

**BELOW**

The Center for Sustainable Landscapes at Phipps, along with the glass-enclosed Tropical Forest Conservatory, are among the greenest buildings in the United States, and the landscape itself is four-star SITES certified.

# FOUR

**AT THE PHIPPS CONSERVATORY,  
ANDROPOGON BROUGHT HOME  
CERTIFICATION BY ALL THE TOP  
ARBITERS OF SUSTAINABILITY.**

BY JANE BERGER



PAUL C. WEDMAN



# FOR FOUR

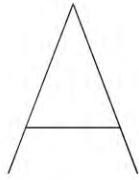






BRIAN COHEN, EDITOR; HAWKEYE AERIAL PHOTOGRAPHY, OPPOSITE





top a former city fueling station and industrial waste yard is one of the greenest properties in the United States. The Center for Sustainable Landscapes at the Phipps Conservatory and Botanical Gardens in Pittsburgh is the first project to attain the highest certification by four sustainable building performance standards. It makes more energy than it uses, cleans and recycles all stormwater and wastewater on site, and demonstrates the benefits derived when humans live in harmony with nature. Now, birds sing in native trees, fish glide through the water, frogs croak, turtles bask in the sun, and a hawk patrols it all daily.

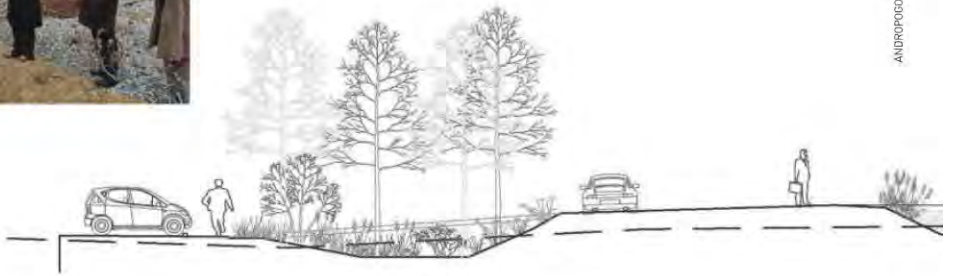
Phipps established its educational component in 1893, when the steel magnate Henry W. Phipps presented the city with a grand Victorian steel and glass greenhouse, which was, at the time, the largest conservatory in the United States. Located in the city's 440-acre Schenley Park, the conservatory was erected as a refuge for workers who toiled in the nearby steel mills and as a place where they could learn about nature.

In 1993, the city transformed Phipps into a non-profit organization, granted it a 100-year lease, and hired a committed environmentalist, Richard Piacentini, as the new executive director. The garden's mission was revised to reinforce a promise to pursue sustainability, research, and human well-being. A three-phase master plan for expansion called for a new welcome center for visitors, the Tropical Forest Conservatory and Production Greenhouse, and the Center for Sustainable Landscapes, which would house administration offices, provide classroom education for children and adults, and conduct research to support sustainable landscape and building practices.

Piacentini explained, as we walked through the center's landscape, that when embarking on the project, he first met with the architect William McDonough, Honorary ASLA, renowned for his commitment to environmentally sound design. McDonough suggested that Phipps pursue LEED (Leadership in Energy and Environmental Design), the sustainability certification program administered by the U.S. Green Building Council ([www.usgbc.org](http://www.usgbc.org)).

**ABOVE**  
An aerial view of the Center for Sustainable Landscapes site shows the dilapidated brownfield used for decades by the city of Pittsburgh.

**OPPOSITE**  
Visitors walk amid native plants along a tropical lagoon that captures roof runoff, purifies wastewater, and supports a diverse array of wildlife.



ANDRUPPON ASSOCIATES

When it opened in 2005, the welcome center was the first LEED-certified visitor center in a public garden. “We got very excited about this whole idea of LEED,” Piacentini said, “and we decided to embrace the principles of LEED in everything we do.”

When the Tropical Forest Conservatory opened a year later, it was the most energy-efficient conservatory in the world, and the Production Greenhouse, with huge glass walls facing south, was adapted to achieve a LEED Platinum certification for existing buildings.

For the Center for Sustainable Landscapes, Piacentini decided to go for the highest LEED rating—Platinum—and for the Living Building Challenge, a green building certification program administered by the International Living Future Institute ([www.living-future.org](http://www.living-future.org)) that includes seven performance categories: place, water, energy, health and happiness, materials, equity, and beauty. Piacentini also accepted the challenge of the WELL Building Standard of the International Well Building Institute ([www.wellcertified.com](http://www.wellcertified.com)), which measures building features that influence health and well-being.

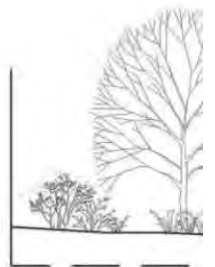
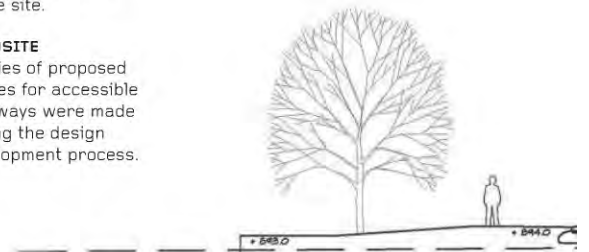
The major problem was the brownfield at the bottom of a 30-foot cliff. The goal was to turn this industrial wasteland into a beautiful landscape that would illustrate sustainable practices in real time. The building and landscape would be powered by sun and wind and would capture, clean, and reuse all water on site. ↘

