Riverfront Park Conceptual Plan

CLAYMONT, DELAWARE

Prepared for the

Claymont Renaissance
Development Corporation

October 2021

CRDS
COASTAL RESILIENCE
DESIGN STUDIO

The Coastal Resilience Design Studio (CRDS) is an interdisciplinary team of student designers, researchers and engineers exploring creative and thoughtful solutions to the many challenges facing Delaware's coastal communities.

The CRDS aims to equip communities with tools, designs, and adaptation strategies aimed at mitigating disruptions from short-term hazardous events and long-term environmental changes.

Our Team

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Please visit our webpage to view our past & ongoing projects and for contact information online at:

https://sites.udel.edu/bsla-crds/

University of Delaware

Our Partners

CRDC
Claymont Renaissance Development Corporation

DELAWARE GREENWAYS

East Coast Greenway ALLIANCE

Sea Grant Delaware

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Introduction

PRIMARY OBJECTIVES

Riverview at First State Crossing is a proposed mixed-use development fronting the Delaware River in Claymont, Delaware. The existing site plan shows conceptual open space and walking trails as residential amenities. The CRDS is collaborating with the Claymont Renaissance Development Corporation (CRDC) to enhance amenities and provide community connection to the Claymont waterfront. CRDS will develop a conceptual design for connectivity to existing hiking and biking trails, the new development, and the new Claymont Regional Transportation Center. The design will enhance environmental resilience and add valuable ecosystem services. Residents of Claymont envision local amenities that honor their community's history and provide riverside recreation opportunities. CRDS's plan centers around resident's needs and desires outlined in 2017 community workshops (North Claymont Area Master Plan Community Workshop, 2018). The primary project objectives include:

- Providing recreational opportunities for the community, such as riverfront access, trails, sports fields, event space, and a marina,
- Establishing connectivity to the surrounding community with universal access,
- Enhancing Claymont's regional profile, and
- Designing resilience solutions that ensure the longevity and vibrancy of the development and its amenities in the face of a changing environment.

COMMUNITY OF CLAYMONT BACKGROUND

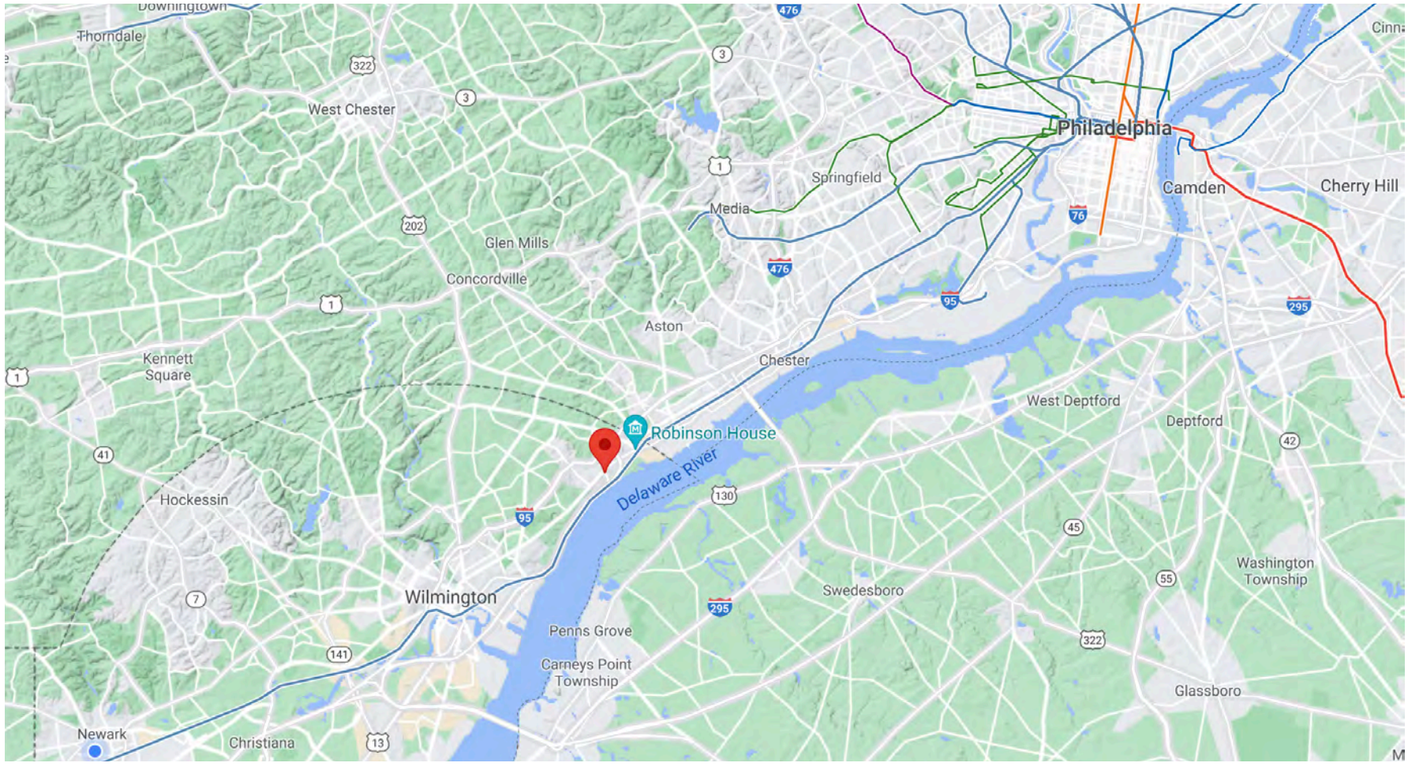
Claymont is located in northern New Castle, DE just south of the Pennsylvania border along the Delaware River. Initially an agricultural community, wealthy Philadelphians transformed the area into a suburban community in the mid- 1800s. In 1856, the wife of John B. Clemson, an Episcopalian Reverend, named the community after Claymont Court, their family plantation in Charles Town, WV (Claymont Historical Society). Claymont became an industrial community in 1917 with the establishment of the Worth Steel mill.

The steel manufacturing operation, which initially produced steel plate and pipe, transferred ownership six times before being shut down in 2013 by the Evraz group. At the operation's peak, production capacity reached 500,000 tons of steel per year (Claymont Steel Timeline, 2014) and employed at least 1,300 workers (Variance Request by Phoenix Steel Corporation, 1977). The redevelopment of prior industrial sites has been critical in revitalizing former industrial towns such as Pittsburg.

https://www.hagley.org/librarynews/steel-making-claymont-delaware

Brownfield redevelopment allows the reuse of a previously contaminated location through remediation, like soil capping. Capping typically kills vegetation but provides an opportunity for new growth after remediation. The redevelopment at First State Crossing requires remedial action which is currently ongoing to ensure a safe environment for future residents.

Claymont occupies 5 square miles and has an estimated population of 15,312 (American Community Survey 2019 5-year data from Census Reporter). The median age is 37.1 years old. The median household income is $59,613. 10.8 of the population is below the poverty line. There are 6484 households, and 30% of which reside in multi-unit dwellings. 12% of the population is foreign-born. 85% of the population speaks English only, while 12% speaks Spanish. Claymont is bounded by PA to the north, DE River to the east, Perkins Run Creek to the south, and the freight railroad tracks to the west adjacent to Arden, DE.



The proposed Electric Ark Park is adjacent to the new Claymont Regional Transportation Center. The new station will provide an easy commute to Wilmington and Philadelphia for the residents of Claymont and beyond. Passenger service is scheduled to begin in the spring of 2023 (WDEL, 2021).

COASTAL ISSUES

Wave energy from storms and ship wake from the Delaware River shipping channel have eroded the site's river banks resulting in significant wetlands loss since 1992 (Figure X). The post-industrial past calls for remediation, including the addition of two feet of topsoil over a large area of the site. Like the wetlands, the topsoil is at risk from erosion unless properly stabilized through planted vegetation or grass seed. Erosion control is necessary for the success of the remediation efforts.

Riparian buffers and wetlands clean surface water before it enters a stream or river system. All waterfront communities have a responsibility to protect the adjacent water.

1992 2017

The development's stormwater management plan is not finalized and was therefore not addressed in this report. Instead, water quality is protected through the placement of riparian borders along the banks of Naaman Creek and the Delaware River, the two bodies of water surrounding Riverview. Enhancing the riparian borders and wetlands will keep the water safe from post-development runoff and provide erosion and flood control.

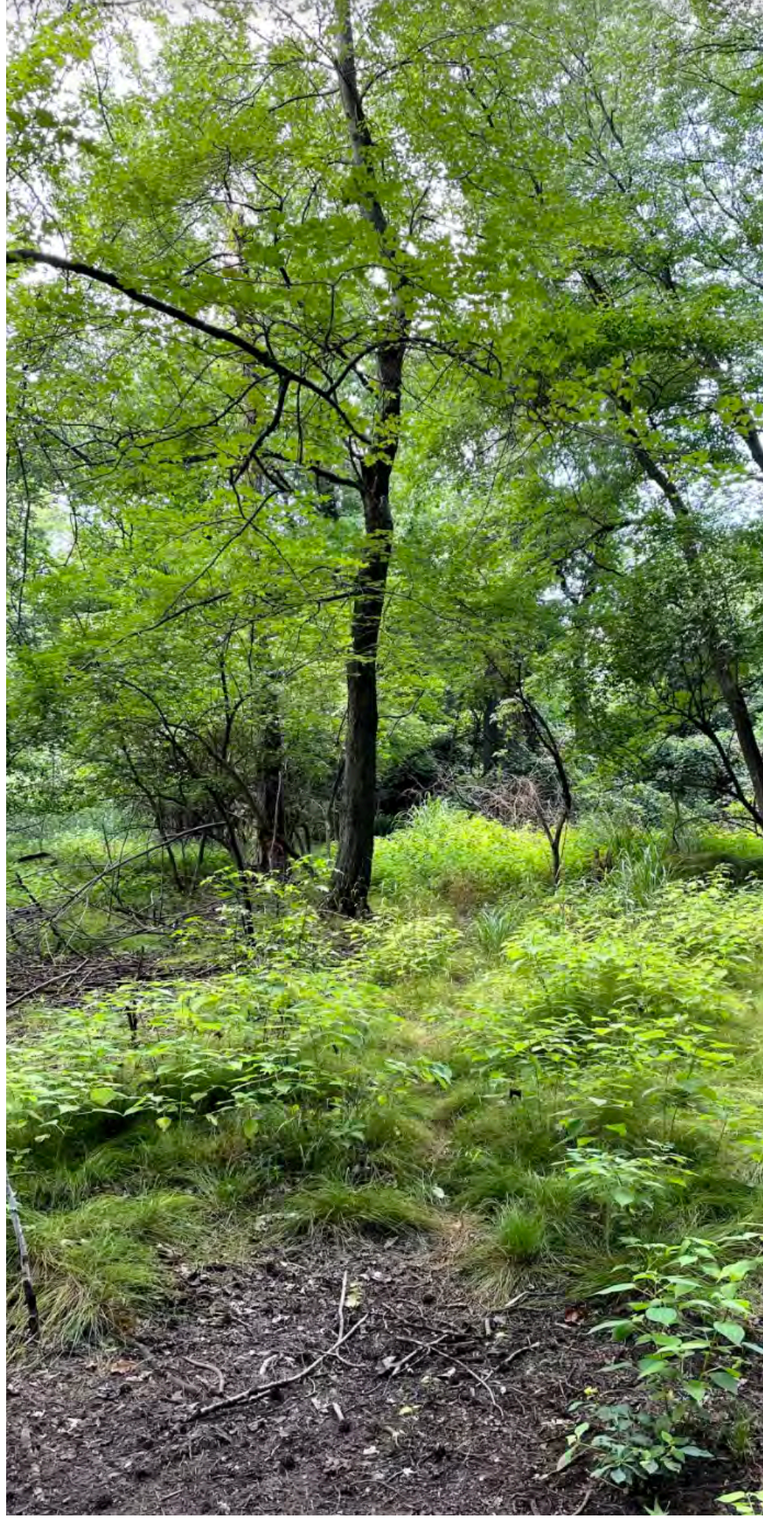
The current riparian zone contains a mix of non-native exotic and native vegetation. Restoring vegetation through riparian buffers provides aesthetic benefits, wildlife habitat, and opportunities for community interaction.

