SHAPING PUBLIC SPACE THROUGH RESILIENCY

Villanova Urban Stormwater Partnership
E&LP Associates
October 17, 2019

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E&LP

Presenter Profile
Villanova Urban Stormwater Partnership
October 17, 2019

Objective 1
Gain a holistic approach to resiliency strategic planning from both a physical and social infrastructure perspective

Objective 2
Define design and performance criteria for both physical infrastructure systems as well as community based social interdependencies

Objective 3
Identify the essential kit of parts for green stormwater infrastructure and other resilient and sustainable technologies

Objective 4
Understand the opportunities for incorporation and integration of these systems/technologies into the design of architectural and public space amenities

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Learning Objectives
Villanova Urban Stormwater Partnership
October 17, 2019

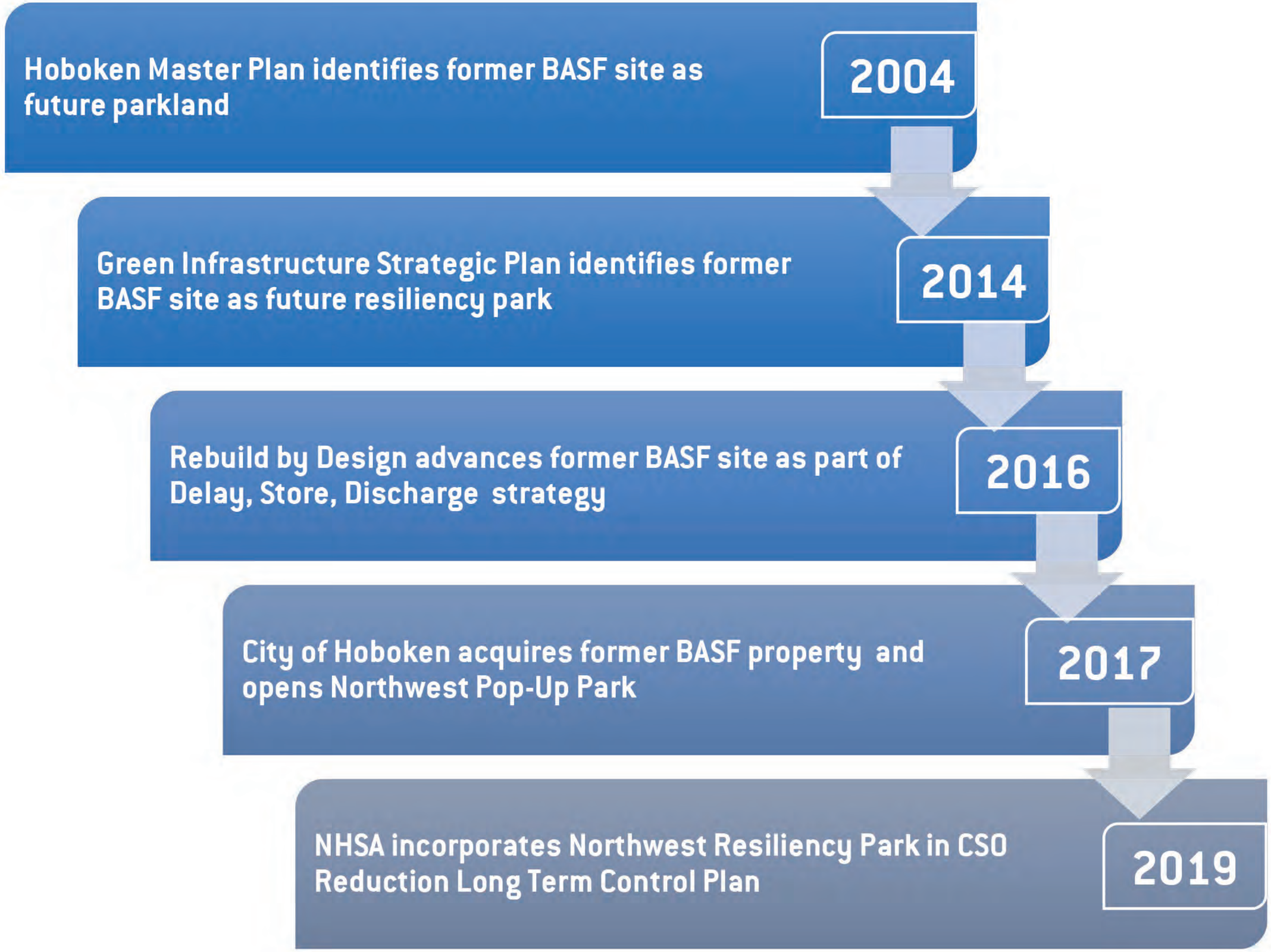
As growing communities transform into vibrant places where people live, work, and play, the public spaces supporting that growth must be just as dynamic while maintaining preparedness for the unknown and the unexpected. They must be both physically and socially resilient.

Hoboken Northwest Resiliency Park

Image Credit: E&LP Associates

Image Credit: OLIN

Gain a holistic approach to resiliency strategic planning from both a physical and social infrastructure perspective


Hoboken Master Plan identifies former BASF site as future parkland
2004
Green Infrastructure Strategic Plan identifies former BASF site as future resiliency park
2014
Rebuild by Design advances former BASF site as part of Delay, Store, Discharge strategy
2016
City of Hoboken acquires former BASF property and opens Northwest Pop-Up Park
2017
NHSA incorporates Northwest Resiliency Park in CSO Reduction Long Term Control Plan
2019

Map 4: Open Space Concept

RETENTION

CONSTRUCTED WETLANDS

SUBSURFACE STORAGE

DETENTION

GREEN ROOFS

RAINWATER HARVESTING

INFILTRATION

BIOSWALES

STORMWATER PLANTERS

Physical Infrastructure Planning

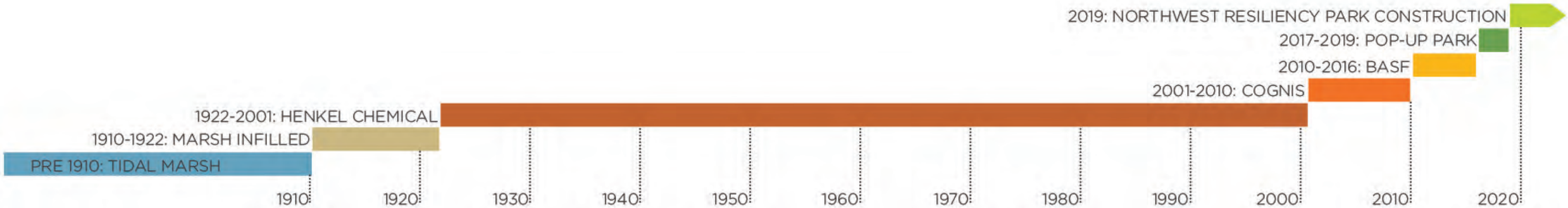


Figure 1.2.1 (Timeline of Development and Ownership)

Source: The New York Public Library Digital Collections

1897

Figure 1.2.2 (1897 photograph of Hoboken meadows)
Source: Rutgers University Community Repository

1890

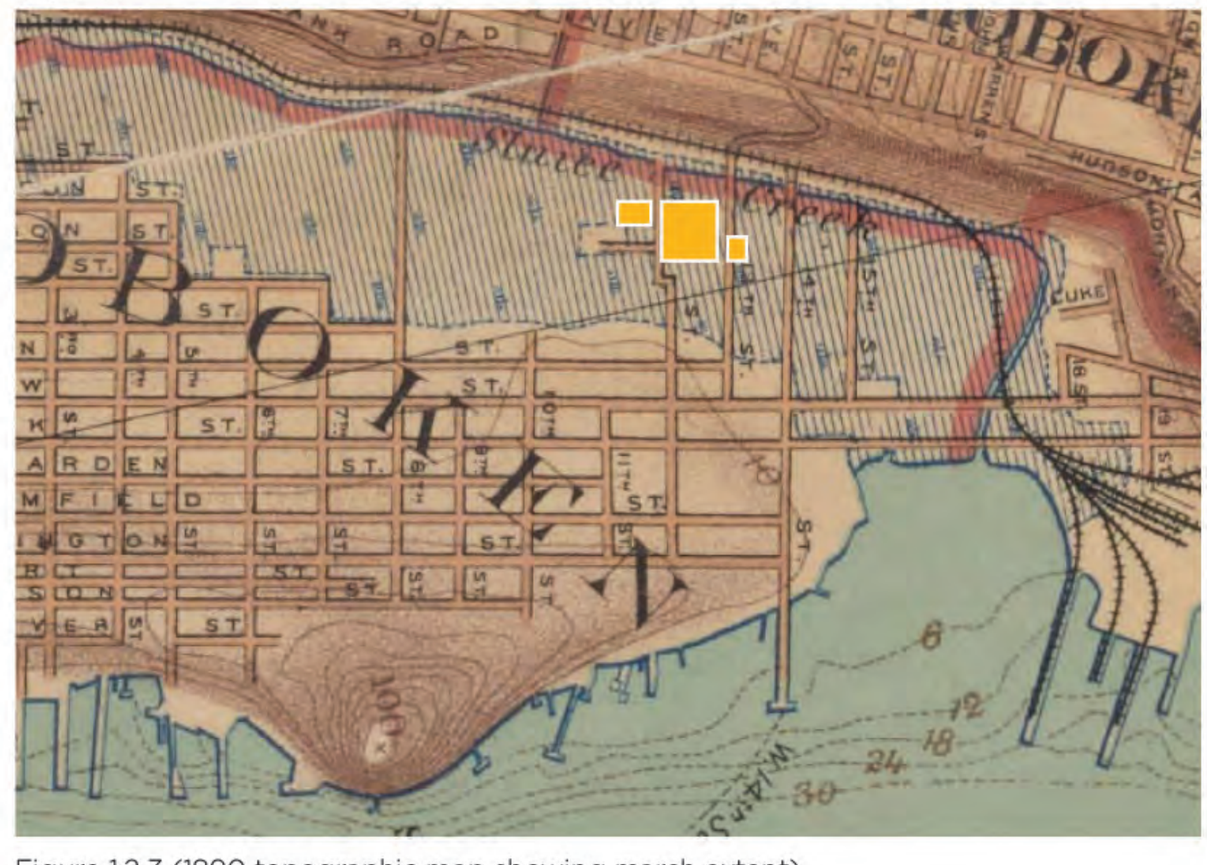


Figure 1.2.3 (1890 topographic map showing marsh extent)
Source: New York Public Library Digital Collections

1967

Figure 1.2.4 (1967 photograph of northwest Hoboken)
Source: Rutgers University Community Repository

1930

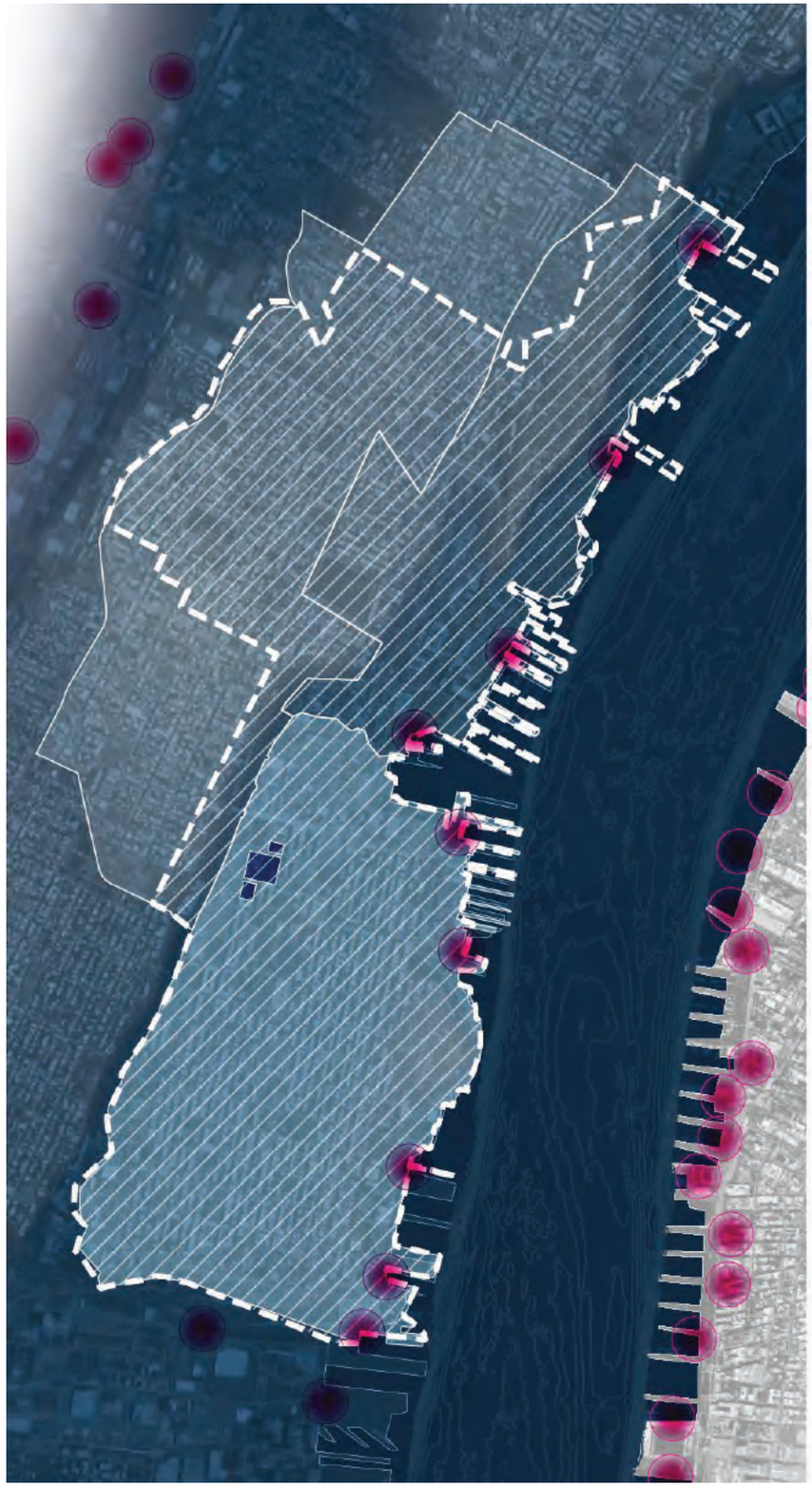
Figure 1.2.5 (1930 aerial image)
Source: New Jersey Geographical Information Network

2017

Figure 1.2.6 (2017 photograph of Pop-Up Park)

2015

Figure 1.2.7 (2015 aerial image)
Source: New Jersey Geographical Information Network



LEGEND

N
W

CSO DISCHARGE LOCATIONS

NHSA Service Area

LEGEND

- HWF SEWERSHED HWF
- H7 SEWERSHED 7
- H6 SEWERSHED 6
- H5 SEWERSHED 5
- H4 SEWERSHED 4
- H3 SEWERSHED 3
- H2 SEWERSHED 2
- H1 SEWERSHED 1

Image Credit: E&LP Associates

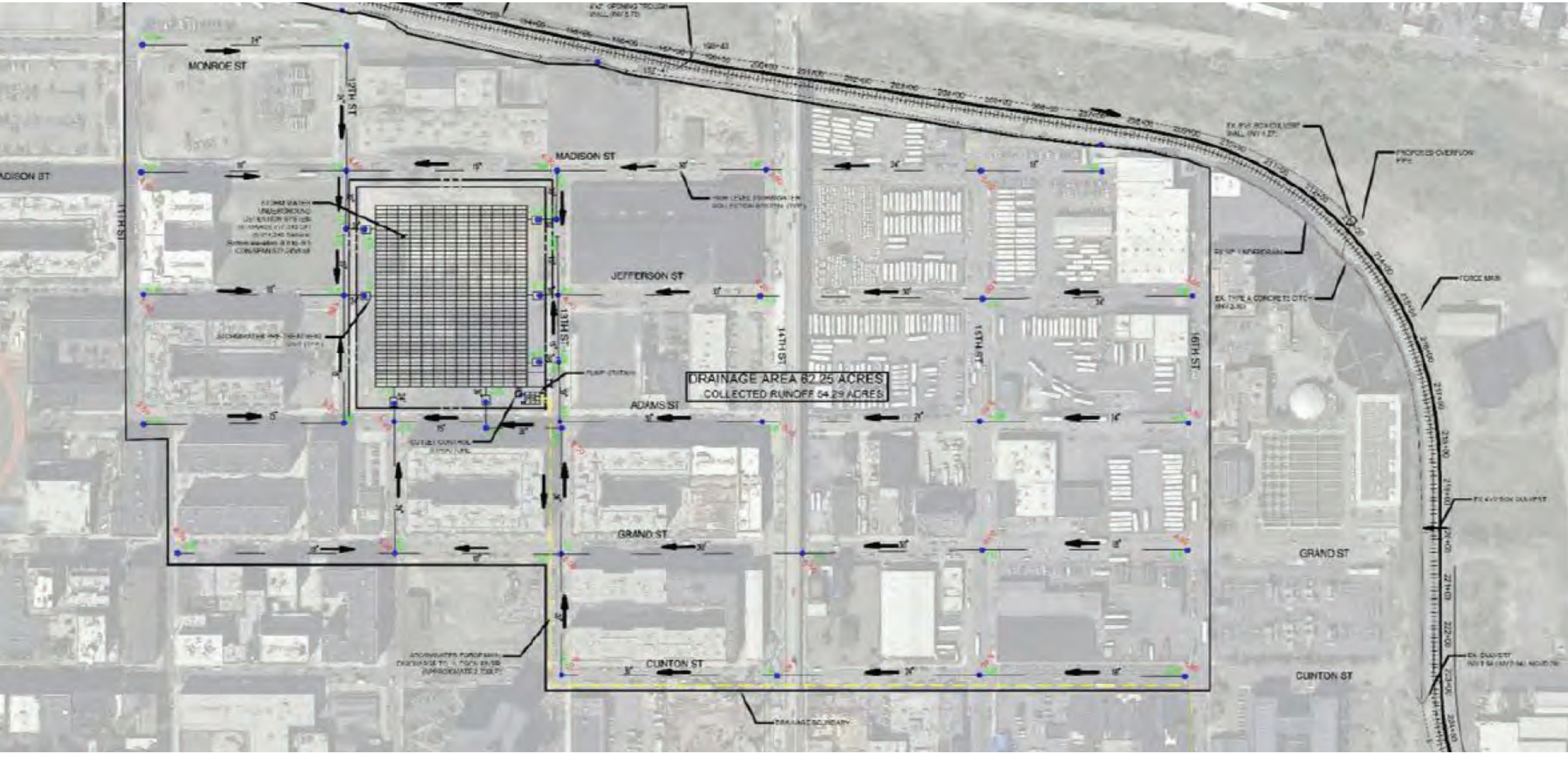


Image Credit: North Hudson Sewerage Authority

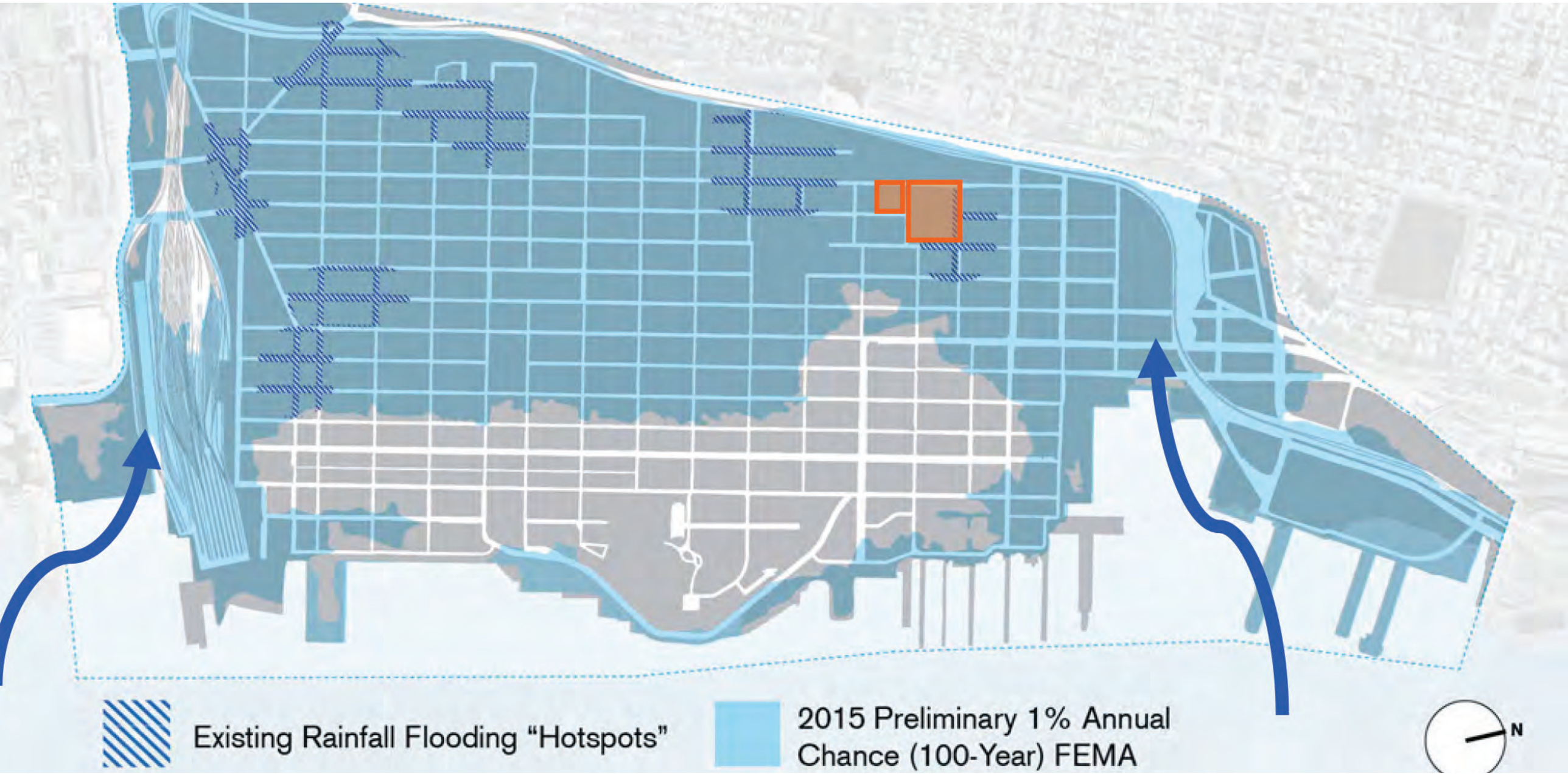


Image Credit: Rebuild By Design Hudson River Final Environmental Impact Statement

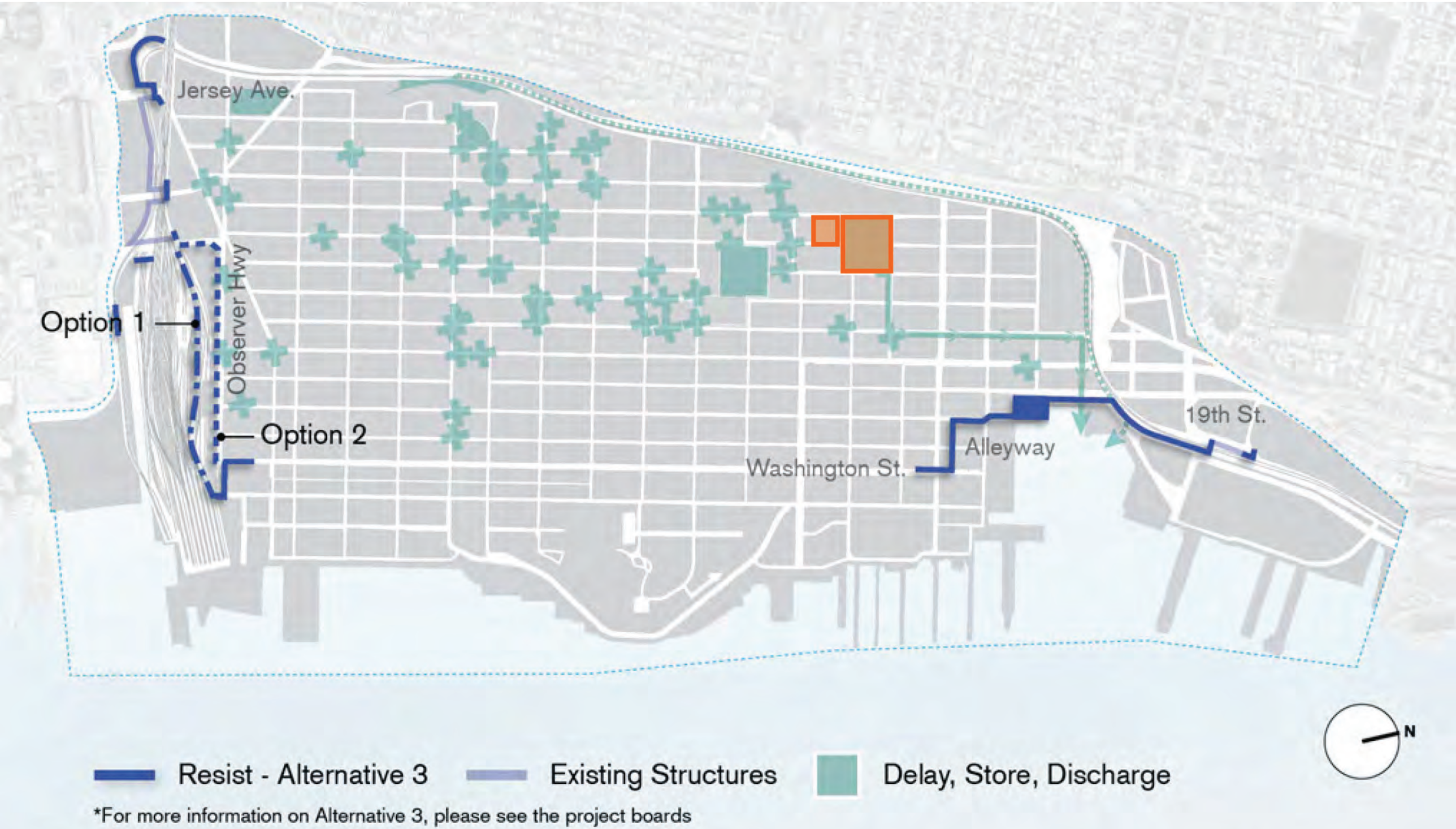


Image Credit: Rebuild By Design Hudson River Final Environmental Impact Statement

