# Environmental Impact Statement

Block 1581 Lot 27 Hamilton Township Mercer Co NJ

Joseph R. Arsenault, Senior Ecologist 3/29/2018



Document prepared for Synnergy LLC to address Hamilton Township Land Use Code, Chapter 154 on Environmental Impact Statement, Sections 1 through 11.

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#### Section 154-1: Document full title

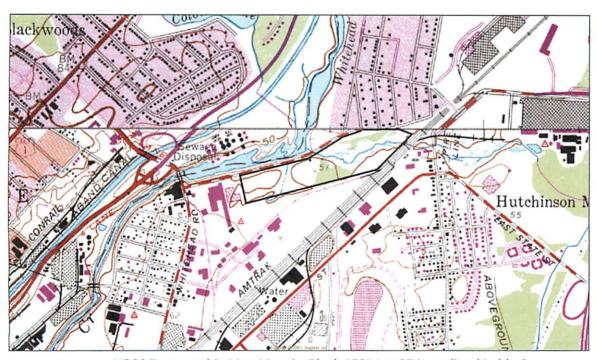
Environmental Impact Statement for the Synnergy LLC Solar Power Array Proposed for Block 1581 Lot 27 Hamilton Township Mercer County New Jersey

## Sec. 154-2: Statement Purpose

Synnergy LLC proposes development of a solar power array on land within Lot 27. This activity requires site plan review by Hamilton Township Planning Board. Application for site plan review requires applicants provide a variety of standard site documents and the Environmental Impact Statement complying to Chapter 157 of the Township Code is such a standard document. This report attempts to provide an objective description of the site, the proposed activity and its anticipated impacts to Township resources.

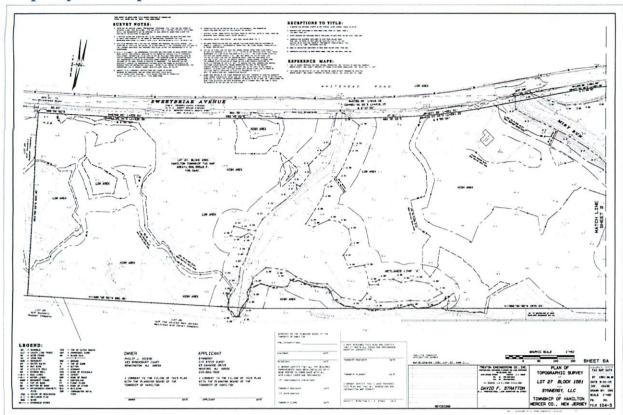
## Sec. 154-3: Technical Level of Detail

This document describes Block 1581 Lot 27 natural resources, its proximity to township support services, the level of use of each anticipated by the project. The report provides lists, maps, photos and summary statement to address the various issues required by this Chapter 154. The report address the site landscape, topography, a brief history, terrestrial and aquatic biotic resources, water resources and quality, as well as vegetation.



USGS Topographic Map Mosaic; Block 1581 Lot 27 is outlined in black

## **Property Description**



Reduced Sheet 5A of 6 showing property topography in solar array vicinity

Lot 27 is a 38.3 acres vacant parcel near the township's northwestern municipal limits. The parcel is approximately 900 feet east of Whitehead Road, between Sweetbriar Avenue and the Amtrack Northeast Rail Corridor. The lot straddles Miry Run, a major Assunpink Creek tributary. It formerly



supported residential and commercial uses, however, today those uses are abandoned, and the site is under a natural forest cover that established subsequent to the cessation of the active land uses. Farming then surface mining altered the surface landscape into an un-natural series of piles and banks that include extensive disturbed sediments on the west side of the parcel.

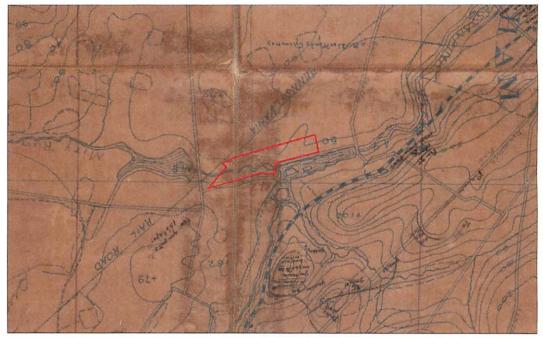
The majority of Lot 27 is within Hamilton Township's Industrial Zone (Zone I, Zone Map,

2015). A portion of the parcel, approximately 20%, north of Miry Run, between the stream and the railroad right of way, is zoned R-10. R-10 is a residential zone reserved for single family dwellings. Lot 27 is with Hamilton Township "Area in Need of Redevelopment" Resolution 04-048. Manufacturing

# Site History



1849 Mercer County Atlas, Rutgers Historic Map Collection



1884 C.C. Vermeule Manuscript #50; East Trenton and Vicinity

Prior to the modern era, farming and industrial uses surrounded Lot 27. Mercer County historic maps show the area was settled early and supported industrial uses since the mid-1800's. Sources show Lot 27 cleared of forest, supporting a dwelling marked J.W. Lee. The Lee family name is frequent on land east of the parcel. The Lee house stood until 2006.

