ZILKER PARK
LANDFILL RECLAMATION & HABITAT RESORTATION PRECEDENTS

03 Freshkills
05 Crissy Fields
07 Alumni Valley
09 Byxbee Park
11 Danehy Park
13 Allegheny Riverfront Park
15 The Highlands
17 Baytown Nature Center

LANDFILL PRECEDENTS

- Freshkills, Staten Island, NY
- Crissy Fields, San Francisco, CA
- Alumni Valley, Wellesley, MA
- Byxbee Park, Palo Alto, CA
- Danehy Park, Cambridge, MA
- Mount Trashmore Park, Virginia Beach. Virginia
- César Chávez Park. Berkeley, California
- Washington Park Arboretum, Seattle, Washington
- McAlpine Creek Park, Charlotte, North Carolina
- Red Rock Canyon Open Space, Colorado Springs, Colorado
- Ariel Sharon Park, Tel Aviv, Israel
- Flushing Meadows-Corona Park, Queens, New York
- Glass Beach, Fort Bragg, California
- Cultuurpark Westergasfabriek, Amsterdam, Holland

HABITAT RESTORATION PRECEDENTS

- Allegheny Riverfront Park
- Baytown Nature Center
- The Highlands, Michigan
- Public Sediment
- Hypar-nature Wildlife Bridge
- Renaturation of the River Aire
- Fox Run, CO
- Lowry Landfill
- Rocky Flats Site and Las Colonias Park

FRESHKILLS, STATEN ISLAND, NY
(Design/Build: 2008 - 2035)

Freshkills Park was built upon one of the largest landfills in North America. The landfill initially closed in March of 2001, but was forced to reopen after the September 11th W.T.C. attack. In 2006, all parts of the landfill ceased operations, and the initial master plan was released by James Corner Field Operations. The plan was heavily influenced by community advisory groups as well as project stakeholders. Freshkills is slated to be completed in phases, with the final phase expected to be finished in 2035. At that point, Freshkills will be the second largest park in NYC (3x the size of Central Park), and will include open grasslands, waterways, hiking/biking trails, and a variety of public facilities for cultural, educational, and social gatherings.

SITE OVERVIEW

- 2,200-acre park (1,000 acres closed landfill and 450-acres of wetland)
- Wetlands act as buffers during storm surges
- Methane captured from decomposing waste provides enough gas to heat 22,000 homes
- Site design emphasizes ecological restoration as well as cultural and educational programming

FEATURES

- Strong community involvement
- Pilot programs involve urban agriculture, wildlife observation, and scientific research
- Horseback riding, mountain biking, and hiking trails
- Water access for kayaking and fishing
- Large-scale public art installations


William T. Davis
Wildlife Refuge
West Shore Expressway
Victory Boulevard
Wild Avenue
NORTH
MOUND
3/4
EAST
MOUND
6/7
Isle of
Meadows
SOUTH
MOUND
2/8
WEST
MOUND
1/9
Arthur Kill Road
Richmond Avenue
Arden Avenue
Korean War Veterans
Parkway
Platinum
Yukon Ave
Forest Hill Ro
open water 210 acres
wetland 360 acres
water basins 47 acres
lowland 668 acres
landfill mounds 1,030 acres

CRISSY FIELDS, SAN FRANCISCO, CA
(Design/Build: 1994 - 2001)

