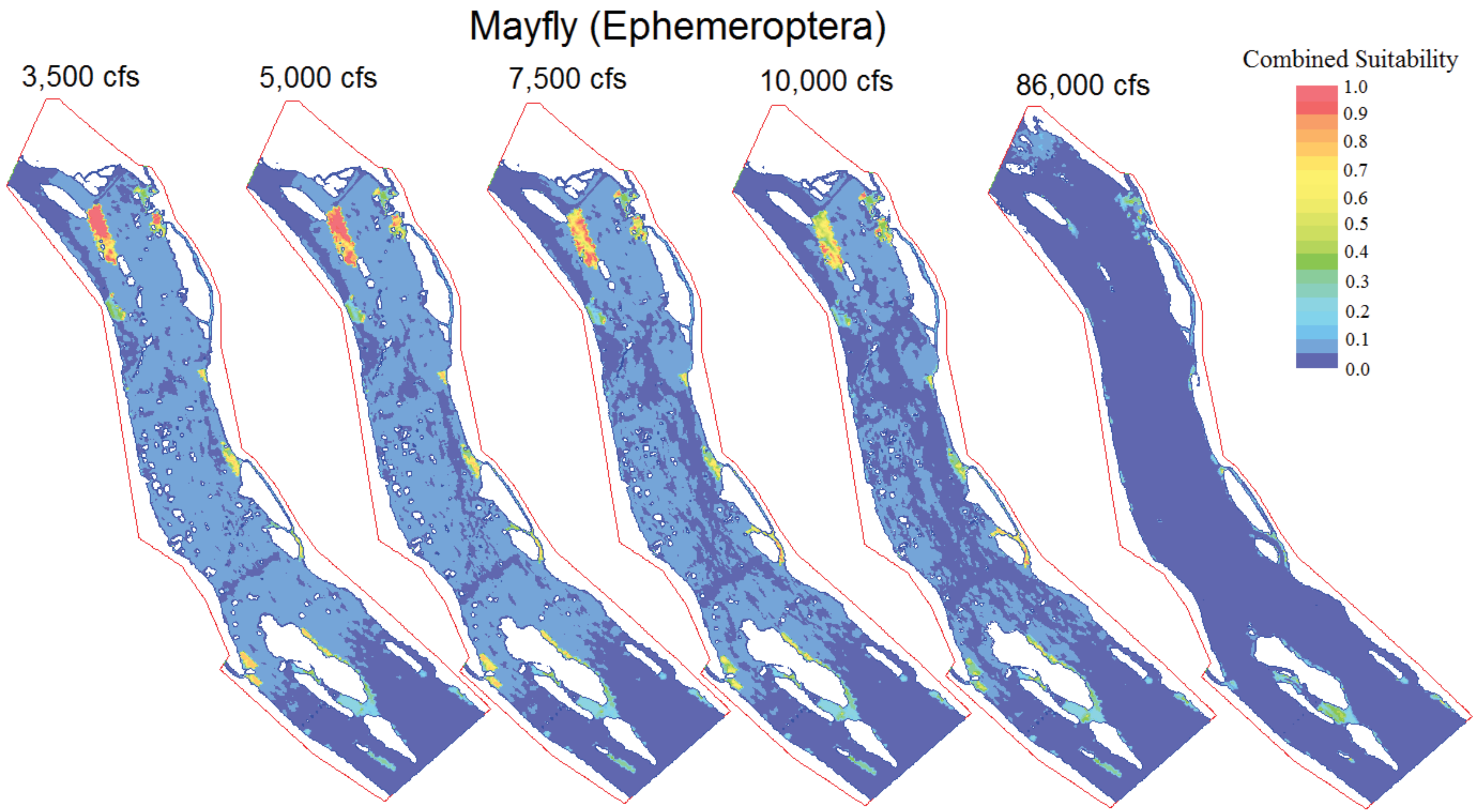


FIGURE 3.3.3.1.7-38: SELECT CADDISFLY (PLECOPTERA) HABITAT MAPS

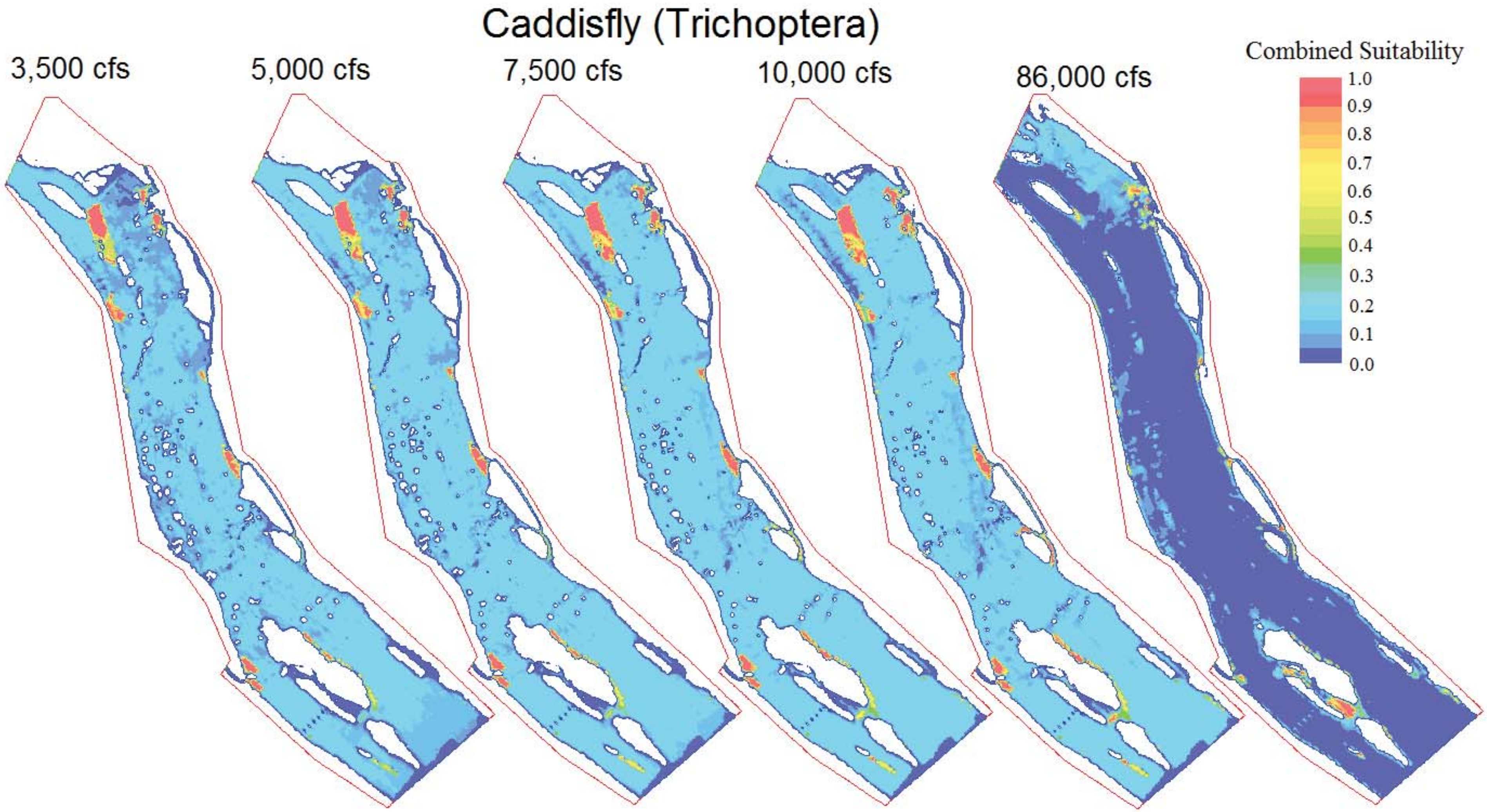


FIGURE 3.3.3.1.7-39: LOW-RELIEF SPILLWAY REACH HABITAT

FIGURE 3.3.3.1.7-40: HIGH-RELIEF SPILLWAY REACH HABITAT

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

3.3.4.1.1 *Upland Botanical Resources*

The region encompassing the Project area is characterized by a diversity of terrestrial botanical resources influenced by geologic features, soil type, hydrology, climate, and historic and current land use.

Botanical investigations have assessed areas near or overlapping the Conowingo Project area. These studies include those conducted as part of the Holtwood Redevelopment Project (PPL and Kleinschmidt 2006), Conowingo Islands Ecological Survey (RMC 1981), Keever (1972), and Harrison (2004) They provide data to generally describe the predominant terrestrial botanical communities that may lie within and in the vicinity of the Conowingo Project. However, comprehensive field surveys were not conducted to determine the presence and/or extent of these botanical resources or the respective plant community boundaries within the Project boundary. Pennsylvania and Maryland Gap Analysis Program (GAP) GIS-based land cover datasets with dominant plant species descriptions (Meyers and Bishop 1999; Maryland/Delaware/New Jersey GAP Analysis Project 2002) were reviewed, in conjunction with soils data, landscape setting, and aerial photographs, to estimate the acreage of plant communities likely to be present withn the Project boundary. The botanical resources were categorized in accordance with theclassification system developed by PADCNR (Fike 1999). Though this system was developed for Pennsylvania, it is useful for describing portions of the Project in Maryland.

Within this context, the primary natural plant communities are likely to include:

- Mixed mesophytic and rich hemlock-mesic hardwood forest (856 acres);
- Dry oak-mixed hardwood or red oak-mixed hardwood forest (202 acres); and
- Virginia pine-mixed hardwood forest (323 acres).

Limited areas also may support Serpentine Virginia pine-oak forest on serpentinite-derived soils (34 acres). These four forest communities are described below.

Mixed Mesophytic and Rich Hemlock-Mesic Hardwood Forest

These communities are associated with the deep ravines and gorges that occur along the tributary streams leading into the Project area. Muddy Creek, Broad Creek, Bald Friar Ravine (about 4,500 feet below the Pennsylvania/Maryland border in Cecil County) and the Ferncliff Wildlife and Wildflower Preserve are examples of locations where these communities dominate. A few of these areas may support virgin stands of timber along the steep slopes. Species dominance within these communities is variable between locations, and assemblages differ slightly from those listed in Fike (1999).

In the Ferncliff area, dominant species (in descending order) include American beech (*Fagus grandifolia*), eastern hemlock (*Tsuga canadensis*), tuliptree (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), northern red oak (*Quercus rubra*), scarlet oak (*Q. coccinea*), sugar maple (*Acer saccharum*), chestnut oak (*Q. montana*), and American basswood (*Tiliea americana*) (Keever 1972). Additional species that may occur at other locations include cucumber-tree (*Magnolia acuminata*), black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), shagbark hickory (*Carya ovata*), Ohio buckeye (*Aesculus glabra*), and yellow buckeye (*A. flava*). The understory of this community may include pawpaw (*Asimina triloba*), bladdernut (*Staphylea trifolia*), rosebay (*Rhododendron maximum*), eastern redbud (*Cercis canadensis*), and witch-hazel (*Hamamelis virginiana*).

Dry Oak-Mixed Hardwood and Red Oak-Mixed Hardwood Forest

These assemblages primarily consist of hardwoods occurring on mesic (red oak-mixed) and drier (dry oak-mixed) conditions. Red oak-mixed hardwood forests make up much of Pennsylvania's hardwood forests (Fike 1999).

This community is found throughout the region at elevations somewhat greater than the mixed mesophytic forests. Species typically found within this community include northern red oak, red maple (*Acer rubrum*), black oak (*Quercus velutina*), white oak (*Q. alba*), yellow birch (*Betula alleghaniensis*), and mockernut hickory (*C. tomentosa*). Understory shrubs include northern arrowwood (*Virburnum recognitum*), maple-leaved viburnum (*Viburnum acerifolium*), spicebush (*Lindera benzoin*), and *H. virginiana*. The herbaceous layer is variable and may include wild-oats (*Uvularia sessilifolia*), may-apple (*Podophyllum peltatum*), and striped wintergreen (*Chimaphila maculata*).

Virginia Pine-Mixed Hardwood Forest

This community is found in dry, rocky, higher elevation areas and is dominated by three species, including chestnut oak, Virginia pine (*Pinus virginiana*), and table mountain pine (*P. pungens*) (USDOI 1980). Other species that may be associated with this community include red oak, scarlet oak, black oak, and white oak, along with black cherry, red maple, sweet birch (*Betula lenta*), and hickories (*Carya* spp.).

The understory is a mix of northern red cedar (*Juniperus virginiana*), shining sumac (*Rhus copallina*), and Allegheny blackberry (*Rubus allegheniensis*) (Fike 1999).

Serpentine Virginia Pine-Oak Forest

This community is represented by a mix of pine and oak trees, underlain by serpentine bedrock where serpentinite chemistry still characterizes the soils and influences species composition (Fike 1999).

Community composition may include Virginia pine, pitch pine (*Pinus rigida*), post oak (*Quercus stellata*), blackjack oak (*Q. marilandica*), sassafras (*Sassafras albidum*), black cherry, northern red cedar, black gum (*Nyssa sylvatica*), black locust (*Robinia pseudoacacia*), and red maple. The understory of this community is often dense and difficult to traverse, and may include greenbrier (*Smilax rotundifolia*), catbrier (*S. glauca*), lowbush blueberry (*Vaccinium palidum*), and deerberry (*V. stamineum*) (Fike 1999).

Other communities are likely associated with wetland and riparian areas and may include red maple-black gum palustrine forest, sycamore-river birch-box elder floodplain forest, and red maple-elm-willow floodplain swamp. Wetland vegetation is described in Section 3.3.4.1.4 and riparian vegetation is described in Section 3.3.4.1.5.

3.3.4.1.2 *Terrestrial Wildlife*

The physiographic setting of the Project area, with its relatively large tracts of undisturbed terrestrial habitats and the broad-leaved terrestrial and palustrine forests, provides a wide variety of habitats for terrestrial wildlife. These include over-wintering and breeding habitats for migratory and resident bird species. Terrestrial wildlife surveys have been performed for areas adjacent to and including parts of the Project (PPL and Kleinschmidt 2006). Wildlife identified in these surveys is likely to be similar to wildlife within the Project area, and include songbirds, large and small mammals, and herptiles (reptiles and amphibians). Avian surveys were conducted as part of this Project and are discussed below. Mammal species that may occur in or near the Conowingo Project, and birds residing in, near, or migrating through the Conowingo Project, are described below. Herptile species are discussed in Section 3.3.4.1.5 as wetland, littoral, or riparian species.

Mammals

Forested areas provide habitats for red and gray fox, raccoon, red and grey squirrel, chipmunk, opossum, and white-tailed deer. Mammals such as mink and raccoon forage for food along the shore. Mammals in the Project area are likely to be similar to the species reported in the PPL study. The presence of most of the mammals identified in the PPL surveys was deduced from tracks, scat, or skeletal remains, not from direct observations. River otter or muskrat middens were observed below the Holtwood Dam (and within the Conowingo Project) (PPL and Kleinschmidt 2006).

Birds

Herons, egrets and gulls have been reported within the Conowingo Project between Holtwood Dam and the Norman Wood Bridge (Route 372) (PPL and Kleinschmidt 2006). Additionally, avian wildlife observed in the Project area in Maryland is documented by the Harford County Bird Club. The Harford Bird Club, a chapter of the Maryland Ornithological Society, maintains a list of birds (244 species) observed by local birders along the Susquehanna River from the mouth of Deer Creek below the Conowingo Dam to Glen Cove Marina above the dam, and within an inland area that extends about 200 yards from the shoreline (Blom 1999). Surveys for osprey, bald eagle, black-crowned night heron, and transmission line avian interaction surveys were conducted in 2010 and 2011 as part of the relicensing studies for this Project. Over 60 species of non-target bird species were observed during these various surveys.

3.3.4.1.3 *Wetlands, Littoral, and Riparian Habitat*

The Conowingo Project encompasses a variety of water-dependent habitats that can be variously defined by frequency of inundation, water depth, and geomorphic position in the landscape adjacent to an open body of water. These habitats are characterized by a variety of vegetation types and wildlife species. Wetlands, the riparian zone, and the littoral zone are three broad habitat types that are present in the Project area.

Numerous field studies undertaken by Exelon during various stages of the relicensing process contribute to the characterization of conditions discussed in this section. These include studies conducted in 2010 (Water Level Management Study; Sediment Introduction and Transport; and Downstream EAV/SAV Study) and reconnaissance studies performed in 2006, 2007, and 2008. Additionally, studies conducted in support of the Holtwood Redevelopment Project overlap with the portion of the Conowingo Project above Norman Wood Bridge, and other studies include the Holtwood Gorge islands. The findings of these studies are also provided below. Rare, threatened and endangered (RTE) species, and critical habitats, are discussed in Section 3.3.5.

3.3.4.1.4 *Wetland Habitat and Emergent Vegetation*

Conowingo Pond

The Susquehanna River between the Holtwood Dam and the downstream end of Hennery Island is a bedrock stream reach (Reusser et al. 2004). Downstream of Hennery Island the bedrock channel bottom is covered with a thickening wedge of sediment that has been accumulating behind the Conowingo Dam since its construction in 1928 (Hainly et al. 1995; Langland and Hainly 1997; Hill et al. 2006). The accumulation of sediment above Hennery Island is minimal because of the high-water velocities associated with releases from the Holtwood Dam, discharges from the Muddy Run facility, and the narrow channel geometry in this section of the Pond. Thus, the Conowingo Pond reach of the Susquehanna River acts as a mixed bedrock-alluvial system. The characteristics of wetlands in the bedrock-dominated reach of Conowingo Pond and the more alluvial reach below Hennery Island differ as a function of hydrology and sedimentary processes.

Bedrock-Dominated Reach. The bedrock reach is characterized by riverbed emergent wetlands. For a distance of about 7,000 feet a large extent of riverbed is exposed below the Holtwood Dam spillway, between Piney Island and the York County shoreline. This area is comprised of intermittently exposed bedrock with shallow pools at low water levels (Figure 3.3.4.1.4-1). A change in habitat character occurs about 3,500 feet below the spillway. This correlates with a hydrologic change manifested by a line of rapids on USGS topographic maps and breaking water on aerial photographs.

The upstream section appears to be a higher energy flow regime. Vegetation grows in cracks and crevasses on the protected downstream side of rocks. The pools here are smaller and more isolated (10 to 100 square feet) while the downstream section has larger more contiguous areas of open water (1,000 to 10,000 square feet) that are wider and deeper. Upstream vegetation is generally shorter and less abundant than that downstream. As the energy conditions diminish downstream, the vegetation becomes more prominent, growing on most available rock surfaces, upstream and downstream. The downstream area corresponds to the riverbed emergent marsh of PPL and Kleinschmidt (2006).

Pioneer vegetation (primarily water willow [*Justicia Americana*] and purple loosestrife [*Lythrum salicaria*]) become established in silt deposited by receding waters in crevasses on bare rock and in the silt matrix of predominantly weathered bedrock and gravel substrates (Figure 3.3.4.1.4-2). Dense root mats with trapped sediment ultimately develop and may be stripped from the rock by moving water. The root mats are important for the development of more complex vegetation zones because, as they continue to trap sediment, they become thicker and provide a foundation for soil development.

Vegetative zones correlating with elevation and inundation are evident. The water willow and purple loosestrife zone (lower elevation with longer periods of inundation) transitions to grasses, sedges and rushes (Figure 3.3.4.1.4-2). The width of these zones is a function of slope (i.e., narrow zones with steep slopes). An element of protection against erosion is afforded to the vegetation growing at higher elevations.

The mosaic of water willow and soft rush patches, undercut root mats, rock ledges and rivulets between bedrock and boulders serves as a nursery for small fish by providing habitat and protection. Fish are observed hiding in and amongst plant stems and root mat ledges over the water.

A different type of wetland is found at the shore margins of the river and islands where riverbed emergent marsh zones transition to wetland dominated by woody vegetation such as black willow (*Salix nigra*) and red maple (*Acer rubrum*) saplings. The wetland community here is more diverse than the riverbed emergent wetland. The vegetation near the shoreline is composed of elements found growing on the riverbed as well as elements that are encroaching from the riparian forest located upgradient.

The Lancaster County Natural Areas Inventory (Nature Conservancy 1990, 1993) indicates that the western margin of Lower Bear Island, between two cleared power rights-of-way, consists of a hardwood dominated wetland. Reconnaissance level field observations recorded at the northernmost edge of this area along the shore identify river birch and purple loosestrife.

In support of the Holtwood Development Project, PPL investigated wetlands between the Holtwood Dam and Norman Wood Bridge (PPL and Kleinschmidt 2006). Emergent and forested wetlands along the tailrace on the east margin and downstream tip of Piney Island and in the spillway along the western margin of the river were delineated. Riverbed emergent marsh consisting of a patchy mosaic of equal parts open water, rock, and emergent wetland was identified below Brushy Island and upstream of the Norman Wood Bridge, and erosional remnant wetlands were identified in bedrock scour depressions at the upstream tip of Piney Island and on adjacent Fry and Holly Islands.

Alluvial-Dominated Reach. The distribution of riverbed emergent wetlands is limited by the location of silt in rock crevasses and pockets of weathered bedrock and gravel substrates with a silt matrix. In the alluvial-dominated reach, opportunities for the establishment of dense wetland cover on substrates occur at sites of accumulating sediment. Wetland surveys in 2008 and 2010 of the alluvial-dominated reach of the pond identified 32 emergent wetlands with varying degrees of open water and scrub/shrub elements (Figure 3.3.4.1.4-3). The distribution of these wetlands reflects different geomorphic settings, water sources and hydrodynamics, or hydrogeomorphic classes: pond margin, tributary margin, pond/tributary. Each of these designations refers to the major driver of wetland properties during typical, non-storm event conditions. That is, pond margin wetlands are influenced primarily by the Susquehanna River; tributary margin wetlands are influenced primarily by the tributary; and pond/tributary wetlands are strongly influence by both the river and tributary.

Emergent species identified in these surveys are provided in Table 3.3.4.1.4-1.

Below Conowingo Dam. Similar to the riverbed emergent wetlands described previously below Holtwood Dam, wetlands below Conowingo Dam consist largely of water willow that has taken root in fine sediment trapped within bedrock crevasses and interstices among boulders. However, emergent vegetation does not extend across the channel as it does near Holtwood Dam but is restricted to river and island margins and tributary mouths (Figure 3.3.4.1.4-4). Table 3.3.4.1.4-2 provides other emergent species identified below Conowingo Dam.

Littoral Zone Habitat and Submerged Vegetation. The littoral zone is the nearshore area extending from the seasonal high water level to the furthest extent of rooted aquatic vegetation. Typically, rooted aquatic vegetation is distributed as an upper zone of emergent rooted vegetation, a middle zone of floating-leaved rooted vegetation, and a lower zone of submersed rooted vegetation (Wetzel 1975). Field studies of littoral habitat in the Project area distinguished between a shallow littoral zone (0 to 5 feet) and deep littoral zone (5 to 10 feet).

Emergent vegetation in the uppermost shallow littoral zone is considered in other aquatic habitat classification systems as wetland habitat (for example, Cowardin et al. 1979). In this application emergent vegetation in this littoral zone is discussed in the Wetlands section. Littoral habitat with a focus on SAV is discussed below in this section.

Conowingo Pond. While the littoral zone of the bedrock-dominated reach of the Pond is dominated by emergent vegetation, the alluvial-dominated reach includes large expanses of SAV (Figure 3.3.4.1.4-5). Substrates vary from fine grained sand (including coal) and silt to bedrock and boulders. Major littoral habitats are situated on alluvium. Large expanses of alluvium are deposited as accretionary features at/near the downstream ends of existing islands and at/near tributary mouths. Accretionary features are stabilized by vegetation when optimal conditions of inundation and sediment stability are reached. Once established, the vegetation initiates a cycle of sediment trapping, stabilization and accretion. This process is particularly prominent at Mt. Johnson Island, Peters Creek, and Fishing Creek. Alluvial accretionary features also are found below the Norman Wood Bridge, e.g., at an unnamed island below Piney Island.

Other littoral zones are characterized by gently sloping, yet very narrow, deposits at the water's edge. These include sediments deposited at the mouths of minor tributaries entering Conowingo Pond (e.g., Muddy Run), sediments associated with stormwater runoff that drained riparian areas, and sediments deposited by receding floodwaters. Steep rock-dominated shorelines have limited littoral habitat. The distribution of dominant substrate type and SAV, and the relationship of both to bathymetric slope below Hennery Island are provided in Figures 3.3.4.1.4-6.

The SAV community was represented by seven species, but hydrilla (*Hydrilla verticillata*), a tolerant invasive species, dominated the coverage in the majority of locations where SAV was growing. SAV species identified in the Pond littoral zone are listed in Table 3.3.4.1.4-3.

Below Conowingo Dam. Littoral substrates below the dam consist primarily of bedrock, particularly in offshore areas (Figure 3.3.4.1.4-7). The majority of the bedrock-dominated areas are unvegetated, exposed outcrops with little or no fine grained sediment. Sand and gravel (boulder, cobble, pebble, granule) substrates are present, but limited in distribution. SAV communities are therefore also limited, present only at the mouth of Octoraro Creek and in the vicinity of Smith Falls, along the peripheries of islands or as narrow bands along the river margin (Figure 3.3.4.1.4-4). The dominant SAV species is Eurasian water milfoil. Table 3.3.4.1.4-2 lists all SAV species observed.

3.3.4.1.5 *Riparian Zone Habitat and Vegetation*

Riparian zones border waterways landward of the littoral zone. In Fischer, et al. (2001), the USACE defines riparian zones as long strips of vegetation adjacent to inland aquatic systems that affect or are affected by the presence of water. Riparian habitat can be a wetland or non-wetland (upland) (Tiner 1999). Field surveys of riparian habitat of Conowingo Pond defined riparian habitats as non-wetland areas only.

The characteristics of upland riparian habitat along Conowingo Pond and island margins are directly influenced by shoreline sedimentation and erosion. The riparian zone is situated at the water's edge at elevations higher than adjacent wetlands and littoral zones, if present. Riparian vegetation may be rooted in rock fractures or unconsolidated sediment (alluvium, colluvium, and soil). Root undercutting is commonplace along unconsolidated shorelines. The width of the riparian zone is a function of slope. Where the upland topography is very steep, the riparian zone is very narrow to absent. For example, along Mt. Johnson Island, steep topography and a rocky substrate limit the riparian area to a zone that is only several meters wide before the forest transitions to a non-riparian upland forest (Figure 3.3.4.1.5-1) . The riparian vegetation is dominated by trees, and the shrubs and herbs are confined to the shoreline. At Peters Creek, the riparian zone is located between the shoreline and railroad embankment. The substrate is composed largely of boulders and gravel and the vegetation is typical of that observed in disturbed areas (e.g., sumac). Black cherry and silver maple are the dominant trees. The Fishing Creek riparian zone also is located between the shoreline and railroad embankment. The banks slope away from the water's edge at approximately 25 to 30 degrees. The composition of the riparian vegetation at Fishing Creek is similar, but slightly more diverse, than that observed at Peters Creek.

The species composition and structure of riparian forests observed upgradient of wetlands were the same as that seen in the riparian areas located adjacent to littoral zones. Topography also strongly influences the extent of riparian forests located adjacent to the wetlands. Riparian vegetation identified in field surveys is provided in Tables 3.3.4.1.5-1 3.3.4.1.5-4.

3.3.4.1.6 *Wetland, Littoral, and Riparian Wildlife*

Littoral zones provide habitat for fish and benthic invertebrates. Wetlands and the riparian zone also provide habitats for many forms of wildlife. Documentation of reptiles and amphibians likely to utilize Project area wetlands and riparian zones is based on surveys conducted near Lake Aldred for the Holtwood Redevelopment Project (PPL and Kleinschmidt 2006) and ancillary observations of wildlife during field investigations for vegetation and physical processes. These surveys included areas within the Conowingo Project area between Holtwood Dam and the Norman Wood Bridge (Route 372). Reptiles and amphibians in the Project area are likely to be similar to the species reported in the PPL study.

Reptiles and Amphibians

During the PPL surveys, grey tree frogs were heard from vernal pools on the rock islands below Holtwood Dam (and within the Conowingo Project). They are likely to also be present in riparian forests. Pickerel, green, leopard, and bull frogs were observed along tributaries and wetlands. Many frogs were observed in the erosional remnant wetlands just below Holtwood Dam. These wetlands protect the frogs from predatory fish. Amphibian tadpoles and adults were observed in wetlands adjacent to the Holtwood

Hydroelectric Station. Snapping turtles, red-eared sliders, painted turtles, northern map turtles, and wood turtles were observed basking along the shore. The black rat snake and northern water snake also were observed. Water snakes were observed in Conowingo Pond during 2008 wetland surveys.

The Maryland endangered northern map turtle (*Graptemys geographica*) has been documented within the Project area, inhabiting the Susquehanna River including the Conowingo Pond area and downstream of the Conowingo Dam. Researchers from Towson State University (Seigel and Richards, 2010 unpubl.) have documented northern map turtles nesting on Wood Island (downstream of the dam), and at Port Deposit, and inhabiting basking sites throughout the Project area.

3.3.4.1.7 *Water Level Fluctuations*

Exelon conducted a Water Level Management Study (URS Corporation and GSE 2012a) in 2010 to determine the effects of water level fluctuations due to current Project operation on the littoral zone with emphasis on EAV and SAV. In addition, the effects of changes in downstream water surface elevations on EAV and SAV due to operations were assessed in RSP 3.17, Downstream EAV/SAV Study (URS Corporation and GSE 2012c).

Conowingo Pond

Bathymetric and LiDAR surveys were conducted along the littoral zone to provide one-foot contour level accuracy within the Project drawdown elevation range of 101.2 to 110.2 feet NGVD 1929. A focused field survey was conducted in August 2010 to quantify the coverage of EAV and SAV and various substrate types in the littoral zone for each one-foot contour interval within the permitted fluctuation range. Transects were established throughout the littoral zone study area where shifts in substrate composition, SAV and EAV community structure, and water velocity conditions were detected. Hydrographic data from the bathymetry and LiDAR surveys were compiled into a GIS database and integrated with the results of the field-based habitat survey to generate multi-parameter habitat layers for each one-foot contour within the licensed 9-foot Project drawdown range.

For the Water Level Management Study, littoral zone substrates were categorized into shallow (0-5 feet) and deep (5-10 feet) for evaluating impacts to habitat from changes in water levels. Based on evaluations of the habitat and bathymetry data, SAV habitat in the littoral zone of the study area would be most affected by drawdown below the 106-foot elevation. Below the 106-foot elevation, the amount of shallow littoral habitat available for SAV growth begins to decrease from its maximum (at 106 feet) and is accompanied by a notable drop in areal coverage of SAV. Sand-dominated substrate, which was often covered by SAV growth, also begins to decline below the 106-foot elevation, and the amount of this substrate type is approximately halved with each successive one-foot reduction in elevation. In parallel with the evaluation of the bathymetry and habitat survey results, historic water elevation data from Conowingo Pond were reviewed and analyzed to determine historical trends in water level fluctuation in the study area. Based on a review and water-level frequency analysis of the pond elevation data, water level fluctuations are primarily confined to elevations between 107 feet and 109 feet and rarely fall below 106 feet. Periods when elevations are lower than 106 feet are infrequent and brief. Therefore, the potential for de-watering of SAV-vegetated habitat in the littoral zone of the study area for extended periods of time is considered minimal.

Below Conowingo Dam

Depending on Project generation and discharge, downstream EAV and SAV communities experience fluctuations in water levels. Downstream water surface elevations and associated flow velocities were quantified using a two-dimensional hydraulic model over a range of operational conditions in Instream Flow Incremental Methodology (IFIM) assessment provided in RSP 3.16.

SAV communities were present only along the peripheries of Roberts, Spencer, Wood, and Steel Islands, upstream of the mouth of Octoraro Creek, and in minimal reaches along the lower eastern and western river shorelines. Water velocities predicted from hydraulic modeling range between 0 and 2 fps across the majority of the study area at generation flows up to 20,000 cfs. These low velocities are not expected to exert adverse effects on communities of SAV that are established in areas containing sand and silt substrate (including mixed substrates of gravel/sand or gravel/silt). At higher generation flows (40,000 to 86,000 cfs), higher velocity waters (4 to 6 fps) are predicted in some areas; however, the majority of these areas are associated with the bedrock channel that has historically been sediment-limited by naturally turbulent, steep-gradient conditions that were present prior to the construction of the dam. These areas, therefore, have historically and are currently not suitable for the establishment of aquatic vegetation seed banks or propagules. Even under a full generation regime, low water velocities (0 to 2 fps) are predicted in the areas containing moderate to densely vegetated sediments such as the lower study area island complex shorelines.

The nearshore areas of the lower islands contain sandy and silty sediments co-located with coarser particles such as granule, pebble, cobble, and boulder. These coarse deposits provide some protection of finer sediments, until strong flow events in excess of the generating capacity of the Conowingo Project (86,000 cfs) rearrange the coarse material. Growth of submergent vegetation appears to be limited to areas of alluvium (e.g., the lower ends of the islands) and unconsolidated fine material where stabilized sediments allow colonization of vegetative root material. As described in the Sediment Introduction and Transport Study Report, the potential for bedload mobility generally increases along the peripheries of the islands. Based on that report, the sand and sand/gravel substrates at downstream ends of Roberts Island and Steel Island and pebble/sand substrate mid-channel between Spencer Island and the west shoreline are considered “highly mobile” at full generation. However, each of these areas was observed to contain moderate to heavy growth of SAV during the 2010 surveys, and have historically contained SAV. Reduced water velocities in the lower portion of the study area coupled with the presence of soft sediment allows for the establishment of these SAV communities along the shorelines of these islands. During the growing season, SAV communities may mitigate substrate mobility by binding and trapping sediment grains.

Upstream of the mouth of Octoraro Creek, a significant bed of sparsely populated water milfoil is present growing within mixed gravel/sand substrates. Sediment mobility in this area is minimally affected by various flow releases from Conowingo Dam, as reported in the Sediment Introduction and Transport Study Report. The low water velocities and relative stability of the habitat across the generation range of flows provides suitable conditions for SAV growth in this area.

Water levels in areas containing SAV also remain relatively static, thus submergent communities do not become light-limited as a result of increasing depth. Prolonged periods of high flow are generally associated with turbid conditions that can contribute to sedimentation and lower light availability, thereby reducing the abundance of SAV (Orth et al. 2010). However, significant sedimentation events that may result in burial of SAV are likely to be associated with flows in excess of those resulting from Conowingo operations, based on the available literature (Langland and Hainly 1997).

During the July-August 2010 habitat surveys, EAV was observed within the gravel-sand margins of the river and atop some bedrock and boulder outcrops. Water willow, the dominant EAV species in the study area, produces flexible fibrous stems that allow individual plants to withstand high flow events and scour. Field experiments of water willow in experimental reservoir systems demonstrated that this species is resistant to desiccation (Strakosh et al. 2005). Individual plants were able to tolerate up to 8 weeks of simulated drought conditions due to the water scavenging and storage faculties of this species’ system of roots and rhizomes. Conversely, inundation trials from the Strakosh et al. (2005) study indicate that water willow is intolerant of flooding conditions. Mortality of water willow in simulated flooding conditions at 2-, 4-, 6-, and 8-week intervals yielded an overall mortality of 69%, compared to a mortality of 5% from simulated drought experiments over the same study intervals. Additionally, plants growing in controlled conditions (shallow depths) had significantly greater dry weights than plants growing for 4 weeks or more under flooding conditions. Moreover, water willow mortality was significant (40%) even under the shortest inundation duration (2 weeks), presumably due to light limitations resulting from decreased water clarity (Strakosh et al. 2005).

In the summertime, when generation flows are typically reduced and EAV growth is at its maximum, a greater proportion of the eastern and western river shorelines are exposed. Exposed shorelines containing unconsolidated sediment, either as a homogeneous matrix or in combination with larger diameter particles (e.g., gravel), facilitate root establishment by emergent species. Predicted relative water level rises are minimal in most areas containing EAV, and a higher proportion of bedrock outcrops with sufficient interstitial sediment for EAV colonization are available during this time period. Although water elevation changes in the lower portion of the study area in the vicinity of the island complex are predicted to be minimal and soft-bottom substrate is available for seed germination, greater water depths in these areas do not permit EAV to become established, even during low-flow periods. Notable exceptions are the upstream ends of Roberts Island and Steel Island, and near the mouth of Deer Creek. Much of these areas become inundated beginning at flows around 40,000 cfs, which under prolonged periods (e.g., two weeks based on the Strakosh et al. [2005] study), may result in adverse effects or cause mortality in downstream emergent plants. Prolonged durations of elevated flows of 40,000 cfs are not typical below Conowingo Dam during the time when water willow growth is in full vigor (late spring into fall), and significant beds of this species were observed at locations in the upper study area that experience significant water level rises with incremental increases in generation flows. These areas include the mouth of Octoraro Creek and a densely vegetated ephemeral island located mid-river approximately 2,300 feet below Rowland Island. Water willow commonly inhabits flood-prone or variably fluctuating lotic waters that experience these conditions in late winter and spring when most vegetative species are still dormant (Haslam 1978, cited in Strakosh et al. 2005).

3.3.4.2 Environmental Effects

The assessment of potential operational impacts on SAV requires consideration of seasonality. Submerged vegetation species common to the low salinity waters of the upper Chesapeake Bay and tributaries become established generally from July through September (Chesapeake Bay Foundation, undated). The presence of these species below Conowingo Dam generally coincides with periods of minimal water level fluctuation and low flows. River flows for the months of July, August, and September exceed a flow equivalent to the maximum generation at Conowingo (86,000 cfs) only 1.0 to 3.5 percent of the time, based on flow duration curves for the USGS Gage at Conowingo Dam (developed as part of the Hydrologic Study of the Lower Susquehanna River). Peaking operations at Conowingo are, on average, more infrequent during the summertime growing period than at other times of the year, lowering the potential for effects associated with elevated generation flows on downstream SAV communities. In contrast, flows at or exceeding 86,000 cfs during the winter and spring seasons (December-May) occur approximately 9.9 to 22.5 percent of the time, based on the results of the Hydrologic Study of the Lower Susquehanna River. As such, although the potential effects of Project operations on downstream SAV communities is likely to be minimal, the likelihood of effects potentially exerted is minimized further by the timing of high flow/high water events, which more often occur during periods when SAV is not present. This is supported from the work of Wang and Linker (2005). Using a three-dimensional model for evaluating the response of SAV to nutrient and sediment loads in Chesapeake Bay, these authors determined that extreme storms can cause substantive damage to SAV communities if the storms occur at times of high SAV shoot biomass, but have no significant impact on SAV if the storm takes place during periods outside of the SAV growing season (Wang and Linker 2005). The ability of Conowingo Dam to attenuate extreme river flows resulting from storms and natural high water events may enhance SAV growth below the dam.

Based on these results of EAV vegetation studies, the maintenance of EAV communities below Conowingo Dam are likely controlled more by water elevation than by flow intensities. This may explain why significant EAV growth was observed in the eastern channel of McGibney Island an area subject to elevated water velocities during periods of higher generation flows. EAV communities below Conowingo Dam are not likely to be impacted to a significant degree by Conowingo operations over the range of generation flows. The less frequent peaking flows during the summer likely promote colonization by EAV by providing reduced water elevations and frequent but brief periods of inundation.

Studies completed for the relicensing have determined that existing botanical habitat is functioning properly, and that terrestrial wildlife populations are also present and functioning properly. No Project effects are anticipated for botanical or terrestrial wildlife resources.

3.3.4.3 Proposed Environmental Measures

Exelon is not proposing any environmental measures relating to non-threatened or endangered botanical or terrestrial wildlife resources.

3.3.4.4 Unavoidable Adverse Impacts

There are no anticipated unavoidable impacts to botanical or terrestrial wildlife resources resulting from the continued operation of the Conowingo Project.

TABLE 3.3.4.1.2-1: CONOWINGO AVIAN SPECIES OBSERVED DURING SURVEYS (2010-11)

Common Name	Scientific Name
American crow	*Corvus brachyrhynchos*
American goldfinch	*Spinus tristus*
American kestrel	*Falco sparverius*
American robin	*Turdus migratorius*
Bald eagle	*Haliaeetus leucocephalus*
Baltimore oriole	*Icterus galbula*
Barn swallow	*Hirundo rustica*
Belted kingfisher	*Megaceryle alcyon*
Black vulture	*Coragyps atratus*
Black-capped chickadee	*Poecile atricapillus*
Black-crowned night-heron	*Nycticorax Nycticorax*
Blue jay	*Cyanocitta cristata*
Blue-gray gnatcatcher	*Polioptila caerulea*
Bobolink	*Dolichonyx oryzivorus*
Bonaparte's gull	*Chroicocephalus philadelphia*
Brown thrasher	*Toxostoma rufum*
Canada goose	*Branta canadensis*
Carolina wren	*Thryothorus ludovicianus*
Caspian tern	*Sterna caspia*
Cedar waxwing	*Bombycilla cedrorum*
Common grackle	*Quiscalus quiscula*
Common grackle	*Quiscalus quiscula*
Common Merganser	*Mergus merganser*
Coopers hawk	*Accipiter cooperii*
Dark-eyed junco	*Junco hyemalis*
Double crested cormorant	*Phalacrocorax auritus*
Downy woodpecker	*Picoides pubescens*
Eastern bluebird	*Sialia sialis*
Eastern kingbird	*Tyrannus tyrannus*
Eastern phoebe	*Sayornis phoebe*
Eastern towhee	*Pipilo erythrophthalmus*
Eastern wood pewee	*Contopus virens*
European starling	*Sturnus vulgaris*
Gray catbird	*Dumetella carolinensis*
Great blue heron	*Ardea herodias*
Great crested flycatcher	*Myiarchus crinitus*
Great egret	*Ardea alba*
Great horned owl	*Bubo virginianus*

Common Name	Scientific Name
Green heron	*Butorides virescens*
Herring gull	*Larus argentatus*
House finch	*Carpodacus mexicanus*
House sparrow	*Passer domesticus*
House wren	*Troglodytes aedon*
Indigo bunting	*Passerina cyanea*
Killdeer	*Charadrius vociferus*
Mallard	*Anas platyrhynchos*
Mourning dove	*Zenaida macroura*
Northern cardinal	*Cardinalis cardinalis*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Osprey	*Pandion haliaetus*
Palm warbler	*Dendroica palmarum*
Pileated woodpecker	*Dryocopus pileatus*
Red-bellied woodpecker	*Melanerpes carolinus*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Rock dove	*Columba livia*
Royal tern	*Thalasseus maximus*
Snow goose	*Chen caerulescens*
Spotted sandpiper	*Actitis macularia*
Tern sp.	*NA*
Tree swallow	*Tachycineta bicolor*
Tufted titmous	*Baeolophus bicolor*
Turkey vulture	*Cathartes aura*
White-crowned sparrow	*Zonotrichia leucophrys*
Willow flycatcher	*Empidonax traillii*
Wood duck	*Aix sponsa*
Yellow-billed cuckoo	*Coccyzus americanus*

TABLE 3.3.4.1.4-1: CONOWINGO POND WETLAND VEGETATION*

Common Names	Scientific Names
American basswood	*Tilia americana*
American beech	*Fagus grandifolia*
American sycamore	*Platanus occidentalis*
Arrow arum	*Peltandra virginica*
Bitter dock	*Rumex obtusifolius*
Black locust	*Robinia pseudoacacia*
Black willow	*Salix nigra*
Box-elder	*Acer negundo*
Broadleaf cattail	*Typha latifolia*
Broomsedge	*Andropogon virginicus*
Burr reed	*Carex sparganioides*
Buttonbush	*Cephalanthus occidentalis*
Cardinal flower	*Lobelia cardinalis*
Christmas fern	*Polystichum acrostichoides*
Common arrowhead	*Sagittaria latifolia*
Common dodder	*Cuscata gronovii*
Common mullein	*Verbascum thapsus*
Common pawpaw	*Asimina triloba*
Common reed	*Phragmites australis*
Day lily	*Hemerocallis fulva*
Elephant ear	*Colocasia* sp.
False hellebore	*Veratrum viride*
False indigo	*Amorpha fruticosa*
False loosestrife	*Ludwigia* sp.
Green ash	*Fraxinus profunda*
Greenbrier	*Smilax rotundifolia*
Hedge bindweed	*Convolvulus sepium*
Hickory	*Carya* sp.
Honeysuckle	*Lonicera* sp.
Jack-in-the-pulpit	*Arisaema atrorubens*
Japanese knotweed	*Polygonum cuspidatum*
Japanese stiltgrass	*Microstegium vimineum*
Ladyfern	*Athyrium filix-femina*
Lady's thumb	*Polygonum persicaria*
May apple	*Podophyllum peltatum*
Monkey flower	*Mimulus* sp.
Mountain maple	*Acer spicatum*
Multiflora rose	*Rosa multiflora*
Nightshade	*Solanum* sp.
Panic grass	*Panicum* sp.

Common Names	Scientific Names
Pin oak	*Quercus palustris*
Poison ivy	*Toxicodendron radicans*
Pokeweed	*Phytolacca americana*
Purple loosestrife	*Lythrum salicaria*
Red maple	*Acer rubrum*
Redbud	*Cercis canadensis*
Rose mallow	*Hibiscus* sp.
Sassafras	*Sassafras albidum*
Sedge	*Carex* sp.
Sensitive fern	*Onoclea sensibilis*
Silktree	*Albizia julibrissin*
Silver maple	*Acer saccharinum*
Slippery elm	*Ulmus rubra*
Small-flowered agrimony	*Agrimonia parviflora*
Smartweed	*Polygonum pennsylvanicum*
Smooth alder	*Alnus serrulata*
Soft rush	*Juncus effusus*
Spikerush	*Eleocharis* sp.
Spotted jewelweed	*Impatiens capensis*
Spotted Joe-Pye weed	*Eupatorium maculatum*
Steeplebush	*Spiraea tomentosa*
Stinging nettle	*Urtica dioica*
Striped maple	*Acer pensylvanicum*
Sugar maple	*Acer saccharum*
Swamp milkweed	*Asclepias incarnata*
Swamp oak	*Quercus bicolor*
Tearthumb	*Polygonum* sp.
Tree of heaven	*Ailanthus altissima*
Tuliptree	*Liriodendron tulipifera*
Virginia creeper	*Parthenocissus quinquefoilia*
Water willow	*Justicia americana*
Water pepper	*Polygonum hydropiper*
White oak	*Quercus alba*
Wild grape	*Vitus rotundifolia*
Wild strawberry	*Fragaria virginiana*
Witch-hazel	*Hamamelis virginiana*
Yellow birch	*Betula alleghaniensis*
Yellow iris	*Iris pseudacorus*
Yellow pond lily	*Nuphar* sp.

*Plant species listed are representative of wetland community. Not all species in wetlands are listed.

TABLE 3.3.4.1.4-2: EMERGENT AND SUBMERGED AQUATIC VEGETATION OBSERVED DURING 2010 FIELD SURVEY BELOW CONOWINGO DAM

Common Name	Scientific Name	Common Name	Scientific Name
Emergent		**Submerged**	
Purple Loosestrife	*Lythrum salicaria*	Eurasian Watermilfoil	*Myriophyllum spicatum*
Water Willow	*Justicia americana*	Hydrilla	*Hydrilla verticillata*
Water Pepper	*Polygonum hydropiper*	Water Stargrass	*Heteranthera dubia*
Smartweed	*Polygonum pennsylvanicum*	Wild Celery	*Vallisneria americana*
Common Dodder	*Cuscuta gronovii*		
Lady's Thumb	*Persicaria vulgaris*		
False Indigo	*Amorpha fruticosa*		
Water Dock	*Rumex hydrolapathum*		
Marsh Mallow	*Althaea officinalis*		
Stinging Nettle	*Urtica dioica*		

TABLE 3.3.4.1.4-3: SUBMERGED AQUATIC VEGETATION IN CONOWINGO POND (2010)

Common Name	Scientific Name
SAV	
Eurasian Watermilfoil	*Myriophyllum spicatum*
Hydrilla	*Hydrilla verticillata*
Water Stargrass	*Heteranthera dubia*
Canadian Waterweed	*Elodea canadensis*
Brittle Waternymph	*Najas minor*
Coontail	*Ceratophyllum demersum*
Wild Celery	*Vallisneria americana*

Figure 3.3.4.1.4-1
Riverbed Emergent Wetlands

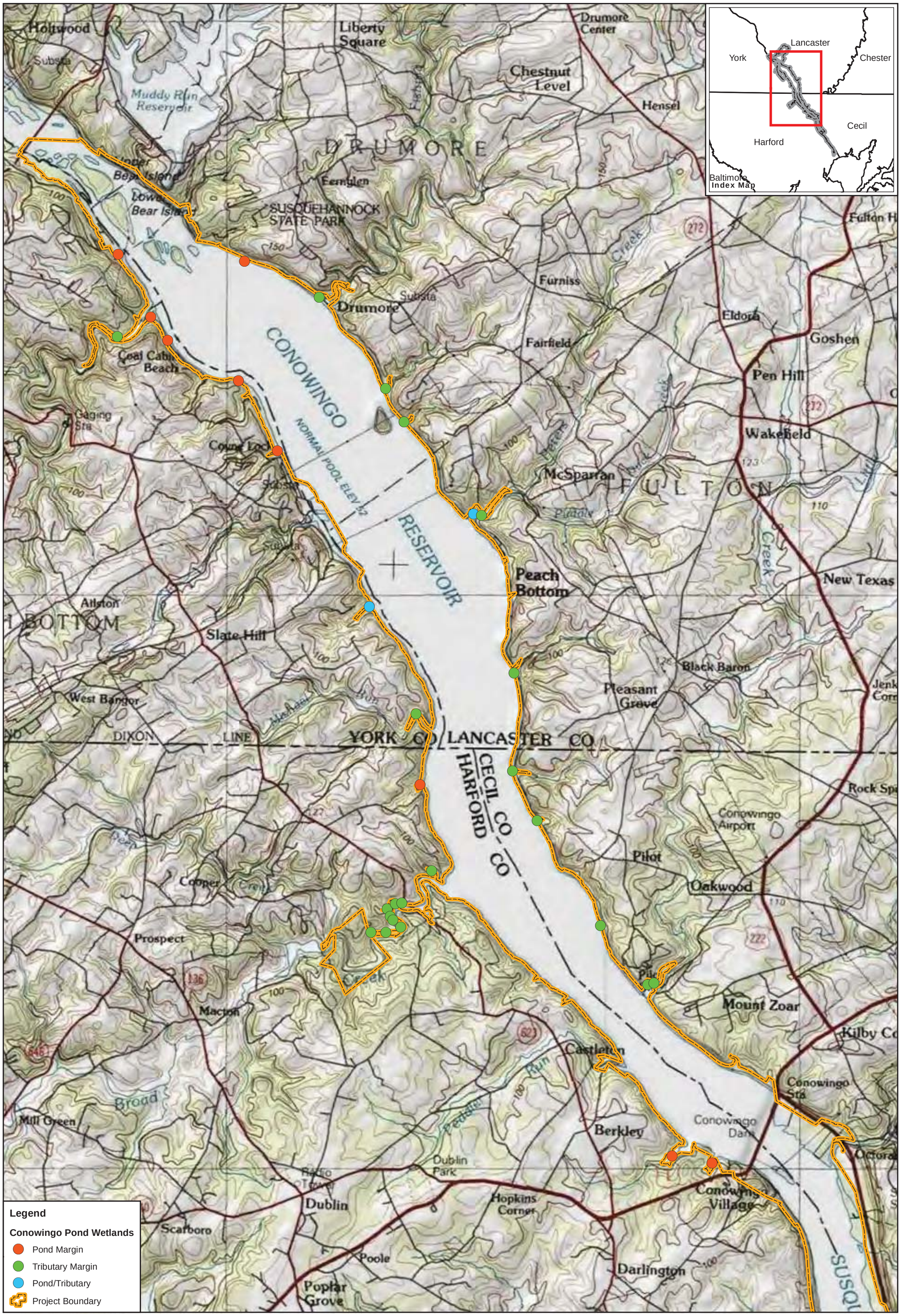
View of Holtwood Dam from Norman Wood Bridge – riverbed emergent marsh with scrub-shrub island margin wetland in center of photo.

Figure 3.3.4.1.4-2
Riverbed Emergent Wetlands

Water willow and purple loosestrife in rock crevasses.

Figure 3.3.4.1.4-3
EAV Wetlands and Hydrogeomorphic Position

Riverbed emergent wetland zones – water willow transition to sedges.



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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

Figure 3.3.4.1.4-3:
Emergent Wetlands

N

1 inch = 1 miles

0 0.5 1 2 Miles

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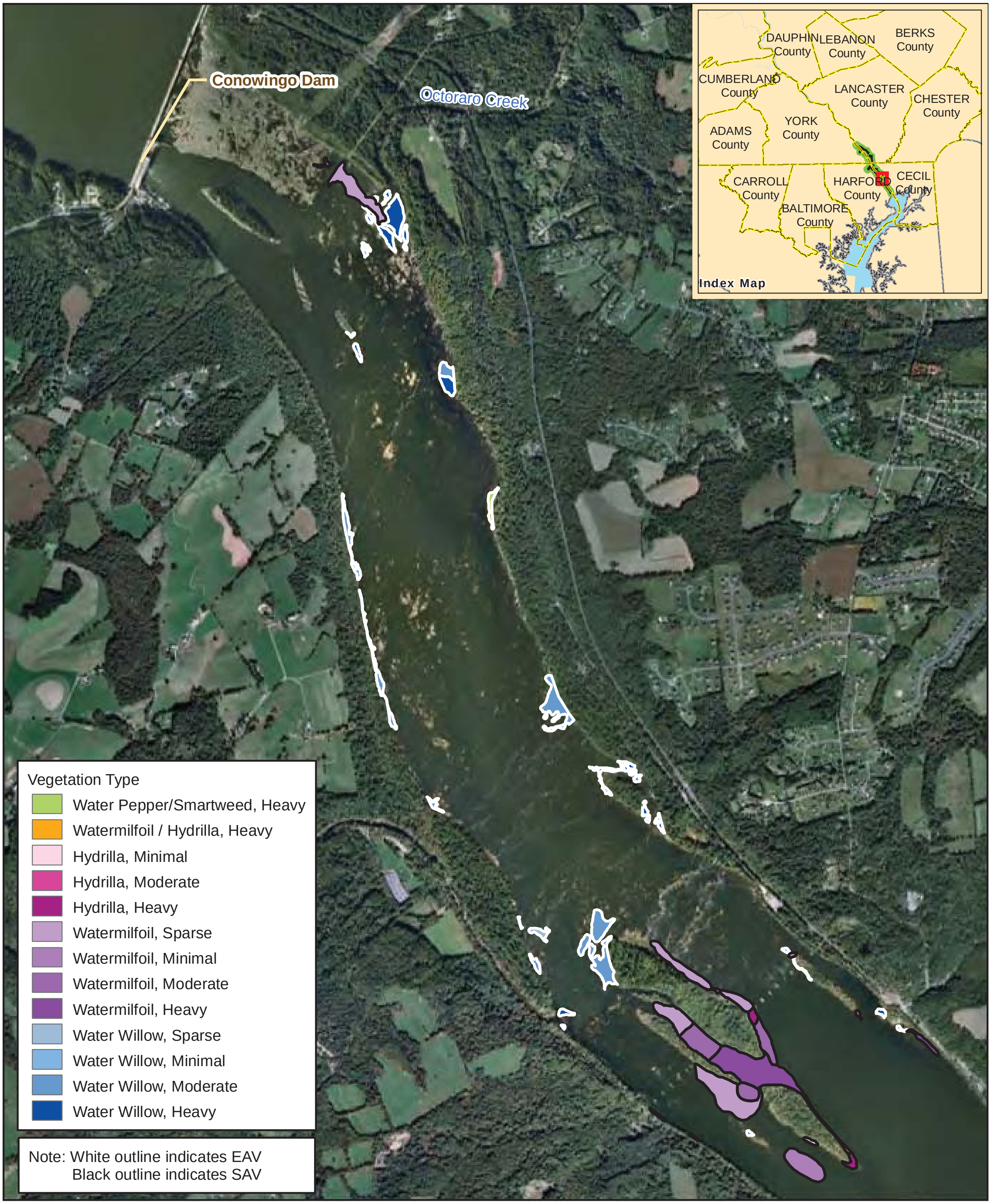

N

1 inch = 0.5 miles

0 0.25 0.5 1 Miles

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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

Figure 3.3.4.1.4-4:
EAV and SAV
Emergent Wetlands

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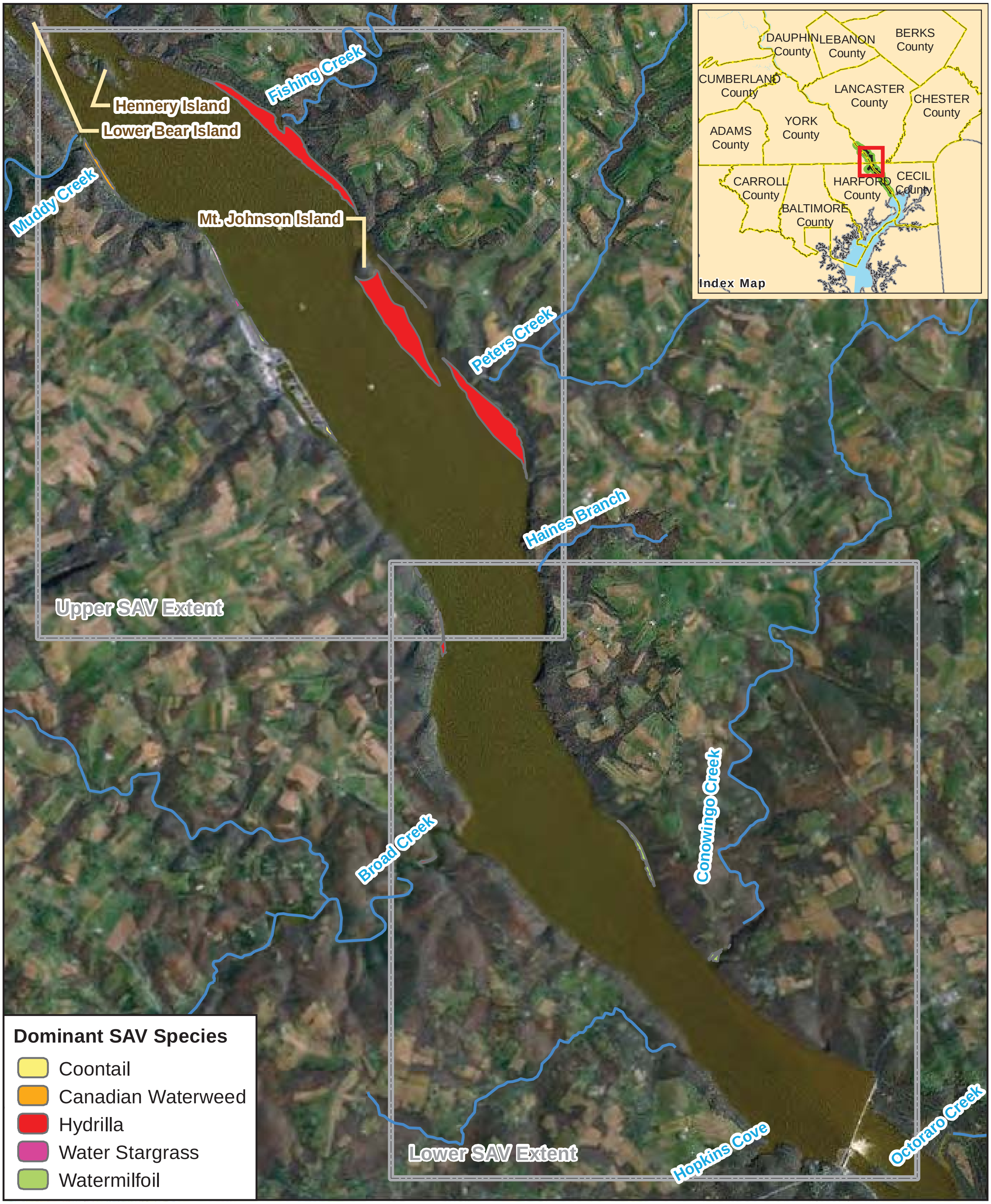

Exelon.

N

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CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

1 inch = 1.25 miles

0 0.625 1.25 2.5 Miles

Figure 3.3.4.1.4-5:
Conowingo Pond Submerged Aquatic Wetlands

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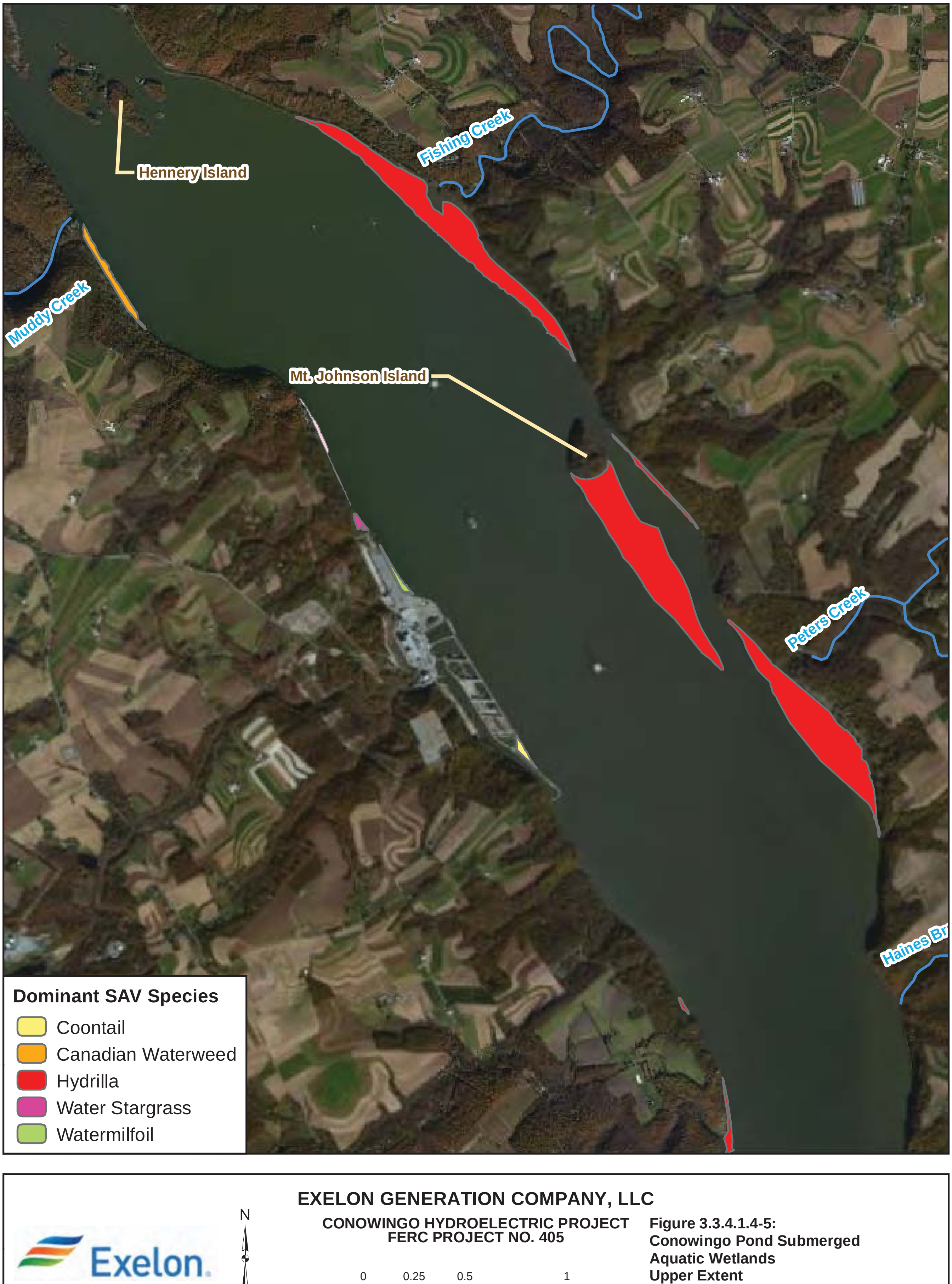

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Figure 3.3.4.1.4-5:
Conowingo Pond Submerged Aquatic Wetlands Upper Extent

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EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

Figure 3.3.4.1.4-5:
Conowingo Pond Submerged
Aquatic Wetlands
Lower Extent

N

0 0.25 0.5 1 Miles

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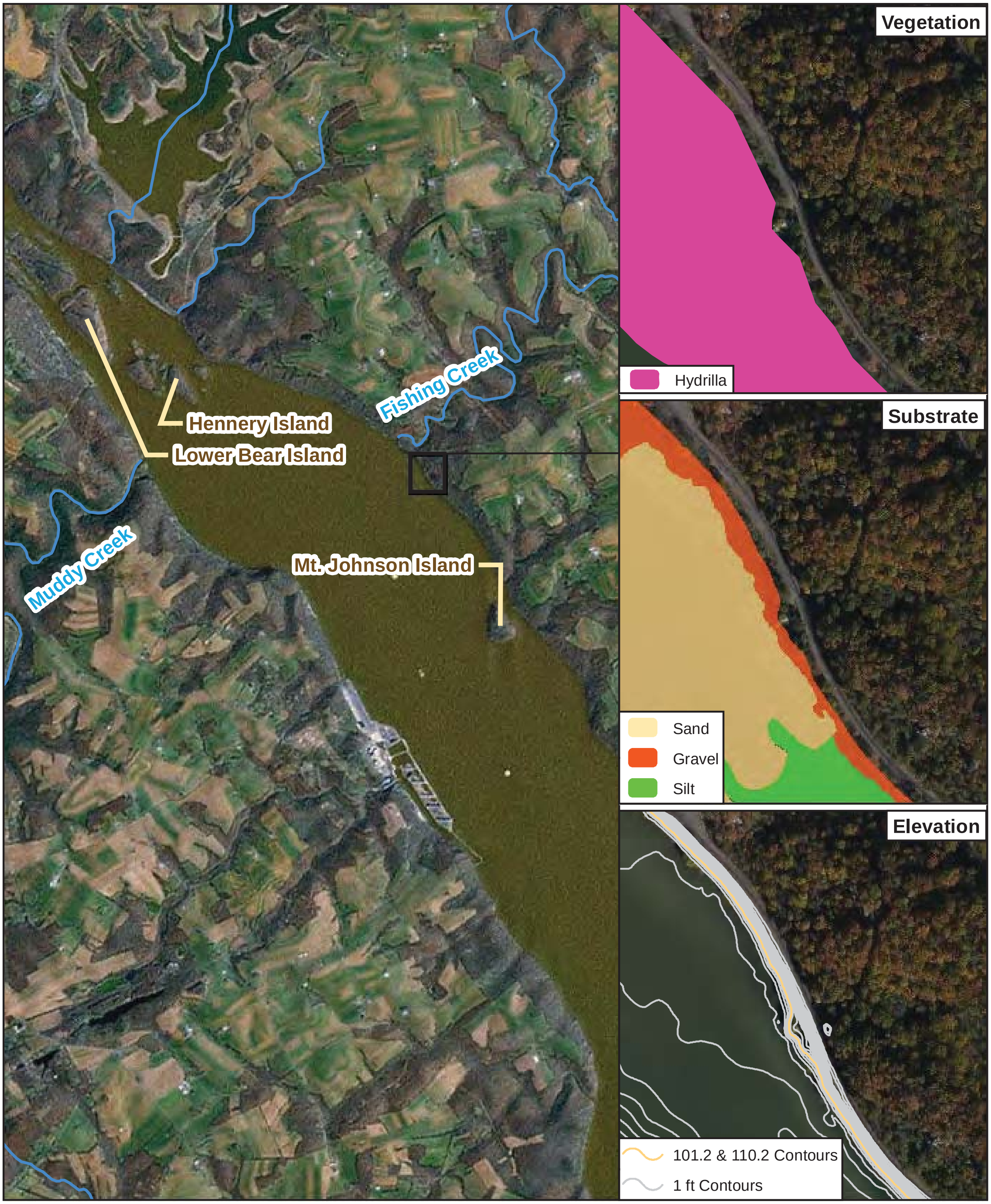


N

0 0.5 1 2 Miles

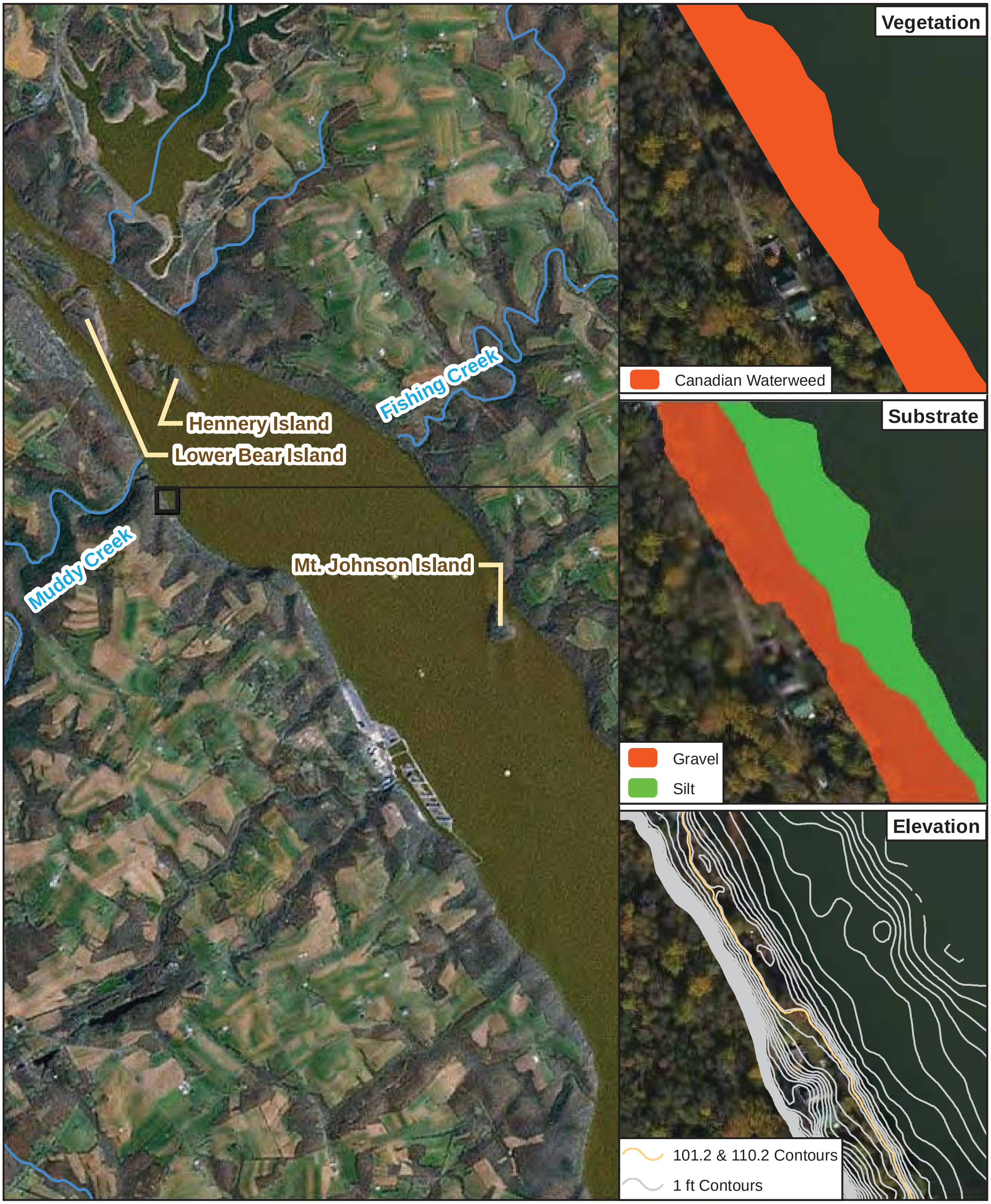
1 inch = 1 miles

EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

Figure 3.3.4.1.4-6:
Conowingo Pond
Sumberged Aquatic Wetland Habitat
Location 1

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_submerged_aquatic_wetland_habitat_loc_1.mxd



Exelon.

N

EXELON GENERATION COMPANY, LLC

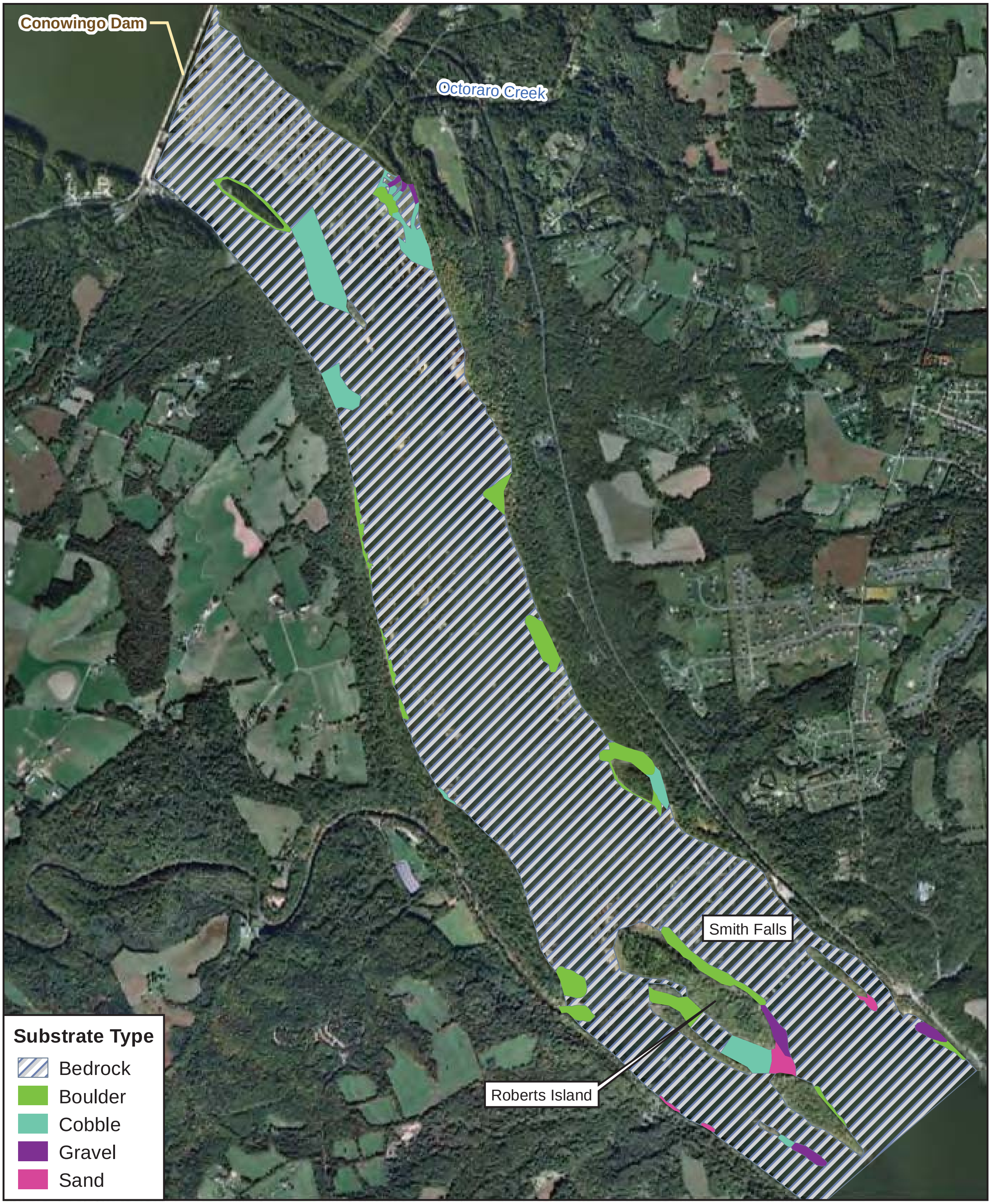
CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

1 inch = 1 miles

0 0.5 1 2 Miles

Figure 3.3.4.1.4-6:
Conowingo Pond
Sumberged Aquatic Wetland Habitat
Location 2

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_submerged_aquatic_wetland_habitat_loc_2.mxd



EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

Figure 3.3.4.1.4-7: Littoral Substrate Below Conowingo Dam

N

0 0.25 0.5 1 Miles

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_littoral_substrate_below_dam.mxd

3.3.5 Threatened and Endangered Species

3.3.5.1 Affected Environment

3.3.5.1.1 *Birds*

In development of the Conowingo Project Pre-Application Document, state and Federal natural resource agencies were queried regarding the potential presence of rare, threatened, and endangered species that may be present in the Project Area. Based on information obtained in that process, listed terrestrial species included:

- Bald eagle *Haliaeetus leucocephalus*
- Black-crowned night-heron *Nycticorax nycticorax*
- Osprey *Pandion haliaetus*

Bald eagle (PA Threatened)

Surveys were conducted in 2010 to determine the abundance levels of bald eagles, specific locations of foraging, roosting, and nesting habitat, and daily/seasonal patterns of use by migrant and nesting bald eagles within the Conowingo Project area. To achieve these objectives, this study used aerial surveying to document the status, distribution, and productivity of nesting bald eagles, used satellite telemetry to delineate eagle roosts and foraging areas, and monitored eagle roosts and foraging areas with ground surveys. Ground surveys as well as final analysis of satellite telemetry data regarding eagle roosts and foraging areas were conducted in 2011.

It was determined that the shoreline forests along Conowingo Pond and the Susquehanna River downstream of Conowingo Dam provide habitat that currently supports 11 pairs of breeding bald eagles, 18 communal roosts, and many foraging bald eagles each year.

Osprey (PA Threatened)

Ospreys have been documented to be present and nesting in the Conowingo Hydroelectric Project area. Although the osprey is not listed as having Federal status under the ESA or Maryland Wildlife Code, it is listed as State-threatened under the Game and Wildlife Code in Pennsylvania and is additionally protected under the Migratory Bird Treaty Act of 1918.

Surveys were conducted according to PGC protocol in the Project area, in Pennsylvania and Maryland in spring and early summer of 2010 and 2011 and were augmented with nest monitoring activities. Methods included surveys for ospreys and/or their nests from boat as well as from terrestrial point locations.

A total of eleven (11) osprey nests were found in the Project area in 2010 and a twelfth (12) nesting location was identified on an unnamed island adjacent to Turkey Island in the Project area in 2011. Of these nests, four are located in the Maryland portion of the Project area and eight are located in the Pennsylvania portion of the Project area. During 2011 surveys, all of the nests identified during 2010 were active with the exception of two nests in the Pennsylvania portion of the Project area. Nests in the Project area ranged from sparse representative of newer nests to larger and well-developed, which is representative of sites with longer nesting histories. Young were known to have fledged from at least four nests in the Project area in 2010 and four nests in 2011.

Black-crowned night-heron (PA Endangered)

The black-crowned night-heron, a colonial nesting wading bird, has been documented to have a historical presence as a breeding bird in the Conowingo Project area. Southeast Pennsylvania, particularly the lower Susquehanna River Gorge, is considered an important nesting area for this species.

Surveys were conducted according to PGC's protocol prior to leaf out during nesting season in 2010 and 2011 in Pennsylvania and Maryland. Methods included habitat assessment and nesting surveys along the shoreline of Conowingo Pond from boat as well as from point locations on land.

Black-crowned night-herons were not observed in the northernmost extent of the Project in Pennsylvania or nesting in the overall Project area during surveys. However, herons were observed in the vicinity of the Conowingo Dam tailrace and spillway and on Rowland Island in both 2010 and 2011. Approximately three to six birds were regularly observed foraging below the dam, traveling between Rowland Island and Fisherman's Park and roosting in trees over the water on Rowland Island. Although heron nests were not observed on Rowland Island during surveys, Rowland Island and the area below Conowingo Dam is considered a potential nesting location for herons in the Project area.

3.3.5.1.2 *Reptiles and Amphibians*

Four listed herptile species were identified by USFWS, PFBC, and MDNR. These species are:

- Hellbender salamander *Cryptobranchus alleganiensis*
- Bog turtle *Glyptemys muhlenbergii* (formerly *Clemmy muhlenbergerii*)
- Map turtle *Graptemys geographica*
- Rough green snake *Opheodrys aestivus*

Hellbender salamander (MD Endangered)

An MDNR (letter dated July 21, 2006) documents the occurrence of the hellbender salamander at Rock Run, a Wetland of Special State Concern.

This wholly aquatic salamander prefers gravel or sand substrate conditions. Abundant large structure is needed for hiding given its secretive behaviors. Preferred water conditions include fast-moving, mid-sized streams/channels with good water quality. Hellbenders breed in August/September and build nests in a saucer shaped excavation in the stream's substrate. Their prey base includes crayfish and snails and they will also consume aquatic invertebrates such as insects and worms.