The Lee house site sat immediately east of the Hamilton Factory, a rubber goods manufacturing company fronting Whitehead Road. The Whitehead Road is named after the Whitehead and Sons properties, rubber and tile industry, found southeast of Lot 27. Early maps name the region Lawrence Station. The property is downstream from Coleman's grist mill, a pond and water works on Miry Run at State Street.

C.C. Vermeule's 1884 manuscript survey identified the site as clear land. The #50 manuscript pre-dates the NJ Topographic Series, and show unpublished detail such as hand written notations, forest edges and identifiable land marks. This source shows Lot 27 without a forest cover, normally indicating an active land use such as farming. Shown on the map are Sweetbriar Avenue, Miry Run, Assunpink Creek, the Pennsylvania Railroad, and regional topography. Notable absence are forest/wood line designations and the un-named Miry Run tributaries. The 50' topographic contour indicates a natural swale in the location of today's corridor.



1930 Air Photo Mosaic #117

The mid century 1930air photo (above) captured the site with two land uses: clearing associated with the former Hamilton Factory industrial activities on the southwest property corner, and a residential/agricultural use at the intersection of Miry Run and Sweetbriar Avenue. Land on the east side of the parcel appears abandoned with vegetation recovering post 19th century farm clearing. Extensive land clearing between 1940 and 1947 southwest of the residential use excavated soils in the area designated for the solar panel array.

Site activities dwindled until the site became vacant. The Lee house was removed between 2002 and 2006, recorded on regional air photos. Today, the site supports a forest cover and no active land uses.



Block 1581 Lot 27 and vicinity current conditions, from 2015, Google Earth

# **Project Description**

Synnergy LLC is a New Jersey corporation interested in developing Block 1581 Lot 27 into a solar power facility. The construction would provide 4.1 megawatts of solar generated power annually at peak output. The power would be produced for a single client, the Ewing-Lawrence Sewer Authority's treatment plant located north of the Assunpink Creek. Synnergy LLC retained Trenton Engineering Co., Inc. to prepare the planning documents for this project. The plan set review was produced by Trenton Engineering Co., Inc. and included:

Title Sheet, sheet 1; Site Plan, sheets 2a and 2b; Tree Location Plan, sheet 3; Construction Details, sheet 4; Surrounding Features, sheet 5; Topographic Survey, sheets 6a and 6b; Outlet Pipes Detail, sheet 7; Landscape Plan, sheet L.S.

The proposed multi- megawatt solar panel array is proposed on 11.98 acres of Lot 27's 38 acre tract. The project's parcel, owned by Philip Vecere, will provide upland space used for the array. The applicant, Synnergy LLC, proposes using Mr. Vecere's property to produce the power needed by the sewer plant.

The Master Plan and Environmental Inventory place this site in Industrial and high density residential zoning. It is mapped with forest, floodplain, wetlands, critical habitat, and redevelopment potential resources. The project will clear the existing upland forest within the 12.307 acre disturbance footprint. The solar array development will remove all vegetation within the footprint, including 820 deciduous trees of a caliper 10" or greater. All clearing will be done outside of the verified wetlands, wetlands transion areas, and riparian buffers except for the storm water basin outlet pipes and access driveways. The activity is wholly within the State's Flood Hazard Area's flood fringe.

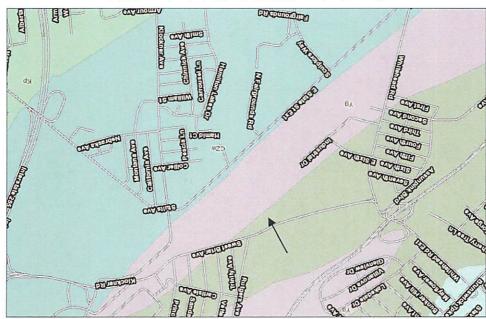
The engineers report for the verification and Flood Hazard Area Individual Permit describes the pre and post activity flood storage ( $V_e$  and  $V_p$  calculations) providing justification for the proposed activity. The array will be split within two separate areas within Lot 27, equalling the 12.307 acre area. 11,532 solar panels will be installed on a pole mounted solar array: 5,392 panels west of the un-named tributary and 6,140 east of the same water course. The array will be created by rows of panels on elevated racks. The panels are elevated above the flood hazard elevation of 50.8' MSL NGVD 29.

