The Memorial Park Conservancy (MPC) is a private non-profit organization whose mission is to restore, preserve and enhance Memorial Park for the benefit of all Houstonians, today and tomorrow. MPC works in close partnership with Houston Parks and Recreation (HPARD) and now Uptown Houston and focuses on conservation, improving park amenities, supporting park maintenance, advocacy for and maintenance of Memorial Park.

Incorporated in 2000, MPC has delivered multiple improvements to Memorial Park with HPARD, including most recently the planting of 90,000 seedlings, 500 acres of invasive control work and construction of the Running Trails Center. The MPC Board in 2012 secured approval from HPARD to create a new long range Master Plan for Memorial Park.

HPARD sees Memorial Park as an important part of the Houston Parks System. The HPARD system has nine signature parks, including Memorial. Within this municipal parks system, Memorial Park is an important large park for wilderness use, active recreation, and golf within the I-610 loop. HPARD owns the land that comprises Memorial Park, and currently does most park maintenance.

The annexation of Memorial Park by Uptown Houston in 2013 created a critical funding source for much needed long range planning in the park and allowed for expenditure of capital improvement projects.
The project began in June of 2012. In September of 2013, Nelson Byrd Woltz Landscape Architects was selected to lead the design efforts. After an eight month research phase, the team moved on to programming and design, with the planning process reaching completion April 2015.

The design team has worked extensively with the public, clients, and consultants during the research, programming, and design phases of the master plan. An ongoing public input process solicited feedback about existing conditions and the proposed design of the park. Client feedback from MPC, HPARD, and Uptown Houston has helped steer the master plan.

A large team of local and national professional consultants has been engaged to guide the research necessary to produce a design that takes into consideration the park’s complex technical aspects. Input from these sources has been critical to the team’s understanding of the park, the generation of the guiding principles, the development of the proposed plan, and the ongoing refinement from feedback received throughout the process.

**Design Team**

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Alissa Diamond
Samantha Daloney
Christopher Woods
Jeremy Jordan
Jennifer Jessup
Sandra Nam Cioffi
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Tim Popa
Breck Gastinger
Fraser Stuart
Beth Lazen
Sandy Rice

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**Civil Engineering**

**Environmental Consulting**

**Public Space Management and Design**

**Cultural Resources and Public Process Planning**

**Public Relations**

**Wayfinding and Signage**

**Bike Park Design**

**Soil Science Consulting**

**Traffic Engineering**

**Historical Consulting**

**Forestry Consulting**

**Lighting Design**

**Videography**

**Graphic and Web Design**

**Golf Course Design Consulting**

**Social Media Consulting**

**Land Surveying**

**Visualization and Rendering**

**Drone Photography**
Thank You

Memorial Park Steering Committee

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Cynthia McManus Mace
Philip Schneidau
Randall Grace
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Russell Brown (Treasurer)
Russell Windham
Shoy岳e (Executive Director)
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Steve Gibson
Steve Jenkins
Suzanne Landau
Tom Thomas
Wendy Hinke

Uptown Houston

Betsy Khosravi
Bob Ehrling
Dalal Mowla
Dot Cunningham
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Dwayne Flowers
Greg Noble
Janice Harris
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Marvin Kaplan
Mary Catherine Miller
Natasha Yanwasom
Patty Vander
Rachel Beaton
Robert Taube
Rod Smith
Sarah Avila
Sarah Newberry (Project Director)
Shannon Daniels
Stephen Wood
Stevie Lerner
Todd Casper

EcoTech Panel

Allan Malone - Texas A&M AgriLife Extension Service
Casey Johnson - Rice University
Chelon Fontaine - MPC Conservation Chair
Chris Adams - AEC
Cin Ty Lee - Rice University
Debbie Mahony - Houston Arboretum and Nature Center
Dee Howell - City of Houston
Dana Foss - Texas Parks and Wildlife Department
Don Gray - Memorial Park Conservancy
Emily Mandarodon - Houston Arboretum and Nature Center
Evan Bernmann - Rice University
Evelyn Merz - Sierra Club of Houston
George Guilen - Environmental Institute of Houston (U of H Clearlake)
Jaime Gonzalez - Coastal Prairie Partnership, Katy Prairie Conservancy
Joc Apalace - HRMA
Lan Shen - Native Plant Society
Les Fitzgerald - Texas A&M AgriLife Extension Service
Marc Reid - Houston Wildcatters
Michael Meritt - Texas A&M Forest Service
Nancy Groig - Cockrell Butterfly Center Houston-Museum of Natural Science, Rice University
Richard Sibbison - Houston Audubon Society
Steve Hupp - Bayou Preservation Association
Trevor Rubenstahl - Houston Arboretum and Nature Center
Victor Cordova - City of Houston
Yukie Rutchi - Rice University

Process Support and Consultants

AEI
Alan Krafthaus - Core Design Studio
Ash Hoglea - Harries Rendering
Alysa Yager - Berg-Oliver Associates, Inc.
Alyson Goeben - Sherwood Design Engineers
Amy Brook - Berg-Oliver Associates, Inc.
Amy Kaufman
Andrew Harness - Harness Rendering
Anne Sharpe
Art League Houston
Ashley Reoace - CHW
Ashley Small - Medley, Inc.
Barclay Spann - Fringe Dry Spann Inc.
Bayou Bend Collections and Gardens

Memorial Park Conservancy

Adam Nwaeke
Andrea Smith
Anne Vincent
Avish Milam
Basa Wallace
Cara Reddick
Casey Doherty
Chelon Fontaine
Chris Knapp
Chuck Canzler
Dena Prasher
Denis Johnson
Gary Moss
Greg Armstrong
James Hendrisen
Jim Dougherty
Jim Porter (Chairman)
John Paulkene
Kate Erlau
Kerry Gooster
Madeleine Hussey
Maggie Brown
Margaret Pierce (Secretary)
Marylin Van Way
Max Murray
Michael Grasley
Mindl Hildbrand (Vice-Chairman)
Nelcy Soreme

City of Houston

Al Heacng
Alvin Byrd
Amy Rick
Andrew Burks
Andy Koch
Brooke Boyett
Daniel Santarmia
Dave Bonem
Dabbly Elliott-Gibbins
James Kosi
JNass Winfield
Janice Evans
Jay Roberts
Jenay Peurchni
Joan M Martinez
John Moss
Karin Haller
Laura Spanjan
Lauren Laake
Maria Inishad
Matt Brocker
Mollie Miss S Newhage
Patrick Warch
Saffy Azar
Sandra Strachan
Sheena Christls
Stella Persina
Traci Elsner
Valencia Luna
Wanda Adams

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Abel Gonzalez
Clifford "Chirp" Perry (General Services Department)
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Estrella Espinosa
Erica Madison
Gal Brown
Jason Harris
Jay Daniel
Jude Blum
Kenneth Allen
Lisa Johnson (General Services Department)
Luc Correa
Mark Ross
Rick Dewees
Somya Ellis
TJ Marks

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Chalon Fontaine
Casey Doherty
Cara Rudelson
Bass Wallace
Averil Brannen
Anne Vance
Anita Smith
Adam Newar
Memorial Park Conservancy

Wanda Adams

Bayou Bend Collections and Gardens

TJ Marks
Sonya Ellis
Rick Dewees
Philip Schneidau
Rick Dewees
Russell Windham
Steve Jenkins
Steve Lerner

Bayou Bend Collections and Gardens

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Approved by
City Council on
April 1, 2015
Motion Number
2015 0215

Thank You
1 Project Background
Memorial Park is the largest public park within the I-610 loop. It is widely used for both passive and active recreation. The recent drought decimated the existing pine-dominant canopy in the park, creating a massive public outcry with the loss of the woodland setting cherished by many Houstonians. This event created an opportunity to reevaluate the long-term planning strategy for Memorial Park.

Legend
- HPARD Signature Park
- HPARD Public Park
- Major Highway
- Waterway
The project began in June of 2012. In September of 2013, Nelson Byrd Woltz Landscape Architects (NBW) was selected to lead the design efforts. After an 8 month research phase, the team moved on to programming and design, with the planning process reaching completion in April 2015.
Project Structure

The design team has received input from multiple sources during the research, programming, and design phases of this master planning effort. An ongoing public input process has solicited public comment from over 3,000 participants on both existing conditions in the park and on the design of the park as proposed by the design team. Client input from MPC, HPARD, and Uptown Houston has helped steer the design efforts. A wide team of local and national professional and volunteer consultants has been engaged to guide the research necessary to produce a design that takes into account the complex technical aspects of the park’s planning. All three of these input sources have helped generate the principles that guide the master plan design.

Guiding Principles

Reconnect...
the land, waterways, trails, people, and memories.

Consolidate...
compatible uses together in appropriate areas.

Restore...
the ecology of the park and our connection to it.

Enhance...
the overall park experience and its amenities.

Tend...
the land and our cultural history and maintain balance through responsible management.
2 Site Analysis
**Pre-Settlement**

The site on which Memorial Park sits is part of the Western Gulf Coastal Plain. The land formed during the last two million years through riverine deposition from the ancient analogues of today's Brazos River. The formation of Buffalo Bayou, which borders the south side of the park, is a much more recent geological event. At the height of the last ice age, about 18,000 years ago, sea level was about 200 feet lower than it is currently. Most of the streams that drain the Upper Gulf Coast, including Buffalo Bayou, were formed at this time. Also at this time, due to cooler conditions, most of Metro Houston would have been enveloped in forest. As conditions warmed with the retreat of glaciers, these forests were reduced to remnants along waterways like Buffalo Bayou, and the area’s vegetation became mostly dominated by marshes and prairies. A 1944 aerial photograph of the site is an early picture of the site’s vegetation, and reflects this gradation from forested areas along the bayou to a transitional savannah to the north, and larger swaths of prairie farther away from major waterways.

**Early Settlement 1830s-1915**

In 1821, Spain ceded control of the region to Mexico. Settlers from the United States and Germany began moving into the Houston area, seeking cheap land and improved economic opportunity. Houston became a key entry point for German settlers arriving in Texas, some of whom stayed in the Houston area, and many more who moved to the hill country north of Houston. As part of this wave of migration, the Reinermann family of Oldenberg, Germany arrived in Texas in the winter of 1834. They moved inland to the Houston area, and the family applied for a land grant in 1835. A portion of this land would eventually become Memorial Park.

Around the same time the Reinermann family was arriving to Houston, major changes were occurring in the region. In 1836, Sam Houston routed Santa Anna’s forces at the Battle of San Jacinto, separating Texas from Mexico. As part of this wave of migration, the Reinermann family was chosen for lease due to its rural nature and its proximity to the main settlement in the area at the time, just south and east of Houston’s ultimate location. Complications in the settlement of the land deterred the enterprising Allen Brothers from purchasing land there, and they instead purchased land further to the north, and founded the City of Houston. In 1845 Texas joined the United States, spurring another influx of American immigrants to Houston.

Key to the development of Houston was its centrality as a transit hub for the region. Buffalo Bayou served as a major route for transportation of cotton and other agricultural products between the state’s vast interior hinterlands and ocean-borne transport lines departing via the Gulf of Mexico. On the Memorial Park site at the Old Archery Range, archeological study has revealed that this part of the park site was used for a large brick kiln complex, charcoal manufacturing, and a plant nursery and orchard. These types of uses would have been common all along Buffalo Bayou, as the waterway was both a transportation route and a locus for industrial development in the Houston Area. Later road and railroad networks reinforced Houston’s position as a main shipping hub for the region. In the late 19th century, investors built Eureka Mills and Eureka Junction just north of the current location of Memorial Park. This facility, adjacent to the Houston and Texas Central Railway, served as a combination sawmill, woolen mill, and cotton mill. This junction at Eureka Mills served as a place where raw goods from the agricultural interior of Texas were unloaded, transformed through manufacturing processes, and reshipped for sale elsewhere.

At the turn of the century, further events in the region spurred Houston’s growth. A major hurricane devastated Galveston in 1900, pushing most shipping further inland to Houston. In 1901, a huge discovery of oil at Spindletop marked the dawn of the petrochemical industry. Also in the early 20th century, as Houston’s residential core expanded, a main rail line running through the newly developed Montrose neighborhood was closed, and the Eureka Cutoff, which currently bisects the Memorial Park site, was constructed. At this point, the site that would later be Memorial Park became linked to major east-west and north-south rail networks that connected to most of the continental United States.

**Camp Logan Era 1917-1919**

In 1917, the United States entered World War I. As the war had been in progress for three years in Europe, America’s late entry necessitated quick mobilization and training for the war effort. Houston won a contract to build one of thirty-two training centers planned throughout the country. The site for Camp Logan was chosen for lease due to its rural nature and its proximity to existing rail lines that provided easy transportation of construction materials, supplies, and soldiers for the camp. During the camp’s existence, tens of thousands of National Guard soldiers trained for campaigns in France. On the site, extensive grading and clearing occurred to enable better drainage, sanitation and use for training. Large temporary tents encampments housed soldiers-in-training, and most communal buildings were hastily erected timber structures. After the end of the war in 1918, a portion of the land became a hospital for convalescing and injured soldiers who returned from Europe. At that time, a nine-hole golf course was constructed adjacent to the hospital for outdoor recreation and recovery. By 1919, most of the buildings had been salvaged for other construction projects, leaving behind few physical traces of Camp Logan.
By 1887, Houston is connected to the Gulf of Mexico at Galveston and the Columbia on the Brazos River, east to New Orleans, and inland to San Antonio, Austin, Dallas, and various other points serving as connections and transshipment points. (O.W. Gray & Son, 1887-1888. Courtesy: Library of Congress. G4031p ct000559 http://hdl.loc.gov.loc.gmd/g4031p.ct000559m)

After this incident, construction of the camp resumed in earnest. Documentation for the condition of the camp proper and remount station are situated south of Chaney Junction, or Junction Tower 14 on the Galveston Houston and San Antonio Central Railway. Tower 13 at Eureka Junction, or Tower 13 at Eureka Junction on the Sunset Route. This provided an alternate route for trains on the supply of cotton supplies, and ammunition when the United States declared war on Germany in 1917. Spurs were quickly added to park railway cars and for a munitions drop-off in the Eureka Junction area.

Figure 17: By 1887, Houston is connected to the Gulf of Mexico at Galveston and the Columbia on the Brazos River, east to New Orleans, and inland to San Antonio, Austin, Dallas, and various other points serving as connections and transshipment points. (O.W. Gray & Son, 1887-1888. Courtesy: Library of Congress. G4031p ct000559 http://hdl.loc.gov.loc.gmd/g4031p.ct000559m)

This map showing connections to Houston and the interior demonstrate the interconnectedness of one of the railroad systems as of 1918. Houston is shown with an arrow pointing to the intersection of the railways to the interior and the connecting line further south to Galveston.

source: Southern Pacific Railroad in Eastern Texas, David M. Bernstein. Tower 13 at Eureka Junction

Further information can be found in the appendix with Suzanne Turner Associates’ complete study.