Bog turtle (PA Endangered; MD and Federal Threatened)

The Conowingo Project is within the range of the federally and Maryland threatened and Pennsylvania endangered bog turtle (letters from USFWS and PFBC dated July 27, 2006 and August 18, 2006, respectively). USFWS has prepared a bog turtle recovery plan (USFWS 2001).

The actual presence of this species within Project boundaries is wholly dependent upon the type of wetlands present given that this species is a habitat specialist. Bog turtles migrate, often through forested areas and small stream channels, between hibernation sites and sites used for foraging, basking and reproduction. The omnivorous bog turtle prefers wetlands with cool spring water, mucky substrates and hummocky vegetation with an open canopy. None of the 31 wetlands surveyed in the Conowingo Pond in 2008 are suitable as potential bog turtles habitats.

Northern Map turtle (MD Endangered)

MDNR (letter dated July 21, 2006) documents the northern map turtle near the mouth of Broad Creek; the occurrence of a breeding population during the 1970s at an unidentified linear cove along the Harford County side of the river; a population recorded in the 1990s at Steele Island and near Steele Island on the Cecil County shoreline; and at the mouth of Octoraro Creek. The rocks north of Steele Island are a good basking location for these turtles.

The northern map turtle is found in deep, slow-moving large rivers and lakes with ample locations for basking. Muddy bottoms with aquatic vegetation are preferred. In addition to vegetation, which comprises a majority of the diet, mollusks and crayfish supplement their largely vegetarian diet. Northern map turtles lay a clutch of eggs in April to mid-July with hatching occurring later in the summer (mid-August to September).

In 2011, Exelon funded studies related to northern map turtles in the Lower Susquehanna River below Conowingo Dam (Seigel, et al. 2011). These studies were conducted by researchers from Towson University, and addressed the following issues; (1) whether current and potential nesting sites can be modified to enhance nesting success by northern map turtles; (2) determine the severity and impacts of altered basking frequency as a function of changes in river flow and human boating; (3) begin a pilot study to determine the feasibility of creating artificial basking platforms; (4) begin a pilot study to determine the feasibility of a rapid population assessment of map turtles in the lower Susquehanna River.

Study results indicated that nesting of map turtles occurs at several locations along the Susquehanna River below Conowingo Dam. During the 2011 studies, predation rates on nests from raccoons, foxes, and feral dogs was nearly 100% at several locations. However, a few select historical nesting sites were relatively free of predation. Nesting most often occurred on sunny days after rain events, and was observed as early as 0630 hours and as late as 1930 hours, but no nocturnal nesting was observed. Turtles were found to make almost immediate use of newly-opened gaps (i.e., tree-falls) in the forest canopy, suggesting that attempts to create new nesting sites by habitat manipulations could be successful, as turtles will quickly utilize new gaps in the canopy cover as nesting sites.

Northern map turtles were seen basking from late April through mid-November, with the most intensive activity seen in September. Northern map turtles used both rocks and logs as basking structures. The overall percent use of each major basking site was 39% logs, 42% rocks, and 19% other substrates. Turtles also commonly switched between basking substrate types even within the course of a single day, depending on water levels and river flow. Northern map turtles also exhibited a tendency to quickly take advantage of new basking logs deposited by flooding activity. For example, one day after the passage of Hurricane Irene, five turtles were found using logs that were newly deposited by the flood waters from the storm. This suggests that northern map turtles do not necessarily rely on historic basking platforms, but instead are at least somewhat opportunistic, using new basking sites as long as they are found in suitable locations. The 2011 study results also indicated that human recreation, such as jet-skies, slow-moving or moored fishing boats, fast-moving fishing boats, kayaks and canoes, and swimmers, and individuals floating on inner tubes, often disturbed basking activities.

Research activities in 2012 will include 1) monitoring at historical nesting sites; 2) habitat opening (i.e., brush clearing) at several nesting locations; and 3) deployment of artificial basking structures, which will include a trial evaluation of various designs that can adjust to changing water level elevations.

Rough green snake (PA Endangered)

PFBC (letter dated August 18, 2006) identified known occurrences of the rough green snake near Conowingo Project. At the very northern portion of its range in the Susquehanna River Valley, this snake is an inhabitant of marshes and moist areas near streams, lakes and marshes. It is an arboreal species, preferring particularly dense growth of brush, trees and vines and it forages primarily on insects (INHS 2004).

3.3.5.1.3 *Plants*

PADCNR (letter dated June 3, 2008) identified 15 Pennsylvania state listed plant species (threatened or endangered) known to have historically occurred in the vicinity of the Conowingo Project in Pennsylvania. In Maryland, MDNR identified 13 Maryland state listed plant species (letter dated July 21, 2006). While MDNR provided information on location, PADCNR did not. Species-specific surveys were not conducted. Although the general habitat for a plant may be present in the Project area, none of these species were observed during any of the field studies. These species are described in the following sections.

<u>*PADCNR*</u>

- Bradley's spleenwort *Asplenium bradleyi*
- Aster-like boltonia *Boltonia asteroides*
- Reflexed flatsedge *Cyperus refractus*
- Flat-stemmed spike-rush *Eleocharis compressa*
- Harbinger-of-spring *Erigenia bulbosa*
- Bicknell’s hoary rockrose *Helianthemum bicknellii*
- American holly *Ilex opaca*
- Common hemicarpa *Lipocarpha micrantha*
- False loosestrife seedbox *Ludwigia polycarpa*
- Umbrella magnolia *Magnolia tripetala*
- Three-flowered melicgrass *Melica nitens*
- Sticky goldenrod *Solidago simplex* ssp. *randii* var. *racemosa*
- Slender goldenrod *Solidago speciosa* var. *erecta*
- Tawny ironweed *Vernonia glauca*
- Appalachian gametophyte fern *Vittaria appalachiana*

Bradley's spleenwort (PA Threatened)

Bradley's spleenwort is a perennial forb (USDA NRCS 2008). This plant grows in acidic rock outcrops and barrens, within crevices and ledges, and on cliff faces (OHDNR 2008). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as crevices of dry, shaded, acid rock outcrops.

Aster-like boltonia (PA and MD Endangered)

The Aster-like boltonia (also known as White doll's daisy or False aster) is a perennial forb often found in wetlands (USDA NRCS 2008) with an open canopy (Hilty 2008). The species prefers sandy to loamy acidic soils; gravel shores; sandy, wet thickets (Slattery et al. 2003); alluvial meadows and marshes; and openings in forested floodplains (Hilty 2008). The Aster-like boltonia is found in the riverside outcrop community of the Holtwood Dam spillway area (Kleinschmidt 2007). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as rocky shores and exposed rocky river beds.

Reflexed flatsedge (PA Endangered)

Reflexed flatsedge is a perennial graminoid (USDA NRCS 2008). This primarily upland plant species (USDA NRCS 2008) prefers an open canopy and sandy soils, and is typically associated with fields, open dry woods, and barrens (OHDNR 2008). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as sand, alluvial banks and dry woods.

Flat-stemmed spike-rush (PA and MD Endangered) (also noted by MDNR)

Flat-stemmed spike-rush is a perennial graminoid associated with wetlands (USDA NRCS 2008) that typically grows in wet sand and gravel or mud (Hilty 2008). This species prefers the full sun and is found in wet depressions in woodlands and limestone glades, wet prairies, roadside ditches (Hilty 2008), and other wet seeps in calcareous grasslands, fens, and waste places (FNA 2002 cited in LeBlanc 2003). MDNR (letter dated July 21, 2006) reports a population of this species between Conowingo Dam and the mouth of Octoraro Creek (in or near in the Susquehanna Floodplain Protection Area). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as wet, sandy ground and stream banks.

Harbinger-of-spring (PA Threatened)

Harbinger-of-spring is a perennial and annual forb (USDA NRCS 2008) found in rich, mixed hardwood forests located in lowlands, coastal plains, and mountain valleys (PNHP 2008). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as seeps and spring heads on wooded slopes.

Bicknell's hoary rockrose (PA and MD Endangered)

Bicknell's hoary rockrose is a perennial subshrub/forb (USDA NRCS 2008) that prefers dry, open areas with abundant sun and generally thin soil (e.g., rock outcrops, exposed banks, barrens, and open forests) (Kunsman 2006). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as dry rocky slopes, open woods and serpentine barrens.

American holly (PA Threatened)

American holly is a perennial shrub or small tree that typically grows in uplands (USDA NRCS 2008). This species can tolerate a variety of light conditions; grows in shallow, well-drained, sandy soil (USDA NRCS 2008); and is adapted to a wide range of habitats, including coastal dunes (USDA NRCS 2008) and deciduous woodlands (Steury and Davis 2003). American holly is found on Piney Island as mature trees and understory (Kleinschmidt 2005, 2007) and on a historic causeway between Piney island and Barclay Island. In its letter dated June 3, 2008, PADCNR describes the habitat for this species as moist alluvial woods and wooded slopes.

Common hemicarpa (PA Endangered)

Common hemicarpa is an annual graminoid typically associated with wetlands (USDA NRCS 2008). This plant prefers moist, sandy soil (OHDNR 2008) and grows in areas of sparse vegetation along the borders of ponds and streams (MNAP 2004) and on sandy beaches (COSEWIC 2002), which often provide the required open canopy. Common hemicarpa is generally very sensitive to habitat disturbance and is found in areas that are protected from strong currents or rough water (COSEWIC 2002). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as moist sand.

False loosestrife seedbox (PA Endangered)

False loosestrife seedbox is a semi-aquatic (Ramstetter and Mott-White 2001) perennial forb associated with wetlands (USDA NRCS 2008). This plant is generally found on level terrain (Ramstetter and Mott-White 2001) and can grow in a variety of substrates, including sand, gravel, silt and muck (Peng 1989 cited in Ramstetter and Mott-White (2001).

The plant prefers a mostly open canopy (Ramstetter and Mott-White 2001). Typical habitats for this species are former oxbows, river channels in floodplain swamps (Sorrie 1986), marshes and wet prairies (Gleason and Cronquist 1991 cited in Ramstetter and Mott-White (2001); NatureServe (2008); KYNPC (2006b); NYNHP (2008b), and on the shores of ponds and other wet places (Fernald 1950 cited in Ramstetter and Mott-White 2001 and Plants for a Future 2008). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as wet meadows and swales.

Umbrella magnolia (PA Threatened)

Umbrella magnolia is a perennial tree usually found in upland areas, preferring fine to medium textured soils that are neutral to slightly acidic. This species has a low tolerance for drought and is shade tolerant (USDA NRCS 2008). It is found in rich woods and ravines (FNA 1993+), near mountain streams and other wet areas (Kling et al. 2008), and in mesic shaded coves (OHDNR 2008). In its letter dated June 3, 2008, PADCNR describes the habitat for this species as rich wooded slopes and floodplains.

Three-flowered melicgrass (PA Threatened)

Three-flowered melicgrass is a perennial graminoid that prefers a partly open canopy and calcareous or sandy loam soil (USDA NRCS 2008). Typical habitats for this species include open dry woods; rocky grasslands; streambanks; and dry to mesic prairies (OHDNR 2008). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as steep rocky slopes and river banks.Sticky goldenrod (PA Endangered)

Sticky goldenrod is a perennial forb (USDA NRCS 2008) that grows in boulder/cobble river bars (KYNPC 2006a). This plant is found in the riverside outcrop community below Holtwood Dam, including areas downstream of the Norman Wood Bridge within the Conowingo Project (Kleinschmidt 2005, 2007). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as rock crevices and shores.

Slender goldenrod (PA Endangered and MD Threatened)

Slender goldenrod is a perennial forb (USDA NRCS 2008) that grows in both loamy and sandy soils, prefers full sun or partial shade, and is found in open woods and fields (Slattery et al. 2003). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as dry, acidic shaley banks.

Tawny ironweed (PA Endangered)

Tawny ironweed is a perennial forb (USDA NRCS 2008) that grows in sandy to clay soils that can be acidic, neutral, or basic (Plants for a Future 2008). It is found in upland woods and dry fields and clearings (Rhoads and Block 2000) and rich woods (Citizens United 2008; Foster and Duke 1990 cited in Plants for a Future 2008). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as dry fields, open slopes or clearings.

Appalachian gametophyte fern (PA Threatened)

Appalachian gametophyte fern is a perennial forb (USDA NRCS 2008) mostly found growing on noncalcareous rocks, in dark moist cavities, and occasionally as an epiphyte on tree bases (Farrar 1993 cited in NatureServe 2008). In its letter dated June 3, 2008, PADCNR describes the habitat for this plant as heavily shaded, moist crevices and overhangs in noncalcareous rock.

MDNR

- Davis' sedge *Carex davisii*
- Hitchcock's sedge *Carex hitchcockiana*
- Glade fern *Diplazium pycnocarpon*
- Flat-stemmed spike-rush *Eleocharis compressa*
- Sweet-scented Indian plantain *Hasteola suaveolens*
- Goldenseal *Hydrastis canadensis*

- American gromwell *Lithospermum latifolium*
- Tall dock *Rumex altissimus*
- Veined skullcap *Scutellaria nervosa*
- Virginia mallow *Sida hermaphrodita*
- Star-flowered false Solomon's seal *Smilacina stellata*
- Swamp oats *Sphenopholis pensylvanica*
- Valerian *Valeriana pauciflora*

Davis' sedge (MD Endangered)

Davis' sedge is a perennial graminoid (USDA NRCS 2008) found growing in both upland and floodplain woodlands where the canopy is somewhat open (Hilty 2008). It is known to inhabit deciduous forested floodplains and moist limestone woodlands; rocky shores; abandoned fields and wet meadows; and unpaved trails (NYNHP 2008a). MDNR (letter dated July 21, 2006) documents scattered populations of this species in the forested floodplains, rocky shores, and moist woods in or near the Northern Susquehanna Canal Protection Area north of the mouth of Deer Creek.

Hitchcock's sedge (MD Endangered)

Hitchcock's sedge is a perennial graminoid (USDA NRCS 2008) that grows under a mostly closed canopy of rich mesic woods, in rock soils along unstable slopes (MADFW 2004), and in calcium-rich loams on slopes near streams (FNA 1993+). MDNR (letter dated July 21, 2006) identified documented occurrences of this sedge in or near the Susquehanna Slopes Protection Area along the wooded shoreline slopes north of Conowingo Creek.

Glade fern (MD Threatened)

Glade fern is a perennial forb (USDA NRCS 2008) that prefers neutral to slightly alkaline soils and grows in moist open woods and slopes, moist meadows, swamps (Connecticut Botanical Society 2005) and forested ravines (Steury and Davis 2003). MDNR (letter dated July 21, 2006) documents scattered populations of this species in the forested floodplains, rocky shores, and moist woods in or near the Northern Susquehanna Canal Protection Area north of the mouth of Deer Creek.

Flat-stemmed spike-rush (PA and MD Endangered) (also noted by PADCNR)

Flat-stemmed spike-rush is a perennial graminoid associated with wetlands (USDA NRCS 2008) that typically grows in wet sand and gravel or mud (Hilty 2008). This species prefers the full sun and is found in wet depressions in woodlands and limestone glades, wet prairies, roadside ditches (Hilty 2008), and other wet seeps in calcareous grasslands, fens, and waste places (FNA 2002 cited in LeBlanc 2003). MDNR (letter dated July 21, 2006) reports a population of this between Conowingo Dam and the mouth of Octoraro Creek (in or near in the Susquehanna Floodplain Protection Area).

Sweet-scented Indian plantain (MD Endangered)

Sweet-scented Indian plantain is a perennial forb (USDA NRCS 2008). The species prefers an open canopy, though it will tolerate some shade. The plant grows in alluvial soils that are found on high-energy floodplains and stream banks but can also be found within open woodlands and along the edges of thickets (Sharp 2000). The species requires some disturbance to maintain suitable habitat; ice and river scour may be immediately destructive to established plants but are necessary to regenerate suitable habitat (Sharp 2000). MDNR (letter dated July 21, 2006) documents scattered populations of this species in the forested floodplains, rocky shores, and moist woods in or near the Northern Susquehanna Canal Protection Area north of the mouth of Deer Creek.

Goldenseal (MD Threatened)

Goldenseal is a perennial forb (USDA NRCS 2008) that requires a mostly closed canopy (Henson 2001). The plant typically grows in moist, well-drained acidic sandy loam soil that contains abundant organic matter (Henson 2001). Goldenseal may be found within mixed hardwood forests (Henson 2001), rich moist woodlands, and along wooded streams (Penskar et al. 2001). MDNR (letter dated July 21, 2006) identified documented occurrences of Goldenseal sub-populations in the wooded bluffs in or near Glen Cove Marina and in or near the Susquehanna Slopes Protection Area along the wooded shoreline between Route 1 and Conowingo Creek boat landing and north of Conowingo Creek.

American gromwell (PA and MD Endangered)

American gromwell is a perennial forb (USDA NRCS 2008) that prefers a partly closed canopy that provides light to medium shade (Hilty 2008). This plant grows in loamy soil that contains abundant organic matter in rich deciduous woods, wooded slopes and along shaded riverbanks (Hilty 2008). MDNR (letter dated July 21, 2006) identified documented occurrences along the shoreline, mostly in rich moist woods, between Route 1 and Conowingo Creek boat landing (in or near the Susquehanna Slopes Protection Area).

Tall dock (MD Endangered)

Tall dock is a perennial forb (USDA NRCS 2008) which prefers full to part sun and rich fertile soil, although it may tolerate gravel and/or clay (Hilty 2008). The plant grows in wet depressions, stream margins (Hoagland et al. 2001) and low areas along ponds, lakes and riverbanks (Hilty 2008). MDNR (letter dated July 21, 2006) documents the occurrence of this species on the north and south sides of the Octoraro Creek mouth (in or near the Susquehanna Floodplain Protection Area).

Veined skullcap (MD Endangered)

Veined skullcap is a perennial forb (USDA NRCS 2008) which grows in wet to mesic deciduous woodlands, near wetland edges, and in wet depressional floodplain forests (Steury and Davis 2003). MDNR (letter dated July 21, 2006) identified documented occurrences along the shoreline, mostly in rich moist woods, between Route 1 and Conowingo Creek boat landing (in or near the Susquehanna Slopes Protection Area).

Virginia mallow (PA and MD Endangered)

Virginia mallow is a perennial forb (USDA NRCS 2008) that prefers a mostly open canopy (OHDNR 2008). The plant grows in sandy or rocky alluvial soil (Gleason and Cronquist 19911991 cited in Ramstetter and Mott-White (2001); NatureServe (2008); KYNPC (2006b); NYNHP (2008b)) on stream and riverbanks (MDWHS 2007; OHDNR 2008). MDNR (letter dated July 21, 2006) documents the occurrence of this species in the WSSC of Wildcat Ravine.

Star-flowered false Solomon's seal (MD Endangered)

Star-flowered false Solomon's seal is a perennial forb associated with wetlands (USDA NRCS 2008) and grows in shallow soils that range in texture from gravelly loam to silt and sandy loam (Pfister et al. 1977; Severson and Thilenius 1976 cited in Habeck 1992; Wasser and Hess 1982; Youngblood et al. 1985). This species generally prefers moist environments; however, it also grows on rocky, well-drained side hills, coastal plains (Cholewa and Johnson 1983 cited in Habeck 1992); Hitchcock and Cronquist 1973 cited in Habeck 1992), thickets, and open forests adjacent to streams (Habeck 1992; Lackschewitz 1991 cited in Habecl 1992; Youngblood et al. 1985). MDNR (letter dated July 21, 2006) documents scattered populations of this species in the forested floodplains, rocky shores, and moist woods in or near the Northern Susquehanna Canal Protection Area north of the mouth of Deer Creek.

Swamp oats (MD Threatened)

Swamp oats is a perennial graminoid associated with wetlands (USDA NRCS 2008). The plant requires full sun and grows in wet meadows and woods, swamps and stream sides (Gleason and Cronquist 1991 1991 cited in Ramstetter and Mott-White (2001); NatureServe (2008); KYNPC (2006b); NYNHP (2008b); OHDNR 2008). MDNR (letter dated July 21, 2006) identified documented occurrences along the shoreline in swamp habitat between Route 1 and Conowingo Creek boat landing (in or near the Susquehanna Slopes Protection Area).

Valerian (MD Endangered)

Valerian is a perennial forb usually associated with wetlands (USDA NRCS 2008). This plant grows in the rich loamy soils associated with forested floodplains, mesic forests (Iverson et al. 1999), and along moist wooded stream banks (NatureServe 2008). MDNR (letter dated July 21, 2006) documents this species on the floodplain downstream of Octoraro Creek (in or near the Susquehanna Floodplain Protection Area) and in forested floodplain, rocky shore, and moist woods habitat in or near the Northern Susquehanna Canal Protection Area north of the mouth of Deer Creek.

3.3.5.1.4 *Fish*

In development of the Conowingo Project Pre-Application Document, state and Federal natural resource agencies were queried regarding the potential presence of rare, threatened, and endangered species that may be present in the Project Area. Based on information obtained in that process listed fish species included:

- Shortnose sturgeon (*Acipenser brevirostrum*) – ESA, listed endangered
- Atlantic sturgeon (*A. oxyrinchus*) – ESA, listed endangered
- Maryland Darter (*Etheostoma sellare*) – ESA, listed endangered
- Chesapeake Logperch (*Percina bimaculata*)- MD, listed threatened

Shortnose and Atlantic Sturgeon (Federal Endangered)

Life history studies of shortnose and Atlantic sturgeons (RSP 3.22) were conducted in the Project area by reviewing regionally pertinent information for sturgeon in the context of historical and contemporary presence and habitat requirements, conducting an analysis of suitable habitat below Conowingo Dam (RSP 3.16), assessing fish stranding below Conowingo Dam (RSP 3.8), monitoring the Susquehanna River with field deployed, data-logging sonic telemetry receivers for presence of tagged fish from other systems, and reviewing east coast fish passage facilities known to pass sturgeons in comparison with the Conowingo EFL.

Shortnose Sturgeon. Shortnose sturgeon was listed as endangered range-wide in the first listing (32 FR 4001) under the Federal Endangered Species Preservation Act in 1967 (16 USC 668 et seq.) and the listing was continued with enactment of the Federal Endangered Species Act (ESA) in 1973 (16 USC 1531 et seq.). Although listed as endangered range-wide (i.e., as a single population) in the species recovery plan, the National Marine Fisheries Service (NMFS) recognized 19 distinct population segments (DPS) including New Jersey/Delaware and Maryland/Virginia (NMFS 1998). NMFS noted that genetic information was needed to help resolve the discrimination of distinct population segments and that DPS recognition is subject to change pending an ongoing Status Review for the species. The recovery plan recognized that shortnose sturgeon were thought to no longer exist in some rivers where they historically occurred, particularly in the Mid-Atlantic rivers (e.g., Chesapeake Bay rivers, including the Susquehanna, NMFS 1998).

The historic abundance of shortnose sturgeon in the Susquehanna River is poorly understood. There appears to be little documentation of sturgeon historically occurring upstream of the site of Conowingo Dam beyond a few anecdotal accounts of captures published in the late 1700’s and early 1800’s (e.g. Anonymous 1890, Mombert 1896). Those events seemed to have been rare enough, even prior to the large scale commercial fisheries, to have been noteworthy, suggesting that sturgeon habitat may have been largely limited to the lower river. A number of falls were identified historically in the vicinity of the location of Conowingo Dam. Amos Falls at the present location of Conowingo Dam had a 20 ft. change in elevation which may have obstructed upstream migration depending on river discharge.

No directed, fishery-independent studies to evaluate sturgeon presence in the Susquehanna River have been conducted, a few shortnose sturgeon collections have been documented in the lower Susquehanna River, including from the Conowingo Dam tailrace. Although not certain, those fish may have originated in the Delaware River Basin and gained access to the Susquehanna River via the 14 mile long Chesapeake and Delaware Canal that enters the upper Chesapeake Bay at Chesapeake City, Maryland (Welsh 2002b). Documented contemporary records resulted from reporting through the USFWS and MDNR coast-wide sturgeon tagging program initiated in 1992 and a smaller reward program initiated in 1996 designed specifically to learn more about sturgeon in the Maryland portion of Chesapeake Bay (Eyler et al. 2009, Mangold et al. 2007). An updated database provided by USFWS in 2010 (Eyler, S. USFWS, personal communication, October 18, 2010) included only five fish reported from the Susquehanna River and three from the Susquehanna Flats or the adjacent upper Chesapeake Bay channel area between 1997 and 2004 (Figure 3.3.5.1.4-1). Additionally, two shortnose sturgeon were caught by anglers in the Conowingo Dam tailrace and turned over to biologists working at the WFL in 1986 (Tim Brush, Normandeau Associates, personal communication, November 17, 2010). Welsh et al. (2002b) hypothesized that shortnose sturgeon in the Chesapeake Bay may have dispersed from the more abundant Delaware River population. This hypothesis was supported by analysis of genetic samples collected from the Chesapeake Bay and Delaware River demonstrating similarity between haplotype frequencies of specimens (Grunwald et al. 2002, Wirgin et al. 2002, Wirgin et al. 2009).

In Exelon's Instream Flow Habitat Assessment Studies, seasonal periodicity of potential shortnose sturgeon presence within the Project Area (as opposed to the Action Area, defined as the the Upper Chesapeake Bay) was described as April – May for spawning, May – June for larval and early juvenile rearing (fry), and year-round for juvenile and adults (see Table 3.3.3.1.7-3). In the analysis, several discrete areas appeared to provide relatively high-quality habitat for multiple life stages. Weighted useable area (WUA) was maximized across life stages between 30,000 and 50,000 cfs (Table 3.3.3.1.7-5).

Spawning habitat was modeled at varying flow levels with a maximum WUA of 14,048,270 ft^2 (322.5 acres) occurring at 50,000 cfs. For spawning 85.7% of the maximum WUA was available at 20,000 cfs, 76.2% at 15,000 cfs, and 60.6% (195 acres) at 10,000 cfs. At 86,000 cfs, 90.6% of the maximum WUA is available. Discrete areas provided suitable spawning habitat, particularly an area along the western shore, southwest of Bird Island, in-between Rowland and Bird Islands, near the mouth of Octoraro Creek, in-between Robert, Wood and Spencer Islands, and downstream of Sterret Island (Figure 3.3.3.1.7-25). For all other life stages, the maximum WUA occurred with flows of 30,000 cfs. For fry, 94.0% of the maximum WUA was available at 20,000 cfs, 87.5% at 15,000 cfs, and 75.7% at 10,000 cfs. For juvenile/adult stages 96.7% was available at 20,000 cfs, 91.8% at 15,000 cfs, and 82.2% (27 acres) at 10,000 cfs. At 86,000 cfs, 77.1%, 76.6%, and 76.6% of the maximum WUA was available for fry, juveniles, and adults, respectively. Essentially the same discrete areas as for spawning provided the most suitable habitats (Figure 3.3.3.1.7-26, 3.3.3.1.7-27).

Since larvae are expected to begin drifting downstream at about 9-14 days post hatch (Richmond and Kynard 1995), and due to the short distance to the tidal river reach, most shortnose sturgeon habitat, aside from spawning and egg incubation habitat, would be in the tidal reach of the lower Susquehanna River and upper Chesapeake Bay, and therefore the effects of Project operations would be greatly diminished. Forage habitats are often mud flats and sandy substrates where prey is concentrated (NMFS 1987), and several studies suggest that access to forage habitat in tidal segments of rivers and the freshwater-saltwater interface are important for shortnose sturgeon (Dadswell 1979, Hall et al. 1991, Dovel et al. 1992, Kynard 1997, Bain et al. 2007). The lower tidal Susquehanna River and upper Chesapeake Bay provide extensive sand, sand-mud, and mud substrate areas. The freshwater-saltwater interface varies in Chesapeake Bay by 6-18 miles (Boynton et al. 1997, North and Houde 2001) and has been documented 9-21 miles downstream of the mouth of the Susquehanna River, (Sanford et al. 2001), or approximately 18 – 30 miles downstream of Conowingo Dam. Overwintering habitat exists in the tidal freshwater area of the lower Susquehanna River, freshwater reach of the upper Bay and in the freshwater – saltwater interface area of Chesapeake Bay, and those habitats were used by shortnose sturgeon. Most captures reported from the upper Chesapeake Bay and four of the captures reported from the Susquehanna River were made in winter. With regard to rearing and forage habitat, Chesapeake Bay water quality issues may be of particular importance because sturgeon are more sensitive to low dissolved oxygen concentration than other fish species (Secor and Gunderson 1998).

Atlantic Sturgeon, five Distinct Popualtion Segments. Atlantic sturgeon was identified as a candidate species for listing under the ESA in 1991. In 1997, as the result of a petition to list the species as threatened or endangered, NMFS and USFWS determined that substantial information existed suggesting that the action might be warranted (62 FR 54018); subsequently, a status review was conducted (ASSRT 1998). In 1998, NMFS and USFWS published their 12-month review determination that listing was not warranted at that time (63 FR 50187); however, they retained the species on the candidate list. As a result of a 2003 workshop regarding Atlantic sturgeon, NMFS determined that a second status review was needed to determine if listing was warranted, and a second Atlantic Sturgeon Status Review Team (ASSRT) composed of scientists representing NMFS, USFWS, and the USGS was assembled. The ASSRT recommended that Atlantic sturgeon be divided into five distinct population segments (DPSs): Gulf of Maine, New York Bight, Chesapeake Bay (including Susquehanna River), Carolina, and South Atlantic, and that the Gulf of Maine, New York Bight, Chesapeake Bay, and Carolina DPSs be listed as threatened. No listing recommendation was made for the South Atlantic DPS, citing a lack of sufficient information to allow a full assessment (ASSRT 2007, 72 FR 15865). In October 2009, NMFS was again petitioned to list Atlantic sturgeon as endangered or to delineate the five DPS's as described by ASSRT (2007). In January 2010 following a 90-day review period, NMFS concluded that the petition presented sufficient information indicating that listing may be warranted (75 FR 838). In October 2010, based on the status review and additional information, NMFS proposed the five DPS’s and listing the Gulf of Maine DPS as threatened and the other four DPS as endangered under ESA (75 FR 61872). In February

2012, NMFS issues a final determination to list the five DPS's as proposed (77 FR 5880-5912, 77 FR 5914-5982).

In a 2007 status review for Atlantic sturgeon, the Susquehanna River was determined not to have a current spawning population, but it was considered to support nursery habitat for use by juveniles originating from other river systems (ASSRT 2007). Atlantic sturgeon from a spawning population may occur in many other river systems, especially in the subadult life stage (Dovel and Berggren 1983), and subadults and adults originating from all five DPSs are distributed in the species range along the Atlantic coast, and are known to occur in the Chesapeake Bay and its tributaries[31]. Chesapeake Bay appears to be an important foraging ground for Atlantic sturgeon (Mangold et al. 2007). A mixed stock analysis, performed from nDNA microsatellite markers, indicated that the Atlantic sturgeon population sampled from Chesapeake Bay were comprised of three main stocks: 1) Hudson River (23 to 30%), 2) Chesapeake Bay (0 to 35%, likely of James River and possibly York River origin), and 3) Delaware River (17 to 27%) (King et al. 2001, ASSRT 2007, Greene et al. 2009).

Historically, Atlantic sturgeon abundance was considered to be high, and in the late 1800's large scale commercial fisheries commenced. The Delaware Bay fishery was the largest, but Chesapeake Bay supported several fisheries as well, specifically in the James, York, Rappahannock, Wicomoco / Pokomoke, Nanticoke, Choptank, Potomac, and Patuxent Rivers. While a number of anecdotal references exist indicating sturgeon presence in the Susquehanna River, particularly pre-1880's, they seem more likely to suggest incidental sightings or captures (e.g. Mombert 1869, anonymous 1890, ASSRT 2007). ASSRT (2007) noted a limited sturgeon fishery in the lower Susquehanna (citing a personal communication with R. St. Pierre, USFWS). The description may indicate a deep area of the river adjacent to Garrett Island, however it is unclear when the fishery existed and what species was harvested. Additionally, since that fishery was considered limited and may have collapsed due to overharvest even prior to the collapse of the Delaware River fishery (Meehan 1900), it seems likely that any spawning population in the Susquehanna River was relatively small. In a review of the commercial fisheries for Atlantic sturgeon, Secor (2002) noted that "surpringly, no harvest records occurred for upper Chesapeake Bay counties".

[31] From NMFS letter dated July 9 , 2012 regarding: Conowingo and Muddy Run, Exelon - comments on Draft License Applications (Projects No. 405 and 2355).

By 1901 the mid-Atlantic fishery had collapsed (Secor 2002). Reviews of fishery dependent and independent captures for Atlantic sturgeon in Chesapeake Bay from the late 1950's through the mid-1990's yielded limited occurrences suggesting to researchers that stocks were depressed to the point that meaningful reproduction was not occurring (Speir and O'Connell 1996), and Secor et al. (2002) found that Chesapeake Bay stocks may be extirpated or below a viable abundance. Secor and Waldman (1999) used fisheries effort and landings data to estimate the historic (1800's) Delaware Bay population of Atlantic sturgeon, yielding an estimate of abundance of 180,000 adult females prior to the commercial scale fisheries of 1880-1890. The authors then used the Delaware Bay abundance estimate to extrapolate estimates for other states. Their method resulted in an estimate of 20,000 females for the entire Chesapeake Bay, mostly from rivers in the Virginia portion of the Bay; 3,000 were estimated for the Maryland portion of the Bay. Although the authors cautioned that their method was probably biased by incomplete catch records, their results suggested that the Delaware Bay may have supported a population size an order of magnitude greater than in other systems. By extension, the Maryland portion of the Bay supported one of the smallest populations and it is likely that the majority were from rivers of the mid Bay area.

The most informative contemporary data regarding distribution of Atlantic sturgeon in the upper Chesapeake Bay comes from the USFWS's coast-wide sturgeon tagging database and the USFWS and MDNR reward program for live sturgeon captured in the Maryland portion of Chesapeake Bay. Welsh et al. (2002A) compiled reports from the reward program for 1996-2000 depicting the distribution of collections reported throughout much of the upper Chesapeake Bay. Only two were from as far up bay as Elk Neck (adjacent to the Susquehanna River) and none were from the Susquehanna River. An updated database of Atlantic sturgeon captures reported in the coast-wide sturgeon tagging database and the Maryland reward program was provided by USFWS in fall, 2010 (Sheila Eyler, USFWS, personal communication). Overall, 122 fish were reported from the upper Chesapeake Bay, defined here as north of Annapolis, Maryland, and its tributary rivers (Figure 3.3.5.1.4-2). Those capture data are dependent on fishery gear, locations, and seasonality. No directed effort to collect Atlantic sturgeon in the Susquehanna River has been made.

Exelon conducted monitoring of the Susquehanna River for sonic transmitter tagged sturgeons from other systems (Delaware River, Potomac River) that might use the Susquehanna River during 2010 and 2011 with fixed station acoustic telemetry receivers (Conowingo SP 3.22). Monitoring was conducted when a number of Atlantic sturgeon might have been at large with active acoustic transmitters (Fisher 2009a, b).

Approximately 46 Atlantic sturgeon tagged in the Delaware River (Matt Fisher, Delaware Department of Natural Resources and Environmental Control, personal communication) and 51 tagged in the Atlantic Ocean offshore of Delaware (ACT database, Dewayne Fox, Delaware State University, personal communication), and more than 100 tagged in the James River, Virginia as well as coastal migrants from other studies coast wide could have been available to use the Susquehanna River. Young-of-year Atlantic sturgeon are generally thought to remain in the estuarine portion of their natal river for months to years before making marine migrations, but the potential movement among systems by early juvenile fish is increased due to the hydraulic linkage of the upper Chesapeake Bay and Delaware Bay estuaries via the Chesapeake and Delaware (C&D) Canal. Fisher (2009a, b) using supplementary data from a network of researchers employing arrays of Vemco data logging receivers, documented overwintering by juvenile Delaware River Atlantic sturgeon in the James River, VA, and Simpson (2008) documented movement of tagged sub-adult Atlantic sturgeon down the C&D Canal to Chesapeake Bay from the Delaware River. No tagged sturgeon were recorded in the Susquehanna River in the Exelon studies. The habitat requirements review suggested that likely rearing, forage, and overwintering habitat for Atlantic sturgeon likely exists in the lower Susquehanna River and upper Chesapeake Bay, beyond the Project area. Spawning in the Susquehanna River is unknown, but spawning is likely on hard, structured surfaces in regions between the salt front and fall-line of large rivers (Hildebrand and Schroeder 1927). Generally, juvenile and subadult Atlantic sturgeon use areas around the freshwater – saltwater interface for forage; the lower tidal Susquehanna River and upper Chesapeake Bay provide extensive sand, sand-mud, and mud substrates and the freshwater-saltwater interface is typically 9- 21 miles downstream of the mouth of the Susquehanna River (Sanford et al. 2001), or approximately 18 – 30 miles downstream of Conowingo Dam. The area associated with the estuarine turbidity maximum (ETM) may provide significant dietary resources for juvenile and adult Atlantic sturgeon. Additionally, the extensive freshwater–saltwater interface area and long saline gradient of Chesapeake Bay provide appropriate overwintering habitat as evidenced by the observation that the majority of collections of Atlantic sturgeon reported from the upper Chesapeake Bay were made during winter months.

In Exelon's Instream Flow Habitat Assessment Studies, Atlantic sturgeon were included in the Deep-Fast and Deep-Slow guilds. The Deep-Fast guild was considered to represent Atlantic sturgeon habitat for spawning, fry, and juvenile/adult life stages and the Deep-Slow guild was considered to represent habitat for the juvenile/adult life stage. Seasonal periodicity of potential Atlantic sturgeon presence within the Project Area included April – May for spawning (Deep-Fast guild), May – July for larval and early juvenile (fry) rearing (Deep-Fast and Deep Slow guilds), and year-round for juvenile/adult habitats (Table

3.3.3.1.7-3). A small amount of habitat for the Deep-Fast guild was modeled with a maximum WUA of 1,219,290 ft^2 (28 acres) at 20,000 cfs. At 15,000 cfs 94.1, and at 10,000 cfs 61.0% of the maximum WUA was available (Table 3.3.3.1.7-5, Figure 3.3.5.1.4-3). The most significant area of suitable habitat for the Deep-Fast guild occurred in-between Rowland and Bird Islands, an area that is upstream of the assumed extent of Atlantic sturgeon migration in the Susquehanna River. For the Deep-Slow guild the modeled maximum WUA of 34,257,996 ft^2 (786 acres) occurred at 5,000 cfs. At 20,000 cfs 41.9%, at 15,000 cfs 58.6%, and at 10,000 cfs 82% of the maximum WUA was available. For the Deep-Slow guild suitable habitat was patchily distributed throughout the Project Area, with a large area of suitable habitat in the tidal reach of the lower Susquehanna River (Figure 3.3.5.1.4-4).

Maryland Darter (Federal Endangered)

The Maryland darter (Etheostoma sellare) was listed as endangered in 1967 under ESA (32 FR 4001). The species was first described in 1912 based on two specimens collected from Swan Creek in Harford County, a tributary to Chesapeake Bay (that is beyond the Project area). The species was rediscovered in 1962 in Gashey's Run, a small tributary to Swan Creek (Knapp et al. 1963). Subsequently in Maryland stream surveys, Maryland darters were collected in only two stream segments: Gashey's Run and a discrete single riffle of Deer Creek. In 1984, USFWS designated critical habitat for Maryland darter including the main channel of Deer Creek from Elbow Branch to the Susquehanna River (49 FR 34228 - 34232). The last observation of the species in any location was in Deer Creek in 1988 (Raesly 1991).

Surveys for Maryland darter were conducted seasonally from fall 2010 through fall 2011 in the lower Susquehanna River (157 locations), Octararo Creek (12 locations), and Deer Creek (24 locations). Deer Creek sampling included the riffle that was the last recorded observation of the species as well as sites upstream and downstream of it. No Maryland darters were collected; however, five of six species were recorded in the lower Susquehanna River Basin, including the congeners *E. blennioides*, *E. zonale*, and *E. olmstedi*. The collection of numerous other darters indicated that the method was a sound approach for sampling Maryland darter. The study represents the most extensive and intensive sampling effort conducted in the Lower Susquehanna River for Maryland darter and contributes to substantial previous effort (Kazyak et al. 2005, Killian et al. 2010, Raesly 1991, 1992, 2010, 2011, Stauffer and Arnold 1986). It is, therefore, extremely unlikely that the species still exists in the Project area, so operations will not have any impacts on the species.

Chesapeake Logperch (Maryland Threatened)

Logperch (*Percina caprodes*) is listed as threatened in Maryland, however the species present in the Susquehanna River has been reclassified as Chesapeake logperch (*Percina bimaculata*). Near (2008) described the long standing use of *P. caprodes* and *P. bimaculata* as synonymous, but proposed that Chesapeake logperch is a distinct species and that the appropriate name for the species is *P. bimaculata*. Ashton and Near (2010) noted that Chesapeake logperch is listed as threatened in Maryland but that the designation is applied to *P. caprodes* until the state recognizes the nomenclature due to recent removal from synonymy with *P. bimaculata* (Near 2008).

Chesapeake logperch use a range of habitat including streams, tributary impoundments, and large rivers. Ashton and Near (2010) reported extant populations of Chesapeake logperch in the lower Susquehanna River (above and below Conowingo Dam) and in the lower reaches of several tributaries including Broad, Conowingo, Deer, Northeast, and Octoraro creeks, MD, and Fishing Creek, Michael Run, Muddy, and Octoraro creeks, PA. Abundance was considered to be infrequent but occasionally locally abundant. In 1996, 211 Chesapeake logperch were captured in Conowingo Pond, mostly by seine but also by bottom trawl, trap net, and electrofishing. Seine stations with the highest catch rates (catch per station) included Broad Creek, a west shore Conowingo Pond tributary in Harford County, MD, and Fishing Creek, an east shore tributary in Lancaster County, PA (Normandeau 1997). Additional Chesapeake logperch were captured in Broad Creek in 1999 and near Frazer Tunnel (Cecil County, MD) among 55 total individuals (Normandeau 2000). Chesapeake logperch also occur in the Susquehanna River below Conowingo Dam. Electrofishing in the Conowingo tailrace and at five stations in the upper tidal zone between Deer Creek and Port Deposit, MD yielded Chesapeake logperch in 1982 and 1983 (RMC 1985a; b). Chesapeake logperch were also caught in the Conowingo tailrace during WFL operations in spring through at least 2001, typically one or two individuals per year (SRAFRC 1991; 1992; 2002). Results of extensive surveys conducted for Maryland darter in the lower Susquehanna River, Deer Creek, and Octararo Creek (RSP 3.10) included collection of many Chesapeake logperch. Darter species were collected in all four seasons and at 72% of the 193 locations sampled in all three water bodies. Chesapeake logperch was the second most abundant species recorded at 1,883 (21% of all darters). Chesapeake logperch was the most abundant of the darter species in Octoraro Creek with 1,260 of the 2,471 (51%) darters recorded.

3.3.5.2 Environmental Effects

Avian Species

Bald eagles and ospreys have successfully nested in the Project area. These species also benefit from the forage opportunities and roosting habitat associated with the Project. Black-crowned night-herons are documented residents in the Project area with potential breeding habitat in the vicinity of Rowland Island. There is no indication that ongoing Project operations have an adverse affect on the breeding activities of any of these bird species. However, potential effects of current Project operations and maintenance on each of these species is discussed below.

Bald Eagle

Operations and associated maintenance activities with potential to affect bald eagles in the Project area include tree clearing and herbicide applications for vegetation management, and activities associated with the maintenance and use of recreational facilities.

Osprey

Operations and associated maintenance activities with potential to affect ospreys in the Project area include tree clearing and herbicide use for vegetation management, and activities associated with the maintenance and use of recreational facilities.

In addition, because ospreys tend to prefer human-made structures for nesting, transmission tower and line maintenance activities may potentially affect ospreys nesting in towers in the Project area.

Black-crowned night-heron

Operations and associated maintenance activities with potential to affect black-crowned night-herons in the Project area include tree clearing and herbicide use associated with vegetation management on the south end of Rowland Island, the portion of the Project area identified as a possible breeding area.

Reptile Species

No potential habitat for bog turtle was identified within the Project boundary, thus the Project has no effect on this species. Northern map turtles have been identified within the Project boundary, no environmental effects associated with the continued operation of the Project are anticipated..

Fish Species

Shortnose Sturgeon

Adult shortnose sturgeon may be in the Project area during spawning season, approximately mid-March – mid-April. Eggs and larvae may be in the Project area for a brief period after spawning, but would likely rapidly drift downstream to the tidal river / upper Chesapeake Bay soon after hatching (at approximately 9 – 14 d post-hatch). Young-of-year, Juvenile and adult sturgeon may reside in the tidal river reach and upper Chesapeake Bay year-round.

Direct effects to shortnose sturgeon could include potential effects of hydroelectric operations on the amount and use of spawning habitat by adults, flushing of early life stages to unsuitable habitat, and stranding or drying of early life stages due to flow fluctuations and collection in the Conowingo fish lifts.

The potential effects of flow fluctuations on alteration of and access to spawning habitat are likely small in most seasonal flow scenarios. Based on historical water temperature data, most of the spawning season is expected to occur during the month of April when minimum flows are 10,000 cfs. Daily average flow exceedence calculated for Conowingo Dam discharge for 40 years of data demonstrated that, daily average discharge exceeded 34,000 cfs 80% of the time in the month of April, and exceeded 23,500 cfs 80% of the time in the month of May (Table 3.3.2.1.1-2). The Instream Flow Habitat Assessment modeled 61% of the maximum available WUA for spawning habitat at 10,000 cfs, and the percentage increased to a maximum with discharge at around 50,000 cfs. A high percentage of available WUA was maintained with higher flows within the range that can be controlled by Conowingo Dam hydroelectric operations. Additionally, habitat persistence calculations indicated that discrete areas of suitable spawning habitat persisted at both minimum and maximum generational flows (Figure 3.3.5.1.4-5). No suitable spawning habitat was identified in the spillway area under the range of operational flows due to combined depth, velocity, and substrate characteristics. Therefore, while some modification of habitat, in terms of WUA, is expected to occur as a result of flow fluctuations, the normal river discharge during the spawning season combined with the persistence of available habitat over a wide range of operational flows, including the seasonal minimum; suggest that the impacts would be muted.

Flow fluctuations can also effect early life stages of shortnose sturgeon by either stranding eggs or larvae in isolated pools and exposing them to unfavorable water quality or drying out of habitat, or prematurely dislodging eggs and flushing larvae downstream to unfavorable habitats due to rapidly increasing flows. As noted above, the risk of stranding should be small below Conowingo Dam because habitat in the spillway area (boulder field) does not represent suitable spawning habitat so it is unlikely that early life stages would be located there. In the area around the mouth of Octoraro Creek, potential spawning habitat was identified and pools can form in low flow regimes. However, those pools tend to be connected and are less likely to form during the sturgeon spawning season based on springtime minimum flows and seasonal flow exceedence calculations. Finally, as noted above, potential spawning habitat was identified based on physical characteristics, but whether sturgeon would in fact use the area for spawning remains speculative.

Historic use of habitat upstream of the present Conowingo Dam is not well documented. In addition, NMFS has also indicated that passing sturgeons upstream of Conowingo Dam is not desirable at this point in time (Julie Crocker, personal communication).

Collection of shortnose sturgeon in the Conowingo fish lifts is not expected or is expected to be rare. If collection does occur, a sturgeon handling plan, which will be developed as part of Exelon's Biological Assessment document, will provide for safe return to downstream thereby minimizing risk associated with collection in the fish lifts.

Atlantic Sturgeon

The habitat requirements review suggested that potential rearing, forage, and overwintering habitat for Atlantic sturgeon likely exists in the lower Susquehanna River and upper Chesapeake Bay, beyond the Project area.

Direct effects on Atlantic sturgeon include the potential effects of hydroelectric operations on the amount and use of spawning habitat, flushing of early life stages to un-suitable habitat, and stranding or drying of early life stages due to flow fluctuations and collection in the Conwoingo fish lifts.

Conowingo Dam is believed to be located above the historic spawning grounds for Atlantic sturgeon (ASSRT 2007, [citing Steve Minkkinen, USFWS, Pers. Comm. 2006]). ASSRT (2007) listed the likely extent of upstream migration in the Susquehanna River at river km 10 (river mile 6.2), which indicates the Robert Island complex just above the head of tide, and approximately 6 km (3.7 miles) downstream of Conowingo Dam. Therefore, the probability of Atlantic sturgeon using habitats closer to the dam is expected to be rare at most. As a result, there is no expected adverse effect of stranding of adults, access to habitat, or stranding or drying of early life stages.

Since the expected upstream extent of migration by Atlantic sturgeon is approximately 6 km downstream of Conowingo Dam, collection in the fish lifts is not expected. However the potential for a wandering fish to enter the fish lifts exist so there is a remote risk of collection. Development of a sturgeon handling plan, which will be developed as part of Exelon's Biological Assessment document, will provide for safe return to downstream of any collected sturgeon thereby minimizing risk associated with any collection in the fish lifts.

Maryland Darter

Maryland darter are only known historically from Deer Creek in the Project area and, have not been observed there since 1988 even though there has been extensive and intensive surveys specifically for this species over many years. Therefore no adverse Project related impacts are expected to occur.

Chesapeake Logperch

In Conowingo Pond, Chesapeake logperch are considered to be locally abundant. In the 2010-2011 lower Susquehanna River Maryland darter surveys, Chesapeake logperch were found to be widely distributed and abundant. Chesapeake logperch was the second most abundant darter species over 193 sampling locations, and the most abundant darter species in Octoraro Creek. The species is established under the existing operational regime. Continued operation of the Project is not expected to result in adverse impacts to this species.

Plants

Surveys for rare plants were not conducted as part of any study, nor was a comprehensive botanical inventory completed for the Project area. It is anticipated that based upon habitat suitability and prior documented occurrences, certain plant species of concern are present in the Project area. Continued operation of the Project is not expected to result in adverse impacts to these species.

3.3.5.3 Proposed Environmental Measures

Exelon has prepared a Bald Eagle Management Plan to address potential impacts to bald eagles which nest and roost in the Project area. The protection of ospreys from potential disturbances or other impacts during the breeding season the following measures will be provided for ospreys nesting on Exelon lands:

- Nest Buffers - Nest buffers of 330 feet will be implemented during breeding season for most activities. For activities with the potential to emit excessive noise (which excludes routine Project operation and maintenance activities),, larger buffers up to 600 feet will be implemented during breeding season.

- Herbicide application for vegetation control will be avoided within 330 feet of nests during breeding season.

- Tower nests – In the event that nests located in towers are identified as problem nests, Exelon will consult with the United States Fish and Wildlife Service to identify the appropriate best management practices and obtain applicable permits for nest removal or relocation. A typical best management practice for problem nests in towers is the installation of nest platforms on towers or nearby.

For the other species described in this section as related to this Project, Exelon is not proposing any environmental measures for these species at this time.

3.3.5.4 Cumulative Effects

CEQ regulations define 'cumulative effects' as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40CFR§1508.7).

For this analysis, the action is the relicensing and continued operation of the Conowingo Project. The cumulatively affected resources are the rare, threatened, and endangered species identified above. The geographic scope of this analysis is the Lower Susquehanna River Basin and the Chesapeake Bay. The temporal scope of this analysis includes a discussion of the past, present, and reasonably foreseeable future actions, and their effects on the resource 50 years into the future.

Atlantic sturgeon and shortnose sturgeon are not present or are infrequent in the Project area, therefore the proposed action is not expected to contribute to any cumulative adverse impacts on the species. It is extremely unlikely that Maryland darter exists in the geographical scope of this analysis, so the proposed action will not contribute to any cumulative impacts on the species.

Non-Project factors that may affect Atlantic sturgeon and shortnose sturgeon include disturbance of habitat or behavior, injury, or mortality due to collisions or entanglement in anchor lines, and fuel spills due to vessel collision. Bridge construction and demolition projects may interfere with normal shortnose sturgeon migratory movements and disturb sturgeon concentration areas. Maintenance dredging of Federal navigation channels can adversely affect sturgeon populations. Within the upper Chesapeake Bay shortnose and Atlantic sturgeon have likely been impacted by pollution. The Chesapeake Bay watershed is highly developed and may contribute to impaired water quality via stormwater runoff or point sources.

Shortnose and Atlantic sturgeon are taken incidentally in anadromous fisheries along the East coast and may be targeted by poachers (NMFS 1998). As evidenced by the USFWS and MDNR coast-wide sturgeon tagging program initiated in 1992 (Eyler et al. 2009), and sturgeon bycatch reward program in the Maryland portion of Chesapeake Bay (Mangold et al. 2007), the incidental take of both species has been documented in Chesapeake Bay and its tributaries.

Non-Project factors that may affect Maryland Darter habitat in Deer Creek include deteriorated habitat due to development (SRBC 2008). Raesly (1991) reported that collections in Deer Creek reflected a significant drop in total fish collected and species richness over time during the late 1980's. In addition, he also reported increases in nitrate and chloride concentrations suggesting a deterioration of water quality (Raesly 1991). Stranko et al. (2010) concluded that effects of urbanization and non-native species were important factors in the extirpation or extinction of 13 aquatic species in Maryland, including the Maryland darter. These various studies suggest that development in the watershed may have been a significant factor in reducing numbers or eliminating Maryland darter from the basin.

3.3.5.5 Unavoidable Adverse Impacts

Avian Species

There are no unavoidable adverse impacts from the Project on bald eagles, ospreys or black-crowned night herons.

Fish Species

Shortnose sturgeon may be present, while Atlantic sturgeon, and Maryland darter are likely not present in the Project area. Exelon does not anticipate there will be unavoidable adverse impacts to these species. There are no unavoidable impacts identified for Chesapeake logperch.

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0 3.5 7 14 Miles

1 inch = 7 miles

Figure 3.3.5.4.1-1:
Shortnose Sturgeon Captures From the Upper Chesapeake Bay
(Labeled by Date of Capture)

Collection data reported to the USFWS for the Coastwide Atlantic Sturgeon Tagging Program and Atlantic Sturgeon Reward Program for Maryland Waters of the Chesapeake Bay, 1992 – Fall 2010, courtesy of Sheila Eyler, USFWS

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\Exh_E_con_shortnose_sturgeon_captures.mxd

Exelon.

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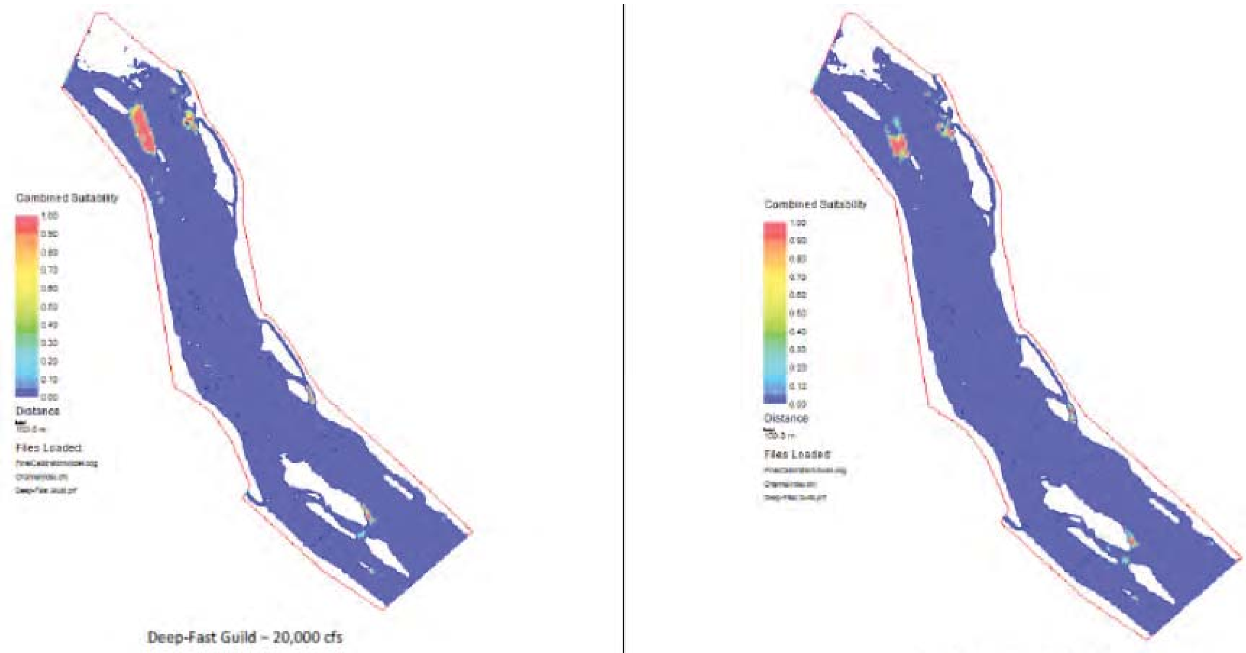
Figure 3.3.5.4.1-2:
Atlantic Sturgeon Captures From the Upper Chesapeake Bay (Labeled by Date of Capture)

Collection data reported to the USFWS for the Coastwide Atlantic Sturgeon Tagging Program and Atlantic Sturgeon Reward Program for Maryland Waters of the Chesapeake Bay, 1992 – Fall 2010, courtesy of Sheila Eyler, USFWS

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\Exh_E_con_atlantic_sturgeon_captures.mxd

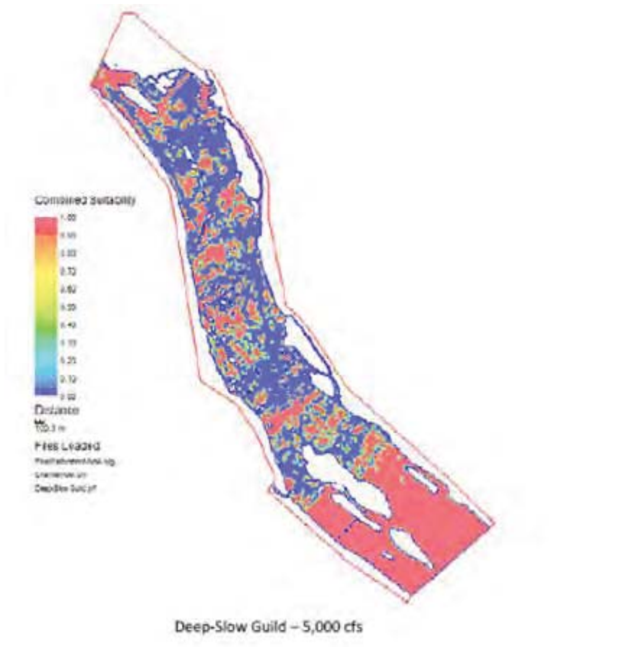
FIGURE 3.3.5.1.4-3. COMBINED SUITABILITY HABITAT MAPS FOR SIMULATION FLOW, DEEP-FAST GUILD, FLOW = 20,000 CFS AND 30,000 CFS

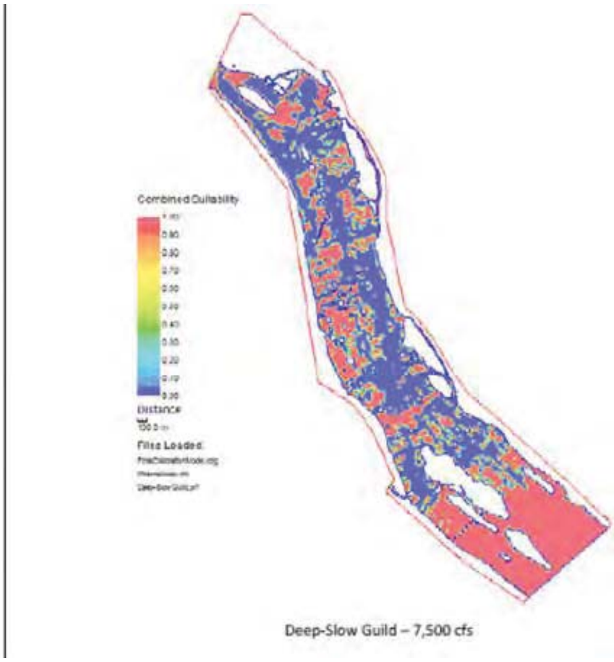


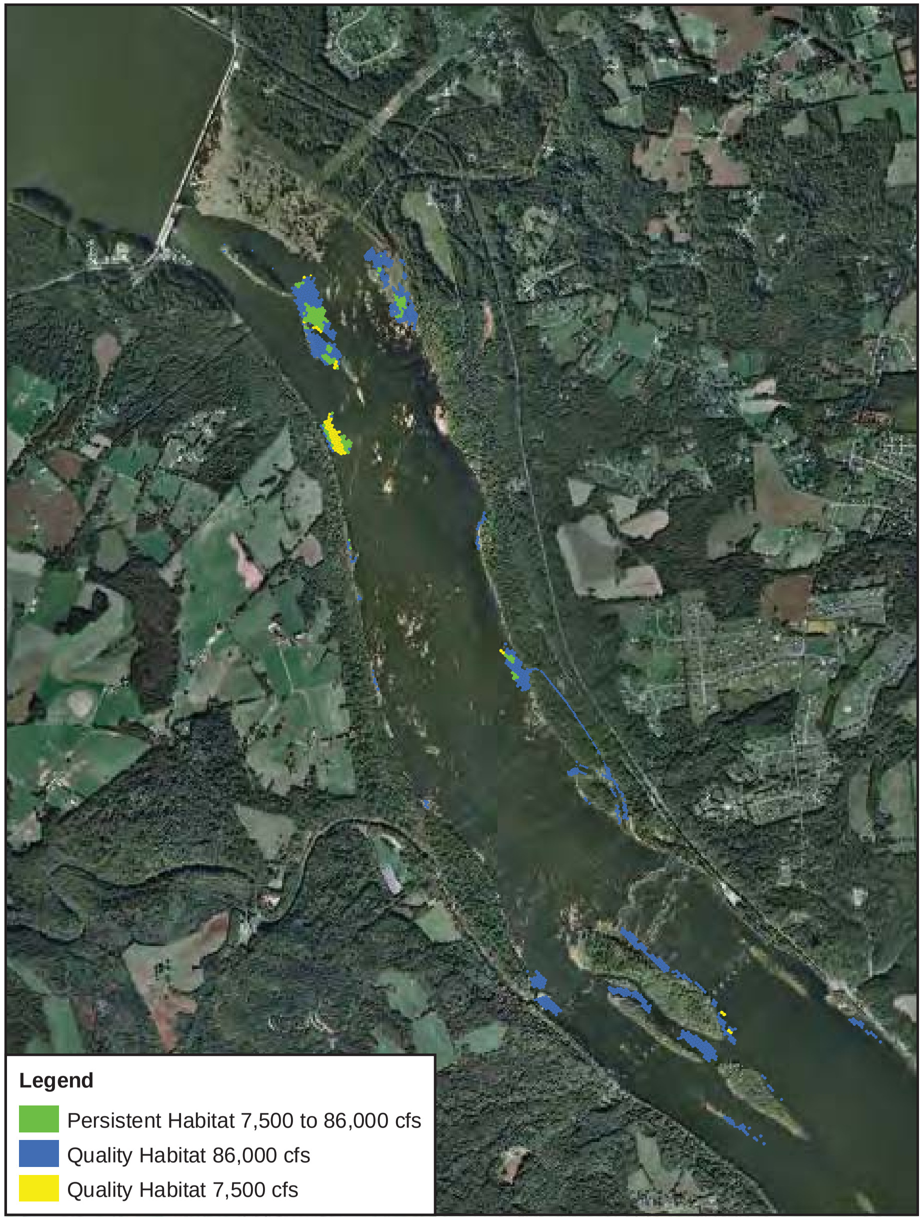
Deep-Fast Guild – 20,000 cfs

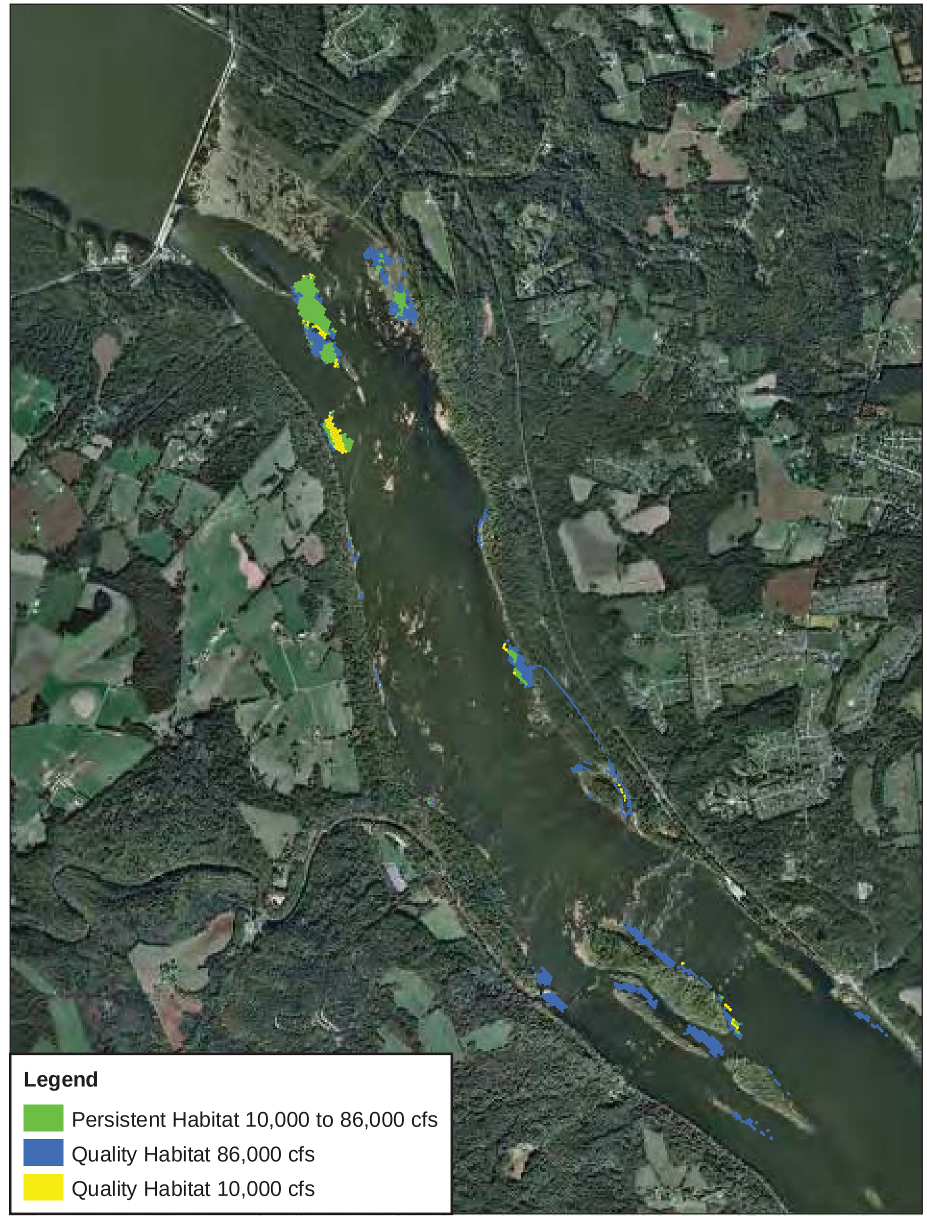
Deep-Fast Guild – 30,000 cfs

FIGURE 3.3.5.1.4-4. COMBINED SUITABILITY HABITAT MAPS FOR SIMULATION FLOW, DEEP-SLOW GUILD, FLOW = 20,000 CFS AND 30,000 CFS









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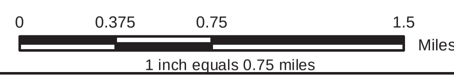
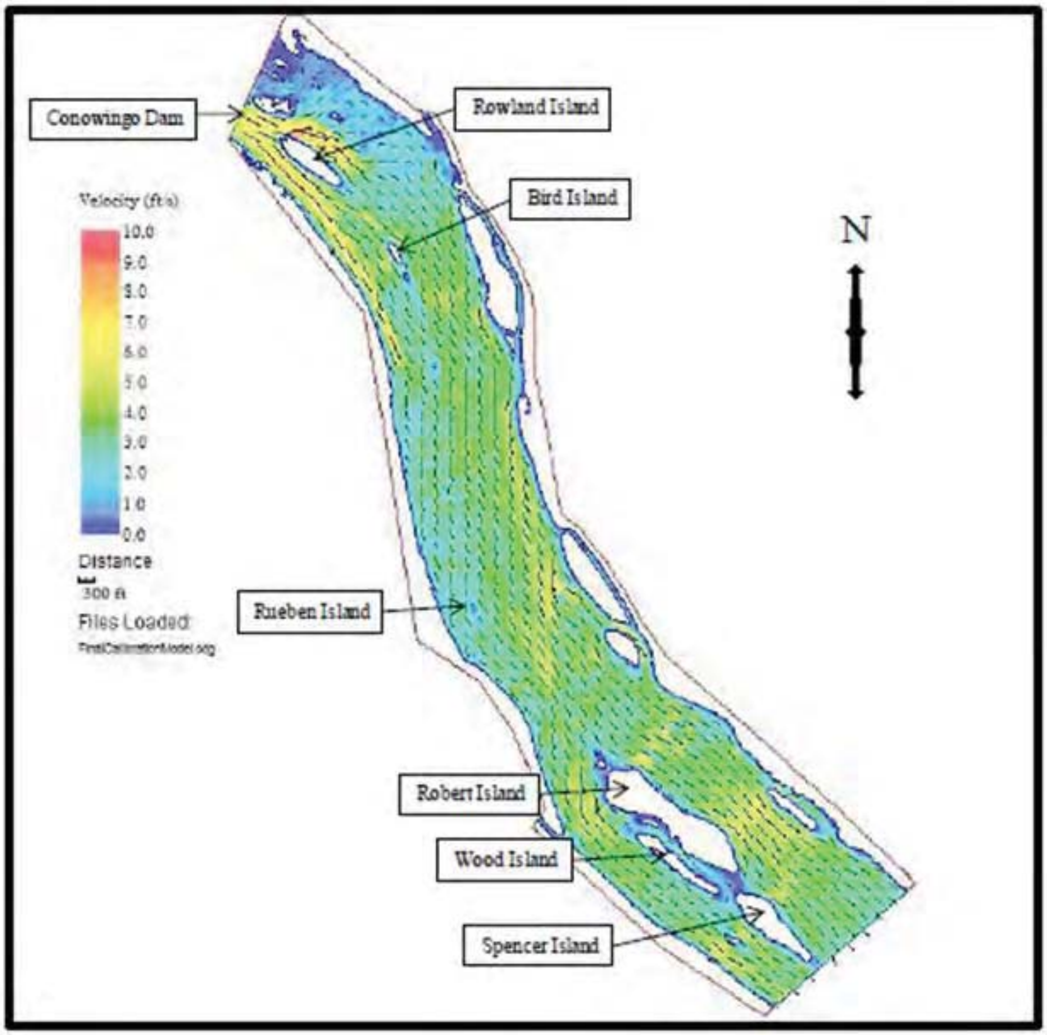


Figure 3.3.5.1.4-5:
Shortnose Sturgeon
Spawning Habitat Persistence

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\Exh_E_con_shortnose_sturgeon_spawning.mxd

FIGURE 3.3.5.1.4-6. WATER VELOCITY IN THE SUSQUEHANNA RIVER BETWEEN CONOWINGO DAM AND SPENCER ISLAND AS DETERMINED BY RIVER MODEL 2D MODEL FOR 86,000 CFS DISCHARGE FROM CONOWINGO DAM



3.3.6 Recreation Resources

3.3.6.1 Affected Environment

Regional Recreation

The Conowingo Hydroelectric Project is situated on the Susquehanna River, located within the Pennsylvania counties of York and Lancaster, and the Maryland counties of Cecil and Harford. Conowingo Dam and the lowermost 6 miles of the Project reservoir, Conowingo Pond, are located in Maryland while the upper 8 miles of the reservoir are located in Pennsylvania. The proposed Project extends 2.5 miles downstream of the dam along the east bank of the river and 0.5 miles downstream along the west bank of the river. Major metropolitan areas exist within an hour and a half drive, including Baltimore, Maryland; Philadelphia, Pennsylvania; and Wilmington, Delaware. The nearest metropolitan area is Lancaster, Pennsylvania, which lies approximately 30 miles to the northeast.

Conowingo is the most downstream of five FERC projects located along the Susquehanna River. The upstream projects include York Haven, Safe Harbor, Holtwood, and Muddy Run. The Conowingo Project is a large component of recreation and conservation opportunities in the lower Susquehanna River Corridor. In addition to the adjoining FERC projects; County, State, and Federal preservation initiatives and recreation facilities create numerous opportunities for public access and recreation. Facilities in the vicinity of the Project include scenic overlooks, hiking trails, fishing, state game land, nature preserves, picnic areas, campgrounds, boat launches, and environmental centers with interpretive displays. Recreation resources and opportunities in the general vicinity of the Project were covered extensively in Exelon's Pre-Application Document (PAD) (Exelon 2009), and Exelon's Recreation Plan RSP 36 (TRC and GSE 2012), and the reader is referred to these documents for additional information.

Project Recreational Facilities

Lock 13. Located on the western shore of the Susquehanna River just south of the U.S. Route 372 bridge, Lock 13 is owned and managed by the licensee. Access to the unrestored site with no public amenities or interpretive improvements is from Lock 12, a Holtwood PPL-owned and managed area 0.3 miles north of Lock 13. This site is accessed via the Mason-Dixon Trail which runs through the Lock 13 area.

Lock 15. Also located on the western shore of the Conowingo impoundment, Lock 15 is owned and managed by the licensee. The site can be accessed off of U.S. Route 372 via River Road. The Susquehanna Tidewater Canal Lock 15 has been restored and offers numerous amenities including picnic facilities (5 ADA tables, 2 grills), bank fishing, historic and interpretive signage, a gravel parking lot for 35 spots, as well as 2 portable toilets, one of which is ADA compliant. The Mason-Dixon Trail also runs through the area and connects the Lock 15 site with the Muddy Creek boat launch site.

Muddy Creek Boat Launch. The Muddy Creek Boat Launch is located just south of Lock 15 on the west shore of the Conowingo impoundment. The site is owned by Exelon, but is leased and managed by the Commonwealth of Pennsylvania, Pennsylvania Fish Commission. The site is accessed off U.S. Route 372 via River Road and includes interpretive panels and an ADA portable restroom. The site provides a newly rebuilt (2009) concrete boat launch which is 20 feet wide and has boat docks on both sides of the ramp. The parking lot provides parking for 44 boat trailers (2 ADA) and 26 vehicles (1 ADA). The Mason-Dixon Trail runs through the area and connects the Muddy Creek boat launch with the Lock 15 site.

Cold Cabin Boat Launch. The Cold Cabin Boat Launch is located just over a mile north of the Peach Bottom Nuclear Plant on the west shore of the Conowingo Impoundment and is accessed from Cold Cabin Road. The property is owned by the licensee but leased to and managed by Peach Bottom Township. Amenities at the site include a 12 foot wide boat ramp, 2 picnic tables and benches and an interpretive sign. Informal parking at the area supports up to 5 vehicles. The Mason-Dixon Trail traverses through this site.

Dorsey Park. Dorsey Park is located on the western shoreline of the Conowingo impoundment, just north of PBAPS. The site is accessed from the Lay Road. The park provides numerous recreational opportunities for the public including ADA picnic tables, charcoal grills, benches, and interpretive signs and kiosk, 2 portable toilets (1 ADA), and two 32 foot wide boat ramps with docks. The site also provides parking for 25 boat trailer and 30 vehicles (2 ADA spaces).

Line Bridge. Located on the western shore of the Conowingo impoundment, Line Bridge is approximately 4 miles north of the Conowingo Dam. The area is owned by the licensee and is leased to and managed by the County Commissioners of Harford County. The site provides public access to the shore for fishing as well as an informal carry in launch area. A small informal parking area which can accommodate 3 cars is also provided at the site.

Broad Creek Public Landing. The Broad Creek Public Landing site is located on the western shore of the Conowingo Pond in Broad Creek and is accessed from Flintville Road. The site is owned by the licensee and leased to and operated by the County Commissioners of Harford County. The site provides an open area for day use, as well as a small dock and 14 foot wide hard surface boat ramp. While there are 4 parking spaces available at the site, the licensee provides offsite parking (adequate for 33 trailers) approximately 400 feet from the site on Paddrick Road. The Mason-Dixon Trail traverses through this site.

Glen Cove Marina. Glen Cove Marina is located just north of the Conowingo Dam on the western shore of the Conowingo impoundment. The site is accessed from Glen Cove Road and Berkley Road. The site is owned by the licensee and operated by a commercial contractor. Amenities provided at the site include a hard surface boat ramp, docks, picnic area, sanitation facilities, fuel, repair services, a small store, and boat slips for approximately 74 boats. There is a launch fee at the site. The on-site parking area accommodates 20 vehicles and 16 trailers, with additional gravel parking located on Glen Cove Road for 11 trailers. Glen Cove Marina is also the upstream portage take-out location for Conowingo Dam. The Mason-Dixon Trail traverses through this site.

Conowingo Swimming Pool and Visitors Center. The Conowingo Dam Pool and Visitors Center is located north of U.S. Route 1 on the west side of the Conowingo Dam. The facility is owned by the licensee and the pool facility is managed and operated by a commercial contractor. The site offers substantial recreation opportunities and provides a swimming pool, wading pool, locker/changing rooms, food concessions, picnic tables, a playground, and restrooms. Also provided at the site is a visitor's center which houses displays, brochures, additional restrooms, conference rooms, and office space for the Lower Susquehanna Heritage Greenway (LSHG). A 213 space paved parking lot is shared by these two facilities. The Mason-Dixon Trail traverses through this site.

Peach Bottom Marina. Peach Bottom Marina is located on the north side Peters Creek, just east of its confluence with the Susquehanna River on the east side of the Conowingo Pond 7.5 miles north of Conowingo Dam. The marina is owned by the licensee and managed by a commercial contractor. The site provides amenities which include boat maintenance, fuel, a 25 foot wide hard surface boat ramp, docks, portable restroom and parking for 33 trailers and 17 vehicles. There is a launch fee at the site. The Norfolk Southern rail line extends along the east shore of the pond and access to/from the marina requires boating under the train trestle spanning Peters Creek.

Conowingo Creek Boat Launch. Located on the east shore of the Conowingo impoundment two miles north of Conowingo Dam, the Conowingo Creek Boat Launch is owned and managed by the licensee. The site is accessed from Conowingo Lake Road and Mt. Zoar Road. The Norfolk Southern rail line extends along the east shore of the pond and access to/from the ramp requires passage under the train trestle spanning Conowingo Creek. The site provides an 80 foot wide hard surface boat ramp, boat tie up area, and parking for 9 boat trailers. As with Peach Bottom Marina, use depends on water levels due to the railroad trestle that runs across the mouth of Conowingo Creek.

Funks Pond. Funks Pond, is owned and managed by the licensee, and is located on the east side of the impoundment on the north side of US Route 1. Funk's Pond is a small inlet separated from Conowingo Pond by the Norfolk Southern rail line. The site offers a pedestrian trail to a small picnic area and shoreline fishing opportunities. A 24 space gravel parking area is provided off Route 1.

Fishermans Park/Shures Landing. The Fishermans Park/Shures Landing facility is owned and managed by the licensee. The site is located on the west side of the impoundment, immediately south of the Conowingo dam, and is accessed via Shure's Landing Road. Amenities at the park include shoreline and platform fishing, a carry-in boat launch (Shure's Landing), observation areas, portable toilets, picnic areas, and birding opportunities. This area also serves as a trailhead for the Lower Susquehanna Heritage Greenway (LSHG) to Deer Creek and a wildflower viewing area. There is a 124 space paved vehicle parking lot, a 14 space paved boat trailer parking lot and a 12 vehicle gravel parking lot associated with this site. The Mason-Dixon Trail passes through the lower part of the parking lot. The site also serves as a canoe portage trail put-in site, and the trailhead for the LSHG.

Octoraro Creek Access. The Octoraro Creek site was constructed by the licensee in 2008 to provide access to the creek for the public. The site is owned and managed by the licensee and is located below the Conowingo Dam on the east shore of the Susquehanna River. The site provides a .4 mile ADA compliant trail along the south bank of Octoraro Creek to its confluence with the Susquehanna River. A 15 space gravel parking and kiosk are located at the trailhead off Route 222. In addition to these amenities, there are several informal paths that lead from the Octoraro Creek trail to the creek itself. Exelon has also leased adjacent land to the Commissioners of Cecil County for the development of an athletic complex consisting of athletic fields, parking lots, concession stands, and trails. Currently, the County has completed construction of a multiuse field and two parking areas.

