Creeksside Park Restoration Project – Conceptual Design Report

City of Sisters and Upper Deschutes Watershed Council

August 29, 2018

Introduction

HENDERSON Environmental Design-Build Professionals (HENDERSON) has been contracted by the City of Sisters (City) and the Upper Deschutes Watershed Council (UDWC) to provide value-engineering services in designing bank/channel restoration within Whychus Creek, utility protection, and restructuring pedestrian trails and public access within the City's Creekside Park (Site).

This report outlines the initial efforts and findings in the development of the Creekside Park Restoration Project's conceptual design package for the City of Sisters and the UDWC. Contributors to this report are as follows – **Rob Sampson, PE** and **Alex Morton, EIT** from HENDERSON, **Chris Boyd, PE** from Rivers Structures Consulting, Inc. (River Structures), **Chelsea Schneider, PLA** from LOCI Studio (LOCI), and **Brett Parker, PE** and **Sean Passage, EIT** from HWA Inc. (HWA) (collectively, the "team"). Conceptual design alternatives and project findings are presented in this conceptual design report for the City of Sisters, the UDWC, and other project stakeholders (collectively, the "client") to gain input and direction before advancing to a 50% design level.

Our team would specifically like to thank **Mathias Perle** and **Ryan Houston** from the Upper Deschutes Watershed Council as well as **Patrick Davenport**, **Paul Bertagna** and **Eric Huffman, PE** for all their help and support throughout this process.

Please contact Alex Morton, EIT at amorton@hendersondesign-build.com or at (503) 387-6355 with any questions or comments about the following conceptual design report. Thank you.

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Table of Contents

Introduction

The City and UDWC are collaborating with HENDERSON and our design team to develop the designs and permits for the enhancement and restoration of a reach of Whychus Creek through downtown Sisters, Oregon at Creekside Park and Campground. Creekside Park is located between Locust Street and Hwy 20 in Sisters, Oregon. Whychus Creek is a state-designated Essential Salmonoid Habitat (ESH) waterway.

A historic footbridge crosses the creek at approximately the middle of the project reach. This timber/wooden bridge spans the width of the Whychus Creek and is supported on mortared rock abutments and wing walls. Creating a constriction in Whychus Creek, the historic abutments were originally constructed at the toe of the banks. Constructed in either 1939 or 1941 by the Civilian Conservation Corps (CCC) and Works Progress Administration (WPA), when the park was developed by the State, the log-span bridge was originally built with an open deck and railing. In the early 1990's all logs were replaced and the covered bridge deck was added. Neither the City, nor other entities have made further structural alterations since this time. Given this history, Oregon State Historic Preservation Office (SHPO) has designated the abutments and wing walls a historic significance and therefore will require special attention in the design and permitting process (see the Environmental Permitting Requirements section for additional information).

A United States Geologic Service (USGS) stream flow gage, installed in 2000, is located at the upstream end of the reach, just upstream of the Locust Street Bridge. Oregon Water Resources Department (OWRD) has since taken over operation of the gage (#14076050 WHYCHUS CR AT SISTERS, OR) and provides gage maintenance.

Along the upstream face of the Locust Street Bridge decking is the City's pressurized sanitary sewer mainline. Downstream, between the footbridge and Hwy 20 is a gravity sewer line with a concrete cap (within the creek) that daylights approximately two feet above Whychus Creek's streambed, creating a fish passage barrier. Flows have been scouring out the bank for the past few years along the north streambank at the concrete cap.

Situated in downtown Sisters, this reach of Whychus Creek within Creekside Park experiences high pedestrian traffic from both residents and visitors. Unfortunately, this public use also produces negative impacts to the creek. Numerous user-created access points to the creek have eroded streambanks. With its aesthetic structure and location, many people take advantage of the historic footbridge as a backdrop for graduation, wedding, and other special event photos. Creekside Park is also utilized for many different community events throughout the year including parties, markets, and festivals. Acknowledging this use as well as its unintended impacts, the City and UDWC hopes to develop a creative, community inclusive restoration design that future local restoration projects can model.

Project components include in-stream and streambank enhancements, Americans with Disabilities Act (ADA) and structural upgrades to the existing footbridge, utility line protection or realignment, recreation management, and native vegetation enrichment. Specific project component locations can be seen in Site Map in Appendix A.

Whychus Creek Stream Enhancements

At the center of this restoration effort and associated design elements is Whychus Creek. Currently the project's reach lacks any type of in-stream diversity and aquatic habitat. Each of the resource concerns, coupled with the physical processes of water and sediment movements will help to develop and rank design alternatives and requirements for these project elements. Within the reach of interest, the average channel width is approximately 33 feet during low flow conditions. During bankfull flows, average channel width increases to approximately 43 feet.

Hydrologic Modeling

OWRD's gage #14076050 has been collecting stage and flow data since 2000 at the upstream end of the project's reach. Stream gage #14076050 is located at 44° 17′ 16.616″N and -121° 32′ 38.681″W, about 20 feet upstream of the Locust Street Bridge. Runoff flows are measured from a drainage area of approximately 50.3 square miles. It is extremely rare for restoration projects to have such accurate, long-term, on-site hydrology data. In order to predict design floods for the Creekside Park project site, a flood frequency distribution, using the Log–Pearson Type III Distribution, was analyzed. Probabilities of floods of various sizes (return periods: 2-yr, 5-yr, 10-yr, 25-yr, 100-yr, etc.) can be extracted from the flood frequency analysis to aid in future hydraulic modeling and design development.

Historical annual peak flow data and stage data were downloaded from OWRD for water years 2000 - 2008 and 2011. Instantaneous flow and stage data (15 minute intervals) were downloaded from October 1st, 2014 through June 18th, 2018. Maximum instantaneous flows were extracted for water years 2015 through 2018 and added to the earlier dataset. Utilizing the 12 years of instantaneous flow data, a Log-Pearson Type III Distribution flood frequency analysis was run to calculate the following flood frequency return periods:

Table 1: Flood Frequency Analysis (Log-Pearson Type III) of Whychus Creek at Locust Street Crossing

Return Period (yr)	Percent Chance (%)	Peak Discharge (cfs)	90% Confidence Interval	
			Upper (cfs)	Lower (cfs)
200	0.5	3,230	9,770	1,820
100	1	2,650	7,290	1,560
50	2	2,150	5,320	1,320
25	4	1,700	3,780	1,100
10	10	1,200	2,270	817
5	20	866	1,440	613
2	50	474	675	331
1.25	80	265	374	159
1.05	95.24	155	236	74.6
1.04	96.15	145	223	67.5
1.03	97.09	127	200	55.3
1.02	98.04	119	190	50.7
1.01	99.01	100	166	39.2
1.005	99.50	85.9	147	31
1.002	99.80	71.2	127	23.4
1.001	99.90	62.6	114	19.3
1.0005	99.95	55.4	104	16.1
1.0001	99.99	42.9	85.7	10.9

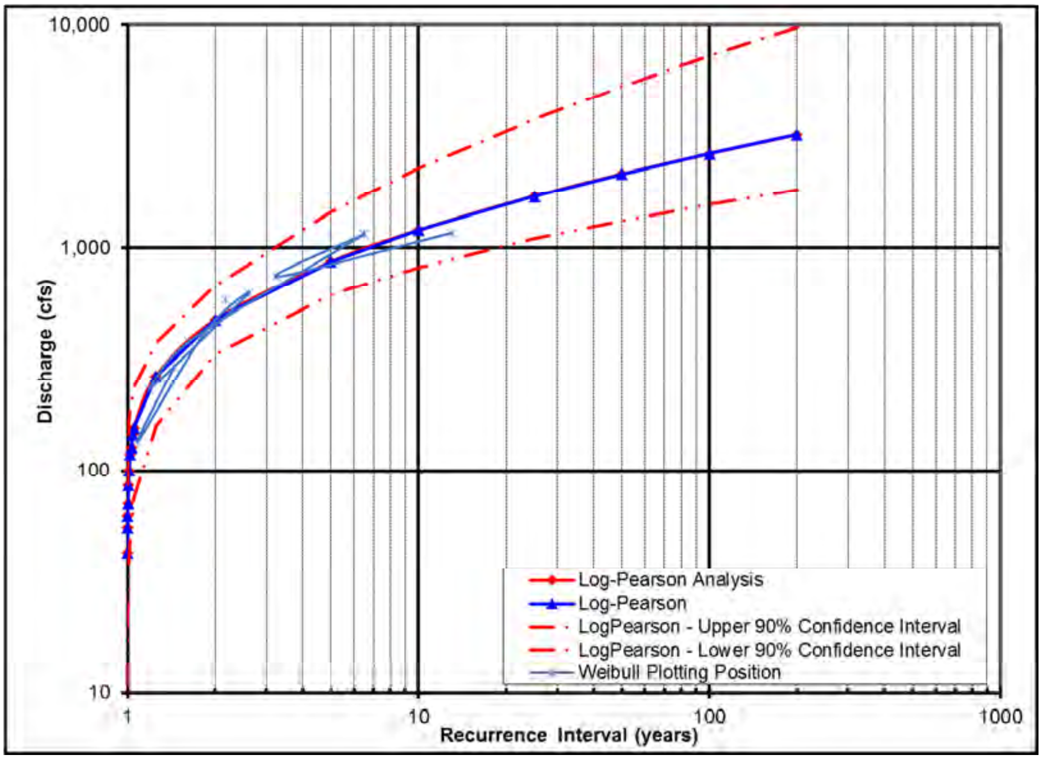

Figure 1: Flood Frequency Analysis (Log-Pearson Type III) of Whychus Creek at Upstream Locust Street Crossing

Hydraulic Modeling

Whychus Creek's geometry follows a relatively wide form, compared to its depth. Out of bank flows are rare outside of the effects of winter ice jams. Whychus Creek's channel is slightly incised, and has a cobble bed, much of which is immobile. The bed material is remnant from wetter climates, possibly dating back to glaciated periods, and exists as lag deposits from the incision. Whychus Creek's stream slope is approximately 1%, and the streambanks are relatively vertical.

To get a sense of the magnitude of the hydraulic forces, a single cross-section, about 150 feet downstream of the footbridge, was examined using WIN XSPro (USFS, 1998 plus updates). A cross sectional plot and a discharge rating curve are shown below. With further design direction from the client, the hydraulics will be examined more closely by looking at the entire reach of stream and the impact of the existing bridges and obstructions. US Army Corps of Engineers' (USACE) rive analysis software (HEC-RAS) will help to develop a water surface profile for various flows, so that changes in the energy distribution can be studied. Further hydraulics modeling will not only be informative for the different project design components, but will most likely play a role in the permitting process as well.

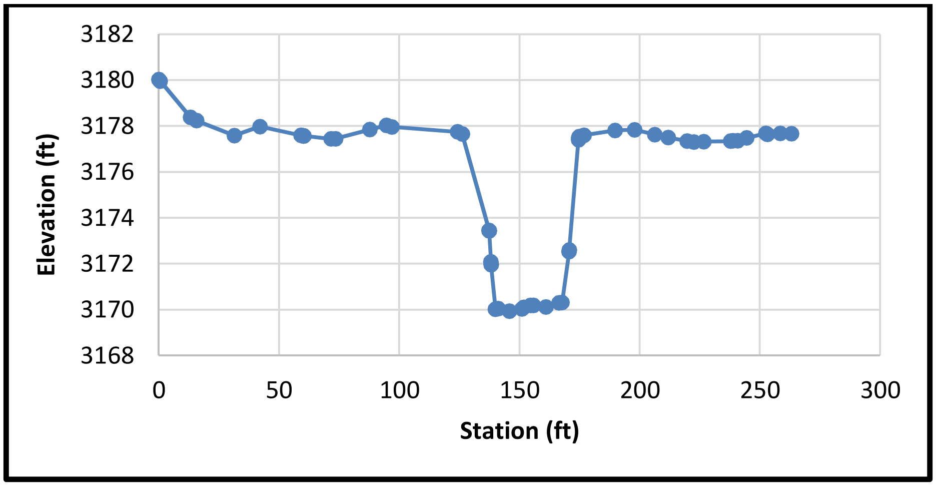

Figure 2: Surveyed and Modeled Cross Section of Whychus Creek, 150 Feet Downstream of Historical Footbridge

Hydraulic analysis examined a surveyed cross section, downstream of the historic foot bridge on Whychus Creek. Within this reach, the cross sections are fairly uniform. Figure 2 is a graphically representation of the surveyed and modeled cross section of Whychus Creek. Figure 2 depicts a channel bottom width of approximately 27 feet. To engage the floodplain during large storm events, Whychus Creek needs to exceed the floodplain elevation of 3,177 feet, which is a river stage approximately 4 feet higher than its typical level.

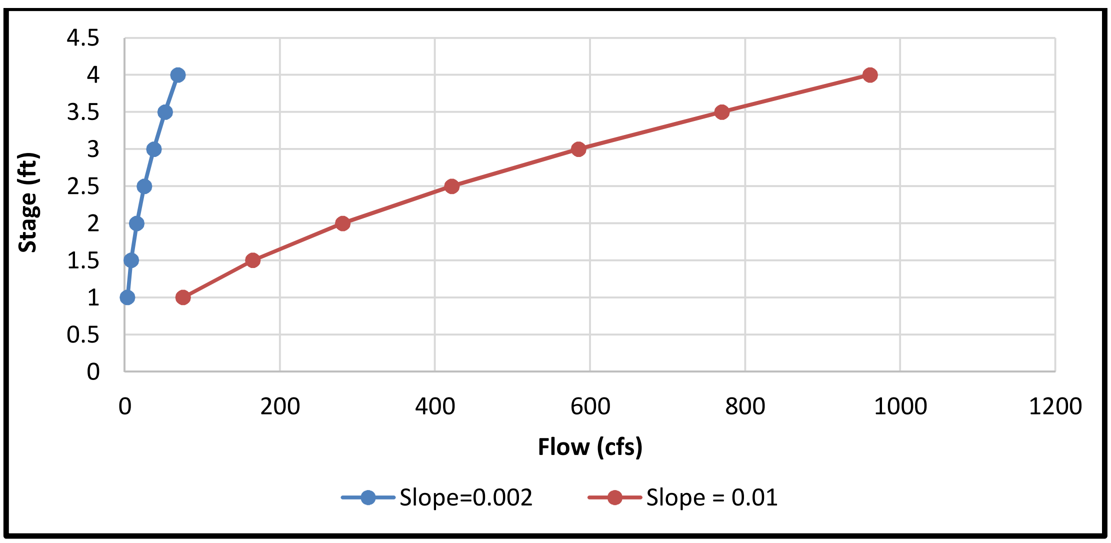

Figure 3: Win XSPro Output Data for Modeled Cross Section of Whychus Creek, 150 Feet Downstream of Historical Footbridge

Figure 3 depicts the WIN XSPro output data for the modeled cross section within the project's reach of Whychus Creek. Stream slopes of 0.2% (blue) and 1% (red) were both utilized in modeling the cross section with WIN XSPro. The actual stream slope is about 1%. As a sensitivity check, both stage-discharge curves are shown.

Maximum shear stress, is 0.39 pounds per square foot (psf), and 1.9 psf, for the 70 cubic feet per second (cfs) (s = 0.002) and the 900 cfs (s = 0.01) flows respectively. In general, 2 psf will transport a rock about 5 inches in diameter, supporting the previous observations of bed forms and cobble size.

Downstream of the footbridge, the cross section selected for analysis can contain about 8 feet of water. A 50 year storm peak flow is about 2,150 cfs (5,320 to 1,320 cfs at the 90% Confidence Interval). 2,150 cfs of flow in the project's reach of Whychus Creek produces a stage of approximately 6 feet. A stream velocity of greater than 11 feet per second (fps) and stress greater than 3 psf is generated from this flow and stage.

