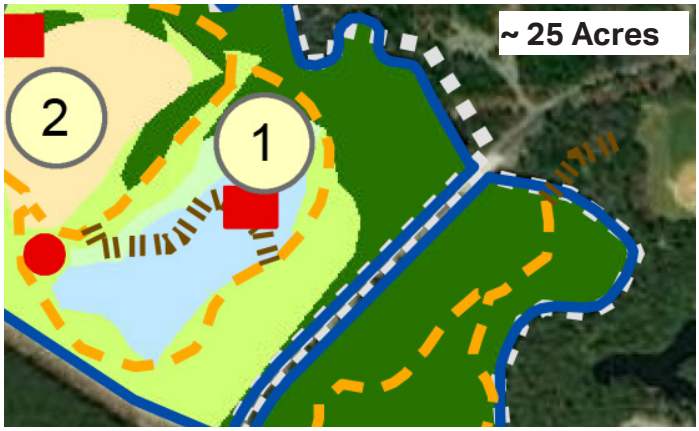
Table 1. NRD Program Elements

1. PERCHED WETLAND/POND/WOODED BUFFER



CONCEPTUAL DESCRIPTION OF ELEMENT ATTRIBUTES

1. **Open Water Limnetic Zone**: deep aquatic environment with complex substrate, fisheries, and submerged habitat
2. **Shallow Water Littoral Zone:** diverse submerged aquatic vegetative community including aquatic bed, emergent and mud flat habitats
3. **Palustrine Emergent Marsh Wetlands:** integrated pit and hummock microtopography forming assorted habitat complexity
4. **Palustrine Scrub/shrub Wetlands:** fringe ecotone providing corridors of dense cover connecting low emergent to forested transition/uplands.
5. **Stream Watercourses:** inter-woven and braided flow through created wetland with diverse benthic substrates/ hydrology
6. **Transitional Buffer:** forested, successional, and herbaceous communities forming complex blends of open and dense cover systems connecting adjacent habitats
7. **Public Connectivity:** ADA accessible trail, viewing / interaction platforms, boardwalk, blinds, and interpretive kiosks to engage, encourage participation, and educate stakeholders

ECOLOGICAL BENEFITS

This complex wetland (ca. 12 of 25 acres) and forested buffer system will provide an extensive suite of ecological and ecosystem services, resulting in ecological continuity with the Toms River corridor. Attributes include:

- **Diverse aquatic resources** providing **forage, nesting, and cover habitat** for fish, amphibians, benthic macroinvertebrates, and waterfowl.
- **Complex wetland habitats** and resources for **wildlife habitat**, providing **water quality and air quality** benefits, **floodwater desynchronization, sediment and nutrient retention and export** functions.
- **Threatened & Endangered Species** **habitat and cover** and **increased connectivity** of adjacent natural lands and site **conservation area.**
- **Wetland transition area** functions for **cover, nesting, and rearing habitat, buffering capability** between the Toms River, the upland buffer, and the ca. 12 acre created wetland system.

HUMAN USE BENEFITS

Located in proximity to the main entrance to the Site, this project will serve as one of several gateway projects. Human use benefits are extensive:

- The **wetland complex trail and boardwalk** will provide that initial linkage to **passive and active recreational** opportunities (e.g., hiking, birding).
- **Special access focus** for **handicap/disability stakeholders in certain designated areas**.
- **Education programs** **for children and adult** stakeholders connected with Element 2,
- **Aesthetic benefits** of reestablishment of **complex natural systems integrated community access** and planned aesthetics.