Adjacent Facilities

Susquehannock State Park. The Susquehannock State Park is owned and managed by the Commonwealth of Pennsylvania, PADCNR, and is located on the east shore of the Conowingo impoundment just south of the Muddy Run Project. Though the large majority of the park is located outside of the Conowingo Project boundary, four acres of Project land are leased to the PADCNR by the licensee and are included within the state park boundary. Access to the park is from Susquehannock Road. There are numerous amenities within the 224 acre park including picnic area, pavilions, playground, ball fields, walking and equestrian trails, an organized group tent site, historical building, and an overlook with view of the Conowingo impoundment and Muddy Run powerhouse.

Broad Creek Memorial Boy Scout Reservation Trails. The Broad Creek Memorial Scout Reservation is located on Broad Creek west of and adjacent to the Project boundary. The camp offers a variety of activities including camping, athletic fields, water activities, an activities building, and trails. Some of the trails, which can be accessed from Susquehanna Hall Road and Auer Lane, extend onto Project land.

Susquehanna River Water Trail. The lower Section of the Susquehanna River Water Trail extends from Harrisburg, Pa. to the Broad Creek Public Landing just below the PA/MD state line (approximately 53 miles) and is part of the Chesapeake Bay Gateways and Watertrails Network and a designated National Recreation Trail.

Lower Susquehanna Heritage Greenway. The trail is located along the western shore of the Susquehanna River, immediately south of the Conowingo Dam. The trail offers several amenities along its extent including benches, picnic tables, interpretive panels, and a historic flint furnace. There are also several informal paths which lead from the trail to the riverbank. Portions of the trail are on land owned by Exelon, though the areas which make up the Lower Susquehanna Heritage Greenway are leased and managed by the State of Maryland, Department of Natural Resources. These sections include a 2.2 mile section that extends between Fisherman's Park and Stafford Road at Deer Creek, a one mile section along the Susquehanna River to the former railroad trestle at Deer Creek, and along the section of the former Conowingo rail line to Lapidum.

Mason-Dixon Trail. The 193 mile long Mason Dixon Trail connects the Appalachian Trail in Cumberland County, Pa. with the Brandywine Trail at Chadds Ford, Pa. The trail in the Project area roughly parallels the west shore of the Susquehanna River between the Holtwood Project to the north and Havre de Grace in the south.

While most of the trail is outside the Conowingo Project boundary, portions of it are located on the Licensee's Project (approximately 3.5 miles) and non-project (approximately 14.25 miles) lands. The trail passes through several of the Project recreation sites (Locks 13 and 15, Muddy Creek, Cold Cabin, Broad Creek, Glen Cove, Swimming Pool/Visitors Center, and Fisherman's Park). There is one informal campsite associated with the trail near Hopkins Cove. The trail is maintained and managed by Mason-Dixon Trail System, Inc. under a license agreement with the Exelon.

Informal Recreation Sites

There are a variety of informal recreation sites within the Project boundary. They mainly consist of foot trails to access the reservoir for hiking or fishing. These sites were developed over time through regular use but have not been improved by the licensee.

Use of Formal Recreation Sites

Exelon conducted an in depth study from March 2008 to March 2009 to assess the character and level of use at formal recreation sites in the Conowingo Hydroelectric Project. Data collection objectives included characterizing specific types and levels of recreational use within the Project boundary and evaluating the potential need for additional access or facilities at the Project. The data was obtained using a variety of methods including spot counts, calibrations counts, traffic counters, and operator-supplied data. Using these methods, the study was able to obtain usage at sites based on recreation days, a recreation day being defined by FERC as each visit by a person to a development for recreational purposes during any portion of a 24-hour period. This study yielded data on the annual, peak, and seasonal usage at the sites. The data collected was also used to calculate facility capacity for each formal recreation site and facility. Percent capacity was generally calculated during summer months as summer is typically the high use period.

In addition to the 2008-2009 recreation survey conducted by the licensee, a User Preference Survey was conducted from April 2010 to May 2011 at the Conowingo Project recreation sites to obtain feedback on the quality of recreation facilities within the Project and need for additional facilities. Users were asked to give a rating, ranging from poor to excellent, on the facility amenities and overall quality of the facility. In conjunction with the development of the Shoreline Management Plan and Recreation Management Plan, public meetings were held in June 2011 and September 2011 to further elicit feedback on the need for improved or new facilities, and the satisfaction level of the existing recreation facilities.

The User Preference Survey revealed that the Conowingo Project was well regarded as a whole, averaging an overall score of good across all recreation facilities surveyed. All topics surveyed received scores at or above the good mark, with parking, fishing, and site maintenance receiving an average score of good.

The most utilized site, Fisherman's Park, received positive scores generally, with 9 of 10 respondents giving the park a good or excellent rating. The average score of each surveyed category scored highly as well, with parking, maintenance, and fishing all scoring good or better in the survey. Throughout the various surveys and public meetings, numerous comments were received regarding potential improvements for recreation at the Conowingo Project. A summary of general stakeholder and public comments received during the Survey is provided below.

Lock 13. Lock 13 usage was estimated to be 782 recreation days for the year spanning from March 15, 2008 through March 14, 2009. During this period, usage was relatively even throughout the summer, spring, and fall months. There is no site usage during winter months as the site is gated during those months. 37 percent of recreation days at Lock 13 were used during the summer months, defined by the survey as May 27 through August 29. Spring saw 33 percent of recreation days, while fall saw 30 percent usage.

The most popular activities observed during the summer and spring months were shoreline fishing, and running or walking. In fall, the only activity observed was sightseeing. Overall, Lock 13 was considered underutilized. With 22 total parking spots available, only 1 spot was utilized on average during the summer season.

At Lock 13, a typically low-use recreation site, the User Preference Survey identified walking as the only activity noted by interview during the 2010-2011 survey period. All of the recreationists who completed the questionnaire rated the overall facilities at the site as excellent. The individual aspects of parking, maintenance, and fishing received all excellent ratings as well.

Lock 15. With 13,066 recreation days spent at the site, Lock 15 was much more widely used than Lock 13. Half of the recreation days spent at Lock 15 were during the summer months. Spring had the next highest usage at 39 percent of total days spent during the year, with fall seeing an estimated 11 percent usage. Lock 15 is gated and closed during the winter months.

Of the numerous activities observed at the site, sightseeing (31% of total yearly usage), running/walking (25%), and boating (22%) were the most popular. Other activities observed were picnicking, shoreline fishing, swimming, hunting, and birding. Throughout the survey, the Lock 15 site was generally underutilized, with average daily usage of 1 parking space. The maximum number observed was 5 spaces, which equaled 14 % of the sites total capacity (36 spaces).

The User Preference Survey identified kayaking most frequently as the primary activity recreationists participated in. Walking was also popular at the site. Ninety-five percent of those surveyed rated the overall facilities at Lock 15 as good or excellent, with opinion divided equally between the two ratings. None of the respondents rated the overall facilities as fair or poor. The average rating for the site as a whole was between good and excellent. Few comments were received requesting improvements at Lock 15, which boasts overall high levels of satisfaction.

Muddy Creek Boat Launch. An estimated 38,742 recreation days were spent at the Muddy Creek Boat Launch, with over half of the days (19,521) during the summer months. Spring also saw high usage, with 28 percent of total usage occurring, while fall and winter were less utilized, seeing 18 percent and 4 percent usage respectively. While the average daily usage was only 106 visitors per day for the site over the course of a year, the summer season saw an average of 205 visitors per day, and an estimated 3,071 visitors utilized the site during its peak weekend.

A wide variety of activities were observed at the site. Boating was the most popular activity, accounting for 64 percent of the yearly usage at the site. During the summer months, boating was the highest use activity, accounting for 83 percent of the usage during this time. The spring season saw the most varied activities at the Muddy Creek boat launch, where the popular activities were boating (32 percent of usage), hunting (25%), running/walking (18%), and shoreline fishing (18%). On average, the parking lot was at 45% capacity during the summer months, with a peak recorded use of 55 spaces. With a total of 69 parking spaces available, the site is considered well utilized, but not over capacity.

The User Preference Survey identified boating and fishing as the primary activity recreationists enjoyed at the Muddy Creek Boat Launch. Kayaking was also quite popular. Ninety percent of those surveyed rated the overall facilities at the boat launch as good or excellent. None of the respondents rated the overall facilities as fair or poor. The average rating for the site as a whole was good to excellent. Site maintenance, fishing and parking were considered to be excellent or good by more than 80 percent of those interviewed. Improvement of the boat ramp was the most frequently mentioned concern of the recreationists. Specific concerns were that the ramp was too steep and too narrow. Portable toilet cleanliness and the desire for permanent restroom facilities were also identified by the comments received.

Cold Cabin Boat Launch. During the 2008-2009 recreation season, an estimated 11,968 recreation days were recorded at the Cold Cabin Boat Launch. The site was most utilized during the summer months, with 44 percent of the total yearly use occurring within these months. Spring was the next most utilized season, with 27 percent of usage, while fall (21%) and winter (7%) were the least utilized seasons. During the study, the sites average daily usage was 33 recreation days, while its peak weekend use was found to be 597 recreation days.

Throughout the year, boating was the most widely observed activity, accounting for 44 percent of the yearly usage at the Cold Cabin Boat Launch. Other popular activities at the site include sightseeing (28% of yearly usage), running/walking (11%), and other activities (13%) such as collecting driftwood and owners checking on cottages. There were several other activities which accounted for less than 5 percent of the yearly usage, including shoreline fishing, picnicking, swimming, and biking. The site on average was at capacity for usage during the summer months, due in part to the lack of formal parking at the site, with 5 out of the 5 parking spots available used on the average weekend. During peak weekends, the site was overcapacity, with 6 vehicles parked at the site, causing the site to be 20% overcapacity.

The User Preference Survey identified a wide variety of recreational activities at the Cold Cabin Boat Launch. These activities included fishing, jet skiing, swimming, canoeing, kayaking and running. Nearly two thirds of those surveyed rated the overall facilities at the Cold Cabin Boat Launch as good. None of the respondents rated the overall facilities as excellent or poor. The average rating for the site as a whole was between average and good. The spring recreationists rated the site the highest, with the summer visitors rating boat launch as fair. Maintenance received the lowest average rating, while parking received an average rating across the recreational period surveyed. Fishing received an average rating for the spring and fall, with a good in the spring and an average rating in the fall. None of the summer respondents were engaged in fishing and all declined to rate that particular area. Maintenance was rated as poor by one respondent. All other responses were that facilities at Cold Creek Public Launch were considered average, good, or excellent.

The installation of restroom facilities or the return of the portable toilets was the most frequently mentioned improvement desired by the recreationists. One-fifth of the comments received were related to parking concerns: additional parking needed, safety issues, and grading/paving. Other areas for improvements included ramp maintenance/drainage at ramps, installation of a dock, and a later closing time.

Dorsey Park. Dorsey Park had an estimated 16,706 recreation days during the 2008-2009 recreation season. As with all boat launch sites in the Conowingo Project, the summer months saw the most usage for the site. Forty-four percent of usage at the site occurred during the summer, followed by fall (30%), spring (17%), and winter (9%). It was estimated the site had 453 recreation days during the peak use weekend.

The two activities most frequently observed at Dorsey Park were boating (42 percent of total usage) and sightseeing (31 percent of total usage). Other activities observed throughout the year included shoreline fishing (4%), running/walking (4%), and picnicking (1%). Other activities accounted for less than 1% of usage throughout the year including swimming, hunting, biking, and birding. The remaining usage (13%) was classified as “other” usage such as lunch breaks at the site. On the average summer weekend, 6 of the 56 available parking spots were used, putting the park at 11 percent capacity. The peak use observed was 34 spaces (60%), which indicates the park is well used, but not overcapacity.

At Dorsey Park Boat Launch, fishing was the primary activity observed, and the User Preference Survey documented that the majority of the visitors reported being very pleased with the facilities. Of the recreationists surveyed there, two-thirds rated the overall site as excellent, with an additional 20 percent considering the location to be good. Maintenance at the Dorsey Park Boat Launch was rated the highest of the areas addressed, with ratings ranging from good in the summer, the location’s busiest time, to excellent in the fall. Parking received an average rating of good, with the fall visitors again providing the highest marks. The quality of fishing at the site garnered the highest rating in the fall (close to excellent) and lowest in the summer (between average and good). For all of the areas surveyed, the recreational users of the Dorsey Park Boat Launch viewed the area as good or excellent in roughly three quarters or more of the responses. Twenty-nine percent of the comments received dealt with the steepness of the boat ramp at Dorsey Park, with an additional 8 percent noting a desire for ramp improvements in general. A request to extend the hours comprised 18 percent of the comments received from visitors to the location.

Line Bridge. The Line Bridge site was used for an estimated 5,789 recreation days, with 35 percent of usage occurring during the spring months. Summer and fall saw similar usage, with 25 and 26 percent of recreation days observed respectively. Winter was the least utilized season at the site, seeing 14 percent of total usage. The Peak Use Weekend saw an estimated 55 recreation days.

The most popular activities at Line Bridge were running/walking (27% of yearly use), sightseeing (23%), boating (canoe/kayak) (13%), and shoreline fishing (9%). Various activities classified as “other” accounted for 24% of recreation use at the site, while picnicking (3%), hunting (1%), and swimming

(<1%) make up the remaining usage. Due to the small size of the site and limited parking (3 spaces), capacity was generally full during the average summer weekend. The peak use recorded was 7 spaces, while the site was also over capacity at 2 of the 16 summer spot checks, and 3 of the 19 fall spot checks.

Recreationists surveyed at Line Bridge Access for the User Preference Survey, all rated the overall facilities at the site as either good or fair. None of the respondents rated the overall facilities as excellent, average, or poor. Fishing received the strongest average rating of good, with parking and maintenance receiving ratings of fair. The low ratings are reflected in the comments received about the site. Two thirds of the comments from the Line Bridge Access site, which is maintained by Harford County, requested that trash and debris be removed, particularly at the boat carry-in.

Broad Creek Public Landing. An estimated 10,138 recreation days occurred at Broad Creek Public Landing. The usage was greatest during the summer months, when approximately 47 percent of recreation days were recorded. Fall was the next highest seasonal usage with 24 percent of recreation days for the 2008-2009 survey year, with spring following closely at 22 percent. Winter saw the least usage, with 7 percent of recreation days. The average daily usage throughout the year was 28 visitors, while 433 recreation days were spent during the Peak Use Weekend in 2008.

Broad Creek Public Landing was predominantly used for boating purposes, accounting for 56 percent of the recreation days during the survey year, and being the most popular activity for all seasons with the exception of winter. As with most of the facilities in the Conowingo Project, sightseeing was the most popular activity in the winter, accounting for 39% of use during the season. While sightseeing was the most popular winter activity, it only accounted for 15% of the yearly use, equaling the usage seen by shoreline fishing. The remaining activities at the site were running/walking (8%), “other” (6%), and biking (1%). The site is considered underutilized, averaging 12 percent capacity on the average summer weekend. The peak use was 12 of the 41 available spaces, or 29 percent capacity. The User Preference Survey identified fishing as the primary activity at the facility. Seventy-three percent of those surveyed rated the overall facilities at the Broad Creek Public Landing as good or excellent. None of the respondents rated the overall facilities as fair or poor. The average rating for the site as a whole was good. The summer recreationists rated the site the highest, with the fall visitors rating the facility as average. Parking received an average rating in the spring and good in the fall. Maintenance and fishing received similar scores from recreationists, receiving an average rating across the recreational period surveyed. As with parking, the ratings were lowest in the spring and highest in the fall.

Improvement of the boat ramp was the most frequently mentioned concern of the recreationists, representing 29 percent of the comments received. Other areas for improvements included higher water levels (14 percent), as mentioned by those fishing in the spring and summer, and parking (14 percent), with both the location and "tight spaces" being issues. Those kayaking mentioned improvements to water access (10 percent of all comments).

Glen Cove Marina. An estimated 707 recreation days were spent at the Glen Cove Marina during the 2008 season. Seasonal data was not provided by the marina operator; however, it was estimated a total of 38 recreation days were used during the peak use weekend. Based on records at the marina, there were 204 boat launches, 8 fishing tournaments (300 participants), and six group activities in 2008. The average summer weekend saw 47 percent capacity, with 22 of the 47 available parking spots used. Based on this, the site is considered well utilized, but not over capacity.

The User Preference Survey did not include the Glen Cove Marina facility; however, the facility operator has indicted a need for additional parking at the site.

Conowingo Dam Pool and Visitors Center. The Conowingo swimming pool was open on weekends beginning June 1, and then daily from June 14 through August 24 in 2008. The pool also was open during the long Labor Day weekend (August 30 through September 1), which were the only days outside of the summer season. Throughout the season, an estimated 8,471 recreation days were spent at the pool, 97 percent of which occurred during the summer months. Data in 2008 was collected for the Conowingo Swimming pool from the facility operator. As a result, only data regarding pool usage was collected. Other amenities at the site, which include a playground and picnic area, were not surveyed. The pool parking lot was at 38 percent capacity (80 of 213 spaces) on the average summer weekend. The site is utilized, but not over capacity.

The User Preference Survey did not include the Conowingo Dam Pool and Visitors Center facility.

Peach Bottom Marina. Open from May through October in 2008, the Peach Bottom Marina saw an estimated 538 recreation days, based on boat launch data provided by the marina operator. The vast majority of theses days (75%) were utilized during the summer season. The remaining recreation days were spent during fall (21%) and spring (4%). As the site is a commercial marina, the primary activity observed is boating. On the average summer day, the marina was estimated to be at 15 percent capacity, with 7 of the 48 available parking spaces utilized.

The User Preference Survey did not include the Peach Bottom Marina facility.

Conowingo Creek Boat Launch. During the 2008-2009 recreation season an estimated 10,594 recreation user days occurred at Conowingo Creek Boat Launch. The usage was stable throughout the year, with peak usage occurring in the summer (29% of total usage), followed by spring (25%), fall (23%), and winter (22%). An average of 29 recreationists per day used the site throughout the year, while approximately 72 recreationists used the site on its peak weekend.

Throughout the year, sightseeing was the most popular activity at Conowingo Creek Boat Launch, accounting for 46% of usage at the site during the year and the most popular activity in all seasons except summer. Boating, accounting for 25% yearly usage, was the most popular summer activity. Other activities at the site included fishing (15% of yearly usage), running/walking (6%), and "other" activities (6%). A variety of activities, such as picnicking, swimming, horseback riding, and birding, saw much less use. With 3 of the 19 available parking spaces used during the average summer weekend, the site was generally underutilized. The peak use observed was 9 spaces, or 47 percent capacity.

Fishing was the predominant activity observed during the User Preference Survey. Fishing was highest in the spring, with 81 percent of visitors engaging in the activity. Canoeing, kayaking, and bird watching were also popular. Sixty-two percent of those surveyed rated the overall facilities at the Conowingo Creek Boat Launch as good or excellent. None of the respondents rated the overall facilities as poor. The average rating for the site as a whole was average to good. The fall recreationists, of which there were relatively few, rated the site the highest (good to excellent), with the summer visitors, who represented the majority of the survey respondents, rating the location at average. Fishing received the strongest average rating of average to good, with the scores being the highest in the spring and lowest in the fall. Parking received average to good scores across the recreational period surveyed. Maintenance received a rating of average. For parking, fishing, and overall facilities, the recreational users of Conowingo Creek Boat Launch viewed the area as good or excellent in well over half of the responses. Maintenance received good to excellent ratings from 46 percent of the visitors. For all areas, roughly one third of the visitors felt the recreation site was average. Maintenance was rated as poor or fair by 20 percent of the visitors, many of whom commented on trash and debris. Parking, fishing, and overall facilities were rated as fair by less than four respondents.

One-fourth of the comments received were related to the installation of restrooms or portable toilets. Debris in the water and on the boat ramp was mentioned in 22 percent of the responses. Roughly one tenth of the comments concerned trash at the site and general cleanliness. The recreationists who visited in the spring of 2011 rated the facilities much higher than those who had visited in the prior spring. All of those visitors rated each of the four aspects of the Conowingo Creek Boat Launch as good or excellent. Forty-six percent of the survey respondents in the spring of 2011 mentioned that they liked the improvements that had been made at the site.

Funks Pond. The Funk's Pond recreation site was not as widely used during the survey year 2008-2009 as most sites in the Conowingo Project, seeing an average of 12 visitors per day. In total, an estimated 4,380 recreation days occurred at the site. The site was most popular in the fall, seeing 40 percent of its total usage for the year during this season. Winter was the next most popular season (26%), followed by summer (20%) and spring (13%). The peak use weekend saw an estimated 108 recreation days.

A variety of activities classified as "other" activities were most widely observed at Funk's Pond. These included work breaks, lunch breaks, and cell phones usage. The "other" activities accounted for 36 percent of activities at the site. Other popular activities at the site include sightseeing (28%), shoreline fishing (15%), and running/walking (15%). Hunting and picnicking were also observed at the site, though at much less frequency. In general, the site was well under capacity, with 2 of the available 24 parking spaces used during the average summer weekend. The peak use observed was 7 spaces, or 29 percent, giving an indication the site is currently underutilized.

The User Preference Survey identified fishing and walking as the only activities observed at Funk's Pond. Of the recreationists surveyed, three-fourths rated the overall facilities at the site as good or excellent. None of the respondents rated the overall facilities as fair or poor. Parking received the strongest average rating of good to excellent, with maintenance and fishing receiving good ratings. None of the respondents assigned ratings of fair or poor to any of the aspects of Funk's Pond. Two items were noted by recreationists surveyed at Funk's Pond: the need for installation/replacement of trash cans and the addition of historical markers. The visitors commented that they "like all improvements" and that the site "looks good for the improvements."

Fishermans Park/Shures Landing. Fishermans Park was the most widely used recreation facility during the 2008 survey year, accounting for over half of all recreation days spent at the Conowingo Project. Summer was the most popular season at the site, with 36 percent of total recreation user days. Fall accounted for 27 percent of recreation user days, while winter (20 percent) and spring (17 percent) were the least utilized seasons. The park was utilized by an average of 388 persons per day, while the Peak Use Weekend saw 2,124 visitors.

Sightseeing and shoreline fishing were the most popular activities observed at Fishermans Park, accounting for 41 percent and 34 percent of the yearly usage, respectively. Birding was also popular, accounting for 15 percent of the yearly usage. Less frequently observed activities at the site included running/walking (4%), biking (2%), boating (1%), swimming (<1%), hunting (<1%), and "other" (3%). With 34 of the 124 available parking spaces utilized, the site was well within its capacity during the average summer weekend. The peak use observed was 58 percent, which indicates the site has adequate capacity throughout the year.

Bird watching and fishing were the activities most frequently observed at Fisherman's Park during the User Preference Survey. Other activities noted included walking, biking, and kayaking. Nine out of ten recreationists using the facilities rated the overall site as good or excellent. The overall average rating for the site was good, with the ratings being consistent throughout the survey period. Maintenance and parking each earned an average rating of good. Fishing was rated average to good across the period surveyed. As with the overall rating, there was little variation from season to season in the user perceptions of maintenance, parking, and fishing at Fisherman's Park. For parking, maintenance, and overall facilities, the recreational users viewed the area as good or excellent in roughly 90 percent of the responses. Fishing received those ratings from 80 percent of the visitors.

A wide variety of comments was received at Fisherman's Park, with no one item garnering more than 14 percent of the response. Highest on the list of concerns was the desire to have the catwalk reopened for fishing. Roughly 10 percent of the comments dealt with expanding trails or trail maintenance. Bicyclists expressed the desire for an improved trail surface on the Lower Susquehanna Heritage Gateway trail. Several recreationists requested improvements to the parking lot, such as additional trailer spaces and handicapped spaces. Many of those engaged in fall bird watching commented on the need for tree trimming. Other areas for improvements included the need for trash cans and trash cleanup (10 percent combined), benches and picnic tables (8 percent), more downstream water/gates open (5 percent), signage improvements (5 percent), improved/expanded restroom facilities (5 percent), and accurate and available water release information (3 percent).

Octoraro Creek Access. During the 2008-2009 recreation season, approximately 7,485 recreation user days occurred at the Octoraro Creek Access site. The site was most popular during the fall season, when

39 percent of its yearly usage occurred. This was followed by summer (33 percent), winter (26 percent), and spring (3 percent). On average, approximately 21 recreationists per day visited the site, with 225 recreationists visiting the site during its peak weekend.

A wide variety of activities were popular at the site, including running/walking (27%), shoreline fishing (26%), sightseeing (13%), birding (12%), hunting (6%), boating (5%), biking (1%), picnicking (<1%), and horseback riding (<1%). "Other" activities comprise the remaining 10 percent of use at the site. On the average summer weekend, the site was at 17 percent capacity, with 2 of the 12 available parking spaces utilized. The peak use weekend occurred during November, when 14 cars associated with a birding group visited the site. While this put the site over capacity, the maximum number of cars observed throughout spots checks during the year was 5, or 42 percent. As a result, the site is considered well utilized, but not over capacity.

Walking was the primary activity at Octoraro Creek Access during the User Preference Survey. The walkers often included dogs in their parties. Fishing and bird watching were also popular. Ninety-eight percent of those surveyed rated the overall facilities at Octoraro Creek Access as good or excellent. None of the respondents rated the overall facilities as fair or poor. The rating was highest in the fall, with 18 % of the survey respondents labeling the site as excellent overall. Fishing, parking and maintenance all received an average rating of good to excellent. The most frequent request received from recreationists at the Octoraro Creek Access was for trash cans (26 percent). Sixteen percent of the comments were to expand the trails. Additional inputs addressed paved parking, trash cleanup, and picnic tables (11 percent each).

Mason-Dixon Trail. The 193 mile long Mason Dixon Trail connects the Appalachian Trail in Cumberland County, Pa. with the Brandywine Trail at Chadds Ford, Pa. The trail in the Project area roughly parallels the west shore of the Susquehanna River between the Holtwood Project to the north and Havre de Grace in the south.

While most of the trail is outside the Conowingo Project boundary, 3.5 miles are located on Project lands. The trail passes through several of the Project recreation sites (Locks 13 and 15, Muddy Creek, Cold Cabin, Broad Creek, Glen Cove, Swimming Pool/Visitors Center, and Fisherman's Park). The trail is maintained and managed by Mason-Dixon Trail System, Inc. under a license agreement with Exelon.

Projected Recreation Demands - Projection of Project Recreation Days

To evaluate the ability of the facilities at the Conowingo Project to meet future recreation demands, recreational use projections by activity were made through the year 2050 for each location. The projections are based on growth coefficients developed as part of *Projections of Outdoor Recreation Participation to 2050*, published by the U. S. Department of Agriculture (USDA) Forest Service, which use a combination of population, income, age, gender, and ethnicity to develop projected regional growth rates for various recreational activities. Table 3.3.6.1-1 presents the activity-specific growth rates.

As shown above, the activities that are anticipated to have the greatest increases in demand are horseback riding (82 percent growth), canoeing or kayaking (60 percent), birding (49 percent growth), sightseeing (48 percent), and biking (44 percent). The lowest growth rates are projected for general boating (17 percent), picnicking (17 percent), and hunting (12 percent).

These growth coefficients were used to project recreation activity by site through 2050. Recreational use from 2008-09 recreational use study serves as the baseline from which the projections were made. Table 3.3.6.1-2 presents the projected number of recreation user days for the year 2050 by activity for each formal recreation site in the Conowingo Project. Growth (or decline) varies from activity to activity. By 2050, sightseeing is anticipated to occupy a larger share of visitor days. Both shoreline fishing and boating are expected to decline, with shoreline fishing decreasing from 22 percent to 20 percent and boating from 21 percent to 19 percent over the next four decades. The percentage of visitors to the Project engaging in running or walking is expected to remain steady at 7 percent.

As shown in the last column of the above table, these differences in demands for activities will result in varying growth rates for the recreation sites. Glen Cove Marina and Peach Bottom Marina, which are closely tied to boating, are expected to experience the slowest growth with an anticipated 17 percent increase from 2008 to 2050 in total recreation days spent at the sites. Fisherman’s Park (38 percent growth) is forecasted to have the largest increase in visitors within the Project area. Project-wide, recreation demand in terms of recreation days is projected to increase by more than one-third from 278,158 in 2008 to 371,841 in 2050.

Projection of Facility Capacity

The site-specific growth rates presented above are the basis for projecting 2050 site capacity, in terms of average summer weekend use. Table 3.3.6.1-3 presents site capacity projected for 2050 at each site within the Conowingo Project.

As shown in Table 3.3.6.1-3, it is projected that the majority of the recreation sites at the Conowingo Project will be under-capacity on the average summer weekend in 2050. Two-thirds of the sites are anticipated to be less than half-filled on those weekend days. Only two sites are expected to exceed capacity at that point in the future: Cold Cabin and Line Bridge. However, this can be easily remedied at Cold Cabin by designating a formal parking area at the site. Line Bridge is problematic due to the small size of the facility and topographic and hydrologic constraints that restrict site expansion.

The usage data from the above areas were combined by recreational resource to develop facility capacity for each of the resource types available at the Conowingo Project. This summary is provided in Table 3.3.6.1-4. For each recreation resource type, the growth presented in the table above includes increases in parking lot demands from all types of recreation. For example, the parking lot at Fisherman's Park that serves the boat launch area also provides space for those sightseeing. While boating is expected to increase somewhat slowly (17 percent) over the next four decades, sightseeing is anticipated to grow much more quickly (48 percent). Therefore, the growth in sightseeing may place additional demands on the parking lot that is used by those launching boats.

By 2050, it is projected that for each type of recreation resource at the Conowingo Project, facility capacity will average 50 percent or less on weekend summer days. That is, while individual sites may be more heavily used, in terms of percentages, ample capacity will be available for recreationists to use any of the recreation resource types the Project offers. With so many of the Project sites underutilized, it would be expected that as demand pressures rise at the more heavily utilized (in terms of percentages) areas, recreationists would shift to facilities with more capacity. However, Exelon will continue to collect Form 80 data over the term of the license and should that data, or evidence of need for additional recreation capacity otherwise become apparent, an appropriate license amendment application will be filed.

3.3.6.2 Environmental Effects

The analysis of Project Effects associated with the continued operation of the Conowingo Project under a new license provided in this section includes a description of the anticipated effects of Exelon's proposed Project, which includes Exelon's proposed PM&E measures.

Exelon's relicensing studies determined that the existing recreational facilities are adequate to meet recreational demand associated with the Project now and in the reasonably foreseeable future. However, some of the facilities are currently in need of upgrading to maintain the proper functioning condition of the facility and to provide for ADA accessibility, or will require replacement or rehabilitation during the term of the new license to maintain the facilities in proper functioning condition.

Exelon's proposed Project includes a Recreation Plan. The primary goal of the plan is to manage public recreation use of the Project's recreation facilities over the term of the new license, and minimize recreation-use impacts to natural, historic, and cultural resources within the Project area. The plan includes the following objectives to help achieve this goal:

- Inventory existing access and facilities.
- Estimate existing and potential recreational use of the Project.
- Assess the need for additional public recreational access, opportunities and facilities.
- Determine enhancements to existing facilities and any new facilities needed to meet recreational demand.
- Determine the cost associated with rehabilitation and development of the evaluated facilities and identify entities responsible for implementing, constructing, operating, or maintaining any existing or proposed measures or facilities.
- Determine how the Project can be integrated with existing or proposed regional recreation plans.
- Address public access, safety and recreation with respect to blocked and impeded access and fluctuating water levels.

The plan includes the following primary sections:

Section 1-4 – Introduction, Purpose, Project Description, and FERC Requirements.

Section 5 – Existing Public Recreation and Access. This section describes existing Project and regional recreation resources, and facilities.

Section 6 – Estimate of Project Recreation Use. This section documents existing Project recreational facility use.

Section 7 – Projected Recreation Demands - This section provides an analysis and estimate of future use of the existing Project recreational facilities.

Section 8 – Recommendations and Proposed Enhancements. This section describes the Project's proposed recreation rehabilitation of existing recreation facilities and capital improvement measures.

Section 9 – Recreation Management. This section describes the recreation-monitoring program that defines how Project recreation facilities, use, needs, and potential associated impacts will be monitored and addressed over the license term.

Exelon also incorporates measures regarding erosion control during construction of recreation facilities through the implementation of a Shoreline Management Plan for the new license. The measures require Exelon to develop in consultation with appropriate agencies and, if required, file with FERC construction erosion control and site restoration plans for recreation facilities work prior to any ground disturbing activity. The Shoreline Management Plan also provides guidance on whether the site requires revegetation or other management measures to address erosion.

Provided below is an assessment of the effects related to recreation resources and how Exelon proposes to address them over the new license term.

The Conowingo Project provides developed hiking, fishing, boating (access ramps and marinas), swimming, picnicking, and sightseeing opportunities at fourteen developed recreation areas distributed throughout Conowingo Pond and on the Susquehanna River below Conowingo Dam. The overall condition of the recreation facilities is good. Most of the boating access facilities are in good to excellent condition. Current facility capacities do not exceed 50% at any of the individual facilities. Projected growth rates through 2050 for the existing recreation activities present at the Project indicate that current capacity will be exceeded at only two of the individual facilities in 2050. As discussed above, however, one site (Cold Cabin) can easily be expanded and the other (Line Bridge) is not easily expanded but will still be able to provide significant recreation opportunity. Moreover, nearby Project recreation facilities will continue to be underused. Based on the condition of the facilities and overall and weekend occupancy levels at each of the fifteen facilities in the Project, the existing facilities should be adequate to handle an increase in use over the new license term with routine maintenance and upgrades to the facilities.

3.3.6.3 Proposed Environmental Measures

While the recreation facilities at the Conowingo Hydroelectric Project have shown to meet current and future recreational demands, Exelon has proposed to improve several sites at the Project. In addition to site improvements, Exelon will also continue its existing partnerships and contracts with vendors to operate and maintain the existing recreation facilities. Specific improvements proposed for the recreational facilities for the new license are as follows[32].

Lock 13. Enhancements at Lock 13 include installation of a trailhead directional sign at the Lock 12 parking area and clearing the vegetation from within the lock to provide an unobstructed view of the structure. Light fencing will be constructed along each side of the lock structure to protect visitors.

Lock 15. Access at Lock 15 will be improved by designating two ADA parking spaces in the existing parking area and installing a dock on the shoreline near the picnic area to allow boaters to access the site. The open shoreline area near the parking area will be stabilized to prevent further erosion. A concrete pad for two portable restrooms will be constructed.

Muddy Creek Boat Launch. Two boat trailer spaces and one vehicle space will be designated for ADA parking in the existing parking lot. Areas adjacent to the southwest corner and southerly side of the parking area will be stabilized to improve drainage and redirect flow away from the parking area and the river. A sign providing information on the Conowingo Dam canoe portage and the location of the portage take-out will be erected on site.

Cold Cabin. Access to the site will be improved by designating a one-way directional traffic pattern through the site and constructing parking for 11 vehicles (five boat trailer and five vehicle spaces), including two ADA spaces. The existing boat ramp will be reinforced to prevent undermining of the ramp and a boat dock will be installed. A sign providing information on the Conowingo Dam canoe portage and the location of the portage take-out will be erected. Two ADA picnic tables will be provided to replace the existing tables. A concrete pad for two portable restrooms will be constructed.

[32] Proposed dredging improvements associated with the existing Peach Bottom Marina and other recreation facilities subject to sedimentation issues within the Project boundary are outlined in this license application as a measure in Exelon's Sediment Management Plan. This Plan is provided in Exhibit E, Appendix C of this license application. In addition, Exelon is committing to work with the Mason-Dixon Trail System to incorporate their requests for trail improvements, where feasible.

Dorsey Park. Both boat ramps at Dorsey Park will be rebuilt. One ADA boat trailer space and one ADA vehicle space will be designated in the existing lot. A concrete pad for three portable restrooms will be constructed.

Conowingo Creek Boat Launch. One ADA parking space will be designated in the existing parking area. A roadside ditch along Mt. Zoar Road will be stabilized and a stone line drainage ditch will be constructed along the south side of the parking lot to redirect runoff from the parking lot and boat ramp area. A sign will be erected providing information on the Conowingo Dam canoe portage and the location of the portage take-out.

Glen Cove Marina. Parking at the marina will be improved and expanded with seven additional boat trailer spaces (one ADA) and 11 vehicle (two ADA) spaces. The Marina's walkway will also be repaired.

Funks Pond. One ADA parking space will be designated in the existing parking area.

Line Bridge. Shoreline erosion control and stabilization work will be performed at this unimproved carry-in boat access area.

Conowingo Swimming Pool. An ADA access ramp will be installed at the swimming pool and an ADA compliant access ramp will be installed at the wading pool.

Conowingo Dam Overlook. This facility will be reopened. Three ADA vehicle spaces will be designated in the existing parking lot. The existing pavilion will be demolished and replaced with a new 24' by 24' wood pavilion. Pavement will be removed from the easterly corner of the existing paved parking area, loamed and seeded, and three ADA pathways and picnic tables will be installed. Security fencing will be installed around the site to restrict access to Conowingo Dam while allowing unobstructed views from the pavilion and picnic area. Two portable restrooms will be provided.

Fisherman's Park/Shures Landing. The access road leading to the facility will be widened three to five feet in order to construct 12-foot wide lanes. A retaining wall will be constructed along the easterly 250 feet of existing parking along the access road due to widening. Five additional ADA parking spaces will be designated in the existing parking lot. The access road leading to Shures Landing will be widened four feet along the eastbound lane for 320 feet, and the access road from the trailhead parking northerly to the retaining wall will be widened two feet. An additional 13 space parking area will be constructed near the Lower Susquehanna Heritage Greenway trailhead at the southerly end of Fisherman's Park. The existing access at Shures Landing will be closed. The existing hard surface boat launch and asphalt access will be demolished. Stone fill will be placed next to the existing wall down to existing grade along the shore. A new 20-foot wide hard surface carry-in boat launch with a floating dock and breakwater will be constructed at Shure's Landing to replace the existing launch area.

Peach Bottom Access Enhancement. A small (approximately four vehicle) road-side parking area will be constructed near the existing informal boat launch area south of Peters Creek. A sign will be erected providing information on the Conowingo Dam canoe portage and the location of the portage take-out.

The estimated cost for this overall recreation improvement proposal is approximately $2.4 million dollars. Specific capital costs and operation and maintenance (O&M) costs are provided in Table 3.3.6.3-1.

3.3.6.4 Unavoidable Adverse Impacts

No unavoidable adverse impacts are expected to recreational resources in the Conowingo Hydroelectric Project. In areas where recreation enhancements are proposed, temporary impacts may result due to construction. These impacts are expected to be minor and short term. Thus, no significant or long term adverse impacts are expected in association with the licensing proposal.

TABLE 3.3.6.1-1: RECREATION PROJECTION INDEX, THROUGH 2050, NORTHEAST REGION

Recreation Resource Type	2000	2008 (b)	2010(c)	2050	Growth Factor, 2008 to 2050
• Boating—general	1.00	1.02	1.03	1.20	1.17
• Canoe/kayak	1.00	1.11	1.14	1.78	1.60
• Biking	1.01	1.08	1.09	1.55	1.44
• Shoreline Fishing	1.00	1.04	1.05	1.29	1.24
• Picnic	1.00	1.06	1.07	1.23	1.17
• Walking-Running	1.04	1.12	1.14	1.52	1.36
• Camping	1.00	1.0	1.09	1.32	1.32
• Hunting	0.98	1.00	1.01	1.12	1.12
• Horseback Riding	1.03	1.12	1.14	2.03	1.82
• Sight-seeing	1.04	1.22	1.27	1.80	1.48
• Birding	1.04	1.18	1.22	1.76	1.49

(b) Source: Bowker, et al.
(c) Interpolated from the projected change between 2000 and 2010.

TABLE 3.3.6.1-2: 2050 RECREATION ACTIVITY IN TERMS OF RECREATION DAYS BY LOCATION

	Boating	Shoreline Fishing	Picnic	Walking/ Running	Swimming	Hunting	Horse-back Riding	Biking	Sight-seeing	Birding	Other	Total	Growth from 2008
Broad Creek	6,670	1,897	0	1,125	0	0	0	18	2,190	0	790	12,691	25%
Cold Cabin	6,165	206	135	1,716	340	0	0	24	4,892	0	2,100	15,576	30%
Conowingo Creek	3,101	1,974	38	908	87	0	84	0	7,159	62	865	14,279	35%
Conowingo Pool	0	0	0	0	4,966	0	0	0	0	0	0	4,966	32%
Dorsey Park	8,171	804	156	886	51	27	0	44	7,553	26	4,099	21,817	31%
Fisherman's Park	1,579	60,254	0	8,130	29	57	0	4,738	84,928	31,477	4,830	196,022	38%
Funks Pond	0	794	33	919	0	276	0	0	1,814	0	2,083	5,918	35%
Glen Cove Marina	829	0	0	0	0	0	0	0	0	0	0	829	17%
Line Bridge	4,384 (c)	618	196	2,142	18	81	0	0	1,959	0	1,879	11,277	32%
Lock 13	0	319	0	399	0	0	0	0	341	0	0	1,059	35%
Lock 15	9,847 (c)	868	1,353	4,466	298	139	0	0	6,063	139	644	23,817	36%
Muddy Creek Boat Launch	29,216	5,672	43	3,069	0	4,552	0	46	2,463	0	1,552	46,614	20%
Octoraro Creek	601 (b)	2,417	34	2,750	0	504	53	62	1,415	1,283	1,020	10,138	35%
Peach Bottom Marina	629	0	0	0	0	0	0	0	0	0	0	629	17%
Total	71,193	75,824	1,987	26,510	11,985	5,636	136	4,932	120,776	32,986	19,882	371,841	34%
Participation Rate	19%	20%	1%	7%	3%	2%	0%	1%	32%	9%	5%		

(a) Based on the growth factors shown in Table 3.3.6.1-1 and the 2008 recreation activity levels.
(b) Includes canoeing and kayaking only.
(c) Includes boating on the headpond in the vicinity of the recreation site, as well as canoeing and kayaking.

TABLE 3.3.6.1-3: PROJECTED 2050 AVERAGE WEEKEND SUMMER CAPACITY BY LOCATION

	Available Parking Spaces	2008 Average Summer Use	Projected 2050 Average Summer Use (a)	Projected Percentage of Use 2050 (a)
Broad Creek	41	4	5	12%
Cold Cabin	5	5	7	140%
Conowingo Creek	19	3	4	21%
Conowingo Pool	213	80	105	49%
Dorsey Park	57	6	8	14%
Fisherman's Park	124	34	47	38%
Funks Pond	24	2	3	13%
Glen Cove Marina	47	22	26	55%
Line Bridge	3	3	4	133%
Lock 13	22	1	1	5%
Lock 15	36	1	1	3%
Muddy Creek Boat Launch	69	31	37	54%
Octoraro Creek	12	2	3	25%
Peach Bottom Marina	48	7	8	17%
Total	720	201	259	36%

(a) Based on growth rates presented in last column of 3.3.6.1-2.

TABLE 3.3.6.1-4: PROJECTED 2050 FACILITY USE AND CAPACITY SUMMARY

Recreation Resource Type	2011 Total Available Spaces (a)	2008 Average Spaces Used, Summer Weekend	2050 Average Spaces Used, Summer Weekend	Facility Capacity, rounded
Access Areas	61	8	11	20%
Boat Launch Areas	410	112	142	40%
Boat Launch Lanes	410	112	142	40%
Marinas	95	29	34	40%
Tailwater Fishing Facilities	124	34	47	40%
Parks	311	92	121	40%
Play-ground Areas	213	80	105	50%
Trails	72	5	7	10%
Picnic Areas	547	154	202	40%
Wildlife Area	124	34	47	40%
Visitor Centers	213	80	105	50%
Interpretive Displays	511	154	201	50%
Other	337	114	152	50%

(a) As shown in the tables presented in Section 3.3.6.1, parking lots typically provide access for multiple recreation activities. Therefore, the capacity associated with a given lot may appear multiple times on this table.

TABLE 3.3.6.3-1: PROPOSED RECREATION ENHANCEMENT COSTS

Facility	Construction Cost (2014 dollars)	Annual O&M Cost (2014 dollars)
Lock 13 Fencing	$11,000	$500
Lock 13 Vegetation Removal	$19,000	
Total Lock 13	**$30,000**	**$500**
Lock 15 dock, parking, stabilization, restrooms	$60,000	$1,200
Total Lock 15	**$60,000**	**$1,200**
Muddy Creek Boat Launch enhancements	$72,000	$6,000
Total Muddy Creek	**$72,000**	**$6,000**
Cold Cabin boat ramp upgrade	$96,000	$500
Cold Cabin parking	$102,000	$500
Cold Cabin picnic area	$12,000	$1,500
Total Cold Cabin	**$210,000**	**$2,500**
Dorsey Park boat ramp upgrades	$265,000	$15,000
Dorsey Park restroom	$9,000	$3,000
Total Dorsey Park	**$274,000**	**$18,000**
Conowingo Creek stabilization	$41,000	$1,200
Conowingo Creek other	$15,000	$2,400
Total Conowingo Creek	**$56,000**	**$3,600**
Glen Cove Marina extra boat trailer parking	$154,000	$1,700
Glen Cove Marina Parking Improvements	$45,000	
Glen Cove Marina Wall Improvement	$21,000	
Total Glen Cove Marina	**$220,000**	**$1,700**
Funk's Pond signage	$300	$500
Total Funk's Pond	**$300**	**$500**

Facility	Construction Cost (2014 dollars)	Annual O&M Cost (2014 dollars)
Conowingo Pool ADA	$127,000	$2,000
Conowingo Wading Pool ADA	$46,000	$1,500
Total Conowingo Pool	**$173,000**	**$3,500**
Overlook pavilion	$142,000	$1,200
Overlook picnic area	$45,000	$1,200
Overlook fence and parking	$45,000	$600
Total Overlook	**$232,000**	**$3,000**
Fisherman's Park boat ramp and parking	$1,093,000	$2,400
Fisherman's Park widening	$101,000	$500
Total Fisherman's Park	**$1,194,000**	**$2,900**
Line Bridge Bank Stabilization	$9,000	$500
Total Line Bridge	**$9,000**	**$500**
Peach Bottom shore access	$20,000	$1,800
Total Peach Bottom Shore Access	**$20,000**	**$1,800**
TOTAL CONOWINGO	**$2,550,300**	**$45,700**

3.3.7 Land Use

3.3.7.1 Affected Environment

The Conowingo Hydroelectric Project is located along the Susquehanna River in the states of Pennsylvania and Maryland. The northern most 8 miles of Project boundary lie within Lancaster and York counties in Pennsylvania, more specifically the townships of Fulton, Peach Bottom, Drumore, Lower Chanceford, and Martic. The Conowingo Dam, as well as the southern 14 miles of the Project boundary are within the Maryland counties of Cecil and Harford.

The proposed Project boundary extends approximately 14 miles upstream from Conowingo Dam to the lower end of the Holtwood Project tailrace, just below Holtwood Road (Route 372) on the western shoreline, to approximately a half mile south of the road on the eastern shoreline. The Project extends 2.5 miles downstream of the dam along the east bank of the river and 0.5 miles downstream along the west bank of the river.

The Project encompasses 10,120 acres: 8,850 acres of flowed land and 1,270 acres above the normal high water elevation. The land in and around the Project boundary is mostly rural, consisting primarily of wooded slopes, agriculture fields, and forested lands. To better manage the Project land, Exelon has classified land use throughout the Project boundary on the basis of its primary land use.

Exelon will negotiate leases with existing recreation facility operators for the continued operation of those facilities located on lands owned by Exelon but no longer within the Project boundary. Exelon also will negotiate a new lease with the MDNR for the continued protection and use of Exelon owned lands outside of the Project boundary for the collocated Lower Susquehanna Greenway Trail and Mason Dixon Trail. The existing lease expires in August 2014.

Existing Land Use

Exelon has defined six land classifications within the FERC Project boundary (Figure 3.3.7.1-1). These classifications are defined as:

- Project Operations – Lands used for power generation and electric transmission/distribution infrastructure and purposes.
- Developed Recreation – Lands managed for developed public recreational facilities and activities. This includes commercial recreation facilities.

- Natural/Undeveloped Lands – Lands that are primarily undeveloped and generally available for public access and use.
- Industrial and other Non-Project Lands – Lands managed for industrial/commercial uses and other non-Project uses including shoreline stabilization projects and agriculture.
- Public Access Lands – Lands generally open to the public but that are managed by a Federal, state, county or conservation entity.
- Cottage Lands – Lands leased to individuals for seasonal residential use.

The majority of land within the Project boundary is fully open for public use, including land classified as developed recreation (118 acres), natural/undeveloped (546 acres), and public access lands (256 acres). These lands account for 71 percent of upland acreage, or 920 acres. Industrial and other Non-Project Lands comprise 179 acres of Project land. Cottage land (155 acres or 12 percent) and Project operations (89 acres or 1 percent) account for the remaining land within the Project boundary.

Special Designated Areas

Portions of land within and adjacent to the Project are designated under various national and statewide programs dedicated to promoting outdoor recreation needs, as well as conservation and protection of the natural environment.

National Trails System

The National Trail System Act of 1968 authorized creation of a trail system comprised of National Recreational Trails, National Scenic Trails, and National Historic Trails. National Recreation Trails may be designated by the Secretary of Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization. Portions of the Captain John Smith Chesapeake National Historic Trail, Susquehanna River Trail, and Mason-Dixon Trail are designated as National Recreation Trails as administered by the National Parks Service and lie within the Project boundary.

National Natural Landmark

The National Natural Landmarks Program administered through the National Parks Service recognizes and encourages the conservation of sites containing outstanding biologic and geologic resources. Though no sites are within the Project, the Ferncliff Wildflower and Wildlife Preserve sits adjacent to the Project, in the township of Drumore, Pennsylvania. The site is popular due to its wildflowers and its excellent examples of River Hills timberland.

Wild and Scenic Rivers

The Federal government, as well as each individual state, has developed a scenic and wild river program intended to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Project is not located within or adjacent to a river designated as part of the National Wild and Scenic River System.

The Maryland Scenic and Wild Rivers System was created by 1968 by an Act of the Maryland General Assembly. Through this program, Deer Creek, a tributary to the Susquehanna River, was designated as a Scenic River. A Maryland scenic river is defined as a free-flowing river whose shoreline and related land are predominantly forested, agricultural, grassland, marshland, or swampland with a minimum of development for at least two miles of the river length [Natural Resources Article, 8-402(d)(2)].

Statewide Water Protection

All surface waters in Pennsylvania are protected for aquatic life, water supply (potable, industrial, livestock, wildlife, and irrigation), and recreation (boating, fishing, water contact sports, and aesthetics). Pennsylvania has assigned a warm water fishes aquatic life designated water use to the Pennsylvania portion of the Conowingo Pond. In addition to narrative standards that are applicable to all surface waters, specific water criteria for parameters such as pH, alkalinity, bacteria, color, dissolved oxygen, temperature, and certain ions, metals, and nutrients are established for critical uses in Pennsylvania.

No rivers within the Project vicinity are designated as scenic in the state of Pennsylvania; however, Fishing Creek is designated as an Exceptional Value Stream. The PADEP designates streams with high biotic integrity and health as exception value streams. These regulations do not permit use along the stream that leads to any degradation of the stream quality.

In Maryland, all surface water must be protected to support water contact recreation, fishing, aquatic life, wildlife, and water supply (agricultural and industrial). In addition, each major stream segment has been assigned to one of eight categories with associated minimum water quality criteria. This criteria in given numeric values for various water quality parameters such as bacteria, DO, temperature, pH, turbidity, color, toxic substances for each designated category. In the Project Boundary, the Conowingo Pond is currently designated as Use I-P (Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply). The Susquehanna River downstream of the Conowingo Dam to its confluence with the Chesapeake Bay is currently designated as Use II (Support of Marine Aquatic Life and Shellfish Harvesting, which includes applicable Use I-P categories).

Pennsylvania Natural Heritage Program

The Pennsylvania Natural Heritage Program is a partnership between the Western Pennsylvania Conservancy, PADCNR, PFBC, and PGC that gathers and provides information on the location and status of important ecological resources such as plants, vertebrates, invertebrates, natural communities, and geologic features. Within the Project, the Conowingo Islands were rated "exceptional" based on its potential natural value. Adjacent to the Project, Wissler Run (rated "high") and Muddy Run Reservoir (rated "notable") were also rated under the program.

Shoreline Management Plan

In addition to these specially designated areas within or near the Project, Exelon has developed a Shoreline Management Plan, which is included in Volume 3 of the license application.. The SMP is a framework for the management of Project lands and river shoreline areas consistent with broader local, regional, state and Federal regulations, initiative, and planning guidelines. This SMP enables Exelon to fulfill its license responsibilities and obligation for the Project, including the protection and enhancement of the Project's environmental and recreational assets. The SMP outlines the measures Exelon has taken to minimize or eliminate negative effects to shoreline resources through programs and policies consistent with FERC regulations. The measures created to manage Project land are described below:

Shoreline Erosion Control

Modifications are allowed to shoreline vegetation in order to construct erosion control measures, provided the modifications do not impair the overall function of the vegetated buffer. Trees and shrubs on steep slopes will be maintained whenever possible. If the buffer function is impaired, a planting plan, using native species included in the native plant guide provided in the SMP, will be devised and implemented to mitigate for the reduced function.

General Maintenance

Modifications are allowed to shoreline vegetation to maintain the health of the shoreline vegetation, provided the modifications do not impair the overall function of the vegetated buffer. If the buffer function is impaired by vegetation removal, a planting plan, using only native species included in the native plant guide in the SMP, will be devised and implemented to mitigate for the reduced function.

Erosion and Remediation Policy

Exelon has identified and characterized incidences of erosion in the Project boundary. While no areas are currently identified as affecting shoreline resources, erosion areas that may in the future affect Project shoreline resources will be addressed through a remediation and monitoring program.

Woody Debris Management

Woody debris is defined as trees and woody material that extend from the shoreline into the impoundment. This material can provide important habitat for fish and wildlife and shall be left in place unless the debris is a navigational or safety hazard.

Approval of Non-Project Use of Project Lands

Any use of and/or construction within the Project boundary by a non-licensee must be permitted by all applicable local, county, state or Federal agencies. Exelon must approve the activity before work can begin consistent with FERC's standard use and occupancy article and any other applicable license requirements. Parties requesting non-Project use of Project lands will provide details to Exelon regarding the location and desired development or use. If it is determined that an activity will be allowed and has received all necessary permits and approvals, including FERC approval when required, Exelon will issue written permission to the party for its development and/or use of Project lands.

Shoreline Vegetation Management

Shoreline vegetation provides many benefits to the Project including wildlife habitat, aesthetic value, and maintaining water quality by providing a filter strip to control run-off. Existing shoreline vegetation will be preserved where feasible. It currently varies in depth depending on the location of the Project boundary relative to the impoundment shoreline and current land use. Existing improved and developed areas with limited shoreline vegetative cover such as the cottage clusters, PBAPS, recreation sites and facilities, and the dam and associated generating facilities, can be maintained as they currently exist. Modifications to the shoreline vegetation in other areas will be considered for viewshed maintenance and development, recreation access, shoreline erosion control, and general Project related maintenance of the vegetated shoreline.

ViewSheds

Modifications and maintenance of vegetation is allowed to provide a reasonable view of the water, provided the modifications do not impair the overall function of the vegetated buffer. If the buffer function is impaired, a planting plan, using the native species plant list included in the SMP, will be devised and implemented to mitigate for the reduced function from vegetation removal.

Access Trails

Modification of the existing vegetation is allowed to provide access trails to the water, provided the modifications do not impair the overall function of the vegetated buffer. If the buffer function is impaired, a planting plan, using the native species plant list included in the SMP, will be devised and implemented to mitigate for the reduced function from vegetation removal.

Sensitive Natural Resource Protection Overlays and Policies

Research and numerous studies were conducted to assess and determine the potential effects of Project operations on various resources. Exelon has compiled existing and new data on these resources to develop a "sensitive resources" overlay to apply to the six land use classifications described above (Figure 3.3.7.1-2). This overlay is defined as areas within the Project boundary that contain (or may contain) resources protected by state or Federal law or executive order, and other natural features important to the area or natural environment.

Historic Properties Management Plan

Exelon has developed, in consultation with the PHMC and the MHT, an HPMP to address historic and cultural resources. The HPMP is included in Volume 4 of the FLA.

Conowingo Island Public Use Policy

Exelon's Conowingo Island Public Use policy establishes guidelines for the use of the islands located in the upper reach of Conowingo Pond from the Pennsylvania Route 372 bridge approximately 1.3 miles downstream, as well as Mt. Johnson Island, which is located five miles downstream of the Route 372 bridge. The policy restricts and regulates island use in order to protect the islands' rare species, cultural resources, and unique geologic and physical features. It is included as an appendix of the SMP, filed in Volume 3 of this license application.

Leased Premises Policy for Cottages

Exelon has developed rules and regulations regarding the use of Project lands for seasonal cottages. Lessees are required to comply with all applicable local, state and Federal laws for the development and use of the land, as well as Exelon's land use rules. Exelon rules and regulations for cottages address such issues as erosion control, vegetation removal, wastewater disposal, shoreline development, and cultural resource protection. It is Exelon's policy not to create any new cottage lease lots within the Project boundary. In addition, leases for existing cottages that are abandoned or become damaged and are not replaced by structures conforming to all applicable regulations will be terminated. All structures and improvements will be removed from the leased lot and the land will be restored to a natural condition. No future cottage leases will be issued at the site. Exelon reserves the right to amend the policy from time to time as circumstances may require, subject to Commission approval as necessary. It is included as an appendix of the SMP, filed in Volume 3 of this license application.

Public Recreation and Access Facilities

Exelon leases several parcels of land to local, county and state agencies and commercial vendors for development and operation of public recreation and access facilities, within and around the Project. The agreements specify that the respective lessees will use the properties for park and public recreation purposes, including providing river access and facilities such as boat launches while complying with all applicable local, state and Federal regulations. All of these sites and facilities, within the Project boundary, are Project recreation facilities regulated under Exelon's FERC license. Exelon will continue to partner with the agencies and vendors for the operation of these facilities and their use by the public.

In addition, Exelon has developed and implemented "Rules and Regulations Governing the Use and Occupancy of Leased Premises" for Project lands. This document applies to all leased Project lands, and has been included as part of the lease agreements for the two existing Project marina facilities, Glen Cove Marina and Peach Bottom Marina.

Limitations on Public Recreational Access

Exelon provides public recreation and access to Project lands and waters pursuant to its FERC license requirements. Access and use of certain portions of Project lands will be restricted for operational, safety and security reasons.

- Fishing in Project waters accessible to the public will be governed by applicable state regulations. Fishing will not be allowed within secure areas or areas that present public safety concerns. This includes shoreline fishing within 100 yards of the base of Conowingo Dam at Fishermans Park (west shore) and for 4,000 feet along the east shoreline downstream of the dam. These areas are restricted for public safety reasons due to changes in water elevations and velocities from generating flows and spilling water during gate operations. In addition to safety concerns, the area along the east shore is also used as a staging and storage area related to Project operations and maintenance. Boating is also restricted immediately above and below the Conowingo Dam.

- Hunting is not allowed within the secure area of the Project, or on other Project lands posted against hunting by Exelon. This restriction is intended to protect the public, adjacent landowners, lessees, sensitive resources, and Licensee's operating capabilities. Exelon issues permits for offshore (water access only) stationary duck blinds and duck blind sites on Exelon land to hunters on an annual basis. The permits allows applicants (up to four individuals per permit) to have no more than two blinds or sites.

- Use of off-road vehicles on Project lands is prohibited.

Overall Land Use Monitoring and Enforcement

Exelon will conduct regular inspections and manage the Conowingo Project in accordance with the terms of its license and applicable FERC rules and regulations.

Continuing Review

Exelon will evaluate appropriate amendments to the SMP as facts and circumstances may warrant.

In addition to the SMP, Exelon has developed and proposes to include in the new license a Recreation Management Plan to manage the recreation sites associated with the Project. The RMP provides a comprehensive overview of public recreational use and needs for the Project and addresses the licensee's responsibilities pursuant to 18 CFR, Chapter 1, Subchapter A, Part 2, Section 2.7. The RMP also includes a report of recreation resources discussing existing and proposed recreational facilities and opportunities at the Project pursuant to 18 CFR, Chapter 1, Subchapter B, Part 4, Subpart F, Section 4.51 (f)(5). The RMP is included in Volume 3 of this license application.

3.3.7.2 Environmental Effects

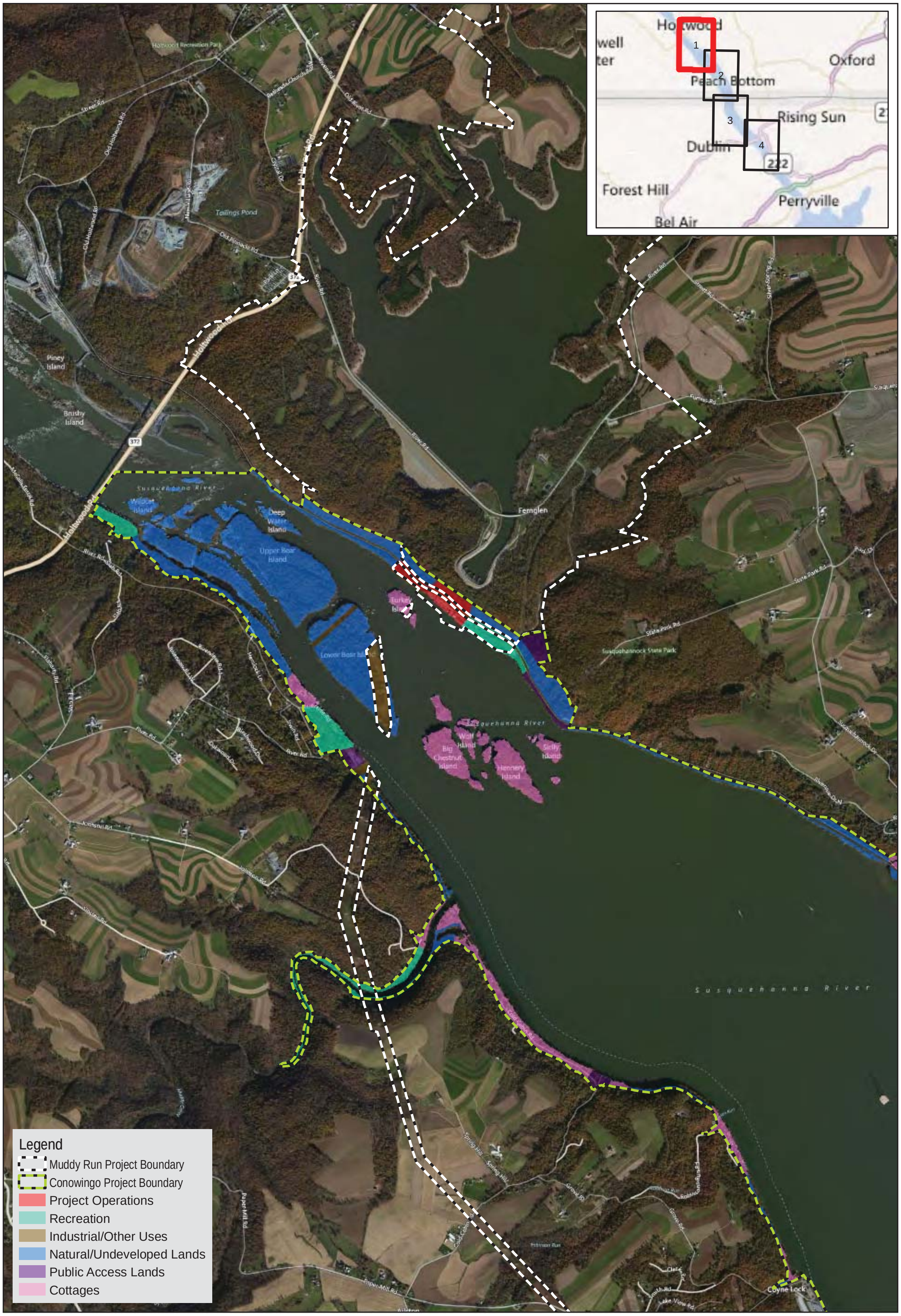
The Conowingo Hydroelectric Project lands, which consist mainly of recreation and undeveloped, publicly accessible land, haves little effect on the land use in the area. Land use adjacent to the Project is currently dominated by agricultural land and heavily forested land. The Project maintains this character and promotes public interaction with the surrounding nature through parks, trails, and interactive displays. As there are currently no proposed changes to Project operations, use of adjacent lands is not anticipated to be affected. The SMP and RMP will ensure that Project lands are beneficially managed in the public interest.

3.3.7.3 Proposed Environmental Measures

Exelon proposes various recreation enhancements to either update existing recreation facilities or to construct new amenities on land currently used as developed recreation (which will incorporate applicable erosion and sedimentation control measures during construction). As the land use acreage dedicated to recreation and public access is more than adequate given the size of the Project, no further environmental measures are being proposed in relation to land use by the licensee.

3.3.7.4 Unavoidable Adverse Impacts

No unavoidable adverse impacts are expected to land use in the Conowingo Hydroelectric Project.



EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

Figure 3.3.7.1-1:
Project Land Use Classification Map

Exelon.

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EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

Figure 3.3.7.1-1:
Project Land Use Classification Map

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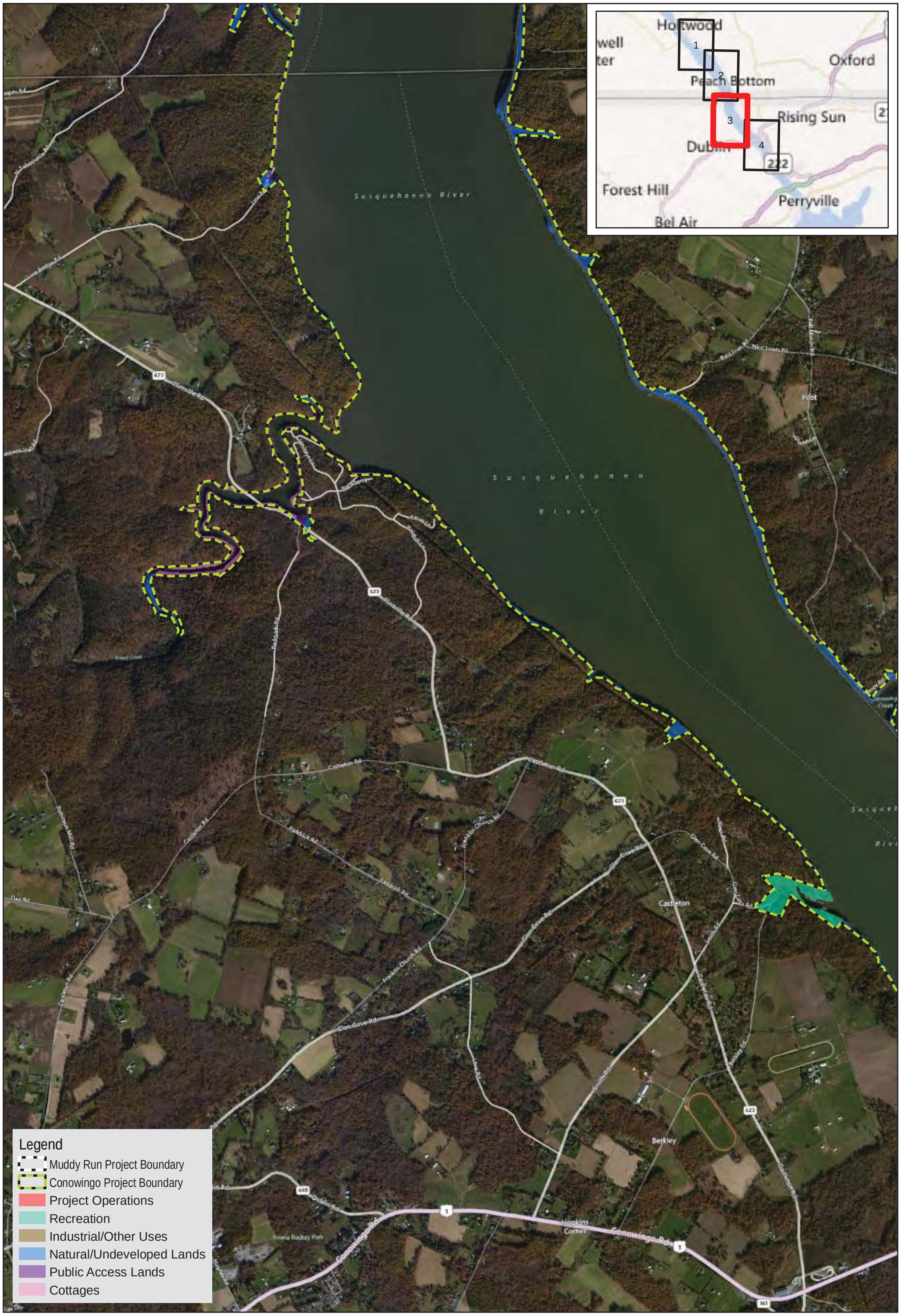

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PROJECT NO. 405

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Project Land Use Classification Map

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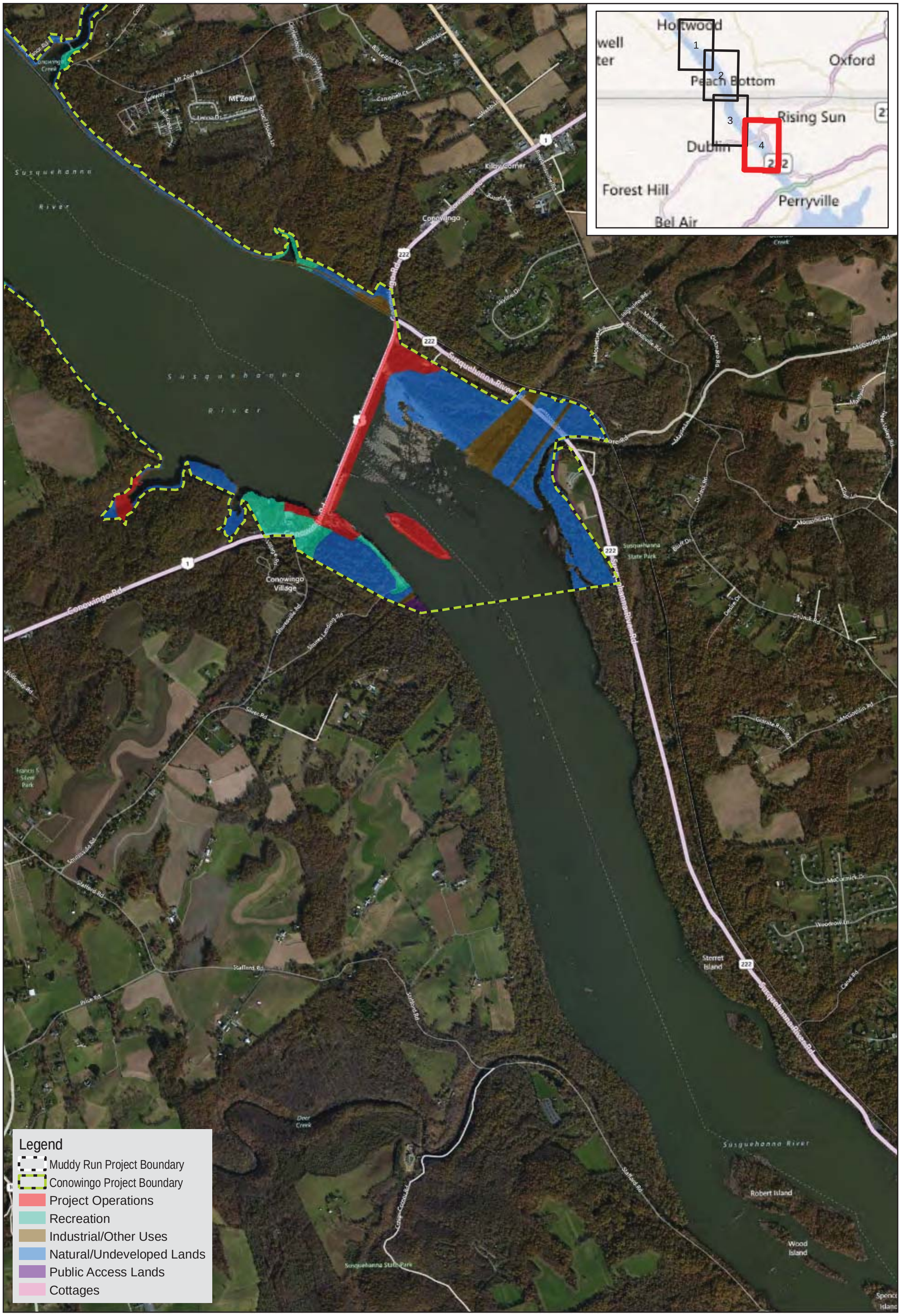

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PROJECT NO. 405

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Figure 3.3.7.1-1:
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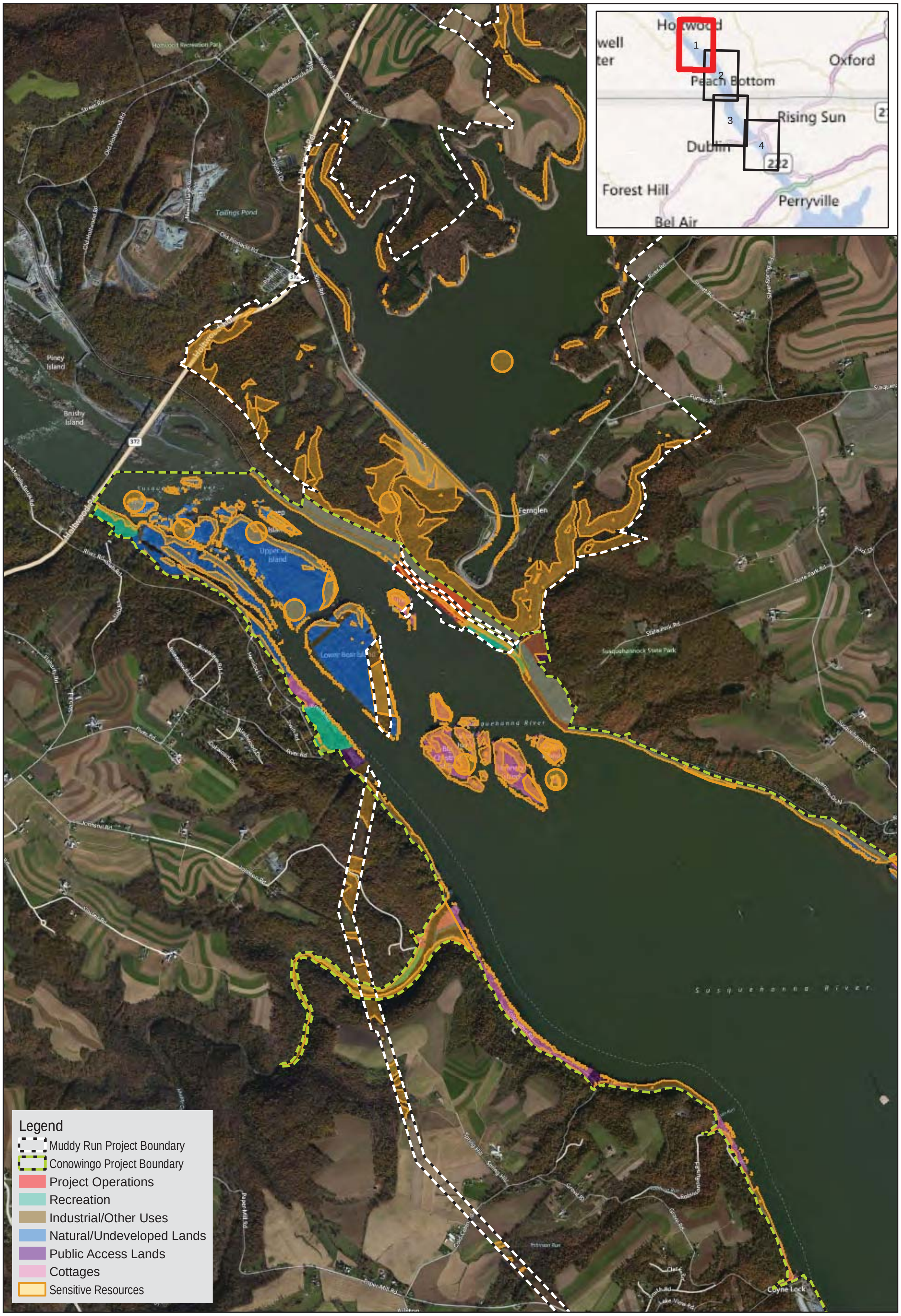

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PROJECT NO. 405

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Figure 3.3.7.1-2
Project Land Use Classification Map
with Sensitive Resources

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Figure 3.3.7.1-2
Project Land Use Classification Map
with Sensitive Resources

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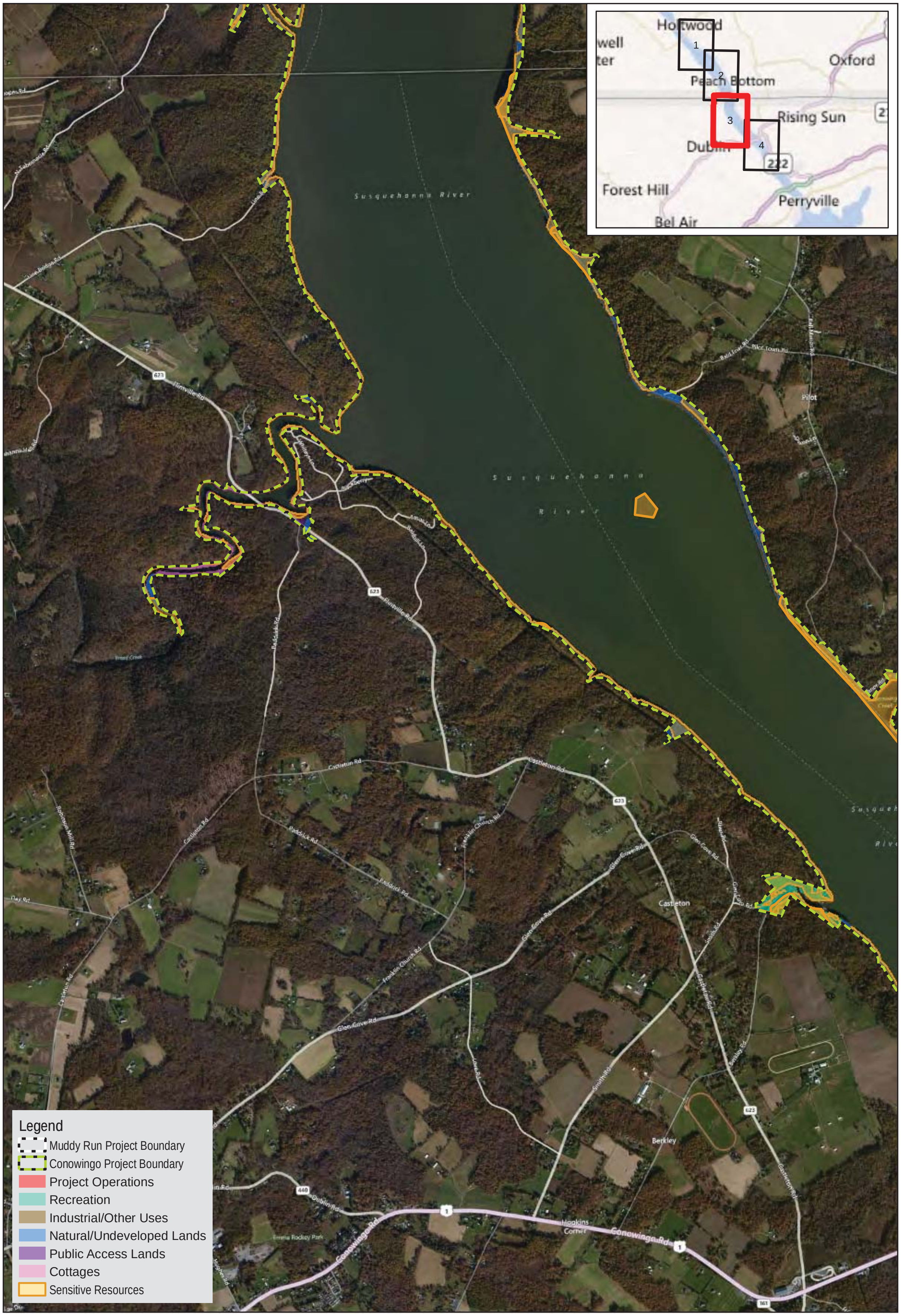

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Figure 3.3.7.1-2
Project Land Use Classification Map with Sensitive Resources

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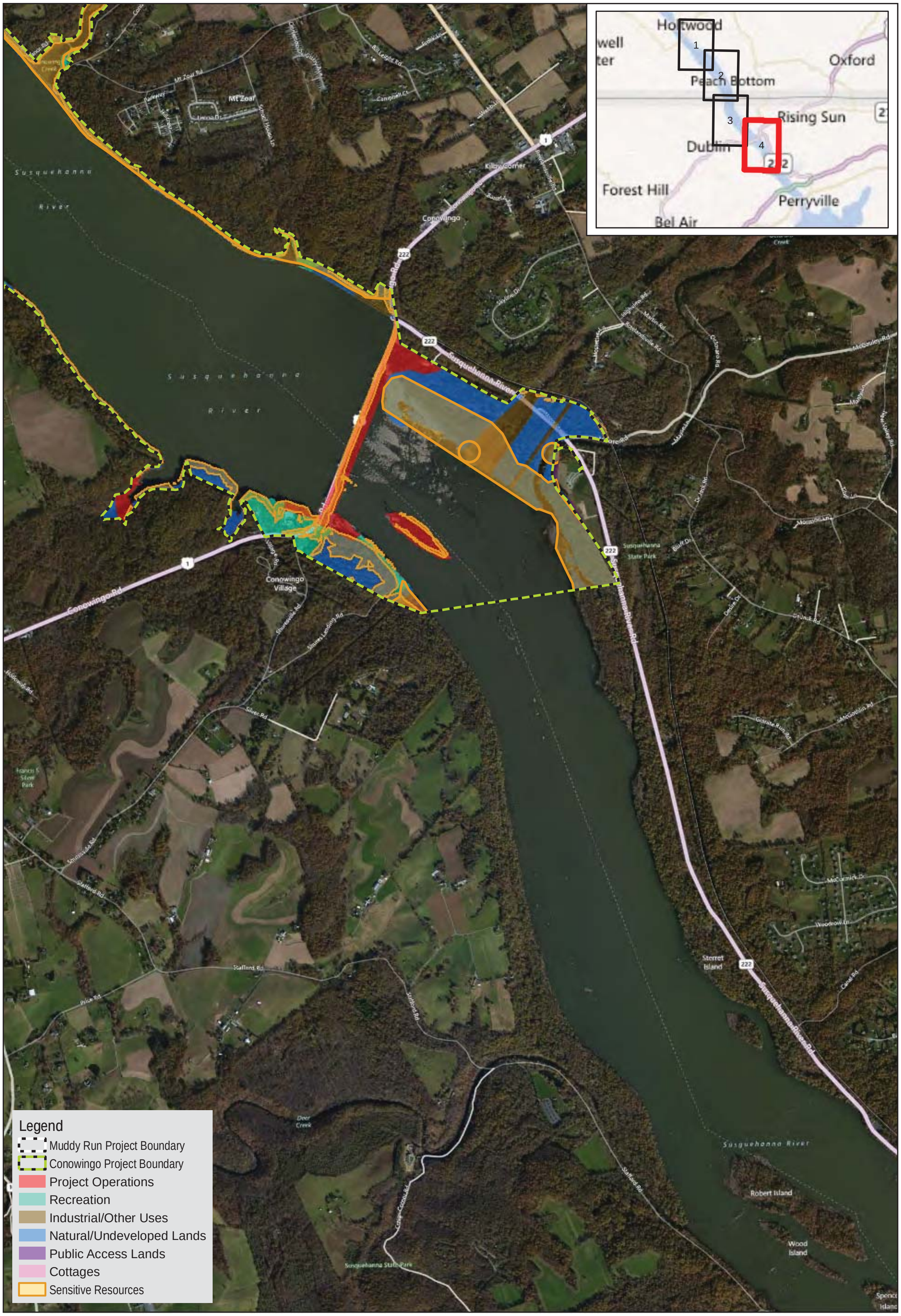

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Figure 3.3.7.1-2
Project Land Use Classification Map with Sensitive Resources

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3.3.8 Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 (Section 106), as amended, requires the Commission to evaluate the potential effects of continued operation of the Project on properties listed in or eligible for listing in the National Register of Historic Places (National Register) within the Project's Area of Potential Effect (APE). Properties listed in or eligible for listing in the National Register are called historic properties. Section 106 also requires FERC to seek concurrence with MHT and the SHPO on any finding of effects, and allow the Advisory Council on Historic Preservation an opportunity to comment before acting on a license application.