Gravity Sanitary Sewer Line / Creek Obstruction

A 10-inch PVC gravity-fed sanitary sewer line is buried underneath Whychus Creek between the historic footbridge and Hwy 20. Two sewer access points allowed for the pipe location and slope to be measured. The upstream invert (on the southern floodplain) elevation at this line is at 3,166.7 feet with the downstream invert (on the northern floodplain) elevation of 3,164.5 feet. The sanitary sewer line is 477.24 feet long with a slope of 0.46%. A concrete cap was installed on top of the PVC line to help protect the line from erosive forces in Whychus Creek. Assuming that concrete was placed flush on the crown of the sewer line, in the middle of the creek, the height of the cap is approximately 4 feet. Of those 4 feet, approximately 2 feet rises above Whychus Creek's streambed. When the sewer line and concrete cap were originally constructed in 2001, it may have been installed flush with the creek bottom. Within the last 17 years, the surrounding streambed material has been scoured away and the line now remains a fish barrier and hazard to the creek and its users within the creek.

Design Alternatives Considered

At a minimum, the sanitary sewer line's concrete cap acts as a fish barrier for migrating juvenile fish. In order to meet the Oregon Department of Fish and Wildlife (ODFW) fish passage requirements, the proposed drop must be, at maximum, 6 inches within a low flow channel for juvenile passage. To achieve this requirement, the concrete cap's elevation will need to be lowered approximately 18 inches. Fish passage can be accomplished with the following alternatives:

1. Construction of a V-shaped weir into cap (with low flow passage)
2. Raising downstream water level through backwatering (step-pool complex)
3. Lowering entire span of concrete cap
4. Construction of a fish passable rock ramp (meeting the existing grade of the concrete cap)
5. Full removal and replacement of concrete cap (removing fish barrier issues)

Depending on the preferred design alternative, partial or full temporary dewatering and diversion of Whychus Creek will be necessary during construction. Larger rock can also be incorporated into the design to produce a more natural look and to cover any remaining exposed concrete. See Figure 4 for an example photo rendering of the V-shaped weir. Due to the recreational use of the stream, one of the foremost conditions will be safety, particularly of any possibility of impingement or entrapment.

Partially removing the concrete cap by creating a V-shaped notch will be the most cost and time efficient option. All design alternatives, except for #3 and #5 will have exposed concrete, unless otherwise covered. As previously mentioned, fish boulders or large rock can be placed around and buried into the streambed to provide a more natural looking aesthetic. Creating a backwater effect to raise the water level downstream of the cap would require a series of low rock weirs. Elevation change between each step should not exceed 6 inches for fish passage requirements and structural stability. Depending on the existing conditions, the Hwy 20 Bridge may located be too close to the concrete cap to allow for this design option. Alternatively, developing a fish rock ramp would also achieve this goal, but would require a large quantity of rock to slope the channel up to the concrete cap as well as to fill in the scour pool that has been created. Full replacement of the concrete cap could potentially also require replacing the 10-inch sewer line, at least between the existing access points. Design alternatives have been present graphically in the two Fish Passage and In-Stream Habitat plan sheets in Appendix A.

Figure 4: Photo Rending (C. Schenider) of Example V-Shaped Notch Weir along In-Stream Concrete Cap

In-Stream Restoration

Other than the man-made concrete cap, no instream complexity exists within the project's reach. Stream complexity can be important for regulating stream temperature, biodiversity, and in providing aquatic habitat. Small structures or additions to the creek can have lasting positive impact. In-stream enhancements can also play an important role in permitting with certain governing agencies.

Design Alternatives Considered

Addition of simple structures can have a very positive impact to aquatic life within Whychus Creek. The following alternatives were considered for the in-stream restoration:

1. Placement of boulders or boulder clusters
2. V-shaped rock weir(s) to force small pools
3. Streambank rootwad clusters

Individual fish boulders or clusters can be placed throughout the creek to create hydraulic diversity, which leads to diversity in the substrate. Boulders or clusters of boulders would be placed at geomorphically significant spacing that will maintain scour in the channel bed, creating a self-sustaining pattern. Burying the boulders deep into the streambed will decrease effects to the flow regime while maintaining the benefits to aquatic fauna. Creating one or more rocks weirs would the most expensive alternative and have the greatest impact to the stream. Burying log-rootwad clusters at the toe of the banks would provide similar benefit as the fish boulders. Full temporary dewatering of the stream would be necessary for the rock weir option, whereas only partial dewatering or isolation would be necessary for design alternatives #1 and #3.

Bank Restoration

Heavy use of Creekside Park has led to degraded conditions of Whychus Creek and its banks. Numerous creek access points have been developed over the years. Combined with localized scour and erosion, various locations within the project reach are in need of some type of bank restoration. Approximate locations can be seen within the conceptual Bank Restoration plan sheet in Appendix A. Bank restoration design can also easily incorporate some type bioengineered in-stream enhancements to help better the stream conditions and aquatic habitat.

Beginning about five years ago, the northern streambank at the concrete cap began to fail. Park sprinklers, local turbulent creek flows, capillary action within the soil, and public access to the stream may have all exacerbated this failure. Currently, there is orange construction fencing protecting visitors from the eroded bank. Erosion, scour, and stream access has led the bank to begin to recede. Approximately 10 feet of bank recession has already occurred.

Design Alternatives Considered

To restore the bank to the existing conditions before the bank failure, multiple different materials and techniques can be used. The following four alternatives were considered for restoring the northern bank:

1. Constructing a soil-lift complex to improve banks
2. Implementation of large wood material
3. Heavy native revegetation to improve soil rigidity
4. Integration with recreational creek access design (see Recreational Creek Access section below)

Each of these design alternatives should be planted with native plants to increase long term bank stability as well as to eventually disguise the restoration work. Similarly, woody plants that have the ability to re-sprout (cottonwood and willows) can be installed along with any of the structural measures. Combining fencing, controlled access points (see Creek Access section below), and revegetation, may also help to control foot traffic along creek banks and to prevent further user-created bank degradation. Gravel or sand layers, added as a soil amendment, between the bank and restoration work, should also be considered to protect against preferential groundwater flow paths, which could have led to failure of the streambank from saturation and soil particle migration. When advancing to the 50% design level, preferred bank restoration techniques and designs will be further considered and developed.

Figure 5: Example of a Bio-Engineered Soil Lift (Photo Taken Immediately Upon Completion)

Toe protection and stabilization of soil lifts can be designed with various materials. Depending on the local waterway regulations or preferred esthetics, rock, large wood, or other materials can utilized to provide structural integrity. Creekside Park's project reach lacks in-stream diversity and aquatic habitat. Designing each additional soil lift with large woody material (salvaged during tree removal, if available) and/or rootwads would provide fish and aquatic species habitat to the reach. Additional bioengineering techniques can be incorporated into the soil lifts to provide beneficial habitat and nutrients to the creek, while maintaining its original purposed of restoration the failing banks. Examples of this include fish boulders, engineered large wood structures, laying back creek banks, and strategic native plantings. Size and quantity of the material will be dictated through further hydraulic modeling.

Other Bank Failure Locations

In addition to the prominent northern bank failure location, there are other locations along the project reach where stream banks have been eroded or are showing signs of failure. Stream banks on either side of the bridge on the southern floodplain have been particularly degraded. Across Whychus Creek from the northern bank failure, is also an apparent location of bank failure within the project reach. Similar bioengineered design alternatives can be applied to these locations. As previously mentioned, bank restoration designs can be coupled with creek access or approached (see the Recreational River Access section below) as well as the in-stream restoration. Developing these designs will help restore the condition of the park and campground while also providing much needed diversity and habitat within Whychus Creek.

Recreational Creek Access

Being located adjacent to downtown Sisters and the local elementary school as well as being a very popular campground the project reach experiences heavy visitor traffic. Although access to the creek should be encouraged, user-created trails and access points should be discouraged. Over the years, numerous user-created trails have been created and have begun degrading the streambanks and native vegetation. Whychus Creek designed user access points may help to limit the development of random trails and prevent further bank structure/habitat degradation.

Access Design Alternatives Considered

Various types of trails or steps can be incorporated into the reach to allow for user access to Whychus Creek:

1. Wooden fencing (split-rail)
2. Increased native vegetation
3. Signage (ex: "Please remain on path" or "Creek Access →")
4. Fortified creek access points (stairs / steps)
5. Creek viewing platforms

A couple potential locations for access points have been identified in the conceptual Creek Access plan sheet in Appendix A. Locations were chosen for their low-impact and incorporation into existing conditions as well as where apparent current access points are. Proposed split-rail fence alignments are also presented within that plan sheet. Access points can be easily manipulated to achieve desired aesthetics and functionality. Example access structures can be seen in Appendix A.

Historic Footbridge Enhancements


Figure 6 – Existing Bridge

Creekside Park includes a network of paths on the northern and southern floodplains of Whychus Creek, which are connected by a pedestrian footbridge approximately halfway between the Locust Street and Highway 20 vehicle bridges. This existing footbridge is approximately 40 feet long and consists of a 5-foot wide covered wood walkway supported by two 26-inch diameter timber logs, with grouted rockery abutments on concrete footings (see Figure 6). Bridge approaches consist of asphalt ramps supported by the grouted rockery walls.

Including its wood decking, roof structure, supporting logs, and rockery walls, this footbridge appears to be in good condition. However, the location of the abutments creates a constriction in the active creek channel relative to the channel width upstream and downstream from the bridge. Hydraulic scour and undermining was observed beneath the north abutment, likely the result of accelerated flow velocities between the abutments. Current conditions do not appear to present an imminent danger to the stability of the bridge.

The bridge deck is approximately 4.5 feet above the adjacent ground on the north side and 3 feet above the adjacent ground on the south side of the bridge.

Historical Abutments and Wing Walls

The bridge foundations, including the concrete footings, rockery abutments (see Figure 7), and approach ramps were reportedly constructed by the CCC in either 1939 or 1941. While the abutments and approach ramps are in good structural condition, they do not meet the ADA Standards for Accessible Design. Primary access issues include the steep slope of the approach ramps and lack of guardrails or handrails on the ramp. Replaced in the early 1990's, the bridge superstructure was reportedly and is also still in good condition.

Three alternatives have been identified for providing access meeting the ADA Standards:

1. Retain the existing abutments and replace the approach ramps with a new concrete or paved earthen ramp
2. Retain the existing abutments and approach ramps and provide access via an elevated boardwalk
3. Replace the existing bridge with a new bridge upstream or downstream of the current alignment

Further hydraulic analysis of these abutments, wing walls, and/or bridge approach ramps design alternatives will help to develop a final design that meet or exceed the City of Sister's floodplain regulations


Figure 7 – Rockery Abutment

Design Alternative 1 – New Ramps

Design Alternative 1 would remove the existing approach ramps and historic wingwalls, while retaining the existing rockery abutments and bridge superstructure. New ramps would consist of cast-in-place concrete walls and slab with earth fill. Walls could be covered with a basalt rock cladding to match the appearance of the existing abutments. Ramps would be lengthened to meet the 5% maximum slope requirements required by the ADA Standards and would be designed to tie into the existing network of paths. Guardrails would be installed on the outside edges of the path where the drop from the ramp to the existing ground exceeds 30 inches.

Design Alternative 1 would be the least expensive option for providing ADA access to the footbridge. Considerations related to this approach include:

- By removing the existing rockery wingwalls, SHPO required mitigation in the form of photographs and documentation of the existing facilities
- Ramps will be approximately 95 feet in total length on the northern side of the bridge and 65 feet long on the southern side of the bridge, possibly impacting the usability of this area of the park and impacting out of bank floodplain flows. When designing the additional length of the ramps, it can be nonlinear to avoid impact to existing pedestrian trails.

Design Alternative 2 – New Boardwalk

Design Alternative 2 would retain the existing abutments, wingwalls, and approach ramps, reducing the need to remove any of the historic parts of the bridge. New elevated boardwalks would be installed on the northern and southern sides of the bridge and could be designed to span over the existing ramps where required. A new boardwalk would be supported by drilled concrete piers (sonotube piers). Elevated portions of the boardwalk could be constructed from wood or concrete.

- Boardwalk alignments can be oriented to reduce the footprint as much as possible. By designing the ADA approaches to contain one or two small switchbacks or to include a resting platform, the approaches will be shorter in length, therefore disturbing less land and decreasing its aesthetic, visual, and physical impact.
- Creek access can also be combined within this design consideration. Where the boardwalk is nearest to the creek, a set of stairs could be incorporated to allow users access down to the creek. As this location is central to the park and is the main method for pedestrians to cross the creek, presenting specific access locations off the boardwalk would be convenient to its users.
- A wood boardwalk would be less expensive than a concrete boardwalk and would match the aesthetic character of the bridge and trees in the park. The boardwalk could be constructed from cedar and/or redwood, but would have a shorter lifespan and would be more easily damaged by vandalism and normal wear and tear. In addition, wood or composite decking can become slippery in wet and snowy conditions, so traction control materials may be required for the deck.
- A concrete boardwalk would be more durable and have a longer lifespan than a wooden boardwalk, but would also be more expensive to construct. The drilled pier foundations could be constructed to the height of the boardwalk, and the decking could be precast or cast-in-place concrete. If desired, the concrete piers could be encased or clad in grouted basalt to match the abutments and existing ramps.

Conceptual boardwalk alignments can be seen in the ADA Boardwalk plan sheet in Appendix A. Potential viewing platforms / creek access locations have also been included. The ADA boardwalks also provide the benefit of being able to be modified or removed later without any loss or damage to the existing structures, reducing some of the potentially required SHPO mitigation. As the design advances, SHPO representatives will determine the extent of mitigation required. Smaller impacts to the historic portions of the foot bridge will trigger smaller mitigation requirements and vice versa.

Design Alternative 3 – New Footbridge

Alternatively, the existing footbridge could be replaced with a new footbridge upstream or downstream of the current location. A new bridge would be designed to span the entire width of the channel, reducing or eliminating the hydraulic constriction over a range of flows including the ordinary high-water flow. In addition, longer ADA-compliant approach ramps could be incorporated into the design of the park at the upstream or downstream end of the channel so that they wouldn't bisect the park in the same manner as the current bridge location.

A new bridge could be constructed out of wood, similar to the existing bridge, or could be a precast concrete or fabricated steel pedestrian bridge. A concrete or steel bridge would be more durable and have a longer lifespan, but a wood bridge would mimic the aesthetic of the existing footbridge.

The existing abutments could be removed to improve the channel hydraulics through the park, or could be retained for historic and aesthetic purposes.

Protecting Historic Abutments

Although abutments do not seem to be in immediate danger, the City may want to consider installing some type of armor to avoid future maintenance.

Design Alternatives Considered

1. Replace native soil and heavily vegetate
2. Fill scour hole with native cobble mix
3. Install rootwads

Between Locust Street and Hwy 20, the footbridge is the primary restriction / pinch point within the project reach. Erosion flows during large storm events will most likely continue to scour stream material out from around the abutments, unless protected. To replace the eroded material, the most natural design alternative, would be to replace with native soil and heavily planted with woody vegetation. Due to the shade produced from the bridge, revegetating these areas may not be plausible. Filling the scour hole with a native cobble mix that will be hydraulically stable and immobile would protect the historic abutments and decrease the effects of foot traffic. Additional rootwads could be designed adjacent to the abutments to provide protection as well as habitat for aquatic species. Preferred design alternative should be verified with ODSL to ensure that criteria are met, particularly as Whychus Creek is ESH designated.

Pedestrian Bridge Deck

The existing footbridge deck is approximately 5 feet wide and is covered by a wood roof structure with an approximately 2 feet of overhang on each side. Deck width is adequate for light pedestrian traffic, but during events, bicycle use, and use by dog walkers can be restrictive, especially if users stop on the bridge to admire the views upstream and downstream of the bridge.


Figure 8 – Existing Bridge

Design Alternative Considered

In order to accommodate users who would like to pause on the bridge, the deck could be widened for one or two bays at mid-span of the bridge. By constructing a 2-foot wide 'bump-out' on the upstream and downstream edges of the bridge, it would allow users to step out of the primary traffic way and enjoy the views without impeding the traffic flow.

The bump-outs would be constructed of the same materials as the existing bridge (see Figure 9), including the same size structural decking, roof columns, and railing pickets to match the appearance of the existing bridge. Proposed locations along the existing footbridge can be seen in the Bump-out plan sheet in Appendix A.

