Brodhead Park
30% Conceptual Restoration Design
Basis of Design Report

DECEMBER 2022

PREPARED FOR

One Truckee River and City of Reno
with Guidance from Carson-Truckee Water Conservancy District

PREPARED BY

SWCA Environmental Consultants & Wildscape Engineering, Inc.

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30% CONCEPTUAL RESTORATION DESIGN
BASIS OF DESIGN REPORT

Prepared for

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1 INTRODUCTION

This Basis of Design Report supports a proposed 30% conceptual restoration design for Brodhead Memorial Park (Brodhead Park, or park) in Reno, Nevada, which is the first step in this proposed restoration project (the Project). The vision for the Project is to improve ecological conditions of the riverbank at Brodhead Park and to cultivate local residents' connection to and stewardship of the park. As a pilot project, this effort is aimed at building momentum for future urban restoration projects along the Truckee River. The recommended goals and outcomes of this Project are focused on the specific needs for the park's riverbank and further inform One Truckee River's (OTR's) overall coordinated Vegetation Management Master Planning effort that is underway, funded by Bureau of Reclamation and administrated by Nevada Land Trust. A Project vision statement, goals, and objectives are detailed in Section 1.2.

Brodhead Park is owned by the City of Reno and managed by the City of Reno Parks and Recreation Department. OTR hired SWCA Environmental Consultants (SWCA) and their teaming partners Wildscape Engineering, Inc. (Wildscape), and Resource Concepts, Inc. (RCI), to develop a conceptual restoration engineering design and plans for the park, specifically to address several critical issues facing the Truckee River, including impaired water quality (turbidity and temperature), erosion, pedestrian access, and wildlife habitat needs. The scope of this design includes restoration of the riparian zone (riverbank) along the south side of the river between the Kuenzli Street and Wells Avenue bridges, which is herein referred to as the Project area (Figure 1).

This conceptual phase of the design process aimed to gather stakeholder input through close coordination with agencies, such as the City of Reno and the Carson-Truckee Water Conservancy District (CTWCD), and the following diverse groups:

- OTR Technical Working Group (TWG) members (engaged with the overall Vegetation Management Master Planning)
- Local neighborhood including homeowners and renters
- Public safety and human service outreach teams
- River users, including recreational users and unhoused individuals

This input, along with guidance from local codes and regulations, formulated the design concepts that are presented in this Basis of Design Report as potential strategies to address the management needs and opportunities of the Project. The concepts proposed here are subject to change and will be further clarified based on incoming stakeholder input, outcomes of topographic survey results, and Project developments that occur through the 60% and 90% design phases.

Lessons learned through the proposed Project would have far-reaching implications and benefits for future restoration projects along the mainstem of the Truckee River within Nevada. The proposed Project would improve ecological function along the Truckee River by targeting the riverbank at Brodhead Park and clearly defining trails from the paved path to the water's edge, increasing access to the river and stabilizing the riverbank. This focused riverbank work would support previous improvements to the park, like the 2020 installation of a Portland Loo, and future improvements to the natural and built environment.

Figure 1. Project location.

The Brodhead restoration design complements 1) the OTR Truckee River Water Trail Project, which proposes important recreational facilities, additional put-in/take-out and water access points for paddlers and pedestrians, and trail signage, and 2) the Downtown Reno Partnership's 1-mile Makeover, which proposes improvements to the built environment along the Truckee River Corridor from Lake Street to John Champion Park. It is recommended that this Project coordinate closely with these two efforts to ensure that Brodhead Park restoration plans are compatible with, and further leverage, these other proposed projects.

1.1 Background and Project History

The restoration planning effort within Brodhead Park is a pilot project, which directly complements the OTR Vegetation Management Master Planning effort that has developed a Framework Vegetation Management and Restoration Plan (Framework Plan) for the urban stretch of the Truckee River, within the Reno-Sparks urban core of Nevada (SWCA 2022). In conjunction with development of the Framework Plan, OTR's contractors (SWCA and RCI) developed support tools (regulatory matrix, web map tool, vegetation management strategies planning tool) to assist in development of implementation-level restoration plans. This pilot restoration Project would be the first of many implementation-level plans and would complement the ongoing master planning effort, including any updated or revised versions of the Framework Plan.

Brodhead Park presented an opportunity to address several critical issues facing the Truckee River, including impaired water quality (turbidity and temperature), erosion, pedestrian access, and wildlife habitat needs. However, the OTR Vegetation Management Master Planning Steering Committee and the City of Reno ultimately selected Brodhead Park to be the Project area because the park has been a proving ground for addressing social issues along the Truckee River by being 1) a demonstration site for OTR's prioritized effort to increase public restrooms along the Truckee River with the first "Portland Loo" installed at the park in 2020; and 2) an area where a variety of human activity takes place, making it a fitting location to test and learn from management solutions. A previous example of human management solutions is the Washoe County River Steward Program, managed by the Karma Box Project (Karma Box), where unhoused river users supported ongoing trash cleanups to inspire increased care for the river.

The City of Reno is a Project partner on this effort, and Milestone I has involved the following City of Reno Departments in developing the 30% design:

- City of Reno Parks and Recreation
- City of Reno Public Works
- City of Reno Utility Services
- City of Reno Clean and Safe Team
- City of Reno Police Department
- City of Reno Fire Department

Coordination with the City of Reno and OTR was facilitated by SWCA and included three in-person meetings. The departments listed above will continue to be involved through development of the 60% and 90% designs.

This pilot restoration Project has been designed to meet multiple objectives through several proposed and progressive milestones. The 30% restoration design described herein is the first of the following proposed milestones:

- **Milestone I: The 30% Restoration Design milestone (current)** is to develop a 30% (conceptual) restoration design and this Basis of Design Report 1) in coordination with OTR and City of Reno and with guidance from the CTWCD, 2) with solicitation of agency input on design ideas and permitting requirements, and 3) through public input on river access and desired uses of the Project area. The 30% restoration design milestone also includes preliminary construction resource planning efforts to help identify sources for labor and materials (including some from OTR's partners) to streamline implementation efforts and costs.
- **Milestone II: The 60% Restoration Design milestone (January to June 2023 with funding secured from the Truckee River Fund)** would begin with a topographic survey of the Project area and would then develop the 60% restoration design and a refined cost estimate to take the Project through final design and construction. The 60% restoration design would also provide clarity on the agency permits/approvals needed and further refine sources for materials for implementation (in coordination with OTR's partners). With funding from River Network, a community-led research project will start in January 2023 focused on building a Truckee River Community Advisory Team with the goal of expanding and deepening connections with individuals living and working near Brodhead Park. The advisory team's focus will be to provide perspective about residents' priorities relating to the river. The advisory team could provide more input on the Project as it develops the 60% design. OTR and the City of Reno could use this phase of the Project to test out a few native plant species and community engagement activities in a small defined area of the park to inform future Project phases.
- **Milestone III: The Nonprofit Engagement milestone (proposed work under OTR's Partnership Council in Fall of 2023)** would continue to connect and expand relationships with other local nonprofits to 1) build a system of support where local nonprofits target some of their program activities at Brodhead Park and its riverbank; 2) build out a timeline, outreach strategy, and a variety of specific activities for local resident volunteers to engage with the Project's implementation and support ongoing care after implementation; and 3) develop a proposal for ongoing coordination of volunteers who could provide support to Brodhead Park and its riverbank, could be a committed base of local residents and river users that are invested in the riverbank and park improvements, and could enjoy the park's renewed recreation opportunities.
- **Milestone IV: The 90% Design, Permitting, and Construction milestone (future)** would 1) develop the final restoration design plans and specifications, 2) complete project permitting, and 3) cover restoration implementation, including site preparation, slope stabilization and bioengineering treatments, plant materials, and labor for installation. Project installation could be collaborative, using government, non-profit, and private resources available in the area. The estimated cost and required materials would depend on design elements, permitting requirements, amount of materials/labor provided through in-kind support, and the outcomes of the 60% Restoration Design milestone.
- **Milestone V: The Public Involvement milestone (future)** would focus on the implementation of public outreach and involvement work defined in Milestone III.

1.2 Purpose

The proposed 30% conceptual restoration design (provided in Appendix A) reflects a vision for Brodhead Park that evolved through collaborative discussions among the City of Reno Parks and Recreation Department, OTR, cooperating agencies and partners, and with public input from local residents.

The vision and guidance from Project collaborators, partners, and stakeholders were integral to developing the proposed goals and objectives for restoration described below.

1.2.1 Proposed Vision

The proposed vision for restoration at Brodhead Park reflects an integration of ecological and social goals. Both the City of Reno and OTR have expressed that the success of a restoration project at the park relies on effectively addressing both ecological and social challenges and opportunities, which is captured in the following proposed **vision statement**:

> The City of Reno and OTR envision a riverbank restoration project at Brodhead Memorial Park that would engage the local neighborhood and create an invested stakeholder base to participate in planning, implementing, and ongoing care of the riverbank restoration. The Project would address critical environmental issues facing the Truckee River (impaired water quality, erosion, aquatic wildlife habitat needs, and vegetation loss). In addition, the Project would create more controlled access to the water's edge from the paved path for recreational users and pedestrians. The proposed Project work would support additional renewal efforts in the park space that could include future public gathering spaces, where everyone can enjoy the outdoors and feel an intimate connection to the river. All designs would be developed and implemented to maintain existing flood conveyance and improve riverbank stability.

1.2.2 Proposed Goals

The following proposed goals address the proposed vision for riverbank restoration at Brodhead Park:

- **Ecological Goals**
  - Apply a combination of engineering and native revegetation techniques to stabilize riverbanks and maintain healthy tree canopy to reduce sediment delivery to the Truckee River, enhance aquatic habitat, and increase ecological resilience of the riparian zone, while ensuring compatibility with flood conveyance and other regulatory constraints.
  - Enhance ecological health of the riparian area within Brodhead Park, providing a rich and diverse greenspace to support human health and enhance quality of life.
- **Social Goals**
  - Increase the culture of respect for and connection to the Truckee River to support riverbank restoration efforts at Brodhead Park.
  - Develop an engaged and invested local stakeholder base who would take ownership of the riverbank and park space at Brodhead Park and ensure that restoration improvements are maintained and ecological conditions improve over time.
  - Provide opportunities for community physical and mental well-being through improved access to the water's edge and opportunities for recreation along the Truckee River.
- **Coordinated Vegetation Management Goals**
  - Work through the urban restoration planning process from design through implementation to inform other restoration projects along the urban stretch of the Truckee River in Nevada, including an understanding of all required permits.
  - Use the success of Brodhead Park restoration, outreach, and community involvement as a template to be applied at other urban locations along the river, building momentum for restoration to be completed along the entire urban stretch of the Truckee River in Nevada.

1.2.3 Recommended Objectives

The recommended objectives listed below are steps and (in some cases measurable) metrics to achieve the proposed Project goals. These objectives align with the social and ecological goals or attributes outlined in the Society for Ecological Restoration's (SER's) *International Principals and Standards for the Practice of Ecological Restoration* (SER 2019). **Note: Some of the recommended objectives are suggestions and might not be achievable through the Brodhead Restoration Project alone and instead may be longer term objectives that are achieved through supporting efforts.** Specific quantitative metrics (numbers or percentages) would be defined during the 60% and 90% design milestones.

- **Stakeholder Engagement**
    - Develop a system to continually coordinate community members to be involved with planning, implementing, and supporting ongoing care of the restoration project and Brodhead Park. Proposed metrics include the following: # of individuals participating in volunteer services at Brodhead Park and its riverbank; and total # of volunteer hours spent at the site and the monetary value of those volunteer hours (hours × $29.95).
- **Benefits Distribution and Community Wellbeing**
    - Garner support from nonprofits to provide program activities to support building an engaged Project stakeholder group. Proposed metrics include the following: # of nonprofits involved; and # of program activities conducted at Brodhead Park and along its riverbank.
    - Build social cohesion and a sense of place at Brodhead Park to support restoration of the riverbank and renewal of the park. Nearby residents and visitors regularly enjoy and use Brodhead Park for a variety of uses including recreation and family-oriented activities. Proposed metrics include the following: # of people using the park; and # of different ways Brodhead Park is utilized by the local community. It is recommended that baseline levels be collected at 60%.
    - Provide expanded access to the water's edge through modification of existing trails and addition of new trails. Proposed metrics include the following: # of trails added or formally established for use in the Project area.
- **Knowledge Enrichment**
    - Design and implementation are informed by input from the OTR Vegetation Management TWG. Outcomes of the work are disseminated with the TWG to support future project planning, including revision of the Framework Plan and support tools, which is intended to be a living document. Proposed metrics include the following: # of agencies (including, but not limited to Washoe County, City of Reno, City of Sparks, Reno-Sparks Indian Colony, state agencies) to be given the opportunity to provide input on the restoration design; and development of a comment matrix illustrating how TWG member input informed the restoration design.
- **Sustainable Economies**
    - Explore the establishment of a sheltered employment or training program for underserved individuals to support river care and restoration and increase economic opportunities for at risk individuals transitioning from being unhoused. Proposed metrics include the following: # of people served; and amount of on-the-ground work completed along the Truckee River through the program.
    - Support mixed used retail in the surrounding neighborhood and on the north bank of the river to increase the number and variety of businesses where residents can seek services

(e.g., coffee shops, restaurants, and retail). Proposed metrics include the following: # of services available in walking distance (within 0.5-mile radius) of the river park; and any documented increase or positive change in services available in the area.

- Create opportunities for residents and visitors to come to the park. Coordinate community events to occur at the park to build social cohesion. Proposed metrics include the following: # of events that take place; and # of participants at each event.

- **Halt Ecosystem Deterioration**
  - Manage human use and river access (e.g., manage foot traffic and encampments along the river) to minimize physical impacts to restored areas. Proposed metrics include the following: # of established trails added with a rock-hardened surface; and documentation of vegetation established in previous social or undesignated trail locations.
  - Reduce prevalence of undesirable, non-native vegetation (tree of heaven, select elm species). Proposed metrics include the following: decrease in percent cover of undesirable tree species (documented for each species).
  - Support trash cleanup to reduce unwanted refuse accumulating on the site and entering the river. Proposed metrics include the following: volume of trash removed at Brodhead Park through various cleanup activities; and # of volunteers involved with trash cleanup.

- **Physical Conditions**
  - Reduce sediment delivery entering the river (estimated based on vegetation cover and/or erosion control monitoring in the style of Stormwater Pollution Prevention Plans). Proposed metrics include the following: estimated decrease in sediment volume entering the river; and documented increase in vegetation cover and/or erosion control cover.
  - Support continued maintenance and use of the existing toilet to reduce human waste entering the river by increasing the number of visitors to the park, (i.e., indirect support through activating the space). Proposed metrics include the following: # of visits to toilet (through OTR's existing tracking methods); and documented increase in toilet usage after restoration is implemented.
  - Increase vegetation cover along riverbanks. Proposed metrics include the following: percent increase in vegetation cover; and percent increase in native species richness.
  - Add stabilized soil substrate back to riverbank slopes to address historic erosion. Proposed metrics include the following: volumetric change in topographic profile (using final as-built report); and documentation of successful erosion control along restored riverbank slopes.
  - Maintain existing shade over the next 10 to 20 years (including backfill of shade trees). Proposed metrics include the following: # of canopy trees established as backfill of shade trees; and documented maintenance or increase of canopy cover through time.

- **Structural Composition and Diversity**
  - Increase presence of desirable[1] plants. Proposed metrics include the following: increase percent cover by desirable plants from baseline (for individual or groups of species).
  - Increase cover by native vegetation as understory and some relatively low-growing midstory vegetation[2] (especially vegetation that is 2–4 feet or less), to support ecosystem

[1] A list of desirable plants will be defined as part of the 60% design phase, with input from the City of Reno. Desirable plants would include native species and may include some non-native species that are adapted to site conditions, provide some ecosystem services, and do not pose a threat to other native vegetation in the restored area.

[2] Any plants with shrub morphology or that grow at a height between 2 and 6 feet would be subject to careful analysis to ensure compatibility with sightlines during the 60% design milestone. The specific needs for maintaining sightlines would depend on site conditions, including the angle of the slope, the location of other nearby visual obstructions, and distance to water.

function and line-of-sight. Proposed metrics include the following: increase percent cover by desirable plants from baseline (for individual or groups of species); and documented maintenance of sightlines throughout the park (at established photo points) using a visual obstruction reading or similar method.

- Increase or maintain multistory canopy (trees and vegetation above 6 feet), to support ecosystem function and line-of-sight. Proposed metrics include the following: canopy cover by different canopy functional groups; and documented maintenance of sightlines throughout the park (at established photo points), using a visual obstruction reading.

- **Ecosystem Function and Resilience**
  - Resilience: establish self-sustaining vegetation that does not require supplemental water beyond 2 years. Proposed metrics include the following: no supplemental water being required beyond 2 years, except for areas of vegetation replacement.
  - Adaptive management support: Plan for a robust adaptive management program (with sufficient budget) to address human and environmental impacts that lead to plant mortality. Proposed metrics include the following: develop a comprehensive adaptive management plan (in the 60 and 90% design phases) that identifies actions to address the most common, expected maintenance needs; and identify resources to implement the adaptive management plan after construction.
  - Survival: Plan for 60% (or less) survival rate of container plants and 40% (or less) survival of cuttings. (Note: most projects aim for 80% survival, but because of human activity and environmental constraints at the riverbank, budgets should plan for only 40%–60% [or less] survival.) A combination of overplanting and plant replacement would compensate for high mortality rates. Proposed metrics include the following: documented restoration success (as determined through post-construction monitoring), based on percent cover for understory and most midstory plants. Specific cover goals would be established during the 60% and 90% designs.
  - Recruitment (optional, based on selected plant palette): Native vegetation displays evidence of natural recruitment within 5–10 years of implementation. Proposed metrics include the following: document evidence of natural recruitment (i.e., plants growing that were not seeded or planted) 5–10 years after construction.