If Native American historic properties have been identified, Section 106 also requires the Commission to consult with interested Indian tribes that might attach religious or cultural significance to such properties. No properties have been identified at the Conowingo Project.

3.3.8.1 Affected Environment

3.3.8.1.1 *Area of Potential Effect*

The Conowingo Project is located on the Susquehanna River in Pennsylvania and Maryland, and has a total drainage area of 27,510 square miles. Conowingo Dam is located in Maryland (at RM 10) 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 located in Pennsylvania, within York and Lancaster counties. The Conowingo Project is the most downstream of the five hydroelectric projects located on the Lower Susquehanna River. The upstream projects (York Haven, Safe Harbor, Holtwood, and Muddy Run) are located at RMs 56, 32, 24, and 22, respectively. Tidewater reaches up the Susquehanna River within approximately four miles downstream of the Conowingo Dam, and the river is navigable by large vessels to Port Deposit, Maryland located approximately five miles downstream of the dam.

The APE is defined as the geographic area or areas within which an undertaking (i.e., relicensing) may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The Project's APE includes all lands within the currently approved Project Boundary and any other area outside of the Project Boundary where historic properties might be affected by Project-related activities that are conducted in compliance with the FERC license.

The Conowingo Project APE includes all the lands within the proposed FERC Project Boundary, including an additional 3.8-mile reach below the proposed Conowingo Project boundary limit, where water level fluctuations associated with Project operations have the potential to impact historic properties, as shown on Figure 3.3.8.1.1-1.

3.3.8.1.2 *Prehistoric and Historic Background*

The prehistoric cultural stages represented in the region include the Paleoindian Stage (ca. 12,000-7,500 B.P.), the Archaic Stage (ca. 7,500-1,800 B.P.), and the Late Prehistoric Stage (ca. A.D. 150-1540). These are followed by the Protohistoric Period (ca. A.D. 1540-1860) and the Historic Period (ca. 1860-1950). The stages in this scheme are marked by a gradual development of Native American culture from its earliest beginnings to the peak of its development in the form of horticultural societies living in semi-permanent villages. The succeeding protohistoric period was a time of transition; Native American culture in the region was radically altered before being assimilated into the dominant European culture.

Paleoindian Period (10,000 B.C.- 7,500 B.C.). The Paleoindian period is the earliest recognized period of human occupation in the area and includes three sub-phases: 1) Clovis, 2) mid-Paleo, and 3) Dalton. Paleoindian settlement patterns may be described as semi-nomadic within a well-defined territory. The subsistence focus was on hunting both large and small game and it is assumed that wild plants were exploited for food, textiles, and other purposes. Pleistocene megafauna, such as mammoth and mastodon, were mostly extinct by this time, so the emphasis in hunting was most likely toward deer, elk, and perhaps woodland caribou.

Paleoindian groups throughout the Northeast and Middle Atlantic region are noted for their preference for high-quality lithic materials such as Delaware chalcedony, Flint Run jasper, Normanskill chert, and in Delaware, Custer (1984) describes the Delaware Chalcedony Complex where quarry related sites were systematically exploited. A settlement pattern focused on utilizing the resources of interior swamps, headwaters areas and other resource-rich early Holocene habitats within a quarry-based settlement system seems to be characteristic of the Paleoindian period.

Paleoindian peoples were hunters and foragers who depended, at least partially, on species of game which are now extinct in the region. Game such as mastodon, mammoth, caribou and elk along with deer and smaller game were hunted with thrusting spears tipped with fluted spear points. Such point forms are very similar in style throughout North America.

The Paleoindian period in York and Lancaster Counties, as well as in adjacent areas of Maryland along the Susquehanna River, is sparsely represented, evidenced almost entirely by isolated projectile point finds (e.g., Paul Cresthull collection, Harford County, Maryland). The surface finds of Paleoindian projectile points have been recovered from various environmental settings, however, the majority (surface finds in private collections) were found close to high order streams as well as from islands in the Susquehanna River. It should be noted that in some of these collections, non-diagnostic Paleoindian scrapers are recorded in the site files as evidence of Paleoindian occupations (e.g., 36AD16). Collections from the lower Susquehanna River region show numerous fluted point finds manufactured from a great variety of cherts. These finds are mainly from river terraces, now inundated by rising sea levels in Chesapeake Bay during the Holocene (See Gardner and Wall 1978).

Archaic Period (7500 B.C. - 1000 B.C.). The settlement data from Archaic sites show that during the Archaic period a significant increase in aboriginal populations occurred. It is apparent that regional settlement systems during the earlier part of the Archaic period largely reflect post-glacial adaptations. Though data from excavated Early Archaic sites is rare, these sites tend to reflect many trends seen in previous Paleoindian period manifestations (Carr 1998:63). There is still a major focus on the use of selected crypto-crystalline materials such as jasper, however, a greater variety of raw materials were exploited than in Paleoindian times. Resident populations were organized into small bands exploiting their surroundings in a restricted wandering pattern; that is, hunting and foraging trips stemmed from base camps located near critically important resources. These settlement data show sites in upland areas surrounding the Susquehanna River as well as along the floodplains and terraces of the river itself. Many of the sites known for this area are from riverine settings though slightly less than Paleo-Indian sites in the Susquehanna drainage (Carr 1998:58). It is expected that, during the Early Archaic period, base camps in the region would have been associated with sources of high quality crypto-crystalline materials such as jasper and cherts as well as within areas of maximum habitat overlap such as floodplain and high terrace areas.

Middle Archaic occupations represent significant changes in Early Holocene adaptations in the region that involve exploitation of a wider range of environmental zones and new additions to tool assemblages such as drills and, later, ground stone tools. There is also a higher frequency of these sites compared to the Early Archaic, and trend which perhaps started with the Kirk Phase of the Early Archaic. Sites producing Kirk points (e.g., 36YO288) appear to be more numerous than other sub-phases of the Early Archaic.

Surface sites containing Morrow Mountain and bifurcate-based projectile points have been recorded in both upland and riverine settings.

The Late Archaic period in this part of the Lower Susquehanna Valley ranges from about 3000 to 1000 B.C. Assemblages typically contain scrapers and drills (often fashioned from resharpened points), adzes, celts, netsinkers, anvil stones, and steatite bowls. The appearance of ground stone tools, utilized for the processing of gathered wild plant foods, evidences a reliance on new technology related to shifts in subsistence practices. Southeast of Project area, in Harford County, Maryland, several substantial soapstone quarries have been recorded (18HA91 and 18HA92) containing fragments of several dozen stone bowls in various stages of manufacture and associated with surface finds of Orient fishtail and broadspear points. These quarries show evidence of aboriginal quarry pits dug to obtain the high quality serpentine common in the area.

The investigation of stratified Late Archaic sites in the Lower Susquehanna Valley has been ongoing since the 1950s beginning with sites such as Duncan's Island (Witthoft 1959). The Duncan's Island site revealed stratified Archaic components dating primarily to the Late and Terminal Archaic period. Poplar Island points and other large stemmed points mark the majority of the sequence along with large staged bifaces and ground stone tools. Artifacts were also recovered from coarse textured (yellow sands) sediments stratified beneath thick B-horizon strata (Witthoft 1959). This has implications for the presence of earlier, perhaps Middle and Early Archaic occupations. Similar stratigraphy has been noted at other island sites in the Lower Susquehanna such as Piney Island (36LA65), where a stratified sequence was revealed by excavations conducted by Kent and others in the 1960s and 1970s (Kent 1996). The site revealed, within the Late and Terminal Archaic sequence, a series of hearths and small storage features.

Other Late Archaic and Terminal Archaic occupations on Susquehanna River islands have been recorded on Bare Island, City Island, and Calver Island. On Bare Island, now partially inundated by the reservoir behind Conowingo dam, is a stratified Archaic site known as the Kent-Hally site. From this site, steatite vessel fragments, stemmed and notched Late and Terminal Archaic points, drills, ground stone tools, and seed/nut grinding equipment have been recovered (Kinsey 1959). At many of these island sites, there has been a limited amount of evidence indicating the presence of intact earlier Holocene components. Calver Island also contains a Late Archaic base camp represented by hearth features (Miller et al. 2007).

On the downstream side of Conowingo dam in Maryland, two of the more extensive prehistoric sites recorded in the area include 18CE14, the Conowingo site, and 18CE16, Octoraro Farm. The latter site is a

Late Archaic manifestation initially reported by Cresthull. The Conowingo site (McNamara 1982, 1983, 1985) is a buried multi-component site at the mouth of Octoraro Creek that contains buried prehistoric occupations. Most of the other sites recorded in the vicinity are represented by small assemblages of diagnostic points and lithic debitage. These sites include 18HA3, 18HA167, and 18HA85. Most of these sites have been recorded on hilltops and in low order drainages. By comparison, other areas of the eastern Piedmont, such as the lands around nearby Liberty Reservoir in the Patapsco drainage, have provided significant data on prehistoric site distributions in the region.

Settlement patterns in the region during the Late Archaic show an increased use of all ranges of upland environmental settings. Surface site data show an increase in site size as well and, at the same time, more ephemeral types of environments were being exploited than before. Overall, Late Archaic subsistence covered a broad spectrum of upland resources with the exploitation of acorns, hickory nuts, and butternuts as well as seasonally abundant game, large and small. In York and Lancaster Counties, site distribution data show a tremendous increase in numbers of sites in a much wider range of environmental settings such as upland swamps. Fishing appears to have assumed greater importance over previous times, as many of the sites located in the region are floodplain and island occupations which were probably seasonal fishing stations. These sites consistently yield netsinkers and related fishing equipment. Some base camp sites are located near smaller streams and rivers, and these perhaps are also fishing camps.

Woodland Period (1000 B.C. - A.D. 1600). The Woodland period is marked by the development of settled village horticulture, the growth and development of widespread burial ceremonialism marked by mound construction, and the introduction of ceramics into the material culture. A full-blown elaboration of the burial ceremonialism concept is evidenced by Adena mound complexes. Mound building had been initiated during the previous Late Archaic period, but on a smaller scale with the construction of simple stone mounds or burials on natural hilltop features. Some of these developments diffused into the lower Susquehanna and Chesapeake Bay area, but the evidence is limited chiefly to surface finds of trade items (e.g., Adena blocked-end tubular pipes, hematite hemispheres, and gorgets) along major streams and occasional finds of Adena projectile points. The mounds which typify the burial ceremonialism of this period in other regions do not appear to be represented here but they do occur further upstream, tentatively associated with the Clemson Island culture (Turnbaugh 1977).

During the Early Woodland period (1000 - 300 B.C.), regional trade networks became more established. Early Woodland sites are generally larger than sites of previous times, and there seems to be an increasing reliance on riverine and estuarine resource areas. Cultigens were gradually introduced but never assumed great importance in Early Woodland subsistence economies. Stable wild plant resources along with hunting and fishing continued to support human populations in the region. More sedentary communities were established, particularly in the rich and ecologically diverse riverine settings, although tightly patterned mobility still characterized the settlement patterns of these Early Woodland period societies. In general, adaptive strategies were geared to exploiting a more limited and predictable array of stable resources within a smaller territory than in earlier times. The region's critical resources, such as the soapstone quarries near the mouth of the Susquehanna River, were an essential part of these settlement patterns.

Surface sites dating to the Early and Middle Woodland periods in the lower Susquehanna Valley area are marked primarily by surface finds of Fishtail and Jacks Reef projectile points. Some evidence of Early Woodland occupations has been recovered from buried surfaces on islands in the Lower Susquehanna, such as those described above for the Late Archaic period. Many of the Fishtail points are manufactured from meta-rhyolite, marking the continued preferential use of this raw material. Continuity also is evident in the tools found in Early Woodland assemblages that differ little from their Late Archaic predecessors.

Intensification in trade networks over a large region is one of the notable trends evident by the onset of the Middle Woodland period (300 B.C. to A.D. 900). There is also an intensification of horticultural practices, although hunting, fishing, and plant collecting are still primary subsistence pursuits. The subsistence economy is also marked by the initiation of maize horticulture. The large number of sites for this time period and the extensive size of some of the sites support the argument for seasonal aggregation and dispersal. Tool kits utilized by Middle Woodland peoples are basically the same as those used during the succeeding Late Woodland but more exotic and high quality lithic raw materials are evident in Middle Woodland assemblages. The technology evident in many of the Middle Woodland sites seems to favor bifacial tool production rather than a prepared core and blade flake technology as would be found in the Ohio Valley and adjacent regions at this time.

Late Woodland and protohistoric occupations in the Lower Susquehanna River Valley are found primarily on the floodplains, especially the large villages which are found on levees and adjacent to small tributary streams (Raber 1993). These are primarily horticulturally based villages which evidence the use of maize, beans, squash, and eastern agricultural complex plants. Also found throughout the region are the small base camps and procurement sites. By circa AD 1300, maize agriculture is well established and many settlements show evidence of fortification. Many of the sites in the region that contain Late Woodland artifacts are multi-component surface sites in high order stream locations.

Other trends in the Late Woodland period include shifts in lithic raw material preferences. These shifts may relate to the development of more sedentary lifestyles, the increasing reliance on horticultural products and a concomitant de-emphasis on intensive hunting and gathering. The result would have been smaller foraging and hunting ranges, which would, in turn, have resulted in more limited exploration for lithic raw materials and greater dependence on near-camp resources as well as those easily obtained through trade. Gradual movement of Susquehannock peoples into the Lower Susquehanna region from the Upper Susquehanna can be seen in a succession of archeological sites with the earliest dating to the mid-1500s (Turnbaugh 1977:238). Susquehannock sites include burials with grave offerings of historic items, usually interred just outside of the village, and clusters of rectangular houses surrounded by a palisade. Subsistence pursuits include cultivation of corn, beans, squash, and eastern agricultural complex cultigens, supplemented by hunting and fishing. By 1675, the end of Susquehannock occupation in the region was completed as a result of warfare and disease (Kent 1993).

Colonial Period: Early European Settlement (1620-1775). The earliest European exploration of the Susquehanna River is attributed to John Smith, who sailed into the mouth of the Susquehanna River in 1608 though earlier visits by Spanish Jesuits in the late 1500s are also described in early explorer's accounts. In the early 1600s Edward Palmer established a fur trade post on an island at the head of the Chesapeake Bay now called Garrett Island (Preston 1901; Wright 1967), in Cecil County. Early economic pursuits in the region during the 1600s and the first part of the 1700s were based primarily on tobacco cultivation which was transported overland from tobacco plantations to Bay access points via rolling roads. Shipping points were located on the Gunpowder River and the Bush River, the latter an early settlement area of the late 1600s.

Land at the mouth of the Susquehanna River was cleared for tobacco plantations in the second half of the seventeenth century. Settlement in the Project area in southern York County, Pennsylvania an area known as "The Barrens", was settled by Scottish and Irish families (Hershner 1977) as well as Catholics from Maryland (Fortenbaugh 1950; Rupp 1845; Gibson1886). These early settlements were primarily agricultural with some residents providing services such as blacksmiths, wheelwrights and other supporting enterprises. The economy at that time was focused on wheat production and as wheat farming became more profitable, mills emerged along with additional supportive trades.

By 1709 Mennonites were taking advantage of the rich agricultural lands in Lancaster County, Pennsylvania and were soon followed by the Huguenot families, Scottish, Scotch Irish, English, Swiss, Quaker, Irish and Palatine (Wood 1979). The population was diversified both in terms of ethnic background as well as job skills and religions which included Mennonites, Methodists, Anabaptists, Presbyterians, United Brethren and others such as Catholics and Jews. Lancaster County was established in 1729 as an extension of Chester County, from which many of the settlers originated. At the time it was first settled, this was considered Pennsylvania's western frontier and the settlements were primarily small farms with political leadership being dominated by landed and professional people (Loose 1976).

By the mid-eighteenth century, single-owner proprietorships were the most common. Fur traders on the frontier exchanged raw materials for manufactured goods in Lancaster. As the frontier moved westward, other towns including Shippensburg, Carlisle, and York assumed principal trading responsibilities while local business concentrated on processing and manufacturing. In 1749 York County was formed from Lancaster County.

Settlers suffered from repeated Indian raids during the French and Indian War. The threat of such raids resulted in a system of frontier fortifications and trade supervision. The French and Indian War stimulated the local economy and as hostilities increased, Lancaster became a military center, as well as manufacturing and supply station. Shopkeepers received commissions to supply troops involved in placating the frontier, and military officials requested the services of artisans to provide them with manufactured goods. Local gunsmiths manufactured thousands of guns used during the Revolution and several salt works were set up to manufacture saltpeter.

The development of many of the settlements and villages surrounding the Project relate directly to the proximity to the Susquehanna River and its tributaries and creeks. As these areas developed, the need for various modes of transportation grew as well. The use of roads, ferries, bridges, and canals allowed residents and businesses to transport their goods and travel throughout the region. Roads often served as the earliest and simplest transportation routes. The first post road from Alexandria, Virginia to Philadelphia ran through Harford County, Maryland, located south of the Project, by 1670. The road followed the first settlements along the coastal areas, and was essential in providing early landowners with a crude highway for their travel to the early government seats. By 1687, a second post road was laid out and was noted as a more direct north-south route. It was known as the "path that runs from the Potomack to the Susquehanna" and the "King's Road" (Wright 1967).

Crossing the Susquehanna was often accomplished by ferry in the early periods. Holtwood Village in Lancaster County is located near the site of an early ferry that crossed the Susquehanna. William H. Nelson started the ferry service in 1738, and it was transferred to James McCall in 1806. The well-used ferry, later renamed Clark's ferry, continued throughout the nineteenth century, and was closed around 1936 (Snyder and Boyle 1984c).

The colonial period in the general Project region was marked by agriculture, iron forging, quarrying, and milling. In the seventeenth century, the economy was primarily based on tobacco cultivation, until overproduction compelled settlers to begin milling grain crops as a means of income. Flour mills were built using the tributaries of the Susquehanna River as a power source. The Rock Run Mill was built in 1725 on the Susquehanna River, in what is now Port Deposit, Cecil County. The mill ground grain until 1913 and is still standing (Sarudy 2001:70). In Harford County, the Rock Run millstream empties into the Susquehanna River; the Rock Run Grist Mill (HA-191) is located in the present-day Susquehanna State Park. The first gristmill on Rock Run was built in 1760. The present gristmill dates to 1794, and was in continuous operation until 1954. The State of Maryland restored the mill in 1965 (Historical Marker Database 2007).

Two eighteenth century industries in Port Deposit (known as Creswell's Ferry until 1812) were milling and the quarrying of the area's bluish gray granite. The town's role as a port of deposit for raw materials floated down the Susquehanna River gave rise to its new name. In addition to the quarrying and the port function, the town supported lumber mills, gin mills, foundries, and other industries for processing and distribution (Maryland Historic Trust, National Register of Historic Places Detail Report, Port Deposit Historic District, CE-1291).

The American Revolution (1775-1783). Just prior to the American Revolution, in 1773, the boundaries of Harford County as a separate political unit were established with the county seat placed at Harford Town (or Brush) on the Bush River (Wright 1967). At the time of the American Revolution, the region's population numbered about 13,000. During the Revolution, both Harford and Cecil Counties were important in supplying agricultural products as well as weapons (cannons) and ammunition, produced by local iron works, to the Continental Army (Larew 1981; Miller 1949). Elkton, in Cecil County, served as an important shipping point at this time (Miller 1949).

The primary military engagement of the Revolution included landings on Elk Neck by the British army in 1777 (Miller 1949). In August 1777, General Sir William Howe landed with British troops above the mouth of the Elk River in Cecil County. Eventually, he took Elkton and set up camp. According to local history, eyewitness accounts recorded a scene of brilliant scarlet coats and flashing bayonets pushing across the fields and through the forests of Cecil County. British and Colonial troops crossed the Lower Susquehanna River several times during the length of the war on their way to points on the Chesapeake.

In Pennsylvania, York served as an interim capital for the Continental Congress during a short period, and York County served as a cross-roads for armies moving south during the latter part of the Revolution. Lancaster was also, for a short period, the country's capital during the Revolution and later, the state capital (1799-1812). The role of Lancaster during the revolution was as a producer of both durable goods and food for the war effort (Kessler 1975; Loose 1976). After the Revolution, westward expansion continued and Lancaster assumed a much less prominent role in the region's economy. In spite of this, local industries such as grist- and sawmills, lime kilns, textile industries and craft specialists continued to thrive. The town and county of Lancaster grew quickly in the late eighteenth century and became the residence of a number of wealthy landowners and prominent craftsmen such as iron workers and glass makers such as Henry Stiegel and Robert Coleman.

Before and after the Revolution, there were efforts to utilize land resources, especially in the production of iron. The tradesmen profited from army provisioning contracts; skilled artisans such as metalworkers, shoemakers, tanners, and woodcraftsmen were commissioned to manufacture boots, saddles, casks, barrels, etc. and local gunsmiths manufactured thousands of guns used during the revolution and several salt works were set up to manufacture saltpeter.

The processing of metal was an important part of both Lancaster and York County's early economy. From the middle of the eighteenth century through to the middle of the nineteenth century, Martic Forge, on Pequea Creek (roughly six miles above the Project) in Lancaster County, Pennsylvania, was the industrial center of Martic Township (Clare 1892). Here, too, iron production was the industrial focus for this area early on, and it was also one of the more important iron-producing centers for Lancaster County.

The Federal and Antebellum Periods (1783-1840). A public road system was enacted in Maryland by 1783, and a legislative act in 1785 stated that every farmer or landowner must have the right to a road to his property (Wright 1967). In 1815, an act in Harford called for the first stone or gravel roads in the county; these passed from Belair to the river at Rock Run and toward McCall's ferry near Holtwood, as well as across the river at Conowingo (Wright 1967).

The War of 1812 was the second war between England and the United States. In December of 1812, the British declared the harbors of the Chesapeake and Delaware Bays to be under a naval blockade. In 1813, a large naval squadron commanded by Rear Admiral Cockburn began attacking towns along the

Chesapeake. The campaign's eventual goal was to seize Maryland's largest and most fortified port city, Baltimore. On April 29, Cockburn reached Frenchtown in Cecil County and a small battle took place before the town was captured and burned.

Three days after the burning of Frenchtown, the British engaged the American garrison at Havre de Grace. Landing in the town, the militia was routed, with the exception of one man, John O'Neill, who remained near the Concord Point Lighthouse returning fire. Once taken, Havre de Grace was burned and this once prosperous port town lay in ruins. Eventually, the British left the area, proceeding south into Kent County toward Georgetown before returning to the main British fleet on the open waters of the Chesapeake. The British presence in the Chesapeake Bay remained until the war was ended by the Treaty of Ghent, signed in 1815. Further destruction was inflicted on locations such as Principio Furnace, a major manufacturer of cannons for the war effort. Port Deposit and other principal towns remained intact.

Transportation facilities were improved after the conclusion of the war in 1814 and several bridges were built again to span the Susquehanna River. In 1815, a wooden bridge designed by Theodore Burr was constructed at Rock Run and spanned the Susquehanna River. Using his patented “Burr Arch Truss” the bridge was one mile in length and 27 feet wide. It burned in 1823, collapsed in 1854 and by 1856 was abandoned; only the piers are visible today. (MHT, MHIP Property Detail Report, Rock Run Bridge Piers, HA-196). At Darlington in Harford County, there was a covered bridge that spanned the river that was built by the Rock Run Bridge and Banking Company in 1818 known as the Conowingo Bridge. The bridge was washed out by a flood in 1846 but was not rebuilt until 1858 and was replaced with steel by 1909. The bridge is submerged under the Conowingo Pond (Shagena and Penden 2009).

Castle Fin Forge, located in the southern portion of Lower Chanceford Township on Muddy Creek, opened in 1810 and was also known as Palmyra Forge (Sheets 1991). Lower Chanceford Township was also the home of York Furnace, which was located on Otter Creek and was in operation from 1830 to 1875. Sometimes called “Speck,” the furnace produced cannons during the Civil War (Sheets 1991). By the end of the nineteenth century, Lancaster County furnaces and forges on the Conowingo and Octoraro Creeks were no longer running (Clare 1892).

On the western side of the river, in spite of concerted efforts, early settlers in the Peach Bottom area of York County did not have much luck with growing rye or wheat. These crops, as well as barley, grew better in other parts of York County (Sheets 1991). The abundance of rye and corn in the surrounding area did, however, give rise to the production and sale of whiskey in York County. In fact, from 1800–1830, the county led all of Pennsylvania in whiskey production (Sheets 1991).

The advent of canals was significant for the shipping industry. In the nineteenth century, canals and later railroads connected inland cities to those on the coast, fostered western expansion, and encouraged greater industrial production by facilitating transportation of more goods and raw materials. Large amounts of coal and lumber were transported on canals in the nineteenth century.

The Susquehanna Canal, also known as the Maryland, Port Deposit, and Conowingo Canal, was opened to traffic in 1803 and was located on the east bank of the Susquehanna. It ran from the Pennsylvania-Maryland border south to the outskirts of Port Deposit. It is noted as contributing greatly to the growth of towns in along the Susquehanna, including Port Deposit (MHT, NHRP Detail Report, Port Deposit Historic District, CE-1291). The canal included nine locks. In spite of the corporation holding exclusive rights to the canal and any gristmills or water works built upon it, it was not financially successful (Wilner 1984). It was bypassed frequently on the river heading downstream, so not enough tolls were collected to maintain it properly. The canal was sold at auction in 1817 and was abandoned when the Susquehanna and Tidewater canal opened in 1840. (Shank 1988).

The Susquehanna and Tidewater Canal was the most significant canal for the area with a charter that was approved on April 18, 1835 by the Pennsylvania and Maryland legislatures. Open by 1840, it was located on the west bank of the river and went as far as Wrightsville on the west side of the Susquehanna in York County, terminating in Havre De Grace in Harford County (Smeltzer 1963). Most of the traffic on this canal was going to Baltimore, Philadelphia, and New York (Smeltzer 1963). There was a two-tiered towpath built on the canal; the mules on the lower walkway went east and the mules on the upper walkway traveled west (Smeltzer 1963).

Railroad transportation made an early appearance in the Lower Susquehanna Valley because of its location on a natural travel corridor between the South and the Middle Atlantic states. Railroad investors were also eager to tap the natural resources, especially anthracite coal. Initially, canals had the advantage of capacity and cost. Before long, however, improvements in locomotives allowed trains to pull greater loads. Canals could not operate in the winter months and they were vulnerable to ice and flood damage. As canal revenues slipped after the Civil War, high maintenance costs became an increasing drain on profits. Inevitably, canals came under the control of railroad companies. Some canals became more valuable as rights-of-way for new rail lines or highways (Stranahan 1993). Planned in 1828 and finished in 1834, the "Iron Rail Road" was built from Philadelphia to Columbia on the Susquehanna River and included a stop in Lancaster. It was the first publicly-built railroad in the world. In 1837, the Philadelphia, Wilmington, and Baltimore line reached the Susquehanna. In 1857, local interests incorporated the Columbia and Port Deposit Railroad in Pennsylvania as the Washington and Maryland Line Railroad Company. The name was changed to the Columbia and Port Deposit Railroad in 1864. Its nickname was “The Port Road.” Construction was begun in 1866. Part of the line was in operation by 1874, but the work on constructing the remainder progressed slowly. The entire 40-mile line was put into operation in July 1877.

With the advent of the railroad, the counties within the Project area began to change rapidly. Abundant natural resources allowed the area to continue to grow and prosper. Fisheries, agricultural products, large forested areas, and Cecil and York Counties’ rich wealth of mineral resources, such as chrome, granite, magnesium, and iron ore placed the Lower Susquehanna Region at the heart of America's early manufacturing and extractive industries.

As transportation facilities improved during the nineteenth century—in the form of canals and railroads—numerous industries were able to flourish in the Lower Susquehanna Valley, including tanbark mills, paper mills, fulling mills, sawmills, flint mills, lime kilns, canneries, creameries, and ice harvesting (Sarudy 2001). Mining and quarrying became the economic mainstays of Peach Bottom Township. Although abandoned by 1895, chrome mining at Rock Spring and Epsom salt mining had been notable industries in the township.

The Civil War (1861-1865). Maryland allowed for the ownership of slaves and generally was sympathetic to the Southern cause. Maryland was not, however, initially in open rebellion against the Union. Sympathies within the state were essentially divided. In addition, the Underground Railroad had an extensive system of passages in the northern parts of the state bordering Pennsylvania. Darlington served as a direct passage north for runaway slaves because many religious-minded Quakers abhorred the institution of slavery (Lower Susquehanna Heritage Greenway 2006).

Due to its location between the Northern states and Washington, D.C., Maryland was in a unique position, politically, militarily, and geographically. In the Maryland and Virginia tidewater areas a plantation society existed, which formed a component of the "Old South." But in the northern parts of Maryland, cultural traditions and influences derived from the Quakers, Germans, Scottish, Irish, Swedish, and

Finnish immigrants, caused the area to be decidedly pro- Union (Lower Susquehanna Heritage Greenway 2006).

During the Civil War, it was understood that the extensive transportation networks of Maryland would be necessary for a Union victory, thus the history of the Lower Susquehanna Region during this time was a popular legend of tragedy and the Civil War in miniature. Confederate raiders would routinely travel the Lower Susquehanna region to destroy bridges and railroads, and 100 veteran reservists were sent from Wilmington, Delaware to Havre de Grace to guard ferry and railroad operations. Prior to Antietam, Confederate cavalry brigades cut telegraph wires at Harford Road and Bel Air Road. Their goal was a destructive railroad campaign that led all the way to Havre de Grace. Perryville, initially occupied by Union forces, frequently served as a staging and supply ground for military operations.

During the Civil War, Confederate troops under Generals Gordon and Early entered York for a brief period in June 1863 just prior to the battle of Gettysburg. Also in June, General Ewell’s corps of Confederate raiders, coming from Carlisle, entered Dillsburg under the command of Colonel Jenkins. They camped about 1/4 mile south of town before moving on. Other than this, very few events directly related to battles and troop movements occurred in the area. During the Civil War little military activity occurred in Lancaster County with the exception of troop movements and support facilities before, during and after the battle of Gettysburg.

Post-Civil War and Industrial Expansion (1865-1900). After the Civil War, farming resumed its importance as the primary commercial enterprise in the county. Smaller industries developed as well in this largely rural county. Industrial expansion accelerated along with the growth of transportation networks designed to more efficiently export products of the local economy. Railroad construction increased in the late 19th century to the early 20th century.

The Peach Bottom Railway was chartered in 1868 to build a narrow-gauge rail line from Philadelphia to haul coal from the Broad Top coalfields in southern Pennsylvania. The Eastern Division was supposed to connect Philadelphia with the Susquehanna River at Peach Bottom. Instead, only a line from Peach Bottom to Oxford was completed in 1878. The Middle Division was built between Delta (in the slate belt) and York in 1876. No money was available to build the bridge over the Susquehanna that would unite the divisions. The Eastern Division was reorganized into the Peach Bottom Railroad in 1881 (later the Lancaster Oxford & Southern Railroad) and the Middle Division into the York and Peach Bottom Railway. The York and Peach Bottom Railway reached Peach Bottom in 1883. The Maryland Central

Railroad built a line between Baltimore and Delta. After acquiring the York and Peach Bottom Railroad, they both became part of the Maryland and Pennsylvania Railroad Company (the Ma & Pa). The line was abandoned south of York in 1985 (Maryland and Pennsylvania Railroad Historical Society 2007).

The rains associated with the Johnstown Flood, or the great storm of 1889, had a large impact on the Susquehanna and Tidewater Canal in the Project area. By May 31, the west branch of the Susquehanna was filled with logs and began to rise. Homes, mills, lumber, and crops were carried down the river in the flood. The flood dealt a huge blow to the canal, destroying miles of the canal, marking the beginning of the end (Smeltzer 1963). The canal was bought by the Reading Railroad by the 1890s and closed by 1900.

The Modern Era (1900 to Present). In the early twentieth century, creameries were a significant element of Lancaster's agricultural economy. In 1916 there were 40 creameries in the county. One of the biggest, Farmer's Creamery, was located in Drumore Township (Roddy 1916). Agricultural land use continued into the twentieth century; in 1960, Lancaster County was the largest farming county in Pennsylvania with 4,650 farms (Stevens 1964). In comparison, York County had 2,700 farms, a little more than half of those in Lancaster County (Stevens 1964).

The Columbia & Port Deposit Railroad was the principal route for moving freight between points on the Pennsylvania Main Line and points on the Philadelphia, Baltimore, and Washington line. Freight trains were more efficiently and economically operated through the low grade of the Lower Susquehanna Valley rather than the heavier grades used for through passenger service (Burgess and Kennedy 1949). The Columbia & Port Deposit Railroad was relocated to higher ground from Conestoga Creek Bridge to Safe Harbor in 1905–1906 because of construction of the Holtwood Dam and the resulting lake.

In 1916, the Columbia & Port Deposit Railroad and other lines consolidated into the Philadelphia, Baltimore, & Washington Railroad Company, a subsidiary of the Pennsylvania Railroad Company (Burgess and Kennedy 1949). The railroad was relocated between Port Deposit and Fite's Eddy in 1926–1928, when Conowingo Dam was built. The railroad was electrified in 1938 and then de-electrified in the early 1980s. It is still in active service today and owned by the Norfolk Southern Corporation (Burgess and Kennedy 1949; Trower 2002).

Hydroelectric power production facilities were developed beginning in the early 1900s to take advantage of the Susquehanna River's force. In 1904, the York Haven Hydroelectric Station, located at Conewago Falls, was opened (Sheets 1991). The Holtwood Power Plant, which began operation in 1910, was at the time the largest hydroelectric facility on the Susquehanna and remains a major producer of electricity for south central Pennsylvania (Snyder and Boyle 1984). By 1916, there were nine hydroelectric plants in Lancaster County (Roddy 1916). The massive Conowingo Dam was built near Darlington, Maryland a short distance downstream of the Project between 1926 and 1928 to provide hydroelectric power to supply Philadelphia and southeastern Pennsylvania with electricity (Lower Susquehanna Heritage Greenway 2006; MHT Determination of Eligibility (DOE) Form, US 1 over Susquehanna River/Conowingo Dam, HA-1971).

Construction of the Conowingo Dam was an enormous undertaking. The lake formed by the damming of the river required rerouting of 16 miles of Pennsylvania Railroad track, demolition and relocation of the Village of Conowingo, and rerouting of Baltimore Pike over the dam. Rerouting of the Pennsylvania Railroad's Columbia and Port Deposit branch necessitated blasting tunnels through solid granite and building new bridges to span the tributaries of the Susquehanna. On the east side, the Columbia and Port Deposit Branch of the Pennsylvania Railroad ran through the site, and only a side track needed to be constructed. However, on the west side, an 8.9-mile railroad line connecting with the main line of the Pennsylvania Railroad at Havre de Grace and utilizing the old Tidewater canal towpath was built (Stone & Webster 1928). Huge cofferdams were erected to aid with construction, using nearly 8,000,000 feet of timber, and over 660,000 cubic yards of concrete were poured (Rincliffe 1953).

At the peak of construction, the first week of August 1927, a total of 5,500 men were employed on the Project. The total included 3,725 men working on the powerhouse and dam, 225 men working on the transmission line, 1,400 men working on railroad relocation, and others working on the highway. Two villages, one on each side of the river, complete with water and sanitation systems, were built to house the Project's construction workers. Accommodations consisted of bunks housing 28 men in single iron cots with washhouses, including shower baths, for every four bunks. Each camp had its own mess hall; in addition, on the west side "a negro mess hall seating 600 was also provided" (Stone & Webster 1928). Materials for the Project were hauled along both sides of the river. During construction of the hydroelectric plant, PECO, along with Public Service Electric and Gas Company of New Jersey and Pennsylvania Light and Power Company, formed a power pool. This pioneering cooperative agreement to interconnect the three company's electrical systems was expected to make "possible diversification, dependability and concentration of power on an enormous scale" (*New York Times*, Sept. 17, 1927). The power group was intended to cover the industrial districts and main cities of New Jersey and Pennsylvania, excluding Pittsburgh. Interconnection involved construction of three transmission lines totaling 208 miles, along with switching stations, at a cost of $26,000,000 (Rincliffe 1953; *New York Times*, Sept. 17, 1927).

Electricity from the plant also powered railroad lines between New York and Washington, D.C., and was used for industrial and residential applications. When constructed, Conowingo Dam was the second largest hydroelectric development in the United Sates after Niagara Falls (*Camden County Vocationalite*, June 1930). It was and still is the single largest generation station to be built in one step, and used the most up-to-date technology, as well as the largest turbines and generators ever produced (Exelon 2007). It is "apparently the first dam, of major size, built entirely by chuting concrete" and reportedly the longest slab dam in the United States (Maryland State Highway Administration 1997). Conowingo is a secondary facility, supplementing nuclear and fossil fuel plants. Reliant on water flow, Conowingo can be used to restart the system should the electric distribution system fail (Exelon 2007)

Since the end of World War II, the Conowingo area has developed several residential communities. Farmland has declined, population has grown (and continues to grow), and the landscape has became more suburban in nature. A recently renewed interest in the region's past has led to physical and historical revitalization of the area. In the 1960s, an agreement was passed among Maryland, Pennsylvania, and New York to begin work on clearing the Susquehanna River of sewage, coal-mining seepage, soil runoff, and chemical fertilizers. At the same time, a movement was also taking shape to clean up the Chesapeake Bay.

Tourism has also grown in the area, helping to revitalize ailing economies. After World War II, increasing numbers of visitors flocked to the Susquehanna to enjoy boating, fishing, hunting, and other water-related sports and activities. Because much of the area was unspoiled by development, it presented a haven for nature enthusiasts. The rise of the automobile contributed greatly to this tourism boom, allowing city dwellers to more easily reach the scenic waters of Maryland. The tourism industry has continued to grow to the present day as evidenced by the establishment of summer cottages along the Susquehanna River shorelines or on the rivers islands. Over 420 in number, the cottages were primarily built from the 1940s to the 1980s. Cottages can be seen along the shoreline on maps from the Pennsylvania Department of Highways, indicated by the black triangles illustrating seasonal or summer colony dwellings. The islands were not surveyed for these maps.

On the 1941 map, there are a number of cottages grouped around the intersection of Fishing Creek and the Susquehanna River at Drumore in Drumore Township and at Peach Bottom in Fulton Township. The recreational trend only increased through the twentieth century, illustrated on the 1962 and 1965 maps, which indicates that the number of cottages has grown in both areas. A number of the structures on the eastern bank of the Susquehanna River are located between the railroad tracks and the water in area that had historically been developed at the lock locations of the Susquehanna and Tidewater Canal such as at an area currently known as Cold Cabin Beach. Cold Cabin, as it was originally founded, was a canal-oriented community renamed after the large coal warehouse near Lock 16. The community contained several residences, a lock house, and a boatyard none of which are still extant (Wilson et al 2003). Today the community contains approximately 50 summer cottages and a community building.

3.3.8.1.3 *Prehistoric and Historic Archeological Resources*

Exelon conducted archaeological field surveys to identify cultural resources between 2010 and 2011. The survey of the APE combined verification of data from the earlier surveys and systematic field investigations of locations not previously surveyed. All areas within the APE were included in the field survey, where safety considerations allowed for it. The results of the survey are summarized below.

Nine AOIs were identified during the Phase IA to have a high potential for archaeological deposits based on topographic landform and hydrological association. A Phase IB archaeological survey was performed which consisted of field investigations of the nine selected AOIs identified during the Phase IA study.

The Phase IB archaeological study both confirmed the presence of archaeological resources in previously identified site areas, and identified previously unrecorded archaeological resources in areas that had not been subject to previous survey. As a result of the survey, two (2) previously recorded sites (one in Pennsylvania and one in Maryland) were subjected to further investigation. In addition, seven (7) newly recorded sites, all in Maryland, and two isolated finds in Maryland were newly identified. In total, 2603 artifacts (2084 prehistoric, 492 historic, and 27 organic) were recovered from the survey of the nine AOIs.

Analysis of sampled artifacts from the sites indicates intensive and/or repeated occupation of the Project shoreline areas from the Archaic through Woodland periods of prehistory, and during the Historic period. The two previously recorded and seven newly recorded sites are considered potentially eligible for inclusion in the NRHP. Observations on the status of localized erosion at the site locations are also provided in this report.

3.3.8.1.4 *Historic Period Buildings and Structures*

Exelon conducted an architectural survey and assessment within the APE of the Conowingo Project (Project). The purpose of the architectural survey was to identify and map any NRHP-listed, NRHP-eligible, and previously surveyed architectural resources within the Project APE.

In Pennsylvania, there are currently no NRHP-listed architectural resources or architectural resources determined NRHP-eligible by the PHMC located in the Project APE. There are three previously identified resources within the APE. The former Columbia & Port Deposit Railroad is located along the eastern shore of the Conowingo Pond and follows the Susquehanna shoreline north and south of the Project boundaries. The Columbia & Port Deposit Railroad has not been evaluated for NRHP-eligibility by the PHMC. Additionally, there are two highway bridges surveyed by the Pennsylvania Department of Transportation (PennDOT) and determined not eligible for the NRHP by PennDOT.

Exelon identified six resources 50 years or older not previously identified within the APE: two individual summer cottages; a group of 17 summer cottages with a community building; two nineteenth-century dwellings; and the remnants of the Susquehanna and Tidewater Canal system. Components of the previously identified Columbia & Port Deposit Railroad, including 2 bridges and a culvert were also surveyed. Upon consultation with the Pennsylvania SHPO, NRHP eligibility will be evaluated for the Columbia & Port Deposit Railroad and the Susquehanna and Tidewater Canal System through the completion of PHMC Historic Resource Survey forms.

In Maryland NRHP-listed architectural resources in the Project APE includes the Conowingo Dam and the Lower Deer Creek Valley Historic District. Three contributing resources to this Historic District are located within the APE. There are four previously identified resources extant within the APE, two of which have been determined eligible for the NRHP. The other two resources have not been evaluated for NRHP-eligibility by the MHT.

Exelon identified ten resources 50 years or older not previously identified by MHT within the APE. Exelon is recommending that the Columbia & Port Deposit Railroad and its components are potentially eligible for the NRHP under Criterion A (Transportation) and Criterion C (Engineering). The remaining resources are not eligible based on lack of integrity or historic significance.

3.3.8.2 Environmental Effects

Continued operation of the Project could affect cultural resources listed in or eligible for inclusion in the NRHP. During implementation of the relicensing studies, nine archaeological sites were found, seven of which are evaluated as eligible for inclusion in the NRHP. Ten non-Project related, multi-component structures within the APE have been identified by Exelon as eligible for inclusion in the NRHP. Continued Project O&M and associated Project recreation has a potential to affect sites due to ground disturbing activities (e.g., erosion, trampling and blading). In some cases sites are being affected by siltation, which may be considered a positive effect because it provides site protection. Therefore, Exelon's Project includes as a proposed PM&E to prepare and implement an HPMP.

The purpose of Exelon's HPMP is to prescribe specific actions and processes to manage historic properties within the Project APE. It is intended to serve as a guide for Exelon's operating personnel when performing necessary O&M activities and to prescribe site treatments designed to address ongoing and future effects to Historic Properties, including the Conowingo Dam and hydropower facility. The HPMP also describes a process of consultation with state and Federal agencies. Requirements described in the HPMP include: site management measures; training for all O&M staff; routine monitoring of known cultural resources; and periodic review and revision of the HPMP.

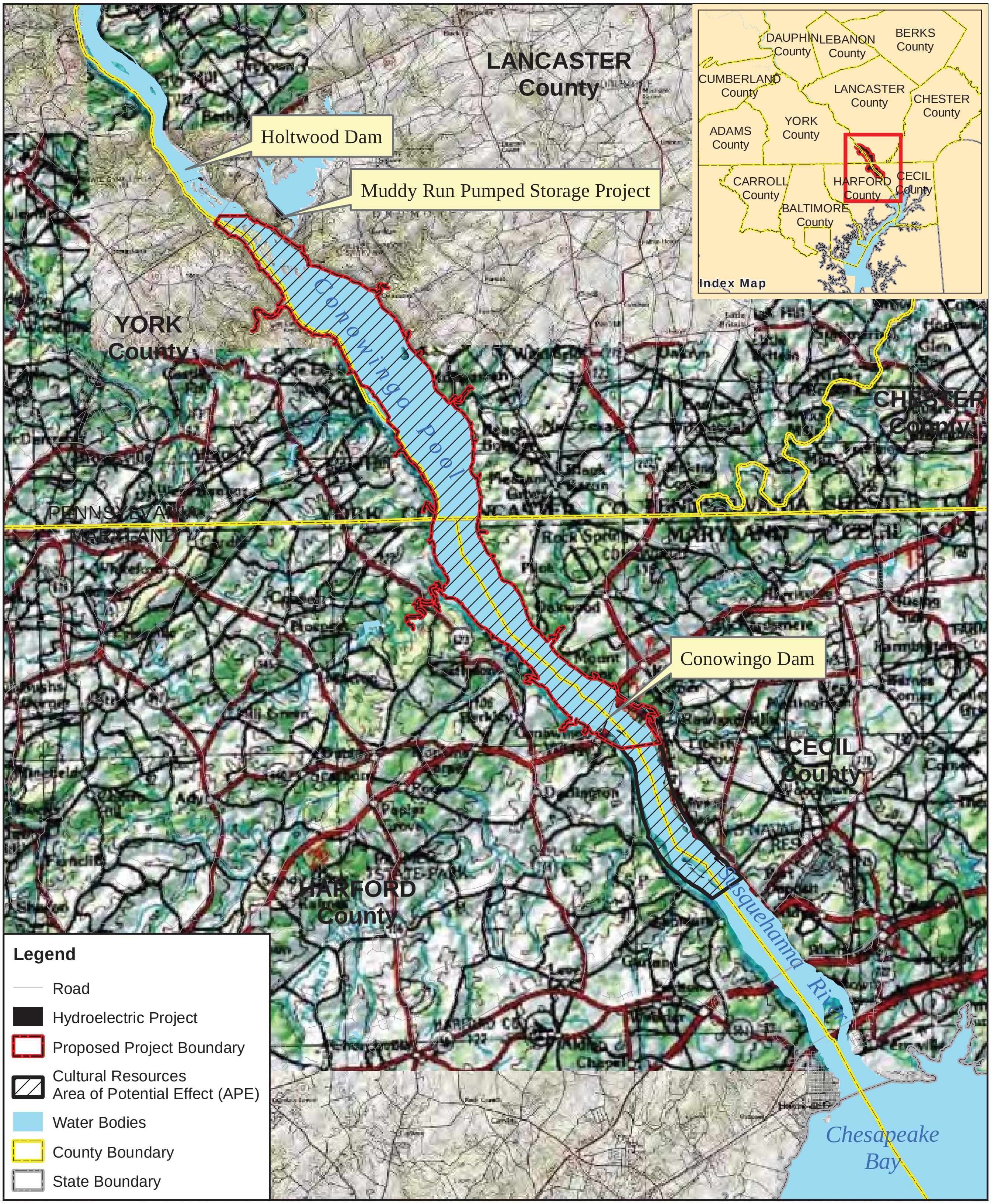
Implementation of the HPMP would assure that the effects of Exelon's Project on cultural resources will be taken into account. The HPMP requires management measure implementation prior to imposing any O&M activities that may affect cultural resources. Exelon anticipates that FERC may execute a Programmatic Agreement with the MHT, the PHMC, and the Council (should it choose to participate), to implement the final Conowingo Project HPMP within 1 year of license issuance, as a condition of any license for the Project.

3.3.8.3 Proposed Environmental Measures

As described above, Exelon's proposed Project includes one measure specifically related to the protection of cultural resources, which is the implementation the HPMP, which is included in Volume 4 of the FLA. At this time, no agencies or other relicensing participants had filed with FERC any recommended measures related to cultural resources for the Project.

3.3.8.4 Unavoidable Adverse Impacts

No unavoidable adverse impacts are expected to historic properties in the Conowingo Hydroelectric Project.



EXELON GENERATION COMPANY, LLC

CONOWINGO HYDROELECTRIC PROJECT
FERC PROJECT NO. 405

Figure 3.3.8.1.1-1:
Conowingo Project
Area of Potential Effects

Path: X:\GISMaps\project_maps\draft_license_application_figures\conowingo\con_cultural_resources_ape.mxd

3.3.9 Aesthetic Resources

3.3.9.1 Affected Environment

The Conowingo Project lands include many areas of high aesthetic value due to their topography, geology, and vegetation. The Project is located on the Lower Susquehanna, a unique area that provides a spectrum of diversified landscapes from steep cliffs to gentle rolling landscapes and open space. The area is generally dominated by agricultural land, as the gentle rolling landscape that surrounds the Project lends itself to numerous small farmsteads.

The Piedmont Province Upland Section gives the Conowingo Pond its unique landform. The rivers and streams in the province carved the rolling topography to form narrow valleys, suitable for the construction of water reservoirs. This erosion of the land created the steep slopes, averaging 300 feet in height above the water which provides the backdrop to the Project area. Stronger rock, more resistant to erosion, helped create the numerous islands that populate the pond. The geologic history is apparent throughout the Conowingo pond, with tributaries displaying glacial erosion of the past in their meanders, chasms, cliffs, and cascades. This history has created a unique vista, with steep slopes marking the transition between the flat narrow shoreline of the pond, and the rolling open space and farmland adjacent to the Project.

The rich vegetation that lines the shoreline throughout the Project creates additionally aesthetic value to the area. Due to the steep slopes and rocky soils that surround the Conowingo Pond, the area has remained relatively untouched and in its native state. This lack of development has allowed the region to facilitate the growth of a wide variety of native plant communities, many of which are considered rare or threatened in the wild. The majority of the shoreline is heavily wooded, with primary natural plant communities of rich hemlock-mesic hardwood forest, dry oak-mixed hardwood or red oak-mixed hardwood forest, and Virginia pine-mixed hardwood forest. Several unusual and unique plants are nestled in these wooded areas, including Snow Trillium, Goldenseal, rhododendron, hemlock, mountain laurel, Umbrella Trees, and the American Holly. The islands of the Conowingo Pond also possess an interesting aesthetic quality, with a unique depiction of plants in several stages of growth. Larger islands harbor stands of virgin forest and mature secondary plant communities, while the smaller islands exhibit early stages of plant succession.

Perhaps the most impressive of the numerous aesthetic qualities in the Project area are the diverse wildlife populations within it. The bald eagle, which maintains a strong population in the Conowingo Pond and Lower Susquehanna River, can be enjoyed by even novice bird watchers. Lying along part of the Atlantic

Flyway, numerous migratory bird species use the Conowingo Pond and Lower Susquehanna River as a resting spot. According to the Harford Bird Club, a chapter of the Maryland Ornithological Society, a total of 244 species of birds has been observed by local birders from the mouth of Deer Creek below the Conowingo Dam to Glen Cove Marina above the dam. Some species known to nest in the area include Osprey, black vulture, white-eyed vireo, scarlet tanager, prairie warbler, screech owl, herring gull, and red-tailed hawk. In addition to the avian wildlife, the forested areas provide habitats for mammals such as red and grey fox, raccoon, red and grey squirrel, chipmunk, opossum, and white-tailed deer. Other mammals observed in the Project area include river otter and mink. The wide variety of wildlife creates high value aesthetic quality for those wishing to observe nature.

There are numerous viewsheds offered to observe the aesthetic beauty of the Lower Susquehanna River, many of which lie within, or adjacent to the Project boundary. From the river itself, the lower section of the Susquehanna River Water Trail allows boaters to enjoy the scenic wonders offered. Twenty-one interpretive panels at access points help boaters navigate the water trail from Harrisburg to the Mason-Dixon line. There are also a variety of hiking trails in the Project area, most notably the Conestoga Trail system and the Mason-Dixon Trail. The trails offer various views throughout the Project area including historic sites such as Lock 12, Lock 13, and Lock 15, as well as panoramic views of the Conowingo Pond and its wildlife.

Located immediately adjacent to Project lands, Susquehannock State Park is a 224-acre park on a wooded plateau overlooking the Susquehanna River in Drumore, Pennsylvania. Among the park's primary attractions are river overlooks, which afford panoramic views of the lower reaches of the Susquehanna River. Hawk Point, the park's main overlook, provides a spectacular view of the upper reaches of Conowingo Pond (Figure 4.9.2-1). The Conowingo Islands are in view from Hawk Point including Mt. Johnson Island, the world's first bald eagle sanctuary. Also located at the park is Wissler's Run Overlook, which gives an excellent view of the original rocky nature of the Susquehanna River's natural riverbed with the well-known Norman Wood Bridge (Route 372) in the background.

Within the Conowingo Pond, there are over 60 islands compromised of the erosional remnant of the native bedrock, unlike other islands further upstream, which are primarily alluvial in nature. These islands are some of the most scenic in the region. In addition, the Ferncliff Wildflower and Wildlife Preserve, located in Drumore, Pennsylvania, is one of only about 600 National Natural Landmark sites that encourage the conservation of outstanding examples of our country's natural history. The preserve is a scenic wooded ravine that is a favorite spot for bald eagles that nest nearby and often are seen soaring above or hunting for fish. Barnes Run, which flows through the preserve, is a direct tributary to Conowingo Pond. Ferncliff also features an old-growth forest and contains many spring wildflowers.

Further downstream lies Fishermans Park/Shures Landing. From this site, the public is offered a view of the powerhouse and dam structures. The impressive structures offer photo opportunities for both amateur and professional photographers. During times when the river flow exceeds the Projects capacity (>86,000 cfs), water can be seen flowing over the spillway, offering a picturesque scene. The primary attraction for photographers, however, is the avian wildlife which is easily viewed from the platform at the site. The site is considered one of the best and most reliable places to view and photograph bald eagles. The hydroelectric plant provides excellent food source for the many birds that gather, increasing the aesthetic value of the area. Project structures that affect the aesthetics of the area are primarily the powerhouse, Conowingo Dam, and the spillway. These developed structures are located beneath U.S. Route 1 and are of concrete construction. The views created by the dam and powerhouse can be considered scenic, and can be observed from Fisherman's Park/Shure's Landing. The impressive structures are firmly embedded in the landscape and do not detract from the natural feel of the area. Those visiting the area are offered many photo opportunities, as numerous species of bird use the area as a feeding ground due to the power generating facility. For this reason, the Project can be deemed to increase the aesthetic value.

3.3.9.2 Environmental Effects

As there are no proposed changes to Project operations, aesthetics are not expected to be affected. The prominent Project features which already exist, including the powerhouse, dam, and spillway, have become embedded in the visual environment surrounding them. As a result, the Project does not detract from the existing landscape. In many facets, the Project adds to the aesthetics of the area, creating cascading water, a visually appealing building with large ornamental windows, and creating a feeding ground for numerous bird species.

3.3.9.3 Proposed Environmental Measures

Exelon is not proposing any measures to enhance aesthetic resources. As there are no proposed changes to Project operations, aesthetics are not expected to be affected due to water level changes or increased erosion. In addition, the results from the Conowingo RSP 3.26-Recreation Inventory and Needs Assessment did not indicate that the use and enjoyment of the recreation sites examined in this study are adversely affected by any visual and/or audio impacts.

3.3.9.4 Unavoidable Adverse Impacts

Exelon is not proposing any operational changes, so no unavoidable adverse impacts are expected.

3.3.10 Socioeconomic Conditions

3.3.10.1 Affected Environment

3.3.10.1.1 *Description of the Project Area*

The Project is located in Lancaster and York counties, Pennsylvania as well as Cecil and Harford counties, Maryland. The Conowingo Dam and powerhouse is located in Maryland connecting Cecil and Harford counties, as is the lowermost six miles of the Project reservoir, Conowingo Pond. The remaining upper eight miles of Conowingo Pond are located in Pennsylvania, within York and Lancaster counties.

Lancaster County, Pennsylvania

Lancaster County is located in southeastern Pennsylvania, encompassing 984 square miles. The Susquehanna River, which is located entirely within Lancaster County, serves as the western border of the County. Dauphin and Lebanon counties lie north of Lancaster County, while Berks and Chester counties lie east of Lancaster County. The City of Lancaster serves as the county seat. The Project Area is located in southern Lancaster County, about 30 miles south of the City of Lancaster, and 35 miles northeast of the City of Baltimore, MD. Although the Project is located in a rural area of the County, it is within 50 miles of two relatively large Metropolitan Statistical Area (MSA) populations. The Philadelphia MSA (located northeast of the Project) has a population of 5.9 million people, and the Washington DC MSA (located southwest of the Project) has a population of 5.5 million people. (2010 Census)

Southern Lancaster County is largely rural in nature, and is dominated by agricultural land uses, which has shaped the history of the county. Today, Lancaster County is dependent upon agriculture (approximately 75% of the county contains lands within agricultural production) as well as manufacturing and tourism. Lancaster County is home to a concentrated population of Old Order Amish and Mennonites, who are well known for their distinctive religious beliefs and practices. Their religious practices to not permit their utilization of many modern conveniences and as such these religious groups are distinctive in their lifestyle.

York County, Pennsylvania

York County is located in southeastern Pennsylvania, encompassing 910 square miles. It is bounded by the Susquehanna River to the east, while the southern boundary of the county comprises both the Pennsylvania Commonwealth boundary and the Mason Dixon Line. Adams County lies west of York County, while Cumberland County lies north of York County. The City of York serves as the county seat. The Project Area is located in southern Lancaster County, about 30 miles south of the City of Lancaster, and 35 miles northeast of the City of Baltimore, MD. The Project transmission line is not associated with any public access or recreational facilities.

The Project is located within southern York County, which is largely rural in nature and dominated by agricultural land uses. Today, while agriculture is an important industry within the County and a predominant land use in the southern portion of the county, it is a relatively small employer, providing only 500 out of the 169,000 jobs in York County. The industries providing the largest amount of jobs in the county include manufacturing (34,000 jobs; 20% of the total jobs in York County) followed by health care (22,000 jobs; 13% of the total jobs in York County) (EDC 2009).

Cecil County, Maryland

Cecil County is located in northeastern Maryland, encompassing 350 square miles. It is bounded by the Susquehanna River and Chesapeake Bay to the west, while the Sassafras River comprises the southern boundary of the county. The boundary with the State of Delaware serves as the eastern boundary of Cecil County. The northern boundary of the County serves as the both the Pennsylvania Commonwealth boundary and the Mason Dixon Line. Elkton serves as the county seat. The Project Area is located in northern Cecil County, about 32 miles south of the City of Lancaster, PA, and 35 miles northeast of the City of Baltimore, MD. The Conowingo Dam and the lower six miles of the Project's headpond (known as Conowingo Pond) are located within Cecil County, as is the small portion of the Susquehanna River downstream of the dam.

In Maryland, the County serves as the entity which provides local governance. There are eight incorporated municipalities in Cecil County, none of which are located within the Project boundary. Also, no census-designated places or unincorporated communities are located within the Project boundary. Northern Cecil County is largely rural in nature, and contains substantial areas of agricultural land uses. Today, while agriculture is a predominant land use in the northern portion of the county, it is a relatively small employer, providing less than three percent of the 22,000 jobs in Cecil County (MD Dept.

of Labor). According to the Cecil County Strategic Plan, the economic conditions within the County reflect a rural and blue collar nature with a much larger percentage of employment (more than double) within the manufacturing sector compared to the state as a whole. By contrast, the state average for the number of jobs in professional services or finances is more than double that found in Cecil County (Cecil County Strategic Plan 2007). The industries providing the largest percentage of jobs in the county include government and trade (21 and 20% of the total jobs, respectively) while the manufacturing sector represents the third largest employer, at 15% of the total jobs in Cecil County (Cecil County Strategic Plan2007).

Harford County, Maryland

Harford County is located in north central Maryland, encompassing 526 square miles. It is bounded by the Susquehanna River and Chesapeake Bay to the east and south, while Baltimore County lies to the west of the county. The northern boundary of the County serves as both the Pennsylvania Commonwealth boundary and the Mason Dixon Line. Bel Air serves as the county seat. The Project Area is located in northern Harford County, about 32 miles south of the City of Lancaster, PA, and 35 miles northeast of the City of Baltimore, MD. The Conowingo Dam and the lower six miles of the Project's headpond (known as Conowingo Pond) are located within Harford County, as is the small portion of the Susquehanna River downstream of the dam. Although the Project is located in a rural area of the County, it is within 50 miles of two relatively large Metropolitan Statistical Area (MSA) populations. The Philadelphia MSA (located northeast of the Project) has a population of 5.9 million people, and the Washington DC MSA (located southwest of the Project) has a population of 5.5 million people. (U.S. Census 2010).

In Maryland, the County serves as the entity which provides local governance. There are two incorporated municipalities in Cecil County, Aberdeen and Havre de Grace. The southern end of the Project boundary is located within Havre de Grasse. There are no census-designated places or unincorporated communities located within the Project boundary. Northern Cecil County is largely rural in nature, and contains substantial areas of agricultural land uses. The I-95 transportation corridor and the cities of Havre De Grace and Aberdeen contribute to the presence of more developed lands and commercial land uses in the southern part of the County.

3.3.10.1.2 *Population, Income, and Workforce*

Population – Pennsylvania

Population data for 1980 through 2020, and the change in population from 1990 to 2020, are provided in Tables 3.10.1.1-1 and 3.10.1.1-2, respectively. The population of both Lancaster and York counties has grown substantially between 1980 and 1990, and showed continued moderate growth between 1990 and 2010. The data also shows that while there has been significant growth in each of the municipalities where the Project is located, the significant growth has been occurring outside the municipalities. The majority of the growth for both Lancaster and York counties has occurred within and adjacent to the more urban areas of the counties, including the cities of Lancaster and York, which serve as their respective county seats.

TABLE 3.3.10.1.2-1: POPULATION OF PENNSYLVANIA, COUNTIES, AND COMMUNITIES, 1980- 2020.

	1980 Census	1990 Census	2000 Census	2010 Census	2014 Projection*	2020 Projection
Pennsylvania Commonwealth	**11,863,895**	**11,881,643**	**12,881,643**	**12,702,379**		**12,787,354**
Lancaster County	**362,346**	**422,822**	**470,658**	**519,445**	**524,597**	**N/A**
Martic Township	3,286	4,362	4,990	5,190	4,968	N/A
Drumore Township	1,682	2,114	2,243	2,560	2,271	N/A
York County	**312,963**	**339,547**	**381,751**	**434,972**	N/A	**450,887**
Peach Bottom Township	2,692	3,444	4,412	4,813	N/A	N/A

Source: EDC 2012, U.S. Census Bureau 2010, 2000, 1990, 1980.

*Projections for 2014 populations presented by EDC were prepared for publication in 2009, and at the municipal level the growth projections are proven to be inconsistent with the actual counts from the 2010 Census. While clearly incorrect, they have been included for demonstrative purposes.

TABLE 3.3.10.1.2-2: PENNSYLVANIA, LANCASTER AND YORK COUNTIES AND COMMUNITIES POPULATION CHANGE, 1980-2020.

	Percent Change 1980-1990	Percent Change 1990-2000	Percent Change 2000-2010	Percent Change Projection 2010-2014/2020
Pennsylvania Commonwealth	**0.15%**	**8.4%**	**-1.6%**	**0.6% (2020)**
Lancaster County	**17%**	**11%**	**10%**	**1% (2014)**
Martic Township	33%	14%	4%	-4% (2014)
Drumore Township	26%	6%	14%	-11% (2014)
York County	**8%**	**12%**	**14%**	**4% (2020)**
Peach Bottom Township	28%	28%	9%	N/A

Source: EDC 2012, U.S. Census Bureau 2010, 2000, 1990, 1980.

Population – Maryland

Population data for 1980 through 2020, and the change in population from 1990 to 2020, are provided in Tables 3.3.10.1.2-3 and 3.3.10.1.2-4, respectively. The population of both Cecil and Harford counties has exhibited sustained growth between 1980 and 2010. The growth in these two counties was substantially higher than growth levels at the state over the same time period. This growth is a likely a reflection of the influence the larger surrounding SMA's have had on these two communities as the adjoining population centers have grown.

TABLE 3.3.10.1.2-3: POPULATION OF MARYLAND, COUNTIES, AND COMMUNITIES, 1980- 2020.

	1980 Census	1990 Census	2000 Census	2010 Census	2020 Projection
State of Maryland	**4,216,975**	**4,780,753**	**5,296,486**	**5,773,552**	**6,339,290**
Cecil County	**60,430**	**71,347**	**85,957**	**101,108**	**125,100**
Harford County	**145,930**	**182,132**	**218,590**	**246,433**	**268,500**
City of Havre De Grace	8,763	8,952	11,331	12,952	N/A

Source: U.S. Census Bureau 2010, 2000, 1990, 1980.

TABLE 3.3.10.1.2-4: MARYLAND, CECIL AND HARFORD COUNTIES AND COMMUNITIES POPULATION CHANGE, 1980-2020.

	Percent Change 1980-1990	Percent Change 1990-2000	Percent Change 2000- 2010	Percent Change Projection 2010-2020
State of Maryland	**13%**	**10%**	**9%**	**10%**
Cecil County	**18%**	**20%**	**17%**	**24%**
Harford County	**25%**	**20%**	**13%**	**9%**
City of Havre De Grace	2%	26%	14%	N/A

Source: EDC 2012, U.S. Census Bureau 2010, 2000, 1990, 1980.

Income – Pennsylvania

Personal income, a primary measure of personal buying power, is a key indicator in assessing community economic health. Personal income can be analyzed by a number of different indicators. For this assessment, per capita income and median household income are provided and discussed.

The per capita income for the Commonwealth of Pennsylvania, Lancaster and York counties are provided in Table 3.3.10.1.2-3, while median household incomes are provided in Table 3.3.10.1.2.4.

TABLE 3.3.10.1.2-3: PER CAPITA INCOME FOR PENNSYLVANIA, LANCASTER AND YORK COUNTY.

	1990	2000	2010	Percent Change
Pennsylvania Commonwealth	***14,068***	***20,880***	***$27,004***	***92%***
Lancaster County	14,235	20,398	24,871	75%
York County	14,544	21,068	26,702	84%

Source: U.S. Census Bureau 2010, 2000, 1990.

TABLE 3.3.10.1.2-4: MEDIAN HOUSEHOLD INCOME FOR PENNSYLVANIA, LANCASTER AND YORK COUNTY.

	1990	2000	2010	Percent Change
Pennsylvania Commonwealth	***$29,069***	***$40,106***	***$50,289***	***73%***
Lancaster County	33,255	45,507	65,390	97%
York County	32,605	45,286	67,892	108%

Source: U.S. Census Bureau 2010, 2000, 1990.

From 1990 through 2010, both per capita income and median household income rose substantially, with the minimum increase of 73% median household income for the Commonwealth of Pennsylvania. The trend of note here is that while the Commonwealth showed a greater increase in per capita income in comparison to the counties, the counties showed a greater increase in median household income relative to the Commonwealth over the same time period.

Income – Maryland

The per capita income for the State of Maryland, Cecil and Harford counties are provided in Table 3.3.10.1.2-5, while median household incomes are provided in Table 3.3.10.1.2.6.

TABLE 3.3.10.1.2-5: PER CAPITA INCOME FOR MARYLAND, CECIL AND HARFORD COUNTY

	1990	2000	2010	Percent Change
State of Maryland	***$17,730***	***$25,614***	***$34,469***	***94%***
Cecil County	$14,314	$21,384	$28,358	98%
Harford County	$16,612	$24,232	$33,372	100%

Source: U.S. Census Bureau 2010, 2000, 1990.

TABLE 3.3.10.1.2-6: MEDIAN HOUSEHOLD INCOME FOR MARYLAND, CECIL AND HARFORD COUNTY

	1990	2000	2010	Percent Change
State of Maryland	***$39,386***	***$52,868***	***$70,017***	***77%***
Cecil County	$36,019	$50,510	$64,377	78%
Harford County	$41,680	$57,234	$76,808	84%

Source: U.S. Census Bureau 2010, 2000, 1990.

From 1990 through 2010, both per capita income and median household income rose substantially, with the minimum increase of these metrics is a 77% median household income for the State of Maryland. The trend of note here is that while the state and the counties showed relatively consistent increases in both per capita and median household incomes, Harford County slightly outperformed both Cecil County and the entire state.

Workforce – Pennsylvania

Workforce statistics, most commonly analyzed in terms of unemployment rates, are a prime indicator of economic conditions. Civilian workforce and unemployment data for Pennsylvania, Lancaster and York County are provided in Table 3.3.10.1.2-5. Workforce statistics are consistent with larger trends, exhibiting growth in both total labor and employed from 1990 to 2000, however the economic downturn starting in 2007 has resulted in substantially higher levels of unemployment, and for the state a reduction in the number of people employed from 2010 compared to 2000. Lancaster County has shown a smaller growth in unemployment in the 2010 census compared to York County and all of Pennsylvania.

TABLE 3.3.10.1.2-5: PENNSYLVANIA, LANCASTER AND YORK COUNTY CIVILIAN LABOR FORCE DATA.

		Pennsylvania	Lancaster County	York County
Total Civilian Labor	1990	9,392,816	321,751	266,104
	2000	9,693,040	358,317	298,226
	2010	10,273,564	406,103	345,148
Employed	1990	5,434,532	215,292	176,908
	2000	6,000,512	235,686	195,926
	2010	5,842,790	249,828	215,887
Unemployed (number/percent)	1990	334,795/3.5	6,921/3.2	7,045/3.9
	2000	339,386/3.5	7,329/2.0	7,301/2.4
	2010	620,700/9.6	21,349/7.9	23,289/9.7

Source: U.S. Census Bureau 2010, 2000, 1990.

Workforce – Maryland

Civilian workforce and unemployment data for Maryland, Cecil and Harford County are provided in Table 3.3.10.1.2-6. Workforce statistics are consistent with larger trends, exhibiting growth in both total labor and employed from 1990 to 2010, however the economic downturn starting in 2007 has resulted in substantially higher levels of unemployment even as the total workforce was larger in 2010 compared to 2000 for both the state and the counties. While the counties and state exhibit the same overall trend for workforce and employment levels, Harford County has a slightly lower rate of unemployment in 2010 than Cecil County or Maryland.

TABLE 3.3.10.1.2-6: MARYLAND, LANCASTER AND YORK COUNTY CIVILIAN LABOR FORCE DATA.

		Maryland	Cecil County	Harford County
Total Civilian Labor	1990	3,736,830	54,369	138,391
	2000	4,085,942	64,715	164,126
	2010	4,545,628	78,585	189,842
Employed	1990	2,481,342	35,227	93,500
	2000	2,608,457	42,953	111,792
	2010	2,917,137	48,875	125,969
Unemployed (number/percent)	1990	111,536/2.4	875/2.4	3,265/3.4
	2000	128,902/4.7	1,834/4.1	3,522/3.1
	2010	232,910/7.4	3,851/7.3	9,153/6.8

Source: U.S. Census Bureau 2010, 2000, 1990.

Employment by Industry for Lancaster and York County, Pennsylvania

Employment by industry sector for Lancaster County has been compiled by the Economic Development Company of Lancaster County, PA. The two industries with the largest number of employees within the County are the Service industry (36.9%) (including healthcare) and Manufacturing (14%). The most notable element of the employment statistics for Lancaster County is that while Agriculture is very important to the image of the County, the total number of employees working in Agriculture is less than one percent of all industries in the County.

In York County, employment by industry sector has been compiled by the Economic Development Company of York County, PA. The two industries with the largest number of employees within the County are the Service industry (43%) (Including healthcare) and Manufacturing (20%).

Employment by Industry for Cecil and Harford County, Maryland

In Cecil County, while agriculture is a predominant land use in the northern portion of the county, it is a relatively small employer, providing less than three percent of the 22,000 jobs in the county (MD Dept. of

Labor 2011). According to the Cecil County Strategic Plan, the economic conditions within the county reflect a rural and blue collar nature with a much larger percentage of employment (more than double) within the manufacturing sector compared to the state as a whole. By contrast, the state average for the number of jobs in professional services or finances is more than double that found in Cecil County (Cecil County Strategic Plan 2007). The industries providing the largest percentage of jobs in the county include government and trade (21 and 20% of the total jobs, respectively) while the manufacturing sector represents the third largest employer, at 15% of the total jobs in Cecil County (Cecil County Strategic Plan 2007).

In Harford County, while agriculture also is a predominant land use in the northeastern portion of the county, it similarly remains a relatively small employer, providing well below one percent of the 82,000 jobs in Cecil County (MD Dept. of Labor 2011). The I-95 transportation corridor and the cities of Havre De Grace and Aberdeen contribute to the presence of more developed lands in the southern part of the County. According to the Harford County Master Plan, the top three occupations within the County are Professional Specialty, Sales, and Administrative Support. The presence of the Aberdeen Proving Grounds military base has had a significant influence on employment within the County. Even though the base is now closed, government sector jobs in 2010 continue to comprise 25% of the total jobs in the County (MD Dept. of Labor). Consistent with the state as a whole, in Harford County, the manufacturing sector represents approximately 5% of the total jobs in the county (MD Dept. of Labor 2011).

3.3.10.1.3 *Regional Benefits of the Project*

The Conowingo Project has a positive effect on the local economies in Cecil, Harford, Lancaster and York County. Project benefits include: (1) providing low-cost renewable power for citizens and industries, (2) paying local and state taxes, and (3) employment related to the operation and maintenance of the Conowingo Project.

Power Benefits

The Conowingo Project provides clean, efficient, reliable, and cost-effective hydroelectric power. The Project is licensed for 573 MW. This amount of generating capacity is capable of providing the equivalent of approximately 430,000 local households with electricity each year, assuming one MW of power services an average of 750 households per year.

Taxes

Exelon is subject to a variety of state, county, and local taxes. In 2011, these taxes totaled approximately $10.5 million. Taxes paid by Exelon positively affect the public as state taxes are deposited into general funds, which are directed, in part, back to the county and local governments.

Employment Benefits

The Conowingo Project is operated and maintained by 56 full-time employees. Exelon employees positively affect the local and regional economy by consuming goods and services, and paying taxes.

3.3.10.2 Environmental Effects

Exelon proposes to operate the Project in substantially the same manner in which it has been historically operated, continuing to supply low cast electricity and jobs, which benefits the socioeconomic health of the region.

All four counties within which the Project is located are comprised of both urban areas as well as small rural communities. The counties have experienced modest to substantial growth rate over the past 30 years, which is reflected in the growth rates for both per capita income and median household incomes in all four counties and again approximately equal unemployment rates with the Commonwealth.

The regional economy is predominantly service industry-based, with the manufacturing industry is a substantial employer in Lancaster and Cecil counties. In Lancaster County, the service and retail trade industries are present largely as a direct result of the tourist-based economy, which contributes substantially to the regional economy of this natural resource rich region. County demographics for both Pennsylvania and Maryland indicate that the communities in the vicinity of the Project are relatively similar to other towns in neighboring counties, and have not been adversely affected by the Project in terms of population, income, or employment opportunities. Importantly, the operation and maintenance of the Project coupled with taxes paid and energy generated have contributed to the economic and social benefits of the area in the immediate vicinity of the Conowingo Project. The Project employs approximately 56 full-time staff who resides in the Project area, and provides economic benefits (e.g., taxes and services) to the area.

Continued maintenance of the Project's facilities, including recreation facilities, would result in some construction-related jobs, however, the labor force required would be very small (i.e., probably less than 20 people) and would only be needed for a short time.

3.3.10.3 Proposed Measures

Because the proposed Project would continue to have a beneficial effect on socio-economic resources, Exelon does not propose any new measures related to socio-economic resources. Exelon proposes to continue operating the Conowingo Project under the existing operating regime, and thus continue to provide the existing local and regional socioeconomic benefits.

3.3.10.4 Unavoidable Adverse Impacts

The Conowingo Project has no known unavoidable adverse effects on socioeconomic resources.

3.4 No-Action Alternative

Under the No-action Alternative, the existing Project would continue to operate as it has historically operated as described in Section 2.1. The measures in the current licenses as described in Section 2.1 would continue - none of Exelon's proposed measures or those that may be proposed by others would be required and any environmental or recreation benefits from such recommendations would not occur. The Project would continue to be of importance to recreation, generation of renewable energy, and minimization of atmospheric pollutants.

SECTION 4.0 DEVELOPMENTAL ANALYSIS

This section analyzes the cost of continued operation and maintenance of the Project under the No Action and Proposed Alternatives. Costs are associated with the operation and maintenance of hydropower facilities, as well as the costs of providing the proposed PM&E measures. The economic analysis has been conducted using a 46-year time period.