Preferred Historical Abutments and Wing Walls Design Considerations

When selecting the preferred design alternative, there a few key factors that should be considered. Due to the historic nature of the bridge abutments, wing walls, and approach ramps, it may desirable socially and historically to retain as much of the original structure as is feasible. Contrasting to this desire, these abutments negatively constrict the stream channel, creating as a localized pinch point where hydraulically it would be preferable to restore the natural flow regime of Whychus Creek. In order to restore natural creek flows the bridge abutments would need to be altered at a minimum, if not replaced, thereby triggering required mitigation from SHPO. SHPO mitigation would be in the form of historic bridge photographic and narrative documentation, on-site signage, and public informational event(s) (see Environmental Permitting Requirements and Approvals section). Completely removing and realigning the pedestrian bridge would have additional immediate impacts to the park and existing trees, but could be designed to meet hydraulic, ADA, and esthetic requirements.

In developing ADA accessible approaches to the bridge, removal of certain trees may be required to accommodate new access structures. Depending on the size, species, and social/historic importance of particular trees, such as the large native pine trees, these may need to be preserved in place, or mitigated for if necessarily removed.

Figure 9: Photo Rending (C. Schenider) of Example Footbridge Bump-Out

Pressurized Sanitary Sewer Mainline Realignment

Along the upstream face of the Locust Street Bridge decking is the City of Sisters' pressurized 12-inch sanitary sewer mainline. Due to its importance to the City, project stakeholders have requested design alternatives to protect the sewer mainline. Damage to the sewer mainline could occur from debris floating down Whychus Creek, ice jams during the winter months, vehicle traffic, or from creek users climbing on top of it.

During a site visit to discuss sanitary sewer design alternatives with HWA, Mel Baker (Ferguson Waterworks), and Paul Bertagna, the option of realigning the sewer mainline to the downstream face of the Locust Street Bridge was discussed. Currently, there are two other conduits (power and communication lines) that are installed on that downstream face of the bridge deck. Although realigning the mainline is potentially feasible with two 45 degree wyes, the City expressed preference in maintaining the current sewer alignment, which would prevent having to cross Locust Street twice. However, realigning the pressurized sewer mainline to the downstream face could potentially decrease the construction cost, permitting time lag, and the need to dewater the creek during construction. This design alternative was not further investigated within this conceptual design report.

Design Alternative 1 – Armoring

Design Alternative 1 includes protecting the sewer mainline with in-place structural steel armoring around the existing pipe. The primary purpose of the armoring would be to deflect ice and debris above or below the sewer line during high flow events. A series of structural steel frames would be installed along the face of the bridge, and then steel cladding plates would be installed on the upstream face of the frames. Steel plates would provide a durable, low friction surface to deflect the debris and ice flows around the pipe. A 12-inch x 8-inch 'hot tap tee', in-line 12-inch gate valve, and 8-inch flanged riser would be installed, at each side of the bridge, for emergency bypass purposes. The tee, valve, and riser assemblies would be located in precast concrete vaults with hatches rated to H-20 loading.

Frames would be attached to the existing guardrail posts using bolts and to the edge of the precast concrete bridge using adhesive anchors (see Appendix A). These frames would be designed for the impact and deflection loading of ice jams and woody debris. It is estimated that the frames would be spaced approximately 2 feet apart and would be clad with ¼-inch to 3/8- inch steel plate.

Design Alternative 2 – Open Trench

Design Alternative 2 relocates the existing 12-inch pressure sewer main from the side of the bridge below ground via the method of trenching. This would require phasing for creek re-routing and dewatering to install the new 12-inch pressure sewer main. New 12-inch HDPE DR-17 sewer pipe is proposed to reduce the number of vertical restrained elbows and to deflect the pipe below the creek. HDPE is considered leak proof as well as maintaining a 100-year lifecycle. This method would require the installation of a 12-inch in-line gate valve at both connections to the existing pressure sewer main. The above ground 12-inch pressure sewer main would be removed from the bridge and the remaining existing 12-inch pressure sewer main, between the new connections, would be capped and abandoned in place.

Design Alternative 3 – Directional Boring

Similar to Design Alternative 2, this option would bury the mainline under Whychus Creek but without impacting the existing creek bed. Adequate staging areas would still be needed on each side of the creek for directional drilling operations. New 12-inch HDPE DR-17 sewer pipe is also proposed for deflection, its leak proof qualities, and lifecycle. Installing 12-inch in-line gate valves at both connections to the existing pressure sewer main would be required. The above ground 12-inch pressure sewer main would be removed from the bridge and the remaining existing 12-inch pressure sewer main, between the new connections, would be capped and abandoned in place.

Landscaping

Landscaping is an important part of this project in order to maintain the esthetics of the park, remediate impacted areas from construction, remove existing user-access creek paths, and enhance native vegetation.

Upland Zone

Upland of the river, on the northern bank, the area is generally treed with Ponderosa pines and turf grass on the ground plain, up to the shoulder of the bank. Little or no vegetative transition exists from active park space to the creek corridor. On the southern bank, turf grass is found close to the streambank shoulder near the bridge approach while other areas have sporadic low groundcover. Active user-created paths exist parallel to the creek and access the creek's edge on both sides of the floodplain. Opportunities exist to develop these areas into a transition zone which will better frame the active area of Creekside Park, define specific creek access points, protect particular areas of the Creek banks, and reduce irrigation demands over the lifetime of the Park.

Design Alternatives Considered

- Utilize visual cues such as low fences, railings at overlook, boulder clusters, signage, increased vertical vegetation, and downed trees to define appropriate access points (also see Recreational River Access section of this report)
- Increase the upland vegetation buffer to require less irrigation than turf grass (once established) while also providing greater habitat variety
- Simplify mowline for easier maintenance and irrigation

Tree Management

Both Creekside Park and the adjacent campground have significant number of mature Ponderosa pines. Design work for trail alignments contemplates potential short and long-term impacts to these trees. Of primary concern are the two Ponderosa pines at the northern approach to the footbridge. They are integral with the existing approach and any renovation to the surface, footings and/or railings will impact these trees. Additionally, if they are successfully preserved, they will continue to grow and affect the new approach structure into the future.

Any trees required to be removed for construction access can be reviewed for integration within restoration areas as habitat material or access discouragement, or within the park as informal seating or material for signage.

Design Alternatives Considered

Protect significant trees

- Inventory existing trees for tree health and significance
- Avoid impacting significant trees through design process by directing new trails away from tree drip zones and elevating trails into boardwalk sections over significant tree root zones
- Develop tree protection plan for construction process, including root zone protection standards and root pruning procedure
- Investigate utilizing helical footings if structures are required in root zones
- Utilize downed trees within Park
  - Reuse wood material as seating benches or integrated into signage
  - Placement along banks and/or floodplain as discouragement along user-created routes
  - Install streamside (see the Bank Restoration and In-Stream Restoration sections of this report)
- Remove and replace
  - For those trees that must be removed, a palette of native tree species will be selected to enhance stream shading, increase canopy variety and ensure succession of trees in the future

Environmental Permitting Requirements

Potential permitting requirements for the project were reviewed to determine if and how specific permits may apply to the four primary design elements of this project. Based on consultation with the involved jurisdictions, review of specific permits required for the anticipated design actions has generated the permitting matrix seen in Appendix C. Of the regulatory permits, authorizations, or consultations that could potentially be required by regulatory or commenting jurisdictions through their preliminary review of the proposed Creekside Park design elements, HENDERSON has only listed those that may apply to each design element at this stage of conceptual design report. Note that many of these permit authorizations are subject to considerations of impact, in part or total, and approval schedules are interdependent and must be completed in coordination with each other.

Potential Regulatory Permits and Approvals

Jurisdictional waters (state or federally-regulated) present within Creekside Park are limited to the Whychus Creek waterway below ordinary high water (OHW). All work below OHW would be subject to regulation and permitting through the Oregon Department of State Lands (ODSL) and/or the US Army Corps of Engineers (USACE). Potential temporary and/or permanent impacts from the proposed work are grouped into three distinct project elements; (1) bank stabilization along the northern bank of Whychus Creek, and reduction of an in-stream concrete fish-passage barrier upstream from the Hwy 20 bridge, (2) impacts associated with the reconstruction or removal/relocation of the timber footbridge across Whychus Creek, and (3) sub-grade trenching across Whychus Creek for the replacement and upgrade of the sanitary sewer main line at the Locust Street bridge. It is likely that should ODSL take jurisdiction over any or all of these project impacts, they would be considered as parts of one project, not three. In streams designated as essential fish habitat (ESH), as is Whychus Creek, ODSL's threshold for required permitting of project impacts is 25 cubic yards of total disturbance below OHW. USACE has no minimum permitting impact threshold. It is possible however that these three distinct project elements could be permitted by the USACE under three separate federal Nationwide Permits. These are often 'pre-approved' for water quality certification and are stringent in review as they are typically applied to regular maintenance or other beneficial work within waters of the United States. For ease of permitting, USACE may require the development of a comprehensive, Individual permit, for the entire project.

At this conceptual level of design, no floodplain impacts are anticipated from the by placement of additional fill within the Creekside Park site. However, should the footbridge and associated approach ramps require significant reconstruction or relocation, potential floodplain impacts could result. If so, permitting of this floodplain mitigation would be required through the City of Sisters and the Federal Emergency Management Agency (FEMA). Preparation and submittal of a Conditional Letter of Map Revision to document and receive approval(s) for this floodplain balancing may be required. Post-construction of the Creekside Park project elements, floodplain impact mitigation, a Letter of Map Revision (LOMR) may also be required for submittal and acceptance.

Depending on the impact to the historic footbridge, SHPO may require mitigation work. SHPO's representative requested that any additions to the footbridge be reversible. A reversible design could be a permanent structure, but have the ability to be removed without damaging the original structure, if future removal is required. If preferred design alternatives do impact the structure, then mitigation in the form of high quality photos, survey, design drawings and narrative, and/or on-site public education may be required.

On a local level, the final approved set of construction plans will be submitted to Paul Bertagna's office at the City of Sisters. One comprehensive permit will be developed for all the different project components.

In considering preferred design alternatives, it is important to understand the permitting process and corresponding time requirements associated with each permit. A permitting matrix (shown in Appendix C) presents the required permits per the conceptual design alternatives for the project's different components.

Community Engagement

As the project is defined and understood by the community of Sisters, City Council and City Park Advisory Board meetings will be the primary avenue of engagement with the public throughout the design process. After the project design is complete, additional community engagement opportunities could include:

Education and Artwork

- Work with the City of Sisters' schools and other community groups to develop content for signage to celebrate specific aspects of the project, including the CCC's involvement with the construction of the pedestrian bridge, the purpose of the creek revitalization project, and the value of protecting this natural amenity
- Work with Sisters Garden Club to highlight plant material that thrives along Whychus Creek
- Develop artwork utilizing trees harvested from the site, including benches or a historic tree cookie display

Appendix

Appendix A: Conceptual Design Plan Sheets (17x11)

Appendix B: Conceptual Design Alternative Matrix

Appendix C: Conceptual Design Alternative Permitting Matrix

Appendix A: Conceptual Design Plan Sheets (17x11)

PLAN VIEW

SCALE: 1" = 80'

(P1) BANK EROSION AND RIPARIAN ZONE DAMAGE

(P2) USER-CREATED TRAIL AND ASSOCIATED BANK EROSION

(P3) BANK FAILURE ALONG NORTHERN FLOODPLAIN AT CONCRETE CAP

EXISTING CONDITIONS - PHOTOS

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CREEKSIDE PARK RESTORATION PROJECT
CITY OF SISTERS AND UDWC
SISTERS, OR

SITE MAP

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SHEET NUMBER
SHEET 1

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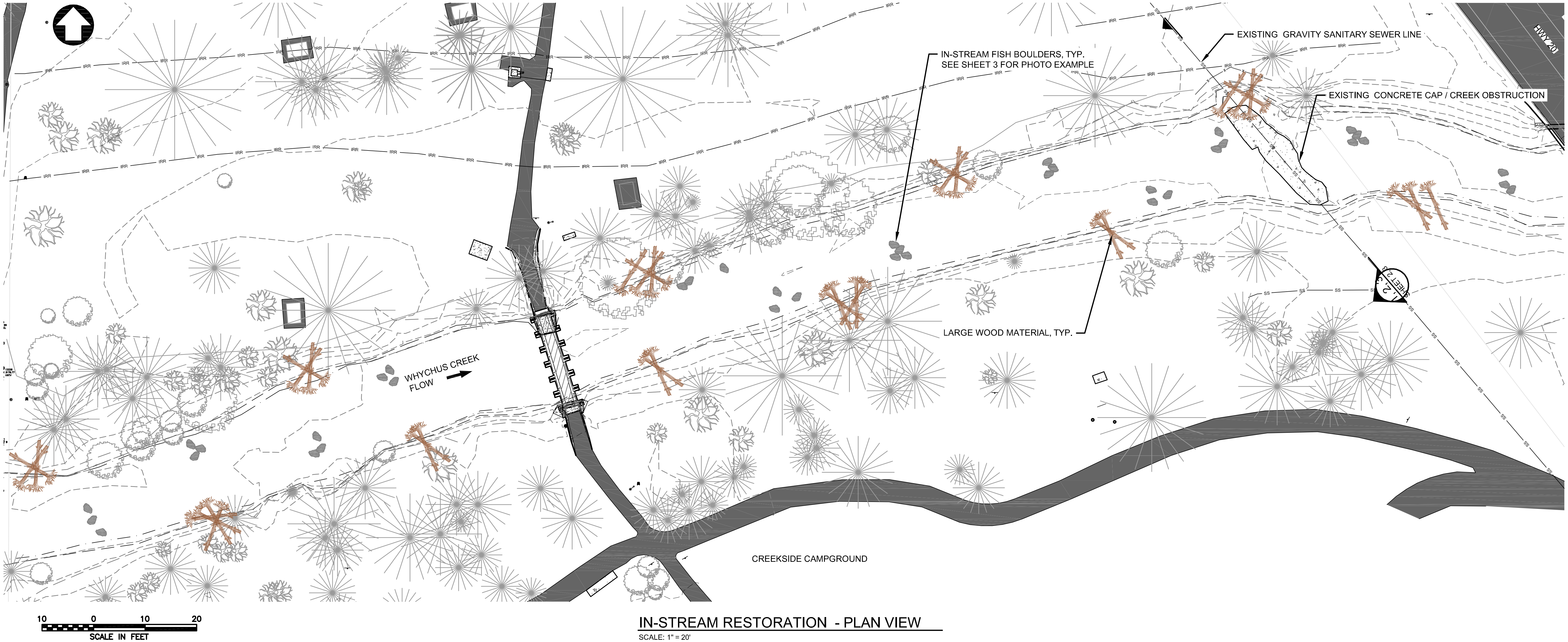
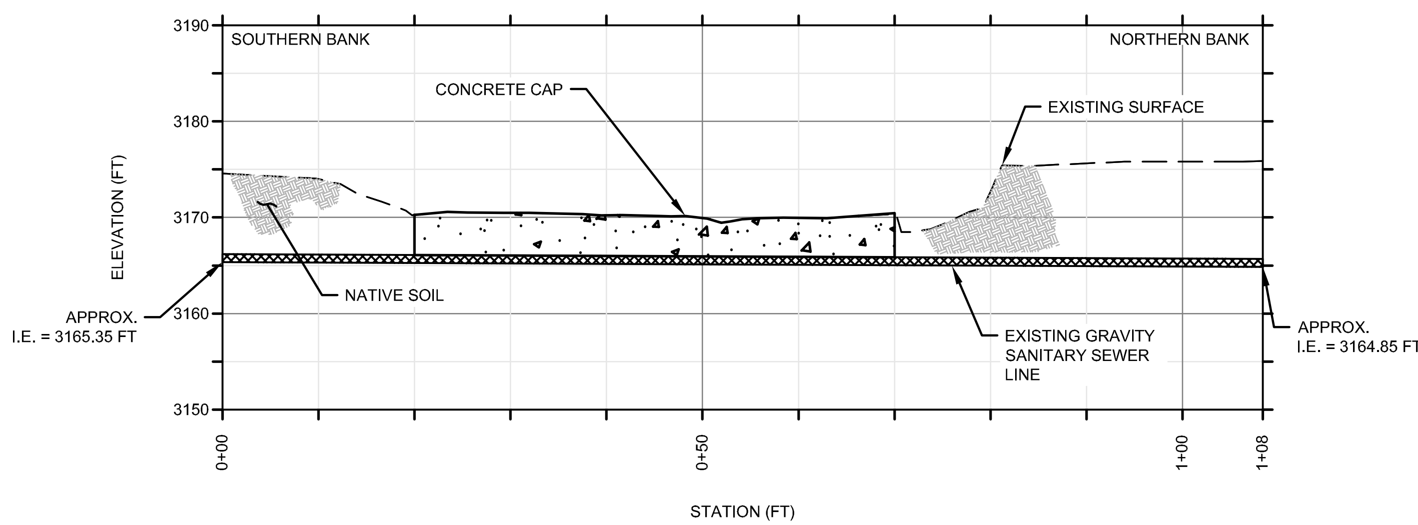


