

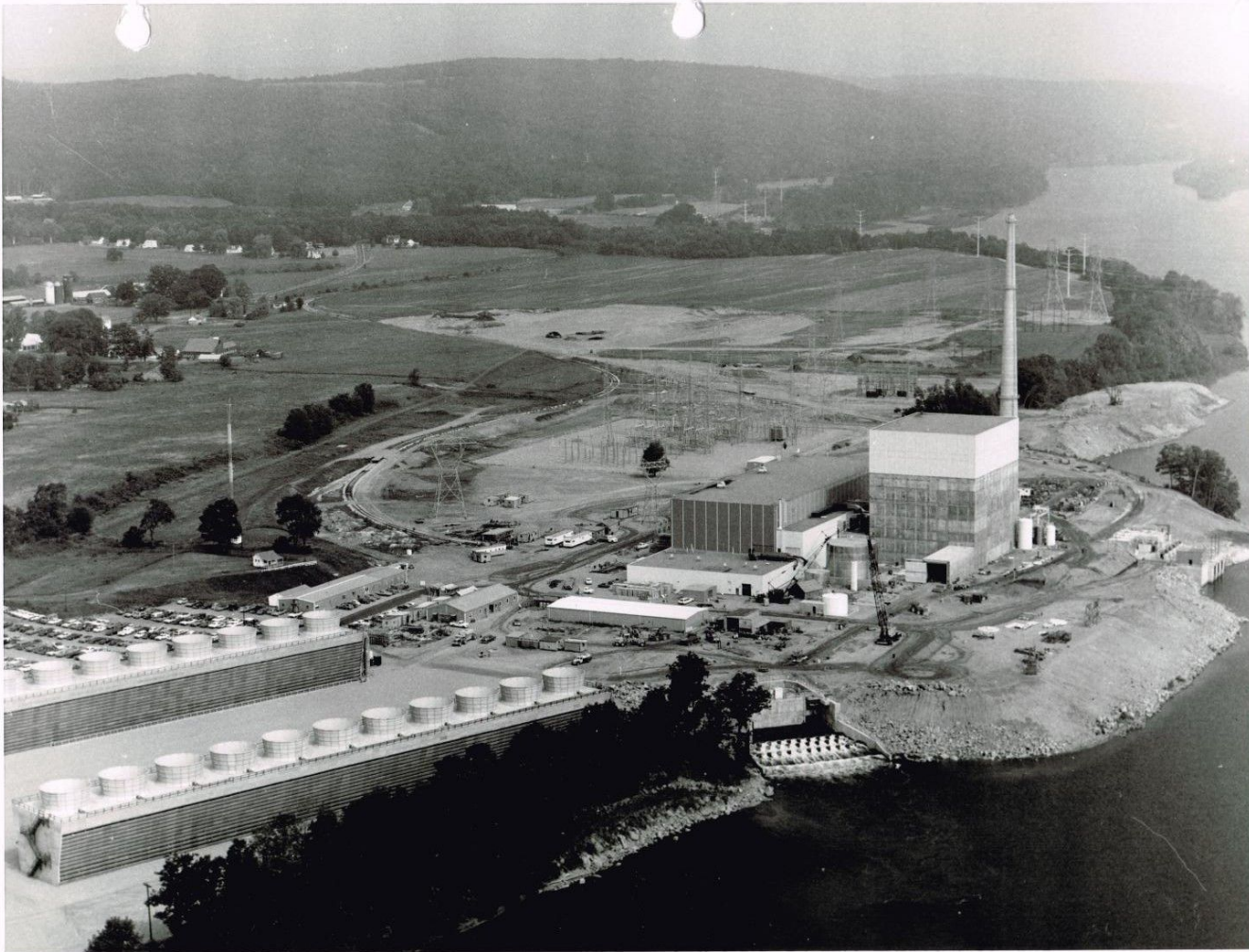
Landscape Inventory of the Vermont Yankee Decommissioning Site

*This story was made with [Esri's Story Map Journal](#).
Read the interactive version on the web at <http://arcg.is/nDijW>.*



A collaborative project between Antioch University New England, NorthStar, the Town of Vernon, and Rich Holschuh.

Project Background



VERMONT YANKEE NUCLEAR POWER STATION

JUNE 21, 1971

Antioch University New England, through the **Center for Climate Preparedness and Community Resilience** ([link: http://www.communityresilience-center.org/](http://www.communityresilience-center.org/)), partnered with **NorthStar** ([link: https://www.northstar.com/](https://www.northstar.com/)), the **Town of Vernon** ([link: https://vernonvermont.org/](https://vernonvermont.org/)), and Rich Holschuh, a cultural resources officer and spokesperson for the **Elnu Abenaki Tribe of Vermont** ([link: http://elnuabenakitribe.org/](http://elnuabenakitribe.org/)), to create an innovative model of collaborative site restoration. This collaborative effort seeks to support redevelopment efforts at the Vermont Yankee Nuclear Power Plant site in Vernon, Vermont.

The objective of this project is to accurately identify landscape characteristics, resources, and natural elements on the study site in order to assess the future usability of the site and assist in the redevelopment of the property. This project is not intended to dictate the future use of the property, but rather assist in the decision making process.