RESIDENT CONCERNS

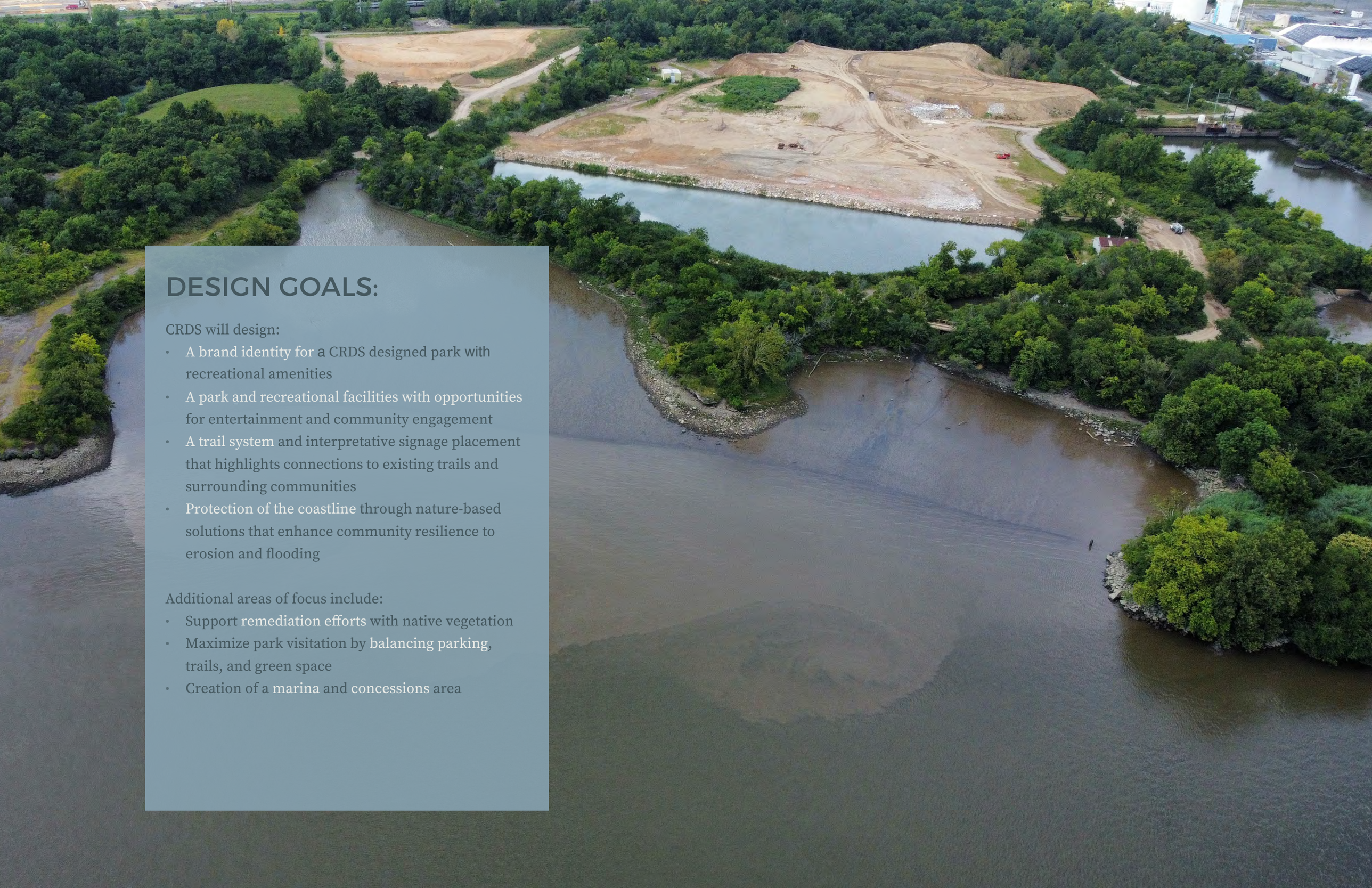
First State Crossing is part of a larger effort to revitalize the Claymont community, called the North Claymont Area Master Plan. A series of three community workshops conducted in 2017 by the Wilmington Metropolitan Area Planning Council (WILMAPCO) provided a platform for residents to voice their needs and concerns regarding the master plan. Approximately 100 residents attended the first workshop, and the second and third workshops both received 120 attendees.

Residents emphasized that one of their top priorities was riverfront access. Riverview parks, trails, event spaces, restaurants, and boat launches were all ideas to connect the community to the river. A common theme was the provision of recreational opportunities. An additional priority was enhancing pedestrian and bicycle connectivity. Residents want trails that give them the option to safely walk from home instead of navigating the Philadelphia Pike and I-495 by car. Residents were also concerned about environmental protection and restoration. The CRDS's involvement will promote the vision and needs of the community.

Sense of Place



Design Goals



DESIGN GOALS:

CRDS will design:

- A brand identity for a CRDS designed park with recreational amenities
- A park and recreational facilities with opportunities for entertainment and community engagement
- A trail system and interpretative signage placement that highlights connections to existing trails and surrounding communities
- Protection of the coastline through nature-based solutions that enhance community resilience to erosion and flooding

Additional areas of focus include:

- Support remediation efforts with native vegetation
- Maximize park visitation by balancing parking, trails, and green space
- Creation of a marina and concessions area

Community Branding

COLOR PALETTE

BRAND TYPEFACES

I am your primary typeface

I am your secondary typeface

I am your accent typeface

BRAND STATEMENT

Sitting on the banks of the Delaware River this is a vibrant community with a rich industrial history. Parks, trails, a marina, and an amphitheater cement Claymont Riverfront Park as one of New Castle County's premier spot for community, recreation, and entertainment. We are proud to call Claymont our home and are excited to welcome you. It's well worth a visit.

Brand Logos

Branding work produced by CRDS Creative Director, professional branding consultant Ben Muldrow. Ben works with Arnett Muldrow and Associates, whose work involves crafting a custom process for each community they work for built around three philosophies: Engaged Community Voice, Strategies Built in Reality, and Plans that get Implemented.

Ben Muldrow is a talented graphic artist who has been designing for over 25 years with experience in a wide variety of marketing applications. He provides community identity and branding services for communities across the United States. Ben has worked on hundreds of projects specializing in the development of city and neighborhood identities, wayfinding strategies, and promotional marketing material and is considered a premier designer of community branding identities.

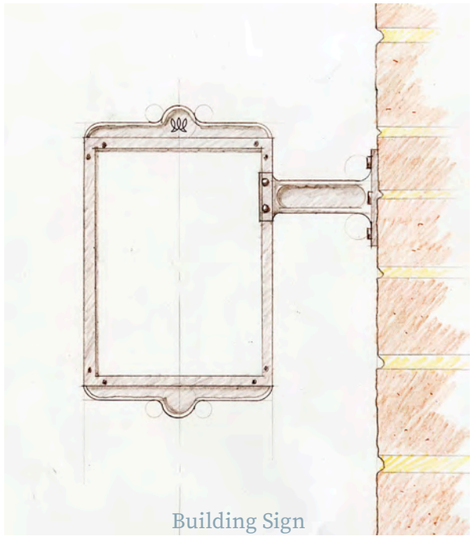
The brand logos were inspired by the design of Worth Steel Company, the original owner of the Claymont steel mill. The design is simple, bold, and memorable. It alludes to first state crossing as a worthwhile home, park, and attraction.

The stylized “W” above “Riverview” references the Worth steel company. It alludes to Riverview as being “worth it.” The “W” is also reminiscent of an electric arc furnace, the type of furnace used at the Claymont steel mill. Its electric filament appearance emphasizes the park’s industrial past. It also looks like three fish, referencing Riverview’s proximity to the river. There are many layers of meaning to the logo, providing opportunity for a diverse population to identify with the logo in whichever way is most resonant.

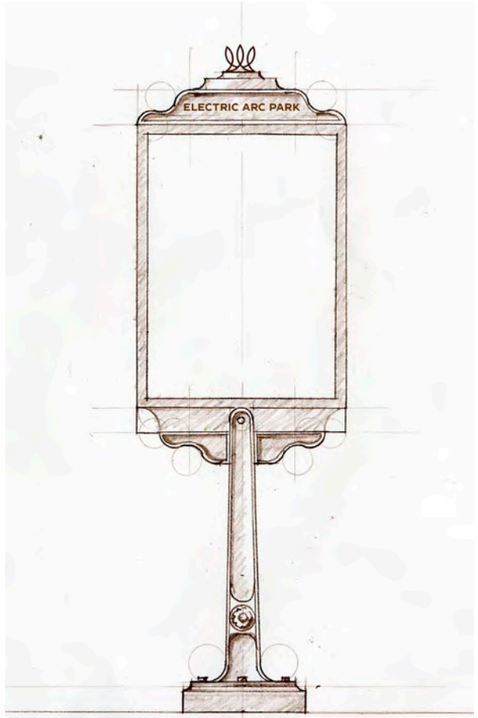
The Electric Arc Park’s logo features the Worth diamond. The logos provide each component of Electric Arc Park an individual identity, but the common style connects them, providing visitors a sense of place.

Wayfinding Signage

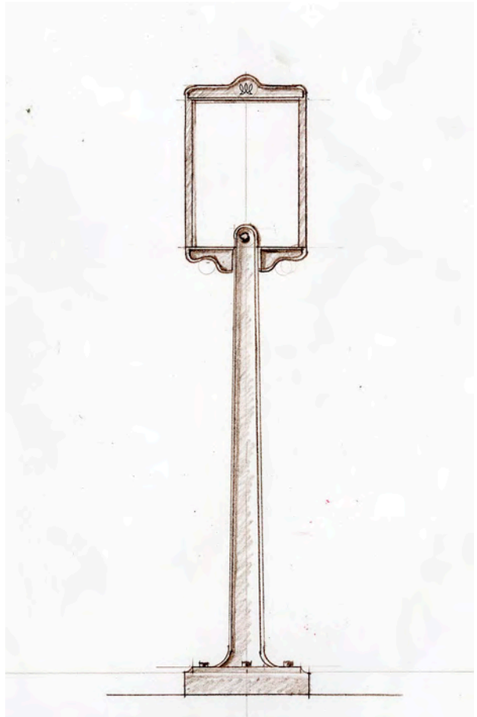
Images and Designs Provided by Arnett Muldrow



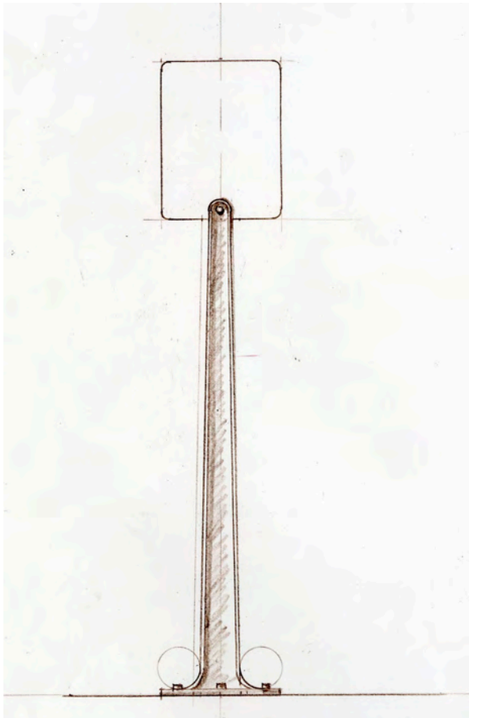
Building Sign



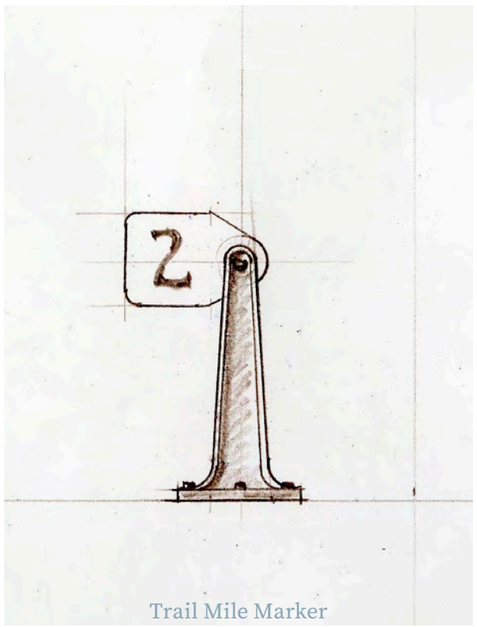
Kiosk



Directional Sign A

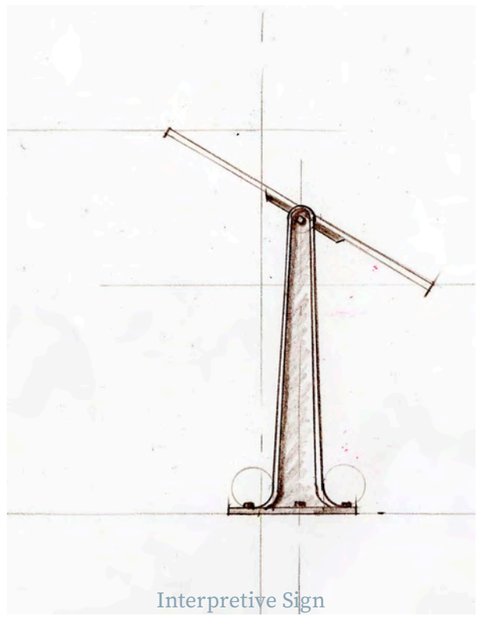


Directional Sign B

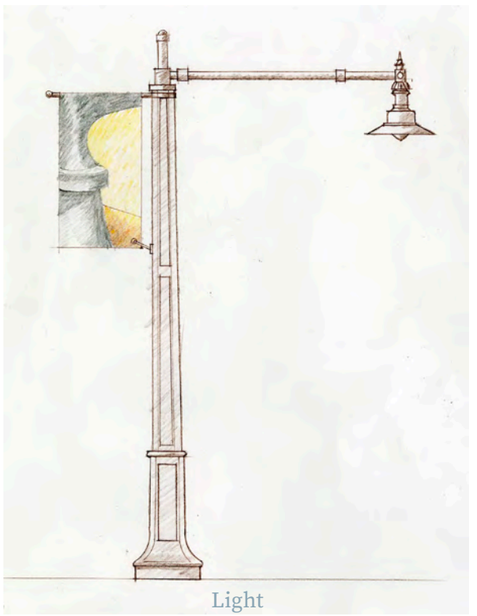


Trail Mile Marker

Planter



Interpretive Sign



Light

The Conceptual Plan

ELECTRIC
ARC
PARK

Electric Arc Park

Proposed Design

Electric Arc Park is a vibrant space for community members to walk, bike, play, and enjoy views of the Delaware River. Named after the electric arc furnace used in the Claymont Steel mill, Electric Arc Park honors the old mill site and its industrial legacy. Electric Arc Park transforms the area into a destination for families, pet owners, sports enthusiasts, boaters, or those looking to exercise. At the center of the park sits the off-leash Arc Bark and Worth Fields. Music lovers can head to the Phoenix Amphitheater for live events. Park-goers can hike through the woods, walk along the water towards the Claymont Marina, or exercise on the Trackside Trail. Additionally, the park's shoreline is lined with restored wetlands. These wetland areas not only enhance water quality and park resiliency but connect the community to nature.

Park Program

- Restore wetlands to clean stormwater runoff and provide resilience.
- Create a trail system with lookouts for the community to feel a connection to the river while promoting healthy living though exercise, hiking, and biking.
- Create recreational amenities including a dog park, sports fields, and event space.
- Create a marina and concessions area to provide boating and economic opportunities.

Worth Fields

Named after the original owners of the Claymont Steel mill, Worth Fields is worth a visit. Basketball courts, tennis and pickleball courts, disc golf, and a multi-use field suits pick-up games, friendly competitions, or league soccer and flag football. Kids can play on the playground as their parents play sports.

