QUIDDITY

Transforming City Parks to Incorporate Stormwater Mitigation Strategies

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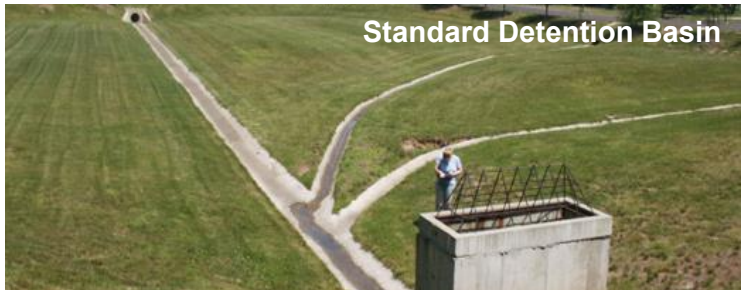
HOUSTON PUBLIC WORKS

QUIDDITY ENGINEERING

HPARD HOUSTON PARKS AND RECREATION DEPARTMENT A CAPRA Accredited Agency

25 YEARS AND COUNTING M2L5 1995-2020

CITY OF HOUSTON TEXAS



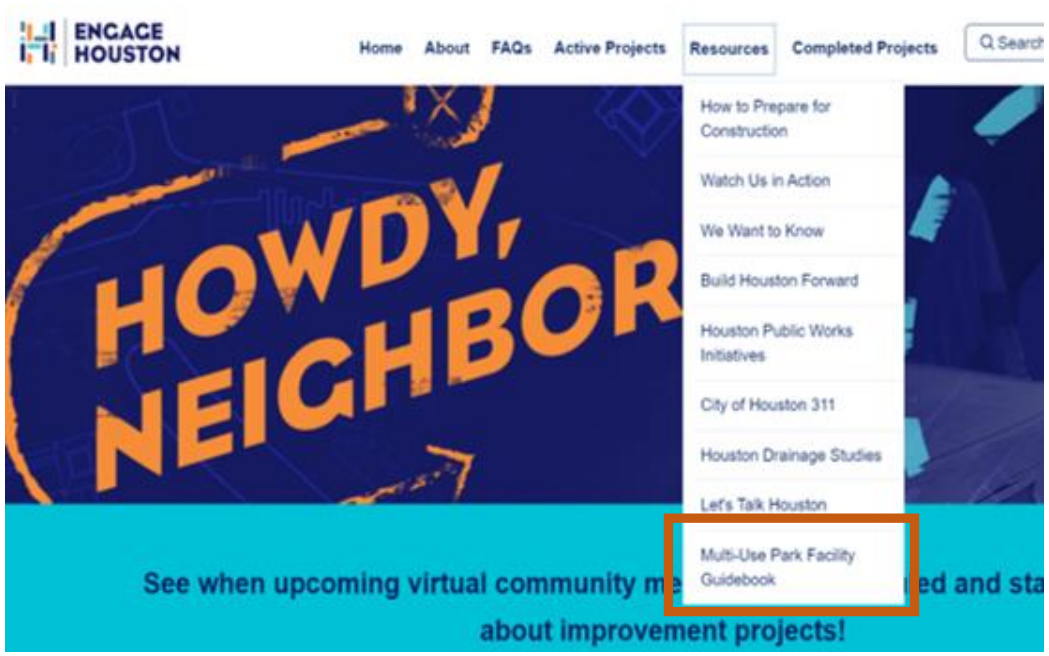
Guidebook Goals

To develop strategies for alternative detention solutions

- Rapid growth
- Atlas 14 rainfall depth
- Strategies to combine detention facilities in a park space
- Enhancements to parks and renovations
- Protect the community from flooding risks
- Build strong partnerships between agencies

100-year, 24-hour Rainfall Depth				
Region 1	***Cypress Creek***	12.4	16.3	3.9
Region 2	***Greens Bayou***	13.2	16.9	3.7
Region 3	***Clear Creek***	13.5	18.0	4.5
		100-yr	Atlas 14	INCREASE

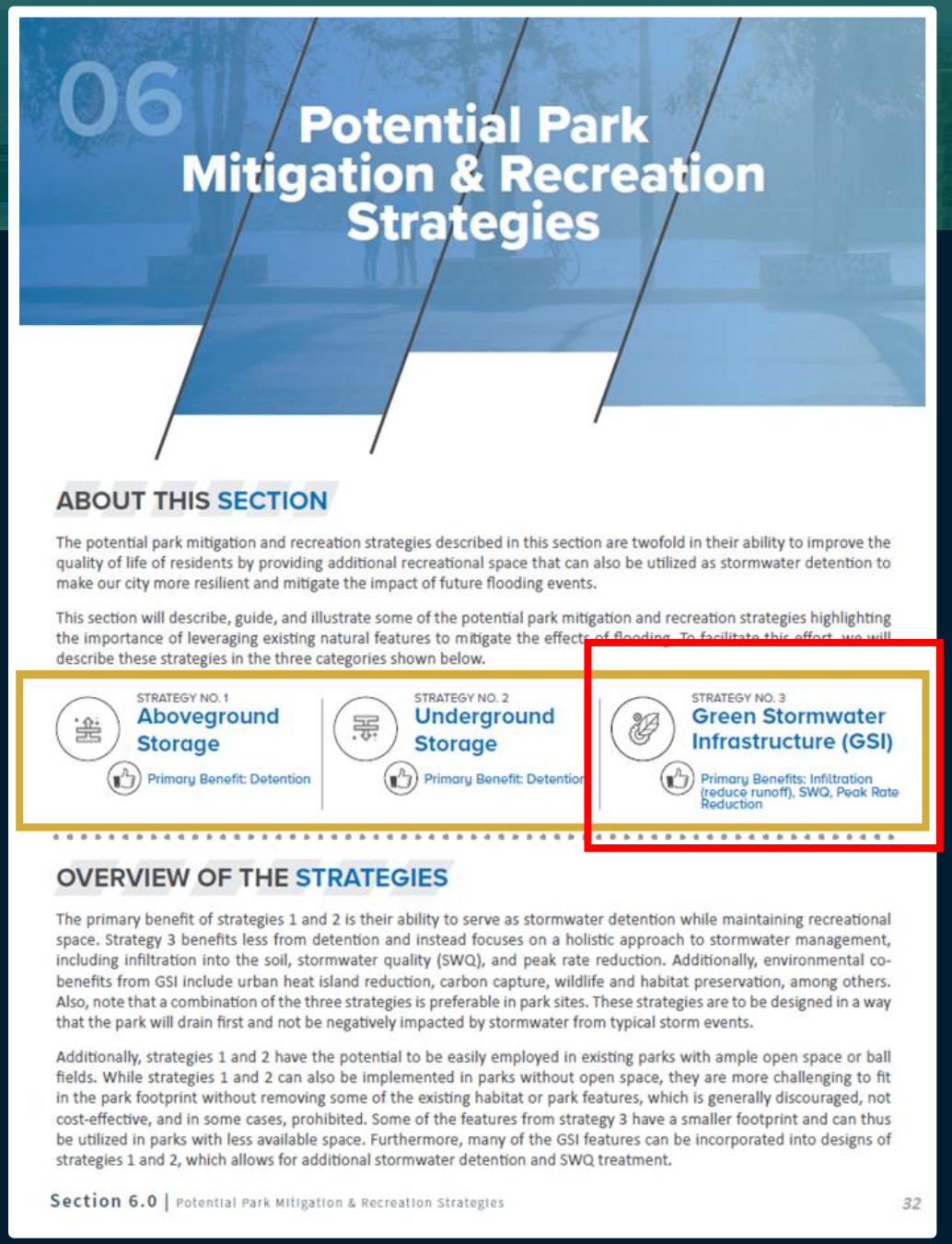
Guidebook Publication



Engage Houston
www.engagehouston.org

Guidebook Published
Published in 2022

Section 6: Potential Park Mitigation & Recreation Strategy



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Potential Park Mitigation & Recreation Strategies

ABOUT THIS SECTION

The potential park mitigation and recreation strategies described in this section are twofold in their ability to improve the quality of life of residents by providing additional recreational space that can also be utilized as stormwater detention to make our city more resilient and mitigate the impact of future flooding events.

This section will describe, guide, and illustrate some of the potential park mitigation and recreation strategies highlighting the importance of leveraging existing natural features to mitigate the effects of flooding. To facilitate this effort, we will describe these strategies in the three categories shown below.

STRATEGY NO. 1
Aboveground Storage
Primary Benefit: Detention

STRATEGY NO. 2
Underground Storage
Primary Benefit: Detention

STRATEGY NO. 3
Green Stormwater Infrastructure (GSI)
Primary Benefits: Infiltration (reduce runoff), SWQ, Peak Rate Reduction

OVERVIEW OF THE STRATEGIES

The primary benefit of strategies 1 and 2 is their ability to serve as stormwater detention while maintaining recreational space. Strategy 3 benefits less from detention and instead focuses on a holistic approach to stormwater management, including infiltration into the soil, stormwater quality (SWQ), and peak rate reduction. Additionally, environmental co-benefits from GSI include urban heat island reduction, carbon capture, wildlife and habitat preservation, among others. Also, note that a combination of the three strategies is preferable in park sites. These strategies are to be designed in a way that the park will drain first and not be negatively impacted by stormwater from typical storm events.

