Final License Application

For New License

Roosevelt Island Tidal Energy Project

FERC No. 12611

Volume 2 of 4

FINAL LICENSE APPLICATION

FOR NEW LICENSE

ROOSEVELT ISLAND TIDAL ENERGY PROJECT

FERC NO. 12611

EXHIBIT E

ENVIRONMENTAL REPORT

DECEMBER 2019

Submitted by:

VERDANT POWER

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LIST OF ACRONYMS

USACE	United States Army Corps of Engineers
ADCP	Acoustic Doppler Current Profiler
BA	Biological Assessment
BO	Biological Opinion
CEII	Critical Energy Infrastructure Information
CEQ	Council on Environmental Quality
Commission	Federal Energy Regulatory Commission
CO-OPS	Center for Operational Oceanographic Products and Services
CORE	Cornwall Ontario River Energy
CR	Control Room
CZMA	Coastal Zone Management Act
D	diameter
DOE	Department of Energy
DTI	UK Department of Trade & Industry
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
EPB	Environmental Policy Board
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FMPP	Fish Monitoring and Protection Plan
ft	feet/foot
GHG	Greenhouse Gases
GHT	Gorlov Helical Turbine
ICD	Initial Consultation Document
IHA	Incidental Harassment Authorization
ILP	Integrated Licensing Process
INEEL	Idaho National Engineering and Environmental Laboratory
KHPS	Kinetic Hydropower System
LOA	Incidental Harassment Authorization
LPC	Landmarks Preservation Commission
m	meter
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NYC	New York City
NYCLPC	New York City Landmark Preservation Commission
NYDOS	New York State Department of State

LIST OF ACRONYMS *(continued)*

NHPA	National Historic Preservation Act
NYSDEC	New York State Department of Environmental Conservation
NYSEP	New York State Energy Plan
NYSERDA	New York State Energy Research and Development Authority
NYU	New York University
PATONS	Public Aids to Navigation
ppt	parts per thousand
RIBS	Rotating Intensive Basin Studies
RIOC	Roosevelt Island Operating Company
RITE	Roosevelt Island Tidal Energy
RTE	Rare, Threatened and Endangered
s	second
SFMP	Seasonal Fishery Monitoring Plan
SHPO	State Historic Preservation Office
TEV	Test Evaluation Vessel
TLP	Traditional Licensing Process
TMDL	Total Maximum Daily Load
UNFCCC	United Nations Framework Convention on Climate Change
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USNSRDC	United States Navy's David Taylor Model Basin
Verdant Power	Verdant Power, LLC
WI/PWL	Waterbody Inventory and Priority Waterbody List

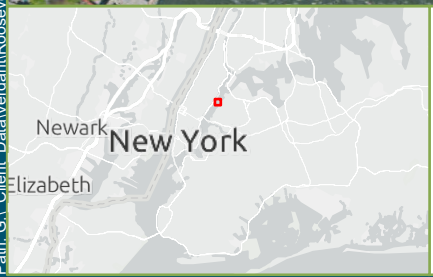
FINAL LICENSE APPLICATION
ROOSEVELT ISLAND TIDAL ENERGY PROJECT
FERC NO. 12611

EXHIBIT E
ENVIRONMENTAL REPORT

1.0 APPLICATION

Verdant Power, LLC ("Verdant Power" or "Applicant") is filing with the Federal Energy Regulatory Commission (FERC or Commission) a Final Application for an Hydrokinetic License (FERC No. 12611) for the Roosevelt Island Tidal Energy (RITE) Project ("Project") to include the staged deployment of up to 15 kinetic hydropower turbines with an estimated installed capacity of 0.5 MW, and additional project components as described herein. This Project would be located in the East Channel of the East River in New York City (Figure 1.0-1).

Project Location



Legend

- TriFrames
- Project Boundary
- County Boundary

Verdant Power, LLC

New York, New York

Drawn By:	Date Drawn:	Checked By:	Date Checked:
ADY	12-20-2019	TJO	12-20-2019

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Date Printed: 12/20/2019

Source: Esri, HERE, Garmin, FAO, NOAA, USGS, Kleinschmidt Associates

PN: 1642004.03

1.1 PURPOSE AND NEED FOR ACTION

1.1.1 Purpose of Action

The purpose of the Roosevelt Island Tidal Energy (RITE) Project is to install, operate, monitor, and deliver clean renewable energy in New York City from the Kinetic Hydropower System (KHPS). The KHPS unit is Verdant Power's patented[1] renewable energy system that converts the kinetic energy of tidal and river currents into electricity for distributed generation or grid connection. The proposed Project will utilize the fifth generation ("Gen5") of the KHPS, developed and refined through the original Pilot License. Through support from NYSERDA, the City of New York, FERC, the U.S. Navy, the Department of Energy, and other public and private sources, the RITE Project has become a world leader and model for the advancement of kinetic hydropower as a new and viable renewable energy resource.

1.1.2 Need for Power

The RITE Project meets many needs on both a local and global scale. First, the commercialization of the KHPS through the RITE Project will help advance kinetic hydropower as a cost-effective source of clean and renewable energy for the United States and world. As a newly tapped source of energy, kinetic hydropower will help meet both the nation and the world's growing demand for energy.

The RITE Project also meets New York's needs for renewable energy. New York has emerged as a leader in clean renewable energy and the New York Climate Plan that was signed in July of 2019 sets a 30-year goal for 100% renewable energy in the State. The RITE Project will help meet these goals and provide an ongoing demonstration of the viability and potential energy available from tidal power.

The Project will also help the New York and U.S. economies by establishing a new market for jobs and commerce through the commercialization of the KHPS units and the advancement of kinetic hydropower overall. Through the demonstration phase and the current

[1] Intellectual property coverage for the Verdant KHPS and related technologies includes six (6) existing patents and twenty (20) Gen5 KHPS patents in process. A detailed list is available upon request.

Pilot License the Project has sparked local commerce, led to new local hires, and begun to provide opportunities for local businesses to gain expertise on this emerging technology and energy source. By advancing kinetic hydropower in the United States, the Project will expand this type of commerce, job creation, and business knowledge, helping U.S. businesses lead the world in the development, global exportation, installation, and servicing of kinetic hydropower technologies.

1.1.3 Avoidance of Greenhouse Gas Emissions

The United Nations Framework Convention on Climate Change (UNFCCC) has concluded that greenhouse gas (GHG) emissions from developed nations must be reduced by 80 to 95 percent from year 1990 levels by the year 2050. As a result of this requirement, the State of New York established a goal in the 2015 Energy Plan to reduce GHG emissions in New York 40 percent below 1990 levels by the year 2030 and 80 percent by the year 2050. Distributed generation facilities are expected to provide the state with great benefits by reducing electricity prices and GHG emissions, while also improving energy source diversity and flexibility. The Project, and Verdant Power's KHPS overall, precisely meets this need for distributed generation sources of clean renewable energy.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 PROJECT DESCRIPTION

For the relicensing action, the RITE East Channel Pilot original Project Boundary would be reduced to approximately half the size and consist of a field array installation of a maximum of fifteen (15) hydrokinetic hydropower turbines (KHPS). The turbines would be installed in a staged manner which will comprise an initial install (B1) under the existing Pilot License of 3 KHPS units on a single TriFrame mount (105kW), followed by the further installation (B-2) of up to nine (9) additional KHPS units on 3 TriFrame mounts (420kW). A final installation (C) will follow some time later to increase the field size to 15 KHPS units on 5 TriFrame mounts. Each KHPS unit is a 5-meter diameter axial flow Gen5 turbine with an individual nominal capacity of 35kW, this will create a total maximum field capacity of 0.525 MW. Underwater cables from each TriFrame mount to a shoreline switchgear vault, that interconnect to the existing Control Room and interconnection points; and appurtenant facilities to ensure safe navigation and turbine operation.

2.2 PROPOSED ACTION

The proposed action for which the Applicant seeks a license is the development, testing, environmental monitoring, and ongoing operation of a 0.5-MW field of up to 15 kinetic hydropower turbines in the East Channel of the East River in New York City. This Pilot Project would consist of a phased build out of turbines with accompanying environmental monitoring. The sequences of the buildout would be:

- Install B-1: Under current Pilot License Install three 'Gen5' KHPS turbines on one TriFrame™ in 2020.
- Install B-2: Install 6-9 additional KHPS turbines on up to three TriFrames.
- Install C: Install the balance of 15 KHPS turbines, for a total of no more than 5 TriFrames.

Additional project components would include instrumentation (water current and temperature measurement devices) and environmental monitoring equipment required under the RITE Monitoring of Environmental Effects (RMEE) plans; underwater cables from each unit to two shoreline switchgear vaults; onshore conduit to the control room and interconnection points;

and appurtenant facilities for navigation safety, operation, and maintenance.

Based on the resource analysis of the temporal and spatial variation of tidal current velocities in the pilot field, the total proposed Project (Install C) would have an average annual generation of 840 to 1,200 MWh.

2.2.1 Location and Layout

The location of the Project is as depicted on Figure 1.0-1 and in Exhibits F and G. It extends from the Roosevelt Island Bridge northward along the east side of Roosevelt Island in the east channel of the East River.

The envisioned full buildout layout (Install C) of the Pilot Project would follow a regular pattern of 5 rows of TriFrames, each containing three KHPS turbines for a total of 15 turbines. The TriFrames are spaced longitudinally at 12D, where D refers to the diameter of the turbine (5 meters). Therefore, the row-to-row spacing is 60 meters or 197 feet. The TriFrames are offset in alternate rows so that the effective streamwise spacing (Row 1 to Row 3) is 24D (120 meters or 394 feet). This spacing is based on hydrodynamic issues related to optimal array operation, as verified by Verdant Power during the RITE Demonstration Project.

The Pilot Project of 15 KHPS units would encompass a project boundary of approximately 8.8 acres, which includes 8.5 acres of underwater land lease and .03 acres of shoreline right-of-way for the control room, cable vaults, and underground transmission lines. The incremental buildouts of Install B-1, B-2, and C will encompass small subset areas of the total project boundary as noted on the Exhibit F and G drawings.

2.2.2 KHPS Technology

The Verdant Power Gen5 KHPS unit consists of four major components:

- Rotor with three fixed composite blades;
- Nacelle (watertight), pylon and yaw mechanism;
- Drivetrain, integrated mechanical assembly (IMA) with generator and brake (within nacelle); and
- Riverbed mounting system, (three KHPS turbines on one TriFrame mount).

Rotor

A 5-meter-diameter, three-bladed turbine rotor will be used. The blades are fixed-pitch, with varying thickness, chord length, and twist. The three blades are mounted on a cylindrical hub with a diameter of 1 meter, and an axial length of approximately 0.45 meters. The blades are fabricated from composite materials (FRP) for increased strength and reliability and have been tested for strength and fatigue.

Generator and Drivetrain

The drivetrain consists of a 5-inch-diameter main shaft on which the rotor hub is mounted. In place of the former off-the-shelf drivetrain components used in the Gen4 demonstration, the Gen5 turbine features a custom designed drivetrain unit that integrates the bearing housing with a special long-life planetary gearbox. At the rotor end this unit incorporates high performance mechanical shaft seals and at the gearbox exit, this also includes an integrated adapter for direct mounting of the generator. The driveshaft continues through the generator and is further connected to a fail-safe brake mechanism.

The KHPS turbine generator is a standard 480 VAC, 1,800 rpm (four-pole) induction motor with a maximum rated power of 56kW, operated at a nominal maximum power of 37 kW (50 hp), with design elements intended for a hostile, humid environment. It has the ability to handle greater power levels for short periods.

The gearbox is a custom planetary-type, designed to increase the rotor speed of approximately 32 rpm to that of the generator which will be approximately 1,200 rpm at full power. The main drive train components, the seals, brake and gearbox, jointly the integrated mechanical assembly (IMA) all have undergone stand testing for performance and durability. All drivetrain components are designed to operate conservatively, in order to provide long maintenance cycles and long life.

The Gen5 turbine includes an automatic, spring-applied braking system that restricts rotation of the turbine blades in certain circumstances. The brake operates in a fail-safe mode whereby if a system fault is incurred or grid connection lost, the brake is automatically applied and will prevent rotation.

In the case of a grid failure at full power, the specification of the brake is such that it will limit the transient rotor speed to approximately 20% higher than nominal velocity for a few seconds prior to stopping the rotor fully.

Because of the power characteristics of the KHPS turbine rotor in water, it is possible to load it near-optimally with a quasi-fixed speed generator, even as the water current speed varies. While the power output of each turbine depends upon the actual water velocity at a given location, based on Verdant's operating experience at the RITE demonstration, the nominal rated capacity of each KHPS turbine to be used in the RITE East Channel Pilot is 35 kW, with a 56kW peak capacity. Because of spatial and temporal variation, velocities can vary widely within the array and on ebb and flood currents, at any given time all turbines in the array may not be generating power; or some turbines may be producing significantly more or less than the nominal 35kW. All drivetrain components are designed to operate conservatively, well below any speed and stress ratings, in order to provide long maintenance cycles and long life.

Nacelle, Cones and Pylons

The nacelle (horizontal body of the turbine) is a 0.75-meter-diameter cylindrical equipment housing made of mild steel with stainless steel end flanges that contain O-ring grooves for sealing. The total axial length of the turbine body, including nosecones at either end, is 4.8meters. The nacelle is a main structural member that carries the weight, torque, and other forces operating through the main bearing housing from the rotor and other equipment, back to the vertical mounting pylon. It is also the water-sealed protective housing for the turbine's main drive shaft, gearbox and generator. The latter is a simple and rugged induction generator that will be connected to the local electric grid via underwater cable. The fixed blades of the turbines rotate at a relatively slow and constant speed of approximately 32 revolutions per minute (rpm), with tip-speeds in the order of 28 feet per second. This is well below normal water vessel propeller speeds and conventional hydropower turbine blade speeds.

The nacelle is attached to the foundation by way of a vertical pylon. The Gen5 KHPS turbine nacelle is bolted to an outer pylon that mounts over an inner pylon, which is a welded part of the TriFrame. The outer pylon (with water-wetted yaw bearings) is lowered over the

inner pylon, which has matching stainless bearing races. The pylons have yaw stop elements that limit the turbine yaw to 172 degrees. Attached to the outer pylon is a FRP fairing to reduce the "tower shadow effect" thus minimizing flow disruption.

The pylon is installed over an inner pylon which extends from the TriFrame gravity foundation structure. The lower mounting flange of the pylon connects directly to the foundation and allows the pylon, nacelle and turbine to rotate around the inner mounting pylon. This allows the turbine to self-rotate into the prevailing current flow (weathervane) so that the blades are optimally aligned to generate energy on both the ebb and flow tides. The pylon rotation is restricted so as to prevent wind-up of the power and signal cables. This yaw method avoids the use of slip-rings and the need to seal the pylon and yaw bearing assembly. The yaw bearing allows passive rotation of the entire turbine assembly up to 172 degrees during slack tide. Watertight electrical connectors are located within the area of the nacelle/pylon flange. Electrical cables travel along the exterior of the pylon assembly, down to the mounting system to the riverbed, and then are bundled to a Power cable which extends to the shore and interconnects at the Control Room.

TriFrame- Riverbed Mounting System

Since 2015, Verdant Power has undertaken a design cycle on the riverbed mounting system reexamining alternative mounting systems that can be economically and accurately deployed and retrieved, have a small bottom footprint, and are stable and suitable for long-term operation in fast water on the riverbed with limited or no anchoring. The design being implemented for Install B-1 is what is being called a 'TriFrame' mount. This structure is a 'hybrid' structure that uses a combination of gravity and physical shape to secure to the riverbed.

The TriFrame design is a steel space-frame structure that can support multiple (three) turbines. The design relies primarily on shape and weight for restraining the system from the water current forces. One advantage to this approach is that multiple turbines are installed with one deployment operation. At the RITE site, following both geotechnical and bathymetric investigation, the TF is designed to be securely mounted with no additional fastening required. It is placed with a specific use designed tool, the Launch and Recovery System that specifically

places the TriFrame in a predetermined location with the use of the TriFrame Positioning System that achieves level installation. The design also does not require major pile drilling or explosives for installation. The components of the KHPS technology are discussed in more detail in Exhibit A of this License Application.

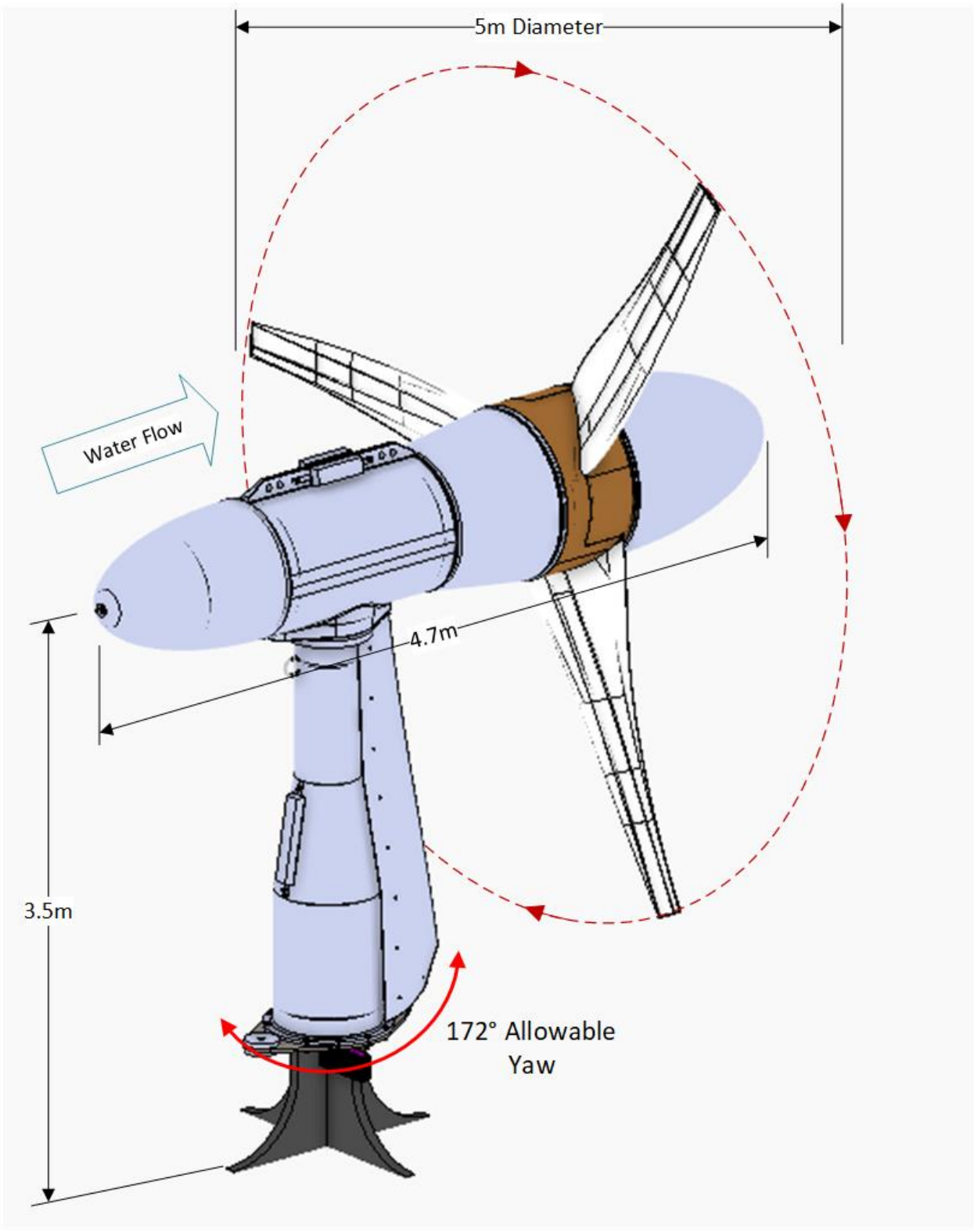

Figure 2.2.2-1. Gen5 KHPS Turbine

2.2.3 Underwater Cabling, Shoreline Vaults and Interconnection

The Verdant Power KHPS is designed to have limited above-water facilities. The RITE East Channel Pilot will include 480V electrical cables (no hydraulic oil systems) from each of the 15 KHPS turbines. Cables will travel through the pylon assembly of each turbine to the TriFrame mount. For each TriFrame mount, the three turbine cables will be bundled together into a set, which will then be routed from the field, weighted along the riverbed and connected to one of two shoreline switchgear vaults.

The existing RITE Licensed East Channel Pilot Control Room will continue to serve in the relicensed project. The Roosevelt Island Operating Company (RIOC) has indicated that a relocation of the Control Room and vault locations may need to occur under the new license and Verdant will be consulting with RIOC under the remaining term of the Pilot License to determine optimal locations. The Control Room serves to receive the Power and Data cables from the TriFrames, thus interconnecting the SCADA for the turbine array, as well the interconnection point for the Acoustic Doppler Current Profiler (ADCP) units.

2.2.4 Appurtenant Facilities

Under the existing Pilot License, Verdant implemented the installation of additional facilities in accordance with the following license articles:

- *Article 401 RITE Monitoring of Environmental Effects (RMEE) plans:* Under the License and NYS WQC requirements, environmental monitoring equipment such as hydroacoustic receivers and noise sensors is or will be installed in the water proximate to the turbine array. Verdant maintains this equipment as required.
- *Article 402 Public Safety- Emergency Shutdown Plans:* This plan was approved by FERC in 2012; and requires, *"daylight video surveillance of the project boundary, for after the fact vessel intrusions."* Verdant has implemented this equipment and system for Install B-1 and proposes to continue this under a new license.
- *Article 404 Navigation and Safety Plans:* This Article requires consultation with the USCG on the *"number and location of buoys to define the exclusion zone."* For Install B-1, Verdant has made these consultations and as approved by the USCG in conjunction with NOAA for navigational charting, will establish two lighted buoys and two lighted danger signs at each end of the array. Verdant remains committed to continue consultation with the USCG as the relicensed array moves forward, to establish buoys, charting and danger signs as required to protect Public safety.

- Article 407 *Interpretive Displays*: For public education, Verdant provided an information board at the Control Room under the existing License. Verdant proposes to maintain the informational board as Install B-2 and C advance in a new license.

2.2.5 Project Design, Manufacturing and Construction

Design

Install B-1 included significant technology development and design cycles for the Gen5Turbine technology and the river mount (TriFrame) system, as well as considerations for installation and long-term Operations and Maintenance, in the form of a *"Retrieve and Replace"* strategy. Lessons learned from the 2020-2021 installation and operation will inform future deployments, however it is generally expected that the design of Gen5 Turbine, TriFrame and LARS for Install B-1, will be the same for future RITE deployments.

