



moffatt & nichol  
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**S/G/A/**



7 JUNE 2021

# St. Paul's Blue-Greenway Synthesis Document

WAGGONNER & BALL  
ARCHITECTURE/ENVIRONMENT

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WBAE.COM



**Paradise Creek Nature Park**  
Portsmouth, VA. *Elizabeth River Project*

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# Project Overview

The St. Paul's Blue/Greenway is the transformation of approximately 26 acres of public housing and other properties into an aesthetic open space designed to treat and store stormwater runoff, as well as support recreational activities. The project is being developed concurrently and in coordination with the broader upland transformation of the St. Paul's district.

In January 2018, the City undertook preparation of a revitalization plan for the St. Paul's area as part of the U.S. Department of Housing and Urban Development's Choice Neighborhoods Initiative (CNI) and developed a visionary master plan to improve: flood resiliency, safety, housing, availability and diversity. The Blue/Greenway serves in the aspect of flood resiliency in that it aims to significantly reduce the effects of flooding for the residents of this area while providing a green space for recreation. With these issues addressed, the space has the opportunity to become an essential part of a large transformational improvement of this neighborhood adjacent to Norfolk's downtown business district.

## Project Benefits

Constructing the Blue/Greenway to conform to the functional requirements is anticipated to provide the following resilience benefits and opportunities:

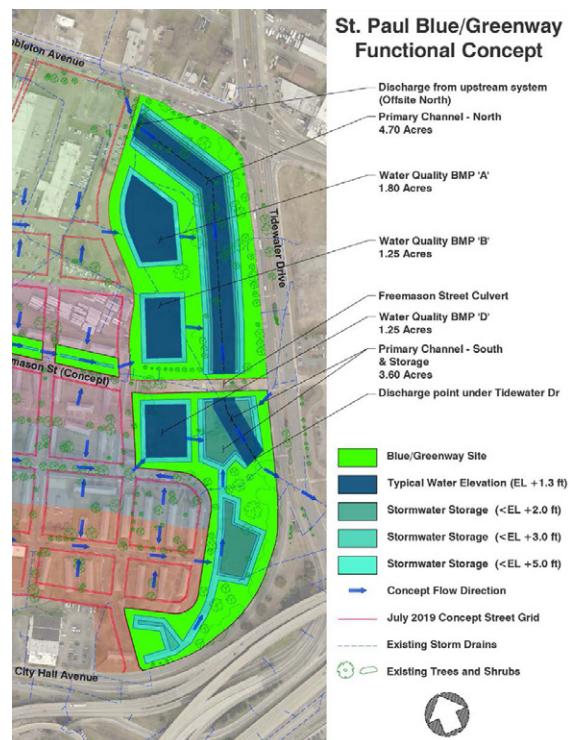
- Removes existing residential dwellings and commercial activities from the flood plain
- Provides over 10.6 million cubic feet of upland runoff storage
- Reduces the extent of flooding in areas upstream of the transformation area
- Removes pollutants from stormwater runoff prior to discharge into the Elizabeth River:
- Provides for the required treatment of the upland neighborhood areas (33.06 lbs/yr TP removal)
- Provides excess removal capacity for possible offsite treatment credit toward other development projects
- Provides additional treatment opportunities within the main storage areas for removal depending on channel configuration.
- Significant preservation of existing mature trees

The analyses also show that future tide conditions due to sea level rise will limit the effectiveness of the site to mitigate flooding unless elements are added to mitigate the effects. Initially, the site will benefit from a tide gate at its downstream end to limit back flow into the system. It is anticipated that a pump station serving the St. Paul's watershed and adjacent watersheds will be part of an upcoming, downstream U.S. Army Corps of Engineers project.



**Vision for Newton's Creek**

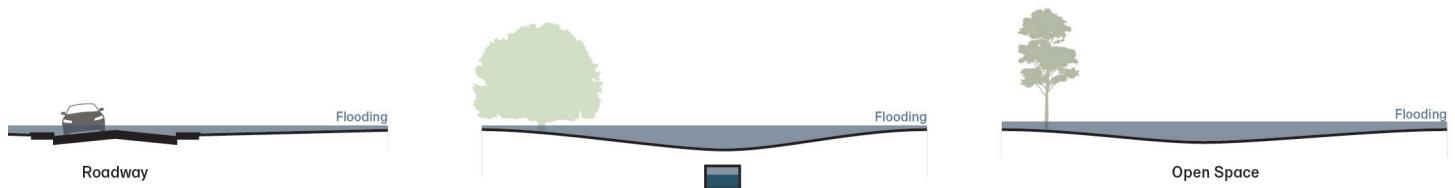
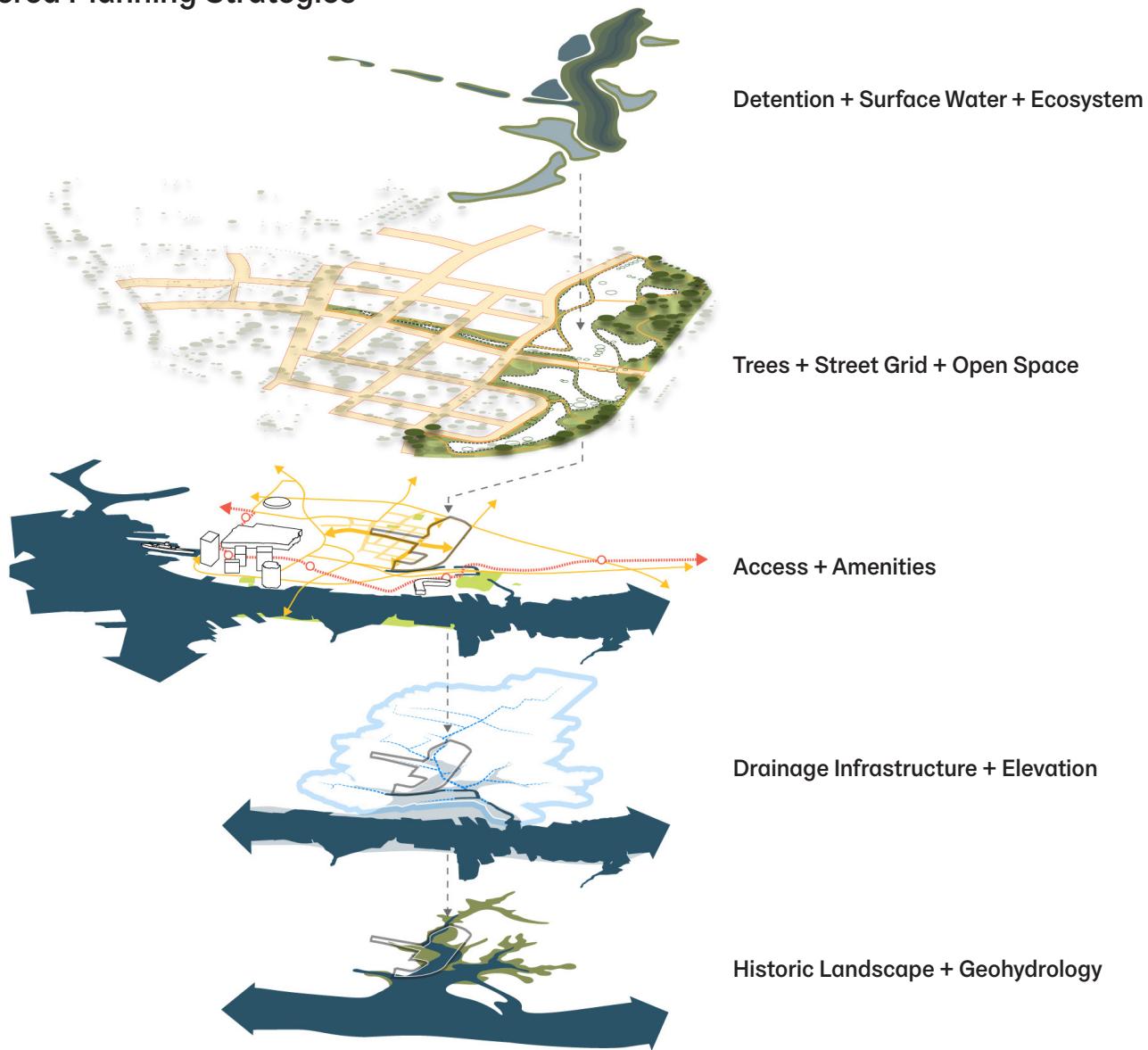
Sketch from the CNI Design Charette, June 2019. WBAE & SGA



**Diagram of Storage Volumes**

St. Paul's Blue/Greenway Functional Concept Design, M&N

## Layered Planning Strategies



## Existing Challenges



## Proposed Strategies

# History and Topography

The St. Paul's Blue/Greenway project is located just east of downtown Norfolk in the Tidewater Gardens neighborhood. The broader area is a mix of institutional, commercial, and multi-family dwellings, much of which was developed in mid-1900s, that forms a low-to medium density urban environment. Several major connector roads surround the area, and the neighborhood has good access to public transportation such as the Hampton Roads Transit (HRT) bus stops and The TIDE light rail. The existing road network disconnected Tidewater Gardens from the larger city street grid with only a single east-west connection (Charlotte Street) between City Hall Avenue and Tidewater Drive.

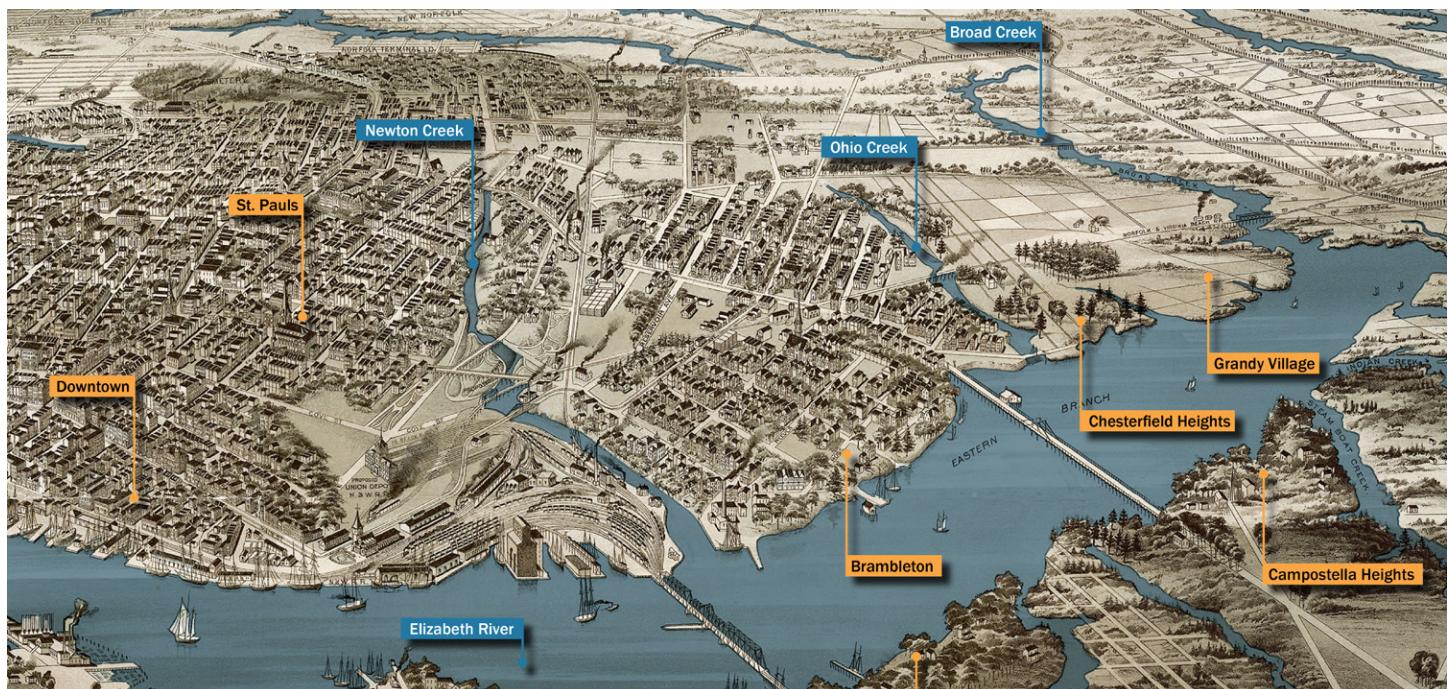
Hydrologically, the site represents the downstream half of an urban drainage basin that extends a little over a quarter of a mile further north to Virginia Beach Boulevard. The principle drainage path flows through the Blue/Greenway site, and then empties into an open air channel under I-264 flowing into the Elizabeth River.

The site of St. Paul's Blue/Greenway was historically a waterway connected to the Eastern Branch of the Elizabeth River formed through tidal action and a natural creek later named Newton's Creek. As Norfolk continued to grow and urbanize, the area was progressively filled in; surface drainage was routed into an underground storm drain. The former creek became the current day floodplain.

Mapping the historic high ground and boundaries of the creek and marshes can help inform the design of the new buildings, roads and Blue/Greenway. The filled waterway and wetlands is prone to flooding, and it has unstable, subsiding, organic soils coupled with groundwater challenges.

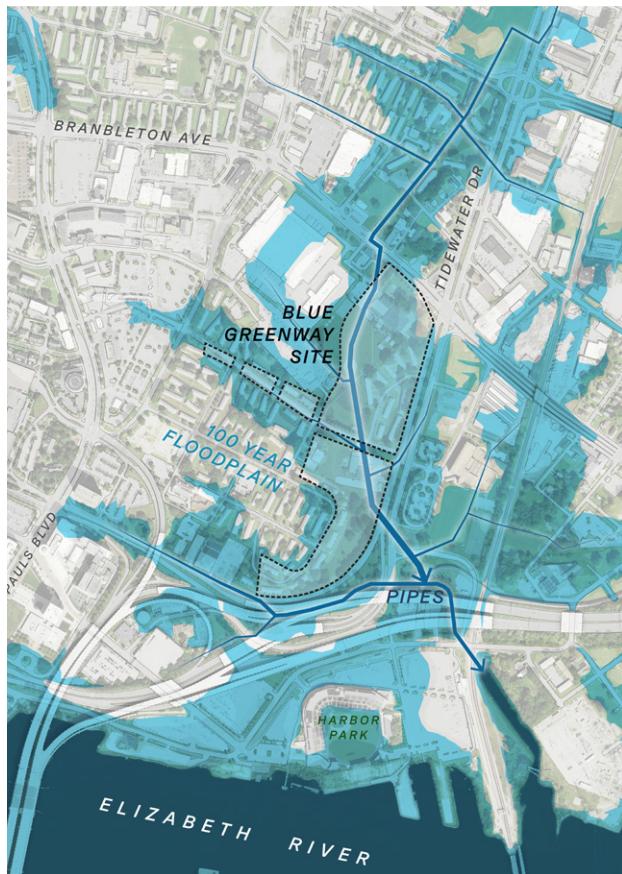


**Circa 1880's Map of Newton's Creek**  
Newton's Creek progressively filled as city expanded

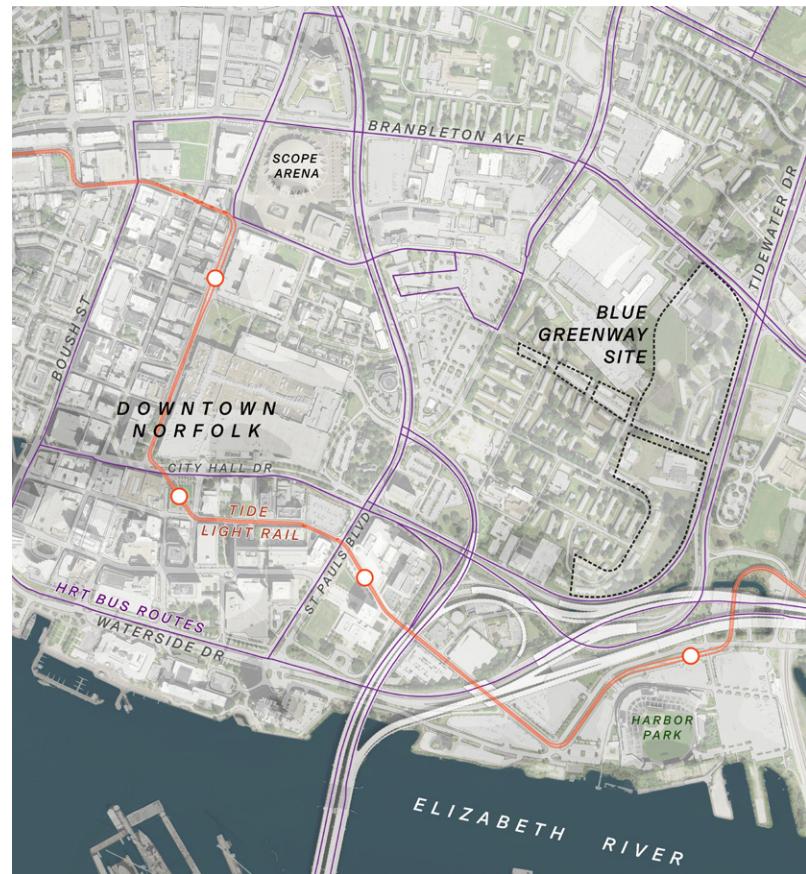


**Historic Creeks East of Downtown Norfolk**

*Credit: NRHA*



100 Year Flood Plain + Existing Drainage System  
Flood risk aligns with historic creek



HRT Bus Lines and TIDE Light Rail  
Site In relation to Downtown and transit Infrastructure



Tidal Flooding Near Charlotte and Walke, October 1953  
Credit: NRHA



Recent Flooding in Newton's Creek Historic Footprint

# Concept Design Refinement

The design of the Blue/Greenway has been informed by a collaborative, iterative process. Two virtual charrette workshops, using the Conceptboard website, brought together agency stakeholders where real-time, simultaneous mark-ups captured inspirations, ideas, brainstorms, critiques, and feedback. The summaries of the two workshops are included in this report as an appendix.