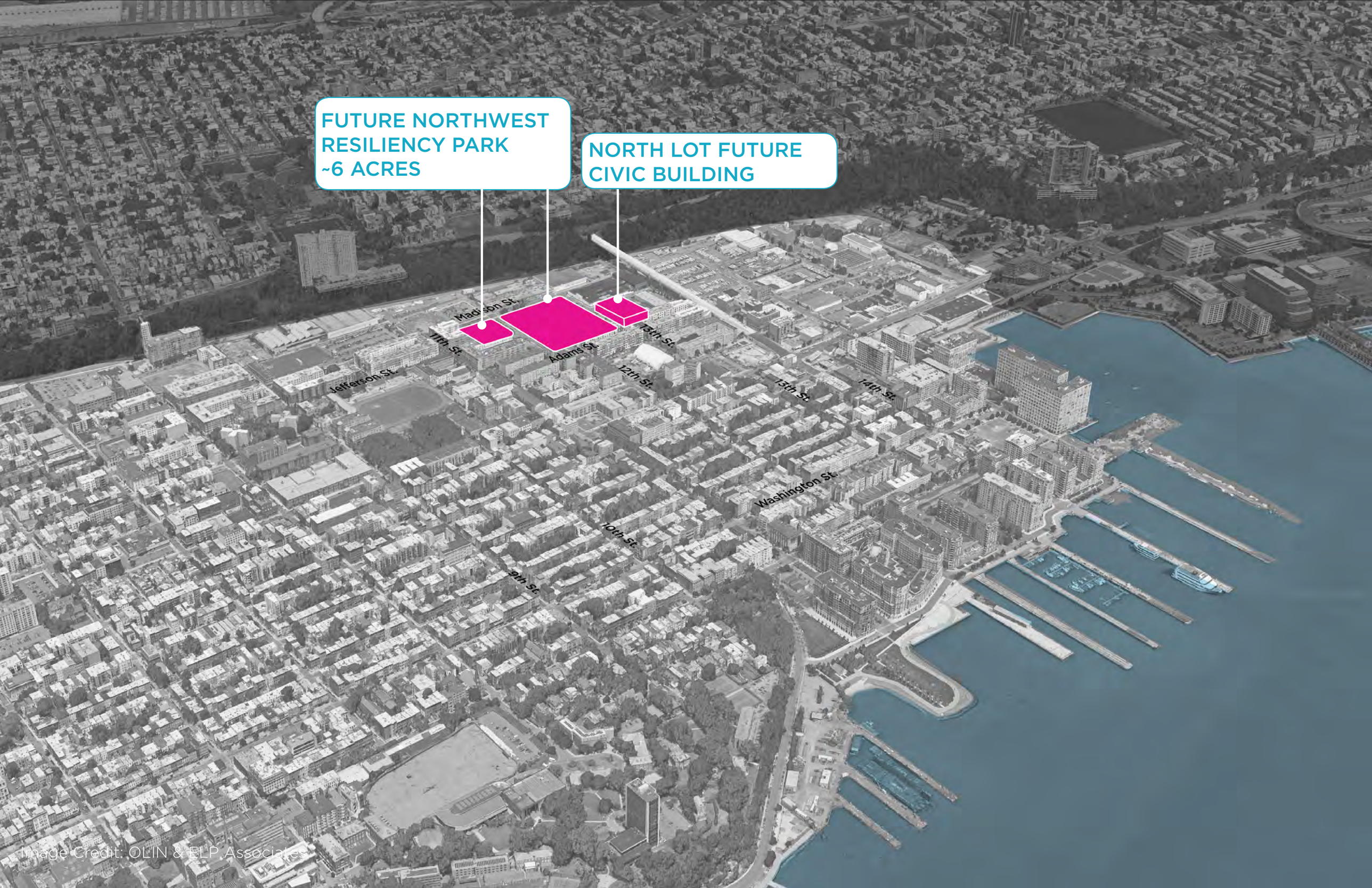


Image Credit: OLIN & ELP Associates

COMBINED SEWER SYSTEM AND FLOODING

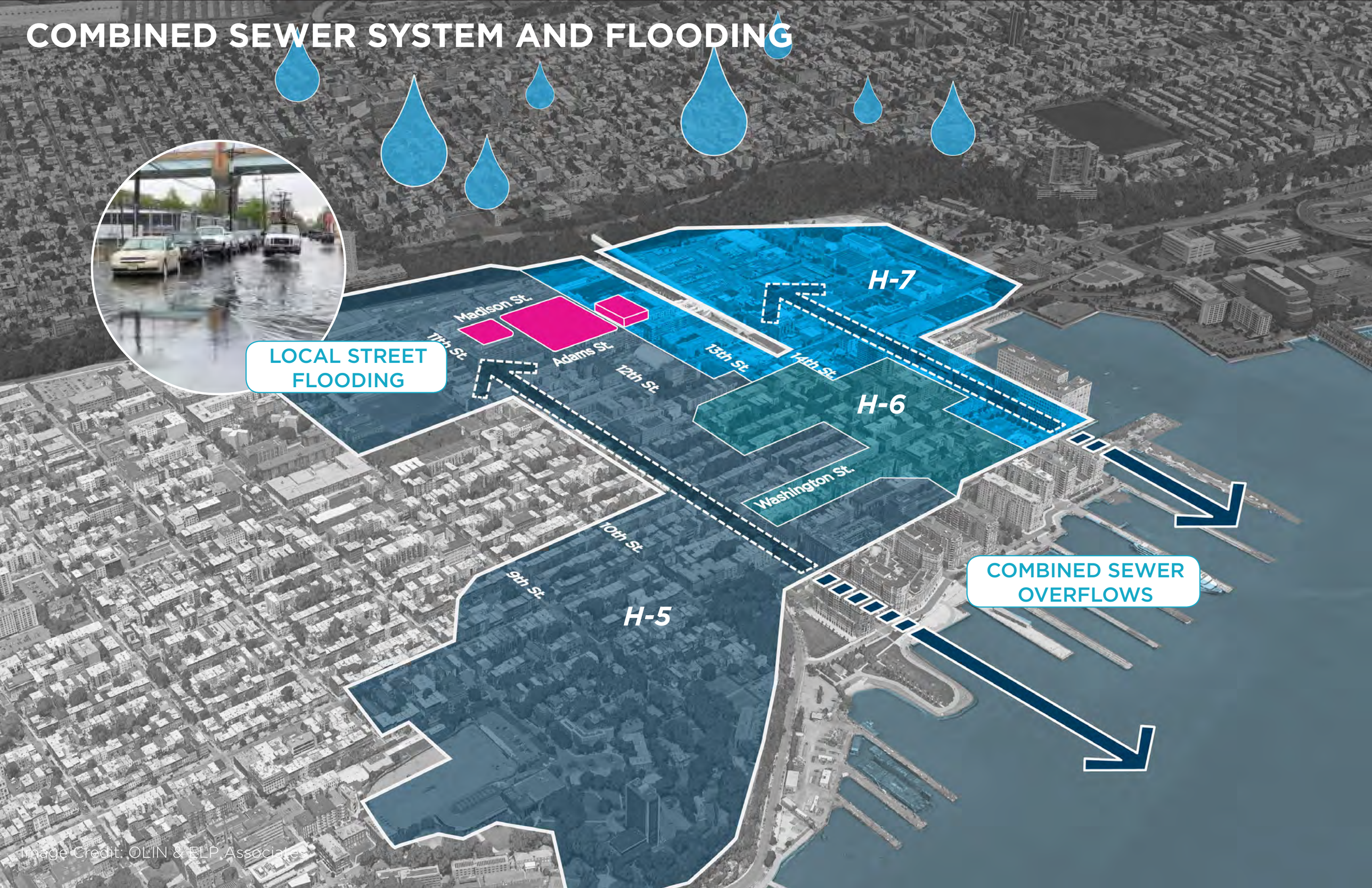


Image Credit: OLIN & ELP Associates

STORMWATER MANAGEMENT STRATEGIES

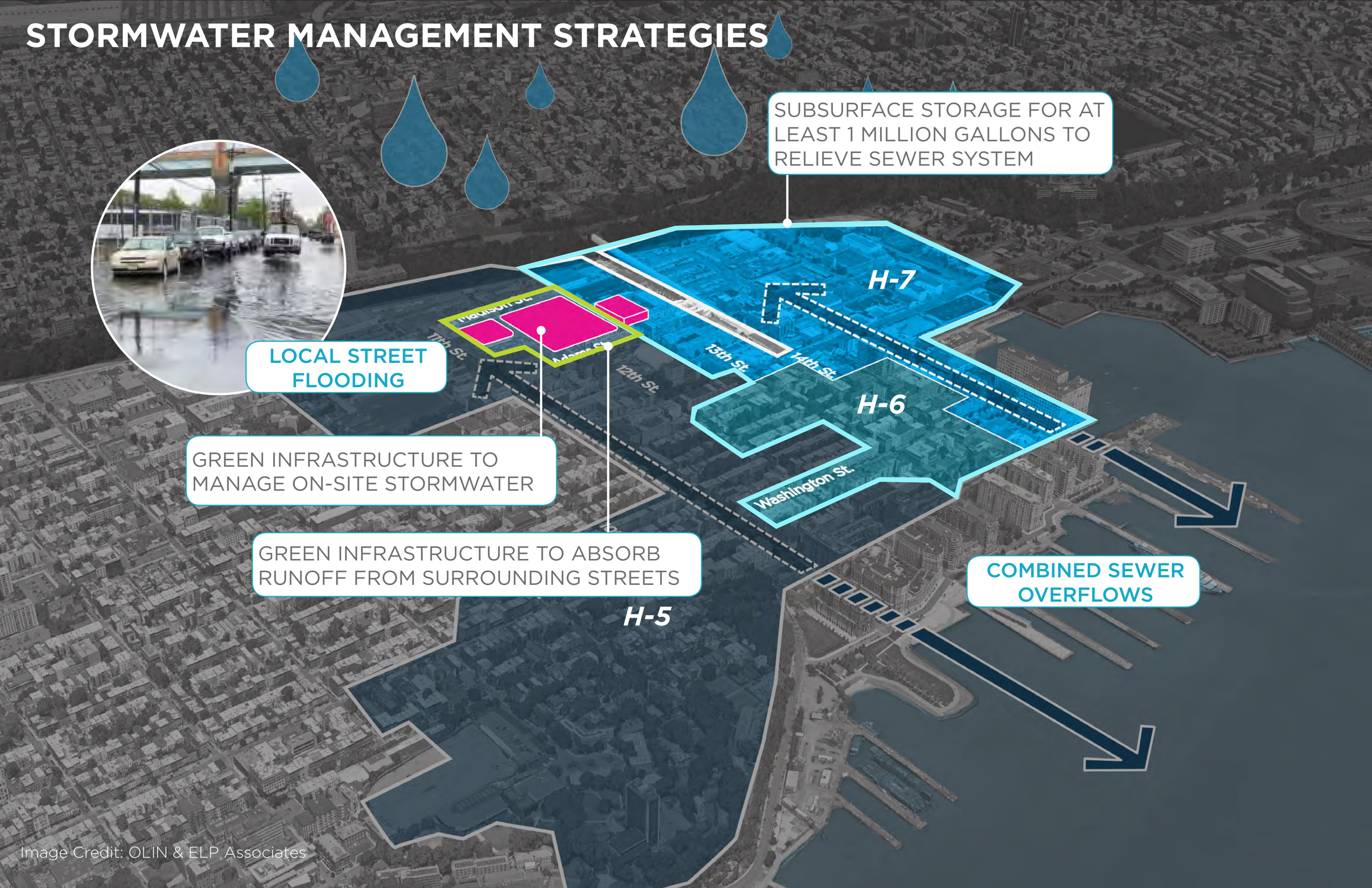


Image Credit: OLIN & ELP Associates

Social Infrastructure Planning

Image Credit: OLIN

Image Credit: OLIN

Image Credit: nArchitects

Image Credit: nArchitects

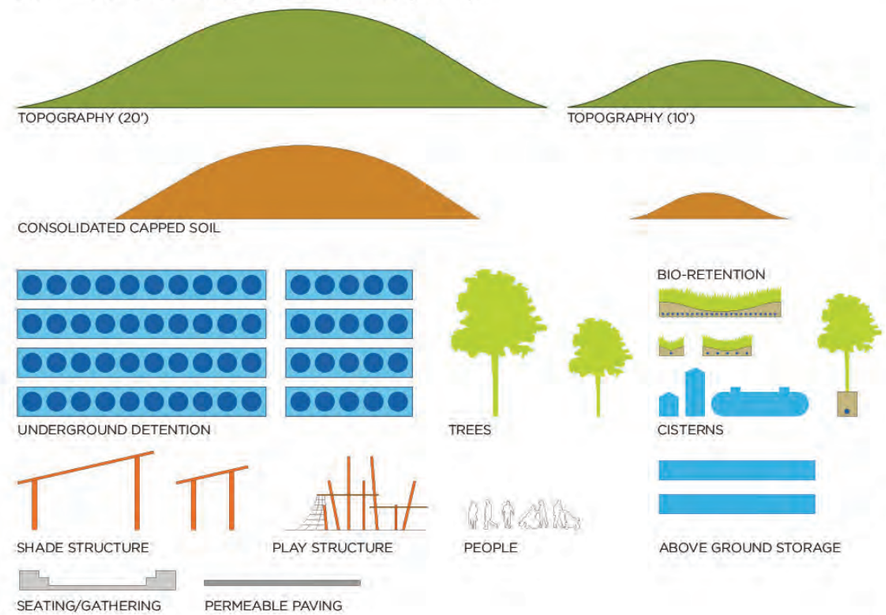
Image Credit: E&LP Associates

Image Credit: OLIN

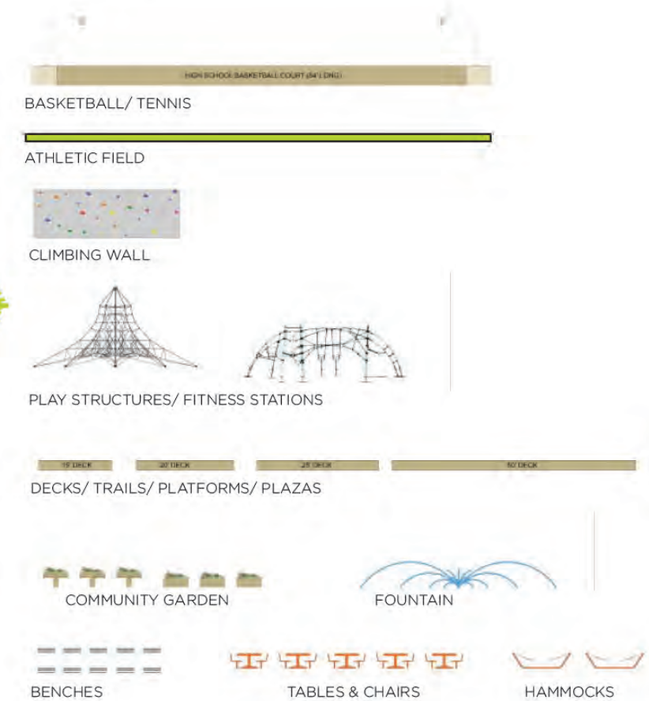
Image Credit: E&LP Associates

Image Credit: E&LP Associates

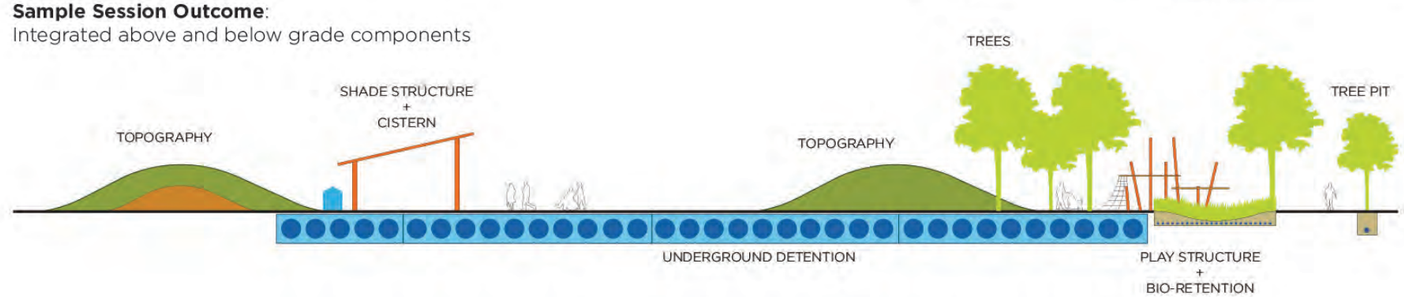
Sample Model pieces:
Stormwater Best Management Practices (BMPs)



Sample Model pieces:
Park Features



Sample Session Outcome:
Integrated above and below grade components



ONLINE SURVEY

WHAT FEATURES WOULD YOU LIKE TO SEE IN YOUR PARK?

BASIC AMENITIES

- TREES 727
- BATHROOMS 712
- SHADE STRUCTURES 659
- DRINKING FOUNTAINS 545
- SEATING 533
- BIKE PARKING 475
- FOOD/CAFE 510
- SWIMMING POOL 501
- LIGHTING 477
- NATIVE PLANTS 424
- FLEXIBLE EVENT SPACE 415
- SPRAY/ FOUNTAIN WATER FEATURE 409
- COMMUNITY GARDENS 400
- ATHLETIC FIELDS 389
- PLAY AREAS 382
- MULTI USE TRACK 370
- PICNIC/GRILL AREAS 367
- TRAILS 362
- FITNESS STATIONS 358
- PASSIVE SPACE 332
- DOG PARK 293
- MINI GOLF 295
- COMMUNITY CENTER 260

LOW DEMAND

- GAMES 237
- ROCK/NET CLIMBING 224
- SURFACE/ WADING WATER FEATURE 207
- BIKE RENTAL 194
- ENVIRONMENTAL EDUCATION 157
- CAR PARKING 132
- BLEACHERS 77

Must-Haves

NATURE
- Natural Elements
- Gardens
- Shade Trees
- Quiet escapes

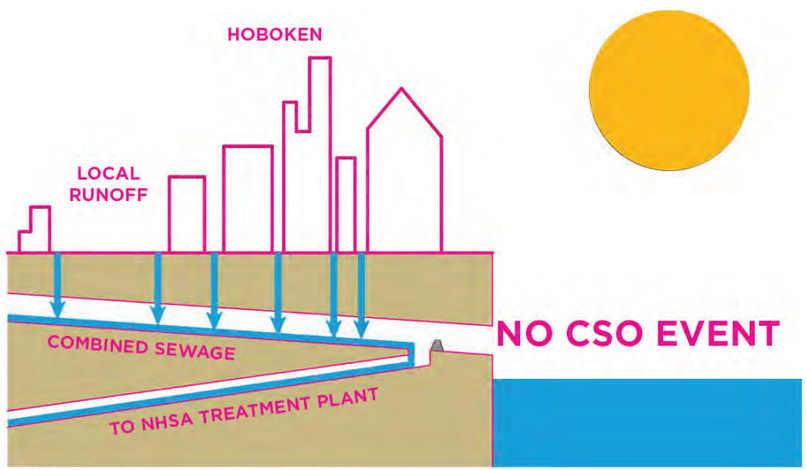
CULTURE
- Civic Terrace/Events
- Park Building/Cafe/ Community Room
- Flexible Open Space
- Comfort Amenities
- Safety

ATHLETICS/FITNESS
- Multi-use Athletic Field
- Fitness Loop & Equipment
- Basketball Court

PLAY
- Multi-generational/ All ages
- Accessible & Inclusive

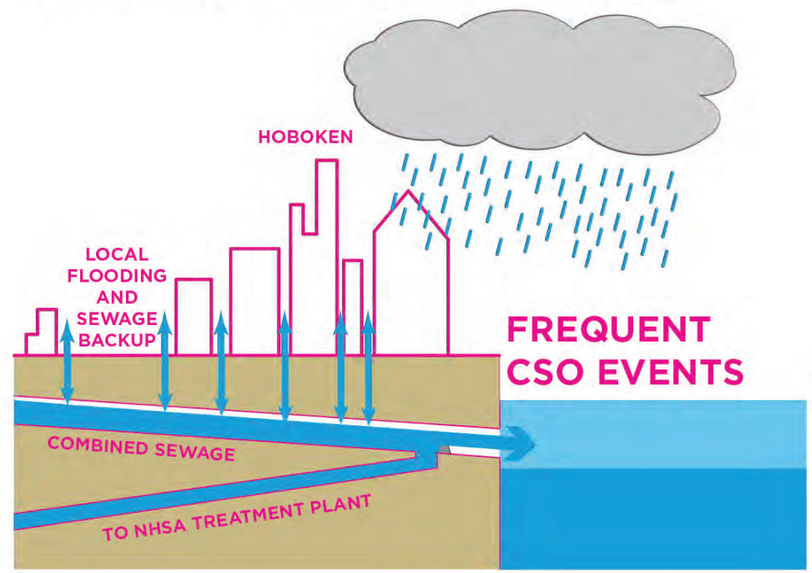
Define design and performance criteria for both physical infrastructure systems as well as community based social interdependencies

DRY WEATHER CONDITIONS

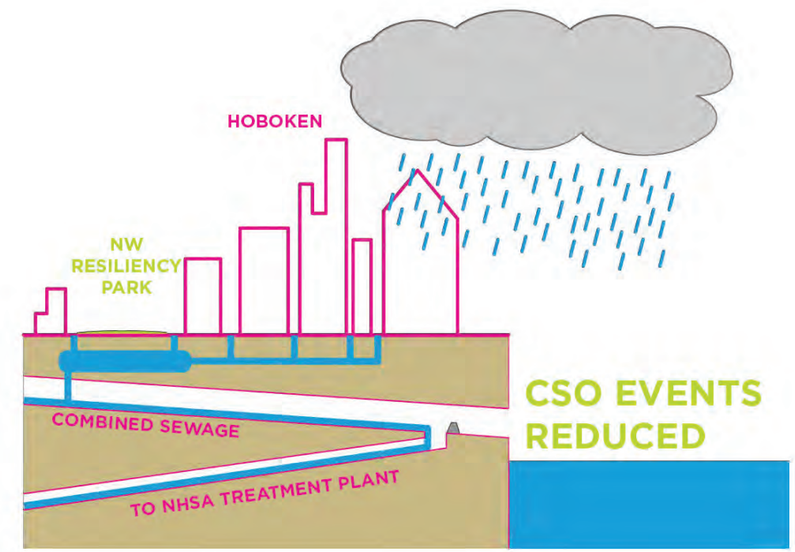


IN DRY WEATHER COMBINED SEWAGE IS CONVEYED TO THE NHSA TREATMENT PLANT BEFORE DISCHARGE.

WET WEATHER CONDITIONS



IN WET WEATHER COMBINED SEWAGE OVERFLOWS DIRECTLY TO THE HUDSON RIVER AND FLOODS LOCAL NEIGHBORHOODS.



ONE MILLION GALLONS OF STORAGE AT NORTHWEST RESILIENCY PARK WILL HELP REDUCE COMBINED SEWAGE OVERFLOWS AND LOCAL FLOODING.

Image Credit: E&LP Associates

1 Million Gallons of Stormwater Storage

SUB-SURFACE STORAGE OPTIONS

CHAMBERS/ARCHES/TANKS/PIPES

Concrete Chambers

Concrete Arches

Raintanks

Size:
3' to 6' deep

Units/Mill. Gallons:
Varies per technology

Surface Coverage
0.53 Ac to 1.0 Ac

Units/ 1.2 Mill. Gal
Varies per technology

Surface Coverage
0.63 Ac to 1.25 Ac

Evaluation Criteria:

- Space Efficiency
- Watertight Feasibility
- Cost
- Structural Support Requirements
- Buoyancy Requirements
- Spatial Configuration Flexibility
- Ease of Installation
- Ease of Maintenance
- Environmental Cap Impacts

DETENTION OPTION 1

CONCRETE CHAMBERS

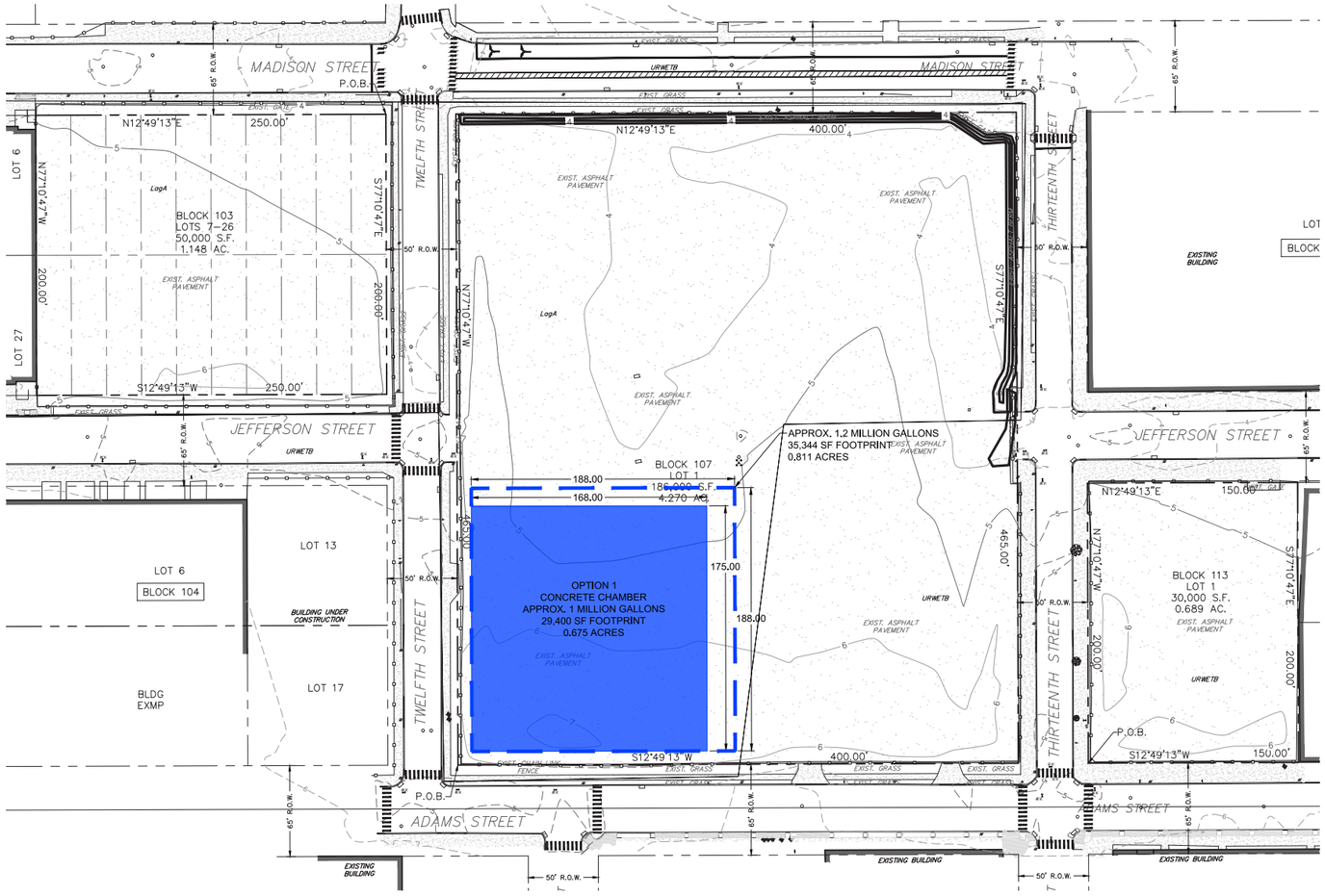


Image Credit: E&LP Associates

Size:
Height - 5'
Width - 1'-1" to 5'-8"

