A newsletter for NPS cultural landscape stewards

LANDSCAPE culture

Park Cultural Landscapes Program

Summer 2022

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Cable Car Berm Planting Bed Rehabilitation

Devon Brewer (Gardener) and Micah Wright (Buildings, Utilities, and Grounds Manager) stand in the established planting beds two years after planting (NPS).

The historic Powell-Hyde Cable Car terminates at the southeast corner of Aquatic Park National Historic Landmark district in San Francisco Maritime National Historical Park (SAFR). The popular cable car ends at a turntable built on a landscaped berm. Originally installed in the 1960s, by 2020, the plants on the berm had become overgrown. Micah Wright, Buildings, Utilities, and Grounds Manager, led the successful rehabilitation of the berm planting beds to produce a landscape that is compatible with the historic character and also responsive to contemporary conditions and maintenance resources.

Landscape History

Victorian Park, where the cable car berm is located, was not part of Aquatic Park's original design. Built in 1962, Victorian Park reflects a mixture of elements from its 1961 design, a 1982 construction project to reconfigure

The cable car berm overgrown and unsightly prior to installation (top); after installation of new drought tolerant plantings (middle); after establishment with consistent maintenance (bottom) (NPS).

the cable car turnaround, and incremental changes that have occurred since then. The cable car berm within Victorian Park was planted in the 1960s using low-growing plants. In the 1980s, the cable car turnaround was re-configured.

The Planting Project at Victorian Park

By 2020, almost 60 years after the berm had been planted, the site was overgrown and difficult to maintain. The park identified the need to replace the planting beds. Micah Wright created the planting design for the project. The plans were reviewed by Gretchen Stromberg (SAFR Chief of Cultural Resources), Amy Hoke (Golden Gate Historic Landscape Architect), and Todd Block (SAFR Historic Architect). They provided guidance to integrate an understanding of historic landscape preservation with current maintenance operations. A landscape contractor installed the planting beds.

The beds were planted shortly before the COVID-19 pandemic began in 2020, and the reduction in visitor traffic allowed the plants to establish. A palette of seven plant varieties was used in the planting project, mostly low-growing shrubs and groundcovers similar to selections that were part of the original design. Water conservation was an additional consideration for the park's plant selection. Drought tolerant and hardy plants were chosen to withstand urban conditions and reduce water and maintenance inputs.

After construction, a gardener was assigned to maintain the berm area, which proved to be a vital element of the project's success. Devon Brewer, the gardener, maintains the plants and removes invasive species. He continually responds to the challenges of maintaining a garden in a busy public space where crowds of visitors, neighbors, homeless individuals, and event attendees all share space. Two years after the installation, the plants are established and provide a beautiful foundation for the cable car stop.

Present Success, Future Maintenance

Wright considers the factors that helped to make this project a success, both within and beyond the park's control: landscape architect involved at each step of the project, timing before the pandemic, thoughtful plant selection with attention to the environmental conditions, and dedicated maintenance staff. Even so, he acknowledges that in a high-use area like Aquatic Park, the maintenance requirements are significant, and it is sometimes necessary to think of landscape projects as cyclic. Additionally, as people pass through the park, he hopes that the placement of an informational sign about the planting will help visitors to have greater care for the vegetation in the historic landscape.

Photos of established planting beds on the cable car berm in the summer of 2022, two years after installation (NPS).

