ATTACHMENT 26

Entergy's Certification of Consistency with New York's Coastal Policies in Connection with Installation and Operation of Cylindrical Wedgewire Screens and Environmental Report In Support of the Draft SEIS For a SPDES Permit (No. NY-0004472) (March 29, 2013)

CERTIFICATION OF CONSISTENCY WITH NEW YORK'S COASTAL POLICIES IN CONNECTION WITH INSTALLATION AND OPERATION OF CYLINDRICAL WEDGEWIRE SCREENS

MARCH 29, 2013

Prepared by:

TRC Environmental Corporation
1200 Wall Street West
Lyndhurst, NJ 07071

NERA Economic Consulting

National Economic Research Associates, Inc.
200 Clarendon Street, 11th Floor
Boston, Massachusetts 02116

Prepared for:

Entergy Services, Inc.
1340 Echelon Parkway
Jackson, MS 39213

Table of Contents

Page

I. CERTIFICATION OF CONSISTENCY WITH NEW YORK'S COASTAL POLICIES IN CONNECTION WITH INSTALLATION AND OPERATION OF CYLINDRICAL WEDGEWIRE SCREENS

A. Introduction

Pursuant to the New York Coastal Zone Management Program ("NYCMP")[1] and comparable New York State law, this submission and all referenced documents (the "CWWS Consistency Certification") constitute the consistency certification for the proposal by Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations, Inc. (collectively, "Entergy") to install cylindrical wedgewire screens ("CWWS") at Indian Point Energy Center ("IPEC"). CWWS would be installed by Entergy, if the New York State Department of Environmental Conservation ("NYSDEC") finally determines that CWWS represent the Best Technology Available ("BTA") within the meaning the federal Clean Water Act and New York State law, including 6 NYCRR 704.5.

The CWWS Consistency Certification is separate and distinct from Entergy's submission to the New York State Department of State ("NYSDOS") in connection with the License Renewal Application ("LRA"), filed by Entergy with the United States Nuclear Regulatory Commission ("USNRC") on April 23, 2007, requesting renewal of the Indian Point Unit 2 ("IP2") and Unit 3 ("IP3") operating licenses ("License Renewal") for a period of 20 years ("License Renewal Consistency Certification"). The CWWS Consistency Certification relates to a BTA determination premised upon License Renewal for IPEC. USNRC's License Renewal determination for IPEC requires a determination by USNRC that License Renewal is consistent with or exempt from the federal Coastal Zone Management Act, 16 U.S.C. §§ 1451 *et seq*. (the "CZMA").[2] Thus, there is no need for the ALJs to address matters subject to the License Renewal Consistency Certification for federal CZMA consistency purposes in the pending NYSDEC proceedings. Rather, the License Renewal Consistency Certification addresses in detail the coastal effects of ongoing operation of IPEC, and is provided to this Tribunal solely for informational and completeness purposes.

B. Background Information

Relevant facts for the CWWS Consistency Certification are summarized below.

The CWWS proposal (the "CWWS Proposal") would involve installation of 144 cylindrical wedgewire screens on the Hudson Riverbed[3] within the IPEC Safety & Security Zone

---

1 The NYCMP is set forth in a document entitled "New York State Coastal Management Program and CZM Program Final Environmental Impact Statement" with changes from 1982 to 2006, published by the New York State Department of State.

2 *See* 16 U.S.C § 1456(c)(3)(A).

3 The description of the project is detailed in Enercon Services, Inc., *Technical Report for Indian Point Units 2 and 3—Implementation of Cylindrical Wedgewire Screens, ENTGIP152-PR-CWW-06* (2012); Enercon Services, Inc., *Project Scoping Report for Indian Point Units 2 and 3, Implementation of Cylindrical Wedgewire Screens, ENTGIP152-PR-CWW-07* (2012); Enercon Services, Inc., *Phase I Technical Report – Wedgewire Screen Array Design, Indian Point Units 2&3,* (Apr. 2012) ; and *Environmental Report, New York State Environmental Quality Act, In Support of the Draft SEIS for a State Pollution Discharge Elimination System (SPDES) Permit (No. NY-0004472), Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian*

("S&SZ").[4] Each screen would be approximately 72 inches in diameter and approximately 257 inches long, with a 2 mm slot size. Groups of 12 screens would be installed using a single plenum box as a foundation. The plenum boxes supporting the screens would be located on the Hudson River bottom approximately 300 to 500 feet from the existing IP2 and IP3 intake structures. The centerlines of the CWW screens would be approximately 10 feet above the existing river bottom elevation. Each of these 12 groups would feed into a cooling water intake bay through a single 8-foot diameter header pipe, resulting in six screen intake trains each for IP2 and IP3. The header pipes would be buried below the river bottom and follow approximately the slope of the river bed. The 12 screen intake trains would feed into four large concrete transition boxes, two for each unit. The transition boxes would be located just off-shore, approximately 30 feet from the existing intake structures. Three rectangular intake ducts would span from each of the transition boxes to the existing intake structures (12 intake ducts total).

To keep the screens clear of debris, an airburst system ("ABS") may be installed that requires a dedicated pipe routed from the ABS equipment on land to each individual screen under water (for a total of 144 ABS pipes). The ABS pipes would be routed as six bundles of 24 pipes each from the new ABS building support platform to the screen arrays. The pipes would be buried below the river bottom and follow approximately the slope of the river bed. Above-water components of the ABS would be housed in a newly constructed building (the "ABS Building"). The ABS Building would be located approximately 9 feet offshore of the Unit 1 Wharf on an in-river support structure and would be connected to the existing wharf via a ramp. The building, which would be constructed of prefabricated concrete panels, would be approximately 170 feet long, by 40 feet wide, by 37-38 feet high (when measured from the top of the in-water support structure). The support structure would be approximately 14 feet above mean water height, making the total structure approximately 51 feet high relative to the mean water elevation in the river. The ABS Building is the only structure associated with the CWWS Proposal that would be visible from land; all of the remaining components would be installed underwater.

Delivery of equipment and materials and installation of the CWWS Proposal would be completed from barges to the extent practicable. Construction of the ABS Building may be completed from the existing Unit 1 Wharf or from barges, with materials delivered by barge. The only on-land construction anticipated is the installation of certain utility conduits to service the ABS Building. To the extent on-land access is necessary, the activity is expected to be limited to the delivery and staging of materials. No on-land construction beyond the installation of utility conduits is planned.

C. Organization of this CWWS Consistency Certification

Section II of this CWWS Consistency Certification addresses each of the 44 policies of the NYCMP that pertain to CWWS. Policies that are not relevant to the CWWS Proposal are noted, with an explanation of why the policies do not apply. Where a more detailed discussion is warranted, the data and information presented in the License Renewal Consistency Certification and SEQRA CWWS ER documentation is referred to herein and incorporated by reference. The

Point 3, LLC, prepared by TRC Environmental Corporation, dated March 25, 2013 ("SEQRA CWWS ER") at § 2.3.

4 The S&SZ is depicted on SEQRA CWWS ER Figure 2.2-2.

information in those documents is not repeated herein. Supplemental information is provided where appropriate.

Section III of this CWWS Consistency Certification has been prepared specifically to address the New York State law requirements applicable to New York State agencies issuing permits for the CWWS Proposal.

***

In connection with the License Renewal Consistency Certification, Entergy has advanced arguments regarding the application and scope of the CZMA to License Renewal, including before the Atomic Safety and Licensing Board ("ASLB") and New York Supreme Court, Albany County. These arguments, and other arguments regarding the limited scope and application of the CZMA, apply with equal force to this submission. As such, Entergy expressly reserves its rights to raise any and all such arguments, as they may be decided by the ASLB and New York courts, in this proceeding. Nothing herein shall constitute any waiver of such rights.

II. FEDERAL CONSISTENCY CERTIFICATION FOR FEDERAL PERMITS

The federal CZMA requires, in connection with certain federal permits allowing activities affecting the coastal zone, that federal permit applicants shall certify consistency with the state's enforceable coastal zone policies.[5] This requirement is applicable in states, such as New York State, with coastal zone management programs that have been approved by the United States Secretary of Commerce acting by and through the National Oceanic and Atmospheric Administration ("NOAA") under the CZMA. The NYCMP, as approved by NOAA, sets forth 44 coastal policies. Within the federal permit context, subject to the exceptions set forth in Section I.B. above, applicants for certain federal permits authorizing activities that affect New York's coastal zone are required to certify consistency with the enforceable elements of any of the 44 policies which are applicable.

A discussion of all 44 NYCMP policies, and the consistency of CWWS with those policies, is set forth below.

A. NYCMP Development Policies

Policies 1 through 6 of the NYCMP are designed to promote the use of coastal resources. These policies encourage revitalization of underutilized waterfronts, location of water dependent uses within the coastal zone, the expansion of New York State's major ports, redevelopment of the existing built environment (as opposed to undeveloped areas), and expediting permitting procedures. NYCMP Policies 1 through 6 are set forth below:

> NYCMP Policy 1: Restore, revitalize, and redevelop deteriorated and underutilized waterfront areas for commercial, Industrial, cultural, recreational and other compatible uses.

> NYCMP Policy 2: Facilitate the siting of water dependent uses and facilities on or adjacent to coastal waters.

> NYCMP Policy 3: Further develop the State's major ports of Albany, Buffalo, New York, Ogdensburg and Oswego as centers of commerce and industry, and encourage the siting, in these port areas, including those under the jurisdiction of State public authorities, of land use and development which is essential to, or in support of, the waterborne transportation of cargo and people.

> NYCMP Policy 4: Strengthen the economic base of smaller harbor areas by encouraging the development and enhancement of those traditional uses and activities which have provided such areas with their unique maritime identity.

> NYCMP Policy 5: Encourage the location of development in areas where public services and facilities essential to such development are adequate.

[5] 16 U.S.C. § 1456(c)(3)(A).

NYCMP Policy 6: Expedite permit procedures in order to facilitate the siting of development activities at suitable locations. (NYCMP chap. II-6, pp. 3-19)

The six development policies of the NYCMP are not applicable to CWWS. CWWS would not be a new development or use within the coastal zone within the meaning of those policies. Instead, CWWS would facilitate continued operation of IPEC—an existing water dependent use within the coastal zone—by providing in connection with ongoing IPEC operations enhanced protection for aquatic organisms. *See* discussion of NYCMP Policies 1 through 6 in the License Renewal Consistency Certification.

B. NYCMP Fish and Wildlife Policies

Policies 7 to 10 of the NYCMP relate to different fish and wildlife considerations associated with the coastal zone. Because CWWS will be installed at IPEC solely to the extent that NYSDEC determines that the CWWS Proposal represents BTA for protection of the aquatic organisms, the CWWS Proposal necessarily will advance the purposes of policies 7 through 10.

1. NYCMP Policy 7 - Significant Coastal Fish and Wildlife Habitats

NYCMP Policy 7 provides that:

> Significant coastal fish and wildlife habitats ["SCFWH"] will be protected, preserved, and, where practical, restored so as to maintain their viability as habitats. (NYCMP chap. II-6, p. 20)[6]

In order to determine consistency with NYCMP Policy 7, NYSDOS applies a habitat impairment test to ensure that land and water uses or development will not:

1) destroy the habitat;[7] or

2) significantly impair the viability of a habitat.[8]

---

[6] NYSDOS guidance recognizes that certain habitats (i.e., SCFWHs) have been designated as critical to fish and wildlife populations, including those that:

1) are essential to the survival of a large portion of a particular fish or wildlife population (e.g., feeding grounds, nursery areas);
2) support populations of rare and endangered species;
3) are found at a very low frequency within a coastal region;
4) support fish and wildlife populations having significant commercial and/or recreational value; and
5) would be difficult or impossible to replace (NYCMP chap. II-6, p. 20)

[7] Habitat destruction is defined as the loss of fish or wildlife use through direct physical alteration, disturbance, or pollution of a designated area or through the indirect effects of these actions on a designated area. Habitat destruction may be indicated by changes in vegetation, substrate, or hydrology, or increases in runoff, erosion, sedimentation, or pollutants.

[8] Significant impairment is defined as reduction in vital resources (e.g., food, shelter, living space) or change in environmental conditions (e.g., temperature, substrate, and salinity) beyond the tolerance range of an organism. Indicators of a significantly impaired habitat focus on ecological alterations and may include but are not limited

NYSDOS has identified the following range of physical, biological, and chemical parameters determinative of the viability of SCFWHs that should be considered in assessing if an activity will impair or destroy a SCFWH:

> 1) Physical parameters, such as living space, circulation, flushing rates, tidal amplitude, turbidity, water temperature, depth (including loss of littoral zone), morphology, substrate type, vegetation, structure, erosion and sedimentation rates:
>
> 2) Biological parameters, such as community structure, food chain relationships, species diversity, predator/prey relationships, population size, mortality rates, reproductive rates, behavioral patterns and migratory patterns; and
>
> 3) Chemical parameters, such as dissolved oxygen, carbon dioxide, acidity, dissolved solids, nutrients, organics, salinity, and pollutants (heavy metals, toxic and hazardous materials).

a. Consistency of CWWS with NYCMP Policy 7

After Entergy's License Renewal Application was filed with USNRC in 2007, NYSDOS promulgated regulations proposing to expand the boundaries of River Mile ("RM") 44 to 56 SCFWH to include RM 57 to 60 and RM 40 to 43—the portion of the Hudson River adjacent to IPEC. The newly expanded "Hudson Highlands" SCFWH is shown on Figure III-1a of License Renewal Consistency Certification. As explained in the License Renewal Consistency Certification, this recently proposed change to the NYCMP has been determined by NOAA not to be applicable to License Renewal because it was approved by NOAA in 2012,[9] after the License Renewal application was submitted to USNRC on April 30, 2007. Likewise, because Entergy's application for renewal of its SPDES permit,[10] and associated Water Quality Certificate,[11] both pre-date NOAA approval of the expansion of the Hudson Highlands SCFWH, the new regulation should be inapplicable within the context of federal consistency review for those pending permit proceedings.[12] However, even if the new regulation is retroactively applied within the context of the prior pending permit proceedings, the data and analysis nonetheless demonstrate that CWWS would not destroy habitat, or significantly impair habitat, within the Hudson Highlands SCFWH or elsewhere in the Hudson River.

An area of about 5.2 +/- acres would temporarily be disturbed by construction of the CWWS Proposal. SEQRA CWWS ER § 2.6, Table 2.6-1. The area permanently covered by CWWS would be about 0.9 acres. *Id*. § 4.5. Some incremental additional

---

to reduced carrying capacity, changes in community structure (food chain relationships, species diversity), reduced productivity, and/or increased incidence of disease and mortality.

[9] NOAA approved the Hudson Highlands SCFWH as a routine program change to the NYCMP under the CZMA on November 30, 2012.

[10] The SPDES permit renewal application was filed with NYSDEC in 1992 by Entergy's predecessor in interest.

[11] The Water Quality Certification application was filed with NYSDEC on April 3, 2009.

[12] See, e.g., 15 CFR § 930.51; 15 CFR 923.84.

areas are expected to be temporarily disturbed by barge moorings. *Id.* The total amount of dredged materials to be excavated is about 100,000 cubic yards; the volume to be handled would be about 120,000 cubic yards. SEQRA CWWS ER § 2.6, Table 2.6-2. Construction is expected to extend from March 2014 until November of 2016. SEQRA CWWS ER § 2.5.4, Figure 2.5-2. The vicinity of the CWWS Proposal is characterized by river bottom conditions associated with reduced current velocities and thin sediment deposition. SEQRA CWWS ER §3.2.4.4 and Figure 3.2-4. Sediment deposition is expected to continue at a rate of 0.3 to 0.9 inches annually with a small increase in deposition due to the screens. *See* Applied Science Associates, Inc., *Analysis of Potential Sedimentation Effects of Proposed Cylindrical Wedgewire Screens for Intake of Cooling Water at Indian Point Energy Center* (March 29, 2013) (the "ASA Sedimentation Analysis") §2 (page 5) and §4. This ongoing sediment deposition will lead to recovery of any habitat value of the temporarily disturbed area over time. SEQRA CWWS ER § ES 4.3.2 and § 4.5.

The aquatic impacts of constructing CWWS would range from NONE to SMALL. SEQRA CWWS ER § 4.5.3. As explained at § 3.3.4 of the SEQRA CWWS ER:

> The shoreline area at IPEC has been substantially altered and includes the original construction of the generating facility and, as such, does not include any tidal wetlands. . . . [M]uch of the shoreline is armored, and the water depths increase rapidly with distance from the shore. As such, there are no tidal wetlands present on the River's main stem for two miles upstream or downstream of IPEC . . .

The NYSDOS description of the newly-designated SCFWH adjacent to IPEC describes "a very narrow and deep (up to 200 feet deep) section of the Hudson River with strong currents and a rocky bottom substrate." *See* NYSDOS Coastal Fish and Wildlife Rating Form for *"Hudson Highlands,"* last revised August 15, 2012, at 2, available at: http://www.dos.ny.gov/communitieswaterfronts/consistency/Habitats/HudsonRiver/Hudson_Highlands_FINAL.pdf In contrast, Figure 3.2-4 shows depth profiles and substrate types at the proposed CWWS location, where the substrate is "depositional" and "the river bottom consists of a mixture of gaseous and aqueous sediments." SEQRA CWWS ER § 3.3.5 and Figure 3.2-4.

All dredging and related work that may result in sediment re-suspension would be performed in accordance with federal, state, and local permits and approvals and applicable Best Management Practices ("BMPs"). SEQRA CWWS ER § 2.6.2 and § 4.4.1.2. Dredging would result in SMALL impacts to the benthic and water column habitats. SEQRA CWWS ER § 4.5.1.2. Those SMALL, temporary, impacts during construction would be offset by the enhanced protection of aquatic organisms provided by CWWS during ongoing operation of IPEC. *See* discussion of NYCMP Policy 7 in the License Renewal Consistency Certification and SEQRA CWWS ER §§ 4.4 and 4.5, and the discussion of potential benefits of CWWS in NERA Economic Consulting, *Benefits and Costs of Cylindrical Wedgewire Screens at Indian Point Energy Center* ("NERA Report"), § 4.

b. Conclusion and Proposed Findings

Because, as noted above, to be installed, the CWWS Proposal must be selected by NYSDEC as BTA, CWWS would advance the purposes of NYCMP Policy 7.

2. NYCMP Policy 8 - Hazardous Wastes and Pollutants that Bioaccumulate or Cause Lethal or Sublethal Effects

NYCMP Policy 8 seeks to:

> [p]rotect fish and wildlife resources in the coastal area from the introduction of hazardous wastes and other pollutants which bio-accumulate in the food chain or which cause significant sublethal or lethal effect on those resources. (NYCMP chap. II-6, p. 25)

NYCMP Policy 8 is inapplicable to the CWWS Proposal—which has no effect on the discharge of pollutants. *See* discussion of NYCMP Policy 8 in the License Renewal Consistency Certification.

3. NYCMP Policy 9 - Recreational Use of Fish and Wildlife Resources

NYCMP Policy 9 seeks to:

> [e]xpand recreational use of fish and wildlife resources in coastal areas by increasing access to existing resources, supplementing existing stocks, and developing new resources. (NYCMP chap. II-6, p. 28)

NYCMP Policy 9 is directed primarily at wildlife agencies managing fish and wildlife resources for recreational use. The CWWS Proposal, if selected as BTA, will have been determined by NYSDEC to fulfill the express purpose of minimizing adverse impacts on aquatic organisms. CWWS therefore would advance the purposes of NYCMP Policy 9. *See* discussion of NYCMP Policy 9 in the License Renewal Consistency Certification and discussion of potential recreational benefits in NERA Report, § 4.

4. NYCMP Policy 10 - Commercial Fishing

NYCMP Policy 10 seeks to:

> [f]urther develop commercial finfish, shellfish and crustacean resources in the coastal area by encouraging the construction of new, or improvement of existing on-shore commercial fishing facilities, increasing marketing of the State's seafood products, maintaining adequate stocks, and expanding aquaculture facilities. (NYCMP chap. II-6, p. 30)

The CWWS Proposal, if selected as BTA, will have been determined by NYSDEC to fulfill the express purpose of minimizing adverse impacts on aquatic organisms. CWWS therefore would advance the purposes of NYCMP Policy 10. *See* discussion of NYCMP

Policy 10 in the License Renewal Consistency Certification and discussion of potential commercial benefits in NERA Report § 4.

C. NYCMP Flooding and Erosion Policies

Policies 11 through 14 of the NYCMP seek to minimize damage to property, natural resources, and human lives as a result of flooding or erosion caused by the siting of buildings or other structures, or the construction or reconstruction of erosion protection structures. These policies are addressed collectively below. NYCMP Policy 15 pertains to mining, excavation, or dredging activities; NYCMP Policy 16 addresses the use of public funds for erosion protection; and NYCMP Policy 17 provides guidance with respect to nonstructural measures to minimize damage to natural resources and property from flooding and erosion.

1. Discussion of NYCMP Policies 11 through 14 -Siting Structures to Minimize Flooding and Erosion

NYCMP Policies 11 through 14 are set forth below:

> NYCMP Policy 11: Buildings and other structures will be sited in the coastal area so as to minimize damage to property and the endangering of human lives caused by flooding and erosion;
>
> NYCMP Policy 12: Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding and erosion by protecting natural protective features including beaches, dunes, barrier islands and bluffs;
>
> NYCMP Policy 13: The construction or reconstruction of erosion protection structures shall be undertaken only if they have a reasonable probability of controlling erosion for at least thirty years as demonstrated in design and construction standards and/or assured maintenance or replacement programs; and
>
> NYCMP Policy 14: Activities and development, including the construction or reconstruction of erosion protection structures, shall be undertaken so that there will be no measurable increase in erosion or flooding at the site of such activities or development, or at other locations. (NYCMP chap. II-6, pp. 32-37)

The CWWS Proposal is designed to operate in and under water. See SEQRA CWWS ER § § 2.3 and 2.4, and Figure 2.3-3. CWWS would not obstruct water flow patterns in a manner that could reasonable be considered to cause or contribute to flooding or erosion in a measurable manner. *See* ASA Sedimentation Analysis § § 3.3.4 and 4; SEQRA CWWS ER § 4.3. CWWS installation and operation would be fully consistent with Policies 11 through 14. *See* discussion of NYCMP Policies 11 through 14 in the License Renewal Consistency Certification and SEQRA CWWS ER §§ 4.4 and 4.5.

2. NYCMP Policy 15 - Mining, Excavating, or Dredging

NYCMP Policy 15 provides that:

> [m]ining, excavation or dredging in coastal waters shall not significantly interfere with the natural coastal processes which

> supply beach materials to land adjacent to such waters and shall be undertaken in a manner which will not cause an increase in erosion of such land. (NYCMP chap. II-6, p. 39)

As noted in response to Policies 11 through 14, installation of CWWS could not reasonably be considered to interfere with the natural coastal processes, or otherwise cause an increase in erosion. *See* discussion of NYCMP Policy 15 in the License Renewal Consistency Certification, and ASA Sedimentation Analysis § 4.

3. NYCMP Policy 16 - Public Funding for Erosion Protection

NYCMP Policy 16 identifies the appropriate uses of public funds for erosion control:

> [p]ublic funds shall only be used for erosion protective structures where necessary to protect human life, and new development which requires a location within or adjacent to an erosion hazard area to be able to function, or existing development; and only where the public benefits outweigh the long term monetary and other costs including the potential for increasing erosion and adverse effects on natural protective features. (NYCMP chap. II-6, p. 41)

CWWS would not entail the use of public funding for the construction or reconstruction of erosion protective structures. Accordingly, NYCMP Policy 16 is inapplicable. *See* discussion of NYCMP Policy 16 in the License Renewal Consistency Certification.

4. NYCMP Policy 17 - Non-Structural Measures for Flood and Erosion Control

NYCMP Policy 17 provides that:

> [n]on-structural measures to minimize damage to natural resources and property from flooding and erosion shall be used whenever possible. (NYCMP chap. II-6, p. 42)

Because CWWS would be installed almost entirely underwater, typical non-structural methods to minimize erosion are not relevant. BMPs will be used to minimize suspension of sediments within the water. See SEQRA CWWS ER § § ES 4.3.1 and 2.6.2. *See also*, discussion of NYCMP Policy 17 in the License Renewal Consistency Certification.

D. NYCMP General Policy

1. NYCMP Policy 18 - Safeguarding the State's Vital Economic, Social and Environmental Interests

NYCMP Policy 18 provides that:

> [t]o safeguard the vital economic, social and environmental interests of the State and of its citizens, proposed major actions in

> the coastal area must give full consideration to those interests, and to the safeguards which the state has established to protect valuable coastal resource areas. (NYCMP chap. II-6, p. 44)

Adequate supplies of reliable, baseload electricity from lower cost electricity resources are essential to safeguard the State's economic interests. Installation of CWWS would help IPEC to continue to serve the State's economic interests for the reasons set forth in the License Renewal Consistency Certification. *See* discussion of NYCMP Policy 18 in the License Renewal Consistency Certification.

E. NYCMP Public Access Policies

1. NYCMP Policies 19 and 20 - Public Access

NYCMP Policy 19 seeks to:

> [p]rotect maintain, and increase the level and types of access to public water-related recreation resources and facilities (NYCMP chap. II-6, p. 50).

NYCMP Policy 20 provides that:

> [a]ccess to the publicly-owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly-owned shall be provided and [i]t shall be provided in a manner compatible with adjoining uses. (NYCMP chap. II-6, p. 57)

Physically, CWWS would have no impact on public access. Moreover, CWWS would be constructed entirely within the United States Coast Guard ("USCG'')-mandated safety and security exclusionary zone (33 CFR §§165.30 and 165.169(a)(1)) which prevents public access to this area. *See* discussion of NYCMP Policy 19 in the License Renewal Consistency Certification.

F. NYCMP Recreation Policies

NYCMP Policies 21 and 22 promote water-related and water-dependent recreational activities within the coastal zone.

1. NYCMP Policies 21 and 22 - Water-Related Recreational Opportunities

NYCMP Policy 21 provides that:

> [w]ater-dependent and water-enhanced recreation would be encouraged and facilitated, and will be given priority over non-water-related uses along the coast. (NYCMP chap. II-6, p. 62)

NYCMP Policy 22 provides that:

> development when located adjacent to the shore will provide for water-related recreation, whenever such use is compatible with reasonably anticipated demand for such activities, and is compatible with the primary purpose of the development. (NYCMP chap. II-6, p. 66)

In accordance with NYCMP Policy 21, IPEC is a water-dependent use of the shoreline that would be supported by CWWS. NYCMP Policy 22 does not encourage recreational use where such recreational use is incompatible with existing waterfront uses. For security purposes, access to nuclear power plants is significantly restricted and, therefore, recreational use of the IPEC site and the area to be encompassed by the CWWS Proposal is not practicable. As noted in response to NYCMP Policy 20, the CWWS Proposal would be located entirely within the USCG-mandated safety and security exclusionary zone. *See* discussion of NYCMP Policies 21 and 22 in the License Renewal Consistency Certification.

G. NYCMP Historic and Scenic Resources Policies

Policies 23 through 25 of the NYCMP relate to historic, archaeological, and culturally significant resources.

1. NYCMP Policy 23 - Man-Made Historic, Archaeological and Cultural Resources

NYCMP Policy 23 seeks to:

> [p]rotect, enhance and restore structures, districts, areas or sites that are of significance in the history, architecture, archaeology or culture of the State, its communities, or the Nation. (NYCMP chap. II-6, p. 70)

CWWS construction would not entail disturbance of any previously undisturbed upland areas. The potential presence of underwater archeological resources in the CWWS area would be evaluated during the permitting phase of the CWWS Proposal, prior to commencement of construction**.** The scope of work and research plan for any required subsurface and/or underwater investigations would be coordinated with the New York State Historic Preservation Officer. As described in the SEQRA CWWS ER § 4.12.1, the applicable procedures of Entergy's Cultural Resource Protection Plan would be followed. Accordingly, CWWS construction would be consistent with NYCMP Policy 23. *See* discussion of NYCMP Policy 23 in the License Renewal Consistency Certification.

2. NYCMP Policies 24 and 25 - Scenic, Natural and Manmade Resources

NYCMP Policy 24 seeks to:

> [p]revent impairment of scenic resources of statewide significance. (NYCMP chap. II-6, p. 73)

NYSDOS defines impairment as:

> (i) the irreversible modification of geological forms, the destruction or removal of vegetation, the modification, destruction, or removal of structures, whenever the geologic forms, vegetation or structures are significant to the scenic quality of an identified resource; and
>
> (ii) the addition of structures which because of siting or scale will reduce identified views or which because of scale, form, or materials will diminish the scenic quality of an identified resource (6 NYCRR § 600.4).

NYCMP Policy 25 seeks to:

> [p]rotect, restore, or enhance natural and man-made resources which are not identified as being of statewide significance, but which contribute to the overall scenic quality of the coastal area. (NYCMP chap. II-6, p. 77)

The CWWS Proposal would be almost entirely underwater and not visible. Existing site topography and vegetation would not be altered. The ABS Building would fit into the existing developed industrial character of the IPEC site, and its presence would not materially change the visual character of the existing IPEC site or area. *See* discussion of NYCMP Policies 24 and 25 in the License Renewal Consistency Certification and SEQRA CWWS ER § 4.8 and Figure 2.4-1.

H. NYCMP Agricultural Land Policy

1. NYCMP POLICY 26 - Agricultural Lands

NYCMP Policy 26 seeks to:

> [c]onserve and protect agricultural lands in the State's coastal area. (NYCMP chap. II-6, p. 78)

NYSDOS decided that urban areas, such as Westchester County, are excluded from the mapping of agricultural lands. No agricultural lands would be affected by CWWS installation. *See* discussion of NYCMP Policy 26 in the License Renewal Consistency Certification.

I. NYCMP Energy and Ice Management Policies

Policies 27 through 29 of the NYCMP address siting of energy facilities and use of ice management practices. NYCMP Policy 27 recognizes the need to balance public energy needs against the environmental impacts of the siting of energy facilities in the coastal zone. NYCMP Policy 28 addresses ice management practices to minimize the impacts on aquatic resources and production of hydroelectric power. NYCMP Policy 29 is concerned with development of new energy resources on the outer continental shelf, in Lake Erie, and in other water bodies.

1. NYCMP Policy 27 - Siting and Construction of Major Energy Facilities

NYCMP Policy 27 provides that:

> [decisions on the siting and construction of major energy facilities in the coastal area will be based on public energy needs, compatibility of such facilities with the environment, and the facility's need for a shorefront location. (NYCMP chap. II-6, p. 85)

NYCMP Policy 27, which addresses the siting and construction of new energy facilities based on public energy needs, is inapplicable to CWWS. IPEC is an existing water-dependent energy facility that requires a shorefront location for cooling water, and barge delivery of large equipment such as steam generators and transformers. NYCMP Policy 27 is not applicable to installation of CWWS. *See* discussion of NYCMP Policy 27 in the License Renewal Consistency Certification.

2. NYCMP Policy 28 - Ice Management

NYCMP Policy 28 provides that:

> [i]ce management practices shall not interfere with the production of hydroelectric power, damage significant fish and wildlife and their habitats, or increase shoreline erosion or flooding. (NYCMP chap. II-6, p. 89)

While seasonal ice conditions do occur at certain locations along the Hudson River, IPEC has not experienced any issues associated with intake structure blockage due to ice loading, pancake ice, or frazil ice. Diver reports indicate that small portions of ice can be seen in the river during winter, but they are above the flow of water for the area where the CWWS will be installed with the ABS system and therefore could not reasonably expected to cause blockage. *See* Tr. Pp. 104-05 (Beaver Prefiled Testimony) and SEQRA CWWS ER § 2.4 and Figure 2.3-3. No ice management practices beyond those already contemplated in the CWWS Proposal would be needed. *See* discussion of NYCMP Policy 28 in the License Renewal Consistency Certification.

3. NYCMP Policy 29 - Development of New, Indigenous Energy Resources

NYCMP Policy 29 seeks to:

> [e]ncourage the development of energy resources on the Outer Continental Shelf, in Lake Erie and in other water bodies, and ensure the environmental safety of such activities. (NYCMP chap. II-6, p. 90)

NYCMP Policy 29 applies to newly-proposed energy facilities within coastal waters and is not applicable to CWWS. *See* discussion of NYCMP Policy 29 in the License Renewal Consistency Certification.

J. NYCMP Water and Air Resources Policies

Policies 30 through 40 of the NYCMP deal with certain activities within or near the coastal zone, such as industrial discharges (NYCMP Policy 30); innovative sanitary waste systems (NYCMP Policy 32); stormwater, Combined Sewer Overflow ("CSO"), and non-point discharges (NYCMP Policies 33 and 37); discharge of vessel wastes (NYCMP Policy 34); dredge and fill activities (NYCMP Policy 35); hazardous materials handling and spill response (NYCMP Policy 36); solid and hazardous wastes management (NYCMP Policy 39); and steam electric generating effluents (NYCMP Policy 40). Policies 31 and 38 protect public water supplies. NYCMP Policies 41 through 43 protect air quality.

1. NYCMP Policy 30 - Industrial Discharge of Pollutants

NYCMP Policy 30 states that:

> [m]unicipal, industrial, and commercial discharge of pollutants, including but not limited to, toxic and hazardous substances, into coastal waters will conform to State and National water quality standards. (NYCMP chap. II-6, p. 92)

The purpose of the CWWS Proposal is to provide greater protection for aquatic organisms. IPEC's effluent discharges are regulated by a SPDES permit (# NY-0004472) issued by NYSDEC and would not be affected by CWWS. *See* discussion of NYCMP Policy 30 in the License Renewal Consistency Certification and SEQRA CWWS ER § § 4.4 and 4.5.

2. NYCMP Policy 31 - Triennial Reviews of WQS

NYCMP Policy 31 states that:

> [s]tate coastal area policies and management objectives of approved local Waterfront Revitalization Programs will be considered while reviewing coastal water classifications and while modifying water quality standards; however, those waters already over-burdened with contaminants will be recognized as being a development constraint. (NYCMP chap. II-6, p. 93)

NYCMP Policy 31 relates to NYSDEC's obligations under §303(d) and §305(b) of the federal CWA to conduct triennial reviews to determine whether New York's surface waters meet the numeric WQS as set forth in 6 NYCRR Part 703 and the "best usages" set forth in 6 NYCRR Part 701. NYCMP Policy 31 recommends that during its triennial review, NYSDEC should consider the local Waterfront Revitalization Programs and NYCMP policies. NYCMP Policy 31 is not applicable to CWWS. *See* discussion of NYCMP Policy 31 in the License Renewal Consistency Certification.

3. NYCMP Policy 32 - Innovative Sanitary Waste Systems

NYCMP Policy 32 seeks to:

> [e]ncourage the use of alternative or innovative sanitary waste systems in small communities where the costs of conventional

> facilities are unreasonably high, given the size of the existing tax base of these communities. (NYCMP chap. II-6, p. 93)

NYCMP Policy 32 is directed toward municipalities and/or sewer districts. CWWS would have no effect on sewer discharges. *See* discussion of NYCMP Policy 32 in the License Renewal Consistency Certification.

4. NYCMP Policies 33 and 37 - Best Management Practices for Stormwater, CSOs, and Non-Point Source Discharges

NYCMP Policies 33 and 37 relate to the use BMPs to control discharges of pollutants in stormwater into coastal waters. NYCMP Policy 33 addresses stormwater runoff and CSOs, and NYCMP Policy 37 addresses non-point source discharges of excess nutrients, organics, and eroded soils. These policies are as follows:

> NYCMP Policy 33: BMPs will be used to ensure the control of stormwater runoff and combined sewer overflows draining into coastal waters; and
>
> NYCMP Policy 37: BMPs will be utilized to minimize the non-point discharge of excess nutrients, organics and eroded soils into coastal waters. (NYCMP chap. II-6, p. 94 and p. 97)

BMPs employed at the IPEC facility are described in detail in the License Renewal Consistency Certification. No material change of existing operations or BMPs is proposed as part of the CWWS Proposal. Construction period BMPs are described at § 2.6.2 of the SEQRA CWWS ER. After completion of construction, the CWWS Proposal would have no effect on stormwater discharges or the implementation of stormwater BMPs at IPEC. *See* discussion of NYCMP Policy 33 and 37 in the License Renewal Consistency Certification.

5. NYCMP Policy 34 - Vessel Wastes

NYCMP Policy 34 states that:

> [d]ischarge of waste materials into coastal waters from vessels subject to State jurisdiction ... will be limited so as to protect significant fish and wildlife habitats, recreational areas and water supply areas. (NYCMP chap. II-6, p. 95)

Any vessels involved in construction of CWWS would be required to meet the requirements of NYSDEC's general NPDES permit issued in 2008 by the USEPA, which regulates the discharge of wastes from vessels, including barges (USEPA 201 If). NYSDEC implements this general permit pursuant to its delegation of authority from USEPA under the CWA. Accordingly, construction of CWWS would be consistent with NYCMP Policy 34. *See* discussion of NYCMP Policy 34 in the License Renewal Consistency Certification.

6. NYCMP Policy 35 - Dredge and Fill Activities

NYCMP Policy 35 states that:

> [d]redging and filling in coastal waters and disposal of dredged material will be undertaken in a manner that meets existing State dredging permit requirements, and protects significant fish and wildlife habitats, scenic resources, natural protective features, important agricultural lands, and wetlands. (NYCMP chap. II-6, p. 96)

Dredge and fill activities associated with construction of CWWS would be subject to and with the benefit of permits issued by the ACOE under §404 of the federal Clean Water Act and Excavation or Placement of Fill in Navigable Waters permits issued by NYSDEC pursuant to 6 NYCRR Part 608 (Use and Protection of Waters). Any dredged materials would be disposed of in a licensed upland disposal facility, as required by applicable regulations, and therefore would not pose a threat to ecological communities of the Hudson River. *See* SEQRA CWWS ER § 4.4, and § 4.5. Construction period BMPs are described at § 2.6.2 of the SEQRA CWWS ER. *See* discussion of NYCMP Policy 35 in the License Renewal Consistency Certification.

7. NYCMP Policy 36 - Spill Response and Hazardous Material Management

NYCMP Policy 36 addresses the minimization of spills relating to the shipment and storage of petroleum products and other hazardous materials. NYCMP Policy 36 states that:

> [activities related to the shipment and storage of petroleum and other hazardous materials will be conducted in a manner that will prevent or at least minimize spills into coastal waters; all practicable efforts will be undertaken to expedite the cleanup of such discharges; and restitution for damages will be required when these spills occur. (NYCMP chap. II-6, p. 97)

Construction and operation of CWWS would have no effect on handling or use of petroleum or other hazardous materials at IPEC. *See* discussion of NYCMP Policy 36 in the License Renewal Consistency Certification.

8. NYCMP Policy 38 - Protection of Surface Water and Groundwater Supplies

NYCMP Policy 38 states that:

> [t]he quality and quantity of surface water and groundwater supplies, will be conserved and protected, particularly where such waters constitute the primary or sole source of water supply. (NYCMP chap. II-6, p. 98)

Construction and operation of CWWS at IPEC would have no effect on surface water or groundwater supplies. *See* discussion of NYCMP Policy 38 in the License Renewal Consistency Certification.

9. NYCMP Policy 39 - Solid Wastes and Hazardous Wastes

NYCMP Policy 39 addresses the appropriate handling of solid and hazardous wastes:

> [t]he transport, storage, treatment and disposal of solid wastes, particularly hazardous wastes, within coastal areas will be conducted in such a manner so as to protect groundwater and surface water supplies, significant fish and wildlife habitats, recreation areas, important agricultural lands and scenic resources. (NYCMP chap. II-6, p. 99)

Entergy's solid waste management practices associated with the generation, transportation and storage of solid wastes, including hazardous and mixed wastes, at IPEC are being and will continue to be conducted pursuant to applicable federal and State regulatory requirements as described in the License Renewal Consistency Certification. Construction and operation of CWWS at IPEC would have no effect on such practices. Any dredged material or other solid waste generated during the construction process for CWWS would be handled in accordance with the protocols and requirements established by the applicable permits. *See* discussion of NYCMP Policy 39 in the License Renewal Consistency Certification.

10. NYCMP Policy 40 - Steam Electric Generating Effluents in Conformance with WQS

NYCMP Policy 40 provides that:

> [e]ffluent discharged from major steam electric generating and industrial facilities into coastal waters will not be unduly injurious to fish and wildlife and shall conform to State water quality standards. (NYCMP chap. II-6, p. 100)

Operation of CWWS would have no effect on IPEC's discharges of effluent. NYSDEC staff has already approved the existing IPEC thermal discharges as consistent with applicable thermal criteria. *See* SEQRA CWWS ER § 3.2.4.1 (citing letter to Judges Villa and O'Connell dated May 16, 2011, from Mark D. Sanza, Assistant Counsel, NYSDEC Office of General Counsel). The purpose and intended effect of the CWWS Proposal is to minimize adverse environmental impact, consistent with 6 NYCRR Part 704. Accordingly, CWWS would advance the purposes of NYCMP Policy 40. *See* discussion of NYCMP Policy 40 in the License Renewal Consistency Certification.

Construction of CWWS would have the potential to result in temporary, SMALL effects on Hudson River water quality due to in-river construction activities. Entergy has developed a suite of construction BMPs that would be implemented to effectively minimize the resuspension of sediments in the immediate vicinity of the in-river construction work area. Entergy would also adaptively manage the construction means and methods by way of the selected contractor and through a construction inspection program. A Spill Prevention, Control and Countermeasure Plan "SPCC Plan") would be developed for use during construction to minimize the potential for an accidental release of oils and/or chemicals into the environment. In addition, the CWWS Proposal would be constructed in compliance with the terms and conditions of the applicable permits and of applicable federal, state and local permits. *See* § 4.4 of the SEQRA CWWS ER.

11. NYCMP Policy 41 - Achieving National Ambient Air Quality Standards (“NAAQS”) and State Ambient Air Quality Standards (“SAAQS”)

NYCMP Policy 41 of the NYCMP provides that:

> [I]and use or development in the coastal area will not cause national or State air quality standards to be violated. (NYCMP chap. II-6, p. 101)

Construction and operation of CWWS would not violate any applicable air standards or cause air quality impacts. IPEC’s virtually emission-free energy production plays an important role in attaining NAAQS and SAAQS and thereby protects the public health and environment. *See* discussion of NYCMP Policy 41 in the License Renewal Consistency Certification and § 4.3 of the SEQRA CWWS ER.

12. NYCMP Policy 42 - Reclassifying Prevention of Significant Deterioration Designations

NYCMP Policy 42 requires NYSDEC to consider the NYCMP if it reclassifies land areas based on requirements of the federal Clean Air Act. NYCMP Policy 42 states that:

> [c]oastal management policies will be considered if the State reclassifies land areas pursuant to the prevention of significant deterioration regulations of the federal Clean Air Act. (NYCMP chap. II-6, p. 101)

NYCMP Policy 42 is directed at NYSDEC rulemakings regarding air attainment classifications and has no relevance to CWWS. *See* discussion of NYCMP Policy 42 in the License Renewal Consistency Certification.

13. NYCMP Policy 43 - Acid Rain

NYCMP Policy 43 deals with the causes of acid rain. NYCMP Policy 43 states that:

> [l]and use or development in the coastal area must not cause the generation of significant amounts of acid rain precursors: nitrates and sulfates. (NYCMP chap. II-6, p. 102)

CWWS would have no effect on generation of acid rain precursors. IPEC itself plays a key role in meeting the power generation and energy needs of the State without contributing to the production of acid rain precursors. *See* discussion of NYCMP Policy 43 in the License Renewal Consistency Certification and SEQRA CWWS ER § 4.3.

K. NYCMP Wetland Policy

1. NYCMP Policy 44 - Tidal and Freshwater Wetlands

NYCMP Policy 44 seeks to:

> [p]reserve and protect tidal and freshwater wetlands and preserve the benefits derived from these areas. (NYCMP chap. II-6, p. 103)

An area of about 5.2 +/- acres of Hudson River bottom would be disturbed by construction of the CWWS Proposal. SEQRA CWWS ER § 2.6, Table 2.6-1. Some incremental additional areas are expected to be temporarily disturbed by barge moorings. *Id.*

The aquatic impacts of constructing CWWS would range from NONE to SMALL. SEQRA CWWS ER § 4.5. As explained at § 3.3.4 of the SEQRA CWWS ER:

> The shoreline area at IPEC has been previously altered and includes the original construction of the generating facility and, as such, does not include any tidal wetlands. . . . [M]uch of the shoreline is armored, and the water depths increase rapidly with distance from the shore. As such, there are no tidal wetlands present on the River's main tem for two miles upstream or downstream from IPEC . . . .

Accordingly, CWWS would be consistent with NYCMP Policy 44. *See* discussion of NYCMP Policy 44 in the License Renewal Consistency Certification.

III. STATE CONSISTENCY CERTIFICATION FOR STATE PERMITS

The basic framework governing the state consistency certification process is established by:

> 1. Executive Law Article 42—Waterfront Revitalization of Coastal Waters and Inland Waterways (the "Waterfront Act");
>
> 2. Implementing regulations promulgated by NYSDOS at 19 NYCRR Part 600 (the "NYSDOS Coastal Regulations"); and
>
> 3. NYSDEC regulations implementing the State Environmental Quality Review Act ("SEQRA") at 6 NYCRR Part 617 (the "NYSDEC SEQRA Regulations").

In accordance with the NYSDOS Coastal Regulations and NYSDEC SEQRA Regulations, this CWWS Consistency Certification refers to and incorporates by reference the relevant sections of the SEQRA CWWS ER that address consistency of CWWS with the State's coastal policies.

Under § 912 of the Waterfront Act as enacted in 1981, the State adopted eleven coastal policies. A 1986 amendment of the Waterfront Act extended to policies to encompass "inland waterways" as well as "coastal areas." New York's statutory coastal policies were again amended in 2000 to add policy #10 below, and in 2001 to add policies #13, 14, 15, and 16 below.

The 16 statutory coastal zone policies adopted by the New York Legislature are as follows:

> 1. To achieve a balance between economic development and preservation that will permit the beneficial use of coastal and inland waterway resources while preventing the loss of living marine resources and wildlife, diminution of open space areas or public access to the waterfront, shoreline erosion, impairment of scenic beauty, or permanent adverse changes to ecological systems.

2. To encourage the development and use of existing ports and small harbors including use and maintenance of viable existing infrastructures, and to reinforce their role as valuable components within the state's transportation and industrial network.

3. To conserve, protect and where appropriate promote commercial and recreational use of fish and wildlife resources and to conserve and protect fish and wildlife habitats identified by the department of environmental conservation as critical to the maintenance or re-establishment of species of fish or wildlife. Such protection shall include mitigation of the potential impact from adjacent land use or development.

4. To encourage and facilitate public access for recreational purposes.

5. To minimize damage to natural resources and property from flooding and erosion, including proper location of new land development, protection of beaches, dunes, barrier islands, bluffs and other critical coastal and inland waterway features and use of non-structural measures, whenever possible.

6. To encourage the restoration and revitalization of natural and man-made resources.

7. To encourage the location of land development in areas where infrastructure and public services are adequate.

8. To conserve and protect agricultural lands as valued natural and ecological resources which provide for open spaces, clean air sheds and aesthetic value as well as for agricultural use.

9. To assure consistency of state actions and, where appropriate, federal actions, with policies of the coastal area and inland waterways, and with accepted waterfront revitalization programs of the area defined or addressed by such programs.

10. To work cooperatively with the federal government, local governments and private parties to implement programs to control and abate sources of nonpoint source pollution that may affect coastal and inland waterways.

11. To cooperate and coordinate with other states, the federal government and Canada to attain a consistent policy towards coastal and inland waterway management.

12. To encourage and assist local governments in the coastal area and inland waterways to use all their powers that can be applied to achieve these objectives.

13. To facilitate the redevelopment of urban waterfronts.

14. To encourage local governments to enter into intermunicipal agreements to protect their shared environment and improve their region's economic strength.

15. To encourage state agencies to provide technical and financial assistance for implementation of local waterfront revitalization programs.

16. To encourage local governments and state agencies to celebrate, protect and enhance the special places that made waterfronts distinct ecological systems and the preferred locations for people to live, work and recreate.

The five coastal policies added in 2000-2001 focus upon abatement of nonpoint sources of pollution (#10), redevelopment of urban waterfronts (#13), encouraging inter-municipal agreements (#14), state assistance for implementing local waterfront revitalization programs (#15), and protecting the special places that make waterfronts ecologically distinct and the preferred location to live, work and recreate (#16).

Under § 919 of the Waterfront Act:

(i) Actions directly undertaken by state agencies within the coastal area including grants, loans or other funding assistance, land use and development, or planning, and land transactions shall be consistent with the [16] coastal area policies of this article."[13]

(ii) NYSDOS "shall make recommendations" to state agencies with respect to achievement of such policies.

(iii) NYSDEC shall amend the SEQRA regulations to assure adequate consideration of the impacts on the use and conservation of coastal resources.

Thus, state agencies are responsible for determining the consistency of their actions with the state's coastal policies, with NYSDOS playing a purely advisory role.

Under the NYSDOS Coastal Regulations and the NYSDEC SEQRA Regulations the obligation of state agencies is broadened from consideration of the 16 policies set forth in the Waterfront Act to consideration of the 29 policies set forth in 19 NYCRR § 600.5.[14] Initially, § 600.3(a) of the NYSDOS Coastal Regulations requires that "[n]o State agency involved in an action shall carry out, fund or approve the action until it has complied with the provisions of [the Waterfront

[13] On its face, this consistency requirement for state agencies only applies to actions directly undertaken by state agencies, and does not encompass state agency permit decisions. The Waterfront Act appears to leave existing state permit authority entirely unaffected. In fact, § 919(1) of the Waterfront Act sets forth the following proviso:

> [N]othing in this article shall be construed to authorize or require the issuance of any permit, license, certification, . . . , pursuant to other provisions of law or which is conditioned by such agency pursuant to other provisions of law until such conditions are met.

[14] A chart comparing the 16 policies of the Waterfront Act to the 29 policies set forth in the NYSDOS Coastal Regulations is attached as Exhibit A**.** Instead of tracking the 16 statutory policies of the Waterfront Act, the 29 policies of the NYSDOS Coastal Regulations echo 29 of the 44 policies of the NYCMP (while omitting 15 policies altogether). A chart showing which of the 44 policies of the NYCMP are reflected in the NYSDOS Coastal Regulations is attached as Exhibit B. In order to correct the lack of correlation between the 44 policies of the NYCMP and the 16 statutory policies of the Waterfront Act, § 921(1) of the Waterfront Act directs NYSDOS to amend the NYCMP to comport with the Waterfront Act. NYSDOS does not appear to have adopted any such amendments of the NYCMP.

Act].” However, the NYSDOS Coastal Regulations go on to provide that when an environmental impact statement (“EIS”) is prepared under SEQRA, “[f]ulfilling the requirements of SEQRA, and more specifically 6 NYCRR § 617.9(b)(5)(vi) and § 617.11(e) constitutes a determination of consistency as required by Executive Law article 42.” 19 NYCRR § 600.4(a). 6 NYCRR § 617.9(b)(vi) provides that a draft EIS must address consistency with any of the 29 coastal policies contained in 19 NYCRR § 600.5 which are applicable. 6 NYCRR § 617.11(e) provides that “[n]o state agency may make a final decision on an action that has been the subject of a final EIS until the agency has made a written finding that the action is consistent with the applicable policies set forth in 19 NYCRR 600.5.”

When a SEQRA EIS is not prepared, the state agency must self-certify that its action will not “substantially hinder” achievement of any of the 29 coastal policies set forth at 19 NYCRR § 600.5 which are applicable. 19 NYCRR § 600.4(b). Even if the state action will substantially hinder achievement of state coastal policies, the state agency may approve the action as consistent with the 29 coastal policies if:

> 1. No reasonable alternatives exist which would permit the action to be taken in a manner that would not substantially hinder the achievement of such policy;
>
> 2. The action taken will minimize all adverse effects on such policies to the maximum extent practicable;
>
> 3. The action will advance one or more of the other coastal policies; and
>
> 4. The action will result in an overriding regional or statewide public benefit. *Id.*

19 NYCRR § 600.5 also states that “[i]n evaluating proposed actions against the [29 coastal policies], State agencies are strongly encouraged to consider the coastal policy explanations and guidelines contained in the approved New York State Coastal Management Program document.” Those policy explanations and guidelines are described in detail in the License Renewal Consistency Certification.

Notwithstanding the procedural differences in federal and state consistency review, the purpose and ultimate outcome of the consistency review process must be the same in both contexts: to determine whether the proposed activity is consistent with the state’s coastal policies. NOAA’s CZMA regulations require states “to uniformly and comprehensively apply the enforceable policies of the State’s management program.” 15 C.F.R. § 930.6(a). “Uniformity is required to ensure that States are not applying policies differently, or in a discriminatory way, among various entities for the same type of project for similar purposes, *e.g.*, holding a Federal agency to a higher standard than a local government or private citizen.” 65 Fed. Reg. 77,124, 77,128 (Dec. 8, 2000). Accordingly, either all federal and state consistency reviews are governed by the enforceable subset of the 44 coastal policies of the NYCMP, or all federal and state consistency reviews are governed by the enforceable subset of the 29 policies set forth in 19 NYCRR § 600.5. Federal law does not permit application of different substantive standards to federal and state consistency review.

In an attempt to address this apparent disparity, the NYSDOS guidance for consistency review indicates that all applicants—whether undergoing federal or state consistency review—are required to be consistent with the 44 policies of the NYCMP. "The basic thrust of New York State's Coastal Management Program is to have the State agencies carry out their respective programs consistent with the [44] policies contained in [the NYCMP]." NYCMP, pt. II, § 4, at 7.[15] Procedural differences aside, if taken at face value, the NYCMP provides that the same substantive decision-making standards apply to both federal and state consistency reviews. As a matter of substance, both are subject to NYCMP's 44 policies.

Therefore, as administered by NYSDOS and specified in the NYCMP, the substance of the state and federal consistency process is identical (and is fully encompassed by Section II above). However, for the sake of completeness and because there are no judicial determinations concerning which substantive standards apply to consistency review in New York, or which are "enforceable," the discussion that follows addresses the consistency of CWWS with the 29 coastal policies set forth at 19 NYCRR § 600.5.

A. Development Policies

Regulatory Policy #1:

> Restore, revitalize and redevelop deteriorated and underutilized waterfront areas for commercial and industrial, cultural, recreational and other compatible uses. 19 NYCRR § 600.5(a)(1).

Construction and operation of CWWS at IPEC would have no effect on waterfront uses other than to accomplish enhanced protection of aquatic organisms and thereby facilitate continued operation of IPEC. *See* the discussion of NYCMP Policy #1 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #2:

> Facilitate the siting of water-dependent uses and facilities on or adjacent to coastal waters. 19 NYCRR § 600.5(a)(2).

Construction and operation of CWWS at IPEC would have no effect on water-dependent uses other than to facilitate continued operation of IPEC, an existing water-dependent use. *See* the discussion of NYCMP Policy #2 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #3:

> Encourage the development of the State's existing major ports of Albany, Buffalo, New York, Ogdensburg and Oswego as centers

[15] "The [NYCMP] . . . describ[es] . . . the forty-four coastal policies with which all State agency actions must be consistent." NYCMP pt. I, at 1. "All activities involving a State permit, funding, or other action will be undertaken in a manner consistent with [the 44] coastal policies." *Id.* at 2. "In all cases State agencies are required to adhere to each [of the 44 NYCMP] policy statement[s] as much as is legally and physically possible." *Id.* pt. II, §6, at 1.

> of commerce and industry, and encourage the siting, in these port areas, including those under the jurisdiction of State public authorities, of land use and development which is essential to or in support of waterborne transportation of cargo and people. 19 NYCRR § 600.5(a)(3)

Construction and operation of CWWS at IPEC would have no effect on development of New York's major ports. *See* the discussion of NYCMP Policy #3 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #4:

> Strengthen the economic base of smaller harbor areas by encouraging the development and enhancement of those traditional uses and activities which have provided such areas with their unique maritime identity. 19 NYCRR § 600.5(a)(4).

Construction and operation of CWWS at IPEC would have no effect on small harbors. *See* the discussion of NYCMP Policy #4 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #5:

> Encourage the location of development in areas where public services and facilities essential to such development are adequate, except when such development has special functional requirements or other characteristics which necessitate its location in other coastal areas. 19 NYCRR § 600.5(a)(5)

Construction and operation of CWWS at IPEC would have no effect on the demand for public services and facilities at IPEC. *See* the discussion of NYCMP Policy #5 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

B. Fish and Wildlife Policies

Regulatory Policy #6:

> Significant coastal fish and wildlife habitats, as identified on the coastal area map, shall be protected, preserved and, where practical, restored so as to maintain their viability as habitats. 19 NYCRR § 600.5(b)(1)

The NYSDOS regulation expanding SCFWH to include the area adjacent to IPEC is subject to a pending legal challenge.[16] In all events, because CWWS will be installed by Entergy solely to the extent that NYSDEC determines that the CWWS Proposal represents BTA for protection of aquatic organisms, the CWWS Proposal necessarily will advance the purposes of Regulatory

[16] *Entergy Nuclear Indian Point 2, LLC v. N.Y. State Dept. of State*, Index No. 5450-12 (Supreme Court State of New York, County of Albany).

Policy #6. *See* the discussion of NYCMP Policy #7 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #7:

> Expand recreational use of fish and wildlife resources in coastal areas by increasing access to existing resources, supplementing existing stocks and developing new resources. Such efforts shall be made in a manner which ensures the protection of renewable fish and wildlife resources and considers other activities dependent on them. 19 NYCRR § 600.5(b)(2)

Regulatory Policy #7 is directed primarily at wildlife agencies managing fish and wildlife resources for recreational use. The CWWS Proposal, if selected as BTA, will have been determined by NYSDEC to fulfill the express purpose of minimizing adverse impacts on aquatic organisms. CWWS therefore would advance the purposes of Regulatory Policy #7. *See* discussion of NYCMP Policy 9 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification, and discussion of potential recreational benefits in NERA Report, § 4.

Regulatory Policy #8:

> Further develop commercial finfish, shellfish and crustacean resources in the coastal area by:
>
> 1) encouraging the construction of new or improvement of existing onshore commercial fishing facilities;
>
> 2) increasing marketing of the State's seafood products; and
>
> 3) maintaining adequate stocks and expanding aquaculture facilities. Such efforts shall be made in a manner which ensures the protection of such renewable fish resources and considers other activities dependent on them. 19 NYCRR § 600.5(b)(3)

The CWWS Proposal, if selected as BTA, will have been determined by NYSDEC to fulfill the express purpose of minimizing adverse impacts on aquatic organisms. CWWS therefore would advance the purposes of Regulatory Policy #8. *See* discussion of NYCMP Policy 10 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification, and discussion of potential commercial benefits in NERA Report § 4.

Regulatory Policy #9:

> Ice management practices shall not damage significant fish and wildlife and their habitats, increase shoreline erosion or flooding,

> or interfere with the production of hydroelectric power. 19 NYCRR § 600.5(b)(4)

No ice management practices are required at IPEC; none would be required in connection with CWWS. *See* the discussion of NYCMP Policy #28 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

C. Agricultural Lands Policy

Regulatory Policy #10:

> To conserve and protect agricultural lands in the State's coastal area, an action shall not result in a loss nor impair the productivity of important agriculture lands as identified on the coastal area map, if that loss or impairment would adversely affect the viability of agriculture in an agricultural district, if there is no agricultural district, in the area surrounding such lands. 19 NYCRR § 600.5(c)

No agricultural lands would be affected by construction or operation of CWWS. *See* the discussion of NYCMP Policy #26 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

D. Scenic Quality Policies

Regulatory Policy #11:

> Prevent impairment of scenic resources of statewide significance, as identified on the coastal area map. Impairment shall include:
>
> 1) the irreversible modification of geological forms, the destruction or removal of vegetation, the destruction or removal of structures, wherever the geologic forms, vegetation or structures are significant to the scenic quality of an identified resource; and
>
> 2) the addition of structures which because of siting or scale will reduce identified views or which because of scale, form or materials will diminish the scenic quality of an identified resource. 19 NYCRR § 600.5(d)(1)

Except for the limited interface with the shoreline, CWWS would be entirely underwater and therefore would have no effect on scenic resources. Any above-ground components of the CWWS would be fully consistent with the existing industrial features of the IPEC shoreline. *See* the discussion of NYCMP Policy #24 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification, and SEQRA CWWS ER § 4.8.4.

Regulatory Policy #12:

> Protect, restore and enhance natural and man-made resources which are not identified as being of statewide significance, but which contribute to the scenic quality of the coastal area. 19 NYCRR § 600.5(d)(2)

Except for the limited interface with the shoreline, CWWS would be entirely underwater and therefore would have no effect on scenic resources. Any above-ground components of the CWWS would be fully consistent with the existing industrial features of the IPEC shoreline. SEQRA CWWS ER § 4.8.4. *See* the discussion of NYCMP Policy #25 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

E. Public Access Policies

Regulatory Policy #13:

> Protect, maintain and increase the levels and types of access to public water-related recreation resources and facilities so that these resources and facilities may be fully utilized by all the public in accordance with reasonably anticipated public recreation needs and the protection of historic and natural resources. In providing such access, priority shall be given to public beaches, boating facilities, fishing areas and waterfront parks. 19 NYCRR § 600.5(e)(1).

Physically, CWWS would have no effect on public access to recreational resources. In addition, CWWS would be located in a USCG-mandated safety and security exclusionary zone where public access is prohibited. *See* the discussion of NYCMP Policy #19 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #14:

> Access to the publicly owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly owned shall be provided, and it should be provided in a manner compatible with adjoining uses. Such lands shall be retained in public ownership. 19 NYCRR § 600.5(e)(2).

Physically, CWWS would have no effect on public access to the publicly owned foreshore. In addition, CWWS would be located in a USCG-mandated safety and security exclusionary zone where public access is prohibited. *See* the discussion of NYCMP Policy #20 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

F. Recreation Policies

Regulatory Policy #15:

> Water dependent and water-enhanced recreation shall be encouraged and facilitated and shall be given priority over nonwater related uses along the coast, provided it is consistent

> with the preservation and enhancement of other coastal resources and takes into account demand for such facilities. In facilitating such activities, priority shall be given to areas where access to the recreation opportunities of the coast can be provided by new or existing public transportation services and to those areas where the use of the shore is severely restricted by existing development. 19 NYCRR § 600.5(f)(1).

CWWS would enhance protection of aquatic organisms in connection with operation of IPEC—a water dependent use. Thus, the policy of providing priority for recreation over non-water dependent use of the IPEC site is inapplicable. Moreover, as noted above, CWWS would be constructed entirely within the USCG-mandated safety and security exclusionary zone. *See* SEQRA CWWS ER § ES § 4.2 and Figure 2.2-1. and the discussion of NYCMP Policy #21 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #16:

> Development, when located adjacent to the shore, shall provide for water-related recreation, as a multiple use, whenever such recreational use is appropriate in light of reasonably anticipated demand for such activities and the primary purpose of the development. 19 NYCRR § 600.5(f)(2).

Ample public recreation facilities already exist in the vicinity of IPEC. The IPEC site is devoted to an industrial water-dependent use where public recreational use is incompatible. Moreover, as noted above, CWWS would be constructed entirely within the USCG-mandated safety and security exclusionary zone where public access is prohibited. *See* SEQRA CWWS ER § ES 4.2 and Figure 2.3-2, and the discussion of NYCMP Policy #22 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #17:

> Protect, enhance and restore structures, districts, areas or sites that are of significance in the history, architecture, archeology or culture of the State, its communities or the nation. 19 NYCRR § 600.5(f)(3).

CWWS construction would not entail disturbance of any previously undisturbed upland areas. The potential presence of underwater archeological resources in the area of CWWS installation would be evaluated during the permitting phase of the CWWS Proposal, prior to commencement of construction**.** The scope of work and research plan for any required subsurface and/or underwater investigations would be coordinated with the New York State Historic Preservation Officer. The applicable procedures of Entergy's Cultural Resource Protection Plan would be followed. SEQRA CWWS ER § 4.12. Accordingly, CWWS construction would be consistent with Regulatory Policy #17. *See* the discussion of NYCMP Policy #23 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

G. Flooding and Erosion Hazards Policies

State Regulatory Policy #18:

> Whenever possible, use nonstructural measures to minimize damage to natural resources and property from flooding and erosion. Such measures shall include:
>
> 1) the setback of buildings and structures;
>
> 2) the planting of vegetation and the installation of sand fencing and drainage systems;
>
> 3) the reshaping of bluffs; and
>
> 4) the flood-proofing of buildings or their elevation above the base flood level. 19 NYCRR § 600.5(g)(1)

The CWWS Proposal is designed to function below the surface of the Hudson River. Because CWWS would be installed almost entirely underwater, typical non-structural methods to minimize erosion are inapposite. BMPs will be used to minimize suspension of sediments within the water. *See* SEQRA CWWS ER § §2.6.2 and 4.4.1.2. *See also*, the discussion of NYCMP Policy #17 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #19:

> Mining, excavation or dredging in coastal waters shall not significantly interfere with the natural coastal processes which supply beach materials to land adjacent to such waters and shall be undertaken in a manner which will not cause an increase in erosion of such land. 19 NYCRR § 600.5(g)(2).

The CWWS Proposal is designed to operate in and under water. *See* SEQRA CWWS ER § § 2.3 and 2.4, and Figure 2.4-2. CWWS would not obstruct water flow patterns in a manner that could reasonably be considered to cause or contribute to flooding or erosion in a measurable manner. CWWS would be constructed in an area with soft sediments and where continued deposition of sediments—as opposed to erosion—is anticipated. *See* ASA Sedimentation Analysis at § 2 (page 5) and § 4. No removal of existing vegetation or alteration of natural protective features would occur. *See* the discussion of NYCMP Policy #15 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification and SEQRA CWWS ER § 4.4.

Regulatory Policy #20:

> The construction or reconstruction of erosion protection structures shall be undertaken only if they have a reasonable probability of controlling erosion for at least 30 years as demonstrated in design and construction standards and/or assured maintenance or replacement programs. 19 NYCRR § 600.5(g)(3).

The CWWS Proposal is designed to operate in and under water. *See* SEQRA CWWS ER § § 2.3 and 2.4, Figure 2.3-3. CWWS would not obstruct flow patterns in a manner that could reasonably be considered to cause or contribute to flooding or erosion in a measurable manner. *See* ASA Sedimentation Analysis § 3.3.4. Therefore, the CWWS Proposal is fully consistent with state regulatory policy #20. *See* the discussion of NYCMP Policy #13 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #21:

> Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding and erosion by protecting natural protective features, including beaches, dunes, barrier islands and bluffs. Primary dunes will be protected from all encroachments that could impair their natural protective capacity. 19 NYCRR § 600.5(g)(4).

No removal of vegetation or alteration of natural protective features is planned in connection with the CWWS Proposal. The CWWS Proposal is designed to operate in and under water. CWWS would not obstruct flow patterns in a manner that could reasonably be considered to cause or contribute to flooding or erosion in a measurable manner. *See* ASA Sedimentation Analysis § 3.3.4. Therefore, the CWWS Proposal is fully consistent with state regulatory policy #21. *See* the discussion of NYCMP Policy #12 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #22:

> Activities and development, including the construction or reconstruction of erosion protection structures, shall be undertaken so that there will be no measurable increase in erosion or flooding at the site of such activities or development or at other locations. 19 NYCRR § 600.5(g)(5).

Construction and operation of CWWS would not cause damage from flooding and erosion**.** The CWWS Proposal is designed to operate in and under water. *See* SEQRA CWWS ER § § 2.3 and 2.4, Figure 2.3-3. CWWS would not obstruct flow patterns in a manner that could reasonably be considered to cause or contribute to flooding or erosion in a measurable manner. Therefore, the CWWS Proposal is fully consistent with state regulatory policy #22. *See* the discussion of NYCMP Policy #11 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #23:

> Public funds shall only be used for erosion protective structures where necessary to protect human life, and new development which requires a location within or adjacent to an erosion hazard area to be able to function, or existing development; and only where the public benefits outweigh the long-term monetary and other costs, including the potential for increasing erosion and

> adverse effects on natural protective features. 19 NYCRR § 600.5(g)(6).

As explained above in connection with Regulatory Policy #21 and #22, CWWS would not cause damage to natural protective features, or cause erosion hazards. No public funds are required for erosion protective measures. *See* the discussion of NYCMP Policy #16 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

H. Water Resources Policies

Regulatory Policy #24:

> State coastal area policies and purposes of approved local waterfront revitalization programs will be considered while reviewing coastal water classifications and while modifying water quality standards; however, those waters already overburdened with contaminants will be recognized as being a development constraint. 19 NYCRR § 600.5(h)(1).

CWWS would not be located in an area covered by an approved local waterfront revitalization program. Accordingly, state regulatory policy # 24 is inapplicable. *See* the discussion of NYCMP Policy #31 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #25:

> Encourage the use of alternative or innovative sanitary waste systems in small communities where the cost of conventional facilities are unreasonably high, given the size of the existing tax base of these communities. 19 NYCRR § 600.5(h)(2).

CWWS would not affect sanitary waste disposal systems. Accordingly, state regulatory policy # 25 is inapplicable. *See* the discussion of NYCMP Policy #32 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #26:

> Best management practices will be used to ensure the control of stormwater run-off and combined sewer overflows draining into coastal waters. 19 NYCRR § 600.5(h)(3).

Essentially all of the CWWS Proposal would be installed under water. Thus, stormwater run-off is not an issue. The limited above-water CWWS components along the shoreline would be governed by existing BMPs employed at the IPEC site. *See* the discussion of NYCMP Policy #33 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #27:

> Discharge of waste materials from vessels into coastal waters will be limited so as to protect significant fish and wildlife habitats, recreational areas and water supply areas. 19 NYCRR § 600.5(h)(4).

Any vessels used to construct the CWWS Proposal would comply with applicable NYSDEC requirements for the prevention of pollution from vessels. *See* the discussion of NYCMP Policy #34 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

Regulatory Policy #28:

> Best management practices will be utilized to minimize the non-point discharge of excess nutrients, organics and eroded soils into coastal waters. 19 NYCRR § 600.5(h)(5).

Essentially all of the CWWS Proposal would be installed under water. Thus, stormwater run-off is not an issue. The limited above-water CWWS components along the shoreline would be governed by existing BMPs employed at the IPEC site. Construction period BMPs are described at § 2.6.2 of the SEQRA CWWS ER. *See* the discussion of NYCMP Policy #37 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

I. General Policy

Regulatory Policy #29:

> To safeguard the vital economic, social and environmental interests of the State and of its citizens, proposed major actions in the coastal area must give full consideration to those interests, and to the safeguards which the State has established to protect valuable coastal resource areas. 19 NYCRR § 600.5(i).

IPEC serves the vital economic, social and environmental interest of the State and its citizens. CWWS would facilitate continued operation of IPEC by providing an enhanced level of protection of aquatic organisms. *See* the discussion of NYCMP Policy #18 in the License Renewal Consistency Certification and in Section II of this CWWS Consistency Certification.

IV. CONCLUSION

Review of installation and operation of CWWS at IPEC for consistency with the NYCMP and the state coastal policies is, for the reasons set forth in Section I.C. above, unnecessary or is curtailed. Nonetheless, if and to the extent those policies are applicable to CWWS and consistency review is deemed to be required, this CWWS Consistency Certification and the accompanying documentation demonstrates that the CWWS Proposal is consistent with the applicable and enforceable coastal policies of the State of New York.