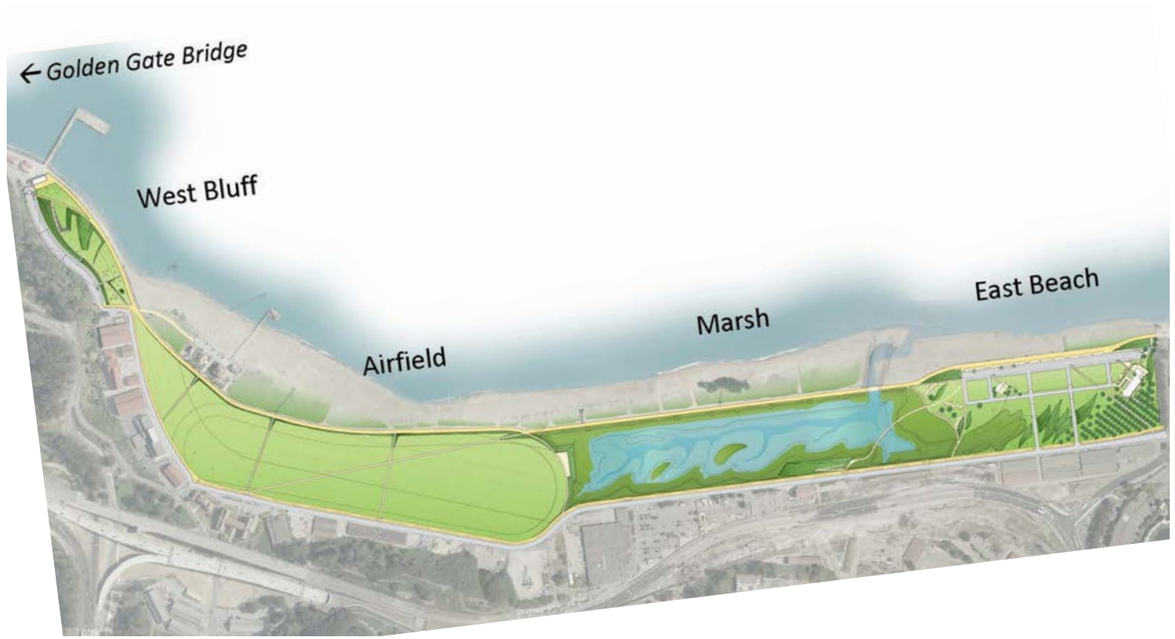
In 1994, the National Park Service and the Golden Gate National Parks Conservancy began work restoring the Crissy Fields site. Prior to this, the site was owned by the U.S. Army, who filled the existing marsh with waste material and eventually constructed an aerodrome to house military planes. When Hargreaves and Associates took over the project, the soil on site was heavily polluted, and the original marsh ecology had been lost. Over the course of 3 years, more than 230,000 cubic yards of soil were excavated to create a channel allowing salt and freshwater to merge at the site for the first time in over 100 years. Today, Crissy Fields supports 105 different species of shrubs, wildflowers, and marsh plants, and over 100 species of invertebrates.

SITE OVERVIEW

- 130-acre site was originally salt-marsh
- 18-acres tidal marsh
- 16-acres of dune habitat
- Monitoring program including physical, chemical, and biological variables to help track ecosystem development and to guide management decisions over a 5-year period

FEATURES

- Restored beaches and dunes create habitat for several native species
- Promenade and trails run through the site and connect to the expansive San Francisco Bay Trail
- Restored tidal marsh provides habitat for 17 fish species, as well as 135 documented bird species
- Native plant communities have been restored and invasive species have been mitigated
- The Crissy Fields Center offers environmental education and summer programs for youth


← Golden Gate Bridge
West Bluff
Airfield
Marsh
East Beach


FORT POINT MINE DEPOT
TORPEDO WHARF
WARMING HUT
Amphitheater
WEST BLUFF PICNIC AREA
WILDLIFE PROTECTION AREA
MARINE SANCTUARY VISITOR CENTER
SAN FRANCISCO BAY
EAST BEACH
GOLDEN GATE PROMENADE / SF BAY TRAIL
TIDAL MARSH
MARINA GATE & ENTRY GROVE
HISTORIC AIRFIELD
CRISSY FIELD CENTER
Mason St.
Doyle Dr.
Glass Palace
Crissy Field Ave.
SF Gymnastics
Stilwell Hall
Pet Cemetery
STABLES
Building 640 Former NGS Language School
Sports Basement
Gorgas Ave.
Young St.
U.S. POST OFFICE
MAIN POST
101
EXPLORATORIUM
PALACE OF FINE ARTS

ALUMNI VALLEY, WELLESLEY, MA
(Design/Build: 2001 - 2005)

In spite of Frederick Law Olmsted Jr.'s calls to preserve the natural topography and native plant communities at Wellesley College, the site became the college's physical plant, a dumping site, and finally a 175-car parking lot. In 2001, MVVA set to work restoring the valley back to its state as a natural hydrological system. In order to fulfill this vision, heavily contaminated soils were excavated and moved off site for treatment, while mildly contaminated soils were treated and capped on-site. Pumping infrastructure was also required to periodically remove the buildup of toxic residues associated with natural-gas processing (non-aqueous phase liquids).