The array would consist of multiple paralel rows in linear racks, separated from its nearest array neighbor by 10' 11". The racks require support poles that will consist of 4"x4" schedule 40 galvinized pipes projecting from a 1' diameter concrete footing installed at or below grade. The poles will not displace more than 10 Cubic Yards (estimated 273 Cubic Feet) of flood storage. The panels will be connected via a subterranian power supply wires. The array will be surrounded by an access driveway of crushed stone on-grade. A stormwater basin will be created in the array to handle the anticipated run off from the crushed stone access drive. Graphic depictions of this design is shown on the attached array plan and the support details supplied by the manufacturer. Power will be carrier to the customer by underground wire connections alongside Sweetbriar Avenue, hung under the Whitehead Road bridge, and then continue underground into the MUA parcel.

The design proposes a 5,544 Cubic Yard net cut to create a gentle sloped working surface. The cut will remove piles of debris remaining from the last industrial land use. Once removed, the area will be regraded. The resultant grade is shown as solid lines on the site plans. The toal area displaced within the NJ DEP regulated Flood Hazard Area by the support pipes is approximately 10 Cubic yards. Therefore, there is no net fill.

# Property Natural Resources

Rase Geology

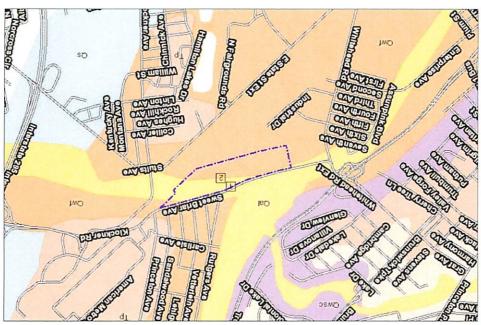


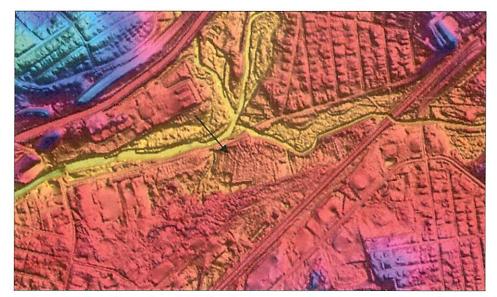
Base Geology, NJ DEP GeoWeb Geology, 2016

Lot 27 is situated on a base geology composed of consolidated, igneous rocks. Gabbro (Ygb, green, base geology above) and gneiss (Yg, pink, base geology above) exist between the Cretaceous Coastal Plain sediments southeast of the parcel (Kp) and the Peidmont Tirassic rocks northwest.

Base geology is not exposed in Lot 27. The base geology is covered by 3-5 meters of unconsolidated sediments transported during the various glacial epochs experienced during the Pleistocene Era.

Surface Geology

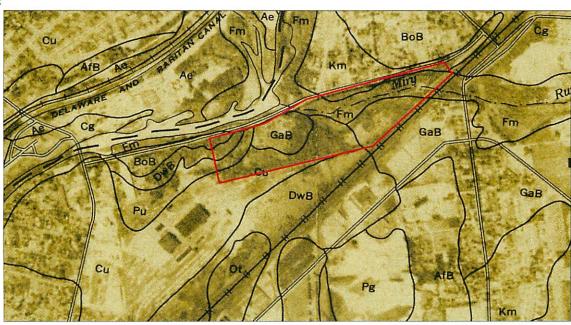




Surface Geology from Geo-Web (top), DEM Imagery, Cintros.org, 2018 (bottom)

The majority of Lot 27's surface geology is mapped as late Wisconsin glaciofluvial deposits (Qwf). This deposit is a water deposited sediment eroded from rock and other glacial sediments north of Hamilton Township. The unconsolidated deposit is dervied from late Wisconsin Era freeze / thaw cycles and redeposition along then existing riverine corridors. The Miry Run floodplain is filled with moden alluvial deposits (Qal) eroded from terrestrial areas upstream of this parcel. These deposits are accumulations of sand and silt subsquent to glacial period.

## Soils



The Mercer County Soils Map (Sheet #23, above) and soil synonyms from Geo-Web identify multiple soil types under Lot 27: Upland soils are shown as Galestown sand (GaB; loamy sand GadB); Dragston and Woodstown sandy loam (DwB; Glassboro and Woodstown GKAWOB); Birdsboro soils gravel subsoil

(BoB; gravel solum BHSGB); Cut and filled areas (Pu, Cu; Udothents, stratified substrata UdstB). Klej sandy loam (Km; Galloway variant GASB) has a polygon margin on the northern side of Miry Run. Most upland soils no longer display intact surface horizons. Fill and surface disturbance associated with the cut and fill mapping is more extensive on the parcel's west side than originally mapped. Bright matrix colors indicate the continued aerated soil environments.

#### Water Resources

Miry Run, a major tributary to the Assunpink Creek watershed (HUC14 02040105240030-11DB), crosses through parcel's eastern side. Miry Run is a FW2-NT ranked stream. A second water feature is a manmade ditch excavated in the 1940's to provide an outlet for an industrial pond created on the adjacent Lots 25 and 26.