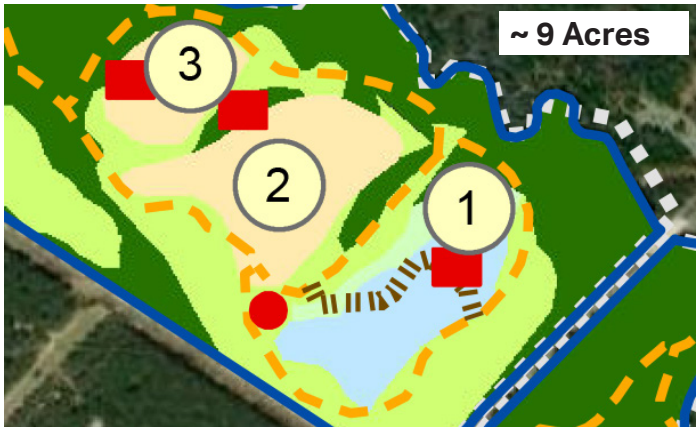
CONCEPTUAL RENDERING

Existing

Proposed

Table 1. NRD Program Elements *(continued)*

2. ENVIRONMENTAL EDUCATION CENTER/GRASSLAND/MEADOW



CONCEPTUAL DESCRIPTION OF ELEMENT ATTRIBUTES

1. **LEED Certified Education Center:** designed to encourage stakeholder involvement with collaboratively developed educational and interpretive programs focused on NJ Pine Barren ecology, green and sustainable environmental practices, and sustainable management. Site-specific research monitoring, ADA accessible, extension of trails and interpretive learning opportunities
2. **Grassland Habitat**: expansion/enhancement of this regionally important and critical cover type for threatened and endangered bird, reptile, and plant species known to exist on site.
3. **Wet Meadow:** extension of transitional wetland and meadow habitats from Element 1. Sloped wet herbaceous habitats with patches of scrub/shrub clusters leading into broader grassland cover.
4. **Pollinator Gardens:** integrated with grassland and meadow habitats. Accessible for education purposes. Patches that highlight the diversity of native pollinator plant species, the range of inter-dependant fauna, and the beneficial ecosystem services provided.
5. **Public Connectivity:** ADA accessible trails where applicable, viewing / interaction platforms, blinds, and interpretive kiosks to engage, encourage participation, and educate stakeholders

ECOLOGICAL BENEFITS

Establishment and enhancement of this transitional mosaic of wet-to-dry cover types will provide abundant ecosystem services and benefits. These include, but are not limited to:

- **Expansive grassland habitats** providing forage, nesting, and cover habitat for grassland dependant songbirds and other avian species that require open cover (e.g., Short-Eared Owls, American Kestrel, Common Nighthawk). Other wildlife that will benefit include reptiles (e.g. lizards, snakes), soil invertebrates, and small and large mammals.
- **Transitional wetlands** and resources providing wildlife including amphibian forage and cover habitat, water quality and air quality benefits, groundwater recharge, floodwater desynchronization, sediment and nutrient retention and export functions.
- **Threatened & Endangered Species** habitat and cover.
- **Pollinator cover** – supporting the recovery of native and beneficial pollinator insects and bird species.

HUMAN USE BENEFITS

The Environmental Education Center is strategically positioned near the entrance to the Site and presents the most concentrated human use benefits as the information hub for the three gateway projects (1-3). Human use benefits are extensive:

- **Education Center** will continue to provide student programs focused on facilitating understanding of Pine Barren ecology and linkage between various terrestrial and aquatic cover types; natural processes and importance of wildlife interactions; industry leading sustainable site closure and land management practices, sustainable development, solar technology at industry scale, among others.
- **Extension of trail network**, linkage to passive and active recreational opportunities (e.g., hiking, birding).
- **Special access focus** for handicap/disability stakeholders in certain designated areas.

  Aesthetic benefits, enjoyment of community access to complex natural systems.