EXHIBIT A TO CWWS CONSISTENCY CERTIFICATION

COMPARISON OF STATUTORY COASTAL POLICIES TO REGULATORY POLICIES

EXECUTIVE LAW, ARTICLE 42 §912 DECLARATION OF POLICY (Through 2011)		19 NYCRR § 600.5 REGULATORY POLICIES FOR THE COASTAL ZONE (Through 2011)	
Policy #	**STATUTORY POLICY**	**State Reg. Policy #**	**REGULATORY POLICY**
1	To achieve a balance between economic development and preservation that will permit the beneficial use of coastal and inland waterway resources while preventing the loss of living marine resources and wildlife, diminution of open space areas or public access to the waterfront, shoreline erosion, impairment of scenic beauty, or permanent adverse changes to ecological systems.	**29**	**SIMILAR TO REGULATORY POLICY #29** To safeguard the vital economic, social and environmental interests of the State and of its citizens, proposed major actions in the coastal area must give full consideration to those interests, and to the safeguards which the State has established to protect valuable coastal resource areas. 19 NYCRR § 600.5(i).
2	To encourage the development and use of existing ports and small harbors including use and maintenance of viable existing infrastructures, and to reinforce their role as valuable components within the state's transportation and industrial network.	**3** **4**	**SIMILAR TO REGULATORY POLICIES #3&4** Encourage the development of the State's existing major ports of Albany, Buffalo, New York, Ogdensburg and Oswego as centers of commerce and industry, and encourage the siting, in these port areas, including those under the jurisdiction of State public authorities, of land use and development which is essential to or in support of waterborne transportation of cargo and people. 19 NYCRR § 600.5(a)(3). Strengthen the economic base of smaller harbor areas by encouraging the development and enhancement of those traditional uses and activities

			which have provided such areas with their unique maritime identity. 19 NYCRR § 600.5(a)(4).
3	To conserve, protect and where appropriate promote commercial and recreational use of fish and wildlife resources and to conserve and protect fish and wildlife habitats identified by the department of environmental conservation as critical to the maintenance or re-establishment of species of fish or wildlife. Such protection shall include mitigation of the potential impact from adjacent land use or development.		**SIMILAR TO REGULATORY POLICIES #6, 7, 8, 15, 16 & 27**
		6	Significant coastal fish and wildlife habitats, as identified on the coastal area map, shall be protected, preserved and, where practical, restored so as to maintain their viability as habitats. 19 NYCRR § 600.5(b)(1).
		7	Expand recreational use of fish and wildlife resources in coastal areas by increasing access to existing resources, supplementing existing stocks and developing new resources. Such efforts shall be made in a manner which ensures the protection of renewable fish and wildlife resources and considers other activities dependent on them. 19 NYCRR § 600.5(b)(2).
		8	Further develop commercial finfish, shellfish and crustacean resources in the coastal area by: 1. encouraging the construction of new or improvement of existing onshore commercial fishing facilities; 2. increasing marketing of the State's seafood products; and 3. maintaining adequate
		15	

		16	stocks and expanding aquaculture facilities. Such efforts shall be made in a manner which ensures the protection of such renewable fish resources and considers other activities dependent on them. 19 NYCRR § 600.5(b)(3).
		27	Water dependent and water-enhanced recreation shall be encouraged and facilitated and shall be given priority over nonwater related uses along the coast, provided it is consistent with the preservation and enhancement of other coastal resources and takes into account demand for such facilities. In facilitating such activities, priority shall be given to areas where access to the recreation opportunities of the coast can be provided by new or existing public transportation services and to those areas where the use of the shore is severely restricted by existing development. 19 NYCRR § 600.5(f)(1).
			Development, when located adjacent to the shore, shall provide for water-related recreation, as a multiple use, whenever such recreational use is appropriate in light of reasonably anticipated demand for such activities and the primary purpose of the development. 19 NYCRR § 600.5(f)(2).
			Discharge of waste materials from vessels into coastal waters will be limited so as to protect significant fish and wildlife

			habitats, recreational areas and water supply areas. 19 NYCRR § 600.5(h)(4).
4	To encourage and facilitate public access for recreational purposes.	**13** **14**	**SIMILAR TO REGULATORY POLICIES #13 & 14** Protect, maintain and increase the levels and types of access to public water-related recreation resources and facilities so that these resources and facilities may be fully utilized by all the public in accordance with reasonably anticipated public recreation needs and the protection of historic and natural resources. In providing such access, priority shall be given to public beaches, boating facilities, fishing areas and waterfront parks. 19 NYCRR § 600.5(e)(1). Access to the publicly owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly owned shall be provided, and it should be provided in a manner compatible with adjoining uses. Such lands shall be retained in public ownership. 19 NYCRR § 600.5(e)(2).
5	To minimize damage to natural resources and property from flooding and erosion, including proper location of new land development, protection of beaches, dunes, barrier islands, bluffs and other critical coastal and inland waterway features and use of non-structural measures, whenever possible.	**18**	**SIMILAR TO REGULATORY POLICIES #18, 19, 20, 21, 22 & 23:** Whenever possible, use nonstructural measures to minimize damage to natural resources and property from flooding and erosion. Such

		19	measures shall include: i. the setback of buildings and structures; ii. the planting of vegetation and the installation of sand fencing and drainage systems; iii. the reshaping of bluffs; and iv. the flood-proofing of buildings or their elevation above the base flood level. 19 NYCRR § 600.5(g)(1).
		20	Mining, excavation or dredging in coastal waters shall not significantly interfere with the natural coastal processes which supply beach materials to land adjacent to such waters and shall be undertaken in a manner which will not cause an increase in erosion of such land. 19 NYCRR § 600.5(g)(2).
		21	The construction or reconstruction of erosion protection structures shall be undertaken only if they have a reasonable probability of controlling erosion for at least 30 years as demonstrated in design and construction standards and/or assured maintenance or replacement programs. 19 NYCRR § 600.5(g)(3)
		22	Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding

		23	and erosion by protecting natural protective features, including beaches, dunes, barrier islands and bluffs. Primary dunes will be protected from all encroachments that could impair their natural protective capacity. 19 NYCRR § 600.5(g)(4). Activities and development, including the construction or reconstruction of erosion protection structures, shall be undertaken so that there will be no measurable increase in erosion or flooding at the site of such activities or development or at other locations. 19 NYCRR § 600.5(g)(5). Public funds shall only be used for erosion protective structures where necessary to protect human life, and new development which requires a location within or adjacent to an erosion hazard area to be able to function, or existing development; and only where the public benefits outweigh the long-term monetary and other costs, including the potential for increasing erosion and adverse effects on natural protective features. 19 NYCRR § 600.5(g)(6).
6	To encourage the restoration and revitalization of natural and man-made resources.	**12**	**SIMILAR TO REGULATORY POLICY #12** Protect, restore and enhance natural and man-made resources which are not identified as being of

			statewide significance, but which contribute to the scenic quality of the coastal area. 19 NYCRR § 600.5(d)(2).
7	To encourage the location of land development in areas where infrastructure and public services are adequate.	**5**	**SIMILAR TO REGULATORY POLICY #5** Encourage the location of development in areas where public services and facilities essential to such development are adequate, except when such development has special functional requirements or other characteristics which necessitate its location in other coastal areas. 19 NYCRR § 600.5(a)(5)
8	To conserve and protect agricultural lands as valued natural and ecological resources which provide for open spaces, clean air sheds and aesthetic value as well as for agricultural use.	**10**	**SIMILAR TO REGULATORY POLICY #10** To conserve and protect agricultural lands in the State's coastal area, an action shall not result in a loss nor impair the productivity of important agriculture lands as identified on the coastal area map, if that loss or impairment would adversely affect the viability of agriculture in an agricultural district, if there is no agricultural district, in the area surrounding such lands. 19 NYCRR § 600.5(c).
9	To assure consistency of state actions and, where appropriate, federal actions, with policies of the coastal area and inland waterways, and with accepted waterfront re-vitalization programs of the area defined or addressed by such programs.		**NO COUNTERPART**

10	To work cooperatively with the federal government, local governments and private parties to implement programs to control and abate sources of nonpoint source pollution that may affect coastal and inland waterways.	 **26** **18**	**SIMILAR TO REGULATORY POLICIES 26 & 28** Best management practices will be used to ensure the control of stormwater run-off and combined sewer overflows draining into coastal waters. 19 NYCRR § 600.5(h)(3). Best management practices will be utilized to minimize the non-point discharge of excess nutrients, organics and eroded soils into coastal waters. 19 NYCRR § 600.5(h)(5).
11	To cooperate and coordinate with other states, the federal government and Canada to attain a consistent policy towards coastal and inland waterway management.		**NO COUNTERPART**
12	To encourage and assist local governments in the coastal area and inland waterways to use all their powers that can be applied to achieve these objectives		**NO COUNTERPART**
13	To facilitate the redevelopment of urban waterfronts.	 **1**	**SIMILAR TO REGULATORY POLICY #1** Restore, revitalize and redevelop deteriorated and underutilized waterfront areas for commercial and industrial, cultural, recreational and other compatible uses. 19 NYCRR § 600.5(a)(1).
14	To encourage local governments to enter into intermunicipal agreements to protect their shared environment and improve their		**NO COUNTERPART**

	region's economic strength.		
15	To encourage state agencies to provide technical and financial assistance for implementation of local waterfront revitalization programs.		**NO COUNTERPART**
16	To encourage local governments and state agencies to celebrate, protect and enhance the special places that made waterfronts distinct ecological systems and the preferred locations for people to live, work and recreate.	**29**	**SIMILAR TO REGULATORY POLICY #29** To safeguard the vital economic, social and environmental interests of the State and of its citizens, proposed major actions in the coastal area must give full consideration to those interests, and to the safeguards which the State has established to protect valuable coastal resource areas. 19 NYCRR § 600.5(i).
	NO COUNTERPART	**2**	Facilitate the siting of water-dependent uses and facilities on or adjacent to coastal waters. 19 NYCRR § 600.5(a)(2).
	NO COUNTERPART	**9**	Ice management practices shall not damage significant fish and wildlife and their habitats, increase shoreline erosion or flooding, or interfere with the production of hydroelectric power. 19 NYCRR § 600.5(b)(4).
	NO COUNTERPART	**11**	Prevent impairment of scenic resources of statewide significance, as identified on the coastal area map. Impairment shall include: i. the irreversible modification of geological forms, the destruction or

			removal of vegetation, the destruction or removal of structures, wherever the geologic forms, vegetation or structures are significant to the scenic quality of an identified resource; and ii. the addition of structures which because of siting or scale will reduce identified views or which because of scale, form or materials will diminish the scenic quality of an identified resource. 19 NYCRR § 600.5(d)(1).
	NO COUNTERPART	**17**	Protect, enhance and restore structures, districts, areas or sites that are of significance in the history, architecture, archeology or culture of the State, its communities or the nation. 19 NYCRR § 600.5(f)(3).
	NO COUNTERPART	**24**	State coastal area policies and purposes of approved local waterfront revitalization programs will be considered while reviewing coastal water classifications and while modifying water quality standards; however, those waters already overburdened with contaminants will be recognized as being a development constraint. 19 NYCRR § 600.5(h)(1).
	NO COUNTERPART	**25**	Encourage the use of alternative or innovative sanitary waste systems in small communities where the cost of conventional facilities are unreasonably high, given the size of the existing tax base of these communities.

			19 NYCRR § 600.5(h)(2).

EXHIBIT B TO CWWS CONSISTENCY CERTIFICATION

COMPARISON OF 44 NYCMP COASTAL POLICIES TO 29 NYSDOS REGULATORY POLICIES

NEW YORK STATE COASTAL MANAGEMENT PROGRAM AND FINAL ENVIRONMENTAL IMPACT STATEMENT (2006)		19 NYCRR § 600.5 COASTAL POLICIES (THROUGH 2011)	
Policy #	**Policy**	**Policy #**	**Policy**
1	Restore, revitalize, and redevelop deteriorated and underutilized waterfront areas for commercial, Industrial, cultural, recreational and other compatible uses.	**(a)(1)**	**#1** Restore, revitalize and redevelop deteriorated and underutilized waterfront areas for commercial and industrial, cultural, recreational and other compatible uses.
2	Facilitate the siting of water dependent uses and facilities on or adjacent to coastal waters.	**(a)(2)**	**#2** Facilitate the siting of water-dependent uses and facilities on or adjacent to coastal waters.
3	Further develop the State's major ports of Albany, Buffalo, New York, Ogdensburg and Oswego as centers of commerce and industry, and encourage the siting, in these port areas, including those under the jurisdiction of State public authorities, of land use and development which Is essential to, or in support of, the waterborne transportation of cargo and people.	**(a)(3)**	**#3** Encourage the development of the State's existing major ports of Albany, Buffalo, New York, Ogdensburg and Oswego as centers of commerce and industry, and encourage the siting, in these port areas, including those under the jurisdiction of State public authorities, of land use and development which is essential to or in support of waterborne transportation of cargo and people.
4	Strengthen the economic base of smaller harbor areas by encouraging the development and enhancement of those traditional uses and activities which have provided such areas with their unique maritime identity.	**(a)(4)**	**#4** Strengthen the economic base of smaller harbor areas by encouraging the development and enhancement of those traditional uses and activities which have provided such areas with their unique maritime identity.

5	Encourage the location of development in areas where public services and facilities essential to such development are adequate.	**(a)(5)**	**#5** Encourage the location of development in areas where public services and facilities essential to such development are adequate, <u>except when such development has special functional requirements or other characteristics which necessitate its location in other coastal areas</u>. (underlined language added)
6	Expedite permit procedures in order to facilitate the siting of development activities at suitable locations.		**------**
7	Significant coastal fish and wildlife habitats will be protected, preserved, and, where practical, restored so as to maintain their viability as habitats.	**(b)(1)**	**#6** Significant coastal fish and wildlife habitats, as identified on the coastal area map, shall be protected, preserved and, where practical, restored so as to maintain their viability as habitats.
8	Protect fish and wildlife resources in the coastal area from the introduction of hazardous wastes and other pollutants which bioaccumulate in the food chain or which cause significant sublethal or lethal effect on those resources.		**------** **NOTE: This concept is addressed in guidance under NYCMP Policy #7 which can be taken into account under NYSDOS Regulatory Policy #6.**
9	Expand recreational use of fish and wildlife resources in coastal areas by increasing access to existing resources, supplementing existing stocks, and developing new resources.	**(b)(2)**	**#7** Expand recreational use of fish and wildlife resources in coastal areas by increasing access to existing resources, supplementing existing stocks and developing new resources. <u>Such efforts shall be made in a manner which ensures the protection of renewable fish and wildlife resources and considers other activities dependent on them</u>.

			(underlined language added)
10	Further develop commercial finfish, shellfish and crustacean resources in the coastal area by encouraging the construction of new, or improvement of existing on-shore commercial fishing facilities, increasing marketing of the State's seafood products, maintaining adequate stocks, and expanding aquaculture facilities.	**(b)(3)**	**#8** Further develop commercial finfish, shellfish and crustacean resources in the coastal area by: (i) encouraging the construction of new or improvement of existing onshore commercial fishing facilities; (ii) increasing marketing of the State's seafood products; and (iii) maintaining adequate stocks and expanding aquaculture facilities. <u>Such efforts shall be made in a manner which ensures the protection of such renewable fish resources and considers other activities dependent on them.</u> (underlined language added)
11	Buildings and other structures will be sited in the coastal area so as to minimize damage to property and the endangering of human lives caused by flooding and erosion.		**------** **NOTE: This concept is incorporated by the six NYSDOS Regulatory policies addressing flooring and erosion.**
12	Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding and erosion by protecting natural protective features including beaches, dunes, barrier islands and bluffs.	**(g)(4)**	**#21** Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding and erosion by protecting natural protective features, including beaches, dunes, barrier islands and bluffs. <u>Primary dunes will be protected from all encroachments that could impair their natural protective capacity</u>. (underlined language added)

13	The construction or reconstruction of erosion protection structures shall be undertaken only if they have reasonable probability of controlling erosion for at least thirty years as demonstrated in design and construction standards and/or assured maintenance or replacement programs.	**(g)(3)**	**#20** The construction or reconstruction of erosion protection structures shall be undertaken only if they have a reasonable probability of controlling erosion for at least 30 years as demonstrated in design and construction standards and/or assured maintenance or replacement programs.
14	Activities and development Including the construction or reconstruction of erosion protection structures, shall be undertaken so that there will be no measurable increase in erosion or flooding at the site of such activities or development, or at other locations.	**(g)(5)**	**#22** Activities and development, including the construction or reconstruction of erosion protection structures, shall be undertaken so that there will be no measurable increase in erosion or flooding at the site of such activities or development or at other locations.
15	Mining, excavation or dredging in coastal waters shall not significantly interfere with the natural coastal processes which supply beach materials to land adjacent to such waters and shall be undertaken in a manner which will not cause an increase in erosion of such land.	**(g)(2)**	**#19** Mining, excavation or dredging in coastal waters shall not significantly interfere with the natural coastal processes which supply beach materials to land adjacent to such waters and shall be undertaken in a manner which will not cause an increase in erosion of such land.
16	Public funds shall only be used for erosion protective structures where necessary to protect human life, and new development which requires a location within or adjacent to an erosion hazard area to be able to function, or existing development; and only where the public benefits outweigh the long term monetary and other costs including the potential for increasing erosion and adverse effects on natural protective features.	**(g)(6)**	**#23** Public funds shall only be used for erosion protective structures where necessary to protect human life, and new development which requires a location within or adjacent to an erosion hazard area to be able to function, or existing development; and only where the public benefits outweigh the long-term monetary and other costs, including the potential for increasing erosion and adverse effects on natural protective features.

17	Non-structural measures to minimize damage to natural resources and property from flooding and erosion shall be used whenever possible.	**(g)(1)**	**#18** Whenever possible, use nonstructural measures to minimize damage to natural resources and property from flooding and erosion. Such measures shall include: (i) the setback of buildings and structures; (ii) the planting of vegetation and the installation of sand fencing and drainage systems; (iii) the reshaping of bluffs; and (iv) the flood-proofing of buildings or their elevation above the base flood level. (underlined language added)
18	To safeguard the vital economic, social and environmental interests of the State and of its citizens, proposed major actions in the coastal area must give full consideration to those interests, and to the safeguards which the State has established to protect valuable coastal resource areas.	**(i)**	**#29** To safeguard the vital economic, social and environmental interests of the State and of its citizens, proposed major actions in the coastal area must give full consideration to those interests, and to the safeguards which the State has established to protect valuable coastal resource areas.
19	Protect, maintain, and increase the level and types of access to public water related recreation resources and facilities.	**(e)(1)**	**#13** Protect, maintain and increase the levels and types of access to public water-related recreation resources and facilities so that these resources and facilities may be fully utilized by all the public in accordance with reasonably anticipated public recreation needs and the protection of historic and natural resources. In providing such access, priority shall be given to public beaches, boating facilities, fishing areas and waterfront

			<u>parks</u>. (underlined language added)
20	Access to the publicly-owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly-owned shall be provided and it shall be provided in a manner compatible with adjoining uses.	**(e)(2)**	**#14** Access to the publicly owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly owned shall be provided, and it should be provided in a manner compatible with adjoining uses. <u>Such lands shall be retained in public ownership</u>. (underlined language added)
21	Water dependent and water enhanced recreation will be encouraged and facilitated, and will be given priority over non-water-related uses along the coast.	**(f)(1)**	**#15** Water dependent and water-enhanced recreation shall be encouraged and facilitated and shall be given priority over nonwater-related uses along the coast, <u>provided it is consistent with the preservation and enhancement of other coastal resources and takes into account demand for such facilities. In facilitating such activities, priority shall be given to areas where access to the recreation opportunities of the coast can be provided by new or existing public transportation services and to those areas where the use of the shore is severely restricted by existing development</u>. (underlined language added)
22	Development when located adjacent to the shore will provide for water-related recreation whenever such use is compatible with reasonably anticipated demand for such activities, and is compatible with the primary purpose of the development.	**(f)(2)**	**#16 [SIMILAR CONCEPT/DIFFERENT LANGUAGE]** Development, when located adjacent to the shore, <u>shall</u> provide for water-related recreation, <u>as a multiple use</u>, whenever such recreational use <u>is appropriate in light of</u> reasonably anticipated demand for such activities and the primary purpose of the development. (underlined language added)
23	Protect, enhance and restore	**(f)(3)**	**#17**

	structures, districts, areas or sites that are of significance in the history, architecture, archeology or culture of the State, its communities, or the Nation.		Protect, enhance and restore structures, districts, areas or sites that are of significance in the history, architecture, archeology or culture of the State, its communities or the nation.
24	Prevent impairment of scenic resources of statewide significance.	**(d)(1)**	**#11** Prevent impairment of scenic resources of statewide significance, as identified on the coastal area map. Impairment shall include: (i) the irreversible modification of geological forms, the destruction or removal of vegetation, the destruction or removal of structures, wherever the geologic forms, vegetation or structures are significant to the scenic quality of an identified resource; and (ii) the addition of structures which because of siting or scale will reduce identified views or which because of scale, form or materials will diminish the scenic quality of an identified resource.
25	Protect, restore or enhance natural and man-made resources which are not identified as being of statewide significance, but which contribute to the overall scenic quality of the coastal area.	**(d)(2)**	**#12** Protect, restore and enhance natural and man-made resources which are not identified as being of statewide significance, but which contribute to the scenic quality of the coastal area.
26	Conserve and protect agricultural lands In the State's coastal area.	**(c)**	**#10** To conserve and protect agricultural lands in the State's coastal area, <u>an action shall not result in a loss nor impair the productivity of important agriculture lands as identified on the coastal area map, if that loss or impairment would adversely affect the viability of agriculture in an agricultural district or, if there is no</u>

			agricultural district, in the area surrounding such lands. (underlined language added)
27	Decisions on the siting and construction of major energy facilities in the coastal area will be based on public energy needs, compatibility of such facilities with the environment, and the facility's need for a shorefront location.		------
28	Ice management practices shall not interfere with the production of hydroelectric power, damage significant fish and wildlife and their habitats, or increase shoreline erosion or flooding.	**(b)(4)**	**#9** Ice management practices shall not damage significant fish and wildlife and their habitats, increase shoreline erosion or flooding, or interfere with the production of hydroelectric power.
29	Encourage the development of energy resources on the Outer Continental Shelf, in Lake Erie and in other water bodies, and ensure the environmental safety of such activities.		------
30	Municipal, industrial, and commercial discharge of pollutants, including but not limited to, toxic and hazardous substances, into coastal waters will conform to State and National water quality standards.		------
31	State coastal area policies and management objectives of approved local Waterfront Revitalization Programs will be considered while reviewing coastal water classifications and while modifying water quality standards; however, those waters already over-burdened with contaminants will be recognized as being a development constraint.	**(h)(1)**	**#24** State coastal area policies and purposes of approved local waterfront revitalization programs will be considered while reviewing coastal water classifications and while modifying water quality standards; however, those waters already overburdened with contaminants will be recognized as being a development constraint.

32	Encourage the use of alternative or innovative sanitary waste systems in small communities where the costs of conventional facilities are unreasonably high, given the size of the existing tax base of these communities.	**(h)(2)**	**#25** Encourage the use of alternative or innovative sanitary waste systems in small communities where the costs of conventional facilities are unreasonably high, given the size of the existing tax base of these communities.
33	Best management practices will be used to ensure the control of stormwater runoff and combined sewer overflows draining into coastal waters.	**(h)(3)**	**#26** Best management practices will be used to ensure the control of stormwater runoff and combined sewer overflows draining into coastal waters.
34	Discharge of waste materials into coastal waters from vessels subject to State jurisdiction into coastal waters will be limited so as to protect significant fish and wildlife habitats, recreational areas and water supply areas.	**(h)(4)**	**#27** Discharge of waste materials from vessels into coastal waters will be limited so as to protect significant fish and wildlife habitats, recreational areas and water supply areas.
35	Dredging and filling in coastal waters and disposal of dredged material will be undertaken in a manner that meets existing State dredging permit requirements, and protects significant fish and wildlife habitats, scenic resources, natural protective features, important agricultural lands, and wetlands.		------
36	Activities related to the shipment and storage of petroleum and other hazardous materials will be conducted in a manner that will prevent or at least minimize spills into coastal waters; all practicable efforts will be undertaken to expedite the cleanup of such discharges; and restitution for damages will be required when these spills occur.		------

37	Best management practices will be utilized to minimize the non-point discharge of excess nutrients, organics and eroded soils into coastal waters.	**(h)(5)**	**#28** Best management practices will be utilized to minimize the non-point discharge of excess nutrients, organics and eroded soils into coastal waters.
38	The quality and quantity of surface water and groundwater supplies will be conserved and protected, particularly where such waters constitute the primary or sole source of water supply.		------
39	The transport, storage, treatment and disposal of solid wastes, particularly hazardous wastes, within coastal areas will be conducted in such a manner so as to protect groundwater and surface water sup-plies, significant fish and wildlife habitats, recreation areas, important agricultural lands and scenic resources.		------
40	Effluent discharged from major steam electric generating and industrial facilities into coastal waters will not be unduly injurious to fish and wildlife and shall conform to State water quality standards.		------
41	Land use or development in the coastal area will not cause national or State air quality standards to be violated.		------
42	Coastal Management policies will be considered if the State reclassifies land areas pursuant to the prevention of significant deterioration regulations of the Federal Clean Air Act.		------
43	Land use or development in the coastal area must not cause the generation of significant amounts of the acid rain precursors: nitrates and sulfates.		------
44	Preserve and protect tidal and freshwater wetlands and preserve the		

	benefits derived from these areas.		------

ENVIRONMENTAL REPORT

NEW YORK STATE ENVIRONMENTAL QUALITY REVIEW ACT

In Support of the Draft SEIS

for a

State Pollutant Discharge Elimination System (SPDES) Permit (No. NY-0004472)

Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC

March 29, 2013

Prepared by:

TRC Environmental Corporation

1200 Wall Street West

Lyndhurst, NJ 07071

Prepared for:

Entergy Services, Inc.

1340 Echelon Parkway

Jackson, MS 39213

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS & ABBREVIATIONS

°F	degrees Fahrenheit
#/m^3	number per cubic meters
§	section
µ	microns
µg/m^3	micrograms per cubic meter
µm	micrometer
3D	3 dimensional
7Q10	seven-day, ten-year low flow
AADT	Annual Average Daily Traffic
AAQS	Ambient Air Quality Standard
ABS	Air Burst System
AEC	Atomic Energy Commission
AEI Report	Entrainment and Impingement at IP2 and IP3: A Biological Impact Assessment," Adverse Environmental Impact Report
ALJ	Administrative Law Judge
AMSL	above mean sea level
ANSI	American National Standards Institute
ASA	Applied Science Associates, Inc.
ASAAC	ASA Analysis and Communication, Inc.
ASMFC	Atlantic States Marine Fisheries Commission
ASSRT	Atlantic Sturgeon Species Recovery Team
BBA	Breeding Bird Atlas
BG	block groups
BMP	Best Management Practices
BO	Biological Opinion
BSS	Beach Seine Survey
BTA	best technology available

CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH	fat clay
CHBP	Croton-to-Highlands Biodiversity Plan
CIT	Commercial/Industrial/Transportation
cm	centimeter
CO	carbon monoxide
CO_2	carbon dioxide
Con Edison	Consolidated Edison Company
COTP	Captain of the Port
CP-29	Commissioner Policy 29: Environmental Justice and Permitting
CPUE	catch-per-unit-effort
Cs-137	Caesium-137
CT	census tracks
CW	circulating water
CWA	Clean Water Act
CWIS	cooling water intake structures
CWWS	Cylindrical Wedgewire Screen
CWWSs	Cylindrical Wedgewire Screens
dB	decibels
dBA	A-weighted scale decibels
DEIS	Draft Environmental Impact Statement
DO	dissolved oxygen
DPS	Distinct Population Segments
DSEIS	Draft Supplemental Environmental Impact Statement
EAC	Early Action Compact

ECL	New York Environmental Conservation Law
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJ	environmental justice
ENERCON	Enercon Services, Inc.
Entergy	Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC
ER	Environmental Report
ESA	Endangered Species Act
ETM	estuary turbidity maxima
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FJS	Fall Juvenile Survey
FMP	Fishery Management Plans
fps	feet per second
FRP	fiber reinforced plastic
FSEIS	Final Supplemental Environmental Impact Statement
FSS	Fall Shoals Survey
ft	feet
ft^2	square feet
FWPCA	Federal Water Pollution Control Act
GDEIS	Generic Draft Environmental Impact Statement
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants
GFEIS	Generic Final Environmental Impact Statement
GIS	Geographic Information System
gpm	gallons per minute
GPS	global positioning system
GZA	GZA GeoEnvironmental of New York

HDPE	high density polyethylene
HRBM	Hudson River Benthic Mapping Project
HRBMP	Hudson River Biological Monitoring Program
HRFA	Hudson River Fisherman's Association
HRPA	Hudson River Pilot Association
HRSA	Hudson River Settlement Agreement
Hz	hertz
I&E	impingement and entrainment mortality
IPEC	Indian Point Energy Center
kg	kilograms
kHz	kilohertz
km^2	square kilometers
kV	kilovolt
lbs	pounds
lbs/ft^3	pounds per cubic foot
Leq	Equivalent Noise Level
LOLE	loss-of-load expectation
LOS	Levels of Service
LRS	Longitudinal River Ichthyoplankton Survey = Longitudinal River Survey = Long River Survey
LRS index	Long River Survey Index
LWRP	Local Waterfront Revitalization Plan
MAFMC	Mid-Atlantic Fishery Management Council
MF	Mixed Forest
mg/l	milligrams per liter
mg/m^3	milligrams per cubic meter
mgd	million gallons per day
MHW	mean high water

$mile^2$	square miles
MLLW	mean lower low water
MLW	mean low water
mm	millimeter
MMBTU/hour	Million British Thermal Units per hour
MMPA	Marine Mammal Protection Act
mph	miles per hour
MSL	mean sea level
Mt	metric tons
Mt/day	metric tons per day
Mt/yr	metric tons per year
MW	megawatt
MWh	megawatt hours
MWh/yr	megawatt hours per year
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NERA	NERA Economic Consulting
NERC	North American Electric Reliability Corporation
NERRS	National Estuarine Research Reserve System
NMFS	National Marine Fisheries Service
NO_2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	notice of intent
Normandeau	Normandeau Associates, Inc.
NO_x	nitrous oxides
NPCC	Northeast Power Coordinating Council
NPDES	National Pollutant Discharge Elimination System
NRC or NUREG	United States Nuclear Regulatory Commission

NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NYAAQS	New York Ambient Air Quality Standards
NYCRR	New York Codes, Rules and Regulations
NYISO	New York Independent System Operator
NYNHP	New York Natural Heritage Program
NYPA	New York Power Authority
NYRHP	New York State Register of Historic Places
NYS CMP	New York State Coastal Management Program
NYSDEC	New York State Department of Environmental Conservation
NYSDEC Noise Policy	NYSDEC Policy DEP-001
NYSDOH	New York State Department of Health
NYSDOS	New York State Department of State
NYSDOS, DCR	New York State Department of State, Division of Coastal Resources
NYSDOT	New York State Department of Transportation
NYSHPO	New York State Historic Preservation Office
NYSOGS	New York State Office of General Services
NYSRC	New York State Reliability Council
O&M	operation and maintenance
O&R	Orange and Rockland Utilities
O3	ozone
OCRM	Office of Ocean and Coastal Resource Management
OH	Organic Clay
OL	USCS designation for silt
OPRHP	New York State Office of Parks, Recreation and Historical Preservation
OSHA	Occupational Safety & Health Administration
PAH	polynuclear aromatic hydrocarbons
Pb	lead

PCBs	polychlorinated biphenyls
pCi	picocuries
PM	particulate matter
ppm	parts per million
PRHPL	Parks, Recreation, and Historic Preservation Law
psu	practical salinity units
PWC	personal water craft
PWR	pressurized water reactors
PYSL	post-yolk-sac larvae
RCRA	Resource Conservation and Recovery Act
RGGI	Regional Greenhouse Gas Initiative
RIS	resident important species
River	Hudson River
RM	river mile
ROD	Record of Decision
S&SZ	Safety and Security Zone
SAFSTOR	NRC's Safe Storage program
SAPA	New York State Administrative Procedure Act
SASS	Scenic Area of Statewide Significance
SAV	submerged aquatic vegetation
SC	Clayey Sand
SCFWH	Significant Coastal Fish and Wildlife Habitats
SEIS	Supplemental Environmental Impact Statement
SEL	Sound exposure level
SEQRA	New York State Environmental Quality Review Act
SiO_2	dissolved silica
SIP	State Implementation Plan
SIP/TIP	State or tribal implementation plan

SO_2	Sulfur dioxide
SPCC Plan	Spill Prevention and Countermeasures Control Plan
SPDES	State Pollutant Discharge Elimination System
SPDES Proceeding	adjudicatory proceeding
SPHINX	State Preservation Historical Information Network Exchange
SPL	sound pressure level
Std	Standard
SW	service water
t	tons
t/yr	tons per year
Technical Design Report	Technical Design Report for Indian Point Units 2 and 3 – Implementation of Cylindrical Wedgewire Screens ENTGIP152-PR-CWW-06
the Biological Team	an expert team of aquatic biologists
the Permit	SPDES Permit No. NY0004472
the Project	CWWS system
the Stations	Indian Point Energy Center nuclear-powered steam electric generation Stations 2 and 3
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TSP	total suspended particles
TSS	total suspended solids
TWSs	traveling water screens
Unit 2	Indian Point Energy Center nuclear-powered steam electric generation Station 2
Unit 3	Indian Point Energy Center nuclear-powered steam electric generation Station 3
URG	Urban/Recreational Grasses
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard

USCS	Universal Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VP	viewpoints
VP#	Visual resources numeric code
WQC	Water Quality Certification/Certificate
WQC Proceeding	NYSDEC proceeding regarding Entergy's application for a Clean Water Act Section 401 Water Quality Certificate in support of Entergy's NRC license renewal application
WWS	Wedgewire Screen
yd^3	cubic yard
YOY	young-of-the-year
YSL	yolk sac larvae

ES. EXECUTIVE SUMMARY

ES.1 BACKGROUND TO THE SEQRA ENVIRONMENTAL REPORT

Entergy Nuclear Indian Point 2, LLC, and Entergy Nuclear Indian Point 3, LLC (collectively, "Entergy") respectively own nuclear-powered steam electric generation Stations 2 and 3 which comprise the Indian Point Energy Center (individually, "Unit 2" and "Unit 3," respectively; collectively, "IPEC" or "the Stations"). IPEC is located on the east shore of the Hudson River ("River") in Buchanan, Westchester County, New York (Figure ES-1). IPEC currently operates using a once-through cooling system where river water is drawn in through shoreline intake structures employing state-of-the-art optimized Ristroph-type screens and fish return systems. Heated non-contact cooling water is discharged back to the River via a combined discharge canal subject to and with the benefit of State Pollutant Discharge Elimination System ("SPDES") Permit No. NY0004472.

In 1992, Entergy's predecessors-in-interest at IPEC submitted a timely and complete SPDES Permit renewal application to the New York State Department of Environmental Conservation ("NYSDEC"). On November 12, 2003, NYSDEC Staff issued a (tentative draft) SPDES Permit for IPEC. That (tentative draft) SPDES Permit contained certain NYSDEC Staff-proposed modifications, including the possible construction and operation of cooling towers at IPEC in a conceptual, undefined closed-loop (or closed-cycle) configuration, provided certain conditions precedent (relating to Nuclear Regulatory Commission ["NRC"] licensing for a 20-year renewal period, permitting and technical feasibility, among other things) were established. The (tentative draft) Permit also authorized Entergy to consider and propose any alternative technology to cooling towers. In late 2003, Entergy and others requested an adjudicatory hearing on the NYSDEC Staff-proposed modifications contained in the (tentative draft) SPDES Permit, commencing the adjudicatory proceeding ("SPDES Proceeding") that currently is pending before NYSDEC Administrative Law Judges ("ALJs") Maria E. Villa and Daniel P. O'Connell, and must be completed prior to issuance of a final SPDES Permit.

On August 18, 2008, the NYSDEC Assistant Commissioner (who was then delegated decision-making authority upon the NYSDEC Commissioner's recusal) issued an Interim Decision in the SPDES Proceeding, which determined that the New York State Environmental Quality Review Act ("SEQRA"), New York Environmental Conservation Law ("ECL") art. 8 and 6 New York Codes, Rules and Regulations ("NYCRR") Part 617, applied to NYSDEC's SPDES Permit renewal for IPEC. The Assistant Commissioner also determined that the ALJs' future recommended decision would constitute the Draft Supplemental Environmental Impact Statement ("DSEIS") required under SEQRA. The NYSDEC Commissioner's current delegee, currently the Region 4 Director, is expected to review the ALJs' recommended decision and reach a final determination in lieu of the Commissioner.

In the Interim Decision, the Assistant Commissioner specifically defined the procedural and substantive requirements for satisfying SEQRA, including the requirement for Entergy (and other parties) to examine, consistent with SEQRA mandates, the potential significant adverse environmental impacts of their respective proposed technologies for satisfying the "best technology available" ("BTA") requirement of 6 NYCRR § 704.5. Pursuant to the Interim Decision, each party to the SPDES Proceeding must present an analysis, consistent with SEQRA, of the potential significant adverse environmental impacts (including socio-economic impacts) of its proposed BTA, among other things.

The ALJs have set the schedule for considering SEQRA matters that involves phasing the SEQRA analyses and includes permitting considerations consistent with the ALJs' order, dated December 14, 2012, which set the level of detail for presenting evidence whether a technology is reasonably likely to receive necessary permits. Phasing for SEQRA involves submission of multiple Environmental Reports ("ERs") or portions of ERs. This portion of the SEQRA ER addresses Entergy's proposed BTA, namely Cylindrical Wedgewire Screens ("CWWSs"), including as compared to IPEC's current operations. Other parties to the SPDES Proceeding may present SEQRA analyses of their proposed BTAs. Further, Entergy will supplement this ER to analyze the BTA proposals, including from other parties, relating to closed-cycle cooling. Once completed, this ER will support the ALJs' preparation of the SEQRA DSEIS pursuant to the Interim Decision and applicable law.

ES.2 SEQRA REGULATORY FRAMEWORK

In the Interim Decision, the Assistant Commissioner determined that the relationship between the NYSDEC BTA determination (under 6 NYCRR § 704.5) and the SEQRA review process (6 NYCRR § 617) is a sequential one. That is, the ALJs are to first apply the defined four-step, site-specific analysis to determine the appropriate BTA technology at IPEC. Once the BTA determination is made, the proposed BTA technology will then be reviewed in accordance with SEQRA and subject to modification in order to achieve SEQRA goals. This SEQRA ER is therefore anticipatory.

The Interim Decision specifies that the appropriate SEQRA vehicle to address environmental information is a Supplemental Environmental Impact Statement ("SEIS") (6 NYCRR Part 617). The Assistant Commissioner noted that the June 25, 2003 Final Environmental Impact Statement ("FEIS") issued by NYSDEC did not examine any site-specific environmental impacts associated with construction and operation of closed-cycle cooling or any alternative technology at IPEC, consistent with the 2003 FEIS, which expressly contemplated further scrutiny of the environmental impacts associated with site-specific BTA for the Stations.

ES.3 IPEC CURRENT OPERATIONS

Both operating Units (2 and 3) at IPEC are pressurized water reactors ("PWR") and use an optimized, open-loop, once-though cooling system to manage heat produced during the generation of electricity. Water from the Hudson River is pumped through the main condensers to absorb the heat contained in the expanded exhaust steam after exiting the steam turbine. The circulating water ("CW") from each condenser is then returned to the River via a combined discharge canal.[1]

The Stations also use an open-loop system to manage auxiliary heating loads (ENERCON 2010). The auxiliary systems at IPEC are significantly smaller than the CW systems and are referred to as service water ("SW") systems (ENERCON 2010). The SW systems supply cooling water to safety and non-safety related systems. The SW systems are used to manage heat loads during normal and accident conditions (ENERCON 2010).

[1] The Stations also use an open-loop system to manage auxiliary heating loads. The auxiliary systems at IPEC are considerably smaller than the CW systems and are referred to as service water ("SW") systems.

ES.3.1 Existing Cooling Water Intake Structures and Flow Controls

Cooling water for Units 2 and 3 is obtained through their respective cooling water intake structures ("CWIS") located along the eastern shoreline of the Hudson River. The Unit 2 and Unit 3 CW pumps are designed to withdraw up to (a maximum of) 840,000 gallons per minute ("gpm") (equal to approximately 1,210 million gallons per day ["mgd"]) of water from the River (ENERCON 2010).

The Unit 2 and 3 CWIS are equipped with and operate multi-speed (dual and variable) CW pumps to limit the actual volume of river water withdrawn to the minimum required for efficient operation, thereby reducing impingement and entrainment mortality ("I&E") of aquatic organisms. Reductions in withdrawal volumes are set by the SPDES Permit and reflect water temperature and Station operating conditions. IPEC also schedules maintenance and refueling outages to reduce river withdrawals when elevated densities of aquatic organisms, subject to potential entrainment, are seasonally high (i.e., spring).

ES.3.2 Existing Aquatic Life Protection Measures

The Stations' CWIS have state-of-the-art optimized Ristroph-type Traveling Water Screens ("TWSs") and fish handling and return systems. The CWIS at each Unit have the following aquatic organism protection features:

- Multi-speed (dual or variable) Cooling Water Intake Pumps
- Dual Speed Continuous Rotation
- Smooth Screen Mesh
- Flow Deflector Lip on Fish Buckets
- Dual-Pressure Spray Wash Systems
- Fish Handling and Return Systems.

Collectively, the optimized design features of the optimized Ristroph-type TWSs and the fish return systems minimize impingement losses at IPEC. The effectiveness of the existing optimized Ristroph-type TWSs in reducing impingement losses (as compared to angled or traditional vertical traveling screens) is documented in *"Flow Dynamics and Fish Recovery Experiments: Water Intake Systems"* (Fletcher 1990). These studies determined the technology to be fully optimized as BTA for impingement (Fletcher 1990), a conclusion that United States Environmental Protection Agency ("USEPA") has echoed, including the consideration of the IPEC configuration BTA for impingement on a nationwide basis (USEPA 2011).

ES.4 CYLINDRICAL WEDGEWIRE SCREEN TECHNOLOGY

CWWSs are a well-known and widely employed type of Wedgewire Screen ("WWS"), a passive intake system consisting of wedge-shaped wires or bars welded to an internal cylindrical frame mounted on a central intake pipe that is submerged completely in the source waterbody (USEPA 2011). The proposed CWWSs, as located, optimize hydrodynamic mechanisms, in conjunction with behavioral avoidance, to achieve consistently high reductions in I&E (USEPA 2011; ASA and Normandeau Associates, Inc. [Normandeau] 2012).

Entergy has proposed CWWS as BTA for minimizing I&E at IPEC. NYSDEC defines "alternative intake technologies" as those, other than closed-cycle recirculating cooling systems, that minimize I&E comparable to closed-cycle cooling. As set out in various submissions to the Tribunal by Enercon Services, Inc. ("ENERCON") and the expert team of aquatic biologists' ("the Biological Team"), the proposed CWWSs minimize I&E in the following ways:

- Utilizing low through-slot and low near-field approach velocities that dissipate rapidly with increasing distance from the screen surface, thereby enabling hydrodynamic exclusion of early life stages of aquatic life, including those smaller than the screen slot size (USEPA 2011).

- Altering the ambient flow fields to allow early life stages of fish to have an avoidance response when in close proximity (ASA Analysis and Communication, Inc. [ASAAC] and Normandeau 2012; Barnthouse et al. 2010).

- Utilizing sweeping flows (i.e., ambient currents) to reduce or eliminate I&E of aquatic organisms by configuring and locating the screens in the source waterbody, compared to in a screen house at the shoreline (USEPA 2001; USEPA 2002; USEPA 2011).

- To the extent hydrodynamic forces do not play a role, providing a physical barrier preventing aquatic organisms larger than the screen slot size from being entrained (USEPA 2001; USEPA 2002; USEPA 2011).

ES.4.1 CWWS System Components

CWWS design has evolved over the past 30 years to include enhanced performance characteristics, including improved flow velocity distribution to advance effective debris removal and to reduce debris obstruction and biofouling, as noted below (ENERCON 2010). The CWWS array proposed by Entergy at IPEC is expected to include the following advanced features:

- Use of internal flow baffels/modifications allow CWWSs to achieve a uniform velocity distribution across the screen surface, thereby avoiding areas of high flow concentration.

- Use of smooth "V"-shaped wedgewire bars to increase the effective flow area of the screen surface while reducing the potential for obstruction by debris. CWWSs are designed to provide a large surface area and a low through-slot velocity.

- Use of alternative construction materials (i.e., various grades of stainless steel, copper-nickel alloys, etc.) depending on waterbody characteristics at the deployment site. In particular, wedgewire fabricated with copper-nickel alloys have proven to be effective in controlling the potential for biofouling of the screen surface and internal screen components.

- An Air Burst System ("ABS") to effectively remove debris from the surface of CWWSs.

ES.4.2 CWWS Design at IPEC

Entergy proposes CWWS array with a 2.0 millimeter ("mm") slot width and a maximum through-slot velocity of 0.25 fps as an alternative technology, consistent with the NYSDEC (tentative draft) SPDES Permit (NYSDEC 2003a). The CWWSs through-slot velocity and slot width screens reflect Entergy's goal of minimizing I&E. With a maximum through-slot velocity of 0.25 fps, there is a rapid and pronounced decrease in near-field approach velocity with increasing distance from the CWWS surface. Consequently, even larvae too small to be physically excluded by CWWSs display an active avoidance response to changes in velocity and direction over the intake flow field created by the screens (Barnthouse et al. 2011).

ENERCON has designed an array of 72 CWWSs per Unit, for a total of 144 CWWSs in order to achieve that through-slot velocity using a 2.0 mm slot size (ENERCON 2012a). Each CWWS would be sized adequately to achieve the design maximum CW intake system flows (ENERCON 2012a). The general arrangement of the CWWS array on the bottom of the River is shown in Figure ES-2. A cross sectional drawing of the system layout is shown in Figure ES-3.

The CWWS array is expected to be installed near the bottom of the Hudson River with a set of buried pipes that would run toward the existing IPEC shoreline intake structures. The array is expected to be installed within the federally-designated Safety and Security Zone ("S&SZ") from which the public and public navigation is strictly prohibited.

Twelve screens serving a single CW bay would be mounted on a plenum box (ENERCON 2012a). A plenum box is a large precast reinforced concrete box that serves as a foundation for the CWWSs and also functions as a flow equalization basin for the CWWSs (and will be wholly or partially buried). A total of 12 plenum boxes are required for Units 2 and 3 (ENERCON 2012a). Transition boxes and intake ducts would provide for the final tie-in of the CWWS system to the existing Units 2 and 3 CW bays. A transition box is a large precast reinforced concrete box that would be partially buried just offshore of each group of three CW intake bays. Thus, four transition boxes are required for the Units (ENERCON 2012a). Three dedicated header pipes would connect to each transition box. To ensure that 100 percent of all CW flows would be drawn through the CWWSs, the existing intake openings at each CWIS would be modified to accommodate new intake ducts from the CWWS transition boxes (ENERCON 2012a).

The ABS would consist of air compressors, accumulators (receiver tanks), distribution manifolds, a control system, and an air distributor manifold (sparger), which would be mounted inside each CWWS (ENERCON 2012b). Land-based components of the ABS would be located in a newly constructed building, referred to as the ABS Building, which would be located immediately seaward of the Unit 1 Wharf on an in-river support structure (ENERCON 2012b).

As the CWWSs are installed, scour protection would be placed and would extend approximately 10 to 15 feet beyond all installed components (ENERCON 2012c). Marine mattresses would be used as the primary scour protection on top of the header pipes and buried ABS pipes (if installed), as well as between the installed plenum boxes. Marine mattresses consist of loose stone, approximately 3 to 6 inches in diameter, encapsulated in a geogrid and tied together to form 8 to 12 inch thick cellular mattresses (ENERCON 2012c). Traditional rip-rap would be used in areas where marine mattresses are difficult to place (ENERCON 2012c).

ES.4.3 Construction and Operation of CWWS System at IPEC

ES.4.3.1 Construction

Construction and operation of the CWWS system (the "Project") would begin with a two-year permitting and preparation phase during which additional optimization to facilitate permitting, constructability and cost-effectiveness may occur. Actual in-river construction activities are planned for three successive construction seasons (from approximately March through November of each year) (ENERCON 2012c). The final tie-in and commissioning of the CWWSs would be conducted during each Unit's scheduled refueling outage. Assuming an authorization date of July 2012,[2] major in-river construction activities would begin around March 2014 and end in November 2016. Final connection of the intake ducts to the Unit 2 cooling water intake bays would occur during a scheduled outage for Unit 2 in the spring of 2016 (without the ABS), and Unit 3 in the spring of 2017, absent delays.

Broadly, the primary construction activities associated with installation of the CWWS include the following (ENERCON 2012c):

- Site preparation (including dredging, sheet pile installation, placement of bedding stone and other foundation elements) for the CWWS components and array within the designated IPEC S&SZ.
- Installation and anchoring of the CWWS components (screen array, support structures, and piping, including installation of an ABS) in the Hudson River in front of the existing IPEC intake structures.
- Modifications to the existing intake structures to support CWWS and emergency bypass operations.
- Tie-in of the screen array with the existing IPEC intake structures.

The majority of construction would be performed from barges and other vessels in the Hudson River, as well as from the eastern shoreline of the River on the IPEC Site.

Transport barges would be used to move CWWS components to the IPEC Site. Plenum box and transition box segments would be cast at an existing precast facility located along the east coast of the United States (ENERCON 2012c), and shipped by barge. These barges would then be towed to the CWWS construction area for installation.

For construction, approximately 100,000 cubic yards ("yd^3") of sediment would be dredged from a river bottom area of about 5.2 acres (+/-) within the IPEC S&SZ; approximately 120,000 yd^3 would require handling and disposal (ENERCON 2012c). Best Management Practices ("BMPs") would be employed. Dredged material would be loaded onto waiting hopper barges for transport to a selected storage site where it would be unloaded, tested and treated according to its chemical composition (ENERCON 2012c).

An estimated 8-acre industrial site with access to the River would be required to provide space for staging areas and for miscellaneous construction support activities (i.e., office, parking, etc.) (ENERCON 2012c). This area has not yet been identified, since site selection would be influenced by the construction contractor chosen to perform the work. However, all necessary

[2] This start date was retained for consistency of testimony and submission during prior trial phases.

permits and approvals would be acquired by the contractor for the work to be performed at the site based on project requirements.

ES.4.3.2 Operation and Maintenance

Following installation of the CWWSs, IPEC would remain essentially the same with respect to current operations, i.e., IPEC would continue to withdraw water from and discharge water to the Hudson River subject to its SPDES Permit. As set forth in the NERA Economic Consulting ("NERA") Report (NERA 2012), IPEC's generation-related activities would continue to produce electricity as a base load facility that contributes to electricity system reliability and electricity affordability without the air quality impacts of alternative fossil fuel generation. The existing intake structure would be capable of functioning in a bypass capacity as an emergency back-up system, providing added assurance for station operations.

Operation and maintenance ("O&M") requirements for the CWWS would be conducted.

Post-construction resedimentation would restore disturbed areas (ASA 2013). Because the area of the installed CWWS system is subject to sediment deposition; some periodic maintenance dredging may be required in the future.

ES.4.4 Potential Significant Adverse Environmental Impacts

Potential significant adverse impacts, if any, associated with construction and operation of the CWWS system were identified. Potential significant adverse impacts were assessed across a range of resource issues, including: air quality, water quantity and quality, aquatic ecology, terrestrial ecology, electrical system, aesthetics, transportation, noise, environmental justice, and archaeological and historic resources. Potential temporary impacts from construction and potential long-term impacts from operation of the CWWSs are described and compared to current operations.

The potential significant adverse impacts resulting from construction and operation of CWWSs have been characterized using a set of impact level categories (or significance levels) derived from those established by the NRC in its assessments of IPEC's license renewal (NRC 2012, 2010). The impact level categories have been defined as follows:

- **NONE (NO IMPACT)** - Environmental effects do not occur or are not detectable (measureable, noticeable).

- **SMALL** - Environmental effects are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource, such as a waterbody, or where socio-economic considerations are involved, the consideration, such as community character or electric-system reliability.

- **MODERATE** - Environmental effects are sufficient to be detectable (measurable, noticeable) and would alter noticeably, but not destabilize important attributes of the resource, such as a waterbody, or where socio-economic considerations are involved, the consideration, such as community character or electric-system reliability.

- **LARGE** - Environmental effects are clearly detectable (measurable, noticeable) and would noticeably alter, and are sufficient to destabilize important attributes of the resource, such as a waterbody, or where socio-economic considerations are involved, the consideration, such as community character or electric-system reliability.

No LARGE (i.e., significant) adverse impacts were identified as a result of constructing and operating CWWSs at IPEC. Consequently, it is expected that the Project, as described in this ER, would be able to acquire all necessary permits for implementation and operation.

Table ES-1 is a summary matrix of the potential significant adverse impacts. These are addressed both with respect to construction (effects of which are temporary) and operation.

Table ES-1
Summary of Potential Impacts

Resource	Cylindrical Wedgewire Screen Potential Impacts
AIR QUALITY	
Temporary Construction	**NONE to SMALL IMPACT** - Construction would cause no violations of NO_2 or PM (-10 /-2.5) standards but localized, temporary *de minimis* emissions would result.
Operation	**NO IMPACT** - No measureable changes in emissions from IPEC. Operations would provide for the continued long-term air quality and climate change benefits of IPEC.
WATER QUANTITY AND WATER QUALITY	
Temporary Construction	**NO IMPACT to Water Quantity** - No measureable consumptive use of River water would occur. **SMALL IMPACT to Water Quality** - In-river dredging conducted under BMPs would temporarily disturb a 5.2 acre (+/-) riverbottom area causing limited increased turbidity and sediment dispersal. Work would extend for several months over each of three consecutive construction seasons.
Operation	**NO IMPACT to Water Quantity** - Cooling water withdrawal volumes would be the same as that for current operations. **NO IMPACT to Water Quality** - Discharge characteristics would be the same as those for current operations. The thermal discharge, which would remain the same as current operations, has been determined by NYSDEC to meet New York State water quality standards such that a balanced, indigenous population of aquatic life would result.
AQUATIC ECOLOGY	
Temporary Construction	**SMALL IMPACT** - Construction would create underwater noise, require some nighttime lighting and increase suspended sediment in the water column. In addition, the riverbottom would be disturbed, and sediment removed would be replaced by CWWS structures, riprap, or marine mattresses. Aquatic resources, such as fish and benthos, would experience, at most, small impacts.
Operation	**NONE to SMALL IMPACT** - No anticipated effects on protected species (i.e., Atlantic and shortnose sturgeon) would occur. Potential adverse impacts (i.e., entrainment) to resident important species ("RIS") would be minimized. **BENEFICIAL IMPACT** - CWWS operation would essentially eliminate impingement losses and minimize entrainment losses.
TERRESTRIAL ECOLOGY	
Temporary Construction	**SMALL IMPACT** - General construction activity in riverfront area over three consecutive construction seasons would temporarily disturb terrestrial and avian species in the vicinity of IPEC.
Operation	**NO IMPACT** - Operations of the CWWSs would not affect terrestrial / avifaunal habitat and wildlife.
ELECTRICITY SYSTEM	
Temporary Construction	**NO IMPACT** - Tie-in and commissioning of Units with CWWSs in place would be done during scheduled refueling outages.
Operation	**SMALL, BENEFICIAL IMPACT** - Operations would result in a net annual increase of electrical generation compared to existing operations.

Table ES-1
Summary of Potential Impacts

Resource	Cylindrical Wedgewire Screen Potential Impacts
AESTHETICS	
Temporary Construction	**NONE to SMALL IMPACT** - Construction equipment and operations present and at the IPEC waterfront would be similar to existing industrial operations.
Operation	**SMALL IMPACT** - Aesthetic impacts would be small given the scale of the new ABS Building and its location adjacent to the existing IPEC industrial complex of buildings, facilities and structures.
TRANSPORTATION (Road and Waterway)	
Temporary Construction	**NONE to SMALL IMPACT** - Construction is expected to require a maximum of approximately 225 – 275 construction-related workers with existing adequate capacity on local roadways. Construction work would occur almost exclusively within the designated S&SZ in the Hudson River from which the public and public navigation is prohibited. Temporary construction vessel movements would represent a maximum 1 to 2 percent increase over existing annual traffic in the River.
Operation	**NO IMPACT** - Operation of the CWWSs would not result in any substantial change to staffing or a related change in traffic volumes, flows or patterns. Routine vessel use would take place in the S&SZ, and no navigation impacts would result.
NOISE	
Temporary Construction	**SMALL IMPACT** - Construction noise would be generated by dredging, pile driving and general construction work activity. Noise modeling results conclude that construction activities would meet NYSDEC Noise Policy guidance.
Operation	**NO IMPACT** - Projected noise levels would not increase above existing conditions.
ENVIRONMENTAL JUSTICE	
Temporary Construction	**NO DISPROPORTIONATE or ADVERSE IMPACT** - No disproportionate or adverse effects would result from CWWS construction, and no such impacts would affect environmental justice ("EJ") Areas.
Operation	**NO DISPROPORTIONATE or ADVERSE IMPACT** - Operation of the CWWS system would not change facility operations in any way that could disproportionately or adversely affect EJ Areas.
ARCHAEOLOGICAL AND HISTORIC RESOURCES	
Temporary Construction	**NO IMPACT** - Limited land-based construction activities would be needed and would occur within IPEC Site areas previously disturbed or in active use. If required by New York State Historic Preservation Office ("NYSHPO"), field investigations, resource evaluations and/or mitigation plans would be conducted. Historic resources do not exist on the site.
Operation	**NO IMPACT** - Operation of the CWWSs would have no impacts on archaeological or historic resources.
All impacts are considered adverse unless otherwise specified (i.e., beneficial).	

1.0 INTRODUCTION AND PERMITTING HISTORY

1.1 INTRODUCTION

1.1.1 Background to the Environmental Report

Entergy Nuclear Indian Point 2, LLC, and Entergy Nuclear Indian Point 3, LLC (collectively, "Entergy") respectively own nuclear-powered steam electric generation Stations 2 and 3 which comprise the Indian Point Energy Center (individually, "Unit 2" and "Unit 3," respectively; collectively, "IPEC" or "the Stations"). IPEC is located on the east shore of the Hudson River ("River") in Buchanan, Westchester County, New York (Figure 1.1-1). IPEC currently operates using a once-through cooling system where water from the River is drawn in through intake structures employing state-of-the-art optimized Ristroph-type screens and fish return systems. Heated non-contact cooling water is discharged back to the River via a combined discharge canal subject to and with the benefit of State Pollutant Discharge Elimination System ("SPDES") Permit No. NY0004472.

In 1992, Entergy's predecessors-in-interest at IPEC submitted a timely and complete SPDES Permit renewal application to the New York State Department of Environmental Conservation ("NYSDEC"). On November 12, 2003, NYSDEC Staff issued a (tentative draft) SPDES Permit for IPEC. That (tentative draft) SPDES Permit contained certain NYSDEC Staff-proposed modifications, including the possible construction and operation of cooling towers in a conceptual, undefined closed-loop (or closed-cycle) configuration, provided certain conditions precedent (relating to licensing, permitting and technical feasibility, among other things) were established. The (tentative draft) Permit also authorized Entergy to consider and propose any alternative technology to cooling towers. In late 2003, Entergy and others requested an adjudicatory hearing on the NYSDEC Staff-proposed modifications contained in the (tentative draft) SPDES Permit, commencing the adjudicatory proceeding ("SPDES Proceeding") that currently is pending before NYSDEC Administrative Law Judges ("ALJs") Maria E. Villa and Daniel P. O'Connell.

On August 18, 2008, the NYSDEC Assistant Commissioner (who was then delegated decision-making authority upon the NYSDEC Commissioner's recusal) issued an Interim Decision in the SPDES Proceeding, which determined that the New York State Environmental Quality Review Act ("SEQRA"), New York Environmental Conservation Law ("ECL") art. 8 and 6 New York Codes, Rules and Regulations ("NYCRR") Part 617, applied to NYSDEC's SPDES Permit renewal for IPEC. The Assistant Commissioner also determined that the ALJs' future recommended decision would constitute the Draft Supplemental Environmental Impact Statement ("DSEIS") required under SEQRA. The NYSDEC Commissioner's current delegee, currently the Region 4 Director, is expected to review the ALJs' recommended decision and reach a final determination in lieu of the Commissioner.

In the Interim Decision, the Assistant Commissioner specifically defined the procedural and substantive requirements for satisfying SEQRA, including the requirement for Entergy (and other parties) to examine, consistent with SEQRA's mandates, the potential significant adverse environmental impacts of their respective proposed technologies for satisfying the "best technology available" ("BTA") requirement of 6 NYCRR § 704.5. Pursuant to the Interim Decision, each party to the SPDES Proceeding must present an analysis, consistent with SEQRA, of the potential significant adverse environmental (including socio-economic impacts) of its proposed BTA, among other things.

1.1.2 Organization of the Environmental Report

The organization and content of this SEQRA Environmental Report ("ER") is consistent with the requirements of the Interim Decision, SEQRA law and regulations (ECL art. 8 and 6 NYCRR Part 617), and informed by NYSDEC guidance. This ER is organized as follows:

- Chapter 1.0 presents the background, context and legal basis for this ER. A brief history of IPEC permitting and the current regulatory environment are included.
- Chapter 2.0 presents a description of Entergy's proposed Cylindrical Wedgewire Screen ("CWWS") system and a brief description of current IPEC operations.
- Chapter 3.0 presents the existing conditions (setting) of IPEC and surrounding area relative to the following resource categories: air quality, water quantity and quality, aquatic ecology, terrestrial ecology, the electrical system, aesthetics, transportation (road and navigation), noise, environmental justice, and archaeological and historical resources.
- Chapter 4.0 presents the potential impacts of Entergy's proposed CWWS system as related to those resources described in Chapter 3.0. The resources examined in Chapters 3.0 and 4.0 of this ER include those specifically referenced in the Interim Decision.

As described earlier in this Chapter, a supplement to this ER will be prepared to address the potential significant adverse environmental impacts (including cumulative impacts) of BTA proposals by other parties (i.e., cooling towers as proposed by NYSDEC), and the comparisons between alternatives that allow SEQRA decision-making.

A technical appendix supports this ER and the analyses contained herein:

- Appendix A - CWWS Construction Air and Noise Impact Analysis.

This ER includes the work of several engineering and environmental firms, as well as individual experts, to address the potential significant adverse impacts associated with construction and operation of CWWS system at IPEC. References and attribution to these entities, as well as to the large set of source references used, are provided throughout this SEQRA ER.

1.2 LICENSING, PERMITTING AND AUTHORIZATIONS

1.2.1 Original Authorization and Ownership

Unit 2 and Unit 3 originally were licensed by the Atomic Energy Commission ("AEC"), the predecessor to the Nuclear Regulatory Commission ("NRC"), on September 28, 1973 and December 12, 1975, respectively[3]. Unit 2 was owned by the Consolidated Edison Company of New York, Inc. ("Con Edison") until Entergy Nuclear Indian Point 2, LLC acquired the Unit in September 2001. Unit 3 was last owned by the Power Authority of the State of New York (aka, the New York Power Authority ["NYPA"]) until acquired by Entergy Nuclear Indian Point 3, LLC in November 2000. Since acquiring IPEC, Entergy Nuclear Operations, Inc. has operated Unit 2 and 3.

[3] Unit 1, also currently owned by Entergy Nuclear Indian Point 2, LLC, no longer generates electricity, but is managed under the NRC's Safe Storage ("SAFSTOR") Program, which places and maintains a nuclear facility in safe storage, pending final decommissioning.

1.2.2 AEC and NRC Licenses

The Stations were designed and constructed to use once-through cooling in accordance with their AEC and NRC licenses. While license amendment proceedings relating to IPEC's cooling systems were pending, NRC's authority to regulate the Stations' cooling system was superseded by amendments to the Federal Water Pollution and Control Act ("FWPCA", also known as the federal Clean Water Act ["CWA"]), specifically the creation of the National Pollutant Discharge Elimination System ("NPDES") program.

1.2.3 NPDES / SPDES Permits

On February 24, 1975, during its administration of the NPDES Program, the United States Environmental Protection Agency ("USEPA") issued draft NPDES Permits for IPEC and several other Hudson River power plants. In 1977, the-then owners of IPEC and several other Hudson River power plants requested administrative hearings regarding those Permits. That proceeding was resolved by means of a multi-party settlement, known as the Hudson River Settlement Agreement ("HRSA"), to which USEPA, NYSDEC, the various Hudson River power plant owners (including the IPEC owners, Con Edison and NYPA), and several environmental groups, were parties. The HRSA was a ten-year agreement that expired on May 10, 1991. Among its other requirements, the HRSA provided for retrofitting of IPEC to include multi-speed pumps, optimized Ristroph-type traveling water screens ("TWSs") and fish return systems. This technology was installed under the direction and oversight of the HRSA participants, and its efficacy was independently reviewed and confirmed (Fletcher 1990).

The HRSA required NYSDEC to issue SPDES Permits to IPEC (and the other Hudson River electric generating facilities) after its effective date. Consequently, NYSDEC issued a SPDES Permit for IPEC in April 1982 (effective date May 14, 1982), and renewed the Permit on October 1, 1987. Subsequently, the majority of HRSA signatories executed a series of separate judicially-approved settlement and consent orders (Albany Supreme Court, Index No. 0191-ST3251). The last such stipulation consent order was executed in 1997 and expired in 1998. However, IPEC and NYSDEC voluntarily agreed to continue its terms until issuance of a renewed SPDES Permit (Entergy 2010).

Entergy's predecessors submitted a timely application to NYSDEC for renewal of the SPDES Permit on April 3, 1992. By operation of the New York State Administrative Procedure Act ("SAPA") and NYSDEC's implementing regulations, the 1987 SPDES Permit has been administratively continued and remains in effect today (NYSDEC 2003).

The Stations' cooling water intake structures ("CWIS") employ variable and dual speed pumps, optimized Ristroph-type TWSs, and fish handling and return systems. Each Unit has the following aquatic organism protection features:

- Dual or Variable Speed Cooling Water Intake Pumps
- TWSs Dual Speed Continuous Rotation
- Smooth TWS Mesh
- Flow Deflector Lip on Fish Buckets
- Dual-Pressure Spray Wash Systems
- Fish Handling and Return Systems

1.2.3.1 NYSDEC Modifications and Changes to the SPDES Permit

Over the years, NYSDEC has modified the terms and conditions of IPEC's SPDES Permit. A summary of the substantial changes made since Entergy's acquisition of the Stations is provided below. The calendar date before the description of each change is the effective date that the modification or change became part of the SPDES Permit.

- November 20, 2000 - NYSDEC modified the Permit to allow discharges of stormwater from bulk chemical storage tank secondary containment areas. A Best Management Practices ("BMP") review was required for the associated containment area berms. The BMP is designed to prevent, or minimize the potential for, the release of significant amounts of toxic or hazardous pollutants to state waters through plant site runoff, spillage or leaks, sludge or waste disposal, and stormwater discharges.

- August 23, 2001 - NYSDEC modified the Permit to authorize the discharge of wastewater resulting from the desilting of the intake structure and forebay into the existing stormwater collection system. The modification allows Entergy to periodically desilt the intake forebays in conformance with the Permit.

- March 7, 2004 - NYSDEC modified the Permit to replace former Part II General Conditions requirements with a requirement of compliance with NYSDEC regulations at 6 NYCRR Part 750-2, Operating in Accordance with a SPDES Permit.

- June 29, 2010 - NYSDEC issued a temporary modification of the SPDES Permit to temporarily suspend the Delta L limit on IPEC's discharges in the SPDES Permit during the course of discharge canal repair work.

1.2.4 Historic SEQRA Process

In 1992, prior to Entergy's acquisition of IPEC, NYSDEC Staff determined that its then-proposed renewal and modification of the SPDES Permit was an Unlisted Action under SEQRA and issued a Positive Declaration requiring the preparation of an Environmental Impact Statement ("EIS") (NYSDEC 2003a). The Hudson River facility owners, including Entergy's predecessors, agreed to participate in the SEQRA process, subject to an express reservation of rights that remains in effect today (Con Edison 1992). The predecessor owners of the facilities prepared a consolidated (or generic) Draft EIS ("DEIS") that was submitted to NYSDEC in July 1993. NYSDEC Staff established a SEQRA schedule, including a variety of technical meetings and public sessions, which took place from 1993 to 1999. A revised Generic DEIS ("GDEIS") for IPEC (as well as for the Roseton and Bowline facilities on the Hudson River) was submitted to NYSDEC on December 14, 1999 (by CHG&E, Southern Energy, New York - successor to Orange & Rockland Utilities ("O&R"), Con Edison, and NYPA). NYSDEC Staff issued a Notice of Complete Application on February 28, 2000, and opened a public comment period lasting through June 24, 2000.

In 2002, certain parties commenced a proceeding against NYSDEC to compel NYSDEC Staff to take action on IPEC's pending renewal application (Matter of Brodsky v. Crotty, Sup. Ct., Albany County, Keegan, J. Index No. 7136-02). On May 14, 2003, the court issued an order reflecting the parties' consensus by requiring, among other things, that NYSDEC Staff complete the Generic Final EIS ("GFEIS") for IPEC (Roseton and Bowline) by July 1, 2003 and issue a draft SPDES Permit for IPEC by November 14, 2003. NYSDEC Staff published the FEIS on June 25, 2003. The FEIS incorporated the 1999 DEIS in its entirety.

1.3 CURRENT SEQRA FRAMEWORK

1.3.1 Overview

As noted in Section 1.1, the Assistant Commissioner issued the August 13, 2008 Interim Decision that modified the 2006 Issues Ruling for the SPDES Proceeding, and advanced various issues to adjudication. Among other things, the Interim Decision defines procedural and substantive requirements for the SEQRA review phase of the SPDES Proceeding, as described below.

1.3.2 SEQRA

In the Interim Decision, the Assistant Commissioner determined that the relationship between the NYSDEC BTA determination (required under 6 NYCRR § 704.5) and the SEQRA review process (6 NYCRR § 617) is a sequential one. That is, NYSDEC Staff are to first apply the defined four-step, site-specific analysis to determine the appropriate BTA technology at IPEC. However, once the BTA determination is made, the proposed BTA technology will then be reviewed in accordance with SEQRA and will be subject to modification in order to achieve SEQRA goals (NYSDEC 2008).

The Interim Decision further defines the application of SEQRA for the SPDES Proceeding. It specifies that the appropriate vehicle to address environmental information is a Supplemental EIS ("SEIS") to be prepared in accordance with 6 NYCRR Part 617. The Assistant Commissioner noted that the June 25, 2003 FEIS issued by NYSDEC did not examine IPEC in a site-specific manner; and moreover, that the 2003 FEIS expressly contemplated further scrutiny of the environmental impacts associated with site-specific BTA for the Stations.

In the Interim Decision, the procedural and substantive requirements for satisfying SEQRA were defined, including the requirement for Entergy (and other parties) to examine, consistent with SEQRA's mandates, the potential significant adverse environmental impacts of their respective proposed technologies for satisfying the BTA requirement of 6 NYCRR § 704.5. Each party to the SPDES Proceeding must present an analysis of the potential significant adverse environmental (including socio-economic) impacts of its proposed BTA, among other things.

The ALJs have set the schedule for considering SEQRA matters that involves phasing the SEQRA analyses and includes permitting considerations consistent with the ALJs' order, dated December 14, 2012, which set the level of detail for presenting evidence whether a technology is reasonably likely to receive necessary permits. Phasing for SEQRA involves submission of multiple ERs or portions of ERs.

This SEQRA ER addresses Entergy's proposed BTA, namely CWWSs, including as compared to IPEC's current operations. Other parties to the SPDES Proceeding may present SEQRA analyses of their proposed BTAs. Further, Entergy will prepare a supplement to this ER to analyze the BTA proposals, including from other parties, relating to closed-cycle cooling, and the comparison of different alternatives. Once completed, this ER will support the ALJs' preparation of the SEQRA DSEIS pursuant to the Interim Decision and applicable law.

1.3.3 NRC Review of IPEC's Current Operations Under the National Environmental Policy Act

SEQRA provides that other relevant environmental analyses should be accounted for; hence, a summary review of the *"Generic Environmental Impact Statement for License Renewal of Nuclear Plants"* ("GEIS") is provided herein.

The NRC has implemented § 102 of the National Environmental Policy Act ("NEPA") of 1969, as amended (42 U.S.C. 4321), in Title 10, Part 51, "*Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*," of the Code of Federal Regulations ("CFR") (10 CFR Part 51) (NRC 2010). The NRC requires supplementing a GEIS for renewal of a reactor operating license (10 CFR 51.20(b) (2)) (NUREG-1437, Volumes 1 and 2, of the GEIS).