Protecting Trees During Construction

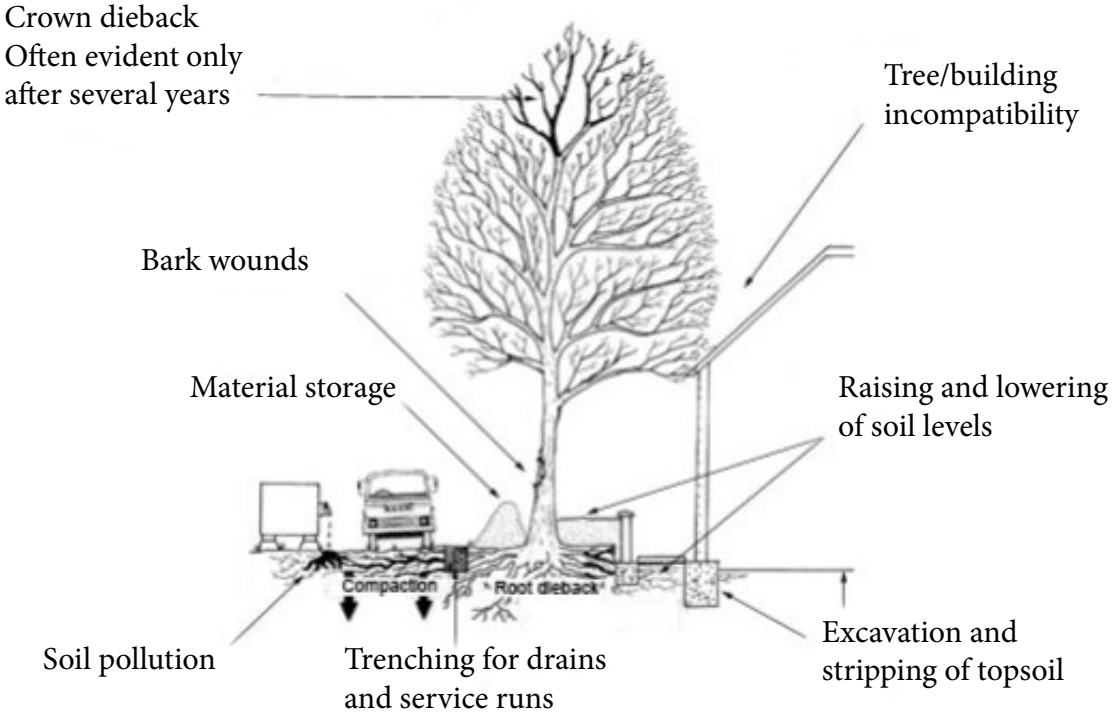
The National Parks and Public Lands Legacy Restoration Fund (LRF), established by the Great American Outdoors Act, is providing the NPS with $6.5 billion over five years to address maintenance needs. With the influx of funding, construction projects must be planned and managed rapidly while preserving existing resources, including sensitive living resources like trees. Michelle Surber, Landscape Architect with Historic Architecture Conservation and Engineering Center (HACE), is incorporating tree protection into a $27 million LRF-funded project to rehabilitate and repair structures and landscapes at Minute Man National Historical Park (MIMA).

While canopy damage and bark wounds should be prevented during construction, much of protecting trees centers around roots and soil. Compacting soil within the root zone of trees reduces the ability of the tree to absorb essential water and nutrients from the soil. Compaction can be caused by vehicle and foot traffic, material staging, and raised soil levels.

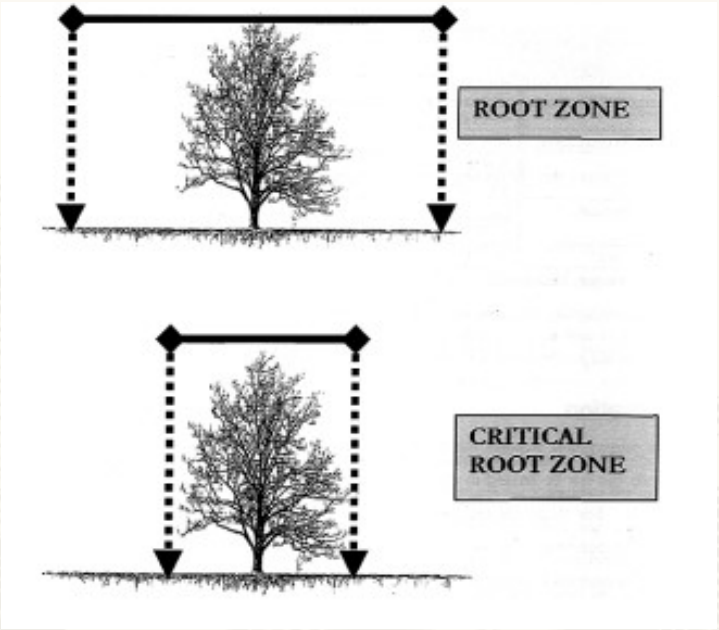
Design and Planning

Tree protection begins in the project planning and design phases. In the planning phase, parks should complete a tree inventory and assessment to document trees within, and adjacent to, the project boundary. The inventory and assessment should include mapping of trees with high accuracy GPS units, and documentation of tree species, diameter at breast height (DBH), condition, and risk by an ISA Certified Arborist. Planners determine which trees to protect based on natural and cultural resource values, condition, risk, and location within project boundary. They can consult Cultural Landscape Inventories and Reports, as well as documents and photos found in park archives to determine the historical significance of trees. When planning protection strategies for the MIMA project, Surber worked with the Olmsted Center for Landscape Preservation and MIMA Cultural Resource managers to determine treatment objectives for all trees within construction limits. Through inventory and analysis of these trees, the park was able to determine which trees could be removed and replaced, and which would require protection.