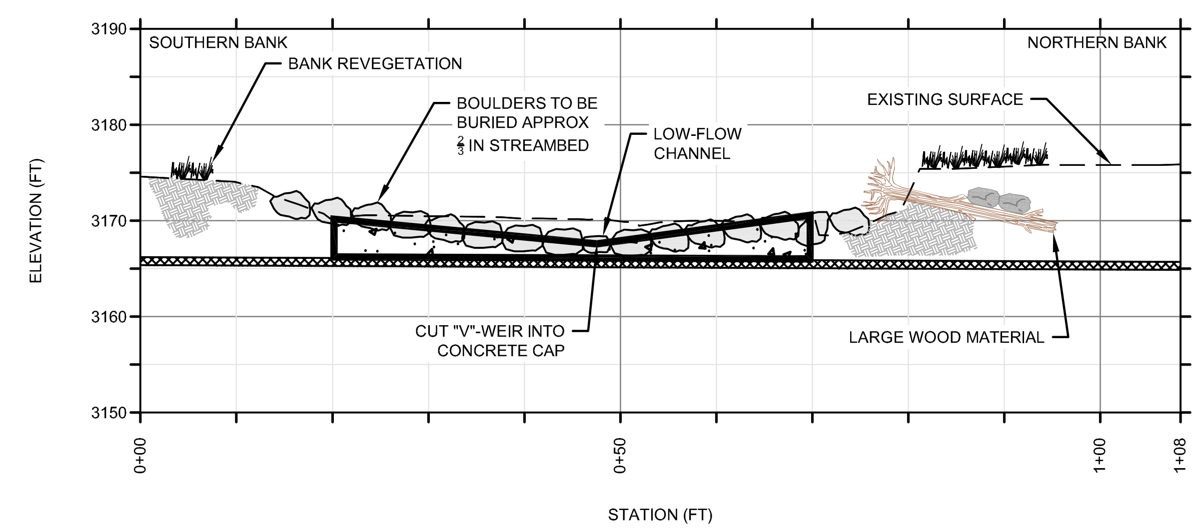
IN-STREAM RESTORATION - PLAN VIEW

SCALE: 1" = 20'



1 SHEET 2 CONCRETE CAP - EXISTING CONDITIONS PROFILE

NOT TO SCALE



2 SHEET 2 CONCRETE CAP - V-WEIR EXAMPLE PROFILE

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CITY OF SISTERS AND UDWC
SISTERS, OR

FISH PASSAGE AND IN-STREAM HABITAT

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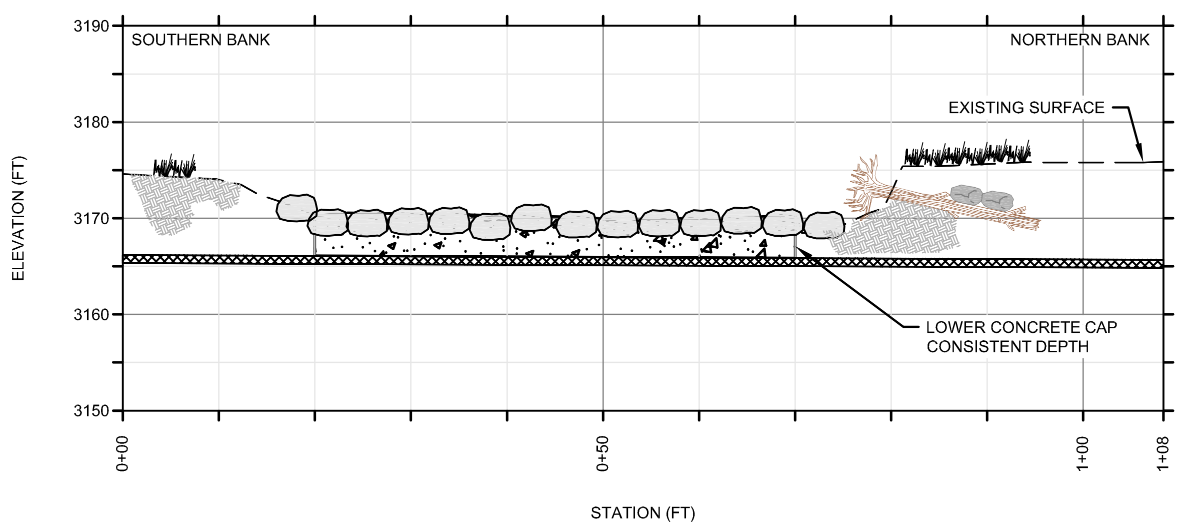
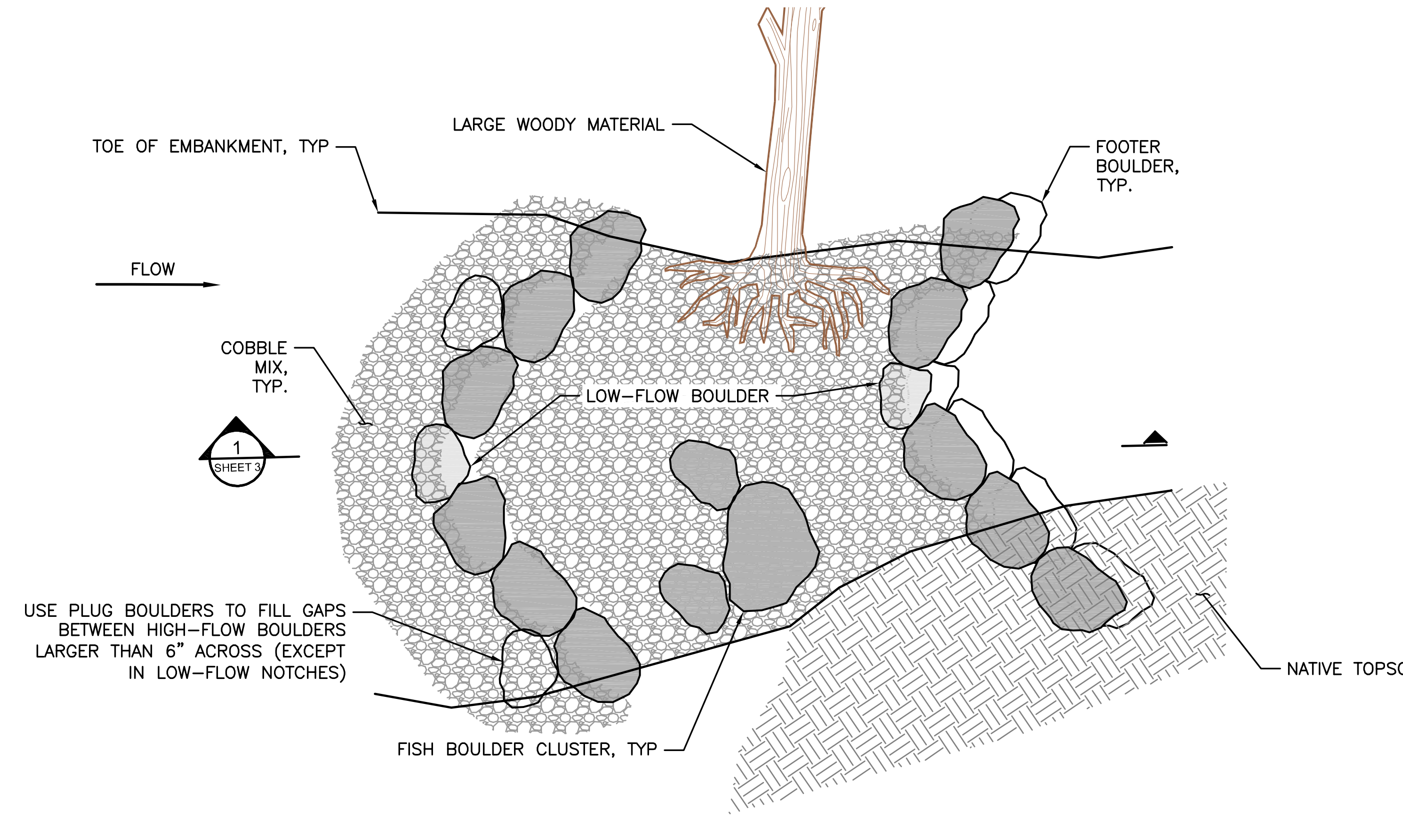
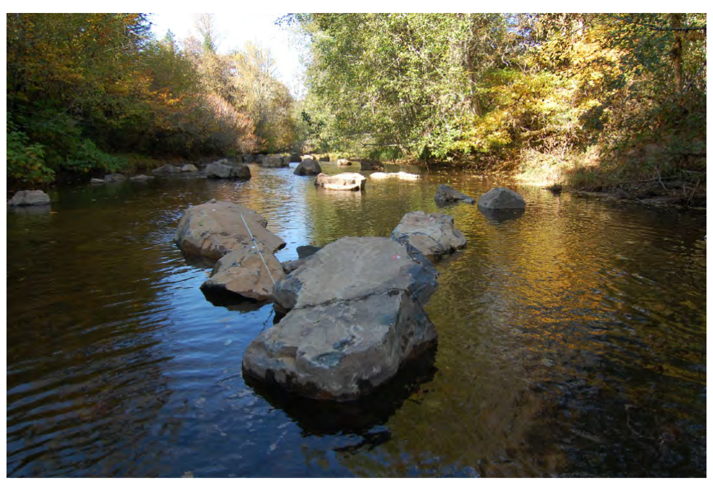
SHEET 2



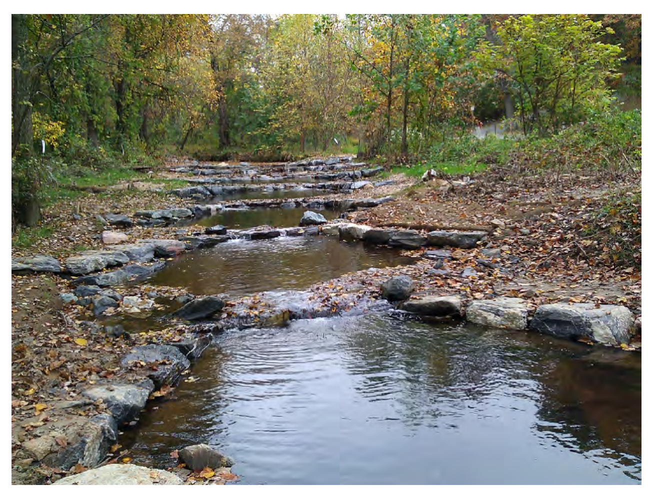
3 SHEET 2 CONCRETE CAP - V WEIR EXAMPLE PROFILE
NOT TO SCALE



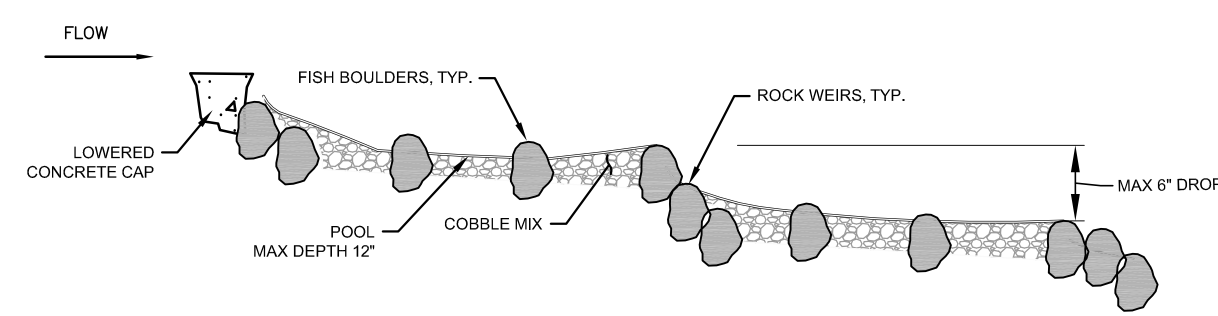
STEP POOLS / ROCK WEIRS - PLAN VIEW



FISH BOULDERS EXAMPLE



STEP POOLS / ROCK WEIR EXAMPLE



1 SHEET 3 ROCK RAMP / ROCK WEIR - EXAMPLE PROFILE
NOT TO SCALE

STEP POOL GENERAL NOTES:

1. ADDITIONAL HYDRAULIC ANALYSIS WILL BE REQUIRED TO DESIGN THE NUMBER AND FREQUENCY OF STEP POOLS AS WELL AS ROCK WEIR SIZE. GENERALLY ELEVATION CHANGES SHOULD NOT EXCEED SIX INCHES BETWEEN STEPS.
2. AS LONG AS THE HYDRAULICS SUPPORT IT, POOLS DEEPER THAN THE 6 INCH STEP DROP IS PREFERABLE IN ORDER TO PROVIDE BETTER AQUATIC HABITAT AND DECREASE VELOCITIES FOR SEDIMENTATION.
3. ALL ROCKS SHOULD BE BURIED APPROXIMATELY 2/3 IN THE STREAMBED TO PREVENT MOBILIZATION.
4. ADDITIONAL MEASURES CAN BE TAKEN WITHIN THE STEP POOL COMPLEX TO INCREASE HABITAT SUCH AS FISH BOULDERS AND LARGE WOODY MATERIAL.