Entergy submitted an application to the NRC on April 30, 2007 to renew the operating licenses for Units 2 and 3 for an additional 20-year period. Entergy's application included a comprehensive ER presenting information regarding environmental impacts. Upon accepting the application, the NRC initiated its environmental review process (10 CFR Part 51) by publishing a notice of intent ("NOI") to prepare an EIS and to conduct scoping. NRC published the Final SEIS ("FSEIS") on December 3, 2010. The FSEIS includes the NRC Staff's evaluation of the environmental effects of the proposed action (renewal of the operating license with continued operations under the current CWIS configuration), the environmental impacts of alternatives (including closed-cycle cooling), and mitigation measures for reducing or avoiding adverse effects. The purpose of the NRC Staff's environmental review was to determine:

> *"...whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable"* (10 CFR 51.95(c)(4) (NRC 2010).

Accordingly, in the FSEIS, the NRC recommended:

> *"...that the Commission determine that the adverse environmental impacts of license renewals for IP2 and IP3 are not so great that not preserving the option of license renewal for energy planning decision makers would be unreasonable"* (NRC 2010).

Subsequently, on June 26, 2012, NRC Staff issued NUREG 1437, Supplement 38, Volume 4 Draft Report for Comment. The supplement included corrections to impingement and entrainment mortality ("I&E") data presented in the FSEIS, revised conclusions about thermal impacts based on newly available thermal plume studies, and provided an update of NRC's consultation under § 7 of the Endangered Species Act ("ESA") with the National Marine Fisheries Service ("NMFS") regarding the shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*Acipenser oxyrinchus*). The license renewal recommendations of the 2010 FSEIS, as noted above, were not changed by the conclusion of the June 2012 NUREG 1437, Supplement 38, Volume 4.

NYSDEC Staff have indicated that it may rely on the NRC FSEIS (NYSDEC 2011).

2.0 DESCRIPTION OF CYLINDRICAL WEDGEWIRE SCREEN TECHNOLOGY

2.1 SELECTION OF CYLINDRICAL WEDGEWIRE SCREENS

ENERCON's *"Evaluation of Alternative Intake Technologies at Indian Point Units 2 and 3,"* ("Alternative Technologies Report") (ENERCON 2010), concluded that installation and operation of CWWSs represents an available alternative technology for Units 2 and 3. In addition, Enercon Services, Inc. ("ENERCON"), relying on input from an expert team of aquatic biologists' ("the Biological Team"), concluded that whether on an annualized basis and over the projected operational lifetime for Units 2 and 3, CWWSs would achieve biological benefits (i.e., aquatic resource benefits) equivalent to or in excess of those that could be achieved by closed-cycle cooling (ENERCON 2010). The aquatic resource benefits afforded through construction and operation of CWWSs at IPEC are further described in Section 4.5.

2.2 OVERVIEW OF EXISTING UNIT 2 AND UNIT 3 COOLING WATER INTAKE STRUCTURES

2.2.1 Cooling Water System

Units 2 and 3 currently use a non-contact, open-loop, once-though cooling system to manage heat produced during the generation of electricity. In the open-loop condenser cooling systems at IPEC, water from the Hudson River (i.e., circulating water ["CW"]) is pumped through the main condensers to absorb heat from the expanded exhaust steam after exiting the steam turbine (ENERCON 2010). The warmed CW from each condenser is then returned to the River via the Stations' combined discharge canal.

The Stations also use an open-loop system to manage auxiliary heating loads (ENERCON 2010). The auxiliary systems at IPEC are significantly smaller than the CW systems and are referred to as service water ("SW") systems (ENERCON 2010). The SW systems supply cooling water to safety and non-safety related systems. The SW systems are used to manage heat loads during normal and accident conditions (ENERCON 2010).

2.2.2 Cooling Water Intake Structures - Physical Description

Cooling water for Units 2 and 3 is obtained through their respective CWISs. The locations of the CWISs are shown in Figure 2.2-1. The Stations' CWISs are located approximately 700 feet apart along the eastern shoreline of the Hudson River at approximately river mile ("RM") 42 within the Station's Safety and Security Zone ("S&SZ") (ENERCON 2010). Descriptions of the physical design, capacities and associated features of the existing CWISs are provided below. Data on the Stations' CWISs are taken from the documents: "*Draft Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point 2 & 3, and Roseton Steam Electric Generating Stations"* (CHGE et al. 1999, IPEC Indian Point 2 System Description 24.0 and IPEC Indian Point 3 System Description 22 [2005]).

2.2.2.1 Unit 2

Unit 2 is equipped with a shoreline intake. Figures 2.2-2 and 2.2-3 show plan and section views of the Unit 2 CWIS, respectively. The structure contains seven bays or channels, which are separated by 3-foot thick concrete walls. Six of the bays provide water to the CW pumps. The seventh bay, located in the center of the structure, provides water to the Unit 2 SW pumps.

The maximum design intake capacity for the Unit 2 CW system is approximately 840,000 gallons per minute ("gpm") (i.e., 140,000 gpm per bay) (ENERCON 2010). The through-screen velocity for the Unit 2 CW TWSs is 1.61 feet per second ("fps") at mean low water ("MLW") (ENERCON 2010). The maximum design intake capacity for the SW system at Unit 2 is approximately 30,000 gpm. As shown in Figure 2.2-2, the centrally located SW bay is partitioned into two sections. The through-screen velocity for the Unit 2 SW TWSs is 0.35 fps at MLW (ENERCON 2010).

Each intake opening is equipped with a wall that extends to a depth of -1 foot mean sea level ("MSL") (ENERCON 2010). Gated openings are provided between the SW bay and the adjacent CW bays to allow flow to be delivered to the SW pumps through the adjacent CW TWSs. Currently, one of the gated openings between the bays is normally open and one is normally closed. The gated openings serve as an alternative flow path in the event of a SW blockage. Each inlet opening also is equipped with a vertical bar rack. The bar racks are designed to prevent large pieces of debris (i.e., greater than 3 inches in diameter) from entering the structure. The bar racks extend the full height of the opening.

Unit 2 also obtains screenwash water and water for its SW system via the CWIS at Unit 1 (ENERCON 2010). The Unit 1 CWIS is a shoreline intake consisting of a concrete bulkhead divided into four intake bays (the two intake bays previously used to provide cooling water to the Unit 1 condensers are no longer active). The remaining two SW bays are used to provide screenwash water and supplemental flow to the Unit 2 SW system on an as needed basis. Each Unit 1 SW intake bay houses a river water pump, two screenwash pumps and dual flow traveling screens (ENERCON 2010). Although both river water pumps could be operated simultaneously, only one pump is operated at any given time, with the remaining river water pump in standby mode (ENERCON 2010).

2.2.2.2 Unit 3

Figures 2.2-4 and 2.2-5 show plan and section views of the Unit 3 CWIS, respectively. The CWIS consists of seven intake bays, served by a common plenum. Seven intake openings are located along the western side (i.e., river side) of the plenum, and single openings are located at its northern and southern ends. Each intake opening is equipped with a vertical bar rack similar to Unit 2. The bottom of the wall at the Unit 3 CWIS extends to an elevation of -1 foot MSL.

Six intake bays provide water to the CW pumps. The CW system for Unit 3 has a maximum design capacity of 840,000 gpm (ENERCON 2010). Three of CW bays are also equipped with screenwash pumps, which have a design capacity of 3,200 gpm (ENERCON 2010). The seventh bay, located in the center of the structure, provides water to the Unit 3 SW pumps. Gated openings are also provided between the SW bays and the adjacent CW bays at the Unit 3 CWIS to allow SW flow to be delivered through the adjacent CW TWSs. The gated openings at the Unit 3 CWIS are normally closed (ENERCON 2010). The through-screen velocity for the TWSs in the CW bays equipped with one CW pump and one screenwash pump is 1.64 fps at MLW (ENERCON 2010). TWSs in CW bays equipped with a single CW pump have a through-screen velocity of 1.61 fps at MLW (ENERCON 2010).

The maximum design intake capacity for the SW system at Unit 3 is approximately 36,000 gpm (ENERCON 2010). The through-screen velocity for the Unit 3 SW TWSs is 0.42 fps at MLW (ENERCON 2010).

2.2.2.3 Optimized Ristroph-type Traveling Water Screens

The Unit 2 and 3 CWISs have optimized Ristroph-type TWSs and fish handling and return systems. The optimized Ristroph-type TWSs and fish return systems were operational at Unit 3 in 1990 and at Unit 2 in 1991 following a collaborative research, design and validation effort among the former owners of the Stations and scientists acting on behalf of Riverkeeper's predecessor organization, the Hudson River Fisherman's Association ("HRFA") (CHGE et al. 1999). NYSDEC and the HRFA approved the installation of the screens and fish return systems as representing BTA for impingement (NYSDEC 1987). In addition, the NYSDEC employed the performance of the prototype as the state's best available technology standard for reducing fish impingements at water intake systems (Fletcher, 1990).

Through the extensive collaborative process referenced above, the optimized Ristroph-type TWSs at each Unit have the following aquatic organism protection features that reflected first-in-kind design when installed, and continue to reflect state-of-the-art design today (ENERCON 2010):

- **Dual or Variable Speed Cooling Water Intake Pumps** - The Stations were retrofit with dual speed (Unit 2) or variable speed (Unit 3) cooling water intake pumps. These multi-speed pumps allow for varying cooling water intake flow rates with corresponding reductions in water use equated to presumed aquatic protection benefits, while maintaining efficient operation of the Stations.

- **TWSs Dual Speed Continuous Rotation** - The TWSs are rotated continuously as impingement mortality is less likely to occur when the available open area of the screens is maintained by the continuous removal of debris from the screens. Continuous rotation also minimizes the time over which impinged organisms are retained on the screen panels or in the fish buckets, reducing impingement losses.

- **Smooth TWS Mesh** - The clear opening slot mesh on the screen panels has a smooth surface to minimize abrasion to fish transferred into the fish return systems (CHGE et al. 1999).

- **Flow Deflector Lip on Fish Buckets** - The curved lip at the leading edge of the fish buckets is designed to minimize vortex stress on fish inside the buckets. The lip eliminates turbulent flow in the interior of the buckets and provides sufficient water depth to allow fish to maintain a stable, upright position (Fletcher 1990).

- **Dual-Pressure Spray Wash Systems** - TWSs employ a series of spray washes during rotation. High-pressure sprays are first used to remove debris from the screen mesh surface, before fish collection. Low-pressure sprays are then used to gently remove aquatic organisms gently from the fish buckets for release through the fish return system. Finally, another series of high-pressure sprays are used to wash off any remaining debris to prevent carryover into the intake bays and assist in maintaining the available open area of each screen panel to reduce potential impingement.

- **Fish Handling and Return Systems** - Each CWIS is equipped with a specially designed separate fish handling and return system to safely return impinged aquatic organisms to the River. The fish handling and return systems consist of specially designed fish return troughs, sluices and transport pipes (ENERCON 2010). Discharge locations for the fish return pipes were selected after conducting dye and fish release studies to identify locations that would minimize the potential for re-impingement (CHGE et al. 1999). The CWIS fish handling and return systems are managed independently of the debris return systems through use of separate collection troughs. Providing a minimum water depth assures an adequate depth of submergence for aquatic organisms during transit.

Collectively, the design features of the optimized Ristroph-type TWSs and the fish return systems minimize impingement losses at IPEC. The effectiveness of the existing optimized Ristroph-type TWSs in reducing impingement losses (as compared to angled or traditional vertical traveling screens) is documented in *"Flow Dynamics and Fish Recovery Experiments: Water Intake Systems"* (Fletcher 1990). These studies determined the technology to be fully optimized as BTA for impingement (Fletcher 1990), a conclusion that USEPA has echoed, including the consideration of the IPEC configuration BTA for impingement on a nationwide basis (USEPA 2011).

2.3 OVERVIEW OF CWWS SYSTEM

This Section does not repeat the engineering availability and efficacy validation of CWWS by ENERCON and the Biological Team. It does, however, identify those findings relevant to considering the SEQRA and permitting implications of CWWS beyond engineering feasibility and efficacy.

CWWSs are a well-known, widely employed passive intake system consisting of wedge-shaped wires or bars welded to an internal cylindrical frame mounted on a central intake pipe that is submerged completely in the source waterbody (ENERCON 2010). A typical CWWS is shown in Figure 2.3-1. More than 1,000 such systems exist in diverse waterbodies throughout the world, some with operating histories of several decades.

As shown in Figure 2.3-2, the CWWS array would be placed within the IPEC S&SZ and, therefore, would not interfere with navigation. In addition, sufficient space is available at IPEC to accommodate multiple screen assemblies within the designated IPEC S&SZ. As shown in Figure 2.3-3, adequate depth (i.e., ranging from approximately 50 to 70 feet referenced to MSL for the proposed location of the CWWS array) is also is available within the IPEC S&SZ, and Figure 2.3-4 shows a cross section of the CWWS.

The IPEC S&SZ consists of a joint designation from the National Oceanic and Atmospheric Administration ("NOAA") and the United States Coast Guard ("USCG"). A NOAA designated Safety Zone is a water area, shore area, or water and shore area to which, for safety or environmental purposes, access is limited to authorized persons, vehicles, or vessels (NOAA 2010). A Security Zone is an area of land, water, or land and water which is so designated by the USCG Captain of the Port ("COTP") or District Commander for such time as is necessary to prevent damage or injury to any vessel or waterfront facility, to safeguard ports, harbors, territories, or waters of the United States or to secure the observance of the rights and obligations of the United States (NOAA 2010).

2.4 IPEC CWWS DESIGN FEATURES

The CWWS system described herein reflects the most recent studies and investigations performed by Entergy and its consultants as described in the *"Technical Design Report for Indian Point Units 2 and 3 – Implementation of Cylindrical Wedgewire Screens ENTGIP152-PR-CWW-06"* ("Technical Design Report") (ENERCON 2012a). The Technical Design Report selects a CWWS array with a 2.0 mm slot size and a maximum through-slot velocity of 0.25 fps.

As described in the Technical Design Report, the CWWS array would be installed near the bottom of the Hudson River and feed large diameter buried pipes that run toward the existing shoreline intake structures. Final tie-ins to the CW bays of the existing intake structures would involve physical plant modifications (ENERCON 2012a). The Unit 2 SW bay would not be physically altered, since it supplies water to essential nuclear safety functions (ENERCON 2012a). The Unit 3 SW bay would be isolated from common communication pathways with the CW bays at the front of the intake (ENERCON 2012a), but these modifications would not impede the supply of water to essential nuclear safety functions. Under normal operating conditions, the modifications to the CW bays limit cooling water intake from the River to water passing through the CWWSs and provide a means of isolating CW bays from SW bays.

2.4.1 CWWS System Components

2.4.1.1 CWWS Description

In order to achieve a maximum through-slot velocity at or below 0.25 fps using a 2 mm slot size, ENERCON designed a CWWS array consisting of 72 CWWSs per unit, for a total of 144 CWWSs for Units 2 and 3 (ENERCON 2012a). Each CWWS would have a diameter of approximately 72 inches and a length of approximately 257 inches, to accommodate the design maximum CW intake system flow of 840,000 gpm per unit (Figure 2.3-3) (ENERCON 2012a).

The screen riser length (screen riser plus spool piece) selected was 7 feet, which provides the requisite one-half screen diameter of clearance plus a 4-foot allowance for potential sediment accumulation (Figure 2.3-1) (ENERCON 2012a).

2.4.1.2 Plenum Boxes

Twelve CWWSs serving a single CW bay would be mounted on a plenum box (ENERCON 2012a). A plenum box is a large precast reinforced concrete box that will serve as a foundation for the 12 CWWSs and also function as a flow equalization basin for the CWWSs serving the dedicated header pipe to each CW bay (ENERCON 2012a). Thus, a total of 12 plenum boxes are required for Units 2 and 3 (ENERCON 2012a). Consistent with efficient in-the-wet construction techniques, the nearly identical plenum boxes for each CWWS array would be precast at an off-site location, and assembled complete with CWWSs installed prior to lowering to the prepared river bottom (ENERCON 2012a).

2.4.1.3 Header Pipes

The buried header pipes, which are currently expected to have a nominal 8 foot diameter, were designed to remain intact and functional under the effects of maximum trench backfill dead load and the weight of the scour protection (i.e., marine mattresses) (ENERCON 2012a).

Fiber reinforced plastic ("FRP") was recommended by ENERCON as the preferred header pipe material because it provides excellent corrosion resistance, biofouling resistance, has low maintenance requirements, is cost-effective, and is lightweight for ease of handling during construction (ENERCON 2012a). To ensure the best durability and reduced maintenance requirements, ENERCON recommended the centrifugally cast method of manufacturing FRP pipe be specified, which provides a strong, durable, abrasion resistant pipe (ENERCON 2012a).

2.4.1.4 Transition Boxes and Intake Ducts

Three dedicated header pipes would connect to the riverside wall of a transition box. A transition box is a large precast reinforced concrete box that would be partially buried just offshore of each group of three CW intake bays (ENERCON 2012a). Thus, four transition boxes would be required for Units 2 and 3 (ENERCON 2012a). The transition boxes serve three functional purposes: 1) provide for a change in elevation between the header pipes and intake ducts; 2) provides a transition between the different geometries of the header pipes and intake ducts; and 3) provide redundant flow paths for each group of three header pipes (and plenum boxes) (ENERCON 2012a).

Intake ducts would provide for the final tie-in of the CWWS system to the Units 2 and 3 CW bays. Intake ducts would span the distance from the landward side of each transition box to the base of the corresponding CW intake bay (ENERCON 2012a). Each intake duct would sit at the bottom slab of the existing intake bay opening (i.e., at elevation -27 feet MSL). The intake ducts would be lightweight, prefabricated, one-piece rectangular ducts having approximate outside dimensions of 11 feet 10 inches wide and 5 feet 10 inches high (ENERCON 2012a). The intake ducts were designed such that they could be scheduled for installation during a normal outage at each Unit (ENERCON 2012a).

2.4.1.5 Existing CWIS Integration

To ensure that all CW flows are drawn through the CWWSs, modifications to the intake bays are required to prevent bypass flow (ENERCON 2012a). At Unit 3, openings between the SW bay and adjacent CW bays that are located in front of the SW TWSs (i.e., between the bar racks and the TWSs) would be closed during normal operation (ENERCON 2012a). Similar openings exist in the northern and southern exterior walls of the existing Unit 3 plenum. These openings would also be closed so that water entering the CW bays is coming exclusively from the CWWSs (ENERCON 2012a).

In addition, the following modifications to the existing CW bays are required (ENERCON 2012a):

- Installing vortex suppressor gratings in the Unit 2 and Unit 3 CW bays.
- Installing sluice gate assemblies to the front of each CW bay in the Unit 2 and Unit 3 intake structures.

The CW sluice gates would stay closed during normal operation and would only be opened in the unlikely event that a CWWS array is not operational (ENERCON 2012a). Due to the potential for debris accumulation on and around an intake duct, the bottom of the CW sluice gate openings would be located approximately 4 feet above the top of the intake duct (ENERCON, 2012). The opening between the intake duct and sluice gate bottom would be closed with a steel plate (ENERCON 2012a). A trash rack would also be provided in front of each sluice gate

(ENERCON 2012a). If an automated system is installed, a control mechanism would monitor water levels on either side of the CW bays and would be designed to open the gates automatically if the differential water level exceeded a maximum setpoint value (ENERCON 2012a).

2.4.2 Air Burst System

CWWSs are designed to provide a large screening area and a low through-slot velocity. Depending on location, CWWS systems may utilize an ABS to periodically remove debris that accumulates on the surface of the screen, as necessary. ABSs, however, are not required at all locations. This Section provides a description of the ABS that would be installed at IPEC.

The ABS for Units 2 and 3 would periodically discharge water, which back flows into the ABS distribution piping, and air to dislodge debris that settles on the screen surface (ENERCON 2012a). The ABS would be capable of discharging to each screen in the array at least once every eight hours (ENERCON, 2012).

As shown in Figure 2.4-1, the ABS would consist of air compressors, accumulators (receiver tanks), distribution manifolds (including valves and piping for each individual CWWS), a control system, and an air distributor manifold (sparger), which would be mounted inside each CWWS (ENERCON 2012a). In operation, the ABS air compressor charges the ABS accumulator (ENERCON 2012a). Once the accumulator has reached the proper operating pressure, a distribution valve would be opened by the ABS control system to release the stored volume of air to a single screen (ENERCON 2012a). This process forces water accumulated in the ABS piping through the screen followed by the burst of compressed air (ENERCON 2012a). This process would be repeated sequentially, one screen at a time, until all CWWSs in an array have been backwashed.

The approximately 168 foot by 39 foot newly constructed ABS Building would be approximately 37 feet high and located immediately seaward of the Unit 1 Wharf on an in-river support structure (ENERCON 2012a). The elevation of the top of the support structure would be roughly equivalent to that of the Unit 1 Wharf. Detailed design data and preliminary design drawings for the ABS are included in the Technical Design Report (ENERCON 2012a).

2.4.3 Maintenance

Although passive intake systems do not require frequent maintenance, the in-river components of the CWWS array would be designed to facilitate inspection and maintenance activities, when necessary. Access hatches would be provided on the top of the plenum boxes and by manhole risers in each header pipe train near the transition boxes (ENERCON 2012a). From the plenum box access hatch, divers can inspect the internals of the plenum box and part of the corresponding header pipe (ENERCON 2012a). From the header pipe manhole, divers can inspect the internals of the rest of the corresponding header pipe, transition box, and intake duct (ENERCON 2012a). The access openings are sized to allow a fully equipped diver to fit comfortably through the openings (ENERCON 2012a).

2.4.4 Scour Protection

ENERCON evaluated local scour potential in the vicinity of in-river CWWS components using published, empirically-based relationships including the size and limits of required scour protection (ENERCON 2012a). To eliminate scour potential, use of marine mattresses and rip-rap is contemplated (ENERCON 2012a).

Since the proposed construction methodologies for the in-river CWWS system components involve left in-place sheet piles, scour protection would extend approximately 10-15 feet beyond the installed components (ENERCON 2012a). ENERCON chose marine mattresses as the primary scour protection on top of the header pipes and buried ABS pipes, as well as between the installed plenum boxes. Marine mattresses consist of loose stone, approximately 3 to 6 inches in diameter, encapsulated in a geogrid and tied together to form 8 to 12 inch thick cellular mattresses ("marine mattresses") (ENERCON 2012a). Traditional rip-rap would be used in areas where a marine mattress would be difficult to place, such as around the manhole risers and the outside perimeter of CWWS array at Unit 2 (ENERCON 2012a).

2.5 CONSTRUCTION

2.5.1 Design Summary

As described by ENERCON in the Technical Design Report, the in-river CWWS system can be summarized as follows (ENERCON 2012a):

- The 144 CWWSs would be positioned underwater near the bottom of the Hudson River approximately 300 to 500 feet from the existing Unit 2 and Unit 3 intake structures. The centerlines of the CWWSs would be approximately 10 feet above the existing river bottom elevation.

- A total of 12 concrete plenum boxes (six per unit) would be used, each buried in the river bottom, supporting 12 CWWSs, and serving as a common "basin" for the 12 screens feeding to one header pipe.

- There would be 12 header pipes in total, one for each of the plenum boxes, resulting in twelve CWWS "trains." The header pipes would transfer the intake flow from the plenum boxes to the transition boxes. The header pipes would be buried below grade and generally follow the slope of the river bottom.

- The concrete transition boxes would be located approximately 30 feet from the existing intake structures. There are four transition boxes, each with three header pipes connected. The transition boxes would serve three functional purposes: provide for a change in elevation between the header pipes and intake ducts; provide a transition between the different geometries of the header pipes and intake ducts; and, provide redundant flow paths for each group of three header pipes (and plenum boxes).

- Three rectangular intake ducts would span from each of the transition boxes to the existing intake structures. Each of the 12 total intake ducts corresponds to a single CW intake bay and CW pump in the existing intake structures. The intake ducts would enter the intake bays at their bottom, below the backup sluice gates, as described in the Technical Design Report (*"Appendix B – Phase I Technical Report - Intake Structure Modifications, Indian Points Units 2 & 3*") (ENERCON 2012a).

- Individual ABS pipes for each CWWS would be routed as six bundles of 24 pipes each from the new ABS Building support platform to the screens. ABS pipes would be buried below grade and generally follow the slope of the river bottom. Each ABS pipe bundle would enter the bottom slab of a plenum box. Half of the pipes connect with the CWWSs on that plenum box, while half would continue through and into the bottom slab of the next plenum box to connect with those CWWSs.

2.5.2 General Construction Methodology

ENERCON determined that in-the-wet construction techniques would be utilized for in-river implementation of the proposed CWWS system. These techniques:

- Reduce the duration of on-site construction activities.
- Reduce the impact on local river conditions.
- Shift material delivery and fabrication/assembly/preparation to one or more remote facilities.

2.5.3 Dredging Methodology

Sheet piling would be used to assist in minimizing dredge volumes, reduce the potential for off-site sediment transport and assist in placement of underwater structures and materials. Sheet piles would be installed using barge mounted vibratory hammers (ENERCON 2012a). Up to four barges would be used for this purpose (ENERCON 2012a). Tall sheet piling, which would extend above the water surface, would be used to encircle the plenum box areas as well as the transition box areas (ENERCON 2012a). To allow for barge access to the plenum box areas, an opening would be left in one section of the tall sheet pile wall. A silt curtain would be installed across the barge entrance point to control sediment transport during dredging, pile driving or other activities that could disturb bottom sediments. Short sheet piles, which would extend to the mudline, would be used to reduce excavation volumes along the ABS piping systems, the header piping systems and around the plenum boxes and transition boxes to tremie concrete to form pile caps (ENERCON 2012a). Tall sheet piling would significantly reduce the potential for redistribution of sediment during excavation.

A hybrid approach to the dredging operation would be implemented, as appropriate, to minimize disruption of *in-situ* materials, assure sediment capture, where applicable, and maintain control of Project cost and schedule (ENERCON 2012a). Mechanical dredging allows the removal of sediments at *in-situ* density with the use of barges and other equipment (ENERCON 2012a). Hydraulic dredge techniques, typically associated with environmental projects, utilize slurry systems to pump potentially contaminated sediments to a designated area for treatment and/or disposal based on pre-characterization analytical results (ENERCON 2012a). Two hydraulic dredges and one mechanical bucket dredge would be required (ENERCON 2012a). Using either dredging method, dredged material would be loaded onto awaiting hopper barges for transportation to a storage site where it would be unloaded, tested and treated according to its chemical composition (ENERCON 2012a). The utilization of barge systems allows for controlled removal, transportation and potential storage of material, should it be required (ENERCON 2012a).

2.5.4 General Construction Schedule

The following information on construction of the CWWS system includes a discussion of a schedule, which would be optimized, as appropriate, during future permitting.

Prior to construction, the optimization and preparation phase of the CWWS system is anticipated to be 18 months to two years. Actual in-river construction activities are planned for three successive construction seasons (from approximately March through November of each year). The final tie-in and commissioning of the CWWSs would be conducted during each Unit's refueling outage.

CWWS construction activities would occur in three phases: 1) array, header, and piping construction, 2) ABS platform construction, and 3) intake structure modifications (ENERCON 2012a). As shown in Figure 2.5-1, the array, header, and piping construction is further broken down into five in-river areas (or zones) as listed below (ENERCON 2012a). All in-river construction work zones are located within the IPEC S&SZ (ENERCON 2012b).

- Zone 1: Plenum Boxes
- Zone 2: Transition Boxes
- Zone 3: Header Pipes
- Zone 4: Buried ABS Pipes
- Zone 5: Intake Ducts

The proposed construction schedule developed by ENERCON is shown in Figure 2.5-2 (Preliminary Construction Schedule). This schedule reflects the phasing of work for each Unit. The majority of construction would be performed from barges in the Hudson River, as well as from barges/vessels from the eastern shoreline of the river on the IPEC Site, all within the IPEC S&SZ.

As shown in Figure 2.5-2, most major in-river construction activities would begin around March 2014 and end in November 2016. Final connection of the intake ducts to the Unit 2 cooling water intake bays would occur during a scheduled outage in the spring of 2016, and for Unit 3 during a scheduled outage in the spring of 2017. As noted previously, the majority of the work would be conducted over three successive construction seasons with an assumption that limited work would be completed in the winter months of each year, generally December through February.

In 2014, Unit 2 in-river construction would occur in Zone 1 (March – November), Zone 2 (May – October) and Zone 3 (May – November). Limited work would take place between December (2014) through February (2015).

Construction work starting in March 2015 and ending in November 2015 would focus on Unit 3 and would occur in three zones: Zone 1 (March – November); Zone 2 (May – October); and, Zone 3 (May – November).

Similarly, in 2016, construction would be initiated in the month of March and end in November of that year. Work would be done in Zone 4 (Buried ABS Pipes) for both Unit 2 (March – October) and Unit 3 (May – November).

The final construction work zone would be Zone 5 (Intake Ducts) to allow for the CWWSs to be tied into the existing intakes. As shown in Figure 2.5-2, there would be two planned facility outages to allow that tie-in work to be completed – one in 2016 (i.e., from mid-March – April for Unit 2), and one in 2017 (i.e., from mid-March – April for Unit 3).

Required intake modifications are expected to be completed by July 2014. Construction of the ABS support platform and ABS Building is anticipated to be completed by July 2016.

2.5.5 Off-site Staging Area

An estimated 8 acres of existing river-access, industrial space would be used to provide space for staging areas and for miscellaneous construction support activities (i.e., office, parking, etc.) (ENERCON 2012a). This area has not yet been identified, since site selection would be influenced by the construction contractor chosen to perform the work. However, all necessary permits and approvals would be acquired by the contractor for the work to be performed at the site based on requirements of the Project.

The off-site staging area is assumed to act as the delivery acceptance, storage, and staging area for the revolving inventory of material and component assemblies required to construct the in-river CWWS system (ENERCON 2012a). This would include the CWWSs, FRP header pipe, high density polyethylene ("HDPE") and stainless steel ABS pipe, and raw materials (stone, gravel, aggregate, reinforcing steel, geotextile, H-piles, sheet piles, etc.) (ENERCON 2012a). Lay-down, staging, and storage areas would require leveled ground (ENERCON 2012a). Note that some raw materials may be delivered on scows, and may not require storage and loading from the off-site staging area (ENERCON 2012a).

2.5.6 Construction Vessels and Equipment

The construction vessels and equipment described below are based on the current engineering design, and past experience on similar projects (ENERCON 2012a). The techniques ultimately utilized for the Project may vary to some degree as the design is optimized, construction contractors are selected, and required environmental permits and approvals are obtained. Nevertheless, with proper planning and implementation of BMPs, the anticipated significant adverse environmental impacts associated with construction activities are not expected to change substantially from those described.

Transport barges would be used to transport components from the off-site staging area to the facility site. Plenum box and transition box segments would be cast at an existing precast facility located along the east coast (ENERCON 2013). These barges would then be towed to the Project site where the plenum and transition boxes would be lifted and lowered onto the pile cap structures. A total of eight transport barges would be required to support the proposed construction sequencing (ENERCON 2013). A barge size on the order of 222 feet x 60 feet x 14 feet, or similar, is estimated such that all segments required for a complete plenum box (two segments) or complete transition box (three segments) can be accommodated on a single transport barge (ENERCON 2013).

Dredging would be performed using both hydraulic and closed bucket mechanical equipment (i.e., clam shell dredge) depending on depth and location (ENERCON 2012a). A large portion of the material to be dredged or handled at the work area is located between 50 to 70 feet below MSL (ENERCON 2012a). Some areas, such as in or around the transition boxes, are in shallower water, but may require greater attention to prevent resuspension of sediments and impacts to ongoing plant operations (ENERCON 2012a).

A catamaran crane is proposed for off-loading and positioning plenum boxes and transition boxes (ENERCON 2012a). A barge-mounted 40-ton crawler crane would be used to place header pipes, ABS pipes, marine mattresses/rip-rap, and to support construction and placement of the ABS Building and ABS equipment (ENERCON 2012a).

A barge-mounted impact pile driver would be used to install the H-piles and/or concrete piles that would support the plenum boxes, transition boxes and ABS platform (ENERCON 2012a). While it may be feasible to drive H-piles using a vibratory hammer, an impact hammer would be required to firmly set the H-piles on bedrock. To meet the Project schedule, two barge-mounted impact drivers would be required (ENERCON 2012a).

Once the foundation piles are installed for the plenum boxes, transition boxes and ABS support platform, a barge-mounted concrete batch plant would be used to generate tremie concrete that would be poured to form the pile caps and complete the concrete walls of the ABS Building (ENERCON 2012a).

Tugboats would be used to maneuver and position equipment and material transport barges during construction. In addition to the delivery of large components of the CWWS from out of state, construction of the CWWS array requires transport of a variety of materials and system components by barge from the staging area to IPEC, including items such as raw materials for the production of tremie concrete, H-piles/sheet piles, ABS piping, rip rap, and marine mattresses. Dredge spoils and debris would be moved to the off-site staging area for unloading, processing, and offsite disposal (ENERCON 2012a). Smaller watercraft would be used to shuttle construction workers to and from the various work barges and to support dive teams during various portions of the construction process (ENERCON 2012a).

2.5.7 CWWS Construction Work Zones

The proposed construction methodology for each construction work zone is described in detail in the Technical Design Report (ENERCON 2012a).

2.6 DREDGE VOLUMES FOR CONSTRUCTION ZONES

Installation of the CWWS array for Units 2 and 3 would involve removal of existing river bottom sediments in areas occupied by screen array components, structural foundations and piping systems. A total volume of approximately 100,000 cubic yards (“yd^3”) of excavated material is conservatively estimated to be removed to allow placement of the CWWS systems (ENERCON 2012b). To calculate dredged material handling volume estimates, a 20 percent expansion factor should be applied (i.e., 120,000 yd^3) (ENERCON 2012a). Of the total excavated volume (after application of the expansion factor), it is conservatively estimated that 25,000 yd^3 may require special handling and/or treatment (ENERCON 2012b). Dredged material requiring special handling or treatment would be loaded directly onto awaiting barges for transportation to an approved treatment and disposal facility. Dredged material not requiring special handling or treatment would be loaded onto awaiting barges for transportation to an off-site staging area for dewatering and ultimate disposal at an approved upland disposal site.

The approximate in-river construction area associated with installation of CWWS array is identified in Table 2.6-1. Most of the CWWS components would be installed below grade and resedimentation in the areas disturbed by dredging and installation of CWWS system components would occur. The area of river bottom that would remain permanently altered is discussed in Chapter 4.0. Dredge volume estimates for the CWWS system are listed in Table 2.6-2 (ENERCON 2012b).

Table 2.6-1
CWWS System In-Water Construction Area

Zone	Item	Area (ft^2)	Quantity	Total Area (ft^2)
1	Risers	20	144	2,880
	Plenum Box (minus risers)	2,190	12	26,276
	Marine Mattress	20,298	1	20,298
	Rip-Rap Backfill	5,531	2	11,062
2	Transition Box	1,759	4	7,038
	Rip-Rap	1,700	2	3,400
3	Marine Mattress	33,417	2	66,834
4	Marine Mattress (Unit 2)	38,179	1	38,179
	Marine Mattress (Unit 3)	41,737	1	41,737
5	Intake Ducts	1,335	4	5,339
Total				222,990 ft^2 24,777 yds 5.12 acres (rounded to 5.2 acres +/-)

Note: Calculations do not include the ABS Building and its foundation, which would result in an additional small increment in surface area.
Source ENERCON 2012b.

Table 2.6-2
Projected CWWS System Excavation Volumes

Zone	Volume (yd^3)
1	35,569
2	10,986
3	30,406
4	19,303
5	1,752
Total	98,016
Roundup	99,000

Note: Calculations do not include the ABS Building and its foundation which would result in an additional small increment in dredge volume.
Source ENERCON 2012b.

In addition to the river bottom area to be occupied by the CWWS components, it is anticipated that vessel mooring would occur within the S&SZ. Because the exact locations cannot be known ahead of time, it is estimated that mooring could occur within the general area outlined by the boundaries of the S&SZ. Depending upon the types of construction vessels employed by the selected construction contractor, it is possible that mooring could consist of anchors, spud barge legs, or jack-up barge legs.

2.6.1 Analysis of Dredge Material

Past testing of spoils from the Hudson River performed by IPEC (and the Riverkeeper [Gobler 2008]) has not revealed the presence of elevated levels of hazardous contaminants, such as polychlorinated biphenyls ("PCBs") or radionuclides. Radionuclides in various media are tested annually in the plant vicinity (Entergy 2011). In fact, Entergy has tested sediment samples for radiological contaminants during previous dredging/spoils removal maintenance activities and has detected only very low levels of Cesium-137 ("Cs-137") consistent with historical annual average concentrations at IPEC (Entergy 2011) (samples from 2007 measured Cs-137 at an average of 368 picocuries ["pCi"] per kilogram ["kg"]). Given prior analytical testing performed on sediments in front of IPEC, there is no expectation that radionuclides would be identified above background levels. In the unlikely event that radionuclides are identified at levels above background, Entergy is expert in managing radiological material, and any material above background attributable to IPEC would be properly managed.

2.6.2 Construction Best Management Practices

To minimize significant adverse environmental impacts, ENERCON would implement state-of-the-art BMPs. BMPs would be consistent with Entergy's existing facility controls and procedures that are designed to ensure safety and minimize environmental impacts. While BMP's would be refined during the final permitting process, key examples of these BMP's include items listed in Sections 2.6.2.1 through 2.6.2.4, below.

2.6.2.1 In-River Construction Procedures

- All vessel based operations would be performed in accordance with applicable USCG regulations and requirements, as well as in accordance with any environmental permits and approvals required for the Project.

- During dredging operations, dredge spoil barges would not be allowed to overflow, unless the construction contractor develops a method approved by regulators for treating the overflow water to ensure that any discharge is in compliance with regulatory requirements.

- All working barges (i.e., working platforms) would have a dedicated Spill Prevention and Countermeasures Control Plan ("SPCC Plan") and be equipped with spill control equipment. In addition, the construction contractor would be required to certify that personnel trained in the proper use of this equipment were on-board during equipment operation.

- Entergy will coordinate with the USCG and local harbormasters to develop acceptable navigation windows for barge transport that may fall outside the IPEC S&SZ. Additional signage and channel markers also would be used to inform recreational boaters of potential dangers within or immediately outside the work zone.

- Work zone area lighting would be used, as needed, during the typical 11-hour work day. To the extent practicable, area lighting will be downward facing. Vessel lighting at night would conform with USCG regulations.

2.6.2.2 Hazardous Materials Procedures

Substantial hazardous material generated by the Project, and therefore its management or handling, is not expected. Nonetheless, potentially hazardous materials generated will be segregated, properly stored, and labeled in accordance with all applicable regulatory requirements and disposed at an approved/licensed facility in accordance with applicable law.

2.6.2.3 Spill Prevention

Spills and releases of hazardous materials are not expected. Nonetheless, the following procedures and precautions would be implemented to protect against accidental spills and uncontrolled releases of hazardous materials during construction activities:

- An SPCC Plan would be developed to address the BMPs to be implemented during construction.

- All employees and/or other handlers of hazardous materials would be properly trained and instructed on the proper reporting and handling requirements.

- All equipment would be maintained in good operating condition and inspected on a regular basis.

- Petroleum products that are not in vehicles would be stored in tightly sealed containers that are clearly labeled.

- Equipment refueling would be performed away from conveyance channels, where possible.

- All equipment refueling would be conducted with extreme care, under continual surveillance using procedures to minimize the potential for a release to occur.

- Land based hazardous materials would not be stored within 100 feet of a waterbody or wetland (Note: This applies to storage and does not apply to normal operation or use of equipment in these areas).

- All equipment operating on the site would have sufficient spill containment equipment on board to provide for prompt cleanup in the event of a release.

2.6.2.4 Construction Oversight

Entergy would assign on-site construction inspectors, as needed, to ensure that construction activities are performed in accordance with contract specifications. In addition, the construction inspectors would be responsible for the following:

- Ensure that all construction activities, environmental mitigation measures and operations are conducted in strict compliance with federal, state and local environmental health and safety regulations and environmental permits.

- Coordinate on-site inspections to confirm the continued proper use, storage and disposal of on-site materials and containers and to ensure that procedures are in place to minimize the potential for pollutants to escape into the environment.

- Provide pollution prevention briefings to the construction contractors at intervals frequent enough to assure adequate understanding of the proper management practices as documented in the SPCC Plan.

- The construction inspectors would be Occupational Safety and Health Administration ("OSHA") Certified for Hazardous Waste Responders and would be responsible for providing the first line of defensive actions in the unlikely event of a release.

2.7 EXPECTED OPERATION AND MAINTENANCE REQUIREMENTS

Operation and maintenance ("O&M") requirements for CWWSs could include the following (ENERCON 2012a):

- Periodic diver surveys.
- Inspection/lubrication of isolation valves and gates.
- Manual exercising of isolation valves.
- Inspection and maintenance of the CWWSs using divers or cameras.
- Inspection of the ABS system.

Station personnel would likely perform O&M activities associated with maintenance of the ABS and isolation valves and gates. The frequency of manual cleaning of the screens would be optimized following installation in order to account for site-specific conditions at the IPEC Site (ENERCON 2012a).

Maintenance costs would include the costs required to maintain the new ABS, and the new sluice gate systems. Additional underwater inspection and cleaning of the CWWSs would likely be performed by a team of divers, on an as-needed basis (ENERCON 2012a).

2.8 ANTICIPATED MAJOR PERMITS, LICENSES AND APPROVALS

The federal and state authorizations and/or consultations potentially required to support construction and operation of the proposed CWWS system at IPEC are listed in Table 2.8-1. The listing will be refined as the design of the proposed CWWS system progresses. Currently, based on the CWWS design presented in this ER, it is anticipated that no NRC license amendment would be required for the proposed configuration change, and that these changes could be completed under the 50.59 Evaluation Process per 10 CFR 50.59(d)(2).

Table 2.8-1
List of Anticipated Permits, Approvals and Consultations for the Installation of CWWS

Agency	Regulatory Authority	Jurisdictional Area
FEDERAL		
U.S. Army Corps of Engineers ("USACE"), New York District	Section 10 Permit Section 404 Permit Marine Protection, Research and Sanctuary Act Permit (If ocean disposal of dredge material is pursued)	Construction of structures in, under or over Navigable Waters Dredge or Fill in Waters of the U.S. Ocean dumping of dredged material. The disposal must meet criteria set forth by USEPA under the Act.
U.S. Department of the Interior, U.S. Fish and Wildlife Service ("USFWS")	Consultation with USFWS relative to the Endangered Species Act, Bald and Gold Eagle Protection Act, Migratory Bird Treaty Act, Fish and Wildlife Coordination Act	Federally-listed threatened and endangered species
U.S. Department of Interior, National Parks Service ("USNPS")	Consultation with NPS and the managing entities of the Hudson River Valley Natural Heritage Area (Hudson River Valley Greenway Communities Council and Greenway Conservancy for the Hudson River Valley) under Section 908 of Public Law 104-333	Hudson River Valley Natural Heritage Area
National Marine Fisheries Service ("NMFS")	Consultation with NMFS relative to the Endangered Species Act, Magnuson-Stevens Act, and Marine Mammal Protection Act.	Federally-listed threatened and endangered species; Marine Mammals; Essential Fish Habitat
U.S. Department of Homeland Security, United States Coast Guard ("USCG")	Maritime Safety, Homeland Security, National Defense, and Environmental Protection	U.S. ports, coasts, and inland waterways to address contractor right-of-entry
NEW YORK STATE		
New York State Office of General Services ("NYSOGS")	License for Easement	Underwater lands in New York
New York State Department of State ("NYSDOS")	Coastal Consistency Certificate for Federal authorizations	Activities within designated New York State coastal areas requiring a Federal permit action
New York State Department of Environmental Conservation ("NYSDEC")	Tidal Wetlands Permit Construction SPDES General Permit (GP-0-10-001) (Possible Construction Dewatering SPDES) 401 Water Quality Certification New York Natural Heritage Program Sign-off Protection of Waters Permit under Article 15 NY Environmental Conservation Law Water Withdrawal Permit (6 NYCRR 601) State Coastal Zone Policy	Tidal wetlands regulated by NYSDEC Stormwater discharges associated with construction activities Discharge to the waters of the U.S. if an individual permit is required by the USACE State-listed threatened and endangered species State waters of New York Construction of any water withdrawal system with an effective capacity of 100,000 gallons per day
New York State Office of Parks, Recreation and Historical Preservation (OPRHP). The OPRHP serves as the New York State Historic Preservation Office (NYSHPO). OPRHP herein is referred to as the NYSHPO.	Section 106 Review and Sign-off	Historic and archaeological resources

3.0 EXISTING CONDITIONS

The existing environmental conditions surrounding the IPEC Site and the lower Hudson River area are described in this Chapter. The resources included are:

- Air Quality
- Water Quantity and Quality
- Aquatic Ecology
- Terrestrial Ecology
- Electrical System
- Aesthetics
- Transportation
- Noise
- Environmental Justice
- Archaeological and Historical Resources.

As discussed in Chapter 1.0, the Interim Decision (NYSDEC 2008) called for a SEQRA analysis including the preparation of an SEIS to examine the significant adverse environmental impacts of closed-cycle cooling and any alternative technologies. The focus of this Chapter is on describing those resources that could reasonably be subject to potential significant adverse impact by CWWS construction and operation.

3.1 AIR QUALITY

This Section characterizes the regional ambient air quality conditions, as measured by NYSDEC. Applicable federal and state regulatory standards are identified and representative air quality data, including that within the Westchester County airshed, are presented. Information from the IPEC meteorological tower is summarized in Entergy's ER to the NRC in connection with the license renewal application for the Stations (Entergy 2007).

3.1.1 National and New York State Ambient Air Quality Standards

The USEPA has promulgated National Ambient Air Quality Standards ("NAAQS") to protect public health and welfare. NAAQS have been established for each of the following six major criteria pollutants: carbon monoxide ("CO"), lead ("Pb"), nitrogen dioxide ("NO_2"), ozone ("O_3"), particulate matter ("PM"), and sulfur dioxide ("SO_2"). Individual states may adopt standards more stringent than the federal NAAQS. The NYSDEC has established Ambient Air Quality Standards ("NYAAQS") for New York that are listed in 6 NYCRR Part 257 (1-10), Air Quality Standards. In some cases, the NYAAQSs are more stringent than the NAAQS, but in all cases the NYAAQS cannot be interpreted to allow NAAQS violations. The NYAAQS for total suspended particulates ("TSP") have been superseded by the more stringent respirable PM NAAQS for PM-10 and PM-2.5 and, therefore, the existing conditions for TSP are not relevant for this study. Table 3.1-1 provides a summary of the NAAQS applicable in Westchester County, which includes IPEC.

Table 3.1-1
National Ambient Air Quality Standards

Pollutant	Primary Standards	Averaging Times	Secondary Standards
Carbon Monoxide (CO)	9 ppm (10 mg/m^3)	8-hour$^{(1)}$	None
	35 ppm (40 mg/m^3)	1-hour$^{(1)}$	None
Lead (Pb)	0.15 μg/m$^{3(2)}$	Rolling 3-month Average	Same as Primary
Nitrogen Dioxide (NO_2)	0.053 ppm (100 μg/m^3)	Annual (Arithmetic Mean)	Same as Primary
	0.100 ppm	1-hour$^{(3)}$	None
Particulate Matter (PM-10)	150 μg/m^3	24-hour$^{(4)}$	None
Particulate Matter (PM-2.5)	12.0 μg/m^3	Annual$^{(5)}$ (Arith. Mean)	15 μg/m^3
	35 μg/m^3	24-hour$^{(6)}$	None
Ozone (O_3)	0.075 ppm (2008 std)	8-hour$^{(7)}$	Same as Primary
	0.08 ppm (1997 std)	8-hour$^{(8)}$	Same as Primary
	0.12 ppm	1-hour$^{(9)}$Not applicable in NYS	Same as Primary
Sulfur Oxide (SO_2)	0.03 ppm	Annual (Arith. Mean)	None
	0.14 ppm	24-hour$^{(1)}$	None
	-------	3-hour$^{(1)}$	0.5 ppm (1300 μg/m^3)
	0.075 ppm (2010 std)$^{(10)}$	1-hour	

Notes:

1) Not to be exceeded more than once per year.

(2) Effective January 12, 2009, replaces the previous quarterly average value of 1.5μg/m^3.

(3) To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).

(4) Not to be exceeded more than once per year on average over 3 years.

(5) To attain this standard, the 3-year average of the weighted annual mean PM-2.5 concentrations from single or multiple community-oriented monitors must not exceed 12.0 μg/m^3. Note: In 2012 EPA reduced the annual primary AAQS from 15 ug/m^3 to 12 μg/m^3 and retained the 15 μg/m^3 as the secondary standard.

(6) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 μg/m^3 (effective December 17, 2006).

(7) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

(8) (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

(b) The 1997 standard-and the implementation rules for that standard-will remain in place for implementation purposes as USEPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.

(c) USEPA is in the process of reconsidering these standards (set in March 2008).

(9) (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is < 1.

(b) As of June 15, 2005 USEPA revoked the 1-hour ozone standard in all areas except the 8-hour ozone non-attainment Early Action Compact ("EAC") Areas.

(10) Based on 3-year average of 99th percentile annual concentrations (effective August 23, 2010). Once in effect this rule also revokes the 24-hour and annual SO_2 AAQS but retains the 3-hour secondary standard.

mg/m^3 = milligrams per cubic meter.

ppm = parts per million.

μg/m^3 = micrograms per cubic meter.

Source: Title 40 Code of Federal Regulations Part 50 - National Primary and Secondary Ambient Air Quality Standards.

3.1.2 NYSDEC Background Air Measurements

The NYSDEC currently operates over 80 monitoring sites statewide for the measurement of criteria and non-criteria pollutants. The data recorded by the NYSDEC for the criteria pollutants are used to compare an area's air pollution levels to the NAAQS to determine attainment status classification. The data are also utilized for the development of attainment and maintenance plans, evaluation of the regional air quality models used in developing emission strategies, and the tracking of trends in air pollution abatement control measures aimed at improving air quality (the 2012 New York State air monitoring program is available on the NYSDEC website [NYSDEC 2013]).

Existing air quality is defined by measurements taken at regional ambient air quality monitors that are considered representative of the air quality in and around the IPEC Site. Recent ambient monitoring data can be used to reasonably characterize the existing background air quality experienced at a specific location, and in particular within the area surrounding IPEC.

3.1.3 PM-10 and PM-2.5 Attainment Status – Westchester County

An area is designated as a "non-attainment" area when it does not achieve the ambient air quality standard based on representative quality assured background monitoring data. Conversely, an area is considered in "attainment" when monitoring data has not shown a violation of the standard for at least the past three years of monitoring. Westchester County is currently classified as being in attainment with all NAAQS (Table 3.1-1), with the exception of the eight-hour ozone standard, the annual PM-2.5 standard, and the 24-hour PM-2.5 standard.

Westchester County is attainment for PM-10. Westchester County was designated on December 17, 2004 as a non-attainment area for the annual PM-2.5 NAAQS established in 1997, and on December 14, 2009 the county was designated as a non-attainment area for the 24-hour PM-2.5 NAAQS established in 2006. Westchester County currently remains designated as in non-attainment with these standards.

NYSDEC has filed with USEPA a redesignation request for attainment of Westchester County with the annual PM-2.5 standard, which remains pending. On December 31, 2012, USEPA issued a final rule determining that the New York-Northern New Jersey-Long Island, non-attainment area for the 2006 24-hour PM-2.5 NAAQS has attained the 2006 24-hour PM-2.5 standard. This rule opens the redesignation path for Westchester County and the next step in the process is for NYSDEC to formally notice for public comment its revised State Implementation Plan ("SIP") and maintenance plan for redesignation to attainment with the PM-2.5 2006 NAAQS. Upon state approval, NYSDEC will submit the revised SIP to USEPA for approval. The anticipated USEPA approval and final redesignation to attainment is on or about the stipulated attainment date of December 14, 2014, but may extend well into 2015 (Table 3.1-2).

3.1.4 NYSDEC Monitoring in Southern New York

With respect to PM-10 concentrations, the representative NYSDEC monitors for PM-10 nearest to the IPEC Site are located in Suffern (Rockland County), roughly 15 miles southwest of the site, and in Mount Ninham (Putnam County), approximately 20 miles northeast of the IPEC Site (both of these monitors were operated only through 1998 and do not represent a temporal background for the region, and were not used). The next closest NYSDEC monitor for PM-10 is the Morrisania monitoring station in New York County (for the years 2010 and 2011), approximately 30 miles south of the IPEC Site in an urban area.

Table 3.1-3 presents ambient concentration data for PM-10 and PM-2.5, based on the highest values recorded at the monitors that were discussed in the preceding paragraphs, along with the corresponding NAAQS. Comparison of the ambient concentrations to the NAAQS in Table 3.1-1 shows that measured concentrations of PM-2.5 achieve the NAAQS. Averaging the most recent three years of PM-2.5 monitoring data allows for comparison with the NAAQS, and is in accordance with the USEPA's definition of the ambient standard (40 CFR § 50.7). Data from 2010 and 2011 show that the maximum 24-hour PM-10 level (37 $\mu g/m^3$) during that period is 25 percent of the NAAQS (150 $\mu g/m^3$); the three-year average 24-hour PM-2.5 level (22.6 $\mu g/m^3$) is 65 percent of the NAAQS (35 $\mu g/m^3$); and the three-year average annual PM-2.5 concentration (8.2 $\mu g/m^3$) is 68 percent of the NAAQS (12 $\mu g/m^3$).

Table 3.1-2
PM-2.5 National Ambient Air Quality Standards Implementation Timeline

Milestone	Deadline
Promulgation of Standard	September 21, 2006
Effective Date of Standard	December 18, 2006
State Recommendations to USEPA	1 year after new standard – December 18, 2007 (based on 2004 - 2006 monitoring data)
Final Designations Signature	2 years after new standard – December 22, 2008 (based on 2005 - 2007 monitoring data). – October 8, 2009 (based on 2006 - 2008 monitoring data) Published November 13, 2009
Effective Date of Designations	30 days after publication in the Federal Register – December 14, 2009
SIPs Due	3 years after effective date of designations – December 14, 2012
Attainment Date	No later than 5 years after effective date of designations – December 14, 2014
Attainment Date with Extension	No later than 10 years from effective date of designations – December 14, 2019
Source: USEPA 2013a.	

Table 3.1-2 presents the timeline for achieving compliance with the PM-2.5 24-hour NAAQS. As illustrated by the timeline and depending on air quality monitoring results, Westchester County may continue to be designated a non-attainment area for 24-hour PM-2.5 until December 2014, and possibly later.

Table 3.1-3
Background Concentrations of Inhalable Particulates (PM-10 and PM-2.5)

Pollutant	Averaging Period	Units	Ambient Concentration ($\mu g/m^3$)			NAAQS ($\mu g/m^3$)	Monitor Location
			2009	2010	2011		
PM-10	24-hour[a]	$\mu g/m^3$	--	32	37	150	Morrisania, 1225-57 Gerard Ave., New York County, NY
PM-2.5	24-hour[b]	$\mu g/m^3$	20.6	26.5	20.8	35	Newburg Monitor Orange County, NY
	Annual [c]	$\mu g/m^3$	7.9	8.1	8.6	12	

Notes:
[a] 24-hour PM-10 is the highest of the second-highest recorded values (allowing for 1 exceedance per year).
[b] 24-Hour PM-2.5 is the 98th percentile value.
[c] Annual PM-2.5 is the maximum annual value.
$\mu g/m^3$ = micrograms per cubic meter.

Source: Monitored background concentrations obtained from the USEPA AIRData and NYSDEC websites (USEPA 2013b and NYSDEC 2013).

With respect to all other NAAQS (Table 3.1-1), Westchester County is classified as being in attainment.

3.1.5 Current Air Permit Status of Units 2 and 3

The IPEC Stations comply with applicable air regulations for regulated air pollutants per 6 NYCRR Part 200.1(bu) *Regulated air pollutant or regulated air contaminant*, which includes:

- Nitrogen oxides and any volatile organic compounds.
- Any air pollutant or contaminant for which a NAAQS has been promulgated including PM, SO_2, CO, and Pb.
- Any air pollutant or contaminant that is subject to any standard promulgated pursuant to § 111 of the Clean Air Act ("CAA") including the new source performance standards ("NSPS") in 40 CFR Part 60, et seq.
- Any Class I or II Ozone Depleting Substance subject to a standard promulgated pursuant to § 601 of the CAA.

Unit 2 (and Unit 1) is designated as Facility DEC ID: 3552200011, and Entergy currently holds a NYSDEC State Facility Permit (NYDEC Permit No: 3-5522-00011/00026) for these units. This Permit addresses the emissions cap for oxides of nitrogen to limit annual emissions to below the 25 tons per year ("t/yr") non-attainment threshold (which is required because Westchester County is designated non-attainment for ozone of which nitrogen oxides are a precursor contaminant). Emissions of the other regulated air pollutants are below any major source threshold. The Unit 2 Permit is current and includes registrations for operation of the following equipment: one stationary diesel generator rated at 3,740 hp, two 65 Million British Thermal Units per hour ("MMBTU/hour") boilers, and three combustion turbine generators rated at 260, 345, and 239 MMBTU/hour each (which while permitted are rarely, if ever, used), in addition to multiple small combustion sources such as emergency diesel generators, compressors, etc, which are not specifically included in the Permit but their emissions must be included in the monthly total as required by the Permit. The various generators are for short-term temporary use for emergency backup power and to provide startup and safe shutdown of Unit 2. The generators are run during periodic testing.

The Unit 3 Air Permit (NYDEC Permit No. 3-5522-00105/0009 addresses the emissions cap for oxides of nitrogen to limit annual emissions to below the 25 t/yr non-attainment threshold. Emissions of the other regulated air pollutants are below any major source threshold. Unit 3 is permitted to operate 14 fossil fuel fired combustion units, which include: ten diesel emergency generators, one propane internal combustion engine, one boiler of 163 MMBTU/hour capacity firing #2 fuel oil, one boiler of 2.6 MMBTU/hour capacity firing #2 fuel oil, and one hot water heater firing #2 fuel oil. This generating equipment is for emergency backup power and short-term temporary use to provide startup and safe shutdown of Unit 3 (with the exception of the 2.6 MMBTU boiler and hot water heater, which are used for heat and hot water at the training facility). The generation equipment is run during periodic testing.

The existing air quality impact from the currently permitted emergency generators at the Stations is considered negligible by NYSDEC, which does not normally require air modeling analysis of such impacts in connection with State Facility Air Permits. Each of IPEC's NYSDEC Air Facility Permit has a cap for annual nitrous oxides ("NO_x") emissions of 24.5 t/yr.

Overall, the Stations have extremely low air contaminant emissions, including with respect to greenhouse gases, because the traditional combustion sources necessary to support the facility are few and relatively small. Therefore, IPEC has a negligible "carbon footprint," especially relative to other classes of energy generation using fossil fuels as the primary fuel for electric generation.

In a report and testimony to the NRC, NERA (2012) developed estimates of the potential increases in carbon dioxide ("CO_2") emissions if IPEC were removed from the electricity system. NERA (2012) noted that while nuclear plants like IPEC emit negligible CO_2 emissions, coal plants emit about 2,100 lbs of CO_2 per megawatt hour ("MWh") on average and natural gas plants emit about 900 lbs of CO_2 per MWh on average. Based on empirical modeling results, NERA (2012) found that, if IPEC were removed from the electricity system, the market response in New York and other states would include significantly increased generation from existing fossil fuel facilities (relative to a baseline scenario in which IPEC continued to operate). The increased generation from such facilities would increase annual CO_2 emissions above baseline levels by about 13.5 million metric tons (on average, based on modeling results from 2016 to 2025). The empirical model for this analysis incorporated the Regional Greenhouse Gas Initiative ("RGGI"), the CO_2 cap-and-trade program covering the power sector in New York and several other Northeastern states. Carbon dioxide emissions could increase from removal of IPEC because baseline emissions in RGGI states were projected to be below cap levels and because some of the increased generation would come from coal and natural gas plants outside RGGI states.

3.2 WATER QUANTITY AND QUALITY

This Section provides a description of the water resources in the vicinity of the IPEC Site, including a description of the Hudson River's physical and chemical characteristics. This Section also provides limited background information for the Hudson River and lower estuary.

3.2.1 Indian Point Region

In connection with administration of the Hudson River Biological Monitoring Program ("HRBMP"), the lower Hudson River was subdivided into 13 study areas or regions between the Federal Dam at Troy and the Battery (i.e., New York Harbor). The 13 designated regions are shown in Figure 3.2-1 and have been adopted for use in this ER to characterize water quantity and water quality monitoring results.

IPEC is located at approximately RM 42 within the Indian Point study area or Region 4, which extends from RM 39 to RM 46. As shown in Figure 3.2-2a, in the northern portion of Region 4 the river channel narrows and reaches depths exceeding 150 feet. In the southern portion shown in Figure 3.2-2b, the river bottom becomes progressively shallower prior to reaching the northern end of Haverstraw Bay, which is located at approximately RM 39. At the IPEC Site, the Hudson River is approximately 4,500 feet wide and 40 feet deep, on average, with depths reaching over 60 feet below mean lower low water ("MLLW") at some locations (ENERCON 2010). Adjacent to the Unit 2 and Unit 3 CWISs, water depth is maintained at approximately 27 feet below MSL through periodic maintenance dredging. Dredging is performed on an as needed basis, roughly every five years.

3.2.2 Hudson River Overview

As shown in Figure 3.2-3, the Hudson River extends approximately 315 miles from its headwaters in the Adirondack Mountains to New York Harbor. The lower Hudson River, extending from the Federal Dam at Troy to New York Harbor, is maintained as a navigable waterway for commercial traffic by the USACE. The USACE's navigation project authorizes a channel width of 400 feet from the Port of Albany to Kingston and a channel width of 600 feet from Kingston to New York City (USACE 2010). Designated anchorages are located near Hudson and Stuyvesant. The authorized channel depth is 32 feet referenced to MLLW in soft bottom sediments and 34 feet MLLW in rock (USACE 2010). Major drainage areas of the Hudson River Basin are listed in Table 3.2-1 (CHGE et al. 1999).

Table 3.2-1
Major Drainage Areas to the Hudson River

Watershed	Drainage Area		Percent of Total
	$mile^2$	km^2	%
Upper Hudson	4,627	11,984	34.6
Mohawk River	3,462	8,967	25.9
Hudson River above Green Island	8,090	20,953	60.5
Lower Hudson Above Newburg	12,000	31,080	89.7
Lower Hudson above the Battery	13,366	34,618	100.0
Source: CHGE et al. 1999.			

Over its 154-mile length, the lower Hudson River is tidal. Under normal flow conditions, approximately 75 percent of the total freshwater inflow to the lower Hudson River enters upstream of the United States Geological Survey ("USGS") Gaging Station at Green Island, with the remaining 25 percent contributed by tributaries discharging primarily into the upper reaches of the estuary below the Federal Dam at Troy (CHGE et al. 1999). Saltwater enters the estuary from New York Harbor.

Because the bottom elevation of the lower Hudson River remains below MSL, the location of the interface between fresh and salty water (i.e., the salt front) migrates with variations in the quantity of freshwater inflow. During the spring when river flow is seasonally high, the salt front is typically located south of the Tappan Zee Bridge (NYSDEC 2009). The salt front typically migrates upriver to the Newburg-Beacon Bridge by late summer, when freshwater inflow is seasonally low (NYSDEC 2009). Locally, however, the position of the salt front also changes in response to tidal conditions, major runoff producing events, and directed releases from the Great Sacandaga Lake reservoir located in the Adirondack Mountains. Under drought conditions, NYSDEC currently directs water releases from the reservoir to maintain the salt front downstream of Poughkeepsie to prevent salty water from being drawn into the City of Poughkeepsie's public drinking water supply intake (NYSDEC 2009).

Tidally induced flow in the lower Hudson River estuary is significantly greater than freshwater inflow (CHGE et al. 1999). The mean tidal flow in the lower Hudson River ranges from approximately 400,000 cubic feet per second ("cfs") at the Battery to 0 ("zero") cfs at the Federal Dam at Troy (CHGE et al. 1999). Within the middle reaches of the estuary, tidally induced flow is estimated to range between 100,000 cfs and 150,000 cfs (CHGE et al. 1999). In the vicinity of the IPEC Site, the average tidal exchange flow would range between approximately 160,000 cfs and 230,000 cfs. By comparison, average monthly flows at Green Island typically range from 6,200 cfs to 31,000 cfs. Therefore, freshwater flow typically is less than 20 percent of the tidally induced flow past the IPEC Site.

Larger tributaries discharging into the lower Hudson River below the Federal Dam at Troy are listed in Table 3.2-2. Table 3.2-2 also lists corresponding tributary drainage areas and average annual discharge estimates for selected tributaries.

Table 3.2-2
Larger Tributaries to the Lower Hudson River Below the Federal Dam at Troy

Tributary	River Mile (RM)	Drainage Area (mile^2)	Mean Flow (cfs)
Sparkill Creek	24.5	-	-
Croton River	34.0	378	-
Moodna Creek	58.0	-	-
Fishkill Creek	60.0	-	-
Wappinger Creek	67.8	208	254
Rondout Creek	92.0	1197	-
Esopus Creek	103.0	425	588
Roeliff-Jansen Kill	111.0	208	-
Catskill Creek	113.0	417	-
Kinderhook Creek	122.0	512	-
Moordener Kill	138.5	33	38
Normans Kill	144.0	168	145
Source: CHGE et al. 1999.			

3.2.3 Tidal Characteristics of the Lower Hudson River

Tidal conditions along the lower Hudson River are influenced by several factors, which include: variations in channel width; cross sectional area; distance upstream from the Battery and regional weather conditions (CHGE et al. 1999). Combined, these factors contribute to differences in tidal amplitude (i.e., the difference in tidal stage between high and low tide) and current speed. The mean tide range in the lower Hudson River varies with location. The mean tidal range at IPEC from July through September 2010 was approximately 3.5 feet and fluctuated from +2 feet to -2 feet MSL (ASA 2011). Tidal range downstream was typically greater than that observed at IPEC due to proximity to the Atlantic Ocean and was recorded to be 4.76 feet, on average, at the Battery (ASA 2011).

Current reversals in the lower Hudson River typically occur four times per day, approximately once every 6.2 hours, with two high tides and two low tides occurring over an approximately 24.8-hour period. This is referred to as a semi-diurnal tide. Tidal amplitudes and current speeds also vary in a cyclic manner in accordance with the lunar month, which extends approximately 28 days.

3.2.4 Water Quality Characteristics

The lower Hudson River Basin is one of the most diverse river basins state-wide (NYSDEC 2008). It encompasses portions of New York City, as well as other urban centers, highly populated and developed suburbs, rural and agricultural areas, and largely unpopulated forested lands, including much of the 700,000 acre Catskill Park (NYSDEC 2008).

Because of the diverse land use characteristics throughout the basin, water quality characteristics are influenced by a wide variety of sources (NYSDEC 2008). Municipal wastewater discharges, urban runoff, contaminated sediments from past industrial activities, sprawling suburban development, agricultural runoff, inadequate on-site septic system treatment, streambank erosion and atmospheric deposition are just some of the sources that influence basin-wide water quality (NYSDEC 2008). These are fairly common concerns in watersheds that are highly populated and support a wide variety of uses (NYSDEC 2008).

For example, various recreational uses, aquatic life use support, and aesthetics in urban rivers and streams throughout the basin are restricted by pollutants from various industrial, municipal, and commercial sources, including urban runoff. The most significantly affected of these waterbodies are located in the New York City metropolitan area and the Albany Pool at the head of the estuary. Nevertheless, improvements in lower Hudson River water quality characteristics since the 1970s has been significant (NYSDEC 2008). As a result, there has been a rise in recreational use and growing public interest for increased swimming opportunities (NYSDEC 2008).

The current NYSDEC water quality classification for the lower Hudson River at the IPEC Site is Class SB. Class SB waters are designated for primary contact recreation, secondary contact recreation and fishing. In addition, Class SB waters should be suitable for both fish propagation and survival.

The federal CWA requires states to periodically assess and report on the quality of waters in their state. Section 305(b) requires NYSDEC to report on the overall condition of surface waters and Section 303(d) requires states to identify *impaired waters*, where designated uses are not fully supported. The *New York State Section 303(d) List of Impaired Waters, which is updated* *every two years,* identifies those waters that do not support appropriate uses and that may require development of a Total Maximum Daily Load ("TMDL"). The most recent Section 303(d) list, including the lower Hudson River Basin, is the Final Approved 2012 New York State Section 303(d) List, Revised February 2013 (NYSDEC 2013).

The lower Hudson River from Albany to the Battery is not listed as impaired on the New York State § 303(d) List for 2012 for temperature or any other attribute reasonably attributable to IPEC. In addition, it is not listed as requiring TMDL development (NYSDEC 2013). Instead, the § 303(d) list indicates the Hudson River in the vicinity of IPEC is impaired solely due to fish consumption advisories issued by the New York State Department of Health ("NYSDOH"). Waters listed as impaired for fish consumption are based on NYSDOH advisories contained in its annual *"Health Advice on Eating Sportfish and Game"* (NYSDOH 2012). NYSDEC lists the source of impairment as "contaminated sediment" (NYSDEC 2013).

These advisories are the result of past industrial discharges, particularly polychlorinated biphenyl ("PCB") discharges in the upper Hudson River (NYSDEC 2008). Atmospheric deposition and toxic/contaminated sediments related to past industrial and municipal discharges basin-wide are also identified as contributing to the fish consumption advisories (NYSDEC 2008). Substances of potential concern include mercury, dioxins/furans, polycyclic aromatic hydrocarbons ("PAHs"), pesticides and other heavy metals (NYSDEC 2013). The most frequently cited sources affecting water quality in the lower Hudson River Basin are past industrial discharges, urban stormwater runoff, agricultural activity and municipal wastewater discharges.

3.2.4.1 Water Temperature

Within the lower Hudson River, temperature varies both temporally and spatially across the length, width and depth of the estuary (ASA 2010b). To evaluate thermal conditions associated with the IPEC discharge, a triaxial thermal study was conducted in late summer and early fall of 2009 consisting of a combination of field work, data analysis and numerical modeling. A report documenting the triaxial thermal study (ASA 2010b) was submitted to NYSDEC on March 22, 2010 that described the field program, the thermal modeling approach and the model results.

At NYSDEC's request, Applied Science Associates, Inc. ("ASA") and Normandeau designed and performed the summer 2010 triaxial thermal study to provide additional validation of the model. The field survey consisted of long term, high resolution, fixed station temperature, current and salinity observations, as well as two days of mobile surveys that captured currents, temperature and salinity profiles in the River at various stages of the tide (ASA 2011). Data were analyzed, along with other publicly available river and meteorological observations to: 1) assess the dynamics of the thermal plume resulting from the IPEC discharge, and 2) to understand the response of the plume to various environmental forcing factors, including tides, water temperature, salinity and meteorological conditions (ASA 2011).

The model validation results for the summer 2010 triaxial thermal study showed that the 4°F temperature rise covered less than 8 percent of the River's vertical cross sectional area at all times during the simulation period, and generally covered less than 2 percent of the cross sectional area compared to the thermal water quality cross sectional area limit of 50 percent (ASA 2011). The model validation results also showed that the surface extent of the 4°F temperature rise was less than 24 percent across the River at all times, and generally less than 10 percent compared to the surface width water quality limit of 67 percent (ASA 2010a). Thus, the model results show that IPEC is in compliance with the dimensional criteria in the NYSDEC thermal water quality standards for the 2010 study period, as it was during the 2009 calibration period (ASA 2010a).

NYSDEC staff reviewed data and information contained in Entergy's "*2010 Field Program and Modeling Analysis of the Cooling Water Discharge from the Indian Point Energy Center*", as well as "*Responses to NYSDEC Staff review comments*" and, based upon this information and the applicable regulations (6 NYCRR Part 704 - Criteria Governing Thermal Discharges), determined that Entergy had provided sufficient thermal analyses and information. Further, NYSDEC Staff determined that an allowance for a thermal mixing zone in the Hudson River near IPEC not to exceed a maximum of 75 acres in total size during any time of a given year (6 NYCRR §704.3) will provide reasonable assurance of compliance with water quality standards and criteria for thermal discharges set forth in 6 NYCRR §§ 704.1 and 704.2, respectively (Letter to Judges Villa and O'Connell dated May 16, 2011 from Mark D. Sanza, Assistant Counsel, NYSDEC, Office of General Counsel).