Manufacturing

For the Install B-1 deployment under the existing License, Verdant developed a US supply chain for the first four Gen5 Turbines, relying on expertise of contracted manufacturing professionals (MRI; succeeded by Dovetail Solutions, Inc.). Procurement of components, including First Article inspections under a manufacturing QMS systems, leading to assembly and testing prior to planned deployment at the RITE site.

By using experience gained manufacturing these initial four units, Verdant has been developing a manufacturing/scale-up plan to provide the 15 KHPS turbines (plus 5 spares) for the subsequent RITE East Channel License. The focus of the manufacturing effort continues to be on key factors of suitability, quality control, and leading to ultimate volume cost reduction. Similarly, a US supply chain for the fabrication, assembly and Turbine integration of the TriFrame was also established and could be expanded for a relicensed project, with local Pennsylvania, New York and New Jersey suppliers.

Construction and Installation Schedule

For the subsequent RITE East Channel License, Verdant intends to use a staged installation procedure to ensure ongoing design validation.

- **Install B-1: Install a single TriFrame with Three Gen5 Turbines**
    - Install B-1 is being executed under the terms of the existing FERC Pilot License, including a NYSDEC WQC; and pending USACE Nationwide Permit No. 52 approval. The initial purpose would be to test the new TriFrame mount component of the technology and prove operation and maintenance techniques.
    - The environmental monitoring, as amended by FERC (October 4, 2019 Order) continues, specifically, RMEE 4, 5, 6, and 7 to be implemented during the 2019-2021 timeframe.
- **Install B-2: Install up to Three Additional TriFrames of Three Turbines Each**
    - Install B-2 would be completed under the new FERC License and additional authorizations; and expand the project to up to 12 operating turbines, should favorable project development conditions arise. This stage would include RMEE *"adaptive management review"* based on the results of Install B-1; but likely would include some modifications intended to be within an array of multiple Gen5 machines to increase the understanding of environmental effects.
- **Install C: Install up to one Additional TriFrame with no more than 15 turbines total**
    - Incremental build out of the full project; incorporating the results of technology and environmental testing in previous stages.
    - This would also be done under the new FERC License.

Through the RITE demonstration (2005-2009) and the Pilot License (2012-2021), Verdant has conducted multiple turbine deployments. The Install B-1 installation is currently in planning with three local marine contractors providing vessel and crane support for the install which is expected to take less than a week. Based on this experience, Verdant expects future construction periods to be equally short.

Other key points of the installation process include:

- Shoreline ground disturbance (if any) is expected to be <1 acre consisting of existing RITE Control Room final location and electrical interconnection; including the location of power and data cabling to shore from the installed TriFrames.
- The LARS system precludes the need for any pile or ground disturbing activities in the river channel. Diver intervention will be minimized but is still needed for shoreline cable weighting and connections.

A detailed construction/installation schedule will be developed under the new license.

2.2.6 Proposed Project Operations

The RITE East Channel Pilot will operate using the natural tidal currents of the East River. The Verdant KHPS captures energy from the flow in both ebb and flood directions by yawing with the changing tide, using a passive system with a downstream rotor. As the flow direction changes, hydrodynamic forces on the rotor, nacelle, and pylon all contribute to yaw torque to align the rotor with the flow. There are no sensors, controls, or actuators to yaw the turbine. Turbine yaw is limited at 172° to ensure that the turbine will rotate in the same direction as the tidal current changes to allow a simple power cabling arrangement without slip rings. The Gen5 turbine utilizes a fixed blade design which Verdant considers to be essential to reliable long-term underwater operation. These elements together contribute to a far simpler design than any active system to control turbine yaw or blade pitch, as there are far fewer elements to foul or fail.

The specific design of the Gen5 KHPS turbine fixed-blade rotor allows good load-matching of the rotor over a range of water velocities to provide a near-constant speed to the induction generator. Generator control is limited to a contactor and brake which are operated automatically, via an internal multi-function relay with standard protective functions which is in turn controlled by a novel circuit used to close the contactor and release the brake when the water velocity is adequate to provide power. The turbine brake is a fail-safe, spring-operated unit that prevents the rotor from turning until the water velocity is adequate to provide power. In addition, the brake is automatically applied if certain failure modes occur. In line with Verdant's philosophy of simplicity and reducing failure modes, this function requires absolutely no additional sensors or instrumentation within the turbine, or associated data cabling, thus enhancing reliability. This simple control of the generator operates automatically and unattended.

For the RITE Install B-1 (and subsequent TriFrames), an industrial standard real-time automation controller (SEL- RTAC) custom adapted for the RITE Project acts as the backbone

of a SCADA (Supervisory Control and Data Acquisition) system operating in the RITE Control Room. The SCADA acquires generator status and performance for each turbine in the overall KHPS array, and with the water velocity data controls the application of the brake at tide change. A data historian will collect and store all generation data and provide secure remote internet-based access. The system will integrate information from the installed turbines and ADCP instrumentation, allowing real-time and post-processed power performance, load monitoring and evaluation.

The Verdant Gen5 turbines are intended as an independent system, passively yawing, starting-up, generating, shutting down and yawing again on slack. All nominal operations are unattended and monitored remotely. In addition, there are no hydraulic systems, therefore operational monitoring of levels or pressures is eliminated. During the RITE demonstration, which extended over 9,000 hours of operation (2005-2009), the system was monitored remotely daily and was only visited periodically for other instrumentation checks. This experience will be confirmed in the 2020-2021 Install B-1 period.

Specific network protection electrical relaying is intended to operate in the same manner as a remote hydro where devices are locked-out and require human intervention to reset. Verdant has included a similar scheme for the licensed RITE East Channel Pilot, with remote-monitoring and no manned control center, but with the availability of dispatch personnel to check the interconnection as required.

The operation of the Verdant KHPS is unique in many distinct areas:

- The operation of the KHPS follows a very predictable tidal cycle, quite dissimilar to the hydrologic cycle of conventional hydropower. This predictive cycle follows a four-time per day on-off cycle with slack tides of no generation, and monthly periods of high spring tides, and lower neap tides with corresponding higher and lower generation periods. While this cycle permits extreme predictability for generation (and O&M activities), it allows no flexibility in terms of seasonal alternative operation. Once deployed, the KHPS turbines continue to yaw (either under load or not) on both ebb and flood cycles.
- As approved in the Pilot license under Article 402, the emergency shutdown of the project can be initiated through a notification flow chart established in an Emergency Action Plan (EAP) for External incidents detected by others such as

the USCG or Public safety entities or Internal incidents detected by Verdant. In either case, if warranted, he Gen5 turbine array can be stopped via the SCADA applied brake.

- For maintenance, a periodic maintenance cycle of Retrieve and Replace (R&R) is expected for the array based on performance of the individual turbines. A 15-turbine KHPS array will likely have periods when some percentage of the turbines are in a 'no-load' condition (i.e., not producing electricity) due to a mechanical or electrical issue. Verdant is optimistic that this percentage will be low due to the simple yet robust design concept of its technology. It should also be noted that, in a no-load condition, the automatic brake would be applied, and turbine rotors would cease rotating. However, because of the first-ever nature of this scaled-up installation, and under the basic premise of a hydrokinetic pilot license operation, flexibility in maintenance decisions is the only alternative for operation of a field of KHPS turbines.

Table 2.2.6-1. KHPS operating schedule (RITE).

Tide	Unit Condition	KHPS Rotors	Generating?	Duration
Slack tide	Transitioning (yaw) from flood to ebb	Rotating at 0-32 rpm	No	~1 ½ hrs.
Ebb flow	Unit fully in ebb position	Rotating at loaded speed 32 rpm	Yes	~4 hrs.
Slack tide	Transitioning (yaw) from ebb to flood	Ramp down from 32 to 0 and 0 to 32 rpm	No	~1 ½ hrs.
Flood flow	Unit fully in flood position	Rotating at loaded speed 32 rpm	Yes	~4 hrs.

This illustrates the ~12-hour operating schedule for the RITE East Channel Project. Each KHPS turbine will begin to rotate automatically when the water velocity is high enough for generation and will independently load and generate. As the water velocity begins to decrease the KHPS will trip off and lock the blades in position as slack tide approaches. The locking of the rotor during this phase of operation greatly reduces unwanted forces on the blades. During this time the machine will passively yaw to the flood position, where it will begin to rotate again, loading to the grid automatically and generating on flood tide. The application of the brake will prevent turbines from free rotating in a “no-load” condition and will therefore reduce maximum blade velocities and forces.

2.2.7 Proposed Project Maintenance

The design philosophy of the Verdant Power KHPS units includes an imperative for simplicity and ruggedness so that operating and maintenance costs are minimized. This is necessary due to the mobilization and time-on-site costs for deployment equipment and personnel. The turbines are designed to be installed, commissioned, and then operate unattended. The minimum target service period is 3-5 years.

The proposed plan for maintenance, as was conducted in the RITE demonstration, is a *"Retrieve and Replace"* strategy with inspection and servicing of the retrieved turbine being conducted on-shore. Both for construction and maintenance in a tidal current, the short 1.5 – 2-hour duration of slack tides is the only period suitable for maintenance activity. During Deployment #3 of the RITE demonstration (September 2008), Verdant was able to execute removal and replacement of one KHPS turbine in under 7 hours (during two tidal cycles). This will be the target metric for servicing the Install B-1 project to be executed in 2020, and the model for a relicensed larger array of the RITE East Channel Pilot. No turbine servicing will be performed on site, but a local service shop is expected to be established to refurbish KHPS turbines for the array.

With 15 KHPS turbines planned to be installed through the RITE East Channel Pilot (as well as 5 planned spares), and depending on the attrition rate and location, the turbines may be serviced either on a regular schedule or an on-demand basis. For this size array, remote generator performance monitoring can give notice of a turbine failure or advance notice of an incipient failure.

2.3 NO-ACTION ALTERNATIVE

The no-action alternative would be to remove the components of the Pilot project and not go forward with a staged development of a commercial tidal energy project in the East River.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

Verdant Power has undergone a lengthy process that included assessing alternative sites

and technologies, addressing concerns of various agencies and stakeholders, and refining the project concept and technology to arrive at the currently proposed project and phased construction approach. Verdant Power also considered and developed a variety of technologies and technological solutions to the challenges of this new waterpower industry.

2.4.1 Alternative Sites Considered

Verdant Power considered a number of alternative sites in developing this proposed project boundary. The primary criteria for siting Verdant Power's kinetic hydropower systems is the availability of adequate water velocities and depths and the acceptability of areas for co-location of other water uses such as commercial and recreational navigation and non-interference with sensitive environmental areas. Another important factor in considering siting is the need and desire by New York City (NYC) and the State of New York to encourage renewable electricity development.

Additional sites were analyzed by Verdant Power as part of developing the RITE East Channel Pilot License Project Boundary. In May 2002, Verdant Power filed for its initial preliminary permit in the East River (P-12178). The initial preliminary permit application considered a site that encompassed the entire eastern shore of Roosevelt Island, described as "the East Channel of the East River approximately 37.5 acres extending from the southern tip of Roosevelt Island to the northern tip of Roosevelt Island." This site was anticipated to be a 10-MW site (494 KHPS turbines) and of a size that would provide significant renewable energy to NYC and New York State. The preliminary permit was renewed in November 2005 (P-12611) with the same site considered. During the course of initial consultations, the initial project boundary was modified for the following reasons:

- The southern tip of Roosevelt Island to the 59th Street Bridge: Verdant Power decided against this site because of insufficient water velocities for kinetic power development;
- The area between the 59th Street Bridge and the Roosevelt Island Bridge: Verdant Power decided against this site due to conflicts with commercial barge traffic making deliveries to the Ravenswood generating facility; and
- From the Roosevelt Island Bridge to the northern tip of Roosevelt Island: Verdant Power found this to be an ideal site, and a portion of this area was developed as the location of the RITE Demonstration Project.

In August 2006, in order to achieve the stated goal of producing 10 MW of energy in the East River, Verdant Power began to consider a different project area, north of the Roosevelt Island site in an area extending from the Triborough Bridge (Hell Gate) north to Lawrence Point in the general area of Astoria, Queens. Verdant Power applied to amend its preliminary permit (P-12611) to include this continuous project boundary extending to the Astoria area. This project boundary was the boundary considered by agencies during a March 2007 FERC scoping meeting.

In March 2007, Verdant Power met with the Navigation and Security Study Group in Verdant Power's offices on Roosevelt Island. At that meeting, representatives of the U.S. Coast Guard and active commercial and recreational vessel operators as part of the Harbor Operations Committee voiced compelling objections to development in the area extending north in the Astoria, Queens area. In the spirit of cooperation and in support of Verdant Power, the U.S. Coast Guard provided supplementary maps of five areas where, through consideration of the federal navigation channel and polling of commercial and recreational interest groups, they believe that kinetic hydropower turbines can be co-located within the waters of the East Channel. Verdant Power considered all five sites; however, only two sites were considered to have adequate velocities to support kinetic hydropower development.

In April 2007, Verdant Power again applied to amend its preliminary permit. FERC approved this amendment in June 2007 to include two areas. After hearing a number of objections from navigation interests and reevaluating technology issues, Verdant Power decided against trying to develop in the West Channel of Roosevelt Island and focused only on development in the East Channel under the Pilot License. Continued monitoring and testing during the Pilot license term confirmed that this location is an ideal site for hydrokinetic turbine testing and deployment with minimal user conflicts and potential environmental impacts.

3.0 CONSULTATION AND COMPLIANCE

3.1 AGENCY CONSULTATION AND COORDINATION OF REVIEW AND COMMENTS

Verdant Power has a long and ongoing history of working with regulatory agencies and stakeholders in a cooperative spirit to understand and address concerns associated with this new and revolutionary method of power generation. Verdant has been active at the RITE site for over 15 years achieving the development of a hydrokinetic project that would harness energy from the strong tidal currents in the East River. Verdant filed an Initial Consultation Document to license the project in 2003 and since that time has conducted numerous studies to understand potential environmental, recreational, or other possible issues associated with a test project deployment. Under the "Verdant Order" (2005), Verdant installed and operated a tidal kinetic hydropower array in the East River from 2006-2009. In December 2010, Verdant filed a final license application (FLA) for a Pilot License. On January 23, 2012 the Commission issued a 10-year Pilot License effective January 1, 2012 (FERC Project No. 12611). This was the first Pilot License issued by the Commission. It was developed in accordance with the guidance provided in the Commission's whitepaper, "Licensing Hydrokinetic Pilot Projects" (August 2007) and in accordance with the Commission's regulations under 18 CFR Part 5.

This license included a staged deployment with environmental monitoring to determine if there are any impacts before expanding the array, an agreement to alter, shut down, or remove the project if unacceptable risks to the public or environment are shown through monitoring efforts, and provisions for ongoing monitoring of environmental conditions in the project area.

Since License issuance, Verdant has worked diligently to comply with the terms of the license. Verdant has made continual progress during this time in developing the project technology while also continuing to collect good baseline environmental and other data that shows the East Channel of the East River near Roosevelt Island is a viable site for tidal power. As defined in the Commission's white paper, "Pilot projects are small, short term, removable, and carefully-monitored projects intended to test technologies, sites, or both." All of the data collected during the Pilot License term to date confirms that this is an ideal site for testing and development of tidal power with minimal potential for environmental impacts. From this we

conclude that the Pilot project was successful for further characterizing and testing the site, though the full testing of the technology has not yet been completed.

Verdant originally filed a request for license extension on December 29, 2017. On May 3, 2018, FERC issued the "Order Denying Extension of License Term" and instructed Verdant to file a Pre-Application Document within 120 days of the Order. Verdant submitted a timely request for rehearing of this Order and FERC denied the request on July 19, 2018. Verdant subsequently filed for an application for new license on August 31, 2018.

FERC approved use of the Traditional Licensing process on November 13, 2018. Verdant held a joint agency/public meeting JAM meeting on Roosevelt Island in New York on January 8, 2019 and filed a summary of the meeting on February 4, 2019. In letters filed on March 4 and 11, 2019, the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) notified Commission staff that the January 8 meeting was held during the funding lapse at certain federal agencies between December 22, 2018, and January 25, 2019, and therefore NMFS and FWS staff were unable to participate. As a result, NMFS and FWS requested that Verdant conduct another joint meeting and site visit. The Commission granted the agencies' requests and asked Verdant to hold a second JAM meeting. Verdant held this subsequent meeting on May 16, 2019. On October 11, 2019, FERC approved Verdant's request for a waiver from the requirement to file a draft License Application for the Project. Verdant held a teleconference with agencies on November 15, 2019 to discuss monitoring plans under the new License. Minutes of this meeting are included with this filing and the monitoring plans have been filed in Volume 4 of the License Application.

3.2 COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

3.2.1 Clean Water Act - Sections 401 and 404

Pursuant to Section 401 of the Clean Water Act, as amended, any activity requiring a federal license or permit that may result in discharge into navigable waterways requires certification from the state that confirms that any such discharge will comply with applicable state water quality standards. This required Verdant Power to obtain Section 401 Water Quality certification prior to issuance of the Pilot License and a subsequent USACE permit under Section

404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.

Verdant Compliance and Consultation:

Verdant Power is in compliance with requirements of the Section 401 water quality certification for the RITE Pilot project. Verdant Power will be filing for a new Section 401 certification in association with this new License.

3.2.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act established exclusive United States authority over all fishing within the exclusive economic zone (200 nautical miles from shore) and is the primary law governing fisheries management in the United States. Before any federal agency can authorize a project that will impact Essential Fish Habitat (EFH), it must be reviewed by the NMFS, who will then respond with recommended steps to avoid or minimize any adverse impacts. The authorizing federal agency must develop an EFH Assessment, and NMFS will review the EFH Assessment and provide conservation recommendations.

Verdant Compliance and Consultation:

Essential Fish Habitat (EFH) is determined by identifying spatial habitat and habitat characteristics that are required for each federally managed fish species through a cooperative effort by NMFS, regional fishery management councils, and federal and state agencies. The proposed project area contains EFH for 18 species/lifestages. The area does not support anadromous fish migration or spawning. Supplemental information pertaining to project effects on EFH was provided in an EFH assessment prepared by Verdant that was submitted to NMFS. In a letter filed on March 4, 2011, NMFS stated that the EFH assessment is suitable for addressing its needs. FERC concluded in the final environmental assessment for this project (FERC 2011) that “licensing the project would not likely adversely affect EFH for any of the 18 species located in the project area.”

In conjunction with this Final License Application, Verdant Power has reviewed the list of potential EFH species/lifestages and found no changes from the previous assessment. developed a draft EFH Assessment document for review. This is included in Volume 4 of this License Application.

3.2.3 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972 is administered at the federal level by the Coastal Programs Division within NOAA's Office of Ocean and Coastal Resource Management. In New York State the NYS Department of State (NYSDOS), Office of Coastal Resources administers the CZMA. The enforceable policies of any Local Waterfront Revitalization Program for New York City, the New Waterfront Revitalization Program, is administered by the Department of City Planning. For federal and state actions within the city's coastal zone, the Department of City Planning will forward consistency determination comments to the Department of State. NYSDOS is responsible for the consistency determination, which is necessary for the FERC license and USACE permits.

Verdant Compliance and Consultation:

During the course of the preliminary permit, Verdant Power consulted with both New York State and New York City to determine consistency and applicability of the proposed project with these requirements for the RITE Demonstration Project. Verdant Power will be submitting the NYC Local Waterfront Revitalization Plan (LWRP) Consistency Assessment form (and associated application materials) to the Department of State.

3.2.4 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires an authorizing or acting federal agency to consult with USFWS/National Marine Fisheries Service (NMFS) on any actions that might affect listed species or their habitats. If the authorizing/acting agency or USFWS/NMFS determines an action is likely to adversely affect a species, formal consultation is required with USFWS or NMFS depending on their jurisdiction over the listed species. Formal consultation consists of submittal by the authorizing/acting of a Biological Assessment (BA) for review by USFWS or NMFS. Upon review of the BA, USFWS/NMFS would each prepare a Biological Opinion (BO) which assesses whether the action is likely to impact the existence of the listed species. The BO may include binding and/or discretionary recommendations to reduce potential impact. An Incidental Take Statement may be attached to the BO if there is potential impact to the species.

Verdant Compliance and Consultation:

As part of the Project relicensing, Verdant Power requested and was designated FERC's non-federal representative to initiate consultation pursuant to Section 7 of the ESA. Verdant Power has prepared Draft Biological Assessments (BA) for Shortnose and Atlantic Sturgeon, as well as for sea turtles that could potentially traverse through the project area. These are attached as Attachment 1 to Volume 4 of this Final License Application.

As fully examined in the FERC and WQC licensing, six federally listed species have the potential to interact with the project:

- the threatened Green Turtle and Loggerhead Turtle
- the endangered Shortnose Sturgeon and Atlantic Sturgeon (listed January 2012)
- the endangered Kemp's Ridley Turtle and Leatherback Turtle

In a letter dated May 16, 2011 to FERC from the NMFS Regional Administrator re ESA Section 7 Consultation for the Verdant Project (FERC No. 12611-005), NMFS agreed with FERC's determination that Verdant' s RITE Project is not likely to adversely affect any species listed by NMFS. This determination includes the Shortnose Sturgeon, Loggerhead Turtle, Kemp's Ridley Turtle, Green Sea Turtle and Leatherback Sea Turtles. In addition, two species proposed for listing at the time, the Atlantic Sturgeon and Loggerhead Turtles (proposed listing change from threatened to endangered) were analyzed. NMFS concluded that it is not reasonable to anticipate that the Verdant' s RITE Project is likely to jeopardize the continued existence of Atlantic Sturgeon or Loggerhead Sea Turtles.

FERC's Environmental Assessment for the RITE Project license (FERC 2011) concluded "Construction and operation of the project would likely have only minimal effects on rare, threatened, and endangered species. The proposed Tagged Species Detection Plan that includes measures to collect data on tagged (VEMCO) fish in the East River near the proposed project would provide useful information on the migratory use of the east and west channels of the East River by federally listed species (Shortnose Sturgeon, Atlantic Sturgeon) and fish with essential fish habitat in the project area (Striped Bass, Bluefish). The proposed measures to monitor and

record species and migration occurrences in the project area would provide useful information on the use of the proposed project area by species."