**TOP LEFT**

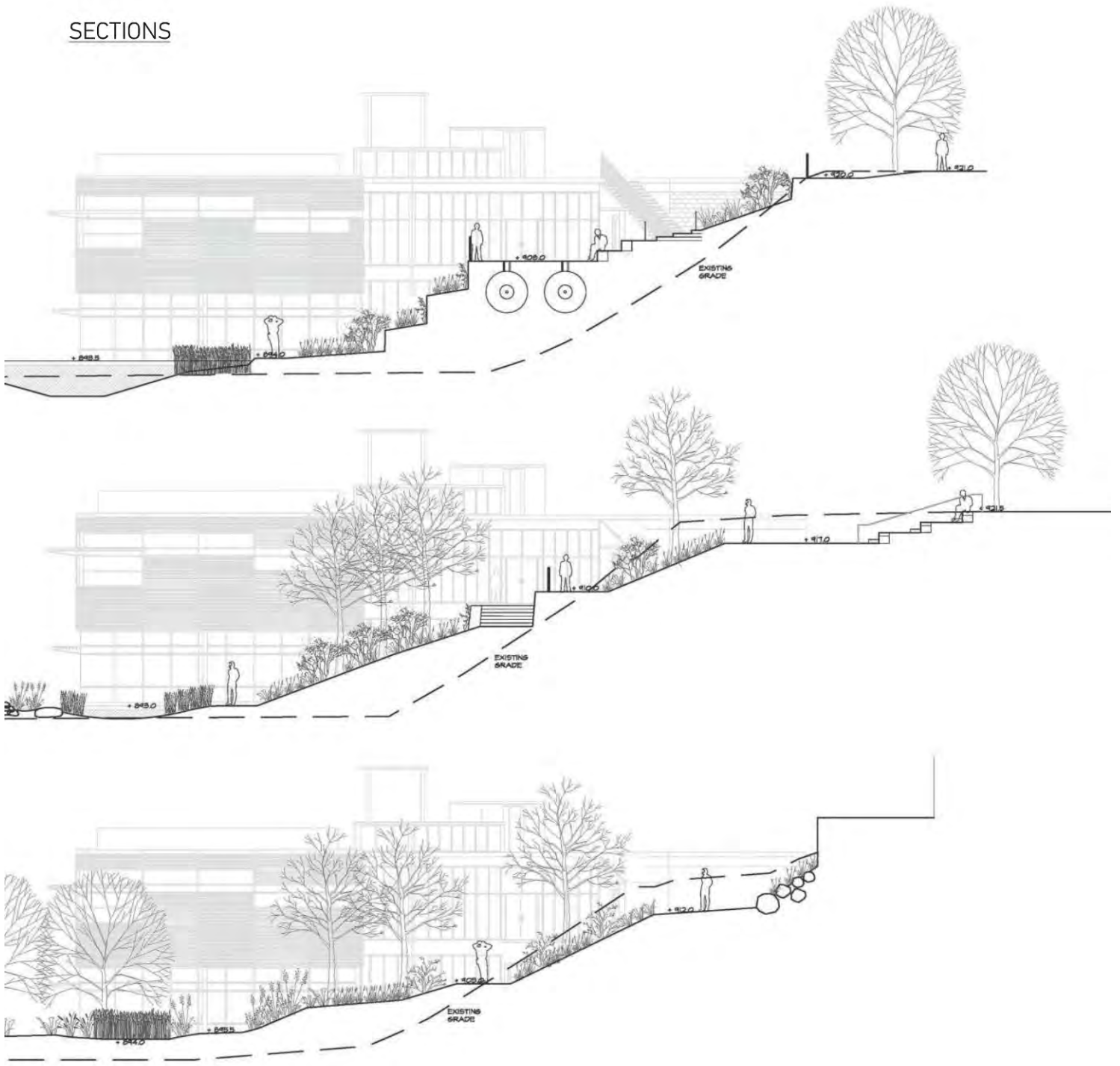
The design team studies exposed rocks and the cliff side during an early inspection of the site.

**OPPOSITE**

Studies of proposed grades for accessible pathways were made during the design development process.

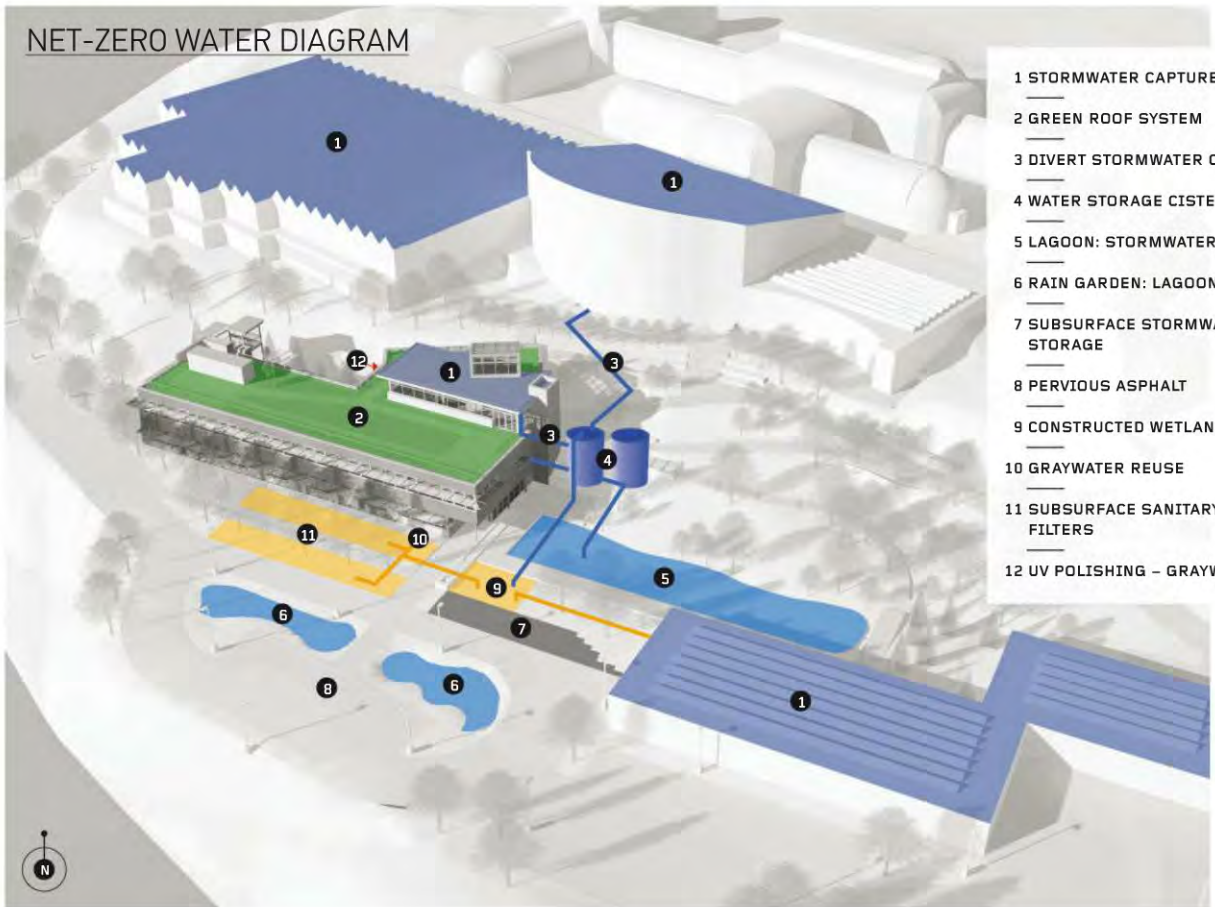


# SECTIONS





# NET-ZERO WATER DIAGRAM



- 1 STORMWATER CAPTURE
- 2 GREEN ROOF SYSTEM
- 3 DIVERT STORMWATER CAPTURE
- 4 WATER STORAGE CISTERN
- 5 LAGOON: STORMWATER STORAGE
- 6 RAIN GARDEN: LAGOON OVERFLOW
- 7 SUBSURFACE STORMWATER STORAGE
- 8 PERVIOUS ASPHALT
- 9 CONSTRUCTED WETLANDS
- 10 GRAYWATER REUSE
- 11 SUBSURFACE SANITARY SAND FILTERS
- 12 UV POLISHING - GRAYWATER