3.2.4.2 Salinity

Salinity is a measure of the salt content of a waterbody. Four salinity zones have been identified in the lower Hudson River (CHGE et al. 1999):

- Polyhaline (high salinity, 18 practical salinity units ["psu"] to 30 psu): RM 1 – RM 19
- Mesohaline (moderate salinity, 5 psu to 18 psu): RM 19 – RM 40
- Oligohaline (low salinity, 0.5 psu to 5 psu): RM 40 – RM 68
- Tidal freshwater: RM 68 – RM 152.

The IPEC Site is located in the oligohaline zone upstream of Haverstraw Bay and generally experiences salinities ranging between 0.5 psu and 5 psu. Under drought conditions, however, the salinity of the lower Hudson River at the IPEC Site can range from 5 psu to 10 psu.

ASA developed an empirical relationship to estimate salinity entering the IPEC intake based on salinity measured at other locations in the River (ASA 2010c). The data sets used for this analysis consisted of conductivity measurements taken every 15 minutes by the USGS at Hastings-on-Hudson (Hastings), Tomkins Cove (Tomkins), and West Point (ASA 2010c). The Hastings station is located 21 miles downstream of IPEC and has been operating continuously since 1992. The West Point station is located nine miles upstream of IPEC and has been operating continuously since 1991 (ASA 2010c). The Tomkins station is located one mile downstream of IPEC, but was discontinued in 2001 (ASA 2010c).

ASA indicated that salinities were typically higher in the summer and fall seasons (ASA 2010c). A statistical analysis was performed on the hourly-modeled salinity predictions at IPEC for the decadal period 2000 through 2009. The mean salinity over the entire period was 1.80 psu, the minimum 0.07 psu and the maximum 7.67 psu. The median, or 50th percentile, was 0.72 psu (ASA 2010c).

3.2.4.3 Dissolved Oxygen

The dissolved oxygen ("DO") concentration of a waterbody can affect the type, distribution and abundance of aquatic organisms. DO is determined by the interaction of several biological and physical processes. These include photosynthesis, mixing, respiration, microbial decomposition, temperature, salinity and atmospheric pressure (CHGE et al. 1999). On a seasonal basis, DO is generally highest during the winter and spring, when water temperature (and biological activity) is low. Primary production and subsequent decomposition of organic matter, whether natural or man-made, can decrease DO concentrations during the summer and fall (CHGE et al. 1999).

The NYSDEC ambient water quality criterion for DO in Class SB waters is as follows:

> *"Not less than a daily average of 4.8 mg/l, with excursions between 4.8 mg/l and 3.0 mg/l allowed for a limited number of days. The DO concentration shall not be less than 3.0 mg/l at any time."*

Over 7,600 DO measurements were recorded in Region 4 during Long River Surveys ("LRS") performed from 1997 through 2011 (Normandeau 2013). At four stations in Region 4, DO measurements were taken at the surface, mid-depth and bottom. At two stations in Region 4 where water depth was less than 20 feet, DO measurements were taken at the surface and bottom. For all stations in Region 4, DO concentrations consistently met applicable water quality criteria and were nearly always (i.e., greater than 91 percent of the time) above 6 milligrams per liter ("mg/l") (Normandeau 2013).

3.2.4.4 Suspended Sediment and Sediment Transport

Numerous investigators have evaluated sediment transport, deposition, and erosional processes along the lower Hudson River. Large scale sediment processes are controlled by the interaction of tides, fresh water inputs, bed morphology, sediment supply, and hydrodynamics (Nitsche et al. 2010). The regional sediment distribution consists of marine sand-dominated sediments in New York Harbor, a mud-dominated central section, and fluvial sand-dominated sediments between Kingston and Albany (Nitsche et al. 2007). Locally, however, regional trends can be highly modified by small-scale variations in sediment distribution (Nitsche et al. 2007).

Sediment enters the lower Hudson River from the upper Hudson River and the multiple small rivers and streams located below the Federal Dam at Troy (ASA 2013). In addition, fine grained suspended sediment can move upriver from New York Harbor by estuarine circulation and tidal currents (Geyer et al. 2001). However, continuous upriver transport is inconsistent with the long-term sediment budget for the estuary (Geyer et al. 2001).

Estuary turbidity maxima ("ETM") occur when freshwater flow mixes with saltwater flow (ASA 2013). The location of the ETM is identified by decreasing suspended sediment concentrations up- and downriver and elevated concentrations where the two water masses interact (ASA 2013). Bokuniewicz identified two ETM zones in the lower Hudson River (Bokuniewicz 1996, as cited in Nitsche et al. 2010). The first is located between RM 5 and RM 20 and the second, which is less stable and varies with salt front migration, is located between RM 34 and RM 46 (Bokuniewicz 1996, as cited in Nitsche et al. 2010). Geyer, et al., found that suspended sediment concentrations in the ETM at the bottom of the water column approach 1000 mg/l near the George Washington Bridge (Geyer et al. 2001).

The bottom characteristics and morphology of the River in the project vicinity have been characterized using high-resolution multi-beam bathymetry, side-scan sonar, sub-bottom profile surveys (i.e., acoustic backscatter data), sediment cores and sediment grab samples under the Hudson River Benthic Mapping Project ("HRBM") (Nitsche et al. 2007). Nitsche et al. (2007) indicate that muddy sediments dominate between West Point and Peekskill and there is a complicated pattern of dynamic and depositional environments (Nitsche et al. 2007). In the vicinity of the proposed CWWS array, Nitsche et al. (2007) indicate that a small, thin (i.e., <0.5 m) depositional environment is currently present.

Recent multi-beam and sub-bottom profile surveys in the area of the proposed CWWS array were also conducted by Substructure, Inc., in April 2010 and by Ocean Surveys, Inc., in November 2010 to identify key geotechnical design considerations (GZA GeoEnvironmental of New York [GZA] 2012). Figure 3.2-4 presents the bathymetry and acoustic backscatter data collected by Substructure, Inc. (GZA 2012). The interpreted sedimentary environment (based on the approximate limits shown by Nitsche et al. (2007) and refined using Substructure, Inc., acoustic backscatter data) indicates the following (GZA 2012):

- The bathymetry indicates a significant topographic depression to the north of the Project due to on-going river scour.

- The area parallel and adjacent to the plant shoreline (extending about 250 feet into the River, including the proposed transition boxes and portions of the pipelines, is characterized by river bottom conditions associated with on-going erosion [general scour]).

- The vicinity of the proposed CWWS array is characterized by river bottom conditions associated with reduced current velocities and thin deposition.

- The area to the north, west and south of the CWWS array is characterized by river bottom conditions associated with on-going erosion (general scour).

Twenty-one vibratory cores were collected by Ocean Surveys, Inc. during the geotechnical investigation (GZA 2012). These cores generally encountered very soft, plastic organic clay down to 30 feet below the riverbed (GZA 2012). At 11 locations in the vicinity of the security barge adjacent to the Unit 1 Wharf, shallow refusal in sand and gravel was encountered (GZA 2012). Borings indicate this layer of sand and gravel is several feet thick and is underlain by clay, which overlies bedrock at depth (GZA 2012). Elsewhere, borings performed under GZA direction found 30 feet of very soft, plastic organic clay underlain by medium stiff to stiff, medium to low plasticity clay, sand/gravel and then marble bedrock (GZA 2012). The top of bedrock was generally found to slope offshore at elevations ranging from -82.3 to -144.4 feet NAVD88 (GZA 2012).

Estimates of the total annual sediment flux for the Hudson River estuary and New York Harbor vary between 500,000 and 1,200,000 metric tons per year (“Mt/yr”) (i.e., approximately 550,000 and 1323,000 tons per year) (Wall et al. 2008). This wide range not only reflects the uncertainties in the estimates, but also the annual variation of the sediment flux in the system (Nitsche et al. 2010). Over the period 2002 through 2006 the USGS estimated the average annual sediment flux past Poughkeepsie (RM 72) to be 730,000 Mt/yr (i.e., 0.8 million tons per year) (Wall et al. 2008). Observed seasonal peaks in sediment discharge at Poughkeepsie are November - January at 3,400 metric tons per day (“Mt/day”) and March - May at 3,200 Mt/day (Wall et al. 2008). Fluctuations in suspended sediment concentrations occur over each tidal cycle, with the highest suspended sediment concentrations corresponding with high freshwater river flow concurrent with spring tides (Wall et al. 2008).

Large-scale dredging and channelization projects within the Hudson River watershed are routine. As discussed in Section 3.2.2, the USACE maintains a 400-foot wide navigation channel from Albany to Kingston, and a 600-foot wide navigation channel from Kingston to New York City. Currently, the USACE performs maintenance dredging in the upper reaches of the estuary, as required. Typical dredging volumes, on average, may range in size from 50,000 yd^3 to 200,000 yd^3.

In the New York/New Jersey harbor area, channel improvements require dredging and managing between one and two-million yd^3 of sediments, or dredge material, each year (NYSDEC 2012).

Some dredging activities are non-routine. In February 2002, USEPA issued a Record of Decision ("ROD") for the Hudson River PCBs Superfund Site that calls for targeted environmental dredging of approximately 2.65 million yd^3 of PCB-contaminated sediment from a 40-mile section of the upper Hudson River. The cleanup of the Hudson River is occurring in two phases (USEPA 2013). Phase 1 is now complete. Phase 2 began in June 2011, and is being conducted at full production to remove the remainder of the contaminated River sediment targeted for dredging (USEPA 2013); Phase 2 targets the removal of approximately 2.4 million yd^3 of sediment (USEPA 2013). Dredging occurs between May and October, when the Champlain Canal is open for the season (USEPA 2013). It is estimated that the second phase of the cleanup will take five to seven years to complete (USEPA 2013).

3.3 AQUATIC ECOLOGY

This Section provides an overview of the existing conditions of the relevant portion of the Hudson River aquatic ecosystem, including a description of the aquatic habitats and aquatic resources that are found at and in the vicinity of the IPEC Site. Given the IPEC location at RM 42, which is within the lower Hudson River estuary, the focus of this presentation is on the habitats and species found within the reach of the River identified as Region 4 (Figure 3.2-1) which encompasses RM 39 to 46.

Phytoplankton, zooplankton, macroinvertebrate, shellfish, and fish communities within the tidal Hudson River were previously described in a DEIS based on studies from 1974 through 1997 as part of the HRBMP, published literature, and reports (CHGE et al. 1999). Results from continuing studies performed from 1998 through 2012 augment and expand upon this earlier work (e.g., ASAAC 2012). The HRBMP, which has been conducted annually since 1974 to assess IPEC's (and other) Hudson River Power Plants' potential effect on the representative important species ("RIS"), covers the entire estuarine portion of the Hudson River from RM 0 (zero) – 152 and is widely considered the finest aquatic dataset of its type.

3.3.1 Hudson River, Indian Point (Region 4) Habitats

Region 4 of the HRBMP contains a variety of habitats, including tidal marshes, intertidal mudflats, soft and hard-bottom unvegetated subtidal areas, and areas of submerged aquatic vegetation ("SAV"). From Lents Cove south to RM 39 the River is relatively narrow and for the most part deeper than 30 feet. To the north of IPEC, Peekskill Bay and the area around Iona Island provide more shallow water and intertidal habitat, including areas of tidal wetland and SAV while the main channel is deeper than in front of IPEC. The hydrology and water quality characteristics of the lower Hudson River are described in Section 3.2.

In general, development and human population growth over time have resulted in significant habitat alteration at many locations adjacent to the River as well as along tributary rivers and streams. For instance, the Peekskill Landing Park shoreline is armored with stone rip-rap, as is the western shore of the River along the railroad tracks, directly across the River from IPEC. Construction of causeways has interfered with or altered tributary inlets, such as in Lents Cove where Broadway crosses the creek, disrupting sediment transport and other natural phenomena. Development has also resulted in the dredging of some habitats and the filling of others, such as the piers and marinas within Peekskill Bay.

3.3.2 Hudson River National Estuarine Research Reserve

The National Oceanic and Atmospheric Administration designated four locations within the Hudson River estuary, representing over 4,800 acres, as part of the National Estuarine Research Reserve System ("NERRS") (Figure 3.3-1). Of these, only Iona Island is within Region 4 (NOAA 2008). Established in 1982, the areas serve as field laboratories for estuarine research, stewardship and education.

Iona Island is located near the Town of Stony Point six miles south of West Point, at approximately RM 45, which is within Region 4. This bedrock island is located near the Hudson Highlands and is bordered to the west and the southwest by Salisbury and Ring Meadows. In the early 20th century, filling activities connected Round Island to the southern end of Iona Island. There is approximately one mile of marsh and shallow water habitat between Iona

Island and the western shore of the River. The area includes brackish intertidal mudflats, brackish tidal marsh, oligohaline tidal marsh, and deciduous forested uplands (NOAA 2008).

The Iona Island Marsh area is located between the west shore of the Hudson River and Iona Island at RM 45, and is three miles upstream from Indian Point Station (at RM 42). Iona Island Marsh is a highly productive 270-acre tidal wetland with conditions ranging from freshwater to brackish water (NYSDOS 1987, as cited in AKRF 2012). Non-vegetated tidal flats, subtidal aquatic beds and tidal creek channels also occur in the area (NYSDOS 1987, as cited in AKRF 2012). Iona Island Marsh is isolated from the main Hudson River channel by a railroad track and berm along the western shore. Culverts or trestles at the north and south of Iona Island allow for some water exchange between the marsh and the main river flow.

This area has been long studied under the HRBMP.

3.3.3 Lower Hudson River Significant Coastal Fish and Wildlife Habitats

The New York State Department of State, Division of Coastal Resources ("NYSDOS, DCR") has identified and mapped Significant Coastal Fish and Wildlife Habitats ("SCFWH") located within or bordering four geographic regions within the Hudson River Valley. However, only Iona Marsh, located three miles upstream of IPEC on the western shore of the River, and Hudson Highlands (RM 44 to 56) occur within Region 4, as shown in Figure 3.3-2.

Modifications to the original SCFWH designations along the Hudson River have been prepared by the NYSDOS. On November 30, 2012, NOAA's, Office of Ocean and Coastal Resource Management ("OCRM") approved NYSDOS's proposal as routine program changes (NOAA 2012). However, on August 15, 2011, Entergy submitted comments to NYSDOS stating that NYSDOS has not established a reasonable legal or factual basis for the modification, and Entergy continues to challenge this modification. Depending on the outcome of these challenges, the IPEC location may become included within the expanded Hudson Highlands area (proposed to expand to include from RM 40 to 60).

3.3.4 Submerged Aquatic Vegetation and Coastal Wetlands

Macrophyte communities are generally divided into three broad groups that include emergent macrophytes, floating-leaved macrophytes, and submerged macrophytes (also known as SAV), all of which are found in predominantly freshwater habitats. Emergent macrophytes in the Hudson River generally occur near the shoreline to a water depth of about 5 feet. Floating leaved macrophytes are also generally found in water less than 5 or 6 feet deep, but can extend a little deeper depending on water clarity. These two groups of plants are typically considered within the context of marsh and other vegetated wetland complexes. Submerged macrophytes or SAV are found beneath the water surface at a depth related to the clarity of the water (CHGE et al. 1999), but generally can be found deeper than emergent or floating leaved macrophytes. SAV is typically considered within the context of aquatic habitats, as the areas that these plant species occurs in is generally considered open water.

Figure 3.3-3 shows the occurrence of mapped coastal wetlands at and immediately upstream and downstream of IPEC within Region 4. As shown, no SAV beds occur within two miles of IPEC; however, recent mapping efforts reveal SAV occurring in the vicinity of Iona Island (Figure 3.3-3).

Submerged aquatic vegetation beds in the Hudson River are represented by two predominant species - the native submerged eel grass (*Vallisneria americana*) and the invasive introduced water chestnut (*Trapa natans*) (Findlay et al. 2006, as cited in AKRF 2012): CHGE et al. (1999) identified 18 species of submergent aquatic vegetation between Kingston and Nyack, including nine species of *Potamogeton* (pondweed), and *Elodea* spp. (common pondweeds used in aquaria), and a variety of other species.

Submerged aquatic vegetation beds are an important aquatic habitat type because the plants provide food and structure where certain macroinvertebrate species can be found in abundance, and younger life stages of some fish species take refuge among the plants. Work by Findlay et al. (2006, as cited in AKRF 2012) shows that the densities of macroinvertebrates in SAV beds were more than three times as high as densities on non-vegetated sediments, suggesting that SAV beds may be the richest feeding grounds in the Hudson River estuary for fish. Further, Findlay et al. (2006, as cited in AKRF 2012) noted that many species of macroinvertebrates that are common in aquatic macrophyte beds are rare or absent from non-vegetated sites.

The shoreline area at IPEC has been previously altered and includes the original construction of the generating facility and, as such, does not include any tidal wetlands. Within Region 4, much of the shoreline is armored, and the water depths increase rapidly with distance from the shore. As such, there are no tidal wetlands present on the River's main stem for two miles upstream or downstream of IPEC, although some do occur around Iona Island and in small patches in tributaries, such as Hollow Creek (Figure 3.3-3).

3.3.5 Benthic Habitats and Species

Based on studies performed in the River at the IPEC Site, the river bottom consists of a mixture of gaseous and aqueous sediments and a lack of hard substrates such as cobble, boulder or bedrock (Substructure 2010; OSI 2011). Gaseous sediments are fine grained (typically silts and clays) and have a relatively high organic content, and therefore support a benthic community adapted to living in and on this sediment type, while aqueous sediments have lower organic content and tend to have a greater percentage of sand that support a slightly different benthic community. Figure 3.2-4 shows multibeam survey data of the sediment surface and the locations that are depositional versus erosional in front of IPEC, as well as contours. With the area of CWWS installation being located in a depositional environment, a soft sediment benthic community can be expected, although no benthic community sampling has been undertaken within the footprint of the CWWS system installation area. The CWWS location is outside the deep channel in a gently sloping area with decreasing depths from upstream to downstream, and generally a flat surface. There are no features of the river bottom offshore of IPEC that would indicate the benthic community is unique within Region 4.

The biologically active depth in sediments can vary, but generally most organisms living in the sediment do so in the top 1 foot or less because the sediments below a depth of 1 foot typically are anaerobic. The group of animals commonly referred to as benthic macroinvertebrates includes those sessile epifauna that live attached to objects such as rocks and pilings, invertebrates that live within the substrate (endobenthic), and mobile invertebrates that live near or on the substrate (epibenthic). Examples of sessile epifauna include barnacles (*Balanus* spp.) and ribbed mussels, which typically attach to rocky substrate or to the shells of other mollusks. Examples of endobenthic invertebrates include various oligocahete (e.g., *Tubificoides* spp.) and polychaete (e.g., *Marenzelleria viridis* and *Heteromastus filiformis*) worms, freshwater and estuarine mussels (e.g., Atlantic rangia clam [*Rangia cuneata*]), chironomids, and other burrowing organisms. Examples of epibenthic invertebrates include amphipods (e.g., *Leptocheirus plumulosus*), crabs, aquatic insects, and shrimp.

The distribution of benthic macroinvertebrates on a large scale in the Hudson River estuary is determined by the salinity gradient from New York City to Albany. Polychaete worms are most abundant in brackish water areas downstream and oligochaete worms are dominant in freshwater areas upstream. In the Hudson River estuary, epibenthic macroinvertebrate collections in brackish water areas are typically dominated by mysid shrimp, especially the opossum shrimp (*Neomysis americana*). In freshwater areas, collections of epibenthic macroinvertebrates are dominated by amphipods, especially of the genus *Gammarus,* and, to a lesser extent, the larvae of aquatic insects. Other crustaceans that comprise a substantial portion of the benthic community include isopods on unvegetated sediments, barnacles on rocky shorelines, crayfish in freshwater habitats, grass shrimp in brackish habitats, and blue crabs, which can migrate from the lower estuary as far north as Troy during some summers (Strayer 2006, as cited in AKRF 2012).

3.3.6 Phytoplankton and Zooplankton

A variety of shellfish species consume plankton, particularly mussels, and within the water column, planktivorous fish, such as herring, feed on plankton. Significant declines in phyto- and zooplankton biomass were reported after the introduction of the zebra mussel (Pace et al. 1998, as cited in CHGE et al. 1999; Strayer et al. 2004, as cited in AKRF 2012). However, more recent work by Strayer et al. (2011) suggests that populations of plankton species may be beginning to recover from the decline seen in response to the introduction of the zebra mussel, and are approaching pre-mussel invasion densities.

3.3.6.1 Phytoplankton

Information presented in this Section is largely derived from: AKRF Inc., Entergy Nuclear Indian Point 2 LLC, Entergy Nuclear Indian Point 3 LLC, and Entergy Nuclear Operations Inc. December 2012, Coastal Zone Management at Consistency Certification in support of USNRC's Renewal of Indian Point Unit 2 and 3 Operating Licenses.

The phytoplankton community in Region 4, encompassing the River segment at IPEC, can be characterized consistent with the rest of the lower Hudson River as described herein. Phytoplankton are microscopic plants that are transported by water currents and often form the base of the food web in aquatic ecosystems, particularly in lakes and in some large river aquatic ecosystems (Wetzel 1975, as cited in AKRF 2012). However, in turbid rivers and estuaries, like the Hudson River estuary, light limits phytoplankton growth in all but the upper few feet of the water column. Instead, organic matter from terrestrial sources in the watershed (washed into the River or deliberately discharged into the River, and referred to as allochthonous organic material) forms the base of the food web, contributing 50 percent or more of the gross primary production (CHGE et al. 1999; Cole and Caraco 2006, as cited in AKRF 2012).

Phytoplankton in the Hudson River estuary typically fall into one of three broad groups or divisions, *i.e.,* diatoms, green algae, and blue-green algae (cyanobacteria), each with different spatial and temporal patterns of distribution and abundance (Storm and Hefner 1976, as cited in CHGE et al. 1999; Marshall 1988, as cited in CHGE et al. 1999). Among this trio, diatoms are numerically dominant throughout much of the year, but most abundant during spring and fall when water temperatures are low and turbulent river flows are high. Green algae are most abundant during summer when water temperatures are higher and freshwater flows are low.

Blue-green algae are principally limited to late summer and early fall. Each of these groups is a common component of phytoplankton communities in estuaries along the East Coast of North America (CHGE et al. 1999). Phytoplankton respiration consumes most of phytoplankton-derived organic matter (gross primary production), which leaves small amounts of this productivity available to higher trophic levels (Cole and Caraco 2006, as cited in AKRF 2012). Thus, small increases in grazing pressure can have profound impacts on phytoplankton.

Phytoplankton biomass and gross primary production in the freshwater reaches of the Hudson upstream from Hudson River Mile 44-56 were reduced by the 1992 invasion of the zebra mussel, and the phytoplankton community has not yet recovered to pre-invasion levels (Cole and Caraco 2006). In addition to decreases in phytoplankton biomass and taxonomic composition, zebra mussels in the freshwater portion of the tidal Hudson River have also been associated with increased dominance of cyanobacteria, especially *Microcystis* (Fernald et al. 2007, as cited in AKRF 2012). Fernald et al. (2007, as cited in AKRF 2012) found that during 1993 through 2005 neither the absolute, nor the relative amounts of cyanobacteria were significantly correlated to zebra mussel filtration rate alone or in combination with other physical or chemical factors that were measured. The combination of temperature and dissolved silica ("SiO_2") explained 90 percent of the variance in cyanobacterial dominance (Fernald et al. 2007, as cited in AKRF 2012). At higher temperatures and lower dissolved silica, cyanobacterial abundance increased at the expense of diatoms that dominated at lower temperatures and in higher silica years.

3.3.6.2 Zooplankton

Information presented in this Section is largely derived from: AKRF Inc., Entergy Nuclear Indian Point 2 LLC, Entergy Nuclear Indian Point 3 LLC, and Entergy Nuclear Operations Inc. December 2012, Coastal Zone Management at Consistency Certification in support of USNRC's Renewal of Indian Point Unit 2 and 3 Operating Licenses.

The zooplankton community in Region 4, encompassing the river segment at IPEC, can be characterized consistent with the rest of the lower Hudson River as described herein. Zooplankton are small, typically microscopic, animals that live in the water column and are transported by water currents. Zooplankton are typically divided into two components: holoplankton, which spend their entire life cycle as part of the plankton community, and meroplankton, which spend only a portion of their life cycle as plankton. Meroplankton include larger macroinvertebrates, which move up into the water column on a regular basis, as well as the eggs and larvae of macroinvertebrates, shellfish, and fish, which temporarily exist as part of the plankton. This section focuses on the holoplankton.

The Hudson River estuary holoplankton community consists of freshwater and marine species. Freshwater species dominate the reach north of Newburgh Bay (RM 68 and north), consisting mainly of flagellates, ciliates, rotifers, copepods, and cladocerans (Pace and Lonsdale 2006, as cited in AKRF 2012). Zooplankton in brackish areas of the Hudson River estuary proximate to IPEC downstream of Verplanck Point (RM 40), including the Croton River and Bay (RM 32–34) and Haverstraw Bay (RM 34–40), are primarily marine species dominated by copepods as well as flagellates, ciliates, and cladocerans (Pace and Lonsdale 2006, as cited in AKRF 2012). The zooplankton community in the Hudson River estuary from Verplanck Point (RM 40) through Wappingers Falls (RM 68), including RM 44–56 and Iona Island Marsh (RM 45 west), comprises a gradual transition from marine to freshwater forms. Sampling of zooplankton within the portion of the River from Croton Point (RM 34) upstream to Albany (RM 152) between April and December 1987 through 1989 identified five taxa that numerically dominated: the cyclopoid copepod (*Diacyclops bicuspidatus* thomasi); the cladocern (*Bosmina* *longirostris*); and three rotifer genera (*Keratella*, *Polyarthira*, and *Trichocera*) (Pace et al. 1992, as cited in CHGE et al. 1999). Larger predatory zooplankton, ctenophores, and mysids are also present in these waters, particularly during summer periods of salinity intrusion (Pace and Lonsdale 2006, as cited in AKRF 2012).

Distribution and abundance of zooplankton varies widely on diel, tidal, seasonal, and inter-annual temporal scales, and varies spatially in zooplankton patches along a river-wide gradient from New York City (RM 0 [zero]) to Albany (RM 152) (Pace and Lonsdale 2006, as cited in AKRF 2012). Seasonal abundance of zooplankton was negatively related to flow, indicating that advection, or downstream transport associated with increased flow, was an important factor in determining abundance. Zooplankton are an important intermediate in the food web, and when abundant in the estuary, serve as important food for many larval fishes. However, zooplankton are not considered a dominant factor governing the overall energy flow of the Hudson River estuary food web, because the biomass they represent is too low to exert significant grazing pressure on phytoplankton productivity or influence nutrient cycling (Pace and Lonsdale 2006, as cited in AKRF 2012).

While not a fouling issue for the IPEC Units, annual monitoring performed in front of the intakes indicates that zebra mussels do occur and settle on hard substrates in this reach of the River (pers. communication, D. Gray of Entergy, March 18, 2013). Given the mixed salinity regime in this region, zebra mussels are unlikely to develop to the invasive population levels seen further upstream, and in some other freshwater environments in New York State.

3.3.7 Fish and Shellfish Resources

In its 1976 guidance document for evaluating the adverse impact of cooling water intake structures, the USEPA provided guidelines for the selection of critical aquatic organisms (which is the precursor term for RIS) (USEPA 1976). These are:

1. Representative, in terms of their biological requirements, of a balanced, indigenous community of fish, shellfish and wildlife.
2. Commercially or recreationally valuable.
3. Threatened or endangered.
4. Critical to the structure and function of the ecological system.
5. Potentially capable of becoming localized nuisance species.
6. Necessary, in the food chain, for the well-being of species determined in 1-4.
7. One of 1-6 and have high potential susceptibility to entrapment-impingement and/or entrainment.
8. Critical aquatic organisms based on 1-7, are suggested by the applicant, and are approved by the appropriate regulatory agencies.

As explained in the *"Entrainment and Impingement at IP2 and IP3: A Biological Impact Assessment,"* Adverse Environmental Impact Report ("AEI Report") (Barnthouse et al. 2008), there are eight species of fish that NYSDEC has selected as RIS. This ER focuses on the same eight species. These eight RIS represent 95 percent of the entrained fish and 93 percent of the impinged fish at IPEC. (CHGE et al. 1999 [Appendix VI, Table VI-1 and Table VI-2]). In addition, the RIS consist of species that include important categories of fish occurring in the River, such as anadromous, forage, commercial, and recreational species. As such, the RIS can serve to provide an overview characterization of the fishery resource, as well as allow for characterization of potential impacts to these groups as discussed in Section 4.5.

3.3.7.1 Representative Important Species

Information presented in Sections 3.3.7.1 through 3.3.7.8 is largely derived from: AKRF Inc., Entergy Nuclear Indian Point 2 LLC, Entergy Nuclear Indian Point 3 LLC, and Entergy Nuclear Operations Inc. December 2012, Coastal Zone Management at Consistency Certification in support of USNRC's Renewal of Indian Point Unit 2 and 3 Operating License, as well as the AEI Report and the NRC December 2010 SEIS.

The eight RIS selected by NYSDEC staff encompass a broad range of attributes, such as biological importance, commercial or recreational value, trophic position, commonness or rarity, interaction with other species, vulnerability to cooling system operation, and fidelity or transience in the local community. Based on the AEI Report, the spatial distribution of each RIS within the 13 defined river segments of the Hudson, as shown in Figure 3.2-1, is presented in Table 3.3-1. As evidenced by Table 3.3-1, Hudson River Region 4 is not unique with respect to any RIS. In fact, most species early life stages occur at substantial distances from IPEC.

Species profiles are included below so that general information on life history characteristics is presented along with information on harvest and resource management efforts. Profiles for the two sturgeon species are presented in Section 3.3.8.

Table 3.3-1
Locations in the Hudson River Estuary Where the Presence of RIS Life Stages Represented at Least 10 Percent of the Total Number of that Life Stage Collected for All Species at all Locations in Referenced HRBMP Surveys or Studies (based on the AEI Report)

<table>
<tr><th rowspan="2">Species</th><th rowspan="2">Life stage</th><th colspan="13">Locations in the Hudson River Estuary
(these locations are identified in Figure 3.2-1)</th></tr>
<tr><th>BT</th><th>YK</th><th>TZ</th><th>CH</th><th>IP</th><th>WP</th><th>CW</th><th>PK</th><th>HP</th><th>KG</th><th>SG</th><th>CS</th><th>AL</th></tr>
<tr><td rowspan="5">Alewife</td><td>Eggs</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">LRS[c]</td></tr>
<tr><td>YSL[d]</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">LRS</td></tr>
<tr><td>PYSL[e]</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">LRS</td><td></td></tr>
<tr><td>YOY[f]</td><td></td><td></td><td colspan="2">BSS[a]</td><td></td><td></td><td>BSS</td><td></td><td></td><td></td><td colspan="2">BSS</td><td></td></tr>
<tr><td>Year + [g]</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">American shad</td><td>Eggs</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">LRS</td></tr>
<tr><td>YSL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">LRS</td></tr>
<tr><td>PYSL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">LRS</td></tr>
<tr><td>YOY</td><td></td><td></td><td></td><td></td><td></td><td></td><td>BSS</td><td colspan="3">LRS</td><td colspan="2">LRS/BSS</td><td>BSS</td></tr>
<tr><td>Year+</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">Atlantic tomcod</td><td>Eggs</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>YSL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>PYSL</td><td></td><td colspan="2">LRS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>YOY</td><td></td><td colspan="2">LRS/FJS[b]</td><td></td><td colspan="2">LRS/FJS</td><td>FJS</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Year+</td><td></td><td colspan="2">FJS</td><td></td><td colspan="2">FJS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Table 3.3-1
Locations in the Hudson River Estuary Where the Presence of RIS Life Stages Represented at Least 10 Percent of the Total Number of that Life Stage Collected for All Species at all Locations in Referenced HRBMP Surveys or Studies (based on the AEI Report)

<table>
<tr><th rowspan="2">Species</th><th rowspan="2">Life stage</th><th colspan="13">Locations in the Hudson River Estuary
(these locations are identified in Figure 3.2-1)</th></tr>
<tr><th>BT</th><th>YK</th><th>TZ</th><th>CH</th><th>IP</th><th>WP</th><th>CW</th><th>PK</th><th>HP</th><th>KG</th><th>SG</th><th>CS</th><th>AL</th></tr>
<tr><td rowspan="5">Bay anchovy</td><td>Eggs</td><td colspan="3">LRS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>YSL</td><td colspan="4">LRS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>PYSL</td><td colspan="5">LRS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>YOY</td><td colspan="4">LRS/BSS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Year+</td><td></td><td colspan="2">BSS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">Blueback herring</td><td>Eggs</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">LRS</td></tr>
<tr><td>YSL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">LRS</td></tr>
<tr><td>PYSL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">LRS</td><td></td><td></td></tr>
<tr><td>YOY</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">LRS/BSS</td><td></td><td></td></tr>
<tr><td>Year+</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">Spottail shiner</td><td>Eggs</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>YSL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>PYSL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>YOY</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>BSS</td><td></td><td colspan="4">BSS</td></tr>
<tr><td>Year+</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>BSS</td><td></td><td></td><td colspan="3">BSS</td></tr>
<tr><td rowspan="5">Striped bass</td><td>Eggs</td><td></td><td></td><td></td><td></td><td></td><td colspan="6">LRS</td><td></td><td></td></tr>
<tr><td>YSL</td><td></td><td></td><td></td><td></td><td colspan="5">LRS</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PYSL</td><td></td><td></td><td colspan="6">LRS</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>YOY</td><td></td><td></td><td colspan="6">LRS/BSS</td><td></td><td></td><td></td><td>LRS</td><td></td></tr>
<tr><td>Year+</td><td></td><td></td><td>BSS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">BSS</td><td></td></tr>
<tr><td rowspan="5">White perch</td><td>Eggs</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">LRS</td></tr>
<tr><td>YSL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="6">LRS</td></tr>
<tr><td>PYSL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">LRS</td><td></td></tr>
<tr><td>YOY</td><td></td><td></td><td>BSS</td><td colspan="6">LRS</td><td colspan="2">BSS</td><td></td></tr>
<tr><td>Year+</td><td></td><td></td><td>BSS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Notes:</td><td colspan="14">(a) BSS: Beach Seine Survey (1974-2005).
(b) FJS: Fall Juvenile Survey (also known as Fall Shoals Survey) (1979-2004).
(c) LRS: Long River Survey (1974-2004).
(d) YSL: Yolk-Sac Larvae.
(e) PYSL: Post-Yolk Sac Larvae.
(f) YOY: Young-of-the-Year.
(g) Year+: Yearling and Older.</td></tr>
<tr><td>Source:</td><td colspan="14">Table adapted from ASAAC 2007.</td></tr>
</table>

3.3.7.2 River Herring (Alewife and Blueback Herring)

River herring (*Alosa spp.*) are entrained primarily as larvae, in limited numbers at IPEC.

Alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) are pelagic, anadromous species found in riverine and estuarine habitats along the Atlantic coast from Newfoundland to the St. Johns River, Florida. The commercial fishing industry does not differentiate between alewife and the blueback herring, but instead refers to the two species collectively as river herring. During early stages of development, their larvae are generally indistinguishable.

Spawning adults enter the Hudson River from the Atlantic Ocean in early spring and spawn once per year between late May and mid-July. Spawning typically occurs in shallow, freshwater tributaries with low current at temperatures between 52°F and 81°F (Everly and Boreman 1999, as cited in NRC 2010; Fay et al. 1983). Females first spawn at three to four years of age and produce 60,000 to 100,000 eggs. Alewives spawn three to four weeks before blueback herring in areas where the two species occur sympatrically, and the peak spawning of each species occurs two to three weeks apart (Fay et al. 1983).

In the Hudson River, peak abundance of river herring eggs generally occurs within the Catskill region of the upper estuary during mid-May (CHGE et al. 1999). Eggs are semi-demersal and carried by currents (Fay et al. 1983; CHGE et al. 1999). Incubation time varies inversely with water temperature and ranges from two to 15 days. The yolk sac larvae ("YSL") stage lasts approximately two to five days, and the post-yolk-sac larvae ("PYSL") stage lasts until transformation to the juvenile stage at approximately 0.78 inches (20 mm). Full development occurs at approximately 1.8 inches (45 mm) at the age of about one month (Fay et al. 1983; CHGE et al. 1999).

Young-of-the-year ("YOY") have been found in both lower and upper regions of the River (Table 3.3-1). Juveniles migrate to the ocean between July and November of their first year. Migration of blueback downriver to the Atlantic Ocean occurs in October, which is generally later than peak migration for both the American shad and the alewife (Fay et al. 1983). Some blueback herring do not migrate and tend to stay within the lower reaches of the estuary during their first one to two years (CHGE et al. 1999).

Juveniles in the lower Hudson River have been reported to feed on chironomid larvae and amphipods. The diet of adult river herring consists primarily of zooplankton, amphipods, mysids, copepods, small fish, and fish eggs. After spawning, alewives feed heavily on shrimp (Fay et al. 1983; CHGE et al. 1999). The species also fulfills an important link in the estuarine food web between zooplankton and top piscivores. Juvenile and adult river herring are prey for gulls, terns, and other coastal birds, as well as bluefish, weakfish (*Cynoscion regalis*) and striped bass (CHGE et al. 1999).

River herring were commercially harvested as a source of fishmeal, fish oil, and protein for the animal food industries (Fay et al. 1983). Commercial landings of river herring peaked in the 1950's and then declined to less than 4,000 metric tons ("Mt") (4,400 tons ["t"]) in the 1970's (Haas-Castro 2006a, as cited in NRC 2010). Between 1996 and 2005, landings of river herring ranged from 300 to 900 Mt (330 to 990 t) annually, with 90 percent of the landings in Maine, North Carolina, and Virginia (Haas-Castro 2006a, as cited in NRC 2010). In New York and New Jersey, river herring accounted for 0.3 percent of annual landings on the Atlantic coast (CHGE et al. 1999). NYSDEC has restricted commercial fisheries for river herring in the Hudson River. However, river herring are often taken as bycatch in the offshore mackerel fisheries.

In recognition of fishing related mortality and coastwide declines, the Atlantic States Marine Fisheries Commission ("ASMFC") implemented a Fishery Management Plan ("FMP") for river herring (and American shad) in 1985. However, the abundance of river herring remains well below historic estimates (Haas-Castro 2006a, as cited in NRC 2010). In 2012, a stock assessment of river herring along the Atlantic coast was conducted using fishery-dependent and independent data, and biology and life history information. Of the 52 stocks for which data was available, 23 were considered depleted relative to historic levels, one stock was increasing, and the status of 28 stocks could not be determined because the time series of available data was too short. In the Hudson River, the assessment revealed alewife and blueback herring stocks are depleted relative to historic levels pre-1970, but stable relative to the data collected over the last ten years (ASMFC 2012). In addition, annual abundance of blueback herring YOY in the Hudson River estuary has been estimated to range from 1.2 million to 50.1 million individuals from sampling conducted with a Tucker Trawl since 1979 (CHGE et al. 1999). As with alewife, stock assessment data for the Hudson River blueback herring stock complied by NYSDEC (Hattala et al. 2009, as cited in AKRF 2012) show that the sizes of adult Hudson River alewife and blueback herring have been declining steadily since the 1970's, and that the total fishing-related mortality rates of adults of both species have regularly exceeded a sustainable level since 2000.

In 2010, the ASMFC (2010) enacted an amendment to the Interstate FMP requiring member states to establish monitoring programs and management plans that will ensure the sustainability of alewife stocks under their jurisdictions. States that did not have an ASMFC-approved management plan in place by January 1, 2013 were forced to close their fisheries.

Figures 3.3-4a and 3.3-4b depicts long-term trends in the abundance of river herring PYSL and YOY in the Hudson River. PYSL abundance for both species combined was stable until 1985, and has since declined (Figure 3.3-4a). With respect to YOY abundance, these two species have tended to vary together (Figure 3.3-4b). YOY abundance in both species declined abruptly in the mid-1980s and has fluctuated without apparent trend since that time, but without returning to previous abundance levels.

Barnthouse et al. (2008) evaluated various hypotheses to explain the recent decline in juvenile and adult river herring abundance in the Hudson River. They concluded that increased abundance of and consequent predation by striped bass was the most strongly supported hypothesis to account for the coast-wide and Hudson River declines of river herring abundance.

3.3.7.3 American Shad

American shad (*Alosa sapidissima*) eggs or larvae are rarely entrained at IPEC.

The American shad, the largest of the anadromous herring species found in the Hudson River estuary, ranges from Newfoundland to northern Florida, but is most abundant between Connecticut and North Carolina. In the northwestern Atlantic, adults spend the summer months in waters off the Gulf of Maine, the Bay of Fundy and the coast of Nova Scotia. In the fall, individuals migrate southward as far as North Carolina (CHGE et al. 1999). American shad has been commercially harvested via gill nets for meat and roe since the late 17th century (Haas-Castro 2006b, as cited in AKRF 2012).

It is unsurprising that large-scale commercial fishing affects shad. American shad spend most of their life at sea and only return to their natal rivers at sexual maturity (average age five) to spawn. Adult American shad can attain a length of 30 inches (76.2 centimeters ["cm"]), weigh up to 12 pounds ("lbs") (5.4 kg), and have a life span of about 11 years (CHGE et al. 1999).

Until recently, the fishery for American shad had two components: an "ocean intercept" fishery that harvested shad during the ocean phase of their life-cycle, and an "in-river" fishery that harvested shad during their spring spawning runs. In response to declines in abundance and harvests that began after 1985, the ASMFC required all states to phase out their ocean intercept fisheries between 2000 and 2005 (ASMFC 1999). For 2008, NYSDEC reported total landings of 37,842 lbs, the lowest landings ever reported (ASMFC 2009a). Of these, half were attributed to the in-river fishery, and half to bycatch in offshore fisheries targeted at other species. Effective March 10, 2010, all commercial fisheries for American shad in New York waters are closed (6 NYCRR Part 10). A determination of the effects of fishing closures is premature.

As an anadromous species, shad require freshwater for spawning. American shad eggs, YSL, PYSL, and YOY are generally found between Kingston and Albany (Table 3.3-1). Egg abundance in the Hudson River peaks in May. YSL transform into PYSL within four to seven days in waters at a temperature of 63°F (Everly and Boreman 1999, as cited in NRC 2010; CHGE et al. 1999). Larvae typically inhabit riffle pools of moderate depth near spawning grounds and develop into juveniles four to five weeks after hatching when they are approximately 1 inch (25 mm) in length (Everly and Boreman 1999, as cited in NRC 2010; Facey and Van Den Avyle 1986). Larvae feed on *Bosmina* spp., cyclopoid, copepodites, and chironomid larvae.

Juveniles travel downriver in schools between June and July (Everly and Boreman 1999, as cited in NRC 2010), utilize the middle estuary north of the IPEC region by September, and move into the lower reaches of the estuary by late October (Limburg 1996, as cited in NRC 2010). Juveniles are opportunistic feeders and consume free-swimming organisms at the surface as well as insects (CHGE et al. 1999). The principal food source of adult American shad is zooplankton, though the species also consumes small crustaceans, small fish, and fish eggs (Facey and Van Den Avyle 1986). The American eel and catfish (*Ictalurus* spp.) prey upon American shad eggs, and bluefish prey upon larvae (CHGE et al. 1999). Once juveniles migrate to the Atlantic Ocean, likely predators include striped bass, sharks, tuna, and porpoises (Facey and Van Den Avyle 1986).

American shad are currently managed by the ASMFC under the Interstate FMP for American shad and river herring. A stock assessment for this species was completed in 2007 (ASMFC 2007a, as cited in FHWA et al. 2012). This assessment found that most American shad spawning populations, including the Hudson River population, have declined to historically low levels. The decline appears to be related to an increase in mortality of adult shad. With respect to the Hudson River population, Hattala and Kahnle (2009, as cited in AKRF 2012) have found that the increase in adult morality has coincided with decreases in mean age, mean size, and stock size. The abundance of juvenile shad as estimated from NYSDEC's annual YOY index has also fallen to very low levels (Hattala and Kahnle 2009, as cited in AKRF 2012). Major concerns for the Hudson River shad stock include adult mortality rates that remain high and above acceptable levels, and the unknown ocean bycatch.

Figure 3.3-5 (from Barnthouse et al. 2008) depicts long-term trends in the abundance of American shad YOY and PYSL in the Hudson River. The abundance of both life stages has declined significantly since the late 1980's. As shown in Figure 3.3-5 there is a strong positive correlation between PYSL abundance and YOY abundance in American shad (Figure 3.3-6a), and no relationship between PYSL survival and YOY abundance (Figure 3.3-6b) (from Barnthouse et al. 2008). Because YOY abundance is correlated with PYSL abundance but not with PYSL survival, it can be concluded that the decline in YOY abundance is a consequence of reduced reproduction rather than reduced PYSL survival.

Barnthouse et al. (2008) evaluated various hypotheses to explain the recent decline in juvenile and adult American shad abundance in the Hudson River. They reported that overfishing was the most strongly supported hypothesis to account for the coast-wide and Hudson River declines of American shad abundance; and that increased abundance of and consequent predation by striped bass was likely also a significant contributing factor. ASMFC lists overfishing as a primary factor responsible for the coastwide decline of American shad, in addition to pollution, habitat loss due to dams, and upland development (ASMFC 2009b).

3.3.7.4 Atlantic Tomcod

Atlantic tomcod (*Microgadus tomcod*) larvae and juveniles are periodically entrained at IPEC.

The Atlantic tomcod is found in northwest Atlantic estuarine habitats, with a range extending from southern Labrador and northern Newfoundland to Virginia (Stewart and Auster 1987). The species is nonmigratory and inhabits brackish waters, including estuarine habitats, salt marshes, mudflats, eel grass beds, and bays. Atlantic tomcod in the lower Hudson estuary represent a small, niche fishery, perhaps since interannual abundance is highly variable and anglers cannot rely on their consistent availability (Normandeau 2003, as cited in AKRF 2012).

The species is short-lived, with an estimated mortality rate ranging from 81 to 98 percent by the age of two years (McLaren et al. 1988, as cited in CHGE et al. 1999). Most tomcod in the Hudson River are thought to remain within the estuary for life, although a small number of individuals have been marked and recaptured in the lower New York Bay, the East River, and western Long Island Sound (Klauda et al. 1988, as cited in NRC 2010).

Tomcod exist in high concentration near the lower portion of the Hudson River estuary (Barnthouse and Van Winkle 1988; Boreman and Goodyear 1988, as cited in NRC 2010) (Table 3.3-1), located in Regions II and III. Spawning occurs under ice between December and January in shallow stream mouths (Stewart and Auster 1987). In the Hudson River, tomcod aged 11 to 13 months contribute approximately 85 to 97 percent of annual egg production, and the majority of tomcod in the Hudson River spawn only once in their lifetime (McLaren et al. 1988, as cited in CHGE et al. 1999). Females produce an average of 20,000 eggs, and incubation time correlates inversely with salinity and ranges from 24 to 63 days (Dew and Hecht 1994, as cited in NRC 2010; Stewart and Auster 1987).

Once hatched, larvae float to the surface and are swept by currents into estuaries where they develop into juveniles. YSL are not common in the lower half of the estuary from RM 0 (zero) to 75, while PYSL are concentrated in the Yonkers and Tappan Zee regions (RM 12 to 33) (CHGE et al. 1999) (Table 3.3-1, Figure 3.2-1). Adults are found at all levels of salinity, but larvae and juvenile densities are highest within the 4.5 to 6.7 psu salinity range (Stewart and Auster 1987).

The Hudson River represents the southernmost major spawning area of the species, and the tomcod is the only major species within the freshwater region of the Hudson River to hatch between February and March (Dew and Hecht 1994, as cited in NRC 2010). Because the species hatches earlier than herring species, tomcod experience little interspecific competition for food until the fall of their first year (McLaren et al. 1988, as cited in CHGE et al. 1999). Tomcod are found at temperatures as low as 30°F and have not been observed to inhabit waters at temperatures higher than 79°F (Stewart and Auster 1987). The species has also been observed at a wide range of depths, varying from the surface to 226 feet (Froese and Pauly 2007, as cited in NRC 2010).

Tomcod in the Hudson River have three visible stages of first year growth. Juveniles show rapid growth during the spring, little to no growth during the summer, and rapid growth again in the fall, which is correlated with prevailing water temperatures (McLaren et al. 1988, as cited in

CHGE et al. 1999). Growth has been found to slow at temperatures above 66°F and growth essentially ceases at temperatures above 72°F (CHGE et al. 1999).

The diet of tomcod consists primarily of small crustaceans, but also includes polychaete worms, mollusks, and small fish. Because tomcod have a lipid-rich liver and prey on many benthic organisms, they are especially sensitive to contaminants in highly polluted waterways, including PCBs and other chlorinated hydrocarbons (Levinton and Waldman 2006, as cited in NRC 2010).

Juvenile tomcod serve as prey in the summer months for yearling striped bass, particularly during years when juvenile striped bass's main prey, the bay anchovy is scarce (Dew and Hecht 1976, as cited in Stewart and Auster 1987). Juvenile tomcod are also the prey of large juvenile bluefish (Juanes et al. 1993, as cited in AKRF 2012).

The Hudson River tomcod population exhibits wide fluctuations in annual abundance because the species is relatively short lived, and a yearly population is generally composed of only one age class (Levinton and Waldman 2006, as cited in NRC 2010). Figure 3.3-7 depicts long-term trends in the abundance of Atlantic tomcod as determined from the LRS data and the Atlantic Tomcod mark-recapture program. The HRBMP's Long River Survey Index ("LRS index") reflects the abundance of late PYSL and early juvenile fish. The mark-recapture index reflects the combined abundance of Age 1 and older (predominantly Age 2) fish. The abundance of Atlantic tomcod has declined since 1980, with the abundance of Age 1 and older fish showing an abrupt decline beginning in 1990. The trend in abundance in the LRS time series is less clear, but the LRS index also has declined since 1990. As shown in Figures 3.3-8a and 3.3-8b, there is no relationship between egg deposition and resulting abundance of age one individuals. However, there is a positive relationship between egg and Age 1 survival and Age 1 abundance (Figure 3.3-8b). Hence, the decline in Atlantic tomcod abundance is related to a decrease in survival rather than a decrease in egg production.

The tomcod has not been a commercially important species in the northeast over the past century, and no catch statistics have been recorded since the 1950's. However, as noted above, along the New England coast, the species is generally a target for winter sport fishing (Stewart and Auster 1987).

3.3.7.5 Bay Anchovy

Bay anchovy (*Anchoa mitchilli*) eggs, larvae, and juveniles are entrained at IPEC.

Bay anchovy occurs along the Atlantic coast from Maine to the Gulf of Mexico (Morton 1989, as cited in CHGE et al. 1999) and is a common shallow water fish in the Hudson River estuary. No commercial fishery for the bay anchovy exists in the Hudson River, but it is preyed upon by other fish, such as the striped bass. Unless otherwise noted, the information below is from Morton 1989, (as cited in CHGE et al. 1999).

NMFS does not collect fishery statistics for this species because of the lack of commercial and recreational fishing. The Mid-Atlantic Fishery Management Council ("MAFMC") has not identified bay anchovy as a managed species.

Considered a warm water migrant, the bay anchovy uses the Hudson River estuary for spawning and as a nursery ground. Adults are found in a variety of habitats, including shallow to moderately deep offshore waters, near shore waters off sandy beaches, in open bays, and at river mouths, all with substantial salinity. Studies conducted in the Hudson River from 1974–2005 suggest that eggs, YSL, PYSL, YOY, and older individuals occur in greatest abundance from the Battery to Haverstraw Bay, that is south of IPEC in Region 4 (Table 3.3-1). There is also evidence from recent work by Dunning et al. (2006) that the peak standing crops of bay anchovy eggs and larvae in New York Harbor, the East River, and Long Island Sound are approximately eight times larger than the population estimates for the lower Hudson River, probably because of the larger water volumes in those areas and the salinity preference of the species.

Spawning generally occurs at water temperatures between 48°F and 88°F from May through October, depending on location. Spawning generally occurs in the late evening or at night, and the eggs are pelagic. Schultz et al. (2006, as cited in AKRF 2012) has reported that anchovies that spawn in the Hudson River are mostly two years old, whereas yearlings predominate in other locations, such as Chesapeake Bay.

Eggs are usually concentrated in salinities of 8 to 15 psu. At temperatures around 81°F, eggs hatch in 24 hours. At hatching, the YSL are about 0.07 to 0.08 inches (1.8 to 2.0 mm) long. Within 24 hours of hatching, YSL consume the yolk sac and become PYSL. Fins begin to develop during the PYSL stage. Larvae are transparent and become darker as they develop into juveniles. PYSL eat copepod larvae and other small zooplankton.

Larvae metamorphose into juveniles at about a length of 0.63 inches (16 mm). Juveniles and adults travel and hunt in large schools. Juveniles acquire adult characteristics at about 2.4 inches (60 mm) in length and gain a silvery lateral band. Adults have a relatively high tolerance to fluctuations in both river temperature and salinity, and there is evidence in the Hudson River that early-stage anchovies migrate up-estuary at a rate of 0.4 miles/day and are capable of periodic vertical migration (Schultz et al. 2006, as cited in AKRF 2012).

Adult and juvenile bay anchovy feed primarily on mysid shrimp, copepods, other small crustaceans, small mollusks, other plankton, and larval fish (Hartman et al. 2004, as cited in AKRF 2012). Important predators include birds, bluefish, weakfish, summer flounder (*Paralichthys dentatus*), and striped bass (CHGE et al. 1999).

Figure 3.3-9 depicts long-term trends in the abundance of bay anchovy YOY and PYSL in the Hudson River. The abundance of juvenile bay anchovy, as measured by the Fall Shoals Survey ("FSS"), declined between 1985 and 1997 (Barnthouse et al. 2008). However, data collected from 1998 through 2009 show no trend, indicating that the population has stabilized (Entergy Exhibit 29, NYSDEC hearing on Section 401 Certification, January, 2012). There has been no trend in abundance of PYSL for either period. No data are available concerning trends in the abundance of adult (age 1 and older) bay anchovy (Tipton 2003). Tipton and Hartman (2006) showed that the bay anchovy present in the Hudson River are part of a large regional population that extends into Long Island Sound and the New York Bight. Tipton (2003) speculates that the reduction in bay anchovy may be linked to increased predation and overall populations of striped bass, bluefish, or other important commercial fish.

As previously indicated, no commercial fishery for the bay anchovy exists in the Hudson River.

3.3.7.6 Spottail Shiner

Spottail shiners (*Notropis hudsonius*) are rarely entrained at IPEC.

According to Mark Mattson testimony on October 24, 2011 as part of the SPDES Proceeding (transcript pages 1497-1498), the 1981-1987 entrainment studies yielded a percentage of 0.18 for the group of larval fish labeled minnow, which because of the inability to taxonomically differentiate larvae of this group, incorporates a number of species, including spottail shiner. Since spottail shiner only make up a portion of the 0.18 percent entrainment, this species represents a very low percentage of the total entrainment, indicating that the spottail shiner larvae are very uncommon in the IPEC region.

The spottail shiner is a small, silvery, freshwater minnow that occurs in a variety of freshwater habitats, from large lakes and rivers to small streams, throughout Canada and the United States (Smith 1985).

The spottail shiner is abundant in the freshwater tidal and lower salinity reaches of the Hudson River estuary, and occurs most frequently over sand and gravel substrates which are not present near IPEC (Becker 1983, as cited in AKRF 2012). Further, the spottail shiner is primarily a freshwater species and does not enter marine coastal waters.

Adult spottail shiners may form large spawning aggregations over sand or gravel substrates in shallow water or at the mouths of tributaries (Scott and Crossman 1973, as cited in CHGE et al. 1999). In the Hudson River, YOY and adult spottail shiners appear in the Beach Seine Survey data from the Poughkeepsie region starting at RM 62 and further upstream Table 3.3-1). Spottail shiners have been reported to produce from 100 to 2,600 eggs (Smith 1985) and 915 to 3,709 (Becker 1983, as cited in AKRF 2012), depending upon the age and size of the female. Spawning probably occurs in late May to early June (Becker 1983, as cited in AKRF 2012). Some individuals are mature at Age 1 and all individuals are mature at Age 2 (Becker 1983, as cited in AKRF 2012).

Very few eggs and larvae have been collected during the LRS, while YOY and adults are collected in the Beach Seine Survey, at distances considerably upstream of IPEC. Juvenile spottail shiners first appear during early July and are most abundant in the shore zone above RM 86, which is also the portion of the estuary with the greatest number of tributaries (CHGE et al. 1999; ASAAC 2012).

In general, spottail shiners are opportunistic predators that feed on aquatic insect larvae, zooplankton, benthic invertebrates, and the eggs and larvae of fish, including their own species. The smaller fish eat the smaller organisms and zooplankton (Scott and Crossman 1973, as cited in CHGE et al. 1999). Johnson and Dropkin (1993, as cited in CHGE et al. 1999) examined the diel feeding habits of spottail shiners in the Juniata River, Pennsylvania, and found that chironomids dominated their diet (100 percent) at 4:00 a.m., potamanthids were the major food item (100 percent) at 8:00 a.m., algae was the primary food source (75-100 percent) from noon to 8:00 p.m., and chironomids and algae were equally consumed at midnight. Peak feeding occurred between 8:00 p.m. and midnight, thus making algae and chironomids the most important food of spottail shiners. Other studies show a high consumption rate of fish eggs, their own and other species, leading to one common name of “spawneater” for this species (Becker 1983, as cited in AKRF 2012).

3.3.7.7 Striped Bass

Striped bass (*Morone saxatilis*) larvae and juveniles are entrained at IPEC.

The striped bass is an anadromous species with a range extending from St. Johns River, Florida, to St. Lawrence River, Canada (ASMFC 2006). Individual stocks of striped bass spawn in rivers and estuaries from Maine to North Carolina. When adults leave the estuaries to go to the

Atlantic, the stocks mix, but return to their natal rivers and estuaries to spawn. The Atlantic coast striped bass fishery has been one of the most important commercial fisheries on the east coast for centuries and has been regulated since European settlement in North America (ASMFC 2006). In 1982, overfishing depleted the striped bass population to fewer than five million fish. Since that time, strict fishing regulations have been implemented and the Atlantic coast population has been restored to 65 million in 2005 (ASMFC 2006).

Striped bass have been important in both commercial and recreational fisheries. Fabrizio (1987, as cited in NRC 2010) reported that of the Age 2 to Age 5 individuals sampled from the Rhode Island commercial trap net fishery in November 1982, 54 percent were from the Chesapeake Bay stock, and 46 percent were from the Hudson River stock. Wirgin et al. (1993, as cited in FHWA et al. 2012) estimated that the Chesapeake Bay and Hudson River stocks combined contributed up to 87 percent of the mixed fishery stock on the Atlantic coast.

The Atlantic coastal striped bass stock is managed as a single unit by the ASMFC (ASMFC 2003). Commercial restrictions on harvesting the Atlantic coastal fishery, in part supported by the Atlantic Striped Bass Conservation Act of 1984 (16 U.S.C. 5151–5158), led to the declaration of full recovery of the population in 1995 (ASMFC 2006). A comprehensive assessment of the status of the coastal stock was completed in 2008 (AMSFC 2009b). This assessment showed that striped bass spawning stock biomass is substantially higher than the target value specified in the FMP, and that the fishing rate for striped bass is at or near the target level specified in the FMP. The ASMFC has determined that the coastal striped bass stock is not overfished and that overfishing is not occurring (AMSFC 2009b).

Separate estimates of spawning stock size and fishing mortality are not available for the Hudson River component of the coastal striped bass stock. However, NYSDEC conducts two surveys that provide information concerning the condition of the Hudson River stock. The Striped Bass Age 8+ Female Spawning Stock Index measures the percent of spawning females that are eight years old or older. This index, which is a measure of the health of the spawning population, has been increasing since the 1980's. For each of the past 15 years, more than 70 percent of spawning females have been eight years old or older (NYSDEC 2010a). The Striped Bass YOY Index, which has been calculated annually since 1979, has fluctuated without trend since the 1980's. The index value for 2007 was the highest ever measured (NYSDEC 2010b).

The striped bass is a long-lived species, reaching up to 30 years of age, and spends the majority of its life in coastal estuaries and the ocean. Females reach maturity between six and nine years, and then produce between 0.5 million and three million eggs per year, which are released into riverine spawning areas (ASMFC 2006). The males, reaching maturity between two and three years, fertilize the eggs as they drift downstream (ASMFC 2006). The eggs hatch into larvae, which absorb their yolk and initially feed on microscopic organisms. PYSL mature into juveniles in the nursery areas, such as river deltas and inland portions of coastal sounds and estuaries, where they remain for two to four years before joining the coastal migratory population in the Atlantic (ASMFC 2006). Recent field investigations by Dunning et al. (2006) have suggested that dispersal of Age 2+ striped bass out of the Hudson River may be influenced by cohort abundance. In the spring or summer, adults migrate northward from the mouth of their spawning rivers up the Atlantic coast, and in the fall or winter they return south, in time to spawn in their natal rivers (Berggren and Lieberman 1978, as cited in NRC 2010; ASMFC 2006).

Several factors play a role in spawning, including water temperature, salinity, total dissolved solids concentration, and water velocity and flow. Peak spawning occurs in water temperatures of 59°F to 68°F, but can occur between 50°F and 73°F (Shepherd 2006a).

Striped bass reach 59 inches (150 cm) in length and 55 to 77 lbs (25 to 35 kg) in weight (Shepherd 2006a). Adult striped bass are omnivores and prey on a wide range of invertebrates and fish, especially clupeids, including menhaden and river herring (Shepherd 2006a). Diets vary by season and location, typically including whatever species are available (Bigelow and Schroeder 1953, as cited in CHGE et al. 1999). Young-of-the-year striped bass diet is made up of fish and invertebrates such as mysid shrimp (Walter et al. 2003, as cited in AKRF 2012).

Compared to other anadromous species, striped bass appear to spend extended periods in the Hudson River, contributing to their PCB body burdens. Moreover, striped bass are high trophic level predators and can accumulate PCBs from contaminated prey. In 1976, the Hudson River commercial fishery was closed because of PCB contamination, although shad anglers continue to catch striped bass in their nets (CHGE et al. 1999).

Based on long-term monitoring data, various life stages associated with this species are found in the Hudson River from Tappan Zee to Albany (Table 3.3-1). Figure 3.3-10a depicts long-term trends in the abundance of striped bass PYSL and YOY in the Hudson River. Figure 3.3-10b depicts long-term trends in striped bass PYSL to YOY survival. The abundance of juvenile striped bass in the River has shown no trend, even though the abundance of striped bass early life stages has greatly increased. The increase in abundance of striped bass larvae has occurred concurrently with the increase in abundance of the Hudson River spawning stock (NYSDEC 2010b; Barnthouse et al. 2003).

The increase in spawning size has been attributed to coast-wide restrictions on harvesting that were imposed to promote the recovery of the Chesapeake Bay striped bass stock. As first noted by Pace et al. (1993, as cited in CHGE et al. 1999), and later confirmed by Barnthouse et al. (2003), there is no correlation between the abundance of striped bass PYSL and striped bass YOY (Figure 3.3-11a). However, there is a strong negative relationship between PYSL abundance and PYSL survival (Figure 3.3-11b). This negative correlation has been interpreted by both Pace et al. (1993, as cited in CHGE et al. 1999) and Barnthouse et al. (2003) as evidence for density-dependent mortality of striped bass larvae. This density dependent mortality is reflected in the long-term trend in PYSL to YOY survival (Figure 3.3-11b), which has declined through time as the size of the spawning population has increased.

The annual coast-wide commercial harvest of striped bass from 1999-2008 has been stable, ranging from 6 million lbs to 7.3 million lbs (ASMFC 2009c). In 2006, the commercial harvest, including discard mortality, accounted for 21 percent of total fishing-related mortality to striped bass (ASMFC 2009c). Commercial striped bass harvests in New York waters from 1999-2008 ranged from 490,000 to 750,000 lbs (ASMFC 2009c). Both coast-wide and New York harvests are now substantially higher than during the 1970's and 1980's, when the coastal stock was severely depleted by overfishing.

Recreational fishing for striped bass in the Hudson River occurs throughout the tidal portion of the River (Normandeau 2003 and 2007, as cited in AKRF 2012).

3.3.7.8 White Perch

White perch (*Morone americana*) larvae and juveniles are entrained at IPEC.

White perch is endemic to the North American eastern coastal areas and range from Nova Scotia to South Carolina. It is not actually a perch, but a member of the temperate bass family Percichthyidae, along with striped bass.

The white perch commercial fishery was closed in 1976 because of PCB contamination. White perch are among those species targeted by recreational anglers in the portion of the Hudson River near the IPEC Site (Normandeau 2003 and 2007, as cited in AKRF 2012). In other parts of its range white perch is intensively fished for recreation (Klauda et al. 1988, as cited in NRC 2010).

Spawning habitats vary and can be clear or turbid, fast or slow, in water less than 23 feet (7 m) deep (Stanley and Danie 1983). In the Hudson River, most spawning occurs in the upper reaches (RM 86 to RM 123) in shallow embayments and tidal creeks, and adults move offshore and down river after spawning (Klauda et al. 1988, as cited in NRC 2010). Spawning in the Hudson River begins in late April when water temperatures reach 50°F to 54°F and can continue until late May or early June when temperatures reach 61°F to 68°F (Klauda et al. 1988, as cited in NRC 2010). Fecundity depends on age and size of the females and ranges from about 5,000 to over 300,000 eggs (Stanley and Danie 1983). When released the eggs sink, and may stick to the substrate or each other.

Hatching takes place between one and six days following fertilization, and the incubation period is inversely related to water temperature, but relatively unaffected by salinity and silt levels (Collette and Klein-MacPhee 2002; Stanley and Danie 1983). Newly hatched YSL are about 0.08 inches (2 mm) long, and after five to six days, the yolk sac is absorbed (Collette and Klein-MacPhee 2002). The YSL generally remain in the same area where they hatched for four to 13 days (Stanley and Danie 1983).

Post-yolk-sac-larvae eat zooplankton and grow rapidly. Juveniles tend to stay in inshore areas of the estuary and in creeks until they are about Age 1 and 8 to 12 inches (20 to 30 cm) in length and then move downstream to brackish areas (Stanley and Danie 1983). Although they may move offshore during the day, they tend to return to shoal areas at night. Most males and females mature at two years. Juveniles eat larger zooplankton. In the spring as water temperature rises, adults, which can reach maximum lengths of 19.5 inches (495 mm), begin their spawning migration and start to move upstream into shallower, fresher waters and into tidal streams. After spawning, they return to deeper waters.

White perch are opportunistic feeders and have a broad range of prey. Young adults in freshwater environments feed on aquatic insects, crustaceans, and other smaller fishes (Stanley and Danie 1983). In brackish and estuarine environments, the white perch feed on fish eggs, the larvae of striped bass, and other smaller adult fish (Chesapeake Bay Program 2006). Young adult white perch also consume amphipods, snails, crayfish, crabs, shrimp, and squid where available. White perch larger than nine inches (22 cm) feed almost exclusively on other fish. White perch are consumed by many larger predatory fish species.

Figure 3.3-12 depicts long-term trends in the abundance of white perch YOY and PYSL in the Hudson River. As shown, the abundance of juvenile white perch declined steadily throughout the 1980's, but has increased since 1990. There is no long-term trend in the annual abundance of PYSL. There is no relationship between PYSL abundance and YOY abundance in white perch (Figure 3.3-13a). There is a strong positive relationship between PYSL survival and YOY abundance (Figure 3.3-13b). Because the analysis shows YOY abundance in white perch is closely related to PYSL survival, but not to PYSL abundance, Barnthouse et al. (2008) concluded that the decline in YOY abundance was due to a decline in PYSL survival rather than to a decline in white perch reproduction.

3.3.8 Threatened and Endangered Aquatic Species

The species discussed in this Section are protected by federal law through the 1973 ESA, as well as through New York State law. Under the ESA, NMFS oversees the listing and protection of all marine fish and wildlife. NMFS was therefore contacted regarding the presence of endangered and threatened species in the vicinity of the IPEC Site.

The shortnose sturgeon has been listed as a federally "endangered species" since 1967, while the Atlantic sturgeon was listed in February 2012 as endangered in various regions, including for the population occurring in the Hudson River. These species are also automatically covered by NYSDEC regulations codified at 6 NYCRR Part 182 (NYNHP 2010).

On February 6, 2012, the NMFS listed the New York Bight population of Atlantic sturgeon, which includes Atlantic sturgeon populations within the Hudson and Delaware Rivers, as endangered under the ESA (Federal Register, Volume 77, Number 24, February 6, 2012).

Juveniles and adults of both species traverse, typically in the deep channel, the Indian Point Region (Region 4) as they migrate to and from their upriver spawning grounds far to the north of IPEC. Critical habitat in the Hudson River has not been designated for shortnose sturgeon or Atlantic sturgeon. NYSDOS has identified several areas in the Hudson River that are essential to shortnose reproduction and survival; however, these areas are located far north of the Indian Point Region (Region 4) (NYSDOS 2012).

Shortnose Sturgeon

The shortnose sturgeon (*Acipenser brevirostrum*) is amphidromous, with a range extending from St. Johns River, Florida, to St. John River, Canada. Unlike anadromous species, shortnose sturgeons spend the majority of their lives in freshwater, moving to saltwater periodically, without relation to spawning (Collette and Klein-MacPhee 2002). From colonial times, shortnose sturgeons have frequently been taken as incidental bycatch in Atlantic sturgeon and shad gill net fisheries (Shepherd 2006b; Dadswell et al. 1984, as cited in AKRF 2012). The shortnose sturgeon was originally listed as endangered on March 11, 1967 under the Endangered Species Preservation Act and has continued to meet the listing criteria under definitions in the 1969 Endangered Species Conservation Act and the 1973 ESA. In 1998, a recovery plan for the shortnose sturgeon was finalized by NMFS (NMFS 1998a). The threats to the species include fishing (bycatch), dams, water pollution, and destruction or degradation of habitat (Shepherd 2006b; NMFS 1998a).

Shortnose sturgeon can grow up to 56 inches (143 cm) in total length, and can weigh up to 51 lbs (23 kg). Females are known to live up to 67 years, while males typically do not live beyond 30 years (Dadswell et al. 1984, as cited in AKRF 2012). Throughout the range of the shortnose sturgeon, males and females mature at 18 to 22 inches (45 to 55 cm) fork length, but the age at which this length is achieved varies by geography. At the southern extent of the sturgeon's range, males reach maturity at age two, and females reach maturity at six years or younger; in Canada, males can reach maturity as late as age 11, and females at age 13 (Dadswell et al. 1984, as cited in AKRF 2012; Office of Protected Resources undated). One to two years after reaching maturity, males begin to spawn at two-year intervals, while females may not spawn for the first time until five years after maturing, and thereafter spawn at three-to-five-year intervals (Dadswell et al. 1984, as cited in AKRF 2012; Office of Protected Resources undated).

Shortnose sturgeons spawn in freshwater during late winter or early summer. Eggs adhere to the hard surfaces on the river bottom before hatching after four to six days. Larvae consume their yolk sac and begin feeding in eight to 12 days (Kynard 1997, as cited in AKRF 2012; Collette and Klein-MacPhee 2002). Juveniles feed on benthic insects and crustaceans and do not migrate to the estuaries until the following winter where they remain for three to five years. As adults, they migrate to the near shore marine environment where their diet consists of mollusks and large crustaceans (Shepherd 2006b; OPR undated).

Shortnose sturgeon traverse the estuary from late spring to early fall before congregating about 44 miles north of IPEC near Sturgeon Point (RM 86). Shortnose sturgeon spawn in the spring just downstream of the Federal Dam at Troy.

The population of shortnose sturgeons in the Hudson River has increased 400 percent since the 1970's according to Cornell University researchers (Bain et al. 2007, as cited in AKRF 2012). Recent work by Woodland and Secor (2007, as cited in FHWA et al. 2012) estimates a fourfold increase in sturgeon abundance over the past three decades, but reports that the population growth slowed in the late 1990's, approaching stasis.

From 1974 to 1990, a total of 32 shortnose sturgeon were observed during impingement monitoring at IP2 and IP3. Adjusting for collection efficiency, it is estimated that a total of 71 shortnose sturgeon were impinged at IP2 and IP3 during this period. There is no information on the number of shortnose sturgeon impinged at IP1 (NMFS 2013b).