Regular meetings with the transportation design team helped to shape the design, especially in regards to the Phase 1 and 2 stormwater sediment basins, the Freemason Street Bridge design, and the Dominion Energy power duct banks. Concerns about existing community assets influenced the design, and multiple alternatives were considered and communicated to the Office of St. Paul's Transformation and Public Works Stormwater. Phasing of demolition and new construction were considered in the arrangement of water management features and open space.

Data collection informed the design of the Blue/Greenway, including recent LiDAR DEM surfaces, geotechnical survey, and tree health, location and diameter survey. Preservation of existing trees was a major design driver. Water quality, quantity, ecological performance, and slope requirements from the Virginia Stormwater BMP Clearinghouse helped define the sectional and plan profiles of the wetlands, basins, and waterways.

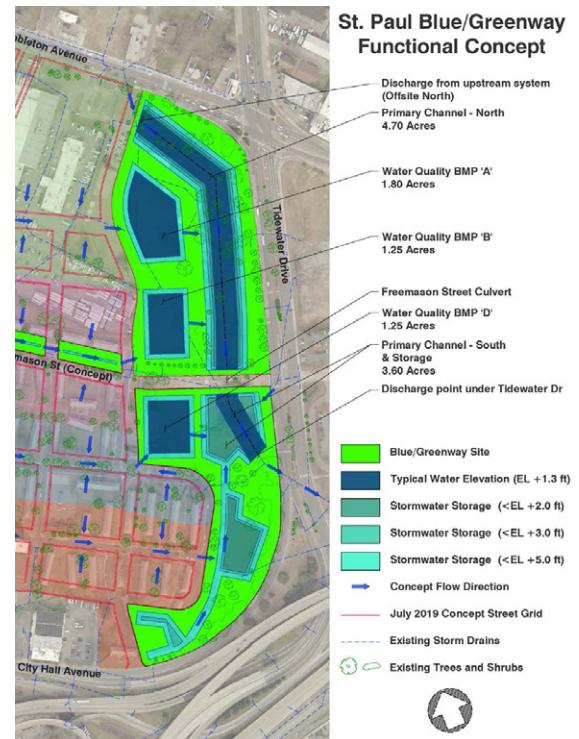


Diagram of Storage Volumes

St. Paul's Blue/Greenway Functional Concept Design, M&N (2019)



Refined Functional Concept, March 2021

Merging of new GIS and elevation data, the latest transformation layout, and the Functional Concept Design report diagrams, resulted in this plan, used during Workshop 1 as a starting point for design discussion.



MIN Version, March 2021

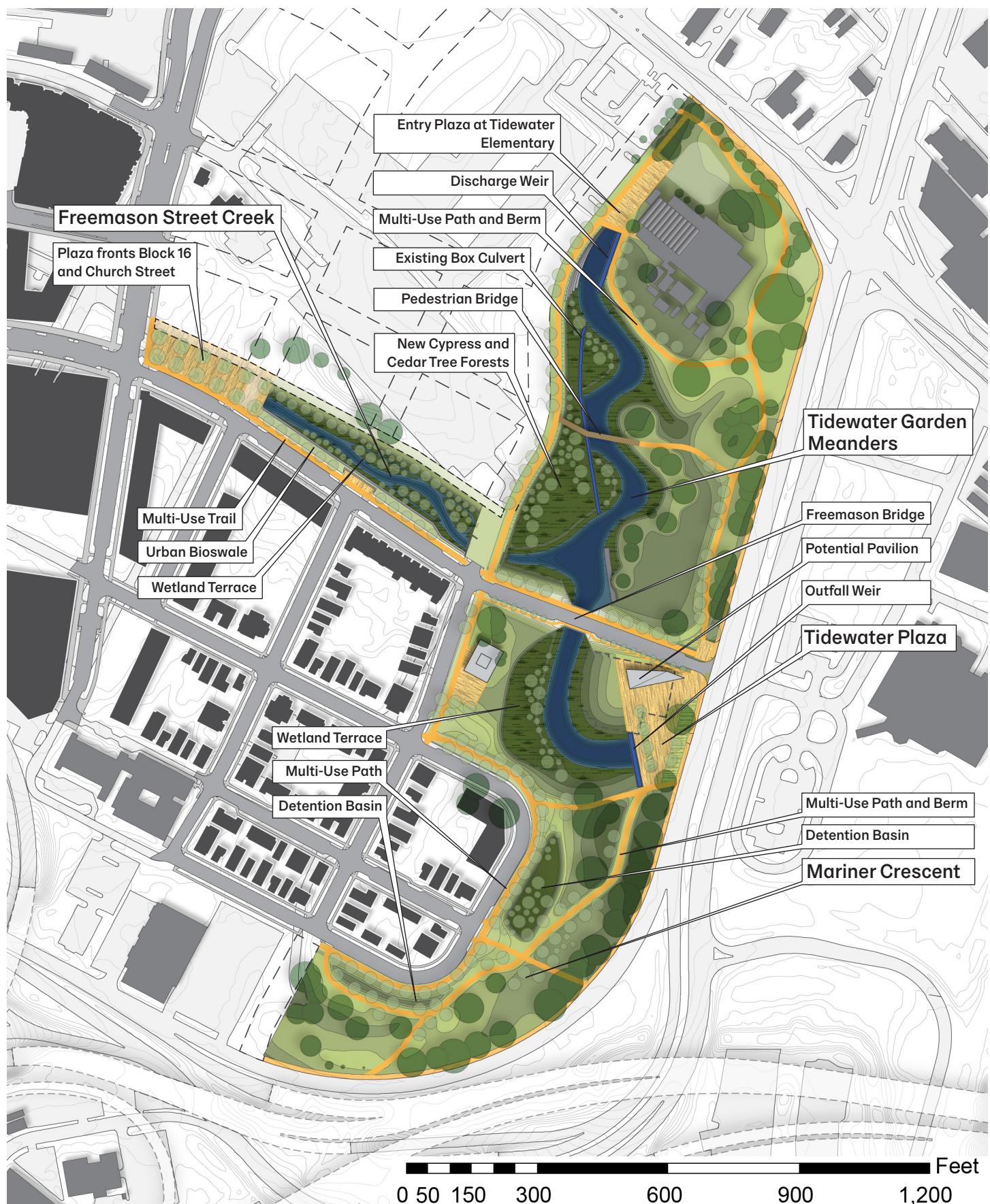
Carve outs for the YMCA and Tidewater Elementary School buildings resulted in a constrained footprint. Former building footprints serve as platforms for recreational uses.



Workshop 2 Version, April 2021

Serpentine meanders were aspirational, but found to be unfeasible due to slopes and grading constraints. This version maximized stormwater storage to compensate for the YMCA footprint, resulting in reduced open space for recreation.

# Concept Design Plan: June 2021



# Tree Preservation

The significant, mature, shade trees in the St. Paul's Transformation Area are valuable assets to be preserved and honored. The design team, along with a group of volunteers, carefully geolocated, measured and cataloged the existing trees, and established a preliminary assessment of tree health, ecological value, and replacement equivalents. This Tree Inventory document is included in this report as an appendix. The new raised streets in the transformation area will impact a large quantity of trees along the periphery of the green space; the trees shaded in the Tree Protection Diagram at right are highlighted for preservation. The design of the Blue/Greenway aims to preserve as many significant trees as possible and is sculpted so that any excavations stay outside of the drip lines of the tree canopies.

*Quercus virginiana*  
Live Oak

Tree #. 8



## Ecology

Native Region: Virginia, Coastal Plains  
Wildlife Value:



## Replacement Equivalents

This tree equals 32 Equivalent Planting Units (EPUs) as outlined by the City Ordinance. To provide the same value, this tree would need to be replaced by:

**11**  
small trees      **8**  
medium trees      **7**  
large trees

## Tree Inventory Excerpt

Stromberg/Garrigan & Associates



**Example of a Compromised Tree**

Identified for removal in the project footprint



**Trees Impacted by Rain and Tidal Flooding**

Blue/Greenway flood management will remove standing water from these significant trees



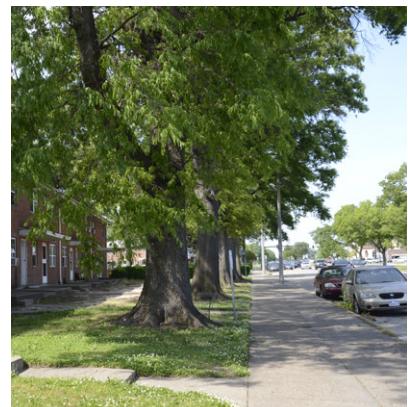
**Aerial Photo of Blue/Greenway Site**

Significant, mature oak trees to be protected.



**Oak Trees**

Healthy trees to be preserved



**Oak Trees along Tidewater**

Provide shade to sidewalk



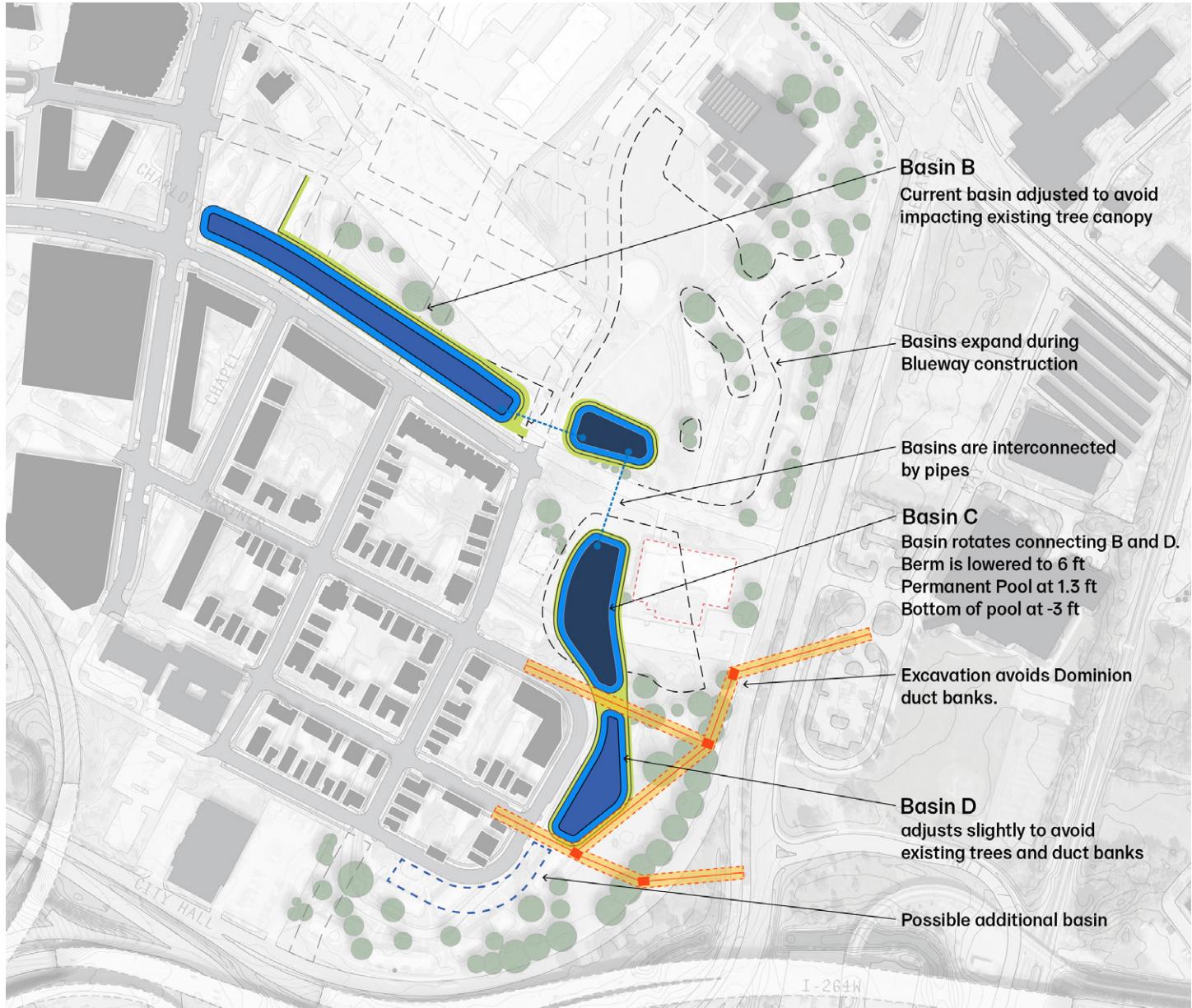
# Phase 1 + 2: Sediment Basins and Duct Banks

Temporary stormwater sediment basins will be created during the construction of the Phase 1 and 2 streets and the new housing developments. These basins will satisfy erosion and sediment control regulations for construction sites. Given the significant size, depth, and cost of these temporary structures, the Blue/Greenway design team is coordinating with the streets and development group to locate and shape the basins to correspond to the final contours of the stormwater park. Additionally, the basins and final design avoid impacting the Dominion Energy duct banks that run underground throughout the project area.