SITE OVERVIEW

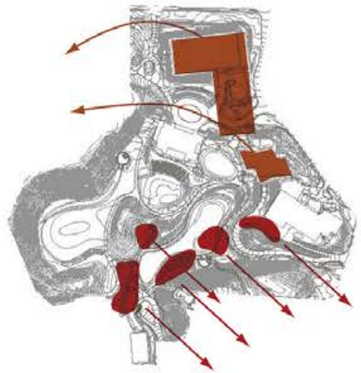
- 13.5-acres of reworked campus
- Site topography formed by glacial movement created natural high and low points
- Entire site was raised 6 feet
- Heavily toxic soils were located, excavated, and moved off site for treatment
- Mildly contaminated soils were re-used on site and were capped with a geosynthetic clay liner to seal contaminated soils and prevent water from prematurely returning to the original water table

FEATURES

- Valley functions as an intermittent wetland; a series of sedimentation forebays and basins hold and treat stormwater. Runoff filters through forbs, sedges, and cattails before flowing into Lake Waban
- The pedestrian experience heightened the importance of the valley as both a visual and physical link between the hilltop nodes of campus life

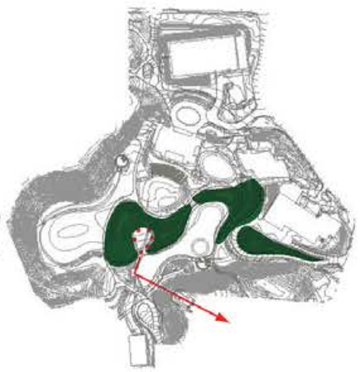
Alumnae Valley Landscape Renewal Aerial Diagram
Wellesley College, Wellesley Massachusetts

1. West Sediment Forebay
2. Infiltration Basin
3. Overflow Swale
4. Upper Inlet
5. Lower Inlet
6. Boat Ramp
7. Stone Spillway
8. Cattail Marsh
9. Marsh Feeder Pond
10. East Sediment Forebay
11. DNAPL Collection Area
12. Physical Plant Service Area
13. Campus Center Loading Dock
14. Parking Facility Access
15. Visitor Parking



1. REMOVE

The most toxic soil was excavated and removed from the site for treatment. Clean soil excavated to make way for new buildings was stored on site for later use. Asphalt parking lot surfaces were removed.