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CITY OF SISTERS AND UDWC
SISTERS, OR

FISH PASSAGE AND IN-STREAM HABITAT (2)

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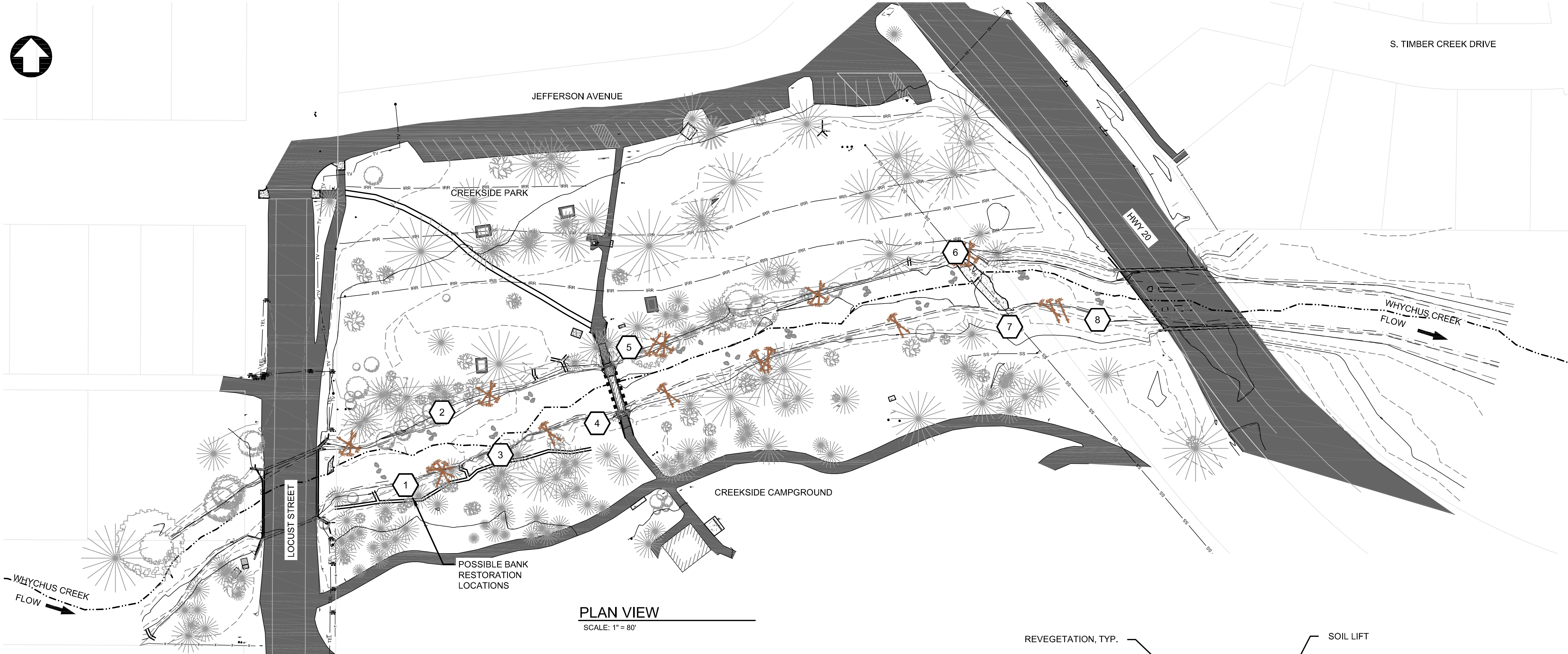
SHEET 3



PLAN VIEW

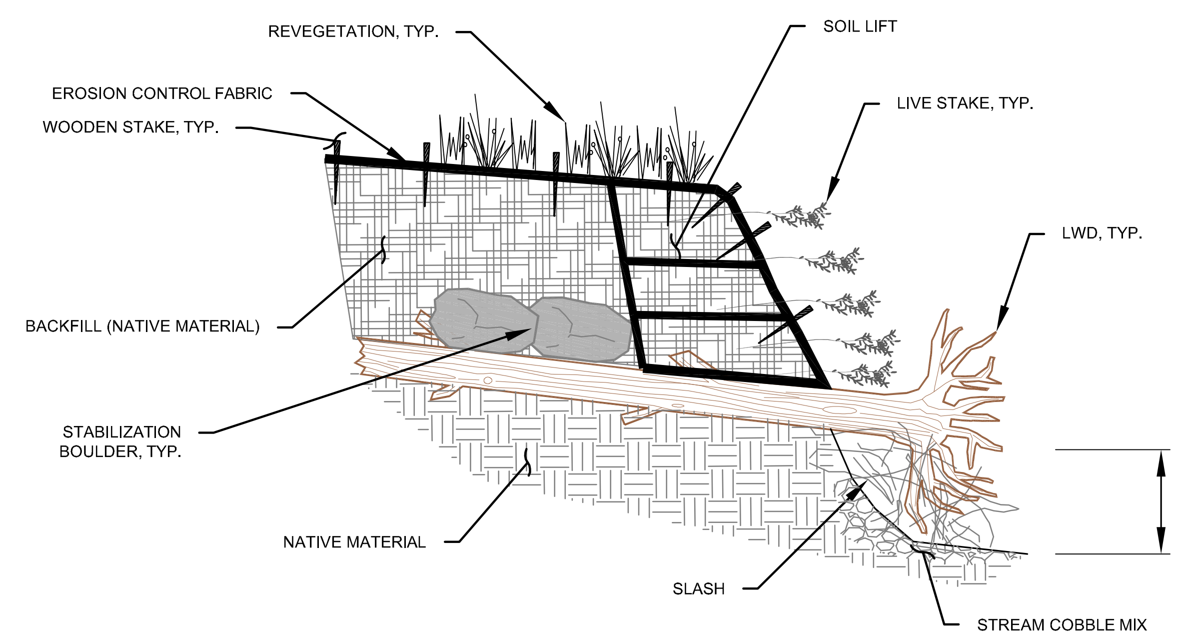
SCALE: 1" = 80'

40 0 40 80
SCALE IN FEET

GENERAL NOTES:

1. BANK RESTORATION LOCATIONS WERE CHOSEN FROM VISUAL INSPECTIONS THE OF THE SITE. ADDITIONAL OR FEWER LOCATIONS CAN BE RESTORED PER CLIENT AND STAKEHOLDERS' INPUT.
2. BANK RESTORATION CAN EASILY BE COUPLED WITH CREEK RESTORATION AND/OR CREEK ACCESS. LARGE WOOD DEBRIS WOULD PROVIDE BANK STABILITY, FISH HABITAT, AND, WHEN PAIRED WITH NE NATIVE VEGETATION AND/OR A SPLIT-RAIL FENCE, WOULD HELP TO DIRECT CREEK USERS TO DEFINED ACCESS POINTS.

BANK RESTORATION EXAMPLES



1 BANK RESTORATION - EXAMPLE PROFILE

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BANK RESTORATION

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SHEET 4

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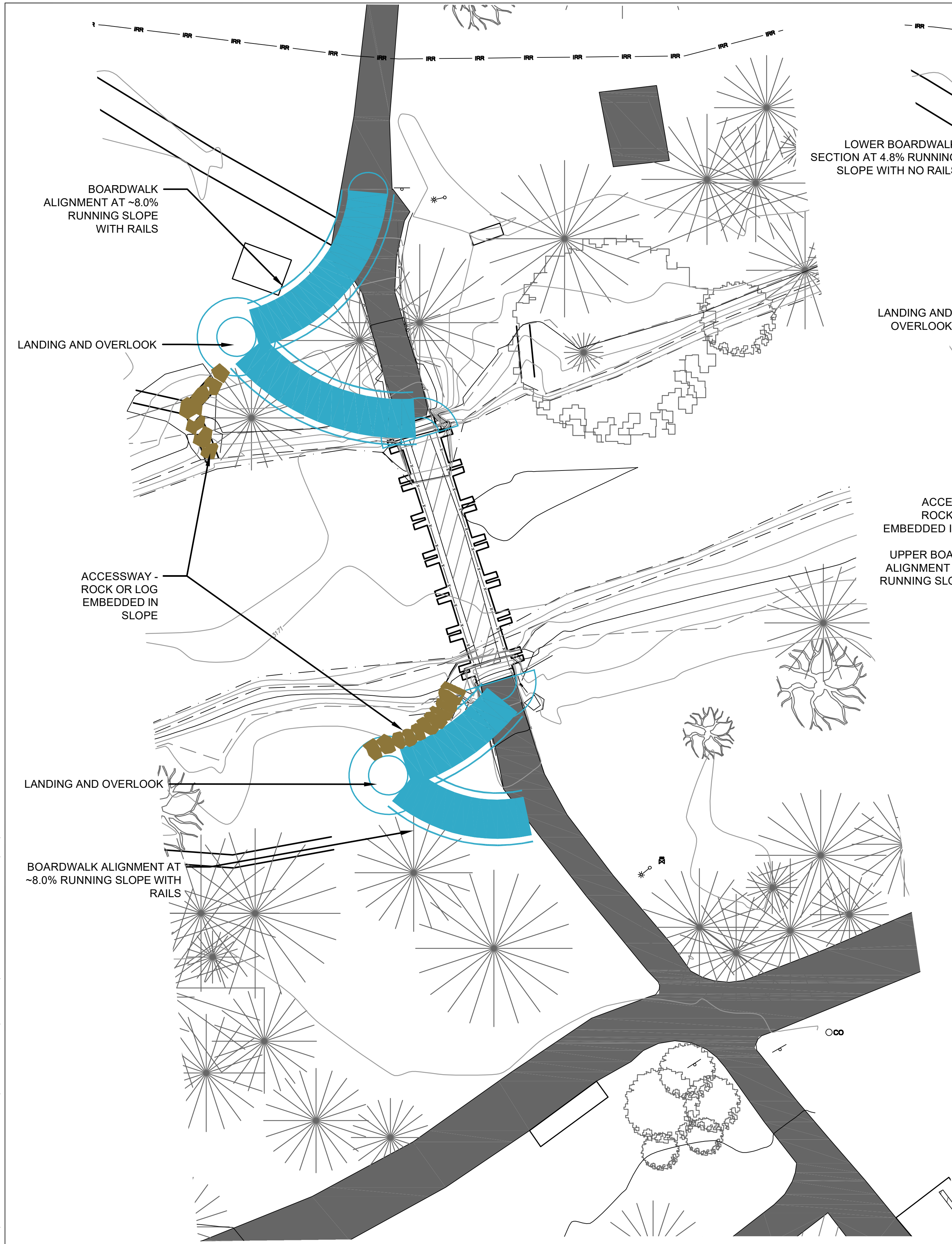
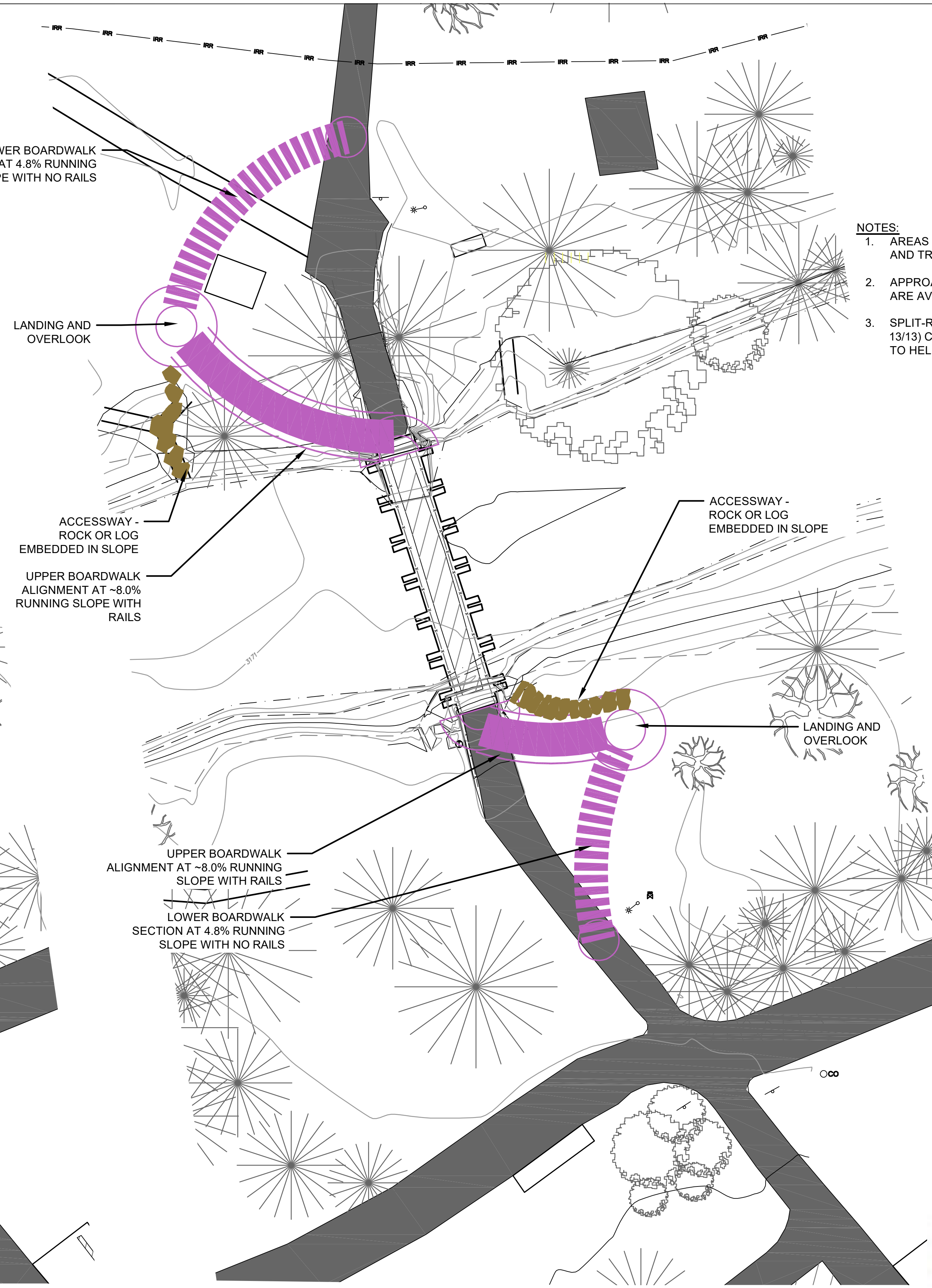


OPTION A
MAX 8% SLOPE



OPTION B
MAX 8% SLOPE ABOVE LANDING
MAX 5% SLOPE BELOW LANDING

10 0 10 20
SCALE IN FEET

NOTES:

1. AREAS OF CONSTRUCTION IMPACT MITIGATION AND TREE PROTECTION TO BE DETERMINED.
2. APPROACH ALIGNMENTS ARE PRELIMINARY AND ARE AVAILABLE TO CHANGE PER CLIENTS' INPUT
3. SPLIT-RAIL FENCING (SEE SHEET 7/13 AND SHEET 13/13) CAN BE PAIRED WITH THE APPROACHES TO HELP DIRECT CREEK USERS

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SISTERS, OR

ADA BOARDWALK APPROACHES

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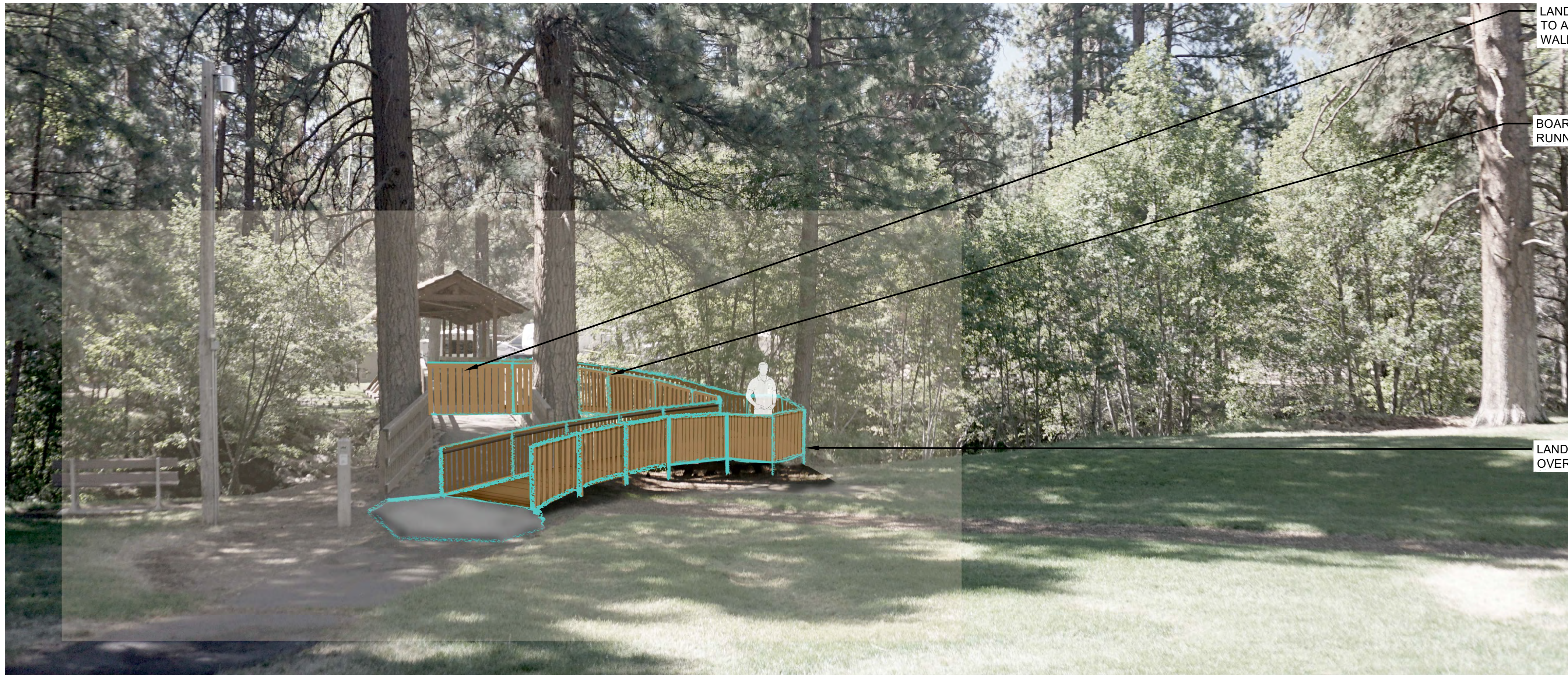
SHEET 5