**Temporary Stormwater Sediment Basin**

Example of a temporary sediment trap with forebay to remove initial inflows prior to final settling and discharge. Credit: Tetra Tech

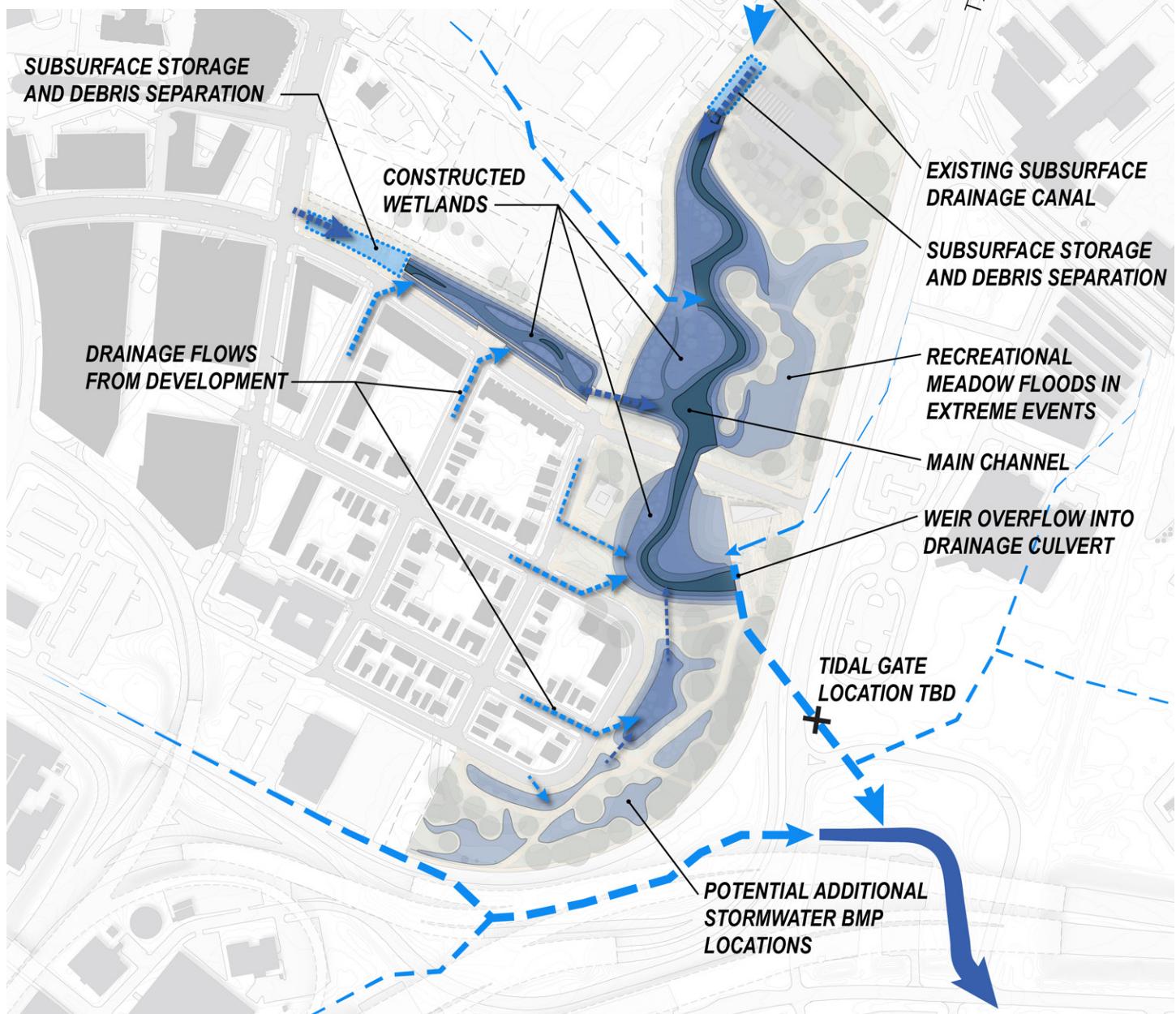
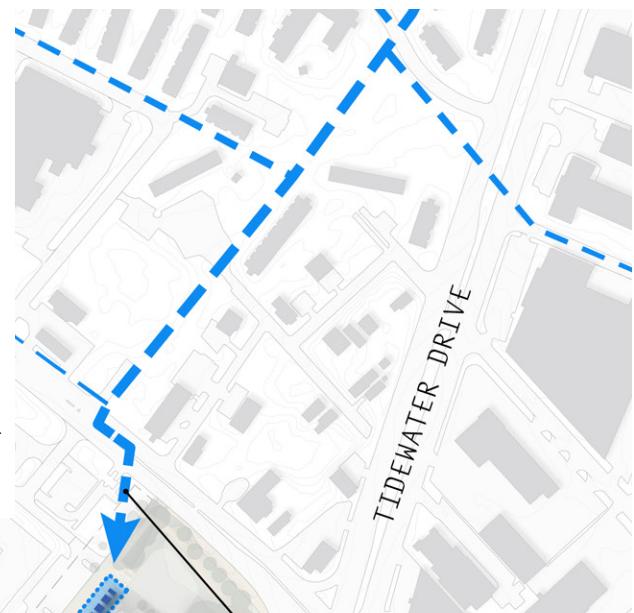


**Proposed Sediment Basin Layout**

Layout avoids Dominion Energy duct banks and anticipates future stormwater park contours

# Stormwater Flows

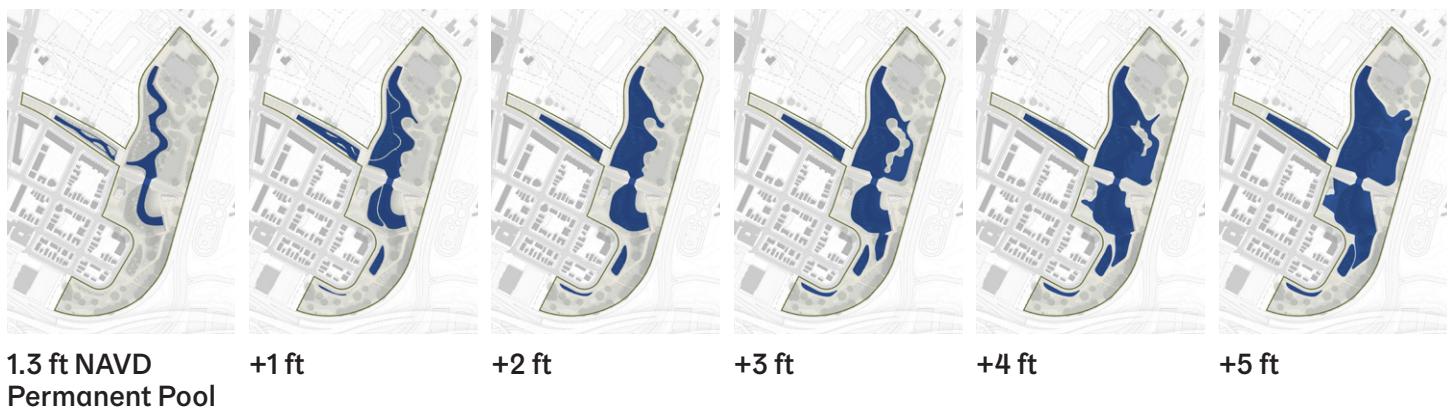
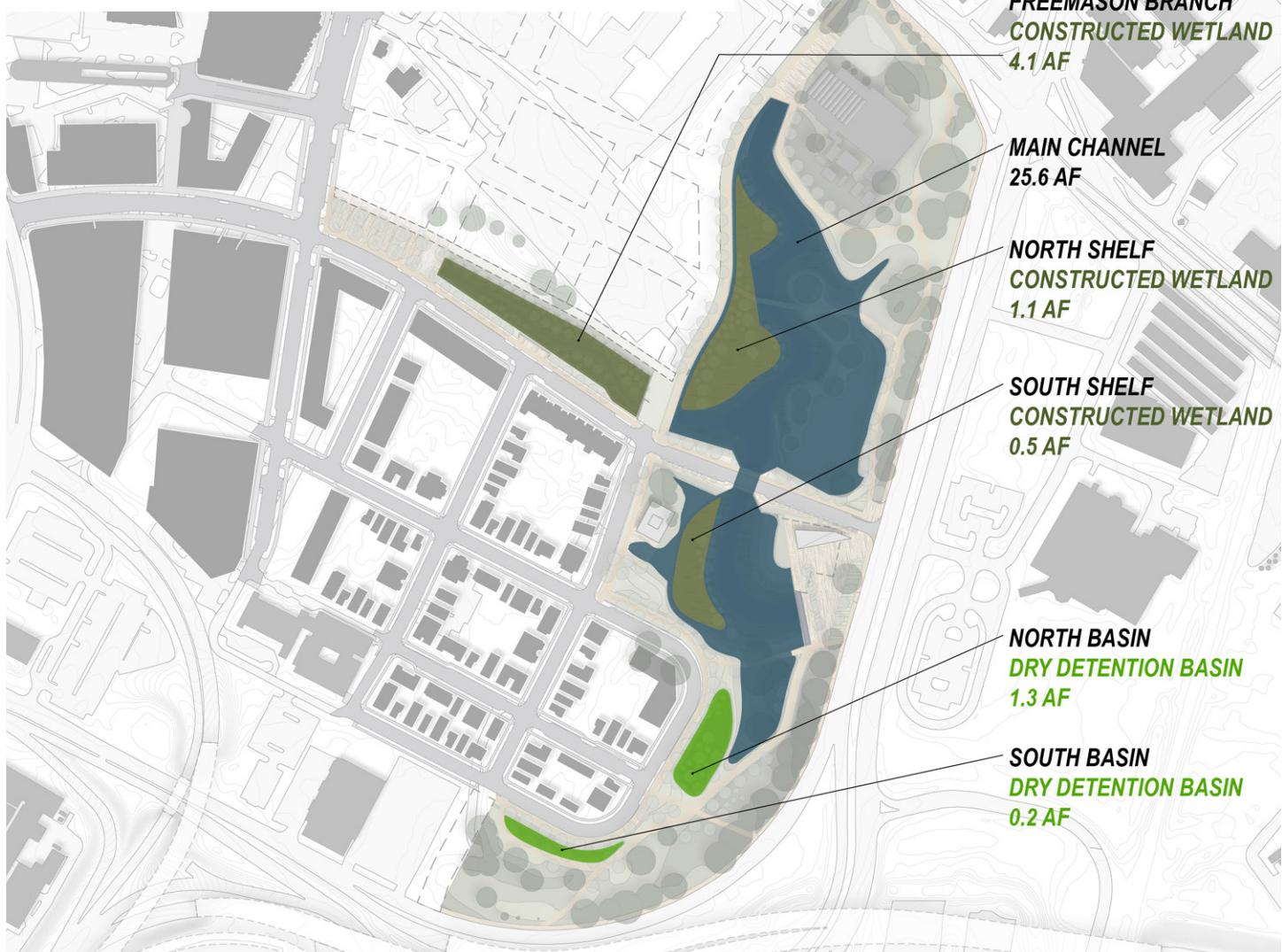
Stormwater enters the Blue/Greenway from the existing drainage network, primarily discharge from the existing box culvert, which drains the watershed above Brambleton, and runoff from the St. Paul's Transformation areas. In the Blue/Greenway design, tidal control structures at the downstream end of the site will manage backflow during high tide. Runoff from the neighborhood streets will flow first into wetland terraces to improve water quality, then into the main channel. Discharge from the box culverts will pass through large scale trash and sediment separators, before flowing into the waterway. As the Blue/Greenway receives stormwater during major rain events, the main channel will fill first, then the wetland terraces, and finally the recreational meadows along Tidewater Drive. Water will flow back into the drainage system and out to the Elizabeth River at the Freemason/Tidewater Plaza.



# Stormwater Storage

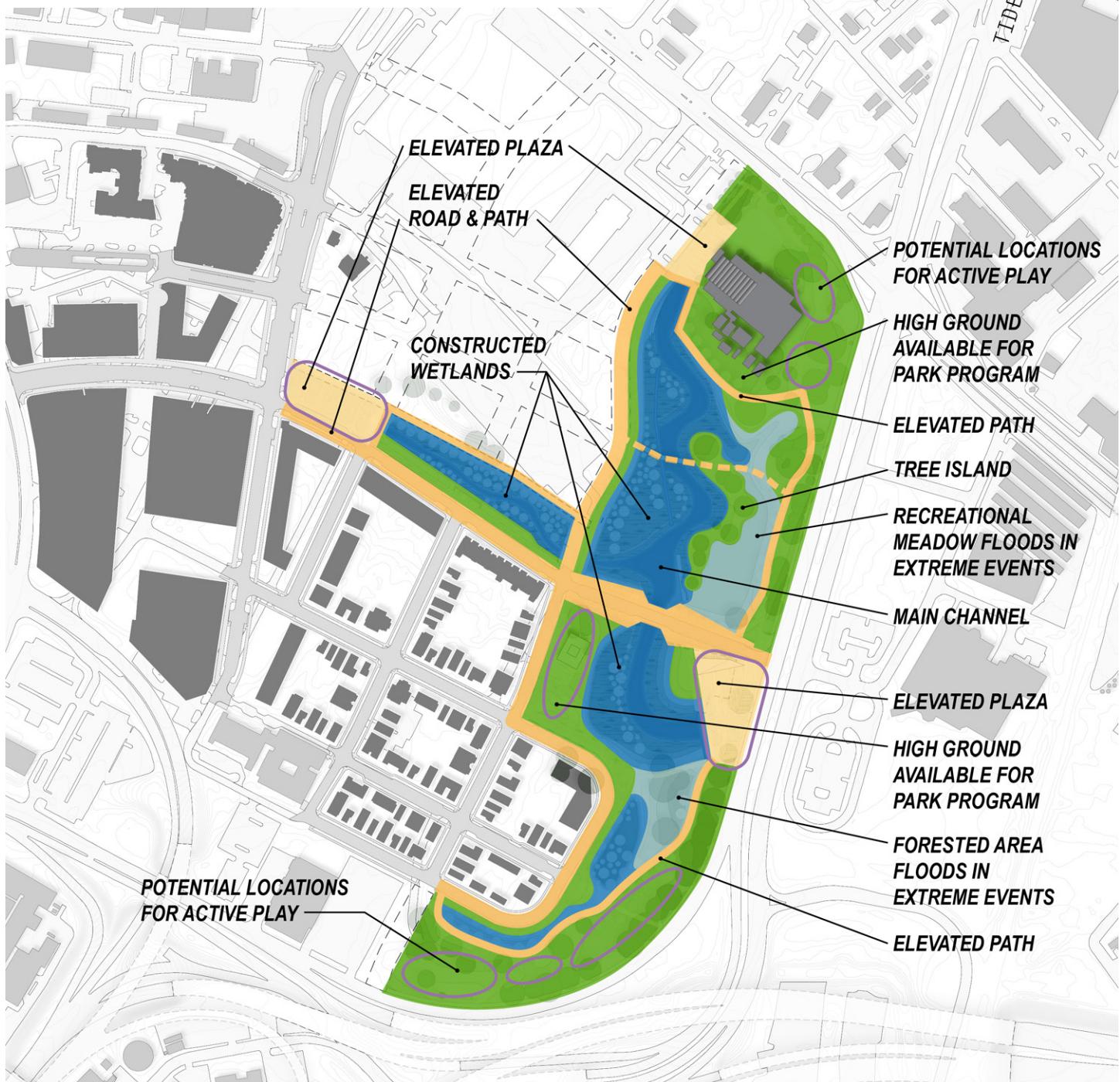
The Virginia Stormwater BMP Clearinghouse was used as a guide for the design of the water management features. Constructed wetlands and dry detention basins manage both water quality and quantity. Water storage occurs between the average surface water elevation of +1.3 feet and the bank full rim elevation of +5 feet NAVD88.

The combined above ground storage capacity of the current design is 32.7 acre/feet, or 10.6 million gallons.



# High Ground

This diagram delineates the areas of the Blue/Greenway that are reserved for future passive or active recreational green space. The majority of the land area is situated either on relatively higher ground, or is separated by a berm from the stormwater basins. A meadow along Tidewater, north of Freemason, will become inundated during large storm events, but is typically dry and can be used for passive recreation. The high ground open areas are also home the mature, shady oak trees. The purple ellipses on the map indicate locations that are large enough for plazas, playgrounds, and ball courts.



# Connections + Gateways

The Blue/Greenway is located in a vital nexus of urban transit and road networks. The Freemason Street realignment helps to reconnect pedestrians and vehicles across Tidewater and shared use paths link the St. Paul Area to the city's growing bicycle network. The paths are sized to meet VDOT guidelines for shared use, including both bicycle and pedestrian requirements for safety. Off-street parking is not envisioned or required for the Blue/Greenway.

Gateway plazas will mark the entry points to the Blue/Greenway, including large urban plazas at Church Street, Tidewater Drive, and Brambleton Avenue, and smaller entry plazas at intersections. Paving, lighting, signage, art, and pavilions can help delineate the boundaries of the park, while inviting users to enter.