Under the RMEE-4 Tagged Species Detection plan, Verdant implemented data collection of tagged species in the vicinity of the RITE Project in May 2011 and has continued this plan through 2019 and submits this data annually to the agencies and FERC. Information from these studies have helped to refine predictions of sturgeon interactions with Project turbines. Additionally, Verdant conducted RMEE-3 species characterization netting in May 2013, under appropriate NYSDEC and NOAA scientific collection permits (no ESA species were collected).

Verdant has consulted with NMFS and other resource agencies in the development of study plans for studies to be conducted under the new Project License.

3.2.5 Section 106 Consultation

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effect of federally permitted projects on historic and cultural resources and requires consultation with the State Historic Preservation Officer (SHPO) prior to authorizing a project. Compliance with Section 106 of the Act also requires consultation with tribes in the region. SHPO consultation also satisfies New York State Historic Preservation Act of 1980. FERC typically satisfies Section 106 requirements for a license term through a Historic Properties Management Plans (developed by the applicant in consultation with the SHPO) or a Programmatic Agreement to which FERC, the SHPO and ACHP are typically the signatories. Environmental review by New York City Landmark Preservation Commission (NYCLPC) is required for projects that require in-ground disturbance and that may affect landmark properties (or historic districts).

Verdant Compliance and Consultation:

As part of the relicensing process, Verdant Power requested and was designated as FERC's non-federal representative pursuant to Section 106 of the NHPA. During the course of the original Pilot Licensing, Verdant Power had several consultations regarding the NHPA and designated properties in and around the pilot project site. On land, there are no Nationally

Registered historic places, archaeological sites, or landmarks near the immediate project area. In April 2007, Verdant Power conducted a side-scan sonar survey to look for underwater wreckages in the project buildout area. There were no wreckages found in the project footprint.

In November 2018, FERC initiated Tribal consultation for the new Project License with four tribal entities in the New York City area, inviting consultation on the Project. During the Pilot License process, The Delaware Nation submitted a letter stating that the location of the project does not endanger known sites of interest to the Delaware Nation though they requested that they be notified if any archeological sites or objects were inadvertently uncovered. The New York State SHPO sent a letter, dated December 22, 2008, stating that "the project will have No Adverse Effect on cultural and historical resources eligible for or listed on the National Register of Historic Places."

FERC's Environmental Assessment for the RITE Project license (FERC 2011) concluded "Construction and operation of the project would not likely affect cultural resources, since the land-based features of the project would not affect any sites on the National Register, and any construction would take place in previously disturbed areas. The proposed consultation with the New York SHPO and Delaware Nation on any unanticipated discoveries of cultural materials or human remains during construction activities and over the license term, and regarding any new post-construction land clearing or ground disturbing activities undertaken in the future, would ensure the protection of any cultural resources in the project area for the term of any license."

The only change from the Pilot License is that Verdant is reducing the number of TriFrames from 10 to 5 further reducing the potential for the Project to affect cultural resources.

3.2.6 Marine Mammal Protection Act (MMPA)

For marine mammals that are not endangered but are still protected under the MMPA, two types of permits can be issued: (1) Incidental Harassment Authorization (IHA) issued by NOAA for non-lethal takes only for a period of 1 year with annual renewals; or, (2) Letter of Authorization (LOA or Incidental Take Authorization) issued by FERC, for a period of 5 years.

Verdant Compliance and Consultation:

Anecdotal evidence has preliminarily indicated that the only marine mammals likely to be in the vicinity of the project area are harbor seals. Verdant Power has prepared a draft Biological Assessment (BA) on potential impacts to harbor seals and this is included in Attachment 3 of Volume 4 of the Final License Application.

3.2.7 Wild and Scenic Rivers and Wilderness Act

This statute is not applicable to the RITE Pilot Project.

3.2.8 Pacific Northwest Power Planning and Conservation Act (Act)

This statute is not applicable to the RITE Pilot Project.

4.0 ENVIRONMENTAL ANALYSIS

4.1 DESCRIPTION OF PROJECT AREA

The East River is a 17-mile-long tidal strait connecting the waters of the Long Island Sound with those of the Atlantic Ocean in New York Harbor. The East River separates the New York City boroughs of Manhattan and the Bronx from Brooklyn and Queens. The Harlem River flows from the Hudson River and connects with the East River at Hell Gate. The East River is not a freshwater river normally described in a FERC application, but a saltwater conveyance passage for tidal flow. There is some freshwater influence from the Harlem River and some direct drainage area from the surrounding metropolis, but the river is predominantly controlled by tidal influence. Figure 1.0-1 provides the project location.

4.2 SCOPE OF THE PROJECT SPECIFIC AND CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's (CEQ) regulations for implementing National Environmental Policy Act (NEPA) (40 CFR §1508.7), an action may cause cumulative effects on the environment if its effects overlap in time and/or space with the effects of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Aquatic resources are the primary resource area having the potential to be cumulatively affected by the Project. The geographic and temporal scope for both project-specific and cumulative effects is discussed below.

4.2.1 Geographic Scope

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action's effect on the resources. Because the proposed action would affect resources differently, the geographic scope for each resource may vary. The geographic scope of the effects analysis broadly includes the East River in the area of the proposed Project.

4.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and reasonably foreseeable future actions and their effects on cumulative affected resources. This Pilot License Application is for a 40-year term which would expire in 2061. This document looks to the future, to the duration of the amended license, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information.

4.3 PROPOSED ACTION AND ACTION ALTERNATIVES

4.3.1 Geology and Soils

4.3.1.1 Affected Environment

Geology

The Urban Core of the New York Bight[2] is situated along the boundaries of three distinct physiographic provinces: the Piedmont Province; the New England Province; and the Atlantic Coastal Plains. The convergence of these provinces provides a diversity of landforms, soils, botanical communities, and habitats within the Urban Core (USFWS, 1997).

The bedrock of New York City and the East River include the Middle Proterozoic Fordham Gneiss, the Cambrian Manhattan Formation (schist), and of the Cambrian and Ordovician Inwood Marble. Outcrops of these formations display the northeast-trending known to New York statigraphy. The Manhattan skyline owes its existence to the durability of its bedrock. Riprap made up of Manhattan bedrock (schist, gneiss) lines the East River's shores, helping to prevent erosion with its durability (USGS, 2003).

Soils

In consultation with the NYSDEC, NMFS, the USFWS, USACE, the New York Department of State, and the New York City Department of Environmental Protection, Verdant

[2] A "bight" is a mariner's term for a bend or curve in the shoreline of an open coast; in the New York region it refers to the ocean between Long Island (to the north and east) and the New Jersey Coast (to the south and west). The East River is a tidal strait that links Long Island Sound and the New York Bight.

Power conducted two separate field surveys of the seabed substrate in advance of the original Pilot License.

Both surveys used a high-resolution side-scan sonar device at frequencies of 500 kHz and 100 kHz respectively. Detailed images of the riverbed features were generated from data collected and included in the reports which were filed as part of the original Pilot License Application. These studies confirmed the presence of boulders and cobbles and did not show any evidence of fine grain soft sediments. Five substrate classes were identified in the survey area: ledge or exposed rock; boulders; cobbles; gravels; and sands.

During the Pilot License term in November 2015 Verdant contracted Ocean Surveys, Inc. (OSI) to conduct additional high-resolution bathymetric surveys in the East Channel of the East River, north of the Roosevelt Island Bridge. The results, presented in Figure 4.3.1.1-1 and Figure 4.3.1.1-2, agree with previous studies and increases the coverage and quality of the bathymetry data within the RITE Project Boundary. The 2015 bathymetric survey is IHO Order 1a compliant; 100% of the sounding points have a Total Horizontal Uncertainty (THU) value of 0.26 m or less and a Total Vertical Uncertainty (TVU) value of 0.32 m or less.

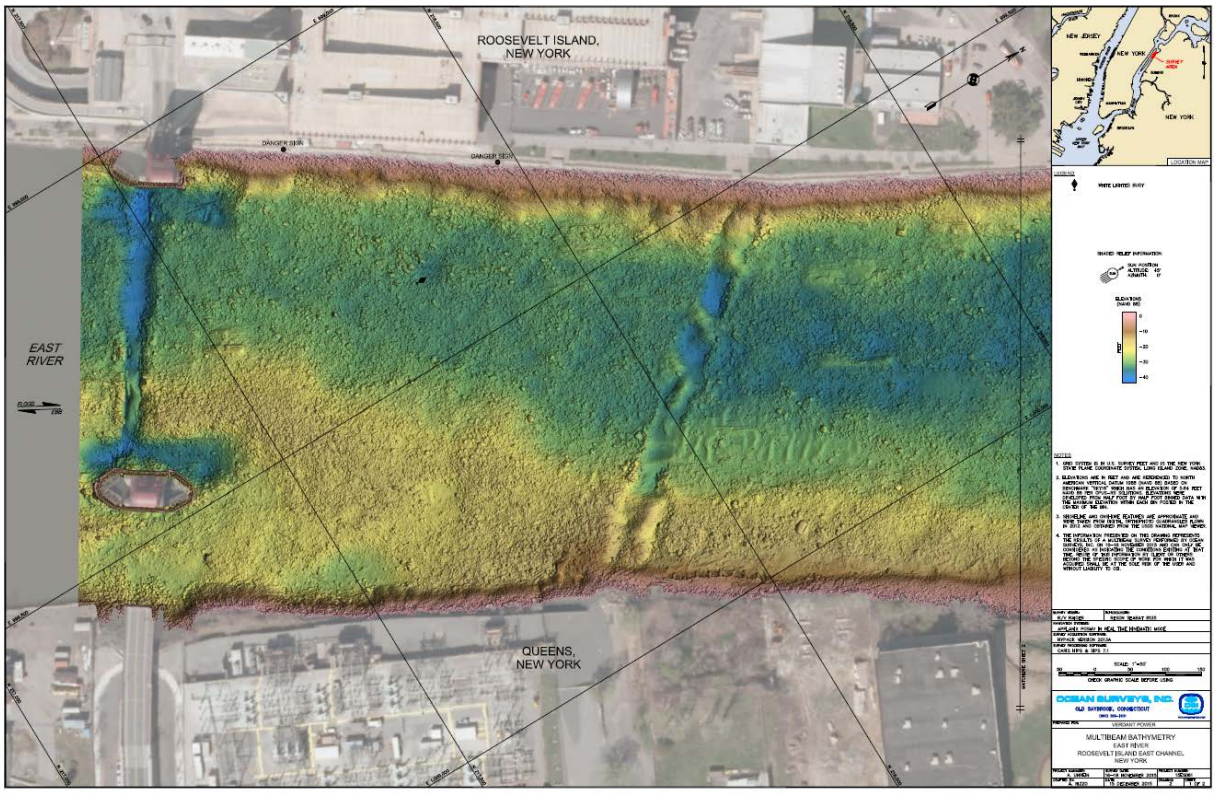

Figure 4.3.1.1-1. 2015 RITE bathymetry upper section.

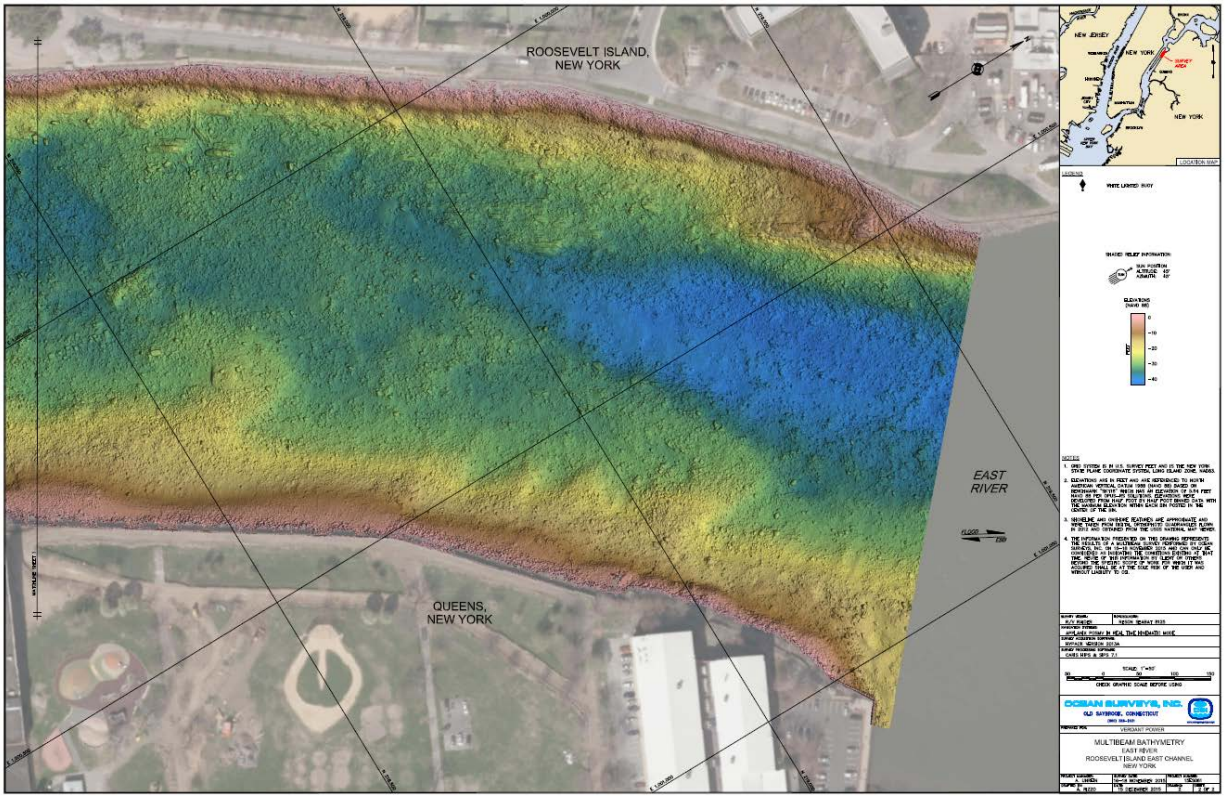

Figure 4.3.1.1-2. 2015 RITE bathymetry lower section.

Verdant also contracted e4sciences|Earthworks LLC to conduct an additional detailed geotechnical investigation in the fall, 2017. This survey included orthosonography, side-scan sonar, seismic and diver-based sample collection and video. Summary results were included in the CEII filing of the SDR in February 2018 and suggest that the conditions at TriFrame #2 for Install B-1 are as characterized in the 2005 and 2007 surveys and can be summarized as:

1) Confirming the absence of fine-grain sediment;
2) Confirming the presence of a field of boulders and cobble.

4.3.1.2 Environmental Effects

Proposed Action

The project likely will have little effect on the geology and soils. The urban and developed setting including developed riprap and shoreline bulkhead in the vicinity of the project boundary pose no concern for shoreline erosion.

Geology

Based on the detailed studies of the surficial geology that have been conducted over the last 15 years, the proposed action does not pose any potential geologic hazards in and around the proposed project area.

Soils

Previous studies and FERC's EA concluded that the river substrate, including the types, occurrence, physical characteristics, and chemical characteristics, has little chance for erosion and potential for mass sediment movement.

4.3.1.3 Unavoidable Adverse Effects

None Identified.

4.3.1.4 No Action Alternative

Under the No-Action Alternative, the geology and soils would remain unaffected.

4.3.1.5 Sources

FERC. 2011. Environmental Assessment for Hydropower Pilot Project License. Roosevelt Island Tidal Energy Project, FERC Project No. 12611-005. May 2011.

U.S. Fish and Wildlife Service (USFWS). 1997. Significant Habitats and Habitat Complexes of the New York Bight Watershed. USFWS. Charlestown, RI.

USGS. 2003. Geology of New York City Region: A Preliminary Regional Field-Trip Guidebook. Website: http://3dparks.wr.usgs.gov/nyc/index.html.

4.3.2 Water Resources

4.3.2.1 Affected Environment - Water Quantity

Water Uses

Water withdrawals in the project vicinity include both industrial and commercial facilities, including thermoelectric power plants (fossil fuel), which utilize water from the East River for process/cooling water purposes. There are also several sources of water discharges from large industrial and municipal wastewater treatment plants that discharge to the East River. Table 4.3.2.1-1 below summarizes these licensed dischargers and the maximum licensed volume for each.

Table 4.3.2.1-1. Licensed dischargers to the East River.

Plant	Type	Volume
NYC Hunt's Point Sewer Treatment Plant	Municipal	200 mgd
NYC Newtown Creek Sewer Treatment Plant	Municipal	310 mgd
NYC Tallman's Island Sewer Treatment Plant	Municipal	80 mgd
NYC Red Hook Water Pollution Control Plant	Municipal	60 mgd
NYC Wards Island Sewer Treatment Plant	Municipal	250 mgd
Consolidated Edison 60th Street Stream Gathering Station	Electric	N/A
Consolidated Edison East River Facility	Electric	541 mgd
Ravenswood Generating Station	Electric	N/A
New York Plaza Building	Cooling	26 mgd
866 UN Plaza Associates	Cooling	6 mgd
Astoria Wastewater Treatment Facility	Combined	N/A

mgd = million gallons per day
N/A: Not Available
Source: NYSDEC, 1999; EPA, 2003.

Water Quantity

Tides are formed as a result of the moon, sun and to some extent the rotation of the earth. As the moon orbits around the earth, its gravitational attraction upon the earth causes an increase in sea level in the area directly below and as a result, directly opposite. This results in an elliptical distribution of water with the major axis aligned to the moon will result in the maximum tidal depth (high tide) and the minor axis will result in the minimum tidal depth (low tide). The gravitational influence of the sun will also have a (lesser) effect but will reinforce and counteract the forces exerted by the moon, depending upon the celestial arrangement, to produce spring and neap tides. Importantly, the range of tidal elevation change can be altered significantly through geographical or coastline features such as estuaries.

Depending upon the geography, most locations on earth will experience a semidiurnal tide, which describes two high and two low tides each day. This includes the RITE location. Rising and falling tides will produce oscillating flows of water known as tidal streams. At the point of high or low tide, any tidal flow will be zero and this point is known as slack tide. At the RITE site a typical monthly tidal stage cycle as recorded by actual Acoustic Doppler Current Profiler (ADCP) instrumentation is represented by Figure 4.3.2.1-1.

Using NOAA Center for Operational, Oceanographic Products and Services (CO-OPS) data, the diurnal tidal elevation variations (Mean Higher High Water to Mean Lower Low Water) at the RITE site was taken to be 1.6 m (5.2 ft). The mean water level variations (Mean High Water to Mean Low Water) were estimated at 1.4 m (4.7 ft), and the maximum water level variation (Extreme High Water to Extreme Low Water) was estimated to be 2.1 m (7 ft).

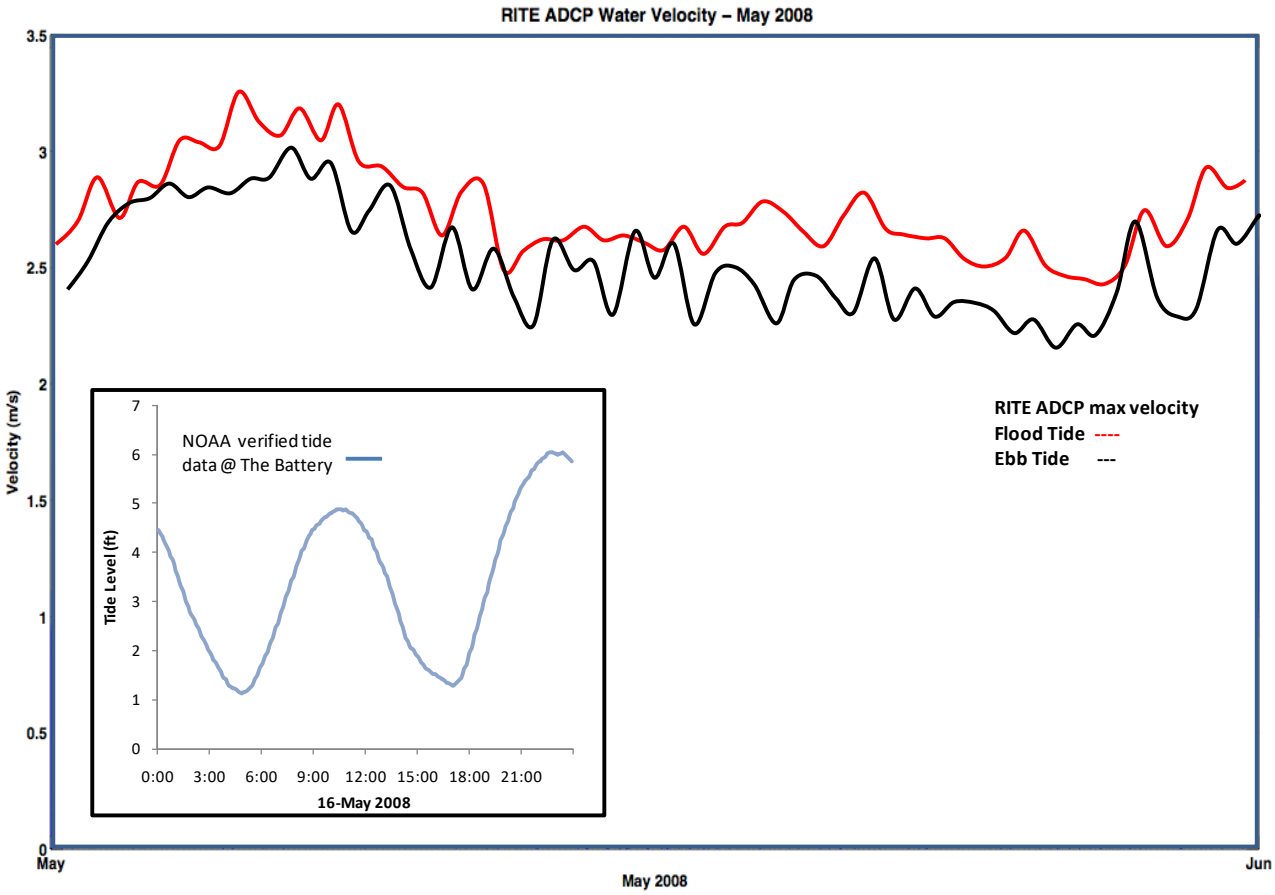

Figure 4.3.2.1-1. RITE Project typical monthly tidal cycle, May 2008, showing maximum flow velocities. Inset illustrates tidal variation over a single day.

Tidal Gages

NOAA has two active tidal gages (stations) near the project site; one station is at the southern tip of Manhattan in Battery Park, and the other is to the north on Kings Point in Long Island Sound. The Battery NOAA station (8518750) has been in service since 1920. The Kings Point NOAA Station (8516945) has been in service since October 1998.