EXAMPLE ADA BOARDWALK RENDERINGS - NORTHERN APPROACH

MATERIAL EXAMPLE
CONCRETE DECKING

MATERIAL EXAMPLE
CEDAR DECKING

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SHEET 6

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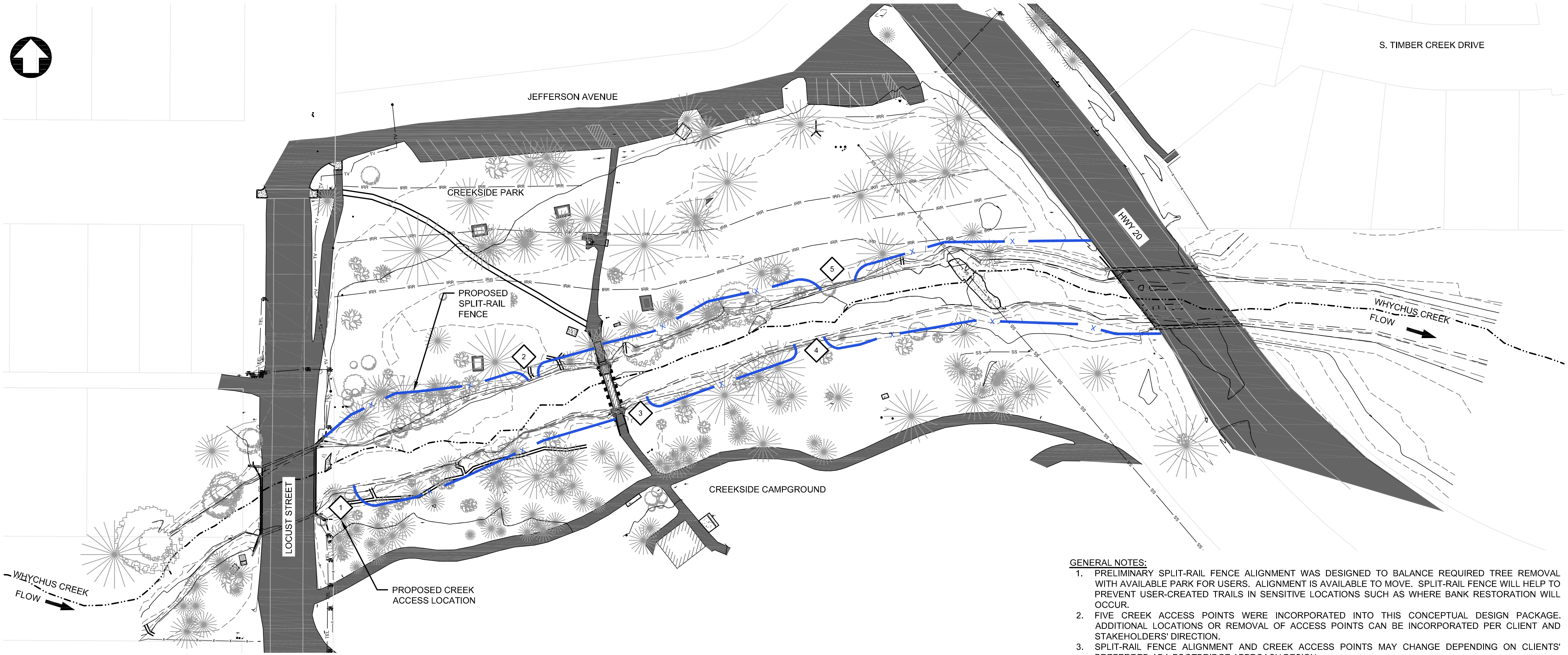
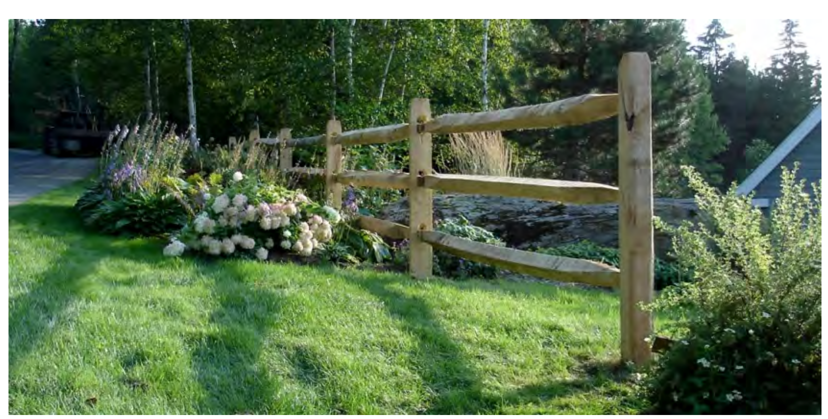


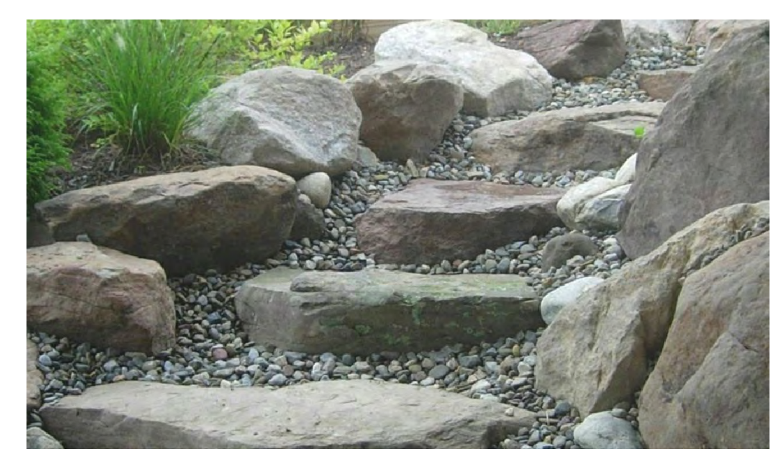
PLAN VIEW

SCALE: 1" = 80'

GENERAL NOTES:

1. PRELIMINARY SPLIT-RAIL FENCE ALIGNMENT WAS DESIGNED TO BALANCE REQUIRED TREE REMOVAL WITH AVAILABLE PARK FOR USERS. ALIGNMENT IS AVAILABLE TO MOVE. SPLIT-RAIL FENCE WILL HELP TO PREVENT USER-CREATED TRAILS IN SENSITIVE LOCATIONS SUCH AS WHERE BANK RESTORATION WILL OCCUR.
2. FIVE CREEK ACCESS POINTS WERE INCORPORATED INTO THIS CONCEPTUAL DESIGN PACKAGE. ADDITIONAL LOCATIONS OR REMOVAL OF ACCESS POINTS CAN BE INCORPORATED PER CLIENT AND STAKEHOLDERS' DIRECTION.
3. SPLIT-RAIL FENCE ALIGNMENT AND CREEK ACCESS POINTS MAY CHANGE DEPENDING ON CLIENTS' PREFERRED ADA FOOTBRIDGE APPROACH DESIGN.





CREEK ACCESS EXAMPLES

PHOTOS REFERENCES:
SPLIT RAIL FENCE – MIDDLEBURY FENCE
WOOD – HAYWOOD ROAD OF WEST ASHEVILLE, NC
STONE – LAKE SHORE GUYS

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SHEET NUMBER SHEET 7

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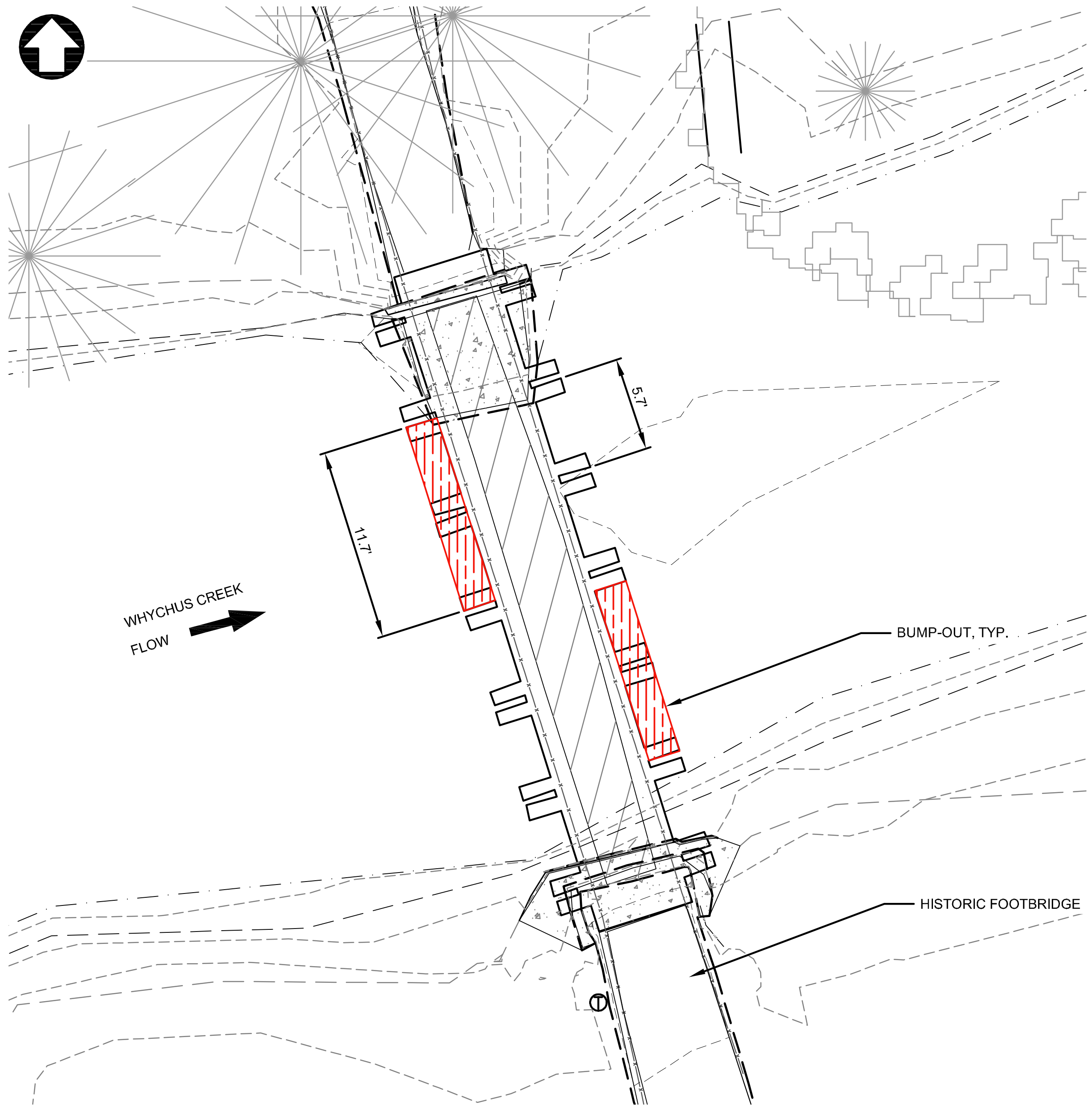

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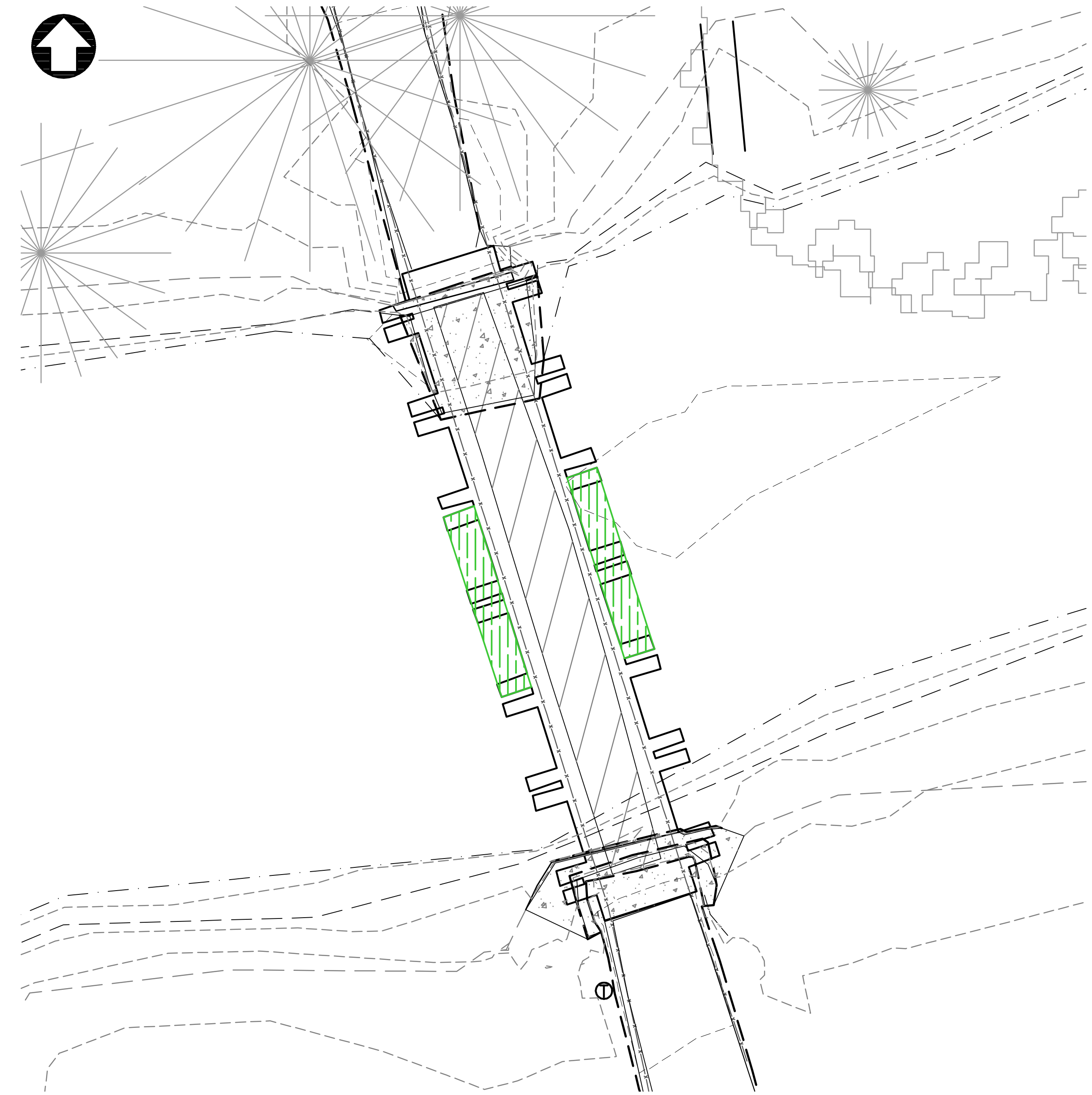
SCALE IN FEET

BRIDGE BUMP-OUT OPTION 1 - PLAN VIEW
SCALE: 1" = 10'



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SCALE IN FEET

BRIDGE BUMP-OUT OPTION 2 - PLAN VIEW
SCALE: 1" = 10'

GENERAL NOTES:

1. A DIGITAL RENDERING OF A BRIDGE BUMP-OUT CAN BE SEEN WITHIN THE DESIGN REPORT THAT ACCOMPANIES THIS PLAN SHEET.
2. BUMP-OUTS CAN BE STAGGERED (PLAN VIEW 1) OR ALIGNED (PLAN VIEW 2) ON THE BRIDGE DECK, DEPENDING CLIENTS AND STAKEHOLDERS' PREFERENCE.
3. BUMP-OUTS CAN BE DESIGNED TO EXTEND ONE OR TWO BAYS. EACH BAY IS APPROXIMATELY 5.7 FEET WIDE. BUMP-OUTS, ON THIS SHEET, WERE DESIGNED TO EXTEND TWO BAYS. BUMP-OUTS WILL BE DESIGNED TO REMAIN FULLY COVERED UNDER BRIDGE ROOF.
4. SEE CONCEPTUAL DESIGN REPORT FOR A DIGITAL RENDERING OF BRIDGE BUMP-OUT