4.1 Power and Economic Benefits of the Project

4.1.1 Economic Assumptions

Under its approach to evaluating the economics of hydropower projects as articulated in Mead Corporation, Publishing Paper Division (72 FERC §61,027, July 13, 1995), the Commission employs an analysis that uses current costs to compare the costs of a project and likely alternative power with no consideration for potential future inflation, escalation, or deflation beyond the license issuance date. The Commission's economic analysis provides a general estimate of the potential power benefits and costs of a project and reasonable alternatives to project-generated power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. For the economic analysis of the Project, assumptions, values, and sources are shown in Table 4.1.1-1.

TABLE 4.1.1-1: ASSUMPTIONS FOR ECONOMIC ANALYSIS

Assumption	Value	Source of Information
Power Value (2011 value) [33]	$43.73	Exelon
Average Annual Generation	1,669,000	Exelon, Oasis Model
Period of Analysis	46 years	---
Net Investment (book value) [35]	$263,430,000	Exelon
Capacity Value[36] (2011 value) [37]	$136.6 per MW-day	Exelon
Ancillary Services (2011 value)	$115,000	Exelon

To estimate generation under Exelon's Proposed Alternative as described in Exhibit E-Section 2.2, as well as under various alternatives including the No Action Alternative, Exelon developed an operations model of the Lower Susquehanna River using the OASIS modeling software. The model simulates the

[33] This is a realized 2011 power value, which is calculated as annual revenue divided by annual generation.
[34] Average annual generation from Exelon's OASIS operations model based on hydrology from 1930-2007.
[35] Does not include construction projects currently in progress.
[36] The capacity associated with Conowingo is 566.14 MW.
[37] Capacity value is from the clearing price from PJM and based on the 2011 planning year.

operation of the Safe Harbor, Holtwood, Muddy Run, and Conowingo Projects utilizing inflow hydrology and operating rules. See Exhibit B for a description of the operations model.

4.1.2 Annual Power Value

Table 4.1.2-1 shows the total valuation of power for the No Action and Proposed Alternatives. For both scenarios, this assumes an average annual generation of 1,669,000 megawatt hours (MWh). The annual market value of the energy and capacity is $101,327,000, or $60.71 per MWh, for both the No Action and Proposed Alternatives.

TABLE 4.1.2-1: VALUATION OF THE ANNUAL OUTPUT OF THE CONOWINGO PROJECT[38]

	No Action	Proposed
Energy at $43.73 (for 1,669,000 MWh)	$72,985,000	$72,985,000
UCAP at $136.60 per MW-day (566.14 MW)[39]	$28,227,000	$28,227,000
Ancillary Services	$115,000	$115,000
Total Value (Energy + Ancillary Services + UCAP)	$101,327,000	$101,327,000
Total value per MWh	$60.71	$60.71

4.1.3 Project Costs under the No-Action Alternative

The total annualized current costs for the Project No-Action Alternative is $85,252,000 (Table 4.1.3-1).

TABLE 4.1.3-1. SUMMARY OF CURRENT ANNUAL COSTS AND FUTURE COSTS UNDER THE NO ACTION ALTERNATIVE.

Item	Annual Cost
Capital Costs	$15,974,000
Local, State and Federal Taxes[40]	$47,192,000
Annual Depreciation and Amoritization	$6,101,000
Operation and Maintenance Expenses[42]	$15,985,000
Total	**$85,252,000**

[38] Annual output calculations are based on 2011 realized power, capacity, and ancillary services values.
[39] Capacity value for 2011 is approximately $28.227 million (566.1 MW * $136.60/MW-day * 365days/yr.)
[40] As described in Exhibit D, Section 4.2.
[41] As described in Exhibit D, Section 4.1.
[42] As described in Exhibit D, Section 4.2.

4.1.4 Project Costs under the Proposed Alternative

Exelon proposes several environmental measures (Table 4.1.4-1) for inclusion in the new license for the Project. The measures would add capital costs, and increase annual operations and maintenance costs for the Project.

TABLE 4.1.4-1: SUMMARY OF ANNUALIZED COSTS (2014 DOLLARS) FOR ENVIRONMENTAL AND RECREATION MEASURES

PME Measure	Total Capital Cost over 50 Years (2014 dollars)	Total O&M Cost over 50 Years (2014 dollars)	Average Annual Cost over 50 Years (2014 dollars)
Fish Lift Maintenance Plan	$0	$9,200,000	$200,000
Upstream American Eel Passage	$718,000	$28,954,000	$645,000
Downstream American Eel Passage	$227,000	$13,165,000	$291,000
Bald Eagle Management	$0	$123,000	$3,000
Historic Properties	$95,000	$973,000	$23,000
Recreation Management	$4,373,000	$2,102,000	$141,000
Shoreline Management	TBD	TBD	TBD
Sediment Management Plan[43]	$0	$438,000	$10,000
Cost to Prepare Application for a New License[44]	$14,989,000	$0	$326,000
Total	**$20,402,000**	**$54,955,000**	**$1,639,000**

4.2 Comparision of Alternatives

Table 4.2-1 compares the power value, annual costs, and net benefits of Exelon's No Action and Proposed Alternative for the Project.

[43] Cost for sediment removal activites related to Project recreation facilities will be determined.
[44] As described in Exhibit D, Section 7.0.

4.2.1 No Action Alternative

Under the No Action Alternative, the Project would continue to operate as it does now. The Project generates an average of 1,669,000 MWh of electricity annually. The average annual power value of the Project under the no-action alternative would be $101,327,000 ($60.71/MWh). The average annual cost of producing this power including depreciation, operation and maintenance costs, and taxes would be about $85,252,000 ($51.08/MWh). The resulting annual net benefit of the Project would be about $16,075,000 ($9.63/MWh).

4.2.2 Proposed Alternative

Under the Proposed Alternative, the average annual generation would remain 1,669,000 MWh. The Project would have an average annual power value of $101,327,000 ($60.71/MWh), an average production cost of $86,889,000 ($52.06/MWh), and an annual net benefit of about $14,438,000 ($8.65/MWh).

TABLE 4.2-1: COMPARISON OF THE POWER VALUE, ANNUAL COSTS, AND NET BENEFITS OF THE NO ACTION AND PROPOSED ALTERNATIVES.

	No Action	Proposed
Annual Generation (MWh)	1,669,000	1,669,000
Annual Power value: Annual		
$ per year	$101,327,000	$101,327,000
$/MWh	$60.71	$60.71
Annual Costs		
$ per year	$85,252,000	$86,889,000
$/MWh	$51.08	$52.06
Annual Net Benefits		
$ per year	$16,075,000	$14,438,000
$/MWh	$9.63	$8.65

SECTION 5.0 CONCLUSIONS

5.1 Comparison of Alternatives

This section compares the developmental and non-developmental effects of Exelon's proposed Project and the No-Action Alternative.

5.2 Comparison Development and Recommended Alternative

Sections 4(e) and 10(a) of the FPA require the Commission to give equal consideration to all uses of the waterway on which a project is located. When FERC reviews a hydropower project, FERC considers the water quality, fish and wildlife, recreational, and other non-developmental values of the involved waterway equally with its electric energy and other developmental values. Accordingly, any license issued shall be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses.

5.3 Unavoidable Adverse Effects

Exelon has performed numerous studies for the relicensing of the Conowingo Project. These studies have identified that with the continued operation of the Conowingo Project, the following unavoidable adverse effects will occur.

- Minor erosion and sedimentation will continue to occur as a result of the minor fluctuations of the Conowingo Pond.
- An unavoidable impact to aquatic resources below the Conowingo dam will occur due to the flow alteration associated with the continued operation of the Project.

5.4 Consistency With Comprehensive Plans

Section 10(a)(2)(A) of the FPA requires the Commission to consider the extent to which a project is consistent with Federal and state comprehensive plans for improving, developing, or conserving waterways affected by the project. On April 27, 1988, FERC issued Order No. 481-A revising Order No. 481, issued October 26, 1987, establishing that FERC will give FPA Section 10(a)(2)(A) comprehensive plan status to any Federal or State plan that meet the following three criteria:

- It is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;
- It specifies the standards, the data, and the methodology used to develop the plan; and

- It is filed with FERC.

FERC's Revised List of Comprehensive Plans, dated April 2011, can be found at FERC's eLibrary (http://www.ferc.gov/industries/hydropower/gen-info/licensing/ complan.pdf). As required by 18 CFR § 5.18(b)(5)(ii)(F), this section provides an explanation of how and why the proposed Project would, would not, or should not comply with each of the plans, or in some cases, directs the reader to the appropriate section of the Final License Application (FLA) for an in depth discussion of compliance with the plan. To facilitate FERC's review, the plans are discussed below in the order presented by FERC in its Scoping Document 2 (SD2), as amended, and the full reference for each plan is provided. As of the time the FLA is filed, relevant resource agencies have not made a determination regarding the consistency of the proposed Project with any qualifying comprehensive plans.

- Atlantic States Marine Fisheries Commission. 2003. Fishery Management Report No. 41 of the Atlantic States Marine Fisheries Commission. (Amendment 5 and 6 to the Interstate Fishery Management Plan for Atlantic Striped Bass). January 1995, February 2003.

The Atlantic States Marine Fisheries Commission (ASMFC) 2003 Fishery Management Plan (FMP) for Atlantic Striped Bass was implemented to better manage this species given the popularity of this species to fishermen, the complex nature of its seasonal distribution, and decline in harvest and poor recruitment during the 1970's. Amendment 5 of this FMP established the management program for the newly recovered striped bass stock. Since 1995 five addenda have been developed and implemented to respond to changing circumstances in the fishery. Amendment 6 was developed to address the management complexity as well as a number of other issues that may arise with the continued management of the species.

The Susquehanna River at the Conowingo Project was subject to the intentional introductions of hybrid fishes for recreational angling, including the striped bass. The fish is no longer stocked in Conowingo Pond. The Project is able to provide habitat for the species, and is consistent with this management plan.

- Atlantic States Marine Fisheries Commission. 1998. Amendment 1 to the Interstate fishery management plan for Atlantic sturgeon (Acipenser oxyrhynchus). (Report No. 31) July 1998.

The Atlantic States Marine Fisheries Commission (ASMFC) 1990 Fishery Management Plan (FMP) for Atlantic Sturgeon was implemented to better manage the species throughout its U.S. range. In 1996, the ASMFC decided to amend the plan with the goal of restoring Atlantic sturgeon spawning stocks to population levels which will provide for sustainable fisheries, and ensure viable spawning populations. The objectives of the Amendment are incorporated through the use of specific management measures whose goals are to establish 20 protected year classes of females in each spawning stock; close the fishery for a sufficient time period to reestablish spawning stocks and increase numbers in current spawning stocks; determine the spawning sites and provide protection of spawning habitats for each spawning stock; reduce or eliminate bycatch mortality of Atlantic sturgeon; where feasible, reestablish access to historical spawning habitats for Atlantic sturgeon; and conduct appropriate research as needed, especially to define unit stocks of Atlantic sturgeon.

The Atlantis sturgeon is not known to inhabit Project waters. The Project is consistent with this management plan.

- Atlantic States Marine Fisheries Commission. 2000. Amendment 3 of the Interstate Fishery Management Plan for shad and river herring. February, 2010.

The goal of the Management Plan is to protect, enhance, and restore east coast migratory spawning stocks of American shad, hickory shad, and river herrings in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass. Objectives identified in the plan were to prevent overfishing of American shad stocks by constraining fishing mortality; develop definitions of stock restoration, determine appropriate target morality rates and specify rebuilding schedules for American shad populations within the management unit; maintain existing or more conservative regulations for hickory shad and river herring fisheries until new stock assessments suggest changes are necessary; and promote improvements in degraded or historic alosine habitat throughout the species range.

States were required to submit fishing recovery plans by July 1999 and annual monitoring reports thereafter. Mandatory fishery monitoring programs for American shad in the Susquehanna River identified in the FMP included annual spawning stock survey and representative sampling for biological data; calculation of mortality and/or survival estimates; recovery of any visibly marked animals; juvenile abundance survey; and hatchery evaluation. The Project is consistent with this plan. The FMP recommended monitoring programs for juvenile river herring and hickory shad in the Susquehanna River included weekly seining from July through October and twice weekly lift nets at Holtwood.

The continued operation of the Project will not have a significant impact on the shad and river herring population of the Susquehanna River, and is therefore consistent with this management plan.

- Atlantic States Marine Fisheries Commission. 2000. Addendum II of the Interstate Fishery Management Plan for American eel (Anguilla rostrata). (Report No. 36). October, 2008.

The FMP for the American eel was developed by the ASMFC to protect and restore the species. The goal of the FMP is to conserve and protect the American eel resource to ensure its continued role in the ecosystems while providing the opportunity for its commercial, recreational, scientific, and educational use. The primary objectives are to improve knowledge of eel utilization at all life stages through mandatory reporting of harvest and effort by commercial fishers and dealers, and enhanced recreational fisheries monitoring; increase understanding of factors affecting eel population dynamics and life history through increased research and monitoring; protect and enhance American eel abundance in all watersheds where eel now occur; where practical, restore American eel to those waters where they had historical abundance but may now be absent by providing access to inland waters for glass eel, elvers, and yellow eel and adequate escapement to the ocean for pre-spawning adult eel; investigate the abundance level of eel at the various life stages, necessary to provide adequate forage for natural predators and support ecosystem health and food chain structure.

The continued operation of the Project will not have a significant impact on the eel population of the Susquehanna River, and is therefore consistent with this management plan.

- Maryland Department of Natural Resources. 1984. Maryland rivers study – final report. Annapolis, Maryland. July 1984.

The Maryland Scenic and Wild Rivers Act as amended in 1978 called for the development of a scenic and wild rivers system to protect the water quality and assure the wise use of Maryland's river resources possessing outstanding scenic, fish, wildlife, and other recreation values of present and potential benefit to the citizens of the state. In response to this directive, the Maryland Department of Natural Resources, through its Scenic Rivers Program, initiated the Maryland Rivers Study. The purpose of this effort is to conduct a resource inventory and assess the natural, cultural, and recreational resource values of 25 Maryland rivers to determine which areas qualify for scenic or wild river designation under the provisions of the Maryland Scenic and Wild Rivers Act.

This study has been accomplished by identifying, describing, and comparatively evaluating important river-related resource values.

The Susquehanna River is not designated as a scenic or wild river under the Maryland Scenic and Wild Rivers Act. The Project is consistent with this plan.

- Maryland Department of Planning. 2009. Maryland Land Preservation, Parks & Recreation Plan 2009. Annapolis, Maryland. June 2009.

Maryland has developed land preservation, resource conservation, and recreation programs which are intended to conserve the state's most important rural and natural resource lands and resource-based industries; ensure that multiple outdoor recreational opportunities are available to citizens; and protect natural environments for current and future Marylanders. Maryland's 2009 Land Preservation, Parks, and Recreation Plan examines how well Maryland's programs are preserving those lands and resources and providing recreational opportunities to its citizens. The Plan also analyzes what is likely to occur if development trends and the State's strategies for land preservation, resource conservation, and recreation and parks continue unchanged. Finally, the plan proposes steps to address the challenges indicated by these findings.

This Plan contains no provisions specific to the Conowingo Project. However, the Project is consistent with the goals of the Plan by providing public access and recreational opportunities to the Susquehanna River for residents of the State of Maryland, and is therefore consistent with this management plan.

- National Marine Fisheries Service. 1998. Final Recovery Plan for the shortnose sturgeon (Acipenser brevirostrum). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. December 1998.

The Shortnose Sturgeon Recovery Plan was drafted by a seven-member recovery team comprising staff from Federal, state and private institutions with both fishery research and management backgrounds with assistance of a group of "Technical Advisors" with diverse expertise in sturgeon research and management and species recovery planning. The Recovery Plan consists of four primary sections: 1) an updated synopsis of the biology and distribution of shortnose sturgeon; 2) a description of factors affecting species recovery; 3) an outline of actions needed to recover shortnose sturgeon; and 4) a detailed implementation schedule for completing specific recovery tasks. It is anticipated that the Recovery Plan will be periodically revised by the NMFS or a NMFS-appointed plan implementation team to reflect new scientific findings, reclassification and recovery of individual population segments, and improved understanding of factors affecting population survival.

Consultation with National Marine Fisheries Service staff has indicated that they do not support passing the shortnose sturgeon above the Conowingo Dam. The Project will not impact the recovery plan for the shortnose sturgeon, and is therefore consistent with this management plan.

- National Park Service. The nationwide rivers inventory. Department of the Interior, Washington, D.C. 1993.

The Nationwide Rivers Inventory (NRI) is a listing by the Park Service of more than 2,400 free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be greater than local or regional significance. In addition to these eligibility criteria, river segments are divided into three classifications: Wild, Scenic, and Recreational river areas. Under a 1979 Presidential Directive and related Council on Environmental Quality procedures, all Federal agencies must seek to avoid or mitigate actions that would adversely affect one or more NRI segments.

The Conowingo Project does not alter the current flows or character of any listed river segments to the extent that the Park Service's classifications of the river segments would change, and is therefore consistent with this inventory.

- Pennsylvania Department of Environmental Protection. 2009. Pennsylvania State Water Plan. Harrisburg, Pennsylvania. January 2009.

The Pennsylvania State Water Plan was designed to evaluate and balance the water needs of multiple users and to avoid potential conflicts that may develop between competing water users. The Plan identifies critical water resource planning areas where the demand for water may exceed available supplies. Designation of such an area triggers more intensive planning efforts. There are no designated critical water resource planning areas in or anywhere near the Project.

There is no designated critical water resource planning area in or anywhere near the Project. This current State Water Plan contains no provisions specific to the Conowingo Project.

- Pennsylvania Department of Environmental Protection. 2006. Pennsylvania's recreation plan, 2004-2008. Harrisburg, Pennsylvania.

Pennsylvania's Recreation Plan for 2004-2008, prepared by the Pennsylvania Department of Conservation and Natural Resource was published in April of 2004 in order to provide a vision for the future of recreation in Pennsylvania. The Pennsylvania Recreation Plan serves the following purposes:

■ It serves as the Commonwealth's official policy document for identifying recreational issues, needs, policies, and capital investment priorities.

■ It is a guide for the acquisition, development, rehabilitation, and protection of resources and provision of recreational opportunities and services to the State's citizens and visitors.
■ It provides a framework ensuring the protection of Pennsylvania's highly valued cultural and natural resources, and enhancing existing recreational opportunities within the Commonwealth.

This Plan contains no provisions specific to the Conowingo Project. However, the Project is consistent with the goals of the Plan by providing public access and recreational opportunities to the Susquehanna River for residents of the Commonwealth of Pennsylvania, and is therefore consistent with this management plan.

- Pennsylvania Department of Conservation and Natural Resources. 2010. The Pennsylvania Scenic Rivers Program Scenic Rivers Inventory. http://www.dcnr.state.pa.us/brc/rivers/scenicrivers/ Harrisburg, Pennsylvania.

The Pennsylvania Scenic Rivers Program Scenic Rivers Inventory, prepared by the Pennsylvania Department of Conservation and Natural Resources, does not currently list the Susquehanna River as a State or Federally designated Scenic River.

- Susquehanna River Basin Commission. 2008. Comprehensive plan for management and development of the water resources of the Susquehanna River Basin. Harrisburg, Pennsylvania. December 2008.

The Susquehanna River Basin Commission (SRBC) developed this management plan to provide a framework to manage and develop the basin's water resources and to serve as a guide for all SRBC programs and activities. The plan is focused on six key water resource needs identified as priority management areas which include water supply; water quality; flooding; ecosystems; Chesapeake Bay; and coordination, cooperation, and public information. Within these priority management areas, SRBC identified 12 areas of special interest. Those areas of special interests related to the Conowingo Project include energy production, flood forecast and warning, migratory fish restoration, and water and wastewater infrastructure.

The Conowingo Project is consistent with the management objectives associated with hydropower development on the Susquehanna River, and is therefore consistent with this management plan.

- U.S. Fish and Wildlife Service. 1985. Revised Maryland darter recovery plan. Department of the Interior, Newton Corner, Massachusetts. September 1985.

The U.S. Fish and Wildlife Service's Revised Maryland Darter Recovery Plan was developed to "protect, maintain, and enhance the present population and habitat of the Maryland darter in order to restore a stable and self-sustaining population." Elements of the Recovery Plan includes establishing a Management Group; determining the species requirements and range; protect and maintain the existing population; protect, maintain and enhance the existing habitat; and develop the public and scientific awareness of the need to accomplish the primary objectives of the Recovery Plan.

Surveys for Maryland darter were conducted seasonally from fall 2010 through fall 2011 in the lower Susquehanna River (157 locations), Octararo Creek (12 locations), and Deer Creek (24 locations). No Maryland darters were collected. The study represents the most extensive and intensive sampling effort conducted in the Lower Susquehanna River for Maryland darter and contributes to substantial previous effort.It is, therefore, extremely unlikely that the species still exists in the Project area, so operations will not have any impacts on the species. Therefore, the Project is consistent with this recovery plan.

- U.S. Fish and Wildlife Service. 1989. Chesapeake Bay striped bass management plan. Annapolis, Maryland. December 1989.

The Chesapeake Bay Striped Bass Management Plan was under a strategy of the Living Resources Commitments of 1987 Chesapeake Bay Agreement. The goal of the plan is to enhance and perpetuate the striped bass stock in Chesapeake Bay and its tributaries, and throughout its Atlantic coast range, to generate optimum long-term ecological, social, and economic benefits. The primary objective of the plan is to abide by the ASMFC guidelines and requirements, but a number of other objectives and management problems as well as strategies were identified.

The Susquehanna River at the Conowingo Project was subject to the intentional introductions of hybrid fishes for recreational angling, including the striped bass. The fish is no longer stocked in Conowingo Pond. The Project is able to provide habitat for the species, and is consistent with this management plan.

- U.S. Fish and Wildlife Service. 1989. Chesapeake Bay Alosid (shad and river herring) management plan. Annapolis, Maryland. July 1989.

The Chesapeake Bay Alosid Management Plan has been developed to protect, restore, and enhance baywide shad and river herring stocks to generate the greatest long-term ecological, economic, and social benefits from the resource. The goals of the plan are to maintain a spawning stock at a size which eliminates low reproductive potential as a cause of poor spawning success; promote protection of the resource by maintaining a clear distinction between conservation goals and allocation issues; reduce fishing effort on alosid stocks until they exhibit increased abundance; improve knowledge of alosid stock dynamics to develop more accurate databases and minimize interjurisdictional conflicts; redefine the tributary survey program to improve water quality and habitat accessibility; and continue restocking programs into areas which historically supported natural spawning migrations and to expand existing stock restoration programs to include areas which do not presently support alosids.

The continued operation of the Project will not have a significant impact on the shad and river herring population of the Susquehanna River, and is therefore consistent with this management plan.

- U.S. Fish and Wildlife Service. 1992. Chesapeake Bay American eel fishery management plan. Annapolis, Maryland. December 18, 1992.

The Chesapeake Bay American Eel Fisheries Management Plan was developed as part of the Living Resources Commitments of 1987 Chesapeake Bay Agreement. The goal identified in the plan is to manage the American eel harvest in the Chesapeake Bay and its tributaries so that harvest does not exceed the reproductive capacity of the population to maintain its size from year to year. The objectives of the goal are to promote protection of the resource by maintaining a clear distinction between conservation goals and harvest regulations; restore self-sustaining population of American eels to their historical ranges; implement appropriate monitoring programs necessary for collecting stock assessment data; provide for fair allocation of allowable harvest, consistent with traditional uses, among the various components of the fishery; promote studies to improve the understanding of economic, social, and biological aspects of the fishery; and continue to pursue and enforce standards of environmental quality and habitat protection necessary to protect the American eel population within the Bay and its tributaries.

The continued operation of the Project will not have a significant impact on the American eel population of the Susquehanna River, and is therefore consistent with this management plan.

- U.S. Fish and Wildlife Service. Undated. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C

The Recreational Fisheries Policy defines the U.S. Fish and Wildlife Service's (USFWS) stewardship role in the management of the United States' recreational fishery resources. The USFWS is committed to promoting and enhancing freshwater, anadromous, and coastal fishery resources for long-term public benefit. This commitment is outlined by the following policies:

1. Preserve, restore, and enhance fish populations and their habitats.

2. Promote recreational fishing on USFWS and other lands to provide the public with a high quality recreational experience.
3. Ensure that recommendations concerning recreational fisheries potentials and opportunities are included as part of appropriate field studies and management assistance efforts performed by the USFWS on non-USFWS waters.
4. Serve as an active partner with other Federal governmental agencies, States, Tribes, conservation organizations, and the public in developing recreational fisheries programs.
5. Promote the conservation and enhancement of the Nation's recreational fisheries through the USFWS's grant in aid programs.
6. Improve and expand quantifiable economic valuations of the Nation's recreational fisheries to demonstrate the importance of this resource to the health and welfare of our society and to the Nation's economy.

To accomplish these policies, the USFWS developed the following goals and strategies:

1. Effect the preservation and/or increased productivity of fishery resources.
2. Ensure and enhance the quality, quantity, and diversity of recreational fishing opportunities.

3. Develop and enhance partnerships between governments and the private sector for conserving and managing recreational fisheries.
4. Cooperate and maintain a healthy recreational fisheries industry.

The Conowingo Project provides recreational fishing opportunities at numersou locqations along the Susquehanna River. The continued operation of the Project will serve to ensure and enhance the quality, quantity, and diversity of recreational fishing opportunities and maintain a healthy recreational fishing industry. Consequently, the Conowingo Project is consistent with this management plan.

- U.S. Fish and Wildlife Service. 2010. Migratory Fish Management and Restoration Plan for the Susquehanna River Basin. Harrisburg, Pennsylvania. November 15, 2010.

This plan was developed to serve as the Susquehanna River Anadromous Fish Restoration Cooperative's (SRAFRC) restoration guide and management plan for migratory fish resources. The goal of the plan is to "restore self-sustaining, robust, and productive stocks of migratory fish capable of producing sustainable fisheries, to the Susquehanna River Basin throughout their historic ranges in Maryland, Pennsylvania, and New York. The goals are 2 million American shad and 5 million river herring spawning upstream of the York Haven Dam."

The Project provides passage opportunities which have the capacity to meet current Federal management objectives for migratory fish passage on the Susquehanna River, The continued operation of the Project will not have a significant impact on any migratory fish population in the Susquehanna River. Consequently, the Project is consistent with this management plan.

SECTION 6.0 CONSULTATION DOCUMENTATION

Throughout the Integrated Licensing Process, Exelon has engaged in substantive consultation with relicensing participants, and have filed all licensing materials with FERC. Names and addresses for Federal, state, and interstate resource agencies, Indian tribes, or members of the public with which Exelon has consulted during relicensing, and a comprehensive summary of all consultation activities between filing of the Proposed Study Plan on August 24, 2009 and submittal of the Final License Application is included below.

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APPENDIX A - RESPONSE TO COMMENTS RECEIVED ON DRAFT LICENSE APPLICATION

Exhibit E – Appendix A

This appendix summarizes Exelon's responses to the comment letters that were filed with FERC on the Conowingo Project (Project No. 405) Draft License Application (DLA). The appendix is divided into two sections. Section 1 provides Exelon's detailed reply to the comment letters submitted to FERC. Section 2 provides a copy of each comment letter, and includes highlighting and cross referencing to the comment response table for each comment which Exelon is providing a response.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
1	FERC	2/10/2012	In section 1.0 (pages A-2 or A-3), you do not provide the dimensions of the ogee spillway. Section 4.51(b)(1) of the Commission's regulations requires the physical composition, dimensions, and general configuration of any dams, spillways, penstocks, powerhouses, tailraces, or other structures, whether existing or proposed, to be included as part of the project. In the final license application, please provide this information.	The dimensions of the ogee spillway have been provided in Exhibit A-Section 1.2 of the Final License Application (FLA).
2	FERC	2/10/2012	In section 1.1 (page A-2), you state that the total length of the dam is 4,648 feet. You also provide specific lengths of different sections of the dam; however, these specific lengths add up to be less than the provided 4,648-foot total length. In addition, the total length of the dam and the length of the powerhouse presented in Exhibit F (drawing F-2) differ from what you provided in Exhibit A. In the final license application, please correct these inconsistencies.	The inconsistencies related to dam length have been corrected in Exhibit A-Section 1.1 and Exhibit F-2 drawing in the FLA.
3	FERC	2/10/2012	In table 1.4-1 (pages A-3 and A-4), you provide intake structure characteristics for turbine units 1 through 7, including the intake area, width, and elevations. You also discuss butterfly valves, head gates, and stop logs at the intakes and how they are operated. You do not, however, provide any such information for the turbine units 8 through 11. In the final license application, please provide similar information for the intake structures for these units.	Table 1.4-1 currently provides information on intake dimensions (i.e., intake area, width, and elevations) for all Project units, including units 8-11. There are no valves within the Unit 8-11 intakes; unit dewatering is performed by placement of headgates and stoplogs. This information has been added to the Exhibit A-Section 1.4.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
4	FERC		Exhibit E includes various discussions related to the Conowingo dam tailrace; however, you do not provide any description of the project tailrace in Exhibit A. Please include a description of the tailrace in Exhibit A of the final license application.	A description of the tailrace has been added to Exhibit A-Section 1.6 of the FLA.
5	FERC		Section 4.51(c)(1) of the Commission's regulations requires a statement whether operation of the power plant will be manual or automatic. In the final license application, please provide a description whether the Conowingo power plant is operated by manual or automatic.	Clarification on the operation of the project has been added to Exhibit B-Section 1.1 of the FLA.
6	FERC		Section 4.51(c)(2)(ii) of the Commission's regulations requires an area-capacity curve showing the gross storage capacity and usable storage capacity of the impoundment, with a rule curve showing the proposed operation of the impoundment and how the usable storage capacity is to be utilized. In section 2.3, table 2.3-1 (B-11) and figure 2.3-1 (B-14) show the Conowingo pond storage and surface area versus reservoir elevation relationship. Therefore, the title of table 2.3-1 and figure 2.3-1 should be changed from the Conowingo pond stage and surface area versus elevation to the Conowingo pond storage and surface area versus elevation.	This comment has been addressed in Exhibit B-Section 2.3 of the FLA.
7	FERC		In section 2.2 (page B-6), you describe flow conditions of the Susquehanna River at Conowingo dam and present annual and monthly flow duration information in a tabular format (table 2.2-2). In the final license application, please also provide monthly flow duration curves, as required by section 4.51(c) of the Commission's regulations.	Monthly flow duration curves have been added to Exhibit B-Section 2.2.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
8	FERC		On page D-7, you stated that the on-peak and off-peak values were \$53.61/ megawatt hour (MWh) and \$37.39/MWh, respectively. Please provide a reference for these values and explain why these are different with the values of the Muddy Run Project (on-peak value: \$53.04/MWh and off-peak value: \$37.45/MWh) within the Pennsylvania-New Jersey-Maryland (PJM) Interconnection, whose geographic area includes that of the Mid-Atlantic Area Council (MAAC) region.	Generators within PJM get paid a Locational Marginal Price (LMP) value based on the generation bus LMP. LMP is the pricing mechanism for wholesale power in the PJM energy market. Each generator in PJM's system has its own generator bus LMP value. An LMP is comprised of three price components: System Energy Price + Transmission Congestion Cost + Cost of Marginal Losses. Although Conowingo and Muddy Run are in located fairly close to each other in a physical sense, Conowingo and Muddy Run do not share the same generator bus LMP and are on different transmission circuits. The differences in their values are a result of their Transmission Congestion and Marginal Losses. Generating units are sent congestion price signals from PJM based on their impact on a constrained line. The interconnection point of the generator is important in indicating where its generation output flows on the transmission line. Both Conowingo and Muddy Run interconnect to PECO's 230kV system, but have different impacts on different parts of the transmission system. Conowingo is connected to the Colora and Nottingham substations which are more closely connected to PECO's southern 230 kV network. Muddy Run is connected to the Peach Bottom and Conchranville (Newlinville) substations which are more closely connected to PECO's northern 230 kV network. Therefore, although these two generating faculties are in fairly close geographic area with one another, the difference in the electricity price signal each unit receives from PJM is largely based on where they connect to the transmission network. The electricity values referenced in Exhibit D were generated from an Exelon software application called VPT (Visual Presentation Tool). This application software retrieves PJM data such as LMP electricity prices from the PJM database. Exelon's program retrieves data every hour and also on a daily and monthly basis. The data referenced in Exhibit D was the historical Real Time LMP values for Conowingo (Pnode #37401237) and Muddy Run (Pnode #734134) for 2011.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
9	FERC		In section 2.1.1, figure 2.1.1-1 (page E-2-33) shows the Conowingo Hydroelectric Project's major project facilities, but the east and west fish lifts are not included in the figure. In the final license application, please add notations for these facilities to figure 2.1.1-1.	Notations for the Project fish lift facilities have been added to Figure 2.1.1-1.
10	FERC		In section 3.3.2 (E-3-38), you state that the average flows between water year 1968 and 2009 measured at the Marietta and Conowingo USGS gages were 39,686 cfs and 41,026 cfs, respectively and monthly average and median flows were compared in table 3.3.2.1.1-1. The average flows between water year 1968 and 2009 are not included in the table. In the final license application, please add the average flows to table 3.3.2.1-1.	Table 3.3.2.1-1 of the FLA has been revised to include the requested average flows.
11	FERC		In section 3.3.2 (E-3-69), figure 3.3.2.1.1-2 shows the comparison of Marietta and Conowingo 30-minute and daily average flow data, but a curve for Marietta daily average is not included in the figure. In the final license application, please add the curve to figure 3.3.2.1.1-2.	Figure 3.3.2.1.1-2 of the FLA has been revised to include the requested rating curve.
12	FERC		In the final license application, section 3.3.3.1.5 should be updated to include the results of the 2012 field sampling, as required in our May 21, 2012 Study Plan Modification letter.	Section 3.3.3.1.5 of Exhibit E has been updated to describe the results of the 2012 mussel sampling below Conowingo Dam

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
13	FERC		In section 3.3.3.1.5 (Mussels), creeper (Strophitus undulatus) is listed as one of the species noted from shell samples during Exelon's 2010 sampling for Conowingo 3.19. Maryland Department of Natural Resources (DNR) has disputed the identification of this species in its comments on the Conowingo 3.19 Updated Study Report, stating that the shell specimen was tidewater mucket (Leptodea ochracea). Please clarify whether creeper was observed during Conowingo 3.19, and in the final license application, provide a table of observed species within the reach from other existing data sources beyond your 2010 and 2012 field sampling, as noted within the Conowingo 3.19 Updated Study Report (e.g., data from Maryland DNR, Marshall University, and other historic data).	MDNR stated that one voucher mussel shell provided by Exelon as creeper (Strophitus undulatus) was misidentified and that, in fact, it is tidewater mucket (Leptodea ochracea). The voucher specimen was reexamined by Exelon. Exelon concurs with the identification of the shell as tidewater mucket (Leptodea ochracea). Table 3.3.3.1.5-1 has been added to Exhibit E, Section 3.3.3.1.5 of the FLA depicting the various species observed in the study area from all known sources.
14	FERC		In section 3.3.3.2.8 (Effects on the American Eel Population and Distribution of the Eastern Elliptio Mussel), you provide little information on eastern elliptio from Conowingo 3.19 to support your statements. Please provide a discussion of the eastern elliptio population below Conowingo dam and how the project may influence the distribution of this species. Also, please provide your review of the USGS Northern Appalachian Research Laboratory research on American eel and eastern elliptio, as noted in the text.	A discussion of eastern elliptio populations below Conowingo Dam, as well as the project's potential influence on the distribution of the species has been included in Section 3.3.3.2.8. Our review of the data received from the USGS relative to the interactions between American eel and eastern elliptio has been included as well.
15	FERC		So that we may adequately describe botanical resources for our environmental analysis, please provide acreage estimates for the upland habitat categories you describe in section 3.3.4, and include information on terrestrial habitats observed within the project boundary from the various study reports that described such habitat communities.	The acreage estimates for the upland habitat categories are provided in Section 3.3.4 of the Conowingo FLA. Descriptions of riparian habitat observed during relicensing studies, including botanical resources, were provided in Section 3.3.4.1.5 of the DLA. Tables 3.3.4.1.5-1 through 3.3.4.1.5-4 listing riparian vegetation and Figure 3.3.4.1.5-1 have been added to this section of the FLA as additional descriptions.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
16	FERC		Section 3.3.4 provides no information or discussion on the location and extent of invasive species observed within the project boundary, or the potential of invasive species to establish or spread within the project boundary. In the final license application, please include this information.	Comprehensive botanical surveys were not a component of any approved terrestrial study. No invasive plant species were noted during studies conducted for the Conowingo Project. However, incidental observations of invasive plant species were made during habitat assessments conducted as part of RSP MR 3.9 (Bog Turtle). This information is provided within Exhibit E, Section 3.3.4 of the FLA for Muddy Run.
17	FERC		In section 3.3.5.2, you state that the project has positive effects on rare, threatened, and endangered species, including bald eagle, osprey, and black-crowned night-heron, based simply on the benefit of foraging and roosting habitat availability associated with the project. Please also provide a discussion on the potential for project operation and maintenance to affect breeding activity of these species.	Sections 3.3.5.2 and 3.3.5.5 in Exhibit E of the FLA have been updated to provide the requested information.
18	FERC		In section 3.3.5.2, you state that bog and northern map turtles have not been observed within the project boundary. Please clarify whether these species have the potential to occur within the project boundary, based on available habitat.	Exhibit E, Section 3.3.5.2 of the FLA has been updated to provide a statement regarding bog turtles and map turtles in the project area. Exhibit E, Section 3.3.5.1.2 of the DLA provides detailed information about the presence of northern map turtles within the project study area. Habitat surveys were not conducted for bog turtle in the Conowingo project area because this was not a study request by any stakeholder or regulatory agency. However, Section 3.3.5.1.2 does state that suitable habitat for this species was not observed during wetland surveys.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
19	FERC		As these habitats and state-listed species may be affected by project maintenance, in the final license application, please provide: 1) information on your standard vegetation maintenance methods within the project boundary, including: the methods you use to manage vegetation (i.e., mechanical, chemical, etc.), your typical maintenance schedule (i.e., activities performed annually, seasonally, as-needed, etc.), your procedures for managing vegetation in sensitive habitats (i.e., wetlands, riparian habitat, etc.), and your procedures when rare, threatened, or endangered plants or animals are encountered during routine maintenance; and 2) a discussion of the potential for project-related effects on the state-listed plant species described within section 3.3.5.2.	Comprehensive botanical surveys were not proposed or conducted as part of any threatened and endangered species study. None of the plant species of special concern were observed during other studies conducted in the project area. Information requested regarding vegetative maintenance and management methods, schedule, procedures in sensitive habitats, and the potential for project-related effects on state-listed plant species
20	FERC		In section 5.4 (page E-5-2), you include the National Park Service's Nationwide Rivers Inventory as a comprehensive plan applicable to the project; however, you list the 1982 plan. Please note that the most recent comprehensive plan for the National Park Service's Nationwide Rivers Inventory on file with the Commission is dated 1993.	Section 5.4 of the FLA reflects review of the 1993 Nationwide Rivers Inventory.
21	FERC		Section 4.44(h) of the Commission's regulations requires that each sheet of Exhibit G must contain a minimum of three known reference points. In the final license application, please include a minimum of three known reference points on the Exhibit G maps.	The elevations of the reservoir and river have been included on the Exhibit G maps provided in the FLA.
22	FERC		Exhibit G maps show a contour for the normal maximum water surface elevation, but you do not specify the elevation in the maps. In the final license application, please specify the normal maximum water surface elevation within the maps' legend.	Reference points have been added to the Exhibit G maps included in the FLA.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
23	FERC		The Exhibit G maps included with the draft license application are in draft form and are not stamped by a registered land surveyor. In the final license application, please remember to provide final Exhibit G maps stamped by a registered land surveyor, as required by section 4.39 of the Commission's regulations.	The Exhibit G maps have been stamped by a licensed surveyor included in the FLA.
24	MDTS		Page E-2-27 Section 2.2.2 Proposed Project Boundary proposes the removal of some lands from the project boundary. We ask that the trail route in those lands be protected if the lands get transferred to another owner.	Exelon intends to renegotiate the current lease (which expires in 2014) with the Maryland Department of Natural Resources for the use and protection of the Susquehanna Greenway, which is collocated with the Mason Dixon Trail on Exelon lands which are proposed for removal from the Project.
25	MDTS		Page 5-43 Section 5.3.20 Lower Susquehanna Heritage Greenway fails to mention the Mason-Dixon Trail. The Mason-Dixon Trail followed the route from Fisherman's Park to the bridge across Deer Creek before the Greenway built their trail on top of it. Please show that the Mason-Dixon Trail is collocated with the Greenway for that part of the route.	This has been noted in the Recreation Management Plan included in Volume 3 of the FLA.
26	MDTS		Page 8-17, paragraph 8.3 Proposed Recreation Enhancements does not contain any of the items requested by the Mason-Dixon Trail System. These enhancements are: 1. Access to the north side of Muddy Creek at the Paper Mill bridge so that the trail can be taken off the roads and put on Exelon Property all the way down to the river and the Muddy Creek boat ramp. A parking lot is proposed at the bridge. It should be noted that a lot of the kayaks observed at either the Muddy Creek or Cold Cabin boat ramps were put in at the Paper Mill bridge. Exelon is working a boundary dispute at the Paper Mill bridge.	Exelon is committing to work with the Mason-Dixon Trail System to incorporate their requests, where feasible. Exelon's commitment is noted in the revised Recreation Plan, included in Volume 3 of the FLA.
27	MDTS		2. Permission to run the trail on Exelon property from Michaels Run to Line Bridge Road when access at Michaels Run is obtained.	See response to Comment 26.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
28	MDTS		3. Permission to run the trail on Exelon Property from Line Bridge Road to Broad Creek. The only private landowner involved has given his permission.	See response to Comment 26.
29	MDTS		4. Permission to run the trail on Exelon Property from Shuresville Rd to Fisherman' s Park.	See response to Comment 26.
30	MDNR		Exelon has not fully completed a number of studies required by FERC, as per your Study Plan Determination. At a minimum, the Departments request that the final license application describe: (1) the status of all approved studies which will not be fully completed by August 31, 2012; and (2) Exelon's proposed schedule for completing such studies, including all reporting and consultation as required by the Study Plan Determination and 18 C.F.R. Part 5.	Exelon has expended a great deal of time and resources to complete nearly 50 studies requested by stakeholders for the Conowingo and Muddy Run relicensing efforts. The completion of these studies has met the prescribed timelines stipulated by FERC's ILP. High flow conditions in the spring of 2011 postponed three studies (Conowingo 3.2-Adult shad turbine mortality study, Conowingo 3.5-Adult shad telemetry study, and Conowingo 3.21 Ichthyoplankton Sampling) until 2012. Exelon has provided a schedule for the completion of these studies in the FLA.
31	MDNR		Pg. 13, Section II, F – Exelon states that the "….Upstream Passage Effectiveness Study calculated fishway attraction effectiveness, upstream fish passage efficiency, and upstream fish passage effectiveness for American shad……" However, the approved passage effectiveness studies were continued in the spring of 2012 and are still ongoing. As a result, it is erroneous to say that the study established attraction or passage effectiveness or passage efficiency. At the time the DLA was submitted, site-specific parameters of American shad passage at the Project have not yet been fully established.	Exelon believes this statement has been taken out of context. Exelon clearly stated on page E3-108 of the DLA, that the results of 2012 radio telemetry will "provide more information on the effectiveness and efficiency of the EFL operation. The 2010 and 2012 telemetry data will also be used to analyze the relationship between station generation scenarios and fish passage success. This additional data will inform consideration of changes to EFL operations that may help to increase upstream shad passage at the Project."
32	MDNR		Pg. 15, Footnote 44 – Footnote 44 acknowledges that an adult shad turbine mortality study is being done in 2012, and there is no acknowledgement in the text itself that Project operations are not adversely impacting downstream passage is made in the absence of findings of the 2012 studies. There is also no mention in the footnote of the 2012 telemetry study that is still on-going.	Again, Exelon believes this statement has been taken out of context. While not explicitly stated in footnote 44, Exelon acknowledges on page E3-108 of the DLA that the 2012 telemetry study is on-going. Exelon also acknowledges on page E3-89 of the DLA that 2012 adult shad turbine mortality study will be used "to determine site-specific survival rates through a Francis and Kaplan unit at the Conowingo Project" for adult shad and will in turn be used to assess the Project's impact on downstream passage.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
33	MDNR		Pg. 16 – Exelon states that they "….. conducted biological and engineering studies which described the spatial distribution and size characteristics of American eels in the Conowingo tailrace, …". However, there was inadequate sampling of elvers and yellow eels in the spillway, as noted in agency comments on the study and also in the workshop cited by Exelon, as a result of insufficient attraction water, no substrate suitable for yellow eels on the ramps and eel pots not being a suitable sampling technique for smaller yellow eels.	Exelon conducted two years of eel sampling in the Conowingo spillway. After completion of the first year of study, Exelon made constructive efforts to work with stakeholders to refine methodologies (e.g., attraction flow, ramp substrate, etc.) to improve the second year study. The suggestions made by stakeholders were adopted essentially carte blanche, and implemented fully in the second year study. Exelon is confused as why MDNR is now insisting the eel sampling in the spillway was somehow inadequate. Exelon contends that the two year sampling program was robust, despite the logistical impediments posed by the sampling area, and provided important information to help site potential eel ramp locations in the future.
34	MDNR		Pg. 18 – It is curious that Exelon can state that their study of the Impact of Plant Operation on Migratory Fish Reproduction (RSP 3.21) "……evaluated the potential impact of Project operations, including the current minimum flow regime, on the reproduction of target anadromous fish (e.g., American shad, river herring, striped bass, and white perch)….." when that study has not yet been completed due to 2011 flow conditions at the dam and is currently underway in 2012. Stating a conclusion before a study is fully complete seems very prescient.	A study report for RSP 3.21 Impact of Plant Operation on Migratory Fish Reproduction was completed after the 2010 study season. This report used existing information to assess project impacts on migratory fish reproduction. The findings of this report were used in the DLA for the environmental analysis on this issue. Exelon agrees that the 2012 ichthyoplankton surveys, a component of the RSP 3.21 study, will likely provide useful information to further analyze this issue.
35	MDNR		Pg. 19. Exelon states that "…..downstream fishery communities are quite robust…..," and as a result they have not proposed to modify minimum flows at the Project. However, their conclusion is based on outdated information (surveys conducted in 1982 and 1987) and data collected with sampling gear that is clearly selective to certain species (the East fish lift). As a result, the community characterizations on which this statement is based are certainly not representative.	RSP 3.18-Characterization of Downstream Aquatic Communities was completed according to the FERC prescribed study plan determination. The study analyzed and based its conclusions on all available data. This included data from the 1980's, more recent data (up to 2009) available from the East and West Fish Lifts, as well as field data collected in 2010 from RSP 3.8-Downstream Flow Ramping and Stranding Study. The depth and breadth of the historic data were important, as it allowed for an analysis of trends in fish community composition and condition over the last 30-35 years.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
36	MDNR		Exelon states that the Recreation Facility Inventory and Estimated Recreation Use Report (RSP 3.26) clearly indicated that the existing facilities meet current and projected use. However, numerous stakeholders, both the general public and Resource Agencies, have repeatedly stated during various FERC licensing meetings that the type of recreational fishing offered by access to the catwalk is unique……we do not agree that Exelon has demonstrated that their proposed enhancements "….meet current and future recreational demand in the Project area….." as stated on page 4.	Exelon's Study Plan 3.32 provides an overview of the existing and estimated capacities of recreational fishing facilities at the Conowingo Project. These FERC approved studies confirm that recreational fishing facility capacity at the Project will satisfy projected demands during the term of the next license. This fact, coupled with the substantial amount of initial and ongoing expenditures that would be required to provide upgraded security measures, has led to Exelon's decision not to include the reopening of the catwalk as a recreational facility in the application for a new license for the Conowingo Project.
37	MDNR		Pg. B-3 – Exelon states "….This temporary variance [i.e., to count the leakage from the Conowingo Project of approximately 800 cfs as part of the minimum flow discharge] is typically approved by resource agencies (i.e., SRBC, MDNR, PFBC, and USFWS)….." The FLA should include a summary tabulation of all instances over the past license term (i.e., date of request) when this temporary variance was requested, an indication of if and when the resource agencies approved the variance, and the time period over which the variance was in effect for each instance.	Exhibit B of the FLA has been revised to include this information.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
38	MDNR		Pg. B-3 – Exelon's states that "….When implemented, the temporary variance allows Exelon to maintain an adequate pond level elevation and storage capacity throughout a low flow period…." The explanation for this situation is that discharges from the dam are the means by which Exelon complies with the minimum flow requirements of their FERC license. However, when the Marietta gauge flows drop below Conowingo minimum flows, total releases from the dam include leakage, such that the total release from the dam exceeds the Marietta gauge flows. Without the variance, outflow from the Conowingo Pond would exceed inflow and the Pond level could eventually drop below the required minimum level. Leakage was not taken into account when the current minimum flows were established under the existing license.	Exhibit B of the FLA has been revised to reflect this clarification.
39	MDNR		Pg. B-14, Pond storage versus elevation – Overall pond storage capacity is impacted by the level of sedimentation in the pond. It is likely that the shallower areas in the upper end of the pond are affected by sedimentation which results in lower storage capacity. It would be helpful if this figure were labeled to indicate whether it represents this relationship given the current and historical levels of pond sedimentation. In 2011, Exelon conducted a bathymetric survey of the Pond which should be used to calculate the loss of storage capacity due to increased sedimentation.	Exhibit B of the FLA has been revised to reflect current storage capacity, based on the recent bathymetric data collected at the Project.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
40	MDNR		Pg. D-4, Section 4.1 – Exelon states that annual capital costs, not including costs for PM&E measures that they are proposing, are $15,974,000. However, Exhibit D does not appear to provide a listing of what is included in those annual capital costs. It is striking that the annual capital costs are nearly identical to the annual O&M costs presented in Section 4.4. A breakdown of O&M costs should also be included in the FLA.	The annual capital costs described in Section 4.1 include life cycle costs such as runner replacements, generator rewinds, and oil circuit breaker replacements and routine replacement of vehicles and tools. Operation and maintenance expenses include interim replacements, insurance, and administrative and general costs. Exelon believes the cost breakdowns provided in Exhibit D are sufficient for FERC to conduct its environmental review.
41	MDNR		Pg. E-1-9 and E-1-10 – Sections 1.3.3 and 1.3.6 appear to be duplicates.	This duplication has been eliminated from the FLA.
42	MDNR		Pg. E- 2-29 and Pg. E-3-247 - It is unclear from the information provided the disposition of land that Exelon will transfer and/or sell. Although the SMP encompasses the new Project boundary, supplemental information should be provided. Agencies would like to emphasize that disposition of Project lands will significantly affect the public.	Exelon will negotiate leases with existing recreation facility operators for the continued operation of those facilities located on lands owned by Exelon but no longer within the Project boundary. Exelon also will negotiate a new lease with the MDNR for the continued protection and use of Exelon owned lands outside of the Project boundary for the collocated Lower Susquehanna Greenway Trail and Mason Dixon Trail. The existing lease expires in August 2014.
43	MDNR		Although Exelon lists several types of BMPs that could be used on a watershed or Project scale, Exelon has not identified the BMPs that Exelon plans to use to manage, mitigate, and remove sediment related to the Project. Further, Exelon's discussion of Project-specific BMPs was limited to minimizing erosion. There was no discussion of sediment management options (i.e., beneficial re-use, final disposition, etc.) once sediments have been removed from the river. Exelon should include detailed engineering evaluations and cost estimates for potential sediment management and off-site disposal options in its sediment management plan to be included in the FLA.	Exelon is proposing to use Project scale BMPs which will minimize erosion related to managing Project lands and activities. Exelon is not proposing to manage or mitigate existing sediments, as FERC has indicated that Exelon is responsible for developing sediment management provisions for benchmarks related to the continued operation of the Project.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
44	MDNR		Pg. E-3-50 and Figure 3.3.2.1.2-9 – The biological significance of levels of dissolved oxygen (DO) below state standards is a function of both the magnitude of the deviation from the standard but also the duration of the low DO episode. This DLA section should be expanded in the FLA to include information on the duration of the low DO episodes. Since the low DO episodes are not an unavoidable impact, Exelon should present operational alternatives that would preclude future occurrences of such episodes.	Section 3.3.2.1.2 has been revised to reflect the inability to perform a duration analysis on a non-continuous dataset.
45	MDNR		Pg. E-3-120, Section 3.3.3.4.5 – Exelon states that "….The Project does not significantly affect the recruitment and population dynamics of resident …. fishes within the Susquehanna River below Conowingo Dam….." This conclusion is contradicted by the paucity of juvenile smallmouth bass in the river downstream of Conowingo Dam and by the results of Exelon's own IFIM study.	Smallmouth bass are present in the fish community below Conowingo Dam, although they are not a dominant species within the community. The reasons for this are not clear and likely results from a combination of factors. RSP 3.16-Instream Flow Habitat Assessment below Conowingo Dam identified lack of ideal substrate as a limiting factor to smallmouth bass habitat below Conowingo Dam.
46	MDNR		Pg. E-5-1, Section 5.4 - Exelon lists comprehensive plans they have reviewed. We note that the "Migratory Fish Management and Restoration Plan for the Susquehanna River Basin" is not listed, even though it has been submitted to FERC for inclusion into the official record.	The Migratory Fish Management and Restoration Plan for the Susquehanna River Basin is not currently listed as a comprehensive plan by FERC in their April 2012 list of plans.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
47	MDNR		Pg. H-10 – Exelon states that the Project is fully equipped to allow staff to perform virtually all routine maintenance functions. However, in Exelon's Study Report 3.9 (pg. 10), it is stated that "…..no substantial preventive maintenance or enhancements to the East Fish Lift have been performed over the last 10 years….." This statement of fact would appear to contradict the statement that the Project is fully equipped to allow staff to perform all routine maintenance functions. To the contrary, it suggests that the Project is not sufficiently staffed to ensure compliance with FERC license requirements.	Both the Conowingo and Muddy Run Projects are sufficiently staffed by Exelon to maintain safe and effective operation of the project, as well as meet its obligations under its FERC license. The commenter seems to have misconstrued the statement in the RSP 3.9 study report. To clarify, Exelon has maintained safe and effective operation of both the West and East Fish Lifts over the last license term. Routine maintenance is conducted every spring before operation begins, and every attempt is made to address service outages promptly during the fish passage season.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
48	MDNR		Based on the National Bald Eagle Management Guidelines (NBEMG) Exelon should use adaptive BMPs to minimize transmission line and eagle interactions while annually identifying nesting locations and establishing clear buffer areas. This was not identified in their plan.	A) NBEMG recommends various voluntary measures aimed at the reduction of transmission line and eagle interactions for the benefit of bald eagles. Per the Muddy Run 3.7 study, deadly or injurious transmission line interactions were not found to be a common occurrence requiring modifications of existing facilities. Although the NBEMG considers nesting on transmission structures as a potential risk to eagles, it should be noted that the majority of eagle nests on Exelon lands are located in super canopy trees, which are abundant on the shorelines of Conowingo Pond and Muddy Run Reservoir. The few nests that are in towers are situated at lower levels in towers than would be the case for problem nests which are typically situated at the tops of towers. Therefore, BMPs such as nest platforms are unnecessary and furthermore may attract birds to nest in or near towers. Platforms should not be installed unless a problem nest is identified in a tower. The BEMP will be updated and submitted with the FLA to include measures regarding problem nests should any be identified in the future. B) Exelon's BEMP provides a range of practices based on recommendations of the National Bald Eagle Management Guidelines (NBEMG). Nest locations on Exelon lands, inclusive of the FERC relicensing project areas, were identified during studies conducted in 2010 (Conowingo 3.23 and Muddy Run 3.8). Both landscape buffers and distance buffers are provided for these nests in BEMP Section 4.1 and Table 4.1-1. The assignment of the two types of buffers is designed to be adaptive for each nest according to nest-specific characteristics (e.g., location, habitat, nest structure) and activity specific guidelines in the NBEMG. Since eagles exhibit nest site fidelity it is anticipated that most nest locations will be in use from one year to the next. Therefore yearly surveys are not necessary or feasible. Additionally, Section 4.1.1 states that new nests discovered during the course of 5-year surveys or within the intervals in between will be assigned landscape buffers. The BEMP will be updated and submitted with the FLA to provide distance buffer information for new nests.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
49	MDNR		Although Exelon proposes eagle surveys, the frequency and intensity of such is not given; this should be clearly stated. Since RSP 3.25 identified birding as a very popular activity on Project lands, public information meetings should be held periodically to inform the public of habitat changes, survey results, projected construction that could impact eagle viewing on Project lands that could affect eagles and to receive input to improve eagle viewing at Conowingo Dam.	A) Section 4.3.1 of the BEMP provides frequency (every five years) and intensity (two aerial and two supplemental surveys each survey year) of eagle surveys proposed by Exelon for monitoring existing and new eagle nests and use areas. B) Throughout the FERC relicensing process Exelon has held public meetings, conducted recreational surveys, and shared survey results from the avian studies conducted for each project area. Numerous locations for bird viewing exist throughout both relicensing project areas as well as on Exelon lands generally. No impacts to eagle or other bird viewing are anticipated from projected construction activities since there are numerous locations available at any given time for this activity. Nonetheless, Exelon plans to enhance public viewing by developing materials for public educational purposes. The BEMP will be updated and submitted with the FLA to provide information regarding these materials.
50	MDNR		Exelon states that it will (Pg 1): "Identify a range of land management practices that would benefit the bald eagle population present on Exelon lands." The plan does not identify how it will enhance or improve eagle habitat on Exelon property. Exelon also did not state whether it possesses an "eagle take permit". Lastly, the Bald Eagle is no longer a State of Maryland listed species and as such, Exelon should coordinate with USFWS since this species is still protected under the federal Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) and that their Project may be subject to the National Bald Eagle Management Guidelines.	The BEMP was updated to identify land management practices expected to enhance or benefit bald eagles on Exelon lands and to provide information regarding eagle take permits. Exelon acknowledges in the Section 1.2 of the BEMP that the bald eagle has been delisted by Maryland but would be protected in Maryland by federal regulations as a function of the Bald and Golden Eagle Protection Act. Exelon has solicited comment on the BEMP from USFWS and has prepared the BEMP to be consistent with the voluntary measures contained in the NBEMG.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
51	TNC		This conclusory statement does not satisfy Exelon's obligation under 18 C.F.R. 5.18(b)(5)(ii)(F) to "[i]dentify relevant comprehensive plans and explain how and why the proposed project would, would not, or should not comply with such plans and a description of any relevant resource agency or Indian tribe determination regarding the consistency of the project with any such comprehensive plan." (Emphasis added). We request that Exelon demonstrate the consistency of its specific protection, mitigation, and enhancement measures with the specific goals and objectives in the relevant comprehensive plans.	Exelon has included in the FLA an analysis of the consistency of the proposed Project with the specific goals and objectives in the relevant comprehensive plans.
52	TNC		Page 15 of the DLA states that "the study concluded that the effect of the Project on entrainment and turbine mortality is moderate for gizzard shad and low for all other target species…Moreover, Project operations do not appear to be adversely impacting upstream or downstream passage." This statement is presumptuous given that key studies (3.2, 3.4, 3.5, 3.6, and 3.7) are incomplete and could indicate that changes to project infrastructure and/or operations are needed.	See Response to Comment 31 and 32.
53	TNC		Project operations adversely impact the mussel community composition and abundance below Conowingo dam by increasing high flow scour and altering the substrate composition. Study 3.15 notes significantly lower diversity and abundance of mussels below the dam, and that diversity and abundance increased significantly with distance from the dam. Study 3.1.6, Figure 4.3-3, shows that high flows associated with peaking operations have a negative relationship to the availability of suitable habitat (as measured by shear stress).	Mussels are fairly well established in the project area, with a mussel community containing five live species, with indications that other species may be present, and in which the most abundant species likely is reproducing. Much of the study reach is a challenging environment for mussels due to the bedrock/boulder-dominated river bottom and turbulent water flow at many locations. The distribution of mussels below the dam is likely influenced by a combination of factors; including areas with unsuitable flow conditions, as well as zones of naturally unsuitable substrate.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
54	NMFS		As noted by us in our comments on the Scoping Document and the Preliminary Application Document, in considering effects of project operations on sturgeon, FERC and Exelon should include information and analysis of at least the following: (1) effects of project operation on downstream flow regime and effects of flow changes associated with project operation on potential spawning habitat, access by adults to that habitat, potential to cause delays to spawning, wash out or scouring of eggs or larvae and alternatively, drying out due to dewatering:, (2) creation of temporary pools below the dam in which sturgeon can become stranded and information on the persistence of these pools as well as the adequacy of existing minimum flow requirements to prevent stranding; (3) effect of the Dam on distribution of sturgeon in the Susquehanna River and limiting access to upstream habitat and resources; and (4) effects of release of water through flood control gates on adult or early life stages of sturgeon.	Exhibit E, Section 3.3.3.5.2 of the FLA has been modified to include the requested information and analysis for sturgeon.
55	NMFS		The DLAs and any NEPA document developed for these projects should, at a minimum, consider the following effects of project operations on alewife and blueback herring: o Impingement and entrainment, including mortality; o Effects of the presence of the dam on upstream passage including delayed migration and an assessment of the effectiveness of the fish passage facilities at passing these species upstream; o Loss of prey or access to prey; and, o Any impacts to habitat or conditions that make the Susquehanna River unsuitable for alewife and river herring.	Exhibit E, Section 3.3.3.5.2 of the FLA has been modified to include the requested information and analysis for alewife and blueback herring.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
56	NPS		Paper Mill Road in the Muddy Creek Gorge. Although the land is in fact technically outside the project boundary, it clearly has bearing on recreational use of lands within the project boundary as boaters entering the Gorge paddle down to the Muddy Creek Boat Launch for takeout. Exelon only refers to that facility as a put in for boaters using the Conowingo Impoundment. The Muddy Creek Gorge, in and of itself, is a highly valued recreational resource for Class II/III paddling, has direct bearing on the aggregate recreational use of project lands and waters and should be addressed in that context. To the extent that Exelon owns lands abutting Muddy Creek up and above Paper Mill, those lands should be included in the project boundary.	Exelon continues to negotiate with the adjacent property owner at Paper Mill Road in order to provide recreational access and parking. Exelon also continues to coordinate with Mason-Dixon Trail to relocate the trail along the northern side of Muddy Run. No specific documentation has been provided for the relicensing which supports the position that that the recreational activities on Exelon lands surrounding Muddy Run Creek, and within the creek itself, has a bearing on the aggregate recreational use of Project lands. Exelon is not proposing a change in the existing boundary to incorporate the recreational uses adjacent to the Project.
57	NPS		Exelon's response to NPS Comment 3 from our April 25, 2011 filing (also at Section 3.26 at Page 54, Exelon Response to Agency Comments), notes that they will consult with MDTS regarding relocation of the trail just above and just below the Conowingo Dam "based on the findings specific to such a report contained in Exelon's Conowingo Dam security assessment reports." Based on the Exelon's response in the DA at Section 8.4.1 **Agency Recommendations not Proposed,** it appears that Exelon is tying relocation of the trail to the continued closing of the catwalk.	Exelon is working with Mason-Dixon Trail to re-establish the location of this trail immediately south of the Conowingo Dam. The trial location will avoid possible conflicts with the catwalk by not routing recreational hikers in the immediate vicinity of this Project feature. Mason Dixon Trail has not requested the segment of trail be placed within the Project boundary. Exelon does not intend to modify the Project boundary in this area of the Project. Exelon views the Mason-Dixon Trail facility as completely independent from the catwalk.
58	NPS		Exelon, in their Final application should address this specific option proposed by the MDTS and explain why it is either unable or unwilling to implement it, when it does not appear to be in any way connected to the continued closing of the Catwalk, as discussed below.	See response to Comment 57.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
59	NPS		The NPS along with several other entities have filed numerous comments regarding the continued closing of the Catwalk to recreational angling….. The NPS not only disagrees with this conclusion, but urges the FERC to order Exelon to fully explain the rationale behind this decision in the Final Application, in order that NPS and other stakeholders have the opportunity to rebut Exelon's conclusion.	Exelon believes that appropriate documentation has been provided in the FLA for the rationale behind the decision to keep the catwalk closed.
60	PFBC		On page E-3-52, Exelon states: "Since no USGS flow gages exist between the Marietta and Conowingo USGS gages, it is not possible to directly assess Conowingo's specific influence on Susquehanna River flows. That is, differences between the Marietta and Conowingo USGS gages are due to the cumulative effect of all four hydroelectric projects. Thus, while the Project's peaking operations do alter the flows in the Susquehanna River downstream of Conowingo Dam, the magnitude of the Project's impacts (relative to the other upstream projects) is unknown based on the streamflow gage information." This statement is patently false. Peaking flows in the river below Conowingo are a direct result of peaking generation at Conowingo which is controlled to maximize profit (see table below for Conowingo discharge on 4-19-2012 at 5:30 AM). How are the flows depicted below explained by operation of upstream projects?	The FLA has been revised to clarify the distinction between the watershed river flows and flow modifications based on peaking operations at the Conowingo Project.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
61	PFBC		In section 3.3.3.4.5, page E-3-120, Exelon states: "The Project does not significantly affect the recruitment and population dynamics of resident and migratory fishes within Conowingo Pond or the Susquehanna River below Conowingo Dam. Exelon proposes to continue the existing flow regime below Conowingo Dam to provide habitat for fish species in this river reach." This statement ignores the paucity of juvenile smallmouth bass in the river downstream of Conowingo Dam. Peaking flows below Conowingo Dam result in a complete lack of smallmouth spawning and juvenile habitat as demonstrated by Table 3.3.3.1.7-4 on page E-3-131.	See Response to Comment 45.
62	PFBC		In section 3.3.3.4.5, page E-3-120, Exelon states: "The Project does not significantly affect the recruitment and population dynamics of resident and migratory fishes within Conowingo Pond or the Susquehanna River below Conowingo Dam. Exelon proposes to continue the existing flow regime below Conowingo Dam to provide habitat for fish species in this river reach." Exelon's steady-state analysis confirms the lack of smallmouth bass spawning habitat. Again, peaking operations have eliminated smallmouth bass spawning habitat below Conowingo Dam.	See Response to Comment 45.
63	PFBC		In section 3.3.3.4.5, page E-3-120, Exelon states: "The Project does not significantly affect the recruitment and population dynamics of resident and migratory fishes within Conowingo Pond or the Susquehanna River below Conowingo Dam. Exelon proposes to continue the existing flow regime below Conowingo Dam to provide habitat for fish species in this river reach." Habitat for juvenile smallmouth bass is also eliminated by peaking.	See Response to Comment 45.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
64	PFBC		Habitat for adult smallmouth bass is also eliminated by peaking: "High quality smallmouth bass adult habitat between 3,500 cfs and 10,000 cfs is found near the mouth of Octoraro Creek, near the mouth of Deer Creek, and near the upstream end of Sterret Island. Moderate quality habitat is found in large areas throughout the study area at lower flows.	See Response to Comment 45.
65	PFBC		Exelon discusses entrainment and impingement potential and survival potential on page E-3-87. We note that a low potential is defined as less than 80%. Thus, a low survival potential could be anywhere between 0 and 80%. The huge interval covered under the "low" definition makes this categorization meaningless.	This qualitative ranking of survival potential was developed from data in the EPRI database, results from additional survival studies, and survival estimates calculated using the Franke model. The low potential category is broad but is meaningful when considered in the context of the other categories below, and provides a means of differentiating and categorizing various levels of fish survival. High (H) = 100-95% Moderate-High (MH) = 95-90% Moderate (M) = 90-85% Low-Moderate (LM) = 85-80% Low (L) = <80%
66	PFBC		In their discussion of American eel trap and transport on page E-3-109, Exelon suggests transport of eels to small tributaries (approximately 50 feet wide). We are not aware of this width limitation and wonder where it originated.	The 50-foot wide criterion is a general standard developed by Exelon. Exelon attempted to engage stakeholders in a dialogue in June 2012 to discuss specifics, such as tributary/eel weir size, related to the proposed downstream eel passage program. Stakeholders declined these overtures, which is unfortunate as it would have been an ideal opportunity to make meaningful progress on developing a more detailed downstream eel passage program. Nevertheless, Exelon expects to engage stakeholders in the future to initiate these discussions.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
67	PFBC		On page E-3-114, Exelon states: "Condition factor and length weight relationships of representative common fish species downstream of Conowingo Dam are comparable to those from other normal, natural populations and are indicative of relatively favorable conditions and habitats in the lower Susquehanna River." Later, on the same page, it states: "*The paucity of non-bedrock substrate downstream of the dam increases the value of the few habitats that exist. These habitats are located downstream of Rowland Island, near the mouths of Octoraro and Deer Creeks, an area southwest of Bird Island, downstream of Snake Island and in-between Robert, Wood and Spencer Islands. These areas often provided unique combinations of depth, velocity and substrate, providing areas of refugia for species and life stages that are not well suited for the conditions* found in the river's main channel." These statements are conflicting and further support our contention that project operation impacts availability of suitable habitat (due to peaking) and gravel substrate (due to sedimentation in the reservoir).	Exelon does not see how these statements are conflicting. The reach below Conowingo Dam does support a good fishery based on composition and condition factor. The non-bedrock substrate areas downstream of the dam represent important habitats, which contribute to the overall condition of the existing fishery.
68	PFBC		On page E-5-1, Exelon lists comprehensive plans it has reviewed. We note that the "Migratory Fish Management and Restoration Plan for the Susquehanna River Basin" is not listed, even though it has been submitted to FERC for the official record.	The Migratory Fish Management and Restoration Plan for the Susquehanna River Basin is not currently listed as a comprehensive plan by FERC in their April 2012 list of plans.
69	SRBC		Calpine Energy should be recognized as a one of the "factors" that influence management of the Conowingo Pond. Calpine shuts down when pool level reaches 98.0 feet.	This comment has been addressed in Exhibit B-Section 1.1 of the FLA.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
70	SRBC		1.4.1 Discussion of operations during adverse years should recognize the efforts of the Conowingo Pond Management Workgroup and the selected operation alternative of QFERC + 1,000 to maintain the level of the Conowingo Pond. QFERC + 1,000 as measured at Marietta (on a seasonal basis) initiates the leakage credit of 800 cubic feet per second (cfs).	This comment has been addressed in Exhibit B-Section 1.4 of the FLA.
71	SRBC		3.3.3.1.4 SRBC disagrees with Exelon's conclusion that the macroinvertebrate community is "moderately rich and moderately dense." Exelon reported collecting 71 taxa while only 8 are deemed sensitive/intolerant. Furthermore, commonly used macroinvertebrate community assessment indices were not utilized to compare community composition to other sites to help determine Conowingo Hydroelectric Project impacts.	A total of three indices were either calculated or are readily discernible from the available data. They are Richness, Community and Population Density, and Percent Contribution of the Dominant Taxon. At the onset of our review, we considered a metric analysis but opted against one. While it is true that valid spatial and inter-year metric comparisons can be produced from this quantitative data set, it did not lend itself to fully accurate metric calculation because the raw numbers for many of the rare and uncommon taxa were not easily available. We also considered condensing the data into an index of biotic integrity (IBI) determination similar to that currently in-use by MDNR for their Maryland Biological Stream Survey (MBSS) however, that protocol is designed to address biotic integrity from much smaller first, second, and third order streams and was not applicable. So we opted for a more descriptive approach that focused on the behavioral and ecological characteristics of most common taxa resident below the dam.
72	SRBC		SRBC disagrees with Exelon's statement: "The Project does not significantly affect the recruitment and population dynamics of resident and migratory fishes within Conowingo Pond or the Susquehanna River below Conowingo Dam."	See Response to Comment 35.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
73	SRBC		SRBC's comments regarding Exelon's failure to timely model alternative operations scenarios follow below. These are preceded by a detailed summary of FERC's hydrologic modeling requirements for Conowingo relicensing, SRBC's comments that precipitated the requirements, Exelon's agreement to the requirements, and Exelon's reporting regarding its failure to perform timely modeling. As of June 2012, Exelon has not completed any modeling of alternative operations scenarios, as required in the February 2010 Study Plan Determination (SPD).1 It has, however, recently initiated a process with the SRBC and the other resource agencies toward that end, as further described below.	Exelon has completed three of the requested alternative modeling scenarios and has included the model runs in the RSP 3.11-Baseline and Production Run Modeling Report, which is filed with the FLA. Six additional model runs are currently being completed as requested, however due to SRBC requests for revisions to these model runs, which was received on August 21, 2012, Exelon did not have the time to complete the model runs and include them in the FLA.
74	SRBC		During May 2012, Exelon requested and SRBC agreed to facilitate a series of meetings of the resource agencies for the purpose of coordinating and recommending to Exelon a series of alternative modeling scenarios to be run consistent with its SPD obligations. Consistent with that request, in June 2012, SRBC facilitated the development of a series of nine (9) proposed alternative modeling scenarios, which were submitted to Exelon on behalf of the resource agencies on July 9, 2012.	See response to comment 73.
75	SRBC		Exelon has not provided any reasonable explanation for its failure to complete the modeling of alternative operating scenarios. Regardless, and of most concern to SRBC, is the impact of the delay in obtaining results from the alternative modeling runs, either those recently recommended to Exelon or those that may be developed in response to the results of the first round of modeling runs. That constitutes a prejudice that adherence to the spirit and letter of the Integrated Licensing Process was intended to avoid.	See response to comment 73.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
76	USFWS		The Service agrees with Exelon that based on the American eel downstream passage models and data collected in association with the Muddy Run eel passage study in 2011, passage mortality is greater than 10%. This is consistent with reported American eel downstream mortality values from Muddy Run Pump Storage and York Haven Hydroelectric Projects. In the event instream collection techniques are found ineffective at capturing silver eels for downstream trap and transport, 3/4 inch bar racks, a guidance system, or other physical or behavioral barrier may be necessary for safe passage downstream.	The USFWS analysis of the 2011 Muddy Run eel passage data indicated that passage survival at Conowingo Dam ranged from 89.9% to 100%. Nevertheless, Exelon's proposal for a downstream trap and transport program, discussed at the October 2012 stakeholder meeting, should be developed further in consultation with stakeholders. Until that program has been developed, implemented, and evaluated for its effectiveness, Exelon feels it is premature to discuss other alternative measures, which will likely be more costly and potentially less effective.
77	USFWS		The Service encourages Exelon, as we did York Haven, to consult with the agencies regarding the need to assess and improve eel passage at their facilities. Improving upstream and downstream passage for American eels, American shad, and river herring is our priority.	See Response to Comment 66 and 76.
78	USFWS		4.1.1 Distance Buffer for Bald Eagle Nesting Sites - There are some inconsistencies with respect to nest protection buffers. As long as nests are "inactive", activities may pursue without disturbing eagles as long as habitat is not removed or altered. However, if intrusion or habitat modifications are anticipated within nest buffers from 0-660 feet, an eagle disturbance permit (50 CFR, 22:26) may be required to be in compliance with the Bald and Golden Eagle Protection Act. A nest removal would require a 22:27 eagle permit.	The BEMP submitted with the FLA has been updated and to address this comment.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
79	USFWS		4.1.4 Foraging Areas and Communal Roosting Sites -Avoidance of recreational boating and fishing near critical eagle foraging areas. Exelon must educate (through updated signage, social media etc.,) and enforce rules to restrict public use in these areas. Encroachment at key eagle perching, loafing and roosting areas specifically; the immediate area of Conowingo pond, is considered a high use eagle area. The rocky shoreline and nearby island encompassing the power line towers are extensively used (year 'round) by eagles near the outfall zone. The eagles are tolerable to public activity on the Harford County side but are easily disturbed on the Cecil County side where eagles are more exposed and numerous.	As indicated in Section 4.1 of the BEMP, Eagles on Exelon lands are regularly exposed to certain land uses and facilities including the use of recreational boats launched from existing boat launches (e.g., Muddy Creek Boat Launch), pedestrian use of hiking trails, and fishing from shoreline locations. Eagles in concentration areas near these types of uses and facilities are likely habituated to visual and auditory disturbance associated with these uses and facilities. Exelon does not agree that eagles are more tolerable to activity on one side or the other as eagles cross back and forth between the Harford and Cecil county sides irrespective of county boundaries. However, since sensitive eagle areas (e.g., roosts and nests) are prevalent on the Cecil County side near the outfall, educational materials including signage and/or social media will be developed by Exelon to educate the public concerning eagle etiquette for additional protection of eagles near the outfall zone. The BEMP updated to provide information on educational materials and submitted with the FLA.
80	USFWS		Recreational hunting- Waterfowl hunting from shoreline blinds or boat blinds must be avoided in areas described in 4.1.1. Shot gun blasts adversely disturb eagles for long periods of time especially in early morning hours which coincide with prime time for eagle foraging. Areas in the vicinity of Conowingo Pond must be restricted from gun hunting where applicable to Exelon lands.	As stated in Section 3.3.7.1 (Limitations on Public Recreational Access) of the Conowingo DLA Exhibit E and Section 3.3.7.1 (Policy Restricting Certain Recreational Uses) of the Muddy Run DLA Exhibit E, hunting is not allowed within secure areas of the Projects or on lands posted against hunting by Exelon. Exelon issues permits for offshore (water access only) stationary duck blinds and duck blind sites on an annual basis and allows hunting in some areas. However, State and federal agencies also control these activities in some areas (e.g., Muddy Run WMA, offshore duck blinds licensed by MDNR). Exelon will provide measures to limit shot gun blasts in vicinity of sensitive eagle use areas to the extent possible in areas where Exelon controls these activities. The BEMP will be updated to provide details regarding restrictions for protection of nests and sensitive eagle use areas from shotgun blasts.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
81	USFWS		Transmission Lines- The Service highly recommends that Exelon conduct bi-annual searches under power lines for eagle electrocutions.	Electrocution of raptors is associated with towers rather than transmission lines. As per the results of Muddy Run Study 3.7, electrocution was not found to be a common occurrence on project towers. These towers are high voltage towers not commonly associated with risk of electrocution. However, since there is potential risk for collision and since eagles are concentrated in certain Project areas, Exelon will incorporate measures for documenting and reporting carcasses found during the course of regular maintenance of lines and towers. BEMP will be updated to include these measures and submitted with the FLA to address this comment.
82	USFWS		Reporting/Planning- All eagle mortalities must be reported to the Fish and Wildlife Service within 5 days. Eagles that collide or found injured should immediately be reported to an onsite contact. A Plan should be developed by Exelon which describes the appropriate State, federal and private association personnel to assist and respond.	Procedures will be developed by Exelon for tracking and reporting eagle injuries and mortalities to the USFWS. Procedures will be developed by Exelon to identify appropriate personnel to assist and respond in the event that injured eagles are found. The BEMP has been updated to include these procedures and submitted with the FLA to address this comment.
83	LSR		We note for the record that Exelon has failed to file timely and complete its obligations under the Study Report timetables established by FERC.	See response to comment 30.

Cmnt No.	Stake-holder	Date	Comment	Exelon's Response
84	LSR		Additionally, Exelon has not provided any type of substantive analysis of how the Project's discharge of sediment affects the state of Maryland's ability to fulfill its water quality obligations pursuant to the Chesapeake Bay TMDL.	The water quality obligations of Maryland pursuant to the Chesapeake Bay TMDL are to reduce suspended sediment and nutrient loads that originate within the Maryland portion of the bay watershed. Maryland's ability to fulfill this obligation is dependent on the extent to which Best Management Practices are implemented within the watershed in accordance with their Watershed Implementation Plan. The potential influence of Project operations on attaining the Chesapeake Bay TMDL water quality goal was addressed in the cumulative effects assessment of the DLA in Section 3.3.1.3. The cumulative effects assessment was conducted within the context of the Chesapeake Bay TMDL, with and without the Project reaching steady-state within the new license term. The substantive technical analyses of Project discharge of sediment, that is, the introduction of sediment to the Project and transport of sediment through and past the Project, were provided in RSP 3.15 and served as the basis for the cumulative effects assessment in the DLA.
85	LSR		A consistent issue is the skewing of scientific data by virtue of incomplete findings analysis. For instance, the Shad Juvenile Turbine Mortality Studies from 3.2 of the Initial Study Reports presents the results of the field study and findings of other shad turbine mortality studies, but does not include a discussion of the extent to which these results are consistent with the modeled mortality estimates presented in the earlier reports.	Exelon disagrees with this conclusion. The comparison of site-specific turbine survival rates and those predicted from model estimates are provided in the Conowingo RSP 3.2-Downstream Fish Passage Effectiveness Assessment.