The Worth Fields amenities were selected based on the Delaware Statewide Comprehensive Outdoor Recreation Plan (2018). The plan included a community poll of desired recreational facilities.

Survey Results:

Walking/Jogging = 84%

Picnicking = 71%

Visiting Historical Sites = 68%

Hiking = 60%

Dog Walking = 59%

Bicycling = 59%

Using Playgrounds = 53%

Fishing = 48%

Nature Programs = 40%

Wildlife Viewing = 38%

Kayaking = 37%

Football = 34%

Basketball = 34%

Baseball = 33%

Soccer = 31%

Softball = 28%

Tennis = 27%

Power Boating = 24%

Horseshoes = 24%

Disc Golf = 19%

Paddle Boarding = 16%

Drones = 15%

Lacrosse = 11% (p.32)

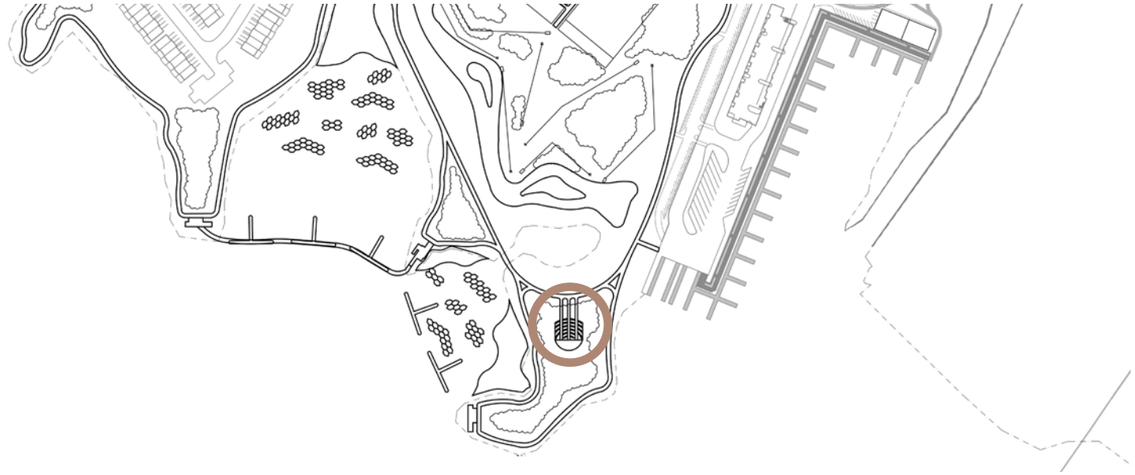
WORTH FIELDS

ELECTRIC ARC PARK

Arc Bark

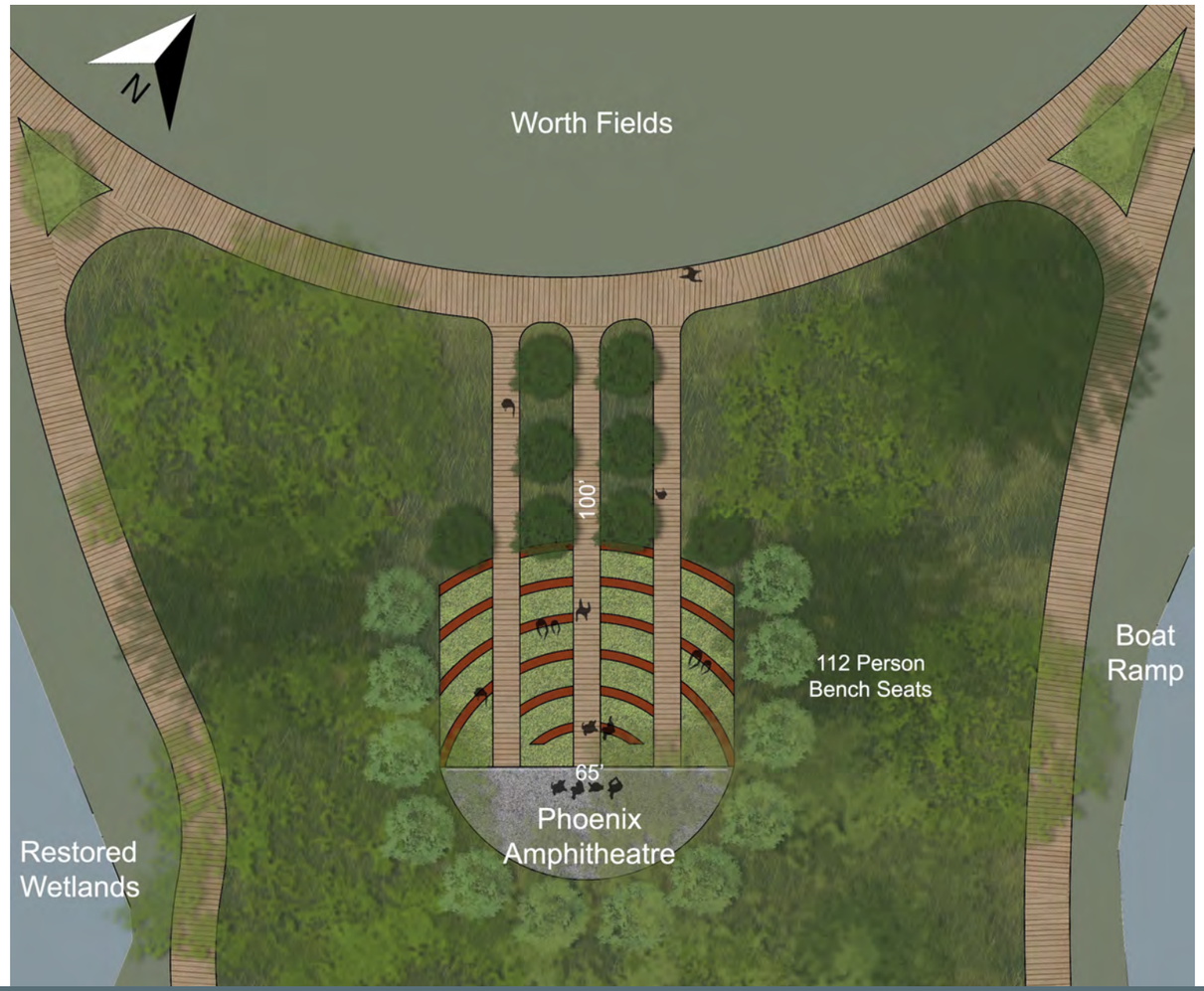
The fenced-in Arc Bark is a convenient amenity for all the dog owners in Claymont and beyond.

ARC BARK
ELECTRIC ARC PARK



Phoenix Amphitheater

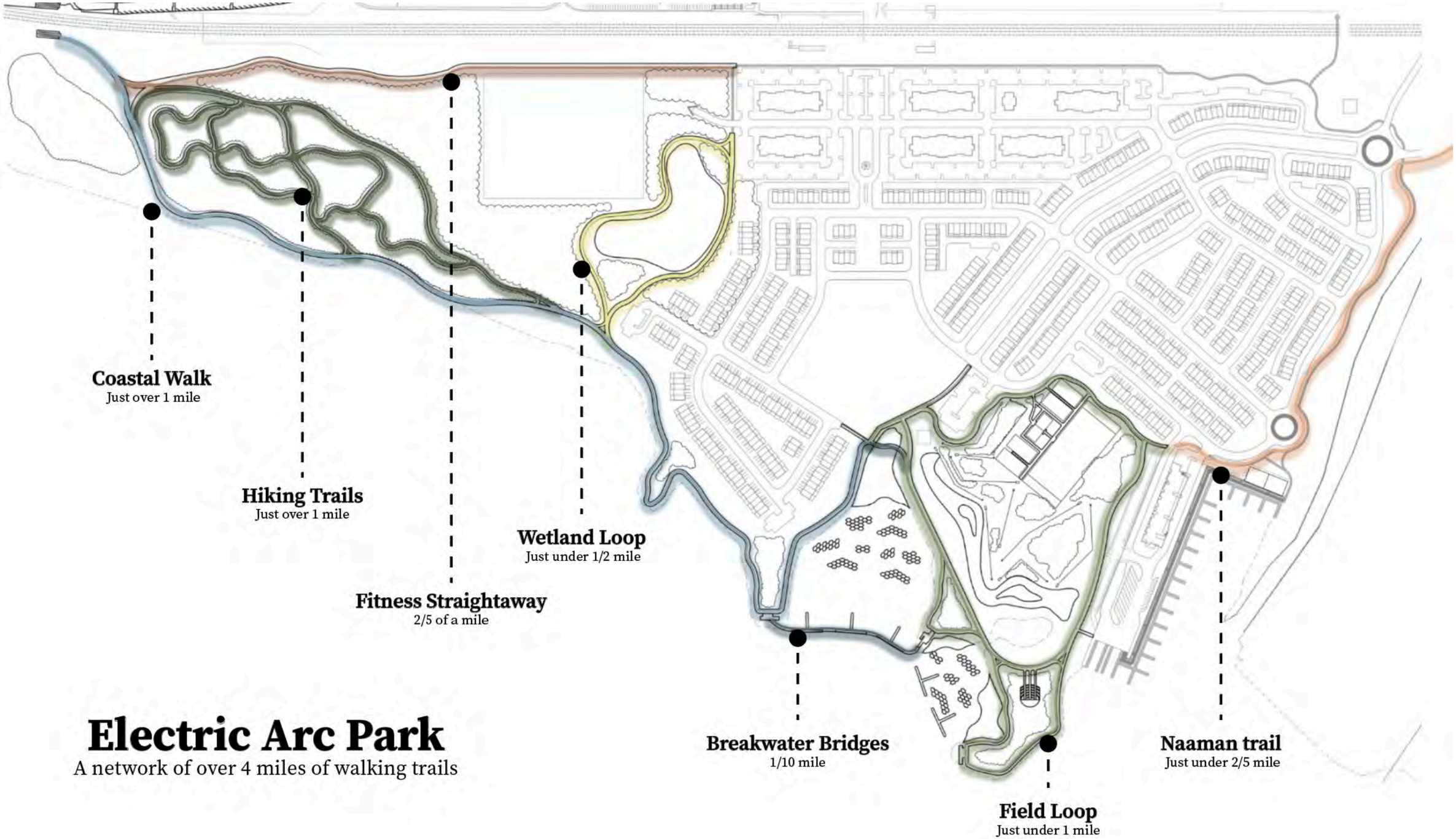
Phoenix Amphitheater is the place to be. Electric Arc Park's event space pays homage to a former owner of the steel mill, Phoenix Steel. Like a phoenix rising from the ashes, the amphitheater revitalizes the former industrial Claymont into a bright new attraction in the Wilmington-Philadelphia area. The phoenix amphitheater has a 112 person capacity and can host concerts, performances, and community events.



Arc Furnace Trail

Arc Furnace Trail

Electric Arc Park offers 4.4 miles of trails for exploration, exercise, and connecting with nature.



Materiality Map

Arc Furnace Trail is composed of three types of materials. Naaman trail and trails that run through developed areas are paved. Trails along the water are boardwalks to prevent foot traffic from exacerbating erosion. Forested trails are natural or cinder trails to create a natural aesthetic.

There is ample space to demarcate trails in existing forests without cutting trees or heavy construction. The ground cover is already flat and clear enough to constitute a trail. It can be supplemented with wood chips, dirt, or gravel.

Arc Furnace trail connects with existing trails on site whenever possible. On main routes, like the coastal walk, multi-use trails will be 15 feet wide. Hiking and smaller trails will likely not exceed 10 feet in width.

Spotlights

The Trackside Trail offers a healthy amenity to the residents of Claymont. This straight trail parallels the train tracks and includes industrial-chic exercise equipment that gives Claymont fitness buffs a place to work out away from the bustle of Electric Arc Park. The park can partner with local healthcare providers like Christiana Care to help fund the installation of fitness equipment.

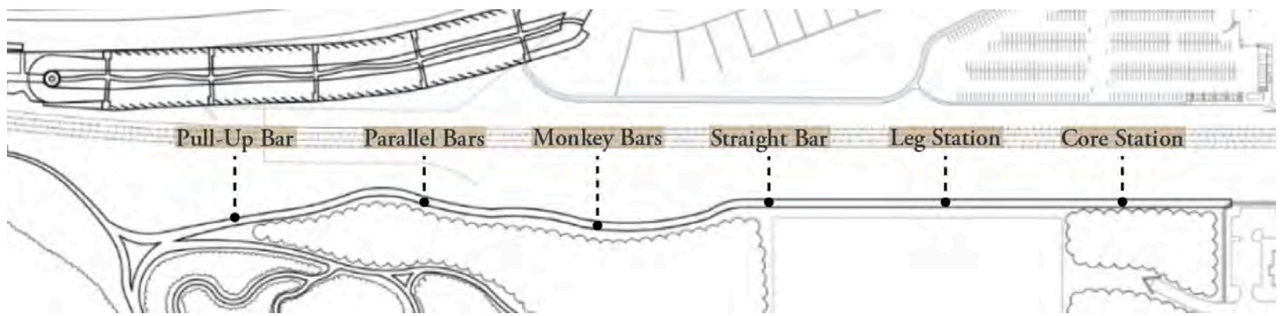
Hiking trails in Electric Arc Park's developed forest provide opportunities for nature hikes, strolls through the woods, or trail biking.

The Coastal Walk and Breakwater Bridge bring visitors right up and over the water. Beautiful vistas, close-up views of the wetlands, and fishing are all benefits of river access.