1.3 Site History and Watershed Overview

Limited site history information is available for Brodhead Park. A compilation of historical imagery is provided in Appendix B. Historical aerial photographs from 1953 (and as far back as 1939) show an irrigation diversion upstream of the property and an irrigation ditch running through the property near the current alignment of the man-made berm (Figure 2). The upstream half of what is now Brodhead Park was cleared of vegetation. By 1966 the irrigation ditch had been removed, and thick vegetation is present in later aerial photographs. Washoe County Assessor records for the parcel (012-015-09) indicate that the property was granted to the City of Reno in 1967. Brodhead Park was named for William Brodhead, the former Assistant Chief of Police for the Reno Police Department. Brodhead Park is a Land and Water Conservation Fund Park and therefore has deed restrictions that support its continued use as a park.

Figure 2. Brodhead Park in 1953.

1.3.1 Watershed

The Truckee River is a terminal river system that flows for 121 miles in a northeasterly direction. The river flows from Lake Tahoe at the dam outlet in Tahoe City through wooded and canyon areas along State Route 89, then through the town of Truckee and along Interstate 80 in California and flows through an urban stretch in Nevada before terminating in Pyramid Lake (within the Pyramid Lake Paiute Tribe Reservation).

People have lived, traveled, gathered, hunted, and fished along the Truckee River and its tributaries for more than 10,000 years. The Truckee River is located on the ancestral lands of the Wa She Shu (Washoe) and Numu (Northern Paiute), whose descendants recognize it as sacred. Members of the Reno Sparks Indian Colony, the Washoe Tribe, and the Pyramid Lake Paiute Tribe continue to care for the river and its resources today. During the Gold Rush in the 1840s and 1850s, Reno/Sparks served as the preferred Truckee River crossing point for travelers on their way to California. Use of the river's water increased in 1859 to support the growing mining and agricultural needs after the discovery of the Comstock Lode. In 1903, the Bureau of Reclamation began work on the Newlands Project, which controlled flow from Lake Tahoe (via the Lake Tahoe Dam) and diverted water from the Truckee River watershed to the Lahontan Valley (Carson River Watershed) for agricultural use.

Today the Truckee River provides valuable drinking and municipal water for residents and businesses in the Truckee Meadows area, generates hydroelectric power, supplies irrigation water, provides recreational experiences, and serves as an important ecosystem for fish and wildlife (including threatened and endangered species).

The Truckee River alignment within the Project reach does not appear to have been directly altered in the past, with the exception of the constructed, and later eliminated, south irrigation ditch in the early to mid-1900s mentioned above (see Figure 2). Throughout a significant portion, the Truckee River has incised over time, reducing its connection with a healthy active floodplain, particularly in the urban encroachment areas, and this reach is no exception.

The unhoused population has affected much of urban reach of the Truckee River, but the 1.5-mile stretch of the Truckee River from Brodhead Memorial Park east to Fisherman's Park at the Reno/Sparks boundary has been significantly impacted by unhoused individuals and trash. This area is further affected by commercial and industrial uses including the Waste Management regional transfer station, the Interstate 580 highway interchange over the river, and Truckee Meadows Water Authority's Glendale Water Treatment Plant. This 1.5-mile stretch has five river-side parks (Brodhead Park, John Champion Park, Fisherman's Park, Fisherman's I, and Fisherman's II).

This area is also characterized by a lack of public infrastructure along the Truckee River. Outdoor recreational opportunities are available along most of the Truckee River corridor, but public facilities, such as restrooms, are scarce. The 2050 Regional Transportation Plan also identifies two bridges (Wells Avenue and Sutro Street) as needing sidewalk, bike, and pedestrian improvements (Reno Transportation Commission 2021). The U.S. Census Bureau's American Community Survey reports that this area of Washoe County has the highest percentage of citizens that spend 30% or more of their household income on rent (Nevada Tomorrow 2022).

1.3.2 Water Rights

The Truckee River has historically been one of the most heavily litigated and managed river systems in the United States. The Truckee River Operating Agreement (TROA) was finalized in December 2015 to increase flexibility in water management between the TROA parties, including Nevada, California, the Truckee Meadows Water Authority, the U.S. Department of the Interior, and the Pyramid Lake Paiute Tribe. The Federal Water Master administers the TROA, which governs management of a series of complex water rights, decrees, and case law, which ultimately controls flow of the river. The TROA increased efficiency of reservoir storage, allowing users to time the releases of water to meet demands for municipal supply, irrigation, and instream flows for fish and aquatic habitat. The TROA's implementation has alleviated many prior water operations and supply concerns within the watershed. The TROA supports collaboration and flexibility for many users along the Truckee River.

1.3.3 Water Issues

While the TROA has addressed many water supply issues along the river, other critical watershed issues remain within the Truckee River, including within the Project reach and downstream into lower reaches:

- **Water Quality.** Water quality has been impacted from urban development, stormwater runoff, and a legacy of historical and current changes to vegetation and hydrologic modification throughout the watershed. While the U.S. Environmental Protection Agency has defined the river as a "water of high quality", stretches of the Truckee River within and downstream from the Project area are listed as impaired waters (under Nevada's 303(d) list) for temperature and turbidity.
- **Ecological Resiliency.** Historical and current human activities, including development, logging, recreation, rail and highway expansion, grazing, and mining, have led to bank hardening and channelization, loss of native vegetation, and proliferation of noxious and invasive species. Aquatic and riparian habitats within many reaches of the river have degraded ecological function.

- **Noxious and Invasive Weeds.** Even with the efforts of local agencies and organizations to eradicate noxious (designated in Nevada Revised Statutes 555) and invasive (other undesirable non-native) weed species, these common species out-compete natives, degrade habitat function, and increase fire risk.
- **Endangered Species.** Pyramid Lake, the terminus of the Truckee River, is home to an endemic, federally endangered fish species, the cui-ui (*Chasmistes cujus*), as well as a large population of federally threatened Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*). Cui-ui are culturally important for the Pyramid Lake Paiute Tribe. Both fish species swim up the Truckee River to spawn and are impacted by degraded water quality and low flows.
- **Flooding.** There have been several damaging flood events in the past on the Truckee River in the Reno area, including the years of 1950, 1955, 1963, 1986, 1997, and 2005. The Truckee Meadows Flood Management Project addresses flooding in the region to prevent and alleviate flooding along the Truckee River in Washoe County. Climate change is expected to intensify the hydrologic cycle, leading to more extreme droughts and flooding.

2 METHODS

2.1 Data Review and Site Assessment

SWCA and Wildscape conducted a desktop review of existing data, including a detailed review of aerial imagery and bathymetric LiDAR data provided by Washoe County. These LiDAR data were collected on December 5, 2014, and included default and ground (including bathymetric returns) and were used to inform the assessment of site conditions.

On February 17, 2022, SWCA and Wildscape conducted a field assessment of the Project area with a focus on the south riverbank north of the paved trail to document current vegetation, soil, and bank slope conditions. This information was collected to inform the engineering design and planting plans. Areas of concern due to severe erosion, steep or unstable slopes, and exposed tree roots were identified. Management opportunities, such as trail access points, stable slopes, and mature and healthy trees were also noted. The Truckee River gage at Reno (U.S. Geological Survey gage #10348000) measured a daily average discharge of 264 cubic feet per second (cfs) on the day of the survey.

2.1.1 Hydrology and Hydraulics

An existing and vetted hydraulic model for the Truckee River including specific hydrology input was provided to SWCA and Wildscape from the CTWCD.

Hydrology provided for the current design analysis is the 14,000 cfs discharge hydrograph used in the CTWCD mixed 1-dimensional/2-dimensional HEC-RAS model (Figure 3), which is the current estimate of the 100-year flood event (0.01 annual exceedance probability). This 100-year event is being used to test the proposed treatment measures to ensure the measures are stable and effective and do not cause a measurable increase in water-surface elevations. Wildscape requested the more frequent 2-year (0.50 annual exceedance probability) hydrology from other agencies to use for fine tuning and vetting the prescribed bank improvements. The CTWCD HEC-RAS model for the Project reach is a one-dimensional model. Review of the model parameters was conducted by the Wildscape senior water resource engineer and no obvious adjustments were required for analysis of the proposed treatments.

2.1.2 Bank Conditions and Topography

Field maps were marked up by the Wildscape engineers, David Thompson, Ph.D., PE, PH and Carol Beahan, PE, during the site assessment identifying the areas of concern and potential solutions for later incorporation into the conceptual design plans. Existing infrastructure and desirable vegetation were noted, so avoidance measures could be incorporated into the plans to preserve those features. Design constraints were discussed during this field effort including, but not limited to, the following:

- Avoid planting thicket-forming willows (*Salix* sp.) that create dense vegetation cover that does not support line-of sight.
- Maintain a 1:1 cottonwood (*Populus* sp.) replacement ratio to limit the amount of introduced floodplain debris that could reduce flow conveyance at bridge crossings.
- Riverbank treatments should focus on erosion control prevention, including any trail designs. For example, per CTWCD the boulder steps may be identified as “erosion control measures” rather than new trails.

2.1.3 Existing Vegetation

A reconnaissance-level survey of woody vegetation was conducted during the site assessment by Senior Restoration Ecologist, Dr. Susan Mortenson. Woody plant identification was conducted via pedestrian surveys in areas above the ordinary high-water mark (OHWM). Data were recorded on paper maps and subsequently digitized in Geographic Information Systems. This vegetation survey primarily focused on identifying sites for vegetation enhancement, including sites dominated by undesired species or sites with low vegetation cover or diversity. Due to the season of the survey, species verification, especially for willows, was not possible but would be verified through future design milestones. Future surveys to locate potential plant materials for bioengineering techniques would be required as the restoration design progresses into the 60% and 90% design milestones.

2.1.4 Soil Conditions

A reconnaissance-level pedestrian survey of soil conditions was conducted during the site assessment by Principal Soil Ecologist, Dr. Mandy Bengtson. Photo point observations were recorded using the Gaia GPS App (v2022.2) on an iPhone. At each photo point location, a photo was taken with observations regarding relative slope steepness, soil texture, and size and density of rock fragments. Photo point observations were also collected to identify possible trail access points, areas of severe erosion, or areas where special considerations would be necessary for the engineering design (Appendix C).

2.2 Community Outreach and Stakeholder Engagement

Community outreach and stakeholder engagement for the Brodhead Project conceptual restoration design included the events listed below. Details on the outcomes of these meetings is provided in Section 3.6.

- Kick-off meeting with consultants and agencies
- Meeting with Reno Police Department
- Community outreach event at IMBIB Brewery
- City of Reno implementation planning meeting
- Conceptual design meeting with City of Reno

3 RESULTS

3.1 General Opportunities and Jurisdictional Constraints

3.1.1 General Management Opportunities

Through collaborative efforts, including meetings and interviews with stakeholders and reconnaissance-level site assessment, OTR, City of Reno, SWCA, and Wildscape identified the following general management opportunities listed below. These opportunities align with those described in detail in the Framework Plan (SWCA 2022) and align with the opportunities addressed with Technique Compatibility Tool (that supports the Framework Plan). Specific opportunities that are proposed to be addressed through the Project are listed below. These opportunities are addressed in Section 4 of this document and the engineering design (Appendix A).

- **Managing foot traffic:** Foot traffic can damage existing and newly planted vegetation and can increase susceptibility of soils to erosion. Unmanaged foot traffic (due to a lack of established trails) at Brodhead Park have created unstable riverbank slopes. Techniques to manage foot traffic are needed at Brodhead Park to redirect human access to areas where it is appropriate and may include physical features of the restoration project (including methods establish river access through trails) but also community-level solutions to inform the public about appropriate river access.
- **Support management of encampments:** Urban encampments have been prevalent at Brodhead Park and have damaged existing vegetation and inhibited establishment of new vegetation. Techniques to support the management of encampments along the riverbank include many physical features of the proposed restoration project, improving and maintaining line-of-sight, sheltered employment and job training programs targeted at underserved community members and unhoused river users, and strategic community outreach to increase recreational use of the river and its corridor. Design features can also include adaptations to the riverbank where periodic encampments exist including hardened surfaces and/or vegetation that is resilient to disturbance.
- **Erosion mitigation:** Many of the riverbank areas at Brodhead Park are characterized by an absence or poor establishment of vegetation, which is in part the result of human activity along the river. Soil stabilization measures by vegetation and other physical erosion mitigation measures are needed to protect soils and water quality and support establishment and longevity of restored vegetation. Steep eroding slopes subjected to flood flows require more robust measures such as planted riprap which is an acceptable “erosion control” treatment under CTWCD’s maintenance program.
- **Protection from wildlife damage:** Beavers have caused significant damage to existing vegetation at Brodhead Park and are a potential threat to any newly planted vegetation. Methods to protect plants from wildlife damage are needed to help ensure the survival of desirable vegetation.
- **Provide shade:** Many mature trees along the river at Brodhead Park are in decline. Dead or declining riparian trees could be replanted or replaced to shade the river channel and mitigate elevated water temperature along the urban stretch of the river.
- **Provide sightlines and ease trash removal:** In some areas at Brodhead Park, midstory understory woody vegetation such as tall shrubs and thicket-forming trees (e.g., some willow trees) can be problematic because it reduces sightlines (for public safety and human services outreach) and makes trash removal challenging. Strategies to promote low-growing vegetation

(forbs and grasses) would be a solution to consider at Brodhead Park, where trash removal and sightline maintenance is needed. The specific needs for maintaining sightlines would depend on site conditions, including the angle of the slope, the location of other nearby visual obstructions, and distance to water.

- **Address soil limitations:** Many of the soils within the Project area are rocky, eroded, exposed, and potentially nutrient-depleted. These conditions may limit growth of existing vegetation or newly planted vegetation. Soil manipulation and supplement, erosion control, and potentially amendments are needed to address soil limitations to successfully establish and maintain desirable vegetation.
- **Weed control:** Non-native species (such as tree of heaven [*Ailanthus altissima*] and Siberian elm [*Ulmus pumilla]*) can cause a nuisance to the Project area and outcompete native or desirable vegetation. An integrated weed management approach would be designed at 60% to address the Project area's weed issues during both restoration implementation and ongoing maintenance.
- **Create or enhance wetland and riparian habitat:** The river corridor at Brodhead Park is a location where native wetland and riparian vegetation can be created or enhanced to provide habitat for terrestrial and aquatic wildlife. Careful selection of species that are ecologically appropriate, are compatible with sightlines, fit within the Project area's other constraints, and provide high habitat value are all important considerations.

3.1.2 Regulatory Constraints and Permitting Considerations

Several regulatory constraints are being considered and addressed through this restoration project, to ensure the Project meets the regulatory requirements and aligns with applicable guidance documents. This conceptual design phase is also considering the possible permits that may be required for restoration implementation. The permits and regulatory requirements described below are currently outlined in two categories: regulations that are understood to be required based on the current project design and regulations that may be required based depending on final design elements. Further clarification on what regulations apply will take place during the 60% design milestone.

3.1.2.1 APPLICABLE PERMITS AND REGULATORY REQUIREMENTS

- **Municipal codes and ordinances.** The Project is located on public land owned by the City of Reno within Washoe County, Nevada. The Project would be subject to City of Reno and Washoe County Codes and Ordinances. These codes and ordinances are detailed in Appendix A of the Framework Plan (SWCA 2022).
- **Guidance and plan documents.** Relevant guidance documents are detailed in Appendix A of the Framework Plan (SWCA 2022) and include the following: City of Reno - Master Plan Conservation Plan (City of Reno 2008); One Truckee River Management Plan (OTR 2016); Truckee River Flood Management Authority Flood Protection Plan (2015); City of Reno Integrated Vegetation Management Plan (RCI 2019); and the City of Reno Public Works Vegetation Management Plan (RCI 2017).

3.1.2.2 POTENTIALLY APPLICABLE PERMITS AND REGULATORY CONSTRAINTS

- **Flood conveyance:** The *Martis Creek Lake Operations and Maintenance Manual* (U.S. Army Corps of Engineers [USACE] 1973) (known as the "Martis Creek Agreement") sets forth the specific parameters for Truckee River channel conveyance capacity maintenance from the Nevada-California state line downstream to the Glendale Avenue Bridge. Under this agreement, the CTWCD maintains the 14,000-cfs conveyance capacity in the Truckee River based upon

assurances from Washoe County and the City of Reno that they would maintain their reaches of the river. Much of the Project area lies within the 14,000-cfs conveyance zone. Depending on the type of activities proposed within the 14,000-cfs inundation zone, USACE Section 408 permitting may be required.[3] Section 408 permitting is a time-consuming and often expensive process, in many cases requiring up to two years; the Project design proposes to only include design features that would not trigger this process. To ensure 14,000-cfs conveyance, the CTWCD reviews plans for planting vegetation species (for new construction or projects that require permits). Based on guidance form the CTWCD, vegetation that is, in most cases, compatible within the 14,000-cfs zone (and may not require a permit for restoration) includes the following: healthy trees that are already established in the flood channel, establishment of young, healthy trees when they are replacing dead or declining trees, low-lying vegetation, herbaceous vegetation, shrubs that bend over when under moving water (i.e., coyote willow [*Salix exigua*]), shrubs that lose foliage and that do not get big and woody/stiff (i.e., do not collect debris/grass), shrubs that bend over and do not capture material. The CTWCD supports removal of dead, woody vegetation (which is potential debris that has potential to restrict conveyance) and replacing it with healthy, compatible vegetation. For example, removal of one or more dead trees could be replaced with one or more healthy trees. Much of the proposed restoration design falls within the 14,000-cfs conveyance zone and would therefore be subject to the requirements of the Martis Creek Agreement.