**Gateway Pavilion and Public Art Create Threshold**  
Providence, RI. INFORM



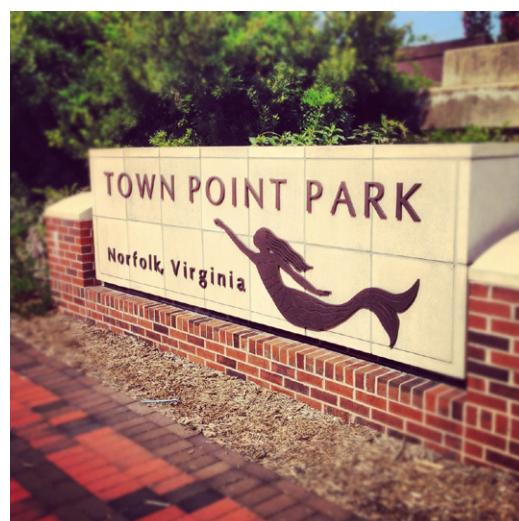
**Gateway Pavilion and Public Art Create Threshold**  
Providence, RI. INFORM



**Paving, Planting, Lighting, and Signage Draw Pedestrians into Park**  
Kunshan Forest Park, China. PLAT Studio



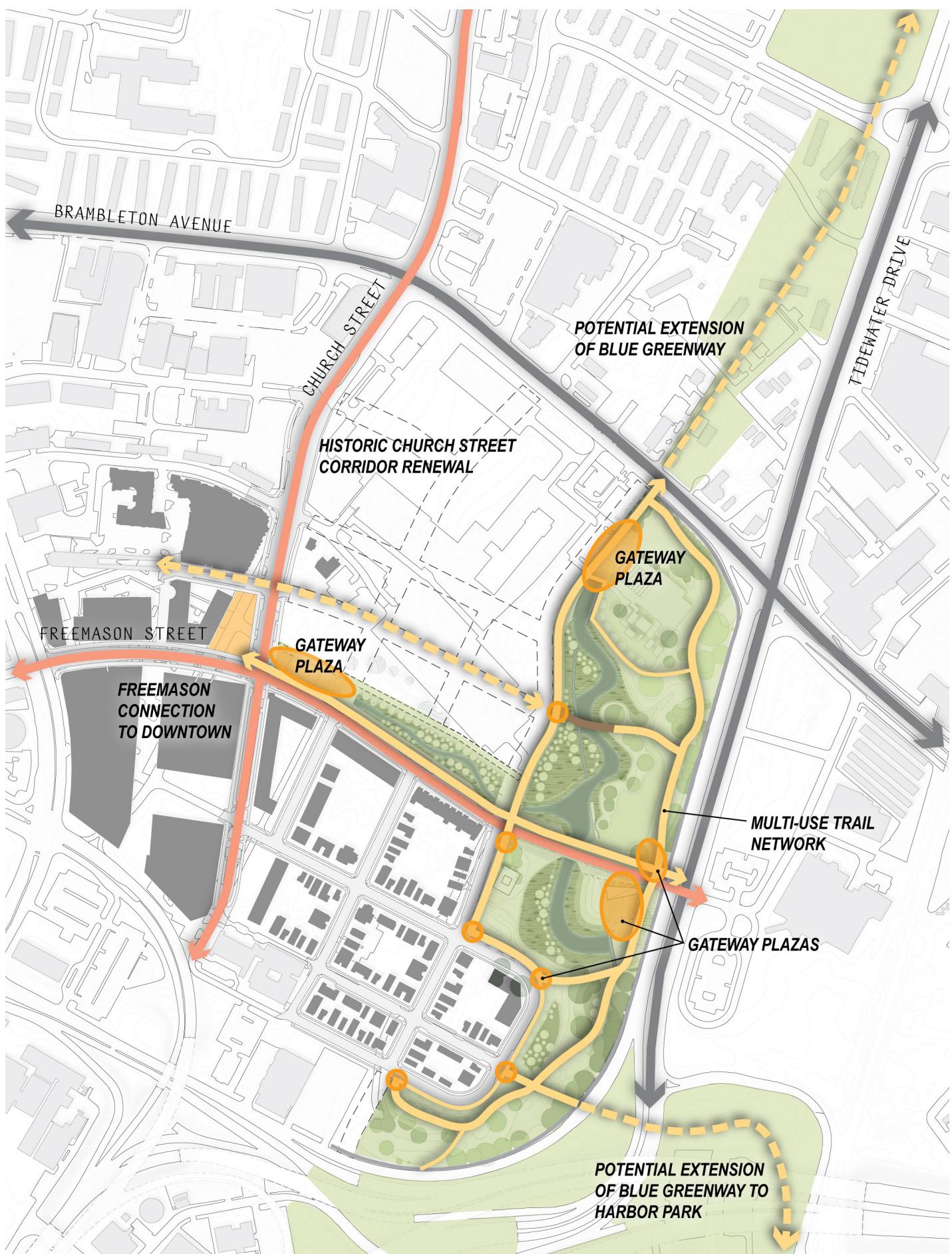
**Plazas Defined by Paving, Lighting, and Art**  
Flushing Meadows, New York City, SELUX



**Town Point Park Entry Marker**  
Norfolk, VA



**Signage Totem Marks Park Entry**  
Kunshan Forest Park, China. PLAT Studio

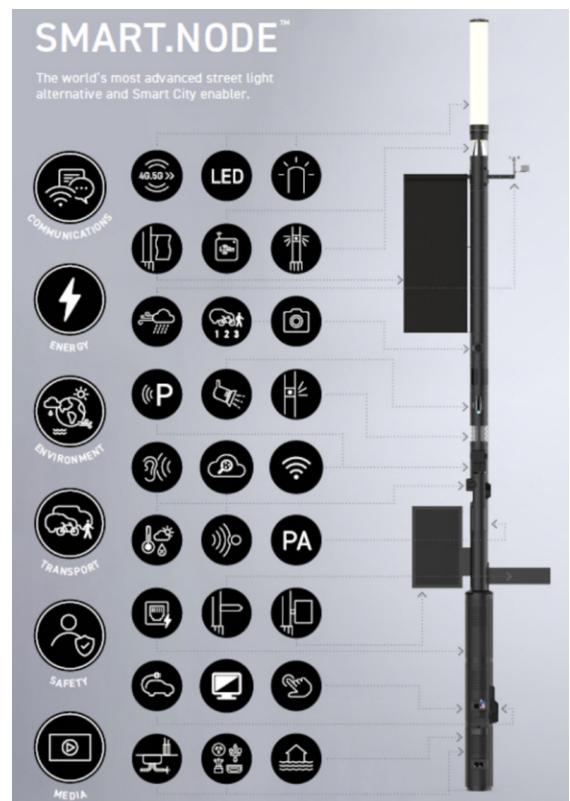


# Lighting + Street Furniture

Cohesive lighting and street furniture selection for the Blue/Greenway and the St. Paul's Transformation Areas can help define neighborhood identity. Coordination with the Office of St. Paul's Transformation, RPOS, Norfolk PD, Stormwater, and other stakeholders will be necessary to determine the level and need of lighting in the Blue/Greenway, in relation to security and operations.

Lights installed as part of the transformation area's new streets can provide illumination to the multi-use paths along Freemason and Resilience Drive. Bollards or pole mounted lights can help define paths within the Blue/Greenway. Bridges and weir structures are highlighted and celebrated with linear LED fixtures, casting and reflecting colored light across the water surface. Plazas and entry spaces are marked and lit with light columns, which are visible from a distance. Modular light poles can serve as armatures for signage, security cameras, police call boxes, accent spot lights, power points, wifi, weather sensors, and many other smart city functions.

Benches, bicycle racks, trash collection receptacles, and other furniture will coordinate with those selected for the rest of the neighborhood.



Modular Light Poles can Provide Multi-Functional Benefits  
Signage, Power, Communications, Security, Etc., Selux



**Cordia - Litter Receptacle**



**Vector - Backless Bench (4')**



**Vector - Bench (6')**

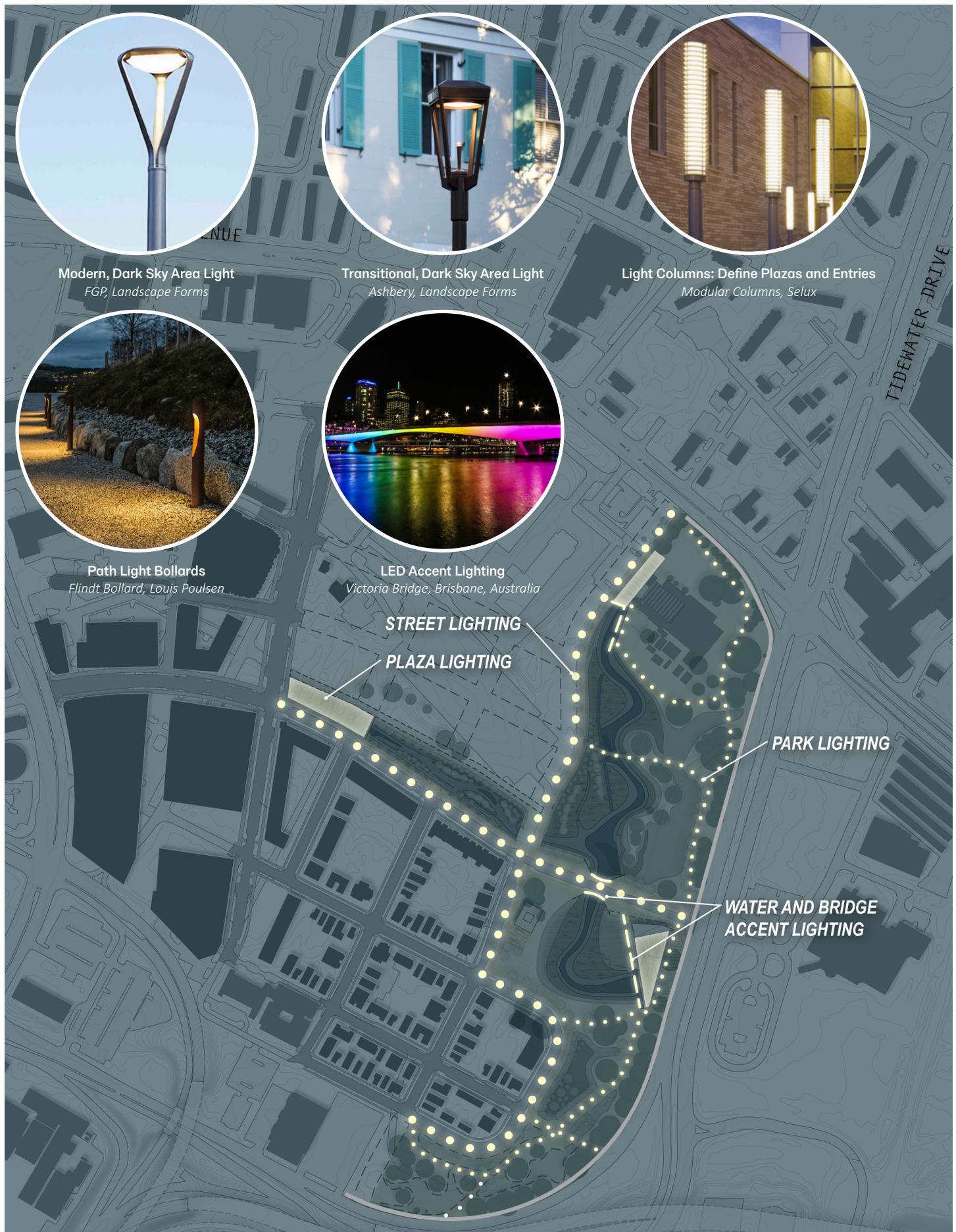


**Twist - Bike Rack**



**Proposed Street Furniture**  
St Pauls Transformation, WPA



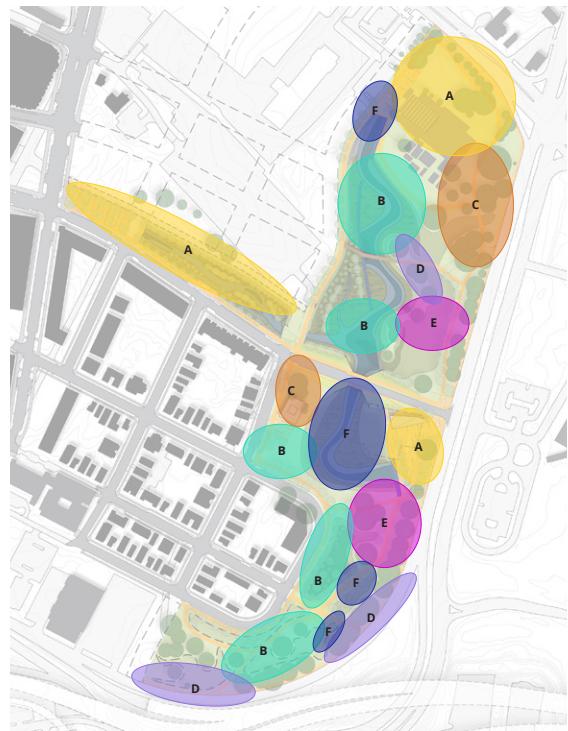


# Landscape Assemblies

The St. Paul's Blue/Greenway will provide many community amenities to the St. Paul's neighborhood as well as help manage millions of gallons of stormwater each year. The design of the space reflects its multifaceted role within the city, providing areas for water quality treatment as well as public recreation. Due to the many services it offers, zones were created throughout the space to concentrate design elements into themed pockets within the Blue/Greenway.

Six unique but compatible foci were identified throughout the park, responding to conditions such as saturation, adjacencies, and connections. These themes, called assemblies, were given titles to help aid communication during this phase of the Blue/Greenway design and encourage continued conversation about identity within the space. If areas or elements of the Blue/Greenway are named in the future, the naming strategy should be directed by current community members to ensure the history and cultural memory of the St. Paul's neighborhood are remembered and celebrated.

The complete landscape Landscape Assemblies report is included as an appendix to this document.



Plan Diagram of Potential Landscape Assemblies

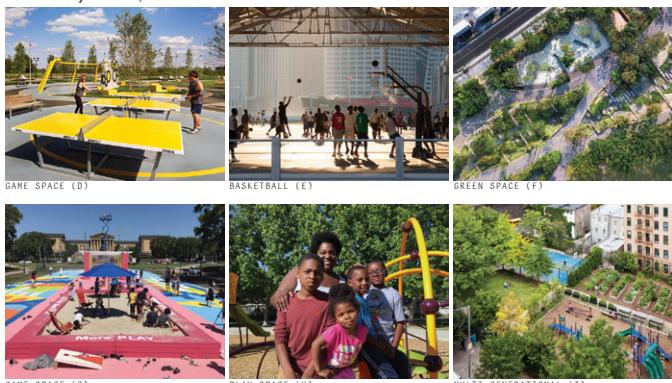
- **Assembly A: Longshoremen's Ports and Charlotte Terraces** depicts places near the edges of the Blue/Greenway ideal for gathering with the community, celebrating the relationship of the neighborhood with the water, and creating active spaces with adaptable uses that the neighborhood can determine by occasion. Assembly A provides open spaces with hardscape amenities like pavers and platforms for year-round community use. These areas are ideal for large-scale community gatherings and events.
- **Assembly B: Bayberry Dunes** derives its name from a native plant often seen growing on the dunes. These areas are elevated and often are adjacent to the fully saturated areas within the Blue/Greenway. They offer smaller scale areas for the community to gather and play in a vegetated environment.
- **Assembly C: Heritage Greens** focuses on open space that can be used for formal and informal activities in a green, vegetated environment. It offers a place to showcase local talent, build a community garden, or celebrate local history through public art or annual events. The defining feature of Assembly C is an open span of grass or low vegetation framed by water and the neighborhood's established trees.
- **Assembly D: Family Retreats** provides a mix of hard and soft amenities well-suited to hosting family or community events. Located both along the edge and in the heart of the Blue/Greenway, Assembly D offers formal places to gather as well as quiet places to enjoy the natural elements of the space.
- **Assembly E: Tidewater Gardens** celebrates the name and connectivity of the current community and provides walking trails and circuits, places to gather in small groups, and multi-generational activities. Assembly E is concentrated near the major entrances to the park – off of the proposed extended Freemason Street and the proposed plaza that faces Tidewater Drive – however the walking and biking trails will extend throughout the park.
- **Assembly F: Meanders** embraces the water that will inundate the “blue” parts of the Blue/Greenway. Assembly F focuses on passive recreation including informal exploration and walking trails that provide opportunities for environmental education and nature play. Assembly F is located along the low-lying areas of the Blue/Greenway.

**A - Longshoremen's Ports and Charlotte Terraces**

The St. Paul's Blue/Greenway will provide many community amenities to the St. Paul's neighborhood as well as help manage millions of gallons of stormwater each year. The design of the space reflects its multifaceted role within the city, providing areas for water quality treatment as well as public recreation. Due to the many services it offers, zones were created throughout the space to concentrate design elements into themed pockets within the blue/greenway.

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Longshoremen's Ports and Charlotte Terraces depicts places near the edges of the blue/greenway ideal for gathering with the community, celebrating the relationship of the neighborhood with the water, and creating active spaces with adaptable uses that the neighborhood can determine by occasion. Assembly A provides open spaces with hardscape amenities like pavers and platforms for year-round community use. These areas are ideal for large-scale community gatherings and events.

**Park Identity - History / Identity****Park Identity - Health / Education****Main Stormwater BMP Components - "Living With Water"™****Vegetation Typologies - Cultural Landscape****Park Identity - Arts / Culture****Park Identity - Recreation Play****Landscape Assembly A: Longshoremen's Ports and Charlotte Terraces**  
*Excerpt from report*

# Freemason Street Creek

Formerly a branch of Newton's Creek, the low-lying finger of land north of Freemason Street will convey water from the new urban development to the new, daylighted creek. The proposed Phase 2 Freemason Street incorporates a 12 foot wide multi-use trail along the edge of the green finger. A wide bioswale planted with shade trees will intercept street runoff and provide a buffer between the trail and the start of the slope. Due to space constraints and to maximize the water quality benefits of a constructed wetland BMP, the edges of the waterway will have a relatively steep, stepped slope. At the bottom, a water channel courses through wetland shelves, planted with native grasses, cypress and white cedar trees.