Additionally, strategies 1 and 2 have the potential to be easily employed in existing parks with ample open space or ball fields. While strategies 1 and 2 can also be implemented in parks without open space, they are more challenging to fit in the park footprint without removing some of the existing habitat or park features, which is generally discouraged, not cost-effective, and in some cases, prohibited. Some of the features from strategy 3 have a smaller footprint and can thus be utilized in parks with less available space. Furthermore, many of the GSI features can be incorporated into designs of strategies 1 and 2, which allows for additional stormwater detention and SWQ treatment.

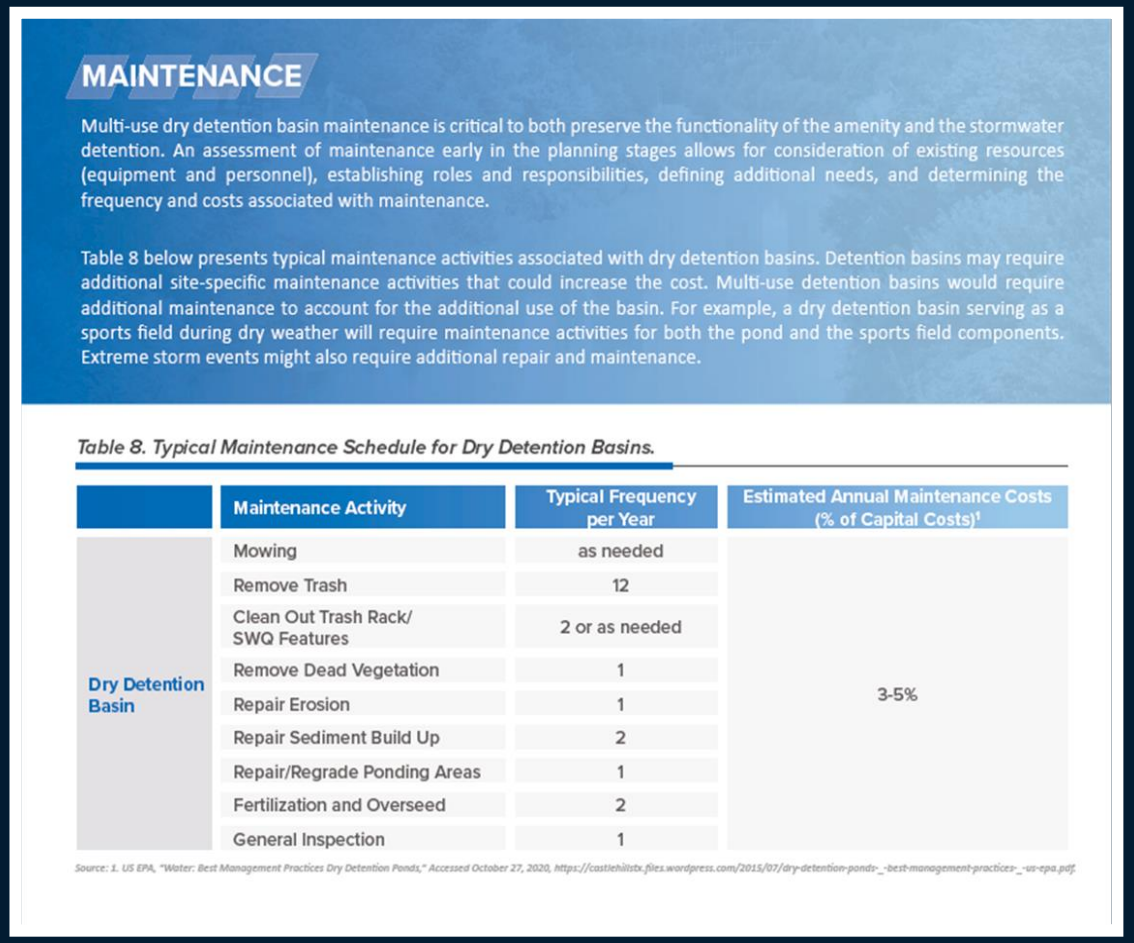
- Utilizing a combination of strategies for stormwater detention is possible and desirable
- Use where the strategies enhance the park's aesthetic appeal as well as stormwater storage and treatment, and are in line with the park's goals

Section 6: Above Ground Storage Strategy

Aboveground Storage:

- Type 1: Multi-Use Dry Detention Strategy
  - Depressed open field or sports field
- Type 2 : Wet Detention Strategy
  - Wet amenity pond

Section 6: Maintenance Considerations



MAINTENANCE

Multi-use dry detention basin maintenance is critical to both preserve the functionality of the amenity and the stormwater detention. An assessment of maintenance early in the planning stages allows for consideration of existing resources (equipment and personnel), establishing roles and responsibilities, defining additional needs, and determining the frequency and costs associated with maintenance.

Table 8 below presents typical maintenance activities associated with dry detention basins. Detention basins may require additional site-specific maintenance activities that could increase the cost. Multi-use detention basins would require additional maintenance to account for the additional use of the basin. For example, a dry detention basin serving as a sports field during dry weather will require maintenance activities for both the pond and the sports field components. Extreme storm events might also require additional repair and maintenance.

Table 8. Typical Maintenance Schedule for Dry Detention Basins.

	Maintenance Activity	Typical Frequency per Year	Estimated Annual Maintenance Costs (% of Capital Costs)[1]
Dry Detention Basin	Mowing	as needed	3-5%
	Remove Trash	12	
	Clean Out Trash Rack/ SWQ Features	2 or as needed	
	Remove Dead Vegetation	1	
	Repair Erosion	1	
	Repair Sediment Build Up	2	
	Repair/Regrade Ponding Areas	1	
	Fertilization and Overseed	2	
	General Inspection	1	

Source: 1. US EPA, "Water: Best Management Practices Dry Detention Ponds," Accessed October 27, 2020, https://castlehillstx.files.wordpress.com/2015/07/dry-detention-ponds-_-best-management-practices-_-us-epa.pdf.

Maintenance Considerations

Field Maintenance

- Mowing, seeding, vegetation, etc.

Stormwater Feature

- Clean out SW infrastructure, repair erosion and sediment buildup, repair/regrade ponding areas

Section 6: GSI Strategy

Green Stormwater Infrastructure (GSI) Advantages

- Uses or mimics natural processes to prevent, capture, and/or filter stormwater runoff (interception, soil infiltration, evapotranspiration, etc.)
- Stormwater quality benefits
- Can be incorporated around park amenities due to generally smaller footprint

Section 6: GSI Strategy

Table 13. BMP Overview and Parkland Use

Small-Scale Strategies

RAIN BARREL/CISTERN

Rain barrels include small systems that capture runoff and convey it into rain barrels for reuse. Generally, rain barrels hold less than 100 gallons and are used in single-family homes. Cisterns are larger rainwater captures systems than rain barrels. They can capture runoff from multiple sources.

- ✓ Community centers

STORMWATER PLANTER BOX

Stormwater planter boxes are bioretention systems that are enclosed in concrete containers. They are utilized to capture and filter stormwater runoff.

- ✓ Near streets
- ✓ Parking lots
- ✓ Sidewalks
- ✓ Visitor centers

GREEN ROOF

A green roof is a vegetated layer that is planted on a rooftop. The vegetation captures and filters stormwater. If properly maintained, the green roof can extend the life of the underlying roof as well as provide atmospheric cooling and stormwater benefits.

- ✓ Community center
- ✓ Maintenance building
- ✓ Parking lots

VEGETATED SWALE

Vegetated swales are wide, shallow channels with vegetation covering the sides and bottom, and can be applied in a variety of locations. They mimic natural drainage systems and are used to promote infiltration, remove pollutants, reduce runoff velocity, and convey and treat stormwater.

- ✓ Community center
- ✓ Maintenance building
- ✓ Parking lots

BIOSWALE

Bioswales are similar to bioretention cells, but are linear and are used for biofiltration, storage, and conveyance. Bioswales are versatile and can be applied in a variety of locations.

- ✓ Small sites
- ✓ Parking lots

Medium-Scale Strategies

BIORETENTION CELL/RAIN GARDEN

Bioretention cells/rain gardens are depressed areas that contain native plantings and are layered with engineered soil media to promote infiltration and filtration. Due to infiltration, stormwater is slowed down, detained, and treated.

- ✓ Small sites
- ✓ Landscaped areas
- ✓ Medians
- ✓ Parking lots
- ✓ Demonstration gardens near community centers

VEGETATED FILTER STRIP

Vegetated filter strips are gently sloping, planted areas that are placed between sources of runoff. Shallow sheet flow passes along the filter strip and is treated in the process. Primary functions include slowing down stormwater runoff, infiltration, evaporation, and removing sediments.