- **State Lands permitting.** For any restoration work being performed below the OHWM, an Application for Authorization to Use State-owned Submerged Lands for Agriculture or Conservation is required.[4] The permit would include the following activities: clear vegetation, debris, or cause temporary obstructions from a river channel, and/or to stabilize or restore a riverbank using natural materials. The application should include a site plan with a scale and compass; the applicant's parcel, Assessor's Parcel Number (APN), and physical address, if any; both adjacent parcels' APNs; any existing littoral structures or improvements on the applicant's parcel; and any existing littoral structures or improvements on the two adjoining properties.
- **Clean Water Act Section 404 and 401.** If the Project would discharge fill (soil, rocks) below the OHWM[4] or within a wetland, Clean Water Act Section 404 and Clean Water Act Section 401 regulations would apply. The Project may fall under a USACE Nationwide 404 Permit such as Nationwide Permit 13 for bank stabilization or Nationwide Permit 27 for aquatic habitat restoration, enhancement, and establishment activities. These nationwide permits require completion of aquatic resource delineations and detailed restoration plans that include best management practices. Clean Water Act Section 401 falls under the jurisdiction of Nevada Division of Environmental Protection or the U.S. Environmental Protection Agency, depending on the location of the Project.
- **Construction stormwater permit.** Nevada Division of Environmental Protection (NDEP) requires owner/operators to obtain a Construction Stormwater Permit if the Project would discharge to Waters of the U.S. and meets one of the following conditions: the Project would 1) disturb 1 or more acres, 2) disturb less than 1 acre but is part of a larger common plan for development or sale that would ultimately disturb 1 acre or more, or 3) impact receiving waters or its tributaries within a 0.25-mile radius of the Project. The applicability of this permit will be determined through the 60% design process.
- **Working in Waterway Permit.** The Working in Waterways Temporary Permit, administered by NDEP, covers temporary working in surface waters of the State such as channel clearing and

[3] If a project is in the 14,000-cfs zone, the CTWCD oversees project approval and supports potential permitting efforts with the USACE; and if the project is in the 6,000-cfs zone, the Nevada Division of Water Resources oversees project approval and supports potential permitting efforts with the USACE.

[4] The need to modify areas within or below the OHWM at Brodhead will be determined during the 60% design phase.

minor repairs to intake structures. This permit is required before operating earthmoving equipment in any body of water unless the activity is considered routine maintenance in which case a general permit is applicable.

- **Working in Waterway General Permit for Routine Maintenance Activities.** The General Permit for Routine Maintenance Activities, administered by NDEP, allows discharges associated with the use of heavy equipment for necessary routine maintenance activities undertaken with the use of wheeled and tracked heavy equipment or vehicles / rolling stock working in waters of the State. The permit requires the use of appropriate best management practices to minimize water quality impacts. The applicability of this permit will be determined through the 60% design process.
- **Washoe County Dust Control Permit.** A Washoe County Dust Control Permit is required for dust-generating activities greater than 1 acre in size. The permit requires fugitive dust emissions be minimized through required control measures determined by the County's Air Quality Management Division. Applications must be submitted 10 business days prior to work commencing on a project.

3.2 Hydrology and Hydraulics

Maximum velocities for the 14,000-cfs event range from about 9 to 15 feet per second (fps) in the Project reach (near the channel thalweg). On the right (south) bank, velocities range from about 3 to 5 fps. A plot of the maximum velocity distribution for the study reach is shown in Figure 3.

3.3 Bank Conditions and Topography

The Project reach between Kuenzli Street and the bridge crossing of South Wells Avenue is approximately 1,200 feet long, and the average bank-to-bank width of the Truckee River over the Project reach is about 130 feet. The average channel thalweg slope is fairly flat at 0.003 (i.e., 0.3%), and right bank slopes in the Project reach range from 25% to 50% (i.e., 4:1 to 2:1). When the new South Wells bridge was installed (assumed to be set well above the 100-year water-surface elevation), the Old Wells Street Bridge was left in place and is likely causing a backwater area where velocities are slowed. If the old bridge were to be removed, the water surface elevation would likely be lowered and there would be an increase in the upstream velocity (Figure 4).

As introduced above, the river is significantly incised and disconnected from its floodplain with the exception of the large active right (south) bank bar that has developed near the downstream end, likely as a result of the old bridge backwater area and is functioning as a localized inset floodplain. In the Project reach, many of the steep banks have been fortified with rounded, native boulders mixed in with intermittent large pieces of concrete debris. Several bank areas display signs of accelerated erosion with noticeable gullies and rills and exposed tree roots from a combination of fast-moving flood waters, concentrated areas of site runoff and heavily used earthen access trails. Rounded river boulders that currently armor several of the banks are not typically used for riprap slope revetment given that they can be less stable and more easily "washed out" along their smooth surface than angular rocks. An upper earthen bank between the Kuenzli Street bridge and the Portland Loo above the paved trail is also very steep (~1:1 slope) and actively eroding.

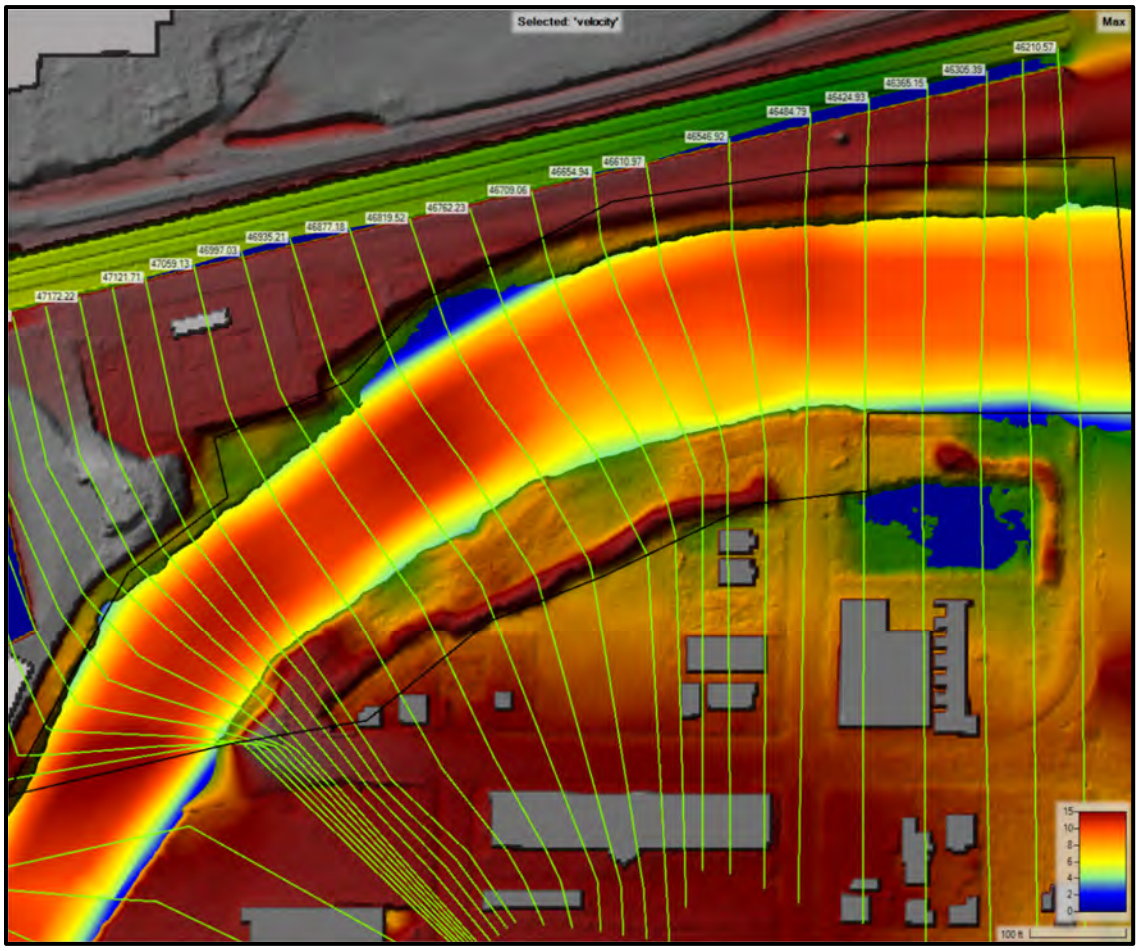

Figure 3. 14,000-cfs velocity distribution (in fps) within the Brodhead Reach (Source: CTWCD Hydraulic Model)

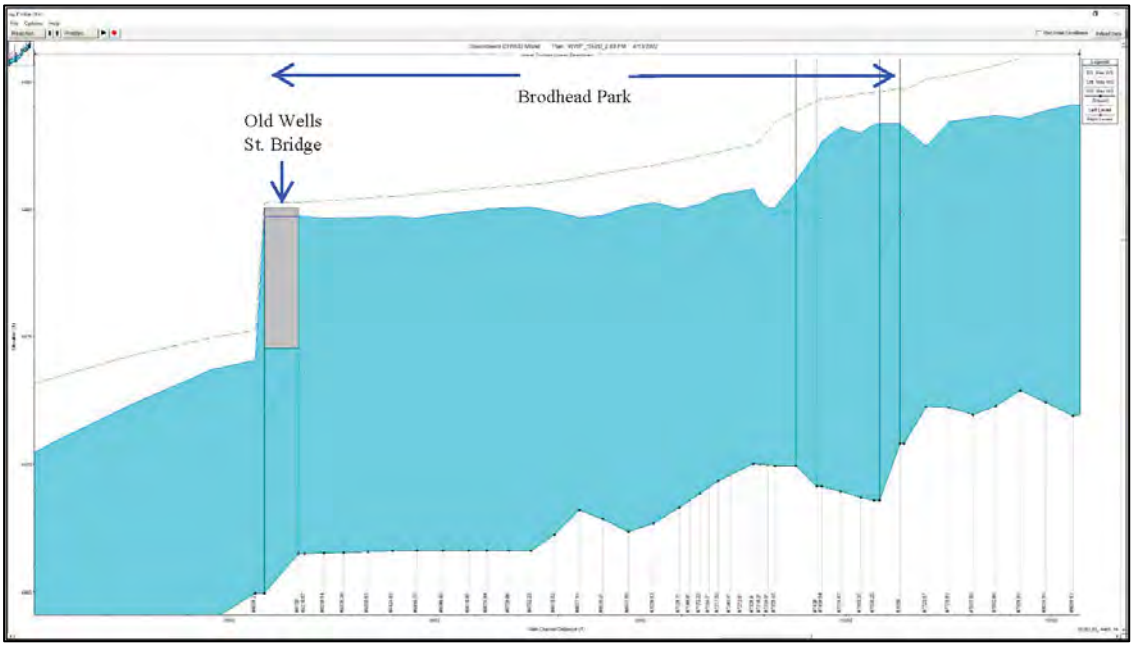

Figure 4. Longitudinal profile of Truckee River through the Project area.

3.4 Existing Vegetation

Existing vegetation within the Project area was mapped at the patch level, as shown in Figure 5. Vegetation within the Project area is composed primarily of overstory trees (e.g., Fremont cottonwood [*Populus fremontii*], Siberian elm [*Ulmus pumilla*], and gray alder [*Alnus incana*]) with greater shrub cover (e.g., crack willow [*Salix fragilis*], and Wood's rose [*Rosa woodsii*]) near the water (Figure 5). Groundcover is mostly lacking because the riverbank and shoreline are compacted by foot traffic. Riparian tree establishment is limited to vegetative spread due to the channelization of the river and sediment dynamics (i.e., dominance of erosion over deposition) except for one large, 0.2-acre island that occurs at the downstream end of the park. Most of the cottonwoods are senescing. Many cottonwood and willow trees have been damaged by beavers although some tree trunks have been wrapped with hardware cloth.

Noxious weeds as defined by the State of Nevada Department of Agriculture were not observed. The most significant invasive weed issue is the tree of heaven. Tree of heaven is allelopathic and forms dense monocultures through vegetative reproduction (DiTomaso et al. 2013). Tree of heaven appears to be a newer invasive plant along the riverbank at Brodhead Park, based on the lack of large trees. The City of Reno uses the cut stump treatment to treat tree of heaven, but re-treatment is almost always required (M. Basile, City of Reno Forester, pers. com.). Siberian elm are also abundant, and discussions regarding the desirableness of this species are needed. Current input from the City of Reno is that small Siberian elms should be considered for removal, where other trees are abundant and where their removal will not cause further bank destabilization (M. Basile, City of Reno Forester, pers. com.). Siberian elm trees to be prioritized for removal would be identified during the 60% design milestone. Crack willows are non-native and are invasive in other parts of the United States (e.g., Great Lakes region), but do not appear to form monocultures along the Truckee River.

3.5 Soil Conditions

Fifteen soil condition photo point locations were recorded during the site assessment. This survey revealed that the majority of the riverbank within the Project area is steep (25% to 50% slopes) and highly eroded; however, soil conditions within the area are variable. The site is generally characterized by exposed slopes with high densities of rock fragments. Most photo point locations had rock fragment densities ranging from 40% to 90%, with most rocks being cobble- to boulder-sized, ranging from 0.5 to 4 feet in diameter. A few locations along the riverbank contained rock densities of 20%–30%. Soil textures along the riverbank ranged from sandy loam to loamy sand.

The area between paved river path and the shoulder of the riverbank is comparatively flat with gentle slopes. While the majority of these areas are flat, they are relatively unvegetated and have few rock fragments (10% or less). It appears that "decomposed granite" may have been applied to the surface in the past, as the soil texture is coarse sand to sandy loam along the surface. Note: After the field surveys were completed, the City of Reno has since applied wood mulch to the flat, upland areas between the riverbank and paved trail, and planted cottonwood saplings near the water's edge.

Detailed observations and photos from the soil condition survey are provided in Appendix C.

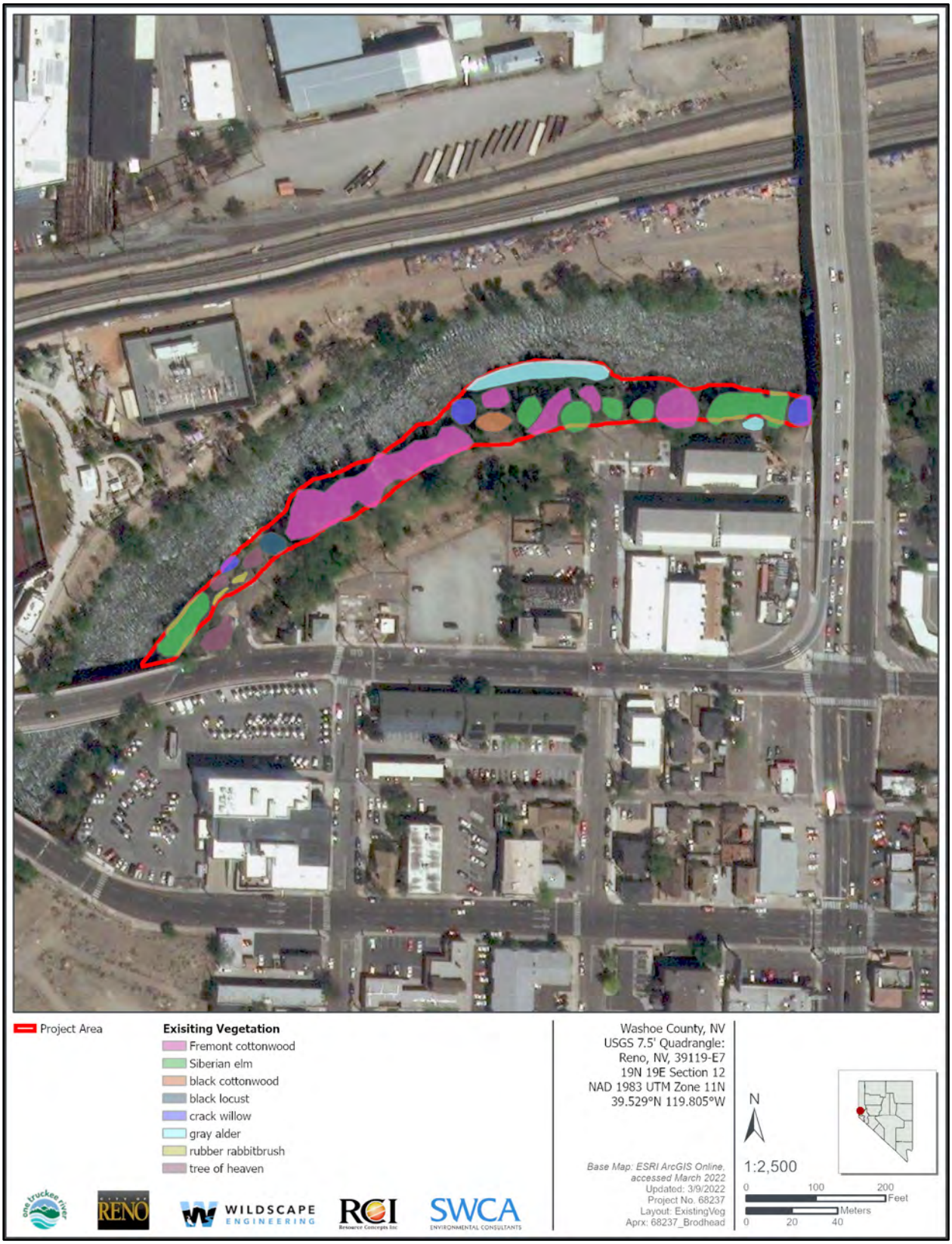

Figure 5. Dominant plants in vegetation patches as mapped in February 2022.

3.6 Community Outreach and Stakeholder Engagement

OTR, with support from SWCA, Truckee Meadows Park Foundation's AmeriCorps Program, and National Park Service conducted several community outreach and stakeholder engagement activities. The purpose of these meetings was to actively involve relevant stakeholders in the conceptual restoration design process and solicit public input on use of Brodhead Park and desired outcomes from park enhancements. Highlights from those meetings are summarized below.

3.6.1 Agency Kick-off Meeting

An on-site agency kick-off meeting was held at Brodhead Park on November 12, 2021, and included representatives from City of Reno Parks and Recreation, OTR, the CTWCD, SWCA, and Wildscape. The meeting was an opportunity to introduce Project team members, discuss the Project background and view the site as a group, so that high level desired outcomes could be identified and discussed. In depth discussions also focused on permitting considerations, jurisdictional constraints (especially constraints related to the 14,000-cfs conveyance zone), and management challenges and opportunities. The outcomes of that meeting have directly guided the engineering design and basis of design report provided here.

3.6.2 Meeting with Public Safety and Human Service Outreach Team

An on-site meeting with public safety and human services outreach team was held at Brodhead Park on January 26, 2022, and included representatives from OTR, Reno Police Department, Karma Box, and SWCA. The purpose of this meeting was to gain clarity on the RPD philosophy and best practices for vegetation management that is compatible with public safety. This meeting was also intended to start building a relationship with RPD to support future collaboration. The meeting afforded an in-depth discussion of public safety needs and best practices, including the standards developed for Crime Prevention through Environmental Design (CPED). For example, CPED has specific guidelines for vegetation and other park features that can support public safety:

- Minimize opportunities to hide by avoiding vegetation between the heights of two feet and six feet.
- Walkways should be direct and follow natural pathways, avoiding blind corners.
- Maintain sightlines and minimize areas out of public

Maintenance of sightlines through vegetation management was one factor emphasized. RPD expressed their genuine support for the restoration project at Brodhead and their desire to see it be successful and further identified other park improvements (outside of restoration) that would encourage positive behaviors and acceptable use of the park.