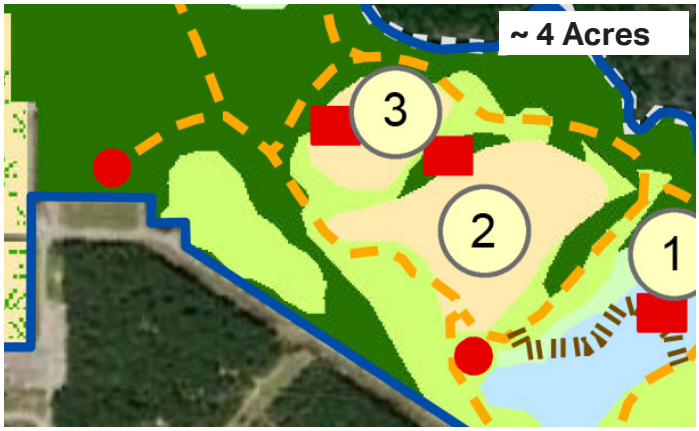
CONCEPTUAL RENDERING

Existing

Proposed

Table 1. NRD Program Elements *(continued)*

3. GRASSLAND/POLLINATOR HABITAT



CONCEPTUAL DESCRIPTION OF ELEMENT ATTRIBUTES

1. **Grassland Habitat:** extension and enhancement of this regionally important and critical cover type for threatened and endangered bird, reptile, and plant species known to exist on site. Expansion and linkage from Element 2, Environmental Education Center. Broad dry grassland and herbaceous habitats connecting to successional fringe/edge along forested Toms River riparian zone. Grassland corridor towards solar grasslands to the west (Element 9)
2. **Pollinator Gardens:** integrated and blended with grassland habitats. Accessible for education purposes. Patches that highlight the diversity of native pollinator plant species, the range of inter-dependant fauna, and the beneficial ecosystem services provided.
3. **Public Connectivity:** easily accessible gateway project potentially with ADA accessible trails, viewing / interaction platforms, bird / wildlife viewing blinds, and interpretive kiosks to engage and encourage participation and educate stakeholders

ECOLOGICAL BENEFITS

Establishment and enhancement of this grassland habitat provides near continuous connectivity with more expansive grasslands with Element 9 and an important open space leading to Toms River riparian zone. The project will further restore the site setting to native habitat and in so doing, extend natural connections within the Toms River corridor. Associated ecosystem services and benefits include, but are not limited to:

- **Expansive grassland habitats** provide resilient drought tolerant habitat that facilitates infiltration for stormwater, soil development and erosion prevention with deep rooted native plants. Extension of forage, nesting, and cover habitat for grassland dependant songbirds and other avian species that require open cover. Habitat for insects, reptiles, soil invertebrates, and small and large mammals.
- **Threatened & Endangered Species** habitat and cover especially for grassland songbirds (e.g., Grasshopper Sparrow) and reptiles (Northern Pine Snake).
- **Pollinator cover** – supporting the recovery of native and beneficial pollinator insects and birds.

HUMAN USE BENEFITS

This extension of the gateway projects provides easy access and direct link to the Environmental Education Center Human use benefits are extensive:

- **Extension of trail network**, where visitor stakeholders can observe the complexity of Pine Barren ecology and linkage between various terrestrial and cover types; natural processes; grassland and riparian edge wildlife interactions. Connections to passive and active recreation opportunities (e.g., hiking, birding).
- **Special access focus** for handicap/disability stakeholders in certain designated areas.
- **Aesthetic benefits**, enjoyment of community access to complex natural systems.

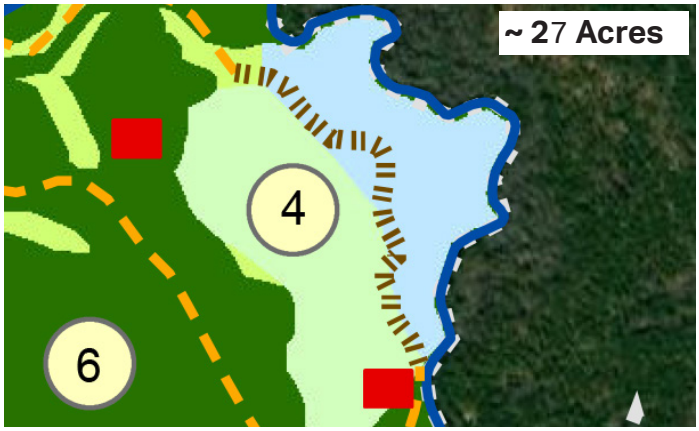
CONCEPTUAL RENDERING

Existing

Proposed

Table 1. NRD Program Elements *(continued)*

4. FLOODPLAIN/WETLAND ENHANCEMENT



CONCEPTUAL DESCRIPTION OF ELEMENT ATTRIBUTES

1. **Toms River Riparian Zone:** Forested and scrub buffer complex b/w riverine and terrestrial habitats
2. **Forested Wetlands:** floodplain with hydrologic input from overbank flood events and upland contributions. Closed and open canopy wetland resources with tiered structural complexity and niche habitats
3. **Vernal Habitats:** critical seasonal aquatic resources for amphibians, specialized invertebrate and plants
4. **Palustrine Emergent Marsh Wetlands:** integrated pit and hummock microtopography forming assorted habitat complexity
5. **Palustrine Scrub/shrub Wetlands:** establish fringe ecotone providing corridors of dense cover connecting low emergent to forested transition/uplands.
6. **Transitional Buffer:** successional and herbaceous communities forming complex blends of open and dense covers connecting adjacent habitats
7. **Public Connectivity:** expanded trail networks, viewing / interaction platforms, boardwalk, blinds, and interpretive kiosks to engage, encourage participation, and educate stakeholders