- ✓ Near roads
- ✓ Near parking lots
- ✓ Near roofs
- ✓ Near bayous and waterways

PERMEABLE PAVING

Permeable paving is a durable, load-bearing method of paving surfaces that allows for water to infiltrate through the paved surface and into the underlying rock base. An underdrain, subsurface detention, or rainwater harvesting system is needed to collect the rainwater due to the clay soils in the Houston area. The primary functionality of permeable paving includes reducing runoff volume and peak flow rates and reducing pollutant loads.

- ✓ Streets
- ✓ Parking lots
- ✓ Sidewalks
- ✓ Playgrounds
- ✓ Plazas

MAINTENANCE!

Large-Scale Strategies

REFORESTATION

Reforestation involves restoring previously forested areas with native species and trees. This strategy provides many benefits, including urban heat reduction, natural habitat restoration, improved infiltration capacity of the surrounding soils, precipitation interception in the canopy, runoff reduction, and cleaner air, among others.

- ✓ Wooded parks that are filled with invasive species
- ✓ Historically forested areas that have been cleared

SOIL AMENDMENT

Soil amendments refer to the additions of organic materials to native soils to improve the stormwater management, landscaping, plant health, and aesthetics of native soils. Processes to increase water storage and infiltration capabilities, such as cutting and filling, tilling, blending, and mulching, are also utilized. Suburban subsoiling is one method of soil amendment that can increase soil health and stormwater infiltration potential.

- ✓ Areas where increased infiltration is desired
- ✓ Below parking lots with pervious pavement

CONSTRUCTED STORMWATER WETLANDS

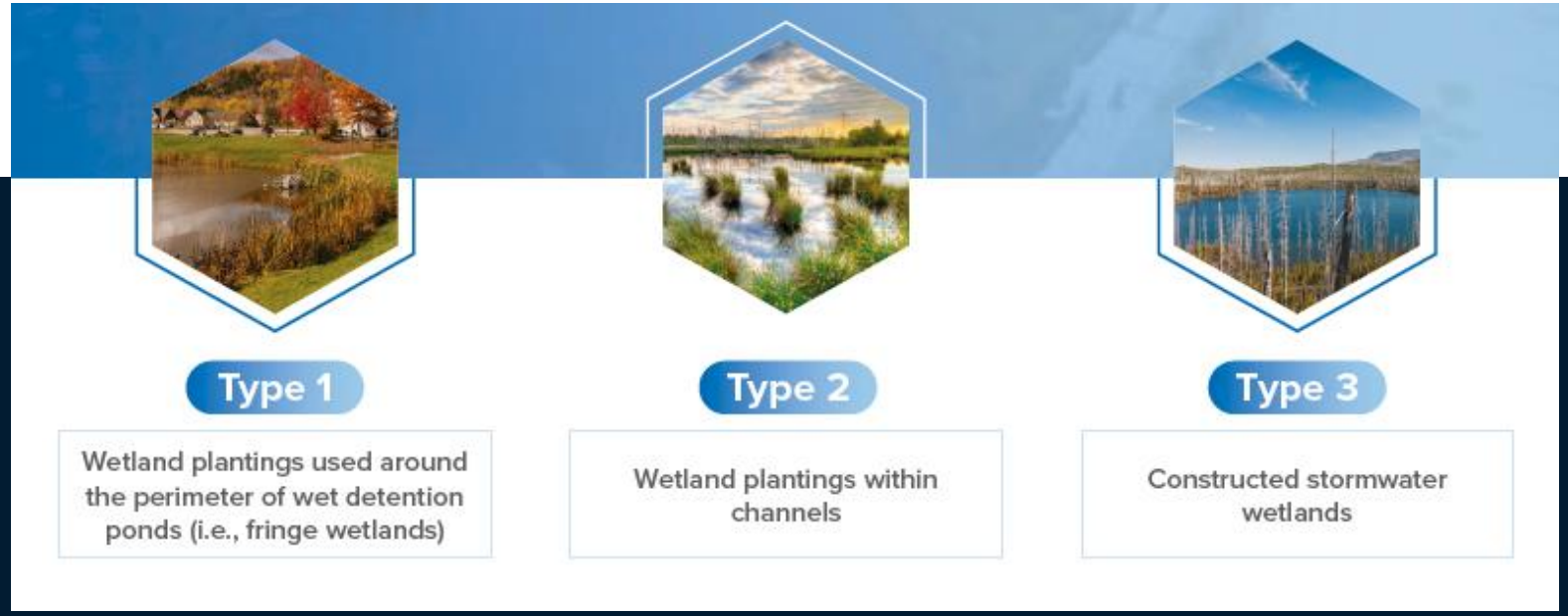
Constructed stormwater wetlands are engineered wetlands designed to store and treat stormwater runoff. They are composed of shallow depressions that promote wildlife habitat. Additional information is included on pages 75-77.

- ✓ Larger sites
- ✓ River corridors
- ✓ Existing drainage areas
- ✓ Natural areas along stream channels

Photo Source No. 24: Brodie & Associates Landscape Architects, Inc. (Bioswale)
Photo Source No. 25: Stormwaterpa.org (Vegetated Swale)

Section 6: Wetlands Strategy

3 Types of Wetlands Detailed In This Guidebook:



- Requested by HPR
- Wetlands as GSI
- Generally larger detention capacity due to larger footprint

Section 6: Examples Provided in Guidebook

Memorial Park

Houston, Texas

EXAMPLE 1

Land Use
Parkland

Project Cost
$205M[20]

Amenities
✓Walking Trails
✓Picnic Area
✓Golf Course
✓ Sports Complex
✓New Parking

Stormwater Storage & BMPs
Native Species Reforestation, Wetlands, Wet Detention, Bioswales, Bioretention, Rain Gardens, Permeable Pavement, Water Reuse

Detention Gained
TBD

About The Project. Memorial Park in Houston, Texas is another example of a park with wooded areas that implements BMPs to provide stormwater detention benefits to the surrounding area. The Eastern Glades project reclaimed 100 acres of parkland and, in the process, replaced invasive species with native species. Additionally, wetlands, a lake, and park amenities including a walking trail, picnic areas, and new parking areas were implemented.Additionally, an Ecological Stormwater Management Plan was proposed in the Memorial Park Master Plan that implements bioswales, bioretention, rain gardens, and permeable pavements to improve stormwater detention and stormwater quality in the park as well as maintain ecological systems, and reduce use of potable water for irrigation.

Bioretention/Bioswales/Rain Garden
These BMPs compose a BMP network and are designed to treat at least the first inch of stormwater runoff from all hard surfaces. The treated water is designed to be released from the BMP within a day and directed toward the primary storm drainage system.

Permeable Pavements
Permeable pavements are used in the BMP network to treat at least the first inch of stormwater runoff from all hard surfaces.

Water Reuse and Detention Storage
An additional initiative of Memorial Park is to store and reuse stormwater for irrigation. The Master Plan notes different water reuse scenarios that provide 50% to 100% of the park's water demand. The stormwater is proposed to be stored in new and existing harvesting ponds, some of which are on the golf course. Furthermore, detention is provided in the ponds above the rainwater harvesting zone.

Native Species/Reforestation/Wetlands
Native species and reforestation will occur throughout the park as one of the main goals of the conservancy project. Gulf Coast prairie and savanna plantings will be reestablished as invasive species are removed. Furthermore, natural wetlands and constructed stormwater wetlands are planned to be built throughout the park for stormwater management and quality purposes.