Historical Context of the Study Site



VERNON, VT.
ATOMIC UNIT
APRIL 11, 1967

#3

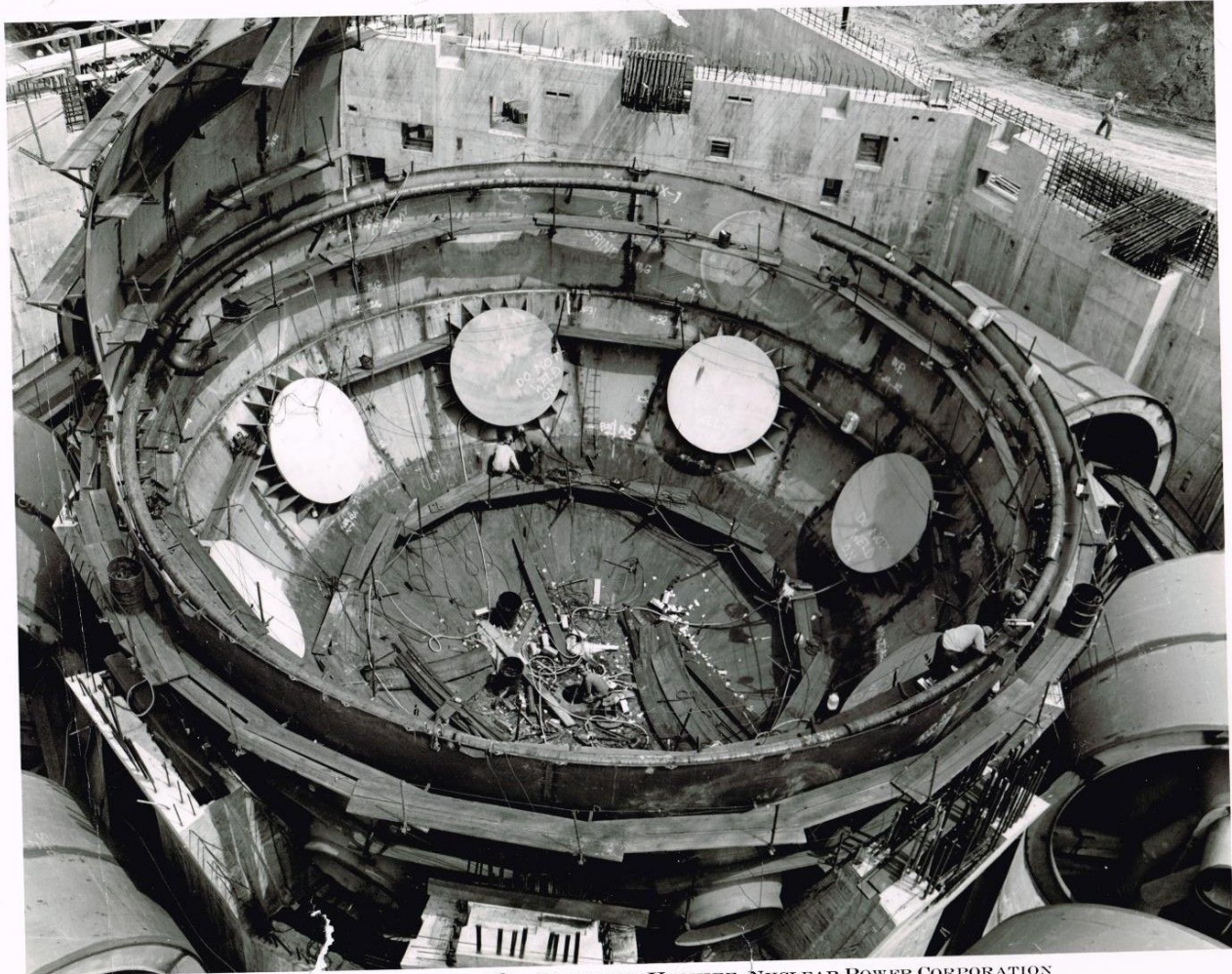


VERMONT YANKEE NUCLEAR POWER CORPORATION
FROM OBSERVATION BLDG. AREA - LOOKING
TOWARD REACTOR BLDG. SITE

These are the indigenous homelands of the Abenaki People. Just south of the study site, where the Vernon hydroelectric dam now stands, is an ancestral fishing ground at Cooper's Point, a significant location for Native presence with continuity both above and below the Great Bend. This expanse of land along the Connecticut River is noted both for fishing migratory and resident species and planting crops. In-ground storage silos and clustered dwellings use the advantage of alluvial terraces rising above the banks of the River. Wetlands at the river's edge and upland forests provide bountiful food, medicine, and materials for everyday living and a landscape for spiritual practices to be conducted. Today's Governor Hunt Road traces a trail that connects Abenaki settlement areas up- and downstream.

In the 1730's-40's European settlers colonized the stretch of fertile meadow on the banks of the river, including on the study site. The land was utilized by European settlers and soon Vermont occupants for agriculture and light industrial, mercantile. Prior to the development of Vermont Yankee Nuclear Power Station (VYNPS), the study site was mainly utilized for agriculture to grow potatoes, corn, and vegetables. Central Vermont Public Service (CVPS) later acquired 125 acres of the farmland for the construction of the VYNPS.

Creation of Vermont Yankee Nuclear Power Plant



VERNON, VT.
ATOMIC UNIT
JULY 3, 1969

136



VERMONT YANKEE NUCLEAR POWER CORPORATION
VIEW OF DRYWELL CONSTRUCTION PROGRESS SHOWING
3 PLATES IN PLACE AND TORUS SECTIONS AROUND
DRYWELL PEDESTAL

In partnership with other New England utility companies, Central Vermont Public Service (CVPS) contracted Yankee Atomic Electric Company (YAEC) to construct a 540 Megawatts (MW) boiling water reactor. Following the issuance of a permit by the US Nuclear Regulatory Commission (NRC) on December 11, 1967, construction began the same year.

Construction of the Vermont Yankee Nuclear Power Station (link: https://publicservice.vermont.gov/content/nuclear_decommissioning_citizens_advisory_panel_ndcap/history) was completed five years later and began operating in 1972. Vermont Yankee secured a license to operate for 40 years, functioning as Vermont's largest electrical provider. The initial operation was jointly owned and managed by CVPS and YAEC. In the late 1970s, Vermont Yankee Nuclear Power Corporation (VYNPC) was formed to operate and manage the power station. Entergy Nuclear Vermont Yankee, LLC purchased and acquired the facility in June 2002.

In March of 2006, the plant power output was increased from the original capacity of 540MW to 650MW. The operating license received a 20-year extension approval in 2011 by the NRC, approving operation through 2032.

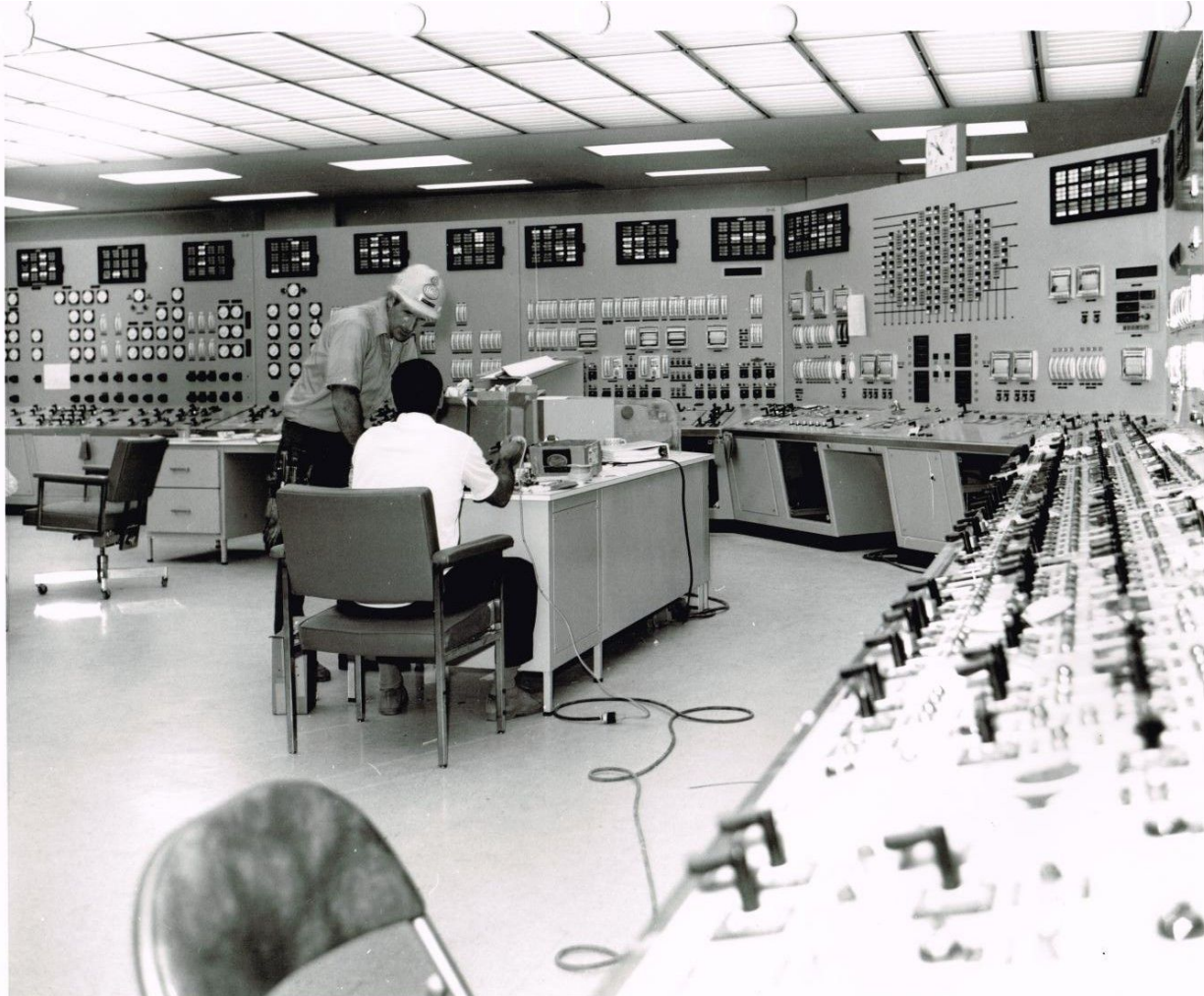
Key Timeline

Construction Permit Issued on December 11, 1967
Operating License Issued on March 21, 1972
Commercial Operations Began on November 30, 1972
Entergy Purchased the Facility in June 2002
Power Upgrade Approved on March 2, 2006
Initial Operating License Expired on March 21, 2012
Permanent Cessation of Power Operations
on December 29, 2014

All Spent Nuclear Fuel (SNF) Placed in Dry Storage (last SNF cask loaded and placed within the ISFSI)
on August 16, 2018

Transfer of License/Sale of VY to NorthStar on January 11, 2019

Significance of Vermont Yankee for the Town of Vernon



VERNON, VT.
ATOMIC UNIT
AUG. 11, 1971

679



VERMONT YANKEE NUCLEAR POWER CORPORATION
INTERIOR OF CONTROL ROOM

For over 50 years, Vermont Yankee served as the primary employer for the Town of Vernon and surrounding communities, influencing its **economy** (link: http://www.donahue.umassp.edu/documents/UMDI_Economic_Impacts_VY_Closure_Dec2014.pdf), its population, and its culture.