The mean tide range at the Battery is reported as 4.5 feet (NOAA), and represents the difference between mean high water and mean low water. The mean tide range for the station at Kings Point is reported as 7.2 feet within Long Island Sound (NOAA, 2003c). This information is only a generalization for the RITE Project, since the primary stations are located too far away

from the actual RITE site to be meaningful.

Secondary stations are those which have operated for less than 18.6 years and oftentimes for less than a month. Their primary role is to provide data metrics in bays and estuaries where the primary station is not enough to determine local tidal effects. Secondary station data is not usually sufficient to precisely determine tidal currents but can be used through comparison to monthly measurements at a primary station to obtain satisfactory predictions.

Two secondary tidal current charts are used for tidal current prediction at the RITE site. These are located at the NOAA Hell Gate tidal current prediction station north of the site and at the Queensboro Bridge tidal prediction station.

Water Velocity Prediction

The complex interaction of the tides between the New York Harbor and Long Island Sound create tidal currents coincident with changes in the tidal stage. The tidal currents in the East River are semidiurnal, having two flood periods and two ebb periods per tidal day (24.84 hours). The reversing flood and ebb currents are of opposite direction, but with similar current velocity profiles. The tidal velocities are at a maximum when the tide stage is near the mean level and are at a minimum when the tides are at high and low stages.

Tidal current data is available from NOAA (2003c) at two sites distant to the RITE project as described above. These predictions of tidal ranges were empirically transferred from the NOAA tidal station to the actual RITE project site, using harmonic constituent analysis. For several years, Verdant Power has maintained a stationary recording Acoustic Doppler Current Profiler (ADCP) instrument within the RITE field to record the instantaneous current velocity (in m/s). This instrumentation allows Verdant Power to accurately quantify and calibrate the currents and tidal current data, facilitates the transfer of actual tidal measurements and predictions at a distant site to the project site, and also is a necessary instrument for operating the KHPS units.

In order to fully understand and predict the velocity patterns within the proposed RITE project field array, Verdant Power integrated mobile ADCP and stationary ADCP data. While the mobile data is a "snap shot" of velocity at the time of the field survey (both temporally and spatially), the stationary ADCP provides a continuous record of velocity but only at one location in the array. The stationary ADCP data set was analyzed to determine the harmonic constituents of the tidal prediction specifically for the RITE field array. Once the harmonic constituents of the tidal cycle at RITE are known, through empirical integration with the mobile data; it is possible to predict the water velocity at the RITE field for any date in the past or future with good accuracy.

Twenty-one harmonic constituents were used to predict the water velocity at RITE for the entire 2008 year, in 30-minute intervals. This yearly tidal dataset was used to calculate the Tidal Velocity Exceedance Curve, which is presented as Figure 4.3.2.1-3. The maximum predicted tidal current velocity at the RITE site during this period is approximately 2.7 m/s, with the KHPS turn-on velocity of 1 m/s exceeded 72% of the time.

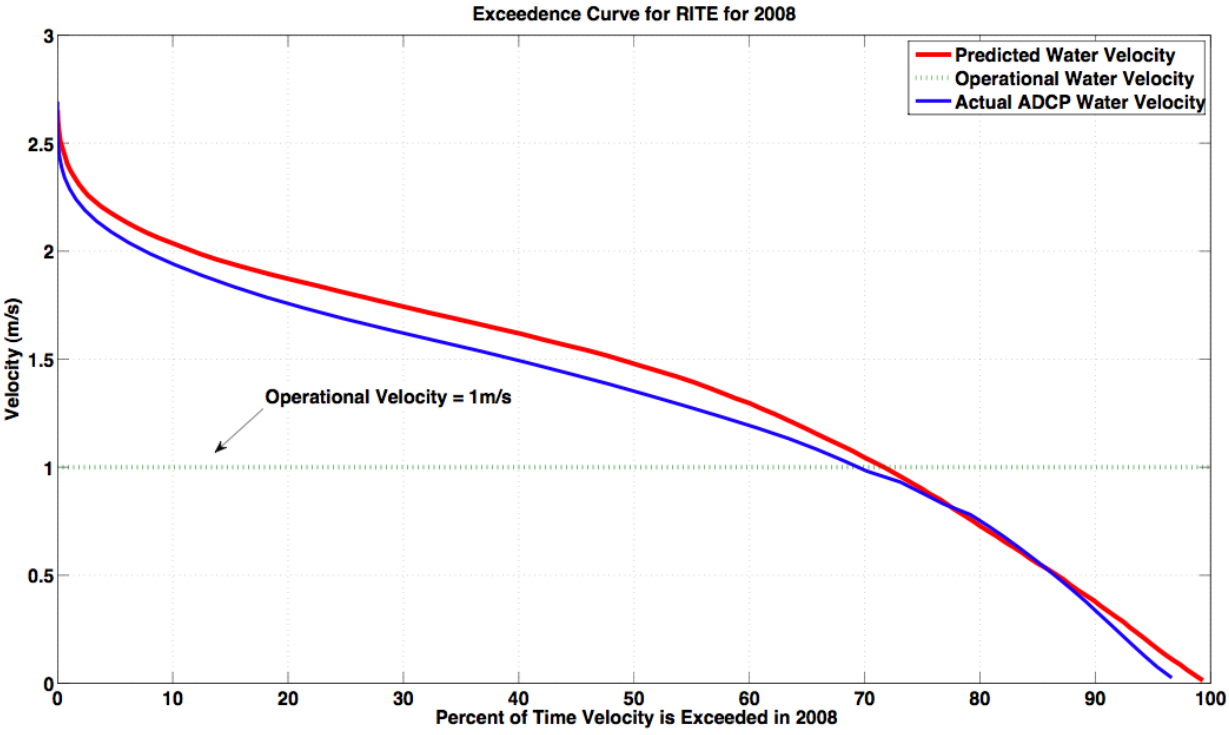

Figure 4.3.2.1-3. Tidal velocity exceedance curve - RITE East Channel Field (2008 data).

Hydrodynamics

Resource agencies initially expressed concern about the installation of the proposed field of submerged tidal turbines potentially affecting flow patterns in the vicinity of the RITE Project and possibly beyond. In particular, two separate concerns were raised by resource agencies during consultation and study scoping meetings. One issue is related to near-field effect of the rotating blades on flow patterns in regard to increased turbulence or creation of small flow disturbances (eddies) which may affect aquatic life predator-prey relationships. The second issue of concern is in regard to a possible modification of flow through the East River (i.e., if the turbines are removing kinetic energy from the system and if so, how that might affect transport flows).

4.3.2.2 Environmental Effects - Water Quantity/Hydrodynamics

Verdant Power conducted both numerical and in-water hydrodynamic evaluations over the last several years (2005 – Present) to better understand these issues. Verdant Power has used a combination of in-house computational tools, advanced external computational resources, and on-water surveys to understand and predict these complex hydrodynamic occurrences.

In brief, the discussions that follow are focused on three levels of hydrodynamic modeling and analysis: Micro-Scale; Meso-Scale; and Macro-Scale. In these three cases, the scale - an important factor to the accuracy and applicability of any model - is non-dimensional, related to the Diameter (D) of a kinetic hydropower rotor. For example, at the RITE Project, the rotor diameter is 5 meters; accordingly, the spatial applicability of results will vary from less than 0.1D (0.5 m) to 700D (3,500 m) and greater.

Micro-Scale Hydrodynamics: ~0.1D to ~2D (D is the Rotor Diameter)

This level of hydrodynamic modeling describes the hydrodynamics in and around an individual turbine, rotor, nacelle, pylon or mounting structure that may affect the structural performance of the machine or the energy extraction performance of the rotor. Commercial modeling software can be generally used for this type of analysis, as well as simplified in-house written codes for these complex problems. Simplifications can be made based on system symmetry, single blade approximations, and/or 2-dimensional (2-d) assumptions.

Verdant Power used ANSYS CFX to model the micro-scale hydrodynamics of a single Gen4 turbine with Gen5 rotor at the RITE site. This work centered on structural integrity and blade hydrodynamics, but information about the near field wake was also obtained, both from the rotating blades and the stationary structures. This work focused on the proprietary design and technology development of the Verdant Power KHPS™ and is only discussed generally here.

Meso-Scale Hydrodynamics: ~2D to 200D

This level of hydrodynamic analysis includes the interactions (downstream, laterally, and vertically) between two or more turbines in an array. These interactions include kinetic energy extraction, structural requirements, and potentially fish behavior in and around an operating turbine. Specifically, these interactions relate to the recovery and interaction of the 3-dimensional (3-d) wake generated as a result of the turbine (rotating or stationary) in the water body and the vortex generation associated with blade rotation and energy extraction. To examine the effects at this scale, there are various approaches to field data collection and modeling that can be taken. These include commercially available software and in-house written code that either models the interaction in 2-d or solves the 3-d interactions directly.

In consultation with the resource agencies, Verdant Power developed and executed the East River Hydrodynamic Survey (Study Plans, 2006). This comprised a series of on-water data collection operations to measure the meso-scale hydrodynamics in the RITE array. These measurements were made before deployment of demonstration KHPS units November 15, 2005 and repeated during Deployment #2 with 4 KHPS units operational simultaneously, May 17, 2007, on both ebb and flood tides. The objective of this study was to determine how the turbines affect the flow patterns in the East River, both near-field and far-field, and to develop some information on the comparison of velocity and circulation patterns in the deployment area prior to and after installation of the turbines. The results of this work were presented in detail in the Pilot Licensing proceeding and in the PAD. Results of these studies are summarized below, along with information collected during the Pilot License term to date.

Macro-Scale Hydrodynamics: ~200D to the Largest River/Estuary/Channel Dimension

This level of hydrodynamic analysis describes the effect of the placement of a field (assume 30 or more) of KHPS units in a natural water body and provides estimates of the far field effects related to energy extraction and also potential changes in natural water conditions with the operation of kinetic hydropower turbines. These models often are developed to examine macro-scale effects of large projects, such as dredging, contaminant dispersal, and sediment transport on large reaches of water bodies (>100 acres or >1 mile). Models in this category typically include 1-dimensional (1-d) and 2-d riverine models adapted to tidal conditions. More complex 3-d calibrated models are available, but these require significant investment of time in data collection and modeling expertise to produce relevant results.

As part of the East River Hydrodynamic Study discussed above, two hydrodynamic field surveys (pre-and post-Deployment #2) were conducted to collect flow velocity and direction (as a measure of turbulence) measurements in and around the operating KHPS units in the RITE Demonstration Project.

These surveys included two transects bounding the buildout site in the East Channel that were selected for replicate flow measurements. A level logger was deployed near each site to measure the changes in the water surface elevation throughout the study. Velocity data was collected and linked to a Trimble XRS GPS. After deployment of the study units, a second survey was performed on the same two bounding transects over a range of tidal flows that best represent the pre-deployment conditions. This data was collected in November 2005, the results of which were provided in a 60-day report (Verdant Power, 2007) and May 2007 (DTA, 2008), respectively, by Verdant Power's contractor and is discussed below.

To evaluate a larger pilot field area and evaluate potential changes associated with operation of a large number of tidal energy turbines, the study plan proposed the development of an empirical model to better understand possible effects on the total flow through the East River. Verdant Power developed and calibrated a 1-d model based on standard open channel flow equations and total energy flux to model the macro-scale hydrodynamics of the 30 turbine (1 MW) buildout proposed in the Pilot License Application.

During the term of the Pilot License, Verdant has continued to advance the state-of-the-art in Computational Fluid Dynamics (CFD) to understand and confirm the micro-, meso- and macro-scale hydrodynamics of the installed project.

Modeling, In-Field Methods, and Results

Micro-Scale Hydrodynamic Modeling

The micro-scale hydrodynamic modeling of a single, non-rotating KHPS unit showed that regions of relatively high and low pressure are created across the pile, pylon, nacelle, and cones. These small differences in pressure lead to the wake regions seen, with reduced water velocity downstream, but do not lead to cavitation. Some local flow acceleration is seen, specifically at the blade tip and around the pile/pylon. Turbulent mixing is increased near the stationary blades and the base of the faired pylon, both of which are well above the river bottom. Additional mixing is seen around the pile; however, the naturally turbulent boundary layer along the river bed is expected to dampen any flow disturbances, significantly reducing any impact.

Additional detailed quantification of the hub-height turbulence was performed in May 2011 with two Acoustic Doppler Velocimeters (ADVs) provided by ORNL. Undisturbed values for Turbulence Intensity and Spectral Energy Density, among others, were characterized and utilized in internal load prediction software to predict the loads on the TriFrame and KHPS with additional accuracy.

Updated CFD work at the University of Minnesota St. Anthony Falls Laboratory on the micro-scale hydrodynamics of an individual KHPS was conducted. Large-eddy simulations of the Verdant Gen4 KHPS and the Gen5 KHPS were conducted in 2011 and in 2017, respectively utilizing in-house numerical methods for solving the complex turbine geometry, including the rotor and all stationary components.

From the published 2012 paper, “The computed results illustrate the complexity of the flow and show that the power output of the complete turbine is primarily dependent on the rotor geometry and tip speed ratio and is not affected by the stationary components of the turbine and the presence of the channel bed. The complete turbine simulation also reveals that the

downstream wake of the turbine consists of three main regions: (1) the outer layer with the spiral blade tip vortices rotating in the same direction as the blades; (2) the counter-rotating inner layer surrounded by the spiral tip vortices; and (3) the core layer co-rotating with respect to the tip vortices. This study is the first to report the three-dimensional wake structure of MHK turbines."

In general, these updated results for the micro-scale hydrodynamics of the Gen4 turbine agree with the conclusions drawn in the Pilot License Application and FERC's EA. The Gen5 KHPS has a nearly identical rotor geometry and rotates at a lower rpm than the Gen4 KHPS. As such, the understanding of the micro-scale hydrodynamics around an operating KHPS has been advanced, confirming the previous conclusions and re-affirming the complex physics associated with the fluid-structure interaction at the micro-scale.

Meso-Scale Hydrodynamics

Velocity magnitudes are greatly reduced directly downstream of a generating unit, while velocity directions are shown up to 90° out of phase with the natural channel direction. These 3-d, rotating, vortex structures convect downstream, centered on the shaft centerline. Their general influence is maintained in a slowly expanding cone downstream from the rotor and is thought unlikely to affect the river bottom.

With regard to localized effects, the presence of the pylon and the areas of lower velocity (reductions up to 50%) behind the stationary KHPS unit pylon during ebb and flood flows do present a potential area of protection and/or habitation. However, as discussed in the Aquatic Resources sections, the fish abundance and population observations generally tend to indicate that fish (both large and small) are not present in the high current zones of the KHPS. Nor are they present in general, during the ebb and flood cycles, and so the decrease in localized velocities would not be likely to affect the predator-prey relationship within the field.

Large-eddy simulations of the wake structure of a TriFrame of three turbines were further investigated during the Pilot License term using both numerical simulations and scale-model experiments. "We found that the wake of the upstream TriFrame turbine exhibits unique characteristics indicating presence of the Venturi effect as the wake encounters the two downstream turbines. We finally compare the wakes of the TriFrame turbines with that of an

isolated single turbine wake to further illustrate how the TriFrame configuration affects the wake characteristics and power production in an array of TriFrames." (Chawdhary et al. 2017).

In general, these updated results for the meso-scale hydrodynamics of the Gen4 turbine agree with the conclusions drawn in the Final Pilot License Application and FERC's EA. Verdant was able to significantly increase understanding of the meso-scale hydrodynamics associated with the TriFrame and KHPS configuration. Further, research suggests that turbine performance on a TriFrame can be improved relative to the performance of 3 individual turbines. Specifically, "The faster momentum deficit recovery and lower turbulent kinetic energy (TKE) in the wake of the upstream turbine of the TriFrame are advantageous when using the TriFrame assembly to build a large turbine array." (Chawdhary et al. 2017).

Macro-Scale Hydrodynamics

A 1-d model was developed in advance of the Pilot License issuance to predict the effects of extraction of kinetic energy on the depth and velocity in the East Channel of the East River. The modelling showed the influence of energy extraction is to slightly increase (12 mm) the overall water depth from the inlet of the channel to the extraction planes. As a result, the water velocity is decreased slightly (-0.07 m/s) throughout the channel.

These modifications to the channel properties are minimal and below the precision available for most measurement devices. As such, the expected generation of 1 MW from the East Channel of the East River was expected to be unlikely to modify the natural channel properties in any way.

Updated CFD work was conducted in 2015-2017 on the macro-scale hydrodynamics of an array of TriFrames and KHPS. Specifically, a new generation unstructured Cartesian flow solver coupled with a sharp interface immersed boundary method for 3D incompressible flows was used to numerically investigate New York City's East River, including the high-resolution bathymetry acquired as mentioned above, and the array of thirty KHPS turbines.

"Simulations indicated that a marginal acceleration in the river flow in the spanwise region where turbines were not placed. Comparison with the baseline flow in terms of mean

streamwise velocity as well as vorticity magnitude indicates that there is a very small signature of the turbine wake at the free surface of the channel. This effect could be negligible compared to the free surface disturbances present in the tidal channel otherwise." (Chawdhary et al. 2018)

Verdant was able to advance the state-of-the art modelling of the meso-scale hydrodynamics from 1-D to 3-D, a significant improvement in understanding and a fundamental advancement in computational modeling, and confirm the previous conclusions regarding de minimus effects of 10 TriFrames in an array. These results can now be viewed as very conservative as Verdant is now proposing a maximum buildout of five TriFrames and 15 turbines, half the number modeled. As part of the operational monitoring, Verdant Power continues to install and record water velocity and level data with the use of Acoustic Doppler Current Devices (ADCPs) that will inform the hydrodynamics of the machines and array, as the staged installation progresses. This data, coupled with the RMEE Plans, will continue to build and support the body of science of hydrodynamic effects of operating KHPS units in different configurations.

4.3.2.3 Affected Environment - Water Quality

The reaches of the East River in the Project Area are classified as Class I. The best usages of Class I waters are secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. In addition, the water quality shall be suitable for primary contact recreation, although other factors may limit the use for this purpose (6 CRR-NY 701.13 current through October 15, 2019).

Potential concerns associated with water quality in conjunction with the RITE Project have included:

1. Erosion and sedimentation during deployment activities;
2. An increase in suspended solids during operation activities; and
3. The presence of toxic constituents in the channel substrates within the project area.

Regional Water Quality

The NYCDEP conducts annual monitoring of the waters of New York Harbor for four indicator parameters: dissolved oxygen; fecal coliform; chlorophyll a; and turbidity. This monitoring has been conducted since 1908 and currently includes 965 water sampling stations, with 1,200 drinking water samples collected each month from up to 546 locations. The data obtained is used to monitor water quality trends and to correlate improvements with advances in wastewater treatment and other environmental protection measures. Overall, the program has documented significant improvements in all parameters due largely to the construction and upgrade of wastewater treatment plants that discharge to the harbor (NYCDEP 2017).

In the upper East River region of the harbor (which includes the East River north of Roosevelt Island, western Long Island Sound to Hart Island, and the Harlem River), bottom dissolved oxygen levels have risen from approximately 3.0 to 3.5 mg/l in the early 1970s to approximately 6 mg/l presently. While there was a dip in oxygen levels in the late 1990s and early 2000s, oxygen levels have been steadily increasing since 2004. The average summer levels for 2017 were 6.15 mg/l at the surface and 5.6 mg/l at the bottom. Fecal coliform levels in the upper East River have improved from summer geometric means in excess of 2,000/100 ml in the early 1970s to 24 cells/100 ml in 2017. Chlorophyll a levels throughout the upper East River region have generally have been below 10 ug/l since 2002 and have shown little variation (NYCDEP 2017). Turbidity in the upper East River has shown variability between areas of the region, with the Harlem River secchi depths of 3 to 4 feet and the East River at 4 to 6 feet transparency. Average summer Secchi values have not varied substantially since 2009 (NYCDEP 2017).

305(b) and 303(d) Listing

Section 305(b) of the Clean Water Act requires states to report to the U.S. Environmental Protection Agency (EPA) on whether waters of the state are supporting the designated uses and standards of the state's water laws. The state's waterbody inventory and priority waterbody list (WI/PWL) are used to inventory the data obtained by state monitoring programs (including the New York State Rotating Intensive Basin Studies [RIBS] program) and to track known or suspect water quality problems. Waterbodies where designated uses are threatened, stressed,

precluded, or impaired, are identified on the PWL and in the 305(b) Report.

The East River is included in the New York State 305(b) listing as an impaired waterbody due to recreational uses and fish consumption that are considered to be impaired by floatable debris, as well as PCBs and other toxics. Urban stormwater runoff, combined sewer overflows (CSOs), contaminated sediment, and the industrial use of the waterway result in conditions that negatively impact recreational use. Recent data shows dissolved oxygen levels in this reach typically meet applicable water quality standards for support of aquatic life. (NYSDEC WI/PWL Fact Sheet – Hudson/East River Watershed 2017).

Existing Water Quality

In conjunction with the RITE Demonstration Project, Verdant Power developed a Sediment Sampling Plan for the proposed Project based on information and consultation with the New York State Department of Environmental Conservation (NYSDEC), NOAA/fisheries, the United States Fish and Wildlife Service, Army Corps of Engineers, the New York Department of State, and the New York City Department of Environmental Protection.

The sediment surveys showed that no sediment or organic material exists within the project area, and therefore, additional sampling activities, including water column monitoring was not necessary for deployment and operation of the units.

4.3.2.4 Environmental Effects – Water Quality

Since the Verdant Power KHPS design has no hydraulic components, the concern of releases or other chemicals from the underwater units is not an issue, particularly because the units will have redundant dynamic (shaft) and static sealing to retain lubricant and exclude seawater.

Verdant Power determined that the East Channel of the East River is located within a larger area that has the potential for toxic contaminants to exist within the underlying substrates. However, based on site-specific information acquired during a number of sediment and bottom surveys over the last 15 years, it is not likely that toxic contaminants will be disrupted during

deployment and/or operation of the RITE Project because no re-suspendible sediment was found at the site.

The proposed Project would not be expected to have an effect on water quality parameters, such as dissolved oxygen or oxygen demand. The Project would not affect levels of fecal coliform or pathogens.

The studies conducted in the Project area show the substrate of the entire survey area is composed of cobbles, boulders, and ledge. None of the surveys identified or suggested the presence of fine sediment (i.e., particles smaller than gravel) within the survey area.