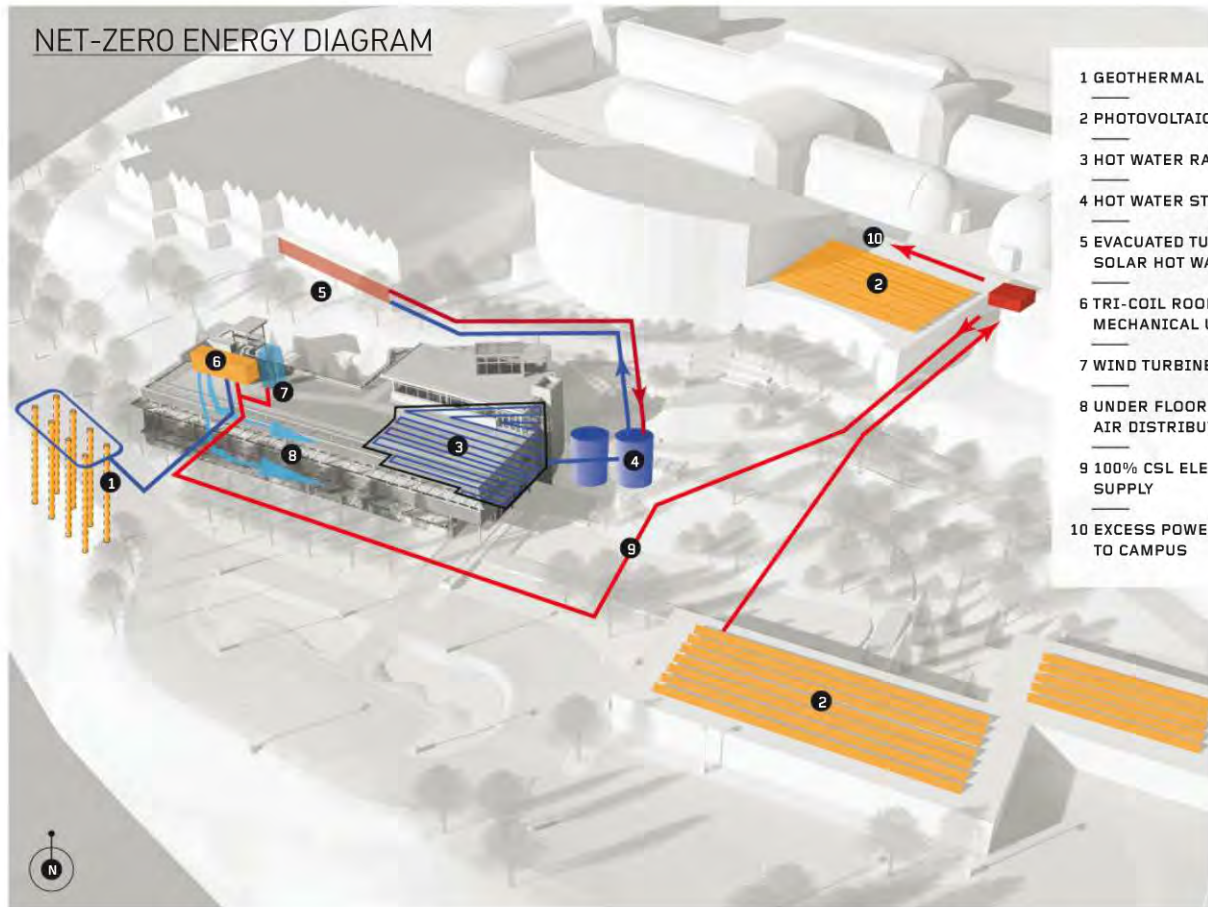
# SOILS NARRATIVE



- PROFILE A: INTENSIVE TREE PLANTING
- PROFILE B: INFILTRATION/RAIN GARDEN
- PROFILE C: INTENSIVE LAWN PLANTING
- PROFILE D: LAGOON PLANTING

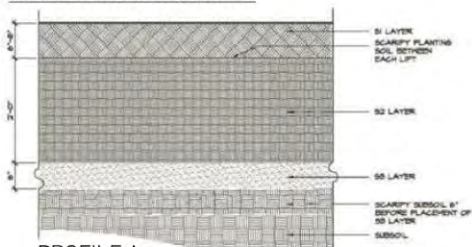
THE DESIGN ALLIANCE, TDP, ANDROPOGON ASSOCIATES, BOTTOM

# NET-ZERO ENERGY DIAGRAM

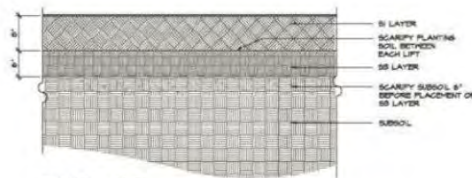


- 1 GEOTHERMAL WELLS
- 2 PHOTOVOLTAIC ARRAY
- 3 HOT WATER RADIANT FLOOR
- 4 HOT WATER STORAGE TANK
- 5 EVACUATED TUBE SOLAR HOT WATER
- 6 TRI-COIL ROOFTOP MECHANICAL UNIT
- 7 WIND TURBINE
- 8 UNDER FLOOR AIR DISTRIBUTION
- 9 100% CSL ELECTRIC SUPPLY
- 10 EXCESS POWER TO CAMPUS