Units/Mill. Gallons:
234 Units

Surface Coverage
.67 Acres

Units/ 1.2 Mill. Gal
281 Units

Surface Coverage
.80 Acres

Cost
1 million gallon
$970,000
(including Material, Freight, and Installation)

1.2 Million gallon
$1,165,000
(including Material, Freight, and Installation)

Maintenance:
Inspection
- Should be done at least 2-3 days after most recent rain event
- Sediment pole to measure and document the amount of silt at each manhole location
- Inspect each pipe opening to ensure that the silt level or any foreign objects are not blocking pipes

Maintenance Procedures
- Completely cleaned whenever sediment occupies more than 30% of the original designed system volume
- Use vacuum truck to remove clarified water above the sediment layer
- Utilize manhole on opposite ends of StormTrap
- Use sewer jetting equipment on one end to force water in the same row from one end to the opposite side that contains the vacuum hose
- Repeat for each row

Weight/ Support/ Buoyancy:
- Heavy concrete – will most likely need support

Additional Features:
- Minimum 6" cover
- HS-20, HS-25, and fire truck loading
- Quick and efficient installation
- Durable, reinforced, high-strength concrete
- Option for watertight system
- Manufactured in a National Precast Concrete Association (NPCA) certified facility

DETENTION OPTION 2

STACKABLE RAINTANKS

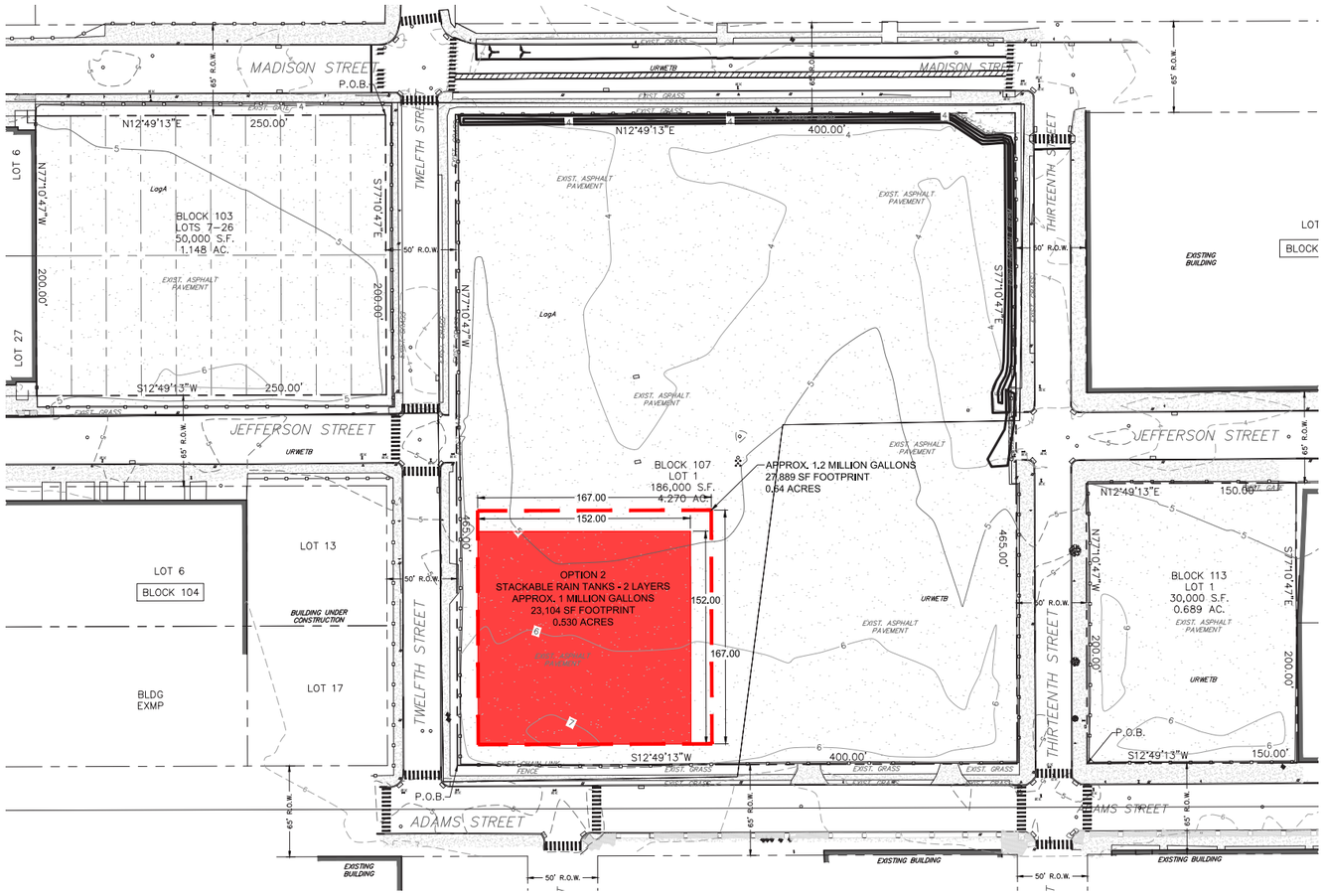


Image Credit: E&LP Associates

Size:
3' x 1.5' x 3' (L x W x H)

Units/Mill. Gallons:
10,208 Units

Surface Coverage
1.055 Acres (1 layer)
0.527 Acres (2 layer)

Units/ 1.2 Mill. Gal
12,250 Units

Surface Coverage
1.265 Acres (1 layer)
0.633 Acres (2 layer)

Cost
$440,000 (1 Mill. Gal)
$528,000 (1.2 Mill. Gal)

Maintenance

Inspection

- Inspect all observation ports, inflow, and outflow connections and discharge areas
- Identify and log any sediment and debris accumulation, system backup, or discharge rate changes
- If there is a sufficient need for cleanout, contact a local cleaning company for assistance

Cleaning

- Using a vacuum pump truck, evacuate debris from the inflow and outflow points
- Flush the system with clean water, forcing debris from the system
- Repeat until no debris is evident

Weight/Support/Buoyancy:

- Each unit 33.1 lbs
- 1-million-gallon system 337,893 lbs = 169 tons
  - One layer = 7.56 lb/SF
  - Two layer = 14.71 lb/SF
- 1.2-million-gallon system 407,472 lbs = 203 tons
  - One layer = 7.39 lb/SF
  - Two layer = 14.78 lb/SF
- Tie down system required for buoyancy

Additional features:

- Option for watertight system
- Utilized for detention, infiltration, capture, and reuse
- Configured in any shape and location
- High-void (97%), high-strength, affordable
- Installed storage assumes 6" stone below, 12" stone above (40% porosity)
- Require minimum cover of 24" for load rating
- Made of PVC columns and polypropylene (PP) side panels
- Designed to resist loads calculated in accordance with AASHTO Load and Resistance Factor Design Bridge Design manual
- Adequate resistance factor for HS-20 and HS-25 loads

DETENTION OPTION 3

PIPES + GRAVEL BED

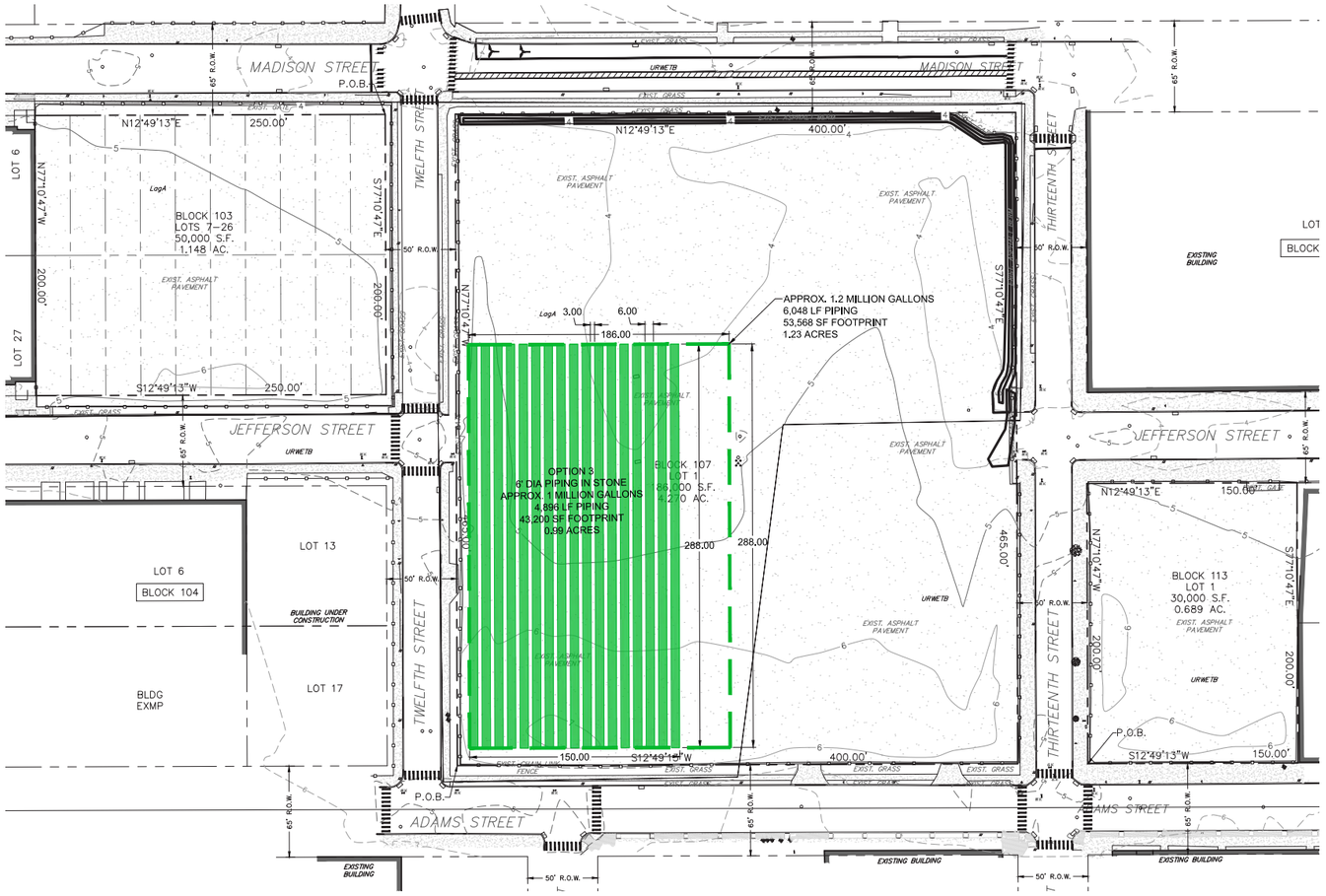


Image Credit: E&LP Associates

Size:
Pipe Diameter: 6'

Units/Mill. Gallons:
4,900 LF Pipe

Surface Coverage
1.0 acres

Units/ 1.2 Mill. Gal
6,000 LF Pipe

Surface Coverage
1.25 acres

Cost
Pending

Maintenance:
- Manhole riser sections with ladders can facilitate any access and scheduled maintenance

Weight/Support/Buoyancy:
- Approximately 42.9 lbs/ft
- Total weight 1-million-gallon system: 210,038 lbs = 105 tons
- Total weight 1.2-million-gallon system: 259,459 lbs = 130 tons

Additional Features:
- Watertight fit to project requirements
- Minimum cover 1'
- Steel Reinforced (80 ksi) Polyethylene Technology
- Provides maximum load carrying capabilities with allowable cover limits (30-50')
- In accordance with ASTM F2562 and AASHTO MP-20
- Strength does not diminish over time or temperature
- Resistant to corrosive effluent
- Available with soil tight, steel reinforced high performance, and welded coupler joint options

DETENTION OPTION 4

CONCRETE ARCHES

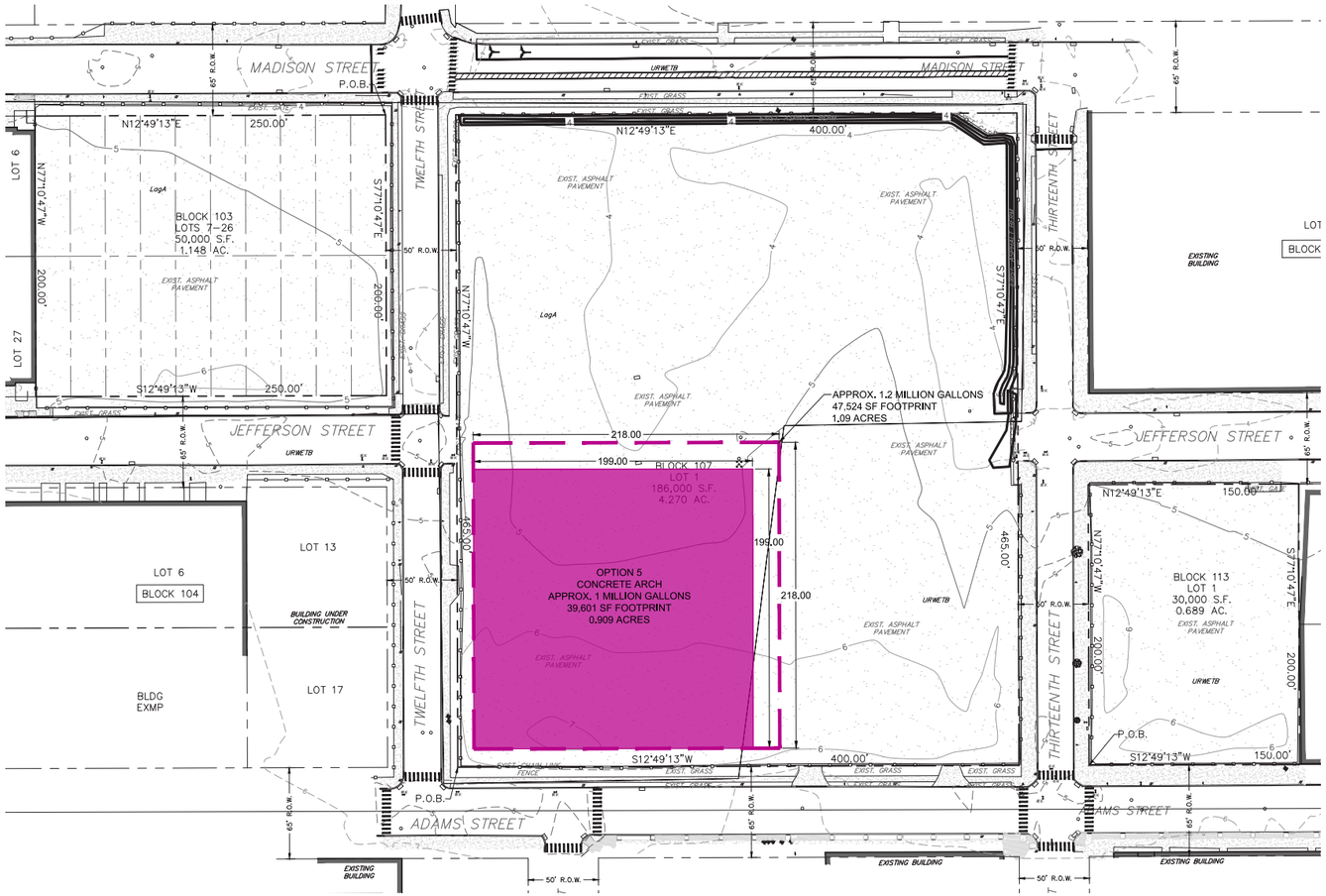


Image Credit: E&LP Associates

Size:
8' x 20' (LxW)
4'-8" Ht

Units/Mill. Gallons:
250 units

Surface Coverage
0.9 acres

Units/ 1.2 Mill. Gal
280 LF

Surface Coverage
1.1 acres

Cost
Pending

Maintenance:

Installation
- With proper excavation and prepared base – one unit can be set every 5 minutes
- 50,000 CF of storage per day
- Including cover and backfill

Inspection
- Frequency of inspections vary on local site conditions
- Visual inspection recommended annually
- Depth of sediment accumulates to 4 inches – cleanout is recommended

Maintenance
- Provides worker access from distribution boxes that extend from grade to the inside of the installed arch
- Removal of sediment and debris from inside the structure
- Cleanout recommended via vacuum truck
- Manhole riser sections with ladders can facilitate any access and scheduled maintenance

Weight/Support/Buoyancy:
- 1-million-gallon storage system
  4,818,446 lbs = 2409 tons
- 1.2-million-gallon storage system
  5,782,128 lbs = 2,891 tons

Additional Features:
- Option for watertight system
- Minimum cover: 12" to final grade
- Loading: HS-25 load rating
- Minimum 5,000 psi compressive strength
- Best applied to sites with restrictions such as
  High groundwater tables
  Minimum separation between the top of the under ground structure and the finished grade
  Shallow invert elevations

ANALYSIS PROCESS

	SPACE EFFICIENCY	WATERTIGHT FEASIBILITY	COST	STRUCTURAL SUPPORT REQUIREMENTS	BUOYANCY REQUIREMENTS	SPATIAL CONFIGURATION FLEXIBILITY	EASE OF INSTALLATION	EASE OF MAINTENANCE	ENVIRONMENTAL CAP IMPACTS
CONCRETE CHAMBERS	+++	+++	++	+	+++	++	+++	+++	++
STACKABLE RAINTANKS	+++	++	+++	+++	+	+++	++	++	++
PIPE + GRAVEL BED	++	++	++	++	++	+	++	++	++
CONCRETE ARCHES	++	+++	++	+	+++	++	+++	+++	++
SURFACE STORAGE	+	++	++	+++	+++	+++	++	+	+

+ *Suboptimal*

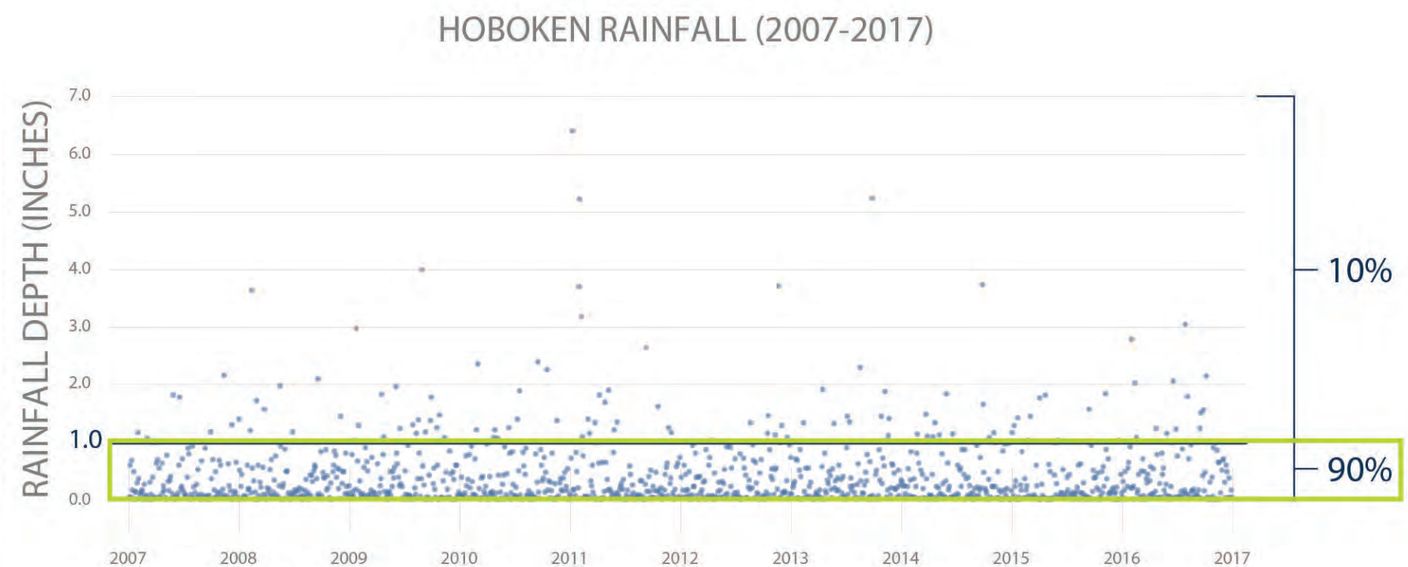
++ *Average*

+++ *Optimal*

Image Credit: E&LP Associates

Reduce Nuisance Flooding

Image Credit: E&LP Associates



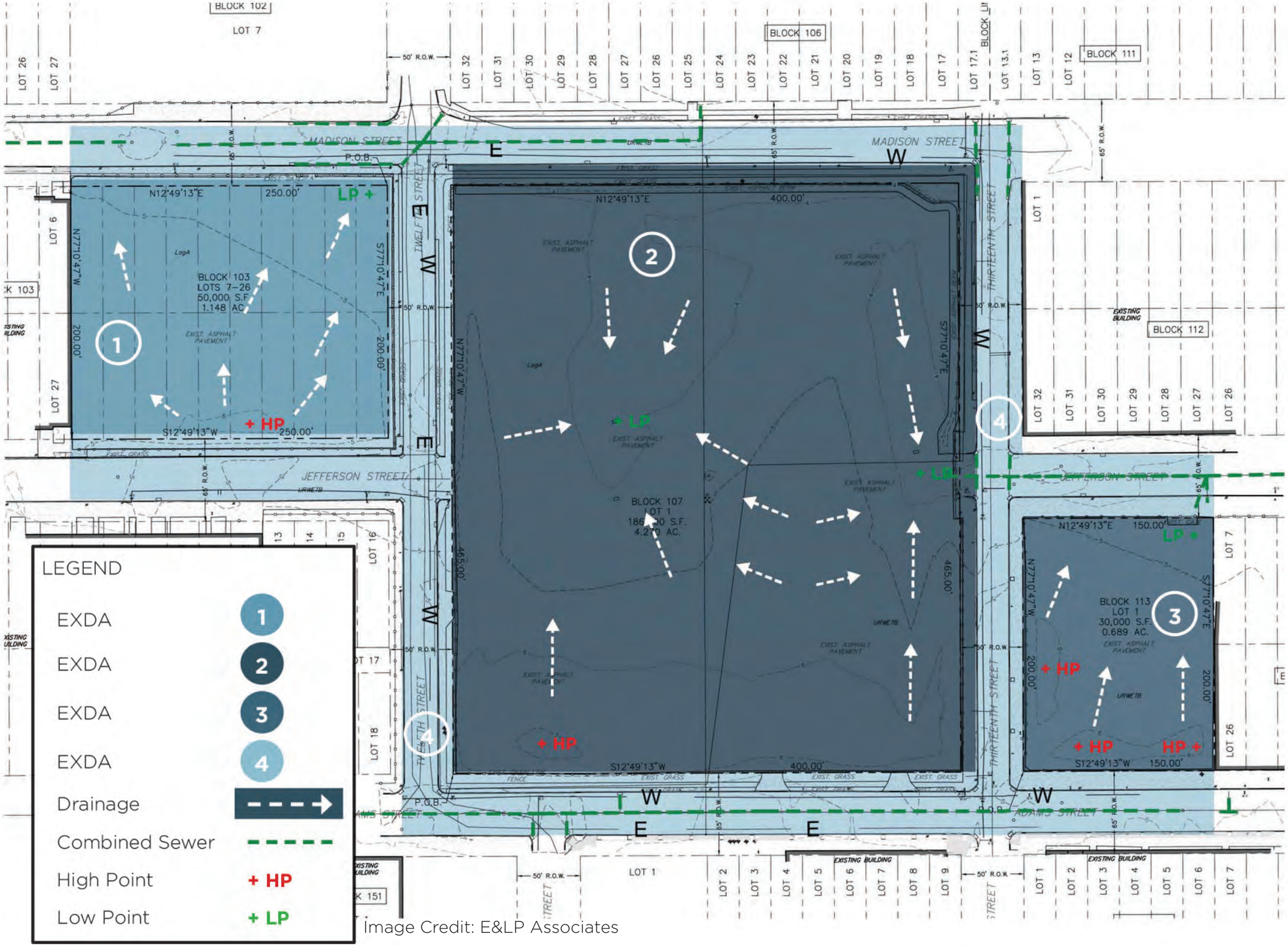


Image Credit: E&LP Associates

TABLE 2.1

Storm Duration	3 month Storm	1 Year Storm	2 Year Storm	10 Year Storm	100 Year Storm
24 hr	1.70 in	2.73 in	3.30 in	4.97 in	8.14 in

TABLE 2.2

Drainage Area Name	3-mn Peak Flow (cfs)	3-mn Volume (cf)	1-yr Peak Flow (cfs)	1-yr Volume (cf)	2-yr Peak Flow (cfs)	2-yr Volume (cf)	10-yr Peak Flow (cfs)	10-yr Volume (cf)	100-yr Peak Flow (cfs)	100-yr Volume (cf)
EXDA B103 L 7-26	1.80	6,168	3.03	10,683	3.68	13,095	5.79	21,009	8.97	32,979
EXDA B 107 L1	6.69	22,901	11.25	39,668	13.66	48,622	21.51	78,008	33.32	122,453
EXDA B 113 L1	1.08	3,701	1.82	6,410	2.21	7,857	3.48	12,606	5.38	19,787
EXDA Adjacent ROW	5.59	19,053	9.59	33,551	11.72	41,347	18.67	67,044	29.13	106,049
EXDA	**15.16**	**51,822**	**25.69**	**90,313**	**31.26**	**110,921**	**49.45**	**178,667**	**76.81**	**281,268**

Image Credit: E&LP Associates

Runoff Rate Comparison
TABLE 2.3

Comparing EXDA Block 103 Lot 7-26 to Required Reduction Factors

Storm	Pre-development Runoff	Storm Required Reduction Factors	Allowable Runoff
2-year	3.68 CFS	50%	<1.84 CFS
10-year	5.79 CFS	75%	<4.34CFS
100-year	8.97 CFS	80%	<7.176 CFS

Runoff Rate Comparison
TABLE 2.4

Comparing EXDA Block 103 Lot 7-26 to Required Reduction Factors

Storm	Pre-development Runoff	Storm Required Reduction Factors	Allowable Runoff
2-year	13.66 CFS	50%	<6.83 CFS
10-year	21.51 CFS	75%	<16.13 CFS
100-year	33.32 CFS	80%	<26.66 CFS