Miry Run occupied a natural channel prior to the 1957. Prior to the 1950's the stream followed a meandering course, following multiple braided channels. This braided condition existed between two mill ponds, one downstream on the Assunpink Creek at Whitehead Road, and on upstream at East State Street's Miry Run crossing (Coleman's grist mill). Post 1953, the Miry Run stream channel was straightened into the corridor visible today. Spoils from the excavation form today's south bank. Wetland have been verified under Sweetbriar Associates file #1103-04-0011.1.



Miry Run

Man-made ditch

#### Vegetation

Lot 27's vegetation is an artifact of the past land uses. Today, the site supports recovering woodland on poorly graded soil piles from the earlier uses. Uplands, wetlands and floodplain environments exist on the property. Uplands within the tract support common trees found on recovering landscapes: box elder maple, black locust, Catalpa, tree of heaven, black cherry, sweet gum, sassafras, and white ash. The understory is a mix of native and non-native shrubs, vines and shade tolerant herbs. Arrowwood, bush honeysuckle, poison ivy, Virginia creeper, oriental bittersweet, are common woody plants in the upland understory. Japanese knotweed, Japanese honeysuckle, Nepalese stilt grass, garlic mustard, field garlic, enchanter's nightshade, poke, and seedlings of canopy trees form a ground cover under the shrubs and canopy trees.





**Upland Forest** 

Floodplain Forest

The wetlands support palustrine conditions dominated by forest. Red maple, sweet gum, pin oak, American elm, and green ash form a narrow forest canopy over the wetlands mapped as linear corridors. Spicebush, common blackberry (cane type, probably *R. allegheniensis*), arrowwood, silky dogwood, elderberry are frequent under the canopies, specifically on the north side of the Assunpink Creek floodplain. Wood reed, false nettle, skunk cabbage, rice cut grass and a variety of wetland sedges form a dense groundcover where saturated soils and light permit.

One plant with State rarity status exists on the parcel: fly poison (S2), *Amianthium muscaetoxicum*. A small colony of approximately 20 plants exist immediately upland of wetland flags C21/22. The plant exists on upland within the 50' transition area, between the Miry Run floodplain and Sweetbriar Avenue. This area is not part of the solar development proposal.

# **Project Uses and Impacts**

## Sec. 154-4: Sewerage Facilities

Township standards require the applicant justify the activity by illustrating there is sufficient sewer capacity and disposal capabilities. The project is located adjacent to Sweetbriar Avenue. The parcel is excluded from the regional sewer service area, yet is immediately adjacent to the Ewing-Lawrence service area (north of Sweetbriar Avenue) as well as the Hamilton Township WCPF service area.

The solar array will be unmanned, requiring no sewer connections. Any activity on site would be accomplished by utility technicians whose home base is remote from the planned panel site.

# Sec. 154-5: Water Supply

Water supply for this section of Hamilton Township is provided by the Trenton Water Department. This purveyor receives water from various sources that include the Burlington City Water Department, New Jersey American Water Company as well as the Trenton Water Department. Water is withdrawn from groundwater wells as well as directly from the Delaware River through the Calhoun Street bridge withdraw plant.

The solar array will be unmanned, requiring no water connections. Water is available in Sweetbriar Avenue and any emergency connections for fire or similar actions would tap these resources.

## Sec. 154-6: Surface Drainage

Land within Lot 27 drains toward the Miry Run and its tributary. Drainage currently follows a circuitous path overland before becoming part of the stream flow of the surface water stream. An unknown volume of infiltration occurs during the overland travel, restricted by the texture of the soils and the depth of the groundwater.

Development of Lot 27 into a solar array will re-contour the western 1/2 of the parcel, directing overland flow into manmade depressed basins created to capture the storm water. The Preliminary Hydrologic Report prepared by Trenton Engineering indicates an increase in peak runoff from all storms (2, 10 and 100 year). To alleviate this increase, these shallow basins would specifically to detain and hold surface flow during each of the periodic storm variations, and slowly release the outflow to the relevant streams.

Volumes have been calculated for the 2, 10, 25 and 100 year storms. The calculations address the proposed development areas D1 and D2. Volumes for peak flow and volumes at peak flow compare the pre and post development conditions. The forest clearing will result in an increase in run off at peak flow for all storm classes 2-100 year. In general, there will be 43% increase of the peak flow rate per second and well as a corresponding 29% increase in the maximum volume output. The proposed water management plan would capture this increase rate and volume, shunting the water into shallow depressions created within the two separate array fields. Emergency outlets would provide points of overland discharge for storms exceeding 100 year volumes.