ARC FURNACE TRAIL
CLAYMONT, DELAWARE

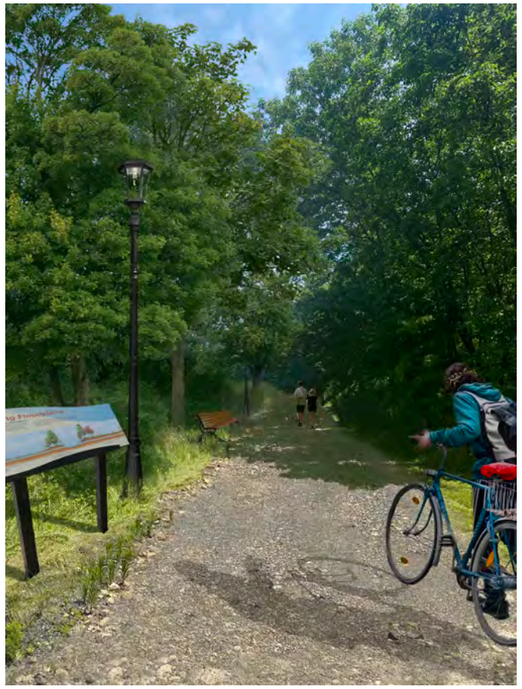
TRACKSIDE TRAIL
CLAYMONT, DELAWARE

NAMAAN TRAIL
CLAYMONT, DELAWARE



Trackside Trail

Hiking Trails



Coastal Walk

Lewis Park, Newark

Examples of the kinds of fitness equipment that could be placed along the Trackside Trail.

EXISTING WETLAND

The existing wetland is a beautiful location in Riverview. The wetland loop brings visitors up close to the natural amenity. The CRDS proposes removing the 24 proposed houses adjacent to the wetland loop. This removal prevents public trails from abutting private property. The gorgeous, existing woodlot is a buffer between developed, private property, and a natural, public amenity.

Restored Wetlands

Existing Conditions

Tidal marshes are some of the world's most productive and valuable ecosystems. These vegetated coastal edges provide wave and storm surge buffering, erosion protection, water quality enhancement, nursery habitat for aquatic species, nesting habitat for birds, and protection from flooding (VIMS, 2009). In Delaware, tidal marsh is the dominant natural habitat along the Delaware Estuary coastlines. In 2010, the estuary's fresh and saltwater wetlands provided an estimated $5.4 billion of ecosystem goods and services (Kauffman, 2011).

Since 1992, 6.35 acres of estuarine wetlands have eroded along the coastline of the redevelopment site. Other onsite wetlands have converted to mudflats. While mudflats provide some services, wetlands are much more productive ecosystems. In the absence of coastal wetlands, services such as wave attenuation, water quality enhancement, and high quality habitat are missing. As the area becomes redeveloped, healthy edge environments such as wetlands and riparian corridors help to clean stormwater runoff before entering the Delaware River.

The site experiences medium wind waves and high boat wake energy (Racoon Creek/Logan Township, Windfinder). It has medium water body energy and a low nearshore slope (F00594, NOAA 2010). It is possible to install wetlands under these conditions, but they require additional structural protection for their growth and success.

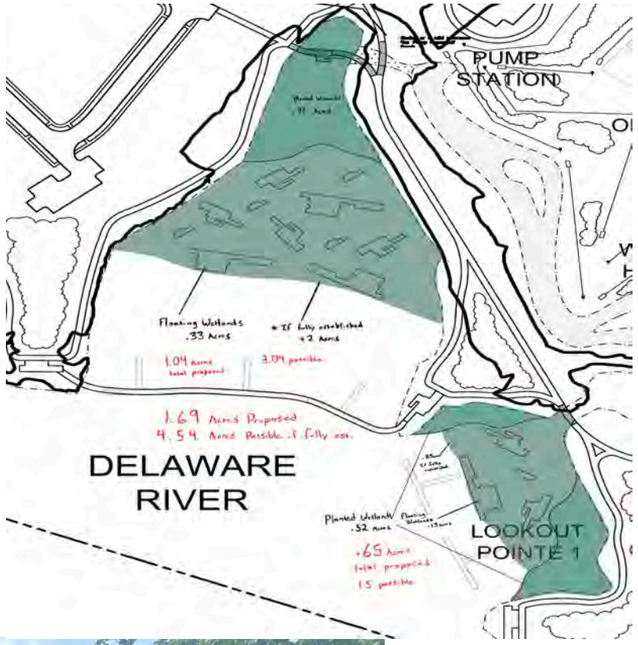
Proposed Design

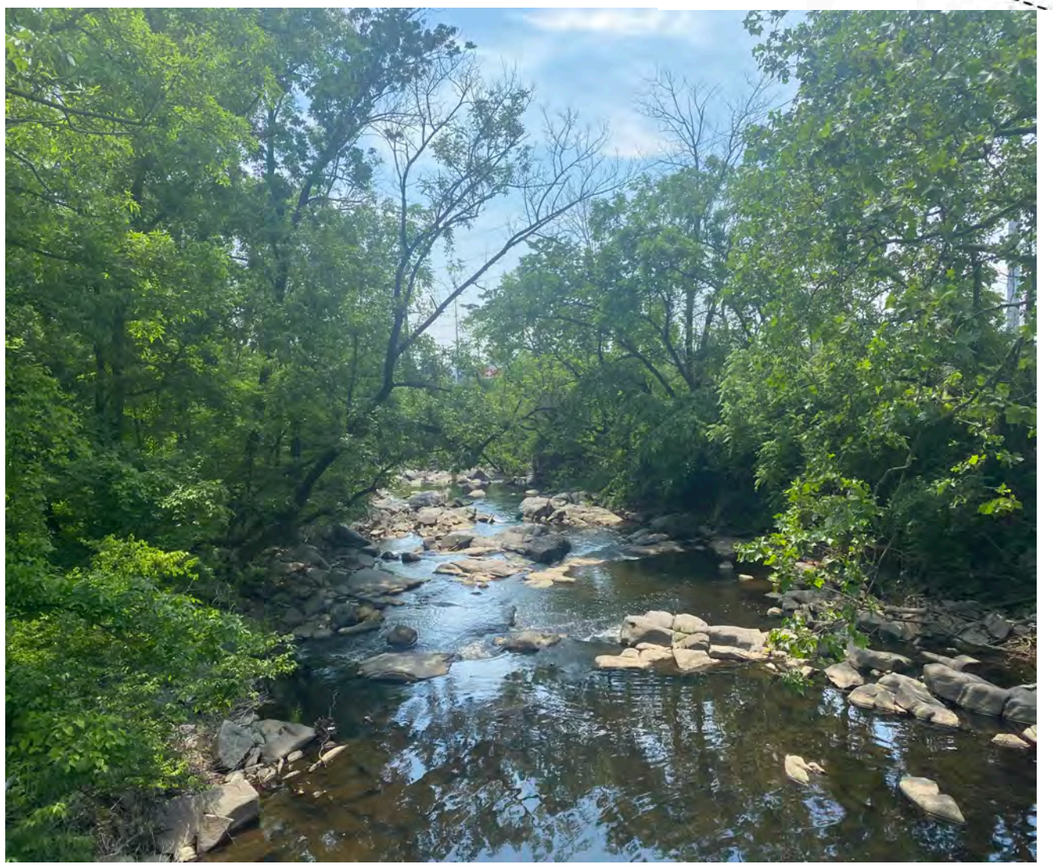
The restored wetlands system is composed of a breakwater, nature-based materials such as coir logs and aquatic vegetation to reestablish the coastal wetlands, and floating wetlands. The breakwater protects the developing wetlands from wave and wake action. This protection allows the wetlands to grow and achieve their maximum potential. In this proposal, the installation of 1.69 acres could eventually expand to 4.54 acres if properly protected and maintained.

The wetlands system has multiple benefits. The wetlands themselves serve as a polishing system for stormwater runoff. They reduce the effects of erosion, storm surge, and flooding, which protects the site's remediation efforts and the Riverview community. Additionally, the wetlands provide opportunities for education and recreational viewing of flora and fauna. Interpretive signage will enhance the educational value of the wetlands.

The breakwaters directly benefit the community by providing additional protection from erosion, storm surge, and flooding. The structure is multi-purpose and supports a pedestrian bridge and aquatic habitat. Park-goers can walk straight over the water and will enjoy viewing the river and wetlands. The new structure and protected wetland will provide space for fish nurseries and perhaps mussel beds.

A long-term management strategy is required to maintain the growth and health of the wetlands.





Installation Program

- Install breakwater bridge to reduce boat wake and wave energy, allowing for the wetlands to grow and succeed behind it
- Restore healthy wetlands system through the installation of native flora and fauna
- Beautify through planting design to serve as a park amenity and point of community interaction
- Develop management strategy to maintain stormwater, erosion, and flood control benefits

Naamans Creek

Naamans Creek requires a riparian buffer to maintain water quality. There is currently vegetated shrubland between the creek and the adjacent road, varying between 50 and 150 feet in width (Delaware National Vegetation Classification System, 2007). The vegetation is a mix of native and non-native exotic species. This project suggests improvements to the current vegetated area through invasive removal and native planting. Ongoing maintenance of native plants will protect the river from stormwater runoff, establish wildlife habitat, and beautify Naamans Trail.

Naamans Creek Program:

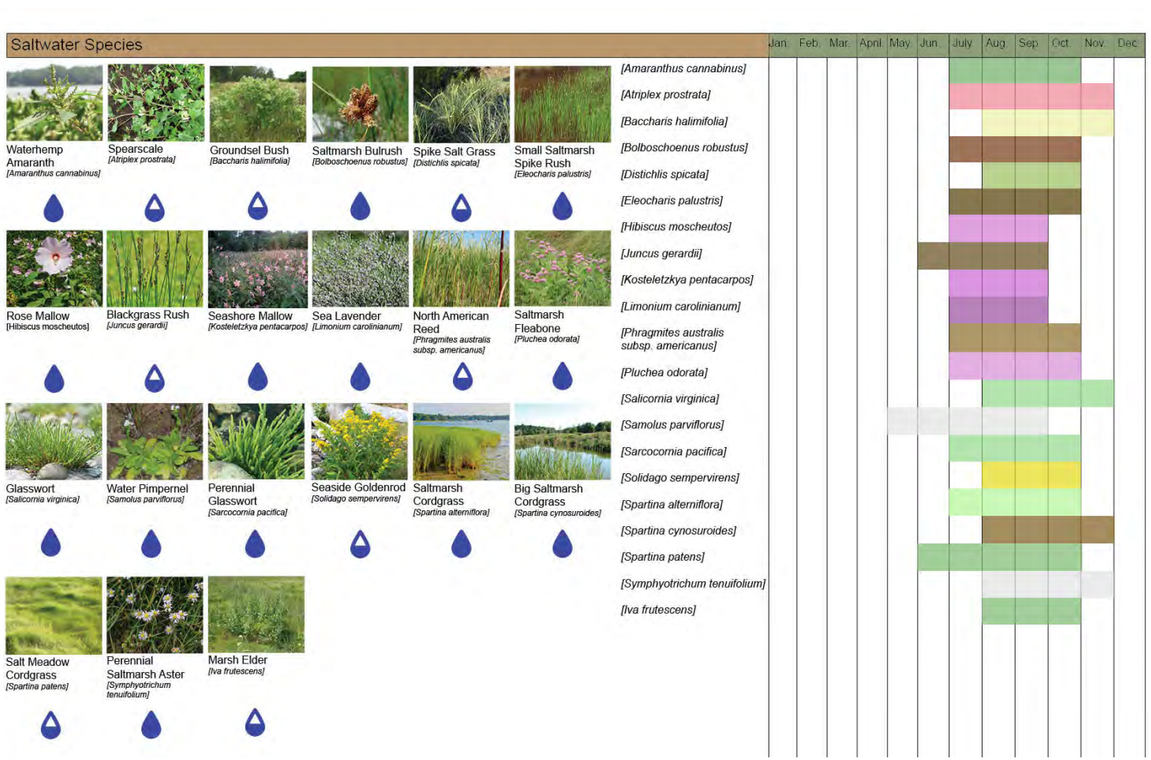
- Remove non-native flora
- Revegetate with native species
- Demarcate Naamans Trail to protect restored vegetation and Naamans Creek

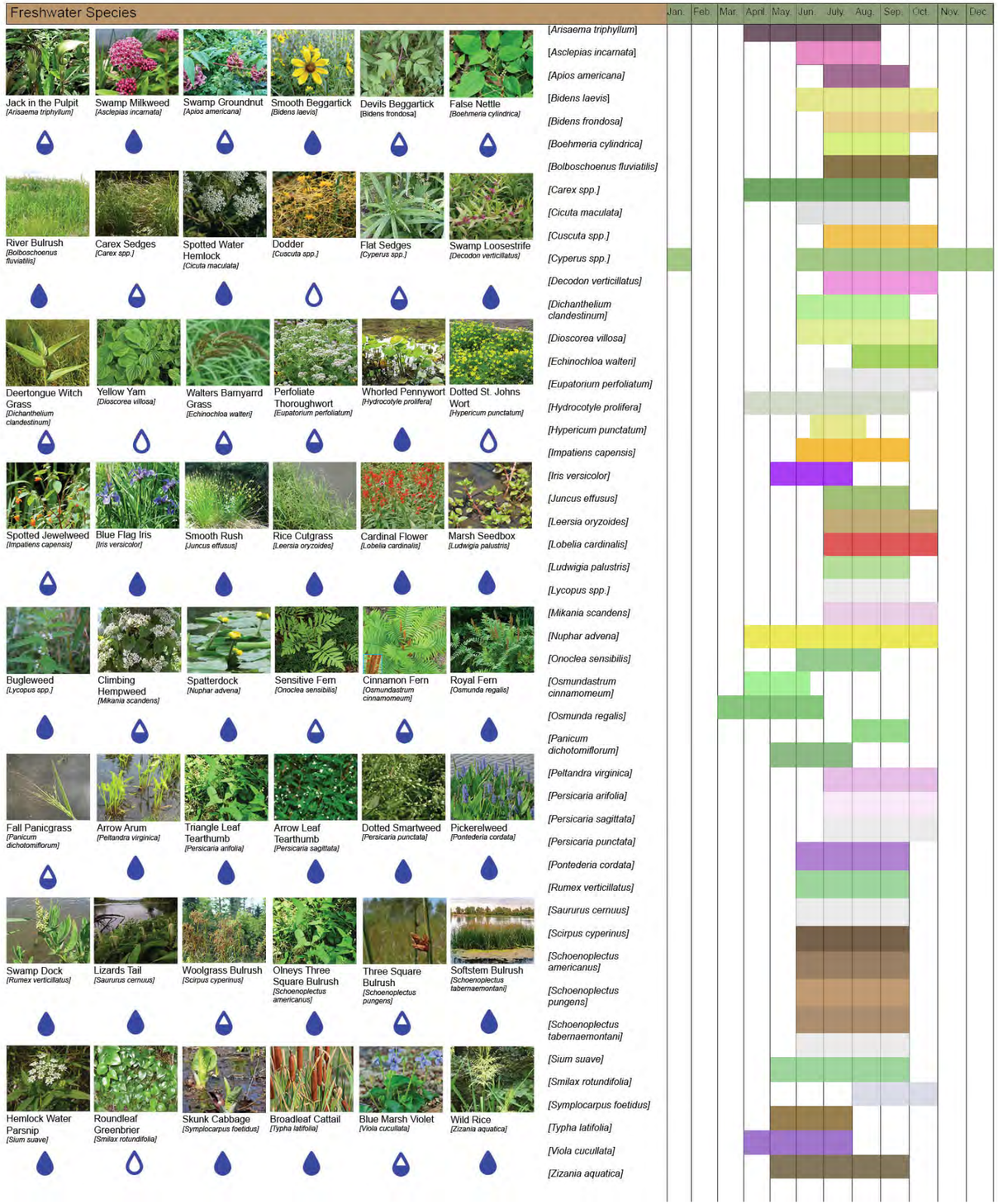
Erosion control

As required by DNREC, two feet of topsoil will be added to the site as part of remediation efforts. We suggest turf planting to stabilize the soil and prevent erosion.