Runoff Rate Comparison
TABLE 2.5

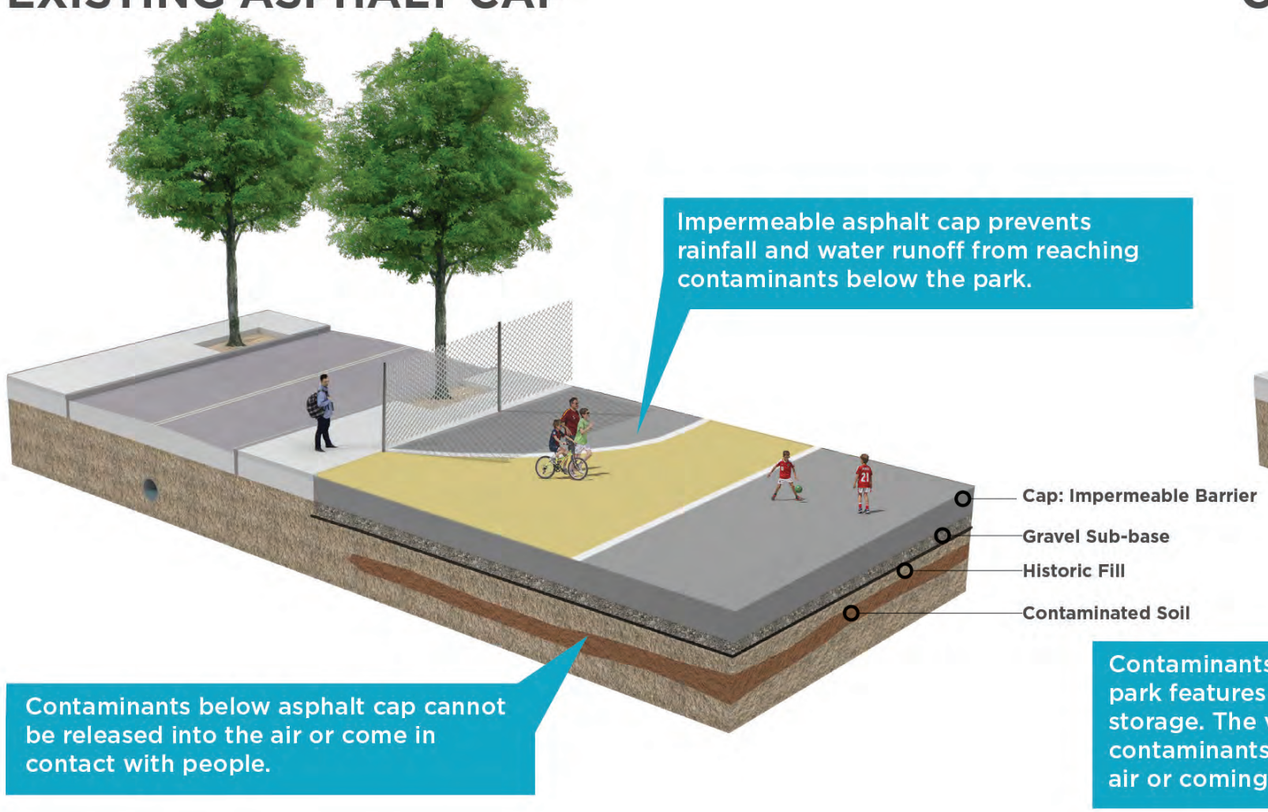
Comparing EXDA Block 103 Lot 7-26 to Required Reduction Factors

Storm	Pre-development Runoff	Storm Required Reduction Factors	Allowable Runoff
2-year	2.21 CFS	50%	<1.12 CFS
10-year	3.48 CFS	75%	<2.61 CFS
100-year	5.38 CFS	80%	<4.30 CFS

Image Credit: E&LP Associates

Balance Cut-Fill

EXISTING ASPHALT CAP



CONSOLIDATION & VEGETATIVE CAP

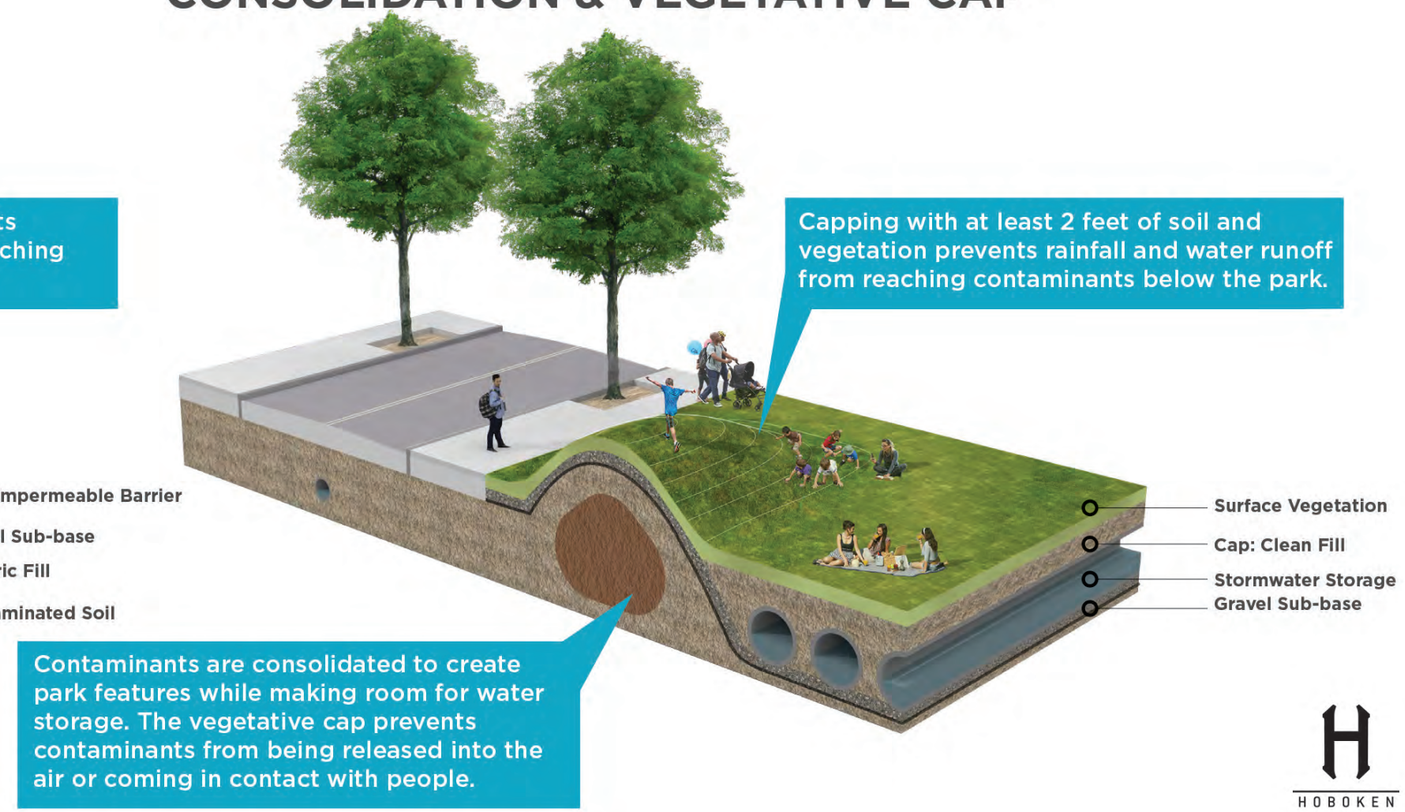


Image Credit: E&LP Associates & OLIN

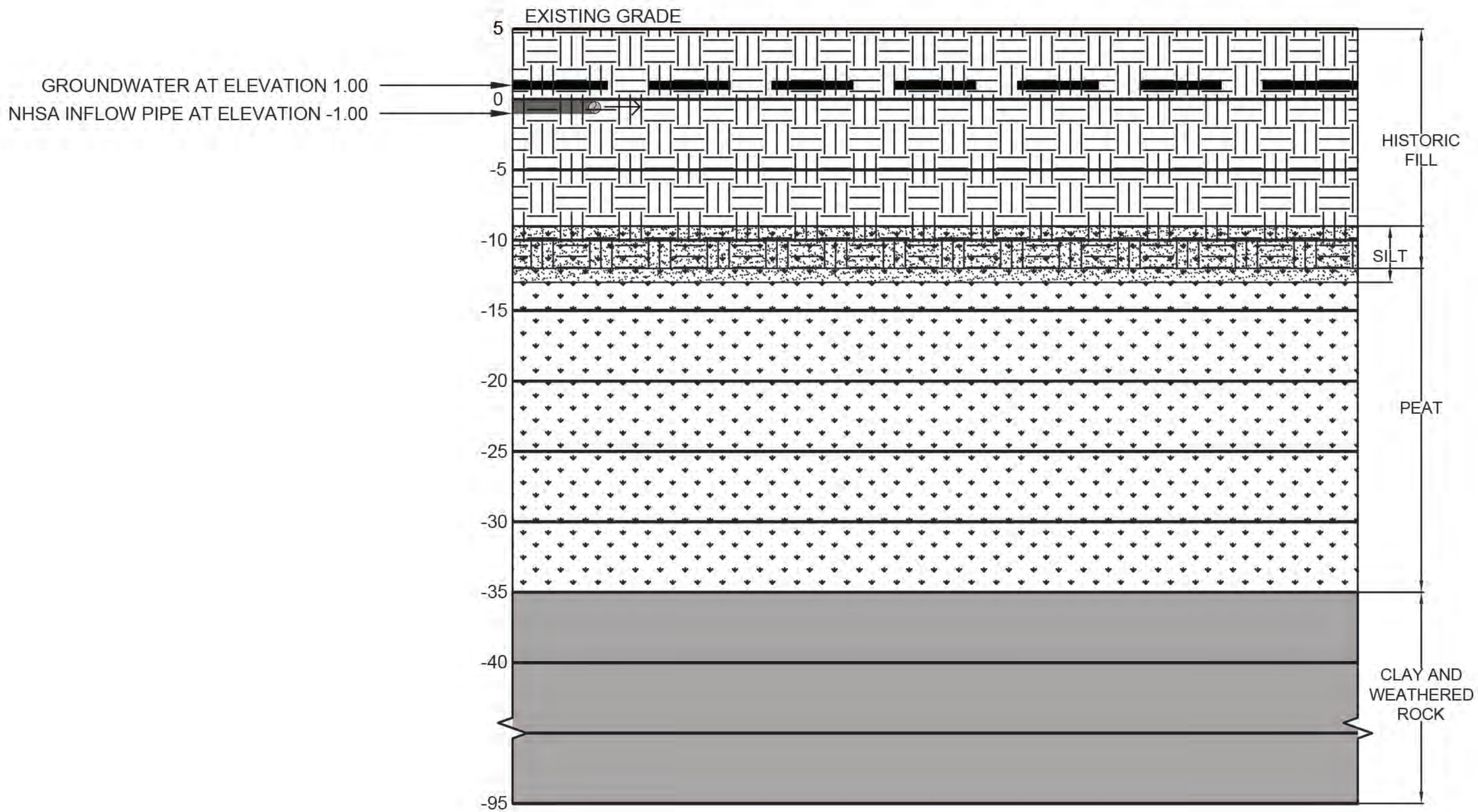


Image Credit: E&LP Associates

FLOOD PROOFING

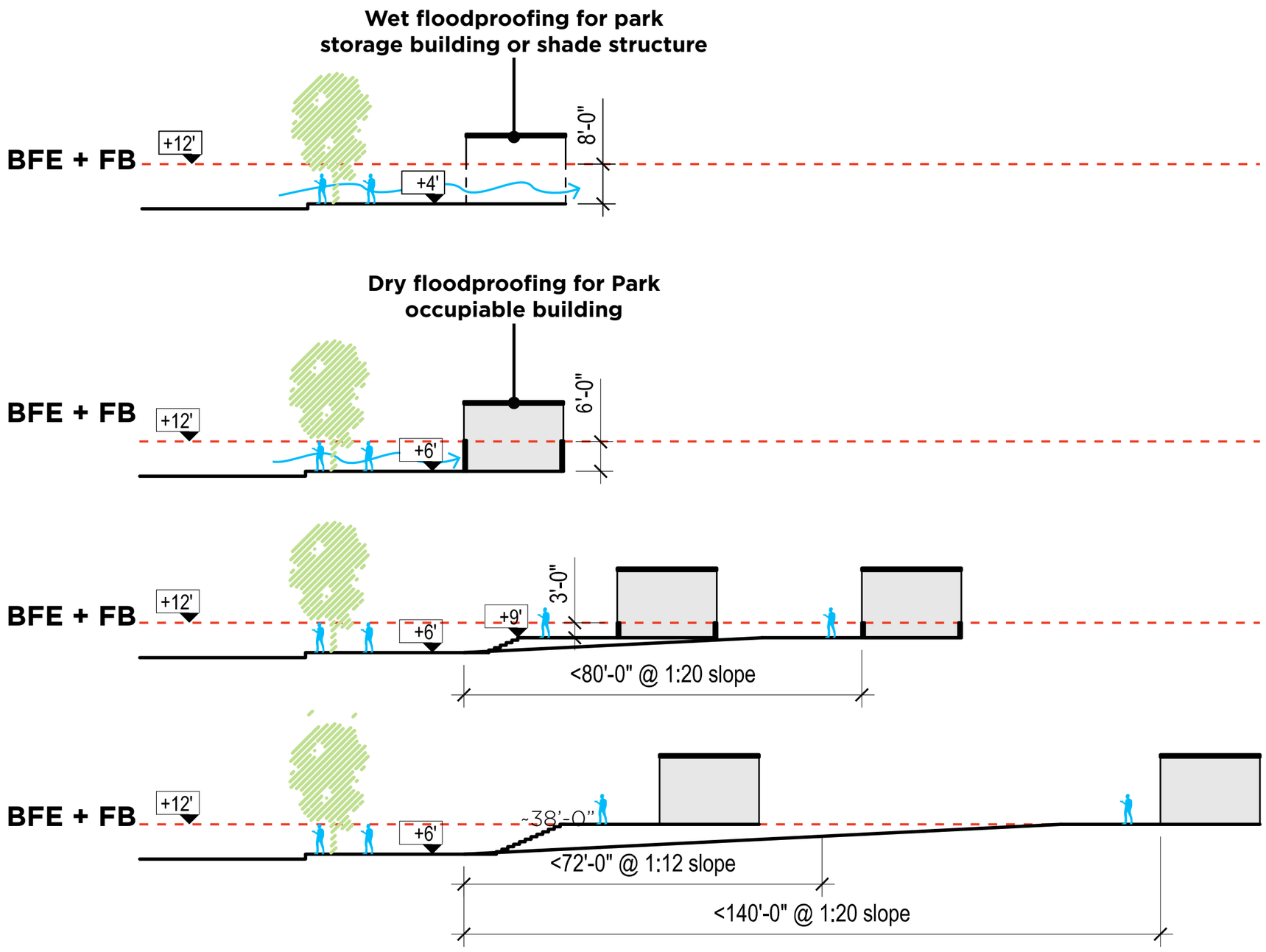


Image Credit: nArchitects

DESIGN FLOOD ELEVATION

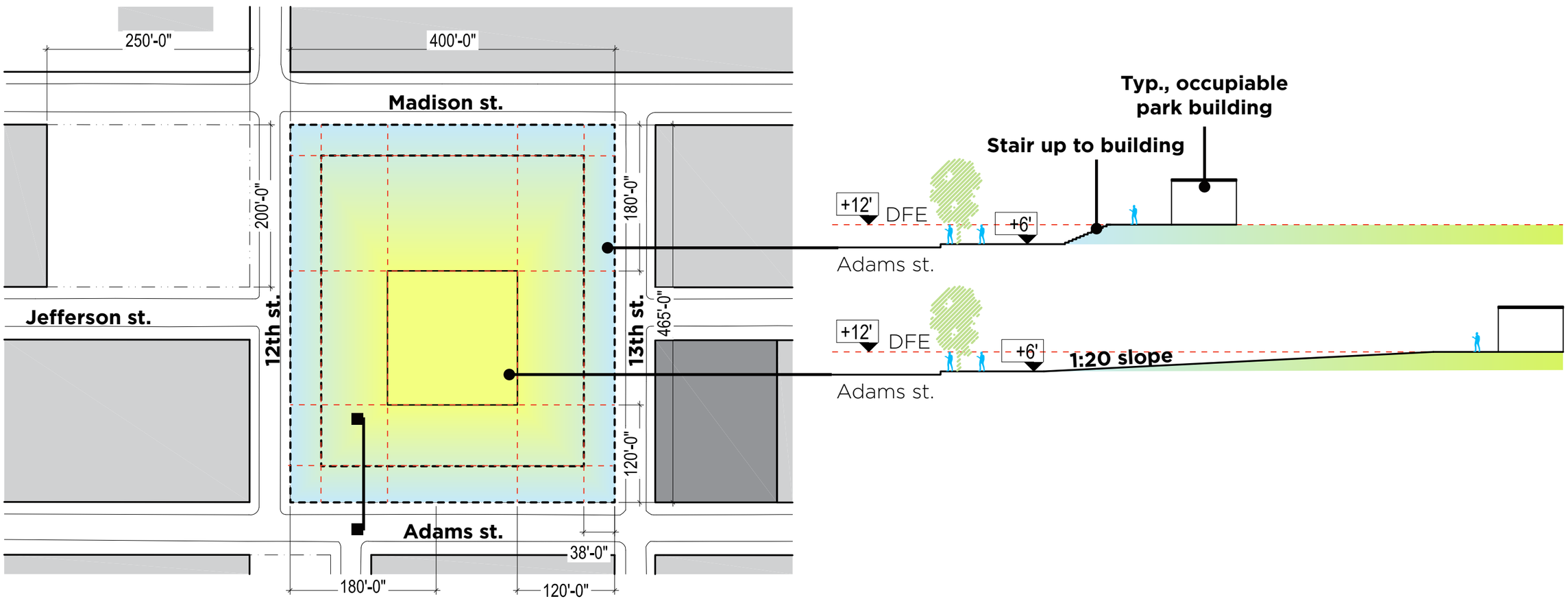


Image Credit: nArchitects

Sustainable SITES Certification

Certification Level	Points
SITES **Certified**	70 - 84
SITES **Silver**	85 - 99
SITES **Gold**	100 - 134
SITES **Platinum**	135 +

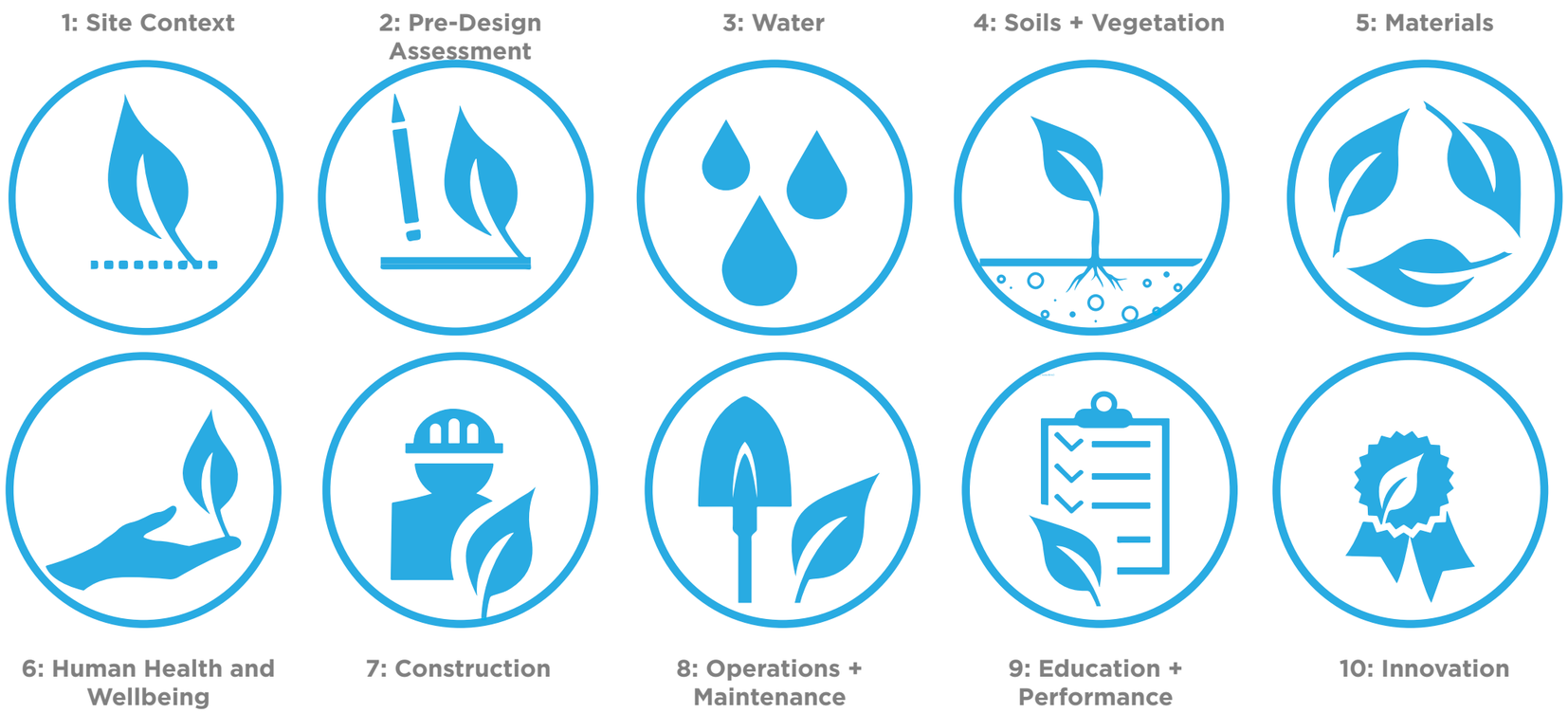


Image Credit: OLIN

Northwest Resiliency Park

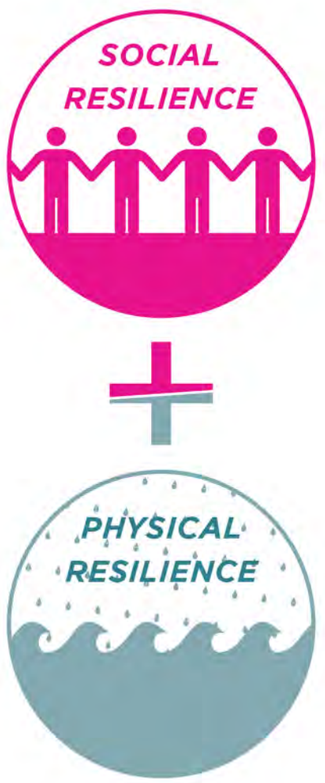
SITES V2 Scorecard Summary

Total Points: 78

Yes	?	No					Yes	?	No				
			1: SITE CONTEXT							6: SITE DESIGN - HUMAN HEALTH + WELL-BEING			
			CONTEXT P1.1	Limit development on farmland					No	HHWB C6.1	Protect and maintain cultural and historic places	2 to 3	
			CONTEXT P1.2	Protect Floodplain Functions			Yes			HHWB C6.2	Provide optimum site accessibility, safety, and wayfinding	2	2
			CONTEXT P1.3	Conserve aquatic ecosystems			Yes			HHWB C6.3	Promote equitable site use	2	2
			CONTEXT P1.4	Conserve habitats for threatened and endangered species			Yes			HHWB C6.4	Support mental restoration	2	2
Yes			CONTEXT C1.5	Redevelop degraded sites	3 to 6	6	Yes			HHWB C6.5	Support physical activity	2	2
Yes			CONTEXT C1.6	Locate projects within existing developed areas	4	4	Yes			HHWB C6.6	Support social connection	2	2
Yes			CONTEXT C1.7	Connect to multi-modal transit networks	2 to 3	3		?		HHWB C6.7	Provide on-site food production	3 to 4	
							Yes			HHWB C6.8	Reduce light pollution	4	4
			2: PRE-DESIGN ASSESSMENT + PLANNING					?		HHWB C6.9	Encourage fuel efficient and multi-modal transportation	4	4
Yes			PRE-DESIGN P2.1	Use an integrative Design Process			Yes			HHWB C6.10	Minimize exposure to environmental tobacco smoke	1 to 2	2
			PRE-DESIGN P2.2	Conduct a pre-design site assessment				?		HHWB C6.11	Support local economy	3	
			PRE-DESIGN P2.3	Designate and communicate VSPZs									
Yes			PRE-DESIGN C2.4	Engage Users and Stakeholders	3	3				7: CONSTRUCTION			
										CONSTRUCTION P7.1	Communicate and verify sustainable construction practices		
			3: SITE DESIGN + WATER							CONSTRUCTION P7.2	Control and retain construction pollutants		
			WATER P3.1	Manage precipitation on site						CONSTRUCTION P7.3	Restore soils disturbed during construction		
			WATER P3.2	Reduce water use for landscape irrigation					No	CONSTRUCTION C7.4	Restore soils distrurbed by previous development	3 to 5	
Yes			WATER C3.3	Manage precipitation beyond the baseline	4 to 6	6		?		CONSTRUCTION C7.5	Divert construction and demolition materials from disposal	3 to 4	
Yes			WATER C3.4	Reduce outdoor water use	4 to 6	6		?		CONSTRUCTION C7.6	Divert reusable vegetation, rocks, and soil from disposal	3 to 4	
Yes			WATER C3.5	Design functional stormwater features as amenities	4 to 5	5	Yes	?		CONSTRUCTION C7.7	Protect air quality during construction	2 to 4	2
		No	WATER C3.6	Restore aquatice ecosystems	4 to 6								
										8: OPERATIONS + MAINTENANCE			
			4: SITE DESIGN - SOIL + VEGETATION							O+M P8.1	Plan for sustainable site maintenance		
			SOIL + VEG P4.1	Create and Communicate a soil management plan						O+M P8.2	Provide for storage and collection of recyclables		
			SOIL + VEG P4.2	Control and manage invasive plants				?		O+M C8.3	Recycle organic matter	3 to 5	
			SOIL + VEG P4.3	Use appropriate Plants				?		O+M C8.4	Minimize pesticide and fertilizer use	4 to 5	
		No	SOIL + VEG C4.4	Conserve healthy soils and appropriate vegetation	4 to 6		Yes	?		O+M C8.5	Reduce outdoor energy consumption	2 to 4	2
		No	SOIL + VEG C4.5	Conserve special status vegetation	4			?		O+M C8.6	Use renewable sources for landscape electricity needs	3 to 4	
		No	SOIL + VEG C4.6	Conserve and use native plants	3 to 6		Yes	?		O+M C8.7	Protect air quality during landscape maintenance	2 to 4	2
		No	SOIL + VEG C4.7	Conserve and restore native plant communities	4 to 6								
Yes	?		SOIL + VEG C4.8	Optimize biomass	1 to 6	3				9: EDUCATION + PERFORMANCE MONITORING			
Yes			SOIL + VEG C4.9	Reduce urban heat island effects	4	4	Yes			EDUCATION C9.1	Promote sustainability awareness and education	3 to 4	3
Yes	?		SOIL + VEG C4.10	Use vegetation to minimize building energy use	1 to 4	2		?		EDUCATION C9.2	Develop and communicate a case study	3	
		No	SOIL + VEG C4.11	Reduce the risk of catastrophic wildfire	4		Yes			EDUCATION C9.3	Plan to monitor and report site performance	4	4
										10. INNOVATION OR EXEMPLARY PERFORMANCE			
								?		INNOVATION C10.1	Innovation or exemplary performance	3 to 9	3
			KEY:							SITE CERTIFICATION LEVELS			
			Yes	Project confident points are achievable						Certified	70		
			?	Project striving to achieve points, not 100% confident						Silver	85		
			No	Project is unable to achieve these credit points						Gold	100		
										Platinum	135		