In the design phase, an understanding of tree biology and soil science informs tree protection specifications. Roots extend beyond tree canopies and generally remain in the top few feet of soil. The Critical Root Zone (CRZ) is the area "immediately adjacent to the trunk where roots essential for tree health and stability are located" (ISA, Managing Trees During Construction, 10). Construction can impact the tree anywhere within



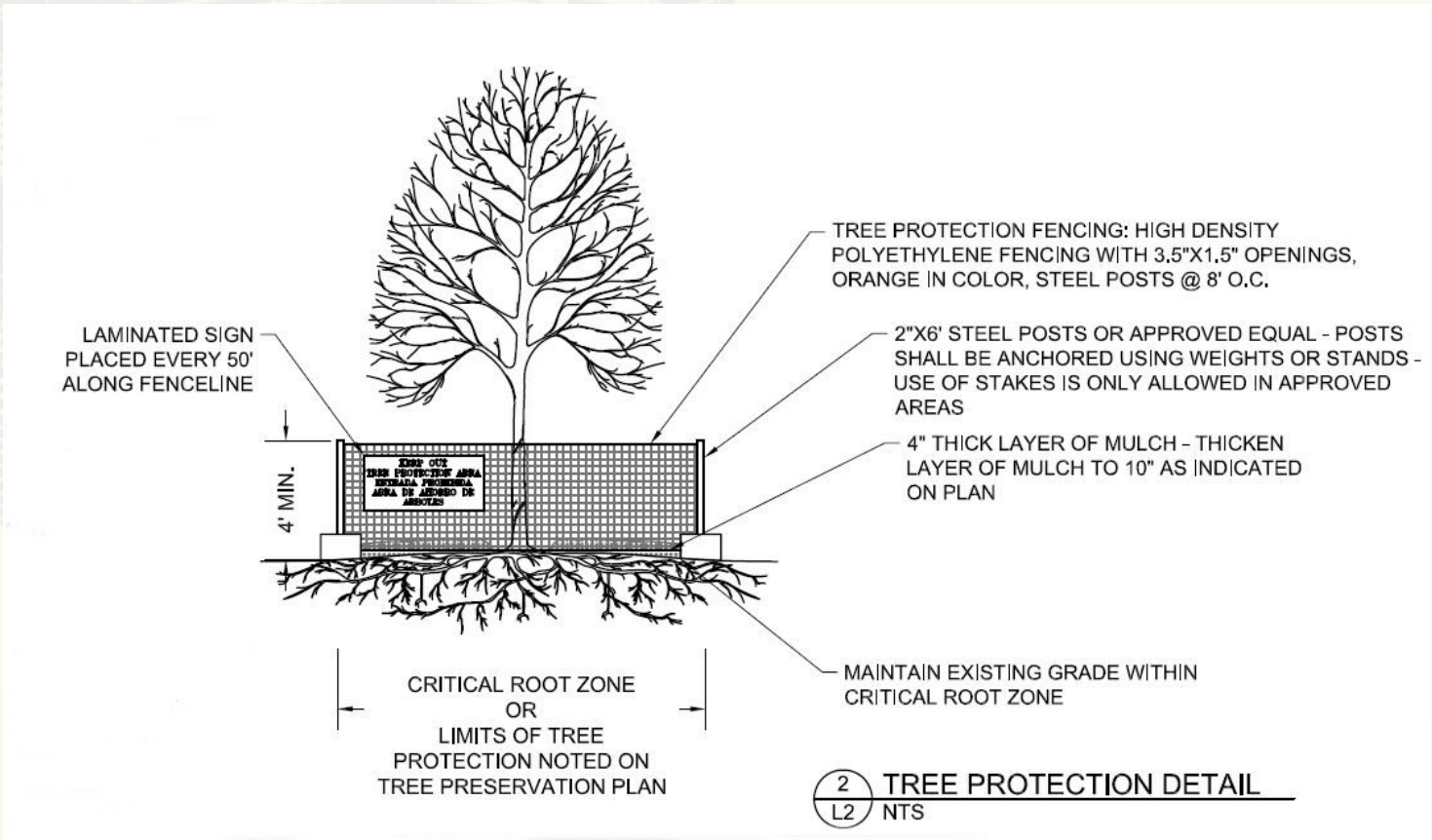
Impact to trees by construction activities (District of Columbia Department of Transportation).