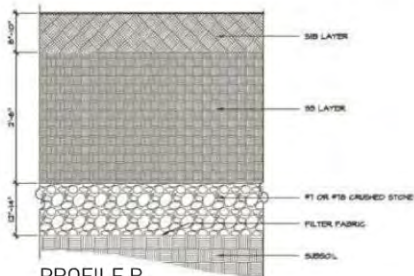
# SOILS NARRATIVE



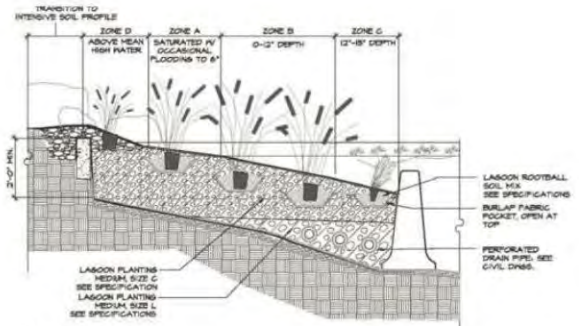
PROFILE A



PROFILE C



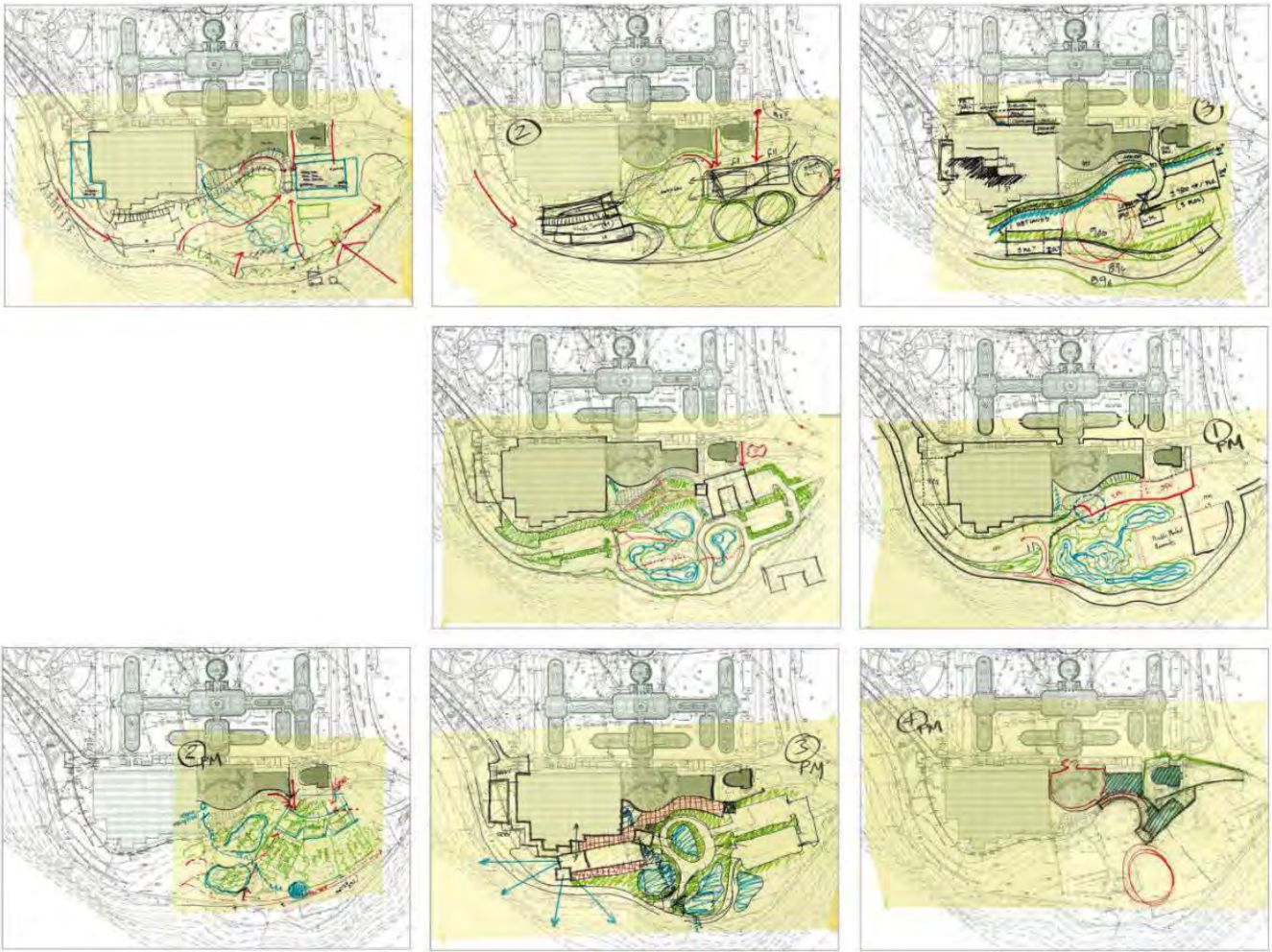
PROFILE B



PROFILE D

THE DESIGN ALLIANCE, TOP; ANDROPOGON ASSOCIATES, BOTTOM





→ To round out the design team, Piacentini selected the landscape architect José Almiñana, FASLA, of Andropogon Associates in Philadelphia for the landscape component because of the firm's long history in sustainable design. Almiñana introduced him to the Sustainable Sites Initiative (SITES), a rating system for sustainable landscapes. Piacentini said if Phipps was going to build the greenest building in the world, he also wanted to build the landscape to SITES standards. Almiñana recalls that the landscape would be "the canvas where everything takes place" and that the building was to be fully integrated within it. (The SITES Rating System is produced by Green Business Certification Inc., which owns exclusive rights to the SITES Rating System, its publications, and its trademarks. The material on which the SITES

Rating System is based was developed through a collaborative, interdisciplinary effort of the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center at the University of Texas at Austin, and the United States Botanic Garden.)

You could not have imagined a project with more potential for failure, given all of the certification requirements. All materials had to be sourced within a certain radius of the site. All plants had to be indigenous and come from within 250 miles. Soils had to be stabilized because of the steep slope and had to support a variety of plant communities. Coarse sand originally specified to fill the gaping 30-foot void was prohibitively expensive because the Marcellus Shale fracking industry had cornered the local market.





**ABOVE**  
 From an amphitheater at the top of the slope, visitors may descend to the tropical lagoon via stepped pathways.

**RIGHT**  
 Workers lay out the walls, paths, and planting beds that define the basic landscape plan.

**OPPOSITE**  
 Sketches developed during design charrettes were part of the integrative design process.



SALLY INGRAHAM, TOP; COURTESY THE ALLEGHENY CONFERENCE, BOTTOM



Over a year and a half, Phipps conducted 15 all-day design charrettes that included Almiñana, architects, engineers, energy and lighting consultants, contractors, academics, Phipps staff, and a changing cast of many other experts. Together, they had to decide where to place the reservoirs, pumps, and other elements that would support the net-zero energy and net-zero water demands of the building and the landscape.

The final design creates one large educational exhibition that encourages the public to discover sustainable ways to interact with nature and understand its importance for people, plants, biodiversity, health, and the environment. The building is connected to an existing outdoor terrace and links the center to the rest of the Phipps campus. An indoor atrium links it to the landscape outdoors on all three levels.