Image Credit: OLIN

Identify the essential kit of parts for green stormwater infrastructure and other resilient and sustainable technologies



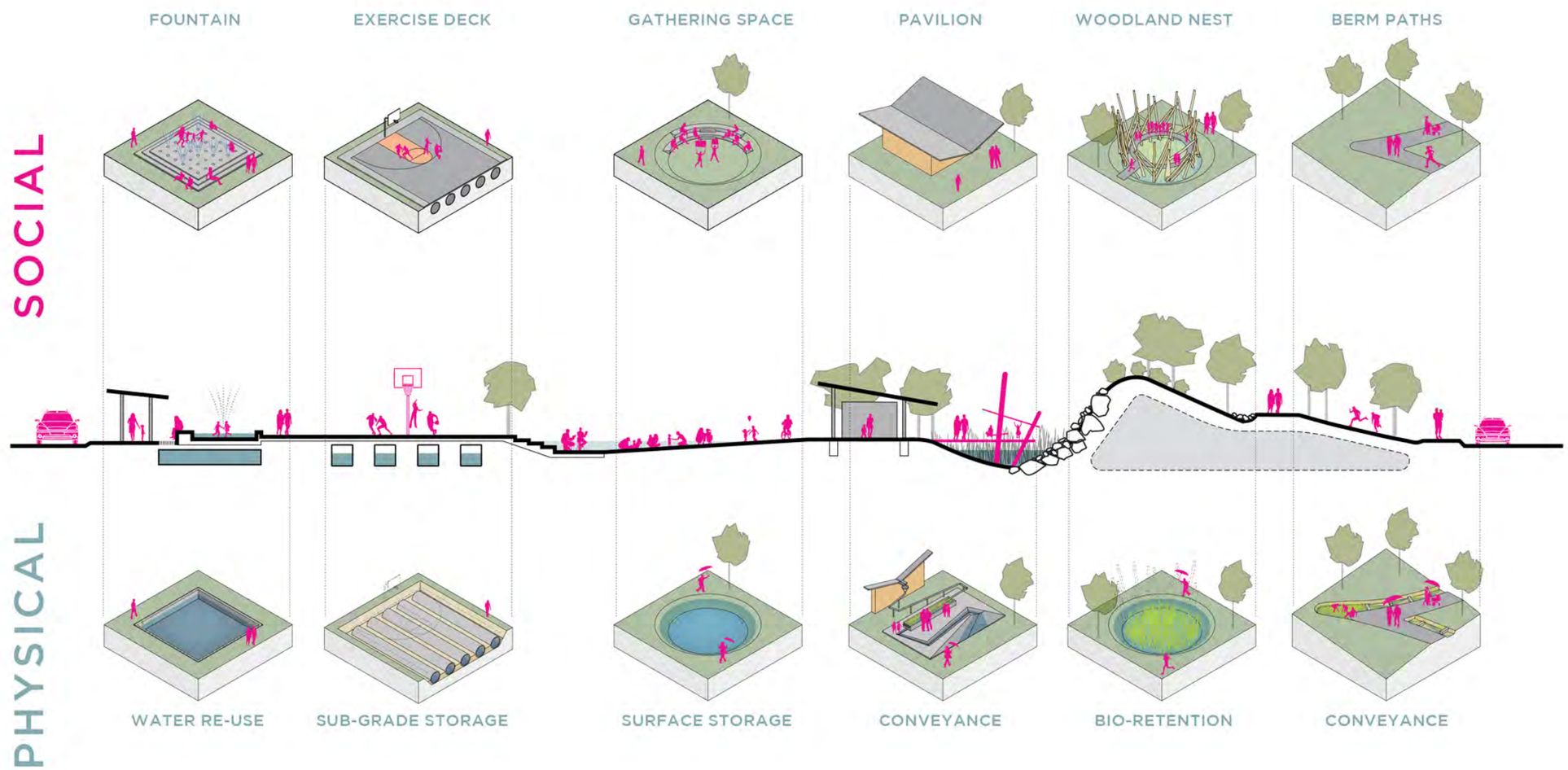


Image Credit: E&LP Associates and OLIN

Bio-Retention

Bio-retention features are surface level vegetated depressions for water storage and infiltration. These BMPs are flexible in their layout, materials, soil profiles, and outlet controls. A typical profile for a bio-retention system will consist of planting and a mulch layer, planting soil, a pea gravel or choker course, and then uncompacted existing soils. Depending on subsurface soil and groundwater conditions they can be designed with an underdrain layer to provide additional below grade storage to supplement the initial surface depression. The footprint size and depth of a bio-retention system can vary greatly from small raingardens with 12 inches of planting soil and no underdrainage to large 4' deep basins with 24-36" planting soils and an underdrainage system accommodating shrub and small tree planting. Bio-retention features are suitable to providing stormwater quantity control, groundwater recharge, and quality control as they have a 90% TSS removal efficiency.

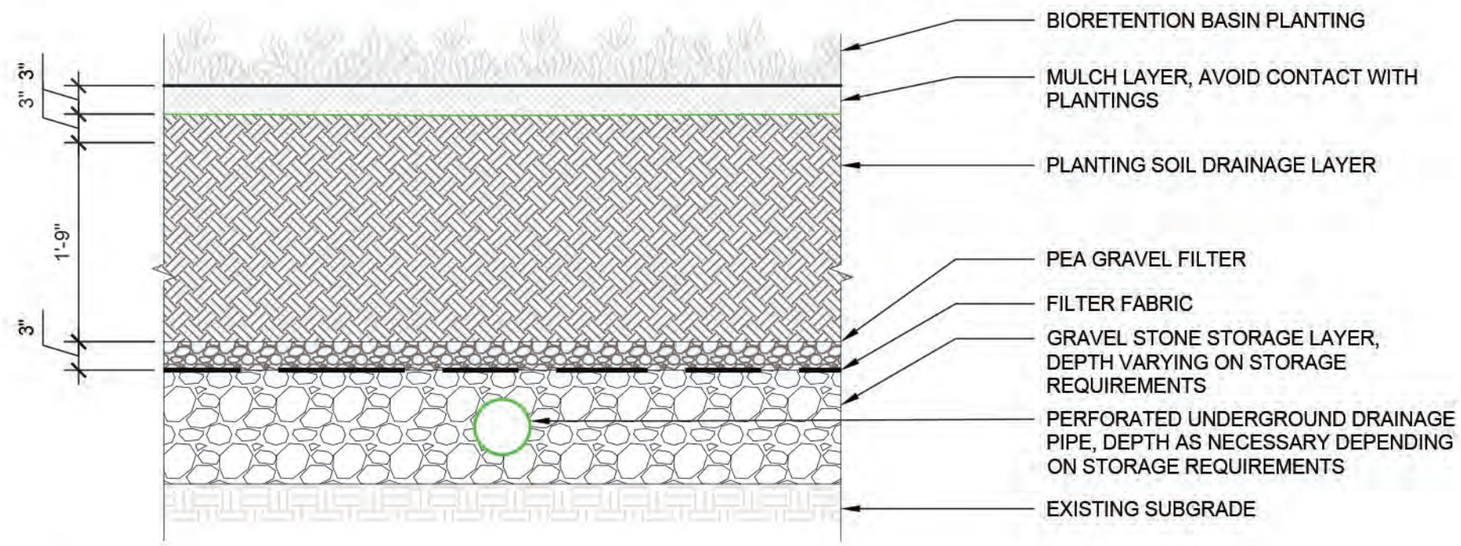


Figure 4.4.2 Bioretention Section

Bio-swales

Bio-swales are a specific type of bio-infiltration feature that functions as a conveyance and water quality measure, but is not suited to stormwater volume storage or quantity control. Swales are surface level vegetated depressions that are sloped along their center line to convey water from one point to another. These BMPs are flexible in their layout, materials, soil profiles, and outlet controls. A typical profile for a bio-swale will consist of planting, planting soil, and uncompacted existing soils. In certain instances a swale can be designed with a flat bottom to provide some stormwater quantity control. In this case, they should be designed with an underdrain layer to provide additional below grade storage.

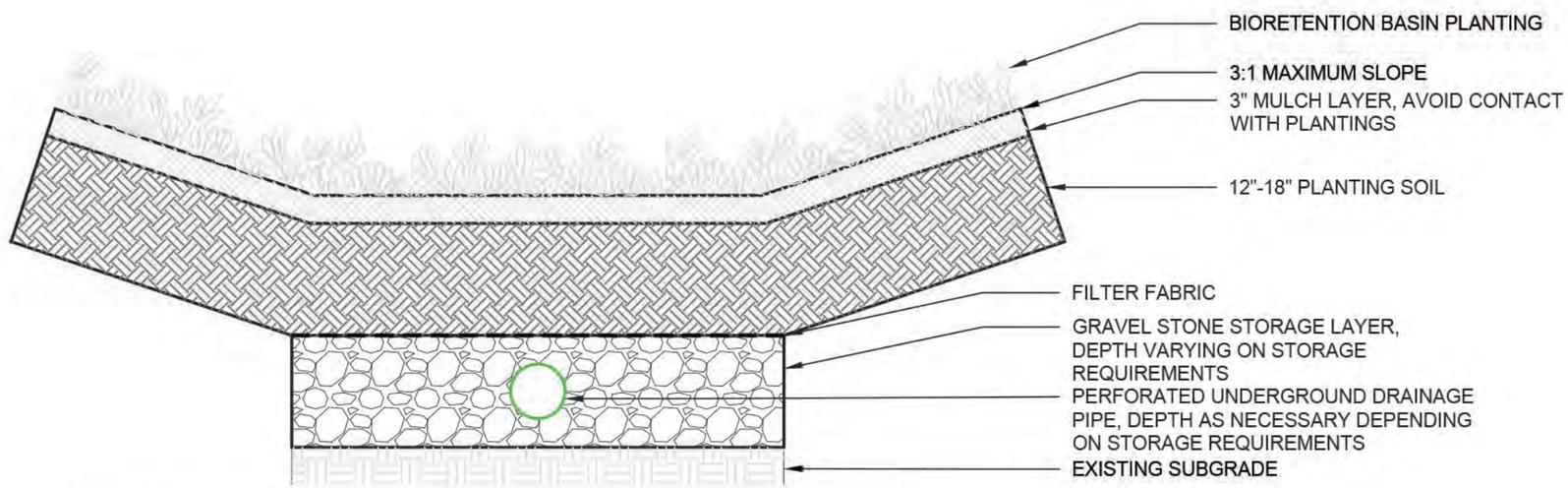


Figure 4.4.3 Bio-Swale section

Image Credit: E&LP Associates

Pervious Pavement

Pervious pavement provides the same structural support as conventional pavement, while allowing stormwater runoff to drain through the pavement profile to a subsurface stone storage bed below. The subgrade storage below the pavement may be designed as a conventional subsurface infiltration or detention system where the depth of the storage bed may vary depending on the quantity control required of the system. The permeable pavement system itself typically includes porous asphalt, porous concrete, or permeable pavers. Additionally, reinforced turf, gravel, resin bonded materials and other synthetic surfaces may all be design to create a porous surface. Constraints for this type of system include limitations of use in high-traffic areas or heavy industrial sites where heavy sediment and pollutant loading are a concern; finished surfaces should not slope greater than 4% in order to avoid creating unusable storage volume; and frequent maintenance including vacuuming is required to maintain the porosity of the surface.

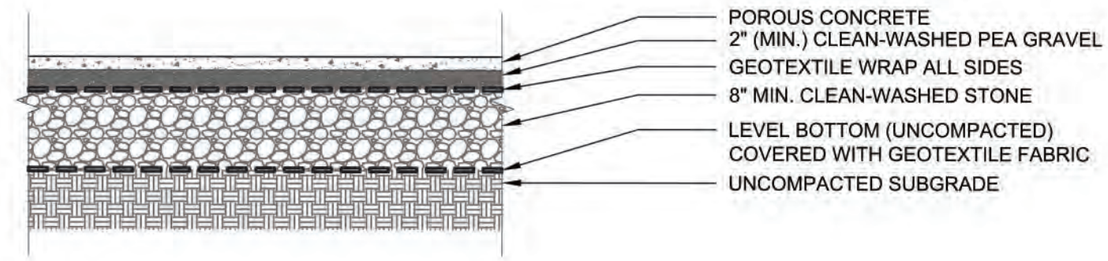


Figure 4.5

Stormwater Planter

A curb bumpout stormwater planter is a specific type of bio-infiltration feature that functions as a storage and water quality measure directly adjacent to a roadway. The surface of the feature is sunken adjacent to the roadway edge and separated by the roadside curb. Curb-cuts, depressed curbs, or other opening in the face of the curb are required to allow runoff to enter the system. A typical profile for a stormwater planter will consist of vegetation, planting soil, a stone underdrain and storage layer and uncompacted existing soils. Other components that are essential to these systems are energy dissipation and sediment removal at the designed curb openings. A method of slowing down runoff from the roadway and allowing sediment to be trapped for maintenance must be integrated into the overall design of the system. Stormwater planters can provide quantity control in small storm events and water quality treatment in all storm events.

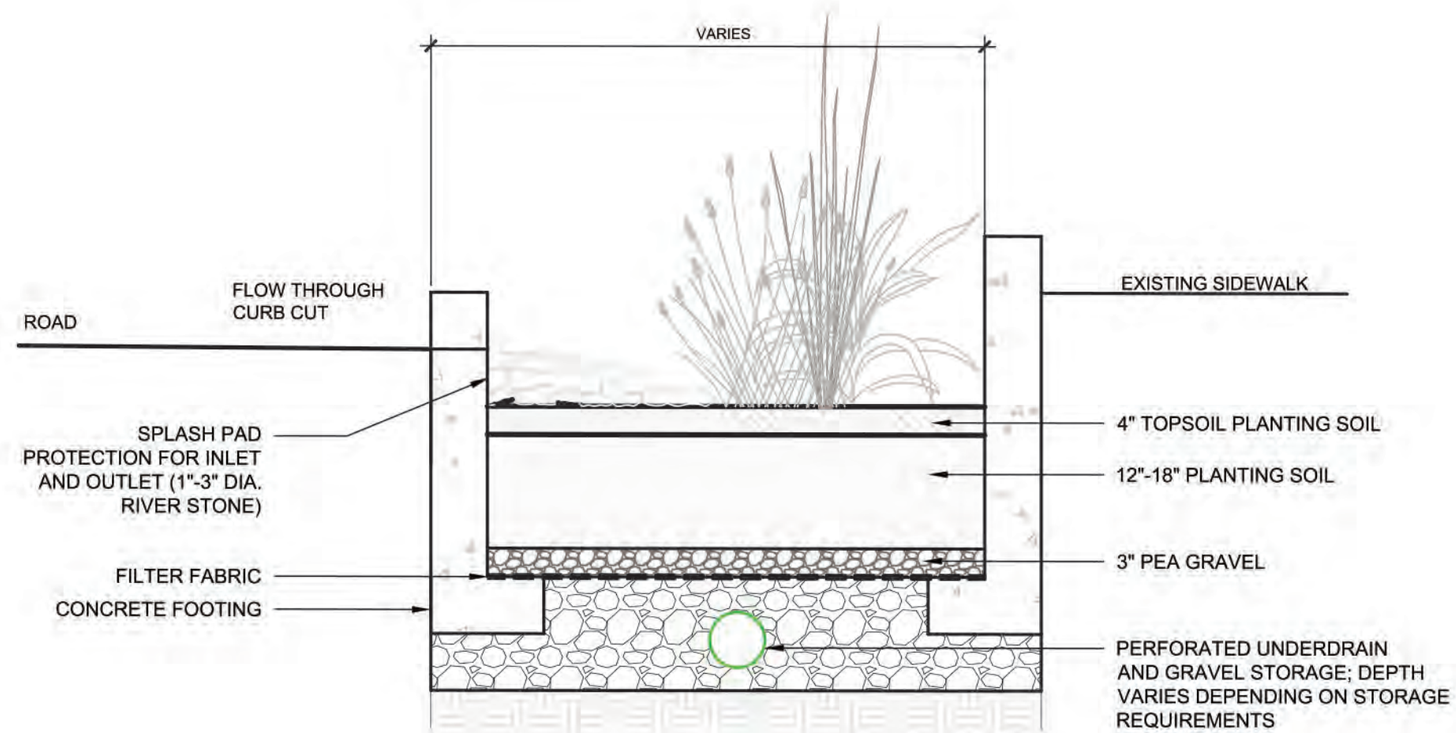


Image Credit: E&LP Associates

Cistern

Cisterns are water storage tanks, located either above or below grade, used to capture and reuse stormwater runoff. This process is often referred to as Rainwater Harvesting. Cisterns may capture water from roof areas or ground level surfaces and are sized to accommodate the required demand of the system for which the captured water is being reused. During reuse, captured water may be gravity fed or pumped to the location of intended reuse. As permitted by local building codes, water may be used for irrigation, toilet flushing, exterior washing (building facades, sidewalks), or make-up water for mechanical systems, and ornamental non-drinking water fountains. In addition, to water reuse, cisterns may be designed as a hybrid system and provide extra storage for detention and quantity control.

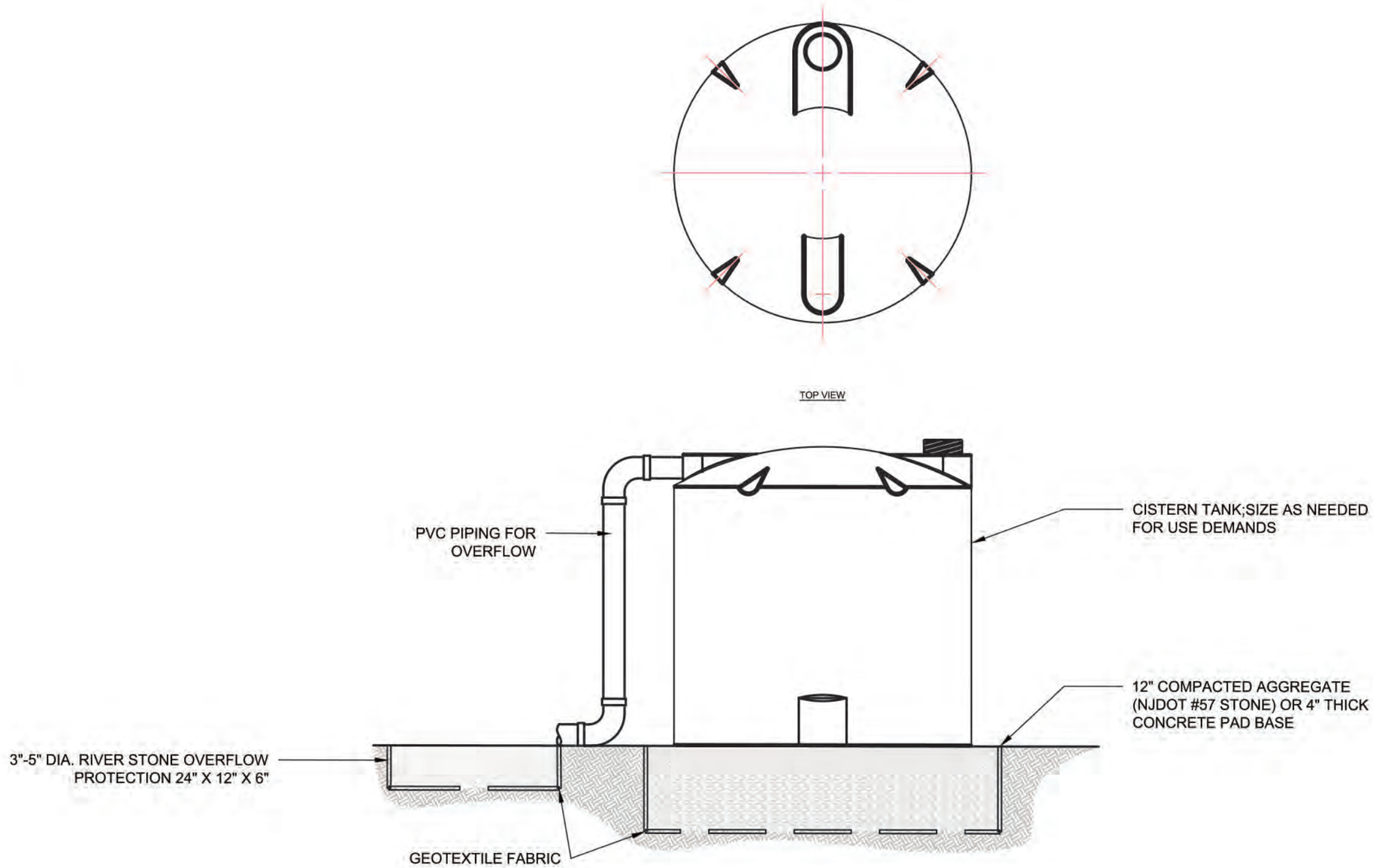


Image Credit: E&LP Associates

Tree Trench

Tree trenches are a method of subsurface infiltration or detention that incorporates tree plantings in linear elements. This practice is most often employed along sidewalks and roadways but can also be used in other configurations such as groves or bosques of trees in large paved areas. A tree trench is configured by connecting at least two individual tree pits with a continuous gravel trench. Runoff from an adjacent roadway or other paved surface may enter the tree pit via a curb cut or subgrade from a nearby inlet. The entire trench should have storage pipes and an overflow pipe/outlet at the bottom of the stone storage bed to pass excess runoff back into the main sewer system in the adjacent street. Tree trenches can provide quantity control, water quality treatment, and groundwater recharge depending on subsurface soil conditions.

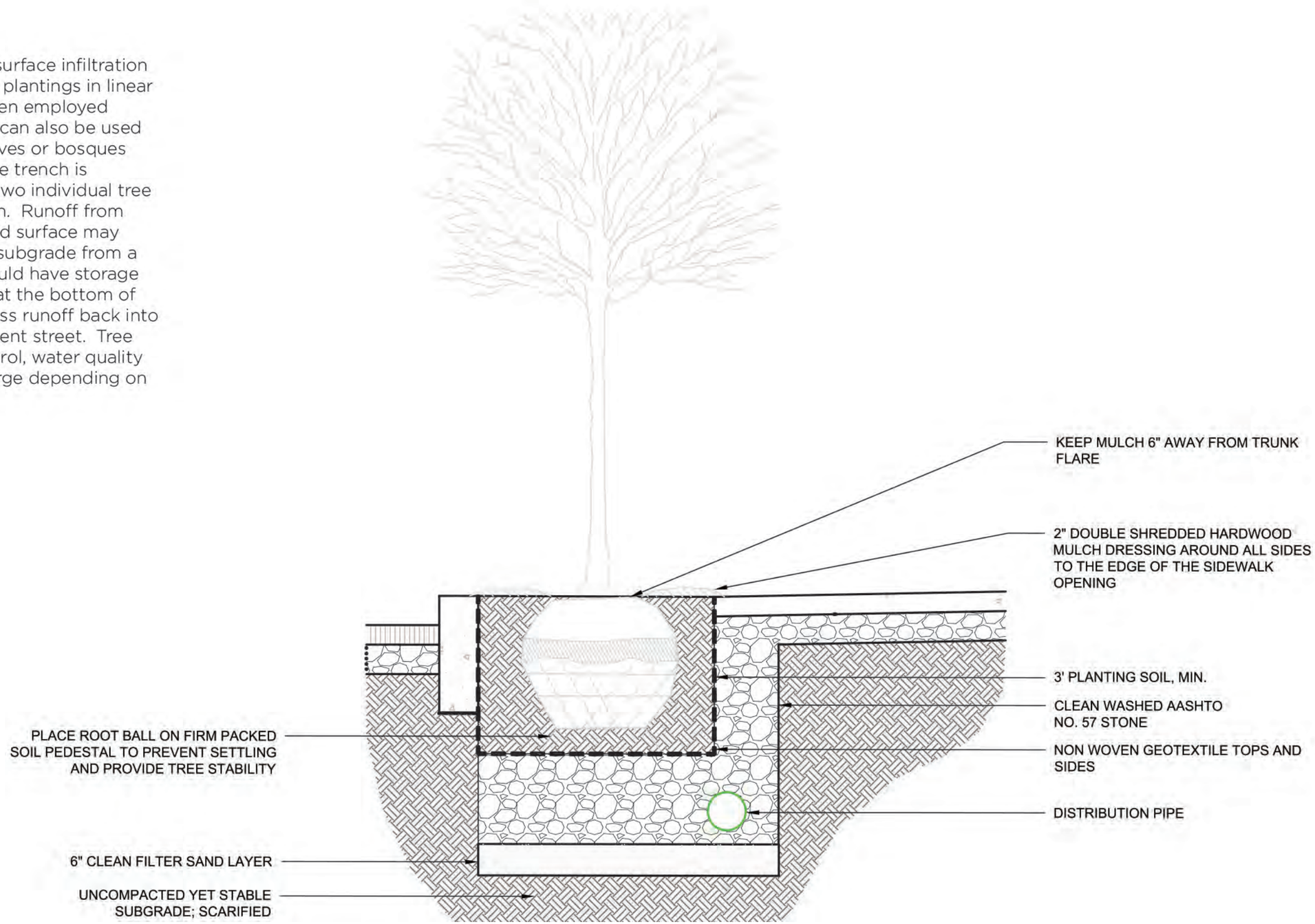


Image Credit: E&LP Associates

Understand the opportunities for incorporation and integration of these systems/technologies into the design of architectural and public space amenities

Must-Haves

NATURE
- Natural Elements
- Gardens
- Shade Trees
- Quiet escapes

CULTURE
- Civic Terrace/Events
- Park Building/Cafe/ Community Room
- Flexible Open Space
- Comfort Amenities
- Safety

ATHLETICS/FITNESS
- Multi-use Athletic Field
- Fitness Loop & Equipment
- Basketball Court

PLAY
- Multi-generational/ All ages
- Accessible & Inclusive

ONLINE SURVEY

WHAT FEATURES WOULD YOU LIKE TO SEE IN YOUR PARK?