ECOLOGICAL BENEFITS

Restoration and enhancement of this complex wetland and buffer system will be designed to provide an extensive suite of ecological and ecosystem services. These include, but are not limited to:

- **Diverse aquatic resources** providing forage, nesting, and cover habitat from predators for amphibians, benthic macroinvertebrates, waterfowl, and riparian dependent species.
- **Complex wetland habitats** and resources for wildlife habitat, providing water quality and air quality benefits, floodwater desynchronization and storage, sediment and nutrient retention, soil conservation and export functions.
- **Threatened & Endangered Species** habitat and cover for reptile, amphibian, bird, and plants known to be present on-site or within the region.
- **Wetland transition area** functions for cover, nesting, and rearing habitat, buffering capability between upland and aquatic resources.

HUMAN USE BENEFITS

An extensive tract of riparian forest and mixed habitat – this project is connected with the Site trail system and provide substantial recreation and education opportunities in addition to infrastructure protection services. Human use benefits are extensive:

- **Flood water desynchronization** protecting downstream property and infrastructure,
- The **trail and boardwalk** will provide that expansion of passive and active recreational opportunities (e.g., hiking, birding).
- **Special access focus** for handicap/disability stakeholders where applicable (in certain designated areas).
- **Education program connections** and informational displays/learning engagements along trails.
- **Aesthetic benefits** of reestablishment of complex natural systems integrated community access and planned aesthetics.

CONCEPTUAL RENDERING

Existing

Proposed

Table 1. NRD Program Elements *(continued)*

5. GRASSLAND/OBSERVATION PLATFORM

CONCEPTUAL DESCRIPTION OF ELEMENT ATTRIBUTES

1. **Grassland Habitat:** extension and enhancement of this regionally important and critical cover type for threatened and endangered bird, reptile, and plant species known to exist on Site. The inclusion of this habitat provides an extensive patch of grassland habitat closely aligned with similar and expansive lands in Element 9.
2. **Pollinator Gardens:** integrated and blended with grassland habitat, particularly along the public trail network. Accessible for education purposes. Patches that highlight the diversity of native pollinator plant species, the range of inter-dependant fauna, and the beneficial ecosystem services provided.
3. **Public Connectivity:** project includes trail linkages to other Program elements, bird / wildlife viewing blinds, and interpretive kiosks to immerse participants in the experience and provide a sense on the importance of each Pine Barrens habitat
4. **Observation Platform:** easily accessible viewing and interaction platform with lower and elevated decks. Enabling expanded views of restored grasslands and Pine Barrens forest communities. Unique vantage point providing novel education opportunities. Exceptional bird / wildlife viewing and interpretive kiosks to engage and encourage participation and educate stakeholders.

ECOLOGICAL BENEFITS

Establishment and enhancement of this grassland habitat provides near continuous connectivity with more expansive grasslands with Element 9 and an important terrestrial ecotone. Associated ecosystem services and benefits include, but are not limited to:

- **Expansive grassland habitats** provide resilient drought tolerant habitat that facilitates infiltration for stormwater, soil development and erosion prevention with deep rooted native plants. Extension of forage, nesting, and cover habitat for grassland dependant songbirds and other avian species that require open cover. Habitat for insects, reptiles, soil invertebrates, and small and large mammals.
- **Threatened & Endangered Species** habitat and cover especially for grassland songbirds (e.g., Grasshopper Sparrow, Savannah Sparrow) and reptiles (Northern Pine Snake).
- **Pollinator cover** – supporting the recovery of native and beneficial pollinator insects and bird species.

HUMAN USE BENEFITS

This project provides additional access to the trail network and a unique elevated observation platform. Human use benefits are extensive

- **Extension of trail network**, where visitor stakeholders can observe the complexity of Pine Barren ecology and linkage between various terrestrial cover types, natural processes, grassland and edge wildlife interactions. Connections to passive and active recreation opportunities (e.g., hiking, birding).
- **Unique Observation Platform**, providing multiple levels for viewing and interaction with restored grasslands, edge ecotones, and Pine Barren forest wildlife and plant communities.
- **Education Center Connectivity**, with integration and sharing of research and learning opportunities.
- **Aesthetic benefits**, community access to complex
- natural systems, immersion in nature from unique elevated vantage points.