The introduction of the nuclear power plant brought an influx of middle-class residents into the Town of Vernon, creating an energy economy in a community previously dominated by agriculture. The power plant created over 600 well-paying jobs for some of the local community members. In addition, Entergy supported the Town of Vernon and local organizations operating within Windham County, as part of its corporate responsibility.

On September 23, 2013, Entergy notified the NRC of its intention to close the nuclear plant by the end of 2014, citing economic factors as the primary influence. This greatly impacted the Town of Vernon's economy and demographics.

Deconstruction of Vermont Yankee



This video can be viewed in the online version of this story map

The **Nuclear Regulatory Commission** (link: https://www.youtube.com/redirect?event=video_description&redir_to_ken=qS-xXUPZdr-Hxqy3G0NIK-CI9mp8MTU4ODQ1Mjl4MkAxNTg4MzY1ODgy&q=https%3A%2F%2Fwww.nrc.gov%2Fwaste%2Fdecommissioning.html&v=EKHeW_nnv5M)(NRC) outlines and enforces standardized regulations for **nuclear decommissioning** (link: https://www.youtube.com/watch?v=EKHeW_nnv5M). The decommissioning process involves the removal and safe storage of fuel and hazardous waste, decontamination of the site, and dismantling infrastructure. Due to its complexity and the amount of time it takes to safely decontaminate the site, this process is expected to be completed by 2026.

NorthStar's current demolition practices at the Vermont Yankee Nuclear Power Plant are captured in the video to the right (<https://youtu.be/-HSeTZDPYF8>).

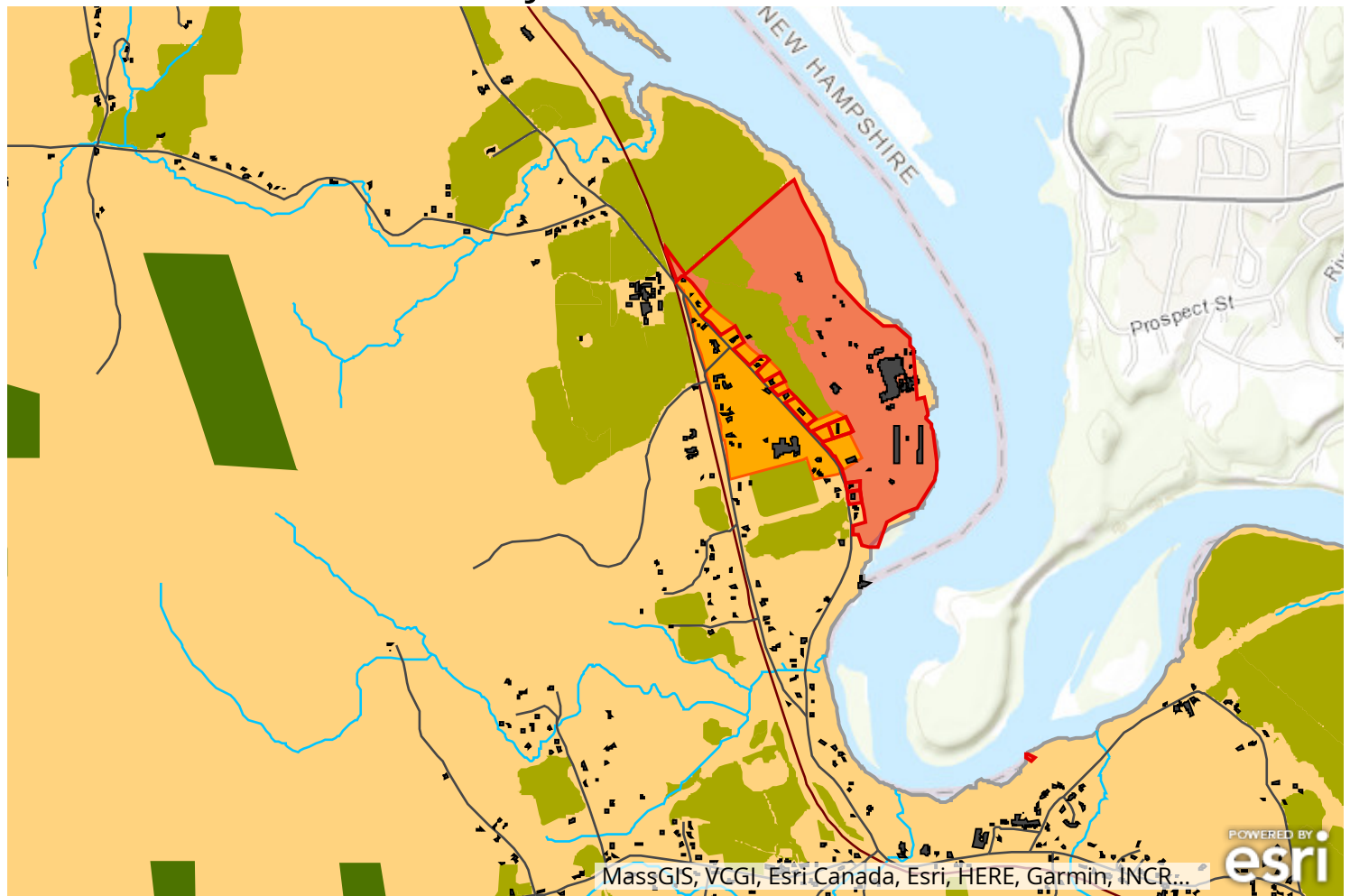
Reassessing the Vermont Yankee Site



The following maps form the elements of a Landscape Suitability Inventory for the Vermont Yankee decommissioning site. These maps, which inventory the natural and built environments of the study site, provide an ecological analysis for guidance in future development in accordance with **the Town of Vernon's Town Plan**. (link: <https://vernonvermont.org/wp-content/uploads/2019/06/TOWN-PLAN-FINAL-8.pdf>). The purpose of this inventory is to aid in the redevelopment of the study site and is not intended to dictate the future use of the property.

The following inventory includes data on the physical, biological, and social elements that constitute the study site. The data utilized for these maps were retrieved from **Vermont Open Geodata Portal** (link: <https://geodata.vermont.gov/>) and prepared by Geographic Information Systems (GIS) specialists at Antioch University New England's Spatial Analysis Lab for the purposes of this project.

Introduction to the Study Site



Study Site



Railway



Agriculture



Buildings



Streams



Protected Land



Roads



Village Center



The study site consists of 125 acres positioned on the Eastern border of Vernon, Vermont along the bank of the Connecticut River. Agricultural fields expand across much of Vernon's riverside, as the river feeds many of these fertile soils. To this day, farmers grow a multitude of crops within the **study site**. [\(link available only in online story\)](#)

Directly to the west of the study site lies the newly established **Vernon Village Center** ([link: http://www.vernoncenter.org/](http://www.vernoncenter.org/)). Here, the Friends of Vernon Center and various partners plan the development of a

rural downtown. To the Northwest and Southeast of the Village Center are clusters of residential developments where many Vernon residents reside.

Traveling west from Vernon's Village Center, development becomes scarcer. The southwestern border consists of the town's largest swaths of protected lands, preserving forests and wetlands for future generations.

Built Infrastructure



12/7/2020	Landscape Inventory of the Vermont Yankee Decommissioning Site	
Study Site	Private Well Waterline	Buildings
		
Vernon Boundary	Leach Fields	Roads
		
Electrical Lines	Sewage Fields	Paved Surfaces
		
Roadway Lights	Storm Drains	Three Phase Power
		
Fiber Optic	Rail Line	Village Center
		
Private Wells		
		

This map depicts the built infrastructure of the site during its operation as the Vermont Yankee Nuclear Power Plant. The majority of the built infrastructure depicted on the site is located along the riverbank, where the Vermont Yankee Nuclear Power Plant utilized a river intake for its cooling towers.

Currently, NorthStar is managing the demolition and rehabilitation of this site. As part of this process, they are disassembling unwanted infrastructure and regrading the landscape. Due to this, several of the buildings (link available only in online story) displayed on this map may no longer remain on the site.