BASIC AMENITIES

- TREES 727
- BATHROOMS 712
- SHADE STRUCTURES 659
- DRINKING FOUNTAINS 545
- SEATING 533
- BIKE PARKING 475
- FOOD/CAFE 510
- SWIMMING POOL 501
- LIGHTING 477
- NATIVE PLANTS 424
- FLEXIBLE EVENT SPACE 415
- SPRAY/ FOUNTAIN WATER FEATURE 409
- COMMUNITY GARDENS 400
- ATHLETIC FIELDS 389
- PLAY AREAS 382
- MULTI USE TRACK 370
- PICNIC/GRILL AREAS 367
- TRAILS 362
- FITNESS STATIONS 358
- PASSIVE SPACE 332
- DOG PARK 293
- MINI GOLF 295
- COMMUNITY CENTER 260

LOW DEMAND

- GAMES 237
- ROCK/NET CLIMBING 224
- SURFACE/ WADING WATER FEATURE 207
- BIKE RENTAL 194
- ENVIRONMENTAL EDUCATION 157
- CAR PARKING 132
- BLEACHERS 77

EVALUATING FEATURES

IN HIGH DEMAND

ENGAGES MANY PEOPLE PER SQUARE FOOT

MULTI-GENERATIONAL

MULTI-USE/ MULTI-SEASION

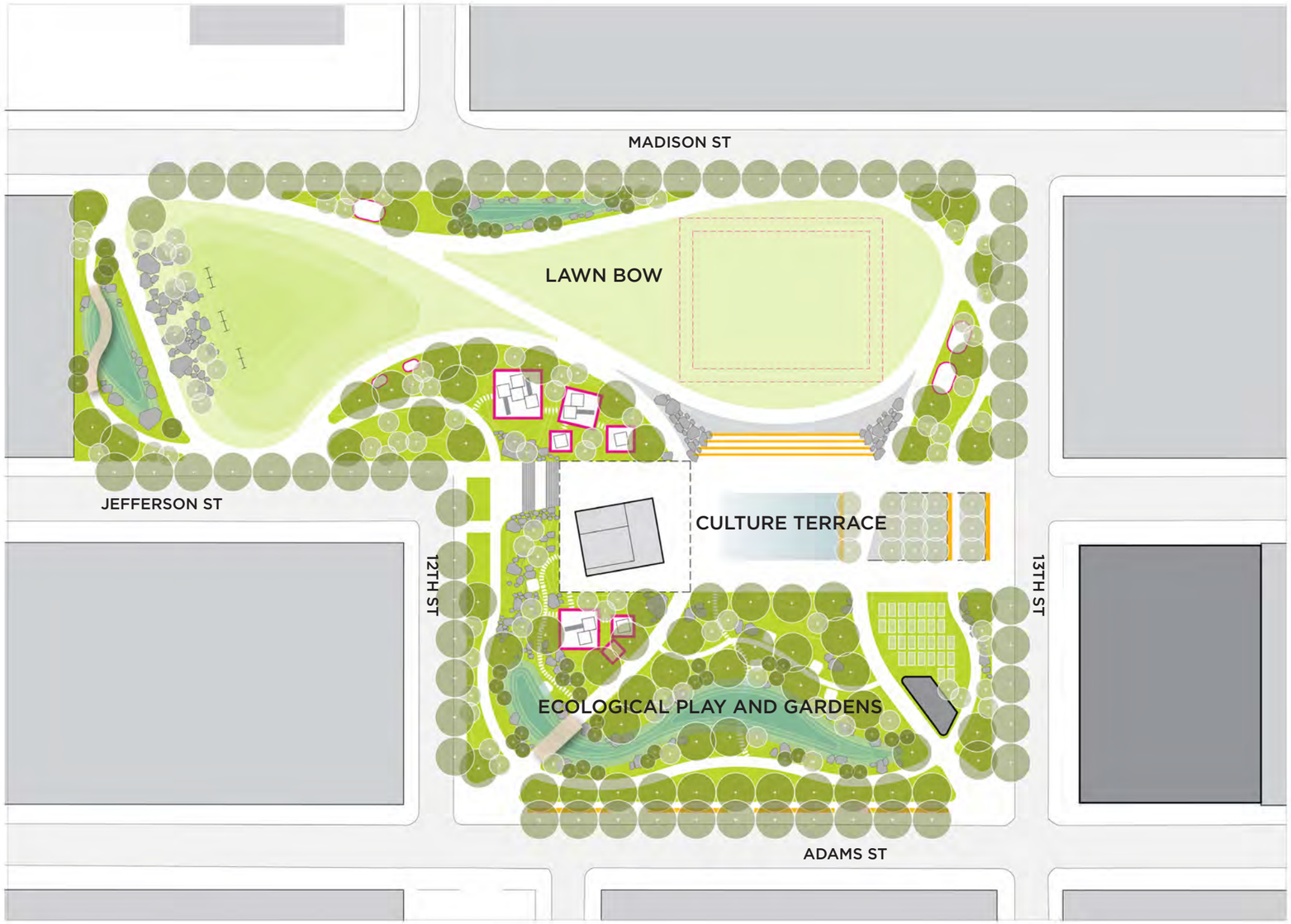
NOT PRESENT/ NEARBY IN HOBOKEN

ENVIRONMENTAL BENEFIT

		IN HIGH DEMAND	ENGAGES MANY PEOPLE PER SQUARE FOOT	MULTI-GENERATIONAL	MULTI-USE/ MULTI-SEASION	NOT PRESENT/ NEARBY IN HOBOKEN	ENVIRONMENTAL BENEFIT
ATHLETICS	TENNIS	+++	++	+++	+	+++	
	SOCCER	+++	+	+	+	+	
	BASKETBALL	++	++	+	+	+	
	BASEBALL	++	+	++	+	++	
	PICKLEBALL	+	+++	+++	+	+	
	LACROSSE	+	+	+	+	+++	
	VOLLEYBALL	+	+++	++	+	+++	
	FOOTBALL	+	+	++	++	++	
	MULTI-USE	+	+	+++	+++	++	
	FITNESS STATIONS	++	+++	+++	++	+	
	ROLLER/ICE HOCKEY	+	+	+++	++	+++	
	SWIMMING POOL	+++	++	++	+	+++	
CULTURE	CAFE	+++	+++	+++	+++	++	
	FLEXIBLE EVENT SPACE	+++	+++	+++	++	+	
	WATER FEATURE	++	++	++	+	++	
	PICNIC AREA	+++	+++	+++	+	+	
	COMMUNITY GARDENS	++	+	+++	+	+++	++
	DOG PARK	++	+	++	++	+	
	ENVIRON. EDUCATION	+	+++	+++	+++	+	+++
NATURE	URBAN NATURE AREAS	+++	++	+++	+	+++	+++
	GARDENS	++	++	+++	+	++	+++
	PLAY AREAS	++	++	+	++	+	
	TRAILS	++	+++	+++	+++	+	++

Developing Design Alternatives

TERRACE + TRAILS



CROSS-PARK CONNECTIVITY

MULTI-USE LOOP TRAIL

MULTI-USE ATHLETIC FIELD:
Flexible lawn can accomodate
105 ft x 135ft Soccer Field (U10)
with 10ft perimeter offset,
live lawn, no fencing

NATURE + ECOLOGY

COLLECTS PARK + STREET STORMWATER

MULTIPLICITY OF SPACES + EXPERIENCES

12TH ST CLOSED; 13 STREET NARROWED
1/4 ACRE ADDED TO PARK

PARK BUILDING:
2990 SF INTERIOR
7010 SF CANOPY/SHADED AREA

Image Credit: OLIN

TERRACE + TRAILS

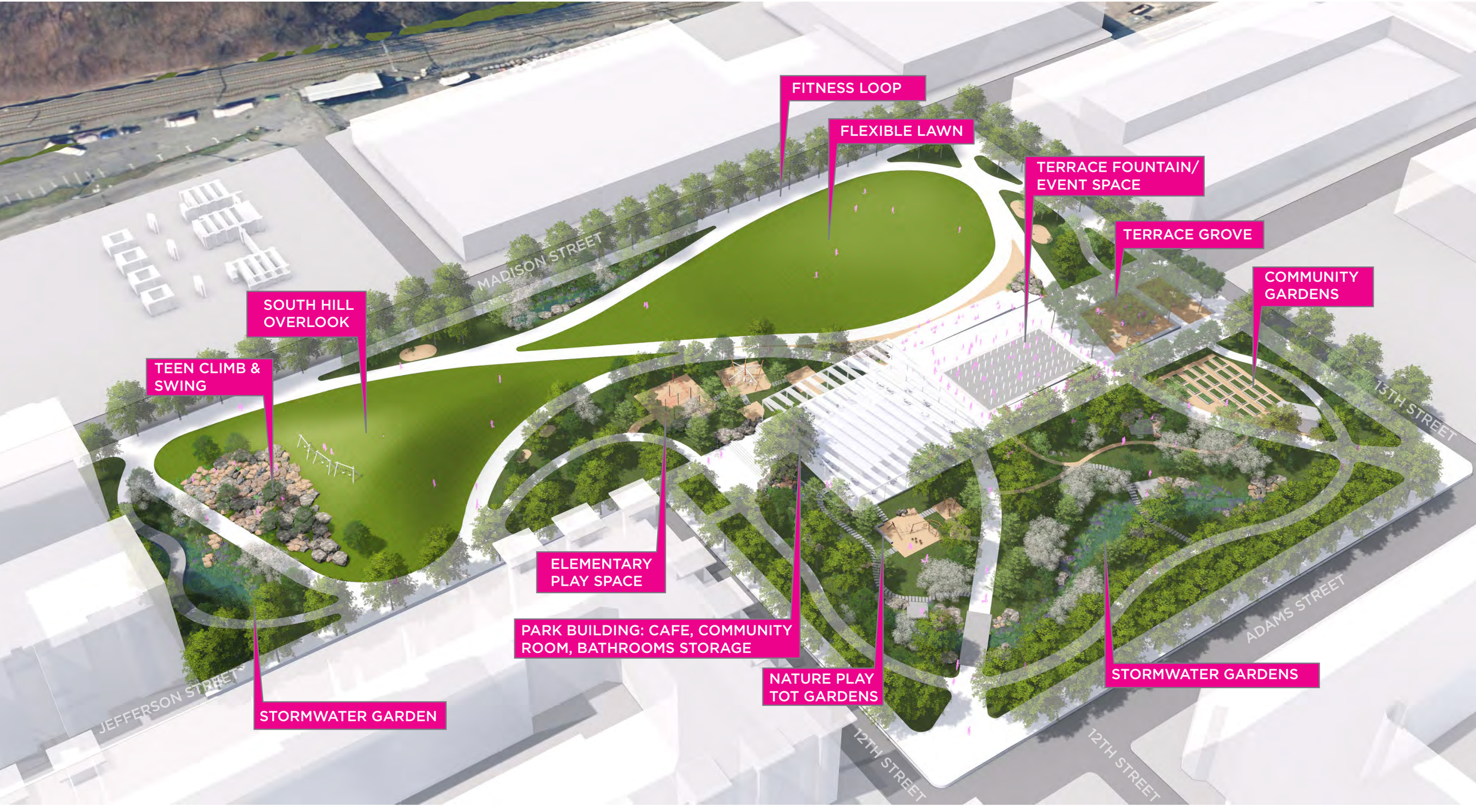


Image Credit: OLIN

TERRACE + TRAILS: CONCEPTUAL WATER SYSTEMS

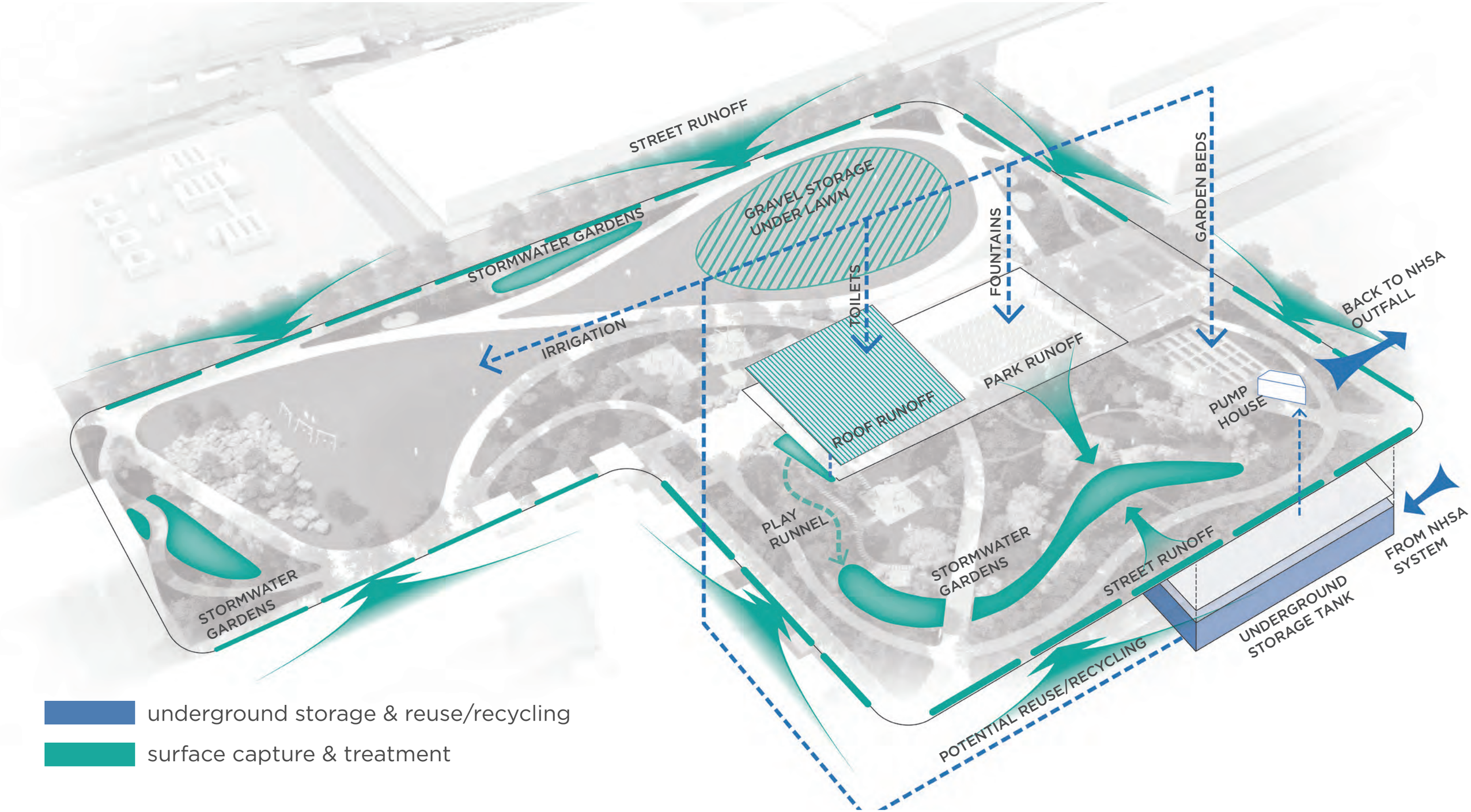


Image Credit: E&LP Associates and OLIN

TERRACE + TRAILS

PUMP HOUSE INTEGRATED INTO GARDEN SHED

COMMUNITY GARDENS

STORMWATER GARDENS

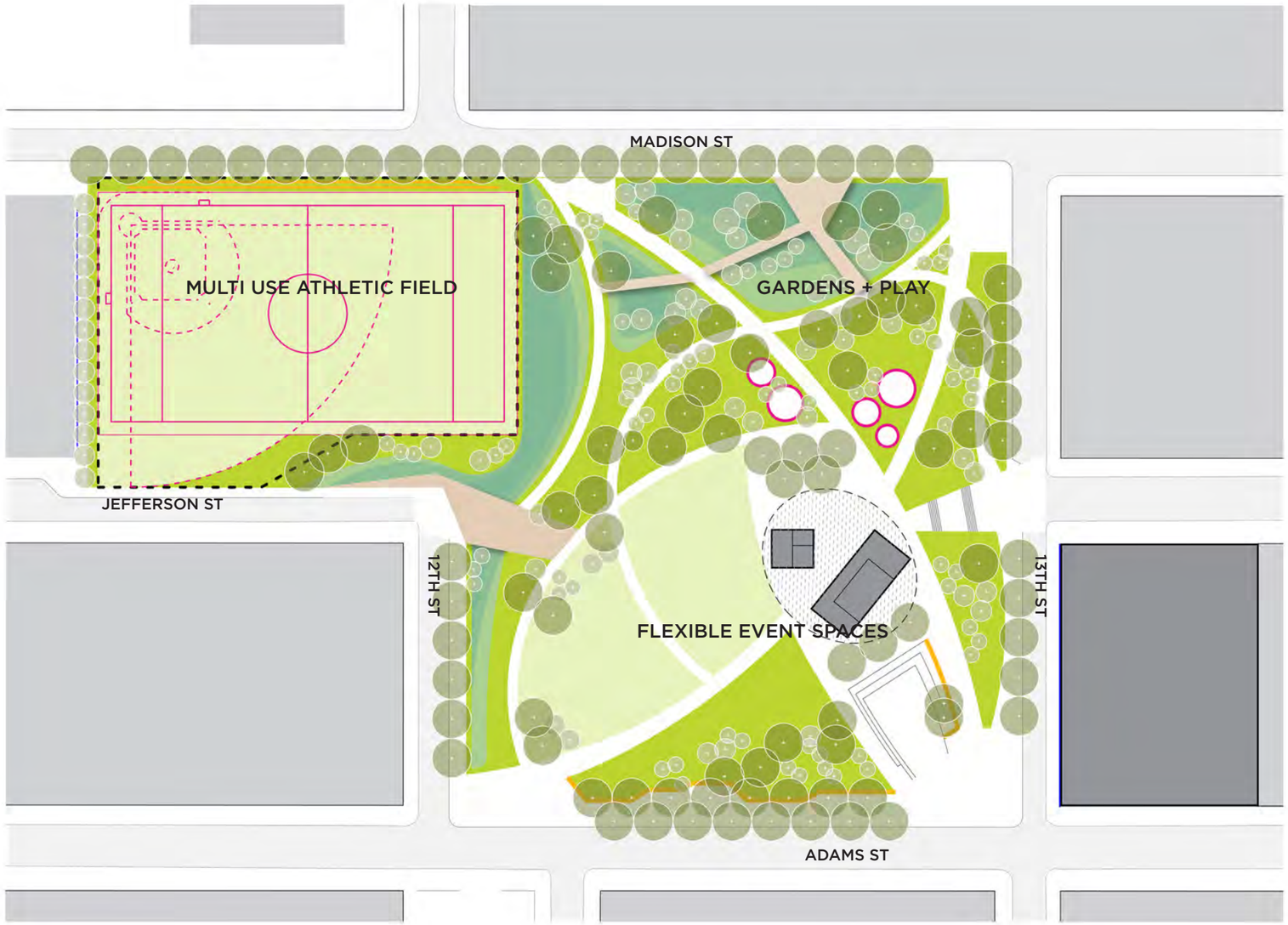
OUTLET FOR WATER REUSE

NHSA STORMWATER INFLOW

1 MILLION GALLON UNDERGROUND STORMWATER STORAGE

Image Credit: E&LP Associates and OLIN

FOREST + FIELDS



CROSS-PARK CONNECTIVITY

WALKING PATHS

MULTI-USE ATHLETIC FIELD:
165ft x 300ft soccer field (HS)
Little league baseball field (200ft oufield)