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BRIDGE BUMP-OUT

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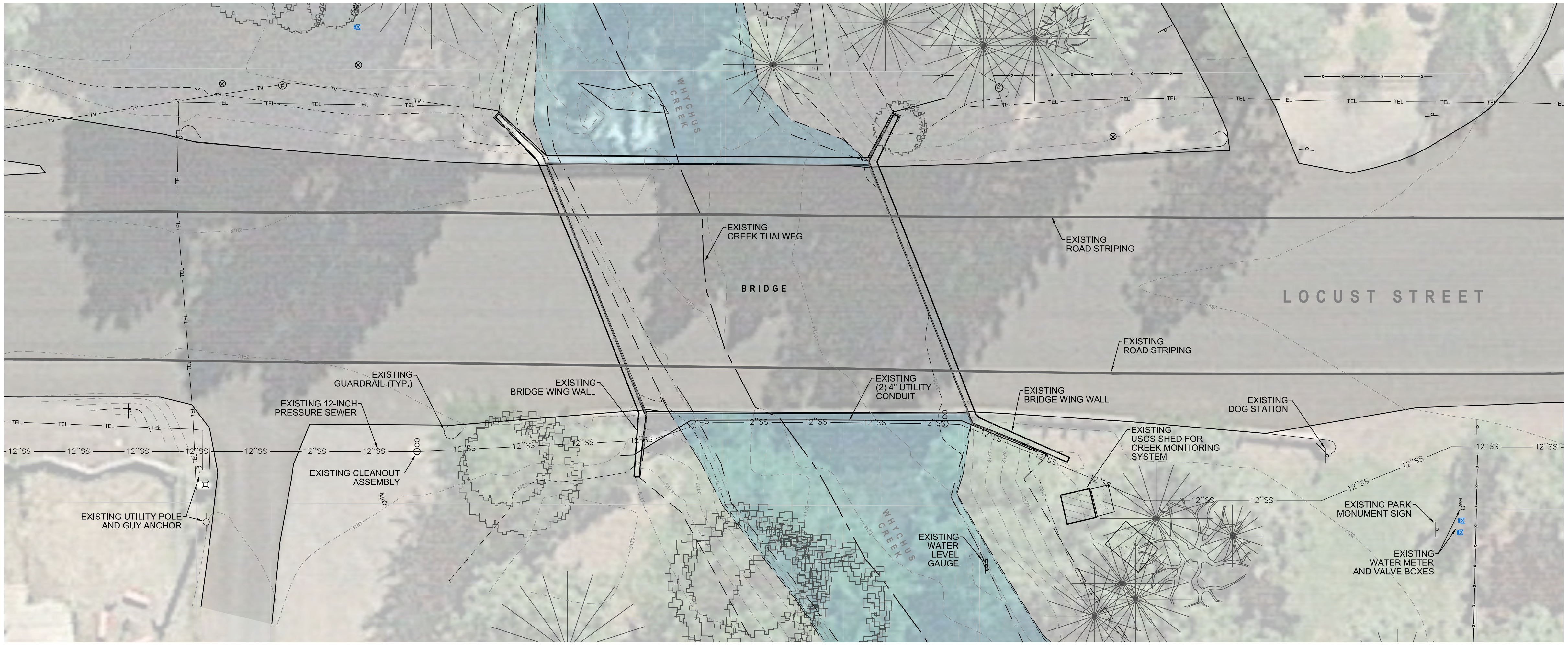
SHEET 8



LEGEND

- ASSESSOR'S TAX LOT LINE (APPROXIMATE LOCATION)
- CURB LINE
- POWER LINE
- SEWER LINE
- UNDERGROUND TELEPHONE LINE
- UNDERGROUND CABLE TV LINE
- UNDERGROUND WATER LINE
- IRRIGATION LINE
- FENCE, TYPE NOTED
- BENCHMARK (SEE NOTE 6)
- IRRIGATION VALVE
- FIRE HYDRANT
- WATER SERVICE
- WATER VALVE
- WATER METER
- CATCH BASIN
- SEWER CLEANOUT
- SEWER MANHOLE
- ELECTRICAL SERVICE
- ELECTRIC TRANSFORMER & CONC. PAD
- UTILITY POLE
- GUY ANCHOR
- LIGHT POLE
- TELEPHONE MANHOLE
- TELEPHONE RISER
- CABLE TV SERVICE/RISER
- BOLLARD
- SIGN
- ASPHALT PAVING
- CONCRETE
- 3620 CONTOUR LINE, 1' INTERVAL
- BUILDING EDGE
- DECIDUOUS TREE
- JUNIPER TREE,
- PONDEROSA PINE TREE,

SURVEY NOTES

1. THE PROPERTY LINES SHOWN HEREON ARE PER DESCHUTES COUNTY GIS TAX LOT INFORMATION, THEY ARE NOT THE RESULT OF A BOUNDARY SURVEY AS DEFINED BY O.R.S. 209.250(1) AND SHOULD BE CONSIDERED APPROXIMATE ONLY.

2. WITH REGARD TO UNDERGROUND UTILITIES, INFORMATION FROM CITY OF SISTERS AND UTILITY LOCATE MARKINGS WERE COMBINED WITH OBSERVED EVIDENCE OF UTILITIES TO DEVELOP A VIEW OF THOSE UNDERGROUND UTILITIES. HOWEVER, LACKING EXCAVATION, THE EXACT LOCATION OF UNDERGROUND FEATURES CANNOT BE ACCURATELY, COMPLETELY AND RELIABLY DEPICTED. WHERE ADDITIONAL OR MORE DETAILED INFORMATION IS REQUIRED, EXCAVATION MAY BE NECESSARY.

3. THIS PROPERTY IS SUBJECT TO ALL EASEMENTS, RESTRICTIONS, AND RIGHT-OF-WAYS OF RECORD AND THOSE COMMON AND APPARENT ON THE LAND.

4. NO TITLE REPORT OR RESULTS OF A TITLE SEARCH HAVE BEEN FURNISHED TO HWA, INC. FOR THE PURPOSE OF SHOWING ON THIS MAP. THERE MAY BE EASEMENTS, RESTRICTIONS OR OTHER DOCUMENTS OF RECORD THAT ARE NOT SHOWN HEREON WHICH A CURRENT TITLE SEARCH MAY DISCLOSE.

5. HORIZONTAL CONTROL STATEMENT
   THE HORIZONTAL DATUM IS THE CENTRAL OREGON COORDINATE SYSTEM.

6. VERTICAL CONTROL STATEMENT
   NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

   BASED ON THE NATIONAL GEODETIC SURVEY (NGS) CONTROL STATION "A 379", HAVING A PUBLISHED NAVD 88 ELEVATION OF 3177.71 FEET.

0 5 10 20 30
SCALE: 1" = 20'

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PH: (541)389-9351 | FAX: (541)388-5416
WEB: WWW.HWA-INC.ORG

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www.HENDERSONDESIGN-BUILD.com
PH (503) 699-8999
OR CCB# 142914
WA CCB# HENDELS954QH

CITY OF SISTERS · OREGON · EST. 1946

UPPER DESCHUTES WATERSHED COUNCIL

REGISTERED PROFESSIONAL ENGINEER 73055PE
OREGON
JULY 14, 2004
BRETT A. PARKER
PRELIMINARY
Renewal Date: 12/31/2018

CREEKSIDE PARK RESTORATION PROJECT
CITY OF SISTERS AND UDWC
SISTERS, OR

EXISTING CONDITIONS PLAN

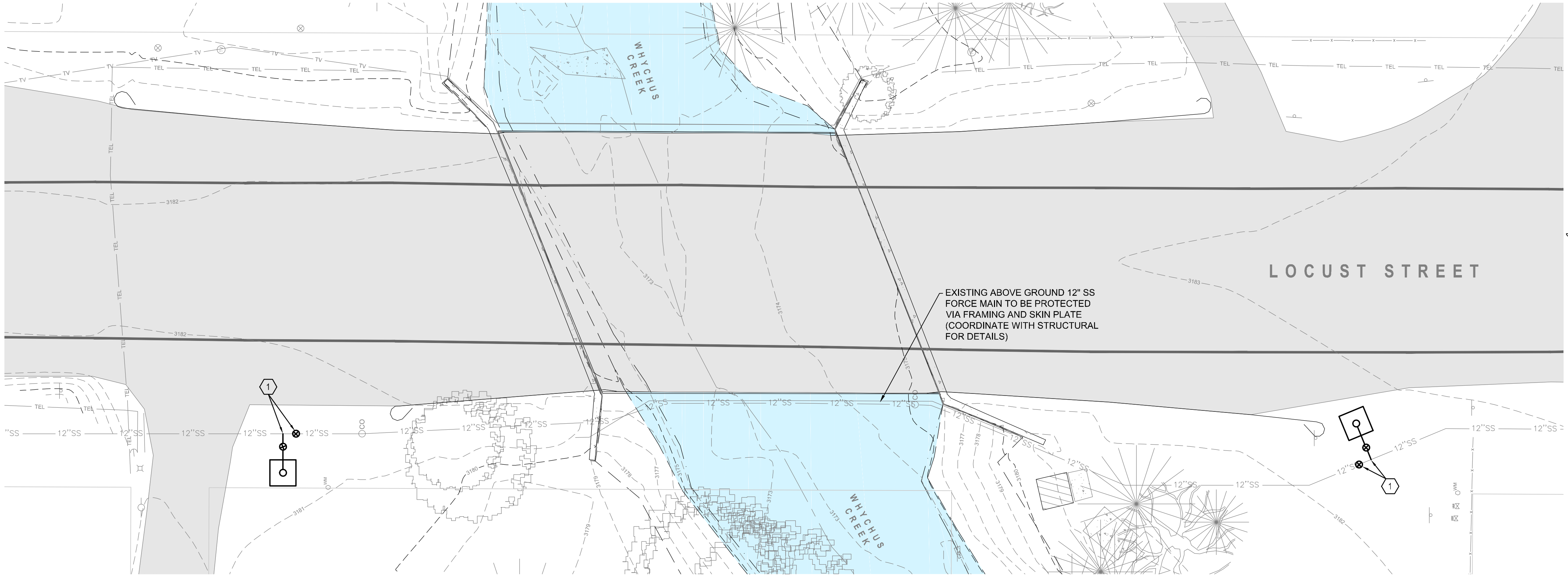
FIELDWORK: DATE:	07/09/18
DESIGN:	SCP
DRAWN:	SCP
CHECKED:	BAP

PROJECT NUMBER
COSCP 18-1

REVISION	DATE

SHEET NUMBER
SHEET 9
SHT 9 OF 13

SeanP S:\Land Projects\180601-Whychus Creek Restoration\dwg\Concept Plans\180601 - Concept Plan HDPE.dwg Tue Jul 17, 2018 - 3:25pm

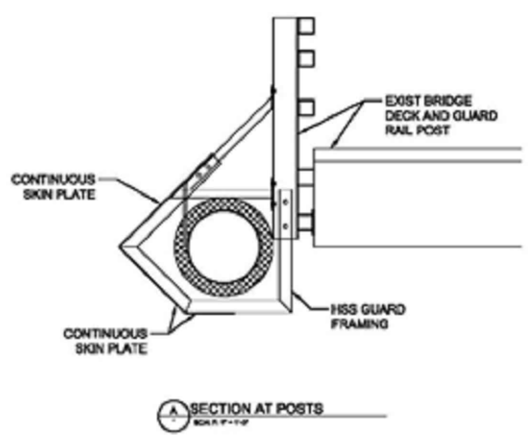


KEY NOTES

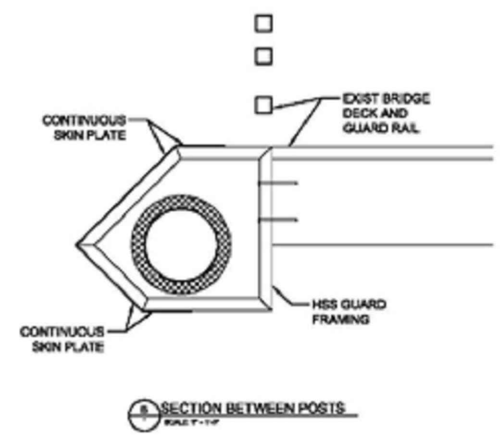
1. INSTALL 12" IN-LINE ADVANCED TECHNOLOGY EZ GATE VALVE
INSTALL 12"x8" HOT TAP W/ THRUST BLOCK
INSTALL PRE-CAST CONCRETE VAULT W/ 8" GATE VALVE AND 8" FLANGED STUB FOR EMERGENCY BYPASS

DESIGN ALTERNATIVE 1 - PLAN

SCALE: HORIZONTAL 1"=20'



A SECTION AT POSTS



B SECTION BETWEEN POSTS

River Structures CONSULTING
PO BOX 1643 | BOISE, ID 83701 | (208) 918-0627

SCALE: 1" = 20'

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WA CCB# HENDELS954QH

CITY OF SISTERS

UPPER DESCHUTES WATERSHED COUNCIL

REGISTERED PROFESSIONAL ENGINEER 75055PE OREGON
PRELIMINARY
Renewal Date: 12/31/2018

CREEKSIDE PARK RESTORATION PROJECT
CITY OF SISTERS AND UDWC
SISTERS, OR

DESIGN ALTERNATIVE 1 (ARMORING)