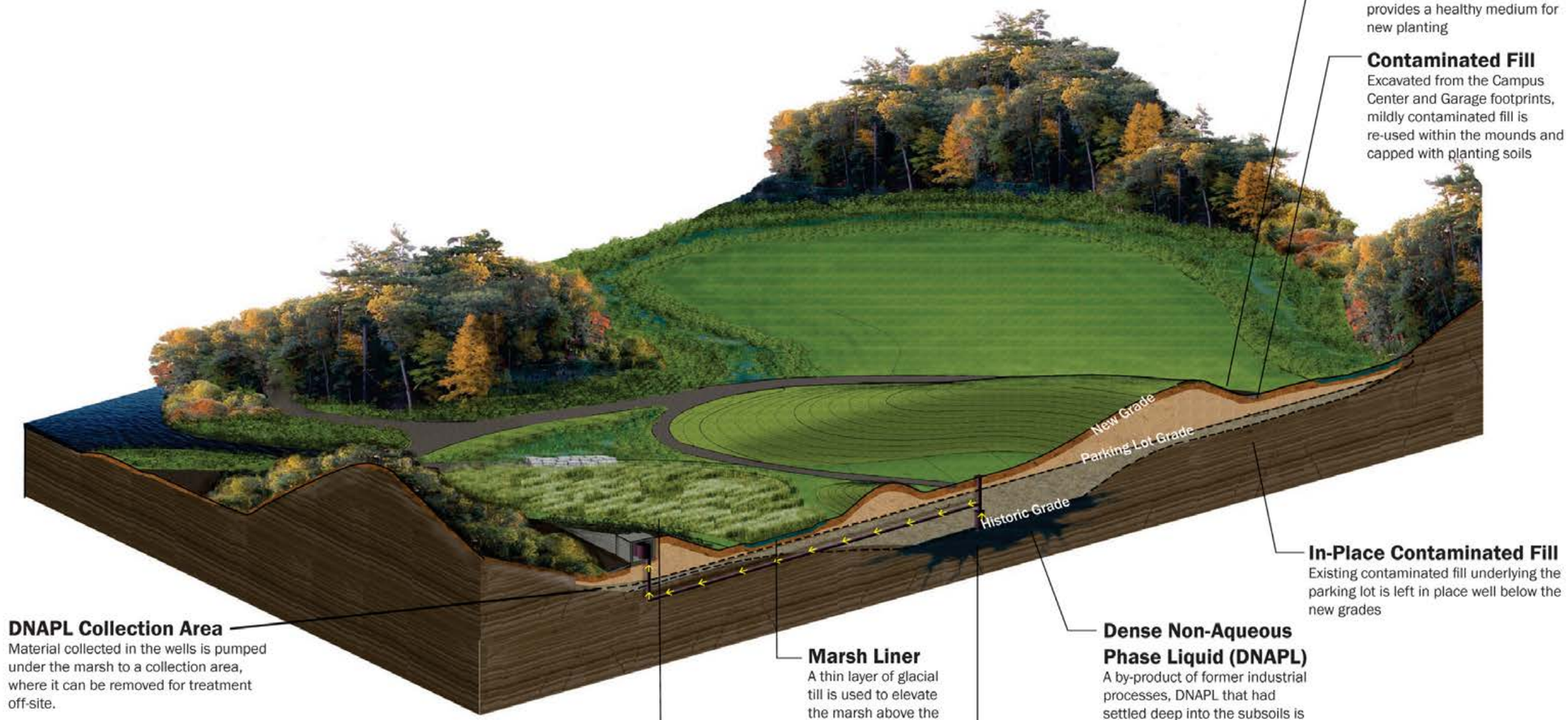


2. CAP AND COLLECT

Mildly toxic soils were left in place and capped. Dense non-aqueous phase liquid (DNAPL) that had collected in the aquifer is pumped, collected, and periodically removed.

3. BUILD TOPOGRAPHY

Soil cut for earlier excavation was used to form 3 drumlin-like mounds, raising the site 6 feet above the previous grade.



Clean Soil Cap
Clean (non-toxic) soil is used to cap contaminated fill and provides a healthy medium for new planting

Contaminated Fill
Excavated from the Campus Center and Garage footprints, mildly contaminated fill is re-used within the mounds and capped with planting soils

In-Place Contaminated Fill
Existing contaminated fill underlying the parking lot is left in place well below the new grades

DNAPL Collection Area
Material collected in the wells is pumped under the marsh to a collection area, where it can be removed for treatment off-site.

Marsh Liner
A thin layer of glacial till is used to elevate the marsh above the contaminated ground

Dense Non-Aqueous Phase Liquid (DNAPL)
A by-product of former industrial processes, DNAPL that had settled deep into the subsoils is removed over time

Cattail Marsh
Provides uptake and transformation of harmful contaminants into benign compounds

DNAPL Collection well
Deep wells that wick contaminants are installed into the DNAPL area

Brownfield Restoration - Efficiently Dealing With Toxicity

A variety of soil remediation techniques are used to treat the contaminated site and restore it as a living system.

BYXBEE PARK, PALO ALTO, CA
(Design/Build: 1990 - 1991)