Based on the lack of re-suspendible sediment found in the RITE Project area, Verdant Power does not anticipate any increased turbidity. Furthermore, Verdant Power does not expect any release of chemicals into the water column because limited to no sediments would be suspended or disturbed during construction. Since the Verdant Power KHPS units have no hydraulics, there is no potential for lubricant leaching. Construction and maintenance activities could increase the potential for accidental release of gas or oil from work boats through vessel collisions. Coordinating activities with the USCG should mitigate potential for vessel collisions.

Because no impacts to water quality are expected from the operation of the RITE Project, no further monitoring is proposed.

4.3.2.5 Unavoidable Adverse Impacts

None identified.

4.3.2.6 No Action Alternative

If the proposed Project is not installed and operated, there would be no increased construction or maintenance vessels that could potentially impact water quality.

4.3.2.7 Sources

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4.3.3 Aquatic Resources

4.3.3.1 Affected Environment

The East River, in the vicinity of the proposed Project, supports a variety of fish species, notably, Winter Flounder (*Pseudopleuronectes americanus*), Atlantic Tomcod (*Microgadus tomcod*), Striped Bass (*morone saxatilis*), and Grubby (*Myoxocephalus aenaeus*). Other fish that may be found in high numbers include the Bay Anchovy (*Anchoa mitchilli*), Atlantic Silversides (*Menidia menidia*), Blueback Herring (*Alosa aestivalis*), Northern Pipefish (*Syngnathus fuscus*), and Atlantic Menhaden (*Brevoortia tyrannus*). Most species are seasonal and migrate through the East River to overwintering areas offshore or spawning grounds further upriver. The two relatively common fish species found in the East River over most life stages are the Atlantic Silverside and Northern Pipefish.

The New York Bight watershed provides important habitat for numerous migratory species, including American Eel, Alewife, American Shad, Atlantic Menhaden, Atlantic Sturgeon, Atlantic Tomcod, Bay Anchovy, Blueback Herring, Rainbow Smelt, Shortnose Sturgeon and Striped Bass. The East River is believed to be used by migratory species as a passageway and as a temporary seasonal habitat (USFWS, 1997; Henderson, 2002).

The New York/New Jersey Bight Urban Core estuary system supports significant recreational and commercial fisheries. Recreational fishing represents approximately two million angler days annually, with primary target species including Flounder, Scup, American Eel, Bluefish, Striped Bass, Atlantic Mackerel, Black Sea Bass and Weakfish (USFWS, 1997). The commercial fishery includes the Hudson River fishery (American Shad, Striped Bass, American Sturgeon, Herring and Baitfish); the lower estuary fishery (Hake, Scup, Flounder and Tautog); and the near shore and mid-water fishery (Flounder Menhaden, Bluefish, Weakfish, and Mackerel). Within the East River itself, commercial shell fishing and fishing are restricted or prohibited for most species due to contamination.

Verdant Power compiled a significant amount of historical fishery data that was collected in and around the RITE project site over the last 30 years. Verdant Power has also conducted a number of studies to evaluate the interaction between the fish and aquatic environment and the

operating KHPS units. These studies represent the first ever in-water monitoring of operating Verdant Power design KHPS units and as such develop a unique body of information related to understanding this interaction, specific to Verdant Power's technology. NYSDEC, NYSDOS, USACE, USFWS, NOAA/NMFS, and EPA were active participants in these groundbreaking efforts and have worked with Verdant Power to develop, modify, and adapt these studies and protocols over the course of the RITE demonstration project. Studies relied on several proven methods and several new applications to examine the interaction of the fishery resource to a kinetic hydropower system. A brief summary of these extensive prior studies follows:

Fixed Hydroacoustic Array

The 2006-2009 fixed hydroacoustic studies utilized an array of 24 Biosonic split-beam acoustic transducers in fixed surveys to gather information on fish spatial distributions and abundance, as well as provide fish behavior information by tracking a fish's swimming location and direction. The split-beam technique provided estimates of individual fish target strength, a measure that roughly corresponds to the physical size of the fish. Verdant Power deployed both phases of first 12 and then 24 fixed hydroacoustic SBT transducers around the array of six hydrokinetic turbines in December 2007. There were a number of issues associated with maintenance of the equipment, but Verdant Power was able to keep a number of these running and collecting data 24 hours per day, 7 days a week, through October of 2009. A large body of information was generated about the presence, abundance and spatial placement of fish communities within the project area. This information is presented in detail in Appendices A and B to the RMEE Plans in Volume 4 of the Final Pilot License Application (which was submitted as the PAD in this relicensing proceeding) and is summarized below.

DIDSON

The split-beam acoustic technology was supplemented with an innovative but still experimental DIDSON system which uses high definition sonar to produce a near video quality graphic display. The stationary DIDSON was deployed in the tidal fluctuation zone during December 2006 and January 2007 and Vessel-Mounted Aimable DIDSON was used between October and December 2008. A detailed summary of this experience and the results obtained is included in Appendix B of Volume 4 of the Final Pilot License Application and a summary of

this information is provided below. Generally, the experience to date strongly supports using the DIDSON for micro-scale monitoring of fish behavior around the operating KHPS units.

In September 2012, Verdant Power successfully completed an in-water test of an updated KHPS turbine rotor including composite blades and concurrently deployed a remotely aimed DIDSON (RAD) system. The automated data analysis performed with the DIDSON identified 34,708 fish tracks, which included both individual fish and schools. Direct observations of the data indicated that individual fish and schools that were headed toward rotating blades generally avoided the blades by adjusting their horizontal swimming direction slights and angling away (ORNL/Verdant, 2016).

Mobile Hydroacoustic Transects

The mobile hydroacoustic survey study plan used the SBT mounted in a downward looking arrangement passing over multiple transects across the East River in a wide pattern in and around the RITE project area to observe fish presence, abundance, and size distributions (by virtue of signal strength). A total of four mobile surveys were conducted prior to KHPS unit deployment (September 2005 to November 2005). Post-deployment mobile surveys were conducted once a month for the first 6 months following turbine installation (January 2007 to June 2007) to assess seasonal changes in fish occurrence, distribution, and abundance. Mobile surveys were conducted for the duration of the study for a total of 10 months of mobile surveys (four pre-deployment surveys and six monthly surveys during fall 2005 and spring 2007).

The goal of the mobile surveys was to identify distribution patterns of fish abundance across the channel and within the water column prior to and after turbine installation. In general, since the data is not species definitive, the mobile survey study plans and protocols yielded very little usable information relative to pre- and post-distributions, and by mutual agency consent no further mobile surveys were executed.

Netting

Fish collections using trawl net gear is very difficult in the East Channel which has many security and navigation issues as well as hazardous sampling conditions (debris and swift

currents). Some netting data was attempted by Verdant Power but was suspended due to safety considerations. Under the Pilot License, Verdant Power contracted Kleinschmidt Associates and Normandeau Associates to conduct a netting effort in May 2013 in the East Channel of the East River. During that effort, 3 total tows, only 2 aquatic organisms were caught:

- Tow 2: *Callinectes sapidus*, Blue Crab; 44 mm; alive; returned unharmed
- Tow 3: *Peprilus triacanthus*, Butterfish; 37 mm; alive; returned unharmed

Based on this 2013 effort, in general, species characterization netting near the RITE Project Area is unlikely to yield meaningful results given the difficulty of netting in strong tidal currents and the general absence of fish in the mid-river. However, extensive fish assemblage data is available from aquatic organism samples collected at Ravenswood Generating Station which is in close proximity to the Project site. Upon review of this data, resource agencies agreed to amend the RMEE plans to suspend the RMEE-3 protocol for mid-2020 planned Install B-1, and for additional deployments under this new license.

4.3.3.2 Environmental Effects

The data collected to date provides a great deal of information about how fish are moving in and around the project area and their potential to be impacted by the proposed Project. This data shows:

- The numbers of fish moving through the area vary considerably on a seasonal basis, with the highest numbers occurring in the late fall period (October - December).
- The late fall peak consists primarily of smaller fish, based on signal strength of hydroacoustic readings. Verdant Power believes that outmigrating juvenile Blueback Herring are the species/size class predominantly causing this spike of smaller fish based on known life history characteristics and data collected at the Ravenswood Generating Station just upriver of the proposed Project.
- Daily densities of fish are relatively low during non-peak periods and primarily consist of smaller fish, independent of turbines in the water.
- Equivalent abundance is seen day and night.
- Greatest movement of fish is observed in the direction of tides or during slack tides (i.e., water velocities <1.0 m/sec, when the KHPS units are non-operational), independent of turbines in the water.
- Fish zonal location data confirms observations that fish tend to the inshore (slower velocity, non-turbine) zones of the KHPS turbine array area, minimizing opportunity for harm.

- Analysis of fish location within the water column shows that fish tend to prefer swimming at the surface or bottom as opposed to the middle of the water column where the turbines would be located.
- The direction of swimming is strongly influenced by tidal velocity and fish were observed to swim faster than the tidal velocity, independent of turbines in the water.
- DIDSON observations showed some avoidance behavior of fish approaching turbines.

The data collected to date appears to indicate a limited likelihood for fish harm or mortality. The slow tip speed of KHPS units (32 rpm now reduced to 28 rpm), lack of ducted pinch points; and ample opportunity for fish movement away from the turbine area indicates minimal opportunity for harm. During the RITE 2006-2009 Deployments #1, #2, and #3, there was no observed evidence of increased fish mortality or injury, nor was any irregular bird activity observed.

Verdant Power has been working with resource agencies to develop a detailed approach to monitoring that includes plans for monitoring each phase of the project and modifying the approach as needed based on the results of the previous phase. The details of the proposed RITE Monitoring of Environmental Effects (RMEE) plans are included in Volume 4 of this final License Application. Continued monitoring during the phased installation of the Pilot Project will provide for an ongoing assessment of the potential impacts of the Project on aquatic resources.

4.3.3.3 Underwater Noise

Affected Environment

The nominal depth of the East Channel of the East River just north of the Roosevelt Island Bridge is approximately 30 feet or 10 meters, or a shallow water noise environment. The shore is covered with riprap extending to below the low water line. The bottom is bare solid rock with some scattered boulders. By specific examinations of bathymetry and substrate conducted by Verdant Power contractors over the past 14 years, there is no sediment, sand, or gravel covering the rock due to the fast currents in the area. Marine vegetation is minimal or non-existent.

The existing underwater environment has many existing sources of potential noise. In addition to the location of the noise source (above water or below water), how that sound couples is important. Anything that is in the water will couple vibration directly to the water much more efficiently than if it has to couple through the air or through rock.

Noise Sources Located Above and Below the Water in the East Channel:

- Automotive and Truck Traffic on Roosevelt Island Bridge and Queensboro Bridge – The Roosevelt Island Bridge is the only means for automotive traffic to access Roosevelt Island and can be fairly busy during rush hours. The bridge abutments couple the traffic noise to the underwater environment.
- Roosevelt Island Bridge Lowering and Raising Operations – The Roosevelt Island Bridge is a lift-bridge which is raised when large vessels pass in the river. The bridge abutments couple the bridge operation noise to the underwater environment.
- Roosevelt Island Bridge and Queensboro Bridge Maintenance Work – The large Queensboro Bridge usually has some part of it being maintained at any time. The Roosevelt Island Bridge does not normally have constant maintenance work. The bridge abutments couple any bridge work noise to the underwater environment.
- Gas and Steam Turbine Operations at Ravenswood Power Plant – This power plant just across the channel and south of Roosevelt Island Bridge has many turbines which might be acoustically coupled to the underwater environment through cooling water pipes when in operation.
- Boat Propeller and Engine Noises – Most of the larger vessels in the East River use the West Channel for transit. However, the East Channel is used by recreational vessels, NYC Police, USCG, water taxis and smaller commercial traffic. Fishing charter boats use the East Channel when the striped bass are present. Large tugboats maneuver large oil barges at the Ravenswood plant. Several times a year when the United Nations is in session, for security reasons all West Channel boat traffic is routed through the East Channel. Boat propellers spin at a much higher frequency than the KHPS units.
- Subway Traffic in Riverbed Tunnel between Roosevelt Island Bridge and Queensboro Bridge – A major subway tunnel passes under the riverbed between Roosevelt Island and Queens between the Roosevelt Island Bridge and Queensboro Bridge. During rush hours subway trains pass through as often as every 5 minutes.
- Water Intake and Output Noises at Ravenswood Power Plant – The Ravenswood Power Plant uses water taken from the East River in its operations. The noise from electric water pumps and potentially other industrial machines such as steam turbines inside the plant will pass through these pipes into the River.

Conclusions − RITE East Channel Underwater Noise Survey

The noise studies and analysis of potential impacts conducted during the Pilot License Period and analyzed in FERC's EA showed that the noise levels from up to 4 operating turbines were well below the source levels that affect fish behavior. Aquatic species are presently living with noise levels generated by the subway tunnel traffic on par with the noise levels generated by the KHPS units.

Verdant Power is confident that the incremental installation of 15 operating KHPS units at the RITE Pilot Project will not increase the background noise to levels that affect the aquatic community. To verify this prediction, Verdant Power has proposed, as part of the RITE Proposed Plans, a noise evaluation study as described below.

Proposed Underwater Noise Monitoring and Evaluation for RITE Pilot Project

The details of the proposed plan are included in RMEE-6 in Volume 4 of this License Application. Generally, Verdant Power, in consultation with the environmental regulatory agencies, will conduct a two-part underwater noise study consisting of:

- Micro-Meso (In-field) stationary underwater noise monitoring within the RITE East Channel Pilot Field; and
- Macro (far-field) stationary noise measurements at up to three established locations beyond the RITE pilot project boundary.

Verdant Power will attempt to compare the micro, meso, and macro field noise signatures when the Gen5 machines are operating to noise signatures during the slack condition. These measurements will be made during Install B-1 and Install C as shown below.

RMEE-6	**Install B-1 (3 KHPS)**	**Install B-2 (9-12 KHPS)**	**Install C (up to 15 KHPS)**
Underwater Noise Monitoring	1 year Stationary for 1 Month 3 far-field locations (1 week)	None proposed unless B-1 indicates effect	1 year Stationary for 1 Month* 3 far-field locations (1 week)

* ***Location for B-1 at ADCP-N and at mid-field for Install C.***

4.3.3.4 Unavoidable Adverse Impacts

It is not yet clear if there are unavoidable adverse impacts to aquatic resources that would occur as a result of the proposed Pilot Project. The purpose of the proposed monitoring plans is to better understand potential impacts.

4.3.3.5 No Action Alternative

If the proposed Pilot Project is not installed, no impacts to the aquatic resource would occur.

4.3.3.6 Sources

Henderson, P.A. 2002. Aquatic Ecology Issues Relating to the Roosevelt Island Tidal Energy Phase I Demonstration Project. Pisces Conservation, LTD., Lymington, England, November 2002.

U.S. Fish and Wildlife Service (USFWS). 1997. Significant Habitats and Habitat Complexes of the New York Bight Watershed. USFWS. Charlestown, RI.

4.3.4 Terrestrial Resources

4.3.4.1 Affected Environment

Botanical Resources

Manhattan Island and Roosevelt Island are developed with residential and commercial development. Due to its location and extent of urban development, the upland plant communities are predominately landscaped parks and greenways. The extent and size of natural botanical communities are significantly limited. Wetland community types include tidal wetlands and submerged aquatic macrophyte vegetation communities. Upland plant communities on Roosevelt Island and Manhattan Island are dominated by urban landscaped species and invasive species. Natural communities are limited.

Wetland Plant Communities

Wetland plant communities in the immediate project area around Roosevelt Island are limited by the extensive shoreline development (including docks, piers, *etc*.) and various forms of armoring (riprap, bulkheads, *etc*.) that have been constructed.

Significant Ecological Communities

No significant ecological communities have been identified along the East River in the immediate vicinity of Roosevelt Island. The upper East River/Long Island Sound area is designated as a Special Natural Waterfront Area by the New York City Office of Planning Waterfront Revitalization Program. The USFWS has identified significant habitats in The Narrows and Lower Hudson River Estuary Complexes of the New York/New Jersey Harbor Bight Watershed; however, none are proximate to the proposed project area (Verdant Power, 2003; USFWS, 1997). No rare, threatened, or endangered plant species have been identified in the immediate project area through consultations with resource agencies.

Wildlife Resources

Because of the dense urban development, the availability of wildlife habitat within the Urban Core of the New York/New Jersey Bight watershed, particularly in the New York City vicinity, is relatively limited. However, there are nearby complexes that provide valuable habitats, particularly for migratory species (Verdant Power, 2003; USFWS, 1997).

The fragmentation of habitats that occurs in urban project areas limits the terrestrial wildlife species that may occur to primarily those opportunistic species that have adapted to living in very urbanized settings. Habitat for herptile species is also limited due to fragmentation and the lack of freshwater habitats in the project area. No threatened or endangered wildlife species have been identified in the area through consultations to date.

Avian Species

Habitats for birds are more diverse and available because the nearby New York/New Jersey Estuary, Long Island Sound Estuary, and small pockets of forests and fields that provide habitat for many species year-round. A number of birds may use the East River for feeding or resting. Dominant species identified so far are the double-crested cormorant (*Phalacrocorax auritus*) and a variety of gulls. Diving ducks, cormorants, and terns migrate through the area from late March through mid-May. The fall migration of species such as the brown pelican (*Pelecanus occidentalis*) or double-crested cormorant may peak in October, but species such as loons (*Gavia spp*.), northern gannets (*Morus bassanus*), scaup (*Aythya spp*.), and ring-necked

ducks (*Aythya collaris*), may peak in November through mid-December, and many tern species (*Sterna hirundo, S. forsteri, S. nilotica*) migrate through the area in September. A New York State threatened species, the peregrine falcon, is known to nest on bridges near the project area.

During consultation with agencies and stakeholders about the RITE Demonstration Project and this Pilot License Application, the main issues raised about impacts on terrestrial resources were concerns for avian species. As a result, Verdant Power, in consultation with the resource agencies, developed a Bird Observation Study protocol that was executed during the RITE demonstration project to meet these goals.

Verdant Power personnel and other local birders and consultants collected the data in accordance with the study plan and this data was summarized in the Final Pilot License Application submitted as the PAD for this relicensing.

4.3.4.2 Environmental Effects

No potential effects to botanical or wildlife resources have been identified or are expected due to the lack of resources in the project area and the fact that the majority of the project is underwater with a minimal land footprint on already developed area.

The Project has the potential to affect diving birds in and around the turbine area. Throughout 2006-2008, as discussed above, Verdant Power logged approximately 290 hours of bird observations before and during deployment of the RITE Demonstration Project KHPS units. Birds were observed around the demonstration project to determine if the KHPS units adversely impact diving birds associated with the East River; Verdant Power believes that the body of developed knowledge does not show any signs of impact on diving birds. This detailed effort in and around the RITE project demonstration site and the general area of the proposed RITE Pilot License did not show any material difference in pre-and post-operation bird activity. The presence of more geese flying through the area in post-deployment during the fall of 2008 can be attributed to seasonal migration patterns. Observations during the operation of the RITE Demonstration KHPS units also did not indicate any increased attraction of diving birds to the site which may have been expected if the turbines impacted fish in the area. Anecdotal evidence

suggests double-crested cormorants, the only diving birds observed at the site, swim/float with the current and only dive during or close to slack tide when the turbines are not rotating.

Based on the observations made at the RITE demonstration project Verdant Power does not believe that the project area is a particularly significant bird migration pathway for resting or feeding because of the urban nature of the location, the limited amount of green space, and the fast currents present.

4.3.4.3 Proposed Pilot License Monitoring Plan

Verdant Power believes that the data collected during the RITE Demonstration Project during a 2-year period represents a baseline understanding of the relationship of operating KHPS units with the resident and migratory bird community in the East River. However, Verdant Power recognizes that extending this observation to a 15-turbine field will require some level of ongoing monitoring to validate the demonstration results for a larger field. Therefore, Verdant Power has proposed an ongoing Bird Observation Monitoring Plan as part of this license application to observe seasonal migratory activity during March to May and September to November in three consecutive years when operating KHPS units are present including before and after Install B-2. The details of the proposed plan are included in Volume 4 of the License Application and are summarized in the Table 4.3.4.3-1 below.

Table 4.3.4.3-1. RMEE-5 Bird Observation.

RMEE-5	Install B-1 (3 KHPS)	Install B-2 (9-12 KHPS)	Install C (15 KHPS)
Bird Observation	1 Year Seasonal Spring and Fall 11 days	2 years Seasonal Spring and Fall 11 days	None proposed

4.3.4.4 Unavoidable Adverse Impacts

No unavoidable adverse impacts to terrestrial or avian species have been identified.

4.3.4.5 No Action Alternative

As in the proposed alternative, the no action alternative would not affect botanical or wildlife resources, including birds.

4.3.4.6 Sources

U.S. Fish and Wildlife Service (USFWS). 1997. Significant Habitats and Habitat Complexes of the New York Bight Watershed. USFWS. Charlestown, RI.

Verdant Power, Inc. 2003. Initial Consultation Document for the Roosevelt Island Tidal Energy Project (ICD), FERC Project Number 12178. October 2003. Prepared by Devine Tarbell and Associates.

4.3.5 Rare, Threatened, and Endangered Species

4.3.5.1 Affected Environment

A population of the federally endangered Shortnose Sturgeon (*Acipenser brevirostrun*) occurs in the Hudson River and has been documented from the Troy Dam to the waters near Staten Island in New York Harbor. Shortnose Sturgeon have been captured near the confluence of the East River and New York Harbor and at least two Shortnose Sturgeon tagged in the Hudson River have been recaptured in the Connecticut River, It is unknown whether these fish traveled through the East River and through Long Island Sound or exited New York Harbor into the Atlantic Ocean and swam around southern Long Island and back into Long Island Sound. The East River is not likely to be a high use area for sturgeon and there have been no documented captures of Shortnose Sturgeon in this waterbody. However, the best available information indicates that at least occasional transient Shortnose Sturgeon may be present in the East River.

Unlike Shortnose Sturgeon, Atlantic Sturgeon (*Acipenser oxyrinchus*) have been documented traversing the Project area by Verdant's RMEE 4 Tagged Species Detection. From May 2011 to present 29 acoustically tagged Atlantic Sturgeon have been detected on the VEMCO receivers Verdant deployed in the East and West Channels of the East River. Of those 6 Atlantic Sturgeon were detected in the East Channel where the Project is proposed and 23 in the West Channel where there is no Project.