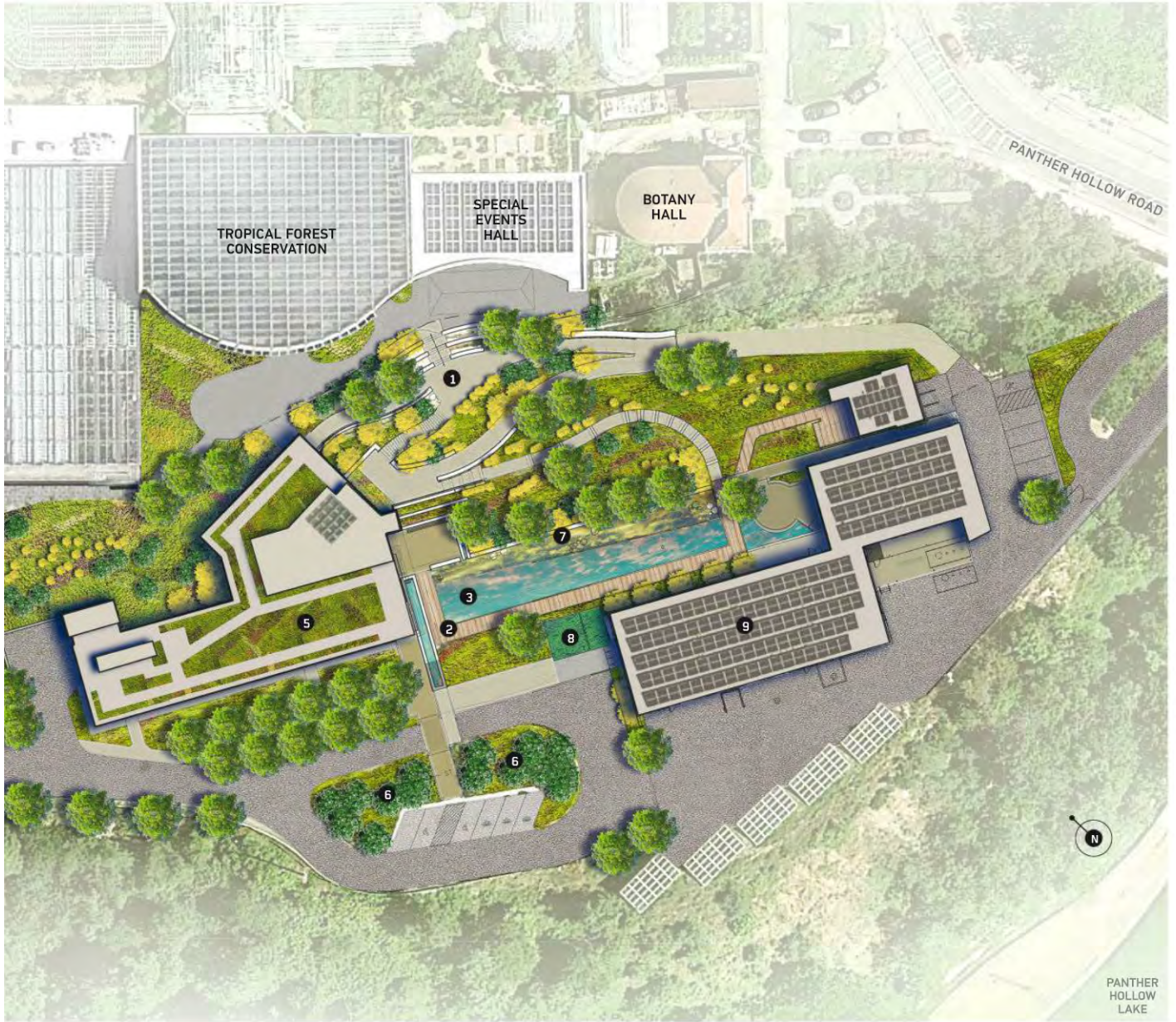
On top of the infrastructure, Almiñana designed a terraced garden with looping east-west ramps and step ramps that take the visitor down through different plant communities typical of the Western Allegheny Plateau. Almiñana says the project presented “an opportunity to describe to people what grows in these kinds of conditions and what you can expect to see in an actual environment when you move from high to low across the slopes.” On the top level of the center, visitors encounter a green roof that insulates the building, captures rainwater, and is planted with edible or medicinal varieties that can be used for educational purposes or in the Café Phipps. As they descend, they pass through woodlands, lowland slopes, wetlands, and rain gardens. In all, there are more than 150 varieties of plants, and Almiñana says they have the potential to attract some 2,400 different species of lepidoptera, which include butterflies, moths, and skippers. He calls it “planting for a purpose.”

Three distinct engineered soils support the plants, with drought-tolerant species near the top level, and plants that tolerate more moisture on the middle and lower levels.

Other landscape elements were added to attract some of the garden’s 350,000 annual visitors down into the site. Guests can sit in an upper-level amphitheater to take in views of Pittsburgh’s

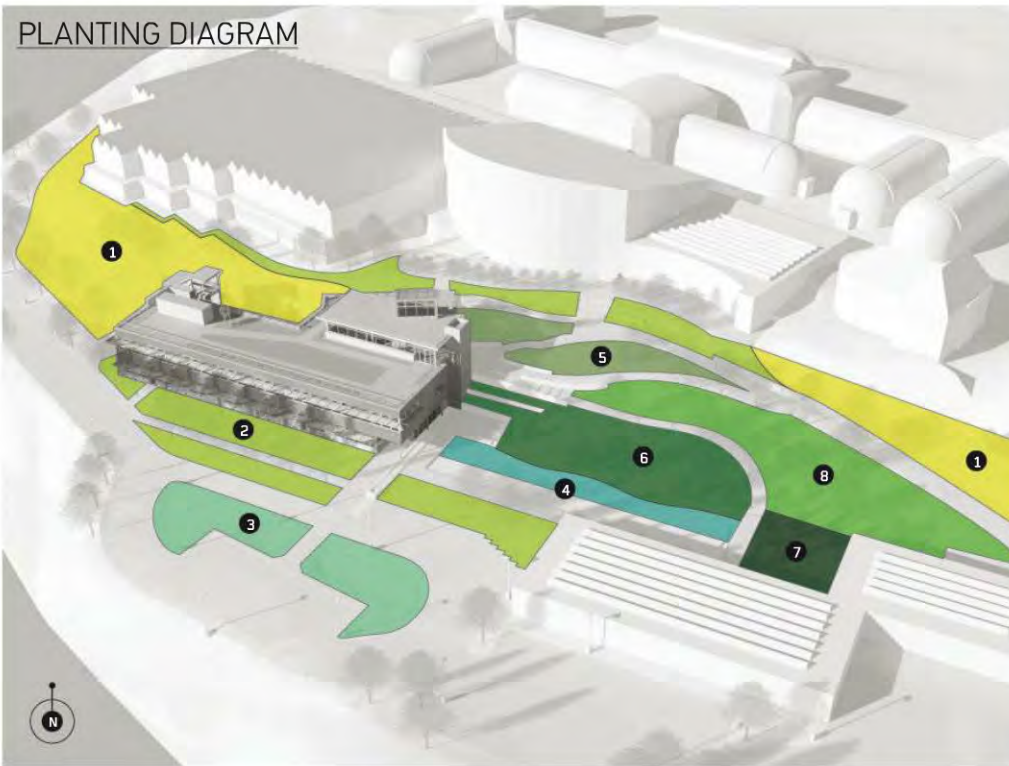








PLANTING DIAGRAM



- 1 SUCCESSIONAL SLOPES
- 2 FORMAL ALLÉES/ ORNAMENTAL
- 3 RAIN GARDENS
- 4 WETLANDS + WATER'S EDGE
- 5 UPLAND GROVE/ GRAY BIRCH WOODLAND
- 6 LOWLAND SLOPE WOODLAND
- 7 EVERGREEN WOODLAND
- 8 UPLAND OAK WOODLAND