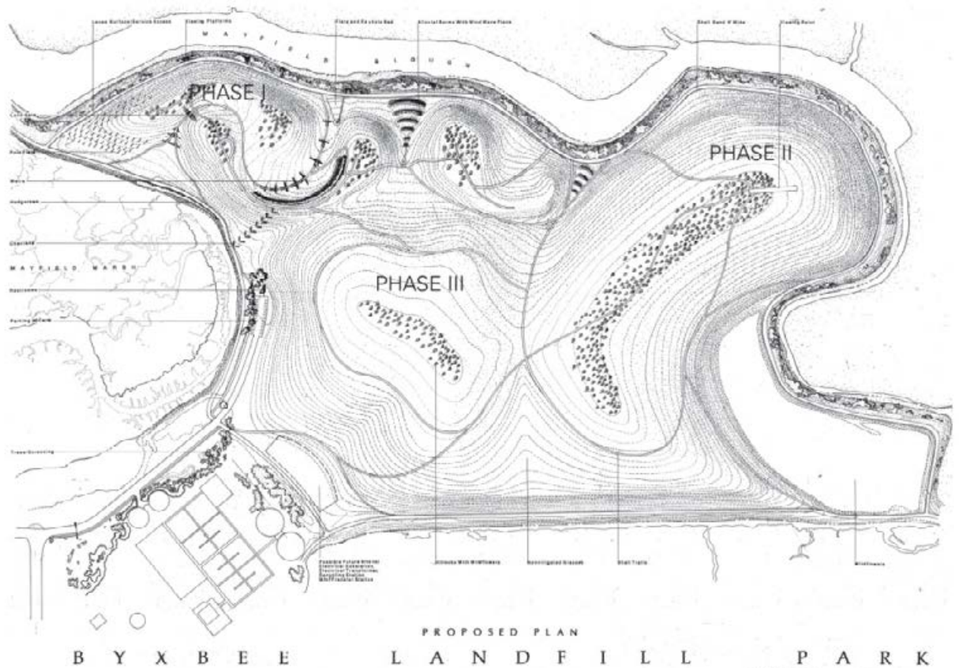
Byxbee Park consists of a 137-acre former landfill in the city of Palo Alto, CA. In 1990, Hargreaves and associates began work on phase one of the project that would turn the former landfill into a public park. The original plan proposed by Hargreaves envisioned a pastoral park reminiscent of the 19th century. Embedded in the design was a goal of habitat expansion as well as creating hydrological connections with adjacent Matadero Creek and the San Francisco Bay. Due to the sites historic use as a landfill (1930 - 2011), a 4' thick soil profile was created consisting of a vegetative soil layer, a compacted clay layer, and a compacted soil foundation layer. A 30-year monitoring program was also put in place to assess refuse settlement, landfill gas and leachate release, and air quality.

SITE OVERVIEW

- 30-acre San Francisco waterfront park
- No impermeable surfaces. All paths made from crushed oyster shells
- No irrigation on-site. Planted with native grasses and shallow rooted trees to prevent puncturing clay cap
- Uneven soil settlement, lack of management, ground squirrels and invasive plant species caused damage throughout the site, leading to necessary soil amendments and the removal of historic structures

FEATURES

- Views of San Francisco Bay
- 4 distinct management zones (tidal marsh, trail buffer, coastal prairie, and coastal scrub)
- Walking trails
- Extensive public art/sculptures on display
- 30-year monitoring program of refuse settlement, landfill gas and leachate release, and air quality



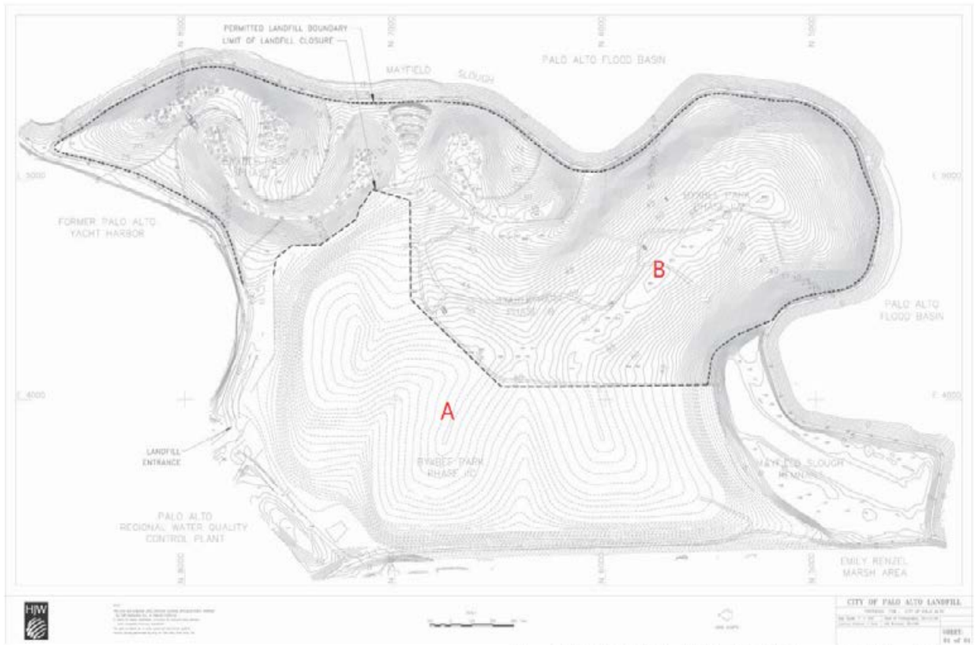


Figure 4: City of Palo Alto Landfill Plan, May 2005, drawn by HJW Geospatial Inc.