Root zone and critical root zone (Tree Technical Manual: Standards and Specifications).

the root zone but has a higher likelihood to kill the tree within the CRZ. The CRZ is generally a one-foot radius for every one inch of DBH for healthy mature trees; with 1.5 to 2-foot radius per inch DBH for specimen trees, and a minimum 8-foot radius for trees with a DBH under 8 inches. Within the CRZ is the Structural Root Plate or No Cut Zone, an area within 6 to 10 feet of the trunk of mature trees. The roots within the Structural Root Plate are essential to tree structural stability, and damage to roots could create a hazard tree. During construction, ideally the CRZ should not be impacted. In cases where construction activities are necessary within the CRZ, the No Cut Zone should be avoided. In healthy trees, a maximum of 30% of the area of the CRZ can be impacted with mitigation. Trees with low vigor and structural issues have less resilience to impacts and should be treated more conservatively.

During the design phase, the Tree Protection Zone is established. This zone will be protected with fencing during construction. If ground disturbance is not allowed due to archeology, free-standing chainlink fences with base stands for stability may be used to delineate the protected area. In other cases, a simple fence of stakes and safety fencing may be appropriate. In establishing a Tree Protection Zone for the MIMA project, Surber used the CRZ as a starting point but also considered project goals. Surber added the Tree Protection Zone to project drawings to clarify where temporary tree protection fences must be installed at the initiation of the project. In many cases, the protection fence was specified to surround multiple trees in order to reduce the amount of fencing and increase the overall area of protection.



Tree protection detail for MIMA LRF project (NPS).

Construction

During construction, best practices include solutions that limit root impact and soil compaction. These practices should be specified in the construction documents and monitored by the contracting officer. If work must occur within the CRZ, a layer of 8 to 12 inches of wood chip mulch covered by a protective mat can disperse compaction along access and construction routes. Wooden planks and wrap can be added to the trunk, spread to protect the root flare. To reduce impact, the smallest equipment possible should be utilized and staging and stockpiling of materials kept outside of the protection boundary. Staging and parking areas should be established outside of the CRZ, and material storage should be confined to areas already compacted.

When excavating within the root zone air spading and boring can reduce the impact to trees. Air spading can be used to expose roots during excavation for foundations or paving. For trenching within the CRZ, a bored tunnel is recommended. Boring should begin and end outside of the CRZ and be 2 feet or deeper for trees with a DBH less than 12 inches, and 3 feet or deeper for trees with a DBH over 12 inches. Structural soil (large aggregates mixed with topsoil and compost) can be utilized to allow future tree root penetration below hard surfaces (roads/sidewalks).

While construction has not begun at MIMA, Surber recently oversaw a brick path repair at Roger Williams National Memorial. Construction was limited to a small envelope, and stockpiling was allowed in areas which were already compacted. In areas where roots were disturbed for construction, following project specifications, roots over one inch were cut with a clean lopper or saw under supervision of a certified arborist to reduce the chance of disease and improve the tree's ability to heal from the damage. In addition, the contractor covered soil with exposed roots with burlap that was dampened at regular intervals to keep roots and soil moist. Trees were provided supplemental water to reduce the stress of construction and disabled irrigation systems. Resin mats created pathways within the CRZ to transfer materials in small equipment across the site. Surber was able to communicate with the contractor steps for tree protection as well as monitor that the contractor was following the project specifications.

Post-construction

The health of trees impacted by construction can be supported by ongoing watering and mulching in the growing season following project completion. Radially trenching with an AirSpade and then backfilling with a soil/compost mixture can reduce the impacts of compaction. The visible indication of tree decline as a result of compaction may not appear for several years. As such, holding contractors accountable for tree loss is difficult, but by following best practices, negative impacts of construction can be avoided.

Path rehabilitations at ROWI. Burlap root cover prevents drying and chainlink fence protects trees (NPS).

Conclusion

Protecting trees during construction is possible through proper planning, design, and construction. According to Surber, "It takes decades to replace a mature tree. In some cases, no replacement can ever truly match what is lost. If we can proactively plan and advocate for the trees in our landscape, we can reduce man-made impacts and preserve historical and cultural assets for our park and our community." With ground to be broken on construction projects across the country in the coming years, with dedicated employees like Surber, the NPS has an opportunity to be a leader in tree preservation best practices and to develop new, creative methods to preserve trees.