Land Cover



Vernon Boundary



Study Site



Seasonal Flooding



Wetlands



Land Cover



Tree Canopy



Grass/Shrubs



Bare Soil



Water



Railroads



Buildings



Roads



Other Paved

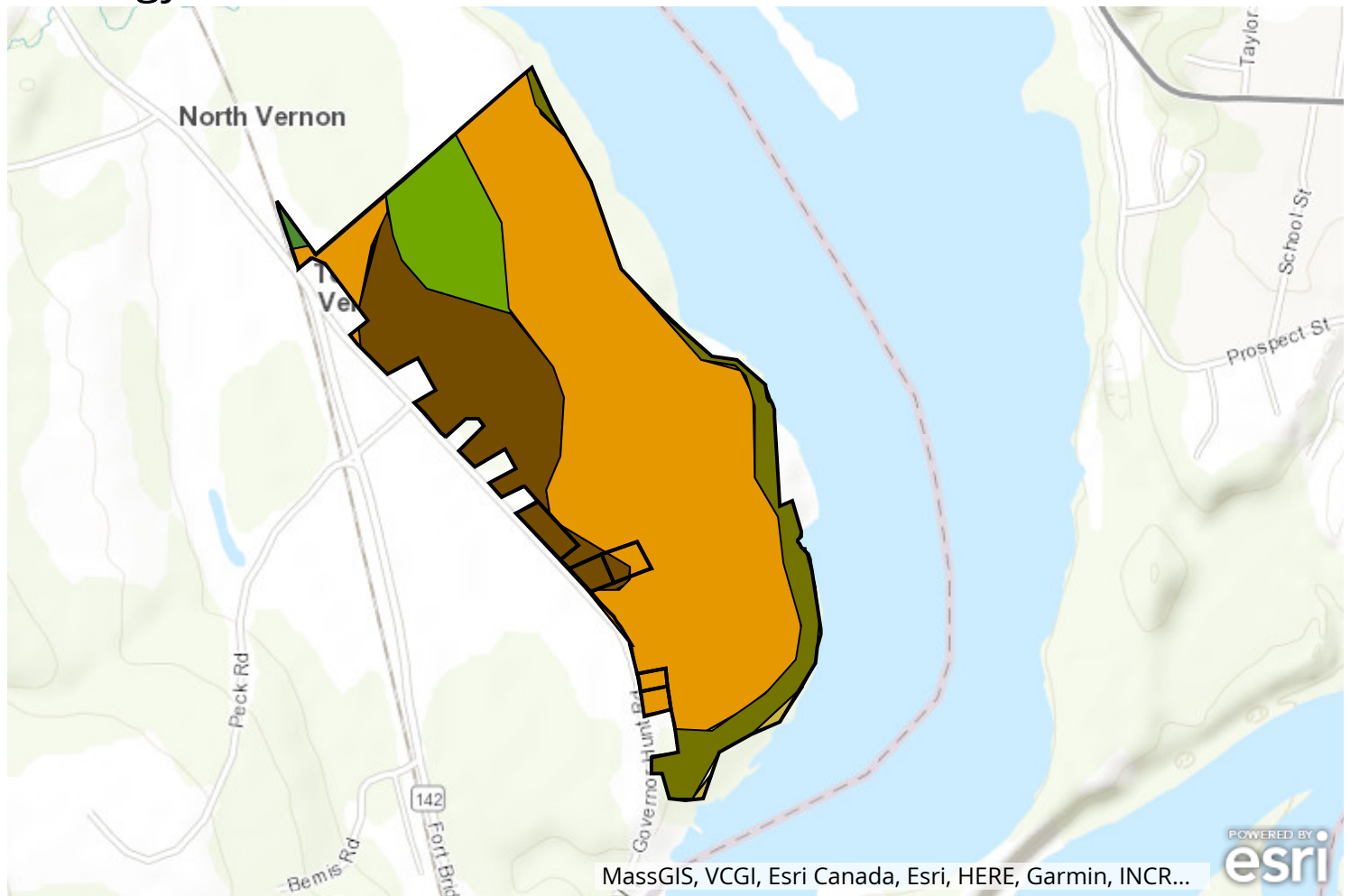
Grass and shrubs dominate the land cover of the study site, representing 48 percent of the land. This land cover type includes the agricultural uses along the study site's western side.

Impervious surfaces make up 33 percent of the study site. Pavement in the form of parking lots and roads make up the majority of this, with buildings only contributing 4 percent of the total area.

Trees cover 19 percent of the landscape, most significantly located on the southern end of the property. However, the portion of powerlines in the northeastern section of the study site are displayed as trees when in fact they are not.

Notable areas of seasonal flooding and wetlands within the study site are located in the northeast section of the study site and along the northern portion of the river bank.

Geology



Study Site

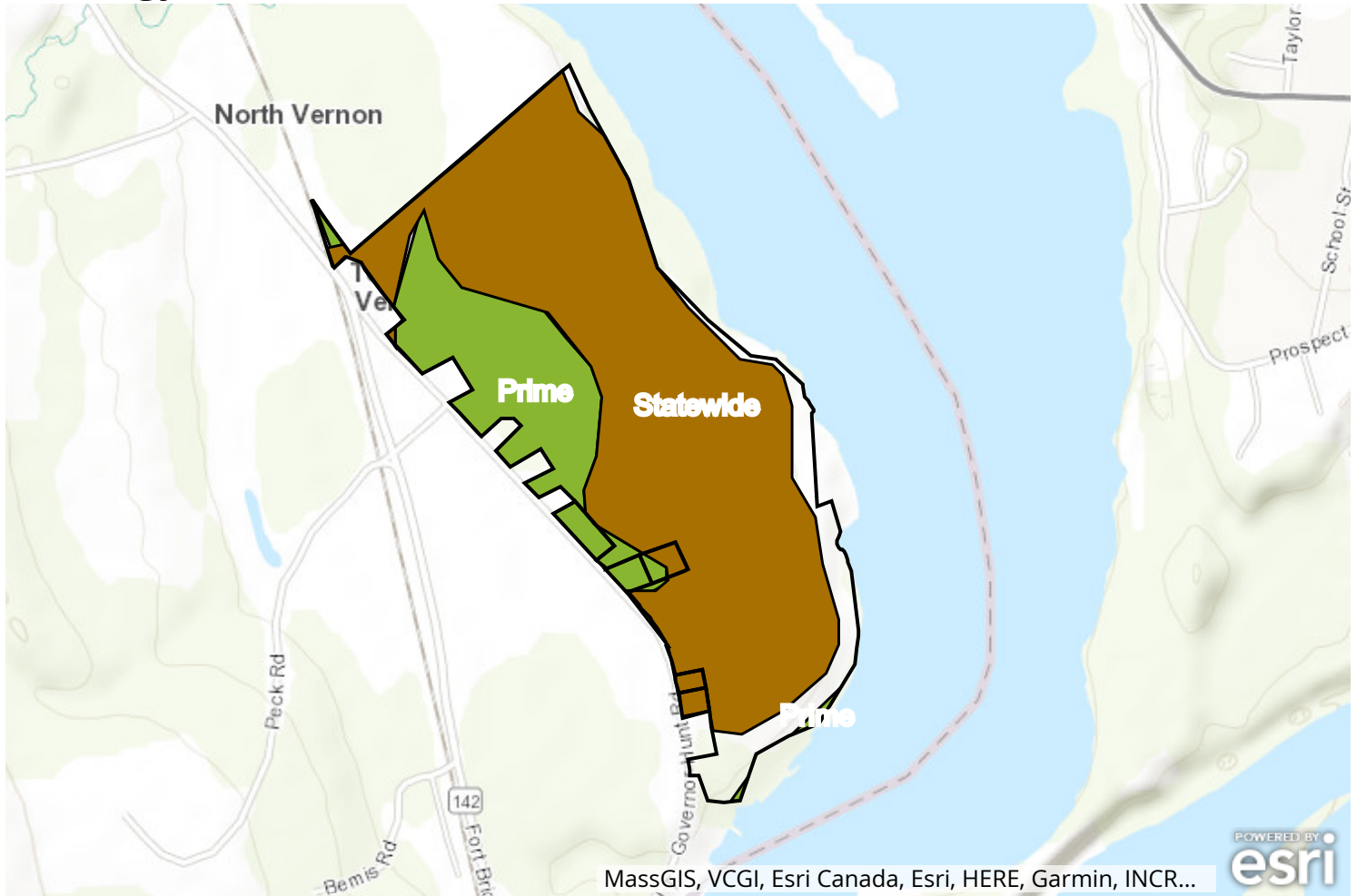


Soil Types

-  Podunk fine sandy loam, 0 to 3 percent slopes, occasionally flooded
-  Windsor loamy sand, 3 to 8 percent slopes
-  Agawam fine sandy loam, 0 to 3 percent slopes
-  Belgrade silt loam, 0 to 3 percent slopes
-  Unadilla silt loam, 3 to 8 percent slopes
-  Windsor loamy sand, 15 to 25 percent slopes
-  Windsor loamy sand, 25 to 60 percent slopes

The Vernon Study Site has a diverse set of **soil types** ([link available only in online story](#)) due to its unique natural history and proximity to the Connecticut River. Due to this, the **Vermont Natural Resources Service** ([link: https://anr.vermont.gov/maps](https://anr.vermont.gov/maps)) has highlighted several areas that contain **soils** ([link available only in online story](#)) of both local and state importance that coincide with the Town of Vernon's **agricultural land use** ([link available only in online story](#)) and locale adjacent to the Connecticut River.