3.6.3 Community Outreach Event at IMBIB Brewery

A community outreach event was held on May 15, 2022, at IMBIB Brewery near Brodhead Park, in Reno, Nevada. The event was aimed at identifying members of the local neighborhood and community who have an interest in Brodhead Park and to begin building relationships with individuals who could become invested stakeholders in the Project in the future. The meeting was attended by nine people, including three members of the local neighborhood, two members of the Reno Parks Commission, one Karma Box employee, and three Reno citizens (who live outside of neighborhood). Public input included the following: identification of what the Truckee River means to each individual and personal stories from the river; general input on OTR's coordinated vegetation management planning effort; specific

suggestions on the restoration design plans; and input on desired improvements to the Truckee River corridor. The public had questions about plans for implementation, including funding sources, as well as concerns about restoration design being adequate to withstand a flood of record. Specific suggestions for the restoration design and park improvements included: input on trail locations and "hangout" areas near the river, community art installations and trail markers, needs for safety, requests for more community events, and requests for interpretive signage to describe the restoration.

3.6.4 City of Reno Implementation Planning Meeting

The City of Reno hosted an interdepartmental meeting on June 29, 2022, to discuss Brodhead Park Restoration plans (including implementation planning) and OTR's greater coordinated vegetation management planning effort. The meeting included City of Reno Public Works, Parks and Recreation, Urban Forestry, Clean and Safe Team, Fire Department, Police Department, as well as OTR and SWCA. Through the meeting, City of Reno staff identified strategies to improve the Framework Plan. Staff also identified potential maintenance concerns for Brodhead and the river in general, including concerns with: trash/dumping, encampments, a need for on-going site maintenance, and crime and safety. CPED strategies were referenced as being part of potential methods to address crime and safety. Other solutions included: controlled access, boulder placement, activation of the space, outreach and events, encourage recreational use, maintenance of sightlines through willow and plant trimming, and increased staff to complete plant maintenance work. The group discussed potential implementation resources that could be provided by the City of Reno to support the Brodhead restoration project, which are described in Appendix D.

3.6.5 Conceptual Design Meeting with City of Reno

A conceptual design meeting was held at Brodhead Park on August 30, 2022, to discuss the draft conceptual restoration design and to solicit input from the City of Reno on design plans and possible improvements. The meeting included City of Reno Public Works, Public Utilities, Parks and Recreation, Clean and Safe Team, Fire Department, Police Department, as well as representatives from OTR, SWCA, and Wildscape. The discussion included opportunities for collaboration on stakeholder outreach (especially with nearby developers), stump/log inventory (to inform restoration planning), and plant propagation with the City of Reno nursery. There were specific suggestions for: 1) plant materials that would be compatible with maintenance and needs for sightlines, including management of thicket-forming willows that do not support line-of-sight; 2) engineering and erosion control, including stormwater outfalls that should be identified, 3) strategies to address human dynamics, and 4) irrigation and maintenance. Those suggestions have been incorporated into the current conceptual restoration and design and would be further integrated into the 60% design milestone.

4 DESIGNS

4.1 Design Approach

The design approach applied for Brodhead Park's riverbank has been one of close collaboration with the City of Reno Parks and Recreation, OTR, SWCA, and Wildscape with critical input from CTWCD, public safety officials, human service outreach team, non-profits, and the public. Through this phase of the design process, it has become clear that the success of this restoration project relies on identifying restoration approaches that are scientifically sound and ecologically appropriate but that also work within the complex human dynamics of the park and riverbank. It is recommended that current and ongoing

community outreach guides the design, to build an invested stakeholder base to care for the riverbank as restoration is implemented, monitored, and maintained.

Note: The following sections and the 30% conceptual restoration design (Appendix A) are being proposed and recommended by SWCA and Wildscape; however, the selection and approval of design elements and vegetation species is ultimately up to the City of Reno and One Truckee River, with final approval being required by permitting and regulatory agencies to be identified during 60% design development. It is expected that concepts proposed here are subject to change and would evolve as the design process proceeds.

4.2 Design Opportunities and Constraints

The Project area contains several design constraints that must be worked within and management opportunities that could be addressed by the design. One consideration is flow velocities. With velocities in the range of 3–fps on the upper portions of the right bank, biotechnical treatments that mitigate for erosion and improve the riparian condition would be effective, however closer to the active channel or floodway where velocities increase significantly to 9–15 fps under the 100-year event, more robust treatments must be considered.

In addition to designing for the anticipated flow velocities and shear forces given the urban setting and need to maintain flood conveyance within the 14,000-cfs conveyance zone, all new treatments must not encroach beyond the existing or previously disturbed bank profile/condition or have the potential to raise flood water surface heights. Therefore, a more strategic approach to planting of riparian woody vegetation (especially willows and cottonwoods per the stipulations listed in Section 2.1.2 must be taken to prevent negative impacts.

There are existing utilities that must also be avoided and protected, including two large power poles with overhead lines that cross the river and a subsurface utility that crosses the river. Stormwater outlets would need to be accommodated. The large right bank bar that is functioning as a localized inset floodplain is not to be modified given CTWCD may need to remove or reduce its size dependent on its future influence on the flood conveyance area.

Using as much on-site native material as possible to reduce the need for import or off haul of materials was also taken into consideration during design development.

4.3 Conceptual Designs

Conceptual designs were developed and proposed by the Wildscape engineers in collaboration with SWCA Senior Restoration Ecologist, Dr. Susan Mortenson, and Principal Soil Ecologist, Dr. Mandy Bengtson, to improve bank conditions and prevent aggravated erosion in a manner that would maintain and increase pedestrian river access and enjoyment along the public access path. In the next revision of the Basis of Design Report during the 60% design milestone, this section would include a subsection that details implementation planning.

The conceptual plans in Appendix A highlight the existing conditions and proposed treatment areas by location and reference typical treatment details. The 14,000-cfs water surface elevation boundary and OHWM are included on the plans. Where banks remain in relatively good condition or where disturbance brings a high risk of further aggravated erosion (Figure 6), no active measures are proposed. Where harder protection is needed, new or enhanced planted riprap is proposed in order to incorporate riparian vegetation within the revetment. There are several areas along the paved path (outside of the 14,000-cfs

conveyance zone) where the grade can be raised and native shrubs planted and logs placed to redirect pedestrians to more stabilized river access points.

Figure 6. Rocked bank with trees near Kuenzli Bridge remain stable (photo left). Large trees and root system still holding slope on downstream end of project (photo right). Additional areas where slopes are unstable or eroding and slope stabilization is recommended are provided in Appendix C.

Six stabilized river access paths are currently proposed that would incorporate one or more types of surface treatments to prevent erosion as shown by several optional typical details in the design. Proposed boulder step trails would create river access paths out of an erosion control measure between Kuenzli Street Bridge and the Portland Loo. The proposed boulder step trails would not be Americans with Disabilities Act accessible, so a viewing area is currently proposed near the top of the trails along the paved river path to provide an alternative viewing point. Potential options for an ADA trail to the water's edge will be explored in the 60% design milestone in collaboration with Wildscape's engineering team and SWCA's landscape architect. The primary challenges to an ADA trail to the water's edge are expected to be conformance with the 14,000-cfs flood conveyance restrictions, the slope of the riverbank, and cost. One of the proposed boulder step paths would be wide enough for use as a put in/take out point for kayakers and rafters.

4.3.1 Vegetation Enhancement

Removal of non-native, invasive plants would be required prior to implementing any of the proposed revegetation treatments. The City of Reno Urban Forester would be responsible for identifying the species and specific trees to be removed, as well as best practices for removal. Tree of heaven is capable of sending up root sprouts 50 feet from the original plant, and removal of adult plants requires excavating the entire root system with a weed wrench or similar tool (DiTomaso et al. 2013). Siberian elm reproduces primarily by seed but can resprout from root material. Where trees are dense, the Urban

Forester recommends removing Siberian elms to create opportunities for other trees. The biggest Siberian elms can be left until new vegetation is better established. For large patches of Siberian elm, removal using large equipment during winter months is recommended followed by monitoring for root sprouts (U.S. Forest Service 2014). Disturbed areas should be restored and planted with desirable species soon after removal of invasive plants, in order to compete with weed species.

As described in Section 3.5, the soils within the Project area are sandy with a high density of rock fragments. Additions of supplemental soil would be required in many cases to provide sufficient fine-grained substrate for establishment of seedlings or larger potted plants. Supplemental soil should be of similar texture to the existing fine grained soil matrix or slightly finer. Inoculation of mycorrhizae is recommended to enhance establishment of natural soil microbial communities and processes. Organic supplements (e.g., weed-free, non-rice straw) may be added to provide some organic matter and to increase the water-holding capacity of the sandy soils. Inorganic fertilizers are not recommended for restoration, as excess nutrients can cause water quality issues in the river and favor establishment of weed species over desirable species. The process of developing the restoration design to its 60% and final milestones would require soil testing to determine what soil treatments are appropriate.

To create a list of proposed plants for restoration (i.e., a restoration plant palette), SWCA used the technique compatibility tool developed through the Framework Plan for this stretch of the Truckee River (SWCA 2022) to select plants that are compatible with one or more or the following jurisdictional constraints and vegetation management opportunities: City of Reno, within 14,000-cfs zone, manage foot traffic, support management of periodic encampments, erosion mitigation, provide shade, and wetland riparian habitat. The resulting plant list was then refined to remove 1) non-native plants based on goals and objectives of the Project, 2) obligate wetland species that would not survive without irrigation at elevations where restoration is being proposed, and 3) remove species with ecological requirements inconsistent with Brodhead Park (e.g., adapted to higher elevations, different soil types). This effort resulted in 58 potential species including 10 forbs, 16 graminoids, 26 subshrubs or shrubs, and 6 trees. The proposed plant list is preliminary and subject to change during the 60 and 90% design phases, based on restoration needs and plant availability. The 60% design milestone will carefully consider needs to maintain sightlines and will not propose any selection or placement of plants that would interfere with sightline maintenance. This analysis will include careful consideration of local viewshed, slope, and plant morphology.

Based on the range of elevations above the Truckee River where planting is proposed, three planting zones were developed based on elevation above base flow and recommendations by Hoag and Fripp (2002). Species were parsed into planting zones using wetland status as defined by USACE (2018), inundation and drought tolerances as defined by the Natural Resources Conservation Service (2022), and Dr. Susan Mortenson's professional knowledge. Planting zones include:

- The **overbank planting zone** is proposed for elevations up to 5 feet above the ordinary high water mark (OHWM; approximately 4,470 feet NAVD 88) and consists of facultative wetland plants or facultative plants with high inundation tolerance (Table 1).
- The **transitional planting zone** is proposed for elevations 5–8 feet above the OHWM and includes facultative and facultative upland plants with low drought tolerance (Table 2).
- The **upland planting zone** is proposed for areas greater than 8 feet above the OHWM and consists of facultative upland plants with medium to high drought tolerance and upland plants (Table 3).

Table 1. Overbank Planting Zone Plant Palette

Species	Common Name	Growth Form	Maximum Growth Height (ft)	Comments / Uses
*Acer negundo**	box elder	Tree	35	Establishment from cuttings rarely successful†
*Alnus incana**	gray alder	Tree	15	Plant using containerized stock†
*Cornus sericea**	Redosier dogwood	Shrub§	12	Would root from cuttings†
Distichlis spicata	saltgrass	Graminoid	1.1	
Equisetum laevigatum	smooth horsetail	Forb§	5	May not be commercially available
*Iris missouriensis**	Rocky Mountain Iris	Forb	1	May not be commercially available
*Juncus arcticus**	Arctic rush	Graminoid§	4	
Salix amygdaloides	peachleaf willow	Tree	45	Use cuttings from younger trees†
Salix bebbiana‡	Bebb willow	Shrub§	12	Would root from cuttings†
*Salix exigua**,‡	narrowleaf willow	Shrub§	10	Would root from cuttings†
*Salix laevigata**	red willow	Tree§	45	Would root from cuttings†
Salix lasiolepis‡	arroyo willow	Shrub§	35	Would root from cuttings†

Note: Nomenclature follows USDA (2002).

* shade tolerant.

†Hoag et al. 2008.

‡Thicket-forming willows (such as Bebb, narrowleaf, and arroyo willow) placement would be subject to analysis of sightlines maintenance during the 60% design milestone. Only under specific circumstances where sightlines can be maintained, would these species be allowable.

§Any plants with shrub morphology or that grow at a height between 2-6 feet would be subject to careful analysis to ensure compatibility with sightlines during the 60% design milestone. The specific needs for maintaining sightlines would depend on site conditions, including the angle of the slope, the location of other nearby visual obstructions, and distance to water.

Table 2. Transitional Planting Zone Plant Palette

Species	Common Name	Growth Form	Maximum Growth Height (ft)	Comments / Uses
*Amelanchier utahensis**	Utah serviceberry	Shrub	10	
Artemisia douglasiana	Douglas's sagewort	Forb	3§	
Asclepias fascicularis	Mexican whorled milkweed	Forb	5§	
Asclepias speciosa	showy milkweed	Forb	6§	
*Clematis ligusticifolia**	western white clematis	Vine	1	
Dasiphora fruticosa ssp. *Floribunda**	shrubby cinquefoil	Shrub	2.5	
*Geranium viscosissimum**	sticky purple geranium	Forb	3§	
Leymus cinereus	Great Basin wildrye	Graminoid	5§	
Leymus triticoides	beardless wildrye	Graminoid	3§	
*Lonicera involucrata**	twinberry honeysuckle	Shrub	10§	Would root from cuttings†
Pascopyrum smithii	western wheatgrass	Graminoid	2	
Populus fremontii‡	Fremont cottonwood	Tree	50	Would root from cuttings†
Prunus virginiana	chokecherry	Tree	15§	Does not propagate from cuttings†

Species	Common Name	Growth Form	Maximum Growth Height (ft)	Comments / Uses
*Ribes aureum**	golden currant	Shrub	10§	Would root from cuttings†
*Rubus parviflorus**	thimbleberry	Subshrub	4§	
Salix lasiolepis	arroyo willow	Shrub	35§	Would root from cuttings†

Note: Nomenclature follows USDA (2002).

* shade tolerant.

†Hoag et al. 2008.

‡The number of Fremont cottonwoods allowed to establish would be determined through discussions between City of Reno and CTWCD.

§ Any plants with shrub morphology or that grow at a height between 2-6 feet would be subject to careful analysis to ensure compatibility with sightlines during the 60% design milestone. The specific needs for maintaining sightlines would depend on site conditions, including the angle of the slope, the location of other nearby visual obstructions, and distance to water.

Table 3. Upland Zone Plant Palette

Species	Common Name	Growth Form	Maximum Growth Height (ft)	Comments / Uses
*Achillea millefolium**	common yarrow	Forb	3§	
Achnatherum nelsonii	Columbia needlegrass	Graminoid	3§	
Artemisia cana	silver sage	Shrub	5§	
Artemisia ludoviciana	white sagebrush	Subshrub	3§	
Artemisia tridentata ssp. *Tridentata*	basin big sagebrush	Shrub	9§	
Atriplex canescens	fourwing saltbush	Shrub	4§	
Atriplex confertifolia	shadscale saltbush	Shrub	3§	
Bromus marginatus	mountain brome	Graminoid	4§	
Chrysothamnus viscidiflorus	low rabbitbrush	Shrub	3§	
Cleome lutea	yellow beeplant	Forb	2.7§	
Elymus elymoides	bottlebrush squirreltail	Graminoid	1.5	
Elymus lanceolatus ssp. *Lanceolatus*	thickspike wheatgrass	Graminoid	2.3§	
Elymus lanceolatus ssp. *Riparius*	streambank wheatgrass	Graminoid	2.3§	
Elymus trachycaulus	slender wheatgrass	Graminoid	3§	
Ephedra nevadensis	Nevada ephedra	Shrub	3§	
*Ephedra viridis**	green ephedra	Shrub	3§	
Ericameria nauseosus	rubber rabbitbrush	Shrub	3§	
Eriogonum umbellatum	sulfur flower buckwheat	Subshrub	1	
*Festuca idahoensis **	Idaho fescue	Graminoid	2	
Grayia spinosa	spiny hopsage	Shrub	3§	
Helianthus maximiliani	Maximilian sunflower	Shrub	5§	
*Koeleria macrantha**	prairie junegrass	Graminoid	1.5	
*Mahonia repens**	creeping barberry	Subshrub	2	
*Poa secunda**	Sandberg bluegrass	Graminoid	1.4	

Species	Common Name	Growth Form	Maximum Growth Height (ft)	Comments / Uses
Prunus andersonii	desert peach	Shrub	6§	
*Purshia tridentata**	antelope bitterbrush	Shrub	6§	
Ribes velutinum	Desert gooseberry	Shrub	6§	May not be commercially available
*Rosa woodsii**	Wood's rose	Shrub	3§	
*Rhus trilobata**	skunkbush sumac	Shrub	4§	
*Sambucus nigra**	black gumweed	Shrub	23§	
*Sambucus racemosa**	red elderberry	Shrub	20§	Would root from cuttings†
*Shepherdia argentea**	silver buffaloberry	Shrub	18§	
Sphaeralcea ambigua	desert globemallow	Forb	5§§	
Symphoricarpos albus	Common snowberry	Shrub	3	

Note: Nomenclature follows USDA (2002).

* shade tolerant.

†Hoag et al. 2008.

§Any plants with shrub morphology or that grow at a height between 2-6 feet would be subject to careful analysis to ensure compatibility with sightlines during the 60% design milestone. The specific needs for maintaining sightlines would depend on site conditions, including the angle of the slope, the location of other nearby visual obstructions, and distance to water.

Most of the areas proposed for revegetation are shaded by existing trees or aspect of the riverbank, and shade tolerant plants, as indicated in Table 1 through Table 3, should be selected for restoration for most of the area.