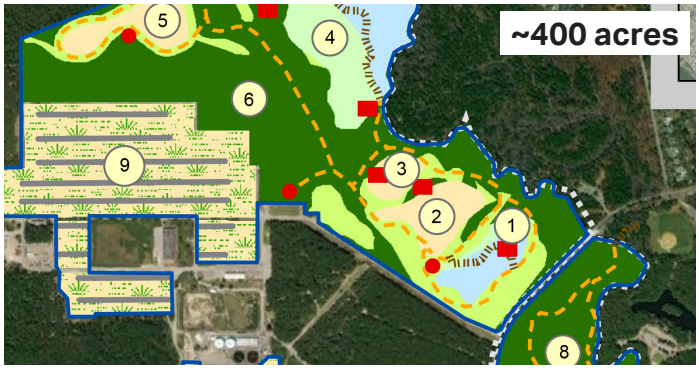
CONCEPTUAL RENDERING

Existing

Proposed

Table 1. NRD Program Elements *(continued)*

6. NORTHERN PINE SNAKE, BAT, AND TURTLE CONSERVATION PROJECT



CONCEPTUAL DESCRIPTION OF ELEMENT ATTRIBUTES

1. **Rare, Threatened & Endangered Habitat Conservation:** Conservation of lands used by rare and T&E species is critical in supporting important Pine Barrens species. Program Element 6 encompasses the combined acreage of Program Elements 1 through 9 (240 acres) as well as approximately 160 additional publicly accessible abutting forested acres in the vicinity of these Program Elements, as depicted in Figure 2. The Project 6 objective is to enhance all 400 acres to support conservation of pine snakes, bats, and turtles. This Program element along the Toms River corridor will benefit T&E species and other species of special concern. This project will focus on research and implementation of conservation measures that consider the entire Project areas, the adjacent land uses, and connectivity's within the Toms River corridor ecosystem.
2. **Nesting and Forage Habitat Management:** BASF will engage academic expertise to research and help determine what land preservation/conservation/habitat elements would best benefit the T&E species at the Site. This project will assess and develop management actions to retain / restore / establish habitats for species such as Northern Pine Snake, Little Brown Bat, Pine Barrens Tree Frog, Eastern Box Turtle and other T&E and species of concern. Grassland and open forest tracts are important forage habitat and will also be managed accordingly.
3. **Hibernacula Preservation & Management:** winter hibernacula have been identified as limited resources. Establishment of artificial hibernaculum has been shown to be an effective management tool to support T&E species. The project will explore the use of constructed hibernaculum designed to support resource limited species that occur within the area.

ECOLOGICAL BENEFITS

The Northern Pine Snake is a listed threatened species documented on the site. Similarly, Eastern Box Turtle and multiple bats are species of special concern. Additional conservation and management practices can provide substantial benefits for these species. Associated ecosystem services and benefits include, but are not limited to:

- **Expansive grassland and open pine/oak forest habitats** provide required forage, cover, and nesting habitat for Northern Pine Snake and other noted T&E species. Conservation of these lands will provide life-cycle benefits to this species and similar reptiles/amphibians that use these resources.
- **Hibernacula resources** are limited, and management and/or construction of artificial hibernaculum can increase longevity and support population growth.
- **Expansive and management of wetlands**, riparian, and terrestrial habitats provide required forage, cover, and nesting habitat for extensive list of T&E resources that use the site.

HUMAN USE BENEFITS

The NRD Program will conserve extensive tracts of pine/oak forest and open mixed habitats that support T&E species. Conservation and management actions that protect such species are also vitally important for human stakeholders too:

- **Unique Education Opportunities** to understand T&E species life-cycle requirements and ecology with possible chance encounters with T&E wildlife and plants.
- **Natural World Connectivity**, stakeholders have challenges connecting with natural environments. Learnings and encounters with rare species and unique landscapes can endear the importance of these resources with stakeholders and result in greater support for, and connection with, T&E species.
- **Research Opportunities (university partnership)** supported with the Education Center resources could further societal understanding of this and other Pine Barrens T&E species and leading to increased conservation practices.