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426

OFFICE OF ENERGY PROJECTS

Project No. 405-087 - Maryland/Pennsylvania
Conowingo Hydroelectric Project

Project No. 2355-011 – Pennsylvania
Muddy Run Pumped Storage Project

Exelon Generation Company, LLC

July 2, 2012
Ms. Colleen Hicks
Exelon Power
300 Exelon Way
Kennett Square, PA 19348

RE: Comments on Draft License Applications

Dear Ms. Hicks:

Pursuant to 18 CFR § 5.16(e), this letter contains Commission staff's comments on your April 3, 2012 draft license applications for the Conowingo Hydroelectric Project and the Muddy Run Pumped Storage Project. Our specific comments on the applications are outlined in Appendix A.

In several places throughout the draft license applications, you indicate that additional information would be provided regarding final/additional study results. Specifically, you are in the process of completing four studies:
Conowingo 3.4 - American Shad Passage Study; Conowingo 3.5 - Upstream Fish Passage Effectiveness Study; Conowingo 3.19 - Freshwater Mussel Characterization Study below Conowingo Dam; and Conowingo 3.21 - Impact of Plant Operations on Migratory Fish Reproduction. Pursuant to § 5.22 of the Commission's regulations, the Commission may find that the application is not ready for environmental analysis until the results of all studies are filed. We expect that these studies will be completed and filed consistent with the schedule outlined in the Conowingo Project's draft license application. In addition, please ensure that the affected environment sections for resource include an appropriate description of the existing environmental condition at the projects, even if you are not proposing any changes that will affect the resource.

If you have any questions regarding this letter or the contents of your final license applications, please contact Emily Carter at (202) 502-6512, or via email at emily.carter@ferc.gov.

Sincerely,

John B. Smith, Chief
Mid-Atlantic Branch
Division of Hydropower Licensing

cc: Mailing List
Public Files

Enclosures:
Appendix A – Comments on the Draft License Applications

Appendix A
Comments on the Draft License Applications

Based on your draft license applications (DLA), we have identified that your final license applications (FLA) will require additional information and clarification regarding your licensing proposals. In our comments, we note the areas of each DLA where additional information will be needed for Commission staff to conduct its required environmental analysis.

<u>CONOWINGO HYDROELECTRIC PROJECT NO. 405</u>

<u>Exhibit A – Project Description</u>

1. In section 1.0 (pages A-2 or A-3), you do not provide the dimensions of the ogee spillway. Section 4.51(b)(1) of the Commission's regulations requires the physical composition, dimensions, and general configuration of any dams, 1
spillways, penstocks, powerhouses, tailraces, or other structures, whether existing or proposed, to be included as part of the project. In the final license application, please provide this information.

2. In section 1.1 (page A-2), you state that the total length of the dam is 4,648 feet. You also provide specific lengths of different sections of the dam; however, these specific lengths add up to be less than the provided 4,648-foot total length. 2
In addition, the total length of the dam and the length of the powerhouse presented in Exhibit F (drawing F-2) differ from what you provided in Exhibit A. In the final license application, please correct these inconsistencies.

3. In table 1.4-1 (pages A-3 and A-4), you provide intake structure characteristics for turbine units 1 through 7, including the intake area, width, and elevations. You also discuss butterfly valves, head gates, and stop logs at the intakes and 3
how they are operated. You do not, however, provide any such information for the turbine units 8 through 11. In the final license application, please provide similar information for the intake structures for these units.

4. Exhibit E includes various discussions related to the Conowingo dam tailrace; however, you do not provide any description of the project tailrace in Exhibit A. 4
Please include a description of the tailrace in Exhibit A of the final license application.

<u>Exhibit B – Project Operation and Resource Utilization</u>

5. Section 4.51(c)(1) of the Commission's regulations requires a statement whether
operation of the power plant will be manual or automatic. In the final license
application, please provide a description whether the Conowingo power plant is 5
operated by manual or automatic.

6. Section 4.51(c)(2)(ii) of the Commission's regulations requires an area-capacity
curve showing the gross storage capacity and usable storage capacity of the
impoundment, with a rule curve showing the proposed operation of the
impoundment and how the usable storage capacity is to be utilized. In 6
section 2.3, table 2.3-1 (B-11) and figure 2.3-1 (B-14) show the Conowingo pond
storage and surface area versus reservoir elevation relationship. Therefore, the
title of table 2.3-1 and figure 2.3-1 should be changed from the Conowingo pond
stage and surface area versus elevation to the Conowingo pond storage and
surface area versus elevation.

7. In section 2.2 (page B-6), you describe flow conditions of the Susquehanna River
at Conowingo dam and present annual and monthly flow duration information in 7
a tabular format (table 2.2-2). In the final license application, please also provide
monthly flow duration curves, as required by section 4.51(c) of the
Commission's regulations.

<u>Exhibit D – Statement of Costs and Financing</u>

8. Section 4.51(e)(8) of the Commission's regulations requires the on-peak and off-
peak values of project power, and the basis for estimating the values, for projects
which are proposed to operate in a mode other that run-of-river. On page D-7,
you stated that the on-peak and off-peak values were $53.61/ megawatt hour
(MWh) and $37.39/MWh, respectively. Please provide a reference for these 8
values and explain why these are different with the values of the Muddy Run
Project (on-peak value: $53.04/MWh and off-peak value: $37.45/MWh) within
the Pennsylvania-New Jersey-Maryland (PJM) Interconnection, whose
geographic area includes that of the Mid-Atlantic Area Council (MAAC) region.

<u>Exhibit E – Environmental Report</u>

Existing Project Facilities

9. In section 2.1.1, figure 2.1.1-1 (page E-2-33) shows the Conowingo
Hydroelectric Project's major project facilities, but the east and west fish lifts are
not included in the figure. In the final license application, please add notations 9
for these facilities to figure 2.1.1-1.

Water Resources

10. In section 3.3.2 (E-3-38), you state that the average flows between water year 1968 and 2009 measured at the Marietta and Conowingo USGS gages were 39,686 cfs and 41,026 cfs, respectively and monthly average and median flows were compared in table 3.3.2.1.1-1. The average flows between water year 1968 and 2009 are not included in the table. In the final license application, please add the average flows to table 3.3.2.1-1. 10

11. In section 3.3.2 (E-3-69), figure 3.3.2.1.1-2 shows the comparison of Marietta and Conowingo 30-minute and daily average flow data, but a curve for Marietta daily average is not included in the figure. In the final license application, please add the curve to figure 3.3.2.1.1-2. 11

Aquatic Resources

12. In the final license application, section 3.3.3.1.5 should be updated to include the results of the 2012 field sampling, as required in our May 21, 2012 Study Plan Modification letter. 12

13. In section 3.3.3.1.5 (Mussels), creeper (*Strophitus undulatus*) is listed as one of the species noted from shell samples during Exelon's 2010 sampling for Conowingo 3.19. Maryland Department of Natural Resources (DNR) has disputed the identification of this species in its comments on the Conowingo 3.19 Updated Study Report, stating that the shell specimen was tidewater mucket (*Leptodea ochracea*). Please clarify whether creeper was observed during Conowingo 3.19, and in the final license application, provide a table of observed species within the reach from other existing data sources beyond your 2010 and 2012 field sampling, as noted within the Conowingo 3.19 Updated Study Report (e.g., data from Maryland DNR, Marshall University, and other historic data). 13

14. In section 3.3.3.2.8 (Effects on the American Eel Population and Distribution of the Eastern Elliptio Mussel), you provide little information on eastern elliptio from Conowingo 3.19 to support your statements. Please provide a discussion of the eastern elliptio population below Conowingo dam and how the project may influence the distribution of this species. Also, please provide your review of the USGS Northern Appalachian Research Laboratory research on American eel and eastern elliptio, as noted in the text. 14

Terrestrial Resources

15. In section 3.3.4, you provide a very general discussion of upland botanical resources that may occur within the project boundary, with a focus on habitat

communities inferred to be present from studies of adjacent or overlapping areas. So that we may adequately describe botanical resources for our environmental analysis, please provide acreage estimates for the upland habitat categories you describe in section 3.3.4, and include information on terrestrial habitats observed within the project boundary from the various study reports that described such habitat communities. 15

16. Section 3.3.4 provides no information or discussion on the location and extent of invasive species observed within the project boundary, or the potential of invasive species to establish or spread within the project boundary. In the final license application, please include this information. 16

Threatened and Endangered Species

17. In section 3.3.5.2, you state that the project has positive effects on rare, threatened, and endangered species, including bald eagle, osprey, and black-crowned night-heron, based simply on the benefit of foraging and roosting habitat availability associated with the project. Please also provide a discussion on the potential for project operation and maintenance to affect breeding activity of these species. 17

18. In section 3.3.5.2, you state that bog and northern map turtles have not been observed within the project boundary. Please clarify whether these species have the potential to occur within the project boundary, based on available habitat. 18

19. In section 3.3.5.2, you describe the likely presence of various upland habitats within the project boundary. You also describe the habitat requirements for various state-listed plant species that may occur within the project boundary, without discussing whether they were observed within the project boundary during field studies, or have the potential to be affected by project maintenance. As these habitats and state-listed species may be affected by project maintenance, in the final license application, please provide: 1) information on your standard vegetation maintenance methods within the project boundary, including: the methods you use to manage vegetation (i.e., mechanical, chemical, etc.), your typical maintenance schedule (i.e., activities performed annually, seasonally, as-needed, etc.), your procedures for managing vegetation in sensitive habitats (i.e., wetlands, riparian habitat, etc.), and your procedures when rare, threatened, or endangered plants or animals are encountered during routine maintenance; and 2) a discussion of the potential for project-related effects on the state-listed plant species described within section 3.3.5.2. 19

Consistency with Comprehensive Plans

20. In section 5.4 (page E-5-2), you include the National Park Service's Nationwide Rivers Inventory as a comprehensive plan applicable to the project; however, you list the 1982 plan. Please note that the most recent comprehensive plan for the National Park Service's Nationwide Rivers Inventory on file with the Commission is dated 1993. 20

<u>Exhibit G – Project Boundary Maps</u>

21. Section 4.44(h) of the Commission's regulations requires that each sheet of Exhibit G must contain a minimum of three known reference points. In the final license application, please include a minimum of three known reference points on the Exhibit G maps. 21

22. Exhibit G maps show a contour for the normal maximum water surface elevation, but you do not specify the elevation in the maps. In the final license application, please specify the normal maximum water surface elevation within the maps' legend. 22

23. The Exhibit G maps included with the draft license application are in draft form and are not stamped by a registered land surveyor. In the final license application, please remember to provide final Exhibit G maps stamped by a registered land surveyor, as required by section 4.39 of the Commission's regulations. 23

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426

OFFICE OF ENERGY PROJECTS

July 3, 2012

Project No. 405-087 - Maryland/Pennsylvania
Conowingo Hydroelectric Project

Project No. 2355-011 – Pennsylvania
Muddy Run Pumped Storage Project

Exelon Generation Company, LLC

Ms. Colleen Hicks
Exelon Power
300 Exelon Way
Kennett Square, PA 19348

RE: Errata to Comments on Draft License Applications

Dear Ms. Hicks:

The list of ongoing studies referenced in the second paragraph of our July 2, 2012 cover letter providing comments on the draft license applications for the Conowingo and Muddy Run projects was incorrect. The second paragraph of that letter should read as follows:

"In several places throughout the draft license applications, you indicate that additional information will be provided regarding final/additional study results. Specifically, you are in the process of completing four required studies: Conowingo 3.2 – Adult Shad Turbine Mortality Study; Conowingo 3.5 – Upstream Fish Passage Effectiveness Study; Conowingo 3.19 – Freshwater Mussel Characterization Study below Conowingo Dam; and Conowingo 3.21 – Impact of Plant Operations on Migratory Fish Reproduction. Pursuant to § 5.22 of the Commission's regulations, the Commission may find that the application is not ready for environmental analysis until the results of all studies are filed. We expect that these studies will be completed and filed consistent with the schedule outlined in the Conowingo Project's draft license application. In addition, please ensure that the affected environment sections for each resource include an appropriate description of the existing environmental condition at the projects, even if you are not proposing any changes that will affect the resource."

Project No. 405-087
Project No. 2355-011

If you have any questions regarding this letter, please contact Emily Carter at (202) 502-6512, or via email at emily.carter@ferc.gov.

Sincerely,

Emily Carter, Project Coordinator
Mid-Atlantic Branch
Division of Hydropower Licensing

cc: Mailing List
Public Files

ORIGINAL

MASON-DIXON TRAIL SYSTEM, Inc.

309 Bank Hill Rd
Wrightsville, Pa. 17368
February 10, 2012

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

Re: Draft Application for a new License for the Conowingo Hydroelectric Project
FERC Project 405

Dear Secretary Bose,

The Mason-Dixon Trail System (M-DTS) reviewed the Exelon's draft application for the relicensing if the Conowingo Dam. We have the following comments

Page E-2-27 Section 2.2.2 Proposed Project Boundary proposes the removal of some lands from the project boundary. We ask that the trail route in those lands be protected if the lands get transferred to another owner. 24

In Volume 3 Recreation Plan
Page 5-43 Section 5.3.20 Lower Susquehanna Heritage Greenway fails to mention the Mason-Dixon Trail. The Mason-Dixon Trail followed the route from Fisherman's Park to the bridge across Deer Creek before the Greenway built their trail on top of it. Please show that the Mason-Dixon Trail is collocated with the Greenway for that part of the route. 25

Page 8-17, paragraph 8.3 Proposed Recreation Enhancements does not contain any of the items requested by the Mason-Dixon Trail System. Except for a parking lot at Muddy Creek/Paper Mill Rd the enhancements will not cost Exelon any money since the enhancements will be implemented by volunteers with the Mason-Dixon Trail System. These enhancements are:

1. Access to the north side of Muddy Creek at the Paper Mill bridge so that the trail can be taken off the roads and put on Exelon Property all the way down to the river and the Muddy Creek boat ramp. A parking lot is proposed at the bridge. It should be noted that a lot of the kayaks observed at either the Muddy Creek or Cold Cabin boat ramps were put in at the Paper Mill bridge. Exelon is working a boundary dispute at the Paper Mill bridge. 26

2. Permission to run the trail on Exelon property from Michaels Run to Line Bridge Road when access at Michaels Run is obtained. 27

3. Permission to run the trail on Exelon Property from Line Bridge Road to Broad Creek. The only private landowner involved has given his permission. 28

4. Permission to run the trail on Exelon Property from Shuresville Rd to Fisherman's Park. The trail was forced to move onto roads after 9-11. At the request of the Exelon consultant a route was flagged and GPSed. (See below) It was stated that the route would appear in the Recreation Plan but we could not find it. The proposed route is far enough from the power plant that it does not represent a terrorist threat to the plan. The only stipulation by Exelon personnel was that a gate would be installed at the Shuresville Rd. to stop people from going down to the park when there were safety concerns due to high water. The end at Fisherman's Park may have to be modified when the other proposed changes to the parking and road are implemented. When the detailed engineering is done, the M-DTS will work with the engineering firm engaged to do the design. 29

Proposed Relocation below the Dam

We look forward working with Exelon in resolving these issues so that more of the Mason-Dixon Trail can be moved off of roads and improve the hike safety and enjoyment.

Respectfully,

James E. Hooper
President

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

July 9, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First St., N.E., Room 1A
Washington, DC 20426

RE: Conowingo Hydroelectric Project
Federal Energy Regulatory Commission (FERC) Number P-405
Comments on the Applicant's Draft License Application

Dear Secretary Bose:

Pursuant to 18 C.F.R 5.16, enclosed for filing in the above referenced matter are comments from Maryland's Department of Natural Resources and Department of the Environment (Departments) on Exelon's Draft License Application (DLA), as well as the Departments' recommendation that FERC prepare an Environmental Impact Statement (EIS). As set forth below, Exelon's DLA is inadequate due to several incomplete and otherwise flawed studies, lack of supporting data, and a significant number of DLA comments. In addition, the Departments would emphasize that an EIS is clearly required for this Project.

<u>INCOMPLETE STUDIES</u>

Exelon has not fully completed a number of studies required by FERC, as per your Study Plan Determination. At a minimum, the Departments request that the final license application 30
describe: (1) the status of all approved studies which will not be fully completed by August 31, 2012; and (2) Exelon's proposed schedule for completing such studies, including all reporting and consultation as required by the Study Plan Determination and 18 C.F.R. Part 5.

For example, under "Hydrologic Study of the Lower Susquehanna River" (Study 3.11), Exelon has modeled only existing operations. *See* "Operations Modeling Baseline Report" (Jan. 2012), p. ii. However, FERC's Study Plan Determination for this referenced study (Feb. 4, 2010) required significantly more model runs that will be used as the basis for evaluating and mitigating the Project's impacts on aquatic resources. According to the Study Plan Determination, "Potential alternatives that <u>must</u> be assessed include: (1) existing conditions; (2) run-of-river operation; (3) introduction of ramping rates; (4) restrictions on peaking operations during time period with

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or toll free in Maryland 877-620-8DNR – www.dnr.maryland.gov – TTY Users Call via the Maryland Relay

critical life history stages for migratory fish; and (5) changes in minimum flows." *Id*., p. 4 (emphasis added.) We attach below a table of incomplete studies.

We specifically request that the Final License Application (FLA) describe the status and schedule for completion of each of the incomplete and/or unresolved studies listed below.

No.	List of Incomplete Studies	Remaining Study Element	Comments
3.2	Downstream Fish Passage Effectiveness Study	Adult entrainment	Turbine mortality studies of adult shad that were postponed in 2011 were conducted in Spring 2012 and a report will be produced later this year. Results will help define impacts of turbine mortality on American shad passage (outmigration of juveniles and down migration of adults). These results could also be used in the shad model (study 3.4).
3.4	American Shad Passage Model Study	Model runs	Exelon developed a population model of American shad. Models runs with different input parameter scenarios have yet to be completed.
3.5	Upstream Fish Passage Effectiveness Study	2012 Radio-telemetry	A second year of American shad radio telemetry studies were postponed from 2011 due to high flows. Studies were conducted in 2012 but problems with lift operations could compromise the results. Results will be used to help define optimal operating scenarios for American shad passage.
3.6	Conowingo East Fish Lift Attraction Flows	Part of 2012 telemetry study	Analysis could be modified by results from 2012 telemetry study.
3.7	Fish Passage Impediments Study below Conowingo Dam	Part of 2012 telemetry study	Analysis could be modified by results from 2012 telemetry study.
3.11	Hydrologic Study of the Lower Susquehanna River	Model scenarios	OASIS model developed and a calibration and baseline scenario were run. Alternative operational scenarios are being developed by agencies to be run by Exelon and will take several months to complete and analyze. Results will be used along with study 3.16 to evaluate the costs and benefits of various operating scenarios.

3.15	Sediment Introduction and Transport (Sediment and Nutrient Loading)	Sediment Benchmarking and sediment transport model	Exelon has not developed benchmarks for potential impacts and actions, or a sediment dynamics model, as required by the approved study plan.
3.16	Instream Flow Habitat Assessment below Conowingo Dam	Model scenarios	Baseline hydrology model used as input to a baseline habitat assessment of current operations. Alternative operational scenarios from study 3.11 are being developed by agencies to be run by Exelon and will take several months to complete and analyze.
3.19	Freshwater Mussel Characterization Survey	FERC required additional study elements	In its 2012 study determination, FERC required additional sampling in 2012. Results will be used to define impacts to mussels from current operations.
3.21	Impact of Plant Operations on Migratory Fish Reproduction	IP survey	Second IP survey conducted in Spring 2012. Results will be used to indicate use of the lower river as spawning habitat by American shad and other species.
3.32	Re-evaluation the Closing of the Catwalk		Maryland and NPS filed comments. FERC study determination pending.

The Departments request that the Office Director order Exelon to complete all required studies, and defer notice of completeness until after Exelon has in fact fully completed the required studies and any disputes related to such completion have been resolved. Under 18 C.F.R. §§ 5.19(b)-(d) and 5.21, respectively, the Office Director may modify the process schedule, resolve any disputes or requests related to information and studies, and require any additional information necessary for an informed decision on the application.

If these concerns regarding incomplete studies are not adequately addressed, the Departments intend to submit an appropriate motion seeking relief shortly following the August 31, 2012 filing of the FLA. This is a matter of fairness and efficiency as Exelon and the participants prepare for development, comment, and evidentiary hearing on preliminary terms and conditions. Participants should not be expected to submit such terms and conditions under 18 C.F.R. § 5.22(a)(4), until the record includes all the necessary information (such as the hydrologic analysis of alternative operations scenarios) which is Exelon's responsibility under FERC's Study Plan Determination.

ENVIRONMENTAL IMPACT STATEMENT

The Departments strongly urge FERC to prepare an Environmental Impact Statement (EIS) for the Conowingo and Muddy Run Projects. An EIS is required for this major federal action because it will undoubtedly constitute a significant impact to the human environment. The purpose of the EIS is to promote informed decision-making through a comprehensive collection of information and analysis. An EIS would provide a holistic and interdisciplinary approach to assessing the impacts of the Project on resources and more importantly, propose actions and/or alternatives to rectify or minimize these impacts.

An EIS would encourage communication and cooperation between the Resource Agencies, Exelon and the public concerning the environmental decisions and would likely expedite the settlement process because it would not only identify the issues but provide possible solutions. The intent of the EIS is to inform decision-makers and stakeholders and provide a balanced approach to weigh implementation of an action with its impacts on the social and natural environment and provide opportunities for mitigating those impacts while keeping the cost and schedule for implementing the action within set standards.

The Project will involve intense short and long term potential impacts in multiple contexts, and as such, requires an EIS. Examples of such impacts include, but are not limited to:

- Significant and sustained effects of the dam on fish passage efficiency, as demonstrated in the radio telemetry study
- The lack of eel passage presently at Conowingo Dam
- The dam is not run-of-the-river and water elevation in the tailrace may vary on a sub-daily basis by 5 feet due to generation and this significantly impacts sediment transport in the lower river resulting in limited Submerged Aquatic Vegetation (SAV), macroinvertebrate distributions, etc.
- The stranding study conducted below Conowingo Dam demonstrated the potential for significant impacts on resident and anadromous fish populations
- Water quality in the lower river is impacted by stratification that occurs in the pool and the residence time of the water in the reservoir
- Successful downstream passage of most species through Conowingo Dam has not been established but is generally through the turbines; therefore, population impacts are likely
- Sediment accumulation, together with nutrients sequestered in those sediments, pose a significant threat to the health of Chesapeake Bay, especially in light of the Environmental Protection Agency’s (EPA) Total Maximum Daily Load (TMDL) for the Chesapeake Bay.
- Cumulative impacts of the Project on water quality, aquatic biota and aquatic and terrestrial biota relying on riverine or pond habitat influenced by Project operations
- The human environment impacts of these Projects are uncertain and involve unique and unknown risks including: altering and unpredictable daily flow variations, water quality variations leading to possible drinking water impacts and/or fish kills, and unknown effects as the ecosystem changes in response to projected population growth in the watershed

- The interrelated impacts of the Project including economic and/or social and natural or physical environmental effects and may include factors such as relocating fish species, daily limiting or eliminating fish habitat, and/or boating/fishing impacts due to rising water levels and poor water quality
- Impacts to rare threatened or endangered species either in the river or impacted due to river flow in the Chesapeake Bay and include species such as Atlantic sturgeon, shortnose sturgeon and the hellbender and species of concern including river herring which although present below Conowingo Dam are restricted from upriver habitat.
- Unknown impacts of plant operations on the abundance and distribution of fish in the Susquehanna River. This includes lift efficiency, predator/prey interactions as a result of delayed passage and unquantifiable turbine disorientation and/or mortality impacts to fish, potential socioeconomic/cultural impacts for Conowingo Dam and include access restrictions for the public on Project property, recreational impacts including loss of riverine habitat and artificially controlled river flows, and cumulative and unquantifiable fish impacts. The local economy is also affected by changes in public access to riverine habitat near the dam or allowing public access only during daylight hours.

In closing, the potential cumulative impacts for these Projects are significant; therefore, we believe an EIS is required which will provide an appropriate and necessary mechanism for public input and consideration of alternatives. Moreover, the deficiencies in the DLA identified herein by the Departments should be considered and evaluated in the EIS.

Sincerely,

Shawn A. Seaman, Program Manager
Power Plant Research Program

DEPARTMENTS' COMMENTS ON DRAFT LICENCE APPLICATION

Comments on Exelon's Cover letter

Pg. 2 – Exelon states "Where the studies and ILP consultations have clearly identified Project impacts, the DLA proposes resource protection and mitigation measures." However, as we pointed out above, a number of studies that are essential for assessing existing impacts have not been fully completed. As a result, the DLA does not and cannot identify protection and mitigation measures for impacts that have not yet been identified or quantified.

Pg. 3 – Exelon states "Exelon's ILP studies demonstrated that the Conowingo Project ……has little impact on resident and migratory fish populations…" However, Exelon's own studies have documented that the Conowingo facility has numerous impacts on fish populations, including but not limited to: (1) impeding upstream and downstream movement by resident and migratory fish, (2) injuring and killing fish passing downstream through the turbines, (3) changing riverine habitat to pond habitat, (4) stratifying dissolved oxygen levels in the pond, and (5) changing hydrology below the dam from a natural hydrograph to a daily or sub-daily peaking regime. As noted in the previous comment, the nature and magnitude of all specific impacts to fish populations have not yet been established because critical studies have not yet been completed.

Pg. 4 – Exelon states, "….The assessment [Exelon's Recreational Inventory and Needs Assessment, Revised Study Plan (RSP) 3.26], which involved on-site data collection for one year, found that recreational users are satisfied with existing recreation conditions and opportunities at the Project, and that capacity at the Project's numerous and diverse recreation facilities far exceeds demand……" However, the scope of their needs assessment was not adequate to address the specific need to re-open the catwalk (see further comment on Section II, I, below). In addition, the scope of the need was only assessed using current users of the existing facilities; therefore, changes in facilities and non-user preferences were not considered.

Pg. 13, Section II,E – Exelon states, "….These findings demonstrate that Project operations have little, if any, adverse impact on water quality……" However, the physical presence of the dam that creates the Conowingo pool *a priori* creates the circumstances that result in stratification of dissolved oxygen levels in the pond, an adverse impact that would never occur if this was an undeveloped riverine environment.

Pg. 13, Section II, F – Exelon states that the "….Upstream Passage Effectiveness Study calculated fishway attraction effectiveness, upstream fish passage efficiency, and upstream fish passage effectiveness for American shad……" However, the approved passage effectiveness studies were continued in the spring of 2012 and are still ongoing. As a result, it is erroneous to say that the study established attraction or passage effectiveness or passage efficiency. At the time the DLA was submitted, site-specific parameters of American shad passage at the Project have not yet been fully established. 31

Pg. 15. The effects of the Project on American shad passage are described by Exelon as if all facts are known and as if there is a sound basis for Exelon's conclusion that "….Project operations do not appear to be adversely impacting upstream…….passage…." However, in the absence of findings from the incomplete 2012 studies, such a conclusion is clearly premature. We provide greater detailed comments of the American shad passage issue in our comments on Exhibit E.

Pg. 15. Given the findings of the partial studies and in the absence of findings from on-going studies, it is inconceivable that Exelon can state, "…..Project operations do not appear to be adversely impacting upstream or downstream passage….." Such a statement would only be true with 100% passage efficiency, 100% turbine passage survival, and no passage delays, which even the incomplete study has disproved.

Pg. 15, Footnote 44 – Footnote 44 acknowledges that an adult shad turbine mortality study is being done in 2012, and there is no acknowledgement in the text itself that Project operations are not adversely impacting downstream passage is made in the absence of findings of the 2012 studies. 32
There is also no mention in the footnote of the 2012 telemetry study that is still on-going.

Pg. 15, Footnote 46 – In this footnote, "…..Exelon acknowledges …..that given fish passage efficiency issues associated with other hydroelectric projects on the lower Susquehanna River, the Project may have a cumulative impact on the American shad….." This statement incorrectly suggests that the only reason the Conowingo Project may have a cumulative impacts is because of passage efficiency issues associated with the other Projects. The Conowingo Project has specific negative impacts on American shad passage that are additive to the passage impacts at the other projects, and most importantly, because Conowingo is the first project encountered by migrating shad, it has a disproportionate impact on the fate of the Susquehanna River population.

Pg. 15, Section II,G – There is no mention here of the current petition to United States Fish and Wildlife Service (USFWS) to list the American eel as threatened and/or endangered, the outcome of which could have implications for future Project operations. The petition includes data and findings that were not addressed in the USFWS 12-month finding that Exelon cites.

While the USFWS final determination of listing in 2007 states that glass eel indices have remained stable for the last 15 years, the finding stated that there is evidence that there have been population declines in freshwater. Figure 6.6 of the 2012 Atlantic States Marine Fisheries Commission (ASMFC) American Eel Benchmark Stock Assessment shows a decline of Young of Year (YOY) eels in four of six regions with only 2011 numbers in the Susquehanna basin altering a significant long term declining trend.

Addendum II, October 2008, of the AFSMC Eel Fishery Management Plan states historically American eel is estimated to constitute 25% of all freshwater biomass and that the abundance of yellow eels has declined through the 1970's, and that "…fishermen, resource managers, and scientists postulated a further decline in abundance based on harvest information and limited assessment data." Further declines are anticipated unless recruitment increases and mortality decreases.

The EPRI 2011 Technical Report, American Eel in the Susquehanna River, commissioned by Exelon, notes the decline in eels since the 1970's and lists the principle causes:

> Potential causes of the decline from the abundance observed in 1970s and early 1980s include both natural and anthropic factors (Castonguay *et al.* 1994a, Castonguay *et al.* 1994b, Lary and Busch 1997, Knights 2003, Wirth and Bernatchez 2003, USFWS 2007, Bonhommeau *et al.* 2008); Haro et al. (2000) list them in alphabetical order: barriers to migration, habitat loss and alteration, hydro turbine mortality, oceanic conditions, overfishing, parasitism, and pollution.

The Atlantic States Marine Fisheries Commission in its 2012 Stock Assessment Overview: American Eel states:

> Both trend analyses and DB-SRA results indicate that the American eel stock has declined in recent decades and the prevalence of significant downward trends in multiple surveys across the coast is cause for concern.

A peer review of the full stock assessment report states that:

> The Panel review concluded the American eel population is *depleted* in U.S. waters. The stock is at or near historically low levels.

In the same overview, the DB-SRA model shows a precipitous decline in estimated (B50%, median) eel biomass from over 40 million pounds in 1880 to slightly over 4 million pounds in 2011.

Exelon failed to work with the Resource Agencies and stakeholders to assess "…the cumulative impacts to biodiversity of the Susquehanna River ecosystem of upstream and downstream passage of American eel, among other objectives." The EPRI technical report, which assessed the impacts of upstream and downstream passage, was produced by EPRI for Exelon with no input from the Resource Agencies or stakeholders.

Pg. 16 – Exelon states that they "….. conducted biological and engineering studies which described the spatial distribution and size characteristics of American eels in the Conowingo tailrace, …". However, there was inadequate sampling of elvers and yellow eels in the spillway, as noted in agency comments on the study and also in the workshop cited by Exelon, as a result of insufficient attraction water, no substrate suitable for yellow eels on the ramps and eel pots not being a suitable sampling technique for smaller yellow eels. 33

Pg. 18 – It is curious that Exelon can state that their study of the Impact of Plant Operation on Migratory Fish Reproduction (RSP 3.21) "……evaluated the potential impact of Project operations, including the current minimum flow regime, on the reproduction of target anadromous fish (e.g., American shad, river herring, striped bass, and white perch)….." when that study has not yet been completed due to 2011 flow conditions at the dam and is currently underway in 2012. <u>Stating a conclusion before a study is fully complete seems very prescient</u>. 34

Pg. 19. Exelon states that "…..downstream fishery communities are quite robust…..," and as a result they have not proposed to modify minimum flows at the Project. However, their conclusion 35 is based on outdated information (surveys conducted in 1982 and 1987) and data collected with sampling gear that is clearly selective to certain species (the East fish lift). As a result, the community characterizations on which this statement is based are certainly not representative. Most importantly, while Exelon developed a state-of-the-art IFIM model that could be used to assess the effects of different flow regimes on the fish habitat below the dam, they have not yet applied the model to any flow regime other than current operations. The consequence is that the tool has not been used to properly assess modifications to flow regimes that could be beneficial to species present below the dam.

Pg. 22, Section II,I - Exelon submitted two reports to FERC resulting from Study 3.32 (Re-evaluate the Closing of the Catwalk to Recreational Fishing)., a vulnerability assessment and a feasibility report. Agencies were prohibited from accessing the vulnerability assessment and were provided with a redacted version of the feasibility report for review. Exelon states that both the vulnerability and feasibility reports concluded that the catwalk posed a significant risk to public safety and security and recommended that the catwalk remain closed to the public. But they do not explain why the feasibility report should even address the topic of risk to public safety and security, since the objective of the study was simply to evaluate measures that would have to be taken to reopen the catwalk. Exelon's estimated cost to reopen the catwalk ($2.5M) includes extensive modifications that do not relate to vulnerability or security of the Project, as we made clear in our comments on the report.

Exelon states that the Recreation Facility Inventory and Estimated Recreation Use Report (RSP 3.26) clearly indicated that the existing facilities meet current and projected use. However, numerous stakeholders, both the general public and Resource Agencies, have repeatedly stated during various FERC licensing meetings that the type of recreational fishing offered by access to the catwalk is unique. That type of fishing had continued uninterrupted for many decades and is still highly sought after by anglers, since no comparable experience is available elsewhere. In the needs assessment, recreationists' demand for improved and/or additional facilities was evaluated through a survey of users of documented recreation sites within Project boundaries. Anecdotal information from numerous agency staff suggests that former catwalk fishermen no longer fish within Project waters because there are no other facilities within the Project that offer opportunities comparable to the catwalk, even the new Fisherman's Park. As a result, the needs assessment did not incorporate input from former catwalk users who no longer use Project facilities, and thus the sampling frame to assess the specific need for catwalk access was clearly inaccurate and inadequate. A survey of all potential catwalk users (e.g., all resident and non-resident Maryland fishing license holders within a regional geographical range) would have been more appropriate. Note that in the Study 3.26 Report (p. 8-14) the desire to have the catwalk reopened was highest on the list of concerns of users surveyed at Fisherman's Park. Without any mention of this very significant issue in the DLA cover letter, we do not agree that Exelon has demonstrated that their proposed enhancements "….meet current and future recreational demand in the Project area….." as stated on page 4. 36

Pg. 26, Cover Letter Conclusion – Maryland cannot agree that Exelon's "…..proposals will enable the Commission to issue a new license for the Project that is best adapted to a comprehensive plan for waterpower development, and the protection, mitigation, and enhancement of fish and wildlife, and for other beneficial uses….." Exelon has proposed only to continue to operate the Project as it has for the past three to four decades and has not fully investigated alternative Project operations that could avoid, minimize or mitigate the Project's significant impacts on water quality, fish populations, sediment, and other elements of the Susquehanna River ecosystem. Thus, Exelon has not demonstrated that current Project operations are "best adapted to……the protection, mitigation and enhancement of fish and wildlife….." In the absence of assessments of potentially beneficial alternatives, Exelon's conclusion is premature and unfounded.

References

ASMFC. 2008. Addendum II to the Fishery Management Plan for American Eel.

ASMFC. 2012. Stock Assessment Report No. 12-01, American Eel Benchmark Stock Assessment. May 2012.

ASMFC American Eel Stock Assessment Peer Review Panel. 2012. Terms of Reference & Advisory Report of the American Eel Stock Assessment Peer Review. Included in Stock Assessment Report No. 12-01 of the Atlantic States Marine Fisheries Commission, American Eel Benchmark Stock Assessment. May 2012.

Comments on DLA Exhibits

EXHIBIT A-PROJECT DESCRIPTION – No comments

EXHIBIT B-PROJECT OPERATION AND RESOURCE UTILIZATION –

Pg. B-3 – Exelon states "….This temporary variance [i.e., to count the leakage from the
Conowingo Project of approximately 800 cfs as part of the minimum flow discharge] is typically 37
approved by resource agencies (i.e., SRBC, MDNR, PFBC, and USFWS)….." The FLA should
include a summary tabulation of all instances over the past license term (i.e., date of request) when
this temporary variance was requested, an indication of if and when the resource agencies
approved the variance, and the time period over which the variance was in effect for each instance.

Pg. B-3 – Exelon's states that "….When implemented, the temporary variance allows Exelon to
maintain an adequate pond level elevation and storage capacity throughout a low flow period…." 38
The explanation for this situation is that discharges from the dam are the means by which Exelon
complies with the minimum flow requirements of their FERC license. However, when the
Marietta gauge flows drop below Conowingo minimum flows, total releases from the dam include
leakage, such that the total release from the dam exceeds the Marietta gauge flows. Without the
variance, outflow from the Conowingo Pond would exceed inflow and the Pond level could
eventually drop below the required minimum level. Leakage was not taken into account when the
current minimum flows were established under the existing license

Pg. B-3, Section 1.2 – Exelon is not proposing any changes to Project operations in the DLA, but has not evaluated any alternative operations that could contribute to enhancement of aquatic resources within the Project boundaries. As such, the DLA must be deemed incomplete.

Pg. B-6, Section 2.2 – Exelon states that "….The Conowingo USGS gage (Station 01578310), located on the downstream face of Conowingo Dam in the Susquehanna River measures the discharge from Conowingo Dam….." However, there are substantial problems with the gage, as described in Exelon's report for Study 3.11 (pg. 20). The report indicates that there is a discrepancy between the gage readings and estimated turbine discharge of + or – 20%. This discrepancy raises significant question about the accuracy of the minimum flow discharges and thus Exelon's compliance with FERC license conditions.

Pg. B-14, Pond storage versus elevation – Overall pond storage capacity is impacted by the level of
sedimentation in the pond. It is likely that the shallower areas in the upper end of the pond are
affected by sedimentation which results in lower storage capacity. It would be helpful if this figure 39
were labeled to indicate whether it represents this relationship given the current and historical
levels of pond sedimentation. In 2011, Exelon conducted a bathymetric survey of the Pond which
should be used to calculate the loss of storage capacity due to increased sedimentation.

EXHIBIT C-CONSTRUCTION HISTORY – No comments

EXHIBIT D-STATEMENT OF COSTS AND FINANCING

Pg. D-4, Section 4.1 – Exelon states that annual capital costs, not including costs for PM&E measures that they are proposing, are $15,974,000. However, Exhibit D does not appear to provide a listing of what is included in those annual capital costs. It is striking that the annual capital costs are nearly identical to the annual O&M costs presented in Section 4.4. A breakdown of O&M costs should also be included in the FLA. 40

EXHIBIT E-ENVIRONMENTAL REPORT

Pg. E-1-6 - Exelon states that it is
"…proposing the implementation of several resource management plans and a comprehensive management and upgrade proposal for the recreational facilities at the Conowingo Project."

The Recreational Plan (provided in DLA Volume III) lists the objectives as:

- Inventory existing access and facilities.
- Estimate existing and potential recreational use of the Project.
- Assess the need for additional public recreational access, opportunities and facilities.
- Determine enhancements to existing facilities and any new facilities needed to meet recreational demand.
- Determine the cost associated with rehabilitation and development of the evaluated facilities and the mechanisms for implementing, constructing, operating, or maintaining any existing or proposed measures or facilities
- Determine how the Project can be integrated with existing or proposed regional recreation plans
- Address public access, safety and recreation with respect to blocked and impeded access and fluctuating water levels.

In general, Exelon neglected to incorporate RSP 3.26 and other related studies for the Project including:

- Assumption that there will be no park operating hours (using instead a steady-state analysis) and projected use rates are based on no additional facilities and likely underestimate usage in the future
- Agency recommendations to improve/modify facilities (Appendix 1) but does not incorporate these comments into their DLA
- These facilities at Conowingo Dam can offer the public many unique wildlife experiences if the proper technology is incorporated including webcams, interactive and educational web-based tools for fish and wildlife and the use of adaptive management to use future technology.
- Parking lot usage may not reflect on the recreational usage of a site as stated in the DLA
- Pg. 8-1 - User Preference Surveys which Exelon used as a baseline for some of the improvements rely on existing users for input and a few written comments sent as a result of public meetings. The neglect of public outreaches across broad geographic and socioeconomic regions to receive non-user preferences for improvements biases the desires of the general public.

- Discussion of the distribution of lands presently owned and maintained by Exelon and proposed to be transferred/sold
- Pg. 9-1 states that public safety is a major concern for Exelon, peaking and dewatering of the tailrace poses a major hazard for boaters and fishermen; releases and turbine shutdowns should be evaluated in light of public safety.

Pg. E-1-9 and E-1-10 – Sections 1.3.3 and 1.3.6 appear to be duplicates. 41

Pg. E-2-22 – Exelon should be required to explain how going to no flow for six hours during the winter time flow period (December 1st through February 28th) "provides for protection and enhancement of aquatic resources downstream of the Project."

Pg. E-2-23 - The RSP for Study 3.14 states that Exelon will determine whether additional measures are required to minimize the impact of debris on downstream debris issues, if appropriate BMPs were being utilized at the Project, and identify current debris management issues; however, none of these issues were addressed in the DLA. In addition, quantification of the debris collected as a percentage of total debris in the river was supposed to be recalculated by Exelon but in their study it was stated as only 3% of the total available debris, resulting in 97% passage of inriver debris.

Pg. E-2-28, Section 2.2.5, Proposed Environmental Measures – Exelon's proposed measures are clearly inadequate to protect and enhance the lower Susquehanna River ecosystem, for many reasons including the following:

- Fish Lifts - Exelon is only proposing preventative maintenance for both the East and West Fish Lifts. Such maintenance should have already been continuous over the term of the current license and should not be considered as enhancement or mitigation.
- Fish Lifts – The agencies may have a need for the west fish lift for use for trucking in addition to collection of stock for egg production, and pending results of the on-going telemetry work, a west lift capable of passing fish directly to the Conowingo pond might be needed
- Upstream eel passage – While the licensing study of eels suggests the most appropriate location for an upstream passage facility is along the west bank, if minimum flows are modified to further enhance the ecosystem downstream of the Project, higher minimum flows could require an additional passage facility on the east side of the power house..
- Downstream eel - Trapping eels in two small (<50' wide) tributaries is an interim measure suitable for the initial stages of a trap-and-truck program. However, later in the term of the license, we would anticipate additional stocking in the mainstem and additional tributaries. Thus, an alternative for trapping downstream migrants, such as installing a bar rack and collection facility upstream of the project as part of a cooperative effort with other project owners should be identified and addressed in the FLA

- Sediment – A bathymetry survey and adoption of best management practices on Project lands is inadequate to address the long-standing sediment issue in the Conowingo Pond.

Pg. E- 2-29 and Pg. E-3-247 - It is unclear from the information provided the disposition of land that Exelon will transfer and/or sell. Although the SMP encompasses the new Project boundary, supplemental information should be provided. Agencies would like to emphasize that disposition of Project lands will significantly affect the public. 42

Pg. E-2-30 – Section 2.2 presents Exelon's proposal, and Section 2.3 lists alternatives considered but eliminated from further analysis. The DLA does not list alternatives to their proposal (e.g., change in Project operations such as modifications to the current minimum flow regimes) that would be subject to analysis, yet the objective of conducting these studies was to identify and quantify impacts in order to determine what alternatives to current Project operations may be necessary to benefit the environment and aquatic resources. Scoping Document 2, Section 3.3 (Alternatives to the Proposed Action) states that "…Commission staff will consider and assess all alternative recommendations for operational or facility modifications, as well as PM&E measures identified by us, the agencies, Indian tribes, NGOs, and the public…." But to date the agencies have not been able to identify potential desirable alternative operations because several critical studies are ongoing and results needed to identify such alternatives have not yet been made available. In fact, the results of these studies may not be available by the date projected for issuance of the FLA. For that reason, FERC must establish at that time that the FLA is not ready for environmental review and not initiate their environmental review until all studies are fully complete, results are available, and the Resource Agencies have had ample opportunity to identify alternative Project operations required for environmental protection, mitigation and enhancement.

Pg. E-3-17 to 21 - Section 3.3.1

In this section, Exelon mentions developing components of a proposed Sediment Management Plan, which will presumably be filed with the FLA. This plan should include benchmarks, which are required by FERC's Study Plan Determination, for potential impacts and actions. The objective of benchmarking "is to be fully prepared to take immediate action when the reservoir fills to capacity as opposed to making a mitigation decision at the last moment." Waiting until potential sediment related impacts are imminent or have already started to occur before initiating minimization and mitigation steps may result in harmful and unnecessary impacts to water quality, natural resources and Project operations. Identifying benchmarks for potential impacts and actions now is a proactive approach toward sediment management that could allow for early initiation of the steps necessary to implement mitigation and minimization, such as obtaining permits, thereby avoiding or reducing time delays and unnecessary impacts. As we have commented previously, the establishment of such benchmarks now, rather than at some undefined point in the future is critical. Although estimates exist as to the remaining capacity of Conowingo Pond, accurately predicting sediment accumulation rates is uniquely complex and subject to uncertainty related to unpredictable storm events.

We are also concerned about Exelon's unilateral decision to rely on a sediment study performed by third-parties outside of the FERC licensing process in order to develop benchmarks. The three-year study by the Army Corps of Engineers (ACOE) was not designed to identify and evaluate benchmarking or other potential actions that may be relevant and unique to the Conowingo Project. Further, these studies may not be conducted in such a way that will yield data necessary for Exelon to develop benchmarking related to the Project. Also, Exelon does not have the ability to direct or dictate any aspect of the ACOE study. Furthermore, the ACOE study may be subject to funding, timing, or other uncertainties over which Exelon has no control.

In the introduction to its Sediment Introduction and Transport Study (RSP 3.15) Exelon states, "this report identifies and highlights discrepancies and limitations of existing data and reveals the need for a single comprehensive and integrated analysis of the lower Susquehanna River watershed." Exelon then later concludes that, "The literature review and HEC-6 analysis highlight the need for a single comprehensive and integrated analysis of the lower Susquehanna River watershed, including all three reservoirs, riverine processes in the Susquehanna River, and the tidal river mouth and upper Bay, in order to address the discrepancies and limitations of previous studies." Exelon's proposed solution to resolve the discrepancies and limitations identified in its study plan report is to rely on a study planned by the ACOE, rather than complete its own study. The modeling study proposed by the ACOE has not yet been completed, and the data will not be available by August 31, 2012. Therefore, FERC should require Exelon to develop its own sediment transport model in a timely manner so that it can be used to develop an adequate Sediment Management Plan.

Although Exelon lists several types of BMPs that could be used on a watershed or Project scale, Exelon has not identified the BMPs that Exelon plans to use to manage, mitigate, and remove 43
sediment related to the Project. Further, Exelon's discussion of Project-specific BMPs was limited to minimizing erosion. There was no discussion of sediment management options (i.e., beneficial re-use, final disposition, etc.) once sediments have been removed from the river. Exelon should include detailed engineering evaluations and cost estimates for potential sediment management and off-site disposal options in its sediment management plan to be included in the FLA.

The DLA includes a proposal by Exelon to undertake a bathymetric survey of Conowingo Pond every five years. While we agree that a bathymetric survey would be an important feature of a sediment management plan, there is no commitment on Exelon's part as to what action(s) Exelon would take based on the results of these surveys. The relationship between the bathymetric results and the timing of Exelon's actions to address sediment accumulation and impact to natural resources is left open for interpretation and discussion at some later point in time. By not including specific actions in its plan, a significant amount of time would elapse between when the need to remove sediment is determined and when an alternative is selected to actually remove sediment and begin the permitting process. Exelon must develop unambiguous future timelines for action to address sediment accumulation and reduced trapping capacity of the dam.

In its Study 3.15, Exelon discussed pros and cons of a few in-reservoir management options such as siphoning, in-situ sediment capping, and dredging behind the dam, but did not provide engineering details or cost estimates with the exception of the dredging option. All of the options were indicated as having indeterminate practical or financial limitations. Exelon indicated that the costs of in-reservoir management options would outweigh the benefits. However, their study was not done with an objective of identifying potential in-reservoir management options but rather cited options that were previously assessed by SRBC. Exelon merely provided an analysis identifying Project-related impacts to downstream sediment that could affect habitat, and outlined options for in-reservoir sediment management for Conowingo Pond. However, Exelon did not identify localized impacts associated with downstream sediment starvation and alterations of sediment characteristics; or determine the potential for increased dissolved oxygen (DO) impacts from sediment accumulation in the impoundment; or determine impacts associated with increased downstream sediment transport assuming the impoundment reaches capacity.

Pg. E-3-50 and Figure 3.3.2.1.2-9 – The biological significance of levels of dissolved oxygen (DO)
below state standards is a function of both the magnitude of the deviation from the standard but
also the duration of the low DO episode. This DLA section should be expanded in the FLA to 44
include information on the duration of the low DO episodes. Since the low DO episodes are not an
unavoidable impact, Exelon should present operational alternatives that would preclude future
occurrences of such episodes.

Pg. E-3-50 – Debris management. See our comments above regarding pg. E-2-23.

Pg. E-3-53 – Exelon states that Station 643 measurements of DO are very similar to those measured in the turbine boils. However, as shown in Study 3.1, there are certain operating scenarios (use of the Kaplan units during low flow summer conditions) when Station 643 readings are substantially higher than in the turbine boils of those units. Exelon should indicate how often this occurs when boil DO levels are below state water quality standards and what measures will be taken to 1) prevent violation of water quality standards and 2) make sure that appropriate measurements are taken to determine whether water quality standards are being met.

Pg. E-3-55. Exelon states that "….The Project does not result in local impacts to the water quality of the Lower Susquehanna River…." However, prior and current studies (e.g., Figures 3.3.2.1.2-6 and 3.3.2.1.2-7) clearly show the DO stratification that occurs in summer in the Conowingo Pond. Such low DO would not occur in the absence of the dam, and thus the Project does result in local impact to water quality in the Pond. Exelon's statement on Page E-3-53 that "….The operation of the Conowingo Project has no effect on the distribution of temperature and DO conditions in Conowingo Pond….." is thus correct but misleading. It should more clearly state that the Project operations are insufficient to eliminate the stratification and low DO in the Pond that the Project has caused.

Pg. E-3-83 and Table 3.3.3.1.1-3 - The Departments requested that Exelon conduct a study to document the current status of the fish community downstream of the Conowingo Project. While FERC rejected that request, we continue to assert and believe that data from sampling programs conducted in 1982 and 1987, more than three decades ago, and data from fish collections in the west fish lift, a very biased sampling gear, are totally inadequate to accurately characterize current populations of fish in the river. Assessments based on these old and flawed data are unsupportable and inadequate for identifying needed PM&E measures for fisheries.

Pg. E-3-86, Section 3.3.3.1.3 (Entrainment, Impingement, and Mortality) – The range of entrainment survival estimates for adult channel catfish, walleye, smallmouth bass, and largemouth bass range from <80%, which could mean as low as zero survival to 100 (channel catfish) or 95 %

(all other species), a presentation of analytical results that is insufficient to reliably predict the magnitude of entrainment mortality to these species and life stages. In the case of adult American shad, additional survival data are available from the 2010 shad telemetry study at Conowingo, the 2008 telemetry study at Muddy Run, and the ongoing telemetry study at the York Haven Project. New data will also be available from the 2012 shad telemetry study at Conowingo. Data from studies that document actual mortality rates results from turbine passage should be incorporated into this portion of the application. Analysis of the 2010 telemetry data shows a survival rate of only 52.6 % (n=38) for adult shad passed upstream at Conowingo and fish released at Safe Harbor fish lift for the York Haven telemetry study. Survival in the Francis units was 51.9% (n=27), 50% in the Kaplan units (n=2) and 55.6% for fish whose downstream route was unknown (n=9).

Pg. E-3-101 – Exelon states that "…..The overall habitat analysis has value in understanding the habitat vs. flow relationship. However, it does not provide insight into the overall habitat quality or how the habitat location and quality may shift with flow. Appendix E of RSP 3.16 includes habitat maps that show habitat quality and location over a wide range of flows……" However, in this DLA, Exelon only provides a section entitled "Steady-State Habitat Analyses**."** In RSP 3.16, the methodology used in the study provides information on habitat persistence over the range of flows that would be experienced at the Project during typical peaking operation, Exelon's proposed mode of Project operation. Those analyses were requested by the agencies specifically to assess how peaking operations might affect the overall suitability of habitat downstream of the dam, and the FLA should include a complete section on habitat persistence, including maps, under a peaking regime to truly reflect how downstream habitats will be impacted under Exelon's proposed alternative.

Pg. E-3-108 – Exelon states that they "….will conduct an additional site-specific telemetry study in the spring of 2012 to provide more information on the effectiveness and efficiency of the EFL operation. The 2010 and 2012 telemetry data will also be used to analyze the relationship between station generation scenarios and fish passage success. This additional data will inform consideration of changes to EFL operations that may help to increase upstream shad passage at the Project." This statement clearly confirms the Departments' view that the data and analyses in this DLA addressing the fish passage issue are incomplete and inadequate for establishing mitigation measures that would be required to ensure a successful American shad restoration effort in the Susquehanna River, and that a Final License Application that does not incorporate such analysis should be found by FERC to be Not Ready for Environmental Analysis.

Pg. E-3-111 – Exelon states that the "….environmental analysis indicated that the minimum and generation flow combinations contained in the proposed alternative provided modest amounts of habitat for several of the immobile life stages of fish and macroinvertebrates evaluated in the study….." What is not stated is that: 1) the proposed alternative is the same as current operations, and 2) the proposed peaking operations dramatically alter habitat on a daily or sub-daily basis for both immobile as well as mobile organisms downstream of the dam. Peaking flow at Conowingo is more than 10 fold the base flow for 11 months of the year. Evaluation of increases in discharge (peaks) of hourly data (15 min data grouped by hour) at the Conowingo gage from Oct. 1, 2007 to May 18, 2012, (each hour compared to previous hours discharge in 1, 2, 4, 6, 8, 10, and 12 hour increments) shows the percent of change for three levels of change in discharge for each hour period e.g. 24.24% of the 17,944 increasing changes for a 6 hour period were greater than 40,000 cfs.

% Change - Increasing Flows

	Delta 1h	Delta2h	Delta4h	Delta6h	Delta8h	Delta10	Delta12h
>40k	1.57	8.94	15.25	24.24	25.81	22.5	19.29
>60K	0.05	2.04	4.80	8.99	9.41	7.53	6.44
>80k	0.01	0.07	0.18	0.52	0.70	0.78	0.89
incr. count	15247	16299	17035	17944	18838	19496	19589
all count	39680	39679	39678	39676	39674	39672	39670

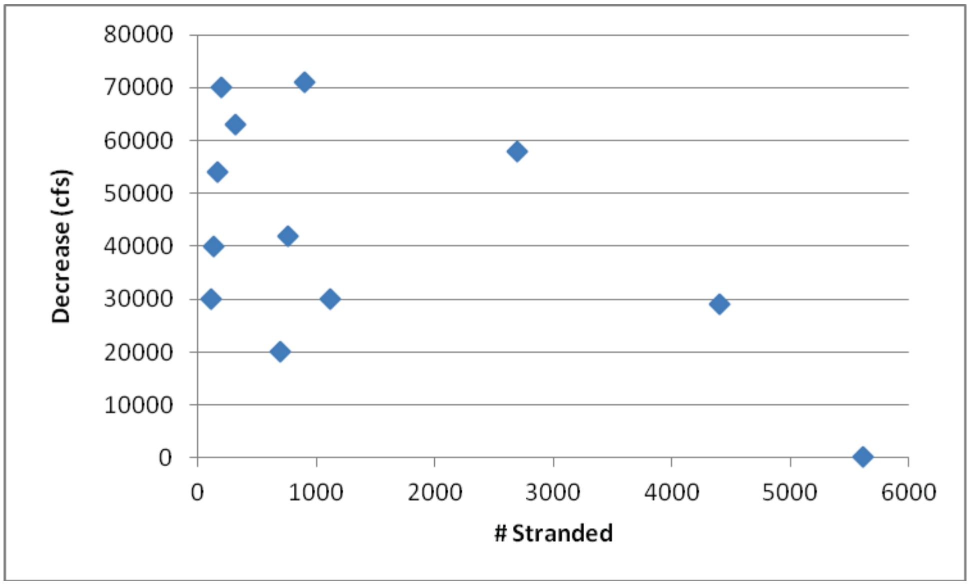
As stated in other comments, the high peaking flows scour sediment required as habitat for various life stages of many components of the aquatic ecosystem downstream of the dam, and the fluctuating flow levels result in habitat being created and destroyed in individual locations downstream of the dam. Exelon has not proposed any change in operation that could help ameliorate these impacts of peaking operations.

Pg. E-3-112, Exelon states that "…During the three-season (spring, summer, and fall) survey, most stranded fish were noted during the summer (10,308) in the spillway study reach. Fewer stranded fish occurred in spring surveys (5,030) and in fall surveys (1,779). The numbers of dead fish documented were highest in spring (18% of the total) and less than 4% of the total in other seasons…." However, stranding numbers presented here are actual numbers from the survey days and not projections of the actual numbers stranded that could be made based on the study data. Stranding numbers expanded for the number of days in each season and for the number of peaks give a very different perspective to the number of fish stranded. For the three seasons represented in the surveys over 420,000 fish were stranded (Table below). This assumes one peak a day for the spring and summer and two for the fall, as shown by the discharge figures for each of the survey periods.

	4/1 - 5/31	6/1 - 9/15	9/16-11/30	12/1-3/31*
Days	61	107	76	121
Sample days	4	4	4	
# Stranded	5030	10308	1779	
Strand/event	1257.5	2577.0	444.8	116
Peak/day	1	1	2	2
Estimate	76707.5	275739	67602	28072
Sample Total	**420049**			
Year Total	448121			

* Winter strand total per event is the total from the last fall survey.

There also does not appear to be any relationship between the drop in discharge and the number of fish stranded (figure below), suggesting fish are stranded at all decreases in flow and that a base flow that keeps the spillway wetted would prevent or substantially reduce stranding. Yet, Exelon has not proposed any alternative operations that could reduce this recognized impact to fish populations.



Pg. E-3-117 – Exelon states that "….gizzard shad have become more abundant over time…" but does not address the extent to which their operation of the East fish lift operation has contributed to the increase in this species and have not suggested measures that might help constrain further population growth.

Pg. E-3-117 – Exelon states that "Radio telemetry data collected in 2010 indicates that 73% of adult American shad that migrated to the Project tailrace entered into the EFL. However, 45% of those adult American shad that migrated to the Project tailrace successfully completed passage through the EFL. In addition, statistical analysis of hourly American shad passage data and station generation scenarios for the 2001 through 2010 migration seasons did not reveal a meaningful overall relationship between the two parameters……" However, in that study 151 fish were tagged but only 89 stayed in the vicinity of the dam or returned to the dam and were thereby considered as participants in the study. Study results also demonstrate that a significant delay in upstream movement is caused by the dam. Animations generated by Exelon clearly show this delay and the text in study 3.5 states that fish changed location in the tailrace to follow the discharge of the units. Mean travel time to the tailrace after the initial drop back was 6d 11.6h (pg 14 and Table 4.4, RSP 3.5). Mean travel time to the EFL after the initial drop back was 11d 16.9h (Table 4.4, RSP 3.5). Mean travel time to passage after the initial drop back was 13d 5.6h (Table 4.4, RSP 3.5). Delays in passage affect the ability of shad to pass three other mainstem dams and reach suitable spawning habitat in a timely manner. Passage effectiveness of 43.8 % (fish that remained upstream of the dam after 48h) is well below pre-dam passage and insufficient for restoration goals. However, Exelon proposes no environmental measures to address what is clearly a significant impact on upstream migration of American shad.

Pg. E-3-119 – Exelon's only proposed environmental measures for upstream passage at the East and West Fish Lifts are preventive maintenance. Preventative maintenance measures should have been in place for both facilities, but were apparently not consistently done under the current license. Such measures cannot and should not be considered enhancement or mitigation of any kind.

The expected life of the west fish lift is stated as up to 15 years with preventative maintenance. As this is less than the expected term of a new license, operating the current structure, even with maintenance, is insufficient for current needs or future uses of the lift to facilitate meeting fish passage goals (trucking and potential volitional passage).

Pg. E-3-120, Section 3.3.3.4.5 – Exelon states that "….The Project does not significantly affect the recruitment and population dynamics of resident …. fishes within the Susquehanna River below Conowingo Dam….." This conclusion is contradicted by the paucity of juvenile smallmouth bass 45
in the river downstream of Conowingo Dam and by the results of Exelon's own IFIM study. Peaking flows below Conowingo Dam result in a complete lack of smallmouth spawning, fry, and juvenile habitat (Pg. E-3-131, Table 3.3.3.1.7-4). In fact, flow at maximum WUA (weighted usable area) is 5,000 cfs for spawning, 2,000 cfs for fry, and 5,000 cfs for juvenile smallmouth bass. Peaking flows up to 86,000 cfs during May and June (smallmouth bass spawning period) and the dominance of bedrock eliminate any usable habitat for the fry and juvenile stages of this species. Thus, with smallmouth bass as an example, Exelon's conclusion cannot be supported. Similarly for migratory fish, Table 3.3.3.1.7-4, on page E-3-131 also shows that WUA for American shad spawning is maximized at flow of 40,000cfs, which is very close to mean flow at Conowingo in May and June (48,000cfs and 34,400cfs, respectively), suggesting that run-of-river discharge would maximize American shad spawning. Exelon's on-going 2012 ichthyoplankton study will provide further information on spawning activity under current conditions and is likely to support a finding that American shad spawning in many areas is eliminated by peaking flows. In fact, Table 3.3.3.1.7-4 shows that for spawning, fry and juveniles, the percent reduction in maximum weighted usable area for all three life stages decreases substantially at higher, peaking flows. Thus, Exelon's conclusion regarding lack of significant effect on the recruitment and population dynamics of migratory fish is unsupported by the results of its own studies.

Pg. E-3-121 - Exelon states: that "Exelon's environmental analysis indicated that the lack of non-bedrock substrate downstream of the dam limits aquatic habitat for certain immobile life stages of aquatic biota." While this is certainly true, the statement does not convey that the absence of non-bedrock substrate downstream of the dam is a result of the high flows associated with peaking operations of the Project as well as the interruption of normal downstream movement of cobble, gravel, and sand as a result of deposition of this material upstream of the dam. This interruption of the natural process of sediment transport and deposition represents a notable Project impact.

Pg. E-3-131 - Table 3.3.3.1.7-4 shows that invertebrate habitat is severely impacted by high peaking flows. Flow that provides maximum weighted usable area (WUA) is between 2,000 and 20,000 cfs for all invertebrates analyzed (mayflies, stoneflies, caddis flies, and the guilds shallow-slow, shallow-fast, deep slow, and deep-fast). WUA declines significantly with higher flows. Exelon's findings confirm that flows typical of their current peaking operation cause significant impacts to this important element of the aquatic community downstream of Conowingo dam. Exelon has not evaluated the potential benefit of a reduction in peak flows that could enhance this specific aquatic community.

Pg. E-3-250 – Study 3.27 states that Exelon will
"…fulfill its license responsibilities and obligations for the Project, including the protection and enhancement of the Project's environmental and recreational values. More specifically, the SMP will:

- Protect environmental attributes such as wetlands, habitat, and spawning areas
- Preserve the scenic quality of the Project lands for boaters and shoreline recreationists.
- Maintain existing water quality.
- Protect historic and cultural resources.
- Ensure cooperation with federal, state, and local government agencies to coordinate adjacent land uses and proposed infrastructure with shoreline uses.
- Ensure coordination with separate regulatory authority permitting review and approval efforts.
- Minimize conflicts among differing uses"

The SMP provides vague information in how it will accomplish these objectives. For the SMP and the extensive 46 miles of shoreline managed by Exelon, there is no mention of sea level rise and the potential impact on the SMP, preserving and enhancing recreational fishing opportunities, coordinating shoreline activities with adjacent landowners and preserving and improving the natural aesthetic quality and scenic environment for boaters, anglers, shoreline viewers, etc., and increase public awareness and educational opportunities at the Project.

The SMP does not address tidal and nontidal wetlands potential impacts, an important habitat component supporting numerous species. Erosion control and stormwater management are important sources of shoreline erosion and pollution, these are also not addressed in the SMP.

Pg. E-5-1, Section 5.4 - Exelon lists comprehensive plans they have reviewed. We note that the "Migratory Fish Management and Restoration Plan for the Susquehanna River Basin" is not listed, even though it has been submitted to FERC for inclusion into the official record. 46

EXHIBIT F-GENERAL DESIGN DRAWINGS AND SUPPORTING DESIGN REPORT – No comments.

EXHIBIT G-PROJECT BOUNDARY MAPS – No comments.

EXHIBIT H-PLANS AND ABILITY OF APPLICANT TO OPERATE THE PROJECT

Pg. H-7, Section 1.2.3.1 – The text describing effects on customers of alternative sources of power provides no details on the potential cost differential if power from Conowingo were to be supplanted by alternative sources, such as gas turbine generators. Quantitative estimates of the financial impacts to customers would contribute to assessing the value of the Project to society.

Pg. H-10 – Exelon states that the Project is fully equipped to allow staff to perform virtually all routine maintenance functions. However, in Exelon's Study Report 3.9 (pg. 10), it is stated that 47
"…..no substantial preventive maintenance or enhancements to the East Fish Lift have been performed over the last 10 years….." This statement of fact would appear to contradict the statement that the Project is fully equipped to allow staff to perform all routine maintenance functions. To the contrary, it suggests that the Project is not sufficiently staffed to ensure compliance with FERC license requirements.

Pg. H-14, Section 2.5 – Exelon states that "…Any [FERC] compliance-related issues noted during the inspections have been promptly addressed by Exelon…" It would be informative to have a listing of all compliance-related issues raised by FERC inspectors over the term of the current license, and some discussion of whether FERC environmental inspections included evaluations of such things as whether all elements of the East Fish Lift were kept in good operating order.

Volume 4 of 4: Bald Eagle Management Plan

Based on the National Bald Eagle Management Guidelines (NBEMG) Exelon should use adaptive BMPs to minimize transmission line and eagle interactions while annually identifying nesting 48
locations and establishing clear buffer areas. This was not identified in their plan.

Although Exelon proposes eagle surveys, the frequency and intensity of such is not given; this should be clearly stated. Since RSP 3.25 identified birding as a very popular activity on Project lands, public information meetings should be held periodically to inform the public of habitat changes, survey results, projected construction that could impact eagle viewing on Project lands 49
that could affect eagles and to receive input to improve eagle viewing at Conowingo Dam.

Exelon states that it will (Pg 1): "Identify a range of land management practices that would benefit the bald eagle population present on Exelon lands." The plan does not identify how it will enhance or improve eagle habitat on Exelon property. Exelon also did not state whether it possesses an "eagle take permit". Lastly, the Bald Eagle is no longer a State of Maryland listed species and as 50
such, Exelon should coordinate with USFWS since this species is still protected under the federal Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) and that their Project may be subject to the National Bald Eagle Management Guidelines.

Summary / Conclusions

Exelon's DLA is inadequate because it is based on numerous incomplete, outdated or otherwise flawed studies or is otherwise incomplete. To the extent that any of the above comments are construed as requests for new information, the incomplete, outdated, or otherwise flawed nature of the studies and data, as set forth herein, constitute extraordinary circumstances because failure to remedy these issues will result in a deficient Final License Application, and in an equally flawed and incomplete Environmental Impact Statement.

The Nature Conservancy. Protecting nature. Preserving life.

July 9, 2012

Via electronic submittal

The Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20246

Re: Comments by The Nature Conservancy on the Draft License Applications for Conowingo and Muddy Run Projects (P-405 and P-2355)

Dear Secretary Bose:

The Nature Conservancy provides comments in response to Exelon's (Licensee) April 3, 2012 filing of the Conowingo and Muddy Run Projects (P-405 and P-2355) "Draft Application for New License" (DLA). This response is in compliance with the Integrated Licensing Process regulations at 18 Code of Federal Regulations Part 5 §5.16 "Preliminary Licensing Proposal."

In addition to the comments below, The Nature Conservancy generally supports the comments that have been or that we expect to be filed by the United States Fish and Wildlife Service (USFWS), Pennsylvania Fish and Boat Commission (PFBC), Pennsylvania Department of Environmental Protection (PADEP), Susquehanna River Basin Commission (SRBC), and Maryland Department of Natural Resources (MD DNR).

I. Description of The Nature Conservancy

The Nature Conservancy (the Conservancy) is a private, non-profit 501(c)3 organization with membership and operations throughout the Susquehanna River and Chesapeake Bay watersheds and around the globe. The Conservancy's mission is to conserve the lands and waters on which all life depends. The Conservancy is a science-based organization that works with partners to identify and implement solutions to complex conservation problems; it has over one million members world-wide. Since its inception in 1951, the Conservancy has protected more than 120 million acres of land, 5,000 miles of streams, and has 150 active marine conservation projects.

As the United States' largest estuary, the Chesapeake Bay is an iconic feature that provides important ecological services along with employment, food, and recreation for millions of people. It also serves as a home for more than 3,600 species and is a crucial nursery for many fish and birds that migrate up and down the Atlantic coast and beyond. The health of the Chesapeake is directly connected to the Susquehanna River, its largest tributary and the largest river on the East Coast of the United States. In addition to its ecological role, the Susquehanna River provides a critical source of drinking water to millions, unparalleled recreational opportunities, and power generation for the Mid-Atlantic region.

Because of their enormous economic and ecological values, the Susquehanna River and the Chesapeake Bay are conservation priorities for The Nature Conservancy. Through its Pennsylvania and Maryland Chapters and Chesapeake Bay Program, The Nature Conservancy has interests that will be directly affected by the outcome of the re-licensing of the Conowingo and Muddy Run Projects. These interests include protecting and enhancing the ecosystem processes that support freshwater and estuarine species and habitats of the Susquehanna River and the upper Chesapeake Bay. Efforts to protect and restore a natural hydrologic regime, sediment regime, and fish passage in the Susquehanna River are a key component of our conservation work. Modifications to the infrastructure and operation of the hydropower facilities on the Lower Susquehanna – including improvements to fish passage and modifying releases to restore critical flows – will benefit priority species and habitats.

The Nature Conservancy has developed global expertise in environmental flow science and management, including creating tools and techniques to assess human influence on water flow and associated ecosystem impacts. These assessments can, in turn, provide important information to develop collaborative solutions that resolve potential incompatibilities between human and ecosystem needs, as well as design and implement an adaptive management plan to improve water management.

As a result of expertise in environmental flows and our interest in the health of the Susquehanna River and the Chesapeake Bay, the Conservancy has developed assessments that directly inform these proceedings. These assessments, "Ecosystem Flow Recommendations for the Susquehanna River Basin," are included as Exhibit 1 and attached to this document. The Nature Conservancy asks the Commission to include it in the public record.

II. <u>General Comments</u>

A. <u>Delayed Studies and Need for Completeness</u>

While the Licensee plans to file a Final License Application (FLA) by August 31, 2012, a number of studies required by the Study Plan Determination are incomplete. The Nature Conservancy requests that the FLA describe the status of any approved studies which will not have been completed, as of August 31, 2012. It should also describe Exelon's schedule for completing such studies, including all reporting and consultation as required by the Study Plan Determination or 18 C.F.R. Part 5.

As of the date of these comments, 6 of the 32 studies approved in the Study Plan Determination have not been completed. For example, under "Hydrologic Study of the Lower Susquehanna River" (Study 3.11), Exelon has modeled only existing operations. *See*

"Operations Modeling Baseline Report" (Jan. 2012), p. ii. However, the Study Plan Determination (Feb. 4, 2010) required more for Study 3.11. "Potential alternatives that must be assessed include: (1) existing conditions; (2) run-of-river operation; (3) introduction of ramping rates; (4) restrictions on peaking operations during time period with critical life history stages for migratory fish; and (5) changes in minimum flows." *Id.*, p. 4 (emphasis added). We attach below a table of studies which we believe are incomplete, relative to the requirements of the Study Plan Determination.

We specifically request that the FLA describe the status and schedule for completion of each of the studies listed below.

No.	List of Incomplete Studies (or studies with comments still due)	Complete	Remaining Study Element	Comments
3.2	Downstream Fish Passage Effectiveness Study **(submitted 3/31/11; juvenile entrainment study submitted 1/24/12; adult entrainment study conducted spring 2012)**	N	Adult entrainment	Turbine mortality studies of adult shad that had to be postponed in 2011 will be conducted in Spring 2012, and a report will be produced later this year. Results will help define impacts of turbine mortality on American shad passage (outmigration of juveniles and down migration of adults). These results could also be used in the shad model (study 3.4).
3.4	American Shad Passage Model Study **(report model development and input variables submitted 1/24/12)**	N	Model runs	Exelon developed a population model of American shad. Models runs with different input parameter scenarios have yet to be completed.
3.5	Upstream Fish Passage Effectiveness Study **(telemetry study conducted Spring 2012)**	N	2012 Radio-telemetry	A second year of American shad radio telemetry studies were postponed from 2011 due to high flows. Studies were conducted in 2012 but problems with lift operations could compromise the results. Results will be used to help define optimal operating scenarios for American shad passage.
3.6	Conowingo East Fish Lift Attraction Flows **(addendum filed 1/24/12 on revised statistical analysis)**	Y except for 2012 telemetry	Part of 2012 telemetry study	Analysis could be modified by results from 2012 telemetry study.
3.7	Fish Passage Impediments Study below Conowingo Dam **(redlined revision submitted to address 2011 comments 1/2412)**	Y except for 2012 telemetry	Part of 2012 telemetry study	Analysis could be modified by results from 2012 telemetry study.
3.11	Hydrologic Study of the Lower Susquehanna River **(submitted 4/29/11 and 6/2/11; baseline model analysis 1/24/12)**	N	Model scenarios	OASIS model developed and a calibration and baseline scenario were run. Alternative operational scenarios are being developed by agencies to be run by Exelon and will take several months to complete and analyze. Results will be used along with study 3.16 to evaluate the costs and benefits of various operating scenarios.

We further request that the new license application propose that the Office of Energy Projects (OEP) Director should establish a schedule for completion of required studies and should defer any notice of completeness until Exelon has, in fact, completed required studies and any disputes related to such completion have been resolved. Under 18 C.F.R. §§ 5.19(b)-(d) and

5.21, respectively, the Office Director may modify the process schedule, resolve any disputes or requests related to information and studies, and require any additional information necessary for an informed decision on the application.

If, in the new license application, Exelon does not propose such further procedures before the notice of completeness, The Nature Conservancy will file an appropriate motion seeking such relief. If necessary, we will file such motion immediately following August 31, 2012. This is a matter of fairness and efficiency as Exelon and the participants prepare for development, comment, and evidentiary hearing on preliminary terms and conditions. Participants should not be expected to submit such terms and conditions under 18 C.F.R. § 5.22(a)(4) until the record includes fundamental information (such as the hydrologic analysis of alternative operations scenarios), which is Exelon's responsibility under the Study Plan Determination.

B. Need for Environmental Impact Statement

On May 11, 2009, the Commission issued a notice of commencement of proceeding stating it intended to prepare an Environmental Assessment (EA) for the Project but noting that there was a possibility that an Environmental Impact Statement (EIS) would be required. "Scoping Document for Conowingo Hydroelectric Project, P-405 and Muddy Run Pumped Storage Project, P-2355," eLibrary no. 20090511-3011. On August 24, 2009, the Commission issued a Revised Scoping Document and reiterated that it would require either an EA or EIS. "Revised Scoping Document for Conowingo Hydroelectric Project, P-405 and Muddy Run Pumped Storage Project, P-2355," eLibrary no. 20090824-3014. Based on the facts in the present case, the Commission should prepare an EIS.

The Commission has adopted regulations requiring compliance with NEPA when acting under Part I of the Federal Power Act (FPA). *See* 18 C.F.R. §§ 2.80(a) and (b). FERC must determine whether the proposed project is "a major Federal action significantly affecting the quality of the human environment." 18 C.F.R. § 707.1(a). If so, FERC must prepare an EIS. *Id.* As stated below, FERC must prepare an EIS in this instance because the existing record shows that the proposed project potentially will have significant effects on the environment.

The Council for Environmental Quality has adopted regulations which provide criteria for determining significance of an impact under NEPA:

> "Significantly" as used in NEPA requires considerations of both context and intensity:
>
> (a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

(b) Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

(2) The degree to which the proposed action affects public health or safety.

(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.

(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

40 C.F.R. § 1508.27.

Based on our review of the existing record, this relicensing meets many of the criteria for "significance." The relicensing will likely have beneficial and adverse effects. While the new license may enhance the baseline condition of some resources, it likely will not fully mitigate the adverse effects of the project's impoundments and alteration of the natural hydrograph. The relicensing will affect public health and a unique and ecologically critical geographic area. As stated in Section I *supra,* the Susquehanna River and Chesapeake Bay have tremendous economic and ecological value. Given the importance of the Susquehanna River and Chesapeake Bay to a number of competing interests, the relicensing is likely to be controversial. The relicensing will affect species listed under the federal Endangered Species Act. While designated critical habitat has not been established, shortnose sturgeon have been documented in the project area, and the National Marine Fishery Service is in the process of developing a recovery plan within which critical habitat will be designated.

C. Obligation to Mitigate

Consistent with its duty to license projects that are in the public interest under Section 10(a)(1), FPA section 4(e) directs the Commission to consider project benefits beyond power generation when deciding whether to issue a license and on what conditions:

> In deciding whether to issue any license... the Commission, in addition to the power and development purposes for which licenses are issued, shall give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife... the protection of recreational opportunities, and the preservation of other aspects of environmental quality.

16 U.S.C. § 797(e).

Also, under 18 C.F.R. § 5.18(b)(5)(ii)(C), the license applicant must provide:

> (C) Proposed environmental measures. The applicant must provide, by resource area, any proposed new environmental measures, including, but not limited to, changes in the project design or operations, to address the environmental effects identified above and its basis for proposing the measures. The applicant must describe how each proposed measure would protect or enhance the existing environment, including, where possible, a non-monetary quantification of the anticipated environmental benefits of the measure. This section must also include a statement of existing measures to be continued for the purpose of protecting and improving the environment and any proposed preliminary environmental measures received from the consulted resource agencies, Indian tribes, or the public. If an applicant does not adopt a preliminary environmental measure proposed by a resource agency, Indian tribe, or member of the public, it must include its reasons, based on project-specific information.

The DLA does not provide adequate information on which the Commission can make findings regarding effects or environmental measures to mitigate the effects. Section III in these comments, along with those submitted by resource agencies on the DLA, provide examples of impacts on critical resources and include loss of migratory and resident fish habitat, ineffective passage through the project, and direct mortality as a result of project operations. Proposals to mitigate these effects are limited or completely omitted from the DLA. Without studies to provide the relevant information, the Commission will be unable to appropriately address the impacts as required by NEPA. At a minimum, the completion of remaining studies identified in Section II.a. of our comments will be essential to identify mitigation requirements.

We request that the FLA propose specific PM&E measures that address the Project's environmental effects. We further request that the FLA propose objectives for the purpose of effectiveness monitoring of PM&E measures which may require adaptation in design or operation (e.g., fish passage).

D. Inadequate Information to Support Findings

Under the FPA, the Commission's licensing order must be based on substantial evidence. *See* 16 U.S.C. § 825l(b).

Under the ILP, it primarily falls to the license applicant to gather and present the information on which the Commission will base the findings in its NEPA document and final licensing order. Exhibit E, specifically, must include extensive information regarding the environmental effects (direct, indirect, and cumulative) of the proposed project based on existing information gathered in the Pre-Application Document (PAD) and studies conducted according to the approved study plan. 18 C.F.R. § 5.18; *see also* 18 C.F.R. § 380.3.

Based on our review of the DLA, Exelon has not provided adequate information on which the Commission can base its environmental analysis, let alone its licensing decision. As stated above, Exelon still has not completed all studies required by the Study Plan Determination. Further, the DLA contains inadequate analysis and explanation of existing information and results of studies that have been completed to support Exelon's findings and proposed measures.

We understand that this is only the draft license application. However, there are significant data gaps and not much time remaining before Exelon must file its final license application. In addition to requiring Exelon to complete all studies required by the Study Plan determination, we request that OEP Staff require Exelon to provide additional information and specific explanation regarding its findings that the proposed new license will have little or no impact on ecological resources prior to accepting the license application and issuing the NREA. Section III, *infra,* provides examples that illustrate areas of the DLA where a lack of substantial evidence contravenes findings of little to no impact to key resources.

E. Consistency with Comprehensive Plans

The DLA, specifically section 5.4 of Exhibit E, states that Exelon reviewed 23 comprehensive plans and found that 18 were relevant to the relicensing. Exelon summarily states that it found no inconsistencies between its proposal and the 18 comprehensive plans it identified as relevant to relicensing.