Planted riprap is proposed for the Project area that require mitigation for erosion (Appendix A). Rounded river rock or more angular fractured rock (commonly used as riprap) are both options for slope stabilization. Riprap is a permanent layer of large stone, cobbles, or boulders used to armor and protect the soil surface against erosion. Plant materials used for these structures are traditionally cuttings from riparian woody plants that extend to the water table. Willow stems are (for many restoration projects) the material of choice for bioengineering structures due to their pliability and ease of establishing via cuttings. Species that would root from cuttings are indicated in Table 1 through Table 3. If using poles or whips, the cuttings would need to be long enough to reach the low water table with 1 foot above the ground. Placement of willows and selection of species would need to carefully consider the public safety needs, specifically maintenance of sightlines, and trash removal, to ensure any willow tree plantings are compatible with human dynamics in the Project area. Selection of non-thicket-forming willows may be best for areas where sight lines need to be maintained. During development of the 60% design, OTR and SWCA plan to have follow-up discussions with the Reno Police Department and human service outreach teams to continue to discuss possible willow planting areas and species that will not impede sightlines.

Angular riprap is commonly used as a method to discourage human use. It is important to note that angular fractured rock commonly has sharp edges and can be a safety concern (in some cases), creating a hindrance to recreational access and river rescue operations. Including vegetation or rounded boulders, minimizing fractured rock cover, and using other bank stabilization methods are strategies to maintain riparian function while encouraging human use (where desired). The design team would work to identify the best rock type (size, shape, and placement) for planted riprap during the 60% design milestone, specifically rock selection that meets recreational, recreation, safety, and engineering requirements.

For the next phase of restoration design, planting areas would be delineated based on these three planting zones, and the plant species proposed for each area would be refined based on local availability, ability for OTR to propagate plants, or the ability to contract-grow. Due to the high density of seed predators,

seeding would only be recommended if the seeds would be covered by erosion control fabric. Potted plants, vegetative mats, and cuttings are the preferred plant material for Brodhead Park.

4.3.2 Recreational Trail Access

An important aspect to establishing and maintaining restored vegetation is ensuring plants are protected from future disturbance, including clearly defining existing trails and developing additional trails for pedestrian foot traffic to control human access along the riverbank and to the river. Concept plans in Appendix A identify six proposed recreational trail locations, where park users may access the river. The proposed recreational trails would be composed of boulders or other natural materials and constructed to mitigate erosion and engineered to withstand high velocity flows. Therefore, the trails would provide bank stabilization purposes, in addition to pedestrian access. Previous trail locations would be blocked, decommissioned, and stabilized using native shrubs or buried logs to redirect users to these new trails.

4.3.3 Strategies to Promote Desired Behaviors

The Framework Plan (SWCA 2022) provides several suggested approaches for promoting desired behaviors in public spaces along the river. OTR would collaborate with the City of Reno and other partners to identify the best strategies to promote desired use of the riverbank and to ensure restored vegetation remains protected from human disturbance. As described above, controlled access via recreational trails would be important to support the protection of riverbank vegetation. A number of other possible strategies that could be considered include: continued community engagement and outreach throughout Project planning and implementation; public outreach to educate the public about the importance of maintaining restored vegetation; public involvement in ongoing care to create a sense of ownership of the riverbank and park; fencing; signage; maintenance of sightlines through strategic vegetation removal and planting; creating rock-covered surfaces in areas where management of encampments is frequent; planting low prickly plants to dissuade pedestrian or other access in unauthorized areas; provide trash clean-up and restoration focused sheltered employment and job training opportunities for underserved individuals and unhoused river users; continued engagement of volunteers; and organizing community events at the park to provide more reasons for a variety of people to visit the area.

4.4 Alternative to a Native Reference Ecosystem

SER (2019) has developed a decision tree to support restoration practitioners in the selection of appropriate native reference ecosystems for restoration projects (Figure 7). Because Brodhead Park is an urban public greenspace within a highly altered and regulated reach of the Truckee River with frequent human use, a native ecosystem that could serve as a reference or target for restoration has not been identified. In light of the constraints posed by the urban environment, SWCA instead suggests applying the most suitable restorative approach for Brodhead Park's riverbank that closely meets the SER's definition of rehabilitation, which is:

> "ecological repair activities that aim to restore ecosystem functioning rather than the biodiversity and integrity of a designated native reference ecosystem. Rehabilitation activities are well suited to a broad range of land and water management sectors where substantial native ecosystem recovery is not possible or desirable due to competing and legitimate human needs."

Without a native reference ecosystem to inform specific restoration targets to measure success of the Brodhead restoration efforts, SWCA recommends that restoration targets focus on meeting the goals and objectives outlined in Section 1.2. The specific metrics for success would be fine-tuned during

development of 60% and 90% design and directly informed through public outreach and stakeholder engagement

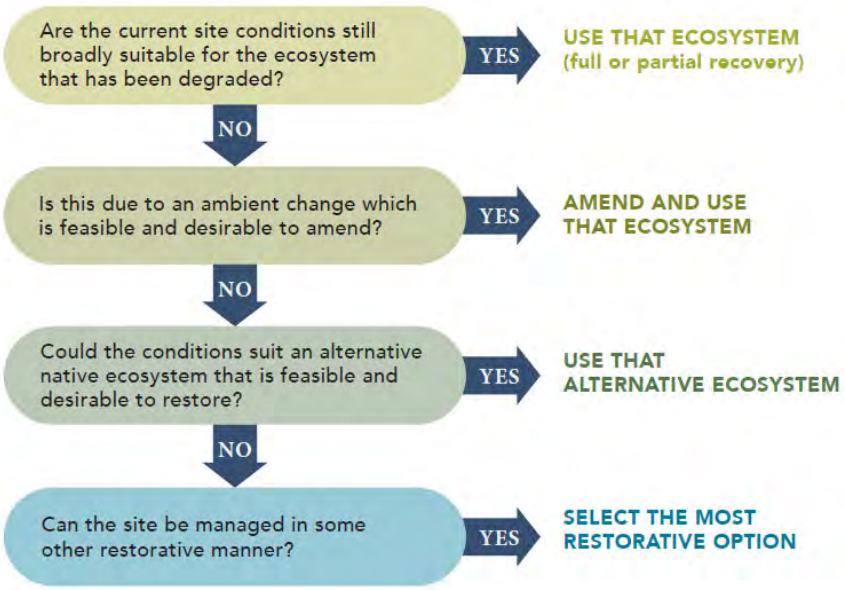

Figure 7. Decision tree to assist the selection of appropriate native reference ecosystems for restoration projects (SER 2019).

4.5 Construction Resources

The Brodhead Park Restoration Construction Resources Report (Resources Report) is the first step to identify the materials and labor needed to complete the Project through construction and ongoing maintenance (see Appendix D). In the development of the Resources Report, meetings were held with local stakeholders to get early commitment to help provide some of the materials and labor needed, and those organizations and agencies are identified within the Resources Report. At this early stage in the Project, many aspects of the restoration design are still subject to change, and implementation would likely not be until 2024; therefore, many materials and labor sources are yet to be identified. During the next phase of the Project, the Resources Report would be further developed as design features are refined and the implementation timeline is further developed and clarified.

4.6 Monitoring, Management and Maintenance

4.6.1 Ongoing Vegetation Management

A benefit of this restoration project is that it provides an opportunity to establish vegetation that is adapted to site conditions and that aligns with the maintenance needs of the park. An effective design would ensure that the cost and burden of ongoing maintenance decreases over time, after vegetation has been established. The greatest maintenance needs would occur in the initial growing season after construction. Plants would require supplemental water immediately after installation and over the first two growing seasons. Supplemental water should be applied monthly during fall and winter and weekly during spring and summer. If temperatures exceed 100 degrees Fahrenheit for more than 5 days, twice weekly irrigation would be required. Deep watering tubes that slowly release water are recommended to be installed for some woody species (e.g., Bainbridge 2014). Irrigation inputs for deep watering tubes can

be from a system via emitters or manual. There are two potential water sources at Brodhead Park that could be utilized for supplemental watering: the Portland Loo or sprinkler heads on the north side of the paved path.

Twice annual monitoring to identify and remove tree of heaven, Siberian elm, purple loosestrife (*Lythrum salicaria*), perennial pepperweed (*Lepidium latifolium*), and other non-native, invasive plants would be needed, especially 2–3 years following disturbance. Early detection and treatment of weeds following construction disturbance is vital to Project success.

Final plans would incorporate replacement of 20% of plants to account for potential mortality (in addition to overplanting that would occur during initial implementation).

Four-foot-tall cages constructed from 2 × 4-inch wire mesh supported by 0.5-inch-wide, 4-foot-tall rebar could be installed around select woody plants to protect plants from beavers and trampling (Figure 8). These cages can be removed after plant establishment, but some trees that are especially palatable for beavers (willows, cottonwoods) would require permanent fencing. Integrity of plant cages would need to be monitored at least monthly for potential damage from floods, animals, or humans.

4.6.2 Monitoring and Adaptive Management

Because of the known and expected human activity at Brodhead Park, as well as the challenges of establishing vegetation along a highly channelized section of the river (with altered hydrology), it is recommended that a robust adaptive management plan be developed to support ongoing management of the site, as part of the 60% design. SWCA recommends conducting regular qualitative monitoring of vegetation success and plant survival and photo point monitoring of engineering structures on an annual basis. A formal monitoring plan would be developed as part of 90% design project milestone. It is expected ongoing maintenance would be required (especially in the first five years after implementation), including supplemental water (during the first two years after construction) to establish vegetation. Adequate funding would need to be secured to cover plant replacement. An active and dedicated group of volunteers could provide supplemental support for care of the restoration project.

Figure 8. Example of a plant cage.

4.7 Next Steps

This Brodhead 30% Conceptual Design and Basis of Design Report is an initial design step that proposes a number of possible restoration design solutions to meet the Project needs, including the proposed goals and objectives (Section 1.2). SWCA and Wildscape can modify and clarify the design based on input from the City of Reno, other agencies, and community outreach and stakeholder engagement to produce through the 60% conceptual design milestone. Next steps include the following:

- SWCA understands that the next milestone for the Project (to be completed with additional grant funding awarded by the Truckee River Fund) would begin with a topographic survey of the Project area and would then develop the 60% restoration design and complete a refined cost estimate to take the Project through final design and construction. The 60% design process would also provide clarity on the agency permits/approvals needed, refine sources for materials for implementation, and identify needs and opportunities grow out of plant materials (in coordination with OTR's partners). Furthermore, with funding from River Network, a community-led research project will start in January 2023 focused on building a Truckee River Community Advisory Team with the goal of expanding and deepening connections with individuals living and working near Brodhead Park. The advisory team's focus will be to provide perspective about residents' priorities relating to the river. The advisory team could provide more input on the Project as it develops the 60% design.
- SWCA recommends future Project milestones identified in Section 1.1 (to be completed with future Project funding) would 1) develop the final restoration design, 2) complete application for all permits, and 3) cover restoration implementation, including site preparation, slope stabilization or bioengineering materials, plant materials, and labor for installation. Project installation could be collaborative, using government, non-profit, and private resources available in the area. The estimated cost and required materials would depend on design elements, permitting requirements, materials/labor provided through the in-kind support, and the outcomes of the 60% restoration design.
- OTR intends to connect and expand relationships with local non-profits in the non-profit engagement milestone. The goal of this effort would be to 1) build a system of support where local nonprofits target some of their program activities at Brodhead Park and its riverbank, 2) buildout a timeline, outreach strategy, and a variety of specific activities for local resident volunteers to engage with the Project's implementation and support on-going care after implementation, and 3) develop a proposal for ongoing coordination of volunteers to provide support to Brodhead Park and its riverbank, creating a committed base of local residents and river users are invested in the riverbank and park improvements and can enjoy the park's renewed recreation opportunities. The work defined in this effort would be implemented in a future public involvement milestone.
- Future Project needs would include ongoing monitoring and maintenance to ensure restored vegetation is maintained. A close collaboration of organizations, agencies, and supplemental volunteer support with adequate funding would likely be needed to ensure the Project is successful.

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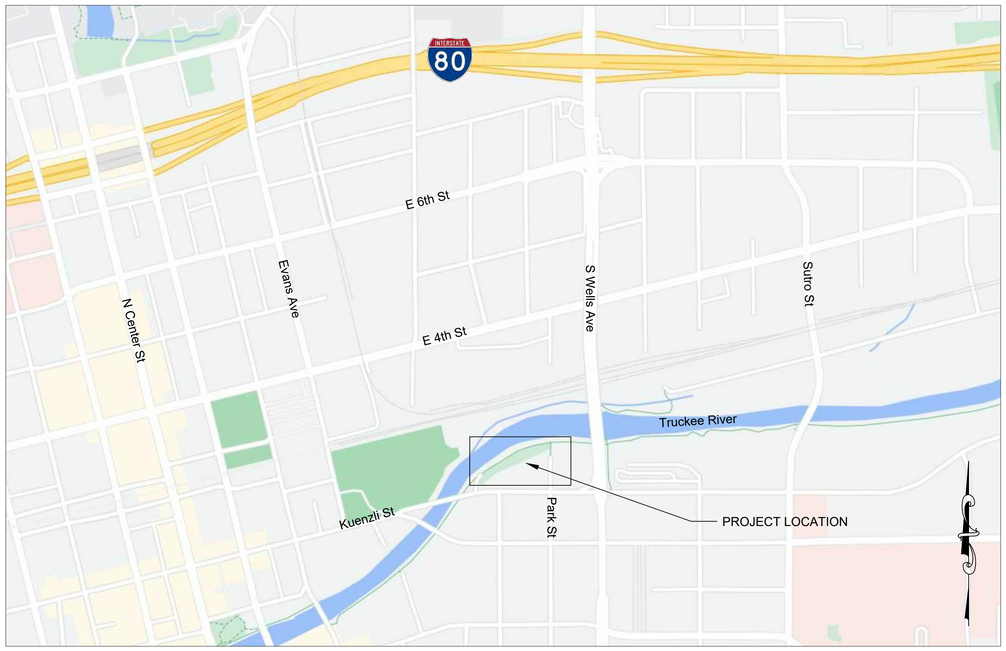
APPENDIX A

Conceptual Restoration Design Plans

Brodhead Park Restoration

WASHOE COUNTY, NV



VICINITY MAP

1"=500'

SITE MAP

1"=100'

APPROVED:

TBD, TBD

DESIGNED:

CAROL Y. BEAHAN, P.E., WILDSCAPE ENGINEERING, INC.

SHEET INDEX:

NUMBER	NAME	SHEET TITLE
1	G-1	TITLE SHEET
2	G-2	GENERAL NOTES
3	G-3	SHEET INDEX
4	C-1	PLAN AND PROFILE
5	C-2	PLAN AND PROFILE
6	C-3	SECTIONS
7	L-1	PLANTING PLAN PLACEHOLDER
8	L-2	PLANTING DETAILS
9	D-1	MISC. DETAILS
10	D-2	MISC. DETAILS

30% DESIGN NOT FOR CONSTRUCTION

WILDSCAPE ENGINEERING

WILDSCAPE ENGINEERING, INC.
1901 Airport Rd, Suite #108
South Lake Tahoe, CA 96150
www.wildscape-engineering.com

SWCA ENVIRONMENTAL CONSULTANTS

RCI Resource Concepts Inc

CITY OF RENO

one truckee river

Brodhead Park Restoration
Reno, NV 89502

Title Sheet

Designed:	Drawn:	Checked:
CYB	JA	CYB

File Date: 06/08/2022

REVISIONS:

No.	Date	Description

Notes:

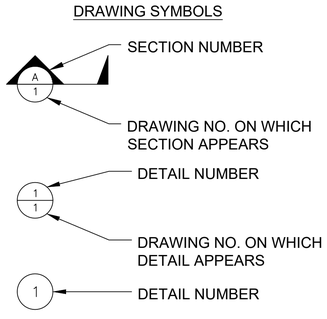
Sheet Scale: AS SHOWN

G-1

GENERAL NOTES

1. CONSTRUCTION SHALL TAKE PLACE FROM X:XX AM TO X:XX PM MONDAY THROUGH FRIDAY. NO WORK TO BE CONDUCTED WEEKENDS OR HOLIDAYS UNLESS OTHERWISE APPROVED ON A CASE BY CASE BASIS.
2. THE LOCATION AND EXTENT OF EXISTING UNDERGROUND UTILITIES IN THE PROJECT AREA ARE SHOWN BASED ON AVAILABLE RECORDS AND SHALL BE CONSIDERED APPROXIMATE AND NOT NECESSARILY COMPLETE.
3. **THE CONTRACTOR SHALL CONTACT UNDERGROUND SERVICE ALERT (USA) AT 811/1-800-642-2444 OR https://www.usanorth811.org AT LEAST 48 HOURS PRIOR TO ANY EXCAVATION WORK TO ENSURE UTILITY AVOIDANCE.**
4. CONTRACTOR SHALL CONTROL ACCESS, AND MAINTAIN ALL SIGNS, BARRICADES, OR OTHER DEVICES NECESSARY TO CONTROL TRAFFIC THROUGH THE CONSTRUCTION AREA AND MAINTAIN PUBLIC SAFETY IN ACCORDANCE WITH THESE PLANS, THE STANDARD SPECIFICATIONS, FEDERAL HIGHWAY ADMINISTRATION (FHWA) MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) 2003 EDITION.
5. NO GRADING OR LAND DISTURBANCE WITH RESPECT TO THE PROJECT WILL OCCUR AFTER OCTOBER 15 UNLESS PRIOR APPROVAL IS OBTAINED FROM THE NEVADA DIVISION OF ENVIRONMENTAL PROTECTION (NDEP)
6. THE CONTRACTOR SHALL MAINTAIN A SET OF AS-BUILT PLANS ONSITE SHOWING “AS-CONSTRUCTED” CHANGES MADE TO DATE. UPON COMPLETION OF THE PROJECT CONTRACTOR SHALL PROVIDE FINAL AS-BUILT PLANS TO ONE TRUCKEE RIVER (OTR) AND THE CITY OF RENO.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING ALL TEMPORARY EROSION CONTROL MEASURES RELEVANT TO THIS PROJECT. THE EROSION CONTROL MEASURES SHALLL BE IN ACCORDANCE WITH THE STORM WATER POLLUTION PREVENTION PLAN (SWPPP).
8. PROVIDE AND MAINTAIN TEMPORARY TOILET FACILITIES IN ACCORDANCE WITH STATE HEALTH DEPARTMENT, AND CITY OF RENO REQUIREMENTS. DO NOT LOCATE TEMPORARY TOILET FACILITIES ADJACENT TO A NATURAL WATER SOURCE, IN A WETLAND OR RIPARIAN AREA, OR IN A LOCATION TO CAUSE A PUBLIC HEALTH HAZARD, CONTAMINATION OR NUISANCE. AT COMPLETION OF WORK, REMOVE TOILET FROM PROJECT SITE.
9. SOURCES OF CONSTRUCTION WATER FOR THE PROJECT TBD (PLACEHOLDER)
10. CONSTRUCT REQUIRED SUBGRADE PRIOR TO PLACEMENT OF STRUCTURES OR FILL.
11. ALL RIPARIAN AND LANDSCAPED AREAS SHALL BE GRADED TO NATURAL SHAPES THAT TRANSITION SMOOTHLY TO ADJACENT FEATURES AND GRADES.
13. THE CONTRACTOR SHALL ONLY USE DESIGNATED SITES FOR STORAGE OF EQUIPMENT AND MATERIALS AS SHOWN ON THESE PLANS AND IS RESPONSIBLE FOR THE SECURITY OF ALL EQUIPMENT AND MATERIALS.
14. THE CONTRACTOR SHALL MAINTAIN COPIES OF ALL NECESSARY PERMITS, LICENSES AND AGENCY APPROVALS OBTAINED PRIOR TO PERFORMANCE OF THE WORK.
15. NO TREES OR RIPARIAN VEGETATION SHALL BE REMOVED UNLESS NOTED TO BE REMOVED IN THE PLANS OR SPECIFICATIONS, OR AS DIRECTLY SPECIFIED ON-SITE BY THE ENGINEER. TREES CONFLICTING WITH GRADING WILL BE LIMBED OR REMOVED UPON CITY OF RENO APPROVAL.
16. EQUIPMENT DELIVERY, SUPPLY DELIVERY AND SERVICE/FUELING VEHICLES WILL ONLY ENTER AND EXIT SITE WORK AREAS VIA THE APPROVED CONSTRUCTION ACCESS POINT(S) DURING NORMAL WORKING HOURS.
17. THE CONTRACTOR SHALL CLEANUP SPILLS IMMEDIATELY AND NOTIFY APPROPRIATE AGENCIES OF SPILLS AND CLEANUP PROCEDURES. REFUELING AREAS AND ANY EQUIPMENT REPAIR OR SIMILAR ACTIVITY WILL ONLY TAKE PLACE IN DESIGNATED STAGING AREAS.
18. PRIOR TO PROJECT IMPLEMENTATION ONE TRUCKEE RIVER AND THE CITY OF RENO WILL NOTIFY THE PUBLIC REGARDING ANY TEMPORARY CLOSURE OF THE PARK OR PATHWAY. IMMEDIATELY PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL INSTALL FENCING AND ADEQUATE SIGNAGE TO INDICATE THAT THE TRAIL IS TEMPORARILY CLOSED UNTIL CONSTRUCTION IS COMPLETE.
20. A TOTAL OF (X) TREES 14" DIAMETER OR LARGER ARE EXPECTED TO BE REMOVED IN ORDER TO ACCOMMODATE CONSTRUCTION AS SHOWN ON SHEET C-X.
21. OFFHAUL AND PROPERLY DISPOSE OF ALL EXCESS MATERIAL NOT INCORPORATED AS BACKFILL OR INTO PRESCRIBED ONSITE TREATMENTS.

DRAWING SYMBOLS



UTILITIES:

CABLE TELEVISION:	**CHARTER COMMUNICATIONS**: 888.369.2408
NATURAL GAS:	**NV ENERGY**: 775.834.4444
ELECTRIC:	**NV ENERGY**: 775.834.4444
SEWER AND STORM DRAIN:	**CITY OF RENO SEWER SERVICE**: 775.334.2095
WATER:	**TRUCKEE MEADOWS WATER AUTHORITY**: 775.834.8080
TELEPHONE:	**ATT**: 800.288.2020

TOPOGRAPHY AND AERIAL IMAGE SOURCE AND CONTROL:

TOPOGRAPHY SOURCE - TRUCKEE TOPOBATHYMETRIC LiDAR (10.05.2014)
HORIZONTAL CONTROL - NAD83 WEST US FEET (1984)
VERTICAL CONTROL - NAVD88 (GEOID99)
AERIAL IMAGE - BING 2021

LEGEND:

- EX MINOR CONTOUR
- EX MAJOR CONTOUR
- PROPOSED GRADE
- PARCEL BOUNDARY
- EX PAVED TRAIL
- SEDIMENT BARRIER (X D–X)
- EXCLUSION FENCE (X D–X)
- TURBIDITY CURTAIN
- OVERHEAD LINE
- UNDERGROUND TELEPHONE
- SANITARY SEWER
- STORM DRAIN
- 14K WSL
- PROJECT BOUNDARY
- RETAINING WALL
- N TRAIL
- EX UTILITY POLE
- PLANTED RIP RAP
- SOIL AND BIODEGRADABLE NETTING
- LOG CRIB WALL
- KEYED IN LOGS
- UPLAND ZONE PLANT PALETTE
- TRANSITIONAL ZONE PLANT PALETTE
- OVERBANK ZONE PLANT PALETTE
- WOODS ROSE AND SKUNKBUSH SUMAC

ABBREVIATIONS

AC	ASPHALT CONCRETE
AB	AGGREGATE BASE
APPROX/~	APPROXIMATELY
CDFW	CA DEPARTMENT OF FISH AND WILDLIFE
CFS	CUBIC FEET PER SECOND
CL	CENTERLINE
CONC	CONCRETE
DBH	DIAMETER BREAST HEIGHT
DIAM	DIAMETER
EG	EXISTING GRADE
EX	EXISTING
EL	ELEVATION
FT	FEET
ENF	EL DORADO NATIONAL FOREST
INV	INVERT
LB	LEFT BANK
LG	LARGE
LOD	LIMIT OF DISTURBANCE
MAX/MIN	MAXIMUM/MINIMUM
N	NEW
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
OHWM	ORDINARY HIGH WATER MARK
OTR	ONE TRUCKEE RIVER
PR	PROPOSED GRADE
PVC	POLYVINYL CHLORIDE
RB	RIGHT BANK
RC	RELATIVE COMPACTION
RSP	ROCK SLOPE PROTECTION
SF	SQUARE FOOT
STA	STATION
TBD	TO BE DETERMINED
TRWC	TRUCKEE RIVER WATERSHED COUNCIL
TYP	TYPICAL
VERT	VERTICAL
W/	WITH
WSE	WATER SURFACE ELEVATION
#	NUMBER
%	PERCENT
'	FEET
"	INCHES
@	AT
3:1	HORIZONTAL TO VERTICAL SLOPE

CONTACT THE ENGINEER FOR SYMBOLS OR ABBREVIATIONS NOT SHOWN

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2	G-2	GENERAL NOTES
3	G-3	SHEET INDEX
4	C-1	PLAN AND PROFILE
5	C-2	PLAN AND PROFILE
6	C-3	SECTIONS
7	L-1	PLANTING PLAN PLACEHOLDER
8	L-2	PLANTING DETAILS
9	D-1	MISC. DETAILS
10	D-2	MISC. DETAILS

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G-3

NOTES:

1. EXISTING CONDITIONS SHOWN ARE BASED-ON 10/2014 LiDAR-GENERATED CONTOURS FROM TRUCKEE TOPOBATHYMETRIC LiDAR.
2. NO LARGE TREES TO BE PLANTED UNDER EXISTING POWER LINES.

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INSTALL N BENCH

LEAVE ~96 LF STABLE RIP RAP BANK AS IS.

TERRACE AND EXTEND ~45 LF MID-BANK ROCK RETAINING WALL OR SIMILAR TO REDUCE SLOPE

1/2 D-2

KUENZLI ST BRIDGE

REPLACE/INSTALL ~909 SF PLANTED RIP RAP WITH TRANSITIONAL ZONE PALETTE PLANTS

1 D-1

PLANT WOODS ROSE AND SKUNKBUSH SUMAC INBETWEEN ROCK.

A C-3

B C-3

PROTECT COTTONWOOD STUMP

KEY IN LOGS

3 D-1

INSTALL BURIED LOGS AND NATIVE SHRUBS FROM UPLAND ZONE PLANT PALETTE TO REDIRECT PEDESTRIANS TO N STABLE TRAIL BY COTTONWOOD.

3 D-1

REMOVE & DISPOSE OF EX CONCRETE BLOCK

REPLACE END SECTION PVC PIPE AND ROCK OUTLET.

X D-X

PLANT TO BLOCK ACCESS

PROTECT EX POWER POLES AND UTILITY BOX. SEE NOTE 2.

INSTALL BOULDER TRAIL ACCESS #1

INSTALL BOULDER TRAIL ACCESS #2

TIE ROCK RETAINING WALL INTO EX RIPRAP

EX PORTALOO

REMOVE TREE OF HEAVEN AND PLANT SHRUBS FROM UPLAND ZONE PLANT PALETTE

INSTALL COTTONWOOD CLUMPS

REMOVE AND SALVAGE DAMAGED COTTONWOODS PER FIELD DIRECT. PRESERVE ANY COTTONWOODS W/ EX WIRE PROTECTION.

OHWM EL:4470

SUPPLEMENT EX RIPRAP

INSTALL LOG BORDER

INSTALL BOULDER TRAIL/LAUNCH ACCESS #3

3 D-1 INSTALL 1-2 OWL/BAT BOXES PER FIELD DIRECT.

PRESERVE HEALTHY COTTONWOODS AND INSTALL BEAVER PROTECTION

5 D-2

INCORPORATE SHADE TOLERANT PLANTS IN LOCALIZED EROSION AREAS BY COTTONWOOD STAND PER FIELD DIRECT.

ADD SOIL TO RAISE GRADE AND STABILIZE WITH UPLAND ZONE PALETTE PLANTINGS

REMOVE TREE OF HEAVEN AND REPLANT WITH CHOKECHERRY

INCORPORATE BOX ELDER PLANTINGS WITHIN EX RIP RAP (~713 SF)

PROTECT MATURE PEACHLEAF WILLOW

5 D-2

SEE SHEET C-2 MATCHLINE

REMOVE COYOTE WILLOW AND SIBERIAN ELMS PER FIELD DIRECT

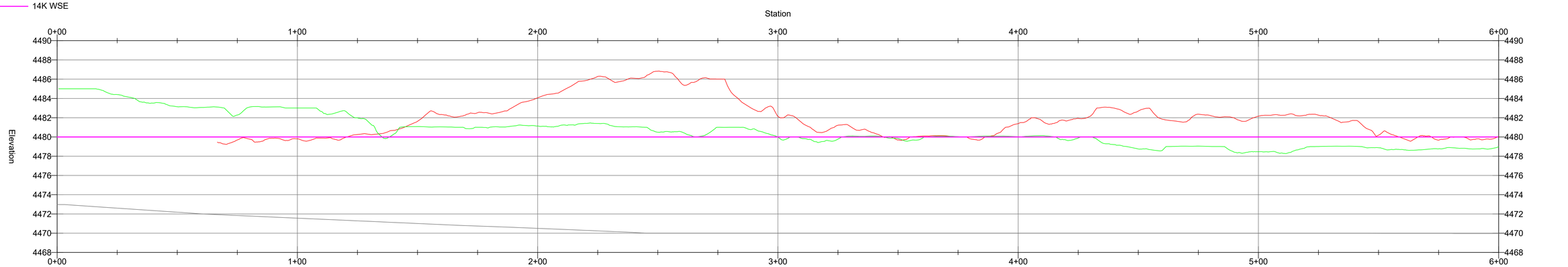
14K WSE

TRUCKEE RIVER

0 20 40
SCALE IN FEET

LEGEND

- CHANNEL CENTER
- RIGHT BANK
- LEFT BANK
- 14K WSE



TRUCKEE RIVER PROFILE
VERTICAL EXAGGERATION X4

0 20 40
SCALE IN FEET

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C-1

4 of 10

NOTES:

1. EXISTING CONDITIONS SHOWN ARE BASED-ON 10/2014 LiDAR-GENERATED CONTOURS FROM TRUCKEE TOPOBATHYMETRIC LiDAR.

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PLANT W/ TRANSITIONAL ZONE PLANTING PALETTE AND UPLAND PALETTE.

BUILD BACK AND STABILIZE BANK WITH PLANTED RIP RAP PER FIELD DIRECT. PROTECT EX LARGE TREES. (X / D-X)

INSTALL PLANTED RIP RAP WITH PLANTS FROM OVERBANK AND TRANSITIONAL PLANTING ZONE PALETTES (~2,869 SF) (1 / D-1)

REMOVE BURNED TREES. INSTALL KEYED BOULDER SEATING AREA.

INSTALL ROCK-LINED SWALE AT OUTLET.

INSTALL ROCK-LINED SWALE AT OUTLET.

14K WSE

INSTALL BOULDER TRAIL ACCESS #5

RESTORE/REVEGETATE ERODED AREAS

REPLACE CONCRETE BLOCKS W/ LARGE BOULDERS

INSTALL BOULDER TRAIL ACCESS #4. (3 / D-2)

INSTALL BOULDER TRAIL ACCESS #6 (3 / D-2)

MATCHLINE SEE SHEET C-1

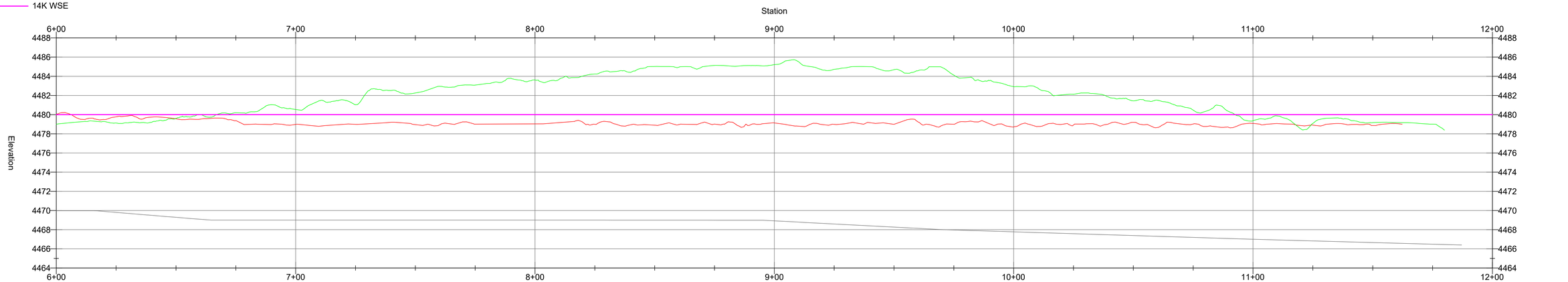
S Wells Ave

10' DIAM SD

0 20 40 SCALE IN FEET

LEGEND

- CHANNEL CENTER
- RIGHT BANK
- LEFT BANK
- 14K WSE



TRUCKEE RIVER PROFILE

VERTICAL EXAGGERATION X4

0 20 40 SCALE IN FEET

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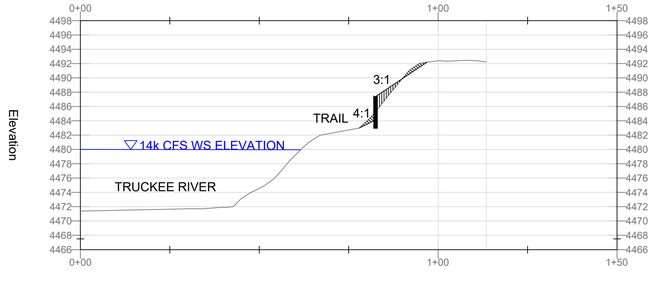
C-2

LEGEND

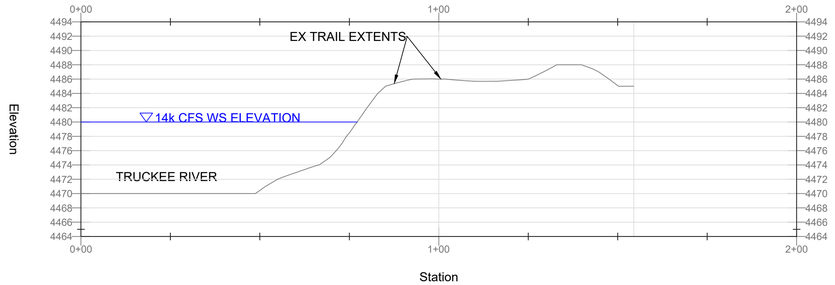
CUT

FILL

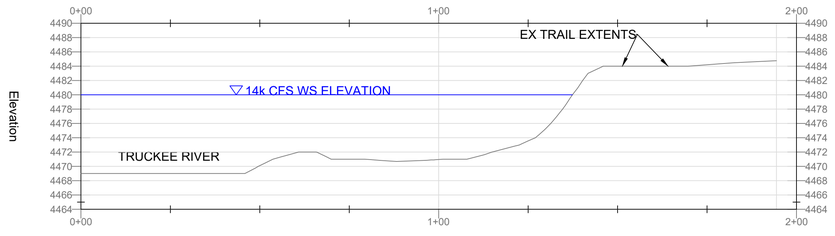
RIP RAP



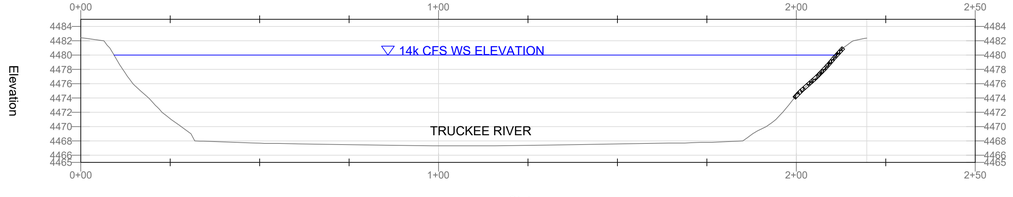
SECTION A-A
VERTICAL EXAGGERATION X2



SECTION B-B
VERTICAL EXAGGERATION X2



SECTION C-C
VERTICAL EXAGGERATION X2



SECTION D-D
VERTICAL EXAGGERATION X2

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0 20 40
SCALE IN FEET

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C-3

Table 1. Overbank Planting Zone Plant Palette

Species	Common Name	Growth Form	Maximum Height (ft)	Comments / Uses
*Acer negundo**	box elder	Tree	35	Establishment from cuttings rarely successful†; Deep plant in tree or tall pots
*Alnus incana**	gray alder	Tree	15	Plant using containerized stock†
*Cornus sericea**	redosier dogwood	Shrub	12	Will root from cuttings†
Distichlis spicata	saltgrass	Graminoid	1.1	
Equisetum laevigatum	smooth horsetail	Forb	5	May not be commercially available
*Iris missouriensis**	Rocky Mountain Iris	Forb	1	May not be commercially available
Juncus arcticus ssp. littoralis*	Arctic rush	Graminoid	4	
Salix amygdaloides	peachleaf willow	Tree	45	Use cuttings from younger trees†
Salix bebbiana	Bebb willow	Shrub	12	Will root from cuttings†
*Salix exigua**	narrowleaf willow	Shrub	10	Will root from cuttings†
*Salix laevigata**	red willow	Tree		Will root from cuttings†
Salix lasiolepis	arroyo willow	Shrub	35	Will root from cuttings†

Note: Asterisks indicate shade tolerance. Nomenclature follows USDA (2002). †Hoag et al. 2008. Narrowleaf willow placement will be subject to analysis of sightlines for law enforcement.