The newly issued NMFS Biological Opinion ("BO") (2013b) authorized the following incidental takes of shortnose sturgeon at IPEC, acknowledging that the majority of shortnose sturgeon at the trash racks are above 3 inches gross body diameter and already dead/moribund:

- A total of 395 dead or alive shortnose sturgeon impinged at the Unit 2 Ristroph screens from now until the IP2 proposed renewed operating license would expire on September 28, 2033.

- A total of 167 dead or alive shortnose sturgeon impinged at the Unit 3 Ristroph screens from now until the IP3 proposed renewed operating license would expire on December 12, 2035.

- A total of 2 shortnose sturgeon impinged at the Unit 1 Ristroph screens from now until the IP2 proposed renewed operating license would expire on September 28, 2033.

It is contemplated that all shortnose sturgeon impinged at Unit 2 or 3 would be returned to the Hudson River through the existing fish return system.

Atlantic Sturgeon

Atlantic sturgeon (*Acipenser oxyrhynchus*) have been commercially and recreationally fished for centuries, leading to an overfished status. Before 1900, landings of Atlantic sturgeon reached 3,500 Mt (3,860 t) per year. This number dropped in the 20th century, and from 1950 to 1990, landings ranged from 45 to 115 Mt (50 to 127 t) per year (Shepherd 2006b). ASMFC placed a moratorium on harvesting wild Atlantic sturgeon for the entire coast in 1997 in an attempt to allow the population to recover. In 1999, the Federal Government banned the possession and harvest of sturgeon in the Exclusive Economic Zone (Shepherd 2006b; ASMFC 2007b). The

ASMFC has determined that the Hudson River Atlantic sturgeon stock is overharvested (NMFS 1998b).

On February 6, 2012, the NMFS listed the New York Bight population of Atlantic sturgeon, which includes Atlantic sturgeon populations within the Hudson and Delaware Rivers, as endangered under the ESA (Federal Register, Volume 77, Number 24, February 6, 2012). In addition to the New York Bight Population, individuals from four other Atlantic sturgeon Distinct Population Segments ("DPSs") in the Atlantic Ocean could also occur in the Hudson River.

Although New York placed a moratorium on harvesting Atlantic sturgeon in 1996, the American shad gill net fishery continued to take sub-adult sturgeon as bycatch. Since all commercial fisheries for American shad are now closed, this bycatch should not occur until such time as the gill net fishery may re-open. The Status Review Team for Atlantic sturgeon concluded in 2007 (ASSRT 2007, as cited in FHWA et al. 2012) that the Hudson River sub-population has a moderate risk (less than 50 percent) of becoming endangered in the next 20 years as a result of the threat of commercial bycatch. Despite this, the Hudson River supports the largest sub-population of spawning adults and juveniles, and some long-term surveys indicate that the abundance has been stable since 1995 or is even increasing (ASSRT 2007, as cited in FHWA et al. 2012).

The Atlantic sturgeon is an anadromous species, with a range extending from St. Johns River, Florida, to Labrador, Canada. The Atlantic sturgeon has long been harvested for its flesh and caviar, as well as its skin and swim bladder. A long-lived, slowly maturing species, the Atlantic sturgeon can reach 60 years of age (ASMFC 2007b; Gilbert 1989, as cited in AKRF 2012). Maturity is reached at seven to 30 years for females, and five to 24 for males, with fish in the southern range maturing earlier than those inhabiting the northern range (ASMFC 2007b). Fecundity is correlated with age and size, ranging from 400,000 to eight million eggs per female. Individuals reach lengths of about 79 inches (200 cm), while the largest recorded sturgeon was 15 feet (4.5 m) and 811 lbs (368 kg) (ASMFC 2007b).

In the spring, adult Atlantic sturgeons migrate to freshwater to spawn, with males arriving a few weeks before the females. In the Hudson River, the males' migration occurs when water temperatures reach 42°F to 43°F; the females appear when water temperatures warm to 54°F to 55°F. Spawning occurs a few weeks later (Gilbert 1989, as cited in AKRF 2012). Eggs are deposited on hard surfaces on the river bottom, and hatch after four to six days (Shepherd 2006b). Individuals do not spawn annually - spawning intervals range from one to five years for males and two to five years for females (NMFS 2007). Females typically leave the estuary four to six weeks after spawning, but the males can remain in the estuary until the fall.

Larvae feed from their yolk sac for nine to ten days and then the PYSL begin feeding on the river bottom (Gilbert 1989, as cited in AKRF 2012). In the fall, the juveniles move downstream from freshwater to the estuaries, where they remain for three to five years, and then migrate to the ocean as adults (Shepherd 2006b). Individuals return to their natal river for spawning and so the species is divided into five DPSs (ASSRT 2007, as cited in FHWA et al. 2012). Juveniles and adults are bottom feeders, subsisting on mussels, worms, shrimp, and small fish (Gilbert 1989, as cited in AKRF 2012; ASMFC 2007b).

Peterson et al. (2000, as cited in AKRF 2012) estimated that the Hudson River population of Age 1 Atlantic sturgeon had declined about 80 percent between 1977 and 1985. The authors suggested that the then-current recruitment could be too low to sustain the population. Threats such as bycatch, water quality, and dredging continue to affect Atlantic sturgeon (ASMFC 2007b). In the Hudson River, the Federal Dam at Troy (the southernmost obstruction in the River) is upstream of the northern extent of the Atlantic sturgeon spawning habitat and therefore is not a limiting factor (ASSRT 2007, as cited in FHWA et al. 2012). Average levels of PCBs in Hudson River sturgeon tissue exceeded Food and Drug Administration ("FDA") guidelines for human consumption in the 1970's and 1980's. Since then, levels of PCBs have dropped below FDA guidelines (ASSRT 2007, as cited in FHWA et al. 2012).

The Hudson River currently has approximately 870 spawning adults per year (ASSRT 2007, as cited in FHWA et al. 2012). Hudson River juvenile Atlantic sturgeon relative abundance has declined since the mid 1970's. Available population estimates for Age 1 Hudson River Atlantic sturgeon were 25,000 for the 1976 year class and 4,290 for the 1994 year class (NMFS 1998b). The American Shad Observer Program (1974-2004), the LRS (1974-2004), and FSS (1985-2004) showed a decline in young juvenile Atlantic sturgeon catch-per-unit-effort ("CPUE") from 12.29 in 1986 to 0.47 in 1990. The CPUE then ranged from 0.47-3.17 and increased slightly to 3.85 in 2003. Atlantic sturgeon YOY have been collected in 1991, 1993-1996, and 2003, which shows evidence of successful spawning (ASSRT 2007, as cited in FHWA et al. 2012). However, the Hudson River Atlantic sturgeon stock may be showing a small increase in abundance (ASMFC 2008).

A total of 601 Atlantic sturgeon were observed during impingement monitoring at IP2 and IP3 from 1974-1990. Adjusting for collection efficiency, it is estimated that a total of 1,334 Atlantic sturgeon were impinged at IP2 and IP3 during this period (NMFS 2013b).

The NMFS BO (2013b) 2012 authorized the following incidental takes of Atlantic sturgeon, acknowledging that the majority of Atlantic sturgeon at the trash racks are above 3 inches gross body diameter and already dead/moribund:

- A total of 269 dead or alive New York Bight DPS Atlantic sturgeon impinged at the Unit 2 Ristroph screens from now until the IP2 proposed renewed operating license would expire on September 28, 2033.

- A total of 145 dead or alive New York Bight DPS Atlantic sturgeon impinged at the Unit 3 Ristroph screens from now until the IP3 proposed renewed operating license would expire on December 12, 2035.

- A total of 2 Atlantic sturgeon impinged at the Unit 1 Ristroph screens from now until the IP2 proposed renewed operating license would expire on September 28, 2033.

3.3.9 NRC FSEIS

In conjunction with the FSEIS, NRC consulted with NMFS, which identified five potential Essential Fish Habitat ("EFH") species, only one of which - Bluefish - is present in the vicinity of IPEC (Barnthouse et al. 2011). Bluefish are not entrained at IPEC. Impingement is addressed through existing state-of-the-art traveling water screen technology, and eliminated by CWWS.

Marine mammals are protected by NMFS under the Marine Mammal Protection Act ("MMPA"). Given IPEC's location at Hudson River RM 42, no species of marine mammals regularly occurs within the vicinity of IPEC. The marine mammals that have been observed in rare instances to occur this far, or further upstream, are seals; for instance, as reported anecdotally in the Hudson

River Almanac over the past decade (see July 20, 2011 report of gray seal (*Halichoerus grypus*) at Hyde Park [RM 82]) (NYSDEC 2011).

3.4 TERRESTRIAL ECOLOGY

This Section provides a description of the terrestrial ecology at the IPEC Site (Figure 3.4-1) and in the vicinity of the IPEC Site (RM 41–44). A description of the existing landscape is provided, as well as a listing of the federal and state-listed threatened and endangered species that may occur in the vicinity of IPEC.

3.4.1 Terrestrial Habitats

The IPEC Site and the surrounding forested areas lie within the oak-chestnut association of the eastern deciduous forest biome of North America (Entergy 2007). After the demise of the American chestnut (*Castanea denata*) around the end of the 19th Century, the dominant hardwood tree species in the vicinity of the IPEC Site is oak (Entergy 2007).

Land cover at the 239-acre IPEC Site includes Commercial/Industrial/Transportation ("CIT"), Mixed Forest ("MF"), Urban/Recreational Grasses ("URG"), and open water cover types as shown in Table 3.4-1. Figure 3.4-1 shows these cover types on the IPEC Site. Due to the limited ecological value of the areas containing URG, as well as the CIT-type uses given to many of these areas on the Site (temporary equipment storage, etc.), they have been combined with areas of CIT in Figure 3.4-1. The areas comprising CIT and URG occur in the central and southern parts of the IPEC Site and consist of developed areas such as the Stations, associated buildings, waterfront and intake facilities, access roads and driveways, paved parking lots, grassed and landscaped areas, and unpaved lots.

Mixed Forest areas consist of deciduous, evergreen and mixed woodlands that occur in small to large patches throughout the northern, eastern, and southern parts of the IPEC Site. These forested patches occur amongst portions of the CIT areas such as roads and parking lots, and comprise a significant portion of the IPEC Site's eastern boundary along Broadway. Thus, as presented in Table 3.4-1, approximately half of the IPEC Site is natural or has re-naturalized from a previously disturbed condition. The largest patch of MF occurs in the northern part of the IPEC Site adjacent to Lents Cove and the Hudson River. Also included as MF are areas of maintained utility corridors on the IPEC Site where no other CIT or URG are present. Some of the MF areas occur on steep slopes, such as along the Hudson River and the southern ridgeline of the northern forested area, and in the southwestern corner of the IPEC Site. Finally, open water is found on the IPEC Site as an approximately 2-acre pond in the northern part of the IPEC Site, within the northern MF area, as well as an approximately 0.2-acre ponded area in the southern part of the site. The Hudson River also comprises open water, although the acreage is not included in Table 3.4-1. Specific Ecological Communities associated with these land use/land cover areas that occur in the Site vicinity are presented below in Section 3.4.1.1.

Table 3.4-1
IPEC Site Land Cover Types

Land Use / Land Cover Description	Acres (approximate)	Percent (%) (approximate)
Open Water	2.2	1
Commercial/Industrial/Transportation	124	52
Mixed Forest	105.8	44
Urban/Recreational Grasses	7	3
Source: Adapted from Entergy 2007.		

There are no federal or state jurisdictional wetlands on the IPEC Site. The nearest NYSDEC designated wetlands are located 0.45 miles northeast of the IPEC Site at Lents Cove, east of Broadway.

3.4.1.1 New York Natural Heritage Program

The New York Natural Heritage Program ("NYNHP"), a partnership between NYSDEC and The Nature Conservancy ("TNC"), utilizes an Ecological Communities classification system (Edinger et al. 2002) to characterize distinct ecosystems within New York State. The ecological communities are categorized as Marine, Estuarine, Riverine, Lacustrine (ponds), Palustrine (non-tidal wetlands), Terrestrial and Subterranean.

As presented in Table 3.4-1, the industrially developed portion of the IPEC Site and its roadways (CIT) constitutes approximately 52 percent of the site. The remaining 48 percent of the site consists broadly of mixed forest (44 percent), open water (1 percent), and mowed lawn (Urban/Recreational Grasses) (3 percent).

Thirteen additional ecological communities, not all of which are categorized as Terrestrial, are present in the vicinity of the IPEC Site, as well as the three Hudson River SCFWHs, the Coastal Zone, and RM 56 to 60 (AKRF 2012).

Terrestrial ecological communities include the following:

Acidic Talus Slope Woodland

This ecological community typically occurs on well-drained shallow soils underlain with non-calcareous bedrock. The canopy cover is typically less than 50 percent and comprised of chestnut oak (*Quercus montana*), pignut hickory (*Carya glabra*), red oak (*Q. rubra*), and white oak (*Q. alba*). Smooth sumac (*Rhus glabra*) and scrub oak (*Q. ilicifolia*) are also common inhabitants. The herbaceous layer often includes Pennsylvania sedge (*Carex pensylvanica)* (Edinger et al. 2002).

Appalachian Oak-Hickory Forest

Appalachian oak-hickory forests generally occur on ridgetops and hillcrests and west- and south-facing slopes. Soils include well-drained loams or sandy loams. This ecological community covers a large range of species and is widely distributed throughout New York State. The canopy layer typically includes one species of oak, along with red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), pignut hickory, shagbark hickory (*Carya ovata*), and/or white ash (*Fraxinus americana*). Characteristic shrubs include flowering dogwood (*Cornus florida*), American witch-hazel (*Hamemelis virginana*), early low-bush blueberry (*Vaccinium pallidum*), and maple-leaf viburnum (*Viburnum acerifolium*). Wild sarsaparilla (*Aralia nudicaulis*) and black snakeroot (*Cimicifuga racemosa*) are often present in the herbaceous layer (Edinger et al. 2002).

Cliff Community

The vertical non-calcareous bedrock walls on which this community can be found support vegetation in shallow soils. While the vegetative cover is typically sparse, a wide range of tree, shrub, and herbaceous species, including various state-listed species, can occur (Edinger et al. 2002).

Chestnut- Oak Forest

This ecological community is noted for its dominant tree cover including oaks such as chestnut oak and red oak. Other trees include white oak, black oak (*Q. velutina*), and red maple. Once dominated by the American chestnut, as described above, the oaks have since taken over. The shrublayer is usually comprised of ericaceous plants such as black huckleberry (*Gaylussacia baccata*), mountain laurel (*Kalmia latifolia*), and blueberry. Groundcover vegetation includes Pennsylvania sedge, wild sarsaparilla, winterberry (*Gaultheria procumbens*), and the moss *Leucobryum glaucum* (Edinger et al. 2002).

Oak- Tulip Tree Forest

This community of hardwoods occurs on well-drained soils. The canopy is comprised of oaks, tulip tree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), black birch (*Betula lenta*), and red maple. Characteristic shrub species consist of flowering dogwood, American witch-hazel, sassafras (*Sassafras albidum*), and lowbush blueberry (*Vaccinium angustifolium, Vaccinium pallidum*). Herbaceous species include New York fern (*Thelypteris novaboracenis*), white wood aster (*Eurybia divaricata*), and Solomon's plume (*Maianthemum racemosum*) (Edinger et al. 2002).

Pitch-Pine-Oak-Heath Rocky Summit

This broadly defined ecological community occurs on warm, rocky ridge and mountaintops. The dry soils and non-calcareous bedrock support sparse ericaceous vegetation such as pine (*Pinus* spp.), scrub oak, or heath shrubs. It is often associated with the chestnut-oak forest community (Edinger et al. 2002).

Red Cedar Rocky Summit

The red cedar rocky summit community occurs on warm, rocky ridge- and mountaintops. It is characterized by eastern red cedar (*Juniperus virginiana*) in the dry soils underlain with calcareous bedrock. This species is often observed as being affected by heat stress in this community, which also supports a variety of lichens. The red cedar rocky summit community is often associated with the Appalachian Oak-Hickory Forest community (Edinger et al. 2002).

Rocky Summit Grassland

This ridgetop, outcrop, and summit community typically supports grass species such as Indian grass (*Sorgastrum nutans*). Woody vegetation is limited, though can include blueberries and red oak (Edinger et al. 2002).

The following community, Floodplain Forest, is a Palustrine ecosystem:

Floodplain Forest

These vast ecological communities can be found in the lowlands associated with rivers, such as low floodplain terraces and in river deltas. The mineral soils support a wide variety of tree species, including silver maple (*Acer saccharinum*), ashes, cottonwood (*Populus deltoides*), red maple, box elder (*Acer negundo*), elms (*Ulmus americana*, *U. rubra*), hickories, butternut and black walnut (*Juglans cinerea*, *J. nigra),* sycamore (*Platanus occidentalis*), white oak, pin oak (*Quercus palustris*), and river birch (*Betula nigra*). Characteristic shrub species include spicebush (*Lindera benzoin*), ironwood (*Carpinus carolinianus),* bladdernut (*Staphylea trifoliata*), speckled alder (*Alnus incana* spp. *rugosa*), dogwoods (*Cornus sericea*, *C. foemina* spp. *racemosa*, *C. amomum*), and viburnums (*Viburnum cassinoides*, *V. prunifolium*, *V. dentatum*, *V. lentago*) (Edinger et al. 2002).

Estuarine ecosystems include the following:

Brackish Intertidal Mudflats

Brackish intertidal mudflats occurring along the Hudson River are typically submerged at high tide and exposed at low tide. The salinity of the brackish water can range from 0.5 to 18 psu. Dominant aquatic vegetation includes spongy arrowhead (*Sagittaria montevidensis*), strap-leaf arrowhead (*Sagittaria subulata*), mudwort (*Limosella australis*), and tapegrass (*Vallisneria americana*) (Edinger et al. 2002).

Brackish Tidal Marsh

This ecological community is characterized by water depths of no more than 6 feet during high tide and salinity levels ranging from 0.5 and 18 psu. Salt- and freshwater vegetation includes species such as narrowleaf cattail (*Typha angustifolia*), crimsoneyed rosemallow (*Hibiscus moscheutos*), seaside goldenrod (*Solidago sempervirens*), saltmarsh fleabane (*Pluchea odorata*), and assorted bulrushes (Edinger et al. 2002).

Freshwater Tidal Marsh

Freshwater tidal marshes are characterized by water depths of no more than 6 feet during high tide and salinity levels of less than 0.5 psu. This community can typically be found in shallow bays, shoals, or associated with large tidal riverine systems. Aquatic vegetation occurring within the freshwater tidal marsh communities include; kidneyleaf mud-plantain (*Heteranthera reniformis*), spotted jewelweed (*Impatiens capensis*), yellow pond-lily (*Nuphar advena*), pickerelweed (*Pontederia cordata*), narrow-leaved cattail, and wild rice (*Zizania sp.*) (Edinger et al. 2002).

Tidal River

This aquatic community is characterized by tidally-influenced, permanently inundated substrates. There are two zones associated with this community; deepwater, which includes depths greater than 6 feet at low tide; and shallow, which includes depths of no more than 6 feet at low tide. Salinity varies as a result of the tidal nature of the waterway. Tidal rivers do not support emergent vegetation (Edinger et al. 2002).

3.4.1.2 Riparian Zone

A riparian zone or riparian area is the interface between land and a river or stream. Plant habitats and communities along the river margins and banks are called riparian vegetation, characterized by hydrophilic (adapted to aquatic environments) plants. Riparian zones typically provide wildlife habitat and can provide food and shelter for wildlife, including herptiles, mammals, and avifauna.

The riparian zone at the IPEC Site in the area of the Stations consists entirely of a developed shoreline with no vegetation. There is a strip of land on the south side of the site (about 600 feet in length and up to a maximum of about 30 feet wide) with a combination of riparian and upland vegetation located along the interior (eastern edge) of the discharge canal and adjacent to a site parking lot. Riparian habitat exists to the north of the power block, and is part of the forested lands noted in Table 3.4-1.

3.4.1.3 Critical or Important Habitats

Federal-Listed

The federal ESA protects fish, wildlife, plants, and invertebrates that are federally-listed as threatened or endangered (ESA 1973), including terrestrial species discussed here. The USFWS has primary responsibility for all terrestrial species. Protection is also afforded under the ESA to "critical habitat," which the USFWS defines as specific areas both within and outside the geographic area occupied by a species on which are found physical and biological features essential to its conservation. According to the USFWS Critical Habitat Portal, no critical or important habitat for federally-listed species has been designated in the vicinity of the IPEC Site (USFWS 2013).

State-Listed

New York State law protects additional terrestrial species beyond the ESA as endangered, threatened, species of special concern, and, in the case of certain plants, rare species. Critical and important habitats are also managed by NYSDEC for species of special interest. As part of its Environmental Report submitted to NRC for a renewal of federal operating licenses for IPEC Entergy contacted the NYNHP to request a review of their database for a list of potential critical and important habitats within a 50-mile radius of the site. The NYNHP was again contacted in 2010 to update the list originally provided in 2006. Both responses indicate that there are no designated critical or important habitats located in the vicinity of the IPEC Site (NYNHP 2010).

3.4.1.4 Biodiversity Areas

The Croton-to-Highlands Biodiversity Plan ("CHBP") (Miller and Klemens 2004), a land use planning and conservation tool developed by four towns in Westchester and Putnam Counties in collaboration with the Wildlife Conservation Society's Metropolitan Conservation Alliance, highlighted 20 biodiversity areas within those counties. According to this plan, the IPEC Site lies in proximity to, but outside of, two biodiversity areas - areas 7 and 8.

Biodiversity area 7 is located approximately 1.5 miles south of the IPEC Site, and is noted for its abundance of wildlife in a relatively small area. It is bounded on three sides by development, but is inhabited by species associated with larger tracts of wildlands, owing to the fact that the forested area is open to the west to the Hudson River.

Biodiversity area 8 is a broad expanse of woodlands (1,500+ acres) located approximately 1.2 miles east of the IPEC Site. It is considered by the plan to be a biodiversity hub that supports a wide range of species, including several bird and amphibian species such barred owls (*Strix varia*), pileated woodpeckers (*Dryocopus pileatus)*, wood thrushes (*Hylocichla mustelina)*, spotted and marbled salamanders (*Ambystoma maculatum* and *Ambystoma opacum)*, wood frogs (*Rana sylvatica)*, gray tree frogs (*Hyla versicolor*) and black rat snakes (*Elaphe o. obsoleta*), that are indicative of high-quality habitat.

Given their proximity to the IPEC Site, it is possible that some of the species associated with these biodiversity areas, particularly the birds and larger mammals, would also utilize appropriate habitats at the site.

3.4.2 Terrestrial Fauna

3.4.2.1 Wildlife

Common mammals that may occur on the IPEC Site and their general associated habitats are presented in Table 3.4-2.

Table 3.4-2
Common Mammals in the Vicinity of IPEC

Scientific Name	Common Name	General Habitat	Habitat Occurring on IPEC Site
Canis latrans	Coyote	Mixed and deciduous forests, fields, brush, towns	X
Didelphis virginiana	Virginia opossum	Deciduous forests, often near shorelines	X
Eptesicus fuscus	Big brown bat	Feeds in forests and fields; roosts in buildings and hollow trees	X
Lasiurus borealis	Eastern red bat	Forests, forested edges	X
Lasiurus cinereus	Hoary bat	Deciduous and mixed forests	X
Marmota monax	Groundhog	Fields, mixed and deciduous forests, forested edges, brush, roadsides	X
Mephitis mephitis	Striped skunk	Brush, fields, mixed and deciduous forests	X
Microtus pennsylvanicus	Meadow vole	Marshes, fields, mixed forest	X
Mus musculus	House mouse	Near/within buildings	X
Mustela frenata	Long-tailed weasel	Forests, brush, fields; often near water	X
Mustela vison	American mink	Freshwater shorelines	X
Odocoileus virginianus	White-tailed deer	Mixed forest, deciduous forest, fields, swamps	X
Ondatra zibethicus	Muskrat	Fresh and saltwater ponds, rivers, lakes and marshes	X
Peromyscus leucopus	White-footed mouse	Mixed forests	X
Pipistrellus subflavus	Eastern pipestrelle	Open forests near water, rock crevices and buildings; winters in warm, moist caves	
Procyon lotor	Raccoon	Forests and brush on edges of streams, lakes, wetlands	X
Sciurus carolinensis	Gray squirrel	Deciduous forest, mixed forest, towns, suburbs	X
Sylvilagus floridanus	Eastern cottontail rabbit	Fields, forested edges, brush	X
Tamias striatus	Eastern chipmunk	Mixed forests, brush	X
Tamiasciurus hudsonicus	Red squirrel	Mixed forests	X
Urocyon cinereoargenteus	Grey fox	Open forests, brush, fields	
Vulpes vulpes	Red fox	Fields, brush, open areas	
Zapus hudsonius	Meadow jumping mouse	Fields, brush, marshes	
Blarina, Cryptotis, Sorex spp.	Shrews	Mixed forests, fields, brush	X
Sources:	NYSDEC 2013a. Wernert 1982. Alden 1998.		

3.4.2.2 Reptiles and Amphibians

According to NYSDEC Herp Atlas distribution maps (NYSDEC 2013b), there are a total of 42 herpetological species that have been documented within the atlas block where the Project area is located (Table 3.4-3). These species include eleven species of salamanders/newts, nine species of frogs/toads, two species of lizards, 12 species of snake, and eight species of turtles.

Table 3.4-3
List of Reptile and Amphibian Species Documented within Project Site Atlas Block

Scientific Name	Common Name
Salamanders/Newts	
Ambystoma opacum	Marbled Salamander
Ambystoma jeffersonianum	Jefferson Salamander
Ambystoma laterale	Blue-Spotted Salamander
Ambystoma maculatum	Spotted Salamander
Notophthalmus v. viridescens	Red-Spotted Newt
Plethodon c. cinereus	Northern Redback Salamander
Plethodon glutinosus	Northern Slimy Salamander
Hemidactylium scutatum	Four-Toed Salamander
Gyrinophilus p. porphyriticus	Northern Spring Salamander
Pseudotriton r. ruber	Northern Red Salamander
Eurycea bislineata	Northern Two-Lined Salamander
Toads/Frogs	
Bufo a. americanus	Eastern American Toad
Bufo fowleri	Fowler’s Toad
Hyla versicolor	Gray Treefrog
Pseudacris c. crucifer	Northern Spring Peeper
Rana catesbeiana	Bullfrog
Rana clamitans melanota	Green Frog
Rana sylvatica	Wood Frog
Rana sphenocephala utricularius	Southern Leopard Frog
Rana palustris	Pickerel Frog
Lizards	
Sceloporus undulatus hyacinthinus	Northern Fence Lizard
Eumeces fasciatus	Five-Lined Skink
Snakes	
Nerodia s. sipedon	Northern Water Snake
Storeria d. dekayi	Northern Brown Snake
Thamnophis sirtalis	Common Garter Snake
Thamnophis sauritus	Eastern Ribbon Snake
Heterodon platirhinos	Eastern Hognose Snake
Diadophis punctatus edwardsii	Northern Ringneck Snake
Carphophis a. amoenus	Eastern Worm Snake
Coluber c. constrictor	Northern Black Racer
Elaphe o. obsoleta	Black Rat Snake
Lampropeltis t. triangulum	Eastern Milk Snake
Agkistrodon contortrix mokasen	Northern Copperhead
Crotalus horridus	Timber Rattlesnake

Table 3.4-3
List of Reptile and Amphibian Species Documented within Project Site Atlas Block

Scientific Name	Common Name
Turtles	
Chelydra s. serpentina	Common Snapping Turtle
Sternotherus odoratus	Common Musk Turtle
Clemmys guttata	Spotted Turtle
Clemmys insculpta	Wood Turtle
Terrapene c. carolina	Eastern Box Turtle
Malaclemys t. terrapin	Northern Diamondback Terrapin
Trachemys scripta elegans	Red-Eared Slider
Chrysemys picta	Painted Turtle
Source: NYSDEC 2013b.	

3.4.2.3 Avifauna

The open water of the Hudson River in the vicinity of IPEC (Region 4) support a number of migrant waterfowl species, including mallard (*Anas platyrhyncos*), Canada goose (*Branta canadensis*), American black duck (*Anas rubripes*), and wood duck (*Aix sponsa*) (Entergy, April 23, 2007). In addition, several species of woodpeckers, songbirds, herons, and raptors, such as osprey (*Pandion haliaetus*) and bald eagle (*Haliaeetus leucocephalus*), utilize the river areas near the IPEC Site. Peregrine falcons (*Falco peregrinus*) and short-eared owls (*Asio flammeus*) are also found throughout much of the Hudson River Valley, including the vicinity of the IPEC Site (AKRF 2012).

The Breeding Bird Atlas ("BBA") is a database of documented bird activity throughout New York State that includes confirmed sightings, as well as likelihood of species breeding within an area (NYSDEC 2013c). The most recent study conducted occurred between 2000 and 2005. The BBA is divided into a system of blocks, which each block representing a 3 x 3-mile area. The IPEC Site is located within Block 5856A, which lists a total of 76 species as breeding or having the potential to breed within that area (Table 3.4-4). Of those 76 species, only 43 species have been found engaging in breeding activities and are thus listed as "confirmed." The remaining 33 species have been found engaging in behaviors that suggest "possible" or "probable" use of the area for breeding.

Table 3.4-4
List of Species Breeding in Atlas Block 5856A

Scientific Name	Common Name	Behavior Code*	Date	New York Legal Status**
Branta canadensis	Canada Goose	NE	4/15/2000	Game Species
Cygnus olor	Mute Swan	FL	5/31/2000	Protected
Aix sponsa	Wood Duck	P2	5/31/2003	Game Species
Anas platyrhynchos	Mallard	FL	6/4/2000	Game Species
Meleagris gallopavo	Wild Turkey	FL	7/1/2000	Game Species
Ardea herodias	Great Blue Heron	X1	5/28/2001	Protected
Butorides virescens	Green Heron	X1	5/31/2003	Protected
Nycticorax nycticorax	Black-crowned Night-Heron	FL	7/1/2000	Protected
Cathartes aura	Turkey Vulture	X1	7/1/2000	Protected

Table 3.4-4
List of Species Breeding in Atlas Block 5856A

Scientific Name	Common Name	Behavior Code*	Date	New York Legal Status**
Accipiter cooperii	Cooper's Hawk	X1	8/6/2001	Protected-Special Concern
Buteo jamaicensis	Red-tailed Hawk	FL	7/3/2004	Protected
Charadrius vociferous	Killdeer	FL	6/4/2000	Protected
Actitis macularius	Spotted Sandpiper	X1	8/6/2001	Protected
Larus marinus	Great Black-backed Gull	D2	3/23/2003	Protected
Columba livia	Rock Pigeon	X1	6/4/2000	Unprotected
Zenaida macroura	Mourning Dove	NE	5/31/2003	Protected
Coccyzus americanus	Yellow-billed Cuckoo	X1	6/17/2000	Protected
Coxxyzus erythropthalmus	Black-billed Cuckoo	X1	6/7/2001	Protected
Chaetura pelagica	Chimney Swift	P2	7/21/2000	Protected
Megaceryle alcyon	Belted Kingfisher	FY	6/7/2001	Protected
Melanerpes carolinus	Red-bellied Woodpecker	FY	7/1/2000	Protected
Picoides pubescens	Downy Woodpecker	ON	8/6/2001	Protected
Picoides villosus	Hairy Woodpecker	FY	5/12/2001	Protected
Colaptes auratus	Northern Flicker	FL	7/16/2000	Protected
Dryocopus pileatus	Pileated Woodpecker	X1	6/24/2000	Protected
Contopus virens	Eastern Wood-Pewee	NY	7/1/2000	Protected
Sayornis phoebe	Eastern Phoebe	NE	5/17/2002	Protected
Myiarchus crinitus	Great Crested Flycatcher	FY	6/19/2004	Protected
Tyrannus tyrannus	Eastern Kingbird	P2	7/21/2001	Protected
Vireo flavifrons	Yellow-throated Vireo	S2	6/19/2004	Protected
Vireo gilvus	Warbling Vireo	NE	6/10/2000	Protected
Vireo olivaceus	Red-eyed Vireo	NY	7/8/2000	Protected
Cyanocitta cristata	Blue Jay	FY	7/22/2000	Protected
Corvus brachyrhynchos	American Crow	P2	7/17/2004	Game Species
Corvus corax	Common Raven	NY	5/17/2005	Protected
Tachycineta bicolor	Tree Swallow	FY	6/25/2001	Protected
Stelgidopteryx serripennis	Northern Rough-winged Swallow	FY	7/8/2000	Protected
Riparia riparia	Bank Swallow	X1	6/13/2005	Protected
Hirundo rustica	Barn Swallow	FY	7/16/2000	Protected
Poecile atricapillus	Black-capped Chickadee	P2	6/10/2000	Protected
Baeolophus bicolor	Tufted Titmouse	FY	7/16/2000	Protected
Citta carolinensis	White-breasted Nuthatch	P2	5/10/2003	Protected
Thryothorus ludovicianus	Carolina Wren	T2	4/22/2001	Protected
Troglodytes aedon	House Wren	T2	5/8/2001	Protected
Polioptila caerulea	Blue-gray Gnatcatcher	X1	5/10/2003	Protected
Hylocichla mustelina	Wood Thrush	NY	7/5/2003	Protected
Turdus migratorius	American Robin	NY	7/8/2000	Protected
Dumetella caroliniensis	Gray Catbird	NE	5/31/2003	Protected

Table 3.4-4
List of Species Breeding in Atlas Block 5856A

Scientific Name	Common Name	Behavior Code*	Date	New York Legal Status**
Mimus polyglottos	Northern Mockingbird	DD	7/21/2001	Protected
Sturnus vulgaris	European Starling	FY	6/13/2005	Unprotected
Bombycilla cedrorum	Cedar Waxwing	FY	7/21/2001	Protected
Vermivora pinus	Blue-winged Warbler	FY	6/7/2001	Protected
Vermivora chrysoptera	Golden-winged Warbler	S2	6/11/2000	Protected- Special Concern
Dendroica petechial	Yellow Warbler	FY	6/4/2000	Protected
Dendroica virens	Black-throated Green Warbler	T2	5/10/2003	Protected
Dendroica discolor	Prairie Warbler	T2	6/24/2000	Protected
Miniotilta varia	Black-and-white Warbler	T2	6/17/2000	Protected
Setophaga ruticilla	American Redstart	FY	7/22/2000	Protected
Helmitheros vermivorum	Worm-eating Warbler	N2	7/1/2000	Protected
Seirus noveboracensis	Northern Waterthrush	FY	7/1/2000	Protected
Geothlypis thrichas	Common Yellowthroat	P2	7/22/2000	Protected
Pipilo erythropthalmus	Eastern Towhee	T2	7/1/2000	Protected
Spizella passerina	Chipping Sparrow	FY	6/7/2001	Protected
Melospiza melodia	Song Sparrow	FL	8/6/2001	Protected
Melospiza georgiana	Swamp Sparrow	X1	7/1/2000	Protected
Piranga olicacea	Scarlet Tanager	FL	7/1/2000	Protected
Cardinalis cardinalis	Northern Cardinal	FL	7/5/2003	Protected
Pheucticus ludovicianus	Rose-breasted Grosbeak	X1	8/6/2001	Protected
Passerina cyanea	Indigo Bunting	FY	6/30/2000	Protected
Agelaius phoeniceus	Red-winged Blackbird	FY	7/8/2000	Protected
Quiscalus quiscula	Common Grackle	FY	6/25/2001	Protected
Molothrus ater	Brown-headed Cowbird	D2	7/5/2003	Protected
Icterus galbula	Baltimore Oriole	NY	6/4/2000	Protected
Carpodacus mexicanus	House Finch	S2	4/15/2000	Protected
Spinus tristis	American Goldfinch	P2	7/16/2000	Protected
Passer domesticus	House Sparrow	FY	6/13/2005	Unprotected

Table 3.4-4
List of Species Breeding in Atlas Block 5856A

Scientific Name	Common Name	Behavior Code*	Date	New York Legal Status**

Notes:

*Behavior Code	Description	Behavior Category
X1	Species seen in possible nesting habitat or singing male(s) present in breeding season.	Possible
S2	Singing male present on more than one date in the same place.	Probable
P2	Pair observed in suitable habitat in breeding season.	Probable
T2	Bird (or pair) apparently holding territory.	Probable
D2	Courtship and display, agitated behavior. Includes copulation, well developed brood patch, or cloacal protuberance.	Probable
N2	Visiting probable nest site.	Probable
B2	Nest building or excavation of a nest hole.	Probable
DD	Distraction display or injury-feigning.	Confirmed
UN	Used nest found.	Confirmed
FE	Female with egg in the oviduct.	Confirmed
FL	Recently fledged young.	Confirmed
ON	Adult(s) entering or leaving nest site indicating occupied nest.	Confirmed
FS	Adult carrying fecal sac.	Confirmed
FY	Adult(s) with food for young or feeding young.	Confirmed
NE	Nest and eggs, bird on nest or egg, or eggshells beneath nest.	Confirmed
NY	Nest with young.	Confirmed

**"New York Legal Status" codes.

Protected-Special Concern	Special Concern Species are those native species which are not yet recognized as endangered or threatened, but for which documented evidence exists relating to their continued welfare in New York State. The Special Concern category exists within DEC rules and regulations, but such designation does not in itself provide any additional protection. However, Special Concern species may be protected under other laws.
Game Species	Game Species are defined as "big game", "small game" or "game bird" species in ECL 11-0103. For some species, there are seasons set when they may be legally hunted. For other species, there are no seasons set and the species may not be hunted or taken at any time in New York.
Protected Species	Protected Species are defined in ECL 11-0103 as all wild birds except those named as unprotected. Some of these birds, such as waterfowl and gallinaceous birds, are also listed as game species with seasons set, while others may not be taken at any time.
Unprotected Species	Unprotected species are those that may be taken at any time without limit. However, a license to take may be required.

Source: NYSDEC 2013c.

Breeding evidence was found in the vicinity of the IPEC Site for several additional species of birds, including the least bittern (*Ixobrychus exilis*), the sora (*Porzana carolina*), the marsh wren (*Cistothorus palustris*), and the Kentucky warbler (*Oporornis formosus*) (AKRF 2012).

3.4.3 Protected Terrestrial Species

This Section contains information regarding both federally and state-listed terrestrial species identified in Westchester County and potentially in the vicinity of the IPEC Site. As indicated in Table 3.4-5 and discussed below, several species occur under both federal and state protected species programs.

3.4.3.1 Federally Protected Species

Under the ESA, the federally protected and candidate terrestrial species identified by USFWS as occurring within Westchester County include two mammals, one reptile, and one bird: the

Indiana bat (*Myotis sodalis*), the New England cottontail rabbit (*Sylvilagus transitionalis*), the bog turtle (*Clemmys muhlenbergii*) and the bald eagle (USFWS 2010). The Indiana bat is listed as endangered, the bog turtle is listed as threatened, and the New England cottontail rabbit is listed as a candidate species. The bald eagle, which was formerly listed as a federally threatened species but was delisted as such by the Department of the Interior on August 8, 2007, is protected under the Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668-668d, 54 Stat. 250) as amended through November 8, 1978) and has been observed near the IPEC Site. Each of the species identified above are described in further detail below.

The Indiana bat is a federally-listed and state-listed endangered species with a distribution in New York State limited to wintering locations, which are caves and mines where they hibernate. There are ten hibernacula currently known in six counties – Albany, Essex, Jefferson, Onondaga, Ulster and Warren (NYNHP 2009). The summer range of this species extends well beyond these counties as the bats disperse to breeding areas and other habitats to feed and raise their young (NYNHP 2010). During the summer, the roosts consisted of living, dying, and dead trees in both rural and suburban landscapes (NYNHP 2009). While the 70-acre forest on the northern portion of the IPEC Site could provide summer habitat for the Indiana bat, there have been no documented sightings of the Indiana bat either at or in the vicinity of the IPEC Site (AKRF 2012).

The New England cottontail rabbit is a federally-listed candidate species (but is not listed by NYSDEC). The New England cottontail prefers early successional forests (generally less than 25 years old), often called thickets, with thick and tangled vegetation. Once large trees grow in a stand, the shrub layer tends to thin, creating habitat that the New England cottontail no longer finds suitable. There have been no documented sightings of the New England cottontail rabbit at or in the vicinity of the IPEC Site (AKRF 2012).

The bog turtle is a federally-listed threatened and state-listed endangered species. Although historical records come from a larger area of the state, extant populations are known from small portions of six counties in the lower Hudson River Valley (Columbia, Dutchess, Putnam, Ulster, Orange, and Sullivan). There are a few records of bog turtles in Westchester County from the 1990's, and it is not known if any extant populations remain. Extant bog turtle populations are also known to exist in a small portion of Oswego County and single locations in Seneca County and Wayne County (NYNHP 2010). There have been no documented sightings of the bog turtle either at or in the immediate vicinity of the IPEC Site (AKRF 2012).

3.4.3.2 State Protected Species

State protected terrestrial species identified by the NYNHP that are known to occur in Westchester County, where IPEC is located, include an additional nine animal species (five birds, three reptiles/amphibians, and one insect) and 156 plant species. The rare or state-listed species that the NYNHP has identified may occur on the IPEC Site or in its immediate vicinity include the bald eagle (NYNHP 2010). The bald eagle is listed as threatened by NYSDEC. Bald eagles have been observed throughout the area surrounding the IPEC Site, are known to nest along the Hudson River, and have occasionally been seen near the site (AKRF 2012). In addition, bald eagles frequently winter along the River. Habitat for wintering bald eagles is generally described as large open waters, i.e., large rivers and lakes suitable for foraging. Habitat near IPEC could possibly support wintering bald eagle because of its location near the Hudson River.

Table 3.4-5 identifies the federal protected and state protected species that are known to occur in Westchester County, where IPEC is located. The table further identifies with a double or triple-asterisk those species that the NYNHP database search indicates (as of 2006 and 2010, respectively) may occur within six miles of the IPEC Site.

Table 3.4-5
Federal and New York State Protected Species*

Scientific Name	Common Name	Federal Status	State Status	Notes
Reptiles and Amphibians				
Carphophis amoenus	Worm Snake**	-	SC	1
Clemmys muhlenbergii	Bog Turtle	T	E	
Crotalus horridus	Timber Rattlesnake**	-	T	1
Sceloporus undulatus	Fence Lizard**	-	T	1
Birds				
Circus cyaneus	Northern Harrier	SC	T	1
Cistothorus platensis	Sedge Wren	-	T	1
Falco peregrinus	Peregrine Falcon**	DL-R	E	1
Haliaeetus leucocephalus	Bald Eagle**/***	DL-R	T	4
Ixobrychus exilis	Least Bittern* *	SC	T	
Podilymbus podiceps	Pied-billed Grebe**	-	T	1
Mammals				
Myotis sodalis	Indiana Bat	E	E	
Sylvilagus transitionalis	New England Cottontail Rabbit	C	-	
Insects				
Tachopteryx thoreyi	Gray Petaltail**	-	SC	1
Plants				
Acalypha virginica	Virginia Three-seeded Mercury	-	E	
Agastache nepetoides	Yellow Giant-hyssop	-	T	
Ageratina aromatica var. *aromatica*	Small White Snakeroot	-	E	
Agrimonia rostellata	Woodland Agrimony**	-	T	
Amaranthus pumilus	Seabeach Amaranth	T	E	
Aplectrum hyemale	Puttyroot	-	E	
Arethusa bulbosa	Dragon's Mouth Orchid	-	T	
Aristolochia serpentaria	Virginia Snakeroot	-	E	
Asclepias variegata	White Milkweed	-	E	
Asclepias viridiflora	Green Milkweed	-	T	
Bartonia paniculata ssp. Paniculata	Screw-Stem	-	E	
Bidens beckii	Water Marigold	-	T	
Bidens bidentoides	Delmarva Beggar-ticks	-	R	
Bidens laevis	Smooth Bur-marigold* *	-	T	
Blephilia ciliata	Downy Wood-mint	-	E	
Bolboschoenus maritimus ssp.*paludosus*	Seaside Bulrush	-	E	
Bolboschoenus novae-angliae	Saltmarsh Bulrush**	-	E	
Botrychium oneidense	Blunt-lobe Grape Fern	-	E	
Bouteloua curtipendula var.*curtipendula*	Side-oats Grama	-	E	
Callitriche terrestris	Terrestrial Starwort**	-	T	2
Cardamine longii	Long's Bittercress**	-	T	2

Table 3.4-5
Federal and New York State Protected Species*

Scientific Name	Common Name	Federal Status	State Status	Notes
Carex abscondita	Thicket Sedge	-	T	
Carex arcta	Northern Clustered Sedge	-	E	
Carex bicknellii	Bicknell's Sedge	-	T	
Carex conjuncta	Soft Fox Sedge	-	E	
Carex cumulata	Clustered Sedge**	-	T	2
Carex davisii	Davis' Sedge	-	T	
Carex hormathodes	Marsh Straw Sedge**	-	T	2
Carex lupuliformis	False Hop Sedge**	-	R	
Carex mesochorea	Midland Sedge**	-	E	2
Carex mitchelliana	Mitchell's Sedge	-	T	
Carex molesta	Troublesome Sedge	-	T	
Carex nigromarginata	Black-edge Sedge	-	E	
Carex retroflexa	Reflexed Sedge	-	E	
Carex seorsa	Weak Stellate Sedge	-	T	
Carex straminea	Straw Sedge**	-	E	
Carex styloflexa	Bent Sedge	-	E	
Carex typhina	Cat-tail Sedge	-	T	
Carya laciniosa	Big Shellbark Hickory	-	T	
Castilleja coccinea	Scarlet Indian-paintbrush	-	E	
Ceratophyllum echinatum	Prickly Hornwort	-	T	
Chamaelirium luteum	Fairy Wand	-	T	
Cheilanthes lanosa	Woolly Lip-fern	-	E	
Chenopodium berlandieri var.*macrocalycium*	Large Calyx Goosefoot	-	E	2
Chenopodium rubrum	Red Pigweed	-	T	
Crassula aquatica	Water Pigmyweed	-	E	
Crotalaria sagittalis	Rattlebox	-	E	
Cyperus echinatus	Globose Flatsedge	-	E	
Cyperus flavescens	Yellow Flatsedge**	-	E	
Cyperus retrorsus var. *retrorsus*	Retrorse Flatsedge	-	E	
Cypripedium parviflorum var. *parviflorum*	Small Yellow Ladyslipper	-	E	
Desmodium ciliare	Little-leaf Tick-trefoil	-	T	
Desmodium humifusum	Spreading Tick-trefoil	-	E	
Desmodium laevigatum	Smooth Tick-trefoil	-	E	
Desmodium nuttallii	Nuttall's Tick-trefoil	-	E	
Desmodium obtusum	Stiff Tick-trefoil	-	E	
Desmodium pauciflorum	Small-flowered Tick-trefoil	-	E	
Dichanthelium oligosanthes var. *oligosanthes*	Few-flowered Panic Grass	-	E	
Digitaria filiformis	Slender Crabgrass	-	T	
Diospyros virginiana	Persimmon	-	T	
Draba reptans	Carolina Whitlow-grass	-	T	
Eclipta prostrata	False-daisy**	-	E	3
Eleocharis equisetoides	Knotted Spikerush	-	T	
Eleocharis ovata	Blunt Spikerush	-	E	
Eleocharis quadrangulata	Angled Spikerush	-	E	

Table 3.4-5
Federal and New York State Protected Species*

Scientific Name	Common Name	Federal Status	State Status	Notes
Eleocharis tricostata	Three-ribbed Spikerush	-	E	
Eleocharis tuberculosa	Long-tubercled Spikerush	-	T	
Equisetum palustre	Marsh Horsetail	-	T	
Equisetum pratense	Meadow Horsetail	-	T	
Euonymus americanus	American Strawberry-bush	-	E	
Fimbristylis castanea	Marsh Fimbry	-	T	
Fuirena pumila	Dwarf Umbrella-sedge	-	R	
Gamochaeta purpurea	Purple Everlasting	-	E	
Geranium carolinianum var.*sphaerospermum*	Carolina Cranesbill	-	T	3
Geum vernum	Spring Avens	-	E	
Geum virginianum	Rough Avens	-	E	
Hottonia inflata	Featherfoil	-	T	
Houstonia purpurea var. *purpurea*	Purple Bluets	-	E	
Hylotelephium telephioides	Live-forever	-	E	
Hypericum prolificum	Shrubby St. John's-wort	-	T	
Iris prismatica	Slender Blue Flag	-	T	
Jeffersonia diphylla	Twin-leaf	-	E	
Lechea pulchella var. *moniliformis*	Bead Pinweed	-	E	
lechea racemulose	Illinois Pinweed	-	R	
Lechea tenuifolia	Slender Pinweed	-	T	
Lemna perpusilla	Minute Duckweed	-	E	
Lespedeza angustifolia	Norrow-leaved Bush-clover	-	R	
Lespedeza repens	Trailing Bush-clover	-	R	
Lespedeza stuevei	Velvety Bush-clover	-	T	
Lespedeza violacea	Violet Bush-clover	-	R	3
Liatris scariosa var. *novae-angliae*	Northern Blazing-star	-	T	
Lilaeopsis chinensis	Eastern Grasswort	-	T	
Limosella australis	Mudwort	-	R	
Linum striatum	Stiff Yellow Flax	-	R	
Liparis lilifolia	Large Twayblade	-	E	
Lipocarpha micrantha	Dwarf Bulrush	-	E	
Listera convallarioides	Broad-lipped Twayblade	-	E	
Ludwigia sphaerocarpa	Globe-fruited Ludwigia	-	T	
Lycopus rubellus	Gypsy-wort	-	E	
Lysimachia hybrida	Lance-leaved Loosestrife	-	E	
Magnolia virginiana	Sweetbay Magnolia	-	E	
Melanthium virginicum	Virginia Bunchflower	-	E	
Mimus alatus	Winged Monkeyflower	-	R	
Monarda clinopodia	Basil-balm	-	E	
Najas guadalupensis ssp. Muenscheri	Hudson River Water-nymph	-	E	
Oldenlandia uniflora	Clustered Bluets	-	E	
Oligoneuron rigidum var. *rigidum*	Stiff-leaf Goldenrod	-	T	
Onosmodium virginianum	Virginia False Gromwell	-	E	
Orontium aquaticum	Golden Club	-	T	

Table 3.4-5
Federal and New York State Protected Species*

Scientific Name	Common Name	Federal Status	State Status	Notes
Oxalis violacea	Violet Wood-sorrel	-	T	
Oxypolis rigidior	Stiff Cowbane	-	E	
Panicum rigidulum var. *elongatum*	Tall Flat Panic Grass	-	E	
Paspalum laeve	Field Beadgrass	-	E	
Pinus virginiana	Virginia Pine**	-	E	
Platanthera ciliaris	Orange Fringed Orchid	-	E	
Platanthera hookeri	Hooker's Orchid	-	E	
Podostemum ceratophyllum	Riverweed*	-	T	2
Polygala lutea	Orange Milkwort	-	E	
Polygonum douglasii ssp. *douglasii*	Douglas' Knotweed	-	T	
Polygonum erectum	Erect Knotweed	-	E	
Polygonum glaucom	Seabeach Knotweed	-	R	
Polygonum tenue	Slender Knotweed	-	R	
Potamogeton diversifolius	Water-thread Pondweed	-	E	
Potamogeton pulcher	Spotted Pondweed**	-	T	
Pterospora andromedea	Giant Pine-drops	-	E	
Pycnanthemum clinopodioides	Basil Mountain-mint**	-	E	
Pycnanthemum muticum	Blunt Mountain-mint	-	T	
Pycnanthemum torrei	Torrey's Mountain-mint**	-	E	
Ranunculus micranthus	Small-flowered Crowfoot**	-	T	
Rhynchospora scirpoides	Long-Beaked Beakrush	-	R	
Sabatia angularis	Rose-pink	-	E	
Sagittaria montevidensis var. *spongiosa*	Spongy Arrowhead**	-	T	
Salvia lyrata	Lyre-leaf Sage	-	E	
Scirpus georgianus	Georgia Bulrush	-	E	
Scleria pauciflora var. *caroliniana*	Few-flowered Nutrush	-	E	
Scutellaria integrifolia	Hyssop-skullcap	-	E	
Sericocarpus linifolius	Flax-leaf Whitetop	-	T	
Sisyrinchium mucronatum	Michaux's Blue-eyed-grass	-	E	
Smilax pulverulenta	Jacob's-ladder	-	E	
Solidago latissimifolia	Coastal Goldenrod	-	E	
Solidago sempervirens var. *mexicana*	Seaside Goldenrod	-	E	
Sporobolus clandestinus	Rough Rush-grass	-	E	
Suaeda linearis	Narrow-leaf Sea-blite	-	E	
Symphyotrichum boreale	Northern Bog Aster	-	T	
Symphyotrichum subulatum var. *subulatum*	Saltmarsh Aster**	-	T	
Trichomanes intricatum	Appalachian Trichomanes	-	E	
Trichostema setaceum	Tiny Blue-curls	-	E	
Tripsacum dactyloides	Northern Gamma Grass	-	T	
Trollius laxus	Spreading Globeflower	-	R	
Utricularia minor	Lesser Bladderwort	-	T	
Utricularia radiata	Small Floating Bladderwort**	-	T	
Veronicastrum virginicum	Culver's-root	-	T	
Viburnum dentatum var. *venosum*	Southern Arrowwood	-	T	
Viburnum nudum var. *nudum*	Possum-haw	-	E	

Table 3.4-5
Federal and New York State Protected Species*

Scientific Name	Common Name	Federal Status	State Status	Notes
Viola brittoniana	Coast Violet	-	E	
Viola hirsutula Southern	Wood Violet	-	E	
Viola primulifolia	Primrose-leaf Violet	-	T	
Vitis vulpina	Winter Grape	-	E	

Notes:
*Protected – Refers to Threatened, Endangered, Species of Special Concern, and Rare (Plants); it does not include New York State status of "protected".
** Indicates that these species are listed in NYNHP 2006 letter as being within six miles of the site.
*** Indicates that these species are listed in the NYNHP 2010 letter that occur, or may occur, on the site or in the immediate vicinity of the site.
- = Not Listed
E = Endangered
T = Threatened
SC = Special concern
DL-R = Delisted, recovered
R = Rare
C = Candidate

Source:
[1] Species referenced in NYNHP 2006 correspondence.
[2] Species no longer listed in NYSDEC 2010 Rare Plants List for Westchester County.
[3] Species no longer listed in NYSDEC 2010 Rare Plants List for New York State.
[4] Species referenced in NYNHP 2010 correspondence.

3.4.4 Invasive Species

Upland Plants

In New York State, there are over 50 upland plants that the NYSDEC considers invasive. Two riparian and upland area species include giant hogweed (*Heracleum mantegazzianum*) and Japanese knotweed (*Polygonum cuspidata*). Other invasive plant species that may occupy disturbed lands and could potentially occur at the IPEC Site work areas include garlic mustard (*Alliaria petiolata*), spotted knapweed (*Centaurea stoebe* ssp. *micranthos*), and mugwort (*Artemisia vulgaris*).

3.5 ELECTRICITY SYSTEM

This Section provides an overview of IPEC's role in the existing New York State electricity system, including IPEC's important and well recognized contribution to system reliability.

IPEC is located in southeastern New York, an area of high electric demand that includes New York City, Westchester County and Long Island. This heavily populated area represents approximately half of the state's electricity demand (NYISO 2012a). The electric supply system within this area is constrained due to the difficulty and cost of siting new generation and transmission infrastructure (NYISO 2012b).

The Stations provide the southeastern New York area with a low-marginal cost source of electricity generation in comparison to fossil-fired generating units. Unit 2 began commercial operation in August 1974 and has a net generating capacity of approximately 1,020 megawatts ("MW") (NYISO 2012a). Unit 3 began commercial operation in August 1976 and has a net generating capacity of approximately 1,040 MW (NYISO 2012a).

3.5.1 IPEC Generation Process and Distribution System

Both operating Units (2 and 3) at IPEC are pressurized water reactors ("PWR") and use an optimized, open-loop, once-though cooling system to manage heat produced during the generation of electricity. Water from the Hudson River is pumped through the main condensers to absorb the heat contained in the expanded exhaust steam after exiting the steam turbine. The CW from each condenser is then returned to the River via a combined discharge canal.[4]

The electricity generated at IPEC is distributed to the Con Edison transmission system through the Buchanan Substation, which is located across Broadway near the main entrance to the IPEC Site, and owned by Con Edison. Each Unit has two main transformers that increase the turbine generator output from 22 kilovolt ("kV") to 345 kV, which is then delivered from each Unit to the Buchanan Substation via double-circuit 345 kV lines (Entergy 2007). The Unit 2 and Unit 3 feeder lines are co-located with two 138 kV transmission lines (referred to as 95332 and 95331) that supply power for startup, shutdown and normal operations, from the Buchanan Substation to Units 2 and 3, respectively (Entergy 2007).

3.5.2 New York State Electricity System

The New York State electricity system is under the governance of the New York Independent System Operator ("NYISO"). NYISO administers the electricity market, in which wholesale electricity suppliers bid to supply electricity to the transmission grid. The bids typically reflect the cost of generating electricity - the higher the cost to generate electricity, the higher the price to the consumer. NYISO also administers a capacity market, in which wholesale electricity suppliers bid to make their electricity generation capacity available to meet electricity demand.

The New York State Reliability Council ("NYSRC") is charged with determining the minimum level of electricity reserves that must be available to provide adequate supply to New York consumers. Prior to each summer season, NYSRC (in coordination with NYISO) determines the reserve margin requirement, which is the ratio of available capacity to expected peak demand. Loss-of-load expectation ("LOLE") is a metric that measures the expected number of days per year during which there would be insufficient capacity to meet demand, resulting in involuntary

[4] The Stations also use an open-loop system to manage auxiliary heating loads. The auxiliary systems at IPEC are considerably smaller than the CW systems and are referred to as SW systems.

disconnection of some customers' loads from the grid (i.e., localized blackouts). The North American Electric Reliability Corporation ("NERC"), Northeast Power Coordinating Council ("NPCC"), and NYSRC mandate a maximum LOLE for the New York State electricity system of 0.1, which translates into an expectation of interruption during one day in ten years.

3.5.3 IPEC and the New York State Electricity System

As shown in Figure 3.5-1, NYISO divides New York State into 11 Zones. IPEC is located in Zone H (Millwood). As discussed in more detail below, Zone J (New York City) depends heavily on energy imports from the Stations.

The Stations provide support to the electricity system for both generation (electricity supply) and voltage (system functionality). With respect to generation, the Stations, like other nuclear generation units, are baseload generators that have low marginal costs and supply electricity during much of the year. Typically, the Stations can operate at full capacity throughout the year and through all hours of the day (exceptions include periods of refueling, maintenance, or unplanned outages). The Stations provide an important contribution to generation in New York. In 2011, the Stations generated 17.0 million MWh of energy (NYISO 2012a), which represents approximately 10 percent of total electricity consumption in New York State in 2011, approximately 18 percent of total electricity consumption in southeastern New York (Zones G-K) in that year, and approximately 31 percent of total electricity consumption in New York City (Zone J) in that year (NYISO 2012a). The Stations generated significantly more energy in 2011 than any other single facility in southeastern New York (NYISO 2012b).

The Stations also play an important role in voltage support for the electric transmission system in southeastern New York. Without this voltage support, less energy would be able to flow through the transmission system to Zone J (New York City) and other load centers, potentially causing involuntary disconnection of some customers' loads from the grid (i.e., localized blackouts). NYISO has estimated that the ability to transmit energy from Zone I (Dunwoodie) to Zone J (New York City) would decrease by 1,335 MW (31 percent relative to the baseline transmission limit) if the Stations were both out of service (NYISO 2005; NYISO 2012c). The ability to transmit energy from Zone H (Millwood) to Zone G (Hudson Valley) would decrease by 370 MW (18 percent relative to the baseline transmission limit) (NYISO 2005; NYISO 2012c).

Based on their energy supply and voltage support, the IPEC Stations provide an important and well recognized contribution to electricity system reliability in New York. NYISO (2012c) modeled removal of IPEC from the electricity system beginning in 2016 and found that LOLE in New York would increase far beyond the maximum of 0.1 set by NERC, NPCC, and NYSRC. In this modeling, NYISO (2012c) used current baseline expectations for power plant additions and retirements in New York (i.e., NYISO assumed that no new power plants would be built specifically as replacements for IPEC). Using base case load forecasts, NYISO (2012c) estimated that removal of IPEC would raise LOLE in 2016 to 0.48 (from a baseline level of 0.02) and would raise LOLE in 2022 to 3.63 (from a baseline level of 0.24). NYISO (2012c) noted the "significant violation of the 0.1 days per year criterion" and also emphasized that "under stress conditions the voltage performance of the system without the Indian Point Plant would be degraded," and as a result, "[i]t would be necessary to take emergency operations measures," including load curtailment.

IPEC also contributes to air quality and climate goals as a generation source with a small air quality and carbon footprint. As discussed in Section 3.1, NERA (2012) has estimated that if

IPEC were removed from the electricity system, annual CO_2 emissions would increase above baseline levels by about 13.5 million metric tons (on average, based on modeling results from 2016 to 2025).

3.6 AESTHETICS

This Section examines the existing visual character and aesthetic conditions of the IPEC Site and surrounding vicinity. The visual and aesthetic characteristics of an area are determined by a composite of different elements including the shapes, sizes, and uses of buildings; street patterns and road characteristics; natural resources including vegetation, topography, geologic formations, wetlands, rivers, or other water resources; and the presence or absence of visual resources, which can include view corridors, vistas, and views of prominent natural or built features (Saratoga Associates 2009).

3.6.1 Regulatory Considerations

NYSDEC issued a policy entitled *"Assessing and Mitigating Visual Impacts"* (which is more commonly known as the "NYSDEC Visual Resources Policy") on July 31, 2000. The NYSDEC policy provides a framework for evaluating visual and aesthetic impacts generated from proposed facilities. The discussion of environmental aesthetics, summarized herein, has been prepared in accordance with the technical guidance provided in the NYSDEC policy.

Because the IPEC Site is located in the Coastal Area, Policy 24 and Policy 25 of the New York State Coastal Management Program ("NYS CMP") may apply in the context of certain federal permit decisions. Policy 24 directs that a project "prevent impairment of scenic resources of statewide significance" (NYSDOS 2001). As interpreted by previous NYSDOS mandates, "*scenic resources of statewide significance*" have included those resources that meet the NYSDEC Visual Resources Policy definition of aesthetic resources of statewide significance (Subchapter 3.6.2). Policy 25 directs that projects, "*protect, restore, or enhance natural and man-made resources, which are not identified as being of statewide significance but, which contribute to the overall scenic beauty of the coastal area*" (NYSDOS 2001).

The IPEC Site is not located within an approved Local Waterfront Revitalization Plan ("LWRP") area boundary. In the vicinity of IPEC, the City of Peekskill and Town of Stony Point have approved LWRPs. These plans require protection of aesthetic resources, including scenic views. All new developments that may be visible from scenic areas within these approved LWRP areas must be consistent with the City of Peekskill and Town of Stony Point LWRPs.

3.6.2 Character and Visual Quality of the Existing Landscape

3.6.2.1 IPEC Landscape

IPEC is located adjacent to the east bank of the lower Hudson River estuary in the Village of Buchanan, Westchester County, New York. Approximately 128 acres of the 237-acre IPEC Site currently are developed, including 32 acres occupied by the existing nuclear generation facilities (Unit 2, Unit 3 and the non-operating Unit 1). Ancillary buildings, parking, roadways, transmission towers/corridors (owned by others), and maintenance facilities occupy the remainder of the developed area.

The most visibly prominent infrastructure at the existing IPEC Site includes the containment and turbine buildings associated with Units 2 and 3, and the Unit 1 main stack. The dimensions of these structures are listed in Table 3.6-1. The structures are shown in the photograph of the existing IPEC Site from the west side of the Hudson River, which is presented as Figure 3.6-1. The facility's main stack formerly rose to a height of approximately 390 feet above grade, being mounted on the roof of the superheater structure associated with Unit 1. The stack has been lowered to 200 feet above MSL ("AMSL") and is expected to be lowered to 170 feet AMSL following the scheduled fueling outage in March 2013. The structures listed in Table 3.6-1 are terraced into a hillside that rises from river elevation (effectively MSL) to over 100 feet within 1,500 feet of the water's edge (7 percent average grade) (Saratoga Associates 2009).

Table 3.6-1
Dimensions of Major Infrastructure at IPEC[1]

Infrastructure	Height (ft)	Height AMSL[2] (ft)	Width (ft)	Length (ft)	Diameter (ft)
Unit 2 Containment Building	219	258	-	-	135
Unit 3 Containment Building	219	258	-	-	135
Unit 2 Turbine Building	110	143	110	480	
Unit 3 Turbine Building	110	135	110	430	
Main Stack	120	200	-	-	30
Notes:	[1]Dimensions of structures were identified by Saratoga Associates using 3D Studio Max Software based on General Arrangement Drawings matched to photos of existing IPEC Site. [2]AMSL- above mean sea level.				
Source:	Saratoga Associates 2009.				

The infrastructure listed above is visible from the shore of the Hudson River between Tomkins Cove and Jones Point and from the shore along the west side of Haverstraw Bay. South of Tompkins Cove, where the River bends southeasterly around Verplanck Point, only the Unit 1 main stack is, and the upper portions of the Units 2 and 3 containment buildings are visible above shoreline vegetation. From points farther inland views of the existing IPEC infrastructure are generally screened by terrain and vegetation.

The operating cooling system currently in use at IPEC requires no external cooling tower structure and does not result in a visible vapor plume. Other facility operations that require the dissipation of process heat and moisture from several point sources and, therefore, occasionally result in visible vapor plumes include:

- The Unit 2 steam generator blowdown system during plant operations.
- The Unit 2 and Unit 3 steam generator power operated atmospheric relief valves, which result in a condensed steam plume during plant start-up and shutdowns.
- Unit 2 and Unit 3 main condenser hoggers during plant startup.
- Circulating water pump water lifting jets during pump startup.

The size of any steam plume resulting from plant operations is small compared to the size of the reactor containment building and turbine building, and would be confined to the IPEC Site and not extend off of the site. Under most meteorological conditions, the visible vapor plumes produced by such facility operations are small in magnitude (including plume length, density, and height). The visible vapor plumes formed are typically wispy, thin, and transparent. As noted above, the potential for visible plumes would usually occur at plant start ups and shut downs, which normally take place every 24 months for each Unit over alternating years.

3.6.2.2 Regional and Local Landscape

IPEC is situated in a portion of the Hudson River Valley that is of natural, scenic, historic, and recreational importance. This portion of the valley where IPEC is located comprises the southern end of the Hudson Highlands, a designated Scenic Area of Statewide Significance ("SASS") that encompasses a 20-mile stretch of the Hudson River and its shoreline. According to NYSDOS, the Hudson Highlands SASS is of statewide aesthetic significance by virtue of the combined aesthetic values of landscape character, uniqueness, public accessibility, and public recognition (NYSDOS 1993).

The landscape of the Hudson Highlands is characterized by mountains that dominate the horizon as they rise over the lowlands of the lower river basin. As described by NYSDOS (1993), the Hudson River also "*carves a spectacular gorge*" through the Highlands. The shoreline configuration includes steep cliffs, bluffs, and gently sloping banks. Several promontories jut into the River, forming bends in the River that mirror the underlying topography. Extensive views of these features (i.e., the Hudson River, its shoreline, and the inland mountain peaks) are available to the public as a considerable amount of the Highlands has been preserved through the State Parks Program (Figure 3.6-2).

The region includes several other scenic and cultural resources that are protected through regulatory designations such as State Parks, National Register of Historic Places ("NRHP"), Scenic Byway, American Heritage River, and National Heritage Area. An inventory of federally and state protected aesthetic and scenic resources in the vicinity of the IPEC Site is provided in Section 3.6.3. These resources all contribute to the exceptional aesthetic quality of the region.

3.6.2.3 Physical Landscape

IPEC is located on the eastern bank of the lower Hudson River estuary, which is a sub-basin of the larger Hudson-Mohawk River Basin. The lower Hudson River estuary bisects the area within a six-mile radius of the IPEC Site and geographically separates Westchester County from Rockland County to the west. Approximately two miles northeast of the IPEC Site, the Hudson River turns sharply from a flow of northwest to southeast, toward the southwest. The River flows from northeast to southwest past the IPEC Site.

The Hudson Highlands region, which surrounds this portion of the lower Hudson River immediately north of the IPEC Site, is generally characterized by steep mountains and deep valleys. In the vicinity of the IPEC Site, peaks extend to about 1,000 feet and include: Bear Mountain (1,284 feet), Bald Mountain (1,000 feet), and Dunderberg Mountain (1,086 feet) on the west side of the Hudson River; and Manitou Mountain (780 feet) and Anthony's Nose (900 feet), on its east side of the Hudson River.

The area to the south of the Hudson Highlands consists of gently rolling landscape with several major hills rising above the valley floor, including Blue Mountain (680 feet), Spitzenberg Mountain (560 feet), and Jacobs Hill (600 feet). More typically, rolling topography ranges from 150 to 400 feet in elevation inland from the River.

Mountainous areas are generally characterized by mature woodlands of mixed deciduous and coniferous trees. On lower slopes and the lowland plateaus, the dense woodland coverage gives way to a combination of mixed woodlands and clearings consistent with the urban and suburban portion of the valley lowlands.

3.6.2.4 Land Uses

Land uses that contribute to and define views in this portion of the Hudson River Valley include a mix of manufacturing, commercial, and institutional uses and residential districts. Residential uses consist of multifamily and single family units. Industrial development is visible both along the east and the west banks of the Hudson River. In addition to IPEC, the Meenan Oil Company storage facility and terminal (in the Town of Cortlandt), the Westchester County waste-to-energy plant (in the City of Peekskill), and the Lafarge North America processing plant (in the Village of Buchanan) are located on the east side of the River. On the west side of the River, industrial uses include the Tilcon Quarry, a bulk material processing plant at Grassy Point in the Town of Stony Point, and the Bowline Electric Generating Plant in the Town of Haverstraw (Saratoga Associates 2009).

Transportation/utility uses are also commonly found in this area of the Hudson River Valley. Interstate and major highways and roads located in the region include: the Palisades Interstate Parkway, Taconic State Parkway, Bear Mountain State Parkway, U.S. Routes 9, 9W, 6, 202, New York State Highway 9A, U.S. Route 9W at Jones Point, the Bear Mountain Bridge and the Bear Mountain Bridge Road (which offers panoramic views of the Hudson River and the surrounding valley). Passengers of Amtrak/Metro North Railroad, which traverses the east shore of the River, enjoy views of the River. The Hudson River itself historically has been a major mode of transportation and a navigable channel is maintained for commercial and recreational vessels. Major utility infrastructure in the area includes a regional electric transmission line that crosses the Hudson River at Verplanck.

The lower Hudson River also includes recreational resources in the area. The Peekskill Riverfront Green Park offers direct riverfront access and a variety of recreational opportunities (boat launch, playground, and bandstand), fishing access, and passive enjoyment of the waterfront. Charles Point Park and Fleischmann's Pier, which are located further south, also offer waterfront recreation. Outside of the City of Peekskill, public waterfront access points include the Lent's Cove Park (in the Village of Buchanan), the Town of Cortlandt Steamboat Riverfront Park, Georges Island County Park, Bowline Point Park, Haverstraw Bay County Park, the Town of Haverstraw Riverfront Park, and Vincent Clark Park (Saratoga Associates 2009).

3.6.3 Visual Resources Inventory

This Section provides an inventory of visual resources located in the vicinity of the IPEC Site in accordance with the NYSDEC Visual Policy and NYS CMP Policy 24 (Saratoga Associates 2009). According to the NYSDEC Visual Policy, resources of statewide significance fall into one or more of the following 15 categories:

- A property on or eligible for inclusion in the National or State Register of Historic Places (16 U.S.C. § 470a et seq., Parks, Recreation, and Historic Preservation Law ("PRHPL") § 14.07).
- State Parks (PRHPL § 3.09).
- Urban Cultural Parks (PRHPL § 35.15).
- The State Forest Preserve (NYS Constitution Article XIV).
- National Wildlife Refuges (16 U.S.C. § 668dd), and State Game Refuges (ECL 11 2105).
- National Natural Landmarks (36 CFR Part 62).
- The National Park System (16 U.S.C. § 1c).
- Rivers designated as National or State Wild, Scenic, or Recreational (16 U.S.C. Chapter 28, ECL 15 2701 et seq.).