Memorial Park area. This map shows the different junctions, towers, and connecting lines of the railroads in the Memorial Park area.
The late 19th century and early 20th century saw the rise of park and city planning in the United States. In the context of widespread urban development and industrialization in the country’s urban centers, municipal decision-makers began to see parks as essential components of city infrastructure, to provide relief from the density of commercial and industrial zones. As early as 1866, an article in the first Houston city directory noted: “our city needs adornment; our people to be treated not merely as money-making machines, but as social, moral and intellectual creatures. Now is the time for suitable locations for public squares, places of resort for the people...where something can be seen to relieve the monotony of brick walls and crowded business.” Highways. Provisions for the cultivation of a taste for the beautiful in city improvements have entered largely into the municipal legislation of all the large cities of the world.”

Major public parks in other cities, including the design of Central Park by Frederick Law Olmsted in 1858 became the standard for planning such park spaces.

In Houston, local planning efforts mirrored these national trends. In 1912 the Houston Board of Park Commissioners offered a call to make recommendations on the future of Houston Memorial Park.

Era of Park Establishment 1919-1930s

In the days since the establishment of Memorial Park, many changes have occurred on site. Some unfolded substantially as planners had foreseen. For instance, during the 1930s, WPA funding allowed for the construction of the 18-hole golf course, designed by renowned golf course designer John Bredemus.

The 1942 donation by the Weiss Family of the land now called the Archery Range expanded the park’s boundary to the west.

However, many new factors unforeseen by the park’s early planners have influenced the land. By the early 20th century, major flooding had become a problem along Buffalo Bayou, due both to increased impervious development in the watershed, and close proximity of structures to the city’s bayous. A major flood in 1935, where Buffalo Bayou reached over 50 feet above its normal level was the last straw, and Harris County Flood Control District was established by the Texas Legislature in 1937. Construction of major flood control structures at Bear and Addicks Reservoirs west of Memorial Park were completed by 1946, and since that time Buffalo Bayou’s water flow has been artificially regulated by these structures to prevent major flooding. Interventions like these dams and later channelization of other waterways in the Houston area sparked public debate about large-scale flood control structures that continues to this day.

Another major factor in the modern development of Memorial Park has been the rise of the automobile during the 20th century. Memorial Park was founded during the heyday of the city’s street car system, which in the 1920s provided easy transport between newly established suburbs and the downtown area. By 1940, the Houston Electric Company ended streetcar service, and busses and cars were the main modes of transportation. In 1942, a new plan showed Memorial Parkway as one of three parkways that would connect Downtown to the city’s outskirts. Soon after in 1955, Houston’s Mayor Thoroughfare and Freeway Plan became the first official plan to include the freeway system. Road development according to these plans divided Memorial Park in ways that could not have been anticipated by early planners. Memorial Drive is now a major road bisecting the park from east to west, and Interstates I-610 and I-10 are now serving as major barriers between the park and surrounding neighborhoods.

Summary of Research and Conclusions

Every great city hopes to have a carefully designed, beautifully maintained, and well-used green space that contributes to the community’s health and well-being. Houston has one of the nation’s best and biggest. In determining the future of Memorial Park, it is important to be clear about exactly what makes the place so special, so that the master plan both safeguards and celebrates the characteristics and features of the park’s history and ecology that distinguish it and give it value.

Each of the layers of occupation adds to the site’s contributions to and reflections of Houston’s urban development. The successive occupancy of Native Americans, early European settlers, and Camp Logan during the heyday of the city’s street car system. By 1940, the Houston Electric Company ended streetcar service, and busses and cars were the main modes of transportation. In 1942, a new plan showed Memorial Parkway as one of three parkways that would connect Downtown to the city’s outskirts. Soon after in 1955, Houston’s Mayor Thoroughfare and Freeway Plan became the first official plan to include the freeway system. Road development according to these plans divided Memorial Park in ways that could not have been anticipated by early planners. Memorial Drive is now a major road bisecting the park from east to west, and Interstates I-610 and I-10 are now serving as major barriers between the park and surrounding neighborhoods.

Memorial Park is also distinguished as an outstanding example of the kind of parks that were designed during the progressive era, when civic leadership sought to elevate the quality of the urban environment through excellence in planning and design. The master plan takes its cues from the structure of the plan by Hare & Hare and embraces this legacy.

At the same time, park advocate Catherine Emmott was lobbying Mayor Holcombe and others for the creation of a large forest park at the site of the former Camp Logan. In 1923 and 1924 the Hogg brothers and Henry Stude, operating as Varner Realty, bought over 1500 acres of former Camp Logan land. In May of 1924, they sold this land to the City of Houston with a $50,000 donation for the formation of Memorial Park. The Hogg family was careful to include reversionary clauses in each deed as they sold land to the city for Memorial Park to protect its use for park purposes only.

Soon after, the city of Houston commissioned the Kansas City Landscape Architecture firm of Hare & Hare to design a preliminary plan for Memorial Park. This plan shows several features that would eventually become part of the park’s current form, a golf course, general play area (baseball, etc), a clubhouse and garden, bridge paths and woodland walks.

No one in the 1920s could have planned for the explosion of demand for active recreation facilities in urban park spaces. Additions of ball fields and other recreational facilities at the Memorial Park site have moved forward in an opportunistic way, without much comprehensive planning with regard to the siting of facilities.

Because of later efforts to develop park property (proposals have included a Presbyterian University, the Astrodome, a restaurant, and oil wells), Ima Hogg, the last surviving member of the Hogg family, shortly before her death in 1975, asked her friends Sadie Gwin Blackburn and Terry Hershey to form an organization to protect the park from development and inappropriate uses. It started out as the Memorial Park Advisory Committee, and later became the Memorial Park Conservancy, which is the current form of this protective organization.

1930s-Present

In Houston, local planning efforts mirrored these national trends. In 1912 the Houston Board of Park Commissioners offered a call to make recommendations on the future of Houston Memorial Park.

The 1942 donation by the Weiss Family of the land now called the Archery Range expanded the park’s boundary to the west.

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It is useful to circle back around and look at Houston through the lens of city planning in the United States, and the efforts that various Houstonians made to shape the city for the benefit of citizens and businesses. Although Houston has no general planning authority in the same fashion as most other cities in the United States, that does not mean that there have not been a great deal of planning efforts, and also plans that have been implemented over time. The initial layout of the city itself was an exercise in planning, orienting the initial neighborhoods in proximity to Buffalo Bayou, which was the primary source of water for the city.

Further information can be found in the appendix with Suzanne Turner Associates’ complete study.
Ecology

Restore Resiliency and Diversity

Summary
Over the last 10 years the site and surrounding area have experienced two major natural catastrophic events: a long term drought to assist in the determination of long term drought to assist in the determination of long term drought to assist in the determination of long term drought to assist in the determination of management and restoration needs and prioritization. A cursory site reconnaissance was conducted to confirm the evaluation efforts of the document review and to evaluate the general current conditions of the site.

Findings

A cursory site reconnaissance was conducted to confirm the evaluation efforts of the document review and to evaluate the general current conditions of the site. This section was conducted throughout the summer of 2014 to further review and document vegetative communities and dominant species, stability of riparian areas, identification of unique features to be preserved and protected, drainage alterations, and the status of the restoration commenced in 2011. This effort identified three vegetative complexes that are native to the park: pine and hardwood mixed forest, savannah, and prairie.

The locations of these complexes, the species composition within them, and overall health were further refined with data collected in the fall of 2014. Using an established grid system, over 300 locations were field surveyed, assigned Geographic Positioning System (GPS) points, and sampled. The number of trees greater than 3 inches Diameter at Breast Height (DBH), species composition, herbaceous and shrub density and composition, and invasive species were identified. Using this data vegetative complexes were refined using the following composition criteria: prairie: 5-10 trees per acre with an 80% herbaceous and 20% shrub understory, forest: 100-150 trees per acre with an understory of 25% shrub and 25% herbaceous; and savannah: 50 trees per acre with 20% shrub and 70% herbaceous understory (see graphic to right “Understanding Forest, Savannah, and Prairie”).

Based on the criteria listed above, much of the site currently qualifies as a pine-hardwood savannah, since the shrub vegetation and hardwood motts are identified as rare interspersed with prairie. The site evaluation indicates a distinct connection of soil chemistry and hydrology with the vegetation makeup. The vegetation complexes identified and species’ dominance identified during site reconnaissance were compared to the general location of loamy versus sandy soil complexes on the site.

Based on the desktop review and several site reconnaissance studies conducted in the current assessment, it was determined that creation of six habitat restoration vegetative complexes will be the final goal of this plan. These six vegetative complexes are as follows: 1) Pine-Hardwood Forest, 2) Pine-Hardwood-Savannah, 3) Wet Prairie-Savannah, 4) Native Prairie, and 5) Barrancos and Riparian Edges, and 6) Riparian.

Based on the detailed analysis performed, it is apparent that the site contains a healthy native grass and woody seed bank in the soil. This has been most apparent in the review of a site that, while dramatically impacted by the loss of mature trees by drought, is recovering and beginning to reveal a native herbaceous understory.
of Little Bluestem and Bushy BlueSTEM simply by the removal of tree slash. This natural recovery offers a simplified management system for habitat restoration. Recommendations for the development and long term management of these areas primarily involve annual use of herbicides, limited mowing, and physical removal of invasive species with some additional planting of desired native species specific to each habitat restoration vegetative complex.

The Pine-Hardwood Forest, Pine-Hardwood Savannah, and Wet Prairie-Savannah will require substantial invasive plant removal and the continued removal of slash left from the impacts of the drought. Existing native vegetation will be allowed to naturally regenerate in the removal areas. Plantings of desirable native species will occur in areas of extensive invasive removal.

The Native Prairie is proposed in a newly created location of the land bridge. Hence this location will require extensive planting of desirable species. Management will be performed by monitoring the introduction of invasives and other opportunistic species and removing them at an early stage. Mowing biannually after establishment is recommended.

The Barrancos and Riparian areas will be designated as preservation areas where limited invasive plant removal will occur, but the existing native vegetation will be allowed to naturally regenerate in the removal areas. Planting will only be needed in areas with extensive invasive species removal. With proper invasive removal and successful planting of native vegetation over the next ten years, the proposed habitat restoration vegetative complexes should mature and grow into a resilient, self-sustaining ecosystem capable of withstanding future environmental challenges. While continued invasives control and other maintenance will be required in perpetuity to allow the site to continue to function as a healthy ecology, investments of time and resources will be smaller after restoration types are established.

Prior to final construction plan approval and commencement of improvements within the park, each proposed modification will require evaluation under Section 404 Clean Water Act permits for unavoidable impacts to waters and wetland resources. Initial evaluations of these resources suggest low to moderate quality per the Hydrogeomorphic Model. Due to the water quality of Buffalo Bayou and the Texas Commission on Environmental Quality Watershed Protection Plan guidance, opportunities to restore and enhance these resources on site exist and may meet the Section 404b(1) and Final Mitigation Rule guidelines.

Further information can be found in the appendix with Berg Oliver Associates’ complete study.
Existing Vegetation

Advanced Ecology, Ltd. (AEL) was engaged by Nelson Byrd Woltz (NBW) to organize and complete a multi-phased forest inventory of specific areas within Memorial Park. The following is a progress summary of work-to-date, outlined by phase, detailing the results.

Phase 1: Urban Forest Inventory

This phase includes a 100% inventory of individual trees considered to be within general openings and maintained areas of the Park. The designated areas include the mowed areas (established fire buffers), the Memorial Park Golf Course, Memorial Drive esplanades, ball fields and the picnic area.

Each tree’s location will be marked with a Geographic Positioning System (GPS) point and attributes such as species, diameter (0.1 inch accuracy), crown coverage, current condition, and management recommendations noted as needed. A picture of each tree will be taken and joined to the GPS marker.

While the data collection for this phase has begun, operations were put on hold due to normal leaf loss in the Fall 2014. AEL is scheduled to re-commence work within the first few weeks of April, 2015 and this phase should be completed by the end of May 2015. No completed data outputs are therefore available for this phase. The final report will be added to the master plan and made available after completion.

Phase 2: Hogg Bird and Archery Range

In November 2014, AEL completed a 100% inventory of the trees considered to be the dominant overstory component and/or “relic” trees within the areas referred to as Hogg Bird Sanctuary and Archery Range. The two areas are approximately 42.3 acres combined. Each tree’s location received a GPS point and was measured for species, diameter (0.1 inch accuracy), crown coverage and current condition. Notes regarding management needs were also made as part of the data collection. Each tree was further categorized as one of the following:

- Native non-invasive species (Pine, Oak, Elm, Sycamore, Ash, Sugarberry)
- Native invasive species (Cherry Laurel, Yaupon)
- Exotic invasive species (Ligustrum, Golden Raintree, Camphor, Japanese Privet, Crape Myrtle)

Hogg Bird Sanctuary Findings:

There were a total of 119 individual trees collected with diameters that ranged in size from approximately 10 inches to 39 inches at Diameter Breast Height (DBH). DBH measurements were taken at 4.5 feet above the ground. The average diameter was approximately 19 inches. Approximately 14 separate species were noted in the overstory. 98% of these trees measured were considered to be native and non-invasive to Memorial Park. The remaining 2% in the overstory is considered to be an exotic invasive.

Archery Range Findings:

There were a total of 191 individual trees collected with diameters that ranged in size from approximately 9 inches to 40 inches DBH. The average diameter was approximately 19 inches. 15 separate species were noted in the overstory. Of these, 92% measured were considered native and non-invasive to Memorial Park, with the remaining 8% considered native invasive (1%) or exotic invasive (8%) (See graphics below). In addition to the 100% overstory forest inventory measurements, 1/20th acre midstory and understory plots were also completed within both areas.