Table 2. Transitional Planting Zone Plant Palette

Species	Common Name	Growth Form	Maximum Height (ft)	Comments / Uses
*Amelanchier utahensis**	Utah serviceberry	Shrub	10	
Artemisia douglasiana	Douglas's sagewort	Forb	3	
Asclepias fascicularis	Mexican whorled milkweed	Forb	5	
Asclepias speciosa	showy milkweed	Forb	6	
*Clematis ligusticifolia**	western white clematis	Vine	1	
*Dasiphora fruticosa ssp. floribunda**	shrubby cinquefoil	Shrub	2.5	
*Geranium viscosissimum**	sticky purple geranium	Forb	3	
Leymus cinereus	Great Basin wildrye	Graminoid	5	
Leymus triticoides	beardless wildrye	Graminoid	3	
*Lonicera involucrata**	twinberry honeysuckle	Shrub	10	Will root from cuttings†
Pascopyrum smithii	western wheatgrass	Graminoid	2	
Populus fremontii	Fremont cottonwood	Tree	50	Will root from cuttings†
Prunus virginiana	chokecherry	Tree	15	Does not propagate from cuttings†
*Ribes aureum**	golden currant	Shrub	10	Will root from cuttings†; Deep plant in tree or tall pots
*Rubus parviflorus**	thimbleberry	Subshrub	4	
Salix lasiolepis	arroyo willow	Shrub	35	Will root from cuttings†

Note: Asterisks indicate shade tolerance. Nomenclature follows USDA (2002). †Hoag et al. 2008. The number of Fremont cottonwoods allowed to establish will be determined through discussions between City of Reno and Carson Truckee Water Conservancy District.

Table 3. Upland Zone Plant Palette

Species	Common Name	Growth Form	Maximum Height (ft)	Comments / Uses
*Achillea millefolium**	common yarrow	Forb	3	
Achnatherum nelsonii	Columbia needlegrass	Graminoid	3	
Artemisia cana	silver sage	Shrub	5	
Artemisia ludoviciana	white sagebrush	Subshrub	3	
Artemisia tridentata ssp. tridentata	basin big sagebrush	Shrub	9	
Atriplex canescens	fourwing saltbush	Shrub	4	
Atriplex confertifolia	shadscale saltbush	Shrub	3	
Bromus marginatus	mountain brome	Graminoid	4	
Chrysothamnus viscidiflorus	low rabbitbrush	Shrub	3	
Cleome lutea	yellow beeplant	Forb	2.7	
Elymus elymoides	bottlebrush squirreltail	Graminoid	1.5	
Elymus lanceolatus ssp. lanceolatus	thickspike wheatgrass	Graminoid	2.3	
Elymus lanceolatus ssp. riparius	streambank wheatgrass	Graminoid	2.3	
Elymus trachycaulus	slender wheatgrass	Graminoid	3	
Ephedra nevadensis	Nevada ephedra	Shrub	3	
*Ephedra viridis**	green ephedra	Shrub	3	
Ericameria nauseosa	rubber rabbitbrush	Shrub	3	
Eriogonum umbellatum	sulfur flower buckwheat	Subshrub	1	
*Festuca idahoensis **	Idaho fescue	Graminoid	2	
Grayia spinosa	spiny hopsage	Shrub	3	
Helianthus maximiliani	Maximilian sunflower	Shrub	5	
*Koeleria macrantha**	prairie junegrass	Graminoid	1.5	
*Mahonia repens**	creeping barberry	Subshrub	2	
*Poa secunda**	Sandberg bluegrass	Graminoid	1.4	
Prunus andersonii	desert peach	Shrub	6	
*Purshia tridentata**	antelope bitterbrush	Shrub	6	
Ribes velutinum	Desert gooseberry	Shrub	6	May not be commercially available
*Rosa woodsii**	Wood's rose	Shrub	3	
*Rhus trilobata**	skunkbush sumac	Shrub	4	Deep plant in tree or tall pots
*Sambucus nigra ssp. cerulea**	black elderberry	Shrub	23	
*Sambucus racemosa**	red elderberry	Shrub	20	Will root from cuttings†
*Shepherdia argentea**	silver buffaloberry	Shrub	18	Deep plant in tree or tall pots
Sphaeralcea ambigua	desert globemallow	Forb	5	
Symphoricarpos albus	Common snowberry	Shrub	3	

Note: Asterisks indicate shade tolerance. Nomenclature follows USDA (2002). †Hoag et al. 2008

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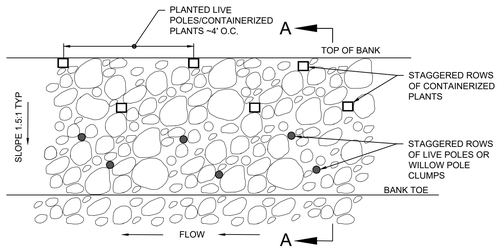
L-1

VEGETATED RIPRAP GENERAL NOTES

1. BOULDER RIPRAP SHALL BE KEYED INTO THE BANK TOE TO AVOID UNDERMINING AT THE TOE OF THE SLOPE
2. WILLOW POLES OR WILLLOW BUNDLES SHALL BE IN CONTACT WITH THE MOIST SOIL BELOW THE RIPRAP. PLANTING OF WILLOW POLES DURING THE DORMANT SEASON OF THE PLANT SPECIES IS PREFERRED.
3. LIVE STAKES SHALL BE 0.75 INCHES TO 2.5 INCHES IN DIAMETER AND A MIN. OF 4 FEET LONG WITH SIDE BRANCHES CLEANLY REMOVED.
4. THE BOTTOM (BASAL) END OF LIVE STAKES SHALL BE CLEANLY CUT AT A 45 DEGREE ANGLE. ALL PLANTINGS SHALL BE INSTALLED PERPENDICULAR TO THE SLOPE.
5. LIVE POLES FOR PLANTED RIPRAP MAY BE INSTALLED THE DAY THEY ARE HARVESTED IF WATERED. SOAKING FOR A MINIMUM 24 HOURS IS REQUIRED WHEN PLANTING IS DELAYED.
6. LIVE POLES FOR PLANTED RIPRAP MAY BE INSTALLED LEAVING A FEW INCHES ABOVE THE TOP OF THE RIPRAP OR CUT FLUSH WITH THE TOP OF THE RIPRAP. AT LEAST TWO BUDS OR BUD SCARS SHALL BE PRESENT ON THE STAKE WHEN INSTALLED.
7. VOIDS IN RIPRAP WHERE LIVE STAKES ARE INSTALLED SHALL BE BACKFILLED WITH A WATER AND SOIL SLURRY MIXTURE TO A MINIMUM DEPTH OF HALF THE RIPRAP LAYER THICKNESS.
8. TALL CONTAINER PLANTS CONSISTING OF NATIVE SHRUBS AND TREES FROM TRANSITIONAL AND UPLAND PLANTING PALETTES MAY SUBSTITUTE FOR WILLOW STAKES IN THE UPPER BANK AREAS. INSTALLATION OF SHRUB PLANTS WITHIN BOULDER PLACEMENT TO BE DONE UNDER SUPERVISION TO ENSURE AN ADEQUATE PLANTING HOLE AND SUFFICIENTLY KEYED IN BOULDERS. SHRUBS WILL REQUIRE TEMPORARY IRRIGATION.
9. RIPRAP BOULDER D50 SIZE TO BE 1 FT DIAMETER. RIPRAP SHOULD BE HARD, DURABLE AND ANGULAR IN SHAPE. SALVAGED ONSITE BOULDERS MAY ALSO BE USED.

1 PLANTED RIP RAP

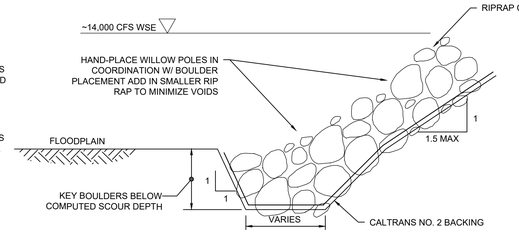
(SOURCE: MODIFIED TDOT)



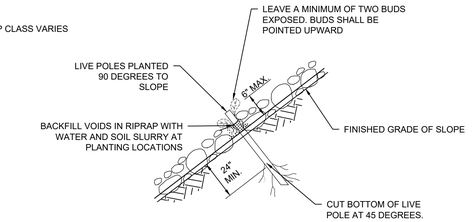
PLAN VIEW
VEGETATED RIPRAP

● LIVE POLE

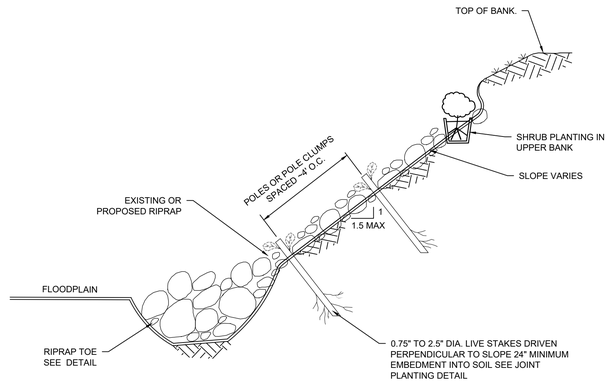
□ CONTAINERIZED PLANT



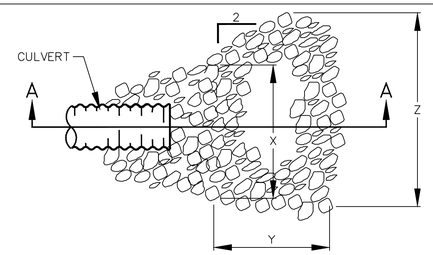
RIPRAP TOE DETAIL



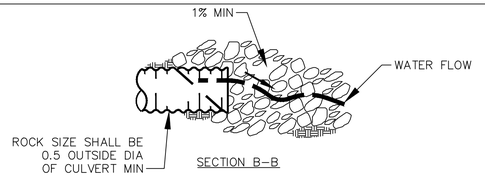
LIVE POLE RIPRAP JOINT
PLANTING DETAIL



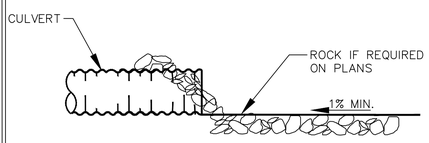
SECTION A-A



INLET PROTECTION
PLAN VIEW

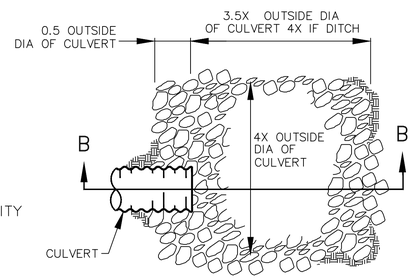


SECTION B-B



SECTION A-A

DO NOT USE
THIS DETAIL
IF THE STORM WATER VELOCITY
IS LESS THAN 5ft./SEC



OUTLET PROTECTION
PLAN VIEW

INLET PROTECTION
MINIMUM DIMENSIONS

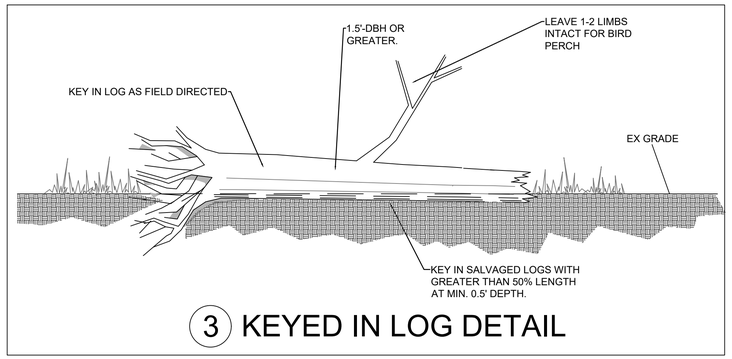
ROCK CLASS	PIPE ø IN.	X FEET	Y FEET	Z FEET
NO. 1 BACKING	12	3	4	5
NO. 1 BACKING	18	4.5	6	7.5
NO. 1 BACKING	24	6	8	10
NO. 1 BACKING	30	7.5	10	12.5
NO. 1 BACKING	36	9	12	15
NO. 1 BACKING	42	10.5	14	17.5
NO. 1 BACKING	48	12	16	20

NOTES:

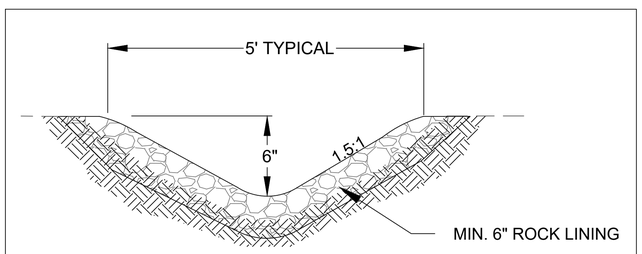
1. HAND PLACE ROCKS.
2. ALL ROCKS SHALL BE ANGULAR.
3. WHERE OUTLET SLOPE EXCEEDS 5%, A SEDIMENT BOWL OR ENERGY DISSIPATOR SHALL BE REQUIRED.
4. ROCK SLOPE PROTECTION SHALL BE SLOPED AT A MIN OF 1% INTO OR OUT OF CULVERT.
5. ALL CULVERTS OF 48 INCHES OR LARGER SHALL BE INSTALLED WITH REINFORCED CONCRETE HEADWALLS AND END WALLS WITH CUTOFF WALLS UNLESS OTHERWISE APPROVED BY THE ENGINEER.
6. ON OUTLET APPLICATIONS, 50% OF THE ROCKS SHALL BE LARGER THAN HALF THE DIAMETER OF THE PIPE.

2 ARMORED PIPE OUTFALL

PLACE HOLDER



3 KEYED IN LOG DETAIL



ROCK LINED SWALE

4 ROCK LINED SWALE

PLACE HOLDER

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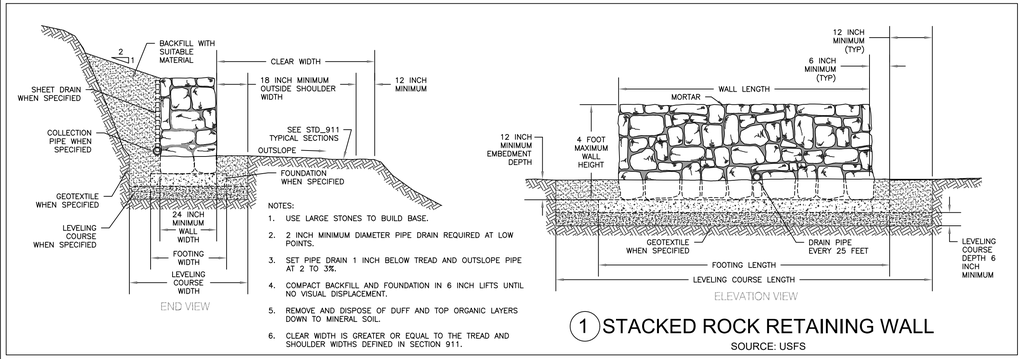
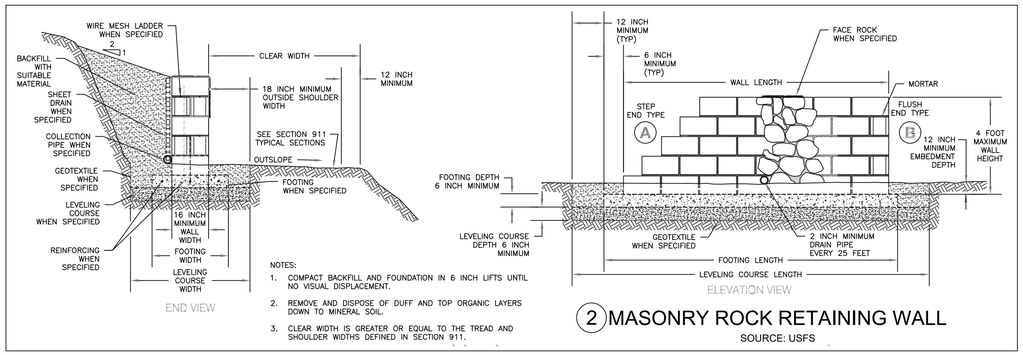


NOTES:

1. USE LARGE STONES TO BUILD BASE.
2. 2 INCH MINIMUM DIAMETER PIPE DRAIN REQUIRED AT LOW POINTS.
3. SET PIPE DRAIN 1 INCH BELOW TREAD AND OUTSLOPE PIPE AT 2 TO 3%.
4. COMPACT BACKFILL AND FOUNDATION IN 6 INCH LIFTS UNTIL NO VISUAL DISPLACEMENT.
5. REMOVE AND DISPOSE OF DUFF AND TOP ORGANIC LAYERS DOWN TO MINERAL SOIL.
6. CLEAR WIDTH IS GREATER OR EQUAL TO THE TREAD AND SHOULDER WIDTHS DEFINED IN SECTION 911.