- A site, area, lake, reservoir, or highway designated or eligible for designation as scenic (ECL Article 49).
- Hudson Highlands Scenic Area of Statewide Significance.
- A state or federally designated trail, or one proposed for designation (16 U.S.C. Chapter 27 or equivalent).
- Adirondack Park Scenic Vistas.
- State Nature and Historic Preserve Areas.
- Palisades Park.
- Bond Act Properties (purchased under Exceptional Scenic Beauty or Open Space Category).

In addition to the resources protected by the NYSDEC Visual Policy, this Section provides an inventory of other places that contribute to the overall scenic beauty of the coastal area and are located within a five-mile radius of the IPEC Site, consistent with the scope of NYS CMP Policy 25. With respect to local resources, the NYSDEC Visual Policy instructs Department Staff to defer to local decision makers who are likely to be more familiar with important places and better suited to address them.

The NYSDEC Visual Policy recommends that all visual resources within a five-mile radius be taken into account for large projects. However, for very large actions, such as power plants (particularly those that may generate visible vapor plumes), the NYSDEC Visual Policy recommends that resources and impacts extending beyond a five-mile radius of a proposed project be taken into consideration.

Consistent with the intent of the NYSDEC Visual Policy and NYS CMP Policy 25, the focus of the visual assessment is on aesthetic resources of statewide significance and local importance within a five-mile area; however, recognizing some existing IPEC structures are currently visible at extended distance along the Hudson River, the study area was extended to include key scenic resources of statewide significance within ten miles of the IPEC Site (i.e., state parks and the Hudson River).

Visual resources of statewide significance and local importance within a five-mile radius of the IPEC Site are identified in Table 3.6-2. A numeric code ("VP#") has been assigned to each visual resource in the table. The locations of each of these resources are illustrated on a map of the surrounding area provided as Figure 3.6-3. A map of all State Parks within a ten-mile radius of the IPEC Site is presented as Figure 3.6-2. The inventory provided in Table 3.6-2 and maps provided in Figures 3.6-2 and 3.6-3 were prepared through review of published maps and other paper documents as well as through online research (Saratoga Associates 2009).

A total of 95 visual resources have been identified within a five-mile radius of the IPEC Site (Table 3.6-2). Over 50 of these resources meet the NYSDEC Visual Policy's definition of a scenic resource of statewide significance.

Table 3.6-2
Visual Resources Inventory

VP#	Resource Name	Municipality	Inventory Type
Cultural Resources			
7	Jones Homestead – National Register of Historic Places (NRHP)	Town of Cortlandt	Statewide Significance
9	Old St. Peter's Church – NRHP	Town of Cortlandt	Statewide Significance
12	Van Cortlandt Upper Manor House – NRHP	Town of Cortlandt	Statewide Significance
13	Van Cortlandtville School – NRHP	Town of Cortlandt	Statewide Significance
16	Nelson Avenue/Ft. Hill Historic District – NRHP	City of Peekskill	Statewide Significance
17	Nelson House – NRHP	City of Peekskill	Statewide Significance
18	Peekskill Downtown Historic District – NRHP	City of Peekskill	Statewide Significance
20	St. Peter's Episcopal Church – NRHP	City of Peekskill	Statewide Significance
21	US Post Office--Peekskill – NRHP	City of Peekskill	Statewide Significance
23	Drum Hill High School – NRHP	City of Peekskill	Statewide Significance
24	Peekskill Presbyterian Church – NRHP	City of Peekskill	Statewide Significance
25	Standard House – NRHP	City of Peekskill	Statewide Significance
38	Bear Mt. Bridge Toll House - NRPHP	Town of Cortlandt	Statewide Significance
39	M/V COMMANDER (Tour Boat) – NRHP	Village of West Haverstraw	Statewide Significance
44	Bear Mt. Inn – NRHP	Town of Stony Point	Statewide Significance
47	Bear Mt. Bridge – NRPH	Town of Stony Point/ Cortlandt	Statewide Significance
48	Fort Montgomery State Historic Site	Town of Highlands	Statewide Significance
49	St. Mark's Episcopal Church – NRHP	Town of Highlands	Statewide Significance
50	Bear Mt. State Park Historic District – NRHP	Town of Highlands	Statewide Significance
60	Stony Point Battlefield State Historic Site	Town of Stony Point	Statewide Significance
63	Fraser-Hoyer House – NRHP	Vill. of W. Haverstraw	Statewide Significance
64	Peck House – NRHP	Vill. of W. Haverstraw	Statewide Significance
68	Stony Point Lighthouse – NRHP	Town of Stony Point	Statewide Significance
70	Rose House – NRHP	Town of Stony Point	Statewide Significance
79	Kings Daughters Public Library – NRHP	Village of Haverstraw	Statewide Significance
81	US Post Office--Haverstraw – NRHP	Village of Haverstraw	Statewide Significance
91	Copland House – NRHP	Town of Cortlandt	Statewide Significance
Recreational Resources			
1	Cortlandt Community Recreation Area	Town of Cortlandt	Local Importance
2	Blue Mt. Reservation - Blue Mt. Trail	Town of Cortlandt	Local Importance
3	Depew Park	City of Peekskill	Local Importance
4	Beecher Park	City of Peekskill	Local Importance
5	Lynwood Gardens Field	Town of Cortlandt	Local Importance
6	Old Toddville School Field	Town of Cortlandt	Local Importance
8	Muriel H. Morabito Community Center	Town of Cortlandt	Local Importance
10	Cortlandt Town Hall Ball Field	Town of Cortlandt	Local Importance
11	St. Columbanus Little League Field	Town of Cortlandt	Local Importance
14	Fort Hill Park	City of Peekskill	Local Importance

Table 3.6-2
Visual Resources Inventory

VP#	Resource Name	Municipality	Inventory Type
15	Monument Park	City of Peekskill	Local Importance
19	Pugsley Park	City of Peekskill	Local Importance
26	Charles Point Park & Fleishman's Pier	City of Peekskill	Local Importance
27	Lent's Cove Village Park	Town of Stony Point	Local Importance
29	Riverfront Green Park	City of Peekskill	Local Importance
30	Westchester River Walk (at Peekskill)	City of Peekskill	Local Importance
31	Annsville Creek Preserve	City of Peekskill	Local Importance
32	Hudson Highlands State Park - Annsville Creek Paddlesports Center	Town of Cortlandt	Statewide Significance
33	Sprout Brook Ball Fields	Town of Cortlandt	Local Importance
34	Sprout Brook Park	Town of Cortlandt	Local Importance
35	Hudson Highlands Gateway Park	Town of Cortlandt	Local Importance
37	Hudson Highlands St. Pk. - Camp Smith Trail	Town of Cortlandt	Statewide Significance
40	Hudson River - off Lents Cove	On River	Statewide Significance
41	Bear Mt. State Park - Dunderberg Trail	Town of Stony Point	Statewide Significance
42	Hudson Highlands St. Pk. - Anthony's Nose	Town of Cortlandt	Statewide Significance
45	Bear Mt. State Park - Boat Launch	Town of Stony Point	Statewide Significance
46	Iona Island Bird Sanctuary	Town of Stony Point	Statewide Significance
51	Bear Mt. State Park - Wayne Rec. Area	Town of Highlands	Statewide Significance
52	Bear Mt. State Park - Perkins Observatory	Town of Highlands	Statewide Significance
54	Hudson River - off Buchanan	On River	Statewide Significance
55	Appalachian National Scenic Trail	Town of Highlands	Statewide Significance
58	Steamboat Riverfront Park	Town of Cortlandt	Local Importance
59	Verplanck Schoolhouse Community Center	Town of Cortlandt	Local Importance
61	Heights Road Park	Town of Stony Point	Local Importance
62	Veterans Memorial Park	Town of Stony Point	Local Importance
65	Samsondale Park	Vill. of W. Haverstraw	Local Importance
66	Laural Drive Park	Town of Stony Point	Local Importance
67	Lowland Park	Town of Stony Point	Local Importance
69	Vincent Clark Park	Town of Stony Point	Local Importance
71	Old Pond Park	Town of Cortlandt	Local Importance
73	Lake Meahagh Park	Town of Cortlandt	Local Importance
74	Georges Island County Park	Town of Cortlandt	Local Importance
75	Montrose Point State Forest	Town of Cortlandt	Statewide Significance
76	Riverfront Park	Town of Stony Point	Local Importance
77	Haverstraw Bay County Park	Town of Haverstraw	Local Importance
78	Bowline Point Park	Town of Haverstraw	Local Importance
80	Peck's Pond Park	Village of W. Haverstraw	Local Importance
82	High Tor State Park - Long Path Trail	Village of Haverstraw	Statewide Significance
83	Hudson River - off Hook Mt. State Park	On River	Statewide Significance
84	Sunset Park and Playground	Town of Cortlandt	Local Importance

Table 3.6-2
Visual Resources Inventory

VP#	Resource Name	Municipality	Inventory Type
85	Tommy Thurber Playground	Town of Cortlandt	Local Importance
72	Letteri Field	Town of Cortlandt	Local Importance
87	Cortlandt Roller Hockey Rink	Town of Cortlandt	Local Importance
88	Graff Sanctuary	Village of Croton	Local Importance
89	Oscawana County Park	Town of Cortlandt	Local Importance
90	Charles Cook Recreation Center	Town of Cortlandt	Local Importance
92	Lake Street Tennis Courts	Town of Cortlandt	Local Importance
93	Blue Mt. Reservation - Spitzenberg Mt. Trail	Town of Cortlandt	Local Importance
94	Briarcliff Peekskill Trailway	Town of Cortlandt	Local Importance
95	Brinton Brook Sanctuary	Village of Croton	Local Importance
Transportation Resources			
22	Peekskill Rail Station	City of Peekskill	Local Importance
28	Amtrak/Metro North Passenger Railroad	City of Peekskill	Local Importance
36	Bear Mt. Bridge Rd. Scenic Byway	Town of Cortlandt	Statewide Significance
43	Bear Mt. Bridge Rd. Scenic Byway Overlook	Town of Cortlandt	Statewide Significance
53	US Route 9W - Jones Point	Town of Stony Point	Statewide Significance
56	Palisades Interstate Parkway	Town of Stony Point	Statewide Significance
57	US Route 9W - Tomkins Cove	Town of Stony Point	Local Importance
86	Cortlandt Rail Station	Town of Cortlandt	Local Importance

Source: Table 5 from Saratoga Associates 2009.

The IPEC Site is located in a region that includes numerous sites and areas that are recognized as being of statewide and national significance. The importance of these resources is reflected in federal and state actions taken to preserve and protect them for public benefit (Saratoga 2009).

The Hudson River and surrounding valley is recognized as a resource of significant cultural and scenic importance as evidenced by several federal and state programs, which have been implemented to recognize and preserve the aesthetic and cultural characteristics of the area. This includes: designation of the Hudson River as an American Heritage River and establishment of the Hudson River Valley Natural Heritage Area and Hudson River Greenway Programs (Saratoga 2009).

The unique scenic, cultural and recreational characteristics of the River and adjacent Hudson Highlands include numerous state and municipal parks, open spaces and preserves. Some important resources of statewide significance in the vicinity of IPEC include Bear Mountain State Park, High Tor State Park, Hudson Highlands State Park, Hook Mountain State Park, Stony Point Battlefield State Historic Site, Bear Mountain Bridge Road Scenic Byway and the Hudson Highlands SASS (Saratoga 2009).

3.7 TRANSPORTATION

3.7.1 Roads

This Section summarizes existing data on vehicular traffic in the vicinity of the Project including the existing roadway network and key intersections. Information was obtained from the New York State Department of Transportation ("NYSDOT") and Westchester County. Field observations were conducted to determine the existing traffic conditions in the vicinity of the IPEC Site.

IPEC is located in the Village of Buchanan. Key roadways within the area include Broadway, Bleakley Avenue, Louisa Street, John Walsh Boulevard, New York and Albany Post Road (New York Route 9A), South Street, and U.S. Route 9. These roadways are described in Section 3.7.1.1.

Substantial construction of regional traffic infrastructure, including the replacement of four local bridges along U.S. Route 9 between the Bay Street overpass and Main Street in the City of Peekskill, has been completed in recent years. The four bridges are:

- U.S. Route 9 over Central Avenue
- U.S. Route 9 over Requa Street
- U.S. Route 9 over Hudson Avenue
- Main Street over U.S. Route 9.

The Main Street Bridge over U.S. Route 9 was raised from its previous 11-foot, 1-inch clearance, which restricted many larger vehicles from using the right lane. The replacement bridge now has a clearance of 16 feet, 7 inches. Additional work included widening to accommodate additional lanes and improved shoulders. The project provided for the addition of on and off ramps and the lengthening of ramps both to and from U.S. Route 9. New curbs, sidewalks, closed drainage systems, sanitary sewers, water mains, landscaping, signs, pavement markings and retaining walls were also installed.

3.7.1.1 Key Roadways

<u>Broadway</u>: Broadway has generally one lane in each direction and a north/south alignment traveling from the Hudson River at its southern end, north to Bleakley Avenue. The main entrance/exit drive for the existing Units 2 and 3 is located along Broadway, which has a posted speed limit of 30 miles per hour ("mph") and is under Village of Buchanan jurisdiction. There are no posted truck restrictions on Broadway. Broadway becomes John Walsh Boulevard where it crosses into the City of Peekskill north of the Bleakley Avenue intersection.

<u>John Walsh Boulevard</u>: John Walsh Boulevard has two lanes in each direction and a north/south alignment traveling from Bleakley Avenue at its southern end, north to Louisa Street. John Walsh Boulevard has a posted speed limit of 30 mph and is under Westchester County jurisdiction as County Route 156. There are no posted truck restrictions on John Walsh Boulevard.

<u>Louisa Street</u>: Louisa Street has one lane in each direction and an east/west alignment traveling from U.S. Route 9 at its eastern end, west to John Walsh Boulevard. Louisa Street has a posted speed limit of 25 mph and is under the jurisdiction of the Westchester County as County Route 155. There are no posted truck restrictions on Louisa Street.

Bleakley Avenue: Bleakley Avenue has one lane in each direction and an east/west alignment. It is under the jurisdiction of the Village of Buchanan and is subject to the village-wide speed limit of 30 mph. The use and access of semi-trailers is restricted on Bleakley Avenue.

New York and Albany Post Road (New York Route 9A): New York Route 9A has one lane in each direction and a north/south alignment through the Village of Buchanan. It features exclusive turning lanes at key locations. New York Route 9A has a posted speed limit of 30 mph and is under the jurisdiction of NYSDOT.

South Street/Lower South Street: South Street/Lower South Street has one lane in each direction and a north/south alignment traveling from New York Route 9A at its southern end, north through Peekskill generally parallel to U.S. Route 9. It is subject to Peekskill's jurisdiction and their city-wide speed limit of 30 mph.

Welcher Avenue: Welcher Avenue has a combination of one and two lanes in each direction and an east/west alignment traveling from Washington Street at its eastern end, west to Lower South Street. Northbound and southbound on and off ramps to and from U.S. Route 9 intersect Welcher Avenue. It has a posted speed limit of 30 mph and is under the jurisdiction of the Westchester County as County Route 92. There are no posted truck restrictions on Welcher Avenue.

The following is a description of intersection geometry and traffic control devices by approaches for the key intersections in the vicinity of the IPEC Site:

John Walsh Boulevard and Louisa Street: This intersection has three approach legs, typically referred to as a "T" intersection. Traffic control consists of STOP signs on the eastbound and northbound approaches.

Louisa Street and Lower South Street: This intersection has four approach legs, typically referred to as a "4-way" intersection. This intersection is controlled by a two-phase traffic signal.

Louisa Street and the Southbound U.S. Route 9 Ramps: This four-way intersection has no regulatory traffic controls.

Louisa Street and the Northbound U.S. Route 9 Ramps: This T-intersection has a STOP sign on the off-ramp.

New York Route 9A and Bleakley Avenue: This T-intersection is controlled by a two-phase traffic signal.

Welcher Avenue and the U.S. Route 9 Northbound Ramps: This is a four-way intersection, which is controlled by a three-phase traffic signal that is directly coordinated with the traffic signal located at the intersection of Welcher Avenue and the Southbound Route 9 exit ramp.

Welcher Avenue and the Southbound U.S. Route 9 Off-Ramp/New York Route 9A: This is a four-way intersection, which is controlled by a three-phase traffic signal, coordinated as noted above.

Broadway/John Walsh Boulevard and Bleakley Avenue/Indian Point Nuclear Generating Station Units 2 and 3 Main Driveway: This is a T-intersection that was once a four-way intersection. Broadway/John Walsh Boulevard and Bleakley Avenue are controlled by a three-phase traffic signal.

Broadway and the Entergy Main Access Drive: This is a four-way intersection. Northbound and southbound Broadway each has a single, shared left-turn/through/right-turn lane. The eastbound Main Access Drive and the westbound Buchanan Substation driveway each have a single lane with no pavement striping.

Broadway and Secondary Access Drive: This is a T-intersection. The eastbound driveway (the former Unit 3 access) has a single shared left-turn/right-turn lane. The driveway is currently closed, but when in use, would be controlled by a STOP sign.

3.7.1.2 Regional Traffic Volumes

Regional traffic volume data along U.S. Route 9 in the vicinity of IPEC were obtained from NYSDOT and the Westchester County Department of Public Works (Traffic Division).

NYSDOT traffic counts were conducted in 2011. The result of the traffic count conducted along U.S. Route 9 north of the Welcher Avenue exit showed an Annual Average Daily Traffic ("AADT") of 33,800 vehicles with an approximate AADT of 16,920 vehicles traveling northbound and an approximate AADT of 16,880 vehicles traveling southbound. The results of the traffic count conducted along U.S. Route 9 south of the Welcher Avenue exit showed an AADT of 30,660 vehicles with an approximate AADT of 15,350 vehicles traveling northbound and 15,310 vehicles traveling southbound.

Additional traffic counts as provided by NYSDOT and Westchester County for various roadways in the vicinity of the IPEC Site, including Broadway, New York Route 9A, Louisa Street, and others are illustrated in Figure 3.7-1. These counts were performed over the past few years.

3.7.1.3 Field Observations of Local Traffic

Existing traffic operations of the adjacent roadway network were observed and showed that the intersections in the vicinity of IPEC appeared to operate at appropriate Levels of Service ("LOS"). As such, there is available roadway capacity.

3.7.2 Navigation In the Lower Hudson River

The Hudson River is navigable from the New York Harbor through Albany with a federal channel 600 feet wide from New York City, New York to Kingston, New York (about 45 miles north of IPEC) and 400 feet wide from Kingston, New York to Albany, New York. The Hudson River serves both commercial and recreational vessel traffic. In the Lower Hudson River, vessels with a draft less than 31 feet may transit any time, while vessels with draft between 31 and 33 feet must transit at the appropriate tidal stage (HRPA 2013). From 59th Street in New York City to Albany, the federal navigation channel is dredged to a depth of 32 feet (NOAA 2012).

3.7.2.1 Commercial Marine Traffic in the Hudson River

Approximately 8,000 to 16,000 vessels transit the Hudson River each year (FHWA et al. 2012). The transit time between Yonkers, New York and the Port of Albany depends on the tides, but is typically 11 – 13 hours (HRPA 2013). Table 3.7-1 provides the size distribution of a small sample of commercial vessels on the Hudson River as reported by members of the Hudson River Pilot Association ("HRPA") who pilot many of the commercial vessels between Yonkers and Albany, New York (FHWA et al. 2012).

Table 3.7-1
Size of Commercial Vessels Transitting the Hudson River

Displacement (tons)	Number of Ships	Min/Max Length (ft)	Min/Max Beam (ft)	Min/Max Draft (ft)	Min/Max Air Draft (ft)
0 - 10,000	46	300/400	40/70	15/20	60/150
10,001 - 20,000	132	120/565	64/75	15/27	100/120
20,001 - 40,000	248	500/600	75/90	16/31	111/140
40,001 - 60,000	233	600/730	76/106	21/33	117/140
60,001 - 80,000	9	623/811	100/106	21/33	129/140
>80,000	8	735/805	106/137	21/33	129/140
Source: Adapted from FHWA et al. 2012.					

3.7.2.2 Recreational Boating in the Lower Hudson River

The lower Hudson River is used extensively by recreational boaters although there is no comparable statistical data available (i.e., transits, sizes). A variety of recreational watercraft ply the waters around IPEC, outside of its S&SZ, including sailboats, power boats, and other personal water craft ("PWC") (e.g., jet skis / waverunners).

3.7.2.3 Navigational Impediments in the Lower Hudson River

Impediments and restrictions to navigation in the lower Hudson River include:

- The Tappan Zee Bridge (approximately 15 miles downriver of IPEC) - The fixed span of the bridge crossing the main channel has a vertical clearance 139 feet mean high water ("MHW"). The 470-foot east and west spans have vertical clearances of 123 feet MHW; there are three auxiliary openings for small boats each with a clearance of 11 feet MHW (NOAA 2012).

- The Bear Mountain Bridge (approximately 4.5 miles upriver of IPEC) - This suspension span of this bridge has a vertical clearance of 155 feet MHW (NOAA 2012).

- The S&SZ at IPEC as shown in Figure 2.3-2.

3.7.2.4 Marinas and Boat Launches

There are approximately 24 marinas within about 15 miles of the IPEC Site. The marinas range in size from approximately 20 slips and moorings to over 1,000 slips and moorings. The marinas provide facilities for recreational vessels, small commercial vessels, and charter vessels. Some of the marinas also provide access to the Hudson River for canoes, kayaks and other small watercraft.

In addition to the marinas, there are 16 public boat launches on the Hudson River or tributary rivers in NYSDEC Region 3 (Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster and Westchester Counties) (NYSDEC 2013).

3.8 NOISE

The existing ambient sound environment is described in this Section by using existing noise level data for locations up to approximately one mile from the IPEC Site.

Sound is measured on a logarithmic scale, expressed in decibels ("dB"). The frequency of a sound is the "pitch" (high or low). The unit for frequency is hertz ("Hz"). The normal human ear can usually distinguish frequencies from 20 Hz (low frequency) to about 20,000 Hz (high frequency), although people are most sensitive to frequencies between 500 Hz and 4,000 Hz. The individual frequency bands can be combined into one overall dB level.

Sound is typically measured on the A-weighted scale ("dBA"). The A-weighting scale was developed and has been shown to provide a good correlation with the human response to sound and is the most widely used descriptor for community sound assessments (Harris 1991). The ability of an average individual to perceive changes in noise levels is well documented. Generally, an increase of less than 3 dBA is barely perceptible to most listeners, a 5 dBA increase is readily noticeable, and a 10 dBA increase is perceived as a doubling of the noise level. In order to provide a frame of reference, some common sound levels and definitions are provided in Table 3.8-1 below.

Table 3.8-1
Common Sounds and Sound Levels

Sound Source	Sound Source (dBA)
Chainsaw at 30 ft	90
Truck at 100 ft	85
Noisy Urban Environment	75
Lawn Mower at 100 ft	65
Average Speech	60
Typical Suburban Daytime	50
Quiet Office	40
Quiet Suburban nighttime	35
Soft Whisper at 15 ft	30

An Equivalent Noise Level ("Leq") is the equivalent sound level over a specified period of time (i.e., one-hour). It is a single value of sound that includes all of the varying sound energy in a given duration.

Statistical Sound Levels are the A-weighted sound levels that are exceeded a certain percentage of the time. The L_{90} is the sound level exceeded 90 percent of the time and is often considered the background or residual sound level. It is representative of the lower range of sound levels without the contribution of intrusive sounds, such as passing trains, cars, aircraft, etc. The L_{10} is the sound level exceeded 10 percent of the time and is a measurement of intrusive sounds, such as aircraft overflight.

3.8.1 Existing Noise Conditions

In September 2001 and January 2002, TRC conducted a sound monitoring program in locations within approximately one mile of the IPEC Site in order to characterize the existing sound environment (TRC 2003) (significant land use changes have not occurred in the vicinity since that time). Eight locations were chosen as representative sound monitoring locations. The contributing sources of sound included insects, vehicular traffic on Route 9 and local roads, some non-IPEC industrial sounds such as the nearby gypsum plant and incinerator north of the site. No noticeable sounds emanating from IPEC were noted.

Monitoring of existing sound levels was conducted at eight nearby sound sensitive areas during daytime and nighttime hours. These locations are depicted on Figure 3.8-1. The monitoring locations, their approximate distance and direction from the IPEC waterfront area, and the results of this monitoring program are summarized in Table 3.8-2.

Table 3.8-2
Average Measured Sound Levels (dBA)

Location	Approximate Distance / Direction	Daytime			Late Night		
		L_{90}	L_{10}	L_{eq}	L_{90}	L_{10}	L_{eq}
Saint Patrick's Church	5,000 / SW	41	50	48	42	48	46
16th Street / Broadway	4,900 / S	38	51	50	40	46	45
Pheasant's Run	4,800 / S	36	47	45	36	44	42
Buchanan Town Hall	5,500 / SE	44	59	55	38	45	46
Bleakley Avenue / Broadway	3,200 / E	45	61	58	38	44	42
Elementary School	4,550 / SE	36	N/A[1]	N/A[1]	36	N/A[1]	N/A[1]
Residence on Broadway	4,100 / S	39	N/A[1]	N/A[1]	40	N/A[1]	N/A[1]
China Pier	5,000 / NE	51	55	54	N/A[2]	N/A[2]	N/A[2]

Notes: N/A: Data not available.
[1] Only the L_{90} was measured at these locations as only L_{90} was required for the type of analysis conducted.
[2] Sound monitoring was not conducted at night as there was no nighttime use of this facility at that time.

Source: TRC 2003.

3.8.2 Applicable Standards and Guidelines

3.8.2.1 Village of Buchanan Sound Ordinance

The Village of Buchanan has a sound ordinance (Chapter 211-23 of the Village Zoning Code) with standards limiting allowable sound levels from a facility by octave band levels. Octave bands define the frequencies of a particular sound, from higher pitched sounds to lower pitched sounds. The standard is applicable at the property line of the sound generating use. The village standard utilizes octave band ranges that are obsolete and no longer utilized for sound level measurement by the acoustic science community. Modern sound level meters no longer measure sound in this manner. The American National Standards Institute ("ANSI") S1.11-2004 (R2009) standard provides a method for converting the obsolete frequency ranges into the octave band center frequencies used today. Therefore, for the purposes of this characterization, the octave band ranges and associated dB levels contained in Chapter 211-23 of the Village Zoning Code have been converted to the currently used octave band center frequencies in accordance with the procedures set forth in ANSI S1.11. Table 3.8-3 presents the Village of Buchanan sound standard in terms of the currently utilized ANSI-based octave band center frequencies. For reference purposes, the combined octave band center frequencies equate to an overall dBA level of 47 dBA. The Village of Buchanan standard also outlines various correction factors for sources, although none appear to be applicable to the operational sound characteristics of the proposed CWWS system.

Table 3.8-3
Village of Buchanan Sound Standard

Octave Band Center Frequency (Hz)	Sound Pressure Level (dB)
63	61
125	53
250	48
500	43
1,000	40
2,000	38
4,000	34
Source:	Village of Buchanan Sound Ordinance, Chapter 211-23 of the Village Zoning Code, modified to current ANSI S1.11 standards.

Construction activities are addressed in Chapter 119-5 of the Village Zoning Code, which prohibits construction between the hours of 7:00 p.m. and 8:00 a.m.

3.8.2.2 New York State Department of Environmental Conservation

NYSDEC issued a program guidance document entitled "*Assessing and Mitigating Noise Impacts*" on October 6, 2000. The guidance discusses various aspects of sound and suggested steps for performing sound assessments (NYSDEC Policy DEP-001). Further, it provides suggestions on evaluating significant increases in sound levels.

The guidance recommends that for non-industrial settings, the sound pressure level ("SPL") should probably not exceed ambient sound levels by more than 6 dBA at a given receptor. The addition of any sound source, in a non-industrial setting, should not raise the total future ambient sound level above a maximum of 65 dBA. This would be considered the "upper end" limit since 65 dBA allows for undisturbed speech at a distance of approximately 3 feet. Sound levels in industrial or commercial areas should not exceed 79 dBA.

The NYSDEC guidance explicitly states that the 6 dBA increase is to be used as a general guideline. There are other factors which should also be considered. For example, in settings with very low ambient sound levels, a greater increase may be acceptable since sound levels are so low.

No other applicable federal or state noise standards were identified.

3.9 ENVIRONMENTAL JUSTICE

This Section identifies low-income and minority populations in the region surrounding the IPEC Site for the purposes of determining whether construction and operation of the CWWS Technology could have any adverse and disproportionate impacts on any potential environmental justice ("EJ") areas. An evaluation of potential adverse and disproportionate impacts on potential EJ Areas in the region of IPEC is presented in Section 4.11.

Environmental justice concerns are being addressed in this ER in accordance with applicable NYSDEC EJ Policy. On March 19, 2003, NYSDEC published "Commissioner Policy 29: Environmental Justice and Permitting" ("CP-29") to provide guidance for incorporating EJ concerns into the NYSDEC environmental permit review process and the NYSDEC application of SEQRA. NYSDEC defines a "potential environmental justice area" as:

> *"a minority or low-income community that may bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies"* (Section III A Definitions of CP-29)

Under Executive Order 12898 (February 11, 1994), entitled "*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,*" federal agencies must consider disproportionate and adverse human health and environmental impacts on minority and low-income populations. In response to Executive Order 12898, NRC issued a "*Policy Statement on the Treatment of Environmental Justice*" in 2004. Consistent with NRC's Policy Statement, EJ issues associated with the renewal of IPEC's operating licenses are documented in the ER that was prepared for Entergy's License Renewal Application and submitted to NRC in 2007 (Entergy 2007). EJ issues are also discussed in the FSEIS issued by NRC in response to Entergy's request for renewal of IPEC's operating licenses (NRC 2010).

Because NYSDEC Staff has indicated their intention to rely, at least in part, on the NRC's FSEIS, the evaluation presented herein is intended to be complementary to the EJ analysis conducted pursuant to the NRC Proceedings.

3.9.1 Applicability of NYSDEC Environmental Justice Policy

Per CP-29, "*it is the general policy of NYSDEC to promote EJ and incorporate measures for achieving EJ into its programs, policies, regulations, legislative proposals and activities*." An application for a new SPDES Permit that is classified as a major project (as defined by 6 NYCRR Part 361), as well as an application for a major modification of an existing permit, are subject to review for EJ impacts pursuant to CP-29. CP-29 expressly applies to applications received after its effective date of April 18, 2003. As the IPEC SPDES Permit renewal application was received in May 1992, more than ten years prior to the effective date of CP-29, the regulations of CP-29 do not directly apply to IPEC's SPDES Permit renewal application. Nevertheless, this ER presents an EJ analysis for the purposes of providing a robust SEQRA review of IPEC's SPDES Permit renewal, responsive to the stated concerns of parties to the SPDES Proceeding (NYSDEC 2008). EJ concerns have been raised by environmental advocacy groups during proceedings for the NYSDEC Water Quality Certification/Certificate ("WQC") and the NRC operating license renewal. It is to be noted that applications for additional NYSDEC Permits may require CP-29 review. Accordingly, this analysis employs the guidelines and methodology set forth in CP-29 to identify low-income and minority communities and to evaluate how these communities would be impacted by the alternative actions.

3.9.2 Identification of Screening Area

CP-29 prescribes a two-step methodology for conducting the preliminary screening analysis:

- Determine whether the proposed action is in or near a minority or low-income community and identify potential environmental impacts.
- Determine whether impacts are likely to adversely affect a potential EJ Area.

CP-29 states that the screening area should encompass "*the area to be affected by the potential adverse environmental impacts*" (Section V: B. Methodology for Conducting a Preliminary Screen of CP-29). CP-29 does not identify a specific numeric distance (for the screening area) that must be taken into account in conducting EJ analyses. However, the NRC EJ Policy Statement indicates that a 50-mile radius should be examined when assessing EJ concerns relevant to licensing and regulatory actions associated with power reactors (NRC 2003). Therefore, the screening area for this ER has been defined to include all census block groups ("BGs") that fall within or overlap a 50-mile radius from the IPEC Unit 1 superheater stack. The boundary of the screening area is illustrated in Figure 3.9-1 and encompasses BGs in Connecticut, New Jersey, New York and Pennsylvania (one county – Pike).

The BGs located within the screening area were identified using ArcView GIS software and by incorporating United States Census 2000 data. Given the extensive screening area, the number of BGs is likewise extremely large and includes: 853 BGs in Connecticut; 3,203 BGs in New Jersey; 9,078 BGs in New York; and 12 BGs in Pennsylvania. A total of 13,146 BGs are located in the screening area.

3.9.3 Other State Environmental Justice Policies

In addition to New York State, Connecticut, New Jersey, and Pennsylvania have adopted policies and undertaken several initiatives that address EJ issues in the context of state permitting and environmental review (refer to Connecticut: Public Act 08-94, An Act Concerning Environmental Justice Communities and the Storage of Asbestos Containing Material [codified at § 22a-20a of the Connecticut General Statutes]; New Jersey: State of Jersey Executive Order #131 and Environmental Justice Advisory Council; and Pennsylvania: Office of the Environmental Advocate and Environmental Justice Public Participation Policy). Because the renewal of the IPEC SPDES Permit and the construction and operation of the CWWS (and other alternative technologies) would not require approval from Connecticut, New Jersey, or Pennsylvania regulatory agencies, further discussion of these states' EJ programs and policies is not warranted.

3.9.4 Identification of Potential Environmental Justice Areas

CP-29 establishes state-specific thresholds in order to identify areas, typically census tracks ("CT") or BGs, where the representation of low income and/or minority populations qualifies the area as *"a potential EJ Area."* Because this analysis is being prepared in the context of a NYSDEC SPDES Proceeding, the BGs in Connecticut, New Jersey, and Pennsylvania were evaluated against the thresholds established in NYSDEC's CP-29.

CP-29 establishes different thresholds for rural and urban areas with respect to a "*minority community.*" In this analysis, the threshold established for rural areas was applied when 50 percent or more people in a BG were determined to live in rural areas as designated by the 2000

United States Census. Table 3.9-1 identifies the BGs by state and county within which 50 percent or more people live in rural areas as designated by the 2000 United States Census.

Table 3.9-1
Block Groups in 50-Mile Screening Area in which 50 Percent or More People Live in Rural Areas

County	Number of Block Groups (BGs)
New York State	
Dutchess County	45 BGs
Nassau County	1 BG (CT 5178.01, BG 3)
Orange County	65 BGs
Putnam County	14 BGs
Rockland County	2 BGs (CT 101.01, BG 1 and CT 105.03, BG 2)
Suffolk County	1 BG (CT 1101.01, BG 2)
Sullivan County	46 BGs
Ulster County	55 BGs
Westchester County	24 BGs
Total	253 BGs
Connecticut	
Fairfield County	18 BGs
Litchfield County	35 BGs
New Haven County	8 BGs
Total	61 BGs
New Jersey	
Bergen County	1 BG (CT 391, BG 3)
Essex County	1 BG (CT 218.02, BG 2)
Morris County	8 BGs
Passaic County	7 BGs
Somerset County	1 BG (CT 527, BG 5)
Sussex County	46 BGs
Warren County	1 BG (CT 313.03, BG 1)
Total	65 BGs
Pennsylvania	
Pike County	10 BGs
Total	10 BGs
Entire Screening Area	
Total	389 BGs
Source:	BGs and percentage of persons living in rural areas identified through Arcview GIS software and by incorporation of 2000 U.S. Census data (Summary File 1).

The New York State threshold for "*a low income community*" is defined within Policy CP-29 as a BG where the low-income population or the percentage of individuals living below the poverty threshold (as defined by the United States Census Bureau) is equal to or greater than 23.59 percent of the total population. For the 2000 United States Census, a low-income population is defined as the percentage of individuals whose 1999 income was less than 100 percent of the poverty level. BGs in which more than 23.59 percent of individuals meet this criterion are considered potential EJ Areas.

The New York State threshold for "*a minority community*" is defined within Policy CP-29 as a BG where 51.1 percent or more of the population is minority in an urban area or when 33.8 percent or more of the population is minority in a rural area. This analysis considers individuals who identified themselves as "*Alaskan Natives*", "*Some Other Race*", or "*Two or More Races*" as minorities. CP-29 does not explicitly account for these United States Census categories, and therefore, the categorization herein is comparatively more inclusive. In this analysis, a minority population includes all individuals other than Single-Race Non-Hispanic/non-Latino Whites. BGs in which 51.1 percent or more individuals in urban areas and 33.8 percent or more individuals in rural areas meet this criterion are considered potential EJ Areas.

Data from the 2000 United States Census regarding income, race and ethnicity were obtained for each of the BGs in the screening area. Data were also gathered for each of the states and counties in the screening area to compare the demographic characteristics of the screening area to larger geographic areas.

Table 3.9-2 lists (by state and county) the number of BGs that exceed the CP-29 minority and low-income thresholds and presents the number of BGs that have been identified as potential EJ Areas. In total, 2,604 low-income communities and 5,357 minority communities are located within the 50-mile screening area (i.e., 2,604 BGs exceeded the CP-29 low-income threshold and 5,357 BGs exceeded the CP-29 minority threshold).

Several of the BGs exceed both the CP-29 minority threshold and the low-income threshold (Table 3.9-2). These BGs were counted only once in identifying the potential EJ Areas within the screening area. Based on the CP-29 criteria and the screening area data, a total of 5,667 BGs are considered potential EJ Areas. Figure 3.9-2 illustrates the locations of these potential EJ Areas. The potential EJ Areas within the 50-mile screening area are concentrated in the counties of New York City within New York State, and in the metropolitan counties of New Jersey, and are generally located to the south of IPEC. In the immediate vicinity of IPEC, the largest number of potential EJ Areas is generally located to the northeast of the site in the City of Peekskill. The BG within which IPEC is located (CT 140, BG 1) does not exceed the CP-29 low-income or minority thresholds and therefore, is not a potential EJ Area.

Table 3.9-2
Low-Income Communities, Minority Communities, and Potential EJ Areas within the 50-Mile Screening Area

Area	Exceed CP-29 Low-Income Threshold (BGs)	Exceed CP-29 Minority Threshold (BGs)	Exceed CP-29 Low-Income and Minority Thresholds (BGs)	Potential EJ Areas (BGs)
New York State				
Bronx County	576	806	570	812
Dutchess County	17	27	14	30
Kings County	925	1,244	721	1,448
Nassau County	21	179	18	182
New York County	323	421	309	435
Orange County	33	35	21	47
Putnam County	0	0	0	0
Queens County	195	1,003	171	1,027
Richmond County	24	50	21	53
Rockland County	10	31	3	38
Suffolk County	6	69	4	71
Sullivan County	7	8	4	11
Ulster County	13	6	2	17
Westchester County	69*	205*	65	209*
Total	2,219	4,084	1,923	4,380
Connecticut				
Fairfield County	47	140	45	142
Litchfield County	0	0	0	0
New Haven	1 (CT 1202, BG 2)	0	0	1 (CT 1202, BG 2)
Total	48	140	45	143
New Jersey				
Bergen County	8	100	4	104
Essex County	167	401	167	401
Hudson County	66	280	63	283
Middlesex County	2 (CT 27.01, BG 1 and CT 36, BG 9)	6	1 (CT 27.01, BG 1)	7
Morris County	1 (CT 448, BG 1)	20	1 (CT 448, BG 1)	20
Passaic County	70	169	68	171
Somerset County	0	0	0	0
Sussex County	1 (CT 3737, BG 1)	0	0	1 (CT 3737, BG 1)
Union County	22	157	22	157
Warren County	0	0	0	0
Total	337	1,133	326	1,144
Pennsylvania				
Pike County	0	0	0	0
Total	0	0	0	0
Entire Screening Area				
Total	2,604	5,357	2,294	5,667

Source: U.S. Department of Commerce, Bureau of the Census, 2000 Census, Summary Files 1 and 3.
Note: * NYSDEC provides GIS data for use in determining potential Environmental Justice areas. TRC has included all of these potential Environmental Justice areas (as Block Groups) in its screening area. TRC has also included Block Group 361190146039 (in Cortlandt) based on the CP-29 Low-Income Threshold, although the NYSDEC had not identified it as such.
BGs = census block groups.

3.9.5 Review of NRC FSEIS

Subchapter 4.4.6 of the NRC FSEIS (NRC 2010) addresses EJ matters through (1) identification of minority and low-income populations that may be affected by the proposed license renewal, and (2) examining any potential human health or environmental effects on these populations to determine if these effects may be disproportionately high and adverse.

In identifying minority and low-income populations, the NRC FSEIS uses the following Council on Environmental Quality ("CEQ") definitions of minority individuals, minority populations, and low-income populations.

- Minority individuals: Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black, or African American. Native Hawaiian or Other Pacific Islander, or two or more races meaning individuals who identified themselves on a census form as being a member of two or more races, for example, Hispanic and Asian.

- Minority populations: Minority populations are identified when (1) the minority population of an affected area exceeds 50 percent, or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

- Low-Income Populations: Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series PB60, on Income and Poverty.

The FSEIS also designates census BGs in which 50 percent or more population is minority as "*minority block groups*" and census BGs in which the percentage of the population living below the poverty threshold (established by the Census Bureau) exceeds the New York State percentage of 14.5 as "*low-income block groups*."

The NRC FSEIS found that 48.7 percent of the population (approximately 16,805,000 individuals) residing within a 50-mile radius of IPEC identified themselves as minorities. The NRC FSEIS also displayed the locations of (but did not quantify) the census BGs that are defined as "*minority block groups*" on a map. Consistent with the SEQRA ER, this map in the NRC FSEIS indicated that BGs with minority populations (greater than 50 percent) are concentrated in the New York City counties and surrounding northern New Jersey counties.

The NRC FSEIS found that approximately 484,000 families (approximately 11.7 percent) residing within a 50-mile radius of IPEC live below the poverty threshold established by the United States Census Bureau. The NRC FSEIS displayed the locations of (but did not quantify) the census BGs that are defined as "*low-income block groups*" on a map. The map presented in the NRC FSEIS showed a larger number of low-income BGs than were identified in this SEQRA ER. This is a result of the fact that the low-income thresholds used in the NRC FSEIS and in this SEQRA ER assessment differ (i.e., the threshold used in NRC FSEIS is 14.5 percent and the threshold used in the SEQRA ER and defined by the NYSDEC is 23.59 percent).

3.10 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

This Section presents the findings of prior (2007 – 2009) archaeological and historical investigations conducted at the IPEC Site. This Section draws primarily on the following documents:

- *"Phase IA Literature Review and Archaeological Sensitivity Assessment of the Indian Point Site, Westchester County, New York"* ("2007 Phase IA Report") prepared by ENERCON (March 22, 2007).

- *"Phase IB Archaeological Investigation of Potential Cooling Tower Construction Sites at Indian Point Energy Center Westchester County, New York" ("*2009 Phase IB Report") prepared by ENERCON (October 9, 2009).

The 2007 Phase IA Report was prepared as part of the NRC License Renewal process, while the 2009 Phase IB Report was prepared to assess the potential presence of historic properties on areas of the IPEC Site where installation of cooling towers responsive to the NYSDEC Staff (tentative draft) SPDES Permit, was considered (Chapter 1.0). Following their review of the Phase IB report, the New York State Historic Preservation Office ("NYSHPO") recommended that Phase II investigations of two archaeological sites recorded during the Phase IB study be conducted to provide additional information necessary to evaluate the sites for potential listing on the State and National Registers of Historic Places.

3.10.1 Regulatory Considerations

The prior (2007 – 2009) studies were conducted in accordance with the NYSHPO Environmental Review Program that includes the following:

- Section 106 of the National Historic Preservation Act (PRHPL) of 1966.

- Section 14.09 of Article 14 of the Parks, Recreation and Historic Preservation Law, which was enacted by the New York State Historic Preservation Act of 1980 (Chapter 354 of the Laws of 1980).

- SEQRA (6 NYCRR Part 617 of the New York State Environmental Conservation Law [ECL]).

Under § 106 of the National Historic Preservation Act and § 14.09 of the New York State Historic Preservation Act, the NYSHPO's role in the review process is to ensure that effects or impacts on eligible or listed properties are considered and avoided or mitigated during the project planning process. In addition, the NYSHPO advises local communities on local preservation environmental reviews, upon request, under the provisions of the SEQRA (NYSHPO 2006a).

3.10.2 Cultural History and Records Review

3.10.2.1 Literature and Records Review

The 2007 Phase IA Report presented the results of the background archaeological and historical research conducted at the request of NYSHPO, as well as a review of general literature and online sources and materials from the Verplanck and Westchester County Historical Society and local libraries. A summary of the cultural history of the general region is provided as follows.

Prehistoric Era

The prehistory of the Hudson Valley Region encompasses the Paleo-Indian, Archaic, Transitional and Woodland periods. Paleo-Indian Period groups were the first prehistoric occupants of the region around 11,000 years ago (ENERCON 2007). The groups were characterized by small bands spread across the region, particularly along the broad meadows and river terraces, and subsisted by hunting large and small mammals. Archaeological evidence suggests that human occupation of the region did not occur again for another 4,000 years until the Archaic Period. The Archaic groups were adept hunters, fishermen and gathering foragers that frequented favorite riverine and uplands locations on a seasonal basis. By the end of the Archaic Period, prime locations were being occupied for extended seasons and year-round.

The Transitional Period brought the first signs of semi-sedentary or settled village life in the region, while permanent villages and the beginning of social order/rankings led to the Woodland Period. At the beginning of the Woodland Period around 3,000 years ago, the use of clay pottery spread throughout the Hudson Valley. Subsistence continued to focus on the hunting of small game, fishing and gathering; however, the Woodland Period also saw an increasing dependency on cultivated crops. It is estimated that 60,000 to 70,000 people occupied the Hudson River Valley area during this period (CHGE et al. 1999). The end of the Woodland Period provides the first written records of the area (around 1600 Common Era).

Historic Period

The Historic Period begins with the first European explorations in the Hudson Valley area in the seventeenth century. Although previously visited by Verrazano, Henry Hudson was the first to make written records of his explorations of the region in 1609. During this time, the area was home to the Lenape or upper Delaware bands (locally known as the Kitchawak), which consisted of numerous smaller communities. The European-American presence in the region remained minimal until 1683 when a Dutch settler named Verplanck purchased what would later be known as Indian Point from the Kitchawak.

With the exception of some troop movements during the Revolutionary War, the IPEC Site had no Revolutionary War significance. In 1777 British troops landed at Lents Cove for the purpose of raiding the City of Peekskill, and Indian Point was the scene of skirmishing before the landing. The Stony Point Battlefield is located on the western bank of the Hudson River and Rochambeau's encampment, from where the French began their march south to join Washington at the Siege of Yorktown, is located on the east side of the River.

During the nineteenth century, the area was scattered with mines, lime quarries, kilns, blast furnaces and small manufacturing facilities. The north end of Indian Point was heavily surface mined during the late nineteenth century. Around 1900, a small farm and a brickyard owned by Charles Southard existed on or near the IPEC Site.

Beginning in the early nineteenth century, steamboats traveled up and down the Hudson River on a daily basis between New York City and Albany. In the 1920's, the Hudson River Day Line Company opened an amusement park on a 320-acre site on the east side of the River below Peekskill. Claiming that its property had been a meeting place for Indians, the Day Line called the park Indian Point. Indian Point Park opened on June 26, 1923 and consisted of a cafeteria for dining, facilities for picnicking, a dance hall, a beer hall and a 100- by 150-foot pool. Indian Point Park drew more than 5,000 people on the weekends and hundreds on weekdays. However, after World War II and the selling of the Hudson River Day Line steamboats to a private company, the popularity of the park declined, and it closed in 1956. Con Edison bought the property and Unit 1 and its support facilities were ready for commercial operation by August 1962.

3.10.2.2 Archaeological Resources

According to the NYSHPO, numerous prehistoric archaeological sites have been identified within a six-mile radius of the site. Information on the archaeologically sensitive areas is stored in the NYSHPO Geographic Information System ("GIS") Public Access. According to the GIS maps, approximately 70 percent of the land within a six-mile radius of the IPEC Site has been designated as archaeologically sensitive.

Review of the NYSHPO GIS indicates the IPEC Site and its immediate environs – both terrestrial and immediate offshore areas – are considered to be archaeologically sensitive (Figure 3.10-1). In 2009, limited field investigations identified three archaeological sites at the IPEC Site (Table 3.10-1).

3.10.3 Historic Resources

The NYSHPO is the primary contact for the two historic registers that track New York's historical resources. The National Register of Historic Places ("NRHP") is the official federal listing of significant historic, architectural, and archaeological resources. The New York State Register of Historic Places ("NYRHP") is the list of significant historic and prehistoric resources throughout New York.

Table 3.10-1
Archaeological Sites Identified During 2009 Phase IB Investigation

Study Area	Site Number	Age/Cultural Affiliation	Description
Potential South Cooling Tower Location	A11967.000106	Prehistoric	A sparse scatter of prehistoric artifacts was observed on the ground surface, consisting of fire-cracked rocks, flakes, shatter, and a single bi-face fragment.
	A11967.000106	Historic	A possible occupation ranging from 1880's to the 1930's was identified based on the finding of sparsely scattered surface artifacts and a post with attached fencing. Historic artifacts and features observed included glass containers (fragments), a collapsed rock wall, a poured concrete foundation, and a concrete slab.
Potential North Cooling Tower Location	A11967.000107	Historic	The site is a surface mine. One location not impacted by mining was identified, and is marked by fluff lines and a steep rock/boulder covered slope. A short section of a collapsed rock wall, believed to be a field or property boundary, was recorded in this area.

Source: ENERCON 2009.

The State Preservation Historical Information Network Exchange ("SPHINX") database, which is constructed and maintained by the NYSHPO, is used to store current information on New York State aboveground historic sites that are eligible for listing or are already listed on the NRHP and NYRHP (NYSHPO 2006b). The area within a two-mile radius of the site covers portions of Westchester County, and Rockland County. The SPHINX database for this area contains entries for many hundreds of individual historical sites and districts eligible for listing and already listed on the NRHP and NYRHP. Westchester County had 397 listed aboveground historic sites. Two of the closest listed historic sites to the IPEC Site are the City of Peekskill Downtown Historic District, approximately two miles to the northeast, and Stony Point Battlefield, approximately two miles to the south. The NRHP- and NYRHP-listed sites located within a two-mile radius of the IPEC Site are presented in Table 3.10-2.

Table 3.10-2
Listed Historical Sites in the Vicinity (Two-Mile Radius) of the IPEC Site

Site Name	Nearest City or Town	Listed NRHP	Listed NYRHP	Distance and Direction
Westchester County				
Standard House	City of Peekskill	Yes	Yes	0.9 Miles NE
Peekskill Freight Depot	City of Peekskill	Yes	Yes	1.1 Miles NE
Thomas Nelson House	City of Peekskill	Yes	Yes	2.0 Miles NE
Peekskill Presbyterian Church	City of Peekskill	Yes	Yes	1.3 Miles NE
St. Peter's Episcopal Church	City of Peekskill	Yes	Yes	1.6 Miles NE
Peekskill Downtown Historic District	City of Peekskill	Yes	Yes	1.2 Miles NE
Ford Administration Building	City of Peekskill	Yes	-	1.5 Miles NE
Fort Hill-Nelson Avenue Historic District	City of Peekskill	Yes	Yes	1.7 Miles NE
Bear Mountain Bridge Road	Town of Cortlandt	Yes	Yes	1.8 Miles N
Drum Hill High School	City of Peekskill	Yes	Yes	1.2 Miles NE
United States Post Office-Peekskill	City of Peekskill	Yes	Yes	1.5 Miles NE
St. Patrick's Church	Town of Cortlandt	-	Yes	0.5 Miles S
Mount Florence	City of Peekskill	Yes	Yes	1.2 Miles NE
Rockland County				
Stony Point Battlefield	Town of Stony Point	Yes	Yes	2.0 Miles S
Stony Point Lighthouse	Town of Stony Point	Yes	Yes	2.0 Miles S

Notes: " – " indicates site may be proposed on State list, but approval of its listing has not yet occurred.

Sources: NYSHPO 2013; NPS 2013.

4.0 POTENTIAL SIGNIFICANT ADVERSE ENVIRONMENTAL IMPACTS

4.1 IMPACT ANALYSIS FRAMEWORK

4.1.1 Introduction

This Chapter assesses the potential impacts associated with the proposed construction and post-construction operation of CWWSs, focusing on potential significant adverse environmental (and socio-economic) impacts. It is based on the assumption that CWWSs are determined to be BTA to minimize adverse environmental impacts pursuant to § 704.5 of 6 NYCRR. Consequently, no further minimization or mitigation with respect to I&E is considered in this ER, although limited summary discussion of relevant conclusions from Entergy's engineering feasibility and efficacy analysis is referenced. The SEQRA-mandated alternatives analysis will be performed in a subsequent ER, as noted in Chapter 1.0.

The total duration for complete Project implementation is projected to be less than six years. A Project schedule has been developed by ENERCON with assumed start and finish dates as shown in Figure 2.5-2 (Preliminary Construction Schedule). In-river work would be performed over three successive construction seasons during the four-year construction schedule, i.e., from about March through November in each of those three years, and in the last year, tie-in of the second Unit is expected to be completed (the first one having been completed by year two).

A detailed description of the proposed CWWS construction methods and equipment is presented in Section 2.5, but optimization of this construction approach may occur during the permitting process; as a result, this analysis considers reasonably foreseeable permit-related evolutions. The processes presented therefore represent the most likely scenario for construction of the Project, although it is recognized that the specific techniques that may eventually be used may vary to some degree as a result of construction-optimization or permitting. It is expected that the potential significant adverse environmental impacts identified in this ER, and any conclusions based thereon, would remain the same, be similar to or be reduced, notwithstanding any such modifications.

The impact analyses do not address certain, off-site construction-related considerations. Those considerations include: off-site construction staging locations for the barges typically developed in consultation with the USCG and USACE; dredged material disposal sites, which cannot be determined until materials are tested and evaluated for contaminants (although the typical range of contaminants is addressed in this ER based on significant historical technical analysis of sediment in the vicinity of IPEC); and off-site locations for construction-related fabrication of CWWS system components although it is expected that facilities that undertake this work would be fully authorized to do so. Construction contracts issued for the Project would require the contractor(s) to comply with all applicable environmental regulations and to obtain all necessary approvals and permits from the requisite federal, state and local regulatory agencies, providing additional assurances that potential adverse environmental impacts are minimized.

Following construction of the CWWS, IPEC operations would remain essentially the same, e.g., IPEC would continue to withdraw water from and discharge water to the Hudson River subject to and with the benefit of its SPDES Permit. In addition, IPEC would continue to generate electricity as a base load facility with a small air quality and carbon footprint. The existing CWIS would remain and be capable of functioning in a bypass capacity as an emergency back-up system, providing added certainty for Station operations.

4.1.2 Methodology

This ER identifies potential impacts associated with CWWSs in accordance with SEQRA (including 6 NYCCR Part 617 SEQRA).

As described in Chapter 1.0, the NRC published a FSEIS on December 3, 2010 and a Supplement to the FSEIS on June 26, 2012 addressing Entergy's April 30, 2007 application to renew the operating licenses for Units 2 and 3 for an additional 20-year period. The FSEIS considered potential environmental impacts (including alternatives to the continuation of current operations) that are or may be associated with continued operation of IPEC during the license renewal period in its existing configuration. The NRC's FSEIS offers useful insight and supports the current analysis for those aspects of the IPEC operations unaltered by construction and operation of the CWWS system. NYSDEC Staff have indicated that NYSDEC may rely, in part, on the FSEIS for purposes of making SEQRA Findings pursuant to § 617.11 in the consolidated SPDES/WQC Proceeding.

For purposes of characterizing the potential impacts resulting from construction and operation of CWWSs and to provide internal consistency in this assessment, a set of impact level categories (or significance levels) is used in this ER. NYSDEC Staff's potential reliance on the NRC FSEIS and the relevance of certain aspects of the FSEIS further supports the fact that the selected impact level categories applied in this ER are derived from those established by the NRC in its FSEIS (Section 4.2). This also should facilitate the consideration of both the NRC FSEIS and this SEQRA ER as part of the SPDES Proceeding.

The impact level categories for biological, physical and socio-economic resources and considerations used in the analyses of this ER are defined as follows:

- **NONE (NO IMPACT)** - Environmental effects do not occur or are not detectable (measureable, noticeable).

- **SMALL** - Environmental effects are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource, such as a waterbody, or where socio-economic considerations are involved, the consideration, such as community character or reliability of the electricity system.

- **MODERATE** - Environmental effects are sufficient to be detectable (measurable, noticeable) and would alter noticeably, but not destabilize important attributes of the resource, such as a waterbody, or where socio-economic considerations are involved, the consideration, such as community character or reliability of the electricity system.

- **LARGE** - Environmental effects are clearly detectable (measurable, noticeable) and would noticeably alter, and are sufficient to destabilize important attributes of the resource, such as a waterbody, or where socio-economic considerations are involved, the consideration, such as community character or reliability of the electricity system.

Besides a beneficial impact (and excluding NO IMPACT [NONE]), or as otherwise specified, the impact level categories listed above are all considered to be adverse.

Given the construction phasing of the CWWSs, a peak period has been identified to characterize the greatest potential for significant adverse impacts. The assessment of impacts for a peak period provides for a full disclosure of adverse impact as well as the identification of measures that would mitigate those effects. Other construction activities would therefore, be mitigated as well since the effects would be less intense than in the peak period.

The peak level of construction activity includes consideration of the following project attributes for the River, the Project site, and the vicinity:

- Location and type of construction activity occurring.
- Identification of on-site construction equipment.
- Operational use (hours) for each equipment type.
- Number of trucks/vessels for material supply or demolition transport.
- Number of construction worker vehicle trips.

These project attributes were determined and incorporated for individual construction activities to analyze the potential significant adverse impacts consistent with the above impact level categories for SEQRA analysis.

The timing of peak analysis periods applicable to the resource being assessed also was integrated into the construction impact assessment. For example, the peak dredging activity was used to assess potential water quality impacts, whereas the peak pile driving period (combined with general construction work) was the basis for potential noise impacts.

The potential significant adverse impacts of IPEC operations with the CWWS system in place also use the impact categories (significance levels) defined for CWWS construction. For example, the physical changes resulting from the presence of the CWWS array in the Hudson River (e.g., sedimentation, hydraulics) are described and their potential impacts are evaluated and characterized. Similarly, those impacts resulting from the operational practices and procedures of the CWWSs are described and their potential impacts also are evaluated and characterized. The operational effects of the ABS are addressed (including the presence of the ABS Building).

As noted above, in addition to those construction and operation activities that can be planned for and considered part of the normal engineering design process, there is the potential for unanticipated and unplanned events. Only those that reasonably are foreseeable and likely to occur, i.e., non-speculative and non-remote, are addressed.

4.2 NUCLEAR REGULATORY COMMISSION FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

In addition to the assessment of CWWSs as part of this SEQRA ER, this Chapter also includes brief summaries of the applicable impact analyses contained within the NRC FSEIS (NRC 2010). As described in Section 1.3.3, the NRC's FSEIS included the NRC Staff's analysis that considers and weighs the environmental effects of renewing the IPEC operating license (the federal proposed action), the environmental impacts of alternatives, and mitigation measures for reducing or avoiding adverse effects. The purpose of the NRC Staff's environmental review, as stated in the FSEIS, was to determine:

> *"…whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable"* (10 CFR 51.95(c)(4) (NRC 2010).

The FSEIS contained the results of the NRC Staff's evaluation of the consequences of renewing IPEC's operating licenses and operating IPEC for an additional 20 years. It evaluated environmental impacts using the NRC's standards of significance - SMALL, MODERATE, or LARGE - based on the CEQ guidelines (NRC 2010).

In the FSEIS NRC Staff recommended that the Commission renew the license for the IPEC Units, stating:

> *"…that the Commission determine that the adverse environmental impacts of license renewals for IP2 and IP3 are not so great that not preserving the option of license renewal for energy planning decision makers would be unreasonable"* (NRC 2010).

Subsequently, on June 26, 2012, NRC Staff issued NUREG 1437, Supplement 38, Volume 4 Draft Report for Comment. The Supplement addressed three topics, incorrect water volume units used in estimating entrainment losses. The 2010 FSEIS had incorrectly used number ("#")/cubic meters ("m^3") when in fact the data was presented by Entergy as #/1,000 m^3. This reduced the conclusion on cooling water system impacts on spottail shiner from LARGE to SMALL. The correction of the volume error also resulted in the presentation of the analysis of entrainment numbers being reduced from "billions" to "millions" of fish per year. The Supplement also updated the thermal impact analysis by incorporating the results of the triaxial plume study (ASA 2011), which after review by NYSDEC, led NYSDEC Staff to conclude that a 75-acre mixing zone will provide reasonable assurance of compliance with water quality standards. Since these standards include protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife, the NRC concluded that thermal shock impacts to aquatic resources would be SMALL. The last item covered in the Supplement was the NMFS review of sturgeon, and that the 2011 BO allowed the NRC to conclude that impacts to shortnose sturgeon would be SMALL. The listing of Atlantic sturgeon as endangered resulted in the NRC re-initiating formal consultation with NMFS, which has resulted in issuance of the BO in January 2013.

The license renewal recommendations of the 2010 FSEIS, as noted above, were not changed by the conclusion of the June 2012 NUREG 1437, Supplement 38, Volume 4.

4.3 AIR QUALITY

This Section describes and evaluates the potential air quality impacts associated with the construction and operation of CWWSs at IPEC. Existing air quality conditions are described in Section 3.1.

4.3.1 Construction

The primary construction activities that would generate air emissions include the operation of tugs transporting equipment and precast components, tugs supporting the overall construction, heavy equipment being used for river bottom dredging, pile driving, and pipe installation (Section 2.5). A matrix was developed by ENERCON that identified the construction equipment (by type and number) expected to be operated by phase (and month) over the construction schedule (ENERCON 2013). It is to be noted that emissions from construction activities do not require a federal or state air quality permit. However, for federal actions occurring in non-attainment areas (like Westchester County), a federal general conformity analysis is required to assess the potential impact of the construction emissions associated with the federal action if the emissions exceed the *de minimis* emission thresholds. The requirement for a General Conformity analysis and the potential air quality impact of the construction emissions are addressed below.

4.3.1.1 Construction Emissions General Conformity

Section 176(c) of the CAA prohibits federal agencies from taking actions in non-attainment and maintenance areas unless the emissions from the actions conform to the state or tribal implementation plan ("SIP/TIP") for the area. Based on air quality data and other information, USEPA, states and tribes identify specific areas as not meeting a NAAQS and USEPA designates those areas as non-attainment. In addition to designating areas as non-attainment, USEPA, for some pollutants, also classifies areas based on the severity of the pollution problem. When the air quality in the non-attainment area improves so that the area is meeting the NAAQS, and the state or tribe develops a plan to maintain the air quality, the area can be redesignated as attainment. These areas are known as maintenance areas. The CAA requires federal agencies to demonstrate that the emissions caused by their actions will not interfere with the plans to attain or maintain the NAAQS in both non-attainment and maintenance areas. The General Conformity regulations only apply to air contaminants that are not achieving the NAAQS, which for Westchester County only include NO_2 and PM-2.5. All other criteria pollutants are achieving the NAAQS and are not subject to General Conformity.

The CAA recognizes that O_3 and its precursors can be transported over long distances and can impact large regions. To address that concern, the CAA permits the establishment of Ozone Transport Regions and Commissions to coordinate the control of O_3 precursors in the region. Of particular concern is the northeast portion of the United States, from Northern Virginia to New England. Westchester County is presently designated as not attaining the 2006 PM-2.5 24-hour NAAQS, and the 2008 8-hour O_3 NAAQS. USEPA promulgated *de minimis* emissions levels for each of the NAAQS pollutants. If the total direct and indirect emissions from the action are below the *de minimis* levels, the action is exempt from the requirements of having to perform a conformity analysis. The *de minimis* levels for PM-2.5 and NO_2 (as an O_3 precursor) are 100 t/yr and 50 t/yr, respectively for Westchester County (USEPA 2011a).

The indirect emissions resulting from the construction equipment were calculated based on the equipment usage schedule for the duration of the CWWS construction period. The annual emissions were tabulated for each year and compared to the *de minimis* values for General Conformity applicability. As shown in Table 4.3-1, the emissions for each year are below the *de minimis* threshold quantities and thus, the construction activities are not subject to the General Conformity regulations.

Table 4.3-1
CWWS Construction Emissions

Construction Emissions (tons/year)						General Conformity *De Minimis* Emission Levels (tons/year)
Parameter	**2013**	**2014**	**2015**	**2016**	**2017**	
NO_2	1.7	31.7	27.1	11.4	0.7	50
PM-2.5	0.1	1.4	1.2	0.6	0	100

4.3.1.2 Construction Emissions Air Quality Impact Analysis

The detailed assessment of potential air quality impacts from CWWS construction is provided in Appendix A of this ER and is the basis for this summary presentation. The air emission contaminants of concern are NO_2, PM-10 and PM-2.5 emissions. SO_2 emissions are expected to be minimal since ultra-low sulfur diesel fuel (15 parts per million ["ppm"] sulfur or less) would be used to fuel the diesel construction equipment. The potential construction-related air quality impacts were assessed assuming a daily work schedule of 11 hours per day for seven days per week, consistent with the Town code of the Village of Buchanan.

In 1987 USEPA established the primary and secondary 24-hour standard for coarse respirable particulate (PM-10) as not to be exceeded more than once per year on average over three years. The PM-2.5 AAQS was redefined by USEPA, effective as of December 18, 2006, as the 98^{th} percentile of the 24-hour average concentrations (measured at each population-oriented monitor within an area, as specified in the definition of the standard) (USEPA 2006). The 1-hour NO_2 AAQS was defined by USEPA, effective as of April 12, 2010, as the three-year average of the 98^{th} percentile of the daily maximum 1-hour average at each monitor within an area (USEPA 2010). In accordance with USEPA guidance, for ambient air quality modeling of both the PM-2.5 24-hour standard and the NO_2 1-hour standard, when considering 365 daily modeling values at each receptor, the top 2 percent (or highest seven values) are ignored, and only the eighth-highest modeled value is considered for comparison to the applicable ambient air quality standard (USEPA 2011b; USEPA 2011b). These standards are included in Table 4.3-1.

The specific construction activities for which potential air quality impacts were assessed, all of which would be within the S&SZ extending from the shoreline at IPEC to a point approximately 900 feet west into the River. In order to evaluate the impacts air quality modeling receptors (geographical locations where air quality impacts are calculated) were placed along the property line of the IPEC Site and extending into the Hudson River bounding the S&SZ and to a distance of 2 kilometers from the IPEC CWISs. The intake structures were used as the location for the center of the air quality modeling receptor grid (Appendix A).

The peak period of construction (with the maximum number and operating hours of equipment), which would include the greatest potential short-term emissions of NO_2, PM-10 and PM-2.5, was assessed. The equipment usage (and emissions) is based on load factor and usage factor. Load factor is the percent of power level of the equipment averaged over the peak period and usage factor is the amount the equipment is actually used over that time. For the 1-hour NO_2 impacts, only the load factor was applied while for the 24-hour PM-2.5 impacts, both the load factor and usage factor were applied to the emissions calculations for each piece of equipment.

In accordance with USEPA modeling guidance provided in 40 CFR 51 Appendix W – "*Guideline on Air Quality Models*", a five-year period of hourly meteorological data was used to define the potential worst-case air quality impact to the short-term NO_2, PM-10 and PM-2.5 standards. Since the construction activities would occur at various times and locations over the construction schedule, the calculation of an annual average for these pollutants is neither applicable nor meaningful; moreover, due to the short duration of each activity and the geographical separation of the construction zones, which further disperses the emissions and reduces ground level concentrations, construction would have a negligible impact to the annual standards. Thus, only the potential impacts of CWWS construction activities on the short-term (i.e., 1-hour and 24-hour) ambient air quality standards are evaluated.

Table 4.3-2 presents the estimated maximum air quality concentrations associated with construction of the CWWS system at IPEC. The estimated eighth-highest (98th percentile) 1-hour concentration of 144 μg/m³ is less than (i.e., is in compliance with) the NO_2 ambient standard. Note that this predicted maximum concentration would be a transient event and based on the unrealistic assumption that the maximum number of construction equipment would be operating at the anticipated operating loads for the full five years of modeling data. The predicted maximum concentrations of PM-10 and PM-2.5 are less than 1 μg/m³, a *de minimis* increase. Consequently, by achieving the applicable short-term AAQSs, the CWWS construction activities would cause NO temporary air quality impacts (NO IMPACT).

Table 4.3-2
CWWS Construction Air Impacts

Nitrogen Dioxide Concentrations (μg/m³)			
Averaging Period	**Maximum (5-year)**	**NAAQS**	**Specific Pollutant**
Eighth Highest 1-hour	144	189	NO_2
PM-10/PM-2.5 Concentrations (μg/m³)			
Averaging Period	**Maximum (5-year)**	**NAAQS**	**Specific Pollutant**
2nd Highest 24-hour	0.8	150	PM-10
Eighth Highest 24-hour	0.6	35	PM-2.5
Notes:	NO_2 ratio of 0.8 applied to NO_2 concentrations per USEPA air quality modeling guidance (USEPA 2011b). "-" denotes no applicable NAAQS.		

4.3.2 Operation

From an air quality perspective, operations of the Stations with the CWWSs in place would remain the same as current operations. Operation of the CWWS system does not require any additional air emission source. Electricity to operate the CW pumps is already provided by an on-site power source and any additional requirements (i.e., electric power to operate the ABS) would similarly be powered by the Stations directly. Moreover, the CWWS system does not require any changes to the permitted on-site generating equipment, used on a short-term basis only, to assist during the startup and safe shutdown of the Stations (as well as periodic emergency diesel generator testing and generation of house service boilers). Thus, there would be NO potential adverse air quality impacts resulting from operation of CWWSs at IPEC (NO IMPACT).

Overall, the Stations' operations have extremely low air contaminant emissions, including with respect to greenhouse gases, because the traditional combustion sources necessary to support the facility are few and relatively small. Therefore, IPEC has a small air quality and carbon footprint, especially relative to other classes of energy generation using fossil fuels as the primary fuel. Operation of CWWSs at IPEC maintains this favorable dynamic.

Specifically, in a report and testimony to the NRC, NERA (2012) developed estimates of the potential increases in CO_2 emissions if IPEC were removed from the electricity system. NERA (2012) noted that while nuclear plants like IPEC emit virtually no CO_2 emissions, coal plants emit about 2,100 lbs of CO_2 per MWh on average and natural gas plants emit about 900 lbs of CO_2 per MWh on average. Based on empirical modeling results, NERA (2012) found that if IPEC were removed from the electricity system, the market response in New York and other states would include significantly increased generation from coal and natural gas plants (relative to a baseline scenario in which IPEC continued to operate). The increased generation from coal and natural gas plants would increase national annual CO_2 emissions above baseline levels by about 13.5 million metric tons (on average based on modeling results from 2016 to 2025). The empirical model for this analysis incorporated the RGGI, the CO_2 cap-and-trade program covering the power sector in New York and several other Northeast states. National CO_2 emissions could increase from removal of IPEC because baseline emissions in RGGI states were projected to be below cap levels and because some of the increased generation would come from coal and natural gas plants outside RGGI states.

4.3.3 Conclusions of the Air Quality Impact Analyses

Construction associated with the CWWSs is consistent with all applicable NAAQS and, therefore, would have NO potential adverse air quality impacts (NO IMPACT). The construction activities would cause a *de minimis* increase in the emissions of NO_2 and PM-10 and PM-2.5 in the immediate vicinity of IPEC, but such emissions would be transient in nature, dispersed over the construction areas, and would not cause the ambient standards to be exceeded.

CWWSs require no increased air contaminant emissions and, consequently, would cause NO adverse operational air quality impacts (NO IMPACT). Operations of IPEC with the CWWS system would have extremely low air contaminant emissions, including greenhouse gas emissions, perpetuating this favorable dynamic.

4.4 WATER QUANTITY AND QUALITY

This Section describes and evaluates the potential water quantity and quality impacts associated with construction and operation of CWWSs beyond those matters already considered in conjunction with CWWS efficacy. The installation of the CWWS array would be performed in accordance with issued federal and state permits, including those requiring compliance with New York State water quality standards.

4.4.1 Construction

4.4.1.1 Water Quantity

Construction of the CWWSs would have no measureable effect on water quantity (i.e., consumptive use) (NO IMPACT). With the CWWSs in place, Unit 2 and Unit 3 would continue to operate as once through cooled generating facilities.