Maintenance Information
The Master Plan notes the renovations will require more maintenance during the establishment period, and should decline after the native species have been established.[21]

Sources:
[20] A.J. Mistretta, "New Houston Parks and Greenspaces Coming Soon," Greater Houston Partnership, January 8, 2020
[21] Memorial Park Conservancy, HPARD, and Uptown Houston Tax Increment Reinvestment Zone. Memorial Park Master Plan 2015 (Memorial Park Conservancy, HPARD, and Uptown Houston Tax Increment Reinvestment Zone, 2015)

Section 6.4 | Parks That Utilize Multiple Types of Detention

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- Utilizing a combination of strategies for stormwater detention is possible and desirable
- Use where the strategies enhance the park's aesthetic appeal as well as stormwater storage and treatment, and are in line with the park's goals

City of Houston

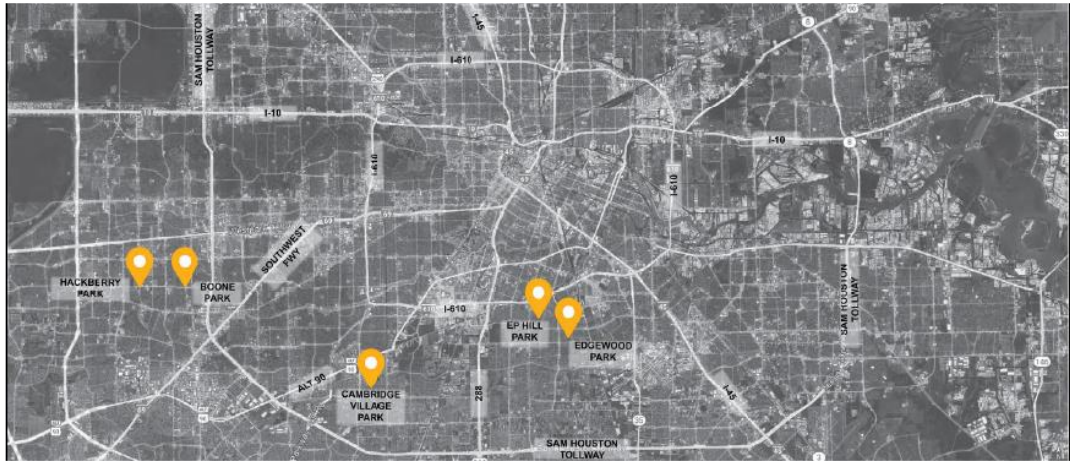
Future Park Design

FIVE PARKS WERE STUDIED

1) EDGEWOOD PARK

2) EP HILL PARK

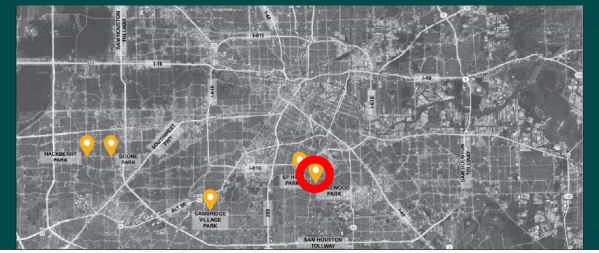
3) BOONE PARK



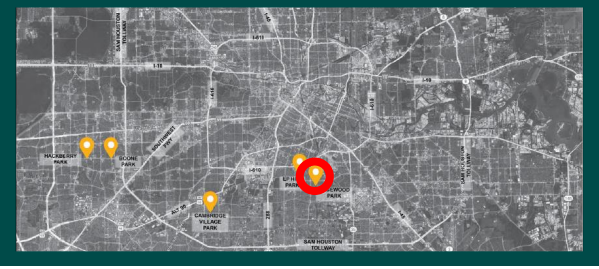
4) HACKBERRY PARK

5) CAMBRIDGE PARK

1: EDGEWOOD PARK
Existing Condition

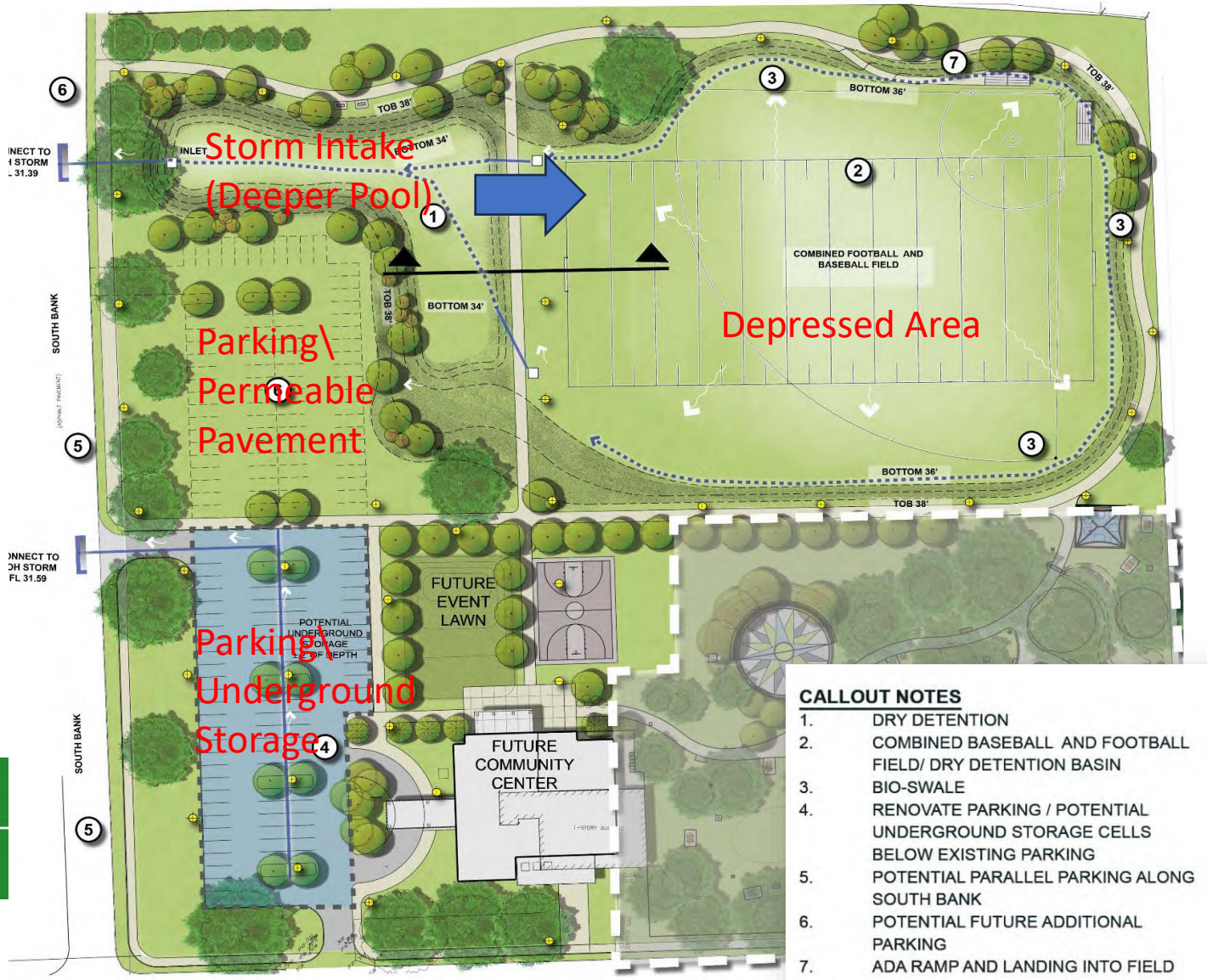


1: EDGEWOOD PARK
Proposed

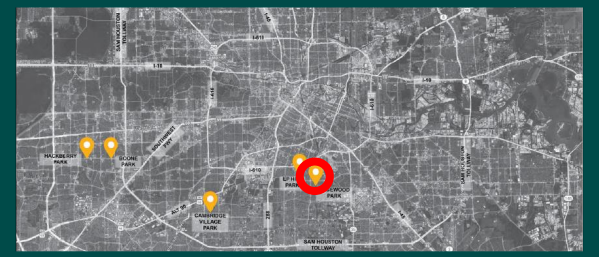


CONCEPTUAL LAYOUT

- Followed master plan for park
- Upgraded trail
- New football field
- Underground storage for future parking lot

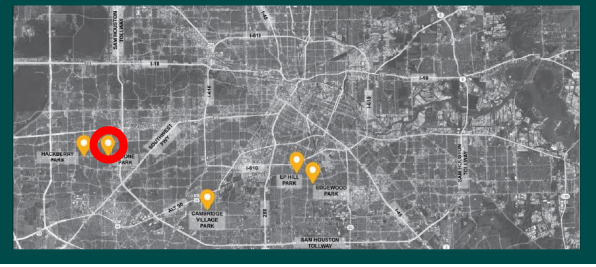


1: EDGEWOOD PARK
3-D Rendering



2: BOONE PARK
Existing Condition

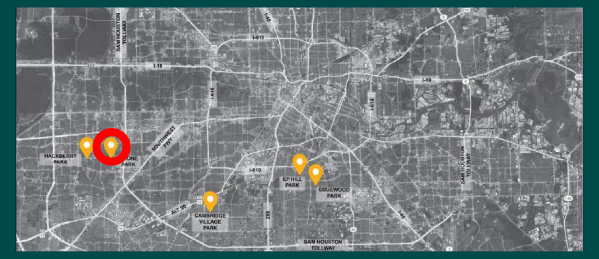
2: BOONE PARK
Proposed



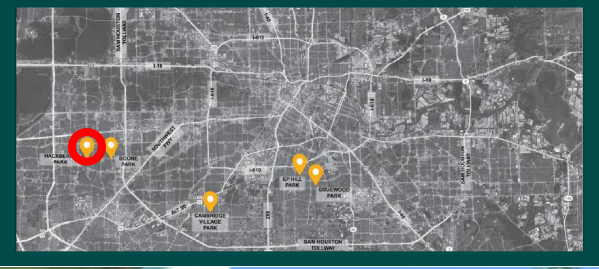
CONCEPTUAL LAYOUT

- Improved soccer field and large swale
- Upgraded volleyball courts
- Replace old pavilion