NATURE + ECOLOGY

COLLECTS PARK + STREET STORMWATER

MULTIPLICITY OF SPACES + EXPERIENCES

12TH ST CLOSED
MADISON, JEFFERSON, 13TH ST NARROWED
1/2 ACRE ADDED TO PARK

PARK BUILDING:
3625 SF INTERIOR
7075 SF COVERED AREA

Image Credit: OLIN

FOREST + FIELDS

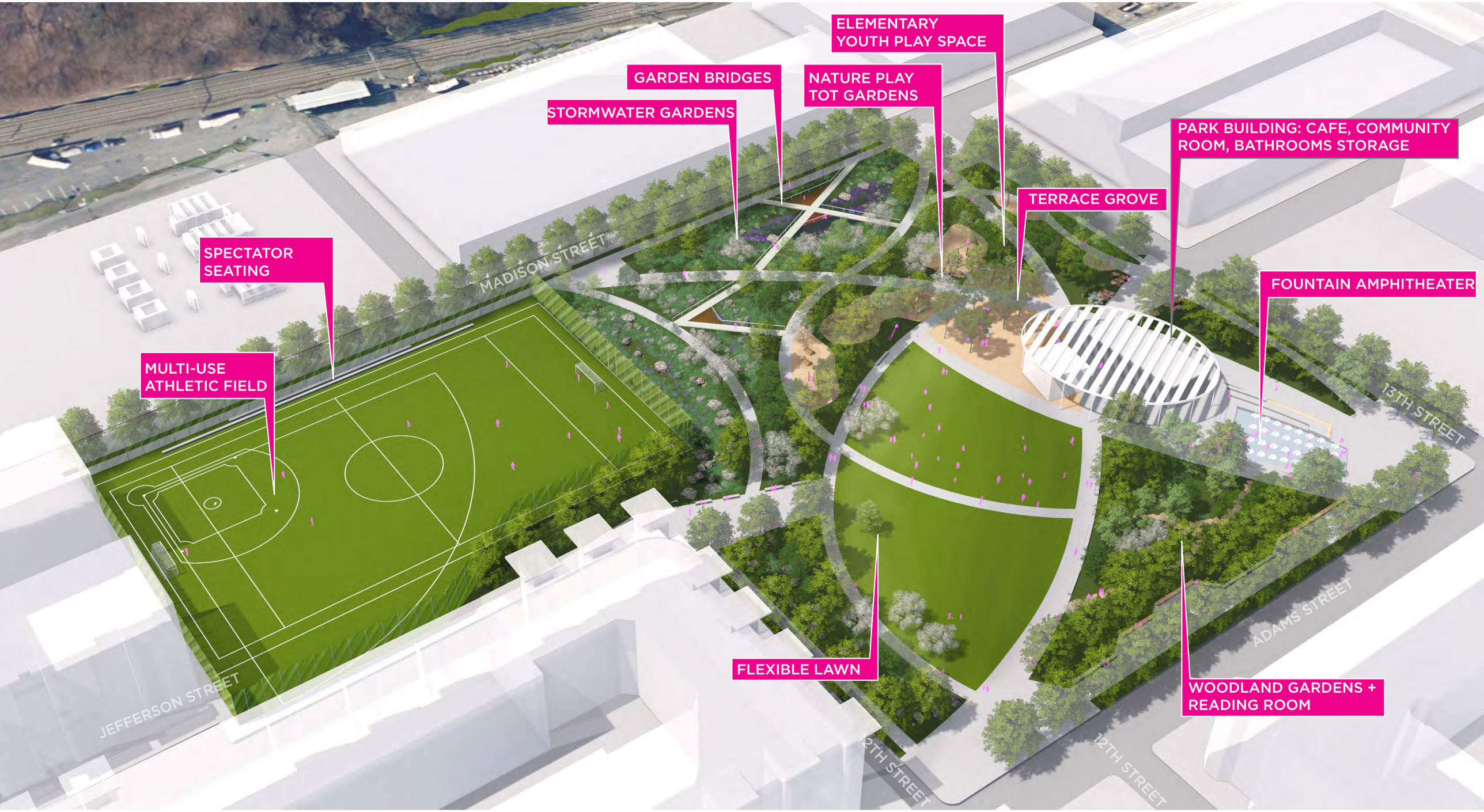


Image Credit: OLIN

FOREST + FIELDS

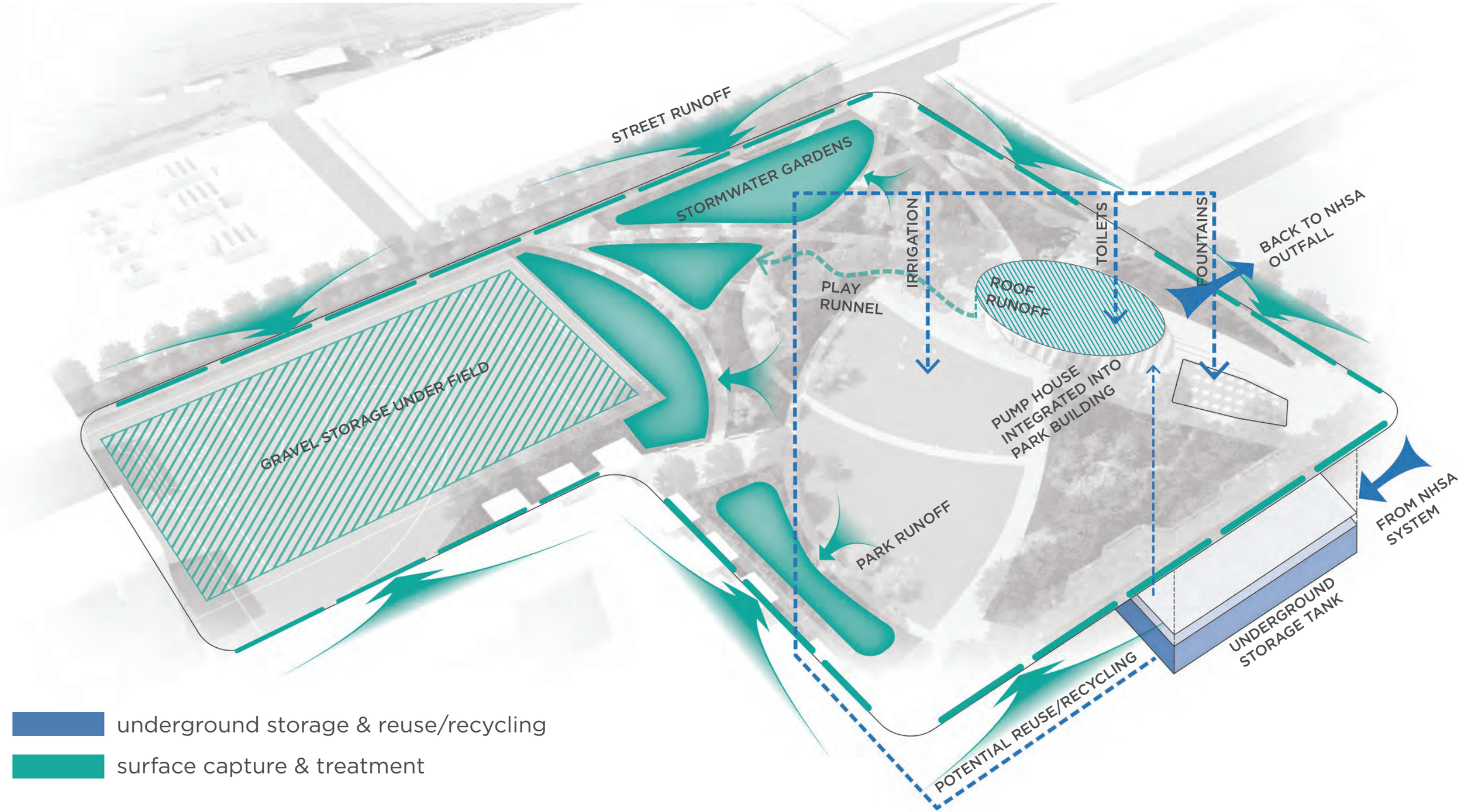


Image Credit: E&LP Associates and OLIN

FOREST + FIELDS

PUMP HOUSE INTEGRATED INTO PARK BUILDING

STORMWATER GARDENS

FOUNTAIN AMPHITHEATER

NHSA STORMWATER INFLOW

OUTLET TO PUMP HOUSE

1 MILLION GALLON UNDERGROUND STORMWATER STORAGE

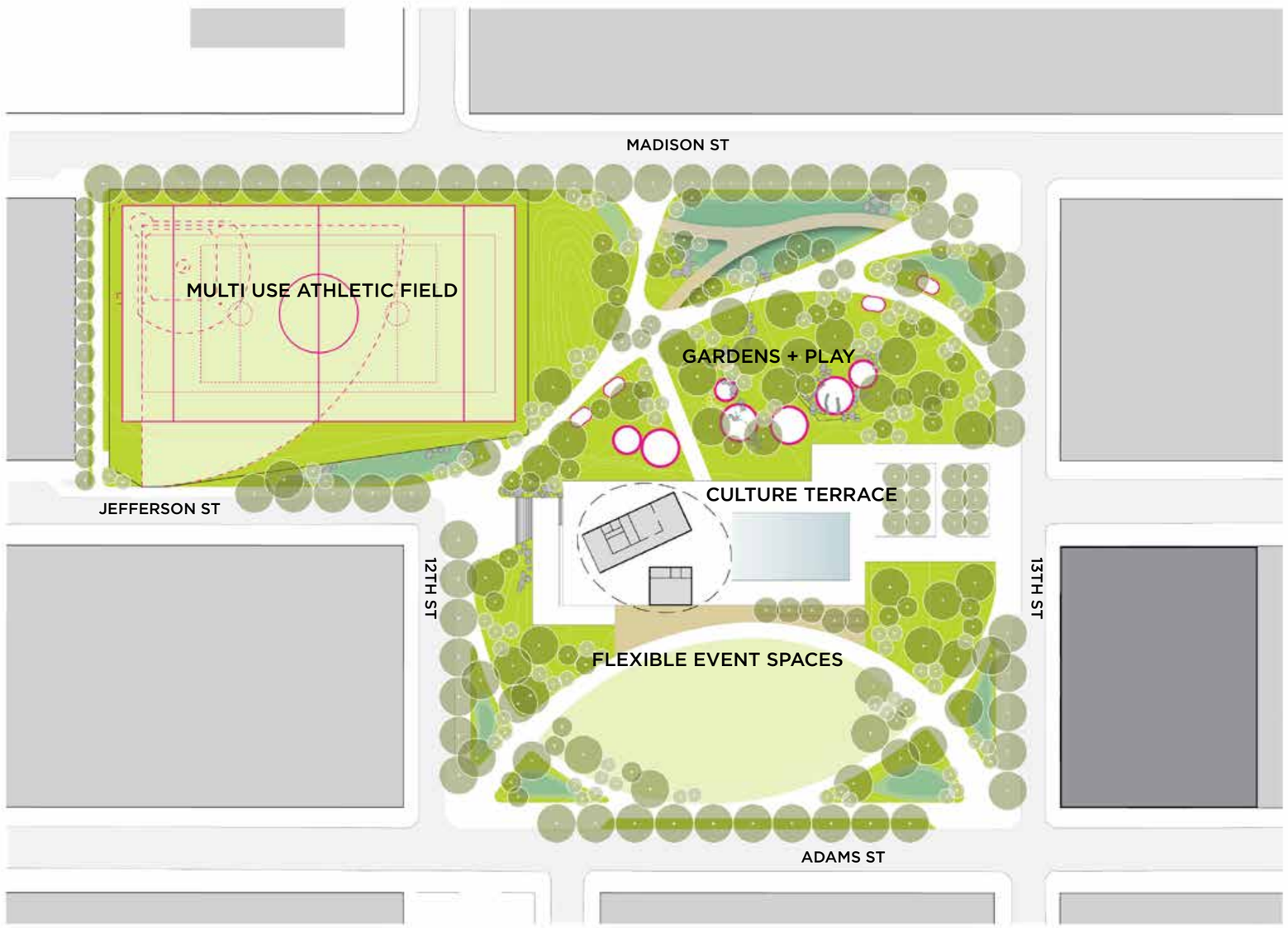
Image Credit: E&LP Associates and OLIN

CONCEPT DESIGN

TERRACE + TRAILS

FOREST + FIELDS

Northwest Resiliency Park Concept Design



CROSS-PARK CONNECTIVITY

MULTI-USE LOOP TRAIL
1/2 mile

MULTI-USE ATHLETIC FIELD:
- High school soccer field (165ft x 300ft)
- Little league baseball field (200ft oufield)
- Youth lacrosse (35yds x 60yds and 40yds x 90yds)

NATURE + ECOLOGY

COLLECTS PARK + STREET STORMWATER

MULTIPLICITY OF SPACES + EXPERIENCES

12TH ST CLOSED
MADISON, JEFFERSON, 13TH ST NARROWED
1/4 acre added to park

PARK BUILDING:
2,465 SF Large Interior (Cafe)
930 SF Small Interior (Community Room)
9,425 SF Covered Area

Image Credit: OLIN

Northwest Resiliency Park Concept Design

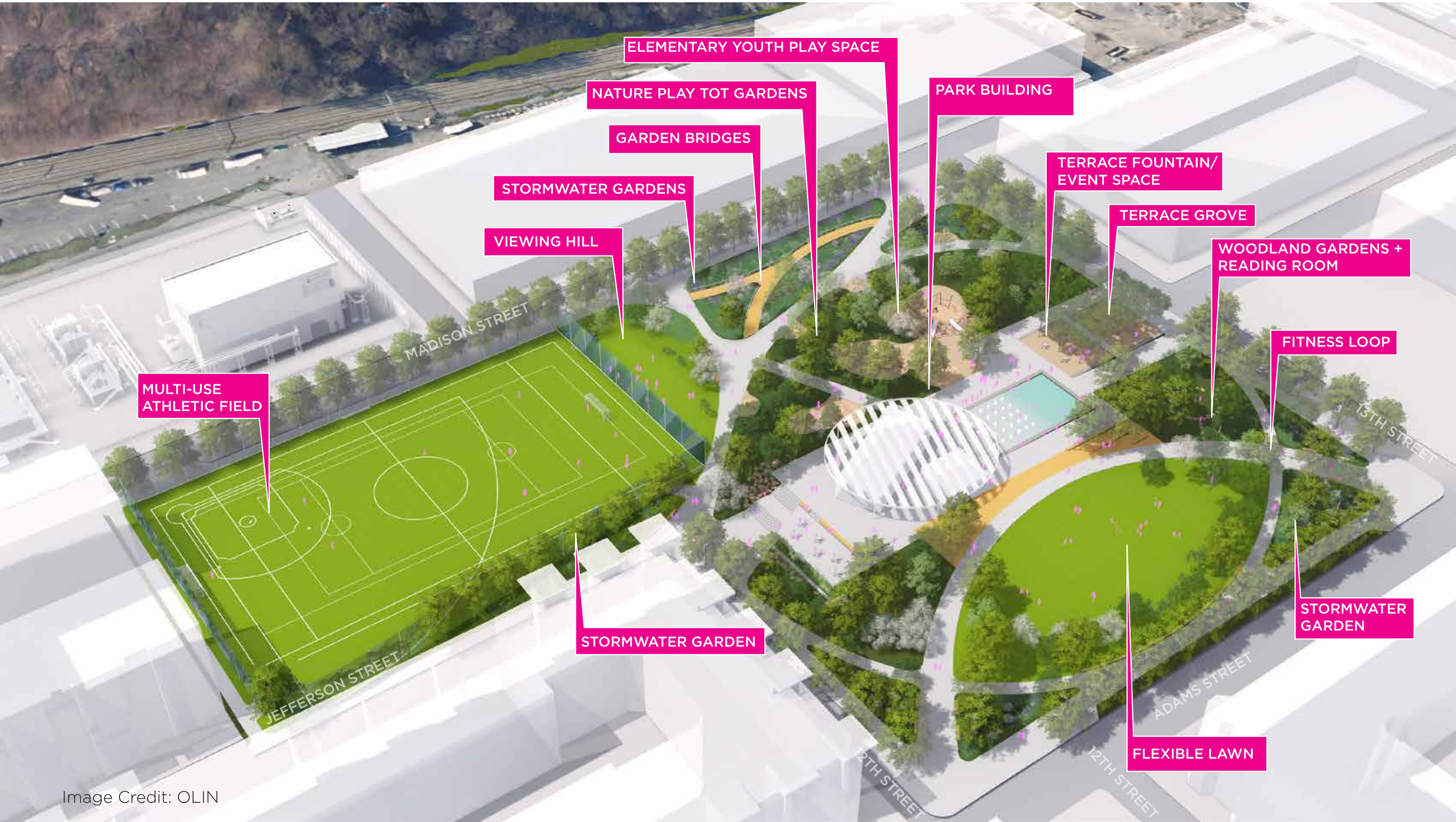


Image Credit: OLIN

Northwest Resiliency Park Conceptual Water Systems

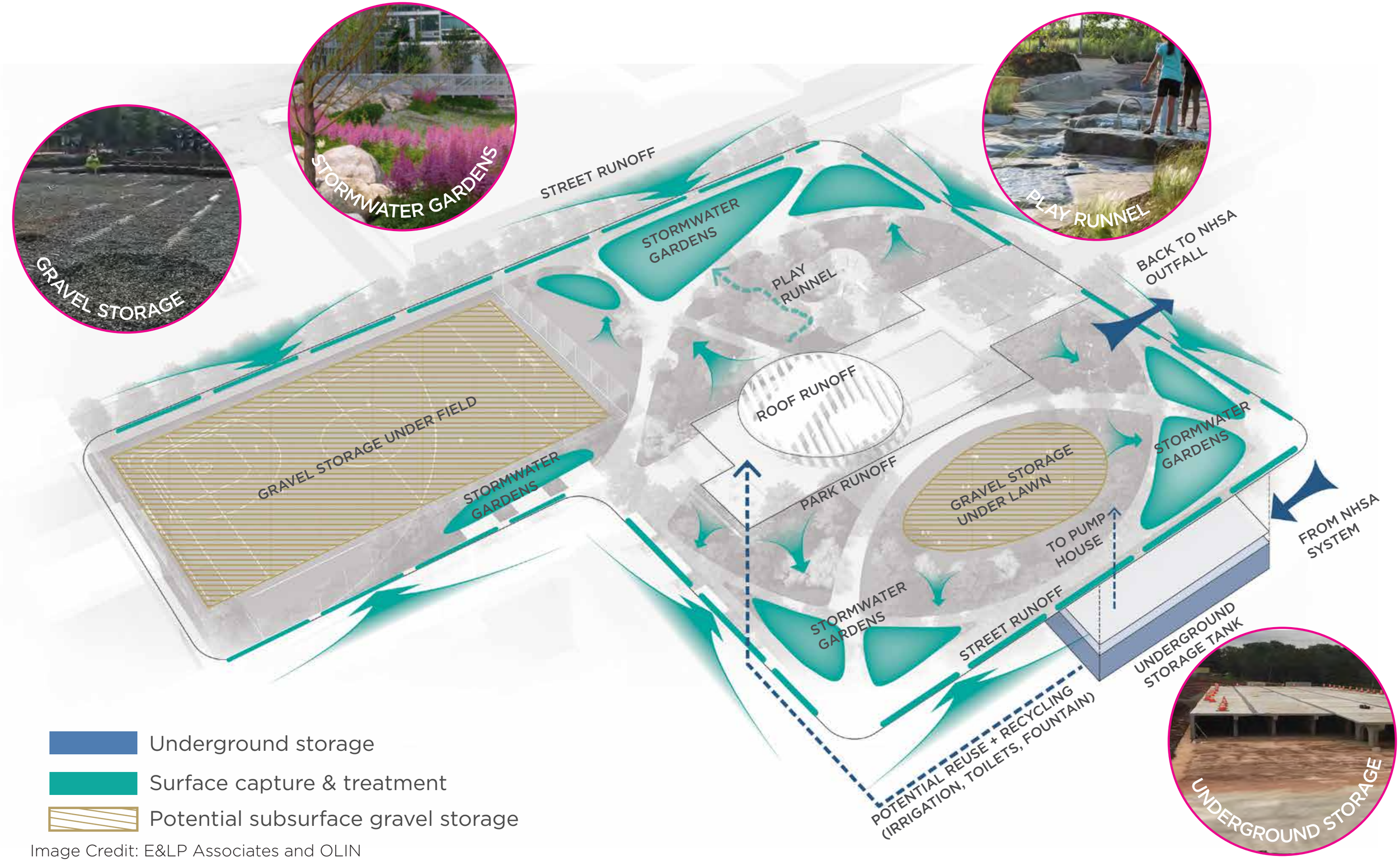


Image Credit: E&LP Associates and OLIN

Final Plan and Details

Image Credit: OLIN

Image Credit: OLIN

Stormwater Systems

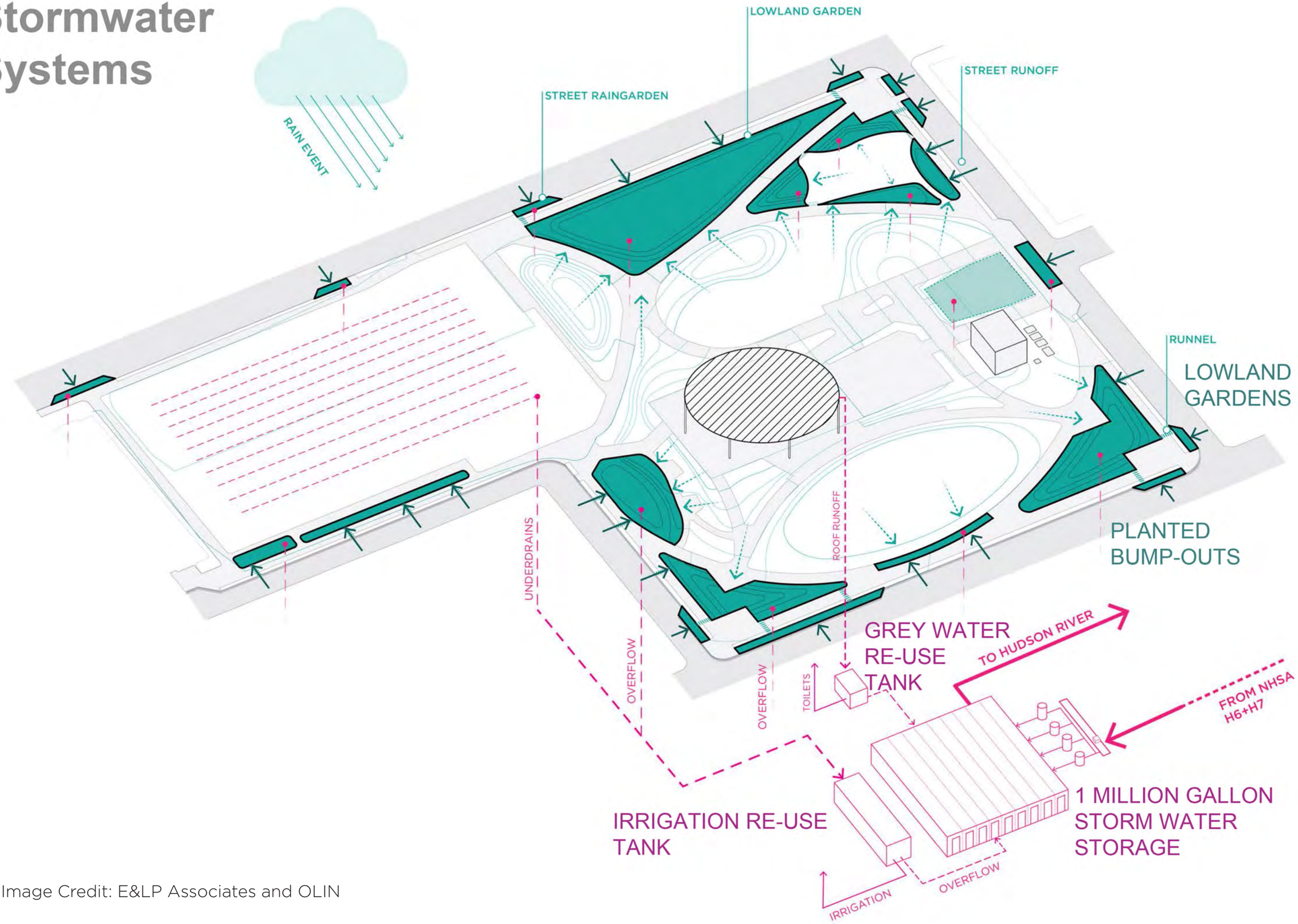


Image Credit: E&LP Associates and OLIN

Planting
Lowlands

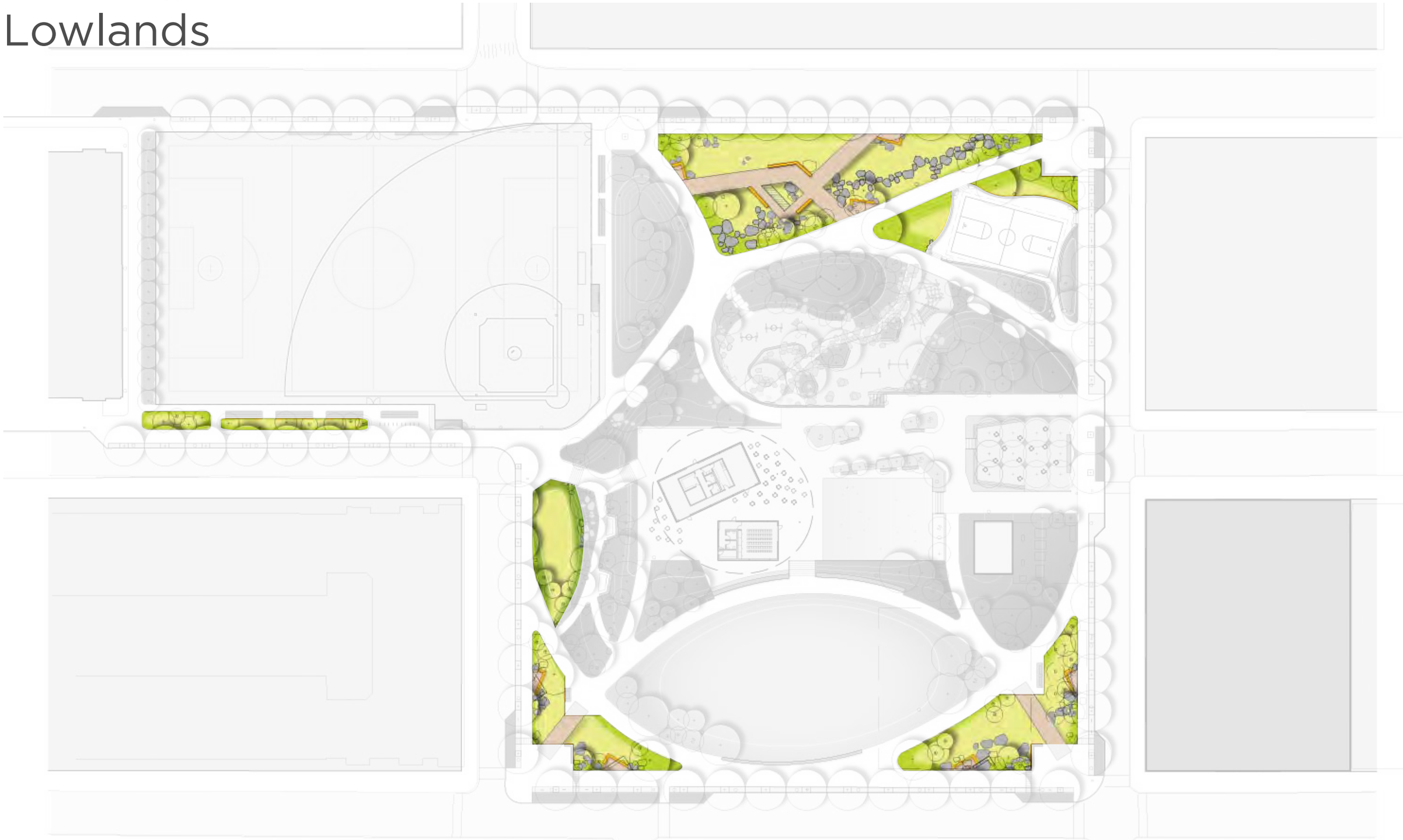


Image Credit: OLIN

Adams Street Entry Gardens + Great Lawn

Image Credit: OLIN

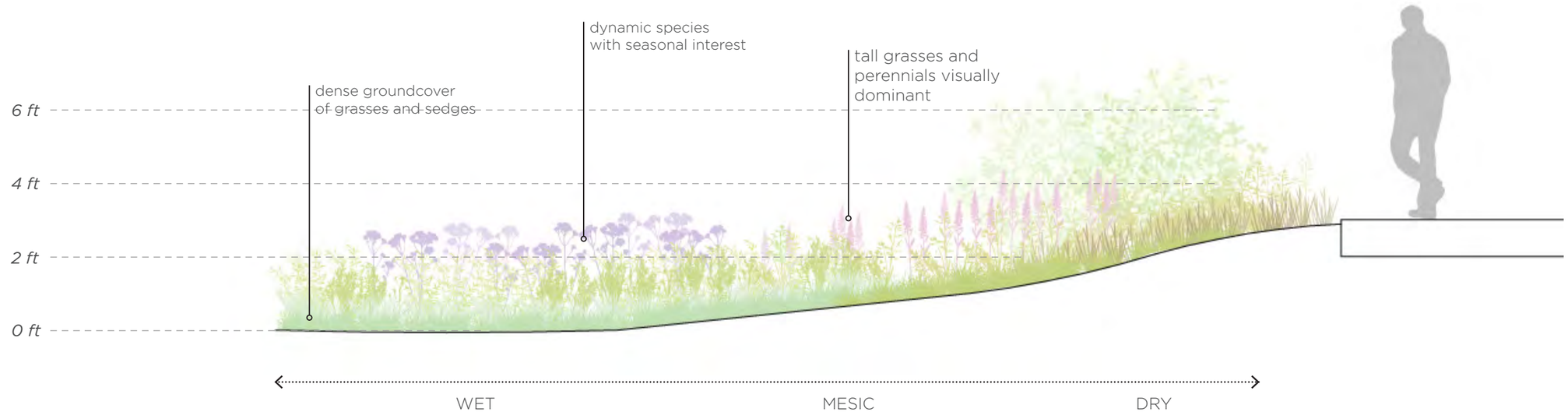
Adams Street Entry Gardens

Image Credit: OLIN

Lowland Gardens

Image Credit: OLIN

Planting
Lowlands



vertical layers

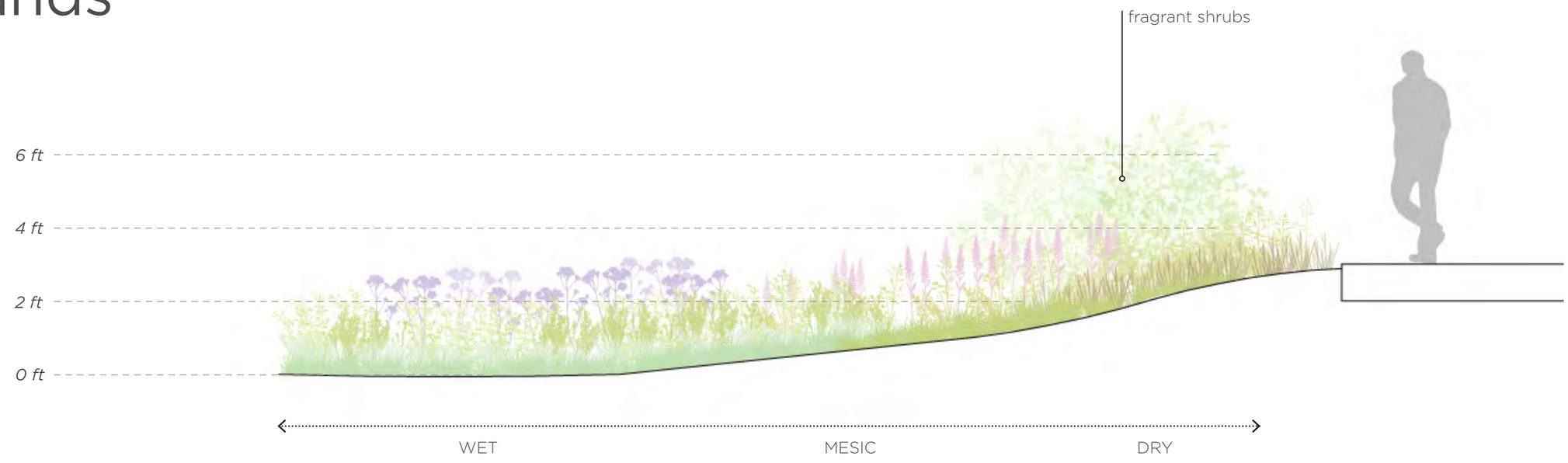
Eutrochium dubium 'Little Joe', Joe Pye Weed
Juncus effusus 'Quartz Creek', Common Rush
Solidago rugosa 'Fireworks', Rougleaf Goldenrod
Deschampsia cespitosa, Tufted Hair Grass
Chelone glabra, White turtlehead
Carex amphibola, Creek Sedge
Iris virginica, Southern Blue flag

Vernonia noveboracensis, New York ironweed
Asclepias incarnata, Swamp Milweed
Pennisetum alopecuroides, Fountain grass
Calamagostris x acutiflora, Feather reed grass
Liatris spicata, Blazing star
Sporobolus heterolepsis, Prairie dropseed
Solidago sphacelata, Autumn Goldenrod
Calamintha nepeta, Calamint
Sesleria autumnalis, Autumn Moor Grass

Schizachyrium scoparium, Little Bluestem
Panicum virgatum, Switch grass
Baptisia alba, White False Indigo
Amsonia hubrichtii, Threadleaf bluestar
Echinacea 'Green Edge', Coneflower
Asclepias syriaca, Common milkweed
Rudbeckia fulgida, Orange Coneflower
Coreopsis verticillata, Threadlead coreopsis
Eranthis hyemalis, Winter aconite

HERBACEOUS LAYER
Image Credit: OLIN

Planting
Lowlands



Spirea tomentosa, Steeplebush
Spirea alba, Meadowsweet
Aronia arbutifolisa, Red Chokeberry
Baccharis halimifolia, Eastern Baccharis

Cornus sericea, Red twig dogwood
Clethra alnifolia , Summersweet
Cephalanthus occidentalis, Buttonbush

Spirea betulifolia, Spirea
Viburnum dentatum, Arrowwood viburnum
Viburnum carlesii, Korean spice viburnum
Syringa vulgaris, Common Lilac