For more information:

- Reducing tree (and soil!) damage during construction
- Managing Trees During Construction
- Trees and Development: A Technical Guide to Preservation of Trees During Land Development

Tool of the Moment: Soil Penetrometer

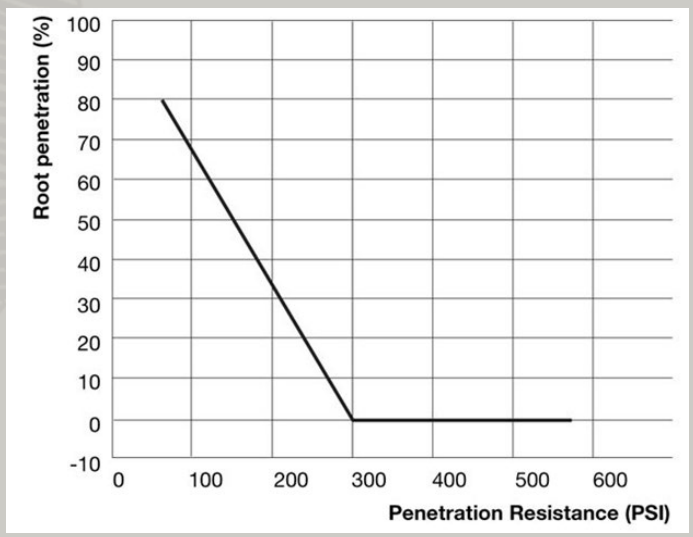
Soil compaction tester being used in the field (Forestry Suppliers).

A soil penetrometer or soil compaction tester is used to measure the level of compaction in soil. Natural soils vary in compaction, and additional unnatural compaction can be caused by foot traffic, vehicle traffic, or material storage. Soil compaction impacts root growth and water movement in the soil. A soil penetrometer consists of a handle with gauge attached to a probe. The probe has a removable tip and usually the unit comes with one tip for soft soil and one for hard soil. Marks on the probe every three inches can be used to measure soil depth.

Using the soil penetrometer

Test the soil at field capacity (24 hours after a rain event when the soil is not too dry or too wet). If possible, initially test a non-compacted location within the site as a reference. Soil moisture content and soil composition impact resistance and should be considered when comparing measurements at multiple sites. To use, hold the penetrometer perpendicular to the ground and push the penetrometer into the soil at a rate of approximately one inch per second. As the penetrometer moves through the soil the gauge will indicate resistance in pounds per square inch (psi). Zones of compaction

Penetrometer gauge (Grainger).



Penetration resistance of 300 psi prevents root growth (PennState Extension).

can be measured if the psi rises and then drops as the tip moves through soil.

The penetrometer is designed to parallel root movement through soil. Studies have found that a penetration resistance of 300 psi does not support root growth. Generally, the ideal range for root growth is from 50 to 150 psi. Soil compaction can be tested in sites to be planted. For trees, soil should be in the range to support growth down to three feet in depth. For already planted sites, the measurements can be used to plan remediation such as mulching and airspading.

Watch this video to learn more (University of Wisconsin Integrated Pest and Crop Management).

Announcements & Publications

Summer issue of Park Science published with feature article How a Navajo Scientist Is Helping to Restore Traditional Peach Horticulture.

Michael Stachowicz, Preservation Maintenance Program Manager at the Olmsted Center for Landscape Preservation, compiled an unofficial list of recommended equipment under $10 thousand for end of year purchases (prices from 2019).

New NPS theme study: Labor History in the United States highlights the diversity of the working-class experience in America.

The 2021 Cultural and Natural Resource Awards recipients announced. Awardees are selected annually in a spring call for nominations and honored bi-annually.

Oral history of Eileen Szychowski, a former park ranger at Grand Canyon committed to access and disability rights, published. This article is part of the *Telling Our Untold Stories: Civil Rights and the National Park Service* initiative.

Training Opportunities

Preservation Horticulture Workshop
NPS Park Cultural Landscapes Program
Sept. 13-15, Gateway Arch National Park, St. Louis, MO; No tuition, travel funding provided.
Course application due July 29th.

Brick Earth Stone and Timber (BEST) Preservation Workshops
Course Catalog

- Asset Management for Historic Structures, Sept. 12–15, Grand Teton National Park
- Integrated Pest Management for Cultural Resources, Nov. 14-16, Death Valley National Park

Non-invasive tree root detection: What is the state of the art?
Tree Fund, webinar, Nov. 1

Engaging underserved populations in community tree management activities
Tree Fund, webinar, Dec. 6

New Directions in the American Landscape Virtual and In-Person Education Series
Course Catalog

Video Corner

Tree Research and Education Endowment Fund (TREE Fund) archive of recorded webinars are available for free online. The videos contain the latest in science-based tree care from top researchers in Arboriculture. Recent webinars include *Growing Trees on Paved Sites* and *A Three Pronged Approach to understanding defensive mechanisms in Green Ash resistant to EAB* .