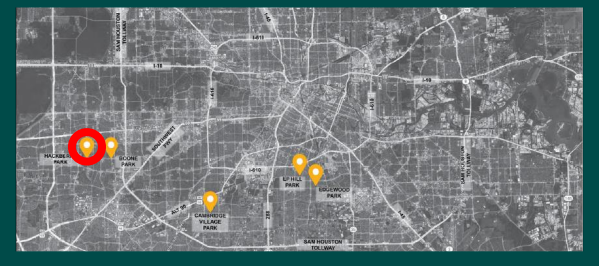
2: BOONE PARK
3-D Rendering



3: HACKBERRY PARK
Existing Condition



3: HACKBERRY PARK
Proposed

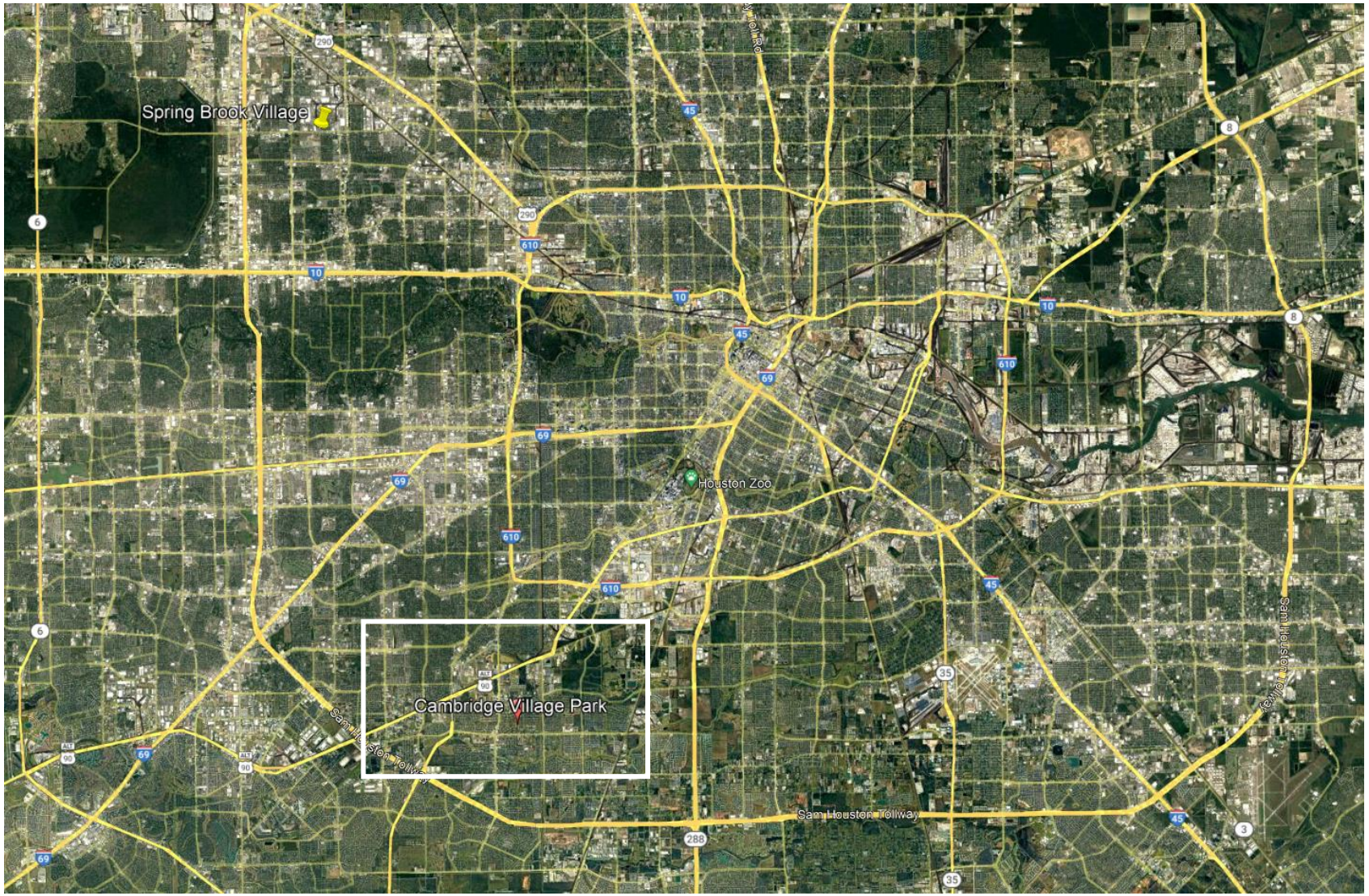


CONCEPTUAL LAYOUT

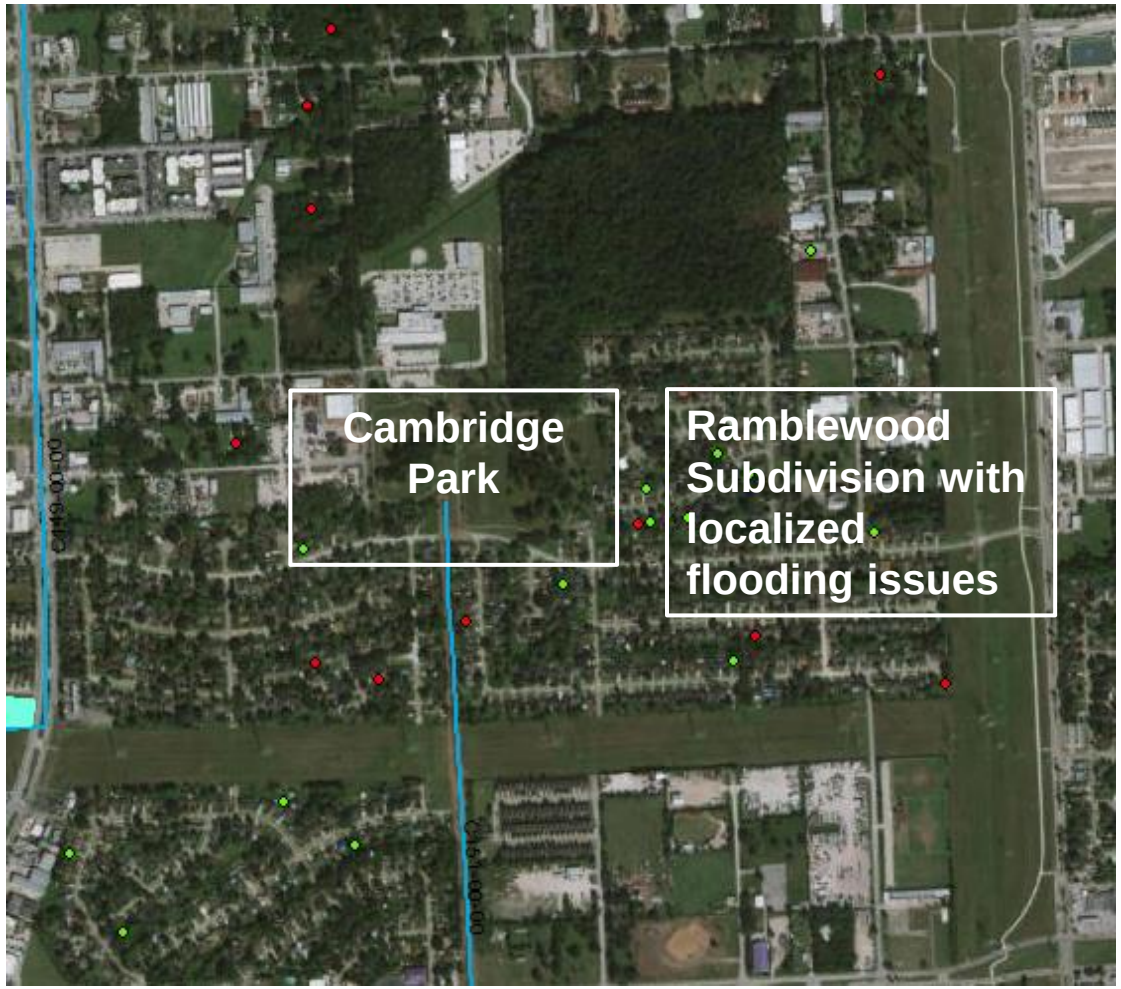
- Connected the water feature
- Removed mounds to create more park space
- Add wetland feature with bird habitat