Geology



Study Site

Important Soils

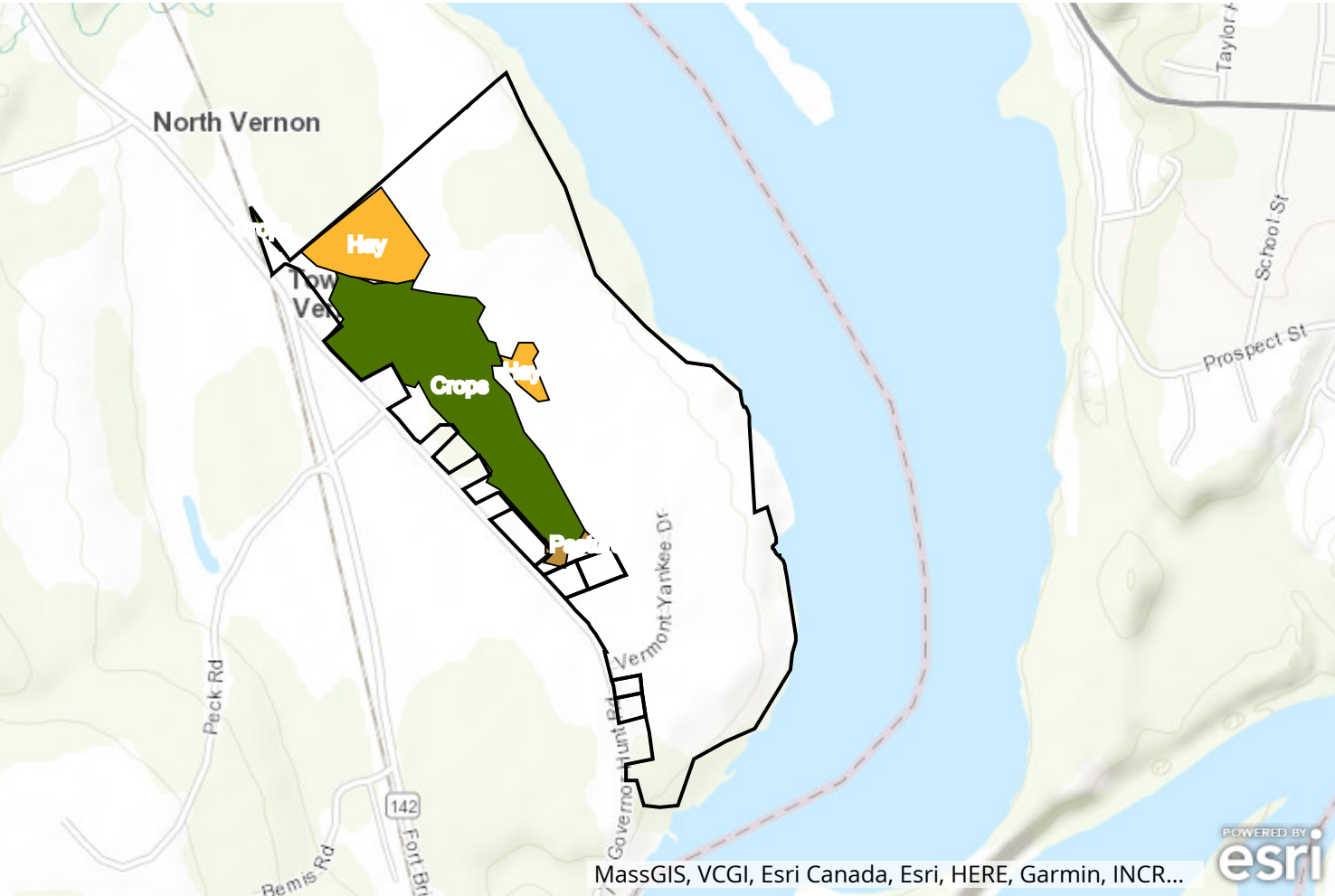


Prime



Statewide

Geology



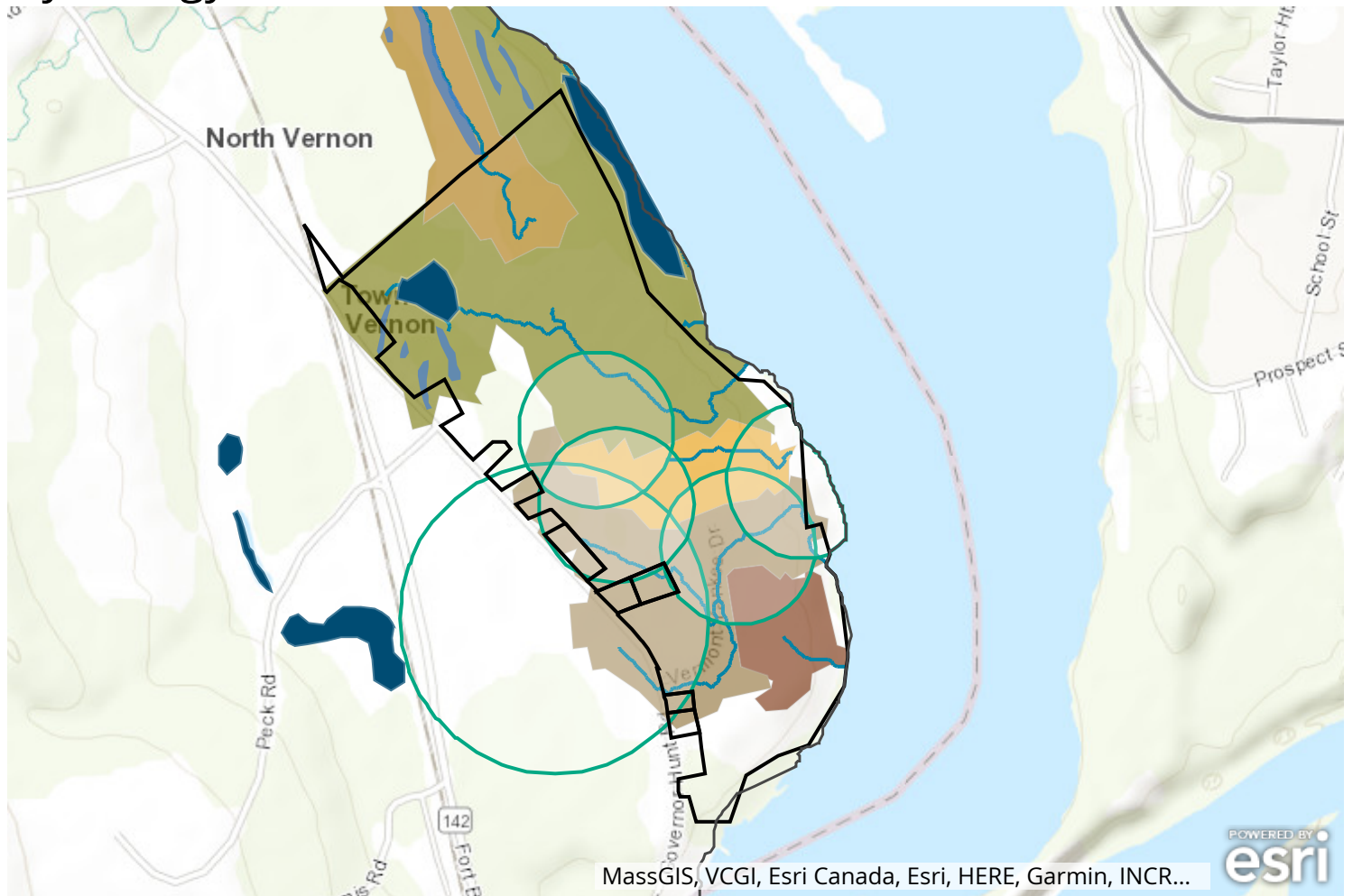
Study Site



Current Agricultural Land Use

- Crops
- Hay
- Pasture

Hydrology



MassGIS, VCGI, Esri Canada, Esri, HERE, Garmin, INCR...