<table>
<thead>
<tr>
<th>Species</th>
<th>Stems Per Acre</th>
<th>Percent Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cherry Laurel</td>
<td>2,716.67</td>
<td>72.34%</td>
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<tr>
<td>Holly Yaupon</td>
<td>306.67</td>
<td>12.48%</td>
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<tr>
<td><em>Ligustrum</em> spp.</td>
<td>166.67</td>
<td>6.78%</td>
</tr>
<tr>
<td>*Golden Raintree</td>
<td>46.67</td>
<td>1.90%</td>
</tr>
<tr>
<td>Maple- Boudoir</td>
<td>43.33</td>
<td>1.76%</td>
</tr>
<tr>
<td>*Camphor</td>
<td>36.67</td>
<td>1.49%</td>
</tr>
<tr>
<td>Ash ‐ Green</td>
<td>30.00</td>
<td>1.22%</td>
</tr>
<tr>
<td>*Oxeldrin- spp.</td>
<td>26.67</td>
<td>1.03%</td>
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<tr>
<td>Elm ‐ Winged</td>
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<tr>
<td>Sugarberry</td>
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<td>0.27%</td>
</tr>
<tr>
<td>Sycamore ‐ Stringing</td>
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<td>0.27%</td>
</tr>
<tr>
<td>Elm ‐ Slippery</td>
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<td>0.14%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,454.67</td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

* Percent Exotic Invasive: 9.36 %

<table>
<thead>
<tr>
<th>Species</th>
<th>Stems Per Acre</th>
<th>Percent Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ligustrum</em> spp.</td>
<td>43.33</td>
<td>34.13%</td>
</tr>
<tr>
<td>* Golden Raintree</td>
<td>16.67</td>
<td>20.83%</td>
</tr>
<tr>
<td>Cherry Laurel</td>
<td>6.67</td>
<td>8.31%</td>
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<tr>
<td>Maple- Boudoir</td>
<td>3.33</td>
<td>4.17%</td>
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<tr>
<td>* Plum ‐ Japanese</td>
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<td>4.17%</td>
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<tr>
<td>Redbud</td>
<td>3.33</td>
<td>4.17%</td>
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<tr>
<td>Redbud</td>
<td>3.33</td>
<td>4.17%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>80.00</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

* Percent Exotic Invasive: 79.17 %

Stem Specifications

- Diameter at breast height (DBH): < 3.0 inches
- Total Heights: < 25 feet

source: Advanced Ecology, Ltd.
Approximately 12 plots were established within the Archery Range and approximately 6 plots within the Hogg Bird Sanctuary. This equates to approximately 1 plot per 2.5 acres. Measurements taken include the understory and midstory.

Understory Tree Measurements
Understory tree measurements were conducted on all trees with an approximate total height of less than 12 feet and a DBH of less than 3 inches. All trees that fell within the plot boundaries and met these parameters were counted and species determinations were made and tallied. Other than count and species, no other measurements for each tree were made. An ocular estimate of herbaceous cover within the plot was also noted (see graphics "Existing Condition: Understory" for both Hogg Bird and Archery below and on facing page).

Midstory Tree Measurements
Midstory Tree Measurements were conducted on all trees with an approximate total height of 12 to 25 feet and a DBH of 3 inches to 5.9 inches. Individual tree measurements included a species determination, diameter (1 inch accuracy) and total stem height in feet (see graphics "Existing Condition: Midstory" for both Hogg Bird and Archery below and on facing page). Percentages were calculated of native, native invasive and exotic invasive species present in both the understory and midstory for both areas. The primary purpose of this process was to provide data that would assist with future vegetative management and planning as part of the Master Plan.

Phase 3: Hazard Tree Assessment – Park Trails
In October 2014, AEL completed a 100% inventory of "Hazard Trees" located within twenty (20) feet of either side of a publicly utilized trail within Memorial Park, and as approved by Memorial Park Conservancy. Hazard trees were classified on the ground as "Dead Standing" or "Dead Fallen" (only if across a trail). Each tree was marked with a painted blue spot and a GPS point for location. An ocular estimate of diameter (large, medium or small) and total height were measured as well. The purpose of this assessment was strictly for maintenance and "Hazard Tree" removal planning.

14 linear miles of trails were assessed that included the Green Ridge, Hogg Woods, Logan Woods, Reynolds Woods and West Ridge areas. There were a total of 1,038 trees inventoried. (See Graphic below: "Hazard Tree Assessment")
Reconnect

EXISTING CONDITIONS: DIVIDED PARK

Over time, the park has been divided into many discontiguous parts by additions of roads, program areas, and other features. As a result, the park currently functions as a series of small and disconnected park spaces.

Legend
- Site rails and roads
- Adjacent roads
- Buffalo Bayou

VISION: RECONNECTED PARK

The master plan proposes reconnecting as many of these disparate park pieces as possible to allow it to function as one large, contiguous space.

Legend
- Site rails and roads
- Adjacent roads
- Buffalo Bayou
The master plan proposes consolidating program areas to clarify the park’s organization and to provide continuous park experiences. Trail use areas are consolidated to the south and west sides of the park. Active recreation is clustered in the northeast, where light and sound from major roads are more compatible with large-scale recreational use. Picnic grounds are dispersed throughout the site, and major cultural and historical resources are interpreted through landscape spaces.

Areas shown colored in this diagram have been impacted by man-made grading, roads, program features, and clearing activities.

The master plan proposes limiting major development to areas already altered by past development, and protecting areas of cultural significance, including areas of Camp Logan remains, Houston Arboretum and Nature Center, and the WPA-era golf course.

In the park’s current configuration, program areas are small and fragmented. Trail use areas to the south and west sides of the park are repeatedly interrupted by ball fields and the large picnic loop. Active recreation features are scattered in several parts of the park.

Areas shown colored in this diagram have been impacted by man-made grading, roads, program features, and clearing activities.
Guiding Principles

• Strengthen and build upon the cultural, historical, and ecological assets of Memorial Park that differentiate it from Houston’s other parks.

• Adopt and sustain management practices that complement the ecological position and features of iconic indigenous species.

• Design a park that has a positive impact on the neighborhoods and the city by collecting, storing, and re-using storm water, improving water quality, and using alternative energy.

• Maintain a record of biotic and abiotic ecological factors to track available quantifiable data to support and influence management practices.

Tend
Tend the land and our cultural history, maintaining balance through responsible management.

• Strengthen and build upon the cultural, historical, and ecological assets of Memorial Park that differentiate it from Houston’s other parks.

• Adopt and sustain management practices that complement the ecological position and features of iconic indigenous species.

• Design a park that has a positive impact on the neighborhoods and the city by collecting, storing, and re-using storm water, improving water quality, and using alternative energy.

• Maintain a record of biotic and abiotic ecological factors to track available quantifiable data to support and influence management practices.

Consolidate
Consolidate compatible uses together in appropriate areas.

• Group similar program uses in the park together to enhance the experience of different aspects of the park and to reduce user conflict.

• Orchestrate circulation in the park to improve safety for all users.

• Make the park inviting by creating gateways and marking paths and amenities to facilitate self-guiding and understanding of the place.

• Maximize social opportunities that allow Houstonians to engage with each other in meaningful ways.

• Construct and improve existing amenities that fit the character, use, and scale of the site. Follow the regional vision of Houston Parks and Recreation.

Restore
Restore the ecology of the park and our connection to it.

• See the park’s current state as an opportunity. The drought and hurricane of recent years have cleared the site of vulnerable vegetation.

• Design landscape types for the site’s climate, soils, and the maintenance capabilities of the park administration by using intrinsic ecologies to ensure future resilience.

• Build a park framework for future generations with adaptive systems that will withstand time, increased use, and variable weather patterns.

• Maintain the park’s character into the future.

· See the park’s current state as an opportunity. The drought and hurricane of recent years have cleared the site of vulnerable vegetation.

· Design landscape types for the site’s climate, soils, and the maintenance capabilities of the park administration by using intrinsic ecologies to ensure future resilience.

· Build a park framework for future generations with adaptive systems that will withstand time, increased use, and variable weather patterns.

· Maintain the park’s character into the future.
Reconnect

Reconnect the land, waterways, trails, people, and memories.

- Enable external access to the park—new connections will allow for increased park use, and improved safety in getting to the park on foot, wheelchair, bike, bus, or car.
- Bridge the park’s internal divisions to expand usable park space and enhance its existing character.
- Provide opportunities for consolidation of habitat areas.
- Link water networks, allowing them to function as a complete system.

Enhance

Enhance the overall park experience and its amenities.

- Maintain and enhance existing programmatic uses in the park including active recreation, wilderness-based trail use, and Houston Arboretum and Nature Center.
- Preserve and interpret elements of the cultural and natural history. In so doing, empower future generations in the continued management of urban landscapes.
- Make space for users to discover, learn about, appreciate and enjoy the flora, fauna and water systems of Memorial Park and the region.
- Interpret and engage multiple cultural narratives that are relevant to Houston’s diverse population.
3 Master Plan Design
PLACES
1. Land Bridge
2. Running Center and Timing Track
3. OAR
4. Living Bridge (existing)
5. Hiking and Equestrian Trails
6. Cycle Track
7. Polo Practice Field (existing)
8. Memorial Groves
9. Rugby Pitch
10. Volleyball Courts
11. Soccer Field/All Weather Field
12. Softball Fields
13. Baseball Field
14. Croquet Court
15. Golf Practice
16. Club House (existing)
17. Golf Course
18. Tennis Center
19. Fitness Center
20. Natatorium
21. Eastern Glades
22. Maintenance Area/Memorial Park Conservancy Headquarters
23. Hogg Bird Sanctuary
24. Bayou Wilds Trailhead
25. Bayou Quiet Area
26. Bayou Wilds
27. Ponds
28. Seymour Lieberman Exercise Trail
29. Bayou Access Boat Launch
30. Bridge Over East Barranco
31. Apache Grove
32. Nicole’s Way
33. Bush Grove
34. Endowment Grove
35. Houston Arboretum and Nature Center
36. Refurbished Equestrian Tunnels

ENTRANCES
A. West Memorial Drive
B. Woodway and I-610
C. Washington/Wescott
D. Arnot
E. East Memorial Drive
F. Pedestrian Entrance to OAR
G. Pedestrian/Bike Entrance Under I-610
H. Pedestrian/Bike Access Under Railroad
J. Pedestrian/Bike Access Over I-10
K. Pedestrian Access at Blossom
L. Hogg Bird Sanctuary Entrance
M. Bridge to Bayou Bend
N. Pedestrian/Bike Access Over Railroad Tracks
A. West Memorial Drive
B. Woodway and I-610
C. Washington/Wescott
D. Arnot
E. East Memorial Drive
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J. Pedestrian/Bike Access Over I-10
K. Pedestrian Access at Blossom
L. Hogg Bird Sanctuary Entrance
M. Bridge to Bayou Bend
N. Pedestrian/Bike Access Over Railroad Tracks

SCALE: 1" = 800'
Master Plan Renderings
Land Bridge Over Memorial Drive
Bayou Wilds and Southern Arc Trail
Eastern Glades
Eastern Glades
Memorial Groves
Kids' Cycle Loop and Playground
Sports Complex
Cycle Track
Running Center and Timing Track
Park Entrance at I-610 and Woodway Drive
Park Entrance at Memorial Drive East With Eastern Glades Beyond
Bayou Wilds Pedestrian Trails Within Restored Savannah
Bayou Overlook on the Southern Arc Trail
Mountain Biking Trail
4 Site Systems
Harris County Metropolitan Transit Authority is currently reconfiguring bus routes to serve as a grid-based system, with changes to go into effect in June 2015. Their goal is to create easier point-to-point access between all parts of the city. Many lines will have increased frequencies, and weekend service will be as frequent as weekday service, benefiting weekend park users.

The master plan proposes a more frequent bus route be introduced along Memorial Drive, and that added stops at major park destinations will allow better access to park features. The plan envisions that where feasible, bus stops be paired with B-cycle stations to allow easy transition from public transit to on-site bicycle use.
The master plan proposes an improved trails network that addresses serious safety and maintenance issues in the existing trail system. The plan proposes several solutions. First, an extensive multi-use trail system connects to major roads and surrounding neighborhoods outside the park as well as to all major use areas of the park. The plan also separates the many trail users on the site into different areas of the park connected by this multi-use trail network. The Seymour Lieberman Trail is expanded to 3 miles. A cycle loop is added in the northwest portion of the park to accommodate cyclists who currently use the picnic loop. A quarter mile timing track is introduced next to the existing Trails Center. The current system of natural surface mountain biking trails are improved and expanded, while pedestrian trails are provided in the more sensitive areas in the Old Archery Range, the Houston Arboretum and Nature Center, and proximate to the Bayou on the south side of the park and in Hogg Bird Sanctuary.

Proposed Parking

Dispersed parking lots provide improved access to park activities. Parking along Memorial Loop Road is eliminated, allowing for two way traffic and a more park-like feeling. Discrete parking areas now provide access to all parts of the site. The proposed parking design provides a more than 30% increase in parking capacity. (Amended per public input review with client group and design team, 03/25/2015.)

Trail System

The master plan proposes an improved trails network that addresses serious safety and maintenance issues in the existing trail system. The plan proposes several solutions. First, an extensive multi-use trail system connects to major roads and surrounding neighborhoods outside the park as well as to all major use areas of the park. The plan also separates the many trail users on the site into different areas of the park connected by this multi-use trail network. The Seymour Lieberman Trail is expanded to 3 miles. A cycle loop is added in the northwest portion of the park to accommodate cyclists who currently use the picnic loop. A quarter mile timing track is introduced next to the existing Trails Center. The current system of natural surface mountain biking trails are improved and expanded, while pedestrian trails are provided in the more sensitive areas in the Old Archery Range, the Houston Arboretum and Nature Center, and proximate to the Bayou on the south side of the park and in Hogg Bird Sanctuary.
Traffic

Modeled Impact of Master Plan on Traffic

As part of the Memorial Park Master Plan, Walter P. Moore was engaged to conduct a traffic study to determine the impact of the proposed master plan improvements at Memorial Park, including the realignment of E. Memorial Loop Drive, the realignment of Memorial Drive west of the Memorial Drive-Woodcreek Drive split, and the reconfiguration of the E. Memorial Loop at N. Memorial Loop intersection. The improvements include Memorial Loop Dr. becoming two-way for its entire length and the addition of a roundabout on Memorial Dr. just east of the intersection with I-610.

Methodology

In order to perform the traffic study, historical traffic counts in the area were reviewed. In addition, new traffic count data was collected at key locations in November 2014 and March 2015. This included 24-hour counts on major roadway links and turning movement counts during peak periods at primary intersections that may be impacted by modifications to the park roadways. Four analysis scenarios were evaluated using traffic analysis software. The scenarios are described below:

Adjusted Existing Conditions – This scenario includes existing 2015 conditions such as traffic signal timings and lane configurations. The existing counts were adjusted to increase the movements that access the park by 80% to account for a seasonal variation.

Background Conditions – This scenario uses existing traffic signal timings and lane configurations, but includes traffic volumes with a 1% background growth in addition to the seasonal adjustment factor.

Proposed Conditions – This scenario uses existing traffic signal timings, but updates the background traffic volumes with an additional 30% growth to account for the parking increase in the proposed master plan. The model also updates the alignment and lanes configurations as shown in the proposed master plan. The proposed lane configurations at Memorial Dr. and E. Memorial Loop assume a standard 150’ eastbound left turn bay and a westbound right turn bay that is comparable in length to the existing right turn bay. The proposed condition also includes a roundabout east of I-610 on Memorial Dr.

Proposed Mitigation – This model uses the proposed volumes and updated alignments and lane configurations shown in the proposed master plan, but also updates the intersection signal timings.