#### Sec. 154-7: Stream Encroachments

Synnergy's solar array would occupy land mapped as floodplain. All of the activity is planned for the land regulated by Flood Hazard Area regulations (NJAC 7:13). A FHA permit application has been submitted for this project with NJ DEP DLUR. The array would occupy flood fringe. No activity is proposed within the floodway or riparian buffers. The proposed array would not require access to the stream corridor and no actions are proposed that would encroach into the channels of either Miry Run or the tributary. The current design provides a 50' riparian buffer from the top of bank, and a 50' intermediate wetland transition area around wetlands.

#### Sec. 154-8: Solid Waste Disposal

Solid waste removal is a site hygiene function associated with disposal of debris from activities of support staff, on site manufacturing or other consumptive uses.

The array will generate vegetation waste during the site clearing phase. The trees and their stumps would be hauled by a licensed operator and disposed to a wood recycling center. Any onsite debris from earlier uses would be removed to proper disposal venues as the product dictates. Thereafter, no solid waste would be generated by the solar array. The array is unmanned, and requires no on-site trash disposal. Any trash or waste carried into the facility would be removed by the contractors or operators.

## Sec. 154-9: Air Quality

Air quality is the measurement of air borne contaminants that have an effect on human health and environmental quality. In New Jersey, most air quality issues on the larger magnitudes originate west,

outside of the State jurisdiction. On a local scale, season modulations of particulates, ozone and carbon monoxide, are generated by regional industrial manufacturing as well as vehicular traffic. Rider University is the nearest monitoring station, where recent June 20 data indicate moderate air quality (68/400) due to elevated ozone measurements.

The proposed solar array will not add gaseous molecules or fine particulates to the regional air column. The solar power generation, post panel production, is a zero carbon industry, thus local air quality will not be affected by emission from this site. The use of solar power will save approximately 1 ton of carbon dioxide per megawatt produced.

The site activity will result in a local microclimate change created by forest removal. This change will increase wind fetch for ground level wind and heat transfer.

## Sec. 154-10: Critical Impacts

The critical impacts created by the solar array are associated with the loss of ecological services and function when 12 acres of forest clearing occurs.

This activity would remove approximately 820 trees with diameters at breast height (DBH) greater than 10". An unknown number of smaller diameter trees would be removed in addition to the large diameter trees. All sub canopy vegetation would also be removed. This forest that has developed since abandonment now supports common regional canopy native trees (box elder maple, black cherry, red maple, sweet gum, green ash, black gum, big tooth aspen, pin oak, river birch) and a suite of nonnatives commonly found on previously disturbed urban landscapes (Catalpa, tree of heaven, white mulberry, black locust, princess tree). The understory is characteristic of disturbed sites, having wild rose, bush honeysuckle, common privet, poison ivy, Virginia creeper and oriental bittersweet as the dominants. These specimens will be eliminated to provide space as well as direct access to unimpeded solar radiation. This loss is a critical impact to Lot 27. It is difficult mitigate for this loss, yet a road side buffer tree planting will be installed to alleviate, in part, the aesthetic forest view lost by forest clearing.

No wetlands, wetlands transition areas, riparian buffers, acid soils, slopes greater than 20%, or mature stands of native vegetation unaffected by previous clearings will be impacted directly by this project.

#### **Environmental Impact Assessment: Forest Clearing**

The development of this will have both positive and negative environmental impacts. The loss of nearly 12 acres of forest cover is the focus of the project's negative impacts. The loss of contiguous forest cover will alter a number of existing ecological functions. The switch to solar power is a positive step toward energy independence that will eliminate carbon dioxide production for a local high volume energy user.

<u>Wildlife Value</u>: The loss of the upland forest will remove canopy and sub-canopy habitat for resident and migratory fauna. It will eliminate nesting sites for native residents and summer passerine avian species. This loss would affect species such as catbirds, American robin, blue jay, tufted titmouse, Carolina chickadee, wood thrush, oven bird, common yellow throat and similar small to medium bird species. The loss would eliminate 12 acres of roosting habitat for regional and migrating raptors such as red tailed hawk, Coopers hawk, sharp shinned hawk, turkey and black vultures. Resident reptiles and

amphibians would lose foraging and hibernating locations. Insect community complexity would be change to species tolerant of open, un-forested environments.

<u>Vegetation</u>: The proposal will eliminate 12 acres of upland vegetation and its associated environmental services. The woody vegetation is proposed to be replaced with native grasses under the panels and road side evergreen trees as a visual buffers.

Carbon sequestration, storm water abatement, and wildlife habitat would be altered. The loss of the ~820 (10") DBH specimens plus the sub-canopy vegetation would eliminate approximately 273 tons of carbon sequestration over the life span of the 12 acres of forest.

<u>Air Quality</u>: Local air quality would be altered by microclimate modification associated with the change in land cover (forest to open field). Regionally, air quality would be unaffected. The use of solar energy to produce electric power would eliminate carbon dioxide production by burning fossil fuels. This would save approximately 1 ton carbon dioxide per megawatt of power produced per year.