3: HACKBERRY PARK
3-D Rendering

4. COH Partnership Project | Cambridge Village Park



4. COH Partnership Project | Cambridge Village Park



COH Partnership Project | Cambridge Village Park

Original Detention Layout

Detention areas

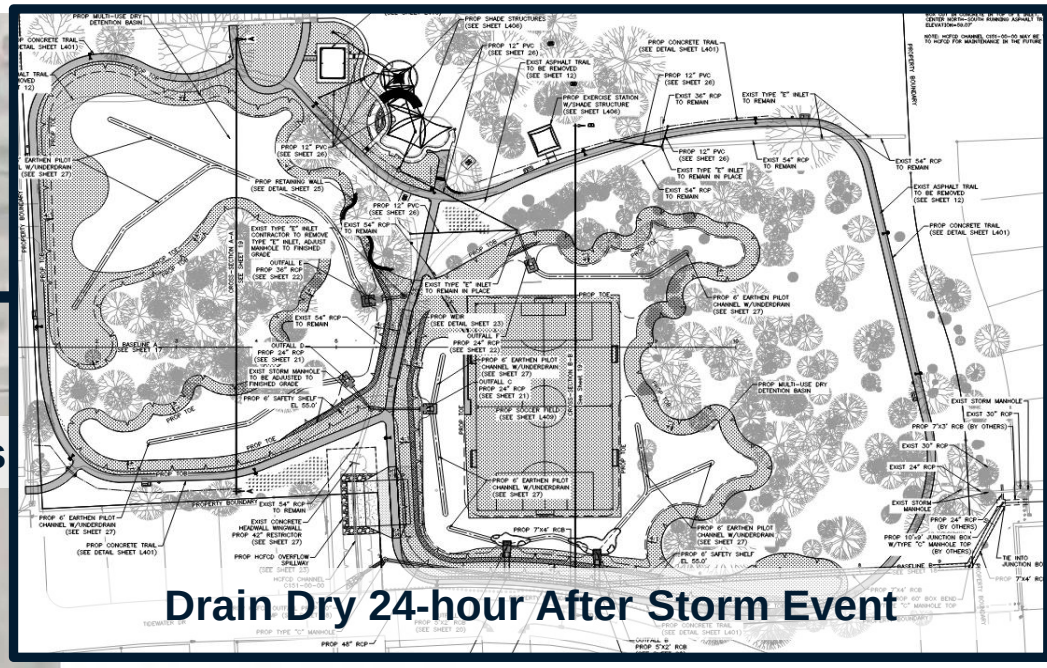
Total detention volume: ~24.0 ac-ft

- We are not proposing a rectangular 8-ft deep dry detention within park
- We are trying not to removing all existing trees to implement detention strategies

COH Partnership Project | Cambridge Village Park

Varies Slopes

Preserve and Plant Trees



LEGEND

- PROP. BIO SWALE
- PROP. STORM SEWER PIPING
- INLET
- PROPOSED AREA LIGHTING

Max Depth: ~7 ft

Side slopes: 4:1 (H:V) minimum

COH Partnership Project | Cambridge Village Park

CALLOUT NOTES

1. DRY DETENTION BASIN / IRRIGATED FIELD
2. ADA RAMP/LANDING INTO DETENTION FOR SOCCER FIELD
3. PICNIC PAVILION WITH PERIMETER TREE ALLEE AND PICNIC TABLES
4. DRY DETENTION BASIN
5. EXPAND PLAYGROUND WITH CLIMBING STRUCTURE AND SHADE SAILS
6. PROPOSED TREE MITIGATION
7. NEW TRAIL
8. PICNIC AREA/ W PROPOSED SHADE TREES
9. PROPOSED BENCHES
10. PROPOSED EXERCISE STATION W/SHADE STRUCTURE
11. STONE CLAD 2 WAY GSI FEATURE

LEGEND

- PROP. BIO SWALE
- PROP. STORM SEWER PIPING
- INLET
- PROPOSED AREA LIGHTING

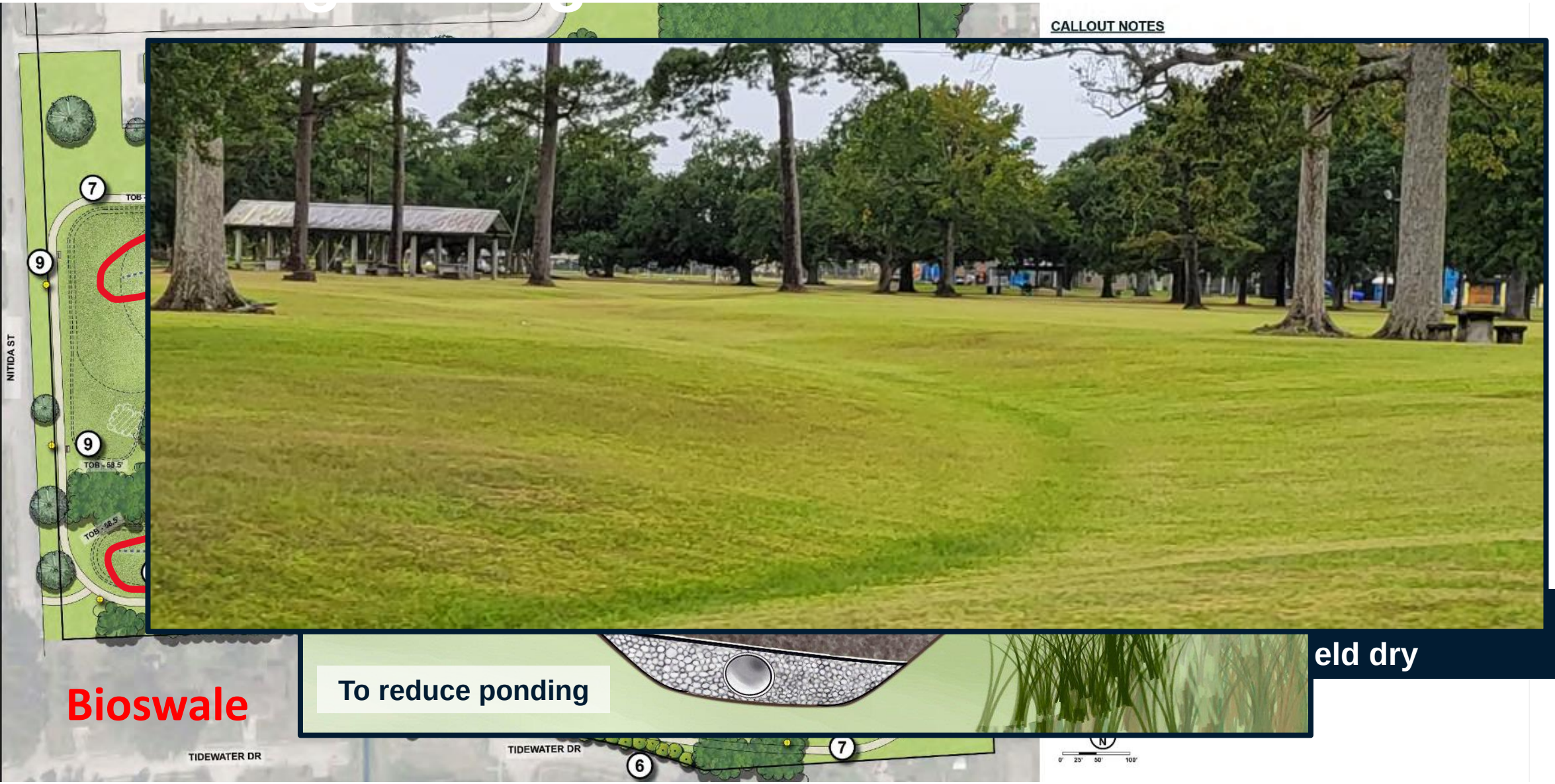
Sports field

- Adjacent ADA ramp landing
- 55’ center elevation

N

0' 25' 50' 100'