This conclusory statement does not satisfy Exelon's obligation under 18 C.F.R. 5.18(b)(5)(ii)(F) to "[i]dentify relevant comprehensive plans and *explain how and why the proposed project would, would not, or should not comply with such plans* and a description of any relevant resource agency or Indian tribe determination regarding the consistency of the project with any such comprehensive plan." (Emphasis added). We request that Exelon 51 demonstrate the consistency of its specific protection, mitigation, and enhancement measures with the specific goals and objectives in the relevant comprehensive plans.

III. Specific Comments

A. Water Quality

Page 12 of the DLA indicates that "findings demonstrate that Project operations have little, if any, adverse impact on water quality…." The basis of this conclusion rests on multiple assumptions, including that Station 643 is representative of the river downstream of Conowingo Dam. Evidence in Study 3.1 (including Table 4-5 and Figures 4-23 and 4-27), indicates otherwise, and Station 643 overestimates dissolved oxygen levels more than 10% of the time. Further, assessing turbine boil data, noncompliance events (DO < 5 mg/L) occurred in summer on units #8 to 11. Unit #11, closest to the East Fish Lift, released lowest values. In order to mitigate the impacts of project operations on water quality, aerators should be installed on the Kaplan units (#8 to 11) and the measurement of attainment should be moved from Station 643 to a location closer to the dam. If these structural modifications are not considered, limited operation of units #8 to 11 should be considered to provide suitable water quality conditions during fish migration.

B. Fish Passage

Page 15 of the DLA states that "the study concluded that the effect of the Project on entrainment and turbine mortality is moderate for gizzard shad and low for all other target species…Moreover, Project operations do not appear to be adversely impacting upstream or downstream passage." This statement is presumptuous given that key studies (3.2, 3.4, 3.5, 3.6, and 3.7) are incomplete and could indicate that changes to project infrastructure and/or operations are needed. 52

C. Flow Regime

Pages 18-19 of the DLA conclude that "the consequences of stranding in the summer were found to be negligible, and the impacts of Project operations to populations of both non-migratory and anadromous fish in the spring were found to be minor." As indicated in our comments of April 27, 2011 on the Initial Study Report (ISR), the measures used to arrive at this conclusion are flawed, and the **potential for significant impacts to migratory and resident fish populations associated Project operations is high**. Extrapolating the mortality associated with 12 discrete ramping events characterized in Study 3.8, to ramping events throughout the year, an estimated 420,000 fish may have been stranded over the year (D. Pugh pers. comm.). Fish mortality associated with stranding was also found to be highest during the spring and summer months. During these seasons several species, including American eel, American shad, river herring, striped bass, and Atlantic and short-nose sturgeon, are migrating and spawning in the Project Area. Modified operations toward restoration of minimum flows, high flows, and rates of change have the potential to mitigate adverse impacts of baseline Project operations on migratory and resident fish populations (Travnicek et al. 1995, Bowen 1998, Freeman 2001).

Project operations adversely impact the macroinvertebrate community below Conowingo dam. Study 3.18 characterizes the macroinvertebrate community below the dam as moderately-tolerant. Further, the study specifically summarized the life history traits of genera below the dam and concluded that the assemblage consists of species adapted to hydrologic alteration. As has been documented in dozens of studies, the community is responding to alteration of the flow regime from hydropower operations including minimum flows, high flows, and rate of change (TNC 2010). Of the genera surveyed, more than half are characterized as tolerant of poor habitat conditions (35 of 71 genera). Upstream of the dam, below Safe Harbor, intolerant/sensitive genera compose a higher proportion of the community and include mayflies, stoneflies and crayfish. Modified operations toward restoration of minimum flows, high flows and rate of change have the potential to mitigate adverse impacts on the macroinvertebrate community (Blinn 1995).

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Project operations adversely impact the mussel community composition and abundance below Conowingo dam by increasing high flow scour and altering the substrate composition. Study 3.15 notes significantly lower diversity and abundance of mussels below the dam, and that diversity and abundance increased significantly with distance from the dam. Study 3.1.6, Figure 4.3-3, shows that high flows associated with peaking operations have a negative relationship to the availability of suitable habitat (as measured by shear stress). This relationship shows that when generation flows increase above 60,000 cfs, there is a loss of more than 50% of suitable habitat due to shear stress forces. Further, this relationship likely underestimates the impact of peaking operations to mussels as it does not consider conditions suitable for connectivity between host-fish and glochidia during spawning, nor does it consider sub-lethal impacts of high flow stress on mussel growth and fecundity that have been documented on other large river systems (Rypel et al. 2009, Moles and Layzer 2008). Modified operations toward restoration of minimum flows, high flows and rate of change have the potential to mitigate adverse impacts on the mussel community composition and abundance (Hardison and Layzer 2001, Layzer 2009).

Project operations adversely impact availability of suitable habitat for all life stages of American shad, striped bass and shortnose sturgeon (Figures 1, 2 and 3 attached as Exhibit 2). By overlaying results of the Weighted Usable Area analysis from Study 3.16 in relation to the minimum flow releases under current project, we see that current minimum flow requirements are significantly lower than those found suitable to support the respective life stages.

Page 19 of the DLA also concludes that "water level fluctuations attributable to Project operations do not appear to be impacting littoral habitat…" and that "downstream fisheries communities are quite robust. Accordingly, Exelon is not proposing to modify minimum flows at the Project at this time." While Study 3.11 is incomplete and will hopefully provide a better basis for evaluation of these statements, data from Study 3.16 (see Table 3-1 in RSP 3.16) clearly indicate that **significant restoration (more than 200%) of usable habitat is possible** through modifications to flow regime, specifically minimum and maximum flows. Further, consideration of habitat persistence, particularly habitat that remains functionally connected over time, clearly indicates that operational modifications can improve habitat (Study 3.16, Appendix G). We hope that the planned development of alternative scenarios between Exelon and resource agencies and stakeholders will elucidate opportunities for habitat improvements.

Finally, RSP 3.20 suggest that sub-daily peaking operations at Conowingo Dam do not appear to significantly influence habitat conditions near Havre de Grace under normal or average flow conditions. Prolonged low flow periods (longer than one day), however, were associated with elevated salinities and temperatures at the River mouth. These subtle changes in water quality indicate the potential for enhanced saltwater intrusion across the Susquehanna Flats during low flow periods, at times when the Flats are more likely to provide important refuge habitat. Trends in water quality data were consistent with similar data developed for the record high and low flows observed in June through August 1972, following Hurricane Agnes, when the salt front rapidly moved into the river system under low flow conditions following the record storm (Anderson et al. 1973). Because the water quality data are not collected within the channel where most of the fresh- and salt-water interactions occur, however, it is difficult to ascertain impacts from the dam operations. We found no studies designed specifically to investigate spatial and temporal variation in habitat quality within the Susquehanna Flats, or to evaluate impacts from low flow operations at the Conowingo Dam. Following completion of Study 3.11, the need for additional monitoring of water quality at Havre de Grace/Susquehanna Flats associated with project operations should be assessed.

IV. Conclusion

We thank the Commission for this opportunity to provide comments.

Dated: July 9, 2012

Respectfully submitted,

[signature]

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DECLARATION OF SERVICE

Exelon Corporation, Conowingo and Muddy Run Projects (P-405 and P-2355)

I, Nicholas Niiro, declare that I today served the attached "Comments by The Nature Conservancy on Draft License Applications for Conowingo and Muddy Run Projects" by electronic mail, or by first-class mail if no e-mail address is provided, to each person on the official service list compiled by the Secretary in this proceeding.

Dated: July 9, 2012

By:

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JUL - 9 2012

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

RE: Conowingo and Muddy Run, Exelon – Comments on Draft License Applications (Projects No. 405 and 2355)

Dear Secretary Bose,

NOAA's National Marine Fisheries Service (NMFS) has reviewed Exelon's draft License Applications (DLA) for the Conowingo and Muddy Run facilities. The Muddy Run pumped-storage hydrolectric project is located on the Susquehanna River in Lancaster and York Counties, Pennsylvania. Conowingo Dam is located in Maryland connecting Cecil and Harford counties, as is the lowermost six miles of the Project reservoir, Conowingo Pond. The reservoir of the Conowingo Project serves as the lower reservoir for the Muddy Run Project. Both facilities are described as peaking operations in the DLAs. No modifications to operations are proposed by Exelon at either facility. The current license for the Muddy Run Project was issued on September 21, 1964, and expires on August 31, 2014. The current license for the Conowingo Hydroelectric Project was issued on August 14, 1980, and expires on September 1, 2014.

The proposed continued operation of these facilities has the potential to significantly impact NMFS' trust resources. Historically, the construction of dams has resulted in the fragmentation of habitat and the extirpation or significant reduction of species utilizing the affected habitat. We have statutory responsibility for protection, mitigation and enhancement of marine and diadromous fish resources that may be affected by the operations of Conowingo and Muddy Run. Those authorities include: protection of federally managed marine fish and shellfish and their habitat under the Magnuson-Stevens Fishery Conservation and Management Act and Atlantic Coastal Fisheries Cooperative Management Act; living marine resources under the Fish and Wildlife Coordination Act; and threatened and endangered species under the Endangered Species Act (ESA). These same authorities obligate FERC to consult with us before taking any action, such as relicensing, that may affect these resources.

Endangered Species Act

Federally endangered shortnose sturgeon (*Acipenser brevirostrum*) occur in rivers along the U.S. East Coast and are present in the Chesapeake Bay. As detailed below, while a spawning population of shortnose sturgeon is not known to occur in the Susquehanna River, shortnose sturgeon have been documented in the river.

Five Distinct Population Segments (DPS) of Atlantic sturgeon are listed under the ESA. The New York Bight, Chesapeake Bay, Carolina and South Atlantic DPS are listed as endangered and the Gulf of Maine DPS has been listed as threatened. In the Chesapeake Bay, spawning occurs in the James River. The Susquehanna River is not known to currently support a spawning population of Atlantic sturgeon. Subadult and adult Atlantic sturgeon originating from all five DPSs are distributed throughout the Atlantic coast, from Canada to Cape Canaveral, Florida and are known to occur in the Chesapeake Bay and its tributaries.

Shortnose sturgeon have been incidentally caught by recreational fishermen fishing at the base of the Dam. In addition, the incidental capture of several shortnose and Atlantic sturgeon from the Susquehanna River have been reported via the US Fish and Wildlife Service's Atlantic sturgeon reward program. Further information of Atlantic sturgeon occurrences in the Susquehanna River is provided in the NMFS, Status Review of Atlantic Sturgeon. There have been no studies undertaken to document the likely number of either sturgeon species that is present below the dam or whether spawning of either species occurs within the river. As fish passage adequate for sturgeon does not exist at the Conowingo Dam and neither sturgeon species has been documented to use the existing fish lifts at Conowingo, it is extremely unlikely that either shortnose or Atlantic sturgeon occur upstream of the Conowingo Dam. As such, neither sturgeon species is expected to be present in the Conowingo reservoir which serves as the lower reservoir for the Muddy Run Project.

Sturgeon may be affected by the operation of hydroelectric facilities. This may be a result of the effects of the dam and dam operations on habitat connectivity, alteration or degradation of habitat, or accessibility of habitat below the dam (e.g., as a result of alteration of water flow) . Additionally, if sturgeon are captured in the fish lift, they may be injured or their normal migratory patterns may be disrupted.

As noted in the DLA and in previous correspondence between us on the Conowingo project, shortnose and Atlantic sturgeon occur in Chesapeake Bay and may be present in the Susquehanna River downstream of the Conowingo project. As noted in the DLA, no sturgeon are known to occur upstream of the project, and no sturgeon have been documented in the fish passage facilities. ESA issues are discussed in Exhibit E, the Environmental Report. While Exelon acknowledges that shortnose sturgeon may be present in the area and may be affected be project operations, there is no similar acknowledgement for any of the five Atlantic sturgeon DPSs. Exelon seems to be concluding that no Atlantic sturgeon are likely to be present in the river, and none would be affected by project operations because no tagged Atlantic sturgeon were detected at telemetry buoys placed in the river in 2010 and 2011. However, Atlantic sturgeon are known to occur throughout the Chesapeake Bay and have been documented in the lower Susquehanna River in modern times. Therefore, while successful spawning of Atlantic sturgeon in the river is currently unlikely, the available information indicates that Atlantic sturgeon may occur downstream of the Conowingo project. Because of this, we recommend that the Conowingo DLA be modified to include a complete analysis of effects of continued operations on shortnose sturgeon and the five DPSs of Atlantic sturgeon. We are most concerned about the effects of flow on these species and their habitats. Also, because the flow regime downstream of Conowingo is influenced by operations of Muddy Run, we also recommend that the Muddy Run DLA also consider effects of operations on shortnose and the five Atlantic sturgeon DPSs.

As noted by us in our comments on the Scoping Document and the Preliminary Application Document, in considering effects of project operations on sturgeon, FERC and Exelon should include information and analysis of at least the following: (1) effects of project operation on downstream flow regime and effects of flow changes associated with project operation on potential spawning habitat, access by adults to that habitat, potential to cause delays to spawning, wash out or scouring of eggs or larvae and alternatively, drying out due to dewatering; (2) creation of temporary pools below the dam in which sturgeon can become stranded and information on the persistence of these pools as well as the adequacy of existing minimum flow requirements to prevent stranding; (3) effect of the Dam on distribution of sturgeon in the Susquehanna River and limiting access to upstream habitat and resources; and (4) effects of release of water through flood control gates on adult or early life stages of sturgeon. 54

Neither of the DLAs contain a draft Biological Assessment (BA). We expect that, pursuant to section 7 of the ESA, FERC will request consultation with us on the effects of the proposed relicensing on listed species. The BA should include an assessment that covers the four issues noted above as well as:

1. A complete description of project activities;
2. A complete description of all affected habitats;
3. A complete analysis of the potential effects of operations on shortnose and Atlantic sturgeon, including:
    a. Potential for stranding in isolated pools below Conowingo
    b. Suitability of habitat for spawning, rearing, and overwintering
    c. Effects to forage (benthic invertebrates)
    d. Fragmentation of habitat due to the presence of the Conowingo dam;
4. Potential for capture of shortnose or Atlantic sturgeon in the fish passage facilities. Because sturgeon are known to enter fish lifts, we recommend that the DLA contain a sturgeon handling plan that would outline procedures for documenting and handling sturgeon that may occasionally enter the fish lifts. This plan should also consider documentation and handling of any sturgeon that are stranded in isolated pools below Conowingo. We recommend that such a plan be required by FERC and be implemented as a License Article.

Candidate Species

NMFS candidate species are those petitioned species that we are actively considering for listing as endangered or threatened under the ESA, as well as those species for which we have initiated an ESA status review that has been announced in the *Federal Register*. "Candidate" status does not carry any procedural or substantive protections under the ESA. Two candidate species, alewife and blueback herring, occur in the project area. In August 2011, we were petitioned to list alewife and blueback herring under the ESA. We found that the petition presented substantial information indicating that the petitioned action may be warranted, and in November 2011, we published a positive 90-day finding. More information can be found in the *Federal Register* notice that announced this decision (http://www.nmfs.noaa.gov/pr/pdfs/fr/fr76-67652.pdf). Habitat fragmentation and mortality at power projects are considered a threat to alewife and blueback herring. The Environmental Report for the Conowingo and Muddy Run projects should be expanded to contain a more thorough evaluation of impacts of the continued operation of these projects on these species. While the Environmental Report notes that impingement and entrainment of alewife and blueback herring occurs, it provides no estimate of the number of individuals killed each year and no assessment of the effects of that loss on these species. FERC should require measures to minimize impacts of the projects on these species to the maximum extent practicable. The DLAs and any NEPA document developed for these projects should, at a minimum, consider the following effects of project operations on alewife and blueback herring: 55

- Impingement and entrainment, including mortality;
- Effects of the presence of the dam on upstream passage including delayed migration and an assessment of the effectiveness of the fish passage facilities at passing these species upstream;
- Loss of prey or access to prey; and,
- Any impacts to habitat or conditions that make the Susquehanna River unsuitable for alewife and river herring.

Section 7 consultation process

Section 7(a)(2) of the ESA, states that each Federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Any discretionary federal action that may affect a listed species must undergo Section 7 consultation. Consultation on effects of project operations on shortnose and the five Atlantic sturgeon DPSs is necessary. Should the listing status of alewife and/or blueback herring change, conference and/or consultation could be necessary. We advise that you confirm the status of these species with us when a BA is prepared to determine if any consultation or conference is necessary. We also recommend that you complete any necessary consultation or conference with us prior to making any final decision on reissuance the Conowingo and Muddy Run operating licenses.

Species of Concern

Species of Concern are those species about which NMFS has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the ESA. "Species of concern" status does not carry any procedural or substantive protections under the ESA. Several species designated by NMFS as "species of concern" may occur in the project area. A list of these species can be found at: http://www.nmfs.noaa.gov/pr/species/concern/. We recommend that FERC and Exelon review the list of species of concern and consider evaluating effects of project operations on these species in the Environmental Report and in any NEPA document developed for these projects.

We are available to discuss relicensing and the section 7 consultation process with Exelon Energy and/or FERC staff. Should you have any questions about these comments, please contact me at 978-282-8485 or Kimberly.Damon-Randall@noaa.gov.

Sincerely,

Kimberly Damon-Randall
Acting Assistant Regional Administrator
for Protected Resources

cc: Chiarella, F/NER4

File Code: Sec 7 FERC Conowingo Dam Susquehanna River

United States Department of the Interior

NATIONAL PARK SERVICE
NORTHEAST REGION
15 State Street
Boston, Massachusetts 02109-3572

IN REPLY REFER TO:

July 6, 2012

Filed Electronically

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

Re: Comments on the Draft Application for the Conowingo Hydroelectric Project FERC #405, and Muddy Run Pumped Storage Project FERC #2355

Dear Secretary Bose:

The National Park Service (NPS) has previously filed comments in association with the current relicensing (NPS April 25 2011 Initial Study Report Comments, NPS April 23 2012 Updated Study Report Catwalk Closing Re-Evaluation Comments). While the Draft Application (DA) has referenced the issues and recommendations provided by the NPS, the responses still leave several important issues to be adequately addressed. Primary among them is the fact that Exelon is not addressing recreational use or demand outside and in several cases, abutting project lands as well as non-project lands owned or otherwise controlled by Exelon.

The Final Application should also note that on May 16, 2012, subsequent to the filing of the DA, the Secretary of the Interior designated four water trails in five states as new historic connecting components of the Captain John Smith Chesapeake National Historic Trail. This agency's comments below relative to the Mason Dixon Trail (MDTS) should also be considered in the context that the MDTS is a similarly designated National Recreation Trail, with several sections within and connecting to the Conowingo Project boundary. As set out below, several opportunities exist to provide safer and more desirable routings, and significantly improve trail user's experiences.

The Lower Susquehanna River and Upper Chesapeake Bay region have a long history of recreational access and use. As stated in Executive Order 13508, the Administration has set a goal of 300 additional public access sites and up to 2 Million acres of land to be conserved to ensure adequate protection of the resources associated with the Susquehanna River, the Chesapeake Bay and their tributaries. As in the ongoing PPL Holtwood (FERC 1881) proceeding, Exelon has an exceptional opportunity to preserve and protect significant land under their ownership and enhance recreational use and access, both within and outside the project boundaries associated with the Conowingo and Muddy Run Hydroelectric Projects.

Muddy Creek Gorge at Paper Mill Road

The only reference to access issues at Paper Mill Road in the Muddy Creek Gorge is the Exelon response to NPS Comment 2 from our April 25, 2011 filing, found in Section 3.26 at Page 54 of Attachment A (Exelon Response to Agency Comments), where they state that "Exelon has recently completed a survey of this non-project land and confirmed that Exelon does own the property. Exelon will address this issue in the Recreation Management Plan (RMP)." The RMP associated with the DA makes a brief reference to this issue in Section 8.4.1 **Agency Recommendations not Proposed** to the effect that they are in discussions with the other party claiming ownership, is attempting to settle the dispute and clear title. If Exelon's survey clearly shows that they do own the property in question, they should be able to exercise adequate leverage on the party formerly claiming ownership to properly address this issue. In fact, the Mason Dixon Trail System, in a letter dated February 10, 2012 (filed with FERC on April 23, 2012) proposed specific measures (which MDTS is willing to pay for and implement) to alleviate access issues. Exelon notes that because the subject land is non-project land, it "has no bearing in the FERC licensing process." Although the land is in fact technically outside the project boundary, it clearly has bearing on recreational use of lands within the project boundary as boaters entering the Gorge paddle down to the Muddy Creek Boat Launch for takeout. Exelon only refers to that facility as a put in for boaters using the Conowingo Impoundment. The Muddy Creek Gorge, in and of itself, is a highly valued recreational resource for Class II/III paddling, has direct bearing on the aggregate recreational use of project lands and waters and should be addressed in that context. To the extent that Exelon owns lands abutting Muddy Creek up and above Paper Mill, those lands should be included in the project boundary. 56

Trail Relocation at Conowingo Dam

Exelon's response to NPS Comment 3 from our April 25, 2011 filing (also at Section 3.26 at Page 54, Exelon Response to Agency Comments), notes that they will consult with MDTS regarding relocation of the trail just above and just below the Conowingo Dam "based on the findings specific to such a report contained in Exelon's Conowingo Dam security assessment reports." Based on the Exelon's response in the DA at Section 8.4.1 **Agency Recommendations not Proposed,** it appears that Exelon is tying relocation of the trail to the continued closing of the catwalk. 57

The MDTS proposal from their comments on the DA, including an aerial image showing where the trail would be relocated to, are set out below along with the image showing a relocation of the trail.

"Permission to run the trail on Exelon Property from Shuresville Rd to Fisherman's Park. The trail was forced to move onto roads after 9-11. At the request of the Exelon consultant a route was flagged and GPSed. (See below) It was stated that the route would appear in the Recreation Plan but we could not find it. The proposed route is far enough from the power plant that it does not represent a terrorist threat to the plan. The only stipulation by Exelon personnel was that a gate would be installed at the Shuresville Rd. to stop people from going down to the park when there were safety concerns due to high water. The end at Fisherman's Park may have to be modified when the other proposed changes to the parking and road are implemented. When the detailed engineering is done, the M-DTS will work with the engineering firm engaged to do the design."

Exelon, in their Final application should address this specific option proposed by the MDTS and explain why it is either unable or unwilling to implement it, when it does not appear to be in any way connected to the continued closing of the Catwalk, as discussed below. The proposed route is not only well outside the Conowingo Visitor's Center and appurtenant recreational facilities, it is also well outside Fisherman's Park, although a portion would be located within the Proposed Amended Project Boundary as shown in figure 2.1 in Volume 3. The route would link up to the new parking lot to be constructed at the lower end of Fisherman's Park adjacent to the Lower Susquehanna Heritage Greenway trail head. To the extent that Exelon owns lands that would or could encompass the proposed trail relocation, those lands should be included in the project boundary. 58

The NPS supports this proposal; however, it is our understanding that the consultation referenced above in Exelon's response has not resulted in any resolution. In an email from James Hooper, President of the MDTS dated July 5, 2012, he states

Fred Smith…. could not tell us why the relocation below the Dam was not in the plan. From what he says we have approval at the lower level for all of our plans but someone at a higher level doesn't want to give final approval.

The NPS urges that Exelon address these trail related issues through consultation with the MDTS and the NPS and include the proposed trail relocation in the FA and associated RMP.

Proposed MDTS Relocation below the Dam

Conowingo Dam Catwalk Reopening

The NPS along with several other entities have filed numerous comments regarding the continued closing of the Catwalk to recreational angling. Most recently, the NPS filed comments dated April 23, 2012 specific to the Re-Evaluation. Considering the magnitude and importance of this issue to so many users, agencies and Non-Governmental Organizations, there should be considerably more discussion than the one sentence contained at Section 8.4.1 **Agency Recommendations not Proposed** stating simply "For safety, security, and operational reasons, the catwalk will remain closed." The NPS not only disagrees with this conclusion, but urges the FERC to order Exelon to fully explain the rationale behind this decision in the Final Application, in order that NPS and other stakeholders have the opportunity to rebut Exelon's conclusion. 59

Ferncliff Wildflower and Wildlife Preserve

Ferncliff is a designated National Natural Landmark, and as such is part of a program administered by the NPS to encourage conservation of sites containing biological and geological resources of outstanding character. Ferncliff is adjacent to the Conowingo Project boundary. In order to adequately protect the values for which the preserve was designated, Exelon owned lands both within and outside the project boundary (which abut the preserve should be permanently protected through the Shoreline management Plan. That plan contains no specific land conservation or preservation proposals.

Conservation of Project and Non-Project Lands Owned by Exelon in the Vicinity of Conowingo and Muddy Run

Exelon has stated at numerous meetings and forums that they will discuss land protection during Settlement Negotiations, tentatively scheduled to begin subsequent to their filing of the Final Application. The NPS fully supports this initiative and is hopeful that it can complement and build on the ongoing Conservation Landscape Initiative in Pennsylvania and the Settlement Agreement reached in the Holtwood Hydroelectric Project License Amendment Application (FERC 1881) currently before the FERC.

If you have any questions or comments regarding this letter, please contact Kevin Mendik at (617) 223- 5299, or Kevin_Mendik@nps.gov

Sincerely,

Kevin R. Mendik
NE Hydro Program Manager

Bureau of Fisheries
Fish Production Services
1735 Shiloh Road
State College, PA 16801
(814) 353-2222 Fax: (814) 355-8264

July 9, 2012

The Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20246

Re: Conowingo Hydroelectric Project, FERC Project No. 405
Comments on Draft License Application

Dear Secretary Bose:

The Pennsylvania Fish and Boat Commission notes that not all studies for the Conowingo project have been completed. We request that the new license application describe: (1) the status of any approved studies which will not have been completed as of August 31, 2012 and (2) Exelon's proposed schedule for completing such studies, including all reporting and consultation as required by the Study Plan Determination or 18 C.F.R. Part 5. Specifically, we request that the new license application describe the status and schedule for completion of each of the studies listed below:

Conowingo 3.4 American Shad Passage Study;
Conowingo 3.5 - Upstream Fish Passage Effectiveness Study;
Conowingo 3.19 - Freshwater Mussel Characterization Study below Conowingo Dam;
Conowingo 3.21 - Impact of Plant Operations on Migratory Fish Reproduction.

As of the date of these comments, for study 3.11 "Hydrologic Study of the Lower Susquehanna River," Exelon has modeled only existing operations. See "Operations Modeling Baseline Report" (Jan. 2012), p. ii. However, the Study Plan Determination (Feb. 4, 2010) required much more from Study 3.11 as the basis for evaluating and mitigating the projects impacts on aquatic resources. "Potential alternatives that must be assessed include: (1) existing conditions; (2) run-of-river operation; (3) introduction of ramping rates; (4) restrictions on peaking operations during time period with critical life history stages for migratory fish; and (5) changes in minimum flows." Id., p. 4 (emphasis added.)

We further request that the new license application propose that the Office Director order a schedule for completion of required studies and defer any notice of completeness until Exelon has, in fact, completed required studies and any disputes related to such completion have been resolved. Under 18 C.F.R. §§ 5.19(b)-(d) and 5.21, respectively, the Office Director may modify the process schedule, resolve any disputes or requests related to information and studies, and require any additional information necessary for an informed decision on the application.

If, in the new license application, Exelon does not propose such further procedures before the notice of completeness, the Pennsylvania Fish and Boat Commission will file an appropriate motion seeking such relief. If necessary, we will file such motion immediately following August 31, 2012. This is a matter of fairness and efficiency as Exelon and the participants prepare for development, comment, and evidentiary hearing on preliminary terms and conditions. Participants should not be expected even to submit such terms and conditions under 18 C.F.R. § 5.22(a)(4), until the record includes fundamental information (such as the hydrologic analysis of alternative operations scenarios) which is Exelon's responsibility under the Study Plan Determination.

The Pennsylvania Fish and Boat Commission appreciates the opportunity to provide the following specific comments to FERC on the Conowingo Hydroelectric project Draft License Application.

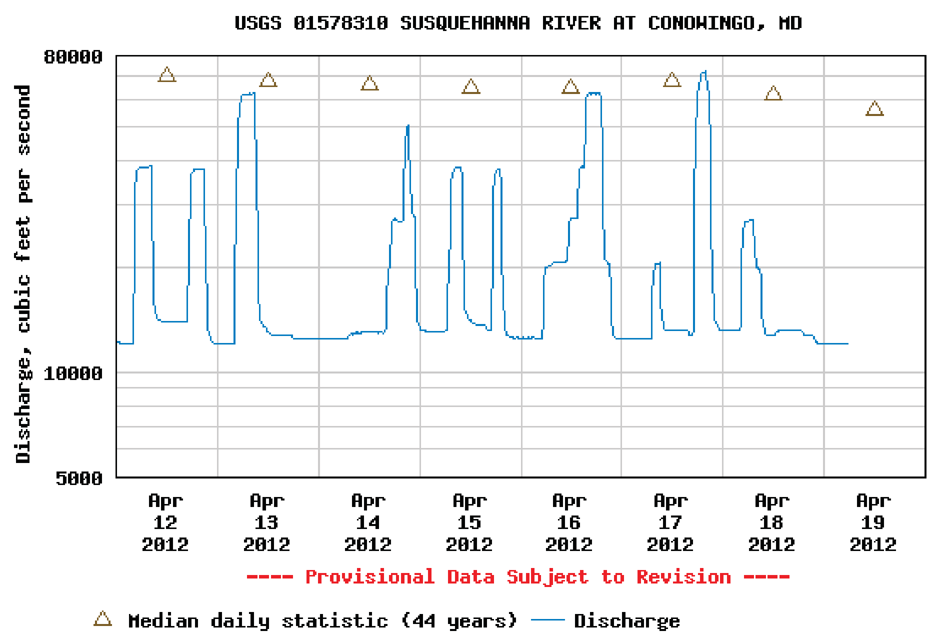
- The PFBC is pleased that Exelon is proposing to maintain the East and West Fish Lifts.
- The PFBC concurs that trap and transport of upstream migrating eels is preferable to construction of an eel passage facility at this time.
- Exelon acknowledges that the Conowingo facility alters the sediment budget of the lower Susquehanna River (page E-3-19) and that the river below Conowingo Dam is lacking in sand and gravel substrates (page E-3-20).
- On Page E-3-39, Exelon states: "*Time series plots reveal that the sub-daily flows do not match between Marietta and Conowingo as well as the daily flow data*." This is clearly a result of peaking operations at Conowingo.
- On pages E-3-44, E-3-47 and E-3-48, Exelon acknowledges that D.O. stratification occurs in Conowingo Pond. This is a direct impact of the Conowingo Project.
- On page E-3-49 Exelon states: "*The cause of the low DO (mostly between 4.4 and 4.9 mg/L; 8 in Units 8-11, 5 in Unit 6, and 1 in Unit 4) in discharge boils is unclear, two explanations seem likely. First, in some instances low DO values might reflect sampling that occurred during or immediately following turbine start up with insufficient time for stabilization before sampling occurred. This may have occurred as the scheduled sampling was to occur on the hour, and no time was allocated for the discharge to stabilize prior to sampling, in the event a unit came on immediately before or during the scheduled sampling time. In such cases, lower DO water sitting in an idle turbine, particularly a large unit, may have been discharged during initial start up and a sample taken from the boil during or immediately after start up might reflect this lower DO water. Second, in the case of the larger Kaplan units (Units 8-11), which do not have aeration capability, lower DO values recorded in these discharge boils may simply be*

more reflective of the DO concentrations being drawn into the unit from the headpond." We believe that the low D.O. recorded in the discharge boils downstream from Conowingo Dam is a result of low D.O. water from Conowingo Pond being discharged below the dam. This is a much simpler and more logical explanation than the first explanation which is convoluted and contrived.

- On page E-3-50, Exelon discusses differences in D.O. between station 643 and the discharge boils. Exelon uses a one-hour lag time for water to get from the discharge boils to station 643. That may be an appropriate lag at low flow, but a high flow, the lag should be much less. Exelon should use data from the modeling exercise to correlate lag time and discharge, then apply that relationship to base lag time on discharge.
- On page E-3-52, Exelon states: "*Since no USGS flow gages exist between the Marietta and Conowingo USGS gages, it is not possible to directly assess Conowingo's specific influence on Susquehanna River flows. That is, differences between the Marietta and Conowingo USGS gages are due to the cumulative effect of all four hydroelectric projects. Thus, while the Project's peaking operations do alter the flows in the Susquehanna River downstream of Conowingo Dam, the magnitude of the Project's impacts (relative to the other upstream projects) is unknown based on the streamflow gage information*." This statement is patently false. Peaking flows in the river below Conowingo are a direct result of peaking generation at Conowingo which is controlled to maximize profit (see table below for Conowingo discharge on 4-19-2012 at 5:30 AM). How are the flows depicted below explained by operation of upstream projects? 60

Discharge, cubic feet per second

Most recent instantaneous value: 12,000 04-19-2012 05:30 EST



Exelon made no attempt to correlate Conowingo discharge with that of Holtwood or Safe Harbor. If flows were dictated by upstream operations, why is Conowingo able to meet downstream minimum flow requirements?

- On page E-3-55, Exelon states: "*The Project does not appear to have appreciable impacts on several water quality parameters, such as dissolved oxygen, water temperature, pH and specific conductivity, as levels in the tailrace meet applicable state water quality standards. The Project does not result in local impacts to the water quality of the Lower Susquehanna River and, therefore, does not impact the Susquehanna River Basin downstream of the Project or the Chesapeake Bay*." Clearly, without the presence of the dam, the stratification would not occur. Figure 3.3.2.1.2-7 on page E-3-78 clearly shows the presence of D.O. values below the state standard of 5.0mg/L. Conowingo installed turbine venting on many of its turbines to mitigate this problem and improve D.O. downstream from the project. The continued presence of episodes of low D.O. below Conowingo Dam is an issue that will require PM&E measures.
- In section 3.3.3.4, page E-3-118, Exelon proposes environmental measures to mitigate project impacts. The PFBC strongly believes that the East Fish Lift is currently at capacity due to the large numbers of gizzard shad using the lift. As provided for in the East Lift design, a second lift bucket should be installed to accommodate increasing numbers of gizzard shad. To date, Exelon has tried to eliminate gizzard shad from the East Lift by increasing entrance velocity. Given the huge numbers of gizzard shad using the lift, that strategy has not been effective. We propose that Exelon try to pass as many gizzard shad as possible, to relieve crowding at the fishway entrance and in the fishway, which may be inhibiting passage of American shad.
- In section 3.3.3.4.5, page E-3-120, Exelon states: "*The Project does not significantly affect the recruitment and population dynamics of resident and migratory fishes within Conowingo Pond or the Susquehanna River below Conowingo Dam. Exelon proposes to continue the existing flow regime below Conowingo Dam to provide habitat for fish species in this river reach."*
  - This statement ignores the paucity of juvenile smallmouth bass in the river downstream of Conowingo Dam. Peaking flows below Conowingo Dam result in a complete lack of smallmouth spawning and juvenile habitat as demonstrated by Table 3.3.3.1.7-4 on page E-3-131. Flow at maximum WUA (weighted usable area) is 5,000cfs for spawning, 2,000cfs for fry, and 5,000cfs for juvenile smallmouth bass. The presence of peaking flows up to 86,000cfs during May and June 61 (smallmouth bass spawning period) eliminates any usable habitat for the juvenile stages of this species. Smallmouth bass spawn in backwater areas, protected from flow. These areas are typically in the lee of islands or points where current velocity is very low. Such habitat exists in the Susquehanna River below Conowingo Dam, but peaking operations cause water level fluctuations which the bass cannot tolerate.
  - Exelon's steady-state analysis confirms the lack of smallmouth bass spawning habitat: "*High quality smallmouth bass spawning habitat between 5,000 cfs and 10,000 cfs is isolated to an area on the downstream tip of Robert Island, with a poor-to-moderate habitat area located just below Rowland Island. At 86,000 cfs,* 62 *there was little to no high or moderate quality habitat in the entire study area."* (page E-3-104). Again, peaking operations have eliminated smallmouth bass spawning habitat below Conowingo Dam.
  - Habitat for juvenile smallmouth bass is also eliminated by peaking: *"High quality smallmouth bass juvenile habitat between 3,500 cfs and 5,000 cfs is found* 63

downstream of Rowland Island, near the mouth of Octoraro Creek and between Robert and Wood Islands. At 86,000 cfs, there are little to no high quality habitat areas, though the Conowingo Dam spillway and shallower areas near Robert, Wood and Spencer Islands provide some moderate quality habitat." (page E-3-104).

- Habitat for adult smallmouth bass is also eliminated by peaking: "*High quality smallmouth bass adult habitat between 3,500 cfs and 10,00 cfs is found near the mouth of Octoraro Creek, near the mouth of Deer Creek, and near the upstream end of Sterret Island. Moderate quality habitat is found in large areas throughout the study area at lower flows. At 86,000 cfs, high quality habitat is limited to the area between Robert and Wood Island, as well as a small area near the mouth of Deer Creek. Moderate quality habitat is also found in the Conowingo Dam spillway area at 86,000 cf."* (page E-3-104). 64
- Table 3.3.3.1.7-4 on page E-3-131 also shows that WUA for American shad spawning is maximized at flow of 40,000cfs. This is interesting since mean flow at Conowingo is 48,000cfs in May and 34,400cfs in June (USGS data). Thus, run-of-river discharge would maximize American shad spawning habitat in the river reach below Conowingo Dam. We have received reports of historical American shad spawning in the river near the mouth of Octoraro Creek (Joseph Townsend, now deceased, former proprietor of Rock Run Landing, personal communication). Ichthyoplankton studies in the early 1980's did not result in collection of American shad eggs or larvae in that vicinity, nor did numerous radio telemetry studies suggest use of that area for spawning. We wait for confirmation from 2012 ichthyoplankton work, but expect to find that American shad spawning in that area has been eliminated due to peaking flows. The four new turbines at Conowingo were installed in 1964, increasing hydraulic capacity from about 35,000cfs to 86,000cfs. Thus, before 1964, without the new turbines installed, the project would have been essentially a run-of-river project in the month of May. The new turbines enabled peaking which resulted in the loss of American shad spawning habitat. In Table 3.3.3.1.7-5. On page E-3-132, we note that for a minimum flow of 7,500cfs, WUA for American shad spawning is estimated to be 40.8 % of the maximum. Thus, peaking causes loss of habitat at both maximum and minimum flows. Minimum flows are required to prevent fish kills due to the huge numbers of migratory fish in the tailrace during the migration season. American shad spawning has also been reported historically at the mouth of the Susquehanna River, on the Susquehanna Flats at Perryville. This spawning was enabled by near run-of-river operations at Conowingo prior to 1964. With a hydraulic capacity of 35,000 cfs, Conowingo generally generated 24 hours per day, given mean flows of 48,000 cfs (May) and 34,400 cfs (June). All night generation provided current velocities conducive to spawning in the area of the Susquehanna Flats. Construction of the new turbines in 1964 meant that Conowingo could peak more during daytime and shutdown at night. Without generation at night, there is not enough current in the Susquehanna flats to permit shad spawning and this spawning location was lost.
- Exelon discusses results of steady-state habitat analysis on page E-3-101. "*High quality (combined suitability greater than 0.75) American shad spawning habitat between 5,000 cfs and 10,000 cfs is limited to an isolated area southwest of Bird*

Island. At 86,000 cfs, however, the area southwest of Bird Island is low quality (combined suitability less than 0.5) habitat. High quality habitat areas at 86,000 cfs are present downstream of Rowland Island, near the mouth of Octoraro Creek and between Robert, Wood and Spencer Islands." We note that no area has high quality habitat at both high and low flows. Thus, peaking operations eliminate American shad spawning habitat below Conowingo Dam.

  - Figure 3.3.3.1.7-13 on page E-3-145 depicts May flows vs. habitat for a number of species and life stages. Note that for American shad spawning, fry and adult, shortnose sturgeon spawning, fry, juvenile and adult, and striped bass spawning, fry and adult, the 90% maximum WUA is centered on the 50% exceedence benchmark. This suggests that run-of-river operation (on an instantaneous basis) would significantly increase habitat for each of these groups.
  - On page E-3-222 Exelon states: "*Shortnose sturgeon may be present, while Atlantic sturgeon and Maryland darter are likely not present in the project area. Exelon does not anticipate there will be unavoidable adverse impacts to these species. There are no unavoidable adverse impacts identified for the Chesapeake Logperch."* This statement is false since impacts due to peaking could be avoided if the project was operated on an instantaneous run-of-river basis.

- On page E-3-121, Exelon states: "*Exelon's environmental analysis indicated that the lack of non-bedrock substrate downstream of the dam limits aquatic habitat for certain immobile life stages of aquatic biota*." This is certainly true, but is a result of the presence of Conowingo Dam which collects gravel and sand. This interruption of the natural process of sediment transport and deposition represents a project impact.
- Exelon discusses entrainment and impingement potential and survival potential on page E-3-87. We note that a low potential is defined as less than 80%. Thus, a low survival potential could be anywhere between 0 and 80%. The huge interval covered under the "low" definition makes this categorization meaningless. To be told that survival will be "low," when that is defined as 0-80% is not very helpful in evaluating impacts. As an example, on page E-3-89 we are told that passage survival of silver eels through the turbines at Conowingo is Moderate-High to Low. This means that survival will be somewhere between 0 and 95%! I find this result believable but meaningless. It should be noted that the resource agencies requested site specific field experiments to estimate turbine passage survival at this project. 65
- In discussion of downstream fish passage, beginning on page E-3-110, Exelon states: "*Both site-specific survival and literature based studies indicate a relatively high survival rate for juvenile and adult American shad passing through the turbines."* Later, it states: *"Based on studies at other hydroelectric projects and calculated survival rates, passage survival through the Francis and Kaplan units is expected to be Moderate-High to Low (95% to <80%) for adult American shad."* Since this range encompasses 0 to 95% survival, it is not enlightening. We look forward to results of the 2012 study to better understand the impact of turbine mortality on down-migrating adult American shad.
- In section 3.3.3.1.4, Exelon discusses impacts on macroinvertebrates. Exelon calls "*the invertebrate community as moderately rich and moderately dense*," but later admits that "*only 8 of 71 genera are considered sensitive/intolerant (tolerance index of 3 or less). Twenty-eight genera were found to be facultative (tolerance index of 4-6) and the*

remaining 35 genera were tolerant (tolerance index of 7-10)." These are not characteristic of a healthy macroinvertebrate community.

- Despite our request, Exelon has not utilized the many bio-assessment indices available including: species evenness, Shannon's Diversity Index, Simpson's Diversity index, Berger-Parker index, Plafkin's EPT index, modified Hilsenhoff biotic index, percent dominant taxa, percent modified mayflies, family biotic index, EPT to Chironomid ratio, ratio of scraper and filtering collector functional feeding groups, percent Chironomidae, percent Tibificidae, etc. Computation of these indices using the existing data would allow the macroinvertebrate community to be compared to other sites and facilitate evaluation of Conowingo's impacts on the resource.
- Benthic species composition and diversity in the river reach below Conowingo Dam appears to be very different from the fauna present in benthic collections from sites above Safe Harbor Dam (studies by PA DEP and SRBC). Mayflies, stoneflies and crayfish, important components of the fauna above Safe Harbor Dam, are absent from collections below Conowingo.
- Table 3.3.3.1.7-4, page E-3-131, shows that invertebrate habitat is severely impacted by high end flows associated with peaking. Flow at maximum WUA is between 2,000 and 20,000cfs for all invertebrates analyzed (mayflies, stoneflies, caddis flies, and the guilds shallow-slow, shallow-fast, deep slow, and deep-fast). In addition, WUA declines significantly with higher flows.
- For stoneflies, Exelon's steady-state analysis concludes that: *"High quality stonefly habitat between 3,500 cfs and 10,000 cfs is found downstream of Rowland Island and near the mouth of Octoraro Creek. Moderate quality habitat is found near the mouth of Deer Creek at 3,500 cfs and 5,000 cfs, but it decreases in quality at higher flows. Almost no high or moderate quality habitat is found in the study reach at 86,000 cfs.*" (page E-3-104-105).
- For mayflies, the steady-state analysis concludes that: "*High quality mayfly habitat between 3,500 cfs and 10,000 cfs is found downstream of Rowland Island and near the mouth of Octoraro Creek. Moderate quality habitat is found near the mouth of Deer Creek and near the upstream end of Sterret Island at 3,500 cfs and 5,000 cfs. Almost no high or moderate quality habitat is found in the study reach at 86,000 cfs"* (page E-3-105). Thus, peaking operations eliminate habitat for both stoneflies and mayflies. These impacts are also apparent from figures 3.3.3.1.7-9 through 3.3.3.1.7-38 on pages E-3-141 to E-3-170, which show severe decreases in suitable habitat over about 16,000cfs.
- Reliance upon antiquated data is not conducive to characterizing present conditions at this project. The most contemporary data included in the benthic study portion of the report is 1991 and marked water quality changes have occurred since this time frame. Reliance upon 20 year old data and collection techniques may be affecting final license decisions that may not be warranted. Cognizant of the water quality changes during this time frame and community improvement upstream of the project by independent collectors (DEP, SRBC, etc.) the present community in this report would be classified as depressed and implicate the operation of the project.

In order to truly characterize the conditions at this facility, more contemporary studies of the invertebrate community are a necessity.

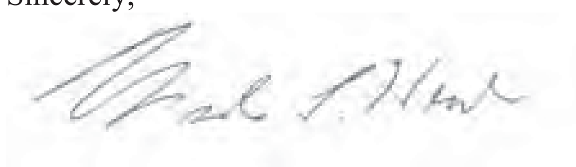
- The licensee admits that the benthos is sparse. On page 4-5 of the study report, the applicant states: *"The Surber sampler study produced a total of 25 taxa in 1982 at a mean density of 2,065 per m2 (Table 4.2-2), indicating a fairly sparse community. Productive ecosystems typically produce invertebrate densities exceeding 10,000 per m2 (Hynes, 1970)."*
- Page 4-7 of the study report: *"This higher density suggests that community density increased in deeper (more permanently wetted) areas."* This is an admission by the licensee that peaking generation impacts the benthic community.
- Page 4-10 of the study report: *"Most of the genera identified from the studies possess some adaptation to water level fluctuation and low dissolved oxygen concentrations."* This is another admission by the licensee that peaking generation impacts the benthic community.
- Only Table 4.3-1 of the study report contains data on decapods (crayfish). A total of 6 crayfish were reported in Surber samples collected in 1983. There are no other records of crayfish reported. However, there are number of crayfish species native to the Susquehanna River. Also, since the late 1980s the introduced rusty crayfish has proliferated in the Susquehanna River to the point that densities in the Susquehanna River upstream of the Conowingo Dam are reaching many individuals per square meter. There is no reason not to expect high densities of crayfish in the riverine reach below Conowingo Dam. Their absence suggests that either conditions are unsuitable or sampling was not adequate to detect them. Crayfish are an important dietary item for smallmouth bass and other species. We believe that peaking plant operations have eliminated crayfish habitat, another project impact.
- With respect to impacts of peaking, Exelon concludes: *"minimum and generation flow combinations contained in the proposed alternative provided modest amounts of habitat for several of the immobile life stages of fish and macroinvertebrates evaluated in the study. "* We note that the key words here are "modest" and "several". The PFBC believes that peaking operations at Conowingo have severe and widespread impacts to the aquatic community, including American shad, smallmouth bass and the entire macroinvertebrate community. These impacts are manifested in loss of habitat, mortality due to stranding, and behavioral modification necessary to cope with fluctuating water levels. There are also severe impacts to recreation, including fishing and boating.

- In their discussion of American eel trap and transport on page E-3-109, Exelon suggests transport of eels to small tributaries (approximately 50 feet wide). We are not aware of this width limitation and wonder where it originated. 66
- On page E-3-114, Exelon states: "*Condition factor and length weight relationships of representative common fish species downstream of Conowingo Dam are comparable to those from other normal, natural populations and are indicative of relatively favorable conditions and habitats in the lower Susquehanna River."* Later, on the same page, it states: "*The paucity of non-bedrock substrate downstream of the dam increases the value of the few habitats that exist. These habitats are located downstream of Rowland Island,*

near the mouths of Octoraro and Deer Creeks, an area southwest of Bird Island, downstream of Snake Island and in-between Robert, Wood and Spencer Islands. These areas often provided unique combinations of depth, velocity and substrate, providing areas of refugia for species and life stages that are not well suited for the conditions found in the river's main channel." These statements are conflicting and further support our contention that project operation impacts availability of suitable habitat (due to peaking) and gravel substrate (due to sedimentation in the reservoir). 67

- On page E-5-1, Exelon lists comprehensive plans it has reviewed. We note that the "Migratory Fish Management and Restoration Plan for the Susquehanna River Basin" is not listed, even though it has been submitted to FERC for the official record. 68

Sincerely,



Michael L. Hendricks
Unit Leader, Anadromous Fish Restoration Unit
Division of Fish Production Services

cc: W. Melnick
A. Shiels
G. Smith
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S. Schreiner, Versar
W. Richkus, Versar
D. Pugh, American Rivers

Susquehanna River Basin Commission

a water management agency serving the Susquehanna River Watershed

July 9, 2012

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
Mail Code: DLC, HL-11.2
888 First Street, N.E.
Washington, DC 20426

Re: Review Comments for Draft License Application;
Conowingo Hydroelectric Project – FERC Project No. 405

Dear Secretary Bose:

The Susquehanna River Basin Commission (SRBC) appreciates the opportunity to comment on the various documents comprising the Draft License Application (DLA) for the Integrated Licensing Process (ILP) submitted by Exelon Generation Company, LLC (Exelon) for the Conowingo Hydroelectric Project (Federal Energy Regulatory Commission [FERC] Project No. 405).

Concurrent with FERC's jurisdiction, SRBC regulates hydroelectric projects pursuant to Article 3, Section 3.10, and Article 10, Section 10.1, of the Susquehanna River Basin Compact (Compact), P.L. 91-575, and SRBC Regulations 18 CFR Parts 801, 806, 807, and 808. SRBC authorizes hydroelectric projects in accordance with the Comprehensive Plan for the Water Resources of the Susquehanna River Basin (SRBC Comprehensive Plan), dated December 2008 (as amended), and as mandated by Article 14 of the Compact. SRBC has participated and will continue to participate in FERC's relicensing process for the Conowingo Hydroelectric Project. Participation should not be construed as an implied waiver of jurisdictional authority over the Conowingo Hydroelectric Project by SRBC. These comments are submitted pursuant 18 CFR §5.16(e).

The SRBC Comprehensive Plan served as a guide during the formulation of specific study requests previously submitted to FERC by SRBC. The SRBC Comprehensive Plan also guided the formulation of the DLA review comments presented herein.

GENERAL COMMENTS REGARDING THE DRAFT LICENSE APPLICATION

SRBC has reviewed the DLA for the Conowingo Hydroelectric Project and offers the following general comments regarding the DLA. Additionally, SRBC is supportive of the DLA technical review comments filed by the Maryland Department of Natural Resources (MDNR), Pennsylvania Fish and Boat Commission (PFBC), Pennsylvania Department of Environmental

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Protection, and United States Fish and Wildlife Service (USFWS) (collectively, the resource agencies), and by The Nature Conservancy.

- The repeated operational issues and mechanical breakdowns at the East Fish Lifts during the 2012 passage season greatly undermine any conclusions Exelon may attempt to draw concerning fish passage at the facility.
- Peaking operations have negatively impacted the available downstream habitat, resulting in negative impacts to macroinvertebrate, resident fish, and migratory fish communities.
- Current fish passage operations are not sufficient to provide adequate upstream and downstream passage of resident and migratory fishes.
- SRBC agrees with Exelon's initial proposal to trap and truck American eels above the hydroelectric facilities.
- Exelon notes that dissolved oxygen stratification occurs in Conowingo Pond. This stratification is a direct impact of the Conowingo Hydroelectric Project.
- SRBC will be collecting water quality and biological data during April to September of 2012 on the Conowingo Pond as part of our ongoing assessment of the lower Susquehanna River. To the greatest extent feasible, SRBC may attempt to correlate newly collected data with that collected in support of Conowingo and Muddy Run study reports.

SPECIFIC COMMENTS REGARDING DRAFT LICENSE APPLICATION

Exhibit B, Section 1

1.1 Calpine Energy should be recognized as a one of the "factors" that influence management of the Conowingo Pond. Calpine shuts down when pool level reaches 98.0 feet. 69

1.4.1 Discussion of operations during adverse years should recognize the efforts of the Conowingo Pond Management Workgroup and the selected operation alternative of QFERC + 1,000 to maintain the level of the Conowingo Pond. QFERC + 1,000 as measured at Marietta (on a seasonal basis) initiates the leakage credit of 800 cubic feet per second (cfs). 70

Exhibit E, Section 3

3.3.2.3.2 SRBC disagrees with Exelon's assertion that the Conowingo Hydroelectric Project does not have appreciable impacts on water quality. Page E-3-78, Figure 3.3.2.1.2-7, shows dissolved oxygen values below 5.0 milligrams per liter (mg/L) thresholds.

3.3.3.1.4 SRBC disagrees with Exelon's conclusion that the macroinvertebrate community is "moderately rich and moderately dense." Exelon reported collecting 71 taxa while 71
only 8 are deemed sensitive/intolerant. Furthermore, commonly used macroinvertebrate community assessment indices were not utilized to compare community composition to other sites to help determine Conowingo Hydroelectric Project impacts.

Table 3.3.3.1.7-4 This table shows the significant negative impact that peaking operations has on macroinvertebrate habitats.

Figure 3.3.3.1.7-34 This figure shows the loss of suitable juvenile smallmouth bass habitat caused by peaking operations.

3.3.3.4.5 SRBC disagrees with Exelon's statement:

> "The Project does not significantly affect the recruitment and population 72
> dynamics of resident and migratory fishes within Conowingo Pond or the Susquehanna River below Conowingo Dam."

Peaking operations and the trapping of sediments behind the dam significantly alter the available habitat below Conowingo Dam and subsequently negatively impact smallmouth bass.

3.3.3.4.6 SRBC notes Exelon's admission that the Conowingo Hydroelectric Project impacts contribute to the lack of appropriate substrate necessary for certain life stages of immobile aquatic biota.

COMMENTS ON STUDY PLAN IMPLEMENTATION SUPPORTING THE DRAFT LICENSE APPLICATION

3.11 Hydrologic Study of the Lower Susquehanna River

SRBC's comments regarding Exelon's failure to timely model alternative operations scenarios follow below. These are preceded by a detailed summary of FERC's hydrologic
modeling requirements for Conowingo relicensing, SRBC's comments that precipitated the 73
requirements, Exelon's agreement to the requirements, and Exelon's reporting regarding its failure to perform timely modeling. As of June 2012, Exelon has not completed any modeling of alternative operations scenarios, as required in the February 2010 Study Plan Determination (SPD).[1] It has, however, recently initiated a process with the SRBC and the other resource agencies toward that end, as further described below.

[1] Exelon Generation Co., Project No. 405-087 (February 4, 2010) (delegated letter order)

Background Regarding Alternative Operations Modeling Requirements for Conowingo

SRBC Proposed Study Plan Comments

On November 23, 2009, SRBC filed comments addressing Study 3.11, Hydrologic Study of the Lower Susquehanna River, and other proposed studies, in relation to Exelon's Proposed Study Plan (PSP), dated August 24, 2009. These SRBC comments proposed that Exelon develop a basis for comparing the effects of Exelon's baseline peaking operations proposal to alternatives, including a return to natural run-of-river flow patterns.[2] SRBC commented that, "Exelon should include in its development of an intra-daily time step model sufficient parameters to analyze indicators of economic benefits and losses attributable to various operation schemes."[3] SRBC commented further that this modeling would allow the resource agencies and FERC "to assess the economic and industrial benefit gained from allowing continued peaking operations at Conowingo versus the environmental benefit gained by reverting to instantaneous run-of-river operations."[4]

Exelon's Revised Study Plan

In its Revised Study Plan (RSP), dated December 22, 2009, Exelon acknowledged the hydrologic studies requested by the resource agencies[5] and indicated that its "operations model . . . can be used to simulate the impacts of alternative flow management scenarios."[6] Exelon stated that, "The results from an alternative operating scenario can then be compared to the baseline condition to determine the relative impacts to reservoir water levels, streamflow, and energy generation."[7] Exelon identified the purpose of the study as follows:

> The study goal is to identify a comprehensive flow management plan for the lower Susquehanna River that minimizes environmental and hydrologic impacts, while maintaining the viability of energy generation and water supply uses. This will be accomplished through the <u>investigation of flow management alternatives</u>, using the Exelon operations model, for the hydropower projects located on the lower Susquehanna River.[8]

The proposal to study alternative operating scenarios was included as "Task 3: Conduct Operations Modeling Production Runs," in relation to Study 3.11.[9] Task 3 requires that:

> Exelon will conduct model production runs to evaluate various alternative operating scenarios (e.g., minimum flow and water level restrictions, run-of-river

[2] SRBC Aug. 24, 2009 Comments, Project No. 405-000 at 10-11
[3] *Id.*
[4] *Id.*
[5] Exelon August 24, 2009 Revised Study Plan at p. 3-82
[6] *Id.* at p. 3-83
[7] *Id.*
[8] *Id.* at p. 3-84 (emphasis added)
[9] *Id.* at 3-86

> operation) at the Conowingo Hydroelectric Project and the upstream hydropower projects, as well as at public water withdrawal and discharge points. These production runs will be used to understand the interactions between the various water users in the study area, and determine the resulting impacts that changes in operation at the hydropower projects and other withdrawal/discharge sites may have on water use in the lower Susquehanna River.
>
> An analysis of the production run results from each scenario will be made relative to current or "baseline" conditions to compare changes in the timing, magnitude, and duration of streamflow conditions in the study area. Documentation of results for each production run will consist of, but not be limited to, discharge hydrographs and monthly/annual flow duration curves at key locations based on hourly flow data, hourly water level graphs, and monthly/annual energy generation totals.
>
> Further, "Task 5: Develop Study Report" requires that:
>
> Study results will be summarized in a report that will include the study methodology, results, and conclusions. The report will be distributed to interested stakeholders for review and comment. Appropriate comments will be incorporated into the report and then submitted to FERC as an Initial Study Report.[10]

The schedule for Study 3.11 provided for conduct of the study in May-September 2010, and in 2011, "if necessary."[11] The schedule required filing of an Initial Study Report on January 21, 2011, and an Updated Study Report on January 21, 2012.[12] Exelon stated that, "the proposed level of effort is adequate to analyze this issue within the study area," and estimated the cost of the entire study to be approximately $130,000.[13]

On January 20, 2010, SRBC filed comments in response to Exelon's RSP. SRBC commented that, as proposed in the RSP, Study 3.11 did not require that Exelon "demonstrate, by way of social and economic values, that operating as a peaking facility convincingly outweighs the benefits of a return to natural flow operation."[14] In this regard, SRBC requested that Exelon perform, "an assessment of the degree to which each hydroelectric facility in the lower Susquehanna contributes to sub-daily fluctuations of river flow, and an assessment of varied dam operations to discern potential benefits to downstream reaches of operations such as run-of-river, ramping, and restrictions on peaking during certain critical times."[15] SRBC

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[10] *Id.*
[11] *Id.* at 3-87
[12] *Id.*
[13] *Id.* at 3-86
[14] SRBC January 20, 2010 Comments at 10
[15] *Id.*

proposed "that the applicant be required to utilize 15-minute data, when available. In the event 15-minute data is not available, the applicant should use the hourly data."[16]

Study Plan Determination

On February 4, 2010, the Director, Office of Energy Projects, issued the Study Plan Determination (SPD) for the Conowingo Hydroelectric Project.[17] Study 3.11 was listed as approved, "as modified."[18] As modified and approved in the SPD, Study 3.11 required Exelon to "simulate the effects of alternative flow management scenarios" and compare these "to the baseline condition to determine the relative impacts to reservoir water levels, streamflow, and energy generation."[19] Further, the SPD required Exelon to use at least an hourly time-step in modeling the alternatives.[20] Additionally, the SPD required Exelon to "include operation alternatives so that potential benefits to downstream reaches of operations may be evaluated."[21]

Study Reports

On February 22, 2011, Exelon filed its Initial Study Report (ISP), indicating that it "has begun development of an operations model for this FERC licensing proceeding," and that "The operations modeling is currently undergoing final enhancements, and once these are complete, production runs will be conducted to analyze current and alternative flow regimes."[22] In its April 27, 2011, comments on the ISP, SRBC addressed the status of the Study 3.11.[23] In response to SRBC's comments, Exelon stated:

> The initial study report submitted in May 2011 to FERC did not contain any operations modeling production runs, though a brief model description was submitted. Exelon will submit to the stakeholders a separate stand-alone report describing the details of the operations model. The report(s) will describe model methodology, model calibration, and a "baseline" model production run. Exelon will consult with stakeholders in designing additional model production runs based on alternative operation schemes proposed.[24]

On January 24, 2012, Exelon filed its Updated Study Report, stating that "At this time, no alternative production runs have been run by Exelon. Exelon intends to design and run alternative operation scenarios in consultation with the resource agencies and other stakeholders as an ongoing task during the relicensing process."[25]

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[16] *Id.* at 9
[17] Exelon Generation Co., Project No. 405-087 (February 4, 2010) (delegated letter order)
[18] *Id.* at Appendix B
[19] *Id* at 11
[20] *Id.* at 12
[21] *Id.*
[22] Exelon February 22, 2011 Initial Study Report Summary RSP 3.11 at 4
[23] SRBC February 27, 2011 Comments at 4
[24] Exelon May 27, 2011 Response to Agency Comments at 25-26
[25] Exelon January, 24 2012 Updated Study Report RSP 3.11 at ii

As of this date, Exelon has yet to complete the modeling of a single alternative operations scenario.

During May 2012, Exelon requested and SRBC agreed to facilitate a series of meetings of the resource agencies for the purpose of coordinating and recommending to Exelon a series of alternative modeling scenarios to be run consistent with its SPD obligations. Consistent with that request, in June 2012, SRBC facilitated the development of a series of nine (9) proposed alternative modeling scenarios, which were submitted to Exelon on behalf of the resource agencies on July 9, 2012. 74

Comments Regarding Alternative Operations Modeling

As noted above, Study 3.11, as approved in the February 4, 2010 SPD, requires that Exelon model alternative flow management scenarios, including run-of-river operation, and compare these to its baseline (peaking) operations proposal. This modeling of alternative scenarios will provide an understanding of the interactions between the various water users in the study area and determine the resulting impacts that changes in operation at the hydropower projects and other withdrawal/discharge sites may have on water use in the lower Susquehanna River. Exelon is required to provide the results of its modeling in its study reports.

As stated by Exelon, the purpose of this modeling is to develop "a comprehensive flow management plan for the lower Susquehanna River that minimizes environmental and hydrologic impacts, while maintaining the viability of energy generation and water supply uses."[26] To pursue continued peaking operations, Exelon must justify that the social and economic value of doing so convincingly outweighs the benefits of a return to natural flow patterns. The results of modeling the alternative operating scenarios would either support Exelon's baseline operations proposal, or aid in identifying other scenarios that may strike a more appropriate balance. These study results are a critical prerequisite toward striking the proper balance between power production and environmental concerns.

As a result of Exelon's delay in modeling alternative operations scenarios, the baseline operations proposal reflected in the DLA lacks critical support. In the DLA, Exelon proposes no changes to current project operations.[27] Absent the results of modeling alternative operations scenarios, Exelon's DLA operations proposal currently lacks foundation.

Further, this delay has deprived resource agencies, including SRBC, and other interested parties, the benefit of the results of the alternative modeling and the resource agency's ability to adequately provide consultation has been severely constrained. Consultation opportunities have been lost as a result of this delay, and it has pushed the resolution of acceptable river hydrology into the third stage of relicensing.

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[26] Exelon August 24, 2009 Revised Study Plan at p. 3-84
[27] Exelon April 3, 2012 Draft License Application, Exhibit B at B-3

Exelon's license application for Conowingo is due August 31, 2012. We assume Exelon will submit its license application on or before that date. Subsequently, by September 14, 2012, FERC may either issue a tendering notice, or find the application to be deficient. If a deficiency finding is made, FERC may provide Exelon up to ninety (90) days to correct the deficiency.

In the case of Conowingo, the record clearly demonstrates a deficiency in that Exelon has failed to conduct all reasonable studies and obtain all reasonable information requested by the resource agencies during second stage of the licensing process. FERC has described the applicant's obligations during the second stage as follows:

> In the second stage, the applicant must diligently conduct all reasonable studies and obtain all reasonable information requested by the resource agencies, and provide the agencies with copies of the draft application, the results of the studies, and allow sixty days for the agencies to comment on the draft license application.[28]

Exelon has not provided any reasonable explanation for its failure to complete the modeling of alternative operating scenarios. Regardless, and of most concern to SRBC, is the impact of the delay in obtaining results from the alternative modeling runs, either those recently recommended to Exelon or those that may be developed in response to the results of the first round of modeling runs. That constitutes a prejudice that adherence to the spirit and letter of the Integrated Licensing Process was intended to avoid. 75

Accordingly, SRBC sees no justification for delaying the completion of the studies beyond the second stage of consultation. Exelon has indicated that it will not undertake more than three alternative modeling scenarios at a time, which will result in even further delay. Exelon should be directed to expend whatever resources are necessary to complete the first round of modeling runs and provide results by the August 31, 2012, license application deadline.[29]

SRBC is hopeful that the nine (9) proposed scenarios will provide sufficient information to allow an analysis of alternatives to the baseline operations scenario. However, until the results of this first round of modeling are available, it is impossible to be sure that other modeling is unnecessary. It is unreasonable for Exelon to wait until 2 months before filing its license application to begin modeling alternative scenarios and then expect resource agencies to agree to arbitrary constraints on the number of models to be performed. Accordingly, SRBC reserves its right to request additional alternative modeling from Exelon.

At a minimum, SRBC requests that the new license application describe: (1) the status of any approved studies which will not have been completed as of August 31, 2012; and (2) Exelon's proposed schedule for completing such studies, including all reporting and consultation as required by the SPD or 18 CFR Part 5.

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[28] Lock+ TM Hydro Friends Fund IV, LLC, 131 FERC ¶ 61,031 at P 14 (2010) (emphasis added)
[29] In this regard, it is noteworthy that Exelon estimated the total cost of Study 3.11 to be $130,000; Exelon's August 24, 2009 Revised Study Plan at p. 3-86

As of the date of these comments, several studies have not been completed. For example, under "Hydrologic Study of the Lower Susquehanna River" (Study 3.11), Exelon has modeled only existing operations. See "Operations Modeling Baseline Report" (January 2012), p. ii. However, the SPD (February 4, 2010) required much more from Study 3.11, as the basis for evaluating and mitigating the projects impacts on aquatic resources. "Potential alternatives that must be assessed include: (1) existing conditions; (2) run-of-river operation; (3) introduction of ramping rates; (4) restrictions on peaking operations during time period with critical life history stages for migratory fish; and (5) changes in minimum flows." *Id.*, p. 4 (emphasis added.)

In addition to Study 3.11, FERC, in a comment letter issued July 2, 2012, and subsequently corrected in Errata letter dated July 3, 2012, has identified four required studies that remain incomplete. SRBC requests that Study 3.11 be included with the list contained in the July 3, 2012, letter and recognized as incomplete.

SRBC further requests that the new license application propose that the Office Director order a schedule for completion of required studies and defer any Notice of Application Acceptance until Exelon has, in fact, completed required studies and any disputes related to such completion have been resolved. Under 18 CFR §§ 5.19(b)-(d) and 5.21, respectively, the Office Director may modify the process schedule, resolve any disputes or requests related to information and studies, and require any additional information necessary for an informed decision on the application.

If, in the new license application, Exelon does not propose such further procedures before the Notice of Application Acceptance, SRBC will file an appropriate motion seeking such relief. If necessary, we will file such motion immediately following August 31, 2012. This is a matter of fairness and efficiency as Exelon and the participants prepare for development, comment, and evidentiary hearing on preliminary terms and conditions. Participants should not be expected to submit such terms and conditions under 18 CFR § 5.22(a)(4), until the record includes fundamental information (such as the hydrologic analysis of alternative operations scenarios) which is Exelon's responsibility under the SPD.

Should you have any questions regarding SRBC's review comments of Exelon's DLA, please feel free to contact me at (717) 238-0423, extension 224, or via e-mail at jrichenderfer@srbc.net.

Sincerely,

James L. Richenderfer, Ph.D., P.G.
Director, Technical Programs

152738.1

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573-4535

July 5, 2012

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E. Rm. 1-A
Washington, D.C. 20426

RE: Conowingo Project, FERC No. P-405, Comments on the Draft License Application

Dear Ms. Bose:

The U.S. Fish and Wildlife Service (Service) has reviewed the Exelon Generation Company, LLC's (Exelon) April 3, 2012, filing of the Draft License Application (DLA) at the Conowingo Hydroelectric Project" (Conowingo Dam). Conowingo Dam is located on the Susquehanna River in Harford and Cecil counties, Maryland. The Service is providing comments on Exelon's DLA under the Federal Energy Regulatory Commission's (FERC) regulations, 18 C.F.R. § 5.12. The Service is filing comments electronically to the "eLibrary" link under the Conowingo Project docket number, P-405.

GENERAL COMMENTS

The Service requests that the new license application describe: (1) the status of any approved studies which will not have been completed as of August 31, 2012, and (2) Exelon's proposed schedule for completing such studies, including all reporting and consultation as required by the Study Plan Determination or 18 C.F.R. Part 5.

As of the date of these comments, several studies have not been completed. For example, under "Hydrologic Study of the Lower Susquehanna River" (Study 3.11), Exelon has modeled only the existing operations. (See "Operations Modeling Baseline Report" (Jan. 2012), p. ii.) However, the Study Plan Determination (Feb. 4, 2010) required much more from Study 3.11, as the basis for evaluating and mitigating the projects impacts on aquatic resources. The alternatives that must be assessed include: (1) existing conditions; (2) run-of-river operation to maximize fish passage; (3) introduction of ramping rates; (4) restrictions on peaking operations during the time period with critical life history stages for migratory fish; and (5) changes in minimum and maximum flows. We also request that the new license application describe the status and schedule for completion of each of the incomplete studies.

We further request that the new license application propose that the Office Director order a schedule for completion of required studies and defer any notice of completeness until Exelon has, in fact, completed required studies and any disputes related to such completion have been resolved. Under 18 C.F.R. §§ 5.19(b)-(d) and 5.21, respectively, the Office Director may modify the process schedule, resolve any disputes or requests related to information and studies, and require any additional information necessary for an informed decision on the application.

If, in the new license application, Exelon does not propose such further procedures before the notice of completeness, the Service will file an appropriate motion seeking such relief. If necessary, we will file such motion immediately following August 31, 2012. This is a matter of fairness and efficiency as Exelon and the participants prepare for development, comment, and evidentiary hearing on preliminary terms and conditions. Participants should not be expected even to submit such terms and conditions under 18 C.F.R. § 5.22(a)(4), until the record includes fundamental information (such as the hydrologic analysis of alternative operations scenarios) which is Exelon's responsibility under the Study Plan Determination.

The comprehensive management plan, Migratory Fish Management and Restoration Plan for the Susquehanna River Basin,[1] (Fish Restoration Plan) is the management plan that is guiding fisheries restoration on the river. The plan was signed by the States of Maryland, Pennsylvania, and New York and the Nation Marine Fisheries Service and the U.S. Fish and Wildlife Service. This comprehensive management plan is referenced and requested to be on record with the FERC to serve as the management plan for fisheries restoration on the Susquehanna River. The Fish Management Plan will be included with our efiling of this letter. The plan has 43 objectives, for example, Task A1 is to pass at least 85% adult American shad migrating to the tail waters of the first dam on the river and 75% at each subsequent upstream dam. Task A2 describes downstream passage of all adult Alosines with at least 80% survival. Other objectives include restoration of American eel and sturgeon to historic upstream habitats upstream of Conowingo dam.

The Service considers the restoration of migratory fish to the Susquehanna River a priority during the relicensing of Conowingo Hydroelectric and other projects upstream. Previous restoration efforts used the available science to rebuild the ecology of the river with the community of fish and invertebrate species that are native and vital to public use to the river basin. For a variety of reasons, these past efforts of the agencies, utilities, and conservation partners have fallen woefully short of our restoration targets. After nearly forty years since the restoration efforts began, relicensing, as intended by the drafters of the Federal Power Act, provides an opportunity to reassess the impacts of these projects, and in particular an opportunity to provide the water flow and fish passage conditions necessary for fish to migrate in a safe, timely, and effective manner. There are currently four hydro-related projects in a FERC relicensing or amendment process that could set the river on a path to recovery. The Service hopes that all the partners share the vision of a functioning and prosperous river during the FERC review.

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1. Susquehanna River Anadromous Fisheries Restoration Committee. 2010. Migratory Fish Management and Restoration Plan for the Susquehanna River Basin. November 15, 2010. Harrisburg, PA.

COMMENTS ON THE DRAFT LICENSE APPLICATION

Vol. 1, F. Fish Passage, p. 13 described the results of the first year of Upstream Fish Passage Effectiveness Study 3.5 and the other fish passage studies that provide an explanation of why American shad restoration on the Susquehanna River has been unsuccessful. The passage efficiency was well below 50% in 2010, and 2011 with passage from 20 to 37 thousand American shad each year from 2010 to 2012. To put the recent 2012 passage numbers (~22,000 American shad) in context, we can compare a dry year in 2001 with a wet year of 2011. One of the lowest flow and annual generation years of recent record, 2001, the East Fish Lift (EFL) passed nearly 200,000 American shad. Last year (2011) was one of the highest flow and annual generation years on record, and American shad passage was the lowest in nearly 20 years. This is an example of how natural water flow conditions and generation can alter fish passage, while identifying the conditions we need to emulate to improve fish passage. It is clear that we do not have the "best management practices" in place for the most favorable fish passage on the river. We can provide fish passage conditions that are more conducive to successful fish passage, but we need new tools and better techniques. We need to establish flow conditions that enhance the fish lift attraction flows at and between dams on the lower Susquehanna River. These conditions must provide passage for all anadromous fish, and indirectly, for riverine fish. In addition, we need real-time solutions when we can increase generation at the hydroelectric station without adversely impacting fish passage. The Service believes HydroLogics, Inc. involvement with the flow modeling study is a vital tool for achieving effective fish passage, while capitalizing on hydroelectric generation. We encourage Exelon to allow HydroLogics to assist the Susquehanna River Basin Commission's Flow Modeling Team.

Exhibit E, 3.2.1, Cumulative Effect of the Conowingo Hydroelectric Project includes the adverse impacts from the past, present, and foreseeable future. The Service believes we have one of our best opportunities at the Conowingo dam, the first dam on the river, to avoid and minimize the impacts that have hampered restoration activities for nearly forty years. We are still studying and addressing the cumulative impacts of excessive turbine discharge during the upstream fish migration, over capacity of the EFL, maintenance problems with fish lifts, and downstream passage mortality. The best available science and best management practices need to be implemented during this licensing period. It is critical that we implement comprehensive measures to improve the fish passage at Conowingo, and Muddy Run Pump Storage, to complement the corrective measures that are already in process at the upstream hydroelectric projects.

Exhibit E, 3.3.3, The aquatic resources have changed in the river during the last few years. The Service agrees with Exelon regarding the large increase in the number of gizzard shad (in excess of one million fish) typically passaged at the east fish lift (EFL). While the gizzard shad abundance has grown, the American shad abundance downstream has remained about the same, and herring abundance has dropped. The Service believes the low passage efficiency of American shad and river herring is partly due to lack of capacity at the EFL. As recently as 2001, blueback herring were lifted at the EFL. Capacity of the EFL or other conditions is likely contributing to the low river herring passage. An objective of the Fish Management Plan is to restore river herring abundance.

The Service agrees with Exelon that based on the American eel downstream passage models and data collected in association with the Muddy Run eel passage study in 2011, passage mortality is greater than 10%. This is consistent with reported American eel downstream mortality values from Muddy Run Pump Storage and York Haven Hydroelectric Projects. In the event instream collection techniques are found ineffective at capturing silver eels for downstream trap and transport, ¾ inch bar racks, a guidance system, or other physical or behavioral barrier may be necessary for safe passage downstream. 76

Upstream fish passage as mentioned previously is a Service priority. The Service agrees with the conclusion that when river flows are between 10,000 and 40,000 cubic feet per second (cfs) there are no velocity barriers to American shad and river herring (Normandeau Associates and GSE 2012). In this range of river flow or turbine discharge there are significant areas of passage where the velocity was below burst speed and in the range of prolonged swim speed. Our review of the 2010 RSP 3.5 Telemetry Study data supports this conclusion. At the maximum project generation discharge of 86,000 cfs, hydraulic modeling did indicate several areas of higher velocities approaching 7 to 9 feet per second. These high velocities were in the tailrace, and as far downstream as Rowland Island, where it was determined that flow of this magnitude could impede upstream migration. Based on these findings, the Service reiterates a request to expand the flow modeling exercise with HydroLogics, in a collaborative framework, to determine a yearlong flow plan that uses a modeled flow regime to achieve suitable results for everyone.

The fish lifts at the Conowingo Dam have a remaining life expectancy of between 15 and 25 years and thus are due for replacement well within the period of the next license. The Service believes the condition and performance of the fish lifts is a contributing factor to the consistent American shad fish passage efficiency below 50% at Conowingo Dam. The proposed preventative maintenance plan is a starting point in resolution of these major problems that include operations, volitional passage, and capacity issues for migratory fish. In light of the impressive number of juvenile American eels[2] being captured at the Conowingo Dam near the West Fish Lift, the Service believes long term passage solutions need to be addressed during this relicensing period. In a recent letter to the York Haven Hydroelectric Power project, the Service stated that when American eel abundance is restored upstream of York Haven with the ongoing elver stocking activities, it will likely take only 5 to 10 years for the eels to mature and begin to out-migrate. The Service encourages Exelon, as we did York Haven, to consult with the agencies regarding the need to assess and improve eel passage at their facilities. Improving upstream and downstream passage for American eels, American shad, and river herring is our priority.

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2. U.S. Fish and Wildlife Service's American eel sampling at the Conowingo Dam began in June 2012 and will continue through August 2012. To date, 70,000 elvers were collected and stocked upstream. The estimate is at least 100,000 will be stocked by August.

The Service is generally in agreement with the draft Bald Eagle Management Guidelines for Exelon Lands except in two categories as follows:

4.1.1 Distance Buffer for Bald Eagle Nesting Sites - There are some inconsistencies with respect to nest protection buffers. As long as nests are "inactive", activities may pursue without disturbing eagles as long as habitat is not removed or altered. However, if intrusion or habitat modifications are
anticipated within nest buffers from 0-660 feet, an eagle disturbance permit (50 CFR, 22:26) may be 78
required to be in compliance with the Bald and Golden Eagle Protection Act. A nest removal would require a 22:27 eagle permit.

4.1.4 Foraging Areas and Communal Roosting Sites - Avoidance of recreational boating and fishing near critical eagle foraging areas. Exelon must educate (through updated signage, social media etc.,) and enforce rules to restrict public use in these areas. Encroachment at key eagle perching, loafing and roosting areas specifically; the immediate area of Conowingo pond, is considered a high use eagle area. The rocky shoreline and nearby island encompassing the power line towers are extensively used (year 'round) by eagles near the outfall zone. The eagles are tolerable to public activity on the Harford County side but are easily disturbed on the Cecil County side where eagles are more exposed and
numerous. 79

Other Recommendations:

Recreational hunting – Waterfowl hunting from shoreline blinds or boat blinds must be avoided in
areas described in 4.1.1. Shot gun blasts adversely disturb eagles for long periods of time especially 80
in early morning hours which coincide with prime time for eagle foraging. Areas in the vicinity of Conowingo Pond must be restricted from gun hunting where applicable to Exelon lands.

Transmission Lines – The Service highly recommends that Exelon conduct bi-annual searches under 81
power lines for eagle electrocutions.

Reporting/Planning- All eagle mortalities must be reported to the Fish and Wildlife Service within 5
days. Eagles that collide or found injured should immediately be reported to an onsite contact. A Plan 82
should be developed by Exelon which describes the appropriate State, federal and private association personnel to assist and respond.

IN CONCLUSION

The Service appreciates working with FERC and Exelon to ensure the best possible result for the fisheries and for our citizens that use these resources. The fisheries resource in the past provided food for settlers on the river, but today the fisheries have economic value as a food source, recreational pursuit, commercial jobs, and an essential ecological link. When we have restored the fisheries to a sustainable level on the Susquehanna River, we will have achieved our goal. If you have any questions regarding these comments, please contact me at David_Sutherland@fws.gov or 410-573-4535.