#### **Required Permits**

The project will require the following permits:

- Hamilton Township Planning Board Site Pan Approval
- NRGS Soil Conservation and Sedimentation Permit
- Mercer County Planning Board Approval
- Mercer County Highway Access Permit
- New Jersey Department of Environmental Protection Flood Hazard Area Permit/Wetland Permit
- BPU Electric Power Generator Approval

# Sec. 154-11: Environmental Impacts Assessment

The Synnergy LLC solar power array will create both positive and negative impacts from the installation of a 4.1 MWp solar array. The most visible and obvious negative impact will be the loss of forest were the panel array will be installed. This will affect the specific natural resource attributes associated with 12.307 acres of a recovering upland forest. Impacts will affect wildlife, storm-water, microclimate, and aesthetics. This loss will be offset by positive attributes that includes the industrial redevelopment site location, proximity to final customer, type of power production and large output of solar array.

The following table summarizes the project impacts:

Impact	Size	Negative	Positive	Mitigation	Benefits
Vegetation	12.307	Ecological functions	Upland habitat only	Replace groundcover, buffer planting	Soil erosion, heat island minimization
Wildlife Habitat	12.307	Nesting, Resting, Hibernation	Upland habitat only	Preservation remaining ~ 25 acres	Stable habitat post site development
Air Quality	Upland Vegetation	Micro-climate changes	Elimination burning fossil fuels	Installation solar array	Removal 1 ton CO <sub>2</sub> /MW generated

## Conclusions

The redevelopment of industrial landscapes within Lot 27 is a positive land use decision. Confining the activity to a recovering upland forest eliminates impacts to critical resources found in undisturbed native forest, wetlands, wetland and riparian buffers and protected species habitats. The use of this portion of the site eliminates the imposition of human activities on landscape not formerly disturbed as part of the urban landscape. The use of approximately 12 acres of upland will allow 26 acres of the remaining land within the tract to be preserved without development.

The use of solar power is a second positive feature. The generation of solar power is preferable to the electrification created by fossil fuels. It eliminates measurable quantities of carbon dioxide and other gases emitted from conventional power sources. Power generation in close proximity to the final user also eliminates technical and additional impacts commonly found with a more remote site selection.

The positive attributes of the reduction in carbon dioxide and use of an industrial zoned redeveloped parcel counter balance the negative impacts of forest loss and cessation of most ecological services.



## References

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Appendix

Maps: Various Site Conditions

Natural Heritage Report

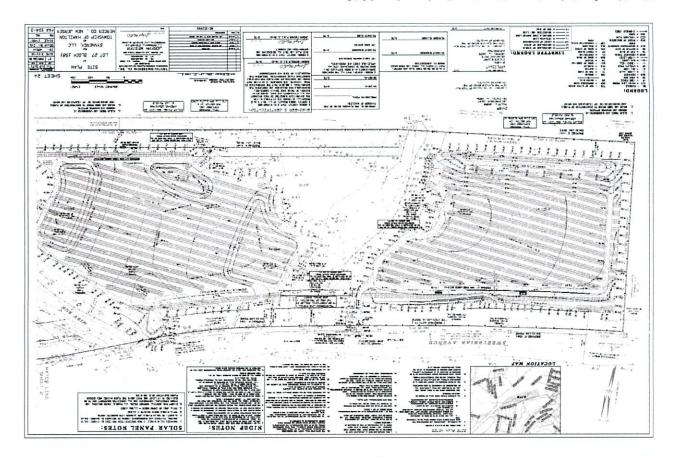
Photography

Preparers Credentials

Supporting Documents:



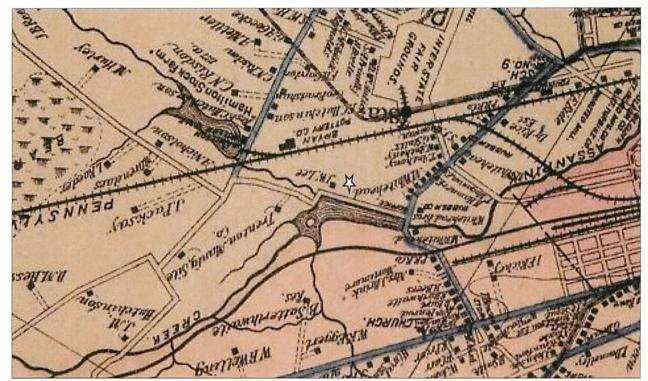
1930 Air Photo with Geo-Web streams overlay shown