The results of the analysis provide three measures to determine if any significant impacts will occur. These three measures are:

Intersection Level of Service – Results of the capacity analyses are reported in standard level of service (LOS) format, with the most favorable conditions being designated as LOS A and the poorest conditions indicated by LOS F. Intersection level of service is based on the amount of delay that each vehicle encounters at an intersection. Transportation agencies generally make sure that vehicles do not queue into the adjacent intersection.

Travel Time – Results of the analysis also provide the amount of time required to travel a designated distance, including time through an intersection.

Results Summary

As can be seen in the Intersection Level of Service tables and figure, during both the morning (AM) and evening (PM) peak hours, all intersections are able to operate at a level similar to background conditions, indicating that there will be minimal impacts to traffic operations at these intersections. As shown, some of the intersections will require mitigation, primarily the re-timing of the traffic signals.

At the roundabout, the intersection will operate at Level of Service F due to vehicles stacked up from the IH 610 frontage road. This stacking would occur whether the roundabout is in place or not. The low level of service is not due to the roundabout design and will only impact the traffic accessing the small parking area to the north.

### Table 1: Intersection Level of Service (Delay in seconds/vehicle) – Morning (AM) Peak Hour

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Approached Traffic</th>
<th>Background</th>
<th>Proposed</th>
<th>Proposed w/ Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Memorial Loop at</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>IH 610 SB Frontage Road</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IH 610 NB Frontage Road</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>IH 610 SB Frontage Road</td>
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</tbody>
</table>

Source: Walter P. Moore

### Table 2: Intersection Level of Service (delay in seconds/vehicle) – Evening (PM) Peak Hour

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Approached Traffic</th>
<th>Background</th>
<th>Proposed</th>
<th>Proposed w/ Mitigation</th>
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</thead>
<tbody>
<tr>
<td>E. Memorial Loop at Crestwood Dr.</td>
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<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Source: Walter P. Moore

Legend

- Traffic Signal Included in Study
- Stop Sign Included in Study
- Traffic Circle Included in Study
- Two Lane Road Included in Study
- Four Lane Road Included in Study
- Six Lane Road Included in Study
- One Way Traffic
- Two Way Traffic

Walter P. Moore selected areas of potential concern at proposed intersections and roadways to determine any impact the Master Plan would have on traffic.
Queue Lengths
While queuing was reviewed on all approaches to the intersections in the study, the critical location for queue length is on Memorial Dr. at the E. Memorial Loop Rd. and Crestwood Dr. intersections. The proposed re-alignment shifts the E. Loop approximately 500' to the east reducing the distance between the E. Loop and Crestwood to approximately 900'.

As can be seen in the Maximum Queue Length tables and figures during both the AM and PM peak hours, the maximum queue length for all scenarios is less than half of the proposed distance between E. Memorial Loop Dr. and Crestwood Dr. along Memorial Dr.

Travel Times
Travel times along Memorial Dr. were reviewed to determine if there would be any additional travel time due to congestion. The re-alignment of Memorial Dr. will add approximately 0.2 miles of length, which will account for the majority of increase in travel time.

As can be seen in the Travel Time Comparison table during both the AM and PM peak hours, the increase in travel time is due primarily to the increase in travel distance. As indicated, the traffic signal timings at the I-610 interchange will need to be adjusted to mitigate any increase in travel time in the PM peak hour.

Summary of Findings
The following is a summary of the key findings for the three areas of Memorial Park that have roadway realignments:

- Memorial Dr. at Crestwood Dr. and E. Memorial Loop Rd.:  
  - The realignment of E. Memorial Loop Dr. does not impact operations at the Memorial Dr. and Crestwood Dr. intersection.  
  - Vehicles on Memorial Dr. between E. Memorial Loop Dr. and Crestwood Dr. will not spill back into adjacent intersections.  
  - The E. Memorial Loop Dr. at Memorial Dr. intersection will require turn bay improvements and signal timing adjustments.

- E. Memorial Loop Dr. at N. Memorial Loop Dr.  
  - With a two-way stop control intersection, queues can be minimized with turn bay improvements at the intersection.

- Memorial Dr. Realignment east of I-610  
  - The realignment of Memorial Dr. will add less than 30 seconds of travel time between the Memorial Loop Dr. and the I-610 intersection during both peak hours.  
  - The I-610 interchange with the northbound and southbound frontage roads will require signal timing adjustments.

Queue lengths (number of cars waiting at a red signal indication) were reviewed to make sure that vehicles will not back up between the E. Loop and Crestwood into the adjacent intersection. The maximum number of vehicles expected will only take up half of the available length between the two intersections.

Travel Time Comparison
The increase in travel time along the Memorial Dr. re-alignment is only due to the added length of approximately 0.2 miles.

<table>
<thead>
<tr>
<th>Intersection</th>
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<th>Proposed</th>
<th>Difference</th>
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<td>15.8</td>
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<tr>
<td>IH 610 SB Frontage Road</td>
<td>26.0</td>
<td>26.0</td>
<td>56.4</td>
<td>30.4</td>
</tr>
<tr>
<td>IH 610 NB Frontage Road</td>
<td>0.2</td>
<td>0.2</td>
<td>56.4</td>
<td>56.2</td>
</tr>
</tbody>
</table>

Further information can be found in the appendix with Walter P. Moore’s complete study.
The proposed trail typologies of Memorial Park have been designed to facilitate mobility throughout the park, improve user experiences, and promote safety. Connectivity to and access throughout Memorial Park will be expanded with additional commuter friendly paths connecting to adjacent neighborhoods. Routes will be completed along both sides of Memorial Drive on the south side of Woodway Drive, and new connections will be added to the north and south. Concrete commuter paths will tie to existing sidewalks both inside and outside the park. Crushed stone pathways will provide all weather and ADA accessible surfaces throughout the park.

On the north side of the park, primary circulation pathways of crushed stone will provide all weather and ADA accessible surfaces throughout the park. On the southern side of the park, the multi-functional Southern Arc Trail will provide an armature to the Bayou Wilds, ADA access to the restored ecologies of the southern area, and much needed emergency service routes. As an armature the trail will provide structure to an otherwise disorienting precinct of the park. The core arc connotes an inner rarefied wilderness and its bridges and on-grade surfaces move users through the diverse ecologies of the southern wilds.

Trails and pathways designated for specific user groups will reduce user conflict and improve experience as surfaces become customized to their specific group. Mountain bike trails will be designed to the geometry and speed of bikes while hiking trails will take into account movement by foot. Graphic and visual cues will alert users to the proper use of these trails and elements placed at the head of trails will discourage improper use. Boardwalks and raised surfaces will be used to protect sensitive ecologies and frequently wet areas. Trail standards for design and sustainability will be utilized on all natural surface hiking and biking trails to reduce standing water, erosion and maintenance costs. Natural surface trails will still be periodically closed by the parks department during inclement weather to reduce deterioration.

The existing Seymour Lieberman Exercise Trail will continue to function as a resource for runners of all ages and will be lengthened to three miles. The trail will connect seamlessly to multi-use trails over the Land Bridge providing easy access to the Running Trail Center and Timing Track.

The Cycle Track in the northwest quadrant will provide a home for the many road cyclists currently appropriating the paved surface through the existing picnic loop.

Major Throughways: Connecting to the Park

THE THROUGHWAYS (8.9 MILES)

The throughways will be the major arteries of the park facilitating the largest amount of non-vehicular traffic. Typically 16’ wide with a concrete surface, three pathways allow multiple kinds of users to move through the park and beyond.
Primary Pathways: Connecting Within the Park

**Primary Circulation Pathways (4.5 Miles)**

The primary circulation pathways allow access to the interior of Memorial Park as well as providing smaller scale connections to adjoining neighborhoods. Typically 12' wide with a crushed stone surface and curb edge, these pathways provide an accessible surface for multiple user groups.

**Southern Arc Trail (2.4 Miles)**

The Southern Arc Trail is the orienting and structuring device of the Bayou Wilds. It is typically 12' wide, crushed stone surface and does not have a curbed edge to minimize impact to the ecologies. Timber frame bridges, boardwalks, and overlooks span the barrancos and bayou edge.
The hiking trails of Memorial Park are primarily located within the riparian portion of the park. These trails will not allow mountain bikes and will provide access to scenic elements of the riparian forest and barrancos. These paths will be natural surface trails typically 2’-3’ wide allowing for a more rugged experience within the park.

**CYCLE TRACK (1.75 MILES)**

This loop will be paved with asphalt, have a width of 24’ and be used by cyclists, designed to accommodate users moving at different speeds. The buffer of planting around the edges will be widened at some points to ensure a safe distance between users and potential hazards.

**SEYMOUR LIEBERMAN EXERCISE TRAIL (3.0 MILES)**

This trail will maintain its current character with a finely crushed stone surface and curbs designed to facilitate primarily jogging and exercise activities.
The mountain bike trails will be for mountain bikers only and largely one-directional. Varying the designed speed and width (2'-3') of the trail will accommodate a range of skill levels. Cleared existing surface will be used when possible and appropriately reinforced where necessary. In some places boardwalks and bridges will be used to cross erosion prone areas.

The multi-use trails will accommodate a range of user groups. Trails will be typically 4' wide with a more even terrain and improved surface than the hiking and biking trails.
Materials

The proposed material palette for designed elements at Memorial Park evokes the geology, industrial history and vernacular materiality of Houston and Memorial Park. Expressed in both contemporary and traditional ways, the master plan seeks to use this material palette to link the diverse aspects of the park into a unique and cohesive design language.

Texas limestone and native Texas Cordova limestone or ‘Shellstone’ are regionally sourced stone types used extensively throughout the state and are synonymous with grand scale in Texas architecture – both San Jacinto Monument and Houston City Hall were built from ‘Shellstone.’

Stone features communicate the grand scale and permanence of Memorial Park especially at the major entrances and thresholds to the park.

Weathering steel, stainless steel, zinc finished metals and concrete evoke a connection back to the railroad, Houston’s industrial past, and familiar vernacular forms in the region.

The use of site-harvested pine, hardwoods and locally sourced gravels will also draw on local vernacular for many pedestrian and trail related site elements.

WEATHERING STEEL
Possible integration into signage and graphics, raised planters, handrail posts, building veneers and sculptural elements

TEXAS CORDOVA LIMESTONE
‘SHELLSTONE’
Site walls, park entrances and thresholds, freestanding kiosks, graphic markers, building veneer and sculptural elements

TEXAS LIMESTONE
Site walls, park entrances and thresholds, freestanding kiosks, graphic markers, building veneer and sculptural elements

BOARD FORM CONCRETE
Transition zones: Linking park and highway overpass and building construction/veneer and possibly stormwater management controls

SITE HARVESTED LUMBER
Boardwalks, bridges and trail signage + building construction/interiors and veneer

STAINLESS STEEL AND ZINC FINISHED METAL
Handrails, raised planters, signage + building interiors and veneer
Stainless Steel and Zinc Finished Metals

Site Harvested Lumber

Texas Cordova Limestone 'Shellstone'

Texas Limestone

Board Form Concrete
Riparian

The riparian corridor, identified by its adjacency to Buffalo Bayou, its steep banks, and its occasional floodplain benches, is one of the most distinct places within Memorial Park both experientially and ecologically. The Bayou is a reminder of this area’s connection to something larger; narrow trails through dense vegetation are a refuge (in a bustling city) to people and wildlife. The soil in these areas is fragile and critical to plant health and stability.

The riparian corridor of Memorial Park is at once a fragile ecosystem and a treasured experience of immersion in nature for many visitors. It is critical to strike a balance between providing limited access and protecting the fragility of this landscape. This stretch of undeveloped bayou, free of encroaching buildings and other man made features is both a key ecological resource and an opportunity to educate and interpret Houston’s riverine landscapes.

### Typical Restoration Section

<table>
<thead>
<tr>
<th>64 ft.</th>
<th>48 ft.</th>
<th>32 ft.</th>
<th>16 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Juncus rovenianus / Black Needlerush</em></td>
<td><em>Eleocharis montana / Knotty Spike-Rush</em></td>
<td><em>Sarcochlamys purpurea / American Bulrush</em></td>
<td><em>Sambucus canadensis / Elderberry</em></td>
</tr>
<tr>
<td><em>Scirpus pungens / American Bullrush</em></td>
<td><em>Tridens strictus / Long-Spike Tridens</em></td>
<td><em>Plantago occidentalis / American Sycamore</em></td>
<td><em>Acer negundo / Box Elder</em></td>
</tr>
<tr>
<td><em>Eleocharis montana / Knotty Spike-Rush</em></td>
<td><em>Scirpus validus / Soft-stem Bullrush</em></td>
<td><em>Quercus pagoda / Cherrybark Oak</em></td>
<td><em>Sambucus canadensis / Elderberry</em></td>
</tr>
<tr>
<td><em>Quercus phellos / Willow Oak</em></td>
<td><em>Tridens strictus / Long-Spike Tridens</em></td>
<td><em>Acer negundo / Box Elder</em></td>
<td><em>Panicum hemitomon / Maidencane</em></td>
</tr>
</tbody>
</table>

**Legend**

- **Riparian Forest**
Existing Condition: The cool, dense shade from the diverse mix of trees creates the unique character of the bottomland forests of the bayou. However, invasive species currently dominate the understory, obscuring views, crowding out native plants, and stifling the rich biological diversity of a healthy forest. The soil is markedly sandy. Coupled with the controlled water flow from Barker’s and Addicks Reservoirs, the river banks are steep, unstable, and highly erosive. A lack of grasses and shrubs at the water’s edge is evident because of unstable banks from altered flow.

Vision: A dense mature mixed bottomland hardwood forest will continue to dominate the majority of the riparian corridor (Populus deltoides, Fraxinus pennsylvanica, Platanus occidentalis, Quercus phellos, Q. pagoda, Q. texana, Fraxinus caroliniana, Diospyros virginiana, Nyssa sylvatica, with some Pinus taeda). Invasives will be removed, allowing for a more transparent, healthier, and diverse understory. The forest floor on shallower slopes will be loosely populated with ferns (Lorinseria areolata, and Onoclea sensibilis). Limited shade-tolerant and water-loving grasses and other perennials (Elymus Canadensis, Dicranopteris dichotomata var. ensiforme, and Chasmanthium sessiliflorum, Desmanthus illinoensis, Hymenocallis liriope, Iris virginica, Eupatorium serotinum, Mitchella repens L., Lobelia cardinalis, and Erigeron philadelphicus, Tripsacum dactyloides, Dicranopteris dichotomata var. ensiforme, and Chasmanthium sessiliflorum, perennials (Hymenocallis liriope, Iris virginica, Eupatorium serotinum, Mitchella repens L., Lobelia puberula, and Erigeron philadelphicus) and select shrubs (Indigo miniata, Sambucus canadensis, Bidens albistiosa, and Agarista populifolia) will be re-established.