DANEHY PARK, CAMBRIDGE, MA
(Design/Build: 2001 - 2005)

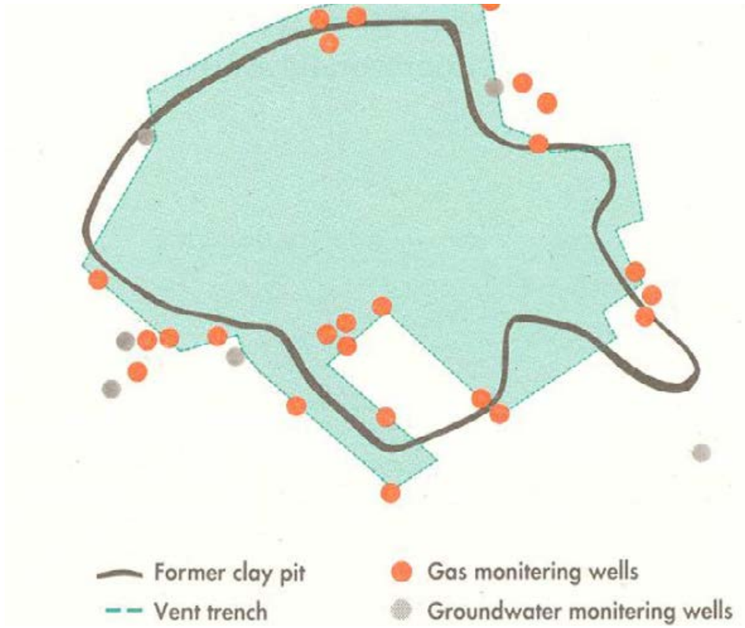
In 1952, the clay quarry at Danehy park ceased operations. In its place, the city began using the site as a dumping ground until 1970 when the landfill reached capacity. For nearly two decades, the site was used as a staging area for local construction projects. In the late 1980s, the city allocated $11 million to redevelop to site into a public park. Due to it's history, the soils were contaminated, unstable, and toxic leachate was entering the groundwater. By recreating the sites wetland and utilizing specific species of both aquatic plants and animals, the landscape now provides ecological, educational, and recreational benefits to park visitors, while improving the areas natural systems.