SHRUB LAYER
Image Credit: OLIN

Multi-Purpose Field

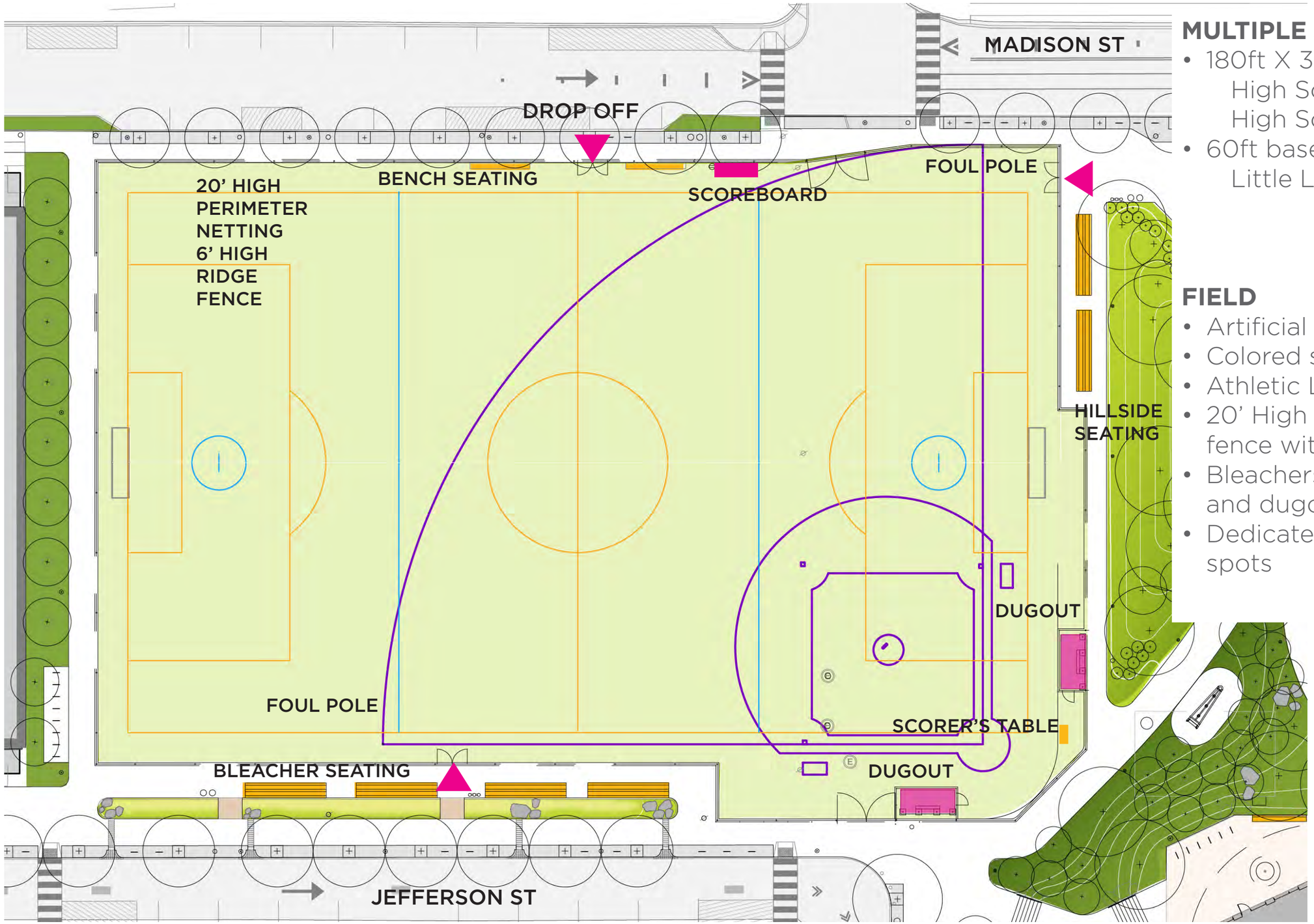


Image Credit: OLIN

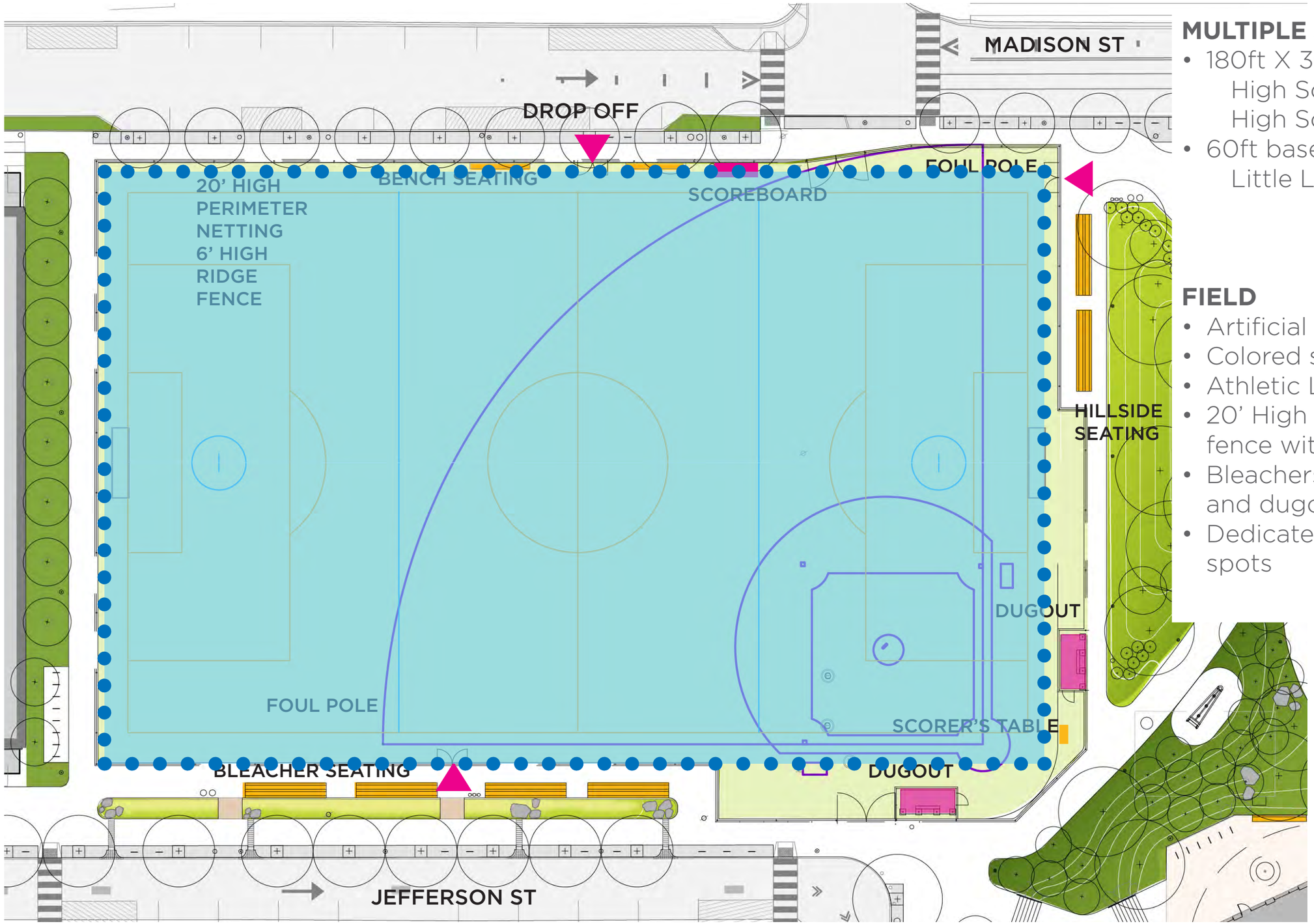
MULTIPLE SPORTS

- 180ft X 300ft (60yd X 100yd)
  High School Soccer
  High School Lacrosse
- 60ft baselines + 200ft outfield
  Little League Baseball

FIELD

- Artificial Turf
- Colored striping for each sport
- Athletic Lighting
- 20' High Netting + 6' high rigid fence with gates
- Bleachers, moveable benches, and dugout shade structures
- Dedicated drop-off parking spots

Multi-Purpose Field



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Madison Gardens + Play Valley

Image Credit: OLIN

Play Valley

Image Credit: OLIN

Play Valley

Image Credit: OLIN

Madison Gardens + Play Valley

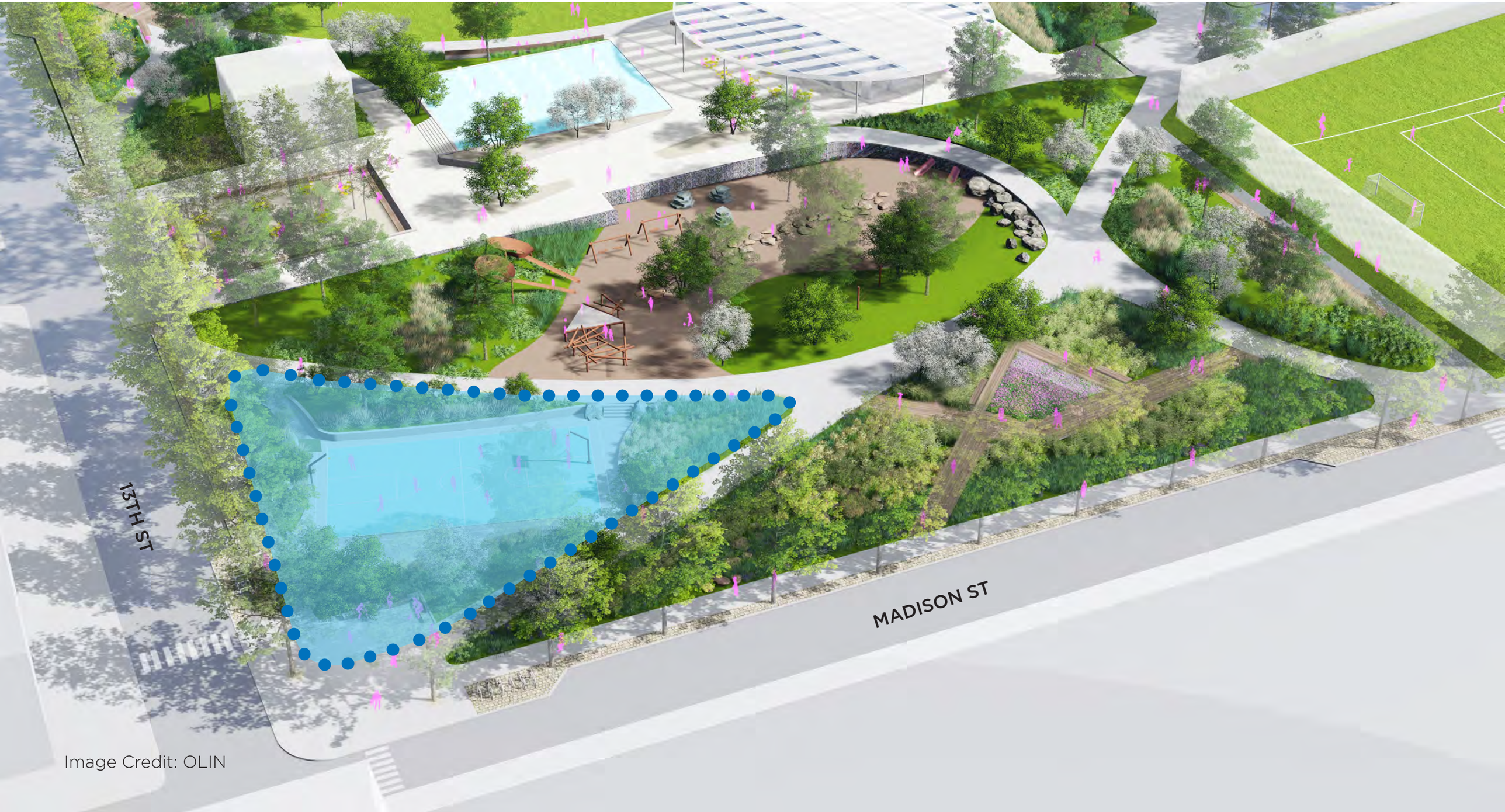
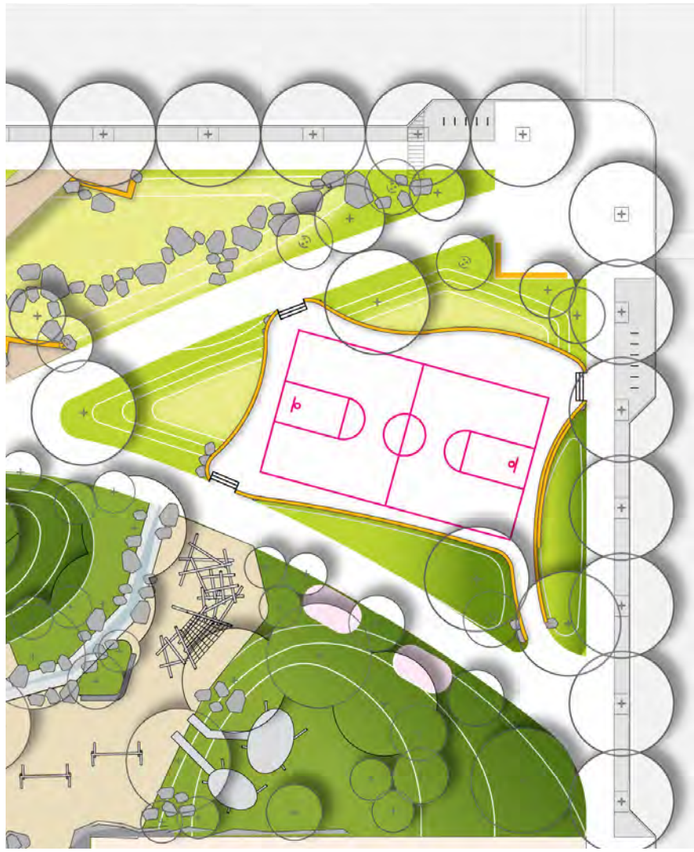


Image Credit: OLIN

Basketball Basin



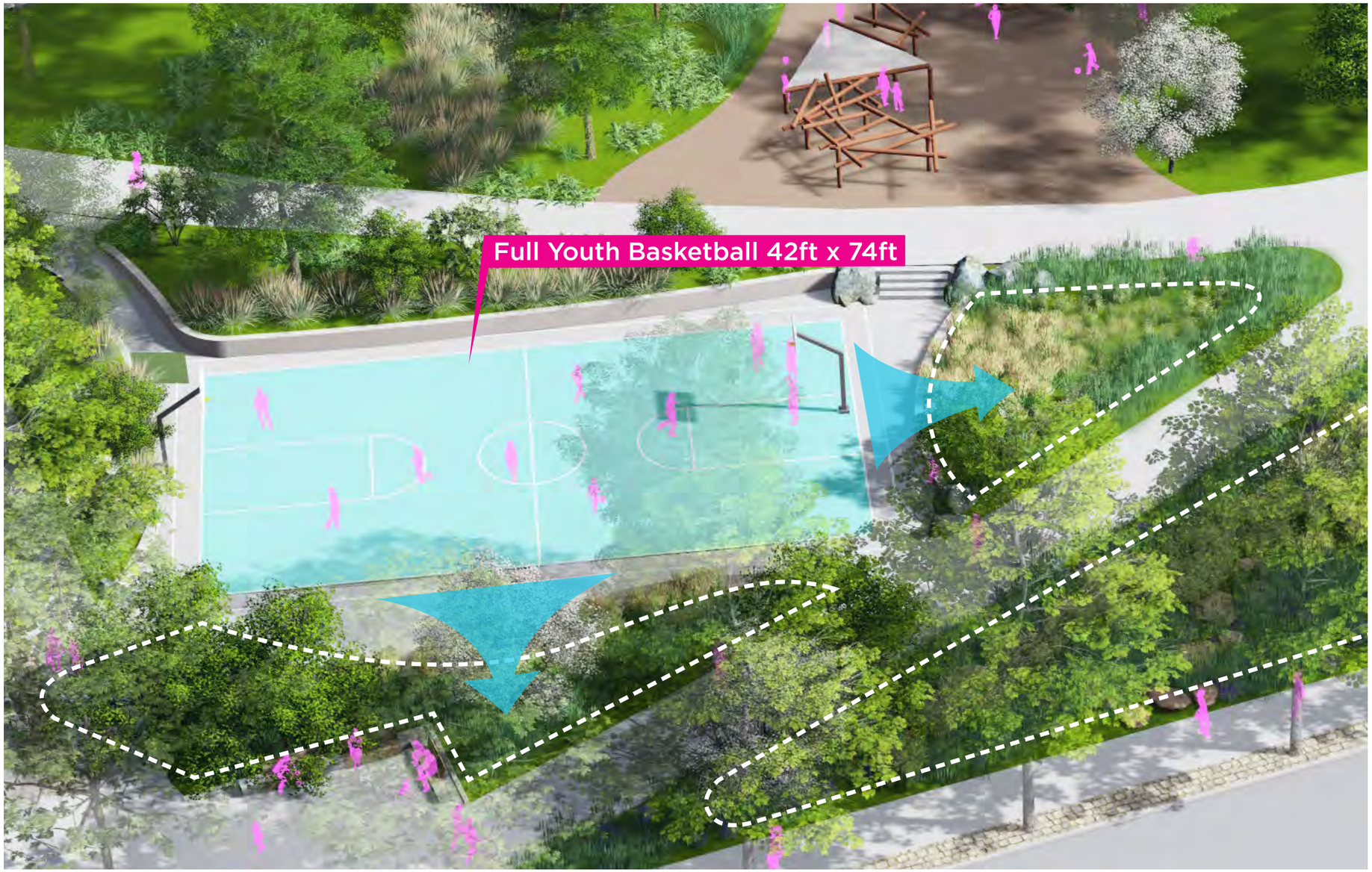


Image Credit: OLIN

Basketball Basin

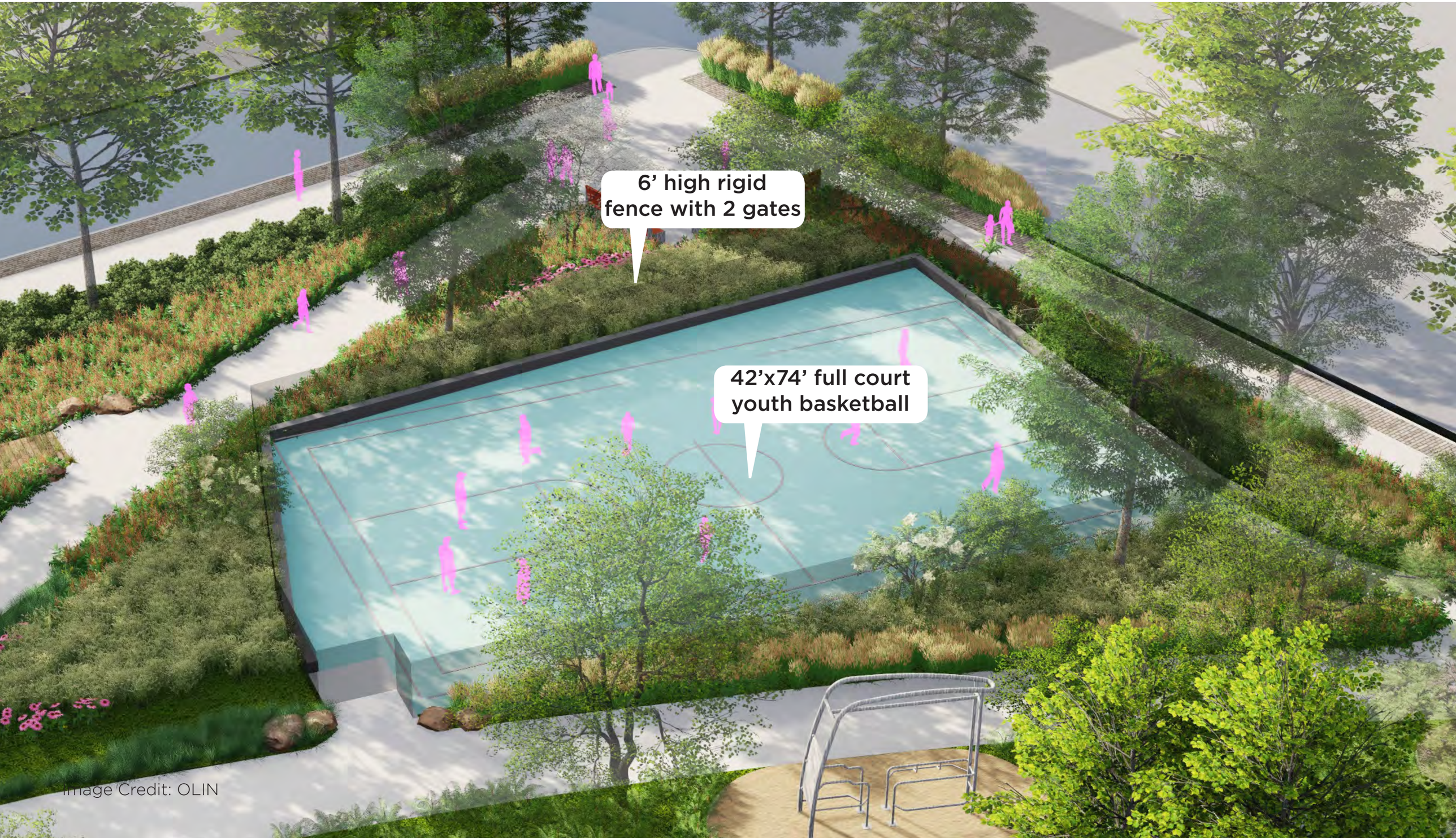
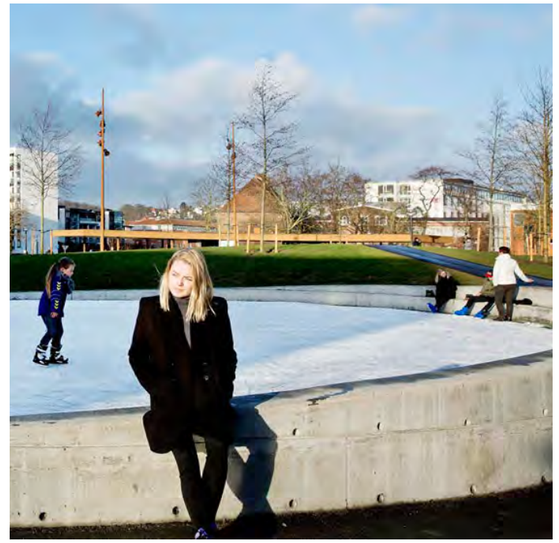


Image Credit: OLIN

Basketball Basin - Flexible Uses



Madison Gardens + Play Valley

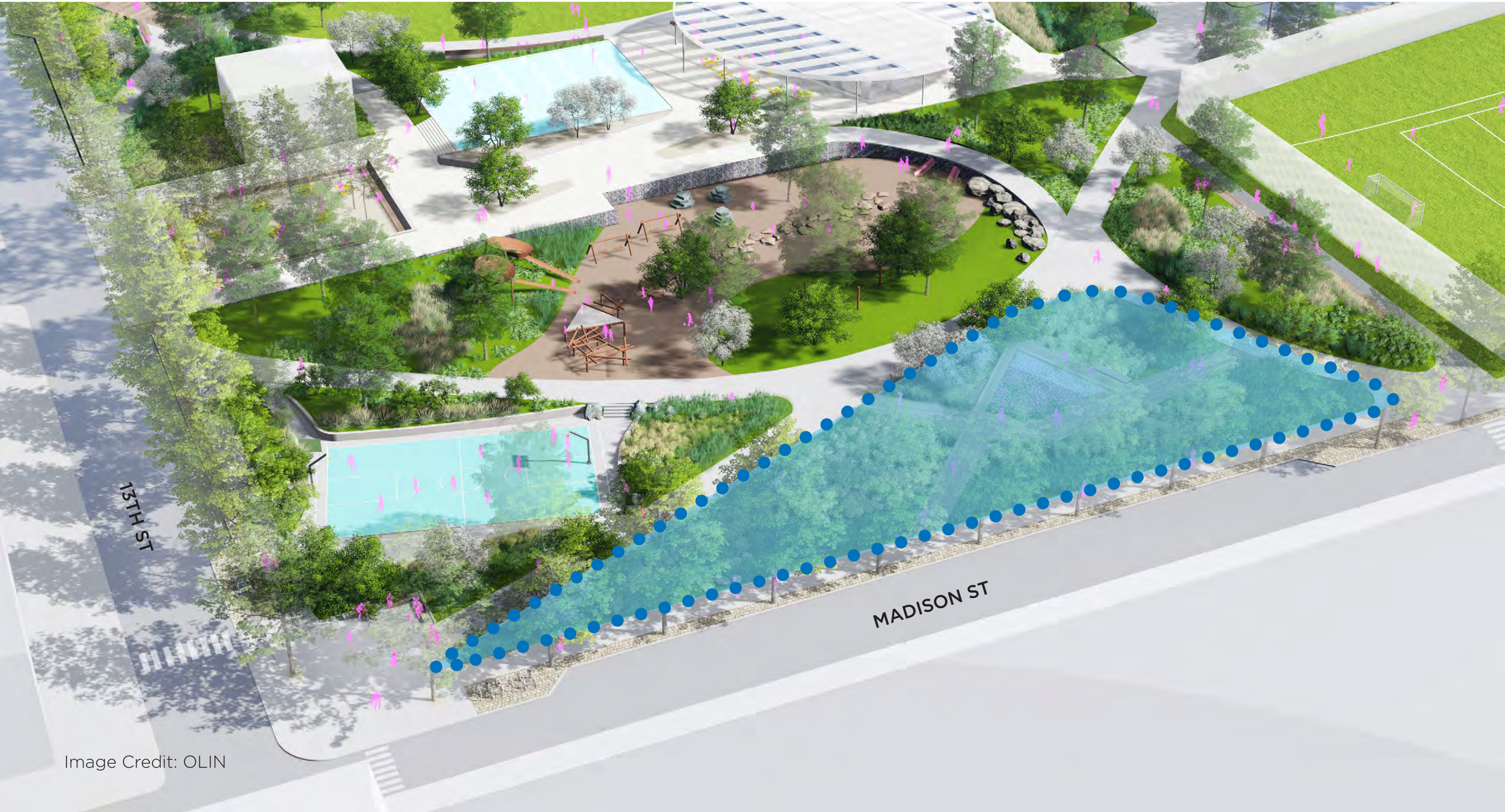


Image Credit: OLIN

Madison Garden + Learning Walk

Image Credit: OLIN

Image Credit: E&LP Associates

Client:
City of Hoboken

Stakeholders:
New Jersey Infrastructure Bank (I-Bank)
Hudson County
New Jersey Department of Environemental Protection
North Hudson Sewerage Authority

Design Team
E&LP Associates, Team Lead + Civil
OLIN, Landscape Architecture
nArchitects, Architecture
Silman, Structural
OLA, MEP
Excel Environmental, Environmental Remediation
Tillett, Lighting Design
Studio Ludo, Playground Design
Geodesign, Support of Excavation
Lynch & Associates, Irrigation
Delta Fountains, Fountain Design

E&LP

Acknoledgements
Villanova Urban Stormwater Partnership
October 17, 2019

QUESTIONS?

Questions
Villanova Urban Stormwater Partnership
October 17, 2019

E&LP