Sincerely,

David W. Sutherland
Coastal Program

Attachment efiled with letter

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

IN THE MATTER OF	)	
	)	PROJECT NO. 405
EXELON GENERATION COMPANY, LLC	)	

LOWER SUSQUEHANNA RIVERKEEPER & STEWARDS OF THE LOWER SUSQUEHANNA, INC.'S MOTION TO INTERVENE & COMMENTS RE: DRAFT LICENSE APPLICATION FOR THE CONOWINGO HYDROELECTRIC PROJECT

Pursuant to 18 C.F.R. §385.214(a)(3), Stewards of the Lower Susquehanna, Inc., represented by the Lower Susquehanna Riverkeeper, hereby provide notice that the organization and its representatives listed below respectfully move to intervene in the above-captioned proceedings. Exelon Generation Company, LLC ("Exelon") filed a Draft License Application ("DLA") for its Conowingo Hydroelectric Project ("Project") with the Federal Energy Regulatory Commission ("FERC") on April 2, 2012. According to Commission communications interested parties have until July 9, 2012 to file timely comments and/or intervention.

Review of the DLA is the starting point by which future proceedings will decide critical terms and conditions of the Project for several decades. The Project area and surrounding watershed possess valuable ecological, recreational and scenic resources used for fishing, sailing, boating, hunting, hiking and birdwatching. Further, the Project's location affects the entire Susquehanna Watershed by inhibiting historic fishery migrations, as well as serves as an ongoing retention device collecting and discharging sediment.

STATEMENT OF INTERESTS

Stewards of the Lower Susquehanna, Inc. (SOLS) is a non-profit environmental advocacy organization headquartered in the city of York, Pennsylvania. SOLS' mission is the preservation and improvement of the ecological and aesthetic integrity of the lower Susquehanna River watershed and Chesapeake Bay. Established in 2005, SOLS has more than 100 members dedicated solely to protecting and restoring the Susquehanna River Basin. SOLS' primary geographic focus begins at the Susquehanna River's confluence with the West Branch at Sunbury, Pennsylvania and reaches downstream to the Chesapeake Bay at Havre de Grace Maryland. In total the territory stewarded by SOLS and the Lower Susquehanna Riverkeeper encompasses over 140 miles of the Susquehanna River and approximately 9,200 square miles.

SOLS' members use the Lower Susquehanna Watershed for fishing, hunting, boating, domestic uses and for its scenic and historic value. Dozens of SOLS' members live, work and recreate along the Susquehanna River and its tributaries in Lancaster, York, and Dauphin Counties, Pennsylvania, and in Cecil and Harford Counties, Maryland. Our members who use watershed resources of the Lower Susquehanna Watershed north of the Project are susceptible to injury from inappropriate, irresponsible, or adverse conditions codified within a final Project license just the same as our members residing and utilizing watershed resources in Cecil and Harford

Counties, the area directly adjacent the Project. The final license for the Project will directly affect the ability of citizens, such as SOLS' members, to fish, swim, recreate and otherwise utilize and enjoy water resources affected by operation of the Project. As such the Lower Susquehanna Riverkeeper and SOLS possess clear, cognizable interests in ensuring future proceedings and the final Project license will not result in harm to the above-mentioned uses.

As part of our mission, Stewards of the Lower Susquehanna, Inc. and its representatives were involved in the Project's FERC License Renewal stakeholder process. Through this process, Lower Susquehanna Riverkeeper raised multiple concerns, in particular concerns regarding anadromous and catadromous fish passage, recreational fishing access, and sediment impoundment and discharge via the Project.

No other party to this proceeding will be able to adequately protect the interests outlined above. Accordingly, SOLS has a direct and substantial interest in the outcome of this proceeding, and our intervention in this proceeding is in the public interest as required by 18 C.F.R. § 385.214(b)(2)(iii). In short, SOLS' participation in this proceeding will lead to better informed decision-making and protection of the Lower Susquehanna Watershed's natural resources. Therefore, because the Project's relicensing will set new operating terms, conditions, and mitigation concerning the aforementioned issues among others, and whereas such determinations will directly affect the interests of the Lower Susquehanna Riverkeeper, SOLS, and its members, the undersigned respectfully motion to intervene in the above-captioned proceedings pursuant to this timely letter.

STATEMENT OF POSITION CONCERNING THE DLA

SOLS and the Lower Susquehanna Riverkeeper support relicensing of the Project provided adequate and binding plans and mitigation are included within a final license concerning the environmental impacts caused by Exelon's for-profit use of a public resource. Specifically, Exelon must provide for increased mitigation of the Project's impacts to American Eel migration and the stunted northern Chesapeake Eel fishery. Exelon must also address particular mitigation needed for the adverse impacts suffered by American Shad and other herring species. Similarly, recreation and shore management plans must continue to provide for traditionally recognized and adequate recreation opportunities. Lastly, and of critical concern, Exelon must provide candid planning and mitigation – tasks that is has thus far failed to substantively provide during the stakeholder process – concerning the Project's continuing role in impounding and discharging sediment along with resulting water quality and ecological impacts.

COMMENTS CONCERNING THE DLA

At the outset we disagree with Exelon's misleading characterization of the Project on page three of its DLA as possessing "little impact" on environmental conditions and narrowly construing its water quality impacts as limited to one downstream monitoring point. As discussed below the Project in fact presents substantial issues as to fulfilling Maryland's pollution-reduction and water quality obligations under the 2010 Chesapeake Bay Total Maximum daily Load ("Bay TMDL") due to its continuing role as a sediment impoundment and discharge point. Similarly, the Project is properly characterized as one of the leading and most significant obstacles to

Susquehanna fisheries' migrations, particularly the American Eel. As a migration obstruction the Project possesses significant impact upon fisheries.

I. General Comments

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We note for the record that Exelon has failed to file timely and complete its obligations under the Study Report timetables established by FERC. On February 4, 2010, FERC issued a Study Plan Determination for the Conowingo Project. The Study Plan Determination included 31 resource studies (Exhibit 1) to be completed during the 2010 study period. Exelon substantially failed to fulfill a number of the FERC-approved studies under the aforementioned Study Plan Determination. In fact, twenty (20) draft study reports were completed by the deadline in January 2011, while eleven (11) study summaries have been completed that, at most, present preliminary findings. We also note that this type of untimely and incomplete study submission continued into 2012 with many of the last study reports – such as those examining sediment impoundment by the Project – being abbreviated if not incomplete. This type of incomplete study report submission meant that stakeholder comments, such as those submitted in March 2012 pursuant to the original study timetable – did not fully address all the issues the Project's relicensing encompasses. Put simply, continued untimely and incomplete submission of reports contributes to poor stakeholder participation and therefore harms the efficacy of public participation. This particular comment is noteworthy here as the DLA exhibits many of the same methodological flaws and oversights as the study process and, as detailed below, has led to incomplete analyses and uninformed conclusions by the applicant.

Specific Comments to the DLA

a. Water Quality

Exelon measured DO, temperature and other water quality parameters in 2010 along 5 historically established transects in the reservoir and along 3 new transects downstream of the dam, weekly from April through October. Turbine boil discharges were sampled on 20 specified dates in July and August and compared with measurements at Station 643, the location historically used for continuous water quality compliance monitoring of the Conowingo discharge. One of the key purposes was to determine if this station is representative of the project's discharges.

The DLA improperly asserts that DO was measured under all operational configurations when in fact not all such configurations were analyzed. For instance, in studies pursuant to RSP 3.1 certain figures indicate the number of hours that various combinations of units were operating during the sampling events in July – August 2010. Yet during this time, there were no occasions when the large turbines were operated without at least 3 of the smaller aerated units also being operated. Exelon still needs to, based on historical operating records, provide the frequency of turbine operating combinations during summer low flow periods (for example, when inflows were less than about 15,000 cfs). Likewise, Exelon has not analyzed whether there are any circumstances during summer low flow periods with low DO in the reservoir when the Kaplan units would be operated without any of the Francis units also being operated and in such manner likely cause DO WQS violation downstream. Whereas these calculations have not yet been completed it is premature for the DLA to conclude the Project fulfills all water quality standards.

Additionally, Exelon has not provided any type of substantive analysis of how the Project's discharge of sediment affects the state of Maryland's ability to fulfill its water quality obligations pursuant to the Chesapeake Bay TMDL. The Bay TMDL is a first-of-a-kind 'watershed TMDL' 84
extending to the entire Chesapeake watershed. Tributary states are currently drafting, revising and implementing pollution control practices for the pollutants of concern: nitrogen, phosphorus, and sediment. The Project cannot be ignored in its pivotal role as an impoundment and discharge point for sediment to the Chesapeake Bay and Lower Susquehanna River. Although the Bay TMDL is not a state water quality standard, this federal TMDL is incorporated into Maryland's water quality regulations, has binding obligations concerning the direct impact of the Project vis-à-vis sediment impoundment and discharge, and thus is relevant and necessary as a discussion matter in this DLA. Likewise, this relicensing is a federal proceeding that must recognize the binding nature of the Bay TMDL on the state of Maryland in its efforts to control and limit discharges of the aforementioned pollutants to the Bay, including via the Project.

There is likewise zero discussion of the nexus between the Bay TMDL, the Project's role in scouring events such as those from Tropical Storm Agnes in 1972 and the recent flooding of Fall 2011, or sediment discharge and mitigation considerations in the DLA. This oversight is inexcusable as a direct impact of the Project to the Project area and watershed is to provide the last, and most significant, site of sediment storage and discharge along the Susquehanna River before the Chesapeake Bay. Previously some aspects of sediment impoundment by the Project have been seen as a benefit to the Bay ecosystem. This is because a quantity of fine-grained sediment and associated nutrients - sources of water quality impairment - reaching the Bay are reduced. Previously, in 2008 the USGS determined that the Project's sediment storage capacity would maintain its sediment-trapping efficiency for between 15 and 30 years. However, in April 2012 the most recent research of the USGS, presented by Robert M. Hirsch, Research Hydrologist for USGS, states otherwise. "The ability of the dams to trap materials is diminishing and the extent and frequency of scour is increasing." In other words, Mr. Hirsch's research points to the conclusion that sediment impoundment at the Project will not continue on for the duration previously expected; rather, the efficiency has already begun to diminish and will continue to diminish, eliminating the previously perceived 'benefit' of the Project's sediment-trapping ability and leaving only the adverse impacts of scouring events.

That is to say scouring events will increase, such events representative of sediment discharges above and beyond true 'natural' sediment loading to the river. As the existence of the Project is the single cause of sediment impoundment in the Project area, (but for the Project, there would be a repository of sediment for scouring events) the Project owner bears responsibility for any amount of scoured sediment that impairs downstream water quality standards and the State of Maryland's ability to fulfill its obligations under the Chesapeake Bay.[1]

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[1] *See* Chesapeake Bay TMDL, Appendix T. Dec 29, 2010. According to the Appendix the Conowingo Relicensing Project is specifically tasked with assessing and addressing the Project's impact as an impoundment and discharge point for sediment. In fact, the Appendix contemplates reduced loading capacity of the Project stating: "If future monitoring shows the trapping capacity of the dam is reduced, then EPA would consider adjusting the PA, MD, and NY 2-year Milestones based on the new loads. The adjusted loads

As concerning sediment the approved study plan provides that Exelon will (1) Identify the best management practices (BMPs) that could be successfully used to manage, mitigate, and remove sediment related to the project (i.e., develop BMPs rather than discuss BMPs); (2) Develop a sediment management plan that includes projections of sediment accumulation, benchmarks for potential impacts and actions, and options to manage, mitigate, and remove accumulated sediment; (3) Prepare a preliminary license proposal (PLP) to include protection, mitigation, and enhancement (PM&E) measures with respect to each resource affected by the project proposal; (4) Perform studies to develop pros and cons of potential in-reservoir management options; (5) Develop a sediment dynamics model.

In fact, the DLA does not discuss any of these issues nor provide reasoned conclusions as to why sediment impoundment and Project operational impacts on water quality related to sediment discharge are not included.[2] Therefore the DLA is incomplete without discussion of the Project's sediment impoundment and discharge role in conjunction with sedimentation controls and appropriate mitigation. For the Applicant and FERC's benefit we note that in 2006 the United States Supreme Court affirmed the Maine Supreme Court in S.D. Warren Co. v. Maine Board of Environmental Protection, 547 U.S. 370 (2006). Water released from a hydropower dam, it held, constitutes a "discharge" within the meaning of Clean Water Act Section 401. Thus, FERC licensing of dams like the Project are subject under that section to state water quality conditions and obligations. We submit that analysis of DO alone is an incomplete assessment of whether the Project meets and maintains Maryland's water quality standards. Instead, the Applicant and the final License Application must assess and account for sediment impoundment and discharge, and the nexus between those functions and existing water quality obligations of the state of Maryland.

b. Fish Passage

Much of the DLA's discussion of Fish passage lacks corroboration and exhibits premature conclusions as to impacts to fish from entrainment, turbine passage, and migration passage effectiveness. A consistent issue is the skewing of scientific data by virtue of incomplete findings analysis. For instance, the Shad Juvenile Turbine Mortality Studies from 3.2 of the Initial Study Reports presents the results of the field study and findings of other shad turbine mortality studies,
but does not include a discussion of the extent to which these results are consistent with the 85
modeled mortality estimates presented in the earlier reports. It appears that blade strike and not pressure differential was the cause of mortality for juvenile American shad, since blade strike is relative to operating head and turbine discharge, although the report states that operating head was 56 and maximum was 82. Thus, the mortality estimate generated by this study appears to be a *minimum* rate of juvenile American shad turbine mortality since there was no modeling involved to estimate the range of mortalities. Since the model was presented as being an accurate tool for estimating potential mortality rates of other species, as a basis for arguing against the need to do studies of other species, such a discussion is necessary.

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would be compared to the 2-year Milestone Commitments to determine if the states are meeting their target load obligations." T-5.

[2] On page 2 of the DLA Exelon states the DLA proposes resource protection and mitigation measures, whereas previous studies and consultations have identified impacts. Here, the DLA fails to propose and protection or mitigation regarding sediment impoundment and discharge.

The fact the DLA asserts that Project operations "do not appear to adversely impact upstream or downstream passage" of fish populations is clearly misleading when the basic science and studies show that the Project not only entrains fish populations, but is a literal obstacle to migratory patterns. Therefore it is inappropriate for the DLA to characterize the Project as lacking any adverse impact on fish passage. This is especially true for the American Eel, discussed next.

c. American Eel

Exelon has repeatedly failed to give appropriate weight to the impact of its Project upon American Eel fisheries throughout the ISR process. This same type of apathy is evident in the DLA where no mention is made of the Dept. of Interior's 2011 decision to re-evaluate American Eel populations – specifically Atlantic seaboard fisheries – for listing under the Endangered Species Act. This oversight borders on negligent misrepresentation whereas numerous stakeholders, including Lower Susquehanna Riverkeeper, have submitted evidence of Northern Chesapeake American Eel fishery decline and corroborating data proving the adverse impact the location and operation of the Project has on this fishery, as well as notice of the Dept. of Interior's renewed investigation of Eel populations as candidates for federal protections.

As we have shown in previously submitted comments now in the record, American Eel populations are in fact threatened, and appear likely to be undergoing sustained declines at the population segment level. Estuarine river systems like the Susquehanna are the sole migratory pathways for female American Eels to gain access to their requisite habitats. Yet current anthropogenic changes to historical habitat – such as the construction and continued use of the Project - has dramatically limited the amount of habitat available and disproportionately eliminated larger, more fecund females from arriving at the Sargasso Sea to spawn. Thus, losing a substantive portion of habitat like the Susquehanna River Basin's 27,000 sq. miles (due to the Project and other hydroelectric facilities presence and operation), combined with the dramatic loss of other riverine habitat along the Atlantic Seaboard, equates to significantly reduced eel productivity and abundance.

Of the few females who may be present above Susquehanna dams and the Project due to trap and transport or migration, during adult female eels' downstream migration out of the Susquehanna watershed it can be safely assumed from studies on other dams and the Applicant's recent studies that the Project and other major hydroelectric dams upriver of Conowingo have a substantial and cumulative mortality rate on the American Eel. Studies on other dams in the U.S. and Canada have shown turbine mortality rates of the 3-foot female adult eels to be approximately 40 to 50%. Project data roughly corroborates this base mortality rate, and when mathematically applied to the other hydropower projects upriver the cumulative mortality rates for downstream silver eels equals 78-88%. If over decades – as this is the life span of freshwater American Eel - we combine these survival rates for females passing all three dams we arrive at a sad figure of approximately 12 to 22% survival. When taken in combination with the lack of substantive upstream passage for new generations of elvers the facts show the collapse of a distinct portion of the American Eel population that once accounted for 25% of the fish biomass of the Susquehanna River Basin.

One of the main problems with the DLA's treatment of the American Eel is the focus of its inquiry: Exelon assessments considered the *expected* overall upstream passage efficiency and downstream passage survival. Such a limited scope is inappropriate in the relicensing of a project spanning decades, where during such period of time the American Eel population has suffered significant declines in the Susquehanna watershed, and is likely to suffer further irremediable adverse impacts due to Project's operation during the proposed relicensing period. Instead, studies and the DLA must consider the historical range of the species and base mitigation procedures designed to increase the American Eel fishery viability based upon the gap between historic and current migration and passage. As data produced here and submitted in our previous comments shows, the Project constitutes a significant adverse impact upon American Eel and therefore necessitates more than the abbreviated discussion provided within the DLA. Instead of merely mentioning the fact that turbine function equates to eel passage, the DLA should explain how the Applicant will use such conclusions to modify future operations rather than relying solely upon proposed trap and transport programs and, should such latter operations provide insignificant support to the fishery, options in the alternative.

d. Closure of Catwalk

The recreational use of the "catwalk" has been inherited by all users of the Susquehanna from the time of the pre-existing agreement to alter the fishery pursuant to construction and operation of the Project. Through multiple wars and threats of terrorism dating back to WWII this agreement (to use the catwalk for recreational purposes) has been maintained. Now, to claim potential threats to security are of some greater level than previously is disingenuous. If security is the true factor in Exelon's push to eliminate this public resource, then the applicant should simply address this issue by providing appropriate security measures. The recreational features such as the fishing pier are in no way equivalent to the access and experience the catwalk provides. Other FERC projects on the Lower Susquehanna River allow for access similar to the debated catwalk, and claims of security risk have never been used to withdrawal those traditional recreational features from public uses. The DLA fails to adequately address these concerns.

CONCLUSION

Stewards of the Lower Susquehanna, Inc. and its representatives respectfully request that the Commission grant this motion to intervene and add the following representatives to the service of process list in this proceeding:

Michael R Helfrich
Lower Susquehanna Riverkeeper
Stewards of the Lower Susquehanna, Inc.
324 W Market St
York, PA 17401-1010
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Guy Alsentzer
Director of Operations
Stewards of the Lower Susquehanna, Inc.
324 W. Market St.
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Guy@LowSusRiverkeeper.org

Dated: July 8, 2012

Respectfully submitted,

/s/ Michael R. Helfrich

Michael R. Helfrich
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APPENDIX B - EAST FISH LIFT MAINTENANCE PLAN

East Fish Lift Seasonal Preventative Maintenance

- Inspection of Trash Racks & picket gates.
  - Dawgs are removed, gates and screens are lubricated. Repairs are made after an inspection by engineering and gates are installed in slots.

- Inspection of Spillway gates A & B and spill trough.
  - Inspect actuators and replace thrust washers and bearing if necessary. Clean stems and grease stems, gearboxes and actuators. Operate gates and set limits.

- Inspect hopper trough gate.
  - Inspect actuator and replace thrust washers and bearing if necessary. Clean stem and grease stem, gearboxes and actuator. Operate gates and set limits.

- Inspect A, B and C diffuser gates.
  - Inspect actuators and replace thrust washers and bearing if necessary. Clean stems and grease stems, gearboxes and actuators. Operate gates and set limits. Verify that the digital readout in the control room is set at 0% for open and 100% for closed. Inspect and set torque settings on actuators with OEM.

- Inspect crowder cylinders.
  - Rebuild crowder cylinders and install on crowder with the regulators in the proper numbered sequence. Adjust the regulators so that the crowder doors swing closed in the proper sequence.

- Inspect flume cylinders.
  - Rebuild flume cylinders and install. Test cylinder for proper operation after installation.

- Inspect all cameras
  - Clean and inspect all 4 cameras to make sure they are in good working order.

- Inspect water supply station.
  - Inspect all piping and valves for leaks or signs of corrosion and operate valves to insure they are functioning.

- Diver inspection.
  - Divers need to inspect the downstream weir seal for silt and gravel deposits, the trash racks for debris build up and the water inlet screen.

- Inspect the air supply and the solenoid valves.
    - Inspect all air supply lines for signs of leaks and test and inspect solenoid valves for proper operation.

- Inspect hopper sheaves and cables.
    - Removes sheaves and replace bearings. Insect cables and check for signs of wear or thinning. Grease cables and hopper rollers.

- Inspect and adjust the crowder drive cables.
    - Inspect cables and check for signs of wear or thinning. Adjust cables so that the crowder is tracking properly on its track.

- Unwatered inspection of the fish lift.
    - Pump out water and remove all debris from above and below the grating. Inspect and replace the grating as needed. Clean mud and debris from hopper well so that the hopper can be lowered fully into the well.

- Inspect the splash guard and replace as needed.
    - Inspect the hardware and structure of the splash guard and replace as needed.

- Inspect the trash chute.
    - Inspect the trash chute as replace the sections as needed.

- Install antenna at the crowder area.
    - Install the antenna between the crowder hoist and the crowder. The elevation of the antenna would be below the minimum tailrace level.

- Install the fabric cover on the hopper.
    - Install the fabric cover over the hopper and stretch it out so it fits tightly over frame work.

- Power wash fish lift.
    - Power wash east fish lift of al bird droppings and other debris prior to the start of fishing season.

APPENDIX C – CONOWINGO PROJECT SEDIMENT MANAGEMENT PLAN

APPENDIX C-CONOWINGO PROJECT SEDIMENT MANAGEMENT PLAN

1.1 Sediment Management Plan

1.1.1 Background

FERC issued its Year Two *Determination on Requests for Modifications to the Conowingo Hydroelectric Project Study Plan* on May 21, 2012. In this determination, FERC requires that Exelon develop a sediment management plan (Plan) for inclusion in the Final License Application that is related to project operations. Specifically, the determination stated:

> *"We recommend that Exelon, as part of its final license application, include a sediment management plan with provisions for establishing benchmarks and any potential actions that may be necessary for continued operation of the project."* (Page B-6)
>
> *"…staff recommends that Exelon include provisions in its sediment management plan for conducting detailed engineering evaluation and cost estimates for potential sediment management and off-site disposal options once a management option is considered necessary."* (Page B-3)
>
> *"As sediment builds up near the intakes, sediment–laden water then could cause damage to turbines and hydropower facilities due to increased abrasion (Neopane, 2011). Therefore, a sediment management plan that includes provisions for establishing benchmarks would help plan for any actions that may need to be implemented to allow for continued operation of the project."* (Page B-5)

The FERC directives provide guidance for development of the Plan. The steps needed to develop and implement the Plan are enumerated in the text that follows. The steps are:

1. Identify potential action(s)
2. Evaluate and select action(s)
3. Identify benchmarks for action(s)

1.1.2 Identify Potential Action(s)

Exelon considers "continued operation of the project" to include both generation facilities and project recreation facilities. The following actions are identified as potentially necessary to manage sediment.

- **Powerhouse Intake Structure**

From the standpoint of operations, identifying the need for sediment and debris removal has similar approaches. That is, the need for removal occurs when the head loss across the trash racks drives capacity down. Units are taken out of service and intakes cleared when unit power level decreases to a pre-determined value.

Abrasion of turbine runners and other mechanical parts by sediment-laden waters could also cause damage. Sediment going through the turbine typically does not cause damage to the runner or wheel. Typically turbine inspections indicate slight wear on the turbine shaft packing and wicket gate end bushings.

Exelon's inspection program is identified as the vehicle for sediment management at the powerhouse intakes. The inspection program is presently geared towards debris removal and includes:

- Yearly capacity tests to identify if a unit is unable to meet its capacity.
- Trash rack differential instrumentation to monitor head loss.
- Turbine inspections every 4 years (3 units per year) for cavitation damage. If any is found, repairs are performed.
- Turbine shaft packing is repacked every 4 years.

Exelon will add sediment-specific protocols to its existing inspection program. The objective is to evaluate the need for sediment removal, along with debris, and determine if sediment accumulation and/or sediment pass through is adversely affecting project operations. Turbines will be inspected for evidence of abrasion (e.g., loss of metal) and sediment accumulation at the intakes will be monitored.

The sediment monitoring that began with the 2011 bathymetric survey will continue. Exelon will undertake a bathymetric survey every five years to provide the physical benchmarking needed to support the development of action benchmarks at the powerhouse intakes. Bathymetric surveys will have sufficient resolution to determine bathymetric changes at the hydroelectric plant intakes.

- **Recreation Facilities**

Shallow water depths due to sediment accumulation limit boat launch egress and ingress at Peters Creek (Peach Bottom Marina), Conowingo Creek, and Broad Creek. The minimum recreation pool elevation is 107.2 NGVD. During a field reconnaissance of navigability conducted in August 2012 when the pool elevation ranged 107.32 to 107.64 NGVD, the boat launch and areas immediately surrounding the ramp at Broad Creek were not useable for motorized boats due to the shallow water and dense vegetation. Water depths leading to the boat launch were generally two feet with areas being less than one foot near the launch. At Conowingo Creek, water depths in the main channel were 4.5 feet and two feet in the vicinity of the boat launch. At Peters Creek water depths were four to five feet in the main channel and zero at mud flats exposed at the time of the survey.

The actions Exelon has taken to date to identify ways to improve recreation boat access at these Project facilities are listed below.

- Recreation condition assessment and user preference surveys
- Tributary access study
- Bathymetric mapping
- Wetland and aquatic vegetation assessments
- Site-specific navigability assessments
- Dredging feasibility analysis for two sites (Peters Creek and Conowingo Creek)

The potential management action identified to improve recreational boat access at these facilities is sediment removal by dredging.

1.1.3 Evaluate and Select Action(s)

The need for, and feasibility of, implementing the potential actions identified will be evaluated as follows.

➢ **Powerhouse Intake Structure**

Station operators currently respond quickly to power loss from debris build-up. Clamming removes debris on the unit intake trash racks. Similarly, sediment removal procedures will need to allow for an expeditious response. Station personnel will need to be consulted to identify feasible protocols and methodologies that will allow for a prompt response. Once identified, sediment-specific issues such as disposal options, impacts of sediment quality, and regulatory constraints will be evaluated.

➢ **Recreation Facilities**

Additional site-specific evaluations are needed before identifying a facility to be dredged, the dredging methodology to be used, the areal extent and depth of dredging needed to support usage as well as protect aquatic resources, and sediment disposal options. Preliminary cost estimates for dredging Peters Creek and Conowingo Creek were conducted independent of wetland and aquatic vegetation surveys performed to delimit areas of dredging that do not impact these resources. These preliminary estimates need to be refined. Additional constraints to be considered are railroad bridge clearances at the mouths of Peters Creek and Conowingo Creek and sediment accretion on the pond side of the Peters Creek channel. Water depths have been observed to be one to two feet less on the pond side of the Peters Creek bridge than in the creek channel. The possible need to extend the dredging area to include the riverside of the bridge should be reviewed.

Exelon will take the following actions to perform these evaluations.

- Develop a sediment sampling plan
- Collect samples at each facility
- Laboratory analysis of samples
- Expand dredging/navigability analysis to include Broad Creek

- Refine feasibility analyses for all three facilities
- Cost estimate for each site
- Assess permitting and regulatory requirements

The site-specific reports will evaluate logistics and estimated costs of alternative methodologies (hydraulic or mechanical dredging); dredge area and volumes of sediment removed; and spoil disposal options. Disposal costs and options will be contingent on the findings of the laboratory analyses of sediment quality. Estimated costs will also include regulatory compliance and time frames, hydrographic surveys, construction documents, construction inspections and continued bathymetric monitoring. Exelon is currently initiating the development of the sediment sampling plan and will proceed with sample collection and analysis during the Fall of 2012. A report of findings of the site-specific evaluations will be completed by the end of 2012.

1.1.4 Identify Benchmarks for Action(s)

Action benchmarks are measurable thresholds that trigger the implementation of sediment management actions.

At the powerhouse, debris removal is currently triggered by the analysis of a combination of factors – net head, river flow, spill conditions, and unit output. Similarly, removal of accumulated sediment will commence when station personnel determine that a combination of conditions warrant a response. Continued monitoring of the bathymetry in front of the intakes, in concert with close examination of head loss at the racks, will be part of the protocol to identify the action benchmark for sediment removal. Regular inspections for abrasion will indicate if sediment in the water column is damaging turbines. Evidence of abrasion will be a benchmark for considering sediment removal.

At the three recreation facilities identified for potential sediment dredging, site-specific water draft depths will be an important consideration in determining need and action benchmarks. The States Organization for Boating Access (SOBA) recommends the toe of launching ramps and boating channels be a minimum of three feet below the lowest expected water level. Sediment accumulation and water depth will be monitored every five (5) years in association with bathymetric monitoring. These data will be the driver for depth benchmarks for action and area of removal.

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)

APPLICATION FOR NEW LICENSE

EXHIBIT F-GENERAL DESIGN DRAWINGS AND SUPPORTING DESIGN REPORT

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
EXHIBIT F-GENERAL DESIGN DRAWINGS AND SUPPORTING DESIGN REPORT

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EXHIBIT F – GENERAL DESIGN DRAWINGS AND SUPPORTING DESIGN REPORT

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 4.41(g) describes the required content of this Exhibit.

Exhibit F consists of general design drawings of the principal project works described under paragraph (b) of this section (Exhibit A) and supporting information used as the basis of design. If the Exhibit F submitted with the application is preliminary in nature, applicant must so state in the application. The drawings must conform to the specifications of § 4.39.

(1) The drawings must show all major project structures in sufficient detail to provide a full understanding of the project, including:

(i) Plans (overhead view);

(ii) Elevations (front view);

(iii) Profiles (side view); and

(iv) Sections.

(2) The applicant may submit preliminary design drawings with the application. The final Exhibit F may be submitted during or after the licensing process and must show the precise plans and specifications for proposed structures. If the project is licensed on the basis of preliminary designs, the applicant must submit a final Exhibit F for Commission approval prior to commencement of any construction of the project.

(3) Supporting design report. The applicant must furnish, at a minimum, the following supporting information to demonstrate that existing and proposed structures are safe and adequate to fulfill their stated functions and must submit such information in a separate report at the time the application is filed. The report must include:

(i) An assessment of the suitability of the site and the reservoir rim stability based on geological and subsurface investigations, including investigations of soils and rock borings and tests for the elevation of all foundations and construction materials sufficient to determine the location and type of dam structure suitable for the site;

(ii) Copies of boring logs, geology reports and laboratory test reports;

(iii) An identification of all borrow areas and quarry sites and an estimate of required quantities of suitable construction material;

(iv) Stability and stress analyses for all major structures and critical abutment slopes under all probable loading conditions, including seismic and hydrostatic forces induced by water loads up to the Probable Maximum Flood as appropriate; and

(v) The bases for determination of seismic loading and the spillway Design Flood in sufficient detail to permit independent staff evaluation.

(4) The applicant must submit two copies of the supporting design report described in paragraph (g)(3) of this section at the time preliminary and final design drawings are submitted to the Commission for review. If the report contains preliminary drawings, it must be designated a "Preliminary Supporting Design Report."

SECTION 1.0 LIST OF GENERAL DESIGN DRAWINGS FOR EXISTING PROJECT FEATURES

General design drawings of the Project works for the Conowingo Project described in Exhibit A are provided in Sheets 1 through 8 of Exhibit F. The drawings include plans views, elevations, profiles and sections in accordance with the requirements of Section 4.41(g)(1) of the Commission's regulations.

In accordance with 18 CFR Part 388, Exelon is requesting that the General Design Drawings for the Conowingo Project be given privileged treatment because the drawings contain Critical Energy Infrastructure Information (CEII). This request for privileged treatment is being made to the Commission in accordance with the Commission’s regulations. Therefore, in conjunction with filing this License Application, Exhibit F General Design Drawings listed below are being filed with the Commission in Volume II of this application under separate cover.

TABLE 1.0-1. LIST OF EXHIBIT F DRAWINGS.

Drawing Number	Title
F-1	Plan of Development
F-2	General Plan & Sections of Dam
F-3	General Plans & Sections of Spillway
F-4	Plan & Sections-Railroad Dike
F-5	General Plan: Power Station, Sheet 1
F-6	General Plan: Power Station, Sheet 2
F-7	General Plan: Power Station, Sheet 3
F-8	Power Station-Elevation, Sheet 1
F-9	Power Station-Elevation, Sheet 2
F-10	Power Station-Elevation, Sheet 3
F-11	Cross Section: Power Station, Unit No. 4
F-12	Cross Section: Power Station, Unit No. 5
F-13	Cross Section: Power Station, Unit No. 8
F-14	Cross Section: Power Station, Unit No. 10
F-15	Power Station – East End Elevation
F-16	East Fish Passage Facility

SECTION 2.0 SUPPORTING DESIGN REPORT

Pursuant to §§ 4.41(g)(3) and (4), an applicant is required to file with FERC a “Supporting Design Report” when the applicant files a license application. The purpose of the Supporting Design Report is to demonstrate that existing and proposed structures are safe and adequate to fulfill their stated functions. This material is contained in Volume 2- Critical Energy Infrastructure Information (CEII)**.**

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
EXHIBIT F-GENERAL DESIGN DRAWINGS AND SUPPORTING DESIGN REPORT

SHEET 1 OF 16: PLAN OF DEVELOPMENT

Critical Energy Infrastructure Information (CEII) has been removed from this page. The material is contained in Volume 2.

SHEET 2 OF 16: GENERAL PLAN & SECTIONS OF DAM

Critical Energy Infrastructure Information (CEII) has been removed from this page. The material is contained in Volume 2.

SHEET 3 OF 16: GENERAL PLANS & SECTIONS OF SPILLWAY

Critical Energy Infrastructure Information (CEII) has been removed from this page. The material is contained in Volume 2.

SHEET 4 OF 16: PLAN & SECTIONS-RAILROAD DIKE

Critical Energy Infrastructure Information (CEII) has been removed from this page. The material is contained in Volume 2.

SHEET 5 OF 16: GENERAL PLAN: POWER STATION, SHEET 1

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SHEET 6 OF 16: GENERAL PLAN: POWER STATION, SHEET 2

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SHEET 7 OF 16: GENERAL PLAN: POWER STATION, SHEET 3

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SHEET 8 OF 16: POWER STATION-ELEVATION, SHEET 1

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SHEET 9 OF 16: POWER STATION-ELEVATION, SHEET 2

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SHEET 10 OF 16: POWER STATION-ELEVATION, SHEET 3

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SHEET 11 OF 16: CROSS SECTION: POWER STATION, UNIT NO. 4

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SHEET 12 OF 16: CROSS SECTION: POWER STATION, UNIT NO. 5

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SHEET 13 OF 16: CROSS SECTION: POWER STATION, UNIT NO. 8

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SHEET 14 OF 16: CROSS SECTION: POWER STATION, UNIT NO. 10

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SHEET 15 OF 16: POWER STATION – EAST END ELEVATION

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SHEET 16 OF 16: EAST FISH PASSAGE FACILITY

Critical Energy Infrastructure Information (CEII) has been removed from this page. The material is contained in Volume 2.

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)

APPLICATION FOR NEW LICENSE

EXHIBIT G-PROJECT BOUNDARY MAPS

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
EXHIBIT G-PROJECT BOUNDARY MAPS

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EXHIBIT G – PROJECT BOUNDARY MAPS

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 4.41(h) describes the required content of this Exhibit.

Exhibit G is a map of the project that must conform to the specifications of § 4.39. In addition to the other components of Exhibit G, the applicant must provide the project boundary data in a georeferenced electronic format - such as ArcView shape files, GeoMedia files, MapInfo files, or any similar format. The electronic boundary data must be potentially accurate to ± 40 ft, in order to comply with the National Map Accuracy Standards for maps at a 1:24,000 scale (the scale of the USGS quadrangle maps). The electronic exhibit G data must include a text file describing the map projection used (i.e., UTM, State Plane, Decimal Degrees, etc.), the map datum (i.e., North American 27, North American 83, etc.) and the units of measurement (i.e., feet, meters, miles, etc.). Three sets of the maps must be submitted on CD or other appropriate electronic media. If more than one sheet is used, for the paper maps, the sheets must be numbered consecutively, and each sheet must bear a small insert sketch showing the entire project and indicating that portion of the project depicted on that sheet. Each sheet must contain a minimum of three known reference points. The latitude and longitude coordinates, or state plane coordinates, of each reference point must be shown. If at any time after the application is filed there is any change in the project boundary, the applicant must submit, within 90 days following the completion of project construction, a final Exhibit G showing the extent of such changes. The map must show:

(1) Location of the project and principal features. The map must show the location of the project as a whole with reference to the affected stream or other body of water and, if possible, to a nearby town or any other permanent monuments or objects, such as roads, transmissions lines or other structures, that can be noted on the map and recognized in the field. The map must also show the relative locations and physical interrelationships of the principal project works and other features described under paragraph (b) of this section (Exhibit A).

(2) Project Boundary. The map must show a project boundary enclosing all project works and other features described under paragraph (b) of this section (Exhibit A) that are to be licensed. If accurate survey information is not available at the time the application is filed, the applicant must so state, and a tentative boundary may be submitted. The boundary must enclose only those lands necessary for operation and maintenance of the project and for other project purposes, such as recreation, shoreline control, or protection of environmental resources (see paragraph (f) of this section (Exhibit E)). Existing residential, commercial, or other structures may be included within the boundary only to the extent that underlying lands are needed for project purposes (e.g., for flowage, public recreation, shoreline control, or protection of environmental resources). If the boundary is on land covered by a public survey, ties must be shown on the map at sufficient points to permit accurate platting of the position of the boundary relative to the lines of the public land survey, the best available legal description of the position of the boundary must be provided, including distances and directions from fixed monuments or physical features.

The boundary must be described as follows:

(i) Impoundments.

(A) The boundary around a project impoundment must be described by one of the following:

(1) Contour lines, including the contour elevation (preferred method);

(2) Specified courses and distances (meets and bounds);

(3) If the project lands are covered by a public land survey, lines upon or parallel to the lines of the survey; or

(4) Any combination of the above methods.

(B) The boundary must be located no more than 200 feet (horizontal measurement) from the exterior margin of the reservoir, defined by the normal maximum surface elevation, except where deviations may be necessary in describing the boundary according to the above methods or

where additional lands are necessary for project purposes, such as public recreation, shoreline control, or protection of environmental resources.

(ii) Continuous features. The boundary around linear (continuous) project features such as access roads, transmission lines, and conduits may be described by specified distances from center lines or offset lines of survey. The width of such corridors must not exceed 200 feet unless good cause is shown for a greater width. Several sections of a continuous feature may be shown on a single sheet with information showing the sequence of contiguous sections.

(iii) Noncontinuous features.

(A) The boundary around noncontinuous project works such as dams, spillways, and powerhouses must be described by one of the following:

(1) Contour lines;

(2) Specified courses and distances;

(3) If the project lands are covered by a public land survey, lines upon or parallel to the lines of the survey; or

(4) Any combination of the above methods.

(B) The boundary must enclose only those lands that are necessary for safe and efficient operation and maintenance of the project or for other specified project purposes, such as public recreation or protection of environmental resources.

(3) Federal lands. Any public lands and reservations of the United States (Federal lands) [see 16 U.S.C. 796 (1) and (2)] that are within the project boundary, such as lands administered by the U.S. Forest Service, Bureau of Land Management, or National Park Service, or Indian tribal lands, and the boundaries of those Federal lands, must be identified as such on the map by:

(i) Legal subdivisions of a public land survey of the affected area (a protration of identified township and section lines is sufficient for this purpose); and

(ii) The Federal agency, identified by symbol or legend, that maintains or manages each identified subdivision of the public land survey within the project boundary; or

(iii) In the absence of a public land survey, the location of the Federal lands according to the distances and directions from fixed monuments or physical features. When a Federal survey monument or a Federal bench mark will be destroyed or rendered unusable by the construction of project works, at least two permanent, marked witness monuments or bench marks must be established at accessible points. The maps show the location (and elevation, for bench marks) of the survey monument or bench mark which will be destroyed or rendered unusable, as well as of the witness monuments or bench marks. Connecting courses and distances from the witness monuments or bench marks to the original must also be shown.

(iv) The project location must include the most current information pertaining to affected federal lands as described under § 4.81(b)(5).

(4) Non-Federal lands. For those lands within the project boundary not identified under paragraph (h)(3) of this section, the map must identify by legal subdivision:

(i) Lands owned in fee by the applicant and lands that the applicant plans to acquire in fee; and

(ii) Lands over which the applicant has acquired or plans to acquire rights to occupancy and use other than fee title, including rights acquired or to be acquired by easement or lease.

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
EXHIBIT G-PROJECT BOUNDARY MAPS

SECTION 1.0 DETAILED MAPS

Exhibit G provides maps showing the Project boundary enclosing the Conowingo Project works described in Exhibit A. The maps conform to the requirements of Section 4.41(h) of the Commission's regulations. Maps of the Project area showing principal Project features and the Project boundary are included.

SECTION 2.0 PROJECT BOUNDARY

The Project boundary is shown on the attached Exhibit G maps. Exelon is proposing several changes to the existing Project boundary. Both the existing and proposed Project boundaries are depicted on the Exhibit G maps.

Exelon is proposing to remove a total of 1,965 acres from the current Project boundary. Of the area to be removed, approximately 1,760 acres lies below the Conowingo Dam, while the remaining 205 acres lies along Broad Creek, immediately east of the Boy Scout Dam.

The 1,760 acre area to be removed begins (see Exhibit G-Sheets 10 thru 14) at a point approximately 3,000 feet below the Conowingo Dam on the western shoreline and continues across the Susquehanna River to a point along Maryland State Route 222 (Susquehanna River Road), approximately 2,000 feet below the confluence of Octoraro Creek and the Susquehanna River. This area was necessary during the initial construction of the Project. As the construction efforts have been completed, these lands are no longer necessary for the operation and maintenance of the Project. This boundary amendment will remove four recreation facilities from the Project boundary, including Lower Susquehanna Heritage Greenway, Deer Creek Access, Lapidum Boat Launch, and McLhinney Park.

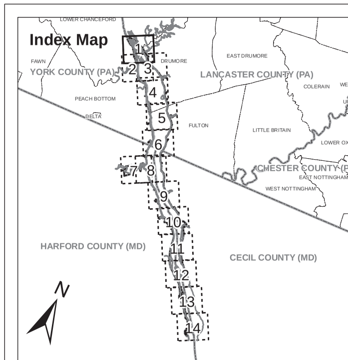
The 205 acre area to be removed near the Boy Scout Dam (see Exhibit G-Sheet 7) begins at a point approximately 1 mile downstream from the Route 623 Bridge and encompasses land between this point and Boy Scout Dam. The area removed does not contain any existing Project recreation facilities and is not necessary for Project operations.

SECTION 3.0 FEDERAL LANDS

There are no public lands or reservations of the United States within the Project boundary.

SECTION 4.0 NON-FEDERAL LANDS

Exelon has acquired, either through fee, easement, or lease, all land rights necessary to operate the Project. Lands to which Exelon holds title or rights to are identified on the attached Exhibit G maps.



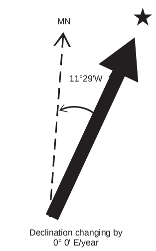
Legend

- R/W Boundary
- Transmission Center Line
- FERC Project Boundary
- Proposed Project Boundary
- Normal Maximum Water Surface Elevation (Elevation 110.2 feet)

Land Ownership within Project Boundary

- Exelon Owned in Fee
- Exelon Permanent Easement
- Exelon Flowage Easement to Railroad Land
- Recreation Area

*Reference Coordinate System
North America Datum 1983 (NAD83)
UTM Zone 18N (meters)



I HEREBY STATE THAT THE PROJECT BOUNDARY DELINEATION FOR THE CONOWINGO HYDROELECTRIC PROJECT (FERC #405) AS SHOWN ON THIS EXHIBIT "G" DRAWING IS DEVELOPED WITHIN REASONABLE ACCURACIES AS REQUIRED IN 18CFR4.41 TO THE GEOGRAPHIC LOCATION BASED ON A GRAPHICAL POSITIONING IN REFERENCE TO USGS QUADRANGLE MAPPING WITHIN +/-40 FEET. THE CONOWINGO HYDROELECTRIC PROJECT DOCUMENTED PROJECT BOUNDARY LINE WAS ADJUSTED AND OR ROTATED TO BEST FIT WITH THE USGS QUADRANGLE MAP FEATURES GRAPHICALLY AND WAS NOT FIELD SURVEYED.

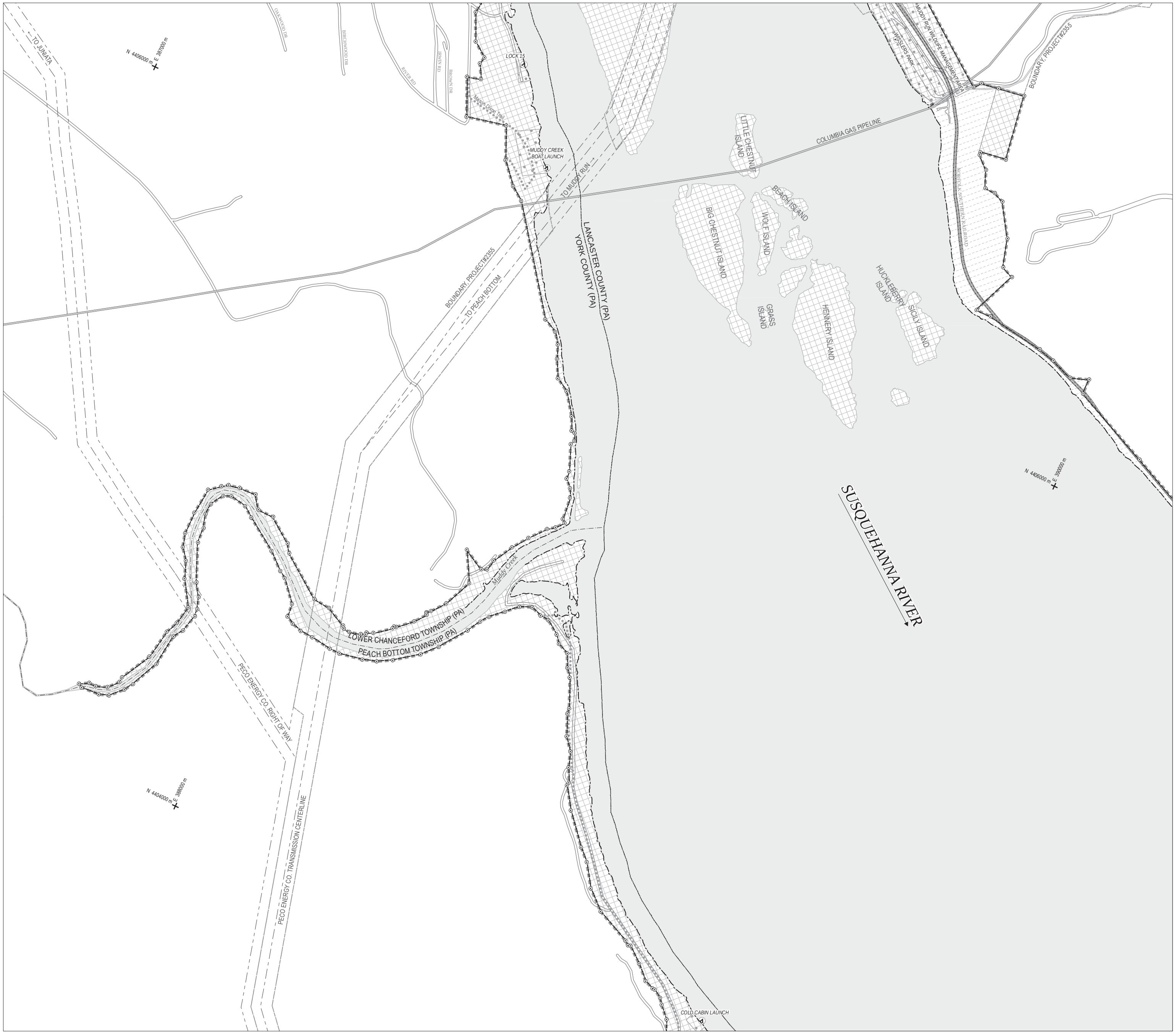
EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

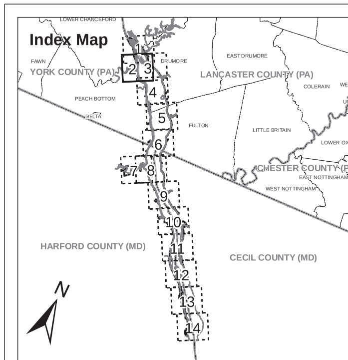
SHEET 1 of 14 **August 2012**

0 200 400 800 1,200 1,600 Feet

EXHIBIT G **1 inch = 400 feet** **1:4,800**

Path: X:\GIS\Maps\project_maps\published_resources\exhibit_g_conowingo.mxd





Legend

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- Transmission Center Line
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- Proposed Project Boundary
- Normal Maximum Water Surface Elevation (Elevation 110.2 feet)

Land Ownership within Project Boundary

- Exelon Owned in Fee
- Exelon Permanent Easement
- Exelon Flowage Easement to Railroad Land
- Recreation Area

*Reference Coordinate System
North America Datum 1983 (NAD83)
UTM Zone 18N (meters)

MN
11°29'W
Declination changing by
0° 0' E/year

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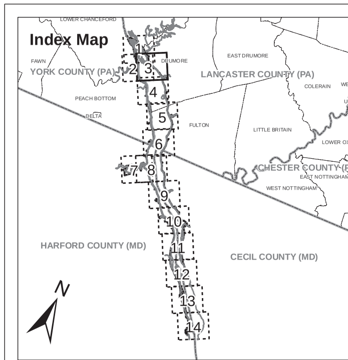
EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

SHEET 2 of 14 **August 2012**

0 200 400 800 1,200 1,600 Feet

EXHIBIT G 1 inch = 400 feet 1:4,800



Legend

- R/W Boundary
- Transmission Center Line
- FERC Project Boundary
- Proposed Project Boundary
- Normal Maximum Water Surface Elevation (Elevation 110.2 feet)

Land Ownership within Project Boundary

- Exelon Owned in Fee
- Exelon Permanent Easement
- Exelon Flowage Easement to Railroad Land
- Recreation Area

*Reference Coordinate System
North America Datum 1983 (NAD83)
UTM Zone 18N (meters)

MN
11°30'W
Declination changing by
0° 0' E/year

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EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

SHEET 3 of 14 **August 2012**

0 200 400 800 1,200 1,600 Feet

EXHIBIT G **1 inch = 400 feet** **1:4,800**

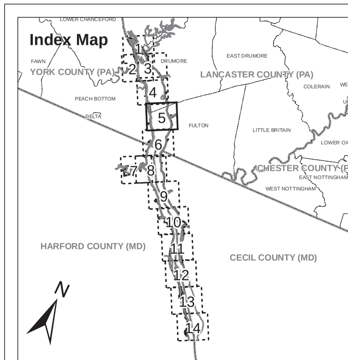
I HEREBY STATE THAT THE PROJECT BOUNDARY DELINEATION FOR THE CONOWINGO HYDROELECTRIC PROJECT (FERC #405) AS SHOWN ON THIS EXHIBIT "G" DRAWING IS DEVELOPED WITHIN REASONABLE ACCURACIES AS REQUIRED IN 18CFR4.41 TO THE GEOGRAPHIC LOCATION BASED ON A GRAPHICAL POSITIONING IN REFERENCE TO USGS QUADRANGLE MAPPING WITHIN +/-40 FEET. THE CONOWINGO HYDROELECTRIC PROJECT DOCUMENTED PROJECT BOUNDARY LINE WAS ADJUSTED AND OR ROTATED TO BEST FIT WITH THE USGS QUADRANGLE MAP FEATURES GRAPHICALLY AND WAS NOT FIELD SURVEYED.

EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

SHEET 4 of 14 — August 2012

0 200 400 800 1,200 1,600 Feet

EXHIBIT G — 1 inch = 400 feet — 1:4,800



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- Proposed Project Boundary
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- Exelon Flowage Easement to Railroad Land
- Recreation Area

*Reference Coordinate System
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UTM Zone 18N (meters)

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Declination changing by 0° 0' E/year

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EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

SHEET 5 of 14 **August 2012**

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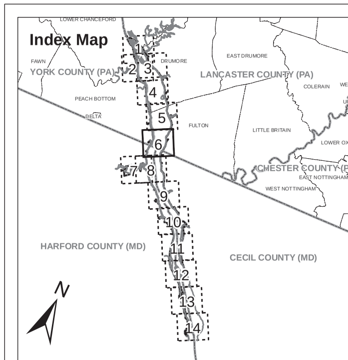

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PROJECT NO. 405

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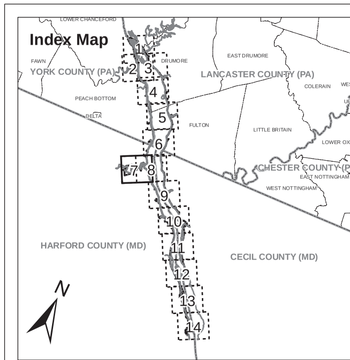

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CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

SHEET 7 of 14 **August 2012**

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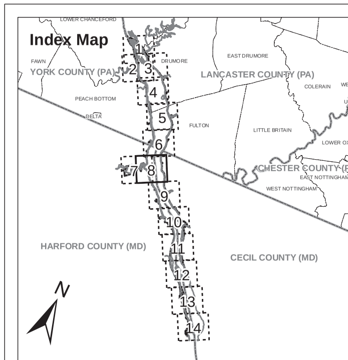

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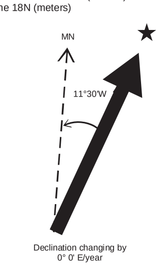

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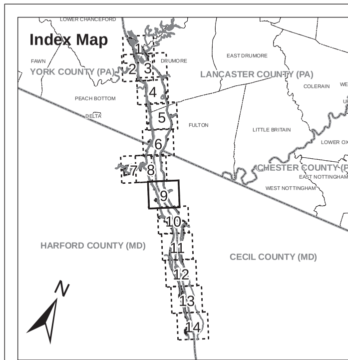

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EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

SHEET 9 of 14 **August 2012**

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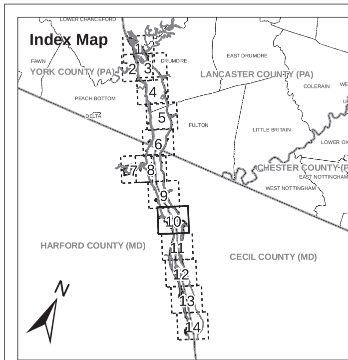

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CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

SHEET 10 of 14 — August 2012

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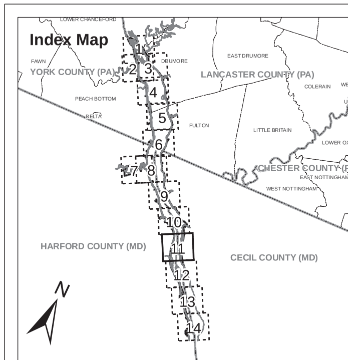

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EXELON GENERATION COMPANY, LLC
CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

SHEET 11 of 14 **August 2012**

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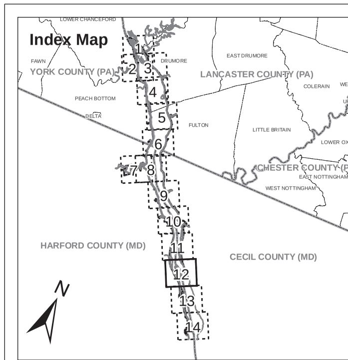
EXHIBIT G 1 inch = 400 feet 1:4,800



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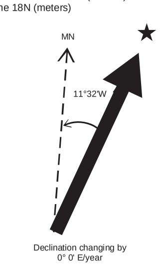

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CONOWINGO HYDROELECTRIC PROJECT
PROJECT NO. 405

SHEET 12 of 14 **August 2012**

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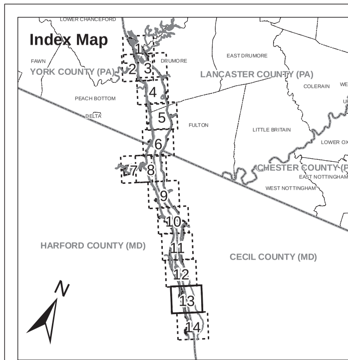

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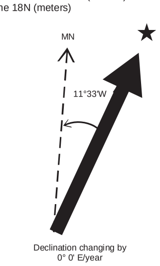

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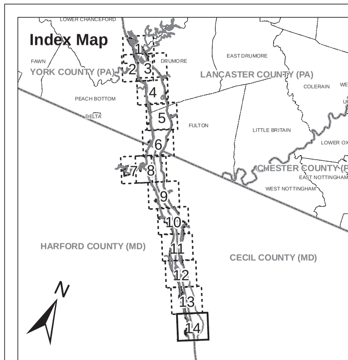

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PROJECT NO. 405

SHEET 14 of 14 — August 2012

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CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)

APPLICATION FOR NEW LICENSE

EXHIBIT H-PLANS AND ABILITY OF APPLICANT TO OPERATE THE PROJECT

CONOWINGO HYDROELECTRIC PROJECT (FERC NO. 405)
EXHIBIT H-PLANS AND ABILITY OF APPLICANT TO OPERATE THE PROJECT

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EXHIBIT H – PLANS AND ABILITY OF APPLICANT TO OPERATE THE PROJECT

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 5.18(c) describes the required content of this Exhibit.

(i) Information to be supplied by all applicants. All Applicants for a new license under this part must file the following information with the Commission:

(A) A discussion of the plans and ability of the applicant to operate and maintain the project in a manner most likely to provide efficient and reliable electric service, including efforts and plans to:

(1) Increase capacity or generation at the project;

(2) Coordinate the operation of the project with any upstream or downstream water resource projects; and

(3) Coordinate the operation of the project with the applicant's or other electrical systems to minimize the cost of production.

(B) A discussion of the need of the applicant over the short and long term for the electricity generated by the project, including:

(1) The reasonable costs and reasonable availability of alternative sources of power that would be needed by the applicant or its customers, including wholesale customers, if the applicant is not granted a license for the project;

(2) A discussion of the increase in fuel, capital, and any other costs that would be incurred by the applicant or its customers to purchase or generate power necessary to replace the output of the licensed project, if the applicant is not granted a license for the project;

(3) The effect of each alternative source of power on:

(i) The applicant's customers, including wholesale customers;

(ii) The applicant's operating and load characteristics; and

(iii) The communities served or to be served, including any reallocation of costs associated with the transfer of a license from the existing licensee.

(C) The following data showing need and the reasonable cost and availability of alternative sources of power:

(1) The average annual cost of the power produced by the project, including the basis for that calculation;

(2) The projected resources required by the applicant to meet the applicant's capacity and energy requirements over the short and long term including:

(i) Energy and capacity resources, including the contributions from the applicant's generation, purchases, and load modification measures (such as conservation, if considered as a resource), as separate components of the total resources required;

(ii) A resource analysis, including a statement of system reserve margins tobe maintained for energy and capacity;

(iii) If load management measures are not viewed as resources, the effects of such measures on the projected capacity and energy requirements indicated separately;

(iv) For alternative sources of power, including generation of additional power at existing facilities, restarting deactivated units, the purchase of power off-system, the construction or purchase and operation of a new power plant, and load management measures such as conservation: The total annual cost of each alternative source of power to replace project power; the basis for the determination of projected annual cost; and a discussion of the relative merits of each alternative, including the issues of the period of availability and dependability of purchased power, average life of alternatives, relative equivalent availability of generating alternatives, and relative impacts on the applicant's power system reliability and other system operating characteristics; and the effect on the direct providers (and their immediate customers) of alternate sources of power.

(D) If an applicant uses power for its own industrial facility and related operations, the effect of obtaining or losing electricity from the project on the operation and efficiency of such facility or related operations, its workers, and the relate community.

(E) If an applicant is an Indian tribe applying for a license for a project located on the tribal reservation, a statement of the need of such Indian tribe for electricity generated by the project to foster the purposes of the reservation.

(F) A comparison of the impact on the operations and planning of the applicant's transmission system of receiving or not receiving the project license, including:

(1) An analysis of the effects of any resulting redistribution of power flows on line loading (with respect to applicable thermal, voltage, or stability limits), line losses, and necessary new construction of transmission facilities or upgrading of existing facilities, together with the cost impact of these effects;

(2) An analysis of the advantages that the applicant's transmission system would provide in the distribution of the project's power; and

(3) Detailed single-line diagrams, including existing system facilities identified by name and circuit number, that show system transmission elements in relation to the project and other principal interconnected system elements. Power flow and loss data that represent system operating conditions may be appended if applicants believe such data would be useful to show that the operating impacts described would be beneficial.

(G) If the applicant has plans to modify existing project facilities or operations, a statement of the need for, or usefulness of, the modifications, including at least a reconnaissance-level study of the effect and projected costs of the proposed plans and any alternate plans, which in conjunction with other developments in the area would conform with a comprehensive plan for improving or developing the waterway and for other beneficial public uses as defined in Section 10(a)(1) of the Federal Power Act.

(H) If the applicant has no plans to modify existing project facilities or operations, at least a reconnaissance level study to show that the project facilities or operations in conjunction with other developments in the area would conform with a comprehensive plan for improving or developing the waterway and for other beneficial public uses as defined in Section 10(a)(1) of the Federal Power Act.

(I) A statement describing the applicant's financial and personnel resources to meet its obligations under a new license, including specific information to demonstrate that the applicant's personnel are adequate in number and training to operate and maintain the project in accordance with the provisions of the license.

(J) If an applicant proposes to expand the project to encompass additional lands, a statement that the applicant has notified, by certified mail, property owners on the additional lands to be encompassed by the project and governmental agencies and subdivisions likely to be interested in or affected by the proposed expansion.

(K) The applicant's electricity consumption efficiency improvement program, as defined under Section 10(a)(2)(C) of the Federal Power Act, including:

(1) A statement of the applicant's record of encouraging or assisting its customers to conserve electricity and a description of its plans and capabilities for promoting electricity conservation by its customers; and

(2) A statement describing the compliance of the applicant's energy conservation programs with any applicable regulatory requirements.

(L) The names and mailing addresses of every Indian tribe with land on which any part of the proposed project would be located or which the applicant reasonably believes would otherwise be affected by the proposed project.

(ii) Information to be provided by an applicant licensee. An existing licensee that applies for a new license must provide:

(A) The information specified in paragraph (c)(1) of this section.

(B) A statement of measures taken or planned by the licensee to ensure safe management, operation, and maintenance of the project, including:

(1) A description of existing and planned operation of the project during flood conditions;

(2) A discussion of any warning devices used to ensure downstream public safety;

(3) A discussion of any proposed changes to the operation of the project or downstream development that might affect the existing Emergency Action Plan, as described in subpart C of part 12 of this chapter, on file with the Commission;

(4) A description of existing and planned monitoring devices to detect structural movement or stress, seepage, uplift, equipment failure, or water conduit failure, including a description of the maintenance and monitoring programs used or planned in conjunction with the devices; and

(5) A discussion of the project's employee safety and public safety record, including the number of lost-time accidents involving employees and the record of injury or death to the public within the project boundary.

(C) A description of the current operation of the project, including any constraints that might affect the manner in which the project is operated.

(D) A discussion of the history of the project and record of programs to upgrade the operation and maintenance of the project.

(E) A summary of any generation lost at the project over the last five years because of unscheduled outages, including the cause, duration, and corrective action taken.

(F) A discussion of the licensee's record of compliance with the terms and conditions of the existing license, including a list of all incidents of noncompliance, their disposition, and any documentation relating to each incident.

(G) A discussion of any actions taken by the existing licensee related to the project which affects the public.

(H) A summary of the ownership and operating expenses that would be reduced if the project license were transferred from the existing licensee.

(I) A statement of annual fees paid under part I of the Federal Power Act for the use of any Federal or Indian lands included within the project boundary.

SECTION 1.0 INFORMATION TO BE SUPPLIED BY ALL APPLICANTS

The Federal Power Act requires applicants for a new license to provide certain information, including information about the applicant's record as the current licensee of the Project. Pursuant to 18 C.F.R. Section 5.18(c), this information is provided in this Exhibit. 18 C.F.R. Section 16.10(a) requires all applicants for a new license to provide certain information such as the need for Project power and the examination of alternative sources; plans to modify an existing Project; an applicant's ability to operate and maintain the project; and the applicant's electrical efficiency programs. This information is included in Section 1.0 of this Exhibit. Pursuant to 18 C.F.R. Section 16.10(b) 5.18(c)(1)(ii), Section 2.0 contains information to be provided by an applicant who is the existing licensee for a Project and discusses the Exelon's safe management, operation, and maintenance of the Conowingo Project; operational history and programs to upgrade Project operation and maintenance; compliance with the current license; and actions related to the Project that affect the public.

1.1. Efficient and Reliable Electric Service

1.1.1. Increase in Capacity or Generation

As discussed in Exhibit B, Exelon has no current plans to increase capacity of the Project. Exelon expects to maintain the high degree of process and controls to maintain the efficient use of the water supply to maximize the generation output and provide the region a reliable and environmentally sound source of generation.

1.1.2. Coordination with any Upstream or Downstream Water Resource Projects

The Conowingo Project operates within the PJM Interconnection (PJM). PJM coordinates the hydroelectric resources on the Susquehanna River in a manner designed to maximize the utility of the water resource. The Project operates in a peaking generation mode with minimum conservation flow releases, meaning a continuous seasonally-varying conservation flow is always passed, with higher flows being passed through turbines during periods of high electricity demand. The water level elevation (and water available for pumping by the Muddy Run Project) in the lower reservoir, Conowingo Pond, is controlled by the Conowingo Hydroelectric Project.

PJM determines when and how much electricity is generated by the Conowingo Project. The Conowingo Project is operated within the licensed water level fluctuation range, as well as inflow and outflow constraints, to meet peak power demand. The current FERC license stipulates that Conowingo Pond must be maintained between a maximum pond elevation of 110.2 feet NGVD 1929 and a minimum pond elevation of 101.2 feet NGVD 1929. Exelon is required to maintain a minimum Conowingo Pond elevation of 107.2 feet NGVD 1929, during the summer recreation season, which is defined as weekends from Memorial Day to Labor Day. Functionally, the Conowingo Pond is maintained above elevation 104.2 feet NGVD to facilitate operation of the Peach Bottom Atomic Power Station (PBAPS). During non-peak periods of electrical demand, some combination of turbine units is used to provide the minimum flow requirements at the Conowingo Project.

1.1.3. Coordination of Operations with Electrical Systems

Exelon coordinates operation of the Project with other electrical systems through its participation in the markets operated by PJM.

1.2. Need for Project Electricity

1.2.1. Cost and Availability of Alternative Sources of Power

Alternative sources of power could be obtained from the markets operated by PJM. Power could also be supplied through the construction of new power plants or by executing bilateral contracts with other market participants.

If a new license for the Conowingo Project is denied, the services that the Project provides to the grid including peaking generation, regulation and black start services would need to be provided by other existing projects or in some other fashion by the system operator.

1.2.2. Increase in Costs if Exelon is not Granted a License

Costs of replacing services that the Project provides would include reduced efficiency of other projects as they would need to modify operations to meet peak daily demand. Because of the grid stability provided by peaking hydroelectric production, true costs associated with not licensing the Project are not easily determined. Resulting loss in efficiencies caused by varying thermal plant generation would increase fuel usage (in addition to increased emissions) and therefore cause additional rate increases to the customer base.

1.2.3. Effects of Alternative Sources of Power

Effects on Customers

The primary purpose of the Project is to supply peaking capacity and energy to the PJM Interconnection, a regional transmission organization that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. This peaking capacity is accommodated by the operational mode provided specifically by the Project. The Project generally provides a small amount of electricity from minimum flow releases when power demand is low.

As a hydropower facility, the Project provides an important source of electricity during times of peak demand. In order to replace this important service, PJM would need to modify its management of energy production. Alternative sources of power, may need to throttle their production levels, which would reduce their overall efficiency. Energy production costs, environmental costs, and construction costs would be higher than the utilization of hydropower used by the Project. None of these increased costs would be beneficial to the consumer base.

Effects on the Applicant's Operating and Load Characteristics

Replacing the Project with an alternative facility would result in a change of the system load characteristics by reducing the available peak generation. The Conowingo Project provides PJM with generation units with ancillary services such as regulation and blackstart which are beneficial to the reliability and efficiency of the PJM electric grid. Both facilities also provide PJM the ability to bring units to the electric grid quickly in support of a grid disturbance such as a loss of a major unit or other change of load occurrence.

Effects on Communities Served

The loss of the license for the Project through a takeover by the Federal Government or through the decommissioning of the Project would result in a loss of tax revenues. In 2011, the Project contributed approximately $10.5 million in state and local taxes. The governmental entities affected by this loss in revenue would ultimately have to seek a reduction in expenses or an increase in other sources of revenue.

Additionally, loss of the license may result in a less reliable and efficient energy grid with the absence of the Project, which offers black start capabilities to mitigate the effects of regional black outs. Also, it is likely that many of the Project's recreation facilities would no longer be available to the community.

1.3. Need for Project Power, Reasonable Cost and Availability of Alternative Sources of Power

1.3.1. Average Annual Cost of Power

The average annual cost of the power produced by the Project includes capital costs, operating costs, and costs associated with Project relicensing, including the proposed Protection Mitigation and Enhancement

(PM&E) measures. As described in Exhibit D, Exelon has performed an analysis of the costs of producing Project power.

1.3.2. Projected Resources Required to Meet Capacity and Energy Requirements

The Project serves a significant role in the PJM regional transmission grid by providing capacity for peak load demand, spinning reserve, substantial annual energy generation and black start capability.

1.3.3. Resource Analysis and System Reserve Margins

The Project, as a peaking hydroelectric project, is well-suited to meet energy demands as its typical operation dictates that it produces power during periods of high demand.

1.3.4. Load Management Measures

Load management is conducted by the PJM interconnect, wherein the energy needs on short-term basis are coordinated.

1.4. Use of Power for Applicant-Owned Industrial Facility

Exelon does not directly use power generated by the Project to operate industrial facilities.

1.5. Need for Power if Applicant is an Indian Tribe

Exelon is not an Indian tribe applying for a project on a tribal reservation; therefore, this section is not applicable.

1.6. Effect on Operations and Planning of the Applicant's Transmission System of Receiving or not Receiving the License

1.6.1. Effects of Power Flow Redistribution

If a party or parties other than Exelon were granted a license for the Project, the new owner(s) may have another market interest, use of transmission and availability of transmission support from the Project could be appreciably different.

1.6.2. Advantages of the Applicant's Transmission System

There are no transmission lines within the Conowingo Project's boundary.

1.6.3. Project Single-Line Diagram

A single-line diagram for the Project is shown in Figure 1.6.3-1.

1.7. Plans to Modify Existing Project Facilities

Exelon currently has no plans to modify the generation facilities at the Conowingo Project.

1.8. Conformance with a Comprehensive Plan for the Waterway

The Project will be operated under the terms and conditions of a license issued by the Commission, which will be based on the Commission's determination of the license terms and conditions which are best suited to comprehensive development of the waterway. The cumulative environmental impacts of the Project in the context of the Susquehanna River Basin are addressed in Exhibit E.

1.9. Financial and Personnel Resources

1.9.1. Financial Resources

Exelon is one of the nation's largest electric utilities with a market capitalization of $26 billion. Exelon, therefore, has the financial resources to operate the Conowingo Project during the term of the new license.

1.9.2. Personnel Resources

The Conowingo Project has a full complement of operations personnel who perform all necessary day-to-day functions related to Project operations and maintenance. In addition to round-the-clock operations personnel, the Project staff includes full-time security, safety, environmental, real estate, and community affairs staff.

On-site staff is fully qualified to handle all aspects of the operation and maintenance of the Project. The Project is fully equipped to allow staff to perform virtually all routine maintenance functions. All personnel receive training commensurate with their responsibilities in an ongoing effort to improve their ability to operate the Project in the safest and most efficient manner possible.

In addition to on-site Project personnel, Exelon's corporate support staff provides additional expertise relative to all aspects of Project operations. Corporate staff includes personnel from the Engineering, Safety, Environmental, Real Estate, Legal, and Public & Governmental Affairs groups.

1.10. Project Expansion Notification

Exelon currently has no plans to expand the Project to encompass additional lands; therefore any notification is not applicable.

1.11. Electricity Consumption Efficiency Improvement Program

1.11.1. Customer Energy Efficiency Program

Exelon ensures customers have the information and resources necessary to conserve electricity. Exelon and its subsidiaries provide initiatives to educate consumers about how and why to save energy. They offer additional incentive for consumers to learn about the importance of saving energy by highlighting the cost savings of conserving electricity.

1.11.2. Compliance of Energy Conservation Programs with Regulatory Requirements

Not applicable.

1.12. Indian Tribe Names and Mailing Addresses

There are no Indian Tribes with land that will be affected by the Project. Nevertheless, Exelon has included the Delaware Nation in the distribution of this license application.

SECTION 2.0 INFORMATION TO BE SUPPLIED BY APPLICANTS THAT ARE EXISTING LICENSEES

2.1. Measures Planned to Ensure Safe Management, Operation, and Maintenance of the Project

2.1.1. Existing and Planned Operation of the Project during Flood Conditions

This information is detailed in Exhibit B of this License Application.

2.1.2. Downstream Warning Devices

Exelon is compliant with all Emergency Action Plan (EAP) requirements and has a system in place to notify emergency response teams and homeowners downstream in the unlikely event of a dam breach scenario. The generating equipment and dam facilities are monitored from the powerhouse, which is staffed with full-time operators.

2.1.3. Operational Changes that Might Affect the Emergency Action Plan

No operational changes are proposed that might affect the existing EAP at the Project. The plan is reviewed and tested annually, and updated as required. There are no known or planned changes either to the plant operations that would affect the EAP.

2.1.4. Existing and Planned Monitoring Devices

Piezometers

The current uplift monitoring program at the Conowingo Project consists of 116 piezometers which are read manually four times a year and 30 electronic piezometers which are read by computer daily. The automatic piezometers report pressure heads continuously, however the daily reading is taken at the same time every day, if a daily reading is suspect, it is compared with other values taken throughout the day. Readings are taken at the rock/concrete interface and within the foundation rock.

Threshold readings, for the automatic piezometers at Conowingo Dam, are determined based on the historic range of head at a particular location. Threshold levels are primarily used in reference to the automatic piezometers, which are read daily, thus an unusually high or low pressure head will be investigated immediately. The manual piezometers do not have any associated threshold levels, readings are simply compared to the historic range.

In the event that a pressure reading is taken that is outside of the normal range for that piezometer, additional readings are taken to check for an incorrect reading. If the readings taken are below the low-low threshold, the piezometer is considered to be inoperative and is replaced.

If the readings taken are above the high-high threshold, the station engineer is notified and the spillway tunnel is inspected, readings of adjacent manual piezometers may also be taken to determine the extent and possible cause of high pressures.

Tendon Load Cells

As part of the 1977 to 1978 post-tensioned anchor installation program, eleven anchors were equipped with invar wire telltales and/or load cells to monitor load losses due to creep. Prior to 1999, readings were recorded on a semi-annual basis, from 1999 to 2004, readings were taken annually in April. The last reading of post-tensioned tendon load cell monitoring units was completed on April 28, 2004.

Crack Monitoring

Due to the selection of aggregates and cement at the Conowingo Project, portions of the Project have been affected by an aggregate-alkali reaction which is manifested by swelling of the concrete. Unfortunately the propensity for this problem to occur and its cause were essentially unknown at the time of original construction. This problem at Conowingo was first detected in the powerhouse in about 1940 when a downriver movement of the A-line wall and cracks in the El. 46 generator floor was observed. At that time a monitoring program was initiated. The problem at the powerhouse was caused by the use of a local aggregate for the powerhouse substructure which reacted with the alkali in the cement to effect the observed growth. This caused the base of the downstream wall of the powerhouse (El. 35.0) to move downstream while the floor above, constructed with a different aggregate, remained stable. In 1955, displacements had progressed to the point where the Project decided to install steel columns adjacent to the downriver wall pilasters to provide additional support for the Elevation 46 floor beams. In 1983 additional beams were added. Monitoring of the cracks adjacent to the wall was abandoned in 1992 following an extended period of no detectable changes. The Eighth Safety Inspection Report concurred that the movement ceased because the reagents in the cement and aggregate causing the reaction had been essentially used up and also agreed that further monitoring of this condition was not necessary. The Project currently installs and checks crack monitors periodically where new cracks are observed.

Foundation Drain Cleaning Program

The Project relies on the summary report of the drain cleaning program to determine the efficiency of the foundation drains. Up to 1998, a drain test program was performed periodically to determine the efficiency and outflow paths of the drains; that program has since been discontinued.

Most of the drains that are cyclically clogged are not located at high-uplift monoliths and thus are not as critical. However drains 15-18 have often been completely plugged or have taken quite a while to clear. These drains are located in and around the monoliths containing Crest Gates 12 and 13, which are high uplift monoliths. Also drains 31-34 in and around Crest Gate monolith 30, a high uplift monolith, have typically been plugged or have required a great deal of time to clean. It is important to keep the drains clear in and around the high uplift monoliths in order to dissipate the pressures on those monoliths.

2.1.5. Employee Safety and Public Safety Record

Exelon manages the Project consistent with their long-standing commitment to employee safety. This commitment begins with compliance with applicable local, state, and Federal regulations regarding the safe operation of industrial and electrical facilities. As Exelon operates the Project's generation facilities, this commitment is implemented primarily through a rigorous safety program adopted by Exelon. Detailed inspection and maintenance programs ensure employee safety relative to operating equipment and facilities. The safety program involves employee training sessions, as well as making safety information available to employees. For the 2007 thru 2011 period, there have been no OSHA reportable incidents at the Project involving Exelon regular employees. The DART rate for Exelon employees is zero. A DART incident is an injury or illness that results in any of the following: days away from work, restricted work, or transfer to another job.

Exelon places a high priority on public safety at the Conowingo Project. Exelon maintains public safety measures (lighting, signage, markers, audible warnings, fencing, etc.) consistent with plans filed with the FERC's New York Regional Office (NYRO). In accordance with 18 CFR 12.10, Exelon files public safety incident reports with the NYRO.

2.2. Current Operations

Operation of the Conowingo Project is described in Exhibit B.

2.3. Project History

A complete Project history with upgrade and maintenance record can be found in Exhibit C of this License Application

2.4. Generation Losses over Previous Five Years

There have been several minor unscheduled outages at the Conowingo Project during the five-year period of time from 2007 through 2011 (Table 2.4-1). However, major unscheduled outages during this period have been limited.

2.5. Compliance with Terms and Conditions of Existing License

The Conowingo Project has been, and continues to be, in compliance with the terms and conditions of the current license. Over the term of the current license, the Project has been subject to FERC's standard operational and environmental inspections. Any compliance-related issues noted during the inspections have been promptly addressed by Exelon.

2.6. Action Affecting the Public

As a major presence in the region, Exelon play a prominent role in ensuring the efficient, productive use of water for hydroelectric generation and recreation. The Project also provides electricity that contributes to the stability of the regional power system. This alone significantly affects the general public by providing a low-cost and renewable-energy source to Exelon’s wholesale customers and contributing to the balance of regional power supply and demand.

In addition to operating the Project for hydroelectric generation, Exelon also manages the Project to provide additional benefits to the local community, natural resources, recreation and the region at large.

Visitors frequent the Project year-round to enjoy the many recreational opportunities available, including boating, fishing, hiking, hunting, and camping. The Project also supports other day-use and overnight-use activities such as wildlife viewing, picnicking, swimming, diving, and camping. In addition to the benefits that Exelon provides to the area's natural resources and the recreating public, the Project contributes to the public benefit through the employment of fulltime and seasonal staff.

2.7. Ownership and Operating Expense Reductions if the Project License was Transferred

If the Project license were transferred to another entity, Exelon's cost of operating and maintaining the Project (see Exhibit D) would be eliminated.

2.8. Annual Fees for Federal or Indian Lands

Exelon does not pay annual charges for Indian tribal reservation lands because the Project does not occupy any such lands.

TABLE 2.4-1: UNSCHEDULE OUTAGES AT CONOWINGO 2007-2011

Critical Energy Infrastructure Information (CEII) has been removed from this page. The material is contained in Volume 2.

FIGURE 1.6.3-1: PROJECT SINGLE-LINE DIAGRAM

Critical Energy Infrastructure Information (CEII) has been removed from this page. The material is contained in Volume 2.