Listed sea turtles also occur seasonally in New York waters and are known to be present in western Long Island Sound and in the New York Harbor complex. The sea turtles in these waters are typically small juveniles with the most abundant being the federally threatened Loggerhead (*Caretta caretta*) followed by the federally endangered Kemp's Ridley (*Lepidochelys kempi*). New York waters have also been found to be warm enough to support federally endangered Green Sea Turtles (*Chelonia mydas*) from June through October. While federally endangered Leatherback Sea Turtles (*Dermochelys coriacea*) may be found in the waters off Long Island during the warmer months as well, this species is less likely to occur in the action area for this project as it is typically found in more offshore waters. Like the Shortnose Sturgeon, there have been no documented captures of sea turtles in the East River, and it is not likely to be a high use area for these species. However, as sea turtles are known to occur in the waterbodies surrounding the East River, it is likely that occasional transient sea turtles occur in the East River. The best available information indicates that listed species may at least occasionally occur in the project area (NOAA, 2008).

4.3.5.2 Life History Information on Identified Species of Concern

Shortnose Sturgeon (*Acipenser brevirostrum)* from NYDEC, 2008

The federal and state-listed Shortnose Sturgeon is the smallest of New York's sturgeons, rarely exceeding 3.5 feet in length and 14 pounds in weight. The Shortnose Sturgeon's life history is complex. The Shortnose Sturgeon is anadromous, migrating from salt water to spawn in freshwater. In the Hudson River, it spawns from April-May. Adult sturgeon migrate upriver from their mid-Hudson overwintering areas to freshwater spawning sites north of Coxsackie. Unlike most fish species, spawning is not a yearly event for most Shortnose Sturgeon. Newly-hatched fry are poor swimmers and drift with the currents along the bottom. As they grow and mature, the fish move downriver into the most brackish parts of the lower Hudson. Shortnose Sturgeon are long-lived. The oldest known female reached 67 years of age and the oldest known male was 32. Bottom feeders, Shortnose Sturgeon eat a variety of organisms. Using their barbels to locate food and their extendable mouths to then vacuum it up, they eat sludge worms, aquatic insect larvae, plants, snails, shrimp, and crayfish. Riverwide population estimates in the 1990s showed the spawning population had increased substantially from that observed in the 1970s. A detailed Shortnose Sturgeon life history discussion is included in the Shortnose Sturgeon

biological assessment located in Volume 4 of this Pilot License Application.

Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

The Atlantic Sturgeon are similar to the Shortnose Sturgeon as a long-lived anadromous species, however, they are larger than Shortnose Sturgeon (Scott and Crossman, 1973). Spawning adults migrate upriver in spring, from April to May. Following spawning, males may remain in the river or lower estuary until the fall, while females typically exit within 4-6 weeks (NOAA 2008). Adults forage on benthic invertebrates while young sturgeon eat a wide variety of bottom-dwelling plant and animal material (Scott and Crossman, 1973). A detailed Atlantic Sturgeon life history discussion is included in the Atlantic Sturgeon biological assessment located in Volume 4 of this Final License Application.

Sea Turtle General Overview

Most of the feeding and nesting range for the Loggerhead, Kemp's Ridley, and Leatherback Turtles is generally in the warm tropics. The annual reproductive cycle for female sea turtles includes migration to the reproductive area, the nesting period, remigration from the nesting beach to the feeding range, and a period of active foraging. Females may nest anywhere from every year to every 7 years. Sea turtles are long-lived animals that depend on multiple nesting seasons to perpetuate the populations. The survival rate of hatchling sea turtles is low due to high predation. Adults and juveniles are free swimming, but hatchlings often drift with mats of Sargassum in the sea currents. Adult and juvenile sea turtles are known to travel several thousand miles from nesting locations to foraging habitat (Ernst et al., 1994).

It is during the foraging period that these sea turtles may wander north to find food beyond the tropical waters. This foraging period comprises the longest phase of a sea turtles life cycle. In the northern latitudes the foraging period may also include a period of hibernation. For the smaller hard-shelled sea turtles such as the Loggerhead, Green, and Kemp's Ridley the foraging habitat can include bays, lagoons, salt marshes, creeks, and the mouth of large rivers. The diurnal activity cycle of the hard-shelled sea turtles includes foraging in the shallows during midmorning and mid-afternoon, and resting in deeper waters midday. The Leatherback Turtle is generally found in the open ocean (Ernst et al., 1994).

Loggerhead Turtle (*Caretta caretta*)

The Loggerhead Turtle is the most abundant sea turtle in North America; however, it is listed as federally threatened in the Endangered Species Act (ESA) (NMFS, 2008). It is also the largest living hard-shelled turtle, commonly growing a shell of more than 3 feet in length. The turtle can be found in the Pacific, Atlantic, and Indian Oceans. Peak Loggerhead Turtle nesting occurs from May to July. It is the only sea turtle that has a nesting range beyond the tropics. It has been found nesting as far north as New Jersey. Loggerheads are omnivores but invertebrates make up a dominant portion of their diet (Ernst et al., 1994). A detailed Loggerhead Turtle life history discussion is included in the sea turtle biological assessment located in Volume 4 of this License Application.

Kemp's Ridley Turtle (*Lepidochelyes kempii*)

The Kemp's Ridley Turtle is also a federally endangered species. It is the smallest sea turtle reaching a maximum shell length of about 2.5 feet. Adult Kemp's Ridley Turtles are rarely found beyond the boundaries of the Gulf of Mexico. Juvenile turtles have wandered along the eastern United States as far north as the Long Island Sound, New York. This species prefers shallow water typically less than 160 feet deep. Nesting occurs from April to July. The Kemp's Ridley Turtle is primarily carnivorous and feeds mostly on crabs (Ernst et al., 1994). A detailed Kemp’s Ridley Turtle life history discussion is included in the sea turtle biological assessment located in Volume 4 of this License Application.

Leatherback Turtle (*Dermochelys coriacea*)

The Leatherback Turtle is likely the most widely distributed reptile in the world, but it is an endangered species (NMFS, 2008). The average shell size of a mature Leatherback Sea Turtle is approximately 5 feet. The species is rarely observed in shallow waters of bays and estuaries. The turtles spend the majority of their lives following drifting schools of jellyfish in the open and coastal waters of the ocean. High concentrations of these turtles can be found where food is in abundance. The Leatherback reaches New England in late spring in time to capitalize on concentrations of jellyfish. One of two relatively high summer abundances of these turtles occur south of Long Island. Leatherbacks migrate to nesting habitat in tropical waters of several

different continents. Only rare occurrences of nesting have been reported along the Atlantic coast and no known nests occur north of Georgia. The nesting season on the Atlantic coast lasts from April to July (Ernst et al., 1994). Critical habitat for the Leatherback was designated for the coastal waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands (NMFS, 2008). A detailed Leatherback Turtle life history discussion is included in the sea turtle biological assessment located in Volume 4 of this License Application.

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is a New York state threatened species. This species was once extirpated from the state but has since made a remarkable recovery. The population decline has been attributed to the use of chemical pesticides such as DDT. Since this chemical was banned the population of this species has been increasing. These birds can be found in many different habitats including tundra, savannah, seacoasts, high mountains, forests, and cities. In urban areas the birds nest on ledges created by tall buildings or artificial nest sites on bridges (NYDEC, 2008). The Peregrine feeds on a variety of birds but especially doves and pigeons (Ehrlich et al., 1988). The abundant source of pigeons is a likely source of forage for the Peregrine in urban habitat.

Bald Eagle (*Haliaeetus leucocephalus*)

On August 8, 2007, the Bald Eagle (*Haliaeetus leucocephalus*) was removed from the Federal Endangered Species list and is no longer protected under Section 7 of the Federal Endangered Species Act; however, Bald Eagles remain on the New York State list as a State-listed threatened species. Bald Eagles are also protected under the Migratory Bird Treaty Act (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755) and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). Bald Eagles have previously been released by New York City Parks approximately 6 miles from the proposed project (Inwood Hill Park) as part of their Urban Park Ranger Eagle Program. If Bald Eagles are found within the project area, Verdant Power will follow the USFWS Bald Eagle Management Guidelines prior to commencement of work.

4.3.5.3 Environmental Effects

Throughout the last several years, Verdant Power has implemented a formal procedure for observations of protected species to be recorded during the bird observation and on and near water activities associated with the operation of the RITE demonstration project and during execution of on-water studies. Verdant Power also attempted to evaluate the occurrence of RTE species in conjunction with performing the Fish Movement and Protection Study with the fixed hydroacoustics in January to June 2007, in conjunction with the deployment of the study units. While it was recognized that evaluating the occurrence of a rare species was difficult; Verdant Power attempted using the hydroacoustics to observe large, slow moving targets (representative of a rare sea turtle). This technique did not yield any observations and this protocol was abandoned by mutual agency consent in August 2007.

In addition to the fixed hydroacoustics, Verdant Power also made efforts to conduct incidental observations of RTE species in conjunction with other field studies -namely monthly mobile hydroacoustic studies (pre-2005; and post-deployment for 6 months in January through June 2007) and during execution of the bird observation hours. No occurrences were logged. Verdant Power personnel operating during the three deployments (December 2006 through and including November 2008; discontinuous) were also asked to observe and record any unusual aquatic observances and the control room logs show no recorded data related to RTE. No incidental observations of rare species were made concurrent with the other >500 hours of other field studies conducted. A review of other intake data from area power plants; specifically, Ravenswood and Astoria yielded no observations in the 17 years of historical record reviewed except for two Shortnose Sturgeon juveniles that were impinged at Astoria in 1993. Verdant Power has also collected operational data such as turbine blade rotational speed and water velocity measurements in and around the turbines to better understand the potential for impact.

NMFS has based some of their recently stated concerns with respect to sturgeon impacts based on reported injuries and deaths of Atlantic Sturgeon at the Annapolis tidal project in Nova Scotia, Canada. However, as indicated in NMFS's letters there are substantial differences between the Annapolis River project and the RITE Project. Of particular importance is the fact that a tidal barrage system, like that used at the Annapolis Project, directs all outgoing tidal flows

through an intake structure and associated turbines while the open design of Verdant Power's KHPS units affects a relatively small percentage of the cross-sectional tidal flow and has the potential to be avoided by most fish species. The concern raised by NMFS about the potential for tidal turbines to affect sturgeon species by disrupting migration or other essential behaviors also does not appear applicable to this type of system, in which the river is not blocked.

Based on known information, the potential for sea turtles to be in the project area is likely to be low. The Loggerhead or juvenile Kemp's Ridley may occasionally be in the area, but the Leatherback would not be expected to be present at any time. The lack of suitable feeding habitat in the area of the turbines would further limit the likelihood of sea turtles being in and around the proposed Project.

The largest potential for the Project to affect any of the endangered species mentioned would be if a species moving through the area was directly struck by a turbine blade, potentially causing injury or mortality. Boat propeller strikes have been reported to cause injury or mortality to sturgeon and sea turtles. However, operational data confirms that the blades on Verdant Power's KHPS units rotate at speeds of 30 rpm, orders of magnitude slower than boat propellers. Boats traveling 30-40 miles per hour have propellers capable of turning at speeds of up to approximately 2000 rpm (to approximately 600 rpm for larger commercial ships), this appears to be a very different situation than a stationary turbine rotating at normal loaded operating condition.

Peregrine Falcons would not be likely to be affected by the project operation as they do not feed in the water where the turbines would be located. Peregrine Falcons do nest on bridges in the project area, but construction and maintenance activities should not affect nesting behavior as it would be similar to other boat traffic on the river.

Though Verdant Power believes the potential for the proposed project to affect any of aforementioned endangered species appears low, Verdant Power requested and was granted FERC designation as the non-federal representative to pursue consultation under the ESA with respect to this License Application. Verdant Power has consulted with NMFS and prepared a

Biological Assessments on Shortnose Sturgeon, Atlantic Sturgeon, sea turtles, which are included in Volume 4 of this License Application.

Proposed Monitoring Plan

As part of the RITE Monitoring of Environmental Effects (RMEE) proposed plan, Verdant Power has proposed to continue to monitor tagged species via hydrophones in the East River on both sides of Roosevelt Island to monitor for tagged sturgeon that have been tagged as part of various efforts along the East Coast. More details on this plan are included in Volume 4 of this License Application. Verdant Power will also continue to observe all species activities and migration including RTE species. Verdant Power will continue to record any incidental observational data that would support providing new information on known species occurrences during the pilot period. These studies should provide additional information on the potential for the turbines to impact any fish species as well document the occurrence of any of these endangered species in the project area.

4.3.5.4 Unavoidable Adverse Effects

No unavoidable adverse effects to any RTE species have been identified. This will be the subject of ongoing consultations with resource agencies.

4.3.5.5 No Action Alternative

While the risks of the proposed KHPS units on RTE species is limited, under the No Action Alternative, new turbines would not be installed and therefore no additional risk would be posed to RTE species.

4.3.5.6 Sources

Ehrlich, P.R., D.S., Dobkin, and D. Wheye. 1988. The birder's handbook: A field guide to the natural history of North American birds. Simon & Schuster Inc. New York, NY.

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National Marine Fisheries Service (NMFS). 2008. Marine Turtles. [Online] URL: http://www.nmfs.noaa.gov/pr/species/turtles/ Accessed November 15, 2008.

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New York Department of Environmental Conservation (NYDEC). 2008. Shortnose Sturgeon Fact Sheet. [Online] URL: http://www.dec.ny.gov/animals/26012.html Accessed November 11, 2008.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada Bulletin 184: 966 pp.

4.3.6 Recreational Resources

4.3.6.1 Affected Environment

The East River was a popular spot for swimming, fishing, and rowing in the first half of the twentieth century. This resource declined in recreational importance as new roadways cut off public access to the water and the river became increasingly polluted with industrial wastes. Water quality in the New York harbor has, however, markedly improved over the past few decades. Initiatives of the New York City Department of Environmental Protection and the USACE have reduced floatable debris in the waters of the New York harbor, while improved sewage treatment has reduced nutrient and pathogen concentrations. Levels of contaminants such as PCBs, dioxins, and mercury have decreased under the Clean Water Act, though these contaminants are still concentrated at high enough levels in fish tissue to warrant consumption advisories for many species in the area. Improved water quality has spurred a recreational renaissance in the New York harbor and nationwide. Recreation competes with other uses of urban waterways and waterfronts, especially commerce, industry, and transportation.

The RITE Project's location within the East Channel is not proximate to any marine sanctuaries, government-protected coastal/marine areas, or state-protected river segments. There are no project lands under study for inclusion in the National Trails System or as a Wilderness Area. There are no state parks on Roosevelt Island or across the East Channel in Queens. Regionally and nationally, there are important recreation areas within New York Harbor; however, none of these are impacted by the RITE Project.

In order to assess the level of usage of the project area for recreational opportunities and the effects of the RITE Project (both demonstration and pilot project buildouts) Verdant Power conducted an assessment to evaluate and characterize existing recreational opportunities and use in the RITE project area. This information was summarized in the final pilot License Application. Additional data has been collected throughout the term of the Pilot License and this information is summarized below.

Table 4.3.6.1-1. RMEE-7 summary of RITE recreational monitoring data 2011 - 2019.

Year	Date	Day	Total Time	Total Vessels
2012	26-May	Sat (MD)	2 hours	7
2012	7-Jul	Sat (ID)	1.5 hours	4
2012	3-Sep	Mon (LD)	4 hours	31
2014	26-May	Mon (MD)	1.8 hours	40
2015	25-Nov	Wed	4.5 hours	16
2019	27-May	Mon (MD)	4 hours	78
2019	4-Jul	Thu (ID)	4 hours	69
2019	12-Jul	Fri	4 hours	25
2019	16-Aug	Fri	4 hours	42
2019	2-Sep	Mon (LD)	4 hours	31

Vessel type defined as:
Marina vessels included small, medium and large vessels, including Government vessels, and sailboats
Commercial vessels included water taxis, the circle line and tugs/barges
Put-in vessels included jet skis, kayaks, paddle boards and canoes

Photo 4.3.6.1-1. Memorial Day 5/27/2019

Photo 4.3.6.1-2. July 4th 7/04/2019

Photo 4.3.6.1-3. Summer Day 8/16/2019

Photo 4.3.6.1-4. Labor Day 9/02/2019

The only change that has occurred since the Pilot License was issued is that the Astoria Ferry Line now stops at Roosevelt Island by the Tramway along the East Channel. Verdant has recently reestablished the USCG approved exclusion zone and is working with the Ferry operators and other marine vessels operators to ensure they understand the updated NOAA charting of the PATON buoys and avoid the exclusion, but staying in the approved Vessel Transit Area, which has adequate area to safely navigate.

4.3.6.2 Environmental Effects

Based on extensive research and consultation conducted prior to the Pilot License Issuance, Verdant Power and FERC concluded that because of the strong currents and restricted points of public access to the East Channel of the East River along Roosevelt Island, this portion of the East River provided minimal recreational opportunities (e.g., swimming, boating, fishing) for local residents.

Table 4.3.6.2-1. Summary of effects of RITE Project on recreational facilities. (Source FERC's EA on the Pilot Project, 2011).

	RITE East Channel
Existing and Planned Parks	No effect
Shore-Based Fishing	Not feasible at site, access available at the northern and southern end of Roosevelt Island
Water-Based Fishing	Minimal exclusion zone for KHPS array - minor effects
Recreational Boating	Minimal exclusion zone for KHPS array - minor effects
Annual Events	Manhattan Island Marathon Swim – no effect No current anchoring for July 4th fireworks - not an issue
Public Shoreline Access	Not available currently on Roosevelt Island
Water Taxi Service	No effect

4.3.6.3 Unavoidable Adverse Effects

The need to provide an exclusion zone around the area proposed for the East Channel Pilot Project will necessarily restrict use of this area for recreational boating and fishing. However, this area currently receives minimal use and ample boating and fishing opportunities will continue to exist throughout the remainder of the East Channel.

4.3.6.4 No Action Alternative

Under the No Action Alternative, no changes in the existing recreational resources would occur. The restriction zone for recreational use, including boating, would not be expanded to cover the full proposed field.

4.3.6.5 Source

Verdant Power, Inc. 2010. Pilot License Application for the Roosevelt Island Tidal Energy Project, FERC Project No. 12611. December 2010. Prepared by Kleinschmidt Associates.

4.3.7 Navigation and Land Use

4.3.7.1 Affected Environment

The waters of the New York Harbor provide vital commercial, industrial, recreational, and ecological services to New York City. The Port of New York-New Jersey is the busiest port on the eastern seaboard. The waterways of the New York harbor support water-based recreation such as fishing and boating, as well as transportation. Activities in and adjacent to the New York Harbor are regulated by federal, state, and local authorities, including the U.S. Army Corps of Engineers, U.S. Coast Guard, the New York Department of State, the New York Metropolitan Transportation Authority, the Port Authority of New York and New Jersey, the New York City Department of Transportation, Office of Emergency Management, and Department of City Planning.

Federal Navigation Channel

The East River is the main artery connecting the Upper New York Bay and the Long Island Sound. With an entire length of 16 miles, the East River is spanned by eight bridges and thirteen tunnels and supports heavy vehicular traffic, as well as commercial and recreational water-based traffic. In the upper portion of the river, the West Channel between Manhattan and Roosevelt Island is more heavily used for transportation and recreational boating. NOAA's ENC Direct mapping system shows that the West Channel of the East River is a commercial navigation channel and is the designated Federal Navigation Channel. The West Channel also has restrictions as a security zone directly located in front of the UN building on the Manhattan side of the river at all times.

In the vicinity of the RITE Project, the East Channel north of the Roosevelt Island Bridge is too narrow and shallow for larger, deep draft vessels to pass through, though the Roosevelt Island Bridge can be opened to allow larger ships to pass. It is designated as a Vessel Transit Area (not a Federal Navigation Channel). However, the U.S. Coast Guard advised Verdant Power that in the event of an emergency in the West Channel, navigation traffic would be routed through the East Channel. Also, during a 2-week window each year when the UN Security Council is in session, it is standard operating policy to restrict navigation in the West Channel and use the East Channel Vessel Transit Area.

North of Roosevelt Island, the East River is joined by the Harlem River, the Bronx River, and the Bronx Kill as it is divided again by Ward's Island. Along the east of Ward's Island, the river narrows into the channel known as Hell Gate before passing through a narrow straight bounded by Astoria, Queens to the east and ending in the Long Island Sound.

This northern portion of the East Channel passage is also designated as the federal navigation channel.

Water Taxis

Water taxis are a common form of transportation for New Yorkers. Currently, there is one active route in the East River that stops at E. 34th Street, Hunters Point South, Greenpoint, North Williamsburg, South Williamsburg, DUMBO Fulton Ferry Landing, and Wall Street Pier 11. All current taxi stops are well outside the RITE pilot project boundary.

NYC Ferry

The Astoria Route of the NYC Ferry stops at Roosevelt Island near the tram on the East Channel. This route is fairly new and travels near the exclusion zone but no impacts to the Ferry operation are expected.

Photo 4.3.7.1-1. RITE Project Site with Buoys Marking Exclusion Area

Land Use

The proposed Project will have some facilities along the east shore of Roosevelt Island. Roosevelt Island is a 147-acre island operated by the Roosevelt Island Operating Company (RIOC), which manages and plans the residential and commercial development of the island. Existing land uses are predominantly urban residential, commercial, and industrial development.

Since most of the project components are underwater, shoreline land requirements are minimal consisting of the footprint of the existing control room, a storage container for equipment, and two planned shoreline vaults. These land-based easements are under discussion with the RIOC.

4.3.7.2 Environmental Effects

As part of the consultation process for the original Pilot License, Verdant Power executed an assessment to evaluate potential impacts to navigation and security associated with the deployment and operation of the RITE Project.

The development of the RITE Project could potentially restrict some navigation in the upper East River. Verdant Power has confined the deployment area of the project to an area that was pre-approved by the stakeholders, thereby having minimal effects on navigation through the East River. In addition, Verdant Power has developed a Navigation and Security Plan as presented in Volume 3 that addresses navigation safety and security.

The proposed Project has a very minimal footprint on land area (existing control room and proposed transmission vaults) so impacts to existing land uses are believed to be minimal.

4.3.7.3 Unavoidable Adverse Effects

Some minor land use for the existing control room and shoreline vaults would be needed. There would also be some increased risk of navigation safety concerns from the proposed exclusion zone and from deployment and maintenance activities, including during the short construction period when large surface vessels are present; however, the vessels will be

extremely well marked and a “Notice to Mariners” will be issued. In addition, these risks would be minimized through close coordination with the USCG for all in-water activities. Once the KHPS units are installed – and Private Aids to Navigation (PATONs) (buoys) are installed – there will be significantly lower surface risk.

4.3.7.4 No Action Alternative

Under the No Action Alternative, the proposed buildout would not be completed. Therefore, no additional impacts to navigation or land use would occur.