Plant Palette

This plant palette offers guidance on the vegetative composition of the restored wetlands and riparian buffer. The water droplet icon underneath each plant indicates how much water it requires to survive. The calendar shows the color and period of each plant's bloom.





Parking & Connectivity

Access Points

There are five access points to Electric Arc Park.

The **old train station** is the southernmost access point and is a primary trailhead. Access from the station to Arc Furnace Trail is for pedestrians and bikers. 80 parking spaces are available.

The second access point is the new **Claymont Regional Transportation Center**. 800 parking spaces are available, and visitors can arrive by train as well. Access to Riverview at First State Crossing residential is for pedestrians and bikers.

The third access point is a **pedestrian-only tunnel** under the train tracks, leading straight into Riverview at First State Crossing and the Claymont Marina.

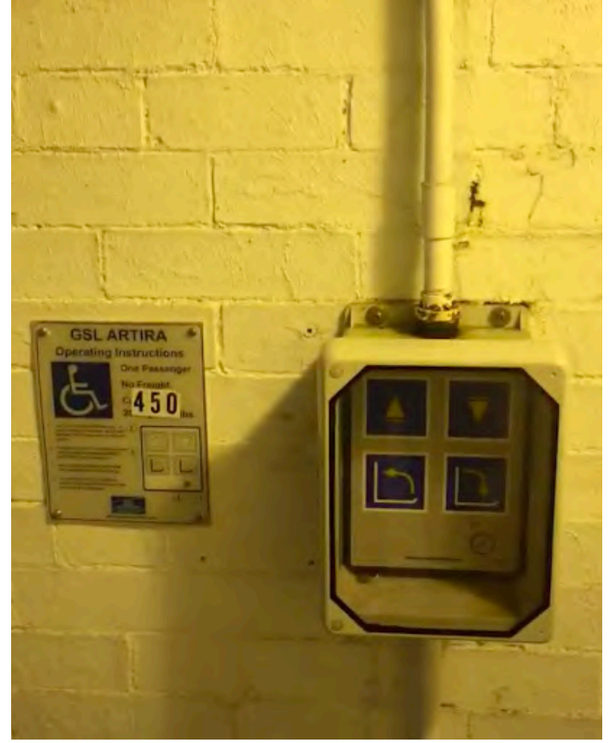
The **fourth access** point is for vehicles only. The road leads into the Claymont Marina.

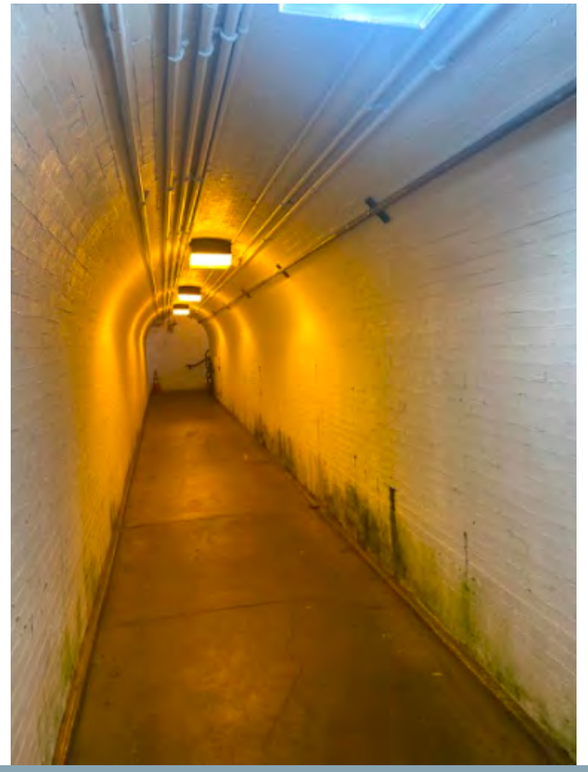
The **fifth and northernmost access point** is accessible by vehicles, pedestrians, and bikers. It leads into Riverview and the Claymont Marina.

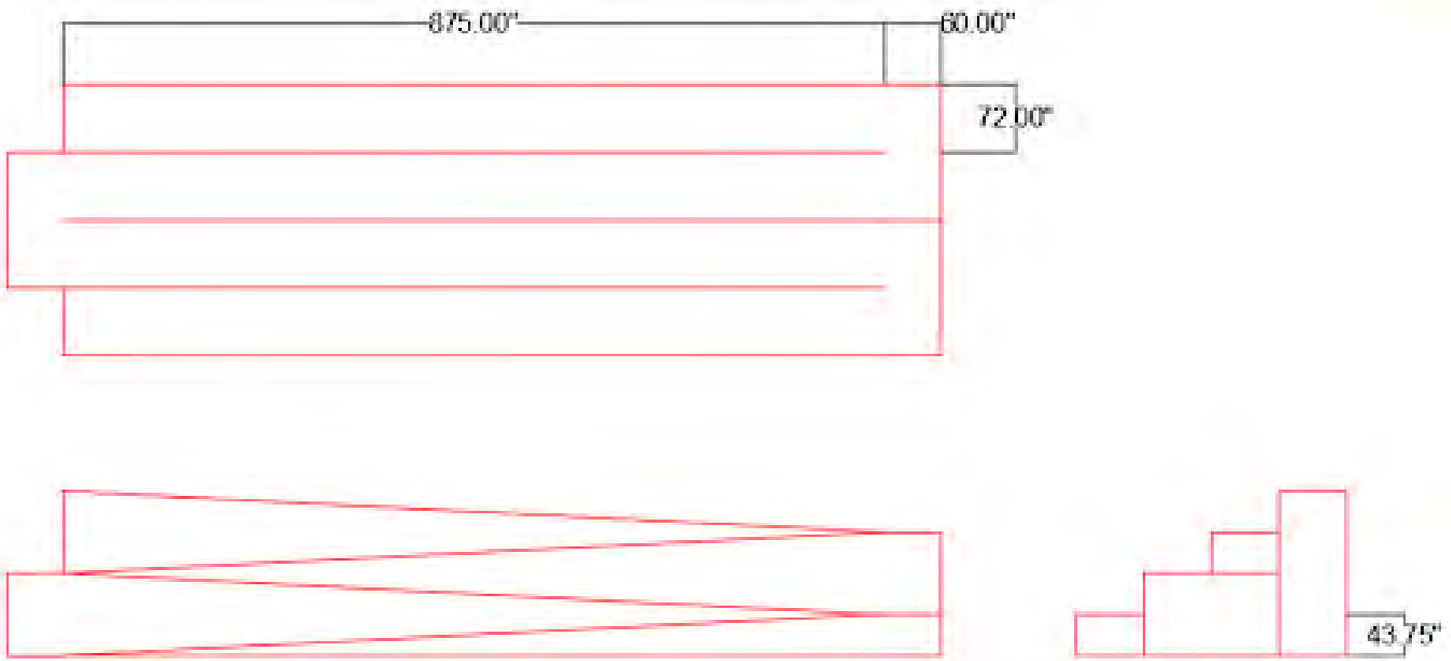
Old Train Station

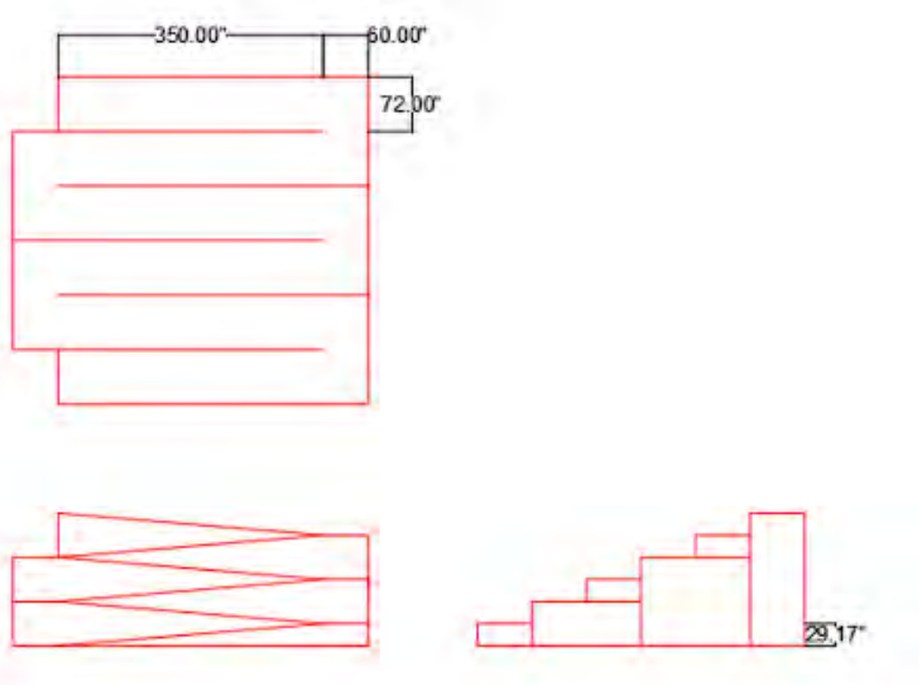
Electric Arc Park's first access point requires remodeling to be easily accessible to all visitors. Visitors currently use stairs or take a wheelchair lift to access a tunnel approximately 14'-5"" underneath the train tracks. Bikers must carry their bikes up and down the stairs.

The tunnel is six feet wide. There is a lighting alert system for when the wheelchair lift is in use, so that pedestrians know not to enter the tunnel. The tunnel cannot easily accommodate more than one wheelchair at a time. A wider tunnel is preferable but would require extensive permitting. Additional lighting and painting the tunnel to make it bright and vibrant is recommended.





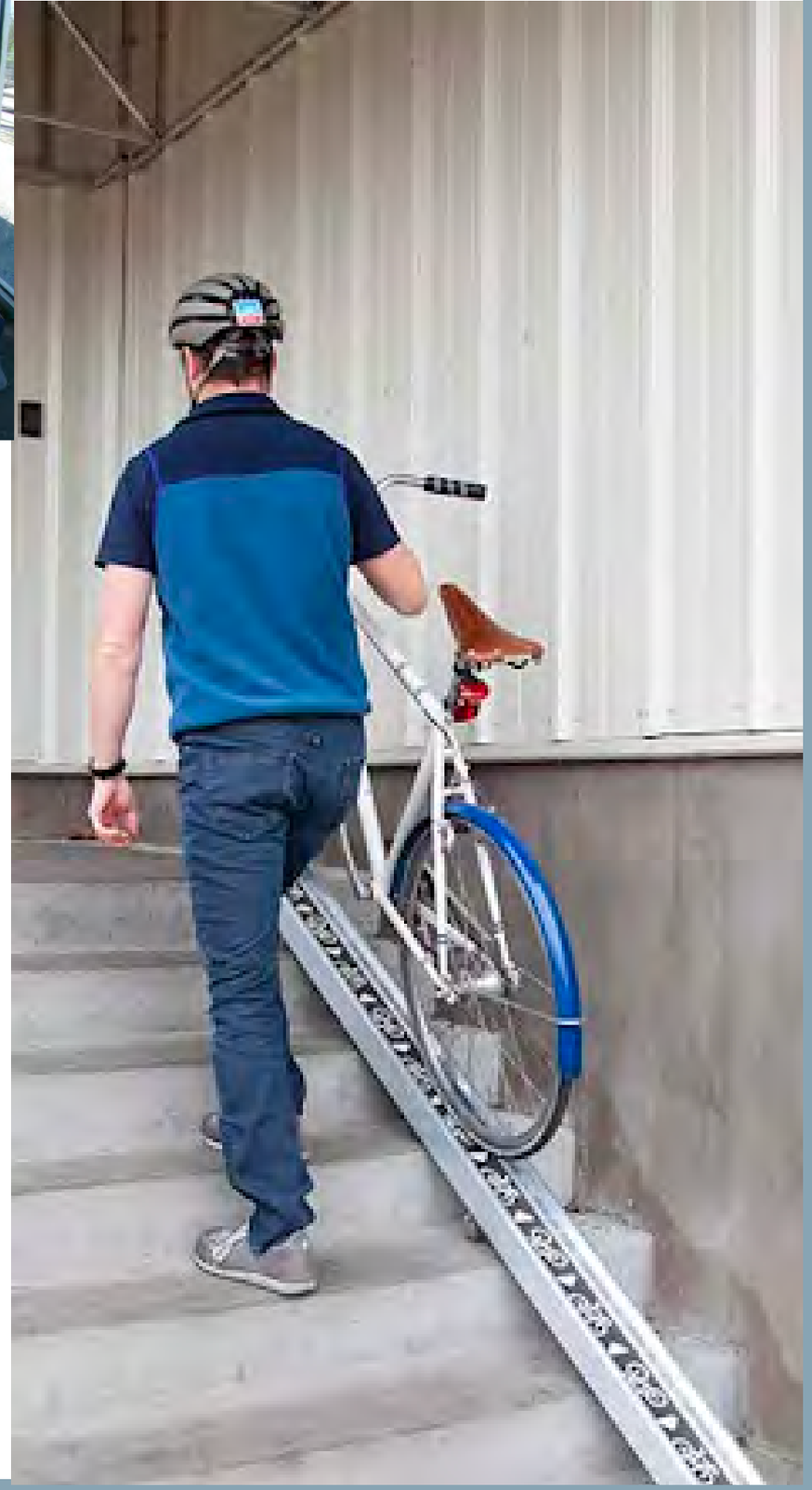




There are three primary alternatives for a more accessible access point. The first alternative is a ramp with a 5% grade. This is the maximum grade allowed for a ramp before American with Disabilities Act (ADA) standards must be applied (4.8 Ramps, ADA). It consists of four switchbacks, each 72'-11" by 6'-0" with three landings, each 5'-0" by 12'-0" These dimensions accommodate two wheelchairs side by side.