ANDROPOGON ASSOCIATES, TOP; PAUL G. WIEDMAN, BOTTOM



## PLANT LIST

### DECIDUOUS TREES

- Acer rubrum***, multistem (Red maple, multistem)
- Betula populifolia*** 'Whitespire'  
(Whitespire gray birch)
- Cercis canadensis*** (Eastern redbud)
- Cladrastis kentukea*** (Kentucky yellowwood)
- Gleditsia triacanthos*** var. ***inermis*** 'Skyline'  
(Skyline honey locust)
- Nyssa sylvatica*** (Black gum)
- Ostrya virginiana*** (Hop hornbeam)
- Populus tremuloides*** (Quaking aspen)
- Quercus alba*** (White oak)
- Quercus imbricaria*** (Shingle oak)
- Quercus muehlenbergii*** (Chinquapin oak)
- Sassafras albidum*** (Sassafras)

### EVERGREEN TREES

- Ilex opaca*** 'Rotunda' (American holly)
- Juniperus virginiana*** 'Emerald Sentinel'  
(Emerald Sentinel eastern red cedar)
- Pinus strobus*** (Eastern white pine)

### UNDERSTORY TREES

- Amelanchier canadensis***  
(Canadian serviceberry)
- Carpinus caroliniana*** (American hornbeam)
- Cercis canadensis*** (Eastern redbud)
- Crataegus viridis*** 'Winter King'  
(Winter King green hawthorn)
- Magnolia virginiana*** var. ***australis***, multistem  
(Sweet bay, multistem)

### SHRUBS AND VINES

- Arctostaphylos uva-ursi*** (Kinnikinnick)
- Aronia melanocarpa*** (Black chokeberry)
- Ceanothus americanus*** (New Jersey tea)
- Clethra alnifolia*** 'Hummingbird'  
(Hummingbird sweet pepperbush)
- Cornus sericea*** 'Arctic Fire'  
(Dwarf red osier dogwood)
- Ilex glabra*** 'Densa' (Dwarf inkberry)
- Ilex verticillata*** 'Red Sprite'  
(Red Sprite winterberry)
- Itea virginica*** 'Little Henry'  
(Little Henry sweetspire)
- Juniperus communis*** 'Effusa' (Effusa juniper)
- Kalmia latifolia*** (Mountain laurel)
- Lindera benzoin*** (Northern spicebush)
- Parthenocissus quinquefolia*** (Virginia creeper)
- Potentilla fruticosa*** 'Primrose Beauty'  
(Primrose Beauty shrubby cinquefoil)
- Rhus aromatica*** 'Gro-Low'  
(Gro-Low fragrant sumac)

- Rosa carolina*** (Carolina rose)
- Sambucus nigra*** ssp. ***canadensis***  
(American black elderberry)
- Vaccinium corymbosum*** 'Blue Ray'/'Bluecrop'  
(Blue Ray/Bluecrop highbush blueberry)

### PERENNIALS AND GRASSES

- Allium cernuum*** (Nodding onion)
- Allium tricoccum*** (Ramp)
- Amsonia*** 'Blue Ice' (Blue Ice bluestar)
- Aquilegia canadensis*** 'Corbett'  
(Corbett columbine)
- Asclepias tuberosa*** (Butterfly milkweed)
- Baptisia australis*** (Blue wild indigo)
- Caltha palustris*** (Yellow marsh marigold)
- Carex stricta*** (Upright sedge)
- Coreopsis lanceolata*** (Lanceleaf tickseed)
- Echinacea purpurea*** 'White Swan'  
(White Swan coneflower)
- Eleocharis acicularis*** (Needle spikerush)
- Fragaria vesca*** (Woodland strawberry)
- Heuchera americana*** 'Silver Scrolls'  
(Silver Scrolls alumroot)
- Iris cristata*** (Dwarf crested iris)
- Iris versicolor*** (Harlequin blueflag)
- Juncus effusus*** (Common rush)
- Juncus effusus*** 'Frenzy'  
(Variegated corkscrew rush)
- Juncus effusus*** 'Gold Strike'  
(Gold Strike rush)
- Liatris spicata*** (Dense blazing star)
- Liatris spicata*** 'Alba' (White gayfeather)
- Lobelia cardinalis*** (Cardinal flower)
- Matteuccia struthiopteris*** (Ostrich fern)
- Monarda punctata*** (Spotted bee balm)
- Nymphaea odorata*** (American white water lily)
- Osmunda cinnamomea*** (Cinnamon fern)
- Packera aurea*** (Golden ragwort)
- Panicum virgatum*** 'Dallas Blues'  
(Dallas Blues switchgrass)
- Panicum virgatum*** 'Heavy Metal'  
(Heavy Metal switchgrass)
- Penstemon digitalis*** 'Husker Red'  
(Husker Red beardtongue)
- Phlox subulata*** (Moss phlox)
- Polygonatum biflorum*** (Smooth Solomon's seal)
- Rudbeckia fulgida*** var. ***fulgida***  
(Orange coneflower)
- Schoenoplectus tabernaemontani***  
(Softstem bulrush)
- Solidago sphacelata*** 'Golden Fleece'  
(Golden Fleece goldenrod)

- Sporobolus heterolepis*** (Prairie dropseed)
- Symphotrichum oblongifolium***  
'October Skies' (October Skies aster)
- Viola pedata*** (Birdfoot violet)

### ALKALINE ORNAMENTAL MEADOW PLANTS

- 30% ***Bouteloua curtipendula*** (Sideoats grama)
- 15% ***Coreopsis verticillata***  
(Whorled tickseed)
- 15% ***Rudbeckia fulgida*** var. ***fulgida***  
(Orange coneflower)
- 25% ***Schizachyrium scoparium*** 'Prairie Blues'  
(Prairie Blues little bluestem)
- 15% ***Symphotrichum oblongifolium***  
'October Skies' (October Skies aster)

### CONSTRUCTED WETLAND PLANTS

- Juncus effusus*** (Common rush)
- Schoenoplectus americanus***  
(Chairmaker's bulrush)
- Schoenoplectus tabernaemontani***  
(Softstem bulrush)
- Typha latifolia*** (Broadleaf cattail)

### FACULTATIVE RAIN GARDEN MIX

- 10% ***Asclepias incarnata*** (Swamp milkweed)
- 80% ***Carex muskingumensis*** 'Oehme'  
(Oehme variegated palm sedge)
- 10% ***Lobelia cardinalis*** (Cardinal flower)

### GROUND COVER—SHADE

- 30% ***Anemone canadensis*** (Canadian anemone)
- 10% ***Asarum canadense*** (Canadian wild ginger)
- 10% ***Packera aurea*** (Golden ragwort)
- 30% ***Phlox divaricata*** 'Manita'  
(Manita woodland phlox)
- 30% ***Podophyllum peltatum*** (Mayapple)