4.4.1.2 Water Quality

Construction of the CWWSs has the potential to result in some localized and temporary effects on water quality, in many instances falling within water quality parameters that reflect the range of the Hudson River's natural variability due to tidal exchange, seasonal changes in flow, and episodic storm events. Further, ENERCON has developed state-of-the-art construction methods and BMPs that serve to mitigate the potential adverse effects on water quality, including those largely associated with sediment resuspension. These method and BMPs are presented in Sections 2.4 and 2.5, and are discussed below as applicable.

Construction-related activities would not affect most physical properties of the water, such as temperature, heat capacity, or density, etc. In addition, chemical properties, such as salinity, conductivity or pH, would not be affected (NO IMPACT). CWWS construction would result in

SMALL, localized increases in total suspended solids ("TSS") and turbidity through resuspension of river bottom sediments.

All dredging and related work that may result in sediment resuspension would be performed in accordance with required federal, state and local permits and approvals. Beneficial use of dredged material as fill material, aggregate, or for other purposes may offer an alternative to upland management of dredged material.

Turbidity and Total Suspended Solids

A principle construction objective of the Project is to ensure that resuspension of sediments in the immediate vicinity of the construction work zone is minimized to the maximum extent practicable to meet both environmental and plant operational objectives. In response, a comprehensive suite of construction BMPs have been developed and would be implemented to efficiently and effectively accomplish this objective. Entergy is committed to implementing these or equivalent BMPs.

ENERCON performed screening level analysis of alternative dredging techniques using the USACE's *DREDGABL Model™* (ENERCON 2011). Results indicate that the recent mud deposits and glaciolacustrine clay within the S&SZ can be removed using either mechanical or hydraulic dredging techniques (ENERCON 2012a). Further, due to the cohesive characteristics of sediments classified as organic clay (i.e., Universal Soil Classification System ["USCS"] designation OH) or fat clay (USCS designation CH), turbidity generated during dredging activities would be considered low relative to sediments classified as silt (USCS designation OL).

The largest source of sediment loading to the freshwater reach of the Hudson estuary is from the upper Hudson River drainage basin, which encompasses approximately 8,090 square miles ("mile^2") above the Federal Dam at Troy (Wall et al. 2008). In 2002, the USGS, in cooperation with NYSDEC began a study to:

- Provide a continuous record of water discharge, suspended sediment concentration, and suspended sediment discharge at the freshwater limit of the estuary.
- Provide insight into the timing and mechanisms responsible for the transport and storage of suspended sediment in and through the freshwater reach of the estuary (Wall et al. 2008).

The USGS study site was located near Poughkeepsie, downstream from the majority of tributaries entering the estuary, with a drainage area of approximately 11,740 mile^2 (Wall et al. 2008). Similar to sediments near IPEC, sediment at the study site consisted primarily of fine grained materials (approximately 96 percent < 62 micrometer ["μm"]). Suspended sediment concentrations ranged from lows of <10 mg/l to highs around 100 mg/l. Daily resuspension due to tides was approximately 20 mg/l in summer and 40 mg/l in winter (Wall et al. 2008). Suspended sediment discharge at the USGS study site over the four years totaled 3.25 million tons, and the mean annual sediment discharge was 0.81 million tons (Wall et al. 2008).

As presented in Table 2.6-2, dredging required for the installation of the CWWS array, including the ABS piping system, has been estimated to total approximately 100,000 yd^3 over an area of approximately 5.2 acres (+/-) (ENERCON 2012b). The construction means and methods proposed to minimize the potential for sediment resuspension during construction are presented in Section 2.5. Z-type sheet piling would be used to minimize required dredge volumes, assist in placing tremie concrete for pile caps and, in certain areas, construction of cofferdams to reduce the potential for off-site sediment transport (ENERCON 2012a).

Based on application of the USACE's *DREDGABL Model™*, an estimated 0 to 5 percent of the dredge volume could be expected to be resuspended in the water column during dredging operations (ENERCON 2011). However, since nearly 50 percent of the total dredge volume would be from areas enclosed by tall sheet pile cofferdams, TRC has conservatively assumed that up to 3 percent of the dredge volume may be resuspended. As shown in Figure 2.5-2, major in-water construction activities would occur for approximately 27 months over three consecutive construction seasons. Dredging would be required during each season as construction proceeds through the five work zones shown in Figure 2.5-1 (ENERCON 2012a).

Assuming, on average, that 3 percent of the dredge volume would be resuspended, an estimated 3,000 yd^3 of sediment would enter the water column over all the three construction seasons, or roughly 1,000 yd^3 per year. Assuming an in-place sediment density of 125 lbs per cubic foot ("lbs/ft^3"), 1,000 yd^3 of sediment would be equivalent to approximately 1,700 tons. Therefore, the estimated sediment resuspension load to the River associated with dredging would only represent approximately 0.21 percent of the average annual sediment load of the Hudson River, estimated at Poughkeepsie over the period 2002 through 2006 by Wall et al. As such, the temporary water quality impact associated with dredging would be SMALL.

Other construction activities that could resuspend sediments include: pile driving, placement of engineered backfill, placement of rip-rap or placement of marine mattresses. Vessel mooring via anchors, spudding or jack-up also have the potential to resuspend sediments as the anchor or spud/jack-up legs are placed and retrieved. It is anticipated that vessel mooring disturbances would occur primarily within the S&SZ, proximate to the proposed work zones. Potential sediment resuspension associated with the above activities is expected to be less than that associated with dredging operations. As such, these activities would only result in a SMALL incremental increase in resuspension related to dredging operations.

Although some resuspension of sediments into the water column is unavoidable during construction, with implementation of appropriate BMPs the suspended sediment concentrations in the River would be reduced to within the annual range observed under natural background conditions within a reasonably sized mixing zone. Boundaries of the mixing zone would be determined during consultation with regulatory agencies as part of the permitting process.

Downstream of Poughkeepsie, Wall et al. (2008) found that suspended sediment concentrations ranged during the year from 20 to 100 mg/l, and that variability was induced by storm events, seasonal flow changes, and also on a shorter cycle based on tidal stage. Given the relatively small volume of dredged material relative to background sediment transport rates in the lower Hudson River coupled with the available mixing and dilution volume associated with tidal exchange, potential sediment resuspension volumes are considered small and potential impacts would be temporary. Therefore, potential impacts on water quality associated with sediment resuspension from construction activities are expected to be SMALL.

Additional test borings and vibratory core samples would be collected during final design to optimize CWWS placement and to complete environmental sampling and analyses programs in conformance with NYSDEC and any other applicable agency permitting requirements. Prior to initiation of environmental sampling, a sampling plan would be submitted to the NYSDEC and any other necessary regulators for review and approval to ensure proper characterization of the proposed dredged material, including sampling requirements for upland disposal.

The environmental sampling program would be directed at confirming the presence or absence of potentially contaminated sediments that could be disturbed during construction. Focus would be on radionuclides, although as discussed in Section 2.6, prior sediment sampling work suggests no likely radionuclides are present above background. In accordance with NYSDEC dredging guidelines (NYSDEC 2004), the sampling program would be used to characterize the vertical and horizontal extent of potentially contaminated sediments. If contaminated sediments are encountered, BMPs specifically directed toward minimizing the volume of resuspended sediment would be reviewed to ensure that potential adverse impacts associated with resuspension of potentially contaminated sediments would be SMALL. Development of dredging BMPs would rely on implementation of references such as "*Technical Guidelines for Environmental Dredging of Contaminated Sediments*" ("USACE Technical Guidance Document") (USACE 2008).

Mechanical and Hydraulic Dredging

A combined approach to dredging (i.e., mechanical and hydraulic dredging), would be used, as appropriate, to minimize disruption of *in-situ* materials, to minimize environmental impacts and maintain control of costs and schedule (ENERCON 2012a).

Mechanical dredging using a closed clamshell bucket considerably reduces the water content of the dredge spoils over that which can be achieved using hydraulic dredging techniques. On the other hand, clamshell bucket dredging tends to produce higher levels of suspended sediments than hydraulic dredging.

Mechanical dredging would be performed using a closed clamshell bucket to reduce the amount of washout in order to minimize the generation of suspended solids in the water column. In accordance with NYSDEC guidance (NYSDEC 2004), the following techniques would also be implemented:

- Bucket retrieval rates would be controlled to minimize turbidity.
- During off-loading of dredged material using a clamshell or backhoe, the bucket would be positioned to minimize swing over open water.
- In the event that an excessive loss of water from the bucket was observed, the bucket would be inspected and repaired.

Hydraulic dredging can reduce the volume of sediment resuspension in the water column during the sediment removal process as water is drawn into the dredge, capturing suspended sediments before they are transported away. Also, sediment resuspension can be reduced when hydraulically dredged spoils are discharged directly to a shoreline dewatering facility or provided with adequate treatment (i.e., sufficient settling time and/or filtration) prior to discharge. When discharging to a hopper barge, adequate treatment would be provided such that water discharged back to the receiving water would not violate water quality standards. Authorization to discharge decant water can be allowed where sediments and corresponding water column concentrations are considered to be clean (i.e., Class A).

Hydraulic dredge techniques would be implemented, as required, to meet the construction schedule (ENERCON 2012a). If hydraulic dredging techniques are implemented, dredge spoils would be discharged to a hopper barge and allowed to settle prior to decanting. If additional settling time is required to meet discharge requirements, water from the dredge hopper would likely be decanted to a second tank or barge to allow for additional clarification prior to discharge. If flocculating agents are required to enhance settling characteristics, any necessary permits or approvals would be obtained. Only additives approved for use by the NYSDEC would be utilized, and all additives would be applied in accordance with manufacturer's recommendations and approved dosing requirements. As such, if hydraulic dredging techniques are implemented, treatment BMPs also would be implemented to ensure that potential impacts would be SMALL.

Barge Overflow

No barge overflow would be allowed during transport of dredged material outside the dredging area. Barge overflow at the dredging site may be authorized by the NYSDEC if requested, provided the sediment is determined to be Class A (i.e., clean sediment) and all regulatory permits and approvals for the discharge of barge overflow or decant water back to the river are obtained (NYSDEC 2004). If the dredged material is characterized as Class B (i.e., exceeding potential impact thresholds), barge overflow may be allowed depending on the contaminant of concern and proposed treatment methods. If the dredged material is characterized as Class C (i.e., exceeding hazard thresholds), discharge of barge overflow water would not be authorized by the NYSDEC (NYSDEC 2004). Therefore, water quality impacts from barge overflow, if approved, would be SMALL.

Dredge Spoil Dewatering

A detailed plan for dredge spoil off-loading and dewatering at the off-site staging area would be developed during final design after the off-site area is identified as appropriate techniques for proper spoil and dewatering effluent management would be site-specific. For example, simple gravity dewatering may be feasible at some sites, while use of frac tanks or settling tanks followed by filtration may be appropriate at others. Regardless of the location selected for the off-site area, an appropriate off-loading and dewatering procedure would be implemented such that the discharge of dewatering effluent would be in accordance with applicable federal, state and local permits and approvals for that location. Therefore, impacts from dredge spoil dewatering would be SMALL.

Comparison with Current and Proposed Dredging Projects

When compared with other proposed construction projects in the lower Hudson River, potential impacts associated with the installation of CWWS array at IPEC are considered SMALL.

For example, under the proposed Tappan Zee Hudson River Crossing Project, approximately 951,000 yd^3 of Hudson River sediment would be dredged over an estimated 139-acre area (NYSDEC 2013). This is nearly ten times the volume estimated for CWWS installation. In addition, that project would include the construction of 42 in-river pile supported piers, as well as installation of 150 lineal feet of sheet pile bulkhead along the shoreline (NYSDEC 2013). Finally, an estimated 107 acres of river bottom would be covered with sand or armor stone at depths up to 2 feet thick (NYSDEC 2013). This represents more than 20 times the area directly affected by construction of the CWWS system at IPEC.

The volume of dredged material associated with CWWS system installation is also SMALL when compared with most routine maintenance dredging activities performed by the USACE along the lower Hudson River. As discussed in Section 3.2.4.4, the USACE performs maintenance dredging in the Port of New York and New Jersey that requires management of between one and two-million yd^3 of sediments annually (NYSDEC 2012). In the navigation channel between Kingston and Albany, maintenance dredging is conducted, on average, every two years with projects typically ranging in size from 50,000 yd^3 to 200,000 yd^3. Viewed in this context, CWWS dredging requirements are comparatively small.

Spill and Pollution Prevention

Construction of the CWWS system would require use of tremie concrete, lubricants, hydraulic fluids, and gasoline/diesel fuels associated with construction equipment and vessels. The construction contractor would be required to store these materials in a manner that minimizes exposure to precipitation and runoff, where appropriate, or otherwise to prevent the release of contaminants to navigable waters. For example, for materials that must be kept dry, methods such as indoor storage, temporary shelters, storage trailers, tarpaulins, and other means would be considered. Component materials that are normally allowed to be exposed to precipitation while being stored would be placed in upland areas away from storm water conveyances in a manner that would not concentrate runoff. Finally, stockpiles of dredge spoils or earthen materials (crushed stone bedding, rip-rap, etc.) would be stored away from storm water conveyance channels and in a manner that would prevent erosion and transport of sediments. Details of the types of BMPs, along with those associated with hazardous waste generation and storage, spill response procedures, and oversight during construction are presented in Chapter 2.0.

In the unlikely event that an accidental release of oils and/or chemicals into the environment occurred during construction, the aforementioned SPCC Plan discussed in Section 2.6.2.3 would specify control, cleanup procedures and identify notification requirements. As a result of the implementation of BMPs in conjunction with the SPCC Plan and the relatively small volume of fluids involved in occurrences such as a hydraulic hose rupture, potential adverse impacts to water quality are considered NONE to SMALL.

4.4.2 Operation

With the CWWSs in place, Unit 2 and Unit 3 would continue to operate as once through cooled generating facilities. As indicated above, operation of the CWWSs would be performed in accordance with issued federal and state permits, including those requiring compliance with New York State water quality standards.

With respect to water quantity, consumptive water use associated with the discharge of heated effluent was estimated by NRC Staff to be less than 60 cfs, which would not adversely impact the quantity of water in the tidal Hudson River (NO IMPACTS) (NRC 2010).

4.4.2.1 Thermal Discharge

As described in Chapter 2.0, no changes are proposed to the condensers, combined discharge canal, diffuser, or operational features of the cooling water system that would affect thermal characteristics of the discharge. In addition, operation of the CWWS system would not result in changes in the thermal discharge characteristics of IPEC.

The current SPDES Permit conditions, including the NYSDEC Staff-proposed redelineation of IPEC's existing mixing zone ensures compliance with state water quality standards and the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife in the Hudson River. As such, potential significant adverse environmental impacts would be NONE to SMALL.

4.4.2.2 Biofouling Control Program

The existing biofouling control system and procedures are summarized in Chapter 2.0.

With the CWWS system in place, there would be no change to the biofouling control system at IPEC. Therefore, through compliance with applicable SPDES Permit conditions, adverse impacts on water quality associated with biofouling control would be NONE to SMALL.

4.4.2.3 Maintenance Dredging

The presence of the CWWSs on the river bottom is not expected to significantly impact local patterns of sediment deposition and resuspension (ASA 2013). The installation and operation of the CWWS array would result in a local decrease in velocity and bottom shear stress, potentially leading to an increase in areas of likely deposition than with no structures present (ASA 2013). Therefore, periodic dredging may be required around the CWWS array, as well as in front of the shoreline intake bypass system, to prevent excess sediment accumulation. It is expected that the majority of maintenance dredging would be performed using hydraulic dredging techniques with the assistance of divers, if required. Given the low volume of material requiring removal, the short duration of the work effort, and the infrequent need for maintenance dredging, the temporary adverse water quality impacts during maintenance dredging activities would be NONE to SMALL.

4.4.3 Conclusions of the SEQRA ER

Dredging and construction of the CWWS array would increase TSS in the Hudson River water column during conduct of the work; however, adverse water quality impacts would be temporary, localized, and characterized as SMALL.

No accidental spills are expected given implementation of BMPs. In the event of an accidental spill, containment and clean-up would occur, and as small volume releases, only temporary and SMALL impacts on water quality localized to the area around the spill are expected.

No contaminated sediment is expected. If contaminated sediments are identified, BMPs would be employed to minimize mobilization of these contaminants, and therefore impacts on water quality would be SMALL. The BMPs that serve to minimize the creation of suspended sediments, would also serve to minimize the mobilization and transport of sediment contaminants.

Continuance of once-through cooling and associated thermal discharge and biofouling control procedures would be no different than existing operations (NO IMPACT).

4.5 AQUATIC ECOLOGY

This Section describes and evaluates the potential aquatic ecology impacts associated with the construction and operation of the CWWSs. Aquatic ecology resources are described in Section 3.3.

4.5.1 Construction

As listed in Table 2.6-2, dredging required for the installation of the CWWS array has been estimated to total approximately 100,000 yd^3 in place over an area of approximately 5.2 acres (+/-) (ENERCON 2012). The construction methods, equipment, locations, and durations are described in Chapter 2.0. In addition, construction practices and BMPs that have been developed to minimize the potential for environmental impacts, including those to aquatic ecosystems are described in Section 2.6.

The following analysis focuses on assessing the impact of relevant construction activities on the suite of aquatic resources that occur at and near the IPEC Site. For ease of presentation, the following text is organized by the major sources of potential impacts to aquatic habitats and species.

4.5.1.1 Underwater Noise/Vibration

Construction of the CWWSs would involve activities and equipment that produce noise in the water. Some of these noises would occur throughout much of the construction work day, such as the use of generators on barges while other sounds would occur more intermittently, such as vessel engines. In general, noise impacts would be minimized through the implementation of BMPs, and the overall design of CWWS installation methods.

Fisheries

Impacts associated with driving of piles would be temporary, localized and SMALL. Fish and larger motile invertebrates, such as shrimp and crabs, are able to avoid the areas affected by construction.

Sheet pile driving and other underwater construction activities may generate underwater sound pressure waves that could adversely affect nearby fish. The degree to which an individual fish exposed to sound waves would be affected is dependent upon variables such as the peak SPL and frequency as well as the species, size, and condition of a fish.

In some cases, SPL greater than 155 dB can elicit avoidance behaviors or stun small fish (Popper and Hastings 2009). Sounds greater than 190 dB have been shown to physically injure some fish. For fish, non-auditory tissue damage is possible starting at 180 and greater dB sound exposure level ("SEL") corresponding to differences in fish mass. Auditory tissue damage is possible starting at 185 dB SEL; and temporary shift in fish movements and actions can occur at 165 dB SEL (Hastings and Popper 2005). The presence of predators can also influence how a fish might be affected by pile driving.

The intensity of the SELs produced during pile driving depends on a variety of factors including, but not limited to, the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the hammer. In a review of studies associated with pile driving, NMFS (2003) reported that fish kills have occurred during use of an impact hammer on hollow steel piles. On the other hand, the rapid repetitions of vibratory hammers produce relatively low intensity sound waves. Evidence also suggests that fish consistently display an avoidance response to sound from a vibratory hammer, even after repeated exposure (Knudsen et al. 1997).

During underwater noise monitoring of pile driving in Washington State, SELs were observed at a mid-depth hydrophone location ranging between 169 and 175 (SELs) at a distance of 33 feet from the pile. Different pile cap materials were tested to see if sound level reductions could be achieved. The best result was obtained with plywood, where a maximum of 26 dB reduction in SEL was observed. An air bubble curtain was also tested which produced a further maximum reduction in the SEL by 17 dB. However, the absolute peak sound levels ranged from 180 to 208 dB. While a specific protocol to monitor or test injuries to fish was not employed as part of this monitoring effort, no injured or dead fish were observed (Laughlin 2006).

Sound exposure level noise level data for sheet piles are not as clearcut nor as widely collected as for hollow steel piles but given the difference in shape, it is likely that sheet piles would generate lower sound levels to those generated by hollow steel piles, as the pressure wave emanating from the pile would be more diffuse over the more linear nature of the sheet pile. The sound waves of the greatest intensity would be limited to the immediate vicinity of the sheet piles.

Marine Mammals

As with fish, underwater noises during construction activities could potentially cause physical damage and/or interrupt marine mammal behavior. Pinnipeds are the only group likely to occur even rarely (as single individuals) in the vicinity of IPEC (Section 3.3). Pinniped hearing has been measured for air and water. In water, hearing ranges from 1 to 180 kilohertz ("kHz") with peak sensitivity around 32 kHz. In air, hearing capabilities are greatly reduced to 1 to 22 kHz. This range is comparable to human hearing (0.02 to 20 kHz). Harbor seals have the potential to be affected by both in-air and in-water noise (USACE 2008). Behavioral responses of marine mammals to sound vary greatly and depend on a number of factors. Some observations suggest that some marine mammals tend over time to become less sensitive to noise and disturbance to which they are repeatedly exposed such as acoustic deterrence devices used in the fishing industry (Weilgart, 2007; MMC 2007).

General construction noise and activity are likely to elicit an avoidance behavior that would keep seals away from the work area, if present. In addition, seals are sighted rarely this far up the Hudson River, and documentation of sitings in the vicinity of IPEC is not available. Therefore, adverse impacts on seals, the only marine mammals with reasonable potential to occur (rarely) in the vicinity of IPEC, are not anticipated. In the event that blasting is required as part of the CWWS installation process, a common mitigation measure is to implement a monitoring program to document that prior to a blast, there are no observed seals in the area. If seals are observed, a delay in blasting can be implemented until seals are no longer observed or determined to be at a safe distance. These details can be incorporated into the permitting process.

4.5.1.2 Dredging

The dredging of approximately 100,000 yd^3 of sediment from the River in front the IPEC Site for the installation of the CWWSs represents a negligible area of river bottom disturbed (approximately 5.2 acres [+/-]) and limited potential for increasing TSS levels at locations beyond the immediate dredging work area. The BMPs associated with dredging intended to minimize the volume and area dredged are described in Chapter 2.0 and water quality impacts are discussed in Section 4.4. The estimated 0.21 percent increase in sediment load during the three year in-water construction timeframe does not represent an increase that would be expected to create significant adverse impacts to the aquatic ecology of the River. As described in Section 4.4.1.2, there is a great natural variability in sediment load during different periods of the year and from year to year.

The dredging footprint (5.2 acres [+/-]) represents 0.12 percent of the river bottom area (4,350 acres, GIS measurement by TRC) in Region 4 (RM 39-46). Within the lower Hudson River estuary, the CWWS dredging footprint represents 0.005 percent of the river bottom with the simplifying assumption that the average width of the River over the 154 miles is one mile.

It is important to put the proposed CWWS dredging into perspective with other authorized dredging activities in the lower Hudson River estuary. More extensive dredging regularly occurs in more marine and estuarine areas of the lower Hudson River, further downstream of IPEC, and involves greater exposure of resident and anadromous fish species. For instance, an overview of the Dredge Material Management Plan for the Port of New York and New Jersey states (USACE 2013a):

> *"New York Harbor encompasses approximately two-dozen separately authorized and maintained Federal navigation channels. These projects, whose authorized depths vary from 8 feet to 50 feet, along with the privately operated berthing areas, generate approximately 1 to 2 million cubic yards of sedimentary material annually from maintenance dredging alone. Further, several of these channels are either under construction or in plans for deepening in the upcoming years to accommodate larger vessels calling at the port. The construction of these deeper channels will also generate substantial amounts of dredged material."*

As described in Section 4.4, the Tappan Zee Bridge Replacement Project has been reviewed and the draft WQC issued in January 2013 by the NYSDEC would authorize 951,000 yd^3 of dredging occurring over 139 acres of river bottom during a four-year period, south of the Haverstraw Bay SCFWH.

In other instances, dredging has occurred upriver, in the freshwater portions of the River where concerns over resident and anadromous fish, coastal wetlands, SAV, and invasive aquatic species would exist. There has been maintenance dredging at Waterford, New York where there was approximately 186,000 yd^3 of dredged sediment removed from the Hudson River at North Germantown with upland placement at the federally-owned Houghtaling Island Dredged Material Placement Site (USACE 2013b).

There have been no reports of significant adverse effects on aquatic organisms from any of these dredging projects.

As presented in Section 3.2, the industrial activities along the Hudson River and within portions of the watershed, have historically resulted in the release of contaminants into the River. Heavy metals, PCBs, and PAHs can be found at varying concentrations within sediments at different locations within the lower Hudson River. If future sampling in the River in front of IPEC identifies the presence of contaminants, appropriate measures would be taken as part of the permitting process to minimize adverse effects on aquatic biota. Many of the BMPs discussed in

Section 2.6.2, related to minimizing the resuspension and transport of sediments, would also serve to minimize the risk to aquatic biota from sediment adsorbed contaminants.

Hudson River National Estuarine Research Reserve System and Significant Coastal Fish and Wildlife Habitats

Hudson River NERRS units are distant from the IPEC Site with the closest being the Iona Island NERRS site, located three miles upstream on the western shore of the Hudson River (Figure 3.3-1). Therefore, there would be NO adverse direct or indirect affects resulting from the dredging activities, including effects of TSS levels generated by the dredging, which would be well dispersed before potentially reaching these units.

With IPEC located in the Hudson Highlands SCFWH (RM 40-60), the dredging would result in SMALL impacts to the benthic and water column habitats of this SCFWH. The 5.2 acres (+/-) of dredging area represents about 0.06 percent of the total (8,340 acres, GIS measurement by TRC) river bottom in this SCFWH alone. Therefore, adverse impacts to the habitats and associated species of this area would be SMALL.

The upper most extent of the Haverstraw Bay SCFWH is located downstream of RM 40, hence more than two miles away from IPEC, and at most may experience some minor increased TSS levels due to the dredging. These levels would likely be within the range of annual variation that occurs due to seasonal runoff and large storm events. The levels of TSS would be sufficiently dispersed so as to not create adverse impacts. There would be no direct effects to this SCFWH unit, and therefore overall there would be NO adverse impacts to the Haverstraw Bay SCFWH.

The Iona Island Marsh SCFWH unit located upstream at RM 45, along the western shoreline of the Hudson River, is within a similar distance upstream as the NERRS Iona Island unit, and therefore, the assessment and conclusions are the same (NO adverse impact).

Wetlands and Submerged Aquatic Vegetation

There are no coastal wetlands or SAV beds at or adjacent to the IPEC Site, so there would be no physical disturbance of these habitats. Effects of elevated TSS on water quality from dredging would be localized and the coastal wetlands across the River or upstream or downstream would not be expected to be affected as dilution and dispersion would likely reduce TSS to levels reflecting natural seasonal variations. Figure 3.3-3 shows that the nearest mapped SAV beds are more than two miles upstream from IPEC on the west shore in the vicinity of Iona Island. Given the distance to these SAV beds, elevated TSS levels would have NO adverse effect on the SAV because of dilution and dispersion.

Benthos

Large rivers tend to be naturally dynamic environments because of seasonal changes in water quality and quantity and changes in river flow and water quality characteristics in response to episodic storm events. In estuarine tidal sections of such rivers, the variations in salinity, tidal flow velocity and direction, and water surface elevation changes create an even greater level of variability. In such systems, benthic organisms are adapted to survive such variability, either through behavioral, physiological, structural, or reproductive mechanisms. Therefore, the soft bottom benthic organisms that are common in the vicinity of IPEC would experience SMALL adverse impacts resulting from the indirect effects of sediment resuspension and deposition occurring on a short-term basis as a result of dredging. These species would be expected to recover quickly, as they have reproductive mechanisms allowing for rapid colonization. Focusing on dredging, Coastline Surveys Limited (1998) and Newell et al. (1998) suggested that in general, recovery times of six to eight months are characteristic for many estuarine muds, two to three years for sand and gravel, and five to ten years with coarser substrates. Thus, benthic invertebrate populations occurring at the site of the construction work could be reasonably expected to recover in a timeframe of one to two years (Rhoads et al. 1978; Rhoads and Germano 1986; Newell et al. 1998; Whitlatch et al. 1998; Byrnes et al. 2004).

Given the small amount of anticipated dredging relative to the hundreds of acres of soft bottom habitat at comparable depths within several miles upstream and downstream of IPEC, any modified substrate characteristics are unlikely to have greater than a SMALL effect on benthic species populations, and even that effect would be isolated to the area at IPEC. Contaminants, if present, may be redistributed locally, but installation of the CWWSs would add no contaminants. Also, such sediments would be removed from the River for disposal, resulting in a net reduction in contamination. A minor redistribution of contaminants could increase local exposure to previously buried contaminants for a short time, but would not alter the overall magnitude of exposure of benthic organisms in the River-at-large to contaminants that are already present. Dredging would be performed in compliance with permits to be obtained and therefore adverse impacts would be SMALL.

Representative Important Species

The construction of the CWWSs would cause a temporary, localized disturbance to benthic habitats, which could disrupt the activities of demersal fish species that remain within the construction footprint. Indirect effects could also occur, such as localized increased suspended sediments effecting respiration across gill membranes, or behavioral avoidance that forces fish into more distant habitat. Dredging could potentially cause mortality of benthic infaunal and epifaunal organisms (e.g., polychaete and oligachaete worms, crabs, mysids, and sand shrimp) within the 5.2 acre (+/-) dredging footprint, thus reducing the availability of food sources for the fish species until the benthic species can repopulate the area. However, within the Hudson River, the area disturbed represents a negligible fraction of the bottom; therefore, this temporary and localized loss of benthic prey would have only a SMALL adverse effect on the food intake of benthic feeding fish. In addition, recruitment and recolonization of the benthic infaunal communities are expected to occur following construction since soft bottom benthic species have adapted to naturally occurring bottom disturbances through reproductive mechanisms involving planktonic larval recruitment. One review of benthic community disturbances and biological resource recovery, led the authors to conclude that "communities living in fine mobile deposits, such as occur in estuaries, are characterized by large populations of species that are well adapted to rapid recolonization." These authors go on to state that based on literature reported rates of recovery, six to eight months is characteristic of many estuarine muds (Newell et al. 1998).

Given the small dredge footprint, bottom feeding finfish are likely to relocate temporarily to adjacent areas unaffected by construction. Any pelagic piscivorous (fish feeding) species might leave the immediate construction area because of the noise and localized increase in suspended sediments it produces, but would resume feeding in the area when dredging ceases. Entergy would work closely with federal and state agencies to establish a construction window to minimize potential direct and indirect impacts to fish species that would also minimize the duration of overall construction timeframes. Since the magnitude of impacts is not only related to the size of the area impacted, but also the duration of impacts, it is important to complete the construction in a relatively rapid manner, which would be done.

In addition to the benthic disturbance, dredging would result in a temporary and localized increase in suspended sediments, which could potentially lead to gill abrasion and cause impaired respiration of fish species in or adjacent to the dredging location. Turbidity may also hinder the predation efficiency of sight feeding fish in or adjacent to the CWWS installation area. However, the suspended sediments from construction activities are expected to settle quickly out of the water column or be dispersed by the flow of the River and tidal currents at the IPEC Site, resulting in SMALL adverse impacts on RIS species in or adjacent to the CWWS installation area.

Sturgeon

Sturgeon are not present in the vicinity of IPEC as resident species, and typically traverse/migrate in the deep channel. Even if construction of the CWWSs causes a loss of benthic prey within the small (5.2 acre [+/-]) footprint of the dredging area, sturgeon could feed in the available surrounding, unaffected areas. As such, any altered prey abundance or modified substrate characteristics would likely have no more than a SMALL adverse impact on sturgeon. In addition, the proposed location of the CWWS is not typically traversed by sturgeon, as they prefer the deep channel portions of this area.

It is to be noted that more extensive dredging activities in other settings, including primarily the Delaware River, have been documented by the Atlantic and shortnose sturgeon Recovery Teams as potential threats to these species caused by entrapment during hydraulic dredging. However, the instances of entrapment by clamshell dredges are infrequent compared to those occurring by hopper dredging. As described in Chapter 2.0, hydraulic dredging is being considered for installation of the CWWSs; however, this is not likely to include hopper dredges because the dredge areas are confined by sheet piling, which could interfere with the operation of a hopper type of hydraulic dredge.

Given the small area of the river bottom to be dredged, the use of tall sheet piling to isolate some dredge areas, the relatively low numbers of sturgeon likely to be in the dredging area, and the general construction noise and activity eliciting avoidance behavior, it is unlikely that either sturgeon species would be injured by the dredging equipment. Potential adverse impacts from indirect effects related to dredging, such as increased localized suspended sediments or loss of benthic prey, would be SMALL.

Marine Mammals

Dredging activities associated with CWWS installation could cause temporary and localized periods of increased turbidity. However, the increase in turbidity is expected to be limited and would not affect the ability of the rarely present seals to navigate the area. Turbidity also has the potential to hinder the predation efficiency of feeding seals in or immediately adjacent to the work area. In general, the suspended sediments from construction activities are expected to settle quickly out of the water column or be dispersed and diluted by the flow of the River and tidal currents. Since seals are infrequent visitors this far up the Hudson River and would seldom occur in the CWWS installation area, and turbidity would be of short duration, NO adverse impacts to seals resulting from turbidity would occur. Most seals can be expected to avoid the construction area during dredging.

4.5.1.3 Vessel Mooring

Benthos

In the locale where temporary disturbance of the river bottom would occur due to vessel mooring anchors or spud barge leg placement, benthic organisms could suffer mortality; however, the impacts are expected to be SMALL since the area disturbed would be limited, abundant area of similar habitat type occurs in the surrounding vicinity, and the soft bottom community typical to the area is adapted to episodic natural sediment movement related to high flow events that creates temporary impacts. It is assumed that within the river bottom encompassed by the IPEC S&SZ, there would be scattered disturbances of the sediment by the repeated placement and retrieval of anchors, spud legs, or jackup barge legs associated with vessel mooring during construction. These disturbances are less impacting than dredging since the sediment would be pushed aside or turned over, such that some benthos would survive and the parent material would remain in place after construction. Currents would slowly smooth the area out, filling in shallow depressions and knocking down small hummocks. This temporarily disturbed area represents about 0.9 percent of the river bottom in Region 4, and 0.04 percent of the river bottom in the lower Hudson River estuary (TRC estimates of percent area affected).

In estuarine environments, soft bottom benthos reproductive mechanisms allow for recolonization of disturbed areas, so over time, the benthic community would recover. Information reported in the scientific literature indicates that certain benthic invertebrate species opportunistically invade substrate areas that are unoccupied after disturbances have occurred (Hynes 1970; Rhoads et al. 1978; Rosenberg and Resh 1993). In conclusion, adverse impacts on benthos from vessel mooring disturbances of the river bottom would be SMALL.

Aquatic Vegetation

There is no SAV in the construction vessel mooring area of the River; therefore, there would be NO adverse impacts to this resource.

4.5.2 Operation

4.5.2.1 Entrainment and Impingement

With implementation of the CWWS system, Entergy would eliminate impingement losses, and minimize entrainment losses (Barnthouse et al. 2010).

ESA Species

The January 30, 2013, the Biological Opinion ("BO") issued by the NMFS concludes that the continued operation of IPEC Unit 2 and Unit 3 will not jeopardize the continued existence of endangered shortnose sturgeon or the Gulf of Maine, New York Bight or Chesapeake Bay DPS of Atlantic sturgeon. The NMFS also states that no critical habitat is designated in the action area (the area around IPEC where construction would occur); therefore, none would be affected by the Project (NMFS 2013).

Given that the implementation of the CWWS system would eliminate impingement of juvenile or adults of either sturgeon species, it is reasonable to anticipate that no actual take would occur with CWWSs installed. Therefore, IPEC operations with CWWSs in place would have NO adverse effects on the two protected sturgeon species from I&E since the CWWS system would eliminate impingement of these life stages of fish and entrainable life stages of either sturgeon species do not occur at IPEC.

Essential Fish Habitat

As indicated in Section 3.3, EFH at and near IPEC is considered only applicable for potential construction and operations impingement losses of juvenile and older life stages of bluefish. Since CWWSs essentially eliminate impingement losses of juvenile and older life stages of all fish species, the CWWS operations would have NO adverse impacts on this EFH species. Other sources of potential impacts to the EFH for this species from operation of IPEC with the CWWSs installed, such as thermal discharge and biocide discharge, would be NONE to SMALL.

4.5.2.2 Thermal Discharge Impacts

As described in Chapter 2.0, no changes are proposed to the condensers, combined discharge canal, diffuser, or operational features of the cooling water system that would affect thermal characteristics of the discharge. In addition, operation of the CWWS system would not result in changes in the thermal discharge characteristics of either IPEC Unit.

The current SPDES Permit conditions, as well as the NYSDEC Staff-proposed draft SPDES Permit conditions, are intended to ensure compliance with state water quality standards and therefore; the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife in the Hudson River. If the CWWS system at IPEC is approved, compliance with the above SPDES Permit conditions would continue to ensure that aquatic ecology impacts associated with the discharge would be SMALL.

4.5.2.3 Maintenance Dredging

Periodic dredging may be required around the CWWS array, as well as in front of the shoreline intake bypass system, to prevent excess sediment accumulation. The frequency of maintenance dredging is expected to be similar to the current frequency for maintenance dredging in front of the Unit 2 and Unit 3 intake structures. Moreover, the volume of dredged material is likely to be less than the volume involved with the installation of the CWWSs. Since the dredging associated with the CWWS installation would likely have only SMALL impacts on benthos, fish or aquatic habitats, maintenance dredging would have no more than SMALL adverse impacts, and those would be less than installation dredging impacts.

4.5.2.4 Benthic Habitat Conversion

The change of a limited area of river bottom (5.2 acres [+/-]) that is currently predominantly silty/clay sediments to rip-rap, marine mattresses, at or above grade structures associated with the CWWSs would be negligible in terms of the area of similar river bottom habitat within the this River segment as defined in the HRBMP (RM 39 - 46) or within the Hudson Highlands SCFWH. In reality, as indicated in the Sedimentation Report (ASA 2013), the area in front of IPEC is depositional, and that historic rates of deposition range from 0.3 to 0.9 inches per year. If the same rate of deposition is assumed for this area after CWWS installation, the area over CWWS components that are near or at grade could become restored benthic habitat. For example, the interstices and surfaces of rip-rap and marine mattresses over time would become capable of supporting benthic species common to the region as the sediment accumulates and allows for burrowing and colonization through reproductive and dispersal mechanisms. The areas that are likely to require maintenance dredging and hence unlikely to reestablish robust benthic communities include the plenum boxes, transition boxes, and ducts, which represent about 0.9 acres. The remaining 4.3 acres of the 5.2 acres would revert to functioning benthic habitat. The potential loss of a small amount of soft bottom foraging habitat would have NO adverse effect on benthic feeding fish as there is ample similar habitat area in this segment of the River. The installation of the CWWSs would potentially create a small amount of raised-profile habitat for juvenile and adult fish that prefer structure in the River, and the areas around the screens could increase this type of habitat in this segment of the River.

In comparison, the draft WQC issued by NYSDEC in January 2013 for the Tappan Zee Bridge Replacement Project, would authorize placement of sand and stone over 107 acres of Hudson River bottom.

Placement of marine mattresses or rip-rap would likely have NO adverse impact on sturgeon given the very small area of the overall available habitat that would be affected.

Emergency Use of Existing CWIS

In the event that there is a failure of all or a portion of the CWWS system, such that the use of the existing CWIS is triggered, there would be a return to I&E levels comparable to the existing conditions. Under the assumption that any necessary repairs could be completed in a timely manner, the temporary use of the existing intake under an emergency scenario would result in a range of NONE to SMALL impacts on the aquatic resources of the Hudson River. In addition, as previously stated, sturgeon are typically found in deep channel portions of the River, and are not likely to traverse areas of the CWWS array.

Biofouling Control

With implementation of the CWWS system, Entergy would continue to execute its existing NYSDEC-approved biofouling control program in the same way. Therefore, the CWWS system would not cause a change in effect on the aquatic resources of the lower Hudson River estuary (NO IMPACT).

4.5.3 Aquatic Ecology Impact Conclusions

Potential impacts to the aquatic habitats and aquatic species of the lower Hudson River estuary, from construction and operation of the CWWSs, compared to the current facilities and operations, could all be characterized as ranging from NONE to SMALL. Construction impacts would be temporary, localized and therefore, only affect a very small percentage of the available habitat and a limited number of individuals.

Operational aspects of the CWWSs would be localized, or beneficial, such as elimination of juvenile and adult fish impingement losses and a relatively large reduction in entrainment losses or comparable to current conditions. There are NO impacts to aquatic resources identified as MODERATE or LARGE, according to the SEQRA impact framework in Section 4.2. Therefore, the adverse impacts on aquatic habitats or resources from construction or operation of the CWWSs would be NONE or SMALL.

4.6 TERRESTRIAL ECOLOGY

This Section describes and evaluates the potential terrestrial ecology impacts associated with the construction and operation of CWWSs. Terrestrial resources are described in Section 3.4.

4.6.1 Construction

Limited land-based construction work may be required for installation of ABS system components of the CWWSs at IPEC. Primary land-based construction work would involve the installation of the air compressor/accumulator system (including the associated piping) for the ABS. The components of the ABS would be located in the newly constructed ABS Building, which would be sited over the water and built on piers immediately seaward of the existing Unit 1 Wharf structure (Section 2.4.2). No other new aboveground buildings would be constructed on land at the IPEC Site. New conduit and piping would be routed aboveground from the ABS Building to the Unit 1 Building. From the Unit 1 Building, the existing tunnel(s) would be used to route instrumentation through the facility and into the main control rooms.

Otherwise, as described in Section 2.5, the vast majority of the work would be done in the water with comparably minimal land-based equipment located on the developed portions of the IPEC Site waterfront to facilitate construction. Any land-based construction support such as equipment access and storage, material laydown and staging, and other temporary work would be done in the developed portion of the IPEC Site (i.e., CIT land uses described in Section 3.4.1). These are currently paved (asphalt or concrete) and/or previously disturbed areas devoted to existing facility operations.

There would be no loss of vegetation from construction, nor would there be any changes to terrestrial land use or cover. No construction work would be performed and no direct impacts would occur to any on-site ecological communities or species (including potential federally and state-protected species and wildlife).

While no potential direct terrestrial ecological impacts are anticipated as a result of construction and construction-support activities, the schedule for in-river construction (generally March through November for each of three consecutive years) would coincide with the breeding season for avifauna (i.e., generally March through July) (NYSDEC 2013). Breeding bird species would likely avoid the surrounding Project area during construction because of the increased activity and noise (Section 4.10); however, this impact would be considered small, given its temporary nature and the availability of considerable alternative breeding habitat in and around the Hudson River and Hudson Highlands. For waterbirds, the construction and surrounding Project area would become temporarily inaccessible or undesirable for breeding, feeding or other activities. However, habitat for these species would not be limited to the construction and surrounding areas. Species could utilize other available habitat during construction and return after the work is completed (or near completion). Impacts to the area's aquatic and riparian breeding bird populations would therefore be temporary and characterized as SMALL (SMALL IMPACT).

Peak temporary construction noise levels in the nearest portion of the forested lands of the IPEC Site north of the construction zones would be up to 70 dBA. Temporary peak sound levels across most of the forested terrain would be about 45 to 60 dBA (Appendix A). It is anticipated that some disturbance to terrestrial species present in the forested lands would occur; however, the impact would be expected to be SMALL, given the estimated peak sound levels, their temporary nature and limited duration (SMALL IMPACT).

4.6.2 Operation

Operations of the CWWS system would have NO IMPACT on terrestrial ecology. As noted above, the majority of the noise-generating sources for the ABS equipment would be located in the ABS Building. The ABS Building would house the ABS equipment and therefore, effectively attenuate noise from the air system equipment (air compressors, air accumulators and valve system) (Section 4.10.2). Also as detailed therein, the calculated CWWS operational noise levels are projected to be low in absolute terms and relative to existing ambient conditions, generally below 45 dBA in the forested area nearest to the ABS Building, but much lower at further distances. Operation of the CWWS is generally not anticipated to increase noise over existing conditions, and no resultant impacts on terrestrial species are therefore anticipated (NO IMPACT).

4.6.3 Terrestrial Ecology Impact Conclusions

Construction of the CWWS system may cause temporary, adverse effects on terrestrial ecological resources that can be characterized as SMALL (SMALL IMPACT). Portions of the IPEC Site and the in-river construction area would become temporarily undesirable due to construction activities and therefore, species may avoid the area during that time, returning once construction is complete. CWWS operations would have NO potential adverse impacts on terrestrial ecology (NO IMPACT).

4.7 ELECTRICITY SYSTEM

This Section describes and evaluates the electricity system impacts associated with the construction and operation of the CWWS system. The existing electricity systems of IPEC and New York State are described in Section 3.5.

4.7.1 Construction

Construction of the CWWS system would cause NO electricity system impacts because tie-in of the CWWS to the existing intake system is expected to be accomplished during a regularly scheduled outage for IPEC (NO IMPACT) (ENERCON 2013). Thus, the construction of CWWS would not affect the New York State electricity system, including with respect to generation, capacity or voltage considerations related to electricity-system reliability.

4.7.2 Operation

The operation of the CWWS system would affect the efficiency of electricity generation at IPEC. ENERCON (2013) estimates that replacing the continuous operation of Ristroph screens with twice-daily operation of CWWS would lead to gains in operational efficiency at the plant. These gains in efficiency would increase IPEC's annual generation by 600 MWh.

Operation of the CWWS system would cause parasitic power losses from operation of certain ABS-related equipment (e.g., air compressor motors, ventilation fans, lighting, instrument transformer and welding receptacles), if it were installed. ENERCON estimates that the annual parasitic losses from operation of the CWWSs would be approximately 3,300 MWh for IPEC as a whole, assuming fully continuous operation of the ABS (ENERCON 2013). This represents about 0.02 percent of total 2011 generation at IPEC (NYISO 2012).

The parasitic losses would be offset by the reduction in parasitic losses achieved by taking the existing optimized Ristroph-type TWSs out of continuous operation (but not removing them). ENERCON estimates that not operating the TWSs continuously would eliminate about 90 percent of the existing screens' parasitic losses - equivalent to 8,460 MWh annually for IPEC as a whole. The combined reduction in parasitic losses from not operating the existing TWSs would represent approximately 0.05 percent of 2011 generation at IPEC. Thus, operation of the CWWSs would result in a net reduction in parasitic losses of 5,160 megawatt hours per year ("MWh/yr") for IPEC as a whole. This net reduction in parasitic losses would represent approximately 0.03 percent of 2011 generation at IPEC.

As a result of these impacts on efficiency and parasitic losses, operation of the CWWSs at IPEC would result in SMALL but identifiable benefits to the electricity system (SMALL BENEFICIAL IMPACT). NERA estimates the social benefits of the increased generation and capacity at IPEC using projections of regional wholesale electricity prices. The total present value of these benefits (as of January 1, 2013, in 2012 dollars) would be $5.2 million based upon a 3 percent discount rate and $3.3 million based upon a 7 percent discount rate.

4.7.3 Electricity System Impact Conclusions

There would be NO IMPACT to the electricity system from construction of the CWWS system. Operation of the CWWSs would result in a SMALL BENEFICIAL IMPACT on the electricity system, which would be in addition to the substantial continuing benefit of IPEC operation to the electricity system.

4.8 AESTHETICS

This Section describes and evaluates the aesthetic impacts associated with the construction and operation of the CWWS system at IPEC. Existing aesthetic resources are described in Section 3.6. As with the other impact sections, an assessment of the potential impacts that result from both CWWS construction and operation are discussed herein.

4.8.1 Construction

The majority of the work associated with the construction of the CWWSs at IPEC would be performed from the Hudson River using a variety of tugs, barges and construction equipment installed thereon (Section 2.5). All project-related marine and navigation construction work would be done within the designated IPEC S&SZ from which the public and pubic navigation is restricted.

During construction of the CWWSs at IPEC, the temporary marine construction would be a noticeable presence on the river over three consecutive construction seasons (Figure 2.5-2). The construction work would be a more intense level of activity than, but consistent with, the existing facility operations at the IPEC Site waterfront. The physical backdrop to the CWWS construction work would be the IPEC complex of industrial buildings and where vessels and construction equipment currently operate on a routine basis. This presence notwithstanding, any aesthetic impacts would be temporary and SMALL.

Nighttime lighting on some of the river-based equipment would be needed to conduct aspects of the construction work at times (e.g., foundation installation). Therefore, the work area on the river would, in the nighttime, be illuminated. The increased lighting would be temporary and would end at the conclusion of construction. Portions of the IPEC Site are already well lit for existing operational and security reasons. Consequently, these temporary lighting impacts from CWWS construction would be considered SMALL.

Once the work was completed and the CWWSs were installed below the water's surface, all of the construction equipment would be removed, and the aesthetic setting of the Hudson River and the IPEC waterfront area would be return to its prior condition, with the exception of the ABS Building, addressed in the following Section.

4.8.2 ABS Building

The vast majority of the physical components comprising the CWWS system at IPEC would be located beneath the surface of the Hudson River, invisible from the river and from other land-based locations (Chapter 2.0). The CWWS system may require the construction of a new building, the ABS Building, to house air compressors, accumulators (receiver tanks), and other equipment used to dislodge debris from the surface of the submerged screens. The ABS Building would be located immediately seaward of the Unit 1 Wharf on an in-river support structure (Figure 2.4-1).

The new building would be approximately 168 feet long, 39 feet wide and 37 feet tall, subject to change. The finished floor elevation of the ABS Building would be 14 feet above MSL, approximately 1 foot higher than the existing Unit 1 Wharf. The building facade would be precast concrete building panels painted with a textured coating of neutral color to match adjacent waterfront buildings. Sets of ventilation louvers, likely with a factory-applied coating to match the building paint color, would be installed on west and east facing facades. Wall mounted light fixtures would be installed on the east and west facades, and similar fixtures (though likely fewer in number) would be installed on the north and south facades. The entire building would be surrounded by an exterior walkway with a galvanized steel railing.

The equipment housed in the ABS Building would include a set of air accumulators (one for each of the two intakes) and air compressors (two for each accumulator). A new piping network (above and below ground) would also be needed to connect the actuators and compressors to the CWWS array.

There would be no modification of existing IPEC Site topography or any removal of existing site vegetation needed for installation of the CWWSs or the ABS. The photo simulations discussed and presented below address the potential aesthetic impact of the ABS Building.

4.8.3 Photo Simulations

Three representative photo simulations from representative viewpoints ("VP") were prepared to demonstrate how the ABS Building would appear. The locations selected for the photo simulations include:

- VP 54: Hudson River - Off Buchanan
- VP 40: Hudson River - Off Lents Cove
- VP 53: US Route 9W - Jones Point.

Existing condition photographs were taken on April 9 and April 24, 2009 (it is to be noted that the Unit 1 stack has since been lowered considerably from a height of about 390 feet to about 200 feet presently). Photographs were taken using an eight-mega pixel digital camera with a lens setting of approximately 50 mm[5] to simulate normal human eyesight relative to scale. The precise coordinates of each photo location were recorded in the field using a handheld global positioning system ("GPS") unit.

Photo simulations were developed by superimposing a digital rendering of a three-dimensional computer model of the ABS Building into the base photograph taken from each simulated location. The three-dimensional computer model was developed using industry standard software: *Autodesk Civil 3D 2009®* and *3D Studio Max Design 2009®* ("*3D Studio Max*").

4.8.4 Operation

Excluding construction of an ABS Building, essentially all of the operating equipment associated with the CWWSs would be submerged on and near the bottom of the Hudson River within the designated IPEC S&SZ, and would not be visible from any location on land or from the surface of the water.

The ABS Building would be visible from portions of the Hudson River and locations along the opposite shore between Jones Point and Tompkins Cove. From these locations the ABS Building would be viewed as being directly in front of existing IPEC structures, including but not limited to the containment and turbine buildings. Photo simulations are presented as Figures 4.8-1 (a and b), 4.8-2 (a and b) and 4.8-3 (a and b), with each set showing an existing condition photograph and a post-construction setting. The location of the ABS Building in the photo simulations is specifically noted to assist in identifying it along the IPEC Site shoreline. As can be seen in the photo simulations, the new building would be subordinate in scale to, and effectively camouflaged within the mass of the existing, visually prominent buildings at IPEC.

The simulations show that the presence of an ABS Building would not materially change the visual character of the existing IPEC Site or vicinity. In addition, existing site topography and vegetation would not be altered. As such, the CWWS system would result in no substantive change to the visible landscape and would not adversely impact the scenic resources of the study area or nearby Hudson Highlands region. Visual/aesthetic impacts associated with operations of the CWWSs would be SMALL.

With respect to aesthetics and noise, CWWS operational noise would be muted as it would be generated from within the ABS Building. Exterior noise level increases, considered to be SMALL, would be a few dBs (a small impact) in the immediate vicinity of the ABS Building but would not extend outside of the IPEC property or the S&SZ (Section 4.10).

4.8.5 Aesthetics Impact Conclusions

Construction would cause temporary, SMALL impacts to the aesthetic environment. There would be a SMALL impact from operation of the CWWSs (i.e., the potential presence and operation of the new ABS Building) on scenic and aesthetic resources of the region.

---

[5] A Canon EOS Rebel XT digital SLR with a 24-85 mm zoom lens was used for all photography. This digital camera, similar to most digital SLR cameras, has a sensor that is approximately 1.6 times smaller than a comparable full frame 35 mm film camera. Recognizing this differential, the zoom lens used was set to approximately 31mm to achieve a field-of-view comparable to a 50mm lens on a full frame 35 mm camera (31 mm x 1.6 = 50 mm).

4.9 TRANSPORTATION

4.9.1 Roads

The potential traffic impacts associated with construction and operation of the CWWS system at the IPEC Site are discussed below. The local roadways in the vicinity of IPEC generally operate at acceptable LOS (Section 3.7).

4.9.1.1 Construction

As described in Section 2.5.4 and presented in Figure 2.5-2, the construction of the CWWSs would last over three successive construction seasons. The use of barges and other vessels on the River for construction would considerably reduce the potential road traffic compared to if they were not used. Construction work would be limited, in general, to the hours of between 8 a.m. and 7 p.m., as required by the Village of Buchanan code.

Consistent with the analysis methodology defined in Sections 4.1 and 4.2, the peak periods of construction were used to assess the potential for local traffic impacts based on the construction schedule prepared by ENERCON (Section 2.5.4 and Figure 2.5-2). The approximate maximum number of construction personnel was determined by estimating the following: the number of crew members for each construction activity; the number of personnel for general equipment operation (tugs, catamaran crane, etc.); and the number of miscellaneous and support personnel such as field engineers, surveyors, general contractor personnel, additional general laborers, etc. The maximum number of on-site construction personnel was estimated to be approximately 225 to 275 people. This range is an anticipated maximum during the peak month and the actual number of construction personnel could vary considerably from day-to-day. The typical and/or average number of construction workers during the peak period and over the rest of the construction schedule would be less.

As noted above, barges and other vessels would be used for the dual purposes of equipment delivery and CWWS array installation in the River, thus reducing the potential number of vehicle trips into and out of the IPEC Site compared to the use of road-based vehicles only. The number of trucks during construction would also be substantially reduced from what would be required without the barges.

Even if the peak hourly number of trips into and out of the IPEC Site were 275 (the peak work force on the peak day), which would not be expected, there would be no significant adverse traffic impacts on the local road network from construction of the CWWSs. It is to be noted that under existing operations scheduled refueling outages occur at 24-month intervals for each unit, resulting in an outage each year for one of the units. During these refueling outages, employment increases by up to 950 workers for a period of about 30 days (one month). According to Entergy, the associated increased traffic volumes entering and leaving IPEC during refueling outages have not degraded service on local roads and have not required any local road improvements. Comparatively, these numbers of additional workers and resulting trips are substantially greater than the number of workers estimated to be required for construction of the CWWS system. During the short period of time when the outage period would overlap with the CWWS construction period (estimated on the Preliminary Project Schedule to occur during work in Zone 5 [Figure 2.5-2]), the number of additional construction workers for the CWWS would be limited (less than 50), and area roadways are expected to adequately handle this modest increase in traffic volume. Construction traffic impacts would be NONE to SMALL.

4.9.1.2 Operation

Once construction is completed, operation of the CWWS system would be expected to have no impacts on traffic conditions, i.e., CWWS operational traffic would be comparable to existing conditions. The ABS would be operated automatically for the majority of the time; manual operation of the ABS could be performed by existing members of Entergy Operations Staff. The emergency sluice gates would be operated by the control room and would not require additional staffing. Inspection and maintenance of the screen array would require the use of divers who would likely arrive by boat. Inspection and maintenance of the CWWS system, when needed, including the screen array, would require minimal subcontractor assistance, would be infrequent and would not adversely affect local traffic.

It is expected that traffic volumes, flows and patterns associated with IPEC operations would remain much the same with the CWWS system. The CWWSs do not require any substantial changes in staffing levels or facility-related operations that could materially affect traffic volumes or movements. The IPEC Site's existing main entrance and exit along Broadway would operate in the same way as it currently does, providing adequate capacity for vehicular movements into and out of the site. Therefore, there would be NO traffic impacts from the CWWS system operations.

4.9.1.3 Transportation Impact Conclusions

Neither construction nor operation of the CWWSs would result in adverse traffic impacts on the local road network. Construction work would be temporary in nature and not significant in terms of related traffic volumes. Impacts would be NONE to SMALL. IPEC operations with the CWWS system would be comparable to the existing conditions, and there would be NO adverse impact.

4.9.2 Navigation

The dredging necessary for the installation of the screen array would take place in the S&SZ, outside of the navigation shipping channel. In addition, all of the actual construction work, excluding vessel movements (transits) as described below, needed for the CWWSs would be able to be done outside of the navigation shipping channel; moreover, it is expected that the majority of construction work would be located wholly within the IPEC S&SZ where public access and public navigation are prohibited (Figure 2.3-2). Therefore, there would be no projected impacts on navigation from these construction activities.

Throughout the in-river construction work, the work area would be clearly marked with USCG-approved signage to alert boaters of potential navigation hazards. Boat travel along the Hudson River in the vicinity of IPEC would be maintained throughout construction. To minimize any potential adverse effects on marine navigation, coordination with the USCG would be made to establish notice protocols and methods of transit for construction vessels. As necessary, signage would be used to advise boaters of the construction work and work area.

In addition to construction activities occurring in the S&SZ, vessel trips outside the S&SZ would be required for delivery of equipment and materials and for the removal of dredged material. The following sections discuss vessel trips during CWWS construction and operation phases.

4.9.2.1 Construction

Transport of Dredged Material Via Scow

An estimated 120,000 yd^3 of dredged materials would have to be handled once removed from the river bottom within the S&SZ (Section 2.6). Based on a barge with a 2,000 yd^3 capacity to transport the dredged material for transfer / disposal, a total of 60 barge loads would be required (the actual capacity of the barges would depend on the water content of the material and could be higher or lower than 2,000 yd^3). Conservatively, assuming that one tug could move two barges, there would be 30 transits into and 30 transits out of the S&SZ over the three years. On average, that would be about 20 transits (one tug and two barges) per year (it is possible that the first two years would have more dredging work than the final year, which would slightly increase the number of transits in those years).

Delivery of Equipment and Material

This aspect of the construction work would involve three activities: delivery of transition and plenum boxes; deployment of barge-mounted equipment; and, resupply / refueling operations, as described below.

The transition and plenum boxes for the CWWS array (Section 2.4.1) would be delivered to the in-river construction area on barges from the proposed off-site (Chesapeake, Virginia) location. The trip time between Chesapeake, Virginia and IPEC would be four to five days assuming that the tugboats operate 24-hour days and that weather would not cause undue delay (ENERCON 2013a).

It was estimated by ENERCON that eight barges, supported by two tugboats, would be required to deliver the transition and plenum box components for each Unit (ENERCON 2013a) in each of the years of delivery. Under the preliminary construction schedule (Figure 2.5-2), the components for Unit 2 would be delivered near the end of May 2014 and the components for Unit 3 would be delivered near the end of May in 2015 (ENERCON 2013a). This would result in two individual transits in each of the two years (assuming two tugs guide eight connected barges to and from the in-river construction zones).

There would be vessel transits in the navigation channel and outside the S&SZ to deploy the barge-mounted equipment (e.g., crawler crane, pile drivers, etc.) in each construction season. For the purposes of estimating the total number of annual transits, it was assumed conservatively that each piece of barge-mounted equipment would be associated with one inbound trip and one outbound trip for each season during which it would be deployed. Based on the approximate schedule of deployment for barge mounted equipment (ENERCON 2013b), the greatest number of related individual transits would occur in 2014 and 2015, estimated by TRC at about 86 and 72, respectively. Considerably fewer transits would take place in other years.

There are an estimated 8,000 to 16,000 transits of the Hudson River each year (FHWA et al. 2012). The estimated maximum number of annual (construction season) vessel transits needed for CWWS construction would therefore represent approximately a maximum 1 to 2 percent increase over the current number of transits per year (it is recognized that the number of existing transits in this segment of the River is less than the total). In terms of pure numbers, this increase in vessel transits from CWWS construction would represent a SMALL IMPACT on navigation in the lower Hudson River. In addition, from the perspective of location, given that the bulk of the actual work would be performed within the IPEC S&SZ from which navigation is prohibited, the potential navigation impact would also be considered SMALL.

4.9.2.2 Operation

Operation of the CWWSs would likely require some additional vessel movements over the course of a year for inspection and maintenance of the array, all of which would be conducted within the IPEC S&SZ from which public access and navigation is prohibited. Therefore, there would be NO potential impacts to Hudson River navigation. Although navigation is not allowed in the S&SZ, the CWWSs themselves would not impose any restrictions to navigation because of their location on the bottom of the River.

4.9.2.3 Navigation Impact Conclusions

The construction of the CWWSs would result in potential SMALL IMPACTS on lower Hudson River navigation. Operations would have NO IMPACT on navigation in the River.

4.10 NOISE

Potential noise impacts that could result from the construction and operation of the CWWS system at IPEC are described in this Section. Existing noise conditions are described in Section 3.8.

4.10.1 Construction

A matrix was developed by ENERCON that identified the construction equipment (type and quantities) expected to be operated by phase (and month) over the construction schedule (ENERCON 2013). The matrix was reviewed to identify the peak period of equipment use for the purposes of estimated short-term potential noise impacts. The peak period included an estimated total of 37 individual construction equipment sources, including impact pile drivers, which were calculated separately. Sound levels during other periods of construction would be lower than the peak period, as fewer pieces of equipment would be in operation (and if pile driving were to occur, it would be no louder than assessed herein).

Computer modeling was performed by TRC to calculate noise levels that would be generated from CWWS construction. The commercially available CadnaA model was used for the analyses (DataKustik 2006). Existing topographic features of the IPEC Site and surrounding area, and their reflection or barrier effects, were also considered in the modeling. The shielding and reflection effects of larger on-site buildings were included in this analysis.

Maximum sound emission levels for the construction equipment were obtained from reference sources or, if not readily available, were developed based on the source horsepower ratings. Additionally, acoustical load factors for each source were included in the model. The load factor accounts for equipment that would not be operated at full throttle conditions at all times. Load factors for each source were developed by ENERCON (ENERCON 2013).

Details regarding the modeling input and output data, equipment load factors, and source data are provided in Appendix A of this ER.

Results of the sound modeling are depicted as contour maps (out to a distance of approximately 1.5 miles), and for the same discrete receptor locations as identified in Section 3.10 (Figure

4.10-1). The results of the construction sound modeling analysis compared to the existing daytime L_{eq} sound levels at each location are presented in Table 4.10-1. The L_{eq} background sound level is typically used when evaluating construction noise impacts due to the variability of construction sound.

Table 4.10-1
CWWS - Comparison of Calculated Construction Sound Levels to Existing Daytime L_{eq} Sound Levels

Receptor	General Construction	Pile Driving	Total Construction (General plus Pile Driving)	Measured Existing Daytime L_{eq} Sound Level	Combined (Existing plus Total Construction/ Increase
1. St. Patrick's Church	52	50	54	48	55 / 7 dBA
2. 16th Street / Broadway	50	49	53	50	55 / 5 dBA
3. Pheasant's Run	43	41	45	45	48 / 3 dBA
4. Buchanan Town Hall	44	44	47	55	56 / 1 dBA
5. Bleakley Avenue / Broadway	48	47	51	58	59 / 1 dBA
6. Buchanan-Verplanck Elementary School	40	39	43	45[1]	47 / 2 dBA
7. Residence on Broadway	52	49	54	50[2]	55 / 5 dBA
8. China Pier[1]	59	58	62	54	63 / 9 dBA

Notes:
[1]Existing L_{eq} data are from the Pheasants Run monitoring location.
[2]Existing L_{eq} data are from the 16th Street/Broadway location.

The data in Table 4.10-1 show that impact pile driving sound levels would be slightly lower than the sound generated by the balance of construction equipment sources (general construction). Sound levels associated with total construction (which includes impact pile driving) are anticipated to be at or below existing conditions during daytime hours at most residential locations and at the Buchanan-Verplanck Elementary School. The temporary increases in noise levels would range from about 1 dBA to 5 dBA at the residential receptor locations and at the school. Maximum increases of 9 dBA may be temporarily experienced at the St. Patrick's Church and China Pier locations. Generally, an increase of less than 3 dBA is barely perceptible to most listeners, a 5 dBA increase is readily noticeable and a 10 dBA increase normally is perceived as a doubling of sound (FHWA 1995). It is expected that some construction sounds would be heard at times at these potential sensitive receptors.

NYSDEC has published a program guidance document entitled *"Assessing and Mitigating Noise Impacts"* (NYSDEC Policy DEP-001 ["NYSDEC Noise Policy"]). The guidance discusses various aspects of sound and suggested steps for performing sound assessments. It also provides suggestions on evaluating significant increases in sound levels. The NYSDEC states that sound level increases over existing conditions should be less than 6 dBA to avoid significant impacts. The guidance further states that increase(s) of 10 dBA deserve consideration of avoidance and mitigation measures in most cases.

Noise level increases due to total construction activities (general construction plus pile driving as in Table 4.10-1), which would occur during the entire workday, would be below the NYSDEC impact criterion of 6 dBA at all residential locations evaluated and at the Buchanan-Verplanck Elementary School. Noise level increases at the two remaining non-residential locations would be greater than 6 dBA, but would be below the 10 dBA criterion of NYSDEC for considering avoidance or mitigation.

NYSDEC Noise Policy provides methods for mitigating noise, and notes that in particular, reducing the duration of a noise can be an effective mitigation measure. According to NYSDEC Noise Policy, reducing the duration of a noise can include limiting or reducing the hours that the noisier activity occurs, limiting the activity to normal workday hours, and avoiding weekends and holidays. Construction of the CWWS would comply with the Village of Buchanan Zoning Code and Noise Ordinance, which limits construction that is audible off-site to the hours of 8 a.m. to 7 p.m. These measures would be effective in conforming the predicted construction noise impacts to the NYSDEC Noise Policy.

In light of these mitigation measures and the fact that projected increases in noise during construction of the CWWS were determined to be below the NYSDEC criterion at all residential locations, construction of the CWWS would result in temporary, SMALL noise impacts.

Nighttime Concrete Batch Plant Operation

Foundation installation for some components of the CWWSs would require that a concrete batch plant operate in the nighttime hours. Specifically, this work would entail two concrete pours that would occur over an estimated 17-hour period at each of the two Units' construction zones and one additional concrete pour that would occur over an estimated 36-hour period for the foundation of the ABS Platform. Nighttime concrete batch plant operation would include operations of the batch plant conveyer, compressor and diesel generator.

Table 4.10-2 presents the calculated nighttime concrete batch plant sound levels, the measured existing nighttime sound levels, the combined future levels (existing plus calculated batch plant), and the projected increases over existing nighttime conditions. A sound contour map depicting nighttime concrete batch plant sound levels is presented as Figure 4.10-2.

Table 4.10-2
CWWS Construction – Nighttime Concrete Batch Plant Operation Sound Levels and Increases Over Existing Conditions (dBA)

Location	Calculated Concrete Batch Plant	Existing Late Night L_{90}	Combined Future Late Night L_{90}	Increase over Nighttime
1. St. Patrick's Church	23	42	42	0
2. 16th Street / Broadway	22	40	40	0
3. Pheasant's Run	13	36	36	0
4. Buchanan Town Hall	16	38	38	0
5. Bleakley Avenue / Broadway	20	38	38	0
6. Buchanan-Verplanck Elementary School	12	36	36	0
7. Residence on Broadway	22	40	40	0
8. China Pier[1]	31	N/A	N/A	N/A

Notes: N/A: Data not available.
[1]Noise monitoring was not conducted at night at this site as there is no nighttime use of this facility at that time.

The L_{90} sound descriptor, a conservative measure, was used to evaluate predicted nighttime sound levels and potential impacts. The L_{90} is the sound level that is exceeded 90 percent of the time, and represents the sound level that exists in the absence of intrusive sounds such as birds chirping, intermittent vehicular traffic, etc. The data shown in Table 4.10-2 indicate that the calculated sound levels from operation of nighttime batch plant operation would be well below the existing nighttime levels. Because the calculated sound levels are lower than the existing sound levels, it is anticipated that nighttime batch plant operation would likely not be audible at any residential locations. No increases over existing conditions are projected. Accordingly, nighttime batch plant operations would be in compliance with the Village of Buchanan noise ordinance.

The limited nighttime operations of the concrete batch plant would result in NO adverse noise impacts.

4.10.2 Operation

Operation of the CWWS system could require a land-based air compressor/accumulator system for the ABS. A total sound power level of 96 dBA was calculated for the air compressors (based on representative vendor data). Because it is planned to house the air compressors within the ABS Building (ENERCON 2012), a nominal sound transmission loss value of 35 dBA (typical of a modest building) was assumed for the noise modeling. The analysis performed by TRC also accounted for estimated ventilation louver openings dimensions, with no transmission loss assigned to the louvers.

As noise levels associated with airbursts were not directly available, levels were estimated by utilizing the ABS specifications (ENERCON 2012) and the methodology for calculating noise from vents as provided in "*Edison Electric Institute's Electric Power Plant Environmental Noise Guide*" (Miller et al. 1984). The same noise model and methodology for construction noise was utilized for CWWS operational noise. Details for the modeling source data are provided in Appendix A.

Table 4.10-3 presents the calculated CWWS operational sound levels (with an operating ABS), the measured existing sound levels, the combined future levels (existing plus predicted CWWS operations), and the projected increases over existing conditions. A sound contour map depicting CWWS system operational sound levels is presented as Figure 4.10-3.

Table 4.10-3
CWWS - Operational Sound Levels and Increases Over Existing Conditions (dBA)

Location	Calculated CWWS Sound Levels	Existing Daytime L_{90}	Combined Future Daytime L_{90}	Increase over Daytime	Existing Late Night L_{90}	Combined Future Late Night L_{90}	Increase over Nighttime
1. St. Patrick's Church	13	41	41	0	42	42	0
2. 16th Street / Broadway	12	38	38	0	40	40	0
3. Pheasant's Run	4	36	36	0	36	36	0
4. Buchanan Town Hall	8	44	44	0	38	38	0
5. Bleakley Avenue / Broadway	8	45	45	0	38	38	0
6. Buchanan-Verplanck Elementary School	6	36	36	0	36	36	0
7. Residence on Broadway	12	39	39	0	40	40	0
8. China Pier[1]	18	51	51	0	N/A	N/A	N/A

Notes: N/A: Data not available.
[1]Noise monitoring was not conducted at night at this site as there is no nighttime use of this facility at that time.

The L_{90} sound descriptor utilized for the analysis of nighttime concrete batch plant operation was also used in evaluating predicted sound levels and potential impacts associated with operation of the CWWS. The data shown in Table 4.10-3 indicate that sound levels from operation of the CWWS with the ABS would be below 20 dBA at any residential location, and would result in NO predicted increases over existing conditions and, subsequently, would be below the NYSDEC Noise Policy impact criterion. Moreover, CWWS operational noise levels would be below the Village of Buchanan Noise Ordinance limits. NO noise impacts would result from operation of the CWWSs, including the ABS.

4.10.3 Noise Impact Conclusions

Construction of the CWWS system would cause temporary, SMALL noise impacts. Brief nighttime concrete batch plant operations would result in NO noise impacts. CWWS operations (with the ABS) would result in NO noise impacts.

4.11 ENVIRONMENTAL JUSTICE

This Section evaluates whether potential impacts of the CWWS system construction or operation could result in disproportionate and adverse effects on potential EJ Areas, per NYSDEC CP-29. Potential impacts to resources that could potentially affect EJ Areas, which were addressed in preceding Sections of this ER, are summarized herein, as applicable.