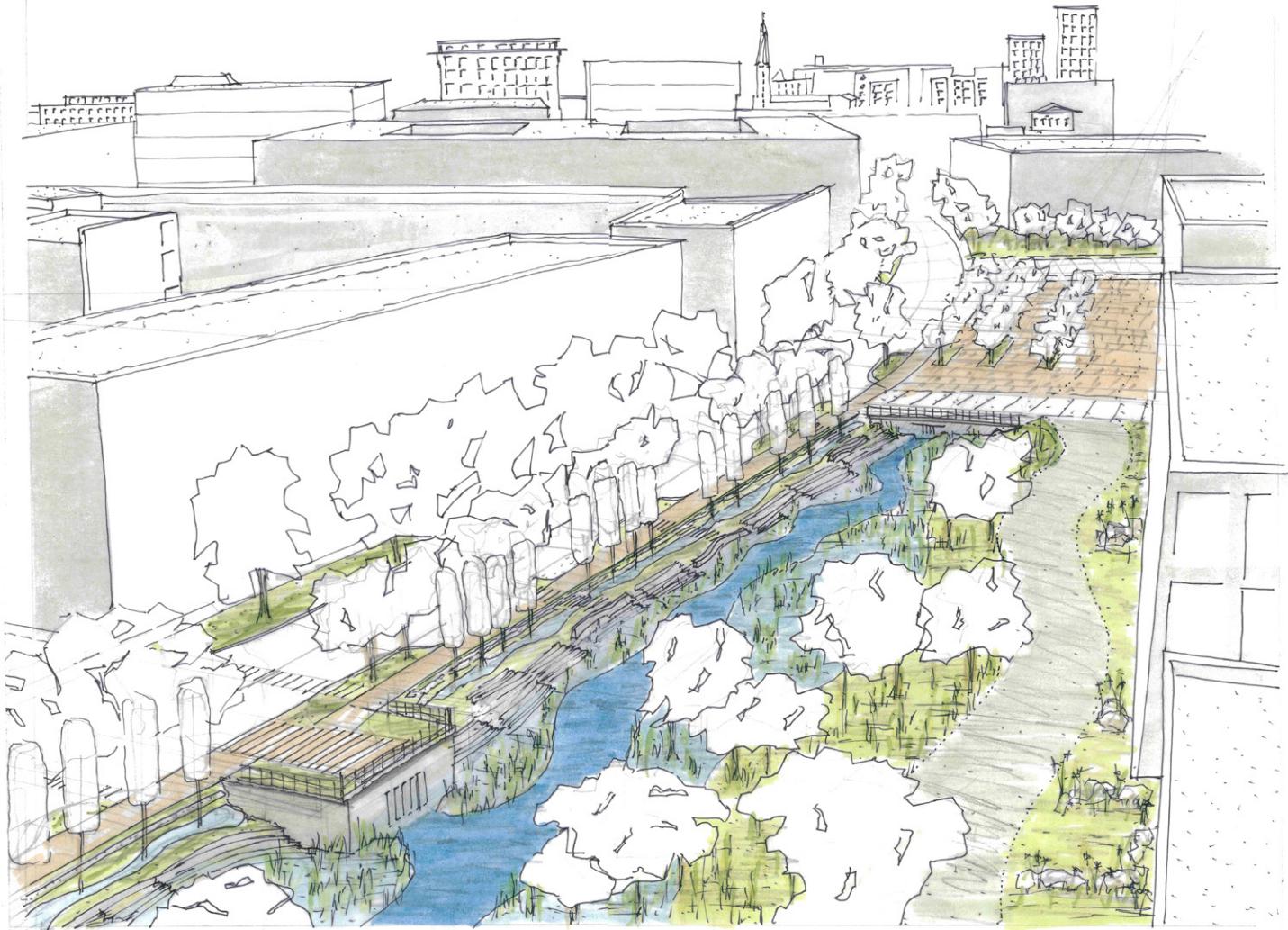
Between Church and Chapel Streets, an urban plaza planted with shade trees, will act as a gateway to the neighborhood and an entry to the Block 16 development. Subsurface storage and sediment control structures under the plaza provide water quantity and quality capacity. At Riley Street, where a potential crossing may span the Blue/Greenway, a small plaza acts as a belvedere overlook. At the future Resilience Drive right of way, the waterway crosses the embankment via culvert and discharges into the main channel. Along the north side, space is reserved for a future 20 foot wide fire lane.



**Mature Trees Preserved**

*Trees north of the Freemason Street Creek should be protected*





Aerial view of Freemason Waterway



Urban Water Plaza with Medium Density Housing  
Tanner Springs Park, Portland, OR. CMS Collaborative



Water Play in Urban Plaza  
Navy Pier, Chicago, . James Corner Field Operations



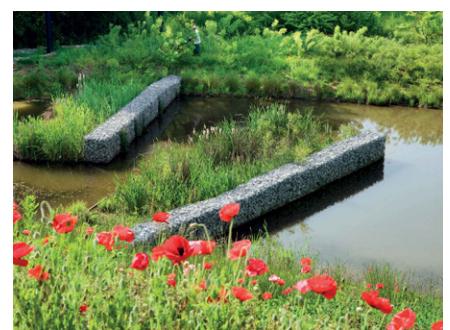
Gabions Reinforce Edge Of Waterway  
credit



Terraced Edge Condition  
Tanner Springs Park, Portland, OR. CMS Collaborative



Modular Subsurface Detention  
R-Tank, ACF Environmental



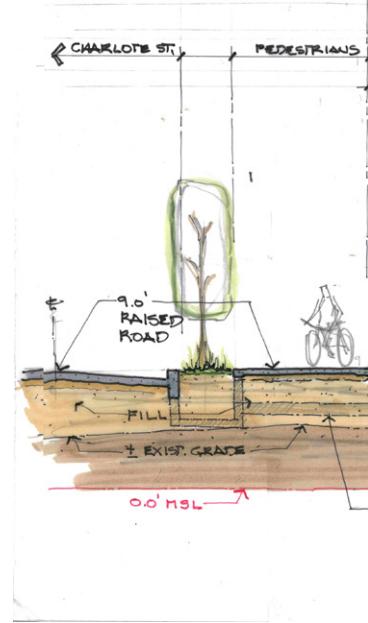
Constructed Wetlands and Waterway  
Renaissance Park, Chattanooga

# Freemason Street Creek



Westersingel Canal, Rotterdam, NL

Stormwater canal and park with urban multifamily and townhouse frontage



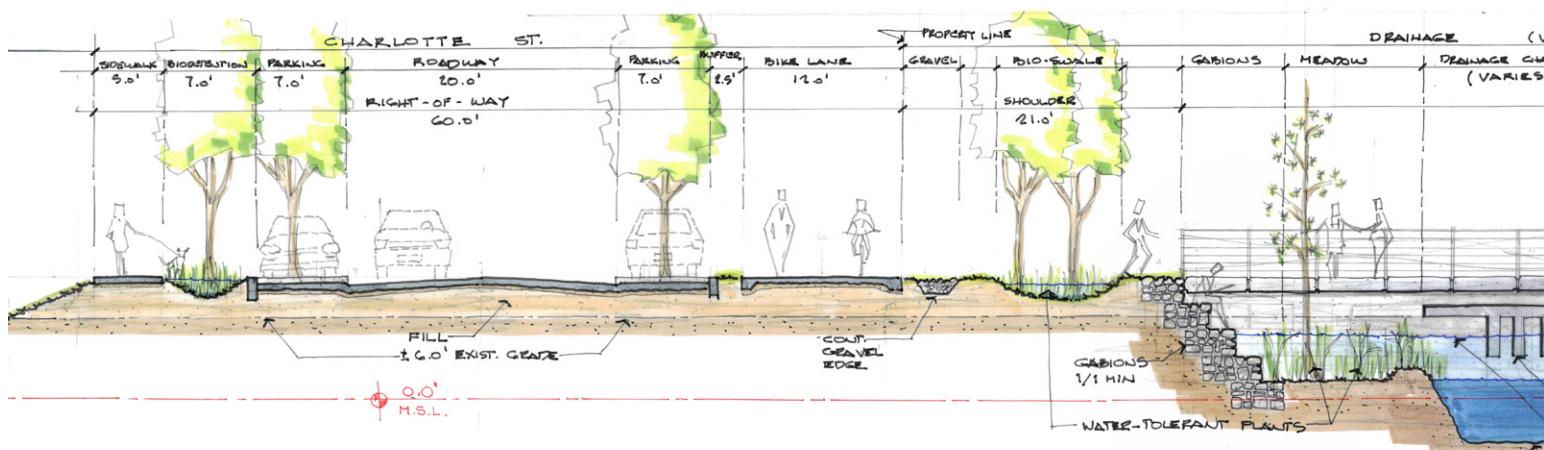
Westersingel Canal, Rotterdam, NL

Plaza at head of canal



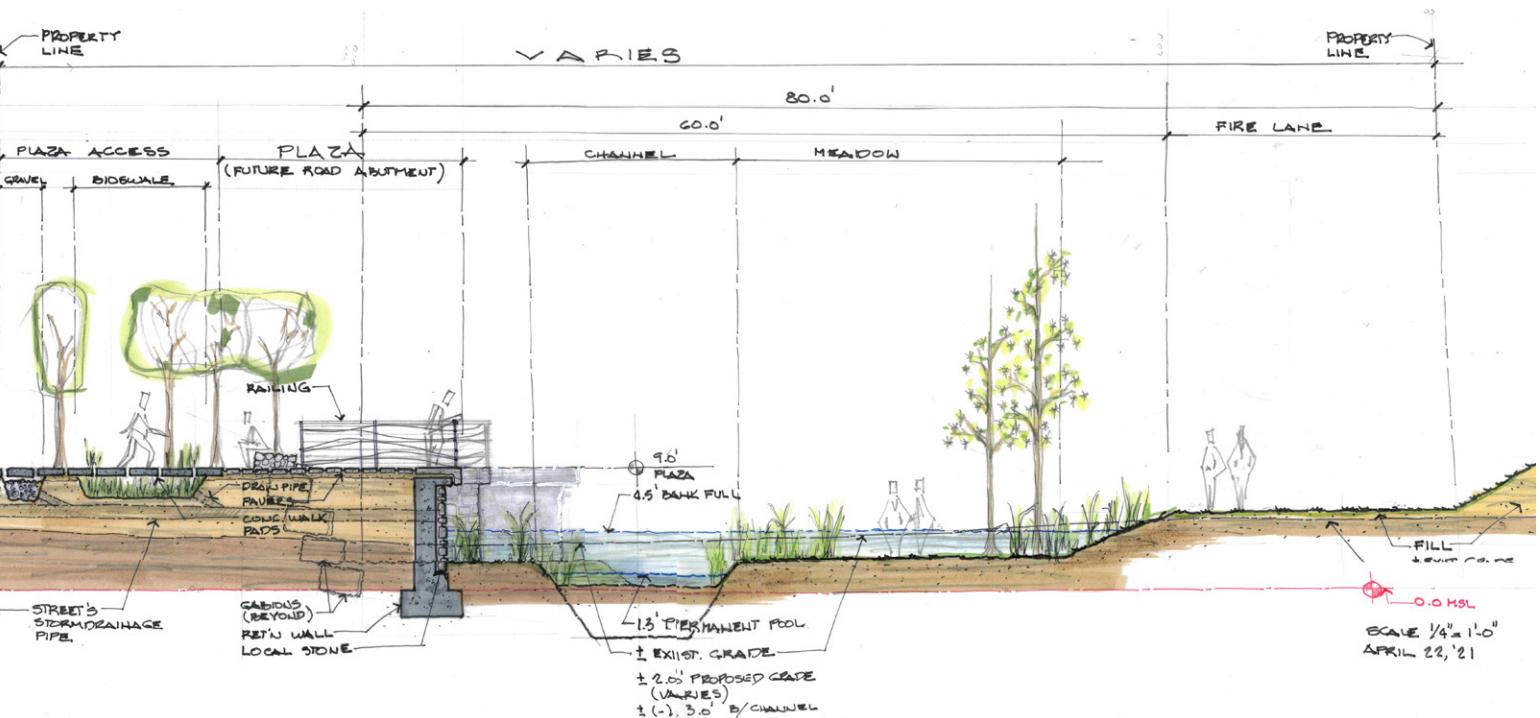
Thornton Place Apartments, Seattle

Housing Fronting on Creek



Section A: Freemason Street Creek

Not To Scale



Section B: Riley Street Belvedere Overlook  
Not To Scale



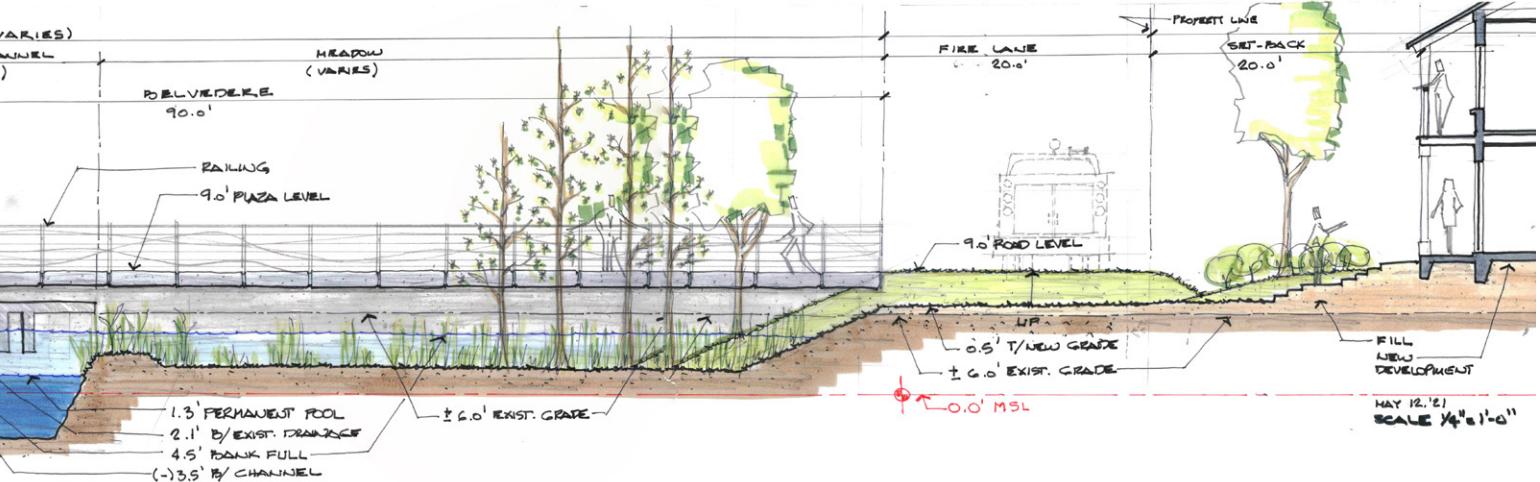
Scrub Oak Sandhill Woodland



Bioswale and Sidewalk  
Cornell University, New York



Multi-Use Trail Provides Separation from Auto Traffic for Pedestrians and Bicyclists  
Baltimore, MD. Black People Ride Bikes (BPRB)



# Tidewater Garden Meanders

Hidden and constrained in an underground culvert for over 80 years, Newton's Creek is daylighted, naturalized, and given space to flow and meander. The main channel of the waterway curves and courses within a wide floodplain, with a typical surface water elevation of +1.3 feet NAVD88. Wetland zones along Resilience Drive intercept and treat runoff from the new street network to the west, while stormwater is discharged from the upstream drainage network into the creek after passing through sediment and trash separator structures under the entry plaza. A remnant of the concrete box culvert is preserved to both educate about the history of the civil engineering, and to serve as a conveyance path for water draining from the wetland shelves into the main channel.

The landscape is sculpted and shaped to preserve existing trees and high ground. Multi-use paths are located at the crest of berms that circumnavigate the Blue/Greenway to contain flood volumes and prevent inundation of Tidewater Elementary and Tidewater Drive. At Wood Street, a pedestrian bridge crosses the waterway, connecting both sides of the park. Along the eastern edge of the channel, sunken meadows serve as open space for passive recreation during dry periods, and stormwater detention during extreme storm events.