### RAIN GARDEN BOTTOM MIX

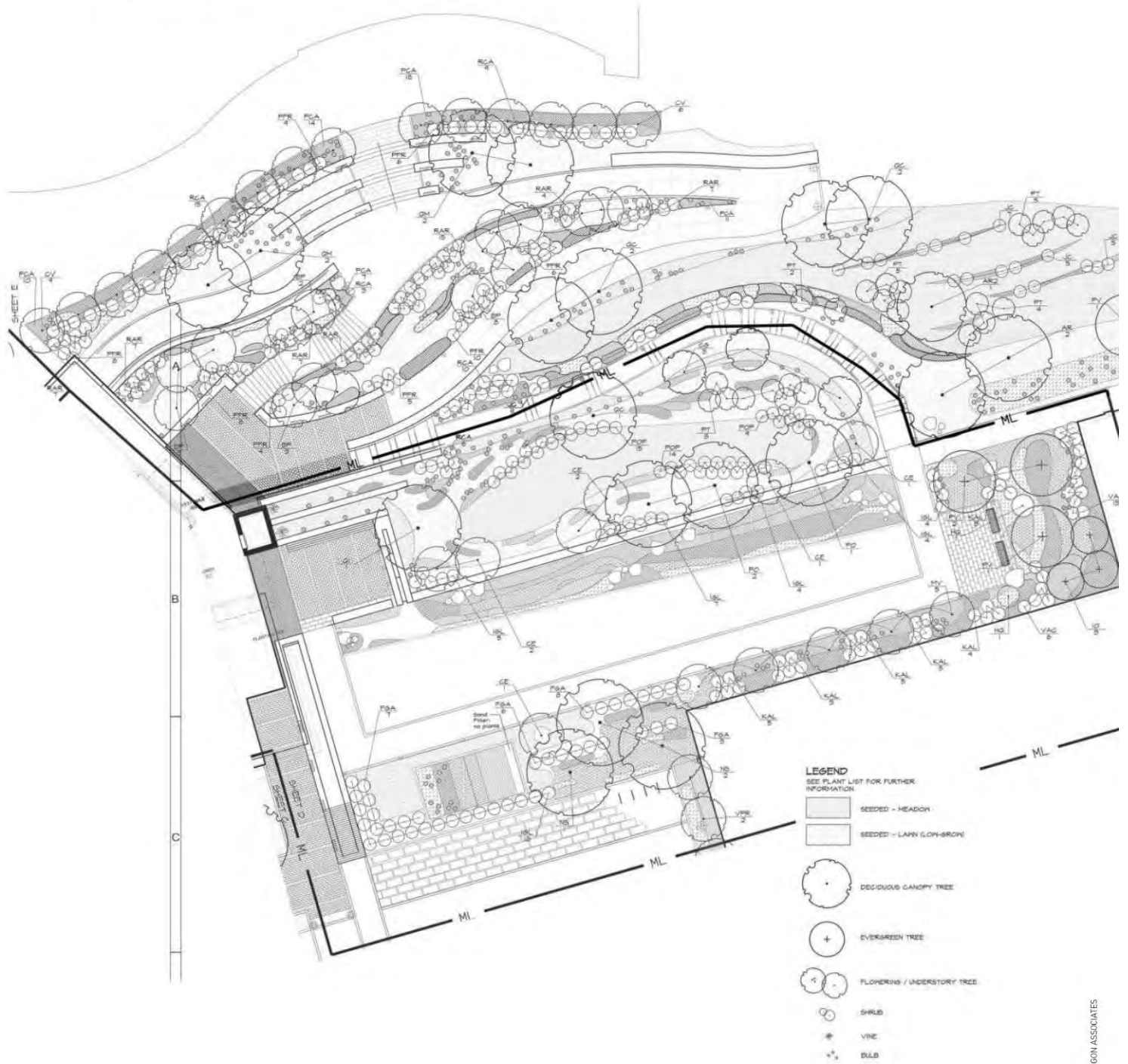
- 80% ***Carex muskingumensis*** 'Oehme'  
(Oehme variegated palm sedge)
- 10% ***Lobelia cardinalis*** (Cardinal flower)
- 10% ***Osmunda cinnamomea*** (Cinnamon fern)

### WARM SEASON GRASS MIX —

- MIX OF THE FOLLOWING SPECIES
- 25% ***Asclepias verticillata*** (Whorled milkweed)
- 15% ***Bouteloua curtipendula*** (Sideoats grama)
- 30% ***Schizachyrium scoparium*** 'Prairie Blues'  
(Prairie Blues little bluestem)
- 30% ***Sporobolus heterolepis*** (Prairie dropseed)



# PLANTING PLAN: TREES AND SHRUBS



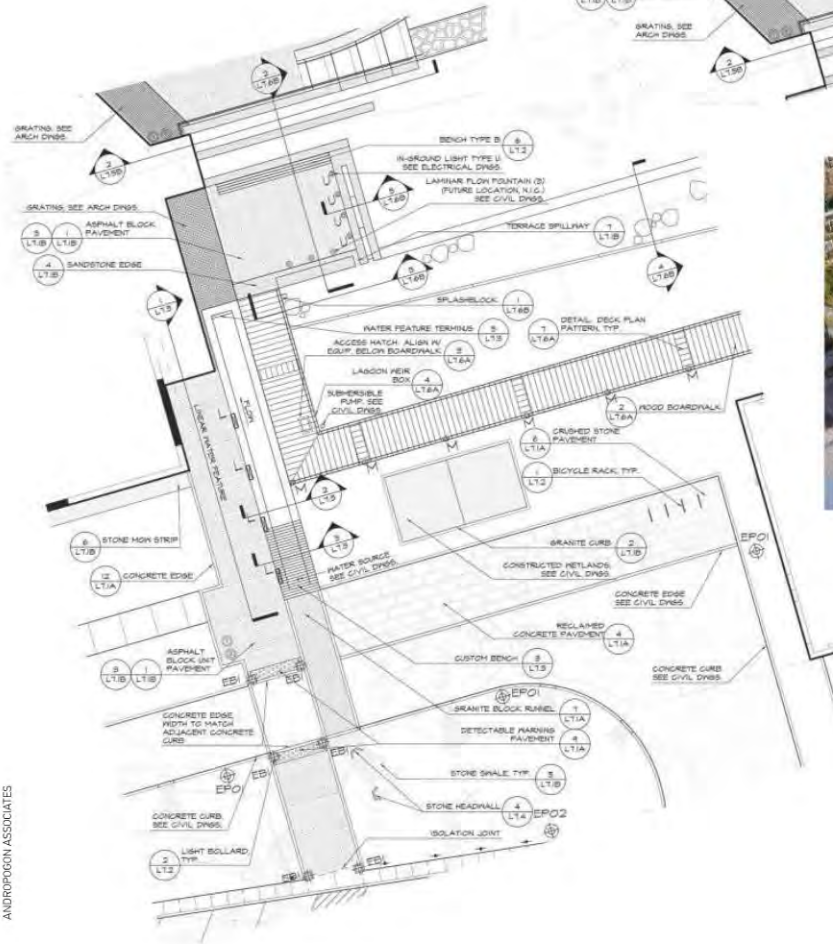
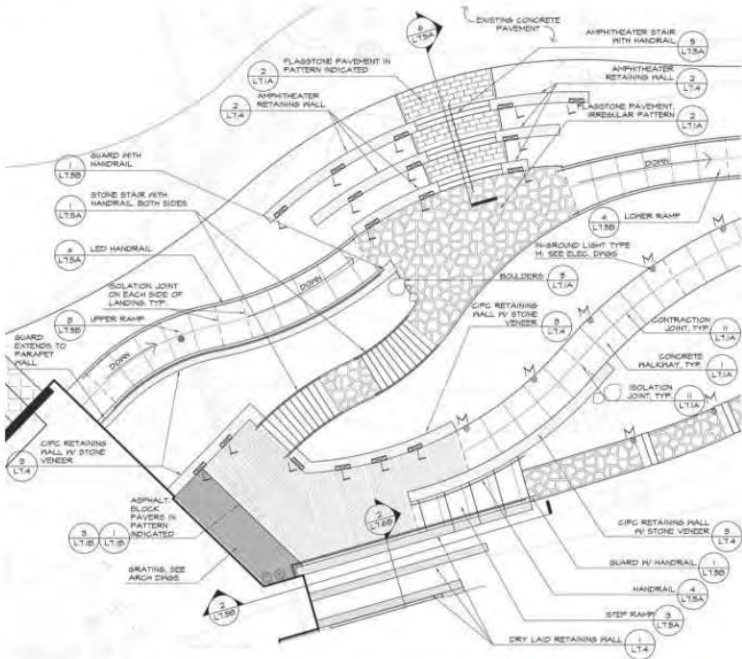
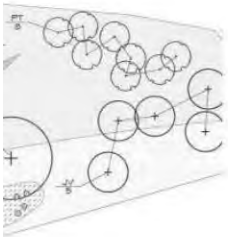
ANDROPOGON ASSOCIATES