Potential EJ Areas within a 50-mile radius of IPEC were identified and mapped (Figure 3.9-2). The nearest potential EJ Area (southern) boundary is located about 0.3 miles to the north of the IPEC Site in the City of Peekskill, Westchester County, New York. The nearest residences in that EJ Area are about one mile away.

4.11.1 Construction

Air Quality

Construction would temporarily increase NO_2 emissions for limited times in and around the IPEC Site and cause temporary construction-related PM emissions, which would be controlled. These impacts, which would vary over time during the construction schedule depending on the level of activity and equipment in use, would be temporary, SMALL and localized in nature and would not adversely or disproportionately affect EJ Areas. There would be no contravention of the applicable NAAQS (Section 4.3).

Water Quantity and Quality

Increased suspended sediment would result from dredging (and other construction activities such as the installation of array foundations and piping) needed for installation of the CWWS system, resulting in a temporary, SMALL adverse impact (Section 4.4). All dredging and related work would be done in accordance with the methods and timing as determined via a USACE Federal Permit. There would be no disproportionate effects on EJ Areas as these short-term impacts would be SMALL and localized near the dredging area in the Hudson River.

Aquatic and Terrestrial Ecology

In-river construction work, including dredging would also cause potential temporary, SMALL adverse impacts on aquatic species (Section 4.5). The limited, land-based construction work would have a temporary, SMALL adverse effect on terrestrial habitat or terrestrial and avian species located on the IPEC Site (Section 4.6). However, none of these construction-related terrestrial and aquatic impacts would result in adverse or disproportionate impacts to EJ Areas.

Electricity System

Construction of the CWWSs would be accomplished during the regular outage schedule for IPEC; hence, there would be NO electricity system impacts and NO potential impacts to EJ Areas.

Aesthetics

Construction of the CWWSs would primarily entail work on the Hudson River to install the screens on the river bottom, including dredging work. Barges, tugs and other vessels, as well as equipment for dredging, installation of the screen array, etc. would be a visible but temporary presence on the River during construction over the three consecutive seasons. The backdrop to the CWWS construction work would be the IPEC industrial complex where vessel operations and construction equipment are routinely present and in use for normal operations. Nighttime lighting would also be used on the river-based equipment, as needed, to conduct the construction work (e.g., CWWS foundation installation) (Section 4.8).

The CWWS project-related vessels and equipment would visible (on and off the River) from some nearby EJ Areas, but primarily from non-EJ Areas. These views would be temporary and intermittent as viewers would be in transit moving past the area on local roadways or on the River (outside of the S&SZ). Nighttime lighting needed for CWWS installation would incrementally increase the lighting presently used on the IPEC Site waterfront for existing operations, safety and security. Therefore, temporary aesthetic impacts from construction would be SMALL and would not adversely or disproportionately affect EJ Areas.

Transportation and Noise

Construction of the CWWS system would require a peak work force of up to 275 workers and there would be potential SMALL, temporary traffic impacts predicted on the local road network (Section 4.9). Navigational impacts from CWWS construction would also be SMALL given the number of vessels to be used, the size of the existing navigation channel in the Hudson River, and the fact that the majority of vessels in operation would be within the S&SZ where public navigation is excluded. Therefore, there would be NO expected traffic and navigation construction-related adverse or disproportionate effects on EJ Areas.

Construction activity, including pile driving, would generate noise. Pile driving would be done for up to 11 hours during daytime hours only and intermittently for up to approximately five months in each of the three consecutive construction seasons. The nearest residences in an EJ Area are located over one mile away from the CWWS construction work area. At that distance, estimated peak construction noise may be audible at times but would be less than the estimated day-time ambient levels. Impacts would be SMALL. Therefore, there would be no disproportionately adverse noise impacts on EJ Areas.

4.11.2 Operation

Air Quality

There would be no change in air emissions and air quality impacts with operation of the CWWSs compared to current operations (Section 4.3.2). Operations would remain in compliance with the existing air permits Entergy holds for the generating Units. No changes to air quality (NO IMPACT) would result, and EJ Areas would not be disproportionately and adversely affected.

Water Quality and Quantity

Water quantity and quality CWWS operational impacts would be the same as the current operations. The once-through cooling system would remain in operation and the current discharge would remain the same. Operations would remain in compliance with the current and effective SPDES Permit. Therefore, there would be NO adverse water quantity/quality impacts resulting from the CWWS operations. Consequently, there would be NO adverse water quality/quantity effects that could disproportionately impact EJ Areas.

Aquatic and Terrestrial Ecology

Operational impacts on aquatic species from the CWWSs would range from being nonexistent (NONE) to SMALL, particularly when considered at the population level. Installation of the CWWSs would essentially eliminate juvenile and adult fish impingement losses, and minimize entrainment losses. Therefore, the operational impacts related to aquatic and terrestrial ecology would not disproportionately or adversely affect EJ Areas.

Post construction, vegetation and land use/land cover at the IPEC Site would remain essentially the same as under existing conditions (Table 3.4-1). The calculated CWWS operational sound levels would result in no predicted increases over existing conditions (NO IMPACT) (Section 4.10). Because operational impacts to terrestrial resources (including avifauna) would not be adverse and would not extend beyond developed portions of the IPEC Site, there would be NO potential disproportionate or adverse impact on EJ Areas.

Electricity System

Operation of CWWSs would cause parasitic power losses, but no operational losses. In fact, CWWS operation would result in a SMALL beneficial impact on the electricity system that would be in addition to the substantial continuing benefit of IPEC operations to the electricity system. Therefore, there would be NO potential adverse or disproportionate impacts to EJ Areas.

Aesthetics

The vast majority of the operating equipment for the CWWSs would be installed and operable under the Hudson River within the designated IPEC S&SZ and would not be visible from any location on land or from the surface of the water. The new ABS Building would be sited on the facility's waterfront in proximity to other site building and structures, resulting in a SMALL aesthetic impact (Section 4.8.4). The other existing visible, aboveground facilities at IPEC would not change in any visibly material manner and site topography would not be altered. Consequently, operation of the CWWSs would have NO potential adverse and disproportionate aesthetic impacts on EJ Areas.

Transportation and Noise

Once operational, the facility would not affect current traffic volumes, flows, and patterns, i.e., they would be expected to remain much the same as under current operations. Navigation would be unchanged compared to current operations, with the exclusion of maintenance of the screens on a routine basis. Therefore, there would be NO potential anticipated adverse or disproportionate transportation-related impacts on EJ Areas from operation of the CWWSs.

Operation of the CWWSs would result in no increase of off-site noise levels over existing conditions, and NO potential adverse or disproportionate noise-related adverse impacts to EJ Areas would occur.

4.11.3 Environmental Justice Impact Conclusions

Neither construction nor operation of the CWWS system at IPEC would result in adverse or disproportionate impacts (NO IMPACT) on potential EJ Areas.

4.12 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

Potential impacts to archaeological and historical resources from the construction and operation of the CWWS system are presented in this Section. A summary of the archaeological and historical investigations previously conducted at the IPEC Site is provided in Section 3.10.

4.12.1 Construction

As described in Section 2.5, limited land-based construction would be necessary to install the CWWSs on the bottom of the Hudson River. The majority of the work would be performed from barges and other vessels on the River. There are no planned excavations on land and general construction activities such as the movement of equipment, storage and laydown would take place on developed areas of the IPEC Site and those areas previously disturbed. Therefore, land-based construction would not impact terrestrial archaeological resources (NO IMPACT). However, should unanticipated ground disturbance be needed in areas of the site not previously studied or not previously disturbed, coordination with NYSHPO would take place in accordance with Entergy's Cultural Resource Protection Plan (EN-EV-121) to develop a field study program to assess the potential for the presence of archaeological resources prior to construction.

As described in Section 3.10.2.2, certain water (and land) areas on and around the IPEC Site are considered archaeologically sensitive by NYSHPO. The presence of potential underwater archaeological resources in the Hudson River where construction work would occur (e.g., dredging, foundation and piping installation, etc.) would be evaluated during the permitting phase of the Project, prior to any construction work being performed. If necessary, an investigation (e.g., a scope of work and research plan for subsurface and/or underwater investigations) would be conducted in coordination with NYSHPO and in accordance with their requirements based on the CWWS design at that time. The applicable procedures of Entergy's Cultural Resource Protection Plan would be followed.

4.12.2 Operation

Operation of the submerged CWWSs and the ABS Building would have no effect (NO IMPACT) on archaeological resources. There are no historic structures on the site and no operational effects would occur to off-site historic resources (NO IMPACT).

4.12.3 Archaeological and Historical Impact Conclusions

As proposed, land-based construction of the CWWSs would have NO potential effects on archaeological or historic resources. If determined necessary by NYSHPO, the presence of potential underwater archaeological resources in the River where construction would take place would be assessed prior to any construction work being performed. Any investigations, including resource evaluations or recovery, would be conducted to mitigate possible adverse effects to such resources, if necessary. NO impacts to resources would result.

5.0 REFERENCES

Executive Summary

Applied Science Associates (ASA). 2013. Analysis of Potential Sedimentation Effects of Proposed Cylindrical Wedgewire Screens for Intake of Cooling Water and Indian Point Energy Center. Prepared by C. Swanson, C. Galagan, D. Mendelsohn, L. Decker, D. Crowley, Y. Kim. ASA Project 2011-292. March 29, 2013.

ASA Analysis and Communications, Inc. and Normandeau Associates, Inc. (ASAAC and Normandeau). 2012. Wedgewire Screen In-river Efficacy Study at Indian Point Energy Center. January 2012.

Barnthouse, L.W., D.G. Heimbuch, M. Mattson and J.R. Young. February 2010. Biological Effectiveness of Alternative Intake Technologies for Indian Point Units 2 and 3. Prepared for Entergy Services. Pp.1-50.

Barnthouse L., D. Heimbuch, and J. Young. 2011. Contextual Analysis of Previously Published Studies of Cylindrical Wedgewire Screen Efficacy. July 2011.

Central Hudson Gas & Electric Corp., Consolidated Edison Company of New York, Inc., New York Power Authority, Southern Energy New York (CHGE et al.). 1999. Draft Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point 2 & 3, and Roseton Steam Electric Generating Stations. December 1999.

Enercon Services, Inc. (ENERCON). 2010. Engineering Feasibility and Costs of Conversion of Indian Point Units 2 and 3 to a Closed-Loop Condenser Cooling Water Configuration. February 12, 2010.

Enercon Services, Inc. (ENERCON). 2012a. Technical Design Report for Indian Point Units 2 and 3 – Implementation of Cylindrical Wedge Wire Screens ENTGIP152-PR-CWW-06. April 2012.

Enercon Services, Inc. (ENERCON). 2012b. Phase I Technical Report - Air Burst System Design Indian Point Units 2 &3. April 2012.

Enercon Services, Inc. (ENERCON). 2012c. Phase I Technical Design Report, Appendix F - Estimate Implementation Schedule.

Fletcher, R. I. 1990. Flow Dynamics and Fish Recovery Experiments: Water Intake Systems, Transactions of the American Fisheries Society. Vol. 119. No. 3. pp. 393-415. May 1990.

NERA Economic Consulting (NERA). 2012. Potential Energy and Environmental Impacts of Denying Indian Point's License Renewal Applications. Report and testimony submitted to the Nuclear Regulatory Commission on behalf of Entergy Corporation. March.

New York State Department of Environmental Conservation (NYSDEC). 1987. New York State Pollutant Discharge Elimination System (SPDES) Permit SPDES Permit Number: NY0004472 Entergy Nuclear Indian Point Units 2 and 3, LLC. September 2, 1987.

New York State Department of Environmental Conservation (NYSDEC). 2003a. Fact Sheet New York State Pollutant Discharge Elimination System Draft Permit Renewal with Modification, Indian Point 2 and Indian Point 3 Electric Generating Station, Buchanan, NY. November 12, 2003.

New York State Department of Environmental Conservation (NYSDEC). 2003b. Final Environmental Impact Statements Concerning the Applications to Renew New York State Pollutant Discharge Elimination System Permits for the Roseton 1 & 2, Bowline 1 & 2, and Indian Point 2 & 3 Steam Electric Generating Stations, Orange, Rockland, and Westchester Counties. June 25, 2003.

New York State Department of Environmental Conservation (NYSDEC). 2008. Interim Decision of the Assistant Commissioner In the Matter of a Renewal and Modification of a State Pollutant Discharge Elimination System Permit pursuant to Environmental Conservation Law Article 17 and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York Parts 704 and 750 *et seq*. by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, Permittee. DEC No. 3-5522-00011/00004, SPDES No. NY-0004472. August 13, 2008.

New York State Department of Environmental Conservation (NYSDEC). 2010. Letter from NYSDEC to Entergy Nuclear Indian Point 2 and 3, LLC on Extension of Temporary Suspension of the Delta L Limit during the Course of the Discharge Canal Repair Work. Received June 29, 2010.

Nuclear Regulatory Commission (NRC). 2010. NUREG – 1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 Regarding Indian Point Generating Unit Nos. 2 and 3 Volumes 1 & 2 Final Report Main Report and Comment Responses. December 2010.

Nuclear Regulatory Commission (NRC). 2012. NUREG – 1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 Regarding Indian Point Generating Unit Nos. 2 and 3 Volume 4 Draft Report for Comment. June 2012.

United States Environmental Protection Agency (USEPA). 2001. Technical Development Document for the Final Regulations Addressing Cooling Water Intake Structures for New Facilities (EPA-821-R-01-036). November 2001.

United States Environmental Protection Agency (USEPA). 2002. Technical Development for the Proposed Section 316(b) Phase II Existing Facilities Rule (EPA 821-R-02-003). April 2002.

United States Environmental Protection Agency (USEPA). 2004. USEPA Phase II—Large existing electric generating plants, Technical Development Document for the Final Section 316(b) Phase II Existing Facilities Rule.

United States Environmental Protection Agency (USEPA). 2011. Technical Development Document for the Proposed Section 316(b) Phase II Existing Facilities Rule, U.S. Environmental Protection Agency, Office of Water (4303T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460, EPA-821-R-11-001 March 28, 2011.

1.0 Introduction and Project History

Atomic Energy Commission (AEC). 1972. License to Operate. December 12, 1975.

Atomic Energy Commission (AEC). 1973. License to Operate. September 28, 1973.

Central Hudson Gas & Electric Corp., Consolidated Edison Company of New York, Inc., New York Power Authority, Southern Energy New York (CHGE et al.). 1999. Draft Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point 2&3, and Roseton Steam Electric Generating Stations. December, 1999.

Consolidate Edison Company of New York Inc. (Con Edison). 1992. Personal Communication between Raymond R. Kimmel Junior and John M. Cianci of NYSDEC. July 16, 1992.

New York State Department of Environmental Conservation (NYSDEC). 1987. New York State Pollutant Discharge Elimination System (SPDES) Permit SPDES Permit Number: NY0004472 Entergy Nuclear Indian Point Units 2 and 3, LLC. September 2, 1987.

New York State Department of Environmental Conservation (NYSDEC). 1997. Fourth Amended Stipulation of Settlement Agreement and Judicial Consent Order, National Resources Defense Council, Inc. et al. vs. New York State Department of Conservation and Consolidated Edison Company of New York, Inc, New York Power Authority, Orange and Rockland Utilities Inc., and Central Hudson Gas and Electric Corp. 1997. Supreme Court of the State of New York County of Albany. Index No. 0191-ST3251.

New York State Department of Environmental Conservation (NYSDEC). 2000. Letter from NYSDEC to Entergy Nuclear, LLC on SPDES Modification to Allow Discharges of Stormwater from a Bulk Chemical Storage Tank Secondary Containment Area.

New York State Department of Environmental Conservation (NYSDEC). 2001. Letter from William E. Steidle, NYSDEC to Dara Gray, Entergy Nuclear Indian Point 3, LLC on SPDES Permit Modification to Authorize Discharge of Wastewater Resulting from Desilting of Intake Structure and Forebay into Existing Stormwater Collection System where it Will Be Discharged through Outfall 001J. Received August 23, 2001.

New York State Department of Environmental Conservation (NYSDEC). 2003a. Final Environmental Impact Statements Concerning the Applications to Renew New York State Pollutant Discharge Elimination System Permits for the Roseton 1 & 2, Bowline 1 & 2, and Indian Point 2 & 3 Steam Electric Generating Stations, Orange, Rockland, and Westchester Counties. June 25, 2003.

New York State Department of Environmental Conservation (NYSDEC). 2003b. New York State Pollutant Discharge Elimination System Draft Permit Renewal with Modification, Indian Point 2 and Indian Point 3 Electric Generating Station, Buchanan, NY. November 12, 2003.

New York State Department of Environmental Conservation (NYSDEC). 2004. Letter from William R. Adriance NYSDEC to Michael R. Kansler, Entergy Nuclear Indian Point 2, LLC On Department Initiated Permit Modification Deleting Part II General Conditions and Amending SPDES Permit to Comply with 6 NYCRR 750-2. Received February 20, 2004.

New York State Department of Environmental Conservation (NYSDEC). 2006. Ruling on Proposed Issues for Adjudication and Petitions for Party Status. February 3, 2006.

New York State Department of Environmental Conservation (NYSDEC). 2008. Interim Decision of the Assistant Commissioner In the Matter of a Renewal and Modification of a State Pollutant Discharge Elimination System Permit pursuant to Environmental Conservation Law Article 17 and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York Parts 704 and 750 *et seq*. by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, Permittee. DEC No. 3-5522-00011/00004, SPDES No. NY-0004472. August 13, 2008.

New York State Department of Environmental Conservation (NYSDEC). 2010. Letter from NYSDEC to Entergy Nuclear Indian Point 2 and 3, LLC on Extension of Temporary Suspension of the Delta L Limit during the Course of the Discharge Canal Repair Work. Received June 29, 2010.

New York State Department of Environmental Conservation (NYSDEC). 2011. Letter to Hon. Maria E. Villa and Hon. Daniel P. O'Connell. RE: Entergy Nuclear Indian Point Units 2 and 3. CWA Section 401 WQC Proceeding NRC - Atomic Safety and Licensing Board's Dec. 3, 2010 FSEIS. January 28, 2011.

Nuclear Regulatory Commission (NRC). 2010. NUREG – 1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 Regarding Indian Point Generating Unit Nos. 2 and 3 Volumes 1 & 2 Final Report Main Report and Comment Responses. December 2010.

Nuclear Regulatory Commission (NRC). 2012. NUREG – 1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 Regarding Indian Point Generating Unit Nos. 2 and 3 Volume 4 Draft Report for Comment. June 2012.

Supreme Court of the State of New York County of Albany. 2002. Matter of Brodsky v. Crotty. Keegan, J. Index No. 7136-02.

2.0 Description of Cylindrical Wedgewire Screen Technology

Central Hudson Gas & Electric Corp., Consolidated Edison Company of New York, Inc., New York Power Authority, Southern Energy New York (CHGE et al.). 1999. Draft Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point 2 & 3, and Roseton Steam Electric Generating Stations. December 1999.

Entergy Nuclear Services Inc. (Entergy). 2011. 2010 Annual Randiological Environmental Operating Report, Indian Point Unit Nos. 1, 2 and 3, Docket Nos 50-03, 50347, 50-286. May 16, 2011.

Enercon Services, Inc. (ENERCON). 2010. Alternative Intake Technologies at Indian Point Units 2 & 3. February 12, 2010.

Enercon Services, Inc. (ENERCON). 2012a. Technical Design Report for Indian Point Units 2 and 3 – Implementation of Cylindrical Wedge Wire Screens ENTGIP152-PR-CWW-06. April 2012.

Enercon Services, Inc. (ENERCON). 2012b. IPEC CWW Dredging Step 2 – Draft White Paper Proposed Methods of Dredging to be Used for the Removal of Anticipated Contaminated Soils. January 2012.

Enercon Services, Inc. (ENERCON). 2013. Personal Communication from ENERCON to TRC. CWWS Construction/Transportation Information. Memo ID: ENTGNU012A. January 21, 2013.

Fletcher, R. I. 1990. Flow Dynamics and Fish Recovery Experiments: Water Intake Systems, Transactions of the American Fisheries Society. Vol. 119. No. 3. pp. 393-415. May 1990.

Gobler, C.J. 2008. Personal communication. E-mail from Christopher Gobler to Philip Muesgaas RE: IP Sampling. July 10, 2008.

National Oceanic and Atmospheric Administration (NOAA). 2010. United States Coast Pilot 2, Atlantic Coast. Cape Cod to Sandy Hook, NJ, 39th edition.

New York State Department of Environmental Conservation (NYSDEC). 1987. SPDES Permit No. NY-0004472, October 1987.

United States Environmental Protection Agency (USEPA). 2011. Technical Development Document for the Proposed Section 316(b) Phase II Existing Facilities Rule, U.S. Environmental Protection Agency, Office of Water (4303T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460, EPA-821-R-11-001 March 28, 2011.

3.1 Air Quality

Entergy Nuclear Operations, Inc. (Entergy). 2007. Applicant's Environmental Report, Operating License Renewal Stage (Appendix E to Indian Point, Units 2 & 3, License Renewal Application). April 23, 2007.

NERA Economic Consulting (NERA). 2012. Potential Energy and Environmental Impacts of Denying Indian Point's License Renewal Applications. Report and testimony submitted to the Nuclear Regulatory Commission on behalf of Entergy Corporation. March 2012.

New York State Department of Environmental Conservation (NYSDEC). 2013. 2012 Monitoring Network Plan, New York State Ambient Air Monitoring Program. http://www.dec.ny.gov/chemical/33276.html. Accessed March 2013.

United States Environmental Protection Agency (USEPA). 2013a. http://www.epa.gov/pmdesignations/2006standards/documents/2009-10-08/timeline.htm Accessed: February, 2013.

United States Environmental Protection Agency (USEPA). 2013b http://www.epa.gov/airdata/ad_data_daily.html Accessed: February, 2013.

3.2 Water Quantity and Quality

Abood, K.A., T.L. Englert, S.G. Metzger, C.V. Beckers, Jr., T.J. Groninger, and S. Mallavaram. 2006. *Current and Evolving Physical and Chemical Conditions in the Hudson River Estuary*. American Fisheries Society Symposium 51.

Applied Science Associates (ASA). 2010a. Preliminary Analysis of Hudson River Thermal Data, ASA report #09-167-1. South Kingstown, RI. Prepared by C. Swanson., Y. Kim, D. Mendelsohn, D. Crowley, and M. Mattson, Prepared for Elise Zoli, Goodwin Proctor, Boston, MA.

Applied Science Associates (ASA). 2010b. Hydrothermal Modeling of the Cooling Water Discharge from the Indian Point Energy Center to the Hudson River, Report Prepared by: C. Swanson, Y. Kim, D. Mendelsohn, and D. Crowley. Prepared for: Elise Zoli, Goodwin Proctor, 55 State Street, Boston, MA 02109, March 22, 2010.

Applied Science Associates (ASA). 2010c. Estimate of Salinity in the Hudson River, South Kingstown, RI. Prepared for Indian Point Energy Center, November 19, 2010.

Applied Science Associates (ASA). 2011. 2010 Field Program and Modeling Analysis of the Cooling Water Discharge from the Indian Point Energy Center. January 31, 2011. Prepared by C. Swanson, D. Mendelsohn, N Cohn, D. Crowley, Y. Kim, L. Decker and L. Miller.

Applied Science Associates (ASA). 2013. Analysis of Potential Sedimentation Effects of Proposed Cylindrical Wedgewire Screens for Intake of Cooling Water and Indian Point Energy Center. Prepared by C. Swanson, C. Galagan, D. Mendelsohn, L. Decker, D. Crowley, Y. Kim. ASA Project 2011-292. March 29, 2013.

Central Hudson Gas & Electric Corp., Consolidated Edison Company of New York, Inc., New York Power Authority, Southern Energy New York (CHGE et al.). 1999. Draft Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point 2 and 3, and Roseton Steam Electric Generating Stations. December 1999.

Federal Highway Administration (FHWA), New York State Department of Transportation (NYSDOT), New York State Thruway Authority (NYSTA). 2012. Tappan Zee Hudson River Crossing Project final Environmental Impact Statement and Section 4(f) Evaluation. July 2012.

Geyer, W.R., Woodruff, J.D., Traykovski, P., Sediment Transport and Trapping in the Hudson River Estuary, Estuaries Vol. 24, No. 5, p. 670–679, October 2001.

GZA GeoEnvironmental of New York (GZA). 2012. Phase I Geotechnical Report Cylindrical Wedgewire Screen Project Entergy Nuclear Indian Point Units 2 and 3 Buchanan, New York. Final Report April 2012, File No. 01.0170641.00.

New York City Department of Environmental Protection (NYCDEP). 2009. 2008 New York Harbor Quality Report.

New York State Department of Environmental Conservation (NYSDEC). 2008. The Lower Hudson River Basin Waterbody Inventory and Priority Waterbodies List. August 208. 1 - 565 pp.

New York State Department of Conservation (NYSDEC). 2009. State of the Hudson 2009. Steve Stanne, Elizabeth Roessler, Kristin Marcell and Bob DeVilleneuve.

New York State Department of Conservation (NYSDEC). 2012. DEC Creates Dredge Team for Port of NY and NJ http://www.dec.ny.gov/press/83720.html accessed on 3/12/2013.

New York State Department of Conservation (NYSDEC). 2013. The Final New York State 2012 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy October 2012, Revised February 2013) http://www.dec.ny.gov/chemical/31290.html.

Nitsche, F.O., W.B.F. Ryan, S.M. Carbotte, R.E. Bell, A. Slagle, C. Bertinado, R. Flood, T. Kenna, C. Hough. 2007. Regional patterns and local variations of sediment distribution in the Hudson River Estuary. Estuarine, Coastal and Shelf Science, No. 71. pp 259 - 277.

Nitsche, F.O., Kenna, T.C., Haberman, M. 2010. Quantifying 20th century deposition in complex estuarine environment: An example from the Hudson River, Estuarine, Coastal and Shelf Science, No. 89.

Normandeau Associates, Inc. (Normandeau). 2011. Analysis of newar-bottom flow in the Hudson River at Indian Point Energy center from data collected by acoustic Doppler current profilers 4 March through 2 November. Final Report, R-21825.001. 29 p. As cited in ASA 2013.

New York State Department of Health (NYSDOH). 2012. Health Advice on Eating Sportfish and Game.

United States Army Corps of Engineers (USACE). 2010. FACT SHEET-Hudson River, NYC to Waterford, NY Maintenance Dredging. http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/8289/fact-sheet-hudson-river-nyc-to-waterford-ny-maintenance-dredging.aspx. Accessed February 2013.

United States Environmental Protection Agency (USEPA). 1986. Technical Guidance Manual for Performing Wasteload Allocation. Book VI Design Conditions. EPA Publication: 440/4-86-014.

United States Environmental Protection Agency (USEPA). 2013. Hudson River Clean Up. http://www.epa.gov/hudson/cleanup.html#quest2, accessed on March 13, 2013).

U.S. Geological Survey (USGS). U.S. 2009 as cited in FHWA 2012.

United States Geological Survey. 2013. National Water Information System: Web Interface (NWIS). http://waterdata.usgs.gov/nwis/. Accessed January 2013.

3.3 Aquatic Ecology

AKRF Inc. 2012. Entergy Nuclear Indian Point 2 LLC, Entergy Nuclear Indian Point 3 LLC, and Entergy Nuclear Operations Inc. December 2012. Coastal Zone Management at Consistency Certification in support of USNRC's Renewal of Indian Point Unit 2 and 3 Operating Licenses.

ASA Analysis and Communications (ASAAC). 2007. 2005 Year Class Report for the Hudson River Estuary Monitoring Program. Prepared on behalf of Dynegy Roseton L.L.C., Entergy Nuclear Indian Point 2 L.L.C., Entergy Nuclear Indian Point 3 L.L.C., Mirant Bowline L.L.C. January 2007.

ASA Analysis and Communications (ASAAC). 2012. 2010 Year Class Report for the Hudson River Estuary Monitoring Program.

Atlantic States Marine Fisheries Commission (ASMFC). 1999. Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. Fisher Management Report No. 35. Atlantic States Marine Fisheries Commission, Washington, D.C. As cited in AKRF 2012.

Atlantic States Marine Fisheries Commission (ASMFC). 2003. Amendment 6 to the Interstate Fishery Management Plan for Atlantic striped bass. Fisher Management Report No. 41. Atlantic States Marine Fisheries Commission, Washington, D.C.

Atlantic States Marine Fisheries Commission (ASMFC). 2006. Species profile: Atlantic striped bass, the challenges of managing a restored stock. http://www.asmfc.org/speciesDocuments/stripedBass/profiles/speciesprofile.pdf. Accessed February 2013.

Atlantic States Marine Fisheries Commission (ASMFC). 2007a. American shad stock assessment report for peer review. Atlantic States Marine Fisheries Commission, Washington, D.C. As cited in FHWA et al. 2012.

Atlantic States Marine Fisheries Commission (ASMFC). 2007b. Species Profile: Atlantic Sturgeon, Ancient Species' Slow Road to Recovery. http://www.asmfc.org/speciesDocuments/sturgeon/sturgeonProfile.pdf. Accessed February 2013.

Atlantic States Marine Fisheries Commission (ASMFC). 2008. 67th Annual Report of the Atlantic States Fisheries Commission. http://www.fishingreportsnow.com/images/Fisheries.Watch.2009/ASMFC-Annual-Report.pdf. Accessed February 2013.

Atlantic States Marine Fisheries Commission (ASMFC). 2009a. Amendment 2 to the Interstate Fisheries Management Plan for Shad and River Herring.

Atlantic States Marine Fisheries Commission (ASMFC). 2009b. Atlantic coastal diadromous fish habitat: a review of utilization, threats, recommendations for conservation, and research needs. Atlantic States Marine Fisheries Commission, Washington, D.C.

Atlantic States Marine Fisheries Commission (ASMFC). 2009c. Striped Bass 2009 Review Of The Atlantic States Marine Fisheries Commission Fishery Management Plan For Atlantic Striped Bass *(Morone Saxatilis)* 2008 Fishing Year. Atlantic States Marine Fisheries Commission, Washington, D.C.

Atlantic States Marine Fisheries Commission (ASMFC). 2010. Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring (American Shad Management). http://www.asmfc.org/speciesDocuments/shad/fmps/Amendment3_FINALshad.pdf. Accessed February 2013.

Atlantic States Marine Fisheries Commission (ASMFC). 2012. ASMFC Stock Assessment Overview: River Herring. May 2012. http://www.asmfc.org/speciesDocuments/shad/stockassmtreports/riverHerringStockAssessmentOverview_May2012.pdf. Accessed February 2013.

Atlantic Sturgeon Status Review Team (ASSRT). February 23, 2007. Status Review of Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus). Report to National Marine Fisheries Service, Northeast Regional Office, pp. 174. http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/atlanticsturgeon2007.pdf. As cited in FHWA et al. 2012.

Bain, M.B., N. Haley, D.L. Peterson, K.K. Arend, K.E. Mills, and P.J. Sullivan. 2007. Recovery of a U.S. Endangered Fish." PLoS ONE 2(1): e168. Department of Natural Resources, Cornell University, Ithaca, New York. http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0000168. As cited in AKRF 2012.

Barnthouse, L.W. and W. Van Winkle. 1988. Analysis of Impingement Impacts on Hudson River Fish Populations. American Fisheries Society Monograph 4, pp. 182-190.

Barnthouse, L.W., D. Glaser, and J. Young. 2003. Effects of historic PCB exposures on the reproductive success of the Hudson River striped bass population. Environmental Science and Technology 37:223-228.

Barnthouse, Lawrence W., D.G. Heimbuch, W.V. Winkle, and J. Young. 2008. Entrainment and Impingement at IP2 and IP3: A Biological Impact Assessment.

Barnthouse, L.W., M.T. Mattson, and J.R. Young. 2011. Response to National Marine Fisheries Service Comments on NRC'S Essential Fish Habitat Assessment. September 2011.

Becker, G. C. 1983. Fishes of Wisconsin. The University of Wisconsin Press. Madison. 1,052 pp. As cited in AKRF 2012.

Berggren, T.J., and J.T. Lieberman. 1978. "Relative Contribution of Hudson, Chesapeake and Roanoke Striped Bass, Morone saxatilis, Stocks to the Atlantic Coast Fishery." U.S. National Marine Fisheries Service Fishery Bulletin 76, pp. 335-345. As cited in NRC 2010.

Bigelow, H.B., and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fishery Bulletin 74, Fishery Bulletin of the Fish and Wildlife Service, Volume 53, Contribution No. 592, Woods Hole Oceanographic Institution. U.S. Government Printing Office. http://www.gma.org/fogm. Accessed February 2013.

Boreman, J., and C.P. Goodyear. 1988. Estimates of Entrainment Mortality for Striped Bass and Other Fish Species Inhabiting the Hudson River Estuary. American Fisheries Society Monograph 4, pp. 152-160. As cited in NRC 2010.

Central Hudson Gas & Electric Corp. Consolidated Edison Company of New York, Inc., New York Power Authority, Southern Energy New York (CHGE et al.). 1999. Draft Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point 2 and 3, and Roseton Steam Electric Generating Stations. December 1999.

Chesapeake Bay Program. 2006. White Perch. http://www.chesapeakebay.net/fieldguide/critter/white_perch. Accessed February 2013.

Cole, J. R. and N. F. Caraco. 2006. Primary Production and its Regulation in the Tidal-Freshwater Hudson River. Pages 107-120 *in* J. S. Levington and J. R. Waldman, editors. The Hudson River Estuary. Cambridge University Press, New York, New York., as cited in AKRF 2012.

Collette, B.B., and G. Klein-MacPhee (eds.). 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine (3rd Ed.), pp. 748. Smithsonian Institute Press, Herndon, VA.

Dadswell, M.J., B.D. Taubert, T.S. Squires, D. Marchette, and J. Buckley, 1984. Synopsis of biological data in Shortnose sturgeon, (*Acipenser brevirostrum)* Lesueur 1818. Fish synop. 140. Tech. rept. 14. National Marine Fisheries Service. pp.45. As cited in AKRF 2012.

Dew, C.B, and J.H. Hecht. 1976. Observations on the population dynamics of Atlantic tomcod (Microgadus tomcod) in the Hudson River Estuary. Proc. 4th Symp. On Hudson River Ecology. Paper 25. Hudson River Environmental Society, Bronx, N.Y. As cited in Stewart and Auster 1987.

Dew, C.B. and J.H. Hecht. 1994. "Hatching, Estuarine Transport and Distribution of Larval and Early Juvenile Atlantic Tomcod, Microgadus tomcod, in the Hudson River." Estruaries, Vol. 17, No. 2, pp. 472-488. Accessed at: https://estuariesandcoasts.org/cdrom/ESTU1994_17_2_472_488.pdf on December 11, 2007. (Agencywide Documents Access and Management System (ADAMS) Accession No. ML073460164). As cited in NRC 2010.

Dunning, D.J., Q.E. Ross, M.T. Mattson, and D.G. Heimbuch. 2006. Distribution and Abundance of Bay Anchovy Eggs and Larvae in the Hudson River and Nearby Waterways. American Fisheries Society Symposium 51, pp. 215–226.

Everly, A.W. and J. Boreman. 1999. Habitat Use and Requirements of Important Fish Species Inhabiting the Hudson River Estuary. National Oceanic and Atmospheric Administration, Technical Memorandum NMFS-NE-121. http://www.nefsc.noaa.gov/nefsc/publications/tm/tm121. Accessed February 26, 2013. As cited in NRC 2010.

Fabrizio, M.C. 1987. Contribution of Chesapeake Bay and Hudson River Stocks of Striped Bass to Rhode Island Coastal Waters as Estimated by Isoelectric Focusing of Eye Lens Proteins. Transactions of the American Fisheries Society 116, pp. 588–593. As cited in NRC 2010.

Facey, D.E. and M.J. Van Den Avyle. 1986. Species Profile: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (South Atlantic) – American Shad. U.S. Fish and Wildlife Service Biol. Rep. 82 (11.76). U.S. Army Corps of Engineers, TR El-82-4. http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-045.pdf. Accessed February 2013.

Fay, C.W., R.J. Neves, and G.B. Pardue. 1983. Species Profile: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Mid-Atlantic)— Alewife/Blueback Herring. U.S. Fish and Wildlife Service Biol. Rep. 82 (11.45). U.S. Army Corps of Engineers, TR EL-82-4. http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-009.pdf.

Federal Highway Administration, New York State Department of Transportation and New York State Thruway Authority (FHWA). 2012. Final Environmental Impact Statement and Final Section 4(f) Evaluation for Tappan Zee Hudson River Crossing Project. July 2012.

Fernald, S. H., N. F. Caraco, and J. J. Cole. 2007. Changes in cyanobacterial dominance following the invasion of the zebra mussel Dreissena polymorpha: long-term results from the Hudson River estuary. Estuaries and Coasts 30: 163-170., as cited in AKRF 2012.

Findlay, S., D. Strayer, M. Bain, and W.C. Nieder. 2006. Ecology of Hudson River Submerged Aquatic Vegetation. Final Report to the New York State Department of Environmental Conservation. http://www.nysl.nysed.gov/scandoclinks/ocm82162378.html. As cited in AKRF.

Froese, R., and D. Pauly (eds.). 2007. Microgadus Tomcod Atlantic Tomcod on FishBase: World Wide Web Electronic Database. Version (10/2007). http://www.fishbase.org/summary/Speciessummary.php?id=316. Accessed February 2013. As cited in NRC 2010.

Gilbert, C.R. 1989. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Mid-Atlantic Bight)—Atlantic and Shortnose Sturgeons." U.S. Fish and Wildlife Service Biological Report 82 (11.122). U.S. Army Corps of Engineers TR 82 4, pp. 28. As cited in AKRF 2012.

Haas-Castro, R. 2006a. Status of Fishery Resources off the Northeastern U.S.: River Herring. Northeast Fisheries Science Center Resource Evaluation and Assessment Division, National Oceanic and Atmospheric Administration. http://www.nefsc.noaa.gov/sos/spsyn/af/ herring/archives/38_RiverHerring_2006.pdf. Accessed December 17, 2007. As cited in NRC 2010.

Haas-Castro, R. 2006b. Status of Fishery Resources off the Northeastern U.S.: American Shad. Northeast Fisheries Science Center Resource Evaluation and Assessment Division, National Oceanic and Atmospheric Administration. http://www.nefsc.noaa.gov/sos/spsyn/af/shad/archives/39_AmericanShad_2006.pdf. As cited in AKRF 2012. As cited in NRC 2010.

Hartman, K.J., J. Howell, and J.A. Sweka. 2004. Diet and Daily Ration of Bay Anchovy in the Hudson River, New York. Transactions of the American Fisheries Society 133, pp. 762–771. As cited in AKRF 2012.

Hattala, K. and A. Kahnle. 2009. Status of American shad in the Hudson River, New York. Hudson River Fisheries Unit, Bureau of Marine Resources, New York Department of Environmental Conservation. Available at www.dec.ny.gov/docs/fish_marinehrshadstatus.pdf. As cited in AKRF 2012.

Hattala, K., M. DuFour, R. Adams, and A. Kahnle. 2009. Status of New York river herring stocks. Hudson River Fisheries Unit, Bureau of Marine Resources, New York Department of Environmental Conservation. Available at http://www.dec.ny.gov/docs/fish_marine_pdf/hrshadstatus.pdf. As cited in AKRF 2012.

Johnson, J. H. and D. S. Dropkin. 1993. Diel variation in diet composition of a riverine fish community. Hydrobiologia. 271:149-158. as cited in CHGE 1999.

Juanes, F., R.E. Marks, K.A. McKown, and D.O. Conover. 1993. Predation by Age-0 Bluefish on Age-0 Anadromous Fishes in the Hudson River Estuary. Transactions of the American Fisheries Society 122, pp. 348–356. As cited in AKRF 2012.

Klauda, R.J., J.B. McLaren, R.E. Schmidt, and W.P. Dey. 1988. Life History of White Perch in the Hudson River Estuary. American Fisheries Society Monograph 4, 69-88. As cited in NRC 2010.

Kynard, B. 1997. Life History, Latitudinal Patterns, and Status of the Shortnose Sturgeon *Acipenser brevirostrum*. Environmental Biology of Fishes 48, pp. 319–334. As cited in AKRF 2012.

Levinton, J.S. and J.R. Waldman (eds.). 2006. The Hudson River Estuary. Cambridge University Press, New York. As cited in NRC 2010.

Limburg, K.E. 1996. Modeling the Ecological Constraints on Growth and Movement of Juvenile American Shad (*Alosa sapidissima*) in the Hudson River Estuary. Estuaries 19:4, pp. 794-813. As cited in NRC 2010.

Marshall, H. 1988. Season Phytoplankton Composition and Concentration Patterns within the Hudson River. Final Report to the Hudson River Foundation. 34 pp., as cited in CHGE et al. 1999.

McLaren, J.B., T.H. Peck, W.P. Dey, and M. Gardinier. 1988. Biology of Atlantic Tomcod in the Hudson River Estuary. American Fisheries Society Monograph 4, pp. 102-112. As cited in CHGE et al. 1999.

Morton, T. 1989. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Mid-Atlantic)—Bay Anchovy. U.S. Fish and Wildlife Service Biological Report 82 (11.97). U.S. Army Corps of Engineers TR EL-82-4 13 pp. http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-097.pdf. As cited in CHGE et al. 1999.

National Marine Fisheries Service (NFMS). 1998a. Draft recovery plan for the Shortnose sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose sturgeon recovery team for the National Marine Fisheries Service, Silver Spring, MD.

National Marine Fisheries Service (NMFS). 1998b. Status Review of Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus). September 1998. Accessed online at : http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/atlanticsturgeon.pdf

National Marine Fisheries Service (NMFS). 2006. Essential Fish Habitat Source Document: Bluefish, Pomatomus saltatrix, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-198.

National Oceanic and Atmospheric Administration (NOAA). 2008. National Estuarine Research Reserve System. http://nerrs.noaa.gov/ReservesMap.aspx. Accessed January 2013.

National Oceanic and Atmospheric Administration (NOAA). 2012. November 30, 2012 letter from Joelle Gore of NOAA to George Stafford of NYSDOS approving NYSDOS's request that SCFWH changes be incorporated into the NY CMP.

New York Natural Heritage Program (NYNHP). 2010. Letter from Tara Salerno, New York Natural Heritage Program to Jacqueline Fusco, TRC Environmental on Review of New York Natural Heritage Program database. Received August 20, 2010.

New York State Department of Environmental Conservation (NYSDEC). 2010a. Hudson River Fisheries Unit. http://www.dc.ny.gov/animals/26736.html. Accessed November 4, 2010.

New York State Department of Environmental Conservation (NYSDEC). 2010b. Hudson River Fisheries Unit. http://www.dc.ny.gov/animals/50131.html. Accessed November 4, 2010.

New York State Department of Environmental Protection (NYSDEC). 2011. Hudson River Almanac July 16-July 23, 2011. Accessed March 12, 2013 at: http://www.dec.ny.gov/lands/76015.html.

New York State Department of State (NYSDOS), Office of Communities and Waterfronts. 2012. Routine Program Change Summary: Significant Coastal Fish and Wildlife Habitat Modifications, Hudson River, Counties of Albany, Rensselaer, Greene, Columbia, Ulster, Dutchess, Orange, Putnam, Rockland, Westchester. http://www.dos.ny.gov/communitieswaterfronts/newsEvents/pdf/Hudson_River_SCFWH_RPC_approval.pdf. As cited in FHWA et al. 2012.

New York State Department of State (NYSDOS). 1987. Coastal Fish and Wildlife Habitat Rating Form: Iona Island Marsh. As cited in AKRF 2012.

Normandeau Associates, Inc. 2003. Assessment of Hudson River Recreational Fisheries. Final Report. Prepared for New York State Department of Environmental Conservation, Albany, NY. As cited in AKRF 2012.

Normandeau Associates, Inc. 2007. Assessment of Spring 2005 Hudson River Recreational Fisheries. Final Report. Prepared for New York State Department of Environmental Conservation, Albany, NY. As cited in AKRF 2012.

Nuclear Regulatory Commission (NRC). 2010. NUREG – 1437 , Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 Regarding Indian Point Generating Unit Nos. 2 and 3 Volumes 1 & 2 Final Report Main Report and Comment Responses. December 2010.

Ocean Surveys Inc (OSI). 2011. Final report, Geophysical and Geotechnical Investigation, Indian Point Power Station, Hudson River, Buchanan, New York. OSI Report #10ES058, March 2011.

Office of Protected Resources (OPR). Undated. Shortnose Sturgeon (Acipenser brevirostrum). National Marine Fisheries Service. http://www.nmfs.noaa.gov/pr/species/fish/shortnosesturgeon.htm. Accessed February 2013.

Pace, M. L., and D. J. Lonsdale. 2006. Ecology of the Hudson River Zooplankton Community. Pages 217-229 *in* J. S. Levington and J. R. Waldman, editors. The Hudson River Estuary. Cambridge University Press, New York, New York. As cited in AKRF 2012.

Pace, M.L., Findlay, S.E.G. and D. Lints. 1992. Zooplankton in advective environments: the Hudson River community and a comparative analysis. Can. J. Fish. quat. Sci. 49:1060-1069. As cited in CHGE et al. 1999.

Pace, M.L., J.A. Downing, H. Cyr, S. Baines, and S. Lalond. 1993. Analysis of Hudson River populations from the utilities monitoring program. Final report to the Hudson River Foundation. Institute of Ecosystem Studies, New York Botanical Garden, NY. As cited in CHGE et al. 1999.

Pace, M.L., S.E.G. Findlay, and D. Fischer. 1998. Effects of an Invasive Bivalve on the Zooplankton Community of the Hudson River. Freshwater Biology 39, pp. 103–116. As cited in CHGE et al. 1999.

Peterson, D. L., M. B. Bain, and N. Haley. 2000. Evidence of declining recruitment of Atlantic sturgeon in the Hudson River. North American Journal of Fisheries Management 20: 231–238. As cited in AKRF 2012.

Schultz, E.T., K.M.M. Lwiza, J.R. Young, K.J. Hartman, and R.C. Tipton. 2006. The Dynamics of Bay Anchovy in the Hudson River Estuary: Process-oriented Studies and Long-term Changes." American Fisheries Society Symposium 51, pp. 197–213. As cited in AKRF 2012.

Scott, W.B., and E.J. Crossman. 1973. Freshwater fishes of Canada. Fish. Res. Bd. Can. Bull. 184:966., as cited in CHGE et al. 1999.

Shepherd G. 2006a. Atlantic Striped Bass. http://www.nefsc.noaa.gov/sos/spsyn/af/sbass/archives/40_StripedBass_2006.pdf. Accessed February 2013.

Shepherd G. 2006b Status of fishery resources off the Northeastern US – Atlantic and shortnose sturgeons. Available at www.nefsc.noaa.gov/sos/spsyn/af/sturgeon/. Accessed February 2013.

Smith, C. L. 1985. *Inland Fishes of New York State*. New York State Department of Environmental Conservation, Albany. Available at: http://www.nysl.nysed.gov/scandoclinks/ocm13881714.htm. Accessed February 2013.

Stanley, J.G., and D.S. Danie. 1983. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic)—White Perch. U.S. Fish and Wildlife Service, Division of Biological Services, FWS/OBS-82/11.7. U.S. Army Corps of Engineers, TR EL-82-4. 12pp. http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-007.pdf. Accessed February 2013.

Stewart, L.L. and P.J. Auster. 1987. Species Profile: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Mid-Atlantic) – Atlantic Tomcod. U.S. Fish and Wildlife Service Biological Report 82 (11.76). U.S. Army Corps of Engineers, TR EL-82-4. http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-076.pdf. Accessed February 2013.

Storm, P.C., and R.L. Heffner. 1976. A comparison of phytoplankton abundance, chlorophyll and water quality factors in the Hudson River and its tributaries. In Hudson River Ecology. Fourth Symposium on Hudson River Ecology., as cited in CHGE et al. 1999.

Strayer, D.L., K.A. Hattala, and A.W. Kahnle. 2004. Effects of an Invasive Bivalve (*Dreissena polymorpha*) on Fish in the Hudson River Estuary. Canadian Journal of Fisheries and Aquatic Sciences 61, pp. 924–941. As cited in AKRF 2012.

Strayer, D. L. 2006. The benthic animal communities of the tidal-freshwater Hudson River estuary. pp. 266-278. *in*: J. S. Levinton and J. R. Waldman, editors. The Hudson River Estuary. Cambridge University Press, New York, New York. As cited in AKRF 2012.

Strayer, D.L., C. Nuria, and H.M. Malcom. 2011. Long-term changes in a population of an invasive bivalve and its effects. Oecologia 165, pp. 1063-1072.

Substructure, 2010. Data Report for the April 2010 Multibeam and Sub-Bottom Profile Survey in the Hudson River Near Peekskill, New York. Prepared by Substructure, Inc., Portsmouth, NH for Normandeau Associates, Inc., Bedford, NH. May 2010.

Tipton, R.C. 2003. Distributional Ecology of Bay Anchovy (Anchoa mitchilli) in the Hudson River Estuary, USA. A dissertation submitted to West Virginia University. Forest Resources Sciences Wildlife and Fisheries Program. http://wvuscholar.wvu.edu:8881/exlibris/dtl/d3_1/apache_media/L2V4bGlicmlzL2R0bC9kM18xL2FwYWNoZV9tZWRpYS82NTg5.pdf. Accessed February 2013.

Tipton, R. C., and K. J. Hartman. 2006. Distributional ecology of bay anchovy Anchoa mitchilli in the Hudson River estuary. American Fisheries Society Symposium 51:227-249.

United States Environmental Protection Agency (USEPA). 1977. Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b) P.L. 92-500. May 1, 1977. PP 1- 64.

Walter, J.F., A.S. Overton, K.H. Ferry, and M.E. Mather. 2003. Atlantic Coast Feeding Habits of Striped Bass: A Synthesis Supporting a Coast-wide Understanding of Trophic Biology. Fisheries Management and Ecology 10 (5), pp. 349–360. As cited in AKRF 2012.

Wetzel, R. G. 1975. Limnology. W. B. Saunders Company. Philadelphia. 743 p., as cited in AKRF 2012.

Wirgin, I., L. Maceda, J.R. Waldman, and R.N Crittenden. 1993. Use of Mitochondrial DNA Polymorphisms to Estimate the Relative Contributions of the Hudson River and Chesapeake Bay Striped Bass Stocks to the Mixed Fishery on the Atlantic Coast. Transactions of the American Fisheries Society 122, pp. 669–684. As cited in FHWA et al. 2012.

Woodland, R.J., and D.H. Secor. 2007. Year-Class Strength and Recovery of Endangered Shortnose Sturgeon in the Hudson River, New York. Transactions of the American Fisheries Society 136, pp. 72–81. As cited in FHWA et al. 2012.

3.4 Terrestrial Ecology

AKRF, Inc. (AKRF). 2012. Appendix C: Flora and Terrestrial Fauna Habitat and Communities in the Vicinity of IPEC. USNRC's Renewal of Indian Point Unit 2 and 3 Operating Licenses. Coastal Zone Management Act Consistency Certification. December 2012.

Alden, Peter. National Audubon Society Field Guide to New England. 1998. Andrew Stewart Publishing, Inc. New York, NY.

Edinger, G.J., D.J. Evans, S. Gebauer, T.G. Howard, D.M. Hunt, and A.M. Olivero (editors). 2002. Ecological Communities of New York State. Second Edition. A revised and expanded edition of Carol Reschke's Ecological Communities of New York State. (Draft for review). New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, NY.

Entergy Nuclear Operations Inc. (Entergy). 2007. Applicant's Environmental Report, Operating License Renewal Stage (Appendix E to Indian Point, Units 2 & 3, License Renewal Application). Inc. April 23, 2007.

Endangered Species Act (ESA). 1973. 16 U.S.C 1531 – 1544.

Miller, N. A. and Klemens, M. W. 2004. Croton-to-Highlands Biodiversity Plan: Balancing development and the environment in the Hudson River Estuary Catchment. MCA Technical Paper No. 7, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

New York Natural Heritage Program (NYNHP). 2009. Online Conservation Guide for Myotis sodalis. Available from: http://www.acris.nynhp.org/guide.php?id=7405. Accessed February 2013.

New York Natural Heritage Program (NYNHP). 2010. Letter from Tara Salerno, New York Natural Heritage Program to Jacqueline Fusco, TRC Environmental on Review of New York Natural Heritage Program database. Received August 20, 2010.

New York State Department of Environmental Conservation (NYSDEC). 2010. New York Natural Heritage Program. http://www.acris.nynhp.org/. Accessed February 2013.

New York State Department of Environmental Conservation (NYSDEC). 2013a. Mammals. Accessed on February 12, 2013 at http://www.dec.ny.gov/animals/263.html.

New York State Department of Environmental Conservation (NYSDEC). 2013b. Amphibian and Reptile (Herp) Atlas, 1990-1999. Accessed on February 4, 2013 at http://www.dec.ny.gov/animals/7140.html.

New York State Department of Environmental Conservation (NYSDEC). 2013c. Breeding Bird Atlas 2000 – 2005. Accessed January 2013 at http://www.dec.ny.gov/animals/7312.html.

United States Fish and Wildlife Service (USFWS). 2010. USFWS Federally Listed Endangered And Threatened Species And Candidate Species In New York (By County). Accessed February 2013 at http://www.fws.gov/northeast/nyfo/es/CoListCurrent.pdf.

United States Fish and Wildlife Service (USFWS). 2013. USFWS Critical Habitat for Threatened and Endangered Species. Accessed on January 21, 2013 at http://criticalhabitat.fws.gov/.

Wernert, Susan J., North American Wildlife. 1982. Reader's Digest. Pleasantville, NY.

3.5 Electrical System

Enercon Services, Inc.(ENERCON). 2010. Alternative Intake Technologies at Indian Point Units 2 & 3. February 12, 2010.

Entergy Nuclear Operations Inc. (Entergy). 2007. Applicant's Environmental Report, Operating License Renewal Stage (Appendix E to Indian Point, Units 2 & 3, License Renewal Application). Inc. April 23, 2007.

NERA Economic Consulting (NERA). 2012. Potential Energy and Environmental Impacts of Denying Indian Point's License Renewal Applications. Report and testimony submitted to the Nuclear Regulatory Commission on behalf of Entergy Corporation. March.

New York Independent System Operator (NYISO). 2005. 2005 Hudson Valley Voltage Analysis. November 18. (www.nyiso.com/public/webdocs/market_data/reports_info/oper_studies_sys_perf_reports/2005_hudson_valley_voltage_study_oc_approved.pdf).

New York Independent System Operator (NYISO). 2012a. 2012 Load & Capacity Data ("Gold Book"). April. (http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2012_GoldBook_V3.pdf) Accessed February 2013.

New York Independent System Operator (NYISO). 2012b. Power Trends 2012. May. (http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/Child_power_trends_2012_final/Power_Trends_2012_-_State_of_the_Grid_May_2012.pdf). Accessed February 2013.

New York Independent System Operator (NYISO). 2012c. 2012 Reliability Needs Assessment. September 18. (http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Planning_Studies/Reliability_Planning_Studies/Reliability_Assessment_Documents/2012_RNA_Final_Report_9-18-12_PDF.pdf). Accessed February 2013.

3.6 Aesthetics

New York State Department of Environmental Conservation (NYSDEC). July 31, 2000, Program Policy Assessing and Mitigating Visual Impacts, (DEP 00-2), Albany, NY.

New York State Department of State (NYSDOS), Division of Coastal Resources and Waterfront Revitalization. July 1993. Scenic Areas of Statewide Significance.

New York State Department of State (NYSDOS), Division of Coastal Resources and Waterfront Revitalization. 2001. New York State Coastal Policies. http://www.dos.ny.gov/communitieswaterfronts/pdfs/CoastalPolicies.pdf. Accessed February 2013.

Saratoga Associates. 2009. Indian Point Energy Center Closed Cycle Cooling Conversion Feasibility Study Visual Assessment. June 1, 2009.

3.7 Transportation

New York State Department of Transportation, Engineering Division, Traffic Data Viewer. https://www.dot.ny.gov/tdv. Accessed January 2013.

Westchester County, New York, Department of Public Works, Division of Traffic Engineering, Traffic Counts. http://publicworks.westchestergov.com/traffic-counts. Accessed January 2013.

Federal Highway Administration (FHWA), New York State Department of Transportation (NYSDOT), New York State Thruway Authority (NYSTA). 2012. Tappan Zee Hudson River Crossing Project final Environmental Impact Statement and Section 4(f) Evaluation. July 2012.

Hudson River Pilot Association (HRPA). 2013. http://hudsonriverpilots.com/index.html. Accessed January 2013

National Oceanic and Atmospheric Administration (NOAA). 2012. United States Coast Pilot 2, Atlantic Coast: Cape Cod to Sandy Hook NJ 2013 (42nd) Edition.

New York State Department of Environmental Conservation (NYSDEC). 2013. http://www.dec.ny.gov/outdoor/7832.html (Accessed January 2013).

3.8 Noise

American National Standards Institute (ANSI) S1.11-2004 (R2009).

Harris. 1991. Handbook of Acoustical Measurements and Noise Control, Third Edition. McGraw-Hill, Inc.

New York State Department of Environmental Conservation (NYSDEC). 2001. Assessing and Mitigating Noise Impacts.

TRC Environmental Corporation. 2003. Indian Point Peaking Facility, Village of Buchanan, Westchester County, New York. Preliminary Scoping Statement.

3.9 Environmental Justice

Clinton, William. 1994. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

Entergy Nuclear Operations, Inc. (Entergy). 2007. Applicant's Environmental Report, Operating License Renewal Stage. (Appendix E of Indian Point, Units 2 & 3, License Renewal Application). April 23, 2007.

New York State Department of Environmental Conservation (NYSDEC). 2003. Commissioner Policy 29, Environmental Justice and Permitting. March 19, 2003.

New York State Department of Environmental Conservation (NYSDEC). 2008. Interim Decision of the Assistant Commissioner In the Matter of a Renewal and Modification of a State Pollutant Discharge Elimination System Permit pursuant to Environmental Conservation Law Article 17 and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York Parts 704 and 750 *et seq*. by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, Permittee. DEC No. 3-5522-00011/00004, SPDES No. NY-0004472. August 13, 2008.

Nuclear Regulatory Commission (NRC). 2003. Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions.

Nuclear Regulatory Commission (NRC). 2010. NUREG – 1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 Regarding Indian Point Generating Unit Nos. 2 and 3 Volumes 1 & 2 Final Report Main Report and Comment Responses. December 2010.

United States Department of Commerce, Bureau of the Census, 2000 Census, Summary Files 1 and 3.

3.10 Archaeological and Historical Resources

Central Hudson Gas & Electric Corp., Consolidated Edison Company of New York, Inc., New York Power Authority, Southern Energy New York (CHGE et al.). 1999. Draft Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point 2&3, and Roseton Steam Electric Generating Stations. December, 1999.

Enercon Services, Inc. (ENERCON). 2007. Phase IA Literature Review and Archaeological Sensitivity Assessment of the Indian Point Site Westchester County, New York. March 22, 2007.

Enercon Services, Inc. (ENERCON). 2009. Phase IB Archeological Investigation of Potential Cooling Tower Construction Sites at Indian Point Energy Center Westchester County, New York. October 9, 2009.

National Park Service. 2013. National Register for Historic Places Program: Research. http://www.nps.gov/nr/research/. Accessed February 2013.

NYSHPO New York State Historic Preservation Office (NYSHPO). 2006a. New York State Historic Preservation Office Geographic Information System (GIS)-Public Access. System contains information and data from the State and National Registers of Historic Places GIS Database and Archaeological Sensitivity GIS Database (SHPO Archaeological Site Files and New York State Museum Archaeological Site Files). Accessed at http://www.oprhp.state.ny.us/nr/, February 2013.

New York State Historic Preservation Office (NYSHPO). 2006b. New York State Historic Preservation Office State Preservation Historical Information Network Exchange (*SPHINX). Accessed at http://www.oprhp.state.ny.us/sphinx/login.asp, February 2013.

New York State Historic Preservation Office (NYSHPO). 2013. New York State Historic Preservation office GIS - Public Access. http://pwa.parks.ny.gov/nr/. Accessed February 2013.

4.1 Potential Significant Adverse Environmental Impacts

No References

4.2 NRC Final Supplemental EIS

Applied Science Associates (ASA). 2011. 2010 Field Program and Modeling Analysis of the Cooling Water Discharge from the Indian Point Energy Center. January 31, 2011. Prepared by C. Swanson, D. Mendelsohn, N Cohn, D. Crowley, Y. Kim, L. Decker and L. Miller.

Nuclear Regulatory Commission (NRC). 2010. NUREG – 1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 Regarding Indian Point Generating Unit Nos. 2 and 3 Volumes 1 & 2 Final Report Main Report and Comment Responses. December 2010.

4.3 Air Quality

Enercon Services, Inc. (ENERCON). 2013. Personal Communication from Clubb, R. Enercon to TRC. "Equipment Loading - RevD.xls", January 2013.

NERA Economic Consulting (NERA). 2012. Potential Energy and Environmental Impacts of Denying Indian Point's License Renewal Applications. Report and testimony submitted to the Nuclear Regulatory Commission on behalf of Entergy Corporation. March 2012.

United States Environmental Protection Agency (USEPA). 2006. 71 FR 61144, USEPA, "National Ambient Air Quality Standards for Particulate Matter – Final Rule", October 17, 2006.

United States Environmental Protection Agency (USEPA). 2010. 75 FR 6474, USEPA, "Primary National Ambient Air Quality Standards for Nitrogen Dioxide – Final Rule", February 9, 2010.

United States Environmental Protection Agency (USEPA). 2011a. http://www.epa.gov/oar/genconform/training. Last updated on Friday, July 22, 2011. Last visited: 2/11/2013.

United States Environmental Protection Agency (USEPA). 2011b. Fox, Tyler. Memorandum: Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard. March 1, 2011.

United States Environmental Protection Agency (USEPA). 2011c. Fox, Tyler. Memorandum: Update to the 24 Hour NAAQS Modeled Attainment Test. June 28, 2011.

4.4 Water Quality and Quantity

Applied Science Associates (ASA). 2013. Analysis of Potential Sedimentation Effects of Proposed Cylindrical Wedgewire Screens for Intake of Cooling Water and Indian Point Energy Center. Prepared by C. Swanson, C. Galagan, D. Mendelsohn, L. Decker, D. Crowley, Y. Kim. ASA Project 2011-292. March 29, 2013.

Enercon Services, Inc. (ENERCON). 2011. Dredgability Evaluation Summary Report, Project ENTGIP152. November 4, 2011.

Enercon Services, Inc (ENERCON). 2012a. Memorandum to Entergy Nuclear operations. Indian Point Wedgewire Screen Installation Volume and Area Estimates. January 30, 2012.

Enercon Services, Inc (ENERCON). 2012b. Technical Design Report For Indian Point Units 2 And 3 - Implementation Of Cylindrical Wedge Wire Screens ENTGIP152-PR-CWW-06. April 2012.

New York State Department of Environmental Conservation (NYSDEC). 2004. In Water and Riparian Management of Sediment and Dredged Material. Technical and Operational Guidance Series (TOGS) 5.1.9. November, 2004.

New York State Department of Environmental Conservation (NYSDEC). 2012. DEC Creates Dredge Team for Port of NY & NJ. http://www.dec.ny.gov/press/83720.html. Accessed March 2013.

New York State Department of Environmental Conservation (NYSDEC). 2013. Draft Permit Under the Environmental Conservation Law for Tappan Zee Bridge Replacement. Facility DEC ID:3-9903-00043/00012.

United States Army Corps of Engineers (USACE). 2008. Technical Guidelines for Environmental Dredging of Contaminated Sediments. ERDC/EL TR-08-29. September 2008.

Nuclear Regulatory Commission (NRC). 2010. NUREG – 1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 38 Regarding Indian Point Generating Unit Nos. 2 and 3 Volumes 1 & 2 Final Report Main Report and Comment Responses. December 2010.

Wall, G.R., E.A. Nuystrom, S. Litten. 2008. Suspend sediment transport in the freshwater reach of the Hudson River estuary in eastern New York. Estuaries and Coasts (2008) 31:542-553.

4.5 Aquatic Ecology

AKRF Inc. 2012. Entergy Nuclear Indian Point 2 LLC, Entergy Nuclear Indian Point 3 LLC, and Entergy Nuclear Operations Inc. December 2012. Coastal Zone Management at Consistency Certification in support of USNRC's Renewal of Indian Point Unit 2 and 3 Operating Licences. pp 1 – 146.

Applied Science Associates (ASA). 2013. Analysis of Potential Sedimentation Effects of Proposed Cylindrical Wedgewire Screens for Intake of Cooling Water and Indian Point Energy Center. Prepared by C. Swanson, C. Galagan, D. Mendelsohn, L. Decker, D. Crowley, Y. Kim. ASA Project 2011-292. March 29, 2013.

Barnthouse, L.W., D.G. Heimbuch, M. Mattson and J.R. Young. February 2010. Biological Effectiveness of Alternative Intake Technologies for Indian Point Units 2 and 3. Prepared for Entergy Services. Pp.1-50.

Byrnes, M. R., R. M. Hammer, S. W. Kelley, J. L. Baker, D. B. Snyder, T. D. Thibaut, S. A. Zichichi, L. M. Lagera, S. T. Viada, B. A. Vittor, J. S. Ramsey, and J. D. Germano. 2004. Environmental surveys of potential borrow areas offshore northern New Jersey and Southern New York and the environmental implications of sand removal for coastal and beach restoration. U.S. Department of the Interior, Minerals Management Service, Leasing Division, Marine Minerals Branch, Herndon, Va. OCS Report MMS 2004-044, vol. 1 and vol. 2.

Coastline Surveys Limited. 1998. Marine aggregate mining benthic and surface plume study. Final report to the U.S. Department of the Interior, Minerals Management Service and Plume Research Group. Report 98-555-03.

Enercon, 2012. Letter from Richard Clubb to Fred Dacimo regarding "Indian Point Wedgewire Screen Installation Volume and Area Estimates". January 30, 2012. 5 pages.

Hastings, Mardi C. and A. N. Popper. 2005. Effects of Sound on Fish. Subconsultants to Jones and Stokes under California Department of Transportation Contact No. 43A0139, Task Order 1. January 28, 2005.

Hynes, H.B.N. 1970. The ecology of running waters. University of Toronto Press, Toronto. 555 pp.

Laughlin, J. 2006. Underwater sound levels associated with pile driving at the Cape Disappointment boat launch facility, wave barrier project. WA State Department of Transportation. March. Pp 1-45.

Marine Mammal Commission. 2007. Marine Mammals and Noise. A Sound Approach To Research and Management. A report to Congress from The Marine Mammal Commission, March. PP 1-50.

National Marine Fisheries Service (NMFS). 2003. Non-fishing Impacts to Essential Fish Habitat and Recommended Conservation Measures. Editors J. Hanson, M. Helvey, and R. Strach. Alaska Region-Northwest Region South west Region. Available online at: NMFS http://www.nwr.noaa.gov/Salmon-Habitat/Salmon-EFH/upload/EFH-nonfishing.pdf. Accessed February 2013.

National Marine Fisheries Service (NMFS). 2013. January 30, 2013 letter from John Bullard of NMFS to Amy Hull of the NRC transmitting the Biological Opinion on continued operations of IPEC Units 2 and 3.

Newell, R. C., L. J. Seiderer, and D. R. Hitchcock. 1998. The impact of dredging works in coastal waters: A review of the sensitivity to disturbance and subsequent recovery of biological resources on the sea bed. Oceanography and Marine Biology: an Annual Review 36:127-78.

Popper, A.N. and M.C. Hastings. 2009. The effects of anthropogenic sources of sound on fishes. J. of Fish Biology 75:455-489.

Rhoads, D. C., P. L. McCall, and J. Y. Yingst. 1978. Disturbance and production on the estuarine seafloor. Am. Sci. 66:577-86.

Rhoads, D. C., and J. D. Germano. 1986. Interpreting long-term changes in benthic community structure: a new protocol. Hydrobiologia 142: 291-308. In [Byrnes et al. 2004].

Rosenberg, D.M. and V.H. Resh (eds). 1993. Freshwater Biomonitoring and Benthic Macroinvertebrates. Chapman & Hall, New York, N.Y. 488 pp.

United States Army Corps of Engineers (USACE). 2008. Environmental Assessment and Finding of No Significant Impact: Anchorage Harbor Dredging & Disposal Anchorage, Alaska. August 2008, United States Army Corp of Engineers Alaska District.

United States Army Corps of Engineers (USACE). 2013a. FACT SHEET-Dredged Material Management Plan NY/NJ. http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/8201/fact-sheet-dredged-material-management-plan-nynj.aspx - site visited 2-4-2013.

United States Army Corps of Engineers (USACE). 2013b. FACT SHEET-Hudson River, NYC to Waterford, NY Maintenance Dredging. http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/8289/fact-sheet-hudson-river-nyc-to-waterford-ny-maintenance-dredging.aspx - site visited 2-4-2013.

Weilgart, L.S. 2007. A Brief Review of Known Effects of Noise on Marine Mammals. International Journal of Comparative Psychology. 20:159-168.

Whitlatch, R. B., A. M. Lohrer, S. F. Thrush, R. D. Pridmore, J. E. Hewitt, V. J. Cummings, and R. N. Zajac. 1998. Scale dependent benthic recolonization dynamics: life stage-based dispersal and demographic consequences. Hydrobiologia 375/376: 217-26. In [Byrnes et al. 2004].

4.6 Terrestrial Ecology

New York State Department of Environmental Conservation (NYSDEC). 2013. Breeding Bird Atlas 2000 – 2005. Accessed January 2013 at http://www.dec.ny.gov/animals/7312.html.

4.7 Electrical System

Enercon Services, Inc. (ENERCON). 2013. Memorandum: Estimated Operational Costs for Indian Point Cylindrical Wedgewire Screen Design. March 27, 2013.

NERA Economic Consulting (NERA). 2013. Benefits and Costs of Cylindrical Wedgewire Screens at Indian Point Energy Center. Privileged and Confidential. Prepared at Request of Counsel. March 29, 2013.

New York Independent System Operator (NYISO). 2012. 2012 Load & Capacity Data ("Gold Book"). April. (http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2012_GoldBook_V3.pdf).

4.8 Aesthetics

No References

4.9 Transportation

Enercon Services, Inc. (ENERCON). 2013a. Personal Communication from ENERCON to TRC. CWWS Construction/Transportation Information. Memo ID: ENTGNU012A. January 21, 2013.

Enercon Services, Inc. (ENERCON). 2013b. Personal Communication from Clubb, R. Enercon to TRC. "Equipment Loading - RevD.xls", January 2013.

Federal Highway Administration (FHWA), New York State Department of Transportation (NYSDOT), New York State Thruway Authority (NYSTA). 2012. Tappan Zee Hudson River Crossing Project final Environmental Impact Statement and Section 4(f) Evaluation. July 2012.

4.10 Noise

DataKustik GmbH. 2006. Computer Aided Noise Abatement Model CadnaA. Munich, Germany.

Enercon Services, Inc. (ENERCON). 2012. "Technical Design Report for Indian Point Units 2 and 3 – Implementation of Cylindrical Wedge Wire Screens ENTGIP152-PR-CWW-06", Enercon, Inc. April 2012. ("Technical Design Report)" ("Phase I Technical Report - Appendix C - Air Burst System Design Indian Points Units 2 and 3").

Enercon Services, Inc. (ENERCON). 2013. Personal Communication from Clubb, R. Enercon to TRC. "Equipment Loading - RevD.xls", January 2013.

Federal Highway Administration (FHWA). 1995. Highway Traffic Noise Analysis and Abatement Policy and Guidance. Prepared by U.S. Department of Transportation. Federal Highway Administration Office of Environment and Planning. Noise and Air Quality Branch. Washington, D.C.

Miller, L.N., E.W. Wood, R.M. Hoover, A.R. Thompson, and S.L. Patterson. 1984. Electric Power Plant Environmental Noise Guide. Prepared for Edison Electric Institute by Bolt, Beranek and Newman, Inc., Cambridge, Massachusetts.

4.11 Environmental Justice

No References

4.12 Archaeological and Historical Resources

Entergy Nuclear Operations, Inc. (Entergy). 2008. Nuclear Management Manual. Cultural Resources Protection Plan (EN-EV-121, Rev 1). March 27, 2008.