CONCEPTUAL RENDERING

Existing

Proposed

Research and Conservation Management:
1. T&E Amphibian Research
2. T&E Reptile Research
3. Bat Research
4. Ecosystem Value Connection
5. Wildlife Activity Monitoring

Photo credits: Ohio.gov, Ben Wurst, George Cevera, Research Gate, respectively

Table 1. NRD Program Elements *(continued)*

7. FOREST RESTORATION

CONCEPTUAL DESCRIPTION OF ELEMENT ATTRIBUTES

1. **Toms River Riparian Zone:** Forested and scrub habitats for a complex buffer b/w riverine and developed terrestrial habitats – current recharge area to be restored to mixed forest / natural buffer environment.
2. **Transitional Buffer:** successional communities form complex and temporal transition that blend from open to dense covers over time and connect adjacent habitats within the Toms River corridor. The tiered structural complexity provides niche habitats for plant and wildlife resources
3. **Interior Forest Cover:** progressive elimination of edge habitat and expansion of mature forest interior habitat. Support of broad range of wildlife associated with interior forest resources.

Project 7 will require an interactive and iterative approach to introduce flexibility in project options. In large part, the Project 7 ecological uplift will be dependent on the availability of treated groundwater (i.e., if treated groundwater that is currently discharging to this area is consumed by Project 1, Project 7 will evolve accordingly).

ECOLOGICAL BENEFITS

Restoration and enhancement of this forested resource will be designed to provide an extensive suite of ecological and ecosystem services. These include, but are not limited to:

- **Restoration of Complex Forest Interior Habitats** will develop over time. Resources for wildlife habitat, providing water quality and air quality benefits, soil conservation and export functions.
- **Threatened & Endangered Species** successional to interior forest habitat cover for reptile, amphibian, bird, and plants known to be present on-site or within the region.
- **Expanded Forest Buffer** functions for, nesting, and rearing habitat, buffering capability between developed upland and riparian and aquatic resources.

HUMAN USE BENEFITS

Restoration of interior forest and mixed habitat will provide increased buffering, and water quality, services. Human use benefits are extensive:

- **Water Quality Benefits** via precipitation recharge, nutrient uptake, increased forested buffer b/w riverine and development and infrastructure,
- **Air Quality** benefits from increased successional and forest cover.
- **Aesthetics** from restoration of native forest and complex ecosystems.

CONCEPTUAL RENDERING

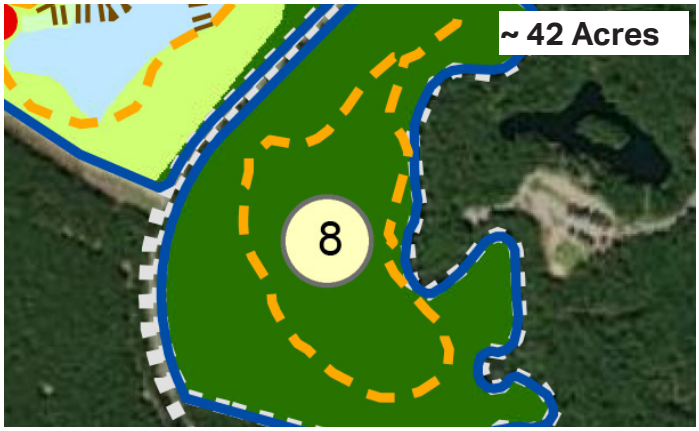
Existing

Proposed

Photo credit: https://www.markbetz.net/slideshows/the-jersey-i-know/

Table 1. NRD Program Elements *(continued)*

8. WINDING RIVER PARK CONNECTION



CONCEPTUAL DESCRIPTION OF ELEMENT ATTRIBUTES

1. **Toms River Riparian Zone:** Forested and scrub buffer complex b/w riverine and terrestrial habitats
2. **Forested Wetlands:** floodplain with hydrologic input from overbank flood events and upland contributions. Closed and open canopy wetland resources with tiered structural complexity and niche habitats
3. **Public Connectivity:** expanded trail network connecting and extending public park use and access areas, viewing / interaction platforms, boardwalk/bridge, interpretive kiosks to engage, encourage participation, and educate stakeholders

ECOLOGICAL BENEFITS

Preservation and enhancement of public connectivity to this complex riverine, wetland and floodplain buffer system. Will be designed to preserve ecological and ecosystem services, while providing public access. The ecological benefits include, but are not limited to:

- **Diverse Toms River and Riparian Aquatic Resources** conservation / preservation that provide forage, nesting, spawning, and cover habitat for fish, amphibians, benthic macroinvertebrates, waterfowl, and aquatic habitat dependent species.
- **Complex wetland habitats** and resources for wildlife habitat, providing water quality and air quality benefits, floodwater desynchronization and storage, sediment and nutrient retention, soil conservation and export functions.
- **Threatened & Endangered Species** habitat and cover for reptile, amphibian, bird, and plants known to be present on-site or within the region.