On the banks approaching and adjacent to the water’s edge, obligate and facultative wetland grasses (Equisetum, Elymus, Juncus, Tripsacum, Tridens, Paspalum, and Panicum) will become more dense, providing critical cover, nesting habitat, and forage for wildlife. Shrubs and understory canopy trees will serve a similar purpose and help stabilize slopes (Betula nigra, Celtis laevigata, Cyrilla racemiflora, and Crataegus opaca).

This area will not have a regular understory management regime, but it will require a regular regime of invasive species control. Dead wood will be left undisturbed, standing or fallen, for wildlife habitat, except where it encroaches on trails and program areas, or proving a risk to people.
Barrancos and Riparian Edges

The barrancos, “ravines” in Spanish, that carve into an otherwise flat landscape are a defining feature of Memorial Park. Three major barrancos drain site water to the bayou with their origins in higher, flatter zones of the site. In the southern portions of the park, these waterways are often quite deep and incised. While in the northern reaches, they often diminish to shallower stream channels.

Sandwiched between the riparian corridor and in most cases pine-hardwood forests, their characteristics are a combination of the two. Steep slopes, deep shade, well-drained sandy soil, and transitional plants define these areas of the park. Unstable slopes and frequent flooding necessitate grade-separated pedestrian crossings (boardwalks or bridges) in barrancos and at sensitive riparian edges.
**Existing Condition:** The upper reaches of the riparian corridor and the barrancos that stretch into the park are crisscrossed by bike and pedestrian trails, exacerbating an already unstable soil condition, and overrun by invasive species in the mid- and understory.

**Vision:** At this edge where the well-drained slope nears the terrace flats and the dense forest from the bayou begins to open up, trees transition to hardwood and pine species that can withstand periods of drought and inundation. Overstory canopy trees (Acer negundo, Liquidambar styraciflua, Magnolia grandiflora, Pinus taeda and echinata, Ulmus alata, and Quercus michauxii and nigra) and understory trees (Asimina triloba, Diospyros virginiana, Carpinus caroliniana, Crataegus drummondii and marshallii) will become dominant features of this landscape as understory invasives are cleared out, exposing the unique character of these trees.

On average, the ground plane will consist of 25% shrubs and 25% herbaceous plants. This loose and scattered shade-tolerant shrub layer will provide wildlife habitat and forage and stabilize these sandy and highly erosive slopes (Agarista populifolia, Callicarpa americana, Phlox divaricata, Rubus trivialis). The establishment of a native shrub palette will be important for when invasives are removed to minimize disturbance.

With more pine straw and leaf litter on the forest floor and dappled sunlight, only certain grasses and other perennials (Chasmanthium latifolium and sessiliflorum, Elymus virginicus, Paspalum plicatum, and Euapotium perforatumserotinum, Mitchella repens L., and Dryopteris marginalis), and ferns (Dryopteris marginalis, Lorinseria areolata, and Ophioclea sensibilis) will thrive here.
Pine-Hardwood Forest

When the invasive thicket is removed, the pine-hardwood forests will have a very different character than they do now. Instead of appearing like an impenetrable mass, they will be filled with light and air between the trees with occasional groupings of shrubs and a low, native understory.

These areas within Memorial Park will be ideal for both people and wildlife. The canopy of the existing mature trees are ideal bird habitat. A restored understory and midstory will become better habitat and forage for wildlife. Carefully designed trails will allow people to experience select areas within the forest.
Restored Pine-Hardwood Forest Description

**Existing Condition:** The steep sandy slopes of the bayou and barrancos give way quickly to the flat broad terrace of Memorial Park. Other disparate patches of pine-hardwood forest have become established across the site over the past 100 years.

The vegetative composition of this forest is currently a jumbled mix of incredibly dense invasive species in the understory that physically and visually obscure pine and hardwood trees. Many trees were badly damaged during the recent drought and hurricane.

**Vision:** These woods will range in density from 150 trees per acre closest to the riparian corridor to 100 trees per acre on the edges that border savannah. The dominance of either pine or hardwood trees will depend on the type of soil. Pine-dominant woods (Pinus taeda and Pinus echinata to be established) will be scattered with motts of dry-mesic hardwoods (Carya spp.; Quercus alba, Q. falcata, Q. virginiana, Q. prinus and Q. stellata; Morus rubra; Celtis occidentalis; Sassafrass albidium; Liquidambar styraciflua, Catalpa bignonioides and Tilia caroliniana).

On average, the ground plane will consist of 25% shrubs and 25% herbaceous plants. Shrubs will tend to be loose in structure and planted in odd groupings of 3-5 (Agarista populifolia, Callicarpa Americana, Rubus trivialis). Perennials will be planted similarly and en masse (Amsonia illustris, Cooperia drummondii, Desmanthus ilioensis, Conoclinium coelestinum, Dryopteris marginalis, and Mitchella repens L.). Grasses will be diverse in species and follow a similar form and distribution as perennials. (Tripsacum dactyloides, Elymus virginicus L., Chasmanthium sessiliflorum, Muhlenberga capillaris, Schizachyrium scoparium, Panicum virgatum) as will ferns (Pteridium aquilinum (L.) Kuhn var. pseudocaudatum, Dryopteris marginalis).

Clearing of brush on a bi- or triennial basis will be necessary in this landscape to keep the forest floor open and to keep hardwoods from becoming too dense. A rigorous invasive species management regime will be necessary.
Pine-Hardwood Savannah

Although unfamiliar to Memorial Park in recent decades, the pine-hardwood savannah that was once a dominant feature of this area will become the park’s defining ecological type. Clusters of pines and hardwoods known as “motts” of varying sizes will dot an understory of native grasses and forbs. The presence of more sunlight will allow for the development of specimen trees, ones that become sculptural characters in the landscape. When dead standing wood and invasives are removed and a more open overstory is created, an existing dormant seedbank of native species will emerge and thrive. The tawny grasses and full canopy trees of the savannah will become the iconic landscape type of Memorial Park.
Existing Condition: Over the past 60 years, most of the flat terrace of Memorial Park has become densely forested. Before this time, or that of Camp Logan or the Reinermanns, a coastal prairie with pine hardwood savannahs would have dominated this landscape. The recent drought and hurricane were destructive forces to the trees that had grown since then; however, their clearing effect has left a prairie-savannah ecology that would have been familiar to the Karankawa, some of the early inhabitants of this area. While some patches have been cleared, others still have standing dead wood, dead brush, and invasives that require thinning, clearing, and grubbing.

Vision: The pine-hardwood savannah of Memorial Park will become one of its most defining landscape typologies. It will be the intersection of the rich native prairie with clusters of pine trees and hardwood motts. The tree palette will typically mirror the pine-hardwood forest with the occasional addition of Carya illinoiensis (the state tree of Texas) and Juglans nigra. Long views through the grasslands will punctuate otherwise loosely wooded areas. On average, there will be about 50 trees per acre grouped in clusters, leaving significant open areas. Shrubs will comprise 20% of the ground plane while herbaceous plants will comprise 70%.

These areas are not intended to be occupied like lawns. While occasional foot traffic is anticipated, paths winding through them with small gathering areas are how they will be experienced.
Native Prairie

Existing patches of native prairie in Memorial Park are thriving in the CenterPoint utility easement and around Memorial Drive. These patches will be expanded and become the geographic center and the heart of the park.

Stretching across the contours of the land bridge, lower vegetation will afford views that have never been seen before in this part of Houston.

With a diverse mix of grasses and forbs, the expanded prairie complex will be beautiful year-round and important habitat for nesting birds and other small animals, reptiles, and insects.

Legend

Native Prairie

Typical Restoration Section

Quercus virginiana / Southern Live Oak
Quercus alba / White oak
Quercus falcata / Southern Red Oak

Rudbeckia hirta / Black-eyed Susan
Salvia azurea / Blue Sage
Amsonia illustris / Showy Blue Star

MEMORIAL PARK CONSERVANCY
HOUSTON PARKS AND RECREATION DEPARTMENT
UPTOWN HOUSTON

2015 MEMORIAL PARK MASTER PLAN
EXECUTIVE SUMMARY

NELSON BYRD WOLTZ LANDSCAPE ARCHITECTS
**Existing Condition:** The existing areas of the park maintained as native prairie adjacent to Memorial Drive and the utility easement will remain and continue to be maintained as this habitat type.

In other areas where prairie will be restored, the landscape is either overrun by invasive shrubs that occlude the presence of native grasses or is recently cleared after the loss of trees.

**Vision:** The prairie landscape of the West Gulf Coastal Plain is the dominant typology in this ecosystem. The area earmarked to be restored to a prairie is centered around land bridge. It will connect to H.A.N.C.’s restored prairie and spread southward toward the bayou and north along the railroad in sections.

There will be only 5-10 trees per acre, such as *Juglans nigra*, *Quercus virginiana* and *Q. falcata*, that will be the same dry-mesic species of both the savannah and pine-hardwood forest. Oaks will be the dominant species, and the lack of competition for sunlight will allow them to grow to full size and form, making them sculptural treasures of the park. Their maintenance will be critical for this reason.

Shrubs and flowering perennials (indigo miniata, Coreopsis lanceolata, Desmanthus illinoensis, and *Dalea purpurea*) primarily along trails, roadsides, and the railroad will take up 20% of the ground plane and will provide excellent habitat for butterflies for the public to view. 80% of the ground plane will be grasses and other forbs. The species makeup and maintenance regime for this complex will be similar to those in the savannah grassland (specifically *Andropogon geradii*, *Panicum virgatum*, *Schizaehryum scoparium*, and *Sorgastrum nutans*.) Within the native prairie, *Bouteloua curtipendula* will be established, as it is the state grass of Texas.

Standing and fallen dead wood, when not a threat to people, will be left for wildlife habitat. People will experience this landscape on foot, on bike, and car with long views through grasses and to distant savannahs.
Wet Prairie-Savannah

Seasonally wet areas will be a feature of Memorial Park as long as it is flat, its claypan soil horizon remains, and Houston receives 50 inches of rain per year. Outside of high use areas, wetlands and frequently ponded areas can be beautiful and unique landscape typologies. They are critical to certain plant and wildlife species and provide a natural means of temporarily storing stormwater on the site.
Existing Condition: There are a number of seasonally and perennially wet areas within the park. Their state and official designation remain unknown during the master plan process. Further exploration of these areas for any design work will be necessary.

Vision: Wet prairie and savannahs, like jurisdictional wetlands, are critical to wintering and migrating wildlife as places to nest, rest, and forage as well as to general ecosystem function. These areas flood seasonally. They will be important for naturally occurring stormwater detention. They could also be used for educating the public about the function and importance of wetlands and wet areas and their place in Texas ecology. Boardwalks and interpretive areas may intersect with or traverse these landscape types.

They have different soil and water properties, and because of this, their vegetation varies from that of dry areas. They contain more facultative (FAC) and facultative wetland (FACW) forbs and grasses (*Panicum anceps*, *Paspalum plicatum*, *Paspalum floridanum*, *Elocharis montana*, *Scirpus pungens*, *Scirpus validus*, etc.) and can harbor trees and shrubs that don’t mind wet feet (*Taxodium distichum*, *Platanus occidentalis*, *Nyssa aquatica* and *sylvatica*, *Quercus texana*, etc.).

The structural characteristics of both the wet savannah and wet prairie will resemble their dry counterparts in number of plants per acre.
OVERSTORY TREE PALETTE

Obligate Upland (UPL)

- Catalpa bignonioides | Southern Catalpa
- Quercus prinus | Chestnut Oak
- Quercus stellata | Post Oak
- Tilia caroliniana | Carolina Basswood

Facultative Upland (FACU)

- Carya illinoensis | Pecan
- Carya ovata | Shagbark Hickory
- Celtis occidentalis | Hackberry
- Morus rubra | Red Mulberry

Facultative (FAC)

- Acer negundo | Box Elder
- Diospyros virginiana | Common Persimmon
- Gleditsia triacanthos | Honey Locust
- Magnolia grandiflora | Southern Magnolia

Facultative Wetland (FACW)

- Nyssa sylvatica | Black Tupelo
- Prunus padus | Longleaf Pine

VERSTORY

Plant Palette

SITE SYSTEMS

Plantings

MEMORIAL PARK CONSERVANCY

HOUSTON PARKS AND RECREATION DEPARTMENT

UPTOWN HOUSTON

2015 MEMORIAL PARK MASTER PLAN

EXECUTIVE SUMMARY

NELSON BYRD WOLTZ LANDSCAPE ARCHITECTS
OVERSTORY TREE PALETTE (CONTINUED)

**Obligate Wetland (OBL)**

- *Nyssa aquatica* | Water Tupelo
  - F, R, B
- *Sorbus nigra* | Black Willow
  - R, S
- *Taxodium distichum* | Bald Cypress
  - R, WP

**No Wetland Designation**

- *Carya texana* | Black Hickory
  - F, S, P
- *Salix nigra* | Black Willow
  - R, B

UNDERSTORY TREE PALETTE

**Facultative (FAC)**

- *Asimina triloba* | Pawpaw
  - F, R, B
- *Crataegus opaca* | Mayhaw
  - R
- *Cyrilla racemiflora* | Swamp Titi
  - R, B
- *Carpinus caroliniana* | American Hornbeam
  - F, R, B
- *Fraxinus caroliniana* | Carolina Buckthorn
  - R
- *Cornus drummondii* | Rough-Leaf Dogwood
  - R, B
- *Crataegus marshallii* | Parsley Hawthorne
  - R, B
- *Crataegus mollis* | Downy Hawthorne
  - R, B
- *Crataegus texana* | Texas Hawthorn
  - F, S

**Facultative (FAC) Continued**

- *Itea virginica* | Sweetspire
  - F
- *Ilex decidua* | Deciduous Yaupon
  - F
- *Baccharis halimifolia* | Eastern False Willow
  - F, S, P
- *Carya texana* | Black Hickory
  - F, S, P
- *Ilex vomitoria* | Yaupon
  - F
- *Ambelone canadensis* | Elderberry
  - R, WP, B
- *Morella cerifera* | Wax Myrtle
  - F

**Facultative Wetland (FACW)**

- *Catalpa bignonioides* | American Bignonia
  - F, R, B
- *Symphoricarpos orbiculatus* | Coral Berry
  - F, B

**Obligate Wetland (OBL)**

- *Symporhicarpus oblongus* | Coral Berry
  - F, B

**Facultative Upland (FACU)**

- *Agarista populifolia* | Florida Hobblebush
  - R, F, B
- *Sorbus americana* | American Crabapple
  - F, R, B
- *Itea virginica* | Sweetspire
  - F
- *Leucothoe populifolia* | Florida Leucothoe
  - R

**Facultative Wetland (FACW)**

- *Abelia frutescens* | Abelia
  - F, S
- *Juglans nigra* | Black Walnut
  - R, S, P
- *Sambucus canadensis* | Elderberry
  - R, WP, B
- *Rubus trivialis* | Dewberry
  - F, B

**No Wetland Designation**

- *Ageratina altissima* | Zinnia Elegans
  - F
- *Callicarpa americana* | Beautyberry
  - F, B
- *Rubus trivialis* | Dewberry
  - F, B
- *Indigofera miniata* | Indigo
  - R, S, P, B
- *Symphoricarpos orbiculatus* | Coral Berry
  - F, B

*F=Forest, R=Riparian, S=Savannah, P=Prairie, WP=Wet Prairie, B=Barranco*
Extensive site improvements planned for Memorial Park provide an opportunity to cleanse stormwater through low impact water quality design features, planned in conjunction with new roadways, parking lots, and other facilities. Features will work to slow stormwater drainage, filter runoff from hard surfaces and provide a portion of the stormwater detention volume required by local regulators. The remaining balance of the detention requirement will be provided in the site’s proposed new ponds, expansion of existing ponds, or proposed new detention specific areas, depending on the location in the park.