POWERED BY
esri

Vernon Boundary



Study Site



Groundwater



Seasonal Flooding



Wetlands



Streams



Watershed



Northern Watershed



North-Central Watershed



Central Watershed



South-Central Watershed



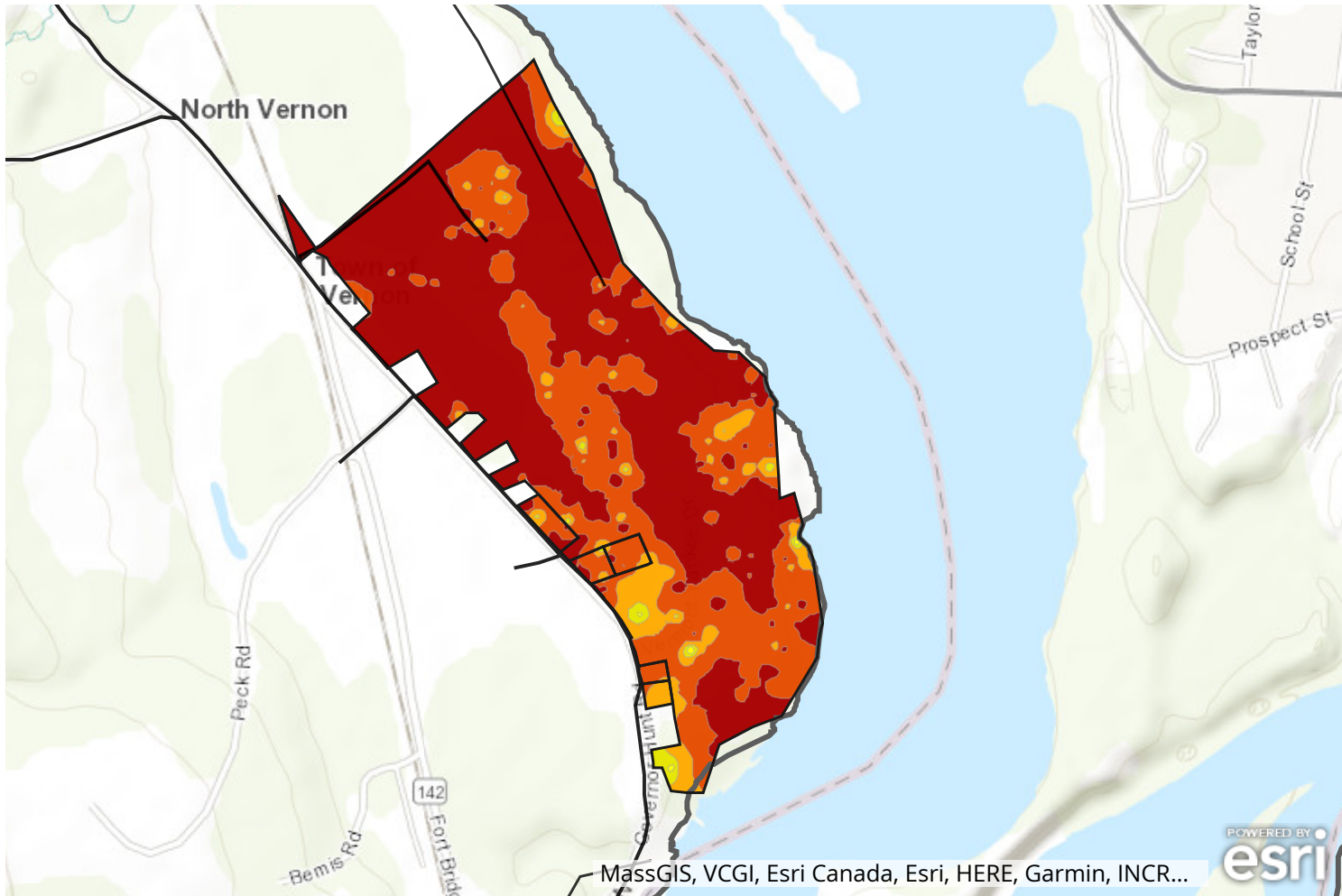
Southern Watershed

The study site drains into five micro-watersheds. The delineation of these watersheds provides information on how water accumulates and moves across the landscape. During rain and snowmelt events, the study site drains into five streamlets, each of which drain into the Connecticut River.

This information about how water interacts with the landscape informs the development and management of the site. Proper site and water management ensures the protection of natural ecosystems, built infrastructure, and drinking water reservoirs. The micro-watersheds displayed

here overlay several groundwater sources (link available only in online story) that service the Vernon community. The display size of each circle symbolizes the wellhead protection buffer.

Solar Radiation



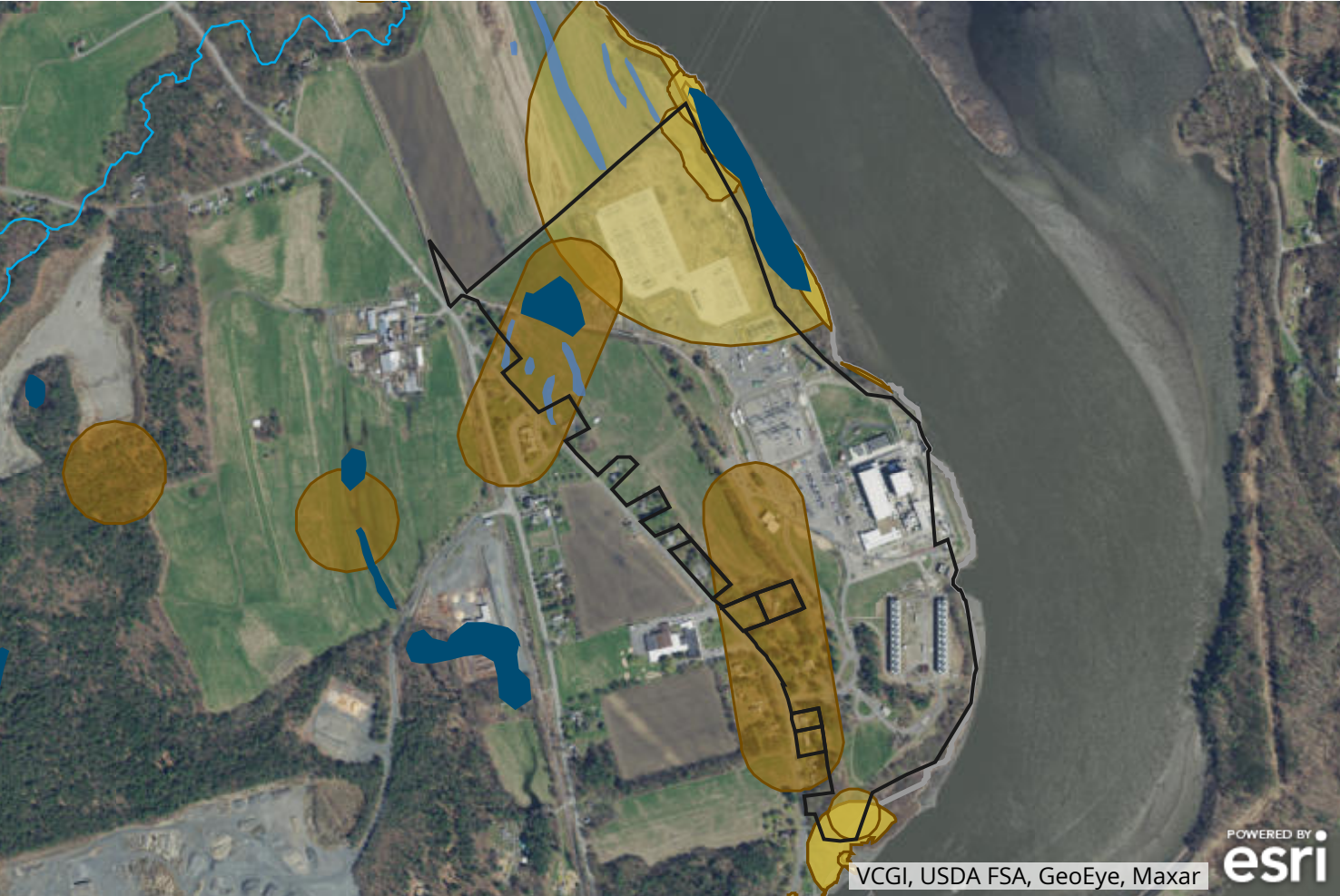
Study Site	Three_Phase_Power_Lines	Solar Radiation
		Relatively High
Vernon_Boundary	Electrical Lines	High
		Moderate
		Low
		Relatively Low