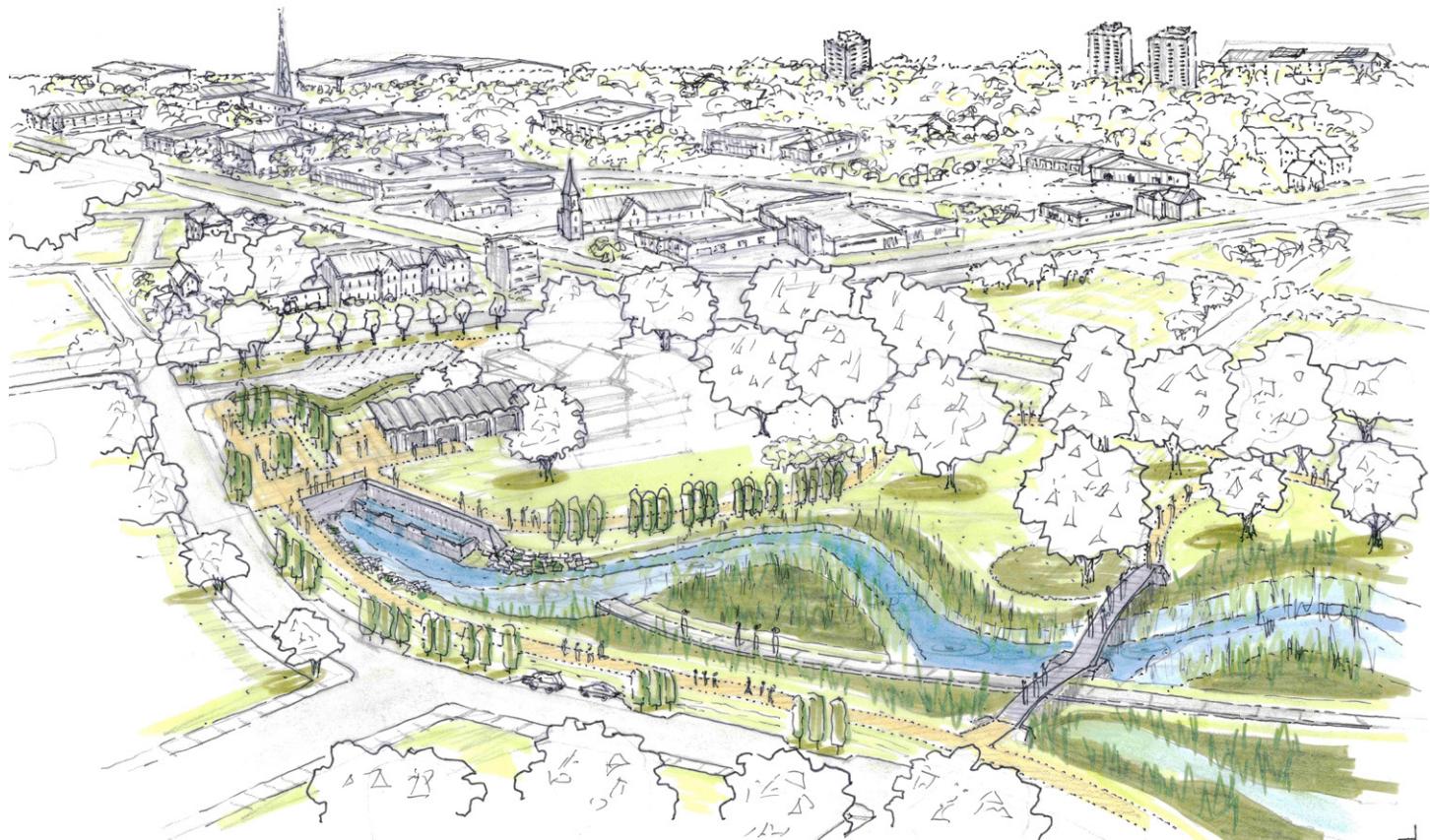
**Mature Tree Allée**

*Marks entrance to Tidewater Gardens Elementary Plaza*



**Aerial View of Tidewater Gardens Elementary**

*School and Open Space, Blue/Greenway Extents. Credit: WSSI*

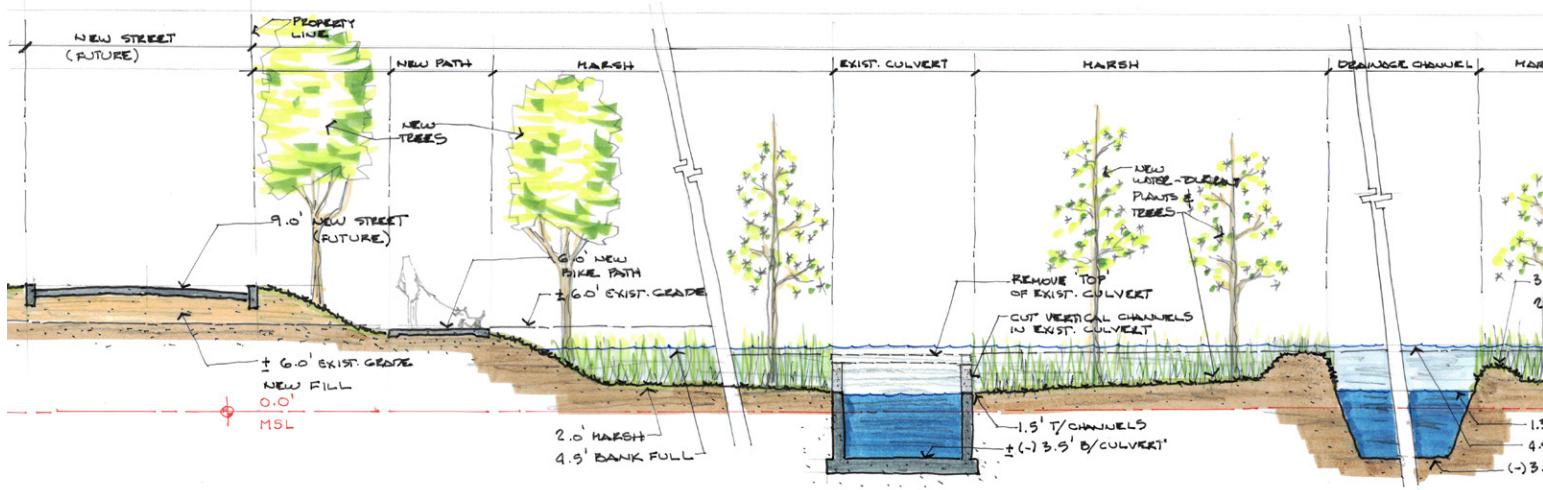


**Aerial View Looking North**

*Meanders, Pedestrian Bridge, Discharge Weir, Tidewater Gardens Elementary*



# Tidewater Garden Meanders



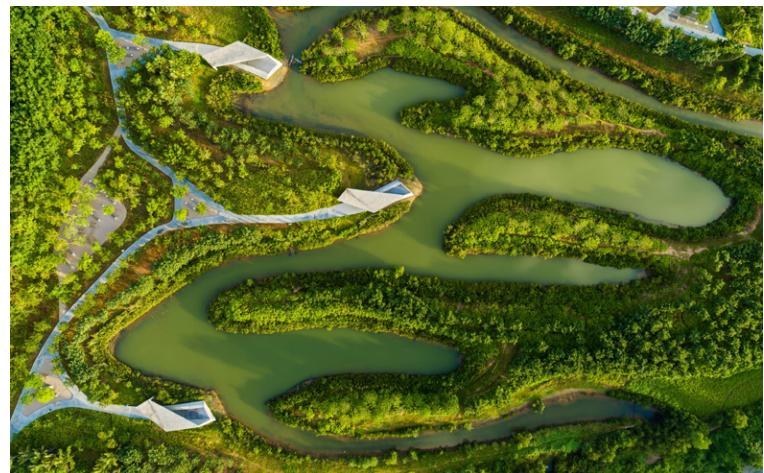
Section C: Daylighted Creek, Constructed Wetlands

Not to Scale



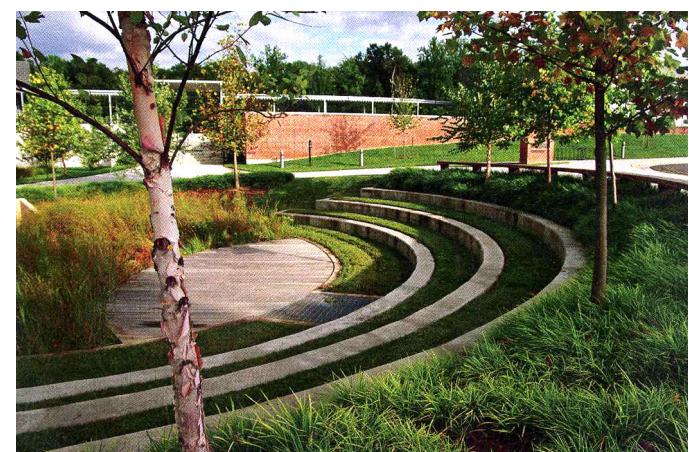
Atlantic White Cedar Forest

Virginia DCR



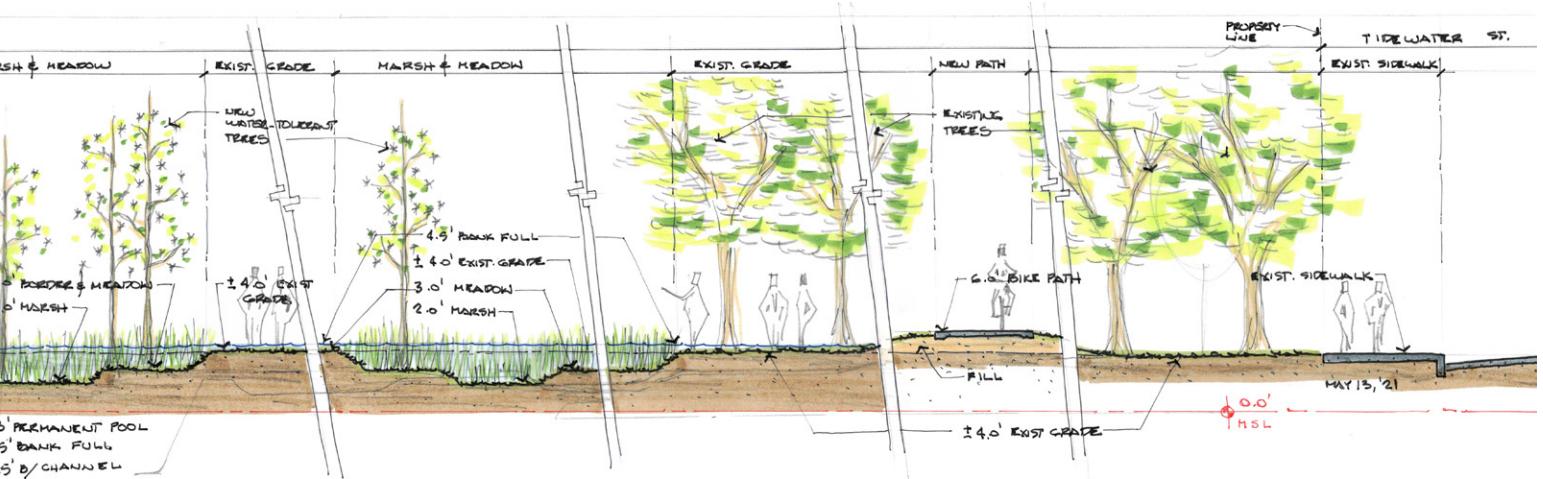
Sanya Mangrove Park

Sanya City, China. Turenscape



Title  
credit

Amphitheater, Stage, and Wetlands  
Queen Elizabeth II Olympic Park, Hargreaves-Jones



**Nature Play and Multi-Use Paths**  
Maggie Daley Park. MVVA



**Riverfront Park**  
Newark, NJ. Weintraub Diaz



**Boardwalk in Wetlands**  
New Orleans City Park Sculpture Garden



**Tidal Wetland**  
First Landing State Park, Virginia DCR



**Wetland Terraces and Boardwalks**  
Yanweizhou Wetland Park, China. Turenscape

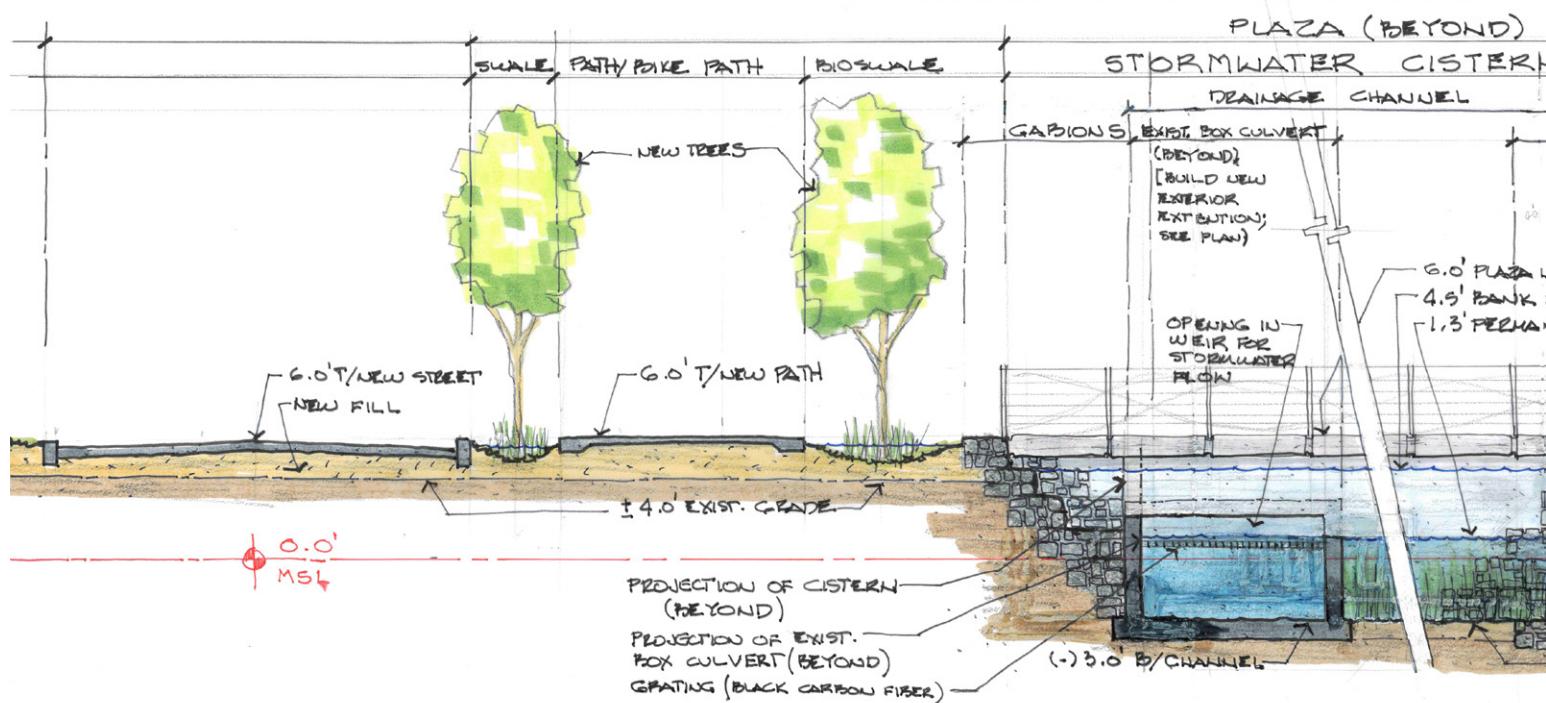
# Tidewater Elementary and Discharge Weir

At the head of the daylighted Newton's Creek waterway, a new plaza provides entry to the park and the Tidewater Gardens Elementary School building. Under the plaza, the box culvert that channels runoff from the drainage watershed north of Brambleton passes through underground sediment and trash separating control structures before flowing out into the open air. Water is discharged via a preserved remnant of the box culvert, modified to act as an overflow weir. The long length of the weir increases the discharge flow rate and creates an expressive water feature.

At this phase of the design process, Tidewater Gardens Elementary School is currently occupied and the layout of the proposed design preserves space around the building site. The main floor of the building is situated five or six feet below the current 100 year return period FEMA Base Flood Elevation (BFE) and is at risk for inundation during major storm events. If the school relocates, the expressive cafeteria and entry portico can be adaptively re-purposed as an open air pavilion or as a wing of a new community center, potentially housing the William A Hunton YMCA. To wet flood proof the structure, electrical outlets and other mechanical services can be raised above the BFE. A new addition built above the BFE can house new functions, such as a gymnasium, classrooms, catering, auditorium, etc.