# MATERIALS PLAN ENLARGEMENTS

## LEGEND

- EPH LIGHT POLE. SEE 4L.2
- BB LIGHT BOLLARD. SEE 2A.L2
- TRASH/RECYCLING RECEPTACLE
- IN-GROUND LIGHT
- RECESSED WALL LIGHT
- BOULDER. SEE DTL. 5A.L1A
- ASPHALT PAVEMENT. SEE CIVIL DWS.
- ASPHALT BLOCK PAVEMENT. SEE DETAIL UL.T1B
- GRISHED STONE PAVEMENT. SEE DTL. 5A.L1A
- CONCRETE WALKWAY. SEE DTL. 5A.L1A
- FLAGSTONE PAVEMENT. SEE DTL. 2A.L1A
- DRY-LAID STONE RETAINING WALL. SEE DTL. UL.T4
- CAST-IN-PLACE CONCRETE RETAINING WALL IV STONE VENEER. SEE DTL. 5A.L1A



**ABOVE**  
A trough that descends the hillside doubles as a design feature and an oxygenation device that cleans and aerates water pumped up from the tropical lagoon.





↳ steep slopes, pause at a waterfall, walk along the boardwalk on the lower level, appreciate landscape art and sculpture, and linger beside the 4,000-square-foot lagoon, which doubles as a water reservoir and a home to bass, turtles, and other wildlife. They can also study the adjacent constructed wetlands, where plants such as cat-tails and rushes clean wastewater.

Aside from solar panels and a rooftop wind turbine, most of the Center for Sustainable Landscapes's operating systems are artfully disguised in the landscape. Fourteen geothermal wells are located next to a driveway. Underground reservoirs at various locations store rainwater used for irrigation in the conservatories. The center's wastewater flows through settling tanks, constructed wetlands, sand, and UV filters before it is pumped up for reuse in the building's restrooms. Overflow goes to a solar distillation system, where it's purified to pharmaceutical grade and used for watering orchids. Rooftop runoff feeds the lagoon, and excess stormwater goes into storage tanks under rain gardens in the parking area.

Landscape materials complied with the strictures of the Living Building Challenge and SITES. Almiñana used pavers cut from recycled concrete, sandstone from the Pittsburgh area for walkways, white oak decking, and repurposed cobblestones of dolomitic limestone.

As the landscape matures, everyone involved in the project is watching performance carefully. Sensors are embedded throughout the property to monitor

the functioning of all of the center's integrated systems—moisture levels, green roof runoff, and weather conditions, just to mention a few factors. It's a measure of how well the site was designed and whether it performs in the way it was meant to. Almiñana notes that, given that landscapes are never static, designers and researchers in the decades to come are going to find out whether this landscape is capable of succession within the controlled setting of a botanical garden. He says he hopes that a decade from now, "a child that was here at age five will think differently about the world... that's what you want at the end of the day." ●

JANE BERGER IS A WRITER AND PROFESSIONAL LANDSCAPE DESIGNER IN WASHINGTON, D.C.

#### Project Credits

**CLIENT/OWNER** PHIPPS CONSERVATORY AND BOTANICAL GARDENS, PITTSBURGH. **ARCHITECTURE** THE DESIGN ALLIANCE ARCHITECTS, PITTSBURGH. **LANDSCAPE ARCHITECTURE** ANDROPOGON ASSOCIATES, PHILADELPHIA. **STRUCTURAL ENGINEERING** ATLANTIC ENGINEERING SERVICES, PITTSBURGH. **CIVIL ENGINEERING AND WATER ENGINEERING** CIVIL & ENVIRONMENTAL CONSULTANTS, PITTSBURGH. **MECHANICAL, ELECTRICAL, PLUMBING** CJL ENGINEERING, PITTSBURGH. **LEED AND LIVING BUILDING CHALLENGE MANAGEMENT** EVOLVEEA, PITTSBURGH. **COMMISSIONING** H. F. LENZ, JOHNSTOWN, PENNSYLVANIA. **INTERPRETATION** KOLANO DESIGN, PITTSBURGH. **PRECONSTRUCTION MANAGEMENT** MASSARO CORPORATION, PITTSBURGH. **ENHANCED COMMISSIONING** PITCHFORD DIVERSIFIED, BUTLER, PENNSYLVANIA. **INTEGRATED DESIGN FACILITATION, ENERGY MODELING, DAYLIGHTING ANALYSIS, AND MATERIALS CONSULTING** 7GROUP, LLC, KUTZTOWN, PENNSYLVANIA. **WATER TREATMENT** SUNDRIVE, OTTSVILLE, PENNSYLVANIA. **OWNER'S REPRESENTATIVE** INDEVCO, PITTSBURGH. **ESTIMATING** VERMEULENS COST CONSULTANTS, TORONTO. **GENERAL CONTRACTOR** TURNER CONSTRUCTION, PITTSBURGH.



PAUL G. WIEGMAN, TOP LEFT; ANNIE O'NEILL, OPPOSITE

**ABOVE**  
From the roof garden of the Center for Sustainable Landscapes, there are views of the entire integrated landscape and the distant slopes of the city.

**OPPOSITE**  
Visitors descend through woodlands and lowland slopes planted with native trees, shrubs, and other plants typical of the Western Allegheny Plateau.