FIELDWORK:	
DATE:	07/09/18
DESIGN:	SCP
DRAWN:	SCP
CHECKED:	BAP

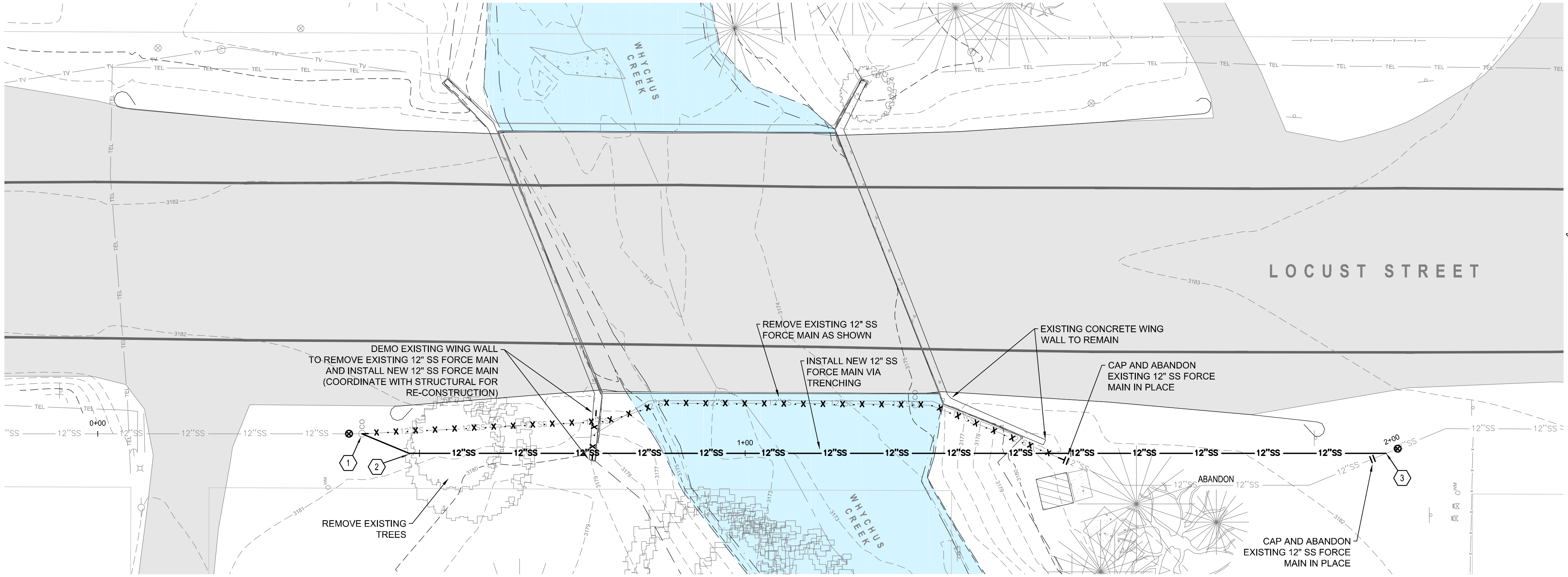
PROJECT NUMBER COSCP 18-1

REVISION DATE

SHEET NUMBER
SHEET 10
SHT 10 OF 13

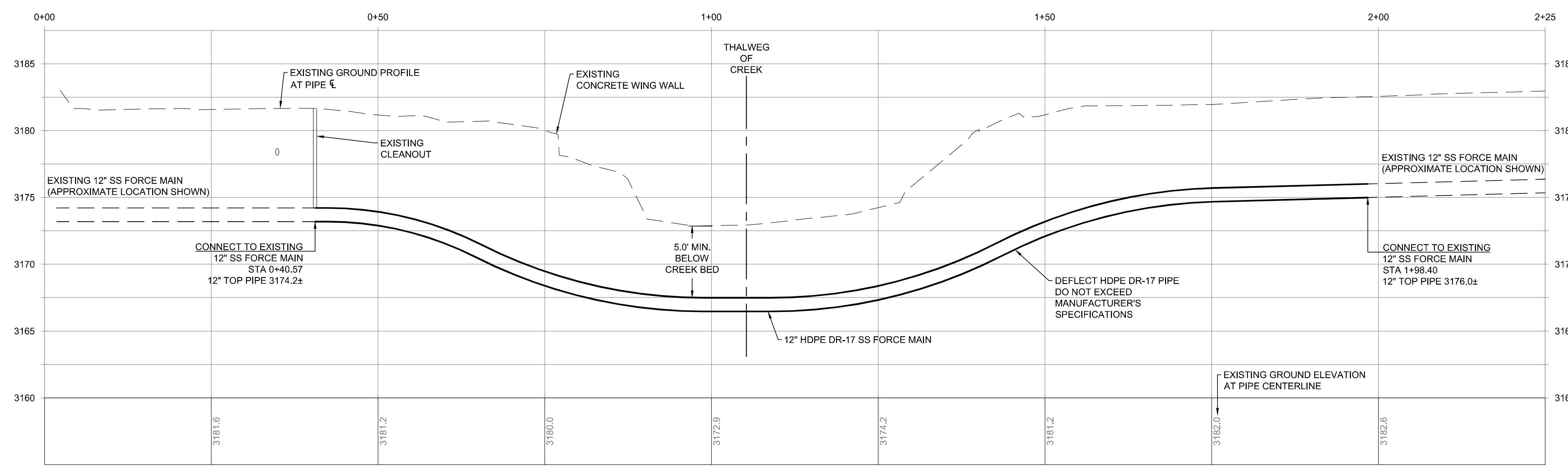
KEY NOTES

1. CONNECT TO EXISTING 12" SS FORCE MAIN
   INSTALL 12" IN-LINE
   ADVANCED TECHNOLOGIES EZ GATE VALVE
   INSTALL 12" 22.5° ELBOW W/ THRUST BLOCK
2. INSTALL 12" 22.5° MECH. REST. ELBOW
3. CONNECT TO EXISTING 12" SS FORCE MAIN
   INSTALL 12" IN-LINE
   ADVANCED TECHNOLOGIES EZ GATE VALVE
   INSTALL 12" 22.5° ELBOW W/ THRUST BLOCK



DESIGN ALTERNATIVE 2 - PLAN

SCALE: HORIZONTAL 1"=20'



DESIGN ALTERNATIVE 2 - PROFILE

SCALE: HORIZONTAL 1"=20' / VERTICAL 1"=10'

HORIZ SCALE: 1"=20'
VERT SCALE: 1"=10'

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CITY OF SISTERS, OREGON, EST. 1946

UPPER DESCHUTES WATERSHED COUNCIL

REGISTERED PROFESSIONAL ENGINEER
75055PE
OREGON
... 14, 2004
BRETT A. PARKER
PRELIMINARY
Renewal Date: 12/31/2018

CREEKSIDE PARK RESTORATION PROJECT
CITY OF SISTERS AND UDWC
SISTERS, OR

DESIGN ALTERNATIVE 2
(OPEN TRENCH)

FIELDWORK:	
DATE:	07/09/18
DESIGN:	SCP
DRAWN:	SCP
CHECKED:	BAP

PROJECT NUMBER
COSCP 18-1

REVISION DATE

SHEET NUMBER
SHEET 11
SHT 11 OF 13

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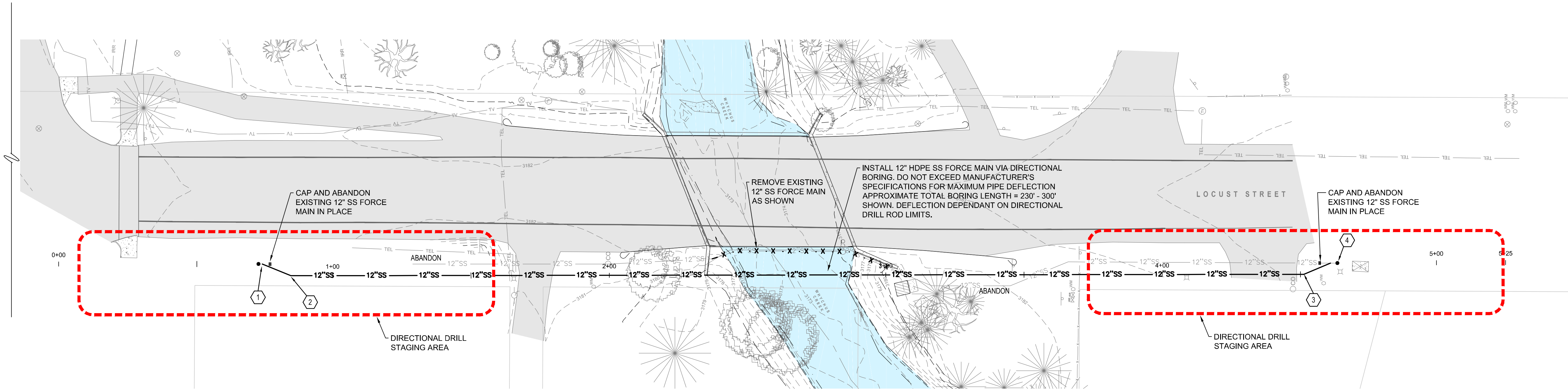
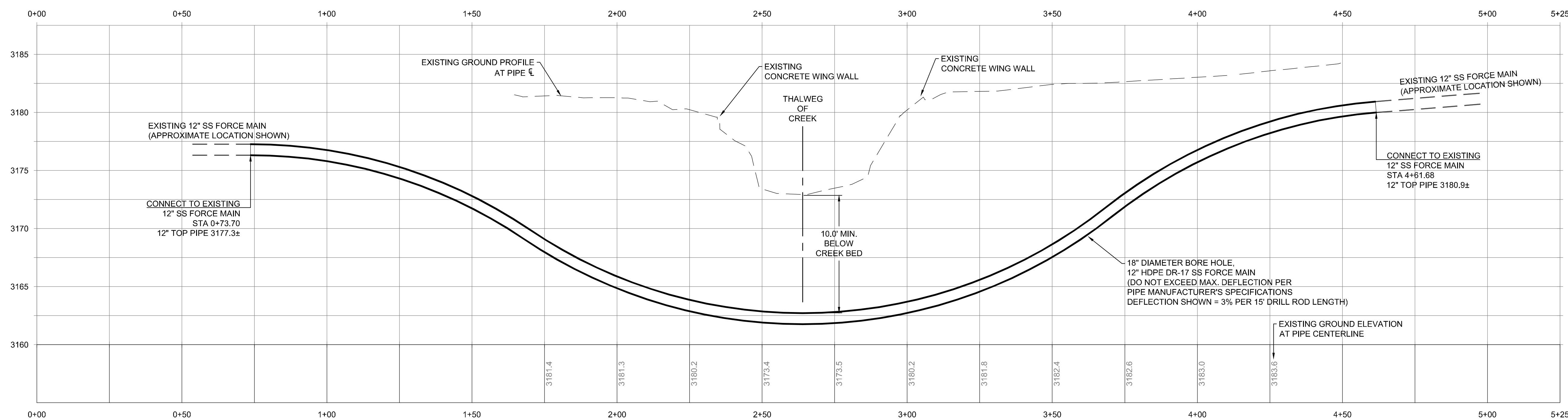


DESIGN ALTERNATIVE 3 - PLAN

SCALE: HORIZONTAL 1"=40'



DESIGN ALTERNATIVE 3 - PROFILE

SCALE: HORIZONTAL 1"=40' / VERTICAL 1"=10'

KEY NOTES

1. CONNECT TO EXISTING 12" SS FORCE MAIN
   INSTALL 12" IN-LINE ADVANCED TECHNOLOGIES EZ GATE VALVE
   INSTALL 12" 22.5° ELBOW W/ THRUST BLOCK
2. INSTALL 12" 22.5° MECH. REST. ELBOW
3. INSTALL 12" 22.5° MECH. REST. ELBOW
4. CONNECT TO EXISTING 12" SS FORCE MAIN
   INSTALL 12" IN-LINE ADVANCED TECHNOLOGIES EZ GATE VALVE
   INSTALL 12" 22.5° ELBOW W/ THRUST BLOCK

HORIZ SCALE: 1"=40'
VERT SCALE: 1"=10'

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OR CCB# 142914
WA CCB# HENDELS954QH

CITY OF SISTERS

UPPER DESCHUTES WATERSHED COUNCIL

REGISTERED PROFESSIONAL ENGINEER
OREGON
BRETT A. PARKER
PRELIMINARY
Renewal Date: 12/31/2018

CREEKSIDE PARK RESTORATION PROJECT
CITY OF SISTERS AND UDWC
SISTERS, OR

DESIGN ALTERNATIVE 3 (DIRECTIONAL BORING)

FIELDWORK:	
DATE:	07/09/18
DESIGN:	SCP
DRAWN:	SCP
CHECKED:	BAP

PROJECT NUMBER COSCP 18-1

REVISION DATE

SHEET NUMBER
SHEET 12
SHT 12 OF 13

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PLAN VIEW-LANDSCAPE CONDITIONS
SCALE:1=60'

NOTES:
1. AREAS OF CONSTRUCTION IMPACT MITIGATION AND TREE PROTECTION TO BE DETERMINED.

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CITY OF SISTERS

UPPER DESCHUTES WATERSHED COUNCIL

CREEKSIDE PARK RESTORATION PROJECT
CITY OF SISTERS AND UDWC
SISTERS, OR

LANDSCAPE CONDITIONS

FIELDWORK:	--
DATE:	--/--/--
DESIGN:	--
DRAWN:	--
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PROJECT NUMBER COSCP 18-1	
REVISION ----	DATE ----
SHEET 13	

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Appendix B: Conceptual Design Alternative Matrix

Design Alternative	Cost	Lifespan	Annual Maintenance	Constructability	Impact
Whychus Creek Enhancements					
Gravity Sanitary Sewer Line / Creek Obstruction					
V-Shaped Weir	$$	50	$	1	1
Backwatering (Step Pools)	$$$	10	$	3	3
Lowering Entire Span	$$	40	$	2	3
Fish Passage Rock Ramp	$$	50	$	1	1
Removal and Replacement	$$$$	50	$	1	1
In-Stream Restoration					
Fish Boulders	$	50	$	1	1
V-Shaped Rock Weirs	$$	20	$	3	3
Rootwad Clusters	$$	20	$	2	2
Northern Bank Restoration					
Soil Lift	$	20	$$	1	1
Large Wood Material	$$	20	$	1	2
Native Revegetation	$	50	$	1	1
Recreational River Access					
Fencing	$	50	$	1	1
Native Revegetation	$	50	$	1	1
Sinage	$	50	$	1	1
Fortified Creek Access Points	$$	25	$	1	1
Viewing Platforms	$$	50	$	1	2
Pedestrian Bridge Enhancements					
Historical Abutments and Wing Walls					
New Ramps	$	50	$	1	3
New Wood Boardwalk	$$	25	$$$	2	2
New Concrete Boardwalk	$$$	50	$	2	2
New Bridge	$$$$	50	$	3	1
Pedestrian Bridge Deck					
Viewing Bump-outs	$$	25	$$	2	1

Pressurized Sanitary Sewer Mainline Realignment					
Sewer Mainline Realignment					
Armoring	$$	30-50	$	1	1
Open Trench	$$$	100	$	2	3
Directional Boring	$$$$	100	$	3	3
Landscaping					
Upland Zone					
Upland Vegetation	$	50	$	1	3
Simplify Mowline	$$	20	$	1	2
Signage	$	15	$$	2	1
Tree Management					
Remove and Utilize	$$	20	$$	2	2
Remove and Replace	$	100	$	1	2

Matrix Key

Cost ($-$$$$)

Lifespan (years)
0 - 50 years

Annual Maintenance ($-$$$$)
All design alternatives will require annual maintenance

Constructability (1-3)
1 - Most Constructible
3 - Least Constructible

Impact to Creekside Park (1-3)
1 - Least Impact
3 - Greatest Impact

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Appendix C: Conceptual Design Alternative Permitting Matrix

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Conceptual Design Alternative Permitting Matrix

	Permit or Approval	Authorizing Agency	Regulatory Authority	Type of Permit/Approval	Applicable to Creekside Park Project Elements	Anticipated Maximum Processing Schedule
Federal	CWA 404	USACE	Section 404, Clean Water Act of 1987	Joint USACE/ODSL Joint Permit Application	All	120 days
	CWA 401	EPA ODEQ	Section 401, Clean Water Act of 1987	Water Quality Certification 1200C ESC Permit >1-acre disturbance	All, unless pre-authorized through Nationwide Permits	120 days
	Endangered Species Act	USFWS NOAA	Section 7, Federal Endangered Species Act, Public Law 93-205	Consultation. Biological Opinion may be required.	All, but unlikely. Anticipate agency permit review only	Unspecified Schedule
	CLOMR/LOMR	FEMA/DHS	Homeland Security Act of 2002	Floodplain Map Revisions	Pedestrian Bridge Abutments	Unspecified Schedule
	Fish and Wildlife Coordination	NOAA ODFW	Fish and Wildlife Coordination Act of 1934	Consultation. Biological Opinion may be required.	All, but unlikely. Anticipate agency permit review only	Unspecified Schedule
	Cultural Resources Review	SHPO	Section 106, Historic Preservation Act of 1966, Executive Order 11593	SHPO Approval Letter. Requires review by tribes historically associated with site.	Pedestrian Bridge Abutments	Unspecified Schedule
State	Oregon Removal and Fill Permit	ODSL	Oregon Removal-Fill Law, ORS 196.800-990	Joint USACE/ODSL Joint Permit Application (JPA)	All, but unlikely if total impacts are less than 25 cubic yards	120 days
	Oregon Endangered Species Act	ODFW	Oregon State Endangered Species Act, ORS 496	Joint USACE/ODSL Joint Permit Application	All, but unlikely. Anticipate agency permit review only	120 days (typically concurrent with JPA)
	Fish Passage Approval	ODFW	Oregon General Protective Regulation – Fish Passage, ORS 509.580-910 and OAR 635, Division 412	Fish Passage Approval Permit	Reduction of concrete fish-passage barrier	120 days (typically concurrent with JPA)
	Water Quality Certification	ODEQ	Section 401, Clean Water Act of 1987	401 Water Quality Certification ODEQ NPDES 1200-C Permit	N/A as total project impacts would be less than 1-acre	365 days (though typically within 45 days AFTER CWA 404 authorization)
	Cultural Resources Review	SHPO	Section 106, Historic Preservation Act of 1966, Executive Order 11593	SHPO Approval Letter. Requires review by tribes historically associated with site.	Pedestrian Bridge Abutments	Unspecified Schedule
Local	Land Use Review	City of Sisters	Paul Bertagna's office at City of Sisters	Stamped Construction Plans	All	Unspecified Schedule

Acronyms

CWA	Clean Water Act
DHS	Department of Homeland Security
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
NOAA	National Oceanic and Atmospheric Administration (formerly National Marine Fisheries Service)
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Department of State Lands
SHPO	State Historic Preservation Office
USACE	US Army Corps of Engineers
USFWS	US Fish and Wildlife Service