ADA standards apply to the second ramp alternative. It has a grade of 8.33%, which is the maximum grade allowed for a ramp. It has six switchbacks, each rising under 30", the maximum rise not requiring handrails. Each run is 29'-2" by 6'-0", and each of the five landings is 5'-0" by 12'-0." These dimensions accommodate two wheelchairs side by side.

Ramps are required on both sides of the train tracks. Stairs alongside the ramps accommodate additional visitors. Bike ramps along the stairs provide quick and easy access for cyclists.



Although these ramps can feasibly be constructed, there are several concerns to keep in mind:

- The large amount of grading so close to the train tracks will make permitting difficult
- The gas and hazardous waste pipelines on the southern side of the tracks will be a barrier to grading
- The material and grading costs will make this an expensive project

The third and least expensive alternative is to install a higher-quality wheelchair lift to provide fast and safe access to the tunnel. Visitors in wheelchairs can also be directed to the new Claymont Regional Transportation Center, which is fully accessible.

Widening the tunnel is not feasible given permitting restrictions imposed by Amtrak. The tunnel can only be used by one visitor in a wheelchair at a time. The current lighting system is, therefore, still required for every alternative.

A final alternative should be selected after further study, including input from visitors in wheelchairs.

The existing building is a trailhead that will include bathrooms, a park information center, and a community bulletin board. Existing parking will be reduced to 80 spaces to accommodate ramps and landscaping. The new Claymont Regional Transportation Center will replace the lost parking.

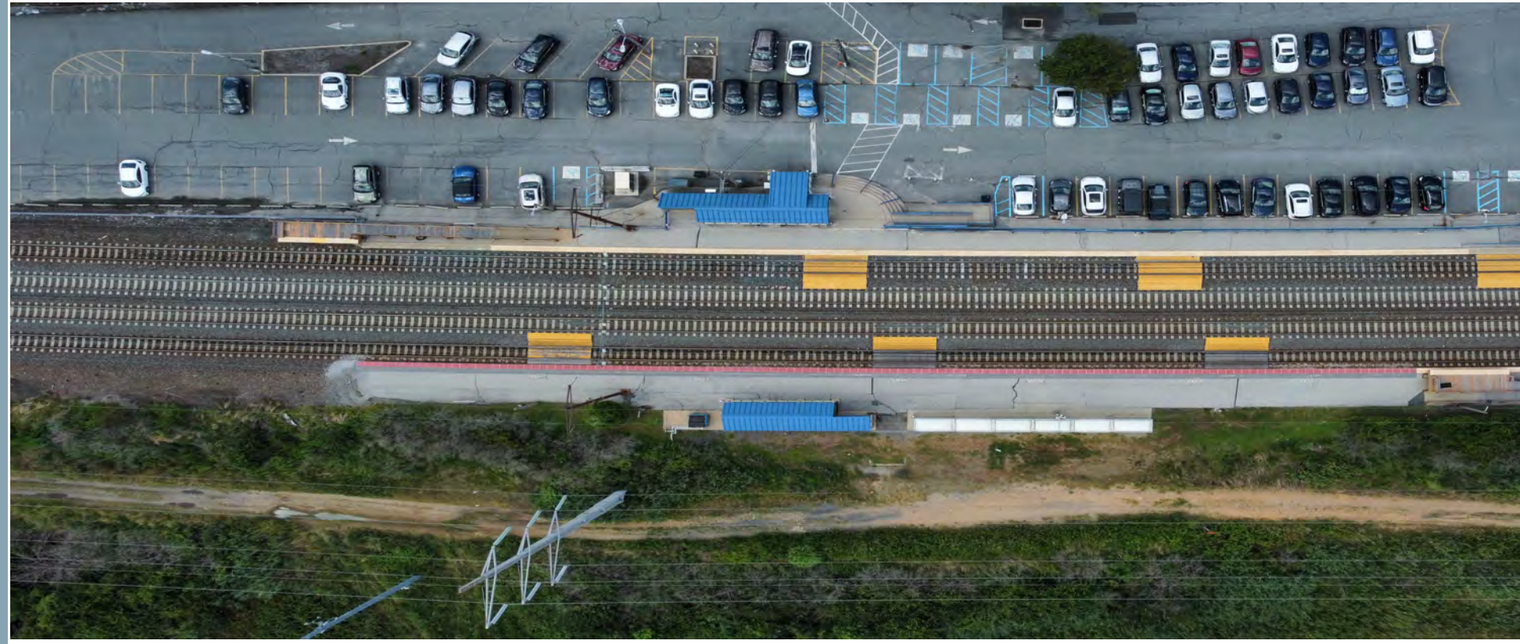
Claymont Riverfront Park

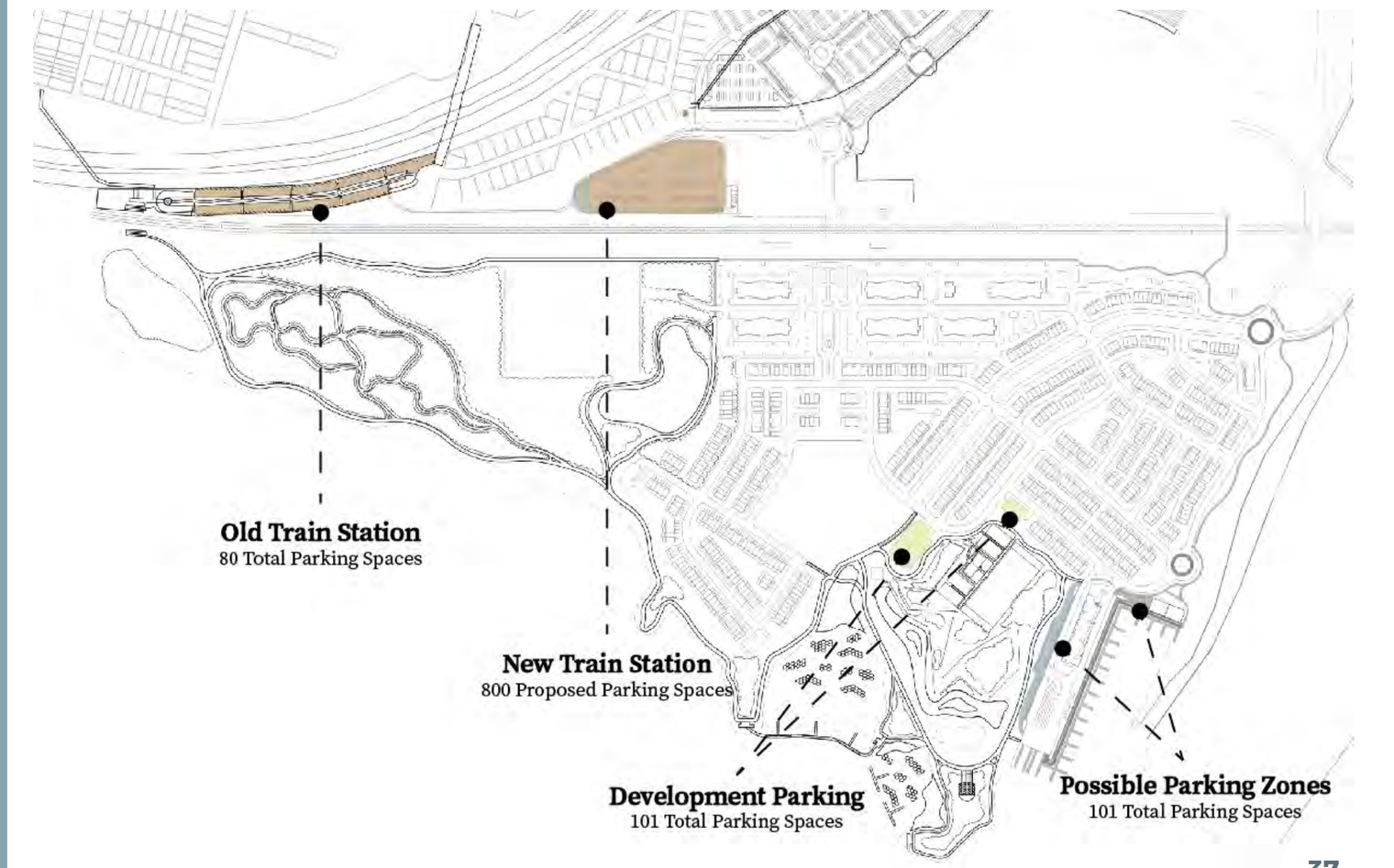
Electric Arc Park (aka Claymont Riverfront park) has 101 public parking spaces included on the proposed development plan. This includes boat parking at the Claymont Marina. Additional parking is a consideration for Electric Arc Park (aka Claymont Riverfront Park).

Proposed Parking

Claymont residents are encouraged to walk into Electric Arc Park and explore the trails and amenities. Therefore, the CRDS aims to balance active park space and parking lots.
The CRDS proposes an additional 101 parking spaces between Worth Fields and Claymont Marina. This lot primarily services Worth Fields, Claymont Marina, Phoenix Amphitheater, and surrounding trails. Existing lots in Riverview primarily service Worth Fields and the Arc Bark.

Visitors exploring the Arc Furnace trail system park at the old and new train stations. The remodeled old train station parking lot has 80 parking spaces. There are 880 parking spaces between the two stations, providing plenty of parking during peak times, like events at Phoenix Amphitheater. However, it is approximately 1 mile to the Phoenix Amphitheater. Providing shuttles from the train stations to the amphitheater during events is an ideal way to ensure access without inundating Electric Arc Park with parking.





East Coast Greenway

A key stakeholder in Electric Arc Park (aka Claymont Riverfront Park) is the East Coast Greenway Alliance (ECGA). The primary objective of the ECGA is to:

- Connect 3,000 miles of trails from Maine to Florida across 15 states and 450 cities. (ECGA, n.d)
- Provide infrastructure investments to promote job growth
- Create safe transportation that connects cities and towns
- Use interpretive signage to connect trails across the ECG and create a seamless travel experience

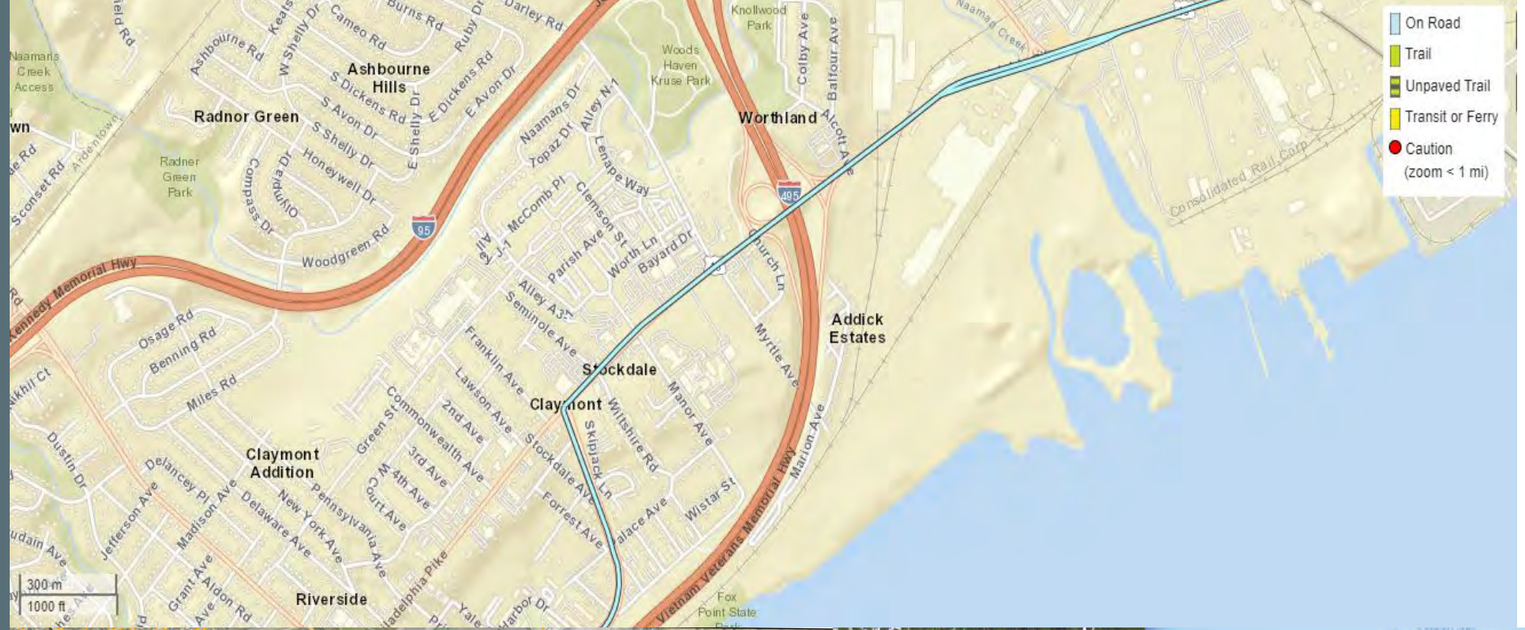
Existing Conditions

The East Coast Greenway runs directly through Route 13, following Philadelphia Pike until Governor Printz Boulevard, paralleling I-495.