COH Partnership Project | Cambridge Village Park

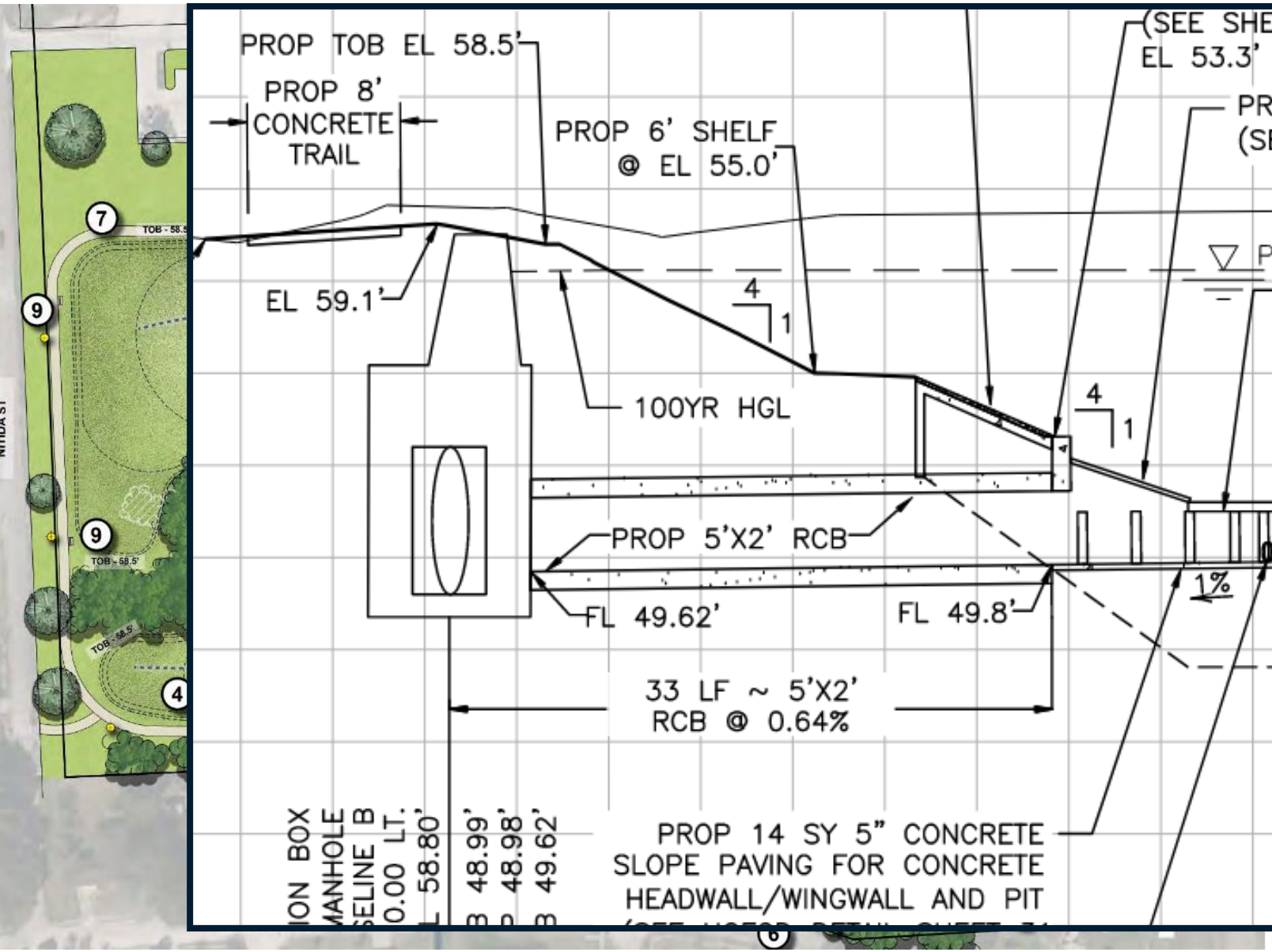


Bioswale

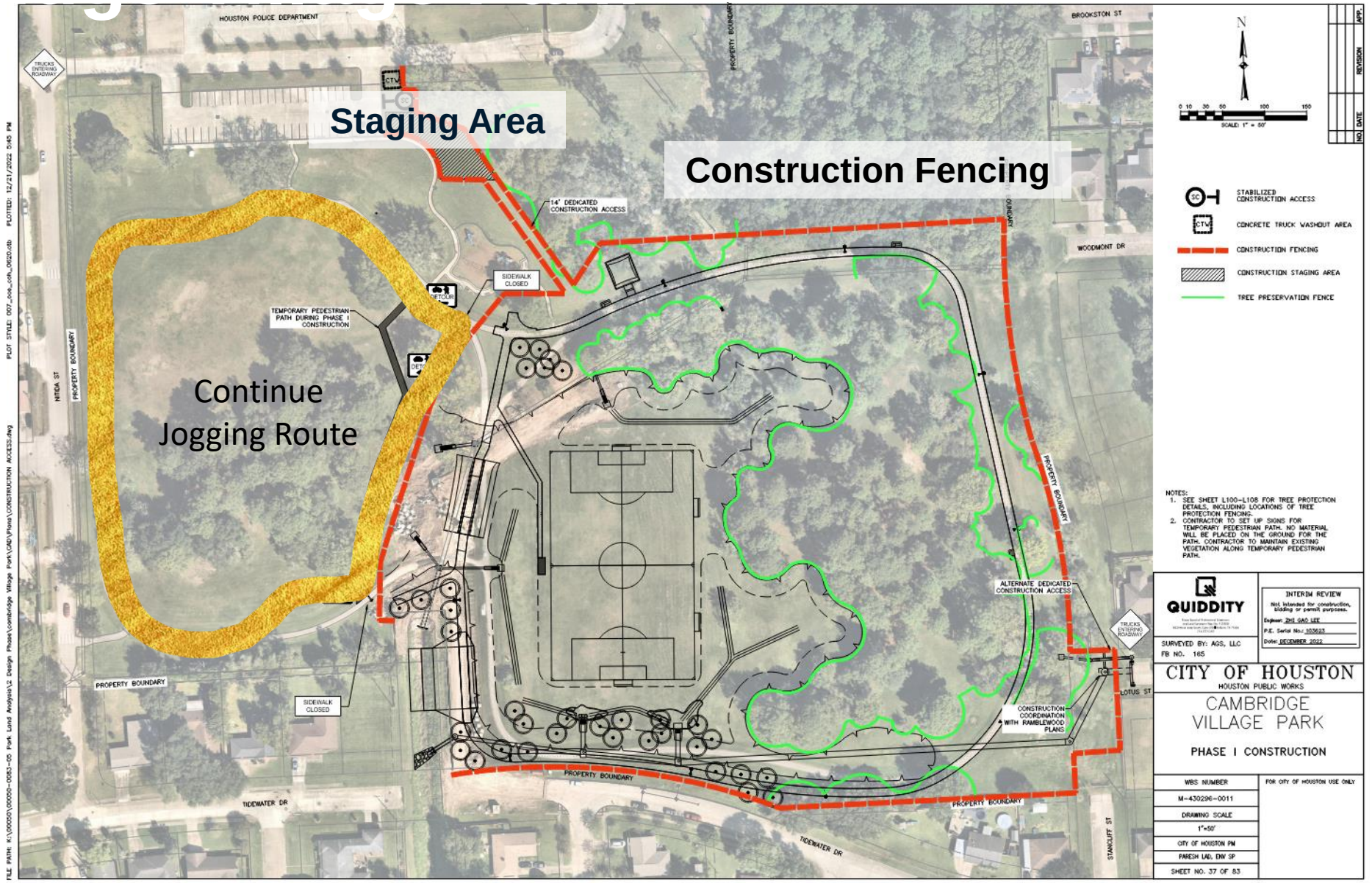
To reduce ponding

eld dry

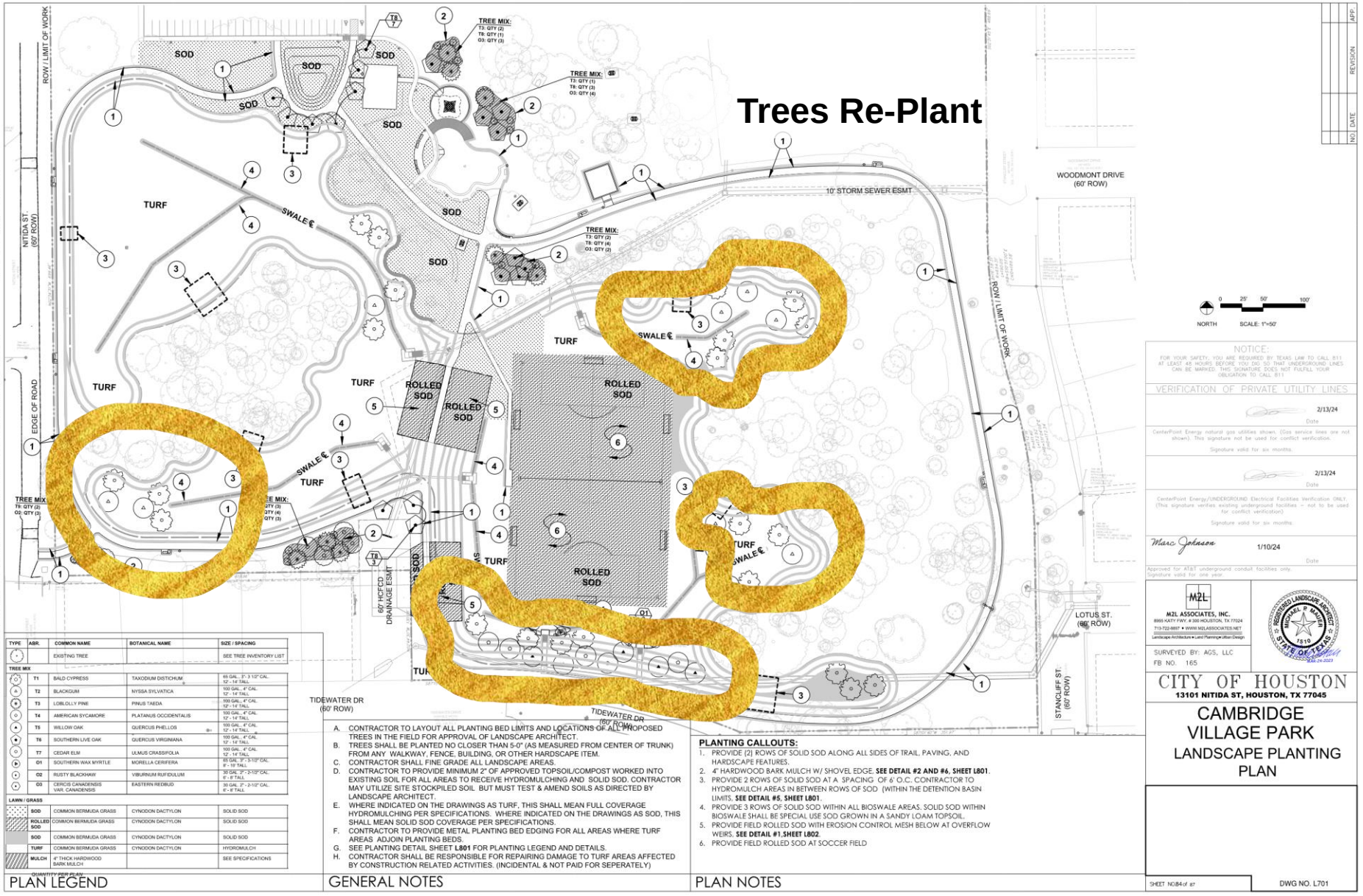
COH Partnership Project | Cambridge Village Park