HUMAN USE BENEFITS

Winding River Park provides year-round passive and active recreation to Toms River residents and visitors. Connection to a trail network and natural resources within the approximately 43 acre tract will extend those community benefits. Access to the south side of Toms River was generally limited, the new connection will provide substantial recreation opportunities. Additionally, linkage with the on-site Education Center will extend recreation and connection opportunities. Human use benefits are extensive:

- The **trail and boardwalk** will expand passive and active recreational opportunities (e.g., hiking, birding).
- **Special access focus** to link Winding River Park and Education/on-site trail network.
- **Education program connections** and informational displays/learning engagements along trails
- **Aesthetic benefits** of providing and connecting communities to complex natural systems

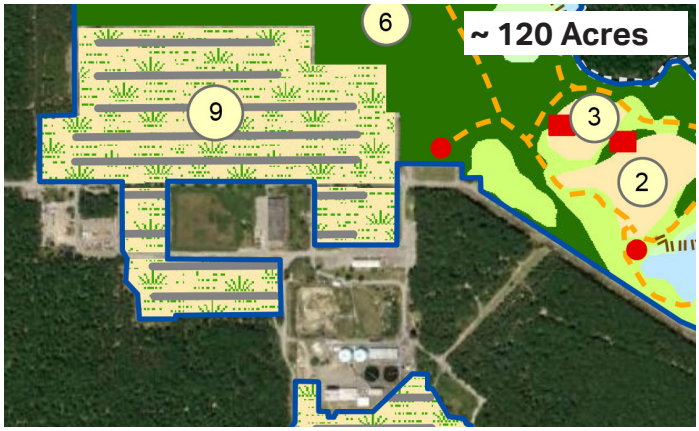
CONCEPTUAL RENDERING

Existing

Proposed

Table 1. NRD Program Elements *(continued)*

9. UPLIFTED GRASSLAND/POLLINATOR HABITAT/SOLAR ARRAY



CONCEPTUAL DESCRIPTION OF ELEMENT ATTRIBUTES

1. **Grassland and Pollinator Habitats:** significant expansion/enhancement of this regionally important and critical cover type. Substantial increase in the support for threatened and endangered bird, reptile, and plant species known to exist on site and depend on grassland habitat.
2. **Solar Array:** progressive adaptation of remedial lands to provide combination of renewable energy and integrated with important grassland tracts
3. **Pollinator Gardens:** integrated and blended with grassland habitats. Accessible for education purposes. Patches that highlight the diversity of native pollinator plant species, the range of inter-dependant fauna, and the beneficial ecosystem services provided.
4. **Public Education Linkage:** grasslands and solar array benefits, monitoring, and research projects integrated with Education Center programs to demonstrate and document ongoing interactions and benefits of project. Encouraging participation and providing education opportunities to stakeholders

ECOLOGICAL BENEFITS

Establish and enhance grassland habitat integrated with solar array development. Provides restoration of an expansive grassland habitat, an important terrestrial cover type. Associated ecosystem services and benefits include, but are not limited to:

- **Expansive grassland habitats** provide resilient drought tolerant habitat that facilitates infiltration for stormwater, soil development and erosion prevention with deep rooted native plants. Extension of forage, nesting, and cover habitat for grassland dependant songbirds and other avian species that require open cover. Habitat for insects, reptiles, soil invertebrates, and small and large mammals.
- **Threatened & Endangered Species** habitat and cover especially for grassland songbirds (e.g., Grasshopper Sparrow, Savannah Sparrow) and reptiles (Northern Pine Snake)
- **Pollinator cover** – supporting the recovery of native and beneficial pollinator insects and birds.

HUMAN USE BENEFITS

Solar array closely connected with Environmental Education Center. Presents additional human use and education benefits and complements the three gateway projects (1-3). Human use benefits are extensive:

- **Solar Array**, on former industrial lands as integrated renewable energy and wildlife habitat complex provides substantial clean energy source and beneficial reuse of dormant lands.
- **Carbon sequestration** and offset from solar energy, supporting increased regional air quality
- **Connectivity with Education Center** will expand available opportunities for student programs. Potential for grassland and T&E species research. Link to informational programs on sustainable site closure and land management, and sustainable development,
- **Birding and nature observation** from outside the perimeter fence will provide passive recreational opportunities

CONCEPTUAL RENDERING

Existing

Proposed