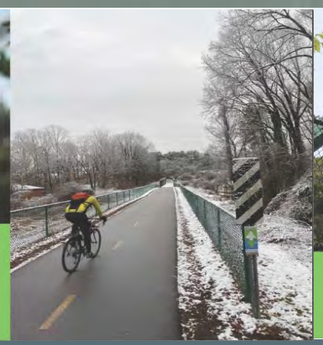
Proposed Design

Arc Furnace Trail branches from the ECG in two routes. The main trail exits the ECG towards the north of the development leading to the pedestrian underpass and Electric Arc Park. An alternative branch exits the ECG farther south and runs directly through the new Claymont Regional Transportation Center. Both branches will reconnect at the old train station. A pedestrian overpass over I-495 connects the old train station to the ECG.

The CRDS suggests that the trails adhere to the ECGA Design Guide (n.d). These guidelines present safe and accessible trail design and provide a framework for installing wayfinding signs. Following these guidelines will connect Arc Furnace trail to surrounding trails and communities.



Left: East Hartford, CT
Right: Blackstone River Greenway in Rhode Island



Above: Delaware River Trail in Philadelphia, PA
Right: American Tobaco Trail in Durham, NC

Left: Quinebaug River Trail in Killingly, CT
Right: Eastern Trail in Kennebunk, ME

Claymont Marina & Commercial Development

https://www.bryancountynews.com/news/business/waterways-township-begins-construction-of-new-marina/

CLAYMONT
MARINA
ELECTRIC ARC PARK

Proposed Marina

The Claymont Marina will become a hotbed of activity. A boat launch and docks offer Claymont residents and others access to the water. Visiting boaters can moor their boats to enjoy the park's amenities. A 7700 square foot marina building can house a restaurant or community rec center and the boardwalk provides recreational fishing opportunities.

Restaurant and Concessions

Claymont marina is an ideal place for a concession stand or riverside restaurant. It is a central rendezvous point for Riverview residents, boaters, soccer players at Worth Fields, concert-goers to Phoenix Amphitheater, and hikers finishing up the Arc Furnace Trail. Selling ice cream to little-leaguers or dinner to park visitors adds economic activity to Electric Arc Park.

The Design Process

The **Design** Process

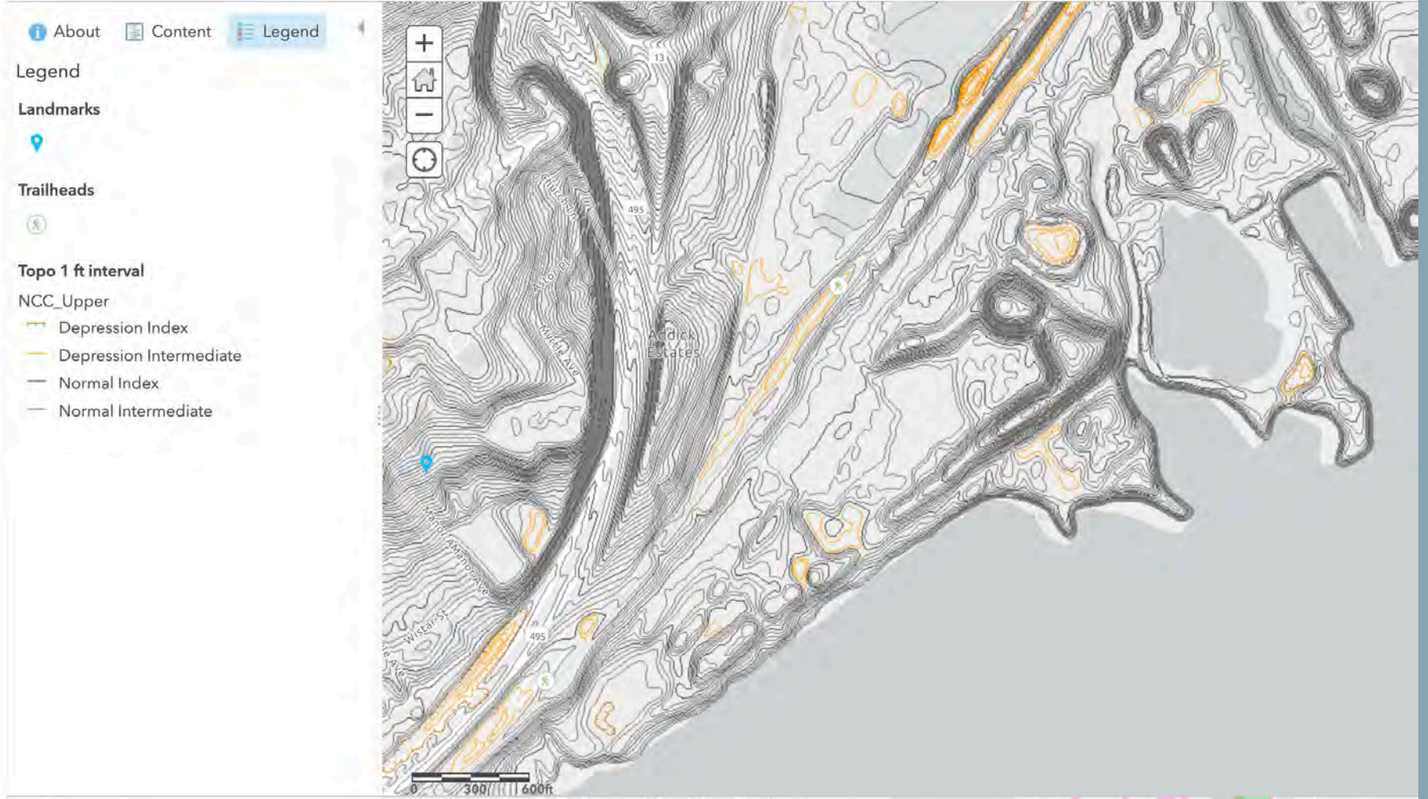
The Coastal Resilience Design Studio endeavors to understand the needs of each community and what makes each place unique before any design solutions are offered.

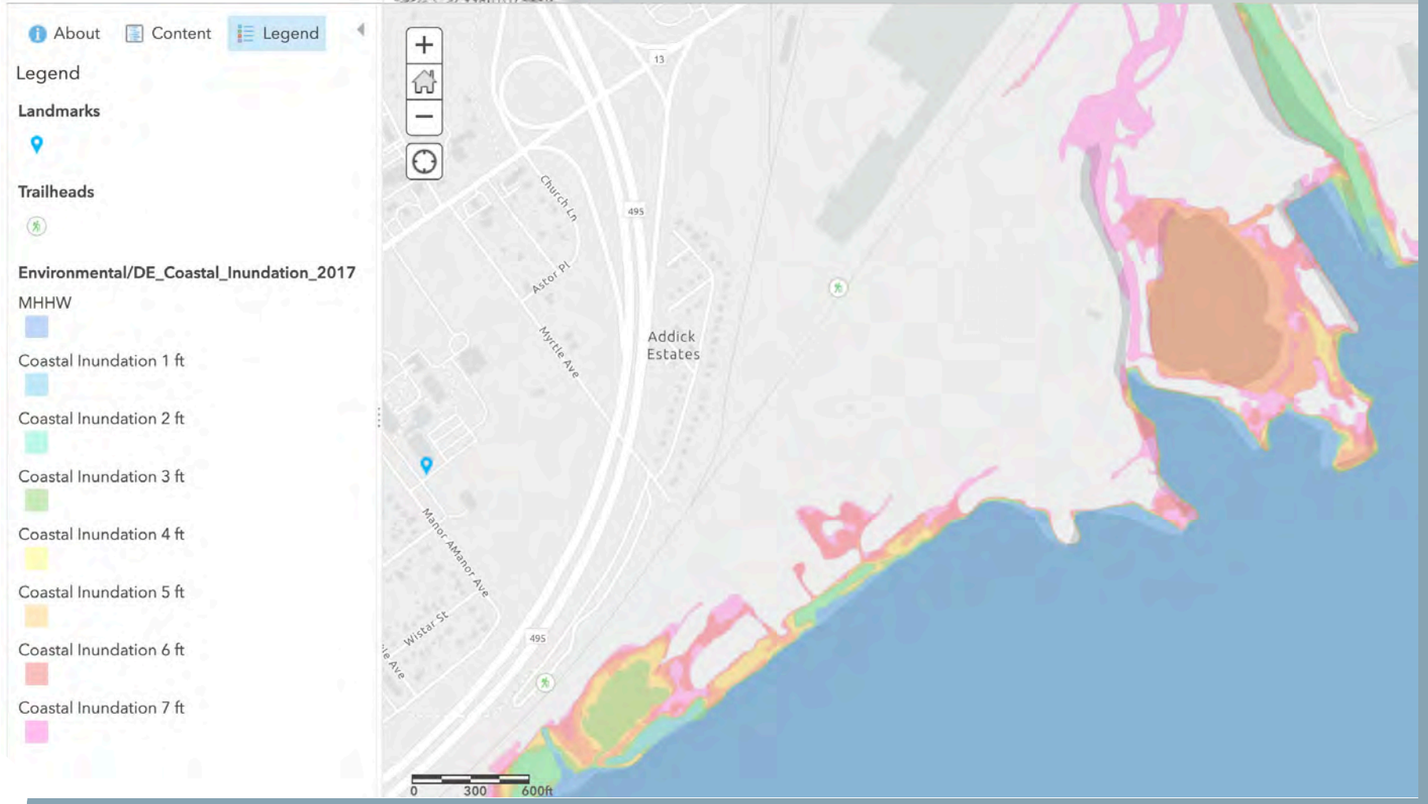
The Studio's iterative process uses interdisciplinary site research, multiple site visits, community input, stakeholder and agency feedback, and multi-stage technical and professional reviews.

After the analysis phase is complete, the Studio develops multiple solution, converging toward a set of design recommendations to present back to the community for additional feedback.

This document details the collective research and analysis that was used to derive all proposed design solutions.

Community Discovery Process





Topographic Map

Placement of trails and park amenities were based on the topography of the site.

Sea Level Rise

Sea level is rising globally. As the earth gets warmer, ocean water expands, and glaciers melt, causing global sea level increases. The low mean elevation and localized land subsidence in Delaware amplify sea-level rise (SLR) impacts. The result is a rate of SLR that is twice the global average. Between 8% and 11% of land in Delaware may be covered with water during high tide by 2100 (Preparing for Tomorrow's High Tide: Recommendations for Adapting to Sea Level Rise in Delaware, 2013).

0.5 m, 1 m, and 1.5 m are the low, moderate, and high SLR estimates respectively projected for Delaware in the next 100 years. A small part of Riverview's shoreline south of the substation will be inundated in these projections. The location of Worth Fields will be inundated in the 1.5 m estimate. However, DNREC requires a 2 foot topsoil cap for remediation efforts. This cap should address most SLR concerns, particularly at Worth Fields. Only forested areas are uncapped, and should not impact human activity or park amenities. The only exception is that the coastal walk will be inundated. The hiking trails will be unaffected and ensure access across the park regardless of the coastal walk's status.

Soils

VoB - Urban land-Othello complex, 0 to 5 percent slopes
Landform: Flats, depressions, swales
Runoff Class: Negligible
Drainage Class: Poorly drained
Slope: 0 to 2 percent
Frequency of flooding: None
Frequency of ponding: Rare
Available water storage: Moderate (about 8.8 inches)
Depth to Seasonal High Water Table: About 10 to 20 inches
Hydrologic Soil Group: C/D
(Web Soil Survey, 2021)

The entirety of the site is composed of Volusia silt loam (VoB), which is in the hydrologic soil group of C/D (drained v. undrained, USDA, 2017). Groups C & D are known as the 2 groups out of 4 with the highest runoff potential and low infiltration, as their compositions consist of large amounts of clay. Due to low infiltration, these soils are poorly drained. VoB has a water table depth of 10in-20in, as well as a rare occurrence of ponding and the ability to hold 8.8 inches of water.

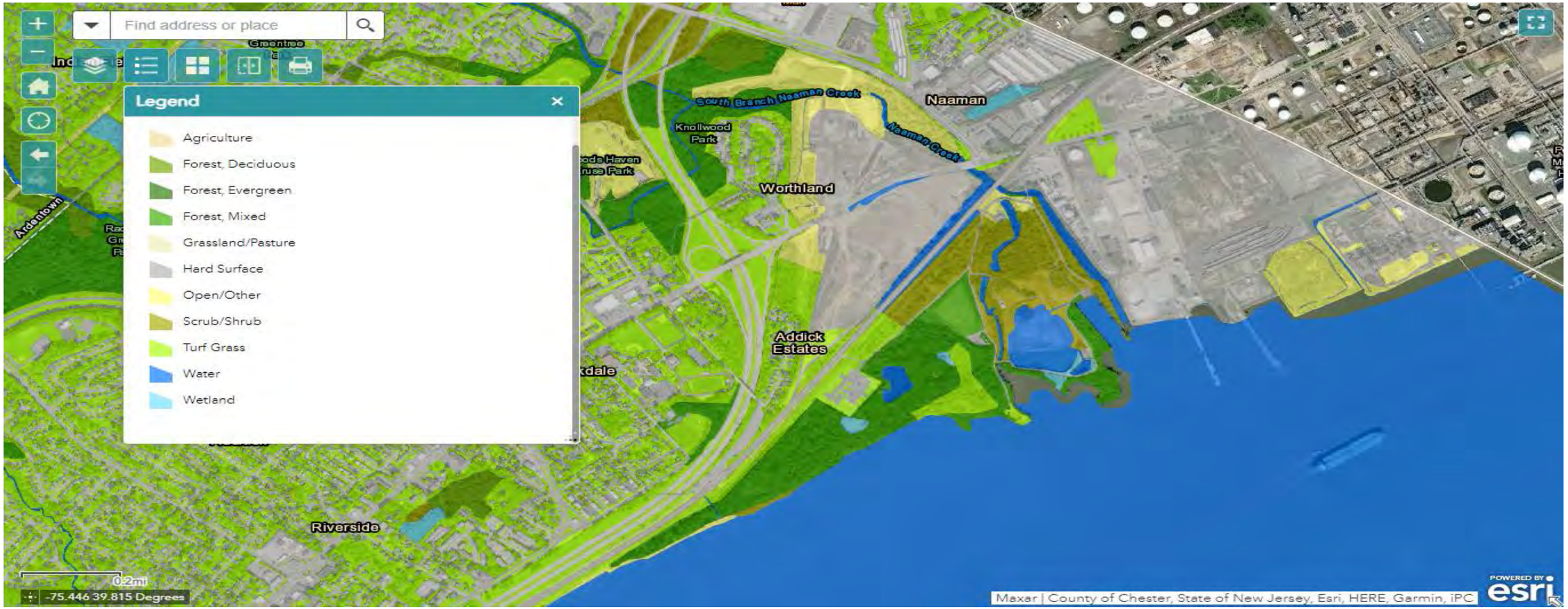
Soil that currently exists on site provides insight as to how we can design our proposed features to manage stormwater, restore wetlands, and to provide an aesthetically pleasing location to the park. Given that the soil has high runoff, it will need to be cleaned which helps further define the rationale of revitalizing the wetlands lost on site.