1 STACKED ROCK RETAINING WALL

SOURCE: USFS

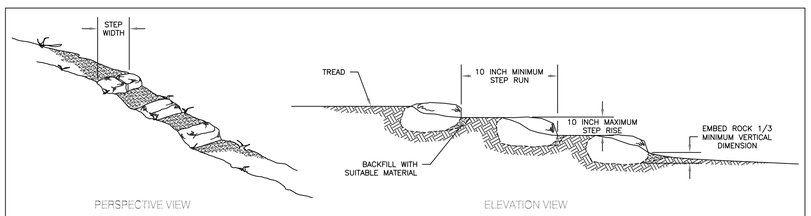


NOTES:

1. COMPACT BACKFILL AND FOUNDATION IN 6 INCH LIFTS UNTIL NO VISUAL DISPLACEMENT.
2. REMOVE AND DISPOSE OF DUFF AND TOP ORGANIC LAYERS DOWN TO MINERAL SOIL.
3. CLEAR WIDTH IS GREATER OR EQUAL TO THE TREAD AND SHOULDER WIDTHS DEFINED IN SECTION 911.

2 MASONRY ROCK RETAINING WALL

SOURCE: USFS

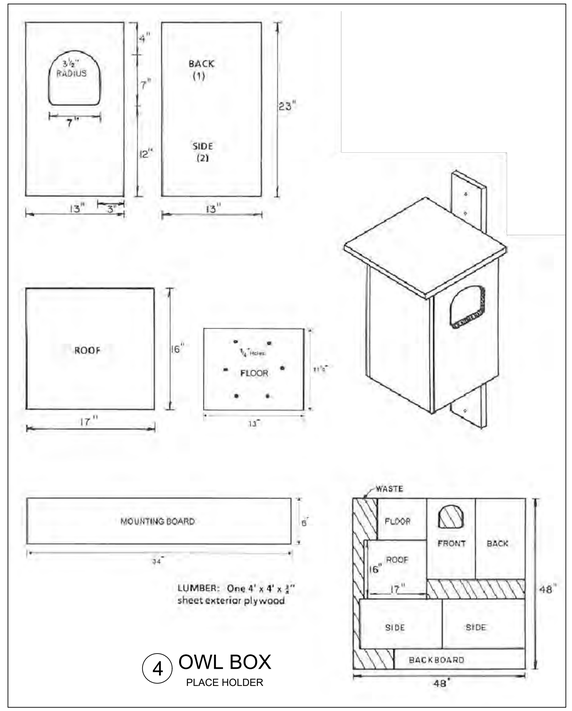


NOTES:

1. COMPACT BACKFILL IN 6 INCH LIFTS UNTIL NO VISUAL DISPLACEMENT.
2. REMOVE AND DISPOSE OF DUFF AND TOP ORGANIC LAYERS DOWN TO MINERAL SOIL.

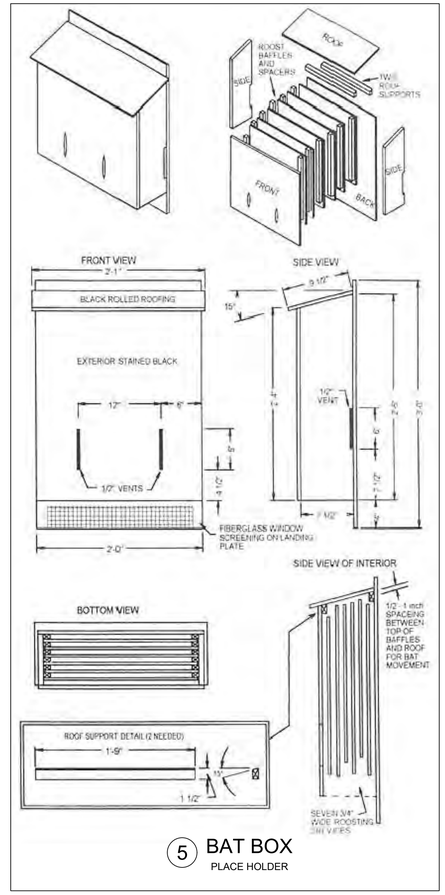
3 INDIVIDUAL ROCK STEP

SOURCE: USFS



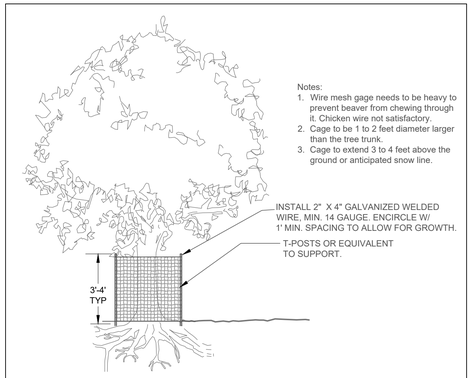
4 OWL BOX

PLACE HOLDER



5 BAT BOX

PLACE HOLDER



Notes:

1. Wire mesh gage needs to be heavy to prevent beaver from chewing through it. Chicken wire not satisfactory.
2. Cage to be 1 to 2 feet diameter larger than the tree trunk.
3. Cage to extend 3 to 4 feet above the ground or anticipated snow line.

5 BEAVER TREE PROTECTION

30% DESIGN NOT FOR CONSTRUCTION

WILDSCAPE ENGINEERING
WILDSCAPE ENGINEERING, INC.
1901 Airport Rd, Suite #108
South Lake Tahoe, CA 96150
www.wildscape-engineering.com

SWCA ENVIRONMENTAL CONSULTANTS

RCI Resource Concepts Inc

CITY OF RENO

one truckee river

Brodhead Park Restoration
Reno, NV 89502

Terrace Bank Retaining Wall Option/Trail

Designed:	Drawn:	Checked:
CYB	JA	CYB

File Date: 10/18/2022

REVISIONS:

No.	Date	Description

Notes:

Sheet Scale: AS SHOWN

D-2

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APPENDIX B

Historical Imagery

Figure B-1. June 1939 Aerial Image – Irrigation Ditch on South Side of Truckee River Easily Identifiable, Old Wells Bridge and Underpass at Railroad (Source: Western Nevada Historic Photo Collection: accessed at https://wnhpc.com/).

Figure B-2. May 1966 Aerial Image – Irrigation ditch has been eliminated, Old Wells Bridge and Railroad Underpass still viewable. (*Source: Western Nevada Historic Photo Collection accessed at https://wnhpc.com/)*.

Figure B-3. June 1994 Aerial Image - New Wells Street Bridge adjacent to old bridge. *(Source: Google Earth)*.

Figure B-4. 1967 USGS 1:24000 Map *(Source: USGS Topo Maps accessed at https://ngmdb.usgs.gov/topoview/)*.

Figure B-5. *1891 USGS 1:125000 Map (Source: USGS Topo Maps accessed at https://ngmdb.usgs.gov/topoview/)*.

APPENDIX C

Soil Conditions Assessment

Field Notes and Site Photos

Figure 1. Brodhead Restoration Plan project location with photo points.

Soil 1. Dense trees, minimal fine-grained matrix with 2–3-foot rounded boulders.

Soil 2. Steep, eroding slope with few rock fragments; soil is greater than 5 inches deep with sandy loam texture.

Soil 3. Steep slope, sandy loam texture with 90% rock fragments (boulders ranging from 1–3 feet).

Soil 4. Steep, partially destabilized slope, sandy loam texture with 75-90% rock fragments (cobbles and boulders ranging from 0.5–2 feet).

Soil 5. Steep, eroding slope with existing mature cottonwoods; possible trail access areas; sandy loam texture with 40–50% rock fragments (boulders ranging from 1–3 feet).

Soil 6. Steep, partially eroding slope with mature cottonwoods and possible trail access areas; sandy loam soil texture with 40–50% rock fragments (boulders ranging from 0.5–3 feet).

Soil 7. Area identified for possible slope adjustment or stabilization.

Soil 8. Open flat area for planting. Coarse sand to sandy loam texture with 10% rock fragments (0.5–3-inch gravel).

Soil 9. Steep slope, sandy loam texture with 90% rock fragments (1–3-foot boulders).

Soil 10. Steep, partially eroding slope, sandy loam texture with 70–80% rock fragments (1–4-foot boulders and concrete rubble).

Soil 11. Cluster of mature cottonwood trees with roots exposed from erosion.

Soil 12. Moderate, eroding slope, loamy sand texture with 30–50% rock fragments (cobbles and boulders ranging from 0.5–3 feet).

Soil 13. Steep, eroding slope with exposed tree roots, loamy sand texture with 30% rock fragments (cobbles and boulders ranging from 0.5-3 feet).

Soil 14. Steep, eroding slope, variable rock density, with 20-50% rock fragments (cobbles and boulders ranging from 0.5-3ft).

Soil 15. Moderate slope, sandy loam to loamy sand texture with 50–70% rock fragments (boulders ranging from 1–4 feet).

APPENDIX D

Construction Resources Report

TECHNICAL MEMORANDUM

To: Iris Jehle-Peppard
One Truckee River
2601 Plumas Street
Reno, NV 89509

City of Reno
1 E. First Street
PO Box 1900
Reno, NV 89505

From: Sophie Butler, Assistant Project Manager

Date: December 7th, 2022

Re: **Brodhead Park Restoration Construction Resources Report / SWCA Project No. 68237**

INTRODUCTION

SWCA Environmental Consultants (SWCA), in partnership with their teaming partners Wildscape Engineering, Inc. (Wildscape) and Resource Concepts, Inc. (RCI), has developed a conceptual engineering design and a basis-of-design report for the Brodhead Memorial Park Pilot Vegetation Management and Restoration project (Project). As a supplement to the design and report, SWCA has developed the Construction Resources Report (Resources Report) to help guide One Truckee River (OTR) toward execution and completion of the Project once final engineering designs have been completed.

This Resources Report provides a general overview of the resources required to construct the Project and identifies potential providers of these resources. Implementation of the Project will require resources for construction and the maintenance period following construction to optimize Project outcomes. The needs and Project timeline for these two phases are described separately.

The next two phases of this Project will be to develop the 60% and final engineering restoration design. During each of these phases, as engineering designs are being developed, more refined final versions of this Resources Report will be created in greater detail, which will outline partners and contractors that can provide expertise and resources to the Project. The next phase will also identify all required permits so the application process can begin at the start of the third phase.

OVERVIEW OF RESOURCES FOR RESTORATION IMPLEMENTATION

The materials and resources required to implement the Project have been separated into four categories (planting materials, bioengineering materials, manual and machine equipment, and labor). The specific resources included within each category currently represent a high-level understanding of what will

ultimately be required to implement the Project. In the subsequent versions of the Resources Report, the specific resources needed within each category will be further clarified.

Planting Materials

Native Plants

The engineering and restoration design will include planting of both riparian and upland plants native to northern Nevada. Examples of plants that may be needed includes, but is not limited to, showy milkweed (*Asclepias speciosa*), western wheatgrass (*Pascopyrum smithii*), basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), and Wood's rose (*Rosa woodsii*). Chosen plant species will need to be cultivated at least 1 year in advance of construction, therefore a finalized plant list will be made prior to completion of the 60% restoration design to provide enough time for cultivation. There may be a need to source different plants from different providers.

Tree Saplings

Trees for planting in the Project area will be chosen according to specific needs and constraints within the Project area, as will their planting location. Examples of trees that may be needed includes, but is not limited, to coyote willow (*Salix exigua*), redosier dogwood (*Cornus sericea*), Fremont cottonwood (*Populus fremontii*), and chokecherry (*Prunus virginiana*). Chosen tree species will need to be cultivated far in advance of construction therefore a finalized tree list will be made prior to completion of the 60% restoration design. There may be a need to source different plants from different providers.

Soil/Organic Enhancements

Due to current soil conditions within the Project area, soil enhancements may be needed to create improved conditions for vegetation restoration. Specific treatments for soil and organic enhancements may include the addition of soil substrate, other soil supplements, and inoculation of mycorrhizae. These enhancements would create conditions sufficient for establishment of seedlings or other potted plants. Final strategies for soil enhancement will be determined in future phases of engineering and restoration design.

Mulch

Mulch may be required in upland planting areas and around newly established trees. A healthy layer of mulch can prevent establishment of invasive and noxious weeds and protect plants from other damage. Mulch may be acquired through donation from local arborists or municipal agencies, or purchased from a local source.

Bioengineering Materials

Rip rap

Design plans currently include sections of planted rip rap for bank stabilization. The rock needed will be either sharp or rounded fracked rock of varying sizes. At this point in the design process, the extent of the rip rap and specifications for rocks have not been determined. The extent and size of rip rap material should be established in the 60% design so as to determine potential sources of material. Rip rap may be acquired through donation from local companies or purchased.

Rocks/Boulders

Bank stabilization efforts will be supplemented with additional large rocks and boulders. The rocks and boulders will also be used to create steps that operate as designated trails to the river. Rocks and boulders of varying sizes will be needed. Specifications for size will be determined in the 60% design phase of design. Rocks and boulders may be donated from local companies or purchased.

Logs

There are several keyed-in logs currently featured in the restoration design to separate pedestrian and non-pedestrian areas along the bank once plantings have been completed. Specifications for logs will be determined in 60% design phase of design. Logs may be acquired through donation from local arborists or local municipalities or purchased from a local source.

Manual and Machine Equipment

A wide variety of hand tools will also be needed for activities that do not require heavy equipment. Hand tools will ideally be borrowed from local organizations.

Presumably, heavy mechanical equipment will be provided by companies that are to be selected to implement construction of the Project. Machinery may include an excavator, backhoe, or loader.

Labor

A mix of both contract labor and volunteer labor is desired for the Project's implementation. The most technical and consequential work at the site will be completed by contract labor. Less technical work that still requires a skilled workforce will be completed by trained, experienced volunteers, and any additional work can be completed by untrained volunteers from the community. OTR plans to partner with other local businesses and organizations to find these volunteer groups.

OVERVIEW OF NEEDS FOR ONGOING SUPPORT

Planting Materials

Maintenance activities may require supplemental planting materials depending on the success rate of the initial plantings. Advanced planning will be required to acquire the additional plants needed for ongoing maintenance and should be accounted for in planning for construction. The types of plants and trees will be the same as the plant palette developed in the 60% design phase.

Equipment

Equipment needed for ongoing support will be the same as described above. The higher need will be for manual equipment and hand tools. If there is a need for heavy equipment during this stage, contractors will need to be hired.

Labor

The labor needs will be similar to above but with a heavier reliance on volunteers. Contract labor would only be needed for work requiring heavy equipment. City of Reno employees may also be involved in maintenance activities, but the Project intends to rely on volunteers where possible to decrease the cost of maintenance to the City of Reno.

RESOURCE PROVIDERS

Resource Categories	Potential Provider
Construction Resources	
Construction labor	To be determined (TBD) – 60% and 90% design milestones
Heavy equipment operators	TBD – 60% and 90% design milestones
Hand tools	Keep Truckee Meadows Beautiful (KTMB), Truckee Meadows Parks Foundation (TMPF)
Trained planting labor/volunteers	TMPF
Untrained planting volunteers	KTMB
Planting Materials	
Mulch	City of Reno
Native Plants	Nevada Department of Forestry (NDF) – Washoe State Plant Nursery
Soil/organic enhancements	TBD
Tree saplings	NDF – Washoe State Plant Nursery
Bioengineering Materials	
Rip rap	TBD – 60% and 90% design milestones
Rocks/boulders	TBD – 60% and 90% design milestones
Logs for crib wall	City of Reno
Heavy equipment	TBD – 60% and 90% design milestones
Maintenance resources	
Volunteers	KTMB
Supplies (hand tools)	KTMB

City of Reno Parks and Recreation

OTR and its consultants met with an interdepartmental group from the City of Reno on June 29, 2022. During the meeting, the list of resources needed for implementation was shared to solicit feedback from the group. Staff from the City of Reno Parks and Recreation Department gave a provisional commitment to help provide mulch and logs, depending on their availability at the time of construction. The City of Reno may be able to help cultivate native plants for the Project, but additional support or resources may be needed for the City of Reno to provide plant materials. OTR intends to build in funding for this in future grant proposals for the Project.

Advance coordination will be needed for cultivation of native seedlings and saplings: a preliminary list of species should be provided a year in advance of the expected start of construction.

Nevada Division of Forestry – Washoe State Tree Nursery

The Washoe State Tree Nursery specializes in producing native and locally adapted plants for use in activities like the Project. By using their Custom Growing Service, OTR will be able to work with the nursery to cultivate the plants needed for the Project. Coordination will begin at least one year in advance to provide adequate time for proper cultivation of plants. Additional planning will need to be completed with both Washoe State Tree Nursery and City of Reno to understand what each entity can reasonably produce, then OTR will strategize which entity to work with for specific species.

Keep Truckee Meadows Beautiful

OTR and its consultants met with Keep Truckee Meadows Beautiful (KTMB) Executive Director, Mark Cameron, on July 18, 2022. KTMB provided a high-level commitment to assist in the implementation of the Project by coordinating untrained volunteers to help complete the upland planting components. OTR expects between 60 and 80 volunteer hours over 2–3 shifts of volunteers will be needed to complete the Project. The scale of volunteer needs and what aspects of the restoration design they will be completing will be better established in future design phases.

KTMB has also agreed to help supply hand tools for implementation of the Project, to be used with or without their volunteers present.

Truckee Meadows Parks Foundation

OTR and its consultants met with the Elena Larson, Wetland Restoration Program Directors, from the Truckee Meadows Parks Foundation (TMPF) on July 15, 2022. The TMPF provided a high-level commitment to assist in the implementation of the Project by providing trained volunteers in the form of their Wetland Restoration Technician AmeriCorps Members (Wetland Technicians) to help complete the riparian planting components. The TMPF Wetland Technicians regularly complete similar work at the Rosewood Nature Study Area, making this Project a good fit for their skills. It is anticipated that four Wetland Technicians will be available to help with riparian planting for the Project in late 2023/early 2024. The regularity of this commitment will be better established in future design phases, but the current expectation is 2-3 days a week for 2-3 weeks.

Construction Contractors

Construction contractors for the Project have not been identified at this stage. During the development of the 60% restoration design, it will become clearer what restoration activities will require contractors. Then, identifying the right contractors for the Project will become feasible.