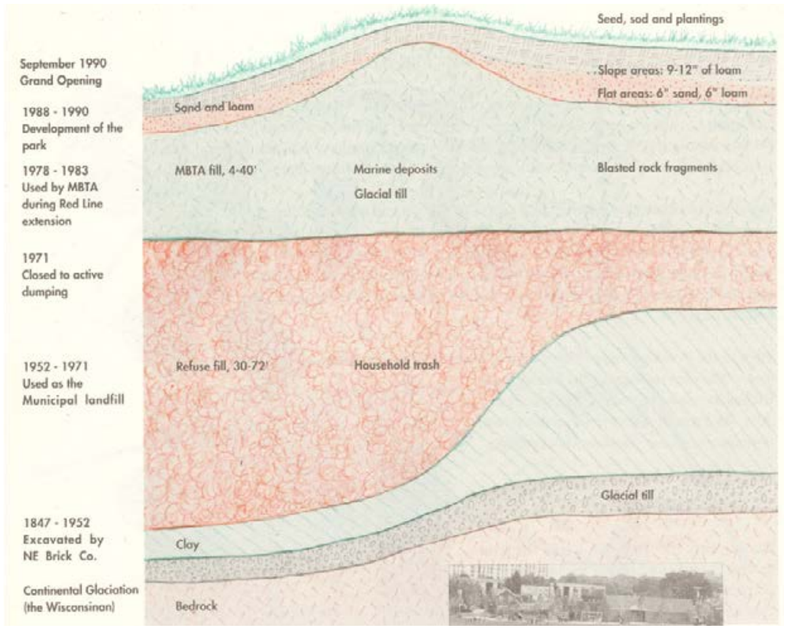
SITE OVERVIEW

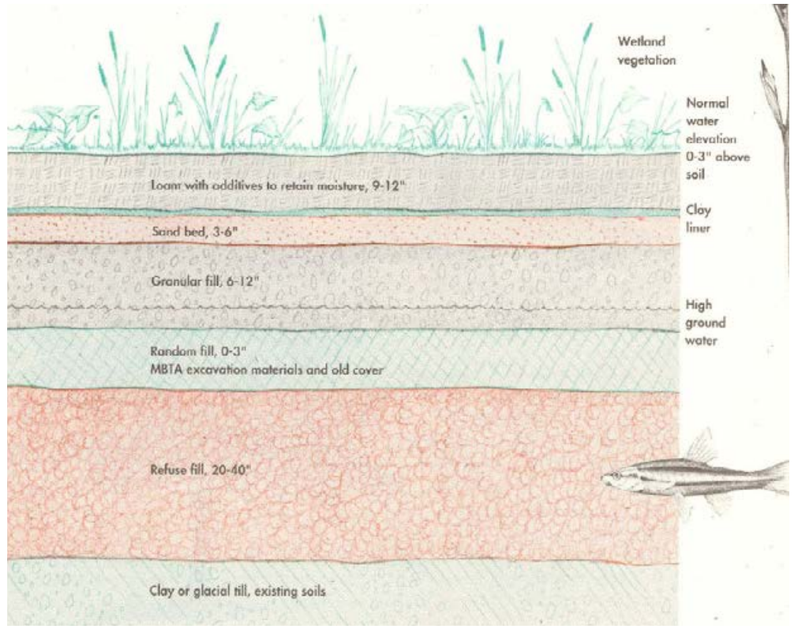
- 50-acre site. Formerly a clay quarry and landfill
- No large buildings or structures on site due to instability of buried trash and the release of methane
- Clay liners used below football fields and meadow marshland to protect people and wildlife from leachate
- A contaminated wetland built above trash deposits was filled with sand and gravel, and was capped with a clay liner. A new wetland was constructed directly above the cap roughly 1' above high groundwater level

FEATURES

- Increased Cambridge's open-space by 20%
- Groundwater monitoring wells to measure water quality and direction of groundwater flow
- Stormwater infrastructure including a 2-acre wetland habitat and nature preserve
- Multiple athletic fields, nature trails, and picnic areas
- 1' of loam added over the entire area


Former clay pit
Vent trench
Gas monitering wells
Groundwater monitering wells


September 1990
Grand Opening
1988 - 1990
Development of the park
1978 - 1983
Used by MBTA during Red Line extension
1971
Closed to active dumping
1952 - 1971
Used as the Municipal landfill
1847 - 1952
Excavated by NE Brick Co.
Continental Glaciation (the Wisconsinan)
Seed, sod and plantings
Slope areas: 9-12" of loam
Flat areas: 6" sand, 6" loam
Sand and loam
MBTA fill, 4-40'
Marine deposits
Glacial till
Blasted rock fragments
Refuse fill, 30-72'
Household trash
Glacial till
Clay
Bedrock


Wetland vegetation
Normal water elevation 0-3" above soil
Loam with additives to retain moisture, 9-12"
Clay liner
Sand bed, 3-6"
Granular fill, 6-12"
High ground water
Random fill, 0-3"
MBTA excavation materials and old cover
Refuse fill, 20-40"
Clay or glacial till, existing soils

ALLEGHENY RIVERFRONT PARK, PITTSBURGH, PA
(Design/Build: 1994 - 1998)