COH Partnership Project | Cambridge Village Park



COH Partnership Project | Cambridge Village Park



TYPE	ABR.	COMMON NAME	BOTANICAL NAME	SIZE / SPACING
		EXISTING TREE		SEE TREE INVENTORY LIST
TREE MIX				
	T1	BALD CYPRESS	TAXODIUM DISTICHUM	65 GAL., 3" - 3 1/2" CAL. 12' - 14' TALL
	T2	BLACKGUM	NYSSA SYLVATICA	100 GAL., 4" CAL. 12' - 14' TALL
	T3	LOBLOLLY PINE	PINUS TAEDA	100 GAL., 4" CAL. 12' - 14' TALL
	T4	AMERICAN SYCAMORE	PLATANUS OCCIDENTALIS	100 GAL., 4" CAL. 12' - 14' TALL
	T5	WILLOW OAK	QUERCUS PHELLOS	100 GAL., 4" CAL. 12' - 14' TALL
	T6	SOUTHERN LIVE OAK	QUERCUS VIRGINIANA	100 GAL., 4" CAL. 12' - 14' TALL
	T7	CEDAR ELM	ULMUS CRASSIFOLIA	100 GAL., 4" CAL. 12' - 14' TALL
	O1	SOUTHERN WAX MYRTLE	MORELLA CERIFERA	65 GAL. 3" - 3 1/2" CAL. 8' - 10' TALL
	O2	RUSTY BLACKHAW	VIBURNUM RUFIDULUM	30 GAL. 2" - 2-1/2" CAL. 6' - 8' TALL
	O3	CERCIS CANADENSIS VAR. CANADENSIS	EASTERN REDBUD	30 GAL. 2" - 2-1/2" CAL. 6' - 8' TALL
LAWN / GRASS				
	SOD	COMMON BERMUDA GRASS	CYNODON DACTYLON	SOLID SOD
	ROLLED SOD	COMMON BERMUDA GRASS	CYNODON DACTYLON	SOLID SOD
	SOD	COMMON BERMUDA GRASS	CYNODON DACTYLON	SOLID SOD
	TURF	COMMON BERMUDA GRASS	CYNODON DACTYLON	HYDROMULCH
	MULCH	4" THICK HARDWOOD BARK MULCH		SEE SPECIFICATIONS

QUANTITY PER PLAN

PLAN LEGEND

GENERAL NOTES

A. CONTRACTOR TO LAYOUT ALL PLANTING BED LIMITS AND LOCATIONS OF ALL PROPOSED TREES IN THE FIELD FOR APPROVAL OF LANDSCAPE ARCHITECT.
B. TREES SHALL BE PLANTED NO CLOSER THAN 5-0" (AS MEASURED FROM CENTER OF TRUNK) FROM ANY WALKWAY, FENCE, BUILDING, OR OTHER HARDSCAPE ITEM.
C. CONTRACTOR SHALL FINE GRADE ALL LANDSCAPE AREAS.
D. CONTRACTOR TO PROVIDE MINIMUM 2" OF APPROVED TOPSOIL/COMPOST WORKED INTO EXISTING SOIL FOR ALL AREAS TO RECEIVE HYDROMULCHING AND SOLID SOD. CONTRACTOR MAY UTILIZE SITE STOCKPILED SOIL BUT MUST TEST & AMEND SOILS AS DIRECTED BY LANDSCAPE ARCHITECT.
E. WHERE INDICATED ON THE DRAWINGS AS TURF, THIS SHALL MEAN FULL COVERAGE HYDROMULCHING PER SPECIFICATIONS. WHERE INDICATED ON THE DRAWINGS AS SOD, THIS SHALL MEAN SOLID SOD COVERAGE PER SPECIFICATIONS.
F. CONTRACTOR TO PROVIDE METAL PLANTING BED EDGING FOR ALL AREAS WHERE TURF AREAS ADJOIN PLANTING BEDS.
G. SEE PLANTING DETAIL SHEET **L801** FOR PLANTING LEGEND AND DETAILS.
H. CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING DAMAGE TO TURF AREAS AFFECTED BY CONSTRUCTION RELATED ACTIVITIES. (INCIDENTAL & NOT PAID FOR SEPERATELY)

PLAN NOTES

PLANTING CALLOUTS:

1. PROVIDE (2) ROWS OF SOLID SOD ALONG ALL SIDES OF TRAIL, PAVING, AND HARDSCAPE FEATURES.
2. 4" HARDWOOD BARK MULCH W/ SHOVEL EDGE. **SEE DETAIL #2 AND #6, SHEET L801**.
3. PROVIDE 2 ROWS OF SOLID SOD AT A SPACING OF 6' O.C. CONTRACTOR TO HYDROMULCH AREAS IN BETWEEN ROWS OF SOD (WITHIN THE DETENTION BASIN LIMITS. **SEE DETAIL #5, SHEET L801**.
4. PROVIDE 3 ROWS OF SOLID SOD WITHIN ALL BIOSWALE AREAS. SOLID SOD WITHIN BIOSWALE SHALL BE SPECIAL USE SOD GROWN IN A SANDY LOAM TOPSOIL.
5. PROVIDE FIELD ROLLED SOD WITH EROSION CONTROL MESH BELOW AT OVERFLOW WEIRS. **SEE DETAIL #1,SHEET L802**.
6. PROVIDE FIELD ROLLED SOD AT SOCCER FIELD

NOTICE:
FOR YOUR SAFETY, YOU ARE REQUIRED BY TEXAS LAW TO CALL 811 AT LEAST 48 HOURS BEFORE YOU DIG SO THAT UNDERGROUND LINES CAN BE MARKED. THIS SIGNATURE DOES NOT FULFILL YOUR OBLIGATION TO CALL 811.

VERIFICATION OF PRIVATE UTILITY LINES

2/13/24 — Date
CenterPoint Energy natural gas utilities shown. (Gas service lines are not shown). This signature not be used for conflict verification.
Signature valid for six months.

2/13/24 — Date
CenterPoint Energy/UNDERGROUND Electrical Facilities Verification ONLY. (This signature verifies existing underground facilities – not to be used for conflict verification)
Signature valid for six months.

Marc Johnson 1/10/24 — Date
Approved for AT&T underground conduit facilities only.
Signature valid for one year.

M2L ASSOCIATES, INC.
8955 KATY FWY. # 300 HOUSTON, TX 77024
713-722-0897 • WWW.M2LASSOCIATES.NET
Landscape Architecture • Land Planning • Urban Design

REGISTERED LANDSCAPE ARCHITECT — MICHAEL P. MAHAN — 1510 — STATE OF TEXAS — 06-24-2023

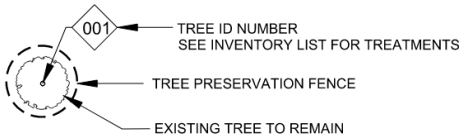
SURVEYED BY: AGS, LLC
FB NO. 165

CITY OF HOUSTON
13101 NITIDA ST, HOUSTON, TX 77045

CAMBRIDGE VILLAGE PARK
LANDSCAPE PLANTING PLAN

SHEET NO.84 of 87 — DWG NO. L701

LEGEND DIAGRAM



TREE IDENTIFICATION LEGEND (NOT TO SCALE)

PLOTTED: 3/22/2023 12:05 PM
FILE PATH: \\192.168.0.12\Landscape\PROJECTS\JONES AND CARTER\CAMBRIDGE PARK\10_WORKING CAD\03_LAYOUT\JC_CAMBRIDGE_LAYOUT_PLOT SHEET.dwg

COH Partnership Project | Cambridge Village Park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