4.3.8 Aesthetic Resources

4.3.8.1 Affected Environment

As described in the ICD, the proposed RITE Project is located in one of the most densely populated urban regions of the country. Accordingly, the viewshed from the project area is primarily urban with a mix of residential, commercial, and industrial settings. The aesthetic resources of the project area include the working waterfront of the East River and manmade scenery such as the famous Manhattan skyline and several bridges. Natural scenic areas occur north of Roosevelt Island within the upper East River/Long Island Sound and southwest of the project area within New York/New Jersey Harbor.

The installation of the RITE 6-pack demonstration field within this urban environment provides an opportunity to understand the elements of a somewhat larger RITE East Channel buildout that is the subject of this pilot license application. As such, the photos of the existing RITE 6-pack serve as excellent representations of the visual and aesthetic aspects of the Project.

The visible components of the RITE Demonstration Project included:

- the surface buoy system that protects the underwater KHPS turbine array (Photo 4.3.8.1-1);
- the existing small control room/equipment shelter (Photo 4.3.8.1-2); and
- the storage container that is next to the control room (Photo 4.3.8.1-3).

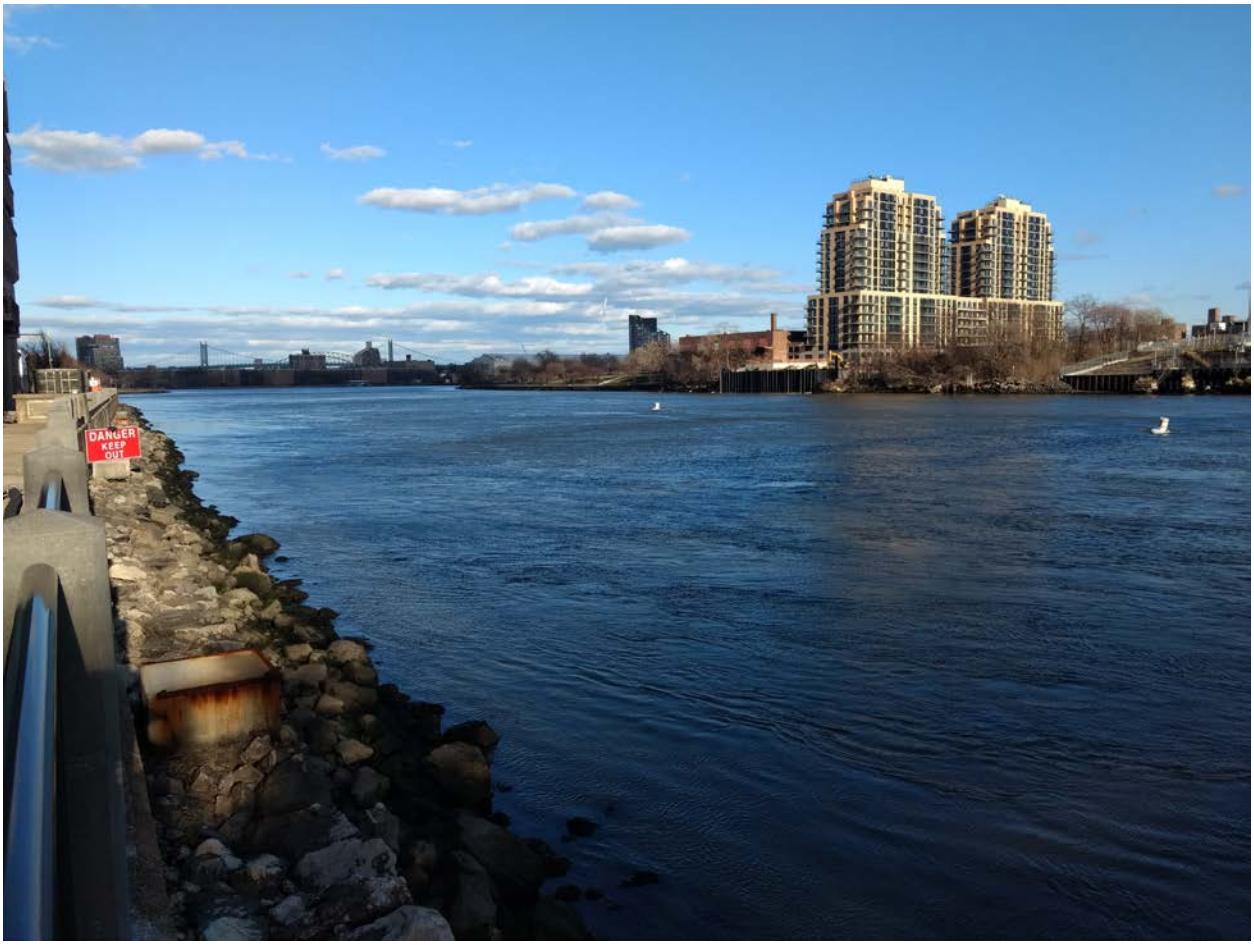

Photo 4.3.8.1-1. Verdant Power RITE Pilot site (November 2019)

Photo 4.3.8.1-2. Verdant Power's RITE Control Room (November 2019)

Photo 4.3.8.1-3. The CR and SC (storage container) at the RITE Site

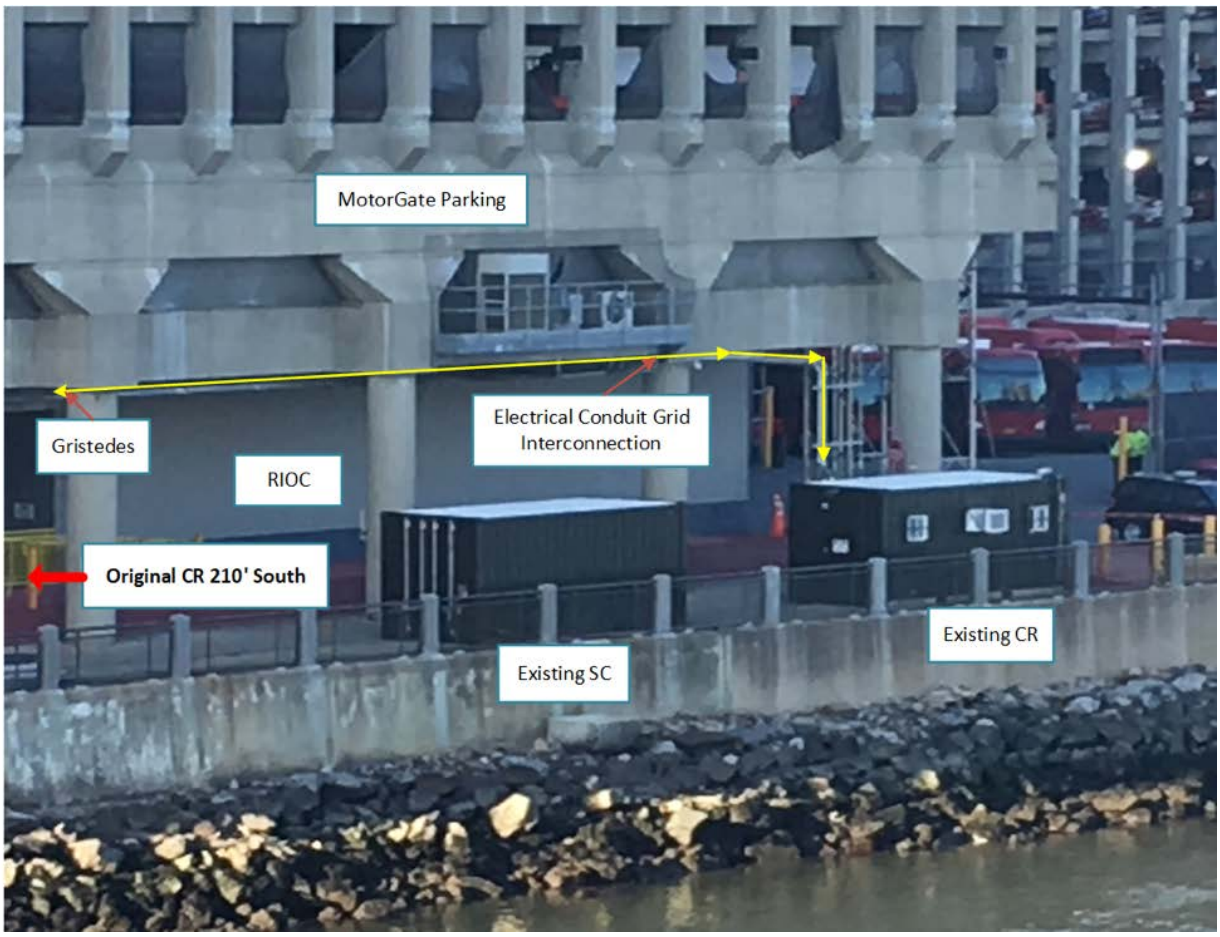

Photo 4.3.8.1-4. The CR and SC at the RITE Site (view from East River)

4.3.8.2 Environmental Effects

The proposed buildout would have only minimal additional aesthetic effects than the Demonstration Project. Verdant Power will install a buoy system to designate a boating and recreation exclusion zone. The buoys are necessary for navigation and recreation safety. This buoy system will look similar to the existing buoy system (Photo 4.3.8.1-1) but will cover a wider area. In addition, a "Danger Keep Out" sign is located in the area of the control room.

Verdant Power will install two small shoreline utility vaults to house the switchgear and cable to bring the power from the turbines to the shore (Photo 4.3.8.2-1). Verdant Power has designed the shoreline switchgear and cable vaults to blend in with the existing shoreline by mimicking the circa 1975 steam tunnel vents which are currently located between 135 ft and 185 ft apart along the shore (Photo 4.3.8.1-1). These land-based facilities would be designed as relatively low-profile structures, thus minimizing any aesthetic impact.

In addition, Verdant Power will install an informational kiosk similar to the poster on the existing control room for the demonstration Project**.** The kiosk will provide educational information regarding KHPS unit technology and the Project.

The urban setting of the RITE buildout project includes numerous sources for ambient sound; including the traffic (vehicular and commercial navigation), proximity to an operating natural gas peaking station (Ravenswood) and subway train route, as further detailed in the aquatic resources section. The acoustic characteristics of the project vicinity would not be likely to be impacted by the presence of the project.

Verdant Power does not expect any significant impact to the aesthetic resources from the pilot project buildout. Because of the minimal above-water infrastructure required by the RITE Project, no further aesthetic monitoring or studies are proposed for the new license term.

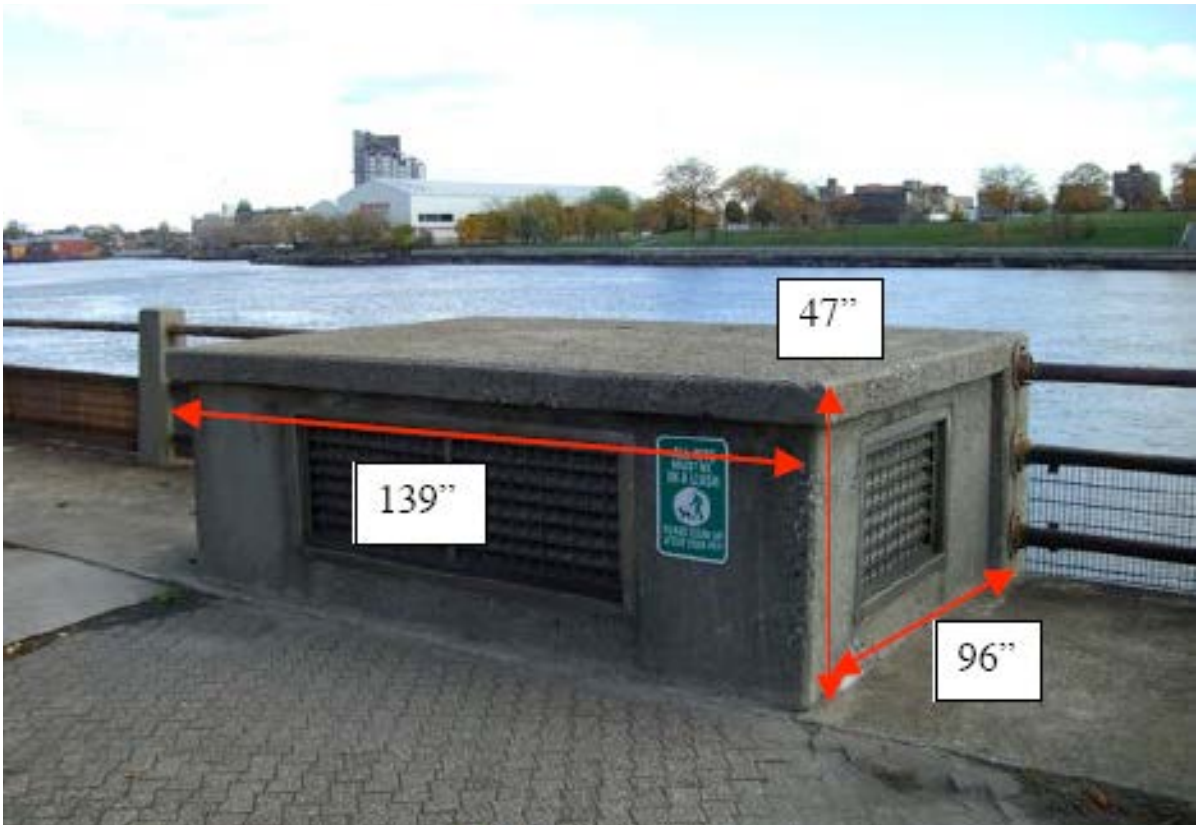

Photo 4.3.8.2-1. Typical Existing Steam Tunnel Vent

4.3.8.3 Unavoidable Adverse Effects

The buoys in the project exclusion zone, the danger signs associated with the project, and the shoreline vaults will need to be new features of the local viewshed. Because these have been designed to have minimal aesthetic effect and are similar to other features along this waterway, these effects are expected to be minimal.

4.3.8.4 No Action Alternative

Under the No Action Alternative, no additional effects to the aesthetics would occur. The cable vaults and informational kiosk would not be constructed. Buoys would not exclude a wider area of the water surface.

4.3.8.5 Source

Verdant Power, Inc. 2010. Pilot License Application for the Roosevelt Island Tidal Energy Project, FERC Project No. 12611. December 2010. Prepared by Kleinschmidt Associates.

4.3.9 Cultural Resources

4.3.9.1 Affected Environment

Under Section 106 of the National Historic Preservation Act of 1966, federal agencies must take into account the effects of federal actions on historic properties and give the Advisory Council on Historic Preservation opportunity to comment on actions and decisions. Consultation related to historic properties is done with state historic preservation offices. Also, under the National Historic Preservation Act (as amended in 1992), federally recognized Native American Indian tribes can assume the position of a state historic preservation officer for any activities affecting tribal lands.

Because the RITE Project is located in the City of New York, the Project is also subject to environmental review by the City of New York Landmarks Preservation Commission (LPC).

To describe the affected environment, Verdant Power conducted a literature review and desktop study for the Pilot License application and compiled a list of National Register Historic

Properties and Landmarks on Roosevelt Island. This was in response to a request from the City of New York LPC for additional information about the Project for the purposes of environmental review. In this information request, the City of New York LPC indicated that designated New York City Landmarks and properties listed on the National Register of Historic Places were located within the vicinity of the Project, and that the project area may be archaeologically significant. Based on the review and as summarized on Table 4.3.9.1-1; none of these properties, or other notable land-based historic sites, are proximate to the proposed RITE Project.

Table 4.3.9.1-1. National Register of historic places and the Landmarks Preservation Commission on Roosevelt Island.

SITE	DESCRIPTION
Roosevelt Island Lighthouse	Located on the north end of the island, the lighthouse was designed by architect James Renwick, Jr. and built in 1872. The lighthouse was built using inmate labor from the island's prisons.
City Hospital and The Octagon	Listed separately on the National Register these two sites were originally part of the first New York City mental health hospital, built in 1835. Designed by architect Alexander James Davis, the building was one of New York's finest buildings in its time. The facility was renamed Metropolitan Hospital in the 1890s and remained in use until the 1950s when the hospital was moved to newer buildings in Harlem. Most of the original hospital was demolished in the 1970s, and what remained of it was damaged by fires in 1982 and 1999. Today the Octagon remains and has been incorporated into the new Octagon Building (offices of Verdant Power), Apartments and Ecological Park.
Chapel of the Good Shepherd	Designed by Frederick Clark Withers the chapel was built in 1888 and later donated to the Episcopal City Mission Society. The mission served the imprisoned and infirmed of the island. Today the building houses the Good Shepherd Community Center.
Blackwell House	The Blackwell House was built in 1794 and is the fifth oldest wooden house in all of New York City.
Smallpox Hospital	Also designed by James Renwick Jr., the Smallpox Hospital was constructed in 1854 to house highly contagious smallpox patients on the island from the majority of the city's population.
Strecker Laboratory	Built in 1892 and designed by architects Withers and Dickson, Strecker Laboratory was built as a pathology lab for the City Hospital. It later housed the well-known Russel Sage Institute of Pathology.

Source: Verdant Power, 2003.

The New York State Historic Preservation Office (SHPO) maintains archaeological sensitive maps for New York State. These maps display all known archaeological sites. Like much of Manhattan and the surrounding New York boroughs, Roosevelt Island, Astoria, and the East River in the vicinity of the Project are located within a generally archaeologically sensitive buffer zone, as is much of Manhattan and Queens.

Prior to the Pilot Project, Verdant conducted a number of studies to evaluate potential impacts to historical and cultural resources associated with the deployment and operation of a field of KHPS turbines in the East Channel of East River as detailed in the final Pilot License application.

4.3.9.2 Environmental Effects

The detailed field studies verified that there are no sunken ships in the RITE East Channel buildout field. Based on the data collected in the field surveys, the proposed action will not disturb sunken artifacts.

Furthermore, the land-based features of the RITE East Channel Project do not affect any sites listed on the National Register of Historic Places. In a letter dated December 22, 2008, the New York State SHPO stated that "the project will have No Adverse Effect on cultural and historical resources eligible for or listed on the National Register of Historic Places." Based on these findings, we believe that a Historic Properties Management Plan (HPMP) for the RITE East Channel Project, if needed, would primarily be focused on notification if something unexpected is discovered during construction activities.

Based on detailed investigations of the field array site and land-based components within the project boundary, Verdant Power concludes that no further studies or mitigation is required besides normal construction precautions in the vicinity of the RITE East Channel buildout. In the event that an archeologically or culturally sensitive artifact is discovered during construction, Verdant Power will cease ground-disturbing activities and the appropriate group (i.e., Tribe, SHPO, etc.) will be promptly notified.

4.3.9.3 Unavoidable Adverse Effects

None Identified.

4.3.9.4 No Action Alternative

If the proposed RITE buildout Project is not constructed, no potential impacts to undiscovered cultural resources, if present, would occur.

4.3.9.5 Sources

Verdant Power, Inc. 2003. Initial Consultation Document for the Roosevelt Island Tidal Energy Project (ICD), FERC Project Number 12178. October 2003. Prepared by Devine Tarbell and Associates.

4.3.10 Tribal Resources

4.3.10.1 Affected Environment

For the Pilot License, Verdant Power determined that there are no federally listed Native American Indian tribes with interests in the project site or prehistoric archaeological sites near the Project. In accordance with FERC procedures for relicensing, the FERC tribal consultation process was initiated by FERC by letter on November 13, 2018 to four Native American tribal liaisons:

- The Delaware Nation in Anadarko, OK;
- The Delaware Tribe in Bartlesville, OK;
- The Stockbridge Munsee Community of Wisconsin, Bowler, WI; and
- The Shinnecock Indian Nation in Southampton, NY.

These tribes were contacted to solicit participation in the relicensing process for the RITE project, identified by FERC as Native American Indian Tribes possibly affected by deployment and/or operation of the RITE Project. No responses have been received that Verdant is aware of. Prior to the Pilot License, the Delaware Nation submitted a letter in 2008 stating that the location of the project does not endanger known sites of interest to the Delaware Nation though they requested that they be notified if any archeological sites or objects were inadvertently uncovered.

4.3.10.2 Environmental Effects

To date no further direction for consultation has been received by Verdant Power. To Verdant Power's knowledge, no concerns about the effects of project construction and operations on water resources, fish and aquatic resources, wildlife and botanical resources, wetland, rare species, recreation and land use, aesthetic resources, cultural resources and socio-economic resources have been raised from tribal cultural or economic interests. Further consultation under the FERC license will take place regarding any potential historical or cultural properties associated with the project if any sensitive resources are detected. In the event that an archeologically or culturally sensitive artifact is discovered during construction, Verdant Power will cease ground-disturbing activities and the appropriate group (i.e., Tribe, SHPO, etc.) will be promptly notified.

4.3.10.3 Unavoidable Adverse Effects

None identified.

4.3.10.4 No Action Alternative

Under the No Action Alternative, no activities that would potentially disturb tribal resources would occur. Therefore, there would be no impact to tribal resources.

4.3.11 Socioeconomic Resources

4.3.11.1 Affected Environment

The RITE Project is located in New York, New York. New York City is the largest urban area in the United States and the fifth largest metropolitan area in the world (including surrounding NYC metropolitan area) (World Atlas, 2008). New York City is recognized as a global hub for commerce, finance, international relations and cultural activity. According to the U.S. Census Bureau, the population of New York City was 8,302,659 in 2009. This was an increase of 3.7% from the population size in 2000 (8,008,278)[3]. The following tables summarize data regarding the population and industries in New York City.

[3] U.S. Census Bureau, 2005-2009 American Community Survey 5-Year Estimates

Table 4.3.11.1-1. Population distribution (2005 - 2009).

By Age:	
Under 5 Years Old	6.9%
18 Years and Over	77.1%
65 Years and Over	12.1%
Median Age (Years)	35.6
By Gender:	
Male	47.7%
Female	52.3%
By Race:	
One Race	97.9%
White	45.4%
Black or African American	25.1%
American Indian or Alaska Native	0.3%
Asian	11.7%
Native Hawaiian and Other Pacific Islander	0.0%
Other	15.3%
Two or More Races	2.1%
Hispanic or Latino (of any race)	27.4%

Table 4.3.11.1-2. Household information (2005 - 2009).

Median Household Income	***** $50,173
Total Housing Units	3,329,572
Owner-Occupied Housing Units	1,032,277
Renter-Occupied Housing Units	2,014,878
Vacant Housing Units	282,417

***** 2009 inflation-adjusted

Table 4.3.11.1-3. Economic Sectors (2007)[4].