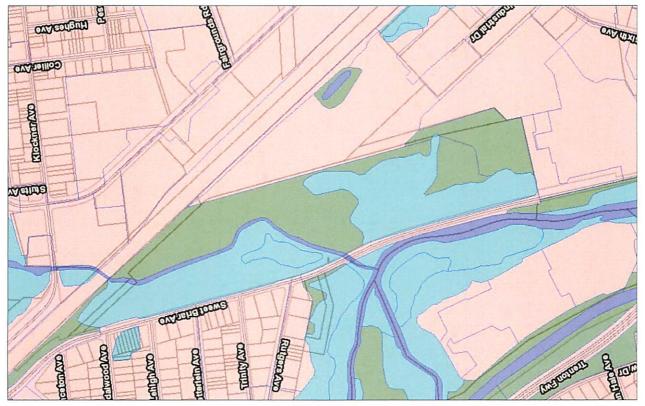
Site Plan for Solar Array, Trenton Engineering, 2018



1906 NJ Topographic Map showing regional development



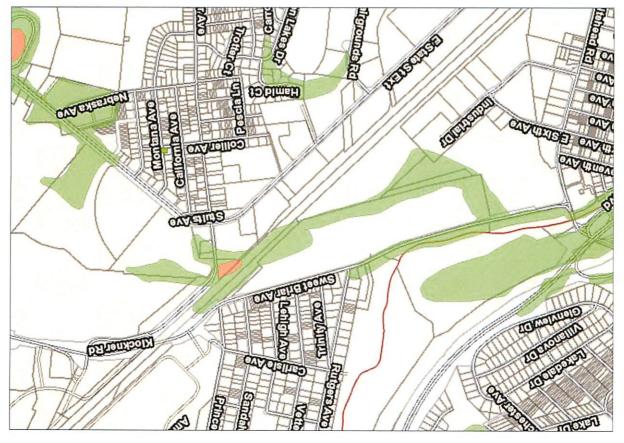
1918 Mercer County Map showing activities and ownership



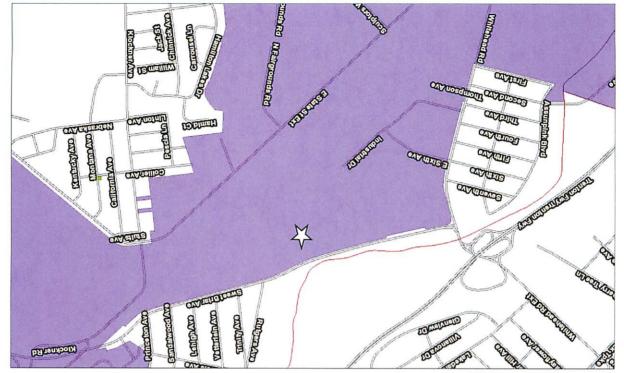
NJ DEP Geo-Web: Land Use/Land Cover: Purple-water, blue-wetland, green-forest, pink-urban



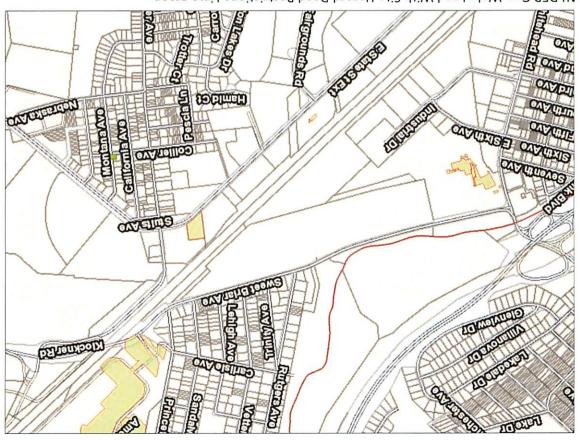
N DEP Geo-Web: Landscape Program 3.1, levels 1 (yellow), 2 (brown), 4 (green)



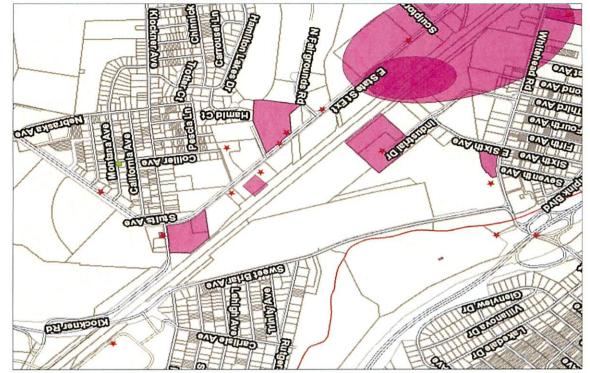
NJ DEP Geo-Web: Filled land - Lime green