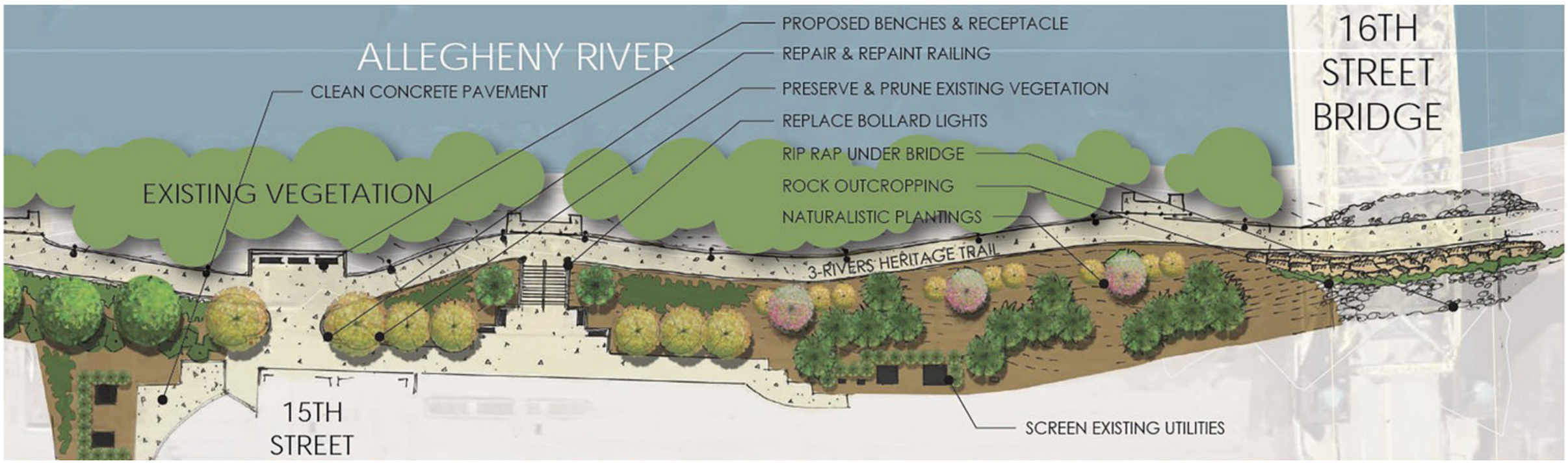
Frederick Law Olmsted Jr. called for a park system along the riverfront in 1911. In spite of his suggestions, the city chose to use the space for a series of highways until 1990, when the Pittsburg Cultural Trust submitted plans to improve the public usefulness of these spaces. Work soon began creating two promenades. One lower, along the rivers edge, and a second, 25 feet higher, creating spectacular views of the river and connecting to the adjacent arts district. The language of the two spaces is notably different, with the lower level deliberately wild in its plantings. The purposefully dense plantings, which were inspired by overgrown shipwrecks further downstream, are able to regenerate themselves after floods and ice storms.

SITE OVERVIEW

- (2) 4,000' promenades along the Allegheny River
- Designed to provide a greenway connecting existing and future developments
- Upper and lower levels differ in their planting and material choices
- 25 foot grade change from upper to lower levels
- Inspiration for dense planting came from stranded boats downstream that had become overgrown with vegetation

FEATURES

- Waterfront access allows for jogging, hiking, biking
- Resilient design allows for regeneration after seasonal flooding and ice storms
- Two ADA ramps traverse the 25-foot grade change allowing access to both top and bottom promenades
- Climbing vines along the upper roadway shield pedestrians from vehicle noise and pollution


ALLEGHENY RIVER
CLEAN CONCRETE PAVEMENT
EXISTING VEGETATION
PROPOSED BENCHES & RECEPTACLE
REPAIR & REPAINT RAILING
PRESERVE & PRUNE EXISTING VEGETATION
REPLACE BOLLARD LIGHTS
RIP RAP UNDER BRIDGE
ROCK OUTCROPPING
NATURALISTIC PLANTINGS
3-RIVERS HERITAGE TRAIL
16TH STREET BRIDGE
15TH STREET
SCREEN EXISTING UTILITIES

BAYTOWN NATURE CENTER, BAYTOWN, TX
(Design/Build: 1994 - 2002)

The Brownwood residential neighborhood was a highly desirable place to live through the 1960s. A series of hurricanes in the 70's and 80's, however, caused extensive damage to the communities roads and homes, leading most residents to abandon the heavily flooded area. In 1984, the city of Brownwood prepared its first master plan to turn the community into a dedicated nature preserve. Work began by sealing off inlets to the peninsula, and pumping out flood-waters so houses, roads, and utilities could be removed. Three 60' wide channels were then excavated to provide crosscurrent flow to encourage natural restoration activity. Native bottomland shrubs and tree species planting were also chosen to lure a wide variety of animal to the site.

SITE OVERVIEW

- 450-acre peninsula was former residential subdivision
- Land sinking due to hurricane impacts
- Brownwood Marsh Restoration Project Master Plan released in 1994
- 60'-wide channels provide crosscurrent and tidal exchange to create edge habitat for fish, birds, and crustaceans
- Flora chosen based on high value for wildlife to provide nesting, food, and shelter

FEATURES

- Fishing piers, observation platforms, picnic areas, and walkways along the shoreline
- Two islands with mixed woodlands, salt and fresh-water marsh, and tallgrass habitat
- 317 observed species of resident and migratory birds
- Nursery for multiple shrimp, crab, and fish species