The primary element of stormwater quality enhancement will be bio-swales designed to capture and detain the first flush runoff from the site area served. These bio-swales will filter runoff using either appropriate vegetation or engineered media designed to remove runoff pollutants. In some locations, open bio-swales will be replaced with rock filled swales to allow foot traffic to conveniently pass over the swale. Utilizing an extensive bio-swale network, the following stormwater goals will be met:

**Overall Stormwater Goals:**
- Treat at least the first inch of stormwater runoff from all hard surfaces using bio-swales, bio-retention, rain gardens, or permeable pavements.
- Manage stormwater drainage using low impact development techniques to maximum extent.
- Design irrigation systems to utilize harvested storm water
- Maintain and enhance ecological systems using the stormwater drainage system

Bio-swales are typically designed with a storage volume sufficient to treat the first inch of runoff that enters the swale. Soil berms placed at intervals along the swale force ponding to occur allowing water treatment to take place. The treated water is then discharged from the swale in less than a day. Larger flow rates are designed to be conveyed above the treatment volume and over the berms. Discharge from the treatment cells and any overflow will be directed to the primary storm drainage system or barrancos.

The physical geography of Memorial Park consists of large flat areas which pond after a rain event. Within the site’s natural geography, the primary storm drainage path is along one of the barrancos and into Buffalo Bayou. Slowly, the park’s ponded areas drain toward these barrancos. This natural system of drainage takes place over a longer period of time than a man-made system of drainage pipes and concrete channels. By using bio-swales to slow and treat runoff from impervious surfaces, constructed drainage systems can more closely mimic the park’s natural stormwater patterns. Rain that falls on impervious surfaces in the park will either filter through a network of bio-swales or other stormwater BMPs into the barrancos, or be collected in a harvesting pond for reuse as irrigation water.

The proposed system of low impact development management features functions to improve stormwater water quality, maintain and improve ecological systems, and reduce demand of potable water for irrigation.
Water Reuse Plan

The water reuse strategy for Memorial Park includes a series of measures that will be taken to allow for the harvesting of stormwater runoff for irrigation use. The harvested water will be utilized to reduce the need for city potable water.

Collection of stormwater runoff will be included in the construction of new site improvements with the runoff directed to either new or existing harvesting ponds. These ponds will also serve as stormwater detention systems. Water harvesting will take place within a designated range between the pond’s normal high and low water levels (the freeboard). Detention will be provided above the harvesting zone.

Water Reuse Strategy for Memorial Park Golf Course

The largest water consumer within Memorial Park is the city-owned golf course. The Memorial Park public golf course is a popular, historic course operated by the city-owned golf course. The Memorial Park public golf course is a popular, historic course operated by the city’s Department of Parks and Recreation. Maintenance of the golf course includes an ongoing effort to minimize use of potable water. Irrigation is limited to watering the fairways, greens, tee boxes, and portions of the roughs. Areas outside of these locations are not watered using irrigation.

On an annual basis, about 110 acres of the course is irrigated using about 59 million gallons of city potable water. The irrigation system pump draws water from a golf course pond. This is an existing pond (which will be expanded) shown as Pond 1 in the Exhibit. Makeup water is added to the lake from a city potable water line.

The water reuse strategy for providing harvested rainwater for the Municipal Park golf courses consists of three steps to be taken to offset increasing portions of the potable water demand. The scenarios below are presented in the order of greatest benefit to cost as follows:

- Scenario 1 - GC 1 Watershed
  - 113 acres, 6.5 acres, 48%
  - Storage Pond 1
  - GC 3
  - Storage Pond 2
  - GC 1, GC 2, and GC 3 Watersheds

- Scenario 2 - GC 1 and GC 2 Watersheds
  - 113 acres, 5.1 acres, 42%
  - Storage Pond 1
  - GC 1, GC 2, and GC 3 Watersheds

- Scenario 3 - GC 1, GC 2, and GC 3 Watersheds
  - 113 acres, 5.1 acres, 42%
  - Storage Pond 2
  - GC 1, GC 2, and GC 3 Watersheds

Golf Course Water Reuse

<table>
<thead>
<tr>
<th>SCENARIO 1</th>
<th>WATERSHED AREA</th>
<th>STORAGE PONDS 1 AND 2</th>
<th>% IRRIGATION DEMAND FROM STORMWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>GC 1</td>
<td>113 ACRES</td>
<td>6.5 ACRES</td>
<td>48%</td>
</tr>
<tr>
<td>GC 2</td>
<td>113 ACRES</td>
<td>5.1 ACRES</td>
<td>42%</td>
</tr>
<tr>
<td>GC 3</td>
<td>113 ACRES</td>
<td>5.1 ACRES</td>
<td>42%</td>
</tr>
</tbody>
</table>

Ballfield Water Reuse

<table>
<thead>
<tr>
<th>SCENARIO 2</th>
<th>WATERSHED AREA</th>
<th>STORAGE PONDS 1 AND 2</th>
<th>% IRRIGATION DEMAND FROM STORMWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>GC 1</td>
<td>113 ACRES</td>
<td>5.1 ACRES</td>
<td>42%</td>
</tr>
<tr>
<td>GC 2</td>
<td>113 ACRES</td>
<td>5.1 ACRES</td>
<td>42%</td>
</tr>
<tr>
<td>GC 3</td>
<td>230 ACRES</td>
<td>5.1 ACRES</td>
<td>42%</td>
</tr>
</tbody>
</table>

Eastern Glades Water Reuse

<table>
<thead>
<tr>
<th>SCENARIO 3</th>
<th>WATERSHED AREA</th>
<th>STORAGE POND 2</th>
<th>% IRRIGATION DEMAND FROM STORMWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>GC 1</td>
<td>113 ACRES</td>
<td>5.1 ACRES</td>
<td>42%</td>
</tr>
<tr>
<td>GC 2</td>
<td>113 ACRES</td>
<td>5.1 ACRES</td>
<td>42%</td>
</tr>
<tr>
<td>GC 3</td>
<td>113 ACRES</td>
<td>5.1 ACRES</td>
<td>42%</td>
</tr>
</tbody>
</table>

Further information can be found in the appendix with Sherwood Design Engineers’ complete study.
As part of the Master Plan, this comprehensive plan for signage in Houston Memorial Park has been prepared to communicate with park visitors. Signs are a major visitor interface in any park and reflect both the park and city image. Each message is the park’s “voice” and as such is an opportunity to speak with clarity while expressing the park’s values and character.

This sign plan identifies and defines all types of signs and other graphics needed to help the park function for the thousands of visitors each day. Included are designs and standards for signage for drivers, pedestrians and cyclists and for all the unique physical areas and amenities of the park.

Also included are signs and related elements for interpretive signage to present the many stories of Houston Memorial Park. These stories may include such topics as park and area history, flora and fauna, ecology, and geology to enrich a visit to the park.

Benefits of the Sign Plan as part of the Master Plan
The many elements of the sign plan combine to provide substantial benefits for the park visitor and to the park itself:

- Sense of welcome and arrival
- Statement of park identity
- More effective vehicular and pedestrian wayfinding
- Improved visitor circulation to all areas
- Improved presentation of visitor destinations and activity choices
- Continuity with master plan design elements
- Improved synergy with the City of Houston
- Improved overall visitor experience
- Improved presentation at trailheads
- Improved trail signage
- Reduction of visual clutter
- Better presentation of rules and regulations

Signage Principles
Three overarching principles have guided the planning and design of the sign plan for Memorial Park:

- Identity – consistently identify the park itself at the vehicular and pedestrian entrances as well as the many internal destinations and amenities with a unified visual language and design approach.
- Access – provide tools for self-guiding throughout the park in vehicles, on foot and by bicycle. Make the park understandable and usable with clear operational signs and regulatory information.
- Reveal – tell the many stories of the park through interesting and accessible interpretive displays.

Design Approach
Each of the types of signs in the program has been designed to visually integrate with the overall design approach of the park itself. A limited set of materials, type fonts and colors have been selected to complement the landscape, hardscape and other master plan design elements. Each element, from the smallest regulatory sign to the major entrance pieces reflects the design philosophy of the master plan.

The plan is organized into four categories of signs:
- Identification
- Motorist
- Pedestrian
- Interpretive

Organizing the signs in this way allows for easier location planning, message sequencing and ultimately, simpler procurement and implementation.

Identification – Signs that identify the park, internal destinations and amenities
Motorist – Signs to direct and inform drivers in and around the park, including in many instances, cyclists
Pedestrian – Signs to direct and inform pedestrians in and around the park and on trails, including regulatory information
Interpretive – Signs and other elements to provide historical and other information to supplement park visits

The signs are shown in comparable silhouette illustrations with sight type code numbers and color-coded to the sign location plans. Representative signs from each category are shown with dimensions and notes on materials and sign-making techniques.

Further information can be found in the appendix with Hunt Design’s complete study.
Memorial Park is one of the most popular parks in the City of Houston. Encompassing almost 1,500 acres, the park is heavily used and offers opportunities for recreational activities such as running, walking, hiking, biking, golf, tennis, swimming, various team sports, and picnicking. Lighting is required to make the park functional during evening hours. The extensive site improvements planned for Memorial Park provide the opportunity to reconsider the way the park is lighted – to create a cohesive lighting approach that enhances safety and user comfort, provides visual cues for wayfinding and supports the environmental stewardship goals of the Houston Parks and Recreation Department.

Lighting should be provided for all areas where activity is encouraged and/or anticipated after dark. This includes vehicular roadways, such as Memorial Drive and Memorial Loop Drive, pedestrian and running trails, such as Seymour Lieberman Trail, sports and recreation areas, parking areas and picnic zones. Lighting levels should be matched to the intended activities. This master plan and design guidelines present criteria for luminaires, lighting sources and illuminance quantities. The criteria are based on recognized best practices for lighting that maximize energy efficiency and minimize environmental impact.

The most critical function of lighting in Memorial Park is to enhance safety and visibility at night. Enhanced safety is achieved by providing adequate light levels while minimizing shadows and contrast. Additional components include good color rendering and appropriate lighting fixture placement, optics and shielding to minimize disability glare.

In addition to enhancing visibility and security, lighting is an important tool for improving wayfinding within the park. By separating roadway and pedestrian lighting into two distinct lighting systems, dividing active recreational areas from ‘wilderness’ areas, and accenting specialty areas and park features, lighting can clarify paths of circulation and highlight destinations. Specific luminaire and pole types are recommended within this master plan for each unique area to reinforce wayfinding.

Sustainable lighting solutions will help to ensure that future generations can continue to enjoy Memorial Park and its amenities. This includes providing adequate light to ensure safety without over-lighting and using efficient, low wattage, long life sources, such as LED. The planned improvements for Memorial Park, including the segregation of active areas - like sports fields - on the north side, from wilderness areas on the south side, create the opportunity for providing higher lighting levels for activity areas, while minimizing lighting in wilderness areas, thereby mitigating the potential negative effects of artificial lighting on wildlife and insects.

A plan for long-term maintenance is critical to reaping the ongoing benefits of high quality lighting systems. This master plan recommends standardizing lighting fixture types for various applications and using LED sources for their long life and efficiency. These strategies will minimize maintenance and operations costs. However, by separating pedestrian lighting from roadway lighting, a smaller proportion of the new park lighting (roadway lighting only) will be maintained by CenterPoint. Because of this, it is recommended that lighting maintenance for all other lighting be done by an outside maintenance contractor to handle burn-outs, group relamping and other maintenance issues. This will allow park staff to concentrate on other needs while ensuring that lighting systems remain in good working order, and that properly skilled personnel with the right equipment provide lighting maintenance.

Further information can be found in the appendix with The Lighting Practice’s complete study.
Visitor Counts
Memorial Park (MP) has never performed a comprehensive visitor count. Visitors to the park’s recreational facilities, such as the tennis center, pool, ballfields and golf course are tracked; however, trail use has never been officially monitored. The ballfields are the most frequently used recreational facilities in the park, accounting for over 150,000 visitors annually. The pool, tennis center, and fitness center together bring in another nearly 60,000 visitors. In order to get a better understanding of how many additional users visit the park, ETM purchased and installed a counter on the Seymour Lieberman Trail (SLT) in November of 2014. This counter will remain in place for one year to help Memorial Park Conservancy (MPC) tabulate the number of visitors using the SLT annually. During the four (4) month period between installation and mid-March 2015, more than 414,000 individuals, with an observed discrepancy of -10%, were counted, which represents an average usership of 100,000/month (Table 1) excluding recreational facility usage. The Trust for Public Lands estimates a total annual usership at 3.2 million for MP.

Methodology and Landscapes
The first critical step for understanding the implication of the master plan on future maintenance needs was to define the landscape types proposed in the master plan. ETM and Nelson Byrd Woltz Landscape Architects (NBW) identified restoration (natural) areas, recreational features (ballfields, sports fields, etc.), trails, and other park facilities (restrooms, playgrounds, etc.) that will need to be maintained. Altogether, nineteen (19) distinct landscape types and six (6) trails/connection systems were identified (Table 2). Annual maintenance tasks were then developed for each landscape type, along with an estimated number of hours needed for maintenance of one (1) unit of each landscape type. The task hours required per unit were then multiplied by the total number of units for each landscape type. This allowed ETM to determine an estimated total number of hours needed for annual maintenance of MP (Table 3).

Existing Management and Maintenance
Houston Parks and Recreation Department (HPARD) is currently the primary manager of MP. HPARD provides the following:

- Park maintenance
- Maintenance of the golf course
- Facility management - Pool - Tennis Center - Ballfields
- Permitting of sports facilities

MP sits within HPARD’s Memorial District which includes MP and 30 other smaller parks. Over time, due to budgetary restraints, there has been a dramatic reduction in staff and financial resources. Currently, HPARD spends about $500,000 annually for maintenance in MP.