Sector	Number of Establishments	Sales, Shipments, Receipts ($1,000)
Manufacturing	6,626	10,411,572
Retail Trade	31,459	78,206,482
Information	5,729	Not Available
Real Estate and Rental and Leasing	18,792	36,279,097
Professional, Scientific, and Technical Services	25,138	78,440,396
Administrative and Support and Waste Management and Remediation	8,539	25,027,661
Educational Services	1,946	3,212,957
Health Care and Social Assistance	20,839	62,555,079
Arts, Entertainment, and Recreation	5,322	14,487,525
Accommodation and Food Services	17,494	22,095,094
Other Services (except Public Administration)	19,105	26,308,524

[4] U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 2002 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, Census of Governments.

Table 4.3.11.1-4. Employment (2005 - 2009)[5].

Civilian Employed Population 16 Years and Over	**3,808,779**
Occupation	
Management, Professional, and Related Service	37.5%
Service	21.4%
Sales and Office	25.0%
Farming, Fishing, and Forestry	0.1%
Construction, Extraction, Maintenance, and Repair	6.8%
Production, Transportation, and Material Moving	9.2%
Industry	
Agriculture, Forestry, Fishing and Hunting, and Mining	0.1%
Construction	5.4%
Manufacturing	4.5%
Wholesale Trade	2.7%
Retail Trade	9.4%
Transportation and Warehousing, and Utilities	6.2%
Information	4.2%
Finance and Insurance, and Real Estate and Rental and Leasing	10.6%
Professional, Scientific, and Management, and Administrative and Waste Management Services	12.3%
Educational Services, and Health Care and Social Assistance	25.4%
Arts, Entertainment, and Recreation, and Accommodation and Food Services	9.4%
Other Services, Except Public Administration	5.6%
Public Administration	4.2%
Class of Worker	
Private Wage and Salary	78.3%
Government	15.1%
Self-Employed in own not incorporated business	6.5%
Unpaid Family Workers	0.1%

5 U.S. Census Bureau, 2007 Economic Census

4.3.11.2 Environmental Effects

The Project would not likely have any negative impact to the local economy but rather would likely benefit the local economy largely through job creation and business opportunities in the construction, manufacturing, and utilities industries. Verdant Power has utilized the U.S. Department of Energy National Renewable Energy Laboratory's *Job and Economic Development Impact (JEDI)* model, recently developed in beta for hydrokinetics, to estimate the potential economic development benefits, including job creation that would result from the development of the 0.5 MW RITE East Channel Pilot:

Table 4.3.11.2-1. Estimated economic benefits.

	Jobs	Earnings ($MM)	Output ($MM)
During Construction Period:	6	$4.5	$13
During Operating Years (Annual):	6	$0.04	$0.8

Additionally, the world-first nature of the RITE Project has not only generated a great deal of publicity for Verdant Power, but also for New York, which too has become viewed as a world leader in kinetic hydropower technology. Coupled with this public awareness is a growing number of local firms providing support to the RITE Project and thus gaining industry-leading expertise in kinetic hydropower systems manufacture and installation. This positions New Jersey, New York City and New York State as a hydrokinetic industry locale – both for local project development as well as the exportation of goods and expertise globally – which will result in continued and significant economic benefits for the area.

Based on our experience with the Pilot Project, Install B-1 over the period 2015 to 2019, Verdant Power has projected the following capital cost of construction and long-term O&M associated with a subsequent license for the RITE project.

Table 4.3.11.2-2. Estimated costs of construction.

RITE Project Cost Component	Install B-1 TF 1	Install B-2 TF 2-3-4	Install C TF -5	Totals 0.5 MW
Land and Land Rights	$50,000	$150,000	$50,000	$200,000
KHPS Turbines and Generators and TF	$2,500,000	$6,750,000	$2,000,000	$11,150,000
Assembly, Installation and Commissioning, (including underwater cabling)	$850,000	$2,400,000	$750,000	$4,000,000
Electrical Equipment, Instrumentation and Data Acquisition	$500,000	$1,000,000	$250,000	$1,750,000
Environmental Monitoring/ Regulatory Costs	$150,000	$200,000	$100,000	$450,000
Interconnection Costs	Included above	$400,000	$100,000	$500,000
Total Capital Costs	**$4,050,000**	**$10,900,000**	**$3,250,000**	**$18,050,000**
Annual O&M[6]	**$850,000**	**$950,000**	**$1,000,000**	

The estimated ongoing Operation and Maintenance (O&M) needs for the project area based on experience with in-water O&M expenses associated with the RITE Demonstration, and also include many one-time, first-time startup costs associated with operating an array of KHPS for an extended period of time. The estimates were based on the FERC code of accounts and include all costs for both operation and maintenance of hydraulic plant and O&M of transmission facilities. Implicit in the O&M costs for Install C is a full O&M cycle on the entire field of turbines in Years 5 and 8 of operation. Also included are the capital and O&M costs for ongoing environmental (RMEE) plans, safeguard plans, and financial assurances, including either relicensing or removal at the end of the license terms. It should be noted that these cost estimates represent projections of an entry-level commercial, kinetic hydropower project, and as such include, from experience, high contingencies associated with first-time applications and regulatory uncertainties.

6 Includes annual O&M and a levelized annual recovery based on a 7-year Retrieve and Replace maintenance cycle.

Additionally, any economic analysis of the RITE East Channel Pilot must take into account that the KHPS unit technology and the RITE project are unprecedented and thus the capital costs associated with this preliminary installation are not indicative of future and larger-scale installations and projects. The capital costs included in the Verdant Power Draft License Application are premised on the RITE Project being the world's first installation, thus benefiting from few economies of scale. In addition, there are significant fixed costs, regardless of the relatively small size of the installation, for the groundbreaking environmental, regulatory and manufacturing technology advances required by the project. In fact, the permitting and environmental costs associated with the RITE Project have far exceeded the fabrication and installation costs of the underlying system.

In order to help manage these early project capital costs, Verdant Power has been working to build a coalition of public and private partners to participate in a capital buy-down subsidy.

4.3.11.3 No Action Alternative

Under the No Action Alternative, the economic benefits of job creation would not be realized. The role of New York City and New York State in terms of becoming a leader in kinetic hydropower technology would be limited to the testing that has already taken place.

4.3.11.4 Sources

Census Bureau. 2006. American Community Survey 3-Year Estimates. [Online] URL: http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=ChangeGeoContext&geo_id=05000US36061&_geoContext=01000US&_street=&_county=new+york&_cityTown=new+york&_state=&_zip=&_lang=en&_sse=on&ActiveGeoDiv=geoSelect&_useEV=&pctxt=fph&pgsl=010&_submenuId=factsheet_1&ds_name=ACS_2008_3YR_SAFF&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry= Accessed December 2, 2010.

Census Bureau. 2008. State and County QuickFacts. [Online] URL: http:quickfacts.census.gov/qfd/states/36/36062.html Accessed December 2, 2010.

WorldAtlas.com. 2008. City Populations [Online] URL: http://www.worldatlas.com/citypops.htm. Accessed December 2, 2010.

4.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) of the Federal Power Act (FPA) requires the Commission to consider whether or not, and under what conditions, the project would be consistent with relevant comprehensive plans on the Commission's Comprehensive Plan List.

Verdant Power has reviewed the following plans we believe to be relevant to this project for consistency and are aware of no conflicts noted to date in any of the consultations.

New York

- New York State Office of Parks, Recreation, and Historic Preservation. 1983. People, resources, recreation. Albany, New York. March 1983. 353 pp. and appendices.

United States

- Atlantic States Marine Fisheries Commission. 1998. Interstate fishery management plan for Atlantic Striped Bass. (Report No. 34). January 1998.
- Atlantic States Marine Fisheries Commission. 1992. Fishery management plan for inshore stocks of winter flounder. (Report No. 21). May 1992
- National Marine Fisheries Service. 1998. Final Amendment #11 to the Northeast Multi-species Fishery Management Plan; Amendment #9 to the Atlantic sea scallop Fishery Management Plan; Amendment #1 to the monkfish Fishery Management Plan; Amendment #1 to the Atlantic Salmon Fishery Management Plan; and Components of the proposed Atlantic Herring Fishery Management Plan for Essential Fish Habitat. Volume 1. October 7, 1998.
- National Marine Fisheries Service. 2000. Fishery Management Report No. 36 of the Atlantic States Marine Fisheries Commission: Interstate Fishery Management Plan for American Eel (*Anguilla rostrata*). Prepared by the American Eel Plan Development Team. April 2000. 78 pp.
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LICENSE APPLICATION
ROOSEVELT ISLAND TIDAL ENERGY PROJECT

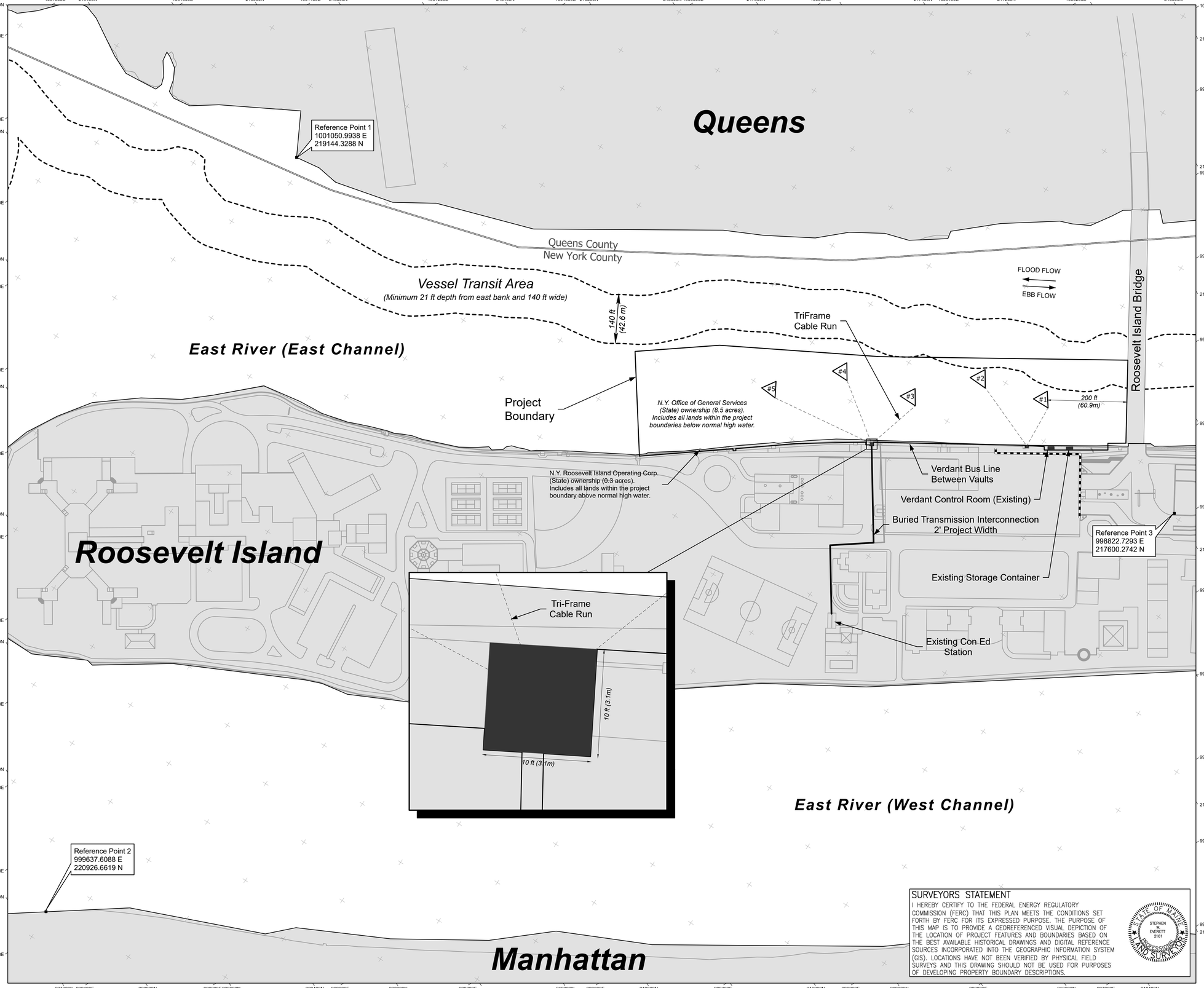
FERC NO. 12611

FINAL

EXHIBIT G
PROJECT BOUNDARY MAP

DECEMBER 2019

Submitted by:



12.79°W
12/17/2019

- Project Boundary
- Project Structures
- County Line
- Rivers
- Vessel Transit Area
- Proposed TriFrame Structures
- Reference Points
- Transmission Line
- Beckwith Connection Conduit

Map notes:

1. Coordinate system: New York State Plane, Long Island Zone (US Feet), NAD 83.

2. Vessel transit area based on NOAA navigation Chart "Tallman Island to Queensboro Bridge" updated June 2008. Depth soundings based on Mean Low Water Elevation.

3. Elevations shown are in feet, USGS Vertical Datum.

SURVEYORS STATEMENT

I HEREBY CERTIFY TO THE FEDERAL ENERGY REGULATORY COMMISSION (FERC) THAT THIS PLAN MEETS THE CONDITIONS SET FORTH BY FERC FOR ITS EXPRESSED PURPOSE. THE PURPOSE OF THIS MAP IS TO PROVIDE A GEOREFERENCED VISUAL DEPICTION OF THE LOCATION OF PROJECT FEATURES AND BOUNDARIES BASED ON THE BEST AVAILABLE HISTORICAL DRAWINGS AND DIGITAL REFERENCE SOURCES INCORPORATED INTO THE GEOGRAPHIC INFORMATION SYSTEM (GIS). LOCATIONS HAVE NOT BEEN VERIFIED BY PHYSICAL FIELD SURVEYS AND THIS DRAWING SHOULD NOT BE USED FOR PURPOSES OF DEVELOPING PROPERTY BOUNDARY DESCRIPTIONS.

STATE OF MAINE
STEPHEN W. EVERETT 2161
PROFESSIONAL LAND SURVEYOR

ROOSEVELT ISLAND TIDAL ENERGY PROJECT
FERC NO. 12611-NY
VERDANT POWER LLC

Exhibit G-1

Project Boundary Map

0 50 100 200 300 400 Feet

1:4,800

ROOSEVELT ISLAND TIDAL ENERGY PROJECT

FERC NO. 12611

FINAL APPLICATION FOR NEW LICENSE FOR MINOR WATER POWER PROJECT

EXHIBIT H
INFORMATION REQUIRED UNDER 18 CFR § 16.10

DECEMBER 2019

Submitted by:

VERDANT POWER

ROOSEVELT ISLAND TIDAL ENERGY PROJECT
FERC NO. 12611

FINAL APPLICATION FOR NEW LICENSE FOR MINOR WATER POWER PROJECT

EXHIBIT H
INFORMATION REQUIRED UNDER 18 CFR § 16.10

DECEMBER 2019

Submitted by:

VERDANT POWER

FINAL APPLICATION FOR NEW LICENSE
FOR MINOR WATER POWER PROJECT

EXHIBIT H
INFORMATION REQUIRED UNDER 18 CFR § 16.10

TABLE OF CONTENTS

FINAL APPLICATION FOR NEW LICENSE
FOR MINOR WATER POWER PROJECT

EXHIBIT H
INFORMATION REQUIRED UNDER 18 CFR § 16.10

1.0 INFORMATION TO BE PROVIDE BY ALL APPLICANTS

The Federal Power Act requires applicants for a new license to provide certain information about the applicant's record as the current licensee of the project. Pursuant to 18 CFR § 16.10, this information is provided in this Exhibit. 18 CFR § 16.10(a) information requirements include the need for power and the examination of alternative sources; plans to modify an existing Project; an applicant's ability to operate and maintain the Project; and the applicant's electrical efficiency programs. This information is included in Section 1.0 of this Exhibit. Pursuant to 18 CFR § 16.10(b), Section 2.0 contains information to be provided by an applicant who is the existing licensee for a Project and discusses Verdant's safe management, operation, and maintenance of the Pilot Project; compliance with the current license; and actions related to the Project that affect the public.

1.1 Plans and Ability of Verdant to Operate the Project

Because of the nature of this project, a first of its kind tidal energy Pilot project, most of the information required by this section of the regulations is not applicable. The B-1 deployment under the existing Pilot license should provide additional information on power output, operations and maintenance. Operation of the RITE project is not coordinated with any other projects as it is the only tidal energy project in the East River and the tides are not controlled or altered by operation of any developments. There are other reasonably available sources of power that could replace power produced by the project, but this is an effort to develop a new form of renewable energy technology that may have applicability throughout the world.

1.2 Financial Resources

Verdant will supply this information in required filings under the existing Pilot License.

1.3 Personnel Resources

The applicant, Verdant Power, LLC is a wholly-owned subsidiary of Verdant Power, Inc. and as such shares management and technical personnel, as of 2019, numbering 9 total; including four technical, engineering positions specifically dedicated to the operation and compliance of the Licensed RITE project.

These individuals have been integrally involved in the operation and compliance of the current Pilot licensed project, and thus have the necessary technical skills and on-the-job-training to perform duties in the relicensing period.

1.4 Names and Mailing Addresses of Indian Tribes

In accordance with FERC procedures for relicensing, the FERC tribal consultation process was initiated by FERC by letter on November 13, 2018 to four Native American tribal liaisons:

- The Delaware Nation; P.O. Box 825; Anadarko, OK 73005
- The Delaware Tribe; 5100 Tuxedo Blvd.; Bartlesville, OK 74006
- The Stockbridge Munsee Community of Wisconsin; N8476 MoHeConNuck Rd.; Bowler, WI 54416
- The Shinnecock Indian Nation; P.O. Box 5006; Southampton, NY 11968

These tribes were contacted to solicit participation in the relicensing process for the RITE project, identified by FERC as Native American Indian Tribes possibly affected by deployment and/or operation of the RITE Project. No responses have been received that Verdant is aware of. Prior to the Pilot License, the Delaware Nation submitted a letter in 2008 stating that the location of the project does not endanger known sites of interest to the Delaware Nation though they requested that they be notified if any archeological sites or objects were inadvertently uncovered.

2.0 INFORMATION TO BE PROVIDED BY APPLICANT WHO IS AN EXISTING LICENSEE

2.1 Statement of Measures by Licensee to Ensure Safe Management and Operation of the Project

As described in Exhibit A of this application, the Project operation follows the tidal cycle and high water events are both uncommon and not relevant to operations as the turbines are well below the high water line under any flood conditions. Water is not impounded here like it would be in conventional hydroelectric project developments so there are not provisions for downstream safety. There have been no employee or public safety incidents at the Project.

Questions pertaining to project operations and lost generation during unplanned outages are not applicable for this Project as the project has not been generating during the majority of the Pilot License term. Install B-1, slated to occur in 2020, will provide additional information on operation and maintenance considerations.

2.2 License Compliance Activities

Verdant has been active at the RITE site for over 15 years successfully developing a hydrokinetic project that harnesses energy from the strong tidal currents in the East River. Verdant filed an Initial Consultation Document to license the project in 2003 and since that time has conducted numerous studies to understand potential environmental, recreational, or other possible issues associated with a test project deployment. Under the "Verdant Order" (2005), Verdant installed and operated a tidal kinetic hydropower array in the East River from 2006-2009. In December 2010, Verdant filed a final license application (FLA) for a Pilot License. On January 23, 2012 the Commission issued a 10-year Pilot License effective January 1, 2012 (FERC Project No. 12611). This was the first Pilot License issued by the Commission. It was developed in accordance with the guidance provided in the Commission's whitepaper, "Licensing Hydrokinetic Pilot Projects" (August 2007) and in accordance with the Commission's regulations under 18 CFR Part 5.

This license includes a staged deployment with environmental monitoring to determine if there are any impacts before expanding the array, an agreement to alter, shut down, or remove

the project if unacceptable risks to the public or environment are shown through monitoring efforts, and provisions for ongoing monitoring of environmental conditions in the project area.

Since License issuance, Verdant has worked diligently to comply with the terms of the license. Verdant has made continuous progress on understanding the Project site throughout the term of the Pilot License. This has included collection of site data for License Compliance and RITE Monitoring of Environmental Effects (RMEE) studies that continue to show this area to be a viable site for installation and testing of Verdant's tidal turbine technology. Specifically, Verdant has filed the following plans since being issued the Pilot License and NY State Water Quality Certification (WQC):

- RMEE-2 Seasonal Dual-Frequency Identification Sonar (DIDSON) Monitoring (WQC #11): Verdant successfully beta-tested the DIDSON equipment at the RITE site in 2012; and during 2014-15 worked with the Oak Ridge National Laboratory to post-process the DIDSON imagery to support the scientific evaluation of fish presence, abundance and behavior in the presence of an operating KHPS. An agency filing was made in 2016, and FERC ordered, after petition by Verdant this monitoring be suspended.
- RMEE-3 Seasonal Species Characterization (Netting) (WQC# 12): In 2013, Verdant competed the first seasonal netting activity, which was reviewed by the agencies. and FERC ordered, after petition by Verdant this monitoring be suspended.
- RMEE-4 Tagged Species Detection (WQC #13): Beginning in 2011, Verdant Power voluntarily initiated this plan well in advance of the license requirements and has continued data collection and reporting throughout 2012-19.
- Monitoring of Rare, Threatened and Endangered Species (WQC #14): Verdant has made compliance filings through 2019.
- RMEE-6 Underwater Noise Monitoring (WQC #16): In anticipation of RITE Install B-2 Verdant has begun a protocol design effort to develop the instrumentation required for this plan.
- RMEE-7 Recreational Monitoring (WQC#17): Verdant has voluntarily begun observation and compliance reporting on recreational use at the project site.
    - Article 404 - Navigation and Safety Plans: In accordance with the license, in March 2015 Verdant commenced consultation with the U.S. Coast Guard (USCG) regarding the final location of the RITE exclusion zone and associated buoys. A key element of that discussion was the exact definition and requirement for the "vessel transit area (navigation channel)" depicted on the project Exhibit F-1. In order to accurately define that channel and the relative RITE Project Boundary and navigation aides, Verdant provided the agencies with construction quality mapping of the boundary to support final

project drawings. The preliminary results of that effort have been submitted to the Commission (as CEII) and Verdant will continue consultation with the USCG under this Article.

- Verdant has made annual filings in 2013, 2014, 2015, 2016, 2017, 2018 and pending 2019 reporting on annual field reconnaissance of project works and an update of the Emergency Action Plan (EAP) notification chart for the project.

The Project does not occupy any federal or Indian Lands and there are no annual fees.