Hazard Overlays

The majority of the site is in an area with minimal flooding hazards (X), also known as the 500-year flooding event which has a 0.002% chance of occurring annually. The Delaware River is labeled as a VE zone, and a large portion of areas which include some of the coast, the sedimentation pond and the land adjacent to Naaman's Creek is labeled as AE. Both VE and FE zones have a 1% annual chance of flooding and 26% over a 30-year mortgage. They are also known as a 100-year flooding event. VE zones differ from AE zones in that VE zones make up part of the coastal area.

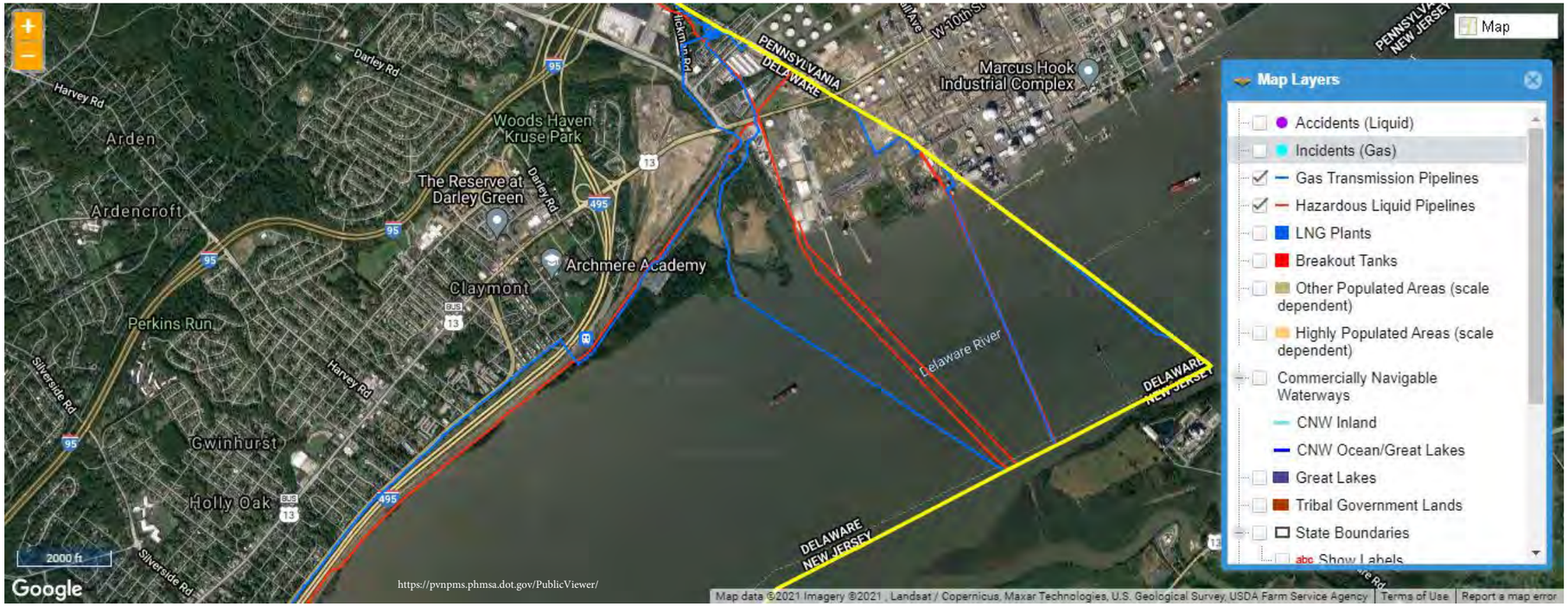
Vegetation and Invasive Species

Native plants are natural occurring plants found in a specific region. These uncultivated plants adapt to the surrounding environmental conditions, and therefore, favorably contribute to the region's ecosystem. Through time, as the plant adapts to an ecosystem and environment, the surrounding wildlife does the same. Insects adapt to specific natives for energy consumption and habitat. For example, native monarch butterflies (Danaus plexippus) are specialists when it comes to plant species. They rely on the nectar from the Common Milkweed plant (Asclepias syriaca) for nourishment. An invasive plant on the other hand is a plant that is non-native or alien to the specific region. An invasive plant thrives in the region as it takes over and disrupts the ecosystem. With rapid growth and reproductive rates, invasive plants inhibit surrounding plants' growth. Unlike native plants, invasive plants do not provide the energy and habitat requirements for wildlife that have been adapting to the same region over time. An example is the Common Reed Grass (Phragmites australis). The plant is non-native, spreads fast, limits growth of other plants, and contributes little to the wildlife in the area. Not all non-natives are invasive. As the name states, a non-native plant is an alien to a specific region. Invasives can thrive in the environment it was introduced in, while some introduced plants do not thrive well naturally in the introduced region. Many non-native plants cannot survive without the help of humans, and are often annuals in nature because they were found in different growing conditions. The Petunia is an example because the plant cannot survive itself during the winters on the East Coast. A weed on the other hand can be a native or non-native plant. A plant is considered a weed if it is not desired in the area focused on, and competes with other desired plants in a landscape. An example can be the native Oxalis. Oxalis will often show up in a landscape and compete with the other plants. Though the Oxalis is native, it is typically unwanted.



Pipelines

There are gas and hazardous liquid pipelines running along the northern edge of the site, from the old train station until Philadelphia Pike. These preclude design interventions requiring grading or digging on the northern edge of the site.



Design Considerations

Osprey Nesting

Currently there is an active osprey nest onsite. Ospreys are habitual and return year after year to the same osprey nest (U.S. Fish and Wildlife Service, n.d.). The Migratory Bird Treaty Act (MBTA) protects these beautiful birds as well as their nests, but each state wildlife agency has different requirements. The Chesapeake Bay Field Office of the U.S. Fish and Wildlife Service is in charge of projects involving migratory birds in Maryland, Delaware, and Washington D.C. (U.S. Fish and Wildlife Service, 2020). In this region, nests are usually inactive from September to February, meaning they do not have any eggs in them or are not regularly visited by ospreys (U.S. Fish and Wildlife Service, 2020). As long as the nest is inactive, no permits are required to move a nest; however, a nest should only be removed if it is threatening human health or safety, if there is a risk to the osprey, or if the function of the property is being compromised (U.S. Fish and Wildlife Service, 2020). Ospreys may abandon a nest if there is too much human disturbance in the area. Disturbances can also cause the young to become scared and jump from the nests (DNREC, n.d.). It is particularly important that there are no disturbances to osprey nests during April, May, and June when the ospreys are the most sensitive and defensive of their nests (DNREC, n.d.). When moving a nest, the structure should be secure before March 1 as osprey start returning to Delaware in mid-March (DNREC, n.d.).

Case Studies

East Shore Park, New Haven - Living Shoreline

East Shore Park was created from 70ac of tidal wetlands that were filled between 1931-1951. The park itself was not developed until the late 1970's. Despite the development, the shoreline had not changed much over time until storms and flooding, beginning in the 2000s, eroded upland areas affecting a trail that existed close to the shore. East Shore Park has relatively poor drainage resulting in further erosion and colonization by invasive species thus impacting biodiversity.

The site was built entirely on fill, and the use of standard erosion control methods for this site was not feasible. The erosion caused the beaches to thin and created steep slopes. A living shoreline was designed to address all the coastline issues. The Living Sea level rise can be manipulated so that sediment is carried to the shore in set amounts which will allow for strengthening of coastal habitats.

The implemented remedy included removal of invasive species, restoration of dunes and slopes, removal of riprap revetments, and sills that are meant to protect tidal marshes. The proposal involves plants to fill the tidal marshes which will seek to mitigate erosion from barren soil and the proposed rock sills will seek to break up wave energy to lessen the impact on the coastal areas where the erosion has occurred. Although the feasibility was questioned due to the new premise of living shorelines in CT, Precedent projects that were successful were used as an example of how East Shore Park could implement the program and find results. Currently, the city is working on phasing and authorization before work can begin.

Lessons Learned: While erosion can occur due to wave energy and storm surges, living shorelines offer potential solutions to stabilize areas while providing room for natural growth in aquatic or semi aquatic conditions. Solutions can include multiple features, such as rock sills to break up wave energy and native plants to maintain existing conditions in the area. Although success is dependent on a range of factors including site specific design and post-installation monitoring,, previous projects provide a positive reminder that these solutions can only be achieved if the effort is put in place to implement them.

https://www.ctpublic.org/news/2021-07-28/living-shorelines-becoming-more-common-in-ct-for-erosion-control

https://www.ctpublic.org/news/2021-07-28/living-shorelines-becoming-more-common-in-ct-for-erosion-control

https://www.nae.usace.army.mil/Missions/Civil-Works/Navigation/Massachusetts/Plymouth-Harbor/

https://www.south-shore-hiking-trails.com/hiking-trails-plymouth-harbor-breakwater.html

Plymouth Harbor Breakwater

The 3,500 foot long stone breakwater located in Plymouth, Massachusetts serves as a recreational hotspot with access to the Plymouth bay. The breakwater contains an easterly path that is 1,400ft long and then diverges 2,100ft in the southeast direction. While a portion of the coast is protected by Plymouth Beach. The breakwater which is known as “The Jetty” protects the surrounding coastal area from wave action not mitigated by the existing beach. Plymouth Harbor is subject to an average tidal range of 9.76ft.

The structure was made by the United States Army Corps of Engineers and consists of walkable giant rocks that allow for the Plymouth Harbor to mitigate high-action waves that provide recreational benefits such as boating, docking, walking, and fishing.

Lesson Learned: Breakwater structures are important to bodies of water where the goal is to minimize wave action and protect shorelines while also providing feasible recreational benefits. These structures must be designed to handle average wave heights so their purpose can be fulfilled consistently.

Three Mile River

Three Mile River was developed in response to regulations enforced by the Department of Energy and Environmental Protection in Connecticut. Due to the residential development and engineering of the location, coastal hurricanes ravaged the area. After the hurricanes hit in 1954, shoreline flood and erosion control structures were created which include hardening or shorelines and removal of vegetation. DEEP has insisted on re-implementing living shorelines as a solution.

Solutions in their design included gentle slopes, riprap, and a tidal wetland buffer. The nature-based solution provided a better aesthetic as well as flood protection which is more effective than hard structures. Natural vegetation provides erosion protection, and using native vegetation allows for wildlife to exist in these areas.

Lessons Learned: Instead of providing a coastal solution in a hard structure which will eventually deteriorate and fail, natural vegetation combined with low slopes offer a better solution to prevent erosion. Introducing native species to an area will also bring potential to allow for an overall increase in biodiversity which can enhance the richness and aesthetic of a focus area.

https://ctdeep.maps.arcgis.com/apps/MapJournal/index.html?appid=4f6604af81934bcb9126cb31597d0f5f

https://www.wrightsvillebeachmarina.com/location

Wrightsville Marina - Marina Design Inspiration

The Wrightsville Marina is located in Wrightsville Beach. North Carolina and lies near a no-wake zone. The Marina is located just 3 miles north of the Masonboro inlet where there is direct access to the Atlantic Ocean. The location also touts that there is something for everyone in terms of amenities. Beach relaxation, surfing, walking along a fitness trail, fishing, exploring, and dining are some of the many features the site offers, and it is referred to as “a boater’s dream”, Wrightsville Marina has the defining feature of ease of access to various amenities and recreational features.

Lessons Learned: Providing amenities in close access to a boat launch or dock allows for connectivity that can welcome a variety of people who are visiting the site on boats. A close proximity of attractive features that can lure people into the area will be economically beneficial while also promoting connectivity through the existing community. Boat launches can be used as access points and provide as many benefits as using parking spaces can, while conserving space and retaining natural conditions. The design of the docks that include branches from the main boardwalk was something that inspired the marina in Electric Arc Park, using similar dimensions as Wrightsville’s marina.

Opportunities & Constraints

Opportunities

- Rich site history
- Use of old industrial relics to showcase prior land use
- Redevelop wetlands to provide shoreline protection and habitat
- Old port has business development possibilities including marina, concessions, kayak launch, and restaurant
- Existing woodlands lends itself to beautiful trails through natural terrain
- Connection along existing Greenway trail system
- Open space use for recreational facilities such as leagues on recreational facilities (i.e basketball, disc golf, soccer, football, etc).
- Adaptive reuse of old train station and its parking lot as trailhead access
- Possible use of dredge material
- Possible recreational activities to be tied into marina/ launch area
- Wooded areas along eastern side provide refuge from noisey traffic areas

Constraints

- Brownfield development requires additional care to redevelop in a safe and healthy manner. Building in areas where slag is present is limited
- Industrial slag requires additional study for how it impacts proposed wetlands.
- Noise from nearby traffic
- Old train station access point is not currently ADA accessible - people needing this accommodation would have to go to the far end for entry
- Natural gas and power lines running alongside the train especially by the old train station make ramp solutions near old train station difficult
- Wave energy impacts coastal solutions and require breakwaters or other structural feature to lessen wave energy
- Pedestrian tunnel modifications require long-term communication between developer and Amtrak to arbitrate feasibility
- Various solutions are more cost-intensive than others

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