Memorial Park Conservancy (MPC)
The mission of the MPC is to preserve, restore, and enhance MP for the enjoyment of all Houstonians, today and tomorrow. Founded in 2000, MPC aspires to implement principles of exceptional park management and stewardship in a successful public-private partnership with HPARD. MPC advances this mission through the following areas of focus:

- Conservation, including reforestation and site preparation, watering and irrigation, invasive species control, wildlife conservation, soil conservation, and fire protection zones
- Amenities, design, construction and maintenance, including new trails, trail maintenance, new buildings and construction, commemorative plaques and pavers
- Community involvement and education, including volunteer conservation and forestry work, community events, newsletters and social media, and advocacy for Park needs
- Leading an informed long-range master plan in collaboration with HPARD and the Uptown Houston, with the goals of restoring the habitat and a healthy ecosystem to the park, upgrading existing amenities, addressing unmet community needs, elevating the Park to a nationally recognized, award-winning park, and honoring human and natural history

- Executing current projects, including ongoing forestry care and preparation, construction of the Running Trails Center with an onsite Conservancy office, SLT refurbishment and daily park maintenance

Today’s dense understory is a result of the gradual evacuation of many important ecological functions such as grazing by large mammals and naturally induced grass fires. These regimented disturbances have historically worked in sympathy to create and maintain vegetative composition. The human manipulation of land surrounding the park through the development of the city, combined with a deliberate lack of human intervention in land management ultimately created a profound disruption to the natural forest succession—creating a weak and vulnerable environment.

2011 was the driest year and second hottest on record in Houston, creating another ecological disturbance. At that time the forest/savannah/prairie ecosystem was almost entirely composed of single-age closed canopy forest with little to no natural regeneration occurring. In addition to the drought, Hurricane Ike (2008) caused significant damage, which in turn stimulated an abnormally severe pine bark beetle infestation. The lack of biodiversity, coupled with the density of the canopy, left this ecosystem particularly vulnerable to the stresses of these routine natural disturbances. In addition to this, growing concerns about potential forest fires emerged.

Working in partnership with HPARD since 2012, MPC has:

- Initiated fire hazard mitigation
- Removed thousands of dead trees

Table 1: Eco Counter (11/17/2014 – 3/16/2015)
The counts for November and March represent only half of the full month.

Table 2: Landscape Types and Trails by Percentage
**PINE HARDWOOD FOREST**

**Description:** The Forests will include both categories of Native Prairie Pine, Hardwood Forest - Existing and Pine, Hardwoods Forest - Restoration. The Forested areas will have a composition of 100-150 trees per acre, with an understory composition of 25% shrubs and 25% herbaceous. The Forested Areas will provide habitat for birds and small animals. A healthy forest will consist of an irregular mix of native species of varying densities and age.

**Unit = Acre**

<table>
<thead>
<tr>
<th>Forests</th>
<th>QTY</th>
<th>Unit</th>
<th>Unit (mins)</th>
<th>Once (mins)</th>
<th>Debt (hours)</th>
<th>Annual Freq</th>
<th>Total Hours</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove litter/debris</td>
<td>4</td>
<td>mfd</td>
<td>3</td>
<td>20</td>
<td>0.3</td>
<td>12</td>
<td>4</td>
<td>10% of an acre, weekly</td>
</tr>
<tr>
<td>Natural resource management</td>
<td>11</td>
<td>mfd</td>
<td>15</td>
<td>165</td>
<td>3</td>
<td>6</td>
<td>17</td>
<td>Invasive species removal, trimming, pruning etc., assume 25% of an acre</td>
</tr>
<tr>
<td>Tree canopy thinning and hazardous tree management</td>
<td>allow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Selective canopy opening and tree removal</td>
</tr>
<tr>
<td>Tree maintenance</td>
<td>13</td>
<td>each</td>
<td>15</td>
<td>195</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>Assume 125 trees/acre, 10% of total trees; fertilizing, pruning and replacement</td>
</tr>
<tr>
<td>Replanting</td>
<td>allow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Replanting of woody species and understory</td>
</tr>
<tr>
<td>Temporary Fence</td>
<td>10</td>
<td>elf</td>
<td>5</td>
<td>50</td>
<td>0.8</td>
<td>12</td>
<td>10</td>
<td>Install/maintain temporary fencing, assume 1,000 ft/acre</td>
</tr>
<tr>
<td>Irrigation maintenance</td>
<td>allow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Applied to first 4 years of establishment; Includes</td>
</tr>
<tr>
<td>Fireline control</td>
<td>allow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>testing, additional temporary fencing &amp; additional</td>
</tr>
<tr>
<td>Temporary signage</td>
<td>allow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>invasive species control and spot watering</td>
</tr>
<tr>
<td>Establishment Tasks</td>
<td>allow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3: Example of Maintenance and Task Hours by Landscape Type**

- Implemented a site preparation program treating over 500 acres of invasive plant species, and
- Planted approximately 105,000 seedlings and trees.

The cost of these efforts has totaled nearly $2 million.

At present, MPC is primarily focused on improving the health of the natural systems of the park. This is an important area of focus as the natural areas make up more than 60% of MP. Beginning in FY 2016, MPC intends to transition fundraising efforts to focus on maintenance and park care, marking a transition from funding special projects, which will instead be a component of a forthcoming master plan capital campaign.

Given the limited budget provided for maintenance in the park, allocating these funds should make a significant difference in the park user experience and in the long-term health of the park’s natural resources. ETM recommends an expanded role for MPC in the maintenance of MP beyond a focus on the natural areas to also include:

**Natural Resource and Green Space Support**
- Invasive species control
- Hazard tree removal
- Stump grinding
- Gardens maintenance
- Brush hog / transition zone maintenance
- Spot watering
- Mulching of landscaped areas
- Irrigation maintenance
- Maintenance of seasonal flowers at entrances
- Turf maintenance (mow, blow and edging)

**Sanitation Services**
- Supplemental trash removal, restroom cleaning

**Site Amenities Maintenance**
- Site furnishings care (kiosks, benches, fire pits, picnic tables, exercise equipment)
- Power washing, paint touchups/ repainting
- Paths/sidewalks maintenance

These additional tasks could be accommodated by increased in-house staffing levels, contracted services, or a combination of both, as well as by a continued reliance on the City to perform certain services.

**Park Management**

**General Park Management Goals**

The overarching goals of any effective management strategy are:

- To develop new sources of consistent revenue and build on existing ones
- To develop an entrepreneurial managerial spirit
- To develop and implement a unified management structure that will coordinate all maintenance and operations
- To ensure consistent, high quality maintenance standards and service delivery
- To instill a long-term sense of ownership and stewardship among park staff, stakeholders and users.

Implementation of the master plan will be phased over a number of years in conjunction with a partnership model between HPARD and MPC. Taking into account the anticipated increase in costs to maintain MP, as well as the inadequate spending by HPARD at present, other funding sources will need to be considered in order to ensure adequate funding for maintenance and operations of MP as the master plan is implemented.

The master plan provides an opportunity to improve MP revising how the park is maintained, and evaluate current and future roles for MPC. Continued fundraising for implementation of the master plan will be dependent on protecting previous capital expenditures. HPARD will likely continue to see a reduction in resources to maintain MP; MPC will need to assume a larger role for maintenance and should begin moving in that direction sooner rather than later. Expansion of current in-house efforts with more staff and contracted services will help to deliver additional maintenance.

As MPC assumes a larger role in O+M, it will continue HPARD’s progressive strategy of supporting urban parks by mobilizing philanthropic efforts in order to oversee maintenance and operations. It will be important that HPARD continues to provide support at or near existing levels.

It is not unusual for non-profits to grow over time and assume a greater role in park maintenance. As master plan projects are completed, MPC and HPARD will need to determine the maintenance needs for these projects, how services are delivered and by whom. The assumption in this report is that MPC will continue to assume a greater role in park maintenance, and as an organization, MPC will need to grow over time in order to take on the additional maintenance responsibilities.

Additional staff and more contracts with outside contractors will be needed to ensure delivery of services.

Organizational growth will not be limited solely to increased maintenance efforts. Administrative and operational staffing levels will, more than likely, increase over time to both support increased maintenance efforts, and to meet new administrative and operational opportunities for MPC. Additionally, decisions regarding operations of the Natatorium and Tennis Center, and perhaps the golf course, will need to be made and operational strategies developed for these facilities.

Funding for increased O+M will be a challenge and all potential resources of revenue will need to be examined. MPC and HPARD are currently working to develop a plan. ETM has been engaged to analyze and develop cost assessment, so as fundraising begins, maintenance and operations costs can be incorporated.

Further information can be found in the appendix with ETM’s complete study.
The master plan proposes walls and signs at all major pedestrian and vehicular entries to the park. These thresholds will serve to reinforce the park’s identity within the city and to more explicitly mark the park’s boundaries.

East entrances at Memorial Drive, Arnot, and Washington/Westcott are designed in a more traditional language of signage, with large stone walls and pillars and letters inscribed in stone to reference the era of the park’s founding. Entries on the west side of the park take on a more contemporary language to reflect the more modern context of the surrounding neighborhoods on that side.
The design for this area builds upon the momentum of the newly constructed Running Trail Center and Living Bridge near the intersection of Memorial Drive and the railroad. The biggest feature in this area is the large land bridge, which spans over the park’s most divisive feature, Memorial Drive. Both the native prairie and savannah ecology and the multi-use trail network will span over the road at this location, creating a moment where park users can cross the highway without interacting with traffic. Adjacent to the land bridge is the existing Running Trail Center and a proposed pavilion. A quarter mile timing track to the southeast would be located in the woods to provide a quiet experience for runners.
artist's rendering: running trail center

PRECEDENT PROJECTS

headquarters' woodland track, Beaverton, OR

Path in a prairie complex

Wildlife bridge, Bukit Timah, Singapore
Bayou Wilds

The areas south of Memorial Drive and east of the railroad track are in large part reserved for trails use. Entry and access to the Bayou Wilds is provided from the Bayou Wilds Trailhead just south of Memorial Drive. From this point, users can connect to the site-wide multi-use trail system that passes through this zone to either enter the Bayou Wilds or cross under a bridge at Memorial Drive to the north side of the site. The Southern Arc Trail is the major spine throughout the south side of the site, its arcing geometry serving as an orienting landmark in the wooded zones of this natural area. Mountain bike trails traverse mostly the areas outside the Southern Arc Trail, while hiking trails inhabit the more sensitive bayou edges and barrancos south of the arc. Travel along these trails is punctuated by two observation towers, one near the Bayou Wilds Trailhead, and one on a plateau to the west with good views to the Bayou and to surrounding landscape features.
Southern Arc Trail Sections

Sedge Wren
Wintering grassland bird that lives on wet bayou mud flats.

American Pipit
Wintering grassland bird that lives on wet bayou mud flats.

White Ibis
This iconic bird prefers grassy flats of wet areas. Its cousin the White-Faced Ibis is a Threatened species with similar habitat.

Red-Eared Slider Turtle
Lives at the water’s edge and is regularly seen in the Houston Nature Center and along Buffalo Bayou.

Spiny Softshell Turtle
Lives along the bayou and prefers slow moving water and sandy or muddy bottoms.

River Otter
Mammal that lives along bayou banks with sufficient vegetative coverage and in the water.

Red-Tailed Hawk
Raptor that lives year-round in mixed, often open woodlands and eats insects in flight.

Brown-Headed Nuthatch
Year-round Pine forest species that eats seeds.

Mississippi Kite
Raptor that lives year-round in mixed, often open woodlands and eats insects in flight.

SECTION A: RIPARIAN FOREST
SOUTHERN ARC TRAIL IN RESTORED BAYOU ECOSYSTEM WITH HIKING AND EDUCATION AREAS

SECTION B: PINE-HARDWOOD FOREST TO RIPARIAN EDGE FOREST
SOUTHERN ARC TRAIL IN RESTORED PINE ECOSYSTEM WITH SENSITIVE HIKING AND BIKING TRAILS

Legend
- Riparian Forest
- Pine-Hardwood Forest
- Pine-Hardwood Savannah
- Native Prairie
**Riparian Forest**

- **Prothonotary Warbler**
  Bird that migrates to these swampy woodlands to breed in the summer. Eats insects and snails.
- **Five-Lined Skink**
  Amphibian that prefers decaying wood habitat along the river’s edge and wet areas.
- **Southern Bald Eagle**
  Raptor that lives in large deciduous or mixed pine woodlands and nests in January/February in tall trees along the water’s edge.
- **Strecker’s Chorus Frog**
  Amphibian that prefers moist woodlands near the water.

- **Big Brown Bat**
  This species is highly adaptable and forages in variety of habitats including forests, open fields, rivers and streams.
- **Pileated Woodpecker**
  Raptor that lives in deciduous and mixed pine woodlands. They nest in dead trees and rely largely on carpenter ants that live in dead and fallen trees.
- **Red-Headed Woodpecker**
  Summer breeding bird that forages for insects and seeds and lives among dense shrubs and herbs at the woodland edge.
- **Painted Bunting**
  Summer breeding bird that lives in deciduous woodlands and eats caterpillars.
- **Yellow-Billed Cuckoo**
  Summer breeding bird that lives in deciduous woodlands and requires leaf litter in which to forage.
- **Wood Thrush**
  Summer breeding bird that lives in deciduous woodlands and requires leaf litter in which to forage.
- **Swallow-Tailed Kite**
  Near-ground raptor that forages and nests in the trees of woodlands, often in wet woodlands.
- **Summer Tanager**
  This species migrates through Texas in the summer. It can be found in mixed riparian woodlands eating fruit and insects.
- **Indigo Bunting**
  Woodland edge species that forages insects and seeds and lives among dense shrubs and herbaceous layer.
- **Broad-Winged Hawk**
  A woodland raptor that spends much of their time underneath the canopy of large deciduous or mixed forests. It eats mostly small mammals, amphibians, and insects.
- **Eastern Red Bat**
  Fast flying bat that prefers forested habitats away from human activity.

**Mature Mixed Bottomland Forest**

- **Orchard Oriole**
  Migrating bird that prefers open woodlands and pastures with scattered trees.
- **Slender Glass Lizard**
  Legless diurnal reptile that lives in open woodlands. It eats insects, rodents, and reptile eggs like the scarlet snake.

**Hiking Trail**

- **House Wren**
  Bird that nests in tree cavities and prefers open forests, forest edges, and areas with scattered grass and trees.
Sedge Wren
Wintering grassland bird that lives on well bayou mud flats.

American Pipit
Wintering grassland bird that lives on well bayou mud flats.

White Ibis
This iconic bird prefers grassy flats of wet areas. Its cousin the White-Faced Ibis is a Threatened species with similar habitat.

Red-Eared Slider Turtle
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Bird that migrates to these swampy woodlands to breed in the summer. Eats insects and snails.

Loggerhead Shrike
A summer breeding bird that thrives in open grassland mixed with shrubs, small trees, and short grasses.

Five-Lined Skink
Amphibian that prefers decaying wood habitat along the river’s edge and wet areas.

Eastern Box Turtle
Lives on bayou mud flats and in wet short grasses.