**Overflow Weir, Waterway, and Wetlands**  
Boardwalk over weir, Westerpark, Amsterdam, NL



**Section D: Discharge Weir and School**  
credit



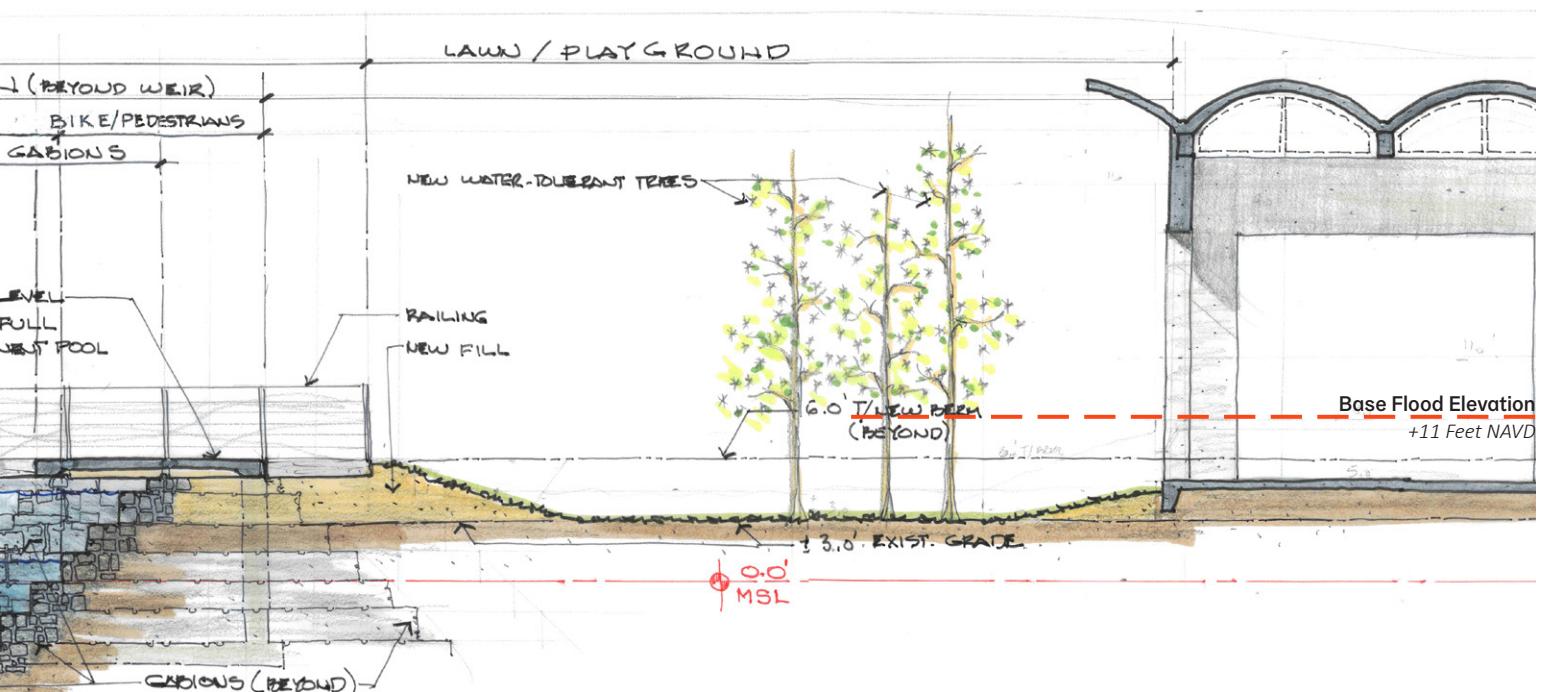
**Alternate Site Plan with Potential YMCA Addition**

New construction elevated above flood plain, existing structure wet flood-proofed



**Mid-Century Modern Concrete Roof is an Expressive Landmark**

Cafeteria can be readily adapted into a multi-use space



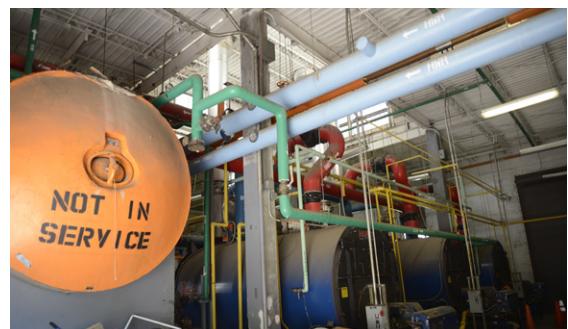
# Freemason/Tidewater Plaza

At the corner of Freemason and Tidewater, a large urban plaza marks the entry to the St. Paul's Area and Blue/Greenway. The eastern edge of the space is defined by the existing box culvert, where an overflow weir structure celebrates the return of the water from Newton's Creek back into the drainage system.

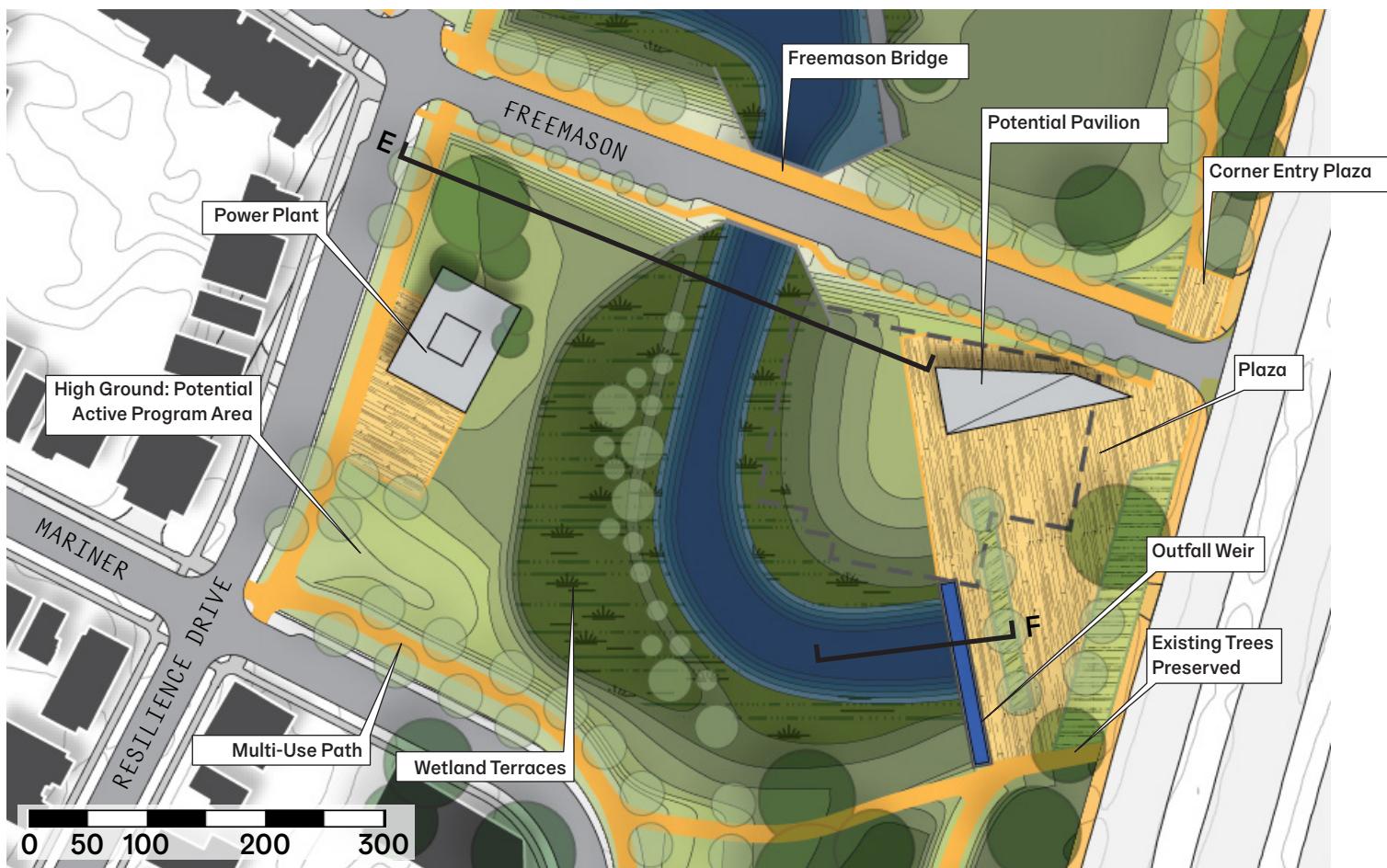
This urban plaza can be a space for markets, performances, and community gatherings. A potential shade structure or pavilion will mark the corner, and encourage gatherings. On the other side of the Blue/Greenway, along Resilience Drive, the power plant for the Tidewater Gardens Housing Development is scheduled to be the last building demolished. The building is simple and utilitarian, but it has good bones. It could be cleaned out, windows and doors added, and it could serve as a market shed, community center, or service building for the area. If preserving the building is deemed unfeasible, the high ground it occupies could be used for active recreation uses, such as hard courts or playgrounds.

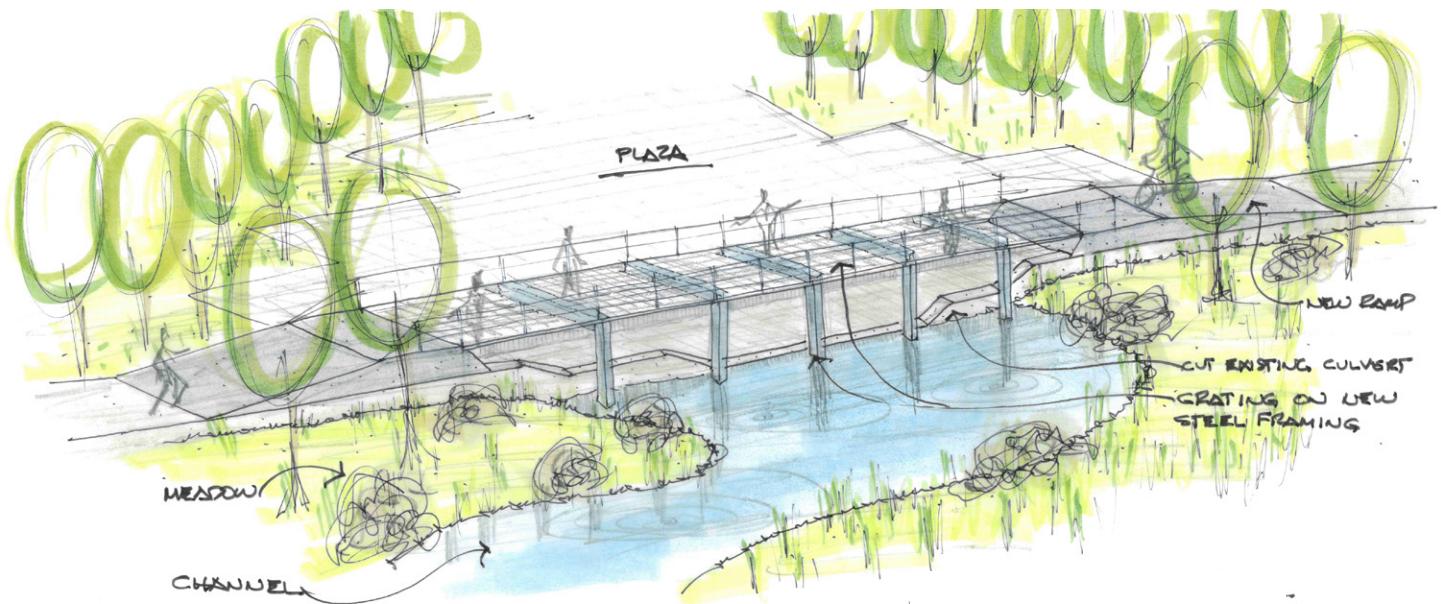


**Entry Pavilion and Shade Structures**  
*St. Landry Visitors Center, Louisiana*

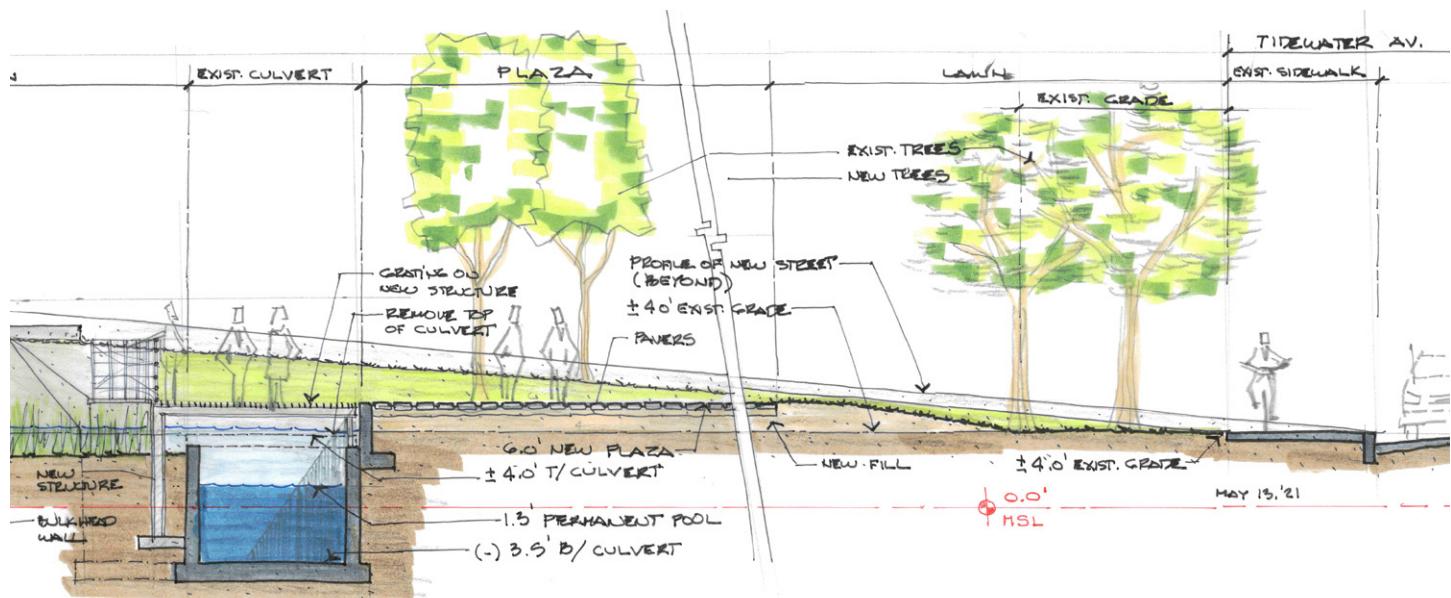


**Power Plant: Potential Renovation**  
*Opportunity for Market Pavilion, Community Space*





Overflow Weir  
Not-to-Scale



Section F: Outfall Weir and Plaza  
Not-to-Scale



Outfall Structure and Overlook Platform  
Renaissance Park, Chattanooga. Hargreaves & Associates



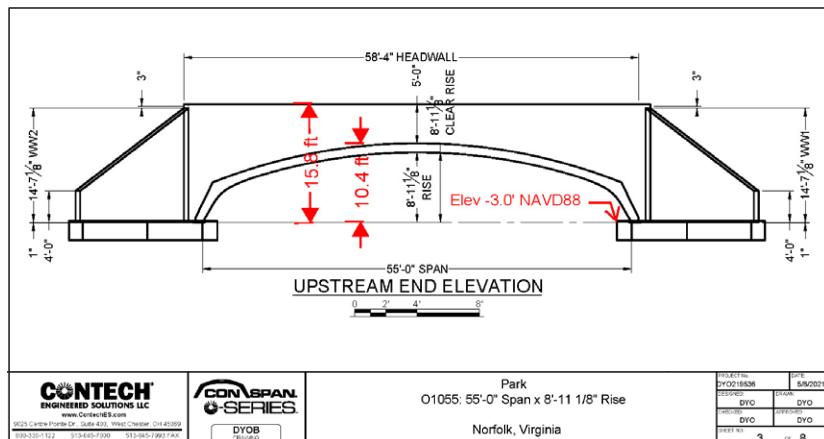
Piano Key Weir  
Geometry increases discharge capacity. River Kennet, UK

# Freemason Street Bridge

A bridge will be required where Freemason Street crosses the St. Paul's Blue-Greenway main channel. Due to the short approach geometries, a bridge with a shallow rise is required. As a short span bridge, there are three economical structural system options for the crossing: precast concrete box culverts, precast arch culvert, and steel girder systems.

Precast box culverts are likely the most cost effective system, but have the least "bridge-like" appearance. Arch systems are expressive, but the length of spans are limited by the rise and height of the arch. Steel bridges have a shallow cross sectional profile and greatest span of the three choices.

Regardless of the bridge system selected, the bridge abutments, wing walls, edge and facade details, and railings are opportunities for expressive design. Concrete surfaces can be textured, or clad in stone or brick. Railings will be experienced by pedestrians and bicyclists using the bridge and the park. They can be minimal and elegant, or can be canvases for decorative art and sculpture.