While the Vernon study site has a number of buildings, built infrastructure, and tall standing natural vegetation, there is a large amount of solar radiation present. Wide-ranging agricultural fields, flat, impervious surfaces, and open space characterize much of the study site's surface topography. As NorthStar continues its site demolition, solar radiation is most likely to increase.

**Important to note: This solar radiation model has been modified to accommodate the requirements of web display. A more finely detailed analysis of the site's solar radiation exists to*

inform planning decisions.

Natural Communities and Notable Species



Study Site



Wetlands



Seasonal Flooding



Notable Species



Protected Land



Vernon Boundary



Streams



Multiple communities of notable plant and animal species can be found on the study site. These communities are primarily located in and around the two sections of wetlands, highlighting the biodiversity that these habitats provide. Development of the study site should consider the impacts

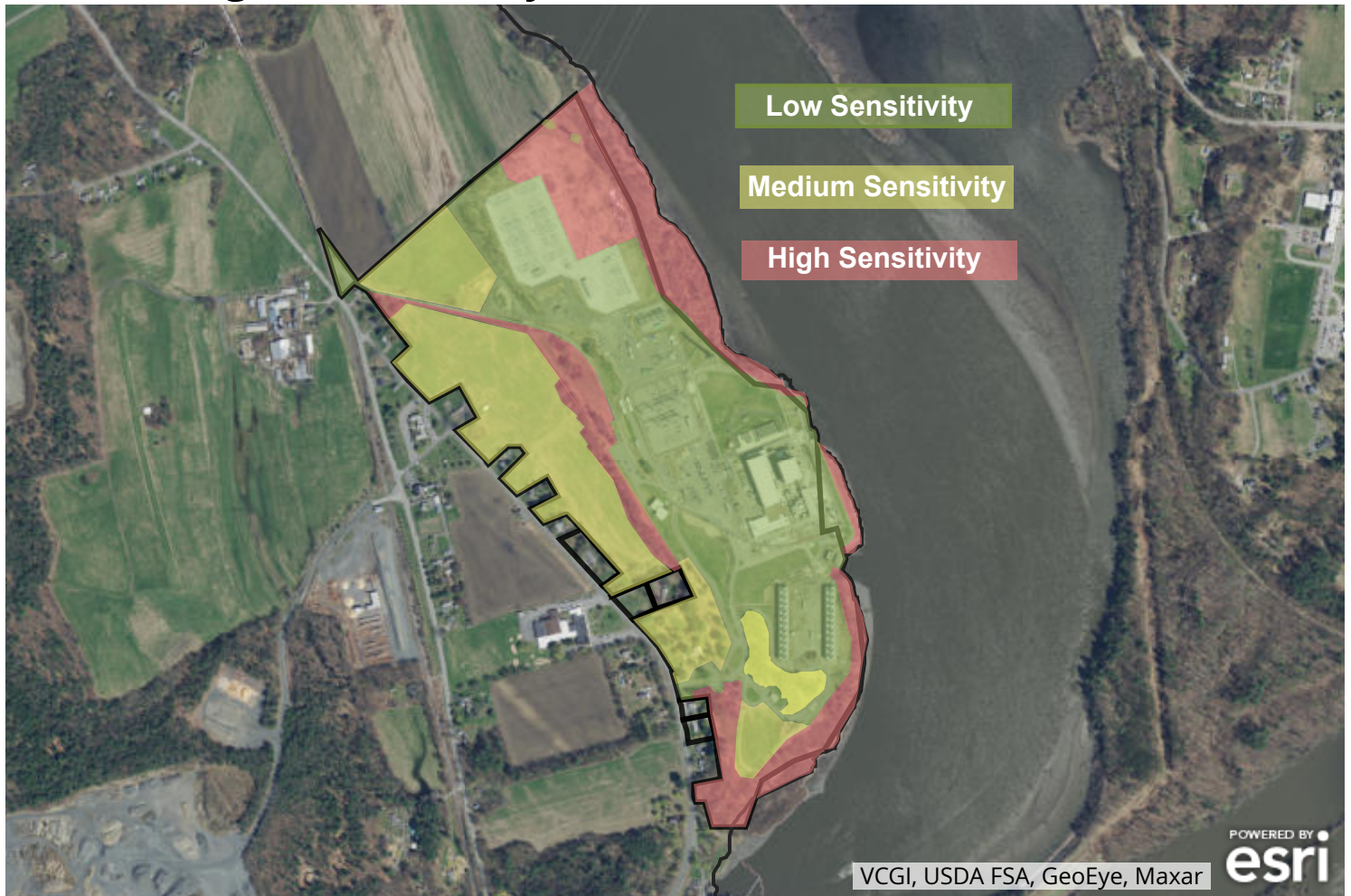
on notable flora and fauna in the area and should restrict development within 500 feet of all wetlands, maintain patches of open pasture, and minimize the removal of old-growth trees. The data displayed in this map was collected in 2015; therefore an updated assessment of natural communities and notable species should be considered when planning for future development.

The circles and ovals displayed on this map represent the estimated buffer zone within which notable species were observed. The actual species observation point occurred at the center of the circle or oval. The remaining region indicated assumes migration and multiple occurrences of species through suitable habitat.

The Vermont Fish and Wildlife Department's Natural Heritage Inventory (NHI) (link: <https://vtfishandwildlife.com/conservation/conservation-planning/natural-heritage-inventory>) provides a complete list of notable species that are rare to Vermont. Vermont Fish and Wildlife, the publishers of the data, have a plethora of different resources pertaining to conservation, land management, and natural history that expand upon the information captured within this map.

To view the entirety of notable species observations in Vernon, **pan out.** (link available only in online story) At this extent, you can observe that the occurrence of notable species often is located near wetland areas and outside of protected land.

Archaeological Sensitivity Index



Vernon Boundary

Study Site



An archaeological sensitivity map was created to depict the sensitivity of the landscape to future development. This map does not depict known areas of archaeological artifacts. It indicates areas that are likely to be sensitive and therefore, should be evaluated for significant archaeological importance prior to development.

The level of sensitivity across the study site was determined by the results of an archaeological assessment conducted by R. Christopher Goodwin & Associates Inc. In this analysis, the authors conducted a cultural resource assessment by reviewing information from the Vermont Archaeology Inventory, historic maps and aerial photos, and available engineering plans. Using this information, they analyzed the changes in the landscape during the construction and operation of VYNPS and determined the range of archaeological sensitivity based on levels of disturbance, historical evidence, and environmental factors.

Levels of archaeological sensitivity are divided into three categories, low, medium, and high. The greater the level of sensitivity, the more likely the area is to have undisturbed natural soils or

Potential Land Use Scenarios



Wetlands Buffer	Village Center	Roads
Study Site	Electrical Lines	Three Phase Power
Vernon Boundary	Rail Line	

The study site has a lot of potential for redevelopment and the following scenarios display just a few examples. As requested in the Town of Vernon's Town Plan (link: <https://vernonvermont.org/wp-content/uploads/2019/06/TOWN-PLAN-FINAL-8.pdf>), many features of the site will be maintained and utilized in future

redevelopment scenarios. This includes the preservation of all roads and parking lots, the rail line, and the Vermont Electric Power Company (VELCO) switchyard and powerlines. This property is extremely desirable for commercial and industrial investors seeking waterfront property in close proximity to major highways with existing infrastructure such as roads and parking lots, a fully operational rail line, access to the VELCO switchyard, private wells, septic fields, and fiber optics.