Common Snapping Turtle
Snapping turtles generally prefer slow-moving fresh or brackish water and a soft muddy or sandy bottom.

Evening Bat
Forest dwelling bat species that lives in tree hollows and behind loose bark. It prefers to forage along edges of mature forests, in clearings, and over waterways.

Horned Lark
Bird that lives at the forest’s edge along the water and can be found in mixed forest with grasslands.

Prothonotary Warbler
Bird that migrates to these swampy woodlands to breed in the summer. Eats insects and snails.

Eastern Box Turtle
Lives at the forest’s edge along the water and can be found in mixed forest with grasslands.

Horned Lark
Bird that lives on bayou mud flats and in wet short grasses.

Five-Lined Skink
Amphibian that prefers decaying wood habitat along the river’s edge and wet areas.

Scissor-tailed Flycatcher
This summer nesting bird prefers savannas with scattered trees and shrubs.

Loggerhead Shrike
A summer breeding bird that thrives in open grassland mixed with shrubs, small trees, and short grasses.

Evening Bat
Forest dwelling bat species that lives in tree hollows and behind loose bark. It prefers to forage along edges of mature forests, in clearings, and over waterways.

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Wood Stork
Migratory bird travels through Harris County to and from Mexico. It lives in shallow standing water and is a State Threatened species.

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Le Conte’s Sparrow
Wintering grassland that bird thrives in more moist, open, dense grasses.

Field Sparrow
Wintering bird that lives in the grasses of sparse, dry, overstory savannahs.

Sprague’s Pipit
Wintering grassland bird that breeds and lives in open grassland with no shrubs or trees.

Bachman’s Sparrow
Wintering bird that lives in the grasses of sparse, dry, overstory savannahs.

Eastern Meadowlark
This wintering grassland bird is most common in native grasslands, prairies, and wet fields while singing from exposed perches.

White-Tailed Hawk
Raptor that lives year-round in open canopy prairie and eats small mammals, birds, and reptiles.

Short-eared Owl
A bird that winters in the open grasslands, nests on the ground, and eats small mammals.

SECTION F: NATIVE PRAIRIE AND WOODLAND EDGE TO PINE-HARDWOOD FOREST
MOUNTAIN BIKE TRAILS IN PRAIRIE GRASSLAND AND SOUTHERN ARC TRAIL AT WOODLAND EDGE
White Throated Sparrow
Requires the dense, diverse shrubs at woodland edges.

Indigo Bunting
Woodland edge species that forages for insects and seeds and lives among dense shrubs and herbaceous layers.

Eastern Towhee
Requires the dense, diverse shrubs at woodland edges.

Short-eared Owl
A bird that winters in the open grasslands, nests on the ground, and eats small mammals.

Woodland Edge
Species that require the dense, diverse shrubs at woodland edges.
Bayou Wilds Trailhead

This area is just south of Memorial Drive and east of the Land Bridge, roughly in the location of the existing picnic loop. This area is both a departure point for the extensive path network on the south side of the site and a recreation destination in its own right. A large parking lot at the north side of the complex allows for easy parking and drop off. Amenities in this area include picnic areas, trail heads, a pavilion/shelter, children’s biking loops, nature playground, an observation tower, and pump track all within a shaded setting. The trailhead’s central location allows users to experience a wide range of landscape types including wooded streams, open prairie, and restored savannah in close proximity to this trailhead.
Eastern Glades

The design of this area is a reinterpretation of the entry sequence proposed in the Hare & Hare plan, the first master plan for the park drafted in the 1920s. That plan proposed a formal garden space near the eastern edge of the park, and this plan proposes a series of formal landscape spaces. The glades are envisioned as two large spaces where the grass is mown, but existing trees are preserved to create a shady and quiet space for picnicking and other passive uses. Wide promenades around these spaces allow for pleasure walking and orientation. To the west of the garden spaces, the plan proposes a large pond that will be a visual amenity, providing views to water and a shelf planted with wetland plants across the water. It will also serve a practical purpose, holding stormwater to be used for irrigation in landscaped spaces.

1. Eastern Glade
2. Eastern Glade
3. Pond Esplanade
4. Pond and Cypress Grove
5. Parking
6. Multi-use Trail
7. Seymour Lieberman Trail
Proposed Entry and Gardens, golf course, and scenic roads by Hare & Hare Landscape Architects. Approved during the time of the park’s founders.

Although many parts of the plan were never built, the proposed organization of spaces remains relevant and culturally significant.
Tennis, Fitness and Natatorium

This area is proposed for the tennis, fitness center, and natatorium (indoor swimming facility). These facilities are separated from the adjacent neighborhoods by a thick planted buffer. They are served by a parking lot to the southwest.
PRECEDENTS
Sports Complex

In the northeast sector of the park, the plan proposes creating a sports complex that will house all active team/group recreation sports facilities. This facility will have 1 rugby pitch, 2 volleyball courts, 1 soccer field, 1 baseball diamond, 5 softball diamonds, and 2 croquet courts, all in close proximity to parking. The plan also proposes a sound wall at the north edges to mitigate sound from the adjacent I-10 highway.
ARTISTS RENDERING - SPORTS COMPLEX

PRECEDENTS

Soccer field in a natural setting

Marina Park, Villes, Spain

Penn Park, Philadelphia, PA
Golf Course

The Memorial Park Golf Course is the jewel of the Houston municipal golf course system and is one of the oldest components of Memorial Park, beginning as 9 holes in 1918 and expanding to the current 18 holes in 1936 as part of a re-design by John Bredemus. The Memorial Park Golf Course has hosted important tournaments over the years and some of golf’s greatest players have competed there. Expanding on and enhancing this legacy for generations to come will be an important part of any future golf course master plan.

Golf courses and their associated infrastructure components—greens, tees, sand bunkers, drainage pipes, irrigation systems, cart paths, etc.—have limited life cycles and must periodically be replaced to ensure quality conditions and avoid unexpected (and more costly) fiscal expenditures when not properly planned for in advance. In this regard, the golf course was renovated and updated in 1994-1995 to address infrastructure improvements, ongoing maintenance and drainage issues, and incorporate design elements in keeping with the earlier course conditions. Given that 20 years have now passed since the last renovation, many of the course infrastructure items have come to (or exceeded) their expected useful lives and will be in need of replacement soon. This presents an excellent opportunity to conduct a golf course master plan process to address infrastructure and other needs as well as review design opportunities.

The purpose of a golf course master plan is to conduct an extensive review of an existing course and entire facility in order to address current and long-term needs. Any master plan for the Memorial Park Golf Course will need to be conducted through the lens of not only the golf course, but also with regard to how the course integrates within and complements the overall Memorial Park facilities. Once the overall Memorial Park master plan has been approved, a comprehensive master plan process will be undertaken to properly and thoughtfully identify needs and opportunities at the golf course.

A few areas of specific review that would take place when preparing a golf course master plan to include:

1. Incorporation of storm drainage requirements to meet park-wide goals for stormwater detention and treatment as outlined in the Memorial Park master plan. Utilize the golf course to increase stormwater runoff treatment and detention before runoff reaches Buffalo Bayou.
   a. Increase surface runoff on the golf holes and add more drainage catch basins to pick up water and transfer it to ponds and treatment areas.
   b. This will also help improve playing conditions on the golf course.

2. Review of options outlined in Memorial park master plan to reduce dependence on city water for golf course irrigation. This could include:
   a. Implementation of a pond and capture system to utilize storm runoff (offsite and onsite) to irrigate the golf course and reduce the amount of city water required.
   b. Installation of a modern, efficient irrigation system which better targets minimum watering requirements and is more efficient in water use and power requirements.
   c. Installation of soil monitoring devices throughout the golf course to measure moisture content, further allowing targeted irrigation of the golf course only when needed.
   d. Review options to reduce the overall amount of irrigated golf turf without negatively impacting the playability of the golf course for the average golfer.

3. Analysis of the capacity for the course and facility to once again host premier tournaments and as well as recommendations to meet those needs.
   a. Overall course length/yardage
   b. Spectator movement and viewing areas
   c. Media requirements
   d. Areas for hospitality and sponsor opportunities
   e. Parking and logistics

4. Review of the existing tee yardages available for players to ensure the course remains fun and enjoyable for all golfers into the future.
   a. Review addition of a “U.S. Kids Course” type tee system for younger and beginning players.
   b. Review hole variety (yardage, direction, aesthetics, etc.) and propose improvements.
   c. Review course yardage with regard to professional tournament needs and propose any needed upgrades.

5. Expansion and improvement of the Practice Range (Range) and practice facilities as generally conceptualized in the Memorial Park master plan.
   a. The current Range is limited in utility (number of players and length) and not attractive with nets and poles needed for safety due to the limited size and length of the Range.
   b. Even so, the current Range is highly utilized and is a tremendous source of revenue for the golf course.
   c. Plans should be made to dramatically expand the Range tee area so that more players can practice at one time (more revenue) and the Range should be lengthened so players can simulate real-time practice and hit full shots.
   d. Teaching and lessons are an important component to the existing course and for helping to grow the game. Consideration should be given to creating a dedicated building and area specifically for teaching, lessons and clinics. This would greatly enhance the experience for the course.
   e. Limiting or eliminating the need for poles and nets would be a positive impact.
   f. A separate Short Game area with multiple practice greens should be explored to further enhance practice opportunities for users of the facility.

   a. Is the existing facility sufficient to support long-term, quality maintenance of the golf course?
   b. Review options to relocate the maintenance facility to be more convenient to public roads and eliminate the current situation where vehicles and deliveries must drive across golf holes. This is unsafe and a distraction to the experience.

7. Analysis of the ability of the golf course renovation to assist other non-golf park Master Plan projects.
   a. Review whether export fill material can be generated on the golf course by implementing stormwater treatment and detention areas and expanding existing natural topographic features into the golf course.
   b. If successful this export material could go to other park projects, thereby reducing costs for those other projects and reducing the number of delivery trucks and road wear to supply needed fill material to those projects.

8. Review opportunities to incorporate the overall park landscape concept throughout the golf course to tie the golf course in to the overall park landscape restoration theme.

9. Review opportunities to better highlight the natural topographic features (bouyav and ravines) present on the south side of the course and integrate the golf course better into those features.
   a. Evaluate expansion of those natural features further into the golf course.

Planning and study of the golf course as proposed here provides the opportunity to update and improve the beloved recreational asset in Memorial Park. While the golf course is currently well managed and very well used, further study would provide opportunities to both improve the user experience and further integrate the golf course into the ecological and spatial strategies proposed for the rest of park. The proposed master plan for Memorial Park does not preclude any of the studies outlined above that would occur in preparation of a golf course master plan study. Study of the specific design areas as listed in this summary will only enrich the overall concepts outlined in the Memorial Park master plan.
1. Existing Club House
2. Proposed Practice Range
3. Water Reuse Ponds
4. Existing Maintenance Area
Memorial Groves

In the areas just east of the railroad track with the highest number of Camp Logan remnants, the plan proposes a series of memorial groves to honor the World War I soldiers who trained on-site. Existing concrete remains of Camp Logan structures would be preserved, as would large and healthy motts of existing trees. Access roads with parallel parking would be inserted in roughly the same alignments as Camp Logan-era roads, and picnic spots and shelters would be added to allow for small groups to congregate. The bulk of this area would be planted with rows of pine trees, to recall both the pine-dominated landscape of Camp Logan, and individual soldiers in formation standing at attention.
Cycle Track and Trails

In the northeast portion of the site, the Master Plan proposes a realignment of Memorial Drive to the south and west to provide more contiguous space for trail use. In the resulting consolidated area is a one and three-quarter mile cycle track for road cyclists and criterion races. Within and around this cycle loop are a series of grade-separated pedestrian and equestrian trails. Along the west edge of this quadrant, a large parking area provides easy access to these trails, as well as to picnic pavilions at the edge of the space.
Central Park trail bridge, New York, NY

Equestrian trails

Hard surface cycle track

Precedents
Old Archery Range (OAR)

This area of the park was once an archery range, a market nursery and was mined for clay for brick making. Currently cut off from the rest of the park by major roads, OAR needs to be tied back into the park as a whole. A pedestrian bridge to this area of the park from the sidewalk on the west side of 610 will allow for a connection to both Uptown and to the borders of the Arboretum. A vehicular and pedestrian entry at Woodway will reinforce Memorial Park’s identity and the bayou boat launch will draw water enthusiasts to occupy this edge of the park and bayou both up and downstream. The direct connection to this navigable waterway points to the need for water-focused education and programs that could take the form of a boat-building workshop and small boat rental facility.

This site’s location adjacent to Uptown and this more heavily developed bayou edge points toward program and land management strategies that could open the edge of this property to the bayou in ways unlike the southside of the park east of the railroad track or in the Arboretum. There could be more beach-like flats that could be used for recreation in ways similar to Buffalo Bayou Park while still restoring the riparian forest edges in many locations.

Of all the areas of the park adjacent to the bayou, OAR appears to be the most heavily burdened by intense invasive species colonization. In this regard it will require some of the most intensive invasive removal regimes and replanting strategies.
Precedents: youth boat building programs

Lookout Tower, Tiree, Scotland

Birkahoe Boardwalk, Stockbridge, MA

Bronx River Alliance, Bronx, NY
Hogg Bird Sanctuary

The design proposes keeping existing parking and providing walking trails to allow access to the bird sanctuary. Ongoing work in this area by the Houston Garden Club and Rice University will provide new bird habitat and restoration of native plant species. In the future if HCFCD’s Demonstration Project proceeds it will be essential for these groups, and HPARD and MPC to devise a plan for the replanting of disturbed slopes with native vegetation conducive to creating bird habitat.
Conclusions

This master plan for Memorial Park is aspirational in its breadth and depth and will require the collaboration of private and public groups and individuals for the next 50 years or more. The preceding document and associated appendices present a vision for the park to be implemented over time through the discrete design and construction of multiple phased projects. This vision represents the collaboration of scores of people who dedicated their time and expertise to this creative design process.

The goal of this master plan document is to provide a guide for Houston to reimagine and recreate a Memorial Park that honors the past and promotes the future of this great city.
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List of Appendices

The items and information listed below are not included in this document but are provided separately in digital format and on file at HPARD.

Nelson Byrd Woltz
Site Atlas

Sherwood Design Engineers
Ecological Stormwater Management, Water Reuse and Existing Site Analysis

Berg Oliver Environmental
Ecological Evaluation

ETM Associates, L.L.C.
Operations and Maintenance Report

Hunt Design
Signage Master Plan

Gravity Logic
Bike Trail Assessment

Suzanne Turner Associates
Cultural Landscape Report

Advanced Ecology
Forest and Urban Resource Inventory Summary

The Lighting Practice
Lighting Master Plan and Design Guidelines

Walter P. Moore
Traffic Study

Lupher, L.L.C.
Existing Conditions Survey

Jacob and Associates
Soil Survey