**CON/SPAN O-Series**  
CONTECH Engineered Solutions



**Precast Box Culvert**

Gasser Drive, Napa, CA. Jenson Precast



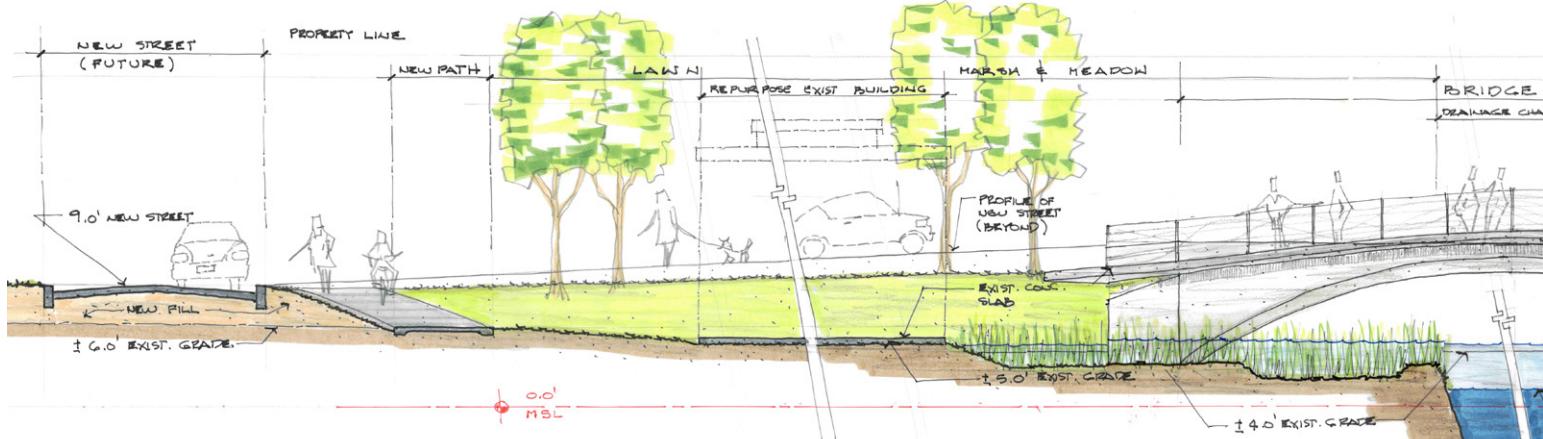
**Steel Press Brake Formed Tub Girder System**

Monroe County, MI. Short Span Steel + Bridge Alliance

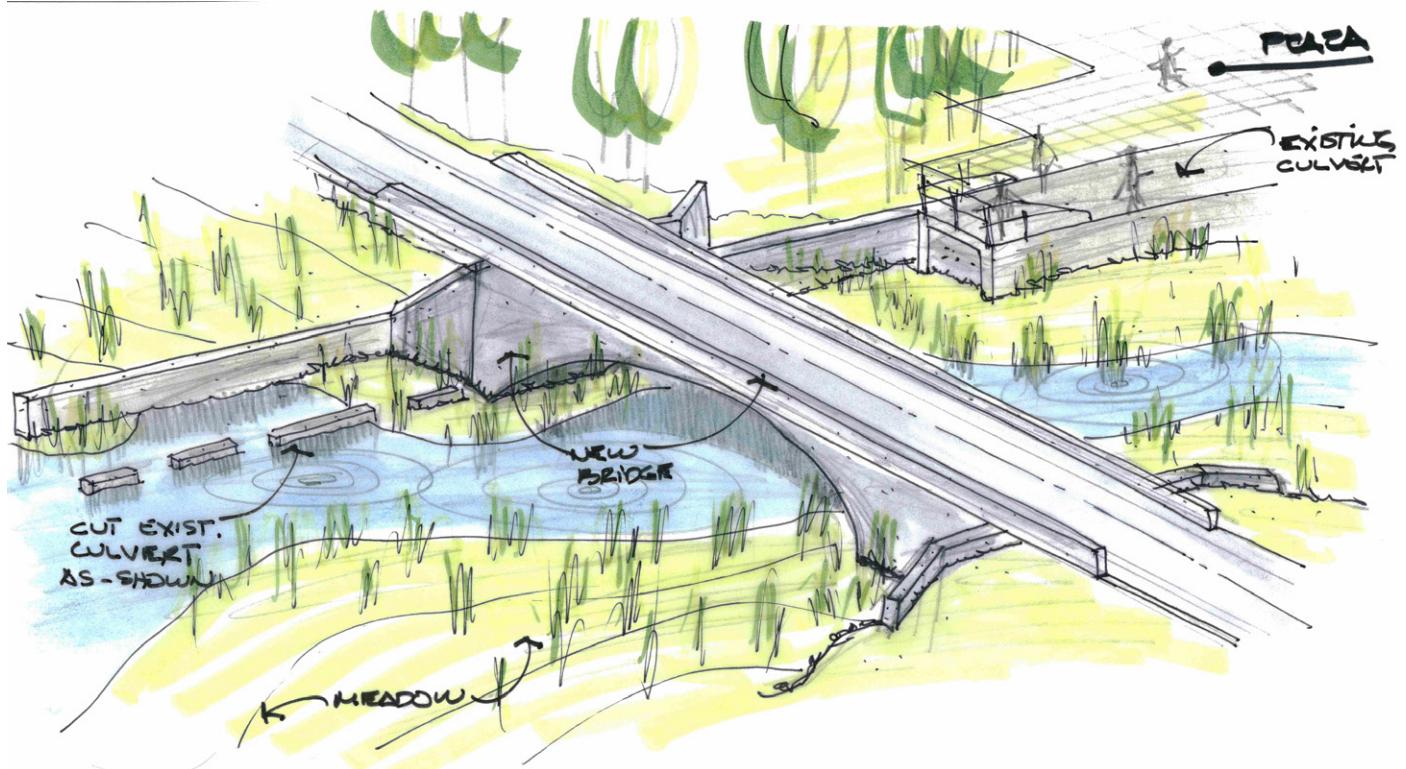


**Precast Arch System**

Manchester, KY. CONTECH Engineered Solutions



**Section E: Section Study of Bridge and Weir**  
Not-to-Scale



Aerial Sketch of Bridge and Weir Beyond



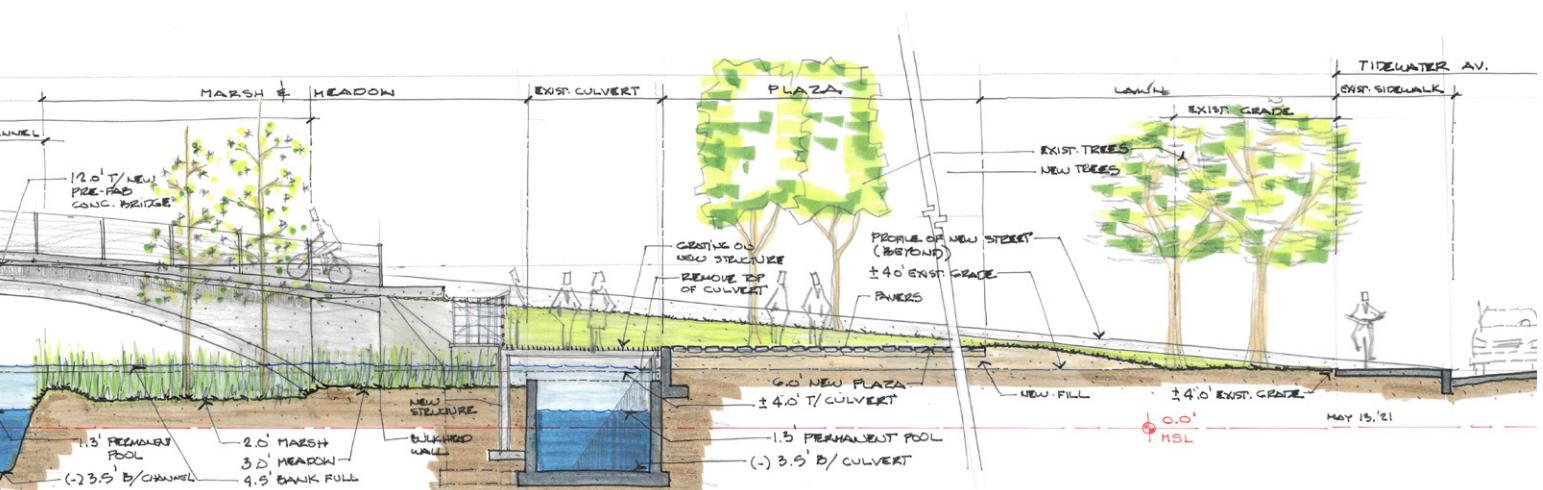
Minimal Steel Railings Maximize Views  
AMG Metals



Decorative Panels are Opportunity for Arts  
Laser Cut Cor-Ten Steel, Revamp Panels



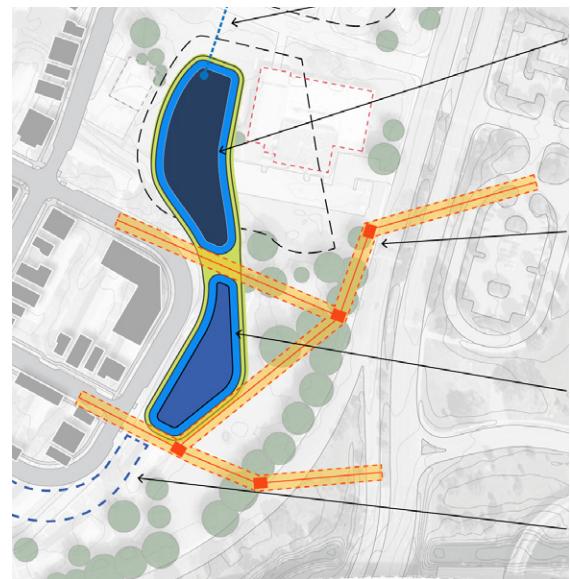
Expressive Bridge Geometry  
ipv Delft



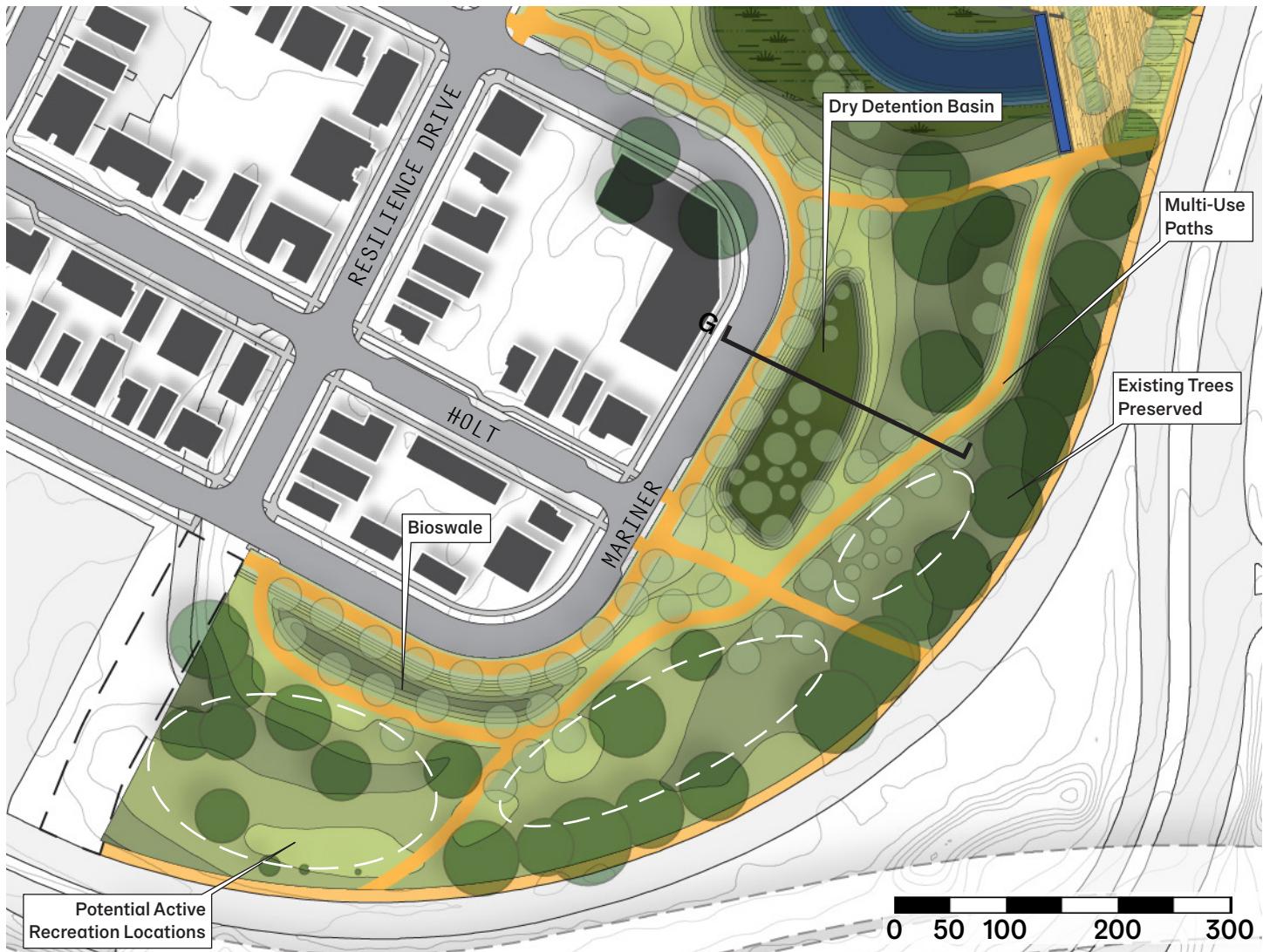
# Mariner Crescent

The preliminary design drivers of this zone were preservation of existing, mature oak trees, the excavation of the Phase 2 roads temporary sediment basins, the location of the Dominion Energy power duct bank corridors, and the existing land surface elevation.

Multi-use paths are located in the duct bank corridors, and are elevated to contain stormwater volumes, protecting Tidewater Drive. A large dry detention basin and bioswale, which receive runoff from the adjacent transformation area, are planted with native meadow grasses and trees. The remainder of the space, has significant natural beauty and character, with shady oak trees and lawns, and can be used for passive recreation. Open spaces between the trees, where buildings have been demolished, could house play spaces and hard courts.



**Dominion Energy Duct Banks and Phase 2 Sediment Basins**  
Incorporated in final design layout





### Existing Open Space

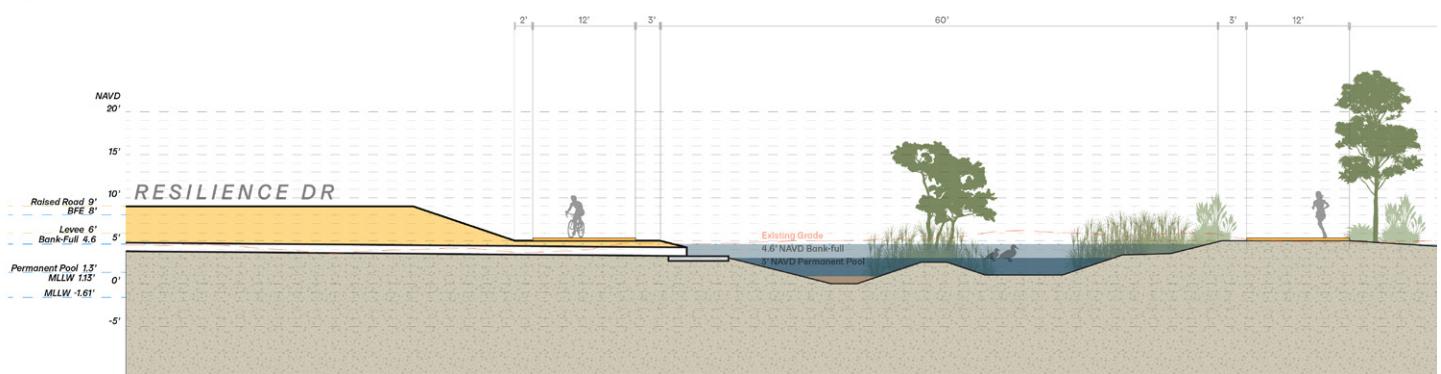
*Opportunity for water management or recreation*



**Large Stormwater Dry Detention Basin with Native Plantings**  
Botanic Gardens Bioswale, Cornell University, New York



**Paths and Berms**  
Hudsons Edge, New York. Reed Hildebrandt



**Section G: Section Study of Stormwater Detention**  
Not-to-Scale