The storage of spent nuclear fuel will remain on site until the US Department of Energy (DOE) determines an alternative storage facility for all nuclear waste in the United States. A section of undefined use, displayed in yellow, is incorporated in the scenarios to account for the safe storage of spent fuel in purpose-built Independent Spent Fuel Storage Installation (ISFSI). The future redevelopment will coexist with these ISFSI and the Town of Vernon will ensure the safety and management of this area.

The maps in this section are examples of potential land-use scenarios for the future development of the study site in accordance with the Town of Vernon's Town Plan and stakeholders' objectives. These possible redevelopment scenarios are not intended to dictate the future use of the study site.

Scenario 1 is an example of commercial property with a managed natural landscape and recreation features for community members. It includes several buildings for commercial use, a conventional park with a gazebo and walking trails, an Indigenous Peoples land acknowledgment kiosk, a boat launch, a bike trail, the VELCO switchyard and power lines, and an undefined area for the safe storage of spent nuclear fuel.

Potential Land Use Scenario 2



Wetlands Buffer



Village Center



Roads



Study Site



Electrical Lines



Three Phase Power



Vernon Boundary

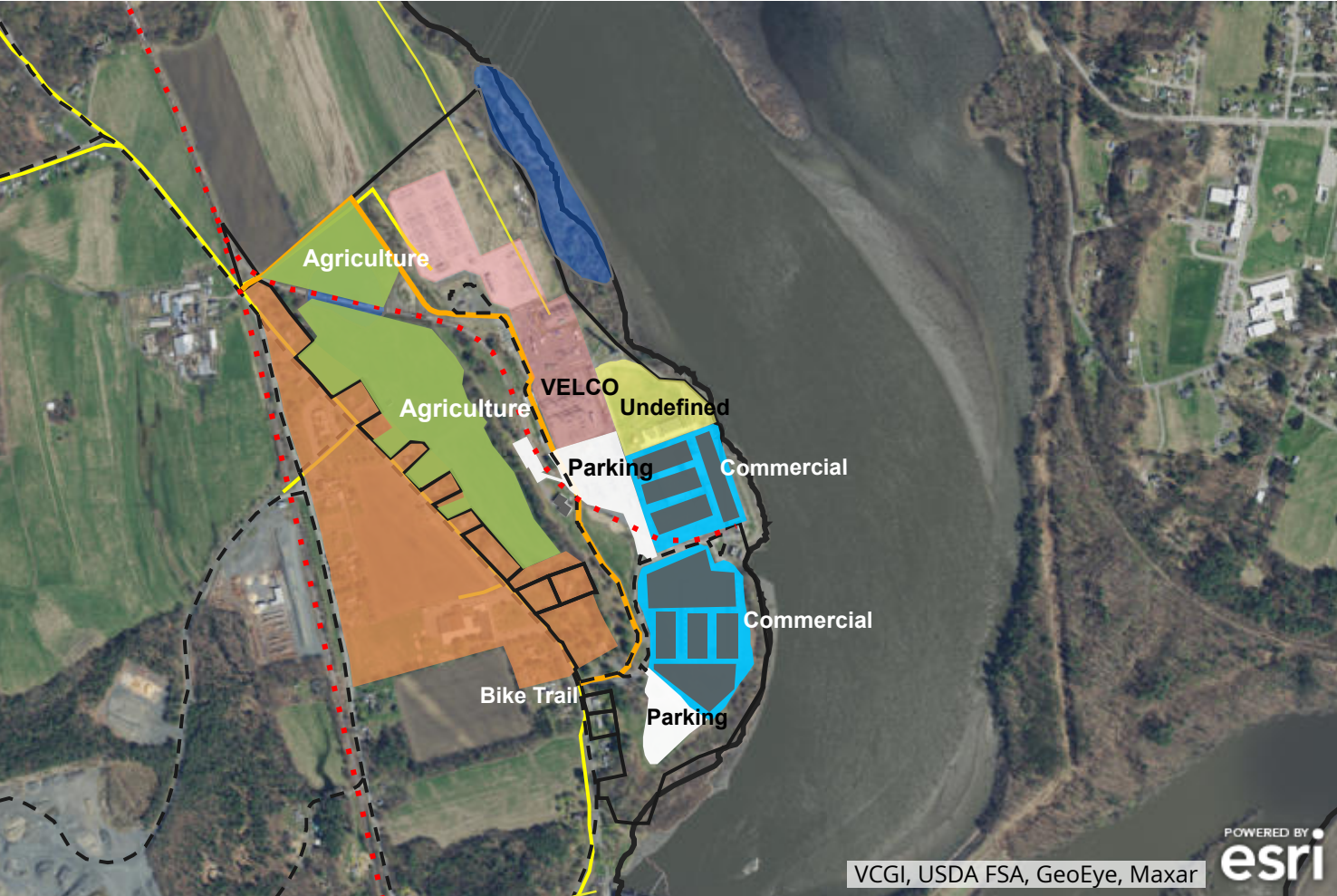


Rail Line



Scenario 2 is an example of an industrial park with an area of unmanaged, natural vegetation meant to reestablish the native landscape of this property and allow community members to connect with the land. It includes several buildings for commercial use, a native vegetation landscape, an Indigenous Peoples land acknowledgment kiosk, a boat launch, a bike trail, the VELCO switchyard and power lines, and an undefined area for the safe storage of spent nuclear fuel.

Potential Land Use Scenario 3



Wetlands Buffer



Study Site



Vernon Boundary



Village Center



Electrical Lines



Rail Line



Roads



Three Phase Power



Scenario 3 is an example of a larger industrial park with no natural landscape features. It includes several buildings for commercial use, parking lots, agricultural land, a bike trail, the VELCO switchyard and power lines, and an undefined area for the safe storage of spent nuclear fuel.

Indigenous Land Acknowledgement



We acknowledge that the land on which we stand is a part of the homelands of the Sokoki Abenaki, their ancestors, and allies - the Indigenous People of this land - upon which we live, work, and conduct ourselves. We acknowledge our responsibility as a community to honor, care for, and respect all that Creation gives and has given to provide life. This includes the land, water, air, fire, animals, plants, and our ancestors.

This expanse of land along the Connecticut River is noted both for fishing migratory and resident species and planting crops. In-ground storage silos and clustered dwellings use the advantage of alluvial terraces rising above the banks of the River. Wetlands at the river's edge and upland forests provide bountiful food, medicine, and materials for everyday living and a landscape for spiritual practices to be conducted. Today's Governor Hunt Road traces a trail that connects Abenaki settlement areas up- and downstream.

For more information, please visit <http://elnuabenakitribe.org/> (link: <http://elnuabenakitribe.org/>) and <https://www.atowi.org/> (link: <https://www.atowi.org/>).

Moving Forward



This project is an innovative model of collaboration for site restoration planning that will support redevelopment efforts at the Vermont Yankee Nuclear Power Plant site once the decommissioning process is completed. This collaboration and partnership will yield multiple benefits for the Town of Vernon, State of Vermont, Antioch University, NorthStar, and other stakeholders involved in the decommissioning and site restoration process. Overall lessons learned will be instrumental in guiding best practices moving forward for subsequent site decommissioning(s) and arrangements for restoration and redevelopment.

The next phase of the project will focus on the following goals and objectives:

- Collect stakeholder input on the StoryMap with consideration for additions to the landscape inventory that could help guide future decision-making for the site
- Continue to collect information on the decommissioning process as a case study on the project for lessons learned and best practices
- Update the design of possible future development scenarios for the site based on stakeholder feedback. These visualizations, derived from the spatial and ecological data provided, will help guide the community and the Town of Vernon on possible plans for the future use of the site.

Acknowledgment



Authors and Map Creators:

Erik Nielsen, GIS Specialist (enielsen@antioch.edu)

Jo Corvus, GIS Specialist (ojones@antioch.edu)

Alec Kaisand, GIS Specialist (akaisand@antioch.edu)

Partners and Contributors:

Jude T. Nuru, Photojournalism Project Assistant (jnuru@antioch.edu)

Steven Lamonde, Antioch Spatial Analysis Lab, (slamonde@antioch.edu)

Christa Daniels, Ph.D., Faculty & Project Coordinator (cdaniels1@antioch.edu)