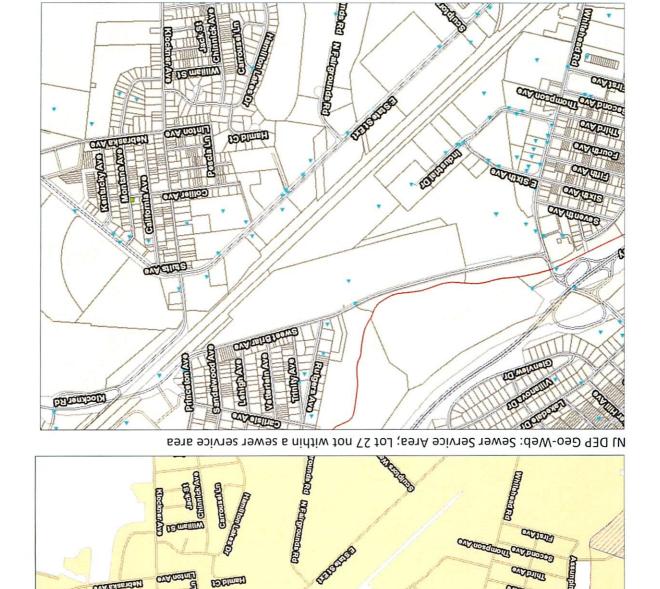
NJ DEP Geo-Web: Land for Redevelopment as per Twp Resolution-purple



N DEP Geo-Web: Land With Site Hazard Deed Restrictions-Lime green



NJ DEP Geo-Web: Known Contaminated Sites, Well Restriction Areas- KCS-star, well protection-purple



X

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CONCINCIO

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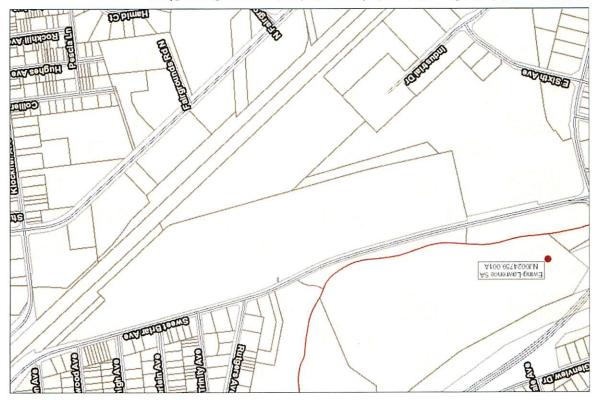
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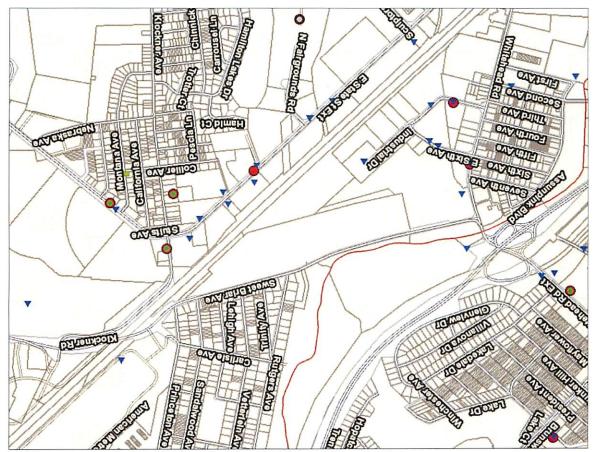
CINCIPED

EDITION OF

N) DEP Geo-Web: NJEMS-site cases surrounding Lot 27: Land Use files on site: #1103-04-0011.1



N) DEP Geo-Web: Surface Water Discharges-Ewing-Lawrence Sewer Plant



N) DEP Geo-Web: Underground Storage Tanks in vicinity of Lot 27; none on site



Road Frontage West of Miry Run







Road Frontage East of Miry Run

East



Miry Run



At Sweetbriar Avenue



Interior

Nanmade Channel



Upland / Facultative Vegetation



Excavated channel

Wetland / Floodplain Habitats



Seasonal Saturated Forest



Vernal pool on floodplain

Upland Forests



sbnslqu ni bnslboow əlqsm- dsA



Black cherry box elder with Virginia creeper and enchanter's nightshade ground cover

## Preparer's Certification/Resume

#### Credentials

A brief list of the education and experience for:

## Joseph R. Arsenault

961 Clark Avenue Franklinville, New Jersey 08322 856-697-6044, facsimile 697-6050, Email NJPlants@aol.com

#### **Education & Certifications**

- o BA 1978, Rutgers University-Camden College of Arts and Sciences: Biology
- o MS 1981, Rutgers University-New Brunswick: Biology
- o Senior Ecologist, 2010- Certified by Ecological Society of America

#### Philip M. Arsenault

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#### **Education & Certifications**

- o BA 2007, Rutgers University-Camden College of Arts and Sciences: Political Science
- o MA 2010, Rutgers University-Camden College of Arts and Sciences: Public Administration

#### **Arsenault Environmental Consulting Expertise & Skills**

- Aerial Photographic Interpretation / Historic Scene Reconstruction
- Systematic Botany, Ecological and Vegetation Sciences
- Environmental Land Use Investigations: Impact Statements Natural Resource Inventories, Wetland Services
- ® Environmental Permitting Services: Freshwater Wetlands, Coastal New Jersey Programs
- ® Natural Landscape Restoration: Restoration, creation and enhancement